Nuclear Free Local Authorities

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UK Government National Policy Statements on Energy Re-consultation

This paper has been developed for the NFLA by the NFLA Scotland Policy Advisor and the NFLA Secretary. It relates to the UK Government's decision to re-consult on its suite of National Policy Statements (NPS) on Energy.

This edition of New Nuclear Monitor should also be read in conjunction with NFLA New Nuclear Monitor Issue 19 and the NFLA's official submission to the NPS consultation in February 2010, much of which remains consistent with this briefing. New Nuclear Monitor 23 goes into detail over the main changes to the NPS and key issues of concern.

1. Introduction

The Department for Energy and Climate Change (DECC) has launched a second round of consultation on the six energy National Policy Statements (NPSs). The suite of documents published includes a revised overarching energy NPS (EN-1) (1), a revised Nuclear NPS (EN-6) (2), a revised consultation document, (3) a document which responds to the first NPS consultation (4) which took place earlier this year, (5) and a second response document which responds to issues raised in Parliament. (6)

The revised consultation document highlights the main changes to the draft energy NPSs and Appraisals of Sustainability (AoSs). It does not attempt to highlight every change made or to discuss why the changes have been made - that discussion is contained within the Government Response document. Obviously the Government would like consultees "*to focus their responses on those aspects of the policy that have changed and on any aspects which they think should change in the light of the revised AoSs*..." (7)

Over 3000 responses were received to the first consultation, so many of the changes are in response to these comments. The Government Response Document (8) identifies the key themes and responds to them. The second response document addresses each of the House of Commons Energy and Climate Change select committee's thirty recommendations and has responded to what it considers were the main issues raised in the House of Lords. (9)

The most significant changes are:

(a) the selection and appraisal of policy alternatives within the AoSs for EN-1 to EN-5 (the non-nuclear energy NPSs) have been reconsidered. New alternatives have been developed and appraised;
(b) the section on the need for new energy infrastructure has been updated to take account of the latest modelling and 'Pathways to 2050' work;
(c) Kirksanton and Braystones in Cumbria have been removed from the list of potentially suitable sites for new reactors within EN-6. Dungeness in Kent also remains off the list;

Nuclear Free Local Authorities Secretariat, c/o PO Box 532, Manchester, M60 2LA
Tel: 0161 234 3244 Fax: 0161 234 3379
Email: s.morris4@manchester.gov.uk Website: http://www.nuclearpolicy.info

(d) the suite of documents now also includes a draft Appraisal of Sustainability Monitoring Strategy which will test the actual significant environmental and sustainability effects of implementing the energy NPSs against the predicted effects. Updated site assessments have been produced within the revised EN-6 for potentially suitable sites.

Responses have to be sent to nps.consultation@decc.gov.uk by ***24th January 2010***.

2. The need for new infrastructure

The Government says new infrastructure is needed to replace power stations which are closing down, and to switch to low carbon forms of electricity generation. It has revised the energy need statement in response to respondents' suggestions to look further ahead than 2025. DECC's analysis for Pathways to 2050, published in July alongside the Annual Energy Statement, shows the need for even greater amounts of electricity in the run up to 2050. It claims that reductions in electricity consumption resulting from improvements in energy efficiency will be far outweighed by increases in electricity demand, (caused by, for example, the electrification of transport and domestic heating) potentially leading to a doubling of electricity demand. Generation capacity will need at least to double to meet this demand and, if a significant proportion of UK electricity is supplied from intermittent sources, then the total installed capacity might need to triple. (10) To have the required impact on emissions, the electricity being consumed will need to be almost exclusively from low carbon sources. Contrast this with the first quarter of 2010, when nearly 80% of UK electricity was generated by burning gas and coal. (11)

Respondents to the first consultation suggested that new nuclear power will come online too late to be of benefit for the UK in meeting its emissions targets or filling the predicted energy gap. The Government says it is confident that new nuclear power stations can start to be deployed from 2018; and France has already demonstrated that it is technically feasible to build nuclear power stations at the rate that would be needed in the UK if new nuclear power stations were to be constructed on all of the sites listed in the revised draft Nuclear NPS before the end of 2025. (12) The Government's confidence is remarkable given the experience so far with new reactor construction in Finland and France, which are years behind schedule and billions over budget. (13)

The Government says "*the purpose of the consultation was not to re-open discussion of whether nuclear power should form part of our future energy mix (which was itself the subject of a separate consultation in 2007 before publication of the Nuclear White Paper)*". (14) It is Government policy that new nuclear power should be able to contribute as much as possible to the UK's need for new non-renewable capacity. (15) Consequently, the revised EN-1 explicitly directs the Infrastructure Planning Commission (IPC) to give substantial weight to the contribution which projects would make towards satisfying the urgent need for "*a mix of all types of energy infrastructure*" in order to achieve energy security at the same time as dramatically reducing greenhouse gas emissions. (16)

EN-1 in numbers

Total Current Generating Capacity	85GW
Peak electricity demand now & 2020	60GW
Average demand	43GW
Large combustion plant directive closures by 2015	12GW
Nuclear closures over next 20 years	10GW
Generating Capacity required in 2025	113GW
Of which new generating capacity	59GW
Of which renewable	33GW
For industry to determine	26GW
Non-nuclear already under construction	8GW
Proposals for new reactors already proposed	16GW

The Government says it would be prudent to plan for 59GW of new generating capacity by 2025, but points out that:

"...it is not the Government's intention in presenting the above figures to set targets or limits on any new generating infrastructure to be consented in accordance with the energy NPSs. It is not the IPC's role to deliver specific amounts of generating capacity for each technology type." (17)

As in the original EN-1 the UK Government says it does not believe that decentralised and community energy systems are likely to lead to significant replacement of larger-scale infrastructure. But the new EN-1 no longer mentions that the "*lead scenario in the UK's Renewable Energy Strategy contains around 4GW of small scale electricity*". (18)

3. All Electric Society?

It is clear that the UK Government is quietly trying to move towards an all electric society, with all domestic heating and cooking switching from gas to electricity, and all new cars powered by electricity by 2030. EN-1 shows total generating capacity climbing from 85GW now to 113 GW in 2025. But if it is to double by 2030 to 170GW, it is not surprising that ministers are said to be privately considering a much larger nuclear programme than the 16GW currently proposed. (19) This vision of an all-electric future might be one way to tackle climate change, but it is certainly not the best, and it is extremely doubtful that it will assist other government objectives such as the elimination of fuel poverty.

The Department for Transport says that electrification of the whole transport sector (not including aviation and shipping) would add 16% to overall electricity demand but given much charging would take place during the night, this would not require massively more capacity in practice. (20) So heat is the main issue in future energy use.

One technology which is ideal to provide low carbon heat and tackle fuel poverty is Combined Heat and Power (CHP) with District Heating, such as the scheme run by Aberdeen City Council, and promoted by the Scottish Government as an example of how local authorities can tackle fuel poverty. (21) DECC nominally supports CHP technologies and has set a target of at least 10,000 MWe by the end of 2010. Yet DECC's chief scientist David MacKay says the "...*growth of gas-powered combined heat and power would be a mistake. Such combined heat and power is not green: it uses fossil fuel, and it locks us into continued use of fossil fuel*." (22)

A study undertaken by Imperial College and Surrey University for the CHP Association says that while an all-electric future could be low carbon, it isn't necessarily the best way of doing things. Heat is a very important end-use of energy in the current energy system and is expected to remain so in 2050. In 2007, heat represented 41% of total final energy consumption in the UK. Over half of this heat demand comes from the domestic sector, highlighting the significant challenge associated with decarbonising this sector particularly. No route to low carbon heat is without challenges, but the all-electric future would not necessarily be optimally efficient, since thermal losses from power generation are large. The all-electric scenario would also be contingent on overcoming certain critical issues, which are neither easy nor fully understood. If the roll-out and performance of heat pumps, insulation and low carbon generation is not as expected, then the scenario will not be able to deliver the emission reductions required. It also gives rise to a set of challenges associated with the management of power flows.

On the other hand, a diverse combination of technologies can help overcome some of these problems, and provide a more robust energy system in the long run. An integrated approach would use a range of heat options, not just gas-fired CHP, including biomass fired CHP plant, and even CHP with carbon capture and storage technologies. (23) Once district heating networks are established geothermal heat, waste heat from industrial processes, heat pumps using boreholes or rivers, solar heat, and so on can also be used.

One of the authors of the report, Dr Rob Gross, explains: "*No route to 80% carbon reduction is without challenges. But it seems clear that improvements can be made to the 'all-electric' approach we are currently pursuing. The integrated scenario we have identified offers a potentially extremely valuable contribution to efforts to green our energy system*."

Keith Allott, Head of Climate Change, WWF, welcomed the report findings: "*A strong focus on energy efficiency is the low-risk, low-cost solution, and combined heat and power and district heating networks have a central role to play in delivering this. If the UK intends to meet its carbon targets, there simply isn't room for ruling out these options."*

Janine Freeman, head of Public Affairs at National Grid said: "*As operator of both the UK gas and electricity transmission systems, we share the view that we should explore the alternatives for providing low carbon heat. Electrification of heating will not provide the whole answer because it will not be efficient to build power stations and electricity networks to supply electric heat for the one or two months a year when it is really cold. Our own work on the use of biomethane for injection into the gas grid indicates this could make a significant contribution to domestic heating. And as this report sets out, other technologies such as CHP and solar thermal will also have important roles to play in a decarbonised energy future*." (24)

Centrica has already opened a plant at Didcot sewage works in Oxfordshire which produces renewable gas for households to use. (25) National Grid believes at least 15% of all gas consumed (or 50% of domestic supplies (26)) could be made from sewage slurry, food waste and organic waste created by businesses such as breweries.

Now, up to 200 Oxfordshire homes will be using biomethane made from sewage they had flushed away three weeks earlier. British Gas, Thames Water and Scotia Gas Networks hope to roll out the process across the UK. The practice of using anaerobic digesters - carefully managed bacteria - to turn faeces into a means of generating electricity is already well established across the country. British Gas says supplying renewable gas directly is much more efficient, as about two thirds of the energy is lost when electricity is generated. So an additional plant installed earlier this year at the Thames Water sewage treatment works in Didcot cleans up the spare biogas that is produced and turns it into biomethane suitable for household hobs and in gas central heating.

United Utilities is hoping a similar £4.3m scheme, which will cater for 500 homes in Manchester, will be ready by summer 2011. The UK produces 1.73 million tonnes of sewage sludge every year, which could potentially be used to produce biogas. Hypothetically, if all of the UK's 9,600 sewage treatment facilities in the UK were fitted with this type of technology, they could provide enough renewable gas for up to 350,000 homes.

Adnams the brewer has opened an anaerobic digestion facility in Suffolk using waste slurry which will provide renewable gas to about 235 homes. British Gas is also involved in this project and is planning to open three more. (27)

4. CHP can reduce gas consumption

A study by Pöyry Energy Consulting looked at industries across the UK which could generate as much electricity as 10 nuclear power stations and halve gas imports by installing or extending CHP plants. (28) Implementing a decentralised energy strategy which makes the most of CHP and District Heating need not be locking the UK into using fossil fuel gas. For a start, as the Poyry study shows, it could lead to dramatic reductions in gas consumption much sooner than would otherwise be the case. Secondly, once the district heating networks are established they can be converted to run on other fuel sources such as biomethane, biomass, geothermal and solar in the future. The Government's all electric vision is tending to lead to proposals for new types of wasteful electricity generating plant, such as the three Forth Ports biomass proposals in Scotland which will not be capturing a significant percentage of the waste heat.

As moves towards higher penetration rates for renewable electricity gain momentum, the electricity supply system has to be able to manage a significant increase in periodic renewables, while still maintaining supply to the customers. The intermittency of renewables, and wind in particular, demands flexibility of response for operation from other suppliers on the grid. That is why the successful combination of CHP and renewables is attracting increasing attention. (29) Presently in Denmark, when the wind speed drops by 1 metre per second the country needs to find an

additional 350 MW of electric power capacity. Gas CHP has the capacity to respond quickly to such fluctuation, but to maintain high efficiency the system must also find a use for the heat produced when generating electricity. In Europe, traditional CHP users are beginning to find new ways (such as temporary heat storage or buffering) to meet this need for flexibility. Danish district heating companies are increasingly providing the grid with balancing services, and the Danish model shows how a combination of a high wind generating capacity and CHP can run together smoothly. (30)

In Germany, micro combined heat and power (CHP) has been identified as the solution to balancing wind in the network. LichtBlick is the largest independent energy supplier in Germany and has announced its goal to place 100,000 micro CHP systems with an electric output of 20 kW each into homes and buildings in Germany. The property owner will be provided with the cogeneration unit and a heat storage unit and be guaranteed that the home will be supplied with heat as required. (31)

If CHP is not promoted as a way of balancing renewable, non-CHP gas-fired electricity generating stations will most likely be used, so, as shown by Poyry in the case of industrial CHP, gas consumption could end up being higher in the all-electric scenario. A study by PB Power for the Mayor of London and Greenpeace UK concludes that a Decentralised Energy (DE) strategy could reduce CO_2 emissions from London by 27.6% by 2025. Despite the increased use of gas for CHP, gas consumption could be 15% lower under a high DE scenario compared with a high nuclear scenario. (32) A similar report by PB Power for the City of Edinburgh Council, Greenpeace and WWF, concluded that the most cost effective way for Edinburgh to reduce its carbon emissions and increase energy security is by following a DE pathway. (33)

5. The role of microgeneration

The UK Government's own Microgeneration Strategy (34) quotes from a study commissioned by the DTI from the Energy Saving Trust (EST) which suggested that by 2050, microgeneration could provide 30-40% of the UK's electricity needs and help to reduce household carbon emissions. Yet the UK Government's Low Carbon Transition Plan (LCTP) only expected 2% to come from small-scale renewables by 2020. If the UK is aiming to produce 40% by 2050, a target of 10% for 2020 should be set. This would obviate the need for new nuclear reactors. Domestic-scale CHP could be providing 20% of the UK's electricity, more than current UK nuclear capacity, not long after 2020. (35)

6. The role of Renewables

There are changes to section 3.4 on renewables of EN-1 which probably reflect a clearer focus on what the IPC needs to know, rather than arguing the general case for renewables. Gone is the reference to half a million jobs in the original EN-1; instead the revised document says:

"Renewables have potential to improve security of supply by reducing reliance on the use of coal, oil and gas supplies to keep the lights on and power our businesses. Meeting the 15% renewables target could reduce fossil fuel demand by around 10% and gas imports by 20-30%." (36)

Mentions of the Renewable Energy Strategy, (37) produced by the previous Government, have been almost completely removed, (38) despite the fact that it is a White Paper, apart from two footnotes on page 25 of the revised EN-1. Nor is there a single mention of the Low Carbon Transition Plan, which is also a White Paper. (39)

The NFLA believes the UK Government needs to clarify the status of the Renewable Energy Strategy and Low Carbon Transition Plan as a matter of urgency.

7. The Role of Nuclear Energy

The Government relies on a British Energy study from 2009 to show that nuclear power is low carbon. (40) This analysed carbon emissions from Torness and concluded emissions were 7gCO_2/kWh compared with 400g for gas and 900g for coal. The Government says it continues to monitor the results of published Life Cycle Analyses (LCAs) conducted throughout the world to ensure it keeps abreast of developments. (41) Yet it makes no reference to an analysis of 103 lifecycle studies by Benjamin Sovakool from the National University of Singapore published in Energy Policy Journal. (42) He concludes that typical lifecycle emissions from nuclear plants appear to be about 66gCO_2e/kWh.

Unlike the Government Response document, EN-1 gives a range for carbon emissions from the nuclear life cycle of 7-22gCO_2/kWh. (43) The higher figure is still one third of the 66g figure given by Sovacool. EN-1 gives as its sources papers by the Sustainable Development Commission (SDC) (44) and the International Atomic Energy Agency (IAEA) (45). The SDC gives as one of its main sources the Paul Scherrer Institute. The Institute's current web page on Life Cycle Assessments includes a list of papers the most relevant of which are authored by Roberto Dones, sometimes with others. (46) Sovacool criticises Dones for using old data regarding emissions from uranium mining and enrichment. Sovacool looks at several papers by Dones as well as the paper by SDC. Sovacool concludes that:

"Put simply, investments in nuclear power are much worse at fighting climate change than pursuing wind, solar, and other small-scale power generators. Policymakers would be wise to embrace these more environmentally friendly technologies if they are serious about producing electricity and mitigating climate change." (47)

In the NFLA's view, it seems remarkably remiss of the Government not to have looked in detail at the work of Sovacool, despite claiming to be monitoring life cycle assessments.

8. Nuclear Economics

The Government says it believes new nuclear will become the least expensive form of low carbon electricity generation. (48) It says cost overruns and delays at Olkiluoto have arisen partly because of changes made to the design during construction. The Generic Design Assessment process should mean design issues can be resolved early in the process, rather than addressed during construction, when resolution may be more complex, costly and time consuming. (49)

In 2008, when the government revisited nuclear costs, it assumed the construction cost was £1,250/kW ($2,000/kW), but the estimated cost of new reactors now appears to have increased to at least $6000/kW. At this price new reactors seem unlikely to be affordable except where huge public subsidies are offered and/or there is a strong likelihood of full cost recovery from consumers, no matter what the cost is. According to the US Government's Energy Information Administration (EIA) capital costs for new nuclear and coal-fired power plants are 25-37% higher than those reported a year earlier. The increase reflects higher global commodity prices, the small number of firms able to engineer complex projects such as a new nuclear or advanced coal facility, and the general trend of increased costs of capital-intensive projects in the power sector. EIA found the capital costs for a new dual-unit 2,236MW nuclear plant were $5,335/kW. However, solar capital costs fell markedly. (50)

Similarly, Dr Mark Diesendorf of the University of New South Wales, speaking to a solar industry conference in Canberra said nuclear costs had risen from about $US2000/kW of installed capacity in 2002, to about $US7400/kW today. In contrast the capital cost of onshore wind power last year was around $1900 to $1700/kW, and solar around $5120 to $7000/kW (and as low as $3000 for utility-scale projects). (51)

9. Nuclear Subsidies

On the question of subsidies, the Government insists there won't be any. (52) However, it is clear that consumers will be expected to foot the bill to incentivise the construction of new reactors.

"*The Government's definition of a subsidy is literally a bag of cash delivered personally by George Osborne to each nuclear power plant*," says Peter Atherton, utilities analyst at Citigroup. "*This is laughable. What's going to happen will be an economic transfer of risk from company to consumer. Of course it's a subsidy*." (53)

Existing Government subsidies to nuclear power have been detailed by the Energy Fair Group. (54) The Government, for example, admits that it intends to maintain a limit on nuclear operator's liability in the event of a nuclear accident, albeit at the increased level of €700m. (55)

However, changes made to Part 2 of EN-1 reflect the new UK Coalition Government's plans to implement a carbon floor price, reform the climate change levy and further interventions in energy markets it believes are necessary in order to ensure that developers come forward with proposals to build enough of the kind of infrastructure it claims is required. (56) The fact is that the UK Government is planning to force consumers to fund an expensive unsustainable technology which generates nuclear waste for which there is no long term management solution in place, when there are cheaper low carbon technologies which are capable of tackling climate change much more effectively. (57)

10. Radioactive Waste

On nuclear waste, there are three points where the UK Government has changed the wording of EN-6. These changes are intended to:

(a) demonstrate the Government's confidence that 'geological' disposal will be implemented;
(b) clarify the Government's expectations in relation to the likely duration of the onsite storage of higher activity waste; and
(c) clarify the role of the IPC in relation to arrangements for the management and disposal of wastes from new nuclear power stations. (58)

Annex B of EN-6 (59) sets out how the UK Government has satisfied itself that effective arrangements will exist for the management and disposal of waste produced by new reactors. The Government assumes there will be no reprocessing so "higher activity waste" will consist of spent fuel and intermediate level waste. EN-6 says geological disposal is the way in which higher activity waste will be managed in the long term. This will be preceded by safe and secure interim storage until a geological disposal facility can receive waste. In reaching its view on the management and disposal of waste from new nuclear power stations the Government has in particular satisfied itself that:

- geological disposal of higher activity radioactive waste, including waste from new nuclear power stations, is technically achievable;
- a suitable site can be identified for the geological disposal of higher activity radioactive waste; and
- safe, secure and environmentally acceptable interim storage arrangements will be available until a geological disposal facility can accept the waste. (60)

EN-6 adds that:

"The question of whether effective arrangements will exist to manage and dispose of the waste that will be produced from new nuclear power stations has therefore been addressed by the Government and the [Infrastructure Planning Commission] *IPC should not consider this further."* (61)

The new EN-6 goes on to clarify that the IPC can look at proposals for waste management facilities on the site of a proposed reactor in accordance with the policies set out in EN-1 and EN-6. (62)

Whilst this is a welcome clarification for local authorities in the vicinity on proposed new reactors, it is still not clear when arrangements for dealing with spent fuel from new reactors will be clarified. A recent Nuclear Decommissioning Authority report for the Nuclear Industry Association outlines options for storage, transport and disposal of spent fuel from potential new nuclear reactors. Local and centralised spent fuel storage and local and centralised encapsulation of spent fuel all remain options, which means a local authority presented with plans for a new reactor does not know the full implications of the plan. In the NFLA's view, this is unacceptable. (63)

On the Geological Disposal Facility (GDF), the Government says it has not yet taken a final decision on whether the facility will be examined under the Planning Act as a major infrastructure project, but at this stage considers this to be likely. (64) This could mean the Infrastructure Planning Commission (IPC), or its successor, is simply told that the strategic question of whether nuclear waste should be disposed of in a geological repository has already been decided (and that it has also been "justified"). Therefore as a result, the Government position is that any planning application for a geological disposal facility only needs to be examined with regard to local planning issues. In other words there is unlikely to be a public inquiry at which technical problems which cast doubt on risk calculations produced by the nuclear industry can be examined in public and open to cross examination. In the NFLAs view, the UK Government needs to provide an alternative means to allow independent challenges to the scientific basis for geological disposal.

11. High burn-up fuel

The Government's "*arrangements for the management and disposal of waste*" document published along with the first set of draft NPSs stated that it is possible to envisage that storage of spent fuel might be required for ***160 years*** from the start of the power station's operation. (65) The House of Commons Energy and Climate Change Committee pointed out that from the perspective of the local community it is a misnomer to describe this as interim storage as it will be several lifetimes between the commencement of a power station's operation and the eventual removal of waste from that site. (66)

The Government says it acknowledges that prolonged on-site storage of spent fuel is a matter of concern for local communities and that more detail might allay that concern. (67) The Government's response document discusses various measures which might be used to reduce the cooling period for spent fuel including "*mitigating actions which could reduce the heat load on each disposal canister".* (68) The Government suggests that the period of cooling after the station has finished generating electricity could be reduced to 50 years. The source the Government uses to reach this conclusion is the NDA study carried out for the Nuclear Industry Association which states that with "*the judicious mixing of long-cooled and short-cooled*" spent fuel the cooling period needed to allow the spent fuel to be considered for disposal could be halved from the previous estimate of 100 years to 50 years. (69)

The NPS has now been revised to indicate the Government no longer expects spent fuel to be stored on reactor sites for as long as 160 years, although it says a Geological Disposal Facility (GDF) will not be able to accept new build waste until 2130, so it's likely to be 110 years anyway. The Government says it recognises that interim storage might be required for longer, but there are also factors which might make the storage period shorter, for example arrangements might be made to store waste in a central storage facility. Either way:

"*The Government will expect operators to ensure their waste is disposable when a GDF is anticipated to be available to take the waste*." (70)

12. Comments made by Nuclear Waste Advisory Associates

On the question of whether geological disposal is technically achievable the Government says several respondents "*drew attention to gaps in technical knowledge, as evidenced by ongoing programmes of research, while others raised specific questions around the evidence base used in the NPS*". (71)

Clearly referring to a submission from Nuclear Waste Advisory Associates (72), the Government says: "*One detailed response highlighted reports by the European Commission's Joint Research Centre (JRC), the EA and the NDA. It argued that issues raised by these reports highlighted major knowledge deficiencies with regard to technical issues, which called into question whether geological disposal would prove technically feasible*." (73)

In response the Government says it:

"*...believes, in the light of CoRWM's work and wider international experience, that there is already sufficient research work available to be confident that geological disposal is technically achievable*." (74)

The Government says it has examined the reports from the JRC and the EA, but concludes that neither the JRC nor the EA have stated that the technical issues they have identified cannot be resolved. (75)

Despite the numerous problems reported by JRC, (76) its overall conclusion is that the technology of geological disposal has developed well enough for programmes to be implemented. Yet this conclusion was based largely on a description of ongoing research projects – rather than their results - and nuclear agency reports, which tend to be collective statements based on views rather than an analysis of scientific literature. Only three papers published in scientific journals are referenced. Similarly, the Organisation for Economic Co-operation and Development's (OECD) Nuclear Energy Agency (NEA) states that *"geological disposal is technically feasible"* and that a *"geological disposal system provides a unique level and duration of protection for high activity, long-lived radioactive waste"*. (77) Again these statements are based solely on the collective views of its Radioactive Waste Management Committee, not on an analysis of the existing scientific evidence.

On the other hand, a review of the scientific literature for Greenpeace International (GPI) provides an overview of the status of research and scientific evidence regarding the long-term underground disposal of highly radioactive wastes. It identifies a number of phenomena that could compromise the containment barriers, potentially leading to significant releases of radioactivity. (78) Many of the processes involved are poorly understood and many of the assumptions made to predict the rate of leakage are impossible to verify. Unless and until these difficulties can be resolved, the data suggests that it is quite likely that a significant release of radioactivity from a deep burial facility could occur, with serious implications for the health and safety of future generations.

13. UK Inventory of Radioactive Waste

It is worth noting that the Appraisal of Sustainability on Hazardous and Radioactive Waste (79) looks at an inventory of waste from a 10GW new nuclear programme, and repository footprint, and compares this to the baseline of legacy waste. Yet the Government says it anticipates proposals being put forward for 16GW of new reactors (Up to 3.2GW at each of Hinkley, Sizewell. Wylfa, Oldbury and Sellafield), (80) which begs the question why only look at a 10GW programme? Obviously any community considering hosting a GDF will want to know what the maximum inventory could be. Consequently the West Cumbria Managing Radioactive Waste Partnership has been looking at the waste inventory and repository footprint from a 16GW programme. Information on this will appear on the Partnership website shortly. (81)

The Environment Agency (EA) has set a limit on the risk that may be caused by the burial of radioactive wastes of 10^{-6} (i.e. one in a million) i.e. the risk of a person contracting non-fatal cancer, fatal cancer or inherited defects must be less than one ion a million. (82) However, the NDA Disposability Assessment Report for waste arising from new EPR reactors states:

"…a risk of 5.3 x 10^{-7} per year for the lifetime arisings of a fleet of six EPR reactors each generating a lifetime total of 900 canisters is calculated" (83)

This is more than half the total risk of 10^{-6} allowable for a GDF. Clearly a GDF with spent fuel from a 16GW new reactor programme, as well as legacy waste, will probably exceed the risk targets set by the EA. Thus, it is quite possible that two separate GDF's might well be required.

In the NFLA's view, the Appraisal of Sustainability on Hazardous and Radioactive Waste needs to be rewritten to take into account the likelihood of a 16GW nuclear programme, and the probability that two nuclear deep-waste repositories will be required.

14. The Appraisal of Sustainability

As well as looking at alternative sites the Nuclear AoS considers whether or not the objectives of EN6 could be delivered using alternative options. The UK Government says its:

"...view (is) that none of the alternative options looked at can be relied upon to deliver the objectives of this NPS by the end of 2025."

Chapter 3 of the Nuclear AoS Main Report looks at "Need Alternatives", (84) and uses DECC's Updated Energy and Emissions Projections. (85) Curiously, references to the Low Carbon Transition Plan and the Renewable Energy Strategy have been mostly removed. Fuel poverty is now referred to as "affordability". (86)

The Government relies on analysis by Redpoint, (87) and MARKAL modelling for the Committee on Climate Change, (88) to show that if new reactors were excluded from the energy mix they would be replaced by gas-fired generation. But there is no comparison with, for example, an energy policy which involves a high level of Government support for decentralised energy and combined heat and power. So the AoS is basically comparing new nuclear reactors with Combined Cycle Gas Turbines and a third option in which nuclear reactors may get built but without an NPS in place to facilitate the approval of planning applications.

The Appraisal of Sustainability needs to be redone so that the public can see a proper comparison between the Government's proposals for up to 16GW of new reactors with and energy policy based on support for decentralised energy and combined heat and power.

15. The terrorist threat

The Office of Civil Nuclear Security (OCNS) now gets a mention in the NPS, which it didn't previously, and there is a new paragraph about the terrorist threat:

"The Government is conscious of the significant detriments to health that could result from an accident or terrorist attack at a new nuclear power station. However, the scale of potential damage must be seen in the light of the robust regulatory regime which exists in the UK to prevent accidents and protect against security threats including terrorist attacks. Government and industry have an emergency preparedness framework in place to mitigate health effects in the unlikely event of any accidental release of radiation into the environment." (89)

No evidence is presented to indicate that an assessment of the environmental impacts of radioactive releases arising from a range of credible malevolent acts that affect the reactor core or stored spent fuel have been considered. (90) Furthermore, due to the sensitivity of such issues – threats to civil nuclear reactors are classes as one of the biggest risks in the UK Government's National Security Review (91) – there appears to be little, if any, independent verification of the work of the OCNS. This point has been raised by the NFLA and a number of NGOs at the DECC / NGO stakeholder dialogue meetings and it compares unfavourably with experience in other countries, particularly the United States.

In answer to a series of detailed Parliamentary Questions from Green Party MP, Caroline Lucas, Energy Minister Charles Hendry replied:

"*The government does not comment on the detail of security matters at civil nuclear sites. It is important that security measures adopted at civil nuclear installations are proportionate to the threat. Nuclear site licence companies are responsible for meeting the costs of security.*" (92)

Unless a mechanism can be found to give assurances that the Government has carried out threat assessments and an assessment of the environmental impact of a range of malevolent acts, the NFLA can only assume that these issues are simply being ignored. Given that other low-carbon energy options exist that are arguably preferable on other grounds, the Government needs to give some well-argued reasons to outweigh these concerns. (93)

15. Nuclear emergency planning concerns

EN-6 is also very generic in nature when it comes to nuclear emergency planning issues. Given that both EDF and Horizon – the likely constructors of new nuclear reactors – have expressed a desire to build two or even three reactors at the listed sites, the potential footprint of these developments is huge in scope.

All of these reactors are in predominantly rural locations where access routes are limited, communities are isolated and the emergency services may have to travel substantial distances to a major incident. EN-6 largely plays down these concerns yet; to take the example of Bradwell, a substantial population on nearby Mersea Island could be cut adrift in the event of an incident with access routes closed to them (94).

Though emergency planning at existing nuclear reactors are highly regulated and, fortunately there have not been serious incidents to date since the Windscale fire; there have been a whole range of examples of significant fires, leakages and safely breaches at every UK nuclear reactor over the last three decades. The doubling and tripling of such sites for new build inevitably increases the complexity of the sites and requires a complete reassessment of the risk. It also potentially increases the pressure on the emergency services and local authorities in providing an adequate response to a major incident – this at a time when such services are enduring a likely major contraction of staff due to the substantial cuts in the public finances.

EN-6 does go into some detail of one main emergency planning risk – major flooding – but it does not adequately outline what a wider area flooding incident would mean on large two or three reactor sites. The flooding in Cumbria in spring 2010for example, which saw large areas of the county cut off due to the collapse of a number of bridges and significant damage to roads, leads the NFLA to lay out the obvious scenario – how effective could the emergency response have been if there was flooding or another type of major emergency incident at Sellafield at the same time? Similarly, climate change models outline the real potential for more severe bouts of inclement weather in future decades – the UK Government needs to produce independently verified research that all new reactors can withstand the increased flooding risk.

Furthermore, the development of a large number of new reactors will also inevitably increase the transportation of nuclear materials by land and sea in coming years. This has a major impact not just on the areas around the new reactors, but across the UK. Recent NFLA supported studies on the safety and the knowledge of radioactive material shipments and UK nuclear weapon convoys have uncovered worrying gaps in detail on emergency plans and on local response, particularly in areas which do not contain fixed nuclear sites (95). The NFLA is now about to undertake further research of the knowledge and planning awareness of local authorities and emergency services on civil nuclear transports by road and also the response to nuclear terrorist attacks, and expects to find some similar results.

The NFLA believes the UK Government should undertake a thorough review of the fragmented nature of UK nuclear emergency planning response arrangements and the knowledge of such plans across the board, not just in areas with fixed nuclear sites – to which DECC's Nuclear Emergency Planning Liaison Group presently focuses on (95).

16. KiKK & COMARE

There are new paragraphs on the KiKK study of childhood cancer in the vicinity of German nuclear power plants. (96) It points out that KiKK:

"...*noted that the exposure to ionising radiation in the vicinity of German nuclear power stations was lower by a factor of 1,000 to 100,000 than the exposure to natural background and medical radiation, and that therefore the findings of the study could not be explained in the present state of radiobiologic and epidemiologic knowledge*".

It goes on to say that the German Commission on Radiological Protection concluded that the design of the KiKK study was not suitable for establishing a correlation with exposure to radiation from nuclear power plants. It says the database of childhood cancers being used in the UK is much larger than that used in the KiKK study.

"COMARE is currently undertaking a further review of the incidence of childhood cancer around nuclear power stations, with particular reference to the KiKK study and COMARE's 10th and 11th reports. This will be published as COMARE's fourteenth report later this year. COMARE is also keeping the incidence of childhood leukaemia and other cancers in the vicinity of Sellafield and Dounreay under surveillance and periodic review."

The Government relies on a re-examination of UK cancer data by Bithell (97) to conclude that:

"...there is no evidence ... that living with 25km of a nuclear generating site in Britain is associated with an increased risk of childhood cancer".

However the Appraisal of Sustainability does not appear to have examined the alternative viewpoint such as the recent letter published in Radiation Protection Dosimetry, by Dr Ian Fairlie and Dr Alfred Körblein (a German radiation scientist) which raises many objections to the Bithell paper (98).

17. NFLA's conclusions on the NPS re-consultation

1. There needs to be a much wider debate about the implications of moving towards an all-electric society by 2030 than is offered by this consultation.
2. The Government simply asserts that decentralised and community energy systems are unlikely to lead to significant replacement of larger-scale infrastructure, but it fails to assess properly how a scenario based on these would compare with one based on a new programme of nuclear reactors.
3. The Government fails to explain how its nuclear electric energy policy will tackle fuel poverty compared with a scenario based on decentralised energy.
4. The Government needs to clarify the status of the Renewable Energy Strategy and Low Carbon Transition Plan as a matter of urgency.
5. The Government has failed to take account of life cycle assessments of carbon emissions from the nuclear cycle as it said it would.
6. The Government has failed to take account of recent increases in the capital cost on new reactors which appear to have tripled from around $2,000/kW to $6,000/kW since 2008.
7. The Government is planning to 'incentivise' nuclear power against the spirit of earlier commitments not to subsidise new reactors. This means consumers will be forced to fund an expensive unsustainable technology which generates nuclear waste for which we have no long term management solution in place, when there are cheaper low carbon technologies which are capable of tackling climate change much more effectively.
8. There is still no clarity for communities around proposed new reactors about how waste will be managed - whether or not there will be a waste encapsulation plant for instance.
9. Spent fuel could still be stored on new reactor sites for 110 years – hardly 'interim storage'. There will still be several lifetimes between the commencement of a power station's operation and the eventual removal of waste from that site.

10. The Government needs to clarify how the public will be able to put forward evidence and cross examine witnesses with regard to plans to build a deep geological disposal facility.
11. Statements claiming there is an international consensus on deep geological disposal of nuclear waste are based the collective views of proponents, not on an analysis of the existing scientific evidence.
12. The Appraisal of Sustainability on Hazardous and Radioactive Waste needs to be rewritten to take account of the likelihood of a 16GW nuclear programme, and the probability that two nuclear waste repositories will be required.
13. A mechanism needs to be found to give assurances that the Government has carried out threat assessments and an assessment of the environmental impact of a range of malevolent acts otherwise it can only be assumed that these issues are simply being ignored. Given that other low-carbon energy options exist that are arguably preferable on other grounds, the Government needs to give some pretty good reasons to outweigh these concerns.
14. There needs to be a much thorough consideration of the impacts of developing new nuclear reactors on local and wider emergency planning response, particularly given the potential for wide-area flooding incidents, other serious incidents and perceived gaps with the transportation of nuclear materials. A review of the UK nuclear emergency planning regime and a widening of the remit of the Nuclear Emergency Planning Liaison Group should be considered as a corollary to this re-consultation.
15. The Appraisal of Sustainability needs to examine alternative viewpoints on the German KiKK study to the one put forward by COMARE, and no final decisions should be taken regarding new reactors until the forthcoming COMARE report has been subjected to a full critique.

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