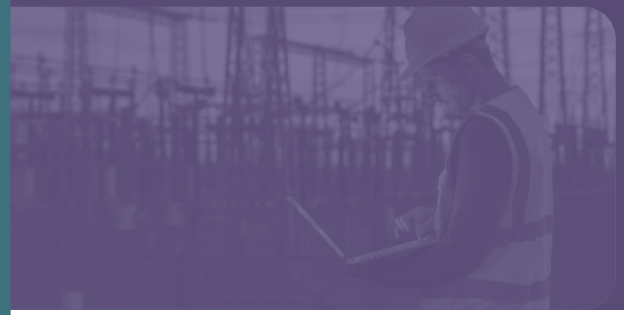
UtilityWeek

DELIVERING CUSTOMER, COST, CARBON AND CONNECTIONS DIVIDENDS

# Addressing waste & inefficiencies



Authored By:
Eric Brown
Maxine Frerk
Roger Hey
Laura Sandys
Steven Steer
Alan Whitehead

DELIVERING CUSTOMER, COST, CARBON AND CONNECTIONS DIVIDENDS

CONTENTS





# Designing the smartest most efficient energy system

The sector has designed a world leading electricity system that we should be proud of and embrace. This report does not aim to diminish the significant progress the sector has made or act as a critique to those that have delivered so much. However in getting to this position there has not been total focus on whole system efficiencies.

This is understandable due to the speed of transition, however there now is a need for some housekeeping in conjunction with, and embedded into the next stage of decarbonisation.

This report aims to highlight where there are immediate and systemic efficiencies that can be realised to ensure that with the extensive change needed to totally decarbonise the system, we do this as quickly and effectively as possible. Standards and processes embedded into the system are sometimes over 70 years old, designed prior to digitalisation, asset automation and most importantly not reflecting the new system decarbonised architecture required.

Possible actions were identified following a “brain-storming” approach in which all ideas that arose were considered and those thought worthy of extra exploration were captured in this report. We have developed ideas and actions that are intended to provoke and encourage discussion that will enable them to be further qualified and quantified. The objective is to highlight to Mission Control, DESNZ, Ofgem and NESO that there are potential significant efficiencies to be gained and that from these recommendations those that are found to have real merit should be progressed at pace to realise their benefits. Many of these ideas have been identified and examined by others but there is value in reinforcing the case for progressing them.

Our proposals aim to deliver whole system efficiencies, accelerate delivery of net zero, reduce carbon and methane emissions, deliver customer and exchequer cost benefits, and eliminate the need for excess investment into the future. Put together they will deliver greater customer satisfaction with limited cost. We believe that through the waste busting measures in this paper, a very conservative estimate of 6–10% of energy could be saved. Just as importantly, these measures are particularly important at this stage as we double our electricity consumption so we need to address these inefficiencies as otherwise this waste will increase exponentially.

We have identified measures that can deliver cost reductions, modernisation, acceleration for decarbonisation and greater efficiency while delivering accessible, safe, reliable, resilient energy service to consumers. In addition, many recommendations increase the capacity for creating connections, unlocking crucial investment opportunities that are currently a bottle neck to progress.

These measures can be put in place and efficiencies can be delivered over the next few years through policy, regulation and tasking key actors within the sector. This will also show to the Treasury that with the investment required DESNZ can find significant savings with less impact on costs to customers and taxpayers.

## Approach

This report highlights some possible actions that could deliver real benefits to the energy system, and do so with relatively low cost and at pace. Some of these actions need some additional stress testing and we pose these recommendations as questions to the sector, the regulator and to Government to take forward.

We believe that these measures deserve consideration with the ambitious 2030 decarbonisation target and can contribute to achieving that goal at lower cost, and increasing the capacity of the system.

The ideas – and the measures proposed – are described with a problem statement, a summary of the opportunity, actions that should be undertaken and the benefits that might be realised. They are organised in three categories:

- **Whole System Management:** the crucial building blocks to unlock efficiencies across the system.
- **Operational Efficiencies:** key measures that need to be prioritised and addressed in short order to unlock today's and more importantly tomorrow's efficiencies.
- **Waste Reduction:** specific measures that are important and will deliver benefits but sit more in specific parts of the sector.

# Recommendations Overview

Savings outlined are estimated but drawn from research and innovation projects already undertaken.

| | |
|---|---|
| **Green:** | Essential to drive efficiency and resilience for the system – key enablers without which the other areas might be more difficult and where much of the work has been done but needs implementing and driving forward. |
| **Yellow:** | Quick wins. |
| **Orange:** | Useful approaches for greater efficiencies. |
| **Blue:** | Accelerators of transformation. |

| Measure | Outcome | Rationale | Responsibility | Action | Potential Savings | Timescale |
|---|---|---|---|---|---|---|
| **Whole System Costings** | Require key actors to provide whole system costings | The complexity and the value lies between the silos | DESNZ modelling team | Task DESNZ to design a common whole System framework for Ofgem/ NESO / DSO | At least 3% savings and significantly better decision making | 12 months |
| **Embedding Efficiency** | Establish a fund of £1 out of every £10 spent on supply to be invested in efficiency measures | Significant system saving but more importantly consumer and commercial savings | DESNZ / HMT | Minister to mandate this ratio | 3% of energy costs with upside for domestic and commercial customers | On-going |
| **Implement Standards Review** | Establish a Modernisation and Digitalisation Unit | Significant savings and modernisation opportunities from this review | DESNZ | Task DESNZ to provide a timeframe for implementation of Standards Review by NESO | Initial £8-10bn savings | Progressive benefits over a 3 year period |
| **Deep Digitalisation** | Establish a Modernisation and Digitalisation unit in Mission Control | System transformation will not be feasible or viable without significant digitalization; it will deliver significant efficiencies | DESNZ as driver but NESO / Ofgem / DSO and other key stakeholders to deliver digitalisation | Task actors to deliver Data and Digitalisation Taskforce recommendation at speed. Question all actors about their digital strategies and capabilities | Without digitalisation significant cost but also big resilience risks | A digital architecture, roadmap and delivery plan should be available within 6 months with active delivery programmes being established. |
| **Coordination and Clarity** | Define the roles, responsibilities and accountabilities between the key players | There is lack of clarity at the heart of the transformation and confusion will impact time, resilience and cost | DESNZ / Ofgem | DESNZ to define roles and responsibilities with urgency | Deployment will be quicker, with less wasted time and money on muddled roles and responsibilities. | Initial arrangements within 6 months and ongoing implementation to be complete in 12 months. |
| **Streamline Consultations** | Consultations speeded up through triaging and implementing agreed changes Consider new customer body | Consultations too lengthy, too many bodies representing small silos of the system, and consumers rarely considered as central to reforms | DESNZ / Ofgem | DESNZ and Ofgem shaping the new consultation processes Consider a new or enhanced customer body | Decisions will be able to be implemented quicker with more of a customer focus | On-going |
| **Flexibility First** | Flexibility to become much more central to all policy and regulatory | Too often flexibility is a secondary issue when it needs to be central to the future of the system | All actors | DESNZ to focus on flex but also drive others to prioritise this and hold them accountable | £7-8bn flexibility rewards | On-going |

| Measure | Outcome | Rationale | Responsibility | Action | Potential Savings | Timescale |
|---|---|---|---|---|---|---|
| **Review Operating Standards** | Commission a review of operating standards<br>RIIO3 to embed most efficient technologies within the networks | We are not optimising the system parameters and operating standards nor deploying the most efficient technologies | DESNZ / Ofgem | DESNZ to<br>commission review with Ofgem and ask Ofgem to prioritise whole systems efficiency in RIIO3 | 6-8% efficiencies across the networks – transmission and distribution | Timing important for RIIO3 –<br>review to report in 12 months |
| **Optimise Voltage Levels** | Immediately reduce voltage levels to European Standards<br>Subsequently allow dynamic and varied voltage management | Currently we are running far too high and customers are wasting money as well as having overvoltage challenges | DESNZ / Ofgem | Lower the voltage level standards to European levels Subsequently change legislation to allow it become dynamic | 3-4% energy savings | 6 months for first measure delivering 3% efficiencies. Wait for legislation for the full measures |
| **Connection Regime and Sharing** | There are approaches to connections that are either under utilised or not well designed that could increase capacity | There is a lot of connection capacity not being utilised and not being actively managed | Ofgem / NESO / TOs/ DNOs | Examine the barriers to consortium connections Revise connection regime with more flexible and variable contracts | Increase of connections both boosting energy deployment but also commercial decarbonisation | 18 months |
| **Smart Meter Roll Out** | Speed up deployment either through change in regime and / or new technologies to deliver some of the benefits<br>Take gas meters out of the smart meter programme | We are 10 years from completion of the roll out | DESNZ / Ofgem | Create a 3 month task & finish group to report on: how to accelerate smart meter rollout | Whole system roll out delivering £3bn cost savings | 3 months with a game plan and options for action Legislation required for significant change but incremental enhancements possible within 12 month |
| **Network Losses** | Reinstate incentives on networks losses.<br>Greater reporting and transparency on losses | There is close to 10% losses on the system which will rise substantially as more assets are deployed | Ofgem | Minister to task Ofgem to ensure losses are included in RIIO3 | 3-4% of savings | Ready for RIIO3 |
| **Methane Losses** | Gas networks to invest more in accurate methane leakage | Methane is being<br>leaked through the gas & replacement targeting is sub- optimal | Ofgem | Networks to improve leak detection with incentives to reduce actual leakage levels | Reduction in methane leakage<br>with cost and climate benefits | From the beginning of RIIO3 |
| **Innovation Impact** | Truly benefit from great innovation from young and dynamic companies embedding efficiencies and new ways of working | Maximise the productivity and value realised from innovation funding | DESNZ / Ofgem / NESO / Innovate UK | Review all great innovations from the last 5 years and require those with value to the system as BAU | Better use of innovation funding and building new exciting businesses serving the energy sector | 6-12 months but important that some of these innovations are incorporated into RIIO3 |

**Green:** Essential to drive efficiency and resilience for the system – key enablers without which the other areas might be more difficult and where much of the work has been done but needs implementing and driving forward.

**Yellow:** Quick wins.

**Orange:** Useful approaches for greater efficiencies.

**Blue:** Accelerators of transformation.

# Whole system management

**Cost and efficiency**
Funding Allocation

**Modernisation and digitalisation**

**Coordination and clarity**

## Should we establish a common whole system costings model?

### PROBLEM

Too many planning, investment and funding decisions are made in silos with knock-on costs and risks being passed to other parts of the system that fall out of the responsibility of a specific technology or function. As the system becomes more complex, value and savings will be found and accessed in the interaction across the current technology boundaries. This is particularly the case for the role of demand, flexibility, the value of customer actions and the value of storage on the system.

### OPPORTUNITY

DESNZ has whole system modelling capabilities, but their modelling methods and outputs are rarely communicated or used as a common framework. Rarely does Ofgem report on whole system costs of decisions, while it is not clear that the NESO has clear responsibilities for whole system costs across both the utility and consumer parts of the system.

### ACTIONS

- Minister to task the DESNZ modelling team to establish and make transparent, a standardised framework to be owned by Mission Control and to be rolled out to other actors including NESO, DSO, DNO, Elexon and Ofgem and should be incorporated as a key tool for all strategic planning functions including SSEP, RESP FES, DFES.
- Misson Control to task DESNZ, Ofgem and NESO to undertake whole system impacts and costings for all their tasks and proposals.

### BENEFITS

- **Decision making:** Much more efficient and common decision making, regulatory regimes and policy development.
- **Value and Waste Unlocked:** Sitting between the silos.
- **Accountable for Total Costs:** Key players accountable for all system costs.
- **Demand Important:** Demand actions & assets equally valued and rewarded appropriately.
- **No Place to Hide:** Openness and transparency on actions and accountability.
- **Avoided Cost of Energy:** Unlocks avoided costs and values them in whole system costs.

REFERENCE: This work builds on the ReCosting Energy Programme that worked with the BEIS modelling team to develop these metrics. These were also developed with LCP and Frontier Economics. www.challenging-ideas.com/wp-content/uploads/2021/02/Whole-System-Costs-1.pdf

# Can we embed efficiency into fiscal rules?

(3% cost reductions)

## PROBLEM

Energy efficiency has been neglected by policy and regulation and can seem to be an afterthought rather than integral to the whole system design. While there is a big investment and deployment challenge to build the decarbonised energy system, financially there are some real gains to be made by embedding efficiency into the policy framework as a strategic part of the transition.

## OPPORTUNITY

For every £1 spent on generation assets the whole electricity system cost is approximately £1.49. Every £1 spent on energy efficiency displaces the need for £1.49 in increased generation and delivers a total saving of just under £1 without taking into consideration fuel poverty support.

Politically and fiscally, this delivers real life benefits to all domestic customers helping with the cost of living, while the C&I sectors will significantly increase their productivity with their savings falling straight to the bottom line. Energy efficiency should be a priority of the Treasury, DBT as well as DESNZ.

The Treasury should consider the merits of the actions proposed below for providing discipline within the spending envelope but also saving business and consumers' money.

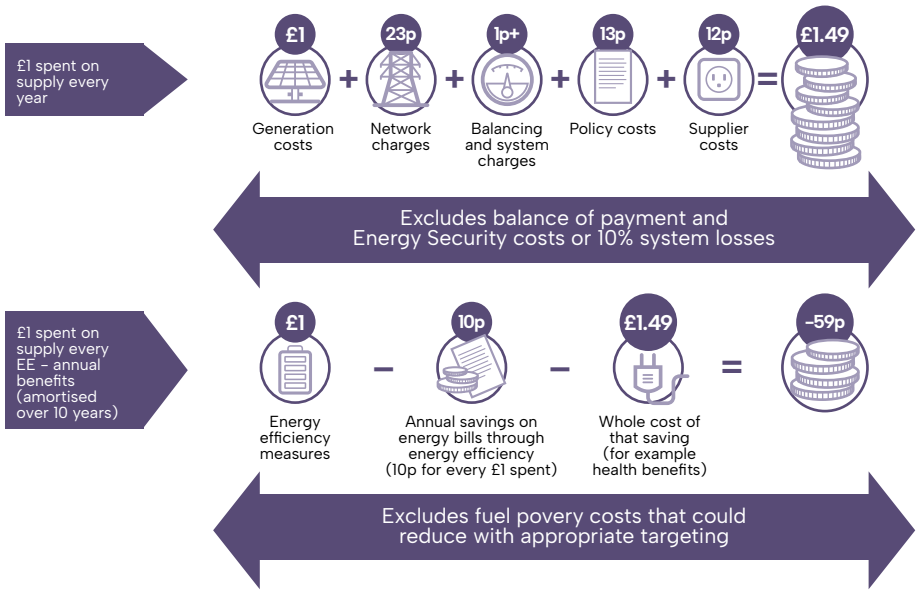
A rough equivalence of the cost of £1 spent on supply and £1 spent on energy efficiency is illustrated in the figure opposite.

## ACTION

- DESNZ / Treasury should embed a fiscal rule that for every £10 spent on investment into the generation of decarbonised energy, £1 should be spent on efficiency measures. This would immediately give confidence to and create a clear indication to the supply chain, customers and the sector that reducing energy consumption is an integral component of the energy transition.

## BENEFITS

- **Doing more with less:** Energy efficiency would no longer be the Cinderella of the system.
- **Fiscally Cost Effective:** Significant cost benefits to both the system and directly to consumers.
- **Scale Energy Efficiency:** Unlock confidence in the efficiency supply chain.
- **Business Resilience and decarbonised:** Industrial efficiency delivering significant benefits to the businesses and profitability.



# Whole system management

Cost and efficiency | **Modernisation and digitalisation** Engineering standards and digitalisation | Coordination and clarity

## How do we implement the engineering standards review?

Capture one off savings of £8-10bn and ongoing savings throughout the system

### PROBLEM

Energy system engineering standards were designed between 30 – 70 years ago with limited incremental change. They were designed before digitalisation and the development of many new technologies that can deliver efficiencies, lower energy costs and improve resilience.

### OPPORTUNITY

The Electricity Engineering Standards Review: Independent Panel Report (publishing.service.gov.uk) was commissioned by BEIS and Ofgem, and reported in December 2020. An independent expert panel, chaired by Simon Harrison explored what was needed to change across the landscape of engineering standards to improve customer value, and enable decarbonisation. The panel was supported in its work by Frazer Nash Consultancy, who produced an accompanying report.

They covered a wide range of drivers to deliver modernisation and efficiencies throughout the system and the immediate benefits to the system were calculated at between £8–10bn with on- going saving and productivity gains year on year. The opportunity cost here is significant and through the implementation of the recommendations new technologies and innovations will emerge further boosting the energy tech sector. The review divided the short-term gains and the longer term changes required.

The recommendations have all been accepted following its publication but little action has been taken to implement these recommendations.

### ACTIONS

- Task DESNZ to deliver an action plan and timeframe for Implementing the recommendation of the Engineering Standards Review.
- Mandate key actors to deliver the changes identified.
- The Standards Review recommendations to be incorporated into RIIO3 as far as they relate to network companies.

### BENEFITS

- **At the heart of delivering efficiencies:** The Standards Review supports many efficiency improvement measures and addresses key aspects of system modernisation.
- **A driver of modernisation:** It will drive greater modernisation throughout the system and support review of code bodies as well. It would create a benefit of underpinning the transition to a much more consumer-centric system.

# Can we turbocharge the deep digitalisation of the system?

## PROBLEM

Digitalisation is not a nice to have but essential to running the new system, avoiding massive increased costs, managing a changing system, optimising the assets on the system and enabling innovative business models. Without deep digitalisation, efficiency measures and other system benefits outlined in this paper will be not be able to be realised.

There are pockets of good digital delivery in the energy system, but these are still limited. There is a gap in the sector at providing design and digital engineering expertise, oversight and leadership. Within the sector there is a tendency to layer on digital technology onto existing and sometimes 30 year old processes. This will not deliver a digital transformation of the sector or realise the efficiencies required.

## OPPORTUNITY

The sector can radically improve decision-making, operational efficiencies and investment planning through improving data access and digitalisation. Data access and digitalisation has to be a priority for the sector and in particular for the NESO and DSOs who should consider themselves tech companies. In addition, the regulatory and policy frameworks and working methods need to be modernised to scale up sector oversight to keep pace with its growing complexity, including for example, using dynamic operability parameters in real time, rather than manual and deterministic models, monitoring and decision-making.

Importantly digital strategies required in the energy sector can draw from deep experience and approaches that are tried and tested in other sectors limiting technology and digital development risk. In addition the Government commissioned the Data and Digitalisation Taskforces that have set the roadmap for deeper digitalisation of the system. It is moving to implement these but needs greater urgency and strong leadership to ensure that the sector actually delivers.

Government needs to establish a strong Digital and Modernisation Delivery Unit within Mission Control capable of overseeing the design and engineering of the sector's digital investments with cross cutting functions across the department, Ofgem and the sector and would act as an integral part of change management.

## ACTIONS

- Establish a Modernisation and Digitalisation unit in Mission Control to provide a coordination point across the sector to ensure that energy system digitalisation happens at pace and delivers the required outcomes. The unit should be established with urgency, be led by a senior individual and have cross departmental responsibility.
- This unit needs to work closely with NESO to ensure coordination across the energy system and coherence in plans and actions and ensure that NESO has the appropriate skills and ambition.
- A new focus on security and cyber risk needs to be implemented.
- Ofgem needs to monitor RIIO2 commitments and enforce the core recommendation of data "presumed open" data and extend this principle across other parts of the system.
- Ensure that RIIO3 prioritises the modernisation and digitalisation of the system.
- Ministers to profile the energy sector as highly appealing to digital talent.

## BENEFITS

- **Mission Critical to the Future of the System:** Deep Digitalisation is widely acknowledged to be required to achieve good climate, economic and social outcomes.
- **Significant Efficiency Gains:** Without deep digitalisation the system will be much more expensive, impossible to manage and it will not be possible to deliver the smart system required to reduce costs.

# Whole system management

Cost and efficiency | Modernisation and digitalisation | **Coordination and clarity**

## Do we have muddled roles and responsibilities across parties slowing down transition?

### PROBLEM

The challenges and opportunities of energy system transformation span many departments of Government, more than one regulator and several delivery agencies and operational entities. There are impacts at national, regional and local levels and opportunities for industry and individuals. Decisions are siloed and cannot be relied upon to be coherent.

There is significant lack of clarity regarding roles, responsibilities and accountabilities. There are gaps and overlaps in understanding and in execution. The amount of money, effort, time and opportunity cost expended due to the lack of clarity of roles and responsibilities is very significant. This extends to well established parties including the network companies, government and the regulator and has been made more complex with the formation of Mission Control and GB Energy and the National Energy System Operator (NESO). Failure to clarify roles, responsibilities and accountabilities will slow deployment, erode energy security, place system resilience at risk and lead to higher capital and operational costs.

### OPPORTUNITY

Mission Control needs to clarify these roles as soon as possible to accelerate action and enhance coordination across the sector. This in particular requires clarification of the NESO, Mission Control, Ofgem, DSO, TO and DNO architecture, their roles and responsibilities and their accountabilities. This need to extend to include local and regional actors, other regulators and government at all levels.

Improving and communicating how the parties work together and coordinate their efforts will allow all stakeholder to see the opportunities, understand the dependencies and trade-offs and make better, timely decisions. This will lead to cost savings and more productive use of scarce resources. It should also greatly support the efforts to accelerate decarbonisation of the energy system. This focus on coordination and coherence will be supportive of the new Government's mission based approach and will deliver benefits beyond just the energy mission.

### ACTIONS

- DESNZ needs to deliver a clear roles, responsibilities and accountabilities structure and operating approach. It is important that this is in place before RIIO3. This should include the new bodies (Mission Control, GB Energy) and the substantially changed NESO as well as existing organisations such as Ofgem.

### BENEFITS

- **Speeds Up Deployment:** This will enable progress in keeping with ambitions such as decarbonization of the power system by 2030.
- **Clarity of Risk:** this will reduce risk premium costs currently faced by the lack of clarity.

# Should we streamline consultations and make them more customer centric?

## PROBLEM

The energy sector is burdened by an inefficient approach to consultations. Multiple consultation processes can lead to delay and attenuation of strong and meaningful change. Change and transformation will have winners and losers; currently the consultation processes aim to please everyone.

Importantly the consultation processes more or less exclude the "users" of the system with limited customer input or co-creation. This has created markets that customers don't use, systems that serve the energy sector but not the wider economy and in particular the commercial and industrial sectors that have a very limited influence on the outcomes. Domestic customers are not well represented or advocated on behalf.

## OPPORTUNITY

The greatest barrier to investment is lack of clarity and the current prolonged process of consultation is detrimental to all not least society and the decarbonisation agenda. The whole consultation landscape needs to be fully focused on outcomes for customers – energy is a service to them but can appear to focus on serving the sector. There is also a very limited focus on commercial and industrial customers who are crucial to the transition.

Politically the exclusion of customers through this transition is a danger and by reshaping the approach to consultation, it will ensure greater acceptance of the transformation needed.

Energy Consumers Australia is a great example of an active and forthright body for current consumer advocacy; following its approach would be a great signal to customers that Government is on their side.

## ACTIONS

- All reforms must not be held up by the most contentious single issues. Proposals should be modular and, with triaging of proposals agreed, action should be taken to deliver agreed modules, rather than waiting for the complete set of proposals being agreed where significant dependencies and trade-offs are not present.
- Consultations should start with the customers rather than the sector and be focused on outcomes.
- Review the use of digitally-enabled engagement approaches such as those proposed by the Linear Infrastructure Planning Panel (www.lippanel.org).
- Review with Citizens Advice how they could change their structure to be much more aligned to the Australian model and if not possible consider establishing a stand alone energy customer entity that would include commercial and industrial representation.
- Ensure that the current code reform programme explicitly addresses streamlining their consultation processes.

## BENEFITS

- **Acceleration of Action:** Speed up the policy making and implementation process.
- **Address Breaks on Change:** Reduce the potential to hold back change.
- **Rationalise the number of lobbying voices:** Drive the sector to come to consolidated rather than siloed positions.
- **Customer Centric:** Ensure that the sector focuses on those that it provides a service to – the customers – domestic, commercial and industrial.

# Operational efficiencies



## Should we put flexibility first?

### Conservative estimates of £7-8bn per annum cost reduction

**PROBLEM**

Flexibility is acknowledged as important but still lives in a silo regarded as an added extra, rather than as default. Flexibility is not a nice to have but essential for an efficient and productive system. By 2035 FES states that we will need between 20-30GW of flexibility – apparently this is being uplifted in the next FES.

Flexibility can be delivered throughout the system from large storage through to demand shifts. While there has been a lot of progress on grid scale flexibility assets there has been much less focus on demand side flexibility. Numerous innovation projects have proven the potential of flexibility however the sector is still lacking in confidence of its role.

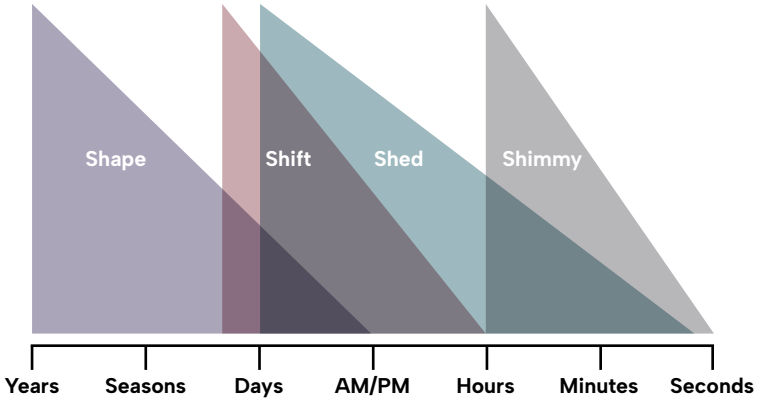
By 2035 the number of EV cars on the system will require the equivalent of 3 nuclear power stations – either we will have to build this level of capacity, or they can become part of the system design both playing a part in storage and flexibility. Those customers providing flexibility are not fully rewarded for their actions – see ReCosting Energy.

Flexibility also comes in different forms and currently the flexibility market is seen as being a just in time "shimmy" action; however it should be broadened to be seen as a wider system optimisation process with customers being able to provide a much wider range of services to the energy sector. In addition, and worryingly, flexibility markets are being designed without the adequate input or co-design with the customers who will deliver the flexibility. The US are developing more sophisticated approaches to flexibility as seen here https://www.utilitydive.com/news/shape-shimmy-shed-renewables-are-revamping-drs-future-value-in-californ/435215/

**OPPORTUNITY**

It was calculated in 2015 that there would be £7-8 bn of cost reduction through deep flexibility and this opportunity has grown considerably. Well designed markets and contracts would deliver for customers – both domestic and C&I - real benefits through participating, with too many of them currently being excluded from badly and not customer centric designed markets.

New technologies and new business models would significantly increase the uptake of flexibility of all sorts so the markets need to be designed around customers needs and constraints rather than designed around the energy system. In addition, culture change is required to encourage much greater use of flexibility to reduce the exposure to fossil fuel balancing options.




https://eta.lbl.gov/sites/default/files/seminars/

## ACTIONS

- All actors should be able to participate in flexibility markets opening up the Balancing and Capacity markets to domestic flexibility.
- The IT infrastructure that enables participation in balancing markets needs customer-centric re-development.
- To prioritise flexibility opportunities for customers and assets, flexibility should be extracted from the lengthy REMA process and implemented now.
- Require NESO / DSOs to develop flexibility markets that reflect the value and capabilities of those that can provide flexibility – be customer centric and rewarded for whole system value.
- Require an assessment of different types of flexibility – shape, shift, shed and shimmy as part of the market / contractual menu of options as 20-30GW will be impossible to manage through just in day flexibility markets.
- Mandate that all assets on the system are digitally enabled and have optionality to engage with flexibility propositions.
- Ask Ofgem to mandate NESO and DSOs to report on why flexibility options were not used in balancing the system rather than carbon based options.
- Drive the sector to work to predictive rather than deterministic outcomes through deep digitalisation.
- Review the role of PAS 1878 and PAS 1879 and question their suitability for delivering needed outcomes, making updates as required. Accelerate their adoption as modified.

## BENEFITS

- **Customer Benefits:**
  Customers both domestic and C&I can benefit from participating in the system.
- **Cost Reduction:**
  Flexibility services reduces whole system costs, and reduces carbon significantly.
- **Balancing Costs:**
  Cost of balancing will be significantly reduced.
- **Capacity Unlocked:**
  The increase in supply and networks required if flexibility assets are not utilised effectively will increase the cost of transformation significantly.
- **New Business Opportunities:**
  Creates new business opportunities for innovators and allows customers to become active participants in the system.
- **Pivotal Role:**
  This is a crucial new actor within the sector and will, if properly incentivised, make a significant contribution to the transformation.

## CONSIDERATIONS

- Greater clarity of roles and responsibilities throughout the sector needs to include primacy of the deployment of flexibility interventions.

# Operational efficiencies



## Is it time to review network operating standards & deploy higher efficiency technologies?

### Increase network utilisation and increase resilience

**PROBLEM**

Electricity networks (DNOs and TOs) operate on standards many of which are at least 30 years old, do not address or apply digitalisation and do not reflect the new system design required for decarbonisation. The tolerance levels of capacity have not been reviewed for over 20 years.

Operating norms are static; benefits could be achieved if they were more dynamic.. For example, using sensors to monitor the condition of overhead cables allows more electricity to be carried than simply relying on standard assumptions that cater for a range of weather conditions. Dynamic line rating technology is proven and should be rolled out.

Network design for the local network (230V) provides for a design range for voltage levels between–6% and + 10%. The higher voltage network (at 11kV and above) is designed with its own parameters of -6% and +6%. The two systems are designed independently. It should be possible to optimise the design across the voltage levels thereby gaining the benefit of diversity – saving capital and permitting extra demand or generation on the final system.

Networks need to show to the regulator that they are employing the most efficient technologies – and the regulator needs to assess these against efficiencies of the whole system not just within the regulated networks themselves. There are many territories not least the USA that are adopting best in class efficiency technology, such as equipment to control line flows, novel cable technologies, advanced voltage control solutions and equipment to safely connect distributed generators are not always utilized the UK. Current industry approaches and continued reliance on legacy design standards is holding back the connection of generation and acting as a barrier to economic development.

## OPPORTUNITY

Through digitalisation and increasing data collection and the implementation of the Standards Review, the use of more sophisticated tools and technologies will provide the opportunity to use dynamic operability parameters in real time, driving greater efficiencies and resilience across the system. These approaches are particularly lacking across DNOs and the new DSO function will have to adopt new approaches to network management, dynamic operations which will allow for greater flexibility on the system and more customer focused connections regimes.

Growth in renewable, asynchronous generation brings the opportunity to reconsider the approaches and parameters used in system operation. Today system services are being used to replace the dynamic behaviours synchronous generators provide. A net zero system provides an opportunity to reconsider the technical parameters considered within system operation, e.g. the relaxation of frequency standards.

## ACTIONS

- Commission a review of network headroom to deliver a consolidated, consistent view of unused capacity in the system that could be used to enable flexibility, increased connections and greater overall capacity without compromising system resilience.
- Accelerate implementation of relevant recommendations made by the Electricity Network Commissioner as provided in the response by Government (Electricity Networks Commissioner Report and Transmission Acceleration Action Plan).
- Task Ofgem to drive DNOs to adopt some of the dynamic system management approaches in place throughout the transmission system.
- Review and progress operability opportunities identified by Energy Systems Catapult and others (A Zero Carbon Energy System: The Operability Challenge – Energy Systems Catapult).
- Embed into RIIO2, through a reopener, dynamic line rating across all transmission networks and that T3 and ED3 require the most efficient system design and adopting best in class technologies drawing from the experience and insights from other markets eg: advanced conductor technology. Siemens have done a review of dynamic line rating and stated that they could improve capacity by up to 30%.

## BENEFITS

- **Efficiency and Capacity Unlocked:** Significant efficiency improvements across the whole system through adoption of best technology for transmission and distribution network design with US reports highlighting 7–12% productivity gains.
- **Standardisation:** Alignment of different network designs could deliver significant efficiencies.

## CONSIDERATIONS

- There is an argument that there will be less resilience in the system if you reduce the tolerance levels. As these standards were developed 30–40 years ago there has to be some efficiency improvement with the emergence of digitalisation and other markets experiences.
- There are different levels of tolerance to energy resilience across different parts of the economy and all customers do not require the same level of resilience and can have varied contractual relationships to assist with greater whole system efficiencies.

# Operational efficiencies



## Consider optimisation and reduction of voltage for LV networks

Reduce energy consumption by 4% or more

### PROBLEM

The UK operating model uses significantly higher voltage on Low Voltage Networks than other countries and was designed around the incumbent system at privatisation. It has not kept up with current European norms or product standards set by BSI. This has resulted in the vast majority of customers in UK receiving excessive voltage, typically 243V but up to 253V, which is proven to be inefficient and is costing them money. There is also current detriment to customers with solar and batteries that are tripping out due to high voltages. Anecdotal evidence on social media indicates this is a growing problem for consumers and this will only increase.

In addition, with more distributed assets, voltage management has become much more complex and the current standards and operating procedures are out of date.

### OPPORTUNITY

By reducing the operating voltage requirements and allowing networks to much more dynamically optimise voltage depending on time of day, consumption patterns and distributed assets on the system, they can very quickly save up to 4% of energy consumption, and more in the mid to long term. With better data (including voltage data from smart meters) networks can be much smarter in the way that they manage voltage.

Voltage reduction is an extremely easy win and can be achieved in two stages.

- Deliver savings by driving more dynamic management and optimisation across a wider voltage range through updated regulation from 2025–2028 and beyond building on the current large scale pilots being carried out by DNOs.
- Deliver up to 4% savings, by reducing the operating requirements through regulation.

### ACTIONS

- Conclude the slow moving DESNZ review of UK voltage operating limits.
- Immediately reduce the lower allowed voltage limit to 207V and require that distribution network operators reduce the standard voltage provided to the Low Voltage Network on an explain or comply basis – within 12 months.
- In ED3 require the networks to install the equipment needed to apply intelligent, optimised voltage as demonstrated in recent trials (e.g. Boston Spa Energy Efficiency Trial) – with early action funded by reopener in RIIO ED2.

### BENEFITS

- **Immediate Cost Reduction:** Delivers up to 4% reduction in total electricity consumption.
- **Customer Benefits:** Reduces customer bills by around £770m per annum. This is based on the findings of previous industry/BEIS evaluations as well as assessments by Northern Power Grid who are running a pilot in Boston Spa.
- **Business Profitability:** Will not only benefit households, but will also have a big impact on the industrial and commercial sectors (including small and medium enterprises) making them more profitable and productive.
- **Carbon Reduction:** Reduces GHG by 1.4m tonnes per annum.
- **System Benefits:** Accelerates readiness to deliver a zero-carbon electricity system.

# Operational efficiencies



## Are we moving fast enough on the connection regime and introducing variations to connection contracts?

### PROBLEM

The constraints on new connections is becoming one of the biggest barriers to decarbonisation – both for the energy sector but also for industry's ambition to decarbonise.

There is potentially significant existing connection capacity that is not being fully utilised. There are several reasons for this. This is particularly the case with CCGTs who only produce between 15-20% of the time. Many of these generators are keen to share their connections either with renewable assets or demand side customers. This is not currently possible.

In addition the sector is far too focused on its own needs and does not address the needs and investment loss from the restrictions in connections from industry and commercial investors. If an industrial or commercial customer wants to self-generate for their own use but still be connected to the grid for additional top up supply, the whole of their generation, despite 80% being self-generated, is considered as the capacity of the connection required.

Some of the barriers to this arise because of the lack of dynamic system management at the LV networks which should be addressed by greater digitalisation of the system. This is driving some industrials to come off grid and be totally self-sufficient.

The design system – SQSS – needs to be upgraded and modernised reflecting digitalisation. With greater digitalisation of the system more flexibility and dynamic utilisation of the capacity on the system can be delivered on both the demand and supply sides.

### ACTION

- Examine where the barriers to consortium connections lie and examine changes to connection rules to allow for greater co-location of assets on underutilised connections.
- Revise connection contracts with customers to specify what is the real connection requirement and do not include their whole energy requirements as the capacity required for the connection.
- Encourage more flexibile and variable connection contracts using digital technologies to automatically control the customer generation or consumption to ensure the electricity grid remains within safe operating limits. Such solutions are well proven but relatively few grid areas have this Active Network Management solution applied.
- Sharing and trading of connections – enable for inter-company agreements to share connections self managing the access to the system and load.
- Connections incentives within RIIO3 – best in class standards.

### BENEFITS

- **Increased Connections:** Unlocking significant connection capacity with co-location of assets.
- **Faster Deployment of Decentralised Assets:** the queue of renewable assets reduced.
- **Business Investment and Decarbonisation:** Increase ability for industrials to get connections that truly reflect their utilisation of the connections with more and more self-generating.

# Operational efficiencies

Flexibility first | Operational methodologies | Voltage optimisation | Connection regime | **Smart meter roll out** £3bn of value

## Can we accelerate the smart meter roll out?

### PROBLEM

We are struggling to get smart meters rolled out. There are some technical difficulties still to be overcome in certain geographies and home settings. The technology has been so overengineered that we are currently creating more barriers to simpler and more effective "digitalisation" of the in-home meter. The benefits of digital metering to system optimisation and customer experience is significant but with the current approach roll out is estimated to take 10 years.

While the delivery system was fundamentally flawed not being more efficiently delivered through networks, there is a need to accelerate the delivery programme and to build confidence in it. Those customers that don't have smart meters will also face detriment unable to access new services and tariffs which would benefit them and reduce their bills.

### OPPORTUNITY

We must drive forward digitalisation faster than the current smart meter roll out can achieve. In addition to unlock real value and system optimisation we must open up smart meter data to deliver greater value to the consumers and more efficient system management.

The original (2012) smart meter IA showed £3bn of benefits of which 70% were primarily about individual energy saving and that the rollout was optional. It is now clear that smart meter data is crucial to managing the system efficiently (eg £1.2 – 3.6 bn of benefits from market wide half hourly settlement ) and should move to being mandated or more strongly incentivised.

### ACTION

- Create a "Task and Finish" group to report back within 3 months on what can be done in a timely way to get the programme back on track.
- Unlock smart meter data according to the recommendations made by the Public Interest Advisory Group (PIAG) with Ofgem driving Data Best Practice to other licensees beyond energy networks and reviewing the restrictions on networks access to data.
- Examine cheaper options, such as for wider roll out of digital self-install snap on readers.
- Consider giving the residual roll out of smart meters to networks to enable a street by street mop-up and consider putting it on their RAB.
- Make getting a smart meter a requirement to access grants eg heat pump subsidies.
- Mandate landlords to install smart meters.
- Stop rolling out gas smart meters which will significantly reduce the complexity of the programme with limited value gained.

### BENEFITS

- **Accelerate Consumer Digitalisation:** Smartening current meters will deliver significant benefits to customers, suppliers and the system.
- **Whole System Cost Reductions:** Smart meters more widely deployed will significantly reduce whole system costs.
- **Consumer Control:** It will reduce costs to consumers while optimising the system more effectively and unlocking greater flexibility options.
- **Consumer Choice:** Consumers will have more power within the market to find the tariff and provider that meets their needs.

# Waste reduction

**Network losses**
3–4% savings

**Methane reduction**

**Innovation impact**

## Can we reduce losses on the electricity system?

### PROBLEM

Around 10% of the electrical energy that we generate is lost in the form of heat as it travels across the electricity network (around 7% at distribution and 2.5% transmission) – with perhaps double that rate at peak times. While it is not possible to reduce these to zero, losses, as part of the RIIO regulatory framework, have been downgraded from a target (with a financial incentive) to a reputational issue. The greening of the grid means losses will cease to count towards the networks' carbon emissions but they remain a crucial system efficiency issue. With higher losses more system capacity is needed and with the increase in electricity consumption as part of the transition, these will rise to significant sums.

Increased utilisation of the network will further increase losses (which increase with the square of current) – in particular at the LV level and at peak times (when losses can be perhaps twice the rate). Use of low loss equipment, alongside smarter network build and operation decisions, including voltage management, would enable this increase to be kept to a minimum and potentially allow losses to be reduced.

### OPPORTUNITY

Losses should be considered as important within the design of the system.

While some network developments and interventions might result in higher losses, there must be a focus on how this waste can be addressed alongside these changes to system operation. It should also be noted that having more distributed assets on the system would help reduce losses if it meant that power was travelling shorter distances over the network.

Historically there have been problems measuring losses but digitalisation and network monitoring should allow a step change in our understanding and control of losses.

### ACTION

- Reinstate incentives on network losses as part of the RIIO3 targets.
- Mandate all network companies to produce losses-inclusive design evaluations.
- Require Distribution Network Operators (DNO) to model, understand and publish data on network losses, using digitalisation and network monitoring to reveal location and magnitude of losses.
- Require Ofgem to have a duty to minimise losses to a level that is economically optimised. Other countries regulators have similar duties.
- Consider who owns losses – currently losses are paid for by all consumers through energy bills. In some countries the networks are responsible for their losses rather than them being socialised.
- Clarify responsibilities at transmission between the Transmission Owners and the National Energy System Operator.
- Properly cost losses as part of whole system planning and in network charging decisions.

### BENEFITS

- **Whole System Cost Reduction:**
  A whole system saving of 3-4% between now and 2030 would seem an achievable goal against a counterfactual of rising losses.
- **Carbon Reduction:**
  Carbon reductions – in particular as losses are highest at peak when carbon intensity is highest.

# Waste reduction

Network losses | **Methane reduction** | Innovation impact

## Should we not focus on Methane Reduction and Gas Network Efficiency?

### PROBLEM

Gas networks are currently constructed in a way that means there is a level of methane leakage which adds to customer bills and greenhouse gas emissions as well as being a safety issue. Currently, levels of leakage are modelled based on decades-old data from a sample of sites and networks have to carry out blanket replacement of aging pipes rather than focussing on those that are particularly leaky. There is no programme for tackling leakage at above ground installations on the distribution networks because it is not included in the model.

As well as leakage being wasteful, methane is a greenhouse gas with about 84 times the greenhouse impact of carbon dioxide over a 20-year period, so minimising leakage is critical to climate change mitigation as well. Moreover, because methane is a short-lived gas, reducing methane emissions has the potential to reduce the stock of emissions in the atmosphere and hence could contribute to the reversal of temperature increases that otherwise risk creating irreversible climate tipping points.

While the gas networks have some (very limited) incentives to reduce methane and are funded for their blanket mains replacement programmes, they do not have up to date detection equipment and measurements cannot be taken into account in the model.

The scale of transformation required in electricity means it tends to attract more focus, but the gas networks will be operational for decades to come and efficiency will become all the more important as gas demand falls. Gas networks have also been slower to digitalise.

### OPPORTUNITY

Improved monitoring and detection combined with data analytics could allow methane management to be done in a smarter way.

Other opportunities in the gas sector include the use of smarter pressure management which could allow more biomethane to be injected (which currently is constrained off at times when demand and hence pressure is low). As the Public Interest Advisory Group (PIAG) highlighted, better gas demand data is also needed to inform thinking on heat decarbonisation and, ultimately, network decommissioning.

### ACTIONS

- Through RIIO3 Ofgem should be driving the companies to improve their leak detection using the latest monitoring equipment and data analytics with incentives to reduce actual leakage levels.

### BENEFITS

- **Methane Reduction:** Valuable methane leakage reduction reducing bills and greenhouse gas emissions.
- **Cost Reduction:** Avoid the costs of blanket rollout of mains replacement, instead targeting where the most benefit can be achieved.

# Waste reduction

Network losses | Methane reduction | Innovation impact

## Can we turn more innovation into business as usual?

Investment in innovation in the energy sector has been £ ½ billion over 5 years.

### PROBLEM

Innovation is languishing on the shelf and many excellent innovations have not become Business as Usual which has both wasted the Ofgem and Innovate UK investments but also hasn't adequately helped to transform the sector. In particular a number of the topics raised in this report on voltage management, losses, methane leakage detection have been the subject of numerous innovation projects but are still not being addressed.

There are projects that were completed 8 years ago that haven't become business as usual and similar projects are being commissioned today to prove the same point. There is a reluctance and deep caution from the sector also in taking any "innovation" project to BAU as innovation is considered as risky or is difficult to integrate into legacy operating regimes. There is therefore a culture of "Pilotitis" that needs to be addressed.

There are new methodologies for network efficiencies and optimisation across both transmission and distribution in other countries that are not being adopted including the USA, Australia and India.

### OPPORTUNITY

We have some of the best innovators and with ideas that will accelerate the transition at less cost and with wider economic and growth potential. This can and should be realised and unlocked.

### ACTIONS

- Ministers require from Ofgem, the NIA and NIC and the SIF processes a review of the last 5 years of pilots that have been successful and delivered efficiencies with recommendation of how these could become BAU either as reopeners or within RIIO3.
- SIF process must require from the energy company timeframes on how the innovation would migrate to business as usual if the outcomes were as proposed.
- Ofgem should commit to funding the rollout at scale of successful projects through an Innovation Rollout Mechanism.
- UKRI needs to be more transparent with the data that emerges from the innovations.
- Minister should commission an assessment from Ofgem about the new approaches to network build globally that would increase productivity, connections and optimisation. These would include grid-forming technologies, reconductoring networks or dynamic line rating, superconducting cables, use of DC, deployment of storage and application of digitalisation including Artificial Intelligence to enhance operations.

### BENEFITS

- **More Innovation Driving greater efficiencies:** A faster deployment of great innovations into the sector – improving efficiencies and productivity with a system fit for the future.
- **Better Use of the Innovation Budget:** Less wasted effort, opportunity and funding within the innovation budget.
- **New Technology Companies:** More exciting companies coming forward and building sustainable companies.

# Meet the authors

This report has been prepared by a wide range of experts who all have whole systems experience but also bring very specific levels of expertise and are highly regarded in the sector. We have also had experts advice from Keith & Bridget Jackson on the voltage reduction recommendation.

## Eric Brown

Eric is an independent consultant in energy systems, working through his company Grid Scientific Limited. In his work he focusses on delivering projects and initiatives that address the challenges and opportunities of energy system transformation in pursuit of Net Zero. He is also Professor of Practice in Energy Systems at the University of Strathclyde. He is the former Chief Technology Officer at the Energy Systems Catapult, having been part of the team that established the organisation. He remains engaged with the Catapult as Executive Adviser. He became involved in the energy sector after having gained many years' experience in the telecommunications industry.

## Maxine Frerk

Maxine is a consultant and thought leader with a strong background in energy regulation. She spent fifteen years in a range of roles at the energy regulator Ofgem, including as Senior Partner for Networks and a member of the executive board, leading the RIIO ED1 price control. Prior to joining Ofgem she was Head of Regulation at BT.

She now has a portfolio of non exec and advisory roles including as an independent director for SSEN Distribution (electricity network), chair of the Independent Stakeholder Group for SGN (gas network), board member of Smart Energy GB (smart metering communications) and of Low Carbon Hub Oxford (a community energy company). She is an Associate with the charity Sustainability First (focussed on social and environmental issues in utility regulation), a member of Ofgem's Strategic Innovation Fund Advisory Group and a regular contributor to Utility Week.

## Roger Hey

Roger is a Chartered Electrical Engineer with over 30 years experience in the Energy Sector He has held many senior leadership roles across engineering and digital domains and led the research, demonstration and deployment of smart grid techniques with the UK's largest Distribution Network Operator.

Roger now supports clients through the provision of advisory services, helping them realise value and deliver customer propositions. Roger chairs the UK Committee for CIRED, the international community for Distribution Grid professionals and sits on the organisations General Assembly.

He possesses a comprehensive understanding of the energy sector and the potential for digitalisation to assist with the decarbonisation of heat and transport for homes and businesses. Roger has extensive knowledge of transport and heat decarbonisation including the development of DSO services, EV charging/V2G and low carbon heat solutions.

## Laura Sandys

Laura Sandys has been working in energy transformation for 20 years and chairs The Green Alliance, The Food Foundation and British Standards Institute Advisory board on Net Zero. She is an advisor to the International Energy Agency on smart grids and is on the board of SSE Transmission, Ohme Global, Sero Homes and Highview Power.

She was the Chair of the UK Government's Energy Digitalisation Taskforce and is now working globally to spread best practise of the digitalisation of the energy system. She was also a member of the UK Government's Energy Efficiency Taskforce chairing the domestic efficiency working group.

She co-founder of POWERful Women and was former Deputy Chair of the Food Standards Agency. She chaired the Northern Ireland Energy Strategy Group and is member of the UK Ministerial Council for Carbon Capture and Storage.

## Steven Steer

Steven specialises at developing complex data ecosystems; he works at Zühlke Engineering, was Head of Data for Ofgem and, was a member of the University of Cambridge Energy Policy Research Group. Steven holds a PhD in Nuclear Physics, is a chartered physicist and author of 70+ scientific papers. His contributions to data and digitalisation include:

- Creating Ofgem's standards for Data Best Practice & Digitalisation Strategies.
- Overseeing the Energy Data Taskforce for Ofgem.
- Designing the Energy Digitalisation Taskforce's governance solution.
- Running government's Modernising Energy Data programme.
- Authoring Ofgem's first digitalisation strategy & action plan.

## Alan Whitehead

Alan Whithead served as the Labour MP for Southampton Test from 1997 until stepping down ahead of this summer's election. He held a number of shadow roles, and between 2015 and 2024 was the Labour party's spokesperson on energy and climate policy. Prior to his political career, Alan worked for a number of charities. He continues to take an interest in energy and net zero policy, including providing his thoughts for this report.

# UtilityWeek

Utility Week is the UK's unrivalled provider of utility news, insight and impact analysis. It provides a complete understanding of market changes, the impact and steps to take. Its membership empowers utility leaders and their teams to transform with confidence – improving outcomes for stakeholders and customers.

**utilityweek.co.uk**