



International Atomic Energy Agency

NPP CHARACTERISTICS, PROVEN TECHNOLOGY AND LICENSABILITY

**Ami Rastas
Consultant**

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NPP Design Aspects to Be Assessed

- **Plant size and characteristics**
- **Proven technology and licensibility**
- **Standardization**
- **Simplification**
- **Constructability**
- **Operability and maneuverability**
- **Inspectability and maintainability**
- **Refueling cycle**
- **Plant Availability**
- **Plant life time**
- **Physical protection**
- **Decommissioning**
- **Capital, operation and maintenance cost**
- **Project schedule**
- **Degree of national participation**
- **Technology transfer and technical support**

NPP Main Characteristics

- **The NPP size should be in conformance with the demand of new power generation capacity in accordance with a national energy strategy to cover the growth of power demand, and/or to replace existing power plants.**
- **NPP shall meet grid requirements.**
- **NPP shall be in conformance with site characteristics.**
- **NPP should meet performance and operational requirements.**
- **NPP shall be safe and licensable.**
- **NPP should be based on proven technology.**



Size Considerations

- **The economy of scale is speaking for bigger size.**
 - **The bigger size means normally lower specific investment cost (\$/kW).**
 - **There are many mandatory activities, like licensing, infrastructure development and human resources, which are practically independent from the size.**
- **A generally applied principle is that a single power plant should represent no more than 10% of the total installed capacity connected to the grid.**
 - **NPP is most efficiently run as base load generation and the dispatching of its full capacity should be possible.**
 - **Transients of NPP should not jeopardise the stability of the grid. A detailed grid stability analysis is always needed.**
- **Several (two) smaller steps with suitable intervals may fit better to demand growth curve than one big step.**
- **Need of reserve capacity is lower in case of smaller units.**
- **Burden of financing is easier in case of smaller units.**



Site Considerations

- **Turbine condensor cooling and ultimate heat sink (sea, lake, river, atmosphere)**
- **Meteorological, hydrological, geological and seismological characteristics**
- **Protection against natural phenomena, such as earthquakes, tornados, hurricanes, floods and tsunamis**
- **Protection against man-induced events, such as dam ruptures, aircraft crashes, chemical explosions and malicious acts**



Performance and Operational Considerations

- **Thermal efficiency**
- **Operability and maneuverability**
- **Inspectability and maintainability**
- **Refuelling cycle**
- **Availability**
- **Life time**
- **Decommissioning**

Arguments for Proven Technology Requirements

- **By requiring a proper level of “proven technology” the technical, schedule, and economic risk is reduced to an acceptable level.**
- **Eliminating technologies that have not been proven increases the confidence that the design will not require modification prior to or during construction and that the proven system will function as planned.**

Examples of Proven Technology Requirements (1) ^x

- **“Proven technology should include overall NPP system and elements. The elements should include components, plant structures, design and analysis techniques, maintainability and operability features and construction techniques.”**
- **“Proven technology of overall NPP system should be demonstrated through several years of operation of similar NPP as a commercial plant with a good operational record.”**

^x Quatations from IAEA document “Common User Considerations (CUC) by Developing Countries for Future Nuclear Power Plants”



Examples of Proven Technology Requirements (2)

- **“Proven technology of the elements should be demonstrated through one or more of the following;**
 - **several years of operation in existing NPP,**
 - **full or part scale testing facilities, several years of operation in other applicable industries such as fossil power and process industries.”**
- **“The Supplier should review existing databases of operating experience to identify both positive experience as well as causes of significant events and unplanned outages, and incorporate appropriate features in the NPP design.”**



Dilemmas of Proven Technology Requirements

- **Too strict requirements for proven technology may lead to obsolete design solutions.**
- **By definition, new advanced design solutions, should be better than the old ones.**
- **One possible compromise could be to require proven technology for those elements that are directly needed for power production and allow new features (like passive solutions) for safety systems. The rationale for this is that there exist only few safety systems that are proven in practice (in real accident situations).**



Licensing Principles

- **Accordance to IAEA guidance, even if a similar NPP design has been authorized in another country, the national regulatory body should still perform its own independent review and assessment.**
- **It may take into account the review and assessment made in other country, and also new experience and knowledge that have been gained since that review and assessment.**
- **The owner/operator (licensee) is responsible for the licensing. Depending on contractual approach, the supplier may be responsible for the licensability.**



Aspects of Licensability

The licensability includes the following:

- **The technical solutions of the NPP meet all regulatory requirements.**
- **The licensing documentation is complete and meets all regulatory requirements.**
- **The licensing documentation will be submitted timely so that all relevant licenses, permits and authority approvals can be obtained in due time.**

Potential Licensing Problems

- **The safety requirements applied in the design of NPP may not be same as those to be applied in the licensing of the NPP.**
- **The national regulatory framework, including a nuclear legislation and an independent regulatory body, may not be fully developed.**
- **One possibility to cope with the situation would be to accept the regulatory requirements of the country of system origin.**

Examples of Licensability Requirements ^x

- “The NPP shall meet the requirements of the IAEA nuclear safety standards and comply with those of the user’s national nuclear regulator.”
- “The NPP should comply with nuclear regulation of the country of system origin with regard to design approval.”
- “The reactor system should have been licensed or should be licensable in the country of system origin and the licensing information should be made available.”

^x Quatations from IAEA document “Common User Considerations (CUC) by Developing Countries for Future Nuclear Power Plants”



Dilemmas of Licensability Requirements

- **“Country of system origin” may not always be clear.**
- **The NPP design licensed some time ago in the country of system origin may not anymore be licensable as a new plant in that country due to the development of regulatory requirements.**
- **Many of new NPP designs available on the market are not yet completely licensed anywhere.**
- **What is the value of “design certificate”?**

Involvement of Regulatory Body

- It is advisable to have open and continuous dialogue with the national regulatory body during the Technology Assessment process and to assess with them the licensability of various NPP designs.
- One recommend way is arrange trilateral meetings between the owner, the regulatory body and the corresponding supplier. Safety features of the NPP design and the application of national regulatory requirements could be addressed in those meetings before the start of the real licensing process.

Thank you for your attention!