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Making a positive difference
for energy consumers

Ofgem Innovation Vision 2021 – 2025

Introduction

The transition to net zero (including decarbonising power, heat and transport) and the impact of democratisation, decentralisation and digitalisation will redefine and shape the energy landscape over the next 20 years. Ofgem, as the regulator for energy markets, recognises the need to stimulate innovation, particularly in more tightly regulated areas, such as network monopolies. Ofgem offers three innovation delivery vehicles – the Innovation Link (IL), RIIO network innovation stimulus and the Energy Company Obligation to directly support innovation (see Annex). We have also developed a set of innovation priorities to highlight areas where Ofgem has identified the need for significant innovation, with a view to encouraging regulated parties and other innovators to innovate in these spaces, and better align funding bids to the broader system need. The innovation priorities and principles should also assist network companies and the ESO as they prepare to enter and deliver the RIIO2 price controls.

Broader reform of energy markets will heavily impact innovation and its successful delivery. This document focuses on the current set of market arrangements and structures and recognises that innovators will need to work within current limits.

Innovation Principles

We welcome innovation on emerging technologies, products, services, methodologies and business models that will support decarbonisation and a fairer more inclusive energy system of the future. In addition, we are interested in exploring how existing commercial applications work at a systems level, such as enabling components to work across a system and understanding how the system interacts with these applications. We encourage all innovators, not just those leveraging our funding or support, to adopt the following principles to help ensure robust and equitable insights come from their work:

- **Innovation should create value for the whole system** through genuine cost reduction or through enabling greater value creation across the energy value chain. Innovation should only redistribute costs between parts of the energy system if this results in a total system cost reduction.

- **Innovation should be customer focused:** there should be clear consumer benefit created by the innovation, and innovation should, as far as possible, design in inclusivity or have a clear sense of how to achieve this as the market develops. Innovators should leverage behavioural insight research that allows for a widened range of consumers (including those in vulnerable situations) to participate in and benefit from a smart, flexible, energy system.

- **Information on innovation should be widely disseminated:** Ofgem supported innovation should be conducted in a culture of openness and shared insights; the underlying data and learnings from must be disseminated amongst other innovators and the broader industry. Each mechanism (see Annex) has its respective requirements.

Priority Innovation

Ofgem has considered our innovation priorities alongside our strategic change programmes (SCP) in our Forward Work Programme, and the desired outcomes from innovation are consistent with the objectives of each SCP.[1] We have also ensured our innovation priorities are aligned with the government's forthcoming Net Zero Research and Development Delivery Plan and have identified that the two are complementary.

Looking ahead, we value the role innovators can play in helping build an evidence base to provide impartial and unbiased insights so that other potential users (energy sector players and consumers) can benefit from the experiences of individual projects. The four key themes where we encourage innovators to bring forward new products, services, methodologies and business models that have the potential to benefit consumers are listed below.

Low Carbon Infrastructure

Innovation Priority	The Problem Space
 **Built Environment** Electrification of Heat (including heat pumps and retrofit)	Electrification of heat will challenge the electricity sector and increase costs, creating significant additional demand and increasing the winter peak. Innovation that seeks to minimise the system wide cost of electrified heating is essential. We are interested in innovations that explore: • Solutions for low carbon heating that minimise network or system peaks and allow better network asset utilisation • The use of electric heat and heat and power storage • Investable models for the mass deployment of unregulated infrastructure required for building heat decarbonisation such as, but not limited to, heat pumps and storage solutions. • Arrangements that enable better sharing of network capacity or more resilient networks, for instance the use of technology that responds to congestion levels. • Other innovations that reduce costs (including that of monitoring equipment on LV networks), increase system resilience and improve the customer experience or attractiveness of electrified heat such as improved solar PV, solar thermal and wind turbine generation capability (particularly onshore) • Small scale, safe nuclear generation plants • Reduction and removal of SF6 from the network is also encouraged In line with the Government's Ten Point Plan for a Green Industrial Revolution[2], areas of GB that are off-gas grid are also priority geographical zones for heat electrification innovation or conversion from carbon-based fuels. This does not, however, diminish the need for innovation across on-gas geographies.

[1] https://www.ofgem.gov.uk/publications-and-updates/forward-work-programme-202122
[2] https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution

Innovation Priority	The Problem Space
H_2 **Gas & Hydrogen** Feasibility and safety	Hydrogen has a role to play in the net zero energy system. We are therefore interested in innovation that targets: • Innovation and trialling of hydrogen in a wide range of applications such as heating, storage and transport; where trialling is involved, leverage locations and applications where hydrogen usage is more likely to be enduring such as in industrial clusters • Blending of hydrogen or other green gas into the gas networks (including connections, capacity and access) • Commercial and regulatory models that consider the impact of gas transition on the consumers and that ensure protection for industrial and domestic users, particularly consumers in vulnerable situations • Other innovation to ensure that hydrogen can be transported safely on the network
 **Local** Localised approaches to decarbonisation	Low carbon infrastructure development must account for local systems, needs and preferences. We expect that articulation of local system challenges, and local stakeholders' role and involvement will grow. Therefore, we welcome innovation in the following: • Solutions that reflect the differing challenges of GB's various regional net zero targets and varying local and regional circumstances, including use of regional assets that support decarbonisation (e.g. local heat sources) • Innovations to better manage or mitigate identified network constraints and locational characteristics that impact the range of possible solutions • Integrated solutions to local energy needs (heat and energy efficiency, transport, and power) that result in lower whole-system decarbonisation costs • Approaches to technical analysis and local energy mapping and planning to improve the effectiveness of localised initiatives to deliver net zero outcomes and increase the likelihood of appropriate infrastructure implementation Best practice in joining up tailored local and regional solutions with devolved and central government approaches.

Full Chain Flexibility

Innovation Priority	The Problem Space
 **Smart Energy and Energy Storage** system and market flexibility, flexibility technologies, and energy storage	Flexibility, smart energy and energy storage are essential components of our net zero energy system. Key priority areas of innovation are those which test and develop new system planning and operational approaches incorporating non-build solutions including: • New network management models (such as dynamic network operation, development of new ancillary services, and network and control) and managing synergies and conflicts in the operation of transmission, distribution and cross-border interconnection functions of the system • Data-centred business model innovation to drive energy efficiency and smart home systems • Business models allowing prosumer participation such as demand side response to unlock peak load shifting and evolved supplier models to facilitate the use of local grids • The role of smaller, aggregated distributed energy resources installed behind the meter to increase flexibility and reduce network costs, including for example, batteries, heat storage (including phase change long duration storage) and heat pumps • Devices and systems capable of responding to locational and time of use price or congestion signals, along with working directly with suppliers to create beneficial effects of consumer behaviour on the grid • Demonstration of smart controls and grid-aware systems, including self-regulating grid edge technologies and charging devices Beyond non-build, further considerations for smart energy include • The role of long duration energy and heat storage and energy efficiency in enabling flexibility • Interoperability of smart technologies across multiple dimensions: business model and service offering to consumers, data and communication/control standards
 **Electric Vehicles (EVs)** Electrification of Personal Transport	All new cars and vans will be zero emitting by 2035. This shift to electrified personal transport not only presents power supply and network challenges, but also opportunities. Innovation can help explore: • New ways of ensuring the electricity system is prepared for the uptake of EVs (e.g. new approaches to strategically planning or operating the system) • The use of electric vehicles (EVs), including vehicle to grid (V2G), to manage network loading and aid security of supply • The development of new EV-related products and services • Investable models for mass deployment of unregulated EV infrastructure such as, but not limited to, EV chargepoints and controls Improvements in the safe, secure use of data to accelerate the efficient integration of EVs within the changing energy system.

Future of Retail

Innovation Priority	The Problem Space
 **Consumer** Consumers' role and acceptability of products and solutions	Achieving decarbonisation is likely to involve greater consumer participation in the energy system and more active involvement and decision-making (e.g. in decarbonising heat). Some consumer-related touchpoints are covered in other sections with this section focusing on innovation to promote consumer engagement and understanding of how their energy choices and behaviours relate to decarbonisation. This could include innovation: • In inclusive design to solve the needs of consumers in vulnerable situations, ensuring accessibility, affordability, up-take and ongoing engagement so all consumers can benefit from a decarbonised and digitalised sector • To provide compelling, transparent and easy to understand information (service, cost, benefits) to help inform consumer choice and encourage engagement in decarbonisation • In products and services, such as automation and smart devices and control systems that suit consumers' needs and which enable them to provide flexibility to the energy system

Data & Digitalisation

Innovation Priority	The Problem Space
 **Cyber Security** prevention, detection and recovery from cyber attacks	Cyber security is a growing concern in many industries and in society as a whole. It is of particular concern within the downstream gas and electricity subsector due to its potential to disrupt essential services to consumers. Decarbonisation can further raise the cyber risks if increasingly decentralised control systems become accessible to cyber-attackers. For these reasons Ofgem is keen to explore • Emerging techniques specific for preventing, detecting and recovering from cyber-attacks. • Quantifying the cyber risks to essential consumer services • Model based security engineering The point of contact specific to cyber topics is Chris Few, Head of Cyber Research & Development; chris.few@ofgem.gov.uk.

Innovation Priority	The Problem Space
 **Energy Data** innovation aligned with the Modernising Energy Data Programme	Digitalisation, and the use of energy data is central to a low-cost energy transition. BEIS and Ofgem are jointly developing a Data & Digitalisation Strategy[3]; we fully support the Modernising Energy Data suite of initiatives and require all the regulated network companies to publish their digitalisation strategies[4]. A central feature of this digitalised transformation is greater transparency of and access to market and system data, both in energy and in adjacent sectors such as transport, heating and waste. This data supports better system operation and whole systems, local energy planning. We expect data and digitalisation to feature in all innovation categories, but in particular we consider the following as innovation priority needs: • Information services to improve system planning through transparency about the energy system and providing insights about grid characteristics, such as system constraints • Integrating data for more efficient investment planning across the range of systems of GB infrastructure that comprise net zero and the wider economy • Creating new cross-sectoral services that enable opportunities amongst electricity and gas, water and transport, such as cross sector flexibility markets, or that provide services that apply energy data as a tool for monitoring peoples' health • New services that enrich data by applying artificial intelligence (AI) and data science methods, such as Machine Learning, to complex challenges (e.g. urban planning and energy system frequency response, system balancing response services and flexibility) • Low cost techniques for capturing, curating and de-sensitising (e.g. anonymising) smart meter data to support better national and local system planning and improved regulatory insights • Better end-consumer services built on portable consumer data (inter alia smart meter data), enabling targeted and adaptable retail services, such as through integration with home finances • The data and technology that would permit the ESO to operate the system carbon-free by 2025 • Innovation in communications and data platforms as well as digital services such as for asset registration and mapping

Alignment with Other Public Innovation Bodies

Ofgem works with government and other public innovation bodies to ensure a greater degree of alignment to support the transition to net zero. We have recently partnered with UK Research and Innovation and Government to improve the way we manage innovation and create better alignment across funding programmes. By working through the Net Zero Innovation Board[5], we endeavour to ensure complementary innovation priorities, avoid

[3] Planned to be published in summer 2021
[4] https://www.ofgem.gov.uk/publications-and-updates/digitalisation-strategies-modernising-energy-data
[5] The Net Zero Innovation Board will soon replace the existing Energy Innovation Board https://www.gov.uk/government/groups/energy-innovation-board

duplication and where possible join up innovation funding to ensure value is delivered for UK consumers.

Sharing Learning

Ofgem supports a culture of openness and shared insights from its innovation resources. We already publish case studies from the Innovation Link[6], and as sandboxes ramp up, Ofgem is considering how best to disseminate information and learning from them. We will also endeavour to work collaboratively with other innovation bodies to ensure that learning from publicly funded innovations is efficiently and effectively shared.

The Energy Network Association's (ENA) Smarter Networks Portal[7] is a repository for network consumer funded innovation project learning, news and events. Furthermore, potential project partners to an innovation project can register their interest, capabilities and offering as well as establish communication with network companies through the Network Innovation Collaboration Portal[8]. The ENA also hosts an annual conference to disseminate information and report on network innovation benefits

Going Forward

While the principles outlined in this document should remain current, we expect the themes to change over time as the energy system evolves. This vision therefore establishes a desired direction of travel for the next 3-4 years. Within that period, we will review our priorities and issue updates as the landscape changes. This short period can only be navigated successfully through wider collaboration and open discussions around innovation and the technological as well as social solutions they unlock toward a decarbonised world. For that reason, Ofgem seeks to be increasingly engaged in this dialogue on the necessary research and our priority innovation activities. To discuss further, you may contact Ofgem's Strategy & Decarbonisation Team at StrategyFeedback@ofgem.gov.uk

[6] https://www.ofgem.gov.uk/publications-and-updates/innovation-link-case-studies
[7] https://www.smarternetworks.org/
[8] https://www.nicollaborationportal.org/

Annex

How Ofgem Enables and Supports Innovation

One of Ofgem's roles is to create a regulatory environment more conducive to and permissive of innovation. Ofgem encourages competition, making markets more attractive and allowing the entry of new innovators. We also expect the market to bring forth business model and technological innovation that will change how consumers interact with energy. However where there are gaps that markets cannot address because of regulatory barriers or the existence of network monopolies, then there may be a need for Ofgem to support innovation more actively.

Ofgem offers three innovation delivery vehicles – the Innovation Link (IL), RIIO network innovation stimulus and the Energy Company Obligation (ECO). Each seeks to align to the principles and priorities in this document, and each of these will apply the principles and priorities according to their own distinct rules and governance. RIIO funding is typically for network companies; however, Government is looking at how these rules can be broadened[9].

Innovation Link

We invite all energy innovators to use the Innovation Link's services. The Link can help innovators operating in any corner of the energy sector, although the vast majority of innovators we support are currently interested in the retail electricity market and deploying distributed energy resources. These sorts of innovations might include new retail products, buying energy service offerings, selling services to the grid or directly to other consumers, or other significant shifts in the relationship between consumer and traditional suppliers. The Link's role is to help innovators navigate what is a complex sector with challenging regulatory requirements consistent with an essential service. The Link can help organisations understand the regulatory implications of their propositions and, where necessary, how to adapt their approach for today's markets.

As well as supporting innovators through our Fast Frank Feedback service, the Link will increasingly focus on broadcast services which will have greater reach and impact on more innovators and consumers; broadcasts will include 'how-to-guides' and webinars on common issues that innovators encounter.

The Link also offers the Energy Regulatory Sandbox, a service for innovators that want to trial or bring to market new products, services or business models but require some regulatory relief. The Sandbox was refreshed in July 2020[10], expanding the tools available to innovators. It is an on-demand service, led by innovators' aspirations and needs. The Link helps to inform our policy thinking about potential barriers to innovation and whether reforms are needed, and in time, Ofgem may commission policy-led Sandboxes or innovation challenges where we would invite innovators to pursue innovation projects of particular scope. A full description of

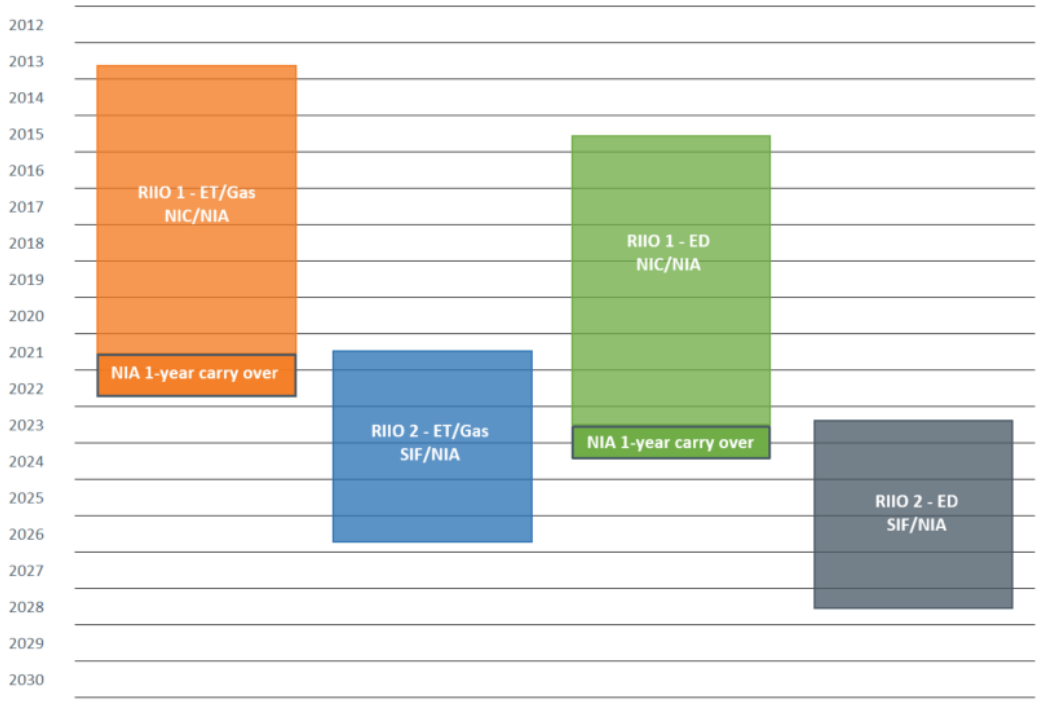
[9] Page 77: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf

[10] https://www.ofgem.gov.uk/publications-and-updates/energy-regulation-sandbox-guidance-innovators

the Innovation Link and services offered can be found on our website[11], and we endeavour to continuously improve our service offering to maximise the effectiveness of our support to innovators.

RIIO Price Control Innovation Mechanisms

The innovation stimuli within the RIIO price control are currently available to the licensed monopoly network companies and the ESO to incentivise network innovation projects which can show the potential to deliver a net benefit to network consumers. There are three stimuli, and the below illustration demonstrates the expected periods for the Network Innovation Competition (NIC), the Network Innovation Allowance (NIA) and the Strategic Innovation Fund (SIF).



The SIF will make £450 million available over the duration of the RIIO-2 price control for strategically important network innovation projects, and this figure can be adjusted upward according to need. The focus of the SIF is to support network innovation that contributes to the attainment of the net zero target, while taking into consideration cross–sector initiatives aiming at the same goal. We have also confirmed that the Network Innovation Allowance (NIA), which are individual allowances controlled by network companies and the ESO, will continue in RIIO-2, providing around £210 million for innovation projects that focus on the energy system transition or helping consumers in vulnerable situations. Details can be found

[11] https://www.ofgem.gov.uk/about-us/how-we-engage/innovation-link

on our website at our main Network Innovation page[12] and via our latest RIIO 2 publications[13].

Energy Company Obligation (ECO)

Further innovation alignment is achieved through Ofgem's environmental programmes and in particular the Energy Company Obligation (ECO)[14]. ECO is an energy efficiency scheme to help reduce carbon emissions and tackle fuel poverty. Within ECO3, energy suppliers are able to deliver up to 10% of their obligation through installation of innovative measures to eligible households including insulation, heating solutions and connections to district heating systems (new and upgrades)[15]. The Department for Business, Energy and Industrial Strategy sets the overarching framework and scheme rules, while Ofgem has an implementation role. Specifically, Ofgem is responsible for assessing applications made through the innovation route and have established an ECO Technical Advisory Panel to help facilitate this process.

[12] https://www.ofgem.gov.uk/regulating-energy-networks/current-network-price-controls-riio-1/network-innovation
[13] https://www.ofgem.gov.uk/publications-and-updates/riio-2-final-determinations-transmission-and-gas-distribution-network-companies-and-electricity-system-operator
[14] https://www.ofgem.gov.uk/environmental-programmes/eco
[15] https://www.ofgem.gov.uk/environmental-programmes/eco/installers-and-industry