Economist Intelligence Unit | The Economist

THE GLOBAL ENERGY CONVERSATION

TRANSITIONS FROM WEST TO EAST

Supported by

CONTENTS

PREFACE

This report, edited by the Economist Intelligence Unit and supported by Shell, follows an event held in June 2011 that brought together energy experts based in London, Singapore and Shanghai for the world's first live global conversation on the future of energy.

We have invited the same group of experts that participated in the debate to explain their views on the most challenging questions that arose during their discussion. The report also highlights some of the best contributions made in the online debate that surrounded their conversation.

We would like to thank all of those who participated in the research.

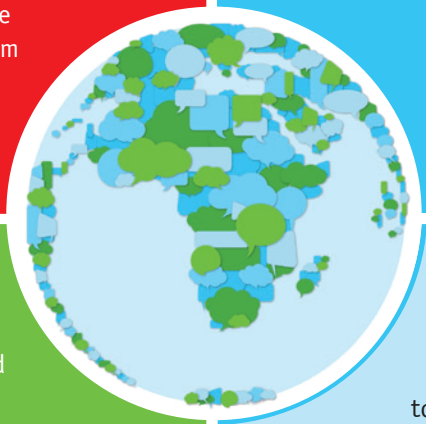
If you would like to view the event, you can access it online by registering at http://live.economistconferences.co.uk

ENERGY REBALANCING BY THE NUMBERS

To support the event, the Economist Intelligence Unit conducted a survey of 767 people around the world. The survey was carried out between May and June 2011 and respondents were drawn from the Americas (30%), Europe (30%), Asia- Pacific (30%) and the Middle East and Africa (10%).

PANELIST QUOTES

Where points made by panelists during the event are relevant to articles written for the follow-up report, these are noted in the text.



PANELIST ARTICLES

A selection of the experts who participated in this debate have written articles for the follow-up report. These articles are highlighted by a green bar in the text.

ONLINE CONTRIBUTIONS

More than 1,600 people registered to watch the event live online and more than 400 contributions were received via the event's live feed. Where online contributions are particularly relevant to the topic being addressed in an article, these are noted in the text.

INTRODUCTION From the Economist Intelligence Unit

The economic and political circumstances surrounding energy consumption are in flux. As countries such as China and India continue their rapid development, the world's economy is rebalancing from West to East and the pattern of global energy demand is shifting. As the articles in this collection clearly show, this rebalancing process is leading energy experts to question the achievability of existing environmental goals and worry about rising political tensions.

World energy consumption increased by 45% between 1990 and 2010, but rates of growth varied significantly. Over this period US consumption rose by 19% and Europe's increased by 5%, but China's went up by 149% and India's increased by 116%. Underlining the shift, China has now overtaken the US as the world's largest consumer of energy.

What does this kind of rebalancing mean for the world's energy system? And how might it influence efforts to tackle climate change? A poll of more than 760 executives conducted between May and June 2011 underlines just how worried business leaders are about the world's energy future. Nearly three-quarters of those surveyed think the process of economic rebalancing is going to create energy supply problems. Partly as a result, nine out of ten think that real energy prices are going to increase over the next 40 years and 88% think that energy security will become more of an issue.

The expert contributors to this collection agree that energy-related political tensions are on the rise. Pierre Noël (see page 6), sees the potential for increased friction between the US, China and India as Asia's emerging superpowers begin to demand a greater role in securing international energy supplies. Similarly, Simon Tay (page 12) raises concerns about rising tensions in the South China Sea, as regional players such as China and the Philippines begin to clash over territorial claims in waters that could be rich in natural resources.

Against this increasingly difficult backdrop, people are sceptical about the world's capacity to come up with the solutions needed to meet its energy challenges. For example, only 6% of survey respondents think governments will reach a meaningful international deal on climate change in the next five years, and 16% do not think a meaningful deal will ever be reached.

These figures will be a source of concern for those who think a multilateral deal is an indispensable part of dealing with the world's environmental challenges. Interestingly, however, elites are beginning to question whether a multilateral deal is as crucial as originally thought. As Simon Henry argues (page 13), "demand growth is focused in a small number of developing countries: if the right technology and systems, along with strong economic incentives, are put in place by such countries, what governments do multilaterally may not matter as much."

Ultimately, progress on climate change is likely to rely on evolving preferences about the trade-off between economic growth and environmental sustainability. In dealing with this topic, John Sauven (page 10) argues that "we need a new system where human, social, manufacturing and finance capital exist within the boundaries of our natural assets."

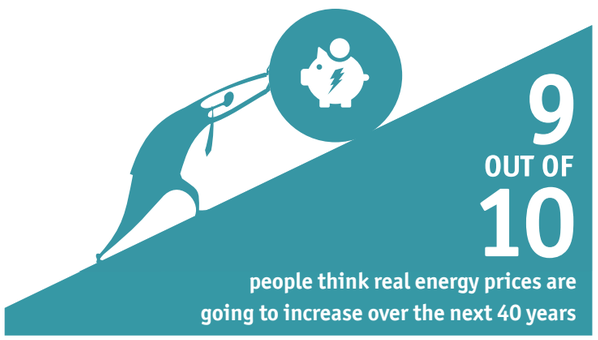
That may well be so, but our survey offers a valuable insight about where people's preferences currently lie. About two-thirds of respondents (64%) are concerned about climate change, but nearly four-fifths (78%) are concerned about economic growth.

These figures will be familiar to many pollsters. Once again, they confirm that in the trade-off between economy and environment, most people still value the former more highly than the latter. No wonder that less than 20% of respondents believe that the world's governments are committed to dealing with climate change; in the present circumstances, any politician that made a serious attempt to do so would quickly be voted out of office.

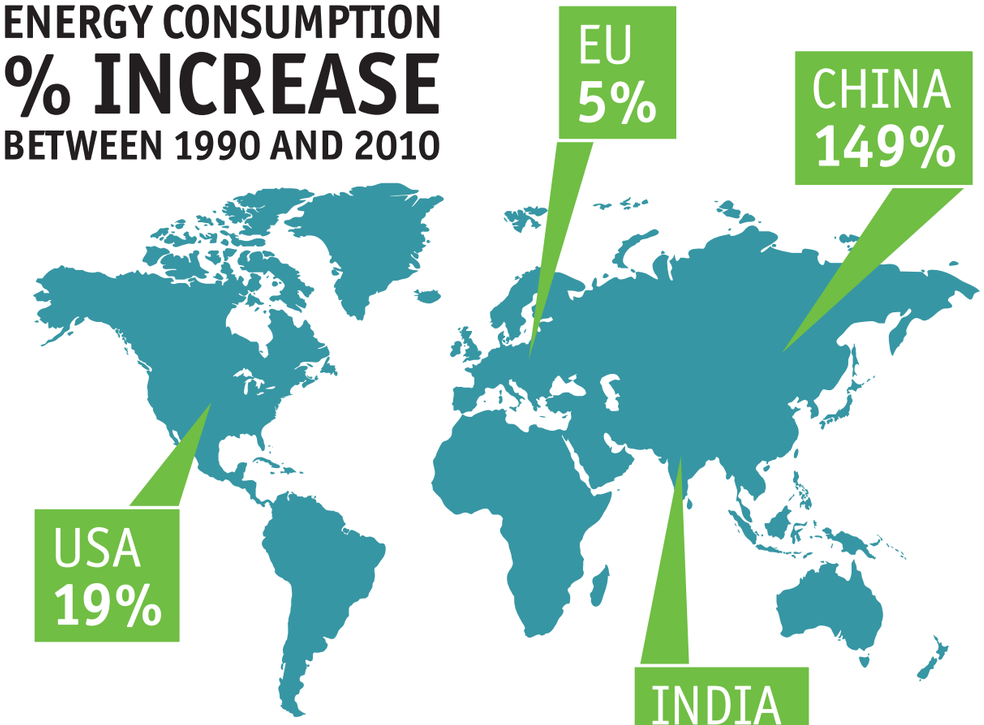
ENERGY REBALANCING BY THE NUMBERS

ECONOMIC IMPLICATIONS OF REBALANCING FROM WEST TO EAST

74% of people think the process of economic rebalancing from West to East will create energy supply problems



ENERGY CONSUMPTION % INCREASE BETWEEN 1990 AND 2010

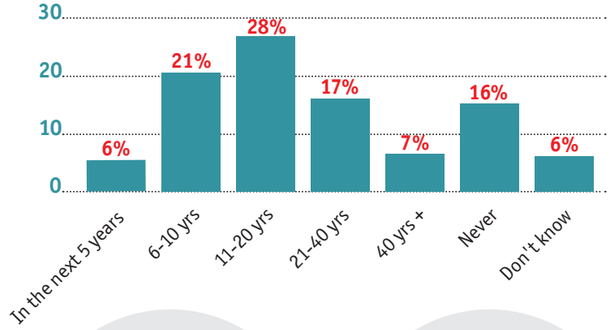


WORLD ENERGY CONSUMPTION INCREASE: 45%

Source: Economist Intelligence Unit.

FOCUS ON THE FUTURE: ECONOMIC AND POLITICAL CHANGE DURING A PERIOD OF TRANSITION

When, if ever, do you expect the international community to reach a meaningful deal on climate change?



56% of people think governments are committed to achieving or maintaining economic growth...

...but less than **20%** think that the world's governments are committed to dealing with climate change

POLITICAL IMPLICATIONS OF REBALANCING FROM WEST TO EAST

64% of people think the development of countries like India and China should be cleaner than the West's was

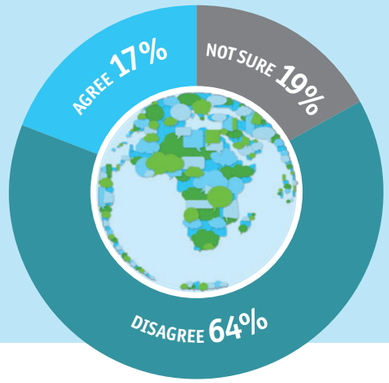
88% of people think energy security will become more of an issue over the next 40 years

81% think that climate change will become more of an issue over the next 40 years

2 OUT OF 3 people believe there will be an increase in energy-related military conflicts over the next 40 years

BUT ONLY 12% think that governments should consider military action as a way of securing energy supplies

THE WORLD WILL HAVE SOLVED ITS ENERGY SUPPLY CHALLENGES BY 2050



Unless otherwise indicated, infographics depict the results of a survey of 767 people conducted by the Economist Intelligence Unit in May. 2011.

ASIA'S RISE AND THE NEW GLOBAL ENERGY POLITICS

Pierre Noël explains why economic rebalancing from West to East could have major consequences for the politics of energy supply and climate change

As the source of global economic growth shifts towards emerging economies and especially fast-developing Asia, so does the geography of energy consumption growth.

In 2010, the developed economies of the Organisation for Economic Co-operation and Development (OECD) consumed 2.4% more energy than they did in 2000. In comparison, energy demand has grown by 63% outside the OECD and has nearly doubled in emerging Asia.[1] Recent projections by several organisations show a continuation of this trend: emerging Asia is expected to account for about 60% of global energy consumption growth in the next 20 years, and non-OECD countries in general are forecast to account for between 90% and 100%.[2]

The energy impact of China's economic rise has been particularly significant. In 1975 China represented 5% of global primary energy consumption, but by 2010 this had risen to 20%. China has now overtaken the US as the world's largest energy-consuming country and its consumption is currently growing by the equivalent of the total energy consumption of the UK each year (see chart).

One of the problems is that economic growth in emerging Asia is three times more energy-intensive than in OECD economies, while the carbon intensity of energy – the released carbon used in its production – is 28% higher.

The main reason for this is that coal, the most carbon-intensive of fossil fuels, plays a major role in fuelling economic growth in Asia, especially in China. Despite the impressive growth in nuclear, gas and even renewables, coal still covers between two-thirds and three-quarters of growth in primary energy consumption (see chart). The result is that China now consumes as much energy as the US, but emits more CO_2 despite having an economy that is only 25% of the size.

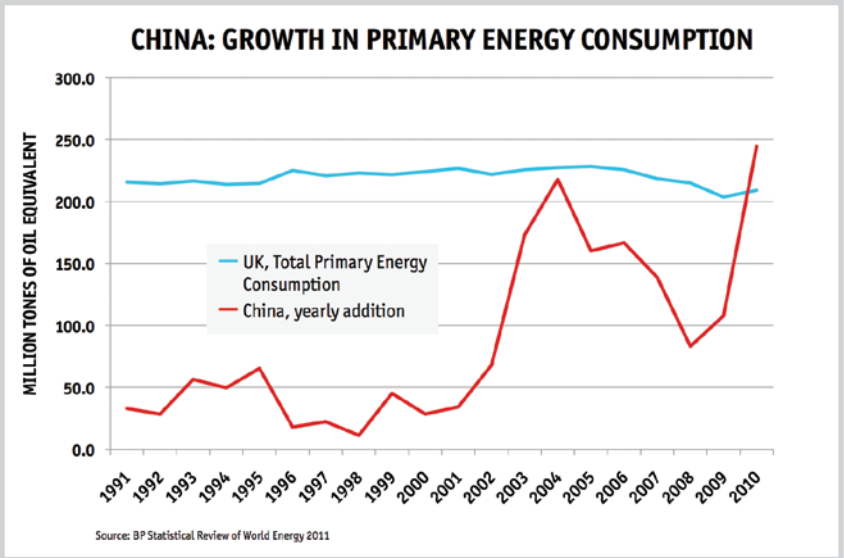
The rise of Asia has profound implications for the two main items on the global energy policy agenda: the fight against global climate change and the link between energy and international security.

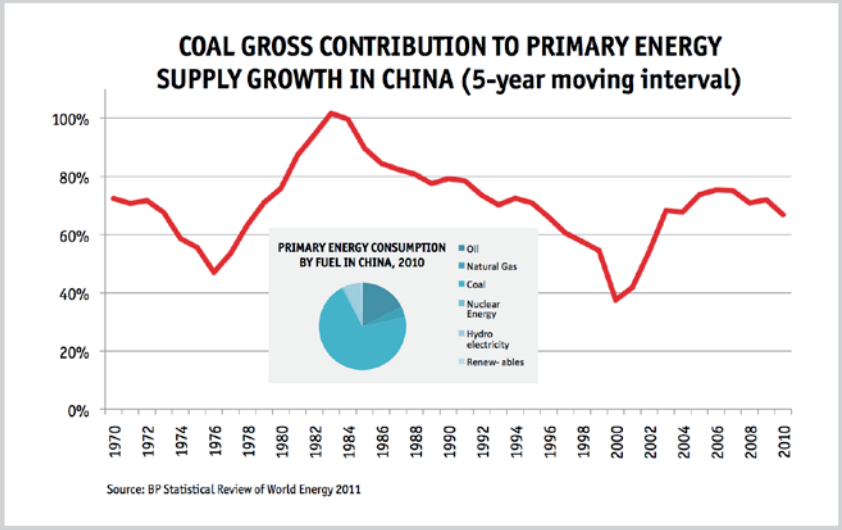
Without a quick and dramatic fall in the cost of carbon-free sources of electricity and heat in the years to come, the rise of the emerging world, especially energy and carbon-intensive Asia, will lead to a steady increase in global CO_2 emissions way beyond 2030.

In Europe, the public could finally realise that no matter how much they are willing to pay to decarbonise their economies, the global problem is not being meaningfully addressed, leading to erosion in the support for green policies.

> **In theory, a low-carbon economy would be more secure, but it's all a question of cost. It's a political task of a first order to persuade people that they will have to pay more in order to subsidise the new renewable technology.**
>
> 
>
> The Rt Hon Lord Howell of Guildford, *Minister of State*, Foreign and Commonwealth Office

Internationally, the focus of climate policy could move towards adaptation and attempts to manipulate the earth's climate through geo-engineering. For instance, if China and India are exposed to severe impacts of climate change, they could increase their support for ambitious programmes to develop and test geo-engineering solutions, which, for example, could put large amounts of





sulphur particles into the atmosphere in order to deflect sunlight.

Reliance on imported energy could also cause problems. China's oil consumption has doubled between 2000 and 2010 and the country accounted for 42% of global oil consumption growth. Its net oil imports have grown by 13% per year on average since 2000 and the country now relies on international markets for 55% of its consumption, a level comparable to the US.

The growing reliance of China- and increasingly India- on internationally traded energy will open a new era in international oil security. For several decades, the US has been at the centre of the international oil security regime. It has "sanctuarised" Saudi Arabia from regional security threats and provided security to global sea lanes. The US has also initiated a multilateral regime of emergency oil stock co-ordination through the International Energy Agency (IEA). However, China and possibly India will demand to participate in securing international energy markets, and this could prove politically tricky.

Co-operation between the US, China and India on energy market security will have to develop in a context where numerous issues could generate tensions, including Taiwan, the development of Chinese power projection and Sino-Indian rivalry.

Objectively, the US and emerging Asian great powers have the same interests when it comes to international energy market security. Whether they can learn how to fulfil them collectively will be challenged by many geopolitical issues, most of which have nothing to do with energy.

[1] Asia-Pacific region less Australia, New Zealand and Japan. Unless otherwise indicated, data are from BP Statistical Review of World Energy 2011.

[2] See BP, BP Energy Outlook 2030, London, January 2011, p. 16-17; International Energy Agency, World Energy Outlook 2010, Paris, p. 622 ("New Policies" scenario); ExxonMobil, The Outlook for Energy: A View to 2030, Irving (TX), 2010, pp. 7-8; US Energy Information Administration, International Energy Outlook 2010, Washington DC, table A1.

AUTHOR BIOGRAPHY

Pierre Noël is a Senior Research Associate at the Electricity Policy Research Group, an energy policy research group at the Judge Business School, University of Cambridge. Mr Noël works on the political economy of international energy markets and policy, with special emphasis on oil and natural gas.

MEETING THE WORLD'S FUTURE ENERGY NEEDS

Stephen Lincoln reviews the options for meeting the world's future energy needs

World energy use has doubled over the last 40 years, bringing with it an unprecedented level of prosperity to much of humanity. Many now expect demand to double again over the next 40 years as emerging economies go on developing and the world's population continues to rise. This surging demand for energy raises challenging questions around supply. How can the world meet its future energy needs?

A total of 80% of world primary energy comes from fossil fuels, with most of the rest generated from combustible biofuels and waste, hydroelectricity and nuclear power. The much heralded wind, solar, wave, tidal and geothermal technologies together contribute only about 1%. On this basis, fossil fuels will dominate energy supply for some time to come and carbon dioxide emissions will grow from the current level of 30bn

> **"The proportion of solar energy will become more significant as grid parity becomes a reality in bigger parts of the world.**
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> 
>
> Victor Bekink
> *Senior Manager*
> Talesun Solar

> The main concern is not just higher energy prices, but greater volatility. The key options to address this are strong policies to reduce energy demand in all economies, and at the same time to drive forward innovation and clean technology deployment. Strong policies are needed, rather than waiting for high fossil fuel price spikes to lead to changes.
>
> 
> Keith Allott,
> WWF-UK,
> UNITED KINGDOM

> Manufacturing industries/hubs should meet 30% of their energy demands from renewable energy and governments should make it mandatory for core industries to use renewable sources of energy. In India, it is already happening with a directive for telecom towers to shift from diesel-based source to renewable-based to meet their energy demands.
>
> 
> Abhishek R,
> Energy startup,
> INDIA

tonnes per year unless innovative action is taken.

At current extraction rates, known conventional reserves of liquid crude oil, natural gas and coal are likely to last about 45, 60 and 120 years, respectively. The "unconventional" fossil fuels in oil shales and sands together with shale and coal seam gas offer very large increases in reserves, but their extraction is expensive and has the potential for water and soil contamination. In addition, large ice-like methane hydrate deposits on continental shelves offer a challenging new source of natural gas. These unconventional reserves are largely outside the Middle East and major exploitation would change the geopolitics of energy supply.

Of course, using fossil fuels to meet the world's growing energy demands carries significant risks. The related growth in carbon dioxide emissions would increase the risk of dangerous climate change unless the efficiency of the technologies used to convert fossil fuels to energy is markedly improved. Such improvements are not out of the question, however.

The possibilities around efficiency are clear when we look at electricity generation, which makes up 18% of world energy consumption. Currently, two-fifths of the world's electricity is produced by burning coal and is often delivered to the user with efficiencies as low as 30%. A change to modern natural gas technology is capable of simultaneously increasing efficiency to 50%, while also halving carbon emissions.

Another option is nuclear. This currently provides 6% of global primary energy, but output could probably be tripled. The problem is that uranium is an exhaustible resource and the Generation 4 breeder reactors which could prolong the use of nuclear power are unlikely to make significant contributions for several decades. Meanwhile, fusion power remains a distant dream despite on-going research.

This leaves the sun, which delivers an annual supply of energy equal to 8,000 times the world's present energy use. Solar energy in the form of biofuels, wind energy, and photovoltaic, solar thermal and hydrogen energy show great promise. However, these technologies require improvement and their use must be accelerated to secure a balanced energy supply and to avoid dangerous climate change by 2050.

Based on these perspectives, it is likely that global growth in natural gas use will outpace that of other fossil fuels owing to its increasing availability and lower carbon dioxide emissions. Meanwhile, nuclear power use will probably also increase, particularly in the developing nations, despite concerns about the Fukushima incident. Finally, the use of solar energy in its various forms is set to grow from its present low base as its performance improves.

> **It is highly likely that there will be a rise in the real price of energy in the coming decades. Except for occasional short periods of correction, the economic growth of the giant economies of the developing world – China, India, Indonesia, Vietnam, Turkey, Brazil, and so on – is unstoppable.**
>
> 
> Manu Bhaskaran
> *Director and CEO*
> Centennial Asia Advisors

AUTHOR BIOGRAPHY
Stephen Lincoln, from the University of Adelaide, was awarded in 2002 the H. G. Smith Medal, the senior research award of the Royal Australian Institute. He frequently collaborates with top universities in China and the United States to produce new research in nanoscience, energy and the environment.

CHINA: THE WORLD'S NEW ENERGY GIANT

China's heavy reliance on coal will see its carbon emissions continue to increase, argues Lin Boqiang

China's economy is developing quickly. What kind of pressure is putting on its energy system?

China's going through an intense period of industrialisation and urbanisation – both of which are putting enormous strain on its energy system. The economy's been growing at about 10% per year for the last decade, and it's expected to go on expanding at a similar rate over the next decade.

At the same time, urbanisation is accelerating across China. About 48% of the population currently lives in urban areas, with this share expected to rise to around 62% by 2020. As a result, about 300 million people – roughly as many as currently live in the United States – will move into China's cities over the next ten years. Facilitating that shift requires considerable investment in new housing and infrastructure, which in turn calls for more energy to feed the increased demand for construction materials, such as steel and cement.

How is China planning to meet its growing energy needs?

The government wants to reduce China's dependence on coal from 75% to 65% of the total energy supply over the next ten years, but there are serious concerns about whether it will be able to achieve this goal while also meeting rising energy needs.

China has made remarkable progress on wind power over the last decade, but wind remains a small part of the overall energy mix. Also, most of China's economic and population growth is taking place in the East, whereas the areas that are most suited to wind power are in the West. This raises the issue of the cost of transmission to end users.

> **In China, given the target for carbon emissions and energy supply, it's very hard at the moment to give up nuclear.**
>
> 
>
> Professor Zou Ji
> *Director*
> World Resources Institute China

Another option is nuclear. China is planning to construct at least 60 gw of new facilities by 2020. There probably would have been even more, but, following the Fukushima incident in Japan earlier this year, concerns about safety have grown and enthusiasm for nuclear has waned a little.

Gas will also be an important part of the equation. It is cleaner than coal and gas-fired power stations are quick to build, so the use of gas is most likely to grow significantly over the coming years. If China is to reduce its use of coal, nuclear and gas will be central parts of the solution.

How serious do you think China's government is about reducing carbon emissions?

The Chinese government is committed to reducing carbon emissions because it wants to be seen as a responsible member of the international community. However, maintaining social stability is the policy priority that trumps all others in China - and that means sustaining economic growth. There needs to be a balance between reducing carbon emissions and maintaining economic growth. However, if reducing emissions is seen as threatening growth, growth is likely to win.

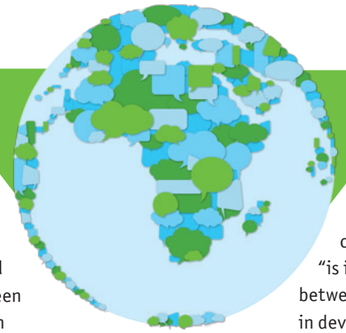
> **China and India have got the opportunity to build an energy system that is far more cost effective than that of Western countries.**
>
> 
>
> Rob Murray-Leach
> *Chief Executive Officer*
> Energy Efficiency Council
> Australia

That said, the government is conscious that China's energy demand will continue to rise and that fossil fuels are an exhaustible resource. This is why it is keen on renewable energy as a long-term solution to China's energy needs. That renewable energy also happens to be clean energy could be of secondary importance, but it will certainly help to reduce carbon emissions.

AUTHOR BIOGRAPHY

Dr Lin Boqiang is Director of the China Centre for Energy Economics Research at Xiamen University and a member of the National Energy Consultation Committee under the National Energy Commission. From 1993 to 2006, Mr Lin was Principal Energy Economist at the Asian Development Bank (ADB).

ENVIRONMENT VS. DEVELOPMENT: WHERE DOES THE BALANCE LIE?



JOHN SAUVEN

AUTHOR BIOGRAPHY

John Sauven joined Greenpeace in the early 1990s and has been Executive Director since 2007. He co-ordinated the international campaign to secure a moratorium on further destruction of the Amazon by soya producers.

At heart, the world's problems are economic. Economic growth is a means to an end, not an end in itself. But society has forgotten this. Every time we talk about "the global economic downturn" or the need to "stimulate the economy", what we are doing is urging more expenditure without regard to its environmental and social consequences.

There is no economic value put on our standing forests, our water, our soil, the life in our oceans or our biosphere – all of which are vital to sustaining life on the planet. But the economic model we have created is built on the liquidation of these natural assets.

What kind of world will that leave us with? A climate changing world represents a critical threat to our way of life, especially in developing countries. Many of the 1.4 billion people who now live in severe poverty already face serious ecological debts - in water, soil, and forests – and these will be exacerbated by changing consumption patterns, rising wealth, urbanisation and climate change.

The world's ecological crisis is not a matter for tomorrow after today's financial crisis has been solved. So far, our reaction to warnings of terminal planetary disease has been to dismiss them. Almost 15 years after the world began negotiating the Kyoto Protocol, the levels of greenhouse gases are accelerating. Nearly 25 years after the Brundtland Report alerted the world to the urgency of moving towards sustainable development, the planet's stock of natural resources continues to be depleted and degraded at an alarmingly rapid rate.

We urgently need to ask the question of what we want to achieve from economic growth and development. These words have been used for decades to promote a high resource extraction, carbon-heavy industrial growth – a model which is now failing.

We need a new system where human, social, manufacturing and finance capital exist within the boundaries of our natural assets. But it can only succeed if we find a mechanism for sharing the burden of costs and potential discomforts. Per head fossil fuel CO_2 emissions in the United States are more than 20 times higher than in most of Sub-Saharan Africa. Ultimately, for our security we need to see humanity as a single vulnerable species rather than a collection of nations locked in pointless and perpetual competition and conflict.

Our leaders, in public at least, accept two imperatives – carbon stabilisation and continuing economic development. They must, as a corollary, accept an absolute duty to dramatically increase the level of "carbon productivity" in the economy. In other words, more output for far less energy and natural resources. We need a tenfold increase in carbon productivity by 2050, which will require radical changes in the world economy.

Ultimately, addressing climate change is neither a scientific nor an economic challenge – it is a human challenge, where capitalism needs to tell the ecological truth. The potential for technological improvements, renewable energy, carbon sequestration and perhaps a hydrogen-based economy is far from being exhausted. But it is a radical transformation in a short time scale requiring huge investment and resources.

In the debates about climate change the question is often raised: "is it possible for us to strike a balance between the pursuit of economic growth in developing countries and the need to reduce global carbon emissions?" The simple answer to that question is that we have to. Progress towards higher standards of living in the developing world is not an optional extra to be pursued if we have the carbon budget to spare; it is essential.

It is essential, on moral grounds, that we address the suffering that is represented by absolute poverty – the 2.5 billion plus people still living on less than US$2 per day, the 1.5 billion that still lack access to basic services such as safe water supplies or electricity, the 72 million children still out of schools, or the 26,000 children that die every day from largely treatable or preventable causes.

But it is also now, perhaps for the first time in history, essential on enlightened self-interest grounds as well. Climate change has no respect for national boundaries and has to be dealt with as a global problem requiring a global solution. As the UN's 2009 Copenhagen conference showed, developing countries are not going to sign up to a deal on carbon that fails to reflect adequately where the historical responsibility for emissions lies or fails to provide sufficient assistance to help them make the transition to a clean development path.

The UN Secretary-General's Advisory Group on Energy and Climate Change proposed two key goals in this respect in its April 2010 report:

1. Ensure access to modern energy services for the 2 to 3 billion people currently excluded from them by 2030.
2. Reduce global energy intensity by 40% by 2030.

Reliable and affordable modern energy supplies are vital to provide essential services in the home (for lighting, cooking, heating, cooling and preservation of food, and, communications) and the community (electricity for refrigerating vaccines in health posts or providing lighting in schools, for example). They are also essential as a platform for establishing businesses and creating the livelihoods that will eventually help people out of poverty. The UN's proposal is that the elimination of energy poverty be recognised as a priority for development assistance over the coming years.

Reducing energy intensity is clearly the global challenge that will determine whether we manage to avoid catastrophic climate change or not. The UN argues that this is achievable and realistic but would "...require the international community to harmonise for key energy-consuming products and equipment, to accelerate the transfer of know-how and good practices and to catalyse increased private capital flows into investments in energy efficiency".

In reality, universal energy access is affordable — the International Energy Agency estimates that around US$35 billion per year would be required to 2030, only around 3% of the expected global annual investment in energy infrastructure over the same period. Ensuring that this goal is met must be part of the overall package of actions necessary to reach an international settlement on carbon.

SIMON TRACE

AUTHOR BIOGRAPHY

Simon Trace is the Chief Executive of Practical Action. He has nearly 30 years' experience in international development and took up his current post with Practical Action in 2005.

"Domestically, many countries are guilty of having a pre conceived answer to what the climate change or energy security needs."

Simon Tay, *Chairman,* Singapore Institute of International Affairs; *Senior Consultant,* WongPartnership

"I think we should concentrate our efforts on conserving energy and harnessing new methods of renewable energy. There are many ways of harnessing new energy. Nothing much has been done by most countries in the world, except for Japan and Northern Europe, about utilising garbage, which is a big headache.

Charles Tang, *Chairman,* Brazil-China, Chamber of Commerce and Industry

REGIONAL STRIFE

Energy issues will put a major strain on Asia's regional politics, argues Simon Tay

The continuing rise of developing Asia contrasts with the economic difficulties being experienced in the US, Europe and Japan. Yet, Asia's economic growth depends on energy and unless affordable and sustainable resources are found, the energy challenge may constrain growth in the region.

Consider recent events in the Middle East and in Japan. While there has been no major disruption of oil supplies to date, the Arab Spring has alarmed markets and the long-term view cannot take the previous stability for granted. In Japan, the tragedy concerning the Fukushima nuclear reactor has created enormous concern about nuclear safety.

Asian countries that are new to the industry and yet have committed to building plants - Indonesia, Vietnam, Malaysia and Thailand - would be well advised to proceed only after extensive investigations into safety and transparency.

Asia's energy challenges also lead to disputes over territory. The rising tension in the South China Sea, with differing claims over different islets and shoals, is not sentimental. Explorations are being conducted in what could be a resource-rich area for future energy. Maritime power projection will be part of this equation and protecting shipping lanes will be vital to the supply of oil.

The power balance is shifting globally. Asian powers do not have an established order acceptable to all. The region's energy concerns will not simply be technical but unavoidably connected to politics, economics and security. The Asian people will find good reasons why the words "energy" and "power" are often synonymous.

AUTHOR BIOGRAPHY
Simon Tay is Chairman of the Singapore Institute of International Affairs, Professor of International Law at the National University of Singapore and Senior Consultant at the WongPartnership.

RAISING EFFICIENCY

Rob Murray-Leach explains the role that energy efficiency can play in helping to deal with climate change

Asia's rapidly growing demand for energy is driving up the global prices of coal, gas and oil. While rises in fuel costs will increase the incentive for energy efficiency in both the East and the West, governments need to tackle a series of market failures that prevent us from fully realising the benefits of energy efficiency.

A smart mix of generation and end-use technologies across the economy could dramatically increase the services that we get from each unit of fuel. Coal-fired generators in Australia lose about 70% of the energy in coal as heat. A further 10% of the energy is lost during transmission, and an astonishing 95% of the remaining energy is wasted in a conventional light bulb.

In total, less than 2% of the energy in coal is turned into light.

In contrast, a cogeneration system loses less than 30% of the energy in gas, because when it generates electricity it uses the waste heat to warm and cool buildings. There are virtually no losses between the generator and the appliances it powers, and by using a compact florescent bulb you get in total five times as much light out of the energy in the gas.

The West and the East will need to approach energy efficiency in slightly different ways. In Asia, there are a lot of new buildings and industrial sites being constructed right now, which makes it critical to focus on ensuring that new infrastructure and equipment are as efficient as possible.

> **Efficiency is definitely a first step, but the energy market needs to move away from a centralised supply.**
>
> 
>
> posted by @AliciaAyars via twitter on June 28th 2011 10:06

In contrast, much of the infrastructure in the West is well established. For example, it is estimated that two-thirds of Australia's commercial building stock in 2030 will be buildings that

already exist. This means that while the West also needs to ensure that new vehicles and appliances are efficient, it will also need to focus on "retrofitting" existing infrastructure.

Nevertheless, there is a lot of common ground. Irrespective of their location, most countries need seriously to overhaul their energy markets to support distributed generation and ensure that they invest in energy efficiency when it's more cost effective than supply. Similarly, every country needs to invest in skills, education and information. Alongside traditional information programmes, this means establishing mandatory energy efficiency rating programmes for buildings and equipment to help prospective buyers determine how efficient they are.

Finally, there are some areas where international co-operation could boost the global economy, including investing in R&D and setting international energy efficiency standards for vehicles and appliances. How countries collaborate on energy demand and energy efficiency will be critical for both climate change and economic growth.

AUTHOR BIOGRAPHY
Rob Murray-Leach is the Chief Executive Officer of the Energy Efficiency Council, the peak body for commercial and industrial energy efficiency in Australia. He was recently an adviser to the Prime Minister's Task Group on Energy Efficiency and previously part of the Garnaut Climate Change Review secretariat.

DO WE NEED A MULTILATERAL CLIMATE CHANGE DEAL?

A meaningful international deal on climate change still seems a distant goal, but this might not be as damaging as many fear, argues Simon Henry

The global energy system is in the early stages of a historic transformation. It is being propelled by the growing global population, mainly in the developing world, which could reach 9 billion people by 2050, resulting in a surge in energy demand. Shell's scenario planners believe that if we continue to use energy as we do today, energy demand could rise as much as three times by 2050, from its level in 2000.

This would lead to a big gap emerging between demand and supply of energy, which will have to be filled either by a dramatic reduction of demand or a jump in supply, or a combination of both. But exactly how this is going to happen remains unclear. Hence, our scenario planners call this a "zone of uncertainty". Furthermore, even as we work to meet the surging energy demand, there is clear agreement among scientists that the world must take action to halve CO_2 emissions by 2050.

What then might be done to help the world meet this twin challenge?

Right now, we don't see multilateral agreements to reduce CO_2 working but we do see national governments acting in their own interest, and these interests generally correspond to cleaner energy systems. The demand growth is focused in a small number of developing countries: if the right technology and systems, along with strong economic incentives, are put in place by such countries, what governments do multilaterally may not matter as much.

> **"China and India have the opportunity to surge ahead in the "green race" by taking a systems approach to energy - leap-frogging incumbent energy infrastructure and systems in the developed world. This will not only benefit their economies but will also benefit the planet.**
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>
> Mark Griffiths,
> SecondNature Partnership,
> UNITED KINGDOM

Instead, other forms of action could make a difference. For example, putting an appropriate price on carbon – perhaps through cap-and-trade systems - will help to encourage a switch to lower CO_2 options. This, together with stable, long-term investment regimes, will also encourage companies to develop the technologies needed to help the world meet its future energy needs in a more sustainable way.

> **"It is really not a question of whether it is legitimate to expect China, India and other developing economies to adopt cleaner energy than the West used during its economic take-off. The risks to the global environment are much more serious now than during the West's take-off: any responsible country has to find ways to co-operate with the rest of the world to rein in energy use.**
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> 
>
> Manu Bhaskaran
> Director and CEO
> Centennial Asia Advisors

> **I think people are going to move very quickly towards climate policies that do not need international agreement, that is, a mix of adaptation and geo engineering, and I think it's the direction we're taking for now.**

Pierre Noël, *Research Associate and Director of Energy Policy Forum,* Judge Business School, University of Cambridge

The key question is which route major developing countries such as China and India, together accounting for 2.5 billion people, will take. China, for example, plans to reduce its CO_2 emissions per unit of GDP by 17%, as part of its Five Year Plan. It is already attempting to move away from its heavy reliance on coal-fired power plants, which currently provide 80% of its electricity. It is investing heavily in natural gas, the cleanest burning fossil fuel, is rapidly deploying renewable energies like wind and solar, and is a world leader in developing battery technology for vehicle electrification.

Such steps taken by China, where energy demand is expected to double over the next 40 years, could make a big difference, whether or not the world reaches a global agreement. To meet the world's surging energy demands and address the environmental impact at the same time will require a major effort by countries, communities and companies.

AUTHOR BIOGRAPHY

Simon Henry became Chief Financial Officer of Royal Dutch Shell in May 2009. Prior to this he was Chief Financial Officer for Exploration and Production (EP), leading global EP finance, planning and supply chain functions.

THE GOLDEN AGE OF GAS

The Rt Hon Lord Howell of Guildford, Minister of State, Foreign and Commonwealth Office

Climate change is a threat to the world's security and its prosperity. There is a large body of robust scientific evidence showing that the impact of climate change will be increasingly widespread and severe. Climate change is a security threat multiplier: by accelerating famine, flooding and migration, it exacerbates tensions in some of the most vulnerable regions of the world. The world cannot afford to stand idle: if we fail to act, climate change could cost the equivalent of at least 5% of global GDP each year.

Some speculate that ambition to tackle climate change is incongruent with the need for low-cost energy. This is a mistake: in combination with nuclear and renewable technologies, gas can provide an affordable road to achieving major reductions in greenhouse emission.

Gas is the cleanest fossil fuel under traditional generation: at combustion it generates 50% less carbon dioxide per kilowatt-hour than coal and a fraction of its nitrogen dioxide emissions. Switching from coal to gas helped the UK to reduce carbon emissions by 27% between 1990 and 2009, while electricity bills dropped and the economy grew an average 2% per year.

In the future, as production increases and gas becomes a more tradeable commodity, prices can be expected to fall. The number of nations importing liquefied natural gas (LNG) has already doubled in the last decade and trade is evolving towards a true multi-point, multi-basin delivery. Over 120 years of conventional resources remain, and advancements in horizontal drilling and hydraulic fracturing have revolutionised access to unconventional reserves. Supply has already expanded dramatically and prices have fallen, particularly in America. It is vital that investment in these unconventional technologies be climate-smart and more certainty is needed about their carbon lifecycle. But with substantial unconventional reserves in emerging powers, particularly China, the opportunity to move from a coal-addicted world is clear.

> Gas can be a stepping stone towards decarbonisation, but it won't necessarily be. In the UK, we need to decarbonise our power sector by 2030 - other wealthy countries should be aiming for similar rates of decarbonisation. We need policies to make CCS realistic for retrofitting and an electricity market that ensures we use gas for peaking alongside – not instead of – renewables.

Dustin Benton, Green Alliance, UNITED KINGDOM

With the addition of Carbon Capture and Storage (CCS) to gas generation, gas could be a long-term feature of the low carbon future. Gas generation with CCS leads to a near 90% net reduction in carbon dioxide emissions, but significant challenges remain and its commercial viability needs to be proven. The UK is committed to providing public sector investment in four CCS demonstration projects, including

£1 billion of capital funding for the initial project, and it is incumbent on all nations, East and West, to invest in CCS.

While gas could be a significant step towards a low carbon future, it is equally important to moderate demand and diversify supply. Investing in renewable energy can help to stimulate innovation and job creation in the short term, and catalyse technological improvements that reduce energy costs in the long term. Whereas US$75 billion was invested globally in renewable energy in 2009, US$312 billion was wasted on fossil fuel subsidies that distort the market and render global prices unaffordable. Energy efficiency is a win-win as it cuts costs for the individual business and helps to reduce energy prices when implemented collectively.

Emerging and developed economies alike are bound by the common goal of prosperity. Renewables, energy efficiency and subsidy reform enhance that prosperity, while catastrophic climate change could poison it. Gas offers an affordable path to a low carbon future, and if CCS works, gas could be more than just a stepping stone; instead it could become part of the destination.

AUTHOR BIOGRAPHY
Rt Hon Lord David Howell was appointed Minister of State at the Foreign and Commonwealth Office in May 2010. He was for ten years chairman of the UK-Japan 21st Century Group – formerly the UK-Japan 2000 Group.

THE RENEWABLES CHALLENGE

Victor Bekink of Talesun, a Chinese solar panel manufacturer, answers questions about the renewable energy industry and explains why we should be wary of gas as an energy source

Countries like China and the UK have been investing a lot in wind power over the past decade. Which technology is winning the renewable energy race?
I don't really see a race on renewables. I think a lot of the technologies are complementary and need to be deployed selectively depending on the conditions prevailing in each individual area. If you've got an area with a lot of sunlight and no one using the land, then go for solar. If you're located near the coast and have a lot of open sea, then go for wind.

There are a lot of different factors to take into consideration, but at the end of the day I've got my reasons for being part of the solar industry. One of those is that I think solar is most appropriate for urban settings. In cities where you've got a lot people crammed in together and a lot of demand, then solar seems to work. It's more practical where space is at a premium; if you have a south-facing roof, that'll do. That's why 70% of our industry now is roof-mounted.

I don't think solar is the only answer, but I think it's going to be one of the largest components of the power mix going forward, and I think it's proportion is set to grow for many years to come.

What's holding the renewables industry back?
First of all, the environmental externalities related to fossil fuel consumption aren't being priced properly. We've got an unrealistic and incomplete understanding of the cost of fossil fuels, which means they're still being used at prices that are far too low. If externalities were factored into the price, then there'd be a much stronger incentive to bring forward renewables, including solar.

Another issue is that, utilities and governments are hugely bureaucratic organisations that take a long time to change direction. Where energy is concerned we need to remember that they've built up this huge infrastructure around fossil fuels, which is very expensive to replace. The sort of shift we're talking about was never going to happen over night.

There is seems to be growing enthusiasm for gas as a low-carbon alternative to coal. What's your take on that debate?
We don't really see gas as a viable alternative to renewables. First, gas isn't actually low carbon, it just burns cleaner and better than coal, which isn't much of a compliment because coal is really dirty. Second, gas isn't a renewable energy source so it doesn't solve the long-term energy supply problem that we're facing. The world is developing rapidly and energy demand is increasing rapidly too. We're sceptical that fossil fuels can keep up with demand over the long term. Even when you ignore the arguments about environmental sustainability, the world needs to have renewable energy to fuel its long-term growth. It's an energy security issue and fossil fuels can't provide that security over the long term.

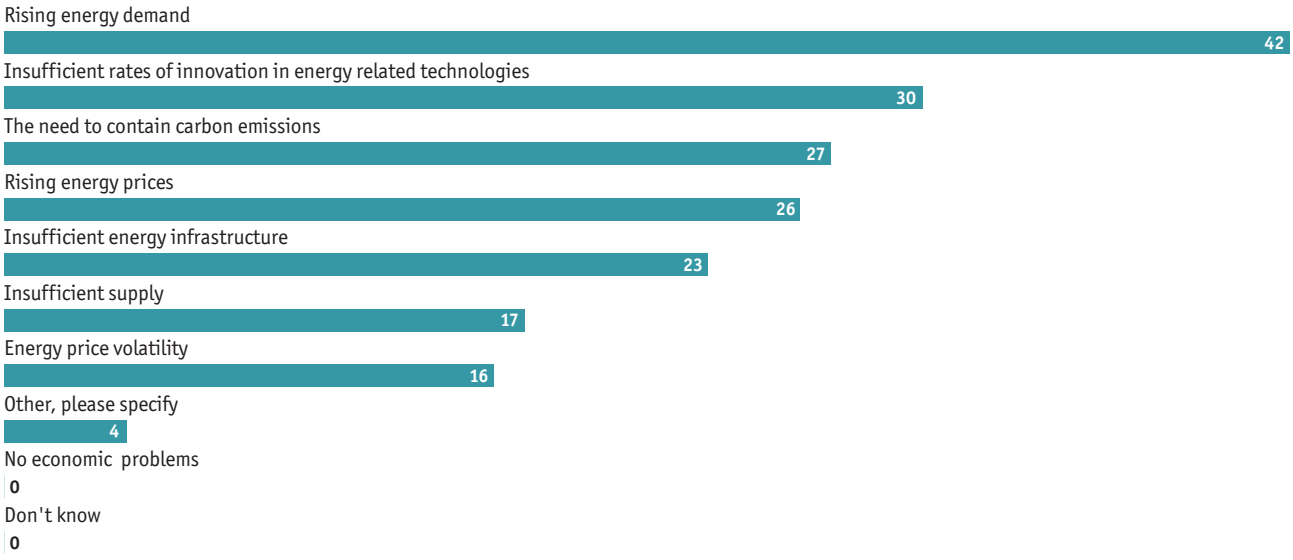
AUTHOR BIOGRAPHY
Victor Bekink is the Senior Manager for Business Development at Talesun, a solar panel manufacturer based in China.

APPENDIX: SURVEY RESULTS

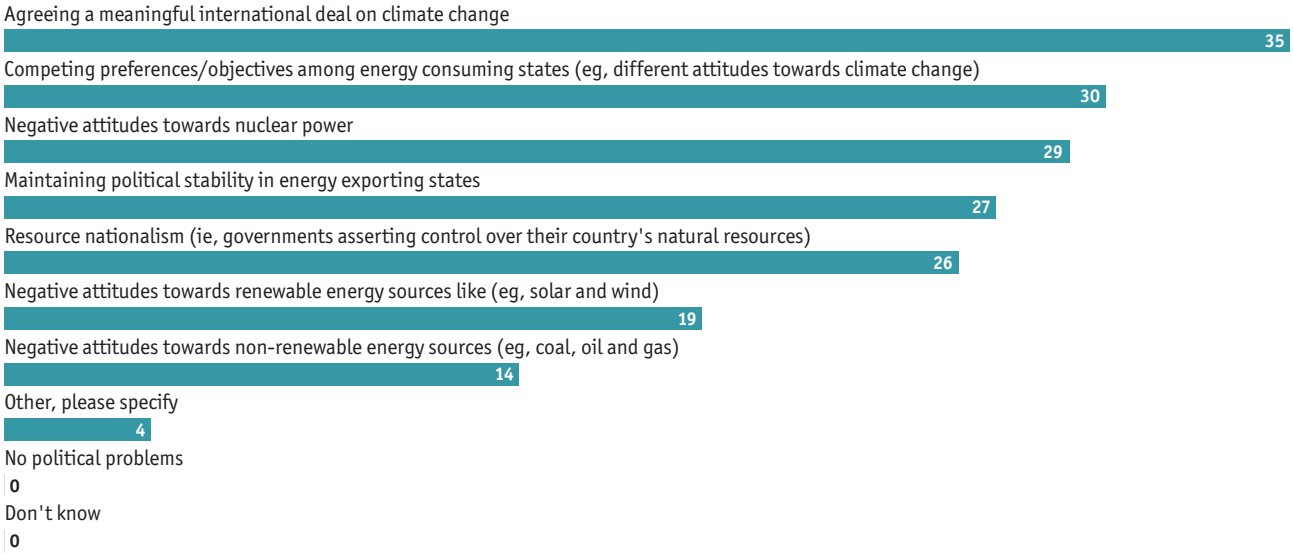
These are the full results of a survey on energy challenges conducted by the Economist Intelligence Unit and supported by Shell. The survey was conducted May-June 2011.

Compared to your peer group, how knowledgeable do you consider yourself to be about energy issues?
(% respondents)

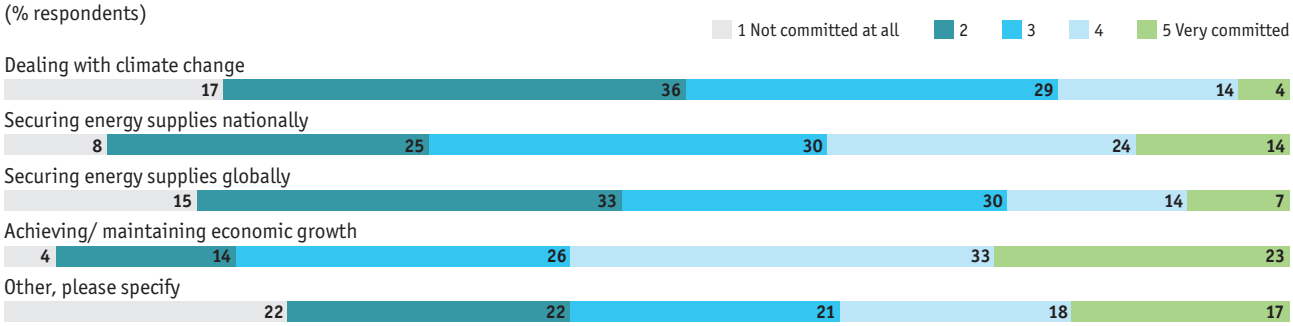
What do you see as the key economic challenges facing the world's energy system up to 2050? Select up to two.
(% respondents)



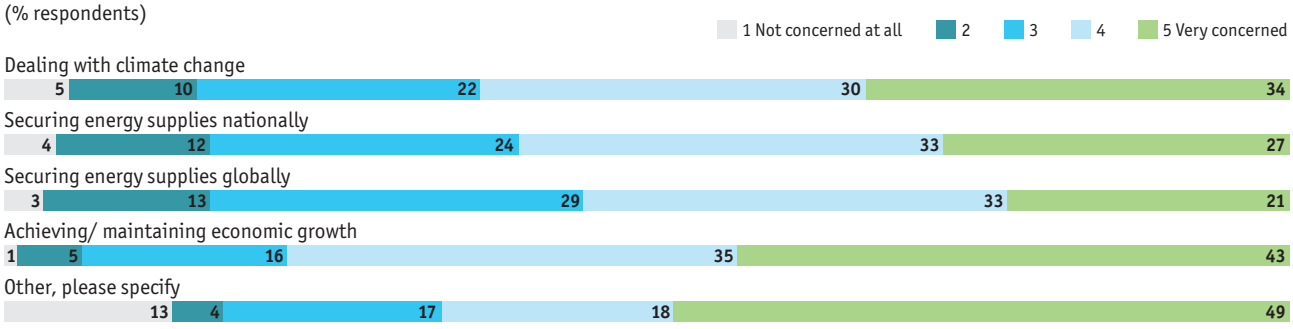
What do you see as the key political challenges for the world's energy system up to 2050? Select up to two.
(% respondents)



How committed do you think the world's governments are to tackling the following issues?
Rate on a scale of 1 to 5, where 1=Not committed at all and 5=Very committed.
(% respondents)

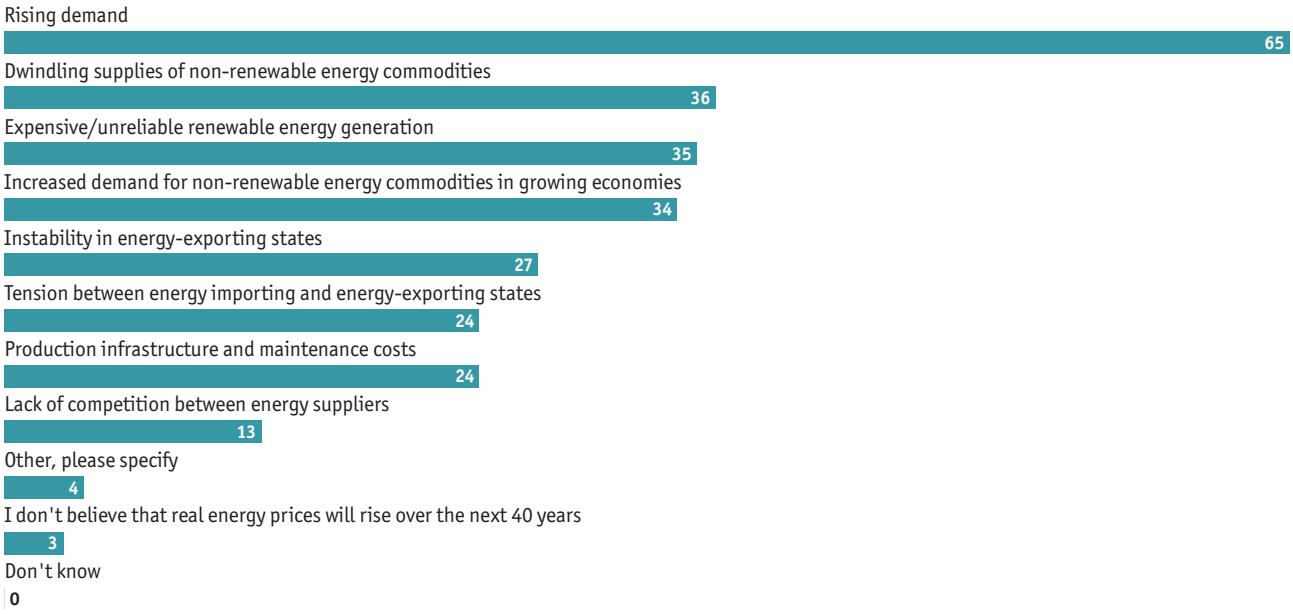


How concerned are you personally about the following issues?
Rate on a scale of 1 to 5, where 1=Not concerned at all and 5=Very concerned.
(% respondents)

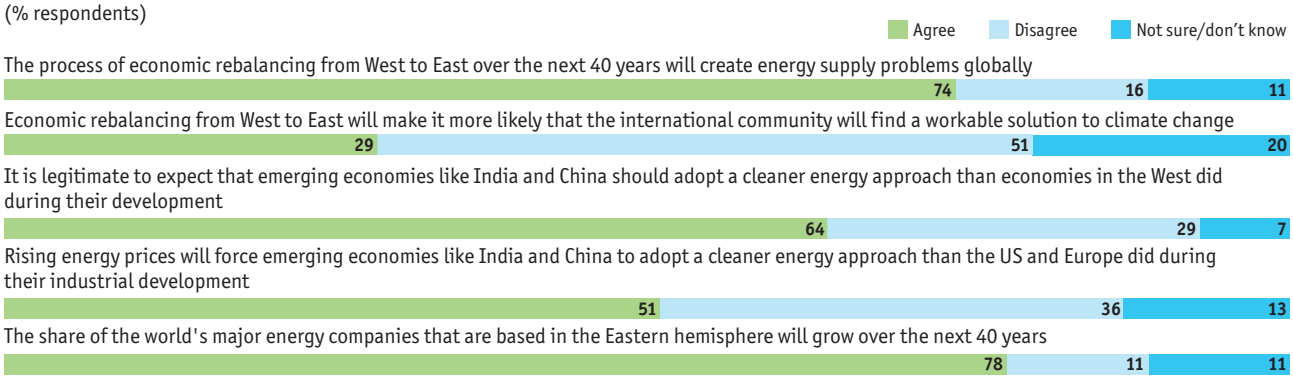


What do you think will happen to real energy prices over the next 40 years?
(% respondents)

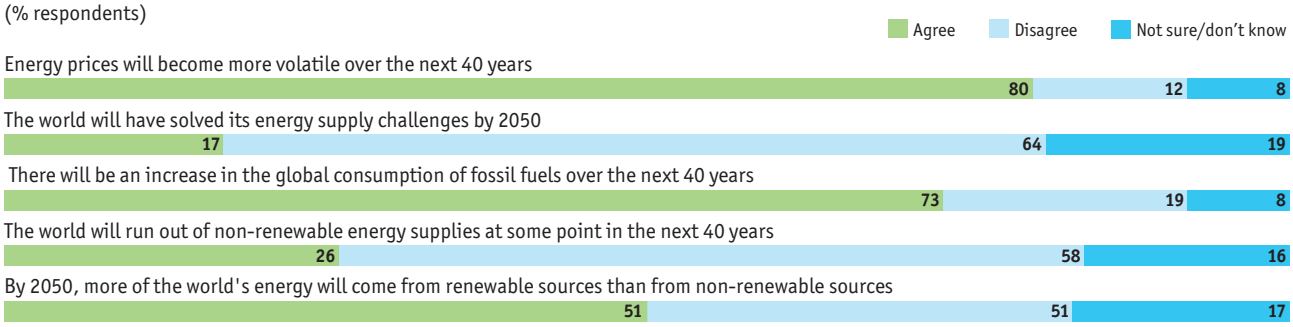
What, if anything, do you see as the main contributors to rising real energy prices over the next 40 years? Select up to three.
(% respondents)



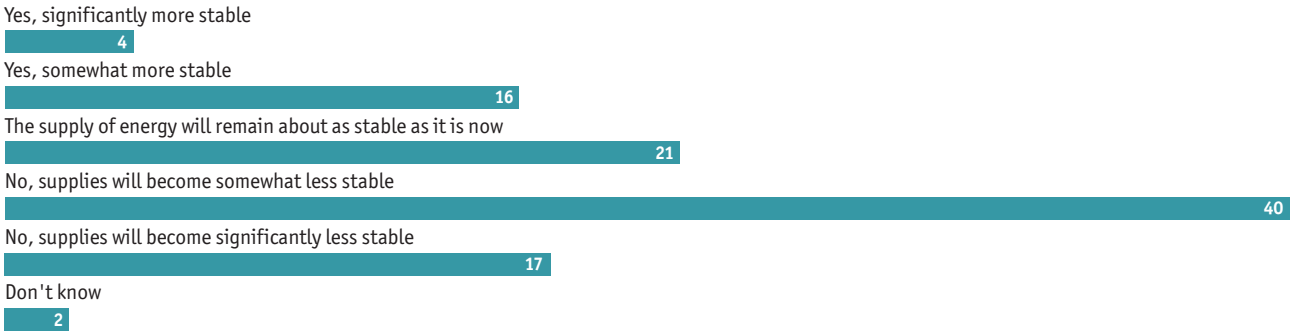
Please indicate the extent to which you agree or disagree with the following statements.
(% respondents)



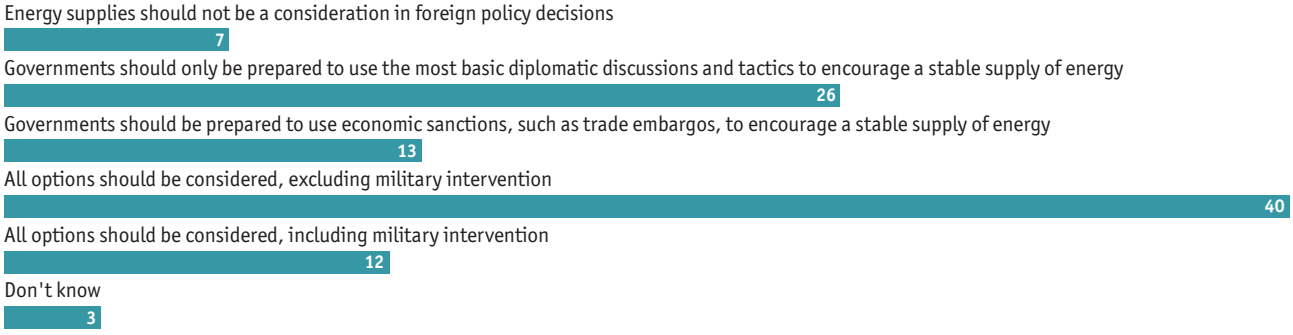
Please indicate the extent to which you agree or disagree with the following statements
(% respondents)



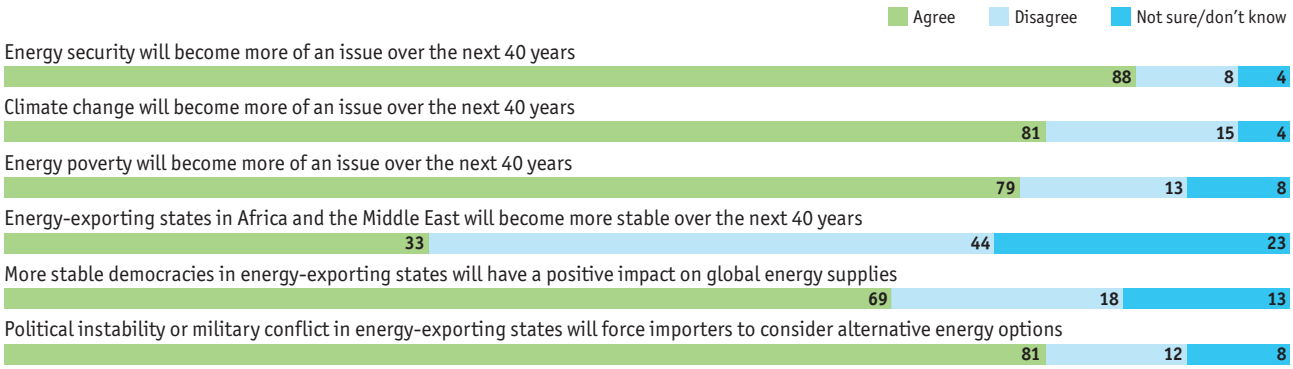
Do you expect energy supplies to become more or less stable over the next 40 years?
(% respondents)



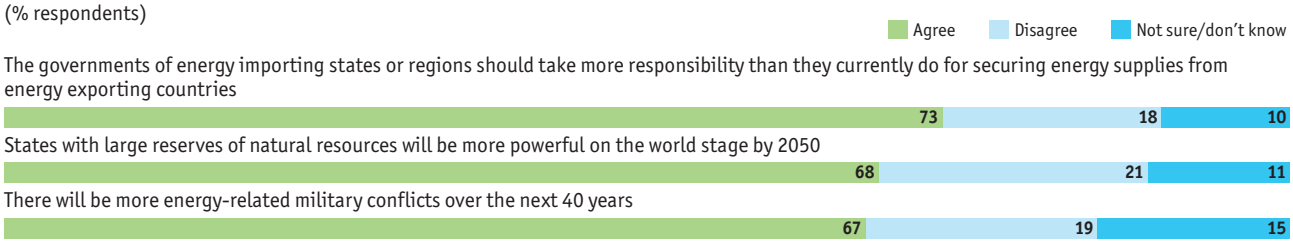
In political terms, how far should the governments of energy importing states be prepared to go to ensure their countries have a stable supply of energy?
(% respondents)



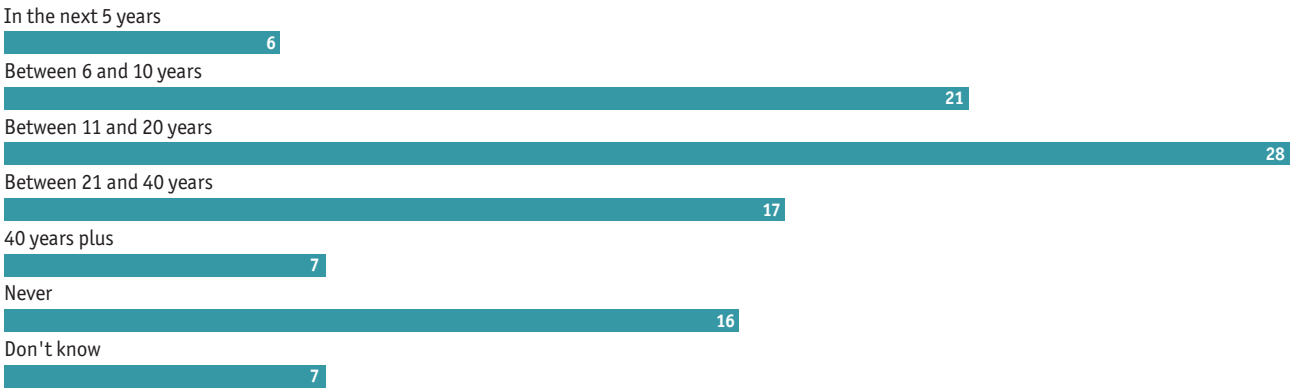
Please indicate the extent to which you agree or disagree with the following statements.
(% respondents)



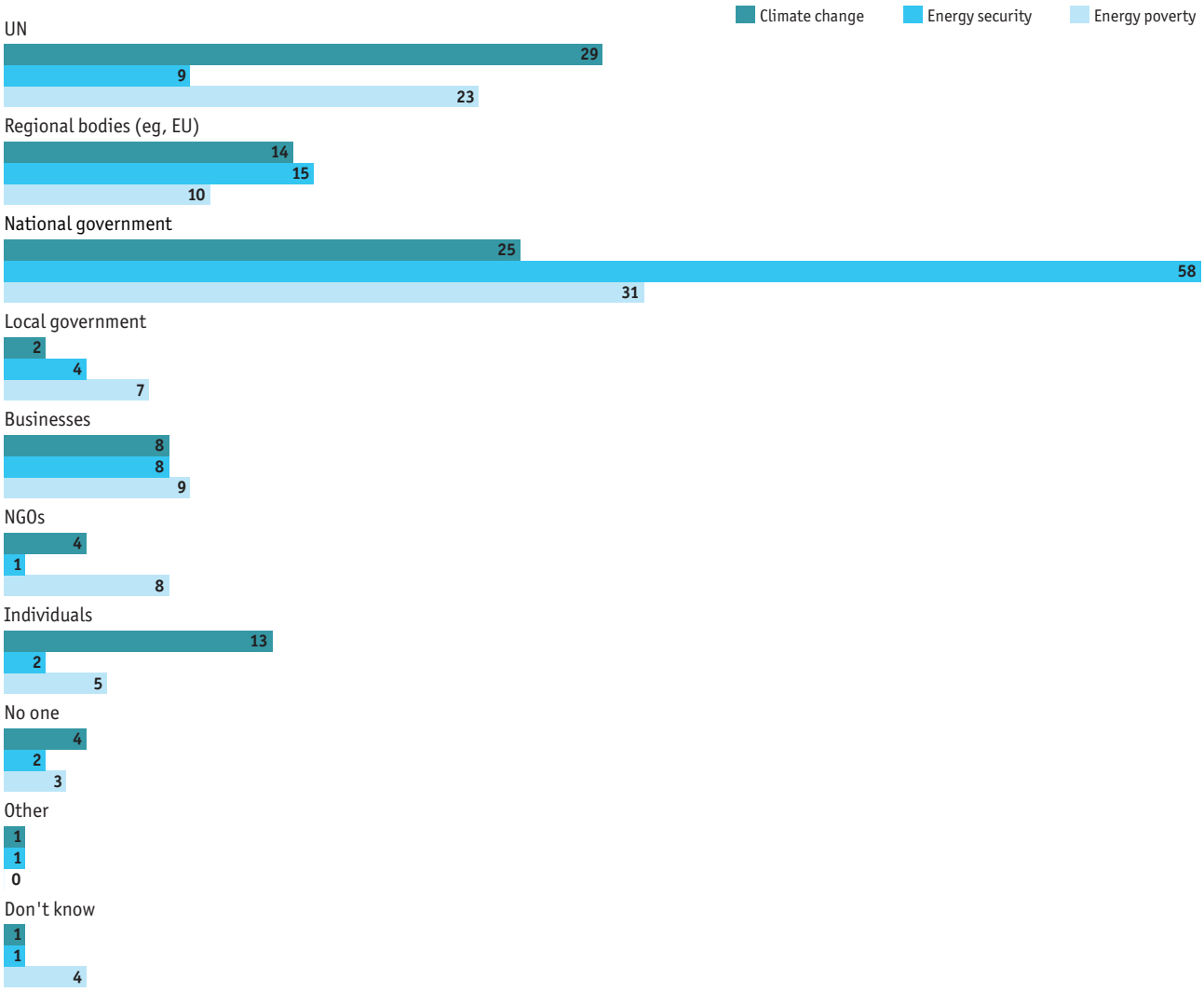
Please indicate the extent to which you agree or disagree with the following statements
(% respondents)



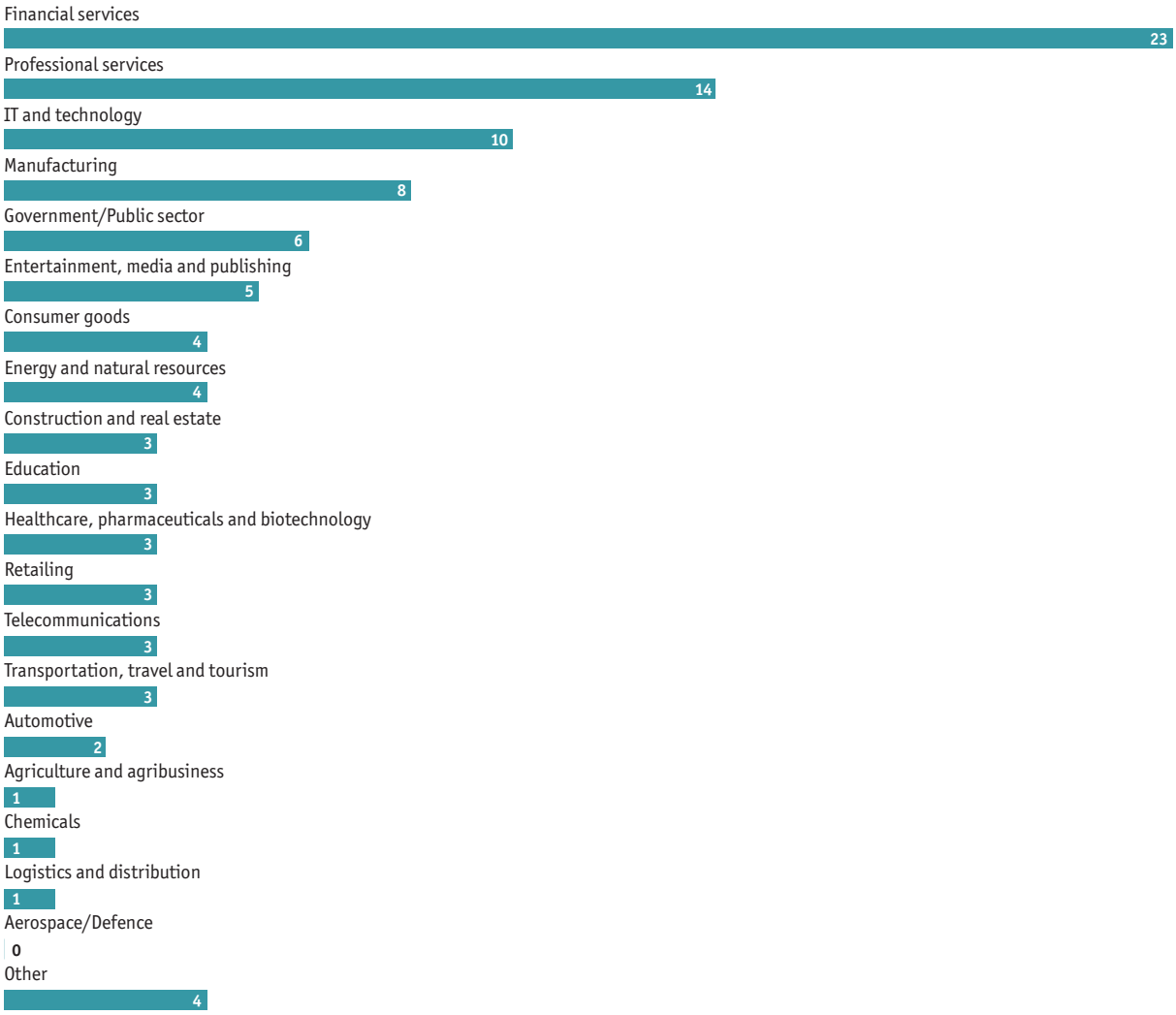
When, if ever, do you expect the international community to reach a meaningful deal on climate change?
(% respondents)



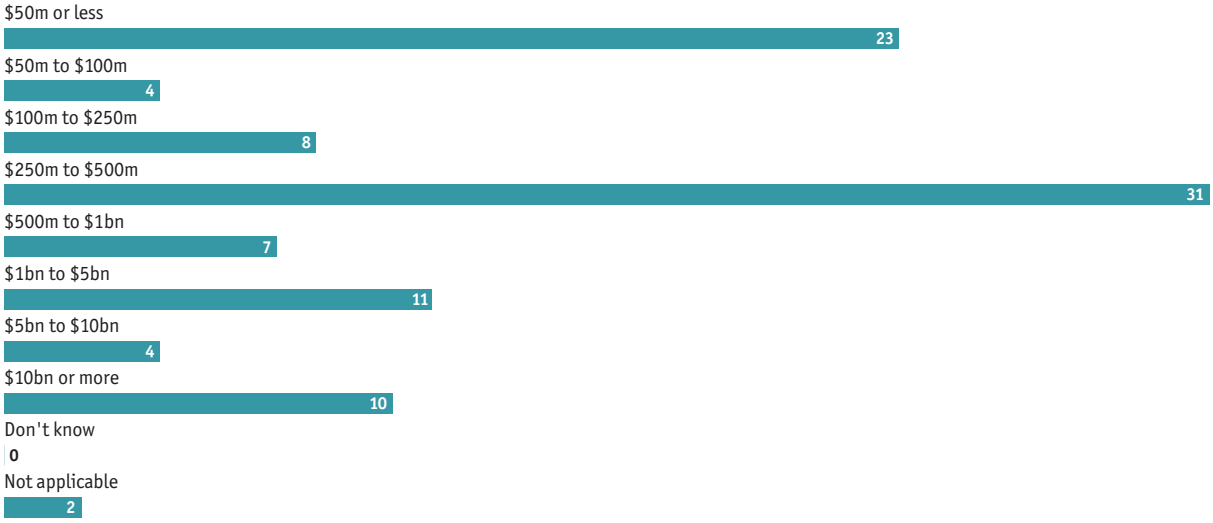
Which of the following groups do you think should take most responsibility for dealing with the following aspects of energy policy and climate change?
(% respondents)



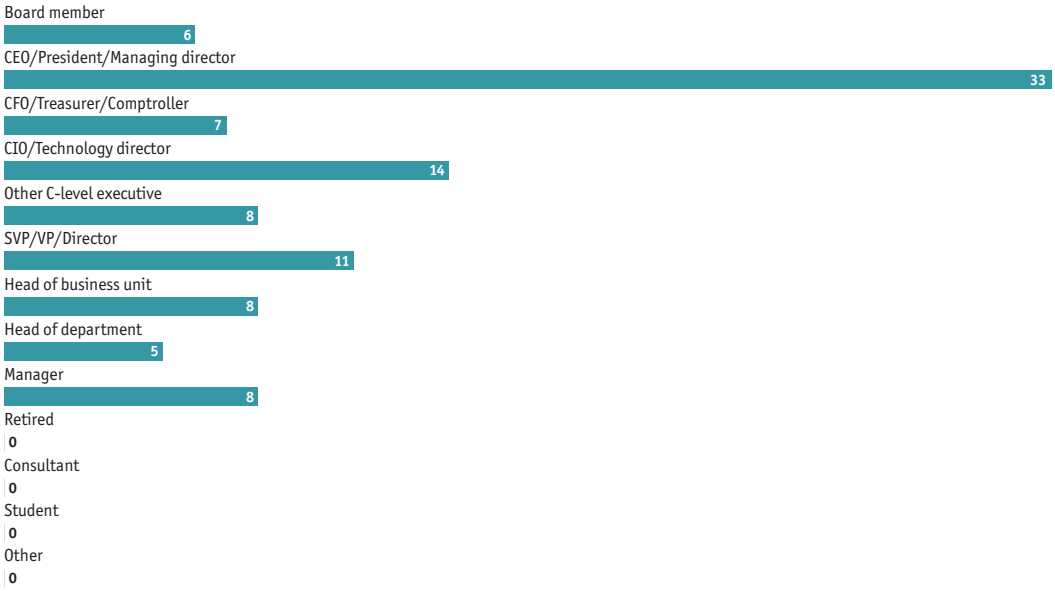
What is your primary industry?
(% respondents)



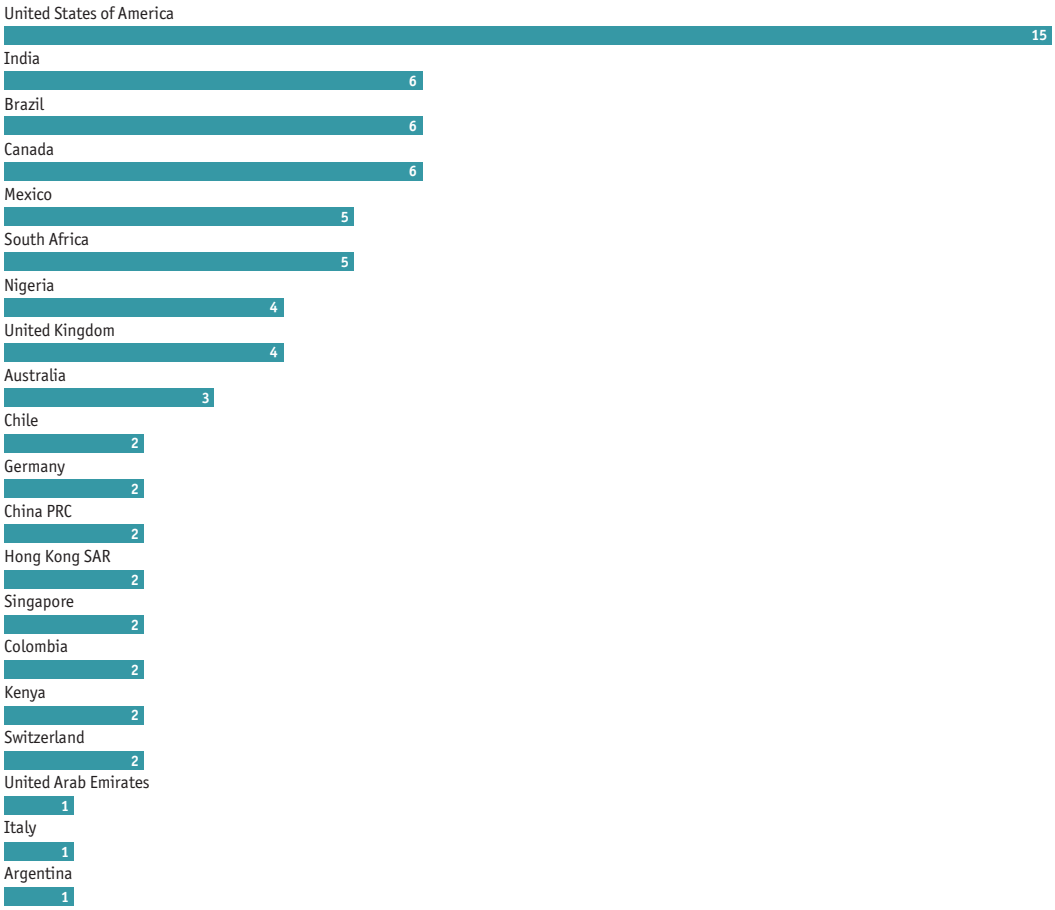
What is your company turnover?
(% respondents)



What is your job title?
(% respondents)



In which country are you personally based?
(% respondents; top 20 countries)



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