Economic growth: new energy to build trust and confidence

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Economic growth: new energy to build trust and confidence

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The people of the USA do not feel economic growth, whatever the published indices may say. That is why they have elected Trump, a development that is unlikely to give them the growth they seek. Despite many differences, the UK, the EU and many other countries are similarly afflicted.

The economy would grow if the working population or their productivity increased. But attitudes to immigration, the ageing population and the steadily falling birthrate, all point to economic decline [1]. Growth based on bureaucracy and regulation is also futile, and simply trusting that new technologies will turn up has proved insufficient in recent decades. A more radical approach is needed.

A new source of energy can raise productivity by providing extra effort (or heat) with minimal human input. Such a new fuel should release energy controllably and safely, but also be powerful, widely available and harmless to the environment. Is there any candidate that fulfils such an ambitious list of requirements?

That may seem unlikely, but twice in the past human society has made such a step and achieved a spectacular increase in productivity. Could it work a third time?

A million years ago in the Promethean revolution humans domesticated fire. The public education and discipline required were facilitated by communication not available to animals. The social concerns were far outweighed by the leap in the quality of life. Human supremacy was firmly established, and so was a respect for fire. Its control is not easy – it can catch and spread like a virus, but we make sure that children know about it.

Then two hundred and fifty years ago in the Industrial Revolution the combustion of fossil fuels was harnessed to power engines that worked for humans. The economic growth was phenomenal. Energy could be provided at the required time and place, whatever the weather. In the 20th Century the related science of electronics gave a further saving of effort and increase in productivity, though it needs a primary energy source to generate the electrical power.

The energy of fossil fuels and electronics is invisible because it is carried by electrons, the outer constituents of all atoms. How this worked was not properly understood until 1924 when the behaviour of electrons was explained as waves [2]. This apparently odd

behaviour is simply described – like sound waves in music, the smaller the instrument the higher the pitch. The energy of electrons is high since atoms are tiny. This energy and its variations can be calculated precisely in agreement with chemistry and electronics.

Because atoms are in contact, their energy can spread rather easily from one to another, giving the contagious release of energy seen in flames and explosions. To this risk should be added that of the emission of gases and particulates. These damage health, pollute cities, and influence the weather and climate. So, at the 2015 Paris Conference the nations of the world agreed that the burning of fossil fuels should be drastically reduced.

But the Paris Agreement is insufficient. Economic and political stability depend crucially on a reliable supply of energy. Where people do not yet have this benefit, they press relentlessly to get it. Many see the only alternative to burning fossil fuels to be the harvesting of energy from wind, solar, wave and biofuels – misnamed renewables. But these are essentially weather-dependent and were found to be unreliable before the Industrial Revolution. Man-made technology cannot alter that. The infrastructure of renewable energy plants is huge because their energy density is weak – about 1000 times weaker than fossil fuels, kg for kg [3]. The size of these "farms" may seem impressive, but it makes them vulnerable to extreme weather events and easy targets for malicious attack. Their unpredictable availability in time and space encourages plans for expensive networks of grids, interconnectors and batteries that interfere with nature and are themselves vulnerable. So, these renewables are ill suited to a stable and resilient electric utility. Where can a new fuel be found to provide a modern electricity supply and the other required energy-intensive supplies of heat, chemicals and desalinated water too?

At the centre of every atom lies a minute nucleus, 100,000 times smaller. Like electrons its constituents are described by waves. Being so very much smaller their pitch is over a million times higher than electronic energy [4]. This is nuclear energy. Writing in the Strand Magazine in 1931

5]

It was not until 1938 that anyone knew how to deliver and control this energy. But by the mid 1950s nuclear powered submarines were circling the globe and power stations were providing reliable electricity [6].

But what has happened since then? How are the changes working out that Churchill foresaw nearly a century ago?

Nuclear physics is not a human invention, but a major component of the natural world. Although human society has flourished by developing technologies that use features of nature, this factor of a million is a far greater step than humans had made in their previous development. By default, they reacted with fear and disengagement. This rejection by

society was made worse by the Cold War, a dark age when secrecy and distrust shrouded public affairs, not only in the United States but worldwide [7].

This legacy of fear remains today. For seventy years no open discussion of nuclear science has been encouraged in schools. For most members of society nuclear energy and radiation are like the regions "here be dragons" on the edge of ancient maps. They describe matters thought too fearsome and sophisticated for anyone with a normal academic paygrade.

Why has this culture of intimidation and black magic continued unchallenged for so long? Many of those in a position to argue that attitudes and thence regulations should be based on evidence have careers and status that themselves depend on this fearsome reputation. These putative experts guard their positions jealously and resist change, despite the evidence. Committees and budgets are designed to preserve the status quo behind a culture of extreme caution that enjoys the imprimatur of the United Nations.

When guns and gunpowder replaced bows and arrows, the increase in energy revolutionised the threat and conduct of war. Fear itself is a powerful weapon and that was especially true of nuclear energy after the end of WWII. The blast and fire delivered by a few kgs. of pure nuclear fuel, such as destroyed the cities of Hiroshima and Nagasaki in 1945, are comparable to that of a few thousand tonnes of TNT. But the fear of a "nuclear holocaust" was augmented by the reputed effect of radiation, long lasting and worldwide. Ghoulish stories excited science fiction and fired imaginative reports in the media, but the enhanced risks due to radiation were never supported by scientific evidence, although a collusion of political and vested interests maintain this phobia. Half a century of evidence shows that radiation added less than half a percent to the death toll at Hiroshima and Nagasaki [8, 9, 10]. Both are now thriving cities, long since rebuilt.

Quite high exposures to nuclear radiation have been routinely used to cure cancers and benefit health since the work of Marie Curie 120 years ago. The boundary of its safety was agreed internationally in 1934 [11]. All the evidence accumulated since then has essentially confirmed that standard. So, it was no surprise that the "disaster" at Fukushima Daiichi in 2011 caused no radiation casualties at all [12,13]. However, the fear it evoked had severe worldwide economic, environmental and social consequences [14].

The human race cannot afford a culture of precaution that is intolerant of risk and is reluctant to learn. Democracy fails insofar as society does not understand. Churchill was no scientist, but he did his homework and showed leadership. Marie Curie's observation "*Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less"* should be heeded along with Churchill's prediction.

No public figure has had the guts to face the challenge of correcting the destructive misapprehension of nuclear risks concocted in the 1950s [14]. This requires a root-and-

branch rebuild of nuclear regulation based on firm scientific evidence. At the same time public perception and education should be reformed. This will take a generation or two.

There will be unrest as the workforce finds that the work to be done has changed. In the Industrial Revolution it moved from the countryside into the factories with much immediate misery. This time many desk jobs will be taken over by Artificial Intelligence. Drivers of road and rail traffic, too, will no longer be able to compete with automation. However, more satisfying employment with direct human contact in health, caring, and education will expand in response to demographic changes [1]. Social status, financial rewards and taxation will have to respond, attracting teachers and nurses, and supporting family life. In the short term these changes will be socially disruptive, though later they will be beneficial and engender trust and confidence.

In conclusion

1. An international initiative is required to replace the current nuclear and radiation safety culture with one based on evidence and understanding [14]. The existing hegemony of experts with their over-cautious analysis based on the misuse of models (LNT) should be stood down.
2. Children should learn the benefits of nuclear technology, including the workings of a simple smoke detector, visits to a radiotherapy clinic and a nuclear power plant.
3. To invest in grid-scale renewables is to step back centuries, an expensive distraction from growth [15]. The policy of current governments in UK, Germany and Australia, for example, are contributing to economic decline But nuclear energy, given proper costing and safety management, will drive economic growth. The range of technical designs and availability of fuel would provide for many centuries, as Churchill imagined.
4. Despite the disruption in its early years, the Nuclear Revolution will ultimately be beneficial.

Notes and links

1. *No one left: Why the world needs more children* Paul Morland ISBN: 9781800754102, July 2024
2. https://en.wikipedia.org/wiki/Louis_de_Broglie
3. https://www.researchgate.net/publication/339629356_Nature_Energy_and_Society_A_scientific_study_of_the_options_facing_civilisation_today#fullTextFileContent
4. https://www.researchgate.net/publication/378215964_The_music_of_chemical_and_nuclear_energy#fullTextFileContent
5. In the Strand Magazine https://www.nationalchurchillmuseum.org/fifty-years-hence.html

6. The launching of USS Nautilus in 1954 https://www.linkedin.com/feed/update/urn:li:activity:7254884572083961857/
7. The distrust reached its peak with the investigative hearings conducted in the USA by Senator McCarthy https://www.britannica.com/biography/Joseph-McCarthy
8. Preston D.et al (2004) https://www.jstor.org/stable/3581199
9. *Radiation and Reason: The Impact of Science on a Culture of Fear* Wade Allison (2011) ISBN: 978-0-9562756-1-5
10. *Nuclear is for Life: a Cultural Revolution* Wade Allison (2015) ISBN: 978-0-9562756-1-5
11. https://www.icrp.org/images/1934.JPG
12. https://www.bbc.co.uk/news/world-12860842
13. Allison W. (2012) Written evidence submitted to Parliamentary Select Committee https://publications.parliament.uk/pa/cm201213/cmselect/cmsctech/428/428vw05.htm
14. Allison W. (2024) https://journals.lww.com/health-physics/abstract/2024/06000/society_and_nuclear_energy__what_is_the_role_for.6.aspx# and references given there
15. Except in certain locations such as Iceland (geothermal) and those places where hydro is viable given adequate rainfall.