Green Economy: Prospects for Sustainable Development

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Abstract: The fundamental challenge that a green economy poses to all government agencies is to unify, harmonize and integrate work on the social, environmental and economic dimensions of sustainable development. Linking "green" and "economic" with human well-being and social justice as primary goals requires a new commitment to better measure and value human and natural assets and place them at the center of economic development. It also calls for more inclusive and proportionate growth. Investments in efficient transport systems, housing, energy efficiency, sustainable sources of biological resources and environmentally sustainable agricultural practices, among other priorities, can bring significant social benefits. For example, household energy investment to replace inefficient biomass/coal stoves with improved stoves and cleaner fuels, and the use of household waste to produce biogas, could improve the sanitation and health of 3 billion people and, in particular, the well-being of women. These linkages point to the need for a comprehensive approach that should form the basis for prioritizing investments in the green economy. Those investments that bring both environmental and social benefits should be prioritized.

1 INTRODUCTION

A Green Economy is: "An economy that improves human well-being and reduces inequalities in the long term without exposing future generations to significant environmental risks and environmental deficits", United Nations Environment Program (UNEP), 2012. There is not a single model of the "green economy", but several forms of local specific activities in the field of "green economy". The key principle is that the "green economy" is about finding economic opportunities through socially and environmentally sustainable practices and vice versa (Auffret, 2020).

Simply put, a green economy is an economy that promotes economic opportunities that are consistent with environmental sustainability and social well-being. It also promotes environmental goals that can provide new forms of socio-economic opportunity. The Theme Group stressed that the term does not mean that there is a single "green economy" or that one model can be applied across Europe. Rather, there will be several forms and types of green economy activities in different rural areas of Europe. Other terms are also used to describe this kind of development, such as green growth. These terms describe new goals and dynamics both in politics and in the (rural) economy itself, with a focus on economic growth that (Tans, 2019):

- is guided by low-carbon, energy-efficient and resource-saving investments and practices;
- increases the resilience of ecosystems to climate and economic changes;
- at a minimum, prevent the loss of biodiversity and ecosystem services and promote reconciliation between the environment and economic growth; and
- is socially inclusive.

Key drivers of a green economy include policies at the national, European and global levels, as well as the emergence of new or more accessible technological innovations. However, the market also plays an important role. The preferences and

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decisions of consumers, retailers, tourists, processors, etc. can make a big difference. These political, technological and market forces exist in a state of constant dynamism. Changes in these dynamics in recent years give new impetus to change (ICTs, 2019). Among the many specific driving forces behind the transition to a green economy in recent times are: the new global deal on climate change; Sustainable Development Goals (SDGs); increasing consumer preference for environmentally sustainable products; and innovation in renewable forms of energy from waste. A study of the transition process to a green economy has identified six components for the transition from a brown to a green economy. These building blocks form a sequence of steps from traditional or business as usual approaches.

Through active environmental management to, finally, a growing recognition of the need to achieve true environmental sustainability through the efficient use of resources and the use of more innovative technologies and methods, as well as finding ways to change demand.

A low-carbon economy is an economy in which businesses, individuals and the environment thrive through carbon management and sustainability, more efficient use of fuels, carbon storage in soil and biomass, and the use of low-carbon technologies to produce products, services and energy (Murtazova, 2021). However, it is important to note that the term "low carbon" does not only refer to carbon dioxide (CO2). It is also used to refer to the reduction of all greenhouse gas (GHG) emissions such as nitrogen oxides and methane. One of the main reasons for this transition in society is the increased contribution to climate change mitigation, in which all sectors have a role to play. There are many ways in which innovative developments can contribute to the transition to a green economy. These include support for green business activities and support for improving the environmental performance of farmers and foresters.

In March 2011, the European Commission set out a low-carbon economy roadmap that proposes to cut EU greenhouse gas emissions by 80% from 1990 levels by 2050. The two most important principles recognized in the roadmap are as follows (Braverman, 2019):

1. The transition to low-carbon technologies is feasible and affordable.
2. All sectors must contribute.

The roadmap outlines the milestones for achieving the goal by 2050:

- Reduce emissions by 40% by 2030.
- Reduce emissions by 60% by 2040.
- Reducing emissions by 80% by 2050.

According to the European Commission: “Reducing emissions by 80% by mid-century will require significant further innovation in existing technologies, but does not require new breakthrough technologies. [Existing technologies such as] solar, wind and bioenergy, smart grids, carbon capture and storage, low or zero energy homes [and] smart cities will be the backbone of a low-carbon economy in 2050.” Action will be required in all major sectors responsible for emissions in Europe – energy, industry, transport, buildings, construction and agriculture, but there are differences between sectors in the number of expected reductions according to their technological and economic potential.

2 RESEARCH METHODS

Carbon provides the basis for agricultural and forestry production in the form of organic matter in soils. Converted to biomass, it forms commodities in the form of food, materials (such as hemp) and fibers (including wood and cane). It also provides energy in the form of fuel used to run businesses and machines, as well as to power homes (Gakaev, 2020). But this dependence on carbon also brings with it some questions and challenges, such as how to maintain and increase existing carbon stocks, how to improve the efficiency of its use, and what are the consequences of this.

When we talk about greenhouse gas (GHG) emissions from the agricultural sector, we are mainly referring to emissions of: methane (CH4) from livestock digestion and manure storage; and nitrous oxide (N20) from organic and mineral nitrogen fertilizers. Globally, agriculture is the largest anthropogenic source of non-CO2 greenhouse gas emissions, accounting for 56% of emissions, this contribution is much smaller at about 10%, although with significant differences between Member States (3-32%) . As for specific sources of GHG emissions in the agricultural sector, their share is distributed among the following source categories (Vladimirov, 2019):

- agricultural soils (51%) – nitrous oxide (N2O) in soils, especially from organic and mineral nitrogen fertilizers;
- enteric fermentation (31%) – methane (CH4) from livestock digestion processes;
- manure management (17%) – both CH and NO
- rice cultivation (0.5%) - CH ; and
- incineration of agricultural waste in the field (0.2%) – CH4.

In addition, land management has other impacts on the carbon balance. On the one hand, there are additional emissions, especially CO_2, from the use of machinery and equipment on farms. On the other hand, certain land management practices can release significant amounts of carbon from soils, forests and swamps. Compared to other sectors, agriculture is expected to be able to achieve significant emission reductions already before 2030. However, further reductions will be more limited beyond that point. Along with transport, agriculture is expected to become one of the main sectors where full decarbonization will not be achieved even in the long term. Overall emissions from agriculture have already declined since 1990, with CO emissions proportionately larger than non-CO emissions. However, the rate of decline has slowed over the past decade, indicating that more action is needed to support the transition to a low-carbon economy in this sector and in rural areas in general.

The land use industries are among the few that can have a positive impact

carbon balance. This is due to the amount of carbon storage and sequestration that can occur through land, which can more than offset emissions associated with land use. Harnessing the potential for carbon sequestration and reducing greenhouse gas emissions through better management of soils and biomass is critical. Doing this consistently is especially important. Increasingly, Member States can look to their Land Use, Land-use Change and Forestry Sectors to contribute to climate change mitigation efforts. They can also be supported, for example, by afforestation and forest management and agroecological and climate measures. This, along with greater resource and energy efficiency, will in turn help support rural businesses and be a strong selling point for green products and low-carbon tourism (Molchanova, 2019).

Effective management of carbon emissions in ecosystems is not only about the environment. The Low Carbon Green Economy takes this idea further to ensure that an efficient and reliable supply of low carbon energy brings environmental, economic and social benefits. This should make ecosystems healthier and more resilient or adaptable to change, which means increased productivity and a more sustainable long-term future for productive sectors.

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3 RESULTS AND DISCUSSIONS

Global ecosystems contribute to the emission and capture of CO2, methane (CH4) and nitrous oxide (N2O), and influence the composition of atmospheric greenhouse gases and climate. Over the past 50 years, the removal of approximately one third of anthropogenic GHG emissions has been associated with terrestrial ecosystems (Egorova, 2020). In producing high-quality and large amounts of food for a growing wealthy population, global food systems are important sources of GHGs, accounting for more than one third of global anthropogenic GHG emissions, of which 71% comes from crop and livestock production. production systems and land-use change activities. Forest ecosystems are one of the most important global carbon sinks and absorb 45% of anthropogenic GHG emissions, with 85–90% of terrestrial biomass produced in forest ecosystems. The ocean covers more than 70% of the Earth's surface and plays an important role in capturing CO2 from the atmosphere. Currently, 22.7% of annual CO2 emissions from human activities are absorbed by the ocean ecosystem. To prevent irreversible deterioration from global climate change, the biosphere must increase biomass production and food supply with less greenhouse gas emissions, remove CO2 from the atmosphere and store it as organic carbon in the biosphere, contributing to carbon neutrality. In this sense, we are focusing on optimizing crop and livestock systems, improving the health of forest ecosystems through soil carbon sequestration, and using soils and marine ecosystems as natural carbon sinks. They can provide breakthrough technologies for carbon recovery and immobilization in terrestrial and marine ecosystems, and they are discussed in more detail in the following subsections (Meckling, 2020).

Over the past 20 years, greenhouse gas emissions from agricultural food production systems have increased by about one-third. Emissions are mainly related to the growth of crop and livestock production: 4.2 GtCO2-eq. per year from enteric fermentation, manure and pasture use and livestock fuel use, 3.6 GtCO2-eq. per year from the use of synthetic nitrogen fertilizers and crop production. for human and animal food and 3.3 Gt CO2-eq. per year as a result of changes in land use for crop and livestock systems (Molchanova, 2019; Egorova, 2020). Given the uncertainty associated with the large-scale deployment of carbon capture and storage technologies in food production systems, alternative technologies or approaches are needed to reduce a significant portion of GHG emissions from agricultural production systems. For example, we need to change our eating habits to diets with less animal products but more plant foods.

4 CONCLUSIONS

The use of fertilizers and water on arable land can significantly reduce greenhouse gas emissions from crop production systems. To increase nitrogen content, new types of synthetic nitrogen fertilizers need to be developed, such as slow and controlled release nitrogen fertilizers, as well as nitrogen fertilizers with urease and nitrification inhibitors. use efficiency. More efficient farming systems, fertilization and irrigation practices, and the use of advanced digital farming technologies such as multi-sensor drones that allow farmers to more efficiently and accurately manage crops, soil, fertilization and irrigation can reduce nitrogen fertilizer consumption and N2O emissions (ICTs, 2019; Braverman, 2019). For example, intermittent irrigation can significantly reduce CH4 generation and increase CH4 oxidation and thus may be an important choice for reducing CH4 emissions from rice fields. Breeding crop varieties with high nitrogen use efficiency (NUE) can reduce nitrogen fertilization rates and reduce nitrogen oxide emissions. Using transgenic and gene editing technologies, the introduction of proliferating cell factor domain proteins such as OsTCP19-H into modern rice cultivars has been shown to increase NUE. Multisensor drone technology for plant phenotyping can evaluate NUE at various nitrogen dosages, thus allowing the selection of superior genotypes with high NUE. In addition, the development of methanogenesis inhibitors or the addition of biochar to rice fields has great technical potential to reduce CH4 emissions. Other options include using microbes to help crops fix nitrogen, thereby saving nitrogen fertilizers and reducing the impact of nitrogen fertilizers. industry. management of livestock production. Enteric fermentation management is one of the key strategies for reducing CH4 emissions in ruminant livestock systems. Methane is a natural by-product of hydrogen removal during enteric fermentation and is released by methanogenic archaea. Methane inhibitors can be obtained by inhibiting H2 metabolism for methanogenesis (Murtazova, 2021). Such inhibitors include alternative electron absorbers, phyto compounds, ionophore antibiotics, and oil. Among them, 3-nitrooxypropanol is the latest developed and promising inhibitor of methanogenesis, which has been shown to reduce methane emissions in ruminants by up to 40%. Vaccination that induces the host's immune system to produce antibodies capable of suppressing methanogens can reduce CH4 emissions and is especially beneficial for grazing systems. Considering that forage-fed ruminants account for 70% of global methane emissions from ruminants, the development of new, highly digestible feeds with higher levels of non-fibrous carbohydrates and lower levels of lignified fiber, as well as high concentrations of secondary plant metabolites such as tannins, saponins and essential oils can be helpful. Manure management practices can significantly reduce indirect GHG emissions by optimizing rangeland management, farm energy generation and low emission organic fertilizer production (Hibbard, 2019). The development of technologies that span the entire manure management chain, such as advanced tank composting to reduce carbon and nitrogen losses and reverse osmosis to concentrate and extract nitrogen from liquid manure for long-distance transport, can maximize the potential for carbon and nitrogen reuse. from manure. The use of manure to produce insect or fungal proteins is another value-added technology that can replace soy and fish proteins in animal feed and reduce feed-related greenhouse gas emissions. Animal breeding techniques consist of genetically selecting highly productive animals with lower GHG emission intensity, thereby reducing the number of animals needed to produce the same amount of food. Shotgun metagenomics provides a platform for identifying rumen microbial communities and genetic markers associated with CH4 emissions, allowing selection of cattle with lower CH4 emissions. Other advanced technologies include the use of cloned farm animals and the manipulation of traits by manipulating targeted genes to increase productivity. The green economy is relevant for all sectors of the economy in rural areas. Links between rural and urban areas are also important, as green investments and activities in rural areas can contribute to green economic growth in urban areas and vice versa. The transition to a green economy will require action on many fronts, and significant investment is likely to be needed to generate the necessary momentum in some areas. Rural Development Programs (RDPs) can play a key role by supporting low-carbon, resource-efficient and socially equitable investments, as well as promoting sustainable natural resource management across economic sectors, not just agriculture and forestry. Although they are often small in scale and not positioned as contributing to the growth of a green economy, there are already many examples of investments and initiatives that can contribute to job creation and economic growth in a low-carbon and resource-efficient manner (Meckling, 2020). However, achieving the full scale of the potential transition will mean adopting existing best practices on a much larger scale than currently, as well as investing in new ideas, technologies and actions. This requires new ways of working, such as collaborating on territorially integrated initiatives and interacting with a more diverse range of actors. Innovation and entrepreneurship in rural areas should be encouraged, as well as the transfer of knowledge, for example through advice, training and mentoring.

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