Pandora's Promise

A Youth Deliberation on the Promise and Perils of Nuclear Power in Bangladesh

Welcome to the 2014 BGreen Youth Deliberation on Nuclear Power in Bangladesh.

We have invited you to take part in a youth consultation on nuclear power because the BGreen Youth Council wishes to learn about your views on what should be done about using it to produce energy in Bangladesh.

Following considerations have contributed to this decision:

- Letter from four top climate scientists distributed to a variety of organizations and journalist pressing the case for environmental groups to embrace the need for a new generation of nuclear power plants.
- Bangladesh government's decision to inaugurate the first phase work for the proposed Rooppur Nuclear Power Plant.
- Write-ups from eminent Bangladeshi scientists, academics and nuclear experts sounding caution and voicing concerns about the safety and devastating consequence of an accident and other critical factors.

In this conference you will share your views with fellow youths. You will also get an opportunity to ask questions of each other and obtain answers from experts involved in the field. At the end of your discussions you will be asked to present your consensus view in the form of oral testimonies in a public hearing to the BGreen Youth Council.

The attached documents provide basic information and links to resources about the subject of this deliberation.

"Science informs us. It does not tell us what to do. The choice is ours." [World Wide Views on Global Warming]

We hope you will take this important opportunity to share with the council and other youth your views about measures that will have dramatic consequences not only in your lives, but also those around the globe and those yet to come.

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Project Timeline:

Monday, January 6th – Wednesday January 8th	Preparation • Pre-survey (Google Docs) • Groups and Facilitators assignments • Facilitator Orientation and training • Distribute briefing materials by email
Friday, January 10th 2:00 - 3:30 PM	Session 1: Initial group deliberation • Introductions and presentation (25 minutes) • Discuss questions about social, ethical, legal concerns within group members (25 minutes) • Identify areas where more information is needed (5 minutes) • Select top 1 question to ask experts (5 minutes) • Participant Break & Facilitators Consolidate questions (15 minutes)
Friday, January 10th 3:30 – 4:30PM	Session 2: Open deliberation with experts panel (moderated) • Answer to participant questions (30 minutes) • Open discussions (20 minutes) • Introduction of three policy priorities (10 minutes)
Friday, January 10th 4:30 – 5:30PM	Session 3: Final group deliberation • Vote individually on 3 policy priorities (5 minutes) • Deliberate on policy priorities (25 minutes) • Vote individually on 3 policy priorities (5 minutes) • Develop 3-5 bullets in favor of the majority position for the group and 1-2 bullets in favor of the minority position for the group (20 minutes) • Nominate spokesperson (5 minutes)
Saturday, January 11th 9:00 – 11:00AM	Session 4: Public testimony to Mock BGreen Youth Council • Facilitator Briefs Students about presentation (30 minutes) • Panel introduction and first day debrief (15 minutes) • Group representative present 3 minute oral testimony to mock stakeholder panel (45 minutes) • Group representative answers questions from members of the panel and general public (30 minutes)
Saturday, January 11th 2:15 – 2:45PM	Wrap up • Post Survey (paper and Google Docs)

To those influencing environmental policy but opposed to nuclear power:

As climate and energy scientists concerned with global climate change, we are writing to urge you to advocate the development and deployment of safer nuclear energy systems. We appreciate your organization's concern about global warming, and your advocacy of renewable energy. But continued opposition to nuclear power threatens humanity's ability to avoid dangerous climate change.

We call on your organization to support the development and deployment of safer nuclear power systems as a practical means of addressing the climate change problem. Global demand for energy is growing rapidly and must continue to grow to provide the needs of developing economies. At the same time, the need to sharply reduce greenhouse gas emissions is becoming ever clearer. We can only increase energy supply while simultaneously reducing greenhouse gas emissions if new power plants turn away from using the atmosphere as a waste dump.

Renewables like wind and solar and biomass will certainly play roles in a future energy economy, but those energy sources cannot scale up fast enough to deliver cheap and reliable power at the scale the global economy requires. While it may be theoretically possible to stabilize the climate without nuclear power, in the real world there is no credible path to climate stabilization that does not include a substantial role for nuclear power

We understand that today's nuclear plants are far from perfect. Fortunately, passive safety systems and other advances can make new plants much safer. And modern nuclear technology can reduce proliferation risks and solve the waste disposal problem by burning current waste and using fuel more efficiently. Innovation and economies of scale can make new power plants even cheaper than existing plants. Regardless of these advantages, nuclear needs to be encouraged based on its societal benefits.

Quantitative analyses show that the risks associated with the expanded use of nuclear energy are orders of magnitude smaller than the risks associated with fossil fuels. No energy system is without downsides. We ask only that energy system decisions be based on facts, and not on emotions and biases that do not apply to 21st century nuclear technology.

While there will be no single technological silver bullet, the time has come for those who take the threat of global warming seriously to embrace the development and deployment of safer nuclear power systems as one among several technologies that will be essential to any credible effort to develop an energy system that does not rely on using the atmosphere as a waste dump.

With the planet warming and carbon dioxide emissions rising faster than ever, we cannot afford to turn away from any technology that has the potential to displace a

large fraction of our carbon emissions. Much has changed since the 1970s. The time has come for a fresh approach to nuclear power in the 21st century.

We ask you and your organization to demonstrate its real concern about risks from climate damage by calling for the development and deployment of advanced nuclear energy.

Sincerely,

Dr. Ken Caldeira, Senior Scientist, Department of Global Ecology, Carnegie Institution

Dr. Kerry Emanuel, Atmospheric Scientist, Massachusetts Institute of Technology

Dr. James Hansen, Climate Scientist, Columbia University Earth Institute

Dr. Tom Wigley, Climate Scientist, University of East Anglia and the National Center for Atmospheric Research

For further reading:

Climate change warriors: It's time to go nuclear

By , CNN
November 3, 2013 -- Updated 1315 GMT (2115 HKT)

CNN.com

James Hansen says environmentalists and world leaders must accept nuclear power now to avoid catastrophic climate change.

(CNN) -- Four top environmental scientists raised the stakes Sunday in their fight to reverse climate change and save the planet.

Climate and energy scientists James Hansen, Ken Caldeira, Kerry Emanuel and Tom Wigley have released an open letter calling on world leaders to support development of safer nuclear power systems.

Wait -- pro-nuclear environmentalists? Isn't that an oxymoron? Apparently, not so much anymore.

Embracing nuclear is the only way, the scientists believe, to reverse the looming threat of climate change which they blame on fossil fuels. Depending who you ask, they're either abandoning -- or leading -- traditional environmentalists who for a half-century have rejected clean-burning nuclear power as too expensive or too dangerous. Opponents cite disasters at Fukushima, Chernobyl and Three Mile island.

Related: Fukushima update

Is nuclear power really that bad?

Chernobyl victims, 26 yrs after accident

Trying to decontaminate Fukushima

Living in limbo near Fukushima

The fear is that time is running out. Without nuclear, the scientists believe global energy consumption will overtake the planet's ability to reverse the buildup of carbon dioxide pollution from burning oil, coal and other fossil fuels. At risk, said Hansen, are disintegrating polar ice sheets and rising sea levels which will threaten coastal regions.

2011: Photographer documents Chernobyl

The letter is among the scientists' strongest public statements backing nuclear power. It also comes as CNN plans to air "Pandora's Promise," a documentary about environmentalists and longtime nuclear opponents who've done complete 180s on nukes.

By releasing the letter, the scientists are "putting their reputations on the line to do something that the ultra-greens regard as treason," said Stanford University Nobel-winning physicist Burton Richter.

Nuclear power is burgeoning in some parts of the world and shrinking in others. Asia is embracing it -- except Japan -- which is still struggling to figure out how to safely deal with the dangerously radioactive Fukushima nuclear power plant.

The Japanese disaster left Germany so unnerved that they've chosen to phase out their 17 nuclear facilities by 2022.

"We've got four top guns in the environmental movement telling [German Chancellor] Angela Merkel, 'You're wrong to shut down nuclear,'" said Richter. "I think that's a relatively big deal."

Are we witnessing the birth of a mutiny within the environmental movement? Will typical 21st-century environmentalists eventually embrace the power of the atom? A leading environmental group opposed to nuclear power says no.

"I don't think it's very significant that a few people have changed their minds about nuclear power," said Ralph Cavanagh of the Natural Resources Defense Council. Nuclear fuel may burn cleaner, the NRDC says, but comes with too many safety issues and too high of a price tag.

The letter admits "today's nuclear plants are far from perfect." However, "... there is no credible path to climate stabilization that does not include a substantial role for nuclear power."

Read the letter

The four scientists say they have no connection to "Pandora's Promise," which blames resistance to nuclear energy on groundless fears rooted in the Cold War, Chernobyl in 1986 and 1979's Three Mile Island.

Related: Chernobyl's local health problems

Map: Closest nukes to your home

In the documentary, which debuts on CNN Thursday at 9 p.m. ET/PT, climate change activist and author Mark Lynas says he knew publicly supporting nuclear energy would put his entire career at risk. "I'd have been much better just to keep my mouth shut," he admits in the film. "But I couldn't do that."

Cavanagh said the "movie attempts to establish the proposition that mainstream environmentalists are pouring into nuclear advocacy today. They aren't. I've been in the NRDC since 1979. I have a pretty good

idea of where the mainstream environmental groups are and have been. I've seen no movement."

Selling nuclear energy to environmentalists is a tough pitch. Hansen acknowledged that many of them won't easily buy into it. Parts of the community operate like "a religion of sorts, which makes it very difficult," Hansen said. "They're not all objectively looking at the pros and cons."

The NRDC hasn't rejected nuclear power out of hand, Cavanagh said. It constantly evaluates nuclear power and "everything else," he said. "I think that's our obligation." Is it possible to be both an environmentalist and a supporter of nuclear power? "You can be," Cavanagh said.

Hansen has been spreading his message to the community's top influencers.

He tells of a recent meeting with Al Gore where he tried to sell the former vice president on how advanced nuclear technology might stabilize climate change. Gore invited two anti-nuclear advocates to the meeting, Hansen said, and by the time it was all over, Gore was unmoved. "I mean, Al essentially understands that we had better try to develop safer, better nuclear power," said Hansen, "but he won't come out and say that."

Here's what Gore did say publicly about it during a recent Reddit "Ask Me Anything" chat: nuclear energy "will continue to play a limited role, and IF the ongoing [research and development] produces cheaper, safer, smaller reactors, they may yet play a more significant role."

Decarbonizing

Among nuclear energy supporters, France remains a hero nation. In the 1970s, it chose to invest heavily in nuclear power creating a system that boasts some of the cheapest energy and cleanest air on the planet.

Germany puts out about 18% of its power with nuclear. But with the upcoming nuke phase-out, there are doubts about whether Germany can offset its nuclear output with wind and other clean energy sources.

Michael Limburg, vice president of the European Institute for Climate and Energy, told CNN in September that the government's energy targets are "completely unfeasible."

"Of course, it's possible to erect tens of thousands of windmills but only at an extreme cost and waste of natural space," he said. "And still it would not be able to deliver electricity when it is needed."

There are 65 commercially operating nuclear plants in the U.S., including 104 reactors. Five new reactors are currently being built, in Georgia, South Carolina and Tennessee. In the past year, utilities have permanently shut down four others and plan to take a fifth out of service in 2014. At least two other planned projects have been shelved.

"Nuclear power is dying a slow death in the market place, which is what matters in determining its future," said Cavanagh.

As an alternative, the NRDC is touting efficiency. Energy-saving technology is becoming so successful, according to a new NRDC report, that efficiency has "significant potential to dramatically reduce power plant emissions." Total U.S. energy use peaked in 2007 and has been trending downward ever since, the

NRDC says.

On the other hand, scientists in "Pandora's Promise" claim energy consumption globally could double by 2050 -- and perhaps triple or quadruple by 2100 -- as growing nations like China, India and Brazil start to want more energy.

A United Nations report released last month re-confirmed Hansen's fears. The study concluded that the planet is heating up, the oceans are rising and there's more evidence that neither development is natural.

Hansen, who was among the initial wave of scientists warning about climate change in the 1980s, said Friday he fears most its "irreversible effects."

"Once we get to a certain point and the ice sheets start to disintegrate, then you can't stop it."

Then Hansen paused. "And we're getting very close to that point."

If we stay on the current path, he said, "those are the consequences we'll be leaving to our children. The best candidate to avoid that is nuclear power. It's ready now. We need to take advantage of it."

CNN's Matt Smith and Oliver Joy contributed to this report.

Is Our Future Nuclear?

Clark A. Miller and Jennifer Richter

Nuclear advocacy is at fever pitch in the United States. This week, CNN will air *Pandora's Promise*, Robert Stone's new film advocating a major push for new nuclear power plants. This weekend, several prominent climate scientists sent letters to newspapers around the world arguing that nuclear power is the only hope for slowing global warming. Earlier last week, *The New York Times* published an op-ed by David Ropeik, an instructor in Harvard University's Extension Service, arguing that fears of nuclear radiation are overblown. There is little doubt that the US and the world need robust, thoughtful deliberation about the future of energy. Unfortunately, the likelihood of that happening is slim, if the current pitch for a nuclear rebirth is any evidence.

The nuclear establishment is focused right now on two claims: first, that nuclear power is safe, and, second, that renewable energy cannot scale up rapidly enough to prevent global warming. Both claims are problematic.

Let's start with the claim that nuclear power is safe. This is, in fact, the wrong question. No technology is ever safe. Even familiar, mundane technologies are dangerous. Cars kill tens of thousands in the United States, alone, every year. Knives kill thousands. Children must be told not to stick their fingers in electrical outlets, nor to run out into busy streets. In Phoenix, every year, toddlers drown in swimming pools due to lack of proper fencing and supervision. Coal-fired power plants and automobiles both contribute to thousands of deaths each year due to asthma associated with air pollution. So, no, no technology is ever safe. The more significant question—if governments and the nuclear industry are willing to own up to it—is whether these organizations can be trusted to operate nuclear power plants and handle nuclear waste responsibly. So far, the evidence on this is ambiguous at best: three nuclear meltdowns in three decades.

Nonetheless, it has become dogma among nuclear advocates to assert "no one has died" as a result of the Fukushima accident, as if they're ability to avoid killing people is the only thing we care about with regard to our power plants. Ropeik reiterates this claim, going further to suggest that the principle danger of nuclear radiation is not the radiation itself but the psychological impact of our fear of it. High doses of radiation will kill you, of course. It seems rational, therefore, to fear explosions at nuclear power plants, particularly if you live nearby.

The problem is compounded by Ropeik's reasoning from hindsight. Years after the event, he presents disputable evidence suggesting that the public has turned out to be safer than it felt in the first few minutes and days. Publics confronting real-life nuclear accidents in their backyards do not have such a luxury. At the outset of a nuclear accident, no one knows how much radiation will be released or who will be exposed to it. Uncertainty is built into the event from the first moment. Monitoring data may well not be available immediately—or may not be released if it is. Even if released, early monitoring is often sparse and spatially generalized, routinely failing to capture the detailed geography of potential high-level exposures. The public itself does not generally have the tools to detect radiation and determine safety for themselves. They must thus rely on official data and pronouncements. Yet, the public may have little reason to trust either industry spokesmen or government regulators to tell the truth. Both groups have an interest in minimizing accidents, at least on day one. Notably, in all three cases of major nuclear accidents so far—Three Mile Island, Chernobyl, and Fukushima—both industry and government officials have either lied about or systematically underestimated the accident's severity in the first few hours and days.

Publics are also rightly concerned during a nuclear accident about the fluidity of events. Accidents are dynamic, not static affairs, in which even facility operators are unsure of precisely what is happening from moment-to-moment. It took plant operators several days to bring the Three Mile Island reactor under control. During this time, uncertainty about how the event might turn out was pervasive, not least among those managing the plant and at the Nuclear Regulatory Commission (NRC). For some time, for example, engineers working for the plant and NRC nuclear scientists were concerned that an explosive hydrogen bubble might be building up within the reactor containment vessel. Such an explosion would have ripped

through the reactor vessel and spread radioactivity into the neighboring towns and countryside. At Fukushima, anyone following events knows that, as of today, over two years after the accident, plant operators still do not have full control over the situation or the radioactive materials stored at the site. Since exposure levels from an accident depend on effective management of radioactive materials and the facilities that contain them, events always contain the possibility that higher exposures may occur in the future, until the accident is over.

Finally, the victims of nuclear accidents are at least partially right to be concerned about a lack of adequate acknowledgement and treatment of resulting problems. This is a common feature of many industrial accidents, not just those in the nuclear industry. Reports from the World Health Organization highlight just how badly the Soviet Union and Russia have treated the victims of Chernobyl, for example. Japanese victims of mercury poisoning in Minimata struggled for decades against both industry and the government to receive adequate health treatment and compensation. The failure to adequately protect victims at Bhopal remains a key reason why India has so far refused to accede to demands to pass legislation that would exempt the manufacturers of nuclear power plants from liability in the case of an accident.

Nuclear advocates' second proposition, that renewable energy cannot scale up rapidly enough to meet global energy demands, is similarly distorted. Has anyone seriously tried? In 1961, President Kennedy advocated for sending a man to the moon. By 1969, we had accomplished the task. It would seem we are victims, today, of a lack of imagination and effort. McKinsey & Co. observes that solar power is already at grid parity for several major applications around the world, even without subsidies. Nuclear advocates scoff at those same subsidies, yet the nuclear industry has received massive government support since the 1950s and would require significantly more government support to scale up at the rate proposed by its advocates. Of this support, perhaps the most generous is the Price-Anderson Act, which caps corporate liability for nuclear accidents. If forced to hold insurance for the full liability of a nuclear accident, the nuclear industry would be uneconomical anywhere in the world today. By providing for the public to step in and bail out the nuclear industry, Price-Anderson provides a deep (if invisible to current accounting rules) subsidy to the nuclear industry.

But the real issue is the rate of growth of renewables. Recent studies by McKinsey & Co. and the International Energy Agency both indicate that, at current rates of investment, solar power will pass 1 TW by 2030. Even under its optimistic scenario, the International Atomic Energy Agency suggests that nuclear energy will reach only 70% of this level, doubling the world's current generating capacity from nuclear reactors. Indeed, the notion that nuclear can rapidly scale up is a polite fiction. Why so slow? The nuclear industry concedes that a nuclear renaissance must happen with new, safer reactor designs and with clear plans for how to handle nuclear waste. Yet, even their fastest estimates suggest that the first test models of new reactor designs could come online no faster than a decade from today. Testing and evaluation of reactor operation would then reasonably take another decade, before widespread adoption of the design could be accelerated. And, even then, site evaluation, planning, permitting, and construction would likely require a further decade before significant numbers of new reactors could come online, even if public resistance can be overcome. In those same thirty years, the IEA anticipates 2 TW of solar energy and another 2 TW of wind energy will come online. Renewable is scaling up fast.

Is the Earth's future nuclear? There seems little doubt that the world's nuclear capacity will grow over the next half century. But the real question isn't nuclear or renewables. It's what kind of world humanity wants to inhabit and whether we're willing to make the effort to build a carbon-free future. That task will require a Herculean effort, perhaps even a new Apollo Project, to secure our children's and grandchildren's prosperity. We can put our money and effort into designing and building a new generation of nuclear power plants. Or we can put it into accelerating the rollout of renewables even faster. As the cartoon on my colleague's door puts it: "When there's a major solar energy spill, its just called a sunny day." The choice is ours.

Rooppur nuke project opens tomorrow

Ahmed Humayun Kabir Topu, Pabna

Sergey Kirienko

Rooppur people in Pabna are now in upbeat mood as the first phase work for the proposed Rooppur Nuclear Power Plant (RNPP) is going to be inaugurated tomorrow.

Prime Minister Sheikh Hasina would inaugurate the country's first ever nuclear power plant.

Sergey Kirienko, director general of Russia's state-owned nuclear power operator, Rosatom, is also expected to attend the programme.

Under an agreement with the government, Rosatom will construct two units of the Rooppur NPP, each of 1,000 MW capacity. The first unit is expected to be commissioned by the beginning of the next decade.

The groundbreaking ceremony is going to be held two years after Dhaka signed a crucial framework agreement with Moscow for the country's maiden nuclear plant at a cost of $1.5 to 2 billion. However, the cost has not yet been finalised.

Mostafizur Rahman, Pabna deputy commissioner, said the PM would lay the foundation stone of the project at the plant site at about 10:00am.

In the afternoon, the premier would address a public meeting in Rooppur where she is expected to open some 30 development projects of the district, Mostafizur added.

Contacted, Shamsur Rahman Sharif Dilu, local lawmaker and also president of Pabna district unit AL, said the Rooppur people had been awaiting the nuclear power plant for about 52 years.

Meanwhile, a high-powered Russian delegation led by Sergey Kirienko arrives in Dhaka today.

The delegation includes high government officials, nuclear energy experts, nuclear educationists and others.

Kirienko, also a former prime minister of Russia, will also attend the opening ceremony of Atomic Industry Information Centre at Bangabandhu Sheikh Mujibur Rahman Novo Theatre in the capital today and the agreement signing ceremony between Bangladesh Atomic Energy Commission (BAEC) and NIAEP, a Russian nuclear power plant engineering, design and construction company, on development of engineering design of the Rooppur NPP.

Kirienko will hold several formal meetings, including a call on Sheikh Hasina. Besides, he will meet state minister for science and technology, BAEC officials and others during the visit.

Last Modified: 100 days ago

PM opens Rooppur nuke plant

Star Online Report

Prime Minister Sheikh Hasina addresses people after inaugurating foundation stone laying ceremony of Roopur Nuclear Power Plant in Pabna. Photo: TV grab

Prime Minister Sheikh Hasina Wednesday inaugurated the first phase of work for the Rooppur Nuclear Power Plant in Ishwardi upazila of Pabna.

The power plant would be constructed after maintaining all safety and security measures, the PM said after the foundation stone laying ceremony of the maiden nuclear plant of the country.

“The project will be implemented after giving the utmost priority to nuclear safety issue,” she said.

Earlier after reaching Ishwardi, the PM laid the foundation stone of the RNPP around 11:15am.

The power plant would be constructed in a way so that natural disasters cannot damage or destroy it, Hasina said.

“Regarding the design of the plant, we are following the guideline of the International Atomic Energy Agency,” she added.

She also hoped that Russia would construct the RNPP maintaining international standards and in a cost-effective way.

The RNPP was inaugurated two years after Dhaka signed a crucial framework agreement with Moscow for the plant at a cost of $1.5 to 2 billion. However, the cost has not yet been finalised.

Under an agreement with the government, Russia’s state-owned nuclear power operator, Rosatom, will construct two units of the Rooppur NPP, each of 1,000 MW capacity.

The first unit is expected to be commissioned by the beginning of the next decade.

The premier around 3:00pm Wednesday will address a public meeting. She is also scheduled to launch 30 other development projects digitally from the meeting venue.

The projects include: the academic building of Pabna Edward College, administrative building of Pabna University of Science and Technology, academic building of Bangabandhu Adarsha High School, Chargargari Dakhil Madrasa, Pabna Town Extension Road, 50-bed Bera Upazila Health Complex, Faridpur Upazila Health Complex, Chatmohar Fire Station, Chatmohar Dakbangalow, silos of Bhangura and Ishwardi, academic buildings of Unus Ali High School and BP High School.

The premier of the country will also lay the foundation stones of the Padma bank protection work, repairing work of Pabna Amin Uddin Stadium, academic buildings of Bera College, Santhia Degree College, Jorgasa College, Nurul Hossain Degree College, Mashumdia Bhabanipur College, Nizamuddin Azgar Ali College, Yasin Ali Degree College, Bhangura Mahila College, Atghoria Pilot High School, Ishwardi Mahila College, Khidirpur Degree College, Banwarinagar CB Pilot High School, Bhangura Union High School, Chinanari Dakhil Madrasa, Boradnagar Dakhil Madrasa and 50-bed Bhangura Upazila Health Complex.

DhakaTribune

Created on August 6, 2013 at 11:52

Powering up Bangladesh

Dr Abdul Matin

The history, prospects, and concerns of Rooppur nuclear plant

Photo- BIGSTOCK

The history of nuclear power in Bangladesh dates back to early 1960s even though no nuclear power reactor has been built as yet. A site was selected at Rooppur in Pabna and necessary land for the construction of the plant was acquired in 1962.

All the gas fields of Bangladesh being situated in the eastern zone, the western zone of Bangladesh where Rooppur is situated had no indigenous energy resources. There was no interconnector between the electrical grids of the eastern and the western zones before independence. That was the reason for selecting the site for the first nuclear plant in the western zone of Bangladesh.

There were three serious offers to build the Rooppur nuclear plant prior to our independence. One was from Westinghouse of USA for a 60MWe (megawatt electric) pressurised water reactor (PWR), one from V/O Technopromexport of the former USSR for a 400MWe PWR (VVER) and another for a 200 MWe PWR from WENESE, a licencee of Westinghouse stationed in Belgium.

The Westinghouse offer was rejected by the then Pakistan government on the ground of high interest rate of financing even though it was one of the best offers we had at that time. The USSR offer was not considered because the size of the reactor was too large considering the small size of the isolated western grid. There were also some concerns about the safety of the proposed VVER reactor without any containment building, an essential safety feature of a nuclear power reactor.

We made considerable progress in our negotiations with the Belgians to the extent that the contract for the construction of plant was due to be signed after the general election of 1970. The Belgians backed out from the deal after war had broken out in Bangladesh following the general election.

The demand and supply situation of the power system changed significantly in Bangladesh soon after independence as many industries became inoperative, partly due to the damages caused by the war of independence and partly due to the departure of the Pakistani industrialists. Consequently, the demand for power dropped considerably.

It was, therefore, difficult to justify the introduction of nuclear power in 1970s as we had more generating capacity than required. A few attempts were made later by the Bangladesh Atomic Energy Commission (BAEC) for building the Rooppur nuclear power plant but none was successful. In the meantime, several feasibility studies had been made which again justified the construction of the nuclear power plant at Rooppur due to the paucity of energy resources.

Natural gas, which once generated more than 80% of our electricity, is depleting rapidly. No new gas field with any significant deposits was discovered in recent years. The present gas reserve is estimated to be 6.9Tcf (trillion cubic feet) which can hardly sustain generation of more than 3,000MW of electricity. These gas reserves are likely to be exhausted in 10 to 15 years unless new gas fields are found.

We have several coal deposits with a total reserve of 3.3Gt (billion metric tonnes). They are situated deep underground, making mining difficult, expensive and risky. There are also some environmental issues associated with the extraction and burning of coal for power generation.

At present, coal is mined only from one coalfield in Barapukuria. A 250MWe coal-fired power plant has been in operation there since 2006. Both the power plant and the mining of coal encountered numerous problems since their inceptions.

The exploration of coal from other coalfields is being hampered without a national coal policy. Speaking hypothetically, even if all the coalfields are explored, they can hardly generate 15,000MWe when in full production. We should remember that it would take 10-12 years to start commercial extraction once we decide to mine a coalfield.

Full production of coal may, therefore, take decades. The government has, however, decided to build two large power plants close to the coastal belt using imported coal. Concerns have been expressed by experts about the environmental impact of the coal-fired plants on the surrounding areas, particularly the mangroves of the Sundarbans.

While our natural gas is being depleted and the extraction of coal remains uncertain, the demand for electrical power has been rising steadily. According to the Master Plan of the Bangladesh Power Development Board (BPDB), the power demand will exceed 10,000 MW by 2015, 17,000 MW by 2020 and 25,000 MW by 2025. Under such circumstances how can we meet the power demand beyond 2020? Is nuclear power an option?

Even after the Chernobyl and Fukushima nuclear accidents, nuclear power remains a viable alternative to conventional power. It may be mentioned here that the causes of the two major nuclear accidents are now well understood and nuclear reactor design has undergone numerous modifications to make them safer.

Modern generation-3 nuclear reactors are much safer than generation-2 reactors. Nuclear power is also economically competitive compared with conventional power based on imported fuel. Environmentally, nuclear power is the cleanest form of energy, as it does not generate greenhouse gases.

Today 437 nuclear power reactors with a combined generating capacity of over 372,000MWe are operating in 31 countries,

producing 13.5% of the world's electricity. It is true that Japan and some countries in Europe decided to phase out nuclear power. Their decisions are mostly based on political considerations. Many countries in Asia, the Middle East and East Europe are building new nuclear power plants.

Alternative energy sources like imported liquid fuel, imported coal and renewable energy being too expensive, nuclear power has good prospects in Bangladesh provided we prepare ourselves to build and operate the nuclear plants safely. As a matter of fact, nuclear power can supply up to 25% of the peak demand i.e. half of the base load in Bangladesh. Bangladesh should, however, plan for a series of nuclear power plants, not just for one or two plants.

Under such circumstances, Bangladesh and Russia signed a memorandum of understanding (MoU) in May 2009 for exchanging nuclear technology and construction of nuclear power plants in Bangladesh. One year later, the two countries signed an agreement of cooperation for design, construction and operation of nuclear reactors. The agreement also covers nuclear fuel supply, return of the spent nuclear fuel, nuclear waste management and personnel training.

In November 2011, the government of Bangladesh inked an agreement with Russia to set up a two-unit nuclear power plant at Rooppur with a capacity of 1,000MW each. The deal does not include any time schedule or the cost of the project.

In February 2012, the Ministry of Science and Technology signed an agreement with Russia for advisory support on nuclear regulation, licensing and supervision. Bangladesh Atomic Energy Regulatory Bill was passed in 2012 and the regulatory authority (BAERA) was formed recently. In January 2013, Bangladesh and Russia signed a $500m loan agreement to cover the costs of a feasibility study, plant design, infrastructure development and training of the plant's personnel.

On April 2, the Executive Committee of the National Economic Council (ECNEC) approved the first phase of a 2,000MW nuclear power project in Rooppur at a cost of Tk5,242crore without specifying the total cost of the project.

BAEC recently signed an agreement with NIAEP-ASE, the Russian state-controlled nuclear power plant design and construction company, to conduct a technical and economic feasibility study, an environment impact assessment study, site engineering survey plus several other studies for the Rooppur nuclear power project (RNPP).

Even though the government intends to go ahead with the nuclear project on a fast track, serious doubts have been expressed by experts about the lack of properly trained manpower, cost of the project, suitability of the Rooppur site, availability of cooling water for the plant, safety of the VVER-1000 nuclear reactors, nuclear disaster management and the expenditure of a huge sum of money for the project before any feasibility study and environmental impact assessment.

Soon after independence, Bangladesh inherited a corps of very highly qualified nuclear scientists and engineers. Among them, there were about 40 nuclear engineers, many of whom worked in very senior positions in the Karachi Nuclear Power Plant and the Nuclear Power Division of the Pakistan Atomic Energy Commission in Karachi. Some of the BAEC engineers later went abroad to build nuclear reactors, to teach nuclear engineering courses at universities or work in the nuclear industry or the International Atomic Energy Agency in Vienna.

Following the retirement of remaining nuclear engineers, there was hardly any recruitment and training of engineers by BAEC for implementation of a nuclear power programme. The BAEC recruited engineers mostly for operation of the research reactor at the Atomic Energy Research Establishment (AERE) at Savar and for maintenance of the BAEC establishments.

Without any nuclear power programme, BAEC grew up basically as a research organisation. It has a large number of research scientists but not properly trained engineers to build, regulate and operate nuclear power plants. Even the director-general of the International Atomic Energy Agency (IAEA), Yukiya Amano, recently commented that "Bangladesh lacks in manpower."

Although negotiations with the Russians started four years ago, serious lapses were noticed in the management of the Rooppur nuclear power project. There were no attempts to recruit and train engineers for the management of the project and for nuclear regulation.

The project management team is the key organisation that supervises all the project activities starting from planning up to handing over the completed plant to the operation team. The function of a nuclear regulatory body is to protect public health and the environment from uses of nuclear facilities and materials.

A competent management team with engineers having experience of construction/operation of nuclear/conventional power plants and a proper nuclear regulatory body are essential prerequisites for initiation of a nuclear power programme.

It takes 3-5 years to train engineers for the project management team and also for the regulatory body. Recruitment and training of engineers for the operation and maintenance (O&M) teams may start 2-3 years prior to the signing of the contract for the construction of the plant.

It took four years to sign the agreement for the preparation of the feasibility study of the project where as it should have been completed two years ago. The feasibility report is now under preparation by a subsidiary company of the likely supplier of the nuclear power plant.

Needless to say the study will lose much of its credibility, as its findings, particularly on the cost of the project and safety of the nuclear plant, are likely to be biased in favour of its parent company. For an impartial appraisal of the feasibility of the project, it was necessary to employ an independent and reputed consultant, preferably from a western country.

Contrary to normal procedures, the Russians granted a loan of $500m (Tk4,000 crores) to Bangladesh and the ECNEC approved the first phase of a 2,000MWe nuclear power project at a cost of Tk5,242crores before the feasibility study and without knowing the total cost of the project.

Such anomalies are likely to occur in the future also unless the management of the project is handed over to a more competent body like a separate nuclear power corporation which will own, plan, build and operate all nuclear power plants in Bangladesh, like in India and many other countries.

It may be mentioned here that nuclear power plants around the world are owned and operated by either electric utilities or corporations, not by Atomic Energy Commission except in Pakistan. However, unlike Bangladesh, Pakistan has a strong group of trained nuclear engineers.

The cost of a 1,000MWe nuclear power reactor is estimated by the government at $1.5-2bn (Tk12,000-16,000 cores) even though the current market price of similar Russian reactors is $4bn (Tk32,000 crores). Two 1,000MWe reactors at Rooppur are, therefore, likely to cost about $8bn (Tk64,000 crores). Will it be wise to spend Tk5,242crores, approved by ECNEC, for such a large project before the establishment of its feasibility?

The site at Rooppur was selected for a 50-60MWe nuclear plant 50 years ago. The proposed size of the plant has increased to 2,000MWe while the flow of water in the Ganges decreased significantly due to the construction of the Farakka Barrage upstream in India. The population around the site has also more than doubled during this period.

A re-evaluation of the Rooppur site is, therefore, essential to ensure the availability of cooling water for the reactors, transportation of heavy equipment to the site through the Ganges, safety of the plant against any seismic activity or liquefaction of the soil during the monsoon periods and evacuation of an estimated three million people to a safe zone in case of a nuclear accident.

Concerns have also been expressed about the safety of the VVER-1000 reactors that have been proposed for Rooppur. Contracts for a total of 11 VVER-1000 reactors (2 in Hungary, 3 in Ukraine, 4 in Germany and 2 in the Czech Republic) were cancelled for failure to meet the European safety standards. Construction of two similar reactors in Balakovo in Russia and one in Iran was also suspended.

The Atomic Energy Regulatory Board (AERB) of India recommended 17 safety-related modifications for the VVER-1000 reactors now under construction in Kudankulam in Tamil Nadu. The Tianwan nuclear power plant in China incorporates

Russian VVER-1000 reactors with a digital instrumentation & control (I&C) system supplied by a western consortium to improve safety and reliability.

It may be mentioned that customised designs usually escalate cost and cause delays in construction schedules. It is claimed that VVER-1200 reactors, producing 1200MWe power, have higher efficiency (36.56%), longer core life (50-60), lower per unit capital costs, shorter period of construction (54 months) and enhanced safety features with a core damage frequency (CDF) of 1×10-7.

VVER-1200 reactors are designed to meet the safety standards of both USNRC and European Utilities' Requirements (EUR) and are under construction in Leningrad II and Novovoronezh II power plants in Russia.

With the projected peak power demand of over 20,000 MW, it may be possible to integrate 1200MWe reactors into the grid by 2022 without any additional risks of system instability. It is, therefore, strongly recommended that we consider VVER-1200 reactors, instead of VVER-1000 reactors, for Rooppur and other sites in Bangladesh.

The essential steps before we proceed for a nuclear power programme are: (i) formation of a separate nuclear power authority, (ii) formation of a competent project management team (iii) re-constitution of a strong and independent nuclear regulatory body, and (iv) building a competent O&M team.

To build necessary manpower, we can take the following steps: (i) recruit experienced nuclear engineers of Bangladeshi origin from abroad, if available, (ii) recruit local engineers who are experienced in construction and/or operation of conventional power plants and train them in nuclear engineering, (iii) train the present BAEC engineers in construction and operation of nuclear or conventional power plants, and (iv) recruit top-grade fresh graduate engineers and train them in nuclear engineering.

I must stress here that there is absolutely no reason to rush to build a nuclear power plant until we are fully prepared with the required and trained manpower. If we do, we shall continue to make mistakes like we have been making. Any experimentation in the construction of nuclear power reactors will be too risky and too expensive.

We waited for 50 years for nuclear power. What is wrong in waiting for a couple years more and build the manpower first? Many professionals have been suggesting the abandonment of the Rooppur nuclear power project in view of the shortage of manpower and concerns about safety.

If our engineers could build and operate nuclear power plants abroad, there is no reason why they cannot do it in Bangladesh. I believe we can build and operate nuclear power plants safely provided we first build the required manpower, buy the nuclear reactors with state-of-art safety features and religiously apply the nuclear safety regulations.

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Lessons on nuclear reactor accidents

Quamrul Haider

BEFORE the Bangladeshi government puts reactor technology to generate power on a fast track, it would be prudent to consider the history of reactor accidents as a background for judging how likely it may be that similar accidents might occur at the Rooppur Nuclear Power Plant.

Nuclear accidents are rated by the International Atomic Energy Agency according to the International Nuclear Events Scale, ranging from 1 ("anomaly") to 7 ("major accident").

From 1954 to now, there have been nearly 100 reactor accidents — some minor and others major — but with only local consequences. There are some that can be placed among the worst disasters we have ever experienced. It is these accidents, with ratings 5 through 7 that will be discussed in this article.

Level 7 (Major accident): The Chernobyl, Ukraine, accident of 1986 is the world's worst nuclear accident. It was caused by inadequately trained personnel conducting unsafe tests on reactors with a history of safety and design flaws. There was an explosion followed by fire that led to a partial meltdown of a reactor's core. The aftereffects of the accident were great: 30 on the spot deaths; hazardous radioactive material spread over much of Europe; 350,000 people living in the vicinity of the plant evacuated; and about 3.2 million people affected by radiation from 1986 to 2000. According to the World Health Organization, approximately 4,000 people died from radiation-related sickness while Greenpeace claims that more than 200,000 died. The Nuclear Energy Agency estimates that latent deaths over the 70 years after the accident will total between 9,000 and 33,000.

The ecosystem of a large portion of Europe, particularly Belarus, Ukraine, and the Russian Federation, was severely affected by the release and deposition of large amounts of radionuclides in the atmosphere, soil, and water bodies.

The only other Level 7 accident in history is the Fukushima disaster of 2011. It was caused by an earthquake followed by a tsunami, resulting in a complete meltdown of three reactors. The failure of the emergency systems caused an explosion, releasing radiation that contaminated a large area around the plant. Because of the Japanese government's efficient handling of the situation there were no deaths, but about 160,000 people living in the surroundings had to be evacuated.

Food grown in the area was contaminated and banned from sale. Last month, elevated levels of toxic radioisotopes, such as strontium-90 and iodine-131, have been detected in the

groundwater near the plant. Large amounts of highly radioactive spent fuel rods are still stored in the pools next to the reactors.

Level 6 (Serious accident): The only Level 6 accident occurred in 1957 at the Kyshtym plant at Mayak, Russia. The accident happened when a tank containing radioactive waste exploded because of a sudden rise in temperature. Approximately 10,000 people were evacuated from the area around the plant. The disaster also exposed about 500,000 people to dangerous levels of radiation and hundreds of square miles of land were rendered barren. Because of the secrecy surrounding Soviet accidents, the actual number of fatalities remains uncertain. However, according to the Institute of Biophysics of the former Soviet Union, over 8,000 people died so far from the effects of radiation.

Level 5 (Accident with wider consequences): There have been three Level 5 accidents. They are:

1957 Windscale, Cumbria, UK: Following a fire in a reactor core, there was release of radioactive material to the environment. There were no immediate fatalities, but dozens of people died later from radiation-induced cancer.

1979 Three Mile Island, Pennsylvania, USA: A partial core meltdown due to loss of coolant was caused by the malfunction of some safety features and operator confusion. There were no fatalities but small amounts of radioactive material were released into the environment.

1987 Goiânia, Brazil: Due to a lack of adequate accounting and inspection procedures for radioactive sources, more than 240 people were exposed to radiation and 4 died when a junkyard dealer opened an old stolen reactor and removed a highly radioactive cake of cesium chloride.

These accidents, caused by design flaws, human error, lack of oversight, meltdowns, fires, and earthquakes, happened despite the many tiers of safety features that were in place at the plants.

After the Fukushima accident, a research study carried out at the Max Planck Institute for Chemistry in Mainz, Germany, concluded that the global risk of a catastrophic reactor accident now is much higher than previously thought.

If Chernobyl was the fuel, then Fukushima was the catalyst that ignited anti-nuclear sentiment all over the world. Fukushima had a profound effect on the safety criteria and procedures followed for the existing plants. It also led many countries to re-evaluate their nuclear programmes. There were immediate shutdowns, gradual phase-outs, and suspension of approvals for new reactors.

These and other accidents should be a wake-up call to judge whether the precautions that will be in place at the Rooppur plant are sufficient or whether the programme should be pursued more slowly and in a way to make greater degrees of precaution possible. The government must realise that to protect the citizens from the aftereffects of a nuclear accident, it will have to take precautionary measures of a type and on a scale that has no historical precedent in Bangladesh. Once a reactor is turned on, processes are set in motion that cannot be reversed for a very long time. Hence, the government should do some serious soul-searching before mortgaging the future of 160 million people to a country with a lousy safety record.

Finally, it is obvious that nuclear accidents do happen and they are capable of doing more than immediate damage. We cannot disguise their potentially lethal effects. They destroy not only the present, but also the future. That is why the fears and angst aroused by nuclear accidents are so much deeper.

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Capital cost of a nuclear power plant

Quamrul Haider

SINCE the mid-90s, environmentalists and many neutral observers alike argue that even if nuclear power plants meet environmental standards, they should not be built because nuclear power is the most expensive way to generate electricity. While the cost of operating nuclear power plants is low, the capital costs of the plants themselves are very high. Moreover, the cost to build a nuclear plant far exceeded those that would have resulted from inflation, thereby undercutting the advantage of low fuel cost. Consequently, nuclear power plant has become a multi-billion dollar misadventure, particularly for the underdeveloped countries

In a 2010 report titled "Updated Capital Cost Estimates for Electricity Generation Plants," the US Energy Information Administration gave an estimate of $5,339 per kW for building a new reactor. The capital cost will, of course, vary substantially across countries.

On October 2, 2013, the prime minister of Bangladesh laid the foundation stone for the construction of the much anticipated Rooppur Nuclear Power Plant. It will be built by the Nuclear Energy State Corporation of Russia, Rosatom, at a bargain-basement price of $2,000 per kW. It won't be an exaggeration to say that in today's economy, it would be foolish to expect a good and a safe reactor at such a bargain price.

Russian nuclear industry, just like its Bangladeshi counterpart, operates under a veil of secrecy. In a 2011 article titled "The Economics of the Russian Nuclear Power Industry," Leonid Andreev of the Bellona Foundation (Norway) wrote: "The economy of the Russian nuclear energy industry is the least known and most opaque of all the many facets that make up the vast dominion that is the Russian State Atomic Energy Corporation Rosatom....economic information, if it is revealed at all, is only made available in relative figures and general data whose accuracy it is impossible to verify."

Construction of new nuclear power plants is beset with spiraling costs and long delays. The 2013 World Nuclear Industry Status Report estimates that in the past decade the cost has skyrocketed to $7,000 per kW installed. The need for additional safety measures arising from the Fukushima accident is also having substantial impact on both the building and operational costs of a nuclear plant. After a reality check, Rosatom finally realised that the cost estimate of the Rooppur reactors is ridiculously low and the actual cost could soar to $5,000 per kW ($10 billion for the two reactors), which is more in line with the actual start-up cost of a reactor.

At the groundbreaking ceremony, the claim made by Sergey Kirienko, Director General of Rosatom, that Russian reactors are 100% safe is scientifically untenable. To the contrary, they are beset with numerous safety issues, as articulated by many writers in this newspaper and elsewhere. In a stunning report prepared after the 2011 Fukushima accident, Rosatom admits that Russian reactors "are grievously under-prepared for both natural and man-made disasters ranging from floods to fires to earthquakes or plain negligence." In view of the climate and topology of Bangladesh, this report should be of greatest concern to the energy policy makers of the government.

Rosatom expects the Rooppur nuclear plant to go into operation in 4 to 5 years time after the construction starts. However, the average building time of a nuclear power plant varies from 8 to 10 years. It should be noted that Rosatom/Russia has not yet developed all the documentation that is required before setting the wheels of construction into motion. Thus the estimate of 4 to 5 years as the completion time for the Rooppur power plant seems far-fetched.

According to the 2013 World Nuclear Industry's Status Report, Russia's plan to build the

nuclear power plant in Bangladesh is not well-defined. It is, therefore, quite likely that the prospects for the construction of the Rooppur power plant won't go beyond the proposals stage.
There is now a general consensus among majority of the world citizenry that nuclear power is no longer an economically competitive choice. The dream of energy that we once thought would be cheaper than the cost to "meter houses" has failed to materialise.
The share of nuclear energy in the world's power generation reached a historic peak of 17% in 1993. Since then, it has steadily declined to about 10% in 2012. If this trend continues, it is quite likely that nuclear power will soon disappear as part of the global energy portfolio.
Nuclear power is also perceived to be unsafe, can be used to make nuclear weapons, produces dangerous wastes, lacks waste disposal facilities, vulnerable to terrorist attacks, and draws funds away from the development of sustainable energy. Dollar for dollar, low-carbon energy sources, such as wind power, solar power, geothermal energy, and biomass can deliver cleaner, safer, and more efficient energy than nuclear power.
Finally, referring to the Chernobyl accident, Alice Slater of the US based Nuclear Age Peace Foundation wrote: "The tragic news uncovered by comprehensive new research that almost one million people died in the toxic aftermath of Chernobyl should be a wake-up call to people all over the world to petition their governments to put a halt to the current industry-driven nuclear renaissance."

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