A multi-level approach in a target country

Connecting Green Economy goals with innovation policy in Ethiopia

Ethiopia aims to achieve middle-income status by 2025. When following the conventional development path, high growth rates would result in a sharp increase in greenhouse gas emissions and unsustainable use of natural resources. To avoid such negative effects, Ethiopia committed to put its growth model on a more climate friendly and sustainable basis.

By Girma Mamo and Andreas Stamm

Ethiopia has a very low level of absolute emissions of greenhouse gases (GHG) and one of the lowest levels of per capita emissions in the world. Nevertheless, the topic of how to combine social and economic development, while protecting the national and global environment, has been high on the political agenda of the country, as stated already in the 1997 Environmental Policy of the nation. Also, the Ethiopian Growth and Transformation Plan (GTP) recognizes the principles of sustainable growth. Ethiopia has, thus, the possibility to develop solutions of how to generate accelerated development in order to improve living conditions of the population without harming the environmental basis for the wellbeing of future generations.

In 2011, the Climate Resilient Green Economy (CRGE) Strategy was adopted as a national policy framework, outlining goals of a green development and climate change mitigation and adaptation actions of the country. The CRGE has made tremendous strides in providing vision, high-level commitment, credible analysis and planning an extensive portfolio of investments in a very short time. It is well received by governmental executive bodies as well as stakeholders at international and national levels, subnational and regional communities. Several development cooperation agencies are already tailoring their programs to support the CRGE's objectives, often not under the concept of green economy, but in developing sustainable energies, forest protection and reforestation etc.

In Ethiopia, the highest emission potential impact is concentrated in agriculture and forestry. Under Business as Usual assumptions, agriculture and forestry would contribute around 45% and 25% respectively to projected GHG emission levels and, together, account for about 80% of the total emission reduction potential identified. Seizing opportunities for innovation based on the latest production platforms, leapfrogging to the newest and best technology rather than reproducing each evolutionary stage, could significantly reduce GHG emissions in these key sectors. The development of a green economy will be based on four pillars:

- Agriculture: Improving crop and livestock production practices for higher food security and farmer income while reducing emissions;
- Power: Expanding electricity generation from renewable energy for domestic and regional (East African) markets;
- Transport, industrial sectors and buildings: Leapfrogging to modern and energy efficient technologies;
- Forestry: Protecting and reestablishing forests for their economic and ecosystem services including as carbon stocks.

Agriculture

Agriculture remains of overriding social importance in Ethiopia. Despite the shift in the economic structure, and the ambitious plans of the government to achieve an industry-based economic development, agriculture remains a principal source of growth for the country, the principal source of income for the rural majority, and critical for food security for all Ethiopians. Ethiopian agriculture is dominated by subsistence, rainfed farming systems, with low external inputs and low outputs. Agricultural productivity in Ethiopia is constrained mainly by inadequate supply of improved agricultural inputs and application of improved practices and climatic variability and natural resources degradation. There is a felt need to increase yield per unit area/labor and conserve the natural resources to attain food security at a household level.

In this regard, focus will be given to support the generation, transfer and utilization of affordable agricultural technologies to enhance agricultural production, productivity, processing and marketing at both household and commercial levels and replacing chemical fertilizers with organic alternatives for greener food production.

Agriculture and related activities as forestry or fish farming are highly dependent on the specific ecological conditions of each locality. Improving soil productivity and building up resilience against climate change cannot be done exclusively by transferring technologies developed under different agro-ecological conditions elsewhere in the world. Rather, what is required is access to internationally generated solutions, but combining them with local developments and indigenous knowledge. Employing advanced techniques to use agriculture as a carbon sink is a largely under-researched field of knowledge, where Ethiopia can leapfrog conventional practices and build up important research and development (R&D) clusters.

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In Ethiopia, scientific technical information related to agriculture is the most advanced subsystem of the national innovation system (NIS). For instance, the local branch of the International Livestock Research Institute provides access to results of international scientific research and experimental development. The Ethiopian Agricultural Research System (EARS) consists of 55 research centers, including the Ethiopian Institute of Agricultural Research, formally established as early as 1966. Additionally, several Higher Education Institutes are also involved in agricultural research. Two important assets of the EARS are the fact that it covers all principal agro-ecological zones of the country, including lowland, pastoral and agro-pastoral areas (MARD 2010) and that most agricultural R&D institutions are also involved in extension work, implying the possibility to directly transfer knowledge and technology to the farmers and tapping into the local indigenous knowledge in co-development projects.

A factsheet by the Agricultural Science and Technology Indicators initiative mentions three main deficits of the EARS. Firstly, due to the fact that agricultural R&D spending is staying behind the growth of agricultural production, the percentage of R&D spending in agricultural gross domestic product is decreasing and reached only 0,19% in 2011 (2000: 0,30%). Secondly, while the total number of agricultural researchers in the public sector has increased significantly in the past decade, most researchers are very young and with a relatively low level of formal qualification (more than 50% only hold a BSc and merely 9% a PhD). Thirdly, coordination among the growing number of R&D institutes is still weak, leading, among others, to a duplication of efforts and an efficient usage of funds (ASTI 2014).

Energy

Currently, emissions of carbon dioxide (CO_2) from energy usage and the combustion of fossil fuels are very low in Ethiopia. This is on one hand the outcome of a focus on renewable energies by the government, on the other hand the consequence of a still very low overall energy consumption of only 381 kilogram of oil equivalent per capita in Ethiopia, as compared with 681 kilogram as the average in Sub-Saharan Africa (data for 2011). Most energy used in the country (2011: 93%) stems from combustible renewables like firewood or dung. Access to electricity is limited to 23% of the population, compared to an average in Sub-Saharan Africa of 31.8% (World Bank 2014). Even assuming continued high economic growth rates and a fast increase of electricity access, the power sector in Ethiopia will contribute little to global CO_2 emissions in the foreseeable future.

The government of Ethiopia has planned to generate up to 10.000 megawatt of clean energy by the end of the GTP period (2014/15). It aims to support the transformation process in the country, combining economic objectives (to become the region's main power producer and principal exporter to neighboring countries) with environmental objectives – (to do so through clean energy) and social objectives (to provide people with access to clean energy). Because hydroelectric power forms the main source of electricity at present, and will do for years to come, there is limited scope for attracting climate finance, which requires a shift from dirty energy sources. The most significant source of renewable energy in Ethiopia is hydropower. Its contribution to the electricity portfolio of the country will further increase, once the Grand Ethiopian Renaissance Dam, being erected close to the Sudanese border, will be finalized (probably in 2017). While being a low-carbon source of electricity, research is currently going on to find ways to reduce emissions of the powerful GHG methane from dams (Maeck, A. et al. 2013), and to avoid effects on other dimensions of the environment (Mc Cartney 2009).

Often, project design and implementation in the field of renewable energies (biogas, clean biomass cooking stoves etc.) are done by Nongovernmental Organizations or international development cooperation. They often follow a holistic and sustainability-oriented approach, but their outreach is necessarily restricted, considering the still very high prevalence of energy poverty in large parts of the developing world.

For Ethiopia, this implies the need to strengthen local efforts in order to develop solutions for sustainable energy provision for all and assure their fast roll-out. For the NIS, this means building up the capacities to search and select internationally the most appropriate and most cost-effective components for energy generation. The fast decrease in global component prices can benefit the country. However, components have to be integrated in local systems, including services for maintenance and repair, adequate fee systems for the electricity and training of the end users. A cradle-to-grave approach should be adopted, developing from the early stage onward concepts of how to safely dispose of or recycle components – especially potentially harmful, such as batteries – once they have reached the end of their life cycle.

Not cutting edge R&D will be required, but a systemic approach of capacity building, multidisciplinary (engineering, business and social sciences) and combining different levels of capabilities (higher education, technical and vocational training).

Transport, industrial sectors and buildings

Today's challenges to sustainable development in Ethiopia have their origin mainly in rural areas and related economic activities and land use change. Manufacturing and urban settlements still play a small role, compared to many other countries. World Bank data indicate that around 17% of the population lives in urban areas, compared to 37% in the average of Subsahara-Africa (World Bank 2014). Medium to large manufacturing companies account for less than 3% of GDP (MoFED 2014). Private car ownership is still very low: Only three in every 1.000 Ethiopians owned a car in 2011, compared to ten cars per 1.000 in Low Income Countries (World Bank 2014).

However, the overall situation will change in the near future, leading to an increasing environmental burden of the urban population and industrial sector. The Ethiopian government follows ambitious plans to accelerate industrial development. In order to break out of the narrow industrial base and to enhance the manufacturing sector's contribution to industrial and economic growth it will be necessary to ensure balanced regional industrial development; integrate Ethiopian industries into regional and global market development; and to pursue both export-led and import substitution industrialization.

Increasing manufacturing and international trade may lead to a growth in GHG emissions. Emissions from transport are projected to grow from around five million tons Carbon dioxide equivalent (CDE) in 2010 to 40 million tons in 2030. The increased emissions are driven first by higher emissions from freight transport (plus 13 % per year) and also by higher emissions from passenger transport (plus 9 % per year). Private car ownership will become more common following the emergence of a middle class that can afford it.

An increasing urban population drives increasing waste generation and energy consumption. Total buildings-related emissions are expected to increase from five million tons CDE today to ten million tons in 2030, with around 25 % of the emissions in 2030 related to off-grid energy consumption, 75 % to waste. Adopting new technologies in lighting and waste management offers an abatement potential of up to 6.9 million tons CDE in 2030. There are proposed initiatives, like reduction of electricity demand through efficient lighting; improved landfill gas and liquid waste management like capture gas for flaring. Depending on the availability of technology, efficient waste management could be complemented by electricity generation techniques that would provide further benefits for the green economy.

Industries are expected to grow at annual rates of up to 20 %. The industry sector shows the highest emission growth rates of all sectors, as its output is rapidly growing and its processes are very emission intense: Overall industrial emissions are projected to grow by 16 % per year from four million tons CDE today to 71 million tons in 2030.

Forestry

Deforestation due to fuel wood consumption, logging and clearance of land for agricultural purposes leads to CO_2 emissions. Emissions are projected to grow from around 25 million tons CDE in 2010 to almost 45 million tons in 2030. The government of Ethiopia approaches to integrate land use management with community forestry has developed Community-based Natural Regeneration Projects as a carbon trading initiative. Both sustainability and inclusiveness have been key features of the projects.

In recent years, the Ethiopian government has implemented a series of programs to build up an effective NIS, such as the establishment of Institutes of Technology in various parts of the country and the Science and Technology Universities in Addis Ababa and Adama. The further development of these units should make sure, that high-level R & D is carried out and linkages with the local and regional company sector, especially the small and medium-sized companies, established. Also, they should be seen as important nuclei for the formation of new technology based companies. Both in activities of technology transfer to existing and in new company formation, the concept of leapfrogging to more climate and environment oriented solutions should be incorporated.

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AUTHORS + CONTACT

Girma Mamo is Team Leader and ***Dr. Andreas Stamm*** is Programme Manager of the National Quality Infrastructure Project.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Hisham Complex (5th floor), Kazanchis Area, P. O. Box 34, Addis Ababa, Ethiopia.
Phone: +251 911 369405, Email: andreas.stamm@giz.de, Website: www.giz.de\Ethiopia