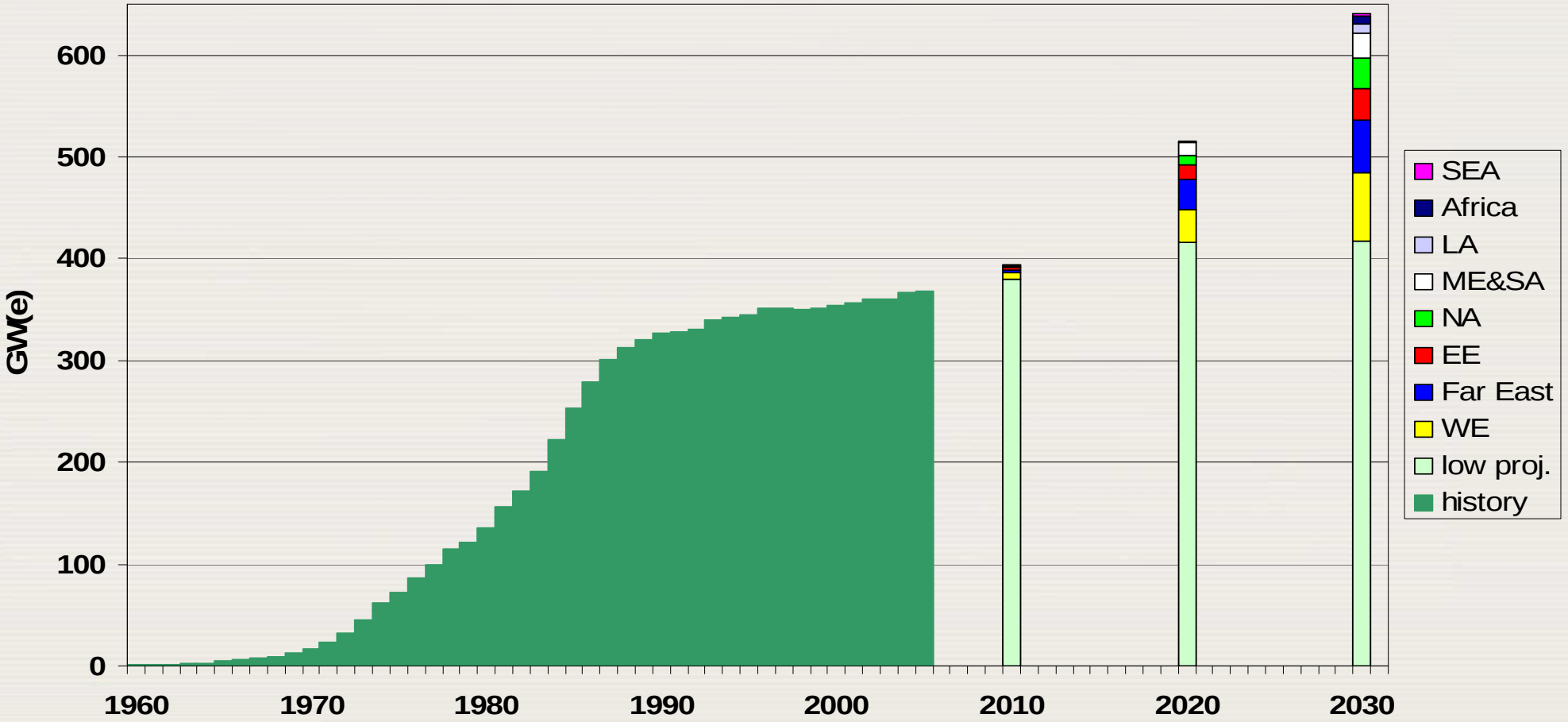
Considerations before the initiation of a Nuclear Power Programme

R Ian Facer

IAEA

International Atomic Energy Agency

Nuclear Energy Projection



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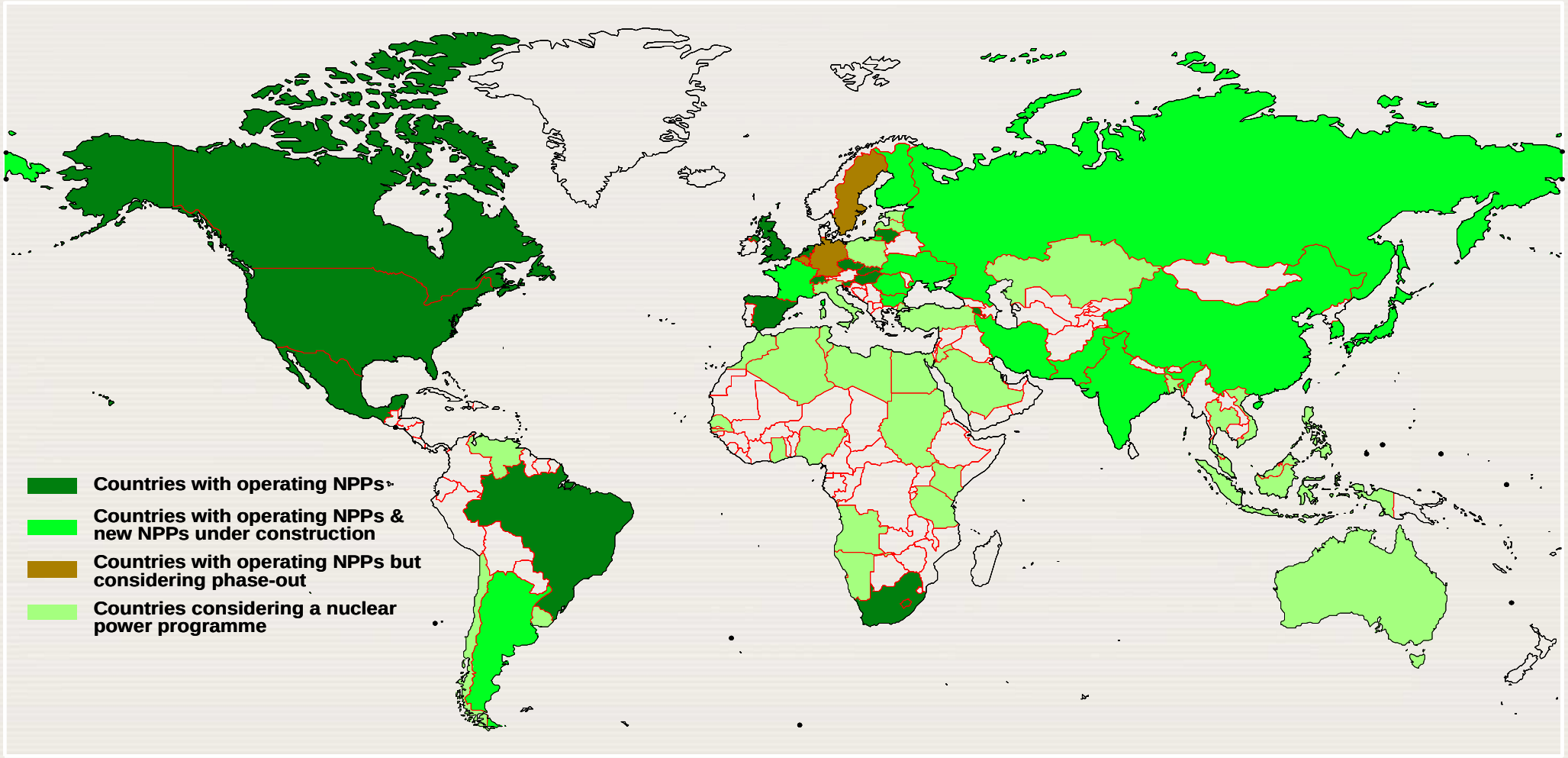
Nuclear power around the globe



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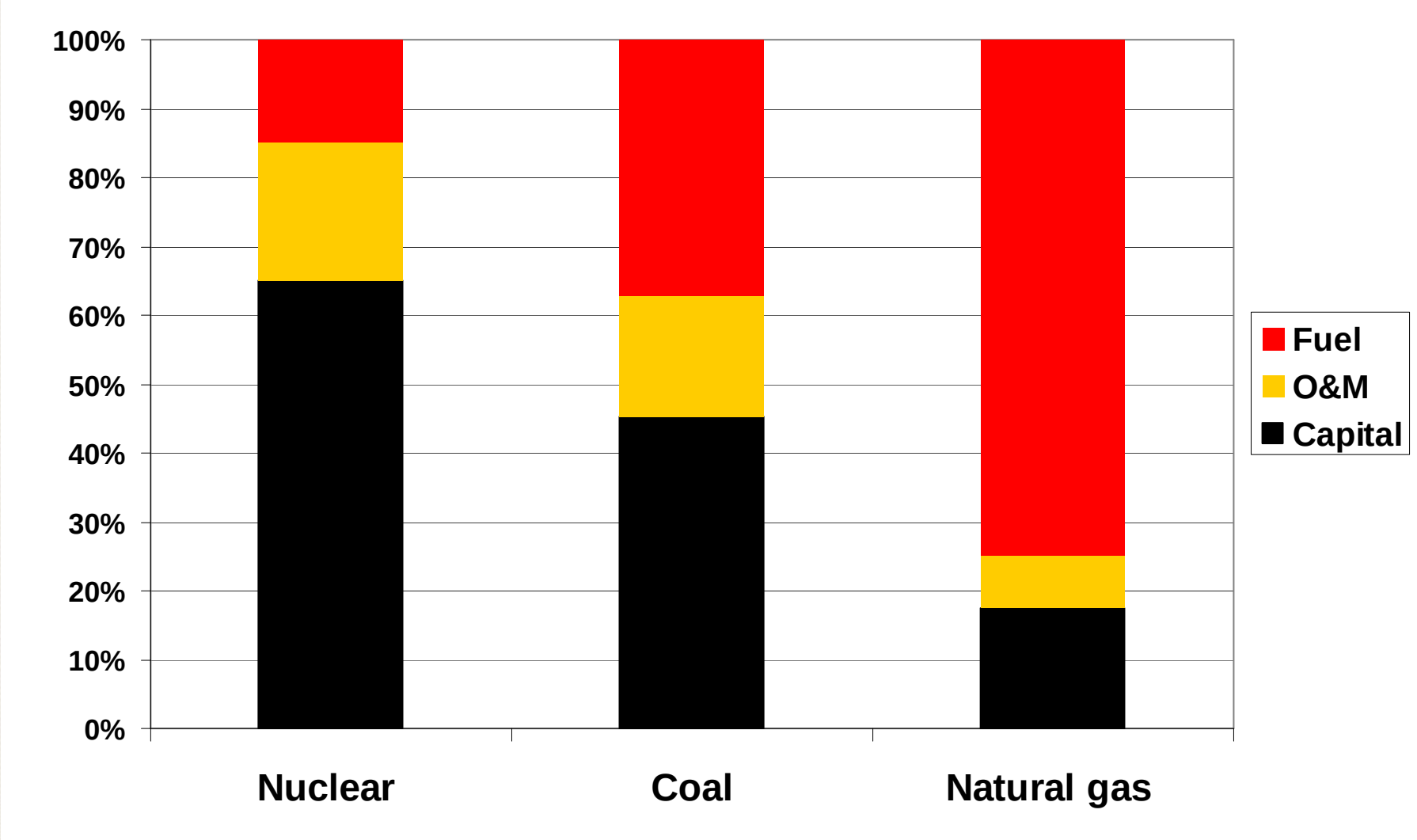
Cost structures of electricity generating options



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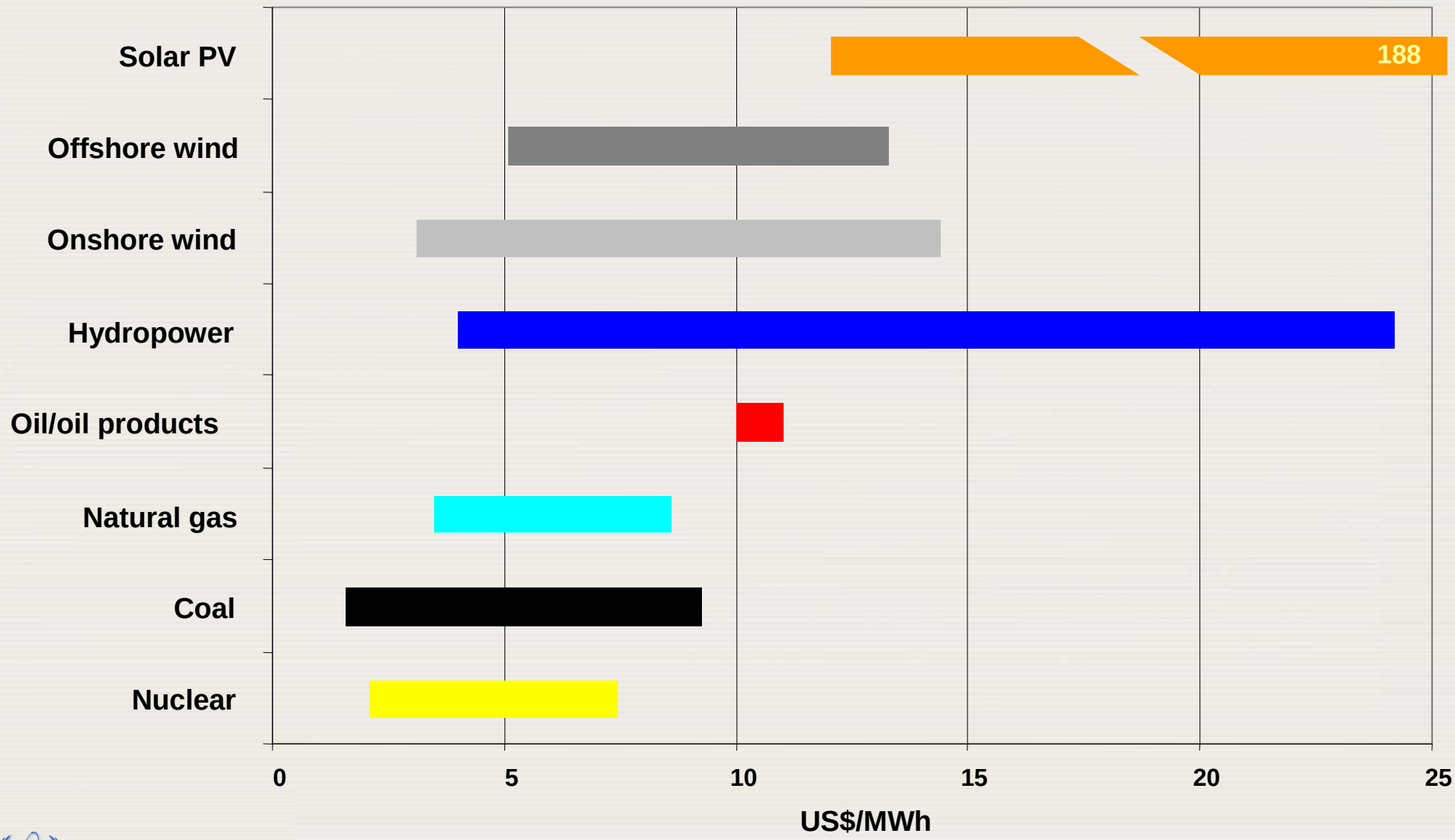
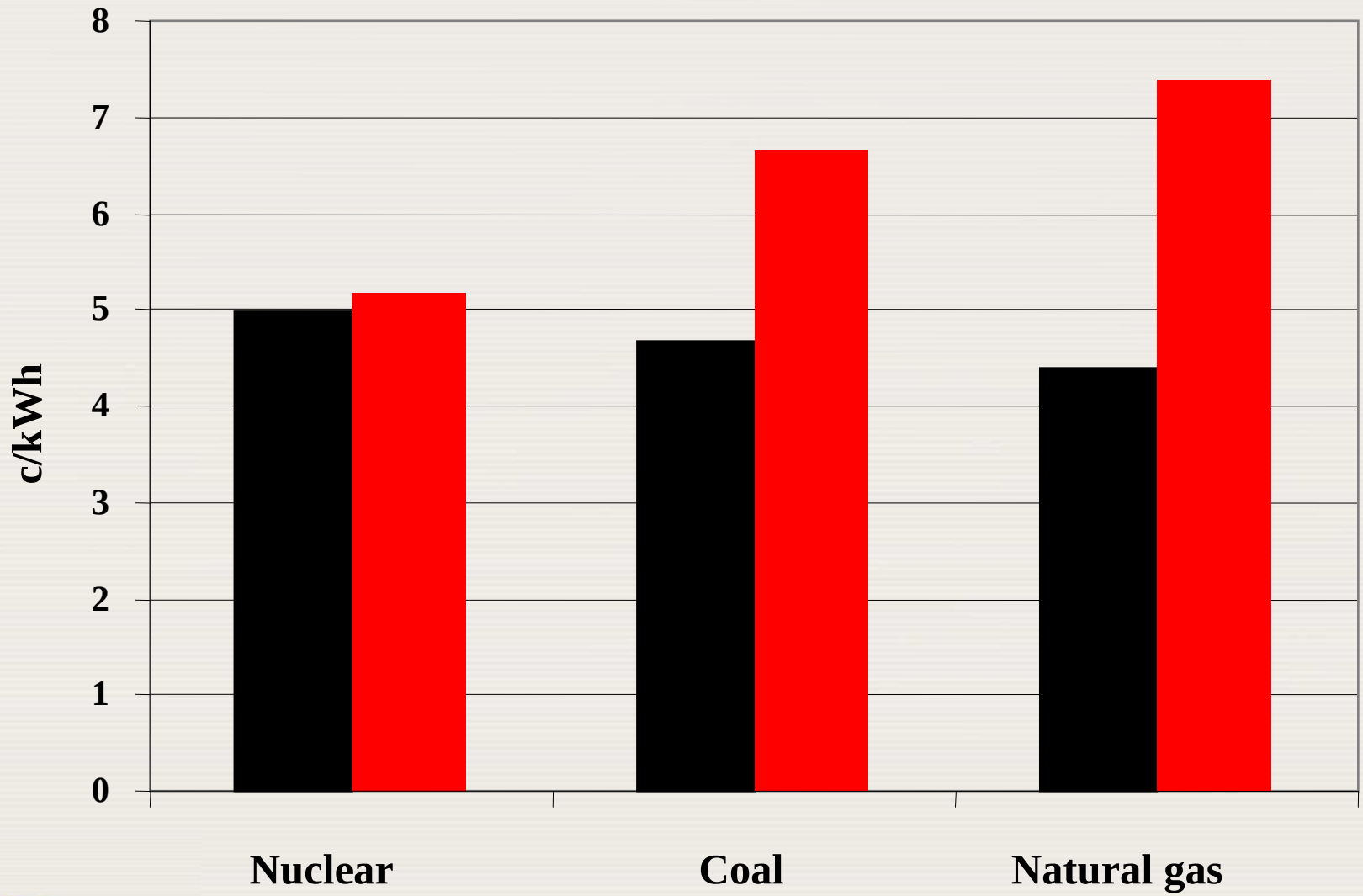
Range of Levelized Generating Costs of New Electricity Generating Capacities



IAEA Source: Adapted from eight recent studies

Impact of a doubling of resource prices



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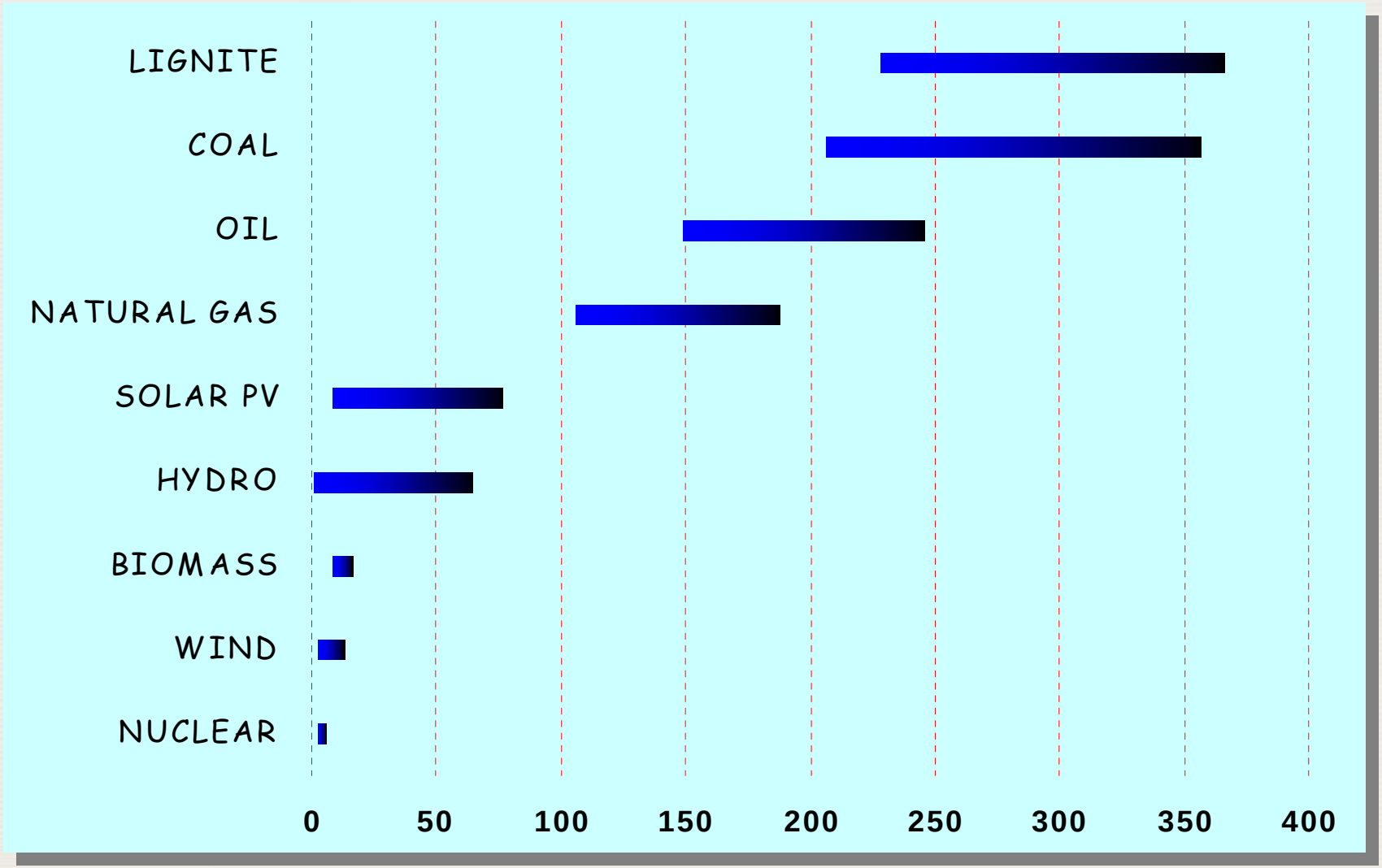
Greenhouse Gas Emissions (gC_{eq} per kWh)



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GC(49)/RES/12.G

- **Approaches to supporting nuclear power infrastructure development**

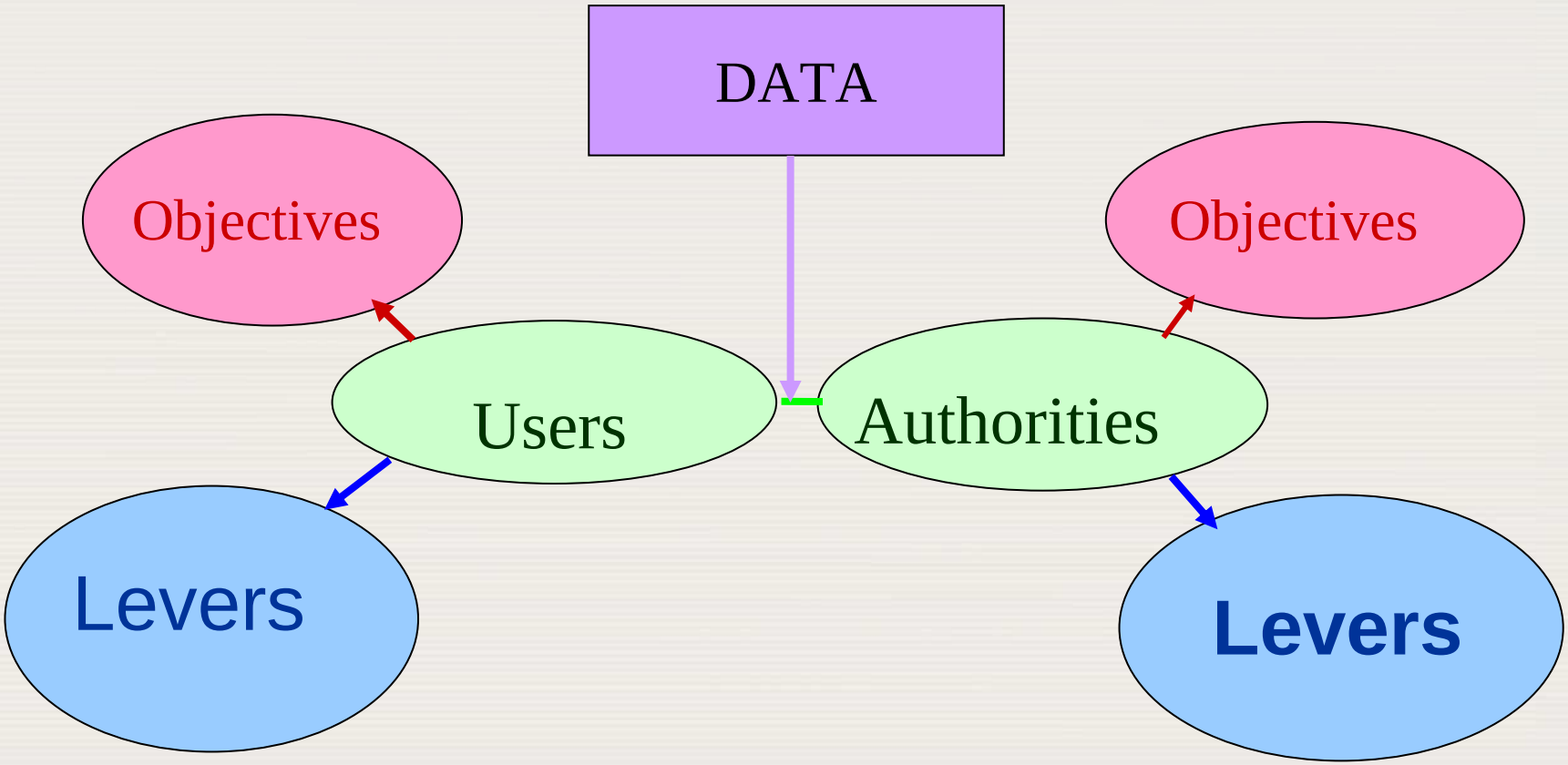
Called for the Agency

- "to undertake generic assessments on approaches and options for
  - addressing infrastructure requirements so as
  - to support the introduction of nuclear energy technologies
  - and their safe and efficient use,
  - for those countries that are considering or planning for the introduction of nuclear energy technologies in the 21st century;"

IAEA DG Speech to GC 2006

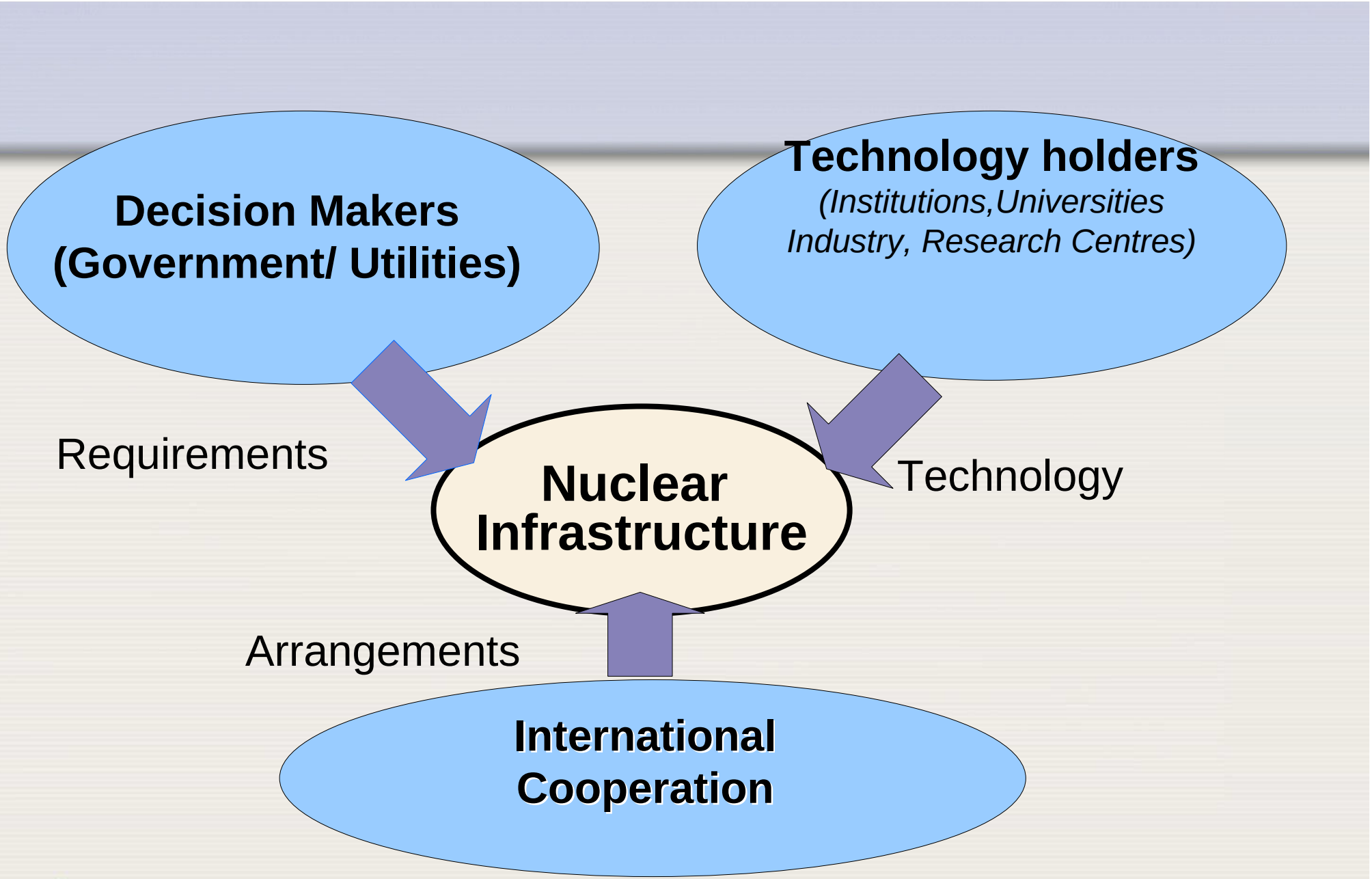
- As a sophisticated technology, nuclear power requires a correspondingly sophisticated infrastructure. For new countries considering nuclear power, it is essential to ensure that the necessary infrastructure will be available.

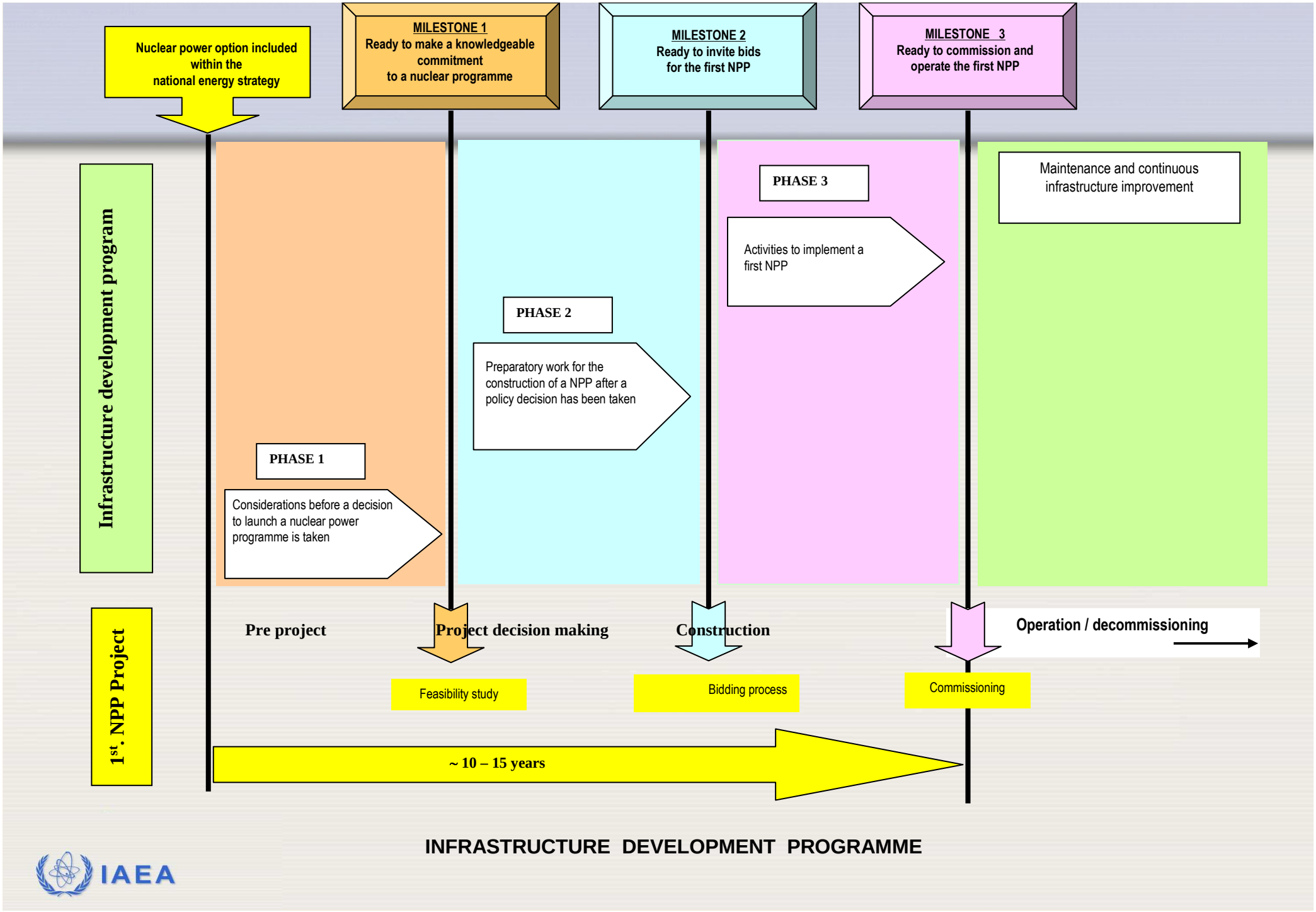
What Actions?



Nuclear Infrastructure

Institutions and Organisations
provide **Legislation and Regulations**
under which **Industry**
develops **technology**, provides **facilities** and
uses **education** and **science** to train **staff**
to enable **society** to be confident that
the **nuclear industry** can operate
Safely, Securely and Economically


Decision Makers
(Government/ Utilities)
Technology holders
(Institutions,Universities
Industry, Research Centres)
Requirements
Technology
Nuclear
Infrastructure
Arrangements
International
Cooperation


Nuclear power option included within the national energy strategy
MILESTONE 1
Ready to make a knowledgeable commitment to a nuclear programme
MILESTONE 2
Ready to invite bids for the first NPP
MILESTONE 3
Ready to commission and operate the first NPP
Infrastructure development program
PHASE 1
Considerations before a decision to launch a nuclear power programme is taken
PHASE 2
Preparatory work for the construction of a NPP after a policy decision has been taken
PHASE 3
Activities to implement a first NPP
Maintenance and continuous infrastructure improvement
1st. NPP Project
Pre project
Project decision making
Construction
Operation / decommissioning
Feasibility study
Bidding process
Commissioning
~ 10 – 15 years
INFRASTRUCTURE DEVELOPMENT PROGRAMME
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Expected preparedness and milestones

ISSUES	MILESTONE 1	MILESTONE 2	MILESTONE 3
National position			
Nuclear safety			
Management			
Funding and financing	CONDITIONS	CONDITIONS	CONDITIONS
Legislative framework			
Safeguards			
Regulatory framework			
Radiation protection			
Electrical grid			
Human resources development			
Stakeholder involvement			
Site and supporting facilities			
Environmental protection			
Emergency planning			
Security and physical protection			
Nuclear fuel cycle			
Radioactive waste			
Industrial involvement			
Procurement			

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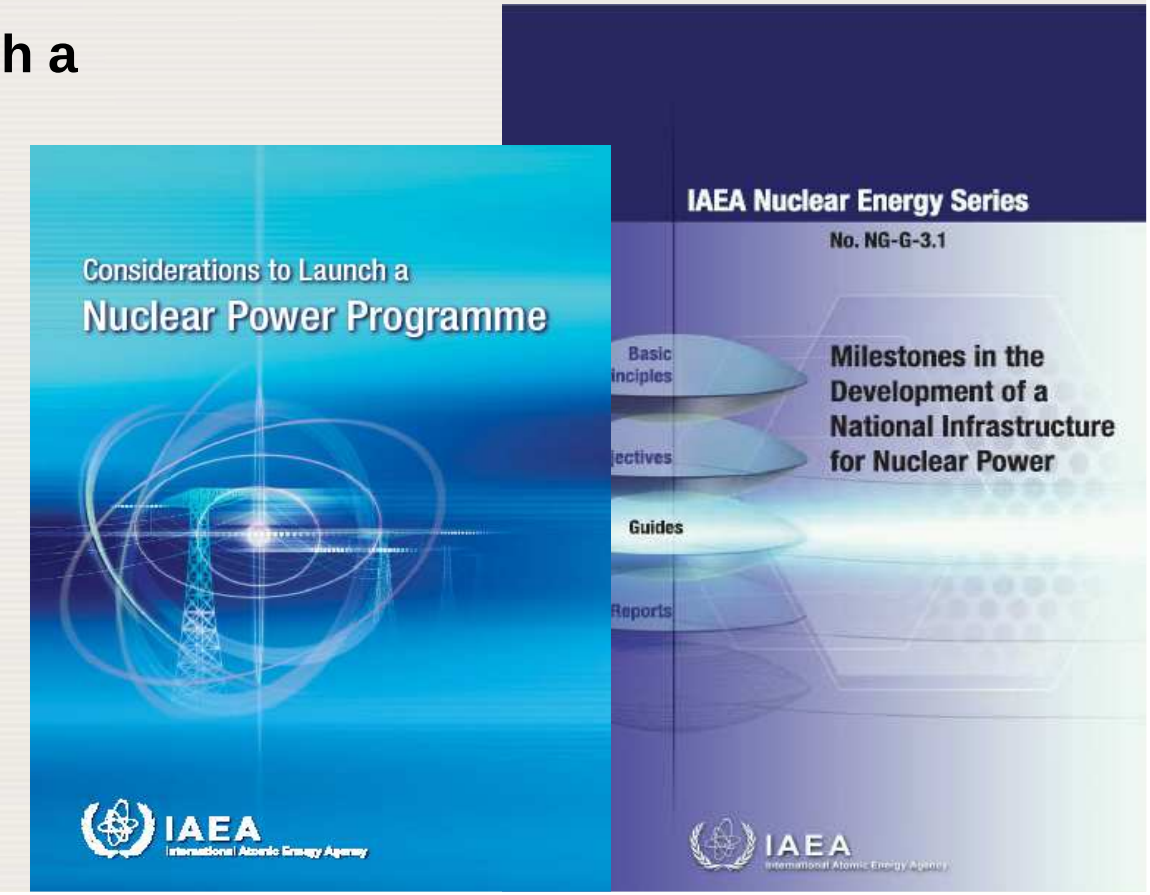
Agency's recent guidance documents for introduction of NP

1. TECDOC-1513 " Basic Infrastructure for a Nuclear Power Project", June 2006
2. TECDOC-1522 "Potential for Sharing Nuclear Power Infrastructure between Countries", October 2006
3. TECDOC-1555 "Managing the First Nuclear Power Plant Project", May 2007

4. Brochure "Consideration to launch a nuclear power programme" (March 2007)

5. NE series guide NG-G-3.1 "Milestones in the Development of a National Infrastructure for Nuclear Power (September 2007)



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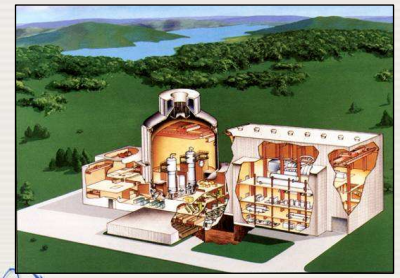
Considerations to Launch a Nuclear Power Programme (GOV/INF/2007/2)

Several interrelated activities considered in

3 MAJOR PHASES

1. **Considerations before a decision to launch a nuclear power program is taken**
2. **Preparation work for the construction of a NPP after a policy decision has been made**
3. **Activities to implement the first NPP**



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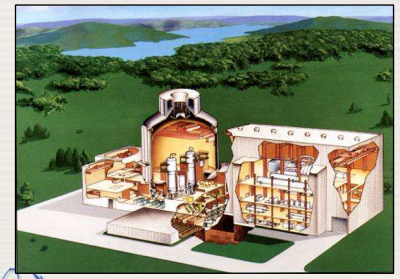
Millestones

At the end of each Phase

3 MILESTONES

- Ready to make a knowledgeable commitment to a nuclear programme
- Ready to invite bids for the first NPP
- Ready to commission and operate the first NPP



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Website
Infrastructure Bibliography

- http://
- www-pub.iaea.org/MTCD/publications/
- ninfrastructure.asp

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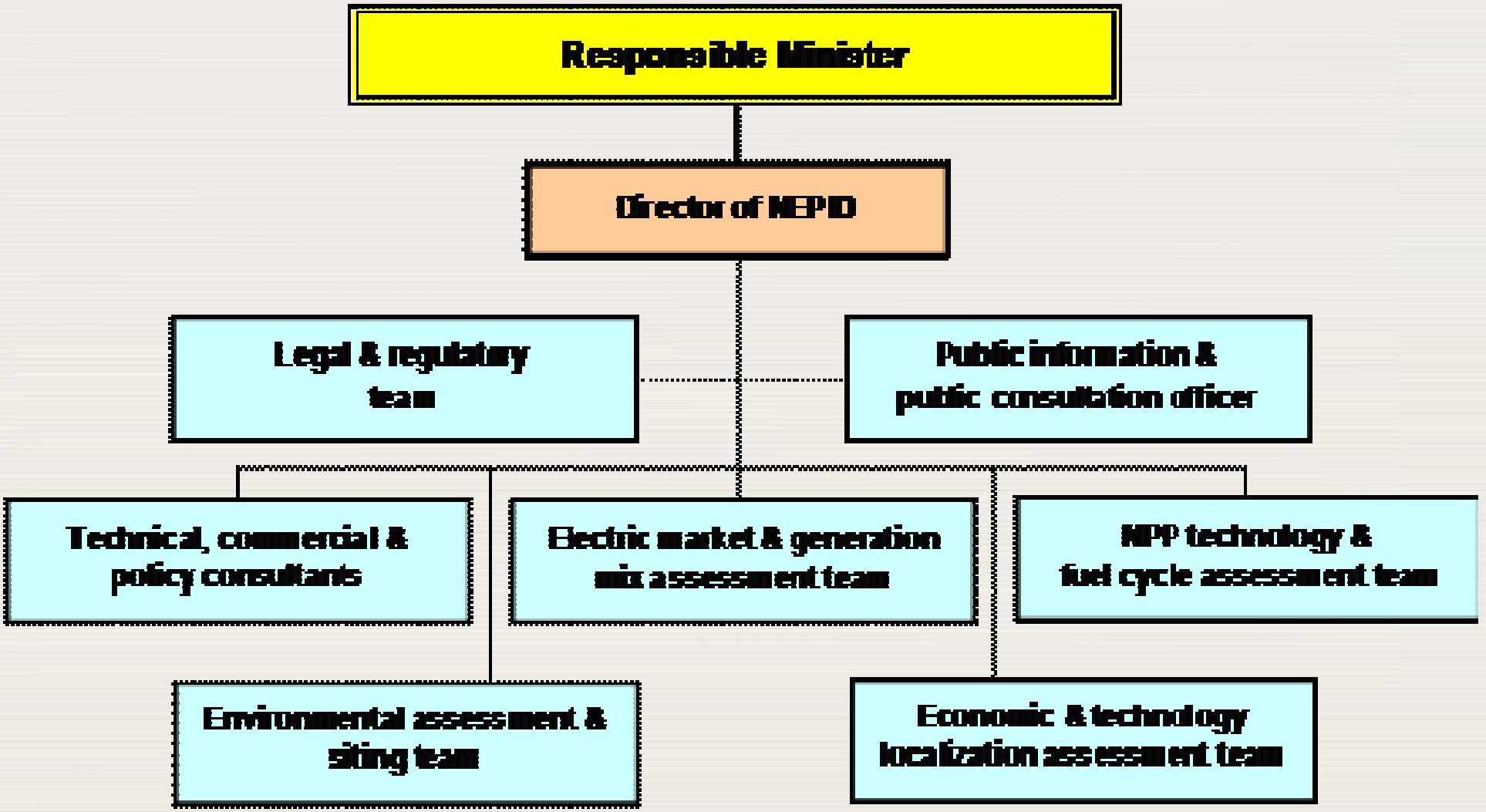
…atoms for peace.

NEPIO
(Nuclear programme implementation organization)

- Government-wide coordination group
- Function
  - To study issues and conditions necessary for successful implementation of nuclear power;
    - NP in the electricity market and generation mix
    - Economics of nuclear power
    - Expected role of the government and the private sector in the development of the nuclear programme etc.

      (TECDOC 1513, Section 2.2)
  - To formulate policy,
  - To plan their implementation, and
  - To recommend to Government (Minister)

Nuclear Energy Programme Implementing Organisation



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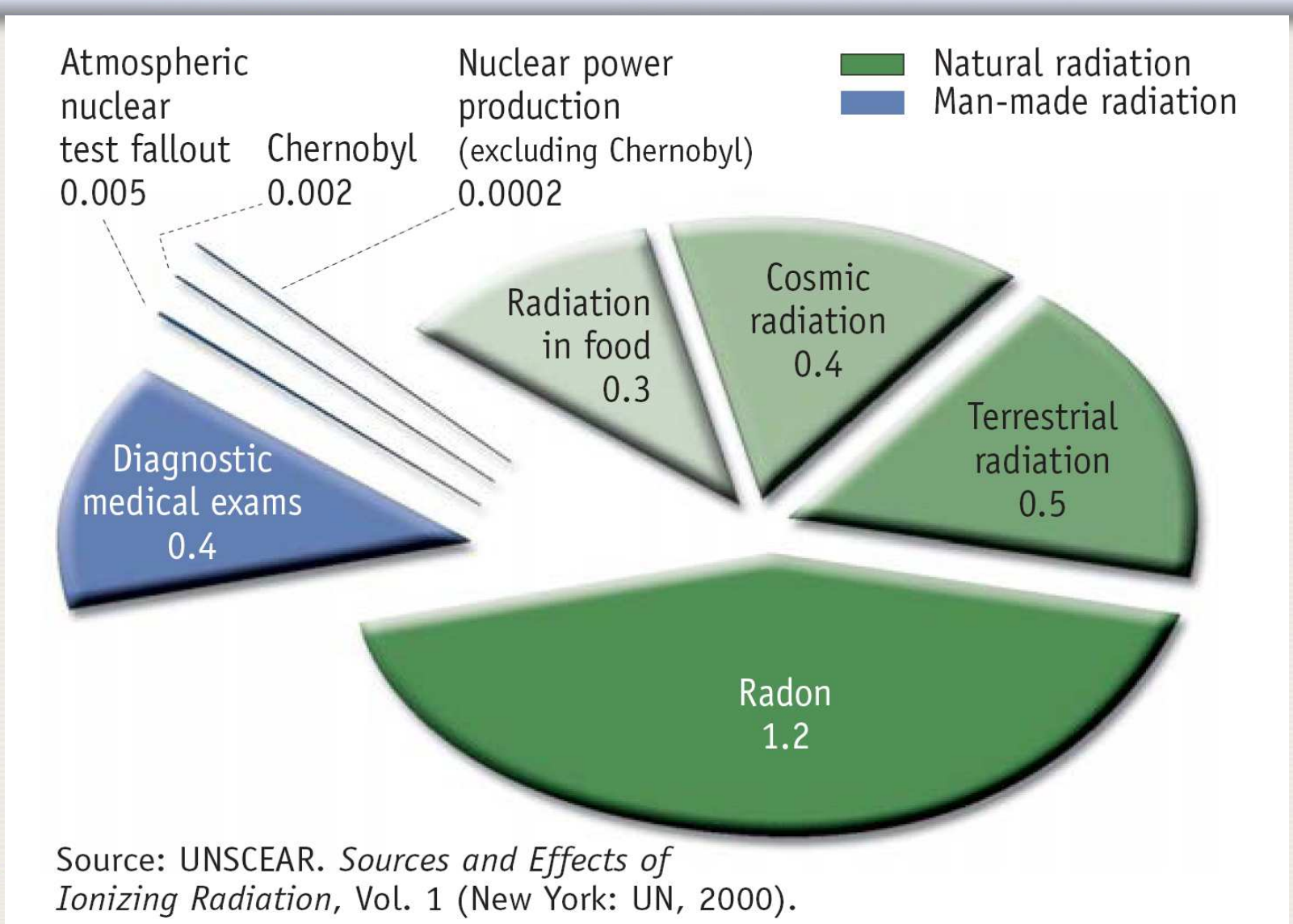
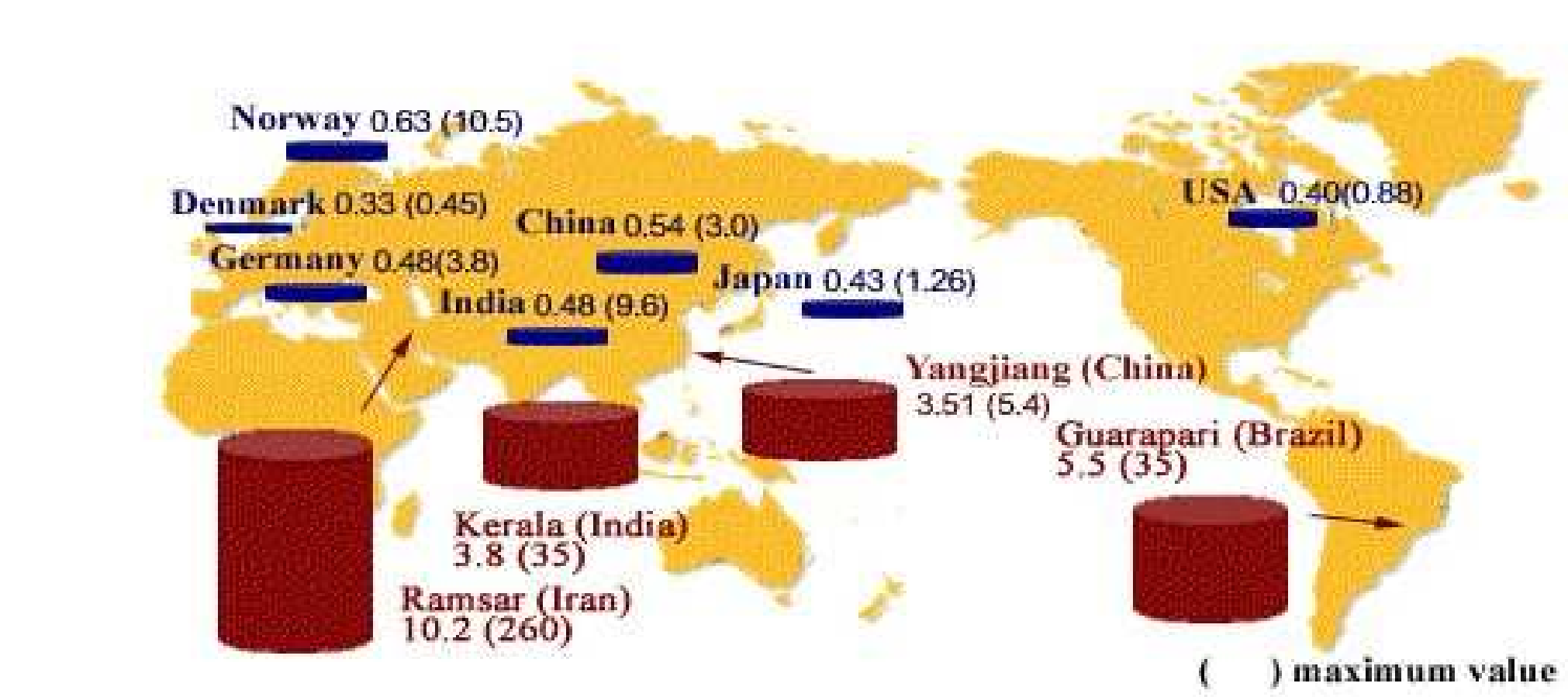
Typical sources of public radiation exposure (in mSv per year)

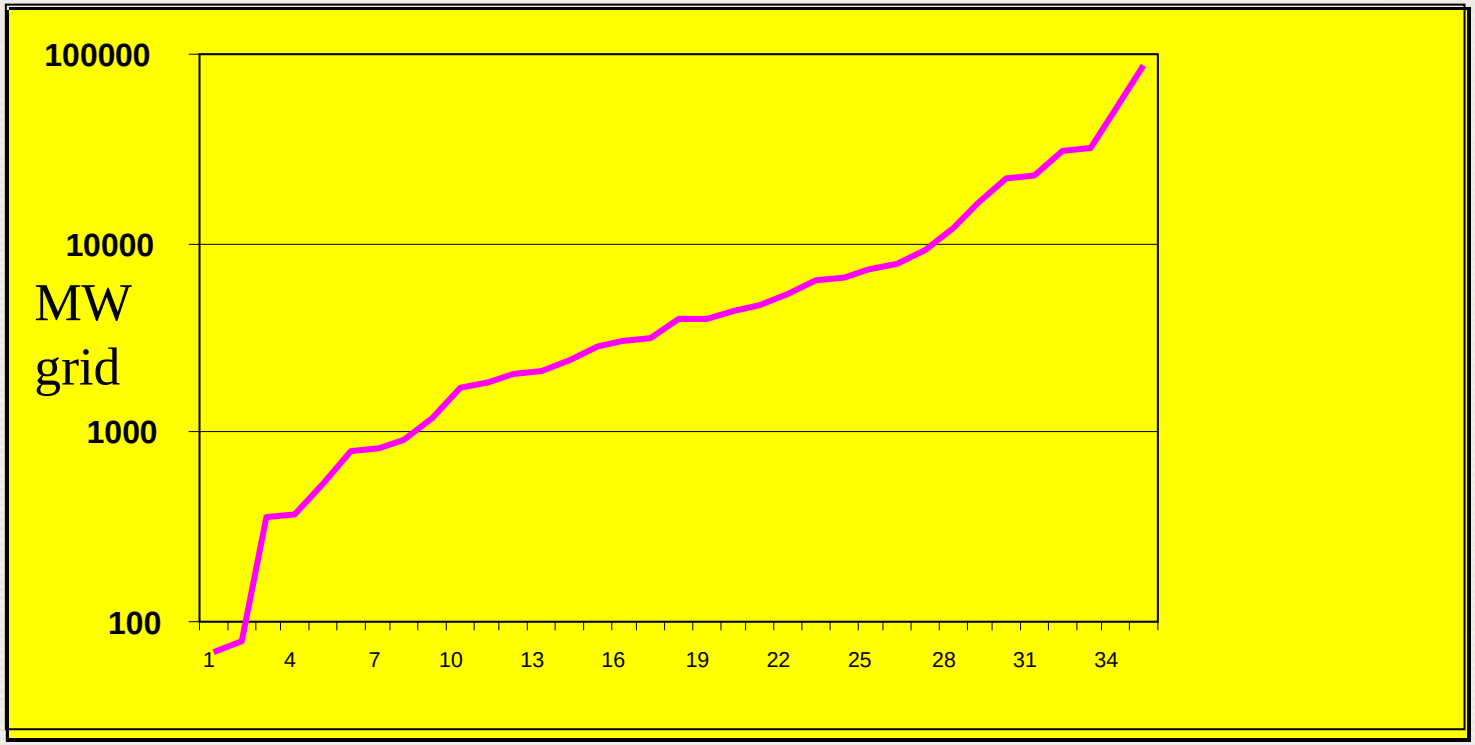


Source: UNSCEAR. *Sources and Effects of Ionizing Radiation*, Vol. 1 (New York: UN, 2000).

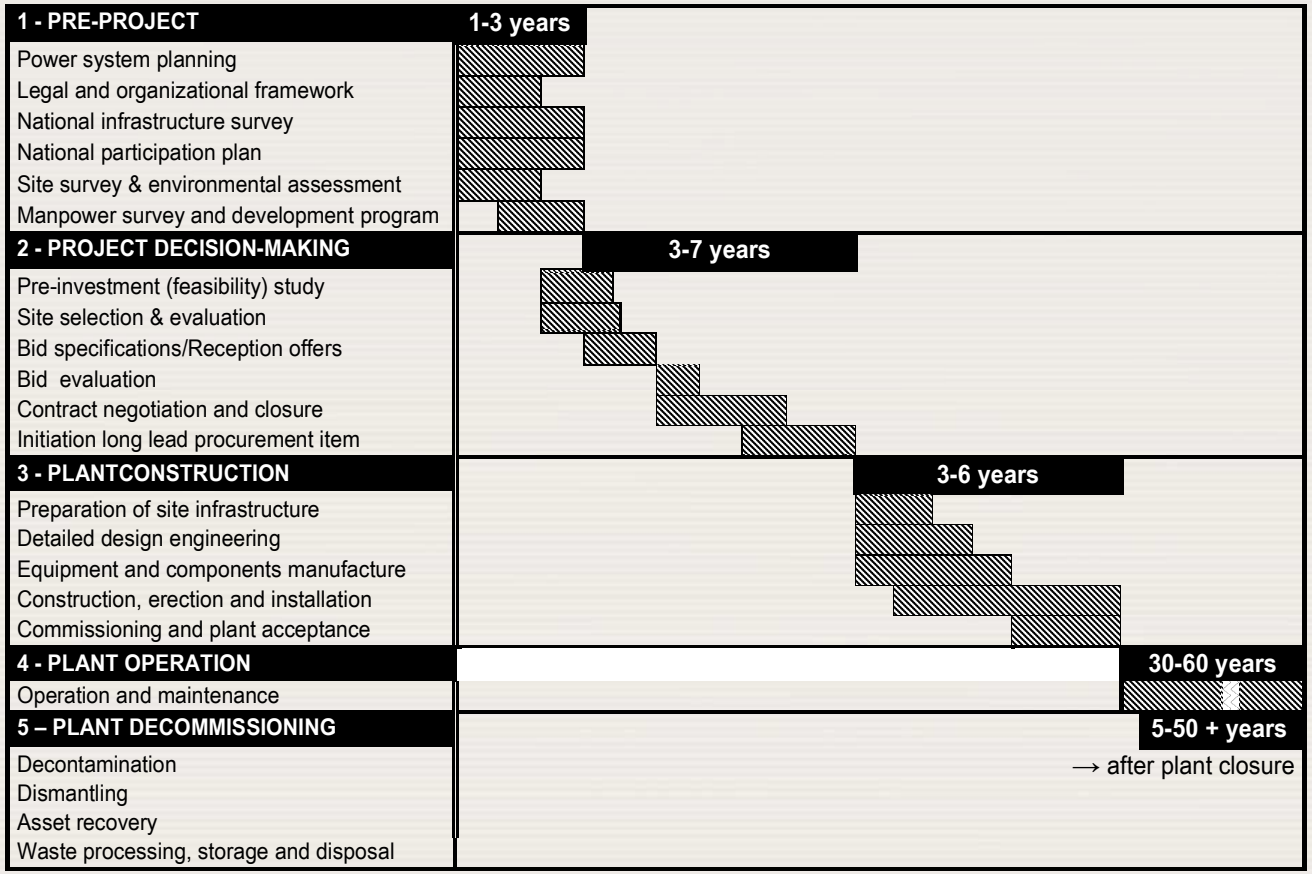
Natural Radiation



Grid sizes of countries interested in NP



Project Preparation



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Phase 1: Considerations Before a Decision to Launch a Nuclear Power Program is Taken

Understanding the need for development and establishment of

- Fuel cycle strategies (procurement policy, disposal)
- Nuclear material management plan
- Communication plan with stakeholders

Phase 1: Considerations Before a Decision to Launch a Nuclear Power Program is Taken

Nuclear power :

requires long-term commitment and stable policy

- At least 10-15 years of extensive work by various sectors (government, Utility, Industry) before connection of the first NPP to grid
- Operation of ~60 years + waste disposal
- Government may wish to support NP programme to reduce uncertainties of the implementation programme, such as
  - Energy policy in support of NP as a option
  - Investment to national infrastructure building
  - Pre-licensing arrangement
  - Funding/loan-guarantee to NPP Project
  - Arrangement for long-term power off-take contracts for capital intensive NPP project

Phase 2: Policy decision for NP project ~ start of construction

- Outline
  - Follows Policy Decision – substantive work begins for ensuring the necessary level of technical and institutional competence is achieved by State and commercial organizations.
  - Ensure the necessary level of technical/institutional competence is achieved
- Assessment
  - Confirm viability of NP by feasibility study
- Establish framework and capabilities
  - Enact legal framework
  - Establish regulatory body
  - Decide financial and operational modality for the ownership and implementation of NPP project (design assessment, establishing user requirement, tendering bid, bid evaluation)

Phase 2 : Policy decision for NP project ~ start of construction

- Establish framework and capabilities (continued)
  - Establish policy for fuel cycle (procurement, transportation, storage of waste, long term waste management)
  - provided for security and safeguards for nuclear materials and facilities
  - provided for radiation protection and emergency planning
  - established a plan for human and physical resource development consistent with the desires for national participation in the manufacturing, construction, operation and support of a nuclear facility
  - Site evaluation and selection

Phase 2 : Policy decision for NP project ~ start of construction

- Establish framework and capabilities (continue..)
  - Evaluate available technology
  - Determine contractual approach for the first NPP
  - Define the role of domestic and foreign entities, vendors and suppliers
  - Establish supply chain (material, services, component, engineering)
  - Tender bid
  - Bid evaluation

Phase 2: Regulatory body

Should have;

- hired, organized and trained a competent staff,
- established site environmental assessment and licensing requirements,
- adopted a set of codes & standards for licensing and operation,
- issued regulations for nuclear plant design and construction,
- issued regulations for safeguards, security, radiation protection and emergency planning,
- issued regulations for the transportation, handling and storage of nuclear and radioactive material,
- performed environmental assessments and licensing of sites,
- prepared for the review and licensing of nuclear plant designs

Phase 2: Regulatory body

Should have;

- begun to develop requirements for operator licensing and training,
- begun preparations for operational inspection and oversight,
- established relationships with the owner/operator and other government agencies,
- established a public communications effort,
- established international relationships with other regulatory bodies.

Phase 2: Owner/operator

Should have;

- increased its staffing as appropriate for bid development and evaluation,
- established a formal management systems programme and begun formal staff training to create a safety and quality management culture,
- developed bid evaluation criteria,
- established a nuclear security and safeguards programme,
- characterized the preferred sites through surveys and environmental assessments,
- determined the appropriate or preferred nuclear technologies for implementation,
- selected a site or sites for which environmental assessments and licensing applications are prepared,

Phase 2: Owner/operator

Should have;

- conducted public education and consultation programme especially with respect to the chosen sites,
- developed a contracting strategy consistent with the existing and developing human and physical resources,
- developed a fuel supply strategy and establish a fuel supply plan consistent with the contracting strategy,
- established a spent fuel and radioactive waste management programme consistent with the contracting strategy,
- developed a financing strategy and begin implementing a financial plan consistent with the contracting strategy,
- established a working relationship with the regulatory body and international and professional organizations.

Phase 3: Activities to implement a first NPP

Owner/Operator

- Construction, engineering, safety, standards and security guides, quality requirements,
- Human resource commitment will be greatest - during construction there can be more than 6000 people in the site.
- Financial Commitment will be greatest
- Expertise developed and accepts the long term management of the NPP
- Develop safety culture
- Deal with regulator in open and transparent manner

Phase 3: Activities to implement a first NPP (cont.)

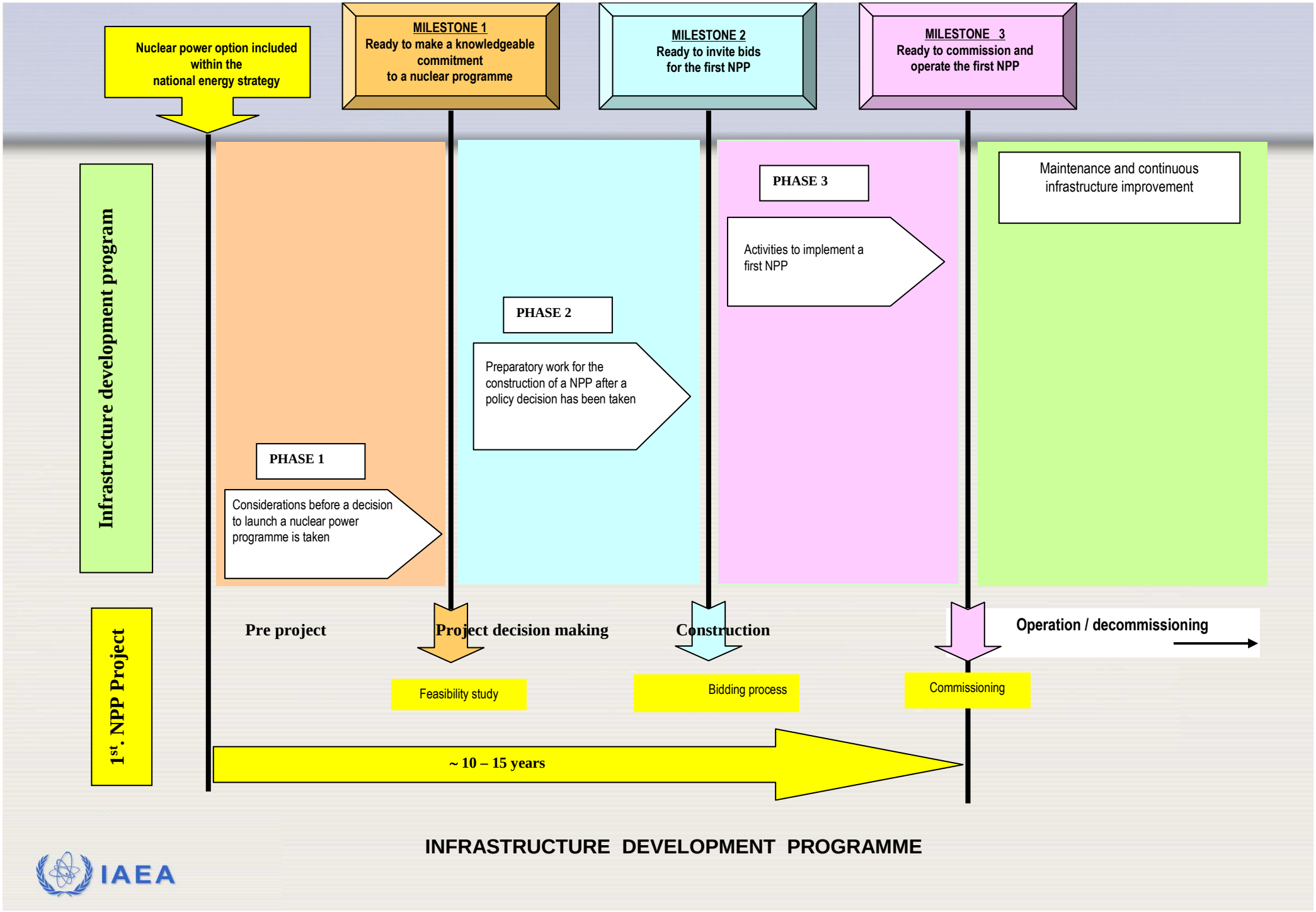
Regulatory Body

- Provide the framework to deal with Owner/Operator
- Possibly establish on site presence for inspection of NPP
- Establish safety standards
- Establish security guidelines

Phase 3: Activities to implement a first NPP (cont.)

Member State

- Maintain international commitments
- Maintain partnerships with other MS.
- Maintain trust of neighbouring States
- Ensure peaceful, safe, and secure operation of NPP project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…atoms for peace.