# Public Perceptions about Atomic Energy and Radiation

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**ABSTRACT**
*Since the discovery of ionising radiation (1895) and radioactivity (1896), atomic energy has practically established itself firmly all over the world. Its applications can be found in practically all parts of the globe andtouches almost every aspect of human life. Today, it is helping the mankind in meeting the challenges of the everincreasing demand for energy, food and water and is assisting them in their industrial growth, mitigation of global warming, healthcare and environmental issues.Although atomic energy and radiation technologies havecontributed immensely to the growth and betterment of human life all across the world, they are always shrouded by undue fears and perceptions which do not have a scientific basis.*

## I A HISTORICAL PERSPECTIVE

A historical perspective of perceptions about atomic energy makes an interesting observation. Immediately after discovery of radiation (x-rays) and radioactivity, there were high hopes from them. They were believed to possess magical healing and health, stamina and sex boosting powers. All these beliefs were not based on scientific finding, clinical research or trials. The acceptance was based entirely on benefits (risks were not known) as perceived by the people and as advertised by the manufacturers. It was only in 1930s that horrifying results of blatant consumption of radioactive substances and over-exposureto radiation started coming to light. Although the craze for these magical radioactive potions died in the thirties, radio quackery is still going on at least in some parts of the world.

The discovery of fission in 1939 by Fermi followed by rapid development of nuclear weapons finally culminating in dropping of nuclear bombs on Hiroshima and Nagasaki in 1945. Theconsequences are deep rooted fear psychosis in the minds of common public which persists even today.

With the declaration of 'Atoms for Peace'programme by Eisenhower in 1953 and subsequent establishment of IAEA and of course marathon efforts by radiation technologists for developing a variety of applications of radiation for societal development, slowly but steadily established atomic energy with a wider perspective. Today, these applications have become so much accepted by the society that the total business in these applications all over the world far exceeds the business of electricity generation by nuclear power. This definitely was helping in acceptance of the nuclear power by society although the ghosts of Hiroshima and Nagasaki continued to maintain a scare about this technology. The very frequent open-air and underground nuclear weapon tests by many countries were greatly contributing to the negative image of nuclear power. Against this backdrop, the mid sixties, seventies and eighties saw deployment of large number of nuclear power plants particularly in USA, Canada and Europe. After the first major accident in a nuclear power station at Three Miles Island, there was a setback particularly in USA although it kept flourishing in Europe with champion efforts of France. When thingswere appearing alright, Chernobyl happened in 1986 and had a prolonged adverseeffect on the global growth of nuclear power.

During the first decade of 21$^{st}$ Century, nuclear power appeared to be making a come-back and was being considered as an important technology for mitigation of global warming. In 2007 the inter-governmental panel on climate change (IPCC) in its 4$^{th}$assessment report stated that "Nuclear (Power) has the largest and lowest cost GHG reduction potential in power generation". Once again when things were looking highly favourable for large expansion of nuclear power sector (even Germany had deferred its earlier decision to close all its NPPs), Fukushima happened and opened up fresh arguments against nuclear power.After more than three years of Fukushima disaster, once again nuclear power is trying to come back with many countries having launched new nuclear construction post Fukushima, of course India being the first one to do so.

During all these years a steady growth in the deployment of radiation technologies for societal benefits kept the flag of nuclear power flying. This happened in three ways – firstly rapid deployment in OECD countries, marathon efforts by IAEA in deployment of these technologies in many developing and under developed countries and may be slow but steady deployment in some developing countries like India through their self-reliant efforts.

## II PUBLIC PERCEPTIONS AND REALITIES

Although there might be hundreds of questions often asked by the society about nuclear power, they can be grouped into six main perceptions. These perceptions and the corresponding realities are as follows.

**(a)** Nuclear power spreads nuclear weapons. This perception is mainly based on the horrific memories and stories associated with Hiroshima and Nagasaki. Often we do not realise the fact that nuclear electricity industry was in no way responsible for Hiroshima and Nagasaki. The reality is that in 1945 when atomic bombs were used against humanity, this industry (nuclear electricity generation) did not exist. First nuclear power reactor came into existence in 1954 at Obninsk in the then USSR. Thus, if we think logically, we come to the conclusion that nuclear power reactors are neither compulsory nor necessary for making nuclear weapons. The problem of nuclear armament is not due to nuclear industry but due to our thinking and approach towards world peace. If the entire mankind takes a resolution not to make nuclear weapons, nuclear power can in fact play an important role in nuclear disarmament by diverting the fissile material used for making weapons, for electricity generation.

The second perception is associated with safety of nuclear power. People often perceive nuclear power as inherently unsafe. This perception has a direct association with the Three Mile Island (1979), Chernobyl (1986) and Fukushima (2011) nuclear accidents. A logical analysis of these accidents and their impact is necessary. The global nuclear industry has an operational experience of 15000 reactor years during which only 3 major accidents have taken place. In the Three Mile Island accident, the reactor was badly damaged but there was no release of radiation or radioactivity. This accident therefore had no impact whatsoever on the health of people or on the environment.In the Chernobyl accident, the reactor was totally destroyed and 237 people suffered acute radiation sickness (ARS) of which 31 died within 3 months of the accident. Most of them belonged to the fire fighting and rescue teams. No further deaths have been identified due to ARS. An UNSCEAR report places the total confirmed deaths from radiation at 64 as of 2008. In Fukushima, four reactors of old vintage were written off due to the accident. Not a single life was lost and there were no harmful effects from radiation on local people.

If we compare the number of accidents and fatalities in the accidents in various electricity generation technologies, the real information comes out. The Paul Scherrer Institute (PSI) of Switzerland who maintain the data base of such accidents, in one of their reports of 2011 have summarized severe accidents with at least 5 immediate causalities during 1970-2008. Nuclear technology stands out as the safest compared to all other technologies including coal, oil natural gas, hydro, bio-fuel and wind.

**(b)** The third perception is that nuclear electricity is comparatively costlier. The reality is that the nuclear electricity tariffs are quite competitive. During 2013-14, the average unit energy cost of nuclear electricity from Indian nuclear power plants was Rs. 2.71 per kWh.In the oldest nuclear power station TAPS 1&2 it was merely Rs. 0.97 per kWh and in the latest power reactor – Kundankulam -1 it is Rs. 3.94 per Kwh. These costs are quite competitive with hydro and thermal power and quite cheaper than most of the renewable resources.

**(c)** The fourth perception is that while many 'wise' countries have either given up or have decided to give up nuclear power, why India is going crazy after it ?Specially after declaration by Germany after the Fukushima accident that they will close down all there nuclear power reactors for ever by 2022, there is lot of debate about it in India. Here we must understand one thing that our geographical status, the status of the neighbouring countries, political situation, economic condition,electricity demand and supply status, energy resources status and population (present and projected) status are totally different from Germany. Actually, we should look at the world status of nuclear power. Presently, there are totally 443 nuclear power reactors in 30 countries of the world with a total installed capacity of 381.2 GWe. 66 nuclear reactors are under construction in 15 countries. As per IAEA, there are 30 countries who propose to build nuclear reactors for the first time. As per Alexander Cychkov, Deputy Director General, IAEA, the global nuclear generation capacity is expected to register an increase of 23-100 % by 2030. Maximum growth is expected in Asia. It is interesting to note here that 23 reactors are currently under construction in China alone.

**(d)** The fifth perception is about nuclear waste. Generally people think that radioactive waste is a problem without solution. Reality is that nuclear waste is the pride of nuclear industry because firstly its relative volume is very low and secondly technology for its management and isolating it from public domain for a long time has already been developed and is being practiced. India, because of its 3 stage nuclear power programme

has been following closed nuclear fuel cycle right from the inception of its programme. The spent fuel from Indian reactors is reprocessed and most of the material (99.9%) is recovered and rescued. The high level waste (HLW) contains more than 99.9% of radioactivity from the reactor (fission products and actinides). This waste is vitrified and immobilized. The vitrified waste is then sealed in double walled SS Canisters which are further sealed in radiation tight lead casks and are stored in a specially engineered underground Solid Storage and Surveillance Facility (SSSF) for 40-50 years. India is amongst a few countries who have mastered this technology. Finally after 40-50 years of storage in SSSF, these canisters are proposed to be stored permanently in specially engineered geological repositories at a depth of more than 1 km – isolated from normal life, ground water or any biological activity. Point to be noted here is that the entire process costs a mere 2 paise per unit which is included in the tariff.

**(e)** The sixth perception is that nuclear energy is not favourable to environment. People often tend to believe that some amount of radioactivity and radiation keeps leaking from a nuclear reactor and has an adverse effect on the neighbourhood population, flora and fauna. Reality is that nuclear reactors are so designed, constructed and operated that the radiation released from them is a very small fraction of the natural background radiation. During the 15000 reactor years of global and 400 reactor years of Indian operational experience of nuclear power reactors, the radiation does isfar less than the permitted levels. During many epidemiological surveys in the neighbourhood areas, not a single incidence of increased occurrence of cancer or genetic defects in new born children has been detected. In fact, we can very proudly say that the environment around nuclear power stations is much better and greener than some public areas of the country. There is abundant greenery around all reactors and various animals, birds and butterflies are found abundantly there.

## III CONCLUSION

Public acceptance is the biggest challenge for the required growth of nuclear power. Eradication of irrational perceptions prevalent in the society is therefore absolutely essential. Dr. Anil Kakodkar, Former Chairman, Atomic Energy Commission often used to say- "The job of the public outreach personnel is as important as that of the person designing a reactor." In fact with an ambitiously expanding nuclear power programme, gaining public confidence assumes even greater importance. We very urgently need to change the public perception so that rather than asking 'Why nuclear? the public must start asking, 'Why not nuclear?'