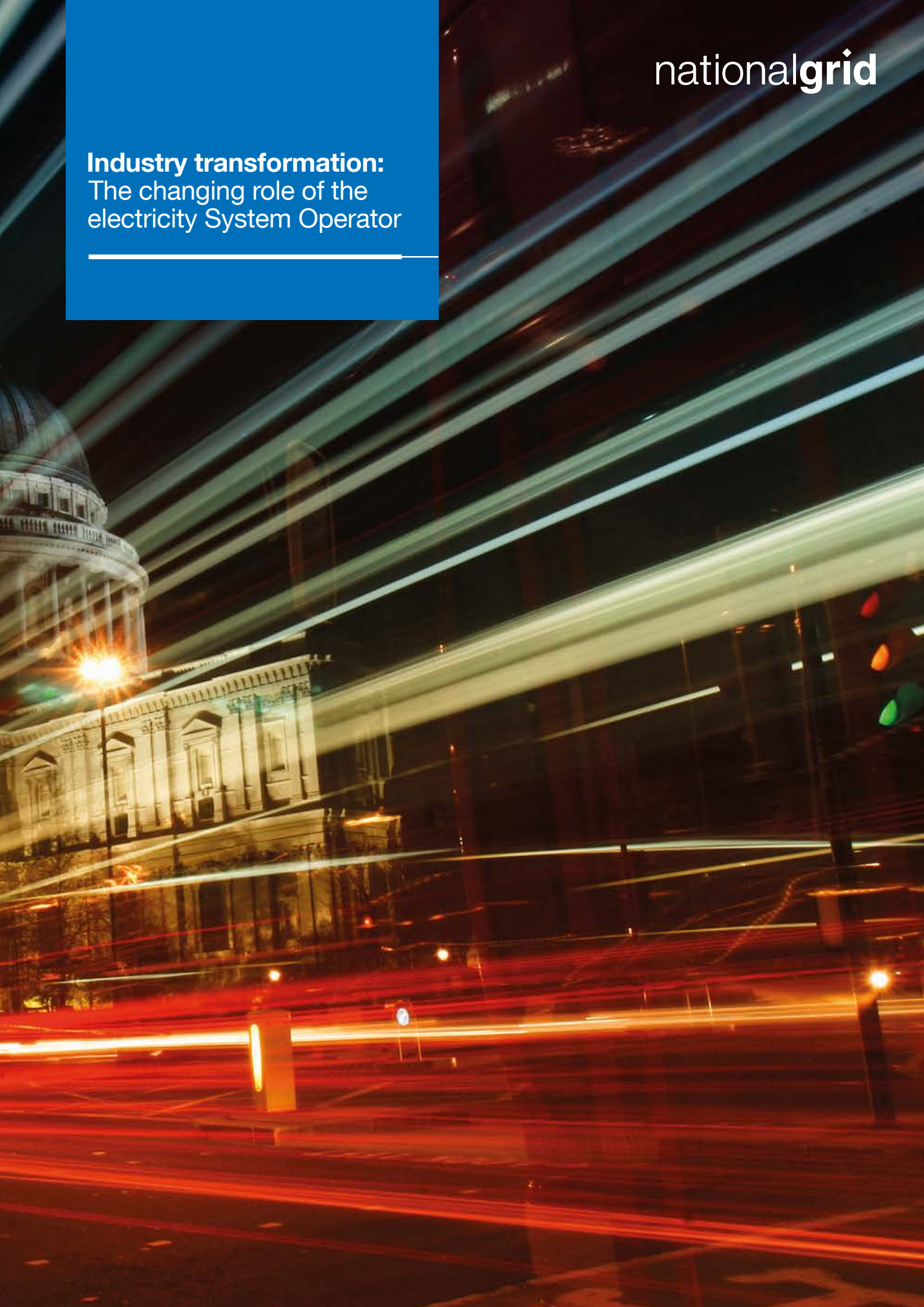
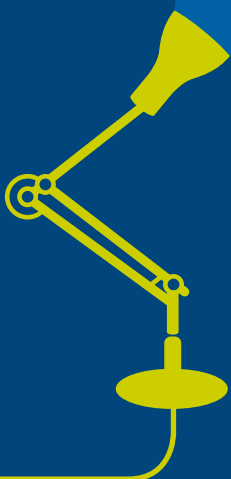


Industry transformation:
The changing role of the
electricity System Operator



We've produced this guide to engage our customers and stakeholders on the changing role of the System Operator. We explain the case for industry change and our Future Role of the System Operator (FRSO) Programme, as well as proposals for greater independence of the electricity System Operator. We look forward to working collaboratively and transparently across industry and beyond as we continuously innovate to deliver efficient outcomes for our customers and energy consumers.

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Transforming the System Operator

As System Operator, we sit at the heart of the nation's energy system and we're tackling some of Great Britain's most pressing energy challenges. We must continually evolve to ensure we can provide secure supplies of energy in a fast-changing world in a way that is both sustainable and affordable.



As the SO we make sure Great Britain's gas and electricity is transported safely and efficiently from where it is produced to where it is consumed. We ensure that supply and demand are balanced in real time and we facilitate the connection of assets to the transmission system. We work with our customers and stakeholders to shape the future of the energy market, providing analysis and insight into the changing nature of supply, demand and networks. We also facilitate changes to the market frameworks to accommodate new technologies and ways of working, while considering how our own role should evolve over time.

The energy landscape in which we operate is undergoing a period of significant and rapid change. In recent years we have seen significant changes in the supply and demand patterns of both gas and electricity. In the gas market, Great Britain's dependence on imports has increased as North Sea reserves decline. What will be the future impact of shale gas and biomethane

as energy sources? Over the coming months our Future of Gas Programme will continue to engage with customers and stakeholders, leading the debate on these topics.

With the rapid introduction of new technologies and business models, the electricity industry is experiencing fundamental change with the opportunity to deliver great value, for consumers and society. In this document we want to talk to you about what this means for the **Electricity System Operator (ESO)**, our vision for how the ESO can facilitate industry transformation that works for all and how the structure of the ESO needs to change to allow it play that role. In January 2017, National Grid, the Department for Business, Energy & Industrial Strategy (BEIS) and Ofgem released joint proposals regarding Future Arrangements for the ESO. This document is intended to provide further insight into how National Grid plans to deliver on the joint proposals.



The future is now: The changing electricity landscape

The shift towards new sources of energy, emerging technologies and different customer behaviour is accelerating.



The GB electricity system is divided into a national high-voltage transmission network and a number of regional, lower-voltage distribution networks. Electricity supply in Great Britain is undergoing a transformation in which significant volumes of large, transmission-connected fossil-fuel power stations are being replaced by smaller, often distribution-network-connected, renewable generation technologies such as wind and solar.

This fundamental shift has implications for how we operate the system. In addition to being predictable and controllable, the output of the large fossil-fuel power stations has historically provided the ESO with the services that it needed to operate the system safely. In contrast, it is much harder to predict the output of renewable technologies and the ESO has little visibility or control over this generation when connected to the distribution network.

In the past electricity flowed in one direction from transmission to distribution. In recent years, significant connections of generation on the distribution networks have led to flows from distribution to transmission.

All of these changes have led to some new challenges for operating the electricity system.

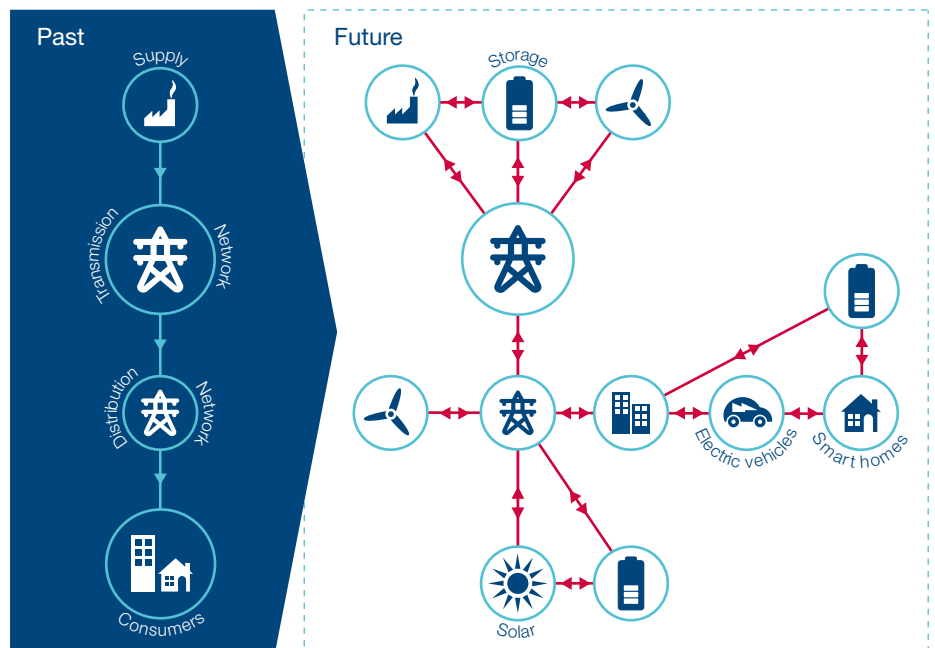
At the same time new technologies and business models such as battery storage, electric vehicles and demand side response are deploying rapidly. These new technologies are complementary to less controllable renewable technologies, providing the ESO with a new suite of tools to help us manage the system efficiently while maintaining reliability for energy consumers.

The successful integration of new energy technologies is essential to delivering the transition to a low carbon energy system that delivers value for consumers. However, stakeholders have told us that there are multiple barriers to entry for new market entrants.

The changing roles of networks

Decarbonisation, decentralisation and digitisation are transforming the GB electricity system.

In the past, electricity flowed from large transmission-connected generation to passive distribution networks. In the future, electricity will flow far more dynamically between transmission and distribution-connected parties including renewables, electric vehicles and battery storage.



Changing supply and demand patterns

> 10GW

Since 2009 we have seen more than 10GW of solar generation come on to the system, a majority of which is connected to the distribution system.



£8 billion

The National Infrastructure Commission estimates that Smart power could save consumers up to £8 billion per year.

- 15GW

Since 2011 we have seen around 15GW of fossil fuel power stations come off the system.



+ 10GW

Since 2009 we have seen approximately 10GW of wind generation come on to the system.

Coal-free day

British power generation saw its first ever coal-free day on 21 April 2017.



+ 42%

Demand for plug-in hybrid electric vehicles rose by 42% in 2016.



201 MW

In 2016 201 MW of battery storage was successful in a tender to provide frequency response to the ESO.



How does the industry need to change?

The markets and frameworks that are used to govern the electricity system need to change to meet the needs of all existing and new market participants.

Current industry frameworks and ways of working have evolved over decades to support the efficient and safe operation of a network in which energy and services were predominantly provided by a small number of transmission-connected generators.

Markets for balancing services, arrangements for network charging and how transmission and distribution work together need to change to ensure all parties can participate on an equal footing, reducing costs to the consumer. As an industry we need to ensure:

- network and market access for all parties regardless of business model or where they are connected
- enhanced investment signals for capacity, energy and flexibility services, including more cost-reflective price signals that better represent the costs and benefits of parties on the system
- the balancing market design evolves in response to the changing energy system.



The Future Role of the SO: What are we going to do differently?

The role of the ESO needs to change to support the transition to a more decentralised and interactive low carbon electricity system that works for everyone.



The ESO sits at the heart of the electricity system. We play key roles in the industry frameworks that need to change, including provisions for network and market access and network charging. We have commercial and technical interfaces with parties across the whole electricity system, including transmission and distribution-connected generation

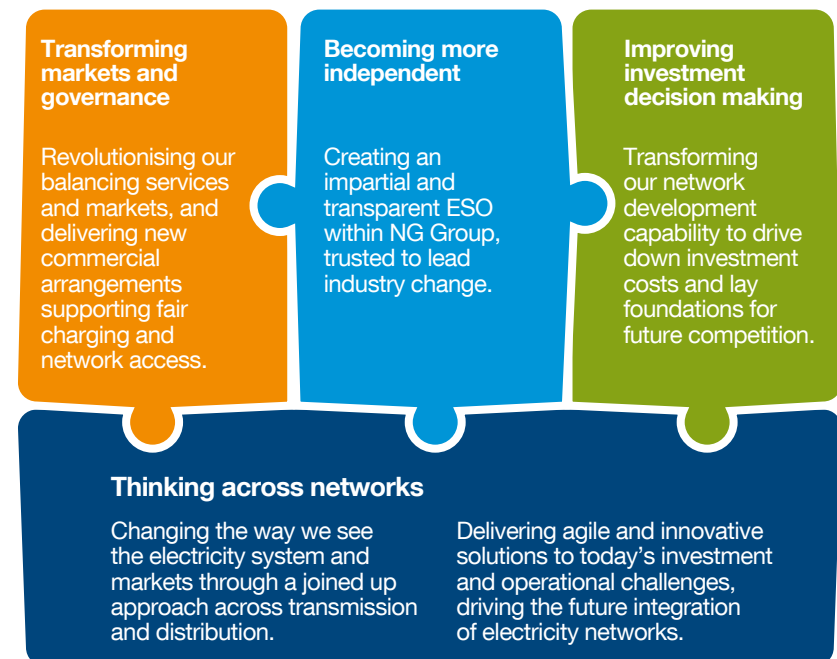
and demand as well as transmission and distribution network owners.

There is a critical role for the ESO to play, facilitating the transition to a more decentralised, low carbon electricity industry model while ensuring minimal disruption and cost for our customers and energy consumers.

The ESO is changing the way it works. Why?

- We need new tools to operate the energy system of the future.
- Our customers want us to transform how we do things to meet new requirements.
- New marketplaces are needed to deliver value for consumers.

We are:





How are we going to deliver change?

The Future Role of the System Operator (FRSO) Programme

In order to facilitate this transition we have established the Future Role of the SO (FRSO) Programme. The FRSO Programme will fundamentally transform both 'what' the ESO does and 'how' we

do it. It is a two-year programme that will deliver change in four key areas while ensuring a joined-up approach across them.



Flexibility



To ensure the costs of balancing the system are kept to a minimum we need all potential market participants to contribute. Our stakeholders have told us that how we procure flexibility is too complicated and that it is hard to offer services to the ESO. We need to review how we procure services and ensure that the service needs and decisions of the ESO are clear and transparent to all market participants.

Over the next two years we will be working with industry to make fundamental changes to how we communicate with our customers and organise the system services that we procure. We will also be listening to customers and consulting with industry to review how we procure services through efficient and transparent markets.

Network Competition



We need to ensure that we deliver value for our customers and bill payers through identifying the most efficient solutions for upgrading the electricity network and constantly improving our investment decision making. We are evolving our Network Options Assessment (NOA) process to enable us to increasingly look beyond transmission network solutions and consider a wider range of commercial and technical solutions. This may include working with Distribution Network Owners (DNOs) and other parties to identify distribution network and other non-traditional solutions such as battery storage.

We will be supporting Ofgem to ensure efficient delivery of network solutions by developing competitive models and tender approaches to utilising competition to provide transmission network solutions where appropriate.

Whole System



We are enhancing cooperation with DNOs, including through the ENA Open Networks Project, to create an improved joint understanding of the whole electricity system. We will work together to develop operational and commercial approaches that will release capacity on the distribution networks, allowing more parties to connect and participate in markets.

We are also working with a wide range of partners to trial different commercial models for parties to buy and sell energy and services to the ESO and each other. In partnership with DNOs we have adopted a 'learning by doing' approach to test agile and innovative solutions with Regional Development Programmes in areas that are facing the highest levels of distributed energy deployment. We will share our findings with our customers and stakeholders to facilitate adoption of new approaches for industry ways of working that promote network access and market participation for all.

Level Playing Field



The ESO will play an active role in support of Ofgem and the industry in reviewing and reforming network charging and access arrangements to ensure consistency of treatment for all parties. We are ready to provide the expertise and balanced support that industry needs to manage significant charging reform. This will ensure all industry parties can participate in the change process, understand what changes are taking place and how their businesses can manage this change comfortably.

We want to ensure that changes to network charging and access arrangements enable wider reforms in flexibility services and the adoption of whole-system thinking. Supporting access to networks and markets will deliver improved investment signals for energy, capacity and services as well as efficient network investment.

In summary

Delivery of enhanced roles for the ESO will make it easier to connect to networks and access markets. The changes will provide transparency and improved investment signals for energy, capacity and networks. This will allow all parties to develop better informed commercial strategies and compete on a level playing field with other market participants.

A more independent ESO

To be able to step up to play an enhanced role facilitating change the ESO will need to be more independent from the Transmission Owner (TO).



With a focus on facilitating access to efficient markets and driving efficiency across the whole electricity system, the above proposals represent a step-change in the role of the ESO. In order to deliver the benefits of this change to our customers and consumers we will need to adopt new ways of thinking, engaging and collaborating.

We propose to set up the ESO as a legally separate company within the National Grid Group. The ESO will have a separate Board of Directors to ensure that it is focused on delivering the outcomes that our customers and stakeholders deserve. It will have independent directors from outside National Grid to challenge our thinking, ensuring that we are innovating to realise value for consumers.

Moving forward together

The ESO has already begun work to achieve the objectives set out above with key milestones for industry change to be delivered over the next two years. We are engaging widely to understand our customers' needs and the expectations of stakeholders for this change. We are committed to working openly and transparently with a wide range of stakeholders, utilising established industry bodies and governance forums wherever possible and reaching out to groups that have historically struggled to make their voices heard in industry governance processes.

As our role changes there will be a renewed focus on ensuring our ways of working meet our customers' needs. We will be embedding the principles of a more independent ESO in our existing as well as enhanced activities.

It is proposed that the ESO will be set up as a legally separate company in April 2019. However, we are making changes now to start operating as a more independent body fit to take on new responsibilities while working hard to ensure there is no disruption for our customers.

The ESO has an important role to play, stepping up to facilitate the transition to a more interactive, low carbon electricity system model. However, in order to realise the benefits of the transition for industry and consumers, all parties will need to play their part. We are looking forward to delivering the new energy future together with you for the benefit of all.

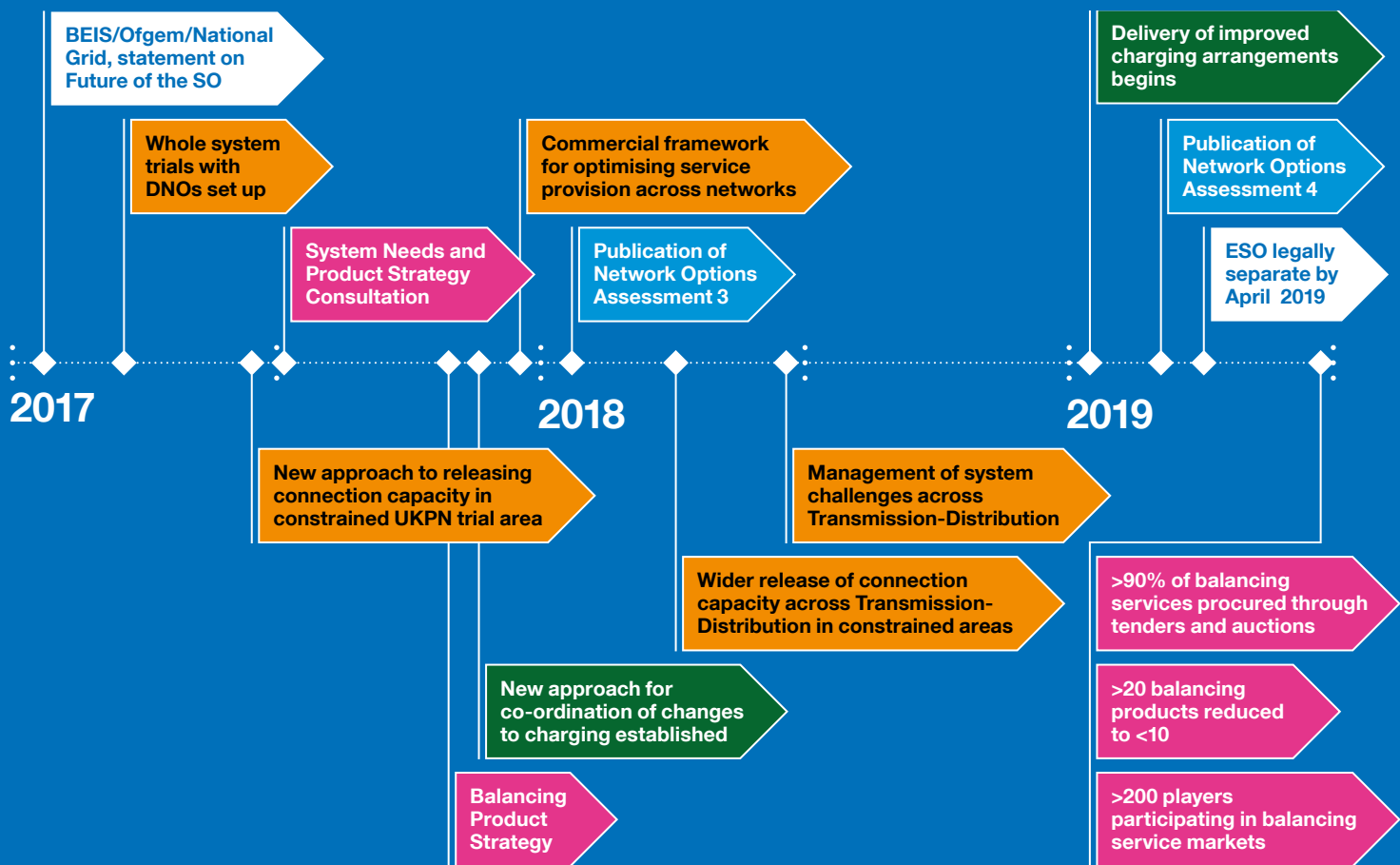
Continuing the conversation:

For more information on how to get involved in shaping the future of electricity system operation go to www2.nationalgrid.com/uk/industry-information/future-of-energy/





Future role of the SO programme – Our outputs



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