

AN OVERVIEW ON RENEWABLE ENERGY SCENARIO AND PROSPECT OF NUCLEAR ENERGY IN BANGLADESH

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Abstract- Energy is the driving force behind all economic activities. Economic growth of a country is directly linked to the energy growth of the country. Now a days, Bangladesh is facing energy crisis. A large amount of population even now does not have access to electricity. At present the demand is fulfilled by gas, coal, oil and hydro based power plants. But real scenario is that all these power plants are not meet our growing demand. Again the gas, coal and oil reserve is not enough. According to Global Energy Network Institute. Though Bangladesh has small reserves of oil and coal, but potentially has large natural gas reserve. As alternative sources renewable energy like solar, wind, tidal, geothermal, nuclear energy etc. may be used to generate electric power. This paper highlights the prospect of nuclear energy in Bangladesh, which can be used for electric power generation.

Keywords: Renewable energy, Nuclear energy, Reactor, Security, Planning.

1. INTRODUCTION

Electricity is a crucial ingredient for poverty alleviation, industrial growth, and infrastructure development, quality of living standard of the people and for overall development of the economy. Energy demand in Bangladesh is increasing day by day. Now a day, Bangladesh is facing energy crisis. Bangladesh government is trying to establish a sustainable development structure for many years but yet to accomplish such target due to shortage of electricity generation. At present only 74% of the people have access to electricity. Every year the demand is increasing at a rate of 10% [1]. Generation capacity could not be increased accordingly during past years which has resulted increasing power shortage in the country. In Bangladesh, there are many natural resources such as coal, gas, petrol. The main and the cheapest source of energy in Bangladesh is Natural gas. It is an important source of energy that accounts for 75% of the commercial energy of the country which is likely to be depleted by the year 2031[2]. Then Bangladeshi people will be faced some problem. Due to prevailing gas crisis and future grain scenario of gas sector development, strategic decision of the government to diversity primary fuel supply for power is critical for sustained development of power sector. This diversification will help to ensure energy security. In this perspective, the plan has been prepared for considering balanced development of different sources of energy. To solve the energy crisis we can use nuclear energy to generate power. For base load demand Nuclear energy is a great option. Nuclear energy will enable us to meet the twin

challenges of energy security and environmental sustainability. It will also have major spin-offs for the development of our industries, both public and private. This paper focuses on the prospect of nuclear energy in Bangladesh.

2. RENEWABLE ENERGY SOURCES IN BANGLADESH

Renewable energy is energy generated from natural resources—such as sunlight, wind, rain, tides and geothermal heat—which are renewable (naturally replenished). Renewable energy technologies range from solar power, wind power, hydroelectricity/micro hydro, biomass and biofuels for transportation [3]. It is derived from natural processes that are replenished constantly. In its various forms, it derives directly from the sun, or from heat generated deep within the earth. The major renewable energy resources in Bangladesh are solar, wind, small hydropower, biogas & biomass.

The country has significant potential of generation from renewable energy sources. All effort being taken by Government of Bangladesh to harness this potential. The Renewable Energy Policy envisions that 5% of total energy production will have to be achieved by 2015 and 10% by 2020[1]. Total renewable energy generation in Bangladesh is shown in Fig.1 up to 2012. To achieve this target, GOB is looking for various options preferably Renewable Energy resources. Under the existing generation scenario of Bangladesh, Renewable Energy has a very small share to the total generation. The share of Renewable Energy exceeds more than 1% till

now[1].The Total Renewable Installed Capacity comprises of Solar Energy-230 MW, Wind Energy-2 MW, Biomass-37 MW. Hydropower-230 MW [4]. Comparative scenario of the five leading Renewable energy sectors of Bangladesh is illustrated in Fig.2 in terms of the installed capacity.

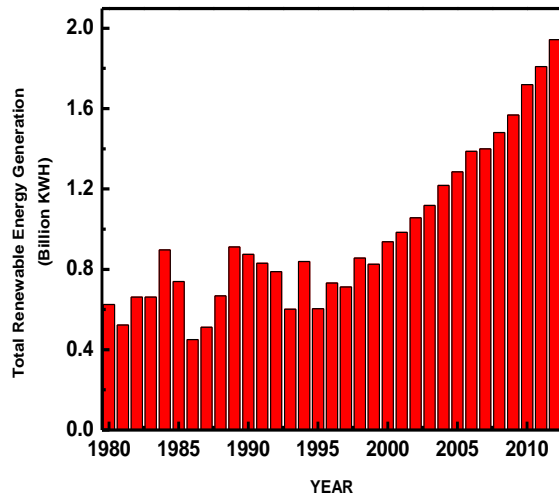


Fig. 1: Total Renewable Energy Generation in Bangladesh up to 2012.

Overview of Renewable Energy in Bangladesh

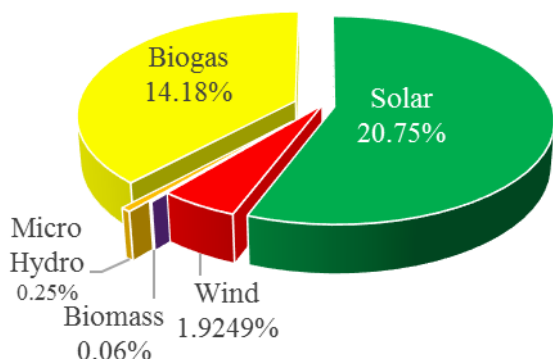


Fig.2: Comparative scenario of the five leading Renewable energy sectors of Bangladesh is illustrated in terms of the installed capacity.

3. NUCLEAR ENERGY AND ITS ADVANTAGES

Modern science has also helped us discover a new source of clean and renewable energy. This is nuclear energy. Most scientists agree that pollution is contributing to global warming and to climate change. This can hurt agricultural production and harm all living beings on our planet. We must, therefore, reduce pollution that causes global warming. This requires environment friendly energy sources – clean and green energy.

Also the cost of fuel for a nuclear power station is very much less than for an equivalent coal fired power station. Electricity from nuclear reactors in many regions is

competitive with electricity produced from coal, even after providing for management and disposal of radioactive wastes and the decommissioning of reactors. So, nuclear energy will be a clean and an affordable source of energy.

Nuclear energy is the energy released from the nucleus of an atom. When nuclear reaction occur weather fission or fusion, it produces large amount of energy. This energy can be released as heat from a chain reaction in a radioactive element such as uranium. The major advantages of nuclear energy are-[5]

1. Lower Greenhouse Gas Emissions
2. Nuclear energy is very powerful and efficient than other alternative energy sources.
3. Nuclear power is reliable. It does not depend on the weather.

The main reason behind the low fuel cost is that it requires little amount of uranium to produce energy. When a nuclear reaction happens, it releases million times more energy as compared to traditional sources of energy.

4. NUCLEAR POWER PLANT IN BANGLADESH

In 1963 the Ruppur site was selected for the establishment of the first nuclear power plant of this country. In 2001 Bangladesh adopted a national Nuclear Power Action Plan. On 24 June 2007, Government of People’s Republic of Bangladesh announced plans to build a nuclear power plant to meet electricity shortages. In May 2010, Bangladesh signed a civilian nuclear agreement with the Russian Government.. In February 2011, Bangladesh reached an agreement with Russia to build the 2,000 megawatt (MW) Nuclear Power Plant with two reactors, each of which will generate 1,200 MW of power. The nuclear power plant will be built at Ruppur, on the banks of the Padma River, in the Ishwardi sub district of Pabna, in the northwest of the country. The RNPP (Ruppur Nuclear Power Plant) is estimated to cost up to US\$2 billion, and start operating by 2021[6].

5. SAFETY CONSIDERATION FOR RNPP

In a country plagued by a 1500 MW current power shortage, a nuclear power plant sounds like a light at the end of a dark tunnel. But to those who have read history and know about the Chernobyl disaster and the recent Fukushima disaster in Japan and re also aware of the fact that our nation plays host to the clash point between three tectonic plates deep below the earth’s surface, they can be understandably expected to be nervous due to RNPP. To establish the nuclear power plant in Bangladesh safety and security is a major consideration from the view of its small densely populated and geo-graphical area, proper site selection, Water management, natural disaster etc. The first and major consideration to set a RNPP is the area and density of the people. According to the international law the radius of the area of nuclear power station is 30Km.The area is divided in to three circular zone with $(3.1416*30^2) = 2,827 \text{ Km}^2$ area. According to the zone, zone-1 is reactor area, zone-2 is security area and zone-3 is for planning disaster. The area of zone-1 is a circular area of $3.1416*1^2 = 3.1416 \text{ Km}^2$. This area is

only for the people who are working with reactors, others entrance is strictly prohibited. The distance of zone-2 is 5 Km away from the center and the total area of is $(3.1416 \times 5^2) = 78.6 \text{ Km}^2$. This area is prohibited for agriculture and industries and only 3 people can leave per Km^2 that is the total people of that zone will be only 200. The distance of zone-3 is 30 Km from the center. This 30 Km area must be free of population. If there are more people than there will be obstacles for rescuing the people. Developed countries nuclear power stations are free of population. That is for those reactors among 30 Km is free from population. For example if there is an explosion in RNPP like Three Miles Island than people leaving there must be transferred $(3.1416 \times 40^2) = 5027 \text{ Km}^2$ area. So if 500 people leave per Km^2 then almost 2500000 people must be transferred from that area. It is quiet impossible. But the problem can be solved through changing some regulation. According to the international law some changes is applicable depending the situation. For example India has changed some regulation to build their nuclear power plant. They have changed the zonal area. They do this because they have the same problem of large population like Bangladesh. But there is a considerable think that as per there total country area the population is to very big. Therefore Bangladesh can their policy can be a little bit safe.

The second major problem is earthquake and natural disaster. The Chernobyl disaster was a catastrophic nuclear accident that occurred on 26 April 1986 at Chernobyl Nuclear Power Plant in Ukraine. The disaster is widely considered to have been the worst nuclear power plant accident in history and is one of only two classified as a level 7 event on the International Nuclear Event Scale [7]. Thirty one deaths are directly attributed to the accident, all among the reactor staff and emergency workers. In this accident about 50 emergency workers who died of acute radiation syndrome, nine children who died of thyroid cancer and an estimated total of 3940 deaths from radiation-induced cancer and leukemia. The radioactive cloud spreads far away as Norway. Mutation in both humans and other animals increased following the disaster. On farms in Narodychi Raion of Ukraine, for instance, in the first four years of the disaster nearly 350 animals were born with gross deformities such as missing or extra limbs, missing eyes, heads or ribs, or deformed skulls. Multiple reports emerged of still born babies with horrible deformities such as inflamed and deformed skull, missing eyes and deformed, undersized or missing internal organs.

The Fukushima Daiichi nuclear disaster was a series of equipment failures, nuclear meltdowns and releases of radioactive materials at the Fukushima Nuclear Power Plant. The accident was occurred from earthquake and tsunami 11 March 2011. It was the largest nuclear disaster after the Chernobyl of 1986 and only the second disaster (along with Chernobyl) to measure Level 7 on the International Nuclear Event Scale [7].

Bangladesh has a large agro industry with a large rural population dedicated to farming. If such a scenario arises

from the Ruppur power plant and large portions of our landmass is declared unfit for farming for years to come. This would have devastating consequences to the general livelihood of the affected population as well as severely affecting our economy. An earthquake and resulting radiation leak could prove fatal for the economy. If an earthquake like Japan happening in Bangladesh then what will our preparation. Now include in all this, the possibility of a leaking nuclear reactor that spews radiation into the atmosphere, soil and underground water reserves. The result is the mother of all nightmares. What are worse, authorities might find it nearly impossible to contain the radiation in the event of an earthquake, as bridges and vital roads that connect the plant are destroyed denying access to the power plant for workers. Airlifting is also a near impossibility as Bangladesh Air Force does not have strategic air lifter capable of transporting large scale machinery needed to contain radiation.

From the above conditions, it can be said with almost absolute certainty that nuclear power carries the highest level of negative externality associated with it. A disaster in the scale of Chernobyl of Fukushima therefore would have catastrophic consequences for our land short and too heavily populated country.

The waste from nuclear power plant in Ruppur is a major consideration. The waste from nuclear power plant will be radioactive and the wastes will be radioactive. Radioactive wastes are wastes that contain radioactive material. Around 20–30 tons of high-level wastes is produced per month per nuclear reactor. There are some 65,000 tons of nuclear waste now in temporary storage throughout the U.S., but in 2009, President Obama “halted work on a permanent repository at Yucca Mountain in Nevada, following years of controversy and legal wrangling” [8]. There are three types of waste. High-level, Mill Tailings and Low level waste. Among these high level waste is most dangerous. During fission, very harmful radiation rays are released. The most harmful of which are gamma rays. When the human body is exposed to radiation, it can cause tumors and can do extreme damage to the reproductive organs. For this reason, problems associated with radioactivity can be passed on to the victim's children as well. That is why radioactive waste produced by nuclear power plants is so dangerous. Radioactive fission products could pose a direct radiation hazard, contaminate soil and vegetation, and be ingested by humans and animals. Human exposure at high enough levels can cause both short-term illness and death, and longer-term deaths by cancer and other diseases. So it has seen that radioactive waste can cause a great harm in Bangladesh if any disaster is occur in the future nuclear power plant. But there is nothing to be worried about it. Because there are new waste disposal technologies invented now a days. Bangladesh can use Experimental Breeder Reactor II. A breeder reactor is a nuclear reactor that generates more fissile material in fuel than it consumes. Breeder Reactor II is being developed by Argonne National Laboratory in the US; almost 100% of the transuranic nuclear wastes produced through neutron

capture can be caused to fission. Generally, the fission products created have shorter half-lives and are not as dangerous. This reactor, dubbed EBR-II, uses liquid sodium as a coolant, which means that the internal reactor temperature is much, much hotter than that of a normal PWR reactor, which uses water as a coolant. Another advantage of EBR-II is that its fuel is not weapons grade quality. When the transuranic wastes are separated from the other wastes in the spent fuel rods, the resultant mix of isotopes cannot be used in a bomb. Thus, the mix can be used as fuel for EBR-II without a chance of it getting stolen by a terrorist group for use in an explosive device. Breeder reactors “breed” fuel. That is, they are designed to create ^{239}Pu from ^{238}U through neutron capture. This “waste” can then be used as fuel.

6. FEASIBILITY OF NUCLEAR POWER PLANT IN BANGLADESH

Bangladesh has decided to install nuclear based power plant in Ruppur to meet the increasing demand of electricity. At present two reactors will be installed with capacity of 2000 MW. Nuclear power is clean, safe, reliable, compact, competitive and practically inexhaustible. Today over 400 nuclear reactors provide base-load electric power in 30 countries. It is relatively mature technology with the assurance of great improvement in the next generation. Nuclear energy produces almost no carbon dioxide, no sulfur dioxide or nitrogen oxides whatsoever. These gases are produced in vast quantities when fossil fuels are burned. One gram Uranium yields about as much energy as a ton of coal or oil- it is the famous “factor of a million”. Nuclear waste is correspondingly about a million times smaller than fossil fuel waste, and it is totally confined. Nuclear waste is to be deposited in deep geological storage sites; it does not enter the biosphere. Its impact on the ecosystem is minimal. So, nuclear power plant is a better alternative for our present power crisis. But, Bangladesh has to take measure on following security issues:-

1. Nuclear power stations require major investment to construct, but their relatively low running costs over a long operational life help to make them one of the most cost-effective generating technologies. So, we have to manage huge amount of capital for implement nuclear power plant in Bangladesh.
2. Though nuclear based power plant is a secured one but some accident has been occurred in recent years. Such as Fukusima power plant disaster, Chernobyl power plant accident. As Bangladesh is densely populated country, if such accident occurs then radiation effect causes a disaster to our nation. Day by day nuclear power technology is developing. After Generation-1, 2 & 3 now at the latest moment fourth Generation technology is available. Various types of GEN-3 and GEN-4 pressurized water reactors are available and the most common are the advance PWR of Mitsubishi, Japan, CANDU of Atomic Energy Canada Limited, VVER(The VVER is the Russian version of the Pressurized Water Reactor (PWR). Considering these disadvantages of Generation-1 & 2 reactor, Bangladesh should built the GEN-3 or GEN-4 reactors with a consideration of system simplicity, economic competitiveness, economic benefits,

economic liability, safety consideration, digital instrumentation and control system, compliments for the latest safety code for the consideration of severe accidents like Chernobyl and Fukushima disaster, Physical Protection and issues of nuclear security. So, proper steps should be taken regarding this matter.

3. Ruppur power plant is near Padma River. Farakka Barrage makes this river nearly dead. So, appropriate measure should be taken for cooling system of power plant reactor. If India opens all the gates simultaneously then it may cause a heavy flood in this zone. So, it may also taken into consideration that excessive flood will not cause any harm to our plant.

4. International threat will also be considered into account. It is known in the history that when Iraq, Syria wanted to installed nuclear power plant, Israel bombard on these plants to ensure no rise of nuclear power in Middle East. India is a super power in this zone and already gains atomic energy. So, Bangladesh has to gain potentiality to challenge these international threats. Present policy of government of Bangladesh is that whole responsibility nuclear power plant is of Bangladesh atomic energy commission.

5. Bangladesh is a grazing land of various foreign detective branches. So, Bangladesh has to take steps to endure all security regarding this matter and to stop theft of technology for terrorist activities.

7. CONCLUSION

The summary of this paper demonstrates that, there is a considerable opportunity of Bangladesh to meet its future power demand and thus economic growth through nuclear energy. Nuclear can help Bangladesh to produce more power in order to reduce the power crisis. Nuclear supplies base load to large grid integrated markets where oil provides some peak supply, back-up capacity, small-scale and nano-grid applications and nuclear plants are robust, secure long-term investments as part of a portfolio of environmentally sound technologies that make the world less dependent on damaging carbon emissions. Time has come to look forward and work in nuclear energy fields to produce electricity rather than depending wholly on conventional method. Nuclear power plant is an excellent solution to our power hunger. There is lot of challenges to implement nuclear based power plants. We have to prepare ourselves considering all threats and security issues. Bangladesh government should ensure energy security for future by establishing a nuclear power plant as earliest as possible.

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