6

CLEAN WATER
AND SANITATION

ITAIPU BINACIONAL

UNDESA – Itaipu Binacional
SUSTAINABLE WATER & ENERGY PARTNERSHIP

ENSURING AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION

CASE STUDY: ITAIPU AND SDG 6

Activities by ITAIPU Binacional supporting implementation of the Sustainable Development Goal 6 (SDG 6) of the United Nations 2030 Agenda for Sustainable Development

Itaipu spillway - Victor Azcona/Itaipu Binacional

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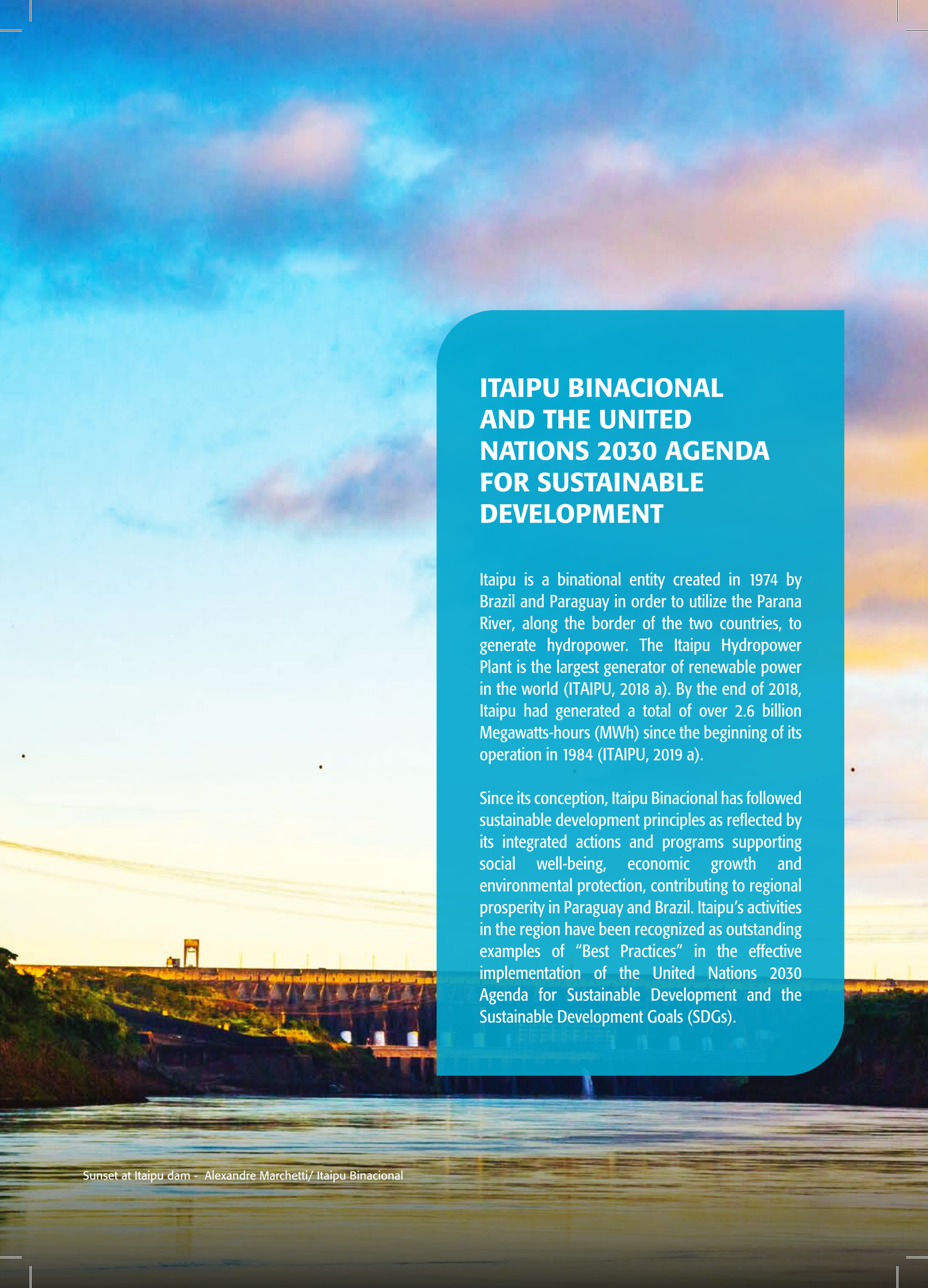


ITAIPU BINACIONAL AND THE UNITED NATIONS 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

Itaipu is a binational entity created in 1974 by Brazil and Paraguay in order to utilize the Parana River, along the border of the two countries, to generate hydropower. 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 outstanding examples of "Best Practices" in the effective implementation of the United Nations 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs).

Sunset at Itaipu dam - Alexandre Marchetti/ Itaipu Binacional

SDG 6: ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

Target 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

Target 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

Target 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Target 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

Target 6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.

Target 6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

Target 6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programs, including water harvesting, desalination, water efficiency, waste-water treatment, recycling and reuse technologies.

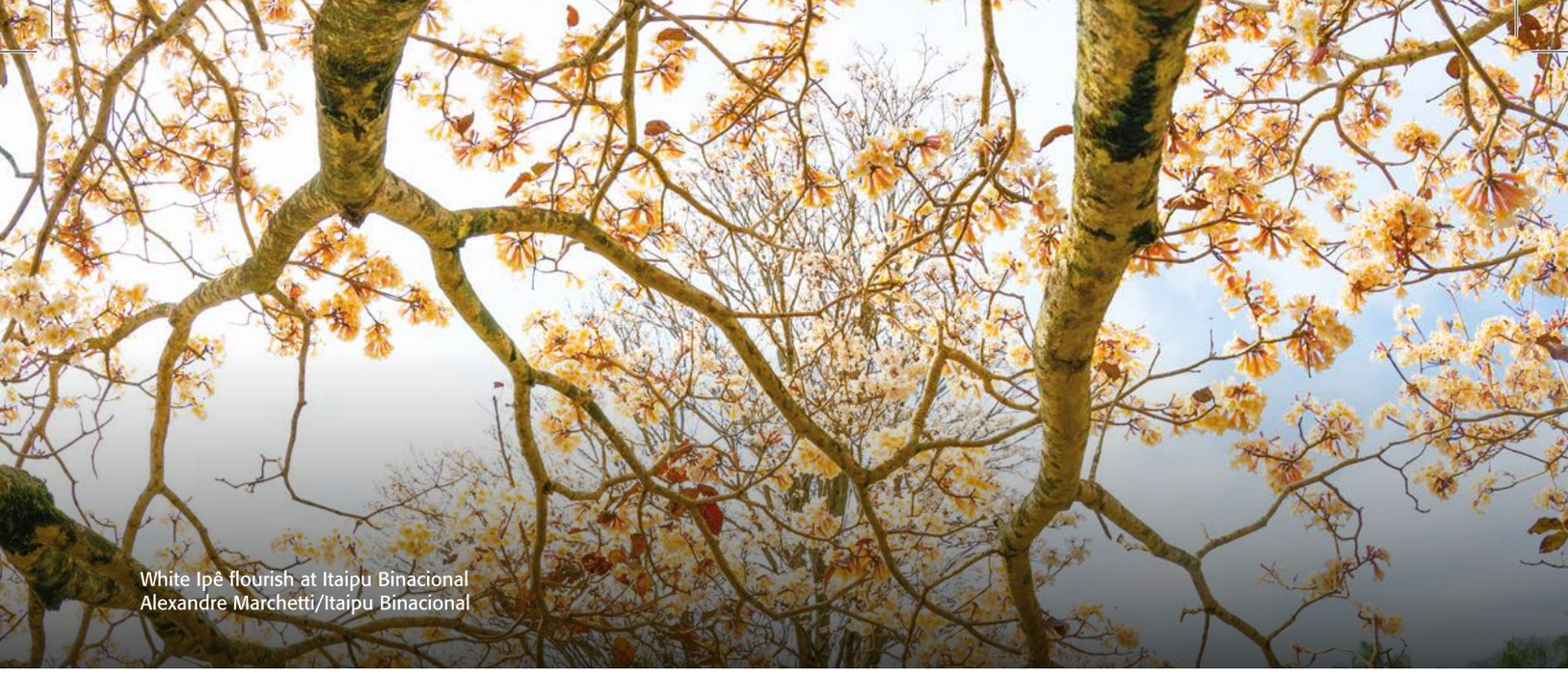
Target 6.b Support and strengthen the participation of local communities to improve water and sanitation management.

Source: United Nations, 2015.

Itaipu Reservoir - Daniel de Granville/ Itaipu Binacional

The Itaipu Reservoir contains 29 billion cubic meters of water with about 135,000 hectares of water surface. Its borders extend for about 170 kilometers along the boundary between Paraguay and Brazil (ITAIPU, 2019 b). The Reservoir is not only used for generating electricity but also for agricultural, fishing, aquaculture, touristic and leisure purposes, as a municipal water source and for maintaining wildlife in the area.

About 101,000 hectares of forests surround the Itaipu Reservoir. **This area represents the protected belt for the Reservoir along both the Brazilian and Paraguayan margins.** It includes a total of 10 protected areas, which include biological sanctuaries and reserves that protect native flora and fauna of the region and advance research and conservation initiatives (ITAIPU, 2018 c). These areas and the Reservoir provide valuable connections among important remnants of the Atlantic Forest located in Paraguay, Brazil and Argentina.The effective integrated management of water resources is essential for the optimum long-term operation of the Itaipu Hydropower Plant. **Also, the protection and conservation of all water-related ecosystems located in the area are key activities supporting sustainability and prosperity for the region.** These ecosystems include the Itaipu Reservoir and nearby rivers, aquifers, lakes, wetlands and forests.



White Ipê flourish at Itaipu Binacional
Alexandre Marchetti/Itaipu Binacional

SUSTAINABLE DEVELOPMENT STRATEGY OF ITAIPU

Itaipu's sustainable development strategy recognizes that water security[1] and sustainable development, at the influence area[2] require optimum environmental management, besides social, economic, cultural and technological development. Each of these five important objectives unfolds in basic goals, used to better understand and manage the actions carried out by Itaipu (ITAIPU, 2019 c). Therefore, Itaipu has partnered with municipalities, communities, private owners and other stakeholders for the effective implementation of this strategy. The programs and actions more directly related to SDG 6 include the protection of springs, the restoration of riverside forests, the formation of biological corridors, conservation of agricultural soils, adaptation of rural roads, the installation of communal agrochemical cleaning stations and the use of livestock waste for the production of renewable energy and biofertilizers.

These initiatives are part of the overall sustainable development strategy of Itaipu, specifically the environmental management, which includes biodiversity conservation, environmental monitoring, integrated management of water and soil and the social development, supporting initiatives related to social actions, health and sanitation. This approach is intrinsically linked to the overall objectives and specific targets of the SDGs on water (SDG6) and energy (SDG7) of the United Nations 2030 Agenda for Sustainable Development.

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).

A model of territorial management is being implemented by Itaipu in the basin of the Reservoir of the hydropower plant. The basin includes 54 municipalities in the state of Paraná, Brazil, 1 municipality in the state of Mato Grosso do Sul, Brazil and 15 municipalities in Paraguay, with an overall population of almost 1.7 million people. Besides covering this territory, some actions are being developed at other areas in Paraguay (PNUD, 2018; DGEEC, 2018).

The model promotes best practices for water and soil conservation, preserving terrestrial and water ecosystems. The results of these actions are monitored through ecosystem integrity and water quality evaluations of the Reservoir and its tributaries. A sustainable culture is induced through awareness and education that promote changes in the habits, values and beliefs of the communities. These activities are implemented in the entire area of influence of Itaipu, covering over 38,000 Km² of water and terrestrial ecosystems and affecting the wellbeing of many people in the region.

[1] Water security comprehends the recovering and preservation of watersheds and reservoirs through permanent and integrated actions that promote the sustainable use of natural resources, better socio-environmental conditions and the best availability of water in quantity and quality for different applications (ITAIPU, 2018 d).

[2] Territorial unit that includes the watersheds from which waters drain towards Itaipu´s Reservoir.

1.

PRACTICES FOR WATER AND SOIL CONSERVATION

Soil conservation - Adenesio Zanella/ Itaipu Binacional

Objective and description

Important activities by Itaipu contribute to reduce sediment delivery from roads to rivers and the Reservoir and increase infiltration of water in the soil, recharging the underground aquifers and decreasing the sedimentation of waterways, including the Reservoir and its tributaries. These activities are key to optimizing the quality and quantity of water for the generation of hydropower and for other water uses (Arruda Filho, et al, 2018). These activities include:

- Selection of important micro-watersheds, prioritizing the springs that contribute to the public water supply system, the areas with the highest concentration of environmental liabilities and rural population.
- Development of the technical agronomic diagnosis.
- Dynamic participatory engagement with communities to address difficulties with current practices and to adopt corrective actions, establishing partnerships in favor of sustainability and supporting effective commitments for water and soil conservation. These actions are the basis for what has been referred to as "Workshops for the Future", community meetings in which people are sensitized, become protagonists and feel responsible for the success of the actions they are involved in.
- Meetings among local partners, with the intention of preparing legal instruments for the physical and financial execution of activities, defining the counterparts of the parties.
- Implementation of the Water Pact: Itaipu, the municipality and other partners sign agreements in which the conditions and counterparts of the parties are established to enable the execution of the actions to correct environmental liabilities.
- Implementation of "Good Practices" by Itaipu and its partners, related to soil conservation, adaptation and sanding of rural roads, recovery and protection of riverside springs and riparian forests, communal agrochemical cleaning stations and communal waste distributers, among others.
- Monitoring of results by Itaipu and its partners, either through participatory monitoring and / or through the Workshops for the Future that are currently active.

Related SDG 6 targets

Practices for water and soil conservation are directly related to the following Targets of SDG6: integrated management of water resources (T.6.5); protection and restoration of water related ecosystems (T.6.6); improving water quality by reducing pollution (T.6.3); and supporting and strengthening participation of local communities (T.6.b).

Challenges

Challenges related to the implementation of practices for water and soil conservation include the initial resistance of the communities for adapting their current practices to the practices of water and soil conservation. There is always a need for constant conflict management when the process is characterized by great community participation. The meetings held in the communities are essential for the discussion of the existing problems and for generating proposals to minimize negative impacts. Another challenge is the need for more investment to cover the expansion of soil conservation areas to include the whole territory of municipalities. The investment is necessary for infrastructure, labor and machinery.

Lessons learned

Through these experiences, Itaipu has learned the value of sensitization, engagement and training of the different stakeholders, which have awakened the culture of sustainability through changes in the habits, values and beliefs of the communities. The result has been positive, and Itaipu has assumed the role of articulation and facilitation, sharing responsibilities with its partners and with the community. This reality has facilitated the sharing of investments with public institutions in environmental projects and related actions based on the engagement of public managers and the community.

Results

These activities have resulted in direct benefits such as the improvement of the quality of water resources that supply the region and indirect benefits, such as terracing of agricultural areas, gully control, improvement of rural roads, protection and remediation of springs, etc. More specifically, a total of 421 micro-watersheds have been recovered, more than 1,600 km of adequate rural roads and over 39,000 hectares in the area have experienced soil conservation (ITAIPU, 2019 c).

Soil conservation - Rubens Fraulini/ Itaipu Binacional

2.

MITIGATING IMPACTS OF AGROCHEMICALS AND OTHER HAZARDOUS MATERIALS FROM RURAL AREAS

Objective and description

Itaipu conducts activities designed to reduce the disposal of toxic agrochemicals and nutrients in the main Reservoir and its tributaries, reducing pollution and diminishing dumping of hazardous materials. Itaipu supports good practices to prevent pollution, including: installation of communal agrochemical cleaning stations for farmers to wash, in an appropriate place, equipment that might be contaminated with pesticides; the acquisition of communal manure spreaders that encourage proper disposal of organic waste, by using manure from poultry and pig farming as fertilizers for agricultural production, and the construction of biodigesters.

The springs are the main sources for supplying water to the communal agrochemical cleaning stations. Therefore, Itaipu is responsible for supporting all restoration and protection of the springs, ensuring that the communal supplier tanks operate properly.

Itaipu leads activities that create community awareness of the need to change customary practices required to improve water quality and reduce pollution, eliminating waste and minimizing the release of chemicals and hazardous materials (Arruda Filho et al, 2018). With the installation of communal agrochemical cleaning stations for the proper handling of pesticides and agrochemicals, for example, the population stops washing containers of toxic products on the banks of the waterways.

Instead, people use the premises duly installed for this purpose. With the cleaning station, the farmers have an appropppriate place to rinse their agrochemical sprayers, preventing contamination of groundwater and rivers.

Related SDG 6 targets

Minimizing the release of agrochemicals and other hazardous materials is directly related to the following

Agrochemical cleaning station in Itaipu´s area of influence.
Rubens Fraulini/ Itaipu Binacional

Targets of SDG 6: integrated management of water resources (T.6.5); protection and restoration of water related ecosystems (T.6.6); improving water quality by reducing pollution (T.6.3); and supporting and strengthening participation of local communities (T.6.b).

Challenges

Some of the challenges in the implementation of these activities by Itaipu include the need to find users willing to become responsible for the cost of the electric power needed to pump the water to the cleaning station tank. In addition, the place where a communal supplier storage tank is installed is privately owned. As the tank is used by many people, some owners do not want to bear the

responsibility of the maintenance of the tank. Another obstacle is related to bureaucracy. In order to install a communal supplier storage tank in certain private property, a registration process is necessary. As it requires approval by the Chamber of Councilors of the municipality, many owners give up the installation to avoid having to deal with all the necessary paperwork and approvals.

Lessons learned

In order to tackle some of the challenges listed above, Itaipu has implemented actions resulting from lessons learned in these areas. As the water pumping system generated electricity costs, the program began to make available other models of tanks and other forms of water pumping, such as gravity and the water wheel, which uses the hydraulic energy of the waterway. To avoid communication problems between owners that are under the responsibility of the waste distributors, the agreement between Itaipu and the municipality foresees how many pieces of equipment are necessary for each locality, according to the activity practiced and the number of residents. This way, there is no need for more demand than the number of pieces of available equipment. Itaipu recognized that the participation and involvement of the community, in addition to the association with the municipalities, are essential to maintaining adequate rural environmental conditions.

Results

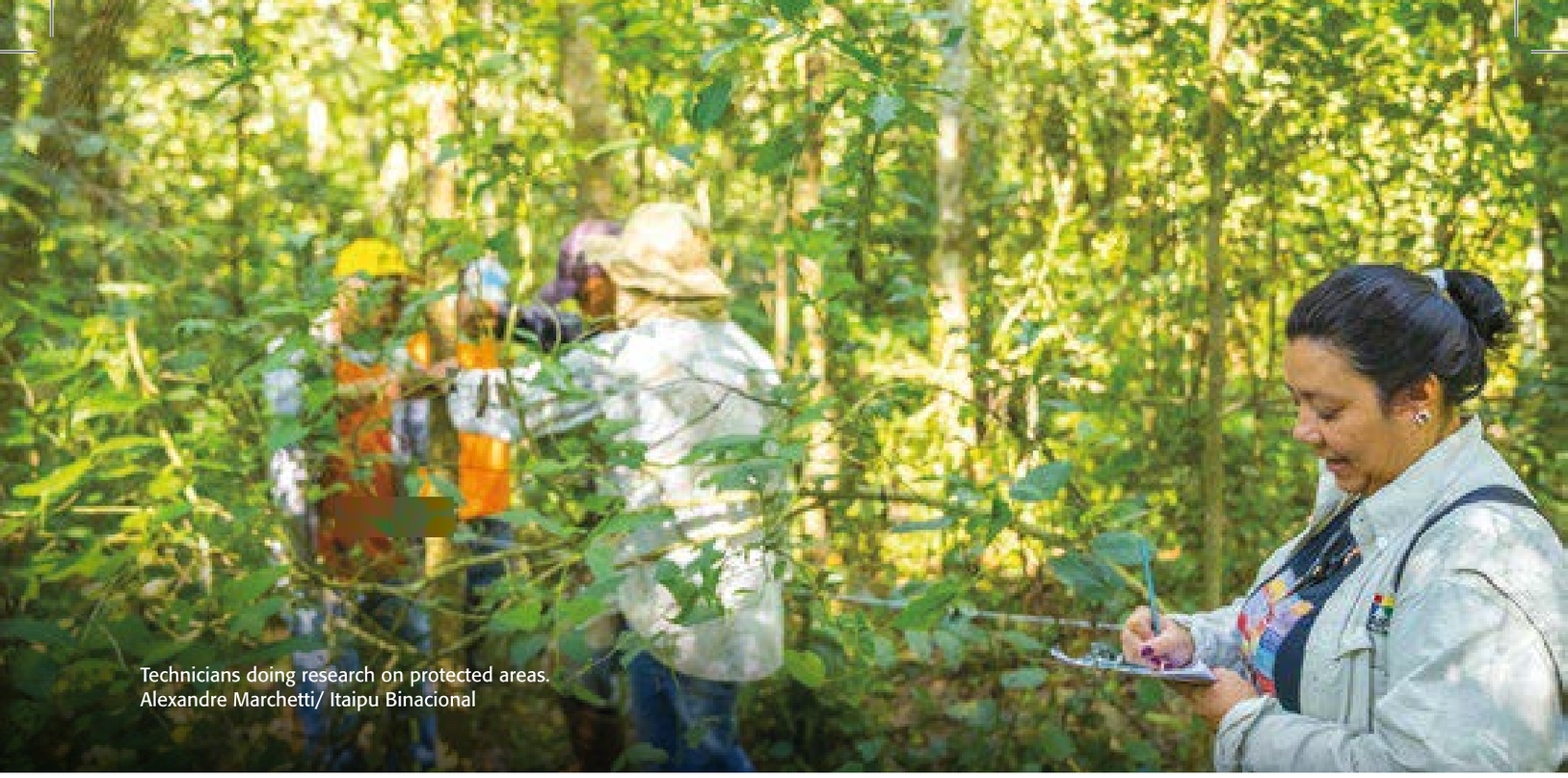
Objective results from the implementation of these activities by Itaipu include the installation and monitoring of 202 communal agrochemical cleaning stations for the proper handling of pesticides and of 299 manure spreaders.

Fish farming on floating net cages at Itaipu Reservoir - Alexandre Marchetti/ Itaipu Binacional

São Francisco Verdadeiro River
Alexandre Marchetti/ Itaipu Binacional

3.

CONSERVATION OF PROTECTED AREAS



Technicians doing research on protected areas.
Alexandre Marchetti/ Itaipu Binacional

Objective and description

Major activities are implemented to guarantee the protection of springs, wetlands and tributary water courses to the Paraná River and the Itaipu Reservoir, ensuring the integrity of the water related ecosystem services of more than 100,000 hectares of protected terrestrial ecosystems (ITAIPU, 2018 e). These activities not only comply with current legislation, they are a strong additional voluntary contribution to protecting the ecosystems and maintaining an optimum management of water resources in the region.

These activities are designed to help maintain the hydrological cycle through the infiltration rate of water in the soil that favors the recharge of aquifers, the attenuation of peak flows, lowering evapotranspiration and the reduction of erosion, as well as underground and superficial runoff that produces silting and eutrophication (Motter et al, 2015). Consequently, the positive impacts resulting from these activities are reflected in the quantity and quality of water that contribute broadly and directly to protecting and restoring the ecosystems of the region.

Awareness raising, engagement, education and practical activities are planned and executed by a trained multidisciplinary team, involving Itaipu technicians, teaching and research institutions, prefectures and other actors in the region, with knowledge of local specificities, in the form of participatory territorial management. This approach is also fully consistent with other SDGs besides SDG 6.

Because adequate vegetative cover in a water basin is important for the quality of the water flowing through that area (Calder et al, 2007), Itaipu has supported and developed the following activities:

- Forest regeneration and restoration
- Environmental remediation, monitoring and observation, and sustainable management of the biological refuges
- Collection and germination of seeds and the production of seedlings of native forest species for use in the areas of Itaipu and the Paraná Basin
- Maintenance of a germplasm bank, an ***ex situ*** genetic bank of native forest species, native plant species ***situ*** and ***ex situ*** research
- Natural regeneration parcels and forest inventory
- Wildlife monitoring and population reinforcement of fauna

- Technical and scientific events related to the environment and biodiversity
- Contribution to the definition of relevant public policies
- Participation in working groups, technical assessments, and recommendations and relevant advice on the environment and biodiversity.

Related SDG 6 Targets

Conservation of protected areas is directly related to the following Targets of SDG 6: integrated management of water resources (T.6.5); protection and restoration of water related ecosystems (T.6.6); improving water quality by reducing pollution (T.6.3); and supporting and strengthening participation of local communities (T.6.b).

Challenges

There are important challenges that are faced by Itaipu and other stakeholders in the implementation of conservation activities in the protected areas. One of the main challenges is the extensiveness of Itaipu's watersheds and remoteness of the protected areas. The watershed that contributes to the Itaipu Reservoir covers more than 38,000 km^2, and the protected area corresponds to a total of 101,000 hectares located on the border of Brazil and Paraguay, where monitoring and conservation activities are difficult to implement. The location implies certain limitations in relation to logistics and security. Another challenge is the traditional habits of community members related to extractive activities, such as hunting, fishing and unsustainable forest uses. Conservation activities can only be achieved successfully after the implementation of long-term awareness efforts designed to change previous attitudes. The presence of invasive alien species, pest attacks, intentional forest fires, encroachment invasions, clandestine dumps, cattle ranching and extreme weather produce negative impacts on the growth of trees and related ecosystem services. Finally, it is important to note that Itaipu's support of monitoring and surveillance has to be coordinated with public institutions according to government procedures.

Lessons learned

The experience of Itaipu points toward a number of valuable lessons learned that will guide future activities in the continuing support of optimum water management and sustainable development. Some of these lessons include:

- Adequate selection of species allows the rapid formation of the forest canopy and a more efficient control of invasive species
- Adaptive management is key in these types of actions. The interventions must adjust to the characteristics of each intervention site and public involved, which implies the adaptation of the activities and goals
- The monitoring of the reforestation and watershed conservation efforts should continue even after the work has been completed, in order to verify the success of the interventions
- The control over the protected worked areas facilitates the development of activities over time and guarantees the continuity of the ecological processes. These are very important factors related to conservation of biodiversity and ecosystem services
- The implementation of integrated activities in one place and at the same time-span is more effective and lasting. This approach brings more benefits to the population involved in the discussion, as well as to the planning and execution of these joint activities. Itaipu's practices of integrated management of hydrographic basins with actions taken place at the same time and in the same area are highly successful

- Collaboration with national and international organizations not only generate greater technical knowledge and innovation, but also greater impetus for conservation work, increasing collaboration of networks, which translate into better results

Itaipu recognizes that it is necessary to make improvements in its programs including: applying new monitoring technologies for protected areas, such as environmental Internet of Things (IOT), increased efforts for the production of native species germplasm bank and tree seedlings, the revision of plans and procedural manuals, the definition of scientific lines of action compatible with business objectives, territorial sustainable development, and the revision of performance indicators.

Results

The experience of Itaipu points toward a number of valuable lessons learned that will guide future activities.

The results of conservation activities by Itaipu in protected areas are very rewarding and illustrate the importance of a comprehensive strategy on sustainable development and integrated management of water resources and water-related ecosystems including forests (Itaipu, 2019 d). Some of these results include:

- Prolongation of the average lifetime of the hydropower plant, that now stands to be more than 180 years

- Restoration and conservation of the protected area of 101,000 hectares, which translates into the capturing of 5.9 million tons of CO_2 equivalent per year, with significant positive implications in relation to climate change mitigation

- Reforestation of almost 22,000 hectares of protected areas with more than 26 million plants in Brazil and Paraguay

Protected areas of Itaipu - Victor Azcona/Itaipu Binacional

- Forest enrichment and management of regeneration in 409 hectares. Work continues to consolidate areas in restoration processes for a total of 2,195 hectares in Paraguay

- Protection of remnants of the Upper Paraná Atlantic Forest, one of the world's 25 biodiversity hotspots.

Itaipu has obtained diverse national and international recognitions for its conservation activities including:

- Recognition of ITAIPU´s protected areas as core areas of "ITAIPU Biosphere Reserve" in the Paraguayan territorry, granted by UNESCO´s "Man and the Biosphere (MAB)" Program.

- Seal of approval as a "Company Friend of the Atlantic Forest"

- The naming of the Bela Vista Biological Refuge (RBV), a protected area, as the Advanced Position of the Atlantic Forest Biosphere Reserve (RBMA) in the context of UNESCO's "Man and Biosphere" Program

- LIFE Certification - Lasting Initiative For Earth, a pioneer process which recognizes public and private organizations that develop relevant voluntary actions favorable to the conservation of biodiversity

Workers at the tree nursery
Victor Azcona/Itaipu Binacional

Cloudy day at the Itaipu Dam - Victor Azcona/Itaipu Binacional

4.

ENVIRONMENTAL MONITORING OF WATER AND SEDIMENTS

Itaipu's technicians do maintenance work in the water monitoring station - Alexandre Marchetti/Itaipu Binacional

Objective and Description

Itaipu conducts monitoring and evaluation activities that are part of its overall sustainable development strategy and its integrated management program of water resources. Monitoring and evaluation procedures are in place to gather physical, chemical and biological information of the ecosystem, guiding decision making related to water security in compliance with legislation and institutional commitments.

The Environmental Monitoring supports several actions developed by Itaipu, such as:

- Sedimentometric Monitoring
- Bathymetric and Hydraulic Surveys
- Water Quality Monitoring
- Monitoring of Micropollutants
- Monitoring of Groundwater

The sedimentometric monitoring aims to estimate the average lifetime of the Reservoir and the silting of water ways. The automatic monitoring network has been in operation since 2001 and has 15 stations that determine the solid discharges and the estimation of the sediment production in the contributing basins, also guiding the upstream conservation actions.

In 2018, there was significant improvement in the process of monitoring sedimentation and one of the reasons for that was the progress in the telemetry network monitoring system, with data transmission for the database according to a specific time interval. The four-year results indicate that the Reservoir has an estimated average lifetime of 184 years. Bathymetric and hydraulic surveys in the Itaipu Reservoir aim at gathering submerged terrain physical data, allowing investigation of the degree of sedimentation of the Reservoir and its tributaries, and the mapping of vulnerable zones to the formation of lagoons. The surveys of the arms in the Brazilian margin occurred in 2017, and in the Paraguayan shore and central body of the Reservoir, in 2018. The vectorization of the bathymetric contour lines of the Reservoir and its arms subsidizes the studies of sediment deposition in the Reservoir and allows comparison of data from 1979 to the present (Mendes, 2018).

Water quality monitoring has been carried out since 1977 and aims at collecting, analyzing and managing physical, chemical and biological information of the waters. Water quality can directly affect multiple uses of the Reservoir, such as urban water supply, irrigation, fishing, livestock and biodiversity conservation, among others (IAP, 2009).

Technicians doing bathymetric surveys
Ever Portillo/ Itaipu Binacional

Quarterly activities include collection, analysis and reports referring to the water quality in the Reservoir and in the tributaries of the area of influence. These activities help calculate the degree of eutrophication and to check if the parameters evaluated are within the limits established by law.

Summer activities include monitoring of water quality for the preparation of information bulletins for the relevant prefectures and population; and methodological and scientific research that support understanding of the aquatic ecosystem and for monitoring new environmental variables.

Itaipu has recently acquired a multi-beam sonar system to perform the baseline survey in the Reservoir. Annual measurements will be made at control points of the entire channel, to evaluate the sedimentation process and calculate the lifespan of the Reservoir through direct bathymetric surveys (ITAIPU, 2018 c).

Automatic equipment transmits data in real time to Itaipu. In addition, Itaipu has the support of residents of the region who promote periodic collections of river water samples for laboratory analysis, guaranteeing the use of technology and the engagement of the community.

Itaipu has a complete database that allows the preparation of technical reports for the board of international consultants of Itaipu. Periodically, the water characteristics of the Reservoir and its tributaries are observed, through graphs and qualitative analysis.

The monitoring of micropollutants captures data that enables the analysis of their influence in the rivers, soil and in the biodiversity of the area between Brazil and Paraguay. Recent research showed low levels of atrazine and glyphosate and its degradation products, common agrochemicals used in corn and soy production. These crops account for 80% of the agricultural land use in the region (PTI, 2018).

Researchers believe that such low levels may be due to the fact that part of the glyphosate might have been absorbed by the soil molecules or that the agrochemical has a short time of degradation.

Technicians doing bathymetric surveys
Ever Portillo/ Itaipu Binacional

In order to provide accurate explanation to the monitoring results, a second phase of the project was proposed with the aim of understanding the dynamics of these micropollutants in the different ecosystem compartments.

As the monitoring is binational, its results allow the two countries to know and compare the micro-watersheds of their corresponding margins and take measures to mitigate the impacts of micropollutants, which have a direct effect on the quality and quantity of both fresh water, in the Parana River basin, and salty water, downstream, in the Plata estuary in Argentina.

The Monitoring of Groundwater, developed within the scope of the Hydrosphere Project, tracks the availability and quality of groundwater in the area of influence. In the region, a significant part of the water supply for the public and for agriculture and livestock production occur through the Serra Geral Aquifer. The Guarani Aquifer is used for thermal tourism and has potential for use in agroindustry. In this context, it is necessary to know the hydrogeological characteristics of the aquifers in order to define their potentialities and recharge areas which are mainly determined by the quality of the water and integrity of the soils and forest cover. The results of the groundwater monitoring are used for the correct management and use of the groundwater and recharge areas (Boscardin et al, 2011).

Related SDG 6 Targets

Environmental monitoring and evaluation activities are directly related to the following targets of SDG 6: integrated management of water resources (T.6.5); protection and restoration of water related ecosystems (T.6.6); improving water quality by reducing pollution (T.6.3); and supporting and strengthening participation of local communities (T.6.b).

Challenges

Challenges to Itaipu's activities related to water monitoring and evaluation include the large area of coverage, that corresponds to approximately 150,000 square km[3], and technology limitation in relation to communication systems and transmission of data over long distances (ITAIPU, 2018 e).

Lessons learned

The large coverage area challenge can be overcome with the improvement of participatory management programs. Continuity and expansion to remote zones not yet covered by the monitoring and evaluation programs are necessary to reach the coverage of the totality of the drainage area relevant to Itaipu.

Results

Results of monitoring and evaluation activities by Itaipu are considered extremely valuable given the importance of protecting and restoring all the water-related ecosystems of the region. Monitoring activities in the 421 recovered micro-watersheds have indicated that the quality of water is adequate according to national regulations, with a tendency for eutrophication in some arms of the Reservoir. In the places with this tendency, conservation and remediation actions in relation to use and occupation of the soil must be intensified. Sediment monitoring programs allow identifying the rivers with the highest sediment transport per year. The drainage basins of these rivers are then identified as the ones that require greater attention and action. Furthermore, the monitoring and evaluation helps signal the possible activities that generate these sediments, including an increase of agricultural areas, the use of direct sowing, etc.

All the results that come from the monitoring of water and sediments serve as a basis to guide decision making related to water security in compliance with legislation and institutional commitments.

[3] This area corresponds to the incremental watershed of Itaipu´s Reservoir

Protected areas of Itaipu - Victor Azcona/Itaipu Binacional

5.

PROVISION OF DRINKING WATER FOR COMMUNITIES IN THE REGION

Provision of drinking water - Ever Portillo/ Itaipu Binacional

Objective and Description

Itaipu facilitates access to safe drinking water to communities in the vicinity of the hydropower plant and to isolated populations with water supply difficulties that cannot be served by the public / private providers of drinking water in the region. This activity illustrates Itaipu's commitment to providing equitable access to safe drinking water for all the people of the region.

During the construction of the Itaipu Hydropower Plant, the work zone was sparsely populated; therefore, houses were built with access to basic services for workers. One of those services was the provision of potable water. A water treatment plant and a distribution network were built to serve the homes of the different housing districts that were built. Today, these housing districts are currently part of already established cities with access to drinking water supported by Itaipu.

The service is provided to communities in the Alto Paraná Department of Paraguay, including the cities of Hernandarias, Ciudad del Este, Presidente Franco and other communities of the region that have water access difficulties.

Itaipu has permanent employees who operate the water treatment and supply plant in cooperation with third-party companies that are responsible for verifying the quality of the water.

For isolated communities, Itaipu acts by complementing actions of the national government, serving the needs of communities by providing support for the drilling of wells, provision of water tanks and construction of distribution networks in isolated communities. Once the work is finished, the system is left in charge of the beneficiary community (Ministerio de Obras Públicas y Comunicaciones, 2018).

For the completion of these activities, Itaipu has to perform meticulous hydrogeological studies to evaluate the quality and quantity of water to be used. In several isolated communities, Itaipu has to facilitate access to electricity to enable the provision of drinking water.

Related SDG 6 Targets

These activities are directly related to the target on access to drinking water of SDG 6 (T6.1).

Challenges

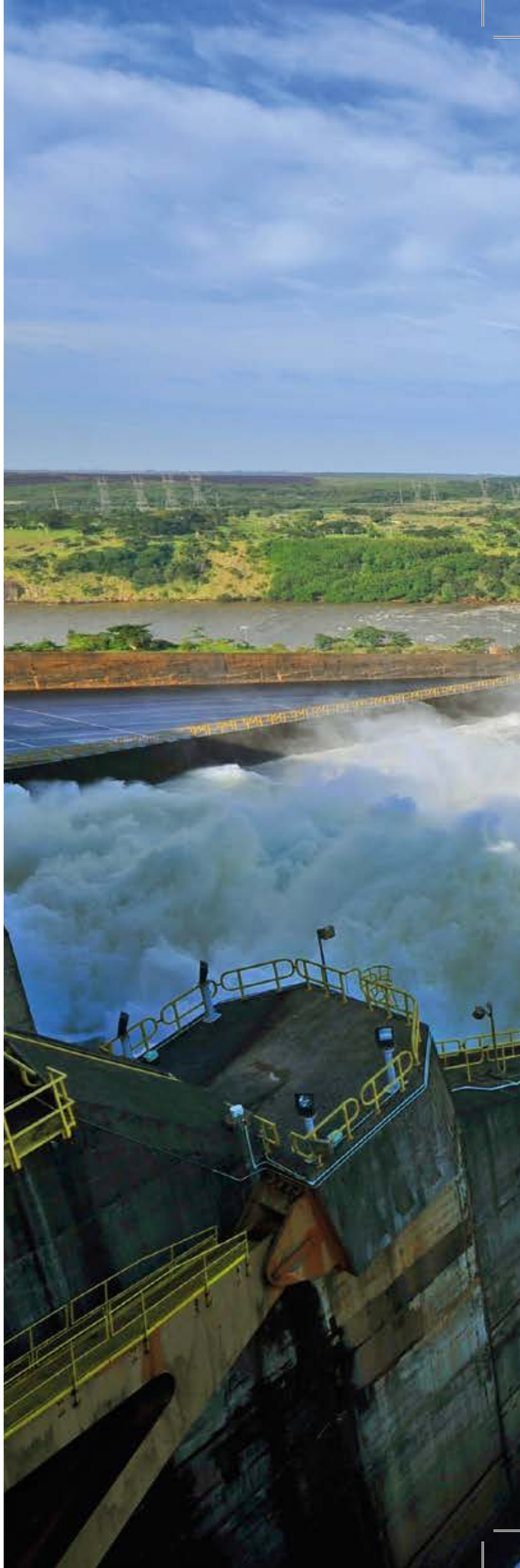
One of the main challenges faced by Itaipu in support of these activities is the continued growth of the population being served with drinking water by the power plant. The growth is particularly important in the communities near the powerplant. In isolated communities, after tanks and water distribution systems are provided, the main challenge for Itaipu is related to the establishment of governance systems for the management of the water supply. To avoid duplication of effort, there is also a need to coordinate activities with the local, regional and national government.

Lessons learned

This experience has demonstrated to Itaipu that, in addition to providing support for water supply and treatment for drinking water, other important relevant activities need to be completed or other additional services need to be provided. In particular, the need to provide electricity in isolated communities and to perform hydrogeological studies in some areas. For an effective coordination of activities, Itaipu is part of the Inter-institutional Coordination Committee of the Potable Water and Sanitation Sector in Paraguay.

Results

The water treatment and supply plant serve more than 100,000 people near the powerplant. Activities by Itaipu in isolated areas have benefited almost 38,000 people in 50 communities in Paraguay in the last 5 years, including educational institutions and indigenous communities (ITAIPU, 2018 f). Another important result is the establishment of water governance systems in the beneficiary communities.



6 CLEAN WATER AND SANITATION

Itaipu spillway - Victor Azcona/Itaipu Binacional

6.

RAINWATER HARVESTING SYSTEMS FOR NON-POTABLE PURPOSES

Rainwater tanks - Rubens de Souza André/ Itaipu Binacional

Objective and Description

Itaipu facilitates rainwater harvesting in the region by installing systems for water collection and storage for non-potable uses, which include cleaning sidewalks and floors, irrigating gardens, orchards and grass and animal troughs, among others. In some locations, the rainwater is also used for sanitary flushing and cleaning purposes in public bathrooms and other common facilities, supporting healthier and more productive environments.

The systems consist of collection channels, water troughs, filtration devices, cisterns and distribution networks. This activity illustrates Itaipu's support for increasing water-use efficiency, inducing sustainable withdrawals and supply of freshwater in the region. The systems are designed for immediate use of the abundant rainwater available in the region. The use of rainwater through these systems prevents the use of drinking water for non-potable purposes, increasing water use efficiency in communities located near the hydropower plant and the overall sustainability of water resources in the region. The systems are installed in schools at urban areas and on farms.

The systems are designed according to the Itaipu model project and taking into consideration historic rainfall patterns of the region, specific characteristics of the particular facility, the position of the cisterns based on hydraulic characteristics and area layout, the filtration needs, and the specific design of necessary pipes and distribution networks. The maintenance of the rainwater harvesting systems is left for the people in charge of the place where the system is installed. Itaipu is studying potential actions that could help optimize and expand the already successful experiences in order to achieve greater water efficiency and coverage.

Related SDG 6 Targets

This activity is directly related to the SDG 6 target related to water-use efficiency and sustainable water withdrawals (T.6.4).

Challenges

A major challenge related to this activity is creating awareness in communities about the need for conservation and efficient use of available drinking water. In many cases, the drinking water is used for purposes such as cleaning sidewalks and bathrooms.

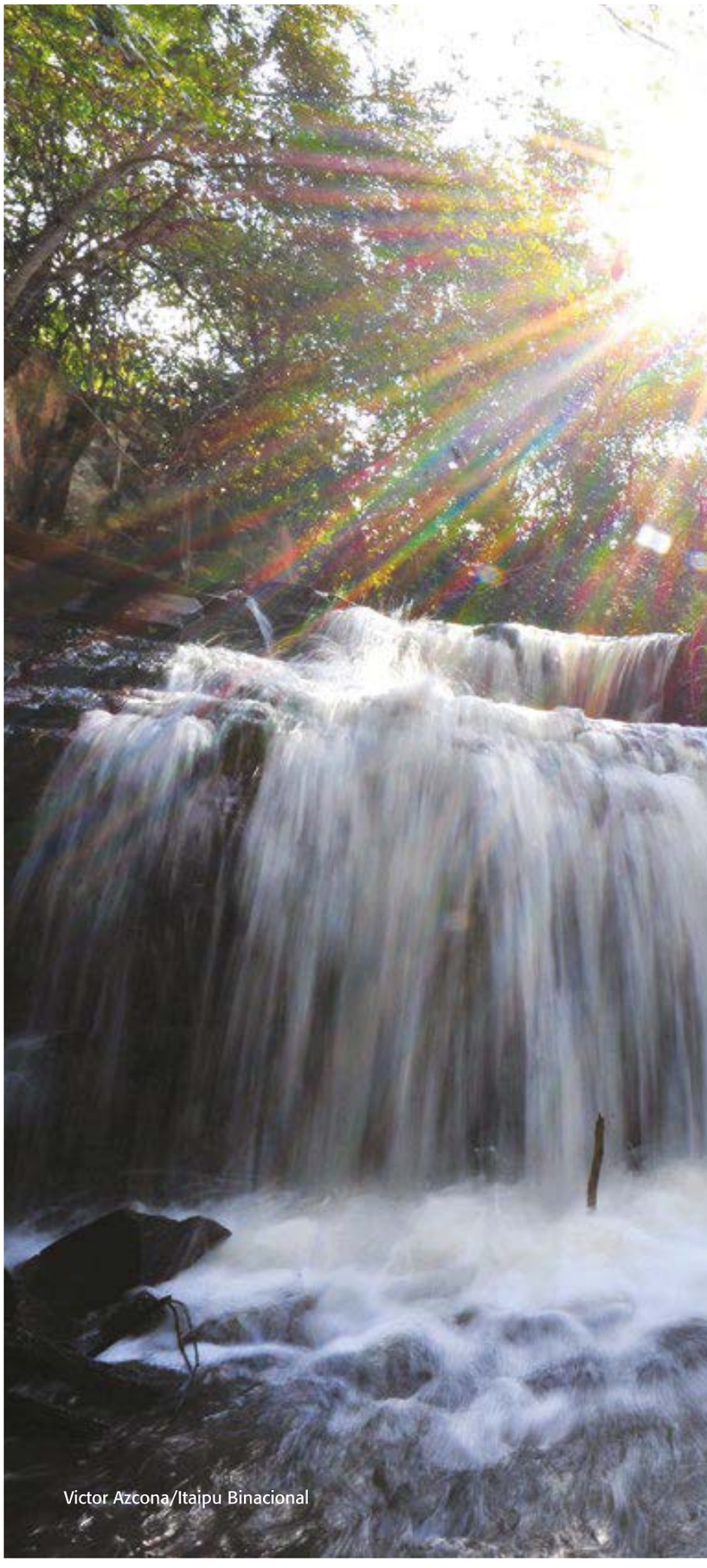
Lessons Learned

Although creating awareness about the value of water has been a challenging activity, the participation of the communities has made people more interested in the efficient use of drinking water and the benefits derived from rainwater harvesting. The schools of the region have performed an excellent job as disseminators of knowledge, creating the important awareness that drinking water should not be wasted.

Participatory processes of citizen science can contribute by promoting environmental and scientific education, bringing further community commitment to the efficient use and monitoring of drinking water and the benefits that can be derived from rainwater harvesting.

Results

A total of 19 major rainwater storage tanks or cisterns have been installed in public areas and rural properties in municipalities located in the western Parana region and in a municipality located in Mato Grosso do Sul, in the southwest of Brazil.



Victor Azcona/Itaipu Binacional

7.

BIOFLOC FISH FARMING TECHNOLOGY

A PROJECT OF RESEARCH, DEVELOPMENT AND TECHNOLOGICAL INNOVATION

Biofloc fish farming - Alexandre Marchetti/ Itaipu Binacional

Objective and Description

Itaipu develops technology for fish production in sustainable systems (biofloc production) to improve environmental control over aquaculture water and production. The intensification, concentration and growth of freshwater fish aquaculture in the western region of Paraná provides a scenario of unsustainability of the current production model, which can compromise water quality in rivers and in the Itaipu Reservoir water, and consequently, their multiple uses.

The project has two demonstration units to produce fingerlings in a system with minimum water use and exchange in the production cycle, called Biofloc Technology (BFT) .

The BFT system consists of promoting controlled organic fertilization in order to favor the growth of microorganisms that use nitrogen compounds for growth, and result in the production of microbial and organic aggregates called biofloc. The microbial system functions as a natural biological filter, allowing the maintenance of water quality and reutilization of nutrients that would have been wasted when feeding the fish and exchanging the water. The system allows operating with high productivity, biosafety and minimal effluent generation (Avnimelech, 2012).

The BFT project is a partnership of Itaipu, the Brazilian Agricultural Research Corporation (EMBRAPA), the Itaipu Technology Park (PTI) and universities.

Related SDG 6 Targets

Biofloc production activities are directly related to water-use efficiency and sustainable withdrawals (T.6.4) and protection and restoration of water-related ecosystems (T.6.6).

Challenges

Some of the challenges related to this activity include elaborating production protocols that meet the reality of the farmers in the region and the small number of qualified professionals to design and operate BFT systems.

Lessons Learned

This experience has demonstrated that it is necessary to keep on improving and disseminating such technology and, in order to do that, it is important to contribute to the training of qualified professionals and to build a demonstration unit to serve as a model in terms of research, development and technology transfer to encourage the diffusion of biofloc technology in the region.

Results

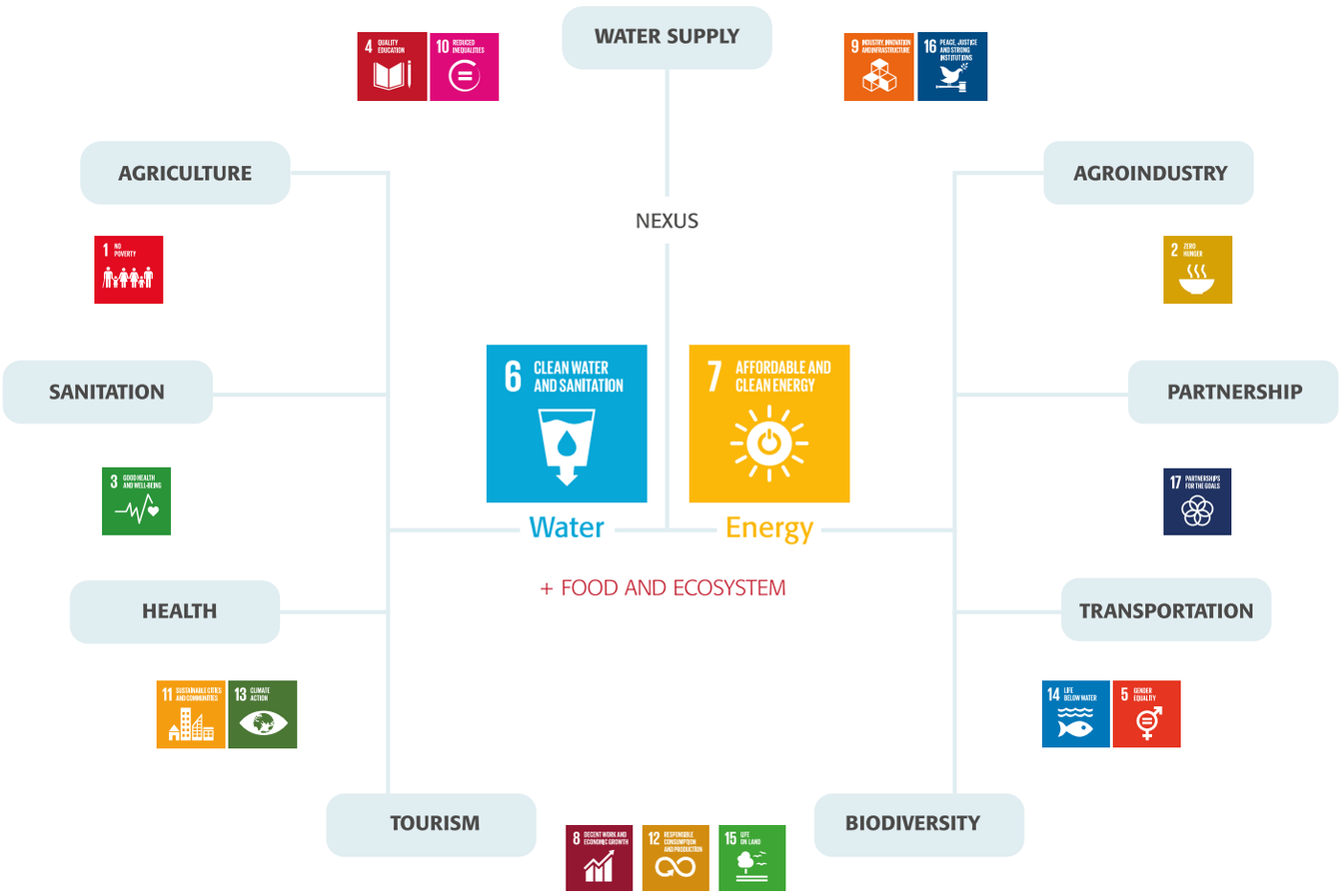
The project has been a success in terms of water-use efficiency. In this system, the water consumption in the production of fingerlings went from 18,000 liters / kg of fish in the conventional system to 500 liters / kg in the BFT system, with no effluent generation.

Technician evaluating the water quality in the biofloc fish tank
Alexandre Marchetti/ Itaipu Binacional

INTERLINKAGES WITH OTHER SDGs

Our actions in the SDGs

Our approach - Integrated actions in the territory



The interlinkages between water related activities (SDG6) and others SDGs are vast. One of the strongest interlinkages is related to energy (SDG7), given the fact that water is the essential factor that allows the generation of renewable energy in the form hydropower at Itaipu. The interlinkage of SDG 6 is also very strong in relation to poverty eradication (SDG1), sustainable agriculture and food security (SDG2), climate change (SDG13), terrestrial ecosystems/forests (SDG15), and economic growth (SDG8).

Another strong interlinkage is with respect to partnerships (SDG17), given Itaipu's great commitment to building long-term partnerships with local communities and other stakeholders to ensure optimum utilization of water resources.

There are also very interesting interlinkages between water activities being led by Itaipu and the rest of the SDGs of the UN 2030 Agenda for Sustainable Development.

Weir of the dam - Victor Azcona/Itaipu Binacional

CONCLUSIONS

Alexandre Marchetti/ Itaipu Binacional

The sustainable development strategy of Itaipu and its comprehensive program of activities related to the optimum integrated management of water resources, protection of water-related ecosystems and the territorial development of the region represent an excellent example of field implementation of the SDG 6 and the UN 2030 Agenda for Sustainable Development.

The strong interconnection between water and energy is evident for Itaipu, and the optimum management of these two resources is key to securing sustainable development and prosperity for the people of Paraguay and Brazil, as well as for protecting all of the ecosystems of the region. Itaipu has been able to generate clean and reliable energy for over 35 years. Through its sustainable development strategy, which includes its integrated management of water resources, the generation of hydropower has been extended to over 180 years due to the increase of the lifespan of the Reservoir.

The integrated management of micro-watersheds and territorial development are therefore as important to Itaipu as the generation of renewable energy.

Itaipu's record as one of the best examples worldwide of successful binational cooperation, by Paraguay and Brazil, is indeed manifested in the sustainable way natural water resources are being managed. Partnerships among companies, government agencies, institutions and academia are fundamental for the success of Itaipu's actions. The support among these actors, through the participative community engagement, is directly linked to socio-environmental actions, that promote sustainable development and prosperity through future generations.

The practices of environmental management and territorial development depend directly on the awareness and involvement of the community. Itaipu's support related to capacity building, through workshops, seminars and courses aimed at the community involvement with environmental practices has resulted in very positive and lasting results. The change in culture and habits of the population towards a sustainable development strategy is a long process that must be strongly based on education and the exchange of experiences among all stakeholders.

Technical cooperation is key to the development and transfer of technologies. The incorporation of successful public policies and cooperation with stakeholders always result in innovation and improvements that support prosperity and long-term success with respect to the optimum management of natural resources.

A summary of specific accomplishments resulting from Itaipu's water activities is illustrated in the diagram below. The diagram demonstrates the integrated and interconnected approach of Itaipu with respect to the social, economic and environmental dimensions of sustainable development.

6 CLEAN WATER AND SANITATION

101,000 HA
of protected areas

More than **1,300 km**
of fence to protect riparian forest

RECOVERY **421**
MICRO-WATERSHEDS

19 RAINWATER TANKS
in public areas and rural properties to reuse water for non-potable purposes

202
COMMUNAL AGROCHEMICAL CLEANING STATION
for proper handling of pesticides, avoiding pollution of water resources

52 SUPPORT TO MUNICIPALITIES
to elaborate environmental sanitation plans

76 STATIONS
for monitoring water and sedimentation

Annual fixation
5.9 MILLION TONS of CO_2 by forest biomass

166 SPRINGS
Recovery and protection

Ecosystem Services

Water Security

Sustainable Regional Development

More than **1,600 KM**
of adequacy of rural roads

187
RURAL PROPERTIES
with access to the water from the reservoir for irrigation and water supply for animals

almost **38,000** people in **50**
isolated communities
benefited with access to water and sanitation

Victor Azcona/Itaipu Binacional

REFERENCES AND SOURCES FOR ADDITIONAL READING

- Arruda Filho, N. de P., & Sedor, R.W.R, & Lopes, F. C., & Rodrigues, L.F, & Pschera, C. (2018). Case study of the Cultivating Good Water Program: Update, institutionalization and replication. Curitiba, Paraná.
- Avnimelech, Y (2012). Biofloc Technology - A Practical Guide Book. Louisiana, EUA:The World Aquaculture Society Baton Rouge.
- Boscardin, N. R, & Borghetti, J.R, & Rosa Filho, E. F. (2011) A integração das aguas: revelando o verdadeiro Aquifero Guarani. Curitiba, Paraná.
- Calder, I., & Hofer, T., & Vermont, S, & Warren, P. (2007). Towards a new understanding of forests and water. Forests and water. Unasylva, 229 (58). Retrieved from http://www.fao.org/3/a1598e/a1598e00.htm
- Dirección General de Encuestas, Estadisticas y Censos. (2018). Proyecciones de población nacional, áreas urbana y rural, por sexo y edad, 2018. Retrieved from http://www.dgeec.gov.py/Publicaciones/evolucionto-tal.php
- Instituto Ambiental do Paraná (IAP). (2009). Monitoramento da qualidade das águas dos reservatórios do Estado do Paraná no período de 2005 a 2008: relatório técnico. Curitiba: IAP, 2009. 120 p.
- ITAIPU Binacional. (2018 a). Sustainability Report. Foz do Iguaçu, Paraná: Social Responsability Advisory Office.
- ITAIPU Binacional. (2018 b). Comunicación de progreso y reporte de sostenibilidad. Retrieved from: https://www.itaipu.gov.br/es/responsabilidad-social/comunicacion-de-progreso-y-reporte-de-sustentabilidad
- ITAIPU Binacional. (2018 c). Plan Director de Gestión Sociambiental Appendix I.
- ITAIPU Binacional. (2018 d). Resolución de Directorio Ejecutivo 276/18
- ITAIPU Binacional. (2018 e, March 3) Ponen en marcha moderno equipo de hidrografía, único en Paraguay. Retrieved from https://www.itaipu.gov.py/es/sala-de-prensa/noticia/ponen-en-marcha-moderno-equipo-de-hidrografia-unico-en-paraguay
- ITAIPU Binacional. (2018 f). Agua limpia y saneamiento. Retrieved from https://www.itaipu.gov.py/es/pagina/agua-limpia-y-saneamiento
- ITAIPU Binacional. (2019 a). Generación. Retrieved from http://www.itaipu.gov.py/es/energia/generacion ITAIPU Binacional.
- (2019 b). Reservoir. Retrieved from https://www.itaipu.gov.br/en/ener gy/reservoir
- ITAIPU Binacional. (2019 c). Documentation Center. Retrieved from http://intranetbr/centrode documentação/.
- ITAIPU Binacional. (2019 d, January 29). ITAIPU recupera 2.300 hectáreas de bosque, gracias al trabajo de reforestación más grande de la región. Retrieved from https://www.itaipu.gov.py/es/sala-de-prensa/noticia/itaipu-recupera-2300-hectareas-de-bosque-gracias-al-trabajo-de-reforestacion-
- Mendes, A.B. (2018) Report from the International Civil Consultants Board. Foz do Iguaçu, Paraná: ITAIPU Binacional.
- Ministerio de Obras Públicas y Comunicaciones. (2018). Plan Nacional de Agua Potable y Saneamiento https://www.mopc.gov.py/pnaps/pnaps.pdf
- Motter, P., & Goelzer de Almeida, H. (2015). Plantio direto: A tecnologia que revolucionou a agricultura brasileira. Foz de Iguaçu, Paraná: Parque Itaipu.

- Parque Tecnológico Itaipu (PTI) (2018, July 3). Projeto vai analisar influência dos micropoluentes no solo e biodiversidade na Bacia do Paraná 3. Extraído de https://pti.org.br/pt-br/content/projeto-vai-analisar-influência-dos-micropoluentes-no-solo-e-biodiversidade-na-bacia-do

- PNUD. (2018). Panorama ODS: Oeste do Paraná em números. Brasília, Brasilia: Gráfs. color.

- Sória, M. A. (2012) Usina de Itaipu- Integração energética entre Brasil e Paraguai. Curitiba, Paraná: UFPR.

- United Nations (2015). Transforming our world: the 2030 Agenda for Sustainable Development, A/RES/70/1.

Monumental lighting of the dam
Victor Azcona/Itaipu Binacional

ITAIPU BINACIONAL

UNDESA – Itaipu Binacional
SUSTAINABLE WATER & ENERGY PARTNERSHIP

6

CLEAN WATER AND SANITATION