University of St Andrews

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Going Nuclear? The Multi-Level Politics of Nuclear Energy

Conference Series

Seminar 2:

Nuclear Energy in the UK

Liverpool: November 1st 2013

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Co-Is: Prof. Andy Plater (Chair in Physical Geography), Dr. Pete North (Reader in Human Geography) and Dr. Raphael Heffron (Lecturer in Energy Law)

The 2nd Seminar titled “Nuclear Energy in the UK” took place in Liverpool for one day and was comprised of 4 sessions with a total of 11 invited speakers. A wide range of different notions of nuclear in the UK were covered: from policy, over financing to public perception of nuclear. In addition to the main speakers, introductory talks about the seminar series itself and concluding round table discussion rounded up the event. The key ideas covered in the series will be sketched below.

Scetching global and national (UK) nuclear contexts and dialogues

In best assessing developments of nuclear energy deployment in the UK, *Gordon MacKerron* did well in contextualising the UK’s position in a global context. According to the International Atomic Energy Agency (IAEA, 2013) 66 nuclear reactors are globally under construction, while 66% of these are constructed in China (28), Russia (9) and India (7). While many speakers touched upon the notion of the often encountered theme of a ‘nuclear renaissance’ in the UK and indeed globally, *MacKerron* pointed to the fact that the share of world nuclear electricity from nuclear peaked in 1993 with 17% while in 2013 the global share was down to 10%. In terms of installed nuclear capacity the peak occurred in 2010, while electricity output from nuclear peaked in 2002 – indicating that globally, closures have exceeded additions to capacity. Thus, these numbers support the notion of a global nuclear renaissance only to a limited extend.

Yet, especially in the UK the perception of nuclear power has shifted quite significantly over past years. *Wouter Poortinga* points to strong public opposition to nuclear power in the late 1970s and 1980s. Environmental movements referred to ‘dreaded’ and ‘unknown’ risk (Slovic, 1987) where the public had persistent fears about radiation and their potential impacts on cancer rates and mutations. These fears were partly driven from the public perception of the Three Mile Island (1979) and Chernobyl (1986) incidents. In addition, multiple speakers such as *Wouter Poortinga* and *Stephen Thomas* referred to the fears of both experts and the public that nuclear energy technology might potentially be used to serve also military purposes. *Poortinga* especially referred to the notion of a difference between ‘Formal’ and ‘Lay’ undertsandings of Risks. While risks formally can be seen as resulting from the variables of probability multiplied by the respective concequence,

the public's lay beliefs of risk are less rational and involve more factors when applied to nuclear energy production such as:

- Qualitative Risk Characteristics (e.g. catastrophic potential)
- Cultural-Political Orientations ('Risk Rationalities' – what type of risks are acceptable)
- Social Amplification Effects (risk amplified/attenuated through intermediate stations – e.g. media)
- Trust in Risk Managers, Governance, and Science
- Perceived benefits resulting from taking respective risks

Since the early 2000s nuclear power is often reframed as a solution to both, climate change and energy security. As the production process of electricity from nuclear sources is very low in terms of CO_2 and other GHG emissions, nuclear energy was reframed to be 'green energy'. In addition nuclear's contribution to energy security is pointed out as it offers a steady and predictable electricity supply (in contrast to the failure of renewable energy in this regard). These characteristics revived the arguments of the benefits of nuclear electricity (Poortinga). However, according to *Andrew Blowers* the reframing of nuclear as a solution to energy security and a means to reduce carbon emissions shifted the governance of nuclear. Decision making became characterised by less inclusive and participative approaches resulting in more centralised and closed decision making, where power relations shifted more towards nuclear interests.

Yet, the reason why most of the capacity under construction is located in emerging markets is two fold. First, their need for energy capacity expansion is significantly higher than in industrialised and developed contexts such as the UK and western Europe broadly speaking, where nuclear offers valuable arguments contributing to energy security by offering steady and predictable electricity supply.

The economics of nuclear new build

Further and more importantly for the UK context, a number of speakers have referred to the problem of financing of nuclear. Amongst others, *Gordon MacKerron* and *Steve Thomas* sketch a picture where common concepts like economies of

scale, design simplification, learning effects from earlier designs, often applicable to most technological development, do not hold for nuclear technology. Further it was pointed out that nuclear seems to be the only energy technology to experience negative learning effects, resulting in ever increasing construction costs. The reactor Hinkley Point C was offeren as an example when pointing to the economies of nuclear. Here *MacKerron* points out to the initially budgeted costs per kW capacity of £ 2,113 in the most pessimistic forecast scenario in 2008, while in 2013 costs were expected to amount to around £ 5,000 per kW– a 135% overrun. As a result, investors face high risks and capital costs at Hinkley Point C. Therefore, in order to complete the construction, a number of subsidies were needed such as a fixed (comparatively high) strike price at which producers can sell electricity to the grid and governmental loan guarantees (amounting to around £ 10bn).

Deriving from these results, *MacKerron* points to contradictions in governmental plans for nuclear. On the one hand the governmental roadmap for nuclear foresees 16-75 GW of new built nuclear capacity until 2050. On the other hand "the market" is to decide about whether and how much nuclear is to be build – using non-UK government finance. Given a long history of continuous nuclear technology development and the on-going need for government subsidies in the face of ever rising security standards in the UK, currently nuclear power plants cannot be developed without government support as exemplified at Hinkley Point C. Thus, a nuclear expansion while relying on free market mechanisms currently seems mutually exclusive.

Health implications

Both regular operational activities as well as melt down scenarios pose significant risks to public health. *Paul Dorfman* analyses studies performed around health implications in the proximity of nuclear power plants and finds mixed evidence. While a German Childhood Cancer Registry study finds that the 'risk of tumour or leukaemia in children under 5 years of age significantly increases the closer they live to a nuclear power plant', other UK studies do not find a link between proximity to nuclear power plants and children's leukemia rates.

In case of nuclear melt downs there is less ambiguity with regards to health implications. The found long-term effects of the Chernobyl melt down only vary in scale where before all non-cancer impacts such as immunological disorders and cardiovascular diseases, especially amongst the young, are significantly increased. Thus the local population is significantly affected by the melt-down in the longer term. Also the short-term impacts of a nuclear melt down are disastrous. Analysing these impacts on the basis of the Fukushima melt down, they translate, amongst other effects, into established no-go zones, large numbers of deaths and displacements. The damage in Fukushima is estimated to be around $ 200 billion in financial terms. With this in mind the current EU nuclear accident liabilities are capped at € 169 million, with the Paris convention signed rising to around € 1.5 billion, leaving large amounts of residual risks.

Nuclear Waste implications on management

Andrew Blowers also raises the issue of nuclear waste, where he refers to nuclear waste management as a 'social and political as well as a scientific and technical issue'. Further waste management requires consensus on public support and consent. Consequently the issue of policy making for radioactive waste requires an integrated approach rather than a single solution. Given the time frame of nuclear radiation of partly millions of years, on site disposal of nuclear waste seems questionable. As the largest share of nuclear power plants in the UK is located at the sea for cooling purposes, *Andy Plater* and *Darren McCauley* as well as *Paul Dorfman* refer to mechanisms such as erosion and sea level rise which have to be taken into consideration for siting decisions. Depending on the scenario, sea-level rise is projected to rise by 0.57-1.1m by 2100 and 0.52-5.49m by 2500. These effects are relevant for both the operational decision making of nuclear power plants as well as the waste disposal aspects and must be taken into consideration for future nuclear decision making.

Subsidies resulting from negative externalities

Thus both health- and nuclar waste implications of nuclear technology point to negative externalities of nuclear power. As the disastrous impacts of Fukushima have shown, the largest share of resulting damage and negative externalities of a

melt down in the UK would not be financially. Neither can the long-term impacts of radiation be accurately forecasted due to the radiation times which extend existence of human civilisation by multiple times. Thus, with regards to financing of nuclear power, such eventualities are not priced into the costs of nuclear energy production, and will need to be covered to large extends by the government, resulting in further subsidies (here for insurance) in case of an eventuality.

Conslusion

Despite the statistical decline of both absolute worldwide nuclear energy capacity since 2010 and the share of nuclear energy in the global energy and electricity mix since the 1990s, the dialogue about nuclear energy in the UK shifted at the beginning of this century, often referring to a nuclear renaissance. A number of scholars and experts perceive nuclear electricity as a useful component in reducing carbon emissions of the electricity sector on the one hand and means to increase energy security on the other hand. Yet, this shift in perception resulted in more centralised and closed decision making and governance.

Significant cost overruns of new built nuclear capacity in the UK and indeed many parts of Europe, point to the failure of economies of scale and learning effects in the nuclear industry over years. Nuclear electricity generation still requires significant government support on many levels. The construction of nuclear capacity is found to be the most significant share of investment costs and bears the largest investment risk, requiring de-risking activities on behalf of the government to reduce the risk investors bear. In addition to these activities, which factually result in subsidies, many externalities are not priced into the construction and operation costs of nuclear, potentially resulting to even larger liabilities to state and society. Such liabilities result from health and environmental concerns from both operational activities of nuclear power as well as from the effects an eventual melt down would have.

Seminar 2 of the ‘Going Nuclear?’ conference series gave a valuable sketch of the dialogue which evolves around nuclear electricity production. Some of the advantages of engaging in nuclear technology were counterbalanced with the

potential negative financial implications and threats to the environment and society in the UK context. Speakers critically reflected on nuclear energy and it's legacy on current and future generations.