



WORKERS ENVIRONMENTAL EDUCATION PROJECT

**Marine Drilling Activity in Blocks
BM-ES-37, 39, 40 e 41, Bacia do Espírito Santo**



This program is a mitigation measure required by IBAMA during the Federal Environmental Licensing process.



Summary

1 – The drilling activity

- Activity Characteristics
- Region Characteristics
- Environmental Impacts
- Mitigation Measures and Environmental Programs

2 – Energy Sources

- Thermonuclear Energy
- Hydroelectric
- Wind Energy
- Solar Energy
- Biofuels

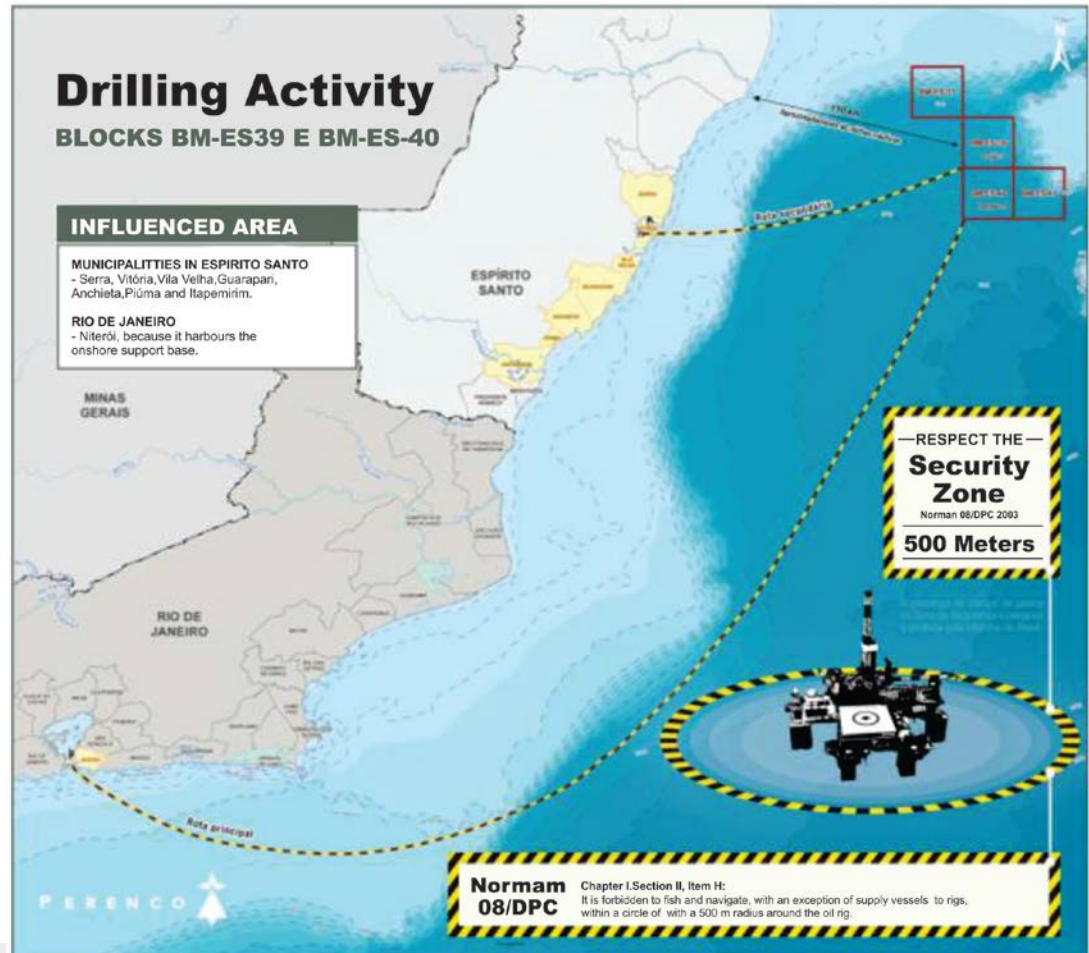


Exploratory Drilling

Two wells will be drilled:

BM-ES-39:
Caju-1 well

BM-ES-40:
Dende-1 well



The BM-ES-39 and BM-ES-40 Blocks are located at a minimum distance from the coast around 110 km



Activity Infrastructure



Ocean Star

Drilling Unit
Semi-submersible Ocean Star

Onshore Support base
Nitshore (RJ)

Air base
Vitória Airport (ES)

Dedicated Vessels
Carmen

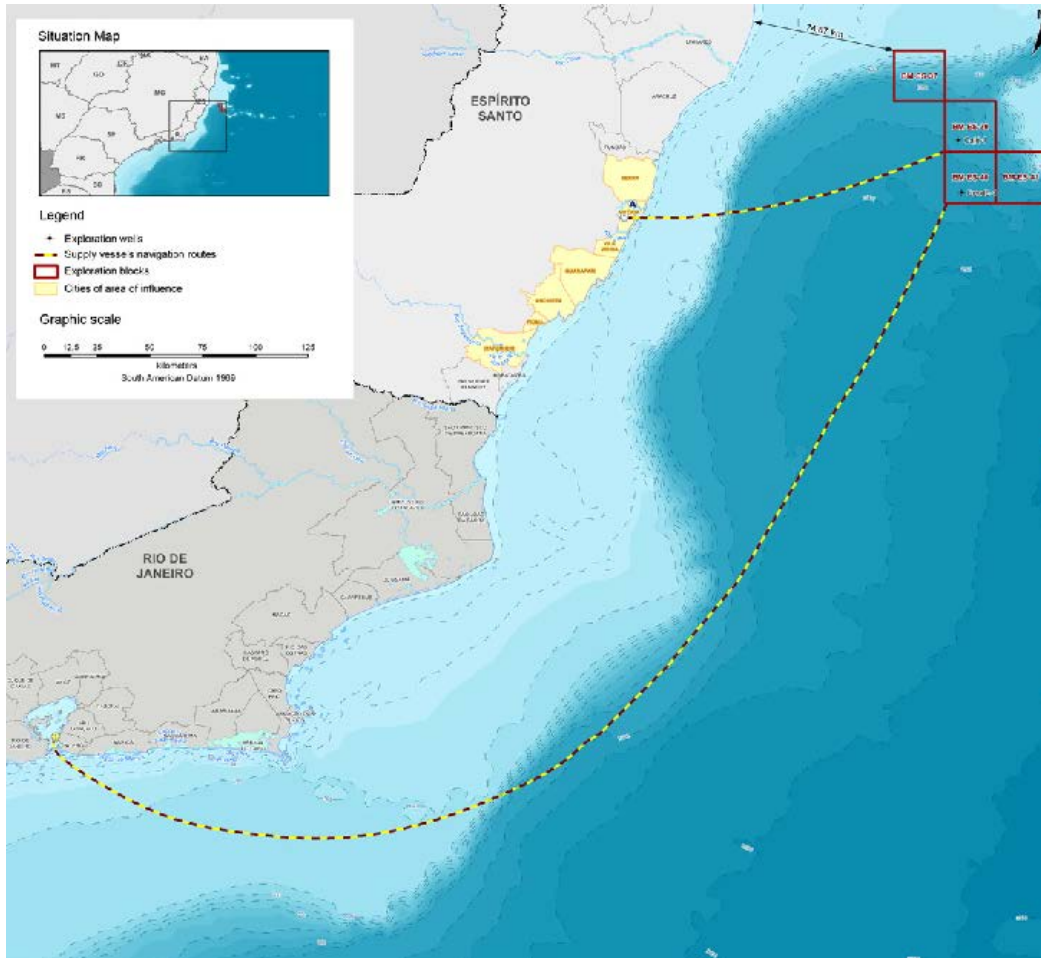
Support vessels
UOS Navigator
Far Sagaris
Chouest Bongo



Nitshore



Influenced Area



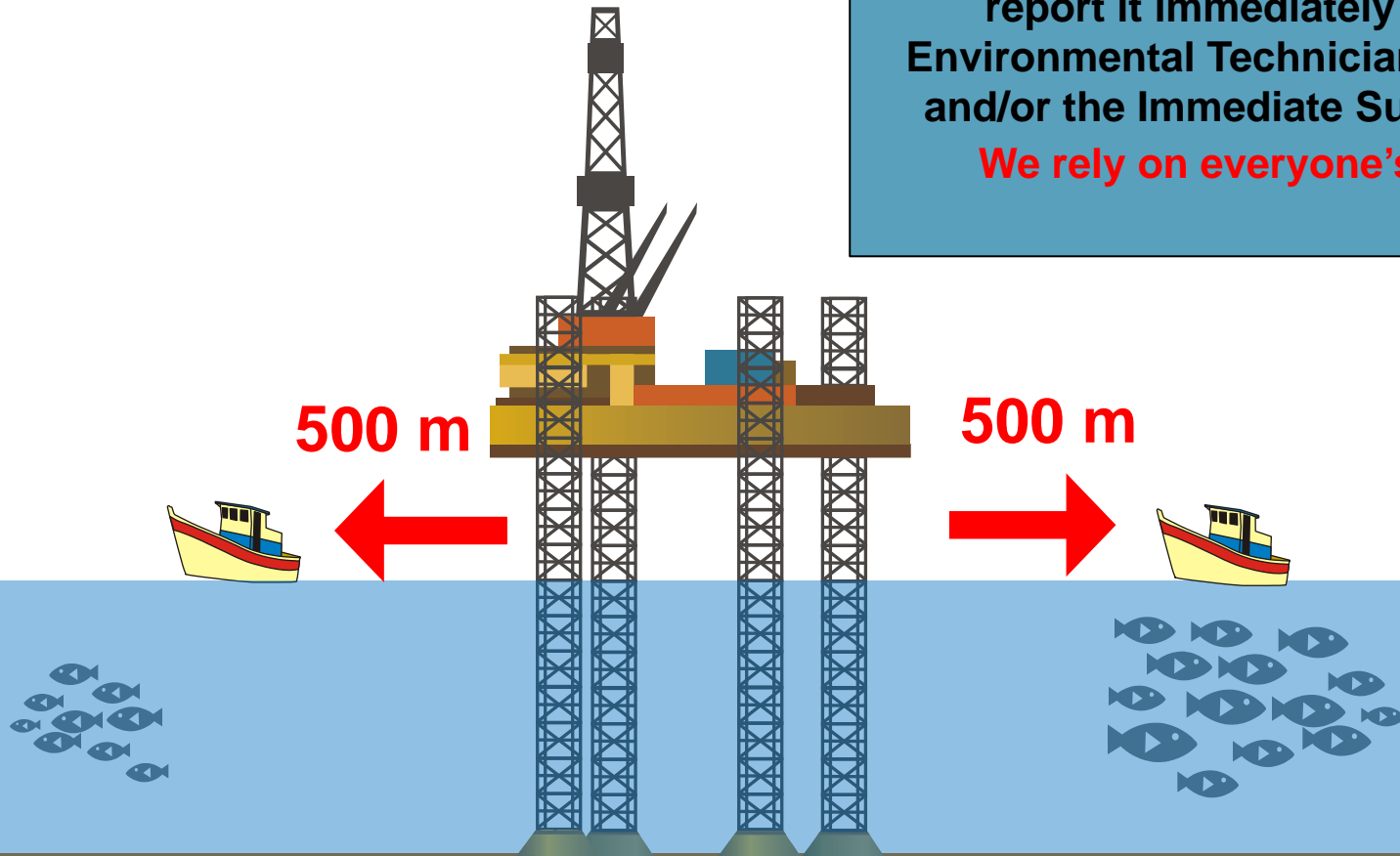
Area that may be positively or negatively affected by the activity

- ✓ Total area of the blocks;
- ✓ Vessel's route;
- ✓ The municipality of Niterói, which hosts the base of logistical support;
- ✓ The municipalities of Serra, Vitória, Vila Velha, Guarapari, Anchieta, Piúma and Itapemirim, in Espírito Santo.



Security Zone

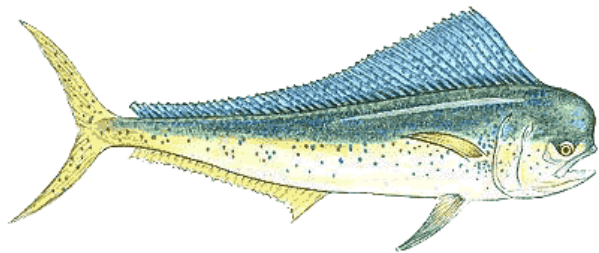
ATTENTION!
 When seeing any fishing vessel near the area of operations, please report it immediately to the Environmental Technician onboard and/or the Immediate Supervisor.
We rely on everyone's help!



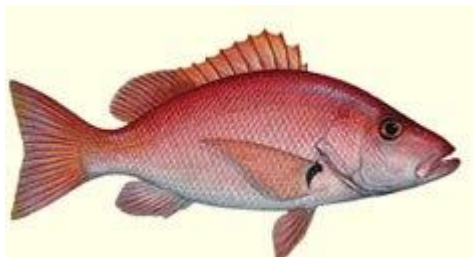
Socioeconomic Environment

Main activities developed in the Influenced Area are:
Artisanal Fishing and Industrial Fishing.

Some species of
commercial interest:



Dolphin-fish



Silk snapper



Tuna

Biological Environment

Ecosystems:

- ✓ Beaches
- ✓ *Restingas*
- ✓ Lagoons
- ✓ Mangroves
- ✓ Rocky Shores

Fauna:



Humpback Whale



Masked Booby

ATTENTION!
 When seeing an animal in the water and/or debilitated birds immediately notify the Environmental Technician!



Environmental Impacts

- ✓ **Real Impact:** All impacts related to the normal operation of the activity.
- ✓ **Potential Impact:** Impacts related to an accident or impacts of uncertain occurrence.
- ✓ **Positive Impact:** Impacts that improves the environmental quality.
- ✓ **Negative Impacts:** Impacts that worsen the environmental quality.



All impacts of the activities developed in Blocks BM-ES-39 and BM-ES-40 were identified and evaluated from the environmental characteristics of the influenced area and the drilling activity dynamics.



Real Impacts

Environmental Factor	Environmental Aspect	Impact	Mitigation Measures	Qualification
PHYSICAL ENVIRONMENT				
Bottom sediment (marine substrate)	Dispose of cuttings and drilling fluid; Positioning and deactivation of the platform.	Revolving and modification of chemical characteristics and composition of the sediment.	Control the volume of cuttings and fluids discharged. Separation of the fluid for disposal of cuttings.	Negative
Water	Dispose of cuttings and drilling fluid; Positioning and deactivation of the platform. Discharge of grinded food, deck water and treated sewage.	Changing the chemical and physical characteristics of water. Revolving of sediments and consequent water turbidity.	Control the volume of gravel and fluid discharged. Separation of the fluid for disposal of cuttings. Maintenance and monitoring of effluent treatment equipment.	Negative
Air	Combustion of fuel by power generators and diesel engines. Formation test emissions.	Emission of air pollutants.	Maintenance of power generators and diesel engines.	Negative



Environmental Factor	Environmental Aspect	Impact	Mitigation Measures	Qualification
BIOLOGICAL ENVIRONMENT				
Turtles/ Marine Mammals/ Fishes/ Plankton	Noise Production; Presence of the maritime unit; Disposal of grinded organic waste.	Disruption of organisms; attractive effect; collision with maritime units.	Guidance to workers about the presence and importance of these organisms. Monitoring the presence of animals. Grinding organic waste before disposal.	Negative
Benthos	Dispose of cuttings and drilling fluids; Positioning and deactivation of the platform.	Burial and contamination of organisms.	Testing of metal concentration and toxicity in the drilling fluid.	Negative



Environmental Factor	Environmental Aspect	Impact	Mitigation Measures	Qualification
SOCIOECONOMIC ENVIRONMENT				
Fishing	Use of maritime space.	Exclusion of fishing areas.	Dissemination of information and awareness. Project of Fishing Monitoring. Project of Environmental Education.	Negative
Trade/ Services/ Workforce	Procurement of materials, equipments, supplies and services.	Generation of specialized job, income and tax revenue.	N/A	Positive



Impactos Potenciais

Impact	Control Measures	Response Measures
SPILL OF DIESEL; CHEMICAL PRODUCTS AND CRUDE OIL		
<p>Change in water and air quality, contamination and death of marine organisms; Contamination of coasts and death of birds and animals; Changes in fishery and tourist activities.</p>	<p>Inspection and maintenance of equipments and security and emergency systems; execution of drills.</p>	<p>Activation of the Oil Spill Response Plan (OSRP)</p>



ENVIRONMENTAL PROJECTS

**Environmental
Monitoring Project**

**Pollution Control
Project**

**Environmental
Education Project**

**Social
Communication
Project**

**Environmental projects implemented
are measures of mitigation and/or
control of activity's real and potential
impacts.**

**Fishing Monitoring
Project**

**Workers Environmental
Education Project**

**Project for
Characterization of
Mesoscale Circulation**



Environmental Education Program

Promote to the artisanal fishing community located in the activity influenced area some educative and formative actions, with a participative imprint.



Social Communication Project

Establish a communication channel between Perenco and the communities of the Influenced Area, in order to clarify any questions regarding the activity, its impacts and mitigation measures.



ATTENTION!
In case of seeing any fishing vessels, immediately report it to the Environmental Technician and/or Radio Operator



Workers Environmental Education Project

Raise awareness, promote reflection, discussion and encourage the development of attitudes, interests, and abilities necessary to preserve and improve the environment in which workers are included, not only in their professional activities, but also in their day to day.



Pollution Control Project



Source: AECOM

Establish procedures for proper management of wastewater (sewage and oily water), solid waste and air pollutants in order to minimize the impact of the activity on the environment.

ATTENTION!

We count on your participation in waste segregation!













Food Grinder



Source: AECOM



Pollution Control Project

SYMBOL	COLOR	WASTE	SYMBOL	COLOR	WASTE
 PAPER/ CARDBOARD	BLUE	PAPER/CARDBOARD	 HAZARDOURS	ORANGE	HAZARDOURS
 PLASTIC	RED	PLASTIC	 NON- RECYCLABLE	GRAY	NON-RECYCLABLE
 GLASS	GREEN	GLASS	 ORGANIC	BROWN	ORGANIC
 METAL	YELLOW	METAL		WHITE	MEDICAL WASTE
 WOOD	BLACK	WOOD		PURPLE	RADIOACTIVE

Questions regarding the color code?

Look for the Environmental Technician on board.

The success of this project depends on everyone!



Project for Fishing Monitoring



Gathering information about fishing production, identifying the species caught, the fishing gear and vessels used in the Influenced Area.

ATTENTION!

The Project will monitor all vessels operating in the area within a radius of 2 km around the platform. There will be a technician on the vessel Carmen and an environmental technician aboard the platform. The communication between them is very important so the approach to fishing vessels succeeds.

Report immediately to the Environmental Technician and/or Radio Operator in case of seeing a fishing vessel.



Source: Perenco

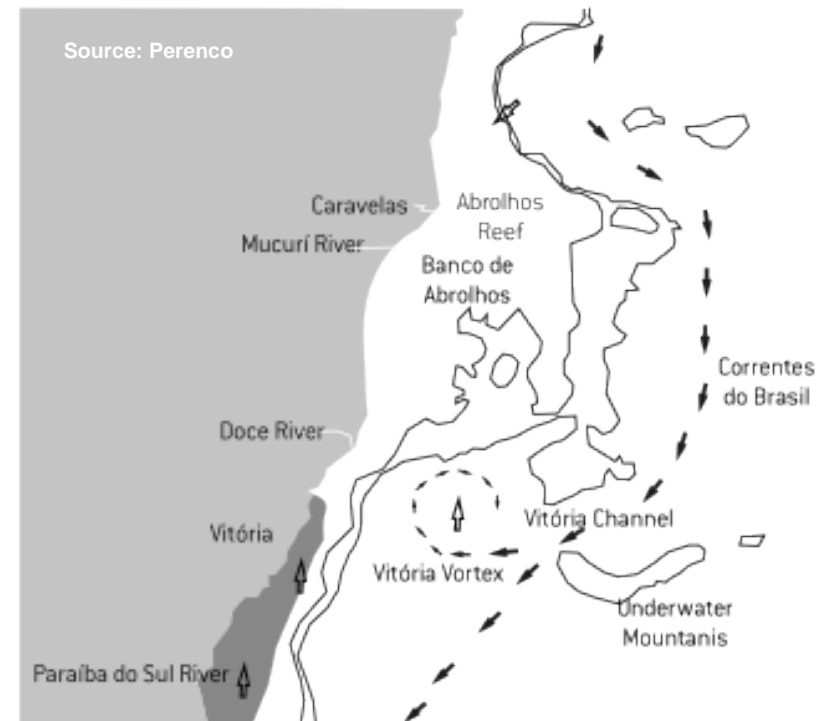


Project for Characterization of Mesoscale Circulation

Characterize the behavior of mesoscale circulation in the region Vitoria-Trindade Chain.

Did you Know?

Perenco will launch three drifters every month, during the operation, to monitor ocean currents in order to characterize the presence of the Vitória Vortex.



Environmental Monitoring Project

Continuously monitors and evaluates the physical, biological and chemical characteristics in the influenced area, allowing a better environmental management of the enterprise.



Subprojects

Sediment Quality Monitoring

Identification, Registration and Classification, by fishing gear and target species of fishing vessels that try to approach the drilling unit.

Benthic macrofauna Monitoring

Visual Inspection in the Location of the Wells

Identification and Registration of Local Marine Life

Drilling Fluids and Cuttings Monitoring

Reinforcement of Projects for Rehabilitation and Release of Seabirds



CURIOSITIES

The Subproject of Environmental Monitoring - Reinforcement of Projects for Rehabilitation and Release of Seabirds is responsible for:

- Vet assistance, rehabilitation and release of seabirds that arrive at the beaches of the influence area, specially penguins.
- Rehabilitation of injured birds in the operational area.





ENERGY SOURCES

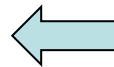


Mineral Coal



Source: www.wikipedia.com

FOSSIL FUELS
The nonrenewable



Petroleum



Source: Curso de exploração e produção de petróleo no mar. COPPE/UFRJ

Natural Gas



Source: <http://turma21112011.blogspot.com.br/2011/04/gas-natural.html>



➔ Why do we need so much power?



Did you know?



It is estimated that by 2050 the renewable sources will supply 80% of energy.
(IPCC, 2007).



Brazil is among the 10 most attractive countries for renewable energy investment.
(Ernest & Young, 2012).



 **Brazil is the tenth largest consumer of electricity.**

 **The United States, China, the European Union and India represent 60% of world electricity consumption.**

Energy Sources:

- Thermonuclear Plants
- Thermoelectric Power Plants
- Sun Plants
- Hydroelectric Plants
- Wind Power Plants



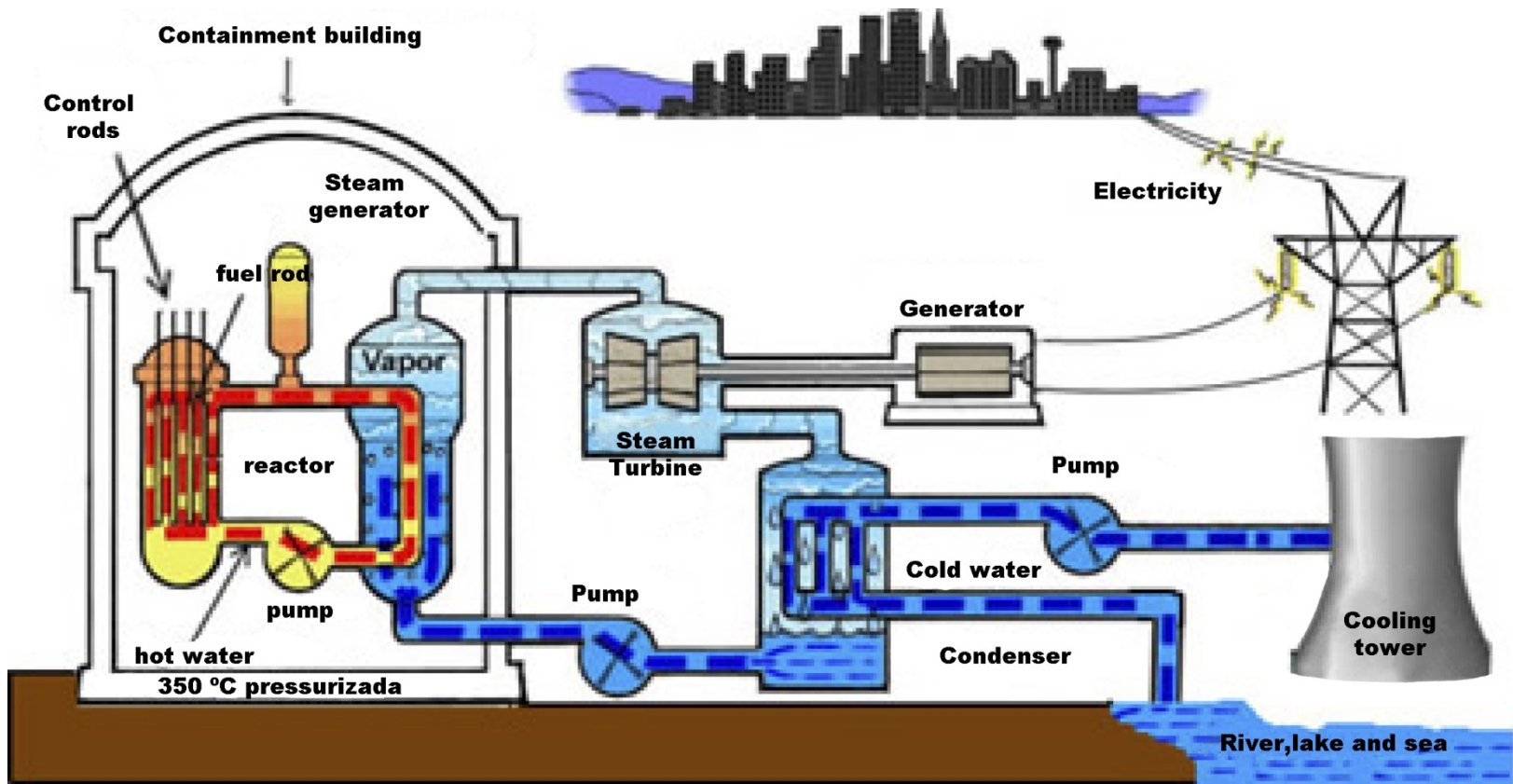


THERMONUCLEAR ENERGY

ENERGY ORIGINATED FROM THE NUCLEAR FISSION OF ATOMS OF RADIOACTIVE ELEMENTS.



The operation of the thermonuclear plants





In Brazil: Angra 1 and Angra 2 plants

In the world:



- **France is the country most dependent on nuclear energy (77% of its energy).**

Source: Exame, 20/09/2012.



- **Other producing countries: USA, Japan, Russia, South Korea, Germany, Canada, Ukraine, China, United Kingdom.**

Source: Exame, 2012.



Fukushima:

The most serious nuclear accident since the Chernobyl disaster (Ukraine) in 1986.



Thermonuclear Energy: use it or not use it?

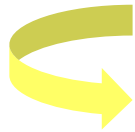
ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> ▪ Does not release greenhouse gases; ▪ Requires a small area for plant construction; ▪ Greater availability of fuel; ▪ Small risk in transportation fuel; ▪ Small amount of waste; ▪ Independence of climatic factors (wind, rain). 	<ul style="list-style-type: none"> ▪ The radioactive nuclear waste should be stored in a safe and isolated area; ▪ More expensive compared to other forms; ▪ Risk of nuclear accidents ▪ Environmental problems due to heating of aquatic ecosystems by the water cooling from the reactors.





HYDROELECTRIC

THE ENERGY PRODUCTION BY HYDROPOWER PLANTS HAS A LOW COST, BUT GENERATES MANY ENVIRONMENTAL IMPACTS.

 China has the world's largest hydroelectric plant with an installed capacity of 22,400 MW.

 In Brazil, more than 80% of electricity is generated by hydropower.

The Itaipu Dam is the largest hydroelectric power plant in Brazil.



Source: G1, 2011; Super Interessante, 2011.

Hydroelectric plants: use it or not use it?

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> ▪ Low emission of greenhouse gases; <ul style="list-style-type: none"> ▪ Low cost. 	<ul style="list-style-type: none"> ▪ Social and environmental impact of damming the river; ▪ (Limited) Dependence on climatic conditions.





WIND ENERGY

PRODUCED FROM WIND POWER - IS PLENTIFUL, RENEWABLE, CLEAN AND AVAILABLE IN MANY PLACES. THIS ENERGY IS GENERATED BY WIND TURBINES, IN WHICH THE WIND IS CAPTURED BY PROPELLERS CONNECTED TO A TURBINE THAT DRIVES AN ELECTRIC GENERATOR.



- **Wind potential evaluation:** it requires a detailed knowledge of the winds behavior (speed and intensity of the wind direction).



Varies with the relief, the rugosity of soil and other obstacles distributed throughout the region!



Off-shore



On-shore

- **Local of installation:** can be made on the mainland (*on-shore*) or at sea (*off-shore*).

- **Brazil:** has 108 wind farms, totaling 2.5 GW of installed capacity.
Greater potential: the northeast coast (144.29 TWh/year) and South (41.11 TWh/year) and Southeast (54.93 TWh/year).

According to the Brazilian Association of Wind Energy (ABE Eólica), the prospects for the end of 2017 indicates 8.7 GW of wind power in operation in the Brazilian energy matrix.

CURIOSITY!

The word eolic comes from *EOLLO*, the “God of wind” in Greek mythology.

Plants installed in Brazil: 113

Installed Capacity (mw) 2613,7

CO2 Reduction (T/year) 2.247.472,5



Source: www.abeeolica.org.br



Wind Energy: use it or not use it?

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> ▪ Does not pollute the environment; ▪ It is endless; ▪ It does not emit greenhouse gases or generate waste; ▪ Decreases the emission of greenhouse gases; ▪ Wind farms are compatible with other uses and land uses such as agriculture and livestock. 	<ul style="list-style-type: none"> ▪ Visual pollution (change of scenery); ▪ Impact on wildlife: bird migration routes; ▪ Noise is another factor that deserves to be mentioned, not only due to the disturbance that causes the inhabitants of areas where wind projects are located, as well as the local wildlife - for example, its interference in the reproductive process of the sea turtles; ▪ The impact on the soil occurs in a punctual way, in the concrete base where the turbine is installed.





SOLAR ENERGY

PRODUCED FROM SOLAR RADIATION, CAN BE USED FOR HEATING (SOLAR THERMAL) OR FOR DIRECT PRODUCTION OF ELECTRICITY (PHOTOVOLTAIC SOLAR ENERGY), ITS ENVIRONMENTAL IMPACTS ARE REDUCED, BUT THE COSTS ARE HIGH.





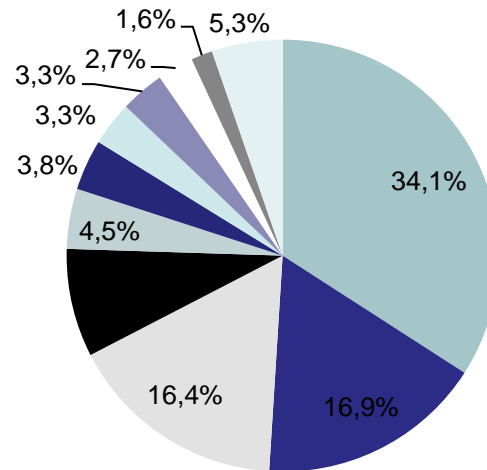
Fonte: www.envolverde.com.br

The largest solar power plant in Brazil was inaugurated in 2012 in the city of Campinas.

Tanquinhos Central will be able to supply 657 households monthly.

Source: G1, 27/09/2012.

Global production of solar energy

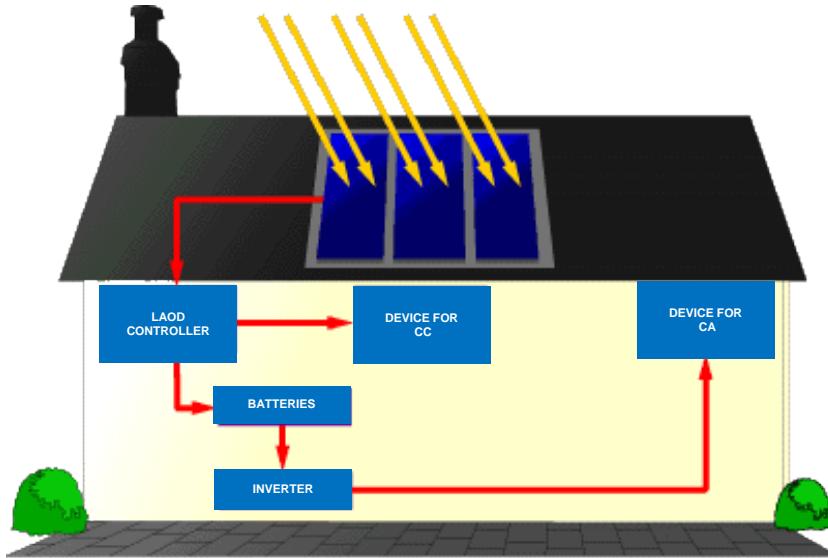


Germany Italy Spain Japan China Czech republic France EUA Belgium South Korea Other Countries

Source: Exame, 28/11/2012.

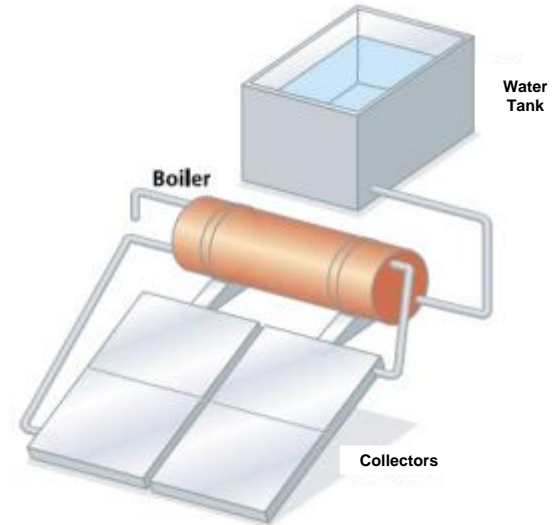


The use of solar energy in residences



Adapted by: www.howstuffworks.com

Fueling a house with solar energy



Heating water system

Solar energy: use it or not use it?

ADVANTAGES

- Low environmental impact

DISADVANTAGES

- High cost;
- Low productivity.





BIOFUELS

RENEWABLE ENERGY SOURCES DERIVED FROM PLANT AND ANIMAL PRODUCTS



Biofuels

Primary Source (natural resources)

Sugar cane, beet sugar, palm oil, sunflower seed, castor beans, corn, cassava, soybeans, wood, forest residues, animal excrement, etc.



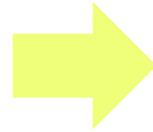
Source: www.agricultura.gov.br



Source: www.cpt.com.br



Source: www.seag.es.gov.br



Secondary Source
Respective vegetable oils

PROCESSING



Result in an oil which can be mixed with petroleum (gasoline, diesel, etc.) or pure.

Major biofuels: ethanol, biodiesel, biogas, vegetable oil, bio-kerosene ...



USE



Brazil is the largest producer of ethanol.

It is the country that has the greatest technological development in the production and use of ethanol, followed by the U.S.

Biodiesel is produced on a commercial scale in Brazil and other countries such as Argentina, USA, Malaysia, Germany, France and Italy.

The World Cup 2014 delegation bus will possibly use Biofuel produced in Brazil.



Source: G1, 2011; Biodiesel.br, 2013.



Energy from sewage: Video

