Energy Fair

David T. C. Davies MP,
Chair of the Welsh Affairs Committee,
House of Commons
London
SW1A 0AA.

25th February 2016

Dear Mr Davies,

This is a response to the Welsh Affairs Committee's invitation for people and organisations to send evidence relating to the "The future of nuclear power in Wales". I am responding as Coordinator for the voluntary organisation Energy Fair (www.energyfair.org), representing the views of that organisation.

Our response is couched in terms of the headings set out by the Committee but we have things to say only under the first two headings.

1 Whether Wylfa Newydd will be built on schedule

We think it is unlikely that Wylfa Newydd will be built on schedule, not because of anything relating to this specific project or to Wales, but because nuclear power stations are notorious for being completed late and over budget.

Here, in the highlighted paragraphs that follow, are some extracts from a report we published in October 2012 (*The financial risks of investing in new nuclear power plants*).[1]

7 Construction risk: build times and cost overruns

From recent news reports, it appears that the nuclear plant which is under construction at Olkiluoto in Finland, is likely to be 3 to 5 years late and likely to be between US$2.8 billion and US$4.5 billion over budget.[2]

From other reports, it appears that the nuclear plant which is under construction at Flamanville in northern France, is likely to be 2 to 4 years late and likely to be between US$3.7 billion to US$4.3 billion over budget.[3]

It has been reported that similar problems have arisen in the building of the Taishan nuclear plant in China,[4] and that "Britain's biggest single nuclear project has run into serious trouble with missed

---

[1] "The financial risks of investing in new nuclear power plants", *Energy Fair*, October 2012, bit.ly/1Ln34vA.
[2] See, for example, "UPDATE 1-Areva EPR bill seen at 6.6 bln eur-paper", Reuters, 2011-10-12, bit.ly/wCl2zy; "UPDATE 1-Olkiluoto 3 nuke plant may be delayed further -TVO", Reuters, 2011-10-12, bit.ly/zxNiyM; "Olkiluoto 31,600 MW nuclear power plant, Finland", Energy, 2011-01-30, bit.ly/zlBZnR; "National Green Tribunal urged to cancel Jaitapur nuclear project", bit.ly/wxFR9r; "For Australia, nuclear is the power of last resort", Sydney Morning Herald, 2011-10-09, bit.ly/x0OtgY.
[3] See, for example, "EDF postpones Flamanville nuclear plant", Break Bulk, 2011-07-21, bit.ly/yuTaA3; "EDF admits French nuclear reactor delayed but says UK projects on target", The Guardian, 2011-07-20, bit.ly/yvYCfi; "New French nuke plant beset by more delays", UPI, 2011-07-22, bit.ly/xvzIQt.

Contact: Dr Gerry Wolff PhD CEng, Energy Fair, 18 Penlon, Menai Bridge, Anglesey, LL59 5LR; *Phone:* +44 (0) 1248 712962; +44 (0) 7746 290775; *Skype:* gerry.wolff; *E-mail:* **gerrywolff65@gmail.com**; *Web:* **www.energyfair.org.uk**.

deadlines and cost overruns threatening the future of the entire nuclear reprocessing operation at Sellafield in Cumbria."[5]

These kinds of problems are not unusual in the building of nuclear plants:

- According to the BBC, "The British nuclear regulator has told Newsnight that ... no British nuclear power station had ever been built on time."[6]
- As noted in Section 4.1, it has been shown that recent estimates of the cost of building new nuclear reactors have been about one third of the actual cost of nuclear reactors completed in the 1990s [MC2009].
- In Canada, construction of the Darlington Nuclear Generating Station started in 1981 at an estimated cost of $7.4 billion 1993-adjusted Canadian dollar, and finished in 1993 at a cost of $14.5 billion.[7]
- Vincent de Rivaz, chief executive of EDF Energy, has said that there is a "productivity challenge" that must be overcome in the construction sector in order to deliver new nuclear plants affordably.[8]

As reported in the Economist, Pierre Noël of Cambridge University Electricity Policy Research Group says that the record for building nuclear plants on time and within budget is "between horrendous and terrible."[9]

Whenever these kinds of problems occur, we are promised that lessons will be learned and that things will improve in the future. But the extraordinary complexity of nuclear power stations—which is likely to increase after Fukushima with the added complexity of new safety systems—means that construction risk will remain a major hazard for investors for the foreseeable future.

Later, it looks as if things have got even worse at Olkiluoto and Flamanville. In another of our reports, published in March 2015 (*Nulear subsidies (Hinkley Point C)*),[10] we say:

- It has been reported that, for Areva's last four nuclear reactors, the average time from start of construction to full grid connectivity was 17.5 years [BJPS2012b, p. 4].
- *The Olkiluoto nuclear plant*. Wikipedia says:[11] "According to [the] Financial Times in December 2014, construction of the Olkiluoto plant [Unit 3] has descended into farce as it is currently expected to open nine years late and several billions of euros over budget." Construction began in July 2005 and the plant is not now expected to start operating until 2018—more than 12 years from start to finish.
- *The Flamanville nuclear plant*. According to Wikipedia,[12] "Construction on a new reactor, Flamanville 3, began on 4 December 2007. ... EDF has ... said France's first EPR would ...

---

[4] See "Problems seen in Olkiluoto-type project in China", YLE.fi, 2011-10-07, bit.ly/zsfAiX. See also "Report raises concerns over safety of nuclear plants", The Independent, 2011-09-10, ind.pn/zhXkEF.
[5] See "Sellafield faces nuclear option as overspending threatens plant's future", The Independent, 2012-02-14, ind.pn/y5302z.
[6] "UK nuclear stations unlikely to be on time", BBC Newsnight, 2009-11-25, bbc.in/AktlVV.
[7] See, for example, "Why was the cost of Ontario's Darlington plant so high?", Canadian Nuclear FAQ, retrieved 2011-10-11, bit.ly/Ai2bxo.
[8] See "EDF Energy: Construction stand-offs threaten UK nuclear delivery", The Telegraph, 2011-12-13, tgr.ph/yzyvxz.
[9] "Nukes of hazard", The Economist, 2011-10-15, econ.st/yzZXRB.
[10] "Nulear subsidies (Hinkley Point C)", *Energy Fair*, 2015-03-02, bit.ly/1Ezwxzp.
[11] See "Olkiluoto nuclear power plant", Wikipedia, retrieved 2015-02-02, bit.ly/1uR9nzo.
[12] See "Flamanville nuclear power plant", Wikipedia, retrieved 2015-02-02, bit.ly/1yviDus.

start commercial operations in 2012, after construction lasting 54 months. ... In November 2014, EDF announced that completion of construction was delayed to 2017 due to delays in component delivery by Areva."

- An indirect and partial indication of problems in this area is that global electricity generation from nuclear plants dropped by an historic 7 percent in 2012, adding to the record drop of 4 percent in 2011.[13] Worldwide, nuclear power is shrinking, not growing.

2 What the cost of Wylfa Newydd will be and whether it represents value for money

Some indication of likely cost overruns has been given in the previous section. This section provides more detail about the very large and growing cost of nuclear power, its hidden costs, some of them very large, and the opportunity cost of nuclear power. There is no doubt that nuclear power represents extremely poor value for money.

If anyone were in any doubt about this, there is the extraordinary statement (in July 2012) from Jeff Immelt, the chief executive of General Electric—one of the world's largest suppliers of atomic equipment—that nuclear power is so expensive compared with other forms of energy that it has become "really hard" to justify.[14]

Only very recently, a formal study has been published, from Mark Cooper, a specialist in the economics of nuclear power, showing that if we are to meet our carbon reduction goals economically, we should not use nuclear power.[15]

Another recent report shows that a combination of wind power with 'windgas'—storing surplus wind power as methane—would be cheaper than Hinkley Point C and would provide good security of electricity supplies.[16]

2.1 The very large and growing costs of nuclear power

In our report on the *Financial risks of investing in new nuclear power plants*,[17] we say:

4.1 The high cost of nuclear power

It appears that, where claims are made that nuclear power is cheap, the evidence has come, directly or indirectly, from the nuclear industry itself.[18] It appears that such claims can only be made with some or all of the following optimistic assumptions: no overruns in the times or costs of building nuclear plants (Section 7), ignoring all the subsidies for nuclear power (Section 5) and assuming that capital costs have been paid off.

---

[13] "World nuclear industry status report", Wikipedia, retrieved 2015-01-30, bit.ly/1LqCLXB.
[14] See, for example, "Nuclear 'hard to justify', says GE chief", Financial Times, 2012-07-30, on.ft.com/MtFwLy.
[15] "New study: Meeting carbon reduction goals economically means no nuclear power", *Green World*, 2016-02-11, bit.ly/1U0vW3T.
[16] See "Wind power with 'windgas' is cheaper and greener than Hinkley Point C nuclear plant, *The Ecologist*, 2016-02-17, bit.ly/1LbyUR3.
[17] "The financial risks of investing in new nuclear power plants", *Energy Fair*, October 2012, bit.ly/1Ln34vA.

[18] See, for example, "Why Britain must take the nuclear path", Financial Times, Vincent de Rivaz, 2010-01-07, on.ft.com/xhj1mY.

If nuclear power was as cheap as is claimed, then it should be able to compete unaided, especially since it is a long-established industry. But nuclear companies have said repeatedly that they need additional support from the Government.[19]

Reports about the high cost of nuclear power may be downloaded via links from www.mng.org.uk/gh/nn.htm#subsidies. For example:

- As noted in Section 2, a report by consultancy Candole Partners has cast doubt on the commercial viability of a proposed nuclear project in the Czech Republic.
- A report from the New Economics Foundation [NEF2005] shows that a kilowatt-hour of electricity from a nuclear generator would cost more than 2.5 times as much as claimed by the industry, once realistic construction and running costs are factored in—and that's without taking account of the subsidies described in Section 5.
- A report by the Union of Concerned Scientists [UCS2011] says that "Government subsidies to the nuclear power industry over the past fifty years have been so large in proportion to the value of the energy produced that in some cases it would have cost taxpayers less to simply buy kilowatts on the open market and give them away."
- A report by the Insurance Forum, Leipzig, a company that specialises in actuarial calculations, shows that, if the current cap on the liabilities of nuclear operators was to be removed, full insurance against nuclear disasters would increase the price of nuclear electricity by a range of values—€ 0.14 per kWh up to € 2.36 per kWh—depending on assumptions made [VL2011].
- A report by Mark Cooper of the Vermont Law School [MC2009] shows that recent estimates of the cost of building new nuclear power stations have been about one-third of what one would have expected, based on the nuclear reactors completed in the1990s.
- As noted earlier (Section 3.1.1), Connie Hedegaard, the EU climate change commissioner, has said that offshore wind power is cheaper than nuclear power.

4.2 Nuclear power is getting more expensive

Most of the cost of nuclear electricity comes from the cost of building nuclear plants, and, in inflation-adjusted terms, those costs have been rising consistently since at least the 1970s [GRU2010, IIASA2009, MC2010]. Cost overruns with the Olkiluoto and Flamanville plants (Section 7) show that nuclear plants can turn out to be unexpectedly expensive.

The cost of existing and new nuclear plants will be increased by, for example, the demand for higher safety standards after a disaster like that at Fukushima.[20] One news report says "The Court

[19] See, for example, "EDF Energy wants Britain to fix the market if it builds nuclear plants", The Times, 2009-11-07, bit.ly/yh2MYN; "Families face nuclear tax on power bills", The Guardian, 2009-10-19, bit.ly/wSWqTU; "Consumers to pay for new nuclear power plants", Daily Telegraph, 2009-08-18, tgr.ph/AqNLkG; "Energy firms in secret talks on nuclear 'levy'", Sunday Times, 2009-08-16, bit.ly/xX3bXT; "UPDATE: UK nuclear industry seeks equal terms with renewables", Easy Bourse, 2009-06-10, bit.ly/yTdsN7; "EDF calls for support for nuclear industry", Financial Times, 2009-05-25, on.ft.com/wiJkx5.

[20] See, for example, "French nuclear plants told to prepare for disasters", Reuters, 2012-01-03, reut.rs/zKILKl.

of Auditors in France has ... published a report revealing that the cost of producing nuclear energy is set to surge in France as old plants need updating and new safety standards put in place."[21]

A commentary in Nature magazine says "Whatever happens in the long term, the French plans have an immediate benefit: they raise the post-Fukushima safety bar for other countries. Those governments, regulators and companies that have yet to propose anything close to such far-reaching measures must now explain why not."[22] Another news report says "... French Prime Minister François Fillon has promised to ensure that nuclear operators will conform to all of the safety requests made by [nuclear authority] ASN. Given voter concern over the dangers of nuclear energy, the French government can do little but enforce new safety regulations and other governments across the world will also need to follow suit."[23]

The way in which the cost of building nuclear power stations has been rising in the USA and in France can be seen graphically in Figure 1.

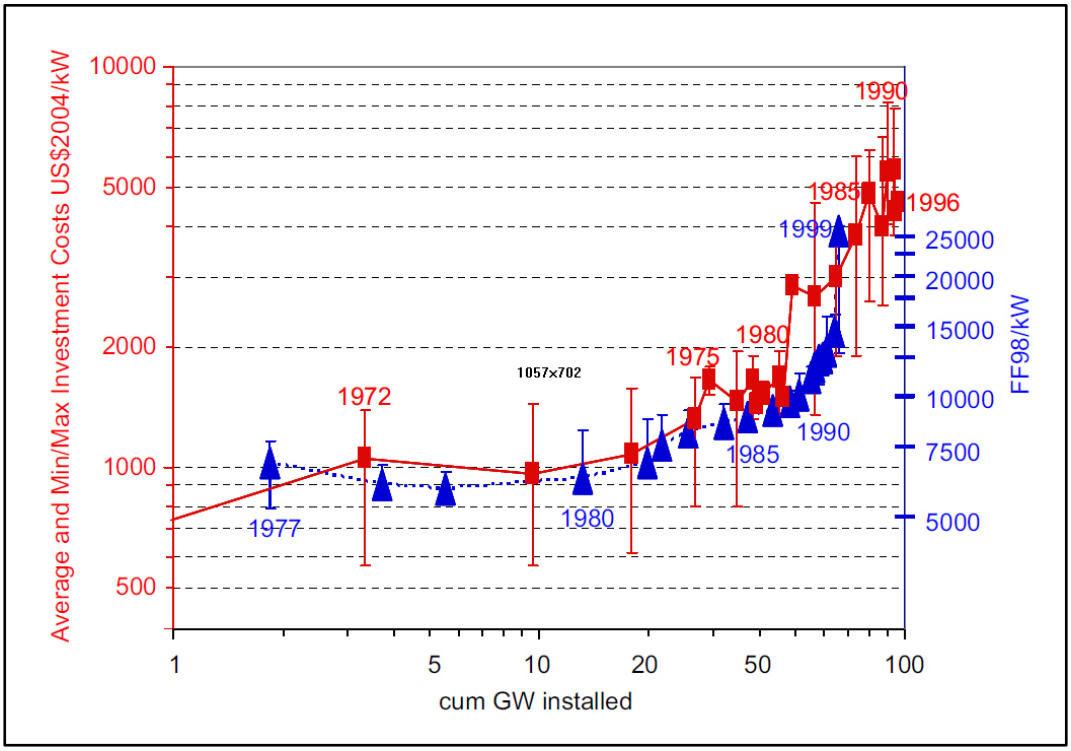

Figure 1. Average and min/max reactor construction costs per year of completion date for US (red rectangles) and France (blue triangles) versus cumulative capacity completed.[24]

2.2 The hidden costs of nuclear power

In our report on *Nuclear subsidies*,[25] we have identified seven types of cost for nuclear power, which are often not recognised as costs for nuclear power and thus represent hidden subsidies for nuclear power. They are:

[21] See "French nuclear set to become more expensive than wind power", European Wind Energy Association. 2012-02-03, bit.ly/xEipjK.
[22] See "Get tough on nuclear safety", Nature, vol 481, p 113, 2010-01-11, bit.ly/y13erg.
[23] See "Europe's reliance on nuclear energy a costly obstacle to green power", The National, 2012-01-14, bit.ly/wRslwQ.
[24] Reproduced with permission from Figure 13 in [GRU2010].
[25] "Nuclear subsidies", *Energy Fair*, 2012-06-07, bit.ly/1qoRrvY.

- *Limitations on liabilities:* The operators of nuclear plants pay much less than the full cost of insuring against a Chernobyl-style accident or worse.
- *Underwriting of commercial risks:* The Government necessarily underwrites the commercial risks of nuclear power because, for political reasons, the operators of nuclear plants cannot be allowed to fail.
- *Subsidies in protection against terrorist attacks:* Because protection against terrorist attacks can only ever be partial, the Government and the public are exposed to risk and corresponding costs.
- *Subsidies for the short-to-medium-term cost of disposing of nuclear waste:* In UK government proposals, the Government is likely to bear much of the risk of cost overruns in the disposal of nuclear waste.
- *Subsidies in the long-term cost of disposing of nuclear waste:* With categories of nuclear waste that will remain dangerous for thousands of years, there will be costs arising from the dangers of the waste and the need to manage it. These costs will be borne by future generations, but they will receive no compensating benefit.
- *Underwriting the cost of decommissioning nuclear plants:* In UK government proposals, the Government is likely to bear much the risk of cost overruns in decommissioning nuclear plants.
- *Institutional support for nuclear power:* the UK government is providing various forms of institutional support for the nuclear industry.

Although quantifying some of these hidden subsidies can be difficult, there is little doubt that several of them are very large. A selection of them are considered in the following subsections.

2.2.1 Hidden subsidies in the limitation on liabilities for nuclear operators

There is, in the UK, a low cap on the liabilities of nuclear operators for the damage caused by accidents such as those at Chernobyl and Fukushima. Although the risk of such accidents is low, their actual and potential costs are so high that the low cap on liabilities represents a very substantial subsidy for the nuclear industry.

As mentioned earlier, a report by the Insurance Forum, Leipzig, a company that specialises in actuarial calculations, shows that, if the current cap on the liabilities of nuclear operators was to be removed, full insurance against nuclear disasters would increase the price of nuclear electricity by a range of values—€ 0.14 per kWh up to € 2.36 per kWh—depending on assumptions made.

If we take the minimum value, this equates with €140/MWh or £112/MWh. Since the Westminster Government has agreed a strike price for electricity from Hinkley Point C of £92.5/MWh—which we may take to be a conservative estimate of the cost of nuclear electricity (excluding other subsidies)—then a conservative estimate of the cost of nuclear power is £92.5 + 112 = £204.5/MWh. This is substantially more than the unsubsidised cost of offshore wind power, which is estimated to be £140/MWh.[26] Offshore wind power is itself considered to be one of the most expensive of the mainstream kinds of renewable power.

Although the figures just given show that the cap on liabilities for nuclear operators represent a very substantial subsidy for nuclear power, they are certainly too low, for reasons described next.

---

[26] "The Offshore Valuation: a valuation of the UK's offshore renewable energy resource", The Offshore Valuation Group, May 2010, bit.ly/w1b7I0.

The experience of Naoto Kan, who was Prime Minister of Japan when the Fukushima triple melt down occurred in March 2011, highlights the potentially huge cost of a nuclear disaster, as reported in the Ecologist magazine:

> "Kan had to make some steely-nerved decisions that necessitated putting all emotion aside. In a now famous phone call from Tepco, when the company asked to pull all their personnel from the out-of-control Fukushima site for their own safety, Kan told them no. The workforce must stay. The few would need to make the sacrifice to save the many.
>
> Kan knew that abandoning the Fukushima Daiichi site would cause radiation levels in the surrounding environment to soar, in turn forcing the evacuation of the neighbouring, and still functioning, Fukushima-Daiichi nuclear site.
>
> With all 10 Fukushima reactors and 11 spent fuel pools untended, there would be multiple meltdowns and the likely ignition of nuclear waste in onsite storage ponds, cascading into an unending radiological disaster. Kan would be ordering that most dreaded 250 km evacuation, including the city of Tokyo.
>
> His insistence that the Tepco workforce remain at Fukushima was perhaps one of the most unsung moments of heroism in the whole sorry saga.
>
> It was then, said Kan, who trained as a physicist, that his whole energy perspective was forever altered. 'It was a moment when my view on nuclear power changed 180 degrees.' Sticking with the nuclear energy path meant that 'the country would go down in ruin.' He could no longer in all conscience 'make the decision to go with nuclear power and risk the survival of a nation.'"[27]

In the same article he is reported as saying "One quarter of the country's population would have had to flee if all the fuel had escaped at Fukushima. We came that close. If 50 million people had had to evacuate Japan, as a state our very survival would have been questioned."

In short, nuclear power can mean that the survival of a whole country like Japan (or the UK) may be threatened.

This kind of risk—and the corresponding costs—are entirely unacceptable, especially since there are very good alternatives to nuclear power (Section 2.3).

2.2.2 Hidden subsidies for the disposal of short-lived nuclear waste

We are assured by the UK government that nuclear operators are required to create a fund to cover the costs of disposing of nuclear waste with a relatively short half- life.

But it is impossible for such assurances to be given because of the very large uncertainties about that kind of cost. For that kind of reason, nuclear consultant Ian Jackson, writing in *Nuclear Engineering International*, has said that:

> "... a fully commercial price would make disposal far too expensive, killing the prospects of any new nuclear build programme in Britain …. The bottom line is that nuclear energy utilities probably need fixed waste disposal 'prices' for repository disposal capped somewhere in the range from £12,200 to £24,400/m^3, but the NDA's *[Nuclear Decommissioning Authority's]* true marginal 'cost' is nearer to £67,000/m^3, and the

[27] "Fukushima PM Naoto Kan: 'if you love your country, let nuclear go!', *The Ecologist*, 2016-02-12, bit.ly/1PUGfog.

> commercial 'value' of the repository asset could approach £201,000/m^3 if operated as a fully private sector venture.".[28]

He expands on these points in another publication[29] where he says that, with regard to the commercial value of the disposal service:

> "Because the NDA is already charging foreign nuclear utilities a premium of 647 per cent profit margin for disposal of substituted intermediate-level wastes, then logically this market premium should be the disposal pricing benchmark for British nuclear utility investors too. Commercially speaking, it is hard to justify charging British utility customers a lower price for geological disposal than overseas utility customers paying for disposal space in the same repository. It would also risk accusations of giving preferential state aid subsidies to nuclear energy utilities investing in Britain, that are potentially illegal under European state aid competition law." (p 61)

In short, it appears that, if the Government wishes to ensure that new nuclear plants will be built, *it will be necessary for charges for the disposal of nuclear waste to be lower than the real cost of disposal and very much lower than commercial rates that could be charged for disposal.* Such under-charging for disposal would be a subsidy for the industry.

2.2.3 Hidden subsidies for the disposal of long-lived nuclear waste

On a long-term perspective, the 'high level' categories of nuclear waste will remain dangerous for thousands of years. The costs arising from the dangers of the waste and the need to manage it will be borne by future generations but they will receive no compensating benefit.

These costs are difficult to quantify but they are clearly large. For each nuclear plant, it is entirely possible that the long-term costs—for thousands of years—of storing and managing the long-lived nuclear waste produced by that plant, and the damaging effects of that waste, exceed the value of the electricity produced by that nuclear plant.

Since these are costs that are created by the nuclear industry but are not paid for by the industry, they represent yet another subsidy to the industry, even though no actual money changes hands. The subsidy will be paid by many generations of people who are not yet born.

Of course, there are no equivalent costs with renewable sources of power.

2.2.4 Hidden subsidies for the decommissioning of nuclear plants

The Energy Act 2008 requires the operators of new nuclear power stations to have plans for decommissioning, including plans for how decommissioning will be financed, and that these plans must be approved by the Government.

This suggests that the operators of nuclear plants will take full responsibility for decommissioning and that the Government will be protected. But this really is not possible given the long timescales and large uncertainties:

> "Perhaps more than any other technology, nuclear power has the habit of making any government the prisoner of past decisions. The economic impact of nuclear energy

---

[28] See "Buried costs", *Nuclear Engineering International*, Ian Jackson, April 2008, bit.ly/212Su6b. See also "Waste cost threat to UK nuclear plans", *Financial Times*, 2008-03-26, http://www.ft.com/cms/s/0/08f7bbc2-fb66-11dc-8c3e-000077b07658.html#axzz1U9FP708A, and http://www.greenpeace.org.uk/media/press-releases/taxpayers-facing-nuclear-missile.

[29] "Nukenomics: the commercialisation of Britain's nuclear industry", Ian Jackson, Sidcup: *Nuclear Engineering International* Special Publications, 2008, ISBN 978-1-903077-55-9.

> decisions made in the 1950s and 1960s are still being felt by taxpayers today. … Investing in nuclear technology uniquely captures governments in a lengthy cycle of expenditure that once started, will take a century to exit…. Few other technologies have the capacity to bind government spending for a 100 years. As a result, the long-term costs of nuclear power can only really be estimated and estimates are only as good as the economic assumptions on which they are based.... accurately forecasting the total cost of front end nuclear build and back end nuclear clean-up still remains more of an art than a science."[30]

And:

> "Decommissioning has been described as rather like a Chinese puzzle box in which new problems are revealed the deeper one looks, as successive layers of complexity are revealed. Each year the decommissioning management contractors tend to look a little deeper at what needs to be done and then cost the clean-up tasks accordingly from the bottom up. As a result, the Nuclear Decommissioning Authority's three-year near-term cost projections are reasonably accurate but forecasts of the total lifecycle cost for taxpayers remain highly speculative. It is these difficult long-term cost projections that are rising by 9 per cent annually. In September 2007 the National Audit Office, which formally audits the Nuclear Decommissioning Authority's annual accounts, commented: 'It is not possible to quantify reliably the impact on the Nuclear Decommissioning Authority's future financial results of the settlement of these liabilities.'"[31]

In 2006, it was reported that Gordon Brown's estimate of the cost of cleaning up the UK's nuclear legacy would be £90bn (€132.5bn),[32] but it has been suggested that the true figure is closer to £160bn (€199bn).[33] It may be argued that these huge sums are simply "water under the bridge" and are not relevant now, with the UK government's declared intention that nuclear power should be commercially viable without any subsidies.

The key point here is that it is *impossible* for the UK government, or any other government, to shed its responsibilities for decommissioning of nuclear power stations (and for nuclear waste and other aspects of nuclear power) by passing everything over to the nuclear operators. There will *always* be the risk of cost overruns and there will *always* be a risk that nuclear companies may fail.[34,35]

This kind of underwriting of decommissioning costs by national governments is a substantial subsidy for the nuclear industry. And it is an unfair subsidy because there is nothing equivalent with renewables.

2.3 The opportunity cost of nuclear power

With any kind of engineering or commercial project, it is standard practice to assess the "opportunity cost" of the project: could the money be better spent elsewhere. In this connection, the main alternatives to nuclear power for generating electricity are unabated fossil fuels, fossil fuels

---

[30] "Buried costs", *Nuclear Engineering International*, Ian Jackson, April 2008, bit.ly/212Su6b. p.3.
[31] "Buried costs", *Nuclear Engineering International*, Ian Jackson, April 2008, bit.ly/212Su6b. p.25.
[32] See "Nuclear costs to hit £90bn, warns Brown", The Observer, 2006-06-04, http://www.guardian.co.uk/business/2006/jun/04/theobserver.observerbusiness.
[33] See "True price of UK's nuclear legacy", The Independent, 2006-04-02, http://www.independent.co.uk/news/business/news/true-price-of-uks-nuclear-legacy-163160bn-472368.html.
[34] None of these problems are solved by the UK government's present proposals that the operators of nuclear plants should put forward plans for decommissioning and that those plans should be vetted by a 'Nuclear Liabilities Financing Assurance Board'.
[35] See "Nuclear decommissioning", Nuclear Spin, September 2008, http://www.spinprofiles.org/images/b/ba/Nuclear_Decomm.pdf.

with carbon capture and storage (CCS), and renewable sources of power. Of these, the first are unacceptable because of the urgent need to cut emissions of CO_2, and the second shows little sign of becoming practical at an acceptable cost within reasonable timescales. This leaves renewables.

There is abundant evidence that, with today's technologies, renewables can meet all our electricity needs securely, that they can do so much more cheaply than nuclear power, and that they have none of the problems of nuclear power.

Subsidies for nuclear power divert resources from renewable sources of power that are altogether better than nuclear power and cheaper.

For reasons given below, subsidies for nuclear power are bad for energy security, bad for the fight against climate change, bad financially for consumers and taxpayers in the UK, bad for jobs, and bad for the development, throughout Europe, of the good alternatives which are ready to go, cheaper than nuclear power, and very much quicker to build. Here are those reasons:

- **Nuclear power is a mature technology that should not require any subsidy**. Subsidies are for newer technologies that are still finding their feet commercially.
- Contrary to what the UK government suggests, **nuclear power is a hindrance, not a help, in ensuring security of energy supplies**:
    - Like all kinds of equipment, nuclear power stations can and do fail. Failure of a nuclear power station is normally very disruptive on the grid because a relatively large amount of electricity is lost, often quite suddenly and with little warning.
    - By contrast, variations in the output of renewables are much easier to manage because they are gradual and predictable. **There are several techniques for managing that kind of variation and also variations in the demand for electricity** (see bit.ly/I4E5vr). **The supposed problem of intermittency in renewables is overplayed**.
    - Nuclear power lacks the flexibility needed for balancing supply and demand on the grid.
    - Contrary to popular belief, nuclear plants are not "always on", 24/7. Apart from unscheduled failures, nuclear power stations often operate at reduced capacity or are taken out of service for routine maintenance.
- Contrary to what the UK government suggests, **Nuclear power is a poor means of plugging the supposed "energy gap" or "keeping the lights on"**:
    - Nuclear plants are notoriously slow to build: they can take 17 years or more to complete. (see bit.ly/1a7idjS, p. 4).
    - In general, renewables can be built very much faster.
    - **There is good evidence for a superabundance of renewable sources of energy** (see bit.ly/9MKP5i).
    - **There are now many reports showing how to decarbonise the world's economies without using nuclear power** (see bit.ly/wRQ8ro).
- Contrary to what the UK government suggests, **Nuclear power is a poor means of cutting emissions**. Peer-reviewed research shows that **the nuclear cycle produces between 9 and 25 times more CO_2 than wind power** (see bit.ly/1afpW06). Other renewables also have much lower emissions than nuclear power.
- Contrary to what the nuclear industry suggests, **renewables create about 3 times as many jobs for a given expenditure than nuclear power or fossil fuels**. Robert

Pollin, the President of Pear Energy and a professor of economics at the University of Massachusetts-Amherst, has studied this matter in depth with the US Department of Energy and the International Labour Organization. As his Pear Energy team writes:

> "The basic facts are simple. When we invest, say, $1 million in building the green economy, this creates about 17 jobs within the United States. By comparison, if we continue to spend as we do on fossil fuels and nuclear energy, you create only about 5 jobs per $1 million in spending. That is, we create about 12 more jobs for every $1 million in spending — 300 percent more jobs — every time we spend on building the green economy as opposed to maintaining our dependence on dirty and dangerous oil, coal, natural gas, and nuclear power."[36]

- Contrary to what the UK government suggests, **nuclear power is, taking account of all subsidies, much more expensive than the clean and safe alternatives, and likely to remain so in the future**:
    - As we have seen, withdrawal of just one of the present subsidies for nuclear power (the cap on liabilities) would raise the price of new-build nuclear electricity to **at least £200 per MWh**, substantially more than the unsubsidised cost of offshore wind power (about £140 per MWh and falling), itself considered to be one of the more expensive kinds of renewable energy (see bit.ly/KisjOT).
    - **The cost of renewables is falling**. Greg Barker MP, former UK Minister of State for Climate Change, has said (see bit.ly/19YlI8W) "There is the potential for solar power to become competitive with fossil fuels without subsidy within the lifetime of this parliament [ie before May 2015]". This trend is confirmed by other sources of evidence. **When that tipping point is reached, there is likely to be explosive growth in solar power**. The cost of other renewables is also falling.
    - In view of the falling cost of renewables, the proposed "contracts for difference" for nuclear power is likely to be a permanent large subsidy for nuclear power throughout the proposed 35 years of the contract.
- There are many acceptable options for siting wind and solar power plants, including wind farms out at sea (where costs are coming down), and solar plants on factory roofs and in association with roads and railways. There is also great potential for importing solar power from southern Europe and beyond, and wind power from Ireland or continental Europe.

2.4 Nuclear power is very poor value for money

In summary:

- Taking account of all direct subsidies and hidden subsidies, nuclear power is much more expensive than any other source of power and costs are rising.
- Most renewables are cheaper than nuclear power and costs are falling.

---

[36] "Over 3 Times More Green Jobs Per $1 Invested Than Fossil Fuel Or Nuclear Jobs", *CleanTechnica*, 2013-03-20, bit.ly/1yoIHuE.

- It is recognised that, per £ of capital expenditure, renewables create about three times as many jobs than nuclear power.
- There is a superabundance of renewable sources of power.
- There are many techniques for managing the supposed problem of intermittency. With these techniques, renewables can provide much greater security in energy supplies than can nuclear power.
- Peer-reviewed research shows that the nuclear cycle produces between 9 and 25 times as much CO_2 as wind power.
- Renewables can be built very much faster than nuclear power.
- Renewables, with conservation of energy provide much more flexibility than nuclear power.
- Renewables do not pose any risk of nuclear disaster, with the risk of mass evacuation and the possibility of ending the life of an entire nation.
- Renewables do not leave waste that is dangerous for thousands of years, an immoral legacy for future generations.

Sincerely,

Dr Gerry Wolff

Coordinator of Energy Fair