

International Developments towards Sustainable Nuclear Fission

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IAEA

International Atomic Energy Agency

Current developments

- Increasing use of nuclear energy expected
 - IAEA projections 2008; increase +27 to +100 % in 2030
- Increasing number of countries with nuclear
 - More than 50 MS expressed interest to study nuclear
 - 12 MS in relatively advanced stage of planning
- Expectations of broader applications of nuclear power
 - Desalination, hydrogen, chemical energy production
- Increasing interest in recycling and advanced reactors
- But increasing concerns about proliferation
- Slow development on waste disposal

IAEA's role

- 1) To ensure **protection**: that, wherever nuclear energy is used to produce energy , it is used:
 - Safely, Securely, and
 - With minimal proliferation risk.
- 2) To ensure continued **technological innovation** to improve its attributes in safety, security, economics, proliferation-resistance, environment and waste
- 3) To ensure that the needs of **developing countries** are taken into account:

Challenges of sustainable expansion

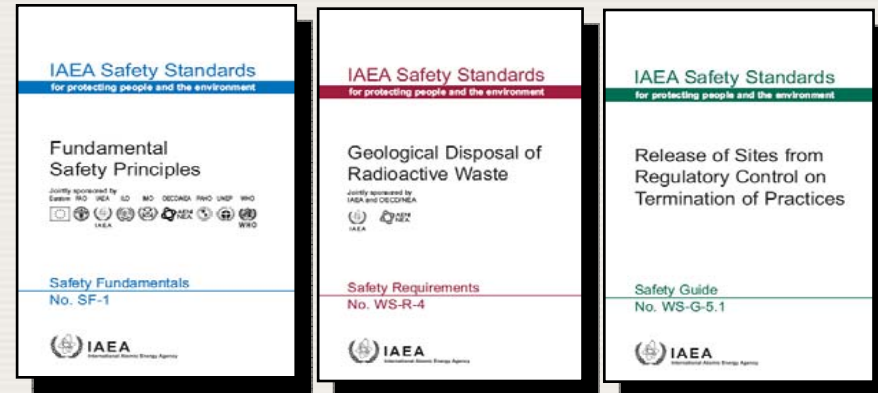
1. Safety and reliability
2. Economic competitiveness and financing
3. Uranium resources
4. Fuel and waste management
5. Human and industrial resources
6. Proliferation risk and security
7. Infrastructures, especially in new countries
8. Public acceptance

The Nuclear Safety Regime



The Safety Convention

International Safety Standards



National Policy and Strategy



National Regulatory Control



Peer reviews

IAEA Safety / Security Review Services

Regulatory Framework and Activities

- **IRRS** – Integrated Regulatory Review Service

Operational Safety

- **OSART** – Operational Safety Review Team
- **SEDO** – Safety Evaluation of FC Facilities During Operation
- **SCART** – Safety Culture Assessment Review Team

Research Reactors

- **INSARR** – Integrated Safety Assessment of Research Reactors

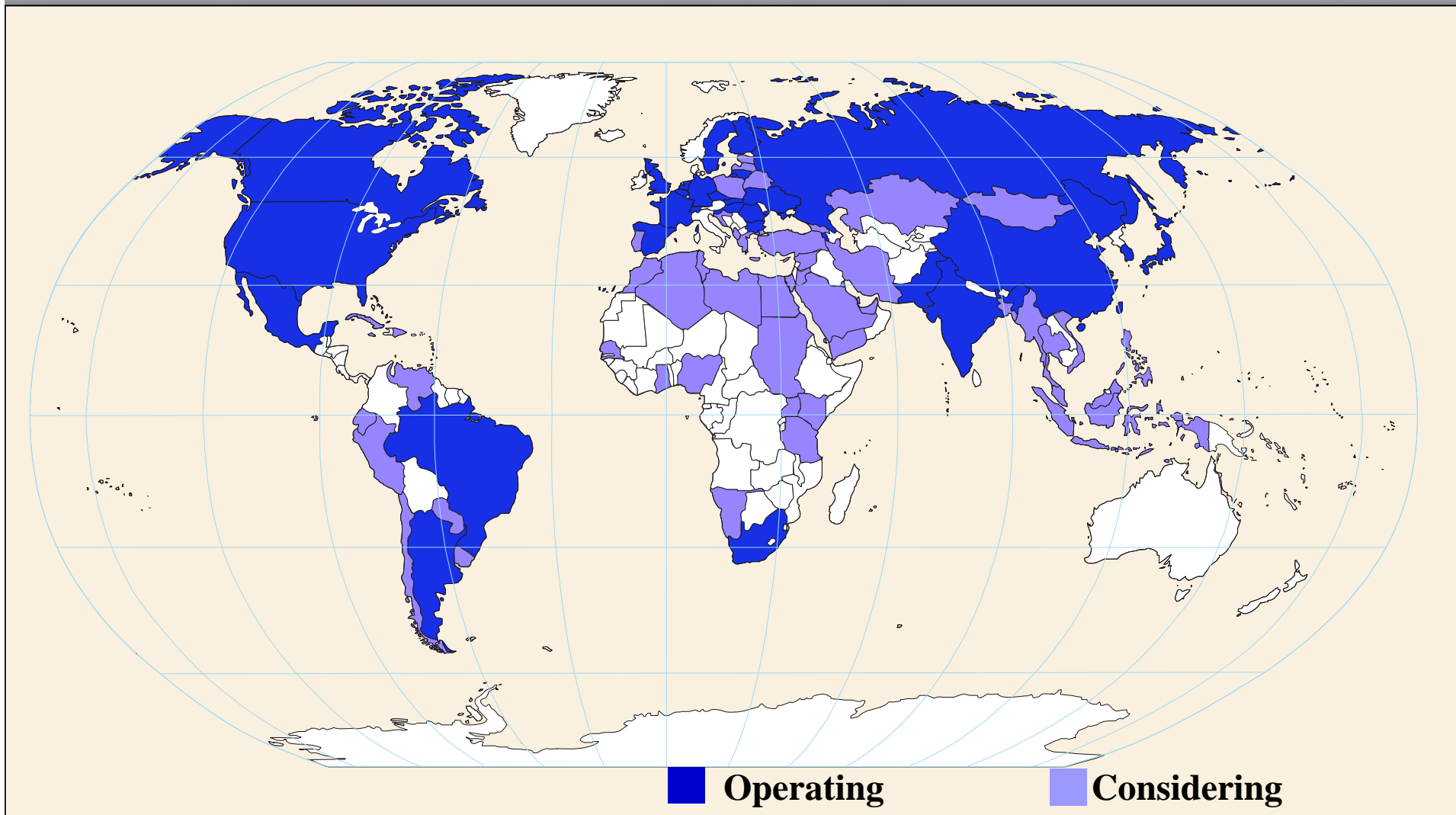
Engineering and Technical Safety

- **DESAR** – Design/Engineering/Safety Assessment Review Services

Security

- **INSServ** – International Nuclear Security Advisory Services
- **IPPAS** – International Physical Protection Advisory Services

Increasing Nr. of countries considering introduction/expansion of nuclear power



Milestones Document

Milestones

Milestone 1: Understanding the commitment (pre-project)

Milestone 2: Ready to request bid for the first NPP

Milestone 3: Ready to commission and operate the first NPP

19 major issues to consider

National Position

Regulatory Framework

Financing

Safeguards

Emergency Planning

Nuclear Waste

Nuclear Safety

Stakeholder Involvement

Management

Legal Framework

Radiation Protection

Human Resource

Security

Nuclear Fuel Cycle

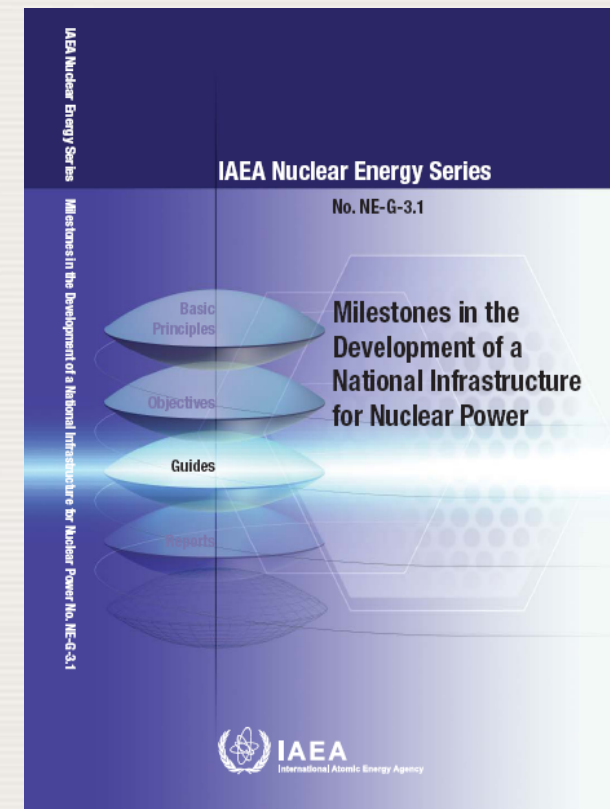
Environmental Protection

Sites selection

Electrical Grid

Industrial Involvement

Procurement



Global expansion – Global vision

Some questions

- What technologies will be needed and available?
- Will uranium (thorium) resources be sufficient?
- How to ensure resource availability for all MS?
- How to optimise resource use and minimise waste problems?
- How to minimise proliferation risks?

Role of IAEA to support sharing of and reconciling the MS's individual visions for our world's nuclear future

As in GIF, INPRO, GNEP, SNETP

Two major international initiatives

IAEA-TECDOC-1434

Methodology for the assessment of innovative nuclear reactors and fuel cycles

Report of Phase 1B (first part) of the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)



GIF-002-00

A Technology Roadmap for Generation IV Nuclear Energy Systems

December 2002

Ten Nations Preparing Today for Tomorrow's Energy Needs



Issued by the
U.S. DOE Nuclear Energy Research Advisory Committee
and the Generation IV International Forum

03-GA50034

INPRO

- Objectives
 - To help to ensure that nuclear energy is available to contribute, in a sustainable manner, to meeting the energy needs of the **21st century**;
 - To bring together **technology holders** and **users** so that they can **consider jointly the international and national actions** required for achieving desired innovations in nuclear reactors and fuel cycles
- Tools
 - INPRO Methodology for **assessing** innovative nuclear systems
 - Global **vision building** on nuclear energy future
 - Common user considerations (dialogue technology holders/users)
 - Collaborative projects

INPRO: Networking of technology holders and users



International Initiatives in Nuclear Power for support of expansion and non-proliferation

New initiatives proposed

- ✓ MNA (M. ElBaradei) – IAEA Fuel Bank
- ✓ Global Nuclear Energy Partnership (GNEP) (USA)
- ✓ President Putin's initiative to develop a Global Nuclear Power Infrastructure (GNPI) (Russia)



Back end issues

- Most countries undecided on spent fuel management – wait and see
- Storage of spent fuel is not a technical problem
- Usefulness/Economy of recycling in LWRs is debated
- Recycling and transmutation in fast systems will
 - Improve resource utilization
 - Simplify waste disposal of HLW (by heat load reduction, lower radiotoxicity and removal of material under safeguard)
- But will include
 - Sensitive technology
 - More handling steps of sensitive material
 - More transports
- International initiatives important

Back end issues (cont)

- HLW disposal will be required irrespective of what route is chosen
- Although no technical rush for disposal – politically important for future nuclear
- Delays experienced in most, but not all, national disposal plans
- Small countries – shared disposal facilities?

Human Resources and Knowledge Management

- ❑ Issues Member States face:
 - ✓ Sustaining existing knowledge for the continued safe operation of existing nuclear installations
 - ✓ Human resources development in new countries
 - ✓ Preservation of knowledge before it degrades or is lost

- ❑ IAEA activities in:
 - ✓ Methodology and guidance
 - ✓ Educational networks
 - ✓ Knowledge preservation

Summary

- Global rising expectations of the role of NP requires a global vision on nuclear power with regard to:
 - Safety and reliability of existing and new power plants
 - Effective use of resources for sustainability
 - Total life cycle considerations
 - Availability of knowledge and human resources
- The role of the IAEA is to help ensure that this is fulfilled through its different means
- International initiatives like GIF, GNEP and SNETP are very



