

# Energy Systems of the Future in Brazil

Wind and solar energy have great potential in Brazil. The project supports the country in improving the conditions for integrating renewable energies and energy efficiency.

## The Challenge

Brazil's demand for energy will continue to increase, although the rapid economic growth of the last few years has weakened significantly. Yet based on the economic and population growth forecast for the next 10 years alone, the energy planning authority (EPE) estimates an increase of 18 % in per capita electricity consumption from 2019 to 2029 (PDE 2029), and a growth rate of over 2.5 % in annual electricity demand .

The Brazilian electric matrix already has a large share of renewable energies. Hydroelectric plants represent more than 60% of installed capacity and about 19% come from other sources of renewable energy, mainly wind, biomass and photovoltaic. However, the predominance of hydroelectric based generation poses some challenges, such as fluctuations in water availability, which have been accentuated by climate change, making the need to diversify the matrix increasingly evident. In recent years, there have been long periods without heavy rain, which have resulted in low water levels in the reservoirs. These unfavourable hydrological conditions have led to an increase in the use of fossil energy sources, which in turn leads to raising energy prices.

For these reasons, the development of other sources of renewable energies, such as solar and wind, and energy efficiency are important for Brazil. It is estimated that, by 2029, there will be an a growth of 25 GW in installed capacity of wind energy, representing an increase of 163%, compared to the year 2019 (15 GW). For centralized solar energy, the expectation is even greater: Increase of installed capacity by 387% in the same period, going from 2 GW to 11 GW . In addition, distributed generation (DG) of energy has grown strongly in the country and should maintain this trend. It is estimated that distributed energy resources (DER) account for 17% of total electricity consumption in 2029 (with more than 11 GW of installed capacity), 86% of which will come from photovoltaic energy.

The expansion will pose challenges for planning, operation and regulation of the energy and electricity sector, since wind and solar energy depend on weather conditions and fluctuate accordingly. Another issue is the location of generation versus consumption. The country's highest wind energy potential is found in the north-east. However, a large part of the electricity generated in this region must

Name of the project	Energy Systems of the Future (Phase II and Phase III)
Comissioned by	German Federal Ministry for Economic Cooperation and Development (BMZ)
Country	Brazil
Political partners	Ministry of Mines and Energy (MME)
Other partners	ANEEL, EPE, MEC, SENAI
Duration	2019— 2024
Budget	€ 15.700.000

be transported to the south-east, where the highest consumption is located. DG also imposes adversities, since additional loads alter the flow of energy and increase the complexity of the system.

Furthermore, growth and modernization of the sector requires a qualified workforce to plan and implement investments in renewable energy and energy efficiency, in addition to ensuring its optimal operation.

## Objective

The conditions for integrating renewable energies and energy efficiency into the Brazilian energy system are improved.

## Our Approach

To capitalize on Brazil's huge potential for renewable energies and for savings through energy efficiency, institutions and policy-makers need access to reliable information and data. GIZ provides advice to ministries and other public institutions, as well as banks and other relevant actors, on strategy development and support for



*Left* Installation of photovoltaic modules in a training center at SENAI

*Right* A wind power specialist

developing management and cooperation structures. Furthermore GIZ offers technical expertise on energy planning and regulation as well as advice on the development of business models.

The vocational training courses available in Brazil do not yet meet the growing market demand for specialists in renewable energy and energy efficiency. GIZ supports, based on international experiences, institutions of professional training and higher education in establishing new courses and disciplines in line with the demands of the sector. To ensure that their needs are met, the project encourages the establishment of networks at the national level for the development of new educational programs involving representatives of the private sector, teachers as well as researchers.

## Impacts

The Ministry of Mines and Energy (MME) and the National Federation of Cooperatives (OCB) have launched a new cooperative business model for the decentralization of energy production across the country together with GIZ and the German Cooperative Confederation (DGRV). So far, at least 19 cooperatives of shared energy generation have been founded, operating 25 generation plants (16 from photovoltaic sources), with an installed capacity of approximately 26 MW that supply more than 1,700 consumer units.

In 2020, the project initiated two learning networks. One of them, led by the MME, focuses on energy efficiency (EE) and DG in public buildings (RedEE - Public Buildings), and the other, on energy management in industries (RedEE - Industry). The first supports 15 public institutions in reducing electricity consumption, while the second offers a space to exchange experiences and knowledge, where managers from 13 industries are trained in EE and energy management.

Also in 2020, the MME, EPE and Brazil's National Grid Operator (ONS) published a pilot study on new mechanisms to integrate an increasing amount of intermittent renewable energy into the energy system. Modelled based on security of supply of the Brazilian energy system, the study demonstrates measures to mitigate the effect of the integration of these sources.

In another innovative initiative, with the support of GIZ, ANEEL and EPE are conducting a study on the insertion of distributed energy

resources (DERs) in the Brazilian electrical matrix. DERs include DG, distributed storage, micro grids and electric vehicles. ANEEL is responsible for monitoring the regulatory improvements necessary for the sustainable integration of DERs in distribution systems, using the best international practices as a reference. Whereas EPE studies models and simulations that capture the diffusion of these resources, in order to assist Brazilian energy planning.

To supply the energy market with qualified professionals, the project supports the Ministry of Education (MEC) and its Federal Network for Professional, Scientific and Technological Education, the Brazilian National Service for Industrial Training (SENAI) and universities in further developing their educational offer for the energy sector. By 2020, 650 teachers and about 4,600 professionals were trained in courses from these institutions supported by the project.

The project also supported the implementation of 10 training centers in photovoltaic energy at SENAI facilities, where approximately 1,000 graduates per year are expected to be trained starting from 2021 onwards. The centers were equipped through a partnership with companies associated with the Brazilian Solar Energy Association (ABSOLAR).

The Brazilian Ministry of Education (MEC) created the EnergIF Program in 2017 to encourage the offer of courses on renewable energy and energy efficiency. In November 2020, EnergIF became a government program through an ordinance. Through the program, MEC already invested 500.000 Euro in laboratory equipment with the objective to open 25 new courses focusing on PV and energy efficiency in buildings. Additionally, the Ministry allocated 12 million Euro for the acquisition of PV power plants to reduce the Federal Network's expenses with electricity.

In higher education, the project encourages the offering of postgraduate programs, such as those already underway at SENAI São Paulo, SENAI Goiás and at the Federal Institute of Espírito Santo (IFES) on energy efficiency. Additionally, the project focuses on the inclusion of subjects on electric mobility and digitalization of the energy sector. In 2020 syllabi were prepared for these two topics and teachers were trained. The university UFSM has already incorporated two new disciplines in its master and doctoral programs and other institutions are expected to follow these steps from the first semester of 2021 on.

Published by	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH	Partners	Ministry of Mines and Energy (MME) Setor de Autarquias Norte, Quadra 1, Asa Norte, Brasília - DF. CEP 70297-400
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Published in	February 2021		