Human Resources Roadmap and Capacity Building for The Egyptian 1st Nuclear Power Project

Ibrahim Ali EL SHEHAWY
Vice Chairman for Projects

*Nuclear Power Plants Authority, Cairo, Egypt*

shehawy55@yahoo.com

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Electricity Demand and Supply

- Peak Load: 25 GW.
- Total installed capacity: 28 GW.
- Electricity demand increased at an average annual growth rate of 8% in the past decade.
- Electricity demand will continue to increase in near future.
- The long term plan is to add about 51 GW by 2027.
- We need to add more than 3 GW/year.
- It is planned to meet our demand in the best possible ways.
- Introduction of the nuclear power for electricity generation.
Main Drivers to Introduce the Nuclear Power Program

- Steadily increasing demand for electricity.
- Limited national fossil energy resources.
- Almost full utilization of hydropower.
- Instability in the prices of fossils energy resources.
- The expected support of nuclear power in developing the industrial and scientific sectors.
- Nuclear energy is technically and economically viable source of energy.
- Appropriate national infrastructure.
National Infrastructure of the Nuclear Power Program

- A National Unified Electrical Grid can accommodate a large NPP size.
- Specialized Nuclear Organizations are in place.
- A comprehensive Nuclear Law and its executive regulations are in forth.
- An independent Regulatory Body is existing.
- Joining relevant international treaties and conventions.
- Concluding several bilateral agreements for cooperation in the peaceful uses of nuclear energy with nuclear countries.
- Large pool of graduates and post graduates in nuclear fields.
- Availability of trained personnel in Two research reactors as well as in conventional power plants.
- A potential for local participation on conventional part and on some NPPs components.
The utilization of nuclear power was foreseen in Egypt since 1955.

In Sep. 2006, a national debate was initiated to develop a comprehensive energy strategy and to assess the feasibility to use nuclear energy.

Several top-level committees have been structured in order to manage, and coordinate different activities necessary for NP program.

Based on the outcome of the national debate including the results of the performed technical and economic studies with close cooperation with IAEA, the president declared the strategic decision in Oct.07.

It declaration states that:

- Construct a number of nuclear power plants for electricity generation.
- Implement the necessary steps to construct the first nuclear power plant.
- Develop the program in cooperation with our international partners and IAEA.
- The program to be conducted within the framework of transparency and respect of commitments of the non-proliferation regime.
Preparation for Nuclear Power: phase 2

Since strategic decision, several activities have been carried out:

- Contract with an international consultant engineering to support NPPA (Utility) in the implementation of the first NPP.
- Issue Nuclear Law and its Executive regulations.
- Establish an independent Regulatory Body (RB).
- Updating and submit Site Permit Documents to RB.
- Complete nuclear technology assessment.
- Develop the financing, fuel supply and local participation issues.
- Conduct several training sessions in and outside Egypt as a part of HRD plan.
- Complete and review by IAEA experts the BIS documents since 2011.
Egypt is at the end of phase two and ready to invite bidders.

After the recent social and political situation in Egypt and Fukushima Accident, the Cabinet decided to postpone tendering process until the election of new parliament to secure commitment to the project.

The main feature of the Egyptian 1st NPP are:
- The PWR reactor type Gen.III, for the first two units.
- The unit size ranges from 900 up to 1650 MWe.
- The project will be EPC Lump Sum Turnkey Contract.
- The proposed NPP shall be licensable in the country of origin.
- The plant shall meet all the IAEA Safety requirements.
- The local capabilities shall be utilized to the maximum extent possible.
- The EPC contractor shall provide proposal for training and technology transfer to the Egyptian staff.
Human Resources Roadmap and Capacity building

Human Resources strategy:

- In Egypt, it is well known that the development of skilled and qualified nuclear workforce is a vital key for realizing the success of the implementation of the Egyptian nuclear power programs.

Vision:

“Egypt will have the necessary competencies to manage the nuclear power program, participate in the implementation of the nuclear power plants and safely and efficiently operate them according to the national and international nuclear standards”.

The main objectives are:

- To develop a sufficient number of qualified personnel necessary to carry out all the NPP program activities in safe and reliable manner.
- To ensure that the availability of the nuclear experienced workforce at the proper time.
- To make effective and efficient use of the available national resources and of the foreign partners in certain specialized and advanced nuclear technical areas.
- To assure the involvement of the stakeholders as well as the long term governmental commitment.
- To co-operate with the relevant international organizations and in particularly IAEA.
- To gain and enhance the mutual benefits from the bi-lateral agreements.
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Opportunities

- Experienced staff in:
  - Pre-Contract activities of the Nuclear Power Project
  - Research Reactors
  - Conventional Electrical power plants
  - Industry and engineering firms

- Good educational infrastructure.

- Existence of the nuclear engineering department.

- Existence of two research reactors.

- Existence of construction and consultation companies.

- Assistance from IAEA.

- Activation of bi-lateral agreements.
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- Determination of manpower requirements
  - Based upon previous and current worldwide nuclear project staffing experience, from available data from Gen.III vendors, EPC contractors, nuclear utilities and IAEA publications.
  - Define the Human Resources requirements by function, skills, experience, qualification to successfully implement a 2x1000 MWe NPP project in Egypt.
  - These requirements have been carried out for:
    - NPPA (Utility).
    - EPC contractor project management team.
    - Construction Craft labor.
  - These requirements cover the following phases:
    - Pre– project phase activities.
    - pre– construction activities.
    - Construction activities.
    - Start up, operation & maintenance activities.
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Pre– project phase activities:

- Begin from the NPP consideration up to EPC contractor singing date.
- Require relatively few but highly qualified staff (peak 130 personnel).
- These staff will form the core of the NPP project organization.
- Among others, they shall be able to handle the main following activities:
  - Siting activities and environmental studies.
  - Technology assessment.
  - Develop long-term strategies and action plans for: nuclear safety, security and physical protection, QA/QC, fuel supply, spent fuel, radioactive waste, project financing, HR development, national localization and public consultation.
  - Preparation of BIS tech & commercial bidding documents.
  - Review and evaluation of the tenders documents.
  - Negotiation & preparing the EPC contract.
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Pre–construction activities

- Starts immediately after EPC contractor signing date and ends at the issue of the construction permit date (24 month).
- About 170, highly qualified and nuclear experienced professionals in Egypt and abroad.
- Able to handle, review and approve the following:
  - Engineering design.
  - Technical specification and bidding documents for the long lead items.
  - The engineering details and construction drawings.
  - The QA/QC documents.
  - The project implementation plan.
  - The safety, security, and health plan.
  - The NPP project schedule.
  - Management of site physical facilities according to owner scope.
Construction phase:

- Starts after the issue of construction permit date and ends at fuel loading.
- It takes between 60-72 month and 5000-6000 full time peoples.
- Includes all activities related to the following:
  - NPP engineering.
  - NPP construction.
  - NPP testing & commissioning.
  - NPP procurement and expediting.
  - NPP nuclear safety, licenses, plant turnover.
  - NPP QA/QC implementation, auditing, and inspection.
  - NPP project controls, & monitoring.
  - NPP economic and finance.
  - NPP project HR, logistics service.
The Owner estimated personal requirements during pre-construction & construction phases, two units.
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Start up, operation and maintenance activities

- Starts after fuel loading.
- Require 1200-1500 for 2x1000 MW NPP station.
- Includes all activities related to the following:
  - Hot testing.
  - Reactor criticality.
  - All contractual performance testing that are required before the NPP is declared ready for commercial operation.
  - O&M activities.
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Training and Technology Transfer

- The main objectives are:
  - To be capable to carry out the designated activities in effective and efficient manner.
  - To manage and secure the success implementation of the project according to the nuclear safety standard, highest quality and within the allocated budget and schedule time.
  - To effectively and safety operate, maintain and monitor the entire operation and all systems and components.

- Training and TT partners:
  - Universities and research and training centres.
  - The International Consultant.
  - The EPC contractor.
  - Cooperation with IAEA and advanced nuclear countries
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Universities and local research and training centres:

- The higher education sector in Egypt provides graduates in almost all specialities.
- The universities, specially the Nuclear Engineering Department(s) and post graduated programs can provide education and researches in the many nuclear aspects.
- Research reactors and thermal power plants training centers can provide basic training for the operation and maintenance.
- The specialist from industry and conventional thermal power plants can participate in carrying out specific project activities.
- There is plans to establish:
  - A new Nuclear Engineering Department.
  - A new two-year Technical Institute to graduate the O&M employees for nuclear and radiation facilities.
  - A new specialized division in an industry high school near the site.
The International Engineering Consultant:

- Specifying and developing the training needs for NPPA personnel.
- Preparation of a training programs for qualifying NPPA personnel in all phases of the project.
- Training of NPPA staff in some vital areas such as project management, safety and quality assurance.
- Provide on-the-job training in his offices.
- Transfer of knowledge and technology during the project phases.
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The EPC contractor:

- The EPC contractor shall provide a comprehensive proposal for training & TT.
- The package shall include technical assistance and transfer of knowledge, technical documents, software and hardware and training materials.
- The EPC contractor shall ensure that there shall be sufficient number of certified personnel required for safe & reliable O&M of the NPP prior to plant start up.
- The trainee number shall be 120% at least of the required personnel.
- NPPA staff shall participate in the project management and site management during construction.
- The operators shall participate to the max. possible extent in design, installation and testing of plant structure, systems and component.
- Training shall carry out in both Egypt and in the home country of the contractor and the selected manufactures.
Training and TT forms:

- Classroom Training Courses and Workshops in and outside Egypt.
- Scientific Visits, to countries in different stages of the nuclear power project.
- On-the-job Training, at the consultant and vendor’s offices, manufacturing facilities and at a reference NP plant.
- Active participation in the project and site management during construction as well as in the design, installation and commissioning activities.
- Full Scope Simulator Training for the NPP operation staff.
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Cooperation with IAEA

- **IAEA is the key partner for the development of Egyptian human resources.**
- **With IAEA assistance, many of Egyptian attended in and outside Egypt workshops, training courses and scientific visits in various topics within the previous years.**
  - The topics include:
    - Site requirements
    - Workforce planning
    - Project management
    - Safety and security
    - Economics and Financing
    - Bid preparation and evaluation
    - Public communication
    - Quality Assurance/Quality control
    - Emergency Plan.
- **New TC project has been designed for the period 2014-2015 to cover the bidding and early construction stages.**
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Cooperation with advanced countries

- Under the bi-lateral agreements, the Egyptian human resources have been trained.

- USA organized two workshops in Egypt on the following topics:
  - Quality Assurance
  - Human Resources Planning

- About 70 persons from NPPA were trained in Russia. The training consisted of 7 courses in the following fields:
  - Bid Invitation Specification and bids evaluation.
  - Site selection
  - Fuel Cycle
  - Nuclear Security
  - Nuclear and Conventional Islands of the NPP
  - Nuclear Waste Management
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- A cooperation project was signed between Egypt and Republic of Korea to develop the NPPA human resources.

- The project duration is **three years** and consists of **three stages**, for the top management, the middle management and the technical staff.

- The training topics include:
  - Project management
  - Nuclear Power Plants safety
  - Quality management
  - Training of the trainers
  - Other agreed upon topics.

- The first group of 10 top management level has finished in May 2013 two weeks training in KAERI and other Korean nuclear power and industry firms.
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Challenges Facing the Human Resources Development

- The repeated delays of the NP program led to the following negative impacts on the human resources development:
  - Many of the highly qualified personnel left the country to join nuclear organizations in other countries.
  - The existing nuclear engineering department are not able to attract good students due to limited employment opportunities.
  - Inability of the nuclear authorities to attract high caliber graduates due to competition from other industries and private sector.
  - Most of the experienced staff retired or about to retire.

- Lack of national specialized nuclear training centers.
- Large financial requirement for the human resources development.
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Possible ways to face and overcome these Challenges:

- Develop a comprehensive re-structuring plan that includes better working environment, to attract employees and retain qualified human resources.
- Recruit and train a number of personnel greater than required.
- Make use of Egyptian experts who have been recently retired from national or international nuclear organizations, and who still have the ability to work efficiently.
- Utilize existing expertise in the Egyptian electricity and industry sectors who have relevant experience in construction, installation and operation of large thermal conventional plants.
- Utilize available international cooperation opportunities from IAEA, Consultant, EPC contactor and advanced nuclear countries.
Thank you
For your attention