

# Response to the Cost of Energy Review

## Key points

The Energy Systems Catapult welcomes the publication of Professor Helm's report and the chance to contribute to the debate via this call for evidence.

The review is a valuable opportunity to step back and consider the broad direction of change in energy markets and policy as the UK progresses further towards a low carbon future.

In particular we welcome Professor Helm's emphasis on simplifying policy, enabling innovation, and delivering decarbonisation across the economy at the lowest cost. We support the broad thrust of much of Professor Helm's diagnosis and the priority given to:

- the importance of **simplifying government intervention in energy markets**
- the creation of a **carbon price on a common basis across the whole economy** to enable carbon budgets to be met at least cost
- unlocking **benefits for consumers from technical innovation and change** (including the growing importance of digitalisation).

However, we have doubts about a number of the review's specific recommendations:

- **Firm power auctions:** this proposal could raise the costs of providing reserve capacity by requiring each party to provide its own reserve. The ESC believes a wider range of options to address security of supply should be explored. In particular there is scope to give energy service suppliers greater decentralised responsibility for service reliability with reduced reliance on government-led contracting. This could strengthen incentives on market players to innovate and enable a range of demand-side and flexibility options.
- **Carbon tax and border tax adjustments:** The ESC agrees that an economy-wide carbon price would enable decarbonisation at least cost. However, the implementation challenges for the tax-based approach recommended in the report are formidable, so we believe that a broader range of options for delivering a consistent carbon price signal should be explored. In particular, the ESC believes that a progressive portfolio decarbonisation obligation placed on energy service suppliers, with tradable certificates, could enable a near economy-wide carbon price to emerge.
- **Creation of a merged 'UK Energy Research Laboratory':** The case for merging a range of existing institutions and research centres each with distinctive objectives is not strong. The Government's new Energy Innovation Board should provide strategic oversight and direction of energy innovation and research and development funding, drawing on a strong evidence base of 'whole energy system' analysis.
- **Reform of transmission and distribution network regulation:** The ESC does not see a strong case to abandon the current framework of network price controls given their strong monopoly characteristics, or to create publicly owned national and regional system operators. Future reforms should focus on increasing the agility of network governance processes (to enable innovation) and increasing the spatial and temporal accuracy of pricing of network capacity and constraints to incentivise flexibility and efficient location and operation of generation.

## 1. Electricity generation

The Review considers three dimensions to the cost of electricity generation: the wholesale market; the capacity auctions; and low carbon support schemes. It outlines the evolution of the wholesale market, arguing that it is becoming less economically significant as a way of recovering the full costs of electricity generation. The Review points to the success of auctions in harnessing competition to bear down on prices, particularly the Capacity Market. It also considers the design of support mechanisms for low carbon generation.

The Review recommends that, in the long term, Contracts for Difference and the Capacity Market are merged into a unified equivalent firm power capacity auction. The Review also recommends that, in the interim, Contracts for Difference should be split into three parts for plant construction, operation and decommissioning to enable consumers to benefit from refinancing.

### Questions

Taking into account the findings and recommendations of the Helm Review:

#### **The longer-term challenges for electricity generation?**

The longer term challenges for electricity generation are well known and include:

- **Decarbonisation** – which will drive fundamental change in technologies and business models
- **Need for new investment** – to replace retiring nuclear and conventional capacity
- **The growing importance of flexibility and demand side options** – given the need to effectively integrate variable renewable generation
- **The need to deliver an efficient mix of generation technologies** that can deliver reliable low carbon electricity and meet consumers needs
- **The challenge of designing markets and regulatory frameworks** to deliver an efficient combination of investments in electricity generation and networks, while internalising carbon and security of supply objectives and bringing forward investment at a low cost of capital.

**ESC agrees with many aspects of Professor Helm’s analysis** of the challenges for investment in electricity generation

- **Energy only wholesale markets are not sufficient** on their own to drive investment in required new electricity generation, even if they were reformed to deliver sharper price signals
- **Simplification is a key priority** because reducing policy complexity will enable competitive markets (and the decisions of market players) to play a stronger role in shaping a secure and efficient mix of new generation assets, inter-connectors and flexibility options including storage and demand-side response
- **FITs and low carbon CfD’s should be phased out** and electricity markets should be structured to internalise system costs into market players’ incentives

- **The need to substantially reshape market incentives**, particularly to enable and incentivise the development of innovative new forms of flexibility and storage
- **An economy-wide carbon price would be a powerful tool** enabling significant simplification of policy, while increasing reliance on markets to drive least cost decarbonisation.

Some key challenges were less fully explored in Professor Helm's analysis, including:

- **The implementation challenges of carbon pricing** – Professor Helm makes the case strongly for introducing a universal carbon price. But he does not address the formidable implementation (and long-term credibility) challenges associated with a taxation-based approach. A wider range of approaches for introducing an economy-wide (or near economy-wide) economic signal for decarbonisation should be considered. In particular, the ESC believes that a portfolio decarbonisation obligation placed on energy service suppliers, with tradable certificates, could enable a near economy-wide carbon price to emerge. This would enable optimisation of decarbonisation efforts across heat and power, promoting convergence and unlocking flexibility across these markets.
- **The importance of taking a whole system perspective** – investment in electricity generation will have important impacts on the strategy and options for decarbonisation beyond the electricity sector. Future market reforms should be designed to reveal and enable market players to realise this value (for example, by developing a clear economy-wide framework for carbon emissions).
- **Challenges and opportunities from convergence of electricity and heat markets** – electrification of a proportion of heat energy demand, but with spatially varied patterns, will create new inter-dependencies between heat and electricity markets and thus raise new challenges and opportunities (e.g. for flexibility mechanisms through heat storage, use of waste heat). Market mechanisms need to be designed with a broader 'low carbon energy services' frame of reference, rather than narrow focus on electricity-specific optimisation
- **The strategic case for carbon capture and storage (CCS) in electricity generation** – there is no policy or pathway for enabling deployment of CCS in the electricity sector. Yet CCS remains a highly valuable option for broader UK decarbonisation, and deployment in the less trade-exposed electricity sector could be a key enabler for this. UK strategy for developing commercial deployment of CCS, including the potential role of electricity sector deployment, needs to be clarified and progressed urgently.
- **The full range of reform options to address security of supply** – Professor Helm's analysis neatly diagnoses the issues with reliance on energy only markets, but only considers a small number of solutions. There is a strong case for a fuller analysis, particularly exploring how suppliers can take greater responsibility for delivering reliable supplies reinforcing their incentive to innovate in promoting demand side flexibility over a range of timescales.

## What matters should the Government take into account in considering the policy framework for electricity generation?

Government should assess *how the challenges identified for electricity generation impact on the choice of policy framework*:

- **The scale and depth of transformation of the electricity sector makes the right future generation mix inherently unpredictable** – this places a premium on adaptability and flexibility in future market and policy frameworks, and on harnessing flexible market mechanisms to incentivise innovation and optimise investment choices as technologies and demands change. Centralised Government-led auction mechanisms may not be agile and flexible, and could crowd out innovative new platforms and business models.
- **The electricity system is likely to be increasingly inter-dependent with transport and heat demands and technologies.** There are likely to be important opportunities to achieve valuable efficiencies and synergies across energy vectors and demand sectors (homes, transport, heat, industry). Market and policy frameworks need to enable and incentivise the discovery and exploitation of these synergies via new technologies, digitalisation and business models. Centrally designed and administered auction mechanisms may not be the best instruments to enable these synergies.
- **The importance of flexibility** – markets and policy frameworks need to deliver clear rewards to providers of flexibility, in line with the system value that they deliver. There are a wide range of potential technologies and business models which can unlock flexibility, so it will be important to ensure that market arrangements are open, technology-neutral (as far as possible) and capable of handling multi-vector approaches.
- **Specific challenges for potentially strategic technologies (CCS, nuclear)** – There remain specific challenges for investment in nuclear and CCS generation. Both of these technologies are potentially highly strategic. The scale of investment, technology-specific risks and the inter-dependencies raise specific challenges for investors which may be difficult to address fully within a generic, technology-neutral market framework.

A number of key principles for the policy framework emerge from our interpretation of the challenges for electricity generation

- **Enable market forces to play a central role** – ideally minimising the role of centrally specified contracts, backed by consumer guarantees, while internalising service reliability and decarbonisation objectives within the prices and incentives facing market players
- **Design markets and platforms that are open and flexible** - this will help to ensure genuine technology neutrality and openness to innovative new business models. Minimising central direction of trading arrangements will enable innovation in trading platforms and contracting and the emergence of decentralised platforms where they can add value. This would in effect allow market arrangements to be co-designed by participants rather than through central design and direction.
- **Internalising societal and/or system costs and benefits** – policy interventions should aim to internalise societal and system impacts into the incentives and prices that face market players.

- **Whole system perspective** - The policy framework for electricity generation should be conceived within a wider market and policy framework for energy service decarbonisation, rather than an electricity-specific 'silo' focused exclusively on minimising the cost of electricity generation. It should also enable convergence between markets for heat and mobility, given the potential for valuable flexibility in demand as energy for these markets is increasingly electrified (alongside other low carbon options).
- **Technology neutrality (as far as possible)** – over the long run efficiency is most likely to be delivered through a broadly technology neutral framework. Specific risks or externalities associated with specific technologies should be handled outside a generic market framework.
- **Credible transition and implementation pathways for reforms** – Professor Helm outlines well the dangers of excessive complexity and successive incremental reform in policies. There is strong case for fundamental reform – but this needs to be backed by credible and realistic approaches to transition and the implementation of a new market framework.
- **Long term credibility** – market players and investors can only take greater ownership of delivering societal goals (i.e. reliable and low carbon energy services) if there is a credible long term underpinning framework. This was recognised in the design of the Climate Change Act, but has not been so to the same extent in the design of electricity policies.

### What additional evidence should the Government consider to reduce the cost of electricity generation in the longer term?

Given the inherent unpredictability of the 'right' generation mix, and the scope for innovation in both technologies and business models, the ESC starts from a presumption in favour of:

- Broad, long term and credibly-designed interventions to internalise societal/system goals (e.g. obligations placed on energy service providers to deliver service reliability and progressive decarbonisation of their supply portfolio)
- Maximising the scope for private contracting and competitive markets to reveal socially optimal solutions
- Open, flexible and technology-neutral market arrangements and governance which allow secondary trading within and outside the electricity market (e.g. in converging markets for low carbon heat and transport energy)

With this in mind we believe the Government should consider

- **Evidence on a broader range of options for delivering long term credible carbon pricing:** Professor Helm is correct to prioritise credible economy-wide carbon pricing. This will be critical to enabling markets to deliver lowest cost decarbonisation across all key sectors, and will be an important determinant of UK productivity over the next decades. The Helm proposal for a universal carbon tax is attractive in principle, but looks difficult to implement in practice. The government should consider evidence from other jurisdictions and other sectors, as part of a broader process of considering a wider range

of options. The ESC believes that there is a strong case for an approach based on a portfolio obligation on energy service suppliers requiring them to progressively reduce the carbon intensity of their services. The government should review evidence on the pros and cons of different approaches.

- **Evidence on how to achieve cost effective flexibility in the electricity system** – A range of evidence, including that from a number of the Energy Technology Institute’s projects (ESME modelling whole energy system analysis; Storage and Flexibility Project and Consumers Vehicles and Energy Integration project) suggests that harnessing multi-vector flexibility, and developing effective managed charging of electric vehicles is likely to be crucial in containing the need to invest in expensive and rarely used generation capacity. A range of evidence should be examined on how best to unlock cost-effective flexibility, building on last year’s BEIS/Ofgem Smart Flexible Energy System consultation.
- **Evidence on potential mechanisms for placing greater responsibility for security of supply on market players** – there is a large literature on the design and efficacy of capacity market mechanisms. They appear inherently complex and difficult to design in ways that are fully technology-neutral. Given the inherent unpredictability of the options available in future to deliver security of supply, and the business models that could release this value (e.g. through unlocking demand flexibility) the government should consider evidence on a broader range of policy approaches to ensuring security of supply, particularly those which place greater responsibility on service suppliers to ensure reliability. This could include the potential use of decentralised reliability options or capacity obligations placed on suppliers (e.g. as in France).
- **Potential importance of locational signals** including evidence on the potential efficiency impact on generation location and operation choices from introducing sharper locational price signals (e.g. locational marginal pricing as is common in many US market regimes).
- **Evidence on the lessons from investing in offshore wind cost reduction** – the Government should review the experience of support for offshore renewables to identify lessons for other technologies. In particular, CCS and gasification technologies could be pivotal technologies for UK decarbonisation, but have so far enjoyed a small fraction of the £10s of billions of policy support provided over a 15 year period (through RO, and then CfD FITS) to enable large-scale commercial deployment and cost reduction in wind generation technology.
- **Evidence on the ease and efficacy of secondary markets** – more reliance could be placed on decentralised market mechanisms to deliver societal outcomes if there were confidence that secondary markets could be created and develop quickly in circumstances where market activity would be socially optimal. Digitalisation and big data technologies could enable this.

## 2. Electricity transmission and distribution

The Review looks at the drivers of network costs and the model of network regulation, and provides a view on how this has worked in practice. It considers the challenges of anticipating evolving demand and rapid technological change several years in advance, and the impact on network company returns and consumer costs under Ofgem's price control regulation. The Review also looks at the capital structures of the network companies and potential challenges these pose for future investment.

The Review proposes moving towards a new regulatory regime that places greater emphasis on competition, moving away from price controls and significantly reducing the role of Ofgem. It advocates creating an independent National System Operator that is fully separated from National Grid and responsible for ensuring GB-level security of supply. At a regional level, it recommends establishing new Regional System Operators as public bodies with obligations to deliver security of supply and support decarbonisation. The Review recommends that the National System Operator and Regional System Operators hold technology-neutral auctions for the services they need to fulfil their obligations. It also recommends merging generation, supply and network licences into a single licence to support competition in auctions between supply, network and demand-side solutions.

### Questions

#### **Taking into account the findings and recommendations of the Helm Review:**

#### **What are the longer-term challenges for electricity transmission and distribution?**

- Electricity networks need to change radically to support a low carbon transition
- Networks will need to accommodate an increasing role for decentralised generation, storage and multi-vector flexibilities
- New demands are likely to be placed on electricity networks (for heat and transport energy). Managing network capacity through time and space is likely to become more challenging. Improving the ability of price signals to incentivise efficient usage of networks and management of constraints is likely to become increasingly important to drive efficient patterns of investment and innovation in future.

#### **What matters should the Government take in account in considering the framework for network regulation, and its associated institutional framework?**

Integrated networks with monopolistic characteristics are likely to continue to play a role for some time to come. However, the demands placed on transmission and distribution networks are likely to change considerably, given profound changes in the generation mix, new technologies (e.g. smart metering) and new sources of demand.

Many of the challenges facing future networks are being considered through the Future Power Systems Architecture (FPSA) project, being managed jointly by the ESC and Institution of Engineering and Technology (IET). We believe the Government should consider the findings of FPSA, in particular the emphasis on the importance of flexible and agile

governance and change management mechanisms to keep pace with emerging trends in the market and new technologies.

FPSA has identified 35 new or extended functions that will be essential to the future efficient, coordinated and economic functioning of the electricity power system serving GB during a period of rapid transformative change driven by decarbonisation, decentralisation, digitisation and democratisation of energy supply.

The second phase of the programme - FPSA2 - identified significant barriers to implementing the required functionality under today's sector governance arrangements, and has proposed a new approach to system governance to overcome these. This new governance is based on a new concept called 'Enabling Frameworks' which would be characterised by inclusiveness, transparency, iteration and agility.

### **What additional evidence should the Government consider to reduce the cost of electricity networks in the longer term?**

- The Government should ensure that Ofgem learns lessons to ensure that the cost of capital assumptions used in network price control setting are not overly generous to network owners, bearing in mind the level of risk they are bearing.
- The ESC believes that local area energy planning can play an important role in guiding decisions about cost effective investments on low carbon local energy systems (including local energy network infrastructures). The evidence and lessons learnt from the Smart Systems and Heat programme managed by the ESC will be valuable in considering how to reduce the cost of energy networks in the longer term. One key issue will be to consider options for governance of collective decisions about energy network investments (e.g. the socially optimal combination of heat networks, electrification and other low carbon options to decarbonise heat in different local areas).

### 3. Electricity supply

The Review addresses the nature of retail costs, including the treatment of cost pass-through such as policy and network costs, and looks at the operating profit margins which suppliers make in their domestic retail businesses. It summarises how Ofgem and the Competition and Markets Authority have sought to remedy failings in the retail market, including overcoming the detriment borne by consumers as a result of such failings.

The Review recognises the opportunities for new market entrants and new products and services, supported by smart meters and new digital technologies. The Review recommends the introduction of a default tariff that provides full transparency on the costs that suppliers control and the margins they make on these costs. It notes that the alternatives are to rely on existing remedies to overcome consumer detriment or introduce caps on supplier margins for more vulnerable customers on standard variable tariffs.

#### Questions

Taking into account the findings and recommendations of the Helm Review:

#### **What are the longer-term challenges for electricity supply?**

##### **Placing consumer needs centre stage**

Professor Helm has considered many of the challenges for electricity supply. ESC would place more emphasis on the importance of placing consumers at the heart of the energy system. A new 'energy service' provider model would be better placed to deliver new innovative products and services to meet consumer needs.

##### **Meeting the needs of vulnerable customers**

In order to understand how to design and deliver services to consumers facing difficulties with low household incomes and the high cost of adequate energy in their homes, the Energy Systems Catapult is trying to better understand what people need and want from energy in their home.

With consumer insight of vulnerable customers, organisations will be able to explore the opportunities for innovation that enable people to access the energy they want through new products and services. This could decrease the risk undertaken in innovation, for both businesses and consumers, and could be applied to developing new propositions, improving customer handling procedures and meeting new policy obligations and changes.

The ESC is partnering with organisations from various sectors to develop a programme – Fair Futures – to better understand the issues faced by a range of vulnerable energy consumer groups and identify the areas where commercial, governmental, community and householder needs and motivations could be aligned to provide more and effective innovative policies, products and services.

#### **What matters should the Government take into account in considering the longer term operation of the retail market?**

The ESC believes that the role of retail Energy Service Providers could be substantially strengthened, making them central to the delivery of service reliability and decarbonisation. This is outlined in more detail in the following sections.

## 4. Cross-cutting

The Review makes a range of other recommendations on issues including policy simplification, innovation, wider approaches to decarbonisation, and use of modelling.

### Questions

**What matters should the Government take into account in considering the wider recommendations of the Review?**

### **An alternative approach: placing greater responsibility for decarbonisation and service reliability on Energy Service Providers**

The ESC believes that there is considerable scope for developing a new consumer-centric market and policy framework, which is organised around the principle of placing greater responsibility for delivery of service reliability and decarbonisation on Energy Service Providers (ESPs).

This approach would entail much reduced reliance on government-led central contracting or auction processes, enabling greater agility, flexibility and openness to new business models, technologies and platforms. The framework could be based on the following essential elements:

- A portfolio obligation structured around decarbonisation could be placed on licensed ESPs operating in the UK (or GB) market. The obligation would progressively tighten according to a defined trajectory, directly aligned with the trajectory required to meet legislated UK carbon targets.
- ESPs would be required to ensure that the portfolio of energy services they sell in the UK market meets a defined decarbonisation obligation expressed either as carbon intensity per unit or per (household) customer. Credits could be purchased to meet the obligation through secondary markets. Failure to meet the obligation would carry penalties.
- The obligation would apply to all energy services to premises (i.e. electricity and heat vectors), thus delivering a market driver to decarbonise across both power and heat. (A similar portfolio obligation could be placed on suppliers of transport energy, with credits tradeable across sectors, thus facilitating the emergence of a near economy-wide carbon price).
- ESPs would be incentivised to better understand customer needs and the fabric of buildings, since these factors strongly condition the effectiveness of decarbonisation options. ESPs as the obligated party at the intersection between customer service delivery and supply chain assembly/management, and enabled by ICT and connected homes technologies, would have levers of control upstream, downstream and across vectors.
- In delivering the obligation ESPs with a deep understanding of the service attributes that customers truly value can develop a competitive advantage in constructing compelling consumer propositions and innovation service bundles based on combinations of smart control, low carbon energisation options, building fabric upgrades etc. This could involve

ESPs managing or commissioning field supply chains to integrate a range of behind the meter technologies, smart controls & appliances, building fabric improvements and hybrid technologies (which could enable vector switching and customer-side energy storage valuable for service flexibility and resilience).

- ESPs would contract upstream and in secondary markets to purchase an underlying portfolio of power and heat supplies required to deliver reliability and progressive decarbonisation. ESPs could offer power purchase agreements to generators and contract for flexibility services – although we would expect a ‘system operator’ backstop function to continue, along with balancing market designs that incentivise ESPs to balance their position as far as possible in real time.

This broad architecture for energy markets and policy would put consumer needs at the heart of the energy transition, while internalising responsibilities for service reliability and decarbonisation in the incentives of market players, and enabling least cost decarbonisation.

### **The approach to innovation**

The ESC agrees with a number of elements of Professor Helm’s analysis of the approach to enabling innovation in the energy sector, including:

- The need to avoid ‘picking winners’
- The role of independent scrutiny and the risk of capture
- The desirability of separating the approach to supporting R&D and innovation from support for deployment of low carbon technologies

However, we do not agree that there is a strong case to merge existing research centres and institutes to create a new ‘UK Energy Research Laboratory’. Each of the institutes listed in section 6 has a clearly defined specific role. Professor Helm does not mention the Energy Innovation Board which is responsible for the co-ordination and strategic oversight of public investment in energy innovation and research and development. This structure should be given a chance to prove itself. The ESC’s whole energy system analysis capability can provide an important source of strategic analysis and evidence to guide oversight of UK energy innovation funding and priorities.

The Government should support investment in initiatives that enable trial and testing of new technologies and business models (e.g. through energy innovation zones).

### **Are there any other matters that the Government should consider to reduce the cost of energy in the longer term?**

The cost of energy in the longer term will be driven by innovation and investment in a balanced portfolio of new technologies and infrastructures. This in turn will depend on the creation of a credible, long-term policy framework which aligns the incentives of market players with societal objectives around service reliability and decarbonisation.

With this in mind, the Government should also consider:

- How best to manage policy transitions, particularly if greater reliance were to be placed on private sector contracting to deliver generation capacity, with correspondingly less reliance on centralised government-led contracting
- Alternative approaches to delivering sufficient long term revenue certainty to back major generation investments where this may be necessary for 'non-marginal' or strategic projects (e.g. CCS, nuclear)
- Governance mechanisms and statutory backing required to create long-term policy credibility (e.g. a relevant analogy might be the statutory framework and backing for independent regulators such as Ofgem, which is of central importance to investor confidence for long term investments).

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