# WATER AT PETROBRAS

Juruena River, area of the “Pacto das Águas” Project

PETROBRAS

# SUMMARY

# INTRODUCTION

Water is an essential resource for our operations and vital to society. In all our activities, we use water and generate wastewater, what makes the theme strategically relevant for our businesses sustainability.

According to projections of the Organization for Economic Cooperation and Development (OECD) for industrial production, electricity generation and domestic use, for example, world water demand is expected to grow by 55% to 2050, compared to the year 2001. Intensified water use and increased demand can lead to water scarcity in several of the world's watersheds. According to the United Nations (UN), the world shall face a global water deficit of 40% by 2030 in a *business-as usual* scenario.

Therefore, and given the importance of this valuable asset for society, we constantly seek to use water rationally in all our facilities. We have as express commitments in our Health, Safety and Environment (HSE) policy the prevention and minimization of the environmental impacts of our projects, processes and products, including those related to water resources and wastewater.

Over the last years, we have improved our water resources and wastewater management system, the corporate database that centralizes

Water is an essential resource for our operations and vital to society.

information on water use in the company and makes it trackable, our water-related risks assessment and mitigation tools and our practices for rationalizing the resource use and for reuse. We have invested in Research and Technological Development and have worked for conservation and recovery of water bodies through Petrobras Socioenvironmental Program.

We invite you to get to know a part of our practices and efforts regarding water resources use and we wish you to get inspired and, like us, be able to seek - in your reality - the best ways of acting to guarantee a sustainable future with water security.

Have a good reading!

Ecological Reserve of Guapiaçu, Cachoeiras de Macacu, Rio de Janeiro.

1) OECD, 2012. *OECD Environmental Outlook to 2050: The Consequences of Inaction.* OECD Publishing, Paris.
2) WWAP (United Nations World Water Assessment Programme). 2015. *The United Nations World Water Development Report 2015: Water for a Sustainable World.* Paris, Unesco.

# HOW WE USE WATER

Company worker in the laboratory of the Henrique Lage Refinery (Revap)

Availability of water in appropriate quantity and quality is essential for our operations. In all our business areas, we directly use fresh water in a variety of activities, such as oil desalination, steam generation, cooling systems, fire-fighting and human consumption. See below.

Company worker at the Henrique Lage Refinery (Revap)

## PRODUCTION OF OIL AND GAS

- Preparation of drilling and completion fluids and drills cooling;
- Hydrostatic tests;
- Make-up water for cooling systems;
- Steam generation;
- Emergency response;
- Secondary oil recovery;
- Human consumption.

## REFINING

- Oil desalination;
- Several oil and by-products processing units;
- Hydrostatic tests;
- Make-up water for cooling systems;
- Steam generation;
- Emergency response;
- Human consumption.

## ELECTRICITY GENERATION

- Make-up water for cooling systems;
- Steam generation;
- Emergency response;
- Human consumption.

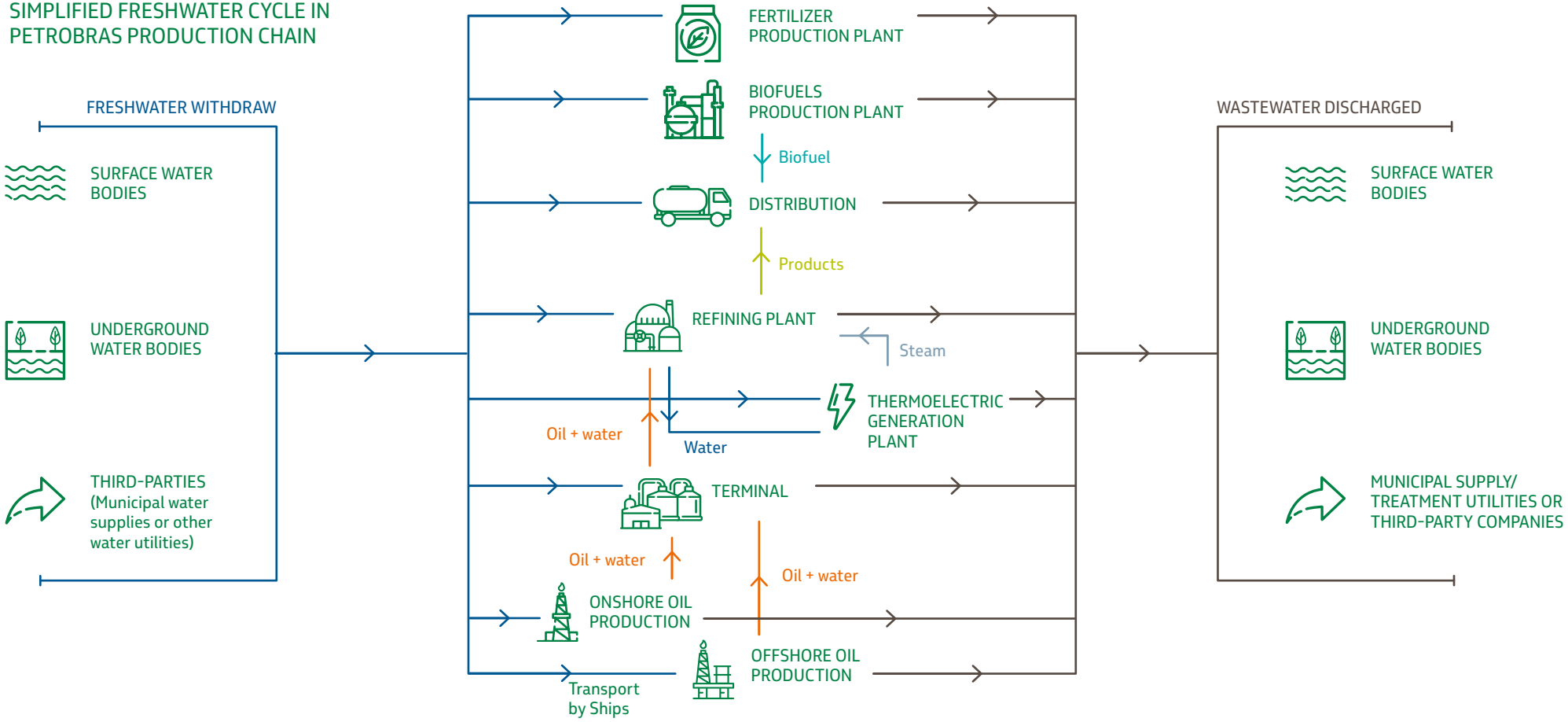
## FERTILIZERS

- Make-up water for cooling systems;
- Steam generation;
- Emergency response;
- Human consumption.

Hence, almost all our activities generate some type of wastewater (industrial, sanitary, produced water and others). Thus, we understand the themes "water resources" and "wastewater" are, in addition of being transversal, of strategic relevance for the sustainability of our business. Therefore, we constantly seek to use water rationally in each process in all our facilities, as a production input or for assimilating wastewater. We have as express commitments in our Health, Safety and Environment (HSE) policy, the prevention and minimization of the environmental impacts of our projects, processes and products, including those related to water resources and wastewater.

To get to know our HSE policy and guidelines, please visit : http://www.petrobras.com.br/en/society-and-environment/environment/safety-environment-and-health-policies/

SIMPLIFIED FRESHWATER CYCLE IN PETROBRAS PRODUCTION CHAIN

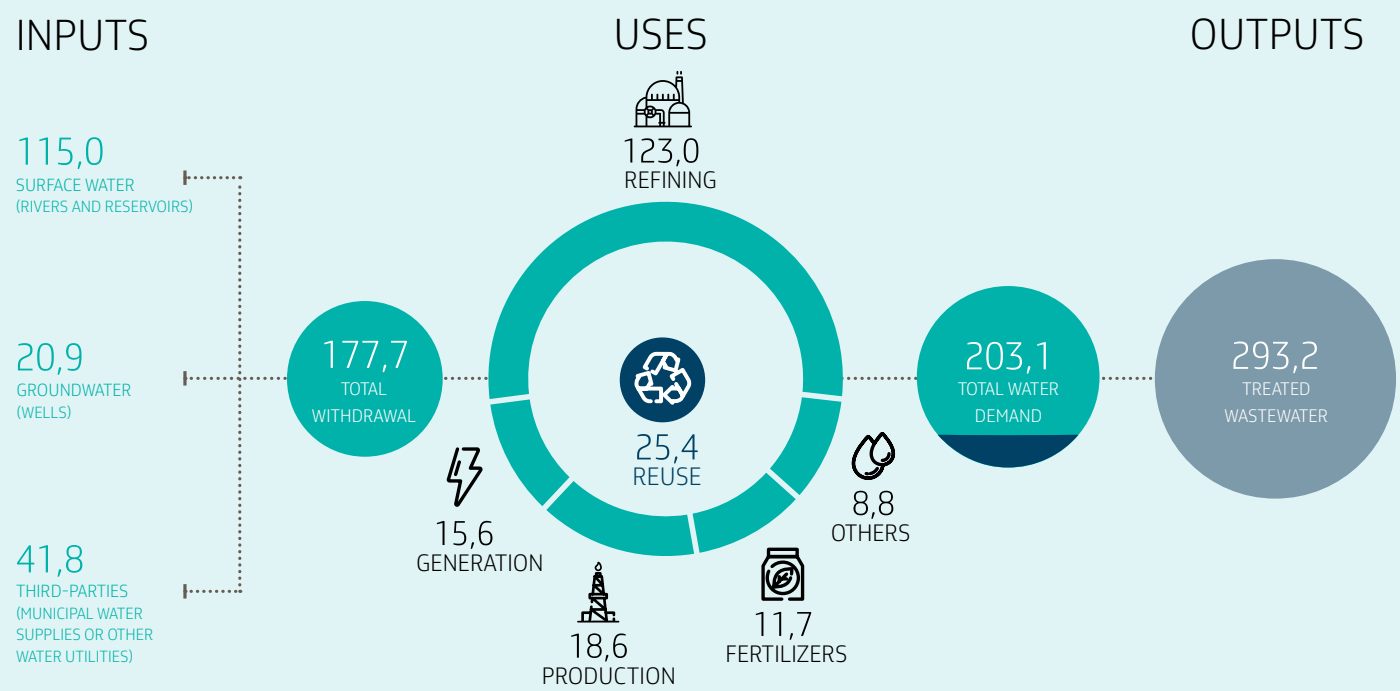


# WATER WITHDRAWAL

During 2017, we collected 177.7 million m³ of fresh water for our operational and administrative activities. Below, we illustrate the company's simplified fresh water balance for the year.

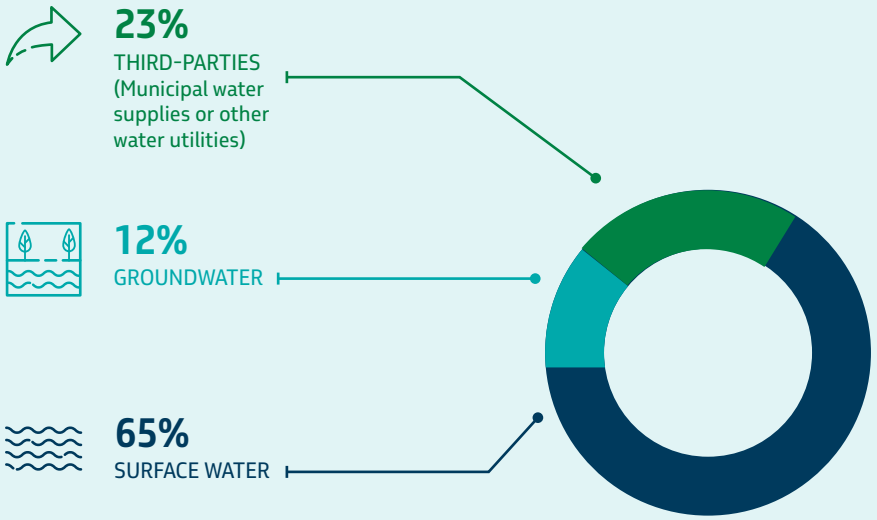
**WITHDRAWAL VOLUME**
**177,7** MILLION
m³ in 2017

## WATER BALANCE
(millions of m³)

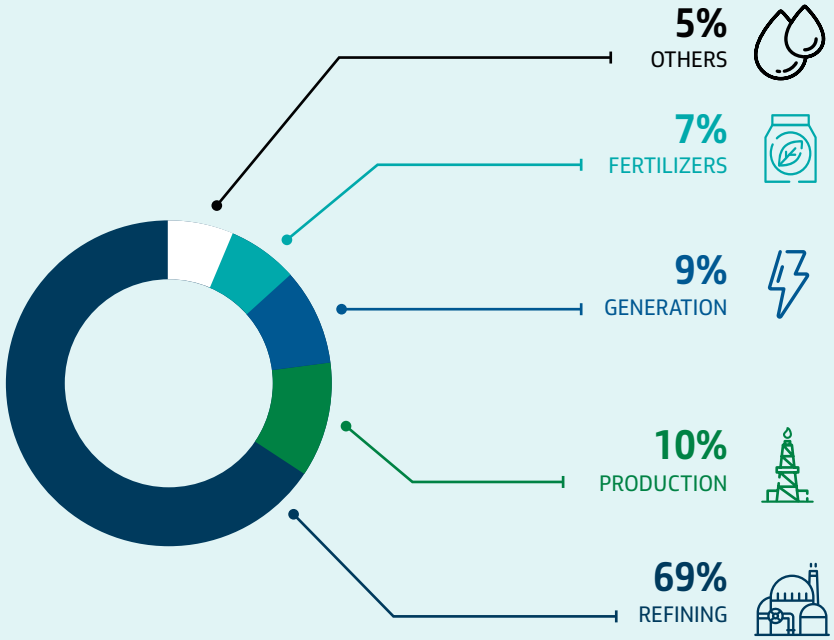



a) Values presented were obtained through the consolidation of direct measurements in the units *(2017 Water Resources and Wastewater Inventory)*.
b) Volume of disposed wastewater presented in the balance refers to industrial wastewater and produced water associated with extracted oil.
c) Rainwater volumes are included in "Third-parties (Municipal water supplies or other water utilities)" category, accounting for 0.05 million m³.
d) Fresh water volumes received from other units of Petrobras or subsidiaries are accounted for in "Third-parties (Municipal water supplies or other water utilities)" category, according to the defined calculation methodology.
e) Volumes accounted for reuse do not include condensate recovered in thermal cycles, recirculated cooling water and produced water reinjected for secondary and tertiary oil recovery purposes.
f) Open-circuit cooling freshwater inputs and outputs are not included. In 2017, we used 30.9 million m³ of fresh water for this purpose.

## FRESHWATER WITHDRAWAL BY SOURCE




## FRESHWATER WITHDRAWAL BY ACTIVITY




Regarding brackish or salt water, in 2017 we collected 2.9 billion m³ for our operational and administrative activities, including the volumes of open-circuit cooling water.

# WITHDRAWAL SOURCES

*Urucu* Oil Production Area

Regarding fresh water, we used 175 withdrawal sources, 158 of which were located in Brazil (accounting for about 97% of total fresh water withdrawn) and 17 in the other countries where we operate (Paraguay, Colombia, Uruguay, Bolivia, Mexico, United States, for example). In Brazil, the maximum limits for fresh water withdrawal from the environment are established by public bodies that are responsible for water resources management, considering hydrological criteria and the multiple human and ecological uses of water within a watershed.

**WITHDRAWAL**

**175** SOURCES

158 located in Brazil

97% of total fresh water withdrawn

We continuously invest in assessing the impacts of our activities, observing protected areas and identifying sensitive ecosystems located in our units' influence areas. Regarding potential environmental impacts, including those related to water resources, mitigation and monitoring measures are implemented through the environmental programs of our units.

# WASTEWATER DISPOSAL

In 2017, the volume of wastewater discharged to the environment was 293.2 million m³, including industrial wastewater and produced water from oil extraction process.

**VOLUME DISCHARGED**

**293,2** MILLION

m³ in 2017

This volume presented the following load: 1.9 thousand tons of oil and grease, 5.4 thousand tons in terms of chemical demand of oxygen (COD) and 1.7 thousand tons of ammonia.

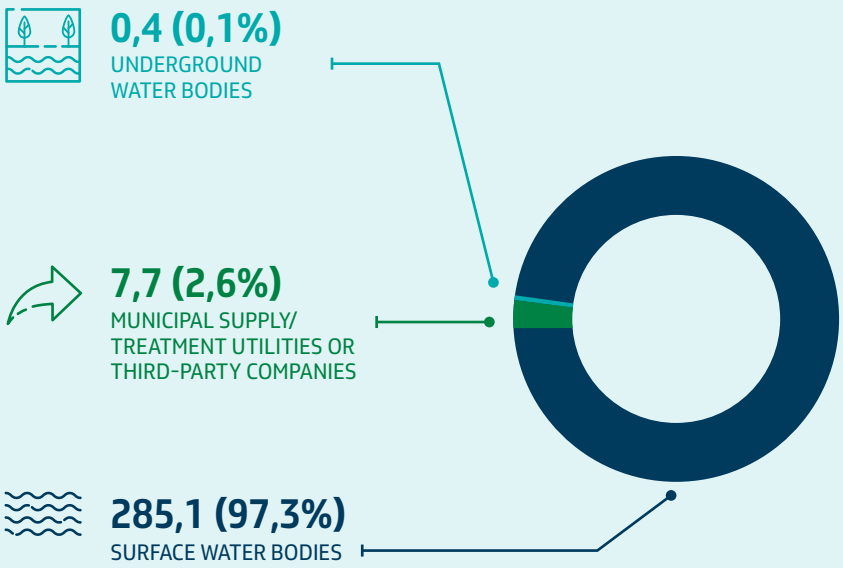
Regarding sanitary wastewater, the volume we discharged to the environment was 3.82 million m³ in 2017.

Disposed wastewater is previously treated in order to meet the discharge quality standards established in environmental legislation. In addition, we constantly improve our operational processes management and control for the continuous improvement of discharged wastewater quality. For example, we can mention that, in the next two years, investments and development of new technologies for produced water treatment are foreseen.

Aeration Pond of Duque de Caxias Refinery (Reduc)

# RECEIVING WATER BODIES

## WASTEWATER VOLUMES DISCHARGED (million m³) BY TYPE OF DESTINATION




a) Data source used for the calculations was the *2017 Water Resources and Wastewater Inventory.*
b) Sanitary wastewater was not considered, when discharged alone.

For our wastewater assimilation, we used 52 surface water bodies, 13 underground disposal points and 21 municipal supply/treatment utilities or third-party companies. We have not identified significant quantitative or qualitative impacts in the water bodies where our wastewater is released.

# INTERNAL MANAGEMENT

Company workers aboard FPSO ship Cidade de Angra dos Reis

Our Water Resources and Wastewater (WRW) management has as its basic principle the constant search for water use rationalization, which allows us to guarantee the necessary supply to our activities and to contribute to water resources conservation in the watersheds where we operate. Thus, we seek the adoption of less water-intensive technologies, the minimization of its use in operations and processes, reuse and identification of alternative supply sources, always considering local water availability and technical-economic feasibility of the actions.

In relation to the generated wastewater, we seek the minimization of discharged polluting substances, the segregation, treatment and proper destination of the streams, observing discharge standards.

> "Results of projects and actions are monitored by senior management."

In our company, WRW management is led by a corporate section dedicated to the theme. Results of projects and actions are monitored by senior management.

The document that establishes and organizes our WRW Management System is the Process Standard *Manage Water Resources and Wastewater*. This document standardizes the guiding principles and practices to be adopted for WRW environmental management throughout the company, both for operating units and for new ventures that use water and discharge wastewater to the environment or which have the potential to interfere in surface or underground water bodies, considering their entire life cycle (design, operation and deactivation phases). The standard requirements are deployed across all of our business areas, thus encompassing all of our activity types.

We also have Petrobras Technical Standards that complement this standard in order to define technical and engineering requirements for our processes. The main one is the Petrobras Technical Standard *Water Resources and Wastewater Management Plan* (WRWMP), which establishes minimum requirements for the elaboration of the WRWMP of our units, making the management planning and the monitoring of water resources uses and wastewater generation possible, as well as promoting continuous improvement of associated processes.

We evaluate our environmental performance in Water Resources and Wastewater through the calculation, monitoring and monthly critical analysis of the following corporate indicators: Volume of Fresh Water Withdrawal, Volume of Discharged Wastewater, Volume of Reused Water and Oils and Greases Mass in Wastewater.

Tanker Nilza at the Isaac Sabbá Refinery (Reman) terminal

# INFORMATION MANAGEMENT - DATA HIDRO

Data Hidro (Corporate System on Water Resources and Wastewater) is our corporate database in which information on volumes of water used, withdrawal sources, potentially polluting loads discharged, industrial and sanitary wastewater volumes, costs involved (among others which are necessary for the management of the theme) is recorded, consulted and processed. It is through this system that we annually elaborate our *Water Resources and Wastewater Inventory*, which, in 2017, included 455 water user and wastewater generator facilities.

**WATER RESOURCES AND WASTEWATER INVENTORY**

**455** FACILITIES

with water use and wastewater generation

Data Hidro allows the registration and consultation of qualitative and quantitative data of the main input and output water streams of company's operating units, allowing quick access to information, in an integrated way. The system is structured to record data on the monitoring of physical, chemical and biological parameters that characterize water streams. Analysis of recorded data allows the user to verify the compliance with water quality standards for the different intended uses and with legal or voluntary wastewater discharge standards.

In 2017, we invested in the development of a new Data Hidro module, which will make it easier to monitor and critically analyze our discharged wastewater streams behavior against the discharge standards, helping us to improve our environmental performance.

## SYSTEM STRUCTURE

### WATER STREAMS

The main input and output water streams in the operational units industrial processes are classified and grouped according to their origin, their physical-chemical characteristics and the activities they are related to.

## DISCHARGE STANDARDS

The system allows the registration of the discharge standards established by federal legislation and by state legislations, in addition to enabling registration of specific standards (environmental licensing restrictions, for example) or voluntary ones, in order to improve company's environmental performance.

## REPORTS

Data Hidro also has some management support tools, such as reporting of water streams monitoring results, water balance, calculation of corporate indicators and costs related to payment for water resources use. Reports can be issued by different levels of the organization (e.g., corporate level, business area level, down to the level of the operating units).

# WATER SCARCITY RISKS ASSESSMENT AND MITIGATION

Ensuring access to the necessary water supply for the continuity of our activities in an environmentally sustainable way is one of the priorities of our water resources management.

We use different tools for evaluating our facilities exposure to water scarcity risks. The most complete one is the water availability assessment study, which must be reviewed and updated periodically. In the review intervals, we also use an internally developed tool with the aim of guiding/directing company's risk mitigation actions, where risks are most relevant. It is the Water Scarcity Risk Index (WSRI), developed in partnership with Rio de Janeiro Federal University (UFRJ). WSRI is composed of three sub-indexes:

## WATER SCARCITY RISK INDEX:

**HYDROLOGY AND WATER USES BALANCE**
**AVAILABILITY**
relation between water demands and available water

**RIVER BASIN'S CHARACTERISTICS**
**VULNERABILITY**
exposure level, damage susceptibility

**FACILITY CHARACTERISTICS**
**RESILIENCE**
ability to react/resist/recover

- **availability** - evaluates the available flows for use in the watershed, considering our facility and the other users demands;
- **vulnerability** - considers the maturity and completeness of the management system and the preservation state of the watershed where the facility is located; and
- **resilience** - verifies the facility's reaction/ resistance capacity in face of water scarcity events.

The Index results from a mathematical calculation that aggregates the results of the several indicators that make up the three sub-indexes.

*Urucu* oil production area

The Water Scarcity Risk Index is represented on a significance scale, divided into five categories:

**A** LOW RISK LEVEL
0 – 20%

**B** FOLLOW-UP LEVEL
20 – 40%

**C** WARNING LEVEL
40 – 60%

**D** CONCERNING RISK LEVEL
60 – 80%

**E** CRITICAL RISK LEVEL
80 – 100%

Thus, Index application allows the identification and prioritization of the locations and facilities where we must direct the water availability studies development to, or even where we must implement other mitigation or risk monitoring measures.

Between 2015 and 2016, we applied the index in a set of operational units that account for about 90% of total fresh water withdrawn by our operations in Brazil and classified such units according to the above-mentioned risk categories. Obtained results were evaluated together with financial representativeness of each unit and supported the prioritization of critical facilities (classes D and E) to develop actions aimed at water security.

In 2017, we established and initiated the implementation of the *Corporate Action Plan* for water risks mitigation and monitoring for the prioritized facilities. This plan is composed of 40 actions of different natures, involving, for example:

- articulation with public water resources management bodies;
- intensification of our units participation in water resource forums (such as Water Basin Committees)
- corporate follow-up of specific workgroups focusing on water security, conducted at local levels in the units;
- development/updating of local water availability studies and identification of alternative supply sources;
- development of studies on new opportunities to rationalize water use in the units;
- research conducting with focus on technological development for optimizing water use.

When it is necessary to develop or update water availability assessment studies and alternative supply sources studies, we also have, as a supporting tool, the *Water Availability Assessment Technical Guide*, also developed in partnership with Water Resources and Environment Laboratory of Coppe/UFRJ. This document presents a series of guidelines for our operational units regarding the contracting and elaboration of this type of study.

> "... we established and initiated the implementation of the Corporate Action Plan for water risks mitigation and monitoring for the prioritized facilities."

We have carried out water availability studies for the watersheds where 12 units of our refining park are located, which have evaluated the current and future balance between supply and demand for water in these regions. We have also concluded a detailed study in the watersheds of Bahia state, which concentrate several exploration, production, handling, refining and fertilizer manufacture activities, and a study in Rio Grande do Norte's and Ceará's basins where production activities are located. Thus, we have mapped water availability with a higher level of detail in units that, together, account for about 70% of our total fresh water withdrawal.

# ENGAGEMENT ACTIONS

Guapiaçu Project

We are aligned to global and local initiatives regarding sustainable water use. We were, for example, the first Brazilian company to become associate member of *World Water Council* (WWC), a global network which mission is to promote awareness, provoke action and build political commitments on critical water issues for facilitating conservation, protection, development, planning, management and efficient use of the resource.

In order to follow-up the discussions and proposals for changes in legal requirements and to identify possible improvements in water use management, we also integrate the Water Resources Network of the National Industry Confederation (CNI, in portuguese) and participate in the Water Thematic of the Brazilian Business Council for Sustainable Development (CEBDS, in portuguese).

Another important engagement action is our participation in local water forums, such as the Watershed Committees, in order to collaborate with participatory management of the watersheds where our facilities are located.

Guapiaçu Ecological Reserve, Cachoeiras do Macacu, Rio de Janeiro State

# ACTIONS TO RATIONALIZE WATER USE

*Urucu* oil production area

We invest in the rational use of water through projects to minimize its use, internal water streams reuse and wastewater reuse, for example. Among the benefits obtained with reuse, we have achieved a reduction in our global needs for "new water" withdrawal, thus removing less of the resource from the environment.

**TOTAL REUSED VOLUME**

**25,4 MILLION**

m³, 12,5% of our total fresh water demand

In 2017, the total reused volume was 25.4 million m³, which corresponds to 12.5% of our total fresh water demand. This reused volume would be sufficient to supply, for example, a city of approximately 615 thousand inhabitants for a year.

Thanks to reuse actions, we estimate approximately R$ 24.2 million in savings in the year, with costs, in the costs related to water withdrawal and wastewater discharges.

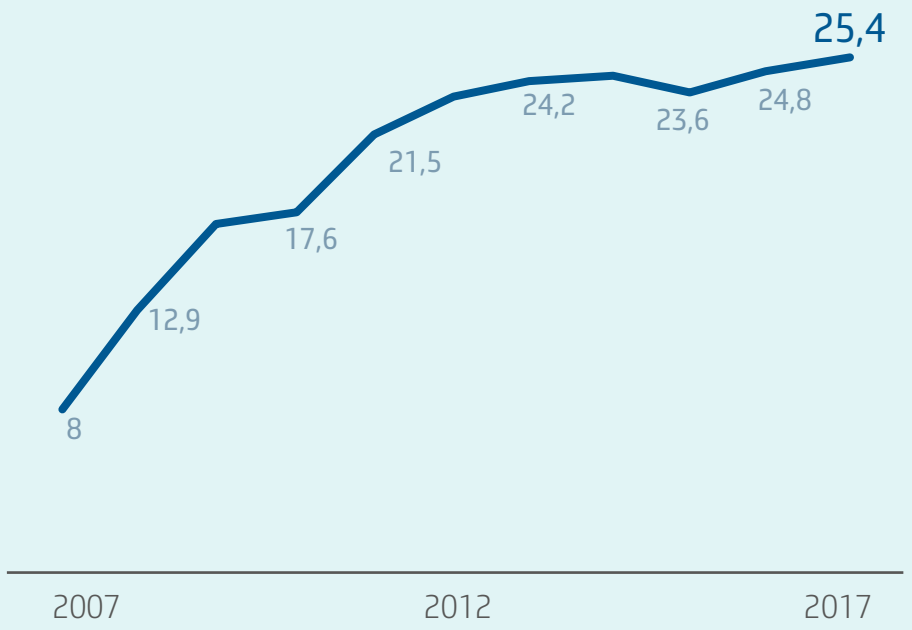
**REFINING ACTIVITY**

**98,5%**

of reused water volumes

PROGRESS OF REUSED WATER VOLUMES

(million m³)




a) Data source used for the calculations was the *2017 Water Resources and Wastewater Inventory.*
b) Volumes accounted for reuse do not include condensate recovered in thermal cycles, recirculated cooling water and produced water reinjected for secondary and tertiary oil recovery purposes.

We have made good progress in the water use rationalization and reuse in our operations and processes. Most of the water, approximately 25 million m³, was reused in the Refining and Natural Gas Business Area (RGN). In this area, we highlight the reuse of internal residual water streams, which are often characterized by not requiring previous treatment to be reused.

**WATER REUSED**

**25 MILLION**

m³ in the Refining and Natural Gas Business Area (RGN)

Below, we present our highlights regarding rationalization and water reuse measures in recent years.

In 2013, our Xisto Industrialization Unit (SIX), in Paraná, recorded a reduction of more than 60% of fresh water withdrawal, compared with base year 2008, as a result of the adoption of a broad set of operational actions and technological improvements.

In 2014, the refineries were major highlights. We implemented a series of measures to promote rational and efficient water use, which made reused water volume rise from 20.3 million m³ in 2011 to 23.3 million m³ in 2014 in our refining park. This increase is sufficient, for example, to supply a city of 75 thousand inhabitants for a year.

Also in 2014, a system for treatment and reuse of produced water (water associated with oil production) was put into operation at Furado field, in Alagoas. Produced water, after proper treatment, was reused for reinjection in oil reservoirs (secondary recovery).

The following year, at the Henrique Laje Refinery (Revap), in São Paulo, through improved technology and process management, we increased the concentration cycles in the cooling systems and reduced the need for make-up water without compromising operational efficiency. This change generated a 23 m³/h water saving and the refinery received the ROE (Return on Environment) award from GE Water & Process Technologies, which recognizes works that seek to balance industrial challenges with environmental sustainability ones.

**REUSED WATER VOLUME RISE**

**3 MILLION**

m³ between 2011 and 2014 in the Refining Area

Still in 2015, we highlight the set of measures adopted at the Paulínia Refinery, in São Paulo, to fight the limited water availability scenario. Actions included operational measures to optimize steam and water use (stripped sour water reuse, for example), maintenance process intensification, small projects for underground water use and contingency actions. Combined measures contribute to a 200 m³/h reduction in water withdrawal on the Jaguari River, located in the Piracicaba watershed, which was affected by 2014-2015 water crisis.

**ECONOMY**

**23**

m³/h of water at the Henrique Laje Refinery (Revap) in 2015

**REDUCTION**

**200**

m³/h in water withdrawal on the Jaguari River by 2014-2015

At the Landulpho Alves Refinery (RLAM) in Bahia, several projects were implemented between 2012 and 2016, including investments in new alignments of stripped sour water (which allowed maximizing the use of the treated water in other refinery units in desalination, washing and cooling processes) and reuse of the reverse osmosis process waste. The projects contributed to a 14.4 million m³ saving in five years. During this period, there was a 75% increase in the water volume reused by the refinery, which increased from approximately two million m³ in 2012 to 3.5 million m³ in 2016.

In 2017, the Water Treatment and Reuse Station (WTRS) of the Cenpes Complex, our Research Center, completed five years of operation, reaching a mark of one billion liters of reused water. The reused volume in each year (200 million liters average) is equivalent to the demand of a three thousand inhabitants community.

The WTRS is an integrated and eco-efficient process unit that reflects our commitment to the environment and society. All the sanitary and industrial wastewater that would be discharged is treated and used in industrial processes, avoiding the discharges and the need for new withdrawals from the municipal water supplier. The station brings together state-of-the-art technologies such as membrane bioreactors and reverse osmosis system, what highlights the Complex as an eco-efficient construction. In addition to WTRS, Cenpes also has a rainwater harvesting system on the roofs and floors for use in sanitary basins and irrigation.

In addition to providing environmental benefits, reuse has proved itself to be quite attractive economically. With the operation of WTRS, we estimate R$ 750 thousand of monthly savings in the water bill of the Cenpes Complex.

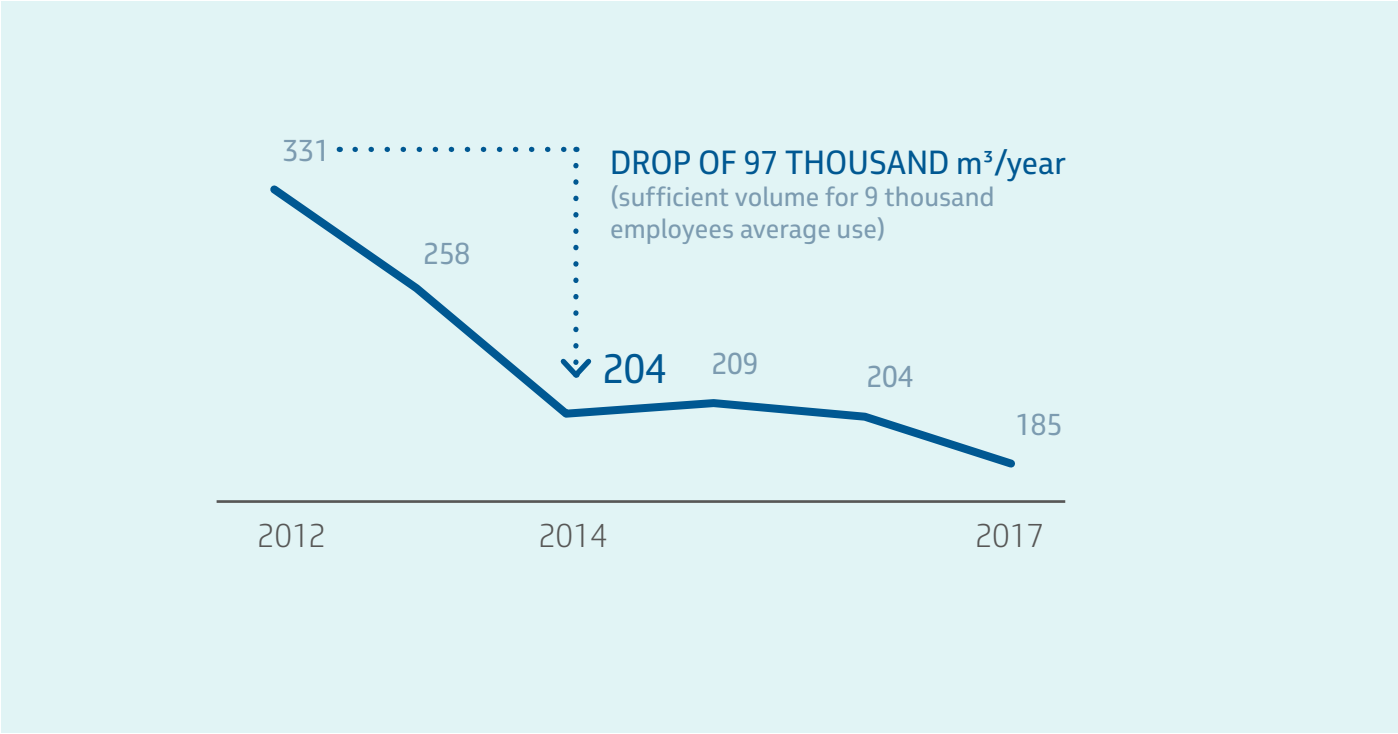
Still in 2017, our Rio Grande do Norte and Ceará Exploration and Production Operation Unit (UO-RNCE) identified produced water use as an opportunity to cope with water scarcity and to optimize water use. For this purpose, two treatment plants were built - one located in Alto do Rodrigues Production Asset and another one in Guamaré Industrial Asset, capable of treating together up to 2,100 m³ of this resource.

Valuable Foprests Project

The implemented treatment system start-up is scheduled for 2018's first half and it aims to suit produced water characteristics, allowing its reuse for industrial purposes, in the case of Guamaré Asset, and for steam generation and subsequent injection in oil reservoirs (secondary recovery), in the case of Alto do Rodrigues Production Asset. Thus, the need for water withdrawal in these regions will be considerably reduced. In Guamaré, for example, it is estimated a reduction of up to 90% in water withdrawal from artesian wells for use in industrial activities.

In our office buildings, we also developed several actions to rationalize and minimize water use. These actions range from simple initiatives such as workforce awareness and adaptation of hydrosanitary equipment (installation of aerators and flow restrictors in taps, dual-flush toilets, proximity sensors in taps and urinals), to interventions of greater complexity, such as losses elimination, network sectorization, rainwater harvesting for non-potable purposes, reuse and processes optimization , such as the cooling tower modernization of our Headquarters Building or the reuse of fan-coils condensation water at Bahia Building.

The rationalization measures employed in four of our buildings with higher water demand in Rio de Janeiro (Headquarters Building, Cidade Nova Building, General Horta Barbosa Building and Ouro Negro Building), developed between 2012 and 2014, provided a drop of approximately 33% in water use. Savings achieved, of around 100 thousand m³/year, could supply over nine thousand employees with similar average per capita demand. In addition, our most modern buildings, located in the cities of Santos and Vitória, reuse water.




In order to provide guidance for actions and measures to rationalize, conserve and reuse water in our administrative areas, we have developed an auxiliary supporting tool in partnership with the Water Reuse International Reference Center of São Paulo University (USP, in portuguese), resulting in the *Technical Guide on Water Conservation and Reuse in Administrative Units*, which covers technologies that can be applied in new building projects, adaptations of existing buildings and acquisition of new ones.

# RESEARCH AND DEVELOPMENT

Research and Development Center (Cenpes)

Research and Development Center (Cenpes)

Created in 1973, our Research and Development Center Leopoldo Américo Miguez de Mello (Cenpes) is one of the most important applied research complexes in the world. Located at Ilha do Fundão, in Rio de Janeiro, it covers an area of more than 300 thousand m², with modern laboratories and simulation/immersion rooms in energy industry processes designed to meet company's business areas technological demands.

Cenpes' mission is to provide and anticipate technological solutions in products and processes for Petrobras and subsidiaries. In its Research and Development projects portfolio, a specific line is dedicated to the topics Water Resources and Wastewater due to the transversality, relevance and strategic importance of these subjects.

Within this context, we present below some of the highlights developed by Cenpes over the last years.

# WATER REUSE MOBILE UNIT

Experimental mobile unit for water reuse

Developed by Cenpes in partnership with the company 'EP Engenharia do Processo', the Mobile Unit has the objective of subsidizing initiatives aiming at reuse implementations in our facilities.

This Mobile Unit received an investment of about R$ 10 million and is composed of two trucks with 15 pilot scale treatment units, which, combined in different ways, can test up to 90 technological routes for water treatment and reuse. The unit is designed to be capable of moving to company facilities and to be autonomous, that is, to operate independently of the process area, minimizing costs and time for the installation of research units.

The main objective of the Mobile Unit is to research on site what are the best routes for water treatment and reuse in refineries or other facilities. Based on the obtained results, the best alternative of water reuse is indicated from the technical and economic points of view.

# COOLING WATER MONITORING MOBILE UNIT

Technician at Cenpes

It gathers, in an integrated way, the instruments that are responsible for acquisition of analytical data related to water quality monitoring in cooling systems. It was built in habitable container structure, in order to allow it to move to the operational units.

By means of automation processes, the Unit carries out real-time monitoring of control parameters and chemical dosages correction, optimizing the systems, reducing expenses with chemical products and making it possible to anticipate operational needs, avoiding negative impacts on cooling systems integrity.

This Unit operation will be fundamental for future studies aimed at evaluating the application of reuse water, from different industrial water streams, as make-up water in cooling systems.

# REUSE OF FINAL WASTEWATER IN REGAP REFINERY FOR COOLING SYSTEM

In order to reuse final wastewater from a refinery, it is necessary to reduce its salts concentration to similar levels of the replaced water content. A technological alternative is desalination, for example, by reverse osmosis or reverse electrodialysis (RED).

Within this context, in 2011, Gabriel Passos Refinery (Regap) started to operate a final wastewater reuse unit. The treated water is used in the cooling system of Refinery's coke unit. The implemented unit has a production capacity of 50 $m^3/h$ of reuse water and is composed of a physical-chemical clarification system with high rate clarifier (ACTIFLO®), sand filters, granular activated carbon filters and reverse electrodialysis.

The volume of water reused through this unit (438,000 $m^3$/year, in average) is equivalent to a six thousand inhabitants city demand. It is also noteworthy that this was the first time in the world that a refinery wastewater, treated by RED desalination process, was used as make-up water in cooling systems.

Worker at the Gabriel Passos Refinery (Regap)

# PETROBRAS SOCIOENVIRONMENTAL PROGRAM

"Seeding Sustainability" Project

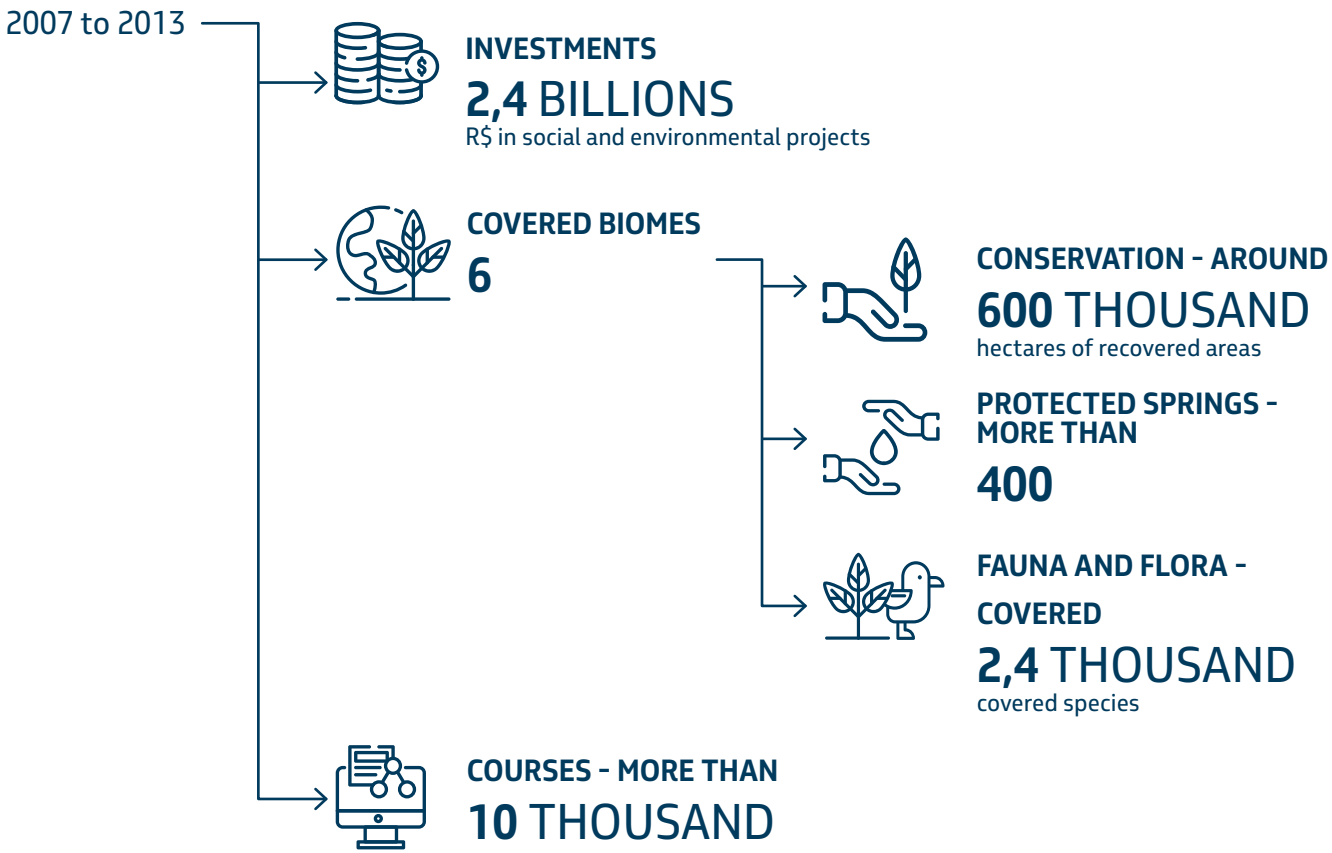
In our Social Responsibility Policy, we restate that we provide the energy that moves society to fulfill its potential, respecting human rights and the environment, maintaining responsible relationships with communities where we operate and overcoming the sustainability challenges related to our business.

We invest in social and environmental projects, contributing to the communities where we operate and, in a broader sense, to the society, in alignment with our business objectives, collaborating to environmental conservation and to improve living conditions.

Since 2003, we have implemented voluntary corporate investment programs in social and environmental projects which include the theme Water with great prominence, including activities such as degradation processes reversal and water conservation, springs and riparian forests protection, strengthening of watershed management instruments, as well as environmental awareness and education initiatives.

Our support to projects that develop sustainable management and water resources rational use was recognized by the National Water Agency (ANA, in Portuguese), which granted us the ANA Award Honorable Mention in 2006.

The results obtained from 2007 to 2013 are summarized in the diagram:



In 2013, we launched the Petrobras Socioenvironmental Program, consolidating social and environmental investments integration as a tool to expand our work with communities, third sector institutions, government and universities, contributing to the mitigation of social risks related to our business and to the local development in areas where we operate.

Petrobras Socioenvironmental Program contemplates activities in three action lines called: Water; Biodiversity; and Forest and Climate. The projects of these three themes include issues related to water, such as springs and forests protection, biodiversity and aquatic species conservation, water resources management, promotion of rational use of water, water resources quality monitoring and improvement, among others.

With activities that include the dissemination of low-cost and eco-efficient technological alternatives, the projects offer incentives and mechanisms that contribute to the achievement of water governance in territories.

See, next, the results obtained from 2014 to 2017:

2014 to 2017

**INVESTMENTS - MORE THAN**
**850** MILLION
R$ in social and environmental projects

**CONSERVATION**
**1,6** MILLION
hectares with activities of productive reconversion, recovery of degraded areas and conservation/forests management

**ENVIRONMENTAL EDUCATION**
**890** THOUSAND
people involved

**FAUNA - AROUND**
**430**
covered species

**FLORA - MORE THAN**
**1** THOUSAND
covered species

Otter Project

For the next two years, we expect to implement a voluntary social and environmental projects portfolio in 20 Brazilian states, directly benefiting more than 110 thousand people. We will focus in social initiatives related to education, sports and children's and youth's rights as well as environmental actions that will protect springs, forests and hundreds of Brazilian species, including about 50 endangered species. They will also generate scientific knowledge, relevant information and databases for environment conservation and sustainable development.

Among those projects, we highlight the ones that work with water resources management and with water security in regions that face water scarcity and stress. In the next page, get to know some of these projects:

## WATER PROJECTS

### DE OLHO NA ÁGUA

Promotes activities to improve water quality of water bodies located at the coastal plain in the municipality of Icapuí (CE), to recover ecosystems and life quality of the population. Actions are based on environmental diagnosis and monitoring, social mobilization and environmental education.

### RENASCENDO

Contributes to 'Baixo São Francisco' Watershed (AL) water sustainability, by recovery and conservation of biodiversity and dissemination of knowledge and practices, aiming to improve life conditions in the semi-arid region.

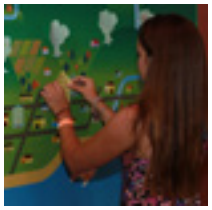
### OPARÁ – ÁGUAS DO RIO SÃO FRANCISCO

Focus in the recovery of degraded areas at Jacaré-Curituba and Bitume watershed in the Baixo São Francisco region (SE), promoting environmental education with participation of local populations and communities that live by the river ("ribeirinhos").



### SEMEANDO ÁGUA

Aims at reverting degradation processes of the water bodies in Cantareira System region (SP), through changes in land use and occupation. Strategy is based on implementing conservation practices in the productive processes, native forest recomposition and environmental education actions.



### TECENDO AS ÁGUAS

Works in the improvement of water resources quality of the Porto Novo - São Sebastião Supply System and of São Francisco System and in the conservation of Juqueriquerê River sub-basin and São Francisco River sub-basin (SP).



### TARAMANDAHY

Invests efforts to improve water resources quality of the Tramandaí Watershed (RS) by the strengthening of its management tools; the integration of water, soil and forest conservation; a regional environmental education program and technical publications.

### PLANTANDO ÁGUAS

Focus in water resources conservation by suiting environmental aspects of rural properties in the State of São Paulo, in a participatory manner.

# EXTERNAL RECOGNITION

Senado Building

A good financial performance is no longer the only criterion for valuing a company and attracting investments. Investors and analysts are increasingly aware of how companies deal with socioenvironmental issues, incorporating such criteria into investment analysis, portfolio management and decision-making.

In this context, and because of its strategic role, the theme 'water' has been constantly demanded by market analysts, who seek to know the companies' practices and performances related to water resources and wastewater, with the objective of assessing the risks that these themes can bring to image and reputation of a particular company.

As a reflection of society's demand, companies have felt the need to report the environmental impact of their actions in accordance with comparative metrics and transparent data to their stakeholders, such as the disclosure information at the Carbon Disclosure Project (CDP).

In 2017, we were recognized for the water-related program of the Carbon Disclosure Project (CDP Water), getting a score that is above the industrial sector and the energy sector averages. Such a program motivates companies to disclose and reduce their environmental impacts by using investors and costumers influence power.

Another important achievement was the score we obtained on the Dow Jones World Sustainability Index. In the Water Related Risks indicator, we scored above the average of the companies that were recognized by the index in 2017 (88, versus 87 points) and above the industry average (88, versus 34 points).

These evaluations recognitions show that we have demonstrated and proved efficient environmental management actions, as well as the existence of robust processes to identify and to mitigate water risks and strategies to capitalize water-related opportunities. These evaluations are made both in the scope of operating assets and of the company in general, which shows the comprehensiveness of our environmental and water management strategy.

" In 2017, we were recognized for the water-related program of the Carbon Disclosure Project (CDP Water), getting a score that is above the industrial sector and the energy sector averages. "


Petrobras Headquarters Building

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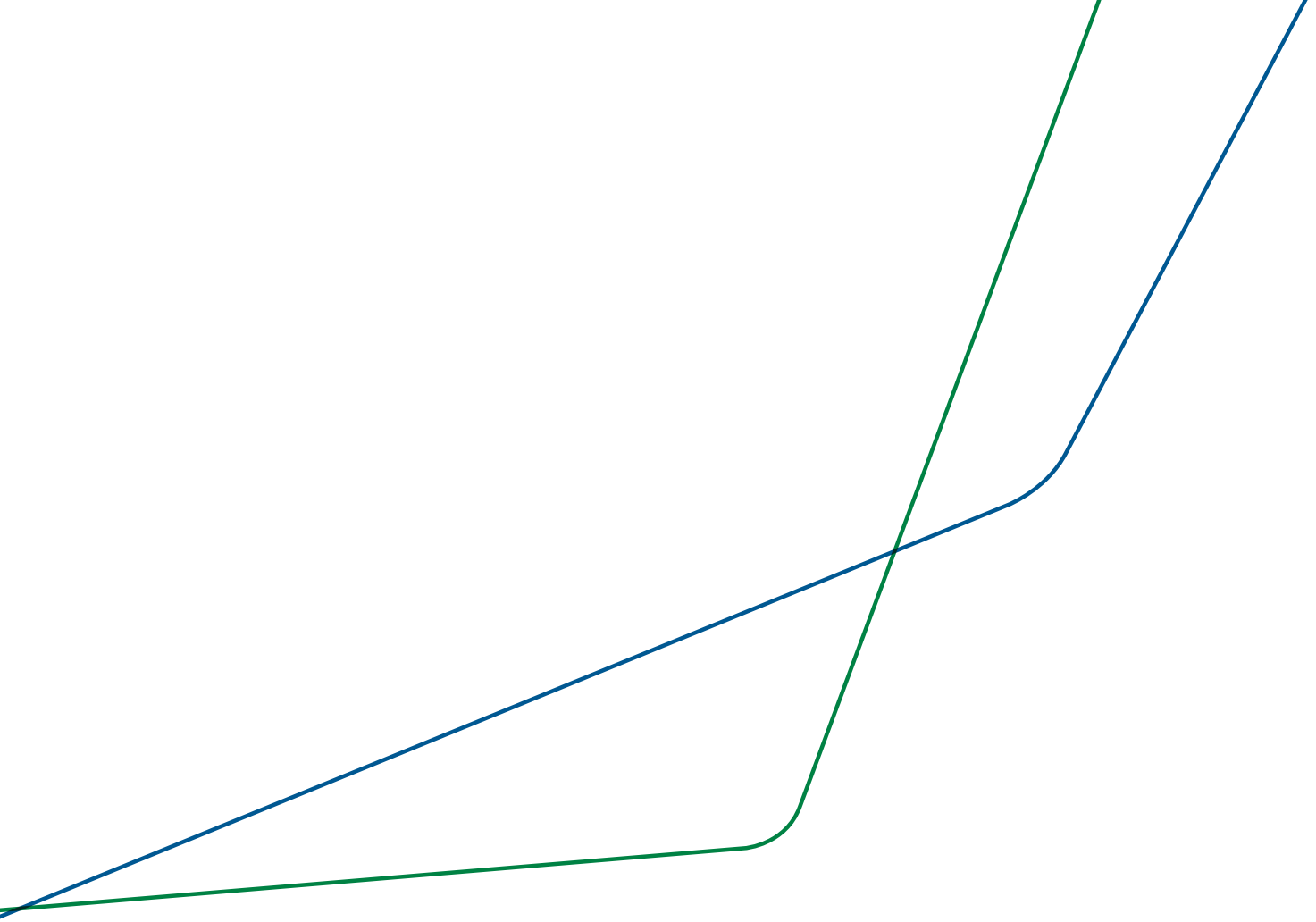

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