International Nuclear Atlantic Conference – INAC 2013
24 - 29 December, 2013, Recife, PE

Round table ENFIR/ENIN: New Technologies for Nuclear Generation

On Brazil's Participation in INPRO Collaborative Projects

by

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Ministério da Ciência, Tecnologia e Inovação
GOVERNO FEDERAL BRASIL PAÍS RICO É PAÍS SEM POBREZA

Outline of Presentation

ABOUT INPRO – International Project on Innovative Nuclear Reactors and Fuel Cycles

BRAZIL's participation in the period 2002 – 2013

PERSPECTIVES AHEAD: Action Plan 2014 – 2015

- **International Collaborative Projects – CP**
- **Dialogue Forums – DF**

Establishment and Membership

LAUNCHING

- **Initiated in May 2001 - 44th IAEA General Conference (2000)**
- **Authorised by IAEA General Conference Resolutions**

MEMBERSHIP (by 2013)

- **39 IAEA Member States plus the European Community**
  - **Cost-free experts**
  - **Funds (extra-budgetary cash)**
  - **In-kind working packages**
  - **INTERNATIONAL COLLABORATIVE PROJECTS (CP)**

Establishment and Membership

INPRO Objectives

OBJECTIVES

- **To help ensure that nuclear energy is available to contribute in a sustainable manner to meeting energy needs in the 21st century**

- **To bring together technology holders & technology users to consider jointly the actions required to achieve desired innovations in nuclear reactors and fuel cycles**

- **To support strategic and long range planning, and decision making in the field of nuclear energy**

INPRO Missions

MISSIONS

- **To provide a forum for discussion on all aspects of NE planning as well as on the development and deployment of innovative NE systems (INS) in the 21st century**

- **To develop a methodology to analyse INS on a global, regional and national scale in order to arrive at a judgement of its sustainability**

- **To facilitate coordination & collaboration among member states for the planning of INS development & deployment**

INPRO Missions

FUNDAMENTAL CONCEPTS WITHIN THE MISSIONS

- **INNOVATIVE NUCLEAR ENERGY SYSTEMS (INS)**
- **INPRO METHODOLOGY**
- **INPRO DIALOGUE FORUM**

Innovative Nuclear Energy System (INS)

INS INCLUDES

All components (or facilities) of the nuclear fuel cycle (no matter where they are located)

Innovative (Gen. IV) and evolutionary (Gen. III & III^{+}) designs of all reactor types and nuclear fuel cycle facilities

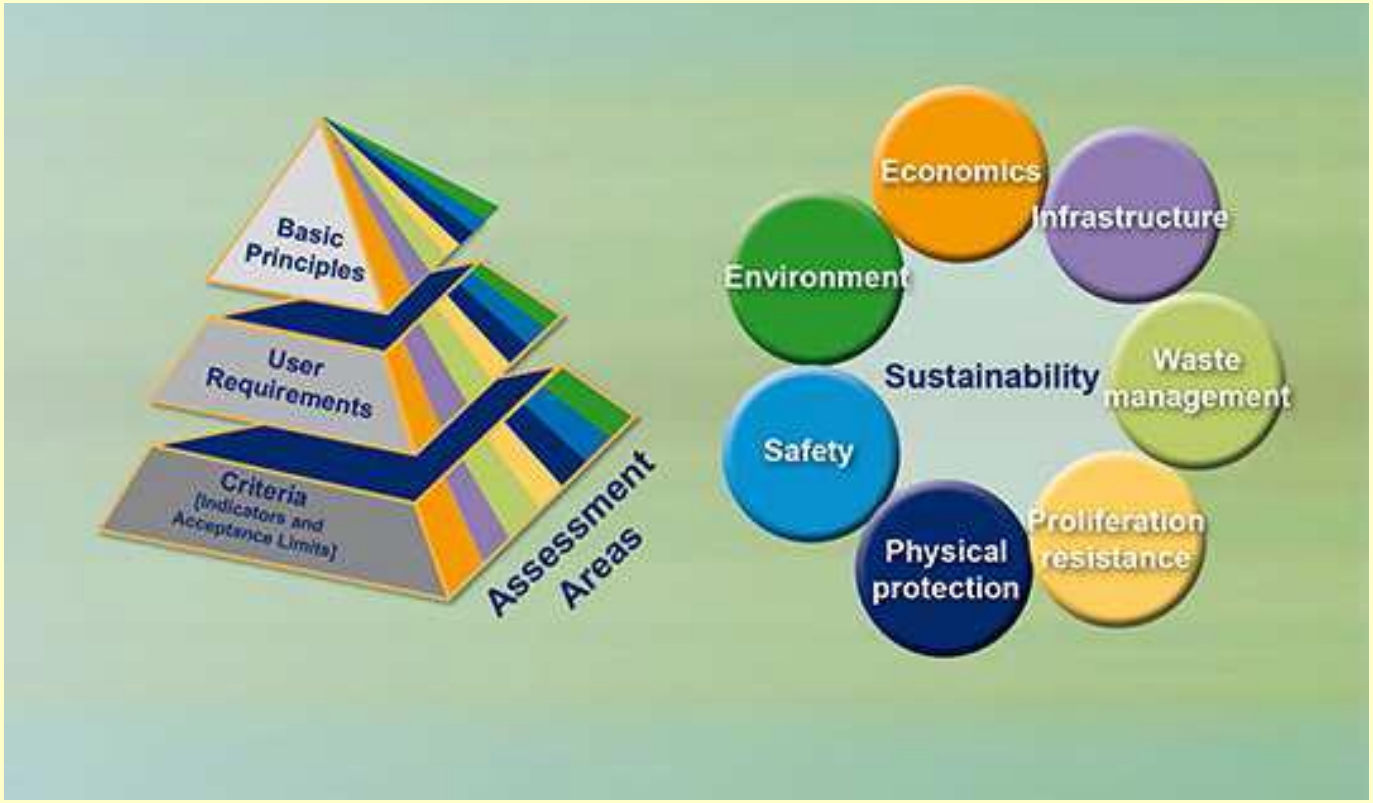
All phases of the nuclear project *(from cradle to crave)*

All infrastructure and institutional measures

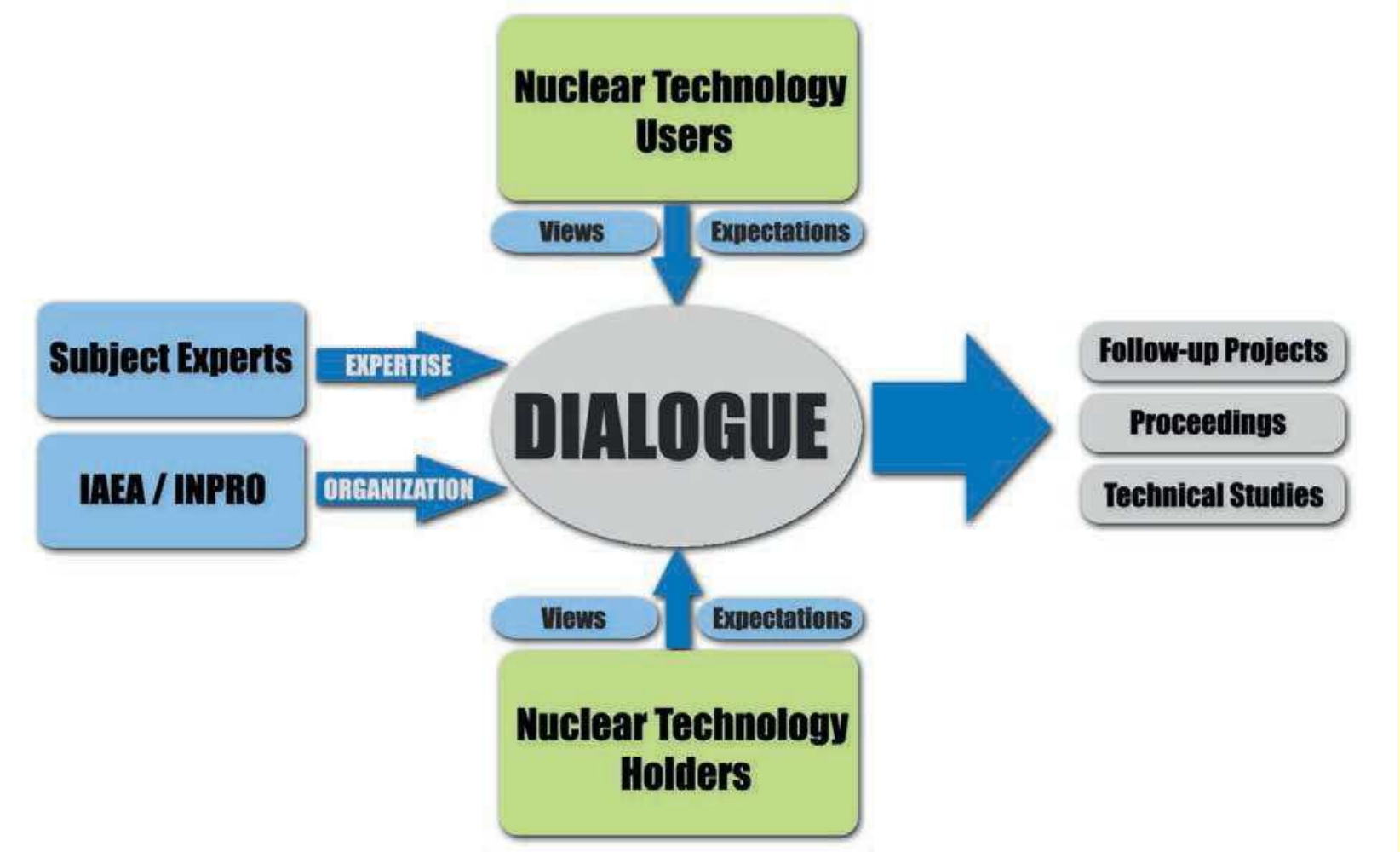
INPRO Assessment Methodology (2006)

SET of Basic Principles, User requirements and Criteria

Holistic approach to assess INS in 7 areas to assure its sustainability



INPRO Dialogue Forum (2010 - …)



INPRO Activities

ESTABLISHMENT of INPRO's ACTIVITIES - ACTION PLANS

Guidance from IAEA General Conference Resolutions

Guidance from the INPRO Steering Committee

Aligned with IAEA's Programme & Budget

ACTION PLANS: FOUR TASKS

- **TASK 1: GLOBAL SCENARIOS**

Develops global and regional nuclear energy scenarios, on the basis of a scientific-technical analysis, that lead to a global vision of sustainable nuclear energy development in the 21st century.

INPRO Activities

- **TASK 2: INNOVATIONS**

Investigates innovations in selected NE technologies, related R&D and innovative institutional arrangements to be deployed in the 21st century, supporting Member States pursuing those innovations.

- **TASK 3: SUSTAINABILITY ASSESSMENT & STRATEGIES**

Assist Member States in developing national long-range sustainable NE strategies and related deployment decision making through application of INPRO Methodology.

INPRO Activities

- **TASK 4: POLICY and DIALOGUE**

Provides an international venue for Member States' guidance, policy coordination and coordination with other international organizations and initiatives *(POLICY)*,

bringing together technology holders and users to share information on long-range nuclear energy system strategies, global nuclear energy scenarios and related technical and institutional innovations *(DIALOGUE FORUM)*.

Brazil's Contributions

PERIOD 2002 - 2013

1 Cost free expert (2002, for 3 months)

1 National Assessment Study on two small sized reactors for electricity generation in Brazil (2006 – 2008)

2 Collaborative Projects: ENV and COOL (2009 – 2011)

5 Dialogue Forums on NE Innovations (2010 – 2013)

18 Steering Committee Meetings (2002 – 2013)

Brazil's Contributions

NATIONAL ASSESSMENT STUDY ON TWO SMALL SIZED REACTORS FOR ELECTRICITY GENERATION IN BRAZIL (2006 – 2008)

IRIS – International Reactor Innovative and Secure

INPRO areas of Safety and Economics

Participants from CDTN (5), IPEN (2) and IEN (1)

FBNR – Fixed Bed Nuclear Reactor

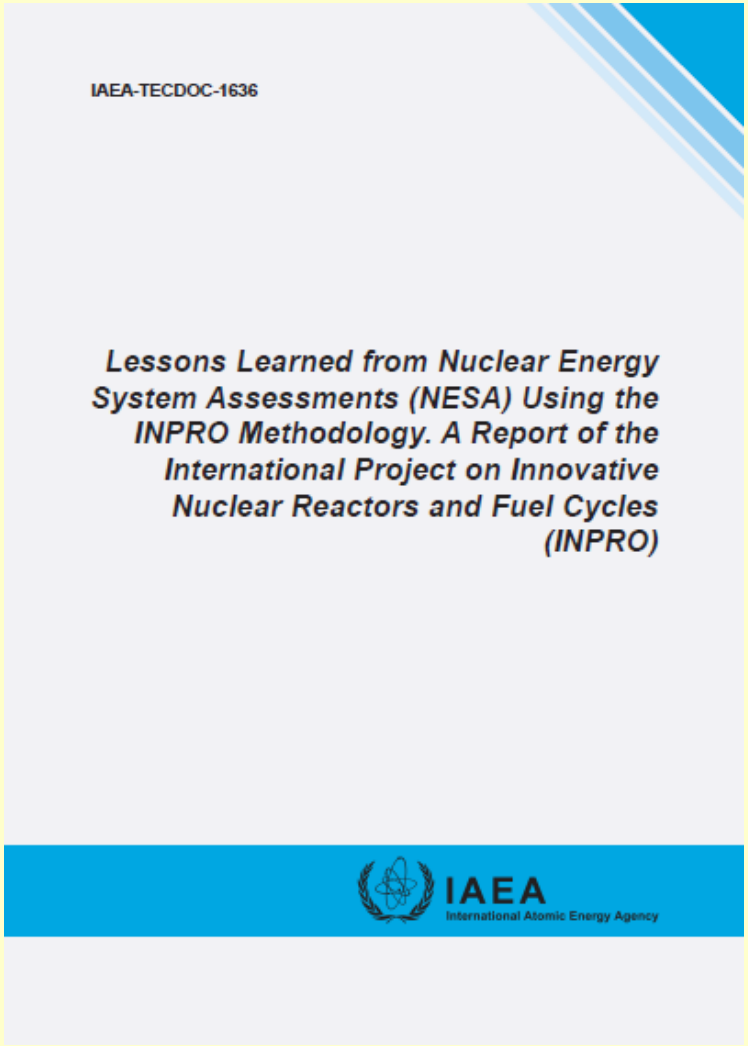
INPRO areas of Safety and Proliferation Resistance

Participants from the Federal University of Rio Grande do Sul

Brazil's Contributions

National Assessment Study on Two Small Sized Reactors for Electricity Generation in Brazil (2006 – 2008)

Summary of the study reported in IAEA-TECDOC-1636 (2009) together with summaries of the national assessment studies of Argentina, Armenia, India, Republic of Korea and Ukraine.



Brazil's Contributions

INTERNATIONAL COLLABORATIVE PROJECTS

CP ENV – *ENVIRONMENTAL impact benchmarking applicable for NE systems under normal operation* (2009 – 2011)

One participant from IPEN (CNEN/SP)

Completed in 2012 (report ready for publication)

CP COOL – *Investigation of technological challenges related to the removal of heat by liquid metal and molten salt COOLANTS from reactor cores operating at high temperature* (2009 – 2011)

One participant from the IEN (CNEN/RJ)

Publication: IAEA/TECDOC- 1696 (2013)

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 (*approved in November, 2013)*

TASK 1 : GLOBAL SCENARIOS (3 Collaborative Projects)

CP ROADMAPS – *Roadmaps for a Transition to Globally Sustainable Nuclear Energy Systems*

Develop a structured approach for achieving a globally structured approach, providing models of cooperation among countries and providing a template for documenting actions, scope of the work, and timeframes for specific collaborative efforts by particular stakeholders.

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 ***(cont'd)***

TASK 1 : GLOBAL SCENARIOS (3 Collaborative Projects)

CP SYNERGIES – ***Synergetic Nuclear Energy Regional Group Interactions Evaluated for Sustainability***

Examines drivers and impediments on a collaborative way to sustainable nuclear energy system. The focus is on short-term and medium term collaborative actions capable to develop pathways to long term sustainability.

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 ***(cont'd)***

TASK 1 : GLOBAL SCENARIOS (3 Collaborative Projects)

CP KIND – ***Key Indicators for Innovative Nuclear Energy Systems Assessments***

Develop guidance on the evaluation of substantial improvements/risks in NE system performance potentially achievable with innovative nuclear technologies. For this uses an approach based on the selection of a limited number of Key indicators in the 7 INPRO areas will be exploited.

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 (*cont'd*)

TASK 2 : INNOVATIONS (3 Collaborative Projects)

CP RISC – *Review of Innovative Reactor Concepts for Prevention of Severe Accidents and Mitigation of their Consequences*

Review of advanced reactor concepts with a focus on technologies that claim to satisfy INPRO requirement that a major release of radioactivity from an installation of a future NE systems (NES) should be prevented so that these installations would need NOT relocation or evacuation measures outside the plant site, except those required for any other industrial facility of similar purpose.

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 (*cont'd*)

TASK 2 : INNOVATIONS (3 Collaborative Projects)

CP FANES – *Nuclear Fuel and Fuel Cycle Analysis for Future Nuclear Energy Systems*

Carry out feasibility analyses of advanced and innovative fuels for different reactor systems and its influences on the development of future nuclear energy systems.

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 (*cont'd*)

TASK 2 : INNOVATIONS (3 Collaborative Projects)

CP WIRAF – *Waste from Innovative Types of Reactors and Fuel Cycles*

Will take the first steps on the road toward considering the back end fuel cycle and waste generation early in the development of new reactors and their associated fuel cycles (e.g. identifying any problematic waste from innovative reactor designs and corresponding fuel cycle which could influence development and deployment of future NES).

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 (*cont'd)*

TASK 3: SUSTAINABILITY ASSESSMENT & STRATEGY (2 Collaborative Projects)

CP PROSA – ***Proliferation Resistance and Safeguardability Assessment (Continuation of CP PRADA)***

CP ENV-PE – ***Environmental Impact of Potential Accidental Releases from Nuclear Energy Systems (Continuation of CP ENV)***

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 (***cont'd***)

TASK 4 : POLICY AND DIALOGUE

- **8th Dialogue Forum (26 – 29 August 2014, IAEA, Vienna):**

  Updating the INPRO Methodology for sustainability assessment of nuclear energy system

9th Dialogue Forum (18 – 21 November 2014, IAEA, Vienna):

International collaboration on innovations to support globally sustainable nuclear energy systems

Perspectives Ahead

INPRO ACTION PLAN 2014 – 2015 (*cont'd*)

BRAZIL'S INITIAL COMMITMENTS

TASK 2 : INNOVATIONS

CP RISC – *Review of Innovative Reactor Concepts for Prevention of Severe Accidents and Mitigation of their Consequences*

(through the INCT on Innovative Nuclear Reactor – to be confirmed)

TASK 4: POLICY AND DIALOGUE

Steering Committee Meetings and Dialogue Forums

Perspectives Ahead

List of Brazilian participant institutions in INPRO

CNEN – ***DPD Research Institutes (CDTN, IEN e IPEN)***

UFRGS – ***project FBNR***

ELETRONUCLEAR – ***Dialogue Forum***

INCT on INNOVATIVE NUCLEAR REACTORS – ***CP RISC***

(to be confirmed)

Thank you for your attention

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