International Atomic Energy Agency

Grid, Industrial involvement and procurement

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Characteristics of Nuclear Power Plant (1)

- Capital intensive but low fuel cost
  - Operator prefers large size unit operated in base load (not in frequency control/load regulation)
  - Regional interconnection of grids enables increased size NPP
- (R→G) Preference to *large size*. **However,** sudden disconnection of a large scale NPP from the grid (reactor trip/scram) creates serious disturbance to the connected grid (frequency change)
  - Reactor trip to secure nuclear safety by sensing (BWR case)
    - Low/High level of reactor water
    - High neutron flux
    - High containment pressure
    - Excessive flow in Steam line
    - Low vacuum in condenser
    - High radiation in reactor building
    - High acceleration (earthquake) etc.

Characteristics of Nuclear Power Plant (2)

- (R→ G) Once disconnected from the grid, the reactor takes time to resume power operation (considering influence to fuel)
- (G→ R) Reliability/quality of the grid influences transient/safety of NPP. In the case of frequency change//interruption/isolation from grid:
  - [Ex.] Frequency drop→ reduced coolant flow → change in reactivity
  - Isolation→ Reactor transient (power-coolant mismatch to fuel due to decrease of coolant flow by pump trip, reactor overpressure due to loss of steam exit to Turbine) and
  - Isolation→ Potential safety issue (loss of power to safety systems etc.)

  Unless appropriate protection & control system in the NPP system design to prevent serious effect to reactor system are in place;
    - Automatic trip of reactor (reactor protection system)
    - Separation of plant electric system from the degraded grid
    - Reliance on DC battery
    - Emergency power source (DG, Gas Turbine)
    - Steam bypass system

Grid

In a relatively early stage of NP planning: Assessment of reliability/quality of grid and of the need to enhance it

- General guidance on grid/NPP interface in the IAEA document: "Interaction of Grid Characteristics with Design and Performance of Nuclear Power Plants: A Guidebook, Technical Reports Series No. 224" (1983)

- Assessment during the process of site selection (impact on economics from strengthening grid performance)

- Need collection of information on the characteristics of the current power system and their projection to the time NPP is built & operated (connection with other grids, load curve, stability, quality, availability of replacement power in case of outage, automatic load shedding etc)

Grid

❑ Phase I

NEPIO to looks at:

- Existing grid and generating capacity in relation to the available NPP technology
- Anticipated future growth of grid capacity & potential for grid interconnections to improve grid characteristics
- Stability and reliability of the electrical grid

❑ Phase 2

Owner/Operator/Utility, based on detailed studies to determine the necessary expansion, upgrade or improvement, plan

- for grid enhancement and/or expansion
- for increase or strengthening regional interconnects to achieve acceptable grid reliability
- for providing redundant, reliable sources of off site power for the NPP
- for funding & schedule for implementation (compatible w/NPP schedule)

Grid

❑ Phase 3

Utility to implement the plan established in phase 2

- ➢ Ensure coordination of grid operations (central grid operations) with NPP operations,
- ➢ Verify the completion of all upgrades and enhancements to the grid and interconnects
- ➢ Install and test the redundant off site power supplies to the NPP.

Industry involvement & Procurement

- Many commodities, components and services to construct, operate and maintain NPP
  - Opportunities for the growth of regional economy & stimulating science & technology
  - What happens if a component fails and the original manufacturer cannot provide replacement in a timely manner or is not in the market anymore?

- Owner/Operator, together with EPC company, to discuss
  - Supply chain including local participation for stable O&M
  - Potential for localization and/or strategic alliance with the original vendors (Some Owners Group coordinates the purchase of replacement and upgrades)
  - Qualification of local suppliers (Compliance with the codes and standards and under rigorous quality programmes)
  - Access to and handling of design information

Industry involvement : Phase 1

NEPIO to assess;

- National and local industrial capabilities,
- Interest of business / industrial leaders in participating in the NPP project considering the special requirements necessary,
- Necessary investment for intended upgrading of industrial facilities

And develop

- Short term and long term policies on the level of local participation

Industry involvement : Phase 2

In preparation of bid specification, **Owner/Operator/Utility** to consider;

- Which national or local suppliers can reliably supply commodities, components or services to nuclear related or non-nuclear portions of the NPP,
- What upgrades in skills and capabilities are realistic in a time frame to support nuclear construction,

And to determine;

- Bid specification in accordance with those decisions.

Local manufacturer

- Planned domestic industry involvement should be called out in the bid specification and will have to be negotiated with NPP supplier.

Industry involvement : Phase 3

Owner/Operator/Utility

- Reassessment of the sources of supply to support O&M
- If the national and local industrial structure has progressed sufficiently, the supply of spare parts, consumable supplies, maintenance services and services can be allocated accordingly

Local manufacturer

- Necessary qualification
- Localization (technology transfer)

Procurement

Phase 1: NEPIO to

- Recognise the need for a procurement policy consistent with the industrial participation policy,
- Consider a strategy to assure the necessary expertise in Industry/Operator is developed in a timely manner

Phase 2: Owner/Operator/Utility to

- Develop procurement programmes and procedures
- Develop formal procurement specifications and vendor lists

Phase 3: Owner/Operator/Utility to

- Establish its own procurement organization with the programmes and skills necessary to conduct nuclear related purchasing of equipment and services
- Establish outsourcing policy and extent of own technical expertise in O&M stage

…Thank you for your attention