9

INDUSTRY, INNOVATION AND INFRASTRUCTURE

ITAIPU BINACIONAL

UNDESA – Itaipu Binacional SUSTAINABLE WATER & ENERGY PARTNERSHIP

BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION

CASE STUDY: ITAIPU AND SDG 9

Activities by ITAIPU Binacional supporting implementation of the Sustainable Development Goal 9 (SDG 9) of the United Nations 2030 Agenda for Sustainable Development

Kiko Sierich/PTI

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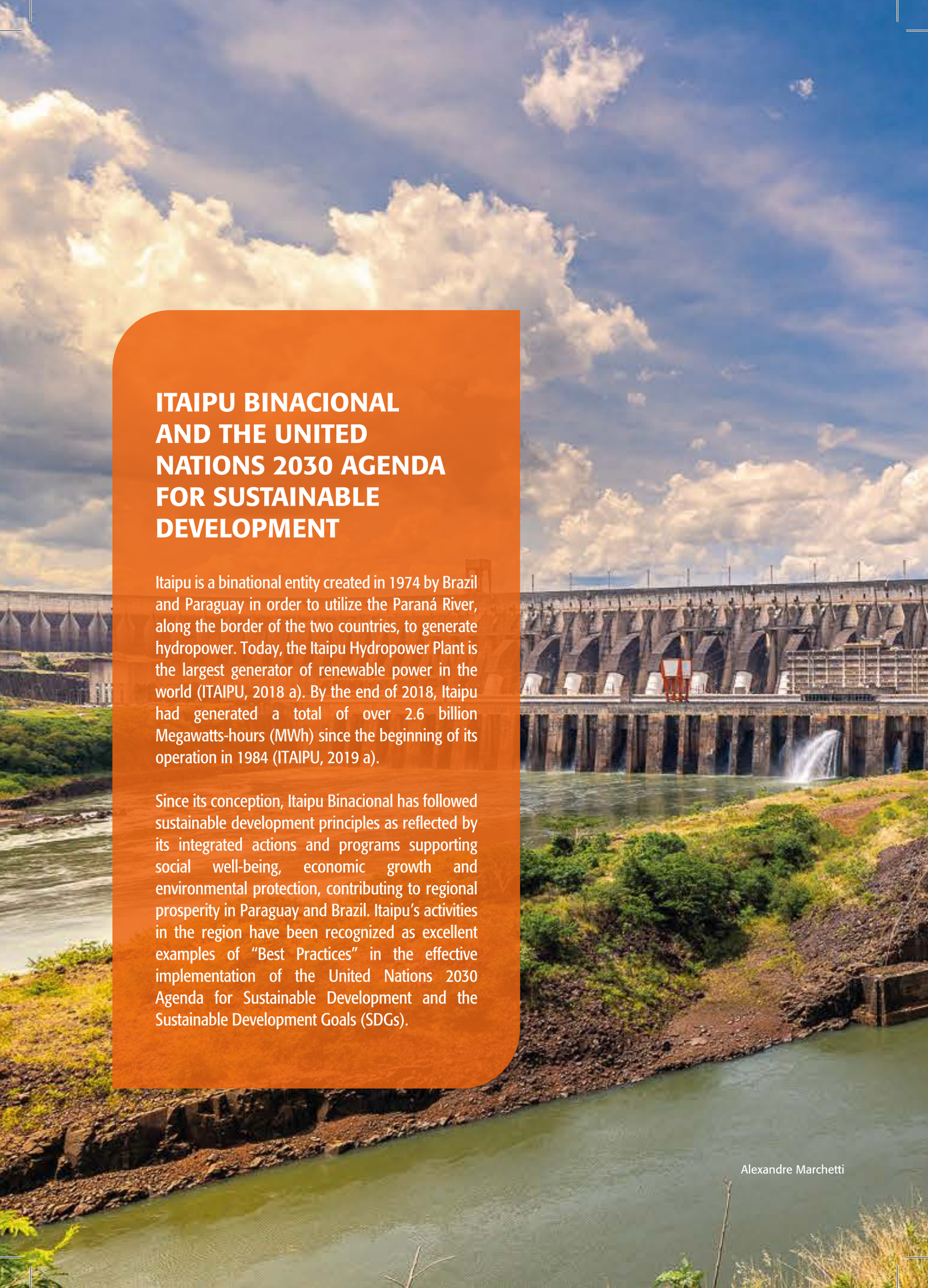

ITAIPU BINACIONAL AND THE UNITED NATIONS 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

Itaipu is a binational entity created in 1974 by Brazil and Paraguay in order to utilize the Paraná River, along the border of the two countries, to generate hydropower. Today, the Itaipu Hydropower Plant is the largest generator of renewable power in the world (ITAIPU, 2018 a). By the end of 2018, Itaipu had generated a total of over 2.6 billion Megawatts-hours (MWh) since the beginning of its operation in 1984 (ITAIPU, 2019 a).

Since its conception, Itaipu Binacional has followed sustainable development principles as reflected by its integrated actions and programs supporting social well-being, economic growth and environmental protection, contributing to regional prosperity in Paraguay and Brazil. Itaipu's activities in the region have been recognized as excellent examples of "Best Practices" in the effective implementation of the United Nations 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs).

Alexandre Marchetti

SDG 9: BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION

Target 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

Target 9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries

Target 9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets

Target 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

Target 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

Target 9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States

Target 9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities

Target 9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

Source: United Nations, 2015.

Rubens Fraulini

SUSTAINABLE DEVELOPMENT STRATEGY OF ITAIPU

Itaipu's vision for 2020 is to be "the generator of clean, renewable energy with the best operating performance and the world's best sustainability practices, promoting sustainable development and regional integration" (ITAIPU, 2018 b).

For Itaipu, sustainable economic growth is a major commitment, intrinsically linked to its management system, constituting one of its most important missions in its different lines of action. Itaipu follows policies and practices that promote prosperity and contribute to improving the well-being of the population in many communities, in both Paraguay and Brazil. The organization represents a powerful force in the advancement of sustainable regional development, helping to build more responsible, equitable and solidary societies. In Brazil, these actions have taken place mainly in the area of influence of the reservoir, and extend to many municipalities in the western region of the state of Paraná. In Paraguay, many of the actions have national coverage and benefit different regions of the country.

Within the economic dimension of sustainable development, activities by Itaipu are designed to help reduce poverty, increase food security and enhance nutrition, improve health, foster better education, and promote equality with respect to gender, age, disabilities, race, religion, ethnicity and economic status. They also promote income generation, protection of children and adolescents, respect for human rights, justice for all, accountable institutions, conservation of biodiversity, and sustainable means of production and consumption. These activities are part of the Itaipu's Business Plan, which includes the corresponding programs and actions that are fully linked to strategic objectives and organizational policies and guidelines (ITAIPU, 2018 c).

Bridge prototype render

Itaipu and the SDG 9

SDG 9 calls for building resilient infrastructures, promoting inclusive and sustainable industrialization, and fostering innovation. Itaipu has been a strong engine for three and a half decades in the trinational border region (Argentina, Brazil and Paraguay), building important infrastructure and supporting industrialization while fostering research, development and innovation. Itaipu's commitment to the sustainable development, and prosperity, of Paraguay and Brazil is demonstrated by actions and policies, including the construction of bridges between the two countries, the overall Regional Infrastructure Development Program and the Technological Update of the Itaipu Hydroelectric Power Plant. The Entity has been supporting industrialization since its beginning through the generation of clean and reliable electricity that allows industries to operate and grow, developing markets for their products and services. Its programs on Sustainable Rural Development and Sustainable Territorial Management have provided additional support for the economic growth. Itaipu has also boosted important research and development, and innovative activities in the region through its scientific centers, such as the Center for Advanced Studies on Dam Safety, the Electrical Systems Automation and Simulation Laboratory, the Territorial Intelligence Center and the Microgrids Pilot Project in Western Paraná.

Rubens Fraulini

1.

CENTRE FOR ADVANCED STUDIES ON DAM SAFETY (CEASB)

Caio Coronel

Objective and description

The objective of the Centre is to work on the development of strategic dam safety solutions via research by universities and research and technology institutions. This integrated partnership arrangement boosts technical and scientific knowledge and the formation of professionals with essential skills for the development of research on dam safety. In its guidelines, CEASB has the function of coordinating, supporting and executing the development of research projects applied in the various areas and disciplines inherent to the theme of dam safety.

The Centre enables a multidisciplinary research environment, integrating the various areas of knowledge surrounding the theme. It also enables integration among companies, research institutes and universities. This action is implemented through an agreement between Itaipu Binacional and the Itaipu Technological Park (ITP), where the headquarters of CEASB is located. This agreement is renewed every 4-5 years.

Safety of the dam ranks among the highest of Itaipu's priorities. The purpose of this action is to reduce the possibility of accidents and their consequences, by keeping structures safe from any type of extreme climate event or accident through instrumentation analysis, visual inspections, special studies and other procedures. Aware of the importance of dam safety, Itaipu continues to invest in equipment and technology, as well as in developing, maintaining and improving highly trained and qualified operation personnel to keep the plant fully safe, thus ensuring safety for the tri-national border region, where the dam is located, and its population.

The safety conditions of the dam are constantly verified by regular inspections and seismic monitoring, with thousands of instruments installed throughout the dam. The periodic maintenance procedures for the safety of the Itaipu Dam are recognized by other plants for the excellence in the periodicity of monitoring the structures, the technical qualification of the professionals involved and the level of detail of the criteria studied to guarantee the multiple uses of the reservoir.

This action has been carried out since 2008 at the Itaipu Technological Park, through the Superintendence of Engineering, Operation, Works and Maintenance.

Related Targets

The activities of the Center are directly related to Target 9.5 because they enhance scientific research and help to upgrade technological capabilities for the energy sector. The activities also encourage innovation and substantially increase the number of research and development workers, and public and private research and development spending.

Challenges

One of the biggest challenges of this action is the development of lines of research that have practical applications, bringing together different ideas and opinions from different institutions (universities, companies, consultants, technicians, among others).

Another major challenge is the development of a culture of scientific research within partner organizations, and the identification of professionals with appropriate profiles for such activities.

Lessons learned

There are many lessons learned from the important activities being conducted by the CEASB. The selection of people for the training and implementation of such specialized research activities is a key process for the successful implementation of all relevant projects. The link between academic studies and applied research is also a major aspect in the identification of dam safety strategies for the specific case of the Itaipu Dam. A close relationship with all types of partners, including academia, private organizations and international research institutions is essential to ensure innovation. The work of the Center is long-term by nature, and therefore procedures need to be in place to ensure the sustainability of the projects through time, the retention of specialized professionals and the availability of necessary financial resources.

Results

The main results of this action are:

- The development of technical and scientific knowledge regarding dam safety, involving professionals from Itaipu, universities and the technical milieu pertaining to dams. In the last five years, about 70 papers have been published in journals and technical and scientific events, as well as theses, dissertations, and monographs;
- The study and application of new technologies in the analyses developed by Itaipu, improving the processes and results related to the regular work of the dam safety teams;
- The assistance towards research in the revision of modeling and simulation methods, as well as structural behavior models, through the application of current methodologies;
- The dissemination of research and applications in the technical-scientific environment, through lectures and articles in congresses and magazines;
- The contribution and development of partnerships in the development of dam safety training courses (specialization, master and doctorate). In this project, about 40 articles were published in journals and technical and scientific events;
- Partnerships with institutions and associations that work on dam safety;
- In Itaipu, the performance control of the structures has 2,792 instruments. The data from these instruments are used in research and return to Itaipu as a form of advanced analysis to assist professionals in decision making and safety assessments of the dam.

In 2018, the results of the computer simulations of the behavior of the structure of the dam, including cases of seismic events and thermal changes, became available. More than 750 students and volunteers participated in more than 100 research projects.

On a monthly basis, CEASB issues a technical and a financial report, which are sent to the management area of Itaipu. From the analysis of these reports, it is possible to verify whether the physical and financial achievements are in accordance with the overall project and the specific objectives of each research project. The management of published information is carried out through technical committees that analyze all texts (articles, books, abstracts, presentations) that will be published, making observations about what has been written and authorizing or not the publishing of the material.

Dam safety Inspection supervised by the Board of Civil Consultant.
Alexandre Marchetti

2.

ELECTRICAL SYSTEMS AUTOMATION AND SIMULATION LABORATORY (LASSE)

Kiko Sierich

Objective and description

The Electrical Systems Automation and Simulation Laboratory (LASSE) allows the testing and verification of the dynamic performance of equipment and systems associated with the generation, transmission and distribution of electricity. One important mission of LASSE is to bring greater technological self-sufficiency to Itaipu Binacional. LASSE also supports the technological updating plan of the Plant through research, development and innovation projects.

Since 2008, LASSE has been developing solutions for hardware and software that adequate to the needs of Itaipu and other companies in the electricity sector. The laboratory provides an effective multidisciplinary research environment, integrating the various areas of knowledge involved in the subject and enabling collaboration among companies, research institutes and universities. As in the case of CIASB, LASSE is also located at the Itaipu Technological Park.

Related Targets

The activities of LASSE support Target 9.5 since they enhance scientific research, help to upgrade technological capabilities, encourage innovation and public and private research and development spending.

Challenges

One of the challenges encountered in implementing this important activity was bringing together a team of experts and professionals capable of meeting the requirements of Itaipu in this specialized area. Another major challenge was the need to demonstrate that this laboratory could achieve effective solutions and could develop practical products with equal or superior quality to those designed and produced in foreign research facilities.

Lessons Learned

The main lesson learned from this experience is that research and development activities need to be conducted independently from conventional engineering services. In addition, it was important to recognize that said activities imply many uncertainties and need to be implemented during long periods of time; therefore, it is essential to maintain qualified technical staff in order to meet the highest quality standards.

Results

With the implementation of research, development and innovation projects, LASSE has generated knowledge, effective solutions, innovative products, economic benefits and autonomy to Itaipu, contributing to the electricity sector of Brazil and Paraguay as a whole.

Since 2008 LASSE has been able to achieve the following results:

- More than 70 technical and technological services performed in the simulation area;
- More than 70 articles published in congresses and magazines of the energy sector;
- More than 30 hired professionals maintained by LASSE;
- More than 50 researchers have worked at LASSE;
- More than 15 solutions installed at Itaipu;
- More than 25 R&D projects are underway.

Itaipu monitors the progress of projects and the overall achievements of LASSE through the indicators presented in monthly reports.

Alexandre Marchetti

3.

TECHNOLOGICAL UPDATE OF ITAIPU HYDROELECTRIC POWER PLANT

Adenésio Zanella

Objective and description

The main objective of this activity is to maintain the reliability of the equipment and systems and ensure the continuity of the high performance of the Itaipu Hydroelectric Power Plant.

Over almost four decades, the Itaipu Hydroelectric Power Plant has achieved several technological evolutions, incorporating point or layer digitization, replacing systems, equipment, and components, always seeking excellence and the implementation of the best engineering practices.

However, the main control systems of the Plant are still based on analogue equipment and technologies, dating from the start-up of the generating units. Although they have high availability rates, these systems are at the end of their useful life, demanding a systemic and structured modernization guided by technological evolution and the new global standards available.

Technological update is also considered an adaptation measure, as modifications to the existing power plant will increase functionality, safety and effectiveness of operation, alleviating climate uncertainties.

Taking these factors into account, Itaipu is undertaking the Technological Update of the Plant and its Substations, including, in this process, the assessment and systemic replacement of equipment and systems for supervision, control, protection, regulation, monitoring, measurement and their respective interfaces with the generation processes, substations, spillway, dam auxiliary equipment, and the powerhouse. Heavy equipment, such as turbines and generators, has a longer life cycle and is not subject to this update.

The expected term of continuous work is 14 years, and the investment will be approximately US$ 660 million.

The studies for the Technological Update began in 2006, with the definition of guidelines and criteria, analysis of equipment status and basic version of the Technological Update Plan, lasting until approximately two years.

In the middle of 2013, the development of the strategic planning of the update began, in which the activities to be developed throughout the project were established,

such as the undertaking of the studies, the methodologies to be used, the premises and previous definitions that were evolving throughout the planning stage.

Between 2016 and 2018, the Basic Project of the Technological Update was undertaken, consolidating studies, guidelines and technical specifications for the tendering process. Throughout this phase, two workshops were carried out with all interested parties from Brazil and Paraguay, clarifying the characteristics of the project and receiving suggestions to be analyzed by the various technical teams of Itaipu.

In the second half of 2018, the first stage of the tender for the Technological Update – called pre-qualification of the companies interested in the execution of the project – was carried out, classifying Brazilian and Paraguayan companies or consortia that are able to attend the bidding process (second stage), with the opening of the proposals planned for the second half of 2019.

In the first half of 2019, the third Technological Update Workshop was held, with the presence of only pre-qualified companies and consortia in the bidding process. The purpose of this workshop was to answer questions regarding the second stage of the bidding process, where the bidders will present their proposals in the tender.

Related Targets

This action is most closely linked to Target 9.4, which aims to upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes.

Challenges

The complexity of the project is mainly focused on the action of updating a large power plant – in operation – and, at the same time, ensure adequate levels of energy production, since Itaipu serves approximately 15% of the Brazilian and almost 90% of the Paraguayan electricity demand. It is a quite different scenario from that of designing and building a new plant.

Therefore, Itaipu defined a strategic planning for the execution of this update, which considers the execution of the works with the plant in operation, with long duration, various work fronts, and various activities to be executed and consolidated.

So far, the great challenge observed in the development of the project is related to the long duration planned for its execution – 14 years – since business planning, budgets, strategic definitions, contracts, and insurance all have horizons of less than 5 years for forecast and control.

Lessons Learned

An important point observed at the beginning of the execution of the technological update plan, and which may be an important recommendation, is how human resources management and knowledge management should be treated for a long-duration undertaking. Regarding human resources, changes in the organization chart of the company, such as substitutions, retirement, new employees, structural changes, etc., can be foreseen.

Results

The Technological Update of the Itaipu Hydroelectric Power Plant is currently in the tender stage. The monitoring of the Technological Update process will be carried out through project management tools and engineering management tools enshrined in the execution of large projects worldwide. Monitoring of the results and supervision of all processes in real-time is planned.

Alexandre Marchetti

4.

DEVELOPMENT OF INTERNATIONAL STANDARD FOR SUSTAINABLE TERRITORIAL MANAGEMENT

Alexandre Marchetti

Objective and description

The objective of this activity is to develop methodology to assess quantitatively the results obtained in actions focused on sustainable development, with emphasis on implications for biodiversity conservation. By developing international standards, Itaipu sustainability actions and programs in a specific region can become a first territorial model for sustainable development, with accountable biodiversity conservation results. The Itaipu sustainable territorial development model and the international territorial standards can be replicated in other territories in Brazil, Paraguay and in other countries and territories committed to sustainable development and biodiversity conservation.

The standards will be based on principles and criteria approved and recognized at an international level, with guarantee of replicability.

The implementation is taking place through an agreement between Itaipu, the Lasting Initiative for Earth Institute (LIFE) and the Itaipu Technological Park Foundation. The effort has already been mentioned at international events, such as COP 14, Egypt and Natural Capital Week in France. Several meetings between the institutions involved have taken place, and an international benchmarking event brought together professionals of all three institutions for the first evaluation and revision of this activity. Three work groups were created in the environmental, social/cultural, and economic areas.

The work plan also foresees the drafting of the standards, their organization in management system documents, validation tests in selected municipalities, operationalization of the management system through software development and validation, training of future software users, dissemination of the management system, and the accreditation of the standard with the International Social and Environmental Standards Alliance (ISEAL), with the publication of reports in Portuguese, Spanish and English.

Related Targets

This major effort is related to Target 9.3, since the value added by the sustainability certification facilitates the recognition of territories, producers, small industries and other companies as of sustainable and biodiversity friendly origin, and, consequently, their access to financial services, including more affordable credit, and their integration into differentiated and emerging value chains and markets.

Challenges

One of the main challenges was the need to prove the innovative character of the proposal, a requirement for international certification by ISEAL. This means that there is no other identical international standard, increasing the difficulty for its development, due to the unavailability of relevant parameters. Additionally, it is necessary to align actors from different levels (from top corporate management to local communities), as well as to involve a large number of professionals with different areas of education and expertise. The harmonization of the cultural, environmental and economic management differences between Brazil and Paraguay constitutes another challenge, given the fact that the methodology is intended to be reapplied in any social, cultural, economic or political context.

Lessons Learned

The main recommendation is related to the need to guarantee constant monitoring at each planned stage to ensure that the goals are being met. Also, it is necessary to perform continuous assessment of progress towards the ultimate goal of this endeavor.

Results

So far, the international dissemination and the implementation of the international benchmarking that confirmed the innovative character of the project are major positive results. Also, the setting up of the main thematic axes for the work groups during the conceptual and operational development phase of the standards, the recent contributions of 36 experts in four areas of knowledge during the first technical workshop of the work plan, and the integration between the Brazilian and Paraguayan technical areas of Itaipu are considered major achievements.

Monitoring will be conducted through edited reports and public consultations. Also, a planned workshop will allow for critical analysis and collective validation by the institutions involved.

Daniel De Granvile

5.

REGIONAL INFRASTRUCTURE DEVELOPMENT

Bridge prototype render

Objective and description

The main objective is boosting the region's economic growth by providing greater gains in productive efficiency and, consequently, reducing costs and increasing the region's competitiveness. Additionally, the expansion of trade frontiers and subsequent widening of the consumer market are considerable economic goals.

Many actions related to regional infrastructure development are being implemented through agreements signed with public entities in the area of influence of Itaipu. Some of these actions include:

Construction of international bridges:

In 2018, Itaipu was authorized by the governments of Paraguay and Brazil to finance two new bridges to enhance commercial activities in the trinational region and to improve security conditions at the border. The total investment is estimated at around US$ 270 million, and construction is expected to take three years, beginning in 2019. The new bridge over the Paraná River, connecting Foz do Iguaçu (on the Brazilian side) and Presidente Franco (Paraguayan side), will strengthen regional integration by improving the infrastructure for trade and tourism. With this new bridge, the existing International Friendship Bridge will be used exclusively for light vehicles and tour buses. Today, it is the main economic corridor between Brazil and Paraguay. It has helped the Paraguayan city of Ciudad del Este to be lifted up to the position of third largest free trade zone in the world.

The other new bridge will be built over the Paraguay River, connecting Porto Murtinho, in Brazil, to Carmelo Peralta, in Paraguay. The construction of this bridge will help consolidate the integration between the Paraguayan and the Brazilian road systems, which are part of the Bioceanic Corridor. The Corridor is part of the project from the Initiative for the Integration of Regional Infrastructure in South-America (IIRSA) to connect the coasts of the Atlantic and the Pacific Oceans.

The two new bridges will be a further spur to regional development, as it will create new jobs, strengthen integration, support freight logistics and mitigate traffic on the International Friendship Bridge.

Improvement Works of the International Port and Dredging and Sediment Removal of the Carumbey River in Guaíra, Paraná State, Brazil.

Signed with the municipality of Guaíra (PR), this agreement aims to mitigate infrastructure restrictions, such as impossibility of navigation with low river levels, organization of flows, and isolation of the port area that compromises the functional effectiveness of the International Port. The planned interventions will give more security, agility and stability to the entities located there and to the users of the infrastructure.

Revitalization of Foz do Iguaçu / Cataratas International Airport and drafting of the Executive Project of Cascavel / Toledo Regional Airport:

This agreement, signed with the Brazilian Airport Infrastructure Company (Infraero), aims to make all necessary efforts to carry out studies for the elaboration of a work plan for the expansion of the airstrip, expansion of the aircraft apron, and duplication of access to the airport passenger terminal, as well as other improvements to be implemented at the Foz do Iguaçu/Cataratas International Airport.

Alexandre Marchetti

Related Targets

The regional infrastructure development program is directly related to Target 9.1, which refers to the development of quality, reliable, sustainable and resilient infrastructure, both regional and transborder, to support economic development and human well-being, with focus on affordable and equitable access for all. The new bridges will boost regional sustainable development and will further support the commercial, social and cultural growth of cities and communities. Communication and trade between Paraguay and Brazil will also be enhanced.

Investment in infrastructure is relevant to the Brazilian reality proposed by the Institute of Applied Economic Research (IPEA) to achieve the goals of Agenda 2030, as it aims at "improving the country's road system, focusing on sustainability and safety in traffic and transportation, balancing regional inequalities, promoting regional and cross-border integration, in the pursuit of lower costs, for passenger and cargo transportation, avoiding losses, with greater participation of high-capacity modes such as rail, waterways and pipelines, making it accessible and providing well-being for all" (IPEA, 2019).

Challenges

This effort has faced challenges including technical difficulties with Municipalities; schedule delays due to bidding processes; and bureaucratic issues in the transportation of materials, equipment and people on the border of Brazil and Paraguay. The correct planning of the works, construction and subsequent management and inspection of the two new bridges represent challenging activities that need to be fully coordinated through a binational effort.

Lessons Learned

A main lesson learned is the need for direct and systematic communication with enforcement bodies in both countries. Much has been learned from the construction and use of the International Friendship Bridge between Brazil and Paraguay. This major infrastructure project has been key for the promotion of economic growth, peace and prosperity for the people of the region. The construction of the two new bridges will further expand all these positive impacts.

Results

In addition to the economic benefits, the region's population benefits from positive impacts on safety and quality of life. Also, the expansion of border trade and, consequently, the expansion of the consumer market are significant economic benefits. The long-term positive results from the construction and use of the International Friendship Bridge are evident for both Paraguay and Brazil. The same results are expected from the new bridges under construction. Itaipu has played and will continue to play an essential role in the development of these important infrastructure projects in the future. For Paraguay, a landlocked country, the interconnected infrastructure being developed signifies a strategic process for accessing new markets and for enhancing relationships with other nations.

Rubens Fraulini

6.

TERRITORIAL INTELLIGENCE CENTER

Kiko Sierich

Objective and description

The Territorial Intelligence Center was created to promote and support science, research and technology for sustainable development applied to areas of interest to Itaipu. Other important objectives include:

- To implement an environmental knowledge management process with its own spatiotemporal database;
- To systematize and provide qualified environmental and territorial information to support Itaipu's decision-making towards sustainable development in Western Paraná; and
- To establish partnerships with non-profit research, technology and education institutions, for the discovery and integration of content related to the areas of activity.

In 2018, Itaipu environmental teams and the Itaipu Technological Park (ITP) established a partnership to implement the Territorial Intelligence Center, to develop research applied in four strategic areas: water security, biodiversity, climate and territorial intelligence.

The Center is a technical-scientific space for associates and partners of Itaipu, the ITP and external collaborating institutions organized to ensure that the efforts and resources of research projects on key themes share the same objectives, goals, indicators and results. As a consequence of this process, there is a common knowledge base applicable to the technical, scientific and social development of the region.

In summary, the Territorial Intelligence Center provides service support, generating and analyzing data and producing planning information in its various instances (local, municipal or regional), in order to give practicality to research activities in the areas of water security, biodiversity conservation, meteorology, climate resilience and adaptation and planning of sustainable regional development.

The research related to these lines is developed in partnership with Universities, taking into account the specialty of each one, such as:

- Water Security: UFABC - Federal University of ABC, UFPR - Federal University of Paraná, UFSM - Federal University of Santa Maria and UNILA - Federal University of Latin American Integration.

- Biodiversity Conservation: UNILA - Federal University of Latin American Integration
- Climate: UEL - State University of Londrina
- Territorial Intelligence - UNIOESTE - University of Western Paraná

Related Targets

This activity is directly related to Target 9.5, which relates to enhancing scientific research and upgrading technological capabilities, encouraging innovation and substantially increasing the number of research and development workers and public and private research and development spending.

In the context of research involving water security and sustainable regional development, the implementation of the Territorial Intelligence Center is an action that seeks to increase public investment in supporting science. This is intended to establish technical knowledge in the region and increase the skilled workforce in areas identified as strategic for sustainable development.

Challenges

When it comes to research and innovation in Brazil, there are two major barriers that are generally faced: the cultural preconception about science, and the excessive bureaucracy associated with any administrative process involving public money. Therefore, achieving expected results requires constant investment in communication and disclosure of the benefits achieved or intended, and redoubled effort in the search for simpler and more efficient processes.

Lessons Learned

Partnering with specialist education and research institutes is crucial to the success of the projects and of the Center. Having a wide range of skills associated with territorial management allows for unique approaches in the analysis and understanding of impacts from natural phenomena.

Results

The Territorial Intelligence Center currently has a research team of 16 visiting doctors, 7 resident doctors, 11 master fellows, 8 specialists and 40 undergrad scholars. However, since the action has only recently started, it is not yet possible to measure the results.

The expected benefits are:

- Expansion of the technical database on natural resources and anthropic actions in the study region.
- Development of techniques applied to environmental, meteorological, climatic and territorial uses monitoring, as well as biodiversity conservation.
- Continuous improvement in the management of social and environmental processes, ensuring the conservation of the ecosystem services and biological diversity.
- Promotion of water security through the expansion of knowledge and technologies applied to regional monitoring and management.
- Strengthening of the institutional image of Itaipu as a reference company in the generation of clean and sustainable energy, and of FPTI as a model institution in research and development for sustainability.
- Consolidation of partnerships with universities, research centers and public and private institutions.
- Knowledge setting and training of technical skills in the region.
- Studies and research that make possible the discussion of the process of territorial development, monitoring of actions and projects that provide development – such as monitoring the goals and indicators of the Sustainable Development Goals (SDGs) – and technical discussions on priorities for sustainable development for the region.

As research progresses, the technical database on natural resources grows, making possible the development of new environmental indexes. The effectiveness of the action can be measured by the impact, positive or otherwise, generated in the planning of public policies, interventionist actions and decision making based on these indexes.

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7.

MICROGRID PILOT PROJECT IN WESTERN PARANÁ

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Objective and description

The objective of this action is to develop a Microgrid Pilot Unit in Western Paraná that will use renewable energy in the form of biogas generated from animal protein residues. A technical arrangement will be developed and validated for the application of the microgrid concept permanently and dynamically in rural areas with potential need for microgrid solutions. The project will allow the mapping and identification of potential communities where the microgrid arrangement could represent an effective and sustainable distributed generation solution. The general purpose is to understand the technical feasibility of implementing microgrids in rural areas, as an option to improve the distribution system, via the implementation and monitoring of a demonstration unit in Western Paraná. Itaipu has designated the Itaipu Technological Park (ITP) and the International Renewable Energy Center (CIBiogás) as the executors of this research and development project.

The action helps to integrate power generation from microgrids with the ability to balance supply and demand to keep services stable, optimizing the grid and postponing investments. The project is being developed in one of the most important animal protein productions in Brazil, which generates increasing organic byproducts and effluents and poses a threat to environmental quality and water security in the region. The microgrid project also supports global climate change objectives regarding renewable energy and energy efficiency efforts for reducing the use of fossil fuel and for lowering GHG emissions. This action is being carried out since 2018 in the rural areas of the municipality of São Miguel do Iguaçu, in Western Paraná (Brazil), which is part of the area of influence of Itaipu. The project is expected to be completed by 2020.

Related Targets

The project is directly linked to the objectives of Targets 9.1, 9.2, 9.4 and 9.5. Microgrids based on biogas from animal waste represent reliable and sustainable infrastructure solutions (Target 9.1) based on distributed generation that allow reliable electricity

access to rural isolated communities. The action will support the development of legal and regulatory policies that will allow the commercialization of microgrids providing a new industrial option (Target 9.2) for rural producers that could generate additional income and increase per capita GDP. Itaipu is supporting the greater adoption of clean and environmentally sound technologies (Target 9.4) by implementing this project that enhances resource-use efficiency. The effort also represents innovation, research and development (Target 9.5) of a sustainable process and system for the management of organic waste and, at the same time, for providing distributed power generation for rural isolated communities.

Challenges

There are legal challenges related to regulatory issues that constraint the application of microgrid connections in Brazil. In general, there is no legislation in the country to regulate microgrids. Preventive guidelines exist which could affect the power generation activities by consumers even in the absence of power supply from the main network. These regulations may prevent the implementation of microgrids or minigrids or other types of distributed generation arrangements. Another major challenge is related to the lack of legislation regarding storage systems. The inclusion of storage systems as an option for intermittent sources is necessary. Relevant policies are necessary to allow distributed generation when there is no power generation from the grid, or when the generation is not enough to meet the demand. Microgrids could represent a form of storage power for these situations that could benefit particularly rural areas.

Market-related legislation allowing arrangements that meet the needs of microgrids also needs to be developed. Based on the relevant law, generation by microgrids may not benefit from free market rates, due to the limits established by law. In general, the microgrid generation is regulated by fixed tariff determined by the local distributor. There are other services that microgrids can offer, that need to be qualified and regulated, enabling a source of revenue for a convenient service to be offered to end consumers. The microgrid alternative could also contribute to improving the quality of the electrical service across the country by reducing the frequency of interruptions. Therefore, it is necessary to modify the current guidelines to allow the implementation of microgrids and successively develop legal standards to enhance their promotion and insertion.

Lessons Learned

The project is still in the implementation stage; nevertheless, the participation of all the relevant stakeholders is considered essential for the success of this project.

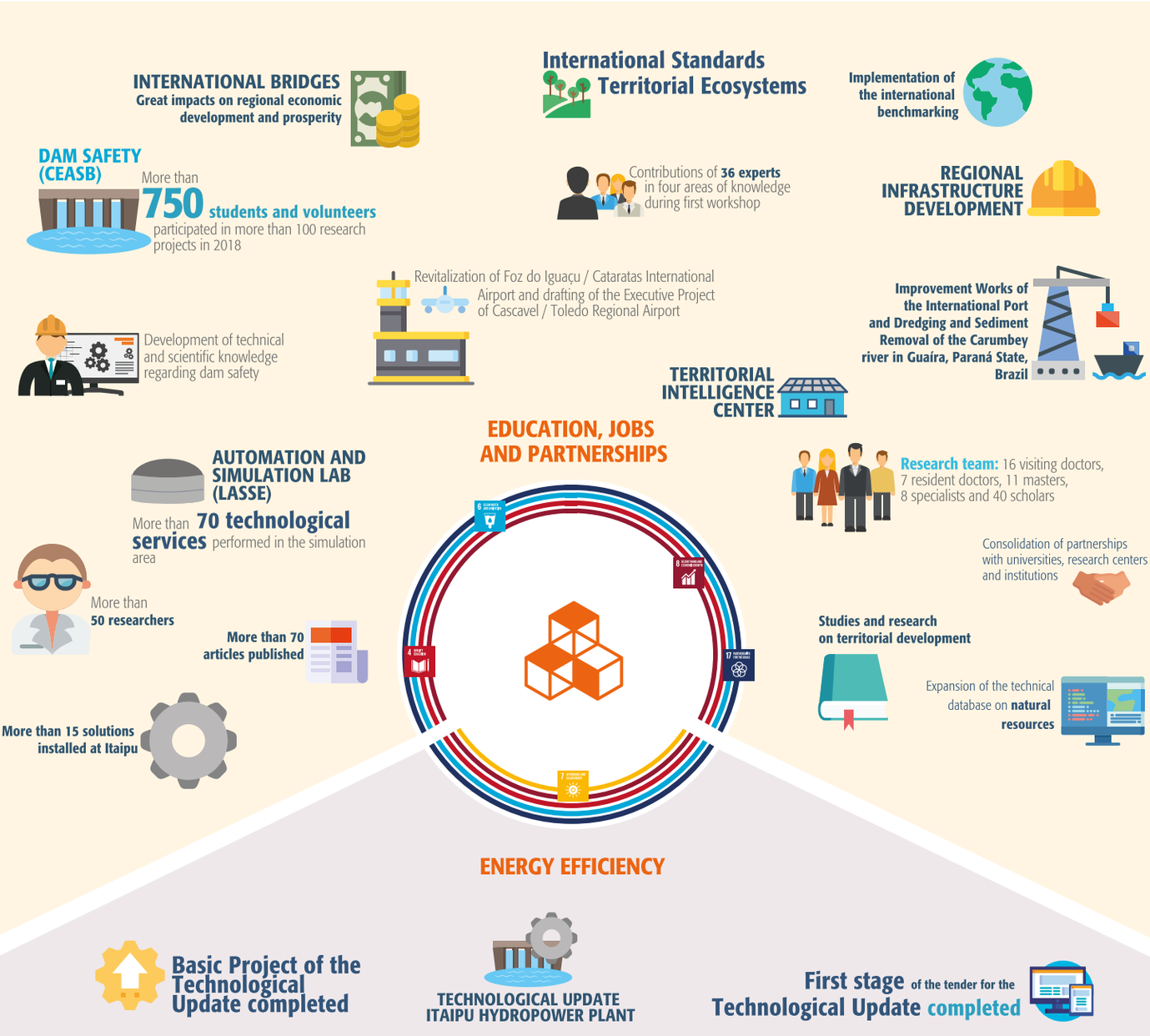
Results

The main results have not yet been achieved as the project implementation is still underway. Nevertheless, it is expected that microgrid pilot units will be deployed in the selected rural areas allowing the generation of clean electricity especially in case of power failure from the grid. The progress and results of this action will be monitored through periodic reports and monthly meetings held among those involved in the project. Technical reports will be produced documenting the steady and dynamic electrical behavior of the pilot microgrids. The reports will support the improvement of electric sector standards and legislation related to microgrids and the mapping of potential areas for potential future implementation that will expand the sustainable use of microgrids.

INTERLINKAGES WITH OTHER SDGs

SDG9 INFRASTRUCTURE, INDUSTRIES AND INNOVATION

There are strong interlinkages between activities by Itaipu related to infrastructure, industrialization and innovation (SDG 9) and other SDGs. The strongest interlinkages relate to energy (SDG 7) as an essential input and to economic growth and jobs (SDG 8) given that SDG 9 activities promote economic development in Paraguay and Brazil. There are strong interlinks with water security and climate change (SDG 6 and 13, respectively) as the Nucleus of Territorial Intelligence, the Microgrid program and the technological Update act in favor of specific targets of these SDGs. There is also a strong interrelation with quality education and learning opportunities (SDG 4) exemplified by all the training and development of specialized professionals in priority areas. The activities are also interlinked to the promotion of partnerships (SDG17). The partnerships at the international, regional, community and local levels are essential for their role promoting regional economic growth that brings prosperity and sustainable development.



CONCLUSIONS

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Itaipu Binacional strongly supports the objectives of SDG 9 as demonstrated by its numerous efforts and initiatives related to building resilient and adapted infrastructures, promoting industrialization and fostering research, development and innovation. The Entity's commitment to these activities began 35 years ago, when operation of its Hydropower Plant began, and has been growing through the years, helping to create sustained economic growth, clean environment, enhanced well-being and sustainable development for the people of the region. The many infrastructure projects are supporting regional integration and enabling the development of new and expanded industries, businesses and markets. The region is now recognized as a hub for innovation and scientific research in technologically advanced systems. All these actions, in combination with Itaipu's integrated approach to sustainable development, are bringing prosperity for people in Paraguay and Brazil.

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