The Wider Economic Impacts of Nuclear Power

A briefing for the government from
Tom Burke, Tony Juniper, Jonathon Porritt, Charles Secrett

20 April 2012

"Those suffering from nuclear amnesia have forgotten why nuclear power faded from the energy scene in the first place, how many times it has failed to deliver, how often it has disappointed its most determined advocates, how extravagantly it has squandered unparalleled, unstinting support from taxpayers around the world, leaving them with burdens that may last for millennia"

Walter Patterson, 2006

The Headlines

1. Costs The costs of nuclear power are notoriously hard to predict and subject to huge budget inflation. But we can say with absolute confidence that, even controlling for inflation, nuclear power is getting steadily more expensive. At the same time, renewables are falling in price as they hit economies of scale and enter their investment 'sweet spot' where technological innovation is rapid and matched by falls in cost. The nuclear timescale is 30+ years; there is abundant evidence that much renewable energy will be cheaper than nuclear energy within the next few years, and may already be so.

2. The European Single Market (ESM) The ESM is a cornerstone of the EU's strategy for economic growth in Europe. Part of the ESM is the commitment to a completely liberalized European electricity market by 2020. Nuclear build does not prosper in highly competitive markets, where construction and other costs are a key determinant of investor priorities. In addition, there will be major infrastructure upgrades.

3. Carbon Leakage In its rush to nuclear, the UK government has committed itself to huge carbon price subsidies via the Carbon Floor Price (CFP). If this is not done Europe-wide, energy-intensive UK industry will move abroad taking jobs and growth with it. Nuclear power is the only source of low-carbon energy that requires such a high CFP, and that it be introduced right now, before similar schemes are introduced across the EU.

4. Impact on the UK Jobs Market Since it now appears that the only reactors to be built in the UK will be to a French design, built by a French company and operated by another French company, both owned by the French state, it is likely that the overwhelming majority of 'suitably qualified and experienced personnel' (SQEP) will be French. Even subcontractor consortia that do not include a French company are being excluded from the bidding process.

5. Job Generation Nuclear energy is highly capital-intensive meaning that the cost of each nuclear job is higher than in any other form of generation. Per terawatt-hour, nuclear is also the least job-productive form of electricity generation.

1. Costs

1.1 Optimism Bias

The cost of energy is the major factor in economic growth in advanced economies. There is now a well-established body of evidence that shows a clear correlation between oil prices (standing as a proxy for all energy prices) and the GDP of advanced economies.[1] So the major impact that nuclear power will have on the wider economic picture in the UK will be its impact on the cost of energy.

The problem with analyzing that impact is that it's hard to know what the cost will be. A report by Sussex University found that 'given the uncertainties attaching to the basic data that contributes to calculations… apparently definitive numbers should be treated with caution in the case of UK nuclear power'.[2] However, there is ample evidence to indicate that when nuclear costs are revised, they are invariably revised upwards. The point about 'optimism bias' in estimating the costs of nuclear new build has been covered more fully in our previous three briefings, but it is worth a quick review of some of the figures.

EDF's most recent estimate for the cost of its proposed Hinkley C reactors is equivalent to $4,260/kW.[3] As the anti-nuclear group No2Nuclear has pointed out, this is more than double the UK Government's 2008 predicted cost of $2,000/kW.[4] It's also different from the figure that EDF gave to UBS in 2010 of $4727/kW, i.e. 11% higher than the figure they now use.[5]

But these all estimate the final cost of a plant where building has not started. When it comes to actual projects currently underway, the figures get worse. According to a report into the anticipated running costs of the Olkiluoto EPR in Finland (under construction since 2003, originally scheduled to start generating in 2009, present estimated completion date 2014):

'Areva's latest estimate (August 2009) is that costs have risen by an additional €2.3bn and could increase further depending on the outcome of negotiations between the owner, TVO, and Areva on the timeline for completion. Therefore at a running total of €5.3bn, costs stand at €3,300/kw ($4,785/KW).'[6]

This figure is 12.3% higher than the figure EDF is presently suggesting that the Hinkley EPR will cost. However, even since that prediction was made, Areva has announced a new 13% upward cost revision, taking the cost of Olkiluoto to €5.7 billion and the kW cost to over $5,000/kw.[7] What the final figure will be is anyone's guess.

Some might be tempted to assume that these figures are confined to the notoriously problematic EPR favoured by EDF. This is almost certainly not the case. In the USA, where the EPR is unlikely to be built, investment analysts argue that even these constantly revised figures are far too low. As long ago as October 2007, Moody's Investor Services (one of the "Big Three" ratings agencies) reported that the cost of nuclear new build would be $5000-$6000/kW, but they now feel that this is far too optimistic. "The numbers have simply gone flying past our highest 2007 estimates," says Jim Hempstead, a senior vice president at Moody's,[8] which now predicts new nuclear power plants will cost $7,500 per kW to build.

Perhaps investors are too shrewd to simply take engineers' and constructors' estimates at face value and have factored in cost over-runs. Recent academic research has shown that the actual cost of building new nuclear reactors has been about three times the estimate for new builds completed in the 1990s.[9]

[1] Oil price Shocks and Real GDP Growth; Empirical Evidence for some OECD Countries I, European Central Bank, Working Paper Series No. 362, May 2004.

[2] The Economics of Nuclear Power; A Report to the Sustainable Development Commission, University of Sussex and NERA Consulting, November 2005.

[3] Representation No. 515. From Peter Roche, received 17 January 2012, National Infrastructure Planning, Hinckley Inquiry. Accessed on 2 April 2012 at: http://infrastructure.independent.gov.uk/projects/south-west/hinkley-point-c-new-nuclear-power-station/?ipcsection=relreps&relrep=515

[4] The Cost of Nuclear Power: Why nuclear will cost us more than the alternatives. No2Nuclear Briefing, February 2011

[5] Can nuclear power survive Fukushima? Global Equity Research UBS Investment Research Electric Utilities April 2011 UBS p20

[6] Industrial Masochism; the Carbon Floor Price and Energy Intensive Industry, Mathew Sinclair, The Taxpayers Alliance, November 2011.

[7] EPR in Crisis, Professor Steve Thomas, PSIRU Business School Greenwich University Nov 2010. Accessed on 24 March 2012 at: http://216.250.243.12/The%20EPR%20in%20crisis%203-11-10.pdf

[8] Bad Reactors; Rethinking your opposition to nuclear power? Rethink again. Washington Monthly, Feb 2009. Accessed on 2 April 2012 at: www.washingtonmonthly.com/features/2009/0901.blake.html

[9] "The economics of nuclear reactors: renaissance or relapse?" Mark Cooper, Vermont Law School, June 2009, bit.ly/AgDts6

1.2 The cost of nuclear is increasing – even if we ignore the optimism bias

Estimating costs for large-scale, complex projects is notoriously difficult. Costs can reasonably be expected to rise as time passes so perhaps discrepancies should be expected. Perhaps nuclear is, by its nature, hard to estimate and we should simply factor in over-runs? Perhaps. But there is strong evidence that nuclear costs steadily and persistently increase over and above the rate of inflation.

In May 2009, the Massachusetts Institute of Technology published an update of its 2003 study into construction costs of large-scale engineering projects. The report stated that, 'since 2003, construction costs for all types of large-scale engineered projects have escalated dramatically', but that the estimated cost of constructing a nuclear power plant 'has increased at a rate of 15% per year heading into the current economic downturn'.[10] Other reports echo these findings, suggesting that real-term costs have been rising consistently since at least the 1970s.

A review of the French PWR programme of the 1970s, 'arguably the most successful nuclear scale-up experience in an industrialised country', with a high degree of standardisation, short construction times and rapid, centralised decision-making, concludes that, 'even this most successful nuclear scale-up was characterized by a substantial escalation of real-term construction costs…[and]… illustrates the perils of the assumption of robust learning effects resulting in lowered costs over time in the scale-up of large-scale, complex new energy supply technologies'.[11] Another report into the same French PWR project states that between the first and last reactors built, costs increased by more than a factor of three.[12] In general, costs fall as a technology enters 'maturity'. With nuclear technology, we see clear evidence of the opposite effect.

1.3 Renewables are hitting their 'sweet spot' for technological innovation and costs reduction

As nuclear costs continue to rise, the alternatives are starting to fall in price rapidly, as a US analyst points out:

'... the costs of nuclear energy have been escalating very rapidly since 2002. The lowest cost renewables, appropriately sited, are already competitive with nuclear. Several more expensive renewables could be competitive with nuclear by around 2020. Furthermore, most renewable energy technologies are capable of much faster growth than nuclear energy ...'.[13]

Ernst & Young suggest that, by 2020, it is likely that commercial and industrial consumers in the UK will be able to generate their own electricity using PV (photo-voltaics) at a cost, without subsidies, that will be competitive with buying it from the grid.[14] A similar date is suggested by other analysts; a report by the European Photovoltaics Industry Association shows that, because of rapidly falling prices, solar PV is likely to become a competitive source of electricity in the UK by 2019, without subsidies—not just for householders paying domestic retail prices, but also for wholesale generators and large commercial and industrial consumers. In sunnier countries like Spain, Italy and Greece, PV will become competitive much earlier, perhaps as soon as 2013.[15]

The same effect is being seen with wind power. According to WWF, Siemens has stated that offshore wind power could be fully cost competitive globally between 2020 and 2025,[16] while E.ON expects to cut costs for building offshore wind farms by 'about 40 percent by 2015'.[17]

Greg Barker MP, Minister of State for Climate Change, has said "There is the potential for solar power to become

[10] Update of the MIT 2003 Future of Nuclear Power, Massachussetts Institute of Technology, 2009. Accessed on 2 April 2012 at: web.mit.edu/nuclearpower/pdf/nuclearpower-update2009.pdf

[11] The costs of the French nuclear scale-up: a case of negative learning by doing, Energy Policy, 38, 2010.

[12] An assessment of the costs of the French nuclear PWR program 1970-2000, Interim Report IR-09-036, International Institute for Applied Systems Analysis, Austria, October 2009.

[13] "Comparing the economics of nuclear and renewable sources of electricity", paper presented by Mark Diesendorf at Solar2010, the 48th AuSES Annual Conference, bit.ly/zzoR0m

[14] "Ernst & Young UK solar PV industry outlook: the UK 50kW to 5MW solar PV market", Ernst & Young, June 2011, bit.ly/yntgfx.

[15] "Solar Photovoltaics competing in the energy sector – on the road to competitiveness", European Photovoltaics Industry Association, September 2011, bit.ly/z88k2L.

[16] Clean energy future within our grasp, WWF press release, October 2011. Accessed on 2 April 2012 at: http://www.wwf.org.uk/what_we_do/press_centre/?unewsid=5375

[17] EON to Cut Costs of Building Offshore Wind Farms 40% by 2015, Bloomberg, 14 March 2012. Accessed on 2 April 2012 at: http://www.bloomberg.com/news/2012-03-14/eon-to-cut-costs-of-building-offshore-wind-farms-40-by-2015.html

competitive with fossil fuels without subsidy within the lifetime of this parliament [i.e. before May 2015]. Solar has gone from being one of the most expensive forms of renewable energy to one of the cheapest".[18]

The huge cost of nuclear power is, of course, the reason why private investors have been so wary of getting involved. But when investors can see real falls in the price of the alternatives that wariness increases. Nuclear already fails to compete with the fossil fuel alternatives. Utilities analyst UBS Global states baldly: 'in developed markets, nuclear is not competitive with gas'. They calculated that the gas price needed to make nuclear competitive is 'three to five times the current US gas price and much higher than other gas prices around the world'.[19]

Nuclear power will drive up energy prices in the UK, and act as a drag on economic growth. The nuclear timescale – they need to be operated for at least 40 years to achieve any meaningful payback – means that the disparity between the cost of nuclear and that of renewables will be an issue for decades to come.

The near-impossibility of tempting private investment (well illustrated by the March 2012 decision by German utilities E.ON UK and RWE npower to pull out of the UK nuclear business) means that it is almost certain that, if nuclear does go ahead in the UK, the only participant will be a nationalized company such as EDF, which will effectively be able to placed in the position of being able to demand whatever 'sweeteners' it needs from the UK Government in order to salvage its nuclear strategy. Simon Harrison, energy director at Mott MacDonald, has warned publically that the unravelling of the Joint Ventures would allow EDF Energy, as the sole player, to demand even higher subsidies to go ahead with its own plans. The subsidies would be funded by consumers (i.e. householders and businesses) via higher energy bills.[20]

[18] "Energy minister Greg Barker says decision to cut feed-in tariffs was justified by fall in cost of solar panels", The Guardian, 2012-02-08, bit.ly/zrm2K3.

[19] Can nuclear power survive Fukushima? Global Equity Research UBS Investment Research Electric Utilities April 2011 UBS p22.

[20] The Times 29 March 2012 Accessed on March 25 2012 at: www.thetimes.co.uk/tto/business/industries/utilities/article3367982.ece

2. The European Single Market in Electricity

Because of the connection between low energy costs and economic growth, noted above, and the correlation between low energy costs and market liberalization, a single European market for electricity in Europe has long been a cherished policy goal in Brussels. Since Directive 96/92/EC in 1996, which began the process of breaking up the old state monopolies and disentangling electricity-generating companies from distribution and transmission companies, the EU has sought to create a free market in production and supply of electricity within the Community. Completion of the European internal market for electricity, which should be in place by 2020, will mean that any consumer in the UK will be able to buy electricity from any supplier, anywhere in Europe. There is already a single market for electricity within the UK, and the UK Government supports the further integration of the European internal market for electricity.[21]

As well as liberalizing the business structure of the European electricity market, the EU is pushing through an ambitious rebuild of the physical infrastructure. The European Electricity Grid Initiative (EEGI) will see a huge expansion in cross-border energy supply capability. This should lead to lower energy prices as spare capacity can be reallocated without the need for shutdowns etc. High speed major network upgrades are now possible. For example, the recently-completed BritNed link between the UK and the Netherlands was installed in about 18 months. It is likely that, by 2020, the European transmission network will have been significantly strengthened.

The Single Market and enhanced grid capability are policies that are intrinsic to the EU and its vision of economic and social development across the single market. But they will both come into conflict with the needs of the nuclear power industry for several reasons. First, liberalization will lead to lower prices, exposing nuclear's cost problems. Second, this cost competition will be exacerbated by the rapid fall in the price of renewable energy. Third, as electricity flows freely between nations, generators will increasingly balk at the subsidies that nuclear power receives. Nuclear subsidies are already being challenged by an NGO, Energy Fair, and it is increasingly likely that major non-nuclear utilities will bring pressure to bear on the Commission to resolve these anomalies.

Lastly, as major European economies such as Germany, Italy and the Nordic nations generate an increasing percentage of their power from renewables and seek to optimize grids for that purpose (for example, by load-following rather than base-loading), there will be increasing conflict between nuclear and non-nuclear states on grid policy - a conflict that will most likely be won by the largest 'bloc', i.e. the non-nuclear one.

[21] "... the Government fully supports further integration of the EU electricity market ...", "Planning our electric future: a white paper for secure, affordable and low-carbon electricity", (para. 9.2.1.) Department of Energy and Climate Change, July 2011, bit.ly/xWnr7b.)

3. Carbon Leakage

When carbon taxes are imposed in order to make renewable or low-carbon energy production more competitive in the energy market, one possible consequence is carbon leakage, the process by which energy-intensive industries shift their major energy-using processes to countries that are not imposing carbon taxes. This obviously has potentially major negative consequences for jobs and for the UK's balance of payments.

MPs on the Energy and Climate Change Select Committee have warned that the Government's decision to set a unilateral Carbon Price Floor could have a "devastating effect" on UK industry, and will artificially raise electricity prices for consumers while having no overall impact on emissions.[22] Tim Yeo MP, Chairman of the Committee, said:

"The Chancellor was right to say we won't save the planet by putting the UK out of business. Ironically, however, it is the Treasury's decision to set a Carbon Price Floor that could result in industry and electricity production relocating to other EU countries. Unless the price of carbon is increased at an EU-wide level, taking action on our own will have no overall effect on emissions other than to out-source them. A revenue-raising exercise disguised as a green policy won't help anybody— the price of carbon has to be increased at an EU level to kick start investment in clean-energy."[23]

The Engineering Employers Federation (EEF), the largest representative of manufacturing industry in the UK clearly agrees, viewing the Carbon Price Floor as a huge risk to the UK's manufacturing competitiveness.[24]

What's Carbon Leakage got to do with nuclear?

Carbon Taxes have the potential to trigger carbon leakage, and would thus need to be introduced on as wide a scale as possible, certainly pan-EU, and ideally globally. But why is carbon leakage and the corresponding loss of jobs and growth for the UK economy a nuclear issue? After all, carbon taxes benefit all low-carbon or renewable generators, and reducing carbon emissions remains essential in controlling climate change.

The problem is that the UK Government has decided it needs nuclear to be built now – or, at any rate, for construction to be under way within a year or two. That's because of the very long lead times for nuclear construction. In order to get private investors to put their money into UK nuclear new build, the Government has no option but to provide a very attractive Carbon Floor Price and to do so immediately. That's why it has to act unilaterally and why it is (apparently) prepared to sacrifice all those parts of the UK industrial sector that will be rendered uncompetitive by that Price. The EEF has made it clear that it believes this is a premature move:

'The Carbon Price Floor provides subsidy for new low carbon generation ***long before it is needed*** and is seen as purely a government revenue generation scheme that adds unilateral costs onto UK manufacturers.'[25]

Sadly, as the recent decision by German utilities E.ON UK and RWE to pull out of the UK nuclear programme illustrates, the Carbon Price Floor may be high enough to devastate swathes of the UK's industrial sector, but not high enough to actually nail down the billions of pounds-worth of private investment into nuclear build that the Government is so desperate to attract.

[22] Go-it-alone UK Carbon Price Floor could harm industry and consumers, Energy and Climate Change Select Committee, 26 January 2012.Accessed on 1 April 2012 at: www.parliament.uk/business/committees/committees-a-z/commons-select/energy-and-climate-change-committee/news/eu-ets-publication1/

[23] Go-it-alone UK Carbon Price Floor could harm industry and consumers, Energy and Climate Change Select Committee, 26 January 2012.Accessed on 1 April 2012 at: www.parliament.uk/business/committees/committees-a-z/commons-select/energy-and-climate-change-committee/news/eu-ets-publication1/

[24] MPs Question Unilateral Climate Policies, EEF Environment Blog, 26 January 2012. Accessed on 1 April 2012 at: www.eef.org.uk/environmentblog/?tag=/climate+change

[25] MPs Question Unilateral Climate Policies, EEF Environment Blog, 26 January 2012. Accessed on 1 April 2012 at: www.eef.org.uk/environmentblog/?tag=/climate+change

4. Impact on the UK Jobs Market

As of April 2012, it appears that the only firm commitment to the UK nuclear project is from the EDF-dominated NuGenNNB, which means that it will be the European Pressurised Reactor (EPR) that will be built. The EPR is a French design built by a French company, AREVA, that is owned by the French state, and which is being commissioned by a French generation company, EDF, also owned by the French state. It would be natural to expect that the most important jobs in any such project will go to French employees. On 26 February 2012, the Daily Telegraph reported that British companies will 'struggle to win the bulk of the £60 billion expected to be spent', despite David Cameron's claim that the 'vast majority' of the content should be 'constructed, manufactured and engineered' by British companies. The Telegraph noted that 'with the heart of the new power stations based on French designs and technology, Mr Cameron has been warned there is little prospect of achieving his aim'.[26]

Industry observers agree. Dr Tim Fox, Head of Energy at the Institution of Mechanical Engineers, said in response to the nuclear power deal between the UK and France, 'this is not necessarily the best deal for securing UK jobs and skills', and that most of the contract for new plants 'will go to France rather than the UK'.[27]

The UK construction industry believes that this process of excluding UK firms and UK workers has already begun. On 2 March 2012, it was reported that ConstructEnergy (the last construction consortium without any French partners, consisting of Costain, Sir Robert McAlpine and Hochtief bidding to build plants for EDF) had been informed that they had no chance of winning. Building Magazine reported:

The fact that the remaining bidders for the civils package include French-owned contractors, has led to speculation that the decision reflected a desire on the part of EDF, in which the French government has a controlling stake, to award the contract to a French firm. The ConstructEnergy consortium was told there were technical reasons for the decision, but one source said: *"It wasn't overt, but there's a feeling it was a political decision to go with the French bids. When it's essentially French government money, it's understandable".*[28]

And this need not be a simple case of narrow economic nationalism. The use of 'SQEP' (Suitably Qualified and Experienced Personnel) is considered a critical part of the safety culture that must be built into the construction process in the nuclear industry. The Nuclear Industry Association's guidance makes it very clear that training alone is not regarded as a sufficient safeguard against mistakes. Experience is also vital.[29] There are almost no UK workers who satisfy the 'experience' criterion of the SQEP qualification for constructing or operating EPRs. Or, for that matter, any other of the new designs being considered for construction in the UK.

Moreover, failures of communication due to language issues have been specifically linked to failures in the current EPR construction programme in Finland and China, as stated in reports by both the Chinese and Finnish nuclear regulators. The Finnish Radiation and Nuclear Safety Authority (STUK) found that 'some subcontractors were inexperienced, documentation was incomplete, and that there were linguistic difficulties among the workforce, 80 percent of whom are foreigners'.[30] Four years later, YLE (the Finnish State Broadcaster) reports that the Chinese nuclear authority is reporting 'a list of problems at Taishan that is very similar: concrete quality problems, unqualified or inexperienced subcontractors, shortcomings in documentation and language problems'.[31]

It seems increasingly likely that both AREVA and EDF may find themselves with no option but to employ French workers on their UK builds. Both safety regulators and investors will likely insist on stringent SQEP standards and that key workers speak fluent French, both of which criteria will mean French workers will take the place of UK ones.

[26] UK firms in danger of missing out on nuclear plant contracts, The Daily Telegraph 26 February 2012. Accessed on 1 April 2012 at: www.telegraph.co.uk/finance/newsbysector/energy/9107211/UK-firms-in-danger-of-missing-out-on-nuclear-plant-contracts.html

[27] Nuclear deal with France is not necessarily the best deal for securing UK jobs, Press Release, Institute of Mechanical Engineers 17 February 2012. Accessed on 1 April 2012 at: www.imeche.org/news/press-release/12-02-17/Nuclear_deal_with_France_is_not_necessarily_the_best_deal_for_securing_UK_jobs.aspx

[28] EDF rejects non-French bids for £2.5bn Hinkley Point job, Building Magazine, 2 March 2012. Accessed on 1 April at: www.building.co.uk/edf-rejects-non-french-bids-for-%C3%82%C2%A325bn-hinkley-point-job/5032744.article

[29] The Essential Guide to the new build nuclear supply chain; Opportunities, routes to market, codes and quality arrangements for nuclear new build in the UK, The Nuclear Industry Association, Feb 2011. Accessed on 1 April 2012 at: namrc.co.uk/wp-content/uploads/2011/.../NIA-essential-guide-v2.pdf

[30] Problems seen in Olkiluoto-type project in China, YLE English Language News, 7 October 2011. Accessed on 1 April 2012 at: http://yle.fi/uutiset/news/2011/10/problems_seen_in_olkiluoto-type_project_in_china_2930807.html

[31] Ibid

5. Job Generation

The more 'capital intensive' an industry is, the fewer jobs are created per unit of capital invested. Nuclear power is an extremely capital-intensive industry, and is therefore not an efficient way of creating employment.

Measuring 'capital intensity' is complex, but when comparing different forms of electricity generation, one can use simpler, more objective measures such as the average number of jobs created per Terawatt hour generated annually. This calculation has been made by Goldemburg,[32] who has estimated that nuclear produces around 75 jobs per Terawatt hour (TWh) of power, compared to at least 1,000 jobs for wind, and at least 30,000 jobs for solar. Fossil fuel generation lies somewhere in between - in the 250 – 370 jobs/TWh range. In other words, nuclear provides the lowest number of jobs - it is the worst option from this point of view. Employment considerations have to be seen as a key requirement for any sustainable development.

The main impact that a nuclear generation programme will have in general is to drive up the price of energy and in doing so will act as a drag on growth. However, this effect will be made worse as the subsidies required will be funded by a levy on business and customers, driving energy intensive industry abroad. The liberalised European electricity market, and the rapid development of electricity distribution infrastructure, means that it is likely that a nuclear programme operating in just one country will be an expensive liability undercut by a range of foreign generators. Added to this, the jobs payoff will be minimal as there are insufficient 'suitably qualified and experienced personnel' in the UK workforce to build the EPR. This is compounded by the fact that the ratio of 'money spent to jobs created' is the worst of all forms of electricity generation.

Conclusion

The main impact that a nuclear generation programme will have in general is to drive up the price of energy and in doing so will act as a drag on growth. However, this effect will be made worse as the subsidies required will in effect be funded by a levy on the business and customer, driving energy intensive industry abroad. The liberalised European electricity market and the rapid development of electricity distribution infrastructure means that it is likely that a nuclear programme operating in just one country will be an expensive liability undercut by a range of foreign generators. Added to this, the jobs payoff will be minimal as there are insufficient 'suitably qualified and experienced personnel' ain the UK workforce to build the EPR. This is compounded by the fact that the ratio of money spent to jobs created is the worst of all forms of electricity generation.

[32] Goldemberg, J., 2004, The Case for Renewable Energies, International Conference for Renewable Energies, Bonn, http://teenet.tei.or.th/Knowledge/Paper/case_for_renewable.pdf

For more information:

www.jonathonporritt.com

www.tomburke.co.uk

Contact:

JPOffice@forumforthefuture.org