Akkuyu NPP construction. BOO in nuclear industry with foreign company participation
Lessons learned

IAEA Technical meeting
Becoming knowledgeable customer
«Building strategic partnership»

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## Why BOO? Pros and Cons

### What is BOO?
Build-own-operate is a model when the company which builds the NPP also is its owner responsible for its operation and power sales, as well as for attracting investments for the NPP construction. The BOO model is frequently used in the thermal power industry, including Turkey. It is the first time when the BOO mechanism is applied in nuclear industry with foreign company participation.

### Why BOO?
- Potential profit from power sales – high dynamics of GDP and power consumption in Turkey
- Forecast for power consumption and increasing capacities deficit
- Electricity market liberalization and electricity price growth in Turkey
- The Turkish market in general is attractive for investors, and the power market – in particular
- Availability of grid infrastructure and possibility to export power to Europe and the Middle East
- Governmental support of the project in Turkey and Russia

### Pros
- Profit from electricity sales after pay back period
- Fixed price PPA (weighted average 12.35 cent/kwh) and fixed quantity - (70% of Units 1 and 2 output and 30% of Units 3 and 4 output accordingly) – revenue guarantee for the investor
- Nuclear industry work-load – opportunities for industrial orders

### Cons
- Need to forecast the long-term electricity price – the high probability of mistake and change in long-term electricity price.
- The Project Company bears all the risks
- Possibility of unpredictable growth of the construction costs, economic and political force majeure
- Difficult to find an investor («long» money)
Akkuyu Nuclear Power Plant is the First Rosatom BOO Construction Project Outside Russia

Akkuyu Project Features

- First Nuclear Power Plant in Turkey
- First Rosatom BOO (build-own-operate) project. Under the IGA, Rosatom is responsible for engineering, construction, operation and maintenance of the plant.
- Legal basis: Intergovernmental Agreement, May 12, 2010
- Project design: AES-2006 (VVER-1200)
- Total capacity: 4,800 MW (4 x 1200 MW)
- Implementation period: 2011-2023
- Power Purchase Agreement for 15 years, fixed price terms
- Support of the Russian and Turkish Governments

Akkuyu site, Turkey
Project Milestones

Stage 1: PREPARATION
- 03/2011: Start site survey
- 05/2014: EIA report
- 2016: NPP construction license
- 10/2016: First concrete
- 2021: Electricity generation license

Stage 2: CONSTRUCTION
- 2020: Unit 1
- 2021: Unit 2
- 2022: Unit 3
- 2023: Unit 4

Stage 3: OPERATION AND MAINTENANCE

Stage 4: DECOMMISSIONING
- 2080

Milestones:
- 2021: COMMISSIONING
- 2021: Start of electricity generation license
Three years in Turkey. What has been done (1)

- APC has received the Akkuyu site with the valid site license and renewed license terms

  **Engineering surveys**
  - Preliminary stage priority engineering surveys and Design stage engineering surveys have been completed by ZAO ASE
  - TECHNICAL SPECIFICATIONS for the engineering surveys of the Working Design stage has been prepared
  - Engineering surveys for the independent seismic evaluation of the site have been completed
  - Environmental monitoring (surface and underground waters, air, seismotectonic, meteorology, current shifts of the earth crust) performed
  - Mining and environmental supervision has been arranged under the terms of the Quarry Operation License and Permit

- Interaction with executive authorities
  - EIA Public Hearings have been conducted
  - EIA Report has been submitted to the Ministry of Environment and Urban Planning. The «EIA-positive» is expected in May 2014
  - Priority documentation for Akkuyu NPP has been developed and submitted to the TR regulatory agencies.
  - Electricity generation license application has been filed
  - Work with the system operator (grid company) on power distribution scheme has started
  - Negotiations with TETAS, electricity wholesale company, on PPA started and are underway
  - Information centers at Büyükececli, Mersin and Istanbul have been opened
  - Mining license for developing and operation of the site mining facility (calcareous quarry) was obtained
Three years in Turkey. What has been done (2).
Interaction with TAEK and IAEA

- The Licensing base for Akkuyu NPP has been agreed with TAEK
- TAEK has approved the “Basic Report for Akkuyu NPP site, Units 1,2,3,4”
- TAEK has approved the “Reference Plant Proposal Report”
- TAEK has approved the General Quality Plan and General Guide on Quality Management System (QMS) (requirements for the NPP Owner)

Joint work with TAEK on licensing in the following WG:
1. Engineering surveys
2. Regulations, codes and standards, licensing base
3. Quality management system
4. Long-lead items
5. Licensing
6. Physical protection
7. Radiation safety and emergency planning
8. Key technical decisions on ensuring NPP safety
9. EIA
10. Control over and accounting of nuclear materials

Ten WGs were established for fast-track/operative interaction
- Monthly coordinating meetings with TAEK, MENR and Akkuyu NPP JSC management as efficient interaction

Training workshops have been organized for employees of:
- TAEK
- Ministry of Energy and Natural Recourses
- Equipment suppliers
- TETAS wholesale company

Work with IAEA is underway in the following areas:
- Participation in Turkey’s SER (self-evaluation report) preparation (INIR)
- Participation in IAEA INIR mission
- Participation in preparation and organization of IAEA seminars on inspections and quality assurance
- Participation in developing A FULL REPORT TO THE 6TH REVIEW MEETING OF NUCLEAR SAFETY CONVENTION– June 2013

Turkish students who are to work at Akkuyu NPP started education at MEPhI University
Three years in Turkey. What has been done (3).

**Design and Survey works and Design Documents development**

- Construction organization plan for preliminary stage has been developed
- Design documentation has been developed by the General Designer and is under revision by the Project Company (APC). NPP Master Layout Plan has been developed
- Technical Specifications and estimate documentation for modular erection facilities of the preliminary period have been developed
  - Off-site water supply pipeline
  - Off-site roads
  - Modular erection facilities
  - Temporary construction camp
  - Temporary marine terminal (West side)
- Design works for the priority construction facilities of the preliminary period are ongoing
- Tender for long-lead item procurements (Nuclear Island) is announced

**Construction and assembly works**

- Directorate of the Akkuyu NPP under construction has been established and in process of development.
- The quarry operation is ongoing by drilling and blasting operations under the granted licenses and permits – more than $3 \times 10^6$ m$^3$ have been quarried
- Works on infrastructure maintenance and modernization are underway with the participation of Turkish companies. Contract for “pioneer base” maintenance has been signed, facilities have transferred for maintenance.
- Stone-crushing plant has assembled. Construction and assembly works on power supply have completed
- Fire-protection roads and zones are underway.

Quarry (before)  
Quarry (after)
Next steps.
Key events for 2014 (1)

Licensing

- EIA Report approval by the Ministry of Environment (May 2014)
- Development of the “Site Parameters” Report and submission to TAEK
- Filing documents for the construction license. Submission of application for construction license.
- Completing of development and approval of zoning plans of the Akkuyu site, coastal line, temporary construction camp after approval of the EIA report
- Converting of the temporary land use permits of the Ministry of Forestry and Water Affairs and Ministry of Finance into the permanent ones
- Receiving licenses for completing the construction and assembly works at the facilities of the preliminary period
- Obtaining the temporary power generation license
- Receiving permits for use of the underground water source for independent water supply of the construction site
- Work with TAEK (Working Groups) in order to organize Project related licensing and permitting activities in Turkey

Design works and Design Specifications and Estimates

- Completion of the engineering surveys for the Working Design stage
- Completion of consolidated reports on evaluation of seismic and tsunami hazards for the Akkuyu site
- Completion of the design documentation development and approval for Akkuyu NPP
- Completion of designing of the five preliminary stage priority construction and assembly facilities
Construction and assembly work

• Implementation of the license terms for the stone crushing production

• Planned development of the calcareous quarry to produce construction materials for preliminary works on terrain

• Quarry development works (mine site), grading and levelling at NPP site

• Finalizing works on infrastructure maintenance and modernization at Akkuyu site

• Start of preliminary stage priority construction and assembly works after getting “EIA Positive”

Manufacturing equipment for Akkuyu

• Quality control when launching manufacture and fabrication of LLI with participation of TSO and TAEK

Administrative and technical events

• Finalization of establishing Directorate for NPP under construction at the Akkuyu site

• Selecting an independent consultant – an Owner’s Engineer
Lessons learned (1)

- Lack of normative base and licensing experience in the relevant areas of nuclear power development negatively affects the timing and quality of decision-making.

Solution:

- Developing normative and licensing base prior to start of licensing and construction
- Approving the normative and licensing base of the vendor country in case of absence of a national normative base by the time of NPP construction/licensing start
- Training of the regulatory bodies’ personnel, including training at the NPP in operation - before the start of construction and licensing period
- Developing nuclear infrastructure before the start of licensing process/NPP construction
- Using experience of regulatory body/authorized (technical support) organization of the vendor country
- Hiring TSO (Technical Support Organization) through tender procedure
Lessons learned (2)

- Lack of responsibility of recipient country for the terms and timing of decision-making leads to delays in decision making and thus delays in construction. In case of BOO project the recipient country does not bear any financial responsibility for the project efficiency and increase of the project cost in case of increasing the project cost and delay of the construction time.

Solution:
- Establish and fix financial liability of the state on which territory NPP is to be built, at least for ensuring infrastructure solutions (INIR)
- Specify the terms for revisions of the documents of the supplier’s organization and the terms and conditions for declining the documents
- Partial participation of the recipient state in the NPP construction projects (ex., EUAS participation in Sinop NPP construction). Recipient’s state participation as shareholders of the project

- Absence of financial guarantees by the recipient state for the guaranteed purchase of amounts (under IGA or PPA) is a significant limitation for attracting investors

Solution:
- Financial guarantees of purchase amount under PPA by the state – these guarantees are not investment guarantees

- Absence of specified and detailed responsibilities of the Parties under the IGA - which opens the room for various interpretation of IGA. IGA provisions should be clarified

Solution:
- Implementation agreement (host government agreement) should be signed in addition to IGA and PPA with clearly stated responsibilities of the Parties, including financial liability
Issues which are to be included in such an agreement, contain but not limited to the following:

- Consolidated financial responsibility of the recipient party (executive and regulatory bodies, state companies) for actions/non-actions resulting in investor’s financial losses.
- Economic balance (protection from changes in domestic legislation, which could lead to financial losses)
- Guarantees of the payment by the recipient for the electricity to be procured in case of PPA termination, liquidation or bankruptcy.
- Tax incentives for the large scale investor – supplier of the NPP
- Responsibility of the host/ domestic Grid company for the grid connection
- Compensation /liability (in case of responsibilities' violation/ breach under the agreement(s) the state should compensate investor’s losses or pay fines)
- Project standards (environmental standards, safety standards, health standards)
- Site (providing investor with enough/ adequate site in its property or the right to acquire site for the project)
- Status of Agreement (subject to private law but has prevailing power over domestic legislation)
- NPP test mode operation payment
- Parties’ responsibility for timely commencement of commercial operation,
- Localization of equipment and materials (including procurement of equipment and materials at local markets),
- Spent fuel and waste management
- Education and training
- Nuclear Damage Liability Insurance, including Nuclear Insurance Pool
- Force majeure etc.
Lessons learned

Examples

• Olive trees Law
The Law “On improving productivity of the olive trees” № 3573 of 26.01.1939 prevents the Governorate from issuing permit for quarry development, and later – for NPP construction.

In accordance with IGA, a site license has been granted to the APC that envisages the construction at the site.

*The provisions of the Olive trees Law contradict IGA and Site License provisions and terms.*

• Tax incentives
While the APC invests 20 bln. USD in Turkish economy (Akkuyu construction CAPEX), the Project did not get a strategic investor status and relevant tax incentives. However less significant investment projects (in terms of size of investment) have received the strategic investor status and relevant tax incentives.

Similar important investment projects (ex., Baku-Tbilisi-Ceyhan pipeline, Blue Stream pipeline) were granted large-size tax incentives

• Coastal line Law

In accordance with the Coastal line Law industrial and energy facilities are prohibited closer than 100 meters from the sea. However only the Mediterranean Sea is the cooling source, technical and household water supply.

In accordance with IGA terms, the PC has been granted a site license which has been confirmed by TAEK in 2013 for Akkuyu NPP construction. *The provisions of the Coastal line Law contradict IGA and Site License provisions and terms.*

• Power Purchase Agreement (PPA)

The majority of the issues related to PPA implementation is outside the authority of the Turkish counter-party of the APC, and should be resolved at the governmental level (ex., state guarantees for purchase of a certain amount of electricity defined in the IGA and PPA)
When formulating plans for nuclear power development, establishment of the nuclear power infrastructure should be first priority:

1. Elaborating the nuclear infrastructure development plan (INIR - Integrated Nuclear Infrastructure Review - plan)
2. Elaborating an adequate normative base
3. Establishing an independent regulatory body with adequate amount of competent personnel, able to make fast and efficient decisions, and having a mechanism for such decision-making
4. Governmental organizations of the emerging nuclear states (newcomers) should have enough competent personnel ensuring qualified decision-making
5. The recipient states should assure government support and consolidated liability of the recipient country for the decision-making
6. The recipient country should keep certain financial responsibility for the project implementation. Large government companies of recipient countries should participate in the NPP construction as co-investors
Thank you for attention!

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