



International Atomic
Energy Agency
(IAEA)

South African Nuclear
Energy Corporation
(NECSA)

REGIONAL PRACTICAL WORKSHOP ON THE DECOMMISSIONING OF RADIOACTIVELY CONTAMINATED FACILITIES

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Decommissioning Activities at IPEN/CNEN-SP Brazil

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Federative Republic of Brazil



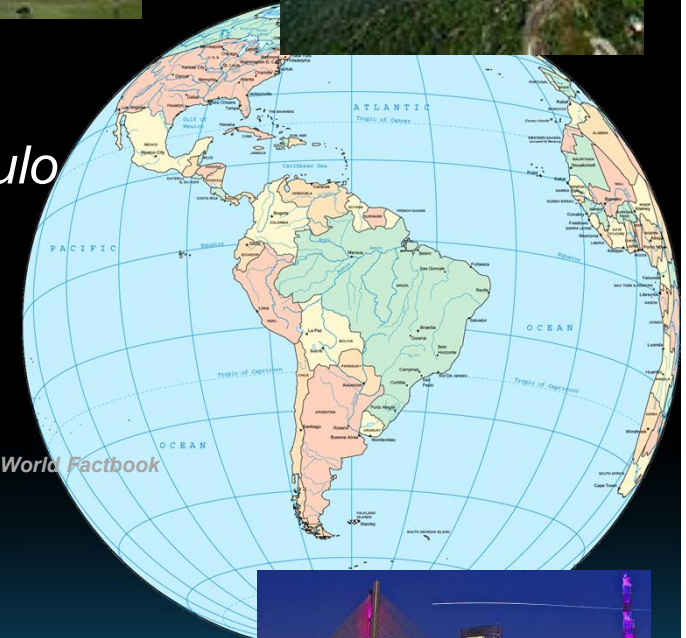
- " 26 states and a Federal District
- " Capital: *Brasília*
- " Most known and beautiful city: *Rio de Janeiro*
- " Biggest city, industrial/economic center: *São Paulo*
- " Population: over 190 million inhabitants (5°)
- " Area: 8.514.876 km² (5°)
- " GDP - Gross Domestic Product (2010) Source: FMI, World Bank, CIA World Factbook

US\$ 2,090 billion (7°)

US\$ 10,816 (63°)

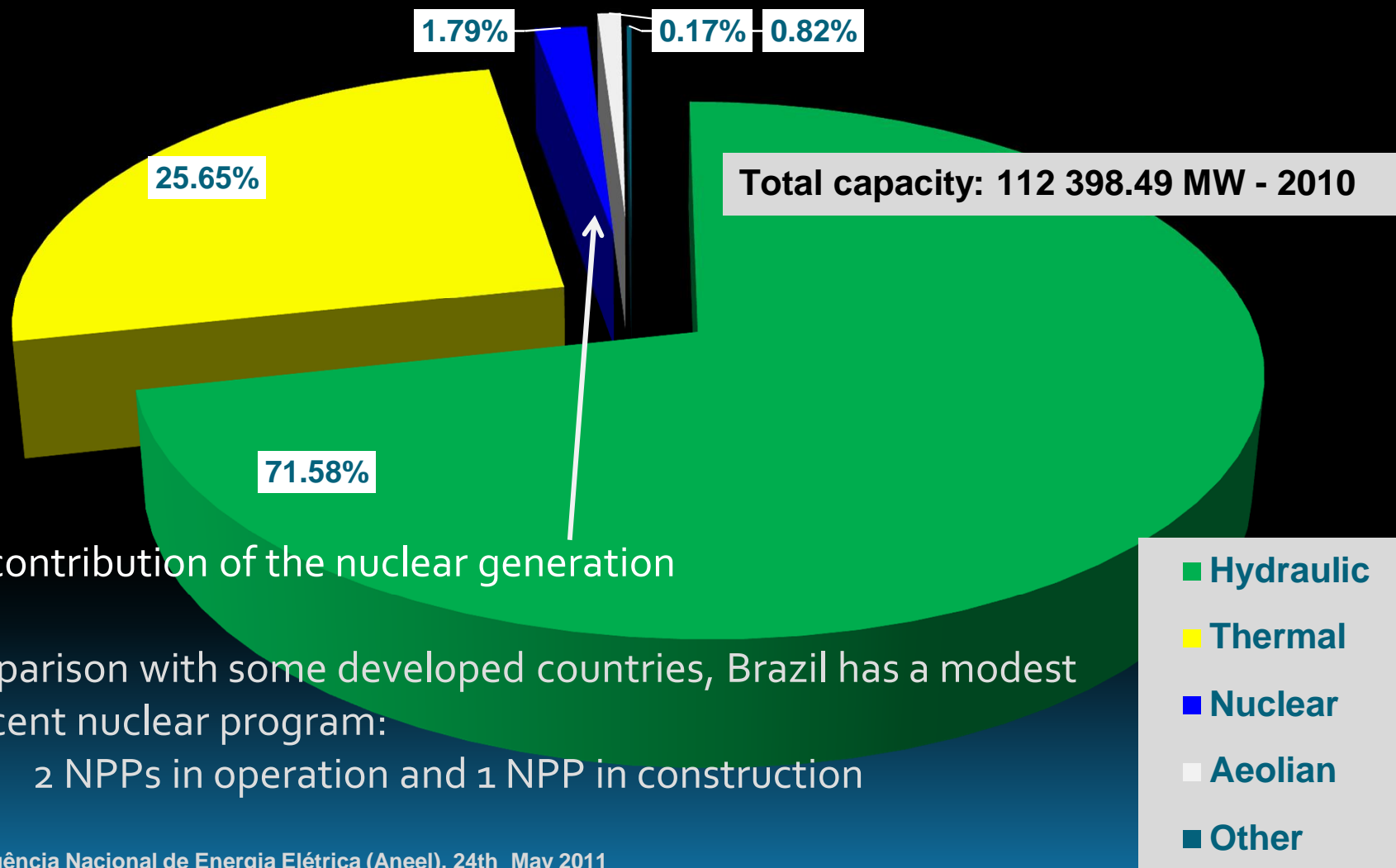
- " Electric Sector

Installed Electricity Generation Capacity: ~112.4 GW (2010)



Brazilian Installed Electricity Generation Capacity

per source (%)



Source: Agência Nacional de Energia Elétrica (Aneel), 24th May 2011

MAIN BRAZILIAN NUCLEAR FACILITIES



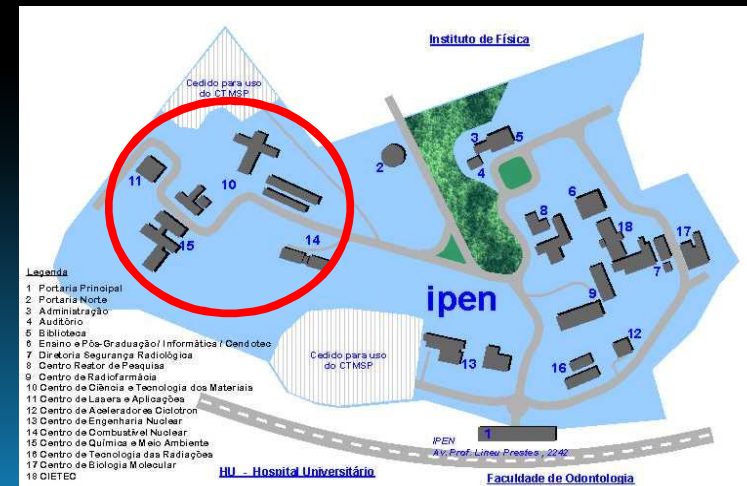
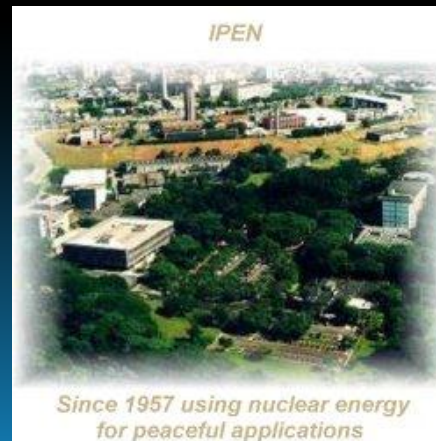
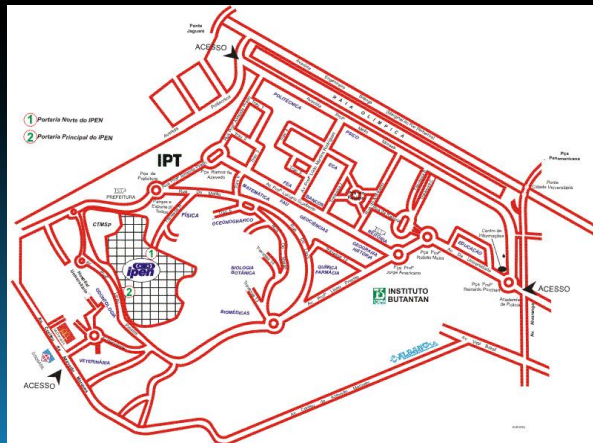
Current Status of Nuclear and Decommissioning Activities

- Brazilian Constitution states: *Federal Government* has the exclusive competence for all nuclear energy activities
- *Nuclear Energy National Commission – CNEN* - is the Regulatory Body in charge of regulating, licensing and controlling nuclear energy utilization, besides research and development, radioisotopes production and radioactive waste disposal
- Brazil has presently:
 - 15 nuclear facilities (power and research reactors, U mining, U enrichment, UO₂ pellets plant, fuel assembling, nuclear materials storage)
 - > 3000 radioactive facilities (medical, industrial, research, radioactive waste storage)
- Decommissioning Activities Accomplished
 - USAM (1993–98): Santo Amaro Plant of INB for rare earths processing from monazite sands
 - Nuclear Fuel Cycle Pilot Plants – IPEN (2000-06): Isotopic Charact. Lab.; UF₄/ Aqueous Route PP; Thorium Sulfate PP; U Dissolution and Purification PP; UF₆ Conversion PP; UO₂ PP.
- Near Future Decommissioning Activities
 - “ Nuclear Fuel Cycle Pilot Plants – IPEN: ADU Precipitation PP; Calcination of ADU to UO₃ PP; Fluidized Bed Denitration (NUH to UO₃); UF₄ Production - Moving Bed Units I and II; Thorium Sulfate Dissolution and Thorium Nitrate Purification; Reprocessing Laboratory.
 - “ Uranium mines: Buena/RJ

Nuclear and Energetic Research Institute - IPEN

- “ Is an institution owned by the Government of Sao Paulo State
- “ Is supported and operated technical and administratively by the Brazilian Nuclear Commission . CNEN (it is the biggest of the CNEN's Institutes)
- “ Is associated to the University of Sao Paulo for postgraduate courses
- “ It was created in 1956 with the main purpose of performing research and development of nuclear energy peaceful applications

IPEN is located in Sao Paulo City at the Campus of Sao Paulo University in an area of nearly 500,000 square meters



Dr. Paulo Lainetti
IPEN/CNEN-SP
August 2011



Pilot Plants Already Decommissioned at IPEN

“ Most Brazilian nuclear fuel cycle R&D activities were accomplished at IPEN, in laboratory and pilot plant scale

“ Most facilities were built in the 70's and 80's years

“ Beginning of 90s . **radical changes of the Brazilian nuclear policy** ⇒

Interruption of most R&D fuel cycle activities and shutdown of facilities at

IPEN

“ Old facilities and occupied area constitute a valuable resource: after decommissioning, buildings have been used for other governmental strategic programmes: fuel cells, Lasers, polymers, biomaterials, environment, nanotechnology.

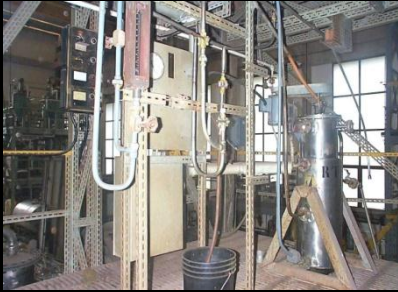
Dismantling of the U Purification Pilot Plant - IPEN



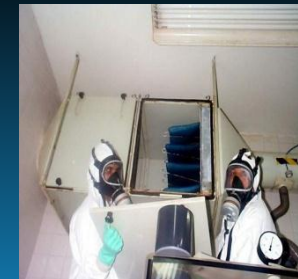
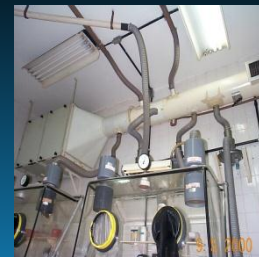
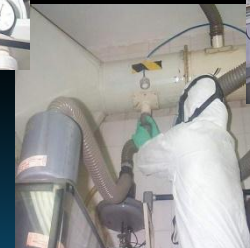
Dismantling of the U Purification Pilot Plant - IPEN



Decommissioning of Thorium Sulfate Dissolution and UF₄ Aqueous Route Pilot Plants



Decommissioning of the Isotopic Characterization Laboratory



UF₆ Pilot Plant Dismantling Operations



Decommissioning of the UO₂ Fuel Pellets Pilot Plant



Conditioning and Decontamination of Radioactive Wastes



Future Decommissioning Activities

Pilot plants

- “ ADU Precipitation
- “ Calcination to UO_3
- “ Denitration - Fluidized Bed (NUH to UO_3)
- “ UF_4 production - Moving Bed - Units I and II
- “ Thorium Nitrate Purification
- “ Reprocessing Laboratory



Present Decommissioning Projects at IPEN

- Design of the Brazilian Multipurpose Reactor:
Subsystem 19300 – Decommissioning
- Person in charge: P. Lainetti

Objectives:

- Licensing requirements
- Use of international experience and lessons learned to give recommendations aiming to facilitate the reactor decommissioning in the future

Decommissioning of Nuclear Facilities in Brazil . Main Challenges

- In comparison with some developed countries, Brazil has a modest and recent nuclear program (2 NPPs, < 2% of the generation capacity = 112 GW, 4 RRs)
- Reduced dimensions of the nuclear market and lack shutdown of facilities projects \Rightarrow *there are not companies specialized in decommissioning*
- Indefinition of the Nuclear Program for a long period (~20 years)
- Lack of a specific Norm related to decommissioning (under preparation, now)
- Political hesitation about the D&D decision and priorities
- There is limited expertise in this field in the country
- Personnel retirement or dispersion (public servants – most nuclear activities)
- Exhausted capacity of radioactive waste storage in IPEN
- Lack of decontamination / treatment techniques suitable for Medium and Low Level Waste volume reduction, considering the amount generated in the dismantlement operations
- Usual lack of resources

Thank all of you, for your attention!