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Re-Monopolising Power?

Ten principles for electricity market reform

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"Patchworks of support mechanisms are destroying the electricity market, creating unmanageable uncertainty for non-subsidised investments. The claim that 'the market cannot deliver' is a self-fulfilling prophecy: ill thought-out interventions destroy economic mechanisms, leading to major uncertainty and underinvestment, leading to more intervention. If the current policy mess is not quickly addressed, the most likely outcome is that the UK will have destroyed one of its most brilliant public policy successes of the past 25 years — the creation of competitive energy markets, envied across Europe and copied the world over — face much higher energy prices, enjoy a lower level of energy security and at the same time fail miserably on its green targets."

Pierre Noel and Michael Pollitt, Judge Business School and ESRC Electricity Policy Research Group, 2010.[1]

Executive Summary

Electricity market reform is currently under a spotlight because of concerns about (a) future security of supply, as a substantial proportion of nuclear and coal generation capacity retires and intermittent renewable generation comes on-stream; and (b) securing investment in low carbon generation in order to meet UK carbon emissions targets. The government has said it will bring forward a white paper on electricity market reform in spring 2011.

The key objectives of policy in relation to electricity are to ensure supply, to mitigate risks from climate change, and to pursue these objectives in the most cost-effective ways, in order to minimise the burden of electricity costs on competitiveness, incomes and employment. Policymakers should not be distracted by other objectives – including Industrial policy objectives, promoting 'green jobs', mitigating future fossil fuel prices, and 'energy independence' – which, if seriously pursued, would risk making the key objectives harder and more expensive to achieve.

Decarbonisation of the UK electricity sector itself tackles less than 1% of global carbon emissions. *How* the UK electricity sector is decarbonised is therefore important for securing global impact from the effort. Unnecessarily expensive policies will not offer a credible or compelling example to other countries. UK electricity decarbonisation is an opportunity to demonstrate cost-effective policy processes and technical innovations – ones that can be easily and cheaply copied – and to discover new information to inform subsequent global electricity decarbonisation.

We cannot at present know the best route to decarbonising electricity over the coming few decades, lacking information on the full range of feasible technologies, their relative costs, the best mix, the right order of deployment, etc. Even within the next 10-15 years, there is plenty of scope for new information to influence decisions. For example, the 1990s 'dash for gas' was not foreseen as little as seven years before it was underway. And the shift in expectations about future gas supplies, as a result of the development of shale gas extraction, has been even faster, with potentially far reaching effects for carbon emissions at a global level through substitution of gas new build for coal new build. More than 15 years out, the scale of unknowns – scientific, technological, economic, social and political – is even greater. Therefore decarbonisation requires an effective process of innovation, information discovery and adaption to new information.

In such environments of uncertainty and change, market processes are the most effective way to experiment, reveal new information, process and transmit it so that decisions may adapt in light of the new information. Competitive markets also have an excellent record in ensuring security of supply, contrary to the common sense – but wrong – intuition that supplies will be more secure if there is someone responsible centrally for ensuring security of supply.

Difficulties have almost always been found in taking an alternative, 'planning', approach in relation to the future. Even over a short number of years, matters rarely turn out as in plans, nor, as far as plans shape matters, do they turn out to represent the best approach (except in the simplest of contexts). This is because planning assumptions are made on the basis of, what later turns out to be, poor information about the future. For example, in 1970 the Central Electricity Generating Board planned on the basis that future electricity demand would require 100 GW of installed capacity by 1995, almost twice as much as was eventually required. In 2003, the energy white paper ruled out new nuclear generation, but by 2006 the government concluded that new nuclear was indeed needed as part of the generation mix.

In the energy sector, markets have demonstrated their ability to deliver both static and dynamic efficiency benefits, improving productivity and innovating in the electricity generation mix, business and technological processes. The UK gas market has recently shown how, when allowed to operate effectively, a competitive market will successfully respond and adapt to a changing environment to maintain high levels of supply

security: the scale of the gas market response to the challenge of reducing North Sea gas supply has been huge, with a 500% increase in UK gas import infrastructure capacity in the last decade, all built privately in the market. In 2009-10, the gas market was able to cope successfully with the severest winter for 31 years on top of disruptions to Norwegian gas supply. It is hard to imagine such an effective response through a central planning approach.

Exploiting the power of well-functioning markets therefore needs to be a priority, in order to discover the best ways of responding to the challenge of climate change while maintaining security of supply.

To function well, the electricity market needs rules, as well as policy interventions such as carbon allowances and/or carbon taxes to shift the market away from carbon over time. The key issue is whether policy interventions seek to *complement* market processes (help markets work well) or *substitute* for market processes, for example by deciding what is to be done, how it is done, when it is done, and by whom it is done. The design of energy policy will, therefore, determine whether interventions exploit the power of the market, or instead prevent the market functioning well.

The previous government paid lip service to the importance of electricity market processes, while overseeing an incremental accretion of policy interventions, with frequent tweaks and changes to these, which in combination have substituted for them. Interventions include, in particular, the Renewables Obligation, its 'banding' to give different subsidy levels to different renewables and a range of other changes to it; as well as feed-in tariffs, the Carbon Emission Reduction Target, a Carbon Capture and Storage deployment subsidy (enabled in legislation), the EU Industrial Emissions Directive, the EU Emissions Trading System and the Climate Change Levy.

This incremental accretion of policy interventions has unnecessarily taken the government into making a whole range of detailed decisions, which chip away at the market's ability to operate well, making it ultimately harder and more expensive to deliver secure, low carbon electricity.

The electricity generation market is becoming salami-sliced into smaller technology-specific markets, tending to increase prices, and chipping away at the market's flexibility. Interventions have led to distortion of market choices between technologies in ways unrelated to carbon reduction. They have led to perverse effects, such as undermining the EU ETS carbon price. Resources are wasted on 'rent-seeking': there are now more than ten UK organisations, each representing particular generation technology sectors, lobbying government for policies and/or subsidies to favour their sectors. There has been increased politicisation, and frequent tweaking and 'fine-tuning', of policy. Markets find it hard to deal with regulatory and political risk, so these raise costs of investing and innovating, and delay investments. Regulatory and political risks may add up to 1.5 percentage points on full asset financing costs, adding around £1.25 billion a year to the

costs of funding the estimated £100 billion of total generation investment required over the next 10-15 years. Perhaps even more important than the increased financing costs, the combined effect of government interventions has been to distract and prevent market players from taking investment decisions, innovating, revealing and adapting to new information. Instead they look to, and wait for government to make decisions on which technologies are favoured, by how much and what the planned outcome for the generation is. Market decision-making is replaced with 'monopoly' decision-making by government.

In March 2010, the then government published its Energy Market Assessment (EMA), discussing a number of options for reform of the electricity market. Most of the options within it have continued to be considered in the new government's Electricity Market Reform project. The EMA reiterated the importance of energy markets, but said little about the problems arising from the accretion of interventions in the electricity market. Instead, it discussed options for additional subsidies for low carbon generation, and for eliminating low carbon generators' exposure to electricity prices, going further to replace market processes. It gave relatively little attention to establishing a more credible, long-term framework for carbon-pricing.

Effective market processes require more than just paying lip service to the market while incrementally chipping away at market flexibility. There are particular risks from being caught in the middle, with the pretence of having an effective market which is held responsible for delivering centrally-planned outcomes. The market will neither deliver the prescribed outcomes, nor the benefits of innovation. Such a position is not stable; it tends to lead toward ever more comprehensive central planning. And the case is currently far from made that we need to discard all the benefits of electricity market processes.

Policy makers have a choice whether to continue down the current road of 're-monopolising' the electricity generation market through the replacement of market decision-making with government decision-making – or to change course. A new course is needed, with a regulatory framework that exploits, rather than damages, the power of a well-functioning electricity market to achieve security of supply and climate goals in cost-effective and innovative ways. Such regulation needs to be simple, give regulatory stability and allow market flexibility.

Recommendations

This Research Note recommends the following ten principles for electricity market reform, against which the government's proposals should be assessed.

1. Electricity market reform should be informed by a full assessment of the combined impact of all existing and proposed interventions on the functioning of market processes.

2. Climate-related policy interventions in the electricity market should be about reducing carbon

emissions.

3. The complex accretion of regulatory interventions should be rolled-back to achieve a simpler regulatory framework that enables market processes to function well.

4. Policy and political effort should be focused on achieving a credible, long-term carbon pricing framework.

5. Policies to support early stage low carbon technologies are important, but there needs to be a clear distinction between those and regulation of the main electricity generation market – between technology development and roll-out.

6. Electricity market reform needs to be complemented by reform in other areas, such as planning, in order to facilitate and remove barriers to effective electricity generation market investment.

7. The Coalition government has reduced the number of output targets across government, and the same approach now needs to be applied in electricity policy. New intermediate targets, including for 2030, should not be created.

8. An independent economic regulator should be maintained, which should have a narrow statutory remit. In particular, the government should exclude economic regulators from Schedule 7 of the Public Bodies Bill which gives ministers much greater powers to influence public bodies.

9. The government should consider putting detailed decisions about the mix and design of carbon reduction policies into an independent institution at arms' length from DECC, in order to reduce costly political uncertainty in relation to the development of market interventions.

10. Decisions on any introduction of capacity mechanisms should not be made now, as current evidence for intervention does not justify their risks. In due course they would need to be supported by better evidence of security of supply risks.

Introduction

UK energy market reform is currently under active consideration. Ofgem published its report of Project Discovery in February,[2] setting out a range of options for reform. Under the previous government, HM Treasury and the Department of Energy and Climate Change (DECC) together published an Energy Market Assessment at the time of the Budget in March 2010,[3] analysing options for reform. The *Coalition Programme for Government* set out a commitment to "reform energy markets to deliver security of supply and investment in low carbon energy, and ensure fair competition".[4] The Coalition government said in its first Annual Energy Statement in July 2010 that it is taking this forward as an Electricity Market Reform

project which "will assess the role that a carbon price, emissions performance standard, revised Renewables Obligation, Feed-in Tariffs, capacity mechanisms and other interventions could play in delivering a system that supports the delivery of a secure, low carbon, affordable electricity mix for the 2020s and beyond."[5] The Annual Energy Statement also announced a parallel review of Ofgem's role. The government has said that the Electricity Market Reform project will issue a consultation document before the end of 2010 and a white paper in spring 2011.

Drivers for electricity market reform include concerns about (a) future security of supply, as a substantial proportion of nuclear and coal generation capacity retires over the next 10-15 years and more intermittent renewable generation capacity comes on-stream; and (b) securing sufficient investment in low carbon generation, in order to meet UK carbon emissions reduction targets.

This Research Note explores the importance of exploiting the power of electricity markets to deliver secure lower carbon electricity generation at least cost to the economy, and the implications for electricity market reform. It does not attempt a blueprint for reform, but frames relevant issues and proposes principles for electricity market reform.

Objectives of UK electricity policy

Before examining electricity market reform, it is worth reflecting on the policy objectives that we want the electricity market to deliver.

Firstly, the electricity market should deliver secure supplies of electricity to customers. Secondly, we want the electricity market to play an effective role in mitigating the serious risks from climate change. And thirdly, we need both supply security and climate objectives to be pursued in the most cost-effective ways, to minimise the burden of electricity costs on competitiveness, incomes and employment.

In practice, other, less justifiable, objectives are also in play. To the extent that policy design takes these other objectives into account, it risks making the three key objectives outlined above harder and more expensive to achieve. Such other objectives include:

- *Industrial policy objectives.* For example, discriminatory and excessive subsidies might be awarded to politically favoured low carbon technologies and sectors. Such industrial policy subsidies most often relate to certain renewable technologies.

- *Promoting 'green jobs'.*[6] One consequence of effective carbon reduction processes will be 'green jobs'. But making green jobs *per se* an explicit objective of energy policy is unlikely to lead to overall higher levels of employment in the long run, and could lead to substantial levels of resources being wasted on inefficient energy decarbonisation policies. (Nor have 'green jobs'

proved to be a cost-effective short-term job creation approach: only around 4,000 jobs in the UK depend on the wind production industry, yet around £1 billion per year of public funding is spent on renewables, and mainly wind, subsidies).[7]

- *Mitigating future fossil fuel price rises and import price volatility.*[8] The future path of fossil fuel prices is uncertain, and the government has no information advantage relative to the joint knowledge base of a multiplicity of market participants, in predicting future prices. Moreover, it is far from clear that gas prices, for example, will rise rather than fall, given recent dramatic technological developments allowing extraction of 'shale gas'. These developments were themselves stimulated by commercial incentives in the face of anticipated scarcity of gas from other sources, illustrating the more general point that markets are more effective than governments in responding to anticipated market price movements and risks.

- *'Energy independence'.*[9] Security of supply is not the same thing as energy independence. Security of supply is obtained in a range of ways, in particular through healthy market processes and a diversity of supply sources, for example through having substantial Liquid Natural Gas import infrastructure. A policy focus on energy independence makes the assumption that foreign energy supplies *per se* are less reliable than domestic supplies. It should be noted however that domestic supply interruptions have most usually been the cause of supply concerns, whether through industrial action, haulage protests or industrial accidents such as the Buncefield fire.

The climate-related objective for electricity policy is often expressed as an aim to lower the UK electricity sector's carbon emissions. The UK generates around 400 TWh[10] of electricity per annum, emitting 183Mt of CO_2 (in 2006). This is only 1-2% of global electricity generation of 18,000 TWh per annum, with global electricity emissions at around 11 Gt CO_2.[11] A tonne of carbon has the same effect on the atmosphere wherever in the world it is emitted. Therefore reducing the UK's own electricity carbon emissions can only have a significant impact on climate change if it is done in a way which helps to secure effective global carbon reduction.

Impact on global carbon reduction might be achieved by the UK leading on domestic emissions reduction, in order to encourage other countries.[*] It could also be achieved through the UK developing and lowering the costs of early stage low carbon generation technologies with the potential to be a significant part of global decarbonisation. In addition, *how* the UK electricity sector is decarbonised is important in securing global impact. The UK could lead by example – showing others how carbon emissions can be cut at reasonable

[*] However, the experience of the Copenhagen summit suggests that UK/EU leadership carried little weight. It is also far from clear that the UK's carbon reduction record is in fact leading: Policy Exchange's report *Carbon Omissions (2010)* found that UK carbon *consumption* has in fact risen by an estimated 30% since 1990).

costs. Conversely, unnecessarily expensive electricity decarbonisation policies would not offer a credible or compelling example to other countries.[12]

So developing and deploying cost-effective approaches to electricity decarbonisation underpins the global impact of UK efforts. Cost-effective decarbonisation provides a more compelling example to others. It enables more carbon reduction – and thus leadership – from a given level of resources. (The public's[13] and businesses'[14] willingness and ability to pay will not be unlimited.) Minimising future decarbonised electricity costs is important if we want to incentivise future switching to electrified forms of transport and heating. And new cost-competitive low carbon technologies may be taken up globally.

Having established the overall policy objectives for electricity, and the electricity decarbonisation, the next section considers the nature of the challenge of decarbonising electricity.

The challenge of the unknown

"We don't know how to de-carbonise at reasonable cost... we simply don't know the extent to which we need each technology and their true cost. We don't know if new, game-changing technologies, processes and business models are about to emerge. There is no way the government can decide on the correct mix… Bypassing the market's discovery process in the name of urgency is the recipe for a costly government failure… The real challenge is to put in place credible policies that are based on acknowledging our ignorance, have a serious chance of delivering and will preserve public support for climate change policies."

Pierre Noel and Michael Pollitt, Judge Business School and ESRC Electricity Policy Research Group, 2010.[15]

It is possible to characterise two mindsets with which people approach the challenge of decarbonising electricity (or the economy as a whole), and these tend to inform views on the shape of policy.[16]

Broadly, the first mindset believes that we already know how to decarbonise UK electricity generation and we just need to get on and implement the solutions in time. This mindset often has one or more preferred decarbonisation approaches, e.g. nuclear or wind turbines. The second mindset believes that we cannot at present know the route to decarbonising electricity consistent with meeting the 2050 carbon target. This mindset believes that the best approach is one which enables an effective process over time of experiment, information discovery, adaption to new information and innovation.

While there is clearly more information about the near term, we consider that the challenge of decarbonising the electricity sector appears generally to be better understood by the second mindset.

Key arguments of the first mindset are that there are a limited set of feasible low carbon generation technologies and that time is too short for significant discovery. For example, a significant proportion of UK

low carbon generation investment has to happen soon – over the next 10-15 years – as a result of generation retirements (driven by the Industrial Emissions Directive and ageing nuclear plants) and the 2020 EU Renewable Energy Target.

We argue that this underestimates both the potential for discovery and the relevant timescales:

Firstly, within the next 10-15 years, there is plenty of scope for information discovery to influence the process of electricity decarbonisation. The 1990s 'dash for gas' was not foreseen as little as seven years before it was underway (see Box 2). The shift in the perceptions of future gas supplies associated with development of shale gas extraction has been even faster (with potentially far reaching effects for carbon emissions at a global level through substitution of gas new build for coal new build). There are a wide range of decisions that will be made over the next 10-15 years, including about choice of generation technology (nuclear, onshore/offshore wind, marine technologies, distributed generation, gas, coal with CCS, energy efficiency, demand-side response or peaking plant), the order and the timing of investments. These decisions will determine the effectiveness and costs of delivering our electricity sector objectives. Yet much new information relevant to these decisions will be revealed during this period, including on relative technology costs. For example, offshore wind is still a relatively early stage generation technology,[17] and right now much is being learnt from early deployment that should inform its role over the next 10-15 years, and could have a major impact on overall customer costs.

Secondly, more than 15 years out, the scale of unknowns – scientific, technological, economic, social and political – is even greater. Box 1 identifies the types of relevant information that will be revealed over the coming years and decades, to inform effective and efficient decarbonisation of perhaps the entire UK electricity sector.

Thirdly, decarbonising UK electricity addresses less than 2% of global electricity carbon emissions and needs to be seen as part of a much broader process of reducing emissions from electricity generation globally. The process of UK electricity decarbonisation is therefore an important opportunity for promoting the discovery of new information to inform subsequent decarbonisation of global electricity generation.

Box 1: Unknowns relevant to electricity market decarbonisation

Some of the types of information which will be revealed and are relevant to decisions about generation investment and approaches to decarbonisation and security of supply over the next 10-15 years are:

- How rapidly certain generation technologies can be deployed, for example, the operational feasibility of proposed rates of offshore wind deployment;

- Feasibility of new technologies, for example, the outcome from demonstrations of full-scale Carbon Capture and Storage;
- Evolution of the relative costs of different technologies, for example, the actual costs of new nuclear, and to what extent offshore wind costs fall (they rose 150% between 2004 and 2009 in the UK);[18]
- Impact of relevant policy changes, for example, reforms of the planning regime to incentivise local onshore wind turbine or energy-from-waste developments; and
- The pace of improvements in energy efficiency, including as a result of government policies like the Green Deal and CRC Energy Efficiency Scheme.

Beyond 15 years, a wider range of unknowns will have an even greater impact on decisions about generation investment and approaches to decarbonisation and security of supply, including:

- The evolution of scientific understanding of climate change risks;
- UK population change and economic growth;
- Developments in new energy-using technologies, with impacts on overall demand;
- International fossil fuel prices;
- Progress on international climate negotiations, and developments in international low carbon markets;
- Evolution in social and political acceptability of technologies, for example, onshore wind, waste incineration, biomass land-use;
- Development of smart grid and control technologies enabling improved demand-side response;
- Progress of European co-ordination of regulation and grid development, including to help manage renewable intermittency;
- Engagement of people and businesses with energy efficiency measures, their effectiveness and costs;
- Effectiveness of demand-side management technologies, including smart meters and associated control technologies;

- Nature and rate of deployment of new electric technologies in the road transport and heating sectors, which will impact electricity demand and capacity for storage, as well as electricity decarbonisation timescales;

- Evolution of the costs of early stage generation technologies (for example onshore wind power costs fell by 90% over the 20 years to 2005);[19]

- Operational constraints, for example, the actual lifetimes of offshore wind turbines, which may need to be replaced within 20 years;[20] and importantly

- Development and demonstration of new technologies, for example, tidal stream power, concentrating solar power,[21] or travelling wave nuclear reactors (for example, Bill Gates is investing in the TerraPower project).[22]

The first mindset also underestimates the difficulties that have almost always been found in taking a successful 'planning' approach in relation to the future. Even over a short number of years, matters rarely turn out as in the plans, nor, as far as plans shape matters, do they turn out to represent the best approach (except in the simplest of contexts). This is because planning assumptions are made on the basis of, what later turns out to be, poor information about the future.[23] Box 2 illustrates this with some examples, from the energy sector alone, of the poor track record of future assumptions about, and plans for, the future.

Box 2: Some examples of past failures of prediction and planning in the energy market

- In 1970 the Central Electricity Generating Board predicted that future electricity demand would require 100 GW of installed capacity by 1995. By 1995, only just over half of that capacity was required.[24]

- In the Sizewell B nuclear power station planning inquiry in the mid-1980s, considerable time was spent examining the likely future of the UK generation market as a whole. None of the many energy experts involved suggested a significant role for gas turbine generation. In the 1990s, gas turbines were basically the only generation being built.

- Predictions in the 1950s and early 1960s were that nuclear power would become 'too cheap to meter'.

- The 2003 energy white paper concluded that new nuclear generation was unnecessary, effectively ruling it out.[25] By the 2006 energy review, the government concluded that new nuclear needed to

be a part of the generation mix.

Five years ago the US Energy Information Administration (EIA) forecast that by 2025 the US would be importing 28% of its natural-gas supply. In the intervening period, the development of technologies to recover unconventional 'shale' gas, transformed the global gas market outlook. The EIA forecast has now come down to 9% of US supply. Estimates of America's "technically recoverable" gas have risen by about 500 trillion cubic feet, or a third, in the past two years.[26]

We need appropriate humility about our knowledge and our ability to predict how best to reach a secure, decarbonised electricity sector as cost-effectively as possible, both in the UK and globally. The discussion in this section has two key policy implications. Firstly, there are significant risks from policy and planning based on a supposed greater understanding of the future than we possess. And secondly, it is important that electricity policy encourages the continual revelation of new information, through innovation and experiment, and the deployment of that information. The next section considers the importance of markets in these processes.

The power of markets

"If the partial genius of market economies lies in their capacity to achieve coordination without a co-ordinator, the greater genius lies in their ability to innovate and adapt in an environment of uncertainty and change. The sustained achievement of market economies comes from their pace of innovation—in products, technology and organisation—derived from the ability of market systems to undertake small-scale experiment, to watch the results, to mimic what works and discard what doesn't."

John Kay, 2007[27]

Across the economy, it has been demonstrated time and again that multiple decision-makers, acting within well-functioning markets, are able to deliver a wide range of outcomes better than 'monopoly' decision-making (central-planning).

Competitive markets have an excellent record in ensuring security of supply – sustained flows of products and services to meet the requirements of customers in an efficient way. Common sense intuition suggests to many people that supplies will be more secure if there is someone in charge of, or responsible centrally for, ensuring security of supply; but such intuitions are not only wrong – being both contrary to the historical experience and explicably wrong in terms of theory – but potentially harmful if translated into policy

making. The reason competitive markets do so well in ensuring security of supply is attributable to the 'negative (stabilising) feedback'* properties of the price mechanism.[28]

Most importantly, markets are dynamic 'discovery' processes, not simply providers of static productive and allocative efficiency. In environments of uncertainty and change, market processes are the most effective way to experiment, reveal new information – from general scientific knowledge to highly idiosyncratic business know how – process and transmit it so that decisions adapt and improve in the light of the new information. It is in the process of 'discovery' that competitive markets have their most decisive advantages over monopoly (central) forms of resource allocation, which by contrast are characterised by poor information.[29] Hayek warned of the 'pretence of knowledge' in policy making and planning,[30] and Box 2 provides examples of the risks of planning based on what turned out to be poor information.

In the energy sector, markets have demonstrated their ability to find ways effectively to deliver both static and dynamic efficiency benefits. Box 3 outlines some of the benefits after the opening of the UK electricity market in 1990.

Box 3: Benefits after electricity market opening

After the opening of the electricity generation sector to competition in 1990, the market rose to the challenge of addressing the former monopoly CEGB's poor productivity. In the five years after 1990, labour productivity doubled; nuclear generation output increased by 28% overall with no increase in capacity and by nearly 50% in the more modern advanced gas-cooled nuclear reactors. Fossil fuel costs per KWh fell 45% and nuclear fuel costs per kWh fell 60% in real terms. CO_2 per kWh fell 28% and SO_2 and NO_X fell by over 40%.[31]

It was competition, rather than privatisation *per se*, that was the key, common driver of improved performance: the productivity gains were shared by all three generating companies, which were subject to competition even though Nuclear Electric remained state owned until 1996.

The competitive market also innovated in the mix of generation, as gas-fired generation rose from almost nothing to 15% of output, and to 30% in 1997, allowing the UK to stop building expensive coal and nuclear options. New entrants accounted for over half of new capacity.[32] Further innovation led to the substantial shortening of lead times for new generation, and ongoing improvement in generation design, so that, for example, new gas turbines are now substantially more efficient, with lower environmental impact.

UK electricity supplies are now among the most reliable in Europe, and electricity supply outages are almost

* Regulatory rules can sometimes combine with competitive processes to provide 'positive' (destabilising) feedback loops. This sometimes occurs in financial markets and is something that policy in energy market needs to take care to avoid.

always the result of physical interruption to monopoly transmission or distribution rather than a shortage in the electricity generation market.[33] Britain has the fourth cheapest electricity prices (and the cheapest gas prices) in the original 15 countries making up the European Union (for the latest period January-June 2010).[34]

The UK gas market provides an example of how, when allowed to operate effectively, a competitive market will successfully respond and adapt to a changing environment to maintain high levels of supply security. Box 4 outlines the huge scale of market response to reducing North Sea gas supply. It is hard to imagine that a monopoly decision-maker could have achieved such an effective response to the challenge through central planning.

Box 4: UK gas market response to decline of UK Continental Shelf

The proportion of UK gas demand supplied from the UK continental shelf has declined sharply, from supplying more than total UK demand to currently around 60% of UK demand, and it is expected to decline further over the coming years.[35]

In response, the competitive gas market has delivered new investment in large quantities, and even ahead of need. This includes new Liquid Natural Gas (LNG) import and transport facilities, to enable a diverse range of gas imports from around the world, as well as providing substantial new gas storage. There has been a 500% increase in UK gas import infrastructure capacity in the last decade, which is now capable of importing 120% of the UK's average gross annual gas demand.[36]

Last winter (2009/10), the gas market was also able to cope successfully with the severest winter for 31 years, record peak demand recorded on 8 January, and technical problems in relation to Norwegian gas fields which considerably reduced imports from Norway, with no involuntary interruptions. Prices also were hardly affected.[37]

As one academic commentator has said: "*The British gas market works so well it has become Europe's western gas corridor. The UK is now the preferred entry point for LNG into Europe; while terminals in Spain remained idle during the recession, traders happily exploited the liquidity of the British market and the option to trade with the continent through the gas interconnectors... In turn, this new status as Europe's western gas corridor brings additional gas supply security to British families and businesses. It creates incentives to add not only new import capacity but new storage as well.*"[38]

The government's March Energy Market Assessment concluded that risk of the gas market being unable to meet demand was very small, even in extreme scenarios.[39]

Over the next few years and decades, electricity markets will need to find ways of responding to the challenge of climate change while maintaining security of supply. That challenge, as discussed earlier, is characterised by conditions of uncertainty and the critical need to discover and use new information and to innovate. Such innovation may come from existing market players or from new entrants from outside – often the most significant new innovations in a market arise from outside of the existing players. Exploiting the power of well-functioning markets needs to be a priority.

All markets need rules, and the electricity market needs rules as well as policy interventions, including carbon allowances and/or carbon taxes to shift the market away from carbon over time. The key issue is whether policy interventions seek to *complement* market processes (help markets work well) or *substitute* for market processes, for example by deciding what is to be done, how it is done, when it is done, and by whom it is done. The design of energy policy will, therefore, determine whether interventions exploit the power of the market, or instead prevent the market functioning well. The next section discusses the impacts of recent developments in electricity market regulation.

Recent development of electricity market regulation

"We have fallen into a Catch 22 situation... The rise of climate change as, rightly, an overriding challenge, combined with shifting political acceptability of different energy technologies... meant that the previous government no longer just expected energy companies to invest in sufficient generation to 'keep the lights on'. Instead, they now expected the lights to be kept on with a particular mix of technologies that suited the prevailing political mood. Knowing this, investors start to be wary that politicians may start tweaking the policy framework to engineer the 'right' outcome. This wariness translates into reluctance to make investments against such uncertainty. In turn, this convinces politicians ever more that the market will not deliver what they want, so they start amending the policy framework, which in turn increases investor wariness further, and a vicious circle is created."

John Cridland CBE, CBI Deputy Director-General, 2010.[40]

Over the last few years the electricity market has seen an incremental accretion of many new market regulations and policy interventions, with frequent tweaks and changes to these. A number of such interventions subsidise deployment of particular chosen low carbon technologies. For example, the Renewables Obligation (RO) was established in 2002 to subsidise deployment of renewable generation. The policy has been tweaked a number of times since its introduction, including a fundamental change in 2009 to introduce 'banding', so that the policy now directs different levels of subsidy for different renewable technologies. In addition this year, a separate scheme was introduced specifically to subsidise small-scale renewable generation through 'feed-in tariffs', also directing different levels of subsidy at different

renewable technologies. A Carbon Capture and Storage deployment subsidy has also been enabled in legislation.

In addition to the increasing range and complexity of subsidies for different generation technologies, other interventions have been introduced to incentivise or dis-incentivise particular technologies. For example, the previous government placed a moratorium on the construction of gas generation in the late 1990s (to protect the coal industry). In 2003, the government ruled-out new nuclear generation in its white paper (before reversing that decision in 2007). In 2009, it brought forward proposals for an Emissions Performance Standard designed to rule-out unabated coal generation. Other regulations have emanated from the European Union, including the 2020 target for 15% Renewable Energy, the Large Combustion Plants and Industrial Emissions Directives that force the early closure of many coal-fired power stations.

While well intentioned, the combined effect of these various new rules and regulations has been to distract and prevent market players from taking investment decisions, innovating and adapting to new information. Instead they look to, and wait for, government to make decisions on which technologies are favoured, by how much and what the planned outcome for the generation is. 'Waiting for government' tends to mean delay in responding to changing market signals and opportunities, reducing economic adaptability and flexibility. Market decision-making is replaced with 'monopoly' decision-making.

The argument of this Research Note is not that market rules and regulations are unnecessary: they are essential to enable the market to operate well and in particular to steer generation away from carbon over time. For example, a credible framework for pricing carbon is essential. But the current approach unnecessarily takes the government into making a whole range of detailed decisions, which chip away at the market's ability to operate well, making it ultimately harder and more expensive to deliver secure, low carbon electricity. More specifically, the implications of this approach include the following:

The direction of the market is dictated using poor information. The information available to inform the various 'monopoly' government decisions – target levels and dates, chosen technologies, subsidy levels, etc – is necessarily limited. As discussed earlier, there are a huge number of unknowns about how best to deliver secure and lower carbon electricity over time, and the track record of predictions is poor. Intervening to an unnecessary extent to direct the market on the basis of poor information risks a substantial waste of resources.

Increased regulatory uncertainty increases costs. The more policies there are which direct market decisions in various ways, the more scope, temptation and even need there is for frequent tweaking of policy. This has been seen, for example, in the regular adjustments to the Renewables Obligation. Scope for frequent tweaking and 'fine-tuning' is one source of regulatory uncertainty that increases risks and therefore raises

the costs of investing and of innovating. Another source is having unrealistic intermediate targets. The 2020 Renewable Energy Target is one example: few market players believe it will be met in the UK,[41] and this creates an expectation of further, unknown, government interventions.

Politicisation of market decisions increases risks. The political process clearly has a paramount role to play in setting the strategic direction for energy and climate policy. But there are real dangers in the politicisation of detailed policy and regulatory decisions which impact the market. Politicisation of decisions creates uncertainty that raises the costs of investing and innovating. Markets find it very hard to deal with regulatory, and in particular, political risk. The electricity market is increasingly becoming a bet on political decisions, rather than on new innovations and competitive investments. A leading generation developer has estimated the impacts of regulatory and political risks to be up worth up to 1.5 percentage points on full asset financing costs, adding around £1.25 billion a year to the costs of funding the estimated £100 billion of total generation investment required over the next 10-15 years.

Regulatory uncertainty delays investment. Regulatory and political uncertainty not only increases costs in the market, but also encourages market investors to 'wait and see'. This is a rational response to a situation where the government is expected to tweak policy on an ongoing basis. Market players reduce their exposure to regulatory risk by delaying investment until the last minute. [42] Indeed the government's Energy Market Outlook projects that the generation capacity margin could fall from 34% to 6-13% by 2020.[43] It needs to be recognised that such projections are difficult to make, and thanks to market innovation, it is possible to bring forward new gas generation quickly to meet any capacity shortfall. What is nevertheless clear is that there are no concerns at all about investment levels in the gas market (see Box 4), where, in contrast to electricity, little regulatory uncertainty has thus far been introduced.

Damage to the market's ability to reveal new information and innovate. The accretion of interventions and subsidies aimed at different generation technologies tends to segment the electricity generation market into separate, smaller markets. This salami-slicing of the market reduces competition and will tend to increase prices. Even more importantly, it chips away at market flexibility – its ability to reveal and adapt to new information. Markets are driven by companies exploiting opportunities to win market share through taking better decisions than their competitors. In the electricity market the opportunities for decisions – including technology choices – are being curtailed. For example, increasing information about the viability and costs of early offshore wind ought to feed into market decisions about the subsequent rate of offshore wind deployment, but the banded Renewables Obligation constrains the ability of the market to respond and adapt, potentially diverting resources into unnecessarily costly deployment choices.

Resources are wasted on 'rent-seeking'. When government makes decisions for a market, there are incentives for market players to put resources into influencing those decisions in their own favour. The

greater number of government decisions in relation to the electricity market, the greater the scope for such lobbying. Under the current direction of policy, such 'rent-seeking' is increasingly replacing innovating and taking risks to succeed in the market. Energy companies and lobby groups have been prominent in attempting to influence the creation and design of schemes, including the 'banding' levels and other rules in relation to the Renewables Obligation. This is an understandable response by companies to the regulatory environment created by government. Box 5 lists some of the UK organisations involved in lobbying government for particular low carbon technologies. The existence of the EU Renewable Energy Target itself – which excludes a competing range of non 'renewable' low carbon options – is probably the greatest success of lobbying by the European renewables industry. Reducing carbon emissions is too important a goal for policy to be captured by particular commercial interest groups.

Box 5: Organisations lobbying for particular low carbon technologies

Energy companies typically spend considerable resources on trying to influence government decisions on the many areas of the energy market in which the government intervenes. In addition, the following is a list of many of the UK energy industry associations which lobby for particular low carbon technologies. These associations usually perform a range of services for their members, but a key part of their role is to lobby and try to influence government decisions to favour their members' sector. This is understandable, but indicates the scale of rents to be sought.

- Renewable UK
- Renewable Energy Association
- Combined Heat and Power Association
- Carbon Capture and Storage Association
- Nuclear Industry Association
- The Micropower Council
- Scottish Renewables
- Solar Trade Association
- British Hydropower Association
- UK Hydrogen and Fuel Cells Association

- Oil and Gas UK

There are other industry associations which typically represent the big energy sector companies, such as the Association of Energy Producers, Energy Networks Association, Energy Retailers Association and Business Council for Sustainable Energy. These also aim to influence government decisions, for example to promote smart metering and smart grids, but their goals are generally broader than simply supporting a specific technology, as they represent many large integrated energy companies.

Market distortion and perverse incentives arise. The current crop of electricity market regulations leads to a range of distorted and perverse incentives. For example:

- The availability of generous subsidies for large-scale deployment of certain lower carbon technologies, such as wind, but no, or limited, subsidies for others such as nuclear power, co-firing of biomass and efficient gas turbines. This distorts market decision-making in ways not related to carbon reduction.

- The large-scale subsidies of renewables across Europe have undermined the EU Emissions Trading System (EU ETS) carbon price, damaging the credibility of the carbon-pricing framework. This is because the subsidies (expensively) deliver most of the necessary carbon reductions to meet the EU ETS cap, reducing the demand for carbon permits. Undermining the carbon price delays development of unsubsidised low carbon generation, including nuclear and CCS, as well as energy efficiency investments. Subsidies for renewable electricity deliver no additional carbon reduction by 2020, than would have been delivered under the EU ETS carbon cap alone. This is because subsidised renewable electricity creates the 'space' under the carbon cap so that, for example, more unabated coal generation can operate.[44]

- Subsidies tailored to specific technologies incentivise suppliers of those technologies to game the system, inflating apparent costs in order to justify high subsidies.[45] This is a particular risk where suppliers have strong market power, as is currently the case in the supply of offshore wind turbines.

- Subsidies may incentivise the generation of electricity at times when none is needed: i.e. even where wholesale prices have fallen to zero because of low demand.

The previous government paid lip service to the importance of the electricity market, while overseeing ever-increasing layers of intervention, such that the government has now, to a significant degree, 're-monopolised' market decision-making. There is something very wrong when political meetings (rather than simply debating policy frameworks) routinely discuss the relative merits of specific electricity generation

technologies – nuclear, renewables, CCS, gas. (Imagine political meetings discussing the relative merits of different technologies for the manufacture of steel or microchips). But that is the consequence of the re-monopolisation and associated politicisation of electricity policy.

Clearly the political process must establish the policy objectives of energy policy, including the objectives for carbon reduction and the resources which society is willing to devote to these policy objectives. But politicising detailed policy design, including choices between lower carbon electricity generation technologies, creates ongoing regulatory uncertainty and has serious consequences in terms of increased financing costs and restricts the market's ability to innovate and invest. As Professor George Yarrow of the Regulatory Policy Institute has said: *"Rather than an incentive structure that rewards those who innovate, act early and take initiatives, we are developing an energy sector in which companies find it more rewarding to wait until politicians and bureaucrats have made up their minds on this or that issue of the day."*[46]

The next section looks at some of the proposals being made for electricity market reform.

The government's 'Energy Market Assessment'

In March 2010, the Energy Market Assessment (EMA) was published by the Treasury and DECC, discussing a number of options for reform of the electricity market. While this document was issued under the previous government, most of the options within it continue to be considered under the Coalition government.

The EMA recognised that steps could be taken to **improve the framework for carbon pricing**, and discussed one way to achieve this: a carbon price 'contract for difference' which compensated generators if the EU ETS carbon price fell below a certain level. The Coalition government has committed to bolstering the carbon price through reforming the Climate Change Levy to introduce a 'floor' price for carbon emissions in the EU ETS.

In addition, the EMA expressed the view that a carbon price was unlikely on its own to bring forward the scale of low carbon generation needed, particularly post 2020. In particular, it cited investors' concerns that the carbon price was unlikely to rise fast enough to compensate for the effects of electricity price volatility.[47] The EMA therefore discussed **additional subsidies for 'low' carbon generation**, for example through a Low Carbon Obligation, which would require suppliers to source a percentage of electricity from particular types of 'low' carbon generation; or 'premium feed-in tariffs' which paid types of 'low' carbon generation a subsidy over and above the wholesale electricity price. The EMA claims that such interventions could be technology neutral.

The EMA advanced a further argument in support of another set of possible interventions. This related to the economics of low carbon generation, which often has high capital but low operating costs and is

inflexible. The argument is that (a) the market price is set by flexible generation costs, which in future will be gas because unabated coal generation will be phased-out; and (b) volatile gas prices mean that there could be periods of low gas prices where the investment costs of capital-intensive low-carbon generation would not be covered by prices. In a different part of the report, the EMA raises the countervailing concern that high gas prices could give "excess profits" for low-operating cost generators. The EMA therefore discussed a number of **interventions for eliminating electricity price volatility** including a 'contract for difference' on the wholesale electricity price, to compensate low carbon generators if the price fell below a given level. The EMA also discussed a number of options for providing guaranteed purchase of "low" carbon electricity, including 'fixed' feed-in tariffs, regulated returns, competitive tendering for the market and a 'single buyer'.

Another new intervention which the EMA discussed is an **emissions performance standard** (EPS), in other words regulating directly to limit high carbon generation, as a way of driving up prices to incentivise lower carbon generation. The EMA recognised the significant risks from such an approach, including for security of supply.

A substantially increased proportion of intermittent renewable (e.g. wind) generation would require additional investment in flexible generation capacity which might be used only infrequently to back-up the renewable capacity. The EMA raised a concern that existing market arrangements might not provide sufficient incentives for investment to provide such back-up generating capacity for the period after 2020. It discussed the use of **capacity mechanisms**, for example placing obligations on suppliers to demonstrate that they were able to meet their expected demand and a pre-determined amount of "spare capacity"; or an obligation on the system operator to maintain a pre-determined capacity margin, with the system operator running long-term capacity tenders to fulfill its obligation.

The EMA also rightly raised the question of barriers to entry in the generation market. It is important that innovations are able to enter the market from outside of the existing players.

Discussion of the Energy Market Assessment

It is beyond the scope of this Research Note to analyse all of the options for electricity reform in detail, but a number of observations on the Energy Market Assessment are particularly relevant to considering principles for reform.

The EMA said little about the problems from the accretion of existing interventions in the electricity market, as discussed in the previous section. There was some recognition of the downsides of government involvement in establishing technology specific rewards. But a much fuller assessment of the costs and

damage to market effectiveness of current interventions is necessary to fully inform proposals for electricity market reform.

The interventions discussed in the EMA to give **additional subsidies for "low" carbon generation**, beyond bolstering the carbon pricing framework, would continue the trend for government decisions to replace market decision-making. Premium feed-in tariffs would continue to involve the government in setting technology-specific subsidy levels. A Low Carbon Obligation (LCO) would require a range of government decisions, each with implications for costs and the operation of the market. These would include decisions on the level of obligation over time, on which technologies qualified as 'low' carbon and any 'bands'. Such decisions would necessarily be based on relatively poor current information about future options and costs. They could skew the market in costly ways, for example, between 'low' carbon investment and 'lower' carbon investment, such as efficient gas turbines (which could be a cheap early way to reduce emissions and might later be fitted with CCS). Feed-in tariffs and an LCO would continue to provide plenty of scope for continued frequent tweaking and rent-seeking. They would also place downward pressure on the carbon price, reducing incentives for new and wider options, including demand-side measures.

The interventions discussed in the EMA for **eliminating low carbon generators' exposure to electricity price volatility** would largely replace market decision-making. Instead the government would decide quantities and/or revenues for low carbon generation, eliminating most market processes. Such an approach would take matters much further still towards monopoly decision-making, losing the benefits of the market to innovate, reveal and adapt to new information over time.

These interventions are proposed in order to reduce risks for low carbon generators. Given the inevitable influence of political factors on carbon pricing for the foreseeable future, it is appropriate for government to take steps to reduce such risk, just as it is appropriate for government to seek to reduce regulatory risk more generally. However, investors and energy companies are best placed to manage electricity and fossil fuel price risk.

Low gas prices would reduce low carbon generation profits, while high gas prices would increase them. The EMA appears concerned about fossil fuel prices, on the one hand, not covering low carbon capital costs yet, on the other, giving them excess profits. Large energy companies and investors are able to hedge risks through holding generation portfolios. Government intervention does not eliminate risks but reallocates them inefficiently from investors to customers. By bearing electricity price risk, investors have incentives to make more efficient decisions about generation investments, incentivised through an effective carbon price.[48] The nature and timing of such decisions are critically important for driving efficiency and innovation. The risks on generators must not be reduced simply to construction and operation risks.

Of course, where a generation technology is 'first of a kind' or early stage then it can be desirable to use fixed prices to transfer risk away from developers where technology risks are too high to attract investors even with an appropriate carbon pricing framework.[49] But such interventions should, by their nature, be confined to a relatively small part of the market, and should not be mixed up with policies intended to influence mainstream market deployment decisions.

Despite its critical importance, the EMA gave relatively little attention to the options for establishing a more credible, long-term **framework for carbon-pricing** (including at the UK-level if EU agreement could be secured).

The Energy Market Assessment has been followed-up with the Electricity Market Reform (EMR) project. The Coalition government has said that it will publish consultation proposals for reforming the electricity market before the end of 2010. To a greater extent than the EMA, the EMR proposals need to address the problems from creeping re-monopolisation of electricity market decisions over the last few years.

Ten principles for electricity market reform

It is beyond the scope of this Research Note to set out a detailed blueprint for electricity market reform. Instead, we set out ten principles, against which the government's electricity market reform proposals should be assessed. These principles are intended to help shape an electricity market regulatory framework which achieves security of supply and carbon objectives cost-effectively. The overarching principle is that a reformed electricity market should exploit, rather than unnecessarily constrain, market processes, in order to secure the benefits from innovation, revelation and adaptation to new information.

This is not intended to be an exhaustive list of considerations relevant to electricity market reform.

1. **Electricity market reform should be informed by a full assessment of the combined impact of all existing and proposed policy interventions on the functioning of market processes.**

This needs to include the effects of regulatory and political uncertainty, government involvement in detailed market decisions, unintended consequences, rent-seeking and other constraints on, and distortions of, market players' ability to make decisions. The assessment should recognise that the cumulative impact of many individual policies and decisions, each of which may appear reasonable on a narrow front, can be very damaging.

2. **Climate-related policy interventions in the electricity market should be about reducing carbon**

emissions.[*]

Policy-makers should not be distracted by particular preferred technologies, in particular renewables, nor other objectives such as promoting 'green jobs', industrial policies and attempting to mitigate future fossil fuel prices.

3. **The complex accretion of regulatory interventions should be rolled-back to achieve a simpler regulatory framework that enables market processes to function well.**

The existing and proposed direction of regulation of the electricity market is for ever more complex layering of lower carbon deployment interventions: technology-specific obligations, feed-in tariffs, emissions standards, central low carbon procurement, etc. This Research Note, previous Policy Exchange reports and others[50,51] have attempted to identify the consequences from this approach, its high costs and the damage it does to well-functioning markets.

The design of a reformed electricity market framework should minimise the number of detailed decisions which need to be taken by the government or regulators, keeping matters as simple as possible. It is pointless for government to seek to fine-tune climate policy design, given the extent of the unknowns about the future.

In this way, the reformed framework would reduce the waste from rent-seeking, the undue delays caused by 'waiting for government', the costs of 'monopoly' decisions made on poor information, the scope for frequent policy tweaking and the temptation for ongoing political interference. A simpler framework would give greater flexibility for market players to take decisions to innovate, invest, reveal and adapt to new information. The Policy Exchange report *Greener, Cheaper*[52] made a number of proposals to contribute to the rationalising and simplifying of climate policies, for example abolishing subsidies for mass deployment of particular expensive small-scale renewable technologies. (Since publication of the report the Spending Review has announced a scaling back of such subsidies).[53] The key overall approach to simpler regulatory framework is to focus on the carbon price.

4. **Policy and political effort should be focused on achieving a credible, long-term carbon pricing framework.**

A carbon price provides an incentive both to the demand and the supply sides of the market.[54] With a credible long-term, technology-neutral carbon pricing framework, the market would have both incentives and flexibility to invest and innovate to deploy the most cost-effective approaches to a lower carbon

[*] Climate change mitigation more generally is not all about carbon reduction, but when it comes to the electricity sector, de-carbonisation is in fact the central issue.

electricity sector, whether those are energy efficiency measures, mature renewable technologies, other mature 'low' carbon technologies, 'lower' carbon technologies such as efficient gas turbines, more efficient use of fossil fuels generally, and bringing-on new near-market technologies. In the absence of a carbon price it is virtually impossible to establish proper signals for mature technologies and near-market technologies, whose response to the proper price signal determines how fast we need to accelerate less developed technologies.[55]

Establishing a framework (a basis) for forming credible, longer-term expectations about the price of carbon is not without challenges, as has been demonstrated by the teething troubles with the EU Emissions Trading System (EU ETS). A number of the challenges in designing an effective carbon pricing framework are discussed in Box 6. These are not reasons to downgrade efforts in favour of continued complex layering of lower carbon deployment interventions. Instead the existing substantial policy effort, resources and political capital should be redirected to the problem of establishing an effective carbon-pricing framework – whether through (EU ETS) carbon permitting, carbon taxation or a mixture of the two. The government has already committed to reforming the Climate Change Levy to develop a floor price of carbon in the EU ETS traded sector. Policy Exchange has set out one approach for taking this further to develop a credible, broad and rising carbon tax.[56]

Box 6: Issues to address in designing a carbon pricing approach

In developing a credible, long-term carbon pricing framework, a number of issues will need to be addressed, including the following:

Credibility of commitment

Electricity generation infrastructure is long-lived. What matters to investors is their expectation of electricity prices, including the carbon price, over the medium to long-term. One criticism of the EU ETS is the uncertainty about the future carbon price/cap, and indeed the carbon-permitting framework itself, after 2020.

All carbon policy interventions suffer the same uncertainty to a greater or lesser extent. Commitments to regulations such as an Emissions Performance Standard may be changed if they become too expensive, as we have seen in the recent extensions to coal plants offered under the Industrial Emissions Directive. And expected subsidies may be reduced, as we have seen in relation to Spain's feed-in tariffs for renewables.

There are a number of approaches to supporting a credible commitment to a carbon-pricing framework. Legislation may be used, similar to the carbon budgeting framework enshrined in the previous government's Climate Change Act, or the EU legislation underpinning the EU ETS. Government reliance on the revenues

from a carbon tax, or from auctioning of carbon permits, may also bolster confidence in the longevity of such policies.[57] Another approach, discussed in the EMA, is for government to enter a contract ('contract for difference') to underpin carbon prices.

'Windfalls' to existing subsidised low carbon generation

Existing low carbon generation has all been in receipt of subsidies of one kind or another, whether that is historic subsidies to the nuclear fleet or Renewable Obligation (RO) subsidies. A strengthened carbon price could further reward such legacy low carbon generation with windfall profits.

This problem should not be over-estimated. All but one of the existing nuclear fleet is likely to close within the next 15 years. If new policies substantially strengthened the carbon price, windfall benefits to legacy generators in receipt of RO subsidies could be mitigated though an appropriate adjustment to the RO or levy.

Impact on competitiveness, particularly of a UK-only carbon price

Higher UK energy prices have implications for UK competitiveness. Higher energy prices may be driven either by a carbon price, or by the costs of subsidies and other climate policies paid for by energy customers through their bills.

The current set of policy interventions is already set to have a substantial impact on electricity prices. DECC has estimated that the current set of climate policies – largely driven by renewables subsidies – will result in electricity prices in 2020 being 33% higher for domestic customers and 43% higher for non-domestic customers.[58] In other words, the Renewables Obligation and other policies already constitute a substantial price – but skewed to preferred technologies rather than focused on carbon. There is therefore considerable scope for rationalising policies into a carbon price without any further energy price increases. And it is credible medium to long-term, rather than short-term, carbon pricing which is most important to investors.

Ultimately, an electricity market design that promotes the most cost-effective approaches to carbon emissions reduction will achieve the greatest carbon reduction for the least increase in energy prices. This Research Note argues that effective carbon pricing is a key part of such an approach.

Ideally, UK competitiveness impacts would be reduced by having a credible carbon price at an EU or wider geographic level. Even for a UK-only carbon price, competitiveness impacts of carbon pricing may be offset by recycling some or all of the revenues from a carbon tax, or from the auctioning of carbon permits, into reduced business taxation elsewhere. In any event, UK competitiveness is heavily influenced by monetary

and exchange rate policies, which offer additional ways of offsetting any unwanted effects on trade balances.

Uncertainty of outcome

Critics of carbon pricing sometimes argue that we cannot be sure that it will deliver desired outcomes. For example, the Committee on Climate Change has estimated that an unrealistically high carbon price would be needed to bring forward offshore wind investment at current costs.

It is true that an approach based on pricing carbon in a well-functioning market cannot guarantee a particular proportion of offshore wind, or of renewables, or of any particular generation mix. That is the point. Specifying particular outcomes, for example in terms of generation mix or precisely meeting particular target deadlines, is not compatible with having a market. The point of having a market is to *discover* the best mix of generation and the best trade-offs between quantity and cost.

Carbon pricing achieved through setting a price rather than through setting a quantity cap also implies accepting a degree of uncertainty about the path towards decarbonisation itself. (And, in practice, a carbon quantity cap is also only ever likely to cover part of the economy and would not provide complete certainty.) There are good arguments for tolerating a degree of such uncertainty, where the costs of certainty are potentially very high. There are good arguments that the certainty that investors need is not about the long-term numerical target for emissions reduction, but the medium to long-term carbon price on which to base today's investment decisions.[59]

5. Policies to support early stage low carbon technologies are important, but there needs to be a clear distinction between those and regulation of the main electricity generation market – between technology development and roll-out.

Decarbonisation of the UK's own emissions can at most reduce global emissions by around 2%. But, as discussed earlier, the UK could have a wider impact through setting an example, particularly through achieving cost-effective decarbonisation. The UK's potentially most significant contribution is by doing things that can be easily copied, which could include policy innovations (for example, effective use of market mechanisms) as well technological innovations which lead to widespread, cost-competitive applications. Therefore policies for supporting research, development, demonstration and deployment of early stage technologies are important, particularly given the political and regulatory uncertainties that are tending to discourage expenditures on innovation.

Demonstration and early stage deployment support policies should target a range of technologies with the

potential to make significant contributions to global (not just UK) carbon emissions reduction and where the UK can add most value. They could take the form of technology-specific feed-in tariffs, or another subsidy arrangement.

Their purpose is to help new but currently expensive technologies, by subsidising *learning* to enable them to reach a position where they can compete with established technologies, with carbon appropriately priced. (Such policies respond to the problem often referred to as the 'valley of death'* where investors are insufficiently willing to risk funding the learning needed in relation to early stage technologies).[60]

Early stage technology deployment policies should have the following characteristics:

- Policies should be focused on securing new learning from demonstration and from early deployment. Each subsidised deployment therefore needs to be properly evaluated and learning applied to subsequent deployments.

- There should be a mechanism to remove support from a technology if it becomes clear that the learning rate is too low.[61] Subsidies should be time-limited and on a declining path. Policy success is to achieve reduction in technology costs through learning, and not all early stage technologies will succeed in becoming cost-competitive.

- Such policies should not become *de facto* subsidies for 'mass' deployment of preferred types of generation to meet deployment targets or industrial policy objectives. Early stage generation technologies are by definition expensive, so the costs of mass deployment too early are high, and achieve less decarbonisation for a given cost.

- Early stage deployment subsidies should not take over the electricity market. If they conform to the above characteristics, and there is an appropriate carbon price, only a relatively small portion of the electricity generation market should need to be specially subsidised. This enables market decision-makers to operate flexibly in the large majority of the market, with the benefits that brings.

The unsubsidised electricity market must not become a small *residual* market – one consequence of the current direction in which policy is heading. Such a residual market would not be effective at delivering our objectives for electricity, and may not attract investors.

The Renewables Obligation muddles up support for early stage technology learning, with a drive to mass deploy renewable technologies to meet the 2020 EU Renewable Energy Target. In fact the latter dominates

* There are plenty of high-tech sectors where there is no valley of death. Indeed there is often over-investment at the early stages, leading to 'winner's curse'. What appear to be lacking in relation to low carbon technologies are the large rewards that are often available to successful innovating entrepreneurs.

the RO's objectives. The result is rapid deployment, inconsistent with maximising learning; huge spending on premature mass roll-out of expensive early stage technologies, such as offshore wind; and around a third of the electricity generation market subject to technology-specific subsidies by 2020.

6. **Electricity market reform needs to be complemented by reform in other areas, such as planning, in order to facilitate and remove barriers to effective electricity generation market investment.**

Meeting our objectives for the electricity market – security of supply, carbon reductions, cost-effectiveness – involves not just reforming the electricity market itself, but also addressing a number of associated areas where ineffective regulation could be a substantial barrier to an effective electricity market.

A key associated area of regulation is the planning system. Planning has proved a key barrier to the market bringing forward some relatively cost-effective types of low carbon generation, such as onshore wind and energy from waste. Attempts to circumvent, rather than address, this barrier led to some of the accretion of new electricity market regulations, including 'banding' of the Renewable Obligation to bring forward expensive offshore wind as an alternative to cheaper onshore wind. The government is bringing forward proposals for reform of the planning system, which will need to get the incentives right for local communities to host developments.

In other areas, regulation in relation to the allocation of very long-term nuclear waste and captured-carbon dioxide storage costs and risks is needed to remove potential barriers to efficient electricity market development.

The government has an important role in putting in place effective regulatory frameworks, in these and other areas, where only government can address the issues effectively. Directly addressing such issues should reduce costs and thus levels of subsidy or carbon pricing needed.

7. **The Coalition government has reduced the number of output targets across government, and the same approach now needs to be applied in electricity policy. New intermediate targets, including for 2030, should not be created.**

What matters in climate change mitigation is reducing global carbon emissions to levels consistent with scientific understanding of the risks of climate change. The government translated part of that into a target to reduce UK-produced carbon emissions to 80% of 1990 levels by 2050. The UK also has a potentially key role, as already discussed, in developing new technologies to support global carbon emissions reductions.

Beyond the ultimate 2050 target, the UK is subject to a host of intermediate targets, including EU 2020 20% carbon reduction target, EU 2020 20% energy efficiency target, UK carbon budgets, UK 15% Renewable Energy Target (the UK's binding contribution to the EU 2020 20% RET), and EU biofuels target. The EU

Climate Action Commissioner has said that she is working on a new set of 2030 climate targets. Other targets relevant to the electricity sector include the fuel poverty target and the Carbon Emissions Reduction Target.

Targets may have positive effects in mobilising action. At the same time they often have unintended negative consequences, which is why the new government has swept many away.

A key problem with the intermediate targets in the electricity market is that the policies which ensure that the target (for example, a proportion of renewable generation by a certain date) is met are incompatible with having a well-functioning market.[62] Markets may be steered towards desirable policy outcomes, for example, through carbon pricing. But the point about market processes – ones which deliver efficient investment decisions, innovation and revelation of new information – is that *they* determine the precise outcome.

Precisely targeting quantities of renewable deployment or carbon reductions by a given date has an unnecessarily high cost. Many factors, such as GDP growth rates, are outside of the control of either policy-makers or electricity market players; targets are set using necessarily poor information, for example, about future technology costs; and the controls needed to ensure targets are met have costly consequences for market processes. Moderate fluctuations in carbon emissions are not critical to mitigating climate change, unless we believe a catastrophic tipping point is imminent, in which case we would need more draconian measures than are currently being discussed.[63]

Another damaging feature of some targets is the uncertainty they can create. For example, few serious players in the electricity market believe that the 2020 15% Renewable Energy Target will be met, and so there is considerable market uncertainty about what the government might do in the next few years in response. There is also uncertainty about what happens in 2021.

The design of the UK's carbon budgets framework includes some recognition of these problems, by including carbon from all sectors and enabling limited banking and borrowing between periods. The target that matters most is the ultimate 2050 target. Intermediate targets matter much less, and they can be actively damaging. And what matters more than targets are the actual policy instruments for achieving carbon reduction.

The Coalition government has reduced the number of output targets across policy areas, and the same approach now needs to be applied in electricity policy. The Renewable Energy Target is particularly damaging, but is currently mandated by an EU directive. New intermediate targets, including for 2030, should not be created.

8. **An independent economic regulator should be maintained, which should have a narrow statutory remit. In particular, the government should exclude economic regulators from Schedule 7 of the Public Bodies Bill which gives ministers much greater powers to influence public bodies.**

The energy sector, in common with other sectors such as water and sewerage, telecoms, airports and post, has a sectoral economic regulator. The key reason for having such economic regulators, like Ofgem, is very specific: it is because these sectors contain network monopoly companies, such as electricity transmission and distribution, and gas networks. The economic regulators' core role is to protect the interests of customers, through setting controls on monopolists' prices and developing competition where possible (while maintaining the financeability of efficient companies). The way that network monopolies are regulated has a profound effect on competitive markets that rely on the relevant networks, including the electricity generation market.

The arrangements for the governance of economic regulators are critically important in enabling them to perform well. This is because, in sectors characterised by high levels of capital investment, market confidence in the predictability of economic regulators' decisions leads to lower risks and thus lower financing costs. The following are criteria for governance arrangements which deliver market confidence in economic regulators:

- *Independence*: Economic regulators need to be able to take decisions within their remit free of political and other interference.

- *Stability*: Economic regulators need a stable set of duties and functions, and setting these out in Parliamentary statute is an important way to achieve this and to limit the pace of any revision.

- *Narrowly defined duties*: Economic regulators need duties (objectives) to be narrowly defined, and, where duties are multiple, in a hierarchical form. Regulators are able therefore to focus on the best means of achieving the ends specified by Parliament; are not making major choices between competing ends (that should properly lie with Parliament) and which introduce regulatory uncertainty; and it is easier to assess their performance.[64]

Each of these criteria has come under threat over the last few years.

Narrowly defined duties: Over the last few years, economic regulators (particularly Ofgem, but also others) have had their statutory duties expanded, to include ones related to environmental and social objectives. For example, Ofgem's principal objective now includes protecting customers' interests in the reduction of greenhouse gases. Broadening economic regulators' duties, for example bundling responsibilities for environment policy with protecting customers from companies' monopoly power, carries potentially serious

costs, and has been criticised by the relevant House of Lords Select Committee, amongst others. The House of Lords Select Committee on regulators carried out a review of economic regulators in 2007. It concluded:

"*Government should be careful not to offload political policy issues onto unelected regulators. When the original privatisation statutes were put in place, the regulators' duties were more focussed than they are now on their economic roles of regulating monopolies, promoting competition and setting prices. Determining which policy issues were for government and which for regulators was therefore relatively clear cut. However, the later increase in the importance within the regulators' roles of other duties (particularly social and environmental duties) means that there is now a less clear distinction between what policy issues should be dealt with by government and which by regulators. Such an expansion of duties, along with a lack of clarity about the respective roles of government and regulators, can arguably reduce the effectiveness of the regulator, create regulatory uncertainty and risk compromising the independence of the regulator. Where a regulator was handed an unclear remit, comprised of broad and imprecise duties, it would necessarily have to exercise broad discretion over how it handled that remit and, in a worst case scenario, objectives which Parliament intended to be central to that regulator's work could fall by the wayside."* [65]

Independence and stability: The previous government took steps to influence sectoral economic regulators, including Ofgem, in the 2000 Utilities Act by making economic regulators subject to 'social and economic guidance' from government. The Coalition government has also made proposals which could increase political influence over economic regulators. The Public Bodies Bill 2010-11[66] includes powers to modify the constitutional arrangements, funding arrangements and functions of a whole range of government bodies including the sectoral economic regulators *by order*. For ministers to have such powers in relation to the economic regulators would reduce market confidence in the bodies' independence and the stability of their functions and duties.

DECC is currently carrying out a review of Ofgem, including examining the boundary of responsibilities between Ofgem and the government, as well as Ofgem's duties.[67] At the same time DEFRA has asked David Gray to undertake a review of Ofwat. These reviews should recommend a return to well-defined and narrow duties for economic regulators, focused on their core purpose. Wider policy objectives, including those on the environment and social welfare, should not be offloaded onto economic regulators. Instead government should take relevant decisions in these areas, and legislate for specific policies, which the economic regulator then needs to take into account in discharging their duties. Examples of this approach include the previous government legislating directly for the Renewables Obligation and for mandated social price support. The current reviews should also ensure that economic regulators' governance arrangements do not compromise their independence from political interference and give them stability. In particular, the government must exclude Ofgem and the other sectoral economic regulators from Schedule 7 of the Public Bodies Bill.

9. **The government should consider putting detailed decisions about the mix and design of carbon reduction policies into an independent institution at arms' length from DECC, in order to reduce costly political uncertainty in relation to the development of market interventions.**

This Research Note has described how climate policy has developed through a process characterised by constant incremental change, short-term political distractions, and rent-seeking. The result has been complexity, regulatory uncertainty and wasted resources. Of course, climate policy-making has been a relatively new agenda, and inevitably political. But the time has now come for political decision-making to focus at an appropriately strategic level. The process of making detailed decisions about the mix and design of carbon reduction policies, such as the bands in the Renewables Obligation or the relative resources devoted to microgeneration subsidies, should become a more technical exercise undertaken in an independent institution at arms' length from DECC and ministers. A key benefit would be greater regulatory certainty, reducing risk and investment costs and enabling better-functioning markets.

In considering how to go about this, lessons can learned from the overall success of sectoral economic regulation. Independent statutory economic regulators depoliticised a number of aspects of energy policy, in particular setting price caps and regulation of energy networks. These arrangements have given markets confidence, thus de-risking investment and reducing financing costs.[68]

The government should consider developing institutional arrangements to depoliticise and stabilise appropriate aspects of climate policy – these arrangements should be separate from the economic regulator which has a different, well-defined purpose. Ministers and Parliament should continue to set the strategic objectives of climate policy, for example carbon budgets, and decide what policy instruments should be available to pursue those objectives, for example, feed-in tariffs, carbon taxes, etc. Decisions about how to apply policies to meet the strategic objectives could however be taken by an independent institution, including the relative mix of policy instruments, and the detailed design of each. Such an institution would need clear statutory duties/objectives in relation to both carbon reduction and costs/spending. In relation to tax instruments, its role in relation to the Treasury would need careful consideration, but even an independent public advisory role would be a step in the right direction. Such an institution might be trialled first in relation to the electricity sector.

An independent institution would help bring the sort of regulatory stability to climate policy which companies and investors currently crave. It could take unhelpful short-term political pressures, distraction by other objectives and rent-seeking out of carbon policy. Importantly, such institutional arrangements also recognise that climate policy cannot be *fixed* because of all the future unknowns discussed earlier, a recent example being the rapid market developments as a result of shale gas. Clearly new information often needs to be factored into policy.

The new independent institution would be able to manage the process of policy adjustment, subject to clear rules and regulatory principles, in a way that gives the market maximum confidence and minimises the penalty in terms of financing costs.[69] It would aim to combine regulatory certainty with market flexibility. In other words, an institution of this kind is likely to be the best approach to achieving a durable regulatory framework – take in its stride and respond effectively to future developments.

10. Decisions on any introduction of capacity mechanisms should not be made now, as current evidence for intervention does not justify their risks. In due course they would need to be supported by better evidence of security of supply risks.

In an energy-only market, such as the UK, generators recover their capacity costs during periods when the wholesale price is above their variable costs. In other market designs, the wholesale price may also include a specific payment for capacity. There are arguments for and against each model, but each has been made to work in delivering new generation investment, and each is also able to incentivise demand-side response.

It is argued that future security of supply problems in the electricity sector, and sometimes in the gas market too, require new capacity mechanisms to be introduced to 'ensure' future security of supply. Capacity mechanisms could include specific additional payments for capacity levels, or obligations on suppliers or on the system operator to maintain specified capacity margins.

A key argument for capacity mechanisms, put forward in the Energy Market Assessment, is that prices under current market arrangements could be insufficient to secure investment in flexible generation to back-up intermittent renewable generation. The argument boils down to concern that the high price spikes needed to give sufficient returns to back-up generation would not work, because government would inevitably step-in to mitigate such spikes, removing the returns to back-up generators.

However, there are a number of reasons to be cautious about any new intervention now in electricity (or, indeed, gas) market in relation to capacity mechanisms:

Firstly, it needs to be recognised that suppliers can make their own contracts for capacity, or build their own. There is nothing that government can do here that suppliers cannot do themselves (and would likely do better, for the reasons mentioned here and earlier). For example, a supplier can have its own peaking plant or can write a 'call' (financial) option with another party for peak supplies in the event of the spot price exceeding £X per MWh.

Secondly, new regulation for capacity mechanisms could have a number of unintended consequences:

- Historical experience shows that security of supply is rarely delivered more successfully by putting someone in charge of supply security, than through the operation of competitive markets.

- Capacity mechanisms would require the government or regulator to make a number of 'monopoly' decisions about the nature of obligations, capacity margins, auction schedules, etc. Such decisions would be subject to the information available to the decision-maker, and the monopoly decision-maker is most likely to err on the side of excessive capacity with unnecessary costs to customers.

- Capacity regulation mechanisms would dampen price signals, so that less unregulated capacity and, importantly, demand-side response is brought forward. This could reduce security of supply in the longer-term or lead to the incremental expansion of regulated capacity interventions.

- For real security of supply, companies need to know that they could go bust if they get their security of supply strategy wrong. Prudential regulation, such as a capacity margin obligation, can easily lead to companies relaxing and abrogating their responsibilities, a form of moral hazard that is not wholly dissimilar to some of the adverse incentive effects currently observable in financial markets.

Thirdly, and perhaps most importantly, we do not yet have the information to support there being a problem to address:

- What levels of intermittent generation will be reached and by when;

- What responses will come forward, such as increased demand-side response made possible by smart meter and grid technologies, where sharp price signals would be critical drivers;

- What impact there will be on prices;

- Whether government will be able to refrain from intervening in price spikes (the volatility from which, it should be recognised, domestic customers can be, and are, largely insulated by energy companies); and

- How investors and generators react.

The EMA does not expect security of supply problems before 2020. The case has yet to be made for tinkering with electricity market capacity mechanisms. (And there is clearly no case for tinkering with the gas market, given the EMA's assessment that the risk of the market being unable to meet demand is very small, even in extreme scenarios).

The government should wait to learn more about any effects from increasing intermittency before taking risks through intervention of this kind. If a security of supply problem did appear to be arising in due course, action could then be taken. The sort of flexible generation needed is not particularly capital intensive and lead times are short (among other things, planning issues tend to be much less significant).

Conclusions and recommendations

It has been demonstrated across the economy generally, and in the energy sector in particular, that markets are able cost-effectively to deliver innovation and supply security in a context of unknowns, while central planning and forecasts have a poor track record.

Policy makers have a choice whether to continue down the current road of 're-monopolising' the electricity generation market through the replacement of market decision-making with government decision-making, or to change course. A new course could instead exploit the power of a well-functioning electricity market to achieving security of supply and climate goals in cost-effective and innovative ways.

Effective market processes require more than just paying lip service to the market while incrementally chipping away at market flexibility, as the previous government did. There are particular risks from the pretence of having an effective market, where the market is held responsible for delivering centrally-planned outcomes: the market will neither deliver the prescribed outcomes, nor the benefits of innovation. Such a position is not stable; it tends to lead toward market malfunction and/or to ever more comprehensive central planning. And the case is currently far from made that we need to discard all the benefits of electricity market processes, and their ability to innovate, reveal and adapt to new information in a context of unknowns.

Markets need to be given a proper opportunity to show that they can continue to deliver security of supply as well as reducing carbon emissions. A regulatory framework is needed which exploits the power of the electricity market, rather than damages it. Such regulation needs to be simple, give regulatory stability and allow market flexibility.

This Research Note recommends the following ten principles for electricity market reform, against which the government's EMR proposals should be assessed:

1. Electricity market reform should be informed by a full assessment of the combined impact of all existing and proposed interventions on the functioning of market processes.

2. Climate-related policy interventions in the electricity market should be about reducing carbon emissions.

3. The complex accretion of regulatory interventions should be rolled-back to achieve a simpler regulatory framework that enables market processes to function well.

4. Policy and political effort should be focused on achieving a credible, long-term carbon pricing framework.

5. Policies to support early stage low carbon technologies are important, but there needs to be a clear distinction between those and regulation of the main electricity generation market – between technology development and roll-out.

6. Electricity market reform needs to be complemented by reform in other areas, such as planning, in order to facilitate and remove barriers to effective electricity generation market investment.

7. The Coalition government has reduced the number of output targets across government, and the same approach now needs to be applied in electricity policy. New intermediate targets, including for 2030, should not be created.

8. An independent economic regulator should be maintained, which should have a narrow statutory remit. In particular, the government should exclude economic regulators from Schedule 7 of the Public Bodies Bill which gives ministers much greater powers to influence public bodies.

9. The government should consider putting detailed decisions about the mix and design of carbon reduction policies into an independent institution at arms' length from DECC, in order to reduce costly political uncertainty in relation to the development of market interventions.

10. Decisions on any introduction of capacity mechanisms should not be made now, as current evidence for intervention does not justify their risks. In due course they would need to be supported by better evidence of security of supply risks.

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