Renewable Energy: Pro Nuclear or no Nuclear

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ABSTRACT

Renewable energy sources in conjunction with preservation methods are universally perceived as the source to the resolution of the world's prospective energy supply needs. There are a number of energy sources of renewable nature. These numerous types of resources may possibly be utilized at a variety of magnitude to provide a variety of needs.

Recently with the advent of sustainable design practices, renewable energy sources provide an opportunity to develop expertise in information collection, analysis and critical evaluation. The aim of this paper is to provide general awareness of renewable energy sources and technologies. The aspect of the paper will focus on the same with special emphasis on highly debated form of renewable energy, i.e., Nuclear energy. Further the paper aims to summarize the majorly deliberated aspects, pro and cons, of use of nuclear energy in relation with the accessibility of various other anodyne sources of renewable energy. It attempts to direct the judgment at the history of important events, facilities management, comparison of energy sources, and advantages and disadvantages of nuclear energy at length.

Keywords: Nuclear, nuclear treaty, uranium mining, three mile isle, chernobyl, governance, waste management, radiation, nuclear proliferation.

1. INTRODUCTION

As per the recent trends, the most significant fuel sources are anchored on fossil fuels. These fossil fuels are related with numerous effluence risks. The most important risk associated with the use of these fuels is the production of carbon dioxide. This risk further enhances the global warming threat. Recent trends and circumstances need the global economies to change the current carbon intensive technologies to more positive renewable energy. Out of the total percentage of the energy demand required by an industrialized and urban society, a sum of total of 50 percent is associated with buildings. Although renewable energy provides a number of key solutions to solve energy crises in various fields, buildings, specifically, provide prospects for use of renewable energy devices near to the point of use. This use of renewable energy in building sector may be limited in size. A few of the renewable energy systems require large scale application to be economically stable and further larger space is also needed which makes it unfit for built up areas. As the use of,

active, passive solar, photovoltaic energy systems, small wind power system can be utilized along with appropriate integration with the built up mass, while wind energy farms, hydro power, nuclear power plants require ample unobstructed space for its implementation.

The design and implementation of active and passive solar systems requires the use of solar thermal heat with the cost ranging from high to virtually nothing respectively. Photovoltaic could be used for direct generation of electricity from daylight with a considerable amount of cost. Wind, hydro tidal wave, geothermal energy is certainly not suited for small built up areas, although small scale applications of wind turbines can be integrated with the built up mass. Nuclear energy can be advocated as a low-carbon intensive system which can be seen as bridging the major gap between the depleting fossil fuels and leisurely escalating renewable energy sources. But nuclear energy is also seen and experienced as one of the hazardous energy source being associated with numerous calamites and accidents.

2. A NUCLEAR RENAISSANCE

Nuclear energy holds prospects making strides towards a carbon neutral future. Numerous governing bodies have been formed to formulate various treaties to deal with nuclear arms limitations and their reduction. In 1946, the United States put forth the atomic energy act for the development and control of atomic energy. There are 24 treaties that have been created and 9 out of these 24 treaties dealt with the establishment of Nuclear-weapon-free-zone. In 1957, the United States established the autonomous International Atomic Energy Agency (IAEA) to administer the member states. IAEA reports directly to the United Nations general assembly and United Nations Security Council.

For the safe implementation of a national nuclear power plant three phases are followed over a span of approximately 15 years. Phase one involve the initial site considerations and the feasibility study. Phase two consists of the issuance of the nuclear law and establishment of the basic regulatory framework. Phase three triggers with the initiation of the contract formulation, application and issuance of the construction license. The construction phase initiates with concrete built up mass and concludes with the fuel delivery.

3. FACILITY MANAGEMENT

Because of the many hazards and accidents related to nuclear energy, people are wary about what's going on in the field. For nuclear energy to become a threat, the main emphasis is on the material. The resource material for the functioning of a nuclear power plant is uranium which is produced after extraction from uranium ore. After the mining of the uranium ores from ground, they are processed into particle size by grinding and treated in the process of chemical leaching. The mining

process is most commonly referred to as conventional and non-conventional methods. The process of uranium mining is done mainly by three methods namely (conventional) underground, open pit, (non-conventional) heap leach and in situ leaching.

Photo (left to right) Navachab Gold Mine open pit, Trekkopje mini heap leach pad, 2008, Uranium in situ leach well field (photo Geological Survey).

The open pit mining consists of removing the top layer by drilling and ballasting. This continues until the ore surface is exposed which is then mined and loaded for transport to storage areas. Workers spend most of the time in enclosed spaces reducing the risk of exposure to the radiation and continuous water spraying reduces the airborne dust produced due to mining.

When the distance between the top surface and the presence of ore within the ground is more for to be operated with the help of open pit method, an underground system of mining is used with the help do tunnels and shafts. Although it produces less waste material to be removed at ground level, this type exposes the underground workers to the maximum level of radiation. If the amount of the mineral present in the ore is too low, it is considered to be more economical to use heap leaching method of uranium extraction which uses the addition of the leaching liquid (often sulphuric acid). This method risks the permanent contamination of water in case of leaching liquid leakage.

Another method of extracting the mineral from the ore is by dissolving them and pumping the pregnant solution to the surface where the recovery of the mineral will be done. This type of technology and uranium extraction method reduces the risk of radiation exposure of the workers. Mining is the process of extraction of nuclear fuel from uranium ore and technology advancement suggests how it can be made safer.

4. SAFETY AND SECURITY

The recent 9.0 rated earthquake in Japan in 2011, and consecutive distress afterwards, has garnered global attention. On Friday March 11, Tsunami waves swirled near a port in Oarai, Ibaraki prefecture and following the failure of the cooling system, a state of emergency was declared at the

Fukushima Daiichi nuclear plant. The Japan Nuclear Energy Safety organization (JNES) has been focusing on the facility security and maintenance.

On national and international levels different agencies and authorities are making efforts to reach certain aims and objectives to prevent accidents. The security parameters of a successful and safe nuclear power plant are to aim at maintaining a high safety levels, effective defenses and to prevent accidents. In addition, the building of nuclear power plants to be simpler, economical, safer, and less prone to terrorist attack. Further the disposal of the nuclear fuel waste also is an important security aspect so as to prevent the diversion of weapons grade nuclear material from the interior of the plant. The response to the security parameters have drastically changed in the past twenty years corresponding to the disasters and accidents in the nuclear power plants.

Nuclear accidents are quite so rare, but with such a high impact over the duration of many lifetimes, one needs to study them intensively. The detailed study of the accidents can explain the changes and precautions to be implemented to avoid these altogether. The domestic safeguards program of Nuclear Regulatory Commission (NRC) is intended to ensure any nuclear related material is not stolen or diverted from the civilian use for power generation to the possible perilous use in weapons.

With reference to nuclear power plant accidents, the ultimate question of surprise are how it happened, how it could have been avoided, and what was the actual fault?

Photo: Three Mile Island, PA.
Source: http://en.wikipedia.org/wiki/Three_Mile_Island

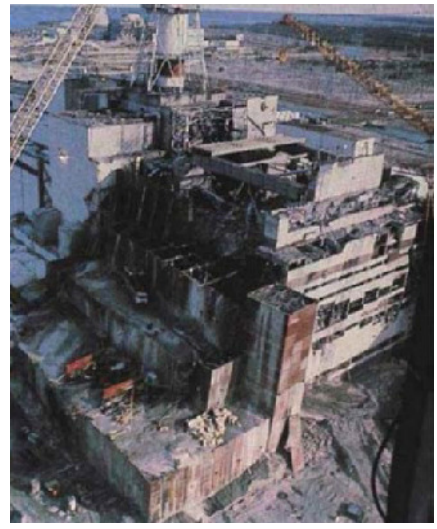

Photo: Chernobyl Accident 26 April, 1986.
Source: http://www.ourtimelines.com/zeborn.html

In Three Mile Island, one of the causes of the radioactive steam release was the lack of knowledge on part of a worker and inability to react according to the situation. In Chernobyl disaster (only one classified as a level 7 event), 135,000 people were evacuated and resettled. In the plant there was no containment building and the operators were revealed to have violated the plant procedures. It was estimated that almost 500,000 people inhabiting (including unborn children) near Kiev province have been exposed to a very high dose of radiation.

Photo: The Victims of Chernobyl disaster. ***Source:© Earthbase Liaison Agency. http://www.planetthoughts.org***

It is evident that procedures, safety and security are very important when it is concerned with a nuclear power plant. There are governing bodies in different countries as Nuclear Regulatory Commission (NRC) and Department of Energy (DOE) in the U.S. regulating the reactors.

The Global Nuclear Energy Partnership (GNEP), now the International Framework for Nuclear Energy Corporation (IFNEC) is a partnership of countries aiming to improve the proliferation, resistance of nuclear fuel cycle while guaranteeing access to fuel supplies. It aims to accelerate the development and deployment of advanced nuclear fuel cycle technologies while providing greater disincentives to the proliferation of nuclear weapons.

5. WASTE MANAGEMENT

As old methods, disposal of nuclear power plant waste includes storage in canisters and its disposal in location far from nuclear plant site. The current waste management practices segregates the waste in three different categories namely low level waste (LLW- 90 percent), intermediate level waste (ILW- 7 percent) and high level waste (HLW- 3 percent). LLW is usually disposed of making use of landfill sites after compacting or incinerating. ILW, short lived, is solidified in concrete or bitumen before burial. The HLW can be reused and thus is reprocessed. The vitrified

waste is placed in glass (Pyrex) inside stainless steel canisters for deep underground disposal, stored in cooling ponds for 30 to 40 years. The future of management of nuclear waste is researching into the technology to regenerate the waste into usable reactor fuel and treatment by Escherichia Coli bacteria.

Photo: Nuclear waste disposal.
Source: © Earthbase Liaison Agency

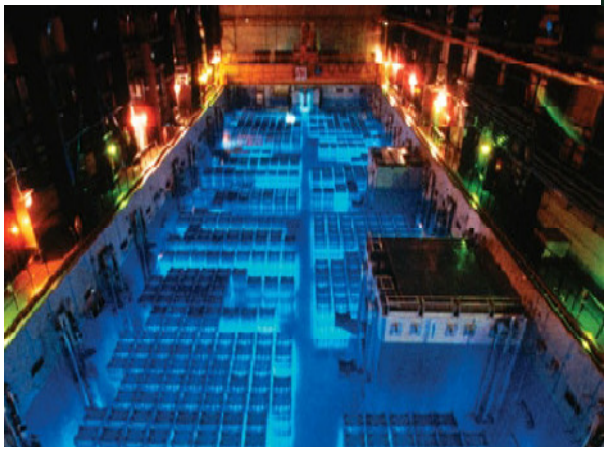

Photo: (left to right). Cooling ponds and dry concrete caskets respectively. ***Source: © Earthbase Liaison Agency***

6. IS IT JUST NUCLEAR?

Due to the risk of climate change and need to reduce carbon dioxide emissions, nuclear energy is looked upon as the only clean energy to e able to bridge the large gaps of energy production, demand and consumption. Other type of renewable energy sources does not provide as much energy as a nuclear power plant. It generates more electricity on far less area than solar plus wind energy, economical as compared to heavy initial implementation costs of solar and wind energy; meets power demand 24 hours a day by means of continuous fuel supply and it does not depend on natural sources and site placements for power generation.

The huge environmental impact form the mining process and industry, the proliferation of nuclear weapons, terrorism, disasters and possible contamination afterwards redefines the use of nuclear energy as a clean nut hazardous energy supple system. Nuclear energy is only said to be clean and green if the functioning of the plant is smooth without any interruptions and the surety is not confirmed and verified if something somewhere should go wrong in the plant functions.

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