The Abdus Salam
International Centre
for Theoretical Physics

United Nations Educational, Scientific and Cultural Organization

IAEA
International Atomic Energy Agency

2374-40

Joint ICTP-IAEA School of Nuclear Energy Management

5 - 23 November 2012

FEASIBILITY STUDY FOR A NEW NPP

ROTARU Ioan

Management Proiecte Nuclear
Sector1, 57 Aleea Teisani
014034 Bucharest
ROMANIA

FEASIBILITY STUDY FOR A NEW NPP

Dr. Ioan ROTARU
Romania
IAEA Consultant

Annual ICTP/IAEA Nuclear Energy Management School

Trieste, Italy, 5 to 23 November,2012

IAEA
International Atomic Energy Agency

MILESTONES APPROACH

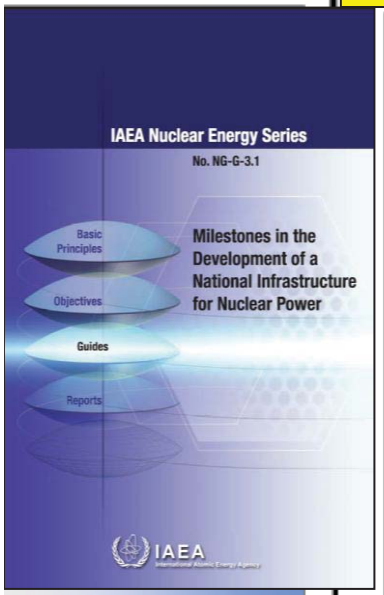
Nuclear power option included in national energy strategy

MILESTONE 1: Ready to make a knowledgeable commitment to a nuclear programme

MILESTONE 2: Ready to invite bids for the first nuclear power plant

MILESTONE 3: Ready to commission and operate the first nuclear power plant

~ 10 – 15 years



PHASE 1

Considerations before a decision to launch a nuclear power programme is taken

PHASE 2

Preparatory work for constructing a NPP after policy decisions has been taken

PHASE 3

Activities to implement a first NPP

First NPP Project

Pre-project

Project decision making

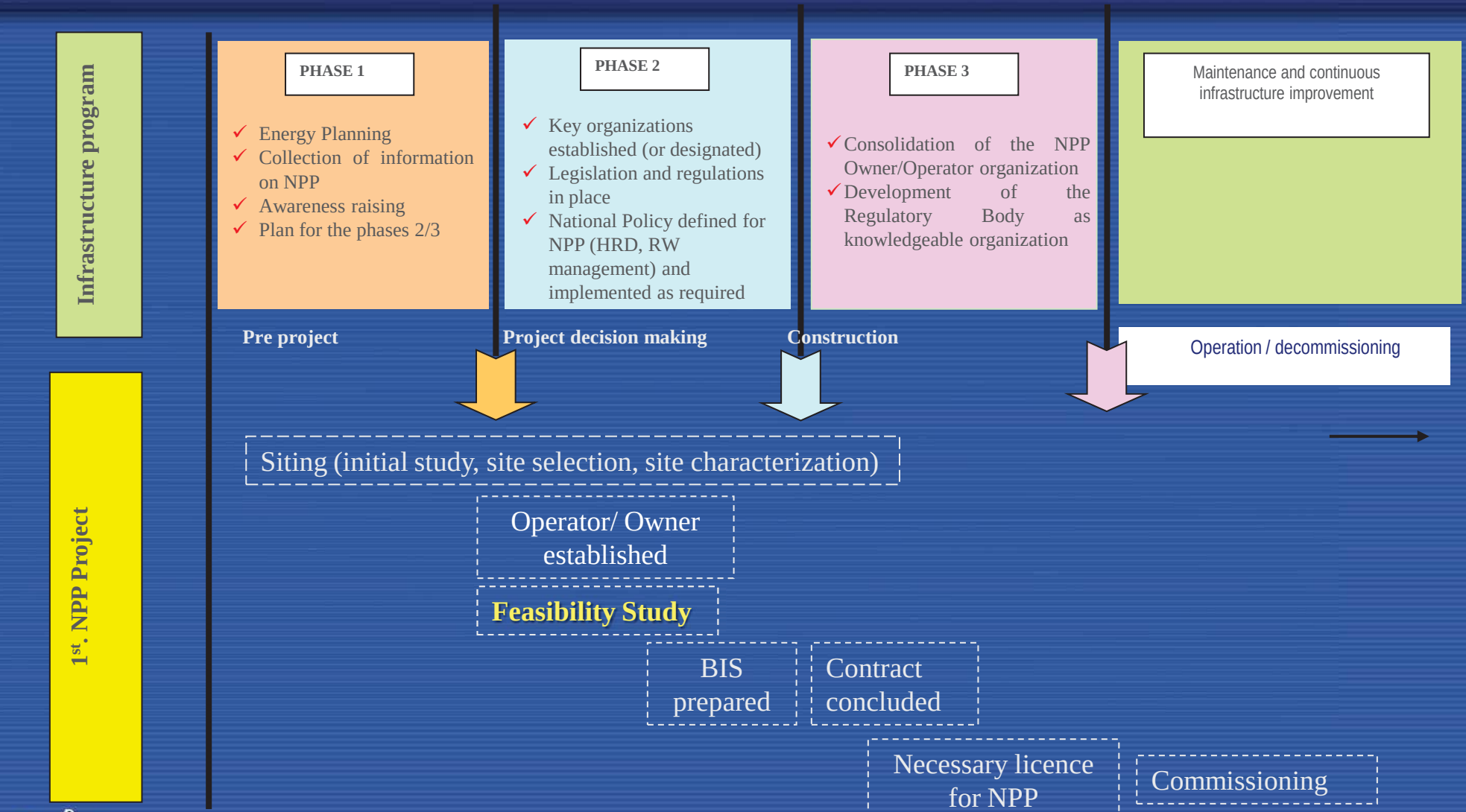
Construction

Feasibility study

Bidding process

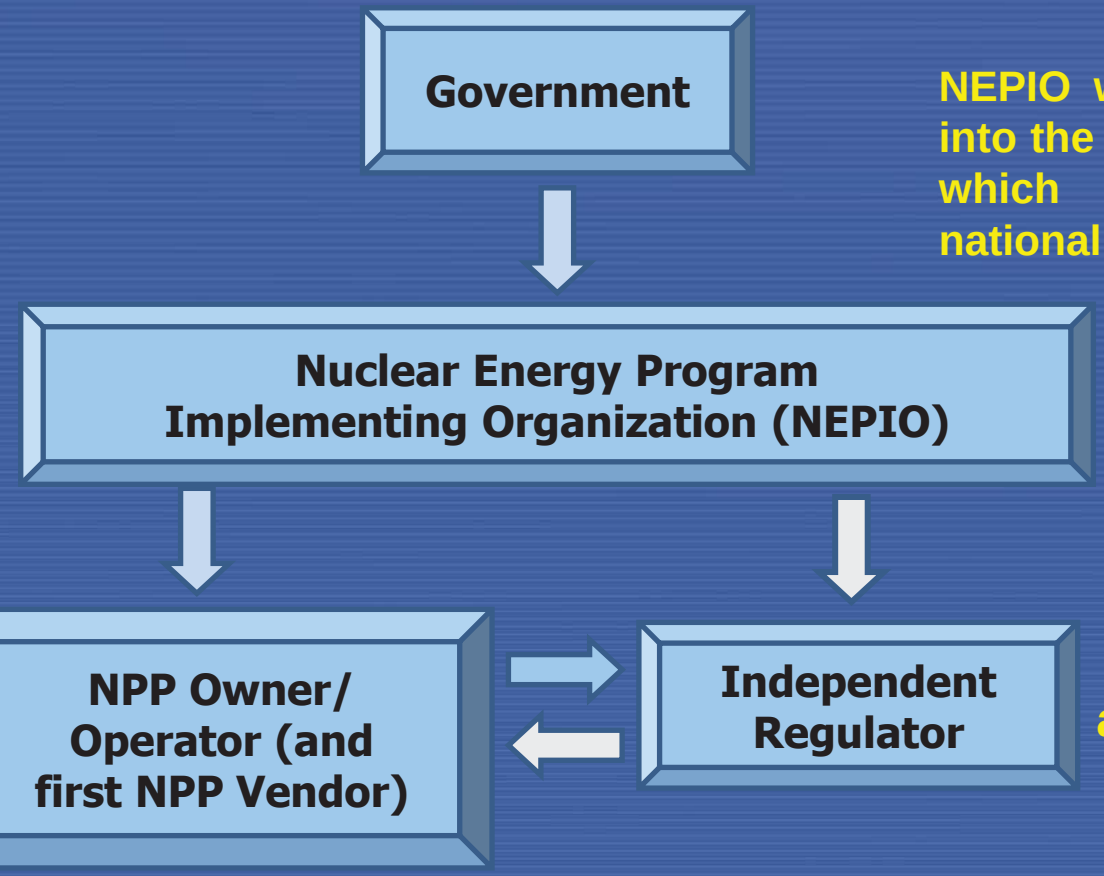
Commissioning

INFRASTRUCTURE DEVELOPMENT PROGRAM



IAEA

MAIN PLAYERS IN NUCLEAR POWER



NEPIO will be incorporated into the government agency, which will act as the national coordinator.

NPP Utility or Project organization

Establishing licensing rules and requirements + Control

Project development [licensee]

IAEA

NPP OWNER RESPONSIBILITY IN PHASE 2

- ✓ Establish the Integrated Management system (including Quality Management) of Owner/Operator organization.
- ✓ Review the potential NPP Vendors references.
- ✓ **Prepare the Feasibility Study (FS) for the first NPP.**
- ✓ Selection of the NPP site.
- ✓ Provide the relevant technical inputs for the selection of the appropriate nuclear power technology for the country (nuclear reactor, nuclear fuel type and fuel cycle).
- ✓ Establish the contractual approach for the first NPP.
- ✓ Develop the financial strategy and financial plan in consultation with the Government authorities and potential foreign and local sources of finance.

IAEA

WHAT IS A FEASIBILITY STUDY?

- ✓ A feasibility study is an **analytical tool** used during a business development process to show how a business would operate under a set of **assumptions**.
- ✓ **Assumptions** often include such factors as:
  - Technology used (equipment, production process, etc.)
  - Financing (capital needs, volume and cost of goods, etc.),
  - Marketing (prices, competition, etc.)
- ✓ The study is usually the first time in a project development process when many key pieces and information about the project are assembled into one **overall analysis**.
- ✓ Main purpose of a feasibility study is to determine if a business opportunity is **possible, practical and viable**.

IAEA

WHY FEASIBILITY STUDY?

- ✓ Developing any new business venture is difficult.
- ✓ Taking a project from the initial idea through the operational stage is a complex and time-consuming effort.
- ✓ A Feasibility Study presents and clarifies the risks associated with the project, so that involved stakeholders can evaluate them.
- ✓ The Feasibility Study evaluates the project's potential for success, comparable with similar technologies.
- ✓ A Feasibility Study enables to take a realistic look at both the positive and negative aspects of the project.

IAEA

OBJECTIVES OF A FS

- To find out if the proposed project can be done:
  - ✓ ...is it possible?
  - ✓ ...is it justified?
- To suggest possible alternative solutions.
- To provide management with enough information to know:
  - ✓ Whether the project can be done ?
  - ✓ Whether the final product will benefit its intended users ?
  - ✓ What the alternatives are (so that a selection can be made in subsequent phases) ?
  - ✓ Whether there is a preferred alternative ?
- A management-oriented activity:
  - ✓ After a Feasibility Study, management makes a “go/no-go” decision.
  - ✓ Need to examine the problem in the context of broader business strategy.

IAEA

WHY TO HIRE A CONSULTANT FOR FS ?

- ✓ Preparation of the Feasibility Study requires a strong background both in the technical and financial aspects of the project.
- ✓ The perceived objectivity of the evaluation is an important factor in the credibility placed on the study by potential members, lenders and other interested parties.
- ✓ For this reason, it is important to hire a consultant with no formal ties to project, equipment manufacturers or marketers, so an unbiased evaluation of project operating potential and efficiency can be made.

IAEA

FS CONSULTANT SELECTION CRITERIA

- ✓ Previous experience creating similar Feasibility Studies (0-20)
- ✓ Knowledge of the industry to be studied (0-15)
- ✓ Qualifications of principal/key member team (0-10)
- ✓ Understanding of the Project owner structure (0-10)
- ✓ Proposed interaction with the Project owner designated representatives (0-15)
- ✓ Verbal presentation/communication skills (0-10)
- ✓ Reasonableness of cost (0-15)
- ✓ Miscellaneous intangible (0-5)

IAEA

FIVE COMMON FACTORS OF FS

1. Technology feasibility
2. Economic feasibility
3. Legal feasibility
4. Operational feasibility
5. Schedule feasibility

T E L O S

IAEA

TECHOLOGY AND ECONOMIC

1. Technology feasibility

- The technology assessment is based on the specific evaluation and criteria applied for existing technologies, in terms of Input, Processes, Output, Fields, Programs and Procedures.
- Technological feasibility is carried out to determine whether the owner has the capability, in terms of software, hardware, personnel and expertise, to handle/manage the completion of the project.

2. Economic feasibility

- Economic analysis is the most frequently used method for evaluating the effectiveness of the new project. More commonly known as **cost/benefit analyses** the procedure is to determine the benefits and savings that are expected from a candidate project and compare them with costs.

IAEA

LEGAL, OPERATIONAL AND SCHEDULE

3) Legal feasibility

Determines whether the proposed project conflicts with legal requirements and determine the required changes in the legal framework.

4) Operational feasibility

Operational feasibility is a measure of how well a proposed project solves the problems and takes advantage of the opportunities identified during scope definition.

5) Schedule feasibility

Schedule feasibility is a measure of how reasonable the project timetable is. Given the required technical expertise, are the project deadlines reasonable? Some projects are initiated with specific deadlines. It is needed to determine whether the deadlines are mandatory or desirable.

OTHERS FEASIBILITY FACTORS

Market feasibility

- Market Feasibility takes into account the importance of the business in the selected area.

Resource feasibility

- This involves questions such as how much time is available to build the new project, when it can be built, whether it interferes with normal business operations, type and amount of resources required and dependencies.

Cultural feasibility

- In this stage, the project's alternatives are evaluated for their impact on the local and general culture.

Financial feasibility

- Financial viability can be judged on the following parameters:
  - Total estimated cost of the project
  - Financing of the project in terms of its capital structure and debt equity ratio
  - Projected cash flow and profitability

IAEA

PRE FEASIBILITY STUDY

- ✓ As its name indicates, a Pre-Feasibility Study is the precursor to a Feasibility Study (FS).
- ✓ Its main purpose is to ensure there is a solid basis for undertaking a Feasibility Study.
- ✓ Its most common use of the Pre-Feasibility Study as the first step in a Project preparation.
- ✓ A Pre-Feasibility Study can also be used as part of Project identification.
- ✓ Pre-Feasibility Study has a similar content with Feasibility Study, but not all the sections will be so well developed.

IAEA

WHEN FS FOR NEW NPP PROJECTS?

- ✓PreFS in Phase 1 - **NEPIO**
- ✓FS in Phase 2 before BIS shall be issued - **NPP Owner** (TSO/Consultant)
- ✓Revised FS (economical part) in Phase 3 after bids received - **NPP Owner** (TSO/Consultant)

IAEA

CONTENT OF A NPP FEASIBILITY STUDY

1. Electrical System Analysis
2. Unit capacity and system integration
3. Site and supporting facilities
4. NPP technology and fuel cycle
5. Environmental impact of the project
6. Licensing and authorization
7. Project implementation approach
8. National participation
9. Organization, human resources and training
10. Project cost estimate
11. Economic analysis
12. Funding and financing
13. Stakeholder communication for transparency
14. Emergency preparedness and response within the NPP site
15. Decommissioning
16. Project risk matrix

IAEA

FS CHAPTERS OUTLINE (1)

1. Electrical system analysis

a) Electricity demand
b) Electricity demand projections
c) Electricity supply system
d) Electricity market structure and organization
e) Electricity system expansion planning

2. Unit capacity and system integration

a) Station capacity
b) Unit capacity
c) Integration to the grid

IAEA

FS CHAPTERS OUTLINE (2)

3. Site and supporting facilities

a) Natural and external events
b) Potential effects of the nuclear facility in the region
c) Population distribution
d) Uses of land and water in the region
e) Preliminary site layout and site preparation
f) Summary of site characteristics and supporting facilities

4. NPP technology and fuel cycle

a) Nuclear power technology market survey
b) NPP technology assessment
c) Fuel cycle evaluation and impact assessment
d) Radioactive and conventional waste management
e) Interim waste storage

FS CHAPTERS OUTLINE (3)

5. Environmental impact of the project

a) Environmental impact assessment report
b) Environmental protection requirements of financial institution
c) Environmental study report format
d) Environmental monitoring and protection plan

6. Licensing and authorization

a) Licensing process and requirements

7. Project implementation approach

a) Ownership structure
b) Contractual approach
c) Procurement program
d) Project schedule
e) Project management

IAEA

FS CHAPTERS OUTLINE (4)

8. National participation

a) National industry survey
b) Establishment of the strategy for national participation
c) Localization plan
d) Technology transfer and goals

9. Organization, human resources and training

a) Construction workforce and logistics
b) NPP owner's organization during construction, commissioning, O&M
c) Staffing requirements
d) Education and training requirements

FS CHAPTERS OUTLINE (5)

10. Project cost estimate

a) Total capital investment costs (TCIC)

b) Nuclear fuel cycle costs

c) Operation & maintenance (O&M) costs

11. Economic analysis

a) Some important issues in economic analysis (monetary value of benefits, discounting, environmental externalities, etc)

b) Project performance indicators (net present value, benefit/cost ratio, Internal Rate of Return, Levelized Unit Electricity Cost)

c) Sensitivity and risk analysis

IAEA

FS CHAPTERS OUTLINE (6)

12. Funding and financing
    a) Plan for funding (state budget)
    b) Financial plan (equity/loans) for the first NPP
13. Stakeholder communication for transparency
    a) Stakeholder
    b) Transparency
    c) Communication
    d) Stakeholder communication strategy
14. Emergency preparedness and response within the NPP site
    a) Preparedness within the site
    b) Site emergency planning and coordination with external agencies
    c) Interface with stakeholders during emergencies

IAEA

FS CHAPTERS OUTLINE (7)

15. Decommissioning
    a) Preliminary decommissioning strategy
    b) Plan for decommissioning funds

16. Project risk matrix
    a) Risks identification and analyses
    b) Risk management plan

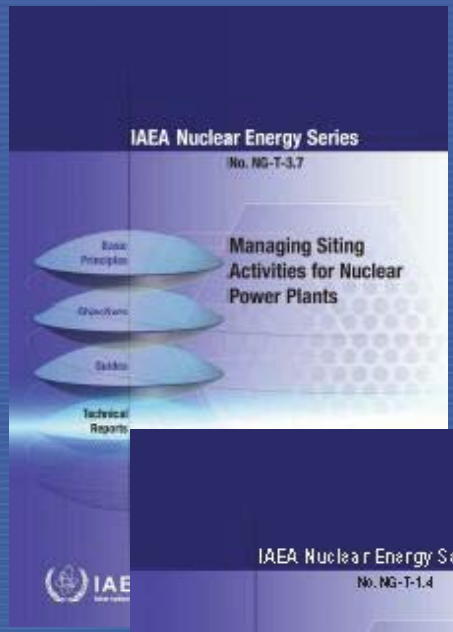
IAEA ASSISTANCE - WSs

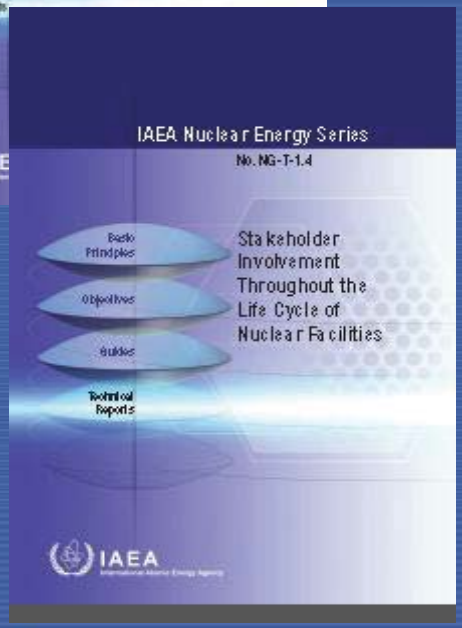
Suggested sequence	When is recommended	Subject of WS
1	Earlier Phase 2	Nuclear Power Program Management, including NPP Owner/Operator interfaces
2	Earlier Phase 2	Establishment of the NPP Owner/Operator organization, including Capacity Building
3	Earlier Phase 2	New Nuclear Power Programs: How to Become a Knowledgeable Customer
4	Beginning of Phase 2	Integrated Management System, Leadership and Safety Culture for the NPP Owner/Operator organization
5	Beginning of Phase 2	NPP Feasibility Study(FS) preparation
6	Beginning of Phase 2	NPP site selection

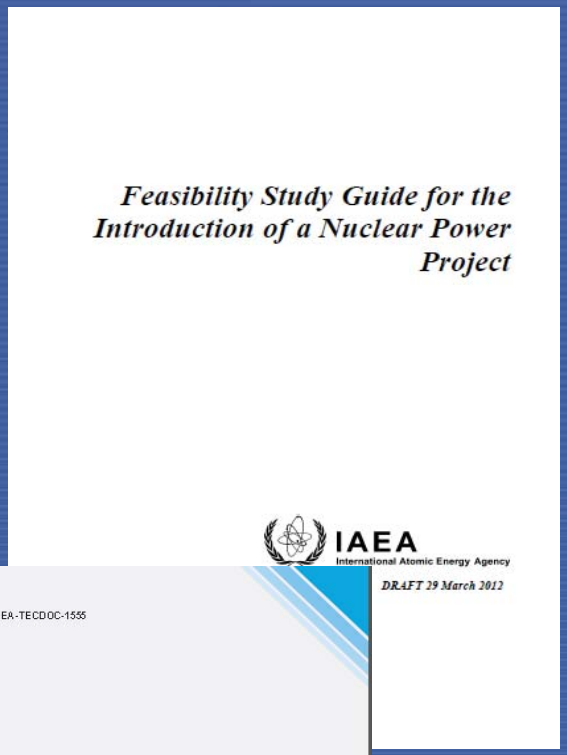
IAEA ASSISTANCE - EXPERT MISSIONS

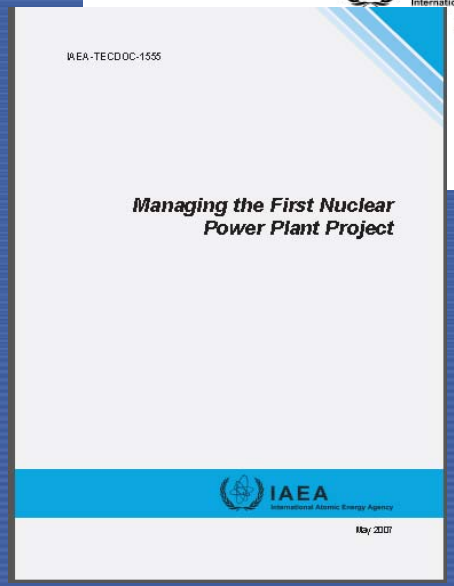
No.	When is required	Subject of WS	Main scope
1	Phase 2	First NPP Feasibility Study (FS) review	To review the draft of the Feasibility Study for the first NPP
2	Phase 2	Review the NPP Owner/Operator Human Resources Development plan	To review the draft of the HRD plan of the NPP Owner/Operator organization
3	Late in Phase 2	Review of the Bid Invitation Specification (BIS)	To review the draft of the BIS for the first NPP prepared by NPP Owner/Operator organization
4	Beginning of Phase 3	Review the Integrated Management System (IMS) of the NPP Owner/Operator	To review the IMS manual and main procedures of the NPP Owner/Operator organization
5	Phase 3	Review construction management process of the first NPP	To review the first NPP construction management process developed by the NPP Owner/Operator organization

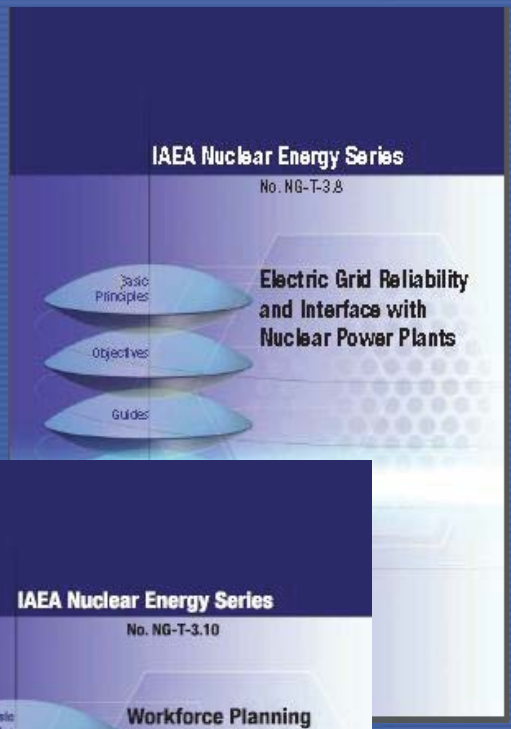
IAEA DOCUMENTS FOR FS [EXAMPLES]

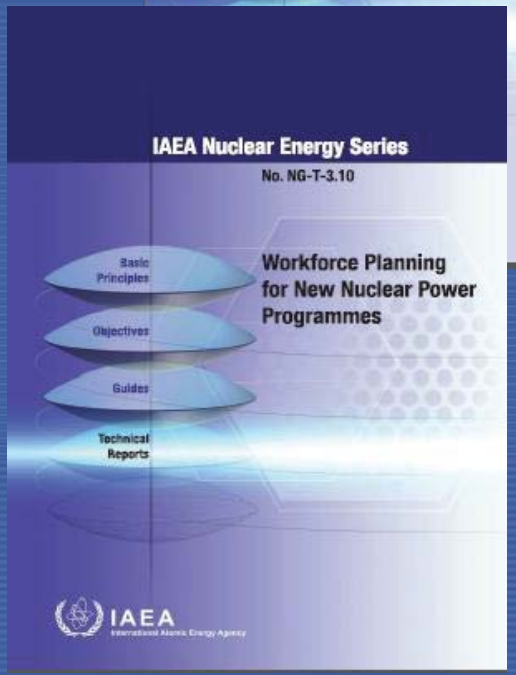












IAEA

CONCLUSION

- ✓ Feasibility Study represents the next step after a knowledgeable decision (nuclear power established as a viable alternative to other energy sources).
- ✓ Feasibility Study will offer the detailed definition and assessment of a specific Nuclear Power Plant (NPP) and how the first NPP will be implemented.
- ✓ FS is primarily intended to provide the relevant interested parties (governmental authorities, stakeholders) with all the necessary detailed information needed for the implementation of the NPP project.
- ✓ FS will also be of importance in the negotiations for financing of the NPP project, as it is usually requested by all financing institutions.

IAEA

Thank you!

IAEA