NUCLEAR ENERGY AT A MOMENT OF TRUTH

SIX REASONS BEHIND THE CASE FOR NUCLEAR POWER

BY JOHN RITCH III

Through the years, the simple word "nuclear" has become the focal point for a seemingly endless controversy, filled with passions and ideologies that sprang originally from a rational fear of nuclear war – but grew into an emotional, and now somewhat institutionalised, standoff that plagues public discourse as to how the world's nations can best meet their energy needs in the 21st century.

Along the way, the very idea of nuclear energy became a political and psychological surrogate. Scepticism about government, distrust of large corporations, worry over toxic industrial effluents, a subconscious fear of cataclysm – all these real feelings and fears are crystallized, for many people, in a vague concept called "the nuclear industry".

If we speak of the car industry, the clothing industry, the food industry, or the industries that provide fossil fuels, we are talking about long lines of production and delivery involving hundreds of thousands of employees processing commodities that are large in quantity and value. The vast revenues from these commodities generate powerful vested interests, well able and strongly inclined to devote resources to defend their position in the marketplace.

In contrast, with nuclear power we are talking about a plentiful commodity called uranium, the essential characteristic of which is that a little goes a long way. The mining, processing and use of that uranium fuel certainly create a degree of economic interest. But in size and scope that interest today is meagre in comparison to, say, coal, oil, or natural gas. Precisely because a mere handful of relatively inexpensive uranium is the energy equivalent of a trainload of coal, the vested economic interests represented in the nuclear fuel cycle are relatively small.

One could, perhaps, reason that a large vested interest in uranium might be found at the end-use point of the nuclear fuel cycle, where the marvellous energy density of uranium delivers its pay-off. But what we find instead is an entity called a utility, which is producing a generic product called electricity, usually by using a variety of fuels and power plants. If so, this multi-fuel utility may wish to defend its nuclear generation of electricity, but it wishes to defend its electricity generation using fossil fuels as well.

This ambivalence could change, of course – if there were a large or preferred market for a product called "cleanly generated electricity". At that point, a special value would suddenly attach to the electricity coming from uranium. But our societies still remain in the early stages of devising any such marketplace incentive.

All of which is by way of saying that in searching for the "nuclear industry" as an economic vested interest, one finds just about what Gertrude Stein found in Oakland: there isn't much there, there.

At the World Nuclear Association, we are working to unify and support the companies that comprise the global nuclear industry, and to promote the technology they represent. But despite what our Green opponents might suppose, we do not represent a vast economic interest. What we are fighting for is at least as much an idea as an industry.

My theme today is that this is an idea whose time has come: that nuclear energy, a half-century after its inception, has reached a moment of truth – in no less than six important respects:

■ First, the technology has come of age. Even while further progress lies ahead, nuclear power has reached a vibrant maturity – not just scientifical-

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ly, but in the institutions we have built to support and channel its use.

■ Second, on a national level, key issues affecting nuclear energy will soon demand decision. In Britain, as a prime example, the need for decisive action on nuclear power has reached a critical point, as it soon will elsewhere.

■ Third, fossil supplies may simply be inadequate to meet world energy needs. In global terms, we now project a future of such overwhelming energy demand that an enormous increase in nuclear power may well be necessary – *even leaving environmental concerns aside*.

■ Fourth, the valuable uses of nuclear power will soon multiply. The world is entering an era when the role of nuclear power is likely to diversify – from simply supplying electricity to supporting two other major elements of the world economy: hydrogen-powered transport and the making of clean water through desalination.

■ Fifth, and of profound importance, a massive shift toward nuclear power is now environmentally indispensable. As we confront what is arguably the greatest crisis in human history – the steadily debilitating effects of economic activity on the Earth's biosphere – the world simply cannot reconcile human need and environmental security without a heavy reliance on nuclear power.

■ Sixth, this moment of truth for nuclear power requires a *telling* of the truth. Given the urgent need for public awareness and political decision, those able to do so must now make the case for nuclear energy – forcefully, without apology or equivocation, and with persuasive effect. A great deal depends on developing the wisdom and will to exploit nuclear technology to full benefit.

Let me touch on each of these six aspects of nuclear power at what I am describing as a moment of truth.

Technological Maturity. By this I do not mean old age, but rather the emergence from a long adolescence filled with growing pains.

Through its history, four questions have surrounded nuclear power: proliferation, operational safety, waste, and cost.

Over the last half-century – beginning in fact with President Eisenhower's "Atoms for Peace" speech 49 years ago – science and diplomacy have combined to produce great advance in all four areas. This progress has built a strong foundation for a sharply expanded use of nuclear power in the 21st century.

In curbing weapons dangers, the Nuclear Non-Proliferation Treaty stands as a landmark success in diplomatic history. All but three nations in the world are now parties, and all but eight nations – those three and the five recognized as weapons-States under the Treaty – are subject to full-scope safeguards designed to deter and detect any attempt to make nuclear weapons.

In the 1990s, the discovery of Iraq's secret bomb programme led to the strengthening of those safeguards as the IAEA acquired improved detection technologies, greater access to national intelligence sources, and expanded investigative authority.

The NPT does not – and could not – ensure against all threat of illicit nuclear activity. But it does ensure against any realistic danger that a civil nuclear power programme would be used as a covert source for illicit weapons development. The NPT has created a wall of confidence that the production of clean energy by nuclear power will not abet those with malicious intent.

If anything, rather than a dangerous link, a useful *defensive* link may now exist – such that the worldwide IAEA monitoring required by the *peaceful* uses of nuclear technology now helps to provide an early warning system against *illicit* uses.

As a practical matter, proliferation concern is simply misplaced when we speak of using nuclear power to meet the world's clean energy needs. Most energy consumption today is occurring in countries

Photo: Delegates at the IAEA General Conference in September 2002 attend a briefing on nuclear energy by the Republic of Korea. (Credit: Calma/IAEA)

that already possess nuclear weapons or can be relied upon as good-faith parties to the NPT. And the largest growth markets in energy are China and India, both of which already have nuclear weapons.

In short, where clean energy from nuclear power will matter most, proliferation is not even an issue.

Turning to operational safety, progress is equally impressive. The creation of the World Association of Nuclear Operators (WANO) constitutes a remarkable achievement in private-sector diplomacy, establishing a second great nuclear institution to stand alongside the IAEA.

Impeccable safety practice must always be the nuclear industry's highest imperative. Through its network of technical exchange and peer review at all nuclear power plants worldwide, WANO has not only raised standards but has institutionalised a global nuclear safety culture.

On waste – which is in fact nuclear power's greatest comparative asset – the question has long been one of politics rather than science. Two developments are now coming into play that will improve this politics.

The first is a growing public recognition that this comparative advantage does indeed exist – that the question of waste, far from being unique to nuclear power, is the fundamental and almost surely incurable weakness of fossil fuel.

The second development is the practical progress being made to demonstrate by action that nuclear disposal is feasible. Last year's overwhelming vote in the Finnish parliament, this year's decisions on Yucca Mountain in America, and the progress under way in Sweden toward community acceptance of a permanent site are moving waste disposal from theory to reality.

The combination of Scandinavian moral authority and American technological leadership will send a message to the world – that nations should, and can, take responsible action to dispose permanently of nuclear waste.

This progress does not preclude the future advent of regional disposal sites. But that further progress can be made only after the principle of national responsibility has been confirmed. Only national actions can relocate the question of disposal from the realm of chronic controversy to the realm of accepted normalcy. This movement is now under way.

We can hope and expect that these recent developments will embolden governments in nations like Britain, where the absence of resolution on waste continues to act as a drag on rational decision concerning the future of nuclear power.

On the fourth factor, cost and competitiveness, all factors are positive. Factors internal to the industry should lower costs, while factors external to the industry are likely to raise costs elsewhere.

Within the industry, the multiplicity of reactor designs that characterized the first half-century of nuclear power will now give way to an era of standardisation that will inevitably lower costs of construction.

In the same vein, operational costs are being lowered by several factors: the practical experience of a half-century, the higher capacity factors encouraged by deregulation, the worldwide technological exchange facilitated by WANO, and the efficiencies of new reactor designs.

Meanwhile, in contrast to fossil fuel, uranium remains a small cost factor with a predictable price. Even if nuclear power expands sharply, the price of fissile material is unlikely to raise overall costs, particularly with weapons dismantlement providing a substantial supplement to known reserves. Today, one of every 10 American light bulbs is illuminated by fuel from Soviet warheads.

By the time any issue of fuel cost might arise, the world should be ready politically for the use of breeder reactors, which extract at least 50 times more electricity from uranium fuel. Technological advance, coupled to economic necessity, could also open the possibility of extracting uranium from seawater.

As to competitors, renewables are likely to remain dependent on heavy subsidy as they deliver limited output; while fossil fuels will almost surely be ever more subject to price rises and volatility, as well as to concerns about energy security and the environment.

As to how government action might affect the marketplace, any rational regime to curtail carbon – whether by a direct carbon tax or emissions trading – will raise the cost of fossil fuel and enhance the competitiveness of nuclear.

Only an irrational carbon control regime – such as a Climate Change Levy that includes nuclear power – will fail to enhance the comparative cost of nuclear power. Given

today's urgent environmental needs, any scheme that penalizes a major clean energy source is a perversion of public policy.

Overall, the traditional questions about nuclear power – proliferation, safety, waste, and cost – have been given sound and compelling answers. Drawing now on over 10,000 reactor-years of experience and still evolving as a robust technology, nuclear power has reached the early stages of a vibrant maturity – poised and well able to deliver energy cleanly and safely on a vastly expanding global scale.

Energy & Environmental Security. The second aspect of this moment of truth is the compelling national need – in many countries – to meet imperatives of energy and environmental security that simply cannot be met without nuclear power.

Nowhere is this truer than Britain. Historically, this nation has been blessed with ample fossil energy, which sustained its industrial revolution and supported its prosperity since. But Britain enters the 21st century with diminished fossil reserves and the challenge of operating a modern, high-energy economy with energy security, clean air and a steady reduction in greenhouse emissions.

Ten years ago, British electricity generation was dominated by domestic coal, with nuclear energy providing about 25% of electric power. A decade later, the "dash for gas" has produced a rough balance among coal, gas, and nuclear. Some reduction has occurred in greenhouse emissions – but at the considerable cost that Britain's once-rich reserves of precious natural gas are now largely depleted.

Under current assumptions that both coal and nuclear will be phased out by 2025, Britain can look to a future in which its electricity will come mainly from natural gas imported across thousands of miles of pipeline from Russia, the Middle East and North Africa – supplemented by a small share, yet unknown, from renewable sources.

Under this scenario, in just of a third of a century, Britain will have moved from total energy sovereignty to full dependence on unreliable foreign sources, supplemented by domestic sources only intermittently available.

As an alternative to this future of vulnerability, the UK's largest generator, British Energy, has propounded the theme that Britain must "replace nuclear with nuclear". This sensible message can be supported by the good arguments that "new-build" will occur on present sites, use existing transmission lines, maintain continuity of employment, and enjoy political acceptability in already-supportive local communities.

"Replacing nuclear with nuclear" also has the political virtue of not appearing to overreach. British Energy offers a future in which the nuclear share of electricity simply remains at 25%, while renewables grow to take an increasing share of the electricity now provided by coal.

To achieve even this goal will be no small feat. To replace Britain's aging nuclear stations, work must begin soon to build ten one-Gigawatt reactors over a period of 20 years – a task that BE's Executive Chairman, Robin Jeffrey, has described as "one of the biggest infrastructure projects every undertaken in the United Kingdom".

Given the looming prospect of dangerous energy dependence – and the need for nuclear energy to turn a political corner toward revitalization – British Energy's proposal is modest and eminently sound.

Yet it is a measure of Britain's current plight that even this extensive programme of nuclear new-build would in fact be *only a first step* in a sound strategy to meet this nation's energy security and environmental needs.

Even "replacing nuclear with nuclear" will leave Britain's transport sector fully dependent on foreign sources, its electricity sector nearly 50% dependent, and – not least – its emissions levels still considerably higher than any sound environmental regime must eventually require.

Each nation has its own energy profile. But the British example underscores the second aspect of this moment of truth: As the 21st century begins, the compelling energy and environmental needs of a modern industrial nation like Britain require a shift – of major and sustained proportions – toward nuclear power.

World Energy Demand. The third aspect of this moment of truth is that we may now be entering an era when global fossil supplies – with or without environmental constraints – are simply inadequate to meet world energy demand.

The question of carbon-energy reserves is one of the energy industry's most controversial issues; and a need for caution arises from the poor record of

past predictions, which have been regularly belied by a steady expansion rather than depletion of known fossil reserves.

This record of expanding reserves has reinforced the faith of those inclined to assume that the power of the market will always deliver us from shortage – that any increase in fossil scarcity will generate its own cure, as rising prices curtail demand and stimulate fresh efforts to exploit known resources and find new ones.

But even some in the petroleum industry are beginning to believe that this faith may now be misplaced. Recently the President of the French Association of Petroleum Professionals, Pierre-Rene Bauquis, delivered a remarkable paper, reappraising world energy supply and demand over the next fifty years.

The key point in this analysis is that past increases in identified reserves were, for the most part, a one-off phenomenon – in which known resources have been re-evaluated upward as to quantity and accessibility.

The upshot of this analysis is that this time the wolf may, in fact, be at the door.

The analysis starts with the generally accepted projection that world energy demand will double and possibly triple by the year 2050.

Where the analysis becomes interesting is in the projection of the limits to the growth of fossil fuel, even in the absence of environmental constraint.

Over the next 50 years, it projects that coal and gas production can do no more than double, while oil production first rises but then falls back below current levels.

If this occurs, then total fossil production can rise by only 50% in the face of a doubling or tripling of world energy demand.

This scenario leaves an enormous energy gap to be filled by nuclear and renewables. If we then apply realistic assumptions about the potential growth of renewables, nuclear power must increase by a factor between 7 and 20 times in the half-century ahead.

This would mean a world with somewhere between 3000 and 8000 1-Gigawatt reactors – requiring a rate of power plant construction over the next 50 years of no less than one-per-week at the low end and as many as one-every-two-days at the high end.

What this projection suggests is the significant possibility that a massive shift to nuclear power in the coming decades may be driven not only by environmental policy but also by real limits on the availability of fossil fuel.

Diversification. The fourth aspect of this new era for nuclear power is diversification of purpose.

In recent years, as the concept of sustainable development has gained global currency, supporters of nuclear technology have rightly touted its vast potential as a source of cleanly generated electricity.

Proponents have also pointed to a dazzling array of nuclear applications that can make a highly cost-effective contribution to sustainable development by using radiation and radioisotopes to help grow and preserve food, improve industrial quality control, support environmental analysis, enhance nutrition, protect livestock, and diagnose and treat human disease.

In both areas – electricity and technical applications – the contribution of nuclear science can be immense.

But as our vision of a sustainable future comes more clearly into focus, we are beginning to foresee two other fundamental roles for nuclear power – each requiring clean energy in the vast quantity that only nuclear power can provide.

The first is desalination to create clean water. Not just in the Middle East but also in many other populous areas throughout the world, the rate of consumption of potable water is now far exceeding its replenishment, creating the spectre that within the next 25 years more than half of global population could be facing a desperate shortage of fresh water.

Nuclear power offers the largest available option for a massive production of drinkable water that does not compound humanity's assault on the environment.

Producing clean water through nuclear-powered desalination can be achieved through stand-alone projects using techniques that are already well understood.

In contrast, the second potentially enormous new role for nuclear energy – the use of nuclear power to support hydrogen-driven transport – will arise through a process of sweeping systemic change in modern economies. But such change can already be seen on the horizon.

The simplest way to think of it is that future transport in a clean-energy society will be powered mainly by electricity, and that batteries and hydrogen

are both ways of storing that electricity. Only nuclear power can deliver the vast quantities of clean primary energy that this system will require.

Hydrogen can also be consumed non-electrically, and without carbon emissions, in a normal internal combustion engine, and many test cars are already so equipped. But hydrogen's main use in transport is likely to be in fuel cells that catalyse the oxidation of hydrogen directly to electricity.

Hydrogen may be stored at very low temperature cryogenically, or at high pressure, or chemically as hydrides. For cars, hydride storage is seen to have the most potential.

The first hydrogen-fuel-cell electric cars are expected to be on the fleet market in 2004.

There is already today a major worldwide industry that provides hydrogen as a chemical used in making nitrogen fertilizers and in converting low-grade crude oils into transport fuels. But this hydrogen is made from natural gas, giving rise to emissions of CO_2.

To make hydrogen cleanly and on a large scale, two nuclear-powered processes are conceivable. In the short term, hydrogen can be produced economically by electrolysis of water using off-peak nuclear power. In future, a major possibility is direct thermo-chemical conversion of water using high-temperature reactors.

Distributing hydrogen in quantities to support a full-fledged transport system will, of course, require major changes in infrastructure. But this transition will be abetted by the non-transport uses of hydrogen.

In the USA, for example, a sizable hydrogen distribution system already exists, using pipelines that allow production facilities to be remote from users.

Another transitional step toward a full-scale hydrogen distribution system arises from the fact that hydrogen can be used for stand-alone small-scale generating plants.

In a large residential or office complex, for example, it may be economical to produce hydrogen on-site using cheap off-peak electricity and then to convert that hydrogen to electricity so as to save money in peak periods. Urban and suburban sites such as this could meanwhile perform double-duty as local distribution points during the early days of hydrogen-powered transport.

One of the beauties of the nuclear-hydrogen link is the harmony between electricity generation and the making of hydrogen. Heretofore, nuclear power has been seen solely as a base-load supplier of electricity. The use of hydrogen to store energy for transport opens the possibility of operating nuclear plants to meet electricity demand at higher levels – even at peak-load – using all excess power to make hydrogen.

The shift to a hydrogen economy will, of course, require a major nudge from government in the form of mandated usages or else limits and penalties on carbon. But once under way – once the direction is set and widely understood – the ingenious creative forces of the free market can be expected to take flight, propelling us into this future with a speed that could be breathtaking.

Indeed, this transition to a clean-energy economy – fully incorporating the principle of hydrogen produced by nuclear power – is precisely the kind of vision that can excite and motivate a whole new generation of environmentalists, scientists, and entrepreneurs.

Catastrophic Climate Change. This vision points to the fifth and most profound aspect of nuclear power at this moment of truth – its indispensable role if the world is to avoid catastrophic climate change.

Shifting to sustainable economies will require many changes in technology and human behaviour. But no aspect of achieving sustainability is more fundamental than producing vast amounts of clean energy for a growing world population.

Under no realistic scenario can this challenge be met without *a central role for nuclear energy* – and an enormous worldwide growth in the industry that provides it.

A few simple facts capture the dimensions of the global challenge. Habituated as we are to the old geopolitics of the Cold War, we have been slow to recognize that these facts now constitute the dominant realities of 21st century geopolitics. They are facts from which no country can escape:

- First, in the next 50 years, global population will grow from 6 billion to 9 billion. In a world where human misery is already vast and widespread, unmet human needs will multiply drastically.
- Second, between now and 2050, as countries seek to meet the needs of this exploding population, global energy consumption will double and possibly triple. In just that narrow period, humankind will consume more energy than the

total consumed in all previous history.

■ Third, the global rate of CO_2 emissions – already 25 billion tonnes a year, or 800 tonnes a second – is still growing. The projected greenhouse gas accumulation will, within the 21st century, rise to more than double the pre-industrial level.

■ Fourth, to stabilise greenhouse gases, even at that higher and possibly perilous level, requires that global emissions be cut by 50%. Developing countries will inevitably emit more greenhouse gases. Thus, any hope of averting catastrophic climate change depends on industrialised countries cutting emissions by 75%.

These facts – facts still barely appreciated by many key policymakers – tell us that if history is a river, mankind is about to hit white water.

The Kyoto Protocol represents one small step toward global action on the environment. But as its limited goals and faltering success underscore so vividly, our governmental institutions are only *just beginning to* respond to the great global challenges that now demand a dominant role for nuclear power.

A serious climate regime – if one is to evolve – must go far beyond Kyoto, by encompassing all nations and by employing some variation of the concept known as "contraction and convergence":

■ *Contraction* means that over the century ahead we must plot a path that will reduce overall global emissions by at least 50% – even as populations and economies expand.

■ *Convergence* means that, in this process, we must accept the principle that every person on Earth is entitled to an equal per-capita level of emissions.

Stated in this stark manner, the goal of 50% contraction seems draconian, while the principle of equal entitlement to emissions seems utopian. In fact, both concepts are eminently practical.

As to contraction, nothing short of a 50% emissions reduction offers any hope of averting catastrophic climate change. This cutback – entailing a 75% reduction in today's advanced economies – accomplishes no more than stabilizing global greenhouse gases at a level over twice that which existed just two centuries ago.

As to convergence, nothing *other* than the principle of equal entitlement offers a basis for the global consensus on which an effective climate regime must depend. Equal entitlement does not mean equal emissions; it is, rather, the basis for an allocation of rights on which a fair and rational emissions trading system can be built.

A system based on this principle – and, I venture to say, *only* a system based on this principle – can be designed to produce the sense of equity, the predictability, and the sound economic incentives needed for smooth transition into a clean-energy future. These incentives can work constructively in developed and developing countries alike.

In this schema, the sense of equity and predictability are created at the very outset of the regime. A nation's population size at an agreed point would be the basis for establishing its long-term emissions ceiling, toward which it would be committed to move on a steady path.

To facilitate a smooth and economically rational transition toward that goal, emissions trading would enable countries and companies to chart their own best path – selling permits where possible, buying them when necessary.

The rate of convergence to a common level would be designed to ensure that, during the long transition, already-industrialized nations as a whole would find it advantageous to purchase emissions permits from countries less developed.

This capital flow could serve the common interest in sustainable development – and climate stability – by financing clean-energy infrastructure in the developing world.

Building this regime is not beyond human wit. Indeed, its simplicity and feasibility stand in favourable contrast to the chaos, social dislocation, vast expense and human misery that unrestrained climate change could bring – and from which no nation would be immune. If the Gulf Stream ever flipped, as some scientists fear, the people of Britain could learn very quickly what it means to live to Lapland.

The world's unsteady progress toward achieving any such regime has been sound cause for profound worry.

Because so much attention has focused on American policy, it bears mention that the essential concept of emissions trading was a valuable American contribution to the climate change process – derived from successful US experience with our Clean Air Act and introduced into the Kyoto Protocol over strenuous opposition from European Greens, whose attitude is that no good

can occur without severe corporate pain.

I hasten to add that current American policy, or lack thereof, constitutes an unworthy abdication of leadership that must be corrected, either by President Bush or his successor. If Kyoto is indeed flawed, as is certainly the case, the United States owes the world a soundly reasoned counter-proposal – instead of an insistent denial that the climate problem even exists.

At this stage, little useful purpose is served by dwelling on whether the United States will ratify the Kyoto Protocol. The chances are in fact nil; and, even if implemented to full effect, the commitments inherent in Kyoto represent scant and incoherent progress toward long-term goals that can be successfully pursued only through a strategy of grand design.

It is time to begin looking *beyond* Kyoto and to ask what it would take for all the world's nations – industrialised and developing – to embrace the kind of far-reaching commitments embodied in the "contraction and convergence" concept.

The major obstacle, I would contend, lies not in this basic construct, which has already shown wide appeal, but rather in the absence of a generally accepted vision of how, realistically, those commitments might be fulfilled.

Once that vision comes into focus for a substantial body of world opinion – and only then – will we have the necessary political foundation for the far-reaching commitments this problem so urgently requires.

Making the Case. *The urgent need for this clear and realistic vision brings us to the sixth aspect of nuclear power at this moment of truth – the necessity that the case for nuclear energy now be made powerfully and with political courage.*

Nuclear energy today faces two barriers:

- One barrier consists in the persistence of misinformation about the technology itself, ranging across all the familiar questions – and folklore – relating to safety, waste, proliferation and cost.
- A second barrier is an incomplete appreciation, even at the highest levels of government, of the full severity of the global problem that urgently demands the massive clean energy contribution that only nuclear power can make.

In many countries, these two barriers tend to be associated with the two sides of the political spectrum. On the political left we see a resistance to nuclear technology, and on the political right a resistance to dealing decisively with the huge environmental and developmental problems that nuclear energy must be used to solve.

Putting it starkly, the political right still hasn't embraced the problem, and the left still hasn't embraced the technology that is essential to the solution.

One half of this syndrome – negligence of the problem – is reflected in current American policy.

The other half – a fantastical approach to the solution – is found among many of those engaged in the climate change negotiations. With genuine conviction, they urge us to solve a monumental and very real problem. But the vision they proffer as a solution – a combination of conservation and a landscape dotted in windmills – is rooted in romantic ideology rather than reality.

What our world desperately needs today is a constructive synthesis. Our goal must be to build a substantial and growing body of opinion – among citizens and politicians across the full political spectrum – that recognizes the full severity of the problem we face while embracing a vision that is technologically feasible.

That vision is now available in the image of a future society that evolves toward a high reliance on nuclear power and renewables to supply electricity directly and via hydrogen to meet its comprehensive energy needs.

In the creation of a political coalition to support that vision, the battle must be fought – primarily at the national level – in countries around the world. Given Britain's eminence and influence as a world leader, an organisation like the British Nuclear Energy Society (BNES) can be of immense value.

Traditionally, it may have been sufficient to regard the BNES as a learned society. Now, it is fair to say that history summons you to a more active role. You are the custodians of a technology that your own nation and the world need to a degree far greater than is generally understood. It falls to you, therefore, to enlist as front-line troops in the battle for public comprehension and support.

Our goal at the World Nuclear Association is to help you and others – in all ways possible – to pursue this battle to nothing less than victory.

I find it not melodramatic at all to say that the very future of our world depends on it. ❐