



IAEA

International Atomic Energy Agency
Atoms for Peace and Development

Safe and Secure use of Nuclear Power to provide Reliable, Affordable and Sustainable Energy for All

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VCNDP Panel Discussion
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SUSTAINABLE DEVELOPMENT GOALS



Sustainable Development Goal 7



Ensure access to affordable, reliable, sustainable and modern energy for all

Realizing SDG7 is essential for achieving the full set of SDGs

SDG7 ...is central to achieving all 17 SDGs

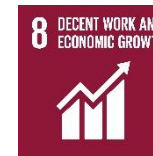
Affordable energy reduces poverty (SDG1) and inequality (SDG10), and supports health (SDG13), education (SDG4), industry (SDG9) and economic growth (SDG8)



Reliable energy is essential for industry (SDG9), agriculture (SDG2), health (SDG3) and education (SDG4)



Energy for all fosters peace, justice (SDG16), and partnerships (SDG17)



Modern energy supports clean communities (SDG11), health (SDG3) and gender equality (SDG5)



Sustainable energy is crucial for climate change (SDG13), ecosystems (SDG14, 15), agriculture (SDG2), water (SDG6, 14), and reducing waste (SDG12)



Nuclear Power as a Clean Energy Option



*“For many countries, nuclear power is a **proven, clean, safe, and economical** technology. And for many countries, it can play an increasingly important role in achieving **energy security**, reducing the **impact of volatile fossil fuel prices**, and mitigating the effects of both **climate change and air pollution**.”*

Yukiya Amano

IAEA Director General

Sustainable development

The concerns central to sustainable development can be broadly characterized as concerns regarding:

The depletion of finite resources

The carrying capacity of ecosystems

Intergenerational equity

Non-material needs for human development

Material needs for human development

Intragenerational equity

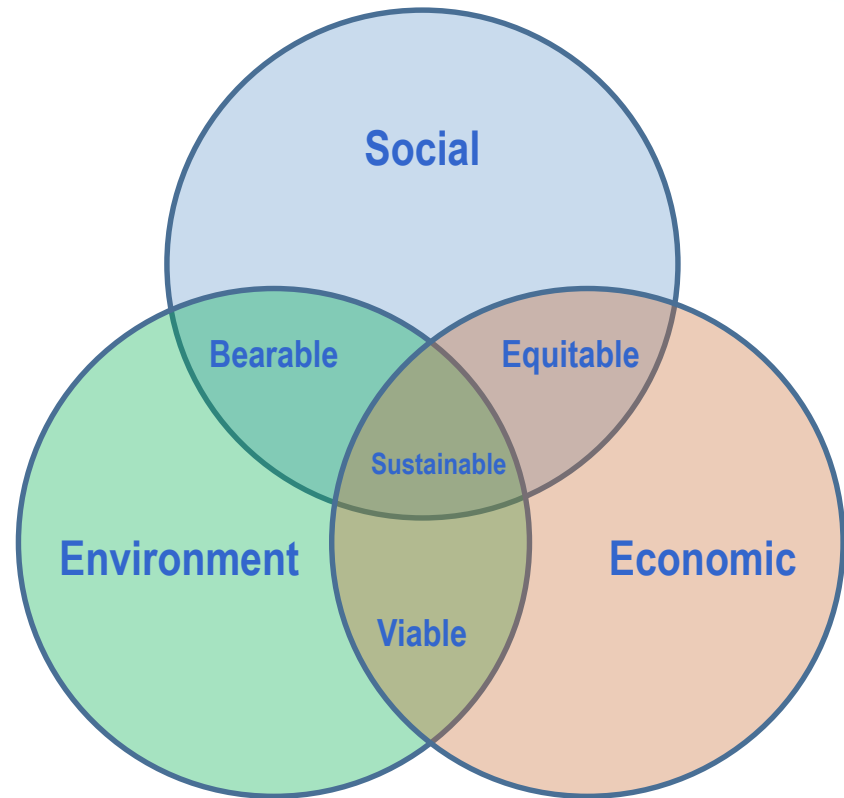
Sustainable development

The concerns central to sustainable development can be broadly characterized as concerns regarding:

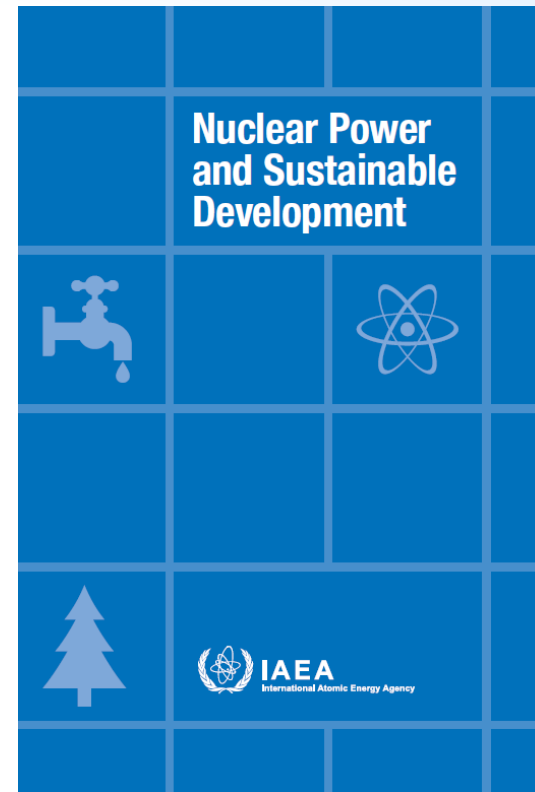
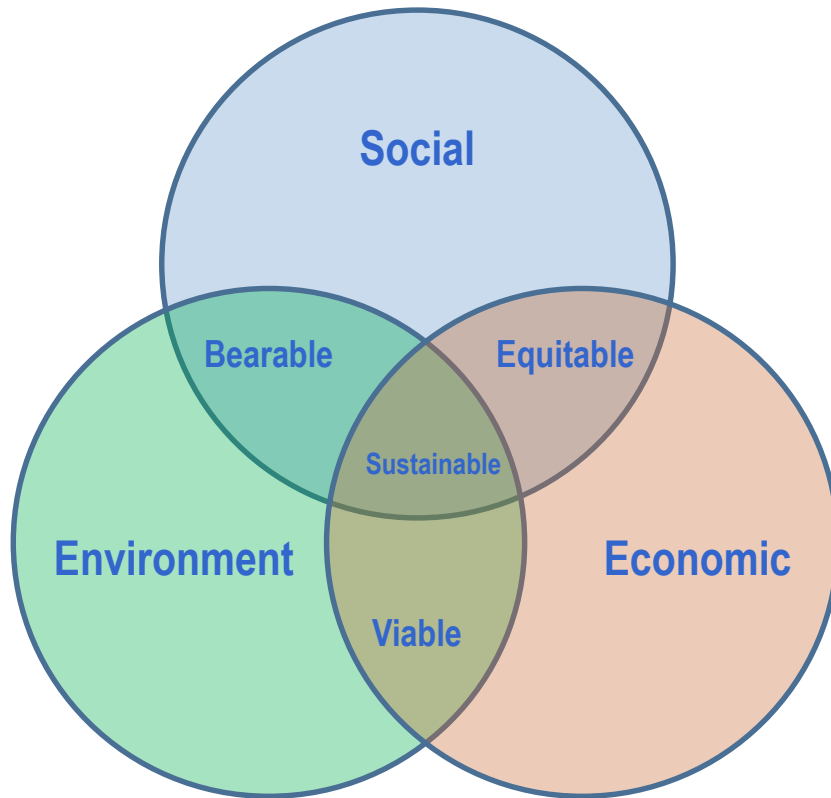


The issues arising in the context of these concerns are typically listed under three “pillars”:

- Social
- Environmental
- Economic

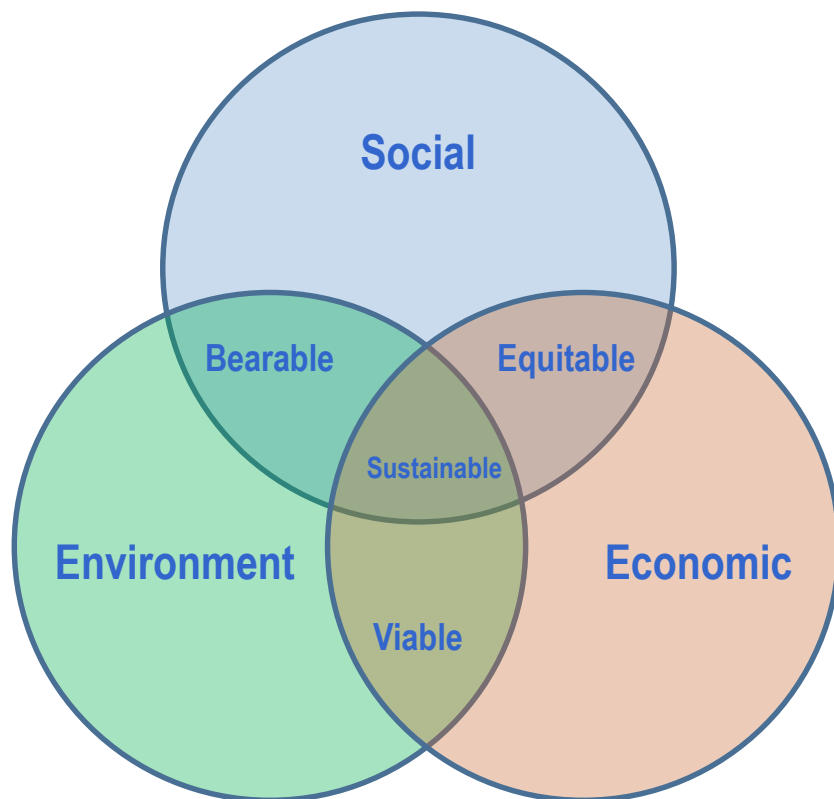


Nuclear power and sustainable development



IAEA 2016

Nuclear power and sustainable development



ECONOMIC DIMENSION

- Resource adequacy
- Energy return on investment
- Generation cost
- Financing nuclear power
- Energy supply security
- Other economic considerations

ENVIRONMENTAL DIMENSION

- Climate change impacts
- Impacts on ecosystems
- Waste generation
- Water use impacts
- Land use impacts
- Other environmental aspects

SOCIAL DIMENSION

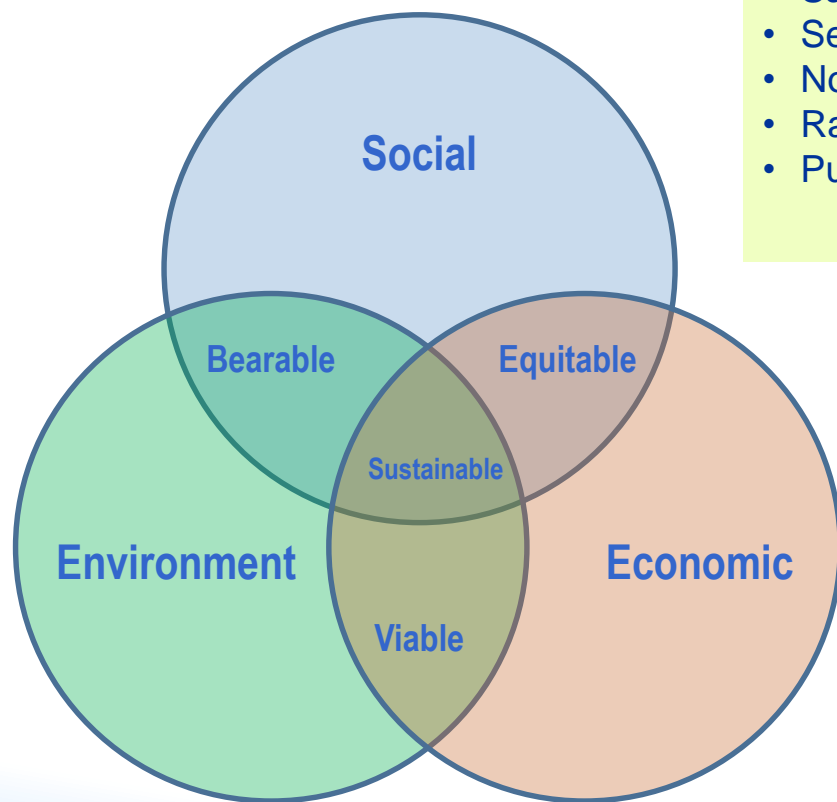
- Impacts on human health
- Employment
- Other social impacts



Nuclear power and sustainable development

CONSIDERATIONS RELATED TO NUCLEAR ENERGY

- Safety
- Security
- Non-proliferation
- Radioactive waste disposal
- Public perception



ECONOMIC DIMENSION

- Resource adequacy
- Energy return on investment
- Generation cost
- Financing nuclear power
- Energy supply security
- Other economic considerations

ENVIRONMENTAL DIMENSION

- Climate change impacts
- Impacts on ecosystems
- Waste generation
- Water use impacts
- Land use impacts
- Other environmental aspects

SOCIAL DIMENSION

- Impacts on human health
- Employment
- Other social impacts



“It is each country’s sovereign decision whether to add nuclear power to its energy mix”

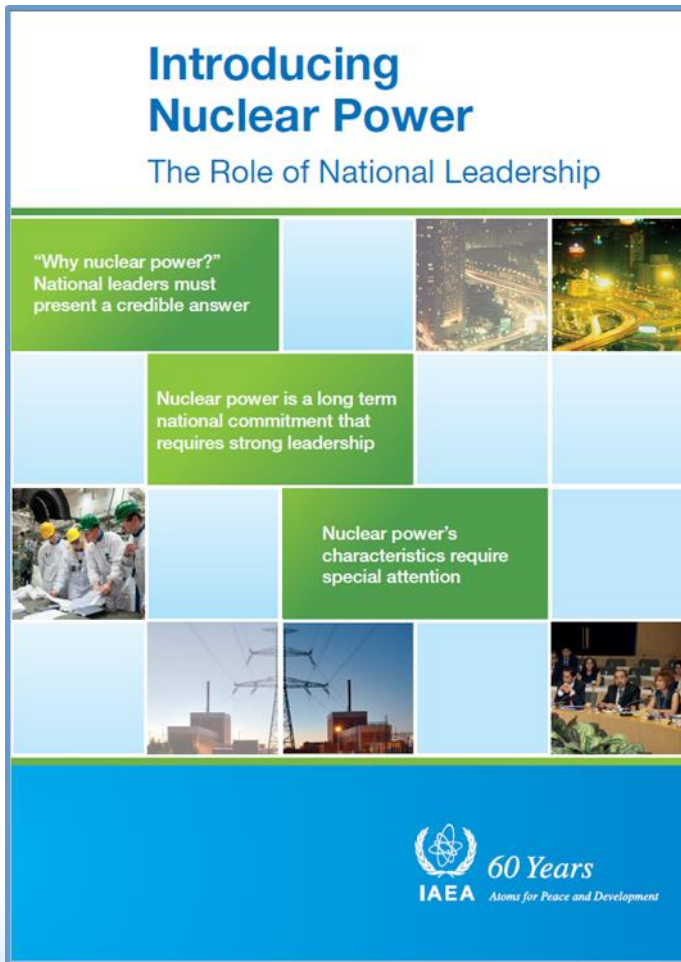


“The Agency has a key role to play in ensuring that expansion in nuclear power takes place in an efficient, responsible and sustainable manner.”

“Assistance to newcomers, especially those which are most advanced on the road to having operational reactors, will remain a high-priority issue.”

Yukiya Amano
IAEA Director General

Considerations for Nuclear Power



Introducing Nuclear Power
The Role of National Leadership

"Why nuclear power?"
National leaders must present a credible answer

Nuclear power is a long term national commitment that requires strong leadership

Nuclear power's characteristics require special attention

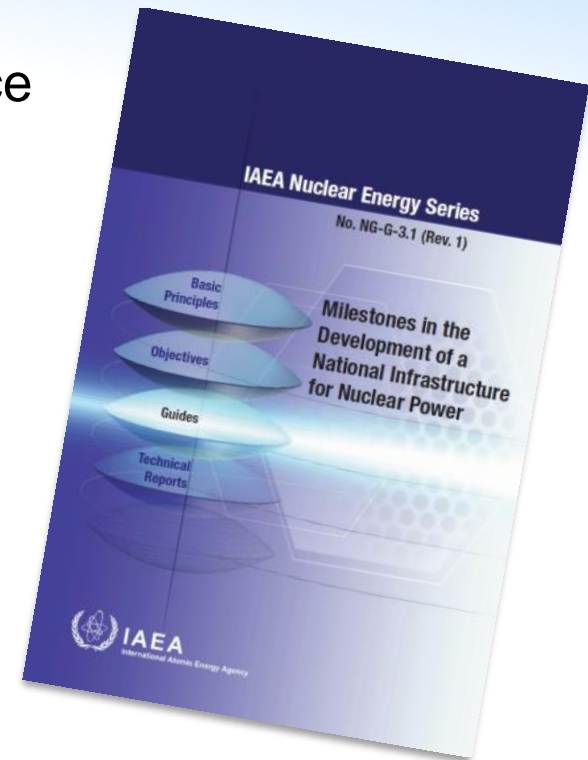
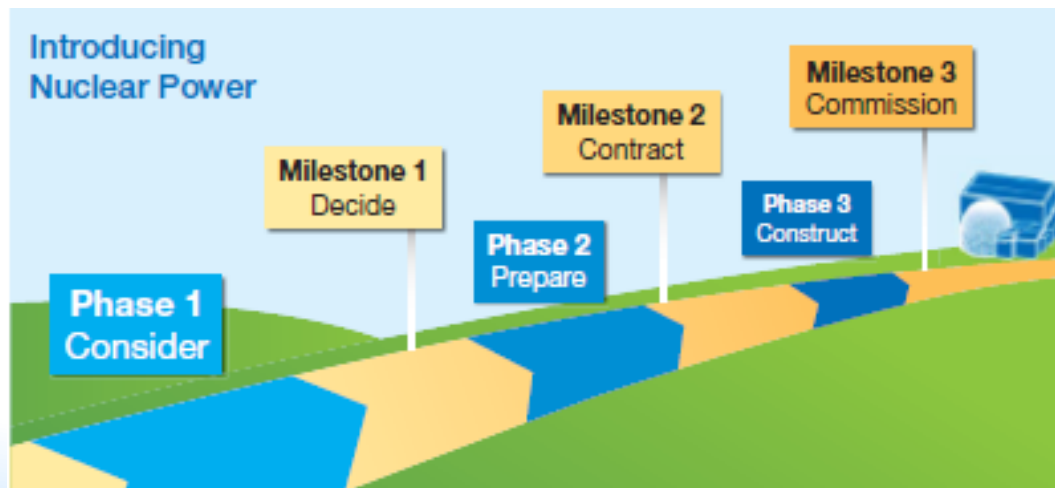
IAEA 60 Years
Atoms for Peace and Development

- ✓ Nuclear power is a long term commitment that requires strong national leadership
- ✓ A successful nuclear power programme requires commitment of at least 100 years.
- ✓ Creating the infrastructure and building the first nuclear power plant will take at least 10–15 years.
- ✓ The leadership should ensure coordination and broad political and popular support.
- ✓ The highest standards of safety, security and safeguards must be applied.
- ✓ The penalties of interruptions and restarts are significant.

IAEA Assistance to Newcomer Countries

The Milestones Approach

- Comprehensive framework for IAEA guidance
 - Adopted by embarking Member States, as well the nuclear industry in general
-
- 3 Phases (Consider – Prepare – Construct)
 - 3 Milestones (Decide – Contract – Commission)



NG-G-3.1 issued in 2007
Updated in 2015

Milestones Approach - Infrastructure Issues



National position



Nuclear safety



Management



Funding and financing



Legal framework



Safeguards



Radiation protection



Regulatory framework



Electrical grid



Human resource development



Stakeholder involvement



Site and supporting facilities



Environmental protection



Emergency planning



Nuclear security



Nuclear fuel cycle



Radioactive waste management



Industrial involvement

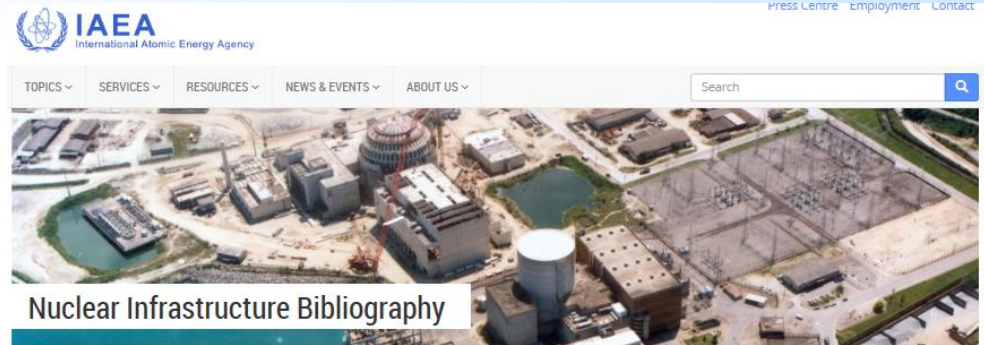


Procurement

The Milestones Approach is holistic and considers 19 specific infrastructure issues

Nuclear Infrastructure Bibliography

- Key and supporting documentation exists for the **19 Infrastructure Issues**



The IAEA guidance publication *Milestones in the Development of a National Infrastructure for Nuclear Power* outlines 19 infrastructure issues that need to be addressed in developing a new nuclear power programme. This bibliography is categorised according to these issues, listed below.

Click on any of the topics below to see the list of relevant IAEA publications. Further technical publications can be found on [IAEA Publications](#).

1. National Position
2. Nuclear Safety
3. Management
4. Funding and Financing
5. Legal Framework
6. Safeguards
7. Regulatory Framework
8. Radiation Protection
9. Electrical Grid
10. Human Resource Development
11. Stakeholder Involvement
12. Site and Supporting Facilities
13. Environmental Protection
14. Emergency Planning
15. Nuclear Security
16. Nuclear Fuel Cycle
17. Radioactive Waste Management
18. Industrial Involvement
19. Procurement

General

Fundamental Documents:

- *Introducing Nuclear Power: The Role of National Leadership*
→ Arabic | Chinese | French | Russian | Spanish
- *Milestones in the Development of a National Infrastructure for Nuclear Power*
- *Evaluation of the Status of National Nuclear Infrastructure Development*

Related Resources

- *Milestones in the Development of a National Infrastructure for Nuclear Power, 2015*
- *IAEA Milestones Approach: Developing the National Infrastructure for Nuclear Power*
- *IAEA Scientific and Technical Publications*



www.iaea.org/topics/infrastructure-development/bibliography

Integrated Nuclear Infrastructure Reviews (INIR)

- Based on the Milestones Approach:
19 Infrastructure Issues
3 Phases, 3 Milestones
- International expert peer review led by a high level IAEA manager
- Identifies areas for further action and makes suggestions and recommendations
- Requested by Member State government - results are delivered to government

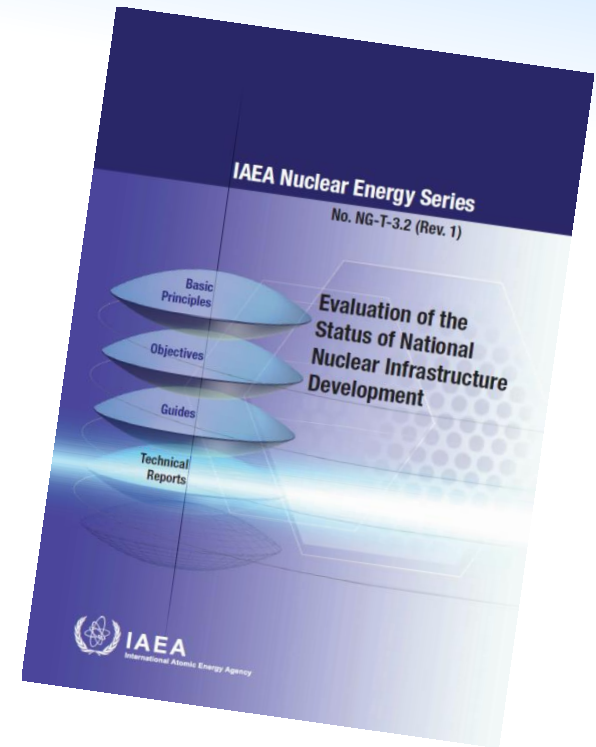


INIR evaluation methodology



For each infrastructure issue, conditions are described that should be met to achieve the Milestone in the specific phase:

- Phase 1: 32 conditions
- Phase 2: 42 conditions
- Phase 3 (*under testing*): 46 conditions



NG-T-3.2 issued in 2008
Updated in 2016

Examples of Phase 1 conditions₁

1. National Position Condition 1.1: Long term commitment made and importance of safety, security and non-proliferation recognized		Phase 1
Summary of the condition to be demonstrated	A clear statement adopted by the government of its intent to develop a nuclear power programme and of its commitment to safety, security and non-proliferation , with evidence that their importance is embedded in the ongoing work programme.	

3. Management Condition 3.1. Need for appropriate leadership and management systems recognized		Phase 1
Summary of the condition to be demonstrated	There is a commitment to leadership and management systems that will ensure success and promote a safety and security culture as well as the peaceful use of nuclear technologies. There are plans to ensure the knowledge gained by the NEPIO is transferred to the future regulatory body and the owner/operator of the programme.	

Examples of Phase 1 conditions₂

<p>5. Legal Framework</p> <p>Condition 5.2: Plan in place for development of a comprehensive national nuclear law</p>	<p>Phase 1</p>
<p>Summary of the condition to be demonstrated</p>	<p>There is an understanding of the requirements of the comprehensive national nuclear law that needs to be enacted, a plan with the actions and timescales for development and enactment, together with a commitment from the government to achieve the stated plan. The plan includes the need for the law to:</p> <ul style="list-style-type: none"> (a) Establish an independent nuclear regulatory body with adequate human and financial resources, and a clear and comprehensive set of functions; (b) Identify responsibilities for safety, security and safeguards; (c) Formulate safety principles and rules (radiation protection, nuclear installations, radioactive waste and spent fuel management, decommissioning, mining and milling, EPR and the transport of radioactive material); (d) Formulate nuclear security principles; (e) Give appropriate legal authority to, and define the responsibilities of, the regulatory body and all competent authorities establishing a regulatory control system (authorization, inspection and enforcement, review and assessment, and development of regulations and guides); (f) Implement IAEA safeguards, including a State system of accounting for and control of nuclear material (SSAC); (g) Implement import and export control measures for nuclear and radioactive material and items; (h) Establish compensation mechanisms for nuclear damage.

Examples of Phase 1 conditions₃

6. Safeguards Condition 6.2: Strengthening of the SSAC planned		Phase 1
Summary of the condition to be demonstrated	The Member State has a plan describing how the existing SSAC will be strengthened or adjusted to deal with the increase of activities and resources, as well as the need for enhancement of capabilities.	

15. Nuclear Security Condition 15.1: Nuclear security requirements <u>recognized</u> and the actions of all relevant organizations coordinated		Phase 1
Summary of the condition to be demonstrated	The NEPIO recognizes the importance of nuclear security , based on a national threat assessment and principles of prevention, detection and response. All competent authorities that are involved in nuclear security have been identified and there is a coordinating body or mechanism established that brings together <u>all</u> of the organizations that have responsibility for nuclear security. Note: The need to establish legislation and a regulatory framework is addressed under infrastructure issues Nos 5 and 7, legal framework and regulatory framework, respectively.	

NEPIO = Nuclear Energy Programme Implementing Organization

Examples of Phase 2 conditions₁

1. National Position Condition 1.3: Commitments and obligations of owner, operator and regulatory body established		Phase 2
Summary of the condition to be demonstrated	<p>The owner, operator and regulatory body have been established and the responsibilities of each organization have been clearly defined and understood, including their safety, security and safeguards responsibilities. The role of any national supporting organization (e.g. a technical support organization) has been clearly defined, as has any significant role for non-national organizations (e.g. vendor or other regulator). The latter is clearly defined in the contracting strategy.</p>	

7. Regulatory Framework Condition 7.2: Regulatory framework developed		Phase 2
Summary of the condition to be demonstrated	<p>The regulatory framework addresses all the relevant aspects for safety, security and safeguards related to siting, design and construction of the proposed NPP (including arrangements for spent fuel, waste management and the transport of radioactive material). The framework will ultimately need to cover all the phases of the programme, but at this stage some aspects (e.g. commissioning, operation, decommissioning) may be covered by future work plans.</p>	

Examples of Phase 2 conditions₂

3. Management Condition 3.3: Management systems established		Phase 2
Summary of the condition to be demonstrated	<p>Management systems have been defined for each of the three key organizations and include roles, responsibilities, organizational structure and processes (for Phase 2), including record keeping. The processes for Phase 3 are in place or planned to be produced before they are required. The management systems cover safety, nuclear security and safeguards, and are consistent with IAEA Safety Standards Series No.GSR Part 2, Leadership and Management for Safety. The systems promote a strong safety and security culture, include plans for self and independent evaluation, and include procedures to ensure that knowledge critical to the safe, secure and peaceful use of nuclear energy will always be preserved. For the NEPIO and the regulatory body, they also include mechanisms to monitor the programme for infrastructure development and to ensure it is consistent with the project schedule.</p>	

15. Nuclear Security Condition 15.4: Programmes in place for promotion of nuclear security culture		Phase 2
Summary of the condition to be demonstrated	<p>All relevant organizations understand the importance of a nuclear security culture and have plans to develop a nuclear security culture at all levels of the organization.</p>	

Examples of Phase 2 conditions₃

5. Legal Framework Condition 5.2: A comprehensive nuclear law enacted		Phase 2
<p>Summary of the condition to be demonstrated</p>	<p>The Member State has enacted the national nuclear legislation that:</p> <ul style="list-style-type: none"> (a) Establishes an independent nuclear regulatory body with adequate human and financial resources, and a clear and comprehensive set of functions; (b) Identifies responsibilities for safety, security and safeguards; (c) Formulates safety principles and rules (radiation protection, nuclear installations, radioactive waste and spent fuel management, decommissioning, mining and milling, EPR and the transport of radioactive material); (d) Formulates nuclear security principles; (e) Gives appropriate legal authority for, and definition of, the responsibilities of the regulatory body and all competent authorities establishing a regulatory control system (authorization, inspection and enforcement, review and assessment, and development of regulations and guides); (f) Implements IAEA safeguards, including an SSAC; (g) Implements import and export control measures for nuclear and radioactive material and items; (h) Establishes compensation mechanisms for nuclear damage. 	

Examples of Phase 3 conditions₁

1. National Position Condition 1.1: Government role assigned and effective		Phase 3
Summary of the condition to be demonstrated	Government entities have been assigned the on-going government responsibilities for the sustainability of the nuclear power infrastructure . There is an agreed mechanism for communication and co-operation among the key organizations.	

7. Regulatory Framework Condition 7.1: Competent independent regulatory body operating effectively		Phase 3
Summary of the condition to be demonstrated	An independent regulatory body is in place with <u>sufficient</u> funding and competent to oversee the peaceful, safe and secure operation of the NPP including review, licensing and inspection activities.	

Methodology under pilot testing – to be finalized

Examples of Phase 3 conditions₂

2. Nuclear Safety Condition 2.2: Leadership and safety culture evident (see also 15.4)		Phase 3
Summary of the condition to be demonstrated	The senior management of all organizations provides effective leadership; a safety culture is evident throughout the owner/operator and its activities are verified and addressed by regulatory inspection.	
15. Nuclear Security Condition 15.3: Leadership and security culture evident (See also 2.2)		Phase 3
Summary of the condition to be demonstrated	The senior management of all organizations provide effective leadership; a nuclear security culture is evident throughout the owner/operator and its activities are verified and challenged by regulatory inspection.	

Methodology under pilot testing – to be finalized

Integrated Work Plans (IWPs)

- Developed in consultation between the IAEA and the Member State
- Reviewed at least annually
- National action plan, recommendations from INIR missions, other reviews and the results of TC projects are key inputs
- Output are the activities for which the IAEA can provide support, typically:
 - Capacity building missions
 - Facilitating scientific visits and fellowships
 - Expert missions
 - Advisory missions
 - Review missions





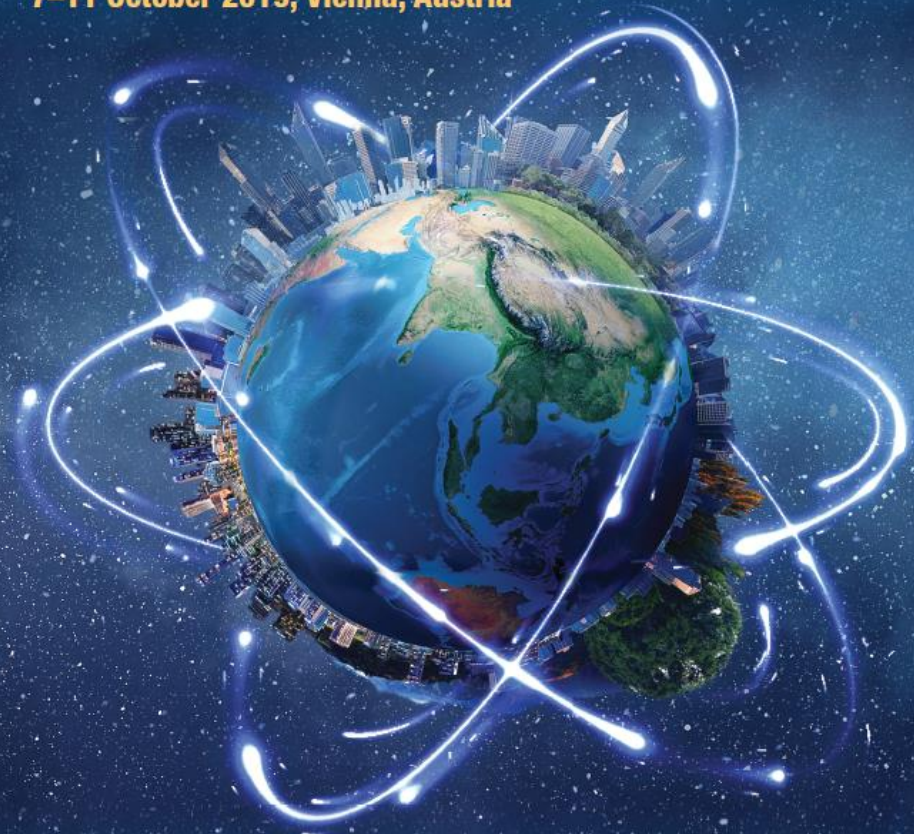
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Thank you!

International Conference on
**Climate Change and the
Role of Nuclear Power**

7–11 October 2019, Vienna, Austria



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