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Nuclear energy and sustainable development

Abstract

The dependency on combustion of coal, oil and gas for energy cannot be indefinite. Thus, the process of replacing fossil fuels with many energy technologies cannot be avoided in order to combat this high dependency. Nevertheless, we argue that in the long term, nuclear fission technology is the answer to the ever increasing demand for energy. This entails that nuclear fission has to play a major role in suppling energy in this age and beyond.

In achieving this, the major aspect is in switching electrical energy generation from fossil fuels to nuclear fission. This cannot be achieved in a short period of time but in few decades citing France as an example.[1] This energy transformation campaign is capable of reducing emissions of carbon dioxide as well as other greenhouse gases at a large scale. In view of this, replacement of coal-fired with gas-fired generating stations will not significantly reduce greenhouse gases emissions.

What about the other energy sources such as wind and solar? These may not be an ultimate answer as they will be hard pressed in supply and may fall short in energy supply at very high scale. This is because they depend on backup power or energy storage hence not able to meet the ever growing high demand of energy.

Therefore, this paper focuses on the current status of nuclear energy. It also discusses the future prospects of nuclear energy and the activities of the International Atomic Energy Agency (IAEA).

Keywords: Nuclear Energy, Sustainable Development, Nuclear fission, Fossil fuels

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Introduction

One may ask a question, "what is nuclear energy?" Nuclear energy originates from a process called fission, which is the splitting of uranium atoms, resulting in heat production that eventually is used to turn a turbine generator in order to generate electricity. This process does not involve burning of fossil fuels hence not emitting greenhouse gases. With the long term demand for energy and drive for sustainable development, analyses foresee a growing role for nuclear energy in answering these two cardinal calls. For example, the report on emissions scenarios shows an increase by a factor of 2.5 in global energy demand.[2]

Nuclear power will be able to cater for the demand of energy as new technologies are continuously brought on board. These include improvements in economics, very high safety levels, an increase in prolification resistance and better solutions for radioactive waste management. In its roles, the IAEA encourages and assists member states in promoting nuclear technologies. This technology assistance comes with a condition to meet sustainable development goals. In all this, there is need to preserve capital assets which include human, social, natural and man-made.

Currently, most costs associated with nuclear power generation are not reflected in the market prices. These may include human health and the environment at large. In this view, world economists are looking at amicable ways of valuing these costs and in turn project them into prices. Achieving a sustainable development framework entails getting prices right by taking into consideration social and environmental costs for both present and future generations. This will allow the comparative assessment of looking into alternative technologies to become an effective policy making tool in the near future.

Nuclear energy and its economic characteristics

It is without exaggeration to mention that nuclear energy has a good number of unique and viable economic characteristics. These characteristics boarder on its attractiveness when it comes to attaining meaningful sustainable development. Nuclear energy programmes demand long-term commitments and will-power from both policy makers and investors. This allows for careful considerations in view of financial risks and future liabilities. To begin with, it must be stressed that despite nuclear power plants having low and stable marginal production costs, their constructions are capital-intensive. They demand for highly qualified human resource as well as a comprehensive infrastructure. The fact that nuclear power plants use limited amounts of natural resources gives us hope and helps to provide security of supply now and in the future.

The current construction time of power plants is around five years or more and they have and expected lifetime of sixty or more years. This may raise concerns for private investors hence the need for serious political will from policy makers aiming at the implementation of sustainable development policies.[3] In order to start realising profit, it takes more than two decades which raises financial risks bordering not only on uncertainties but also technical failures as well as market demand.

In terms of initial investment, about sixty percent of the total generation cost goes to the sector during construction and commissioning.[4] Putting this into perspective, a 1 GWe nuclear unit costs around US$ 2 billion.[5] Once built, nuclear power plants generally have low fuel and operating costs compensating for the huge construction costs. The fact that uranium covers about five percent of the cost entails insignificant impact on the total cost in an event of any rise in the uranium prices.[6] The uranium sources that are at large scale worldwide ensures long term security on supply as uranium and thorium are not generally used for other highly demanding purposes. This contributes further to sustainable development as supply is guaranteed. In addition, uranium resources are large enough in comparison with future demands for consumption.

On the other hand, there is a high requirement for research, educational infrastructure and development under the nuclear energy

sector. This does not leave aside the legal and institutional frameworks as per IAEA requirement. Due to the sophisticated technology under nuclear power plants, the demand for highly qualifies human resource is inevitable. This results in spin-off benefits that enhance nuclear energy's contribution to viable sustainable development's economic and social goals. In addition, decommissioning nuclear facilities as well as long-lived radioactive waste deposition cover costs give rise to financial liabilities. This demands that government and industry must take critical measures to set aside funds for these liabilities in order not to pass the burden on to the generations to come. Lastly, nuclear power plants in operation generate adequate funds due to low operation costs and high demand for electricity.

Nuclear energy and its competitiveness

As earlier on alluded to, nuclear power plants have generally low operating and fueling costs resulting in them competing favourably. With examples from the United Kingdom, Finland, United States and Sweden, it is clear that nuclear power plants are performing well on the markets.[7] Nuclear power plants that were build a long time ago have proved to be very competitive and profitable and with good maintenance, they are likely to operate even far beyond their expected lifetime. With advances in technology, there has been a great improvement in terms of construction, commissioning, technical performance and maintenance costs over the years.[8] This has led to drastic improvement in view of economic indicators resulting in enhanced competitiveness now and in the near future. Technology has helped in improving the lifetime of nuclear power plants while emphasizing on meeting the IAEA current safety standards.[9]

In addition, analyses have shown that the relative cost of generating electricity indicate that nuclear power is without doubt the cheapest option. This gives it an upper hand in competing in an environment with high prices of hydrocarbons and natural gas especially in the recent past. Nevertheless, there is need to try and reduce capital costs so as to ensure greater competitiveness not only with state of the art fossil fuel plants but also with renewable technologies. Construction time also has to be significantly reduced to avoid risks in capital investments due to liabilities.[10]

On one hand, with this reduction in the construction costs, nuclear energy would compete favourably with alternative energy sources on the market. High discount rates in line with economic objectives of both government and private investors enhance competitiveness of technologies. On the other hand, preference for a future consistent with viable sustainable development goals favour technologies that are capital-intense such as nuclear power and renewable energy sources.

Nuclear energy and its external costs

There are a number of external costs in view of nuclear energy that range from health to environmental costs. These external costs are limited not only by norms, but also standards and regulations that aim at monitoring and reducing residue emissions. The fear is, if this is left unchecked, it may leave a burden that will be carried over to the generations to come. Under nuclear energy industry, there are stringent operational safety regulations bordering on limiting atmospheric emissions, water pollution and radioactive waste management. As a result, the industry is mandated to support financially the costs of these responsibilities. In this view, during construction and operations, there is a significant cost allocated to safety features that allow for the protection of workers as well as the public.

In addition, these external costs spread as far as radioactive waste disposal and decommissioning of nuclear plants after their lifetime period expires. In case of any accidents, the industry also must be in the position to cutter for both internal and external costs that may arise due to such disasters. Finally, despite studies not being too accurate on the among of global climate change damages as a result of nuclear power plants, this is a risk that needs close monitoring and avoidance at all cost. This is because it is against sustainable development goals to pass burdens to future generation due to activities that benefited the current generation.

Conclusion

In view of the above analysis, it is safe to mention that nuclear power plants are generally competitive. This is highly due to the fact that their marginal costs are low as compared to other alternatives. In addition, there is a global urge towards improvement of nuclear power plants' economic performance. Furthermore, due to research, development and design being carried out by reactor designers, it is likely that there would be a significant reduction in capital costs as well as construction periods. This has the capacity to lower financial risks and hence forth attract more investors in the nuclear energy industry.

It is vital to recall that the economic goals surrounding sustainable development demands factoring out full costs of any given technology into its product price. Thus, in doing so, the nuclear energy industry has capacity of enhancing its competitiveness. In the meantime, the industry must be focused more on finding amicable way of reducing its costs in order to remain relevant and competitive. This must be done in line with maintaining high standard levels of safety, health and environmental impacts. In short, the industry must convince investors and the public that nuclear energy industry is the answer not only for the future but also the current demand for electricity.

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None.

Conflicts of Interest

None.

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