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Key Areas in Which Nuclear Power can Help the World Achieve Carbon Neutral

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There is an undeniable need to keep global warming below 1.5°C, to avoid the worst consequences of climate change, but in order to do this, greenhouse gas emissions must decline to zero in 2050 [1]. However, despite this looming deadline, the use of fossil fuels has continued to increase, resulting in annual global greenhouse gas emissions rising from 20.5 billion tonnes of CO_2 to 33.3 billion tonnes in 2019 [2].

Continuation of modern, healthy economies are predicated on the supply of energy sources that are both constant and sustainable. However, 73.2% of global greenhouse gas emissions are generated by the production of energy, with heat and electricity accounting for about one third of this. The use of fossil fuels accounts for 83.4% of all energy (electricity, heat and transport) and generate 63.3% of global electricity[3]. The demand for electricity continues to increase and is outpacing the recent increase in the production of electricity by renewable sources [4], which is why little progress is being made in achieving the global goal of net zero by 2050. Some 770 million people, largely resident in sub-Saharan Africa still lack access to electricity [5]. It is a humanitarian goal to raise living standards in these areas, but an estimated 5000GW of additional capacity above the existing 2500GW would be required for this, assuming that there was no further increase in the global population, and that electrification of the economy remained at a similar level to that in today's European economies, both of which are unlikely.

We would therefore seem to have an impossible problem to solve. How do we maintain our energy hungry, modern societies and ensure the continued development of low and middle income countries whilst reducing emissions of greenhouse gases? While the use of renewables has seen a rapid increase in growth, few countries seem to have taken the utility of nuclear power seriously, although the International Energy Agency has noted that without action to support developments in nuclear power, global efforts to transition to a cleaner energy system will become drastically harder and more costly [6]. Even some Green NGOs (www.greensfornuclearenergy) are starting to realise that excluding nuclear is not an option to achieve our decarbonisation targets. A number of countries e.g. Sweden [7] and France [8] have demonstrated that it is possible to dissociate economic growth from greenhouse gas emissions, which should give hope to the developing economies that their goals of societal improvement can be achieved without destabilising the climate for the rest of the world.

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One of the major problems of renewables is that their use is largely restricted to production of electricity only. This is partly because of the area of land required to generate significant amounts of electricity. The high capacity factor of nuclear reactors (global average 82.5%) compares very favourably with other energy sources (coal 49%, gas 29-63%, offshore and onshore wind 45% and 35% respectively and solar PV 18%) and means that significantly less land is required to produce a given amount of energy. A 1000MWe nuclear reactor, which would power 2 million homes in Europe has a foot print of about 3.4 km^2. The land requirement to provide an equivalent output would be between 673 and 963 km^2 for wind farms and 194 km^2 for solar [9]. To use renewables to replace generation by coal, gas and nuclear seems not to be a practical solution, and the amount of land use involved to provide for even modest extension of wind and solar is becoming more of a social issue at the local level, despite being supported in public opinion polls.

Nuclear already has a proven track record in its ability to decarbonise domestic heating and to run air conditioning, which will become increasingly important as climate temperatures rise. Surplus heat from nuclear power plants is being used in a number of countries to provide district heating [10], and can be used to produce the very high temperatures required in a number of industrial processes such as the production of concrete, steel, and the production of alternative power sources such as hydrogen and synthetic fuels [11]. The production of the latter will be key to decarbonising the shipping and aero industries.

So what is preventing us from embracing nuclear power as a partner in climate mitigation? One factor that is often cited is the cost of nuclear energy, yet there are an increasing number of studies that suggest that putting a larger share of nuclear into the energy mix results in lower total cost of electricity for the tax payer and end consumer, due to the longevity of nuclear plants once built [12]. Another factor is nuclear waste, although in truth the nuclear industry is the only low carbon energy source that has sought to internalise all costs in its price. In reality the waste produced by nuclear power is small when compared with solar and wind, with the entire waste since nuclear power came on line being 400,000 tonnes (of which 30% is recycled for reuse in other reactors), whereas it is estimated that by 20-50 some 60-78 million tonnes of electronic waste (which contains toxic chemical entities such as cadmium, antimony and lead) will have been generated by solar PV and 43 million tonnes by the wind energy industry [13,14].

We are running out of time. The chances of reaching net zero by 2050 are diminishing by the second. Reaching these goals by relying on the public to make informed choices about their energy uses will not be enough. Isn't it time we listened to the science and started to invest in a nuclear future, rather than prevaricating and watching our climate becoming ever more unreliable, and reducing the rich biodiversity of this plane still further. As they say, there is no Plan(et) B.

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Writer’s Profile

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