A Paper on Application of Nuclear Processes

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ABSTRACT: Humanity must confront the fact that, for much of its energy needs, it cannot rely forever on burning coal, gas and oil. In the eventual process of eventually eliminating fossil fuels, many energy developments can be considered and most can be used in particular applications. However, in the long term, we argue that nuclear fission technology is the only developed energy supply capable of providing the vast amount of energy required to operate contemporary industrial economies efficiently, effectively, reliably and sustainably, both in terms of the atmosphere and the available resource base. The alternative—dedicated energy storage for grid-connected intermittent energy sources (instead of backup)—is in many situations not yet commercially feasible. However, unreliable sources plus storage may be economically efficient for local energy supply in geographically remote areas without connection to a broad electrical grid. Yet nuclear fission energy will still be required for the majority of fossil fuel displacements this century.

KEYWORDS: Carbon dioxide, Fossil fuels, Nuclear fission, Nuclear fusion, Renewable source, Guidelines.

INTRODUCTION

Electricity is not a primary fuel – it is derived from coal, gas, nuclear or renewable energy. In the case of nuclear power, the heat comes from a controlled fission reaction which is used to generate steam from generators that produce electricity. With the exception of the heat generation process, a nuclear power plant is also very similar to a coal-fired power plant, with similar thermal efficiency levels under current design (~37%).

Uranium is a naturally occurring radioactive component. Radioactivity is a natural feature of the climate, and can be classified in three forms: alpha, beta and gamma. Alpha particles have a large density, bearing tremendous energy that can cause tissue damage, but these particles are quickly blocked by other components [1]. The other big danger is the absorption of alpha radiation. Beta radiation is less damaging to tissue, but it does penetrate materials more quickly. Gamma rays are high-energy x-rays of no mass or electrical charge but high penetration (figure 1). Large levels of radioactivity have the potential to induce tissue death by ionizing living cells. At lower levels, ionization can lead to mutations in the cells that could lead to cancer. Radioactive material can lose its radioactivity by decay over time. The half-life of the sample is the time it takes for 50% of the radionuclide to degrade [2]. For radioactive isotopes, this will vary from seconds to thousands of years, with atoms in each isotope having the same chance of decay and radiation exposure. As a rule of thumb, the radioactivity of the isotope falls to about zero after six half-lives.

LITERATURE REVIEW

In the 1940s, British efforts to build plutonium-based bombs offered expertise with graphite-moderated reactors, which were later to be produced for commercial use. European countries, including the United Kingdom and France, concentrated on gas-cooled technologies for their initial fleet [3][4] while the US research programme developed water-cooled reactors from the outset. Calder Hall was the first nuclear power plant in the UK, a Magnox design that was launched online in 1956. Generation III and III+ water-cooled technologies are currently being designed for new-built projects. Generation III designs are modern light water reactors developed in the 1990s, such as the European Pressurized Water Reactor (EPR) and the Advanced Passive 600 (AP600) [5].

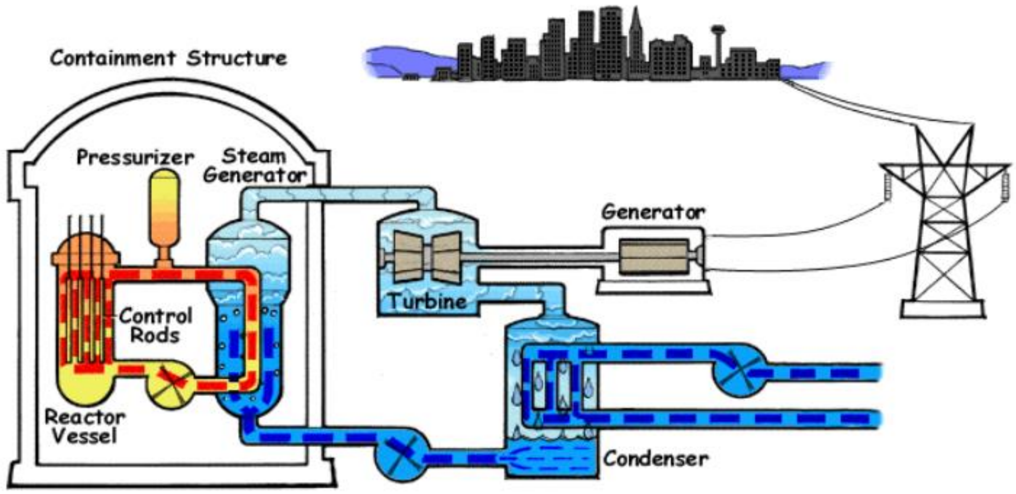

Figure 1: Nuclear power plant

Humanity must confront the fact that, for much of its energy needs, it cannot rely forever on burning coal, gas and oil [6]. In the eventual process of eventually eliminating fossil fuels, many energy developments can be considered and most can be used in particular applications [7].

DISCUSSION

First generation reactors were early designs designed in the 1950s and 1960s, mostly from older military reactors. In the 1940s, British efforts to build plutonium-based bombs offered expertise with graphite-moderated reactors, which were later to be produced for commercial use. European countries, including the United Kingdom and France, concentrated on gas-cooled technologies for their initial fleet, while the US research programme developed water-cooled reactors from the outset. Calder Hall was the first nuclear power plant in the UK, a Magnox design that was launched online in 1956. First generation reactors were early designs designed in the 1950s and 1960s, mostly from older military reactors.

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CONCLUSION

Humanity would have to systematically reduce its reliance on large-scale combustion of fossil fuels for energy production in the coming decades, with the goal of achieving this transition by the end of this century. In doing so, all energy sources should be considered and some can be deployed in useful 'good' applications. However, only nuclear power plants are capable of delivering, sustainably and efficiently, the vast volumes of renewable and economic electricity required to operate modern economies with reduced greenhouse gas emissions.

Renewable energy sources (primarily wind and solar) would not be able to provide the vast volumes of energy required sustainably, efficiently and reliably. In comparison, in many instances, clean energy sources with fossil-fired backup capacity would not lead to the elimination of greenhouse gas emissions. Distorting the market with incentives and regulations to promote intermittent electricity technologies to applications for which they are not well suited is economically wasteful. One way to prevent 'free riding' will be a grid-connection charge to be placed on countries with significant transient generation capacity for the purpose of compensating neighbouring countries for the use of their electricity.

REFERENCES

[1] G. Petridis and D. Nicolau, *Nuclear power plants*. 2011.

[2] OECD Nuclear Energy Agency, "Uranium 2014 : Resources , Production and Demand (The Red Book)," *Iaea*, 2014.

[3] "Nuclear power." https://cdn.britannica.com/62/162162-050-586ADA35/diagram-nuclear-power-plant-reactor.jpg.

[4] H. W. B. Skinner, R. A. Charpie, J. Horowitz, D. J. Hughes, and D. J. Littler, "Progress in Nuclear Energy," *Math. Gaz.*, 1957, doi: 10.2307/3609226.

[5] E. Kriegler *et al.*, "The role of technology for achieving climate policy objectives: Overview of the EMF 27 study on global technology and climate policy strategies," *Clim. Change*, 2014, doi: 10.1007/s10584-013-0953-7.

[6] M. Gill, F. Livens, and A. Peakman, "Nuclear fission," in *Future Energy: Improved, Sustainable and Clean Options for Our Planet*, 2020.

[7] B. W. Brook, A. Alonso, D. A. Meneley, J. Misak, T. Blees, and J. B. van Erp, "Why nuclear energy is sustainable and has to be part of the energy mix," *Sustain. Mater. Technol.*, 2014, doi: 10.1016/j.susmat.2014.11.001.