

A hand is shown holding a small amount of water, with a single drop falling into a calm lake. The background features a majestic mountain range under a clear blue sky, with the sun shining brightly in the upper left corner, creating a lens flare effect. The water in the lake is still, reflecting the surrounding landscape.

Development of an SMR programme and necessary competences

Conference on New Generation Nuclear Energy in Estonia

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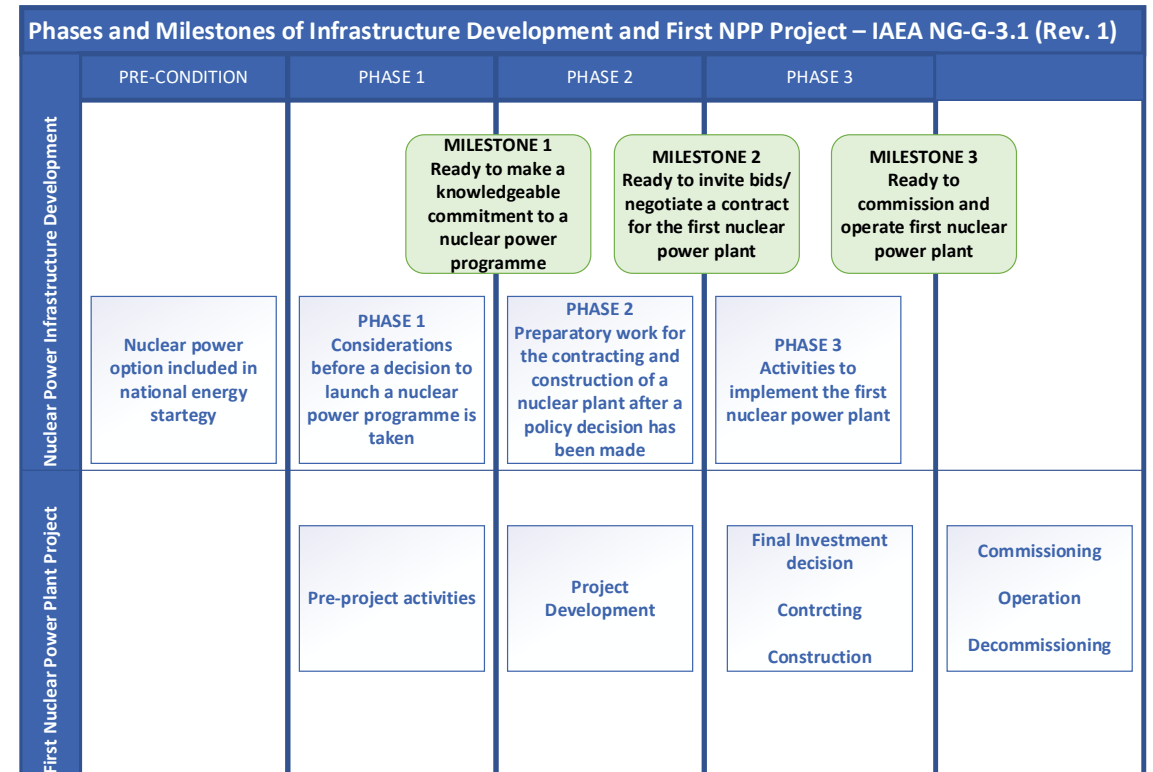
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Outline

- IAEA Milestone Approach
 - Phases and milestones
 - Infrastructure issues
 - Applicability of the Milestone Approach to SMRs
- Distribution of responsibilities between parties in a NPP programme
- Considerations on competence development of an SMR owner / operator

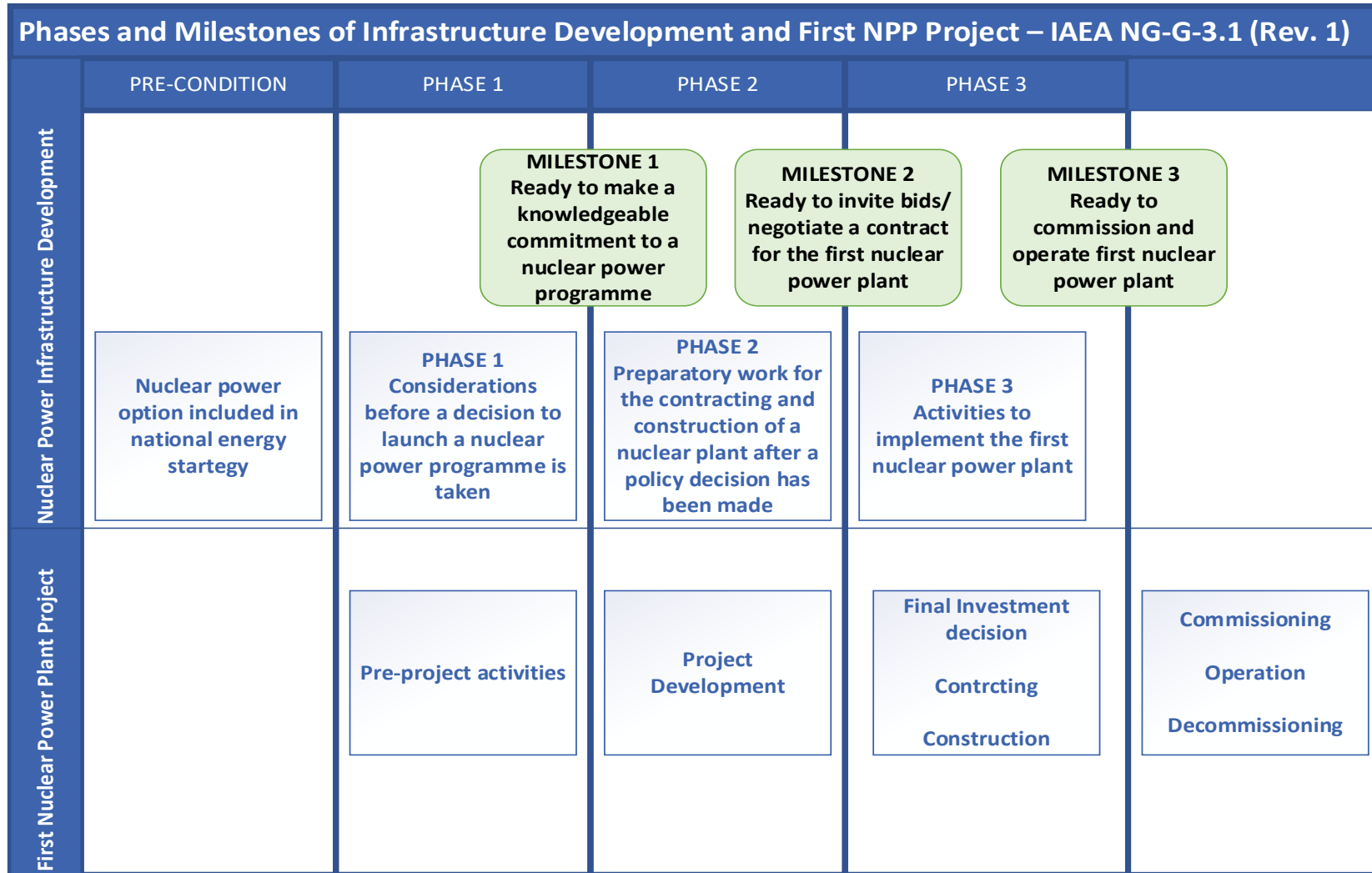
The IAEA Milestone Approach

- IAEA guidance for newcomer nuclear power countries for the development of the necessary infrastructure
- Internationally well-known approach
- The Milestone Approach has been originally developed having large reactors in mind, but should be in principle applicable for SMRs as well
 - In case of an SMR programme, which issues could be streamlined and how?



The IAEA Milestone Approach

Phases and milestones for infrastructure development



The IAEA Milestone Approach

- **19 infrastructure issues**

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

Applicability of the Milestone Approach to SMRs (1/2)

- There is an obvious desire to simplify and streamline the processes in case of SMRs comparing to large reactors
- However
 - All the infrastructure issues need to be addressed also for an SMR programme
- In case of SMRs there may be potential for simplification in some of the infrastructure issues and to apply 'graded approach'
- **In particular, international standardization of designs and close international cooperation in licensing and regulations and in regulatory oversight are prerequisites for commercial viability of SMRs**
 - Ideally: International design approval

Applicability of the Milestone Approach to SMRs (2/2)

- Other examples of simplification potential in case of SMR:
 - Standardization of designs and international cooperation → potential for simplification e.g. regarding *national regulatory framework* and *human resource development*
 - Smaller unit size → potential advantages regarding
 - *Funding and financing*
 - *Grid*
 - *Emergency planning*
 - *Site and supporting facilities*
 - Etc.

National position on nuclear power (IAEA infrastructure issue #1)

- National position in order to launch a nuclear power programme
 - IAEA Milestone #1
 - A knowledgeable decision based on comprehensive studies
 - Consideration of overall energy and climate policy
 - Covers the 19 infrastructure issues
 - Confirms public and political support for the nuclear power programme
 - Commitments and funding to start developing the national infrastructure
 - Provides the basis for preparing the NPP projects
- Later on, there could be separate decisions on individual projects (cf. Decision-in-principle as in Finland)

Stakeholder involvement (IAEA infrastructure issue #17)

- Examples of stakeholders
 - general public
 - government and governmental agencies
 - legislators and other decision makers,
 - the Owner/Operator
 - the Regulatory Body
 - potential suppliers
 - workers
 - communities near possible sites
 - neighbouring countries
 - non-governmental organizations
 - etc
- Relevant information related to the project must be distributed and made available
- Formal ways for participation of the stakeholders and hearing their comments and opinions at relevant decision points must be ensured
- Topics of interest include
 - Nuclear safety
 - Environmental impacts
 - During construction
 - During operation
 - Nuclear waste

The IAEA Milestone Approach

Key organizations for development of NPP Programme

- **Nuclear Energy Programme Implementing Organization (NEPIO)**

- A governmental organization
- Coordinates the necessary studies needed prior to making the decision on launching a nuclear power programme
- Coordinates the development of the national infrastructure for nuclear power programme
- In some countries NEPIO is a large governmental organization that is able to carry most of the studies in the beginning of the programme by its own
- In other countries NEPIO may be coordinating entity (e.g. a governmental committee)
 - For example, in Finland, Advisory Committee on Nuclear Energy can be considered to have been the NEPIO

- **Regulatory body**

- Independent organization
- Needed at latest for Phase 2
- Regulatory framework needed in Phase 2
 - (the regulatory framework is needed before the owner/operator can launch call-for-bids or commercial negotiations)

- **Owner / Operator**

- responsible for preparing and launching the actual NPP project(s)
 - selection of the technology
 - requesting and assessing the bids, negotiating contracts
 - managing the NPP project
 - Will eventually be responsible for the safety of the NPP (SMR)
- Supports NEPIO in infrastructure development as appropriate

Distribution of responsibilities between parties in a NPP programme

- As the programme develops, there will be changes in level of involvement, the roles and the responsibilities of the NEPIO, regulatory body and the owner/operator
- Typically the NEPIO has a strong role in beginning
- Level of involvement of the future owner/operator in the beginning depends on the type of the programme and on the type of the NEPIO

Typical involvement levels of NEPIO, regulator and operator in case of a nuclear power programme which is strongly government (NEPIO) driven:

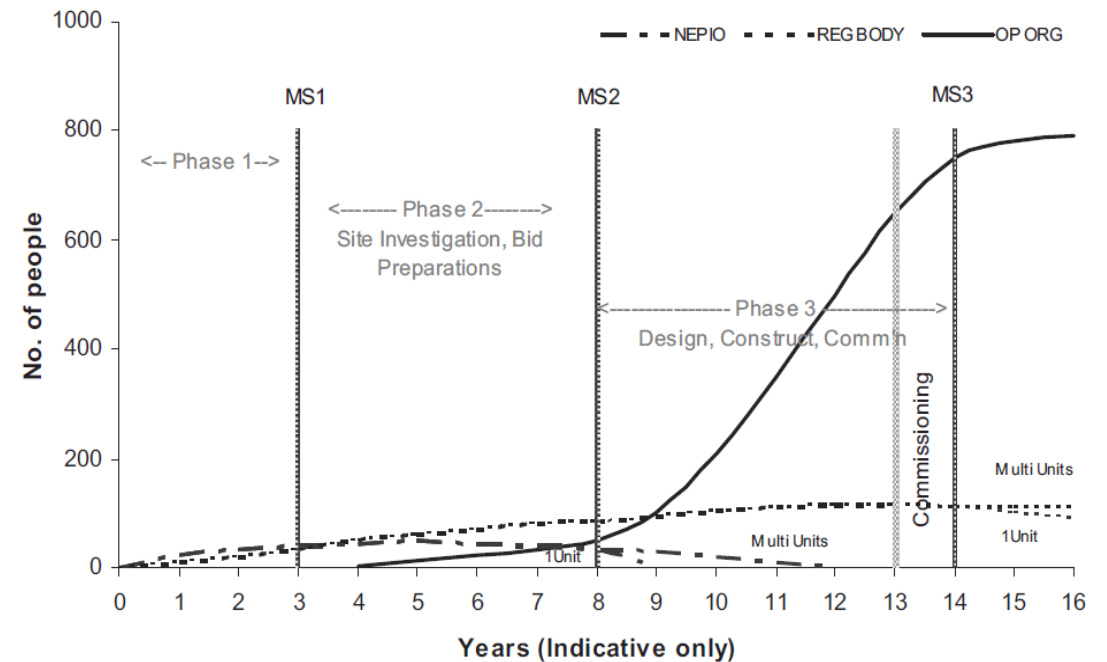


Adopted from
<https://www.iaea.org/topics/infrastructure-development/e-learning-for-nuclear-newcomers>

Competence development of an owner / operator

- The competence development of the owner/operator needs to be started as early as possible
- Owner/operator needs to
 - develop an 'intelligent customer' role for the preparation and implementation of the project
 - be prepared to operate the plant and take responsibility of the safety
- The number of staff will depend on reactor type in question
- The actual staffing needs to be evaluated through careful workforce planning

Typical phasing of human resource requirements for an embarking nuclear power country for large reactor:



Source: IAEA NG-T-3.10. Workforce planning for New Nuclear Power Programmes. IAEA, 2011

Competence development of an owner / operator

- Gradual development of resources
 - Phase 1, limited number of specialized professionals. Training of key persons for next phases
 - Phase 2: Competence building to become owner/operator must be started
 - Phase 3 (design, construction and commissioning), the number of professionals increases to hundreds
- Selection of technology and project model will be one of the major tasks for the owner
 - Developing competences to make the selection
 - Following up the development of potential SMR technologies and their commercialization
 - For a newcomer country it is important to have a proven design which has been licensed in the country of origin (or in another experienced nuclear country)
 - Changes to the design to be kept to the minimum
 - Implementation model
 - Typical approach in a newcomer country: turn-key

Competence development of an owner / operator

- The Owner/Operator will have the ultimate responsibility of nuclear safety, security and safeguards → sets requirements for capabilities in some key areas
 - nuclear power specific disciplines such as reactor physics and nuclear fuel, thermal hydraulics
 - "conventional" engineering disciplines such as power plant engineering, process technology, electrical engineering, automation engineering
 - expertise supplemented with nuclear specific training
 - project management skills

Competence development of an owner / operator

- For SMR, it would be necessary be able to reduce the number of staff needed per NPP unit (comparing to large NPPs)
 - Simplified design with fewer systems to operate and maintain
 - In particular: passive designs → strongly simplified safety systems
 - Standardized design → possibility of sharing staff within a fleet of SMRs
 - Higher degree of automatization?
 - Close O&M cooperation with
 - the supplier?
 - with other NPP owners/operators?
- International cooperation for an SMR owner/operator
 - With the Supplier
 - Bilateral or multilateral agreements with experienced partners
 - International organizations (IAEA, WANO, WNA, OECD/NEA, EUR, Owner's groups, ...)



Tänan
Thank you

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