



IAEA

Webinar

August 14 2025

Developing National Nuclear Infrastructure – Tools, Milestones, and Practical Support

John Haddad

Nuclear Infrastructure
Development Expert

John Haddad

- More than 18 years experience in nuclear power.
- Currently nuclear infrastructure development expert in NIDS in the Nuclear Power Division, Department of Nuclear Energy, having joined the IAEA in 2013. Responsibilities include being an INIR mission team leader or team member; NIDS specialist for Siting and Environmental protection and IWP and INT24 Coordinator. Before joining NIDS, worked as a nuclear safety officer in the Nuclear Safety and Security Department.
- Previously Director of infrastructure in the Jordan Atomic Energy Commission (JAEC) in Jordan in the period 2009-2013. Responsibilities included: siting, technology assessment, bidding and contract evaluation and negotiation. In addition, 15 year of experience in the areas of consulting engineering services and management of nuclear, civil and environmental engineering projects.
- Educational background in nuclear , civil, and environmental engineering, University of Michigan, Ann Arbor in the USA.



Content

- The International Atomic Energy Agency (IAEA)
- Milestones Approach for developing a nuclear power programme
- Building national position for a nuclear power programme
- IAEA support and available tools for infrastructure development
- Conclusion

IAEA at Glance, from 1957 to date

- IAEA founded in 1957
- as the world's “**Atoms for Peace**” organization
- The Agency is Mandated “ to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world “ (Art. II, IAEA Statute)



International Atomic Energy Agency



180 Member States
(as of November 2024)



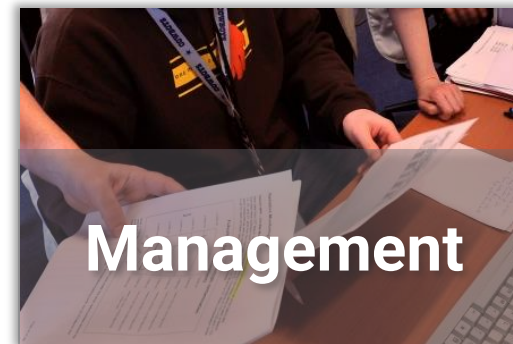
2500+ staff
from
over 100 countries

- 
- **Headquarters in Vienna**
 - **15 international laboratories** (Vienna, Seibersdorf, Monaco) and research centres
 - **2 Regional safeguards offices** (Toronto, Tokyo)
 - **2 Liaison offices** (New York, Geneva)

IAEA Organization

Director General's Office includes the secretariat of the policy-making organs, legal affairs, internal oversight services and press and public information.

- **Departments**



Policy-making Organs



WHO?

All **180** Member States

35 Board Member States

(varies from term to term)

WHEN?

Once per year (Usually in Sep)

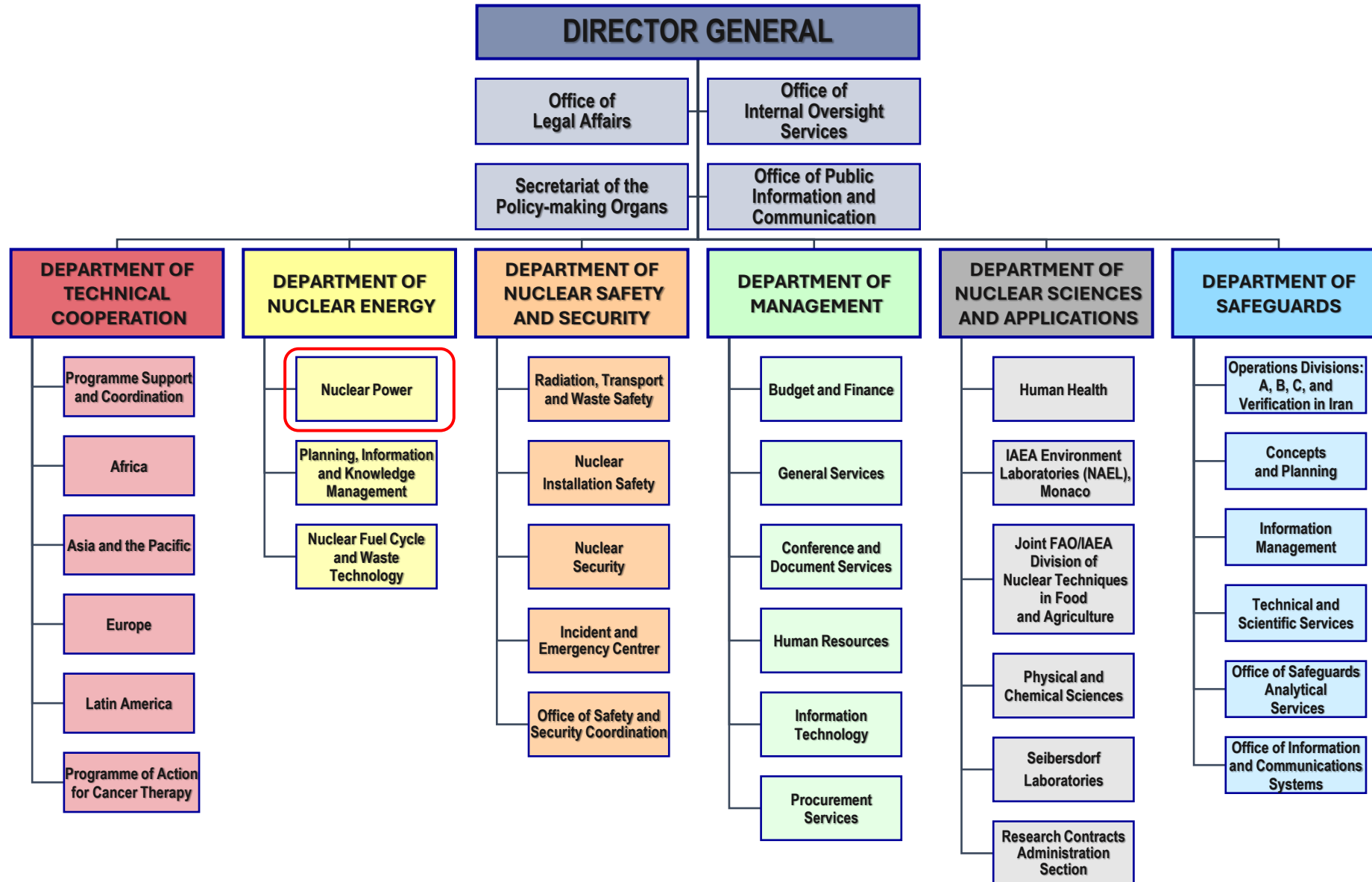
5 times per year (Mar, Jun, Sep, Nov)

WHAT?

- Considers / approves IAEA's programme and budget.
- Decides on other issues raised by the BoG, the Director General, and Member States.

- Examines IAEA's financial statements, programme and budget.
- Approves safeguards agreements and publication of the IAEA's safety standards.
- Appointment of the DG, with the approval of the GC.

The IAEA organizational chart



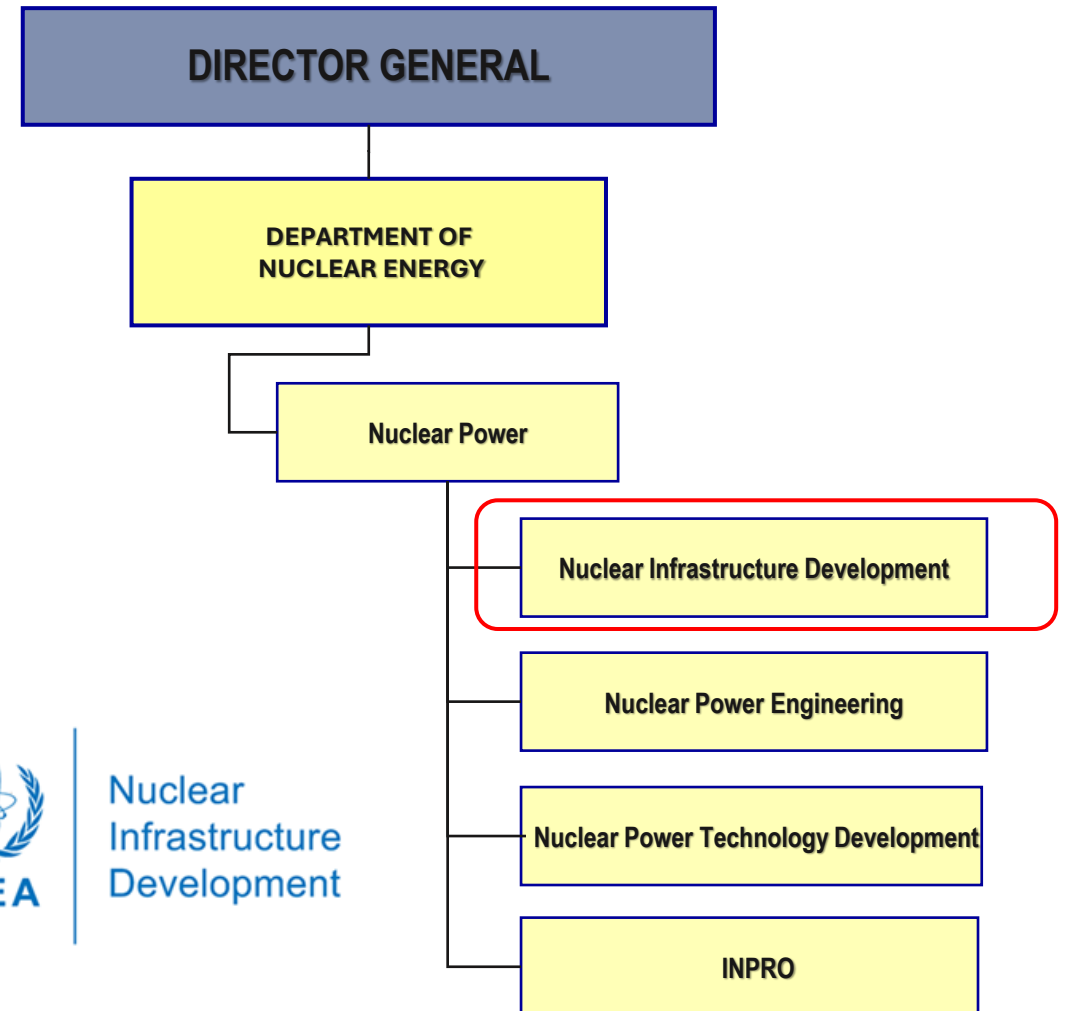
Nuclear Infrastructure Development Section

Coordinate Integrated Support for Nuclear Power Programme Infrastructure Development with the following objectives:

- Support MS in improving their understanding of responsibilities and obligations essential to implementing safe, secure, efficient and reliable nuclear power programmes.
- Support MS in developing, in a phased manner, the necessary infrastructure to enable the introduction of nuclear power.
- Provide integrated and coordinated Agency support to MS embarking on a nuclear power programme.



Nuclear
Infrastructure
Development



More Nuclear Power Needed for Clean Energy Transition

“Nuclear power offers a steady, reliable supply of electricity. It can provide continuous, low-carbon power to back up increasing use of renewables. It can be the key that unlocks their potential by providing flexible support—day or night, rain or shine.”

“Nuclear power needs a place at the table where the world’s energy future is decided.”

Mr Rafael Mariano Grossi
IAEA Director General



“The Milestones Approach is a solid point of reference”

37 Newcomers

Decision-Making Phase: 23 Countries

Countries considering nuclear power without having made a final decision



Post-Decision-Making Phase: 14 Countries

Countries that made a decision and are building the infrastructure or have signed a contract and have started or will soon begin construction

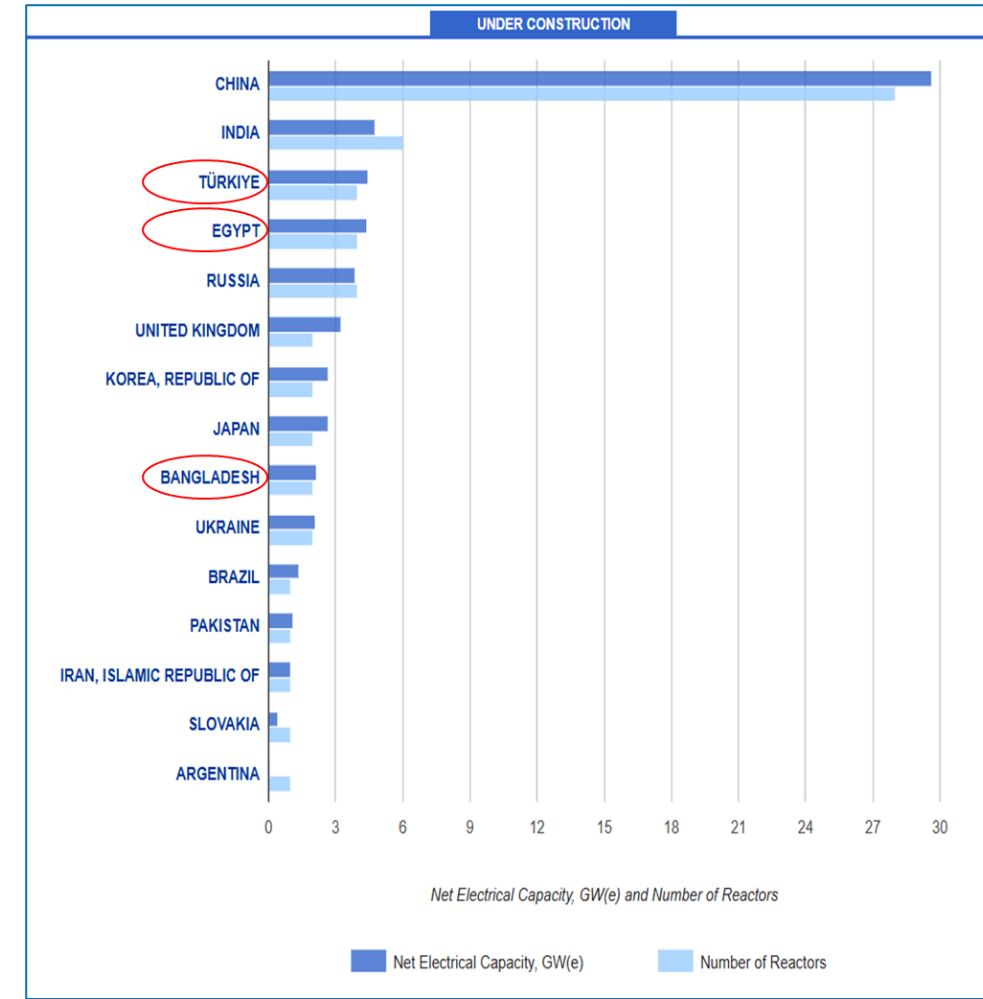


New operating countries

(July 2025)

- Two new operating countries have emerged
- **The UAE** connected to the grid the first unit on 19 Aug. 2020, second unit on 14 Sep. 2021, third unit on 10 Oct. 2022, fourth unit on 23 March 2023.
- **Belarus** connected to the grid the first unit on 3 Nov. 2020, second unit on 13 May 2023.
- Three new operating countries are emerging
- **Bangladesh** is preparing for fuel loading in mid 2025
- **Türkiye** is close to the commissioning of the first units.
- **Egypt** has started the construction of four units.

- Out of 61 reactors currently under construction 10 are in newcomer countries



So, the questions:



What is the Milestones Approach?

What are the infrastructure needed for a nuclear power programme ?



A nuclear power plant project.....

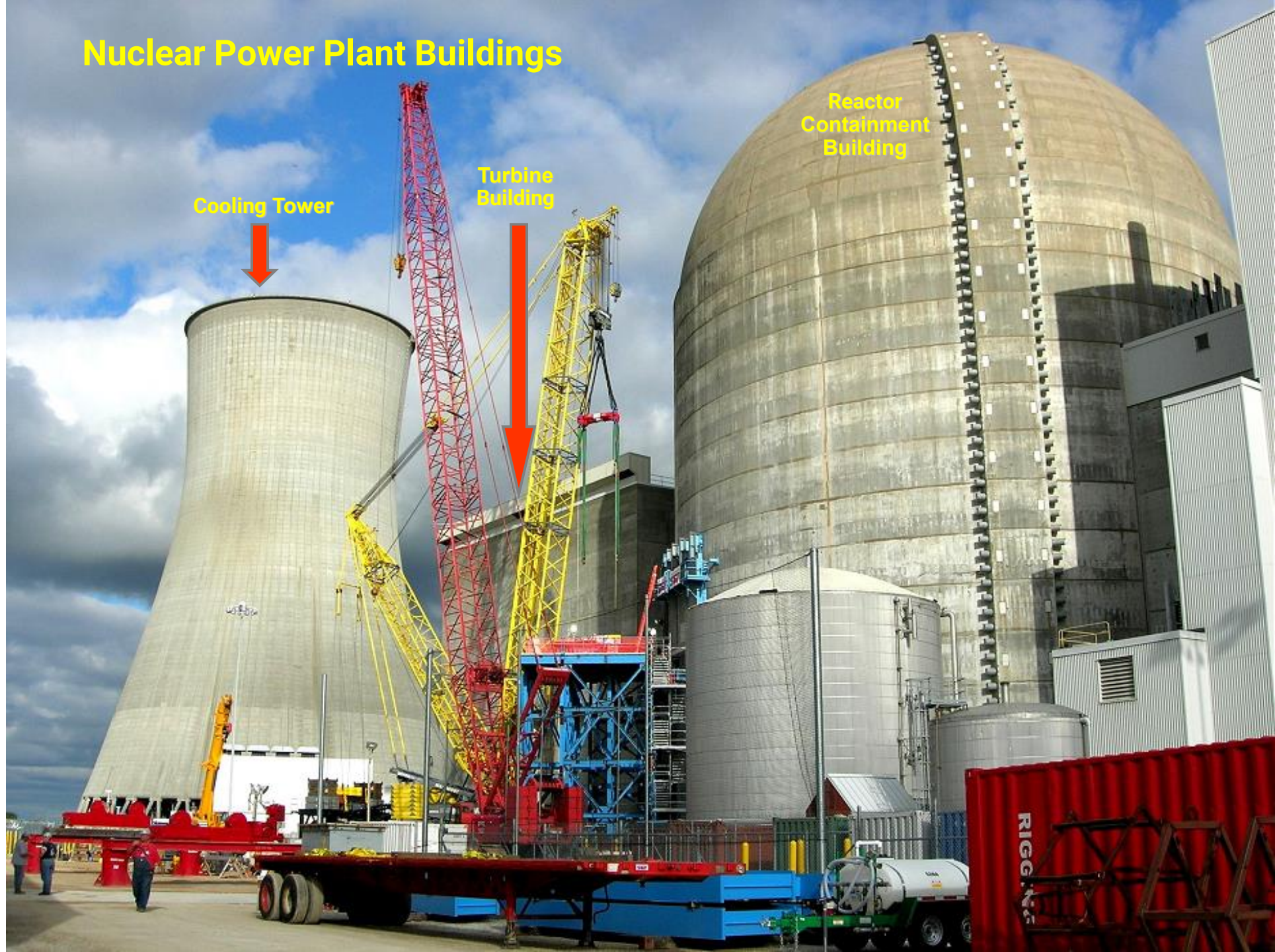


Example of NPP site layout



Example of NPP site layout

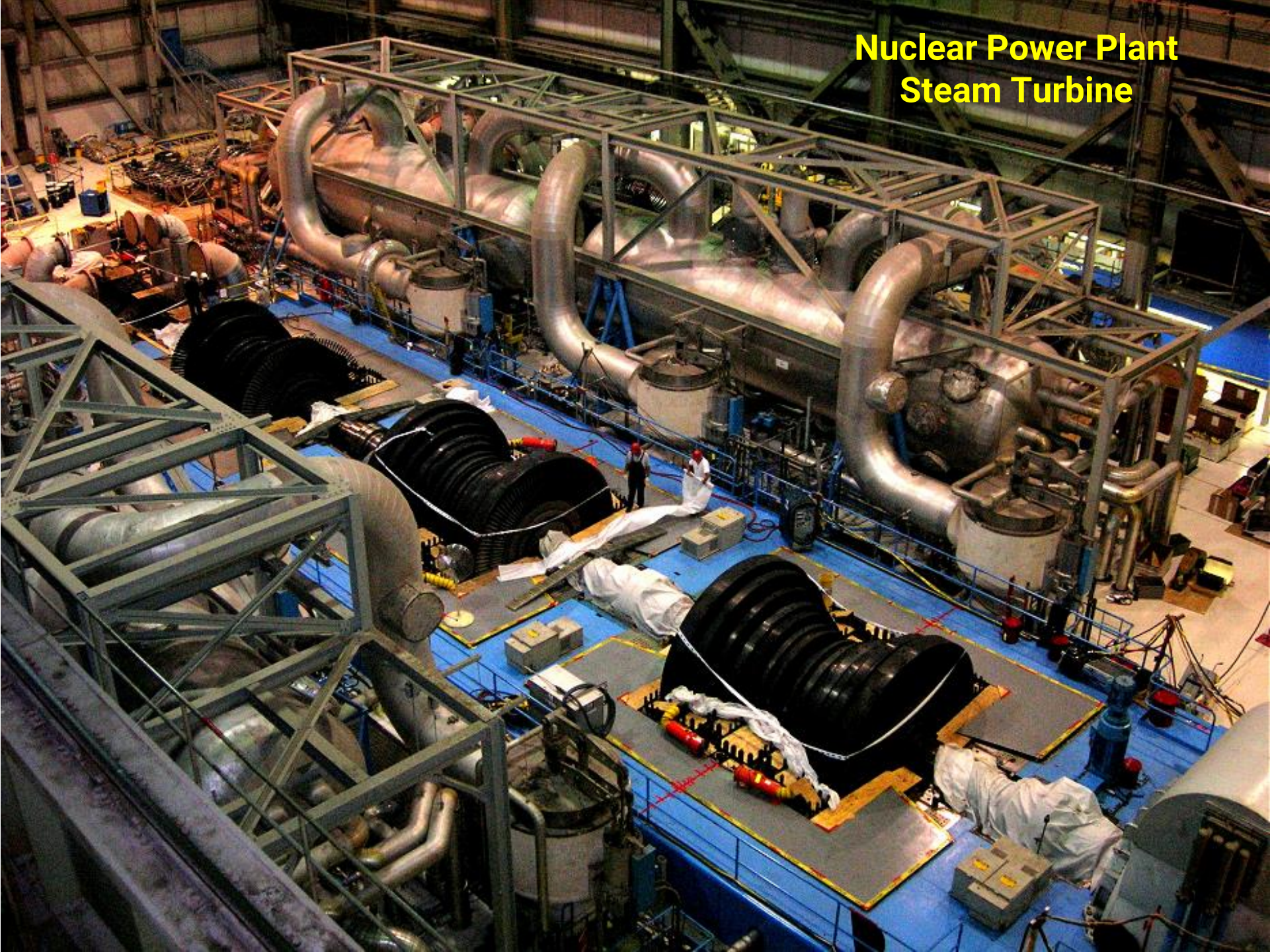
Nuclear Power Plant Buildings



Nuclear Power Plant Steam Generator



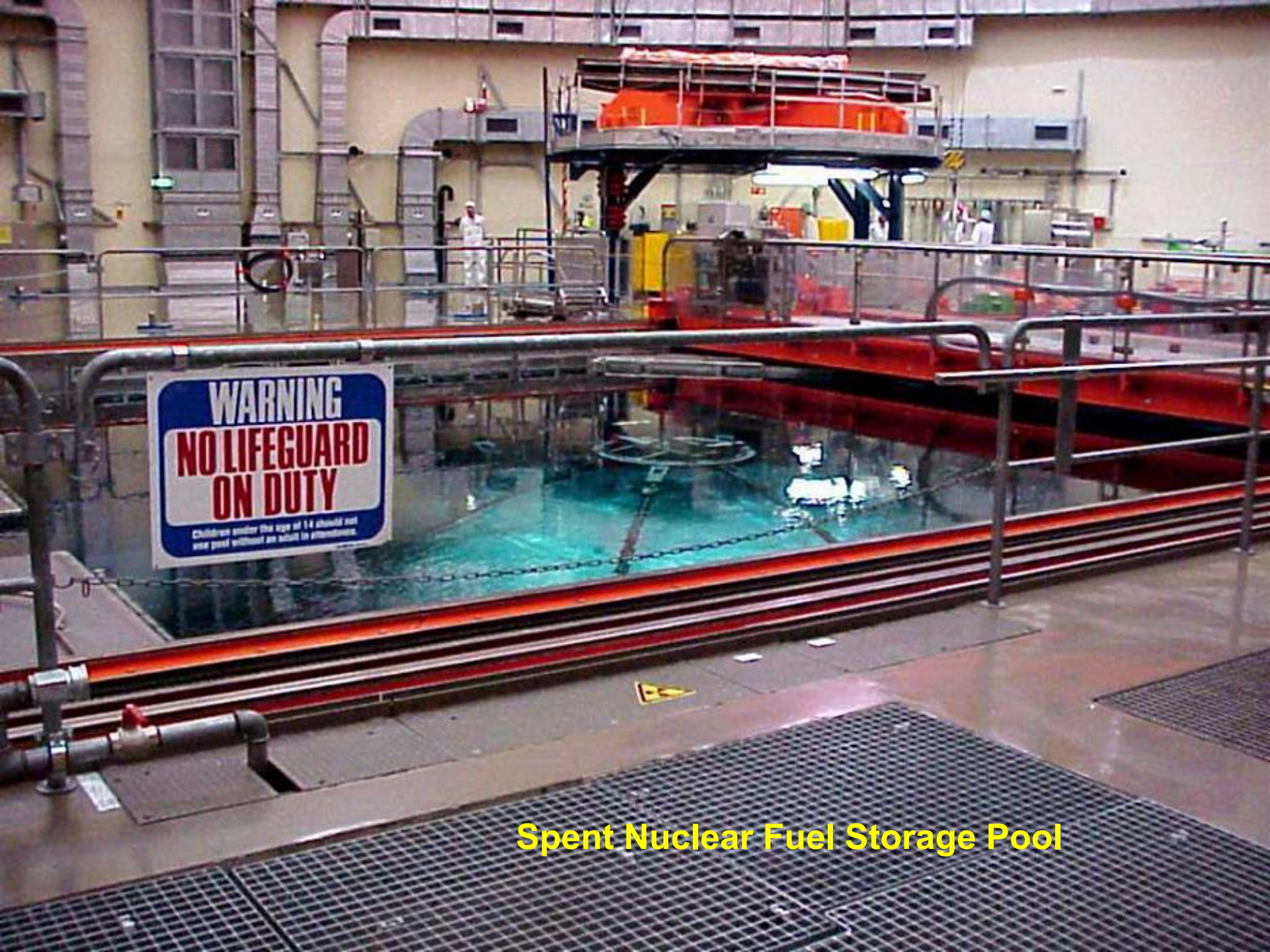
**Nuclear Power Plant
Steam Turbine**



**Nuclear
Power
Plant
Electrical
Generator**



22 8:00 AM




Spent Nuclear Fuel Storage Pool



Spent Nuclear Fuel Transportation



**Nuclear Power Plant
Operational Radioactive
Waste**



*When embarking on a nuclear power programme,
the following issues must be considered and answered:*

19 Infrastructure Issues

- Soft infrastructure issues
- Hard infrastructure issues
- National level with some international elements
- Some are interrelated
- All needs certain actions in each phase of the nuclear power programme

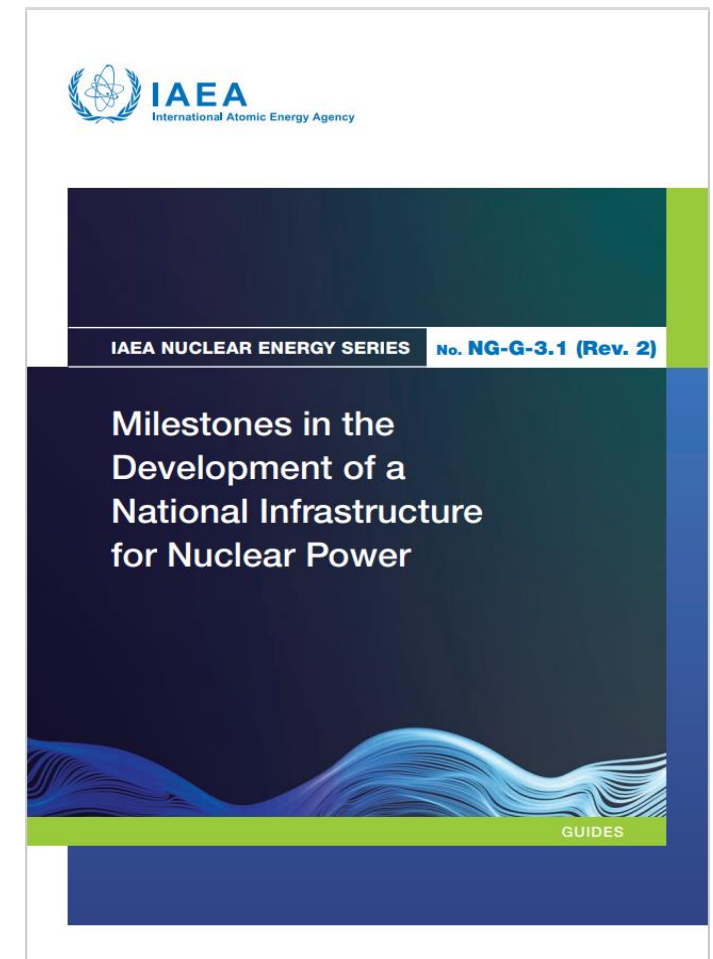


Milestones Approach

Due to the nature of nuclear technology, it is necessary to have an integrated national approach to coordinate and manage a Nuclear Power Programme. The IAEA has developed a framework for assisting States in the implementation of a Nuclear Power Programme.

The Milestones Approach allows a Member State to ensure sequentially, at each milestone, that it has:

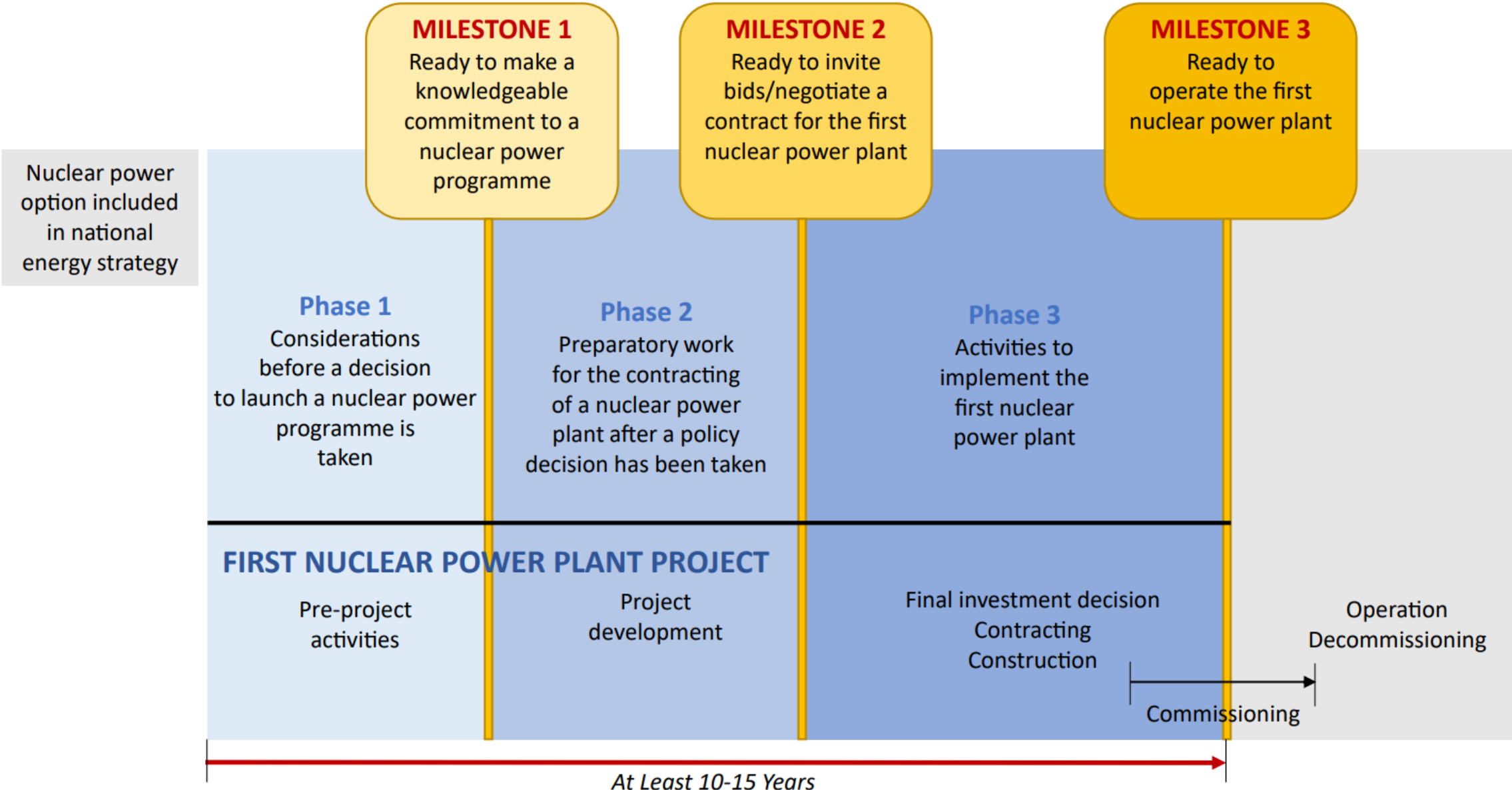
- recognized and identified national commitments
- prepared the national infrastructure
- established all of the necessary competencies and capabilities to regulate and operate a nuclear facility.



2024

An internationally accepted method to implement sustainable nuclear power programmes

NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT

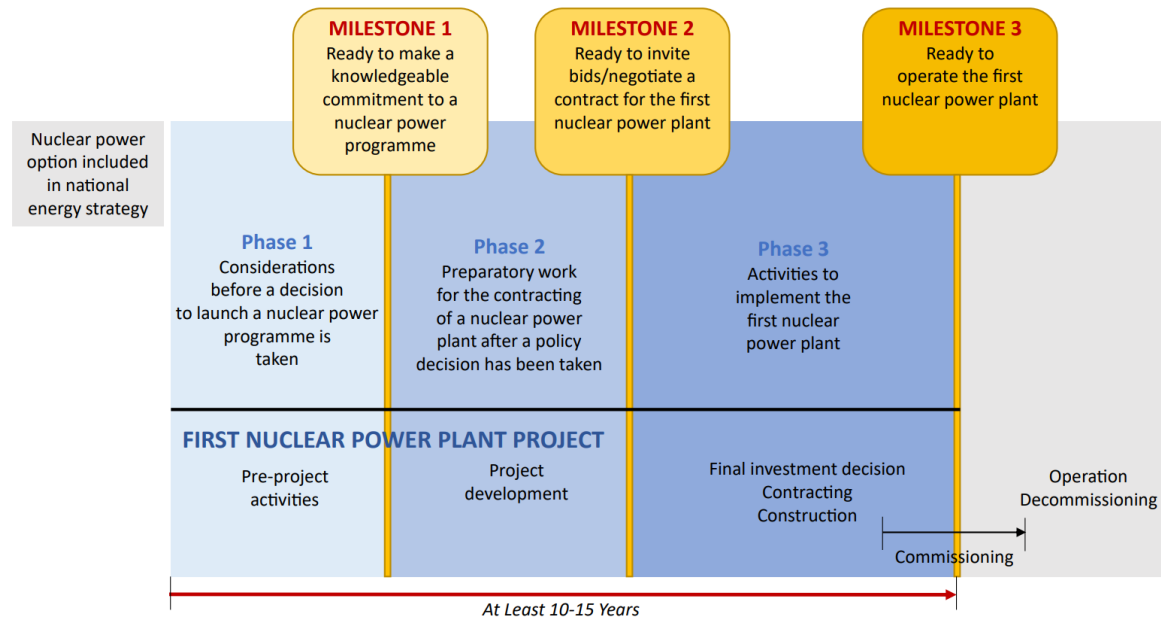


Milestones Approach

A phased and comprehensive **management guide** on creating an **enabling environment** for successful and sustainable **nuclear power programme**

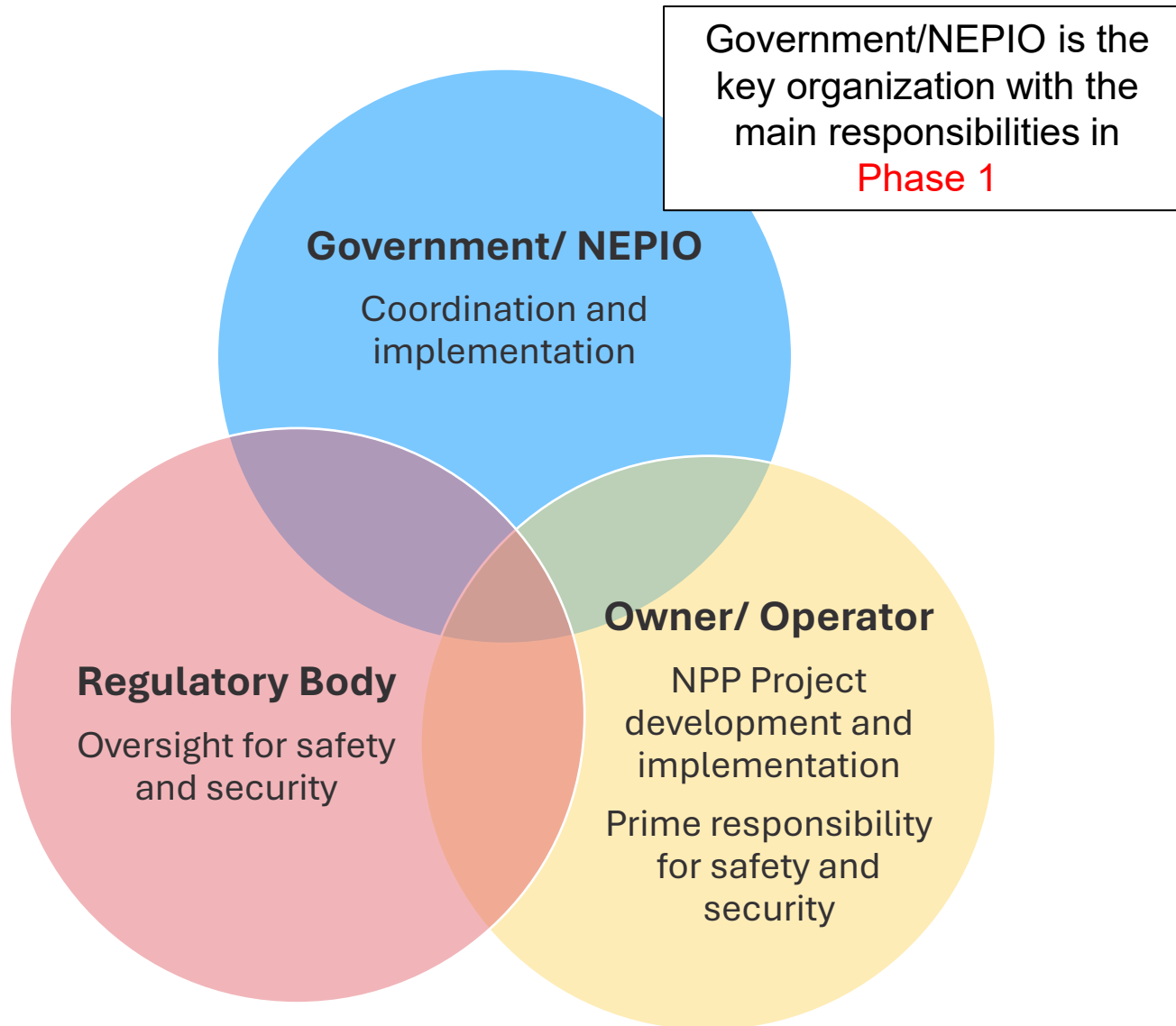
- ③ Phases (Consider – Prepare – Construct)
- ③ Milestones (Decide – Contract – Commission)
- ① Infrastructure Issues

NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT



2024

Three Key Organizations



Other relevant organizations

- Ministry of Energy
- Ministry of Environment
- Security authorities, local and national
- Technical and educational/academical institutions
- Etc.

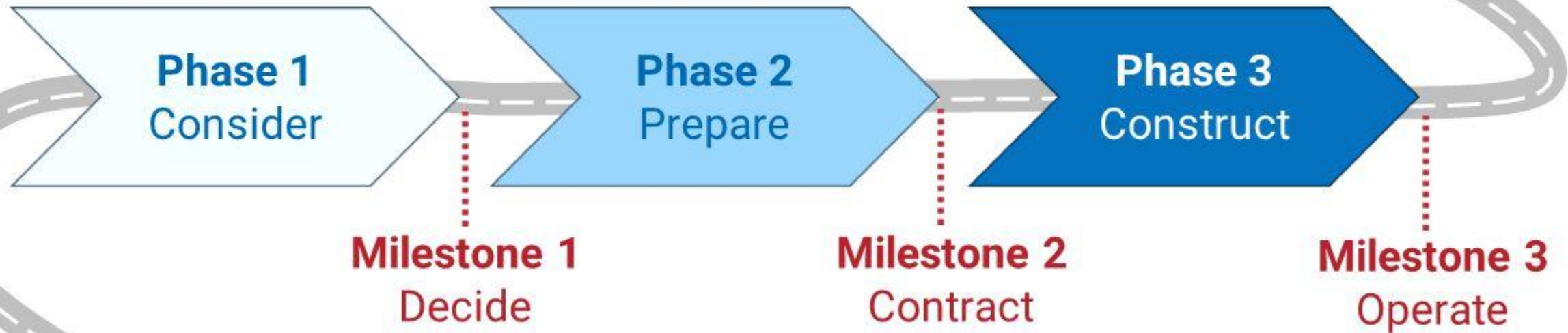
All organizations

- to implement necessary activities in the current Phase
- to make preparations for the next Phases

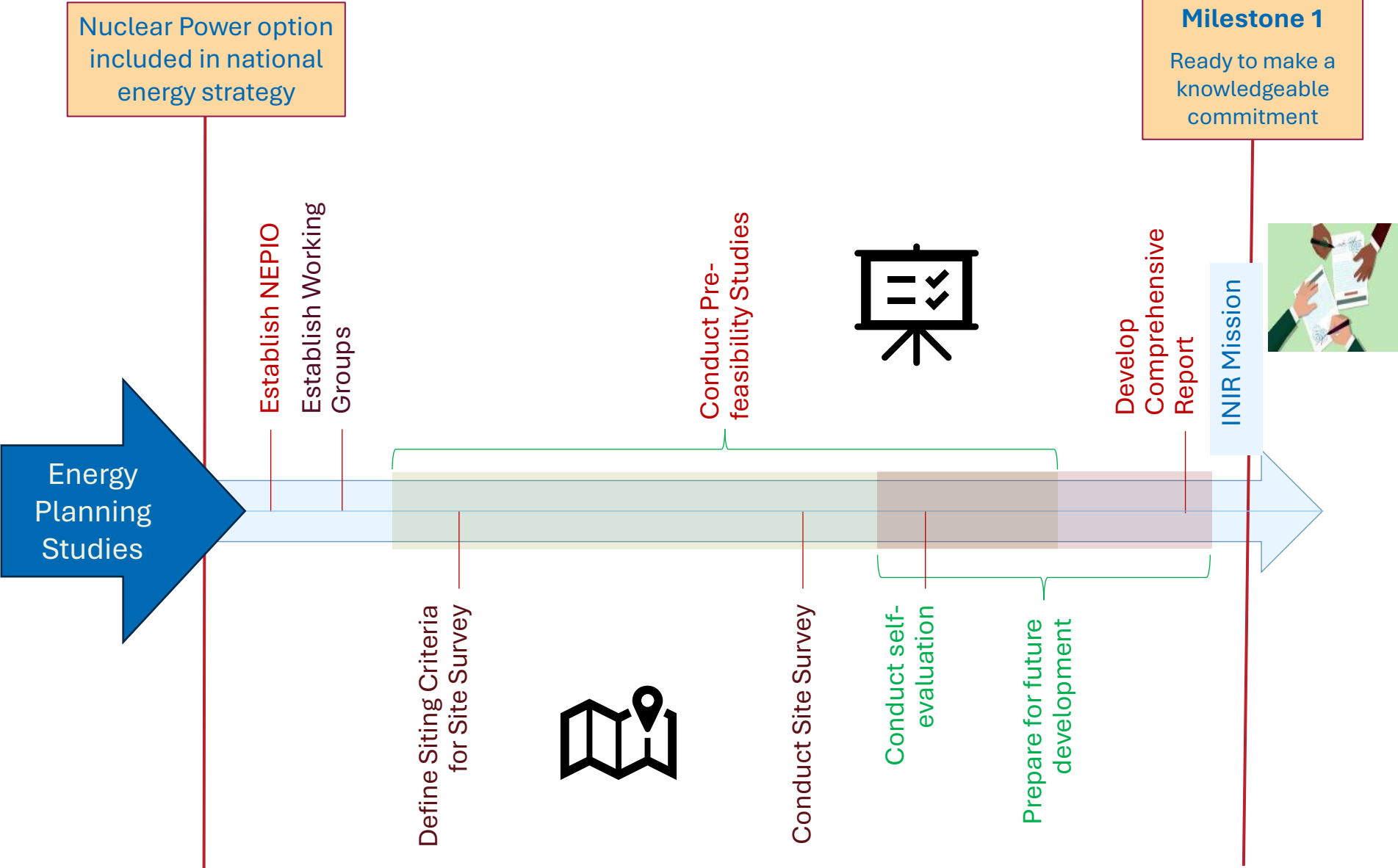
of the nuclear power programme

IAEA Milestones Approach: Infrastructure Development Phases

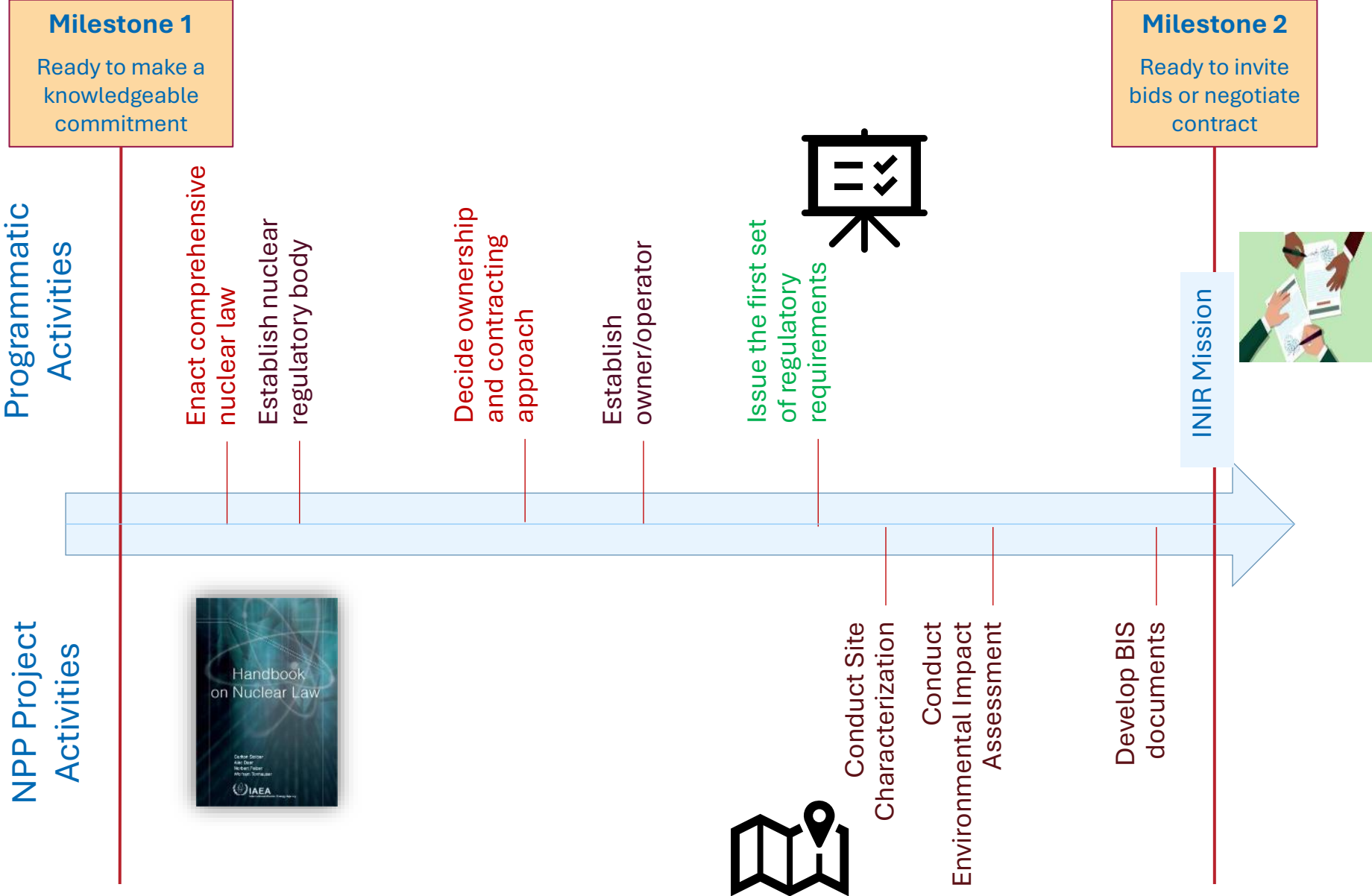
Introducing Nuclear Power



Key activities in Phase 1: Considered



Key activities in Phase 2: Prepare



Key activities in Phase 3: Construct



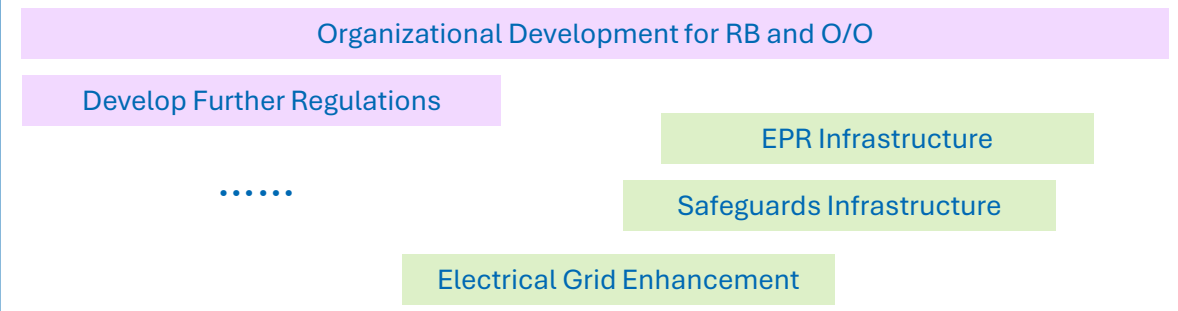
UAE, Barakah (2020)



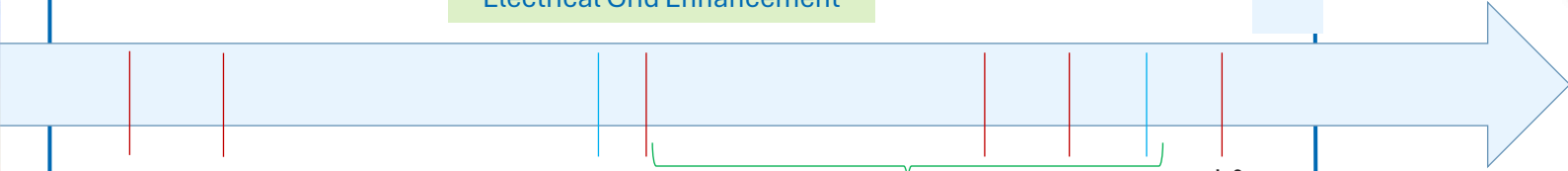
Belarus, Ostrovets (2020)



Bangladesh, Roopur (2020)



INIR Mission



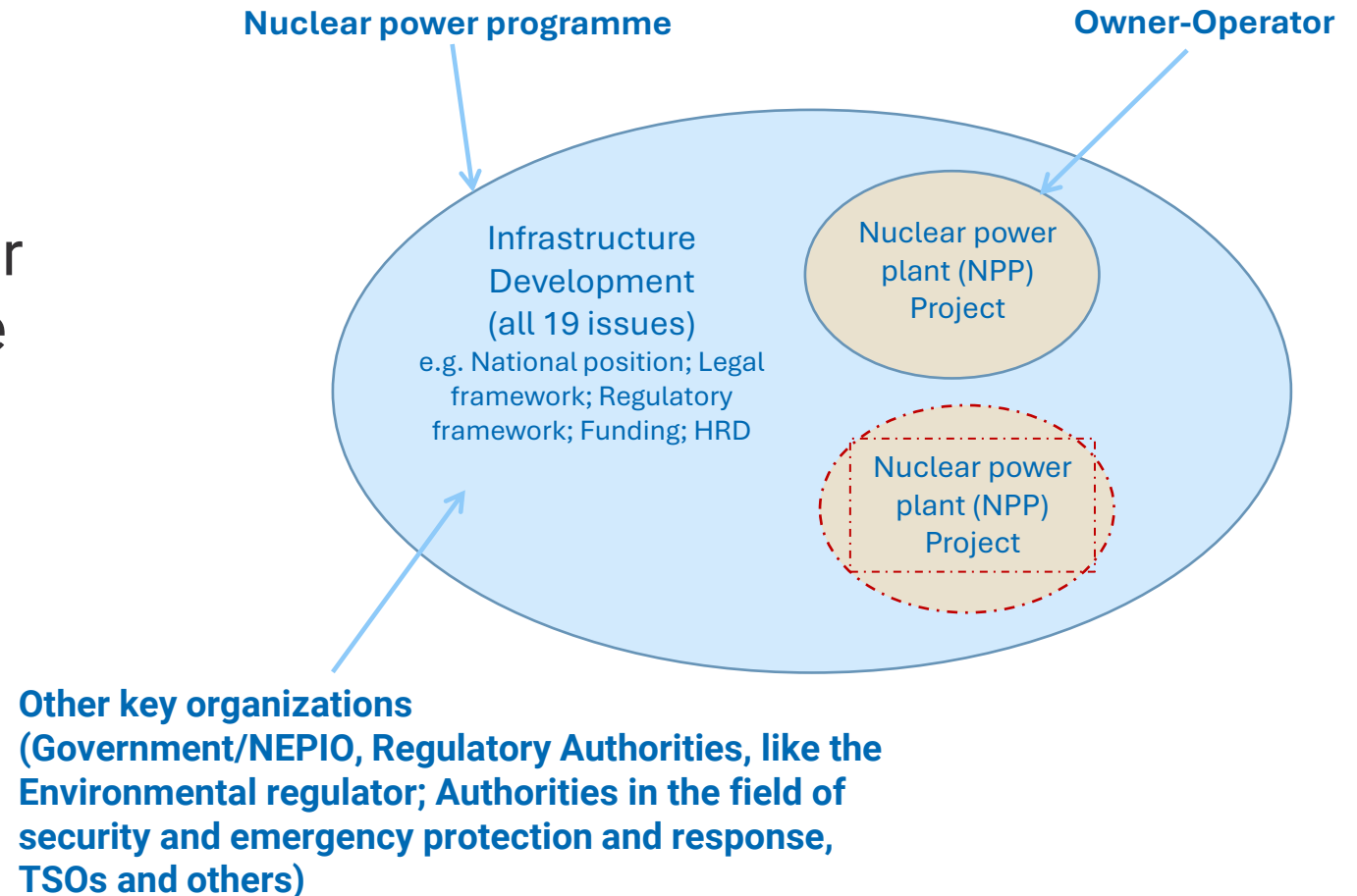
- Bid received
- Contracting
- Site preparation
- Final investment decision
- Construction License Issued
- First Safety Concrete
- Construction and construction oversight
- Start of commissioning
- Fuel delivery
- Operation License Issued
- Fuel loading

Operation

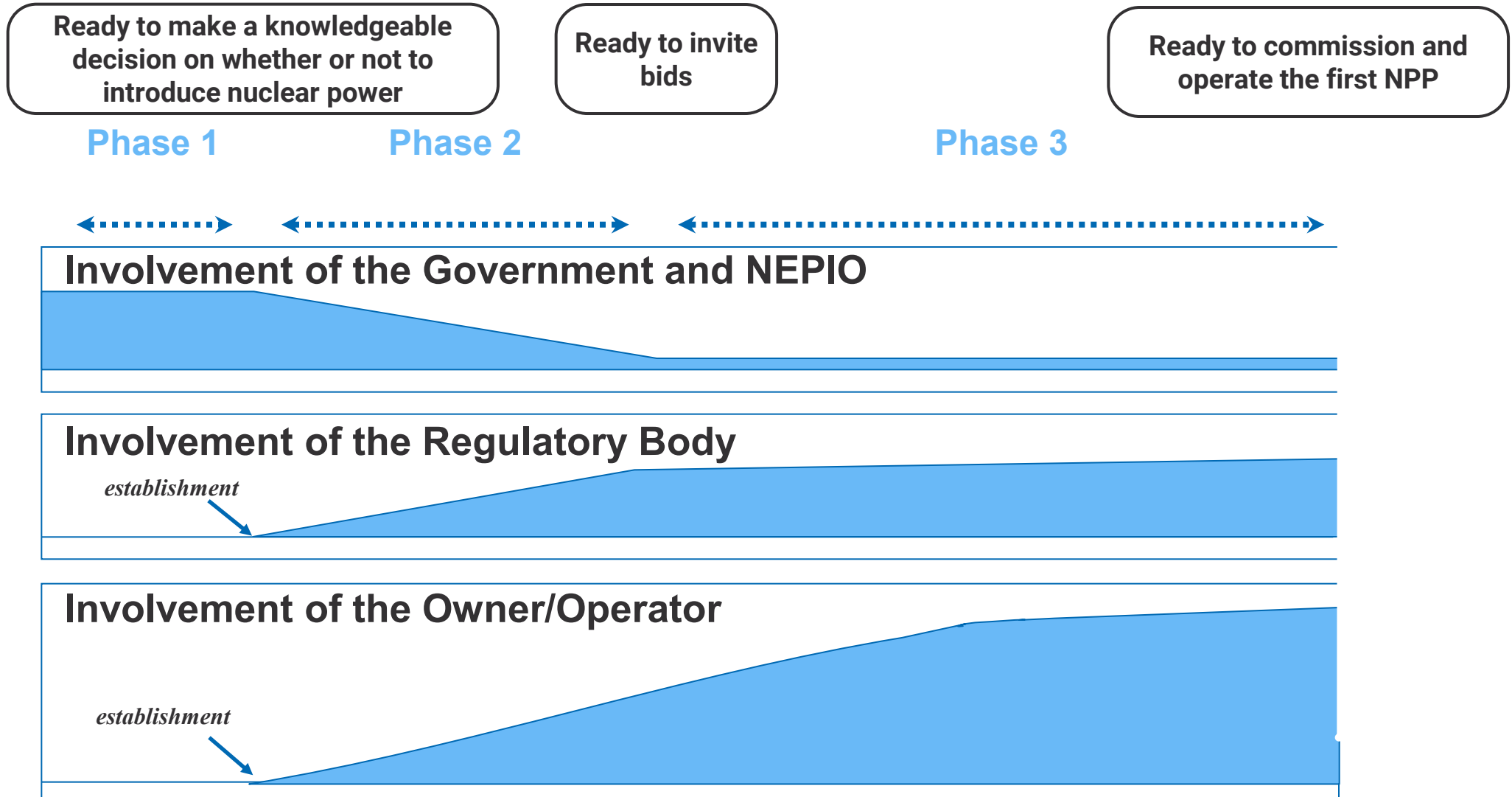
Programme vs Project

The infrastructure provides the processes and capabilities to **enable the project activities** and the subsequent operation of the NPP to be implemented safely, securely and sustainably

- Nuclear Power Programme includes one or more Nuclear Power Plant projects and the supporting infrastructure as enabling environment.
- Projects are temporary undertakings to develop and construct the NPPs



Organisational aspects





Building a national position for a new nuclear power programme

Introduction

- Launching a nuclear power programme **is a major undertaking** requiring careful:
 - planning;
 - preparation; and
 - investment in time, institutions and human resources.
- A decision to embark on a nuclear power programme should be based upon a **well-defined** and **knowledgeable** national position.
- A nuclear power programme **requires a major investment** in time and in human and financial resources.
- While nuclear power is not alone in this respect, **it is different because** of the:
 - safety
 - security and
 - safeguards requirements associated with using nuclear material and the long- term commitment required by a nuclear

Introduction

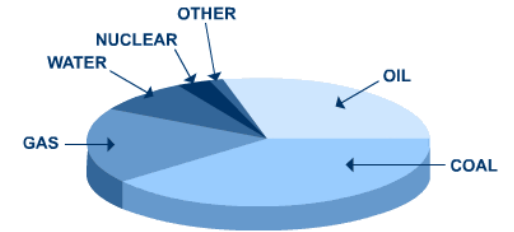
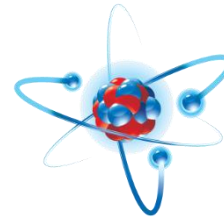
This **commitment** requires

- Establishing a sustainable national infrastructure such as:
 - governmental
 - legal
 - regulatory
 - Managerial
 - technological
 - human resource,
 - industrial and
 - stakeholder
- **Support** of the nuclear power programme throughout **its life cycle**
- The demonstration of **compliance** with:
 - international legal instruments
 - internationally accepted nuclear safety standards
 - nuclear security guidelines and
 - safeguards requirements is essential in establishing a responsible nuclear power programme

Energy planning



Including Nuclear into Energy Mix



Energy Planning



What energy mix?

Lack of Energy

Scenarios of future demand for energy services and optimal energy supply mixes that reflect domestic resource endowment, existing and future energy infrastructures, energy flows and technology options consistent with a country's sustainable development objectives for the next 20 to 30 years.

National Position

*“The government should adopt a clear statement, which reflects broad political support, of its intent to develop a nuclear power programme, and it should communicate that intent locally, nationally, regionally and internationally.” - **Milestones***

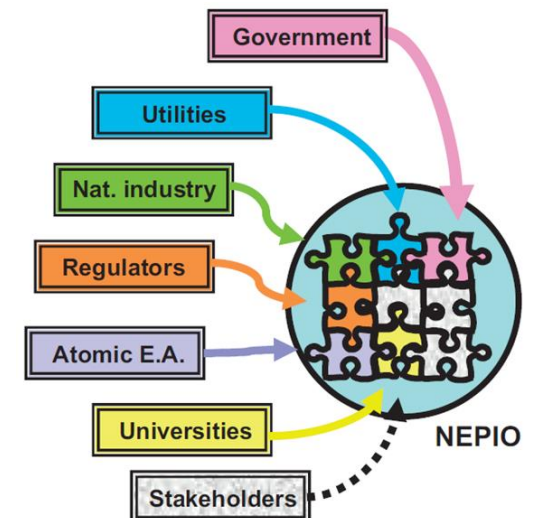
Definition - national position

National position is the **outcome of a process** that:

- begins with the review of a country's national economic and social development policy;
- results in a national decision that clearly communicates the national policy, as well as the *commitment* to proceed according to the international obligations, norms and standards.
- gives a **credible answer** to the question of why nuclear power is being chosen.
- represents the **result of a deliberative** technical and political process with the public

Identifying and involving stakeholders

- Establishing a national position **requires effective communication** with various individuals and institutions both within and outside of government.
- The **exact composition** of the groups involved in this process may **differ** between countries.
- There are **three general sets** of stakeholders :
 - political decision makers and elected officials
 - professional and technical community; and
 - the public and other stakeholders



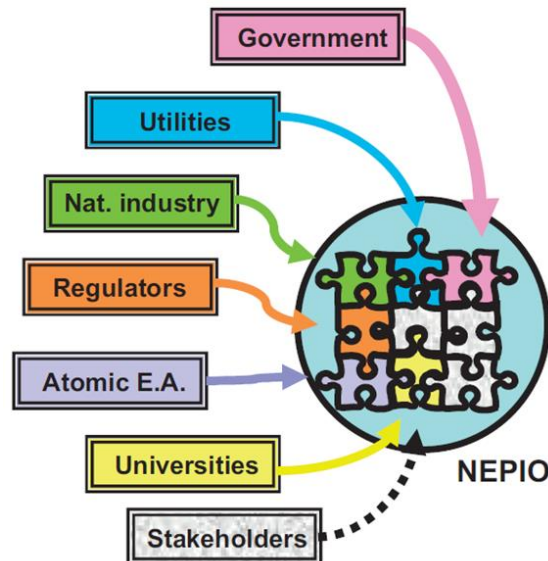
Establishing NEPIO - Overall Coordination



To properly evaluate the introduction of nuclear power, a State may wish to designate a governmental body, as **a coordination mechanism**

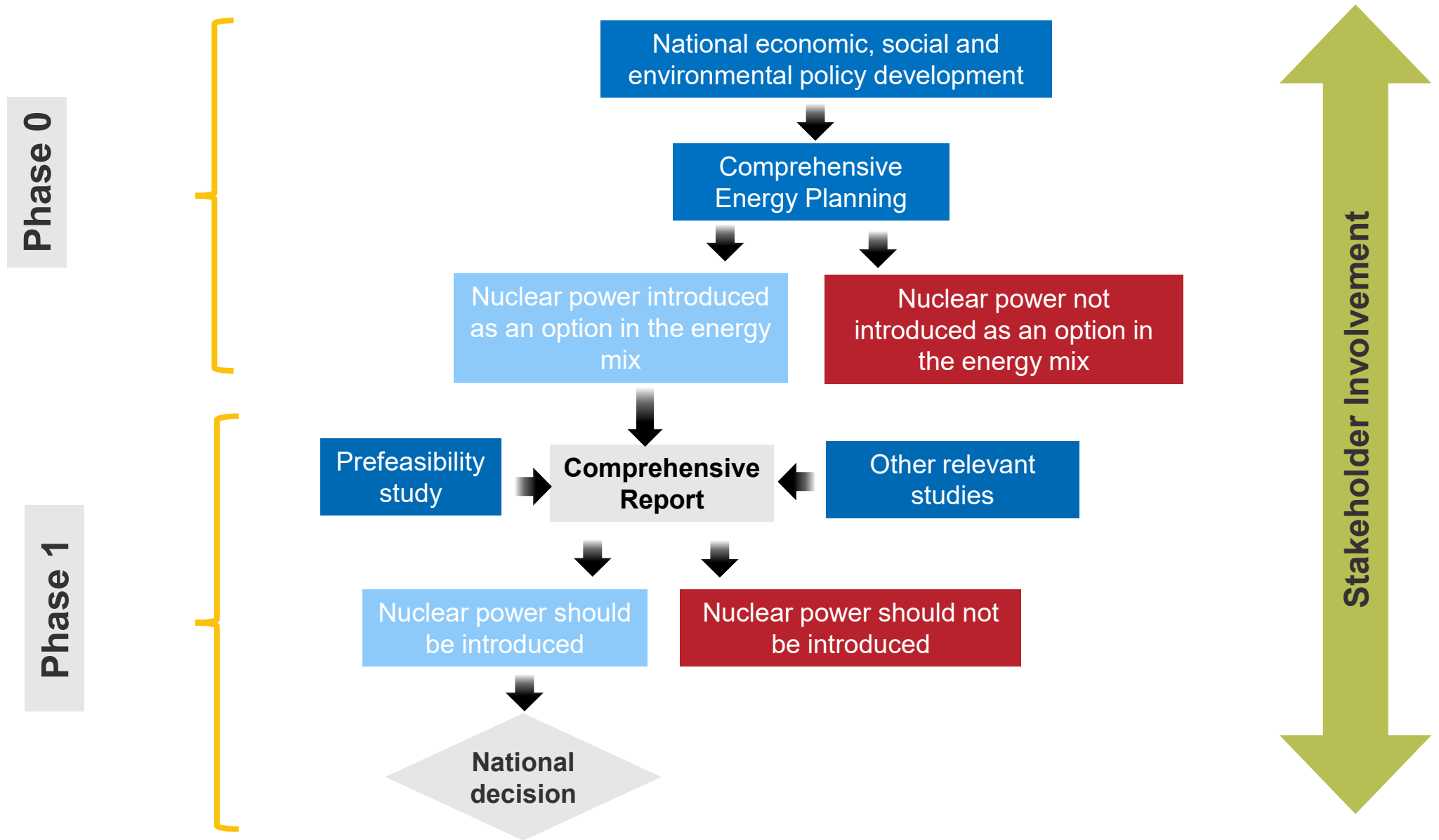
Nuclear
Energy
Programme
Implementing
Organization

to conduct and complete the pre-feasibility studies and a comprehensive report necessary to make a knowledgeable decision



- NEPIO may include designated government officials, and members of the professional and technical community.
- NEPIO members are appointed at a high level in the government
- NEPIO is **empowered with the necessary authority** needed to carry out its functions.

Process of building a national position



National Decision – Communication

The national decision to embark on a nuclear power programme should be communicated in a transparent and unambiguous manner

- Represents a national consensus
- May require a consultative process (e.g., legislature or parliament) to ensure broad, sustainable support
- Should be clearly documented

Documenting the national decision

Member States may document the national decision in different forms, such as:

- A national policy paper or white paper, published by the government and endorsed at the highest level
- An executive or presidential decree
- An act of a parliament or similar institution
- Publication of a government gazette indicating the decision to embark on a nuclear power programme

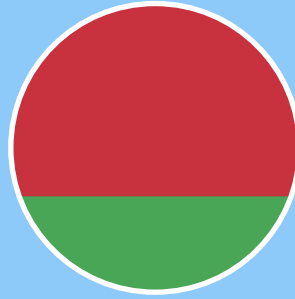
**Maintaining openness and transparency
is essential**

Examples

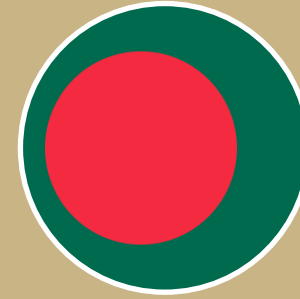


UAE “White Paper” (15 pages) – clear policy statement

- UAE “Roadmap for Success” (174 pages) – comprehensive report providing national strategy



Belarus – *Report of the First Deputy Prime Minister of Belarus, V.I. Semashko at the meeting of the Council of Ministers of Belarus (March 23, 2007)*



Bangladesh Nuclear Power Action Plan (January 2000) – policy statement

- Power System Master Plan for Bangladesh (2010-2030) and Draft Perspective Plan of Bangladesh for the Period 2010-2021 – detailed strategy approved by parliament

Implementing the Decision

Following the national decision to embark on a nuclear power programme, the country:

- Will establish the required infrastructure
 - Legal/regulatory frameworks
 - Regulatory body
 - Owner/operator organization
- Designate roles and responsibilities to the new organizations
- Recommendations from the Comprehensive Report should be translated into action plans, with responsible organizations

Revisiting or updating the national position

When implementation has been **substantially delayed**

for reasons such as unforeseen political, economic and/ or technological challenges,

It is important to provide the government **with a renewed consideration of the nuclear power option** by:

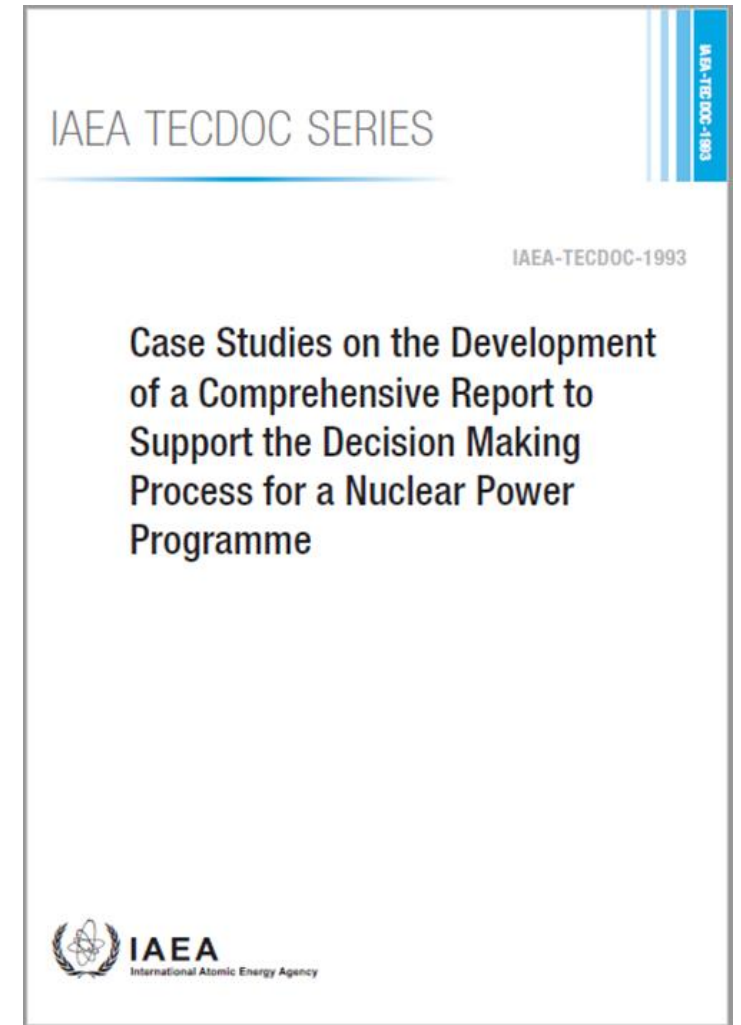
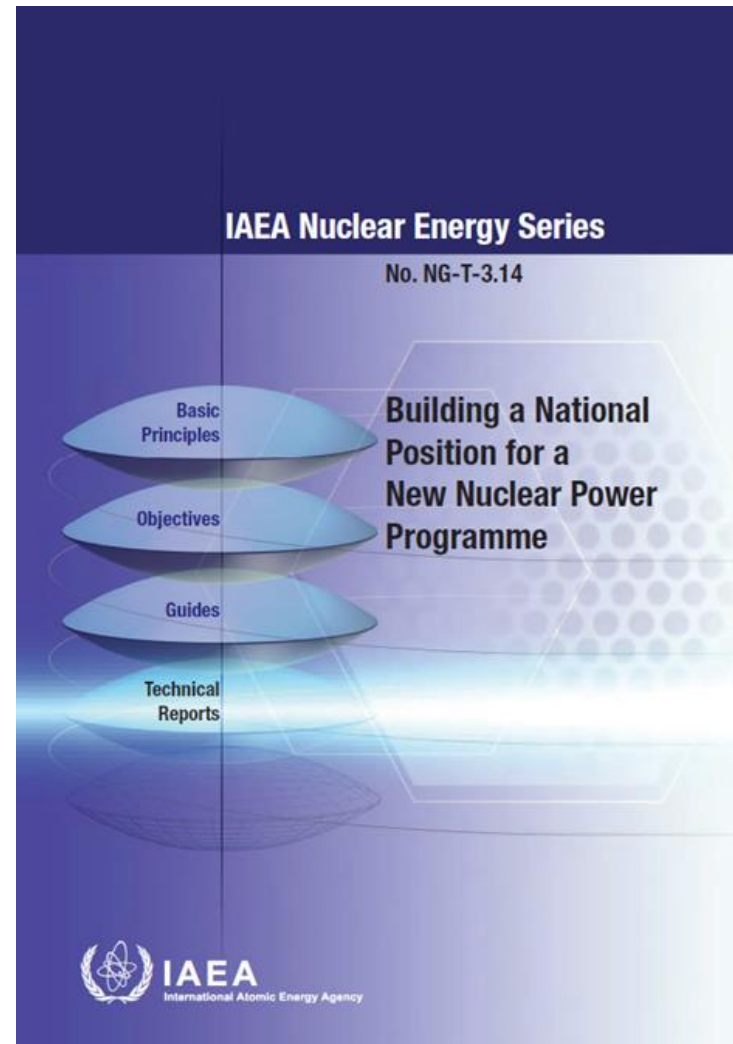
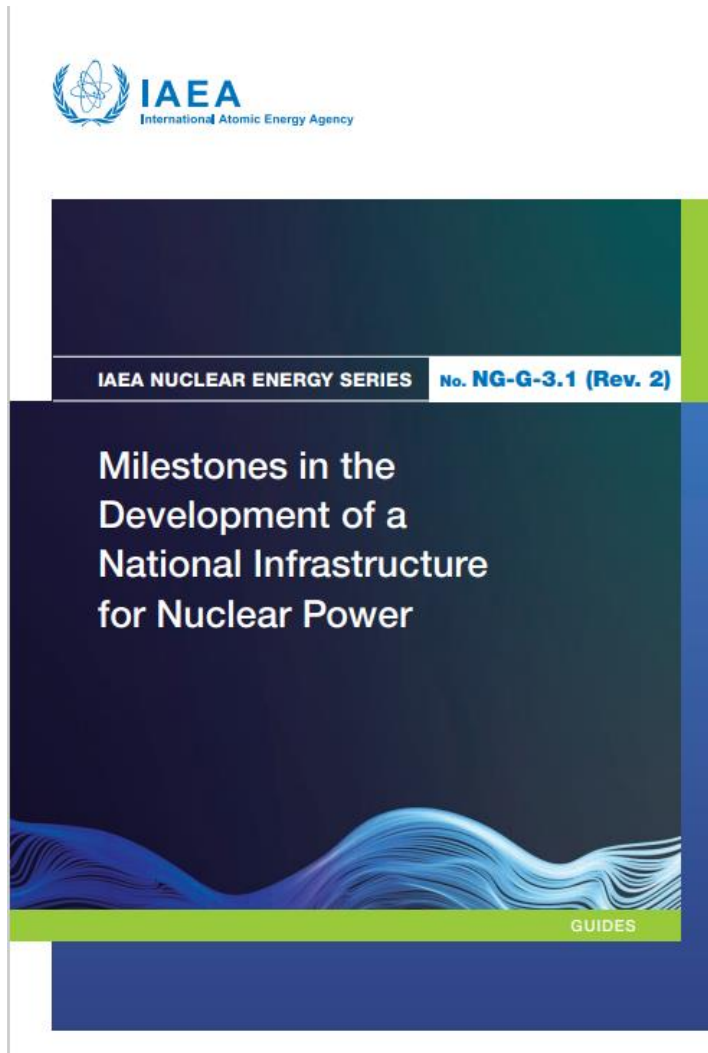
- reviewing the status of the country's infrastructure
- updating relevant studies and the comprehensive report.

Updating national position **after a negative decision**

- review political, social, economic and development objectives
- update the energy planning and other relevant studies, such as the prefeasibility study.

This information may form the basis for a government to reconsider the nuclear power option at a future date

Reference IAEA publications



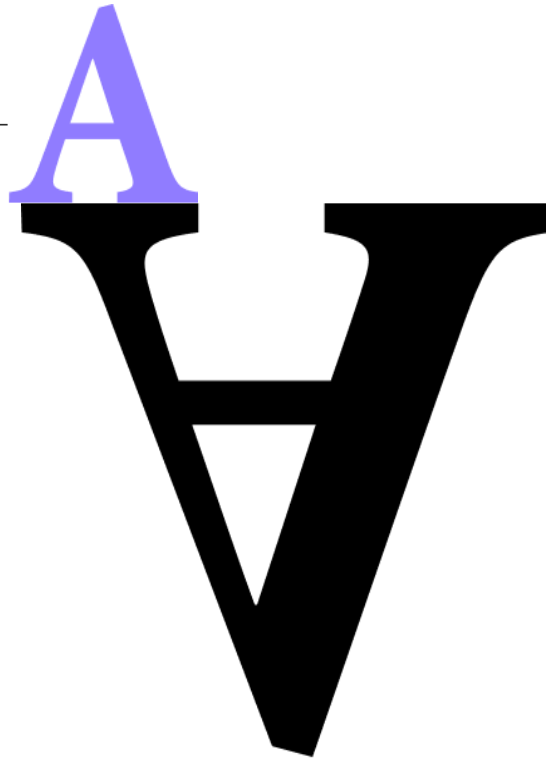


IAEA Support and Assistance

Integrated Approach for embarking countries

Assessment

Self Evaluation Report
INIR missions
National Action Plan



Assistance

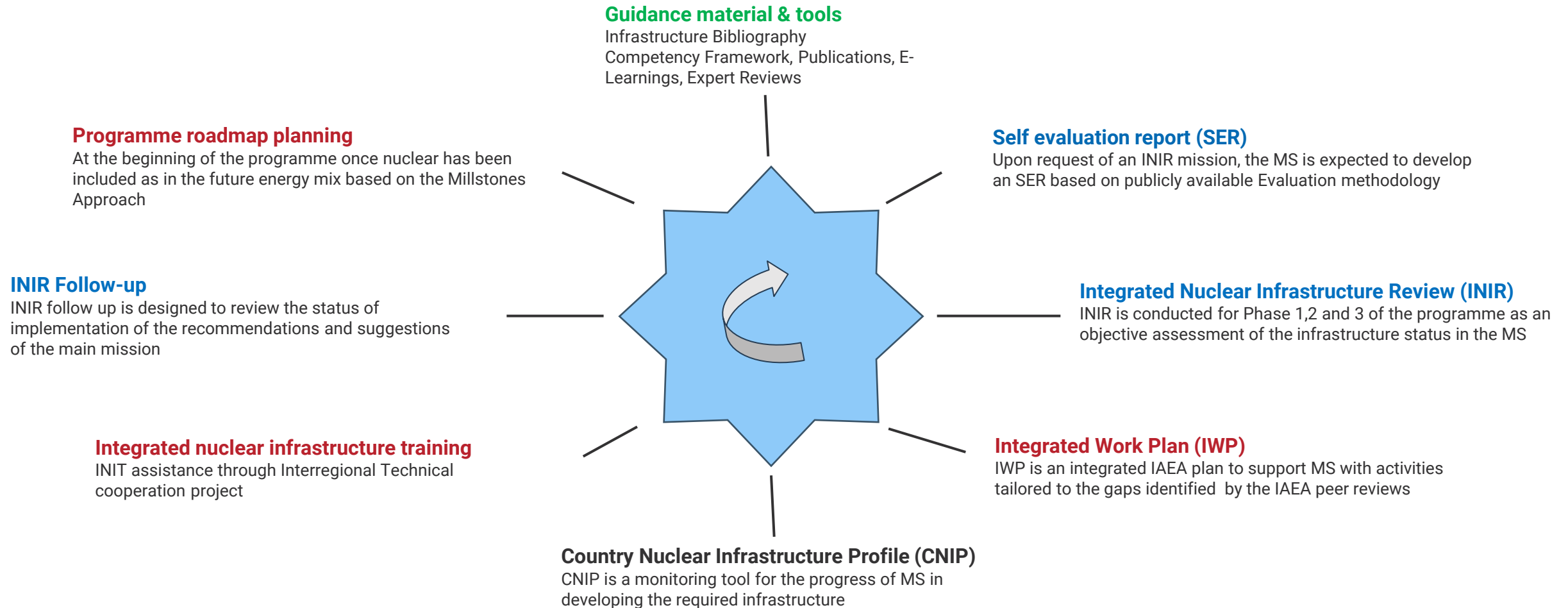
Capacity Building events

- E-learnings
- Interregional Trainings
- National Integrated Work Plans and CNIP
- Management Systems

Competence Building

- Nuclear Infrastructure bibliography – IAEA publications
- Nuclear Infrastructure Competency

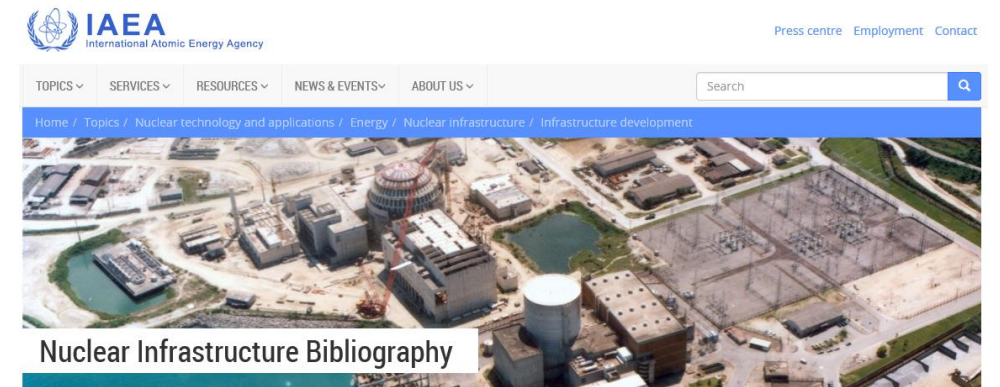
IAEA Integrated Support to Embarking Countries



Assistance

Nuclear Infrastructure Bibliography

The IAEA Nuclear Infrastructure Bibliography offers quick access to a comprehensive collection of IAEA standards and guidance publications covering all 19 nuclear infrastructure issues of the IAEA Milestones approach.



Infrastructure development

- > Milestones Approach
- > Nuclear Infrastructure Bibliography
- > E-learning for Nuclear Newcomers

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

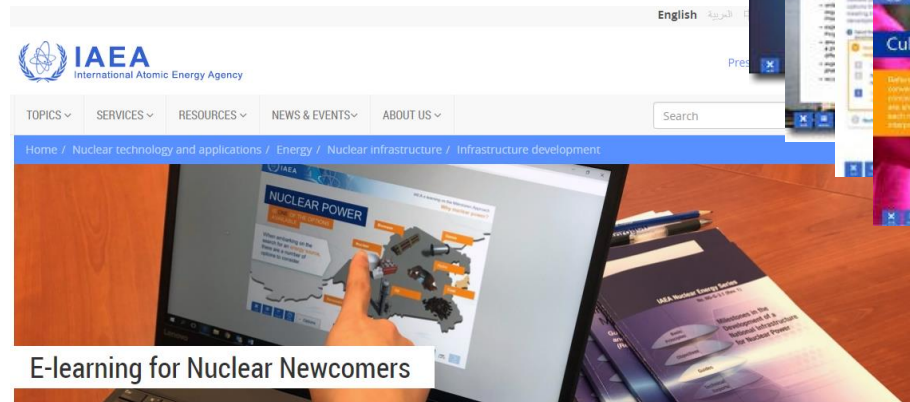
Related Resources

- IAEA Milestones Approach: Developing the National Infrastructure for Nuclear Power (Brochure)
- IAEA Milestones Approach: Developing the National Infrastructure for Nuclear Power (Video)
- IAEA Scientific and Technical Publications
- Nuclear Infrastructure Development Section
- Department of Nuclear Energy
- Department of Nuclear Safety and Security

<https://www.iaea.org/topics/infrastructure-development/bibliography>

Assistance

E-Learning Modules



- < Infrastructure development
- > Milestones Approach
- > Nuclear Infrastructure Bibliography
- > E-learning for Nuclear Newcomers

This IAEA interactive series of e-learning modules covers various aspects of developing a safe, secure and sustainable nuclear power programme.

The modules explain the IAEA Milestones Approach, a phased comprehensive method that covers 19 nuclear infrastructure issues to help countries that are considering or planning their first nuclear power plant understand the commitments and obligations associated with a nuclear power programme. The modules are also appropriate for countries expanding an existing nuclear power programme.

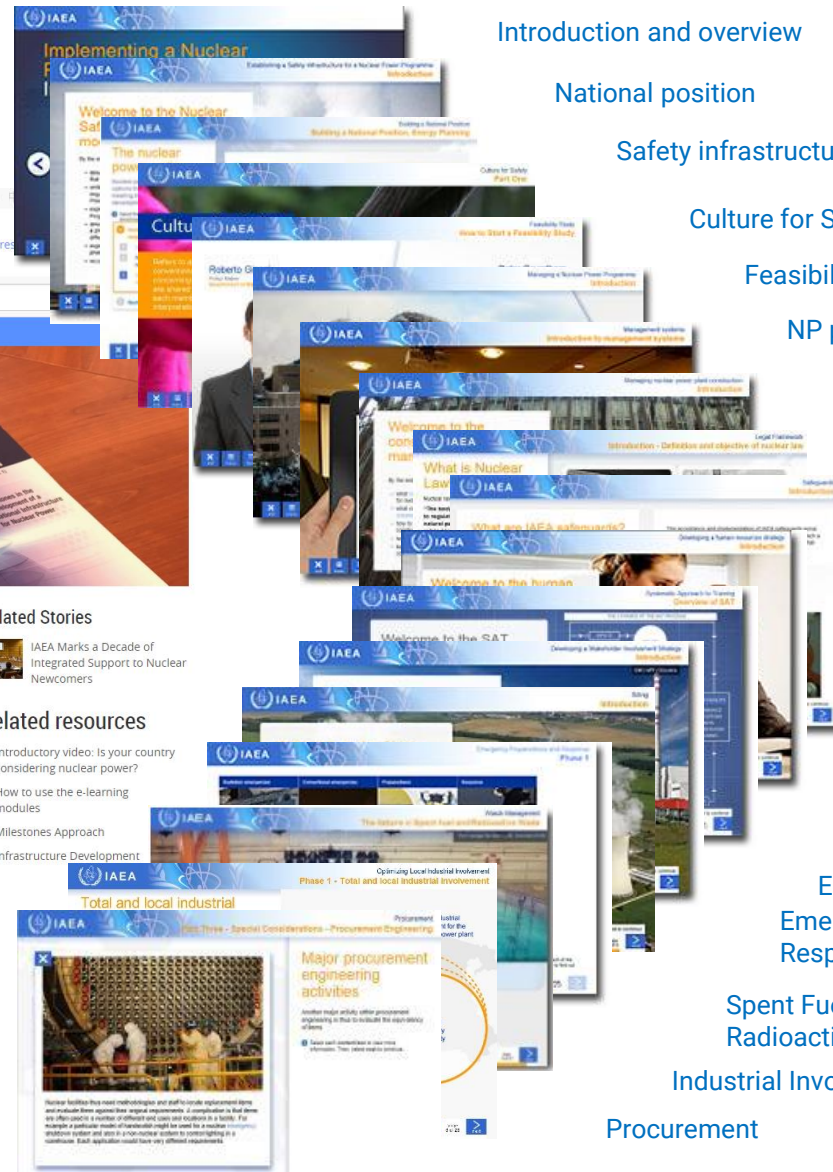


Related Stories

IAEA Marks a Decade of Integrated Support to Nuclear Newcomers

Related resources

- Introductory video: Is your country considering nuclear power?
- How to use the e-learning modules
- Milestones Approach
- Infrastructure Development



Introduction and overview

National position

Safety infrastructure

Culture for Safety

Feasibility study

NP programme management

Management systems

Construction management

Legal framework

Safeguards

Human resource development

Systematic approach to training

Stakeholder involvement

Siting

Environmental Protection
Emergency Preparedness and Response

Spent Fuel and
Radioactive Waste Management

Industrial Involvement

Procurement

<https://www.iaea.org/topics/infrastructure-development/e-learning-for-nuclear-newcomers>

Assessment

Critical Peer Reviews and Advisory services for nuclear power

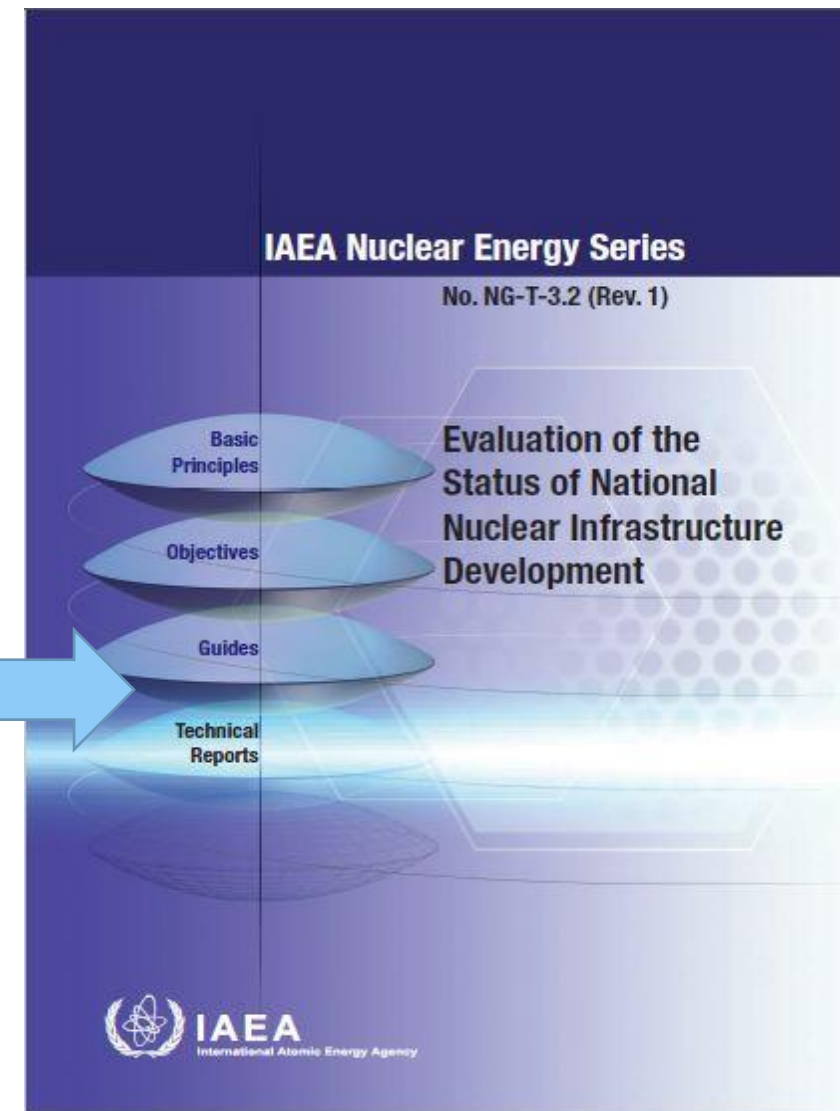
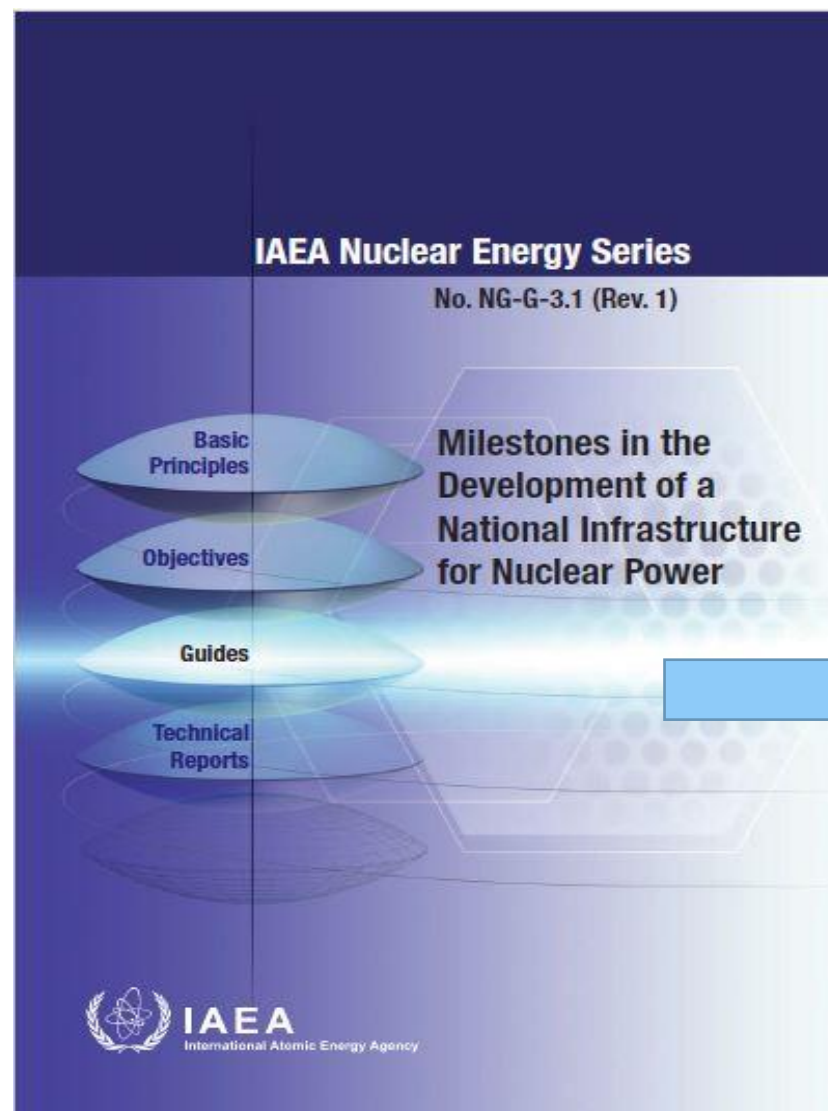
- *Integrated Nuclear Infrastructure Review (INIR)*
- Site and External Events Design Review Service (SEED)
- Integrated Regulatory Review Service (IRRS)
- Emergency Preparedness Review Service (EPREV)
- International Physical Protection Advisory Service (IPPAS)
- IAEA Safeguards Advisory Service Mission (ISSAS)
- Pre-Operational Safety Review Team (Pre-OSART) review



Assessment: Evaluation Methodology

1. Self-Evaluation by Member States
2. Review by INIR team members

Based on the Milestones Document



INIR Missions 2009-2025

1. Jordan (Phase 1) 2009
2. Indonesia (Phase 1) 2009
3. Viet Nam (Phase 1) 2009
4. Thailand (Phase 1) 2010
5. UAE (Phase 2) 2011
6. Bangladesh (Phase 1&2) 2011
7. Jordan follow-up 2012
8. Belarus (Phase 1&2) 2012
9. Viet Nam (Phase 2) 2012
10. Poland (Phase 1) 2013
11. South Africa (Phase 2) 2013
12. Turkey (Phase 2) 2013
13. Jordan (Phase 2) 2014
14. Viet Nam follow-up 2014
15. Nigeria (Phase 2) 2015
16. Kenya (Phase 1) 2015
17. Morocco (Phase 1) 2015
18. Bangladesh follow-up 2016
19. Poland follow-up 2016
20. Kazakhstan (Phase 1) 2016
21. Malaysia (Phase 1) 2016
22. Ghana (Phase 1) 2017
23. Niger (Phase 1) 2018
24. UAE (Phase 3) 2018
25. Saudi Arabia (Phase 2) 2018
26. Sudan (Phase 1) 2018
27. Philippines (Phase 1) 2018
28. Ghana follow-up 2019
29. Egypt (Phase 2) 2019
30. Belarus (Phase 3) 2020

31. Uzbekistan (Phase 2) 2021
32. Kenya Follow-up (Phase 1) 2021
33. Uganda (Phase 1) 2021
34. Sri Lanka (Phase 1) 2022
35. Kazakhstan follow-up (Phase 1) 2023
36. Estonia (Phase 1) 2023
37. Poland (Phase 2) 2024
38. Philippines (Phase 1 Follow Up) 2024
39. Sri Lanka (Phase 1 Follow Up) 2024

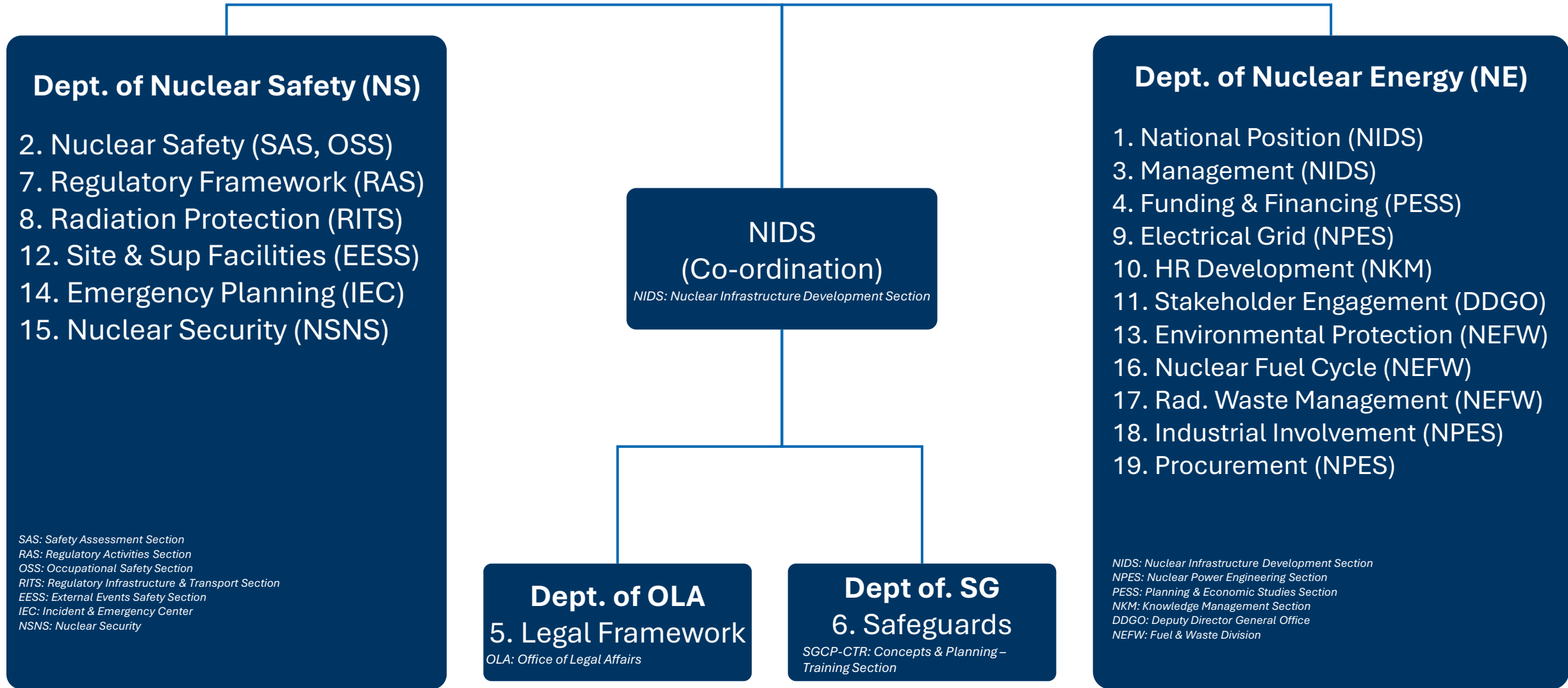
Planned INIR Missions

- ✓ Turkey (Phase 3)
- ✓ Bangladesh (Phase 3)
- ✓ Zambia (Phase 1)
- ✓ Viet Nam (Phase 2)

39 INIR Missions in 25 Member States



IAEA Integrated Support – 19. Infrastructure Issues



Conclusion

- Launching a nuclear power programme is a major undertaking requiring careful planning, preparation and investment in time, institutions and human resources.
- Developing a National Position is a process that involves both technical and political considerations.
- The decision to embark on a nuclear power programme should be based on sound information.
- Milestones Approach is a framework for embarking countries to a successful nuclear power programme and the basis of IAEA support.
- IAEA provides integrated support to MSs through assessment and assistance mechanisms covering all 3 phases and 19 infrastructure issues at different levels of details



IAEA

THANK YOU