

# Energy Systems of the Future in Brazil

## Project improves conditions for the integration of renewable energy and energy efficiency in the Brazilian energy system

### The challenge

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 increase 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 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.

Name of the project	Energy Systems of the Future (Phase III)
Commissioned by	German Federal Ministry for Economic Cooperation and Development (BMZ)
Country	Brazil
Political partner	Ministry of Mines and Energy (MME)
Duration	2019 - 2024
Orçamento	€ 9.700.000

### 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 other relevant actors, on strategy development and support for developing management and cooperation structures.



Photo 1: Solar panels in Maracanã Stadium, in Rio de Janeiro.

Photo 2: Wind power plant in the State of Ceará.



Photos 3 and 4: Biogas production in Toledo (PR).

The project offers technical expertise on energy planning and systems management, regulation, development of new business models and dissemination of innovative renewable energy and energy efficiency technologies. By doing this, the project promotes cooperation between actors in the public and private energy sectors, thus facilitating and sharing technologies and specific know-how.

## 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). To date, 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.

Between 2020 and 2021, the project executed two learning networks. One of them, led by the MME, focused on energy efficiency (EE) and DG in Brazilian public buildings (RedEE - Public Buildings). It supported 15 public institutions in reducing electricity consumption. The second one, named RedEE - Industry, acted in energy management in the private sector and exchanged experiences and knowledge, in which managers from 13 industries were trained in EE and energy management.

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, the National Electric Energy Agency (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.

Since 2022, the Project has developed pilot projects for new technologies in the field of sustainable energy and green growth, with clean generation of at least 94 MWh/year.

Activities implemented in 2022 also include the establishment of an ISO 50.001-certified Energy Management System (EmMS) at the MME headquarters, in Brasília, and an integrated management showcase project at the Ministries Esplanade.

Notable studies are being carried out in partnership with the EPE, with the aim of subsidizing energy planning, such as: best practices in offshore wind measurements, long-term wind and solar public database, isolated systems, renewable energy certificates, and evaluation of new requirements for the supervisory system of ONS.

The largest meteorological database for the wind and solar sectors is being built in a partnership with EPE and Climatempo's Research, Development and Innovation Laboratory. The initiative aims to develop and operate a digital platform with the historical base of reliable climate data, as well as useful tools to contribute to the planning of investments in the sector.

Through studies and training with ANEEL, the project also supports the improvement of the Energy Efficiency Programs and research, development and innovation, both regulated by the agency. In addition, a study is being conducted to address the improvement of the regulation of ancillary services, which are relevant in a context of increasing variable renewable sources.

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