

***Drivers and Impediments Regional Cooperation on the Way
to Sustainable Nuclear Energy Systems***

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Present Situation of Power Sector of Bangladesh*

❖ INSTALLED CAPACITY	6,693 MW
❖ AVAILABLE GENERATION CAPACITY	6,061 MW
❖ PEAK DEMAND	7500 MW
❖ ANTICIPATED LOAD SHED	1500 MW

MAXIMUM GENERATION

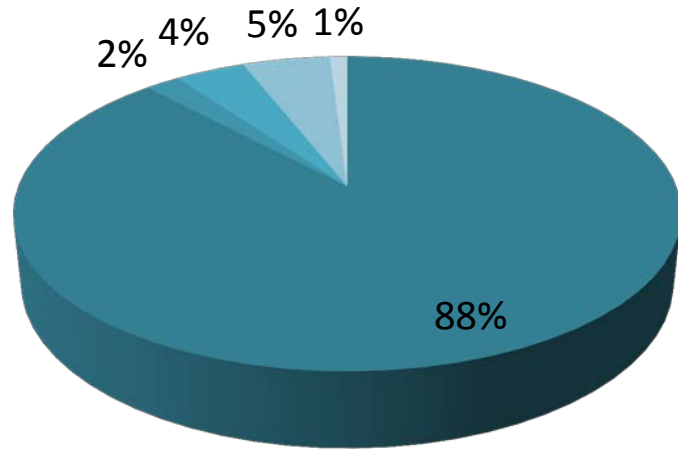
2012	6066.5 MW as on 22/03/2012
2011	5174. MW as on 23/11/2011
2010	4698.00 MW as on 20/08/2010

Presently, about 48% people are enjoying electricity in the country and per capita electricity consumption is 128 kWh

* Bangladesh Power Development Board (BPDB)

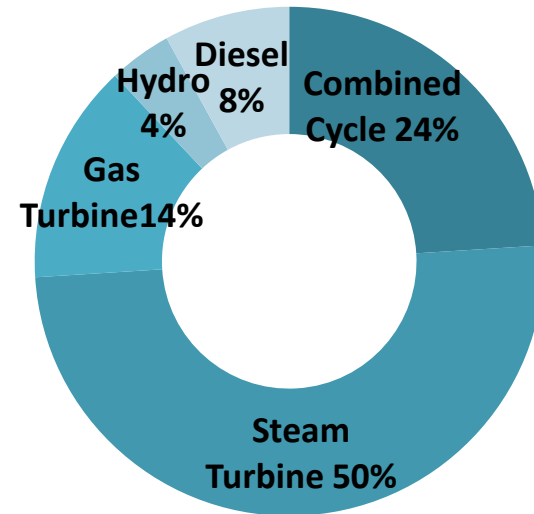
Present situation of Power Sector of Bangladesh

■ NG ■ Hydro ■ F.Oil ■ Coal ■ Diesel

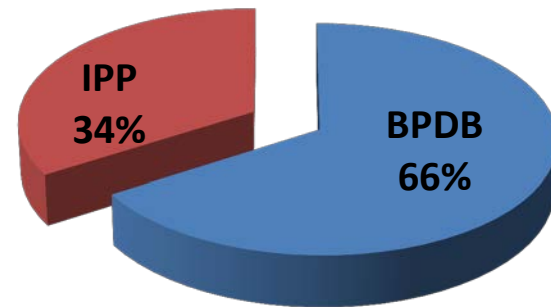


Fuel consumption pattern of Power Generation.

Energy and Power Sector of Bangladesh completely natural gas based mono fuel dependence



TYPE OF POWER PLANTS



Generation Capacity of Public and Private sectors BPDB: 3812 MW and IPP: 1991 MW

Perspective Plan of Bangladesh and Electricity Demand Projection

ELECTRICITY EMAND PROJECTION*

VISION 2021:

**Digital Bangladesh
Universal Electrification**

Target Electricity Generation

The power generation targets for the Six Five Year Plan emerge from the targets of the Perspective Plan: 2010 - 2021

By the year 2013: 8,500 MW

By the year 2015: 11,500 MW

By the year 2021: 20,000 MW (Electricity for all)

By the year 2030: 33,500 MW

* Bangladesh Power Development Board (BPDB)

2016 – 2021 Target of new capacity addition 9000 MW

Energy Resources

- Domestic coal and imported coal based power plants
- Implementation of Nuclear Project (Rooppur NPP)**
- Availability of new gas both in offshore and onshore

Growth of power generation capacity is estimated to be 10% every year and by the year 2021 the per capita electricity usage will be 600 KWh

LONG-TERM ENERGY MIX FOR POWER GENERATION

	Target		
	Current (%)	2021(%)	2030 (%)
Gas	88	30	28
Coal	3.7	53	38
Oil	6	3	5
Hydro	2.7	1	4
Nuclear	0	10	19
Renewable	0	3	6

*By 2021, the share of nuclear power will be 10% of
20,000 MW = 2000 MW (2X1000 MW)*

Nuclear Vision of Bangladesh

The Draft National Energy Policy of Bangladesh has outlined the nuclear power program as follows:

Period	Plan on NPP
By 2021	Implementation of 2 units of NPP (Rooppur NPP) to ensure 10% of total generation from NPP
Beyond 2025	Nuclear share should be 20% in overall generation mix

- ❖ **Present status** : No Nuclear Power Plant Exist in Bangladesh
- ❖ A 3MW research reactor for conducting research, training of personnel and production of isotopes for diagnostic purpose
- ❖ The research reactor is playing an important role in developing skilled manpower for the nuclear power program of the country.

Nuclear Road Map of Bangladesh

❖ 2012-2013

- Finalization of Site evaluation
- Feasibility Evaluation for “Roopur NPP” and design documentation
- Preparation of EIA report
- Establishment of Independent Regulatory Body (Bangladesh Atomic Energy Regulatory Authority)
- Signing of Essential Agreement / Contracts with the identified Vendor country

❖ 2013

- EPCM-Turnkey Agreement with Vendor
- Achievement of IAEA Milestone 2, Approval of Construction License

❖ By the end of 2013-2020

- Construction, commissioning and test operation and acceptance of the Plant

❖ 2020 Commercial Operation for Unit 1

Nuclear Road Map of Bangladesh

BAEC in collaboration with the following stakeholders will build the planned “Rooppur NPP”

Key activities and key Players are identified

❖ National Stakeholders

- University of Dhaka, BUET, GSB, SOB, DOE, BMD, CDMP, IWM, etc.
- National Committee, Technical Committee, Working Group and Sub-Groups and Coordination committee, etc.

❖ The IAEA

- Tentative Integrated Work Plan for Bangladesh Infrastructure Building 2012-15;

❖ The Identified vendor county, the Russian Federation

- Infrastructure Development
- EPCM Turn-key for ‘Rooppur NPP’ construction and commissioning
- HRD
- Regulatory
- Fuel Cycle

Integrated Work Plan for Bangladesh Nuclear Infrastructure Building with IAEA [2012-2015]

❖ **2012-2013 IAEA TC project “BGD2012 Establishing Infrastructure for the introduction of a Nuclear Power Plant”**

❖ **2014-2015 A New IAEA TC Project**

Action Plans by Bangladesh - Milestones

2009-2012	Finalization of Site evaluation, Feasibility Evaluation for “Rooppur NPP”
2010-2012	Preparation of EIA report Establishment of Independent Regulatory Body
2010-2012	Signing of Essential Agreement/ Contracts
2013	Achievement of Milestone 2, Approval of Construction License
2013-2020	Construction, commissioning and test operation and acceptance of the plant
2020	Commercial Operation (Government-owned utility – Turnkey - approach)

Recent Chronological Progress of “Rooppur NPP”

- ❖ An MOU between BAEC and ROSATOM on cooperation in the field of nuclear energy for peaceful purposes was signed on 13 May 2009;
- ❖ A Framework Agreement between Government of Bangladesh and the Russian Federation in the field of nuclear energy for peaceful purposes has been signed on 21 May 2010;
- ❖ Bangladesh government formed a National Committee Headed by the Hon’ble Prime Minister; a technical Committee Headed by the Hon’ble Stats Minister, MOST; a Working Group and eight sub-groups on Rooppur NPP Headed by the Secretary, MOST in 2010;
- ❖ The DG of ROSATOM visited Bangladesh on 10 June 2010 and had a meeting with the Hon’ble Prim Minister and assured his cooperation for construction of “Rooppur NPP”;
- ❖ A resolution for immediate establishment of NPP to combat existing power crisis was passed by the National Parliament in 2010;
- ❖ The IAEA conducted Site Safety Review Mission in July 2011;

Recent Chronological Progress of "Rooppur NPP" Cont...

- ❖ An IGA between Bangladesh and the Russian Federation on construction of a nuclear power plant "Rooppur" ("Rooppur" NPP) consisting of two reactor power units that includes designing, construction, commissioning and warranty operation as well as establishment of necessary infrastructure to ensure the operation two units of Rooppur" NPP was signed on 02 Nov. 2011.
- ❖ The IAEA conducted the INIR mission to review the status of the National Nuclear Infrastructure of Bangladesh during 9-15 Nov. 2011 and the mission conclude Bangladesh nuclear power program in general has progressed into Phase 2, being in the stage of preparation to negotiate the agreement(s)/contract(s) with selected NPP Vendor;
- ❖ The Cabinet approved the bilateral IAA between the Federal Service for Ecological, Technological and Nuclear Supervision of the Russian Federation and the Ministry of Science and Technology of the People's Republic of Bangladesh on cooperation in the field of nuclear and radiation safety in the use of nuclear energy for peaceful purposes;
- ❖ Bangladesh Atomic Energy Regulatory (BAER) Act was enacted in the National Parliament on 31 May 2012. An independent regulatory body will be established soon under the provision of BAER Act;

Recent Chronological Progress of “Rooppur NPP” Cont...

- ❖ An MOU between Ministry of Science and Technology, Bangladesh and ROSATOM, Russian Federation on the training of the staff of nuclear power sector was signed on 4 June 2012;
- ❖ An MOU between Ministry of Science and Technology, Bangladesh and ROSATOM, Russian Federation on the establishment of Information Centre of Nuclear Energy in Bangladesh was signed on 4 June 2012;

Motivation for Introducing NPP in Bangladesh

❖ **Energy Crisis:** Bangladesh facing twin energy crisis-

- An urban energy crisis characterized by power shortages and gas shortage;
- A rural energy crisis reflected in the increasing inability of the rural poor to access traditional biomass;



Both crises need urgent attention, as they directly affect the nation's development prospects and basic livelihood of urban and rural populations.

❖ **Strong Government Commitment:**

➤ In July 2008 the Government has approved an “Annual Development Project (ADP)” with sufficient fund for the period 2008 – 2013 entitled, “Accomplishment of essential activities to implement Rooppur Nuclear Power Plant Project”. Through the project, the government is providing budget for R&D, preparation of essential documents required for implementation of RNPP, training programmes for core professionals, carrying out the detailed investigation of the RNPP site.

➤ Government adopted the concept “Digital Bangladesh – Vision 2021” (Outline Perspective Plan of Bangladesh 2010-2021, June 2010). The updated “Power System Master Plan-2010” projected 2,000 MWe from nuclear by 2021.

Motivation for Introducing NPP in Bangladesh Cont...

- ❖ **IAEA'S Commitment:** IAEA TC Project- Establishing Infrastructure for the introduction of a Nuclear Power Plant;
- ❖ **Public Acceptance:** People of Bangladesh have keen interest in NPP; Almost there is no opposition from general people so far;
- ❖ **International Obligations:** Bangladesh has signed all the relevant international protocol prevailing in the treaties, agreements and protocol prevailing in the nuclear non proliferation and verification regime;
- ❖ Increasing Petroleum and Natural gas price;
- ❖ **Bilateral Agreement:** Bangladesh has signed bilateral agreement with France, China, USA, Russia on cooperation in the use of nuclear energy for peaceful purposes;

Impediments for Introducing NPP in Bangladesh

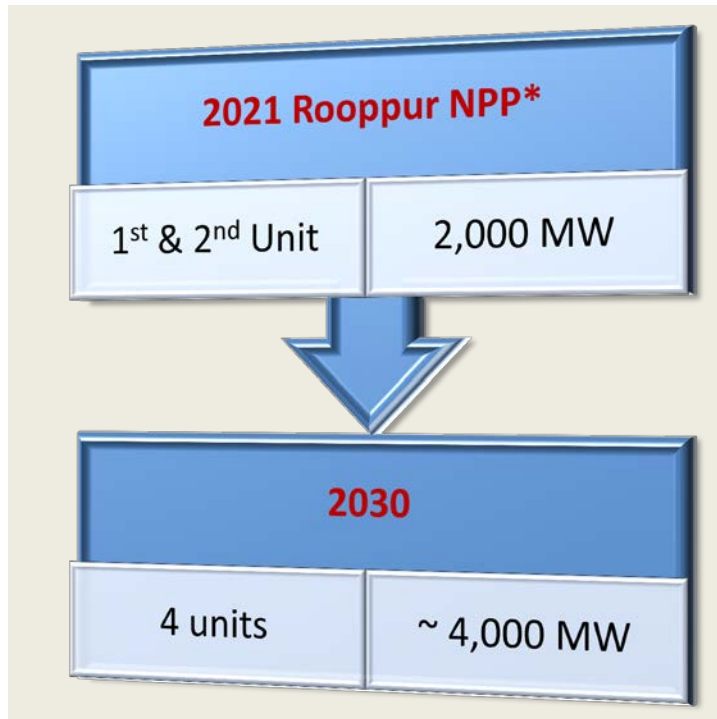
- ❖ **Financing:** Bangladesh is strongly facing the credit ability to introduce such giant project ;
- ❖ **Nuclear Infrastructure Development:**
 - **HRD (Skilled manpower):** Bangladesh has no skilled personnel regarding nuclear power. Development and concurrence on the comprehensive multileveled staff-training program for different phases of RNPP is necessary;
 - **Educational Institution:** Country's educational institutions have no nuclear engineering program though Universities have agreed to implement the same;
 - **Regulatory Authority:** It is essential to establish the independent nuclear regulatory body and development of regulatory competence building;

Impediments for Introducing NPP in Bangladesh Cont..

- **Grid Capacity:** Current grid capacity 7000MW is not sufficient to introduce two new 1000MWe units. Additional major improvements to the grid system are proposed to increase capacity and reliability;
- **Generation Capacity:** Present generation capacity is 6000MW. It proposes the addition of 1000 MW nuclear generation in 2020 and 1000 MW in 2021. By 2020 it forecasts a generation capacity of 20000MW and a demand of 19000MW. So proposed generation and transmission enhancements need to be carried out, in order for the system to have adequate capacity to install a NPP;
- **Integrated Management System:** For the implementation of Nuclear Power Program in the country the integrated management systems in the involved organizations (future NPP owner-operator, regulatory body, etc.) should be developed;

Nuclear Energy System in Bangladesh in 2030 and 2050

- ❖ Bangladesh is committed for addition of 2000 MW(e) Nuclear Capacity by 2021 (the Vision 2021; the Perspective Plan of Bangladesh; the Revised National Energy Policy)



*Power System Master Plan 2010, BPDB



Nuclear Energy System in Bangladesh in 2030 and 2050

	Target			
	Current (%)	2021(%)	2030 (%)	2050 (%)
Nuclear	0	10	19	Not defined yet

❖ Major Milestone to Achieving the Desired Target:

- Implement Rooppur Nuclear Power Project within the time frame;
- Nuclear Infrastructure development;
- Selection of new sites for expansion of NPP to ensure long-term energy security;
- Promote nuclear education and training and encourage research and development programmes in universities and research organizations;
- Ensure nuclear safety and security through developing nuclear regulatory infrastructure and strengthening cooperation with relevant national organizations;
- Strengthen cooperation with IAEA and other concerned regional and international agencies;

Nuclear Energy System in Bangladesh in 2030 and 2050 Cont...

❖ **System Capacity:** As of Power System Master Plan (PSMP) 2010, by 2030, the total nuclear power will be 4000 MW(e);

❖ **Planned Reactor Type:** According to IGA with the vendor, the construction of a nuclear power plant “Rooppur NPP “consisting of two VVER-type (i.e.; water cooled water moderated power reactor with pressurized water) reactor power units;

❖ **Planned of Fuel Cycle (Once-through or Closed):** Bangladesh is planning to adopt an open fuel cycle policy;

❖ **Criteria for Choosing the Reactor Type and Fuel Type:**

- VVER reactor is considered one of the safest reactors in the world (Safest Technology);
- More than 50 nuclear power plant units of VVER type, have been constructed in Russia, Ukraine, Czech Republic, Slovakia, Hungary, Germany, Finland, China. Nuclear power plant construction projects with VVER are at different stages in Russia, India, Iran and Bulgaria;
- Bangladesh will not be involved in the areas of fuel cycle activities relating to uranium production, conversion, enrichment, fuel fabrication and reprocessing of spent fuels. Its participation in the nuclear fuel cycle is limited to procurement of fresh fuel from a fuel leasing country or company, storage of fresh fuels, using the fresh fuels in the reactor, interim storage of spent fuels until they are returned to the supplying country;

Role for the Deployment of Nuclear Power Plant Program by Foreign Suppliers

❖ Plan for National Participation and Technology Transfer * :

- Nuclear power, at least in its initial stage, would be considered purely on the basis of meeting energy needs economically, safely and reliably. Thus, the scope for national participation in the initial plants would be limited and the experience and expertise of the manufacturer would form the core of the implementation process;
- The scope of the participation of the national industry in the project shall be limited to items that do not have safety implications and such works, if undertaken by local parties, shall be coordinated under the supervision and total responsibility of the main contractor;
- The local construction firms and selected industries will have the option to participate in the implementation of subsequent units of nuclear power plants, depending on the expertise acquired and other qualification for undertaking similar jobs. ;
- Selected companies may be encouraged/ motivated to acquire identified technologies in order to enhance the chances of their participation in the project;

* Bangladesh Nuclear Power Action Plan 2000 (BANPAP),

Vision of Back-end Fuel Cycle Services *

❖ **Plans for Spent fuel and high-Level Waste:**

- Bangladesh will not seek to be involved in any front-end and back-end nuclear fuel cycle activity except that would be required for the management of spent fuel and disposal of radioactive waste;
- Bangladesh would seek to conclude with reliable and responsible governments and contractors for the secure supply of nuclear fuel, as well as the safe and secure transportation and, take back of spent fuel via fuel leasing;
- Bangladesh shall develop on-site/off-site safe interim storages (both wet and dry);
- It may acquire the technology of fabrication of fuel elements based on imported raw materials and enrichment services from internationally reliable sources;

Sustainability of Nuclear power program in Bangladesh ???

- ❖ Making electricity available for all;
- ❖ Ensuring reliable and quality supply of electricity;
- ❖ Providing electricity at a reasonable and affordable price;

Energy Independence and Security of Supply

❖ **Priorities Factors to Achieving Energy Independence and Security of Supply:**

- To diversify the use of primary fuels, such as gas, coal and liquid fuel, for power generation;
- To have provision for dual fuel in power plants wherever possible;
- To increase power generation through renewable sources, such as solar, wind, small hydro;
- To implement nuclear fuel based power plant;
- To finance power generation projects through, for example, Public–Private Partnerships, government funding for IPP;

❖ **Constraints**

- Absence of adequate public and private investment in power generation;
- Absence of Cost Reflective Tariffs;
- Absence of Primary Fuel Supply Chain;

❖ **Possibilities**

- Coal-based power plants using domestic and imported coal;
- Ruppoor Nuclear Power Plant;
- Availability of new gas both offshore and onshore;
- Public-Private Partnership Projects;
- Prospect of participation of local investors in the sector;

Cooperation for Energy Projects with Other Countries

❖ Possible Positive Drivers for Cooperation:

➤ **Bilateral Agreement:** Bangladesh have the bilateral agreement with France, China, USA, Russia on cooperation in the use of nuclear energy for peaceful purposes;

❖ **Serious Power Crisis:** People of Bangladesh are facing the serious energy crisis. Only 48% people are enjoying electricity in the country;

❖ Bangladesh takes active participation in nuclear safety regional, bilateral and international cooperation programs such as FNCA, RCA, IAEA, STA, etc;

❖ Financing and Nuclear Infrastructure Developments are the main impediments;

Cooperation for Energy Projects with Other Countries Cont...

❖ **Vendor Selection:**

➤ Policy makers decision;

➤ **Safest Technology:**

➤ **Spent fuel take back policy:** Scope of IGA

➤ **To build strategic partnerships:** University to University partnerships for HRD; Infrastructure development for regulatory authority;

➤ Financially acceptable;

Benefits/Disadvantages of Cooperation for Nuclear Energy Projects with Other Countries

❖ Benefits:

- Disaster Management- (Sharing experience and expertise);
- Spent Fuel Handling- (Sharing experience and expertise);
- Radioactive Waste Management;
- Operating Experience;
- Physical Protection specially for boarder area;

❖ Disadvantages:

- Drainage of Innovative Technology;
- Public Acceptance due to sovereignty and regulatory authority;
- Socio political Impact;

Thank you for your kind attention