

DRAFT QUESTIONNAIRE (2006-11-03)
THE NEED FOR SMRs

1. Statistical and numerical information ¹

1.1. Population and Industry

- 1.1.1. Population
- 1.1.2. What is the degree of urbanisation?
- 1.1.3. Is industry centralized or distributed, i.e. what proportion is outside urban areas
- 1.1.4. Consumption of electricity by household
- 1.1.5. Consumption of electricity by industry

1.2. Current Status of Energy Production

- 1.2.1. Primary energy by source
- 1.2.2. What proportion are from domestic sources
- 1.2.3. What are the sizes of current power generation plants and dates of initial production (list at least the top 10)
- 1.2.4. On current generating capacity, specify:
 - Installed capacity
 - Peak load
 - Total generation
 - Cost of electricity (at the source, and including transmission)
- 1.2.5. What are the sizes of power plants currently under construction or planned for construction in the very-near term (next 5-10 years)?
- 1.2.6. What are the costs of fuel available for current and new generation? Specify range of variation by fuel type and region/location
- 1.2.7. When are existing plants scheduled to be shutdown?

1.3. Grid Characteristics

- 1.3.1. Regarding the grid, characterize:
 - Distribution capacity
 - Distribution network (in km)
 - Connections to other countries
 - Electricity exports
 - Whether there are some larger/smaller segments that are not well connected

¹ Potential sources of information for this section include:

- 1. IEA Statistics 2006 Electricity Information
- 2. UDI 2005 International Directory of Electrical Power Producers and Distributors
- 3. IAEA country profiles,
http://www.iaea.org/OurWork/ST/NE/NENP/NPES/Downloads/CNPP2004_CD/pages/countryprofiles.htm
- 4. Nuclear News 8th Annual Reference Issue March 2006

- Ability of the grid to accommodate additional units and the maximum or ideal size of additions to grid
- How do you operate power plants:
 - In a base load mode within a large grid;
 - In a load follow mode within a small grid.
 - Other (please explain)

1.4. Forecasts, Plans and Considerations for Energy Production Increase

- 1.4.1. What is the forecasted energy demand growth rate in MW(e)/year? What is the forecast planning horizon?
- 1.4.2. What is desired (or projected) energy demand distribution (% of electricity, district heat, process heat, potable water production, etc.)
- 1.4.3. What current generation technologies are under consideration for future increase of generation capacity (specify by plant type, fuel type, and size)? What are technology and size preferences?

1.5. Nuclear Power, Projections and Plans

- 1.5.1. Do you have a national nuclear power programme?
 - Specify projected demand growth rate
 - Retirement of existing objects
 - Target percent nuclear, if applicable?
- 1.5.2. Is the demand for nuclear energy expected to grow?
- 1.5.3. What are the end uses anticipated for nuclear energy in your nation (e.g., use of heat for desalination, district heating, electricity, process heat, etc.). What capacity do you anticipate needing?
- 1.5.4. What is the range of NPP unit capacities best suitable for your needs?

1.6. Nuclear Power, Siting Constraints

- 1.6.1. Are there physical constraints or limits on the size of power plant projects in your country (e.g., defined by space, industrial infrastructure, water, access, etc.)?
- 1.6.2. Does your country have any special climactic or geologic conditions that would affect the nature of a nuclear power plant (such as lack of water, earthquakes, hurricanes, extreme cold, extreme heat, etc.)?
- 1.6.3. What are the possible NPP construction sites:
 - In-land; or
 - On-shore.
- 1.6.4. Do you have particular sites in mind for your country?
- 1.6.5. Do you have restrictions or requirements in providing NPP cooling towers?
- 1.6.6. Taking into account transportation or transmission factors, indicate specific requirements to siting with respect to:
 - Power generation only
 - Heat for district heating
 - Electricity or heat for potable water production
 - Electricity or heat for H₂ production
 - Heat for other process heat applications (give more information)

1.7. Nuclear Power, Targeted Applications

1.7.1. Is your country interested in the application of nuclear power for:

- Power generation only
- Heat for district heating
- Cogeneration of heat and electricity
- Electricity or heat for potable water production
- Electricity or heat for H₂ production
- Heat for other process heat applications (give more information)

1.8. Nuclear Power, Indigenous vs. International Component

1.8.1. Is use of indigenous labour/material an important objective of any reactor project?

1.8.2. Do you have educational and training infrastructure to provide qualified project management and labour?

1.8.3. To what degree will you look to indigenous sources and to what degree to external sources for:

- Fuel supply?
- Power plant supply?
- Service supply?

1.8.4. Describe the desired degree of technology transfer?

1.8.5. What extent of local participation would be possible/desirable and what would be the restrictions?

1.9. Nuclear Infrastructure, Status and Development needs

1.9.1. What infrastructure exists now that would support the use of nuclear energy?

- Physical (research reactors, fuel cycle facilities, and waste management facilities)
- Technological (factories, production lines for NPP components)
- Educational (universities and nuclear energy programmes)
- Legal/regulatory (regulatory body, atomic energy law, nuclear regulations, international treaties)
- Available human resource (engineers, etc.)

1.10. Ownership, Financing and Investments

1.10.1. Describe financial environment and constraints for NPPs:

- Investment (reference size);
- Discount and interest rates;
- Realistic size of a project;
- Taxation benefits or extra charges and constraints;
- Expected rate of return;
- Any specific financing or risk considerations.
- Sources of project financing (domestic commercial banks public financing, international loans or aid, etc.)

1.11. Nuclear Power, Experience with SMRs (Small being less than 100Mwe, Medium 100-700Mwe NPPs)

- 1.11.1. Do you think that building a sequence of SMRs instead a large plant better meets your requirements?
- 1.11.2. What price/kW and lifetime generation cost (LUEC) do you expect from the innovative SMRs?
- 1.11.3. Do you plan to participate in the SMR technology development with a country that wishes to sell them?
- 1.11.4. Are you planning to export any indigenous SMR? If yes, do you think there should be a price/kW of an SMR independent of the supplier's origin?

2. Desired features or preferences for nuclear power

Indicate, which of the following requirements may be important for nuclear energy programme in your country, apply ranking: 2 (low priority) to 5 (high priority), relative to each other, i.e. stability of fuel pricing may be more important than the amount of waste generated therefore it should be rated higher:

Subject	2	3	4	5
Applications				
Applications other than electricity production				
Competitiveness				
Competitive Levelized Unit Electricity Cost (LUEC)				
Competitive total energy cost, including generation costs (LUEC) and transportation (transmission) cost,				
Overnight costs				
Price of nuclear vs. alternatives; type of alternatives:				
Gas				
Oil				
Coal				
Hydro				
Solar,				
Wind,				
Biomass, etc.				
Optimal utilization of available infrastructure and local manpower				
Partnership rather than selling, meaning sharing the costs, expenditures and profits				
Technology transfer				
Domestic components				
Local industry involvement				
Siting				
Size of area served				
Proximity to large populations				
Availability of cooling water				
Size of exclusion zone				

<p>Financing</p> <p>“Just-in-time” follow of energy demand growth (e.g., by gradual increase of production by multi-module plant capacity addition)</p>
<p>Licensing/safety</p> <p>Plant licenseability in country of origin</p> <p>Core damage frequency</p>
<p>Risk</p> <p>Previous experience with certain reactors</p> <p>Sufficient experience in component construction & fabrication</p> <p>Existence of demonstration plant or equivalent conditions for assuring owner of plant performance</p> <p>Existence of a partnership with potential vendor</p> <p>Attractive commercial offer for a FOAK plant to compensate for possibly increased investment risk</p> <p>Innovation/ passive systems</p> <p>Security of energy supply</p>
<p>Construction</p> <p>Construction schedule</p> <p>Start up time of the unit</p>
<p>Operations</p> <p>Guaranteed vendor support for reactor lifetime</p> <p>Guaranteed indigenous support for reactor lifetime</p> <p>Satisfactory conditions for efficient training of operational personnel</p> <p>Securing conditions for long term component replacement and spare parts</p> <p>Simplicity of operation</p> <p>Operational safety</p> <p>Support of NPP from power system operator (indicate, which: reservation, frequency keeping, etc.)</p>
<p>Fuel cycle</p> <p>Availability of domestic front end / back end fuel cycle services</p> <p>Availability of guaranteed outsourced front end / back end fuel cycle services</p> <p>Commitments on spent fuel</p> <p>Quantity of waste production</p> <p>Stability of fuel pricing</p> <p>Long refuelling interval or continuous refuelling</p>

3. Policies

3.1. National

3.1.1.Environmental Constraints

- 3.1.1.1. What are the current environmental effects of energy production?
- 3.1.1.2. Are there policies, laws, or treaties in place that provide environmental constraints on power plant projects?
- 3.1.1.3. Do you have significant limitations of CO₂ release according to Kyoto protocol with restrictions to build fossil plants?
- 3.1.1.4. What policies exist relative to the size and placement of power plants in your country?
- 3.1.1.5. Are there constraints on the storage and disposal of radioactive wastes (legal, physical space, geological, public acceptance, etc.)

3.1.2.Electricity policy

- 3.1.2.1. What are the electricity market arrangements/regulations?
- 3.1.2.2. Is the utility vertically integrated or an independent power producer? Specify utility profiles
- 3.1.2.3. Are there financial constraints or limits on the size of power plant projects in your country?
- 3.1.2.4. What kind of ownership/contracting arrangements would be allowed/considered for any new electricity generating capacity?
- 3.1.2.5. Who is expected to invest in electrical generating capacity and how (government, private utility, overseas investors)?
- 3.1.2.6. What are the restrictions on foreign ownership and/or operation?
- 3.1.2.7. Do you foresee difficulties to provide funds for plant construction?

3.1.3.Nuclear Power, Policy, Public Attitude and Laws Limiting the Use of Nuclear Energy

- 3.1.3.1. What policies exist relative to the use of nuclear energy in your country?
- 3.1.3.2. What is the general attitude of your country's population toward nuclear energy? Is it changing?
- 3.1.3.3. Are there laws that currently limit its use?
- 3.1.3.4. Indicate whether local regulations may affect the use of nuclear power. Explain, in which way.
- 3.1.3.5. What institutional additions you may require to prepare for nuclear deployments?
- 3.1.3.6. Indicate your attitude to reliable outsourced fuel cycle services

3.2. Meeting the international obligations²

3.2.1. What civil nuclear liability regime is enforced in your country

3.2.2. Are you a party to relevant international treaties (list to be provided)

3.2.3. What protections are available for intellectual property

3.3. Expected Support from IAEA

3.3.1. What does your country expect that the IAEA can do in helping your country to embark upon or expand a nuclear power programme?

² Potential sources of information for this section include the IAEA Web-page of international conventions and agreements:

<http://www.iaea.org/Publications/Documents/Conventions/index.html>