The economics of nuclear power

Summary 2007

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image Sellafield nuclear plant, Cumbria, UK

Summary of the economics of nuclear power

The climate change imperative demands a fundamental change in the way we all produce, consume and distribute energy. Global emissions of greenhouse gases need to be halved by 2050 in order to prevent the worst impacts of global warming. Investment decisions which the electricity sector is making today have repercussions for the period 2020 to 2050 and determine whether the world remains locked in to its current course or achieves the emission cuts which are essential.

The nuclear industry would have us believe that it is part of the solution to climate change. Doubling existing nuclear capacity by 2030 would require hundreds of new reactors. But this would cost nearly a trillion dollars of investment and reduce carbon dioxide emissions by no more than a few per cent. A major expansion of nuclear capacity would create additional global hazards. Nuclear power entails substantial risks for the environment and human health, generates a long-lasting burden of nuclear waste and increases the threat of international nuclear proliferation.

The nuclear industry argues that nuclear power is relatively cheap. To examine this assertion, Greenpeace commissioned independent experts to assess the economic realities of nuclear energy.

Their report, "The Economics of Nuclear Power"[1], revealed that nuclear power is an economic risk ultimately borne by the government and taxpayer.

In sharp contrast, given the right policy framework, the renewable energy industry can quickly become an economically viable market player, independent of government funding. Nuclear power undermines real, clean energy solutions to climate change by diverting urgently needed resources away from renewable technologies and measures to improve energy efficiency.

The following is a summary of those findings and contains additional information from a recent report published jointly by the European Renewable Energy Council and Greenpeace report and entitled, "Future Investment; A sustainable investment plan for the power sector to save the climate"[2].

Construction costs consistently two to three times higher than forecast[3]

Nuclear power stations are an economic liability, with actual construction costs consistently sky-rocketing above predicted costs. The Olkiluoto 3 (OL3) reactor, under construction in Finland since August 2005, is a case in point. In August 2007 the project was publicly declared to be at least two years behind schedule and at least €1,500m over budget. Elfi, the Finnish consortium of large electricity users, calculates that this will lead to €3 billion of indirect costs to electricity consumers.

Country after country has seen nuclear construction programmes go considerably over-budget. In the United States, an assessment of 75 of the country's 104 reactors showed predicted costs of US $45 billion (€34bn) but actual costs of US $145 billion, more than three times initial estimates.[4] In India, the country with the most recent experience of nuclear construction, completion costs of the last 10 reactors have on average been 300 per cent over budget. These constant massive cost miscalculations are symptomatic of a range of problems, including estimated construction times and the relative stagnation of the nuclear industry.

The average construction time for nuclear plants has increased from 66 months for completions in the mid 1970s, to 116 months (nearly 10 years) for completions between 1995 and 2000. The Temelín nuclear power plant in the Czech Republic is a clear case of how construction delays increase costs. Completed around ten years later than planned, it ran five times over budget. The International Energy Agency (IEA) has suggested that "despite low operating costs, amortising Temelín's costs (total cost: CZK99 billion, plus CZK10 billion of unamortised interest) will create a significant financial burden for CEZ [Czech Energy Company]"[5] In spite of its 50-year history, this is typical for the nuclear industry.

High capital costs and poor performance make nuclear power uncompetitive

The economics of nuclear power have always been questionable. Nuclear power plants are also uncompetitive. When the electricity industry was mostly a monopoly, utilities were normally guaranteed full recovery of costs. This made any investment a very low risk to those providing the capital. It was consumers who bore most of the risk. Utilities, insulated from financial risk, were able to borrow money at rates reflecting this reduced risk to investors and lenders.

The introduction of competitive electricity markets in many countries transferred the risks of cost overruns to the plant developers. Developers are constrained by financial organisations which view investment in any type of power plant as risky. This raised the cost of capital to levels at which nuclear is less likely to be competitive.

With consumers no longer bearing the economic risk of new plant construction, nuclear power has no chance of performing in countries which move to competitive power procurement.

Summary of the economics of nuclear power - continued

An industry in decline

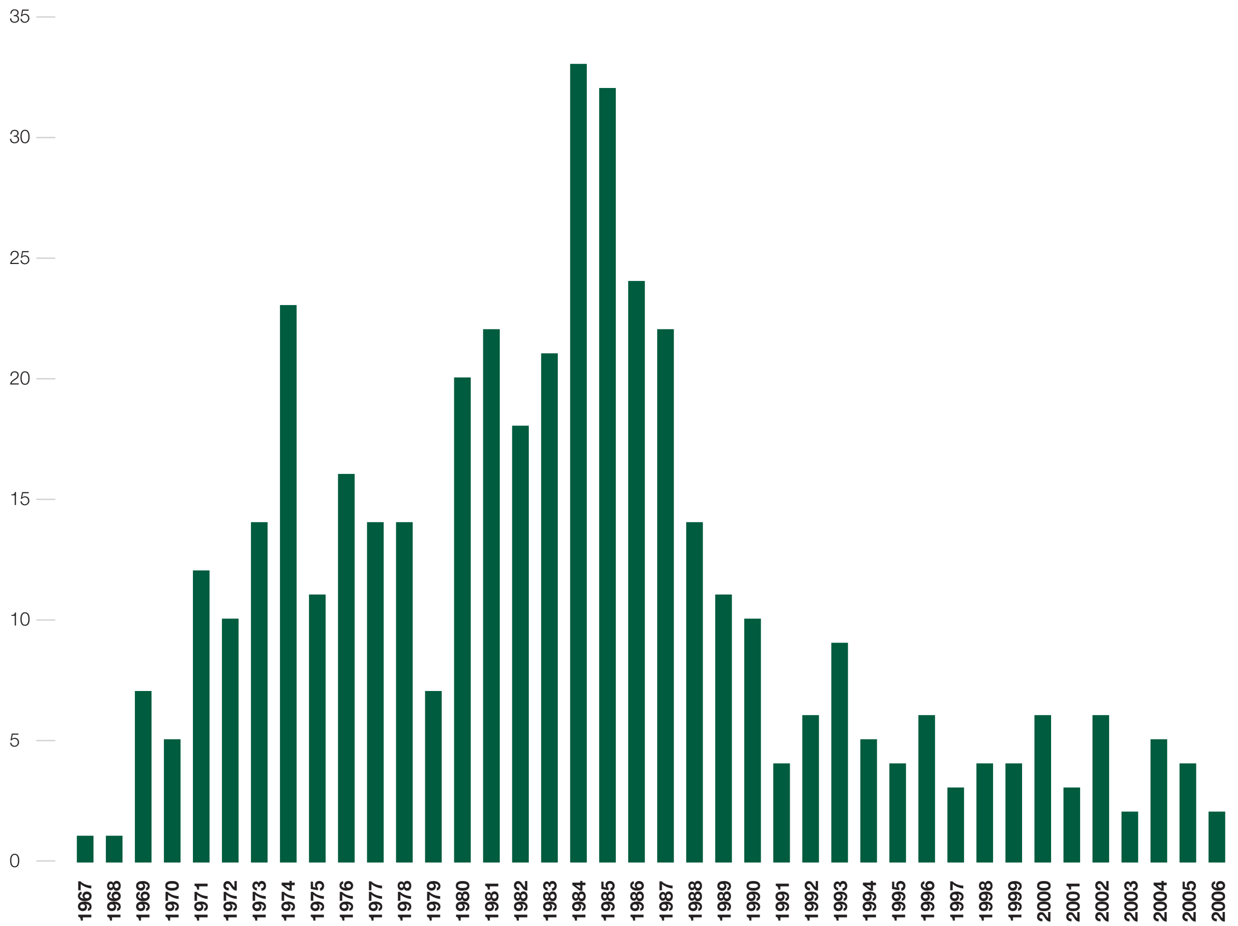
Talk of "nuclear renaissance" is simply not backed up by orders for new operational power plants.

Figure 1 shows the extent of the industry's decline. The IEA states that there are 33 reactors under construction a number of which are suspended or awaiting funding and five were started over 20 years ago.

This does not bode well for an industry already noted for its lack of innovation. One of the cost and financing papers prepared for the Stern Report, the UK Government's review of the economic impact of climate change, stated: "The costs of energy production and use from all technologies have fallen systematically with innovation and scale economies in manufacture and use, apart from nuclear power since the 1970s".[6]

The low level of nuclear construction provides little relevant experience on which to build confidence in cost forecasts. The European Investment Bank says that "very few nuclear power stations have been built in the last few years and thus the cost of recent plants does not seem a good reference to assess future costs".[7]

Figure 1 Installation of new nuclear capacity onto grid



Source: PRIS*.
***:** IAEA Power Reactor Information System Data-base, February 2007 http://www.iaea.org/programmes/a2/.

image Sellafield reprocessing plant, Cumbria, UK.

The impact of oil and carbon prices

Since 1999, the five-fold increase in the price of oil has led to a marked increase in some regions in the price of gas, with a consequent improvement in the relative economics of nuclear power. However, a European Commission analysis on the impact of higher oil and gas prices on the use of different energy technologies predicted a 6.5 per cent increase in the use of nuclear power compared to a 12.5 per cent increased use of renewables under in its high price scenario (US $99/barrel oil).[8]

The global price of oil has always fluctuated; in 1975 and 1980 the oil shocks resulted in prices increasing by up to a factor of eight, before collapsing to 1974 levels in 1986. As the oil shocks of the 1970s showed, oil prices can also have a significant impact on inflation and increase interest rates. Oil shocks resulted in lower energy demand and had a significant influence on the economics of nuclear power due to its high construction costs.

The introduction of a European Emissions Trading Scheme established a regional price for carbon. Lack of experience with a carbon price in the energy market, however, makes it difficult to assess the current impact on the economics of nuclear power. A recent study by Massachusetts Institute of Technology (MIT) calculated that "With carbon taxes in the US $50/tonne carbon range, nuclear is not economical under the base case assumptions". The study assessed nuclear power as only being able to break even under base case assumptions when carbon prices exceeded US $100/tonne carbon (€71/tonne C).[9]

Uncompetitive nuclear power reliant on government money

The Olkiluoto reactor (OL3) in Finland is the first reactor to be built in a liberalised electricity market and is a demonstration of whether nuclear power is economically viable. The source of the plant's capital investment and its unpublished financing details already raises questions. The European Renewable Energies Federation (EREF) and Greenpeace France complained to the European Commission in 2004 that financing arrangements for OL3 contravened European State Aid regulations. According to EREF, the Bayerische Landesbank (owned by the German state of Bavaria) led the syndicate that provided a loan of €1.95bn, or about 60 per cent of the total cost, at an interest rate of 2.6 per cent. Furthermore, two export credit agencies (ECAs) are also involved: France's Coface, with a €610m export credit guarantee covering Areva supplies, and the Swedish Export Agency, SEK, for €110m.

ECAs are public financial institutions and governments determine which projects they use taxpayers' money to support. They are normally involved in financially and politically risky projects in developing world countries - hardly a category that Finland would fit into. And credits are not usually provided for use within the same internal market.

The most important contribution of public money to the project comes from the French State, the owners of Areva. OL3 was offered for a contract price that Areva already knew was unlikely to be profitable. The terms of the contract stipulate that Areva's owners, in other words France's taxpayers, cover the cost overruns.

The arrangements for the construction of OL3 are based on substantial State Aid and a loan with an interest rate far below levels expected to be applied to such an economically risky investment. In September 2007, the European Commission stated it had rejected the complaint from EREF and Greenpeace France but has yet to publish its justifications.

Insurance & liability burden on the State

Table 1 Operator Liability Amounts and Financial Security Limits in a Number of OECD Countries as of October 2006 (Unofficial).*

State	Liability amount in national currency or special drawing rights with USD equivalent	Financial security limit if different from liability amount with USD equivalent
Belgium	SDR 300 million (USD 438m)	
Canada		CAD 75 million (USD 63m)
Czech Republic	CZK 6 billion (USD 252.8m)	CZK 1.5 billion (USD 63m)
Finland	SDR 175 million (USD 255.5m)	
France	SDR 76 million (USD 111.5m)	
Germany	Unlimited	Eur 2.5 billion (USD 3b)
Japan	Unlimited	YEN 60 billion (USD 538.8m)
Mexico	MXN 100 million (USD 9.3m)	
Slovakia	EUR 75 million	
Spain	ESP 25 billion (USD 183.8m)	
Switzerland	Unlimited	CHF 1.1 billion (USD 866.5m)
UK	SDR 150 million (USD 219m)	
USA	USD 10.4 billion	USD 300 million

***:** Deutscher Bundestag 'Nachhaltige Energieversorgung unter den Bedingungen der Globalisierung und Liberalisierung'. Bericht der Enquete-Kommission. Deutscher Bundestag: Berlin. June 2002 Chapter 3.3.2, Table 3.3, Page 232. dip.bundestag.de/btd/14/094/1409400.pdf

The above table shows the wide range of liability limits from very low sums, e.g. Mexico to much higher amounts e.g. Germany.

The international legal regime on nuclear liability is based on two international legal instruments.[10] The Brussels Convention set new limits, in 2004, for the liability of nuclear operators of €700 million. The Convention has yet to be ratified. Canada, China, India, Switzerland and the US are among the nations with nuclear power capacity which are not parties to either convention.

Considering that the costs resulting from the Chernobyl disaster potentially amount to hundreds of billions of euros, it is clear that the limit on liability for nuclear operators set in the Brussels Convention means that governments carry the real financial burden. Insurance cover would probably not be available for nuclear power plants as one major accident could bankrupt entire insurance companies.

A report for the European Commission's Environment Directorate estimates that if Electricité de France (EdF), the main French electric utility, was required to rely on private insurance to fully insure its nuclear plants against the full cost of a worst-case scenario accident, insurance premiums would reach €c5.0/ Kilowatt hour (kWh) and increase the cost of power generation by around 300 per cent.[11] Quite simply, the nuclear industry could not compete in a market where it was responsible for its own liability and insurance cover without government support.

Summary of the economics of nuclear power - continued

Unpredictable decommissioning costs

Nuclear liability does not end when plants cease to operate; it continues along with the nuclear waste for generations to come. Who pays for this long term liability is uncertain. The nuclear industry increasingly advocates a system in which the power company pays a fixed fee per kWh. In return, the State assumes financial and legal responsibility for the waste once the facility is closed. All future risks, therefore, remain with the State and are paid for by the taxpayer.

The costs of decommissioning commercial plants and managing the resulting clean-up are difficult to estimate and there is little practical experience of this. The costs of disposing of nuclear waste, especially intermediate or long-lived radioactive waste, are similarly uncertain. Problems arise when costs have initially been underestimated, the funds are lost or the company collapses before the plant completes its lifetime. Britain has experienced all of these problems. The expected cost of decommissioning Britain's first generation of nuclear plants has increased six-fold in the last 15 years and now stands at, £70 billion, according to the latest official estimate.

Insurance companies are unlikely to provide cover, faced by these major risks. Plant owners therefore depend on governments to offer guarantees to prevent them from exposure to financial risks posed by waste disposal and decommissioning liabilities.

image Temelín nuclear power plant, Czech republic, completed 10 years late and 5 times over budget.

Nuclear power is only economically viable with government subsidies

Nuclear power depends on government money. Whether underwriting capital costs, assuming the large-scale liability risk or fronting underestimated decommissioning expenditure, it is clear the nuclear industry can not survive without being a drain on the taxpayer. The facts speak for themselves.

In the US, for example, 29 years after the most recent order for a new nuclear plant, the industry is struggling. Utilities suffered heavy losses in the 1980s as economic regulators, unwilling to pass huge cost overruns on to consumers, forced utilities to bear the extra costs. The nuclear provisions of the US Energy Policy Act of 2005 (EPACT 2005) were an effort to reverse this situation and protect investors from heavy financial risks. The provisions offer tax credits, federal loan guarantees and contributions to risk insurance worth between US $2-20/Megawatt hour (MWh). It is unlikely any US company would consider investing in a new nuclear plant without the EPACT guarantees.

In June 2007, the rating agency Moody's stated that while they considered that a constructive regulatory relationship will help mitigate near-term credit pressures, the agency was concerned about the prospect of construction delays, cost overruns and the implications for rate-shock and future disallowances. From a credit perspective, business and operating risk profiles will increase for companies that pursue new nuclear generation.[12]

The government financial or contractual guarantees, which are necessary for the industry's survival, effectively take nuclear power out of the market. If nuclear power is to be subsidised in this way, there needs to be clear and compelling evidence that it is a cost-effective and worthwhile way to use taxpayers' and electricity consumers' money. If nuclear power is considered as a long-term option, policymakers and taxpayers must make balanced decisions based on: health, security, environmental impacts and the true economics of nuclear power.

Market for renewable energy is booming

As the declining nuclear industry becomes ever more dependent on government support, the future for renewable energy is bright. With a fairer legal and political framework, green electricity could keep the lights on with carbon-free electricity.

Renewable energy sources provided 18 per cent of global electricity demand in 2004.[13] Large hydro power plants are the largest renewable source, but wind energy is rapidly following. The share of new renewable energy in electricity generation is under one per cent, but has enjoyed double-digit growth rates over the past decade.

In comparison, nuclear capacity accounted for 16 per cent of global electricity generation in 2006.[14] Yet nuclear industry growth has declined dramatically since its pre-Chernobyl peak in the mid '80s whereas renewable energy markets are growing robustly.

image Energy plant near Reykjavik, energy is produced from the geothermal activity.The volcanic rocks are visible behind the plant. North West of Iceland.

Table 2 EC White Paper Projections, progress and prognosis*

Date	1995		2010 projection		2005 actual	2010 MW projection will be achieved
Technology	**Capacity, MW**	**Output, TWh**	**MW**	**TWh**	**MW**	
Wind	2500	4	40,000	80	40,455	Already exceeded
Hydro, large	82,500	270	91,000	300	96,418	Already exceeded
Hydro, small	9,500	37	14,000	55	11,600	~10% under
Photovoltaics	30	0.03	3,000	3	1,794	Will be exceeded
Biomass	(1)	22.5		230	68 TWh	No
Geothermal	500	3.5	1,000	7	822 (2)	Slight undershoot

Notes:
1. Some biomass used to 'co-fire' with fossil plant, so capacities not relevant
2. 2004 figure
***:** EurObserver, '2005 European barometer of renewable energies', Systemes Solaires, Paris 2005 http://ec.europa.eu/energy/res/publications/barometers_en.htm

The table above shows that the majority of renewable energy sources in Europe are already outperforming projected targets for 2010. Worldwide during 2005, renewable power capacity, excluding large hydropower, expanded to 182 GW, up from 160 GW in 2004.

The investment flow not only stimulates growth but continues as the industry booms. An estimated US $38 billion was invested in new renewable energy capacity worldwide in 2005, up from US $30 billion in 2004. Almost all the increase was due to increased investment in solar photovoltaics (PV) and wind power. See table 3.

In addition to renewable energy capacity investment, solar PV industries are making substantial capital investments in new manufacturing plants and equipment. In 2005, this was estimated at US $6 billion. It is expected to reach US $8-9 billion in 2006.

Table 3 Selected indicators

Year of announcement	2004	2005
Investment in new renewable capacity (annual)	$30	$38 billion
Renewables power capacity (existing, excl. large hydro)	160	182 GW
Renewables power capacity (existing, incl. large hydro)	895	930 GW
Wind power capacity (existing)	48	59 GW
Grid-connected solar PV capacity (existing)	2.0	3.1 GW
Solar PV production (annual)	1,150	1,700 MW
Solar hot water capacity (existing)	77	88 GWth
Ethanol production (annual)	30.5	33 bill. litrs
Biodiesel production (annual)	2.1	3.9 bill. litrs
Countries with policy targets	45	49
States/provinces/countries with feed-in policies	37	41
States/provinces/countries with RPS policies	38	38
States/provinces/countries with biofuels mandates	22	38

Renewable electricity costs declining

The growth of the renewable energy industry is helping to drive down the cost of electricity it generates. Many renewable energy technologies are still at a relatively early stage of market development. Accordingly, the costs of electricity, heat and fuel production are generally higher than from competing conventional systems, partly due to environmental costs not being included. However, compared to conventional power technologies, large cost reductions are expected to come from technical learning, manufacturing improvements and large-scale production.

When developing long-term scenarios spanning several decades, or making longer term energy policy decisions, the dynamic downward trend of cost developments is crucial. The DLR Institute developed the Energy Revolution scenario for Greenpeace and the European Renewable Energy Council.[15] DLR found that achieving a 60 per cent reduction in carbon dioxide emissions in the power sector between now and 2050 by using the prescriptions in the Energy Revolution scenario, the average annual savings in fuel costs would be 10 times greater than the additional investment cost. As the renewable energy industry has grown, there have already been substantial reductions in hardware costs leading to final reductions in output costs. Every doubling of global wind energy capacity has been accompanied by a reduction in turbine costs of between 8 and 15 per cent.[16]

Summary of the economics of nuclear power - continued

Figure 2 Cost data for wind turbines and solar modules.

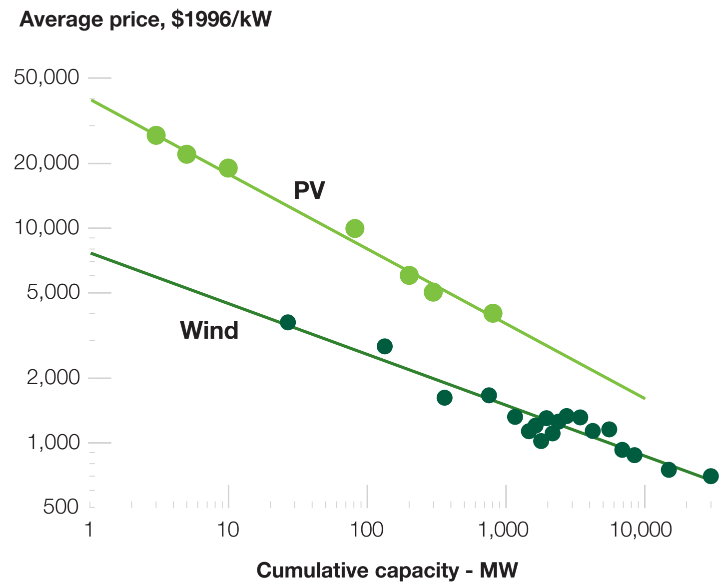
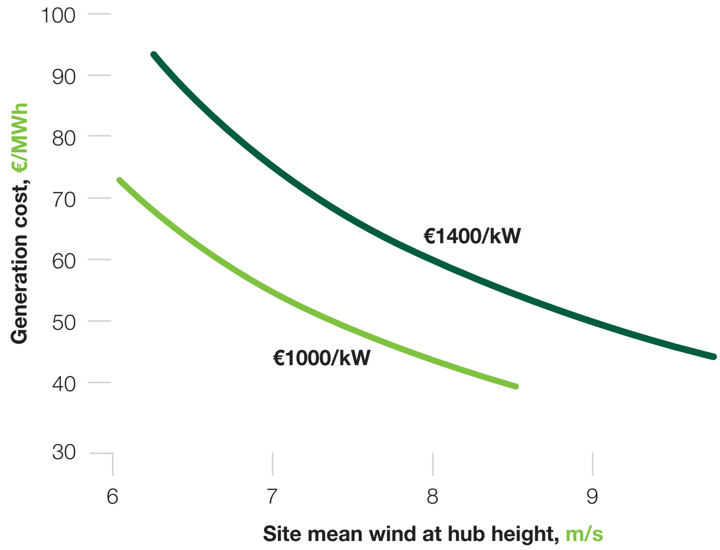


Figure 3 Generation cost estimates for onshore wind.



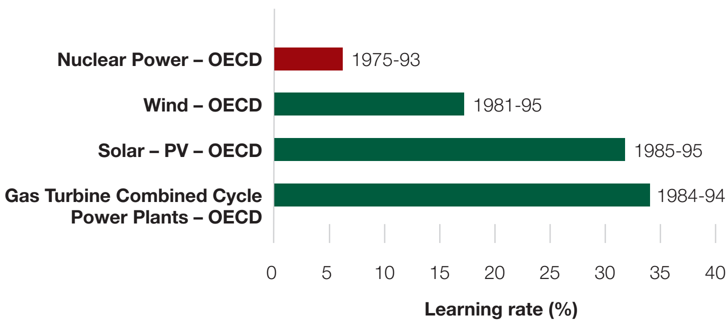
Note: The units used for price do not influence the estimate of the learning rate. Data for the early wind years comes from total shipments from America,* for the central years from data compiled by the Danish Wind Turbine Manufacturers Association (http://www.windpower.org/), and the last point (at 30,000 MW) comes from a wind turbine catalogue.** PV data comes from Shell and the World Energy Council.
:** Jaras, T 'Wind turbine markets, shipments and applications' Wind Data Center, Virginia, 1987 and 1988. *:** Ernuerbare Energien, 'Wind turbine market 2005', SunMedia, Hanover, 2005.

The correlation between specific investment costs and cumulative production volume of a technology can be represented as learning curves, of which figure 1.2 is a good example.

Not all renewable technologies have achieved the same rates of economic improvement, however. Analysis by McDonald and Scrattenholzer suggests that the rate of learning is much lower for nuclear power. The UK Government's Performance and Innovation Unit highlighted a number of areas in which future nuclear power plants may not exhibit comparable learning rates to other technologies, including:

- Relative maturity of civil nuclear technology
  - less room for stretch than with renewable technologies
- Longer lead times for construction and commissioning
- Less scope for economies of scale. Renewables require smaller initial scale with wider potential application

Figure 4 Learning rates of selected energy technologies



Source: McDonald, A. and Schrattenholzer, L. 'Learning rates for energy technologies' Energy Policy 29, 2001, pp. 255-261

image Fairground, Pripyat, abandoned after the Chernobyl nuclear disaster. The State carries the human, environmental and financial liability of nuclear power.

Renewable energy is growing - but time is short

The renewable energy industry is becoming increasingly attractive to investors. The consensus among climate change experts is that fundamental changes need to be made to energy production and use within the coming decade if the worst impacts of climate change are to be averted. Without adequate policy and legal support, the expansion of renewable electricity markets worldwide will not happen fast enough.

Nonetheless, some fine examples of good practice have emerged. Germany has relied on a time-limited feed-in tariff programme in developing the world's most dynamic renewable industry and electricity market. Renewable electricity generators feed power into the grid and receive a fixed premium tariff per kWh for a fixed period of time.

Power sector companies do not always allow renewable electricity to be fed into their grid. However, the simple step of opening up access to the grid makes it possible for renewable energy to begin competing. Power companies then pay a fixed tariff for renewable electricity according to the size and technology of the installation and spread the higher cost of renewable power equally among all electricity consumers via the usual electricity bill. In Germany, the extra monthly costs per household as a result of the feed-in tariff for renewable electricity was less than €1. To keep driving down the cost of renewable electricity Germany reduces its feed-in tariff for newly installed systems by five per cent each year.

Another success story comes from Texas, in the United States, which already generates more electricity from wind than any other US State. Success is due partly to renewable portfolio standards (RPS) signed into law in 1999 by the then Governor George W. Bush. The standards place an obligation on utilities to meet renewable energy targets or face a penalty. The common view among the Texas wind energy industry is that the RPS jumpstarted the market allowing wind power to now compete well against fossil fuels on the open market.

To summarise, renewable energy has a bright future given the right conditions for development and investment. Nuclear power, on the other hand, has 50-year history of cost overruns being propped up by subsidies, unreliable performance and huge liability risks that it has failed to yet leave behind.

Conclusions

The report "The Economics of Nuclear Power" offers a compelling case against both state and private investment in the nuclear industry. Investment in nuclear power stations is a capital intensive risk that combines uncompetitive high prices with poor reliability and a likelihood of serious cost overruns. The forecast figures and schedules which the nuclear industry provides to investors and governments are corroborated neither by historical nor current experience. Significant question marks remain over insurance and liability. There are no insurance companies able to fully insure the nuclear industry against a potential accident or to carry the risk of escalating and unknown decommissioning costs. Today, as before, the nuclear industry's survival depends upon the taxpayer.

Investment in the nuclear industry comes also at the cost of sustainable and efficient energy technologies. As Oras Tynkkynen, a Finnish Member of Parliament said: "We have made the choice, we have chosen the nuclear path and that has meant we have neglected sustainable alternatives like energy efficiency and renewable energy sources".[17]

Renewable energy markets have a healthy outlook. Investment has already led to more cost-efficient output in technologies such as wind and solar PV. Continued technological improvement and innovation make this a dynamic industry with significant potential for further growth and development. Where the right framework has been provided, the renewable industry has become a market force independent of the state.

There is a choice to be made. Either continue to invest in, or spend taxpayers money on, nuclear power - an industry blighted by financial, environmental and human health risks and a liability for generations to come. Or invest in renewable energy - a growth industry that offers an environmental and financially sustainable future.

image Construction site of the proposed new European Pressurized Water Reactor (EPR),Flamanville, France. The other EPR construction in Finland is already estimated €700m (2006)over budget and the figure is growing.

Summary of the economics of nuclear power - continued

Greenpeace Recommendations

An end to the nuclear age:

- Phase out existing reactors without extending their operational lifetimes.
- No new construction of commercial nuclear reactors.
- Stop international trade in nuclear technologies and materials.
- Phase out all direct and indirect subsidies for nuclear energy and fossil fuels.
- Banks and other financial institutions reject lending for nuclear energy investments.
- Stop spent fuel reprocessing.

A renewable energy future:

- Divert state funding for energy research into nuclear and fossil fuel energy technologies towards clean, renewable energy and energy efficiency.
- Set legally-binding targets for renewable energy.
- Adopt legislation to provide investors in renewable energy with stable, predictable returns.
- Guarantee priority access to the grid for renewable generators.
- Adopt strict efficiency standards for all electricity-consuming appliances.

1 The economics of nuclear power, Stephen Thomas, Peter Bradford, Antony Froggatt and David Milborrow, May 2007 http://www.greenpeace.org/international/press/reports/the-economics-of-nuclear-power

2 Future Investment- A Sustainable Investment plan for the power sector to save the climate, Greenpeace and European Renewable Energy Council, July 2007- http://www.greenpeace.org/international/press/reports/future-investment

3 To allow comparisons between plants with different output capacities, costs are often quoted as a cost per installed kW. Thus, a nuclear power plant with an output rating of 1200MW, quoted as costing €2000/kW would have a construction cost €2,400m. Conventionally, quoted construction costs include the cost of the first charge of fuel but do not include interest during construction.

4 Department of Energy, 'An analysis of nuclear power construction costs, energy information' Administration of the US, DOE/EIA-0411, 1986

5 International Energy Agency, 'Energy Policies in IEA Countries, Country Review - Czech Republic', IEA 2001

6 Dennis Andersen 'Cost and finance of abating carbon emissions in the energy sector' p18 Imperial College London, October 2006 (supporting paper for the Stern Review)

7 European Investment Bank 'Energy Review' October 2006

8 European Commission, 'Scenarios on high oil and gas prices', DG Energy and Transport, September 2006.

9 Massachusetts Institute of Technology 'The future of nuclear power' MIT, Boston, 2003 web.mit.edu/nuclearpower/

10 The International Atomic Energy Agency on Civil Liability for Nuclear Damage of 1963 and the OECD's Paris Convention on Third Party Liability in the Field of Nuclear Energy, from 1960 and the linked Brussels Supplementary Convention of 1963. These conventions are linked by the Joint Protocol, adopted in 1988. In 1997 a Protocol was adopted to amend the Vienna Convention, which entered into force in 2003 and in 2004 a Protocol was adopted on the Paris Conventions.

11 'Solutions for environment, economy and technology', Report for DG Environment, Environmentally harmful support measures in EU Member States, European Commission, January 2003 page 132

12 Special Comment Credit Risks and Benefits of Public Power Utility Participation in Nuclear Power Generation Summary Opinion, Moody's June 2007

13 World Energy Outlook 2004, International Energy Agency

14 World Nuclear Association, 'World Nuclear Power Reactors 2005-2007'(http://www.world-nuclear.org/info/reactors/htm)

15 Future Investment - A Sustainable Investment plan for the power sector to save the climate, Greenpeace and European Renewable Energy Council, July 2007- http://www.greenpeace.org/international/press/reports/future-investment. Full Scenario Report- Energy Revolution-A Sustainable World Energy Outloook, Greenpeace and European Renewable Energy Council, January 2007- http://www.greenpeace.org/international/press/reports/energy-revolution-a-sustainab

16 Junginger, M, Faaij, A and Turkenburg, W 'Global experience curves for wind farms' Energy Policy 33, 2005 pp. 133-50

17 In interview with Greenpeace UK-The Convenient Solution- Show casing clean energy solutions to climate change- www.greenpeace.org/solution

image Solar and wind-facility near Rostock, Germany.

Greenpeace

Greenpeace is an independent global campaigning organisation that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace.

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