Rooppur NPP: Safety, Grid Readiness And Strong Governance Must Come First

Bangladesh's nuclear power journey has reached a historic milestone: the first unit of the Rooppur Nuclear Power Plant (RNPP) achieved initial criticality on 11 October 2026. This marks the beginning of a crucial phase of reactor commissioning, testing and preparation for commercial operation.

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Dr Mohammad Shawkat Akbar, Former Chairman of the Bangladesh Atomic Energy Commission (BAEC), made these observations in an interview with Energy & Power Editor Mollah Amzad Hossain.

After nearly six decades of planning and preparation, Bangladesh has reached the initial criticality milestone at Rooppur Unit-1. As a nuclear scientist and former Project Director, how do you feel about this achievement and Bangladesh's entry into the nuclear power generation community?

Power Unit-1 of the Rooppur Nuclear Power Plant achieved its first self-sustaining nuclear chain reaction, reaching initial criticality at 3:34 pm on 11 October 2026. This historic milestone for Bangladesh's nuclear power program is a significant step toward establishing nuclear energy as a reliable source of low-carbon electricity.

When I began my career as a scientist at BAEC in 1993, nuclear power in Bangladesh was still a vision. In 2002, when I took charge of BAEC's Nuclear Power and Energy Division, pre-project activities for Rooppur were just beginning.

Having devoted more than a quarter-century to developing the country's nuclear infrastructure and leading the project from its foundational stages, I find this achievement deeply satisfying. It represents the fulfilment of a long-cherished national aspiration.

This achievement belongs to the people of Bangladesh and reflects the contributions of policymakers, scientists, engineers, project personnel, regulators and international partners. I am grateful to my former colleagues at Rooppur and BAEC, the Bangladesh Atomic Energy Regulatory Authority (BAERA), the Ministry of Science and Technology, the Government of Bangladesh, ROSATOM, JSC Atomstroyexport and its subcontractors, and the International Atomic Energy Agency (IAEA).

Bangladesh's entry into the nuclear power-producing community is an important step towards energy security, economic resilience, industrial development and a lower-carbon energy system.

What does initial criticality actually mean, and what are the major technical milestones that must be achieved before Rooppur Unit-1 can supply electricity commercially?

Initial criticality means that a reactor has achieved a self-sustaining nuclear chain reaction under controlled conditions. It is a major scientific and engineering milestone, but it does not mean the unit is ready for commercial operation.

Upon achieving criticality, the reactor is operated at a very low power level. During this Substage (B2), operators and engineers test control rods, monitor neutron flux, and verify that all core parameters align with computer models and safety designs. After that the power unit enters Stage C (Power Start-up) under a separate permission or license from BAERA. During Stage C, the reactor's thermal power is incrementally increased (about roughly 1%, 5%, 10%, 20%, 30%) to generate thermal energy, supplying steam at progressively higher pressures to the secondary circuit to accelerate the turbine step-by-step until it reaches its normal operational speed of 3,000 RPM. Once the reactor safely stabilizes at 30% to 35% power, the turbine generator is formally synchronized and connected to the electrical grid. At this initial connection level, the unit delivers its first block of experimental electricity, typically around 240 MW to 360 MW of its 1,200 MW nominal electrical capacity.



Dr Mohammad Shawkat Akbar

The plant must complete the prescribed tests and demonstrate its ability to operate at full capacity continuously for at least 15 days. Commercial operation can begin only after all commissioning tests, contractual requirements and regulatory conditions have been fulfilled and the necessary commercial operation license obtained. The transition from initial criticality to commercial operation requires close coordination among the project organization, operator, regulator, grid operator and technology supplier. My advice is straightforward: technical discipline, quality assurance and nuclear safety must never be compromised to meet a schedule.

Grid synchronization is not the beginning of commercial production or continuous electricity supply. It initiates further testing of reactor systems, turbine-generator performance, safety controls and grid integration.

During trial operation (Stage D), output will increase progressively towards 100% capacity under a separate license from the BAERA. The plant must complete the prescribed tests and demonstrate its ability to operate at full capacity continuously for at least 15 days.

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What are the most significant challenges Bangladesh must address to bring both units into successful commercial operation?

Rooppur is a strategic infrastructure project with a planned capacity of 2,400 MW. Its successful operation requires coordinated progress across several technical and institutional areas.

First, nuclear safety and quality assurance must remain the highest priorities. Every inspection, test and system integration activity must comply with the approved commissioning program, plant design documentation, IAEA safety standards and BAERA requirements. Test results must be verified and documented before the project advances to the next stage. Any deviation must trigger investigation and corrective action, with appropriate review and approval by the contractor, operator and regulator.

Second, Regulatory oversight must be continuously strengthened. To achieve this, BAERA must develop its institutional capacity, technical competence and infrastructure to ensure effective, independent oversight during the commissioning and trial operational stages, while introducing strict hold points and witness points.

Third, the Nuclear Power Plant Company Bangladesh Limited (NPCBL) must establish its competence as a licensed, competent operating organization with qualified management, licensed personnel, clear responsibilities and effective systems for operation, maintenance and safety.

Fourth, grid readiness is essential. The national transmission system must be capable of receiving the plant's output while maintaining stability under normal and abnormal conditions.

Fifth, Bangladesh must ensure effective emergency preparedness, physical protection, cybersecurity and coordination among organizations responsible for nuclear safety and security.

Finally, strong project management and risk mitigation are essential amid macroeconomic uncertainty and global supply-chain challenges. Continuous coordination between BAEC/NPCBL, JSC Atomstroyexport and their subcontractors, alongside high-level cooperation between the governments of Bangladesh and Russia, will be critical. The agreed project schedule and approved commissioning program must guide implementation.

How can Bangladesh ensure that nuclear safety remains the overriding priority during the transition from commissioning to commercial operation?

Nuclear safety and governance must be embedded in the culture, leadership, and daily practices of every organization involved in a plant's operation. The operating organization must promote a strong nuclear safety culture built on psychological safety, a blameless culture, a questioning attitude, transparent reporting of problems, learning from errors, conservative decision-making, and ethical governance.

No production target, financial consideration or administrative pressure should take precedence over safety. Unexpected test results must be investigated and resolved before work proceeds.

Quality assurance must cover equipment inspection, equipment registration, documentation, maintenance, training and operating procedures. operational mode declaration are equally important.

Reliable logistics are also essential. Previous delays involving faulty safety valves underline the importance of effective inventory management. Separate commissioning and reserve inventories should be maintained for critical components, strategic spares and operational consumables.

Operating personnel must receive continuous training and demonstrate competence before assuming safety-related responsibilities. Building a strong safety culture from the outset will be essential to public confidence and the long-term sustainability of Bangladesh's nuclear program.

What institutional and regulatory improvements are necessary to strengthen BAERA's capacity as Bangladesh enters the operational phase of nuclear power generation?

An effective nuclear regulatory system is fundamental to safe operation. BAERA must have sufficient institutional independence, technical expertise, resources and infrastructure to perform its responsibilities effectively

Its role must extend beyond licensing and construction-stage inspections to cover commissioning, operational safety, radiation protection and ongoing inspections throughout the plant's operational lifetime.

This requires qualified inspectors, specialist technical personnel, comprehensive regulations, clear guidelines and effective management systems. Adequate facilities and human resources are necessary both at its Dhaka headquarters and near the Rooppur site.

BAERA must independently evaluate safety documentation, inspect the plant, verify compliance with licensing conditions and enforce corrective measures when required.

Bangladesh should continue cooperating with the IAEA and benchmark its nuclear

infrastructure against international standards. Peer reviews, including Operational Safety Review Team (OSART) and Emergency Preparedness Review (EPREV) missions, as well as completion of the Integrated Nuclear Infrastructure Review (INIR) Phase 3 mission, can help strengthen national capabilities.

Regulatory capacity must develop alongside the nuclear program. It is a continuing national responsibility, not a one-time requirement.

NPCBL will be responsible for operating Rooppur NPP. What must the company do to establish itself as a competent and sustainable nuclear operator?

Nuclear power generation requires a different institutional culture from conventional power plants. The operator must understand reactor technology, safety systems, operating procedures, maintenance requirements and regulatory obligations in considerable depth.

NPCBL must establish a capable operating organization characterized by clear accountability, effective management, and qualified personnel. This requires a competent executive and corporate management framework, a robust on-site management system, core operations departments consisting plant operations, engineering, maintenance, safety & radiation protection, while fully integrating on-site nuclear security and emergency preparedness frameworks.

The Novovoronezh-II nuclear power plant provides a relevant reference for the VVER-1200 technology used at Rooppur. However, NPCBL must develop its own institutional competence and ensure that operating arrangements meet the plant's specific requirements and applicable international standards.

NPCBL also needs a long-term human resource development plan to maintain the plant safely and sustainably throughout its lifetime.

Grid stability is often identified as a major challenge for a country introducing nuclear power. How prepared is Bangladesh to integrate 2,400 MW of nuclear electricity into its national grid?

Grid integration is one of the most critical technical challenges facing Bangladesh. Nuclear power plants provide continuous baseload generation, but their safe operation depends on a stable and properly managed electrical grid.

Power Grid Bangladesh PLC (PGCB) must ensure that the transmission network can accommodate Rooppur's output while maintaining prescribed frequency and voltage limits. Severe grid disturbances can activate protective systems and cause a nuclear unit to disconnect automatically.

The associated 400 kV and 230 kV transmission infrastructure must be completed, tested and operated in accordance with approved designs and technical requirements. Grid studies must verify automatic frequency control, protective relaying, dynamic stability and redundancy.

Clear communication and operating procedures are needed between the Rooppur team and national grid operators to manage routine operations, generation changes, system disturbances and emergencies.

The grid must also satisfy the N-1 security criterion, enabling it to withstand the unexpected loss of its largest generating unit without system-wide failure. Bangladesh should additionally assess the consequences of an N-2 contingency involving the simultaneous loss of both 1,200 MW units. Such stress testing would help identify vulnerabilities and improve resilience.

How important is adequate spinning reserve capacity when Rooppur begins supplying electricity, particularly when both units eventually operate at full capacity?

Adequate operating reserves are essential to maintaining grid reliability. If a nuclear unit suddenly trips because of a technical fault or external disturbance, the power system must respond quickly enough to prevent wider instability.

Bangladesh must assess the implications of losing one 1,200 MW unit and, under more severe circumstances, both units simultaneously. Reserve arrangements should be based on detailed grid studies, operating requirements and applicable technical criteria.

Reserves need not come from a single source. Depending on system conditions, they may include available generation capacity, fast-response resources, interconnections, demand response and other flexible resources.

The key requirement is that sufficient capacity must be available and capable of responding within the necessary timeframe. As Rooppur's output increases, grid operators must regularly reassess reserve requirements, frequency response and contingency plans.

Integrating nuclear power is not simply a matter of adding generation capacity; the entire power system must be prepared to manage the associated technical risks.

Bangladesh's power sector faces fuel import costs, financial pressure and increasing demand. How could Rooppur contribute to long-term energy security and economic development?

Nuclear power can strengthen Bangladesh's energy security by diversifying the electricity generation mix and reducing dependence on imported fossil fuels. Nuclear fuel is highly energy-dense, requires relatively small quantities and can be stored on-site for extended periods. Fuel costs also represent a comparatively small share of total nuclear power operating expenses.

Once operating reliably, Rooppur can provide stable, low-carbon baseload electricity and help reduce exposure to international fossil fuel price volatility. Predictable electricity generation could support industrial expansion, information technology, transport electrification and broader economic development.

However, these benefits depend on safe operation, sound financial management and effective long-term arrangements for fuel supply, spent fuel and radioactive waste.

Developing a sustainable nuclear power program also requires continued international cooperation on nuclear safeguards, safety and security. Strong governance, nuclear diplomacy for supply chains, regulatory independence and technical competence will therefore be fundamental to ensuring that Rooppur delivers lasting benefits to Bangladesh.