The London School of Economics and Political Science

Managing the Transition:

An Analysis of Renewable Energy Policies in Resource-Rich Arab States with a Comparative Focus on the United Arab Emirates and Algeria

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A thesis submitted to the Department of Geography and Environment of the London School of Economics for the degree of Doctor of Philosophy, London, October 2012

Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

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Abstract

This study analyses renewable energy policy in hydrocarbons-wealthy Arab states. Integrating elements of energy policy analysis, Middle Eastern studies and socio-technical governance theory, the thesis contributes to the understanding of renewable energy policy in this region as well as to the question of transferability of governance concepts.

The thesis is structured in three parts. Part A discusses relevant research literature and presents the multi-level-perspective which structures the policy analysis. Additionally, the policy design model of transition management that closely interacts with the multi-level-perspective is presented. Then, the material content of renewable energy policies in hydrocarbons-wealthy Arab states is discussed and the research questions developed. A methodological discussion concludes Part A.

Part B applies the analytical categories developed to two case studies, Algeria and the United Arab Emirates. The two countries represent the main types of Arab oil and gas wealthy states (large territorial and small city states) and two relevant regions (North Africa and the Gulf States). In addition to domestic renewable energy policy, the thesis also discusses the Desertec project, as well as Abu Dhabi's Masdar Initiative as case studies within the larger country case studies.

In the last part of this study, a cross-case analysis highlights common regional features and particularities in terms of renewable energy policy in the target region and formulates policy recommendations deriving from its critical use of the transition management approach. Lastly, it addresses theory-related outcomes of the case studies with regards to the transfer of Western policy design models to hydrocarbons-rich Arab states.

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List of Abbreviations

AC	Alternating current
ADWEA	Abu Dhabi Water and Electricity Authority
ADWEC	Abu Dhabi Water and Electricity Company
AMU	Arab Maghreb Union (*Union du Maghreb arabe*)
ANDI	*Agence nationale de développement de l'investissement* (Algerian National Agency for the Development of Investment)
APRUE	*Agence nationale pour la promotion et la rationalisation de l'utilisation de l'énergie* (Algerian National Agency for the Promotion and Rationalisation of Energy Use)
AU	African Union
bn	billion
BTU	British thermal units
CC	Combined Cycle
CDER	*Centre de développement des energies renouvelables* (Algerian public institution for research in the domain of renewable energies)
CDM	Clean Development Mechanism
CEN-SAD	Community of Sahel-Saharan States (*Communauté des Etats Sahélo-Sahariens*), alternative abbreviation: COMESSA
COMELEC	*Comité maghrébin d'électricité* (Electricity Committee of the Arab Maghreb Union)
COP	Conference of the Parties
CREDEG	*Centre de recherche et de développement de l'électricité et du gaz* (Centre for Research and Development of Electricity and Gas)
CREG	*Commission de régulation de l'électricité et du gaz* **(**Algerian Regulatory Commission of Electricity and Gas**)**
CSEM-UAE	*Centre Suisse d'Electronique et de Microtechnique* – UAE (Swiss Centre of electronics and microtechnology – UAE branch)
CSP	Concentrating Solar Power
CTF	Clean Technology Fund
DC	Direct current

DEWA	Dubai Electricity and Water Authority
Dii	Desertec Industry Initiative
DLR	*Deutsches Zentrum für Luft und Raumfahrt* (German Aerospace Center)
DNI	Direct Normal Irradiation
DRS	Départment de Renseignement et de la sécurité (Department of Intelligence and Security, Algeria)
DUN	Desertec University Network
EIA	U.S. Energy Information Administration
ENTSO-E	European Network of Transmission System Operators for Electricity
EOR	Enhanced Oil Recovery
EU	European Union
FEWA	Federal Electricity and Water Authority (United Arab Emirates)
FNC	Federal National Council (UAE parliament)
GECF	Gas Exporting Countries Forum
GCC	Gulf Cooperation Council
GW	Gigawatt
HVDC	High Voltage Direct Current
IAEREE	*Institut algérien des énergies renouvelables et de l'éfficacité énergétique* (Algerian Institute for Renewable Energy and Energy Efficiency)
IEA	International Energy Agency
IPP	Independent power producer
ISCC	Integrated solar combine cycle (power plant)
KAUST	King Abdullah University of Science and Technology
KPC	Kuwait Petroleum Corporation
LAS	League of Arab States
LEC	Levelized Electricity Costs
m	million
MEM	*Ministère de l'énergie et des mines* (Algerian Ministry of Energy and Mining)
MENA	Middle East and North Africa

MLP	Multi-Level (governance) Perspective
MW	Megawatt
NEAL	New Energy Algeria (company)
NOC	National Oil Company
OAPEC	Organisation of Arab Petroleum Exporting Countries
OECD	Organisation for Economic Co-operation and Development
ONE	*Office National d'Electricité* (National Electricity Office – Moroccan utility)
OPEC	Organisation of Petrol Exporting Countries
PV	Photovoltaic
RE	Renewable energies
RET	Renewable energy technology
SEWA	Sharjah Electricity and Water Authority
SONELGAZ	*Société nationale de l'électricité et du gaz* (Algerian Electricity Utility)
SONATRACH	*Société nationale pour la recherche, la production, le transport, la transformation, et la commercialisation des hydrocarbures* (Algerian National Society for Research, Production, Transportation, Transformation and Commercialisation of Hydrocarbons)
ST	Socio-technological
S&T	Science and Technology
SWF	Sovereign Wealth Fund
TRANSCO	Abu Dhabi Transmission & Despatch Company
TREC	Trans-Mediterranean Renewable Energy Cooperation
TWh	Terawatt hours
UAE	United Arab Emirates
UfM	Union for the Mediterranean
UNFCCC	United Nations Framework Convention on Climate Change

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Part A: Introduction, Theory, Technology and Policy Assessment

Figure 1: Map of the Arab World

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1. Introduction, research objectives and thesis structure[1]

"The recognition that oil is an energy resource limited in life span has prompted strong interest in the development of alternative sources of energy. We as oil producing countries naturally share this interest as a means of diversifying our energy sources for the day when the oil wells run dry." (Ali Ahmed Attiga, OAPEC Secretary General, quoted by Kettani & Malik, 1982)

In recent years, the search for non-fossil ways of power generation has become a global endeavour for various reasons: while climate scientists and environmentalists argue that large-scale renewable energy power production will play a key role in combating global climate change,[2] researchers in development studies stress the potential of off-grid solar energy cells in rural communities. Financial institutions have started to offer clean investment funds, and countries with a strong national engineering tradition such as the United States or Germany view renewables as a major opportunity to

[1] This thesis will number both figures and tables consecutively.

[2] Cf., among the multitude of studies, Stern (2008), UNEP (United Nations Environment Programme, 2003), or IPCC (2007b).

diversify their export portfolios. Certainly, renewables have become a profitable business in OECD,[3] and increasingly in the BRIC states (Brazil, Russia, India, and China).

However, the situation in other regions still lags behind, most notably due to insufficient investment capital and regulatory frameworks, technological underdevelopment, political instability and little capacities for fast-tracking the technology innovations needed to meet the environmental challenges of the twenty-first century. The Arab countries of the Gulf and North Africa are a perfect example of this case. Although efforts to increase the role of renewables in the region started as early as in the 1970s[4] and despite the region's high sun and significant wind potentials, the spread of renewable energies still lags behind compared to global standards. In 2009, merely 2.5% of the global investment in renewable energies of US$ 162bn (= US$ 4.05bn) were invested in the region (United Nations Environment Programme (UNEP) & Bloomberg, 2010, p. 19).

Economically, the Arab states can be divided into three groups. First, there are a sizeable number of comparatively poor and institutionally weak states that lack substantial resource income from hydrocarbon rents. These states in North Africa, the Levant, as well as in parts of the Arabian Peninsula are characterized by a lack of domestic natural resources that can fund a strong national economic development. Some states of that category, such as Morocco, Jordan, Tunisia or Lebanon have been able to lift large numbers of the domestic populations above the poverty line through industrial development, trade and successful higher education programmes.

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[3] In recent years, new investment in "clean" energy industries like wind and solar power rose sharply to a peak of US$ 173bn in 2008, with US$ 162bn in 2009 (United Nations Environment Programme & Bloomberg, 2010). Analysts expect renewable energies to be 70 per cent of the global energy market by 2030 (*AMEInfo,* 2009b).

[4] Already in 1978, the Organisation of Arab Petroleum Exporting Countries (OAPEC) launched a study on renewable energies in the region. According to that report, research on that topic started in the Arab world in universities in Sudan and Tunisia in the last 1950s and 1960s. "Arab professors struggled for years to promote solar energy despite the general indifference of the policy makers and the public. It is only when interest in solar energy emerged in the West that official interest followed in Arab countries…The different efforts resulted in many activities which are most often uncoordinated not only between Arab countries, but also between different departments in the same country" (Kettani & Malik, 1982, p. 12).

A second category is constituted by hybrid cases, such as Egypt, Syria and Bahrain. While these states possess hydrocarbon reserves and are partially still members of Arab oil governance bodies like the Organisation of Petrol Exporting Countries (OPEC) or the Organisation of Arab Petrol Exporting Countries (OAPEC) their reserves are rapidly dwindling, hydrocarbons are no longer the key source of national income and these countries have become net importers of hydrocarbons (or are on the threshold of becoming so). Yemen is a case in point: while still a net exporter of oil, it struggles to secure minimum levels of subsistence for the majority of its population, and is, moreover, characterized by growing areas of limited statehood. While the future of the other states might arguably not be as bleak as that of Yemen, the resource economic issues remain strikingly similar. Thus, in spite of fulfilling the formal criteria of oil states, a comprehensive economic assessment shows that these instead show typical features of category 1.

Third, there are those Arab states that have come to benefit from the substantial oil and gas reserves on their national territories (see Figure 2 and Figure 3).

Figure 2: World natural gas reserves by country as of January 1, 2010

Country	Reserves (trillion cubic feet)	Percent of world total
World	**6,609**	**100.0**
Top 20 Countries	**6,003**	**90.8**
Russia	1,680	25.4
Iran	1,046	15.8
Qatar	899	13.6
Turkmenistan	265	4.0
Saudi Arabia	263	4.0
United States	245	3.7
United Arab Emirates	210	3.2
Nigeria	185	2.8
Venezuela	176	2.7
Algeria	159	2.4
Iraq	112	1.7
Australia	110	1.7
China	107	1.6
Indonesia	106	1.6
Kazakhstan	85	1.3
Malaysia	83	1.3
Norway	82	1.2
Uzbekistan	65	1.0
Kuwait	63	1.0
Canada	62	0.9
Rest of World	**606**	**9.2**

Source: US Energy Information Administration, 2010, p. 57.

Figure 3: World oil reserves by country as of January 1, 2010 (bn barrels)

Country	Oil reserves	Percent of world total
Saudi Arabia	259.9	19.20
Canada	175.2	12.94
Iran	137.6	10.16
Iraq	115.0	8.50
Kuwait	101.5	7.50
Venezuela	99.4	7.34
United Arab Emirates	97.8	7.22
Russia	60.0	4.43
Libya	44.3	3.27
Nigeria	37.2	2.75
Kazakhstan	30.0	2.22
Qatar	25.4	1.88
China	20.4	1.51
United States	19.2	1.42
Brazil	12.8	0.95
Algeria	12.2	0.90
Mexico	10.4	0.77
Angola	9.5	0.70
Azerbaijan	7.0	0.52
Norway	6.7	0.49
Rest of World	72.2	5.33
World Total	1,353.7	100.00

Source: US Energy Information Administration, 2010, p. 37.

In addition to Libya and Algeria, this group of states consists of the oil states of the Persian Gulf and the Arabian Peninsula, including Iraq, Saudi-Arabia, the United Arab Emirates, Kuwait, Qatar, and Oman. These countries' hydrocarbon resources were largely discovered in the first half of the last century[5] and continue to fuel their national economic development until the present day (see Table 1).

Table 1: Resource-rich economies – GDP share of mining and other indicators (selection)

Country	Share of mining in GDP	Per capita mining (US$ million, 2001	Total mining (US$ million, 2001	Per capita GDP (000 US$, 2001	Population, 2001 (million
Iraq	0.91	0.68	16	0.8	23.3
Qatar	0.58	13.29	10.2	23	0.8
Kuwait	0.43	7.29	14.9	17	2
Oman	0.43	3.19	8.4	7.5	2.6
Algeria	0.35	0.6	19.2	1.7	31.7
Saudi Arabia	0.34	2.7	61.5	8.1	22.8
Libya	0.34	2.28	11.6	6.7	5.1
UAE	0.3	8.6	20.7	28.9	2.4
Bahrain	0.25	3.07	2	12.4	0.6

Source: Michaels, 2010, p. 57.

Looking at the resource-rich Arab states in greater detail it becomes evident that these countries fall into two sub-categories. The first sub-category is the small city states of

[5] Among the multitude of publications on the history of oil discovery and politics cf. Yergin (2003) Citino (2002) and Mejcher (1980; 1990) for detailed accounts of that period.

the Gulf region, such as Qatar, Kuwait and the United Arab Emirates (UAE). Economically, they are characterized by a large non-native work force and a high GDP-per capita-ratio (see Table 2). On the political level, these states have been most active in reforming their traditionally weak governance structures by an on-going (albeit at times symbolic) reform process. Due to the small national populations hydrocarbon rents can be generously distributed, resulting in high human development indices (Henry & Springborg, 2001, p. 2).

The second sub-category of hydrocarbons-wealthy states includes the territorial states of Iraq, Libya, Algeria and Saudi Arabia. In spite of their major oil and gas reserves, this wealth needs to be distributed between much higher numbers of nationals on a major national territory[6] making these states upper- or even lower middle-income states. These factors, as well as the at times turbulent interior dynamics of these states, have generated entirely different governance structures than in the Gulf sheikhdoms, resulting only in "medium human development" values alongside many other non-resource-rich Arab states.

Table 2: GDP per Capita (PPP) and HDI in select hydrocarbons-rich Arab states

Country	GDP per capita (PPP) in 2009 US$	Country Category (thesis)	HDI 2007	Classification
Qatar	85,600	Cat. 1	*33*	*High HDI*
Kuwait	54,300	Cat. 1	*31*	*High HDI*
UAE	37,400	Cat. 1	*35*	*High HDI*
Bahrain	33,300	Cat. 1	*39*	*High HDI*
Saudi Arabia	19,800	Cat. 2	59	Medium HDI
Libya	13,300	Cat. 2	55	Medium HDI
Algeria	6,600	Cat. 2	104	Medium HDI
Iraq	3,500	Cat. 2	Not reg.	Medium HDI

Sources: GDP per capita: CIA World Factbook (2009); Human Development Indices (HDI): Henry/Springborg (2001), p.3.[7]

As noted below in Section 3.2.1, the resource-wealthy Arab states display classical characteristics of a rentier state (Beblawi & Luciani, 1987): the social contract is mainly based on the state allocating wealth to its citizens while at the same time autocratic rulers remain the dominant force, largely unchallenged by civil society groups, if so only by conservative representatives of political Islam. Having derived most of their

[6] The migrant labour populations in these countries are significant as well, but they do not amount to such high percentages of the population due to the large national populations.
[7] The HDI includes education, literacy, and life expectancy as well as per capita income.

countries' wealth from the extraction of hydrocarbons, stakeholders in many of these countries were keen to introduce national diversification strategies in order to achieve long-term, economically sustainable growth.

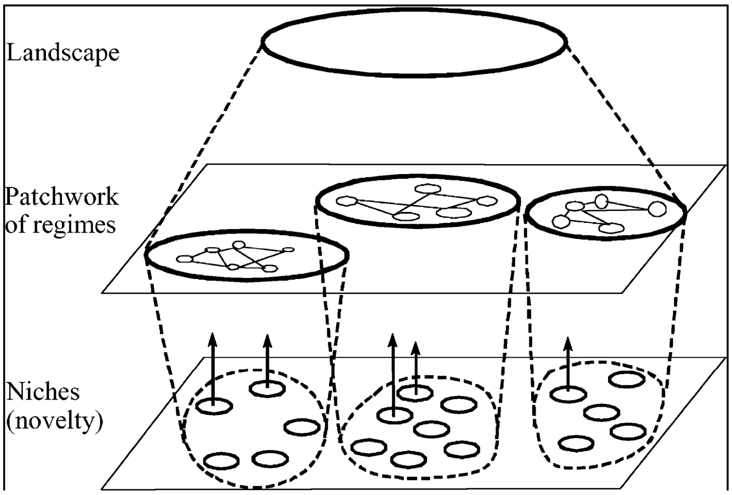
In the field of renewable energy policy, noticeable changes have occurred. In most hydrocarbons-wealthy Arab states, national renewable energy strategies have been developed. Starting from the east, Oman has expressed its interest in developing a meaningful renewable energy strategy and launched a major exploratory study in 2008. Moreover, the UAE's efforts to become a landmark in that field by launching the Masdar Initiative and hosting the International Renewable Energy Agency (IRENA) are publicly known and will be analysed below in greater detail. In North Africa, Algeria has launched significant renewable energy programmes that have, however, largely gone unnoticed in Europe. So far, however, no systemic breakthrough or a change in the domestic energy production regimes is imminent. Judged by their high potential, hydrocarbons-wealthy Arab countries still underperform in that field.

This work analyses renewable energy policies in resource-wealthy Arab states and will attempt to answer the question of why there exists such a significant renewable energy-related underperformance in this group of states. In a second step, this study examines to what extent policy design models, which have been developed in the European context, can be applicable to the governance situation in hydrocarbons-wealthy Arab states. Having chosen a case study approach, the work analyses renewable energy policy models for the United Arab Emirates and Algeria as representatives of the two types of hydrocarbons-wealthy Arab states identified above. It thus represents an attempt to close a gap in renewable energy-related research literature on the Middle East.

As will be shown in Subchapter 2.2, the standard scholarly literature on political systems or Middle Eastern studies research does not provide a comprehensive analytical framework to analyse why this significant underperformance occurred and how renewable energy transitions could be triggered. Furthermore, this literature does not significantly contribute to understanding policy and technological aspects of renewable energy policy. Instead, for reasons given below, this work turns to multi-level governance theories and the Transition Management (TM) approach to provide the core analytical tools of the thesis. Developed by authors such as Kemp, Loorbach, Geels and others, the multi-level perspective (MLP) provides the overall analytical framework for this thesis.

The MLP suggests that in order to understand technology transitions, developments need to be understood on three levels (micro-, meso- and macro-level). Interactions between these levels are represented by the image of a nested hierarchy (Figure 4).

Figure 4: Multiple levels as a nested hierarchy



Source: Geels (2002), p. 1261.

On the smallest scale, the niches are the level from which radical (or incremental) technology innovations usually emerge. Protected from standard market forces, niches can serve as “incubation rooms” for new technology developments. These niches are classically supported by subsidies or grants or are in other ways protected from the fact that the initial low performance of technology innovations makes them commercially less attractive than the standard production pathways of a given good. In terms of national energy systems, the development of alternative forms of power generation can be regarded as such a niche.

The meso-level of the MLP forms the heart of this analytical system. It is constituted by a socio-technical regime in which most regime-relevant decisions are made. It consists of social groups and actors, formal and cognitive rules of a society, as well as the material and technical elements relevant to the respective case. Typically – energy systems are no exception – ruling regimes are characterized by path dependencies and technology lock-ins as stakeholders have vested interests in the continuation of these systems and existing standards, rules and physical infrastructure favours a path dependent development that is unfavourable to radical system innovations.

The macro-level of the MLP is the socio-technical landscape forming an "exogenous environment that usually changes slowly and influences niches and regime dynamics" (Verbong & Geels, 2007, p. 1026). Landscape level developments are key variables that cannot be influenced by particular inner-systemic actors. In terms of national energy policy, such developments are regional socio-economic or political developments such as oil prices or EU regulation, but can also include more material issues such as wars or climate change.

It is important to note that MLP authors assume that the power to change system development pathways is distributed among a variety of actors. There is no single actor at any level that can successfully trigger changes on a unilateral basis.[8] However, while the regime level is by far the most dominant layer in terms of analysis of the current circumstances, most genuine systems innovations stem from the niche levels. The reason for that is that usually existing regimes are entrenched and stabilized by the rules they have given to the system themselves. The likelihood of success for the niche-based innovation, however, depends on the interplay of variables and generally favourable conditions on both the regime and landscape levels (Geels, 2002).

In terms of energy policy design, proponents of the MLP stress the vital importance of niches in order to trigger innovation. The policy design model of TM represents an attempt to foster niche-based developments and to feed their innovations back into the socio-technical regimes under which they operate. This approach is a theoretical overlap with more analytically-oriented Gulf studies literature. According to Hertog's analysis (Hertog & Luciani 2009), a similar innovation model has often been applied in practice to the Gulf States: although large parts of the Gulf bureaucracy tend to be slow and opaque, by using self-contained economic enclaves such as Masdar City or ones in

[8] See Meadowcroft (2007) for a discussion of agency question in governance systems.

the petrochemical industry sector, Gulf rulers have established "islands of efficiency" in their regimes. Those zones are characterized by insulation from political predation and rent-seeking through the special protection of the ruler; a handpicked, often expatriate leadership and special regulations that have allowed these institutions to bypass the inefficiency of the countries' administration. In place since the 1970s, these enclave-based programmes of innovative diversification have generated large revenues for these states. A key criticism expressed by Hertog, however, is that innovation is often locked in these systems and is not allowed to feed back into Gulf societies. Phrased using MLP, niche-based innovation attempts have been unsuccessful.[9]

This thesis therefore sets out to analyse why, given the abundant renewable energy resource potential and the availability of finance and (partially) technology, renewable electricity production has still not caught on in a major way in hydrocarbons-wealthy Arab states. By adopting an interdisciplinary approach informed by socio-technical governance theories, Middle Eastern studies literature and material energy policy this thesis tests how far the MLP approach can produce a valid analysis of the situation and whether TM as related policy design models can be applied to a non-OECD country, exemplified by the particular governance situation of hydrocarbons-wealthy Arab states. It is the goal of this thesis to contribute to the question of the applicability of governance theory through space in its theoretical dimension, as well as to produce renewable energy governance that is fairer and better adapted to the respective countries' needs on the normative-managerial level.

This study limits itself to the various applications of solar and wind technology for power production. Other renewable energy sources such as geothermal energy or biomass have not been included as they currently have little commercial significance or potential in the MENA region. Also, hydroelectricity is not examined in this thesis since there are few large MENA hydropower potentials already in use and no further large-scale development in the region can be expected from that means of power genera-

[9] In the area of eco-cities, this has also been the case with other projects; see for instance the Chinese eco-city of Dontan, after which Masdar City has partially been modelled, cf. Interview no. 66 – private and public investor, Gulf States, and Pentland (2011).

tion. In addition, the focus of this study is on large-scale, usually on-grid electricity systems. The spread of off-grid renewable systems is more closely connected to questions of local economic development, less so to national energy policy. The spread of these systems follows different agendas and has different methodologies and stakeholders. Consequently, these issues have only been covered insofar as they were relevant for the large-scale uptake of renewable electricity production.

As graphically represented in Figure 5, the study has the following research aims:

Part A

- To provide a summative overview of existing literature in the related fields of Middle Eastern, Gulf and renewable energy studies, as well as socio-technical transitions literature.
- To develop a multi-level framework of analysis and MLP-related policy design models for technology transitions.
- To analyse key material dimensions of renewable energy policies in hydrocarbons-rich Arab states under the MLP approach.

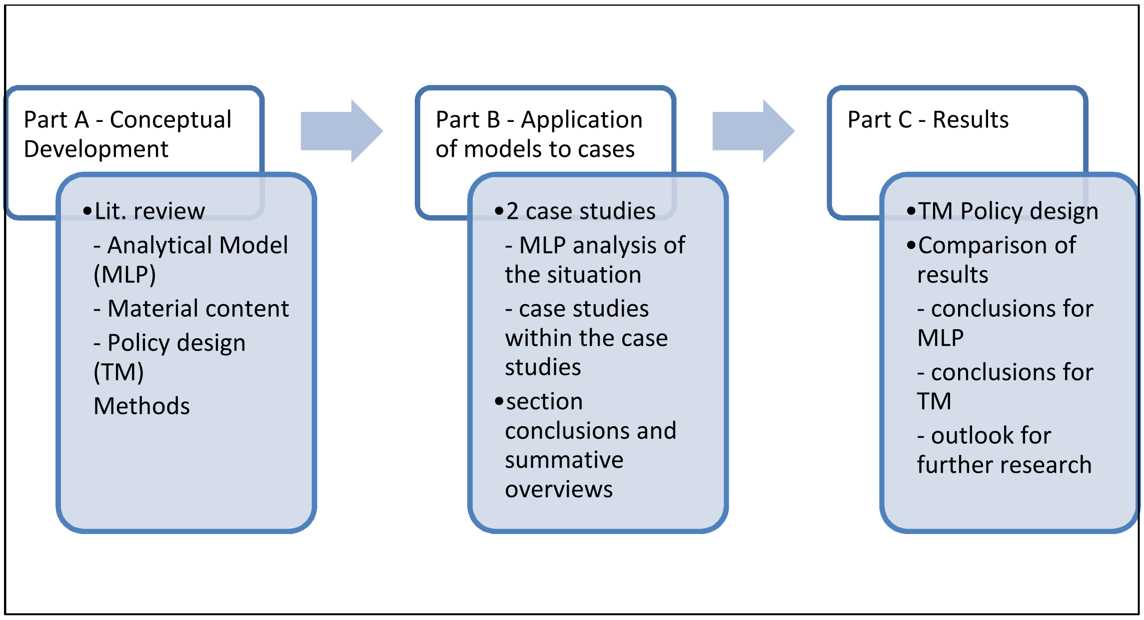
Part B

- To analyse the energy systems of Algeria and the UAE, within the MLP analytical structure.

Part C

- To test the applicability of TM to this group of countries by drafting renewable energy strategies for both case studies using these policy design models.
- To offer case-specific and general conclusions on: (i) the reasons for the slow spread of renewable energy technologies in resource-wealthy Arab states, and (ii) the applicability of Western energy governance concepts to non-Western governance structures.

Figure 5: Research aims and steps of the thesis



In greater detail, the thesis is structured as follows: Part A sets the context for the analysis of the case studies of Part B. In Chapter 2, Subchapter 2.2, the relevant literature addressed in this thesis is discussed (Middle Eastern studies literature, energy governance theories, and energy policy studies). This is followed by a more in-depth discussion of the analytical framework chosen for this study; the multi-level perspective (Subchapter 2.3), as well as the policy design tool of TM (Subchapter 2.4) that is applied to the case studies in Part B.

Chapter 3 contains an extensive introduction to the policy context for renewable energy policy in resource-rich Arab countries, through the lens of the chosen multi-level perspective. Structured by the three layers of the MLP (landscape-, regime-, and niche-level), a select number of aspects will be presented that are essential in scoping the research questionnaire. Among them are issues such as climate change and political systems, economic diversification measures and key regional organisations (landscape-factors, Subchapter 3.2), national energy markets, as well as legal and financial aspects for the uptake of renewable energy technologies (regime-level factors, Subchapter 3.3), and finally technology developments and the related topic of industry structures and technology transfer (niche-level factors, Subchapter 3.4). In Section 3.4.2, the research questionnaire for the case studies has been developed by collating the individual research questions that concluded the sections of Chapter 3.

Building on the theoretical discussions of Chapter 2 and the material policy aspects of Chapter 3, Part A's final section, Chapter 4 further develops the methodology for the thesis. Subchapter 4.1 provides a methodological rationale for the discussed aspects of the case study approach and the use of elite interviewing. Lastly, Subchapter 4.2 defines the four different groups of interviewees identified, which structured the 94 expert interviews conducted for this thesis.

After a brief introduction, Part B focuses on the United Arab Emirates (Chapter 5) and Algeria (Chapter 6), the two case studies of this thesis. This part discusses the energy policy situation with the analytical tools that have been developed in Part A of the thesis and with the same analytical categories of multi-level governance theory. Furthermore, two "case studies within the case study" will shed light on developments that are of particular importance to the energy policy situation in the respective country (Subchapter 5.7: the Masdar Initiative for the UAE case and Subchapter 6.7: Desertec and further trans-Mediterranean renewable energy schemes for the Algerian case). In order to provide a systematic overview of the respective results, each case study ends with reiterating the key analytical highlights of the respective national renewable energy system as analysed under the MLP perspective.

Having analysed the broader energy policy framework by means of the multi-level perspective, in the final section, Part C, renewable energy policy designs for the respective case studies will be drafted by means of the TM policy design model discussed in Part A. This informs the assessment of the applicability of this theoretical approach to the countries at hand, as well as generates material energy policy suggestions (Chapter 7). This is followed by a concluding discussion of the study's analytical and empirical outcomes from a comparative perspective (Chapter 8). Moreover, this chapter assesses how far the multi-level-governance approach is an appropriate analytical tool to assess energy policy in resource-rich Arab states and to what extent related policy design models can be applied to this particular governance context. The thesis ends with final conclusions and a sketch of further research areas (Chapter 9).

It is the aim of this thesis to contribute to theory building in the field of international renewable energy governance. By using the MLP in resource-rich Arab countries as an analytical tool and TM as a policy design model, this work attempts to innovate energy governance concepts and policies with regards to the named group of states. As is most evident in Part C of this work, the approach is thus always guided by a theoretically-analytical, as well as by an empirically-heuristic research interest. Focusing on only one of these two aspects would have appeared to be a non-exhaustive treatment of the topic of the thesis.

2. Literature review and development of the analytical framework

2.1. Introduction

This chapter begins with a discussion of available research literature relevant to the previously stated objectives of the thesis. Divided into three subchapters, Subchapter 2.2 will show that although Middle Eastern Studies approaches and energy policy analysis have much to contribute to the analytical and material elements of this thesis, they do not, in and of themselves, offer a comprehensive framework for the analysis of renewable energy policies in hydrocarbons-rich Arab states. As will be argued, this is most adequately captured by the multi-level governance perspective (MLP), whose function as an analytical tool for this thesis will be presented more closely in Subchapter 2.3.

Lastly, TM, a policy design model to trigger and steer innovation in national energy systems, will be discussed in Subchapter 2.4. TM will thus finalize the analysis conducted with MLP.

2.2. Renewable energy policy in hydrocarbons-rich Arab countries: relevant research literature

This work begins by addressing the conceptual framework informing the study. By establishing interlinkages between regional studies, transition studies literature, as well as renewable energy policy analysis; this study aims to contribute to the three following overlapping research strands in an interdisciplinary approach:

First, by the regional focus this study takes, it is located in the broader area of Middle Eastern studies[10] attempting to further knowledge about the region, its systems of

[10] The most appropriate term to use for the study of culture, religion and societies between Morocco and Iran is debatable. In this thesis, the term "Middle Eastern studies" used to describe the entire field of related regional studies; the terms "North African" or "Gulf Studies" will be used to describe research specific to the respective subregion.

innovation and political economy. As will be shown in Section 2.2.1, this literature strand does not offer specific contributions to renewable energy in a sufficient quantity and quality to exclusively utilize its conceptual approaches. It is, however, instructive to analyse the general setting of Middle Eastern societies, and their political systems – landscape level factors according to the MLP analysis – and is thus relevant for this thesis.

Second, in its attempt to understand and – to a certain extent – contribute materially to questions of renewable energy policy design this thesis discusses the more technical aspects of energy policy regarding the region. However, as will be highlighted in Section 2.2.2, the scholarly character of policy-related renewable energy publications is, by and large, poor. Mostly, such studies are the result of consultancies funded by various national, regional or international organizations with a stake in the matter. While these studies offer the most recent updates on the topic at hand, their theoretical level and analytical content is usually poor and thus, although are invaluable sources of data, their explanatory value is low and their impartiality questionable.

Third, the most comprehensive analytical frameworks for the interplay between technological developments, energy policy and political systems are studies broadly originating in the field of sustainability (governance) studies discussing social-technical systems and innovation theory. Although these studies considerably inform this thesis, their key limitation is a lack of application to non-Western regions, particularly the greater Middle East area, as will be made evident in Section 2.2.3.

In order for the thesis to produce a comprehensive analysis it necessarily engages with all three strands of literature that rarely interact with one another. It is in this very interaction of various strands of theory by which this thesis seeks to make its main scientific contribution as only a trans-theoretical approach can provide a multi-factorial analysis as this thesis does. The chapter will proceed by discussing the three aforementioned research strands in the same order.

2.2.1. Middle Eastern Studies literature

The first literature strand – the broader field of Middle Eastern studies – focuses on various aspects of the respective political histories and current realities of the states at hand, including regional dynamics and the socio-economic problems these states face. An increasingly important and growing part of this research is concerned with economic (Hakimian & Moshaver, 2000) or regional security issues (Spencer, 2009). In the case of Algeria, one of the two countries analysed in this work, many publications deal with Algeria's past and the phase of civil strife in the 1990s ("The lost decade/*Les années noires*"), as well as with the attempts to stabilize the country in the post-war era (Tlemçani, 2008; Bouatta, 2009); see Ghettas (2010) for a most recent assessment of the Algerian political system and Sonatrach corruption scandal. Here, a particular focus is placed on civil and military elite research (Werenfels, 2007; Cook, 2007); other authors, like Algeria's eminent historian Mahieddine Djender (2006), however, focus on the traditional areas of historical research, particularly the political history of Algeria and its leadership. In the case of the Gulf, the questions of inter-regional cohesions, the on-going territorial disputes with Iran and the security dynamics on the Arabian Peninsula are well covered by the extant literature (Davidson, 2008, 2009; Coates Ulrichsen, 2009; Hvidt, 2009; Krane, 2009). A further sub-trend of this literature emphasises resource economics, the (re)distribution of wealth in oil-rich states and investment strategies for re-investing the income generated through sovereign wealth funds and other investment vehicles (Behrendt, 2008; Saif, 2009). While there is comparatively little written about this issue in North African oil states such as Libya and Algeria, a large amount of literature has been produced about the situation in the Gulf States. These studies, therefore, do not have as their main focus energy policy, which only attracts researchers' attraction when it interlinks with a nations' broader policy or economic system. Instead, they take energy policy results such as hydrocarbon export revenues as a socio-economic variable for the political system as a whole and attempt to gauge its role for the broader policy agenda.

Furthermore, if this literature strand discusses energy (policy), the focus is usually on fossil fuels. The Masdar phenomenon aside, renewable energies are rarely taken into account. Yergin's works are a case in point (Yergin, 2003): his narration of the history of the modern Middle East focuses on the story of oil, its discovery and economic impacts. Very little attention is given to other factors shaping the region's history and current politics, such as religion, Arab nationalist and anticolonial ideologies, the Palestine issue, among others.[11] In conclusion, while it is evident that this strand of broader Middle Eastern studies literature is key in highlighting long-term regional (MLP: "landscape level") trends and needs to be taken into account to obtain a complete picture of Middle Eastern affairs, the literature's insufficient focus on renewable energies prevents it from being the sole theoretical background for this thesis.

In order to conceptually capture the knowledge gained through Middle East studies research, theoretical considerations and regional categorisations generally play a major role. While game theoretical approaches such as Putnam's (1988) and the application of his thought to the Algerian-Moroccan context by Boukhars (2001) are very instructive for the analysis of international climate negotiations, they are of only limited relevance to this thesis, as arguably the most decisive (renewable) energy policy decisions are taken at national policy regime levels. An influential approach for this thesis, however, is Henry's & Springborg's (2001) conceptual division of Arab states into "praetorian republics", "bunker states" and "globalizing monarchies". These categories capture the analytical approach of this thesis with its diagnosis that Middle Eastern countries are divided between the economically well-to-do Gulf monarchies whose rulers have gained legitimization by the sheikhdoms' economic success and the economically underperforming North African "republics", formal democracies devoid of any form of true mass participation and generally held together by an authoritarian security regime. This is not to say that Gulf states have unchallenged, smoothly running governance systems; however, the current rulers of these states seem to be more capable of long-term economically successful planning than their North African counterparts.[12] Two researchers who follow similar research agendas are Cook (2007) in his

[11] While his latest work also discusses alternatives to oil as the key source of global energy, he continues to present the Middle Eastern context as strongly oil and gas dominated (Yergin, 2011).
[12] For a further discussion of this concept see Section 3.2.1.

book “Ruling but not governing” and Salamé’s edited volume (1994). Cook’s analysis of the power structures within Middle Eastern societies, which are dominated by a politically active military apparatus, is instrumental to understanding the Algerian situation. Meanwhile, Hermassi (1994), in Salamé’s volume, defines the concept of “authoritarian liberalism” as an outcome of the mixture of the military-political elites and the business world.

This leads to the key question of rentier state theory, namely if there is a link between the prevalent governance structures and oil/gas as the predominant factor of national income. In this research area, the classical volume by Beblawi/Luciani (1987) still sets the standards for socio-economic analysis within this framework. While various works honed this theoretical system in terms of state-non-state actor interaction, the effect of (lacking) taxation on regime survival (Moore, 2002; Smith, 2004) is arguably still contested. While some remain critical, Davidson, Krane and others affirm the link between the two using Davidson’s term “ruling bargain”. Meanwhile, Waterbury, in Salamé’s volume, disputes the prevalent notion of “no representation without taxation”, arguing that “neither historically nor in the twentieth century is there much evidence that taxation has evoked demands that governments account for their use of monies...there has been no translation of tax burden into pressures for democracy” (Waterbury, 1994, p. 29). While the debate about this suggested causal nexus itself is of only secondary interest to this study, this assumption should not be underestimated. As will be discussed in Section 3.2.1, providing citizens with abundant and heavily subsidized electricity thereby meeting their citizens’ expectations is regarded by many scholars as one key barrier to the spread of renewable energy capacities in the region. Krane, for instance, argues that electricity prices reflecting the actual power generation costs, let alone wholly unsubsidized market prices would essentially be a form of government taxation, diametrically opposed to the key “ruling bargain” of the rentier states and thus politically untenable (Krane, 2010a).[13]

[13] A recent publication on Algerian energy policy confirms the sensitivity of this issue for the Algerian context as well (Cross-border information, 2011, p. 16).

Thus, while the link between participatory structures and increased taxation is not yet a generally accepted assumption, the uneasiness with which political rulers address energy pricing has been confirmed by the author's research interviews and review of energy studies literature. It is integrated into the analysis below as one of the reasons of renewable energy-related underperformance in the target countries.[14] Furthermore, Hertog's work on Saudi Arabia (Hertog, 2008, 2010a, 2010b) and his paper on sustainability issues in the Gulf (Hertog & Luciani, 2009) can also be positioned within the broader framework of rentier state theory, to which he introduces the "islands of efficiency" concept to describe the phenomenon of innovation lock-in in Gulf States. While not addressed to the region, there is a parallel here with the geographer Timothy O'Riordan's argument that innovation can become the "handmaiden of control of the elites" instead of the force of wealth-production and social renewal (O'Riordan, 1981).

In addition to the rentier theory-related publications, another influential strand of political science literature exploring the linkages between many countries' resource wealth and violent conflict, weak governance standards, and poor or negative economic growth (Rosser, 2006; Omeje, 2008) is resource curse theory. Although this work has not focused on the oil and gas-wealthy Arab states, its brief consideration seems warranted here as resource curse literature comes to a very different set of conclusions (Al-Batrani, 2005; Basedau & Lacher, 2006). Algeria can serve as a case for resource curse theory, as the negative effects of hydrocarbon wealth on governance structures and the entire political economy of a country, the main tenet of resource curse theory, is palpable. Shabafrouz (2010), for instance analyses the outbreak of violence in Algeria by attempting to establish a context-sensitive matrix within the resource curse framework. Her goal is to refine the methodological toolbox resource-based violence research by being able to take into account other non-economic factors, such as political movements and ideology. This commendable publication, however, is too focused on the resource curse paradigm and fails to take historical reasons sufficiently into ac-

[14] See also the paper by Patlitzianas et al. (2006) which has a similar analysis of the situation.

count. Approaches such as the mentioned Henry/Springborg model fittingly capture the current situation ("bunker state"). The authors also integrate the historical dimension in their model stating "while tracing the connections between Algeria's oil wealth and its slide into the disasters of 1990s, [I] will argue that the original sin was a primitive form of French colonialism, not hydrocarbons" (Henry, 2004).

Integrating Henry/Springborg's model, this thesis will use a rentier theory approach for its further analysis of the landscape-level situation as the combination of these two approaches has greater explanatory value for the analysis of Middle Eastern energy systems than the resource curse theory can offer. However, since this literature strand neither sufficiently discusses (OAPEC) renewable energy politics nor is a strong contributor to concepts of sustainability steering approaches, two further literature strands need to be taken into consideration as well.

2.2.2. Energy Studies

The second research strand to be considered relates to the field of energy studies. Much research has been conducted in this area, with particular attention being given to renewable energies in the past two decades. Inspired by the rapid deployment of renewable energy power generation in some European states such as Spain and Germany, many publications discuss the most effective legal, financial, and technological instruments to promote renewable electricity production. To some extent outside the classical fora of academic literature, a plethora of scientific studies, government papers and non-academic research examines aspects of grid systems, renewable energy finance, technology assessments, the question of systemic competition between fossil-based, nuclear and renewable energy carriers and the economics of RE-based power generation. Generally, this strand of literature varies in its comprehensiveness, quality and (energy-) political bias. However, it is highly relevant to this thesis since it provides the most specialized and up-to-date information.

Although the majority of these works deal with political, economic and technological issues within developed western-style democracies, many of the results these studies yield – especially on the technological side – can also be used for the OAPEC context. Examples of these Euro-American studies are UCTE's (Union for the Co-ordination of Transmission of Electricity) report on European grids and transmission systems (2008) or a recent study on clean energy in the G20 states (Pew Charitable Trusts, 2010) which outlines current challenges for the world's most advanced renewable electricity markets. Moreover, various studies on Germany and Spain, the two leading European nations in terms of renewable energy production (Reiche, 2004; Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2009), as well as on governance and security aspects of renewable energies (Tänzler, 2007; German Advisory Council on Global Change, 2007) present the world's best performers, assess their technology, and analyse the regulatory decisions taken (Butler & Neuhoff, 2004; DENA, 2007; Lecoufle, 2009). Most studies conducted from a financial background discussing risks and opportunities of large- and small-scale renewable energy investments (KfW Entwicklungsbank, 2005; Deutsche Bank, 2008) and Bloomberg/UNEP's most recent renewable energy report (United Nations Environment Programme (UNEP) & Bloomberg, 2010) belong to this category. A financial perspective that is more focused on the Middle East region has been published by the European Investment Bank (2010). This study critically highlights the strong gap between political renewable energy announcements and actual funding and will be discussed in greater detail in Subchapter 6.7.

In the renewable energy field, Mason and Mor (2009) provide a comprehensive selection of conference papers on Middle Eastern renewable energy issues; also Mason and Kumetat's edition of papers on energy policy in North Africa shed light on several relevant details of the issue (Mason & Kumetat, 2011). Apart from the large compendia of oil companies and international organizations (OPEC Secretariat, 2006; ExxonMobil, 2007; REN21, 2010; US Energy Information Administration, 2010; International Energy Agency, 2011), OME's Mediterranean Energy Perspectives serve as an in-depth source of energy (policy) data on Algeria (Observatiore Méditterranéen de l'Energie (OME), 2008). Alnaser and Alnaser's work (2009), and two recent German studies on MENA energy systems (Supersberger et al., 2009; Fritsche, Schmidt, & Loy, 2008) contribute further details to the analysis.

Among the number of publications that directly focus on energy policy in the Middle East, two research trends can be identified revealing a research agenda that is slightly different from that of this study. First, much of the Middle East-focused energy literature [e.g. (United Nations Environment Programme (UNEP) & Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2007)] is situated in the context of local area studies and development, discussing questions of rural electrification, solar cooking, or solar thermal water heating in the comparatively poorer, resource-lacking Arab states. Although a relevant topic for the development debate, many of the subsequent recommendations are not useful when addressing the entirely different situation in resource-wealthy Arab states thereby leaving the question of large-scale power production policy unanswered. Also, publications focusing on capacity building and regulatory effectiveness of electricity regulators in developing countries, such as the works by Cubbin & Stern (2006) are informative studies that contribute to the wider landscape of energy policy research, but again are only minor sources of information for this thesis.

The group of MENA-oriented publications that essentially deal with problems of energy policy relevant to the group of states this thesis focuses on are, however, mostly concerned with carbon-based energy carriers – an unsurprising phenomenon given the fact that hydrocarbons-rich Arab states generate substantial shares of their national incomes by immediate oil/gas rents or revenues from carbon-related products.[15] This often rather technical research strand discusses implications of oil price rises for their economies, as well as how to reach higher levels of the oil-products production chain within the country in addition to questions relating to oil field depletion (Fattouh, 2007, Kazim, 2007; Höök, Hirsch, & Alekett, 2009) thus implicitly addressing the issue of peak oil (Sorrell, Speirs, Bentley, Brandt, & Miller, 2009) and energy security more broadly. It is worth noting that in this field of technology-oriented publications, Arab

[15] See Section 3.2.4 for a broader discussion of these issues.

researchers are the most vocal compared to the other areas discussed. The case can be made that local researchers have decided to focus on scientific areas with comparatively little political exposure. This hypothesis could also help understand why, with the exception of researchers such as Entelis (1999), only a few international (and even fewer local) researchers have chosen or were able to penetrate governance structures in the carbon-based parastatals such as Algeria's SONATRACH (*Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures*), SONELGAZ *(Socièté Nationale de l'Electricité et du Gaz*), Kuwait's KPC (Tétreault, 1995) or Abu Dhabi's ADNOC (Abu Dhabi National Oil Company). Somewhat notable exceptions are the works of Rebah (2006) giving the most recent history of this company and Marcel & Mitchell (2006). Rebah's work, however, is not a critical appraisal of SONATRACH's policy over the past decades but rather an official history of the company since its foundation in 1963.

In the broader field of Algerian energy policy, many publications focus more strongly on conventional forms of energy production (Mattes, 2007) or energy security (Witton, 2010). There is, however, a noteworthy number of renewable energy-related works on Algeria, such as Himri et al.'s energy potential assessments (Himri, Himri, & Boudghene Stambouli, 2009), Boudeghene Stambouli/Khiat's paper on energy pluralism on the national Algerian level (Khiat, Flazi, & Stambouli, 2007), Fekraoui's paper on geothermal sources (Fekraoui, 1988) or a more general renewable energy review papers (Himri, Malik, Boudghene Stambouli, Himri, & Draoui, 2009). Also, the more technical papers on the effects of sand storms on the solar panels – a product of local research from as early as 2000 – are noteworthy. From the international angle, a British-Spanish paper by Ghilès (2009) argues that the current Algerian energy policy situation is by no means a viable way forward and ought to be changed instantly, also in the interest of Europe's energy security agenda. Further, the German Chamber of Commerce and Industry in Algiers has recently produced a comprehensive renewable energy industry/business assessment for that country (2009), and a similar, although more analytical and policy-relevant publication has been produced by Marks et al. (Cross-border information, 2011). The afore-mentioned publications, however, generally cater to international industry needs and, while useful for the gathering of up-to-date information, are weak from a research point of view.

Finally, a large variety of further studies on renewable energies-based desalination have been produced by Algerian researchers (cf. Mahmoudi, Abdellah, & Ghaffour, 2009 or Bouchekima, 2002). These do not focus on power production in the narrower sense, but since water desalination is a highly energy intensive process and desalination will be increasingly extended in the entire MENA region, this is a key side-aspect of the work and can help in devising solutions that make relevant contributions for future OAPEC energy policies.

Meanwhile, the studies conducted by the German Aerospace Center (DLR) on the export potentials of renewable energy and concepts of energy innovation, particularly from the Maghreb to the EU, have been instrumental to this research (German Aerospace Center (DLR), 2005; 2006a; 2006b; 2009). In addition to that, the publications by the Euro-Mediterranean Energy Market Integration Project (MED-EMIP) (2010b), Ernst & Young & Fraunhofer Institute (2011), as well as an Algerian-German research project on export potentials from Algeria to the EU (Supersberger, Abedou, Brand, Ferfera, Kumetat, & Hammouda, 2010) demonstrate the growing international interest in that field. This is also reflected by a small but growing number of related products of British academia such as the paper by O'Brien et al. (2007) and two recent Master's theses (Hamiane, 2009; Reinisch, 2009). O'Brien et al. analyse Abu Dhabi's environmental framework and attempt to identify a newly emerging paradigm in environmental policy-making in high-income developing countries. Unfortunately, the authors focus on concepts of ecological modernization, granting only limited attention to energy policy, and not even mentioning the Masdar complex. Reinisch and Hamiane, on the other hand, present original, highly instructive, studies about Masdar city and energy in Abu Dhabi as well as barriers and potential drivers of the introduction of solar energy in Algeria.

The numbers of publications on both regions covered in this thesis (the Gulf and North Africa), however, are expected to rise in the near future since Masdar and Desertec are mega-projects, attracting both media and research attention. As shall be analysed more broadly in the corresponding Subchapter 6.7, numerous research studies have been published about Desertec and transcontinental power networks between Europe and North Africa in the last 18 months (Kemfert & Schill, 2009; Schinke & Klawitter, 2010; Werenfels & Westphal, 2010). While many papers add little value for experts, more weight is carried by studies on the framework conditions of solar thermal energy in MENA (Abdel Gelil, 2007), investment risk assessments (Kurokawa, 2006) or attempts to draft road maps (PriceWaterhouseCoopers & Potsdam Institute, 2010). Also, Pfluger et al. (2009) reported important results on the impact of North African electricity imports on the Italian power markets and Trieb's et al. global CSP assessment (2009) and their studies on CSP import corridors from the MENA region (German Aerospace Center (DLR), 2009) belong to a more innovative category. Again, taking a closer look at these studies, it is striking that apart from Werenfels & Westphal (2010), very few address conceptual questions of energy governance and problems of triggering, steering or managing innovation as discussed in Section 2.2.3 of this chapter.

The fact that landscape and regime-level energy policy situation in the Gulf States strongly resembles those in Algeria is also reflected in the research literature: again, most studies focus on fossil fuels, where a strong interest in natural gas markets and policy can be identified (Dargin, 2008). A related issue in Gulf energy politics are the frequent power cuts and undersupplies. Unfortunately, the demand issues are rarely treated systematically through open-access publications. Instead, they are often merely mentioned by journalistic articles (Hariharan, 2009; Naylor, 2009) or in pieces focussing on energy efficiency, such as two recent Gulf energy policy papers by Krane (2010a, b) or a major Japanese energy efficiency study focusing on Saudi Arabia (Japan International Cooperation Agency, 2009).

Also, it is primarily the Gulf region, where issues of regional cooperation through the newly created GCC grid are discussed (*BusinessIntelligence Middle East,* 2009b; Al-Asaad, Al-Mohaisen, & Sud, 2007), and the same is true for the other key alternative energy option MENA stakeholders take an interest in: nuclear energy. A study by the International Institute for Strategic Studies (2008) analysing nuclear programmes and proliferation potentials in all Middle Eastern states can be regarded as a key publication in the field of nuclear energy and strategic studies. Regarding the nuclear power sector, Jewell's two papers instructively assess the nuclear energy aspiration of Arab states from a historical perspective (Jewell, 2011a, b) Moreover, the study lead by Schneider (2009) provides a relevant data source for the worldwide nuclear energy industry, while a recent Citibank analysis casts its doubts on the economics of nuclear energy developments (Atherton, 2009) that are also of more general value for the North African and Gulf states' nuclear energy aspirations. As mentioned, Abu Dhabi also has a published nuclear energy strategy (Government of the United Arab Emirates, 2006).

Unsurprisingly, the Masdar complex takes the prime position regarding renewable energy developments on the Arabian Peninsula. This initiative is the subject of several recently published research articles (Reiche, 2010a, b). While Reiche's brief article on Masdar does not add much new information to the debate and by and large reproduces well-known facts, in his most recent paper, he analyses the (limited) possibilities of renewable energy policy in the GCC rentier states in the larger framework of "ecological modernization". Unfortunately, however, the author remains strongly in the field of climate policy[16] and gathers most of his data from international governance indices without obtaining too many energy-specific regional data. Regrettably, Masdar's planners themselves have not published any conceptual work exceeding the level of advertisement brochures. Also the recent postponement of the project completion was only announced through the media and with little information given (*BusinessMaktoob.com,* 2010).

Focusing on the Gulf region, there are hardly any renewable energy studies exclusively focusing on Abu Dhabi and the UAE. In Supersberger/Tänzler's study (2009), a large

[16] For instructive works on OAPEC's role in international climate governance see Luomi (2010) and Barnett (2008). The quickly growing amount of climate change literature often treats renewable energy policy only as a subordinate problem. However, an instructive risk assessment of electricity infrastructures in the face of climate change can be found in Paskal (2009). The related question of Arab sustainability concepts have unfortunately rarely been treated outside the realm of Islamic studies and the concept of "biah" (environment). Yousri (2005) has presented a contribution on Muslim concepts of sustainability that is unfortunately below academic par. Although not focusing on a region, Evans et al. (2009) work in which he attempts to identify sustainability indicators for renewable energies is most enlightening.

section can be found about principles of UAE energy policy in a comparative perspective with Iran and Algeria. This study also contributes strongly – albeit also on a non-academic level – to the inter-OAPEC comparison of energy policy. Apart from that, Alnaser & Alnaser (2009) and Woertz (2008) cover the Emirates in their overview papers, while Raouf's works on climate change threats and water issues (Raouf, 2009, 2008) slightly overlap with the genuine energy policy debate. One of the few more detailed pieces of renewable energy multi-level governance research is al-Saleh's (2010) UK doctoral thesis, which only covers Saudi Arabia. Also, his scenario approach employing the Delphi method of reiterating rounds of expert interviews does not add too much value to the renewable energy policy research carried out here. This also holds true for Supersberger's doctoral thesis (Supersberger, 2007), in which the author conducted an energy systems analysis with a suggested energy diversification scenario in Iran.

As has been shown in this section, the renewable energy literature focusing on the Middle East presents itself as a rich research landscape. It represents the key source for this thesis for up-to-date technical data and policy information on the subject matter, information that is usually too specific to be found in the classical Middle Eastern Studies literature. However, the key problem remains: while the studies presented here offer invaluable data about the energy (policy) situation in the countries analysed, they usually exclusively focus on technical, economic or engineering aspects of renewable energy; only a few have a precise policy focus, and even fewer interact with socio-technical steering literature or broader social science theory. Additionally, those studies are usually weak on the political system analysis front, which is essential to understanding systems of governance in the Gulf and in Algeria. Thus, a third group of publications that focuses exclusively on these aspects needs to be taken into account in order to fill this gap identified in the previous two sections.

2.2.3. Governance theories and concepts of socio-technical change

This third research strand is largely unrelated to regional studies, but is instead driven by a focus on theories of socio-technological change and related problems of innovation, the development of policy processes and agency in a more general sense. This section is divided into a brief discussion of literature informing the conceptual research agenda and those regarding more substantive energy policy questions.

On the analytical side, many publications begin with the very basic question of how systemic change can be analysed and whether social systems can indeed be steered into certain trajectories. Most authors of this research strand agree that the positivist-rationalist notion that whole societies can be steered by any type of supreme, quasi-omniscient institution or actor is obsolete and that new analytical models need to be found. This is taken into account most thoroughly by works of Albert, Kiel and Wimmer (Albert, 1995; Kiel & Elliott, 1996; Wimmer & Kössler, 2006). While the works of the first two innovatively explore the interrelations between chaos theory and social change, the latter has collected a broader range of theories of change in his edition. On a slightly different level, Voß et al. (2007) deal with the general problem of uncertainty within steering theory in sustainability transitions. In their paper, they develop governance designs that try to tackle the three problem dimensions of uncertainty, goals ambivalence and distributed power by introducing a matrix of steering situations. This matrix facilitates decision-makers and analysts to find a matching steering theory for different problem sets. This system, which has been developed further in Voß' doctoral dissertation (2007), combines the methodological and theoretical problems of steering theory while at the same time contributing to actual decision-making processes.

However, since Voß does not have a regional focus, his work lacks a dimension that forms a central part of the conceptual innovation of this study: the question of the transferability of governance concepts to other world regions. This touches upon the fundamental problem of whether a concept of any kind – as long as it subscribes to the principles of Aristotelian logic[17] – inherently contains cultural biases or whether scientifically founded theories can indeed claim global validity. In the globalized world of the 21st century, it can be argued, this issue is more relevant than ever as it touches the core of multinational governance concepts and cultural relativity.

[17] Even the concept of Aristotelian logic can by no means be accepted as universal; the Indian and the Chinese systems of formal logic suggest solutions of logical problems that differ substantially from the Greek model, cf. Matilal et al. (1998) or Mou (2001).

By applying TM to Middle Eastern governance contexts, this thesis aims to contribute to this discussion. The question of the transferability of governance concepts has been explored in depth by the works of Risse et al. The authors convincingly argue that many recent governance concepts have been conceived with the implicit assumption of a democratic, high-income country as standard model for their work. This is an issue as states “located outside the OECD world…differ structurally from modern Western nation-states with regard to cultural and religious aspects as well as concerning configurations of actors and modes of action” (Risse, 2007). Although the named authors focus on areas of limited statehood and not on hydrocarbons-wealthy Arab states; this quote serves as a guideline for the conceptual research of this thesis. Meanwhile, Benecke et al. (2008), other authors from the same Berlin-based research cluster, attempt to identify governance concepts that transcend their “methodological nationalism”. Magen et al. (2009), who are also part of the same research cluster, illustrate their point by analysing the phenomenon of American and European efforts of “democracy promotion”. However, these studies have only few contributions relating to the Middle East, which do not focus on the field of energy governance or socio-technical steering theory. However, what remains relevant is their concept of “governance spaces”. Following Benecke et al.’s argument, governance spaces can be regarded as collective terms for a multitude of contextual factors, laws, ethics, power constellations and discourses which if taken together, shape the framework conditions in a certain field of governance (Benecke et al., 2008, p. 23). This concept, which is very similar to the MLP analytical model to be discussed further below, attempts to give analytical structure to an amorphous and in many ways inconsistent field. However, while the approach “governance space” appears compelling, it does not offer such a large and comprehensive system of analysis as the MLP model offers. It is for this reason the MLP model was selected for the purpose of this thesis.

Moreover, the authors stress that the discipline of social sciences has experienced a spatial turn in recent years. This notion takes into account that space – here: the national energy system – as a “governance space” is not a “neutral container” (Benecke et al., 2008, p. 15), which can be filled with any arbitrary (governance) content and still be expected to perform well. While a spatial turn-inspired researcher would naturally refute this notion, it is much harder to characterise what could in fact fill this gap. This thesis regards itself as part of research in the wake of the “spatial turn”. Yet, while the applicability of governance concepts to world regions, in principle, is frequently discussed, there is very limited material tackling this question from the point of view of a sustainability transitions policy in the governance context of Middle Eastern states – let alone an even more restricted sub-field (hydrocarbons-wealthy states) within this spectrum. The only instrumental regional studies with a similar research agenda can be found in research exploring sustainability transitions in Asia (Berkhout, Angel, & Wieczorek, 2009; Angel & Rock, 2009), where governance structures are somewhat comparable those in resource-rich Arab states. These authors maintain that in many Asian states, environmental standards had been initially induced by the states consuming Asian export articles and argue that this might be a potential way to trigger more comprehensive socio-technical changes. Unfortunately, this aspect cannot be adapted for the states analysed here given that this has no or little meaning for their fossil export products.

In terms of socio-technical steering theory for (renewable) energy technology and policy for the material conclusions of the thesis, various meta-studies on overcoming innovation barriers have been published recently, such as the publications of the IAE (Kofoed-Wiuff, Sandholt, & Marcus-Møller, 2006), the German Wuppertal Institute (Fischedick, 2010) or, most recently, the World Economic Forum (2011). While these studies follow a comprehensive approach, in-depth studies on individual aspects such as carbon lock-in (Unruh, 2000) or the role of institutional roadblocks (Myers & Kent, 2008) they identify structural deficiencies in support of investment policies. In essence, this literature is closely interlinked with research analysing the conditions for a diffusion of (regulatory or technological) innovations in socio-technical regimes. The large body of work on history and present validity of technology transitions by researchers such as Geels (2002, 2004) and Loorbach (2007) have set ground-breaking marks for transition research under a multi-level governance perspective.[18] While Kemp et al. (1998) focuses on the development of niche-based innovation strategies, others have explored the historical dimensions (Geels, 2005; Verbong & Geels, 2007; Schot, 2010) of socio-technological transitions or have examined announced technological developments predictions that have eventually never materialized (Geels & Smit, 2000).

Furthermore, Smith and Stirling (Smith, 2007; Smith & Stirling, 2007) and particularly van Bergh and Bruinsma (2008) have applied TM to renewable energy policies. The authors of both works, however, are very much focused on Europe and the UK, much like Kemp, Loorbach, Smith and Kern (Kemp, Loorbach, & Rotmans, 2007; Smith & Kern, 2009) who evaluate the experiences of TM in the Dutch energy system.[19] Although the energy policy situation in the Netherlands differs substantially from the policy context of the case study examples discussed here, the general theory strand remains relevant to this thesis. Its multi-level governance perspective combined with evolutionary innovation theory elements lends itself to the thesis as it offers the most comprehensive and systematic perspective on governing socio-technical transitions. Both the multi-level-perspective and the transition management approach will be dis cussed in the following two subchapters. In addition to an in-depth presentation of these tools, the discussion of possible limitations of these models as well as on the applicability of these models (especially TM) to Middle Eastern policy contexts will be emphasised.

To conclude Subchapter 2.2, three strands of literature that are instrumental for this thesis have been identified:

- Middle Eastern studies literature as a regional focus
- (renewable) energy studies and related works

[18] One of the most notable works about the entire strand of literature is the publication by Markard, Raven and Truffer (2012), who give a summative overview of sustainability oriented transitions literature and also provide a bibliographical analysis of 540 titles thereby demonstrating the impact certain researchers such as Rotmans, Smith, Kemp, Rip, Geels and Schot have had on the field.
[19] See also Kern's recent doctoral dissertation (2009).

- literature focusing on governance theories and the transferability of these concepts to other world regions

In spite of the wealth of specialized literature on various aspects of the topic, there is a lack of comprehensive research literature focusing on energy transitions within resource-rich Arab states. It has been established that while most works are strong in one of these areas, they lack depth in the other two fields, which are equally important to the research aims of this thesis.

Since the internal logic of essential sub-systems such as the political framework, rentier economy, or the market conditions for renewable energies differs substantially and needs to be understood in different categories, a multi-level perspective offers itself as the most appropriate analytical tool for this thesis. Only this can adequately analyse the complex interplay of multiple socio-technical layers within and in between the three analytical levels that seem appropriate for this thesis. However, since the MLP as analytical tool is not instrumental in policy design, TM has been chosen as an appropriate tool in order to test whether such models can effectively be used in the context of resource-wealthy Arab states.

This combination of MLP and TM has thus been selected as a suitable arrangement to satisfy the stated research aims of

- Developing a comprehensive framework for renewable energy policy system analysis in resource-rich Arab states and identifying a model of policy design of these countries (Part A)
- Applying these elements to two major states of this region by case studies with both analytical and policy design elements (Part B)
- Drawing comparative conceptual conclusions from the results of the two case studies and the test of the MLP as analytical and TM as policy design tools for this region (Part C)

In line with these aims, the following subchapters shall discuss multi-level governance theories (Subchapter 2.3) as an analytical tool and TM as policy design models (Subchapter 2.4). Then Chapter 3 – using the structure of the multi-level-perspective – will focus on the analytical categories for this thesis.

2.3. The multi-level perspective as an analytical tool

As discussed in the previous subchapter, the multi-level governance perspective can be regarded as the most appropriate analytical tool for this thesis in that it is both more comprehensive and more developed as a theory than, for instance, the "governance space" approach. The following section will first discuss the MLP in greater detail (Section 2.3.1) and will then proceed in Section 2.3.2 to apply the analytical categories to renewable energy policies in resource-rich Arab states. This categorization will structure the more in-depth MLP analysis of Chapter 3 as well as the analysis of the case studies.

2.3.1. The MLP concept

Multi-level governance theory aims to provide an analytical tool to capture socio-technical transitions. First developed by Rip and Kemp (1998), it has been described more extensively by Kemp et al. (2001) and various publications by Geels and his collaborators (Geels, 2002, 2004, 2005; Geels & Smit, 2000; Schot & Geels, 2008; Verbong & Geels, 2007; Geels & Schot, 2007).

The MLP takes into account the distributed character of power in societies by an analytical division of societal processes in separate layers and actor groups. One key assumption is that socio-technical transition processes are de-centred and "not caused by one single event or driver" (Verbong & Geels, 2007, p. 1031), a tenet that calls for a multi-dimensional, multi-causal analysis. Instead, transition processes are characterized by uncertainty, complexity and non-linearity in their outcome (Grin, 2008).

Whereas classical governance models appeared to look at the state as the key driver in such developments, MLP assumes that – although the power balance between different layers and actors might be asymmetrical – no single actor possesses the power to lastingly alter the entire system. Only an alignment of major system actors can, in a "stepwise and co-evolutionary" approach (Verbong & Geels, 2007, p. 1031), instigate regime transformation. Usually, a major regime change only occurs when this situation is accompanied by changes at the regime and landscape levels (Kemp et al., 2001, p. 277).

MLP theorists identify three layers of socio-technical change: niches (micro-), regimes (meso-) and landscapes (macro-level). These layers cannot be seen as hierarchical, but as an integrated entity facilitating or preventing systems to follow a certain development path. On each level, various decision-making bodies and persons interact, form coalitions or conflict with each other in order to achieve the common goal of their respective agency structure.

In greater detail, the *landscape-level* is the macro-level of analysis and refers to any wider, circumstantial factors that nonetheless can have major impacts on socio-technical developments in a given system. Changes in the landscape level occur only in the medium or long term. Geels uses the metaphor "landscape" in order to express the characteristic "hardness" of that layer (Geels, 2004, p. 913), which is beyond the reach of even powerful regime-level actor groups and that cannot be changed at will. With electricity systems of the hydrocarbons-rich Arab states taken as regime-level reference points, relevant examples for landscapes are a set of factors such as oil prices and macroeconomic goals of the national economies, wars and political history, overall power structures in the state in its political organisation, the dominant mode of electricity production and grid infrastructure, climate change, or commonly held social values. In addition, the wider regional policy arena can have a major implication of domestic electricity systems, as Verbong & Geels show in the case of the EU's influence on the Netherlands' energy policy (2007). This is also the case for Algeria, where currently European transcontinental renewable energy projects such as Desertec, the Mediterranean Solar Plan (MSP) or MedGrid have a major influence on the national renewable energy policy discourse. Taking a critical view at the mentioned examples of potential landscape-level factors it is striking that – as a collective – they form a very heterogeneous group with strongly diverse causal patterns and effects on the regime and niche levels. In order to present a more differentiated analysis within the landscape level, attempts have been made to classify the inter-level impact patterns. Van Driel and Schot (2005) present three patterns within the landscape level category derived from their case study on technology innovation in the port of Rotterdam (gradually changing factors such as the climate; long-term changes such as industrialisation throughout the century and rapid external shocks on the landscape level, such as oil prices or wars). In their work, Geels and Schot propose an even more differentiated model of five impact types (regular – hyperturbulence – specific shock – disruption – avalanche impact, Geels & Schot, 2007; p. 404f).

While MLP-inspired researchers tend to emphasize the importance of landscape-level developments for regime- or niche-level developments, ST landscapes often remain out of the focus of many publications. Arguably, this is due to the fact that beyond very general statements of influence (e.g. "climate change can drive renewable energy policy") it is difficult to establish concisely – let alone to quantify – a causal link between landscape and regime developments. This is in line with the notion, as Geels and Schot maintain, that landscape level developments do not "mechanically impact niches and regimes" (Geels & Schot, 2007, p. 404) but their perceived or real impact on ST transitions are translated by regime- or niche-level actors into actions on the ground. More generally, the two authors state the MLP produces "narrative explanations" (Geels & Schot, 2007, p. 414) , which rather than identifying precise variables or empirical data, provide a broader picture of specific patterns that are produced by typical forms of processes within and between the socio-technical levels. While this can undoubtedly produce relevant analyses, this fact presents a serious limitation of the MLP's analytical capability beyond a certain general level. Acknowledging this fact, however, these macro-drivers still need to be taken into account, which this thesis does on a qualitative level through interview data.

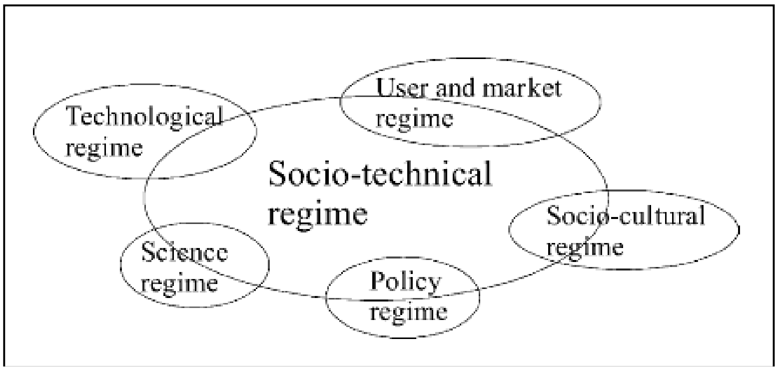
The key level of analysis of the MLP is the level of *socio-technical (ST) regimes*. ST regimes are the dominant macrostructures in which the incumbent systemic actors define rules and practices for a given system. They contain the "grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures…ways of defining problems; all of them embedded in institutions and infrastructures" (Rip & Kemp, 1998, p. 340). Socio-technical regimes thus occupy a central position in modern societies.

Following Schot and Geels (2008), the concept of a socio-technical regime has its origin in the technical regime literature of the 1980s which focused more strongly on the conditions for the development of technology trajectories within expert groups (Nelson & Winter, 1982). In the 1990s, sociologists developed this theory further by stressing the role of other societal stakeholders, such as politicians, business or civil society interests groups in the technology policy process (Bijker, 1997).

The adaptability of ST regimes to innovation varies strongly according to the openness of the incumbent regime actors. While some allow for incremental change which might eventually guarantee regime survival in the long term, others block the (mostly niche-based) radically innovative practises which might lead to their own demise in the medium term (Geels, 2004).

It is important to note that a socio-technical regime interacts with a number of different ST regimes through the mutual interconnectedness of social systems. In Figure 6, Geels lists the five major subsystems of ST regimes.

Figure 6: Actor systems in socio-technical regimes



Source: Geels (2004), p. 905.

The following elements of the regimes can be identified when applying this categorisation to renewable energy policies in resource-rich Arab states:

- Technological regime
    - Transmission and power generation infrastructure

- User and market regime
    - Regulations and policies
    - Distribution of power between relevant regime actors
    - Demand rise issues
- Socio-cultural regime
    - Consumption patterns
    - Environmental awareness
    - Potential role of religion or environmental ethics
- Policy regime
    - Regime-level and transregional governance structures
    - Existence and role of civil-society organisations (CSOs)
- Science regime
    - R & D infrastructure
    - Technology ownership
    - Technological developments

These elements will guide the regime-level analysis of Subchapter 3.3 as well as the corresponding sections of the case studies.

Moreover – a result of Luhmann's theory of social systems (Luhmann, 1987) – each sub-regime usually has its own inner-systemic logic (Luhmann: "code"), drivers, power structures according to which it operates, as well as other sub-system "memberships" at the same time. The scientific regime, for instance, works according to the code "truth", while a policy regime might operate to the code "power" and a market regime to "profit". This determines the sub-system's specific agenda within the wider ST regime. A simple example: while it might be in the financial interest of the incumbent system operator to keep its monopolistic position for as long as it can in order to generate more profit, a government might have an interest to decrease its overall power subsidies and thus hope that by introducing market competition, price competition increases and thus prices drop. At the same time, the scientific regime is interlinked with the renewable energy regime, but also with regimes of universities and religious education. The market regime defining electricity prices is, in turn, also interlinked with larger macro-economic drivers of the economy, and so on.[20]

Lastly, *socio-technical niches* are regarded as crucial by MLP researchers. As the performance and regime-level acceptance of novelties is initially low, they emerge in protected spaces to shield them from market forces, usually by means of regulatory support or financial (public or private) subsidies. This way, niches can serve as "incubation rooms" for social and/or technical innovations and can thus be the spaces in which a radical, regime-changing innovation by means of a deviation from the regime-level rules can usually be tested and honed until it is ready for mainstream deployment.

A niche can have two different functions. First, it can be system-endorsing (which most niche-level efforts are), whereby niche-level innovators attempt to resolve existing regime-level problems by technological improvements or other regime-stabilizing initiatives. Such processes are usually fully steered by the regime level and can, for instance, be technological optimization processes in the car or IT industry that, in research terms, do not leave a certain locked-in development pathway. While even those processes are not regularly accepted by the incumbent systems (cf. Roger's prominent example of the QWERTY-keyboard; Rogers, 2003), radical changes developed in niches are even less welcome. MLP research regards those "radical niches" as the places where entire systems can be changed fundamentally. It is for this reason some MLP authors have a certain predilection for niches as starting points of policy designs.[21]

The strength of the MLP is in its explanatory power which captures the systemic change on these three analytical scales as well as the interplay between them. Geels suggests the concept of "nested hierarchy" to describe this interaction (see Figure 4).

This nested character expresses the view that niches are embedded within ST regimes, which are in turn parts of macro-landscapes. As mentioned, this theoretical framework usually states that innovation is produced in the niches and, while initially developed

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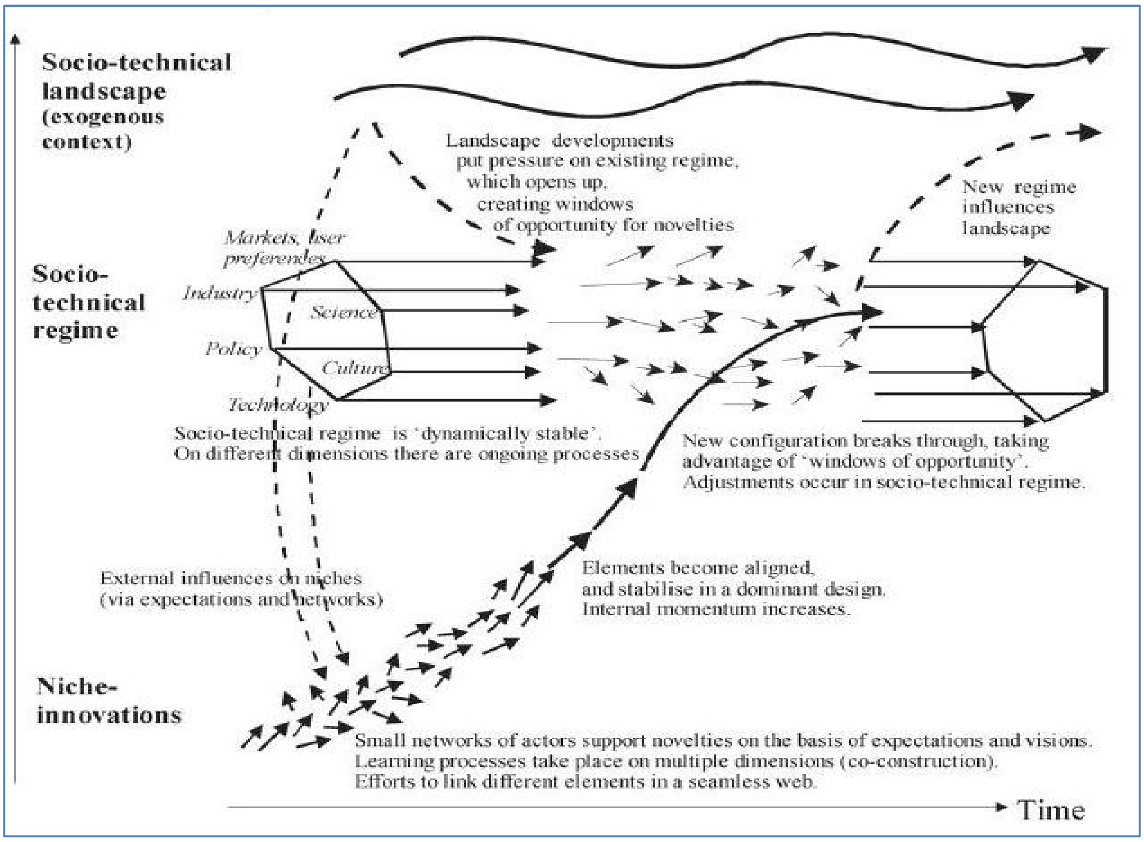
[20] This discussion follows Meadowcroft (2007, p. 7), who also notes the proximity of the MLP with parts of Luhmann's sociological analysis.
[21] See for instance the works of Kemp et al. or Hoogeven et al. (Kemp et al., 1998; Hoogeveen et al., 2002).

for an old ST regime, can instigate change at the regime and even the landscape level. Niche-based innovation, however, cannot be expected to single-handedly alter the higher socio-technical scales. Instead, “the further success of a new technology is not only governed by processes within the niche, but also by developments at the level of the existing regime and the socio-technical landscape” (Geels, 2002, p. 1261). As discussed in Subchapter 2.2, many renewable energy studies primarily focus on regime level developments, such as renewable energy promotion policies or market barriers. However, as Verbong argues, such analyses often remain limited because they do not operate within a multi-level perspective meaning that they often do not take “deep structural trends into account” (Verbong & Geels, 2007, p. 1035). Meanwhile, the MLP offers a balanced assessment through its broad, three-level analysis of regime developments, while simultaneously stressing the strategic character of a niche. Thus, in spite of the focus on ST niches, one of the MLP’s key tenets is that beyond the niche level, the alignment of developments across the scales will reinforce or block regime shifts.

A representation of multilevel interaction is given in Figure 7[22].

[22] As Geels and Schot (2007) argue, this diagram has become somewhat of a “standardised picture” depicting the key elements of the MLP transition dynamic. As a result of the criticism highlighted below, the authors have added “downward arrows” on the left-hand side of the figure thus indicating the previously overlooked inter-relatedness of the three layers, particularly focusing on the impact of landscape level developments on the niche and regime levels.

Figure 7: A multi-level perspective on transitions

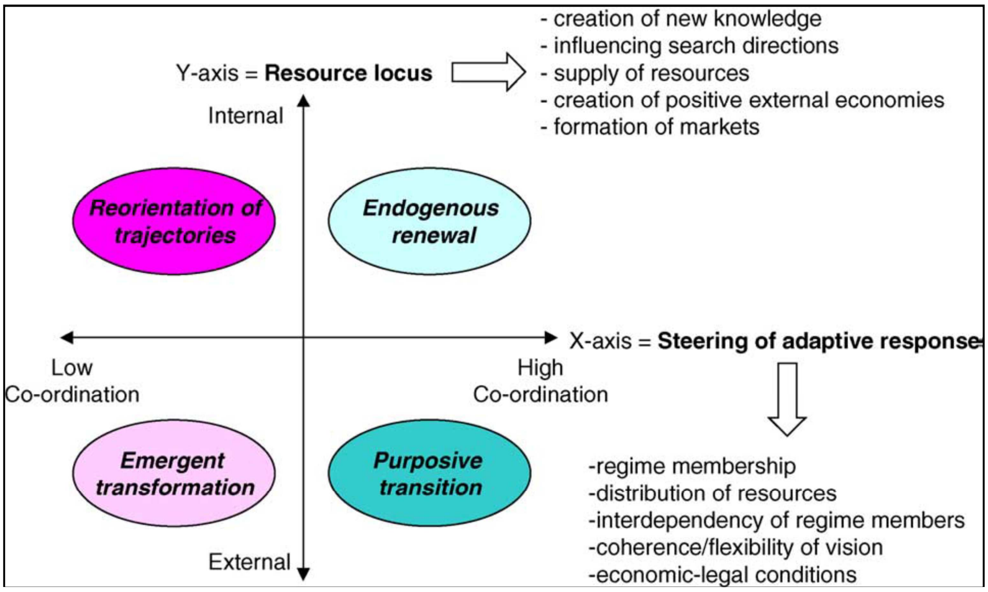


Source: Geels/Schot, 2007, p. 401.

According to the MLP analysis, socio-technical change occurs when niche-based innovation potential is met by landscape level pressures on the incumbent regimes triggering reform of the ruling regime (=niche incorporation if regime actors are sufficiently ready to adapt) or its demise. This notion has led to various systematic attempts to distinguish types of niches and regime reaction to niche-based innovation (Berkhout, Smith, & Stirling, 2004; Geels & Schot, 2007). In their paper Smith, Stirling and Berkhout (2005) develop a classification of transition contexts, which are mapped on a two-dimensional matrix (see Figure 8). This is instrumental for this work as it sets the stage for the policy design model employed, Transition Management (see the following Subchapter 2.4). While the first dimension measures the degree to which an ST innovation process is desired and actively coordinated by regime actors, the second dimension maps how far selection pressures rely on resources and are endogenous or exogenous to the regime under study. Accordingly, the authors propose four ideal types of transformation processes:

- reorientation of trajectories
- endogenous renewal
- emergent transformation
- purposive transition

Figure 8: Transition contexts as a function of the degree of coordination to selection pressures and the locus of adaptive resources



Source: Smith et al. (2005), p. 1499.

The authors maintain that TM is close to the "purposive transition" model (Smith et al., 2005, p. 1502) as it presupposes a willingness to govern – or at least influence change – on the actor level.

While this model, as presented, is a valuable analytical tool for the purpose of this thesis, researchers' criticism regarding the validity of this model as a whole needs to be taken into account. In their 2007 article, Geels and Schot identify three main points of criticism that have been highlighted in previous years.

The first point is the question of scale in its empirical application, which is located on several different levels. While in the case of electricity systems, a regime level can be defined as a national power pool; a different MLP analysis might consider other systems where national levels appear as landscapes or, vice versa, even overlook them when being applied to very large global systems. Geels and Schot rightfully admit that this could become an issue. They therefore claim that the analyst first needs to demarcate the borders of the *empirical level* of the object of analysis and then proceed to operationalize the MLP. This cannot be limited to merely one industry or technology, but should rather address – the regime level – the level of "organisational fields" to reflect its broad analytical approach. Applied to this thesis, the level of analysis is sufficiently broad and varied in order to justify such an approach, as national energy systems are neither limited in the scope of their technologies of choice nor limited to certain industries, users or models of regulation.

Another issue is the already addressed focus of the MLP on socio-technological niches as principal locations of change. As discussed in the corresponding section on the landscape level above, the authors have differentiated their previous analysis and introduced at least five attributes of change. Here, they also underline their view that (as pointed out by the alteration of their key graphic representation of Figure 7 compared to previous versions) the three MLP levels mutually interact with each other. In contrast to models such as strategic niche management that assign utmost importance to ST niches[23], they only have a relative value with Geels and Schot as they are by no means the only variables that matter in a MLP framework. To further counterbalance the notion of an overly strong focus on bottom-up developments the two authors develop a whole range of models for different transition pathways based on the timing and nature of interaction. While further differentiating cases, (e.g. between the configurations and respective "readiness for change" among the three levels that may cause slightly different outcomes in transition pathways) their overall argument, that socio-technological change is a de-centred, multi-actor process that is enabled by certain inter-scalar constellations between the MLP layers, remains the same.

Arguably, the major point of criticism, as the authors point out, is its "relative neglect of agency" (Geels & Schot, 2007, 400) leading to the argument that MLP was, in es-

[23] See the instrumental publication of Smith & Raven (2012) for a recent discussion on individual aspects of ST niches that are – contrary to their frequently stated importance in transitions literature – by and large under-researched.

sence, a functionalistic theory, which seriously damages its broad explanatory claim.[24] As the authors point out, the underlying concept of agency within MLP is a multi-dimensional one, through which agency is, in fact, "always present" (Ibid., p. 413) in the actual processes while it arguably remains under-represented on the level of figures and graphs. They claim that, according to the different transition processes, the main protagonists are regime actors, outside groups and incumbents, yet, new companies or new niche actors are by no means absent. The reason for this apparent underrepresentation of agency is that MLP models usually tend to be reproduced as highly aggregated models showing large groups of actors within superstructures evolving over long periods of time, often several decades. Zooming into these structures, there cannot be any doubt that the issue of agency is appropriately addressed within the MLP system. The complexity in such overarching, multi-level and multi-actor research, however, lies in the fact that we can expect multiple types or agency with combined with alternating causal processes (p. 415). Seeking to take this assessment into account, this thesis attempts to paint a multi-layered picture of renewable energy related phenomena in both case studies. Analysing the broader energy systems on country levels with their multitude of (at times conflicting) drivers and actors involved, this study attempts to trace causal links between agents and legal, social and economic structures on all three levels of MLP thereby preparing the ground for an integrated policy design model to develop renewable energy policies for the analysed cases. For singular cases within the larger MLP framework, other theories of agency and political power, such as advocacy coalition research[25] might be employed. Yet again, the advocacy coalition framework could not have been able to outdo the complex and comprehensive analysis that is made possible by the application of MLP. In addition to this, it should be asserted that the analytical approach selected for this thesis is essentially one that puts its primary focus on structures, rather than on actors. This does not mean that agency should not be highlighted wherever possible – indeed, the focus on

[24] Researchers' concern that transition management is essentially apolitical and lacks the dimension of power follows a similar line, cf. Section 2.4.1.
[25] See the most influential works by Sabatier & Jenkins-Smith (1993) and Sabatier (1999), as well as the research article by Schlager (1995).

individual actors and their powers will, at times, be essential in order to understand political decision-making structures. Yet, the study focuses on the systemic framework conditions, institutional arrangements and potential drivers for ST change in the field of renewable electricity rather than exclusively focusing on the individuals driving these trends.[26]

In conclusion, the multi-level perspective is a strong tool for analysing the conditions of socio-technological change. While laying a stronger focus on structures and on actor groups it is not – nor does it claim to be – an ontological description of transformation processes. Instead, it underlines its character as a hermeneutic tool to make sense of the multifacetedness and complexity of socio-technical change (Geels, 2002, p. 1259) and is thus, in its refined version, an appropriate tool to analyse renewable energy policies in resource-rich Arab states.

2.3.2. Analytical dimensions of renewable energy policy for hydrocarbons-rich Arab states

As a variety of socio-technical regimes are interlinked, the attempt to develop wide-ranging analyses for socio-technical change on multiple levels can run the danger of becoming a mere collection of individual factors without a logical interrelation or consistent argument. Consequently, a selection process has to be conducted in order to gain overall explanatory value, as it is often not self-evident where the systemic borders for MLP analysis ought to be drawn. In this thesis, the main drivers to be covered for an analysis of renewable energy policy in resource-wealthy Arab countries can be summarized as follows in Table 3:[27]

[26] This dichotomy between analyses focusing on individuals and those stressing the importance of structures is not new and cannot be easily resolved in one direction or the other. Arguably, a theory integrating elements of both descriptions can produce the best outcomes in analyses such as this one, where the analytical scope comprises millions of individuals and hundreds of potential actors and impact factors.

[27] All analytical dimensions presented here will be developed fully in Chapter 3.

Table 3: Analytical dimensions of renewable energy policy in hydrocarbons-rich Arab states structured by the multi-level perspective

Scale	Definition	Analytical focus on
Landscape Level	Long-term macro-drivers that cannot effortlessly be altered by regime-level stakeholders	- Political system - Key regional and transregional energy governance bodies - Climate change - Long-term national economic diversification - Country branding
Regime Level	Entrenched actors and dominant regulatory, financial and political systems	- *Technological regime:* transmission and power generation infrastructure - *User and market regime*: structure of national energy markets, pricing and demand issues; legal and institutional frameworks - *Socio-cultural regime*: consumption patterns, environmental awareness and potential role of religion or environmental ethics - *Policy regime*: regime-level and transregional governance structures, CSOs
Niche Level	Protected spaces with a potential for radical change in the established regimes	- *Science regime*: industry structures, R&D strategies[28] - Technological developments

Source: own compilation.

This list represents the criteria for a modified MLP model applied to the analysis of renewable energy policy in hydrocarbons-rich Arab countries. This essentially new model offers an overarching framework for the policy analysis in the described cases. Its explanatory value and comprehensiveness will be tested through its application to both cases in Part B and shall later be evaluated in Part C.

2.4. Policy design: the Transition Management approach

Although the main focus of this work is analytical, the final segment of the thesis, Part C, will discuss which renewable energy policies can be recommended for the specific energy policy situation in the case study countries analysed by the multi-level perspective approach. While the previous subchapter introduced the MLP as an analytical tool and defined the categories that are relevant for a MLP analysis of renewable energy

[28] Contrary to Geels' classification in Figure 6, this thesis treats science regime questions as niche-level phenomena. While ST niches can indeed be regulated, the niche-focused perspective of the policy design theories applied make this a more fitting classification.

policies of resource-rich Arab states, this subchapter shall discuss models of policy design interlinked with the MLP.

Section 2.4.1 will introduce TM as a comprehensive model of ST system steering that will inform later policy design sections of this thesis. It will also discuss the most prevalent critical arguments regarding this approach. The final Section 2.4.2 will then discuss under which preconditions policy design in resource-rich Arab states can be carried out using this approach.

2.4.1. Policy design with the transition management approach

Transition management is a governance model developed to formulate policies, which trigger innovation for complex socio-technical constellations in need of change. Discussed for public policy applications since the early 2000s[29], it is the objective of this approach to trigger a transition process facilitating the creation of alternative socio-technological regimes, which perform better from a general welfare point of view (Kemp et al., 2007).

Examples for situations are, for instance, global anthropogenic climate change or unsustainable transport policies. Moreover, the transition to post-fossil systems of power generation in a given country or world region can, as shown in this thesis, also be regarded as such a case.

Renewable energy policy in any society is multi-scalar and touches upon a variety of key societal sub-systems hosting actors with strong vested interests in the continuation of these sub-systems. Thus, transition processes cannot be expected to happen without major external pressure or an active policy process attempting to steer the power sector of a country into a more sustainable direction.

The TM toolbox has largely been developed by Dutch researchers (Kemp, Rotmans, Loorbach, Verbong, and Schot) and the SPRU research unit at the University of Sussex

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[29] See Rotmans et. al (2001) for one of the first explicitly TM-related discussions in the field.

(Smith, Stirling, and Berkhout)[30] in close cooperation with policy makers. Its first policy application was performed in choosing the TM method to steer transitions in the Dutch power sector.[31]

Taking the view that socio-technical steering processes are multi-scalar, complex and partially open in their outcomes, TM puts forward the concept of goal-oriented modulation combined with the idea of quasi-evolutionary selection processes of technology innovations. Its main interest is not the achievement of particular outcomes, but rather the creation of a "variation-selection-retention process" by triggering a whole bandwidth of potential technology pathways and their integration into adaptive socio-technical regimes (Kemp & Loorbach, 2006). This open-ended system is expected to yield better results than classical, hierarchically controlled and state-centred national planning policies. In misguided attempts to take the role of an omniscient *deus ex machina* (Grin, 2008), those have often produced large undesirable effects or misallocations while at the same time not integrating major stakeholders into the system.

Thus, TM is a strategy in which government stakeholders are regarded as managers of socio-technical transition processes, not as most powerful, let alone exclusive actors. Instead, TM relies strongly on market forces and the signal function of market prices to reach its transition goals. TM is thus a process-orientated governance model. As for epistemological reasons the goal cannot be known during the start of a transition, TM focuses on different potential trajectories of socio-technical change using sustainability visions and long-term goals in an adaptive manner. Government, as a transition manager, needs to maintain a great deal of flexibility and adaptive capacity in order to monitor and protect, but not to suffocate the transition process.

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[30] The Dutch transition research of Geels, Schot et al. focuses more strongly on technology transitions in history and the present and therefore represents a key research strand in that field. While Rotmans, Loorbach and the SPRU team share with their colleagues the MLP approach, they focus more closely on societal transitions than their counterparts.
Many relevant publications have already been named in the course of this chapter. For further references see Loorbach (2007), van Bergh & Bruinsma (2008), Rotmans et al. (2000; 2001), Kemp et al. (2007a&b) and Kemp & Rotmans (2004; 2005) for the Dutch school and Smith & Stirling (2007), Smith et al. (Smith et al., 2005), Stirling & Scoones (2007), Smith & Stirling (2008) for the UK school.
[31] See Smith & Kern (2009), as well as Dietz el al. (2008) and Loorbach & Kemp (2008) for related research.

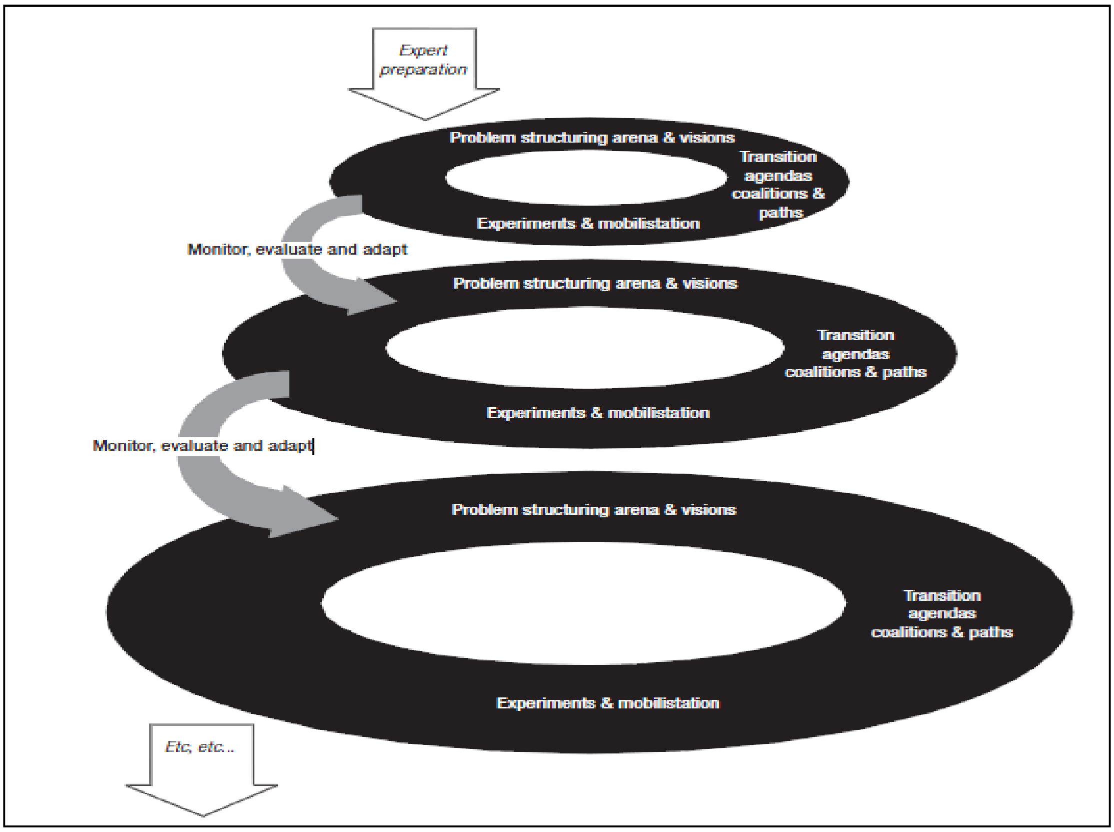
While a conflict with mainstream government policy could arise, Loorbach maintains that the two processes can coexist in the manner in which government policy frames and triggers a transition process, thereby identifying a limited transition arena to explore alternative futures to a given regime. Interacting with existing policy programmes, such transition processes could influence mainstream policy over time through a process of scaling up its transformative vision (Loorbach, 2007, pp. 272; 291-292). Grin also stresses that it is not the role of transition policy to "go against the tide" but rather to amplify on-going transition processes with a choice of transition instruments that enable change (Grin, 2008).[32]

These transformative visions are explored and developed in transition arenas, integrating the positions of stakeholders from government, the power sector, research and civil society organisations. It is the government's role to shield the niches developed in the process through protective policies, and to periodically re-assess and, if necessary, re-adapt the goals of the transition arenas when niche underperformance or other regime change occurs.

As a whole, TM is a cyclical process. After the phases of problem identification and the development of a vision in transition arenas, the next step is to test and further develop the established goals in transition experiments. When the results have been monitored and assessed, a new cycle of (adapted) policy development begins. The reiterative nature of the TM cycle is represented in Figure 9:

[32] The significant role of ST landscapes is also highlighted by Geels. While conceding that broad cultural changes in values, ideologies or political power setups can exert pressure on regimes, he singles out climate change as a significant factor causing the internal restructuring of the energy sector, "triggering changes in technical search heuristics and public policies" (Geels, 2004, p. 914).

Figure 9: The Transition Management cycle



Source: Loorbach (2007), p. 124.

In the case of renewable energy innovation in Arab states, a TM process would entail the following elements:

1) *Problem structuring in the transition arena and formulating a vision*: coordinated by government, setting up a multi-stakeholder energy council with the aim to develop a renewable energy vision as part of a wider national energy policy blueprint
2) *Devising a concrete transition pathway and agenda*: identifying key goals and realistic targets for mid- and long-term developments; choosing policy instruments (e.g. feed-in-tariffs, tax benefit system, legal changes in energy law or market restructuring)
3) *Experimental phase*: putting the designed policies into action for a limited amount of time
4) *Monitor and evaluate the results*: assessing the results, clearly identifying failures in the system, unexpected flaws and underperformances

5) *Adaptation*: attempting to find solutions to the negative outcomes/reinforcing the successful elements of the programme
6) *Start again from step 1* (problem structuring) on a more advanced level

Having said that, it needs to be underlined that the TM approach in and of itself is by no means uncontroversial. This does not only relate to the transferability issue discussed in the thesis and to be introduced in the following Section 2.4.2, but also involves criticism from different theoretical angles.

In their book chapter, Rotmans and Loorbach (2008), two noted TM researchers, present key points which will be discussed here.

First, the TM model has drawn criticism from theorists considering it both as too top-down and technocratic as well as unrealistically bottom-up. Both, however, do not ring fully true as one of the specificities of the TM model is precisely to integrate both approaches in a new, "third way" (Kemp et al., 2007a, p. 85). The conceptual strength, the authors maintain, lies particularly in the synthesis of both models.

Second, Berkout and others have argued (2003) that the very idea of developing a guiding vision upon which a certain government policy was to be oriented is flawed in itself. Instead, as the example of many failed socialist economic plans shows, innovation was rarely inspired or even guided by a "central plan". In many ways, one could argue that the above-made characterisation of innovation as chaotic, complex and generally not steerable would give ample reason not to attempt such a measure by introducing a planned development. Yet, Rotmans and Loorbach (2008) counter this argument by giving a more nuanced view of the TM-inspired vision and transition process. Most importantly, they maintain that a TM vision does not constitute a single-minded, technocratic plan that, like an instruction manual, guides the "users" through steps after which they will have reached the necessary outcome. A "vision" in the TM sense is much broader as it inspires the more technical plans that are to be found in individual technical, legal or economic reports and strategies and paints an overall picture of the ST transition at hand. Additionally, they stress that this vision need not be shared by all those participating in the TM process; a heterogeneity in ideas and (at least partially) in desired outcomes is very well possible, probably even necessary to maintain the creative, evolutionary and re-iterative process that characterizes TM design.

On a more general level, the entire assessment of ST literature shows a classical dilemma of government. Even taking into account that transition processes are in essence chaotic and extremely difficult to steer into a desired trajectory, governments all over the world have a responsibility to at least attempt that. The alternative decision not to interfere – equally a form of government action – would mean to leave the entire realm of ST development to market forces alone. Whether this would necessitate more desirable outcomes for the national (or global) public benefit is, at least, doubtful. This counterweighs the argument put forth by Hajer and Poorter (2005) that is essentially based on that paradox. In awareness of this dilemma, TM aims for flexible target-oriented outcomes and has explicitly abandoned a determinist set of rules.

Another problem raised by Meadowcroft (2005) is the one that has already been discussed in the previous subchapter: the one of suitable system boundaries for both analysis and the policy process. In a globalised world, it needs to be questioned almost by default whether or not the national level is a suitable system boundary for analysis. Technological advancement is today not – and probably never has been – limited by the borders of a nation state. That rings also true for social innovation. Why then, does this study, focus on national energy systems as reference points? There are two fundamental reasons that need to be highlighted. First, while technological or even social innovations are global, energy systems – on the whole – are not: legislation, energy markets, as well as most vital actors in this field remain organised on a national level. Subsidies are granted on this level, electricity demand and (renewable) energy markets are defined by these borders as well as many other vital aspects to be discussed in Chapter 3. Undoubtedly, national energy systems are connected with global energy developments. However, in order to develop a methodologically meaningful unit of analysis for this thesis (or any other research work, for that matter) a choice has to be made. For instance, a technology-oriented, trans-boundary analysis can be conducted with the caveat of cutting through many vital discourses on the national levels. Alternatively, some global interconnections have to be severed in order to present a comprehensive picture on a national level. Since the focus of this study is rather in the (energy) political, economic and governance domain than a technological study, the national level appears to be the more appropriate unit of analysis for this purpose. Secondly, the analytical MLP model, to a certain extent, allows for integrating transboundary phenomena into the scope of analysis, mainly on the landscape level. Thus, the focus on national level case studies appears to be a warranted – and indeed the only feasible – model for that matter.

This, in turn, makes the analyst focus on a dimension that is strongly related to the level of nation states: politics and power relations. In his doctoral thesis, Kern (2009) laments that in a classical TM approach the political dimension often remains neglected. Rotmans and Loorbach (2008), using Avelino's argument, acknowledge this previous deficit of TM and call for more empirical work in that field. Further, they distinguish between structural and innovative power.[33] While the former is mostly in the hands of the incumbent system actors on regime level and can be used to either foster or withhold innovation, the latter is more commonly found in ST innovators. Redefining ST development trajectories, they argue, often entails a power shift from an old to a new regime. Yet another noteworthy consideration is that these shifts in power do not necessarily mean that individual incumbent actors, e.g. national power utilities, lose them in a ST innovation. However, as will be visible in this thesis' case studies, this often appears to be one of their main concerns. Following Kern's assessment, (power) politics play a crucial role in understanding socio-technological change and of its blockade. This thesis shows that without taking into account the actual power relations, certain developmental failures of attempted renewable energy innovations in Algeria and the UAE are not to be understood from a purely managerial, technical point of view. Understanding, let alone steering system innovations without this remains essentially impossible.

[33] See also the instructive paper by Avelino & Rotmans (2009) for an in-depth analysis of ST transformation and different possible forms of power relations.

2.4.2. Transition Management and its application to hydrocarbons-rich Arab countries

Before delving into the details of how to apply TM as a form of policy design to renewable energy policies in oil- and gas-rich Arab states, one fundamental criticism needs to be addressed: critics of TM have argued that this model is unfit for transregional application since it closely reflects a Dutch model of policy making that can be best described as “liberal consensus model” (Rotmans et al., 2008, p. 39f). Yet this appears to be too generic a criticism for a theory that, in principle, regards itself as having a global scope and transferability. In order to present a more nuanced argument in this thesis, the following section develops a first set of criteria upon which the discussion regarding the applicability of this policy design theory to Middle Eastern policy contexts will be based.

Discussing TM and its tenets, it is apparent that this model has been developed with a non-traditional understanding of the role of government in mind, as well as tacitly seeming to presuppose an affluent, western-style democracy as the overall political framework. While the oil-wealthy Arab states in principle do not lack disposable incomes – although not all states of that category are high-income states (see for instance Table 2) – all states in this group are governed by non- or at most semi-democratic regimes. It is thus questionable how far open-ended steering processes, in which government regards itself as a mere manager of open-ended transition processes, are conceivable in this region. Governance structures in the target countries appear to favour strongly a centralized, top-down policy model that is suspicious towards liberal, open-ended transition processes. Also, while it is already an open question how far autocratic governments are at all willing to codify national energy visions or similar policy documents, it is even more questionable, what actual political value such documents possess and how far governments hold themselves accountable to these documents in a way that gives businesses sufficient securities to invest into new technologies. In other words: who can hold an autocratic ruler accountable for a sudden policy change?

Similarly, the relevant actor groups to be integrated into the process, such as scientific organisations or NGOs specializing on energy and environmental issues, usually do not exist as independent bodies in these countries. In contrast to that, national oil companies or energy governance bodies, such as national petroleum councils or OPEC, have a disproportionate influence on government policies due to the vital role of hydrocarbons in this group of countries.

On top of that, the vital function of transparent assessment of the policy experiments is extremely difficult: in a society where processes are organized in a top-down manner and where success – at least on paper – is a mandatory requirement set by quasi-absolute rulers, it is not in the interest of officials or employees in the middle or lower tiers of the hierarchy to report failure to the top level. As research interviews by the author have shown, fear of relegation is great. While this is not a new phenomenon in itself, this means that an open assessment of experimental failures and adaptive learning processes – key modules for TM – can hardly be successfully launched.

In conclusion, the following barriers to the success of TM for renewable energy policy in hydrocarbons-rich Arab states can be identified:[34]

Table 4: Critical points regarding the application of TM as policy design model in Arab oil and gas wealthy countries

Challenge	Description
1	The role of government and its self-conception as a policy actor (“managers vs. rulers”)
2	Role, policies (and existence of) relevant non-governmental stakeholders, such as businesses, civil society, research organisations, national oil companies, other traditional energy governance bodies and international organisations (OPEC, etc.)
3	Willingness of government to codify its own policy in the form of a long-term vision and more tangible policy goals and instruments
4	Accountability and consistency issues: willingness of government to adhere to the course set by a national policy document or similar announcements; ability of stakeholders to sue government/hold it accountable for sudden policy shifts
5	Transparency issues in the assessment of renewable energy introduction

[34] In addition to this, there are standard challenges of technology promotion policies that exist in most societies that opt for a TM-inspired model. Renewable energy-related examples are for instance: the reaction of consumers (acceptance or rejection of ST innovations); grid integration; living up to the promised long-term cost reductions.

	schemes both in terms of technologies and market introduction
6	Inner-systemic adaptive capacities for ST regime change

After an extensive MLP analysis that provides the relevant data, this policy design model will be used in both case studies to develop TM pathways for the Algerian and the UAE energy system. The aspects most relevant to the overall theoretical research aim of the thesis, however, is not so much the aspect of material energy policy design,[35] but rather the theoretical implications concerning the transferability of governance concepts to different regions of the world. The latter will be discussed from a comparative perspective in Subchapter 7.1 of Part C.

2.5. Conclusion and outlook

After the general introduction in Chapter 1, Chapter 2 first discussed the available research literature for renewable energy policy research in Arab resource-rich states in three sections focusing on Middle Eastern studies (Section 2.2.1), energy studies (Section 2.2.2) and governance theories and concepts of socio-technical change (Section 2.2.3). Having established that none of the research strands discussed can serve as an exclusive reference for the research aims of this thesis, a multi-level governance approach has been identified as the most adequate approach for this purpose, as it is able to integrate different explanatory models in the various dimensions of energy transitions analysed. Section 2.3.1 accordingly discussed the multi-level approach as an analytical tool in greater depth, which in turn was applied to the material dimensions of renewable energy policy in Arab hydrocarbons-wealthy states in the following Section 2.3.2. This latter section remained focused on the formal introduction of MLP analysis as the following Chapter 3 is fully devoted to the material dimensions of renewable energy policy analysis in resource-rich Arab states.

[35] These aspects will briefly be discussed in the two case studies on an individual case study level and in Subchapter 7.1 under a comparative perspective.

While the MLP is a key analytical tool for energy transition, its contribution to policy formulation remains limited. Thus, the final Subchapter 2.4 discussed TM as a model of policy design that is closely interlinked with MLP. However, as was argued in Section 2.4.2, TM has significant limitations in its application to countries outside of Western-style liberal democracies. A list of the most critical issues has been collected in Table 4 and will inform the model application in Part B and C of the thesis.

In conclusion, Chapter 2 has defined the theoretical framework for the thesis both for its analytical and its policy application side. While the MLP will structure the following chapter as well as the major parts of the case study analysis in Part B, its purpose is of an overall analytical, not a heuristic nature. Thus, informed and structured by MLP, the TM, a model conceived with the specific purpose of policy design, will generate elements of material renewable energy policies, and, more importantly for the theoretical contributions of this thesis, be tested in its role as an adequate policy design model in Parts B and C.

In the following chapter (Chapter 3), the general policy setting of renewable energy policies in resource-rich Arab states will be discussed. Informed by MLP and the analytical dimensions of MENA renewable energy policy outlined in Section 2.3.2, it will discuss general trends for the region. After Chapter 4 presents the research methodology of this thesis, Part B will then proceed with the analysis of the case studies against the background of what has been established in Part A.

3. The policy context for renewable energy policy in resource-rich Arab countries under the multi-level perspective

3.1. Introduction

This chapter introduces analytical dimensions of renewable energy policy in resource-rich Arab countries as identified by the multi-level perspective and summarised in Table 5, including where these sections are discussed in this chapter. Structured by the multi-level perspective, the chapter presents the key elements of renewable energy policy in the three dimensions suggested (landscape, regime and niche-level). It thus introduces the key elements that will guide the analysis in the two case studies of Part B. This chapter only discusses transnational trends and challenges that are of relevance for the case study analysis. As the structure of Chapter 3 and its subchapters will be replicated in both case studies, a more in-depth discussion of the more country-specific issues can be found in the case study chapters respectively.

All major sections of this chapter end with research questions that formulate conditions of a success for renewable energy policy in resource-wealthy Arab states and that will be taken up in the related chapters of Part B.

Table 5: Chapter orientation: analysis of renewable energy policy in hydrocarbons-rich Arab states structured by the multi-level perspective

Scale	Definition	Analytical focus	Covered in Sub-chapter
Landscape Level	Long-term macro-drivers that cannot effortlessly be altered by regime-level stake-holders	- Political system - Key regional and transregional energy governance bodies - Climate change - Long-term national economic diversification - Country branding	- 3.2.1 - 3.2.2 - 3.2.3 - 3.2.4 - 3.2.5
Regime Level	Entrenched actors and dominant regulatory, financial and political systems	- *Technological regime*: Transmission and power generation infrastructure - *User and market regime*: Structure of national energy markets, pricing and demand issues; legal and institutional frameworks - *Socio-cultural regime*: Consumption patterns, environmental awareness and potential role of religion or environmental ethics	- 3.3.1 - 3.3.2 - 3.3.3

		- *Policy regime*: Regime-level and transregional governance structures, role of CSOs	- 3.3.4
Niche Level	Protected spaces with a potential for radical change in the established regimes	- *Science regime*: Industry structures, R&D strategies[36] - Technological developments	- 3.4.1 - 3.4.2

3.2. Landscape-level factors

3.2.1. Political system

Renewable energy policy always takes place in the context of national political systems as they relate to wider landscape-level phenomena, which cannot easily be altered by system actors. Two theoretical approaches guide the analysis of political systems in hydrocarbons-wealthy Arab countries: Henry/Springborg's "bunker state" theory (Subsection 3.2.1.1) and Luciani/Beblawi's "rentier state" theory (Subsection 3.2.1.2). While Subsection 3.2.1.3 focuses on personal patronage networks, the final subsection discusses to what extent the spread of renewable energies could be a goal adopted by conservative elites to boost regime survival and whether a democratizing effect of renewable energies could be expected (Subsection 3.2.1.4).

3.2.1.1. Algeria: "Bunker state" theory

Henry and Springborg (2010) conceptualize the difference between Arab states by distinguishing between four categories of Middle Eastern political systems: bully praetorian republics (Egypt, Tunisia), bunker states (Algeria, Iraq, Libya, Sudan, Syria, and Yemen), globalizing monarchies (UAE, Qatar, Kuwait, Morocco, Saudi Arabia, Oman, and Bahrain) and fragmented democracies (Israel, Iran, Lebanon, and Turkey) (Henry & Springborg, 2010, pp. 26–27).[37] For resource-wealthy Arab countries, the categories of

[36] Contrary to Geels' classification in Figure 6 this thesis treats science regime questions as niche-level phenomena. While ST niches might be regulated, the niche-focused perspective of the policy design theories applied appears a more fitting classification.

[37] In light of the recent events in the Arab world, the analytical categories arguably will have to be altered, especially in terms of the "bully praetorian republic" category. It is, however, beyond the scope of

bunker states and globalizing monarchies are particularly apposite. According to this model, with its largely paralyzed state structures, a strong security apparatus, a weak, post-socialist private sector Algeria is regarded as a "bunker state", while the UAE falls into the category of a globalizing Gulf monarchy that has managed to follow a dynamic and flexible development pathway that will be further described in the next subsection. The authors derive the name "bunker state" from the observation that this group of states is being "ruled physically or metaphorically from bunkers" (Henry & Springborg, 2001, p. 99) by an elite that historically gained its public legitimacy in the wake of anti-nationalist colonialist revolutions. Bunker states, the authors maintain, are potentially always in a state of war with the societies they rule with the help of strong, if not violent armies and other forms of security services.

In the case of Algeria, for instance, Bouteflika's last election in 2009 was only made possible after a constitutional change that allowed his third tenure.[38] By and large, Algerian political leaders place themselves in the tradition of the democratic, anti-colonialist struggle of the Algerian War of Independence (1954-1962). Apart from that, however, this state is characterized by the absence of a significant, independent and vocal intelligentsia or strong entrepreneurs who amass political power or capital. In Algeria, these groups have mostly been "deactivated, silenced, forced into exile, or eradicated" (Henry & Springborg, 2001, p. 100) during the civil war in the 1990s.[39] Consequently, these countries' administrations perform poorly and have little power to inform or influence the policy process.

In relation to the thesis and the Algerian case study, the militarization of society and the opaqueness of its decision-making structures in a country where the presidential elite feels besieged by the military security service DRS needs to be taken into account as landscape-level influences on renewable energy policy. Renewable energy policy

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this thesis to tackle that problem, particularly considering the fact that the "Arab Spring" is an on-going phenomenon.

[38] See Werenfels (2009) for an assessment of the 2009 presidential elections.

[39] In a different publication, Henry argues that such a group has never actually existed in Algeria and that, while it is publicly believed that the country's "original sin" was oil and gas; it was in fact the long and brutal phase of French colonialism.

designs targeting successful niche-based innovation systems have to integrate the strong position of the national oil company SONATRACH and the Algerian Ministry of Energy and Mines (MEM) as well as take into consideration the governance environment, which is characterized by physical force and top-down approaches.

Thus, the corresponding research question for the Algerian case study is as follows:

- How far do the Algerian political system and the non-existence of independent CSOs allow for system innovations in the energy sector, particularly bottom-up innovations?

3.2.1.2. UAE: rentier states and globalizing monarchies

The resource allocative character of the smaller, wealthy hydrocarbons-based societies, such as the UAE, has to be underlined.[40] Conceptually, this is best described by the rentier state model (Beblawi & Luciani, 1987) according to which the social contract is based on the state allocating its wealth to its citizens while, simultaneously, its quasi-absolute rulers remain politically dominant, largely unchallenged by weak civil society groups.[41] Although these monarchies have substantial financial resources, they are politically more vulnerable as they have not undergone the same period of violent, anti-colonial transition some of the bunker states (e.g. Algeria) have. Another subsidiary aspect is that in spite of the comparatively strong public acceptance of the hereditary, quasi-monarchical governance structures, political power is protected by strongly repressive measures and the quasi-absence of the rule of law on the top level. Thus, by and large politically docile or intimidated citizens enjoy the extensive benefit sys-

[40] In his publication, Luciani criticizes the term “hydrocarbon society” and argues in favour of the term “allocation state” (1987, pp. 65–67). He emphasises that oil in the region has incentivized formerly competing Emirs to arrange federal structures (UAE), partially quelled the secessionist tendencies in the Hijaz region, and has helped in “gluing together” the three Libyan regions of Tripolitania, Cyrenaica and the Fezzan. Again, in light of recent events in Libya, this thesis is likely to undergo substantial criticism soon.

[41] Cf. Salem’s study on Kuwait (2007). Also Nonneman analyses the Gulf States as systems that are essentially held together by legitimization through payments to the subjects, patronage and charismatic leadership (Aarts & Nonneman, 2005).

tems,[42] the favourable taxation regime and largely withdraw from the public sphere into private fulfilment thus honouring the "ruling bargain" described, among others, by Davidson and Krane (Davidson, 2005; Krane, 2010b).

This "shrinking of democratic space" (Abubakar, 2008, p. 220) combined with the rent-seeking behaviour of citizens affects all spheres of life including the realm of (renewable) energy. As with Algeria, a key question that emerges is how authoritarian, top-down governance structures allow for niche-based system innovation in the context of the state-induced (and subsidized) renewable energy policy initiatives that are characteristic to the UAE. In a state where there is no vocal civil society in the environmental sector and where the state directly funds renewable energy research and businesses, it is pertinent to ask how far an innovation system which might run contrary to the vested interests of the governing elite can preserve its momentum.

In parallel to the Algerian case, the corresponding research question for the political system of the UAE is therefore:

- How far does the UAE's political system and the non-existence of independent CSOs allow for system innovations in the energy sector, particularly bottom-up innovations?

3.2.1.3. Personal patronage networks

For this thesis, one of the most important elements of political system analysis is the strong role of personal patronage networks to members of the ruling elites. These informal power structures weaken a stronger institutionalisation and render formal decisions subordinate. Due to largely opaque top-level decision-making structures, personal allegiances can be secured by granting commercial privileges[43] or government careers. As Henry/Springborg put it "In the monarchies the local business elites act as

[42] A study from the UAE has recently claimed that an average male UAE citizen collects approximately US$ 55,000 per year as benefits from his government (Brown, 2007).
[43] Due the fact that most resource-rich Arab states have mandatory 51% ownership rules for foreign investment, there is a wealth of lucrative partnerships that can be given to favourites of the ruling elites.

part of a big extended family" (Henry & Springborg, 2001, p. 168). For foreign companies as well as domestic outsiders, the workings of those patronage networks are often difficult to comprehend as they form an informal power structure that exists parallel to the formal structures of the state. Their importance for eventual top-level political decision making should not be underestimated. As one interviewee in Abu Dhabi said:

"Well, here in Abu Dhabi, of course, there are these rather opaque circles of power around the ruling family. But this doesn't mean that someone from these people can just command the state structures to do a big project, and then it will be done without questions asked. Institutions here are at least that strong that they force decision-makers to seek a formal approval and have experts heard before they make an official decision" (Interview no. 74 – national and international power sector, Gulf States)[44]

However, other expatriates take a very different view stating that:

"Well, decision-making structures remain unclear to me. I think, whatever the ruler "in his infinite wisdom" decrees will be done, everything else is just a façade..." (Interview with undisclosed Public stakeholder, Gulf States)

While Henry/Springborg have highlighted this phenomenon with regards to the "globalizing monarchies", it needs to be stressed that these networks are at least as relevant in the case of Algeria, where the infamous Tlemçen-clan around president Bouteflika, and the military service DRS have long battled for supremacy (Lacher, 2010). Due to the republican face of the Algerian *body politique* no Algerian politician could capitalize on a royal background. Instead, functional equivalents are a military, energy (Sonatrach) or political one. This, however, does not mean that personal patronage networks were less obscure or self-serving than in the Gulf States, as the bunker states' rankings on transparency and corruption indices demonstrate. In the Transparency International's 2010 global corruption perception index, for instance, the Gulf States receive much higher ranks than the resource-rich North African states.[45] Thus,

[44] The research interviews conducted by the author have been coded according to the four interviewee categories (Public stakeholders – Private and public investors – National and international power sector – R & D) and the interviewee's regional background (Algeria – Europe – Gulf States), e.g. "Public stakeholder – Algeria". If the interviewee has consented to publish his or her name this is preceded by the interview number referring to the list of interviewees provided in Annex II. See Chapter 4 for an in-depth discussion of research methodology, the development of the questionnaire and the interviewee categories.

[45] Qatar has scored the highest with a global 19th place out of 175; UAE: 28th, Oman 41th, Kuwait 45th, Bahrain 48th, Saudi Arabia 50th Egypt 98th, Algeria 105th, Libya 146th (Transparency International, 2010).

the issue of political patronage networks is of key relevance for the analysis of political processes in these countries.

A research question with regards to personal patronage networks for both case studies is:

- To what extent are the official decision-making processes the actual decision-making structures?

3.2.1.4. Regime stability vs. democratisation: governance effects of renewable energy systems

Providing cheap and reliable electricity constitutes an important element of regime stability in all allocative Arab states. This poses the following question: in which way could the interest in regime stability by conservative elites, who have a stake in the continuation of the political and economic status quo, drive the spread of renewable energies in the region? While, paradoxically, the possession of nuclear energy capacities might produce more external guarantees for regime survival (Marktanner & Najmeddine, 2011), political leaders could be motivated to invest in renewable energies for domestic reasons, such as freeing more domestic resources for the sale on global energy markets, bolstering their domestic and international positions and creating employment opportunities for their citizens.

Apart from that, creating outside dependencies by large-scale renewable power interconnections, as has been advertised in the Euro-Mediterranean sphere, could have a positive impact on regime stability – arguably not as much as the positive side effects for domestic industries for these projects,[46] but rather in the same way as oil and gas deposits today raise the Western stakes in regime survival of these states. Consequently, what might be the result is the continuation of Western oil policies (energy for silence in terms of human rights violations, see, for instance, Saudi Arabia) trans-

[46] Scholvin (2009) and others are very sceptical about that. See also Kumetat/Hamiane (2011) for a discussion on the potential role of the Maghreb renewable energy sector in these projects.

formed to a different energy carrier[47] bolstered through this potential new form of energy interdependence.[48]

Therefore, currently, regime stability might have a mildly positive effect on the spread of renewables in the region because this may consolidate local energy security, long-term price stability in addition to other effects discussed below. More impact may only come about should external major powers obtain stakes in the renewables sector in the Arab countries, as might possibly be the case with Algeria and the Desertec Initiative.

In contrast, Western voices representing CSOs, donors or renewable energy lobby organisations, attach very different aspirations to the spread of renewables in the MENA region. Franz Alt, for instance, views the spread of renewables as pivotal for international peace:

"Coal, gas and oil, but also uranium…are finite. The sun, wind, water, biomass...are infinite. Many wars have been waged for the sake of oil…[but] the sun shines for us all...Thus, the most important question for the 21st century is: war for oil or peace through the sun? Either we abolish our current energy policy or it abolishes us...It would serve peace better to install solar power plants across Iraq's deserts than to bomb the country." (Alt, 2002)

Whether an assumed causal nexus from decentralized energy production to a democratic political system can actually be established at all, must remain doubtful.[49] Instead of a research-based, scientifically cogent argumentation this appears to be a rather one-dimensional projection of Western concepts and political ideals into the Middle East as a region and into renewable energy as a form of energy production. However, various studies, such as Adelphi Consult & Wuppertal Institute (Tänzler, 2007), stress that an ecological transformation of energy systems can in fact yield a peace and a human security dividend through the diversification and decentralisation

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[47] A recent article already problematized the fact that Morocco, a key partner in Desertec, plans to build two of the five RE demonstration plants in the annexed West Saharan territories (*Schattenblick,* 2010); a concern that the Desertec Industry Initiative's (Dii) PR section was quick to deny (Maung, 2010). Moroccan and the consortium's final site assessments, however, are yet to be announced.

[48] Schot et al. show that the move to create dependencies (with potential peace dividends) through the interconnection of energy infrastructure has been under discussion since at least the early 20th century (Schot & Lagendijk, 2008; Schot, 2010).

[49] See Subsection 3.4.2.1 for a more detailed discussion of both the governance and the technical aspects of this point.

of energy supply as well as through lifting least developed countries out of their status of absolute energy poverty.

To this author it appears highly unlikely that the spread of renewable energies would trigger a democratization process in hydrocarbons-wealthy Arab states. The causal link between distributed renewable energy production and more transparent or participatory political systems is, at best, weak, and overstretched. In fact, if such a link could be established by Arab energy stakeholders, this could potentially develop into a key barrier against the spread of renewable energies in their countries.

Furthermore, Western idealists pin their hopes on small, decentralized renewable power systems, which aim to strengthen the (then-) independent consumers in their new role as power producers. This is an unlikely scenario for the hydrocarbons-rich Arab states, because, as will be argued in Parts B and C of this thesis, de-centralized systems are unlikely to play a major role in this region; if so, an industry-scale, state-induced and -controlled spread of renewables will transpire. Thus, the most likely scenario for these states is a Middle Eastern form of environmental authoritarianism[50] and a continuation of a state-controlled, centralized form of power generation. In terms of installed capacity, this might be an environment conducive to renewable energies; in terms of participatory governance structures, however, this is unlikely to be the case.

A corresponding research question from this section follows:

- What do interviewees regard as the key governance effects of renewable energy production?

[50] See Beeson (2010) for a discussion of this concept with respect to Asia. He highlights that although authoritarian regimes may well be "unattractive" as countries, they might develop better response capacities to environmental pressures than other, more democratic forms of government. Spiess (2008), however, criticises the notion that the Gulf States would have actually developed such capacities.

3.2.2. Key transregional energy governance bodies

On the landscape-level, policy is also co-designed by governance bodies whose role transcends national policy-making. In contrast to the governance bodies presented in Subsection 3.3.4.2, which do not exceed the mandate of the member states and do not have own policy agendas, the three governance bodies IRENA, OPEC, and OAPEC, yield substantial influence.

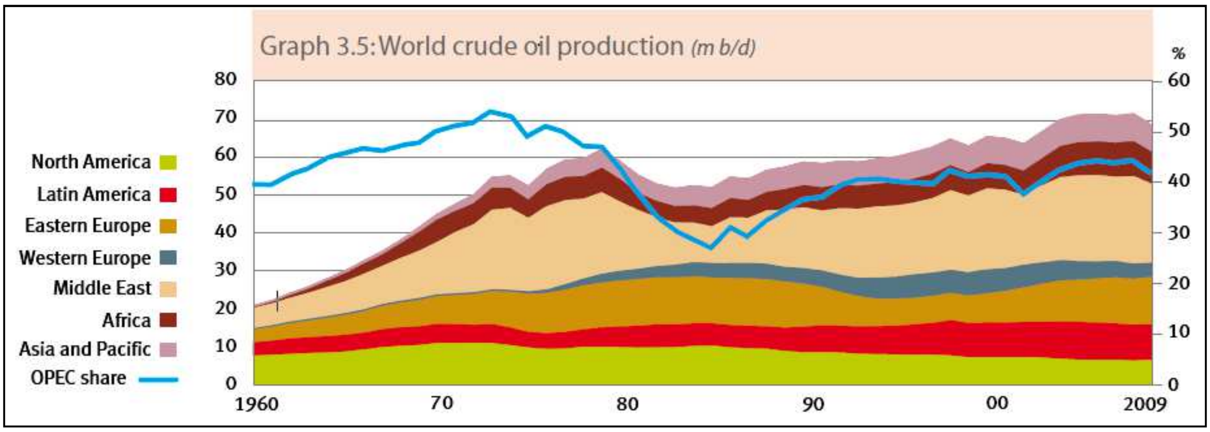
IRENA

The International Renewable Energy Agency (IRENA) has just become a full-fledged international organisation. Until April 2011, it operated from its headquarters in downtown Abu Dhabi as a "preparatory commission". As part of Abu Dhabi's original bid for IRENA at the founding conference in Sharm el-Sheikh, Egypt, in June 2009, IRENA's headquarters will eventually move to Masdar city. However, due to the various reassessments of Masdar city, IRENA is still in its temporary offices in downtown Abu Dhabi. This situation is unlikely to change until at least 2013 (*Interview no. 54 – public stakeholder, Gulf States*) (*Arabianbusiness.com,* 2011). As a sufficient number of member states have ratified the IRENA treaty, the delegates' meeting on 4-5 April 2011 constituted IRENA's first conference of the parties (COP) during which Adnan Amin was elected IRENA's first General Secretary. In June 2012, the IRENA statute had 158 signatories, including all Arab states. However, merely 98 states, including only seven Arab states (Qatar, Bahrain, Oman, Tunis, Algeria, the UAE and Yemen) and the EU have also ratified the treaty. With the exception of Saudi Arabia, which retains only an applicant's status, all other signatory Arab states are yet to ratify the statue.

OPEC

The Organisation of Petroleum Exporting Countries (OPEC) is arguably the most well-known energy cartel worldwide. Founded in Baghdad, OPEC holds about 80 per cent of global oil reserves (Organization of Petroleum Exporting Countries (OPEC), 2010a, p. 24). This share is not reflected in current and historic production shares: OPEC contributes currently between 40 and 50 per cent of the total oil production (see Figure 10).

Figure 10: OPEC share in relation to world crude oil production 1960-2009 in mb/day



Source: Organization of Petroleum Exporting Countries (2010a), p. 35.

With slight changes in membership over the years, it currently comprises the Arab oil exporters of Algeria, Iraq, Qatar, Saudi Arabia, Kuwait and the UAE, as well as the non-Arab states of Angola, Nigeria, Iran, Ecuador and Venezuela.

According to the organization's long-term strategy, OPEC's goal is it to ensure "fair and stable prices" (Organization of Petroleum Exporting Countries (OPEC), 2010b, p. 5). However, it is remarkable that this recently written policy document does not take into account a potential shift of long-term oil demand. Furthermore, while the report mentions the potential "downward pressure on all forms of fossil fuel demand" through climate change mitigation (Organization of Petroleum Exporting Countries (OPEC), 2010b, p. 8), there is no mention of renewable energy in the strategy whatsoever. As will be underscored upon discussing Abu Dhabi's key conventional oil and gas governance bodies in the case study, the fact that the Supreme Petroleum Council does not take into account renewables seems to be a common phenomenon among oil and gas governing bodies. Traditional oil and gas bodies, it appears, do not entirely change their focus to renewable electricity production, as this would exceed their mandate and may potentially be at odds with member states' policies, which have strong vested interests in the continuation of the oil and gas energy regime.

OAPEC

The same characteristic can be observed in the case of the Organization of Arab Petroleum Exporting Countries (OAPEC).

"OAPEC is primarily a technical organisation. Unlike OPEC (with which we of course cooperate closely), OAPEC works much less on political issues such as international oil policies, production quotas and the like. OAPEC focuses more on the promotion of inter-Arab oil and gas cooperation, research and business operations." (Interview no. 57 – public stakeholder, Gulf States)

The rather apolitical character of this organisation is also the reason for the difference in member states. OAPEC comprises most Arab states that have (at least at one point in time) a significant oil and/or gas production.[51] Its members are: Kuwait, Libya, Saudi Arabia (founders, Beirut, 1968), Algeria, Bahrain, Qatar, UAE, Iraq, Syria, Egypt, and Tunisia (Organisation of Arab Petroleum Exporting Countries (OAPEC), 2008).

In its entirety, OAPEC states control approximately 56% of global oil and 28% of global gas reserves (Organisation of Arab Petroleum Exporting Countries (OAPEC), 2010), making it the by far most significant regional organisation of oil exporting states. Despite its close contact with Vienna, OAPEC is not a subsidiary organisation to OPEC, nor are there other sub-groupings within OPEC with other regional foci (e.g. African or South American OPEC members). Furthermore, another noteworthy difference between OPEC and OAPEC is that not all OAPEC states are also Arab members of OPEC: Bahrain, Syria, Egypt, and Tunisia are members of OAPEC exclusively.[52] Conversely, however, the picture is less blurred: all Arab OPEC members are also members of OAPEC. However, the OAPEC does not regard itself as a sub-organization of the League of Arab States (LAS). A proposal to this effect in the period preceding OAPEC's founda-

[51] According to its statutes, OAPEC membership is open to Arab countries in which "petroleum…constitute(s) a significant source of its national income" (El-Gebali, 1981, p. 37).
[52] This is also the reason why this thesis always uses the slightly lengthy term "resource-wealthy Arab states". The term Arab OPEC or OAPEC states means political groupings within the Arab world, which is not the focus of this work.

tion was rejected by its three founding members[53] thereby rendering it an independent Arab energy association in its own right.

The predominantly technical character of today's OAPEC, however, is a relatively recent phenomenon in the organisation's history. OAPEC has trailed pan-Arab politics. Indeed, its very foundation was political, brought about by the partially-implemented Arab oil embargo following the 1967 war. It was therefore designed as a pan-Arab oil pressure group only to admit Arab states, which pursued strong anti-Zionist politics. In addition to that, all three founding members had to approve the admission of new member states, such as Egypt, Iraq, Algeria and Syria (El-Gebali, 1981, pp. 29–32). While the organisation played a major role in organizing the 1973 oil boycott together with OPEC, no further political initiative of that sort was carried out successfully. The organisation showed signs of political weakness when Egypt was excluded from the organisation after the signing of its peace treaty with Israel in 1979.[54] Also, Tunisia's membership has been suspended upon its own request since 1986. However, the latter is still counted as a member state, and, according to the OAPEC secretariat, would be able re-activate its membership at any time. Today, OAPEC is mainly limited to commercial oil cooperation in the Arab upstream and downstream sectors.[55] As was confirmed by stakeholder interviews, renewables are only of marginal interest to this organization, and its stakeholders do not regard it necessary to change this.

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[53] In theory, the League of Arab States is the umbrella organisation for all political and economic affairs regarding Arab states. Thus, OAPEC could have become a sub-regional forum of the LAS, which the progressive regimes of the late 1960s like Iraq and Egypt supported. The conservative regimes and later OAPEC founders (Kuwait, Saudi Arabia and the then-Kingdom of Libya), however, rejected this proposal citing the LAS' poor performance. In the founding period, however, the Libyan revolution under Gaddafi changed the character of the OAPEC founders; and Libya now promoted the extension of OAPEC to the revolutionary Arab states of Algeria, Syria, Egypt and Iraq, which were eventually admitted to OAPEC alongside all other current members in March 1970 (El-Gebali, 1981, pp. 30–31).

[54] El-Gebali discusses the exclusion of Egypt and the legal problems attached to it at length (1981, pp. 52–67).

[55] OAPEC coordinates various inter-Arab joint ventures in the petroleum sector and related industries, such as maritime petroleum transport (Arab Maritime Petroleum Transport Company AMPTC), shipbuilding (Arab Shipbuilding and Repair Yard Company ASRY), petroleum investments (Arab Petroleum Investment Corporation APICORP), exploration (Arab Drilling and Workover Company ADWOC), among other key joint ventures. In addition to that, OAPEC also runs the Arab Petroleum Training Institute (APTI), which was established in 1978 in Baghdad, which issues a monthly bulletin and the journal "an-naft wa at-ta'awun al-'arabi" (Oil and Arab Cooperation) (Organisation of Arab Petroleum Exporting Countries (OAPEC), 2008).

Thus, the following research question can be identified:

- Which role do transregional energy governance bodies such as OPEC, OAPEC or IRENA play in the promotion or stalling of national renewable energy policy in the respective target country?

3.2.3. Climate change vulnerability and low environment-related profile of oil-producing states

Another important contextual factor relating to the national political economies of the resource-rich Arab states is the region's strong exposure to the negative effects of anthropogenic climate change. While the projected effects of climate change to the two case study countries will be discussed in the case study chapters respectively, some transregional aspects will be highlighted here.

First, currently, more than half of the water used in the MENA region originates from desalination. In light of the sharp rise in demand for fresh water and the quickly dropping renewable water tables, this quota is likely to increase. Besides the production costs, a pertinent issue to this research is the close nexus between desalinated water and energy. On average, desalination plants require 1.5-15 kWh to produce one cubic meter of water (German Aerospace Center (DLR), 2006a, p. 22). Thus, the rising water production by desalination further increases the already high annual growth rates of national electricity demand. The case study chapters shall discuss whether the large-scale application of renewable energy for seawater desalination could be an entry point for renewable energies in Arab countries.[56]

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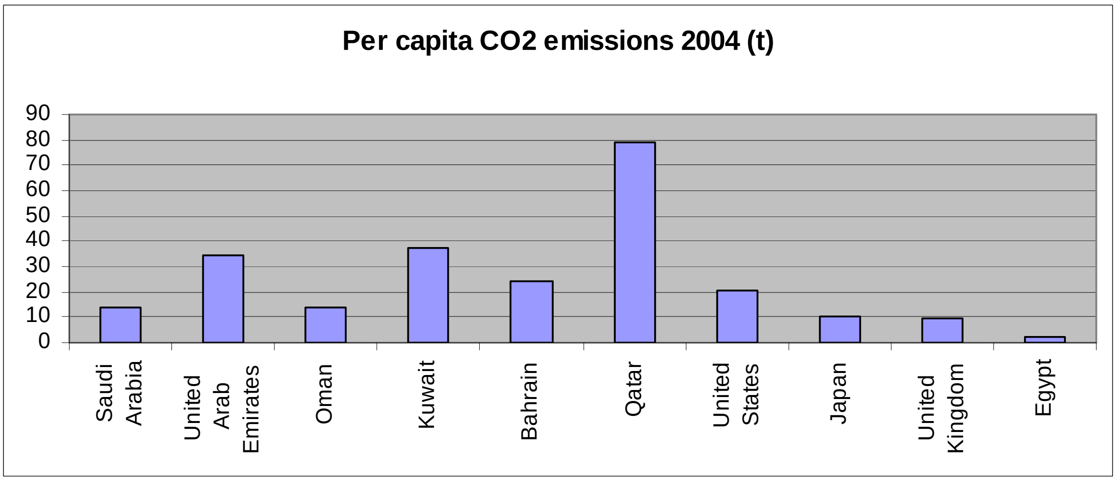
[56] See for instance (Bouchekima, 2002; Enzili, 2007, German Aerospace Center (DLR), 2006a; Mahmoudi et al., 2009). One of the most recent and comprehensive research projects on that subject was the EU-funded Promotion of Renewable Energy for Water production through Desalination (PRODES) project, cf. Papatreou et al. (2010) for the final report and http://prodes-project.org/index.php?id=45 for the project homepage (last accessed 25 February 2011).

Further regional issues include the carbon footprints, which are far higher than the average of OECD states (see Reiche, 2010b as well as Figure 11),[57] Arab leaders' scepticism towards climate change and their poor performance in the recent post-Kyoto negotiations. While all resource-rich Arab states are signatories of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto protocol, they have merely joined as non-Annex-I-states, meaning that these states do not have any binding obligations to cutting greenhouse gas emissions under the Kyoto protocol (Reiche, 2010a).[58]

Figure 11: GCC CO2 emissions relative to GDP in 2004



Source: Hertog & Luciani (2009), p. 3.

This is particularly noteworthy because the Arab region is heavily water-stressed and strongly vulnerable to a climate change induced rise in average temperatures. Thus, it could have been expected that there is an interest among decision-makers to cooperate constructively in the post-Kyoto negotiation process in order to eliminate or at least minimize this potential stress multiplier.[59] However, this was not to be in recent

[57] As discussed in Subsection 3.3.1.1, another reason for the high carbon emissions in the region's desalination plants is the boom in the construction sector and energy intensive industries.

[58] As information on the multitude of aspects touched upon in this chapter is widely spread, this text cites numbers from a broad variety of sources as there is no standard volume where all the necessary information was published. Unless otherwise highlighted, the author cites important numbers only from peer-reviewed journals, major government reports or credible international organisations.

[59] In recent years, climate change debates have moved successively towards the securitization of this issue (Brzoska, 2008). Thus, there are a growing number of publications on this topic from traditional security circles (see for instance the US Center for Naval Analyses CNA Corporation, 2007). For CSO-

COPs (Conference of the Parties) to the UNFCCC and the Kyoto protocol. As Depledge shows, the well-staffed and well-funded Saudi Arabian delegation in particular played a key role in undermining many UNFCCC initiatives (Depledge, 2008), which Luomi confirms (Luomi, 2009; 2010).[60] Furthermore, the UNFCCC's Clean Development Mechanism (CDM), a means to promote low-carbon growth and North-South technology transfer, has hardly been used by the Arab hydrocarbon rich states (see Table 6).

CDM credits, which could be sold to industrialized countries registered in Annex I of the Kyoto protocol, could help gather the necessary investment money for renewable energy projects. Until 2009, Qatar's (large-scale) Al-Shaheen CDM project was the only one of its kind in the GCC. However, the number of projects is gradually growing in resource-rich Arab states. In October 2011, out of 3542 registered projects, the entire Arab region merely registered 23 projects (less than 1% of the total number registered).

Table 6: Overview of CDM projects registered under the Kyoto protocol in the Arab region

Country	Registered Project s	Country	Registered Project s	Country	Registered Project s	Country	Registered Project s
Egypt	10	Syria	3	Qatar	1	UAE	5
Jordan	2	Tunisia	2	Morocco	6	TOTAL	29

Source: UNFCCC (2011).

In conclusion, the climate change mitigation agenda, the UNFCCC regime and carbon credits could develop a significant momentum in the spread of renewable energies as it does in other world regions (e.g. the EU). A corresponding subsidiary research questions in this respect is:

- Is the climate change agenda actively considered in the political decision-making on renewable energy developments?

funded or academic research see for instance the two publications by Brown et al. (Brown, 2008; Brown & Crawford, 2009), Kumetat (2011) or Carius et al. (2007) for a more in-depth discussion of climate change and security-related issues in the MENA region.

[60] Although Luomi holds a slightly differentiated view highlighting the potentially significant role of the smaller Gulf States in weakening the oil-rich states' coalition from within, Luomi is only cautiously optimistic with regards to the outcome of future COPs.

3.2.4. Long-term national economic diversification

In hydrocarbons-rich Arab states, the importance of hydrocarbon revenues for the national economies is striking. Aware of this revenue's eventual finiteness, the key economic goal in these countries is to diversify their national economies. Apart from the fact that national economic diversification is an important strategic form of hedging against future income deficits through depleting hydrocarbons reserves or diminishing demand on the world markets, it is also a precautionary measure against strong fluctuations in world oil prices. Such fluctuations and their high GDP dependency on oil exports (see Figure 12) have left the resource rich Arab states vulnerable to significant drops of national income in some years while having to deal with inflationary problems[61] in years of high cash inflows into their national economies due to oil price peaks.

Figure 12: Oil export revenues as share of GDP in select Arab countries

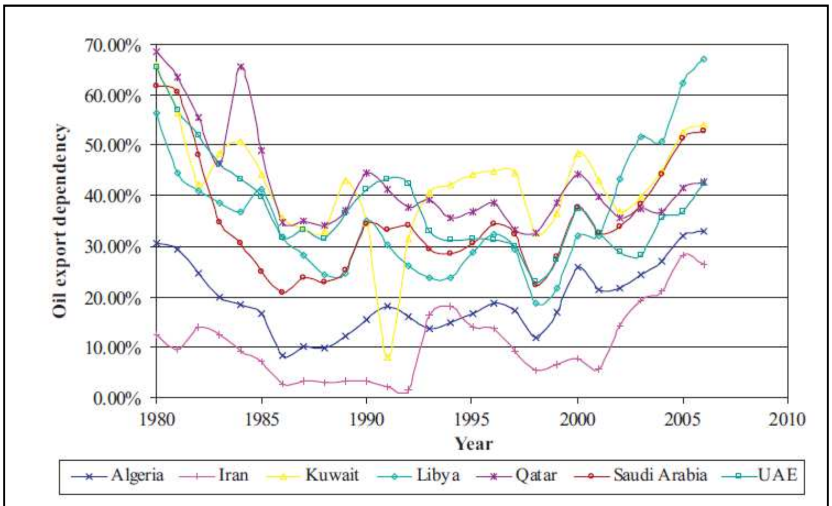


Fig. 3. Trend of oil export revenue as a share of GDP.

Source: Bhattacharyya, 2010, p. 1101.

[61] In their paper, Woertz et al. (2008, p. 4) give inflation rates for the Gulf States between 2002 and 2007. In 2007, inflation rates in all GCC states were between 5.3 (Oman) and 12.8 (Qatar) per cent. The authors state that approximately two thirds of this can be attributed to the abundant liquidity and a domestic investment boom, about one third of this has been imported through price peaks in global food and commodity prices. The recent stark increases in government-paid salaries for GCC nationals in the wake of the Arab spring have only exacerbated these tendencies.

The recent oil price peaks have generated additional revenues for these countries amounting to trillions of dollars. The large amounts of cash have been handled very differently with some of it trickling down towards the domestic population and some re-invested into long-term sustainable assets. By and large, the Gulf States have tackled both challenges well by dispensing generous benefits to the national population and carefully managing sovereign wealth funds (see Table 7). Although states like Libya, Algeria and Iraq established similar institutions, as well, the trickle-down effect to the general public was much less. With their institutions, infrastructure and human resources crippled by the wars in the 1990s and 2000s, Iraq and Algeria are yet to fully develop dynamic and transparent mechanisms governing their hydrocarbon incomes. The outcome of the 2011 Libyan uprising and what this will yield for the country's economy in the long term still remains unclear.

Table 7: Select Arab Sovereign Wealth Funds in 2008

Country	Name	Established	Est. size (US$ bn)	Year of estimate
Algeria	Revenue Regulation Fund/*Fond de Regulation des Recettes*	2000	56.1	2011
Bahrain	Mumtakalat	2006	9.1	2011
Kuwait	Kuwait Investment Authority (KIA)	1953	213	2008
Oman	Oman State General Reserve Fund	1980	8.2	2011
Qatar	Qatar Investment Authority (QIA)	2003	60	2008
Saudi Arabia	Saudi Arabian Monetary Agency (SAMA)	1952	330	2008
UAE (Abu Dhabi)	Abu Dhabi Investment Authority (ADIA)	1976	627	2011
UAE (Abu Dhabi)	International Petroleum Investment Company (IPIC)	1984	48.2	2011
UAE (Abu Dhabi)	Mubadala Development Company	2002	13.3	2011
UAE (Dubai)	Investment Corporation of Dubai	2006	19.6	2011
UAE (Ras al-Khaimah)	RAK Investment Authority	2006	1.2	2011

Source: Behrend, 2008, p. 5 and www.swfinstitute.org, 2010.[62]

[62] Algerian officials have hinted that the FFR was at a size of around US$ 75bn at the end of 2011 (APS - Algérie Presse Service, 2011f).

Most states of the region have developed economic strategies[63], which are supposed to link decision-makers in their daily work with the national long-term objectives of economic diversification and the creation of employment for the steadily increasing national populations (see Table 8).[64] Considering the fact that members of the large, poor and unemployed youth population were among the most destabilizing factors for the former regimes in Tunisia and Egypt, Arab rulers in resource-wealthy states are taking this aspect increasingly into account.

Table 8: Growth of population in selected MENA countries according to UN medium growth scenario

Country	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Algeria	30.5	32.9	35.4	38.1	40.6	42.9	44.7	46.2	47.5	48.6	49.5
Libya	5.3	5.9	6.4	7	7.5	8	8.3	8.7	9	9.3	9.6
Egypt	67.3	74	81.1	88.2	94.8	101.1	107.1	112.7	117.8	122.2	125.9
Oman	2.4	2.6	2.9	3.2	3.5	3.8	4.1	4.3	4.6	4.8	5
Kuwait	2.2	2.7	3	3.4	3.7	4	4.3	4.5	4.8	5.1	5.3
Qatar	0.6	0.8	0.9	1	1	1.1	1.2	1.2	1.3	1.3	1.3
Saudi Arabia	21.5	24.6	27.7	30.8	34	37.2	40.1	42.9	45.3	47.5	49.5
UAE	3.2	4.5	5	5.6	6.1	6.7	7.2	7.7	8.2	8.7	9.1
Yemen	17.9	21	24.5	28.5	32.7	37.1	41.5	46	50.5	55	59.5
Bahrain	0.7	0.7	0.8	0.9	0.9	1	1	1.1	1.1	1.1	1.2

Source: German Aerospace Center (DLR), 2009, p. 139.

With regard to the thesis, renewable energies are increasingly identified as target areas for strategic national investments as this area promises a direct use for the usually strained capacities of the national power sectors as well as resource economic benefit by being able to sell more hydrocarbons on the world markets instead of using them for domestic (and subsidized) power production. Lastly, domestic development of renewable energy technologies offers the ownership in one of the most relevant future technologies, which could turn into a source of export income and soft power in the medium to long term.

A relevant subsidiary research question is:

[63] See Hvidt (2010; 2011) for an analysis of development schemes of the GCC countries.
[64] For an in-depth study on Arab demographics see Winckler (1998).

- Are the renewable energy-related efforts connected to the national economic visions or national SWF activities in the respective country?

3.2.5. Country branding

For oil and gas exporting countries, a related asset of a strong domestic renewable energy policy lies in the realm of public diplomacy. In addition to the fact that most hydrocarbons-wealthy Arab states have hardly democratic political systems – a fact that is not highly regarded by the global public – these states have a particularly bad image with regards to environmental issues. This is due to their poor performance on indicators such as carbon footprints, energy efficiency ratings, waste management or, as described above, their positions vis-à-vis a post-Kyoto regime. Renewable energies can therefore significantly raise national profiles, without considerable changes in the lifestyle of both the domestic population or of the political system.[65]

More recent attempts of country branding often include the hosting of major sports[66], cultural or business events, the marketing of its products as premium goods[67] or the targeting of special-interest groups for tourism, travel and trade. Country branding usually aims to increase tourism, investment and trade balances in addition to the hardly quantifiable outcomes of a global positive image, such an increased political clout, cultural leadership or an influx of global skilled labour into that nation. A country image can be defined as:

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[65] As the case of Masdar featured in Chapter 6 shall exhibit, such a PR campaign would not necessarily mean that a full-fledged energy transition will take place (one interviewee dubbed this project a "*tri-umph of marketing over substance*" [*Interview no. 85 – R&D, Gulf States*]). However, one can argue that even a prolonged promotion of renewable energy efforts (without much substance) might serve as an entry point to the otherwise rather closed and opaque Middle Eastern energy markets.

[66] See Berkowitz et al. (2007) for an analysis of China's efforts to use the 2008 Olympics as a reputational asset. Similarly, Qatar is likely to attempt to make use of the 2022 FIFA World Cup it will be hosting. See also Gripsrud et al. (2010) for research on the effects of sporting events on a country brand.

[67] In the last decade, Dubai has attempted to imitate the country-of-origin policy of Switzerland and combine this with attributes, such as speed and efficiency to become a global brand name (Interview no. 92 – R&D, Gulf States). It remains to be seen to what extent this will be transferable into a longstanding public perception. Cf. Bagageen (2007) for an urban planner's view on Dubai's branding efforts in: "Brand Dubai: The Instant City; or the Instantly Recognizable City".

"[…] the sum of beliefs and impressions people hold about places. Images represent a simplification of a large number of associations and pieces of information connected with a place. They are a product of the mind trying to process and pick out essential information from huge amounts of data about a place." (Kotler & Gertner, 2002, pp. 250–251)

Thus, those country images (and the related attempts to create brands out of them) are usually composed of consumers' beliefs based on personal experience (if existent) and the already described imagery shaped by media, social, political and economic conditions in a given cultural setting (O'Shaughnessy & O'Shaughnessy, 2000, pp. 57–58). Bearing in mind that most members of the public are unlikely to have any directly conceived, strong stances towards distant countries, there is large potential for active country marketing of resource-rich states.

It is therefore not surprising that particularly the states on the Arabian Peninsula, are in a race both to bolster the positive public imagery and to generate associations connected with their names[68].

Arguably, the most successful Gulf State in that regard is Qatar, a country that has emerged as a well-known and -respected member of the international community through its proactive policy initiatives. Peterson maintains that, like other small or micro states aiming to be recognized on a global scale, Qatar attempts to occupy a "unique niche whereby the small state provides a service or commodity that benefits neighbours, the region, or the broader world" (Peterson, 2006, p. 724).[69]

As shown in the case of Abu Dhabi's Masdar Initiative, a comprehensive and well-advertised renewable energy initiative can have the character of such a niche. Again, the actual outcome of this is difficult to quantify. However, the perceived greening of one of the largest oil and gas exporters worldwide and the hosting of the Arab world's only international organisation speaks for itself, as it is unlikely that Abu Dhabi would

[68] The North African oil states are much less active on that front. This, however, does not mean that public diplomacy or an improvement of their image would remain out of their interest or reach.

[69] Examples of this niche strategy: "Kuwait (formerly important player in gold imports/re-exports, dhow building and trade); Bahrain (regional commercial headquarters, financial services, regional service industries, and a weekend resort for neighbouring states); Dubai (gold imports/re-exports, emergence as a regional entrepot, free trade zone, consumer bargains, and tourism)" (Peterson, 2006, p. 742).

have been successful in its bid to house the new International Renewable Energy Agency (IRENA) had it not launched the multi-billion dollar Masdar Initiative. There is scope for this to be copied by other oil-wealthy Arab states through similar initiatives. Indeed, sustainability-related initiatives could be an important driver for the spread of renewable energies in hydrocarbons-rich Arab states that are struggling with their public image both in terms of environmental issues as well as with regards to the nature of their political systems.

In the long run, marketing tools will not be able to gloss over the hard facts that are revealed by investment, R&D, legal and electricity output indicators. If carefully managed, the benefit of branding, however, might outlast the actual achievements.

In conclusion, the relevant research question regarding that area is:

- Is country branding a catalyst in the spread of renewable energies?

3.3. Regime-level factors

As discussed upon introducing the MLP perspective in Subchapter 2.3, the regime level is arguably the key layer of socio-technical systems. Here, the dominant market players negotiate structures, interact with other major societal regimes and decide which types of innovations will be given the room to develop from niches into regime-wide standards. This subchapter identifies the key hypothesized regime factors that are thought to be relevant to renewable energy policy in resource-wealthy Arab states. As was the case in the previous subchapter, each discussion of general regime-level drivers in Arab energy markets will conclude with one or two subsidiary research questions that will inform the questionnaire for the empirical research and further discussion of the subject matter in Parts B and C.

3.3.1. Technological regime

3.3.1.1. Challenges for the power sector

Although rapidly growing the energy systems of most Arab resource-rich states remain relatively small (see Table 9).

Table 9: Electricity systems in resource-rich Arab countries

Total Installed Capacity (GW)						
	2004	2005	2006	2007	2008	2009
Algeria	7.3	7.5	7.9	8.1	8.1	NA
Bahrain	1.8	2.3	2.8	2.8	2.8	NA
Iraq	7.6	7.6	8.0	7.0	7.2	NA
Kuwait	9.9	10.9	10.9	10.9	10.9	NA
Libya	4.6	5.1	5.4	6.3	6.3	NA
Qatar	2.9	2.9	3.0	3.2	3.2	NA
Saudi Arabia	30.7	33.5	35.9	36.6	39.2	NA
UAE	13.6	15.7	17.3	18.5	18.5	NA

Source: EIA, 2010.[70]

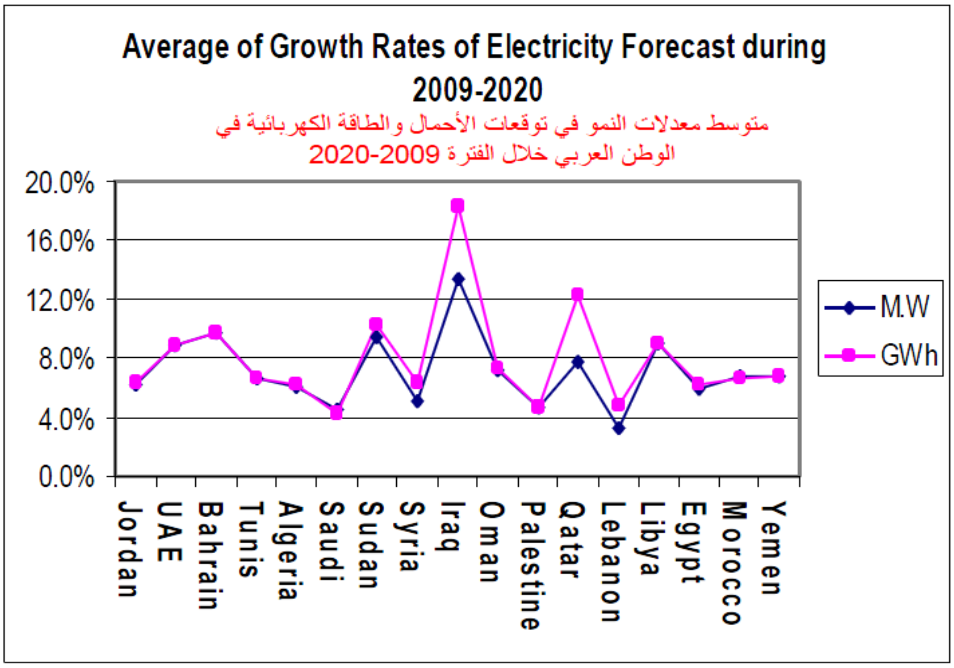
However, as users enjoy a double subsidy in electricity prices (see Subsection 3.3.2.2), the demand for power is rising sharply. Instead of showing a flattening curve like in most mid-to high income countries, electricity demand is constantly on the rise (see Figure 13). While European OECD countries have electricity demand growth rates from 1-2 per cent per annum,[71] primary electricity demand in the hydrocarbons-wealthy Arab states rose on average 5.3 per cent between 1999 and 2009 in MENA (Al Masah Capital Ltd., 2011, p. 7). In the UAE and Saudi Arabia figures were substantially higher, with a 6.1 and 9.6 per cent growth rate per annum between 2000 and 2007 respectively, and an average growth rate of 2.5 per cent per year can be expected until 2035 (US

[70] This table is based on the statistical database of the U.S. Energy Information Administration (EIA). The data was provided on the EIA website http://www.eia.gov/countries, access date: 28 February 2011.

[71] Due to the global economic downturn, global electricity demand sank for the first time in more than 30 years in 2010. In general, however, electricity generation in OECD Europe can be expected to increase by 1.1 per cent per annum on average. Most long-term EU member states have mature electricity markets and stable, if not decreasing population numbers. Thus, most of the demand growth can be expected from new EU member states with stronger population and industrial growth patterns (US Energy Information Administration, 2010, p. 84).

Energy Information Administration, 2010, p. 89). This poses a major challenge to the national power sectors.

Figure 13: Electricity demand perspectives of some MENA countries

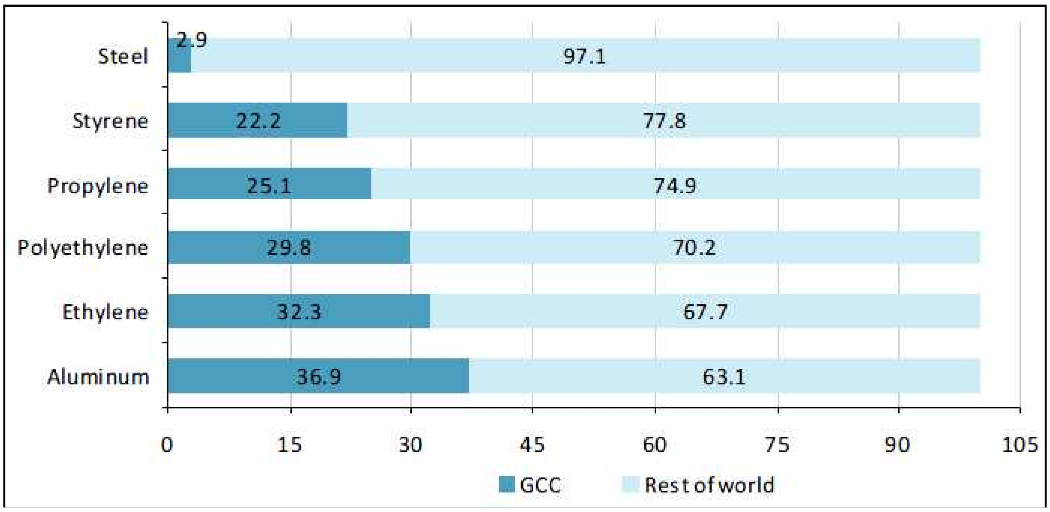


Source: Kharbat, 2010.

Along with the strongly rising domestic consumption which, at peak hours, constitutes up to 60% of the national electricity demand,[72] energy intensive industries represent the second demand driver. The asset of cheap oil and gas, as well as subsidized electricity, has made the region attractive for these industries, which has resulted in the fact that five of the six of the most energy intensive industries (steel, styrene, propylene, polyethylene, ethylene and aluminium) have 25% of their global production capacities in the GCC alone (see Figure 14) (Al Masah Capital Ltd., 2011, p. 7). In addition to that, in the entire MENA region, steel production is expected to rise by an average of 25% per annum to reach 54.9 million tons of steel per annum by 2012 (69th OECD Steel Committee Meeting, 2010).

[72] Confirmed by various interviewees (*Interview no.50, public stakeholder; Interview no. 87, R&D; Interview no. 65, private and public investors, all Gulf States*). The main domestic demand driver in summer is power for cooling.

Figure 14: Announced capacity expansion in energy intensive industries in % as of 2006



Source: Al Masah Capital Ltd., 2011, p. 7.

National utilities face problems providing for the annually rising power demand. This, in turn, poses a threat to the economic development of regions that are remote from the main grids and the centres of power production. Electricity and gas shortages occur, for instance, in the smaller emirates of Ajman, Ras al-Khaimah and Fujairah on an annual basis. As a result, local economic development is hampered by these shortages or the inability of utilities to connect business or industry customers with consumers in a reasonable time frame.[73] As will be discussed in Chapter 5, these emirates are part of the UAE's national grid and are powered by the Abu Dhabi-funded Federal Electricity and Water Authority (FEWA). This issue sparked a controversial debate in the UAE's Federal National Council (FNC)[74] causing representatives of the Northern emirates to

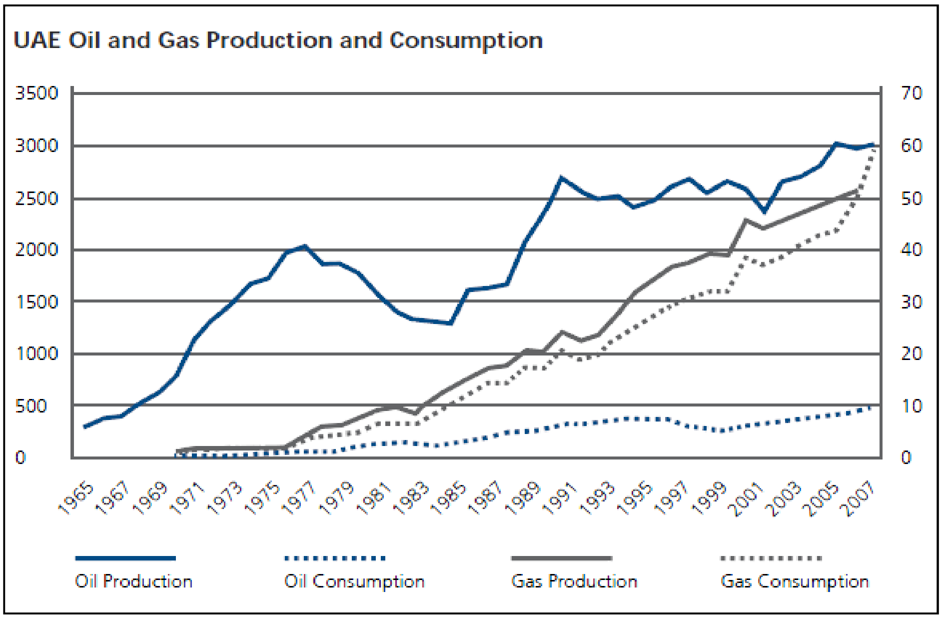
[73] One interviewee stated: *"In Ajman, 15-20% of the industrial projects p.a. cannot be realized because they could not be connected to the grid – there is simply no power for them! The same is true for RAK and Um al Quwain and Fujairah. These are low-income emirates, like developing countries. But because Abu Dhabi and Dubai are so wealthy, we don't get any development funds because on average, our country is high income!"* (Interview no. 56 – Public stakeholder, Gulf States)

[74] The UAE's Federal National Council is the advisory body of the UAE government. Of its 40 members, 20 are directly appointed by the rulers of the 7 emirates of the UAE while 20 members are elected by an electoral college consisting of approximately 12 000 UAE citizens. While this is by no means a fully democratic form of political representation, the FNC remains nonetheless the only element of proto-democracy in the UAE federal structure as many of its citizens confidently demand universal suffrage. According to article 68 of the UAE constitution, seats in the FNC are distributed as follows:
Abu Dhabi 8 seats; Dubai 8 seats; Sharjah 6 seats; Ras Al-Khaimah 6 seats; Ajman 4 seats; Um al -Quwain 4 seats; Fujairah 4 seats.

accuse FEWA of poor planning and to question the responsible federal minister of energy, Mohammad Al Hamli, in the FNC (*gulfnews.com,* 2010b).[75]

As Figure 15 shows, the unrestricted demand rise forms a major problem for Abu Dhabi's power sector. Gas demand, the primary energy carrier for the UAE, is just about to exceed the local production causing gas shortages and necessitating imports from neighbouring gas exporters, such as Qatar, via the Dolphin pipeline (Krane, 2010b, p. 15).

Figure 15: UAE oil and gas production and consumption



Source: Krane, 2010b, p. 15.

In conclusion, the following research question frames the renewable energies-related challenges or potentials for the domestic power sectors:

- To what extent are renewable energies employed to reduce pressure on the domestic conventional power plant park?

[75] See Krane (2010b) for an in-depth discussion of these issues.

3.3.1.2. Renewable energy and the nuclear alternative

In light of the strong demand rise, stakeholders explore different ways for further capacity enhancement by means of nuclear energy. Most Arab countries have run civil (or military) nuclear programmes at one point in time (International Institute for Strategic Studies, 2008). Besides domestic policy elements, nuclear energy appears to be an excellent choice for energy decision-makers in resource-rich Arab states. Nuclear power plants are able to supply large parts of their national base load capacities and are a strongly capital intensive undertaking – typical megaprojects that fit well into the country-specific development pattern outlined above. In addition to that, the authoritarian regime structures and the virtual inexistence of independent civil society organisations ensure that obstacles facing the deployment of nuclear energy in the west, such as local or civil society pressure or lengthy planning procedures, are not an issue in the target region.

On various occasions, it has been claimed that the load combination of nuclear for base load, gas-fired power plants for middle load and solar technologies for peak load were the optimal power mix for our category of states (*Interview no. 58, public stakeholder* and *Interview no. 84, R&D,* both *Gulf States*). This, however, is a disputed contention. While it is beyond the scope of this work to systematically analyse all technology and policy implications of nuclear energy vs. renewable energy in this region,[76] in general this work follows Verbruggen's argument that renewable and nuclear power options are by no means an ideal combination for low-carbon energy systems, but that in many ways, the installation of nuclear electricity prevents the wide-spread deployment of renewable energy in the respective energy systems (Verbruggen, 2008).

In contrast to that, the MENA region is located in a high-resource potential region: part of the global "sun belt", it receives an average solar radiation intensity of 2000-2800 kWh/m^2 per year (see Table 10). While not all areas in the region are ideally suited for concentrating solar power (CSP) technology, other areas could make use of the more

[76] See Marktanner/Najmeddine (2011), Supersberger/Führer (2011) and particularly the two papers by Jewell (2011a & b) for a further discussion of this topic.

diffuse light by the spread of PV panels. In addition to that, there exists also a significant potential for wind energy in those parts of the region that have shores on the coasts of the Atlantic (Morocco, West Sahara), the Indian Ocean (parts of the UAE, Oman, Yemen) and the Red Sea (Egypt).

Table 10: Wind and solar data for MENA countries

Country	Direct normal irradiance kWh/m2/y (for CSP)	Global horizontal irradiance kWh/m2/y (for PV	Full load hours of wind energy (h/y)
Bahrain	2050	2160	1360
Iraq	2000	2050	1789
Jordan	2700	2310	1483
Kuwait	2100	1900	1605
Lebanon	2000	1920	1176
Oman	2200	2050	2463
Qatar	2000	2140	1421
Saudi Arabia	2500	2130	1789
Syria	2200	2360	1789
UAE	2200	2120	1176
Yemen	2200	2250	1483
Algeria	2700	1970	1789
Egypt	2800	2450	3015
Libya	2700	1940	1912
Morocco	2600	2000	2708
Tunisia	2400	1980	1789

Source: United Nations Environment Programme (UNEP) & Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2007, pp. 13; 16.

Furthermore, local demand patterns promote the domestic spread of renewable technologies (especially solar), as standard demand curves in the region follow the sun both on a daily as well as on an annual basis, in the sense that the demand peaks are at least partially parallel to sunlight maximums (daily: noon-afternoon; annually: summer months).[77]

In conclusion, the subsidiary research question in this field is:

- Is the nuclear option seen as a competitor in resources or as a mutually exclusive form of power production?

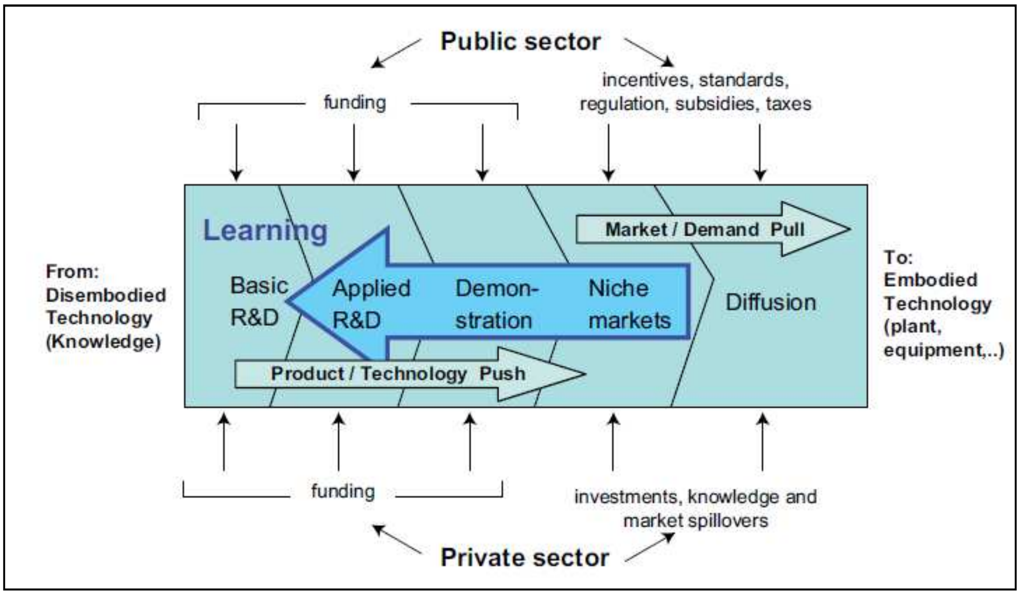
[77] See the corresponding case study chapters for demand curves (Figure 35 and Figure 45 below). While the afternoon peak is indeed by and large parallel to the sunlight, the evening peak forms a challenge if it was to be largely supplied by renewable electricity. In the Arab world this is due to the relative lack of constant industry demand with the domestic demand patterns tending to dominate national demand curves (*Interview no. 45 – R&D, EU*).

3.3.2. User and market regime

3.3.2.1. Market conditions

While innovation processes in the renewable energies sector can be described by multiple models, the key material steps in this process are presented in Figure 16. Following this approach, fundamental support areas for the uptake of any new technology are basic R&D, early test applications, first real-condition demonstrations, as well as protected niche markets, is likely to be successful. This “technology push” phase, however, can only be successful with private and public sector funding, as these nascent technology innovations cannot single-handedly compete with strong system actors. Thus, until a commercial viability can be reached and market forces drive the future development of such innovations (“market pull”) a set of promotion instruments is necessary, as has also been the result of the policy design discussions in Subchapter 2.4.

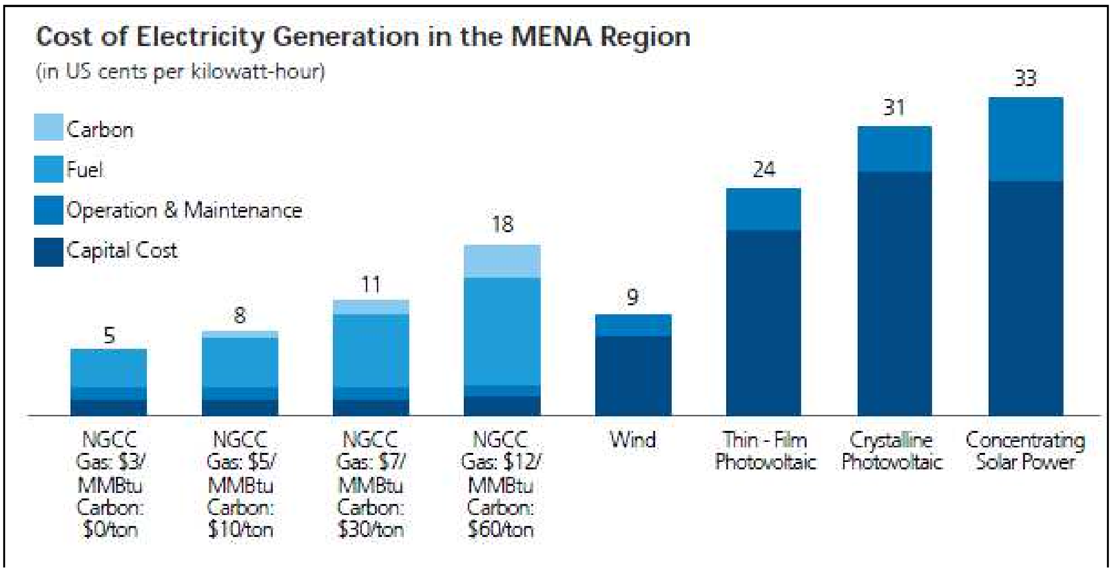
Figure 16: The innovation process



Source: Metz, 2007.

For renewable electricity, this means that, first and foremost, the price differential between renewable and conventional power has to be bridged (see Figure 17). If a national economy runs in line with market rules, this is the key instrument available, as companies will only make investment decisions if they have direct or strategic business incentives. Further dimensions discussed by this thesis, such as climate change or nation branding, will only be relevant to such a decision if there is a quantifiable link to the company's performance. This, however, is unlikely to be the case.

Figure 17: Cost of electricity generation in the MENA region



Source: Krane, 2010b, p. 24.

The manner in which the price gap between conventional power and renewable electricity is closed is irrelevant from a company's point of view. A wide range of tools, from technology subsidies, tax reductions, favourable business conditions, raise of power prices, as well as green certificates is possible.[78]

More than 40 governments worldwide (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2010) have so far opted for feed-in-tariff (FIT) models in accordance with the successful German renewable energies act (EEG). With its EEG, Germany has long been the frontrunner in renewable energies since 2001, when Germany guaranteed producers the right to feed into the national grid with fixed FITs. The price gap between conventional electricity prices and the guaranteed FIT is paid by all electricity consumers amounting to an annual premium of 5.3€bn in 2009 (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2010). A differ-

[78] Publications discussing and comparing different renewable energy promotion tools are abundant. See, for instance, EIB on financing renewable energies (European Investment Bank, 2010); Madlener/Stagl (2005) and Folkmanis (2011) for trading schemes and Philibert (2011) for a discussion on renewable energy vs. climate policies. A most comprehensive list of concrete government measures is presented by EU DG TREN (European Commission DG TREN, 2011b, pp. 4–5).

ent model is the renewable portfolio standard, a system that is, for instance, used in the UK under the name of “Renewables Obligation Certificates” (ROCs). This regulation obliges electricity suppliers to reach a target renewable electricity rate within their overall production portfolio. Entirely designed as a market-based tool, ROCs are distributed to renewable electricity producers by the national regulator, Ofgem (Office of Gas and Electricity Markets). While the number of ROCs provided is MWh-based, different types of renewable electricity production obtain different ROC payments. Suppliers are obliged to purchase ROCs for a given percentage of their overall energy production. When the pre-determined target is not met, a penalty payment has to be paid by the company. While in the FIT model renewable energy premiums can only be altered through a legislative change, the ROC model follows a market mechanism: a shortage of ROCs increases the prices for ROCs, which encourages the market entry of more RE producers. This, in turn, decreases the ROC’s values again until an equilibrium price is established.

Research has long argued whether market-based mechanisms such as the ROC are superior to FIT models in terms of installed capacity, electricity price, or market openness (Butler & Neuhoff, 2004; Fouquet, Grotz, Sawin, & Vassilakos, 2005). While each system has its advantages in theory, actual developments of the last years have shown a higher performance of FIT systems. According to the UK Renewable Energy Strategy, for instance, the UK only produced 5.5% of renewable electricity in 2008. FIT-countries like Spain, Denmark, or Germany have far exceeded that quota. This does not mean that the FIT-model would be the only reasonable option for the hydrocarbons-rich Arab states. As will be demonstrated, their energy systems show strong dissimilarities compared to the ones where FITs have so far been most successful. In addition to that, the interviews have shown that many energy experts in the region would call for government-controlled IPP-models that might in fact lean more towards ROCs.

So far, hydrocarbons-rich Arab states have been cautious about introducing any commonly accessible promotion instruments for renewable energy. If so, like in the Algerian case, they have opted for a (flawed) FIT model prioritizing the incumbent system actors, which have formerly been the state utilities, which monopolise the power supply. Usually, small, independent power producers cannot benefit from the FIT systems as renewables are produced by large utilities which do not disclose information pertaining to their contracts with government. In addition, the transmission system operators are not obliged to purchase the electricity produced by independent power producers, and customers do not have the liberty to choose their power providers; two essential elements for the spread of renewables in Europe. In light of the previous discussions in Chapter 2, a question that needs to be asked is to what extent can European policy design models be transferred and if these would form a necessary condition for the spread of renewable energies in hydrocarbons-wealthy Arab states or whether other policy models that more closely match the local governance structures would not yield better results. This issue will be discussed in the policy design sections of both case studies.

Another regulatory issue, which puts a structural burden on the spread of renewable energies, is the legal obligation of power providers to exclusively purchase the cheapest power available from power producers. While, on first glance, this appears to be a commercially reasonable regulatory measure this can develop into a major structural barrier for renewable electricity. As one senior interviewee in Abu Dhabi said:

One of the key issues that make it hard for us to integrate renewables on a regulatory level is that our electricity law [DK: Abu Dhabi's] demands from us that only the most economic form of electricity production enters our grid. (Interview no. 51 – public stakeholder, Gulf States)

In conclusion, the guiding empirical questions for this section are the following:

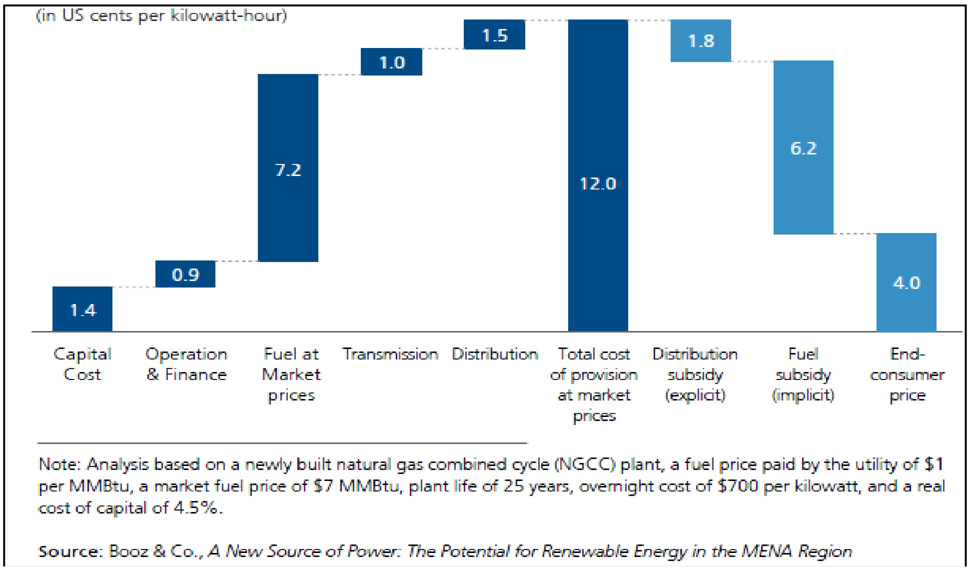
- Is there any system of renewable energy promotion in place?
- Do stakeholders believe that the transfer of European renewable energy policy design models is a viable method for the spread of renewable electricity capacities in the region or would indigenous policy models work better?

3.3.2.2. The system of double subsidies

Electricity markets in resource-rich Arab countries are dominated by fossil fuel based energy production and a system of double price subsidies.

Abu Dhabi, for example, supplied its power plants with gas at US$ 1-2 per million British thermal units (BTU); which equals to selling oil at a price of US$ 6-12 per barrel (Krane, 2010b); a clear underpricing given current world oil market price levels. This means that the suppliers of these plants, the national oil companies (NOCs) forego substantial annual income, as they incur high opportunity costs for not being able to sell their products at world market prices. Consequently, it would be in their commercial interest to burn less fossil fuels domestically and to increase the share of any substitute fuel in the national electricity systems.[79]

Figure 18: Cost and income structure of a typical GCC utility



Source: Krane, 2010b, p. 23.

[79] The extreme case for this is Saudi Arabia, where a sizeable share of the country's energy supply is still produced by the burning of heavy oils. In contrast to the environmental issue, this is a commercially plausible solution. One interviewee stated:
"The reason for that is that in Saudi Arabia, their oil & gas production has only very little unassociated gas. That's why they cannot increase the gas production without increasing the oil production. This extra oil, on the other hand, cannot be sold on the world market due to OPEC quotas – so economically, it makes for them much more sense to go for burning oil." (Interview no. 68 – national and international power sector, Gulf States)

In addition to the power generation side, electricity for consumers on the demand side is equally subsidized. Continuing the example of Abu Dhabi, the above-described system of power generation subsidy allows utilities to produce and distribute electricity for 5-6 US$ cents per kWh. Residential customers pay 2 US$ cents or less per kWh, one fifth of the asking price in the United States. This implies a total subsidy of 8 US$ cents per kWh (Krane, 2010b, p. 11) compared to US prices. These price differentials can only be achieved through active government subsidy (see Figure 18), which incur a heavy burden on the state budgets.

This system of double subsidies structurally favours the already existing modes of power production. In fact, in some countries, such as Kuwait, where the utilities and the NOCs are owned by the state, there is not even a proper separation of balances between the sales of the national oil company Kuwait Petroleum Corporation (KPC) and the national utility (*Interview no. 84 – R&D, Gulf States*). These interlinkages build on informal networks and create path dependencies that make it difficult for new forms of power production to enter the market, particularly for those that need an additional premium to close the price gap in LEC of oil/gas powered power plants and other technologies, such as various forms of renewable electricity production. Thus, electricity pricing remains a key issue for the uptake of renewables in resource-rich Arab countries.

The relevant subsidiary research question is:

- Are strategies developed to create a level playing field for all types of energy carriers by either removing subsidies for conventional power or by integrating renewable electricity into the existing subsidy schemes?

3.3.3. Socio-cultural regime

3.3.3.1. Social acceptance of RETs, potential role of religion or environmental ethics

While prima facie, the social acceptance of renewable energies may not matter much, indirectly, it is a key determinant of success. First, only if renewable energies are regarded as a more desirable form of power production than conventional or nuclear power there will be a general willingness to pay a premium price for this or, in heavily subsidized power systems, like the target countries, there will be a willingness to subsidize these forms of energy production. In addition to that, should small-scale renewable energy programmes be the model of choice for decision-makers, the population would actually need to implement them first by installing solar panels on their rooftops or carrying out similar measures.

Secondly, although the hydrocarbons-wealthy Arab states are far from being democracies, decision-making elites may opt for a substantial renewable electricity programme if they feel renewables are somewhat supported by the domestic population (or at least not openly opposed).

However, as Assefa and Frostell show for the case of Sweden, the level of general awareness towards technology choices for power production is usually low (Assefa & Frostell, 2007) and in-depth discussion rarely leaves expert circles.

An important role in awareness-building – and action expressing a heightened sensitiveness for sustainability issues on a local level – could also be fostered through a pronounced focus on environmental ethics, promoted by schools, universities or religious institutions. While authors such as Zsolnai (2011), Callicot (2011) and Schmidtz & Willott (2002) have discussed the more general features of environmental ethics and environmental education, other researchers such as Shrader-Frechette (2011) have argued for the global use of renewables rather than nuclear power on philosophical grounds. Furthermore, the question of how to develop global valid environmental ethics in the face of de facto moral and religious pluralism has also been discussed (Marietta, 1993). Marietta makes it a point to abandon monistic ethical approaches in the face of the globalized world where the “other voices” must seriously be considered. Yet, he does not delve into local ethical traditions to further elaborate his point. Unlike Marietta, regional philosophers such as Jain (2006) or Nuyen (2011), study and review East Asian traditional religious and philosophical approaches and explore their interrelationship with environmental ethics. The nexus between traditional communities, regional ethical traditions and global environmental ethics has yet to be fully explored in research literature pertaining to the the Arab world, which usually focuses on Islam and neglects to explore secular approaches. This is an important research desideratum that needs to be addressed.

A related research question is:

- How widespread is the knowledge of renewable energies in the target countries? Does religion play a role in legitimizing this energy technology?[80]

3.3.3.2. Labour markets

Technology innovation as a means of national competence building and the diversification of national income emerges as an important policy driver. As shown by the example of Germany's creation of 278,000 renewable energy-related jobs in the last 15 years (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2009, p. 31), the production of renewable energy technology for the domestic, regional and the world market can become important factors in upgrading a nation's position in a major growth market in the decades to come.

In addition to the purely economic aspects, this job creation can play a role in absorbing the large youth bulge of most Arab countries. According to A.T. Kearney (*AMEInfo,* 2009c), the Middle East has the opportunity to become a boom region for solar energy technology in the next 10 years with additional 9,000 MW of concentrated solar power capacities until 2020 and more than 40,000 MW until 2030. A further 100,000 jobs could be created in the region in the next decade. Developing private sector jobs can play a vital role in the restructuring of the Arab domestic labour markets, which, particularly in the oil states, have massive but ill-performing public sector workforces. Particularly in the Gulf States, integrating nationals into the public sector enables the rentier states to distribute their generous welfare package through these positions

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[80] The wording of the second part of the research question focuses on the role of religion in order to test whether religion could indeed be identified as key mover in that regard or whether – as discussed in the text – an approach based on environmental ethics and secular philosophy would not be more appropriate.

(*Interview no. 53 – public stakeholder, Gulf States*). In combination with the substantial salaries of even low and mid-level jobs in the public sector, a main reason behind the Gulf nationals' low interest in private sector jobs, Gulf governments pay their nationals premiums to work in the private sector (*Interview no. 83 – R&D, Gulf States*). In contrast, the labour markets in Algeria or Libya resemble labour markets of "communist states prior to the collapse of the USSR" (Henry & Springborg, 2001, p. 6): inefficient and poorly paid public sector and underpaid private sector jobs are the norm.

In the context of rising power demands and rising numbers of citizens expecting employment, the comparative labour-intensity of renewable energies is a potential policy driver for the region. Compared with nuclear energy or gas-fired power plants, it is claimed that renewable energies create more jobs per kWh, and can thus contribute their share to depressurize Middle Eastern labour markets.[81]

A key research questions in terms of labour markets is thus:

- Is the job creation potential actually employed by promoters of renewable electricity in the country?

3.3.4. Policy regime: Regime-level and transregional governance structures

3.3.4.1. Renewable energy targets and actual performance

The integration of substantial renewable electricity capacities into national power pools poses a major planning challenge to grid operators. In addition to that, states with a mid-term plan to increase their renewables quota will usually develop a national energy strategy – or a slightly less high-level planning document as a functional equiva-

[81] The claim that subsidized renewable energies in fact produce sustainable jobs has been hotly debated. While Spanish researchers maintain that on the whole, renewable energies harm the economic system (Calzada Álvarez et al., 2009), Hentrich et al (2004) support this argumentation in their analysis of labour market effects in Germany.
While both sides mainly acknowledge the creation of new employment opportunities in the renewable energy sector itself, calculations differ regarding the effects on other sectors of the economy, as well as further macroeconomic and environmental costs/benefits.

lent – that outlines a country's mid- to long-term electricity strategy. Until recently, countries in the MENA region hardly had these documents published; and usually, the renewable energy quotas remained low.

This situation has changed most recently: in Arab states, national renewable energy strategies have been launched or at least public interest expressed. Starting from the East, Oman has expressed its interest in developing a renewable energy strategy and launched an exploratory study in 2008 (Authority for Electricity Regulation, Oman, 2008), while the UAE's efforts to become a landmark in this area culminate in the Masdar Initiative, which will be analysed below in greater detail (see Chapter 5). In June 2009, the Kingdom of Saudi Arabia announced joint-projects between the national oil company *Saudi Aramco* and Japan's *Showa* exploring the possibility of a solar power in the Kingdom in addition to other initiatives in the pipeline. [82] In North Africa, Algeria has set itself an ambitious 5% renewable energies target for 2015 with a designed feed-in tariff, while both Morocco and Tunisia have embarked on ambitious renewable energy plans (Ministre de l'industrie, de l'énergie et des petites et moyennes entreprises, 2009; Kumetat & Hamiane, 2011). Meanwhile Egypt, the Arab world's pioneer in renewable energies, continues with both its ambitious solar and wind energy programmes. Table 11 presents an overview of currently published renewable energy targets or schemes in the Arab world:

[82] Cf. *AMEInfo* (2009a). See also Dargin (2009) and Apricum Advisers (2010) for recent activities, which include the foundation of the King Abdullah University of Science and Technology (KAUST) in 2009 and the King Abdullah City for Atomic and Renewable Energy (KACARE) in 2010. During the inauguration of KAUST, Saudi Arabia's oil minister al-Naimi stated "in the same way we are an oil exporter, we can also be an exporter of power" (Lewis, 2011). However, it must be stressed that Saudi Arabia has so far not given itself a binding renewable energy target, nor does it not allow the on-grid production of renewable energies for independent power producers. Also, the legal systems do not provide further financial incentives.
For a more research-based assessment of the Saudi Arabian renewable energy efforts see the Japan International Cooperation Agency's (JICA) study (2009), the scenario research of al-Saleh et al. (2008) and al-Saleh's doctoral dissertation (2010).

Table 11: Overview of renewable energy plans in MENA with solar and wind share

Country	RE targets	Solar	Wind
Algeria	6% by 2015 (including co-generation); 11-20% by 2020	3 x 500MW hybrid Gas-CSP power plants (total of 110 MW solar); few MW of PV	No target available
Egypt	20% by 2020	1x 140MW hybrid Gas-CSP power plant	7200 MW by 2020
Jordan	10% by 2020	600 MW by 2020; 30% solar water heaters (SWH) by 2030	600 MW by 2020
Lebanon	No national target set	Development of SWHs	No target available
Morocco	10% of energy consumption / 20% of capacity by 2012	500 MW by 2015 (incl. micro-hydropower)	1500 MW by 2012, 2200 MW by 2020
Pal. Territories	20% of energy consumption by 2012	Identified as priority area	No target available
Syria	3% of energy consumption by 2011	2 CSP plants of 110 MW each, 1 PV plant (20 MW)	No target available
Tunisia	10% of energy consumption by 2011	1x 20 MW CSP plant	240 MW
UAE	7% of total electricity consumption by 2020 (Abu Dhabi only)	1 x 10 MW plant (Masdar), 1x100 MW PV plant (Nour 1), 1 x 100 MW hybrid Gas-CSP power plant (Shams 1)	No target available
Bahrain	No national target set	No target available	No target available
Kuwait	5% by 2020	No target available	No target available
Qatar	No national target set	No target available	No target available
Saudi Arabia	No national target set	No target available	No target available
Oman	No national target set	No target available	No target available
Yemen	No national target set	No target available	No target available

Source: own compilation.[83]

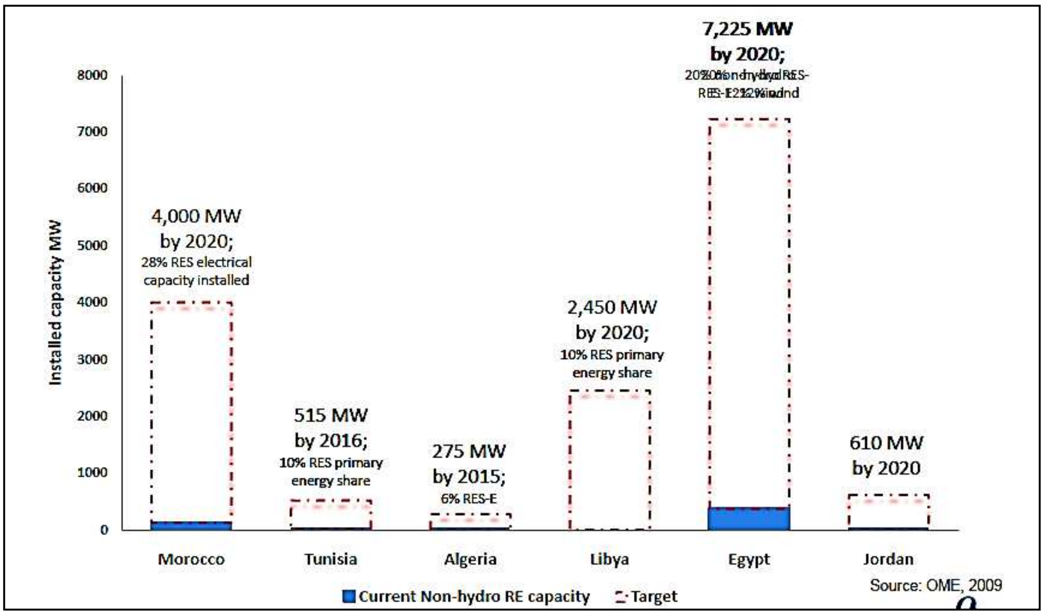
It is striking that the renewables-related efforts of those Arab states without hydrocarbons are much more dynamic than those in resource rich Arab states. Reasons for this are arguably the more immediate need to supply the national energy demands, as well as the more forceful agenda setting by funding agencies as is the case in the hydrocarbons rich states. While there is much media attention on renewables in hydrocarbons-wealthy states, targets in this group of states evidently remain poor or not yet formalized.

In addition to that, even the announced renewable energy targets are far from being realized (see Figure 19). This incongruity between North African targets and reality is also powerfully demonstrated in a recent study by the European Investment Bank (European Investment Bank, 2010). With regards to GCC energy statistics, demand scenarios and targets, one interviewee stated: *"It is well known and most people from the*

[83] For Kuwait and Abu Dhabi cf. The National (2009), New Energy Finance (2009).

power sector will confirm this: most numbers that are published either serve a certain political purpose (for instance to demonstrate the need to install nuclear power in the UAE given the "scientifically proven strong demand rise") or their numbers are entirely made up" (Interview R&D – EU).

Figure 19: RE Targets and current realization in North African countries



Source: Vigotti & Kappauf, 2010.

In conclusion, research questions for this section are:

- Is there a (binding) strategic document, such as an energy roadmap/blueprint or at least a non-binding planning scheme? If so, how does this integrate renewable electricity?

3.3.4.2. Regional infrastructure and electricity governance bodies

This subsection shall introduce the governance bodies regulating the traditional power sector in the oil-wealthy Arab states.

Regional electricity regulation in the Arab states is often established in parallel to the political unions. Those sub-regional organizations also reflect historically developed intra-regional, economic and language ties.[84] However, the two regional organisations in existence do not have a strong say on energy matters. In the Maghreb, the Arab Maghreb Union (AMU) forms the relevant sub-regional organisation. Apart from Egypt it consists of all the North African Arab states (Morocco, Algeria, Mauretania, Libya, and Tunisia). Given the fact that regional integration between the Maghreb states is poor[85] and any political rapprochement stalled through the on-going conflict between Algeria and Morocco on West Sahara (Martinez, 2006), the AMU's weak performance is therefore expected. Also in terms of energy, the AMU – headed by the Tunisian Habib Ben Yahia – is yet to find a way to develop into a significant regional intergovernmental forum.

In terms of electricity markets, the key governing body for AMU members is the Maghreb Electricity Committee (*Comité Maghrébin de l'Electricité,* COMELEC). COMELEC was founded under the umbrella of the AMU in 1989 with the goal of strengthening regional cooperation of the domestic electricity grids, and to harmonize power markets ("Le « COMELEC » en bref", no date). Moreover, it is the regional contact point for EU-funded initiatives like the Euro-Mediterranean Energy Market Integration (MED-EMIP) and grid integration (Medring) projects. However, COMELEC has not played a key role in many respects because not all AMU states have power interlinkages today. The states that operate synchronized grids are Tunisia, Algeria and Morocco (see Figure 20).

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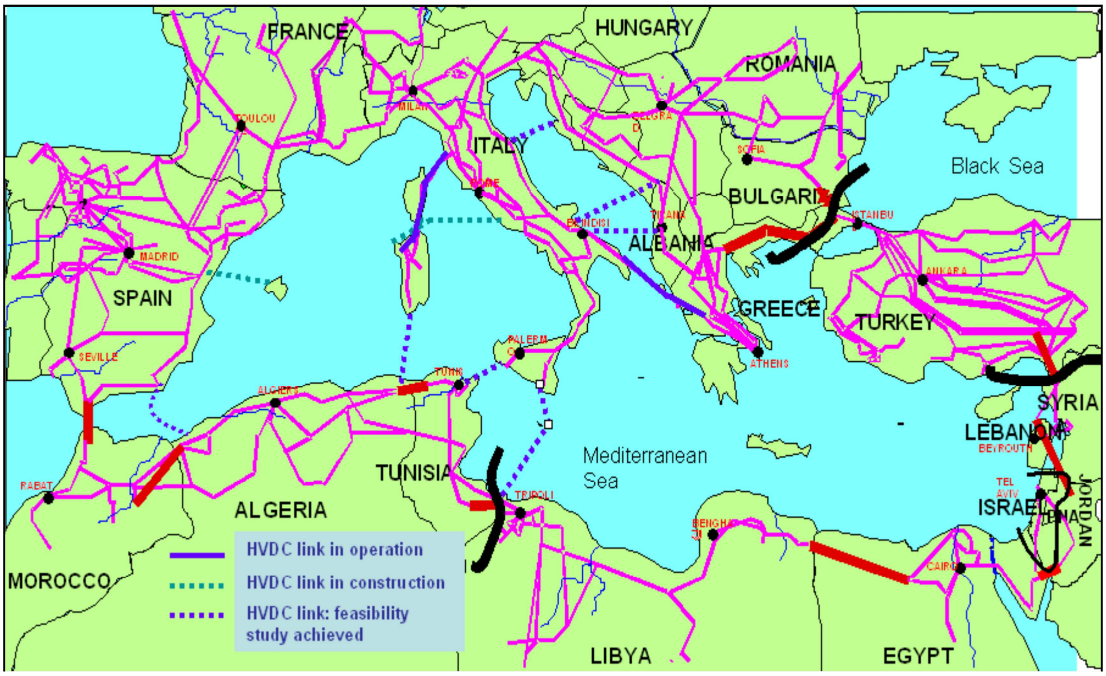
[84] This is the case for the Maghreb and the Gulf states. The states of the Mashreq (occ. Palestinian Territories, Lebanon, Jordan, Syria and to some extent Iraq) have not established a functional equivalent to the other two sub-regional organisations presented here.

[85] In "2003 intra-regional trade between the Maghreb countries (Algeria, Morocco and Tunisia) only reached 3% [of total commercial exchange]" Martinez (2006, p. 6). The cost of the poor regional cooperation in the Maghreb (French *cout du non-Maghreb*) has sparked a series of publications; see for instance Ghilès (2010), Hufbauer/Brunel (2008) or the publication by the Moroccan ministry of economy (Direction des Etudes et des Prévisions Financières, 2008).

Figure 20: Power systems around the Mediterranean basin and open cut-sets



Source: Euro-Mediterranean Energy Market Integration Project (MED-EMIP), 2010c, p. 27.

In addition to enhanced intra-regional electricity trade a second key asset of the three mentioned states is their grid's synchronisation with the European Network of Transmission System Operators for Electricity (ENTSO-E). The three states joined in 1997 (Dahome, 2010) forming the South-Eastern Mediterranean Block (see Figure 21) of the then-Union for the Co-ordination of Transmission of Electricity (UCTE),[86] whose 240,000 kilometres of high-voltage transmission lines connect 26 European countries (Fairley, 2008).[87]

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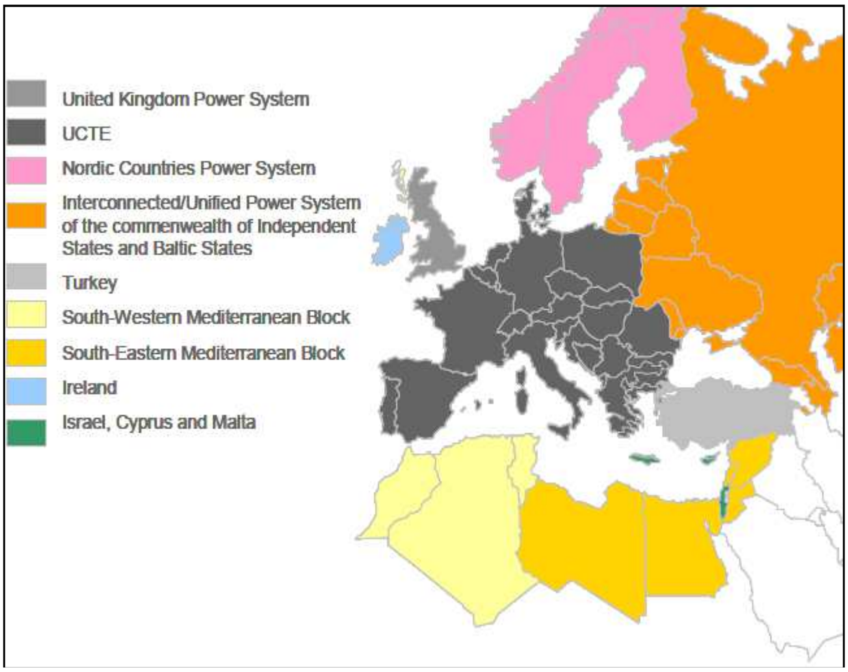
[86] On July 1 2009 UCTE's operations were taken over by ENTSO-E.

[87] While Turkey's grid has been synchronized in September 2010 (European Network of Transmission Operators for Electricity (ENTSO-E), 2010), all other Arab Mediterranean states still lack a synchronisation. Thus, the Mediterranean power ring remains open. The synchronisation attempt between Tunisia and Libya failed on 21 November 2005. See MED-EMIP Study II (Euro-Mediterranean Energy Market Integration Project (MED-EMIP), 2010a, pp. 17–25) for an in-depth analysis of the synchronisation failure. A new synchronisation attempt is scheduled for the following years.

Figure 21: The Euro-Mediterranean power systems



Source: Resources and Logistics, 2010, p. 26.

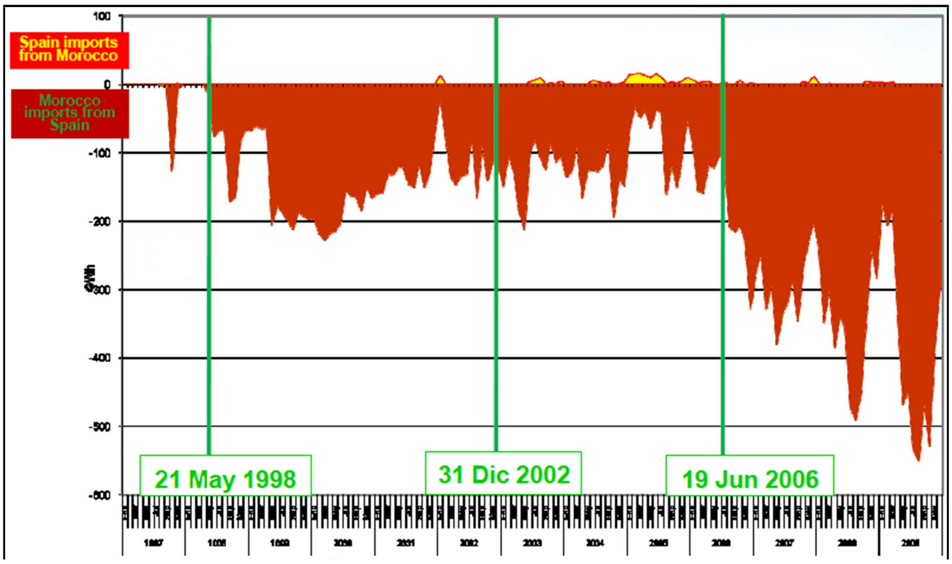
In principle this fact makes it possible for North African electricity to be tradable on the Spanish electricity exchange[88], an important precondition for a meaningful electricity interrelationship with a large renewables component. Although various other connections have been planned (see Figure 20), the only physical power interconnection between the Maghreb and the European grid system exits on the Straits of Gibraltar between Spain and Morocco. This connection has developed into an important source of power for the Moroccan electricity system[89] that is struggling to keep up with rising demand, a reason why the original 700MW capacity of the interconnection has been doubled to 1.4 GW in 2006 (Benabid, 2009). However, the North African-European electricity interrelationship is currently largely an import of power to North Africa (see

[88] Since 2001, the public electric utilities ONE (Morocco) and Sonelgaz (Algeria) have acted as licensed traders on the Spanish electricity exchange platform *Operador del Mercado Ibérico de Energía (OMEL)* (Brand & Zingerle, 2011).

[89] In 2008, for example, the national Moroccan utility *Office National d'Electricité* (ONE) purchased 15.4 per cent of its total annual supply on the European power market and imported it to Morocco through the trans-continental interconnector (Fairley, 2008).

also Figure 22). For a large-scale export of (renewable) electricity to Europe however, new capacity would need to be established.[90]

Figure 22: Spanish-Moroccan electricity trade 1997-2008 in GWh



Source: Garcia, 2010.

The AMU's functional equivalent in the Gulf region is the Gulf Cooperation Council (GCC). Its member states are Kuwait, Qatar, Saudi Arabia, Bahrain, Oman, and the UAE.[91] Based in Riyadh, Saudi Arabia, the GCC is headed by Abdullatif bin Rashid al Zayani and has been successful in many, although by far not all, aspects of economic integration in the Gulf region.[92] Energy matters, however, remain largely out of the scope of this organisation.

In terms of regional cooperation in the power sector, the GCC grid has attained major significance in recent years. The GCC interconnection plan, begun in 2008, covers three phases of interconnection (see Figure 23). In July 2009, the grids of Saudi Arabia, Qatar, Bahrain and Kuwait were linked in a first phase. Yusuf Janahi, chairman of the Gulf Cooperation Council Interconnection Authority (GCCIA) announced:

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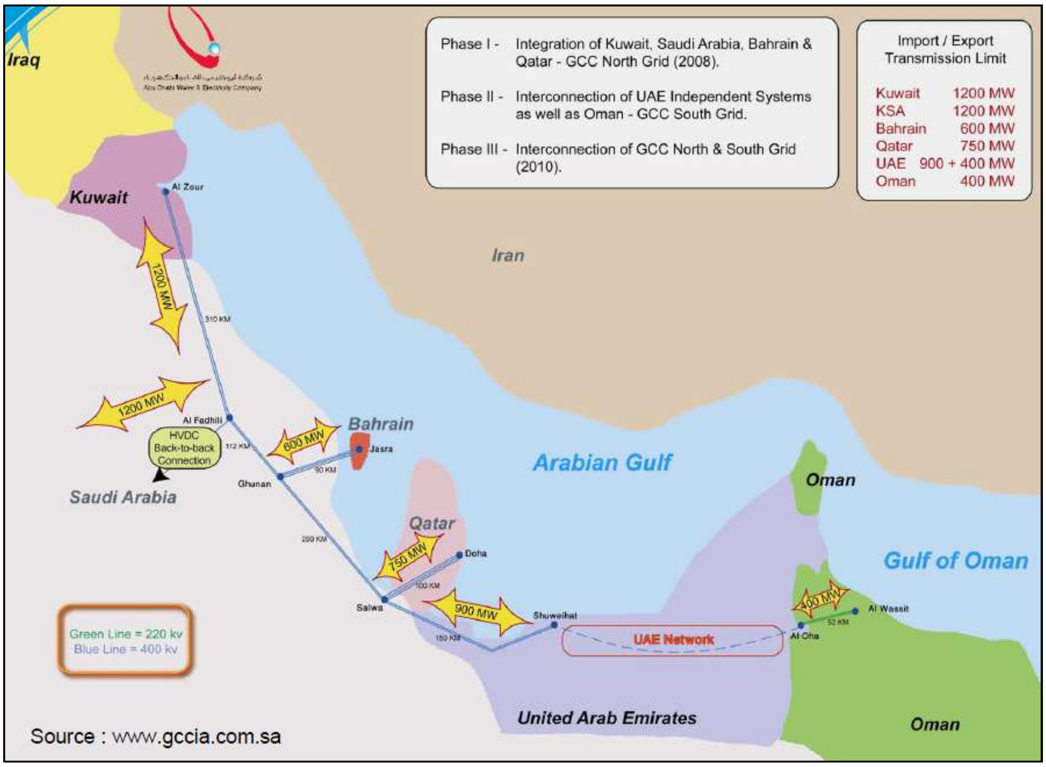
[90] For a further discussion of Euro-Mediterranean energy issues (with a focus on Algeria) see Subchapter 6.5.
[91] See Alasfoor (2007) for a historical review of the GCC.
[92] In May 2009, for instance, the UAE pulled out of the plan for a common GCC currency after not being awarded the seat on the would-be GCC central bank, for which it had launched bids from 2004 onwards. More recently, however, UAE ministers underlined that their interest in a common currency remained strong (*Thaindian News,* 2010).

"With the successful linking of the electricity grids (...), the member countries are close to achieving their goal of having a joint power grid for all six member states. The grid aims at guaranteeing an adequate supply of power even in emergencies and also reducing the cost of power generation in member countries. There will of course be other economic gains." (*BusinessIntelligence Middle East,* 2009b).

Thus, two GCC grids will operate for a period of time and only in a third phase; these will be integrated into one GCC Interconnection Grid.[93] In the same month, all GCC member states except Oman signed a power sharing agreement in order to regulate the flow of electricity between their countries.

Figure 23: Stages and interconnections of the GCC grid



Source: Miller, 2005.

The underlying reason for the GCC grid is the continuously growing power demand and the at times poor capacity of Gulf national utilities to cope with situation. In addition to

[93] Phase one includes a double-circuit 400kV, 50Hz line from Al-Zour in Kuwait to Ghunan in Saudi Arabia with an intermediate connection at Fadhili in the Kingdom and associated substations and a back-to-back HVDC interconnection to the 380kV, 60Hz system at Fadhili, a double circuit 400kV comprises overhead lines and a submarine link from Ghunan to Al-Jasra in Bahrain and associated substations (*BusinessIntelligence Middle East,* 2009b).

that, the GCC utilities can optimize their power production, as well as reserve capacities, if they are able to rely on other regional electricity systems.

Interviewees were divided on the question of whether the GCC states would actually allow for a full-fledged common electricity market as this would necessitate a transparent and common electricity pricing mechanism.[94] As highlighted in Section 3.3.2, electricity pricing issues are sensitive in all resource-rich Arab states. It might thus be the case that electricity exchanges would be performed on a case-by-case basis, for which no prices would be disclosed. In the first stages of the GCC interconnection grid (phase I – see Figure 23), negotiations between summer power exports from Qatar to Kuwait failed (*The Peninsula,* 2009). There are a wide range of regulatory and commercial issues that need to be clarified before any form of intra-GCC electricity trade can take off.

Research questions for this section are:

- Do the regional electricity governance bodies promote political or infrastructure projects that enhance the role of renewable electricity in the target country? Is external demand a pull factor in that respect?

3.4. Niche-level developments

As was established in Chapter 2, the niche level can be regarded as the central socio-technical layer with regards to system innovations. As a consequence, a particular focus has been put on questions of R&D, technology transfer and the development of the technological regime for RETs as a whole. The last issue, however, only comprises key elements of technology developments; more in-depth discussions can be found in engineering and science-oriented energy literature outlined above.

[94] Interviewee no. 52 (public stakeholder, Gulf States): *"Due to price distortions and intransparent subsidies in all states, there is no prospect of a common GCC electricity market in the medium term. The grid will only be there to share reserve capacity for blackouts and to build redundancy for summer peaks."*

3.4.1. *Science regime: R&D and industry structures, technology transfer strategies*

For niche-based innovation to develop, research and development policies are of strategic importance. In the field of technology innovation such as renewable electricity generation, this is strongly interlinked with the area of industry structures as most technological innovations are supported by or take place in the framework of industry research. Thus, the two elements of R&D strategies and national industry structures will be covered together.

As early as 1982, a major OAPEC report identified the lack of R&D capacities as a major barrier to the domestic spread of renewable energy. It particularly criticized two issues:

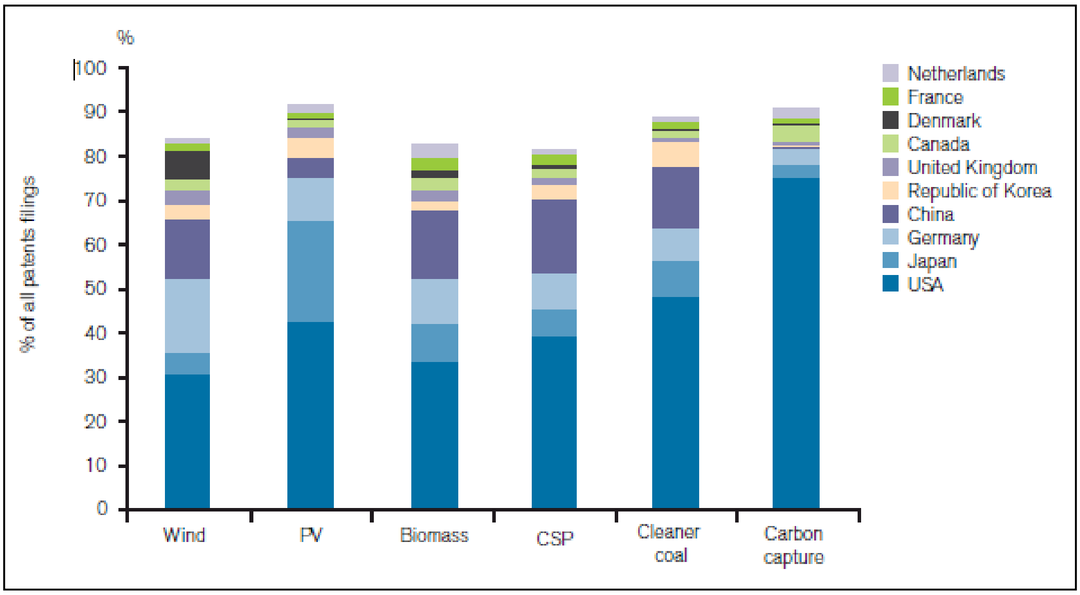
The “pathetically lacking” flow of information and the general lack of cooperation between Arab countries was the first barrier cited. Second, the following list of further impediments hampering the two major types of institutions conducting renewable energy research (research centres and universities), was compiled:

- Lack of allocation of resources and manpower
- Weak relevance of tasks and projects
- Lack of education of local industries and end-users
- No financial stability
- Lack of management policies
- Lack of confidence in Arab talent and the dominance of foreign advisors and educators (Kettani & Malik, 1982, p. 118).

Arguably, many of these issues apply to the Arab R&D landscape today. However, the idea of the technology cluster in form of economic cities, free zones, or other megastructures had not yet been fully developed. Besides the most straightforward function of income generation through national economic diversification, the goal of these initiatives in very different industry sectors is to upgrade the skill level of the national labour force and to enhance the ownership in key future technologies. Often, these industry clusters are interlinked with university research programmes. For instance, the UAE's Masdar Initiative or the Algerian Institute for Renewable Energy and Energy Efficiency (IAEREE) that will be established in the gas district of Hassi R'Mel works in close cooperation with the national renewable energy operator New Energy Algeria (NEAL).

These initiatives are designed to improve the performance in higher education ratings (Giles, 2006) and patent developments in strategic research areas. This appears particularly urgent in the renewables sector, where, according to a recent study, patented renewable energy technology innovations with a relevance to world markets are negligible (Lee et al., 2009). Not only is there no MENA country among the top 10 patent holders at the moment (Figure 24) but the company- or the more detailed (sub-)technology-specific ratings this research reports also do not show any Arab state listed in any rating.

Figure 24: Share of renewable energy related patents by geographical origin – top 10 countries



Source: Lee et al., 2009, p. 15.

This notion is also confirmed by an interviewee representing a global industry association:

"The entire Middle East region is a black box for us. We do not have any formal contacts there, not to experts, not to industry associations. Basically, we don't really know what is going on there." (Interview no. 38 – national and international power sector, Europe)

This underperformance is characteristic for the innovation system in Arab countries. As Nour notes:

"Neither the Gulf nor the Mediterranean countries possessed sufficient financial and human resources necessary to promote S&T[95] for development. Hence, they have manifestly lagged behind the rapidly advancing Asian countries in terms of S&T input and output indicators; the poor S&T input indicators lead to poor S&T output indicators. In both regions most R&D and S&T activities are allocated within the public and university sectors, with very small contribution from the private sector" (Nour, 2005, p. 249).

This awareness of the domestic underperformance in most S&T areas forms the background for the widely reiterated call for technology transfer by the Arab political leadership. Technology transfer as a mode of triggering domestic innovation is not a new research area. While classic authors of innovation theory such as Rogers (2003) predominantly focus on the conditions for the spread of technology innovations from a domestic point of view, the technology transfer in the renewable energies sector has recently been covered by Wilkins and Sawin (Wilkins, 2002; Sawin, 2004). These authors, as well as Usha Rao and Kishore, underline that technology diffusion on an international level is a complex issue, particularly in the case of renewable energies, where currently, all markets are government-created, yet the patents are privately owned and usually the results of costly, long-term R&D processes (Usha Rao & Kishore, 2010).[96]

Also, researchers such as Tomlinson and Kristinssion/Rao contend that traditional forms of technology transfer have not had an overwhelmingly positive record and are only reaching their goals in an insufficient manner. In their comparative paper on wind power generation technology policy in India and Denmark, Kristinsson and Rao, for instance, argue that a classical technology transfer approach has not brought about

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[95] S&T: Science and Technology (the author).

[96] The researchers underline this aspect in their study on low-carbon and climate mitigation technologies. Arguably, renewable energy technology transfer is structured very similarly: "Technology specific intellectual property rights related factors (such as the ratio of R&D to total costs, ease of copying and IPR enforcement; and patent application standards and processes)… affect the rate of innovation and diffusion. The vast majority of patents are held by private firms…There is a clear – and already apparent – tension between the desire to secure these economic benefits and the need to maximise technology diffusion to protect the global climate; as shown by the discussions over whether to include projects in developing countries inside the proposed EU CCS demonstration financing instrument" (Tomlinson et al., 2007, p. 13).

the expansion of the Indian wind power industry and installed capacity. This development was much rather triggered by India's policy of "interactive learning" (Kristinsson & Rao, p. 300), focussing on a bi-directional exchange of technology and expertise. This argument is also made in the comprehensive report by Tomlinson et al. calling for the establishment of effective innovation systems, rather than merely a narrow technology transfer (Tomlinson, Zorlu, & Langley, 2007, p. 10).

This need to successively gain ownership in key technologies is very evident to decision-makers in the target countries, particularly those with a long working history in the oil and gas sector, where Arab national oil companies had long been dependent on the technological know-how of the oil majors. As one Algerian interviewee put it:

"In a post-oil world, we are not interested in further royalties, that's not what brings our country ahead. We have had this subordinate relationship to internationals in the oil and gas sector for too long and this is nothing we aspire to repeat for renewable energies." (National and international power sector, Algeria)

Considering the difficulties on the domestic front, the Gulf States, in particular, have resorted to a new form of technology transfer. Part of the SWFs' mandate is the purchase of strategic assets in international growth technologies, as is the case with Abu Dhabi's Cleantech Fund as part of its comprehensive Masdar Initiative (*Interview no. 51 – public stakeholder, Gulf States*). Whether combining domestic technology clusters might prove a promising method in the medium term, however, remains to be seen.

The following subsidiary research question therefore attempts to gauge the empirical conditions for technology transfer-supported renewable energy innovation:

- Is there an attempt to create a domestic knowledge hub for RETs and is there an industry structure that supports the spread of technologies into mainstream society?

3.4.2. Technological developments

It has been the stated goal of this thesis to contribute to the social science dimension of renewable energy policies in hydrocarbons-wealthy Arab states. However, issues pertaining to technological development cannot be fully left aside, as these developments can become absolute barriers (or major enablers) to the overall growth path of renewable electricity production through all levels of MLP. Since most innovations in that respect can be expected from the ST niches, this discussion has been placed in the niche-level chapter. The first of the following two subsections (3.4.2.1) will focus on key forms of power supply, while Subsection 3.4.2.2 will present a summative assessment of the three major RETs discussed in the thesis, wind power, concentrating solar power (CSP) and photovoltaics (PV).

3.4.2.1. Decentralized vs. centralized power supply

By and large, the application of energies can be distinguished into centralized and decentralized technologies. Centralized forms of power production, in the form of nuclear-, coal- or gas-fired power plants, are usually the most common form of conventional power production. In the early years of their market introduction, renewable energies have traditionally been considered as small-scale, decentralised systems (e.g. single wind turbines or small wind farms with several MW capacity, small CSP or PV installations). In recent years, however, all three technologies analysed here (wind, CSP, less so PV) have been scaled up successfully, which is why the most current industry-scale projects need to be regarded as centralized energy projects.

As indicated in Table 12, both forms of power production have specific assets. Typically, large-scale plants have higher commercial efficiency rates and better return of investment ratios than small-scale ones. This is due to the more favourable economies of scale, better bank credits, combined grid access and production costs. Evidently, the absolute capital costs of centralized installations can be several orders of magnitude higher than for small domestic installations.

Small-scale decentralized forms of power production, however, have their own distinctive advantages, which are mainly in the areas of energy system planning and energy security. First, apart from the aspect of intermittence of renewable power,[97] the dispersed nature of small-scale renewable systems delivers a higher security of supply than a few large, centralized systems of the same total capacity. If there is any supply cut due to sabotage[98] or technological failures, reserve capacities for large-scale power would need to be significantly higher than for dispersed small-scale applications. Due to net redundancy, backup-power capacities would not have to be built in to an extent as large as in the case of centralized power production.

Table 12: Strengths and weaknesses of centralized and decentralized systems

Aspect	Centralized	Decentralized
Technology		
Efficiency	+	-
Net losses	-	+
Costs		
Capital needs	-	+
Specific Investment	+	-
Specific electricity generation	+	-
Backup power	-	+
System integration		
Supply security/redundancy	-	+
Flexibility	-	+
Social		
Local participation potential	-	+
Entry barriers for new market participants	-	+
Vulnerability against hard-security risks	-	+

Source: Supersberger et al., 2009, p. 27.

Another non-technical aspect is the participation potential of the technology option. Large-scale power plants incur substantial investment costs that cannot be financed by individuals or small/local companies or municipal utilities. Compared to small-scale installations, this technology choice will reduce their role in the decision-making struc-

[97] Czisch's research (2005) has shown that intermittence in RE systems can be balanced out to a large extent by smart-grid technologies and load management using not only wind and solar technologies, but also geothermal energy, biomass and pumped storage power stations as backup reservoirs.

[98] See Tänzler et al. (2007) for a general introduction into the impacts of RE on security policy and Lacher/Kumetat (2011) for a hard security threat analysis of renewable and conventional centralized power plants in North Africa.

tures on the nature of the power system to the role of minority shareholders or mere end consumer. Decision-making structures thus remain highly centralized and non-participatory for large groups of the population.

This is also the reason why the division between centralized and decentralized modes of power production has left the purely technical discourse and has entered the publish sphere, where this question is controversially debated in Western energy circles. Classic supporters of centralized structures are usually representatives of the major national utilities, contractors, commercial banks and large solar power industries, while group members of the decentralized faction usually come from small-scale utilities or manufacturers of small-scale renewable energy technologies, farmers, as well as many citizens with a stake in this technology.[99] Along with the technical advantages of small-scale installations, proponents of the decentralizing group particularly highlight the participatory potentials of decentralized renewables,[100] while their opponents highlight the greater cost-competitiveness of large-scale RETs as well as the fact that larger-scale applications are able to supply larger amounts of renewable electricity to the existing electricity system at a quicker pace.

In resource-wealthy Arab states, this entire debate is not as prevalent as in Europe. The main reasons for this are the virtual absence of renewable energy and other environmental pressure groups combined with a political culture that limits controversial public debate. Moreover, in most Arab states, there is the widespread notion that energy policy planning is a governmental task and does not contain in itself a participatory element. In a nutshell, the enabling environment for renewable electricity production capacity extensions differs strongly from the European context. Nonetheless, the two aspects of renewable energies remain relevant as well. By and large, however (as will be discussed in the case studies), OAPEC decision makers seem to favour large,

[99] An excellent example for the divisions centralized – decentralized within the renewable energy scene is the very large scale Desertec project. See Subchapter 6.7 for further details.
[100] See also the above discussion on regime stability vs. democratisation/governance effects of RETs in OAPEC states in Subsection 3.2.1.4.

central structures most and only apply others if necessary, e.g. for remote desert communities.

3.4.2.2. Assessment of renewable energy technologies (RETs)

As a summative assessment of research literature, Table 13 presents assets and liabilities that can be expected with the three named forms of renewable electricity generation (wind, CSP, PV). It becomes apparent that, while all three forms of renewable electricity generation presented here score far better in terms of environmental components but worse in terms of (current) LECs, a technology mix might be the ideal combination for energy systems with a strong renewable electricity share.

Table 13: Summative assessment of technology options

Aspect	Wind	Solar-thermal (CSP)	Solar PV
Base load capability	Medium	High with storage	low
Peak load capability	High	High	High
Integration potential into existing energy system	High	Medium	Medium
Technological maturity	High	Medium	Medium
Lead time	Medium	Medium	Short
(Local) labour intensity	Medium	High	High
Cost degression potential	Medium	Medium	High
Competitiveness in an un-subsidized energy system (LEC)	Medium	Low (2011)	Low (2011)
Impacts on human and non-human environment	Medium	Medium	Low
Impacts through supply chain and decommission-ing	Low	Low	Medium (rare earth met-als)
Industrial use potential	Low	High	Medium
Water use in operation	None	Medium	None
Desalination potential	Low	High	Low
Additional security of supply through diversifi-cation of energy system	High	High	High
CDM-Option	Yes	Yes	Yes
Resource availability in OAPEC	Medium-low	High	High

Source: own compilation.

For the target region of this work, however, a focus on solar energy technologies seem warranted due to the comparatively poor resource potential of wind energy in that region.

Turning to the empirical research of this thesis, the primary scope of the thesis is neither to make qualitative research about experts' opinions on the development paths of individual technologies nor is it to discuss engineering innovations. What is relevant for this thesis, however, is the interviewees' opinion on technologies, since the interviewees surveyed are, in fact, taking investment decisions in one direction or the other, making this an important issue. Furthermore, the question of whether the industry use of certain RETs might not serve as an entry point to a highly subsidized and closed consumers' market in the medium term will also be addressed through the following research question:

- What is the interviewees' opinion on technology choices and on the chance of industry-use of RETs as entry points for further RETs in resource-rich Arab states?

3.5. Conclusion: the policy context for renewable energy policy in hydrocarbons rich Arab states and development of the research questionnaire

In conclusion, the key aspects of renewable energy policy that have been discussed thus far are striking due to the variety of macro-drivers (and barriers) for renewable energies, originating in key challenges of socio-economic development in resource-rich Arab states. It has become evident that a pure focus on resource economy and demand growth would be too narrow to draw up a comprehensive energy system analysis. (Renewable) energy policy is necessarily also industry and R&D policy. Simultaneously, it is also income generation through increased domestic hydrocarbon resources, country marketing, a climate change mitigation measure and, as a whole, a potential means of regime survival, imperfectly governed by a range of regional institutions.

In most discussions of renewable energy policies, many of these elements appear only fragmentarily; publications focus on one or another sub-aspect of this topic. In line with the broader theory argument of this thesis, the analysis of the two case studies shall be guided by the aspects discussed so far. Key elements of the analysis are reflected by the collection of the respective research questions of each section. A full compilation of the individual research questions is presented here:

<u>Landscape-level</u>

Political system

Research questions for the political system

1. How far do the political system and the non-existence of independent CSOs allow for system innovations in the energy sector, particularly bottom-up innovations?

Research questions with regards to personal patronage networks:

2. To what extent are the official decision-making processes the actual decision-making structures?

Research questions regarding long-term effects of renewables on the political system

3. What do interviewees regard as the key governance effects of renewable energy production?

Key transregional energy governance bodies

4. Which role do transregional energy governance bodies such as OPEC, OAPEC or IRENA play in the promotion or stalling of national renewable energy policy in the respective target country?

Climate Change

5. Is the climate change agenda actively considered in the political decision-making on renewable energy developments?

Long-term national economic diversification

6. Are the renewable energy-related efforts connected to the national economic visions or national SWF activities in the respective country?

Country branding

7. Is country branding a catalyst in the spread of renewable energies?

<u>Regime-level</u>

Technological regime

Questions regarding the national power sectors

8. To what extent are renewable energies employed to reduce pressure on the domestic conventional power plant park?

Nuclear option

9. Is the nuclear option seen as a competitor in resources or as a mutually exclusive form of power production?

User and market regime

Market conditions

10. Is there any system of renewable energy promotion in place?
11. Do stakeholders believe that the transfer of European renewable energy policy design models is a viable method for the spread of renewable electricity capacities in the region or would indigenous policy models work better?

System of double subsidies

12. Are strategies developed to create a level playing field for all types of energy carriers by either removing subsidies for conventional power or by integrating renewable electricity into the existing subsidy schemes?

Socio-cultural regime

Social awareness and the role of religion or environmental ethics

13. How widespread is the knowledge of renewable energies in the target countries? Does religion play a role in legitimizing this energy technology?

Research questions in terms of labour markets:

14. Is the job creation potential actually employed by promoters of renewable electricity in the country?

Policy regime

Questions on renewable energy targets and actual performance:

15. Is there a (binding) strategic document, such as an energy roadmap/blueprint or at least a non-binding planning scheme? If so, how does this integrate renewable electricity?

Questions regarding regional infrastructure and governance bodies:

16. Do the regional electricity governance bodies promote political or infrastructure projects that enhance the role of renewable electricity in the target country? Is external demand a pull factor in that respect?

<u>Niche-level</u>

Science regime and technology transfer

17. Is there an attempt to create a domestic knowledge hub for RETs and is there an industry structure that supports the spread of technologies into mainstream society?

Technological developments

18. What is the interviewees' opinion on technology choices and on the chance of industry-use of RETs as entry points for further RETs in resource-rich Arab states?

The case study chapters of Part B are structured in parallel to the analysis of Chapter 3. Discussions there will be guided by the research questions developed here and will be followed by comprehensive overviews of the respective national renewable energy policies thus helping to identify reasons for the underperformance of the spread of renewable energies in resource-wealthy Arab countries. Having identified the major shortcomings, the ensuing policy design chapters can interact with this information.

Second, in the comparative Part C of the thesis, the results will be used to identify common barriers to the spread of renewable energies in hydrocarbons-wealthy countries as well as regional particularities.

4. Methodological design of the study

As highlighted in the Introduction (Chapter 1), it is the main goal of this thesis to analyse renewable energy systems of hydrocarbons-rich Arab countries by means of the MLP and to test the application of the TM policy design models in this region. While the theoretical frameworks to analyse renewable energy transitions and to draft renewable energy policy models have been discussed in Chapter 2, Chapter 3 provided an overview of the policy context in resource-rich Arab states, outlined key elements of analysis and developed a research questionnaire. This chapter discusses the research methodology in greater detail. First, it will present the case study approach chosen for this thesis and discuss issues related to elite interviewing – the main method of data collection chosen for this study (Subchapter 4.1). In the same section it will present the rationale for choosing the UAE and Algeria as case studies. In the last subchapter (4.2) the different groups of interviewees will be presented.

4.1. Case study research and elite interviewing: opportunities and limitations

As Stake remarks, case studies have become popular means of inquiry in recent years (Stake, 2003). However, this does not imply that the selection of the case study method comes as a "natural" choice. Case studies can help to identify trends and patterns within certain developments or phenomena. By distinguishing the particular from the general, case study research can go beyond a merely descriptive level[101] and add to theory formulation. Case study research can have different epistemological goals. Yin discusses potential rationales for case study design (Yin, 2003, pp. 39–42). The four most relevant are the following:[102]

[101] Yin (2003, p. 9): a case study method is warranted if "a 'how' or 'why' question is being asked about a contemporary set of events over which the investigator has little or no control.

[102] In his paper, Cousin (2005) suggests a slightly different order system that, however, does not differ from Yin's in substance.

First, case studies can be used to test the hypotheses of certain established theories in practise which are believed to be true by a certain scientific community.

Second, they can also serve as in-depth studies of the particular in a unique or rare case. In such a case, a “thick description” (Geerz, 1983) of a case may be warranted to further knowledge, for instance, about a very rare disease.

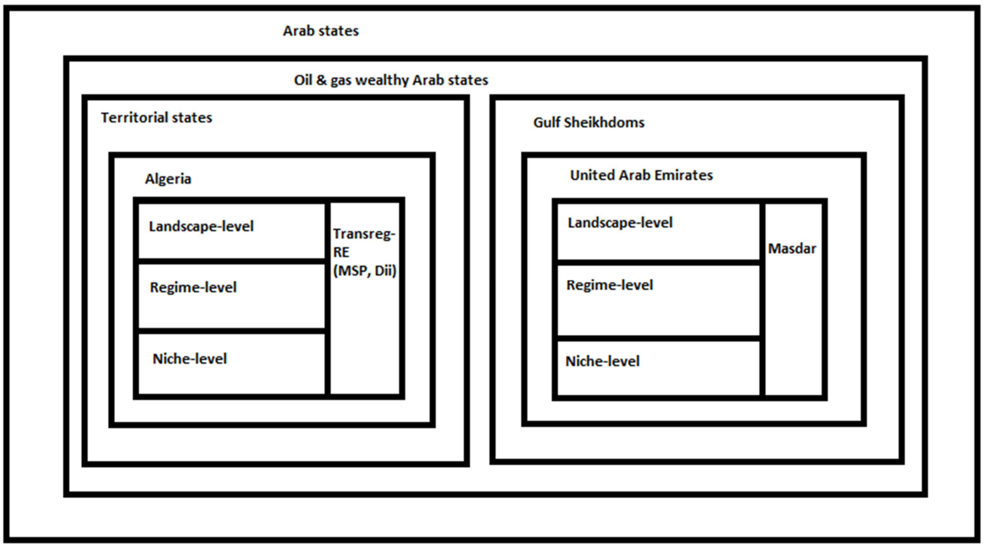
Third, a case could go into details about a representative or typical case, e.g. an average neighbourhood or work in a standard factory or clerical position. In that case, the goal is not to describe the particular, but rather a mainstream phenomenon that shapes societies or social contexts.

Fourth, case studies can be used as revelatory cases, in which a paradigmatic phenomenon can be analysed that had before been unavailable for scientific scrutiny and can therefore further research in a broader sense.

Evidently, the four models identified by Yin are ideal types that in practice often overlap. Case studies could thus be revelatory and by their very nature challenge prevalent knowledge about a certain phenomenon. Also, models two and three could interact with theory if their results would have such implications. Consequently, the case study models for this thesis overlap as well. With the description of Algeria and the UAE it analyses in detail two energy systems of more populous, hydrocarbons-rich Arab states and thus provides new information in an explorative manner (model four). In addition to that, it contributes to theory building through the testing of TM as a model for policy design under the governance situation of this group of states (model 1).

A special aspect of this thesis is that it works with a case-study-within-a-case-study approach. In addition to the MLP-structured analysis of the state of domestic renewable energy policy as described in the two previous chapters both countries exhibit one initiative that transcends these layers and is a significant driver of the domestic agenda. In the case of Algeria, it is the trans-Mediterranean dimension (Desertec/Mediterranean Solar Plan), and in the UAE it is Abu Dhabi’s Masdar Initiative, a lighthouse project that claims importance far beyond this emirate and now houses IRENA. Figure 25 shows the different layers of this study’s approach.

Figure 25: Case study approach of this study



While the research aims for individual case studies may differ substantially, all face similar questions of validity. Although Yin concedes that a multiple case study arrangement often cannot be performed due to time or financial restraints of the researchers (Yin, 2003, p. 9), the validity of single case study results can be substantially upgraded if another, comparable case can be added to the study as a whole.[103] As Stake puts it, illustrating "how a phenomenon occurs in the circumstances of several exemplars can provide valuable and trustworthy knowledge" (Stake, 2003, p. 444). By choosing two states of the same population that represent different types in this group (common denominator: high oil and gas rents and rentier state characteristics; differences: size of national territory, number of national residents, Maghreb – Gulf region) this thesis aims to perform this task.

Qualitative methods are most commonly used in combination with case study design. Nonetheless, this does not always have to be the case. Denzin and Lincoln, for instance, remark that case studies and qualitative research should not be confounded (Denzin & Lincoln, 2003). Instead, a quantitative research design or survey method can be very fruitful in case of clinical studies or as a multiple-method case study (Yin,

[103] Contrary to main stream, single authors also challenge this notion; see for instance Flyvbjerg (2006). While the author of this thesis differs with Flyvbjerg in that regard, Flyvbjerg's view is very much in line with the argument of this thesis when he stresses the notion that case studies can be used for the testing and building of theory.

2003). While the stated research goals of this thesis do not necessarily imply a qualitative approach, it is the nature of the primary data used in this study that warrants a qualitative approach. This study does not consider itself a technical study on grids, energy pricing or engineering-related aspects of renewable electricity generation. Instead, it is particularly the actors' perceptions and judgements about governance concepts that are of empirical interest. These, however, cannot be identified by quantitative methods. In addition, energy policy in the Arab world is considered sensitive by many regime stakeholders and, particularly in the case of Algeria, where in-depth reports on the functioning of renewable energy policy in this country are rarely published. Thus, a method that elicits information from stakeholders in a private research interview situation has more chances of success than gleaning information from written texts or through less personal method of telephone interviews. Although personal interviews have been the method of choice for this thesis, a few telephonic interviews were used in order to add further information to the data set in cases where interviewees were unavailable for personal interviews during the field trips.

Moreover, the interviews were coded the due to the actual or perceived sensitivity of the data. As discussed by Lee (1993, pp. 179–182), protecting the confidentiality of qualitative data is vital when stakeholders perceive the data they are providing as sensitive. While energy policy in many European countries might be regarded as a subject comparatively open to public scrutiny, many stakeholders in Arab resource-rich states regard the entire sector as politically sensitive as it touches on the economic core of this group of states. Thus, stakeholders are less willing to talk openly to researchers as they fear retribution for what may be deemed as leaking policy information or documents. It is unlikely that this thesis would reveal direct government secrets; however, it may reveal information about stakeholders that interviewees would not like to be publicly associated with. The interviewees have been categorized by their home country and the interviewee category that will be developed in Subchapter 4.2. This information protects the identity of the interviewee while at the same time providing information about the person's profession and nationality.

Furthermore, additional limitations of a qualitative case study approach must be taken into consideration. A key one that has been described by Crang (2003) is the question of how far the researcher as an informed outsider co-constructs his field by his research design, the choice of interviewees, and so on. While this issue cannot fully be solved for this thesis, arguably the problems arises more if more intensive or intrusive research methods (e.g. ethnographical research with participant observation) had been chosen. In our case, this would have been required if the goal of the study would have been to reflect on the everyday use of off-grid renewables in rural areas or other questions revolving around the popular acceptance and use of certain energy carriers or issues of environmental awareness. Thus, the challenges of cross-cultural research discussed by Liamputtong et al. (2008) are only of limited relevance to this thesis.

With a system of data collection relying on elite, stakeholder interviews, however, other methodological issues remain a challenge, such as the manner in which interviewees are selected. The starting point for the interviewer is mostly that of an informed outsider who selects interviewees who are available and willing to be interviewed without any previous personal introduction. After a first initialization phase, a few of these well-connected interviewees might serve as “gate-keepers” by actively supporting the researcher in securing further interview contacts and information (Valentine, 1997). Particularly if the interviewer recruits further interviewees through snowballing, “gate-keepers” can facilitate additional contacts thanks to their expert knowledge and positions. Here, the researcher can make the most of the trust that is bestowed upon him through the gate-keeper’s respected position in a given community. Although indispensable in many cases, the researcher should be aware that these gate-keepers can – be it willingly or unwillingly – can effectively distort the results of the entire research project through the interviewer’s exclusive exposure to certain groups of stakeholders or points of views.

More systematically, Lee (1993, p. 131) distinguishes between three groups of gate-keepers or sponsors:

- The “bridge”: a person who provides the link into a social world that has been previously unknown to the researcher;

- The “guide”: a person who maps a route through unfamiliar terrain and gives orientational knowledge by providing explanations of certain phenomena or political events or warning against certain persons;
- The “patron”: a sponsor who associates himself/herself with the researcher and helps him/her secure trust among the group of interviewees

As will be discussed in the case study reports in Part B the author of the thesis has made use of “patrons” and “guides” in both cases respectively (Subchapters 5.2 and 6.2) as they provided invaluable help in terms of access to information and interviewees as described above. However, as too close a relationship with a key stakeholder or expert can quickly lead to an unwelcome degree of complicity, these stakeholders had to be kept at a certain distance from the interviewer.

Second, with regards to the interviewees, the question of gender bias needs to be briefly discussed (Rubin & Rubin, 2005, pp. 111–113): the power sector as a whole is strongly dominated by men in both the Arab world as well as in Europe. Consequently, only a few women, constituting 20% of interviewees at most, were interviewed. Given the poor total representation of women in the power sector, however, this is an over- rather than an under-representation in terms of figures.

The list of interviewees as well as the questionnaire developed for this series of semi-structured expert/stakeholder interviews can be found in the appendices. The questionnaire used adheres to the standardized, semi-structured, in-depth elite interviewing model. Elites can be defined as those elements of society “considered to be the influential, the prominent, and the well-informed members of an organization or community and are selected on the basis of their expertise in areas relevant to the research” (Marshall & Rossman, 1997, p. 83).

Targeting this group can be beneficial as they can provide invaluable information and in-depth analyses. They are more likely to be familiar with a broader background of legal and/or administrative structures of an organization and have – or are at least expected to have – an overview of the less obvious strategic long-term policies of their organizations, their histories and structural difficulties**.** On the other hand, these groups are more likely to change the structure of an interview fundamentally by being unwilling or legally unable to speak about certain topics. Since they often strongly identify themselves with the organization they represent, it can be difficult to glean information about organizational flaws and structural or communicative shortcomings, because they either do not acknowledge them or simply do not see these problems, as they might be one of their originators. Also, there is a difference in power and social status between the interviewer and interviewee. In contrast to much social research conducted, where the interviewer as an academic might have a higher social status than the interviewee, this situation is reverse in the case of elite interviews (Lee, 1993, pp. 107–111).

Interviewing a CEO or a high-ranking government official can be difficult. At worst, the researchers may not be taken seriously because of younger age or the senior position occupied by of the interviewee. At best, however, the interviewee may regard the researcher as "harmless" and grant a "one-off-interview" particularly when the interviewer is not media-related. In these rare situations interviewees can benefit from the deep insight of a leading figure in an organisation. This, however, is unlikely to happen. The unwelcome alternative would be a streamlined PR interview repeating formalistic statements (Rubin & Rubin, 2005, p. 221) that do not add much to the researcher's knowledge about the case.

The general technique of in-depth interviews can be applied to various a-priori research models. It is often difficult to rigidly structure interviews into predetermined response categories when using this model since the interviewer is interested in receiving creative responses to certain questions and does not want to limit the expert's knowledge. Thus, open-ended or semi open-ended questions should normally characterize this type of research. The overall mood of such a meeting works best in a less formal situation in which the interviewee is at ease and in a structured conversation rather than undergoing an inflexible interrogation (Esterberg, 2002, pp. 102–104). With the aim of maintaining this mood, the interviewer ought to allow the flow of the conversation to dictate the questions asked, those omitted and the order in which they are posed, i.e. the "participant's perspective on the phenomenon of interest should unfold as the participant views it, not as the researcher" does (Marshall & Rossman, 1997, p. 80). Yet, it is important to maintain a certain degree of comparability with the other interviewees; a semi-structured system with standardized questions has been used to create this specific mixture of qualitative data: a holistic, in-depth understanding of the interviewees' points of view towards a select set of questions.

While the positive aspects of in-depth, semi-structured interviews are evident, arguably, one of the greatest problems is the issue of availability of interviewees, particularly elite stakeholders. It has been the experience of the researcher that high-ranking officials rarely commit to interviews longer than 15-25 minutes, which is hardly enough for an in-depth interview. While there still remains the potential for a high-quality interview with these stakeholders, in many cases, there is the opposite effect in place: the lower the rank (and often also the expertise in the subject matter) of a potential interviewee, the more quickly he or she agrees to meet for an interview. While again, it is beneficial to broaden the population of interviewees as widely as possible this paradox has been observed during the research for this thesis as well. Having chosen interviewees from different levels of institutional hierarchy, this study attempts to counterbalance these effects.

In conclusion, conducting multiple case study research with a qualitative interview methodology is, as are other possible ways of data collection, an approach fraught with practical limitations and theoretical inconsistencies. Still, this approach has been identified as the most fruitful and most viable one for the purpose of this study.

4.2. Groups of interviewees

In order to enhance the structure of the interviews and the results, the population of interviewees has been divided into four stakeholder categories. As shown in Table 14, 94 interviews[104] were conducted for this thesis. By the maximisation of perspectives on the subject matter the study aimed at the saturation of the data, the instant when new

[104] On several occasions, interview events consisted of more than one interviewee. These cases have been counted as one interview only. See Annex II for a list of all interviews conducted.

data collected by interviewing no longer changes the results or gives essential additional input (Bauer & Gaskell, 2000).[105] Analysing the regional distribution of interviewees presented in Table 14 it is striking that a comparatively high number of interviews were conducted in Europe or with European stakeholders. The rationale for this is that particularly in the case of North Africa, the EU and its renewable energy policy in the Mediterranean, as well as industry associations on the private level, form a key landscape level driver for Algerian renewable energy policies. At the same time, the large distance and only loose interregional connection of the EU to the Gulf States led to the fact that the overwhelming majority of interviews conducted in Europe effectively covered Algerian or Euro-Mediterranean affairs exclusively.[106] Thus, the European interviewees can effectively be counted towards the North African regional dimension of this thesis.

Parallel to that, the interviews that were led in other Gulf States (most notably in Kuwait) strongly focused on the conditions for the success of renewable energy policies in the Gulf. Specific North African or Euro-Mediterranean issues have by and large not been touched upon during these occasions.

Taking these two factors into account, the study shows an equal regional distribution of interviewees (see Table 15).

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[105] (Theoretical) saturation this is a term coined by grounded theory research. This approach is certainly part of the methodological background of the study, but empirically grounded theory development forms only a part of this study as a whole. Thus, this research method has not become the dominant approach chosen. For the discussion of grounded theory cf. Glaser (1978), Strauss & Glaser (2009), Strauss & Corbin (1990) and Kelle (2005).

[106] A notable exception is formed by the interview conducted at the Masdar PV factory in Germany which, for obvious reasons, focused on Masdar policies and the success of this plant in Germany. In addition to that, some of the interviews with European government officials touched on IRENA. UAE domestic energy policy, however, has hardly been touched in these interviews.

Table 14: Distribution of interviewees by region and stakeholder group

Group	Algeria	EU	UAE/Gulf region	Total
1 Public stakeholders	6	12	12	30
2 Non-operative business	3	4	7	14
3 Operative business	4	2	13	19
4 Research and development	8	8	15	31
Total	21	26	47	94

Table 15: Aggregated distribution of interviews by region

Group	Algeria + EU	UAE/Gulf region	Total
1 Public stakeholders	18	12	30
2 Non-operative business	7	7	14
3 Operative business	6	13	19
4 Research and development	16	15	31
Total	47	47	94

The four following stakeholder categories have been identified by the author:

1. Public stakeholders
    a. politicians, members of administrations/regulatory agencies
    b. lobby groups, CSOs
2. Private and public investors (non-operative business)
    a. representatives of multilateral banks, SWFs
    b. private investors
3. National and international power sector (operative business)
    a. grid operators, power companies (fossil and RE)
    b. manufacturing and construction industry
4. Research and development
    a. academics
    b. business-related in-house researchers and consultants

In the thesis, the interviews are coded by their regional background and their interviewee category. Examples for this would be "R&D sector, Algeria" or "National power sector, Europe".

Analysing the stakeholder distribution of the two cases in greater detail (see Figure 26 and Figure 27) it is apparent that in both cases, groups 1 and 2 are slightly over-represented.

Figure 26: Distribution of interviewed stakeholders in the UAE/Gulf region

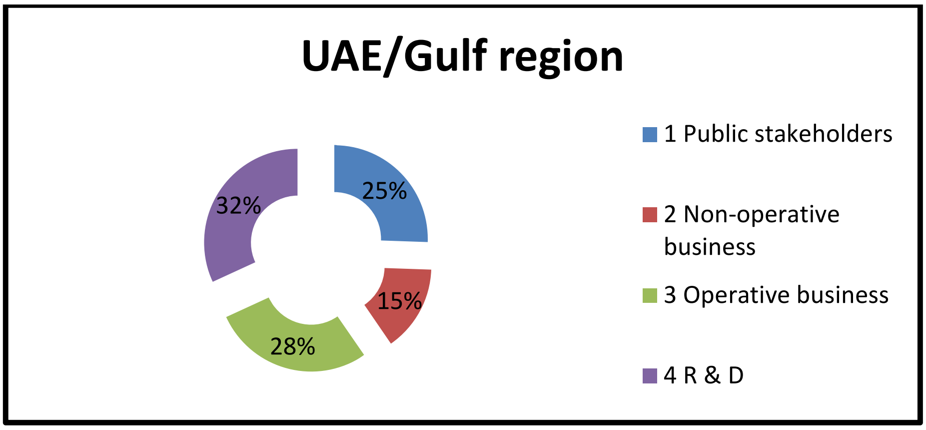
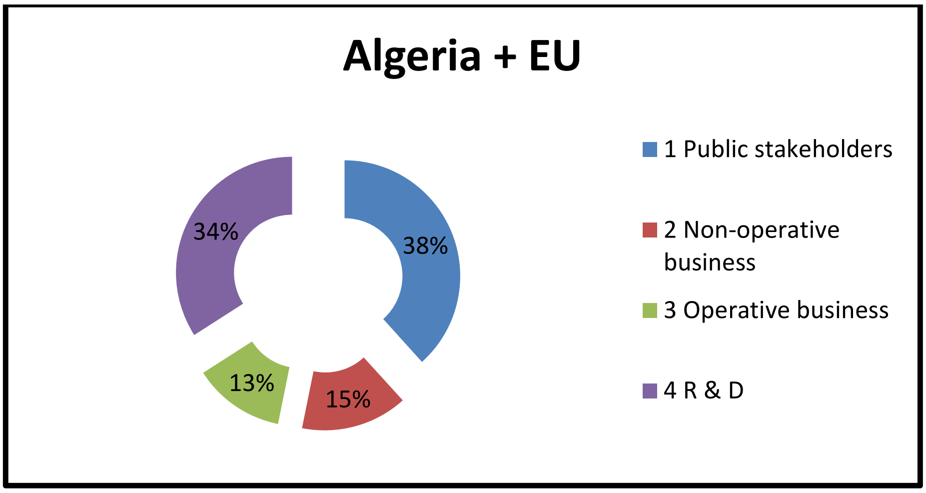


Figure 27: Distribution of interviewed stakeholders in Algeria + EU



This is largely due to the fact that business interviewees were the least willing to talk to the interviewer. Secondly, while the two business-related interviewee categories 2 and 3 provided valuable insight into the national power sectors respectively, stake-holder categories 1 and 4 could often provide the interviewer with a higher level of analytical knowledge about steering theories and the overall context of renewable energy policies in the case studies. In addition to that, the overall number of interviews can be regarded as sufficient to grant extensive insight into all four key areas covered.

In the subsequent sections, the four categories and their role for the analysis of the projects will be presented. It has to be stressed that these categories are hybrid because there is significant overlap in content. Actors and institutions have been assigned to the category into which they fit most; individual classifications remain, however, debatable. In each section, several interviewees have been named in order to exemplify what has been said. However, for reasons of legibility, not all interviewed companies or institutions have been named in the respective sections. See Annex II for a full list of interviewees.

4.2.1. Public Stakeholders

"Public stakeholder" is a collective category for all those who have an official public mandate or who regard their work as being part of or informing policy processes, which is to be understood in the wider sense of the word. In an immediate sense (group 1a), this encompasses politicians, members of regulatory agencies, as well as national and international administrations. Secondly, the wide field of lobby groups and non-governmental organisations regularly describe themselves as public stakeholders (group 1b). This thesis does not attempt to assess the validity of these claims – which sometimes appear doubtful – but instead takes them at face value.

In this study, group 1a contains representatives of national ministries of environment, Abu Dhabi's Ministry of Electricity and Water, the UAE Ministry of State for Federal National Council Affairs, as well as the Algerian Ministry of Energy and Mines. Unfortunately, access to civil servants in both countries has been difficult, sometimes even impossible due to restrictions through the information and interview policy of the ministries themselves.

Further, the same category has been assigned to the energy sections of the embassies of foreign powers, such as the United Kingdom in the UAE, or France in the Maghreb as former colonial power and presently staunch supporter of nuclear energy. The German global promotion of renewable energy and energy efficiency has been taken into account by an interview with the German Renewable Energy Export Initiative of the Federal Ministry of Economics and Technology, Berlin. Also, the respective chambers of commerce and industry have been contacted to receive a comprehensive picture of the actors at hand, as well as their policies and opinions. In order to receive the larger view of international organizations and actors, renewable energy experts from the International Energy Agency (IAE), the EU's Directorate-General for Energy and Transport (DG TREN) and the French Ministry of Environment and Innovation, which is leading on the Mediterranean Solar Plan, and the German Ministry of Economic Affairs were interviewed and a talk with a representative of the Regional Centre for Renewable Energy and Energy Efficiency (RECREE), Cairo has been held.

Category 1b, the area of lobby- groups and non-governmental organisations, comprised of a wide array of organizations including a Greenpeace's Energy (R)Evolution department representative; Eurelectric, the Union of the Electricity Industry, and the Desertec Foundation, the lobby group successfully promoting the idea of an intercontinental renewable energy production and grid system.

It is intended that these interviews give pertinent insight about the policy dimension of renewable energy in resource-rich Arab states and identify structural political barriers that slow down and driving forces attempting to speed up process of spreading of renewable energies based power production in the two countries at hand. Because these interviewees know the policy processes in the UAE and Algeria best, policy design models can also be discussed with members of this group.

4.2.2. Private and public investors (non-operative business)

The common denominator of stakeholder group 2 is the fact that all members are involved in the renewable energy from a non-operative point of view; not all, however, are representatives of the profit-oriented private sector. Secondly, as investors/donors, all of this group have their primary focus on the financial and economic soundness of the projects; they are not crucially involved in the operative business as far as immediate power production or the manufacturing of spare parts is concerned. The general problem of business elite interviewing, as this thesis encountered, is their availability and willingness to spend time on an interview that is not directly beneficial to the success of their business.[107] What is, however, of greater concern here is the question of validity: one cannot expect business representatives to give sensitive information that might prove harmful to their personal achievement or to the overall business success of their company. Also, recorded interviews can serve as legal documents that, once they have been given to the researcher, can hardly be controlled or confiscated.[108] Again, the establishment of trust through gatekeepers, the interviewer's demeanour or his institution cannot be overstated.

Subcategory 2a encompasses representatives of Abu Dhabi's sovereign wealth fund *Mubadala*, as well as the MENA energy section of Deutsche Bank.

Apart from that, the industry side is represented through interviews with a Dii representative as well as with the Dii's only North African founding member, the Algerian *Cevital* group.

Interviewees of category 2 have been instrumental in shedding light on the business- and investment-related barriers that renewable energy production (and the production of parts, such as solar wafers, etc.) is facing and have produced feedback on how the investment climate in this field can be improved, what investors are currently concerned about, and how their future analyses are.

4.2.3. National and international power sector (operative business)

Stakeholder category 3 encompasses the operative business in the power sector, the construction of power plants as well as related manufacturing industry. As currently attempted with Masdar, the latter can play a vital role in building up a national profile for renewables and constitutes a necessary part in any large-scale renewable energy production scheme lest such a country wants to perpetuate a dependency on foreign

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[107] Cf. the section "Identifying Respondents and Obtaining Interviews" in Healey & Rawlinson (1993).
[108] This is also an issue with public stakeholders and academics in countries where risks to the personal wellbeing or politically motivated sanctions of other kinds for unwelcome published quotations cannot be excluded. Cf. earlier remarks on interviews pertaining to sensitive issues in Subchapter 4.1.

expertise and technology. Since no large energy corporation solely focuses on renewable energies, most interviewees have risen into their positions in the conventional power sector, with renewables being just one branch of their company. A confinement to “renewables only” companies would have neither been feasible nor particularly sensible. The expected difficulties in obtaining interviews and information are by and large parallel to what has been said for stakeholder category 2 as it is the managerial elites of the respective company who are the targeted interviewees.

Subcategory 3a comprises grid operators, and national power companies, such as the Algerian New Energy Algeria (NEAL) that has been founded with the explicit goal of promoting renewable energy power production in the country. Also, the Spanish company Abengoa-Abener that is currently finalizing the construction of Algeria’s first large-scale combined-cycle gas-solar power plant (Solar Power Plant 1) has been interviewed as part of this category.

In category 3b, manufacturing and construction industry, such as representatives of Masdar’s joint ventures with Masdar PV, Erfurt (Germany), have been interviewed.

As expected, many of the interviewees currently working towards the spread of renewables are doing so not as a career choice but due to their individual management biography within a major power company. This, contrary to the view of many renewable energy activists, is not intrinsically problematic as a slight detachment might lead result in a more balanced view on the subject matter than a renewable energy enthusiast’s.

It should be noted that particularly in this category, the two subcategories cannot be accurately separated. There is a large overlap between the two due to the highly centralised nature of the international power sector and the varying degrees of cooperation, parenting and mutual ownership of companies. Nevertheless, since the subdivision is of a more hermeneutical nature than a rigorous separation, this problem does not have a major repercussion on the analysis. Interviews with representatives of this category are expected to elucidate information about the current state of the building projects and day-to-day problems the operative power sector faces, as well the question about security issues on site (for Algeria). Also, a managerial practitioner's view on possible ways forward will be expected.

4.2.4. Research and development

The final stakeholder category has been designed for those involved working in research and development branches of renewable energy technology companies, engaged in related academic research, or those who apply related expertise in management or non-partisan policy consulting. By and large, members of this group have enjoyed a solid postgraduate education before assuming their current posts. Many of them have freely opted to work in renewable-energy related field, thus, they are usually sustainability/renewable energy enthusiasts, willing to talk to fellow researchers and happy to provide (optimistic) information to the interviewer.[109] A potential caveat of these positive features is that the researcher cannot always be sure to record well-balanced account of "the facts"; instead, the own enthusiasm (or their own business) might at times lead involved researchers to overly optimistic statements.

As mentioned above, subcategory 4a exclusively contains academics in the non-profit and predominantly public sector. Academic interviewees in Algeria are based at the Centre for Renewable Energy Development and Research (CDER), the *Université des Sciences et de la Technologie* in Oran, the *Centre de Recherche en Economie Appliquée pour le Développement* (CREAD) in Algiers, and the General Direction for Scientific Research and Technological Development. Among institutions in Europe are the Wuppertal Institute for Climate, the Environment and Energy and the German Institute for International and Security Affairs (SWP). Institutions in the Gulf are, among others, Dubai's Gulf Research Center[110] and Abu Dhabi's Masdar Institute of Science and Technology.

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[109] Their eagerness to give interviews is also the reason why this group is slightly over-represented in the sample of this study.

[110] The Gulf Research Center had to discontinue its work in Dubai in 2011 after its licence was not renewed by the UAE authorities.

In contrast, subcategory 4b comprises energy researchers and consultants working for profit-oriented private businesses. Again, these two subcategories overlap substantially; however, the primary institutional affiliation of an interviewee can usually serve as a good approximation. Researchers and officials of Algeria's R&D Centre for Power and Gas (CREDEG, a daughter company of Sonelgaz) have been interviewed, as well as the UAE's and Algeria's country officers of the risk consultancy Control Risks. Furthermore, interviewees with staff from *Deloitte* Abu Dhabi and the UK-based specialised renewable energy consulting firm *Nur Energie* (Arabic "light") have been held.

Ideally, the author expected these interviews to produce data from informed, but nonpartisan analysts of the subject matter, and, more specifically, their view on the respective R&D landscape, the institutional setting of renewable energy agencies in the two countries' decision-making structures and their interrelation with policy and business. Moreover, given the interviewees' erudition and (assumed) affinity to abstract thought and sound theory development, discussions about socio-technological steering models and the greater question of adaptability of governance concepts were most fruitful with this category 4.

4.3. Conclusion

In conclusion, this chapter introduced the methodological framework chosen for data collection. It was argued that the case study approach can elicit relevant and up-to-date information for the focal area of renewable energy policies in resource-rich Arab states. Subchapter 4.1 has elucidated that in addition to desk research, a qualitative, interview-based method of data collection best suits the set-up and the research interest of this study.

Moreover, four stakeholder categories have been presented in Subchapter 4.2, in line with the questionnaire, which was in turn informed by the research questions of Chapter 3. The interviewee population, as has been shown, can inform the two case studies in a way that would lead to innovative, relevant and saturated data. Further details on the research interviews and the respective data collection phases will be presented in Subchapters 5.2 and 6.2.

Part B: Case Studies

As outlined in the previous chapter, Algeria and the United Arab Emirates have been identified as appropriate case studies for this research.[111] They are comparable in their basic economic structures as hydrocarbon exporters and have both made efforts to foster renewable energy production on their territories. While Algeria has opted for a more structural, laws-based and so far inefficient approach for its domestic power production, the Mediterranean Solar Plan and the Desertec Industry Initiative might one day serve as powerful landscape-level incentives for a strong support of renewables in the country. The UAE, by contrast, have hardly developed a structural model of renewable energy integration into their power systems. Instead, the largest and most influential emirate of Abu Dhabi has committed itself to renewables through the Masdar Initiative's substantial investments, although the amount of innovation triggered through this project is yet to be established. Thus, while in Algeria, the landscape-level appears to have the highest potential for the spread of renewable energies in this country, it is precisely the niche-level of Masdar that drives renewable energy policy innovation in the UAE. This significant distinction will be discussed in greater detail later in the thesis.

First, the case studies will analyse the current energy production regime guided by the research questions and the MLP system of analysis developed in Part A. In order to have a more straightforward analytical structure, each case study will first analyse the respective country by means of the research agenda outlined in Chapter 3. In conducting this analysis, the structure of analytical units will exactly mirror the system developed in Chapter 3. All sections will close with "section conclusions" highlighting the main empirical results. Subsequently, these section conclusions will be merged in a final overview of the energy system in the respective country. Second, each case study

[111] Data collection for this study was completed in February 2011. All policy initiatives that were launched after that date are only taken into account rudimentarily. As the UAE and Algeria, the two case studies for this work, have not (yet) been significantly affected by recent political events in the Arab world, the findings remain valid to a large extent. This is also the case because the challenges Arab countries face in terms of energy policy are unlikely to change with the advent of a new political system.

will display a "case study within a case study" featuring a particularly promising or influential renewable energy project in the country before presenting the conclusion of the case studies, which will again highlight key findings and provide links to the policy design and governance theory sections of Part C.

Following the two case studies, Part C will then conduct a comparative analysis of the two cases with the help of the results identified in Part B. Moreover, it will discuss policy design questions both for the single cases country and from a comparative perspective before putting forth more deliberations on energy governance theories.

5. The United Arab Emirates

Figure 28: Map of the United Arab Emirates

Graphs © 2013 TerraMetrics, Map Data ©2013 Google

5.1. Introduction

Due to their substantial crude oil reserves, the United Arab Emirates is a key oil- and gas-exporting Arab state. Since the country's formation in 1971, the UAE has been organised as a federation of the following emirates: Abu Dhabi, Dubai, Sharjah, Ajman, Ras al-Khaimah, Umm al-Quwain and Fujairah. Abu Dhabi, by far the largest and wealthiest emirate[112], plays an eminent role on most political decisions within the

[112] Abu Dhabi owns the majority of the UAE's hydrocarbon resources (95% of the oil and 6% of the natural gas) giving it possession of 9% of the world's proven oil and ca. 5% of the world's natural gas reserves. This hydrocarbon wealth forms the basis for one of the highest per capita incomes in the world. In 2006, Abu Dhabi held a global third position with a nominal GDP per capita of US$ 63,000 (*AMEInfo,* 2007). Abu Dhabi has a territory of 67,430 square kilometres, which is equivalent to 80% of the UAE's total land area, cf. http://www.visitabudhabi.ae/en/uae.facts.and.figures/country.size.aspx, accessed 21 November 2011.

UAE.[113] The key aspects of state power such as defence and foreign policy, however, remain in the hand of the individual emirates (Davidson, 2009).

This divide between relatively weak federal ministries and strong emirate-based ministries is also reflected in the field of energy policy: the Federal Ministry of Energy headed by Mohamed bin Dha'en Al Hamili covers national aspects, while key decisions with regards to hydrocarbons exports/imports, electricity policy etc. are taken at the Emirate level.[114]

In greater detail, the structure of UAE energy policy is as follows: under article 23 of the UAE constitution, the competence for energy remains with the individual emirates, which has led to the important side-effect that the system of electricity supply is emirate-based as well. As a consequence, for this comparatively small country with a total energy system of around 20 GW (see Table 16) there are four water and electricity suppliers:

- ADWEA (Abu Dhabi Water and Electricity Authority)
- DEWA (Dubai Electricity and Water Authority
- SEWA (Sharjah Electricity and Water Authority)
- FEWA (Federal Electricity and Water Authority)

Table 16: Installed capacity in the UAE by type of generation (MW) in 2008

Steam turbine	Gas turbine	Combined cycle	Diesel	Hydro	Wind and solar	Total
6,144	13,656	-	14	-	-	19,814

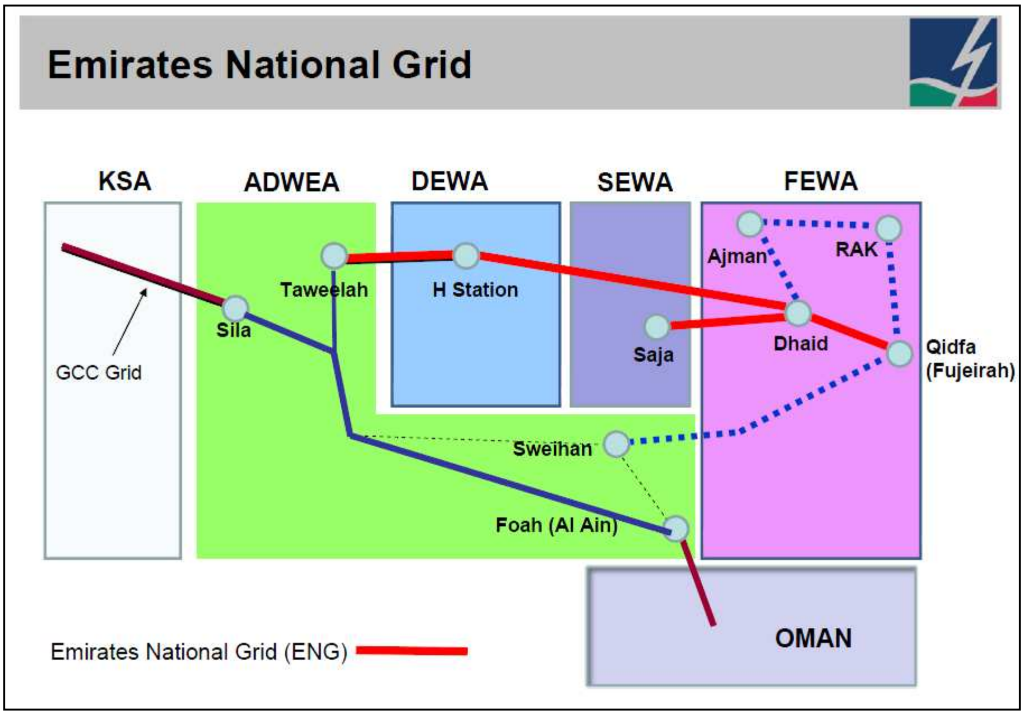
Source: Kharbat, 2010.

While the first three institutions operate under the directive of supplying their respective emirate with water and electricity, FEWA is also based in Abu Dhabi and is responsible for the electricity and water supply of the smaller emirates. This distribution of

[113] As Abu Dhabi is also the by far most important centre of renewable energy policy and technology innovation in the UAE, the following sections will focus strongly on that emirate, although developments in other emirates will also be taken into account.
[114] Particularly in the field of energy policy, this is expected: as oil rents were the prime source of income for the emirates when the UAE constitution was negotiated, it was not in the interest of any ruler to transfer control over this key economic instrument to the federal level.

responsibilities is a historical result, as the smaller emirates traditionally displayed low electricity growth rates. Thus, it is not surprising that they were only connected to the Emirates National Grid in 2008 (see Figure 29). However, the strong demand rise in recent years has put the current system under stress, which regularly leads to black-outs in the smaller emirates during the summer months.[115] In addition to the personal inconvenience caused, this also affects local economic development in the smaller emirates and has sparked debates in the FNC, where members have called upon Abu Dhabi as the wealthiest emirate and in the spirit of inner-UAE solidarity, to supply the others with as much electricity as is needed by their citizens (*gulfnews.com,* 2010b).

Figure 29: The Emirates National Grid



Source: Carter, 2010, p. 6.

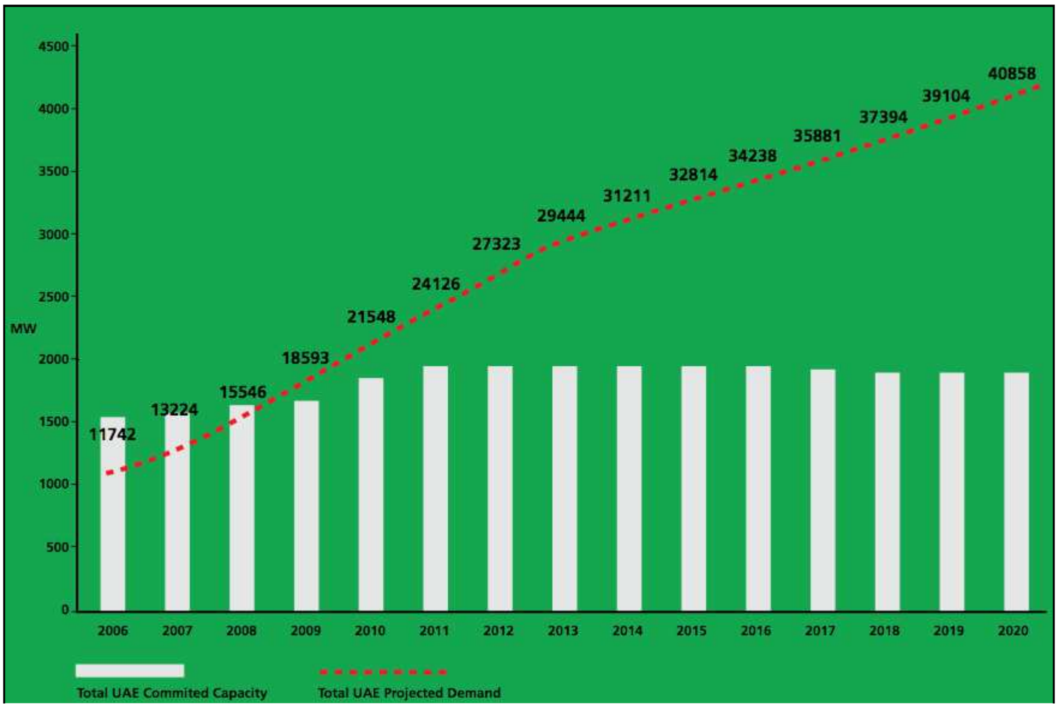
[115] A multitude of cases could be cited here, see, for instance, Al Serkal on the Sharjah blackouts in 2010 (Al Serkal. *gulfnews.com,* 2010) and Kakande (2011) on the concerns of the Northern Emirates for the summer of 2011.

While the power sector with the three smaller suppliers remains fully government owned, in Abu Dhabi, ADWEA privatised five of its seven power plants with a majority share of 60% still held by ADWEA, and a 40% share held by international investors (German Embassy in the United Arab Emirates, 2010). These “Independent Water and Power Plants” (IWPP) are run on the basis of the “build, own, operate” (BOO) principle and sell their output to the country’s single buyer, the Abu Dhabi Water and Electricity Company (ADWEC). It should be emphasised that in Abu Dhabi, as in the rest of the country, power prices are not the results of price formation in a liberal power market, but arranged by power and water purchase agreements (PWPAs) (Abu Dhabi Water and Electricity Agency (ADWEA), 2010, p. 13).

Traditionally, energy supply policy in the form of promoting certain forms of energy production was not a key concern in the Emirates. However, energy-related issues have recently received growing attention in the UAE. At least on the level of public statements Emirati stakeholders are looking for sustainable sources of cheap electricity supply to support the efforts of energy-intensive industry diversification and the climbing of the production chain in oil-related products. Further, facing a rapidly rising domestic power demand (see Figure 30), the UAE power production capacities need to be substantially extended in the near future to meet these projections.[116]

[116] The only UAE data on energy system planning available up to 2020 is the development of UAE’s electricity generation capacity increasing by 9 per cent per year (Government of the United Arab Emirates, 2006). This pathway (Figure 30) assumes a more or less constant high growth of electricity generation capacity at around 9 per cent per year.

Figure 30: Projected future UAE power demand



Source: Government of the United Arab Emirates (2006).

While the UAE power market is currently 100% supplied by natural gas, ADWEA is aiming to diversify its fuel basis by looking for alternative forms of energy for power generation. This is a necessary endeavour and in principle, all options (coal, nuclear and renewables) are being considered (Abu Dhabi Water and Electricity Agency (ADWEA), 2010, pp. 42–43). In short, these are decisive times for UAE energy policy. Championed by Abu Dhabi, the renewable energy initiatives could pave the way to a substantive renewable energy deployment if the political and commercial circumstances provide favourable framework conditions. In addition, it remains to be seen whether Abu Dhabi's comprehensive Masdar Initiative will have a tangible outcome in terms of structure of the (renewable) energy policies in Abu Dhabi/the UAE or if its impacts for the emirate(s) will predominantly be in the field of science, industry policy and country branding.

After a summative account of the data collection (Subchapter 5.2), this chapter will employ the MLP framework to address the 18 research questions developed in Part A (landscape level in Subchapter 5.3; regime-level in Subchapter 5.4; niche-level in Subchapter 5.5). Wherever relevant, the results of the research interviews will also be integrated into the text. Each subsection will end with section conclusions summarizing its main findings. The main outcomes of this analysis will be presented in Subchapter 5.6 drawing heavily on the individual section conclusions.

Due to the pivotal role of the Masdar Initiative, as will be shown in the MLP analysis, Subchapter 5.7 will then feature a “case study within a case study” and focus exclusively on this most prominent and comprehensive renewable energy initiative in the UAE. The ensemble of the results presented in Subchapter 5.6 will serve as background analysis indicating under which conditions energy policy, and particularly the Masdar Initiative, has to operate in the UAE.

The data results produced in this chapter will also inform Subchapter 7.1 of Part C, in which the TM policy design model will be applied by drafting renewable energy policy models for the UAE. Simultaneously, this exercise will have the function of testing how far such policy design models can be applied to the particular governance situation in an oil- and gas-wealthy Arab state.

5.2. Account of the data collection phase of the UAE case study

Most interviews for the UAE case study have been conducted in the country itself. The author carried out three field trips to the UAE between 2009 and 2011, residing there for a total of seven weeks. In 2009 and 2011, the author was also able to visit the World Future Energy Summit, a global clean energy industry meeting that is held in Abu Dhabi each January as part of the Masdar Initiative. This presence at the summits facilitated the author’s contacts with the relevant business community, whose members are otherwise usually difficult to interview due to time constraints. While research interviews in the UAE were conducted in the Emirates of Abu Dhabi, Dubai, Ras al-Khaimah and Sharjah, the host institutions during these trips were the Gulf Research Center Dubai (GRC) and the Dubai School of Government (DSG), two well-known research centres.[117] The author's affiliation to both institutions served as a door-opener to many policy and research contacts in the country. In addition, a snowballing technique was used to tap into the large German and British business communities in the Gulf. This was facilitated by the author's (German) nationality on the one hand, and the contacts established in London and through the London School of Economics on the other hand. Analysing the list of interviewees in Annex II, it is striking that only a limited number of UAE nationals have been interviewed for the data collection phase. To a certain extent, this represents a typical bias by a foreign researcher who will inadvertently find that professional expatriate networks with a similar background and language skills are more open to interview requests and probably more willing to give personal assessments of the situation in a given country. On the other hand, this represents the typical structure of Gulf labour markets: by and large, most mid-level and senior management positions are filled by expatriate workers, mostly of a European-American or non-Gulf Arab, and to a smaller extent Asian background. Only a tiny political elite or a top-level manager of a company is Emirati, and is usually unwilling to give interviews to comparatively minor research projects such as PhD theses. During the course of his work the author has attempted to interview a variety of Emirati stakeholders, such as members of the Federal National Council (with an energy profile), clean energy CEOs and ministry officials. In spite of positive introductions by third parties, however, most of these interview requests remained unanswered or were forwarded to less senior European management staff.

This lack of access to high-level representatives in the Emirati elite forms a challenge, particularly when it comes to tracking decision-making structures. Due to the very personalized nature of power in the country, this meant that in most cases, mid-level management available for research interview could not or would not answer to ques-

[117] The author chose not to affiliate himself with Abu Dhabi's Masdar Institute of Science and Technology (MIST). During the first visits, the MIST was only in a start-up phase. In a later stage, it would have arguably been problematic to collaborate with MIST too closely for a research project that also has the task of critically assessing that very institute/the Masdar Initiative as a whole. In the last phase of the research, the author's relationship to MIST has been a cordial, yet distant one; and the information gathered by visits to MIST and interviews on campus represent valuable sources for the overall assessment of the situation.

tions around the rulers' predilection for one policy option or another. Thus, the question as to why certain policy initiatives in the country remain stalled and how the below-mentioned formidable challenges in the publicly announced spread of renewables in this country can be overcome often remained open. This problem represents a serious limitation for data quality and could in parts be triangulated by other interview data. In addition to that, this problem is faced by all other social science oriented researchers in the UAE and thus only reflects the implicit restrictions in academic freedoms and self-censorship interviewees often apply when talking to foreign researchers.

While this is undoubtedly regrettable, it does not mean that mostly interviewing expatriates had produced insufficient data. Particularly in terms of technical and structural matters it can be argued that expatriates' analyses would not markedly differ from that of an Emirati. At the same time, the author often had the impression that expatriate interviewees would speak more openly about political, economic, or leadership shortcomings in the UAE *body politique* than their Emirati counterparts. This was true for English-language conversations, to some extent with Arabic-language interviews with non-Gulf Arab citizens, and most strongly in the case of interviews conducted in German. The situation of an expatriate researcher interviewing an expatriate manager often created a bonding "we" and "they" situation; in which the "we" was often defined by common national/regional background and language. Thus the usually strict borders between the interviewee (and his company) and the interviewer (and the rest of the outside world) were blurred. Naturally, the information received in these I'll-tell-you-how-it-really-works-here-moments has to be treated with caution. However, their value for a comprehensive and open assessment of national energy policies, particularly in a closed society like the UAE, is high.

In addition to the majority of UAE-related interviews having taken place in that country, the author conducted several further interviews in the United Kingdom, Germany and Kuwait. In the UK, Gulf and energy experts working on similar research projects provided valuable data "at home", while in Germany, the author was able to interview the COO of Masdar PV, a company fully owned by the Masdar Initiative to receive his point of view. Lastly, the interviews in Kuwait were conducted to gather further information about renewable energy policies and research in oil- and gas wealthy countries, as Kuwait has a longstanding tradition in that regard. Additionally, a former acting secretary general of OPEC and a technical director of the OAPEC secretariat were interviewed there in order to shed light on the renewable energy policies and the importance of these organisations in the Arab world.

The overwhelming number of interviews was conducted in a friendly and constructive manner. As highlighted in the methodological discussions of Chapter 4, not all questions have been discussed with all interviewees, as particularly business and high-ranking public officials lacked the time (and in parts: the willingness) to do so. Instead, interviewees usually focused on two sections: those where interviewees had particular professional experience followed by various issues of energy policy governance the interviewees felt passionately about. While the talk on the former issues usually led to rich information on the respective aspects, the latter aspects were not necessarily identical with their area of expertise. In those cases, the information usually was not of such high quality. However, the fact that certain points, such as a common GCC energy market, local electricity supply in the smaller emirates, or a nation-wide renewable energy blueprint, stirred strong emotions among energy experts, provided valuable information which can also identify local political fault lines.

In conclusion, field work in the UAE formed a highly instructive part of the research work for this thesis. Particularly compared to the field trips in the Maghreb, interviewees in the Gulf were much more open, available and willing to provide information on different aspects of renewable energy policies in the UAE. As will be shown in this chapter, however, this does not necessarily mean that the UAE’s policies are much more advanced or effective than in Algeria. Yet, the positive, albeit at times very PR-oriented approach of UAE energy stakeholders made the various research trips intellectually productive.

5.3. Landscape-level developments

5.3.1. The UAE's political system

How far does the UAE's political system and the non-existence of independent CSOs allow for system innovations in the energy sector, particularly bottom-up innovations?

Due to the federal structure of the UAE, political decision-making takes place on several levels. First, at the individual emirate-level, decisions are by and large taken among the top-level leadership of the Emirs and the inner circle of the ruling families; a process that is rarely criticized by the UAE citizens. The same group of leaders also manages federal affairs in the Supreme Council, the UAE's highest authority solely constituted by the rulers of the seven emirates. Parallel to this, the already mentioned Federal National Council (FNC) has the function of an advisory panel or proto-parliament. While FNC members increasingly express their desire for more powers and a more open electoral system,[118] to the present day, the true centre of power remains the Supreme Council. This continuity of a hierarchical, hereditary leadership structure makes the UAE's system of government both highly personalized and top-down. However, one should not make the mistake to assume that decision-making is necessarily unreasonable or less founded on international planning principles than in other similarly developed countries, not least because the UAE, as a high-income country, can afford to purchase excellent quality both in terms of personnel and technology. One interviewee confirms this notion saying

"Yes, the decision-making structures here are very hierarchical and top-down. But do not make the mistake to think that this is a banana republic here! Instead, particularly the Abu Dhabi government has shown a very high degree of professionalism. While initiatives usually come from the very top or can be stopped there at any time, if their initiatives are to succeed, at some point, the rulers cannot avoid the assessment by ministries and other institutions anymore." (Interview no. 74 – National & International Power sector, UAE)

The absence of civil-society organisations with sufficient expertise to champion a renewable energy campaign, which may also be in opposition to government policies,

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[118] Interview with an undisclosed political stakeholder, UAE; see also recent newspaper articles (*The Peninsula,* 2011).

has to be accepted as a fact. One of the few organisations in that field is the Environment Agency Abu Dhabi which, however, is a government organisation and focuses on less controversial topics such as the protection of endangered species, environmental awareness campaigns in schools, and similar activities.[119]

This notion is also confirmed by one of the representatives of the UAE's ruling elite who is active in environmental affairs. He confirmed that there are no major environmental pressure groups in the UAE today:

"I was the chairman of an environmental NGO in the 1990s…There were lots of other groups as well back then, but after 9/11 they were all closed due to 'security concerns'…In general, every criticism in that field is banned; there is a huge brain drain here because people cannot speak out and leave; this is true both for Emiratis and foreigners; there is no freedom of speech here; all speeches, conferences etc. are controlled – this is not good as only a free discourse will bring this society forward." (Interview no. 56 – public stakeholder, Gulf States)

A notable exception, however, might be a new group of industry associations, such as the Clean Energy Business Council (CEBC) or the Emirates Solar Industry Association (ESIA) established in 2010. According to one of the key stakeholders, the ESIA has the following agenda (*Interview no. 64 – Private and public investor, UAE*):

- To build up a solar community in the UAE
- To organize networking events
- To produce research reports on solar energy
- To be a contact point for international companies willing to enter the UAE solar market

CEBC is structured in a very similar way where a greater focus is placed on the provision of information for outside investors, but also to strengthen the renewables lobby within the UAE (*Interview no. 80 – R&D, UAE* and Young, 2010)

Whether these organisations, in addition to Masdar, with whom a good relationship exists, will develop into influential lobby groups for renewable energies in the UAE

[119] The titles of annual reports suggest that one of the goal of this agency is rather country marketing than the formation of a non-government position. Cf. "Annual report 2007 – another year of achievements" (Environment Agency Abu Dhabi, 2007).

with political clout, remains to be seen. In the renewable energy field, however, these organisations are currently the only meaningful, not fully government-controlled bodies in that field that could promote innovation in that sector. Whether this would necessarily be a bottom-up innovation process can only be speculated. As both ESIA's and CEBC's interests largely lie with the big power industry, this would find a significant role in most scenarios published by this group.

As stipulated in the UAE constitution, energy issues constitute a reserved right for the individual emirates.[120] The rationale for this is much less the electricity sector than the oil and gas revenues, which rulers wanted to keep in the hands of their individual emirate since the foundation of the UAE in 1971. The most relevant traditional governance body for the oil and gas markets in the UAE is arguably Abu Dhabi's Supreme Petroleum Council (SPC). As only Abu Dhabi has major hydrocarbons resources left the SPC retained a say in energy politics. However, the SPC has not yet made the decision to take environmental issues, climate change or renewable energies formally and fully into account and thus mostly overlooks these issues.

The same also rings true for the national and international oil companies. As one oil expert confirmed:

"They don't have a big political influence here. They are rather implementing agencies, and also don't have seats on the national councils like the petroleum council. They implement political decisions from the oil or energy ministries, but they can't/won't be pro-active on the renewables front themselves and push for a national/company agenda if the political leadership doesn't give them the mandate to do so. Also, this is not their core business. In addition to this, there is a general lack of awareness among petroleum executives of renewables; this is out of their view usually." (Interview no. 93 – R&D, UAE)

Only in 2009, Dubai's ruler Sheikh Mohamed bin Rashid Al Maktoum has created a Supreme Council of Energy (The Media Office for H.H. Sheikh Mohammed bin Rashid Al Maktoum, 2009) that is also mandated to work more closely on the electricity sector (*AMEInfo,* 2010). So far, however, this council is yet to launch a significant energy initi-

[120] Article 23 of the UAE constitution stipulates: "The natural resources and wealth in each Emirate shall be considered to be the public property of that Emirate. Society shall be responsible for the protection and proper exploitation of such natural resources and wealth for the benefit of the national economy".

ative. Instead, it has been active in PR and environmental awareness campaigns, such as urging Dubai to become the highest energy-saving city in the world (Al Mashni, 2011) – a somewhat futile attempt given the strong rise of the already high per-capita electricity consumption.

At least in Abu Dhabi, the institutional struggles between different government bodies can also be regarded as a greater struggle for political hegemony within the ruling elite. Several interviewees characterized the situation of Abu Dhabi's elite (and to a lesser extent those of most emirates) as currently being in a political tug-of-war between two types of leaders that represent two "speeds of governance".

One the one hand, there is the conservative, long-serving political and economic leadership that is best represented through the UAE's president, the ruler of Abu Dhabi, Sheikh Khalifa bin Zayed Al Nahyan (*1948) and previously his father Zayed bin Sultan Al Nahyan (1918-2004), founder-president of the UAE and long-serving Emir of Abu Dhabi (1966-2004). This type of ruler has governed the country through the Cold War and the first periods of globalisation. In terms of national economic development, these individuals were usually cautious not to digress from the successful oil- and gas-focused path of the last decades and often have little interest in developing new fields of income or diversifying their national economies. Typical institutions for this socio-economic model are, for instance ADWEA, ADNOC (Abu Dhabi National Oil Company), or the SPC.

This is contrasted by a type of policy maker with a different vision of their countries, such as Dubai's Sheikh Muhammad bin Rashid Al Maktoum or Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi. Their vision is much more in tune with the development plans of the last decade or so, including a liberalization of financial and investment regulations, a broad, long-term diversification of the national economies, as well as globally recognized phenomena such as Abu Dhabi's Formula One race course, the Masdar Initiative, the investment vehicle Mubadala, Dubai's extravagant development plans; in short, as one interviewee put it, "*all what is sexy in the Emirates*" (*Interview no. 85 – R&D UAE*).

Section conclusion

In the UAE, a bottom-up system innovation can hardly be expected from non-government UAE entities as personalized, centralized and top-level decision-making structures persist. This has direct impacts on policy making, as the will of these personal and, effectively, absolute rulers in the policy process cannot be ignored, and a mid-level management's attempts to circumvent them would almost certainly be punished as it represents a direct threat to the influence of the rulers. This type of rulership is characterized by a pyramidal decision-making structure. Thus, the leverage of even senior aides to take decisions without the approval of the respective top-level figure remains low. Third, and as a consequence of that, the realisation of the much-advertised mega-projects are at the mercy of good will on the top level. Projects (like the case of Masdar), legal initiatives (like the elusive renewable energy blueprint) and further significant strategic decisions on Emirate level are essentially dependent on the rulers' consent. If, when and under which conditions this is granted remains out of the realm of this thesis and is, like the attempt to predict other absolute rulers' policies – a methodologically difficult and often flawed form of Kremlinology.

A bottom-up innovation approach is thus unlikely to develop any time soon unless upon initiative of the federal government or of well-connected individuals belonging to a faction that can provide political support. Evidently, however, if such an innovation process was to be launched and managed by central government it would lose its main characteristic. Significant innovations in the UAE energy system are most likely to stem from strongly system-entrenched actors such as Masdar and, to a lesser extent, business organisations such as the CEBC or the ESIA.

Second, the fundamental divide in policies is a key analytical tool to understand the different policy systems of UAE policy and will be discussed further below. It is not always evident which of these models of policy making within the ruling elite has the upper hand. However, it seems that although the old oil and gas elites continue to be powerful, they are mostly interested in the perpetuation of the business as usual scenario that has been immensely lucrative in recent decades. As long as their policy model is left untouched, the "newcomers" will not be prevented from launching innovative renewable energy initiatives such as Masdar. Even comprehensive renewable energy initiatives are not a major issue, as they do not diminish the returns on hydrocarbons exports, but rather turn capacities that have previously been bound for domestic consumption into new export capacities. In short, the traditional oil and gas elites might have the power to both launch such initiatives themselves and prevent them from being successful. However, as long as their old business models remains undisturbed, they do not have the economic and political interest to act in either way.

5.3.1.1. Personal patronage networks

To what extent are the official decision-making processes the actual decision-making structures?

While there remains a fuzzy overlap between official and non-official decision-making structures, the official decision-making bodies in the UAE are arguably also those where, to a large extent, policies are made. For the UAE, two aspects need to be highlighted. First, although the official decision-making structures are to a large extent parallel to the actual processes, this does not mean that reasons for certain decisions are publicly given or the decision-making process publicly explained. Second, in the top-level positions of the state, decisions are highly personalized, and, as has been argued in the previous subsection, individuals represent certain approaches of general policies. Perhaps the most striking case of personal patronage in the UAE's renewable energy landscape is the case of Masdar's CEO Dr. Sultan al-Jaber. As a young Emirati, al-Jaber became the figurehead of the Masdar Initiative. Although not from the inner circles of the ruling family, Jaber's profile has grown in parallel to the Masdar Initiative[121], under the protection of Abu Dhabi's Crown Prince. As an example for the working of the personalized management structure:

[121] In mid-2011, for instance, al-Jaber is not only the CEO of Masdar, but also the UAE's Assistant Minister of Foreign Affairs, the UN's contact point for climate change, chairman of the Abu Dhabi Ports Company (ADPC), chairman of Abu Dhabi Media Investment Corp., Chairman of Sky News Arabia, Vice Chairman of the UAE Federal Health Authority and serves on the boards of the Advanced Technology Investment Company (ATIC), ALDAR Properties and ZonesCorp. In addition to this, he holds several other offices. Cf. http://gggi.org/board/member/sultan-ahmed-al-jaber, accessed on 26 June 2011. Undoubt-

"Due to the leadership structure, things are all resting in a few hands, and Masdar still …is a prestige object not only for Jaber, but also important for the Crown Prince. Jaber again has hired a few people (3-5) who are in charge of key projects like the World Future Energy Summit etc. and they operate them on a sink or swim basis." (Interview no. 27 – Public Stakeholder, EU)

This is an example of blurred decision-making structures in the UAE. Prima facie it appears that Sultan al-Jaber is the key decision-maker of Masdar, yet, this does not represent the full truth. However much Sultan al-Jaber develops an independent political clout, his decisions inevitably remain subject to higher-level blessings or swings in the fortunes of the Crown Prince himself.

Other official decision-making structures are even less transparent. During the entire research period for this thesis various interviewees have stressed that the release of an Abu Dhabi strategic energy blueprint, as well as a national FIT system was imminent and merely needed a last signature to be enforced.[122] However, after three years of research, nothing substantial has been released. From an outsider's perspective it cannot be deemed with certainty whether this delay is caused by institutional inertia or active lobbying on behalf of anti-renewable energy stakeholders. The latter, however appears to be unlikely as no publicly visible anti-renewable energy lobby exists in the UAE.

With regards to formal or informal policy networks supporting or blocking the spread of renewables in the UAE, the most pertinent divide has already been discussed in the previous subsection. As confirmed by various interviewees, energy policy in the UAE takes place along these lines. In the greater struggle for directional hegemony over the future development path, (renewable) energy policy merely represents one battle in

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edly, this stellar rise from an "*assistant manager*" in 2004 (*Interview no. 66 – Private and public investors, UAE*) would not have occurred without strong backing of the ruling elite.

[122] Quotes were, for instance, as follows: "*There is no common energy policy document out yet, but it is bound to happen within the next few weeks*" (Interview no. 51 – Public stakeholder, UAE); "*the policy document is 100% ready, it just needs to be signed on the very top level, without this consent, it cannot move*" (Interview no. 63 – private and public investor, UAE) vs. the much less enthusiastic statement "*A comprehensive energy policy is supposed to have been released since more than 2 years now* (=2008, the author) *– but it is still 'under discussion'*" (Interview no. 87 – R&D, UAE).

the conflict. Classical constellations of Western states, such as party-political disputes, CSO campaigns against government policy, or inter-ministerial tensions between the ministries of economy, environment and energy are less relevant or non-existent due to the hierarchical, top-down political system that allows for open political discourse only in very limited contexts.

A noteworthy ancillary-aspect is the fact that in the UAE, there often seems to be a substantial overlap between the political support networks for renewable and the nuclear energy under the terminological umbrella of terms such as “clean” or “future”. One striking example for this is the annual World *Future* Energy Summit, which traditionally displays not only renewable energy products, but also nuclear energy, “clean coal”, CCS and other technologies that renewable energy activists in the West would not like to see associated with RETs. What is incongruous in other countries seems to harmonize rather well in the UAE. The question, however, seems to be whether or not renewable energies will be marginalized under the capital-intensive competition of nuclear energy in the medium term. While the technical issues pertaining to this question will be discussed in Subsection 5.4.1.2, for now, it suffices to deduce that this unusual coalition might actually promote the spread of renewables in the UAE.

In short, concisely tracing decision-making structures within UAE (renewable) energy policy is a daunting task. While, as described, the most powerful actors within this multiple speed structure can be identified, those key stakeholders, usually senior members of the ruling families or ministers, are usually unavailable for research interviews. This thesis is no exception in that regard. Other stakeholders, who are accessible for interviews, usually either do not have personal access to high-level members of the ruling class or, if they do, they will make sure not to divulge this.

This lack of access might constitute a certain deficiency in terms of precise data collection on the case study level. In a more abstract sense, however, this dearth of data on these points reflects the opacity and highly personalised decision-making structures within the UAE government that amass decision-making power within few high-level offices while leaving almost none to mid- or lower-level managerial staff. The fact that other research publications stay equally – or more – quiet with regards to these matters highlights the sensitivity and opacity that clouds these issues.

<u>Section conclusion</u>

UAE renewable energy decision-making processes take place on a highly personalized basis and within a very small national elite. This is indicative of the Emirati political system, in which decisions are usually taken behind closed doors and remain opaque to the outsider.

While there is a large overlap between supporters of nuclear and those of renewable energy under the umbrella of the catchword "clean energy", it needs to be emphasised that the division in this group cannot be regarded as running parallel those lines in western liberal democracies, but rather along the "old vs. new guard" system that, as described in the previous section, is dividing Gulf elites.

5.3.1.2. Governance effects of renewable energy systems

What do interviewees regard as the key governance effects of renewable energy production?

As mentioned earlier, the provision of cheap and abundant electricity is regarded as part of the ruling bargain, thus, major rises in power prices are usually avoided by Gulf rulers. Second, the notion of a long-term democratisation of the UAE *body politique* through a spread of renewable energy capacities is amiss in both the ruling and the slightly government-critical circles. However, what was mentioned several times by interviewees was the principled opposition of the UAE government to both a free and open electricity market and also the full liberalization of the energy production sector. Interviewees felt the government feared losing control over this vital sector stating:

"You don't want to end up with too many decentralised projects; everyone is very pro centralized power production here!" (Interview no. 76 – National and international power sector, Gulf States)

However, it appears doubtful whether this statement in fact implies a confirmation of this assumption. Instead, it appears more likely that this notion results from the typical paranoia of autocratic rule, which attempts to retain control over every aspect of life, the power sector included.

Further, it is striking how well-known the project of a common GCC grid is, bearing in mind that this is a “mere” technology project. In light of the on-going power shortages and the mid-term gas shortage of the UAE and many other GCC states, this project carries within itself one element of an enhanced regional, intra-GCC cooperation. However, as Miller argues (Miller, 2005), key commercial elements of the GCC grid are yet to be developed. Thus, while the grid will form a much-needed emergency back-bone for the Gulf States, it is uncertain how much physical electricity exchange will in fact take place there. First, for the time being, no common electricity market is planned. This cannot be seen as surprising given that even the national electricity prices in the GCC are not created by market forces but by government price-setting and subsidies. Second, as the load peaks of all GCC states occur by and large in the same time period (summer), it remains doubtful how much reserve capacity states will actually have in a phase during which all regional energy systems are under stress (*Interview no. 68 – National and international power sector, UAE*). Third, although so far, the GCC grid connections have proceeded well, a full-fledged grid might face unexpected problems, as in the case of the failed MedRing grid project around the Mediterranean.[123] Also, the fact that Saudi Arabia operates on the US-standard of 60Hz, while the rest of the Gulf operates on a 50Hz standard means that the only way to integrate Saudi Arabia, the largest GCC power pool by far, to the rest of the GCC grid is via HVDC converters (Inte*rview no. 65 - Private and public investors, UAE*); a further obstacle to a major GCC electricity market.

<u>Section conclusion</u>

Answered *ex negativo*, by and large, rulers do not seem to connect the spread of renewable energy capacities with any political agenda. Yet, an agenda can be found in

[123] As discussed in Footnote 87, the closure of the Tunisian-Libyan interconnection failed due to unforeseen technical difficulties. Thus, the closure of the MedRing still remains an on-going project.

the provision of cheap and abundant electricity. This forms a crucial part of the national "ruling bargain", which political elites refrain from challenging.

Furthermore, it can be confirmed that the creation of a common GCC energy infrastructure can certainly promote regional integration in a wider sense. Due to the factors mentioned above, however, it is unclear as to how well this common security backbone will actually work and whether a dysfunctional GCC grid might hamper regional cooperation.

5.3.2. Key transregional energy governance bodies

Which role do transregional energy governance bodies such as OPEC, OAPEC or IRENA play in the promotion or stalling of national renewable energy policy in the respective target country?

As noted above (Section 3.2.2), OPEC and OAPEC have a regional governance mandate that is restricted to technical cooperation in the oil and gas sector (OAPEC) or the oil price and oil policies (OPEC). Neither organisation has devoted many human or financial resources to renewable energies; on the whole, these organisations tend to stay out of national Arab renewable energy policies. Thus, their role on the level of domestic renewable energy politics is, at the moment, negligible. This might also be due to the fact that no hydrocarbons-wealthy Arab state would attempt to implement a policy that could be interpreted as an all-out attack on the oil economies – a move that would not be in any oil-producing states' interest.

With regards to IRENA, its presence in Abu Dhabi has not had any major effect on countries with the same economic structure. While certainly, the combination of Masdar and IRENA in Abu Dhabi have helped promote public awareness of these institutions in the UAE (and particularly in Abu Dhabi), immediate policy implications have so far not been visible.

On the one hand, IRENA officials are careful not to privilege the host state in any way. Although a MENA renewable energy expert is part of IRENA staff, not much conceptual or policy work in that respect has carried out thus far. This was anticipated since 2010 was IRENA’s first full year of operation, a year fraught with leadership difficulties and financial problems.[124] Moreover, it is not the task of this organisation to put a particular focus on the host country or region. As one interviewee put it:

“Just the fact that we are hosted by Abu Dhabi doesn’t justify a special focus on Abu Dhabi or the Middle East as a whole. The UAE is one of our 148 member countries and will not get a special treatment. Of course, we are cooperating closely with some people from Abu Dhabi’s Department of Energy and Climate Change (DECC) as they are our host agency, but that’s all.” (Interview no. 54 – public stakeholder, Gulf States)

Instead of the international organisation attempting to influence policies of its host state, it seems that there has rather been an inverted attempt by the host state to influence the topical focus of IRENA. An open controversy about whether IRENA should also cover or promote nuclear energy has emerged; a direction that would have been very beneficial to Abu Dhabi’s “clean tech” doctrine of confounding these two systems of energy production. The former general director of the preparatory commission for IRENA, Helène Pelosse, strongly rejected this demand (*Khaleej Times,* 2009) with reference to the article III of the IRENA Statue that defines renewable energy as

“All forms of energy produced from renewable sources in a sustainable manner, which include, inter alia:

1. bioenergy;

2. geothermal energy;

3. hydropower;

4. ocean energy, including inter alia tidal, wave and ocean thermal energy;

5. solar energy; and

6. wind energy” (Preparatory Commission for IRENA, 2009)

thus clearly excluding nuclear power from its agenda. Also, several interviewees confirm that there has been a power struggle behind the scenes between Masdar/Abu Dhabi (Jaber) and IRENA (Pelosse).[125]

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[124] In October 2010, founding director Helène Pelosse left the organisation. “IRENA 2.0”, a new staff and financial policy was implemented *(Interview no. 27 – public stakeholder, EU).*

[125] “*Jaber thought, he was her boss, but he wasn’t, this was totally inappropriate*” (Interview no. 53, public stakeholder, UAE); “Pelo*sse was always anti-nuclear; this caused the main friction! Somehow Jaber thought he was her boss…*” (Interview no. 69 – National and international power sector, UAE)

Section conclusion

Transregional energy governance organisations have not had a traceable impact on domestic renewable energy policies in the UAE. In turn, the UAE had a minor negative role in the start-up phase of IRENA. An impact on domestic UAE renewable energy policies by IRENA itself cannot be expected in the medium term aside from the fact that, by hosting IRENA, the UAE (and particularly Abu Dhabi) would suffer global reputational damage in abandoning their domestic renewable energy plans, as well as the Masdar City project.

5.3.3. Climate change vulnerability and low environment-related profile of oil-producing states

Is the climate change agenda actively considered in the political decision-making on renewable energy developments?

The impacts of anthropogenic climate change in the Lower Gulf are already noticeable. As Riegl's research on coral reefs in Abu Dhabi, Dubai and Sharjah demonstrates, local marine ecosystems in the Arabian Gulf are substantially affected by climate change and must be placed among the "most stressed reef environments on earth" (Riegl, 2003, p. 434). In a local climate of increasingly frequent temperature anomalies,[126] unprecedented bleaching events and a heightened coral mortality rate have occurred. In line with the Intergovernmental Panel on Climate Change (IPCC, 2007a) and other meteorological models (Met Office, 2009; Zhang, Aguilar, Sensoy, Melkonyan, Tagiyeva, Ahmed et al., 2005) it is justified to predict that climate change will put additional stress on the regional political and economic systems.[127] Initially, a decrease in precipitation in combination with a projected temperature rise of 1.8°C by 2040 and

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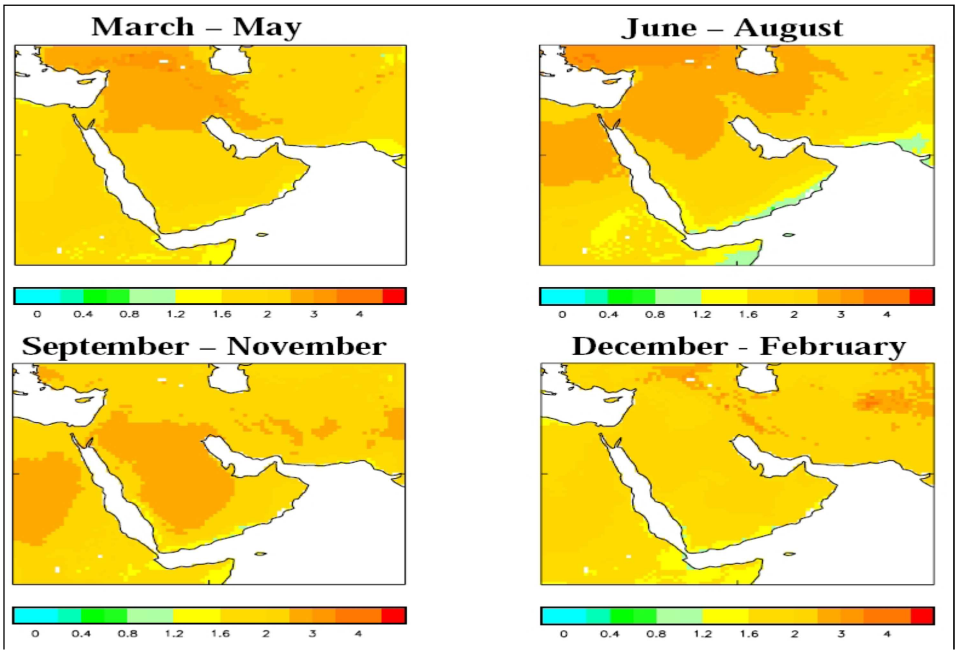
[126] In 1998, average temperatures exceeded 37.3°C in central regions of the Gulf being more than 2°C above average. This was the largest temperature rise in the southern Gulf since 1870 and emphasizes the increase in sea surface temperature in the Gulf of at least 0.2 °C per decade for the last 50 years (Richer, 2008).

[127] As Hemming et al. (2010) discuss, the exact prognosis of climate change related changes on the Arabian Peninsula poses a major challenge to research. The general trend, however, can be regarded as certain.

3.6° by 2070 (see Figure 31) will render even wider areas of the Gulf States unfit for agriculture and uninhabitable for a non-nomad population.

Figure 31: Changes in Regional Climate Model projections of seasonal average temperature (°C) across the Gulf region for the 2040s relative to the 1990s



Source: MET Office, 2009.

This "desertification in the desert" (Richer, 2008, p. 8) will raise the stakes for existing water supplies in the region, accelerating the depletion of non-renewable saline aquifers. Most fossil water resources on the Arabian Peninsula are between 10,000 and 30,000 years old. While the domestic water use in the Gulf is currently about six times the natural renewal rate, also in this case, the question is *when* rather than *if* aquifers deplete (Brook, Al Houqani, & Al Mugrin, 2006).[128] Water tables have dropped sharply as demand from rapidly urbanizing and industrializing populations has outstripped supply from fossil water and local aquifers (Raouf, 2009).

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[128] In 2000, only four countries (Iraq, Iran, Syria and Lebanon) of the entire MENA region had freshwater reserves beyond the water poverty level of 1000m^3/cap/y (German Aerospace Center (DLR), 2006a, p. 4).
It should be noted that the fossil water reservoirs in the Gulf are significantly smaller than in North Africa. Thus, mega-projects like Libya's 'Great Man-made River' tapping the world's largest fossil water reservoir in the Nubian sandstone aquifer system cannot be realized on the Peninsula. This does not suggest that the realization of such a project would be particularly desirable. However, in the Gulf, this is not even possible from a resource perspective. For more information on Libya's project cf. at: http://www.water-technology.net/projects/gmr (last assessed 1 November 2011) and Simons (2000).

Currently, more than half of the water used originates from desalination or wastewater treatment. However, in the mid-term perspective, the growing freshwater demand of the region cannot be sustained by the reliance on fossil water reserves, which is why both the relative and absolute amounts of desalinated water are going to rise. The 15 desalination plants that are currently operating in the GCC on the Arabian Gulf alone already have adverse environmental effects such as releasing gases, hot brine, treatment chemicals and other trace elements. Besides the production costs[129] and their impact on marine life (Abderrahman & Husain T., 2006), the key issue for this research is the close nexus of desalinated water and energy. On average, desalination plants need 1.5-15 kWh to produce one cubic meter of water (German Aerospace Center (DLR), 2006a, p. 22). Thus, the rising water production by desalination further increases the already high annual growth rates of national electricity demand.

Renewable energy policy could interact with climate protection measures in two ways: first, large-scale application of renewable energy for seawater desalination could be an entry point for renewable energies in the UAE.[130] Second, the climate change argument could be used by politicians to justify an enhanced deployment of renewable energies in the UAE.

With regards to the first issue, while CSP-based seawater desalination might be an important driver in the mid-term future, for the time being, this is not an actively considered technology option by UAE stakeholders due to the significantly lower costs of fossil-fuel-based desalination.

The second aspect is the use of the clean development mechanism (CDM) as a potential financing tool for the spread of renewables. This yielded an equally weak outcome. As was shown in Section 3.2.3, the spread of the CDM in the MENA region is strongly

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[129] Until 2020, Saudi Arabia alone will invest US$ 50bn in desalination projects, while an overall investment volume of US$ 200bn has been earmarked for water and energy infrastructure projects (*The Saudi Gazette,* 2010); and in the UAE, desalination costs are expected to rise by 300% over the next 6 years to an annual US$ 3.22bn.

[130] See for instance Bouchekima (2002), Enzili (2007), German Aerospace Center (DLR) (2006a), Mahmoudi, Abdellah, & Ghaffour (2009), and Hashem (2011). One of the most recent and comprehensive research projects on that subject was the EU-funded project *Promotion of Renewable Energy for Water production through Desalination* (PRODES) Papatreou, Wieghaus & Biercamp (2010).

underdeveloped compared to other world regions. No interviewee has mentioned this mechanism as a potential business stimulant for the UAE. One of the very few institutions in the UAE that works actively with CDM is the carbon unit of Masdar (see Subchapter 5.6 for further details). However, most of its projects are not based in the UAE itself, and an employee of this Masdar branch confirmed that, CDM money usually only helps to fund "*the icing on the cake for renewable energy investments, maybe 1-2% of the overall investment costs*". This might serve as an explanation as to why the hydrocarbons-rich states that had large budget surpluses in recent years, have not been interested in using the "*very complicated mechanisms of CDM*" (both quotes: *Interview no. 78 – national and international power sector, Gulf States*) for comparatively little funds.

Section conclusion

The framing of renewable energy policy in the context of climate change plays only a minor role in the UAE. While statements, for instance by Masdar, refer to climate change, public discourse on this topic in this group of states remains very critical towards it. In conclusion, it can be argued that both aspects of climate change only play a minor role in the spread of renewable energy in the UAE.

With regards to finance, the CDM is widely regarded as a mechanism that is both complex and financially not particularly rewarding. Stakeholders have little hopes in its effects. Thus, it is not likely that the CDM – in its current form – is a valuable tool for the spread of renewable energy capacities in the UAE.

5.3.4. Long-term national economic diversification

Are the renewable energy-related efforts connected to the national economic visions or national SWF activities in the respective country?

As discussed in Section 3.2.4, it has become a trend in the Gulf to develop national policy blueprints that are designed to guide the country's development in the decades to come. In this trend, the UAE forms no exception. Due to the particular federal structure in the UAE, the federal blueprint remains rather weak, while most emirates have developed their own set of policy papers.[131] Renewable energy policies in the central policy documents will be analysed next.

Apart from short-term government policy white papers such as the UAE government strategy 2011-2013 (Government of the United Arab Emirates, 2011a), the document on the federal level "UAE Vision 2021: United in ambition and determination" is in its character merely a loose policy document enlisting common aspects of UAE policy. Renewable energy policy does not appear as such. However, the previously discussed blending of renewable and nuclear power is included. The only text passage where energy policy is mentioned reads as follows:

"Balanced growth must be fuelled by a sustainable range of energy sources, within which the UAE will ensure an important role for alternative and renewable options <u>such as nuclear power.</u>" (Text highlighted by the author) (Government of the United Arab Emirates, 2011b, p. 17)

It seems evident that not only are the two forms of energy carriers confounded here, but nuclear energy also is being championed as an energy carrier more than renewables are.

On the emirate level, the documents of Dubai and Abu Dhabi, the most populous and economically powerful emirates, set the tone. At the height of its economic boom (2007), the government of Dubai released a new Dubai Strategic Plan for 2015 after its previous Dubai 2010 plan had been very successful. The 2007 plan was titled "Dubai…where the future begins" and outlined a very ambitious urban development strategy for the emirate. Renewable energies played virtually no role in its strategic eco-

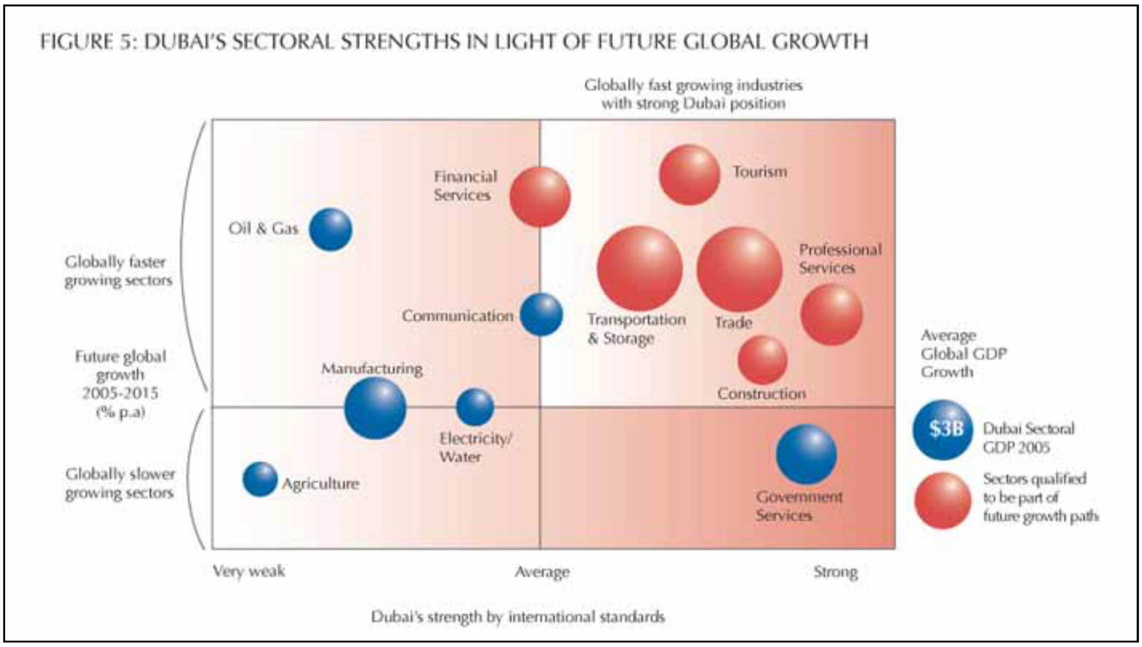
[131] **UAE**: UAE Vision 2021; UAE Education Strategy 2010-2020.
Abu Dhabi: Abu Dhabi Economic Vision 2030 / Abu Dhabi 2030; Abu Dhabi Vision 2020; ADEC 10 Year Strategic Plan.
Dubai: Dubai Strategic Plan 2015 (DSP 2015); Dubai Strategic Plan 2010; Dubai Courts Strategic Plan 2009-2011; Dubai Municipality Strategic Plan 2010-2014; Dubai Municipality Strategic Plan 2007-2011; DTCM Strategic Plan; RTA Strategic Plan.
Ras al-Khaimah: 20 Year RAK Development Plan for Southern Region; 2005 Master Plan (*RAK internet webservice,* 2009)
Source: http://www.dubaifaqs.com/strategic-plan-vision-uae.php, last accessed 20 June 2011.
Consultants' plans to sell to the ruler of Sharjah a similar "Sharjah Vision 2020" in 2003 for US$ 1.9m have apparently been unsuccessful (Amirahmadi, 2003).

nomic assessment (see Figure 32). The only energy-related statements were the two goals in the environment sections of this strategy:

"Provide efficient energy, electricity and water supplies to meet Dubai's growing needs" and *"Maintain Dubai as a safe, clean, attractive and sustainable environment"* (Government of Dubai, 2007, p. 32)

Thus, a link to renewable energy as long-term national economic diversification, industry or labour market policy cannot be identified – a situation that is unlikely to change in the impending re-launch of this strategy.[132]

Figure 32: Dubai's sectoral strengths in light of future global growth



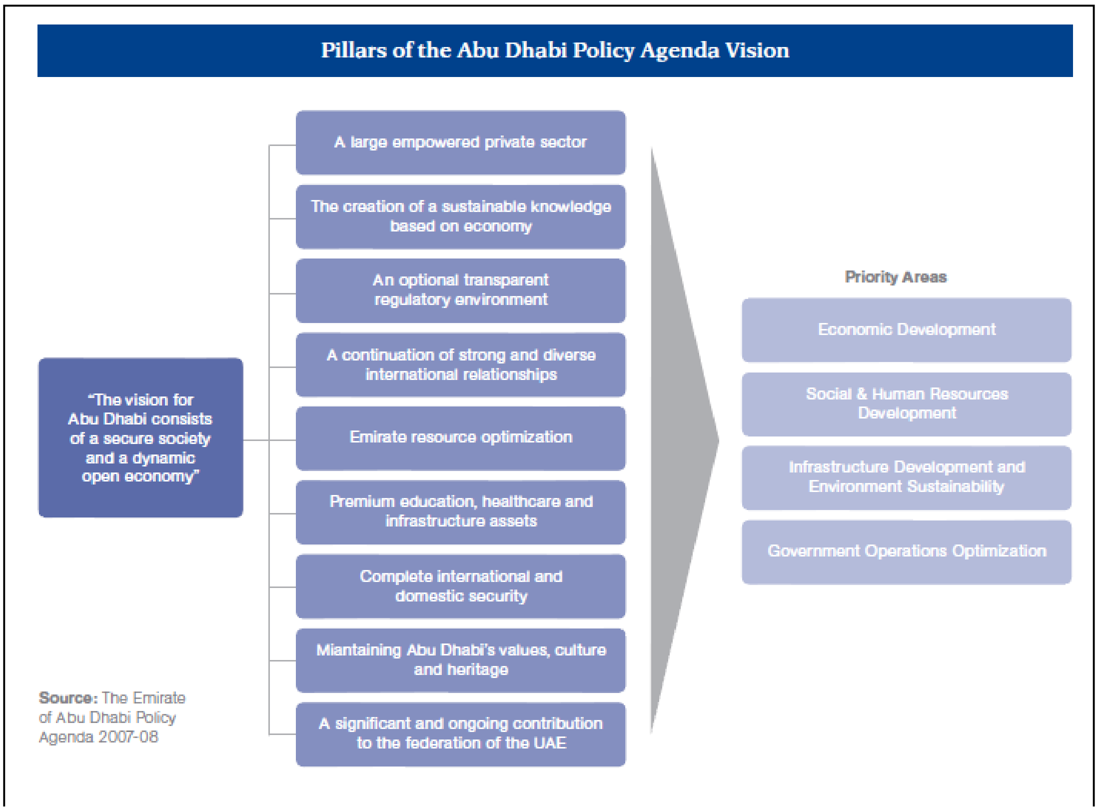
Source: Government of Dubai, 2007, p. 20.

Lastly, the Emirate of Abu Dhabi has arguably presented the most sophisticated and influential set of "visions" that have set the tone for the entire country, the "Abu Dhabi Economic Vision 2030" and the "Plan Abu Dhabi 2030", which, to a certain extent, refer to renewable energies as well. The "Economic Vision" has been issued by the Government of Abu Dhabi and outlines key economic development goals for the next decades. It stresses the strategic importance of diversified economies and a decreased

132 The global economic downturn made the 2007 planning goals unattainable, hence this re-launch. Cf. http://www.dubai.ae/en.portal?topic,hm_dxbstgplan,0,&_nfpb=true&_pageLabel=misc. Last accessed 02 July 2011.

dependence from hydrocarbons revenues for a sustainable wealth in the 21st century and beyond (Government of Abu Dhabi, 2008, p. 7). Moreover, it identifies the following determinants of Abu Dhabi's long-term economic success (see Figure 33):

Figure 33: Pillars of the Abu Dhabi policy agenda vision



Source: Government of Abu Dhabi, 2008, p. 6.

Further, it defines the following economic areas as key for Abu Dhabi's diversified economic growth:

1. Energy – Oil and Gas
2. Petrochemicals
3. Metals
4. Aviation, Aerospace and Defense
5. Pharmaceuticals, Biotechnology, & Life Sciences
6. Tourism
7. Healthcare Equipment and Services
8. Transportation, Trade and Logistics
9. Education

10. Media
11. Financial Services
12. Telecommunication Services (Government of Abu Dhabi, 2008, pp. 11–12)

From that list it is evident that although renewable energy could be subsumed under point 1., it does not have a prominent role in this plan.

Further, the document makes another reference to non-fossil energy sources;[133] in the wake of that statement, however, nuclear energies are championed again while renewables play largely no role – "solar" or "wind energy" are not mentioned at all. This assessment can also be supported by the fact that the much-promoted Masdar Initiative, supposedly the flagship project of renewable energies in Abu Dhabi, is not given major attention in the document and is not at all mentioned in its renewable energy component. The only instance Masdar is mentioned in this 145 page-report is in the context of ADNOC, as Masdar is also in charge of a Carbon Capture and Sequestration (CCS) project that might be beneficial for this NOC. This supports the notion that while this report appears to be innovative and catering to the new group of rulers in Abu Dhabi, it remains very conservative in energy sector terms and even fails to show Abu Dhabi's greatest international renewable energy achievement, Masdar.

The second policy document, the "Plan Abu Dhabi 2030" has been released by the Abu Dhabi Urban Planning Council and is thus of a lower political status as the publication above. Much like its counterpart, Abu Dhabi's second city Al Ain (Abu Dhabi Urban Planning Council, 2009) mostly focuses on planning concern for the built environment of that city and is to a lesser extent a general policy document.

Nonetheless, it sets a positive tone for renewable energies:

"Oil has brought considerable wealth to the city, but it is a finite resource. Abu Dhabi's future lies in the ability to cautiously use existing wealth, to actively explore renewable energy production, to reduce the consumption of non-renewable resources and to educate future generations. Resource efficiency is vital." (Abu Dhabi Urban Planning Council, 2007, p. 6)

[133] "Diversifying energy sources is a key strategy to ensure future energy security" (Government of Abu Dhabi, 2008, p. 80).

In line with its mandate the report does not continue with a detailed energy policy blueprint, nor does it give recommendations in terms of material energy policy, such as feed-in-tariffs, or similar RE promotion instruments. It discusses, however, the Masdar Initiative as key experiment for a zero or low-carbon built environment in the UAE and beyond.

With regards to the role of SWFs and their investments in renewable energies, again, Abu Dhabi leads the way in the UAE. While the size and, in parts, the lack of transparency of the UAE's sovereign wealth funds makes it impossible to identify every renewable energy investment, one, however, needs to be highlighted. As part of its Masdar Initiative, Abu Dhabi successfully launched the Masdar Cleantech Funds. Mubadala[134], one of Abu Dhabi's smaller, transparent[135] sovereign wealth funds, is widely regarded as the investment vehicle of Abu Dhabi's crown prince and the generation of young innovators among the ruling elite. It has partnered with major international banks (Credit Suisse, Deutsche Bank) for its launch.[136] With a total investment volume of US$ 250m and US$ 290m respectively, Abu Dhabi's first two[137] clean tech funds invested in key technologies overseas and created several important joint-ventures for the Masdar Initiative. In the East German state of Thuringia, a PV plant has been built for US$ 230m, Masdar has also announced a joint-venture with the small, Finnish wind-turbine manufacturer WinWinD to set up its business in Abu Dhabi through a 120€m investment. This, and further recent investments do not only have a short-term financial interest. As one interviewee stated:

"Of course we know that we could get a better return on investments with other products in the short term. But these are strategic investments for Abu Dhabi. We want to get ownership in key future technologies – and on way for us to do it is to buy shares in

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[134] Founded in 2002, Mubadala is one of the key investment vehicles of the Abu Dhabi government.
[135] Together with Bahrain's Mumtalakat, it regularly receives the highest transparency ratings of any Gulf SWF (*BusinessIntelligence Middle East,* 2009a).
[136] Masdar as a whole is fully owned and funded by Mubalada.
[137] A third cleantech fund is due to be launched soon. However, release dates and fund sizes have not yet been revealed (*Emirates 24/7,* 2011).

successful companies worldwide or to build them from scratch." (Interview no. 76 – National and international power sector, UAE)

While it is true that Abu Dhabi's much larger SWF IPIC (International Petroleum Investment Company) also makes strategic investments in the energy sector in line with the emirate's economic diversification plans, IPIC's investments remain focused on all areas of hydrocarbons (up- and downstream); renewables are usually not part of IPIC's portfolio. In that sense, the Masdar Initiative and its subsidiaries remain a unique investment strategy in the UAE.

Section conclusion

UAE policy documents remain cautious about the role of renewable energies in the future economic development of this country. While the need for economic diversification appears to be widely accepted (most pronounced in Abu Dhabi), the potential of renewables is only highlighted in the case of Abu Dhabi. However, even here, a concise role of renewable energy as part of a widened spectrum of industry products, and also all references to domestic energy policy are avoided. Although references to nuclear energy are also rare, they are often more concrete than references to renewable energy industry or electricity in the UAE.

Furthermore, compared to the vast financial potential the UAE's SWFs have, their strategic acquisition policy in the global renewables industry has been remarkably low. Only Abu Dhabi has already acted successfully in this regard. However, compared with global renewable energy investments[138] – this sum still remains low. A key determinant of success of this technology transfer/strategic acquisition strategy is the absorption potential of the domestic market and the level of R&D. Subsequent sections will assess in how far all those necessary conditions of success are met or where deficits remain.

[138] In 2009, global renewable energy investment reached US$ 162bn; see Chapter 1.

5.3.5. *Country branding*

Is country branding a catalyst in the spread of renewable energies?

While the UAE was recently ranked 25th in a significant country brand index (Future-Brand, 2011, p. 79), the promotion of renewable energies does not play an eminent role in the official policies of the UAE as a whole, nor of any UAE emirate apart from Abu Dhabi, which by far has the most elaborate branding campaign of the UAE. Since November 2007, the emirate has an official "Office of the Brand of Abu Dhabi"[139]; no other UAE emirate has a similarly professional country marketing office.[140] Again, any reference to Masdar or other clean tech products (even nuclear energy for that matter) are absent in the listing of Abu Dhabi's "brand promise" that, however, registers "hydrocarbons" as a "product feature" (see Figure 34).

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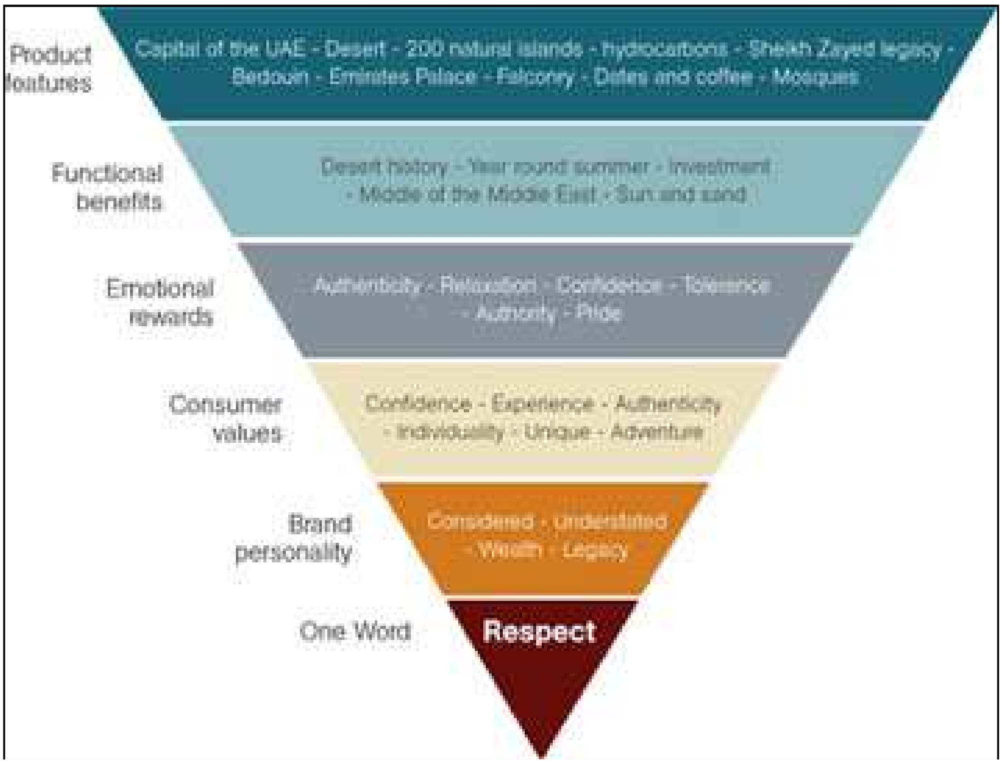
[139] In Arabic, this office is called *maktab abu dhabi lil-hawiya al-alamiya* (Office of the media identity of Abu Dhabi), which further elucidates its.

[140] While Dubai's ruler has attempted to launch a similar institution in 2009 with less success, this does not mean that Dubai is internationally less well-known. This, however, is much less linked to official branding efforts than to its role as globally recognized boom town in the previous decade.

Figure 34: “Brand features” of Abu Dhabi



Source: http://brand.abudhabi.ae/en/the-abu-dhabi-brand/our-brand-promise; last accessed on 01 November 2011.

It remains slightly surprising that Abu Dhabi does not feature the entire energy reputation it has tried to establish during the last years in this context.[141] From the perspective of this thesis, a reference to any form of renewable energy technology, Masdar, or indeed the fact that IRENA is seated in Abu Dhabi was expected. Moreover, and in light of Abu Dhabi’s confounding of nuclear and renewable energy technologies, a reference to its nuclear ambitions, the World Future Energy Summit or CCS research, would have been noteworthy additions for the establishment of an international energy reputation beyond hydrocarbons.

Several expert statements from the research interviews contrast with this analysis. The interviewees’ point of view is most aptly captured here:

[141] Arguably, most of these initiatives, such as Masdar, the WFES or IRENA were only in the start-up phase when the initial “brand portfolio” had been developed in 2006/07. However, given the efforts Abu Dhabi has taken to obtain a globally recognized position in that field, an updated strategy would be a warranted measure.

“Certainly, those real estate mega-projects give you more return on investment; Masdar doesn’t give you much; but there is a big plus in terms of country reputation!” (Interview no. 82 – R&D, UAE)

While this position was repeated by several insider stakeholders, it still needs to be conceded that this interpretation of branding policies it not reflected in Abu Dhabi’s own branding office.

Section conclusion

After the analysis of policy documents in the previous subsection, it was expected that the UAE or its individual emirates would perform below their potential when it comes to possible country branding through renewable energies. This is particularly the case for Abu Dhabi, which has by far the largest, earliest and – in spite of all caveats – most successful renewable energy initiative in the region. Given that the advertising campaign for Masdar and its various sub-organisations permanently makes use of classical branding language (“unique”; “the world’s first”; “innovative and ground-breaking” etc.) it should be noted that the existing branding potential of Abu Dhabi’s renewable energy initiatives has thus far underperformed. It appears that these initiatives have not yet reached the responsible branding offices and therefore is absent from the official “Brand of Abu Dhabi”.

5.4. Regime-level factors

5.4.1. Technological regime

5.4.1.1. Challenges for the power sector

To what extent are renewable energies employed to reduce pressure on the domestic conventional power plant park?

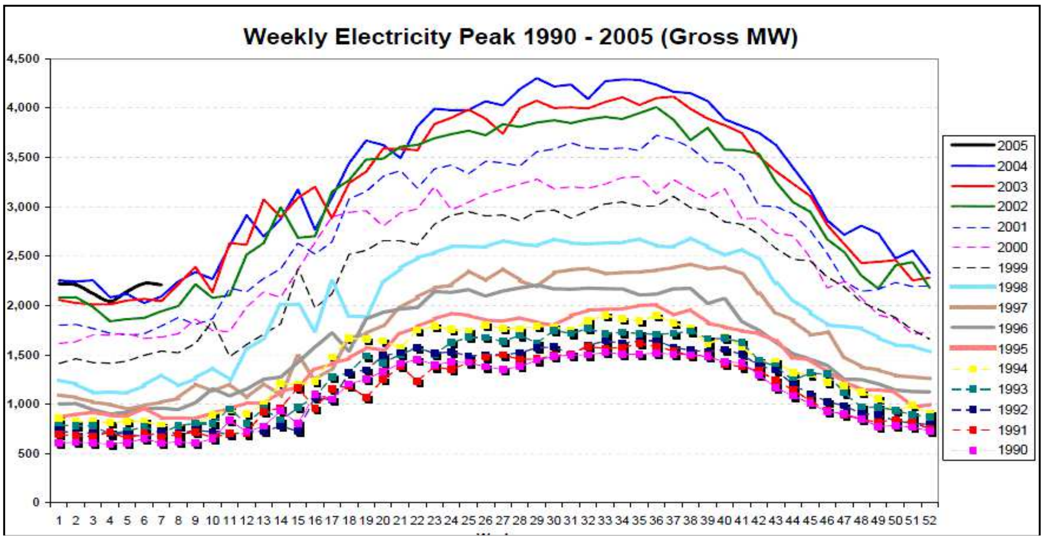
As discussed in the corresponding section of Part A, the spread of industries and other local economic development in all emirates is seriously hampered due to the bottlenecks in capacity extensions. While this is a particularly pertinent issue for the smaller and substantially less wealthy Northern Emirates, this is also partly the case for Dubai, Abu Dhabi and Sharjah. One interviewee describes how even high-profile projects such as Masdar were severely obstructed due to this more general economic situation:

"Originally, Masdar PV was designed to build three production lines: one in Germany (which was built) and another two as 'smart copies' of the first one in Abu Dhabi. We actually purchased the land and the two production lines for Abu Dhabi – but nothing was ever built, as only later, the management realized that there were severe problems with the power supply of those properties –we couldn't get power to these sites for at least two years. Now, these production lines are stored and pretty much useless." (Interview no. 75 – National and international power sector, Gulf States)[142]

However, as many interviewees confirmed, the use of renewable energies to promote local economic development in the Emirates receives only marginal attention. It is largely not actively considered by stakeholders, and if so, it is not regarded as sufficiently reliable.

This is surprising, as the national demand curve (Figure 35) reveals that renewables could play a role in mitigating the daily (and annual) peak demands through peak-load capping since the electricity peaks correspond to the production peaks of renewable energy installations.

Figure 35: Weekly electricity peak 1990-2005 in Abu Dhabi



Source: Miller, 2005, p. 11.

[142] See also *AMEInfo* (2011a) for the decision to suspend the Masdar PV plant in Abu Dhabi – the reason given in the article is not the lack of power supply, but the lack of local demand.

A notable exception can be observed in Ras al-Khaimah's efforts to further develop the solar pond technology, which aims to:

"experiment with low-cost-technologies to reduce the operating costs and particularly to make the system workable in normal economic situations outside oil-rich countries." (Interview no. 88, R&D, Gulf States)

Turning to a second aspect in relation to this subsection, the renewable electricity share in the UAE energy system is currently virtually zero, aside from the 10 MW PV test field within Masdar City, which is partially used to supply its own power demand. The Emirates have been cautious to give renewable energies too large a share in its official energy policy planning. Two of the smaller emirates, Ajman and Fujairah, have in the last years considered a stronger integration of renewable energy capacities on their territory. Ajman has considered a renewable energy strategy since 2010 (*Khaleej Times,* 2010) with a particular focus on waste to energy technology (Kakande, 2010). Apart from a top-level interest in clean electricity production for domestic and industry use, the renewable energies-related activities in Ajman might also have been triggered by the lobbying of Sheikh Abdul Aziz Bin Ali Al Nuaimi, the "Green Sheikh", a member of Ajman's ruling family, who is a pronounced supporter of renewable energies,[143] as was established by a research interview conducted for this thesis.

However, it remains to be seen how much of these proclamations will actually develop into tangible policies for that emirate. Similarly, Fujairah witnessed some development on the wind energy front in the early 2000s.

In 2002, it was announced that the Spanish company *Energia Hidroelectrica de Navarra* was selected from 45 other international companies to manage the establishment of a renewable energy project in Fujairah, including four wind farms (*gulfnews.com,* 2002) of 150-200 MW capacity each, which would have been a significant upgrade of Fujairah's energy system. This plan that was confirmed in a press statement in 2004, that also mentioned a "Fujairah Renewable Energy Centre (FREC)" (*UAE Interact,* 2004)

[143] See for instance *gulfnews.com* (n.y.) or *The Green Prophet* (2010).

which was to help assess the wind data gathered to identify a suitable site for the wind farms and to launch other renewable energy projects in the emirate. Its director Dr Fathy Hussain confidently announced:

"With full support from the Fujairah government, we established the Fujairah Renewable Energy Centre and started gearing up for the huge project" (*United Arab Emirates news agency (WAM),* 2004).

However, at the time of writing this thesis, not a single project has materialized in Fujairah, and none of the interviewees during the course of the study had ever heard of or cooperated with FREC.

Meanwhile, the larger emirates of Dubai and Sharjah have shown little tangible measures in renewable electricity production. As highlighted before, Abu Dhabi has taken a lead role in that field. Its government has committed itself to the target of 7% renewable generation capacity by 2020 (*The National,* 2009) which requires a renewable energy production capacity of approximately 1.5 GW. Currently, one 100 MW CSP power plant is under construction in Madinat Zayed, about 120km south of Abu Dhabi city (Shams 1; Arabic: "sun") which is scheduled to be finished by the end of 2012 (Masdar, Abu Dhabi Future Energy Company, 2010). In addition to that, a 100 MW PV project (Nour 1; Arabic "light") is under way, while other projects, such as a 100 MW wind farm and further PV and CSP power plants are being considered by the Abu Dhabi government (*AMEInfo,* 2011b). Furthermore, this emirate is also working on a smart grid concept, as well as on a solar rooftop programme that will be discussed in Section 5.4.4.

<u>Section conclusion</u>

The large potentials of renewable energy for local economic development are currently not realized, neither with regards to actual capacity extensions nor to public relations.

While all UAE emirates face substantial demand rise pressures, a predicament, which can be resolved by the extension of renewable energy capacities without further increasing the domestic demand for natural gas, only Abu Dhabi has resorted to using this tool. Whereas some of the smaller emirates had unsuccessfully attempted to develop renewable energy capacities, Ajman and Ras al-Khaimah might be more successful in that regard.

5.4.1.2. Renewable energy and the nuclear alternative

Is the nuclear option seen as a competitor in resources or as a mutually exclusive form of power production?

Recent nuclear energy developments have taken place in two forums: at the state and at GCC level. In 2007, IAEA conducted a feasibility study for the GCC already factoring in the benefits of a common electricity market via the GCC grid. The grid would permit the GCC to centralize nuclear power production by building several plants in one location. This would produce substantial economies of scale benefits as far as construction and maintenance are concerned, and also from a proliferation angle, this option might find a speedier acceptance in the international community. Inner-GCC rivalries about the leadership and the actual location of such a site, however, rendered the actual launch of the joint nuclear programme unlikely. Among this group of states, the UAE is likely to be the first nuclear power producer. The current UAE nuclear white paper has projected the year 2017 to be the first possible date for on-grid nuclear power in the country (Government of the United Arab Emirates, 2006). In accordance with a recommendation of the IAEA, the Emirates founded a Nuclear Energy Program Implementation Organization (NEPIO) and the Emirates Nuclear Energy Corporation (ENEC) with seed money of US$ 100m to get the nuclear industry off the ground.[144] In spite of American reservations about such a programme[145], the country went ahead and is now building four 1400 MW_e nuclear reactors with the Korean nuclear energy operator

[144] While the country was keen to abide by IAEA regulations in some regards, the international nuclear energy governance body recently criticized the UAE for not yet having released a sound nuclear waste strategy (Reuters, 2011b).

[145] “Given the U.A.E.’s past history as the major transshipment point for goods destined for Iran’s nuclear and missile programs, serious concerns remain about its eligibility for a nuclear cooperation agreement with the U.S. We still have questions about the effectiveness of its export control system, elements of which have yet to be fully implemented,” said Congresswoman Ileana Ros-Lehtinen, the Ranking Republican member of the House Foreign Affairs Committee.” Congressman Brad Sherman (2009)

KEPCO. The first US$ 3.9bn contract was signed in June 2010 (World Nuclear News, 2010), after which site clearing started immediately at the site of Braka, 300km away from Abu Dhabi, and about 75km from the Saudi border (*gulfnews.com,* 2010a); construction will officially start in late 2012.

As has already been established in Sections 5.3.1 and 5.3.4, the nuclear and renewable energy policy discourse in the UAE remarkably resemble each other and are often led under the common label “clean technology”. Most stakeholders have not voiced any concerns about this nor about the problem of a potential structural privilege of nuclear energy. Only one stakeholder expressed a different view:

*“Nuclear energy has come to the UAE top-down from the political elite; there has been no local involvement in that at all! Why do we need nuclear energy here? I am not totally against that, all I say is that I don’t like nuclear for the following reasons: The uranium resources are scarce – how is this supposed to be a sustainable form of energy if the fuel is so finite? Then, we have a security issue – this is like having live bombs in the country waiting for someone to blow up – and who can exclude the likelihood of a nuclear disaster? Thirdly, there is the waste issue. This waste remains highly toxic for thousands of years - what kind of place are we leaving to our children?” (*Interview no. 56 – public stakeholder, Gulf States)

This statement, however, remained the exception. Most other interviewees did not speak at length about this subject, making it difficult to discern citizens’ views on the topic. Thus, it is difficult to tell how many UAE citizens would agree with or indeed oppose this pointed opinion. According to a public opinion poll conducted by the UAE’s own nuclear energy corporation ENEC, 60% of the polled population of 750 interviewees based in the UAE were in favour of its construction; and 23% indifferent (*Khaleej Times,* 2011).[146]

Also the Fukushima nuclear accident in March 2011 has not altered the UAE government’s course on its way to nuclear electricity production. At the World Economic Forum, the UAE’s energy minister Mohammed Bin Dhaen Al Hamli underlined his country’s determination to pursue the path it had taken, albeit with an even stronger em-

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[146] What the report does not explicitly say is that consequently, up to 17% of the interviewees were against that project. More generally, given that this poll was launched and financed by a pro-nuclear energy agency and given limitations of freedom of expression in the UAE, particularly with regards to political sensitive issues like this, the poll results should be taken with a grain of salt.

phasis on safety issues. He said "Our strategy for nuclear power will not change because of the Fukushima incident…We have a lot of oil and gas, but we must renew and diversify, including into nuclear energy" (Aburawa, 2011). This position has been underlined by the formal power plant registration application submitted at the 55th General Assembly of the IAEA in Vienna. The UAE's permanent representative to the IAEA, Ambassador Alkaabi, reiterated Al Hamli's position by stating that "in light of this unfortunate event, the UAE places utmost emphasis on nuclear safety and security as we take stern and progressive steps towards realizing a peaceful nuclear energy programme" (White, 2011).

This follows from what has been discussed so far that the renewable and the nuclear energy coalition are less clearly separated from each other in the UAE than in other countries. Thus, high-level decision-makers of both groups must be regarded as in fact part of one larger group; Abu Dhabi's high-speed, new level of innovative leaders that attempts to develop the emirate at a quicker pace and at times into a different direction than the desires of the older generation (see Section 5.3.1 for the differentiation between these two groups within the UAE leadership). It can be expected that in the long run, the new leadership generation will fully assume control over the country. Within this elite, however, the mix-up of these two forms of energy carriers might lead to the undermining of the renewables proper agenda by an increasingly powerful nuclear energy interest group.

Section conclusion

It can be stated that the decision to introduce nuclear energy has not been subject to any free public debate, which is not surprising given the centralized, authoritarian and at times opaque decision-making structures of the UAE. Public opinion towards this initiative is thus difficult to gauge within a reasonable margin of error. This also applies to nuclear energy as a competitor for resources for renewable energy or whether resistance against these plans originated from the renewable energies scene. In general, however, system competition between these two options appears to be less of an issue than in many renewable energy research and business centres in Europe or the US.

However, it is difficult to discern, if this is due to the UAE interviewees' more flexible and less ideological views or due to concerns about publicly criticizing high-level government policy.

Additionally, as a political interest group solely and aggressively lobbying for renewable energies hardly exists in the UAE, it is questionable whether such a binary characterisation can be instructive. The danger in the mid-term future, however, is that the renewables component in the clean tech lobby of the upcoming ruling elite cannot sustain itself compared to the financial and (eventual) political influence of nuclear energy interest groups in the UAE.

5.4.2. User and market regime

5.4.2.1. Market conditions

Is there any system of renewable energy promotion in place?

Do stakeholders believe that the transfer of European renewable energy policy design models is a viable method for the spread of renewable electricity capacities in the region or would indigenous policy models work better?

Currently, there is no system of renewable energy promotion in place in any UAE Emirate apart from the limited efforts in Abu Dhabi. Indeed, stakeholders have frequently confirmed that the introduction of a general FIT system was imminent in the framework of a larger energy policy blueprint for the emirate. So far, however, this has not materialized.[147]

This has led several business interviewees at the World Future Energy summit to claim that:

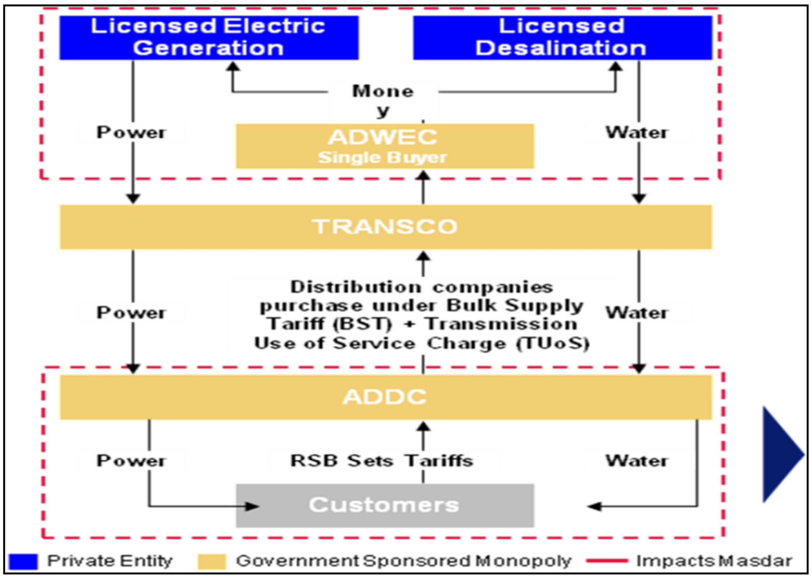
"Currently, there is no renewables market in the UAE. We see market opportunities in the region mainly outside the UAE, but we have still opted to establish our regional offices here hoping that in a few years from now, the market will come here. Clearly,

[147] No public statements explaining this severe delay has been issued. Interviewees either had no information on the reasons or were unwilling to disclose them, thereby spurring speculation. In light of the absence of attestable facts, however, it does not appear productive nor scientifically sound to continue this discussion.

the regulation is missing, that could create a platform and a security for business. When the regulation would be in place, the market would follow automatically. Now, we can't even calculate returns on investment for business!" (Interview no. 69 – National and international power sector, UAE)

Still, Masdar's planned power plants of Shams 1; Nour 1 and future plants will receive a premium from ADWEC, which, in spite of the liberalized market of power production, remains the single buyer for electricity in the country (see Figure 36 for details on the structure of Abu Dhabi's water and electricity sector).

Figure 36: Abu Dhabi's electricity and water sector structure



Source: www.rsb.gov.ae

However, these premiums are usually not disclosed and are, as the above figure shows, also not directly linked to (subsidized) customer prices for electricity, which are set by the Regulation and Supervision Bureau (RSB), Abu Dhabi's regulator.

A second initiative that might be regarded as a proto-system for a general FIT is Abu Dhabi's solar roof programme. This programme is currently in the start-up phase and is expected to reach up to 500 MW of installed PV capacity in Abu Dhabi within the next years. While the feed-in premium will have to be published as soon as the programme is officially launched, its height currently remains undisclosed.

Apart from the programmes mentioned, however, there is no openly accessible premium or other promotion instrument available in the UAE, be it on federal or on emirate-level. In principle, large-scale renewable electricity subsidies are available for all independent power producers (IPPs) in Abu Dhabi that have successfully won a bid for a renewable electricity project – a system, which would work in principle also for the SEWA, DEWA and FEWA should the government wish to install such a plant. However, since the power production markets in these emirates are not liberalized, this theoretical option does not exist. Currently, only Abu Dhabi's solar rooftop PV programme might actually open the renewables markets to a larger share of the general public.

Meanwhile, the barriers hindering the spread of renewable electricity in the UAE continue to be a major development barrier. Article 34 of the law 1998 law no. 2 concerning the regulation of the water and electricity sector[148] (Government of Abu Dhabi - Privatisation Committee Water and Electricity Sector, 1998) defines the "economic purchase rule" as follows:

"Art. 34 - General procurement duties - Economic purchase:

(1) In contracting for the purchase of - capacity for water desalination or capacity for electricity generation; new or additional production capacity; and fuel, the Abu Dhabi Water and Electricity Company shall purchase or otherwise acquire such capacity (or as the case may be, fuel) by adopting the economic purchase method and after consideration of its obligations in this Law."

Consequently, articles 91, 93 and 94 again confirm this rule for the areas of power procurement, transmission/dispatch and distribution/supply licences.

The extent to which Western regulatory concepts can be successfully transported to other world regions remains arguably the most complex issue in this subsection. While stakeholders' answers differed regarding details, a general line of argumentation emerged: the exact transfer of Western governance models cannot be an acceptable or successful way of enhancing renewable capacities in the UAE or other Gulf States. Particularly the instrument of the FIT (feed-in-tariff) was criticized and singled out as unsuitable for the region. As one interviewee put it:

[148] This law is a key legal document for Abu Dhabi's water and electricity sector as it founded ADWEA as a private company, replacing the former Water and Electricity Department (Abu Dhabi Water and Electricity Agency (ADWEA), 2010).

"It's a truism that not all concepts can work in all places and that you need to adapt that, everybody is aware of that. For instance, I have expressed myself rather critically towards feed-in-tariffs (FITs) for different world regions and got strongly criticized for that – but I think it is very obvious that FITs are not the optimal solution for every country; FITs won't save the world! Particularly here, in vertically integrated, wealthy Gulf countries: why do you want to complicate the situation with a FIT?" (Interview no. 54 – public stakeholder, Gulf States)

Moreover, as previously discussed, interviewees regarded the political concerns connected to a "loss of control" over the energy sector as further major impediments to any similarly structured system. Another interviewee highlighted a rather technical, albeit potentially key aspect in favour of the IPP model:

"I think the independent power producer (IPP) model is the one to follow rather than an FIT principle: the authorities can just replicate the template and bidding process for conventional power plants for those renewables plants. This is already happening in Oman, where the first solar-IPP (CSP plus PV) has been tendered." (Interview no. 68 – national and international power sector, Gulf States)

It needs to be stressed, however, that such a proposal would also essentially be a transfer of foreign governance concepts to a UAE context. While potentially very successful, a local governance component would still be elusive.

<u>Section conclusion</u>

On the federal level and on the level of most emirates, no renewable energy legislation (or initiative below the rank of a state law) has been launched. As highlighted before, the only tangible regulatory actions have been taken in Abu Dhabi. While many projects have been initiated with undisclosed renewables premiums in that emirate, the much-advertised solar rooftop PV programme could mark the beginning of an openly accessible FIT for renewable energies.

According to regulators and interviewed stakeholders within the UAE energy system, the economic purchase rule poses a strong challenge to justifying an extension of renewable energy capacities. If the levelized electricity costs are to be exclusively taken as cost reference figures without factoring in the larger environmental costs or further externalities of electricity production, then renewable electricity would currently remain substantially more expensive. This issue can only be resolved through a legal reform that makes clear exceptions for renewable electricity. In the meantime, the conflict between the least-cost-rule and the political will to enhance renewable energy capacities persists.

While the potential transfer of Western governance models to this world region will be discussed in much greater detail in Part C, the interviewees seemed sceptical about the effectiveness of the highly popular tool of FIT. Instead, interviewees maintained that a spread of renewable electricity production capacities in states like the UAE would only be successful with the current IPP model as it would best fit the current Gulf energy governance model: large-scale, top-down, capital-intensive, close to big industry, centralized, and with little or no need for public consultation. This, however, is in principle also not a locally developed model but a global form of energy market organisation. The combination of IPP and renewables promotion on a large scale that has been suggested by interviewees could indeed be a promising venture and could be operated close to a quota model on the utility side. Yet again, this would mean the application of Western governance models in the UAE and not a development of local policies.

5.4.2.2. The system of double subsidies

Are strategies developed to create a level playing field for all types of energy carriers by either removing subsidies for conventional power or by integrating renewable electricity into the existing subsidy schemes?

In the UAE, all forms of fossil fuel consumption are strongly subsidized. According to IEA data, 4.9% of the UAE's total GDP in 2009 went to fossil fuel and electricity subsidies. Taking a closer look at Table 17, it is most striking that by far the largest share of subsidies are used for the electricity and the gas sector (US$ 5.51 and 9.99bn respectively), a substantial 6% of GDP or roughly US$ 2,500 per capita.

Table 17: UAE's fossil fuel consumption subsidy rate as a proportion of the full cost of supply in 2008-2010

Subsidy by fuel (US$ bn.)			
Fuel	**2008**	**2009**	**2010**
Oil	1.98	0.96	2.65
Gas	8.42	5.78	9.99
Coal	0	0	0
Electricity	5,2	4.42	5.51
General values for 2010			
Average subsidy rate			67.8%
Subsidy in US$/person			2489.6
Total subsidy as share of GDP			6%

Source: International Energy Agency (IEA) web service (http://www.iea.org/subsidy/index.html; last accessed 10 July 2011).

Both figures are related to the system of double subsidies in the power sector. As one interviewee put it:

"These markets have two forms of subsidies. For one, the oil and gas that is supplied to the power plants from the national oil (and gas) companies is sold below world market prices, which is why the rise of domestic power demand is commercially unattractive for the local producers...The second subsidy is, of course, on the customers' side. Citizens hardly pay for their electricity use, expats a little bit more, but this is also insignificant." (Interview no. 68 – national and international power sector, Gulf States)

Power prices in the UAE are regulated on emirate level and thus differently set by all four of the UAE's power providers.[149] As a general rule, however, neither the height of the power subsidies nor the price per kWh the single buyers pay to the power plants are publicly disclosed. However, an interviewee of Abu Dhabi's RSB described the process of price building as follows:

"In general, the consumer prices are fixed by the government. The RSB's role is to recommend a certain market price to the IWPPs [Independent Water and Power Plants, the author] *and the government tops up the missing amount of money and we are there to guarantee transparency in this process"*

[149] The level of power prices in the UAE is bound to the economic performance of the individual emirate. While ADWEA provides the cheapest electricity, DEWA is more expensive, and electricity prices in Sharjah (SEWA) "*almost reach common market prices*" (*Interview no. 90 – R&D, Gulf States*).

Insiders confirmed that the usual production price for conventional power plants in the UAE amounts to 10-11 fils (approx. 0.02€) – only possible through the subsidized gas prices in the UAE.

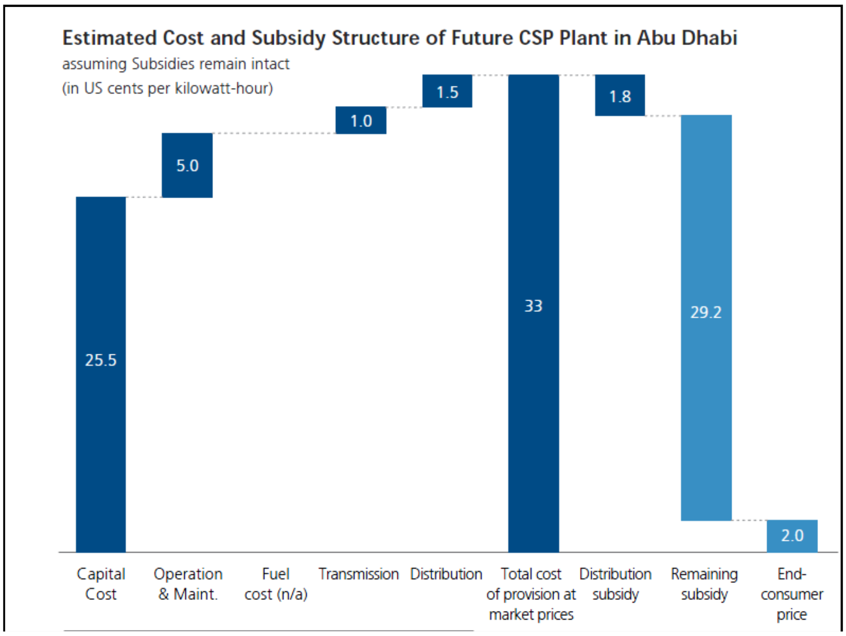
Strategies aimed at creating a level playing field by either integrating renewables into the common subsidies scheme, abandoning the power subsidies entirely, or introducing a new electricity pricing regime are only discussed to a very limited extent and have an almost scholarly character, as an instant change in Gulf energy pricing regimes is regarded as highly unlikely and highly undesirable by regime stakeholders. The reason for this is that supplying cheap power is part of the "ruling bargain" in resource-rich Arab states, as one interviewee confirmed:

"The rulers here must maintain their legitimacy in front of the people; supplying the people with cheap electricity is obviously a key element of that." (Interview no. 68 – national and international power sector, Gulf States)

While it is understood that the political elites do not wish to raise electricity prices, two options remain if a government wished to integrate renewable energy production into its system of subsidies.

In the first and most likely solution, it could simply integrate a certain percentage of renewable electricity into its national power system without raising consumer prices – a model that is similar to the UK quota model discussed in Subsection 3.3.2.1. As currently carried out by Abu Dhabi, governments can tender a renewable energy plant as an IWPP project. Following Krane's calculation (see Figure 37), an average CSP plant in the UAE would need to be supported with 29.2 cent per kWh.

Figure 37: Estimated cost and subsidy structure of future CSP plants in Abu Dhabi



Source: Krane, 2010b, p. 24.

If governments wish to integrate a higher renewables quota but are unwilling or unable to touch the subsidy regime, this will remain the only viable way for the foreseeable future. Effectively, however, it will put severe barriers on the spread of renewables, as governments will be careful to construct too many expensive renewables projects.

Second, a more hypothetical option has been put forward for the Kuwaiti context by a former acting general secretary of OPEC, Dr Adnan Shihab Eldin. This model could also work in the UAE. Instead of offering citizens subsidized electricity rates which do not allow for a liberalization of the electricity market nor offer incentives for end-consumers to save electricity, Dr Shihab Eldin suggested charging citizens full market prices while giving them the equivalent of the former subsidies granted to the power sector to the end consumers. This way, citizens would have ample incentives to economize their power consumption, as it would directly benefit their own financial situation. Moreover, this would create a level playing field, as the government could charge market prices for electricity, and it could offer different, probably slightly more expensive "green" tariffs (Interviews no. 58 - Public stakeholder, Gulf States, and no. 84 – R&D, Gulf States).

Section conclusion

While not all stakeholders were aware of the system of double subsidies as such, the fact that UAE electricity prices are strongly subsidized is common knowledge in the energy community of the UAE. Efforts by UAE energy stakeholders to create a level playing field for all kinds of energy carriers are currently not visible on a regulatory front. This will hamper a swift spread of renewables even if there are significant LEC price drops that match global market prices for conventional power. If regulatory transparency of power prices is not produced, the decision to spread renewables will remain in the hands of the ruling elite, as only they can issue tenders for renewable electricity projects. Other pricing models as suggested by Shihab Eldin are innovative and theoretically promising, but appear unlikely to be realized in the medium term.

5.4.3. Socio-cultural regime

5.4.3.1. Social acceptance of RETs, potential role of religion or environmental ethics

How widespread is the knowledge of renewable energies in the target countries? Does religion play a role in legitimizing this energy technology?

In stakeholders' views, general knowledge about renewable energies is relatively widespread in the UAE, not least because of the various awareness campaigns in educational settings.[150] To many, however, renewables do not seem to be sufficiently efficient to serve as the major source of electricity for their own country.

Secondly, although many citizens would not mind using solar water heaters or domestic PV installations, actual know-how about these installations and positive experiences cannot be found, as these technologies are largely not in use in the Gulf region. This is a direct consequence of the lack of government support schemes and the prohibition of independent power production in the UAE. Currently in the UAE, there are only two

[150] Although the late Sheikh Zayed, "the man who turned the desert green" (*Daily Times,* 2004), promoted environmental awareness in the Emirates, no direct link between his legacy and the modern renewable energy projects has been found.

opportunities allowing the general public to experience the reliability and potential of this technology; the much-advertised and relatively popular Masdar Initiative and its annual events such as the WFES and the luxury desert resorts or natural reserves. As one business interviewee confirmed, in the absence of a standard, on-grid domestic users' market, the only market for solar installations in the country is its high-end use in the desert:

"Our currently finished projects are mostly off-grid solar PV combined with water desalination and filtration. We built an artificial lake (1000 m^3 – the largest artificial lake in MENA) and many other projects for wildlife conservation far out in the desert. These projects are all relatively new, but around them, new biospheres are already developing and might even eventually lift the ground water level so much that a natural oasis develops in the very long term." (Interview no. 67 - National and international power sector, Gulf States)

Similarly, another interviewee argued:

"Absurdly, solar water heaters are luxury items in the UAE! They are not installed on poor men's houses but instead on luxury hotels and palaces." (Interview no. 70 - National and international power sector, Gulf States)

The second issue that should be raised here is the potential juncture between religion, environmental ethics and local advocacy for renewable energies in the UAE. Public references by political leaders to religious beliefs rarely occur in the UAE when it comes to sustainability issues. This is the case for both the Arabic and English version of policy documents that usually do not display strong religious argumentations. The various announcements on and with regards to the Masdar Initiative, or ADWEA's comprehensive 2009 sustainability report (Abu Dhabi Water and Electricity Agency (ADWEA), 2010) are cases in point. Instead, secular references to the concept of sustainability, climate change and a "common future in a clean environment" were frequently made. This supports the argument that the UAE government and its citizens prefer to stress research-based, secular arguments when it comes to supporting the broader issue of sustainability leaving religious references aside. The minor role of religion in this regard is also supported by the statement of one interviewee:

"Well this is not so easy here as Imams don't have their own sermons and everything they say is controlled by government…I mean, sure, this is important, but at the end of

the day, the imam talks in the mosque; what children need more urgently are role models in the household." (Interview no. 56 – public stakeholder, Gulf States)

Apart from confirming the UAE government's tight grip on local Imams this statement shows that UAE nationals also focus on educational role models and ethics-based environmental education in homes and schools when it comes to moral references to sustainability. This assessment needs to be taken into account in future research and policy design.

Section conclusion

Public knowledge about a certain potential of renewable energies undoubtedly exists in the UAE. However, due to the absence of a standard domestic market, the only systems that are actually deployed are luxury items that operate outside the realm of commercial logic. Consequently, positive anecdotal knowledge about this technology cannot be accumulated; hands-on learning effects on the ground thereby remain small.

Further, it can be stated that religion has no part in legitimizing national renewable energy policy in the UAE. Instead, actors promote the role of ethics-based approaches to sustainability and renewable energy policy as points of reference. This allows an environmental education that transcends religious boundaries and cross-references into the global narrative of environmental protection and the individual responsibility for the realisation of environmental policies on a local level.

5.4.3.2. Labour markets

Is the job creation potential actually employed by promoters of renewable electricity in the country?

As discussed in the corresponding section of Part A, the theoretical job potential for renewable energy technologies in the UAE is large, particularly in the long term perspective. For the present time, in the absence of a full-fledged domestic market, business operations and job opportunities in the UAE are reduced to a few dozen jobs in three types of operations:

First, there is the staff of the several branches of the Masdar Initiative in Abu Dhabi, which is mainly limited to managerial as well as R&D positions in the Masdar Institute of Science and Technology. Despite the limited amount of positions, Masdar remains the UAE's biggest employer in the renewables sector.

Second, there is a very limited market for those solar developers in the UAE developing the high-end desert products, off-grid PV guard house projects or other small off-grid projects that are implemented in the UAE, such as EnviTech, EnviroMena etc. With the exception of Mulk Holdings' PV mirror plant for the Indian market (Hashem, 2010), and the Fujairah-based company Microsol no other company produces RET equipment in the UAE.[151]

In addition to that, there are very few companies engaged in genuine R&D on the ground, such as the Ras al-Khaimah-based CSEM-UAE (*Centre Suisse d'Electronique et de Microtechnique* – UAE branch). This group of developers, however, only employs a few dozen employees with a renewable energy focus at best. As in the case of Masdar, the number of Emirati staff is low. As one developer stated:

Unfortunately, we have not yet hired any Emirati engineers; we have Indian, Iraqi and German ones. I think one reason for this is that the local higher education sector in this regard is still young, so potentially qualified employees might still be studying" (Interview no. 67 – National and international power sector, Gulf States)

Thus, job opportunities in the renewables sector, particularly for UAE citizens, remain rare and certainly below any measurable effect on the national labour market.

A third type of companies in the renewables sector do not have active operations in the UAE, but retain an office with representatives or even a sub-division of larger companies in one of the emirates in order to keep abreast of developments and to be able to quickly upgrade their presence in case the domestic governments would in fact initiate a renewable energy market. In both cases, staffing is very low and, again, rarely includes Emiratis.

[151] While journalistic sources estimate Microsol's total staff currently on 325, it has recently acquired the bankrupt German-American company Solon. Another production capacity extension in the UAE is scheduled for late 2012 (Montgomery, 2012).

At the present time, this under-representation of Emirati citizens in the (few) renewable energy-related jobs in the country will continue due to the few opportunities in the region where UAE citizens can in fact gain expertise in that field. However, this need not remain the case. If Masdar and other research centres are successfully established, a larger number of qualified UAE personnel will be on the labour market in the medium term.

This job creation potential, particularly for Emirati citizens, has so far not been included in the announcements of new renewable energy projects. Indeed, employee numbers are usually not even mentioned. As most construction workers in the Gulf are not Emirati nationals, the construction and maintenance of announced projects, such as Shams 1 or Nour 1, will have little short-term impact on the labour market for UAE citizens.

Section conclusion

Although there is a high theoretical job creation potential for renewable energies in the UAE, actual positions are scarce and no measurable labour-market effects for the entire country currently results from them. Additionally, the majority of the few positions that are available are, in line with common UAE HR policy, filled with non-Emirati citizens.

As a consequence of the current underperformance of the UAE renewable energy system, it might not be seen as surprising that the job creation of renewables is rarely highlighted by promoters of renewable electricity. One exception might be seen in the UAE's and individual emirates' commitments to build a sustainable, diversified economy, as discussed in Section 5.3.4. These terms, however, are broad, catch-all terms that could encompass national economic development in many possible directions. If these terms were to be regarded as tangible commitments to extending the renewable energy sector, this would mean incorrectly narrowing them down to one particular meaning.

5.4.4. Policy regime

5.4.4.1. Renewable energy targets and actual performance

Is there a (binding) strategic document, such as an energy roadmap/blueprint or at least a non-binding planning scheme? If so, how does this integrate renewable electricity?

Energy policy in the UAE is largely based on emirate-level decisions. As the UAE's public administrations tend to remain secretive about their plans, very few meaningful energy policy planning documents are made available on either the federal or the individual emirate level[152]. However, in Abu Dhabi, more technology-oriented power plant park extension plans have been released, the most important one being ADWEA's 5-year Strategic Plan of May 2008 (Abu Dhabi Transmission and Despatch Company (TRANSCO), 2007). In addition to the demand forecast in the UAE electricity sector by ADWEA (Abu Dhabi Water and Electricity Agency (ADWEA), 2008), these documents model the expected development in Abu Dhabi's and in the Northern emirates on a purely technical level. Questions of energy policy are not discussed in these documents. Also the UAE's nuclear energy policy white paper (Government of the United Arab Emirates, 2006) is no substitute for a nation-wide energy strategy. What is, however, relevant to renewable energy is that this white paper mentions that 6-7% of renewables could (at most) be in the UAE power mix by 2020. This appears to be based on the same calculations as Abu Dhabi's goals, only projected on to the entire UAE. Nonetheless, this is not referenced in any other document.

In the absence of a comprehensive planning document, Abu Dhabi has made several announcements that can be interpreted as parts of a new strategy that includes the promotion of renewable energies, such as the 7% renewable energy goal (*The National,* 2009), the announcement to launch a solar rooftop programme, and the introduc-

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[152] In early 2012, Dubai announced the launch of an "Integrated Energy Strategy 2030", coupled with plans for a large-scale renewable energy power plant park (1 GW by 2020). Dubai also announced that only 1% of its energy should be based on renewables by 2020, and a 5% goal should be reached by 2030 (Bitar*,* 2012b, *gulfnews.com,* 2012a; *AMEInfo,* 2012). While the goals do not appear to be extremely ambitious judged by international standards, Dubai's plan has not been made publicly available. The announcement's credibility is therefore in question (*Interview no. 40 – R&D, Europe*).

tion of a smart metering system (Stanton, 2010b, 2010a) as a first step into an innovative demand side management system in 2011.

Thus, while elements of a comprehensive strategy have been released, the document as a whole is still missing in spite of its public announcement in early 2009.[153] This is also the case for details about funding schemes, tax deductions, and the height of premiums for renewable electricity or other tangible data that are vital for any substantial business plan.

Also, as Abu Dhabi's 7% target is the only publicly announced renewables target, only this one can be scrutinized. In the press (*The National,* 2011) and in research interviews, stakeholders from various sectors confirm that the 7% was not a political number, but instead part of a thoroughly thought-through energy strategy that is yet to be revealed and certainly within Abu Dhabi's reach. One high-level stakeholder stated:

"This 7% by 2020 goal is certainly not a random number, but a developed target as a result from checking what is realistic in terms of power generation and grid system in Abu Dhabi. We don't know yet if we can exceed the target, but I think it is likely we will stay under 10% of generation capacity for renewables by then." (Interview no. 51 – public stakeholder, Gulf States)

Another stakeholder explained with which components this goal is to be reached:

"7% will approximately mean 1.5GW of renewable power. The rooftop programme alone will supply one third of it; the rest will go forward either through IPPs or through an extension of the rooftop programme, which generally should have the 500MW installed by 2020 max." (Interview no. 65 – Private and public investor, Gulf States)

Asked, how realistic these numbers are, a third interviewee expressed confidently:

"If Germany can install 1.5GW of PV in one summer month alone I am pretty sure the UAE can do this in 10 years!" (Interview no. 64 – Private and public investor, UAE)

However, while the majority of stakeholder subscribed to a by and large positive analysis that Abu Dhabi can achieve its 7% goal, there are also some critical voices, such as this energy executive featured in a professional journal:

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[153] Parallel to the announcement of the 7% goal, the following information was published in January 2009: "The UAE's goal of boosting its renewable energy capacity is an important part of the Government's comprehensive energy policy, which is expected to be published within the next few months." (*The National,* 2009).

"The UAE has been largely successful in cultivating a reputation as one of Asia's hot-beds of solar-energy activity, thanks principally to the Masdar City project under construction outside the capital city of Abu Dhabi. But behind the scenes the UAE is struggling to reconcile its outsized solar ambitions with the relatively poor local conditions for both photovoltaics (PV) and concentrating solar power (CSP), claims Khurram Nawab, managing director of Mulk Renewable Energy. "I think there are some big discrepancies between what people were thinking a few years ago and what we see happening today, because the solar radiation is so poor in the area…If you build a solar plant near Abu Dhabi or Dubai or Sharjah, it needs to be twice the size of [similar capacity] plants elsewhere in the Middle East or India." (Stromsta, 2010)

Moreover, it is debatable how binding this target actually is: certainly, the 7% target has been announced in the most vocal fashion during the 2009 WFES and was approved by Sheikh Khalifa bin Zayed and Sheikh Mohamed bin Zayed, the ruler and the crown prince of Abu Dhabi respectively (*The National,* 2009). Technically, however, this target remains a political aspiration and is not formally part of any energy law or other legally binding commitment. Given Abu Dhabi's commitments with Masdar, as well as the UAE's commitment to IRENA as a host nation, and the public character of this statement, it is not likely that the target will be abandoned as this would be a great loss of credibility for the ruling family and the country, one which Abu Dhabi's government will aim to avoid.

Another option to dilute the previously proclaimed target later in time would be a tacit readjustment of these goals, or an extension of the deadline. While there have been significant and poorly communicated readjustments of the Masdar City project (see Subchapter 5.7 for further details), nothing similar has been communicated about Abu Dhabi's renewable energy target. Arguably, the closing date for this target is still far ahead and several CSP and PV plant projects are works in progress, so there is currently no need to readjust anything. Again, as the accompanying comprehensive policy is still missing, details on funding or other financial support schemes for that industry, where cuts could be expected, cannot be assessed.

<u>Section conclusion</u>

While the publication of an Abu Dhabi energy policy has been "imminent" for several years now, nothing has been published yet, which exceeds energy systems planning, or top-level announcements such as the 7% goal or the similarly "imminent" launch of an emirate-wide solar rooftop programme. Most stakeholders interviewed were of the opinion that the 7% goal was both realistic and attainable. While opinions about the binding character of these announcements differ, their public character and the further commitments of Abu Dhabi to renewable energies, such as the hosting of IRENA make the abandonment of this target an unlikely scenario.

5.4.4.2. Regional infrastructure and electricity governance bodies

Do the regional electricity governance bodies promote political or infrastructure projects that enhance the role of renewable electricity in the target country? Is external demand a pull factor in that respect?

In the GCC, the most relevant common electricity infrastructure project is the GCC grid. As already described in Subsection 5.3.1.2, this grid is regarded by stakeholders as a supply backbone. A common electricity market is not envisaged in the mid-term future. As Miller claims, on top of technical questions, mostly issues around spare capacity and power price subsidies prevent a closer cooperation.[154] The GCC grid has never been designed as an initiative to promote renewable power in the Gulf, in thus far, the success or failure of this initiative might be seen as irrelevant to the spread of renewables in the UAE. However, in a more refined strategy, a working GCC connection could be key to the spread of renewable energies in the UAE, as the intermittent form of renewables-based power generation necessitates a much larger power pool and reserve capacity as a purely conventional power plant park.

Above that, a foreign demand for renewable electricity does not exist from a UAE perspective as there is no country in the vicinity of the UAE that would be interested to purchase renewable electricity for two reasons. First, unlike the case of Europe and North Africa, the UAE does not neighbour any country with a large domestic renewa-

[154] Since there exists no market-based power price in the GCC, any power sharing agreement would be a political decision at the current moment, as it is unclear which power price could or should be taken if electricity was to be sold to a third country. It is not in the economic interest of the GCC countries to sell power to other states at preferential rates, thus cross-subsidizing the power sector of a third country by its domestic power charges or by lower domestic unit fuel costs (Miller, 2005).

bles market that has a lesser resource potential than itself and that is willing to pay for large-scale imports of renewable electricity from third countries. Second, the grid infrastructure in the greater Gulf region is not well developed. Thus, even if there was to be an interest outside the GCC, for instance by Iran, Iraq, Pakistan or India, this demand could not be met in the medium term.

Section conclusion

While the flagship project of regional energy governance bodies in the Gulf, the GCC grid, does not promote the spread of renewables per se, its larger power pool and substantially enhanced reserve capacities could have a positive impact on the UAE's domestic renewable electricity landscape. This, however, could only work if the GCC grid would develop into a truly common inner-GCC power market, which seems unlikely for the mid-term future.

As neither foreign demand nor the necessary electricity export infrastructure to hypothetical non-GCC buyers of UAE green electricity exists, the question whether external demand interacts with domestic renewable energy policy is irrelevant in the current situation in the UAE.

5.5. Niche-level developments

5.5.1. Science regime: R&D and industry structures, technology transfer strategies

Is there an attempt to create a domestic knowledge hub for RETs and is there an industry structure that supports the spread of technologies into mainstream society?

Only one project in the UAE has the potential of developing into a local technology hub for renewable energy technologies – the Masdar complex.[155] Stakeholders with key

[155] This project will be discussed in detail in Subchapter 5.6.

roles in this initiatives confirmed that one of its key goals has always been the establishment of a technology cluster in the UAE. A senior Mubadala official stated:

"It was planned by the Abu Dhabi government to create a technology cluster with Masdar." (Interview no. 62 – Private and public investors, Gulf States).

This notion is confirmed by a key property developer who was instrumental in conceiving the Masdar project in the early 2000s:

"I was responsible in the start-up phase. We wanted to develop a meta-strategy for renewables in the region, not just an individual property project. There were elements of low-carbon policies in the air at that time, for instance the Dubai LEED initiative, but there was nothing comprehensive here. Our real goal was to build up a whole technology cluster with long-term technology transfer strategies.

When we got the ok by Mubadala, we went on a world-wide fact-finding mission to Japan, to the EIA, to companies and to universities to learn about the different elements to build up such a technology cluster. We were very much inspired by Dongtan City in China – unfortunately, this city didn't get off the ground eventually." (Interview no. 66 – private and public investor, Gulf States)[156]

Apart from Masdar, smaller knowledge hubs for renewables-related R&D are the National Energy and Water Research Centre (Abu Dhabi), as well as individual researchers at existing universities, such as the Petroleum Institute of Abu Dhabi.

Housed by ADWEA, the former institution has a strongly technical focus. While the research centre itself is several decades old, its renewable energy department has just been opened two years ago, according to its research team leader (*Interview no. 89 – R&D, Gulf States*). The institute is limited to in-house R&D on PV, and does not take in students. Thus, its external outreach is very limited; major technology innovations by this institute alone cannot be expected. The Petroleum Institute of Abu Dhabi has its focus on the oil and gas industry. However, several individual researchers also offer the students courses in renewable energy technologies. According to the professors, these are in high demand (*Interview no. 91 – R&D, Gulf States*). Both institutes, how-

[156] Dongtan, Masdar's conceptual guideline, was commissioned by the Chinese government in 2005. It was designed to be a carbon-free eco city approximately 9 miles from downtown Shanghai housing 25000 residents by the time of the 2010 Shanghai World Expo (*sustainable cities,* 2009; *City Innovations Review,* 2008). In 2010, however, the project was put on hold and has not been taken up since (*Treehugger,* 2010).

ever, are by no means comparable to the size and comprehensiveness of the Masdar Initiative with regards to renewable energies.

One key determinant of success for this effort is the existence of a local industry structure to which a technology hub such as Masdar can relate to, from which it can draw a trained work force and with which it can share market expertise. Currently, this is a major issue for Abu Dhabi and the UAE RET developments. As analysed in Subsection 5.4.3.2, in the absence of a domestic market there is only a tiny workforce that is trained in the renewables sector. Also there are hardly any companies employing a sizeable amount of people in the UAE. Therefore, as long as the basic market structures in the UAE and in the GCC region itself are absent, any technology hub will face great difficulties in translating the expertise and know-how developed by it into any domestic economic advantage.[157]

In the absence of a strong domestic industry, a further area of cooperation emerges – research cooperation between Masdar and the various established renewable energy researchers in the country. Such an institutionalized cooperation would be an obvious way to create common domestic research clusters, facilitate research exchange and harmonize research agendas to create a maximum of domestic output. Interviews, however, have elicited that domestic research cooperation remains poor. Researchers in the Petroleum Institute have voiced strong criticism on the three aspects of Gulf research networks (1), their view on Masdar's domestic policies (2), and Masdar's technology transfer strategy (3):

"There are no semi- or fully formalized research networks in that area. We shouldn't forget that there are only very poor research networks among Gulf researchers in general, this isn't connected solely to RET. This unhealthy, negative competition is a regional characteristic of research!

Regarding Masdar: yes, of course, everyone knows Masdar, but people actually only have very little knowledge of what else is going on in the country. Masdar is attempting to monopolize all R&D and international renewable energy cooperation…

And regarding the MIST: well, how can you establish a serious knowledge transfer for the region if you only hire international faculty who will leave again after a short while.

[157] See also Section 5.7.4.

We also don't regard them very highly in any technical dimension. You need to produce a stable and steady research environment, where people want to stay!" (R&D, Gulf States)

As discussed in the corresponding section in Part A, the policy of strategic acquisitions in the renewables industry have the potential to develop into a success model for the UAE (see also Section 5.3.4). Besides the active mergers and acquisitions of UAE-based private companies it is particularly the financial backing of the country's SWFs that secures a long-term growth strategy in that field. Yet, as presented, while technology ownership in the form of patents and company shares abroad is an important asset for a country that has traditionally scored poorly in S&T indicators the question remains in how far the country will be able to translate this potential into a domestic renewable energy industry that, as has been established, hardly exits.

In recent years, the Masdar Initiative has been able to launch partnerships with many major companies in the global power industry. However, the purchase of a company does not replace an innovation management strategy that transports the knowledge acquired abroad back to the UAE and that could be an innovation incubator for the domestic renewables industry. While Masdar claims to work as a technology cluster, such an innovation management strategy is yet to be developed. A current example is the world's first molten salt CSP plant that is currently being built by a joint venture between Masdar and the Spanish company SENER (*The National,* 2011). While this can be regarded as a future technology in the renewables industry; it remains unclear how the knowledge produced there could be transferred to the UAE.

As several interviewees confirmed, in the long run, the research produced by the Masdar Institute of Science and Technology (MIST) will be used for other branches of Masdar, such as Masdar Power, as well as to potentially employ MIST graduates at Masdar. So far, however, these concepts are mostly limited to future plans.[158]

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[158] This concept is also championed by Saudi Arabia's King Abdullah University of Science and Technology (KAUST), which is, among other goals, mandated to produce skilled staff for the Saudi Aramco Group (*Interview no. 40 – R&D, Europe*).

In addition to that, external interviewees also criticized Masdar's technology transfer strategy:

"How could they talk about technology transfer and then open a PV plant in Germany and axe the one they wanted to build here? –This is exactly the opposite of what should be done. We in the UAE have a lot of excellent graduates; but again, it's a mentality thing. People believe products are better and more valuable if they have been fabricated in the West. From the technical point of view, we don't have any doubt that you could establish a RE industry in the UAE – but not or at least not only through Masdar!" (Interview no. 91 – R&D, Gulf States)

Another interviewee painted a broader, but equally critical picture of the domestic technology transfer policies:

"In the Gulf, they don't start small-scale, but huge – with megaprojects! This is a big mistake; because: where is the added value for the country; the UAE in our case? Almost non-existent!" (Interview no. 55 – public stakeholder, Gulf States)

A third issue is the potential conflict of interest, which has drawn much of the criticism levelled at Masdar. As will be shown in Subchapter 5.7, Masdar's nature is hybrid. While assuming the role of national agencies without own commercial interests it is at the same time a profit-oriented company with its own business interests. Thus, if Masdar was to purchase or develop a technology innovation that it could translate into a domestic market advantage, its agenda as a profit-maximizing entity would be to use this to its own advantage, and not to develop a diversified industry structure in the UAE or Abu Dhabi. However, at the present time, there have been no known attempts to resolve this dilemma.

<u>Section conclusion</u>

The example of Masdar proves that Abu Dhabi is attempting to create a RET hub in the UAE. Other existing research centres are either small in size or have a different scope thereby not qualifying as a mainly RET-focused effort. Subchapter 5.7 will present a more in-depth analysis of the Masdar project which will also attempt a judgement on the question as to whether the Masdar project can so far be assessed as successful.

While Abu Dhabi's Masdar initiative is globally known, the absence of local industry structures that could feedback and entrench the innovations of this initiative on the ground means success is not a given outcome. In addition, the alternative level of R&D cooperation, which should suggest itself, is riddled with inter-institutional competition and Masdar's tendency to monopolize matters.

In conclusion, the UAE is not yet at a point where a robust domestic innovation system has been successfully established. Its creation is one of the goals of the Masdar Initiative, which, in combination with its strategic acquisition policy, could yield success in the mid-term future. However, as the vocal criticism of Masdar's actual policy decision shows, it is not at all certain whether Masdar can in fact assume such a role, not least because it would necessarily be a partial actor due to its own commercial interests, and not a neutral UAE business agency.

5.5.2. Technological developments

What is the interviewees' opinion on technology choices and on the chance of industry-use of RETs as entry points for further RETs in resource-rich Arab states?

The large majority of interviewees were of the opinion that the key technology options for the UAE are the different forms of solar energy production, particularly the CSP technologies. While this was the prevalent notion among Masdar employees, other energy stakeholders had a more differentiated view and rather favoured PV. In line with the Indian company Mulk, they highlighted that due to the diffuse solar radiation in the UAE, CSP plants need a much larger catchment area (mirror fields) than elsewhere to produce the same amount of power and would thus be less preferable in this context (*Recharge - The global source for renewable energy news,* 2010). This question, however, will be answered by resource availability maps of the country.

With regards to industry use of RETs as an entry point for renewables in resource-rich states a key point of discussion was enhanced oil recovery (EOR). Many national oil companies use their own natural gas for EOR; a technology that exacerbates the gas shortages experienced by states like Abu Dhabi (*Interview no. 85 – R&D, Gulf States*).

Thus, a CSP-steam replacement is of commercial interest to the oil majors and a test project is under way in Oman (*Interview no. 91 – R&D, Gulf States*); other countries with heavy oil fields (where steam-injected EOR might yield good results) are Kuwait and Saudi Arabia. In the UAE, however, the character of the main oil fields makes the use of this method impossible (*Interview no. 90 – R&D, Gulf States*). Instead of steam, the UAE oil fields might use carbon dioxide as a replacement for natural gas, one reason why both the Masdar Institute and Masdar Carbon are working on carbon capture and storage (CCS) projects (*Interview no. 78 – national and international power sector* and *Interview no. 87 – R&D*, both *Gulf States*).

Section conclusion

Industry use of RETs will not develop into a large renewables market in the UAE any time soon, in spite of the existing potentials in other countries. Thus, only the standard electricity sector is expected to yield a strong growth in this area.

5.6. Key findings in the analysis of the UAE energy system

The last three sections have analysed various aspects of the UAE energy system and its renewable energy policy in line with the 18 subsidiary research questions developed in Chapter 3. While the section conclusions exhaustively addressed the respective research questions, the outcomes of the analysis follow:

It has been demonstrated that the UAE's renewable energy efforts are largely limited to the Emirate of Abu Dhabi, and particularly to the Masdar Initiative. While the institutional and legislatory framework remains weak, the most significant policy driver behind the UAE's renewable energy policy appears to be the general attempt at national economic diversification and the quest for new forms of power generation for the Emirates, including nuclear energy. While still incomplete in several major ways, the most striking expression of the UAE's (particularly, Abu Dhabi's) political will to foster the growth of RETs are the already published elements of a comprehensive renewable energy strategy of Abu Dhabi, such as the 7% goal for 2020.

It has become apparent that the main political sponsor of these developments is Abu Dhabi's Crown Prince Mohamed bin Zayed, as well as his very senior aide Sultan al-Jaber and his investment vehicles around Mubadala. While this empirically-grounded observation can be stated, giving a more concise analysis of intra-Emirati high-level decision-marking structures remains elusive as the accumulation of decision-making power in a few members of the ruling elite, their inaccessibility and the silence around them in media and research publications make a precise tracking of how decisions are taken, impossible. Instead, unspecific references by the interviewees to high-level decision makers abound without them being able to give more than anecdotal data in the form of "the final decisions will be taken soon"; "someone very high up the hierarchy decides this" etc.

The fact that the UAE remains an absolute monarchy; a "globalizing" one, to use Henry/Springborg's terms, but nonetheless a monarchy needs to be kept in mind. Thus, the crystallization of decision-making power on the very top combined with a relative powerlessness on all lower levels needs to be taken into account. Additionally, this means that the idea of tracing decision-making structures and agency in a way that researchers can expect from open, transparent democracies is by and large mistaken.

Apart from these problems that are results of the UAE political system, further key barriers to the spread of renewables are largely due to the structure of the power sector: the on-going system of power subsidies and the absence of a level playing field for new forms of power production make any progress in this field dependent on extra-commercial logic of government subsidies and essentially keeps the development bound to top-level political decisions. The unwillingness of government to open up the power sector in that field is reflected in the lack of a binding, long-term renewable energy strategy that specifies renewables premiums and gives investors a clear guideline for investments and profits. The combination of a poor performance in terms of national innovation systems and the small trained work force for that sector outside of Masdar has meant that renewables – beside glitzy advertisements and summits, have so far little substance on the ground.

While the most significant obstacles are arguably the lack of a legal framework and the strong power subsidies, the research has revealed several areas of untapped potential for mobilization or actual developments. These areas often entail 'soft issues', such as climate change, culture and religion, and country branding, but also the potential role of the GCC grid for the spread of renewables – a function of the unsolved subsidies issues, remains unexploited.

On the analytical level, four subjects can be identified:

First, with regards to the interaction of the three layers of the MLP, it has become evident that both the landscape and the niche levels play a subordinate role in the UAE. It appears that most power in the UAE energy system lies with the entrenched regime actors, particularly in the political and in the business sphere. The areas of culture, R&D, and civil society organisations only play a marginal role. As a consequence of this focus on state institutions with poor legitimacy and opaque, top-level decision-making structures, niche-level innovation faces major barriers.

Second, in terms of the UAE political system, it has become apparent that the federal level is largely inactive in that regard, which is also true for most individual emirates apart from Abu Dhabi. While in principle, a lead role of this largest, most populous, wealthiest and most powerful emirate is expected, the almost total lack of similar initiatives in the other emirates is indeed perplexing.

Third, within Abu Dhabi, the overwhelming majority of projects are channelled through the various branches of the Masdar Initiative. While the launch of this initiative has certainly played a large role in promoting renewables in the country and beyond, Masdar alone is unlikely to succeed. It cannot take over government agency functions in parallel to common business objectives and is likely to fail in the continuing absence of a grown renewable industry and expertise around it.

Fourth, in terms of governance concepts, a critical stance towards key tenets of western renewable energy governance theory, such as decentralization, a liberalized power market, and the instrument of feed-in-tariffs has been voiced by stakeholders in the country, which poses a challenge to policy design, as will be discussed further in Subchapter 7.1.

In conclusion, the MLP analysis of the UAE energy system has shown that in spite of various innovative elements to promote renewable energies in the Emirate of Abu Dhabi, this emirate, but more so the entire country does not yet have a comprehensive renewable energy strategy. While, as demonstrated, key aspects are still missing, it is likely that the country's efforts around the Masdar Initiative will be complemented by more wide-ranging efforts on emirate- or on the federal level. This top-down approach will arguably also be the UAE's only chance for a real renewable energy innovation as its policy structures pose strong barriers to all forms of bottom-up innovation. Conceptually, a mere application of western renewable energy (industry) promotion instruments to the UAE appears premature and would yield only few chances of success.

5.7. Case study in the case study: Abu Dhabi's Masdar Initiative

While the in-depth analysis structured by the MLP has shed light on many individual aspects of the UAE's energy system and its renewable energy policies, one aspect developed into a leitmotif of the discussions: the potentially pivotal role of the Masdar Initiative for the UAE's (or, more precisely, Abu Dhabi's) renewable energy efforts. While many UAE outsiders and Masdar representatives have argued that in fact, Masdar embodies the renewable energy policy of Abu Dhabi, the last pages have shown that this claim must be qualified, as many other policy fields, determinants and individual actors are equally relevant. Nonetheless, the Masdar initiative is of key relevance for the renewables agenda in this country, thereby warranting a full section in this case study. It is also highly instrumental to assess whether Masdar can be regarded as a model for successful niche-based renewable energy innovation or whether the UAE energy policy system remains strongly dominated by top-down approaches with only little chances for alternative development models.

This section is structured in four parts. Section 5.7.1 will introduce the planning phase prior to the founding of the project. Section 5.7.2 will present the structure of the original set-up, a phase that can arguably be called the "Masdar I phase". While the third section (5.7.3) will discuss developments since the latest downsizing of the project in 2010 (Masdar II), the final section (5.7.4) will discuss the conditions of success required by this project for a long-term success (Masdar III).

5.7.1. Background and the pre-Masdar planning phase

The conceptual guideline for the Masdar Initiative was developed by a Dubai property development company.[159] As previously highlighted, their goal was to develop a comprehensive renewable energy strategy for Abu Dhabi. A key interviewee reported the following about the first phase of the project:

"Masdar City began in our office in 2004/05. At this time, Sultan al-Jaber was an assistant business manager here. When we conceived the project we called it 'Abu Dhabi Energy Vision'. The name 'Masdar' came up later after the project was accepted in Abu Dhabi; it was chosen by Sheikh Mohamed bin Zayed." (Interview no. 66 – private and public investor, Gulf States)

The proposal is said to have found favour with the Abu Dhabi government for three reasons. First, conscious of its high carbon emissions, the Abu Dhabi leadership felt a new project was necessary to contribute to the solution of this dilemma. Second, this project suited the overall strategy of national economic diversification developed at the time. Third, the UAE's unprecedented economic boom, particularly in the real estate sector also served as a factor. The interviewee continues:

"Then, Mubadala agreed to give us the land of the US$ 22bn real estate plan (today worth maybe 15bn); a US$ 100m seed money for the first clean tech fund and the government paid 20% of the money for the properties the rest was supposed to come from private sources. We got the go-ahead in April 2006, when we also had a big launch of the project."

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[159] Much of the account of this subsection is based on the interview with the CEO of this company and former head of Masdar City. Unfortunately, other similarly knowledgeable and open sources hardly existed. Thus, a potential bias from this main source cannot be excluded, but due to the high informational value of the source it has been decided to take this information into account.

As has already been discussed in Section 5.5.1, the conceptual guideline for Masdar was closely modelled on the idea of a carbon-free eco-city, such as the Chinese Dongtan eco city (Pentland, 2011).[160] However, apart from being a costly country branding object, the planners had intended a much more ambitious role for Masdar:

"Our idea was to empower the people of Abu Dhabi in renewable energy technologies and to create future leaders in that area. The whole concept was always centred around R&D and human capital. Our plan was to start this innovation project with the university as a core, and to do the residential, commercial, the whole real estate section later. Many people asked me why not start with the real estate plans – but this would have defeated the purpose of the entire project!" (Interview no. 66 – private and public investor, Gulf States)

Innovative property developers were therefore able to sell their concept of an Abu Dhabi energy vision to the top-level leadership, at a moment when the new leadership was looking for projects that would be both noticed on the global scale as well as actually benefit the domestic industry. This combination of landscape- and regime-level formation formed the ideational core of Masdar City as a government-steered, niche-based innovation project. Meanwhile, the size of the project was due to the simultaneous exceptional real estate boom and the mutual competition for superlatives between Dubai and Abu Dhabi. However, in spite of many other schemes launched in this period, Masdar actually possessed a meaningful core strategy.

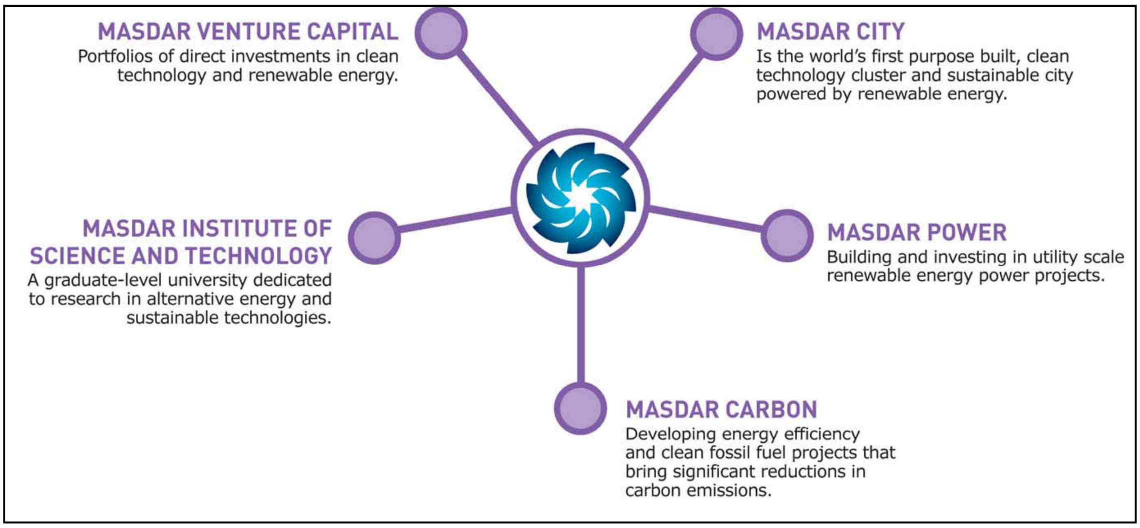
5.7.2. The set-up phase (Masdar I)[161]

After its initial launch in 2006, tangible figures and data were formally disclosed at the World Future Energy Summit in Abu Dhabi in January 2008, and construction began in February of the same year at a site close to Abu Dhabi's international airport. Under

[160] See also Footnote 156.
[161] The following presentation of the main business areas of Masdar is based on Masdar PR sources and several stakeholder interviews with Masdar staff members. The subsection has been written with the purpose of outlining the original plans of this initiative as publicly presented. On the whole, rather than offer an uncritical presentation of the Initiative, this subchapter aims to provide a critical analysis of Masdar's achievements, as well as outline the conditions for a long-term success of this project.

the roof of the Abu Dhabi Future Energy Company (ADFEC), the Masdar Initiative houses the following five elements (see also Figure 38)[162]:

Figure 38: Set-up of the Masdar Initiative



Source: Wouters, 2010, p. 2.

- Masdar City

The city is the core element of the Initiative. Stretching on a 6.5 square kilometre development area, Masdar aims to construct a zero-carbon city thus extending the limits of carbon-neutral urban planning. This car-free city is intended to house up to 90.000 inhabitants. In addition to domestic accommodation and office space for companies from the energy industry, IRENA and the MIST (see below) are to be based here. Originally, MIST had an in-built system of data collection in order to facilitate the construction of further buildings in Masdar City. It is uncertain whether this system is currently in operation.[163]

[162] In addition to the five strategic pillars the Initiative contains several further elements such as the World Future Energy Summit, and, in its context, the Zayed Future Energy Prize.
[163] "*Over 30.000 data points are already installed in the MIST; it has all sorts of usages, such as offices, domestic, grocery, gym, labs, etc. – in all rooms there is data collected on consumption patterns, use of light, AC, fridge, etc. – all this was supposed to feed special programs that would be analysed by a special IT team. But now the entire IT crew has been changed, so I don't know what is happening with all the data now – if this is being used at all at the moment*." (Interview no. 66 – private and public investor, Gulf States)

- Masdar Power

Masdar Power is Masdar's power branch with investments both in the UAE and overseas.[164] It is also one of the main vehicles for technology transfer and one of the major employers in the renewables sector in the UAE.

- Masdar Carbon

Masdar Carbon is working on R&D in the hydrogen fuel sector, and is involved in carbon trading based on the CDM mechanism. In addition to that, it promotes CCS and industry use of CCS through enhanced oil recovery (EOR).

- the Masdar Institute of Science and Technology (MIST) [165]

Partnering from the outset with Boston's Massachusetts Institute of Technology (MIT), the MIST is the research core of the Initiative. The MIST commenced teaching in 2008 on the premises of Abu Dhabi's Petroleum Institute, and is housed in Masdar City since the beginning of the academic year 2010/11. On 5 June 2011, MIST graduated its first group of students in the presence of Sheikh Hazza bin Zayed Al Nahyan, National Security Adviser and Vice-Chairman of Abu Dhabi Executive Council, and further members of the ruling elite. Their attendance is a sign of continuing considerable top-level interest in the project (Masdar Institute of Science and Technology, 2011).

- Masdar Venture Capital/the Masdar Cleantech Fund

The Fund is 100% owned and directed by Mubadala. As discussed, it has now launched three clean tech funds to invest the global renewables industry and related sectors.

[164] As previously discussed, Masdar Power's investments comprise Shams 1, Nour 1 and a PV test field in the UAE, as well as WinWinD, Masdar PV (Germany), and further engagements in Spain and the United Kingdom overseas.

[165] In the Gulf, this has coincided with efforts to improve the level of higher education that has achieved substandard scores in various international ratings (Nour, 2005). One step towards this is the establishment of branches of international universities in the Gulf, such as the Georgetown School of Foreign Service in Qatar (part of Doha's "Education City") and Dubai's University of Atlanta (Davidson & Smith, 2008).

In conclusion, the Masdar I phase started in early 2009 with high hopes, ambitions and short-term success plans. The UAE's successful bid for IRENA in June 2009 confirmed that the project was on a sound development trajectory. However, as will be shown in the following subsection, on closer inspection, many issues in the UAE did not proceed as planned.

5.7.3. The downsizing of Masdar in 2010 (Masdar II)

In early 2010, citing the project's innovative character and its complexity rather than the global financial downturn, it was announced that the original time plan needed to be pushed back to 2020-2025. In addition to this, Masdar's initial rhetoric changed from a "zero-carbon city" to a "low-carbon city", leaving all options open as to what this actually entails. Yet, the first phase stipulating the completion of the IRENA building is set to be finished on time by 2013, and, as highlighted above, MIST has already moved into its premises with the start of the academic year 2010/11 (Egbert, 2010; Pepper, 2010).

Apart from the reasons mentioned, it is not straightforward to identify other causes for this sudden change of plan after such a promising start. In line with the general UAE phenomena of opacity, non-disclosure and blurred responsibilities established in the landscape-level analysis of this chapter, little information was revealed official sources. Interviews with industry stakeholders in the UAE immediately highlighted key shortcomings in the system of Masdar; particularly of Masdar City. According to one stakeholder of an Oil Major:

"Masdar City was run like a normal real estate project. The international partners had to buy office space for very high prices and with zero value, as up to now, none of the office space is actually there! Also, I didn't see any sustainability strategies anywhere when visiting the site. I cannot identify anything particular on that site, nothing extremely environment-friendly, no particular waste management system, etc. Ok, they buy some CDM credits for carbon-offsetting, but this really doesn't make this place a special eco-city; anyone could do this." (Interview no. 74 – national and international power sector, Gulf States)

Another business interviewee confirmed this notion:

"We are not in the UAE because of Masdar, but to develop for the general market. We don't have a registration within Masdar City, as they couldn't offer us anything attractive. This also goes for the other free zones. One sales manager tried to sell me the membership in Masdar as a huge business opportunity, but when I analysed the numbers she gave me it showed that what we would potentially gain extra wouldn't even pay the expensive rent for the offices there." (Interview no. 69 – National and international power sector, UAE)

Additionally, Masdar had to lay off a large number of staff members and sacked the general management of Masdar City, Masdar PV and other senior management positions. Sultan al-Jaber, however, could maintain his position as a CEO of the entire project, although, according to interviews, the restructuring of the project symbolized a strong challenge to his role (*Interviewee no. 52 – public stakeholder, Gulf States*). The current Masdar II phase is riddled with international criticism. Several analysts, who argued that Masdar[166] – as most other eco-cities – is bound to end up in failure, feel their opinions have been confirmed. This, however, appears too pessimistic, as the project continues to evolve.

Two other interviewees also offered a more balanced point of view:

"Masdar is the first mover in that field in this entire region. Of course, first movers are always criticized and must change things, but still, it is a noteworthy initiative!" (Interview no. 64 – Private and public investor, UAE)

"The whole project is like an amoeba! It grows very fast, constantly changing and shifting due to constant learning effects. Take Masdar City for example: it started as a zero-carbon city, and then suddenly developed into a property developer – management cut it short, re-orientating it again to its core-business. Masdar as a whole is a love or hate project. Many of my colleagues told me "you are selling out" when I went to Masdar, but I don't think so. If only a small part of what is being developed here is reintegrated in global modes of living or transport then it was definitely worth it!" (Interview no. 78 – national and international power sector, Gulf States)

Thus, stakeholders come to very different conclusions when it comes to analysing the reasons for the downsizing of Masdar II. What needs to be kept in mind, however, is apart from the management issues it has mostly been Masdar City that has been downsized; the Masdar branches by and large remain intact. Furthermore, the early reshuffle of posts is not an unusual measure in a start-up project that does not show

[166] See, for instance, Pentland (2011) or Matthes (2011).

the desired outcomes or indeed exhibits mismanagement. Still, the downsizing of Masdar I itself after a rather positive 2009 beg the question whether decision-makers could not have anticipated that a more long-term time frame would have been necessary for the success of the project and that the original 2016 deadline could not have been met in any case. A key stakeholder involved in the planning phase stated:

"We had originally planned at least 14 years for the completion of Masdar's development, but our plan was cut down to 7 years by the political leadership. We had no choice but to say 'Yes, sure, we'll finish in this time' – at least some part; knowing this would be a very unrealistic goal. This short time given to us was mainly a function of the speed things were being realized in Dubai (and Abu Dhabi) before the crisis; this atmosphere generated competition, which is why we were forced to do this." (Interview no. 66 – private and public investor, Gulf States)

In conclusion, while the downsizing of Masdar City and the change in the senior management of several Masdar branches met with different reactions, the project as a whole should not prematurely be regarded as a failure. Instead, the global financial crisis has changed key landscape-level determinants of success. Additionally, the over-ambitiousness of Abu Dhabi's decision makers, combined with allegations of mismanagement, might be regarded as the reason for the announced changes. Furthermore, extrapolating from the interviewees' testimonies, renewable energy in the UAE is currently perceived as a new "buzzword". Indeed, there seems to be little understanding of the complex conditions necessary to create an enabling environment for the spread of renewable energy innovation in the country.

5.7.4. Masdar III, or: criteria of long-term success

The previous subsections have demonstrated that the Masdar Initiative is still in flux and that while severe problems have emerged, it has largely retained its original, innovative character. Still, it has become evident that a lot remains to be done for Masdar not to "*end up like one of these other big real estate complexes here in the Gulf; nothing special"*, as some Masdar staff informally fear.[167] This analysis is particularly rele-

[167] Interview no. 69 – National and international power sector, UAE.

vant not only for the internal dynamics of Masdar, but also for Masdar's pivotal role in the UAE energy system. As highlighted above in the MLP analysis, it also showed that this project still underperforms on various levels. Thus, a Masdar III phase might be required to guarantee the long-term success of the project under the aforementioned framework conditions of the UAE energy policy.

Due to the different functions of the Initiative, criteria of its success have to be given accordingly.

With regards to its internal success, the criteria are relatively straight-forward. Downsizing and expectations management are the first, important steps of a realistic assessment of the project's potential. Evidently, only sound business operations will yield success in the long term.

However, the question as to whether Masdar can assume the role of all the aspects highlighted in the MLP analysis of this case study is much larger. What can enable Masdar to develop into a meaningful technology cluster, to be an actual asset in terms of national economic diversification, to be used in a country branding context and to assume the role of a national business incubator, national renewable energy agency, think tank and industry complex under the given circumstances?

This touches upon the wider question of whether such cities function as national innovation incubators, or whether innovation will remain locked-in, as is envisaged by the "island of efficiencies" argument (Hertog & Luciani, 2009).

Currently, even Masdar-funded journalists wonder "whether the money being spent here will translate into practical learning with impact elsewhere" (Gunther, 2011).[168] However, an early Masdar planner underlines that Masdar I has been designed with a concept that strongly differed from the classical "islands of efficiency" in the Gulf, such as petrochemical complexes:

"The Masdar concept was not modelled along the petrochemicals cities in Saudi Arabia. Instead, the plan was to develop a super-strategy for the RET area for Abu Dhabi. For

[168] The article of this renewable energy journalist carries an open disclaimer that his travel to Abu Dhabi was funded by Masdar (Gunther, 2011).

example, the whole carbon initiative, the RE fund, the WFES – all these elements are crucial parts of the concept and are not at all part of these cities in Saudi – they focus rather of oil peripherals with purely economic interest. Our plan was always to establish an innovation mechanism." (Interview no. 66 – private and public investor, Gulf States)

Currently, Masdar does not fulfil its external functions well, not least because of an absence of government policies and industry structures to which it could relate. Moreover, there is the structural issue whereby Masdar suffers from an overload of demands: it will not be able to assume functions that are related to government (and thus neutral) and commerce (and thus economically partial) at the same time in addition to furthering the other agendas touched upon. One step in solving this predicament is the further internal differentiation of Masdar in a Masdar III phase. While this might still result in a conflict of interest in some cases, the current 5-pillar structure could be extended by at least one pillar: a renewable energy agency that takes over government functions and thus provides a clear and impartial guidance for domestic and international investors. This agency could be further subdivided thereby covering functions such as establishing a national innovation system, the coordination of research work in the UAE, the provision of impartial consulting services to the UAE government in energy matters, and other aspects highlighted as currently lacking in the MLP analysis. Naturally, such an agency could also be founded without any link to Masdar. Given the size, contacts and current weight of Masdar, however, it appears unwise not to integrate such an agency in an existing meta-project.

Its conditions of success, however, will always remain tied to the overall energy governance situation outlined above. Thus, although tangible improvements for internal conditions of a Masdar III phase can be made, the question of how system innovation can occur in the UAE energy system, remains. Comparing the ossified power structures in the energy governance as a whole, Masdar still appears fragile. In the UAE and Abu Dhabi, the traditional system of energy policy (under the framework conditions outlined above) is likely to dominate the development of the Masdar Initiative. As will be argued in greater details upon discussing the realpolitik caveats of energy policy design in the UAE (see Subchapter 7.1), it is improbable that Masdar can trigger a systemic innovation process in and of itself. Instead, a top-down process of renewal remains the more likely innovation process in the UAE.

5.7.5. Conclusion

The Masdar Initiative has been through different phases in its still comparatively short existence. Conceived as an "Abu Dhabi energy vision" by real estate developers with a comprehensive, research-based approach, this project suited the desires of Abu Dhabi's ruling elite during the mid-2000s, which is the reason why it was hastily adopted and given a considerable budget. Although the project launch was met with great international enthusiasm and had made early accomplishments such as the hosting of IRENA, the Masdar I phase was also not entirely successful: mismanagement and poor performance for the business community, as well as an excessively ambitious (government-enforced) time schedule soon led to a scaling down of the project, only amplified in its effects due to the global financial crisis of 2008/09. Another reason for these problems was the politically imposed time table that made the initial goals unrealistic from the outset. This also reinforces the impression that Masdar has always primarily been driven by strong political, much less so energy or commercial imperatives.

The currently on-going Masdar II phase is more realistic in its outset and is well capable of yielding some success in the coming years. However, in order to fully live up to its self-proclaimed goals as a business incubator, technology cluster, as well as an asset for country branding, technology transfer and national economic diversification, a Masdar III phase has to be launched. A slightly transformed Masdar Initiative could also incorporate a possible sixth pillar. Such a pillar could take over the impartial, governmental function as a renewable energy agency. This step could be vital to disentangle private-sector interests and governmental functions within the Initiative. Only then can the concern raised by stakeholders and researchers that this project is turning into yet another "island of efficiency" characterized by innovation lock-in and a lack of economic interaction with the rest of the country be avoided.

The Masdar Initiative is an excellent example of the potential of bottom-up-innovation processes. While it entails many promising elements, its conditions of success are determined by the conditions of the UAE energy policy system as a whole, as presented in this case study. As argued above, only an adaptation of the project to the overall variables of renewable energy policy in the UAE in a Masdar III phase will help make this project successful. Analytically, this shows how little a well- funded and well-connected niche-level initiative can move without more comprehensive changes to the regime- and landscape-level determinants of renewable energy policy in the UAE.

5.8. Conclusions of the UAE case study

This chapter presented the first of two case studies that represent the empirical core of this thesis. Analysing the UAE renewable energy system guided by the subsidiary research questions developed in Chapter 3, the case study showed that while renewables receive considerable attention in the UAE on all levels (landscape level: Subchapter 5.3; regime-level: Subchapter 5.4, niche-level: Subchapter 5.5), particularly in Abu Dhabi, the structural elements of legislation and a binding long-term policy are absent. As also the summative overview of the results (Subchapter 5.6) showed, the overall system of energy policy in the UAE is currently characterized, among others, by

- Strong individual initiatives coupled with a poor regulatory context and a low willingness to change this situation
- Opacity and policy of non-disclosure
- Entrenched but uninterested system actors in the fields of oil and gas industry
- Authoritarian structures and, in parts, blurred responsibility
- A certain predilection for megaprojects and prestige.

As the closer analysis of Masdar (Subchapter 5.7) has demonstrated, the role of the Masdar Initiative is pivotal for renewable energy policies in the UAE. However, the aforementioned problems on the landscape and regime levels in combination with Masdar’s current functional overload have rendered the initiative, in its current form, fragile. Without change in these framework parameters, a niche-level project such as Masdar will not succeed, but instead create the much-cited lock-in of innovation. Without change in these framework parameters, a niche-level project such as Masdar will not succeed, but instead create the much-cited lock-in of innovation.

The framework conditions developed by means of the MLP analysis, summarized in the individual Subchapter conclusions, the summative overview of UAE energy policy and its application to Masdar will form the background upon which questions of policy design and the broader issues revolving around the travel of governance models will be discussed in Subchapter 7.1 of Part C. An ideal type application will demonstrate that Western governance models such as TM can only be applied to the UAE in a very limited sense as caveats prevent most key elements of this approach to be successful. This will be succeeded by a comparative analysis of both case studies' results, which in turn will demonstrate whether this is a general trend or whether diverging results of the two case studies cannot confirm such an argument.

6. Algeria

Figure 39: Map of Algeria

Graphs © 2013 NASA, TerraMetrics, Map data ©2013 Google, Mapa GISrael, ORION-ME, Basarsoft, basado en BCN IGN España.

6.1. Introduction

The second case study will focus on Algeria, which represents the second country type of resource-wealthy Arab states identified in Chapter 1. After outlining the basic energy and policy context for Algeria and summarising the data collection, the case study will follow the same structure of the UAE case study by applying the MLP and TM frameworks. Characterized by large hydrocarbon reserves and a large territory and population, these states have developed different governance structures than small, hydrocarbons-rich states like the UAE. While the latter distribute their wealth among small national populations and possess leadership structures that allow for swift policy changes and institutional reform, governments in states like Algeria, Libya or even Saudi Arabia, “bunker states” in Henry/Springborg’s terminology, often display slower, more sclerotic governance structures and generally find it harder to perform massive transfers of wealth to achieve a “ruling bargain” situation that the smaller Gulf states can reach effortlessly. Parallel to the UAE case study, this subchapter will first give a brief introduction into the fundamentals of Algerian (renewable) energy policy and then sketch the further outline of the Algerian case study.

Present-day Algeria is shaped by its war of independence, the Arab socialist regime and the “lost decade” of the 1990s. The uneasy alliance of a strong security apparatus, technocrats, the dominant elites around President Bouteflika and incoming oil money has kept the country afloat. The ministry of energy and mines under Youcef Yousfi has a key position in the country’s institutional setup since it directs SONATRACH (*Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures*), the national oil producer that, in 2009, accounted for 98% of Algeria’s foreign currency revenues.[169] This dominance of hydrocarbons in a largely autocratic “bunker state” (Henry & Springborg, 2001) means that energy policy agenda is largely dominated by conventionalism and by a stress on export stability. In many circles, renewables have traditionally not enjoyed major attention or enthusiastic support. Unlike in the Gulf, Algeria’s national diversification agenda is not far advanced, nor have Algerian policy makers acted with the swiftness that has been visible in the UAE in recent years.

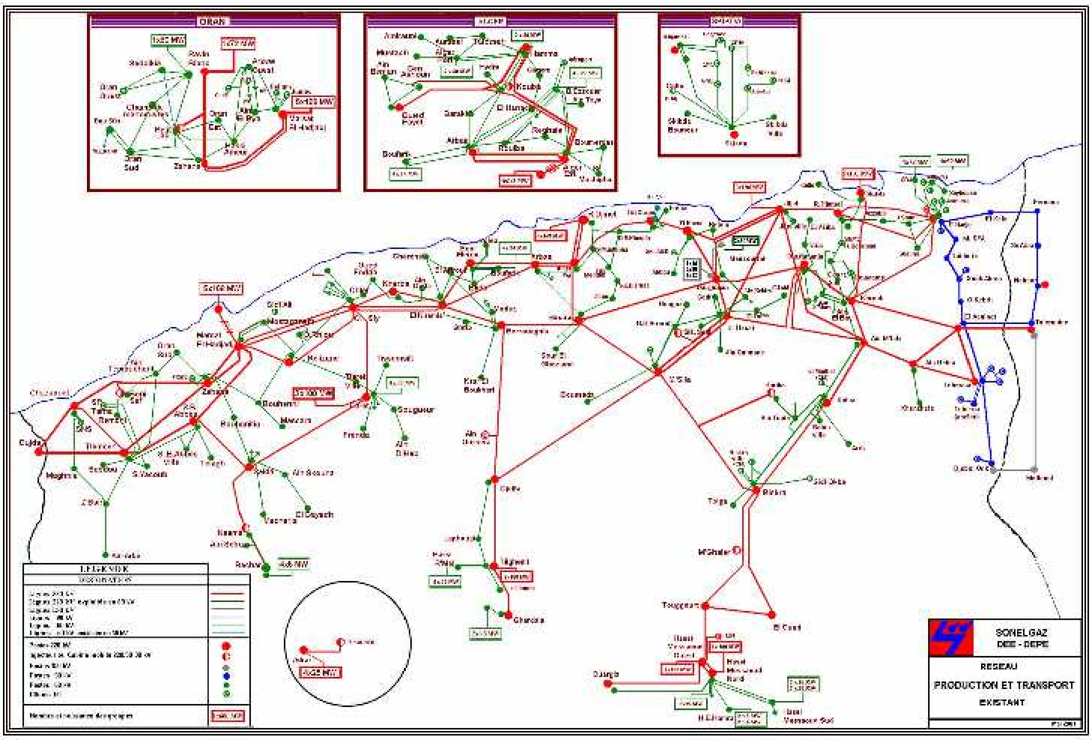
While SONATRACH is an important player in the entire Algerian energy sector, the Algerian state utility is SONELGAZ, the acronym for *Société Nationale de l'Electricité et du Gaz* (Algerian Electricity Utility), currently headed by Noureddine Boutarfa. Although the Algerian electricity sector has formally been liberalized in 2002 with the law n°02-01 on energy, Sonelgaz remains the dominant player in the electricity sector. It continues to produce 87 per cent of the Algerian domestic electricity as an Independent

[169] Cf. Mebtoul (2010). For an in-depth, comparative discussion of Middle Eastern national oil companies cf. Marcel & Mitchell (2006).

Power Producer and co-produces the remaining 13% in international joint-ventures. Additionally, it still owns the national power grid, which has not been liberalised.[170]

Following the main centres of demand and population, the Algerian grid system is well developed in the coastal regions (cf. Figure 40), however, it fails to provide a grid covering the expanse of the country. This is expected given the low population density, economic performance and the adverse conditions of the Sahara Desert. A result of that is that most of Algeria's renewable energy efforts began with rural electrification programmes to impoverished communities in the *Grand Sud* of the country, mostly realized through off-grid PV or, less frequently, CSP.

Figure 40: Map of the Algerian electricity grid



Source: Supersberger et al., 2010, p. 27.

This, however, does not mean that a national renewable energy policy is non-existent. On the contrary, Africa's second largest state has desert territories for solar power plant deployment, a similar expertise in energy exports as the Gulf, large amounts of

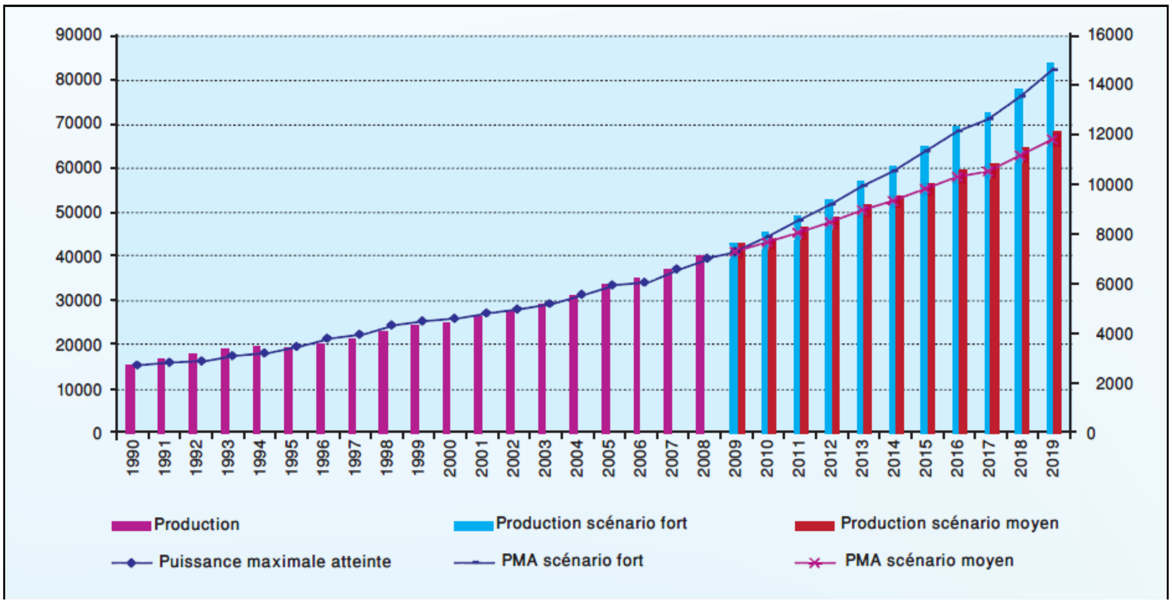
[170] For more details on the structure and historical development of the Algerian electricity market cf. Supersberger et al. (2010, pp. 31-34).

capital available and a multitude of small, albeit rather uncoordinated renewable energy initiatives and centres. Moreover, according to journalistic sources (Bensebaini, 2008) its ministry of environment plans a project similar to Masdar City, the *Nouvelle Cité Boughezoul*.[171]

One key driver for an extension of the electricity production infrastructure, as in the Gulf States, is the steep rise of local power demand (cf. Figure 41 for an overview of the rise in power demand since 1990 and for projections until 2019). Additionally, the proximity to the European Union constitutes an important strongly different incentive from the classic goals of energy policy. Europe's continuously growing power demand and its ambitious renewable energy targets offer a large potential for industry innovation and rent generation through a large-scale construction of concentrated solar power plants and wind parks designed for power export to Europe. The growing interest in this new export opportunity for Algeria is also reflected in Sonelgaz' cooperation agreement with the Desertec Industry Initiative (Dii) (Sonelgaz, 2011) – a direct outflow of the minister's ambitious export goals for 2030. Since this aspect is outside the classic pathways of national renewable energy policy, these developments and potential implications for Algeria will be discussed in a "case study within the case study" in Subchapter 6.7.

[171] As will be demonstrated in Subchapter 6.5, the *Nouvelle Cité Boughezoul* has yet to reach a serious project planning stage. While theoretically a megaproject and eco-city in its own right, currently, its realization in the mid-term future appears beyond reach. Moreover, compared to Masdar, its role is much less significant for Algeria, which is why the case study in the case study in this chapter has not been conducted in this project. Rather the Euro-Mediterranean renewable energy will be given particular attention as this is substantially more significant to the Algerian renewable energy policy.

Figure 41: Historic and projected energy demand in Algeria 1990-2019



Source: Commission de Régulation de l'Electricité et du Gaz (CREG), 2010, p. 11.

Algerian decision-makers have agreed on increasing the currently almost non-existent share of renewable energy in power generation. A key number is a 6%-target until 2015 (Algerian Ministry of Energy and Mines, 2007), which was released in 2007 and has been re-adapted in 2011 to 7% by 2020. While this target already appeared to be ambitious given the very low current RE quota, the new energy minister has launched yet another, substantially more ambitious investment and renewable energy production programme in 2011 that will also entail a technology transfer and domestic industry component. The renewable electricity quota of this investment programme is to be raised to up to 40% of all energy produced by 2030 (12 GW) in addition to another 10 GW destined for exports (Algerian Ministry of Energy and Mines, 2011).

Thus, renewable energy policy in Algeria stands at a crossroads. It may well be that the ambitious plans by the Algerian MEM in the areas of energy and industry policy will lead the country into a prosperous renewable energy future that harvests a part of the country's impressive resource potential. In this positive scenario, external, landscape-level developments such as Desertec and the MSP could trigger synergy effects. However, the Algerian and external renewable energy promoters can only pave the way to a substantive renewable energy deployment if the political and commercial circumstances provide favourable framework conditions. The alternative to this would be a continuation of declaratory policies and the decree of laws without any tangible effects on the ground. The question of which governance structures will persist in Algeria will also determine how far a multi-agent, open government approach such as TM can succeed in this environment and, if not, which alternative means might prove to be more successful.

After a brief and more general account of the field work and the data collection (Subchapter 6.2), this chapter will analyse the Algerian renewable energy system by means of the MLP framework and the 18 research questions developed in Part A (landscape level in Subchapter 6.3; regime-level in Subchapter 6.4; niche-level in Subchapter 6.5). As in the previous case study, results or quotes of the research interviews will be provided wherever suitable. Each subsection will end with section conclusions summarizing its main findings. The results of the section conclusions will be presented in an overview in Subchapter 6.6.

Since, as has been mentioned, the Euro-Mediterranean dimension of renewable energy cooperation constitutes a complex and relevant factor for the Algerian domestic renewable landscape, Subchapter 6.7 will conduct this chapter's "case study within a case study" and discuss this issue and its interlinkages to Algiers more extensively.

Finally, the combination of the results of the Algerian case study and the case study within the case study will provide the material for the final assessment on the conditions of renewable energy policy in Algeria and the theoretical implications to be drawn from that in Subchapters 6.6 and 6.8.

This will serve as the background for Subchapter 7.2 of Part C, in which TM will be applied by drafting renewable energy policy models for Algeria. At the same time, this will serve as a test for how far such policy design models can be applied to the particular governance situation in an oil- and gas-wealthy Arab state of large territory.

As one stakeholder put it:

*Algerian foreign and energy policy is performed in several layers ("*casquettes*"): OPEC, the Arab world, Africa, as well as some close partners from the EU. In order to be successful Algerian stakeholders have to navigate through all these settings, where each* *one is a totally different context with complex interests involved.* (Interview no. 3 – public stakeholder, Algeria)

It is the goal of this chapter to show the interaction of the multiple *casquettes* of the Algerian system of energy policy. It will analyse the conditions under which renewable energy policy is performed in order to retrieve the more general patterns of energy, and particularly renewable energy policy in OAPEC states.

6.2. Account of the data collection phase of the Algerian case study

Research for the Algerian case study was carried out in parallel to the UAE case study. Four research trips were conducted in 2009 and 2010[172]. Due to the strongly centralized structure of Algeria, the prime destination for interviews was the greater Algiers area as most companies, politicians and other interviewees are located in the capital. In addition to that, Algeria's second largest city of Oran was visited twice. An initial visit to interview renewable energy researchers led to the author's participation in a conference the following year, where more Algerian and North African renewable energy stakeholders were interviewed. Unlike in the UAE, the author did not seek an affiliation to a research institute in Algeria.[173]

In general, interviews were conducted in French with occasional talks in Arabic. While access to the mostly expatriate interviewees in the UAE was usually granted and scheduled in advance, this posed a major problem in Algeria: almost no interviews were scheduled from abroad; the most effective method was to call the respective persons on in their mobile phones and to make an appointment for the same day or shortly after. Indeed, this direct way of establishing a contact worked best, whereas introductions by third parties or official email requests usually remained unanswered.

[172] Parallel to the UAE case study, data collection was terminated in February 2011. All policy initiatives that were launched after that date are only rudimentarily taken into account. See also Footnote 111.

[173] While the German-Algerian Chamber of Commerce and Industry was helpful in facilitating contacts to interviewees from the Algerian energy sector and at times offered its rooms for research interviews, this contact did not constitute a formal or informal research affiliation.

In addition to that, obtaining an interview appointment did not mean that a great amount of information was revealed to the interviewer. The remaining security issues in Algeria and the fact that in principle, all energy issues are regarded as highly political, many interviewees did not want to go on record with their assessments of the situation in their home country, nor did they easily reveal insights on Algerian energy policy, particularly if connected to the main state institutions. While this can be read as a general remark on most Algeria-related research projects, the particular circumstances in the research period worsened the situation. In 2010, the long-serving minister of energy and mines, Chakib Khelil, stepped down over a large-scale corruption scandal in the national oil and gas company SONATRACH. Rather than an anti-corruption-sanction, researchers have interpreted this affair as a political manoeuvre in the intra-elite power struggles between President Bouteflika's clique and the military security apparatus[174], the DRS (*Département du Renseignement et de la Sécurité*[175]). The Ministry of Energy and Mines (MEM) – key for Algeria's economy – is now headed by Youcef Yousfi. Due to this situation, the author was unable to obtain an official interview with a representative of the MEM.

Apart from that, however, a limited number of interviewees assisted in establishing contact with further Algerian experts. Methodologically, these interviewees cannot be characterized as gatekeepers. Much rather, their provision of further contacts was a result of a successful snowballing technique. In Algeria itself, the large majority of interviewees were Algerian citizens, as opposed to the UAE case study. The research was therefore conducted in a manner which was much closer to the actual Algerian population. Yet, in terms of results, this does not mean this has always produced the most open and informative interviews. The problem of access produced an important challenge in Algeria. Unlike in the UAE, it was easy to interview local citizens, yet major state institutions such as ministries remained sealed off. Their representatives would not give interviews or agree to meet at all, not even on the condition of anonymity. Additionally, the reasons for the mismatch of much-advertised innovation and the con-

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[174] See Lacher and Ghettas for insightful analyses of this move (Lacher, 2010; Ghettas, 2010).
[175] English translation: Department of Intelligence and Security

tinuation of legal and institutional roadblocks could by and large not be answered by the interviewees. Essentially, these were the author's impressions, even energy experts were poorly connected to the inner circles of the political and security apparatus, where decisions about the future of the national energy system were taken. This has somewhat reinforced MLP's tendency to neglect personal agency and to focus more on structural questions. With this in mind, however, the author was still able to present a comprehensive picture of the (renewable) energy situation in the country both through desk research[176], as well as interviews with nationals and expatriates. As described above, talking with the latter group of interviewees had certain benefits due to the establishment of a perceived or actual personal proximity between the researcher and the interviewee.

In addition to the interviews conducted in Algeria, particularly the "case study in the case study" focussing on Desertec and further trans-continental renewable energy projects and their implications for Algerian energy policy necessitated obtaining data from further non-Algerian sources. For that purpose, several interviews were conducted with European stakeholders in various geographic locations, most notably Brussels, Paris, the UK and Germany.

6.3. Landscape-level developments

6.3.1. The Algerian political system

How far do the Algerian political system and the non-existence of independent CSOs allow for system innovations in the energy sector, particularly bottom-up innovations?

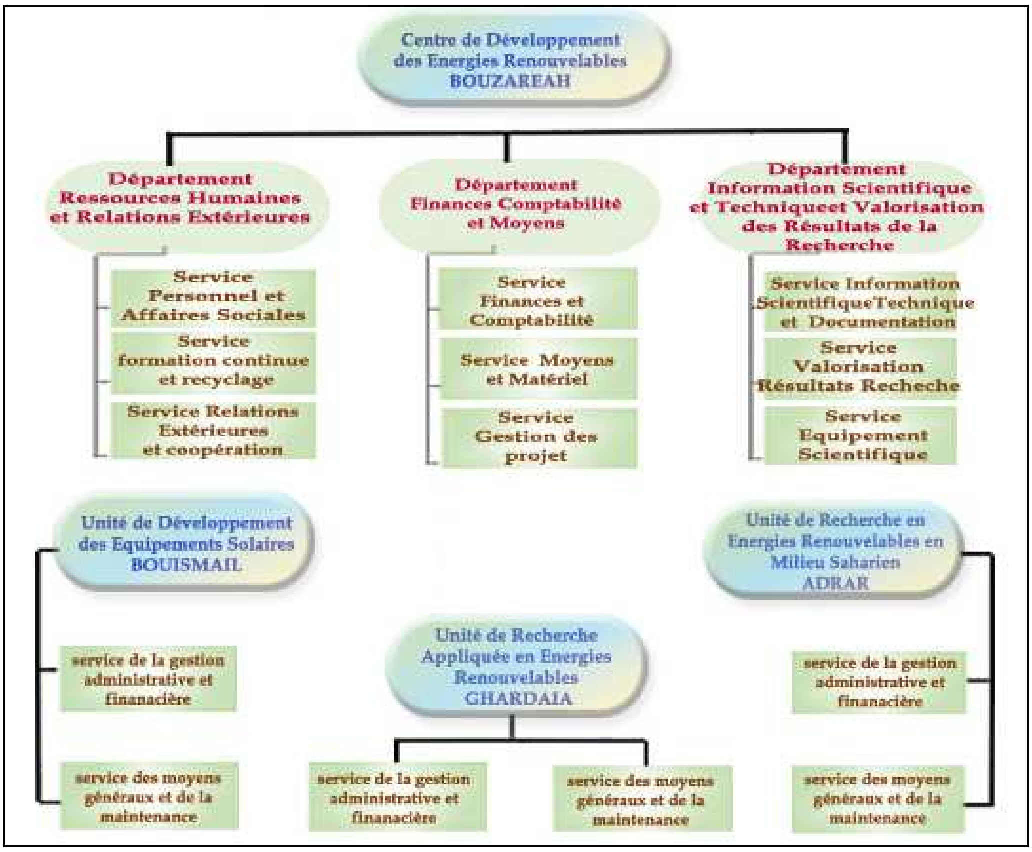
The Algerian system of energy policy remains very much centralized in the capital Algiers. While it is largely dominated by the MEM and the major companies of Sonelgaz and Sonatrach, several other state institutions are relevant to renewable energy policies:

[176] Desk research also did not lead much further in terms of tracing personal agency as other research publications evidently faced the same issues.

- NEC - The *National Energy Council* (*Conseil national de l'énergie*). Established through the presidential decree n°95-102 (8 April 1995), the NEC is charged with supervising and controlling Algeria's long-term national energy policy. The NEC represents the top-level energy body in the country and is presided over by the President of the Republic. Other members include leading Algerian energy officials such as the ministers of defence, energy, finance, the Algerian central bank governor, and the head of the national planning committee. In its scope and work, the NEC is comparable to the UAE's Supreme Petroleum Councils.
- *CREG* – The *Regulatory Commission of Electricity and Gas* (*Commission de régulation de l'électricité et du gaz*)**.** The national regulatory framework has been defined by law n°02-01 released on 5 February 2002. Articles 132 and 133 form the legal basis for the *CREG*. Apart from the standard tasks of a regulatory body, this commission observes and enforces the transparency of electricity markets and the well-functioning of a healthy competition. The CREG is the equivalent of a national regulator in the UAE. It releases national electricity targets and detailed plans of how renewable power is to be integrated into the national energy system
- The *Ministry of Land Use Planning, Environment and Tourism* (*Ministère de l'aménagement du territoire, de l'environnement et du tourisme*). Through its *Directorate for Energy and Development*, this ministry oversees the technological aspects of the power sector and is responsible for enacting laws for the promotion of sustainable development. Headed by Chérif Rahmani, this ministry has a distinctly different conception of renewable energy policy and sustainability issues on the whole. This can be seen by the different projects put forward by its two ministers, the *ville nouvelle Boughezoul* (environment) and the Algerian national energy programme (MEM) (*Interview no. 14 – R&D, Algeria*).
- *CDER* – The *Centre for the Development of Renewable Energies* (*Centre de développement des énergies renouvelables*)**.** Founded in March 1988, the CDER is the best-known renewable energy research institution in Algeria. It focuses

mostly on R&D programmes focusing on solar, wind, geothermal and biomass energy as well as some teaching connected to the newly founded PhD programme (*Ecole Doctorale)*. The headquarters of the *CDER* is based in Bouzareah, in the outskirts of Algiers, but further research and development units are deployed in the oasis of Ghardaia, in the coastal city of Tipaza and in the desert town of Adrar (see Figure 42). While the CDER could potentially be a significant institution in Algeria, it has very limited funding and political influence, mostly because it is not an organisational part of the MEM, but rather a pure research institute under the tutelage of the Ministry of Higher Education and Research.[177]

Figure 42: Internal organisation of the CDER



Source*: CDER Website* http://www.cder.dz/?rub=epst&srub=n&pag=admin, last accessed 05 January 2011.

[177] This notion has also been confirmed by *Interview no.20 – R&D, Algeria*.

- *New Energy Algeria* (*NEAL*) was founded in 2002 as a subsidiary of the Algerian energy incumbents Sonatrach (45%) and Sonelgaz (45%) with 10% extra capital from the private investor SIM (UbiFrance, 2010b). The task of this start-up is to foster and develop any kind of renewable power production in the country. In an interview, the CEO of NEAL acknowledged the difficult task at hand. In addition to navigating between various ministries and the powerful national energy companies, he must also tread carefully in order not to threaten any informal source of income to members of the ruling civil or military elites, otherwise his scope of action will remain limited (*Interview no. 9 – National & International power sector, Algeria*).
- In many ways, the *IAEREE* – The *Algerian Institute for Renewable Energy and Energy Efficiency* (*Institut algérien des énergies renouvelables et de l'éfficacité énergétique*) can be regarded as an institution competing with the CDER for political clout, research money and international recognition. Although only founded in 2009, the IAERE finds itself in a much better starting position as it belongs to the MEM. The institute will be established in the new village of Bellil in the district of Hassi R'Mel (*Maghrebemergent.com,* 2010). It is designed to interact closely with the national renewable energy company New Energy Algeria (NEAL) and other energy companies. The potential role of the institute as a knowledge hub will be treated in the corresponding Section 6.5.1.
- APRUE – The *Algerian National Agency for the Promotion and Rationalisation of Energy Use* (*Agence nationale pour la promotion et la rationalisation de l'utilisation de l'énergie*)**.** Originally created in 1985, this institution has been restructured by law n°99-99 on energy efficiency on 28 July 1999. The APRUE is institutionally weak, but represents efforts to work on demand side management in Algeria.

The diversity of Algeria's renewable energy institutions reveals the country's longstanding commitment to the exploration of this form of energy production. However, all the institutions mentioned are directly or indirectly state-run. No independent energy NGO with a significant expertise in this field exists in Algeria. As a consequence of the state-centeredness of these institutions, the overall energy policy inputs in Algeria remain strongly oil- and gas-focused[178], as the decisive ministries and boards are usually staffed with representatives of this key Algerian industry.

In contrast to the UAE's political system presented in Section 5.3.1, the Algerian *body politique* is strongly modelled on the French system. Its centralised mode of governance concentrates all significant powers in the greater Algiers region. Thus, energy policy is being performed in a top-down mode. Unlike the UAE, where the individual emirates have certain reserve rights when it comes to energy policy as a whole, the Algerian constitution does not grant such rights to the 48 provinces of Algeria (*wilayas*). Additionally, since their governors (*walis*) are directly appointed by the President of the Republic according to Art. 78 of the Algerian constitution[179], they lack the independence their counterparts in federal systems enjoy – rights that are even stronger in the UAE form of federalism which is formed by a federation of quasi-absolute rulers. One business interviewee confirmed this notion by stating:

In the entire region, everything is unfortunately decided in a top-down approach. Power structures are very hierarchical with mid- or low-level management having almost no say. This is often very unproductive. (Interview no. 36 – private and public investors, Europe)

<u>Section conclusion</u>

The strongly centralised political system that is in itself largely dominated by oil and gas and the military elites is hardly open to bottom-up innovation in general, let alone in the renewable energy sector, which is only of marginal interest to many members of the ruling elite. Additionally, the non-existence of independent CSOs leaves a void in the Algerian *body politique*, as no external agenda setter can exert pressure on ruling

[178] As one stakeholder put it: "the focus of the Algerian energy system is on natural gas" (*Interview no. 3 – public stakeholder, Algeria*). More generally, the term *pays gazeux* ("gaseous country") is frequently used to denote the importance of hydrocarbons in Algeria by both experts and – to a lesser extent – the general public.

[179] A most up to date version of the Algerian constitution can be accessed through the online service of the Official Journal of the Democratic Republic of Algeria: http://www.joradp.dz/hfr/Consti.htm, last accessed 28 December 2011.

politicians in that regard. In terms of policy-making, these two facts lead to the assessment that only the incumbent, regime-entrenched actors are potent, not only when it comes to policy formulation, but particularly also with regards to the power to block on-going initiatives and reforms. In essence, this means that in the "bunker state", the interests of the most important groups in the country (in Algeria: the oil bureaucracy, the security apparatus and the top-level political elite around them Tlemcen-clan) must never be crossed during policy formulation. If this is the case, these powers can be expected to render certain initiatives null and void.

By and large in the current Algerian techno-political system, technology and regulatory innovations are either to be imported from abroad or developed domestically, i.e. within the Algerian bureaucracy, a rare occurrence.

6.3.1.1. Personal patronage networks

To what extent are the official decision-making processes the actual decision-making structures?

Unlike the situation in the Gulf States, the republican governance model of Algeria implies that there is no double structure consisting of elected bodies and administrations on the one hand and a hereditary family structure on the other hand.

Yet, the official absence of double power structures does not automatically signify that there is no second (or third) layer of political-economic interest groups in the country. On the contrary, researchers have dubbed the recent reshuffling relating to the Sonatrach corruption scandal a classical power struggle behind closed doors; a military intelligence (DRS) attack against the President's aides ("Tlemcen Clan") in the cabinet (Ghettas, 2010). Endemic corruption, both petty and grand, corroborates this claim.[180]

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[180] Algeria is ranked 112th on the 2011 global corruption perception index (see http://cpi.transparency.org/cpi2011/results/, accessed 10 January 2012). In December 2011, the Algerian president signed a presidential decree establishing a new anti-corruption office (*El Moudjahid - Quotidien National d'Information,* 2011). While first doubts had already been raised regarding the efficiency of this office, a rigorous assessment of its effectiveness could be launched in 2-3 years at the earliest.

In short, it is safe to assume the existence of strong and powerful double structures in Algeria. This notion has also been confirmed by the following interviewee:

If you want to realize a project you can either talk to the officials or try to take the informal channels. It is rather uncertain which way actually works better. (Interview no. 36 – private and public investors, Europe)

Another hint of the influence of non-political interests groups in the Algerian renewable energy policy is the stalling of implementation measures for this policy area. In contrast to the Gulf States, Algeria has been among the first Arab states to have introduced a renewable energies act. This 2004 law[181] was largely modelled on the German feed-in tariff system and was designed to stimulate growth of the renewable energy share in Algeria's electricity production. However, seven years after its entering into force, the law cannot be applied as the necessary administrative decrees for its implementation have not yet been released. According to interviewees, this is "*not normal at all*" considering that this "*is not a luxury for Algeria, but a strategic investment*" (*Interview no. 14 – R&D, Algeria*). While an official explanation for this severe delay that is essentially stalling Algerian renewable electricity deployment has never been issued, interviewees suspect a mixture of oil and gas interest groups and corruption as the true reasons behind this, as the topic is too important and public to merely be the victim of administrational inertia. Unsurprisingly, tangible information proving this suspicion could not be found during the research conducted. Anecdotal and interviewees' testimonies, however, render this speculation quite probable.

Similar to the UAE case, a minute insight into the decision-making structures of Algeria's ruling energy elite remains elusive. Indeed, as also reflected by Henry/Springborg's use of the term "bunker state", in Algeria, state and army institutions remain in power. The combination of low transparency and accountability, as well as unwillingness to give access to foreign researchers made a concise tracking of decision-making processes impossible as access was not granted to the author on most occasions. As highlighted, the non-top-level interviewees were glad to speak to the author.

[181] Law n°04-09 of 14 August 2004, "Law on the promotion of renewable energies in the context of sustainable development" (*loi relative à la promotion des énergies renouvelables dans le cadre du développement durable*). The specific regulations of the law will be discussed in Subsection 6.4.2.1.

Yet, cautiousness or ignorance about top-level decisions and particularly the issue of why exactly the FIT law has so far been stalled caused a level of uncertainty and vagueness in their replies that forbade all precise statements on agency. The named top-level energy, security and political institutions have, no doubt, unspecifiable powers to block the development of certain – in their view – undesirable development trajectories. Which other means and which structures – apart from formal rejections of law proposals – are employed remains, however, uncertain.

Section conclusion

Algerian energy policy is still heavily dominated by the traditional oil and gas elites. While a formalized double power structure similar to that in the UAE does not exist, informally these structures exist constantly blurring the margin between official decisions and opaque, closed-door decision making. However, unlike other countries, the formal decision-making structures around the Presidency, the military security services and the oil and gas industry still command a strong degree of authority. This state of affairs makes it particularly difficult to the outside researcher to precisely pinpoint the influence of interest groups on Algerian renewable energy policy. For by definition, outside researchers are very rarely admitted access to the inner decision-making structures.

6.3.1.2. Governance effects of renewable energy systems

What do interviewees regard as the key governance effects of renewable energy production?

Although renewable energy policy is largely dependent on decisions made by the oil and gas dominated energy opaque power structures around the MEM, there is some interest in the topic by Algeria's elected representatives, as the parliamentary day on renewable energies (*journée parlementaire*) held on December 11, 2011 demonstrates. On this day, representatives of key Algerian renewable energy institutions such as NEAL and the CDER (see above) presented aspects of national renewable energy policy and stressed their strategic importance (Portail Algérien des Énergies Renouvelables, 2011d). However, no references were made towards potentially democratizing effects through a strong domestic spread of renewables or indeed increased political stability through transregional renewable energy cooperation.[182]

While renewables are not regarded as a means to enhance democratisation processes in Algeria, the country is in need of political stability, particularly in light of the turbulent 'Arab spring' events during the year 2011 in its immediate neighbourhood. In principle, renewable energies can contribute to system stability by offering several positive outcomes, such as the diversification of national energy supply and national income; improving the labour market and branding effects for the country and a securing a reliable power supply in Algeria.[183] However, this added stability is not explicitly mentioned by stakeholders as an effect induced by renewable energies.

Section conclusion

Neither did politicians, interviewees nor the available published research acknowledge any direct governance effects this mode of energy production can deliver. While the spread of renewable energy production and related industrial capacity buildings arguably have indirect impacts on overall regime stability, the argument that renewable energies lean towards certain political, bottom-up, democratic structures cannot be confirmed in any way.

[182] Also the greater hopes that by increased regional energy cooperation, the path towards an Arab-Israeli rapprochement could be paved, as Kraemer and other proponents of the Medgrid initiative argue (Kraemer, 2011), should be treated with caution. As will be shown in Section 6.7.2, currently, the stalled Arab-Israeli peace process disturbs transregional energy cooperation rather than vice versa.

[183] See the respective subsections for details on the aspects mentioned.

6.3.2. *Key transregional energy governance bodies*

Which role do transregional energy governance bodies such as OPEC, OAPEC or IRENA play in the promotion or stalling of national renewable energy policy in the respective target country?

While Algeria has traditionally been among those states that have pushed for a greater Arab political coordination in the Arab League, OPEC, OAPEC and other regional fora, its willingness to accept these bodies as actors in local energy policy has remained low. The fact that Algeria has the OAPEC presidency in 2012 (Portail Algérien des Énergies Renouvelables, 2011e) is unlikely to have many domestic impacts on the oil and gas industry. The priority for the Algerian presidency was clearly set by the first official declarations relating to Iraq's role, its membership and production quotas.

While Algeria signed the original IRENA statute during the initial Bonn conference on 26 January 2009 (IRENA, 2011), Algeria's instrument of ratification was only deposited to IRENA's headquarters on 09 May 2012 (IRENA, 2012). Hopes had been voiced that Algeria's interaction with IRENA might have some effects. As one interviewee stated:

IRENA could well be able to give a new impetus to Algerian energy policy. Also, it could trigger new cooperation with Europe, as well as with Africa. (Interview no. 15 – R&D, Algeria)

However, IRENA's role in North Africa has so far been very limited, and its influence on Algerian domestic politics is merely speculation.

As shall demonstrated in Subchapter 6.7 with the European example, major renewable energy policy decisions in neighbouring world regions can serve as landscape level innovation incubators and as pull factors for the domestic renewable energy policy.[184]

<u>Section conclusion</u>

Similar to the case of the UAE, the will (and the potential) of transregional energy governance institutions to shape the domestic energy policy of individual member states is

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[184] This can also be seen in the recent signature memorandum of understanding between the Desertec Industry Initiative (DII) and the Algerian major utility Sonelgaz (Sonelgaz, 2011).

limited, as this would in many ways counteract the purpose of such intergovernmental bodies. Nonetheless, as the case of Europe indicates, renewable energy policies in neighbouring economic blocs can have landscape-level impacts on the domestic renewable energy scene.

6.3.3. *Climate change vulnerability and low environment-related profile of oil-producing states*

Is the climate change agenda actively considered in the political decision-making to spread/block further renewable energy developments?

Due to Algeria's high population density in its coastal regions, its large desert areas and the comparatively small amount of available arable land the country is vulnerable to climate change. The most energy-related climate change-induced challenge will be water scarcity, as national energy demands will soar due to increased desalination efforts. As research has shown (al-Weshah, 2002, p. 6), while Algeria's water shortages are not as severe as in the Gulf States, they still present a formidable challenge.[185] Thus the country's latest 5-year investment programmes (*plan quinquénnal*) of 2009-2014 totalling approximately US$ 150bn (*Le Figaro,* 2009) have included the construction of 12 large-scale desalination plants. While the Algerian energy sector is already the largest GHG emitter in the country,[186] the planned schemes are likely to further increase the emissions.

[185] Further numbers are given in Figure 43 and in Section 3.2.3.
[186] See http://www.cantdrinkoil.org/en/post/Facts-Sheet-Maghreb.aspx, last accessed April 14, 2012.

Figure 43: Water budget of the Arab Region up to 2030

Year parameter	1990	2000	2010	2030	Remarks
Population in millions	226	304 (293)[a]	408 (394)	758 (711)	Using a growth rate of 3% per year
Renewable water resources, $10^9 m^3/y$	264	264 (246)	264 (246)	264 (246)	Using ACSAD [5,6] as a conservative value
Water demand	200	269	362	671	1990's base demands was averaged from wide sources in the literature. 1990's demand rate is assumed for other years
Balance of water budget, $10^9 m^3/y$	64	–5 (–23)	–98 (–116)	–407 (–425)	Year 2000 represents the critical period of full utilisation of renewable resources.
Per capita water resources, $10^9 m^3/y$	1.17	0.87 (0.84)	0.64 (0.62)	0.35 (0.34)	Mid nineties represented the beginning of scarcity.

Source: al-Weshah, 2002, p. 6.

Thus, the spread (or at least the promotion of) renewable energies would be an excellent way to serve the ever-increasing energy needs while cutting GHGs. Additionally, declaring these schemes as CDM projects could bring about further income. Yet, Algeria currently remains below its potential. It has, for instance, not yet registered one CDM project.[187] This is confirmed by an experienced interviewee's view:

"In principle, renewable energy projects would work great as CDM projects in Algeria, but currently, there doesn't seem to be any interest on the Algerian side to implement them – certainly not with foreigners. I have had contacts to a European consultant, who offered his CDM-knowledge here, but he was rejected and his services not bought." (Interview no. 4 – public stakeholder Algeria)

Reasons for this include the weak institutional set-up in this regard. While Algeria has established a National Climate Change Agency (*Agence Nationale des Changements Climatiques – ANCC*) in 2009, this agency remains understaffed and institutionally weak, as its director confirmed in a research interview (interview no. 20 – R&D, Algeria):

"After Copenhagen things are different with regards to climate change policies as for the first time, the energy minister, the foreign minister and the minister of environment have been present at a COP – this has increased top-level awareness and I expect a stronger cooperation" (Interview no. 3 – public stakeholder, Algeria)

This was stated by an interviewee in January 2010, right after the 15th Conference of the Parties of the UN Framework Convention on Climate Change (UNFCCC) which took

[187] Cf. the official UNFCCC statistics http://cdm.unfccc.int/Statistics/Registration/NumOfRegisteredProjByHostPartiesPieChart.html, last accessed December 27, 2011.

place in Copenhagen between 7 and 18 December 2010. However, no change has occurred since with regards to the institutional setup or climate change policies or CDM projects, and the 2011 renewable energy programme does not even make a reference to climate change as an important challenge. However, as there is no existing, strict climate change policy in force in Algeria, climate change cannot be identified as a policy driver for renewable energy policies in a narrow interpretation of the term. It might only be characterized as an ideational motive for some actors and a further declaratory add-on.

Section conclusion

Algeria's main GHG emitter is its energy production; strongly growing due to increased desalination demands that in turn are necessary because of climate change-induced water shortages. While climate change is frequently cited in renewable energy-related speeches, interviews or publications, the lack of any enforceable climate change policies in Algerian national regulation cannot justify the statement that renewable energy policies in this country are indeed driven by climate change policies in the narrower meaning of the word.

6.3.4. Long-term national economic diversification

Are the renewable energy-related efforts connected to the national economic visions or national SWF activities in the respective country?

As Table 18 demonstrates, the Algerian national economy is heavily dependent on hydrocarbons. This quasi-total dependence (a 97.7% share of its export values in 2007) makes the need to prepare for a post-hydrocarbons world and to strategically develop alternative sources of income an undertaking of the highest national priority.

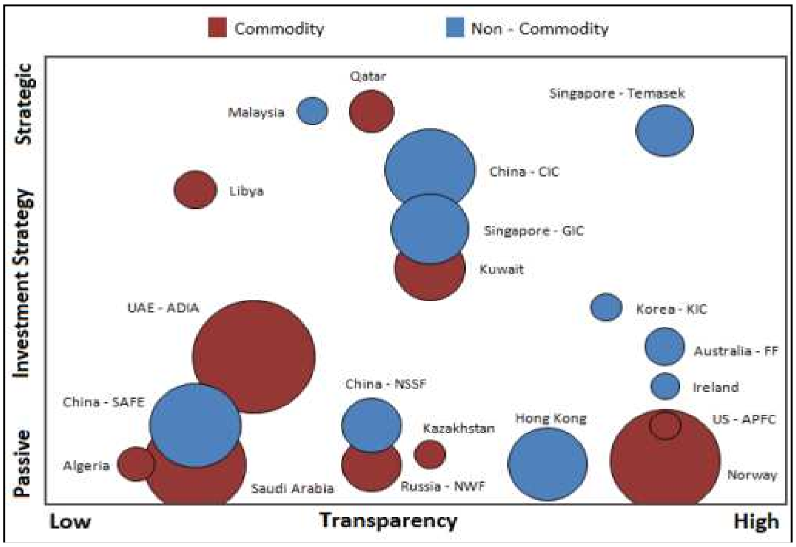
Table 18: Algerian merchandise trade balance 2007 (Faid, 2008, p. 114)

	Exports		Imports		Balance
Category	Million US$	Per cent	Million US$	Per cent	(in million US$)
Consumption goods	33	0.1	4,009	14.6	*-3,976*
Energy	***55,705***	***97.7***	***313***	***1.1***	***55,392***
Equipment goods	46	0.1	10,097	36.8	*-10,051*
Food products	87	0.2	4,827	17.6	*-4,740*
Primary products	170	0.3	1,227	4.7	*-1,107*
Semi-finished products	978	1.7	6,919	25.2	*-8,941*
Total	**57,019**	**100**	**27,441**	**100**	**29,577**

Source: Faid, 2008, p. 114.

Due to its relation to the oil and gas sector, developing a strong renewable energy sector for industry innovation, domestic use and power export, lends itself as an idea. In absence of national long-term strategies or national economic visions similar to those published by the Gulf States, the basis for a sound strategic analysis remains weak. In addition to that, the Algerian national SWF (Revenue Regulation Fund/*Fond de Regulation des Recettes,* FRR, see also Table 7) is not known for its transparency (see Figure 44). Therefore, while it could be possible that Algeria has purchased some strategic renewable energy assets through its SWFs, it appears rather unlikely, as no such news has ever been published by either the FRR or any cooperation partner.

Figure 44: Sovereign Wealth Funds: Strategy and Transparency



Source: Sovereign Wealth Fund Institute (online source) http://www.swfinstitute.org/2011/01, last accessed 04 January 2011.

Nonetheless, the subject of national economic diversification, of a post-hydrocarbons age, and its connections to renewable energies has often been highlighted by research interviewees. One interviewee stated for instance:

As a company investing in Algeria we are interested in diversifying the economy before our gas and oil revenues run out! We must be active! Unfortunately, while the discourse is the same in Algeria as in the Gulf States, not much action is taken here. (Interview no.7 – Private and public investor, Algeria)

Moreover, this line of argumentation is frequently reiterated in newspaper articles and interviews of decision-makers. In February 2011, for example, energy minister Yousfi introduced the launch of his new renewable energy investment programme by stating that that Algeria must prepare its transition towards renewable energies today to develop all aspects of this strategic asset domestically (APS - Algérie Presse Service, 2011c); a statement the minister reiterated during an interview on the occasion of the 40th anniversary of the Algerian nationalization of the hydrocarbons industries (APS - Algérie Presse Service, 2011d).[188] Also the fact that the substantial renewable energy export amount of 10 GW has been identified as a 2030 target in the government's 2011 renewable energy programme (Algerian Ministry of Energy and Mines (MEM), 2011, p. 4) indicates that rent income by renewable power is regarded by key Algerian energy stakeholders as a long-term substitute of hydrocarbon rents.

While ample space is given to this particular asset that renewable energy can represent, it remains doubtful whether this priority is always fully implemented in Algerian energy policy. As the regime-level analyses will show, essential aspects of a functioning renewable energy promotion regime are not in place. This can be interpreted in two ways: either, stressing the potential of renewable power for Algeria is a mere lip service to interested domestic and foreign audiences or the intent is real but insufficiently implemented. However, this debate is irrelevant to this subsection as either, way deci-

[188] Another example is Mokrane who writes in an article "It is well-known that the fossil energy reserves are destined to disappear successively. Thus, the future lies within renewable energies, and particularly…the electricity production through solar energy. Our country is banking on this energy carrier by making tangible commitments in this new era" (Mokrane, 2011) – translation from the French by the author.

sion-makers and interviewees in Algeria utilize the economic diversification argument for the spread of renewable energies.

Section conclusion

In Algeria, renewable energies are given a great role in the diversification towards a post-hydrocarbons era. The wish to remain in the energy exporting business is frequently voiced; Minister Yousfi's new renewable energy programme that includes a strong export share can also be interpreted as a step in this direction. Yet, as will be highlighted in the regime-level analysis of this case study, further major domestic framework conditions, such as a functioning renewable energy law, are yet to be met.

6.3.5. Country branding

Is country branding a catalyst in the spread of renewable energies?

The concept of country branding in Algeria is virtually absent. This is due to the fact that Algeria's political-economic system is still strongly shaped by its socialist tradition with a certain suspicion towards the private sector. Meanwhile, the very idea of assigning a "brand value" to an entire country is a capitalist, market-oriented idea of a west-centred economic globalisation most likely imported to the UAE, among others, by foreign consultants. Needless to say, Algeria also does not have a "National Brand Office" or similar institutions.

Algeria therefore ranks low on international indices, such as the Country Branding Index: whereas it was ranked 100th out of 110 in 2010 (in between Sudan and Ukraine) (FutureBrand, 2010), the same index ranked Algeria in 85th place in 2011 (FutureBrand, 2011, p. 79).[189]

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[189] This brand index is only quoted as an example. By no means does it represent a truly global perspective nor can it claim to be neutral. Instead, it is the work of a brand consulting agency with its own commercial interests and a methodology that cannot fully be assessed through its own publications.

Section conclusion

Given that the concept of nation branding is not part of the public (or experts') discourse in Algeria in itself, an interrelation with renewable energies, which is constructed in the UAE and some European countries, is absent. This is a clear underperformance, particularly if Algerian energy policy stakeholders are intent on carrying out their ambitious renewable energy production and industry programme.

6.4. Regime-level factors

6.4.1. Technological regime

6.4.1.1. Challenges for the power sector

To what extent are renewable energies employed to reduce pressure on the domestic conventional power plant park?

Currently, the Algerian electricity system is strongly based on gas power plants[190]. With an average annual growth of 5.6% in the last ten years (Commission de Régulation de l'Electricité et du Gaz (CREG), 2010, p. 9), the Algerian power sector is under pressure to extend the total power generation capacity, which has been at 9.1 GW in 2009 by 50% until 2019. In parallel to that, over one third of the power plant park has to be replaced with new production facilities (Commission de Régulation de l'Electricité et du Gaz (CREG), 2010, p. 8). This puts the power companies, most particularly the hegemon in power generation and monopolist in transmission and distribution, Sonelgaz, under extreme pressure. In support, the state has launched the extension and renovation programme of the power plant park and its transmission network that will cost a total of US$ 49bn until 2020 (UbiFrance, 2010a).

While the outlined planning procedures to modernize Algeria's power plant park are advanced and published by the MEM and the regulator CREG's annually updated "*programme indicatif*", the renewable energy section of these documents is less differenti-

[190] In 2009, Algerian power was produced as follows: 46% gas-fired power plants; 28% steam-cycle; 24% combined cycle power plants; 1% diesel; 1% hydropower and others (Commission de Régulation de l'Electricité et du Gaz (CREG), 2010, p. 9).

ated. However, the programme calculates two scenarios of 6% and 8% renewable energy quota by 2020, which equals to 1180/1675 MW renewable energy capacity. According to CREG, this means a 235/335 MW capacity extension as of 2015 (Commission de Régulation de l'Electricité et du Gaz (CREG), 2010, p. 23).[191] While the newly released renewable energy strategy presumes even higher renewable energy shares[192], all such plans appear very ambitious given that in 2010, Algeria's share of renewable electricity production remained negligible with a mere share of 0.02% of the installed capacity (UbiFrance, 2010b). However, this situation is bound to change in the 2011 statistics. In June 2011, the country's first hybrid gas/CSP power plant began producing electricity in Hassi R'Mel, Algeria's gas field area in the Sahara with a 25 MW solar electricity share (Abengoa, 2011)[193].

Moreover, a wind park close to Adrar will become operational in 2012 with a capacity of merely 10 MW.[194] Added together, however, the Algerian renewable electricity quota will remain below 1%.[195]

Algeria's aim to use solar-based renewable power generation technologies in an attempt to ease power demand at the day-time peak hours (see Figure 45) would therefore be warranted.

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[191] The same source predicts a majority CSP share, a much smaller PV share, and an only negligible share for other RE sources, mostly wind energy.

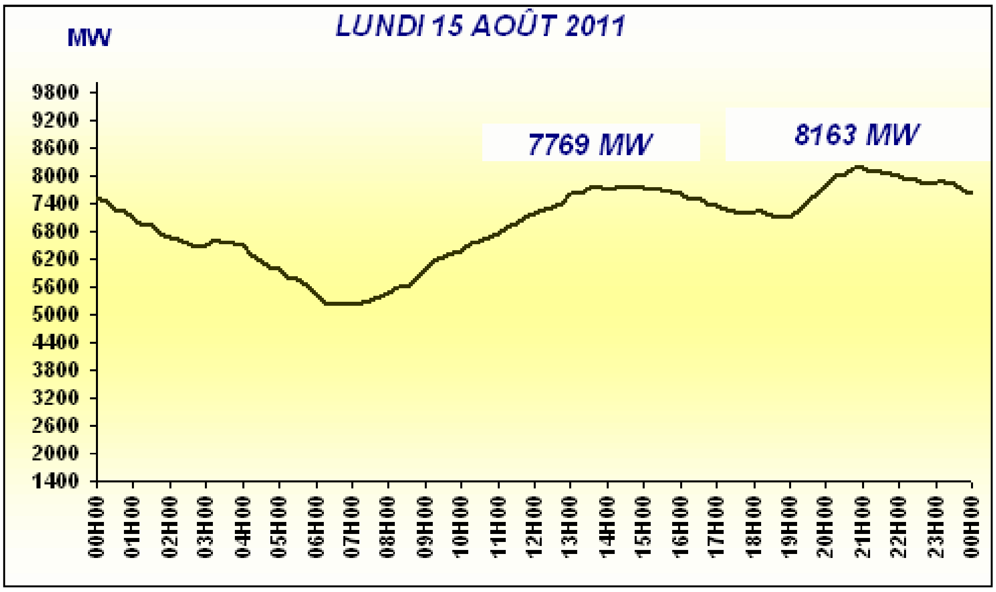
[192] For details see Subsections 6.4.2.1. and 6.4.4.1.

[193] The press statement by the power company as well as other reports failed to mention that the launch was delayed by almost two years, as a company's country representative confirmed (*Interview no. 11 – National and international power sector, Algeria*).

[194] While the national utility Sonelgaz will provide 30€m for the investment, the construction will be carried out by the French wind park developer Vergnet (Agence France Press, 2010).

[195] Furthermore, the construction of a gas-solar hybrid plant (*Le Midi Libre,* 2012) and another 150-MW CSP plant (APS - Algérie Presse Service, 2012) were announced recently. As building has not started yet, their announced finalization dates of 2015 have to be treated with caution given the delay of the Hassi R'Mel plant.

Figure 45: Algerian demand curve for a summer day in 2011



Source: www.ose.dz (Algerian systems operator), accessed 05 January 2012.

Section conclusion

While being less vocal than the UAE about its achievements, Algeria's system operator has already integrated a certain share of renewable electricity in its long-term plan. Thus, the potential of renewables to ease national power demand pressures is partially employed, at least within the relevant planning documents. Meanwhile, the peak-load capping potential of solar power generation ought to be upgraded in the future.

6.4.1.2. Renewable energy and the nuclear alternative

Is the nuclear option seen as a competitor in resources or as a mutually exclusive form of power production?

With its considerable nuclear research activity and its significant uranium deposits, Algeria currently owns one of the most advanced nuclear energy complexes in the MENA region. Indeed, nuclear energy policy on Algerian territory precedes the independent Algerian state: on February 13, 1960, France began to conduct a series of nuclear weapons test in the desert hamlets of Reggane and In Ecker. The last French nuclear test on Algerian soil was conducted on February 16, 1966. Algeria's nuclear energy research is mainly conducted in two centres, the *Centre des Sciences et de la Technologie Nucléaire* (created in 1976) and four regional centres under the auspices of the *Commissariat pour l'Energie Atomique* (COMENA); an agency created in 1996 that directly reports to the Presidential Palace (International Institute for Strategic Studies, 2008).

The Algerian government, a member of the IASA since 1963, has considered the possibility of nuclear power generation since 1974. A full-fledged nuclear energy programme that was mainly designed to save its own fossil fuel reserves for export into the world market was launched in 1981. Since the late 1980s, the Algerian programme has consisted of four facilities on two sites: the *Nur* (Arabic: "light") research reactor and a fuel-fabrication plant at the Draria nuclear complex 20km east of Algiers. Notably, the former 1MWt light-water reactor that went critical in 1989 has not been a turnkey operation. The Algerian government made sure that numerous Algerian engineers were involved in the project run by an Argentinean firm, thus guaranteeing a considerable knowledge and technology transfer towards the Algerian national nuclear programme itself. The second major nuclear site of the country is the *Es Salam* (Arabic: "Peace") research reactor in Ain Oussera 140km south of Algiers. A 15MWt heavy-water reactor was built by a Chinese contractor in line with an Algerian-Chinese nuclear cooperation treaty signed in the 1980s. Owned by the Ministry of Science and Higher Education, it went critical in 1992 (GlobalSecurity.org, 2012).

In the recent past, Algeria has taken new steps towards nuclear electricity production. In his opening address to the 2007 African Union conference on nuclear energy, President Bouteflika strongly supported Iran's nuclear plans accusing the global nuclear regime of unfairly denying emerging powers the support of the nuclear option (International Institute for Strategic Studies, 2008, p. 111). More substantially, on the national level, COMENA announced increased efforts in nuclear energy while the country's then-Minister of Energy and Mining, Chakib Khelil, confirmed the launch of a major nuclear energy scheme in 2006 with the ambitious goal of running a nuclear power plant in Algeria by 2015 (*algerie-dz.com,* 2008), which was later pushed back to 2020 (*Jeune Afrique,* 2009).

Regarding international technological cooperation, Algeria seems to opt for a multiplicity of options. In addition to its December 2007 cooperative nuclear energy framework agreement with France (*Le Quotidien d'Oran,* 2008), Algeria enjoys nuclear research and business relations with South Korea (Rafa, 2011)[196], Russia and the United States (*New York Times,* 2007). Additionally, Algeria has signed a uranium mining cooperation agreement with Jordan in 2010, which aims to enable exchange with the other major potential Arab uranium exporter (APS - Algérie Presse Service, 2010). However, at present, these uranium deposits are not being exploited. The French company Areva withdrew its initial bid both due to uncertainty regarding the actual amount of the findings, as well as because decision-makers in France were concerned Algeria would betray the initial exploitation deal and nationalize this industry if sizeable uranium deposits were to be found (*Interview no. 2 – public stakeholder, Algeria*).

At the present time, however, these plans appear to be somewhat far-fetched as neither has the uranium mining begun yet, nor has the current nuclear impasse with Iran, nor the Fukushima disaster helped furthering the cause for an Algerian nuclear programme.[197] Indeed, some Algerian energy experts doubt that any North African nuclear programme (including Algeria's) would be successful in the near future (Ihsane, 2011).

When asked about their view on nuclear energies, Algerian energy expert interviewees provided cautious answers, avoiding a candid analysis of the situation.[198] It also remained largely unclear whether they thought that an Algerian civil nuclear programme was imminent for the mid-term future, and whether a systemic competition with re-

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[196] The nuclear cooperation with South Korea is remarkable for two reasons. First, Algeria evidently attempts to cooperate with the same country as the only Arab country that is currently implementing a nuclear programme (the UAE, see Subsection 5.4.1.2). Second, this cooperation agreement is part of a much larger Algerian-South Korean framework of cooperation that has recently marked its 20th anniversary (Khris*,* 2011). Among other areas, it also covers the transfer of expertise in the construction of large eco-cities such as the *Nouvelle Ville Boughezoul* (see below).

[197] See *Le Quotidien d'Oran* (2011b) for a critical newspaper article in the post-Fukushima period.

[198] One Algerian interviewee stated that "people normally shy away from the nuclear issue because it is linked with nuclear proliferation and other security issues." The same interviewee also did not see a competition between the two forms of energy production; rather a possible complementarity (*Interview no. 14 – R&D, Algeria*).

newables indeed existed. Most likely, this was due to the military component as in many countries, nuclear energy is a matter of national security that is not as quickly and openly discussed as renewable energies. International interviewees working in the country were much more open. One of them aptly expressed the core opinion of the majority by saying:

I am absolutely certain that Algeria won't see any nuclear power plant for at least another 10 years, if not much more. To me, all those agreements Algeria signed look like mere rhetoric. (Interview no. 21 – R&D, Algeria)

Section conclusion

While Algeria had a noteworthy nuclear energy programme in the past, its present-day nuclear energy efforts have been weakened. This is due to current national and international landscape developments that make the construction of a nuclear power plant in Algeria unlikely. Consequently, it also has not published any schedule for a nuclear power plant. Thus, in the power sector, renewable energy and nuclear energy do not represent direct competitors. Unlike the UAE and their approach to renewables, Algeria also does not have a pronounced nuclear energy lobby that supports these plans. In the fields of research, however, competition might arise. With both renewable and nuclear energy research being conducted in Algeria, a direct competition between the two research areas for funding or political influence has not been found during the data collection phase.

6.4.2. User and market regime

6.4.2.1. Market conditions

Is there any system of renewable energy promotion in place?

Do stakeholders believe that the transfer of European renewable energy policy design models is a viable method for the spread of renewable electricity capacities in the region or would indigenous policy models work better?

In order to achieve Algeria's ambitious renewable energy targets, a set of policy mechanisms and regulative frameworks has been established, which, in principle, operate with the goal of stimulating renewable electricity growth along the lines of a market logic.[199] Similar to the German Renewable Energies Act (EEG), Algeria's 2002 Law on Electricity and Gas Distribution liberalizing the power market incentivizes the construction of renewable energy power production by paying premiums and tax reductions to the power producers. Two years later, a decree on the diversification of power generating costs further introduced feed-in tariffs for various sorts of "green" power. The current feed-in tariffs are the following (AHK - German-Algerian Chamber of Commerce and Industry, 2009):

1. Solar power stemming from combined-cycle plants is paid a premium of 100% and up to 200% of the standard electricity rate, depending on the share of solar energy in the project, which needs to be at least 5% of the total production of the power plant (§ 12)
2. Electricity from waste receives 200% of the standard rate (§ 13)
3. Electricity generated by hydropower receives a 100% premium (§ 14)
4. Wind power is remunerated with 300% of the KWh-rate (§ 15)
5. A "pure" solar power plant receives 300% of the standard rate (§16)
6. Cogeneration through steam or hot water receives 160% of the standard rate, as long as the overall capacity does not exceed 50MW (§ 17)

The combined circle power plants even receive an extra premium since the Algerian Ministry of Energy has classified this technology as the most efficient means of renewable energy power production in the country. With the introduction of this renewable energy law Algeria currently possesses one the most advanced renewable energy promotion tools at its hands in all of Africa and the Arab world. However, so far, the 2004 law is yet to be applied in the country. As one interviewee put it:

I have led a business delegation to the general director of CREG. He openly admitted that the law as such doesn't function and does not attract any investors, as it is lacking the administrative decree to be applied and does not give investors reliable figures about their return on investment. Also, if the renewables premium really remains fixed

[199] This is by no means self-evident. As will be presented below, much of Algeria's energy programme does not follow market logic.

to the gas price it will be much too low anyway. So, while the director told us about a future re-launch of the law as things are standing now, the law is totally dysfunctional. (Interview no. 4 – public stakeholder, Algeria)

Thus, even eight years after its release Algeria's renewable energy law is still not applicable. While Algeria has a relatively advanced renewable energy policy, it is striking that its policy attempts have been limited to structural and regulatory amendments rather than innovative projects as presented in the UAE case study.

In response to why the process has been stalled for so long, one interviewer stated:

Even for Algeria it is most unusual that this takes so long. I think the MEM has long since stalled the law due to a general lack of awareness and also in order to counteract the Ministry of Environment. I am not sure, if people really wanted the renewable energies law in 2004, it was just a trend to make it. The Ministry of Environment pushed it a lot in the government, but they were basically the only ones. (Interview no. 147 – R&D, Algeria)

Most likely, this stalling is owed to the interlinkage between factional interest and a weak state. In addition to this major limitation of the current system, an equally challenging obstacle is the fact that the Algerian energy market is yet to be fully liberalized and that it works – in parts – outside of a market capitalist logic. This means that renewable energy promotion schemes that are designed for European entrepreneurs (as the 2004 law) do not necessarily fit Algiers. The best example of this is the subsidized electricity price: in 2009, Algerian electricity rates for non-commercial power ranged between 2 and 3 Euro-Cent/KWh, about 50% of the EU market price (*Interview no. 14 – R&D, Algeria*), rendering renewables hardly cost-competitive. Recent reports cite the government's intention to gradually adjust national energy prices to the actual generation costs (Zidane, 2006). However, given the volatile situation in North Africa after the Arab Spring, in addition to the key role the provision of cheap electricity plays in making the population honour its side of the "ruling bargain" it appears doubtful that the Algerian government would indeed consider such an unpopular move. Indeed, an Algerian energy official corroborates this inference:

In 2009/10 Sonelgaz wanted to raise the general price of electricity – but the government intervened and made them retain this artificially low price. (Interview no. 9 – national and international power sector, Algeria)

In January 2010, in an attempt to stimulate growth in the renewables sector, a renewable energy fund was introduced in order to bridge the gap between energy price revenues and investment costs.[200] Yet, as its financial resources remained limited, its impact remained small and it has been dismantled. As one interviewee put it, essentially, the assessment of the RE promotion system, be it quota- or FIT based, is always the following:

I think that in principle, FITs should be working well, as long as the payments to producers are really guaranteed. Yet, the question that EVERY system has to answer is the following and is very simple: who pays for the gap between the LCE prices of renewables and those for conventional power? Is it the state or the customer? Basically, these are the only real choices there are. (Interview no. 37 - Private and public investors, Europe)

As demonstrated, the current renewable energy promotion regime is, at best, flawed. Thus, a certain caution has to be exercised upon approaching the newly launched renewable energy programme (Algerian Ministry of Energy and Mines (MEM), 2011) with its above-mentioned capacity additions and an approximate investment volume of US$ 60bn (Razzouk, 2011).[201]

With regards to the second issue in this subsection, the transfer of European renewable energy governance models has already taken place in Algeria, at least insofar as the transfer of the concept of feed-in-tariffs is concerned. While, evident by the interview quotes below, also the quota model is a widely known form of renewable energy promotion, Algerian decision-makers have opted for an FIT model. However, the failure of this promotions law in the last eight years has also shown that the immediate transferability of government models is bound to fail due to a variety of reasons, such as conflicting intra-governmental interest groups and the not fully liberalized energy market. This made it difficult, if not impossible for the market-based FIT incentive system to succeed, as one interviewee emphasised:

[200] See Subsection 6.4.4.1 for more information about the Algerian renewable energy fund.
[201] The programme is to be launched with a start-up and test phase until 2013 and then transform into its deployment phase until 2015, with a final, large-scale roll-out plan between 2016 and 2020 (Portail Algérien des Énergies Renouvelables, 2011c).

Before (in 2010) the new RE investment fund was released, the renewable energy law performed very poorly. Not only did it take much too long to implement, it also didn't promote private sector companies or initiatives at all. It was totally state-centred. I think this will also be the case with the new instruments and programmes released. (Interview no. 7 – public and private investors)

Contrary to the UAE system, characterized by a bottom-up, project-based approach to promote innovation in the energy sector, Algerian decision-makers have opted for a different approach. They chose a top-down model of change management based on the power of legislative regulation. However, its poor performance casts doubts on the success of this approach. By and large, interviewees in Algeria were more critical than their Emirati counterparts about taking over regulatory or other governance models from Europe. However, when it came to regulatory innovation in the energy field, interviewees in both cases inadvertently turned towards European concepts.[202] Certainly, foreign models need to be modified (or the systemic environment adapted accordingly) if they are to come to fruition in Algeria. In the view of non-Algerian renewable energy experts, however, the long-term influence of European regulation on Algeria is expected to remain for the mid-term future. As one interviewee stated:

Probably, the European initiatives such as the Mediterranean Solar Plan or the Dii will slowly pull the Mediterranean Arab states into the regulatory framework of the EU. (Interview no. 28 – public stakeholder, EU)

However, other experts were cautious when it came to determining a specific regulatory system:

Let's not forget that actually, everything is only second best – if it is FIT or obligations or whatever – these are all subsidies to counterbalance the distorted energy markets in general. I think an obligation of the (former) energy monopolists could be easiest and most viable. However, FITs might bring in some more dynamics into the market; we have seen how much they were driven from small projects in the EU in the beginning – this could also be an entry option there. (Interview no. 33 – public stakeholder, EU)

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[202] Part C will deal in greater detail with a comparison between the results of the two case studies both with regards to material policy options (in Subchapter 8.1; the Chinese energy governance models will be proposed as a potential substitute for an EU-inspired model) and the results in terms of renewable energy governance theory (Subchapter 8.2). As will be argued there, while a general criticism towards the uncritical takeover of non-native governance should be avoided, the Arab countries are yet to develop fully home-grown renewable energy governance concepts.

There is therefore no doubt that the proximity to Europe, and the longstanding exchange of ideas and experts be it willingly or through French colonialism enabled the diffusion of regulatory concepts to a certain extent. However, the actual application to the Algerian context can only be successful with additional autochthonous elements of renewable energy governance or at least international models tailored to the Algerian context.

By and large, stakeholders were sceptical towards extremely large structures. As one interviewee stated:

In general, these mega-structures which politicians love are unlikely to succeed in real life, as they are prone to failure. Instead, we should follow a bottom-up approach. We should build small, easily reproducible structures that can be tested, improved and then scaled up at a later point in time instead of the opposite, which is starting as big as possible and then learning after big losses. This, I think, would also help local industries to develop. (Interview no. 14 – R&D, Algeria)

This position was reiterated by a European stakeholder:

Most basically, what is missing is the economic soundness of the renewable promotion system. I think, what could be of interest is a decentralised deployment of renewables, not these huge structures alone. One efficient way to start might be mini grids for the many off-grid areas in the country, of small villages that could then be scaled up in the medium term, but in any case a decentralized system. (Interview no. 25 – public stakeholder, EU)

As a result, while the need for Algerian renewable energy policy to develop its own models of renewable energy promotion, scale-up and deployment is frequently stressed, its results remain weak and cannot be called a full-fledged strategy. However, the governance elements that are in fact outlined by interviewees are diametrically opposed to the very large-scale approach the Algerian energy decision-makers prefer. Indeed, these elements of decentralized renewable power production and gradual scale-up are very close to the models used by successful European nations. While the German FIT model was mostly mentioned in interviews, arguably because this promotion type has been chosen by the Algerian legislators, the quota model is also referred to as another possible renewable electricity promotion option. However, both models do not represent a conceptually new approach, but rather an already existing one that is diametrically opposed to the large-scale model favoured by influential decision-makers. Consequently, what the data shows is much less a quarrel between local and international governance concepts, but rather a struggle between two opposed international models, one promoting industry-size power plants, the other one a system of decentralized, small installations, which will be scaled up in the future.

As these two models have – in principle – covered the range of what is possible as renewable energy promotion measure; there is a more fundamental issue to be raised here. Is Algeria in need of a genuinely native renewable energy governance model? Is this the "missing link" required for international governance concepts to work in Algeria? It would appear that this notion cannot be verified by the data. This would mean that, the discourse on nationalizing theory would need to stop here. What would remain is theory-building that is abstracted from certain regions and the development of a range of models that aim (and claim) to work globally with slight regional adaptations respectively.[203]

Section conclusion

In contrast to most other Arab countries, particularly the hydrocarbons-rich states, Algeria has a long track-record of renewable energy research, promotion programmes and legislation. Yet, this does not mean that its installed capacity is of a sizeable amount. This is due to the phenomenon that once-released laws are blocked by the administration and that key market barriers such as energy pricing are still in place. This history of excellent promises and weak implementation also casts some doubt on the newly released major renewable energy programme. Essentially, Algerian stakeholders will have to decide on whether they want renewable to spread, and, if so, whether they favour a purely market-based system or a government-induced and -coordinated system. Currently, there is an unproductive mixing of both systems, which produces the most undesirable result of all: nothing.

[203] Again, cf. Part C for more in-depth discussion on that aspect.

As has been shown, the diffusion of regulatory concepts from neighbouring Europe can be expected and has partially occurred. Yet, as the example of the feed-in-tariff law shows, the uncritical transfer of Western governance usually remains unsuccessful. Still, various types of conflicting forms of renewable electricity promotion such as FITs or quotas developed in “the West” and mostly also by “Western” scholars appear to be the only models currently in use in Algeria. As the dispute between large-scale, centralized and small-scale decentralized concepts of renewable energy promotion demonstrates, the fault lines do not appear between local and international/Western concepts, but rather between different types of international models.

This dispute notwithstanding, mainstream political decision-makers in Algeria appear to be set on a course favouring industry-sized megaprojects, probably also because these are easier to control and to integrate into the current energy system with its monopolistic structures.

6.4.2.2. The system of double subsidies

Are strategies developed to create a level playing field for all types of energy carriers by either removing subsidies for conventional power or by integrating renewable electricity into the existing subsidy schemes?

As Table 19 shows, electricity rates for end consumers is heavily subsidised in Algeria. Including fuels, Algeria spent a massive 6.6% of its overall GDP on energy subsidies

Table 19: Algeria's fossil fuel consumption subsidy rate as a proportion of the full cost of supply 2008-2010

Subsidy by fuel (US$ bn.)			
Fuel	**2008**	**2009**	**2010**
Oil	5.9	4.02	8.46
Gas	0	0	0
Coal	0	0	0
Electricity	2.36	1.29	2.13
General values for 2009			
Average subsidy rate			59.8%
Subsidy in US$/person			298.4
Total subsidy as share of GDP			6.6%

Source: International Energy Agency (IEA) web service (http://www.iea.org/subsidy/index.html); last accessed 10 January 2012.

As a result of these artificially low prices, which are below the gestation price, no alternative form of energy production can compete on the regular electricity market. This is an additional liability for renewable electricity that is currently still more expensive than conventional power even in fully liberalized power markets. While, as has been argued, it is currently unlikely for a full-fledged electricity price reform to occur, the only solution for upgrading the renewable electricity share in the Algerian power market is the integration of renewable electricity into the government-backed subsidy schemes. This would result in a higher renewables quota, but would simultaneously mean an additional cost for the subsidizing state agency compared to a scenario in which only conventional capacity would be added. Given the publication of its new renewable energy investment programme, a decision to integrate renewables into parts of the funding scheme has evidently been taken within the MEM.

While this represents a major step forward for the spread of renewables in the country, this also means that no independent power producer can easily enter the Algerian market, as the market prices it can offer are kept artificially low, and FIT system will continue to be ineffective. Thus, only companies with a good rapport to the major stakeholders (and subsidy distributors) of the Algerian energy scene will effectively be able to profit from the large-scale renewable energy expansion scheme. This is not only the case because of the funding schemes but also due to the on-dominance of pivotal systemic actors, particularly the CREG. As one interviewee stated:

The permission for all kinds of renewable energy projects in Algeria is granted by CREG. An interested investor approaches them and declares his interest in a series of informal meetings. Then, if he succeeds, CREG issues a tender and most likely, the project developer will get the project. This means, that nothing goes without the CREG in this market. This yes/no position of CREG effectively prohibits the development of a free market such as in Europe, where developers can just build their project without the approval of such an organisation. (Interview no. 9 – National & International power sector, Algeria)[204]

Thus, current market and power structures mean that the FIT system will play only a minor role in Algeria's energy future. By means of the subsidy issue, renewables, as well as the entire Algerian electricity system, are effectively still run on a quota system, which allows for favouritism, market control and perpetuates the existence of pivotal, opaque systemic actors like CREG.

<u>Section conclusion</u>

Energy stakeholders in Algeria are acutely aware of the system of subsidies in the country and voiced quite pessimistic views regarding the possibility of change (i.e., the removal of electricity subsidies altogether) in the immediate or mid-term future. This means that while a spread of renewables is neither inconceivable nor unrealistic, MEM and CREG-affiliated energy elites will retain their control over the design of the power plant park as well as over who is awarded the capacity extensions construction contracts. Independent power production – be it on a large scale or bottom-up – as intended by the system of freely available FITs, will be effectively kept out of the market. The state, therefore, returns to an implicit quota system ruled by government (particularly the MEM) and the hydrocarbons-dominated energy elites.

[204] In addition to what the interviewee stated, this also opens the door to grand corruption.

6.4.3. Socio-cultural regime

6.4.3.1. Social acceptance of RETs, potential role of religion or environmental ethics

How widespread is the knowledge of renewable energies in the target countries? Does religion play a role in legitimizing this energy technology?

Generally speaking, there is considerable public knowledge about renewable energy in Algeria, not only due to Ministry of Environment-sponsored awareness campaigns but also due to the fact that in countries where wealth is based on hydrocarbons, energy topics are in general much more prevalent than in countries where this is not the case. However, as actual installations are not widespread, much like in the case of the UAE, there are only few occasions for the general public to interact with this technology. As one interviewee put it:

Unfortunately, renewable energy and environmental awareness is currently not very high on the schools' teaching agenda. But the Algerians for sure know of the potential of renewable electricity, both for the immediate energy needs as well as a potential income generator in a post-hydrocarbons era. However, the people are usually interest most when they can save money, which is usually still difficult with renewables. The government (APRUE agency) recently launched a very successful programme during which 100.000 low-energy light bulbs were distributed to people. This programme was funded by the Algerian Banque de Developpement Locale *and went very well.* (Interview no. 15 – R&D, Algeria)

Meanwhile, other researchers suggested that the lighting of the new East-West coastal highway could be powered by renewables (*Interview no. 16 – R&D, Algeria*). However, this is not seriously debated by decision-makers at the moment.

Regarding the second aspect of this research question, the Algerian political-military elites, in light of the Algerian civil war, have an uneasy relationship to religious references in any political context. Apart from the fact that some mosques' roofs are used as carriers for solar water heating, public references in all major policy documents remain strictly secular. This is also the case for the government agencies and schools working on awareness-building campaigns.

Section conclusion

Undoubtedly, Algeria's general public, and even more so its stakeholders, are aware of the existence and potential of renewable electricity, not least due to successful awareness campaigns by government agencies. However, the spread of solar or wind installations remains limited for the time being, which might change soon due to the large-scale programme launched in 2011.

This massive programme might also help to build awareness on a local level that so far remains an undertaking based on environmental ethics rather than religious reference systems.

6.4.3.2. Labour markets

Is the job creation potential actually employed by promoters of renewable electricity in the country?

As discussed in the corresponding Part A, the theoretical job potential for renewable energy employment is large.[205] While only a fraction of these jobs are actually on the market, the situation is, by and large, better than in the Gulf States, albeit with much lower salaries, as several interviewees confirmed. The renewable energies job market in Algeria is dominated by public sector jobs such as the specialist CDER with its branches all over the country, as well as several engineering university positions, for instance at the universities of Algiers and Oran. Apart from this, some jobs are available in the private sector: the semi-public specialized company NEAL is most prominent, but also the largest Algerian conglomerate Cevital has a renewable energies branch.[206]

Apart from that, both the recently launched silicon wafer factory *Rouiba Eclairage* and the 2011 large-scale renewable energy programme by the MEM will create further renewable energy employment in Algeria. Journalists already forecast the creation of one hundred (Portail Algérien des Énergies Renouvelables, 2011f) or even two hundred

[205] See also a recent study on potential labour market effects in Algeria through domestic renewable energy industries (*Portail des Energies Renouvelables en Algérie,* 2012a).
[206] The role of Cevital in the renewable energies business is a remarkable one. See also Subchapter 6.7 for more information on Cevital's early role in Dii.

thousand jobs in the Algerian renewable energy by virtue of the 65 planned projects (Korso, 2011), with 50 per cent produced by the power exports and by national renewable energy demand respectively. Experts expressed more caution arguing that the successful establishment of an Algerian renewable energy technology industry is, at best, unlikely (*Interview no. 45 – R&D, Europe*). Without such domestic companies, the aforementioned labour market figures could never be achieved.[207]

This notion is also confirmed by an independent assessment of the value chain effects of the only existing Algerian larger-scale renewable energy project in Hassi R'Mel within the framework of a regional comparative study on value chain effects of renewables in North Africa:

A very large share (up to 90 per cent) of all equipment and components is imported: there is no local share in the manufacturing of the solar field. Civil work at the Algerian site costs up to 30 per cent more than in Spain. Abener is expecting that future projects can use a locally produced steel mounting system. Although some know-how for project development of conventional power plants exists in Algeria, the engineering, procurement and construction (EPC) contractor is always an international company. A local company, Sarpi, provides electronic equipment for the plant. An Algerian engineering company (Algesco) will provide turbine maintenance during operation…Although this analysis finds that the Algerian industry could play a role in local manufacturing, the share of local involvement in the current project is very low. Even components and services with a lower technology level have been provided by international companies (Ernst & Young & Fraunhofer Institute, 2011, p. 11)

In short, labour market effects have been used to justify the planned large-scale deployment of renewable energies in Algeria. Regardless of whether these extension plans will actually come to fruition or not, it remains doubtful whether the Algerian labour market can indeed profit from that to the desired extent.[208]

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[207] To put this number into perspective: Germany, the world's biggest employment market for renewable energies both due to local demand and strong exports, currently employs a work force of 340.000 (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2010, p. 18).

[208] See also Section 6.5.1 for further reflections on Algerian technology transfer, as well as science and industry policy.

Section conclusion

Similar to the Gulf States, the theoretical job potential in Algeria is high. As Algeria does not host a large expatriate work force, it does not have similar issues with regards to of locals' or expats' access to the labour market. Although high hopes are pinned on the incoming renewable energy programme, independent studies expect the yield for the domestic labour market to be substantially smaller.

6.4.4. Policy regime

6.4.4.1. Renewable energy targets and actual performance

Is there a (binding) strategic document, such as an energy roadmap/blueprint or at least a non-binding planning scheme? If so, how does this integrate renewable electricity?

As has been shown, the 2004 renewable energies act did not yield the desired results. Acknowledging these setbacks, decision-makers announced a further funding instrument towards the end of 2009 (*Interview no. 4 – Public stakeholder, Algeria*). Moreover, President Bouteflika established a renewable energy fund[209] in the 2010 financial law, which was designed as an interim period during which a full-scale review of the current renewable energies act could be carried out. The fund is designed to receive 0.5% of the *fiscalité petriolière*, a tax paid by the foreign hydrocarbon companies working in Algeria. Depending on the extent of this important, but fluctuating government revenue[210] it will provide renewable energy businesses with approximately 40€m per annum. Compared with the subsidies spent on renewable energy technologies in Europe, this appears rather modest. Moreover, it remains unclear which ministry or government agency will actually administer the fund (*Interview no. 2 – Public stakeholder, Algeria*). Still, this can be regarded as a first step to counterbalance the flawed 2004 law. Generally speaking, there is a difference between Algeria's binding renewable

[209] *Le président Bouteflika signe la loi de finances 2010* (République Algérienne Démocratique et Populaire: Portail du Premier Ministre, 2009).
[210] In 2009, this tax accounting for 62% of all government revenues dropped by almost 50% in comparison to 2008 (*El Watan,* 2010).

energy system and its de facto ineffectiveness. While the incoming minister Yousfi's new renewable energy programme (Algerian Ministry of Energy and Mines (MEM), 2011) is even more ambitious than that of his predecessor's, in light of the poor record of previous promotion programmes it remains to be seen how many of the 65 projects (Portail Algérien des Énergies Renouvelables, 2011c) will in fact be realized and how long this will take. As one interviewee stated:

Let's not forget that there have been many readjustments of former goals through the backdoor without anyone noticing. The renewable energy quotas were always pushed back. That's why I am very critical about the seriousness of these new plans. I think, we should read them as declarations of intent rather than as rock-solid, detailed capacity extension plans. (Interview no. 18 – R&D, Algeria)

This interviewee alludes to the fact that the CREG's former *programme indicatif* (Commission de Régulation de l'Electricité et du Gaz (CREG), 2008) used to display very different figures and time lines for renewable electricity capacity extensions from the latest version of this official planning document (Commission de Régulation de l'Electricité et du Gaz (CREG), 2010). Also, as the same interviewee highlighted that Algeria originally had published the plan for 5 per cent RE by 2010, which was later pushed to 2015, which again appears to be ambitious given the less than 1 per cent quota at the current moment.

As has been shown before, the MEM attempts to integrate renewable energies mainly through a government-funded action plan. Although the FIT system is dysfunctional and the power prices for end consumers are kept artificially low well below market prices, this is also the only possible way to integrate RE into the Algeria energy system at all.

<u>Section conclusion</u>

As demonstrated, Algeria has a published set of renewable energy policy documents, government policies and a renewable energy law. This puts it into a unique position among the hydrocarbons-wealthy Arab states. However, it remains debatable how credible the currently advertised large-scale capacity extensions as many goals had been tacitly readjusted in the past because of the difficulty in realising them on schedule. Thus, while the set of renewable energy regulation appears well-constructed and solid, its performance has largely been characterized by ineffectiveness. This asymmetry between ambitious political targets and the actual performance on the ground has to be appreciated for policy design as it exposes the little value of adapting foreign laws without the intent of the relevant actors to actually change the energy governance system on the ground.

6.4.4.2. Regional infrastructure and electricity governance bodies

Do the regional electricity governance bodies promote political or infrastructure projects that enhance the role of renewable electricity in the target country? Is external demand a pull factor in that respect?

On the whole, the regional electricity governance bodies in the Maghreb are very active compared to the Gulf. This is due to the fact that Algeria is not only part of the inter-Maghreb/North Africa governance bodies such as COMELEC, but also part of the often EU-funded trans-Mediterranean groups such as MEDREG/MED-EMIP (Euro-Mediterranean Energy Market Integration Project (MED-EMIP), 2010c) operating with the goal of creating a trans-Mediterranean grid network that allows power flows around and across the Mediterranean.

Regional initiatives are regularly well-supported. In 2010, the new energy minister Yousfi signed an agreement with his Moroccan and Tunisian counterparts regarding the successive electricity market integration and the eventual merge of its energy market with the EU (*Equilibres - La Lettre de la Commission de la Régulation de l'Electricité et du Gaz (CREG),* 2010). While a full market merger appears to be rather far-fetched for the time being due to the large differences in market prices, the intra-Maghreb grid interconnections are continually upgraded thereby allowing power flows in demand peak situations. The Pan-Arab council of energy ministers has also worked towards this aim (Portail Algérien des Énergies Renouvelables, 2011e).

However, these cooperation agreements do not have a specific focus on renewable energy. The aim of these initiatives is merely to strengthen the regional grid network. This could also help stabilize the grid through a more diversified load management system thus allowing for more intermittent renewable electricity in the system. However, such purposes have not been made explicit so far. While the prospect of renewable power floating through these networks might appear attractive, many stakeholders might actually have other plans in mind while extending these grids. As one interviewee put it

I am concerned that we will rather see France selling its nuclear power to Africa than African green power being sold to France. (Interview no. 31 – public stakeholder, EU)

In a nutshell, in the current state of affairs, it is uncertain whether a larger Mediterranean power ring will indeed become a reality and – if this was to happen – it is unclear what kind of power would be sold to whom. In line with the interviewee, the only current example of a EU-North African grid connection (Spain-Morocco) clearly shows a flow towards North Africa, and not vice versa (see Figure 22).

Yet, despite all that criticism, the existence of the renewable energy markets in the 27 EU member states and their 2020 climate change mitigation targets has a tangible effect on Algerian renewable energy policy. The massive amount of 10 GW renewable power generation capacity that are scheduled to be built in the Algerian electricity network by 2030 according to the recent renewable energy strategy are indicative of that (Algerian Ministry of Energy and Mines (MEM), 2011). It is, therefore, evident that the extraterritorial politics of a regionally important power can cause domestic policy change in this area as it can be assumed that the existence of such a large market at Algeria's doorsteps and the on-going, early efforts regarding trans-Mediterranean renewable energy projects (see Subchapter 6.7) has impelled Algerian decision-makers to launch this large-scale programme both for domestic consumption and international export. Furthermore, this programme indicates the notion that Algeria is motivated to remain in the energy (exporting) business. Also, it is likely that Algeria intends to fund its domestic renewable capacity extensions, which incur heavy costs due to electricity price subsidies, by using its export revenues of its renewable power to Europe (*Interview no. 40 – R&D, Europe*).

Section conclusion

The intra-Arab electricity grid connections as well as the grid across the Mediterranean reveal that regionalism is on the rise. While the increased system stability of such systems could also allow for more renewable energy in the system, this might merely be a side-effect as the inter-Arab electricity cooperation does not actively promote it. On the other hand, European renewable energy policies have a substantial impact on domestic plans. As the example of scheduled massive export capacities shows, these landscape-level developments have a strong influence on the Algerian policy regime.

However, even if such a trans-Mediterranean power market was to be established, it still remains likely that most of the power transports in both directions would either be based on coal (North Africa to Europe) or on nuclear energy (Europe to North Africa).

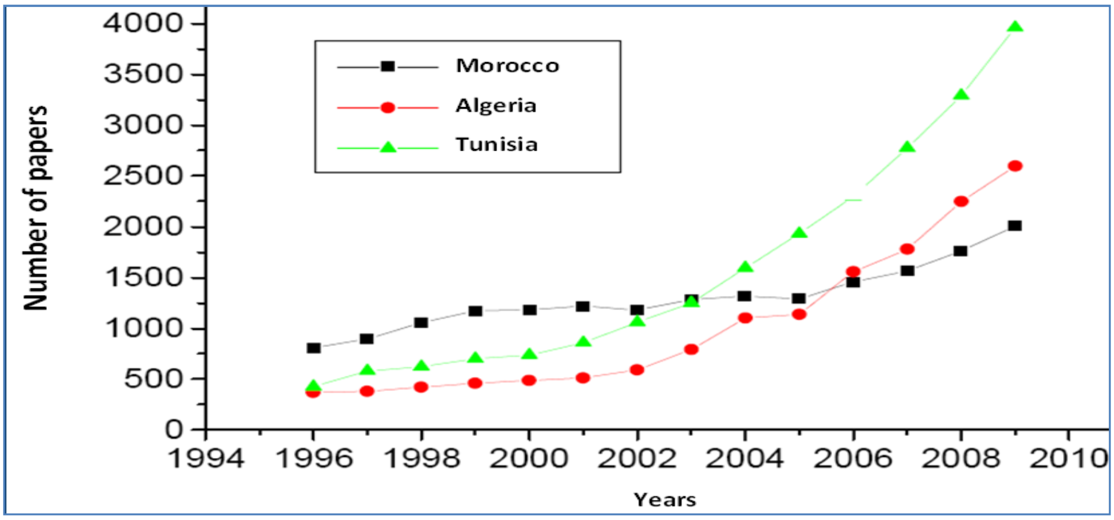
6.5. Niche-level developments

6.5.1. Science regime: R&D and industry structures, technology transfer strategies

Is there an attempt to create a domestic knowledge hub for RETs and is there an industry structure that supports the spread of technologies into mainstream society?

The limited maturity of the renewable energies markets in the Maghreb is also reflected by a lack of specialized educational programmes both on the professional and the university level. Although the number of scientific publications in all Maghreb states is on the rise (see Figure 46), RET-related patent registration in the region remains strikingly low. While immensely underrated, Algeria has taken tangible efforts to create domestic knowledge hubs and a local RET industry in recent years.

Figure 46: Evolution of scientific publications in Morocco, Algeria and Tunisia 1995-2009



Source: Kumetat & Hamiane, 2011, p. 28.

For instance, a long and solid experience has been gained over the last decades and a wide range of high level courses has been developed in the field of hydrocarbons. Yet, trainings and education in the field of renewables were often limited to researchers' level rendering the currently existing RE-dedicated courses very limited. A first post-graduate school (*Ecole Doctorale en Energie Renouvelables*) was launched in 2006 by the Algerian Centre for the Development of Renewable Energies (CDER) in cooperation with a number of Algerian research institutions and universities (*Interview no. 15 – R&D, Algeria*).

However, as previously delineated, this institution has only little direct influence in the policy process as it falls under the supervision of the Ministry of Higher Education rather than the Ministry of Energy and Mines. Its weak or inexistent links to industry and energy policy have so far made its development into a technology hub an unlikely scenario. In January 2011, a new institute was opened that might serve this function, the Algerian Institute for Renewable Energies (IAERE). Founded by executive decree no. 11-33 ("*Décret exécutif n° 11-33 du 22 Safar 1432 correspondant au 27 janvier 2011 portant création, organisation et fonctionnement de l'institut algérien des énergies renouvelables*.", 2011), this institute is under the tutelage of the MEM, and is located close to the major gas fields and Algeria's first operating hybrid CSP-gas plant in Hassi R'Mel. In addition to hosting postgraduate studies and short-term trainings for companies, its goal is to closely interact with industry to generate relevant innovation in the field (*Le Maghreb - Le Quotidien de l'Economie,* 13 March, 2011). As its current director stated:

The new institute's proximity to industry will enable us to conduct relevant research with good results for our domestic industry (Interview no. 17 – R&D, Algeria).

The attempt to carry out renewable energies-related R&D in Algeria might therefore be crowned by success.

Another notable project is the *Ville Nouvelle Boughezoul*, which was launched by the presidential decree no. 479 on April 1, 2004. The declared goal of this project is to build a large eco-city on the Algerian plateau, with original designs proposing to house up to 400,000 citizens and to function as a cleantech technology cluster much like the UAE's Masdar project (*Bilateral - Bi-monthly magazine of the German Chamber of Commerce and Industry, Algiers,* 2008). The city will host four research institutes on agro-ecology, renewable energy and energy efficiency, environmental technology, and urban planning. With an estimated size of 1.900 hectares it will retain much space for an extension. According to one interviewee, Boughezoul is meant to be a pilot project. Based on the project's success, up to four other similar cities – most of them smaller and located deeper in the South – are to be built (*Interview no. 5 – public stakeholders, Algeria*).

In order to make this city a reality, the Algerian Ministry of Environment, which is leading the project, has attempted to cooperate with international partners: in 2009, a visit by the then-German Minister of Environment, Sigmar Gabriel, led to the launch of an intergovernmental cooperation and to a feasibility study conducted by three German urban planning firms (*Interview no. 5 – public stakeholders, Algeria*). A French team of researchers also cooperated with the ministry (*Portail des Energies Renouvelables en Algérie,* 2012b). Boughezoul is scheduled to be completed by 2025; its overall investment volume is an estimated US$ 100bn. According to recent reports construction is scheduled to begin in 2013 (Abdelhadi, 2012).

However, some stakeholders doubt this project will ever be realized. In contrast to Masdar, most activities have so far been only oratorical with nothing substantial taking place in the field. Projects like Masdar have revealed how difficult it is to build a full city from scratch, and it is doubtful whether Boughezoul's attempt would be less fraught with difficulties. Despite the benefits of founding new cities, which would ease the pressure on the coastal zone of Greater Algiers, establishing a new urban centre that can offer a convincing, long-term alternative to the capital is a challenging task. One German stakeholder criticized:

Well, this city Boughezoul project – I don't really see it happening. While an Algerian ministry official told me that Minister Gabriel had made promises during his visit that he hadn't kept, we have a rather different opinion. We asked the Algerians for many things, deadlines, project volume and size, tangible building plans etc. – no one in Berlin has ever received clear answers about these issues. (Interview no. 25 – public stakeholder, Europe)

Figure 47: Site of the Nouvelle Ville Boughezoul in October 2011

[[This content has been removed for reasons of copyright]]

In addition to the organisational challenges of international cooperation, a sceptical journalist described this project as a mixture of the outdated concept of a planned megacity applied to the wrong country in the wrong location (Sabatini, 2011) (for the current state of the site see Figure 47). The same author continues:

The Boughezoul presentation video is quite a strange mix of 2001 Space Odyssey-like images, basic explanatory figures and a list of all the global urban regeneration clichés about green spaces, luxury, and leisure-based activities (*ThinkAfricaPress,* 2011).

Many more questions regarding the city's population, its livelihood, its water reserves currently remain unresolved. Also, the fact that the project does not even have its own website and that its staff were unavailable for research interviews raise severe doubts about the feasibility of this project. In conclusion, while in principle, *Nouvelle Cité Boughezoul* has the potential to become an internationally recognised eco-city, the rather modest success of eco- and garden-cities worldwide, as well as the project's poor planning thus far raise serious doubts about the project realisation in the near or mid-term future.

In addition to what has been discussed so far, Algeria has also launched several initiatives to establish a diversified domestic RET industry producing for export markets (*Le Quotidien d'Oran,* 2011a).

The first of these important projects is Sonelgaz's planned solar module factory. In November 2009, the company announced a US$100m investment to build a solar panel factory in Rouiba with an annual production capacity of 50MW (Aziza, 2009). According to more recent sources, the factory will now be built by a German consortium under the leadership of Centrotherm for around 290€m (centrotherm photovoltaics AG, 2011). The factory is set to be completed by 2014, thus making it the first solar module factory on African soil (APS - Algérie Presse Service, 2011a).[211]

Meanwhile, another source cites that a second panel factory is scheduled to open even sooner than that close to Algiers (APS - Algérie Presse Service, 2011e). According to this source, most material for the solar panels will be produced on Algerian soil, including floating glass from Cevital while the solar wafers will be exported from Europe until *Rouiba Eclairage* opens its production line.

A third and more basic innovation is the production of silicon by the Algerian businesses. According to a ministerial statement, Sonelgaz hopes to be able to produce silicon by 2013 (Khalil, 2011).

These new initiatives run parallel to several new cooperation agreements in the renewable energies sector.[212] These attempts to establish a relevant local industry is in line with Algeria's focus on the development of its own market in order to increase the value chain through technology transfer. As the Algerian prime minister underlined,

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[211] Given the strong intra-Maghreb competition with regards to renewable energy projects and industry in both Tunisia and Morocco (*optics.org - the business of photonics,* 2011) this claim cannot be confirmed with certainty.
More recently, the company announced that it might begin production as early as 2013 (Zineb, 2012). At the moment, however, it cannot be established with certainty that this date is not a mere PR manoeuvre.
[212] In 2011 alone, the minister signed such agreements with Spain (APS - Algérie Presse Service, 2011b), France (Portail Algérien des Énergies Renouvelables, 2011b) and Italy (Portail Algérien des Énergies Renouvelables, 2011a).

"Algeria should aim to develop new and renewable energies according to its own conception, needs and export plans."

In the same speech before the Algerian Upper House (*Conseil de la Nation*) the prime minister stressed the following:

"It is necessary to produce your own equipment necessary to produce renewable energies before entering into negotiations with the promoters of renewables of whatever project, be it Desertec or others." (APS - Algérie Presse Service, 2011c)

However, critics argue that it is unlikely that the factory will succeed in beginning panel production by 2014, since all major components produced will not be internationally competitive. Particularly criticised is its relatively small annual production size of 116 MW (centrotherm photovoltaics AG, 2011). Taking into account that major Asian producers already plan productions with GW capacities, a mere 5% of that production will not give Sonelgaz any particular purchasing power or leverage in supply negotiations (*Interview no. 45 – R&D, EU*). Admittedly, Algeria would be able to shield its domestic production from foreign competition by raising import tariffs for external panels, but this is yet to be seen.

In addition to this, a project manager of one of Algeria's CSP plants provided insights into the current situation:

Of course, in principle, many items for renewable electricity plants could be produced in Algeria, even the mirrors and the absorbing pipes. It is the dream of this government to produce all such things on the ground. But I can tell you that the know-how is currently lacking. That's why at the moment, we import everything, even transformers, we import them from India. There, the quality of products is pretty high and the price pretty low, here, it's the other way around! (Interview no. 11 – National and international power sector, Algeria)

Another interviewee voiced similar doubts:

Technology transfer only occurs by carrying out real projects, not by just talking. In terms of production capacities, sure, most North African countries could produce many parts of a CSP or PV plant, such as the steel, glass, and concrete components. But let's not forget that this only makes up 10% of the added value of such a plant. This is good for the image of some politicians, but economically speaking, it is almost negligible. (Interview no. 36 – private and public investors, Europe)

However, international investment in Algeria, which is key in generating industry and production innovation in Algeria, is a difficult matter. With the 2009 financial law, the government re-introduced the local content regime, which forces any company outside the oil sector to have a 51% majority share held by an Algerian investor *(Interview no. 21 – R&D, Algeria)*. While many large companies are still able to work under this regulation, the repatriation of profit is a reoccurring issue. As the previous interviewee states:

This is all very ambivalent. Why should foreign companies invest in Algeria under such circumstances when they can't even take the profits out? Additionally, there are no general customs agreements, so for every a new customs classification has to be negotiated, which takes extremely long. Frankly, I don't understand why they also haven't introduced any free zones or special import alleviations for renewable energy technologies when they want to have them built here. (Interview no. 11 – National and international power sector, Algeria)

In conclusion, the criticism above reveals part of the gap between the Algerian political aspirations and the reality of businesses on the ground. Despite Algerian industry policy and technology transfer efforts in this sector, the actual challenges facing nascent business and the local industries remain constantly high.

Section conclusion

With the combined efforts of its research facilities around the new IAERE and the forthcoming launch of solar RET industry Algeria has a strong potential to create a successful innovation dynamic in this technological sector. Yet in spite of its tangible feats thus far compared to other Arab states, experts continue to regard the likelihood of its international success with scepticism.

In the same vein, while the *Nouvelle Ville Boughezoul* project has a strong innovative potential, the current project management as well as its original outlay make its success in the medium-term unlikely. As in the case of the renewable energies act, this is another example of the difficulties that can occur upon attempting to apply this European concept of urban planning to Algeria without careful adaptation and reflection.

6.5.2. Technological developments

What is the interviewees' opinion on technology choices and on the chance of industry-use of RETs as entry points for further RETs in resource-rich Arab states?

In many ways, Algeria has great potential to use solar energy for industry technologies, particularly since its oil and gas wells are in the Sahara desert. However, as natural gas is abundantly available at very low costs, the incentives to experiment with CSP- or PV-based electricity production for off-grid industrial appliances are low.

This is also confirmed by one interviewee who states:

Desalination with CSP won't happen in Algeria in spite of some interesting experiments. It might be a different situation in Morocco or Tunisia, but Algeria has too much gas that this would not be worth the while (Interview no. 7 – public and private investors)

A second possible non-electricity entry point would be solar desalination on a small, and potentially also on a larger scale. Some researchers have argued that there is a potential for this technology in rural Algeria (Bouchekima, 2002); others have discussed this technology for very similar conditions in Tunisia (Bourouni & Chaibi, 2009) and in other industries (S. Mekhilef, R. Saidur, & A. Safari, 2011) as well as solar cooling. Yet, much like in the case of the Gulf countries, this vast potential currently lies dormant.

Section conclusion

While there would be several potential entry points for renewables through industry use, much like in the UAE, this is not actively considered by stakeholders at the moment, even in research and Algerian technology studies. Thus, the classical use of renewable energies to generate green electricity remains the most influential and indeed most promising approach.

6.6. Key findings in the analysis of the Algerian energy system

The last three subchapters have analysed various aspects of the Algerian energy system informed by the 18 subsidiary research questions developed in Chapter 3. Beyond the respective section conclusions, a summative analysis of the framework conditions for renewable energy policy in Algeria follows:

As has been established in the previous analysis, the Algerian renewable energy sys tem is in fact more diverse than it seems at first glance. The multiple institutions and combination of interests in national economic diversification and the ambition to establish a local RET industry interlink well with the strong external pull factors induced by the Trans-Mediterranean projects. This desire is reflected in the ambitious recent policy doctrines. In an attempt to identify the most significant policy driver, it could be argued that, like in the case of the UAE, national economic diversification forms the "primary mover" of all efforts because first, all further efforts can be related to this key goal and second, because no other one would, eventually, be able to mobilize considerable resources in infrastructure and technology investments.

Identifying the most significant drivers on a personal level is much more complex, as on the level of personal agency, an unsatisfying picture presents itself. Indeed, the bunker-state character of Algeria is most obvious when attempting to trace clear decision-making and power structures through the thicket and often personalized powers of the Algerian political, economic and security elite: personal access is not granted and transparency is not a given. Based on the results of both desk research and on the ground research interviews, it is safe to say that opacity prevails. Thus, it cannot be stated with certainty that the renewable energy impasse in this country is caused by unwillingness within the ruling elite as no access was granted to this level of decision-making and interviewees also could not offer insightful views in this regard.

In addition to this personal level, further structural barriers to the spread of renewables need to be seen in the continuation of electricity subsidies and the non-existence of a free electricity market. In addition, the dominance of system-integrated actors like Sonelgaz makes it unlikely that the poor performance of the regulatory system and the prohibitive market structures change any time soon. In terms of industry innovation and the establishment of a domestic RET sector, Algeria's hurdles for foreign investment and its difficult regulation as well as the lack of other companies in that field makes the successful launch of an RET industry a difficult undertaking.

The chapter has shown that in many areas, such as climate change, country branding and others, Algeria does not live up to its full potential. The PR underperformance of the existing programmes is a case in point. While in the UAE, only a fraction of the announced programmes reaches a world audience through professional marketing, Algeria's policies in this sector remain unknown outside the realm of expert knowledge. In short, the most significant roadblock for the spread of RETs is the opacity in power structures. Combined with low accountability and system-entrenched market operators with little interest in RETs, the complex of MEM and Sonelgaz have so far effectively prevented larger RE-related developments from being realised and were able to stall major policy initiatives like the Algerian renewable energies act. It is not unlikely that the latest ambitious renewable energy extension scheme will suffer a similar fate.

On the analytical level, the following subjects can be identified:

First, when analysing the interaction between the three MLP layers (landscape, regime, and niche-level) it is striking that the distribution of power and its focus by regime actors is more balanced than in the UAE. While many system actors voiced their doubts regarding the effectiveness of certain measures, for instance with regards to technology policy, Algeria's overall efforts remain visible on all levels. However, actors rooted in the largely hydrocarbons-dominated energy regime level remain pivotal for the overall development of the Algerian national energy system.

Second, Algeria's political system differs greatly from the UAE case. While in the UAE, a tension between the autonomy of the individual emirates and the federal level persists, in Algeria, the top-down, centralistic and presidential governance model neither allows such conflicts nor the regional distribution of innovation and renewables-centred initiatives. Instead, most Algerian efforts are centred in the capital, Algiers. Another striking difference in the political system is the role and application of federal legislation. While UAE decision-makers have been cautious about announcing full-fledged renewable energy laws or even promotion programmes, in Algeria, these have been announced on a regular basis, starting with the 2004 renewable energies act. While, at first glance, this appears promising, the laws' and programmes' poor performance and stalled application reveals the hiatus between Algerian political-legal proclamations and the actual developments on the ground. In short, while the UAE system could be qualified as a bottom-up, project-based approach with only little codified regulation, the Algerian model is a strongly codified, top-down, centralistic approach, albeit with poor implementation.

Third, while it has been demonstrated that Abu Dhabi's Masdar initiative was pivotal for the renewable energies efforts in this Emirate – indeed, one could argue that Masdar is the embodiment of Abu Dhabi's renewable energy policies – there is no similarly emblematic renewable energy project of that size in Algeria. This might be a liability in terms of public visibility. However, the positive consequence is that Algeria's renewable energy efforts are more diversified, both in terms of institutions and staff.

Fourth, the issue of governance concepts remains controversial. Parallel to the overall character of state organisation, Algerian decision-makers tend to favour large-scale, centralized programmes, as demonstrated by the most recent, ambitious renewable energy programme launched in 2011. Remarkably though, most interviewees remained sceptical with regards to the applicability of such models for Algeria and favoured a bottom-up process that – under liberalized, open market structures – would consist of small, decentralized and replicable structures, which would be scaled up gradually. While both groups agreed that a certain level of adjustment to local structures would be needed, essentially, both concepts discussed are non-local concepts that are imported from abroad – a transfer of governance concepts has therefore occurred here in both camps. Claims for the development of local governance models are made frequently by Western scholars. Yet, it would appear that this is a goal Algerian stakeholders do not aspire to – for once, because this aim is not regarded as particularly desirable, and secondly because logically there may be no third option, merely different blends of the two.

In conclusion, the analysis of the Algerian system of renewable energy policy has shown that Algeria is active on a wide range of renewables-related issues, mostly with a large-scale, top-down approach that, in most cases, has so far failed to yield the desired results. Bottom-up innovation systems are generally not encouraged by system operators, market regulators and further entrenched regime incumbents. In short, the analysis of one research interview aptly describes the situation on the ground

Renewable energies in Algeria as such face no other technological difficulties as anywhere else in the world and I think they are manageable. The real issue is that the problems we face are political issues – and that's what makes them so hard to solve. (Interview no. 14 – National and international power sector)

6.7. Case study in the case study: Trans-Mediterranean renewable energy initiatives

6.7.1. Introduction

In the present discussion about the role of renewable energies in a future European energy supply, certain scenarios envision tapping into the substantial North African solar and wind energy potentials. Due to its geographical situation, its size and the strategic importance of its energy sector, Algeria could play a key role in this process. Moreover, current developments such as the large export share (10 GW) of the 2011 renewable energy programme and Sonelgaz' recent MoU with Dii are indicative of the fact that Algerian energy stakeholders increasingly aim to sell renewable electricity to European markets. Thus, European electricity policy is of some importance to Algeria's domestic energy policy programmes. However, this potential might be undone by a series of development barriers that will be analysed in the course of the chapter.

This "case study within a case study" aims to introduce the relevant trans-Mediterranean renewable energy projects – which are potentially linked to Algeria – as well as to highlight stakeholders' views towards this matter.

Section 6.7.2 will focus on the development and current status of the various initiatives for large-scale, trans-Mediterranean renewable electricity schemes, such as Dii, the MSP and further projects. Section 6.7.3 will focus on the Algerian view before Section 6.7.4 will sum up the "case study within the case study" by presenting relevant implications to energy governance theory.

6.7.2. *Current initiatives for large-scale, trans-Mediterranean renewable energy schemes*

6.7.2.1. The framework: European renewable energy policy and supporting regulation

The member states of the European Union have committed themselves to cutting their carbon output (cf. Table 20). A central measure of this agenda is the extension of renewable electricity production.

Table 20: Share of European energy from renewable sources in gross final consumption of energy 2005 and 2020

European National Renewable Energy Targets 2005 and 2020					
	2005	2020		2005	2020
Austria	23,3%	34,0%	Latvia	32,6%	40,0%
Belgium	2,2%	13,0%	Lithuania	15,0%	23,0%
Bulgaria	9,4%	16,0%	Luxembourg	0,9%	11,0%
Cyprus	2,9%	13,0%	Malta	0,0%	10,0%
Czech Republic	6,1%	13,0%	Netherlands	2,4%	14,0%
Denmark	17,0%	30,0%	Poland	7,2%	15,0%
Estonia	18,0%	25,0%	Portugal	20,5%	31,0%
Finland	28,5%	38,0%	Romania	17,8%	24,0%
France	10,3%	23,0%	Slovak Republic	6,7%	14,0%
Germany	5,8%	18,0%	Slovenia	16,0%	25,0%
Greece	6,9%	18,0%	Spain	8,7%	20,0%
Hungary	4,3%	13,0%	Sweden	39,8%	49,0%
Ireland	3,1%	16,0%	United Kingdom	1,3%	15,0%
Italy	5,2%	17,0%			

Source: European Commission, 2009.

These efforts need to be viewed in the broader context of developing a common and diversified European energy supply strategy. This is facilitated by the European energy legislation introduced in 2009: (green) power imports into the European grid are made possible through the recent EU renewable energy directive (European Commission, 2009). Article 9 stipulates that energy produced *outside* the EU can be financially supported through laws promoting renewable energies as long as this energy export does not lower the RE quota in the (non-EU-)country of origin. Also, this power can be added to the respective countries' quotas for renewable energy power production and their carbon budgets. While the Directive shows a certain degree of flexibility in the start-up phase,[213] it does not allow swap deals or green power certificates;[214] instead, it demands a physical power transfer. This is a serious challenge to all parties involved. As one industry stakeholder stated:

I think the main barrier in this process will clearly be the grids, not the power plants themselves. First, if you talk about major amounts of renewable electricity in the grid, there are load management issues to be overcome. What I think is even more difficult is the issue of obtaining planning permissions for the grid lines. Even normal grid upgrades don't work; I was told by a UK operator that it took him seven years to just get planning permission for a 20-miles upgrade of a line. Can you imagine what this means to get planning permissions in several member states for large-scale grid installations? (Interview no. 37 – Private and public investors, EU)

Thus, interviewees agreed that in the start-up phase, most EU member states will rather use the described "joint project" option with other member states or use the two other options offered in the Directive, "statistical transfers" or "joint support schemes". The former option enables states with surpluses of renewable energy so "sell" them statistically to another member state. The latter option provides the framework for a multinational pooling of power production and renewable energy support schemes. Currently, the statistical transfer option is by far the most sought after.[215]

Thus, even three years after the Directive was set in place, it remains unclear whether this particular measure will become a success. A major caveat is that countries will need to open their national renewable energy funding schemes to renewable energy production abroad. In times of strained budgets, this will be a difficult message to convey to voters. When the EU member states submitted their National Renewable Energy Action Plans (NREAP) to the Commission in June 2010, most NREAPs stressed that the 2020 goals could be reached by domestic RE potentials, as well as some statistical

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[213] The Directive also allows member states to agree on green certificates or swap deals as a "virtual electricity import" for a limited period of time as long as the physical electricity exchange is scheduled and an approximate commencing date can be given. This regulation enables states to proceed with large-scale demonstration projects in the country of origin without having to wait until the physical grid interconnection is actually finalized.

[214] According to one stakeholder, the Commission had supported the introduction of green power certificates, but the large member states, particularly Germany and Great Britain had argued against that (*Interview no. 34 – Private and public investors, Europe*).

[215] Cf. European Commission DG TREN (2011a) and *Interview no. 32 – public stakeholder, Europe*.

transfers alone. Only Italy[216] (Italian Ministry for Economic Development, 2010, pp. 28; 84; 159) and Luxembourg (The Government of Luxembourg - Ministry for Economic Affairs and Foreign Trade, 2010) explicitly considered the import of renewable energies from North Africa in these communications. While this is an indicator that EU member states will be reluctant to give too much room for schemes like Desertec in their early planning stages, Dii-representatives reacted calmly stating:

Given the time frame we are working with, the 2020 targets are too early for us anyway – what we are looking at are the 2025 or indeed the 2030 targets, if there are to be any. (Interview no. 39 – national and international power sector, Europe)

While proponents of Dii and indeed some Brussels officials around energy commissioner Oettinger mentioned potential common European FITs it remains doubtful that such a proposal would find a majority among the member states, which continue to dominate European energy policy.[217] It remains to be seen far this will change when the common European energy market is introduced in 2014. While this is primarily designed for conventional electricity, there are voices that claim with some right:

We are facing a dilemma situation with the common energy market. On the one hand, we cannot tolerate that such huge amounts of electricity (= renewables) are not being traded internationally and thus taken out of the market. On the other hand, if we trade renewable power throughout Europe this would effectively mean a cross-subsidization of electricity across national borders: German electricity consumers paying FIT premiums would then finance renewable power purchased by France – it remains difficult (Interview no. 33 – public stakeholder, EU)

Similarly, another interviewee added:

So far, the markets are national and nationalistic. Recently, a Dutch-Scandinavian group built a power line between these 2 countries while at the same time a German company crossed this line for an offshore wind project. So there was the idea of merging these 2 lines – but the Germans refused – this wind project is supposed to be "Ger-

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[216] One EU stakeholder stated that "*Internally, we have called article 9 of the Directive the "Italian Clause" as they always wanted to get power in from the Balkans and Tunisia"* (*Interview no. 33 – public stakeholder, Europe*). Thus, it is logical that Italy is among the first EU member states to consider this mechanism seriously. Also, the recent announcement of a new Tunisian CSP project that is to export solar power to Italy is indicative of this policy (Kraemer, 2012).

[217] "*Yes, the Dii has been lobbying for this, but in our communication from January 2011* (European Commission DG TREN, 2011a, DK) *we say that an EU-wide scheme is not in sight, but that rather the member states should work more on their respective national support schemes."* (*Interview no. 33 – public stakeholder, EU*)

man wind" – the background of this is of course financial: the German FITs financing these arrays are funded by the general el. customer; politicians and utilities would have a very hard time explaining to the general public why the German electricity consumer should pay for infrastructure investments benefitting the Netherlands or other places. (Interview no. 37 – Private and public investors, EU)

Thus, in the long run, a trans-national renewable energy funding scheme might indeed emerge. While this is not likely to happen in the near future, from an economic point of view substantial cost savings could be achieved by a common European electricity trade.[218]

Lately, the trans-Mediterranean energy programmes have received support from a rather unexpected historical development, the Arab Spring. These developments have immediately caught the attention of the highest EU governing bodies. While mostly greeted with cautiously positive reactions, the question of how to support the systemic changes in a sustainable and balanced way emerged. Renewable energies have been identified as one key area of cooperation in that regard. In March 2011, a Joint Communication was presented to the European Parliament, and has subsequently been discussed by EU foreign ministers during their extraordinary Foreign Affairs Council and by the EU heads of states and governments (European Commission & High Representative of the Union for Foreign Affairs and Security Policy, 2011). One key feature in the document is the proposal of an EU-South Mediterranean Energy Community, which is to have a strong focus on the production of renewable energy and regulation of its markets with a long-term option for the North African states to join the EU's common energy market. The Communication states:

It is desirable to open a credible perspective for the integration of the Southern Mediterranean in the EU internal energy market based on a differentiated and gradual approach…starting from the Maghreb countries and possibly extending progressively to the Mashreq (European Commission & High Representative of the Union for Foreign Affairs and Security Policy, 2011, p. 11).

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[218] "Commission analysis estimates that up to 10€bn annually could be saved if Member States treated renewable energy as a commodity in a single European market rather than in national markets. Thus, the move to market integration, in particular the evolution to feed in premiums is too slow, too fragmented and needs to be reinforced." (European Commission DG TREN, 2011a, p. 11)

Most likely, the efforts to establish such a community would be coordinated with the Solar Plan of the Mediterranean Union (see Section 6.7.2.2). At the time of writing, however, no further step into this direction has been taken.

In conclusion, this section has shown the tremendous commercial, political and ecological potential of these concepts as well as the major barriers ahead, of which the most challenging ones for the EU are the division of green power support schemes, the division of renewable energy markets, as well as the related complexities and costs. This needs to be overcome in order for major grid upgrades to become a reality. Thus, while these projects are, technically, rather straightforward, the political, economic and regulatory side as well as the unique character of EU politics are what make the execution of these schemes a difficult undertaking. As demonstrated, the Arab Spring has added a new dynamic to the situation. According to interviewees, its effects can already be felt in North Africa energy sector.[219]

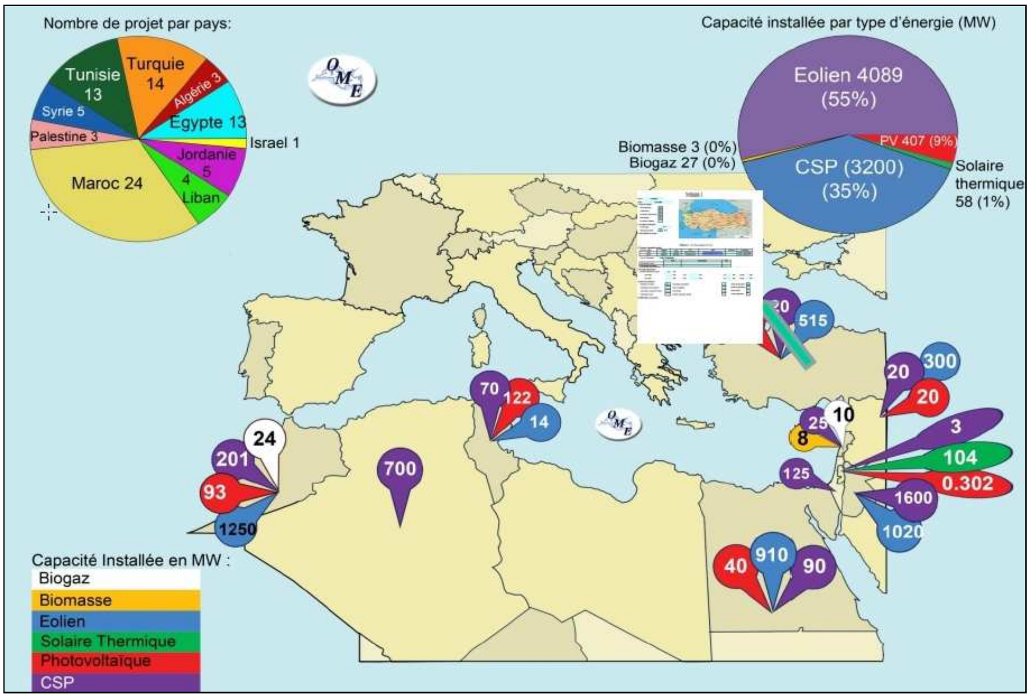
6.7.2.2. Government: the solar plan of the Union for the Mediterranean

As has been shown in the previous subsection, the EU currently shows a strong interest in the development of a trans-Mediterranean renewable energy partnership. This initiative is placed in the wider context of trans-Mediterranean European policies, which since 2008 have been pooled through the Union for the Mediterranean (*Union pour la Méditerranée* – UfM). In total, the UfM consists of 43 members, including all EU member states as well as all countries bordering the Mediterranean. In order to guarantee a balanced system of power-sharing, the UfM is co-presided over by an EU and a non-EU member respectively. While it is the stated intention of its founders to reinvigorate the stalled Barcelona/European Neighbourhood Process, a joint permanent committee in Brussels and a bureau in Barcelona will ensure the day-to-day working processes are followed up and the summits prepared (Secretariat of the Union for the Mediterranean - Office of the Secretary General, 2010).

[219] Testimonies by various interviewees went into that direction, e.g. *Interview no. 45 – R&D, Europe* and *Interview no. 36 – private and public investors, Europe*.

One of the UfM's flagship projects is the Mediterranean Solar Plan (MSP). Financed by the European Neighbourhood Programme, the MSP was included in the final declaration of the Paris Summit of the Union for the Mediterranean on July 13th 2008 (Paris Summit for the Mediterranean, 2008). It will produce a major study characterizing potential sites for RE production, identifying the best possible policies incentivizing the deployment of renewables with a target share of 20 GW of renewable power capacity (see Figure 48) and 20% energy savings compared to a business as usual scenario until 2020, when the "deployment phase" should be completed (Council of the European Union, 2010). Also, the first imports of solar electricity from North Africa to the EU should have commenced by that date and the "Mediterranean Ring" of power transmission in between the various regional grid systems should be completed.[220]

Figure 48: Projects proposed to the Immediate Action Plan by February 2009



Source: Lorec, 2009.

In the Algerian context, six pilot projects, to be constructed at a later stage, have been identified. The first four demonstration projects to be built will be in Morocco and in Italy (each with two projects). Concerning the overall investment costs, a total sum of

[220] See Secretariat of the Union for the Mediterranean (07 July, 2011) for a recent discussion of how to realize the MSP.

45€bn is forecast until 2020. However, only a small sum of this money has already been secured: the World Bank's Clean Technology Fund (CTF) has earmarked 750€m for CSP technology alone; while the unilateral and multilateral European development banks have promised another 5€bn.

While the UfM and its MSP started with ambitious goals, its actual realization has been riddled with difficulties. A key MSP stakeholder explained the structure and goal of the MSP as follows:

Our main stakeholders are the national authorities of our member states; they register projects with the secretariat; we do not conduct any own projects. Thus, what we have here is mainly a labelling process.

Many people have criticized that we do not apply one methodology to all the projects. We omitted this issue on purpose, as it would have taken years to agree on a list of criteria. Given the heterogeneity of the region and its projects, we need to be flexible, otherwise we will not succeed. I think that transparency is an absolute must, but a common methodology not necessarily.

Asked about how the MSP secretariat regards itself, the same interviewee added:

The MSP is not a goal in itself, we are merely facilitators. In an ideal world, the initiatives would soon only lie in the hands of the member states, which is why we welcome the national solar plans of Morocco and Tunisia. Only this way, we can achieve a real buy-in of the stakeholders, which is absolutely vital. (Interview no. 23 – public stakeholder, Europe)

Concluding, the Union for the Mediterranean and its flagship project, the MSP, represent important enablers for the realisation of the concepts of trans-Mediterranean renewable energy. While – with all given problems of the multilateral process – the intergovernmental nature of the UfM can work on the political and regulatory framework conditions that are vital for the MSP's success, it cannot contribute on the business front, as the actors involved here are states that do not own renewable energy technologies, nor can they implement projects independently. For this, non-state actors remain vital.

6.7.2.3. Private sector: the Desertec Industrial Initiative and Medgrid

In recent years, civil society and industry stakeholders have increasingly promoted the construction of large-scale renewable energy power plants in North Africa. One major driver has been the political support group TREC (Trans-Mediterranean Renewable Energy Corporation) that began working with the German section of the Club of Rome. Its plans have been part of the German political discourse for well over a decade. TREC contributed to the discussions by launching its "Desertec White Book" which recently appeared in its fourth edition (Knies, Möller, & Straub, 2009). The TREC concept was taken up by various individuals and a number of national groups (e.g. TREC-UK, TREC-Méditerrané, etc.) were founded. In 2008, the group re-named itself "Desertec Foundation" and registered in Berlin as an incorporated association.

The German government promoted this topic through research support for the above-mentioned DLR studies as well as within the European Union. Moreover, a series of MENAREC Conferences (Middle East and North Africa Renewable Energy Conferences) supported these efforts on an international level.

These activities have recently sparked the interest of German industry: on July 13, 2009, a group of major German and international corporations (ABB, Abengoa Solar, DESERTEC Foundation, Deutsche Bank, E.ON, HSH Nordbank, MAN Solar Millennium, Munich Re, M+W Zander, RWE, SCHOTT Solar und Siemens and the Algerian company Cevital,[221] (the only North African founding member of Dii) announced in a press conference a memorandum of understanding seeking to promote the above Desertec initiative and intending to found a DESERTEC Industrial Initiative (Dii). These announcements met with very different responses in Europe and North Africa. In Algeria, Chakib Khelil, then minister of energy and mines, said:

"I don't have any idea about that project and I cannot make any statement. This project has never been presented at the ministry nor at the relevant institutions… In the (solar energy) field, there are clear conditions about a partnership of Algerian and foreign companies. It is about technology transfer in the area of engineering, equipment

[221] Originally an Algerian dairy and food industry conglomerate, Cevital has grown into the power sector by constructing several off-grid power plants to supply its own industries. Currently, Cevital is Algeria's second largest company by turnover only being outperformed by Sonatrach.

and materials as well as contraction…If it is just about constructing solar panels on our soil and export the solar energy…we are not interested."[222]

Reactions in Europe largely depended on the various actors' stance on solar and nuclear power, major non-EU energy infrastructure investments and on their views vis-a-vis decentralized or centralized power generation. Apart from welcoming statements by political parties, environmental NGOs and research institutions[223], there have also been critical voices. EUROSOLAR, for instance, a German solar energy lobby group, dubbed the plans "mirages in the Sahara desert" and "centralistic plans of the German power sector" that were designed to perpetuate the dominance of a few corporations in the national power sector and to stall the development of decentralized renewable energy production in Europe.[224] Another counterargument was that this system would become prone to abuse by "energy extortion", as Lacher/Kumetat maintain in a recent research article (2011).

After its first months, the number of Dii shareholders and collaborating companies grew substantially. In addition to that, Dii opened two offices in Tunisia and Morocco. This was a vital step, as it had initially been criticized for being too Eurocentric to become a success.[225]

At the time of writing, Dii is working on a detailed implementation strategy defining a road map until 2020. This road map is supposed to be finalized by the end of 2012 and it will entail a long-term vision beyond that point (*Interview no. 39 – national and international power sector, Europe*).

Dii partners have stressed that the current Dii consortium is not intended to remain closed to potential partners who are willing to join, be it in the current scoping phase

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[222] Cf. http://www.electron-economy.org/ext/http://news.fibladi.com/algerie-energie/?ida=35170 Le Maghreb, July 19, 2009, translation by the author.

[223] On September 17, 2009 the German Institute for Economic Research (DIW) issued a rather welcoming statement of the Desertec plans; so did the European Green Parties and other institutions and political groups.

[224] Cf. the interview with Eurosolar founder president, the late Hermann Scheer, Member of the German Federal Parliament (Kaufmann, 2009) for a Desertec reply cf. Desertec Foundation (2009).

[225] As a senior energy official put it: "*To me, it was shocking how many mistakes the Dii people did in the first few months after its establishment. There was an absence of diplomacy, rolling over the North Africa countries German panzer style. This rightfully annoyed many North African stakeholders in the beginning."* (Interview no. 26 – R&D, Europe)

or later in the operational business phase. However, Dii's loose structure could prove a liability as well. As a stakeholder stated:

I think, the potentially large conflicts between the power companies involved in Dii have so far been postponed, but I am sure they will re-emerge. Also, I am yet to be convinced that the companies really mean to invest such big amounts of money. Funding a little project office and some feasibility studies is cheap for these corporations. The litmus test will be when they will have to spend big to make their own studies become reality. I really think that what Dii represents is nothing more than a lobby group and a non-aggression pact that has the effect of mutual control, so that none of them moves into this field without the others noticing. Dii also said it will not develop its own projects. Otherwise, it would compete with itself/the shareholder companies of Dii. Officially, it is merely there to develop a "business case" for a reference project. (Interview no. 36 – private and public investors, EU)

Meanwhile, another stakeholder offered a more critical reading of Dii:

To me, Dii is no different from major oil and gas projects, land or strategic minerals. It has this negative similarity mainly because just in these cases, the Arab countries are used as sources of resources, and hardly profit themselves at all. Consequently, we have the same conceptual questions, equity issues, and the big backlash 'environment versus development'. (Interview no. 30 – public stakeholder, Europe)

Thus, while Dii is a most impressive consortium that has moved the TREC concept as close to realization as can be, its success is by no means a given. Undoubtedly, Dii is a key actor on the industry side, however, many business-related questions, as well as those put in the first two sections of this case study regarding political and regulatory aspects, remain open.

Another private sector consortium in this field is the Medgrid initiative. Originally, Dii has always been regarded by the German government as a pure private sector initiative that does not have strong political ties (BMWi - German Federal Ministry of Economics and Technology, 2010). In France, however, Dii has been viewed as a German initiative developed to counteract the "French" MSP. Led by the French utility *Electricité de France* (EDF), the consortium contains many network operators and equipment makers and is structured in a similar manner as Dii. With a total of eleven French companies, among them heavyweights such as *ABB*, *Alstom/Areva*, *Nexans*, *Prysmian*, *Cap Gemini* or *Atos Origin*, *RTE*, France is the dominant nation involved, however, Spanish and Moroccan companies have also joined, as well as fellow Dii members *Siemens* and *Saint-Gobain*. At first glance, Medgrid, as several stakeholders feared, appeared to be a competitor of Dii:

Who knows, maybe Desertec will slip away from the Germans like IRENA did a few years ago. (Interview no. 32 – public stakeholder, Europe)

However, both consortia signed a cooperation agreement in November 2011 (Desertec Industry Initiative (Dii) & Medgrid, 2011), which was facilitated and welcomed by the EU (European Commission, 2011). The agreement stipulates that Medgrid will focus on establishing the grid connections (with a beginning of five transcontinental interconnectors) while Dii will focus on constructing and running the power plants.

There is a chance, therefore, that the potential national competition lurking behind both initiatives remains dormant and does not infringe on the project performance. Indeed, this project might obtain a "truly European dimension" (Reuters, 2011a) that the EU has spotted in the cooperation of both.

In conclusion, two types of initiatives were presented in this chapter, government-backed (MSP) and private sector oriented (Dii and Medgrid) ones. While both types have large opportunities in their own area; they also have the potential to fail. Whereas the MSP operates in the sometimes difficult and politically loaded framework of the UfM, the private sector character of the other initiatives emerges as an asset in terms of inter-company technological and operational synergy effects, the apolitical nature of the work and the speed in which decisions can be taken. This, however, could also turn into a development barrier, especially in the state-centred business environments to be found in many states of the Southern Mediterranean, and most certainly in Libya and Algeria. Here, a European private sector initiative might face a greater set of problems in terms of dealing with the state's administration, than a state actor might do.

Most recently, the cooperation agreement has been signed in Marrakech between Dii and the UfM which will alleviate fears of an open competition and mutual blockade between private and public sector initiatives (*Portail des Energies Renouvelables en*

Algérie, 2012c). Yet, such a MoU cannot gloss over all potential fault lines. For instance, general competition could exist between multiple actors with overlapping interests. In this case, which company or initiative will succeed and where? Who will be able to obtain the necessary private funds? It also remains uncertain how the working relationship of the companies involved in the Dii with the North African administrations will evolve: as seen above technology transfer is one of the recurring issues in North African ministerial statements. Here, the European power sector represented through Dii or MedGrid might not show a great interest to move, while the MSP's political framework might be more amenable to that.

6.7.3. Trans-Mediterranean energy projects and Algeria

As has been shown above, the initial Algerian reaction with regards to the publication of the TREC/Desertec plans was reserved. A number of Algerian stakeholders posed questions echoing Minister Khelil's position (see Subsection 6.7.2.3):

We asked ourselves: what kind of an initiative is this? We don't know about it, Algerian nationals haven't developed it and yet they think they can plan with land in our country? This has a bad aftertaste, a bit like eco-colonialism! (Interview no. 18 – R&D, Algeria)

As has been shown, Dii and its partner initiatives had to exert much effort to mend the damage done in the initial phase of the project.

More recently, however, the Algerian stance has changed considerably. In October 2010 the new Minister of Energy Yousfi named three conditions for cooperation with these initiatives: technology partnership, a sizeable Algeria-based production capacity, and the opening of the European power markets for potentially existing overcapacities (El Hadj, 2010).

Gradually Algerian politics took a more positive stance on this matter culminating in the recent cooperation agreement between Sonelgaz and the Dii (Sonelgaz, 2011; Mokrane, 2011), as well as the sizeable renewable energy share in Algeria's new national programme that is designated for export. In the same vein, the CEO of Sonelgaz has recently announced the construction of a new 1000 MW renewable energy power plant in cooperation with Dii. In line with the Algerian national renewable energy scheme, 10% of the generated electricity would be designated for the Algerian power pool while 90% of its production will be sold to Europe, (*Portail des Energies Renouvelables en Algérie*).

Therefore, after an initially reserved reaction, Algeria would later become convinced and successively involved in this initiative inducing it to change its domestic policies into a more renewable-friendly, export-oriented system. While these production capacities are yet to be established, the mere existence of a variety of renewable energy initiatives has triggered a transition in many levels of externally-related Algerian energy policy. However, this does not mean that the challenges for the realisation of the trans-Mediterranean renewable energy projects identified in this subchapter had all been overcome. What has, however, transpired is a landscape-level influence.

6.7.4. Conclusion: implications of renewable energy governance theory

The last sections have presented the multitude of current, largely Euro-centric trans-Mediterranean renewable energy efforts (6.7.2) and the Algerian reactions towards them (6.7.3). This section seeks to draw conclusions, which would inform theory building and serve the purpose of this “case study in the case study” in the Algeria chapter of this thesis.

In terms of governance models, all options presented here work on a landscape-level or even attempt to create a meta-landscape through the establishment of a pan-Mediterranean space. In terms of how the similar goals are to be realized, however, differences are visible. As corporate initiatives, Dii and Medgrid are very large-scale, top-down initiatives that remain largely controlled by European companies. As has been already emphasised, while local economic development and energy policy change in North Africa might not be the primary agenda of the cooperation between energy corporations, it should be acknowledged, that these initiatives have so far had more success than the MSP model, which follows a multi-stakeholder, international bottom-up model that is government-controlled and much less characterized by a

North-South power imbalance as is the case with the private sector initiatives. The politically-motivated avoidance of a methodology and of standards of the MSP might be a necessary tool to integrate all members of the UfM. In terms of project quality and feasibility, however, this appears rather ineffective. Furthermore, it has also become evident that whichever model is more successful in the long run, a stable regulatory environment in the region is crucial for this success. Therefore, only by creating an open, level playing field, can initiatives succeed. Since this is currently not entirely the case, the probability of success of these projects remains uncertain.

Lastly, while the power of the TREC imagery is considerable, Dii adds to it the necessary credibility with regards to finances and technology ownership. Arguably, this combination induced Algerian officials to readdress their initially reserved policy towards these trans-Mediterranean renewable electricity schemes. In conclusion, the trans-Mediterranean schemes presented here have turned into substantial landscape-level variables for domestic Algerian renewable energy policy. However, it is difficult to discern what the effect on Algeria would be if the European regulatory-political or indeed the business community would abandon these project altogether. Most likely, this would constitute a severe blow for the entire Algerian renewable energy system and would not be limited to the export-oriented parts of the domestic schemes as renewables would lose a key export market. Moreover, the symbolic force of renewables failing in Europe, the frontrunner in both market regulation and technologies, should not be underestimated.

6.8. Conclusions of the Algerian case study

This chapter presented the second of the two case studies of Part B. As the previous case study, the Algerian case was analysed by means of the MLP analytical categories developed in Chapter 3. It has been shown that Algeria is the basis of initiatives on all the three MLP levels (landscape level: Subchapter 6.3; regime-level: Subchapter 6.4; and niche-level in Subchapter 6.5) that, compared to the UAE, are of an even more ambitious size while significantly less well publicised. Moreover, in contrast to the UAE, it is particularly the regime level, where the political elites attempt to introduce changes through the regulatory re-structuring of the Algerian energy market and the recent renewable energy programme. As shown in the summative overview of Subchapter 6.6, key features of the Algerian renewable energy policy system are:

- its strong focus on a legal change with a poor monitoring of progress on the ground
- centralized and opaque power structures with little room to manoeuvre for non-system-entrenched actors
- a focus on long-term national megaprojects with a structural preference for centralized, top-down means of power production
- a weak, but growing level of regionalization in the energy sector, both within the Maghreb and with regards to Europe

As the analysis of the trans-Mediterranean renewable energy efforts in Subchapter 6.7 has shown, these initiatives have substantial impact on Algerian domestic policies. The strong export element in its extension plans can only be explained by this interaction. However, while the multitude of actors in this sector can be regarded as an innovative asset of this process, it has been shown that each initiative has its respective vulnerabilities, and that it is particularly the framework conditions set by the EU and its member states that need to create a conducive environment for these planning schemes to work.

In the following chapter, the national and transnational framework conditions identified in this case study will be applied for policy design by means of the TM model (Subchapter 7.2). An ideal type application of this policy design model to Algeria will show the potentials and limitations of this system.

Part C: Comparison and Outlook

After Part B exhaustively analysed renewable energy policies in the two case study countries, the following third part of this thesis aims to draw summative conclusions from the case studies with regards to the governance theory employed (TM) and further elements of material energy policy (Chapter 7) as well as to contribute to a broader discussion of governance theory (Chapter 8). The thesis will conclude with a summative presentation of the work's research findings and will sketch pathways for further research in the relevant areas (Chapter 9).

7. Comparison of the results of both case studies

In light of what has been discussed in the policy design section in Part A (Subchapter 2.4), this chapter applies TM as a policy design model to the results of the UAE and the Algerian case studies (Chapters 5 and 6) thereby attempting to highlight the key governance features that determine the structures of renewable energy policy in resource-wealthy Arab states.

This is performed in two different subchapters (7.1 and 7.2). Structured in parallel, the first sections (7.1.1 and 7.2.1) draft an ideal type energy policy informed by TM. Subsequently, Sections 7.1.2 and 7.2.2 contrast these results with the findings of the case studies, showing the realpolitik caveats of the respective energy policy system. Lastly, Sections 7.1.3 and 7.2.3 analyse this sections' results with regards to options and challenges for the application of TM to policy design in the UAE and Algeria. Subchapter 7.3 then presents a brief comparative discussion of the case studies' results identifying features that are common to both types of resource-wealthy Arab state analyses in this thesis.

Further questions on the travel of governance concepts and the call for de-Westernising governance theory will be discussed in Chapter 8.

7.1. Policy designs for the UAE energy system

As has become apparent from the analysis of the UAE renewable energy policy system, the MLP analysis and the Masdar case study, UAE renewable energy policy is characterized by a multi-speed, multi-actor system. Although particularly Abu Dhabi has launched elements of a significant renewable energy policy, it is yet to deliver a comprehensive policy document. With regards to the other emirates and the federal level, this is even more so the case.

7.1.1. Policy design with the Transition Management approach (ideal type)

As Section 2.4.1 concluded, TM suggests a re-iterative policy design model that can be represented as a configuration of several interlinked innovation cycles that gradually increase in scale (see Figure 9).

Following key transition literature such as Loorbach (2007, pp. 272; 291-292), Kemp (Kemp et al., 2007a&b; Kemp & Loorbach, 2006) and Grin (2008)[226], the six steps of TM are:

1) *Problem structuring in the transition arena and formulating a vision*: coordinated by government, setting up a multi-stakeholder energy council with the aim to develop a renewable energy vision as part of a wider national energy policy blueprint;
2) *Devising a concrete transition pathway and agenda*: identifying key goals and realistic targets for mid- and long-term developments; choosing policy instruments (e.g. feed-in-tariffs, tax benefit systems, legal changes in energy law or market restructuring);
3) *Experimental phase*: putting the designed policies into action for a limited amount of time;
4) *Monitoring and evaluating the results*: assessing the results, clearly identifying failures in the system, unexpected flaws and underperformances;
5) *Adaptation*: attempt to find solutions to the negative outcomes/reinforce the successful elements of the programme;
6) *Starting again from step 1* (reiterative problem structuring) on a more advanced level.

Applied to the UAE, an ideal system of policy design modelled by TM can be sketched as follows:

1) *Problem structuring in the transition arena and formulating a vision*

[226] Cf. Subchapter 2.4 for a more in-depth discussion of TM.

- The relevant government authority – e.g. the Federal Ministry of Energy or, on emirate level, the power supplier and the regulator – set up a multi-stakeholder energy council with the aim to develop a national energy vision/blueprint
- While the government's role is restricted to moderation, it ensures that the interests of all stakeholders (power companies, CSOs, environmental and religious groups, industry) are heard and their positions integrated into a final policy document
- In the process, the strengths and weaknesses of the energy system are openly assessed and potential scenarios developed to integrate renewables into the system
- The council develops a policy paper through which the emirate-level or federal government formulate policy options

2) *Devising a concrete transition pathway and agenda*

- The council identifies tangible goals (e.g. the 7% goal) for the mid- (2020) and long-term perspective (2030; 2050) in the context of a national energy mix
- The council adopts a set of renewable energy promotion instruments with reliable tax guarantees, renewables premiums
- The council identifies a set of necessary changes in the regulatory set-up of the energy system and the power market

3) *Experimental phase*

- The measures are set in action on a small scale in order to test their efficiency and feasibility. This could take place in a free zone, or one particular town/neighbourhood of Abu Dhabi or Dubai

4) *Monitoring and evaluating the results*

- The results are assessed, openly identifying systemic failures, unexpected flaws and underperformances

5) *Adaptation*

- The council takes notice of the test results and develops alternative or mitigating measures for the underperforming elements of the test

6) *Starting again from step 1*

- Roll-out of the plan after consultation with the energy council as a re-iterative project

7.1.2. Realpolitik caveats of the ideal type model

The previous section has outlined what could be regarded as an ideal policy model designed by TM for the integration of renewable energies in the UAE energy system. However, as the individual section conclusions and its overview reveal in Subchapter 5.6 – both informed by the MLP analysis – there are major constraints to the undifferentiated adoption of this policy.

Table 21 re-enlists the key caveats highlighted in Section 2.4.2 extended by a column highlighting results of the UAE case study.

Table 21: Critical points regarding the application of TM as model for policy design for the UAE

Challenge	Description	Findings of the UAE case study
1	Role of government and its self-conception as a policy actor (“managers vs. rulers”)	Government representatives have a self-conception of “rulers” and do not regard themselves as managers in open government processes. Acute fear of a loss of power.
2	Role, policies (and existence of) relevant non-governmental stakeholders, such as businesses, civil society, research organisations, national oil companies, other traditional energy governance bodies and international organisations (OPEC, etc.)	Transregional and non-governmental stakeholders are almost irrelevant to national renewable energy policy decisions, business circles are the only notable exception

3	Willingness of government to codify its own policy in the form of a long-term vision and more tangible policy goals and instruments	Low willingness to do so
4	Accountability and consistency issues: willingness of government to adhere to the course set by a national policy document or similar announcements; ability of stakeholders to sue government/hold it accountable for sudden policy shifts	High willingness to abide by agreed policy decisions, but low accountability of high-level decision-makers on the whole
5	Transparency issues in the assessment of renewable energy introduction schemes both in terms of technologies and market introduction	Poor transparency
6	Inner-systemic adaptive capacities for ST regime change	Poor capacities

Combined with the ideal type TM policy design elements of the previous section, the following table presents those policy options that remain feasible after a realpolitik scrutiny.[227]

Table 22: TM policy design, realpolitik caveats and remaining policy elements in the UAE

Ideal type TM policy design for the UAE	Realpolitik caveat	Remaining policy option/ expected outcome
1) *Problem structuring in the transition arena and formulating a vision*		
The relevant government authority – e.g. the Federal Ministry of Energy or, on emirate level, the power supplier and the regulator – set up a multi-stakeholder energy council with the aiming to develop a national energy vision/blueprint	Possible but not actively imple-mented	
While the government's role is restricted to moderation, it assures that interests of all stakeholders (power companies, CSOs, environmental and religious groups, industry) are heard and their positions integrated into a final policy document	- Government is unlikely to ac-cept pure management role - Inexistence of meaningful CSOs and other non-business stake-holders - Unlikely a UAE government would invite real opposition members into the committee	- Top-down approach favoured - Coalition between strong government and industry without other groups
In the process, strengths and weakness-es of the energy system are openly as-sessed and potential scenarios devel-oped to integrate renewables into the system	Inexistence of meaningful CSOs and other non-business stake-holders	Assessments are likely to have a disproportional focus on business and technical issues with no balanced assessment pro-

[227] The logical order of the following table is: "TM ideal type model" (column 1) – "Realpolitik caveat" (column 2) = "Remaining policy option/expected outcome" (column 3).

		vided. Yet, they, might still be valuable contributions in the absence of other source material
The council develops a policy paper on the basis of which the emirate-level or federal government decides	Possible in theory, in practise unclear how much top-level leadership will heed the council's advice	Production of a report by a pro-government body where is it uncertain whether the governments heeds its advice
2) *Devising a concrete transition pathway and agenda*		
The council identifies tangible goals (e.g. the 7% goal) for the mid- (2020) and long-term perspective (2030; 2050) in the context of a national energy mix	Implementable in the UAE context, but so far not fully done except the 7% target for Abu Dhabi	Implementable
The council adopts a set of renewable energy promotion instruments with reliable tax guarantees, renewables premiums	- Implementable in the UAE context, but so far not fully done - Strong favours of centralized measures against FITs and IPPs	Centralized model without open FITs and little role for independent producers
The council identifies a set of necessary changes in the regulatory set-up of the energy system and the power market	Implementable, but so far not done	
3) *Experimental phase*		
The measures are implemented on a small scale in order to test their efficiency. This could take place in a free zone, or one particular town/neighbourhood of Abu Dhabi or Dubai	Implementable and done on a small scale for solar roof programme; inclination towards mega-projects competes with this (Masdar)	
4) *Monitor and evaluate the results*		
The results are assessed, clearly identifying failures in the system, unexpected flaws and underperformances	Could only be implemented if assessment is not publicised	Unpublished assessment
5) Adaptation		
The council takes notice of the test results and develops alternative or mitigating measures for the underperforming elements of the test	Implementable	
6) *Start again from step 1*		
Roll-out of the plan after a consultation of the energy council as a re-iterative project	Implementable	

7.1.3. Applying TM as a policy design model in the UAE context – conclusions

As a consequence of the assessment above, the following conclusions can be drawn with regards to TM-inspired energy policy design in the UAE:

Initially, what remains from the original TM with regards to material policy design? In essence, the overall structure might formally appear similar to the TM setup. Thus, a commission that works on the development of a national/emirate-level energy policy blueprint is certainly imaginable in the UAE context. However, it might differ substantially from TM in its content and governance. While a multi stakeholder approach of TM is conceivable in the UAE setting, this chapter has indicated that it is unlikely that the government will integrate stakeholders from all parts of society, particularly genuine opposition groups, into such a transition arena. Also, the self-conception of the UAE (or any emirate-level) government does not allow meaningful managerial autonomy in (energy) policy-making. Instead, it is likely that a high-level government official will claim ownership and demand control of the process. A decidedly critical dialogue on equal footing can hardly be expected. Furthermore, due to the autocratic governance structures in the country, it remains to be seen if a decision, once it has been taken, has a binding character or whether it can be altered easily. Although the Abu Dhabi leadership appears to be adhering to its 7% target, in most other tangible renewable energy policy elements it has yet to deliver.

Conceptually, a bottom-up niche strategy, as envisaged by TM, also does not truly match the UAE governance system. Certainly, a small-scale project to be rolled out at a later point in time is not unthinkable; yet, decision-makers have a clear preference for megaprojects, such as Masdar and the centralized, hierarchical power structures that come with it. Moreover, any system of open renewable energy promotion with a transparent pricing system is likely to face difficulties. Instead, stakeholders favour an opaque system of undisclosed prices for the renewables sector, to be negotiated between the power companies and the government. It is evident that these structures are beneficial to the larger power companies. Domestic power producers or similarly small groups could hardly profit from such arrangements.

Lastly, this stress on central government combined with the lack of participatory elements in the political system and very few independent interest groups make an authentic, publicly accessible assessment of the relevant policies a difficult undertaking. In a society where open government criticism is not taken for granted and government claims ownership for most policies, any re-iterative project, such as the introduction of a new energy production technology, necessarily faces systematic challenges. Innovation depends on an open, critical assessment, otherwise it cannot improve. If this is made impossible by stakeholders' fear of speaking out, this creates a structural dilemma in the national innovation process. The only way for a TM-inspired approach to circumvent this dilemma would be the launch of a fully confidential assessment in a closed-door meeting with the multi-stakeholder energy council.

Finally, it has become apparent that TM as a policy model for the UAE functions only under severe constraints. Key elements of this model cannot be applied to the UAE's political and economic system. The theoretical implications of this outcome for the broader discussion on the conditions of – and the need for – the transfer of governance concepts will be discussed in Chapter 8 combined with the results of the Algerian case study.

7.2. Policy designs for the Algerian energy system

The corresponding case study has shown that Algeria's energy policy system remains dominated by the traditional oil and gas elites. While the central government still introduced several renewable energy support schemes, their effects have so far not been palpable in terms of renewable electricity generation and RE power share. Lastly, it has been demonstrated that one pivotal enabling factor for intra-Algerian renewable energy politics are the various developments on the EU level, both from the government and on behalf of the private sector, as they might be able to provide Algerian politicians with sufficient momentum and commercial interests to also foster domestic renewables.

7.2.1. Policy design with the Transition Management approach (ideal type)

Having presented the six steps of an ideal type, TM-inspired renewable energy policy in Sections 2.4.1 and 7.1.1, their application to the Algerian case could be sketched as follows:

1) *Problem structuring in the transition arena and formulating a vision*

- The Ministry of Energy and Mines (MEM), in combination with the CREG, Sonelgaz and further non-governmental groups establish an energy council and further develop the already existing national energy policy documents and laws
- While the government's role is restricted to management, it assures that the interests of all stakeholders (power companies, CSOs, environmental and religious groups, industry) are heard and their positions integrated into a final policy document
- The strengths and weaknesses of the Algerian energy system are openly assessed and potential scenarios to integrate renewables into the system developed
- The council develops an updated version of the existing national policy documents

2) *Devising a concrete transition pathway and agenda*
- The council identifies tangible goals (e.g. the 7% goal) for the mid- (2020) and long-term perspective (2030; 2050) in the context of a national energy mix. It might critically reassess the numbers that have been previously published
- The council analyses the regulatory renewable energy promotion instruments that are in place (RE law, market liberalisation) and critically assesses their effectiveness
- The council identifies a set of necessary changes in the regulatory set-up of the energy system, its subsidy structure and the power market

3) *Experimental phase*
- The new programme is tested on a regional scale (i.e. several *wilayas*/administrational districts) in order to test their efficiency and feasibility. Given that Algeria has already introduced a (defunct) national renewable electricity programme, this step might not be necessary

4) *Monitoring and evaluating the results*

- The results of the test cases and of the previous phases of the national renewable energy programme are critically assessed, with a particular focus on regulatory flaws and underperformances

5) *Adaptation*

- The council takes notice of the test results and develops alternative or mitigating measures for the underperforming elements in the programme

6) *Starting again from step 1*

- Roll-out of the plan after a consultation of the energy council as a re-iterative project

7.2.2. Realpolitik caveats of the ideal type model

The previous section has sketched what a TM-guided policy model might yield as a result in terms of renewable energy policy design for Algeria. However, as the section conclusions and the MLP-inspired overview in Subchapter 6.6 argue, a series of caveats prevents the unquestioned application of this model to the Algerian case.

Table 23 re-enlists the key caveats highlighted in Section 2.4.2 extended by a column highlighting results of the Algerian case study.

Table 23: Critical points regarding the application of TM as model for policy design for Algeria title

Challenge	Description	Findings of the Algerian case study
1	Role of government and its self-conception as a policy actor ("managers vs. rulers")	Government representatives have a self-conception of "rulers" and do not regard themselves as managers in open government processes. Acute fear of a loss of power; centralized, top-down governance structures persist
2	Role, policies (and existence of) relevant non-governmental stakeholders, such as businesses, civil society, research organisations, national oil companies, other	State-directed oil and gas business retain pivotal influence; few large private companies are influential; NGOs, int. energy bodies etc. remain insignificant

	traditional energy governance bodies and international organisations (OPEC, etc.)	
3	Willingness of government to codify its own policy in the form of a long-term vision and more tangible policy goals and instruments	High willingness as documented by several official national energy policy programmes in recent years
4	Accountability and consistency issues: willingness of government to adhere to the course set by a national policy document or similar announcements; ability of stakeholders to sue government/hold it accountable for sudden policy shifts	Low accountability, re-adjustment of numbers, very poor performance of current regulatory and market regime
5	Transparency issues in the assessment of renewable energy introduction schemes both in terms of technologies and market introduction	Theoretical capacity exists, but poor transparency to actually perform this task
6	Inner-systemic adaptive capacities for ST regime change	Poor capacities

Combined with the ideal type TM policy design elements of the previous section, the following situation emerges:

Table 24: TM policy design, realpolitik caveats and remaining policy elements in Algeria

Ideal type TM policy design for Algeria	Realpolitik caveat	Remaining policy option/ expected outcome
1) *Problem structuring in the transition arena and formulating a vision*		
The Ministry of Energy and Mines (MEM), in combination with the CREG, Sonelgaz and further non-governmental groups establish an energy council to develop further the already existing national energy policy documents and laws	None	
While the government's role is restricted to moderation, it assures the interests of all stakeholders (power companies, CSOs, environmental and religious groups, industry) are heard and their positions integrated into a final policy document	- Government is not likely to accept pure management role - Absence of meaningful CSOs and other non-business stakeholders - The coalition of MEM and the oil and gas conglomerates remain the most powerful interest group and will attempt to undermine any challenge of their hegemony	Top-down approach favoured Coalition between strong government and state-run hydrocarbons industry with few private businesses under the exclusion of other groups
Strengths and weaknesses of the Algerian energy system are openly assessed and potential scenarios developed to integrate renewables into the system	Lack of transparency; unlikely that of such information would be published	Documents are likely to have a disproportional focus on business and technical issues with brief mention of governance and regulation
Council develops an updated version of	Possible, however uncertain	Re-assessment of current

the existing national policy documents	whether this version would mention and remove all necessary barriers	programme is likely to be issued as a "new launch" without serious assessment of failures of former RE programmes
2) *Devising a concrete transition pathway and agenda*		
Council identifies tangible goals (e.g. the 7% goal) for the mid- (2020) and long-term perspective (2030; 2050) in the context of a national energy mix. It might critically reassess the numbers that have been previously published	Implementable, goals exist already, their feasibility needs to be re-examined	Implementable
Council analyses the regulatory renewable energy promotion instruments that are in place (RE law, market liberalisation) and critically assesses their effectiveness	- Implementable, however, market structures & price subsidies (main barriers) are unlikely to be tackled - Strong favours of centralized measures against FITs and IPPs	Centralized model without open FITs and little role for independent producers
Council identifies a set of necessary changes in the regulatory set-up of the energy system, its subsidy structure and the power market	Unlikely to be implemented; market structure is unlikely to change	Closed market conditions might remain, only the integration of RE into the national subsidy theme remains as realistic option
3) *Experimental phase*		
New programme is tested on a regional scale (i.e. several *wilayas*) in order to test their efficiency. Given that Algeria has already introduced a (defunct) national renewable electricity programme, this step might not be necessary	Implementable, might not be necessary for Algeria	
4) *Monitor and evaluate the results*		
Results of the test cases and of the previous phases of the national renewable energy programme are critically assessed, with a particular focus on regulatory flaws and underperformances	Could only be implemented if assessment is not publicised	Unpublished assessment
5) Adaptation		
Council takes notice of the test results and develops alternative or mitigating measures for the underperforming elements of the test	Implementable	
6) *Start again from step 1*		
Roll-out of the plan after a consultation of the energy council as a re-iterative project	Conflict with already existing schemes might arise	Altered re-launch of already existing programmes is the most likely option

7.2.3. Applying TM as a policy design model in the Algerian context – conclusions

Following the caveats presented in the previous section, the following conclusions can be drawn:

As in the UAE case, the Algerian system of energy policy already features some elements that are taken up by TM, such as long-term national planning documents that are developed in close cooperation between the MEM, CREG and Sonelgaz. Yet, this already highlights one key caveat: Algerian energy policy decision-makers are by and large system-entrenched actors that will neither allow any form of open government nor genuinely multi-stakeholder approaches. It has been demonstrated that the absence of substantial civil-society groups in the field and the weakness of RET companies make their integration unlikely. This is also the case for the managerial concept of government, which does not appeal to the current Algerian political elite. Further, the vast gap between the de jure legal situation and the de facto performance on the ground do not appear open to an independent assessment of test results.

Furthermore, the engrained Algerian centralism, the partially-open market regime and the state-centeredness of business cast doubts about the efficiency and innovatory power of the socio-technical niches that the government is attempting to create and that, in principle, would align well with TM.

In conclusion, the highlighted elements make successful, TM-inspired policy planning unlikely. The realpolitik caveats show that a large number of essential TM features are unlikely to succeed under the present circumstances in Algeria.

Meanwhile, the main tenets of TM, such as the concepts of bottom-up strategy and its reiterative processing based on transparent assessments of the achievements and shortcomings of the test programmes do not fall on fruitful ground in Algeria. Instead, through a continued centralization and the support of mega-projects, the country's most powerful institutions cling to power and remain in control. Additionally, TM is designed for an open market with transparent price structures and subsidy schemes. Needless to say, this is not present in Algeria and it is likely to remain as such for the time being. As a result, this reinforces the power of the entrenched companies as only they have sufficient negotiating channels, contacts and insider information to reach an agreement with state institutions. Others, such as small-scale, decentralised and/or foreign agents are thus unlikely to be given preference at all.

In a nutshell, TM as a policy design model for Algerian energy policy is unlikely to yield the desired results as core elements of this model are diametrically opposed to the structures of Algerian energy policy.

7.3. Results of the case studies compared

Both case studies have shown how the energy policy systems in the respective Arab state categories[228] present themselves under a multi-level perspective. Informed by the country case study analyses, the previous sections have identified which realpolitik caveats European innovation policy model are likely to face in both countries. However, it also became evident that in spite of their vastly different socio-economic indicators, systems of government and population structures, overall energy policy functions along the similar lines in both states. More specifically, this is the case for renewable energy policy, which supports the conclusion that the framework conditions for renewable energy policy in hydrocarbons-wealthy Arab states are, after all, similar due to the pivotal role of resource exports and the rentier character of societies. The structure of the electricity markets, the opacity and centralisation of governance structures,

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[228] See the definitions in the Introduction (Chapter 1):
"The resource-rich Arab states…fall into two sub-categories: on the one hand, there are the **small city states of the Gulf region**, **such as Qatar, Kuwait and the United Arab Emirates** (UAE). Economically, they are characterized by a large non-native work force and a high GDP-per capita-ratio. On the political level, these states have been most active in reforming their traditionally weak governance structures by an on-going (albeit at times symbolic) reform process. Due to the small national populations hydrocarbon rents can be generously distributed, which results in high human development indices.
The other subcategory of hydrocarbons-wealthy states is constituted by **the territorial states of Iraq, Libya and Algeria and Saudi Arabia**. In spite of their major oil and gas reserves, the wealth needs to be distributed among much larger numbers of nationals on a major national territory making these states upper or even lower middle income states. These factors, as well as the at times turbulent interior dynamics of these states, have generated entirely different governance structures than in the Gulf sheikhdoms, resulting only in "medium human development" values alongside many other non-resource-rich Arab states."

the lack of climate policy awareness and the other aspects shown in the MLP analysis of Part B also support this argumentation.

In addition to this, the previous sections have elaborated that although TM can generate innovative concepts for renewable energy policies on paper; its practical implication remains a daunting task. This is owed to the fact that in both cases, the markets are not open to all participants and electricity prices are not free-floating. Instead, any energy policy that intends to be implemented will have to acknowledge the fact that it must set incentives in systems characterised by closed-off markets and fixed prices. Furthermore, the prevalent opaque and authoritarian governance structures, the persisting power of the oil and gas elites and the absence of substantial, adequately empowered civil society groups form political framework conditions that cannot be ignored. A crucial consequence of this is that the states analysed show little sign of moving to more participative, distributed and bottom-up forms of political process. This goes parallel with the rulers' fascination for megaprojects, such as Masdar in the UAE or Desertec and the new renewable energy policy scheme in Algeria – a fact that any actually implementable innovation policy has to take into account.[229]

As had been established above, the actual differences between the respective political elites are in fact smaller than originally envisaged. While the oil-wealthy royal families in the Gulf (in our case: the UAE) enjoy a quasi-absolute rulership that is characterized by limitations on free expression, the political-military complex in Algeria gives itself a more democratic appearance but is, in fact even more sclerotic and sceptical towards change than most Gulf rulers. While both countries are in theory ruled by a constitution, the more personalised form of government in these de facto absolute monarchies allows rulers in the Gulf States much room for manoeuvre. However, the difference between the de jure and de facto regime in Algeria is so substantial that effectively, rulers enjoy a similarly large range of instruments of power and are equally little bound to previous rules, laws or official announcements they have made.

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[229] While regional energy experts are aware of the fact that projects like Masdar do not produce much knowledge that can actually be used in actual market situations (*Interview no. 88 – R&D, UAE*), in pyramidal power structures as are given here, rulers' predilections have to be factored in to a certain extent.

The conditions, enablers and uncertainties for renewable energy policy in resource-wealthy Arab states have therefore been delineated thereby revealing that despite the multitude of differences at first glance, the underlying structures remain strikingly similar. The significant underperformance of the Arab rentier states with respect to the spread of renewables, one of the research questions posed in the introduction to this thesis can be explained by the political intricacies and legal and economic inconsistencies.

In line with the initial research aims, it is not the goal of this chapter to develop a fully-fledged national energy policy for one country. This requires more technical work on issues such as electricity pricing structures, law reform, technology options and the other problems discussed in Part B and would constitute the work of governmental policy planning or energy consulting. Instead, the goal of this section was to highlight the key governance features that any material energy policy has to take into account. The exercise of drafting energy policy by means of TM has identified which governance structures present realpolitik caveats to an overly quick application of such approaches and– coupled with the MLP analysis of the national energy systems – has laid open the fundamental governance structures that form the pivotal conditions of success of material energy policy in resource-wealthy Arab states.

8. Outcomes for theory development

After Chapter 7 discussed the results of both case studies with regards to the applicability of TM and the similarities and differences between the country types analysed by the MLP method, this chapter aims to further discuss a series of wide-ranging questions, on two different layers. Policy design models and potential substitutes for the TM model for material energy policy design will be discussed in Subchapter 8.1 while Subchapter 8.2 will focus on the implications of socio-technical governance concepts and the interaction of the results with a broader call for a de-westernisation and indigenisation of governance theory.

8.1. Transition Management and substitute policy design strategies

Informed by the MLP-based analysis of the two case studies (Chapters 5 and 6) the previous Chapter 7 has demonstrated that designing renewable energy policy with TM-inspired policy models in these cases – and by proxy in this group of countries[230] – has only somewhat limited chances of success. In short, TM's critics that it is essentially reflecting and made for a Dutch liberal consensus type of polity have indeed highlighted a serious shortcoming. In more detail, it was shown that this problem is rooted in TM's strong reliance on elements of open government, transparency and liberal market systems. In opposition to Kern (2009) who argues that TM does not reflect national politics and power relations enough and thus becomes overly functionalistic, the author would contend that TM – in principle – takes these variables into account on the theory level as it integrates governments, non-governmental agents and further stakeholders and movers in society and is thus open and flexible to work with different modes of governance. However, for a TM-inspired policy design model to succeed, those variables cannot be filled with the factual content they would get in the two case

[230] It is one of the key methodological tenets of case study research that the results produced by a thorough analysis of the case studies are representative to the type of state as a whole. However, context-related contingencies always make the transferability of results provisional; a transfer can never take place without a critical analysis and context-adaption of the results.

studies since the way these structures work would undermine the very structure of TM policy design. Most bottom-up policy design elements face strong resistance in the region; the government's aim to retain their role as sole actors in the process that are both hardly accountable and beyond criticism. As a consequence, hopes for the success of niche-based innovation models are empirically unfounded for the target region. This also applies to the "islands of efficiency" concept that has been discussed earlier. Gulf rulers take a particular liking in the notion of these niches and other lighthouse projects that have had a certifiable success in other industry sectors. However, at the current moment, system-transforming innovations cannot be expected from such approaches in the field of large-scale renewable electricity production.

Thus, how could a policy design model that is alternative to TM and that reflects the experience from the case studies be adequately characterized? The following rough list of seven realpolitik phenomena, renewable energy incentives and barriers has to be taken into account:

First, the model needs to work under a top-down system of government that is less open, more autocratic and more erratic than a TM ideal type government. It must also incorporate the insufficient legal guarantees that exist for already extant scheduled projects and initiatives.

Second, such a model must factor in only a minimal role of civil society intervention and cannot focus much on transparency towards third parties. Thus, what is needed is a system that enables the strongly intertwined oil and gas business and the political elites to find a formula that offers them sufficient incentives to move ahead with real change in the renewables sector.

Third, this model requires a pricing system that heavily subsidizes electricity prices for the end users. Its only chance is to be integrated in the existing subsidy scheme.

Fourth, mega-structures appear to appeal to leaders in this group of countries. Decentralised, bottom-up structures might therefore be desirable for the various reasons discussed, yet, they are unlikely to succeed. Ideally, these structures will become "islands of efficiency" in their respective field. Yet, considering the uncertain future of Masdar, this is not a given.

Fifth, renewables can garner potential support by the ever-growing electricity demand in the countries analysed thereby resulting in an eventual drop in the fossil reserves bound for the world market. While environmental and climate change concerns play only a minor role here, long-term economic growth scenarios take renewables into account.

Sixth, these states currently perform poorly on the science and technology indicators. However, while technological leadership on behalf of this group of states is unlikely any time soon, there is an industrial potential in the mid-term perspective. In this regard, particularly the sizable funds of the SWFs could stimulate growth.

Seventh, key movers for public awareness on the local level could be well-designed campaigns using secular references to environmental ethics thus transcending religious boundaries and cross-referencing education in schools and universities with the global environmental discourse.

The Chinese model, with its strikingly similar features, offers inspiration for a renewable energy policy design model, which operates successfully under similar conditions. Most elements described are arguably similar to the Chinese model. Features such as political authoritarianism and government opacity, a predilection for long-term plans and mega-projects, poor innovation indicators, inexistence of civil society, subsidized electricity pricing can be found in both settings. Remarkably though, in spite of the intricacies highlighted, the People's Republic has succeeded in launching a highly successful renewable energy programme during the last decade. Large investments supported the spread of renewable power capacities in the country, with the Chinese solar module producers, in particular, experiencing unprecedented growth.

While it is beyond the scope of this chapter to present a full account of Chinese renewable energy policies it is remarkable how many parallels appear between the Chinese model and the energy policy system of resource-rich Arab countries. It would be a worthwhile undertaking to develop a policy design model for these countries on the basis of the Chinese energy policy. Developed on the basis of a realistic best-practise assessment of Chinese renewable energy policies, such a policy design model could indeed be instrumental for resource-wealthy Arab states.[231]

In conclusion, the MLP has emerged as a regionally neutral methodology capable of *analysing and explaining* the core structures of energy policy in any given country. The *policy design* model of TM, in contrast, proved to be too value-laden, too normatively-based on European concepts rendering it unfit for an application in a fundamentally different policy setting. As it is unlikely that social, political and economic framework conditions similar to those envisioned by TM will evolve in the Arab world any time soon, an empirically grounded policy design model based on Chinese energy policy has been suggested as a potential thread for further research.

8.2. Indigenisation and de-westernisation? Implications for socio-technical governance concepts

This thesis has shown that the application of TM as a somewhat typical "Western" renewable energy governance approach to the context of resource-wealthy Arab states had severe shortcomings. While this is an important conclusion in and of itself, finding potential alternatives for this policy design model triggers a more in-depth reflection. Given that an MLP-inspired analysis revealed the structures of a national energy system, would we merely need a more Middle East-applicable policy model than TM? On a purely managerial, policy design level, and as suggested in the previous subchapter, this is the obvious conclusion. Yet, on a more fundamental level, the question remains, as it is likely that eventually, other policy design models empirically grounded on a different *body politique* would generate a criticism similar to the one levelled at TM.

Would that, in turn, entail that any policy design model to be applied to another region needs to be genuinely autochthonous in order for it to have a real impact? It is indeed

[231] One expert interviewee with expertise in the field of Chinese politics confirmed this notion (*Interview no. 46 – R&D, Europe*).

evident that the effectiveness of policy design elements needs to be critically assessed when applied to different regions. A FIT system, for instance, cannot be introduced in a similar manner into societies that have an entirely different socio-economic fabric. This rings true in this case to the extent that it is almost a truism. However, on a more fundamental level, the matter is more complex as governance theory is confronted with the irreconcilable difference between cultural relativists and logical essentialists.[232]

On one end of the spectrum, the outcome of this conundrum would be a call for the indigenisation of governance concepts. Claiming that all political concepts essentially reflect the society in which they were developed, such a transfer could not but be flawed. Thus, supporters of this school of thought would assert that this is not related to questions of merely identifying which policy element works best in which context in a legal-technocratic manner. Instead, the underlying differences between indigenous cultures run too deep to be glossed over by such managerial issues. Such a cultural relativist model would argue that cultures even develop different logical systems that cannot be bridged. The way that "Western" concepts of statehood such as "democracy" and "capitalism" appear to have succeeded to enter governance systems on a global scale is a merely temporary phenomenon that overlooks the vast difference how the apparently identical concepts are in fact employed and defined around the globe. On a more political level, this could be interpreted as the attempt of "the West" to force a hegemonic discourse, a system of governance and economy on other world regions thereby securing its supremacy on most levels. Followers of this argument would consequently call for a deep de-colonization and de-Westernisation of all governance sectors to undo "provincializing Europe" (Chakrabarty, 2008). In the same vein, Badie traces the modern concept of "the State" back to post-enlightenment Europe and its violent European export by means of colonialism forcing most other societies to adopt a non-native governance model for their own social organization. While this process also had repercussions on the original European model, these arguably were less significant than the "failed universalization" process, which has affected and

[232] The issue of global energy governance has recently been the subject of research literature; cf. for instance Lesage et al. (2010).

continues to affect many non-European governance systems in a major way (Badie, 2000). Meanwhile, Badie and Birnbaum argue that most national governance structures are essentially based on a system reflecting the particular historic socio-political and economic circumstances in colonial Europe, essentially built on the principles of Westphalian sovereignty. While this concept has diffused and differentiated over the course of the last two centuries in the (post-)colonial states, it remains the basic organisational structure until today (Badie & Birnbaum, 1991).

Renewable energy governance is a case in point. European energy governance models in terms of market organisation, technology choice and legal regulation have spread around the globe with hardly any conceptual alternative. Yet, it is evidently not a given that a German FIT-system or liberal market pricing models are a cure to under-priced and outdated electricity systems as well as the ever-growing electricity demand in the MENA region.

On the other hand, the variation of concepts in this subject area is remarkably limited; in fact, genuinely local governance patterns for large-scale energy systems hardly exist. This noteworthy phenomenon feeds well into arguments of the opposing, logical-essentialist position, which Buisson describes as "universalistic and teleological" (Buisson, 2007, p. 118). In response and in opposition to Badie and Birnbaum, Bayart contends that while state structures in Africa and Asia are often regarded as conceptual imports, the main principle of historical state formation is "conflictual, unintentional, generally unconscious and, as a result, often paradoxical" (Bayart, 1996). Bayart continues by stating that while, undoubtedly, there are some European roots in modern non-European statehood, the days of only copying European governance structures are long gone. Instead, drawing on Homi Bhaba's "mimicry" (Bhabha, 2003), these institutions have by now "acquired their own social roots and have become culturally appropriated" (Bayart, 1996), or "hybrid", as Bhaba puts in. Contrary to Bhaba, however, Bayart severely attacks the "invention" of postcolonial studies and largely rejects the significance of the colonial area for today' globalized world (Bayart, 2011).

With respect to renewable energy matters, proponents of this argumentation might concede that many mistakes can be made (and avoided) on the managerial level by choosing a best-practise model for the governance situation in a certain country. Yet, it appears untenable that every region or state would need to develop its very own, autochthonous regulatory structure. It is questionable whether there are conceivable logical alternatives, for instance, to a quota system and a FIT model. Similarly, the underperformance, opacity, corruption and authoritarianism that dominate some their political systems (and by proxy their energy markets, energy regulation and governance structures) cannot be seen as outflows of a governance model that is fundamentally different from a Western one. Only then could we assume that such a system operates according to a different (sound, not criminal) logic that needs to be protected and respected on a theoretical as well as on a practical level. In short, the existence of a *tertium* between the often binary logic of socio-technical regime governance appears to stand on a poor empirical ground.

The cultural-relativist model can also be criticised for how it identifies the units that are allegedly the indivisible cultural core around which an energy governance system could to be constructed "organically". Obviously, state borders do not qualify as they are far too volatile and often artificially constructed; major religions also appear as unsatisfactory as languages. Indeed, no unit, which fits these descriptions and could withstand a well-structured criticism of logical essentialists, comes to mind.

Far from claiming to resolve this deep academic dispute, it appears that the call for indigenisation with a de-colonializing agenda in the field of energy governance is rather detached from the socio-political realities. The following research findings of this thesis should, therefore, be underlined:

- Western energy governance models cannot and should not claim a conceptual monopoly for energy policy guidelines in other world regions in and of themselves. While most governance models in the renewable energy sector worldwide have their origin in the West, these models are not expected to perfectly "fit" in the Arab world. Although Europe can claim to have developed a world-leading renewable energy related performance, Arab leaders might find energy policy design models in other parts of the world, which match the local policy landscape, more appropriate. One example is China, but also other states, such as Brazil or India might be valuable partners for South-South cooperation in the field of renewable energy governance.

- In turn, governance concepts cannot merely be rejected because they originate from a non-OAPEC world region or lack explicit regional connections. However, governance theory needs to take the local socio-political situation into account and highlight constraints that influence the energy sector.
- The claim of governance theory in the renewable energy sector is always transregional. It is uncertain to what extent the technicalities of the organisation of energy sectors could be indigenised both on a theoretical as well as on a practical level.
- While a naïve copy-and-paste post-colonialist model obviously does not exist in the case study countries, a colonial legacy remains tangible in terms of state organisation and regulation. Algeria’s political system is closely modelled on that of France. Its centralised structure and law-oriented reform approach in the renewable energy sector also resemble France’s approach. In the UAE, on the other hand, the legal and constitutional system is far less developed. Instead, the renewable energies initiatives are more project-based and decentralised, which is probably influenced by the continued Anglo-American presence in the Gulf (Onley, 2009).
- In the corresponding country case studies, the local energy governance debates are led were those between centralists and proponents of a decentralised approach; between market liberals and supporters of subsidized, closed markets, those rejecting Western concepts as eco-colonialism and those embracing them. In the two cases analysed, however, no local energy governance theory has emerged, neither as a fully-fledged theory nor as latent ideologemes that reach beyond a rejection or embrace of Western governance elements. Thus, all the options discussed in Algeria and the UAE must be considered as non-native theory imports, and the call for the appreciation of local governance concepts in the renewable energy sector stands on a somewhat shaky empirical

ground. One might argue that it is precisely this local element of theory that is missing in both states in order to help renewables off the ground. This is, however, only a weak argument that is not empirically grounded, and the opposite could equally find support.

This chapter has delineated the thesis' results on energy governance theory in light of the larger, controversial debate on post-colonial legacies in the areas of governance and state formation. While it is easy to concede that a badly performed transfer of policy design models to different world regions stands little chance of success without a deep conceptual root in the country to which it is transferred, postcolonial theory further complicates matters. Whereas a call for a de-Europeanization and a stronger development (and factoring in) of indigenous theory elements is easy to sound, as shown in the case studies, no indigenous governance models for the renewable energy sector have actually been developed, much less custom-made, for resource-rich Arab states.

9. Final conclusions and recommendations for further research

This thesis set out to address a wide range of issues related to renewable energy policies in resource-rich Arab countries. The final chapter sets out to present the thesis' key results in a summative overview recalling the essence of each chapter (Section 9.1.1) and highlighting key findings of this work (Section 9.1.2). Finally, Subchapter 9.2 will present an outlook for further research pathways with regards to renewable energy and innovation policy studies in the Middle East.

9.1. Conclusions

9.1.1. Summative overview

The thesis displayed the following structure:

Part A introduced the main elements necessary to conduct a case study analysis in Part B. Chapter 1 introduced the main themes of the study, presenting the increased global willingness to extent global renewable energy production facilities and contrasted this with the significant underperformance of these efforts in Arab world as a whole, and among the resource-rich Arab states in particular. Despite their affluence, their steadily growing demand for energy and a resource-economic incentive to export as much hydrocarbon resources as possible, these states have so far missed out on the global renewable energy boom. After defining two sub-categories (small city states vs. territorial states) two states (Algeria and the UAE) were identified as suitable representatives of the respective categories to analyse the issue in greater detail.

Meanwhile, Chapter 2 reviewed key strands of research literature (Subchapter 2.2). The chapter argued that since the nature of this study is interdisciplinary, the work has to interact with three strands of literature simultaneously: the broader field of Middle Eastern Studies (Section 2.2.1), the area of material energy studies (Section 2.2.2), and the field of governance theory and concepts of socio-technical change (Section 2.2.3). In spite of the wealth of specialized literature on various aspects of the topic, it has been shown that there is a lack of comprehensive research literature focusing on energy transitions within resource-rich Arab states. By integrating elements from all three areas of research into the country case studies of Part B, this thesis aims to contribute to research at the crossroads of these areas. Following a discussion on the main areas of research literature, the chapter then developed the *analytical* framework for the case studies, the multi-level perspective (MLP, Subchapter 2.3). Its tripartite structure allows the researcher to analyse trends and interdependencies on each and between the three levels respectively. Having discussed the shortcomings of MLP as well, this subsection developed analytical dimensions of renewable energy policy in hydrocarbons-rich Arab states that served as a guideline for the case study analyses (see Table 3). While the MLP analysis was introduced to serve as a tool to guide the *analytical* section of the thesis, i.e. the country case studies, Subchapter 2.4 introduced the *policy design* theory for this thesis, the Transition Management model. This model has been used to trigger governance processes in the renewable energy sector in various western European countries. After critically presenting both its advantageous and problematic characteristics in Section 2.4.1, Section 2.4.2 discussed how to transfer governance concepts through space and what the experiences of such transfers have revealed thus far in areas such as regulation and market structures. This section sets the stage for Part C, which later sets out to examine the transferability of governance concepts in different regions of the world. Table 4 concludes this section enumerating critical issues relating to the application of TM as a policy design model in Arab oil and gas wealthy countries. This overview is taken up again and developed further in the two sections discussing realpolitik caveats of the application of TM (Sections 7.1.2 and 7.2.2).

After interacting with the research literature and establishing the analytical and policy design frameworks in Chapter 2, Chapter 3 presented the material policy context for renewable energy policies in resource-rich Arab states on the three levels defined by MLP: landscape- regime- and niche level. In its three subchapters it discusses material renewable energy policy issues, which determine whether a country makes significant progress with the renewable energy strategies it has developed or whether these, at times, ambitious strategies take no actual effect in the country. Each section or subsection concluded with a corresponding research question, which formulated the key research interest for the overall purpose of the thesis and informed the development of the 18 questions in the research questionnaire presented in Subchapter 3.5.

Chapter 4 marks the end of Part A. This chapter discussed questions of research methodology with a particular emphasis on the five aspects the thesis covers: a qualitative, elite research approach (1) using expert interviews for data collection (2); a comparative case study approach including "case studies within the case study" (3); structuring and analysing the interview and case study results with the help of the MLP method (4), whose results will be used to draft renewable energy policy models with TM (5).

Meanwhile, **Part B** represents the empirical core of the thesis. In two extensive case studies, the energy systems of the UAE (Chapter 5) and Algeria (Chapter 6), have been analysed using by the analytical structure and theories developed in Part A. Both case studies begin with an account of the data collection phase followed by three main analytical subchapters, the landscape- regime- and niche-level analyses of the respective energy system.

The individual sections concluded with two country analyses (Subchapters 5.6 and 6.6) where key findings were presented in a summative overview of the individual section conclusions, which were in turn guided by the research questions developed in Chapter 3. In order to enhance the legibility and comparability of the data, both case studies were structured in a parallel manner. In addition to the answers to the research questions, these sections also contained the main analytical points of these case studies. For instance, both cases reveal that in spite of promising renewable energy initiatives, a success is by no means a given. These realpolitik caveats of renewable energy policies have also been used to inform the discussion in Chapter 7.

In addition to the MLP analysis of both case study countries, the energy systems of Algeria and the UAE have encountered/launched initiatives that are of a potentially pivotal importance for the overall success of the countries' renewable energy efforts. However, due to their size and complexity it appeared reasonable to present these structures and analyse their role in the national energy systems as well as conditions of their success, hence the addition of the Masdar Initiative and the trans-Mediterranean renewable energy policy subchapters (Subchapters 5.7 and 6.7 respectively).

The final **Part C** aimed to draw conclusions from both case studies both with regards to material energy policy as well as energy governance and innovation theory. Chapter 7 applied the TM policy design model to the results of the case studies. After presenting a standard TM-inspired policy design, an ideal type model was drafted and subsequently applied to the case study results in Sections 7.1.2 and 7.2.2. However, the gap between the outcomes and reality showed the difficulty of using TM – or any similar Western-oriented policy design model – to draft renewable energy policy for resource-rich Arab states. In spite of the differences in the political systems of the two country types analysed, the barriers to the application of TM persisted.

Following this assessment, Chapter 8 discussed these results and their consequences with regards to the applicability of TM to different world regions (Subchapter 8.1). It emphasised that while applying open government approach such as TM had severe caveats, drafting policy design models inspired by a different political setting, such as China, might be a rewarding future research path. Subchapter 8.2 concluded by feeding into the broader discussions on governance theory and the notion of indigenization. Stressing the shortcomings of applying a European model to the specific policy context of Arab OPEC states, this section argued that while the post-colonialist call for indigenisation is often swiftly sounded, empirical findings for such attempts in resource-wealthy Arab states remain poor.

9.1.2. Key contributions to research and methodology

As mentioned in both case studies, the author experienced difficulties gaining access to some of the key stakeholders in both Algeria and the UAE. This is owed partially to the fact of being a non-resident foreigner in both countries, but mostly due to the extremely hierarchical and often blurred decision-making structures present in both cases. The level that might have been able to clarify unanswered issues would have been, in the case of the UAE, a member of the ruling family in the rank of a minister; and a similarly high public or military official in Algeria. The likelihood of obtaining an on-the-record research interview allowing critical questions for such a project is indeed small. However, this does not mean that the data collected was less valid as it is the aim of this comprehensive approach to lay bare the structures of (renewable) energy policy and conditions for its innovation under the circumstances of a resource-rich Arab country. This energy system analysis, as well as the gathering of stakeholders' opinions about the transferability and the potential for home-grown energy governance models could still be conducted as the multiple interviewees and the different sources consulted helped procure a valid, multi-dimensional picture of the subject matter.

The following section will present a list of the thesis' key findings. In addition to the three subject areas mentioned above, it will also discuss methodological findings as well as integrated results reflecting the interdisciplinary character of the study. The section represents the abridged and combined results of both cases highlighting only the findings of both case studies.

I) Findings in the field of Middle Eastern studies

1. The traditional oil and gas elites continue to exercise control over the respective energy sector in its entirety; renewable energies do not form an exception. So far, renewable energy institutions have remained weak and have failed to gain substantial political clout independent of third parties, agencies or personalities that protect them for larger political or economic shifts. On the political level, the power struggles between the old energy elites and the promoters of clean energy often produce a lock-in of renewable energy developments.
2. In the highly personalised governance structures of the Gulf States, support for renewables must eventually be located within the ruling family. If this is not a given, success rates will remain poor. While governance structures often remain weak, key political agency remains in the hands of the "globalized monarchs" and their immediate kin. Aiming to pressure them into certain policy agendas or side-lining them through the institutional structures of the country is unlikely to succeed.

3. In states characterized by “bunker state” structures such as Algeria, political power is less personalized due to the absence of hereditary political power. It is replaced by seemingly untouchable institutions of the civil (ministry of energy, presidency, oil majors) or security-related (military, military intelligence, policy) branches of government. While not necessarily anti-renewable energies, these institutions have the power to block any innovation in the energy field. Their interests must thus be integrated into successful policy design.
4. As references to religion are rarely used in sustainability awareness campaigns and official publications, promoting renewable energy and sustainability policies on a local level is arguably more successful with referential framework of secular environmental ethics creating links to the global environmental discourse.
5. Independent energy or environment NGOs or other non-governmental agencies are either inexistent or do not play a role in energy policies in resource-wealthy Arab states. This produces a strong focus of all RE-related initiatives, research and further activities on the governments and the national energy incumbents. As an effect, they occupy unhealthily large roles in these steering processes and, simultaneously, stifle critical assessment of government policies.
6. While there is a multitude of national and regional energy governance bodies, their actual effectiveness remains limited and their advice, often, not heeded. This is an effect of the phenomenon of personalized power or power in essentially unaccountable institutions on a nation state level.
7. Despite the numerous laws and renewable energy promotional programmes in the region, their impact on the ground remains hardly visible. The lack of transparent and critical assessment further blurs the actual performance of these programmes. A low accountability on the policy level makes it difficult for investors to rely on the actual continuation of announced programmes, as shifts may occur with only little or no prior notice or subsequent compensation.

8. Attempts to create domestic renewable energy technology industry and production have so far failed due to often poor industrial structures, a lack of trained staff and the domestic RET market's miniscule absorption potential.

II) Findings in the field of energy policy studies

9. Contrary to general opinion, resource-wealthy Arab countries have been working in the field of renewable energy policy and technology for many years. Yet, while there is an abundance of ambitious RE promotion schemes and legislation, the implementation of these projects falls back behind the publicly made pledges.
10. With their long-term strategies, national economic diversification programmes and SWFs can be regarded as key agents for renewable energy R&D in this group of states. These secure funds could develop into a major strategic asset in the mid-term future if used for long-term investment in this field. The resource-rich Arab states therefore have the immense advantage of available funds for lighthouse projects, which may develop into international technology and innovation leaders in that field. If not used with such purposes, success might not set in.
11. Unlike in other regions in the world such as the EU, climate policies cannot be regarded as movers of renewable energy policies in resource-wealthy Arab states. Climate change policy has kept a low profile in the target states. One reason for this is their registration as developing countries without binding emissions targets.
12. Strongly subsidized electricity prices and closed-off market conditions form the main barricades for renewable energies. As a liberal price reform is unlikely in the foreseeable future because of rulers' fear of political unrest and the strong entrenched power of incumbent regime players with the power to block all major initiatives, renewables would need to be integrated into the subsidy schemes in order to make large-scale and meaningful progress.

13. While some elements of the political elites in resource-wealthy Arab countries are strong supporters of very large-scale showcase projects, these have not triggered a renewables boom in their countries. This is partially due to the case that most of those few interested top-level supporters of RE are not whole-hearted, committed sponsors to the idea and still derive substantial part of their financial resources from hydrocarbons.

III) Findings in the field of governance theory and socio-technical transitions

14. Niche-based, bottom-up innovation models have so far not had empirically documented larger successes in the renewable energy sector of the target countries. The latter assessment includes the popular "economic city" development model in the Gulf (Masdar).
15. Applying a typical Western European policy design model (transition management) to draft renewable energy policies in resource-wealthy Arab states has had only limited success due to the large societal, economic and political differences between these two world regions and their respective *body politique*. One key reason is that the main focus of the model is structural and consensual, personalized agency and power relations between those figures and public office or government are, after all, insufficiently explored. The application of Western governance structures in a Middle Eastern energy policy context thus remains very limited.
16. In search of a successful governance model that closely matches the model in the target states, a more top-down, government-centred and closed-off energy market model like the Chinese system could also be applied to this region with greater success.
17. The transferability of governance concepts to other world regions continues to offer a theoretical and practical challenge. While the broad postcolonial call for a de-Europeanization of (in this case) Arab governance regimes is valid, it must be emphasised that there is a dearth of genuinely local governance models in

the region itself. This paradox necessitates the import of regulatory models in the renewables sector – at least in the mid-term.

IV) Methodological findings

18. The multi-level perspective (MLP) turned out to be an adequate model for an in-depth, interdisciplinary analysis of an energy system. Its broad applicability enabled the research to combine questions relating to various aspects of Middle Eastern energy system and to combine their results in order to obtain an unbiased, comprehensive picture of the case study analysed. As initially discussed, the analytical focus of MLP tends to be on structures, omitting personal agency and personal power that are important explanatory elements in this group of states. Its integrative approach, however, is able to partially balance this out. It could be argued that this problem is indicative of the generally opaque and centralized decision-making structures that characterize this group of states. A tracking of and access to key decision-makers in both "bunker states" as well as "globalizing monarchies" remains a formidable challenge. This lack of access is also reflected by the dearth of other research literature in that regard.
19. While offering a broad, tripartite analysis, the MLP tends to overstress the role of the regime level removing attention from the niches and landscapes. Researchers' criticism in that regard is valid. This phenomenon might be caused by the fact that this level is easiest to document and arguably key for a social sciences inspired study, as both other layers might be too technology- or science-oriented (niches) or have very long impact periods (e.g. climate change) or are essentially not predictable (wars) (all landscape level).
20. Expert elite interviews, the method of data collection, produced ample qualitative data on mid-level stakeholders' views, offering a broad analysis of the various aspects of the local and regional energy systems. Indeed, the research interviews constituted a vital data source for the analytical narrative of the thesis in light of a situation of flux due to the on-going developments in this field, a

climate of government secrecy towards researchers and a dearth of energy transitions literature on the region. While the difficulty in gaining access to some stakeholders has already been highlighted, a pure desk study could not have contributed this amount of in-depth analysis, critical views and original data. Furthermore, as discussed in the methodology chapter, a quantitative approach could not have been the method of choice for an interdisciplinary energy system analysis that conducts a multi-factor analysis of energy systems. Thus, a qualitative research working with stakeholder interviews constituted the logical and most productive option.

21. The case study approach has proven to be a viable method for comprehensive, multi-level energy system analysis. Another option would have been, for instance, a multiple-country, subject-based analysis of individual aspects such as energy market, pricing regimes or RE industry structures. While this might have led to more in-depth results with regards to a select number of features, it would not have been able to address the goal of the thesis, which sought a comprehensive analysis of individual national energy systems in an attempt to explain why renewables perform so poorly. Also, the likelihood of the isolated explanation of phenomena discounting the wider political context would have been higher. While case study approaches always have to tackle the issue of transferability of data to other countries, it has emerged that the drivers and barriers of renewable energy governance in both types of resource-wealthy Arab states analysed are extremely similar. With all the necessary caution, this supports the validity of the data for other cases as well.
22. The “case study in the case study” element was featured in both cases. While naturally standing out of the MLP-inspired three-dimensional system of analysis, it was instrumental to shed light on one project of particular relevance to the country. Through this approach, particular energy policy elements and developments vital for the country could be presented in greater detail. Integrating them in the MLP analysis would have led to an imbalanced focus on one phenomenon alone.

V) Integrated contributions to knowledge

23. This study has chosen an interdisciplinary approach. By integrating theories and data from the three very different research areas mentioned it has demonstrated its explanatory strength. It is evident that neither a purely Middle Eastern Studies focus nor a transitions theory nor a material energy study would have been able to integrate the broad range of drivers, actors and explanatory elements that, in sum, are able to paint a comprehensive picture of the energy systems in the case study countries. Guided by principal research questions, a comprehensive energy systems analysis is bound to employ such a method, which is key in the advancement of our understanding of renewable energy policy transitions in the Arab world. Since this approach runs through the entire work it would defy the inner logic of this thesis to identify one isolated finding in this subsection. Instead, the original, integrated contribution of this thesis to this field is its approach, and thus, the very concept of the thesis itself.

Concluding, it has not been the goal of this section to give a minute account of the more detailed results of both case studies and the policy design part of the thesis. Instead, the 23 points mentioned seek to present an overview of the main results of both case studies highlighting key messages as well as significant insights that can also be regarded as relevant to future research.

9.2. Recommendations for further research

The thesis concludes with the following suggestions for rewarding future research.[233] Depending on the particular research interest, several research pathways appear promising. As in the preceding pages, the discussion will be divided in contributions to

[233] The author has refrained from giving extensive further references in this subchapter as this is a presentation of future research pathways that are yet to be fully explored.

three major fields of knowledge (Middle Eastern studies, energy policy and governance theory) as well as to methodological issues.

In the field of Middle Eastern Studies and renewable energy policy, it could be a rewarding undertaking to compare renewable energy policies of a resource-poor state with these of one of the OPEC-members. Building on the work done here, the research could identify which policy patterns are characteristic to resource-rich Arab states (e.g., the strong role of oil and gas elites, subsidized electricity pricing, etc.) and which elements crystalize as pan-Arab policy denominators. In addition to such intra-regional comparisons, an inter-regional comparison of (renewable) energy policies of further, non-Arab OPEC-members, for example Venezuela, Iran or Nigeria could be a promising venture. Assuming somewhat similar macroeconomic structures and priorities, again, could further elucidate the characteristic regional structures.

Another related area that remains under-researched in the broader field of Middle Eastern Studies is the issue of the interaction between the global discourse of sustainability and local environmental and renewable energy policy. How can these two be interconnected and which institutions, social activities and curricula would be the most appropriate to do so? A particularly important corollary of this discussion is the question of how far can environmental education and action on the ground be matched. This could either lead to a series of localized case studies or to a more philosophical work with a partially parallel research agenda as this one: discussing the transferral of governance models with a supposed global claim to different world regions. Owing to the aim of producing a comprehensive energy system analysis of the two cases at hand it remained impossible to further explore this very relevant ethical question in this work. However, this is a potentially very rewarding research area for further interdisciplinary studies.

The final Middle Eastern Studies related research topic to be suggested here is related to new social movements and regime change. In many ways, the Arab Spring has changed politics in expanse of the Arab arena, and not exclusively in those states, which are going through a transformation or conflict. It would therefore be a rewarding endeavour to explore what effects the changed regional dynamics have on the area of energy policies, and to what extent these new (or old) social and religious movements are carriers of innovation able to break traditional power structures in the energy sector.

The second core area of research suggested related to material energy policy studies regarding to the MENA region, which lacks depth in its current form. As described above, there are plenty of regional overviews (usually drafted by commercial consultants). However, in-depth analyses exclusively focusing on a single country remain rare. While these studies could all be carried out with a similar analytical research outline (MLP, case studies focusing on countries as basic units of analysis), it would also be rewarding to devote an entire study to one individual level or indeed one single aspect of the energy system. Therefore, the entire analysis can aim to identify the routes bottom-up innovation ought to take or to trace in detail how an international climate agreement (or other landscape-level events, such as oil prices, real changes in the national governance structures, etc.) have an effect on national energy policies. More limited scopes of research could focus on only one layer, which , for instance, could be subjects like renewable energy laws, electricity pricing (and RE support) models, or the energy market structure all of which represent topics that are sufficiently complex to warrant entire studies focusing on these aspects. This would no doubt be a rewarding undertaking. The downside of this exclusive focus on one aspect, however, would be the dearth of comprehensive information on a given country or market region. Yet, this trade-off can hardly be overcome.

The third research area this thesis sought to contribute to is the field of renewable energy governance theory, as well as theories of socio-technical change and innovation. This thesis attempted to apply one Western policy design theory to this world region. The brief discussion on the Chinese model has shown that an analysis of this model and an attempt to apply this to resource-rich Arab states might be a fruitful undertaking. In the field of innovation theory, it is important to address and readdress the question which seeks to identify the institutions that can currently trigger change and innovation in the Arab oil and gas states. This thesis has shown that the “islands of efficiency” development model that is popular among elite circles in the Gulf States has not benefitted the renewable energies sector thus far. Indeed, other models could be identified that better fit those states. Also, the field of indigenisation of governance theory warrants exhaustive studies. How can the tension between the over-simplistic imports of foreign governance concepts in a copy-and-paste-mode and the naïve call for indigenous theory development in areas where pure logic dictates a certain pathway (and forbids all others) be reconciled? Under which conditions does the travel of governance concepts not constitute an attempted Westernisation, an export of Western concepts of statehood, but a logically stringent application of concepts respectful of local contents? It is evident that this debate remains a rich one. It is never merely *l’art pour l’art* inasmuch as it adds a philosophically-grounded social and regional science dimension to energy policy research that is missing all too frequently. Studies where this is the case are usually characterized by an exclusive focus on a technical and managerial level while failing to take into account the multitude of social, political and at times religious aspects, which ought to be considered if the policies proposed are to have lasting effects.

Finally, other methodological models are, of course, also viable. This thesis has adopted a qualitative model of elite interviews, a multi-level perspective and a case study model. However, a few other options have already been highlighted. While research interviews might not be advisable in a study focusing exclusively on individual aspects (in these cases, data collection in the field might altogether be abandoned), a researcher could opt for opinion research and focus on the views and knowledge of environment and RET-related aspects within a representative population. Despite the obstacles opinion research in the states covered by this thesis might face, it remains a rewarding subject. Evidently, other, even more comprehensive studies of the region such as multi case-study projects, which analyse several countries, could be fruitful, yet, the sheer volume of such works might prove to be an issue. Naturally, researchers could also opt for purely quantitative studies. These research methods appear to be most useful for large-number comparisons and analysis of energy systems. A solely quantitative approach to a comprehensive country energy system studies such as this thesis, would have left many aspects uncovered.

In conclusion, there cannot be any doubt that renewable energy policy in the Arab region remains one of the most rewarding, relevant, dynamic and still-uncharted fields of research this discipline has to offer. The present thesis has not been but an attempt to fill one of the many research gaps in that area. Much more remains to be done in the years to come.

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Annex

I. Interview guideline

Landscape-level

Political system

Research questions for the political system

1. How far do the political system and the non-existence of independent CSOs allow for system innovations in the energy sector, particularly bottom-up innovations?

Research questions with regards to personal patronage networks:

2. To what extent are the official decision-making processes the actual decision-making structures?

Research questions regarding long-term effects of renewables on the political system

3. What do interviewees regard as the key governance effects of renewable energy production?

Key transregional energy governance bodies

4. Which role do transregional energy governance bodies such as OPEC, OAPEC or IRENA play in the promotion or stalling of national renewable energy policy in the respective target country?

Climate Change

5. Is the climate change agenda actively considered in the political decision-making on renewable energy developments?

Long-term national economic diversification

6. Are the renewable energy-related efforts connected to the national economic visions or national SWF activities in the respective country?

Country branding

7. Is country branding a catalyst in the spread of renewable energies?

Regime-level

Technological regime

Questions regarding the national power sectors

8. To what extent are renewable energies employed to reduce pressure on the domestic conventional power plant park?

Nuclear option

9. Is the nuclear option seen as a competitor in resources or as a mutually exclusive form of power production?

User and market regime

Market conditions

10. Is there any system of renewable energy promotion in place?
11. Do stakeholders believe that the transfer of European renewable energy policy design models is a viable method for the spread of renewable electricity capacities in the region or would indigenous policy models work better?

System of double subsidies

12. Are strategies developed to create a level playing field for all types of energy carriers by either removing subsidies for conventional power or by integrating renewable electricity into the existing subsidy schemes?

Socio-cultural regime

Social awareness and the role of religion or environmental ethics

13. How widespread is the knowledge of renewable energies in the target countries? Does religion play a role in legitimizing this energy technology?

Research questions in terms of labour markets:

14. Is the job creation potential actually employed by promoters of renewable electricity in the country?

Policy regime

Questions on renewable energy targets and actual performance:

15. Is there a (binding) strategic document, such as an energy roadmap/blueprint or at least a non-binding planning scheme? If so, how does this integrate renewable electricity?

Questions regarding regional infrastructure and governance bodies:

16. Do the regional electricity governance bodies promote political or infrastructure projects that enhance the role of renewable electricity in the target country? Is external demand a pull factor in that respect?

<u>**Niche-level**</u>

Science regime and technology transfer

17. Is there an attempt to create a domestic knowledge hub for RETs and is there an industry structure that supports the spread of technologies into mainstream society?

Technological developments

18. What is the interviewees' opinion on technology choices and on the chance of industry-use of RETs as entry points for further RETs in resource-rich Arab states?

II. List of interviewees[234]

II.1. Algeria

Nr.	Stakeholder category	Name of Interviewee	Institution	Date and Location of Interview
1	Public stakeholders	Alexander Knipperts	Director of the Friedrich Naumann Foundation, Project Maghreb	Algiers, 05/10/2010
2		Sarida Bendjeddou	Division of energy, environment and sustainable development, French Embassy Algiers	Algiers, 02/02/2010
3		Mohamed Aminour	Climate Security and Energy Affairs Officer, British Embassy Algiers	Algiers, 31/01/2010
4		Alex Dhina	Deputy Director & Head of Economic Services; German-Algerian Chamber of Commerce	Algiers, 01/02/2010 and 11/10/2010
5		Dounia Guerfa	Project Manager Environment, German-Algerian Chamber of Commerce	Algiers, 04/02/2010
6	Private and public investors (non-operative business)	Dr Toufiq Hasni	Former general director of New Energy Algeria (NEAL); energy consultant	Algiers, 11/10/2010
7		Dr Boukhalfa Yaici	Renewable Energies Project Manager, CEVITAL	Algiers, 27/01/2010 and 06/10/2010
8		Dr Mustapha Mekeideche	Former SONATRACH official, member of the Algerian national economic council	Berlin, 12/11/2010
9	National and international power sector	Driss Derradji	CEO, New Energy Algeria (NEAL)	Algiers, 27/06/2009

[234] This list represents the professional positions of the interviewees at the time of the research interviews.

10	**(operative business)**	Abdelkrim Benghanem	Former CEO, Sonelgaz	Algiers, 20/11/2010
11		Francisco Gomez	Director General, Solar Power Plant 1, Abengoa-Abener	Algiers, 24/06/2009
12		Youcef Himri	Engineer, Sonelgaz, Béchar Branch	Oran, 25/01/2010
13	**Research and development**	Robert Parks	Center for Maghrebine Studies (CEMA), Oran	Oran, 25/01/2010
14		Dr. Sifeddine Labed	Director, General Direction for Scientific Research & Technological Development	Algiers, 28/01/2010
15		Dr. Belhamel, Dr. Abdelkrim Chennak	Director General & Chef of Division, Centre for Renewable Energy Development & Research (CDER)	Algiers, 23/06/2009
16		Mr. Rezoug	Director General Assistant; Research & Development Centre of Power and Gas (CREDEG)	Algiers, 24/06/2009
17		Aicha Adamou	Spokesperson, international cooperation, New Energy Algeria (NEAL)	Algiers, 04/02/2010
18		Prof Amine Boudghene Stambouli	Université des Sciences et de la Technologie d'Oran, Department of Electrical Engineering	Oran, 25/01/2010
19		Dr Abderrahmane Abedou, Mohamed Y. Ferfera, Nacer Eddine Hammouda	Centre de Recherche en Economie Appliquée pour le Développement (CREAD)	Algiers/ Bouzaréah, 10/10/2010
20		Kamel Mostefa-Kara	General Director, Agence Nationale des Changements Climatiques (ANCC)	Algiers, 10/10/2010
21		Tim Willis	Control Risks Algeria	Algiers, 31/01/2010

II.2. Europe

Nr.	Stakeholder category	Name of Interviewee	Institutional Affiliation	Date and Location of Interview
22	Public stakeholders	Simone Rave	Head of Energy and Climate Change Sector, EU DG EuropeAid	Brussels, 14/07/2010
23		Philippe Lorec	French Ministry of Environment and Innovation	Paris, 13/07/2010
24		Neil Quilliam	MENA Energy Team, UK Foreign and Commonwealth Office	London, 10/04/2010
25		Christina Wittek	German Federal Ministry of Economics and Technology	Berlin, 19/03/2010
26		Paolo Frankl, Cédric Philibert, Samantha Ölz	International Energy Agency, Renewable Energy Division	Paris, 02/07/2010
27		St. John Hoskyns	International Energy and Technology Division, UK Department of Energy & Climate Change (DECC)	London, 17/02/2011
28		Tom Meredith	Renewable and Alternative Energy Division, Department of Energy & Climate Change (DECC)	London, 02/03/2011
29		Kilian Baelz	General Director, Regional Center for Renewable Energy and Energy Efficiency (RECREEE), Cairo	London, 17/10/2009
30		Mark Radka, Myriem Touhami	UNEP Energy Branch Paris	Paris, 02/07/2010
31		Roderick Kefferputz	Heinrich Böll Foundation, Brussels Office	Brussels, 14/07/2010
32		Janis Folkmanis	Principal Administrator, EU DG TREN, Brussels	Tunis, 10/11/2010
33		Tom Howes	Deputy Head of EU renewable energy policy EU DG TREN, Brussels	Phone interview, 11/03/2011
34	Private and public investors (non-operative business)	Frauke Thies	EU Energy Campaigner, Greenpeace Brussels Office	Phone interview, 07/09/2010
35		Roxanne Torfeh	MENA Team, Deutsche Bank London	Phone interview, 09/09/2010

36		Dr Till Stenzel	COO, Nur Energie Ltd.	London, 10/09/2010
37		John Scowcroft	Head of Unit, Environment & Sustainable Development Policy, Eurelectric, the Union of the Electricity Industry, Brussels	Phone interview, 18/02/2011
38	**National and international power sector (operative business)**	Sarah Bryce	Global Wind Energy Council	Brussels, 14/07/2010
39		Dr Angelika Denk	Dii, Director of working group "Markets", Dii Strategy Division, Munich	Abu Dhabi & phone interview, 07/02/2011
40		Dr Nikolaus Supersberger	Senior Business Developer, GIZ, Eschborn, Germany	Berlin, 10/09/2010
41	**Research and development**	Paola Mazzucchelli	General Secretary, European Renewable Energy Research Centres Agency (EUREC)	Brussels, 14/07/2010
42		Dr Jean-Yves Moisseron	Institut de recherché pour le developpement	Amman, 05/11/2010
43		Dr I. Werenfels & Wolfram Lacher	German Institute for International and Security Affairs (SWP)	Berlin, 10/07/2009
44		Prof Manfred Fischedick, Dr Peter Viebahn, Dr Daniel Vallentin	Interim director and research fellows, Energy research group, Wuppertal Institute for Climate, Energy and Environment	Wuppertal, 10/04/2009
45		Bernhard Brand	Institute of Energy Economics, University of Cologne	Cologne, 15/08/2009
46		Dr Paul Suding	GIZ Office Washington (former head of REN 21, Paris)	Phone Interview, 28/02/2011
47		Dr Francis Ghiles	Barcelona Center for International Affairs (CIDOB)	Barcelona, 21/07/2010

II.3. UAE/Gulf region

Nr.	Stakeholder category	Name of Interviewee(s)	Institutional Affiliation	Date and Location of Interview
48	Public stake-holders	Dr N. Janardhan	UAE Ministry of State for Federal National Council Affairs	Dubai, 29/09/2010
49		Kirsten Staab	Hamburg Representative, German Chamber of Commerce and Industry	Dubai, 29/09/2010
50		Dr Martin Böll	Resident Expert, Germany Trade and Invest	Dubai, 29/09/2010
51		Dr David Scott	CEO, Executive Affairs Agency of Abu Dhabi	Abu Dhabi, 30/09/2010
52		Matthias von Pohlenz	Counsellor, Economic Affairs, German Embassy Abu Dhabi	Abu Dhabi, 30/09/2010
53		Thomas Birringer	Regional Representative to the Gulf States, Konrad Adenauer Foundation Abu Dhabi	Abu Dhabi, 20/01/2011
54		Hugo Lucas	Director, Outreach and capacity building, IRENA	Abu Dhabi, 26/01/2011
55		Mustapha Taoumi	Project Officer, Knowledge Management Regional (MENA), IRENA	Abu Dhabi, 26/01/2011
56		H.H. Sheikh Dr. Abdul Aziz bin Ali bin Rashid Alnuaimi	Member of ruling family of the Emirate of Ajman, "The Green Sheikh"	Sharjah, 29/01/2011
57		Dr Samir Alkareish	Director of Technical Affairs, OAPEC	Kuwait City, 31/01/2011
58		Dr Adnan Shihab-Eldin	Director, Kuwait Foundation for the Advancement of Sciences (formerly: acting general secretary of OPEC)	Kuwait City, 15/03/2011
59		Mike Wood	Kuwaiti Ministry of Energy and Water	Kuwait City, 01/02/2011
60	Private and public investors (non-operative business)	Chee Lee	Regulation and Supervision Bureau, Abu Dhabi	Phone interview, 06/02/2011
61		Hamidullah Siddiqui	Operation and Despatch Manager, Transco Abu Dhabi	Abu Dhabi, 19/01/2011
62		Tushita Ranchan	Advisor, Project & Corporate Finance, Mubadala	Abu Dhabi, 28/09/2010
63		Matthias Gerhardt	Head of Project Development & Project Management; AIC Projects GmbH Chemnitz (Abu Dhabi Office)	Abu Dhabi, 18/01/2011

64		Vahid Fotuhi	Director, BP Solar Middle East, Dubai	Dubai, 24/01/2011
65		Mohamed Al Attas	Solar Roof Programme Manager, Abu Dhabi Water and Electricity Authority (Adwea)	Abu Dhabi, 27/01/2011
66		Khaled Awad	Director, Grenea	Dubai, 29/01/2011
67	**National and international power sector (operative business)**	Alexander Bergfeld	Business Development Manager, EnviTech	Abu Dhabi, 26/01/2011
68		Suresh Bhaskar	Head of Strategy, GDF Suez Energy MENA	Dubai, 24/01/2011
69		Hendrik R. Bohne, Hatem Hamam	Director of Sales and Regional Sales Manager, Middle East	Abu Dhabi, 18/01/2011
70		Bashar G. Muhtadi	General Manager, Millennium Energy Industries	Abu Dhabi, 20/01/2011
71		Ravi Ivaturi	General Manager International Marketing & Sales; Microsol International	Abu Dhabi, 20/01/2011
72		Andy Wang	Senior Accountant Manager, Yingli Solar	Abu Dhabi, 19/01/2011
73		Frank Wouters	CEO, Masdar Power	Abu Dhabi, 03/10/2010
74		Georgine Roodenrys	Manager Policy and Communications, Middle East, BP Hydrogen Power	Abu Dhabi, 22/09/2010
75		Dr Peschke	COO Masdar PV Germany	Ichtershausen, 13/08/2010
76		Romain Sautrau, Sascha Menzendorf	Masdar Power	Abu Dhabi, 28/09/2010
77		Dr Soughata Nandi	Tecom Holding	Dubai, 29/09/2010
78		Grant Little	Business Development – Carbon Projects, Masdar Carbon	Abu Dhabi, 26/01/2011
79		Walker Frost	Communications Manager, Suntech Power Holdings Co.	Abu Dhabi, 19/01/2011
80	**Research and development**	Dr Karen Young	American University of Sharjah	Dubai, 29/09/2010
81		Dr Mohamed Raouf	Gulf Research Center	Dubai, 21/09/2010
82		Marie Bos	Control Risks UAE	Dubai, 21/09/2010

83		Hannes Reinisch	Deloitte Abu Dhabi	Abu Dhabi, 26/01/2011
84		Dr Salem Elhajraf, D. Mamun Absi-Halabi	Renewable energy section, Kuwait Institute for Scientific Research	Kuwait City, 31/01/2011
85		Rob Sherwin	Regester Larkin UAE	Abu Dhabi, 22/09/2010
86		Chris Stanton	Energy journalist, The National	Abu Dhabi, 30/09/2010
87		Prof Georgeta Vidican, Dr Yasser al-Saleh	Masdar Institute of Technology	Abu Dhabi, 03/10/2010
88		Dr Hamid Kayal	CEO, CSEM-UAE, UAE Emirate of Ras el Khaimah	Ras el Khaimah, 04/10/2010
89		Ammar M. Munir	Research Team Leader, Renewable Energy Department, National Energy & Water Research Center	Abu Dhabi, 20/01/2011
90		Robin Mills	Petroleum Economics Manager, Emirates National Oil Company Ltd. (ENOC)	Dubai, 25/01/2011
91		Dr Lisa Lamont, Dr Lana Chaar Moumneh	Assistant Professors, Electrical Engineering Program, Petroleum Institute	Abu Dhabi, 26/01/2011
92		Jim Krane	Journalist, author, energy expert, Cambridge University	Cambridge, 04/02/2010
93		Dr Valerie Marcel	Associate Fellow, Chatham House Energy, Environment and Development Programme, London	Dubai, 27/01/2011
94		Heinz Krier	Chairman,Fraunhofer-Masdar Steering Committee, Abu Dhabi	Abu Dhabi, 03/10/2010