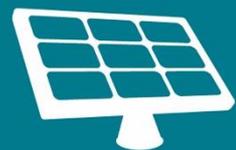


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Making a positive difference
for energy consumers



Our strategy for regulating
the future energy system

Overview

The energy sector is undergoing fundamental change. The regulatory and market arrangements will need to evolve to ensure this happens in a way that protects and advances consumers' interests and enables them to benefit from innovation and new services. This document sets out our strategy for regulation over the coming years in the context of the energy system transformation, and how our current and proposed activities fit within this.

The strategy forms part of a group of related documents. We have recently published:

- an open letter to start our formal development of the second round of price controls for network companies under our RIIO framework (RIIO-2)¹
- a joint plan for a smart, flexible power system with the Government, which is a follow-up from our call for evidence last year and has actions in three categories - removing barriers to smart technologies, smart homes and businesses, and markets which work for flexibility²
- our direction of travel on proposals to separate the System Operator (SO) into a distinct legal company and our latest thinking on the future design of the regulatory framework for the SO³
- our launch statement for the Electricity Settlement significant code review⁴

Alongside this document we are publishing our launch document for the Targeted Charging Review,⁵ setting out how we will take forward the review of residual charges for electricity networks and related matters.

This paper covers a number of the themes that we have been considering in those documents but also looks more widely at other regulatory issues we will face for gas and electricity as the system transforms.

Section 1 provides an overview of the drivers of change in the energy system in future, highlighting both the scale of change and the level of uncertainty.

Section 2 sets out our high-level approach to our work in relation to the energy system transformation. Given the uncertainty, we expect that the regulatory framework will need to evolve over time. While we will seek to build resilience and flexibility into the framework, we will also need to respond to emerging challenges. To increase predictability and provide strategic direction to the evolution of the regulatory framework over time, we set out our vision for the regulatory and market arrangements.

¹ <https://www.ofgem.gov.uk/publications-and-updates/open-letter-riio-2-framework>

² <https://www.ofgem.gov.uk/publications-and-updates/upgrading-our-energy-system-smart-systems-and-flexibility-plan>

³ <https://www.ofgem.gov.uk/publications-and-updates/future-arrangements-electricity-system-operator-response-consultation-so-separation>

⁴ <https://www.ofgem.gov.uk/publications-and-updates/electricity-settlement-reform-significant-code-review-launch-statement-revised-timetable-and-request-applications-membership-target-operating-model-design-working-group>

⁵ <https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-significant-code-review-launch>

Sections 3-7 then set out our current priority actions to address the key challenges and opportunities that future changes could create for different aspects of the energy market and regulatory arrangements under the following themes:

Cross-cutting platforms to enable the energy transition (section 3). Smart meters will allow consumers increased control of their energy usage, and together with the associated communications platform can allow for a substantial modernisation of how billing occurs. Early evidence suggests they are also key to increase consumer engagement in the energy market. We are holding suppliers to account on the rollout of smart meters and taking forward reforms to the process for payments in the industry. These are a key foundation of the energy system transformation as they are other market and regulatory reforms we are considering.

Balancing supply and demand at all times (section 4). Energy is an essential service, and businesses and households expect their reasonable requirements to be met at all times.⁶ To achieve this requires supply and demand to balance on a continuous basis. This task is likely to become more challenging as the proportion of non-dispatchable and intermittent generation increases, and many traditional providers of flexibility are phased out.

We have a range of projects underway in this area, working with the Government and industry. These include actions in our joint plan with Government for a smart, flexible power system and the SO's planned reforms to how it procures balancing services.

Efficient locational management and development of the energy system (section 5). The efficient use of the gas and electricity networks has an important role to play in the energy transition. Networks allow energy to be transferred from locations where there is surplus generation to where there is surplus demand. Ensuring that there is an efficient level of network capacity is an important aspect of ensuring people have reliable access to the energy they need as cost-effectively as possible.

We might use the gas and electricity networks quite differently in future, and there are a range of possibilities of what might happen. In developing the RIIO 2 framework we will look to ensure that there are the right mechanisms to handle this uncertainty while driving network companies to deliver consumer value. This will include considering the risks to network companies in being able to recover their historic costs, and how the RIIO-2 framework can best support companies in making the right investment decisions in light of this issue.

New loads on the electricity network could potentially require network upgrades. However, increasingly new technologies and more flexible demand have the potential to provide for cheaper alternatives to conventional network investment. One of our key aims is therefore to ensure these new solutions are used to the full extent they can offer savings to consumers, while also ensuring that those triggering new network investment are appropriately exposed to these costs. We are taking this forward through:

⁶ In performing our duties, Gas Act 1986 and the Electricity Act 1989 set out that we need to have regard to:

- the need to secure that, so far as it is economical to meet them, all reasonable demands in Great Britain for gas conveyed through pipes are met
- the need to secure that all reasonable demands for electricity are met

- ensuring there are effective signals to users about the incremental costs and benefits they confer on the network at different times and locations. We believe there are a number of issues with the signals provided by the existing arrangements for connecting to and using the networks. We are starting some new work to review options for improving these signals, including considering more market-based approaches. We will work with industry to develop these.
- ensuring that network companies are adequately incentivised to pursue alternatives to network upgrades where this can provide better value to consumers. Our RIIO framework has already introduced changes to reduce network companies' historic bias towards capital expenditure on their networks. The framework also includes other incentives for network companies to pursue innovative approaches. A key part of our development of the RIIO-2 framework will be to consider whether further changes are needed.

Residual network charges top-up the amount recovered from forward-looking charges (that reflect incremental costs going forward) to meet network companies' allowed revenues. It is important that these charges are recovered in a way that avoids harmful distortions or distributional and equity concerns. We will be undertaking a significant code review of the current methodologies for residual electricity network charges, which we have announced in a separate document.

System coordination and the institutional framework (section 6). As the energy system changes, and traditional boundaries and distinctions break down, there is a pressing need to ensure the system as a whole is effectively coordinated to deliver value for consumers.

We are taking forward work to support improved coordination between the SO and network companies to drive efficient outcomes for the system as a whole, both in the short-term and for the longer-term. The main current focus is on improving coordination across electricity transmission and distribution boundaries. We will also be considering where more coordination between electricity and gas may be beneficial.

We will continue to work to ensure industry parties are clear on their responsibilities and objectives, and to make sure they have the incentives to drive the change necessary for the energy system transformation. This includes for the SO and for Distribution Network Operators (DNOs) as they evolve to increasingly take on distribution system operator roles. As roles evolve, we will be vigilant to potential conflicts of interest. We are currently putting in place greater separation between the SO and National Grid's transmission owner business to address such concerns.

Cyber resilience is an increasingly important part of a well-functioning energy system. We will review our own role on cyber-resilience, particularly in relation to other government bodies, and consider what this means for how we regulate.

Supporting innovation whilst ensuring good outcomes for consumers (section 7). As the energy system transformation progresses, new business models will emerge and there will be new ways in which consumers interact with the energy system. The regulatory framework will need to evolve to support such innovation and avoid undue barriers to entry. At the same time, it will need to ensure there are adequate protections for consumers, including those less willing or able to actively engage. It may become necessary in future for there to be a more fundamental review of industry arrangements to ensure

that all parties are able to compete on a level playing field with suppliers, while ensuring we have the right protections in place for consumers. We will keep this under review.

We are already in the process of simplifying the gas and electricity supply licences with a move towards a principles-based approach. We also have a number of initiatives in place to support those with new business models entering into the market while ensuring adequate consumer protection. This includes our work on the most appropriate approach for aggregators, third party intermediaries, and our Innovation Link service; a 'one stop shop' offering support on energy regulation for businesses looking to introduce innovative or significantly different propositions in the energy sector.

Section 8 summarises key next steps across the work areas discussed.

1. Drivers of change in the energy system

The energy system has already undergone significant change over the last decade, driven largely by the need to decarbonise our energy supplies and technological innovation. In particular, the electricity generation mix has become cleaner, increasingly intermittent and more decentralised. This is as a result of the substantial increase in renewables generation (from below 5% of total UK electricity generation in 2004, to 34% in 2016⁷) and with over a quarter of overall generating capacity now connected to local distribution networks.⁸ There have also been significant reductions in energy demand, with improved energy efficiency playing an important part in this.

Looking forward, the decarbonisation agenda will continue to be a major driver of change. This will need to include a step change in the decarbonisation of heat and transport sectors, which will have significant implications for the gas and electricity systems.

The longer-term future of the gas system remains uncertain; there is not yet a clear direction on how heat will be decarbonised. The gas system may still have a significant role (for instance, if gas is used in hybrid heat pumps, or if carbon capture and storage technologies develop further), or could be re-purposed (for instance, if hydrogen is used for heating). Alternatively, if there is a high degree of electrification of heat or heat networks, we could see the role of the gas system substantially diminish over the long-term. In practice, the outcome could include a mix of approaches and vary geographically.

In electricity, there will be a need for additional low carbon generation capacity. Much of this is likely to come from generation technologies that depend on the availability of ambient sources of energy, such as wind and solar, and can less readily flex the amount they supply relative to the old fossil fuel plants they will be replacing. The potential for electrification of heat and transport could significantly increase demand.

At the same time, innovations in technologies and business models are driving substantial advances, opening up new options and driving down costs. The cost of solar photovoltaics, wind and batteries have fallen rapidly. Innovation and competition are likely to continue to drive reductions in the cost of these and other technologies. The development of smart technologies (including automated demand side response) and new business models offers a much wider range of parties to provide services to help manage the system. It also makes it easier for individual consumers to control when and how they use energy. These new business models and service providers will provide opportunities for consumers to save money and reduce their environmental impact. The extent to which consumers respond to these opportunities will impact on the pace of change.

Another trend is the growth in community-based or local energy solutions. The strength of the move to local energy solutions will play an important part in determining the extent of decentralised energy. Consumer preferences will also be a key driver of the direction and pace of change on the decarbonisation of heat and transport.

⁷ National Grid Future Energy Scenarios 2017 <http://fes.nationalgrid.com/media/1253/final-fes-2017-updated-interactive-pdf-44-amended.pdf>

⁸ National Grid Future Energy Scenarios 2017 <http://fes.nationalgrid.com/media/1253/final-fes-2017-updated-interactive-pdf-44-amended.pdf>

Government and regulatory policy are also key drivers of future change. In setting out our approach to regulating in the context of the energy system transformation, this document attempts to provide more predictability on how we will develop regulatory and market arrangements.

2. Our high-level approach to reforming the regulatory framework

What might happen to the drivers of change we describe in section 1, and therefore what might happen to the energy system as a whole, is uncertain. Scenario analysis can provide valuable insights to our policy and regulatory decisions, but it is important to recognise that changes we have seen in the energy system in recent years lie outside the range of possibilities previously envisaged in forecasts and scenarios.

Given this uncertainty, the regulatory framework will need to evolve over time, and we will need to respond to unforeseen challenges as they arise. A key part of our approach will be to build resilience and flexibility into the framework. We will also continuously monitor developments, seeking to learn from what has worked (including from trials, where appropriate) and responding in an agile way to changes.

In order to increase predictability and provide strategic direction, we have developed a broad vision for the regulatory framework. This is drawn from our strategic objectives and our published regulatory stances, which are both focused on achieving our statutory duties and in particular the interests of current and future consumers.

Our overall aim is to **ensure a regulatory framework that drives innovation, supports the transformation to a low carbon energy system and delivers the sustainable, resilient, and affordable services that all consumers need.**

We believe it will best do this by following the principles in our regulatory stances, and in particular:

1. Aligning the SOs' and network companies' interests with those of consumers, through clear obligations and well-designed incentives.
2. Ensuring that charging for monopoly services reflects incremental costs and benefits and recovers other revenue requirements in ways that are fair and reduce distortions.
3. Ensuring that regulation is neutral between different technologies, systems and business models, while encouraging new entry and innovation by, for example, promoting a level playing field between entrants and existing companies, and between network reinforcement and alternative solutions.
4. Providing a predictable regulatory regime which supports efficient investment and allocates risks efficiently.
5. Promoting competition and harnessing market based mechanisms where it is in consumers' interests to do so.

The following sections indicate where the current regulatory and market arrangements do not adequately reflect these principles in the context of the changing energy system. Where change is needed, will need to prioritise which areas to take forward at a given time. Our prioritisation decisions will depend on the extent of potential consumer benefit or detriment; the impact of timing - some changes might need to be considered early given that they could render other, more incremental changes redundant; and whether we are the party best placed to take forward an area. Given that we will soon start setting the framework for the next round of price control arrangements for the network companies we have also considered as part of our current prioritisation exercise what changes need to be considered now in order to inform that process.

3. Cross-cutting platforms to enable the energy transition

The meters in our homes are a key piece of system infrastructure, but most currently have limited functionality. The roll-out of smart meters and the associated communications network will change this. It will provide a key foundation for the energy system transformation: prompting consumers to engage more in the energy market through the provision of information; and giving the SO and network owners access to the information needed to manage the networks more efficiently.

The Government is responsible for the overall smart metering policy and regulatory framework. Suppliers must take all reasonable steps to complete the rollout of smart meters by 2020, and we are closely monitoring their progress. We also focus on suppliers' compliance with their other smart metering obligations which relate to the engagement and protection of consumers. We also regulate the Data and Communications Company (DCC) responsible for the nationwide communications system linking meters in premises with suppliers, networks and other users.

For electricity, an important benefit of smart meters is that they will enable suppliers to settle their customers' consumption on a half-hourly basis. This will give consumers the opportunity to benefit from new smarter tariffs or other approaches (eg installation of smart technologies) through shifting their consumption from peak periods.

We have already mandated that the consumption of all business customers, apart from microbusinesses, is settled on a half-hourly basis. This means that suppliers will have the right incentives to offer smart tariffs because they are exposed to the real costs of their customers' patterns of using energy during the day.

We have also taken steps to remove the barriers to suppliers electing to do this for domestic and microbusiness consumers with smart meters. We expect that we will need to mandate all suppliers to settle their customers' consumption on a half-hourly basis to realise the full benefits of smart meters once they are widely deployed. The timetable for a decision on mandatory half-hourly settlement is set out in the recently published Electricity Settlement Reform Significant Code Review Launch Statement.

Many of the other reforms set out in this document are dependent on the rollout of smart meters and half-hourly settlement.

Summary of work on cross-cutting platforms to enable the energy transition

Work areas	Key milestones
Overseeing suppliers' roll out of smart meters	Ongoing monitoring of licence obligations
Regulation of the DCC	The Operational Performance Incentive regime will commence in April 2018
Move to mandatory half-hourly settlement of household electricity bills	We will publish our outline business case in mid-2018

4. Balancing supply and demand at all times

Electricity

For electricity, there is a need to match supply and demand almost instantaneously in order to maintain a stable system. There is also a need to ensure adequate 'black start' capability, to be able to recover supply in the unlikely event of a system-wide outage.

These tasks are likely to become more challenging as the proportion of non-dispatchable and intermittent generation increases, and many traditional providers of flexibility and black start capability (large-scale gas and coal plant) are phased out. This means that access to new providers of flexibility, such as storage, new forms of flexible generation and interconnectors, will be important to reduce the need for expensive back-up plant and (as discussed in section 5) network upgrades.

Another key source of flexibility will be demand-side response. This is currently focused on businesses (temporarily) increasing or reducing their demand in response to price signals at times of system need. As households get smart meters they will also be able to provide demand-side response. This could take the form of households actively adjusting their demand or an automated response via technology. The greater the willingness and capability of consumers to vary their demand then the greater the potential cost reductions that could be achieved.

One of our key principles means that system users should pay for the costs they create for balancing the system and be paid for the benefits they provide. Not only is this fair, but it is also likely to lead to more efficient use of the energy system. By putting incentives on system users to manage costs, this can also reduce the need for intervention by the monopoly SO and drive greater scope for innovation and new business models.

For example, we think the introduction of sharper imbalance prices through our Electricity Balancing Significant Code Review is a significant step forward in this regard. In future we think there will be a need to consider whether more balancing responsibility can be put into the market to reduce the SO's residual balancing role (for example, ensuring the market can balance as close to real-time as practical). However, we do not see this as a short-term priority at this stage given there are other changes in arrangements that might deliver greater value.

We are also working to ensure that those parties responsible for system operation, including the DNOs, have the right obligations and incentives to operate the system as it changes. We think that a key priority is to improve the efficiency of the transmission SO's residual balancing procurement. In particular, there is a need to reform the range of products that the SO procures to improve transparency, liquidity and accessibility for new providers (eg storage and DSR). We have set out our expectations for the SO through our future SO project and the SO is currently consulting on its thinking.⁹ A key part of the SO's work is to ensure it can adequately access the increasing amount of system resources located on distribution networks (we discuss in section 6 the need to coordinate effectively

⁹ <http://www2.nationalgrid.com/UK/Services/Balancing-services/Future-of-balancing-services/>

with DNOs in doing so to deliver the best outcomes for the system as a whole). We support its efforts in this area.

As part of joint work with the Government, we have been working to remove barriers to new ways of providing flexibility in either supply or demand to help balance the system. This includes removing barriers to storage and aggregation of small players to provide system services. We have set out further detail on our thinking in our and the Government's joint plan for a smart, flexible power system including considering changes to clarify how electricity storage fits within the licensing framework.

In order to meet the government's low carbon objectives, additional investment is likely to be needed in new, predominately low carbon generation sources. While the wholesale price and other revenue sources we oversee (such as revenues available from providing balancing services to the SO) play a part in this, the low carbon contracts for difference and the capacity market are now important drivers of investment. The Government leads on the design of these mechanisms and we manage the Capacity Market rules, which lay out the practical detail on how the mechanism works. We will engage with Government and support its decision-making to ensure a coordinated overall approach.

We have a role in supporting efficient investment in new interconnectors to other countries through our regulatory framework, including the scope for projects to have a regulated cap and floor on their revenues. We have recently published a consultation on our initial assessment of the three projects that applied in our second application window for cap and floor treatment.

We think these projects could bring significant benefits to GB consumers and are minded to approve them for cap and floor arrangements. If all new projects are built (including six projects that we have already approved for a cap and floor regime and two projects that are proceeding through the exemption route) this would take our interconnector capacity from 4GW now to around 18GW. It is not yet clear whether all of these projects will proceed. Looking further ahead, in 2018/19 we expect to conduct a review of the need for, and timing of, any future cap and floor application windows.

Gas

The situation in the gas system is quite different from electricity.

The market is going through a period of change, with some aging assets nearing the end of their lives coupled with significant decrease in demand for gas (which has fallen by almost a quarter over the last ten years). The Rough storage facility has recently announced its closure, given current market conditions and the investment required to extend its life.

GB gas supply sources remain diverse and flexible, comprising gas from Norway, the UK Continental Shelf, interconnectors to the continent, medium range storage facilities and LNG tankers. As such, we are not dependent on any one piece of infrastructure for security of supply. There is considerable headroom left in the market in terms of supply, which remains the case even with the withdrawal of Rough. It is worth noting however that the market is undergoing a period of change – responding to both declining demand and an increase in sources of supply, which may lead to increased price volatility.

In terms of shorter-term operations, we implemented a number of changes to balancing arrangements to reduce the risk of a gas security of supply incident, through our gas security of supply significant code review (SCR).

With the interactions between the electricity and gas markets, demands on the gas market are changing. Gas-fired generators are playing an increasingly important role in balancing the electricity market, resulting in greater variability of within-day gas demand. We will continue to monitor this situation, and work with the gas SO and industry to ensure that market arrangements remain appropriate as the system changes.

Summary of work on balancing supply and demand at all times

Work areas	Key milestones
Reforming the SO's regulatory and incentive framework	Further details in section 6
Removing barriers to new ways of providing flexibility to help balance the system	Our plan for a smart, flexible system just published with Government sets out further details. Further details in section 6
Clarifying the regulatory treatment of electricity storage	We will consult on a modified generation licence for storage with the aim of it being introduced by Summer 2018;
Managing changes to the capacity market rules	We recently published our decisions as part of our annual process for amending the rules.
Regulation of new electricity interconnectors	Review of the need for, and timing of, any future cap and floor application windows in 2018/19
Gas security of supply in light of changing market conditions	Ongoing monitoring and industry engagement

5. Efficient locational management and development of the energy system

Managing uncertainty over future use of the networks

The need to decarbonise energy could drive significant changes to the gas and electricity systems, but as mentioned previously, there is uncertainty as to what direction that will take and to what degree it will impact networks.

In some scenarios this could lead to elements of the networks being utilised less. For example, if heating and transport are substantively electrified then this could reduce the utilisation of large parts of the gas network (while significantly increasing loads on the electricity network). Another element of uncertainty is to what degree the decentralisation of electricity generation and greater demand flexibility plays a role, and how this could impact utilisation of elements of the electricity transmission and distribution network.

Considering how to manage this uncertainty will be an important aspect of our development of the RIIO-2 framework. We will be considering the risks to network companies in being able to recover their historic costs, and how the RIIO-2 framework can best support companies in making the right investment decisions in light of this issue. We will also consider whether changes are needed to improve the mechanisms already used in RIIO-1 to manage uncertainty.

There is also a question as to what extent network users that trigger network investment should bear the risk that it ends up being underutilised. We will cover this as part of our work on improving signals for electricity network usage, discussed below.

Facilitating new loads while minimising network upgrade costs

The prospect of new loads on the electricity networks (such as the extent to which heat and transport are electrified) could lead to constraints on the network, which would need to be managed if the reasonable expectations of consumers are to be met. For example, the electrification of transport means that some consumers are likely to make greater demands on the electricity network, potentially causing network congestion and driving expensive network upgrades or system actions. However electric vehicles could also provide an important new source of flexibility which could provide system benefits. Investment decisions by businesses could also have a significant impact on local network constraints.

Similarly, consumers and businesses that invest in demand flexibility, storage or generation (that can offset local peak demand) could help reduce constraints and manage these costs. It is important that the right incentives exist to ensure efficient use of the system by consumers. This can reduce or defer the need for traditional network investment to substantially reduce costs. Modelling by Imperial College/Carbon Trust for the Government suggests potential savings of up to £4-15bn cumulatively to 2050 from reducing capital expenditure on electricity network reinforcement if flexibility providers are able to help address network constraints.¹⁰

In order to secure these potential savings for consumers while accommodating new low carbon technologies, there need to be effective signals to network users about how they can alter their behaviour to reduce the costs or increase the benefits they confer on the system. These signals can take a number of forms:

¹⁰https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568982/An_analysis_of_electricity_flexibility_for_Great_Britain.pdf

- Network access rights: how users (both supply- and demand-side) are granted access to the network, the nature of the capacity allocated and the terms under which this access can be restricted by the SO or DNOs to resolve constraints
- Network access charges or other price signals (eg locational marginal prices or network charges): currently, forward-looking elements of charges for connecting and using the networks, which can vary according to location and time or other factors
- Direct procurement of flexibility services by the SO or DNOs

For the reasons set out in the box below, **we have decided that we should review the signals for electricity network usage.**

There are a number of industry initiatives in this area already. We will look to work with industry, including through the new Charging Futures Forum (that we are announcing in the Targeted Charging Review published alongside this document) to develop an assessment of the different possible options, and to consider how best to take forward changes. We intend to kick-off this process by publishing a working paper in the autumn setting out a range of options for discussion.

In developing these options we will ensure close links with our work on the Targeted Charging Review (discussed below), so that there can be a holistic view of how charging may need to evolve over the two areas.

In addition to effective signals for network users, it is also essential that network owners and the SO have strong incentives to pursue smart alternatives to network upgrades where this can create value for consumers. As part of RIIO-1 we have introduced changes to reduce network companies' traditional bias towards capital expenditure on their networks. There are also a number of incentive mechanisms to drive innovation to improve customer outcomes. While we have seen some progress as DNOs begin to take on distribution system operator roles (including the introduction of flexible connections, as mentioned in the box above), we think more is needed. A key part of our development of the RIIO-2 framework will be to consider whether further changes to the incentive framework is needed to encourage network companies to make full use of smart alternatives, as well as how best to continue to drive innovation. We will also be considering the appropriate role of competition in future network investment projects.

Different means of providing signals for network users can affect the role of the SO and network companies, and consequently what needs to be incentivised through RIIO-2 and incentives for the SO. For example, under some models there would be less need for the SO or DNOs to directly procure flexibility services as the necessary signals would be provided through access arrangements or prices. We will manage these interactions as we progress thinking on user signals and develop the RIIO-2 framework.

Network security standards can also be an important driver of the need for network upgrades. It is important that they adequately reflect efficient system developments, though we note that there is scope for network companies to take alternative approaches from those indicated by the standards (eg through derogations from the standards where alternative approaches are more efficient). We strongly support the current industry review

of the distribution network security standard to ensure that it reflects how smart alternatives to network investment can support network security.

Why we intend to review signals for electricity network usage

The arrangements that provide forward-looking signals are being tested by changes in the sector and there are separate reviews and change proposals being led by different parts of industry. We think there is a strong case to consider all of these arrangements holistically and to consider whether changes to improve and harmonise some of these arrangements could provide benefits. We also think there is merit in considering options for more transformational change alongside incremental improvements currently being considered. The reasons we think it would make sense to review the arrangements include:

Network access rights

- Connection agreements for both transmission and distribution networks are allocated on a first come, first served basis, with limited ability to transfer access rights between parties
- Connection to the transmission network generally provides financially firm access, whereby the generators are paid by the SO if they need to be curtailed. Under the connect and manage approach, allowing more connections onto constrained areas of the network can only be achieved by increasing costs to the SO, which are consequently passed on to consumers.
- At distribution level, DNOs are increasingly offering non-firm (flexible) generation connections in constrained parts of their network. We welcome these as a means to unlock more network capacity and provide quicker and cheaper connections. We think there is a need to consider whether arrangements can evolve to allow for more efficient allocation of firm access (rather than be purely based on the order in which users are connected to the network) and provide a better signal to DNOs about where there is a case for network upgrades.
- In contrast to gas transmission, electricity network users provide limited ongoing financial commitment to the network investment they trigger, though this does differ between transmission- and distribution- due to differences in the extent of upfront connection charges.

Network access charges or other price signals

- Price signals are currently largely derived through forward-looking network charges. There may be benefits from more market-based mechanisms.
- There are significant differences between the approach at transmission and distribution levels which could be creating distortions, and/or mean the charges insufficiently reflect key drivers of network costs, including:
 - While there are locational signals through transmission charges, distribution charges (except for those connected at extra high voltage level) only provide a generic signal that varies by voltage level across a DNO area. We think stronger locational signals may provide benefits.
 - Temporal variation of network charges works quite differently between transmission and distribution charging. For example, half-hourly settled demand customers on the transmission network are charged based on their

usage during 'triad' periods, whereas on a distribution network they would be charged on usage during 'Red-Amber-Green' or 'super-Red' periods.

- In contrast to transmission generation charges, forward-looking distribution charges on generation are on aggregate offset by credits. We think there is a need to review this given that the increasing amount of distributed generation is likely to increase distribution network costs in places.
- The models used to generate the forward-looking charges for distribution and transmission work quite differently and there may be benefits in a more harmonised approach.
- The upfront connection charging arrangements for transmission and distribution also work differently. While there could be benefits in greater harmonisation, we are aware that changing the connection boundary would be potentially disruptive and hence clear benefits would be needed to justify such a change.
- Households are typically able to access 100 amps of energy (for a single phase connection) without being liable for any reinforcements costs their demand could trigger. This level is substantially above current average household consumption and far more than the wider system could cope with if all consumers used this full connection capacity at the same time. With 'Smart Charging', increased connection and usage of electric vehicles could be managed effectively and bring benefits to the wider system. However, without clear signals charging electric vehicles could create significant costs for the wider network and these costs could be socialised across all consumers in that area.

Direct procurement of flexibility services by the SO or DNOs

- Signals sent through access arrangements or network charges have the potential to enable the market to respond more dynamically to changing system needs, thereby reducing the need for the SO and DNOs to actively procure flexibility to manage the system. As part of our review we will be considering the extent to which these types of signal can provide a more effective route to bring forward flexibility cost-effectively rather than principally relying on procurement by the monopoly companies.
- However, alternative means of providing signals are unlikely to be able to provide all of the flexibility that the SO and DNOs need, so there is always likely to be some need for them to procure some flexibility directly. We outline elsewhere in this document the work we are proposing as part of our and Government's Smart Systems and Flexibility plan to ensure that this is as efficient as possible, including ensuring access for new types of provider and adequate coordination to achieve the best outcome for the system as a whole.

The arrangements for gas entry transmission provide a useful comparison. Existing capacity in the gas transmission network is allocated through auctions run by the SO. The auctions cover a range of capacity products with different durations (ie a mix of longer-term and shorter-term access rights). Auctions for longer-term rights include a reserve

price methodology. It is also possible to have secondary trading of rights between market participants. This means that there is in theory scope for the value of access to be priced by the market close to real-time, and for access to be re-allocated to those who value it most. Any auction premiums observed through this process can also provide an indication of constraints in the network that are candidates for reinforcement. In practice, falling demand and changes in supply have resulted in excess capacity throughout the gas system suppressing congestion. As a comparison to the status quo network access model in the electricity system however, the arrangements have features which have merit.

In our review of signals for electricity network usage we intend to consider the scope to introduce more market-based approaches, alongside considering what more incremental improvements would look like.

Recovery of residual network costs in a non-distortive way

Residual network charges top-up the amount recovered from the forward-looking element of charges to meet network companies' allowed revenues.

In electricity, we have recently made our final decision on the industry-led modification to reduce distortions arising from one particular payment that smaller generators connected to the distribution network can receive. We have also consulted on launching a Significant Code Review (SCR) to review the transmission and distribution network residual charges and consider options to reduce distortions and improve fairness (our 'Targeted Charging Review').

Currently residual charges are largely based on net electricity consumption as measured at the meter, and we are concerned about the likelihood that different groups of users are paying very different contributions to the common costs of the network they all use. We have decided to proceed with the SCR on these matters and have published a launch document alongside this strategy.

In gas, an industry-led charging review is underway, building on work completed under the gas transmission charging review, reviewing the gas transmission charging methodology.

Summary of work on efficient locational management and development of the energy system

Work areas	Key milestones
<p>RIIO-2 framework development, including considering how to manage network usage uncertainty and incentivise smart alternatives to network upgrades</p>	<p>Open letter consultation currently open; range of stakeholder engagement throughout the rest of the year; consultation on RIIO-2 framework in Q1 2018</p>
<p>Review of forward-looking signals for electricity network usage</p>	<p>We will publish a working paper in autumn and look to develop options with industry</p>
<p>Targeted Charging Review of residual electricity network charges and related matters</p>	<p>Launch paper published alongside this strategy; we will publish a working paper on policy options in autumn.</p>

6. System coordination and the institutional framework

The traditional boundaries in the energy system are increasingly breaking down, between supply and demand, across transmission and distribution boundaries within each sector (eg geographical and voltage level boundaries), across different energy forms (gas and electricity), and with neighbouring countries. There is also increasing interactions with other sectors, particularly heat and transport. There is a need to ensure that these interlinked systems evolve in a way that leads to the most efficient outcome for consumers as a whole.

Markets can support coordination if participants face effective cost-reflective signals. For instance, cross vector technologies (including power to gas and hybrid heating systems) have potential to provide system benefit, but need cost reflective signals in both gas and electricity to do so. The work set out in section 5 should support this. Cost reflective signals need to sit within a coherent and consistent overall policy and institutional framework. In some areas, such as decarbonisation of heat and transport, there is a growing need for strategic policy direction, to which the market can then respond.

Responsibility for the overall policy framework in these areas sits with the Government. We are taking forward work to ensure that the parties and arrangements that we oversee drive the necessary coordination within the context of that evolving framework.

A key strand of this is work to support improved coordination between SO and network companies to drive efficient outcomes for the system as a whole.

The clearest current need is for improved coordination across the electricity transmission and distribution boundary, where there is a need for both coordination in planning how the system as a whole develops and in operating it. We are clarifying our expectations of the SO and will be reforming its incentive framework, to ensure its incentives are aligned to consumers' interests across its range of roles. We have also been considering coordination between the SO, transmission owners and DNOs as part of our work with the Government on moving to a smart, flexible energy system and have just published our joint plan with BEIS for this area.

In broad terms, we think that the RIIO 1 framework can support the necessary coordination over the next few years (subject to a range of regulatory clarifications being made) and believe the onus is on the network companies and SO to make rapid progress. We will be considering whether further changes may be needed to the roles and regulatory arrangements for the SO and network owners, with a view to any new functions being adequately reflected and incentivised through RIIO-2.

There is also potential for increasing interaction across electricity and gas networks. The nature and scale of necessary coordination between SO and network companies in this area is less clear, particularly given uncertainty over the future of heat. We will be gathering further evidence on this and will look to ensure key synergies are incentivised through the RIIO-2 price control framework or other means.

In addressing the challenges of system coordination, we believe that focus of efforts should be on evolving the roles of existing parties, broadly retaining the current split of

responsibilities.¹¹ However, we remain open to the idea of reconsidering more fundamental change to the division of roles and responsibilities between parties at a future juncture, in light of progress and/or the emergence of new evidence.¹²

We will also continue to be vigilant to potential conflicts of interest that could arise as roles evolve. This has been a concern as the role of the SO has broadened. We are therefore separating the SO (with National Grid’s agreement) into a distinct, ring-fenced company within National Grid Group. We recently published our direction of travel on the SO’s future separation arrangements. We will keep arrangements for both the gas and SO under review to ensure they remain fit for purpose going forward.

Another area where coordination and clear governance is needed is the process for changing industry codes and the associated industry central systems, given the amount of change to these that will be needed. We strongly support the conclusions of the Competition and Markets Authority, following their market investigation, that reform of the industry code governance arrangements is needed. We intend to publish an update later this summer setting out our planned next steps.

We also think there is a need to consider governance for cyber-security, given this is a critical new source of risk for security of supplies. We are in discussions with the Government to further define our role relative to other government bodies as part of implementation of the EU Directive on the Security of Network and Information Security (‘the NIS Directive’).

Summary of work on system coordination and institutional framework

Work areas	Key milestones
Coordination between system operators and network companies to drive whole system outcomes	We will work with industry over the remainder of this year to test where regulatory clarifications and changes are needed to facilitate industry progress in the immediate term, taking any necessary steps as soon as possible following this; We will consider whether any further changes are necessary at RIIO-2.
Separation of the SO and reforms to its incentive framework	We have just published a working paper on the regulatory and incentives framework and our direction of travel on SO separation. We intend to develop options for SO performance metrics and incentives and will hold workshops in Autumn to road test our designs.

¹¹ Please note that this does not preclude an additional role for third parties in supporting coordinated system and network operation where this can provide benefits. For instance, in our Call for Evidence we described the potential for independent local platform operators to support some models of service procurement.

¹² This includes taking into account the findings of the range of thinking underway in this area, including the work of the Energy Network Association’s [Open Network project](#), the [Smart Grid Forum](#), the Energy System Catapult and its [Future Power System Architecture](#) project, and the [Centre for Energy Systems Integration](#), amongst others.

<p>Implementation of the CMA code governance reforms</p> <p>Further defining our role in cyber-resilience</p>	<p>We published an update letter on 27 July 27.</p> <p>Ofgem and BEIS will clarify their respective roles in cyber resilience under the NIS Directive by Autumn 2017, following which Ofgem will establish the necessary processes and capabilities to discharge its role. Government plans to consult on its proposed implementation approach for the NIS Directive this summer.</p>
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7. Supporting innovation whilst ensuring good outcomes for consumers

Our ambition is for an energy system that works for all consumers, both now and in the future. As the system becomes more complex and diverse, the interface between consumers and the system will become increasingly important in ensuring consumers' needs are met. Traditionally, this has been the role of energy suppliers competing in the retail market. However, a wide range of alternative business models are emerging that have the potential to add value for consumers, such as aggregators, energy service companies and community ventures.

Competition will play an important role, both between suppliers and between intermediaries. We want to see a market where competition constrains prices, drives efficiency and delivers the quality of service that consumers need, befitting energy as an essential service. It is important that the specific needs of people in vulnerable situations continue to be met. To achieve this, we need to encourage disruptive competition, hold suppliers to account for their conduct and tackle the barriers that prevent more consumer engagement. Our approach needs to be flexible to manage the uncertainties and potential changes discussed in the first section of this document. In time, we believe there may be a need for a more fundamental review of industry arrangements, including the licensing framework, to ensure that intermediaries and other parties are able to compete on a level playing field with suppliers in providing services to consumers while continuing to have confidence of good outcomes for consumers.

We are undertaking a range of projects to ensure the regulatory framework is fit for purpose in the energy system transition. We are in the process of simplifying the supply licence with more principles-based approach. This will put responsibility on suppliers to deliver good consumer outcomes, provide future-proof effective protection for consumers in a rapidly changing market, and allow room for suppliers to compete and innovate.

This includes introducing new principles so that suppliers pay particular attention to consumers in vulnerable circumstances. This will be particularly important as the energy system transforms given they may face additional barriers to engage and change their energy consumption patterns.

We have already seen significant increases in new entry of suppliers over recent years, offering an increasingly diverse set of services. However, as the energy system changes, the role and importance of suppliers and types of new entrant may change. As part of our work on the move to a smart, flexible energy system we are considering changes to clarify how we should ensure sufficient consumer protections for consumers engaging with aggregators. We have also been working on oversight of third party intermediaries. Our work on principles based regulation could form the basis for extending consumer protection to these other intermediaries in the market.

We have also set up our Innovation Link - a one-stop shop offering support on energy regulation to businesses looking to introduce innovative propositions to the energy sector. The Link currently has two offerings: fast and frank feedback for innovators who need to understand how their proposed approaches interact with our regulatory framework; and a regulatory sandbox to allow innovators to trial business propositions that will benefit consumers without incurring all of the usual regulatory requirements.

We think these steps provide a good foundation for enabling new business models to enter into the market while ensuring consumer protections.

Summary of work supporting innovation whilst ensuring good outcomes for consumers

Work areas	Key milestones
Reforming the supply licence with a more principles-based approach	We are taking forward changes to strengthen the Standards of Conduct and introduce new broad principles that are due to come into effect this autumn
Innovation Link	The second window for sandbox applications will open in early October 2017. Fast, frank feedback is offered to innovators on an ongoing basis
Clarifying the regulatory treatment of aggregators	We have recently issued a letter that sets out its views to guide industry thinking on how to deliver efficient access for independent aggregators.

8. Next steps

We will be taking forward individual work areas as described in sections 3-7, and summarised in the table below.

As set out in section 2, we envisage that we will need to adjust our work programme in response to new developments and will provide updated views of our priorities as part of our overall Forward Work Programme publications.

We welcome any feedback on this document to energysystemstrategy@ofgem.gov.uk.

Overview of work across

	Work areas	Key milestones
Cross-cutting platforms to enable the energy transition	<p>Overseeing suppliers' roll out of smart meters</p> <p>Regulation of the DCC</p> <p>Move to mandatory halfhourly settlement of household electricity bills</p>	<p>Ongoing monitoring of licence obligations</p> <p>The Operational Performance Incentive regime will commence in April 2018</p> <p>We will publish our outline business case in mid-2018</p>
Balancing supply and demand at all times	<p>Reforming the SO's regulatory and incentive framework</p> <p>Removing barriers to new ways of providing flexibility to help balance the system</p> <p>Clarifying the regulatory treatment of electricity storage</p> <p>Managing changes to the capacity market rules</p> <p>Regulation of new electricity interconnectors</p> <p>Gas security of supply in light of changing market conditions</p>	<p>Further details in section 6</p> <p>Our plan for a smart, flexible system just published with Government sets out further details. Further details in section 6</p> <p>We will consult on a modified generation licence for storage with the aim of it being introduced by Summer 2018;</p> <p>We recently published our decisions as part of our annual process for amending the rules.</p> <p>Review of the need for, and timing of, any future cap and floor application windows in 2018/19</p> <p>Ongoing monitoring and industry engagement</p>

<p>Efficient locational management and development of the energy system</p>	<p>RIIO-2 framework development, including considering how to manage network usage uncertainty and incentivise smart alternatives to network upgrades</p> <p>Review of forward-looking signals for electricity network usage</p> <p>Targeted Charging Review of residual electricity network charges and related matters</p>	<p>Open letter consultation currently open; range of stakeholder engagement throughout the rest of the year; consultation on RIIO-2 framework in Q1 2018</p> <p>We will publish a working paper in autumn and look to develop options with industry</p> <p>Launch paper published alongside this strategy; we will publish a working paper on policy options in autumn</p>
<p>System coordination and the institutional framework</p>	<p>Coordination between system operators and network companies to drive whole system outcomes</p> <p>Separation of the SO and reforms to its incentive framework</p> <p>Implementation of the CMA code governance reforms</p> <p>Further defining our role in cyber-resilience</p>	<p>We will work with industry over the remainder of this year to test where regulatory clarifications and changes are needed to facilitate industry progress in the immediate term, taking any necessary steps as soon as possible following this; We will consider whether any further changes are necessary at RIIO-2.</p> <p>We have just published a working paper on the regulatory and incentives framework and our direction of travel on SO separation. We intend to develop options for SO performance metrics and incentives and will hold workshops in Autumn to road test our designs.</p> <p>We published an update letter on 27 July 27.</p> <p>Ofgem and BEIS will clarify their respective roles in cyber resilience under the NIS Directive by Autumn 2017, following which Ofgem will establish the necessary processes and capabilities to discharge its role. Government plans to consult on its proposed implementation approach for the NIS Directive this summer.</p>

<p>Supporting innovation whilst ensuring good outcomes for consumers</p>	<p>Reforming the supply licence with a more principles-based approach</p> <p>Innovation Link</p> <p>Clarifying the regulatory treatment of aggregators</p>	<p>We are taking forward changes to strengthen the Standards of Conduct and introduce new broad principles that are due to come into effect this autumn</p> <p>The second window for sandbox applications will open in early October 2017. Fast, frank feedback is offered to innovators on an ongoing basis</p> <p>We have recently issued a letter that sets out its views to guide industry thinking on how to deliver efficient access for independent aggregators.</p>
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Making a positive difference
for energy consumers



Our strategy for regulating
the future energy system
