

Energy in a democracy: people need to know

Climate Change, Renewables and Nuclear Power

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The report from the IPCC published last week tells us what is already becoming clear to many, namely that the era of carbon burning should end and that our way of living will change. So we are faced with a historical choice:

- ignore the problem and expect others to be prepared when extraordinary disasters occur;
- engage personally in understanding the alternatives and be proactive in preventing conditions overwhelming us and our children.

Experience shows that the first is unrealistic and is bound to fail. In a democracy the second is the choice that everyone who is able should make, however difficult that may seem. What are those alternatives and how may they be simply understood? Look first at the principles and leave the numbers until later.

Mankind gained ascendancy on Earth when he dared to domesticate fire, a step that no other animal ever made. Energy in the pre-industrial period came from the Sun via the wind, water power and the growth of vegetation. However this supply in its various forms was limited, weak and intermittent. The Industrial Revolution replaced these with fossil fuels and steam power bringing a great leap forward in the human condition and the size of population supportable on the Earth. However the IPCC is now telling us that that is not true, the consumption of carbon fuels in any form – coal, oil, gas, vegetation – is not sustainable for the population and lifestyle we expect today.

What are the options? We may join Donald Trump in dismissing the science that the IPCC shows us, but few are ready to do that.

More popular is the alternative of going back to the use of exclusively pre-industrial sources of energy, now called Renewables. It is true that their energy can now be harvested by modern means over vast areas, but the sources are weak as they always were. To replace a large fossil fuel power station requires hundreds of huge windmills over several square miles or a similar area closely plastered with solar panels. Alternatively large rivers can be dammed generating ecological scars and displacing communities on a grand scale. Much damage has already been done on the Nile, Yangtze, Tigris and Mekong, but the number of suitable rivers is limited and water is itself a precious resource. These Renewables damage the environment and can hardly be described as Green!

But even more serious is the oft-described intermittency of Renewables: they cannot provide energy, anytime and anywhere, as a modern economy needs. Some opinion relies on the Micawber Principle, that in the end “something will turn up”, but there are clear scientific limits, for instance from the Periodic Table of the chemical elements on prospects for battery technology.

But science already offers another source, first revealed by Henri Becquerel and Marie Curie, and fully studied for over a century. Nuclear energy is accepted by some but feared by many. Compared with coal nuclear power provides nearly a million times the energy per kilogram of fuel, any time and almost anywhere. Plants are robust and compact, requiring as little as 15 hectares for one giga-

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watt output. And what about their safety and impact on the environment? “Look what happened at Chernobyl” is a frequently voiced reaction. The accident in April 1986 devastated a large region in Ukraine that had to be evacuated – but did it? Wildlife pictures recorded there in recent years report that animals living in the region are thriving, radioactive but better off now without human interference than they were before. The animals must know something that we do not.

“*But they know nothing*” Doctor Watson might say to this.

“*Quite so*” Sherlock Holmes might reply, “*but we may know something that isn't so.*”

The evacuees at Chernobyl were terrified when told that they had been irradiated and should leave their homes immediately. This unseen and unexplained condemnation caused severe mental illness and social damage, but only 43 deaths can be linked to the radiation itself – 28 workers and 15 thyroid deaths in the wider population. The thousands of deaths and the waste land expected by most commentators never happened. The truth was reported by IAEA and WHO in 2006, though stopping short of concluding that the health effects of radiation are significantly over-stated. As a result the human tragedy was repeated at Fukushima in 2011. Although there were no casualties from the radiation, the unnecessary evacuation and the fear, as devastating as a mediaeval curse, caused much human suffering. Expensive economic and technical steps were taken around the world following the accident. But the message from the animals at Chernobyl shows that those steps were unnecessary.

I have spent many years understanding how life is affected by radiation and how we have come to fear it. Nuclear energy is very powerful, even compared with chemical energy. Both are parts of nature and can be abused to make weapons. A nuclear explosion may cause local destruction and fire, but the release of radiation is not the threat that the Cold War encouraged everybody to believe. Anyway nuclear energy plants cannot explode like bombs and the tiny quantity of waste they produce has never caused a fatality in 60 years.

Why is radiation so relatively harmless? From its beginnings 3,500 million years ago life had to evolve fool-proof ways to survive natural radiation and other oxidative agents, particularly with an immune system to suppress cancerous growth. Civilisation has no such immunity from Climate Change. Its survival will depend on gaining widespread acceptance of nuclear power in society through changes to education and public health, similar to when it domesticated fire all those millennia ago. An informed society would set a simple safety threshold for low and moderate radiation dose rates. That would halve the time and effort to provide nuclear power from smaller local plants that also offered desalination, hydrogen production and district heating. In this way financial and regulatory obstacles should be dramatically reduced with popular understanding.