Addressing the energy gap: a review of UK energy policy 2009-2010

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Abstract

It is estimated that the UK will have lost around one quarter of its baseload electricity generating capacity by 2020 through the closure of aging nuclear and fossil-fuelled power stations. The question of how to replace this lost capacity is complicated by having to meet both climate change and energy security objectives. The aim of this article is to examine the effectiveness of current UK energy policy in addressing this potential 'energy gap'. A detailed review of secondary sources identified a number of key themes that suggested a gap in electricity generating capacity is unlikely because of the negative social, economic and political consequences. Importantly, the government cannot decide the future of the electricity sector alone; instead, change must be negotiated between multiple stakeholders with different agendas and interests in order to maintain democratic legitimacy. The discussion concludes by suggesting the reason the government is struggling to formulate a coherent electricity policy is due to the fact it is as much a socio-political task, as a technical and economic challenge.

Keywords: Electricity, Energy Policy, Energy Gap, Nuclear Power, Fossil-fuelled Power, Climate Change, Renewables.

Introduction

Energy is essential to our modern way of life and comprises of electricity, heat and transport. As the way we use and produce energy creates around 80% of global greenhouse gas (GHG) emissions, it is clear that our current energy system is both the primary cause and primary means of mitigating climate change (Anderson et al. 2008; Brinkley and McIlveen 2010; Smith 2009; Scrase et al. 2009a, 3). The particular importance of decarbonising the electricity sector arises from the fact that virtually every aspect of our modern way of life is dependent on electricity; from keeping the lights on in our homes, to powering our industry, transport, and communications networks. Furthermore, by 2050, not only is the demand for electricity expected to double as the result of using more electricity for transport and heating, it will also need to be virtually emissions free in order to meet both climate change and energy security objectives (Black 2005; DECC 2009a, b, d; Greenpeace 2008; Helm 2008 & 2009; Loughhead 2005; National Grid 2008; Rhys 2009). Currently, fossil-fuelled and nuclear power plants are responsible for around 90% of the UK's total electricity supply (DECC 2011b). Therefore, it is of particular concern that around one quarter of these, or 20-22GW out of a total of around 75-80GW of the nation's baseload electricity generating capacity, are due to close over the next decade (DECC 2009a; DECC 2011a).

This is as a direct result of the recent implementation of the European Union Large Combustion Plant Directive (EU LCPD) limiting sulphur and nitrogen oxide emissions (Brinkley and McIlveen 2010; DECC 2009a, b, d) with power plants facing even stricter controls on emissions from 2016 when the Industrial Emissions Directive (IED) comes into force (DECC 2009b; Murray 2010). Combined with the government's legally binding commitment to reducing greenhouse gas emissions, many commentators have voiced serious doubts that enough replacement low-carbon generating capacity can be built in time. This possible 'energy gap' in terms of electricity generation has the potential to seriously threaten the UK's economic, security and social wellbeing (Black 2008; DECC 2009a, 85; DTI 2006; Doosan 2010; EON 2008; Ofgem 2010; Scrase and Mackerron 2009; Webb 2010; UK Parliament 2010). As the former Energy Minister Malcom Wicks puts it: '… the good British people are not going to thank us if we tackle global warming by the country getting darker' (Greenpeace 2008, 10).

The question of how to replace this loss of baseload electricity generating capacity is contentious. While nuclear power plants are low-carbon and reliable, they are phenomenally expensive to build and run. Carbon Capture Storage (CCS) is not yet proven on a commercial scale and remains twice as carbon intensive as gas; neither is expected to be operating before 2020. Nor is wind power the solution. The National Grid estimates 25GW of wind power is the equivalent of only 5GW of fossil-fired generation and suggests it is largely additional to, not a replacement for, fossil fuels (DECC 2009a, c; EON 2008; Helm 2008; National Grid 2008; Rogers 2012). Perhaps gas could be a short-term solution? Certainly the present government seems to think so (DECC 2012c; Harvey 2012; Rogers 2012). Gas-fired power stations are relatively cheap to build and can be turned on and off quickly to cope with renewables intermittency problems as well as emitting only half the amount of carbon as coal (CCC 2010). Exacerbating the situation is the difficulty of aligning the many disparate interests in a liberalized, privatized electricity market to achieve the government’s multiple objectives. The result is a situation where many believe a gap in electricity generating capacity during the next decade is likely (Brinkley and Mcllven 2010; DECC 2009a; DTI 2006; EON 2008; Helm 2008; National Grid 2008 & 2010; Smith 2009).

Neoliberalism and the markets

Before privatization of the energy markets in the 1980s, energy policy issues were mainly thought to be problems on the supply side, solvable by supply side solutions. The result was long-term, capital intensive projects such as coal and nuclear power plants (Scrase et al. 2009a, 5). Privatization and liberalization have led to a situation where market-based approaches prioritize low-cost and short-term solutions. Expertise in government has been replaced by a complex web of energy consultants, multinational corporations, energy utilities, specialist energy markets, infrastructure environmental regulators, the EU and regional bodies. Each has different short- and long-term goals and each is seeking to advance their interests through a variety of strategies. Achieving policy targets under these conditions mean navigating a much more complex, interdependent and multi-layered policy arena than previously encountered (Scrase and MacKerron 2009; Smith 2009, 55). Yet markets are still designed around the technical and economic characteristics of connecting centralized fossil-fuelled power plants to the transmission grid. Therefore reforming markets is essential in order to reflect a future power sector where fossil fuelled electricity generation has virtually been eliminated (Helm 2008; Rhys 2009).

The issue of 'lock-in'

The complexity and scale of the UK's modern electricity generating system has created a powerful momentum or a 'lock-in' effect that makes any transition to a new technological pathway difficult (Foxon 2002; Jefferson 2008; Scrase et al. 2010; Scrase and MacKerron 2009, 95; Unruh 2002; Watson 2008). One of the barriers to creating momentum behind energy efficient and low carbon technologies is that most capital assets in energy systems are long-lived, have high capital intensity, and use a specific type of fuel. For example, a fossil fuel fired power station has a typical lifespan of around 40 years, converting the facility to a low carbon fuel is extremely expensive and difficult, if possible at all. The implication is that the UK electricity system is already locked into a high carbon system and the lock-in effect will persist for many years to come, no matter what action we take now. It is clear the government is reluctant to commit to a single approach for fear of choosing the wrong technologies that will lock the UK into a sub-optimal system that proves too expensive. On the other hand, many businesses are frustrated by the lack of clearly stated preferred options because they cannot decide on what technologies to invest in (DECC 2010b; Scrase et al. 2010; Singh 2008; Stirling 2009; UK Parliament 2010; Watson and Scott 2009).

Energy security

Government documents tend to frame energy security in simplistic terms, claiming it will automatically improve by reducing energy imports (Chaudry et al. 2009; DECC 2009a; Watson and Scott 2009; Wicks 2009; UK Parliament 2007). As long as modern economies remain dependent on fossil fuels, securing enough at affordable prices will remain a priority. Given the majority of proven reserves of oil and gas are located in the Middle East and Russia, which are perceived as insecure, it contributes to fears on overreliance on the region for supplies. Emerging economies such as China and India are also perceived as a threat as they are buying much of the available supplies (Scrase and Ockwell 2009; Watson and Scott 2009). Ironically, the biggest threat to the UK's energy security over the last thirty years has come from internal forces. It has been technical failures in the network (domestic fuel blockades such as the dispute at Grangemouth, accidents such as fires at Pembroke oil refinery, and the miner's strikes of the 1970s and 1980s) that have caused the major disruptions to the UK's energy system. This viewpoint receives far less attention in the literature. Instead, the general trend tends to focus on the physical delivery of energy sources, rather than recognizing many recent failures in the electricity system have resulted from technical failures in the infrastructure (BERR 2008; Grubb et al. 2005; Howell and Nakhle 2007; Jamasb and Pollitt 2008; Watson and Scott 2009).

Nuclear back on the agenda

The last few years have seen a bitter debate fought around the issue of whether or not to include nuclear power as part of the UK electricity generation mix (Ash 2009). On the face of it, nuclear seems to offer reliable baseload, low carbon electricity in a secure way (Scrase et al. 2009b, 227). However, there is no shortage of opposition and nuclear power remains a politically and environmentally unattractive proposition in the UK (McGowan 2009, 213). Studies conducted by Pidgeon et al. (2007) and Ash (2009) suggest an explanation. They examined how the framing of nuclear power is related to people's different perception of risk. For example, the current debate over nuclear's future in electricity generation has been reframed by the government in order to emphasize its role in climate change mitigation. Reframing the issue this way seemed to lead to more people reluctantly accepting nuclear power whilst those opposed perceive the risk to the environment an unacceptable risk. Consequently, both sides of the debate hold very different ontological beliefs and prioritize risk differently; the result is two very different framings of policy problems leading to an inability to agree on the way forward.

Renewables

Although renewables can provide low-carbon electricity and are a vital ingredient in the government's strategy to decarbonize the power sector, all options are embroiled in political and environmental controversy (DECC 2009a; DTI 2007; Howell and Nakhle 2007). Despite this, the UK has an ambitious target of sourcing 15% of all its energy needs from renewables by 2020, the majority of the increase coming from wind. This implies that the percentage of electricity generation from renewables will have to increase from their current levels of 6.6% to 32% by 2020 (Booker 2012; DTI 2007; DECC 2010b). Both EON and EDF's response to the National Grid's 'Consultation: Operating in 2020' highlight the problems of intermittency associated with wind generation to provide firm, dispatchable generation. EDF noted any increase in wind capacity would have to be 'matched to a large extent' (National Grid 2009b, 6) by back up, fossil fuelled power plants for when the wind does not blow (National Grid 2009b, c, d). Therefore, building wind turbines is expensive, reduces energy security and when the wind does blow, power stations providing the back-up energy supplies lose money (DECC 2009a; Helm 2009; Jowit 2010a; Rogers 2012; Stewart and Wachman 2010). If security of supply is to be maintained and an energy gap avoided, there must be massive investment in both fossil-fuel and nuclear power plants (DECC 2010a, b; Helm 2008; UK Parliament 2010).

By contrast, the WWF's response to the National Grid's consultation is that those concerns are unfounded. Energy analyst David Milborrow, writing on behalf of the WWF, points out that the 'wind rarely stops blowing everywhere at once', therefore 'wind power does not need to be backed up megawatt for megawatt', and only requires a 'very limited amount of additional backup' (Milborrow in National Grid 2009a, 4 & 5). Likewise, Gross et al. assert that, although wind does not displace fossil fuelled generating capacity, it does displace fossil fuelled generation (2006, iii).

Carbon Capture and Storage

As we make the transition towards greater dependency on intermittent renewables, sources such as wind, coal and gas will continue to play a vital role in ensuring a reliable and secure electricity supply. Although the UK has abundant reserves of coal, utilizing it is problematic, for coal emits more carbon emissions per unit of electricity than any other fuel. A potential solution to this challenge is carbon capture and storage (CCS), an emerging suite of technologies that could potentially reduce fossil-fuelled power station emissions by as much as 90%. While technically feasible, end-to-end use of CCS remains unproven on a commercial scale (Cohen et al. 2009; DECC 2009a, b; Gibbins and Chalmers 2008; Helm 2008; McGowan 2009, 215; Nuttall and Manz 2008; Rogers 2012).

The DECC's report on Clean Coal (2010a) and their latest publication 'CCS Roadmap – Supporting the deployment of Carbon Capture and Storage in the UK' (2012a) acknowledge the importance of CCS in tackling emissions from coal-fired electricity generation and contributes to the diversity of the UK electricity supply. Similarly, EON warns against becoming overly dependent on gas, stating that coal still has an important role to play in providing flexible back-up generation for wind. However, this depends on successful implementation of full scale CCS. EON notes ironically that many environmental groups that are demanding large cuts in CO_2 emissions are also campaigning against using coal, with or without CCS, which businesses such as EON as well as the government consider essential to the energy mix (DECC 2010a; DECC 2012b; Greenpeace 2008; National Grid 2009c; Rogers 2012).

Is gas the solution?

The UK has enjoyed secure gas supplies over the last thirty years. A surplus of supply, together with increased competition, saw prices fall and coincided with the advent of Combined Cycle Gas Turbine (CCGS) technology that largely displaced coal. Further, a liberalized market made the low capital cost of gas-fired power stations very attractive. Currently, the UK has 31GW of existing and 32GW of new build gas power capacity in the planning system (CCC 2010, 68; DECC 2012c). One of the main drivers behind the increased demand for gas in power generation is the UK government's policy to reduce carbon. The relatively low carbon intensity of gas compared to coal allowed the UK to reduce its GHG emissions by around 23% below 1990 levels by 2010, exceeding its Kyoto targets of 12.5% (Honoré 2006; Smith 2009).

However, as Brinkley and Mcllveen point out, the UK's increasing reliance on gas for electricity generation is 'turning this solution into a new problem' (2010, 5). They observe that, over the coming decade, CCGT's are the only off the shelf technology that could be built in time and claim that the choice of technology is driving the choice of fuels, not vice versa. More specifically, Scrase and MacKerron say CCGTs will be built because it is the cheapest option available for private investors (2009, 100). If, as it seems, gas is going to play an increasingly large part in the UK's fuel mix for generating electricity in the coming decade, then all authors agree that increasing dependence on the global markets for supply will be bad for UK energy security (Brinkley and Mcllveen 2010; Macalister and Vidal 2010; Scrase and MacKerron 2009).

Electricity generating gap

Historically, policy analysis has focussed largely on ensuring the supply side of the equation meets whatever demand arises. On the demand side, energy users have typically had little choice in what type of technology supplies them with electricity other than choosing the technology that electricity activates the device (Bows et al. 2006; Martiskainen and Watson 2009; Greenpeace 2008). The government's White Paper (DECC 2009a) acknowledges the importance of encouraging energy efficiency in the hope of reducing consumption and has implemented a number of policy instruments for addressing emissions. Their investment of at least £550 billion by 2020, to meet renewable energy and climate change targets (by upgrading the power sector's infrastructure and building new electricity generating capacity), dwarfs any investment in energy efficiency schemes, signalling where their intentions lie (CCC 2010; Jowit 2010a). Clearly, the Government recognizes that consumption of electricity is unlikely to decrease, especially in light of the predicted increase in electricity consumption to replace fossil fuel used for heating and transport. Thus, the importance of decarbonising the power sector is reinforced if climate change and emission reduction targets are to be met (DECC 2009a & 2010b; Rhys 2009).

Then there is the fundamental question of whether a gap in electricity generating capacity will even materialize in view of recent decisions by the European Union. They have decided to delay new regulations, that would have led to the closure of heavily polluting coal-fired power stations by 2019, after Britain argued it would have faced and 'energy crunch' before replacement low carbon technology came online (Macalister 2010). In short, the existing infrastructure's lifespan will be extended.

Decentralized generation

At present the UK's existing electricity networks are dominated by large-scale, vertically organized power plants. Electricity is transported in a one-way direction from a central power plant to the consumer. Therefore, integrating and exploiting the advantages of decentralized generation requires transforming the entire electricity infrastructure, not just connecting them to the existing network. However, electricity generation systems often display a considerable level of technological and institutional 'lock-in' to particular pathways. Incumbents seek to maintain the current system to protect their huge, long-term capital investments by building up their institutional, ideological and political power (Sauter and Bauknecht 2009, 163; Scrase and Ockwell 2009, 226). Thus, existing institutional arrangements tend to favour the incumbent large players and exclude new entrants from entering the market due in part to the government's non-interventionist approach to the markets (Scrase and Ockwell 2009, 226).

Yet generating electricity locally was the norm before 1938 and the establishment of the National Grid, it was the scaling up of electricity generation technology that reduced generating costs and improved living standards (Patterson 2007, 47). This does not necessarily mean the cost of returning to a more decentralized generation system will escalate costs, as the government could instigate a number of policy measures, such as financial incentives that offer viable returns for developing low carbon innovations that have yet to benefit from scale economies (Foxon 2002).

Discussion

This research revealed the complexity of the subject and the confusion surrounding the debate. To meet government emission targets, virtually all electricity will need to be generated using low carbon sources such as renewables, nuclear and fossil fuel plants fitted with CCS technology. This prospect means the composition of the electricity generating system will have to undergo a major transformation. Ideally, a diverse mix of low carbon electricity generation technologies will ensure energy security by reducing reliance on one particular technology or fuel (Brinkley and McIlveen 2010; DECC 2009a; Gross et al. 2006; Patterson 2007). However, so far the government's policy concerning electricity seems to be based on the following assumptions:

- Nuclear, CCS and renewables will generate enough low carbon electricity to prevent a gap in electricity generation despite the fact that nuclear and CCS are not expected to be operating before 2020, and renewables suffer intermittency problems
- A liberalized energy market will deliver the urgent changes necessary despite the fact that businesses invest to make money, not necessarily to do what is best for the nation.

Clearly, privatization and liberalization of a previously nationalized and highly centralized electricity system resulted in greater economic efficiency, but is ill equipped to deal with current policy objectives (Scrase et al. 2009b; Smith 2009, 75).

The diversity of responses encountered in the literature reflects the difficulties of achieving a consensus between multiple actors with different agendas. What is also clear, are concerns over the complex interdependencies between stakeholders that make legitimately decarbonizing the power sector extremely challenging (Smith 2009, 75). Importantly for the author, these results emphasized the significance of addressing some of the important subthemes that emerged. For instance, understanding the role played by the government's core imperatives, coupled with how underlying ontological and epistemological beliefs influence the framing of issues, may help explain why energy policy seems so intractable.

A key issue is that governments of contemporary developed nations must fulfil a number of functions, or core imperatives, in order to ensure their survival:

- Raise revenue
- Sustain economic growth
- Maintain domestic order
- Maintain civil legitimacy
- Survive internationally as an independent state

The state must deliver against these core imperatives. This means all other concerns, like climate change, are unlikely to have any success in influencing policy unless they are discursively constructed, or framed, in such a way as to contribute to achieving a core imperative. 'Framing' refers to the underlying assumptions a policy is based on and the different ways debates construct, emphasize and link issues. Thus, the linguistic framing of energy policy problems and solutions are just as important as the actual policy itself (Keeley and Scoones 1999; Scrase and Ockwell 2009, 52). For example, the large scale use of renewable technologies is primarily promoted as bringing new opportunities for economic growth. Without this framing, it would be perceived that renewables were threatening the core state imperative of sustaining economic growth by removing the economic benefits of existing, large-scale, centralized technologies. Simply put, it is very unlikely that a policy discourse framed around renewables' environmental and social benefits would be successful in influencing policy (DECC 2009a; Scrase and Ockwell 2009).

In terms of the electricity sector, research suggested there was a need for the state and markets to work together. This challenges the notion that expert-led, government policies alone can instigate the urgent changes needed in markets, institutions, technologies, behaviours and culture to transform the power sector. One perspective for understanding the challenges to decarbonizing the electricity system is that of examining 'socio-technical regimes'. Analysis from this perspective looks at socio-technical regimes as a result of interactions between the technologies, markets, institutions, behaviours and cultures. Therefore, it is not a single decision-maker that determines the future, despite some actors having more influence than others. Instead, change is negotiated through interactions between businesses, government, civil society and experts. This challenges the traditional role of experts in the technocratic-rationalistic model whereby policy-making is portrayed as a rational, objective, linear process in which scientists 'speak truth to power' that culminates in a solution (Hulme 2009; Lehtonen and Kern 2009, 121; Scrase and Ockwell 2009, 107).

The term 'speaking truth to power' describes a positivist conceptualization of the relationship between science and policy where scientists are perceived as providing technical analysis untainted by the politicization of policy issues. The case against technocracy has highlighted a number of problems: whether or not a policy is going to be decided by purely technical arguments; are the technical experts neutral; and what happens to democracy when policy debates are confined to experts (Keeley and Scoones 1999)? It is tempting to choose a more technocratic model, given the urgency of tackling climate change, because it is difficult to see how multiple stakeholders can align their agendas and expectations in order to implement the urgent changes necessary (Watson 2008), especially as the public are increasingly sceptical of official bodies, calling into question formal scientific pronouncements about climate change. Recent opinion polls reveal an increase in the percentage of the British public who remain unconvinced that humans cause climate change. In this context governments will struggle to retain legitimacy for the urgent actions it needs to take (Jowit 2010b; Keeley and Scoones 1999).

Another possibility is that the major challenge for UK energy policy is the dilemma of markets versus intervention, and urgency versus legitimacy. The government has a strong desire to set out a framework and let 'the market' deliver. However, greater government intervention and radical policies will be needed to implement the necessary changes, but they can only legitimately take action within a democratic society if they have enough political and public support. The difficulty is that this requires real leadership, compromise and accommodation between stakeholders holding varying interests. No matter what form of technology is chosen, nuclear, renewables or CCS, each has some undesirable environmental, social or economic consequences. Therefore, legitimacy is essential to success, and this links back to the government's obligations to meet its core imperatives (Scrase et al. 2009b, 249).

The literature is awash with prescriptive formulas for how we can best meet our requirements for generating electricity while satisfying energy security and emission reduction targets. However, a theme that repeatedly emerged is that the main challenge is the difficulty of aligning the disparate interests of multiple actors across multiple objectives (Stirling 2009, 258). To date, finding a generally acceptable pathway to decarbonizing the power sector has proven extremely difficult. While there is no shortage of possible technological solutions, dealing with the underlying socio-political issues is extremely challenging. These conflicts shape what appear to be technical debates. In reality, they are complex, social, ideological and political issues promoting certain agendas;

therefore, changes in both policy processes and policy substance are required. In terms of process, governments will need to build substantial public support for the radical changes necessary to maintain legitimacy. In terms of policy substance, governments need to motivate behavioural change and encourage investment in low-carbon technologies by developing credible policies. Policy success or failure depends on recognizing the complex interdependencies between the many stakeholders involved; the government alone cannot decide the future of the electricity sector (Lehtonen and Kern 2009; Scrase et al. 2010; Scrase et al. 2009b, 249).

Conclusion

Around one quarter of the UK's baseload electricity generating capacity will close over the next decade and replacement is complicated by having to meet both climate change and energy security objectives. Government is struggling to create and implement coherent polices in an incoherent situation, in order to rapidly reduce emissions and decarbonize the electricity sector. However, this creates a tension between the principles of democratic government and the need to take urgent action (Lehtonen and Kern 2009).

Careful analysis indicates that a gap in electricity generating capacity is unlikely. The negative social, political and economic consequences of permitting a gap are such that the government will probably extend the lifespan of current nuclear and fossil-fuelled power stations, build more CCGSs, or simply miss the emission targets altogether. Achieving an effective energy policy is difficult, as it is susceptible to strong agendas from powerful interest groups intent on advancing their own particular knowledge claims, not necessarily doing what is best for the nation. Certainly, the author believes there is no prescriptive formula and recognizes that the complex interdependencies between stakeholders makes legitimately and rapidly decarbonizing the power sector extremely challenging. The government alone cannot decide the future of the electricity sector. Yet, somewhat contradictorily, the evidence seems to suggest that when there is such a plethora of opinions the government actually needs to take a more interventionist role in energy policy and state clearly articulated goals, without losing its democratic and authoritative legitimacy (Smith 2009, 75; Stirling 2009). In short, it is not simply a matter of choosing the most appropriate fuels and technologies to replace lost electricity generating capacity; rather it is just as much a socio-political task.

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