PIU Energy Project

NUCLEAR – INITIAL SCOPING NOTE

Reference: Nuclear 1 v1.0
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1. PURPOSE OF THIS NOTE AND WAY FORWARD

1.1 The purpose of this note is to summarise the history and current position of nuclear power and to identify key issues and areas of uncertainty regarding its future prospects.

1.2 This is one of a series of initial scoping notes that have been prepared by the PIU Energy Review Team on a series of topics. The team will not be producing scoping notes on every aspect of the Review. Some areas relevant to the Review have already been explored in depth by the PIU Resource Productivity and Renewables Review Team which has been working since January 2001 and which has been merged into the Energy Review Team.

Readers should not assume that the PIU has in any respect closed its mind. Propositions are made, and questions are put, in order to draw responses.

1.3 We will be taking forward discussion of the questions and propositions raised in this note over the next two months.

1.4 This will be done via bi-lateral meetings with key stakeholders. We are also likely to arrange a workshop involving all key stakeholders where views on the key issues can be exchanged and debated, probably during October.

1.5 The PIU has already invited all interested parties to put submissions to it by 10th September on all aspects of the PIU Energy Review. Interested parties are invited to respond in their submissions to the questions and propositions raised in this scoping note.

1.6 We would also be grateful if interested parties could let us know as soon as possible if they consider this note overlooks key questions, if any of the questions posed, or propositions put, are fundamentally misconceived, or if the note contains any factual errors.

2. HISTORY AND BACKGROUND

2.1 There are currently 3 types of nuclear power station in the UK. The Magnox stations were built in the 1950s and 1960s and currently produce some 16 TWh/year. Some of these have already closed and have started the process of decommissioning. The Advanced Gas-Cooled Reactor (AGR) stations were completed during the 1970s and 1980s and currently produce some 55 TWh/year. The single Pressurised Water

Reactor (PWR) station, Sizewell B, was completed in 1995 and produces some 8.5 TWh/year. Between them, the nuclear stations currently produce some 23% of UK electricity needs.

2.2 In general, the cost of the UK nuclear stations turned out to be higher than expected when they were commissioned. This is particularly true of the AGRs which not only suffered substantial capital cost overruns but then suffered from poor performance. The Magnox stations have been generally reliable although at lower capacities than their original designs and the PWR has also been generally reliable although it too suffered capital cost overruns. Since 1990, there has been significant improvement in the performance of the AGRs such that there remains little scope for increasing the annual amount of generation from existing nuclear stations.

2.3 Most of the fuel required for UK nuclear stations is fabricated by British Nuclear Fuels Limited (BNFL). BNFL is a private limited company (plc) although it is wholly owned by the Government. BNFL is also the main provider of back-end fuel services, including reprocessing, for UK nuclear stations. BNFL also provides fuel services, including reprocessing, for nuclear generators in a number of other countries including Germany and Japan. In recent years, BNFL has also expanded its international operations in the field of nuclear decommissioning, reactor design capability and nuclear fuel services[1]. The nuclear industry in the UK employs some 30,000 people[2].

2.4 In recent years, the broad thrust of Government policy towards nuclear power has been that it should be neither encouraged nor discouraged relative to fossil fuel generation[3]. In practice, this has meant that no new proposals for nuclear stations have come forward, with nuclear being more costly than the main fossil alternative for new baseload electricity generation, namely combined cycle gas turbines (CCGTs).

2.5 The main aspect of policy affecting nuclear over the last decade has been the effort to privatise as much of the industry as practicable. The AGR and PWR stations were privatised as British Energy in 1996 and Government has been pursuing efforts to inject private finance into BNFL, the current owner of the Magnox stations and the provider of fuel fabrication and spent fuel handling services for all the nuclear stations.

2.6 The Government conducted a review of nuclear power in 1994 and issued a White Paper (Cm 2860) in May 1995 of which the main conclusions were:

- Current and foreseeable circumstances did not warrant public sector support for new nuclear build;
- Private sector operators were encouraged to investigate new nuclear build on a purely commercial basis;

[1] For example, BNFL bought the Westinghouse reactor design and construction business in 1999 and ABB's nuclear fuel business in 2000.
[2] Source: DTI Energy Report 2000 page 106. The figure is for 1999.
[3] Although nuclear generators benefited from receipts from the Fossil Fuel Levy during the early 1990s, these receipts were structured as essentially lump sum payments that did not affect the marginal incentives for nuclear generation.

- New nuclear build was not needed on emissions abatement grounds in the near future or to provide diversity of supply;

- The AGR and PWR stations would be privatised, whilst the Magnox stations would remain in the public sector.

2.7 There has been substantial deployment of nuclear power in a number of countries other than the UK. Experiences of, and attitudes towards nuclear vary considerably from one country to another. International aspects of nuclear are discussed further in Section 4 of this note.

3. PROSPECTS

3.1 Existing Stations

3.1.1 All the Magnox stations are currently expected to close between now and around 2010, reaching operating lifetimes averaging about 40 years. The prospects for life extension of these stations are thought to be limited, not least by the need, under the OSPAR Convention, to curtail radioactive emissions from the plant which reprocesses the spent fuel from these stations.

Questions:

Is there a real possibility of any Magnox stations being life extended significantly beyond 2010?

If so, at what cost?

What are the main factors inhibiting Magnox life extension?

What are the risks of all the Magnox stations closing well before 2010?

3.1.2 The AGR stations are currently expected to close between about 2010 and 2025, by which time they would be some 30-35 years old. The prospects for life extension beyond this are though to be quite limited – perhaps a further 5 years.

Questions:

Is there a real possibility of AGR stations being life extended to 40 years or more?

If so, at what cost?

What are the main factors inhibiting AGR life extension?

What are the risks of all the AGR stations closing by around 2010?

3.1.3 Sizewell B is expected to last until at least 2035 when it will be 40 years old and could last considerably longer.

3.1.4 All the existing stations have annual running costs amounting to about 1.0-1.5 p/kWh. However, the need for significant refurbishing, or fault repair, could increase avoidable operating costs to higher levels such that if wholesale electricity prices remain at around current levels of about 2.0 p/kWh, stations could be closed earlier than indicated above.

Questions:

Is it worth taking steps to ensure existing stations do not close early?

How could this best be done, bearing in mind (a) that the Magnox stations remain in public ownership and (b) that any measures would need to be consistent with UK competition policy and EU State Aids policy?

3.2 New Stations:

3.2.1 In the 1995 White Paper, the cost of electricity generation from new nuclear stations was estimated to be around 4 p/kWh (in today's money values) if built by the private sector in a competitive, liberalised, generation market. The capital cost was of the order of £1500/kW. The cost estimates included allowances for the disposal of all waste arisings. By comparison, the cost of electricity from a new CCGT station is currently around 2.0 p/kWh (of which about half is the cost of fuel).

3.2.2 These "cost" figures represent the electricity revenues that the station owner would need to be confident of receiving over a period of some 10-15 years in order to justify investment in the plant.

3.2.3 The nuclear industry argue that costs could be significantly reduced from 4.0 p/kWh through:

- Series ordering and economies of scale;
- multiple units on the same site;
- quicker planning and licensing processes;
- new reactor designs

However, there have also been arguments that without some kind of public support or tax advantage, new nuclear build is unlikely to be commercially viable in competition with fossil-fuelled plant in the foreseeable future.

3.2.4 In some other countries, particularly France, nuclear has appeared a competitive option against fossil-fuelled generation, at least in the context of a centralised monopoly generator and a country without significant fossil fuel reserves of its own. On the other hand the costs of new nuclear could exceed 4.0 p/kWh since the industry, at least in the UK, has a history of underestimating costs and overestimating performance.

3.2.5 Whilst a great deal has been learned from the experience of building and operating the stations now in existence, the complexity of the construction process and the evolving safety and regulatory standards applicable to plant design and construction mean that past experience may not be a reliable guide to the future.

3.2.6 The large capital costs of nuclear power stations, and the long lead times between project approval and operation, impose substantial commercial risks. Private sector builders could adopt a range of measures to manage or share these risks, including the use of multi-firm consortia and advanced sales of the electricity. The need to deal with these risks is likely to mean a high cost of capital and hence higher overall costs. To date, no nuclear power stations have been ordered anywhere in the world by private sector operators in competitive electricity markets.

3.2.7 Most plant currently in operation worldwide are "Generation II" designs of which the best known and most popular is the PWR. "Generation III" designs are just starting to be introduced, with some under construction in Asia. It is probable that any new stations ordered in the UK in the next 20 years would be Generation III plant. Examples of Generation III plant are the AP 600 / AP 1000 Westinghouse designs of Advanced Light Water Reactor (ALWR). Generation III plant are projected by the nuclear industry to offer lower costs, greater safety, and less waste than Generation II designs.

Questions:

To what level could nuclear generation costs fall for plant designs likely to be available over the next 10 years?

What level of confidence can be placed on such cost estimates?

Does past experience enable new stations to be built more cheaply?

3.2.8 One of the key problems facing potential investors in new nuclear power stations is the long time lags at the start of the project. It took 15 years for Sizewell B to complete the planning application and construction process. It is unlikely that any new nuclear station could be completed in the UK before 2010, and perhaps not until 2015 if a new technology, not previously licensed in the UK, were to be used. By contrast, a new gas station could be in operation as little as 3 years after seeking planning approval.

Questions:

Are the above estimates of lead times for nuclear realistic?

Could more be done to reduce lead times by harmonising UK licensing procedures with those of other countries?

4. THE INTERNATIONAL PERSPECTIVE

4.1 Nuclear power has been widely deployed in most OECD countries and some non-OECD countries, especially in the former Soviet Union and Eastern Europe. Nuclear provided some 17% of world electricity needs in 1999[4].

4.2 There are some 14 countries in which nuclear accounts for between 20% and 50% of electricity requirements, including the UK, Germany, Japan and the USA, and a further 14 where it accounts for less than 20%. There are 3 countries where nuclear accounts for more than half of electricity requirements: France (76%); Belgium (57%); and Lithuania (82%). Most existing nuclear stations were built during the 1970s and 1980s.

Proposition:

It is almost certain that nuclear plant will continue to operate in a number of countries, including some European ones, for at least the period to 2020.

4.3 In OECD countries there have been few orders for new nuclear plant since the early 1990s and in most there have been no new orders. Some countries, notably Germany and Italy, have stated that they do not intend to build any new nuclear plant in future. At present there are 12 units under construction in OECD countries with a further 4 committed and another 23 planned[5]. Most of these units are in Japan and Korea but new stations are being built in the Czech Republic and Slovakia and are planned in Finland and Turkey. A number of non-OECD countries, notably Russia, China and India are continuing to push ahead with substantial new investment in nuclear power.

Propositions:

Construction of new nuclear power stations will continue in at least some countries for many years to come (unless halted by a major accident).

There is a considerable likelihood of new nuclear stations being ordered somewhere in Europe in the next 10 years.

4.4 Public attitudes to nuclear power vary from country to country. However, there are signs at international level that nuclear power is not viewed as favourably as other forms of carbon abatement as a means for combating climate change. The recent agreement on the Kyoto protocol at Bonn confirmed that nuclear projects will not qualify under the Clean Development or Joint Implementation mechanisms, whereby countries can contribute to their own emission reduction targets by funding carbon abatement projects in other countries.

[4] NEA Nuclear Energy in a Sustainable Development Perspective Table 1.1
[5] NEA Nuclear Energy Data 2001

5. ENVIRONMENTAL IMPACTS

5.1 Greenhouse Gas Emissions

5.1.1 Nuclear power stations emit no greenhouse gases in normal operation.

5.1.2 As large projects, nuclear power stations require considerable quantities of energy for their construction. Energy is also used to prepare the fuel and handle it after use. However, even when these factors are taken into account, greenhouse gas emissions from nuclear power are very small compared to emissions from fossil fuel generation.

> **Proposition**:
>
> Greenhouse gas emissions associated with nuclear generation are very small compared to generation from fossil fuels.

5.2 Acid Gas Emissions

> **Proposition**:
>
> Nuclear power produces negligible emissions of the gases causing acid rain (sulphur dioxide and nitrogen oxides) compared to generation from fossil fuels.

5.3 Radioactive Waste

5.3.1 Nuclear power produces radioactive waste. Some of this is "low level" and will decay to harmless levels of radioactivity inside a few decades. Other, "high and intermediate level" waste (including unreprocessed spent fuel) is extremely hazardous and will remain so for thousands of years into the future.

5.3.2 Although many in the nuclear industry would argue that the technical expertise already exists to dispose of high and intermediate level waste (HILW) safely in deep underground repositories, no country in the world has yet developed a means of disposing of that waste in a manner that commands widespread public support and would not require continuous monitoring for the foreseeable future[6]. HILW is currently kept in special storage facilities.

> **Propositions**:
>
> It is highly unlikely that a disposal route for HILW will be available for use in the UK within the next 20 years.
>
> It is highly unlikely that the UK could dispose of HILW in some other country in the foreseeable future.
>
> The technology already exists to store HILW safely, for many decades if necessary.

[6] Finland may be closest to reaching a high level waste disposal route.

5.3.3 The absence of HILW disposal routes means that nuclear generators do not know how much money to set aside during the lifetime of their stations to meet the eventual waste disposal costs. The long timescales involved could mean that the companies concerned are no longer in existence by the time disposal routes are established.

Questions:

How can nuclear generators set aside adequate sums to meet eventual waste disposal costs?

If the generator were to set aside sufficient funds to meet highly pessimistic estimates of waste disposal (and interim storage) costs, what fraction of total generating costs would this represent?

5.3.4 Regardless of whether any new nuclear power stations are built, there are considerable quantities of nuclear waste already in existence, resulting from past nuclear generation, nuclear R&D activity and also from nuclear weapons programmes. This situation is especially true of the UK given our leading role in early nuclear R&D. The quantity of waste will inevitably rise further when existing stations are closed, defuelled and decommissioned.

5.3.5 The existence already of large quantities of nuclear waste means that some acceptable way of dealing with it will need to be found. The problem will not just go away.

5.3.6 New nuclear stations are likely to generate considerably less HILW than existing UK stations. For example, a report by RWMAC estimated that a programme of 8 new PWRs would increase the total amount of intermediate level waste in the UK by only 10%[7]. A programme of that scale would be sufficient to replace all the existing AGR stations that produce most of the UK's nuclear generation. It is an internationally recognised industry objective that new designs of nuclear power station would produce less waste than conventional PWRs.

5.3.7 Substantial amounts will need to be spent in future to develop, design and build a high level waste disposal facility, or otherwise maintain *existing* wastes in a safe condition. As a result, the *additional* costs of dealing with extra quantities of waste are likely to be quite small in relation to the costs that will in any case have to be incurred to deal with existing and unavoidable waste.

Propositions:

Waste arising from new stations is likely to be significantly less than from existing stations;

New waste will not be significantly different in kind to existing waste and will not require distinct approaches to storage or disposal;

[7] Radioactive Waste Management Advisory Committee: Rethinking Disposal. January 1998. Refered to in DTI evidence to PIU – page 84.

The marginal costs of dealing with extra waste are likely to be small compared to the costs of dealing with unavoidable waste.

5.3.8 A key issue for both interim storage and final disposal facilities will be location. No communities are likely to welcome such facilities in their area and local employment benefits are likely to be small.

Question:

If active consideration was to be given to compensating local communities for accepting nuclear waste facilities, would this significantly alter the acceptability of nuclear waste storage and disposal facilities.

5.4 Safety

5.4.1 Everyone is exposed to some level of background radiation. However, the operation of nuclear power stations and their associated fuel facilities leads to some additional exposure of plant workers and, to a lesser extent, the general public, to radioactivity. These exposure levels, and releases of radioactivity to the environment, are regulated by the Nuclear Installations Inspectorate, which is part of the Health and Safety Executive, and by the Environment Agency.

5.4.2 There is always a small risk that accidents at nuclear facilities could have catastrophic results leading to the death or injury of large numbers of people and /or the contamination of large areas of land, rendering them unsuitable for farming or habitation for long periods. Other accidents which would not be widely regarded as catastrophic could still lead to injury, loss of life and land contamination.

5.4.3 There have been 5 significant accidents to date:

- Windscale (UK 1956)
- Kyshtym (Soviet Union 1957)
- Three Mile Island (USA 1979)
- Chernobyl (Soviet Union 1986)
- Tokaimura (Japan 1999)

Of these, only Chernobyl had consequences that could be described as catastrophic. To a greater or lesser extent, the others came close to having catastrophic consequences.

5.4.4 It is unlikely that private companies would be able to obtain insurance to cover the full consequences of catastrophic events. At present, compensation for the consequences of catastrophic accidents is covered by an international convention with Governments accepting a large part of the liability.

> **Question**:
>
> Views on the current and prospective safety risks, and on public attitudes to risk, are invited.

5.4.5 The safety of new plant designs is assessed during the planning process and the risks considered in the context of the prospective benefits of the project. However, the justification for operation of the plant must, under EU Directive, be reviewed again after it has been completed but before it is commissioned. The nuclear industry argue that this second assessment adds significant risks to their projects.

> **Question**:
>
> Could pre-commissioning justification be more limited in scope?

6. NUCLEAR AND SECURITY OF SUPPLY

6.1 The raw material for nuclear power is uranium and uranium constitutes about 10% or less of the total cost of nuclear power. Uranium is abundant in the earth's crust and conventional resources are estimated to represent some 250 years of current consumption[8]. Uranium reserves are quite widely distributed although few are found in Europe or the UK. The main potential sources of uranium for the UK would be Australia, Canada, Russia, South Africa and the USA. The Euratom Supply Agency believes that uranium supplies to Europe will remain plentiful and reasonably priced for the foreseeable future.

6.2 It is not possible to switch rapidly from other energy sources to nuclear since nuclear power stations have long lead times and those already in place are likely to be used at close to full capacity. In view of this lack of short term substitution possibilities, it is unlikely that world uranium prices would reflect shocks in fossil fuel prices.

> **Proposition**:
>
> The UK is likely to be able to secure sufficient supplies of uranium at relatively stable prices for the foreseeable future.

6.3 It is technically possible to reprocess spent nuclear fuel in order to recover significant amounts of the energy content, partly in the form of plutonium. Reprocessing facilities currently exist in the UK, France and Russia and are used by other countries including Japan and Germany[9]. They were built at a time when future supplies of uranium were expected to be significantly more expensive than is now the case. Reprocessing separates the reusable uranium and plutonium, and concentrates the highly active waste, but it does increase the volumes of lower active waste. Plutonium is the preferred material for nuclear weapons and needs to be very

[8] Source: NEA Nuclear Energy in a Sustainable Perspective (2000). Page 35.
[9] Reprocessing facilities are currently under construction in Japan.

carefully guarded[10]. However, reprocessing is not essential. Spent fuel from modern reactors can be stored awaiting final disposal[11].

Questions:

What, if any, is the economic case at present for reprocessing spent fuel from new reactors?

6.4 The main constraint on the scale of the nuclear resource, other than supplies of fuel, is the availability of suitable sites for the power stations. There are already 12 nuclear generation sites in the UK and several of these could accommodate additional stations. It is probable that additional suitable sites could be found.

Proposition:

If new nuclear power stations were to be publicly acceptable in general terms, the availability of suitable sites in the UK seems unlikely to be a significant constraint.

6.5 Current nuclear power station designs exhibit substantial economies of scale. During the 1994 nuclear review, the industry put forward plans for a twin PWR reactor project with 2,600 MW capacity. Although newer designs might be more suitable for smaller scales, nuclear stations are likely to remain of at least the scale of current conventional fossil fuel plant and much larger than most renewables plant. The scale of nuclear power stations has certain system implications:

- Continuing need for a centrally controlled electricity transmission and distribution network;
- Possible need for back-up electricity generation capacity in case of accidents or generic faults that could put a number of stations out of action at the same time.

6.6 Another feature of nuclear plant is that it is not well suited to the rapid and frequent changes in output necessary for load-following. A system with a large nuclear component would probably need at least some flexible generating plant (perhaps fossil fuelled or hydro) and /or flexible demand adjustment options.

6.7 New nuclear stations could add to the diversity of UK energy supplies, particularly if they replace existing stations and in that sense they could make a contribution to security of supply. The main security risk associated with nuclear is that discovery of a fault, or an accident, could lead to the simultaneous shut down of a significant part of the country's generating capacity. The discovery of faults in some AGR stations was a major factor behind the tight plant margins, and unusually high wholesale electricity prices, in the winter of 1994/95.

Proposition:

Nuclear plant is more prone to the risk of widespread shutdowns on safety grounds than other types of generation.

[10] All civil nuclear material in the UK is subject to Euratom safeguards and to the terms of the tripartitie UK/Euratom/IAEA safeguards agreement.

[11] It may be harder to avoid reprocessing of fuel from some older reactor designs, such as the Magnox stations.

7. UK CAPABILITY TO BUILD NEW NUCLEAR

7.1 The most recent station completed in the UK was Sizewell B, completed in 1995 and built to the Westinghouse PWR design. Sizewell B is the most recent and modern station to have been completed in Western Europe (other than France) or the USA .

7.2 Approximately 90% of the value of the contracts for Sizewell B was met by British companies. However, some significant components of Sizewell B were manufactured abroad, in particular the pressure vessel which was made in France.

7.3 Since the completion of Sizewell B, BNFL has purchased the nuclear businesses of Westinghouse and ABB which have new reactor design, reactor services and control technology capabilities. The bulk of Westinghouse's operations remain in the USA and it is probable that a good deal of the detailed design work for a new UK station using a Westinghouse design would in fact take place in the USA.

7.4 So long as new nuclear development continues to take place in at least some countries, and especially OECD countries, the UK should be able to import the necessary expertise to design and build new plant that would meet UK safety standards if that expertise were not available locally. And if there is no significant new build in other OECD countries, then it is perhaps less likely that new build would be considered acceptable in the UK. The case of France has also indicated that a country of broadly the size and level of development of the UK has been able to sustain a substantial nuclear industry based largely on domestic orders.

7.5 In view of the high contribution of capital costs to the total costs of nuclear power, there will be strong commercial pressures to keep capital costs to the minimum consistent with safety. This would be best achieved by international tenders for work and, as with other energy technologies and capital goods more generally, there could be a tension between cost minimisation and local production.

Questions:

Are there good energy policy grounds for ensuring that the UK retains the local expertise and capability to build new nuclear plant?

Would it be practicable for UK nuclear safety regulators to rely on using foreign personnel if the relevant skills were not available in the UK?

Are there stronger grounds to ensure local nuclear capability than for other energy technologies?

Is it likely that the UK would wish to proceed with new nuclear plant if other OECD countries were not doing so?

If it were felt important to retain a local nuclear build capability, what would be the best way of doing so, short of ordering new stations?

8. PUBLIC ATTITUDES TO NUCLEAR POWER

8.1 Nuclear power is likely to remain a highly controversial issue, mainly on account of the risks of catastrophic accidents and concern about the means of dealing with radioactive waste. Other concerns include the level of radioactive releases in normal operation and the possible link to nuclear weapons.

Question:

How far would a declaration that fuel from any new reactor would not be reprocessed improve the public acceptability of nuclear power by avoiding further separation of plutonium and breaking the link with nuclear weapons?

8.2 Opinion polls in the UK suggest that about 25% of the population would be strongly opposed to new nuclear power plant. The views of the remainder may vary according to their perceptions of the alternatives available, their cost, and their ability to meet environmental objectives.

8.3 It has been suggested that recent opinion polls in the Western USA have shown reduced opposition to nuclear power, as concerns about security and adequacy of electricity supply have mounted in the wake of shortfalls in California.

8.4 Public attitudes to nuclear power could be affected by the process of decision-making. The nuclear industry is widely perceived as having a history of secretive decision making, in collusion with governments which may sometimes own the facilities in question. The industry in the UK is now putting greater efforts into structured stakeholder dialogues to achieve a more participatory style of decision-making, involving local communities and experts from outside the industry with relevant knowledge and experience.

Questions:

Are public attitudes to nuclear largely fixed or could they change with circumstances, such as changed perceptions of the problems associated with fossil fuel use?

Could greater public involvement in nuclear decision-making significantly reduce public opposition to nuclear power and new nuclear facilities?

Since large nuclear stations in relatively remote sites can meet the electricity needs of large populations, is nuclear power compatible with effective involvement of local communities in decision taking?

9. RESEARCH AND DEVELOPMENT

9.1 Research is underway internationally on a wide range of future reactor types that could be given the generic term of Generation IV reactors. These reactors would be lower cost, minimise waste production and deliver improved safety, compared to existing designs. However, it is unlikely that commercial versions of such reactors could be commissioned before about 2020.

9.2 One particular type of Generation IV design that is currently exciting some interest is the Pebble Bed Modular Reactor (PBMR) being developed by Eskom of South Africa in which BNFL has a minority stake. This project is currently at the feasibility study stage with a decision on whether to progress to a prototype reactor expected soon.

9.3 Publicly funded research into fission reactors in the UK stopped in 1994 and research into nuclear technology has reduced steadily over recent years. A combination of public and private funding supports modest levels of R&D on "risk management" issues such as safety, proliferation resistance, environmental protection, waste management and decommissioning. In the case of both BNFL and British Energy, R&D expenditures are similarly designed to solve current problems with existing technology rather than to develop new reactor types. The DTI continues to support R&D into nuclear fusion under a collaborative European project and a review carried out by DTI in 2000/01 concluded that the UK should continue its current role as a key player in fusion research[12].

9.4 The costs of developing new reactor designs to the stage of being licensed for commercial application are likely to be very large, involving construction of prototype reactors. It is not clear that individual companies or countries would wish to take these risks on their own and the case for international collaboration in nuclear research could be strong. For example, the Euratom Fifth Framework programme which runs from 1998 to 2002 has a total budget of 1,260 million euros and provides funding for both fission and fusion research. On the other hand, there is a risk that international research projects, especially those involving significant public funding, develop a momentum of their own which can carry them away from commercial realities.

Questions:

Is there a realistic prospect of new reactor designs emerging that could allay public concerns about safety, waste and proliferation?

Can we expect the private sector to come forward with new reactor designs?

Is there a case for further UK public investment in new reactor designs?

What is the appropriate role for international collaboration in nuclear R&D?

10. POSSIBLE POLICY RESPONSES

10.1 In very broad terms, there would appear to be 4 possible policy positions that the UK could adopt now towards nuclear power:

- ANTI: This would involve a commitment to early closure of existing stations and a commitment not to permit new stations in the UK for the foreseeable future.

[12] The cost to the DTI of fusion research last year was some £14 million.

- NEUTRAL: This would involve broadly the continuation of current policy. Nuclear stations would be treated in the same way as fossil stations and decisions on closures and new build would be left to the private sector operating in the competitive electricity market. This option is unlikely to lead to new build.

- WEAK SUPPORT: This would allow nuclear to be treated more favourably than fossil stations on the grounds of its contribution to carbon reduction. Decisions on closures and new build would still be left to the market. Whether or not this would lead to new build would depend in part on the degree of support.

- STRONG SUPPORT: This would involve a clear commitment to new build. This could be secured by some sort of obligation or perhaps by direct financial support from Government.

10.2 In principle, it would be possible to take a different policy approach to existing and new stations. A more positive approach to new stations, compared to existing ones, might be justified if new stations were thought to offer significant advantages over existing ones or if the potential for life extension of existing ones were thought to be very limited. On the other hand, a more positive approach to existing stations, relative to new ones, would be consistent with the view that nuclear did not represent an acceptable long term strategy for the UK, but that existing stations could form a bridge, particularly in terms of reduced carbon emissions, towards an acceptable long term pathway.

10.3 The concept of "keeping the nuclear option open" could be consistent with either the neutral or weak support options.

Question:

Is this classification correct – and how should any chosen option be given effect?