

ITAIPU BINACIONAL

RENEWABLE ENERGY





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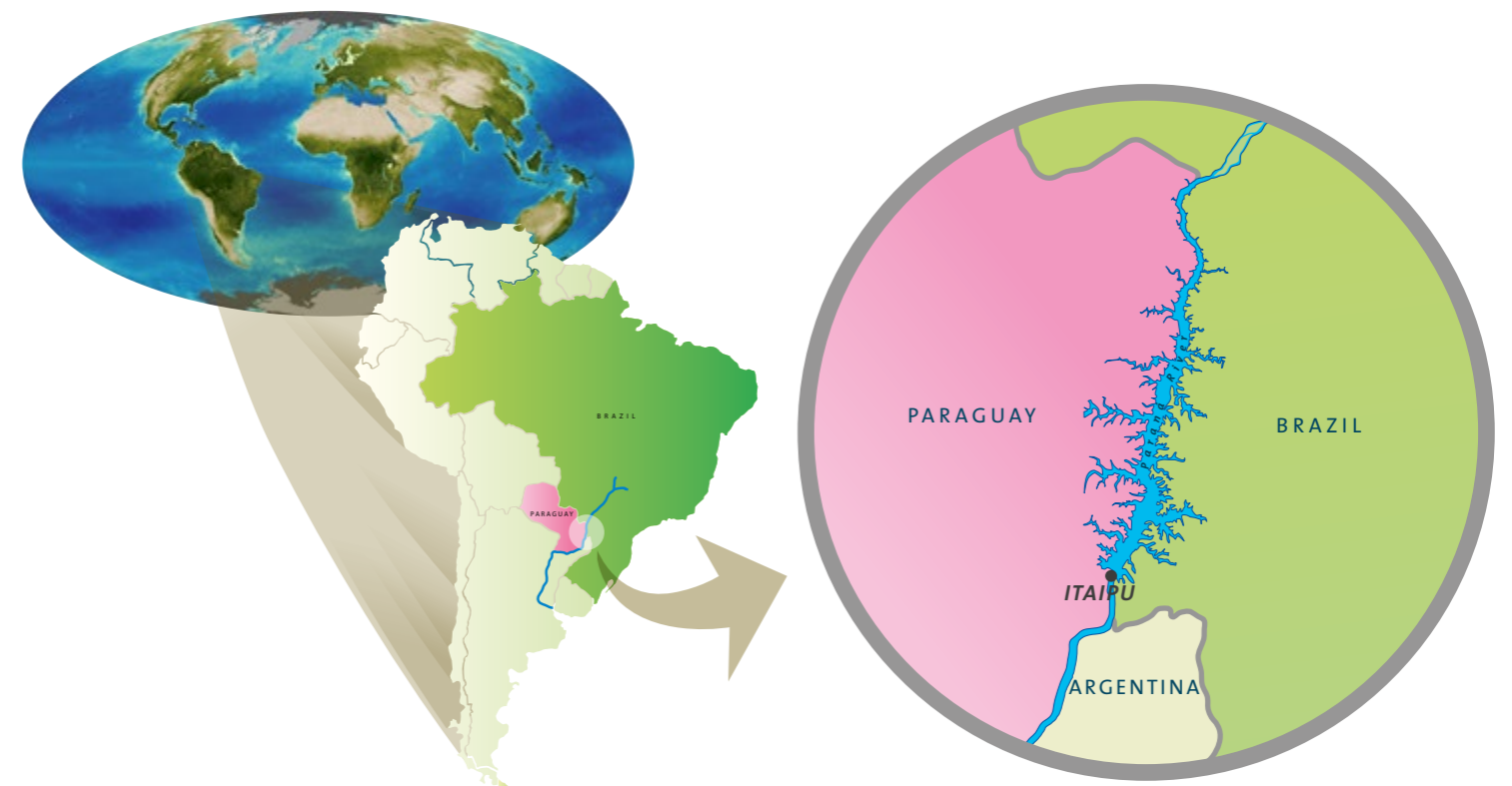
taipu is a binational entity created and governed by the treaty signed in 1973 by the governments of Brazil and Paraguay.

With 20 generating units and 14 thousand MW of installed power, Itaipu is the world leader in the generation of clean and renewable energy, having produced, since 1984, 2.8 billion MWh. Currently, the hydroelectric power plant is responsible for supplying approximately 11% of all energy consumed by Brazil and approximately 90% by Paraguay.

The plant is **located on the stretch of the Paraná River**, the fifth longest in the world, and which forms the border of the State of Paraná, on the Brazilian side of the hydroelectric plant, and the department of Alto Paraná, on the Paraguayan side.

In addition to generating energy, Itaipu has always promoted social and environmental actions, aiming at water security through the preservation of its asset: water. On the other hand, territorial development, raising the quality of life of the population in its area of influence.

The Brazilian and Paraguayan margins of Itaipu act differently in their territories, considering the legal and socioeconomic differences between the two countries. Thus, the renewable energy actions presented here are the responsibility of the Brazilian margin of Itaipu, through its Coordination Board.





AREA OF OPERATION (BRAZILIAN SIDE)



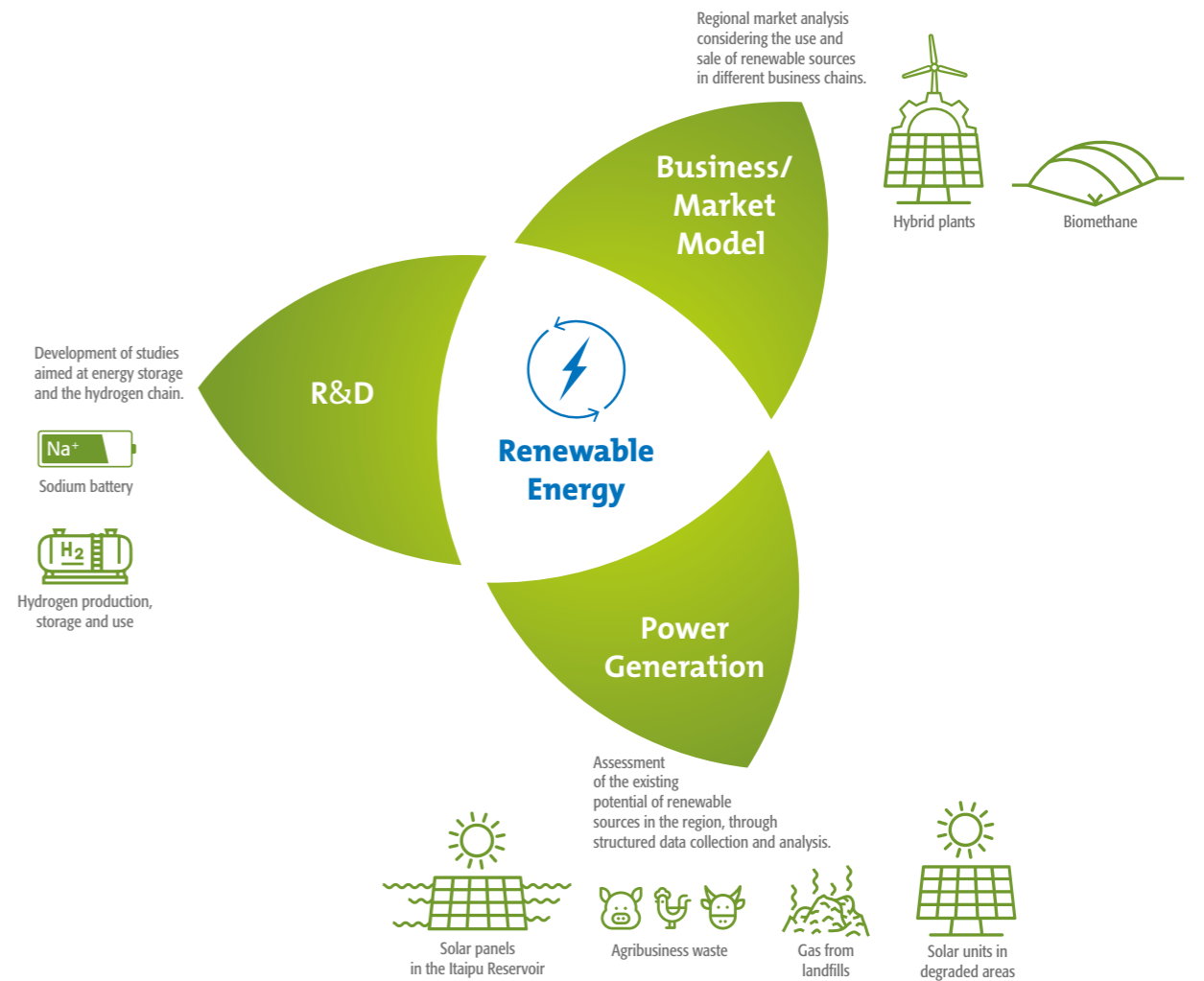
WHY INVEST

- ◆ Foster decarbonization actions.
- ◆ Enhance the energy use of environmental liabilities (ex: swine waste, landfills, etc.) existing in the area of operation of Itaipu, with a view to territorial development and water security.
- ◆ Alignment with the federal government's policies for the use of renewable energy sources – Ministry of Mines and Energy.
- ◆ Foster research, innovation and technology implementation using renewable energy sources according to corporate strategic actions and objectives – "OE7".

STRATEGY FOR RENEWABLE ENERGY

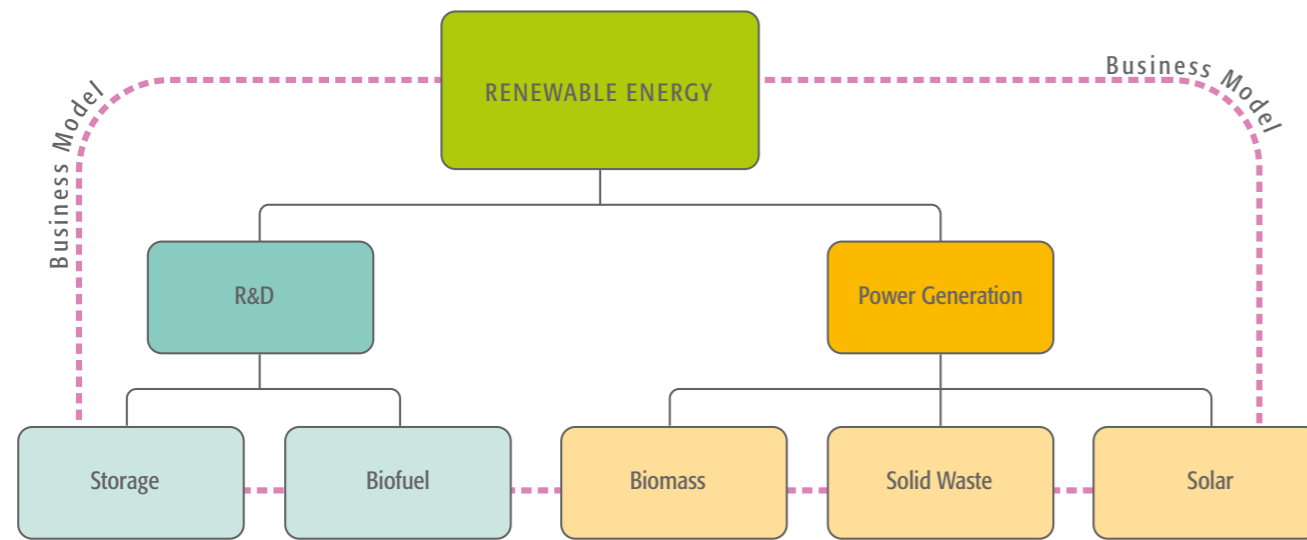
The renewable energy initiatives are structured in 3 lines:

- ◆ R&D;
- ◆ energy generation; and
- ◆ business/market model.

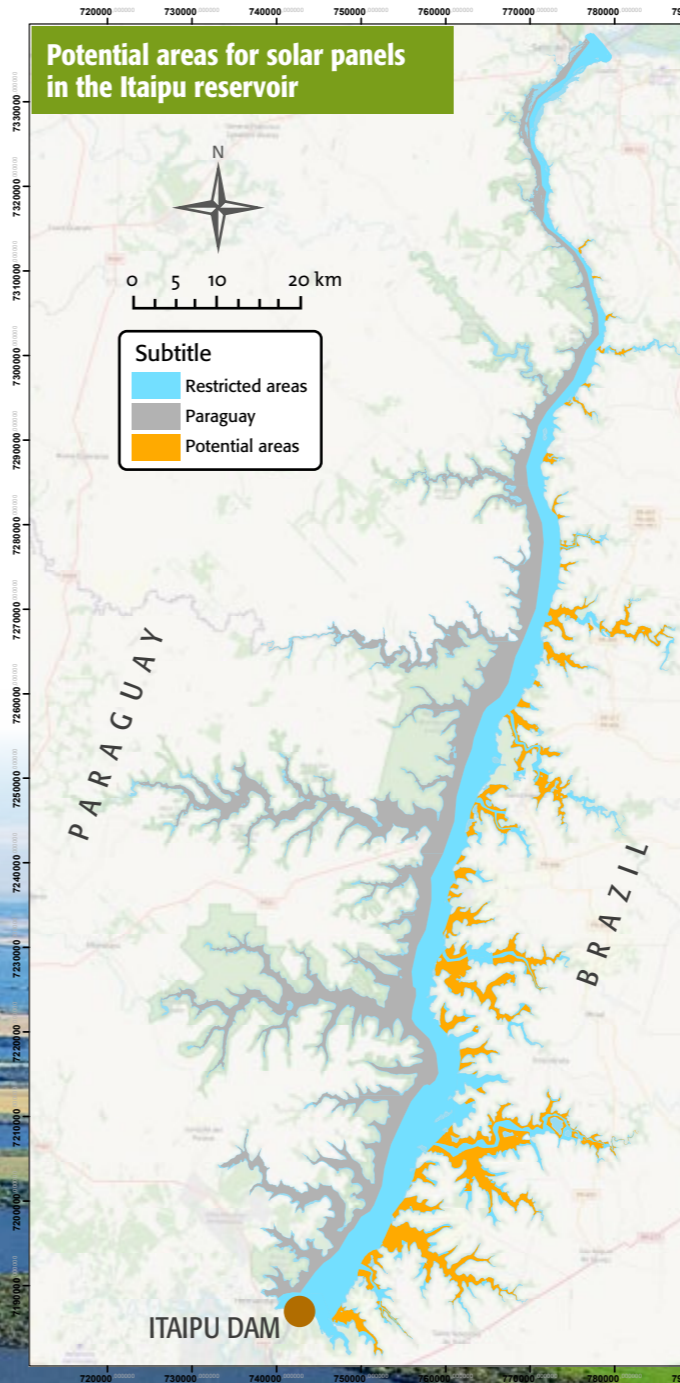


PROJECT STRUCTURE

The renewable energy initiatives are structured in 3 lines: R&D, energy generation and business/market model.



RENEWABLE ENERGY POTENTIAL ANALYSIS: solar energy production in reservoirs



OBJECTIVE

Environmental and technical analysis for solar production by third parties in the ITAIPU reservoir.

CHALLENGES

- ◆ Parameters for zoning potential areas in the reservoir.
- ◆ Feasibility study for floating panels (third parties).

ESTIMATE

Water blade: 197 km² on the left margin of the reservoir. Considering environmental and technical aspects, 20-30% of such area could be used (6.000 MWp).

RENEWABLE ENERGY POTENTIAL ANALYSIS: solar energy production in degraded areas

OBJECTIVE

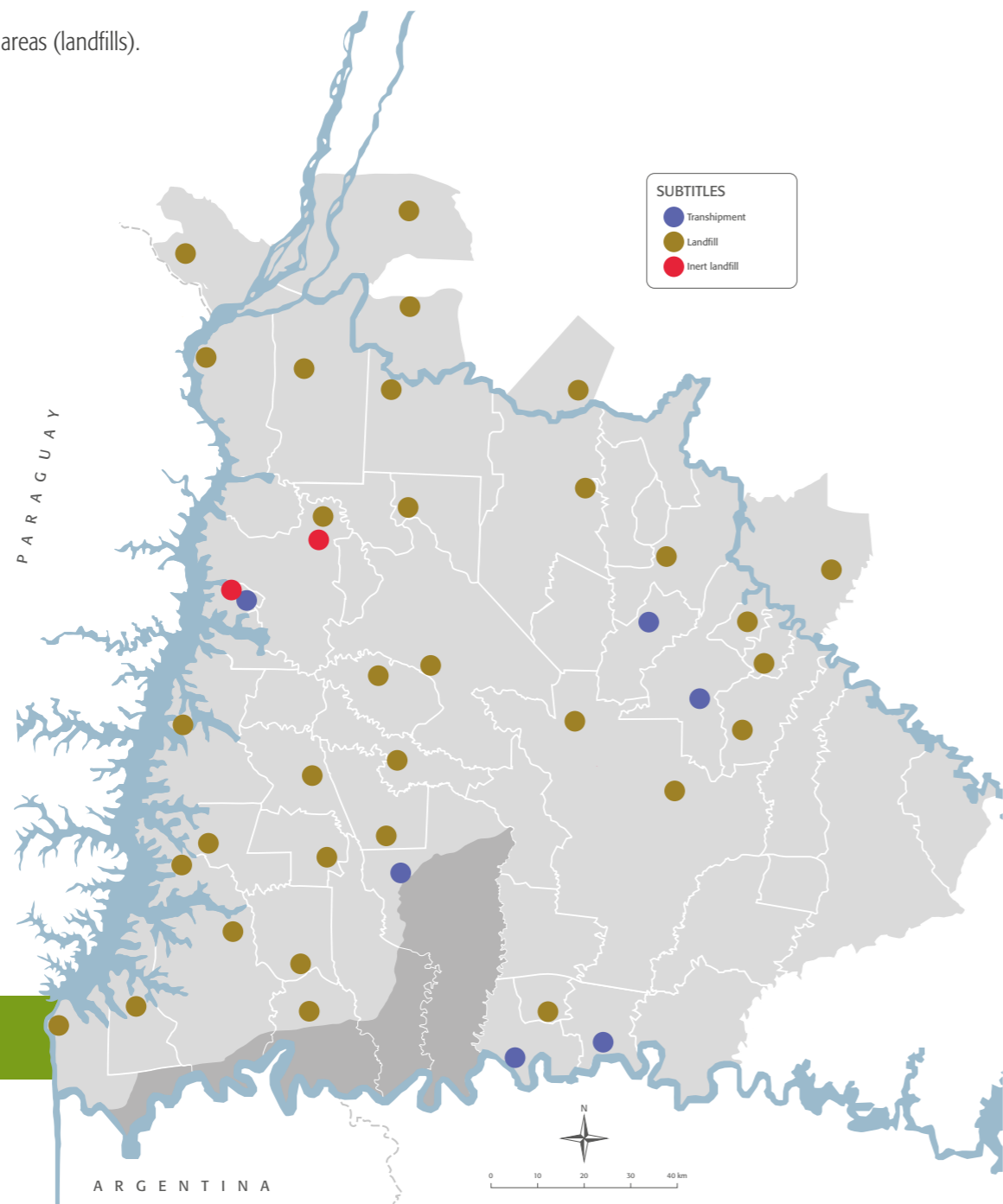
- ◆ Use of degraded areas (inappropriate solid waste disposal) for energy generation.
- ◆ Hybrid plants (solar + biomass).

CHALLENGES

- ◆ Feasibility study of potential energy generation in degraded areas (solar + biomass).
- ◆ Small/medium solar and biomass systems.

ESTIMATE

80-100 MW in degraded areas (landfills).



Degraded areas

OPERATING INITIATIVES: solar units

RESULTS

- ◆ Planning for up to 9 MW in 54 municipalities in the West of Paraná and 1 in Mato Grosso do Sul.
- ◆ 120 units (75 Kwp).
- ◆ Savings of up to BRL 8,5 million/year in energy for the counties in the area of influence of Itaipu; the amount will be invested in environmental management actions.
- ◆ Municipal public sector awareness of the technical and economic feasibility of investments in renewable energy generation.

PROJECT HISTORY

Year	Implementation plan	Investment BRL (million)
2021	1 MW	3,5
2022	3 MW	11,6
2023	4 MW	16
2024	1 MW	4,1
TOTAL	9 MW	35,2

Solar panels in the city of Quatro Pontes/PR.



Solar panels in the city of Maripá/PR.



OPERATING INITIATIVES: bioenergy central

OBJECTIVE

- ◆ Bioenergy plant, with process innovation in biodigestion (swine carcasses).
- ◆ State legislation and regulations for final disposal of carcasses.

RESULTS

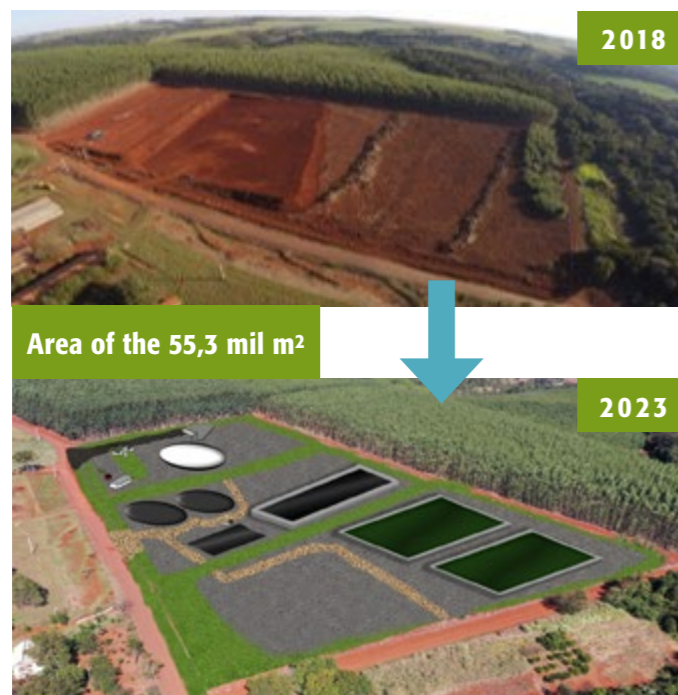
- ◆ Operational biogas plant:
 - ◆ 3.800 MWh/year;
 - ◆ 800 t of swine carcasses per year;
 - ◆ 110.000 m³ swine waste per year.
- ◆ Decarbonization of electrical matrix.

CHALLENGES

- ◆ Certification of the Bioenergy Central (30.000 t of CO₂ in carbon credits).
- ◆ Business plan for marketing the biofertilizer.

STATUS

Under construction in the city of Toledo, PR. Operations will start in the second semestre of 2022.



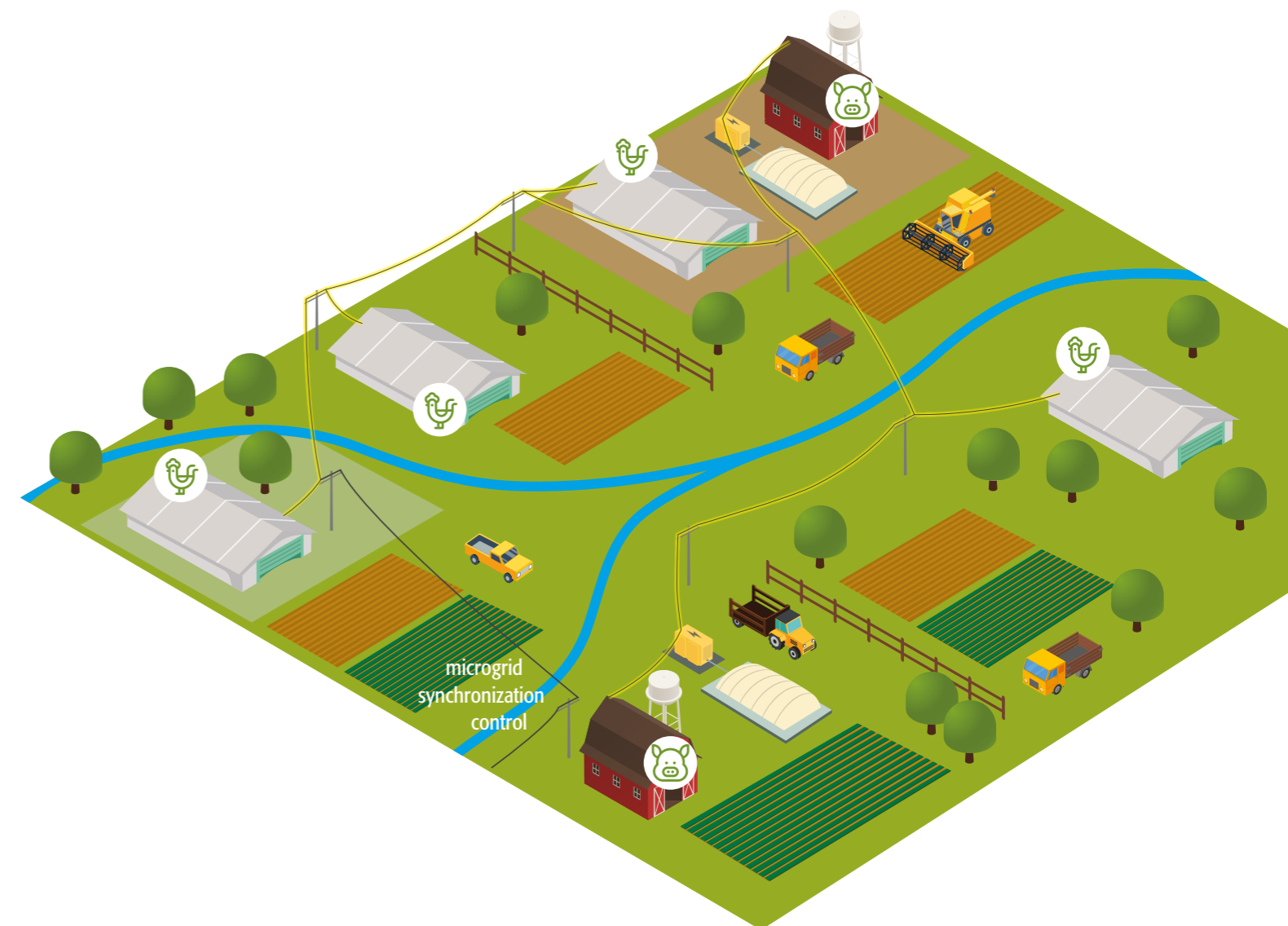
OPERATING INITIATIVES: microgrid

OBJECTIVE

- ◆ Clear understanding of the technical viability of a microgrid in rural areas as a means to energy security (pilot project in the West of Paraná).
- ◆ Renewable energy source = Biogas (swine waste).

RESULTS

- ◆ Automatic charge supply under 3 minutes of network fail, within established regulatios for energy distribution.
- ◆ Network operation procedures, aiming at security for operators and facilities in remote areas, as to set the basis for regulations at national level.



OPERATING INITIATIVES: hydrogen – investment in R&D

OBJECTIVES

- ◆ Pilot plant for H₂ production.
- ◆ Human resources.
- ◆ Nationalization of equipment.
- ◆ Technology promotion in Brazil.

RESULTS



Experimental plant

Storage

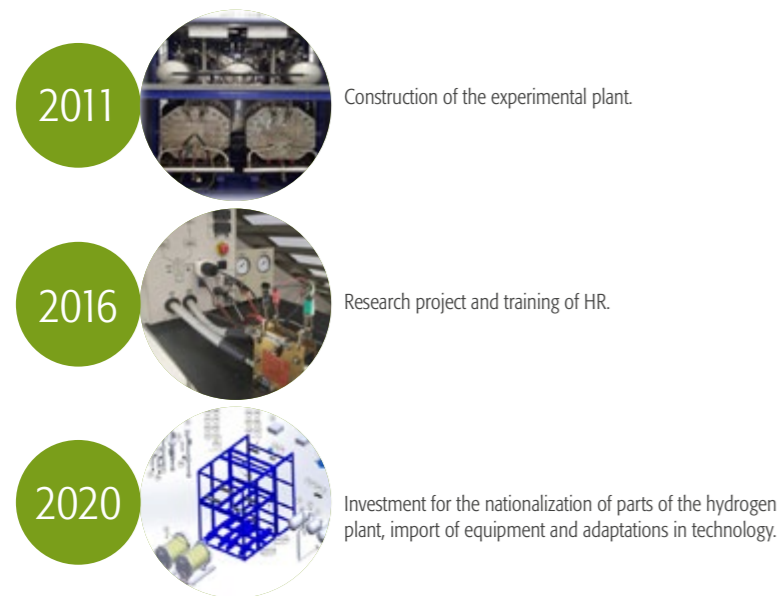
Internal combustion

Oxygen for hospitals

Fuel cell (stationary and mobile)

Lighting

HISTORICAL OF INVESTMENTS



2011

Construction of the experimental plant.

2016

Research project and training of HR.

2020

Investment for the nationalization of parts of the hydrogen plant, import of equipment and adaptations in technology.

OPERATING INITIATIVES: hydrogen research core

OBJECTIVE

- ◆ Contribute to technological development with research and development of hydrogen projects.
- ◆ Maintenance and operation of experimental plant (hydrogen production) at the Parque Tecnológico Itaipu.
- ◆ P&D&I.
- ◆ Technical expertise in energy storage (hydrogen).

RESULTS

- ◆ Qualified professionals and knowledge dissemination.
- ◆ Prototypes for hydrogen and oxygen production, at low cost and with domestic technology.
- ◆ Workshops for knowledge dissemination.

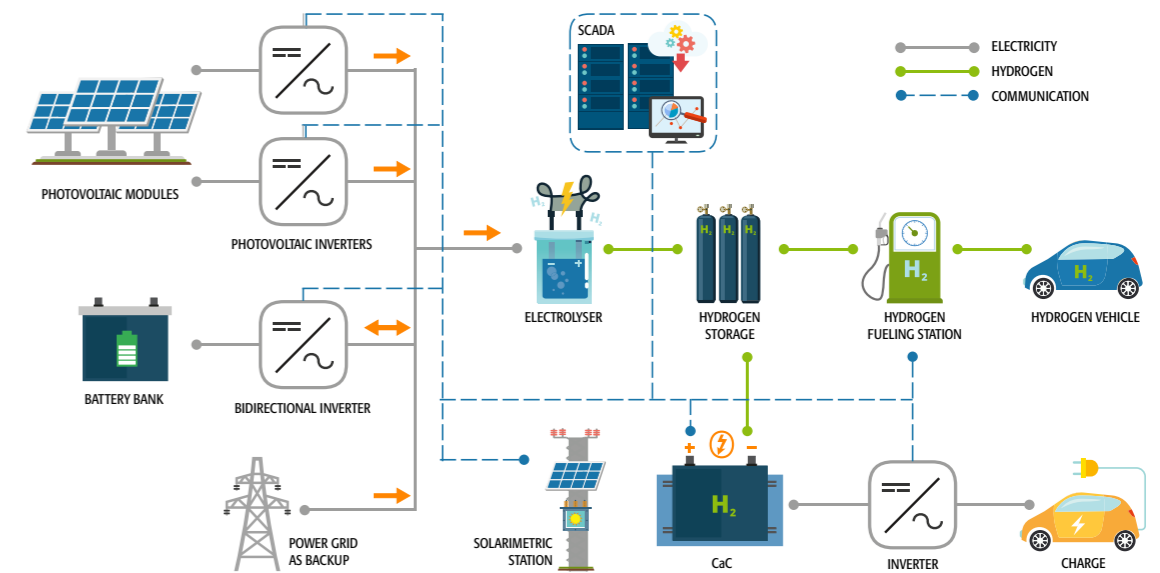
CHALLENGES

- ◆ Lowering production costs – economic feasibility.
- ◆ H₂ supply chain and market development.
- ◆ Development of public policies for hydrogen.

CURRENT STATUS

Conversion of experimental plant from blue to green with solar power.

Green Hydrogen Plant



FINAL CONSIDERATIONS

- ◆ Fostering of initiatives and projects for technology development and applied research in renewable energy, including hydrogen as the energy matrix.
- ◆ Development of public policies and modernization of the electricity sector, such as microgrid regulation.
- ◆ Innovation and implementation of technology for renewable energy, focusing on energy security and decarbonization.



ENERGY SECURITY



DECARBONIZATION



