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# Why Renewables need Nuclear?: a Brief Narrative

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## **WHY RENEWABLES NEED NUCLEAR? A BRIEF NARRATIVE**

### *EXORDIUM*

*In August 2005 a set of scenarios, sponsored by the Irish government, was produced entitled Energy Scenarios Ireland. Nowhere in any of these scenarios was the potential contribution of nuclear power mentioned as a possible, plausible or probable, let alone preferred factor in facing the widening energy gap that most observers predict. Among members of the Futures Academy at DIT, it was felt that this omission devalued, if not discredited, the use of scenario thinking in identifying alternative imaginable futures, exploring the implications of different policy options and, at the very least, constructing contrasting conditions to inform and stimulate debate.*

*For at least the next few decades, probably longer, the key question is how we generate enough electricity, whilst, at the same time, reducing carbon emissions. Today, worldwide, about 64% of electricity comes from fossil fuels, 16% from nuclear fission and 19% from hydro, with very little from other renewables. There is really no prospect that we can do without any of these. Likewise, there are only a few realistic options for curtailing carbon dioxide emissions from electricity generation:*

- increase efficiency in electricity generation and use;*
- expand the use of renewable energy sources such as wind, wave, solar, biomass and geothermal;*
- capture carbon emissions at fossil-fuel electric generating plants; and*
- increase the use of nuclear power.*

*It is reasonable to suppose that globally we shall need all four options. Moreover, it is our view at The Futures Academy that we should seek to explore and evaluate policy measures that could be adopted to sustain and develop nuclear power as one of the prime options for meeting future world energy needs at low cost and in an environmentally acceptable manner. Furthermore, in a world where we constantly discover that everything effects everything else, we would argue for a more imaginative, holistic, and visionary approach towards strategic policy analysis.*

*The following short narrative aims to provoke some thought in these directions.*

### **INISH BEG, WEST CORK, APRIL 2055.**

#### **The eve of the Lovelock Prize awards (The Gaias)**

Dr. Ruth Saurin perched on the verandah of her Georgian lodge sensitively located at the edge of the woods on a small private island estate in beautiful West Cork just outside the picturesque port of Baltimore. Looking across the ancient burial grounds, she watched as night fell on the rippling waters of the Llen, and the sky above the low hills beyond still glowed with the last light of dusk. The chill spring evening made her draw the emerald green shawl more closely around her shoulders, and the lingering aroma of burnt wood was like rural incense in the air. Unusually, she was not alone. In the shadows behind her

sat a visitor, Touchstone, a celebrity interviewer, who had come to disturb her island idyll.

In the midst of all the tranquillity, Ruth found herself strangely troubled. When this famous British broadcaster had called, she had willingly granted his request for an interview and invited him out to Inish Beg, rather than her apartment in Dublin, as being a more restful and reflective retreat where from to reminisce. She had, after all, been retired for almost ten years, and whilst she was happy to recall the turmoils and the triumphs of her career, she now felt a frisson of fright at the thought of the interrogation ahead. Or was it the cold night air? Tomorrow, in any event, she was honoured with the worldwide award of the 2055 Lovelock Prize- The “Gaia”.

Touchstone, the interviewer from Global Holocaust, had at her request, sent a preparatory list of questions. These had surprisingly plunged her into a mood of unease and uncertainty – a state of mind that had started to plague her more and more over recent years. Had they been right? Of course they had, she shrugged. Going inside, settling before the turf log fire and pouring a couple of glasses of Kilbeggan, the interview commenced.

#### AN AGE OF REGULATION

“Have you always believed in the efficacy of nuclear energy?” began Touchstone. “Not at the very start. As a young researcher in The Futures Academy at DIT, I shared the deep mistrust, even loathing, of nuclear power, so prevalent in Ireland at that time. My professor at The Academy, however harboured an equal, and lifelong predisposition towards it. Frankly, both our stand points were initially based on hunch and prejudice. It was only when a tract called Energy Scenarios Ireland was published in 2005 that my mind was turned to exploring the issue more closely, and more objectively. First, because it made no mention whatsoever of the nuclear option as a significant source of energy for the future. And second, because of the partiality demonstrated by the authors, and the clumsy way in which they handled the methodology. This made both my boss and I wish to redress the balance of inquiry.”

“You were converted?” queried Touchstone, between sips of the oleaginous peat imbued spirit. “Not immediately. Clearly there were problems. Problems of cost, safety, waste and proliferation. But most of all, especially in Ireland, the problem of public attitude.” “How did you address these?” “Somewhat superficially at first, but until 2010 I was only a postgraduate student. In 2006, we conducted a scoping study at The Futures Academy on Nuclear Power: Friend or Foe?, which led me to producing a dissertation in 2007 on “How Renewables Need Nuclear” for my masters in Sustainable development at DIT and then to my doctoral thesis at MIT in 2010 on ‘The Future of Nuclear Power.’ What seemed simple suddenly turned complex.” And what turned complex, thought Ruth, finally seemed simple.

“Taking the problems in turn, how were they reconciled?” asked Touchstone.

“Cost was relatively easy. In the deregulated markets of the early 2000’s nuclear power was not competitive, but as time went on, environmental regulation, especially carbon emission credits, declining oil and gas stocks, and the political desire to reduce dependency on imported energy, all converged to make nuclear energy truly cost competitive by about 2015. With safety, it has taken a little longer. The legacy of Three Mile Island and Chernobyl will always be with us, but successive generations of nuclear power plant design and ever tighter safety regulation led to a general recognition by around 2020 that nuclear is by far the safest way to generate electric power, and, moreover, the occupational health risk is far lower. There have, in fact, been more deaths maintaining wind-farms over the past fifty years than in constructing, operating and decommissioning nuclear power stations.”

“But what about waste - that is surely a different matter altogether?” said Touchstone, showing a sudden and sharp change in tone. “Yes – waste is different”, conceded Ruth cautiously. “The main challenge over the past hundred years for nuclear energy has been the management and disposal of high-level radioactive spent fuel. Great stress and huge demands were placed on operating agencies, regulatory procedures and political institutions over the first couple of decades of this century. It was difficult to make a convincing case, on the basis of waste management considerations alone, that the benefits of advanced, closed fuel cycles outweighed the attendant safety, environmental, security risks and economic costs. That was to change, however, when...”

“Perhaps we can return to that,” interjected Touchstone. “It’s a matter I’d like to examine more closely. But, for now, what about proliferation?” “Well...”, started Ruth, gathering her thoughts away from the dilemma of waste, “...the protocols of the Nuclear Non-proliferation Treaty collapsed in 2012 and the work of the International Atomic Energy Agency stumbled on until the early 2020’s with increasing bouts of regulations being introduced relating to the proliferation risks at the front-end of the fuel-cycle from enrichment technologies; the movement to an approach based on continuous material protection, control and accounting using surveillance and containment systems; and the massive increase in inspections beyond declared facilities. Although, there were a number of scares, and the terrible tragedy surrounding the Cape Town Olympic Games in 2020, we know now, with the benefit of hindsight, that international terrorism has had more recourse to other threatened and actual means of mass destruction.”

Touchstone turned inquisitorially in his chair: “You mentioned that public attitudes were a big issue at the outset of your career. Perhaps you could expand?” He re-filled their glasses expectantly.

“The first twenty-five years of the century were generally characterised by public suspicion, even antipathy, towards nuclear power. Even in the US, where the majority of Americans approved nuclear energy, they approved the building of more power stations. And in Europe, apart from France, Finland and the UK, public opinion was largely against and governments unwilling to take a lead. There was disillusionment from exaggerated claims on behalf of the technology; a mistrust of commercially sponsored science; a memory of the two major disasters; a justifiable concern over waste disposal;

and complacency about other fuel stocks. The industry, moreover, did not help itself – exuding a patronising air of arrogance and a somewhat cavalier posture towards risk.”

“But a massive expansion of nuclear plants took place elsewhere.” Touchstone commented. “That’s right. Across China, India and other parts of the far East nuclear power stations mushroomed during the second decade of the century, and subsequently the 2020’s saw nuclear facilities spread across South America, Australasia and, as we recall, with some dire consequences sub-Saharan Africa.”

“Remind me, what you were doing during this period?” asked Touchstone. Ruth relaxed into reminiscence. “From 2010 to 2015 I worked in the technical division of Sustainable Energy Ireland. A frustrating time, as I witnessed the slow adoption of renewable energy sources in Ireland and the blind disregard of the potential prospects offered by nuclear power. For the next ten years, I worked in the energy policy field in Europe, with my main tasks being, first to preserve the nuclear option for the EU, and second develop a more effective decision-making process for determining the location of major projects such as nuclear power stations, waste treatment plants and airports.

“How would you describe this period?” Touchstone asked. “For me – one of discovery. For world energy policy, one of coercion and compliance.”

#### AN AGE OF AWARENESS

As they paused for reflection, and the refreshing of their glasses, darkness has fallen over the estate, spiked with just a few shimmering lights from scattered cottages across the inlet. Ruth stood and slowly stretched, looking across at the holocaust was in front of which tomorrow she would receive her Gaia. It would be a virtual event. Few could afford the cost of international air travel these days – even for such a special occasion.

Touchstone shuffled his notes. The next part of Ruth’s career covered the period of his own privileged adolescence and his activist university years. He had campaigned against the reconstruction of an enlarged Sellafield – now named Jupiter Hall. He broke the brief silence. “After Brussels, you went to Beijing. A change of course, and of continent?”

“Yes. I was lucky enough to be selected to join the newly formed Global Energy Authority.” “A defining moment in your life?” “Certainly. But much more importantly, it must be remembered that the late 2020’s and all through the 2030’s was probably the time when the world finally woke-up. Since 2015 the onset of climate change had really been beginning to tell; blackouts and brownouts and extended breakdowns were becoming common place; water wars were waged across the world; extreme weather conditions were worsening global economic competition had replaced the Cold War as the prevailing international system; and mass migratory

movements placed enormous pressures on national governments. Then, from around 2025, the world began to change.”

“Why?” “It was a concerted confluence of conditions and circumstances. The global pandemic of 2019. The ‘figurehead assassinations’ of 2020 and 2021. The collapse of the Brazilian economy leading to the subsequent destabilisation of South America in 2022. The great stock market crash of 2023 and the implosion of Africa the next year. An isolationist United States, a fragmented Europe, ‘Chindian’ protectionism, militant Islamophobic Christian evangelicism, and of course, the strangehold of the organised energy cartels and their continuing conflict with the international Youth Now terrorist alliance. Armageddon seemed to have arrived. Then came the turning point.

No one event can explain it. Along with a generally shared sense of the world getting smaller and more vulnerable, and a growing awareness of the interconnectivity of issues, actions and peoples, there was the emergence of a new set of values which started to contribute significantly to the transformations in society we have experienced over the past quarter of a century”.

“How would you describe these changing values?” probed a rapt Touchstone. “Above all, a growing acceptance of cultural diversity, with a shift from a focus on multiculturalism, the acknowledgement and celebration of difference, to interculturalism, where the emphasis has increasingly been placed on what can be shared within a framework of mutual respect and common principles. It sounds a little pompous, doesn’t it.” Ruth added somewhat self-consciously. “Not at al. But how did this affect you and the role you know play?”

“During this period, let’s call it the ‘transformation’, it became clear that renewable energy from all sources was simply not going to compensate for the decline in fossil fuel reserves and meet the demands of the global economy as well as tackle environmental degradation. Ireland is a good example. Targets for renewable energy generation consistently fell far short of expectation. Not for any technical reasons, but mainly institutional. The unsightly spread of commercial wind-farms, the ill conceived early wave power plants and the deformed rural landscape subsidised biomass production, all combined to produce a public opinion and planning process backlash. The cost of renewable energy also remained high.” “Surely, no one ever denied the need to switch significantly over to renewables?” Interjected Touchstone. “Of course not. But a growing awareness dawned that a serious crisis faced mankind, sooner rather than later, if the shortfall in burgeoning world energy demands were not met. A radical solution was required. And the work I did for the GEA, the Global Energy Authority, leading to the World Council’s Energy Action Summit in 2030, showed that the only realistic answer was to invest hugely in the wide-scale development of nuclear power. We needed to buy time. Time to build a resilient and sufficient energy framework. Not just in terms of generation, but also in respect of transportation and connection policies and practices.”

“Were you worried in any way about this?” “Frankly no. I had come to realise that nuclear energy offered an abundant and reliable source of power. Costs of

construction had fallen. Prices were competitive. Experience of safe operation had expanded and matured. Compatibility with an evolving hydrogen economy was high. Health and environmental costs had largely been internalised. And, with advanced conversion technology, the source fuels of uranium and thorium are more than adequate for the transitional period of say 50 to 100 years before renewables can reasonably take over powering the world.”

“But what about nuclear waste?” The sonorous tenor of Touchstones interrogative became strangely sombre. He poured another large shot of whiskey for himself- then, more solicitously, for her. “Well...” Ruth said thoughtfully, sensing a slight constriction in her brow. “There is always the question of waste. To begin with, the pebble-bed HTGR technology first developed in the early years of the century has successively and successfully ameliorated nuclear waste disposal issues. On top of which, it does not disgorge large quantities of excess heat, is terrorist-resistant, solves persistent problems concerning weapon proliferation and is inherently safe.”

“There is still radioactive waste! Every generation has its obligations as trustee to protect the interests of future generations. Surely Dr. Saurin you subscribe to the Trustee Principle?” “Call me Ruth please. But when it comes to principles I tend more towards two other key tenets. First, the Precautionary Principle that actions which pose a realistic threat of irreversible harm or catastrophic consequences should not be pursued unless there is some countervailing need to secure an adequate continuing supply of global energy. And second, I adhere to the chain of Obligation Principle, whereby each generation’s primary obligation is to provide for the needs of the living and succeeding generations. Here, I would emphasise that near-term concrete hazards have priority over long-term hypothetical hazards. The energy gap is the greatest hazard we face right now.”

“What does this mean in practical terms?” “More storage sites. The existing geological repositories in Nevada, Siberia and the Gibson Desert of Australia have worked well, but we need multiple facilities in more locations. I am also convinced that the current accent on geologic disposal in deep boreholes should be augmented by oceanic storage containers. Ocean storage may have greater technical and political problems than land-based solutions, but arguably it provides greater protection over time because it negates the threat of terrorism.

Touchstone scowled sceptically for a moment, but quickly regained his professional composure. Keeping any note of sarcasm out of his voice, he continued: “What were your own achievements during this age of dawning awareness?” “Education mainly – though some would call it public relations. The nuclear power industry had gained a bad press for decades. Rationality had never been an ingredient in any debate about nuclear energy in my younger days. Indeed, it had been uniquely misrepresented. Especially in Ireland, largely as a result of Sellafield. My early and constant view, ever since going to MIT from DIT, was that the world faced an urgent, vast and growing need for increasing amounts of clean energy – and that during the 21<sup>st</sup> nuclear power provided the obvious answer. The most important single piece of work

I undertook, however, was the Global Energy Prospective produced for the GEA in 2028 which spawned a plethora of publications for dissemination at all levels of society. I like to think that this contributed towards a tipping-point in public opinion worldwide regarding the role and promise of nuclear energy.”

“And how would you describe this period?” “One of consciousness and competition – when the world became economic as well as acceptable.” Ruth looked wistfully at the clock. It was five minutes to midnight. How befitting she thought.

## AN AGE OF WISDOM

Coffees had replaced the whiskey, and a gusting wind had sprung-up around the lodge, rustling the woods and rattling the windows. Ruth threw a few more peat logs onto the smouldering embers of the fire, while Touchstone collected himself to conclude the conversation. “How do you see things now?” “We have come to recognise that the major issues facing us have all become global. Beyond the reach and remit of national governments. From climate change, cross-border pollution, desertification, the loss of biodiversity and the accumulation of space junk, to drugs trading, weapons trafficking, organised crime, the spread of epidemics and the constant threat of international terrorism. Energy supply and toxic waste disposal are at the forefront of these global issues. I believe we have now entered an age of wisdom where long-term strategic thinking outweighs short-run expediency, the collective good is more important than individual profit, social values transcend private aspirations and civic responsibility surpasses corporate greed.”

“How has this happened?” “We have learned to select from the best attributes of two distinct worldviews – the ‘mechanistic’ worldview and the ‘systemic’ worldview. The mechanistic worldview draws largely from the Occidental philosophical heritage of the north and west. Based on doctrines of rationalism and empiricism, its tools are observation, measurement and logical analysis, all residing within a lineal causal framework. It sees the world as a machine, the behaviour of which can be analysed and understood in terms of the properties of its parts. These properties can be studied in isolation, measured and quantified, and their actions and interactions with other parts calculated and predicted with identifiable degrees of certainty. The parts, in turn, can then be classified into neat categories and hierarchies. In ecological terms it is anthropocentric, with the human race seen as separate from and above nature, having a divine right to rule, changing its processes to provide maximum benefit to the human species”

Ruth paused for a moment, took a sip of coffee, before continuing on a favourite theme. “The systematic, or systemic, worldview draws mainly from Oriental philosophical heritage of the south and east. Based on ideas of holism and communalism, its tools are intuition, participation and adaptability, all residing within cyclical causal framework. It sees the world as an organism, a system encapsulating countless sub-systems all of equal importance. Together they form a whole which is greater than the sum of the parts. In ecological terms again, it is eco-centric, with the

human race as an inextricable part of the planetary system, influencing, and being influenced by the behaviour of the system.”

“The Gaia theory espoused by Lovelock” “Exactly.” “How apposite – please go on.” “Well, whereas the mechanistic worldview is goal-oriented, the systemic worldview is process-oriented. The mechanistic worldview stresses linear progression, hierarchy and fixed states such as equilibrium, as well as placing an emphasis on quantities and formulae, and where development is seen as synonymous with growth. The systematic worldview sees continuous improvement or an unfolding to a higher level. It stresses continual feedback and adjustment, networks within networks, dynamic balance or ‘homeostasis’, and an accent placed on quality and pattern. Measurement and prediction, moreover, are directed towards the qualitative features of the system’s behaviour, rather than the quantitative values of its variables at a particular time.”

“But how do you relate this evaluation to the use of nuclear energy?” asked Touchstone. “You have to understand that early thinking in the field of sustainable development tended towards the mechanistic, whereby the energy issue was to be addressed primarily by tackling a series of separate problems in a largely reactive manner, invariably by means of technology, and preferably against asset of indicators by which progress could be measured. The difficulty we found with this predominantly reductionist approach was that many of the criteria were qualitative, not quantitative, and therefore, subject to personal, political and cultural differences. Furthermore, these criteria would change as their relationships with one another changed, making it virtually impossible to define acceptable quantitative parameters for the energy gap objectively to be appraised.”

“So?” “Through time, the realisation dawned that a more systemic approach was suitable to understanding and managing sustainable development, and gauging the part nuclear power might play. This called for a more pro-active and flexible method of working. Instead of measuring progress towards a goal, such systems thinking monitored fluctuations within the system- so that adjustments could adroitly be made to keep the system in dynamic balance. Rather than posing mechanistic questions along the lines of ‘how much can we use, for how long?’ we tried systematically to provide answers in the form of ‘as little as possible, for as long as possible’.”

“How does this kind of thinking, talking, planning and acting, creatively and collaboratively, as to how current nuclear fission technology in energy generation can ultimately be phased out, fusion technology developed for a period, and renewable electricity generation sources be further promoted to ultimately take-over electricity generation completely. Nuclear power must be seen to have a limited future. It has become too cheap and too efficient. The balance on terms of the precautionary principle needs to be tilted back, and the chain of obligation forge some different links for future generations.” “How can this be done?” Touchstone asked.

“First and foremost we need a ‘new economics which, using systems thinking goes beyond conventional economic theory towards a more multi-disciplinary approach

which embraces the complexities of institutional change and the dynamic behaviour of large organisations and global systems. Put crudely, such a networked economy would be based on a financial framework, monetary system and accounting protocols which internalise the externalities and represent the interests of all groups of developed, developing and transition economies.”

“Quite a revolution.” “Yes. But really the secret lies, as so often it does, in education. The pace and degree of change and affecting all aspects of our lives makes the ability to explore, examine and evaluate alternative futures paramount. For the past thirty years or so I have been involved, through the World Futures Studies Federation, in designing and delivering ‘futures studies’ programmes to communities and constituencies at all levels of society around the globe. Changing the mind-set of young people particularly from all parts of the world, and from all cultures, so that they might control their lives and actions, and direct their choices for the future with a better understanding than have past generations is the key. We can shape the future if we want to. At least, thanks to nuclear power, we have the energy to do so.”

Ruth leant forward towards Touchstone. “And, before you ask, I would describe the period we are entering into one of community, civics and collaboration.”

Touchstone drained the last dregs of whiskey from his glass, uttered his thanks to Ruth and wished her well for her forthcoming award ceremony later that day. As he left the lodge he recalled the words of one of the leaders of yesteryear, he could not quite remember who: “If the present tries to sit in judgement of the past, it will lose in the future.”

### *PROPOSIUM*

*Over two thousand years ago the Roman writer Publilius Syrus stated: “In a heated argument we are apt to lose sight of the truth.” Clearly, there are problems connected to nuclear power, but it is difficult to see how the global economy can meet the twin challenges of climate change and adequate energy supply without nuclear power making a significant contribution to electricity generation for the foreseeable future. Renewable energy sources have the potential, through time, to play a larger and larger role, until hopefully; they provide the prime source of the worlds supply of electricity. Unfortunately, targets for steadily increasing the share of renewables are rarely reached; their absolute share of present energy production remains insignificant; the development of new sites often meets with local resistance; and many renewable sources are still more expensive than conventional fuels. Nevertheless, it is worth recognising that nuclear energy and renewables have one important feature in common. They give us access to virtually limitless resources of energy at negligible opportunity cost.*

*Taking a fifty year view, it is difficult to devise any realistic scenario based on sustainable development principles which does not depend significantly on nuclear fission to provide large-scale highly-intensive energy, along with renewables to meet*

*small-scale, often dispersed, low-intensity needs. The key proposal, therefore, is to promote the notion of sustainability by factoring-in all the external costs. A new economic model. This, of course, requires stronger strategic political will and much greater professional impartiality. A rare combination, but again it was Pubilius Syrus who coined the phrase:*

*“If you share your friend’s crime, you make it your own.”*