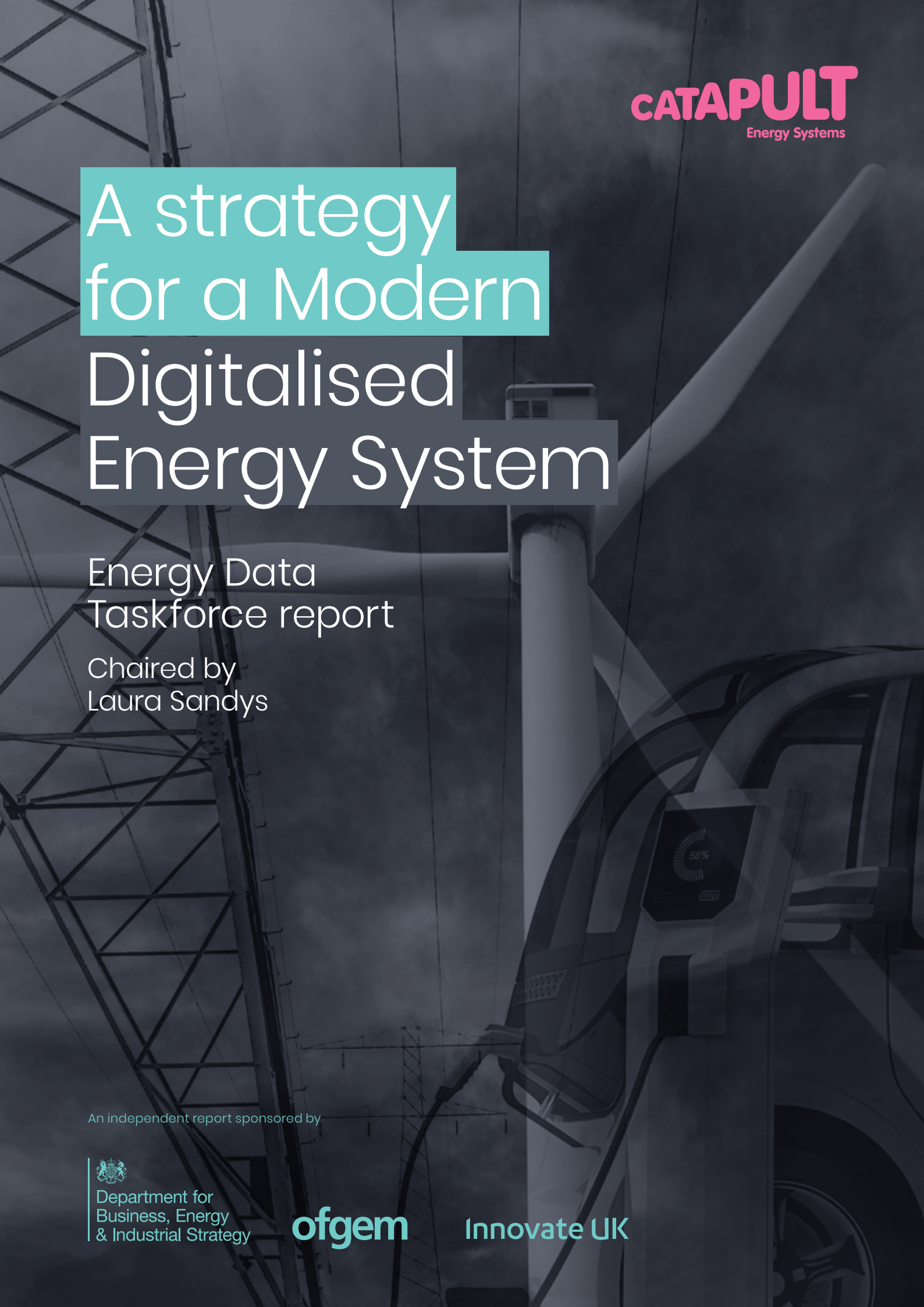


CATAPULT
Energy Systems

# A strategy for a Modern Digitalised Energy System

## Energy Data Taskforce report

Chaired by
Laura Sandys

An independent report sponsored by

Department for Business, Energy & Industrial Strategy

ofgem

Innovate UK

## Purpose, remit and acknowledgements

The Energy Data Taskforce was established to provide Government, Ofgem and Industry with a set of recommendations on how data can assist with unlocking the opportunities provided by a modern, decarbonised and decentralised Energy System at the best value to consumers.

This work is part of the Smart System strategy being developed by Government, is in line with the Industrial Strategy, Clean Growth Strategy, and the Government and Ofgem's Smart Systems & Flexibility Plan. It is also aligned with programmes and initiatives being undertaken or planned by Ofgem, Innovate UK and others across the sector including the range of 'Prospering from the Energy Revolution' projects. In all these strategies and ambitions, data is recognised as crucial to building a smart system that supports achieving decarbonisation objectives and creates significant economic opportunities.

The purpose of the Taskforce also reflects national data strategies beyond energy; these are reflected in the National Infrastructure Commission's report 'Data for the Public Good', multiple Industrial Strategy themes, and the Furman Report on digitalising Government.

In the course of the Taskforce's work it became clear there are a number of fundamental issues which are inhibiting the existence, accessibility and utility of data across the Energy System. These issues have led the Taskforce, in consultation with its sponsors, Government, Ofgem and Innovate UK, to focus on a more holistic set of recommendations than were envisaged in the Taskforce terms of reference. Implementation of these recommendations will not only satisfy the original objectives, but in addition, establish a solid foundation for on-going change and create key Building Blocks that will help accelerate this change.

## Contributors

Laura Sandys, Dr Richard Dobson, Eric Brown, Gordon Graham, Rebecca Lane and Jake Verma.

## Contents



Data is recognised as crucial to building a smart system that supports achieving decarbonisation objectives.

# Foreword

This is a challenging, exciting time to be involved in energy. Our electricity system is undergoing rapid decarbonisation, with just over 50% of all electricity generated over the past two years coming from low carbon sources[1].

Increasingly, energy assets are distributed, with homes and businesses able to generate and store electricity and provide demand response services. Suppliers are offering smart time-of-use tariffs that give consumers greater control of their energy bills. And the electric vehicle revolution will put new demands on our energy networks.

Data is fundamental to the future of our economy, which is why it is the focus of one of the Grand Challenges in our Modern Industrial Strategy. In the power sector, it is the key to unlocking system and consumer benefits and managing the fast-approaching challenges of flexibility, resilience and costs in the most efficient way. Effective storage, sharing and management of data will allow the markets to develop that will put consumers at the heart of this change while allowing networks to support the proliferation of new business models and technologies. Interoperability, the virtue that allows different organisations to share and understand information, is critical too if we are to solve the complex challenges of decarbonising energy, heat and transport.

However, there are barriers in the current energy system to the effective use of data. Lack of common data standards, no openly shared data repository and a culture of data hoarding rather than sharing all impede competition, innovation and ultimately a truly flexible and optimised system. A smart and flexible system can contribute to cumulative savings of up to £40bn by 2050[2] — in order to realise this, we need to act.

In October 2018, as part of Green Great Britain Week and the Smart Systems and Flexibility Plan, my department launched the energy data taskforce, led by Energy Systems Catapult and chaired by Laura Sandys, to investigate how to release the power of data within our energy system. This report provides a suite of recommendations on how to do this and my department will consider them closely, alongside Ofgem and Innovate UK who also funded the taskforce. It is clear to me that this is going to require commitment and effort from not only the Government, but all stakeholders across the energy sector and beyond to bring about the change that the taskforce has articulated in this report.

I want to thank Laura, the taskforce, and the team at Energy Systems Catapult for their hard work, imagination and rigour and I look forward to setting out our initial responses to this important work in the forthcoming Energy White Paper.

**Chris Skidmore, MP**
Energy and Clean Growth Minister

1. Provisional estimate for 2018, BEIS
2. An analysis of electricity flexibility for Great Britain.pdf

# Introduction

"...simply having data is not enough. It needs to be shared across the public and private sectors with the appropriate levels of secure access to enable its value to be fully leveraged for public benefit."

Data for the Public Good (NIC 2017)[1]

The Energy Data Taskforce's aim is to provide a set of recommendations that will support the delivery of a *Modern, Digitalised Energy System* unlocking the benefits of *decarbonisation and decentralisation* through better use of data.

The Taskforce believes that digitalisation releases value, opportunity and resilience, enabling decarbonisation and decentralisation to be delivered at optimal cost for the benefit of consumers.

This report concludes that data and digitalisation, while not the sole enablers of Energy System transition, are essential to unlock the decarbonisation and decentralisation dividends for the benefit of consumers. As the system becomes more disparate, diverse and decentralised, data sharing will be crucial to coordinate the wide range of actors undertaking new roles across the sector and ensure system stability. In addition, greater data openness will provide far superior price and market visibility, increase liquidity and drive investment into the right technologies, locations and solutions for the system, all delivering better system and price outcomes for consumers. [1]

At the core of the Taskforce recommendations are the principles that the sector should be *Digitalising the Energy System* and that in order to maximise value, Energy System Data should be *Presumed Open*. A series of recommendations have been developed which provides core ambitions and key principles, and proposes some first step Building Blocks, that together contribute to the overall strategy for the sector. This report is supported by a series of appendices that provide additional detail and insight into the consultation, research and deliberation which has informed the recommendations.

*A Modern, Digitalised Energy System* should deliver the most productive, efficient and cost-effective use of assets, enable the creation and deployment of the most innovative services, and support participation of all actors, both large and small, through better understanding and insights into the opportunities and risks of the rapidly decarbonising and decentralising system. This will be enabled, and benefits will be unlocked, through more data, easier access to data, much improved analytics, greater interoperability and greater digital capabilities across the energy sector. In the future, we anticipate an energy sector rich with algorithmic balancing, automated asset optimisation, software platforms managing the interactions between multiple actors and truly cross-vector provision of energy. Just as importantly, digitalisation will enable consumers to participate in, benefit from and take more control of energy markets, opening up value they can gain from behind-the-meter assets and services.

1. NIC (2017) Data for the Public Good

Introduction — continued

A digitalisation strategy for the Energy System needs to be 'future fit'. It is not a destination but a journey, and requires nimble, agile approaches to drive forward change, while complementing other economy-wide infrastructure digitalisation projects.

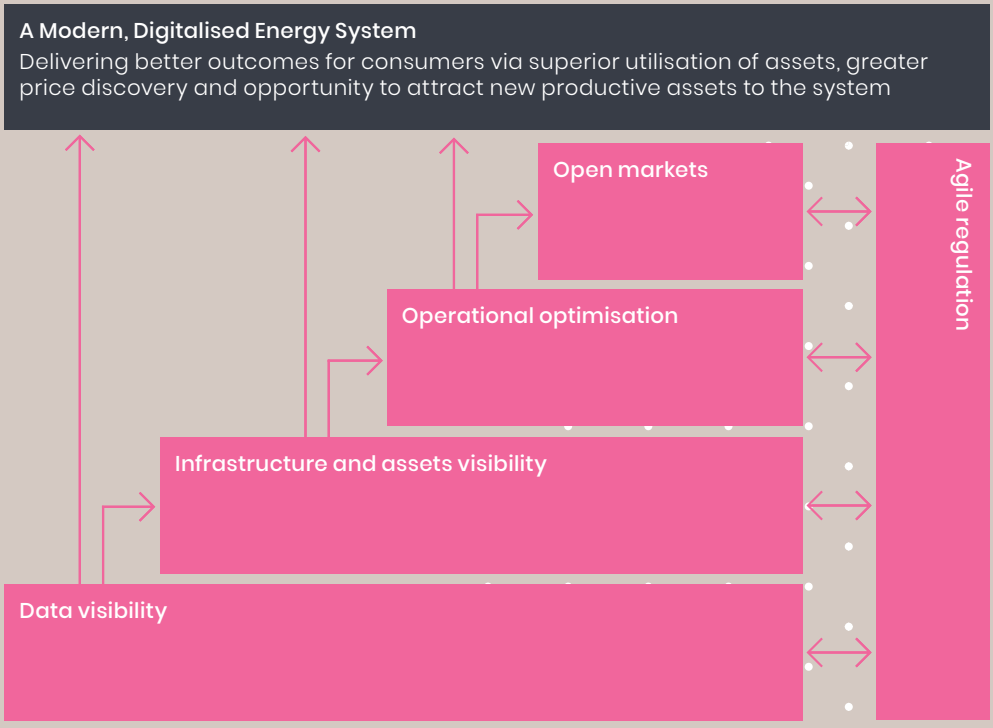
The Taskforce has taken a staged approach to the digitalisation journey with each digitalisation objective building on the previous and informing the next step in the journey. The first two visibility steps will need to be driven and encouraged by regulation while operational optimisation and open markets can be developed from increased access to data.

- **Data Visibility:** Understanding the data that exists, the data that is missing, which datasets are important, and making it easier to access and understand data.
- **Infrastructure and Asset Visibility:** Revealing system assets and infrastructure, where they are located and their capabilities, to inform system planning and management.
- **Operational Optimisation:** Enabling operational data to be layered across the assets to support system optimisation and facilitating multiple actors to participate at all levels across the system.
- **Open Markets:** Achieving much better price discovery, through unlocking new markets, informed by time, location and service value data.
- **Agile Regulation:** Enabling regulators to adopt a much more agile and risk reflective approach to regulation of the sector, by giving them access to more and better data.

Throughout the Taskforce's consultation and engagement, there has been enthusiastic backing for the overarching approach. The sector understands the value of data openness and recognises that significant improvements are needed now to ensure that the system is fit for both today and the future.

"Digitalisation and data are essential to managing the Energy System efficiently and securely through the energy transition. We welcome this industry-wide digitalisation strategy and we look forward to closely supporting it's delivery."

Fintan Slye, Director
National Grid Electricity System Operator



## Taskforce scope and definitions

The Energy Data Taskforce was established to focus on Energy System Data rather than consumer data, which is covered by General Data Protection Regulation (GDPR) and is the subject of many groups' work and research projects.[2]

**Taskforce defines the *Energy System* as:**

→ 'the infrastructure and systems which are used to generate, store, transform, trade, transport or control energy' across electricity and gas.

Whilst much of the value that can be articulated today relates to electricity data, the Taskforce recommendations create requirements and expectations across electricity and gas with applicability to heat, transport and other energy vectors, including through the work of the EV Energy Taskforce for example. Cross-vector data is essential to ensure that truly optimal, whole system solutions can be found.

**The Taskforce considers *Energy System Data* to be:**

→ 'Facts and statistics collected together in an accessible digital format which describe the Energy System and its operation (current, historic and forecast), including: the presence and state of infrastructure, operation of the system, associated market operations, policy and regulation'.

Whilst the remit of the Taskforce is Energy System Data, its findings and outcomes have wider relevance across the energy sector and beyond. The Taskforce has engaged with several economy wide initiatives including the Digital Framework Task Group, Department of Transport, the Geospatial Commission, Ordnance Survey, the Digital Government Service, the Department of Culture, Media and Sprt (DCMS) and Her Majesty's Revenue and Customs (HMRC), contributing to wider cross-Government data and digitalisation strategies.

Finally, energy is devolved to the Northern Ireland Executive and Northern Ireland has its own energy regulator, the Utility Regulator. The Energy Data Taskforce has engaged with representatives from Northern Ireland as many of the recommendations are both relevant and transferrable to the NI energy sector.

2. Smart Meter PIAG (Sustainability First and the Centre for Sustainable Energy), Smart Energy Research Lab (University College London), midata in Energy (Ofgem and BEIS), Ofgem Disengaged Customers Database.

# The challenge

Data has revolutionised the way many sectors operate. From healthcare to finance, data is acting as an enabler for change. The energy sector has been slow to harness the potential that data offers and has, in some ways, been left behind.

The energy sector faces a unique set of challenges which have hindered the progress towards a more digitalised, data rich system:

- **Fragmentation:** It is hard to build a business case for collecting data when costs and benefits are distributed unevenly across many organisations.
- **Power Imbalance:** An inequality of influence exists between incumbents and challengers. Regulated monopoly cooperation is often 'make or break' for innovative technologies and business models.
- **Culture:** Risk aversion tends to create a preference for command and control rather than collaborative, data driven solutions.
- **Skills:** It is hard to get the right combination of data, energy and engineering talent.

In addition, the lack of a sector wide data strategy has resulted in a complex data landscape with many data silos, a plethora of bespoke data agreements and overly complex data processes which underpin the sector's functions. The diagram below, produced as part of the Energy Data Review[3], represents an extract of one description of the energy data landscape and goes some way to illustrate the sheer complexity of the current system.

"Our data indicates that around 40% of total renewable electricity generation is connected to regional Distribution Network Operators (DNOs), rather than directly to the National Grid. As this dataset is not visible to National Grid, this means that there is no comprehensive, national source of generation data for National Grid to perform balancing and planning services."

Electralink[4]

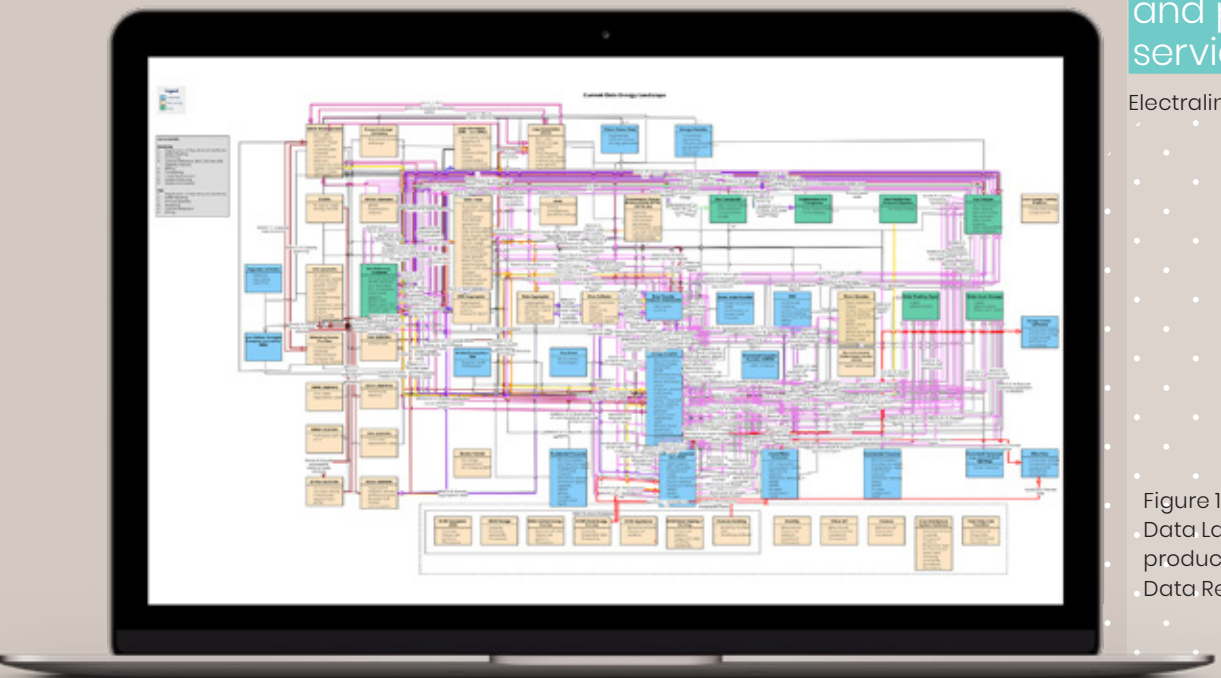


Figure 1: An extract of the Data Landscape Model produced by the Energy Data Review project

There is growing recognition that the current situation is not sustainable. The Taskforce has identified 2 key issues:

## Data gaps

Today, data quality is often poor, information can be inaccurate, imprecise or missing. Data gaps may exist for a number of reasons:

- → It may exist in a non-digital format
- → It may be collected and used for a specific purpose but not stored
- → It may not have been collected

Data gaps restrict the deployment of new operating models, limit innovation and maintain the status quo.

## Extracting value

Organisations who collect and control Energy System Data are not able to extract its full value. The following factors limit the ability of others to extract value:

- → Highly restricted access
- → Poor data discoverability
- → Overly strict terms and conditions
- → Low quality and consistency of data

The value of data is not being maximised: innovation is being stifled, the system is less efficient, and the consumer is worse off.

## The cost of doing nothing

Failure to respond to the challenge of successfully harnessing the potential of data, or delay in doing so, carries significant costs and has substantial implications.

- → **Slower more expensive transformation:** The architecture of the Energy System is becoming more complex, with increasingly diverse technologies and new participants. It is not possible to approach management of this transformed system using current methods. There will be a dependency on effective, efficient and timely exchange of data. Transformation will be excessively costly if data strategies are not deployed in a coordinated, collaborative way to minimise "false starts", duplication of effort, divergent direction and misaligned effort
- → **Fragmented datasets reducing efficiency:** Data is being inconsistently collected, creating unreliable datasets with the potential to cause confusion and inefficiency.[4] Registration of energy assets is a prime example with many registration processes existing to gather similar data which is captured with varying degrees of accuracy. No one dataset is complete, nor are relevant datasets connected in a coherent way that could offer completeness. This creates system operational inefficiencies. An estimated 10% of assets are not visible to the electricity system operator today , this figure will continue to grow.

3. Energy Data Review – Energy Systems Catapult
4. Electralink (n.d.) Embedded Generation Insight
5. ESO estimate corroborated by GreenSync

The challenge — continued

- **Increased risk to system stability:** Without visibility of assets, their operation and how they interact with each other at local and national levels, system stability is more at risk. Transparent actions matched with data modelling and machine learning will greatly improve the operational resilience of the system. This will become an increasingly important issue as we move to having system operation distributed across multiple entities.[6]
- **Commercialisation of Energy System Data:** Companies that own or have access to Energy System Data are already capturing this data for commercial benefit. While data can and should be used to create commercial value, Energy System Data that has value to the wider system and has been generated by monopoly or consumer subsidy should be available for the benefit of the 'system as a whole'.
- **Divergent standards and data management approaches:** Energy System actors are developing standards and approaches that are not coordinated or interoperable — some varying even within companies. Interoperability and common approaches will greatly facilitate the use and value of data to drive collaboration and system optimisation. It is acknowledged that the timing of finalising standards is a key consideration: implemented too soon and innovation can be stifled; implemented too late and the costs of lost investment and delay can be substantial.
- **Reduced innovation:** The low visibility and accessibility of data reduces the ability for innovators, especially SMEs, to break into the energy sector in order to create new products and technologies which can improve consumer experience, drive efficiencies and deliver carbon reductions. The impact of this effect is felt in two ways: in the pace and cost of the Energy System transformation in GB and in the loss of economic opportunities from exporting expertise, technologies and solutions to other parts of the world. Data and AI are a key part of the government's flagship industrial strategy.

6. Current+ (2018) Opening Up Part 2: Energy Networks Association and the Open Networks Project look back at 2018

"Access to data at (the low voltage) level is important... as we see the growth in EVs and potentially electricity for heat... to start understanding the impact (on the system)."

Nigel Turvey
Open Networks Advisory Group

# The opportunity

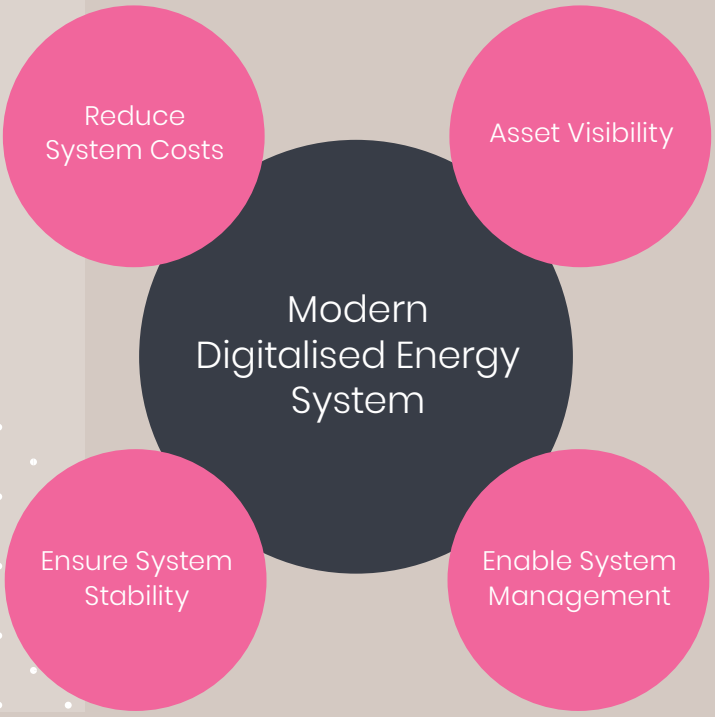
"Data is vital to creating a smarter, cleaner and more flexible Energy System that will unlock a whole range of new benefits for Britain. This report recognises that energy networks are the nerve centre of that system."

David Smith — CEO
Energy Networks

Decarbonisation and decentralisation are transforming the energy sector, offering new opportunities to deliver a more productive, efficient and cost reflective Energy System. This includes the power sector, which increasingly extends into mobility, heat, home services and beyond.

This is a fundamental shift from centralised command and control-based structures, to more interactive behaviours, networked actions, collaborative solutions and layering of interventions. The management of this new system, by multiple actors at different levels, will require the exchange and interoperability of data.

From a consumer's perspective, the transformation of the Energy System will almost certainly cost less and offer better products if we embrace data driven technologies that enable superior price discovery, drive efficiency and create productivity gains. However, the opportunity to deliver decarbonisation at the best cost, promoting the best technologies and interventions, is currently uncertain due to the lack of visibility of the system, the assets and how assets interact with each other.



The opportunity — continued

## The potential of today's system data

Successful transformation of the Energy System will depend on realising the potential of today's system data as well as establishing the foundation for ongoing creation and exploitation of data as the system transforms. More data, greater openness and access to system data will build on the potential of existing data and current practices for the future.

A strong UK energy data strategy will be crucial for the future Energy System and will:

"The growing amount of data... can be used to develop innovative energy management platforms that would... facilitate a shift from the current redundancy-in-asset to intelligent-operation-based delivery of security... ultimately leading to improved system operation and investment performance."

(Strbac et al. 2016)[7]

Deliver Energy System visibility:

- **Visibility of infrastructure and assets:** Increased system visibility will allow for much more granular and accurate assessment of asset location, connection, availability, function and potential interactions. It will also offer greater understanding of infrastructure requirements, operational constraints and investment needs. This will become much more important with the emergence of highly distributed, demand response and behind the meter assets including Electric Vehicles (EVs), Photo-Voltaic (PV) installations and storage.
- **How do our assets perform:** Better data will enable assets to be managed more effectively, faults predicted, maintenance optimised, and lifetime cost minimised. Pooling asset performance data between organisations could create even more efficiencies.

Enable the future of system management:

- **Improving operation of the system:** Sharing asset data will provide greater transparency and increase optionality for system management. This will become increasingly important with practices including layering of interventions needed across distributed assets, collaborating to deliver 'firm' power, managing new energy services and deploying more localised solutions.
- **Optimising operation of the system:** With greater data and information sharing, more predictive and automated approaches to system management will be possible and further productivity and optimisation gains can be realised. It should also allow for new business models for system operation to emerge using AI, machine learning and interoperable operational support systems.
- **Optimising across energy vectors:** Improved visibility across multiple energy vectors will enable 'whole system' optimisation though holistic assessment of available assets, their capabilities and demand profiles. This will enable the sector to better understand the impact of vector shifting solutions.
- **Unlocking the flexibility market:** With visibility of assets, their functionality and availability, the flexibility markets will open to a wider range of assets, business models and competition from small and larger potential actors. This will increase the range of flexibility sources and drive down costs.

Ensure system stability and facilitate risk assessment:

- **Enabling clarity across the multiple actors in the system:** With more visible assets and increased performance and behaviour transparency, multiple actors can coordinate, collaborate and secure system stability via interoperable platforms, driving productivity and efficiency gains. Access to data can also enable new actors such as mobility providers to actively engage with markets.
- **Securing the new Energy System:** New actors are already entering the system and there is little visibility of their actions, their capabilities and the potential risk to system stability. With data transparency and openness, risk can be much better understood and mitigated through coordinated and collaborative actions.
- **Regulatory oversight and risk assessment:** As the system becomes more complex, lack of system visibility poses significant regulatory risk. Data openness will provide the regulator with greater 'symmetry' of information with operators and enable it to build risk assessment tools that it currently doesn't have. In addition, investment decisions by monopoly players can be better assessed for the benefit of all parties.

Reduce full system costs:

- **Optimising procurement and cost reduction:** A greater visibility of infrastructure and assets and their operation both individually and in system context combined with an evidence-based forecast for future demand will provide significant opportunities. It will be possible to more precisely deploy smart technologies and focus the acquisition of new assets based on future needs for a given location and at a particular time.
- **Opening the system to new markets and better price discovery:** With transparency of system asset and operational data, new markets will emerge to drive better price discovery, layering time, location and service values at national and local levels.[9]

"A common (data) framework... is needed to support maximum exploitation of data potential traditional siloes must be broken down and a lack of interoperability must be addressed."

Energy Data Review (Energy Systems Catapult 2018)[8]

7. Strbac et al. (2016) Delivering future-proof energy infrastructure
8. Energy Systems Catapult (2018) Energy Data Review
9. Carbon Trust (2012) Strategic Assessment of the Role and Value of Energy Storage Systems in the UK Low Carbon Energy Future

The opportunity — continued

## The potential of tomorrow's system data

The benefits delivered by opening up today's Energy System Data will be increased substantially by the creativity of new players that will be attracted to the sector. Access to more open data will allow them to shape the transformation of the system and create new benefits for consumers. Developing the digitalisation strategy will start to unlock the potential of future approaches to data and ensure that the Energy System is future fit.

→ **Data visibility creates opportunity for all:** Making data available to new market players, innovators and academics will stimulate new business models, new system management tools and new insights which can drive positive transformation.

→ **AI and Machine Learning:** With data available and common standards in place, the Energy System could be enhanced and evolved in potentially disruptive ways through new technologies and system management approaches further driving productivity and efficiency gains. .

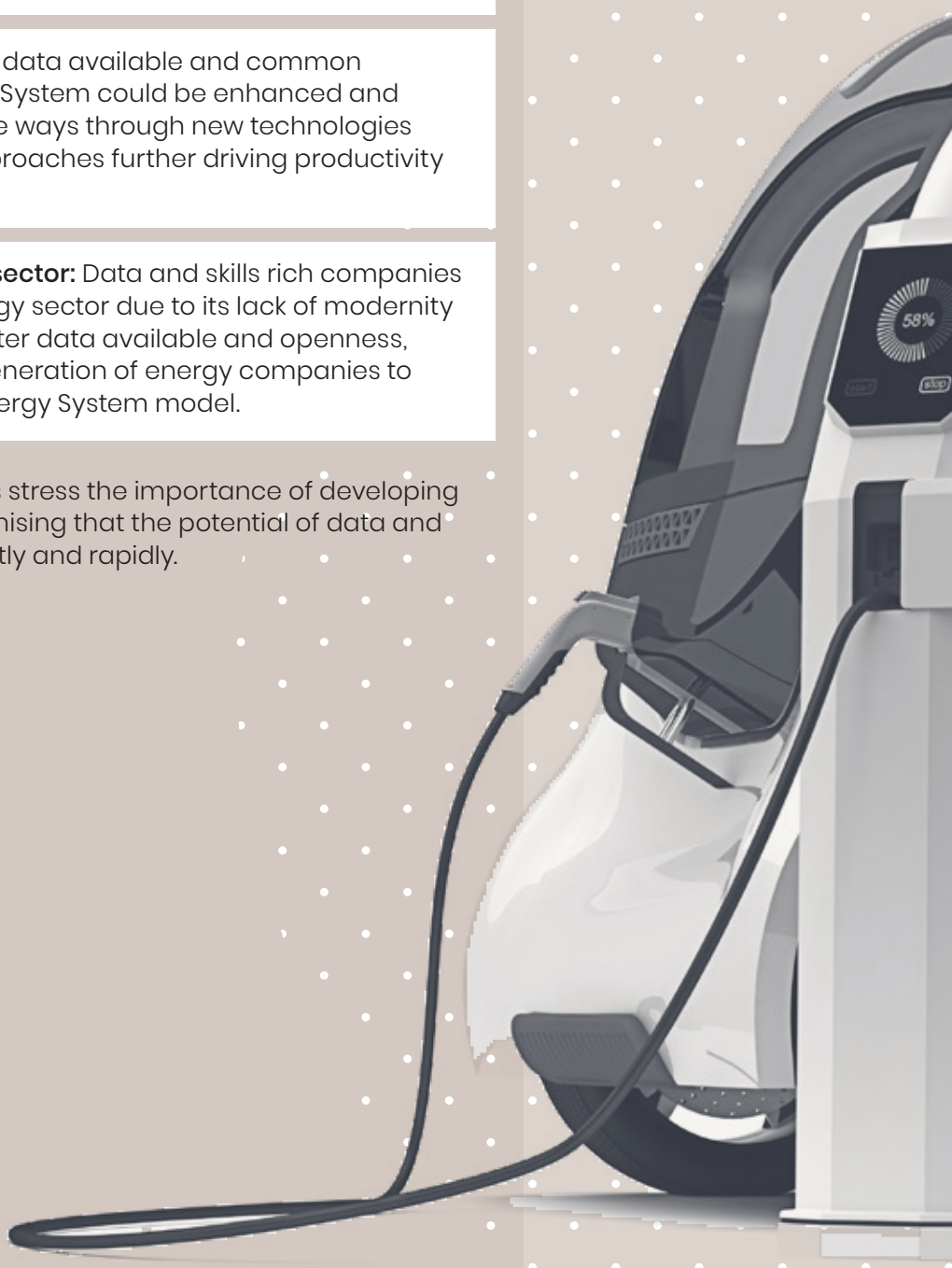
→ **Attracting new players to the sector:** Data and skills rich companies have tended to avoid the energy sector due to its lack of modernity and its opaqueness. With greater data available and openness, the sector will attract a new generation of energy companies to challenge the current 1990s Energy System model.

The Taskforce's recommendations stress the importance of developing solutions that are 'future fit' recognising that the potential of data and digitalisation is evolving significantly and rapidly.

"Net system savings (could) increase radically between 2020 and 2050,... (with) net annual system benefits (of) £0.12bn in 2020, around £2bn in 2030, (and) in 2050 we see an increase to over £10bn per year."

Carbon Trust (2012)[9]

9. Carbon Trust (2012) Strategic Assessment of the Role and Value of Energy Storage Systems in the UK Low Carbon Energy Future



"This report sets out a positive vision for a more transparent and accessible energy system that will benefit market participants and customers alike by enabling decarbonisation and increasing innovation across the system. It is vital we capitalise on the gathering momentum in this area."

Lawrence Slade FEI
Chief Executive, Energy UK

Recommendations

# Delivering a modern, Digitalised Energy System

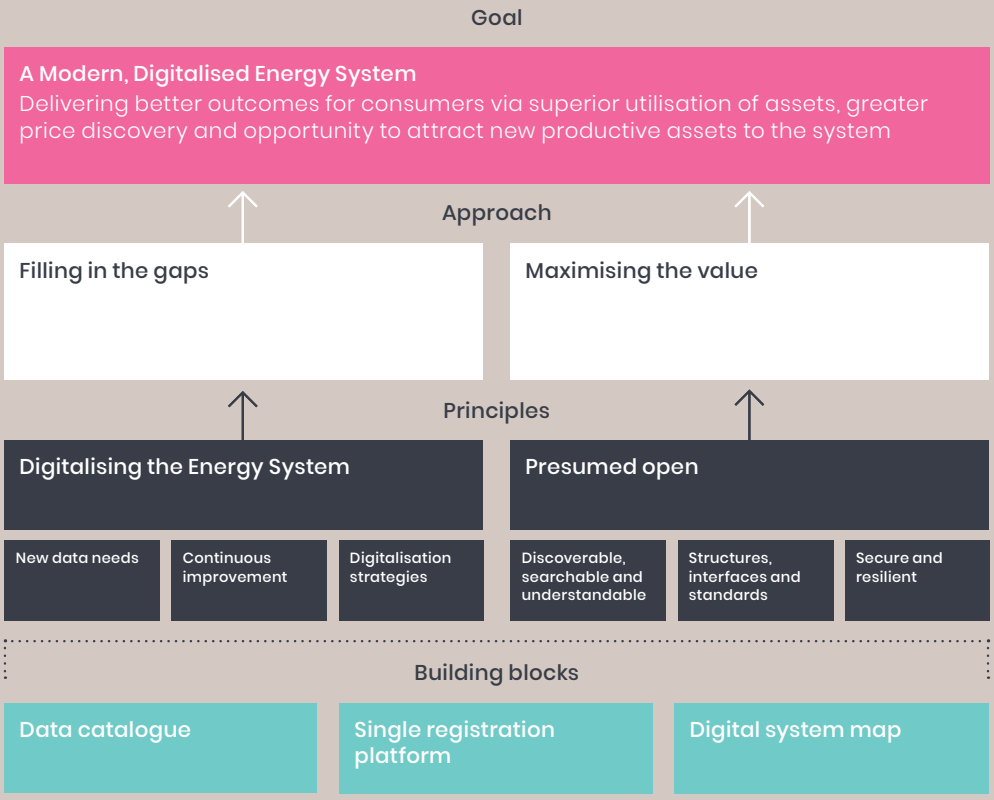
The Energy Data Taskforce has focussed on accelerating the transformation of today's "analogue" system to a *Modern, Digitalised Energy System*. This ambition is addressed through two key approaches: *Filling the Data Gaps* and *Maximising the Value of Data*.

To fill the data gaps, the Taskforce proposes the core principle of *Digitalising the Energy System* which is supported by *New Data Needs*, a process of *Continuous Improvement* and a requirement for organisations to develop and deploy *Digitalisation Strategies*. These principles are enabled through a range of regulatory and policy levers building on existing regulatory frameworks.

To maximise the value of data, the Taskforce proposes the core principle that Energy System Data is *Presumed Open*. To create the maximum impact, open data should be *Discoverable, Searchable, Understandable*, adopt a sensible approach to *Structures, Interfaces and Standards* and ensure that it supports a *Secure and Resilient* Energy System.

The Taskforce also recommends 3 Building Blocks, projects that deliver on the principles, demonstrate commitment and realise early benefits. These projects start to unlock the value of data:

- → The *Data Catalogue* will create visibility of existing and future Energy System Data.
- → The *Asset Registration Strategy* will coordinate new asset registration, improve user experience and ensure that data is captured effectively.
- → The *Digital System Map* of the Energy System will deliver system visibility and start the journey towards a Digital Model.



A digest of recommendations and sector actions is included in *Appendix 1.*

## Recommendation 1
### Digitalisation of the Energy System

Government and Ofgem should direct the sector to adopt the principle of *Digitalisation of the Energy System* in the consumers' interest, using their range of existing legislative and regulatory measures as appropriate, in line with the supporting principles of 'New Data Needs' 'Continuous Improvement' and 'Digitalisation Strategies'.

Page 20 →

## Recommendation 2
### Maximising the Value of Data

Government and Ofgem should direct the sector to adopt the principle that Energy System Data should be *Presumed Open*, using their range of existing legislative and regulatory measures as appropriate, supported by requirements that data is 'Discoverable, Searchable, Understandable', with common 'Structures, Interfaces and Standards' and is 'Secure and Resilient'.

Page 24 →

## Recommendation 3
### Visibility of Data

A *Data Catalogue* should be established to provide visibility through standardised metadata of Energy System Datasets across Government, the regulator and industry. Government and Ofgem should mandate industry participation though regulatory and policy frameworks.

Page 38 →

## Recommendation 4
### Coordination of Asset Registration

An Asset *Registration Strategy* should be established to coordinate registration of energy assets, simplifying the experience for consumers through a user-friendly interface in order to increase registration compliance, improve the reliability of data and improve the efficiency of data collection.

Page 42 →

## Recommendation 5
### Visibility of Infrastructure and Assets

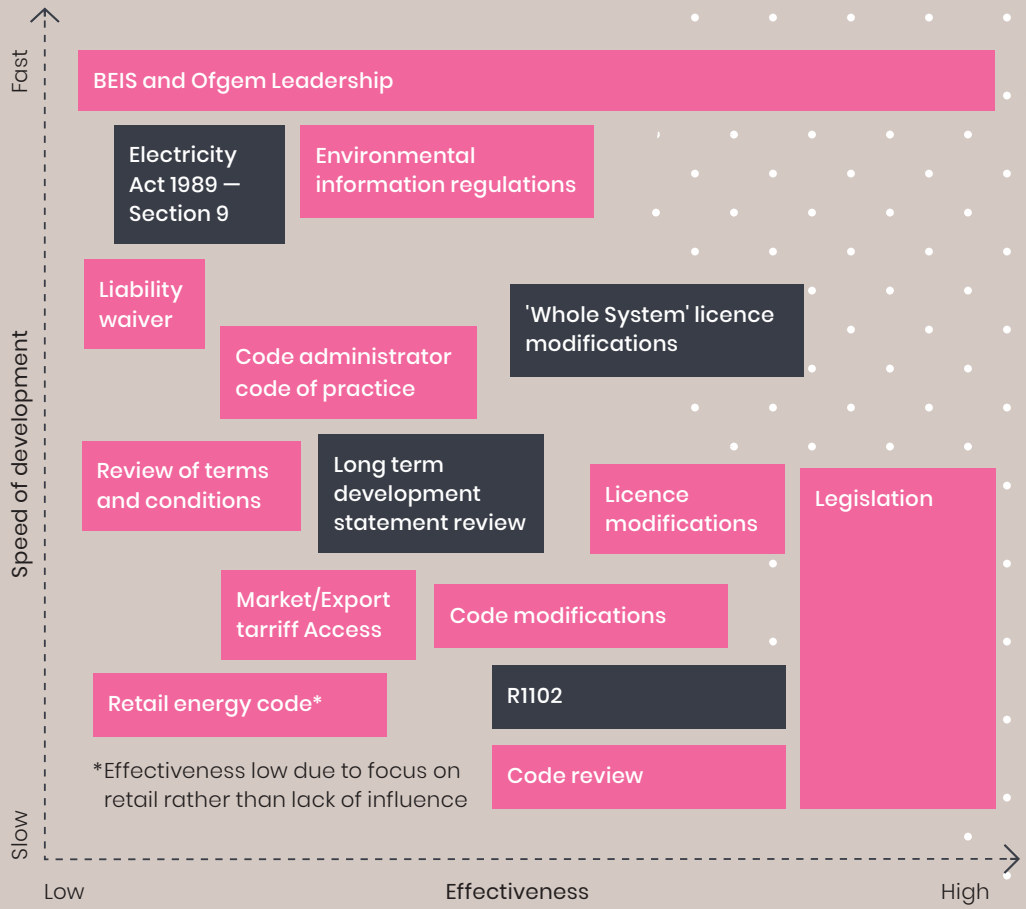
A unified *Digital System Map* of the Energy System should be established to increase visibility of the Energy System infrastructure and assets, enable optimisation of investment and inform the creation of new markets.

Page 46 →

Recommendations: Delivering a Modern, Digitalised Energy System — continued

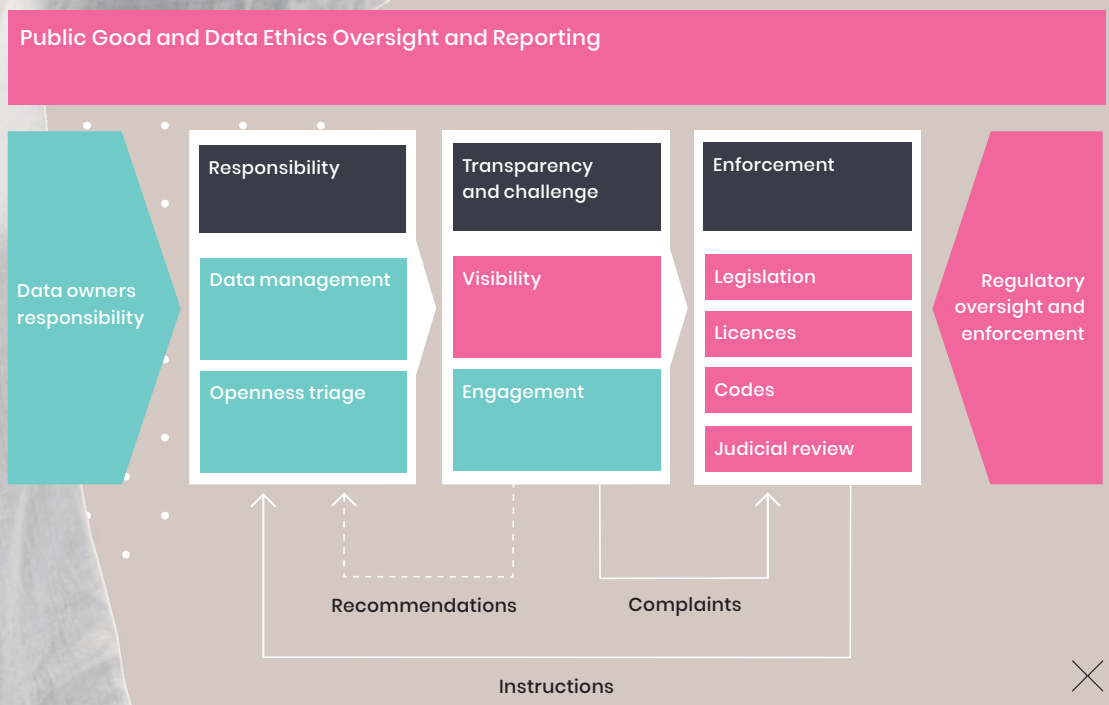
## Policy and regulation measures

The Taskforce has identified several mechanisms that will drive the sector towards greater digitalisation, resisting the creation of any new bodies or additional regulatory measures. Each of these existing levers provide an opportunity for the regulator and Government to embed the recommendations. The mechanisms are described in the Enabling Recommendations section and each recommendation section highlights the measures which are applicable.




## Governance

The Taskforce has developed a governance model that builds on existing responsibility and enforcement measures. We have added a very strong focus on transparency, including an annual report on openness which is informed by evidence of data publishing and demand rather than the regulator's interpretation. Transparency enables challenge which drives change. Enforcement is the last resort in recognition that digitalisation is a journey. The whole process is supported by cross sector data ethics to provide holistic consumer protection.



Recommendation 1

# Digitalisation of the Energy System

Today's Energy System has its roots in the 1900s, and while it has evolved and developed, it remains at heart, an 'analogue' system with some 'digital additions'.

In order to meet the demands of the future it is critically important to *Digitalise the Energy System*, ensuring digital systems and data are available to describe, operate and optimise the system in increasingly complex situations.

A Modern Digitalised Energy System is one where all infrastructure and assets are described by data, where monitoring and analytics work together to provide a detailed view of system state over time and where data is used to optimise operation and drive markets.

The sector has made progress towards digitalisation, but fragmentation, power imbalance, culture and skills have limited the extent. Without external input, the sector is highly unlikely to develop a truly digitalised Energy System which provides the data required to unlock value for consumers.

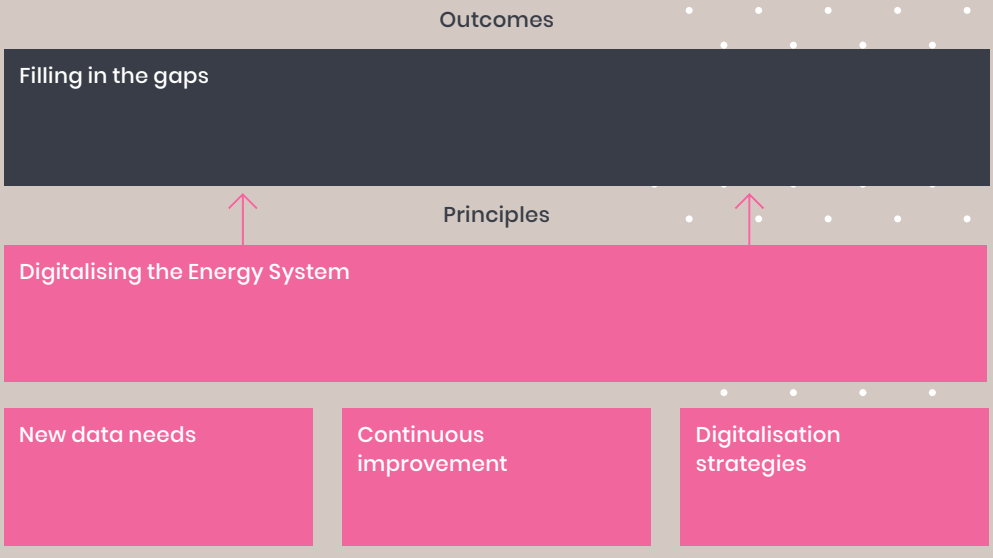
There are three principles underpinning the core principle of Digitalisation of the Energy System: *New Data Needs, Continuous Improvement and Digitalisation Strategies*.

**New data needs:** Building and using data more effectively

→ The future Energy System will require more detailed, accurate and timely data to enable new operational paradigms and business models. Energy infrastructure and assets should be digitally enabled and have data which enables them to be operated efficiently, and their impact evidenced.

### Recommendation 1: Digitalisation of the Energy System

Government and Ofgem should direct the sector to adopt the principle of Digitalisation of the Energy System in the consumers' interest, using their range of existing legislative and regulatory measures as appropriate, in line with the supporting principles of 'New Data Needs', 'Continuous Improvement' and 'Digitalisation Strategies'.



10 DECC (2015) Towards a smart Energy System

The data which exists about today's Energy System is incomplete. In some cases, the information exists but is not available in a usable digital format, such as image-based network maps, control system data (which is not stored), paper records etc. In others cases the information was never recorded or there is no data logging capability, such as technical information not recorded at installation, real time decisions, analogue equipment. *Appendix 5* discusses the new data needed to enable efficient multi actor system operation, including the DSO model. For electricity sector actors aspiring to become DSOs, digitalisation will be mission critical.

*The Taskforce recommends* new data needs should be proactively identified and addressed through a variety of approaches, from installation of new monitoring equipment to the use of data analysis on existing data. The smartest solutions will blend strategic monitoring with data science, analytics and modelling to maximise the value of investment, rather than solely relying on the mass deployment of equipment.

*The Taskforce recommends* that Government and the regulator provide clear leadership through initiatives such as the 'DSO - regulatory principles, priorities and key enablers' workstream. This will be important to give industry the confidence to invest, the motivation to recruit new skills and the freedom to investigate innovative solutions.

**Continuous improvement:** Improving data quality, coverage and skills

→ Energy data owners should be aiming for continuous improvement with regards to their data quality, coverage and skills. There should be sufficient business drivers for this, but regulation may be required.

"Cultural inertia and skills gaps within existing energy companies may be a factor in slowing the uptake of... technologies (to adopt new forms of flexibility)."

(DECC 2015)[10]

Recommendation 1: Digitalisation of the Energy System — continued

Data improvement should be a continual process with organisations aiming to iteratively develop the quality and coverage of their data assets but also improve their data handling and management skills. They should strive to be 'best in class' with regards to their specific sector function and focus on data talent development.

*The Taskforce recommends* that regulation should be used to incentivise continuous improvement where appropriate but recognise that improving data and skills are part of running a modern business and can create organisational benefits.

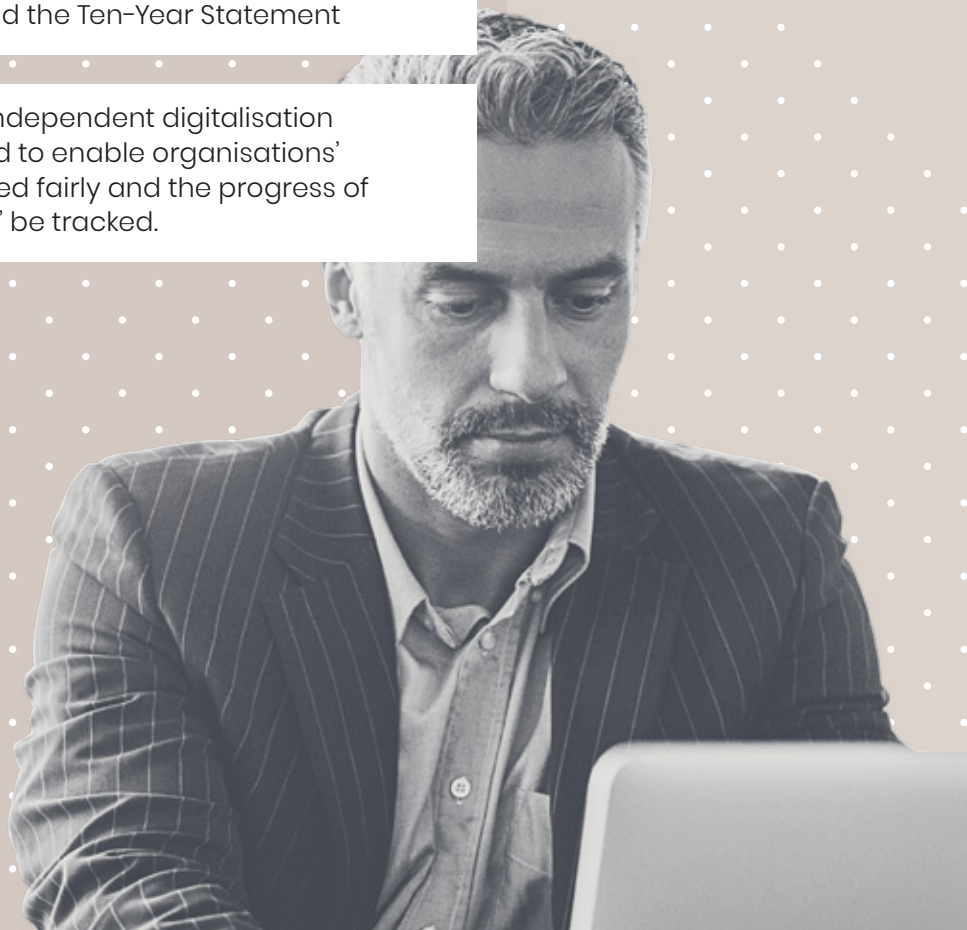
**Digitalisation Strategies:** Coherent plans for digitalisation and data

→ Digitalisation of the Energy System cannot be achieved via regulatory interventions alone. Organisations need to develop long term data strategies and plans for implementation.

It is important that organisations, including Government and the regulator, develop data strategies which identify the objectives, direction and actions required to develop new data, address data gaps and quality issues, and define the organisation's plan for digitalisation. A good digitalisation strategy should consider: a range of digitalisation approaches from monitoring to AI, the interoperability of systems and data, and building the right skill base.

→ **The Taskforce recommends** that baseline expectations of digitalisation strategies are set through measures such as the RIIO2 business planning process, the Whole System Licence, the Long-Term Development Statements (LTDS) and the Ten-Year Statement

→ **The Taskforce recommends** that independent digitalisation strategy assessment be advocated to enable organisations' digital strategies to be benchmarked fairly and the progress of 'Digitalisation of the Energy System' be tracked.

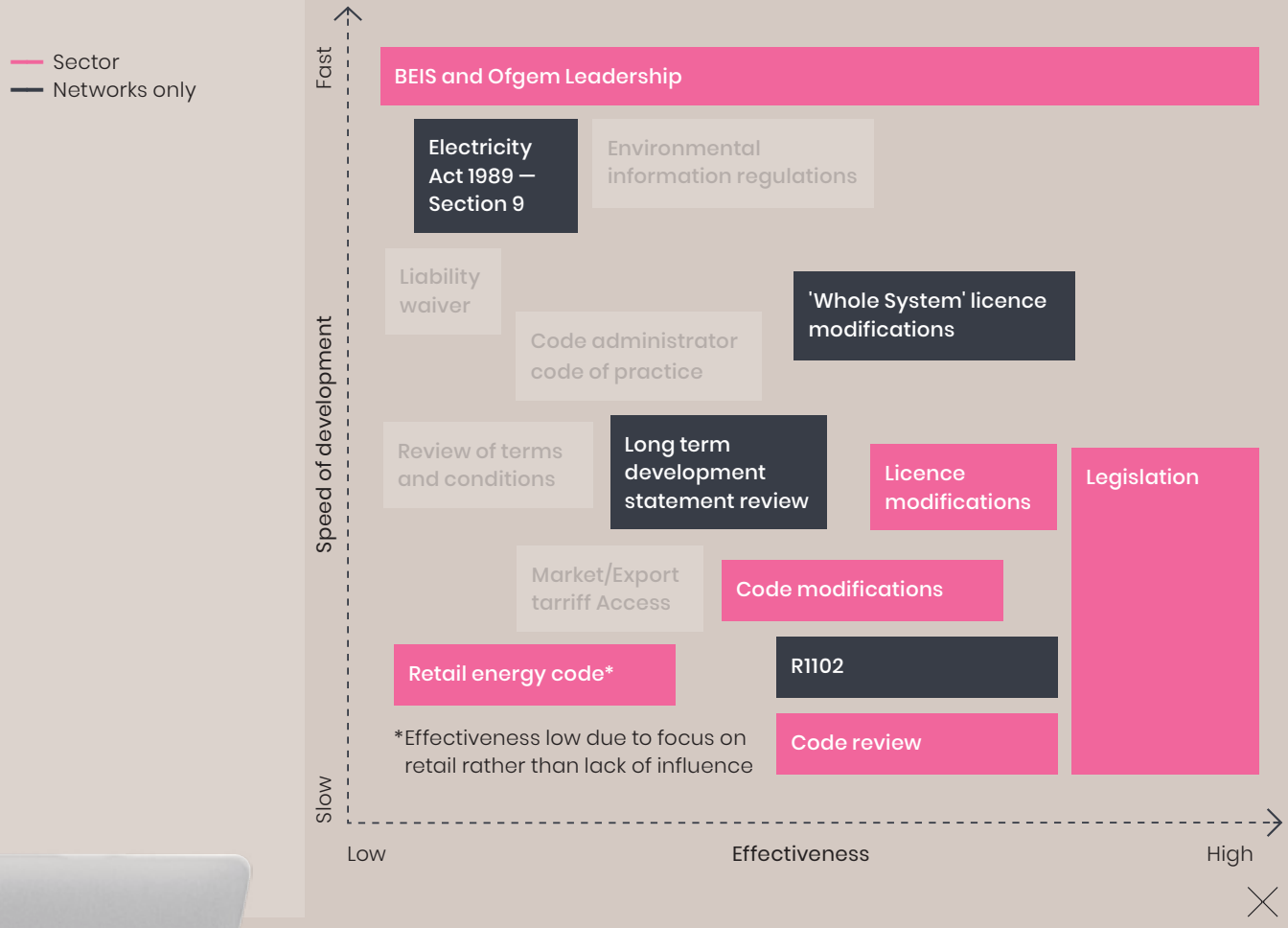


## Future fit

Digitalisation of the Energy Sector is a key enabler for future system operation. Digitalisation will create a greater quality and quantity of data that can inform investment, drive efficiencies and enable innovation to future proof the system.drivers for this, but regulation may be required.

## Enabling recommendations

Adopting the principle of Digitalisation of the Energy System across the sector will require a combination of leadership, legislation and regulation. The diagram below highlights the Enabling Recommendations which could be utilised to implement Recommendation 1: Digitalisation of the Energy System and embed the principle of Digitalisation of the Energy System.



Recommendation 2

# Maximising the value of data

Presumed Open reverses the current default for data accessibility from closed to open. This principle recognises that Energy System Data needs to be managed and that totally open is not always appropriate; however, this principle places the onus on data owners to "start from open" justifying why any restriction might be required.

The principle of Presumed Open should apply fairly and equitably to all parties in the sector including Government, the regulator and industry. The Taskforce has been encouraged by the sector to make a clear proposal that the principle of Presumed Open should be established right across the sector.

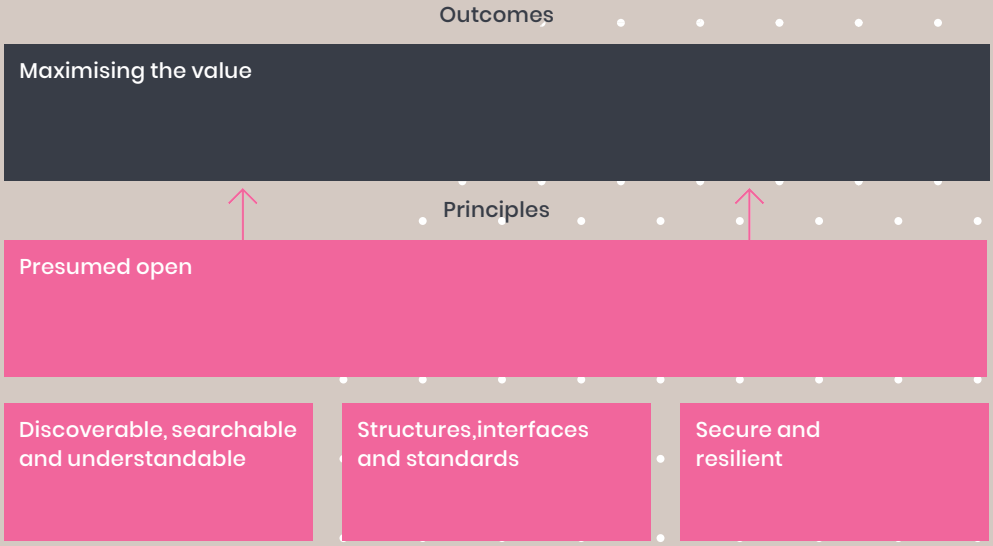
More open data reduces friction across the sector, improving system management, supporting better decision making in asset procurement and deployment, and delivering overall cost efficiencies across the whole system. In addition, open data will create new opportunities including:

- **Innovation:** Reducing barriers to access data will attract innovators who can create operational efficiencies, develop new business models and define new value propositions. Increasing the speed at which new markets can be developed may improve attraction of inward investment due to the improved ability to understand the risks and opportunities up front.
- **Operational Excellence:** Utilising data expertise from all types of organisations should improve decision making at all levels across the system.
- **Transparency:** Better data and the insight that can be generated from it, will enable the regulator and third parties to ensure we are delivering the most robust, clean and efficient Energy System possible. This includes the production of more rigorous energy statistics.[11]

**Recommendation 2: Maximising the value of data**

Government and Ofgem should direct the sector to adopt the principle that Energy System Data should be Presumed Open, using their range of existing legislative and regulatory measures as appropriate, supported by requirements that data is 'Discoverable, Searchable, Understandable', with common 'Structures, Interfaces and Standards' and is 'Secure and Resilient'.

**Figure 0:** Chart title position or identifier



11. EA Technology (2017) Network capacity for charging electric vehicles to be further aided by opening up data from substations

### What is Open Data?

The Open Data Institute's Data Spectrum illustrates different ways in which data can be made available.

- **Open:** Data is made available for all to use, modify and distribute with no restrictions
- **Public:** Data is made publicly available but with some restrictions on usage
- **Shared:** Data is made available to a limited group of participants possibly with some restrictions on usage
- **Closed:** Data is only available within a single organisation

## Adopting Presumed Open

Adopting the principle of Presumed Open will require significant leadership across the sector to drive the culture, policy and regulation changes required to unlock the value of data for the benefit of consumers. While none of the recommendations in this report dilutes or reduces the responsibility of the data owner or data manager to address and manage their current risk assessments, clear guidance which demonstrates the behaviours which are desired will be of great value. The taskforce recognises that not everything will be perfect straight away, but it is imperative that we start this journey.

Open data provides lots of benefits but there are factors which may make open data inappropriate. Issues can occur across privacy, security, consumer impact and commercial domains but these can be mitigated using anonymisation, aggregation, redaction or introduction of noise. If issues cannot be resolved through the above techniques, it may be appropriate to limit rights (public data) or limit access (shared data), such that key parties can safely utilise data to create value.

The Taskforce is recommending 3 key mechanisms by which Presumed Open can be effectively managed by the responsible data manager:

- Data Openness Triage
- Open Data Issue Mitigation
- Governance

### Data Quality and Management

Whilst Presumed Open will create value from existing data it is acknowledged that in many cases data quality may be unacceptably low, particularly with legacy equipment.

Where quality issues are identified, the organisations responsible for data collection and management should put best practice information management processes in place to rectify issues at source.

Recommendation 2: Maximising the value of data — continued

## Data Openness Triage

*The Taskforce recommends* that as part of embedding the principle of Presumed Open, organisations adopt an Openness Triage process which considers a range of risk factors and develops an appropriate range of mitigation mechanisms.

The aim of data openness triage is to systematically find issues which should inhibit open data, identify the 'least impact' mitigation technique(s) and make the process transparent.

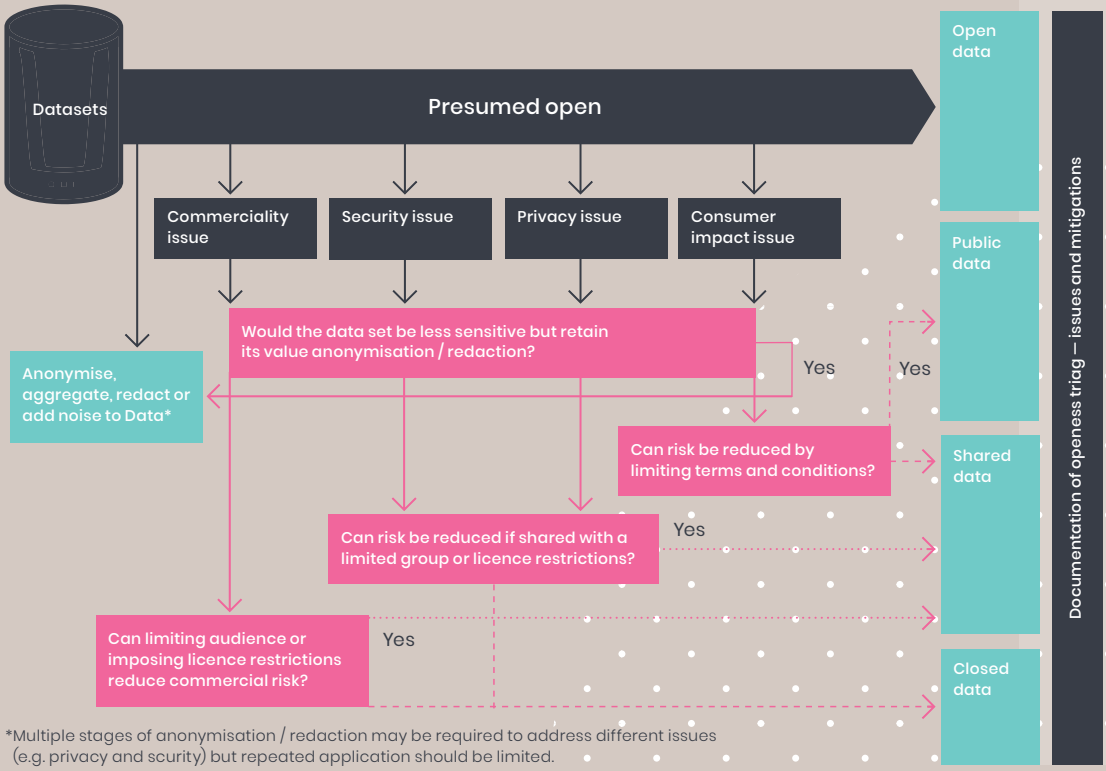
The triage process aims to identify potential issues within key areas:

- **Consumer Privacy:** Data that relates to a person who can be identified directly from the information in question or can be indirectly identified from the information in combination with other information.
- **Negative Consumer Impact:** Data that is likely to drive actions, intentional or otherwise, which will negatively impact the consumer.
- **Security:** Data that creates incremental or exacerbates existing security issues which cannot be mitigated via sensible security protocols such as physical site security, robust cyber security or buffer databases.
- **Commercial:** Data that relates to the private administration of a business or data which was not collected as part of an obligation / by a regulated monopoly and would not have been originated or captured without the activity of the organisation.

"We're at an exciting point where different sectors such as automotive, energy and IT have opportunities to come together to help the UK move towards a smart electricity grid."

Richard Potter
OpenLV Project Manager
EA Technology[11]

Openness Triage diagram




*Multiple stages of anonymisation / redaction may be required to address different issues (e.g. privacy and scurity) but repeated application should be limited.

### Electric Vehicle Energy Taskforce

Electric Vehicles (EVs) will play a key role in enabling decarbonisation objectives to be met. It is essential that the Energy System is ready for and able to exploit the mass up-take of EVs. Data sharing amongst stakeholders including the networks, the charging infrastructure suppliers, aggregators, service providers, the EV manufacturers and others will be required if ambitions are to be successfully achieved. The triage process can assure that the respective interests of stakeholders are protected while enabling data to be shared appropriately and the most effective whole system solution to be implemented and operated.

There is an opportunity to align the principle of Presumed Open and the mechanisms that support it with the work and findings from the EV Energy Taskforce whose remit includes the data and data sharing requirements that will support EV uptake.

If the triage process identifies an issue, the aim should be to preserve the value of the dataset for the greatest number of users possible. Open data with limited redactions may be preferable to shared data without, but if redactions render the data useless then public or shared data may be better. A dataset may be made available in multiple forms to retain value for different parties.

When issues are identified and mitigated through reduced openness or data modification, both the issue and mitigation technique should be documented. Where possible, the documentation and mitigation script / protocol should be made available alongside the published data. Whenever processed data is published, it is best practice for the script / protocol to also be presumed open and assessed with the openness triage. This provides transparency, promotes consistency across the sector and enables challenge.

→ *The Taskforce recommends* that the sector should consider if there is value in a standardized procedure for openness triage, PAS 185 details a triage process for smart city applications.

### Open Data Issue Mitigation

*The Taskforce recommends* that open data risk mitigation techniques be applied in all matters of open data. These techniques either reduce the sensitivity of the data or reduce the likelihood of negative outcomes. Reducing the sensitivity of the data includes techniques such as aggregation, redaction, adding noise to the data, etc. Reducing the likelihood of negative outcomes involves either creating restrictions about the data usage, identifying and tracking users or restricting the audience of the data.

Thought should be given to the reason for sensitivity when selecting the mitigation technique. For example, privacy issues can quite easily be mitigated through a sufficient level of aggregation whereas commercial issues may be addressed via usage limitations. Thought should also be given to the value of the data to others. For example, distribution network data has security sensitivities relating to the location of CNI sites which could be mitigated by obfuscation or redaction. However, if the purpose of the data is to avoid damage from street digging, then this is not useful.

Recommendation 2: Maximising the value of data — continued

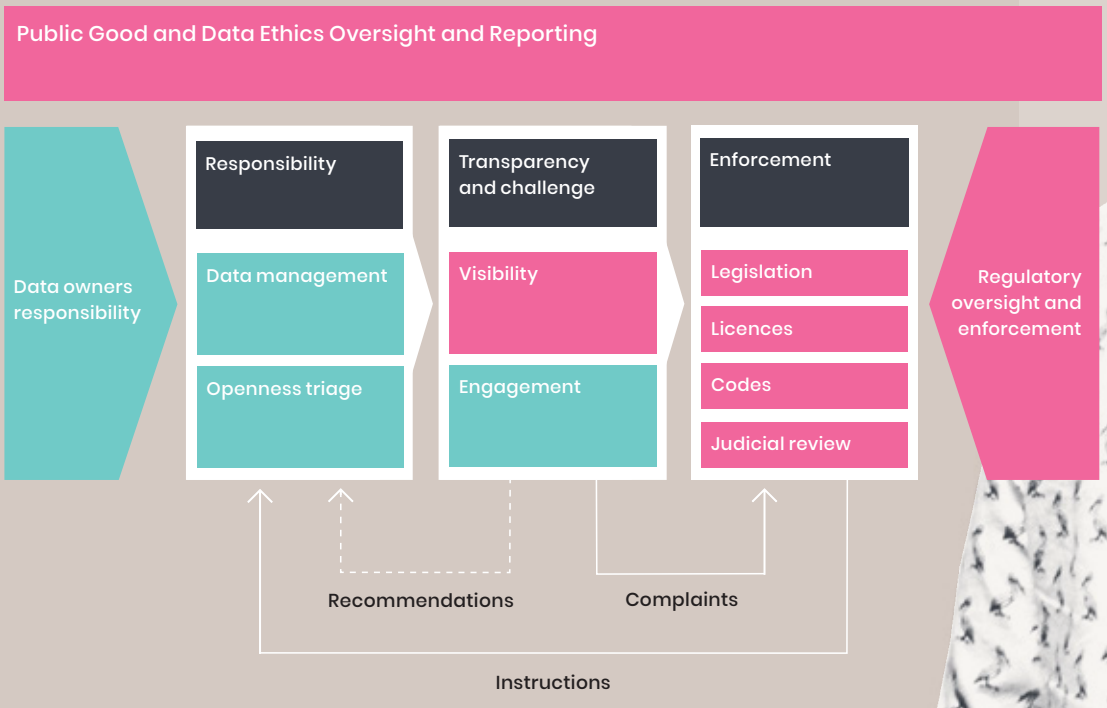
## Governance

*The Taskforce recommends* that support for Presumed Open should leverage existing mechanisms of organisation responsibility and enforcement instruments combined with a layer of transparency which enables continuous challenge. In addition, a wider requirement for cross sector public good and data ethics oversight is identified and should be progressed through the Centre for Data Ethics and Innovation.

- **Responsibility:** Organisations that generate, collect, process and disseminate data have an existing responsibility to manage data effectively. GDPR clarifies their responsibilities with personal data. Legal and regulatory obligations exist which require data sensitivity to be assessed, accuracy ensured, and data secured where appropriate.
- **Transparency and Challenge:** Creating transparency enables the regulator and peers to review and challenge decisions of other organisations in order to identify issues which have been missed or where overly aggressive mitigation techniques have been used. Utilising an independent organisation to report on openness may be valuable.
- **Enforcement:** The recommendations include legislative and regulatory enforcement measures which can be utilised today and areas where new tools can be created for the future, such as new licence conditions. In the early stages, the need for iterative, collective development should be recognised and therefore, these measures should be used sensitively. The regulator has utilised resolution committees in similar self-governance scenarios to help resolve disputes and could be of value here too.

However, for the Presumed Open principle to fulfil its potential it is important that data is *Discoverable, Searchable, Understandable*, pragmatically utilising *Structures, Interfaces and Standards* and the system is *Secure and Resilient*.

Overview of the governance approach



### Discoverable, Searchable, Understandable: Data should be easily visible

Data should be easy to find; it should be possible to identify similar datasets across organisations and datasets should be accompanied by the information needed to understand their content.

### Open Data Hosting

Organisations wishing to publish data openly can utilise a range of open data storage solutions which have been developed across the sector and beyond, such as:

- Energy Data Centre
- UK Data Archive
- Data.gov.uk

There is a large amount of useful data which is published about the energy sector through mandatory reports, innovation trials and consumer tools. However, datasets are often published on standalone webpages with limited descriptions of the information contained. In addition, there is no comprehensive, easily accessible directory for Energy System Data. This makes it very difficult for both incumbents and innovators to discover, search and understand datasets.

The Taskforce is specifically recommending that a *Data Catalogue* is established to reveal Energy System Data. This recommendation includes a common metadata standard underpinned by a common glossary. Reference: Recommendation 3: Visibility of Data

#### Case study — Telecoms

Standardisation in telecoms is predominantly market based (ETSI, IEEE, ITU, 3GGP). In telecoms, interoperable systems are key to the business models of telephony and data transmission, the more connections to more networks the better the value proposition.

### Structures, Interfaces and Standards: A proportionate approach to standards

Data structure and interface standards should be adopted or developed where appropriate to enable data across organisations to be aggregated and utilised more easily.

The evolution of the energy sector, and the digital systems which support it, have resulted in a proliferation of different approaches to data and a range of incompatible data structures and interfaces. In order to realise the benefits of a smart, flexible Energy System there is a need for the pragmatic standardisation of data structures and interfaces to enable interoperability, improve collaboration and allow innovation to be scaled up effectively.

The Taskforce has studied standardisation within the energy sector, the detail of which is included in *Appendix 6*. Additionally, *Appendix 5* discusses the need for standardisation to enable multi actor system operation. This has informed the creation of three approaches to standardisation that respond to the varying situations which may help or hinder the development and adoption of useful standards.

**Standardisation Driven by Value:** Much of the required standardisation can be driven by industry and international groups when there is a clear, shared value for all participants. This may not be a formal standard as such but a shared data structure or interface that pushes consistency and interoperability as market goals.

**Government or Regulator Led Adoption:** Where standard adoption has stalled there may be need for the Government or regulator to intervene in order to consolidate the gains made and maximise the value to the sector as a whole. Intervention could take the form of enhancing the value case by linking standardisation to a cost or value driver e.g. reporting or flexibility services. Alternatively, the standard could be mandated by legislation, licence or code; this approach can result in surface level compliance which does not deliver the expected benefits.

**Government or Regulator Led Development:** Where there is little value to industry actors or value is unequally distributed, it may be necessary for the regulator or Government to drive standards development. This can be through a focussed group convened by Government or the regulator, or it could be developed by an independent group. Adoption may be voluntary or led by the Government or regulator (see above).

### Secure and Resilient: Data openness should promote security and resilience

It is possible to be more open with Energy System Data whilst ensuring robust system security and increasing overall resilience. In many instances data release and openness supports a secure and resilient system.

Security of the Energy System has traditionally been largely based on maintaining low visibility of important assets and controlling who has access to systems and data. As we move towards a smart, flexible Energy System with an increasing need for multiple actors to have visibility of the system and coordinate actions, the status quo cannot be sustained. However, as is seen in many other countries and industries, increased visibility does not need to result in reduced security. In fact, the durability of the system can be increased though better understanding of risks, the ability to predict outages and the opportunity to build in resilience. This is particularly notable in review of Energy Systems in Australia, Germany, Estonia, France and Japan.

It is important for all involved to balance the opportunities against risk. With the right level of governance and oversight, the recommendations in this report can be valuable tools to increase the amount and value of data without compromising security.

Security risk is an on-going issue and will constantly need to be reviewed. As we move into a world with more connected infrastructure there will need to be a balance of traditional security (obscurity and access control), system resilience and the benefits a more connected system can provide to maximise the value to consumer whilst managing risk.


### Cross Sector Standards

Energy is becoming increasingly intertwined with other sectors, this drives the need for whole system solutions. It therefore may be valuable to develop or adopt standards which enable cross sector interoperability and maximise value from technologies such as AI and Digital Twins. In addition, where a problem is universal, such as information management, adopting best practice is preferable to developing a sector solution. The Digital Framework Task Group are considering such cross-sector issues.

Recommendation 2: Maximising the value of data — continued

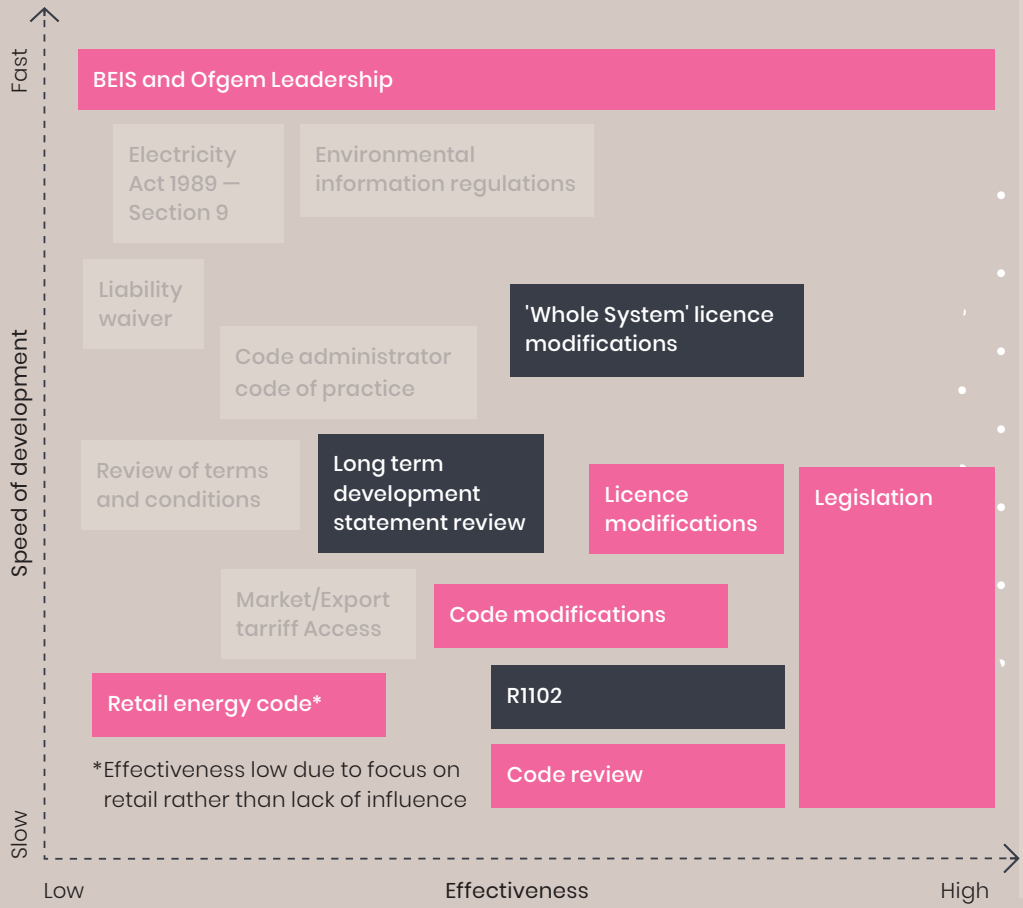
*The Taskforce recommends* that the sector progressively manages risk by:

- **Maintaining Current Practice:** Infrastructure companies already undertake security risk assessments and these practices should be applied to data.
- **Utilising Security Advisors:** Utilising Government and private security advisors to assess and develop internal security processes.
- **Deploying Openness Triage:** Systematically reviewing data to identify and mitigate security issues before publication.

*The Taskforce recommends* that the sector uses mitigation techniques to retain the value of data when security issues with data are identified, including:

- **Data Modification (obfuscation):** Subtly changing data to remove or reduce sensitivity e.g. altering network maps where connection details could reveal locations of CNI. Data is made openly available after modification.
- **Registration and Tracking:** Requiring simple registration (contact details and email address) to enable tracking of data requests.
- **Access Control:** Requiring verification of identity and authorisation to access the most sensitive of data sets. If this solution is required at scale, then sector wide solution should be considered (e.g. EstFeed[12]).

12. elering.ee/en/smart-grid-development

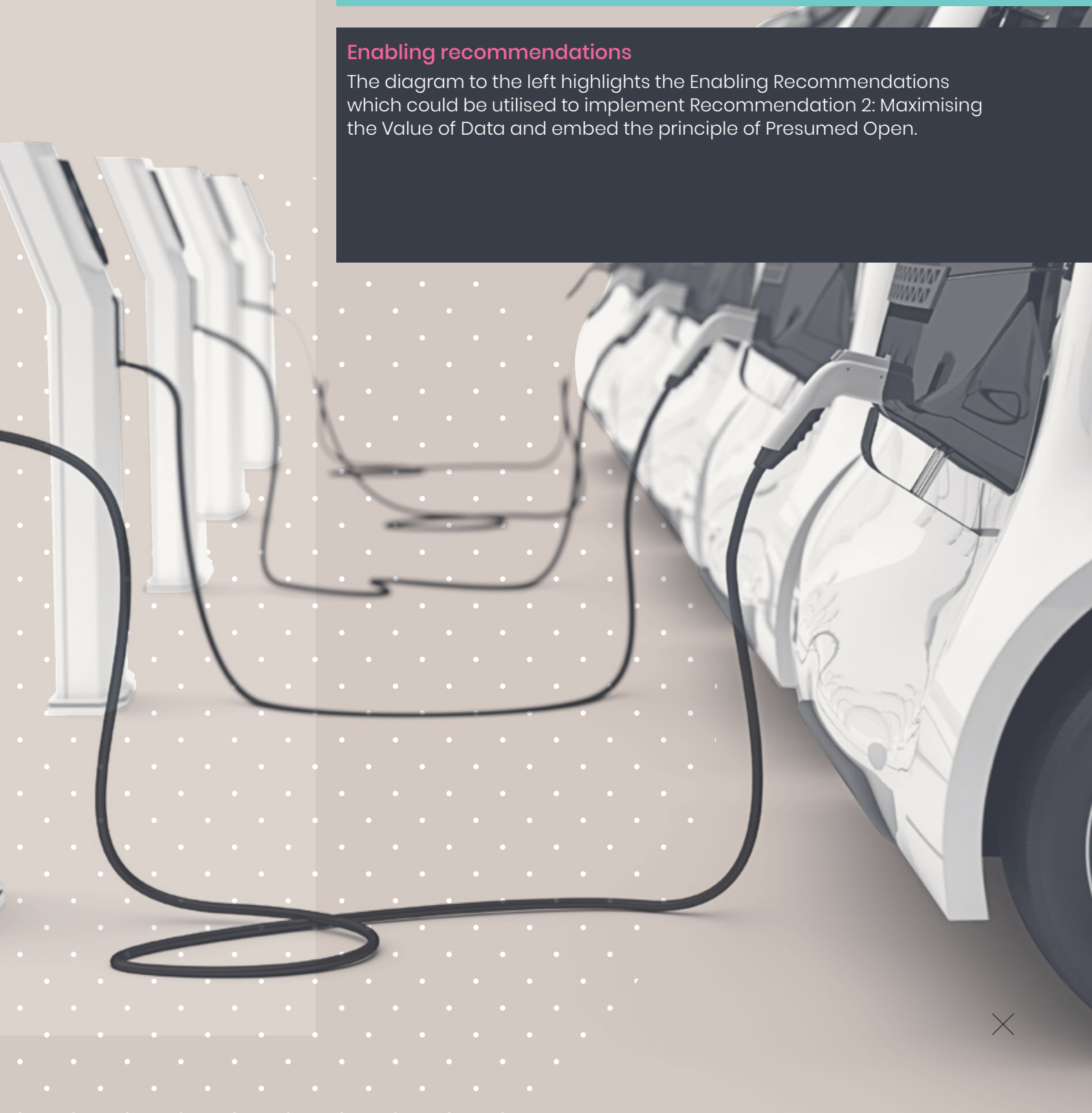



## Future fit

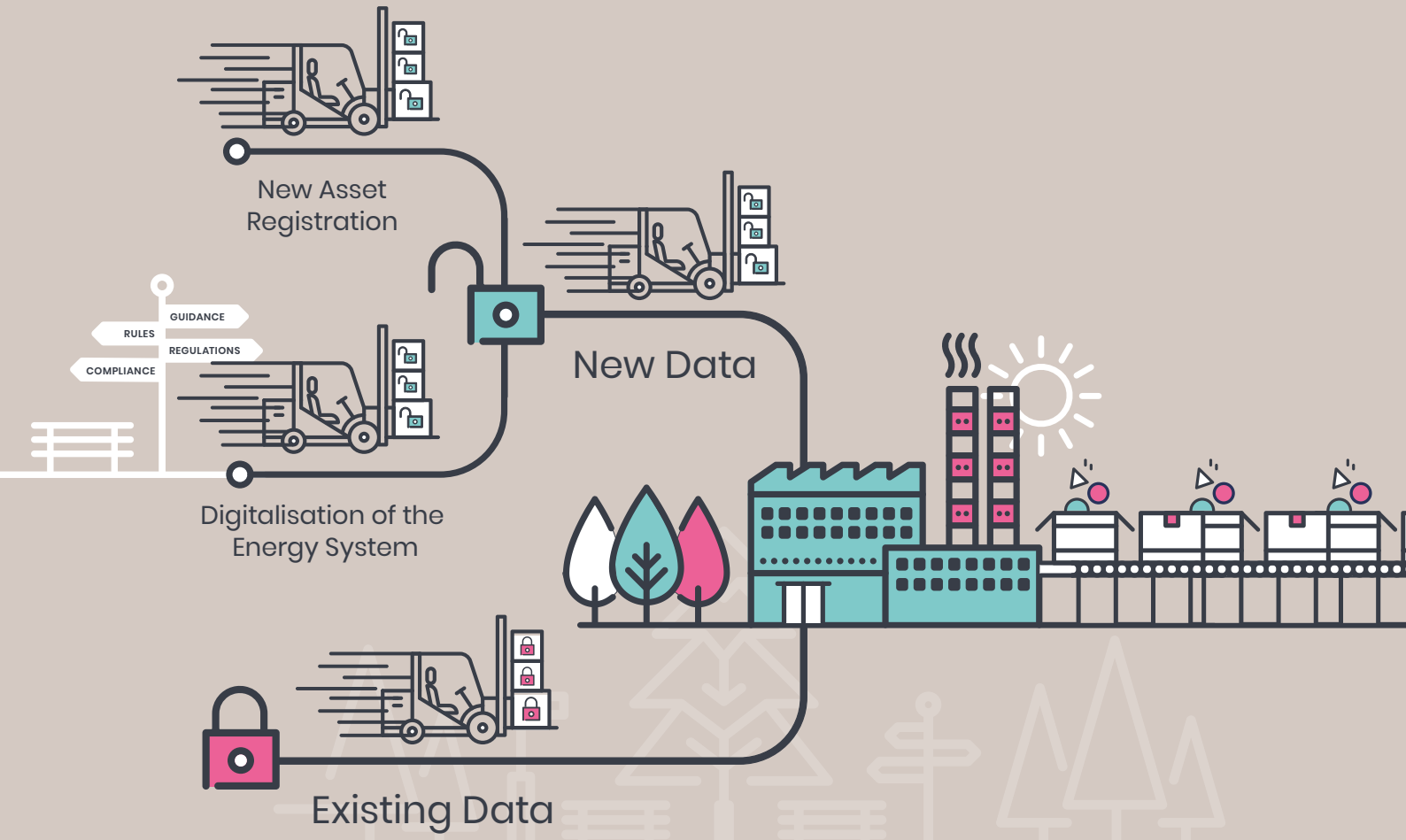
Unlocking value through open data will be iterative. As data is opened, new opportunities and risks will be identified. Data visibility is an important first step in a longer journey. Data quality and consistency will be required for effective data sharing between organisations.

## Enabling recommendations

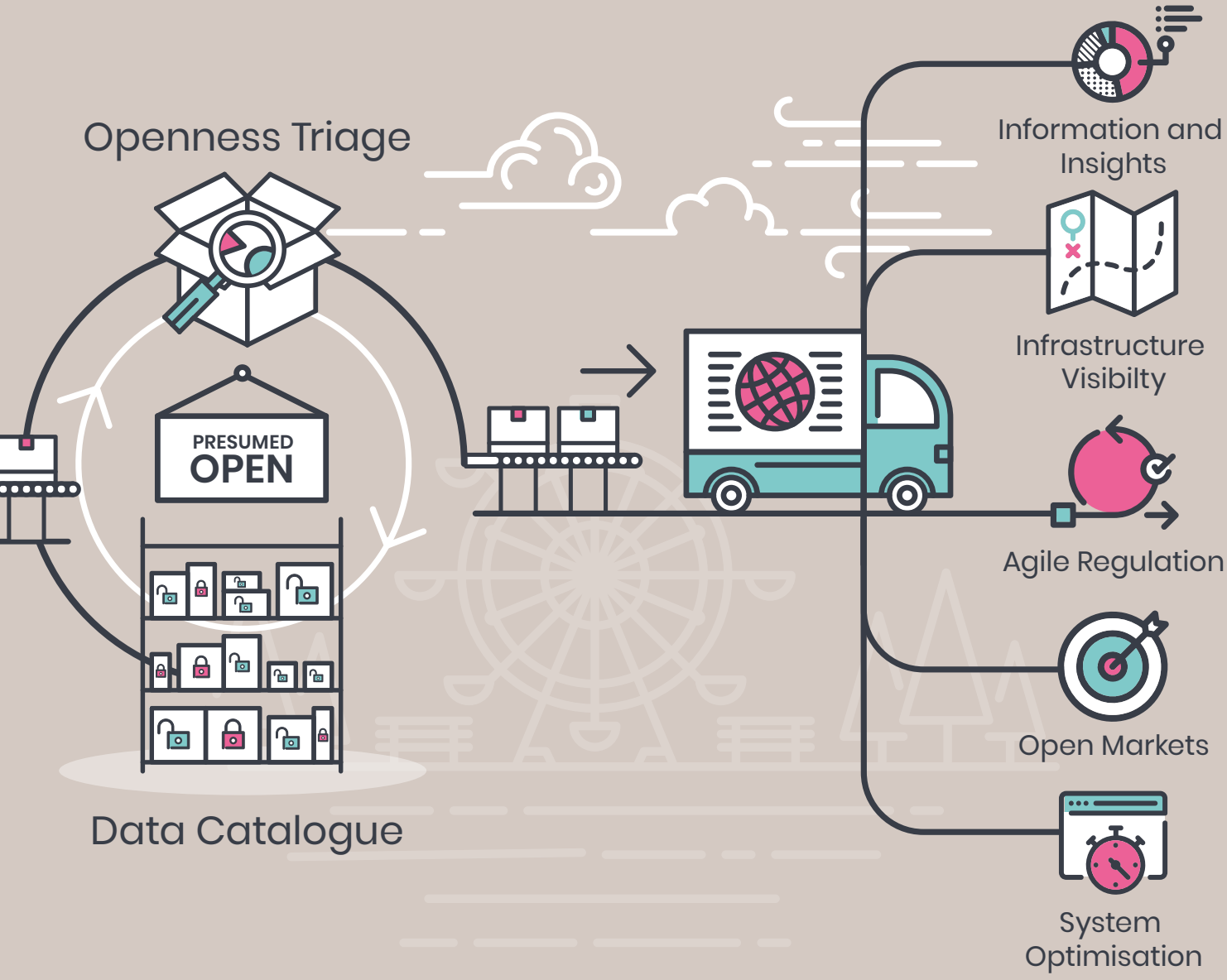
The diagram to the left highlights the Enabling Recommendations which could be utilised to implement Recommendation 2: Maximising the Value of Data and embed the principle of Presumed Open.



# A strategy for a Modern Digitalised Energy System



Individually, the taskforce recommendations create positive change but together, they create an environment where data and digitalisation will deliver substantial value for consumers.



# Building Blocks

The Taskforce has identified the need for early action to realise the benefits of effective and innovative use of data in transforming the Energy System, and is making recommendations for the development, deployment and use of three key Building Blocks:

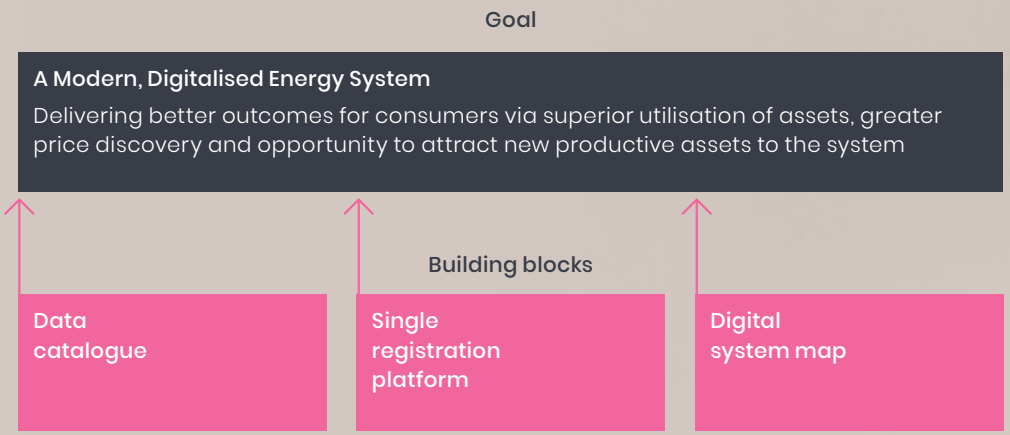
→ **Data Catalogue:** A single, searchable location that provides visibility of Energy System Datasets

→ **Asset Registration Strategy:** A coordinated approach to new asset registration.

→ **Digital System Map:** A digital representation of the Energy System.

These recommended Building Blocks offer the first steps in implementing the foundation of a Modern Digitalised Energy System. Each is valuable individually, but together they deliver substantial additional benefits and positively support each other; for example the Asset Registration Strategy facilitates the development and maintenance of the Digital System Map.

The Building Blocks directly support embedding the principles of Digitalisation of the Energy System and Presumed Open, providing effective mechanisms to bring the principles to life.



Together they deliver substantial additional benefits and positively support each other.

Recommendation 3

# Visibility of data: Data Catalogue

*The Taskforce recommends* that a Data Catalogue be established to provide visibility of the data that exists across the sector through a common metadata standard. This needs to encompass all Energy System Datasets across Government, the regulator and industry. Government and Ofgem should mandate participation though regulatory and policy mechanisms.

## Why a Data Catalogue?

Visibility of Energy System Data is currently very poor. New innovators and experienced incumbents alike struggle to identify if a dataset exists, which organisation owns it and if they can gain access. This creates several negative impacts including stifling innovation, obscuring data quality issues and creating inefficiency when the same data is collected many times over.

The Data Catalogue is designed to address the problem of data visibility by requiring organisations holding Energy System Data to contribute metadata about their datasets. The Data Catalogue collates this into a single, searchable location and enables parties to quickly and easily find out if data exists and who holds it. Where data is open or publicly available it can be directly linked but in other cases a request for access can be created via the Data Catalogue. A more detailed system design is included in *Appendix 2*.

The principle of Presumed Open advocates that all data should be as open as possible, but it will take some time to assess the sensitivity and determine how open each dataset can be. The Data Catalogue provides a mechanism to objectively *measure the demand for datasets* and prioritise sensitivity assessment, potential mitigation and publication accordingly.

**Recommendation 3: Visibility of Data**

A Data Catalogue should be established to provide visibility through standardised metadata of Energy System Datasets across Government, the regulator and industry. Government and Ofgem should mandate industry participation though regulatory and policy frameworks.

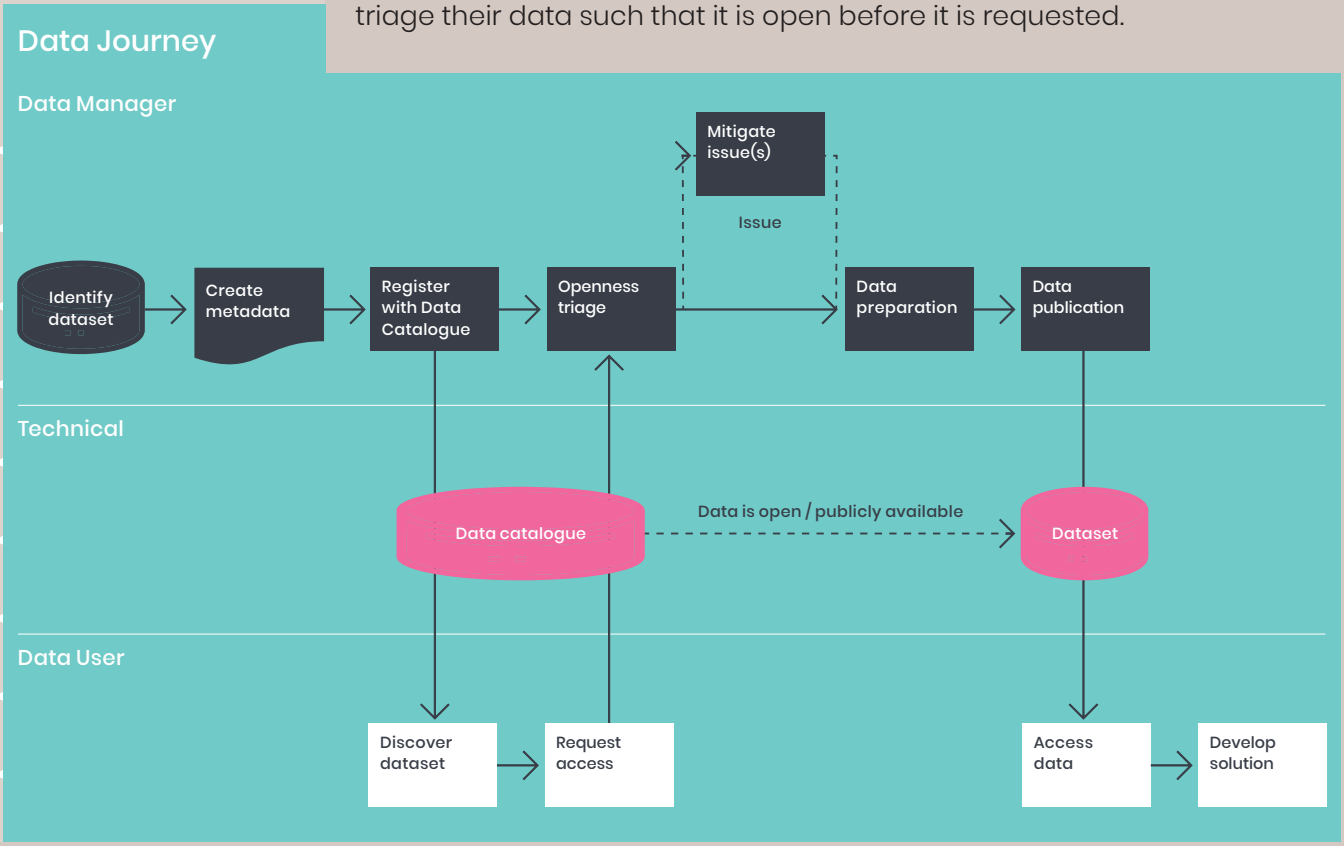
The Data Catalogue collates metadata from the sector

## The benefits delivered

The Data Catalogue offers the following benefits:

- → Greater transparency of data which is being collected and by which organisations and the outcome of its openness triage.
- → Identification of data quality/granularity issues and sector-wide data gaps.
- → Increase adoption of metadata standards and information management best practice.
- → Enable objective evaluation of increasing data openness by organisations and comparison of the capabilities and performance of similar organisations.
- → Support market demand-based prioritisation for open data.

The diagram below shows a possible demand driven journey which data can take from identification to use in a third-party solution. Note, organisations can and should proactively triage their data such that it is open before it is requested.



Recommendation 3: Visibility of Data — continued

## Governance

The Data Catalogue can provide many practical tools to enable greater data transparency across the sector and deliver many useful governance functions

→ **Data Catalogue:** The Catalogue creates a high level of dataset visibility through the registration of metadata for Energy System Datasets. This is an enabler for the following points.

→ **Openness Report:** The Data Catalogue will provide key metrics about organisation and sector datasets and openness. This information can be periodically collated and published as a report for Ofgem and Government on the data openness of the sector.

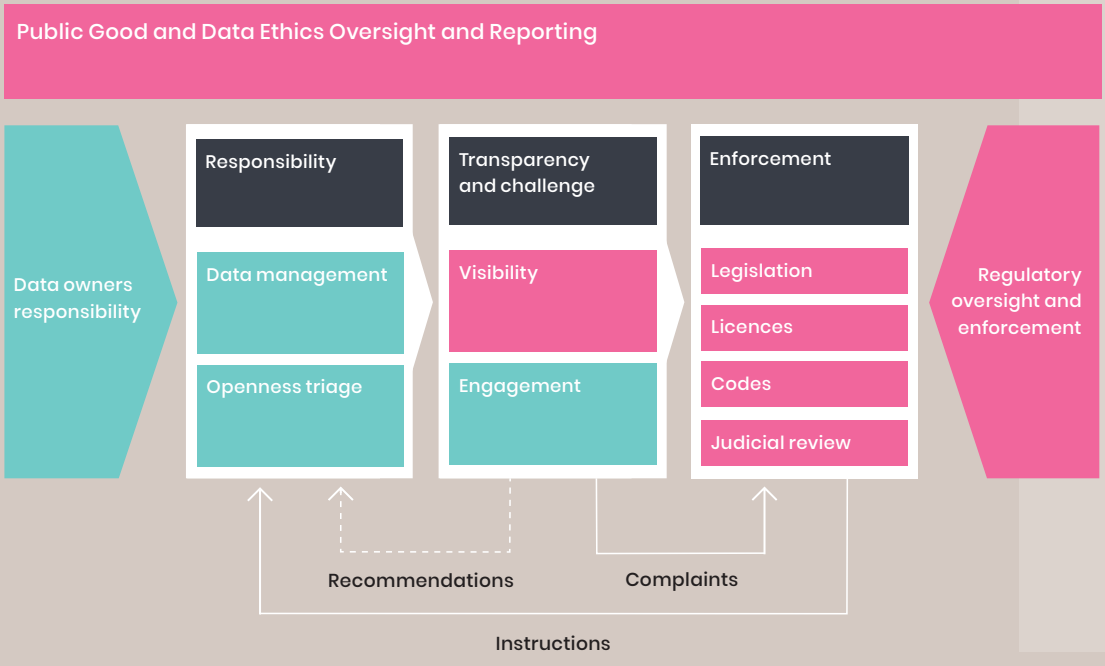
→ **Peer Review:** The Data Catalogue enables peers to review the openness of datasets and challenge where appropriate. This enables organisations to benchmark their openness and provide feedback where new issues are identified.

→ **Market Pull:** Requests for access to non-public datasets can be tracked, enabling market pull to be quantified and used to form a priority for opening.

## Future fit

The Data Catalogue is an important mechanism to make data visible and create transparency across the sector. The Data Catalogue can drive future value by encouraging more data to be open, incentivising data linking and creating data sharing opportunities.

An overview of the governance approach



## Implementation recommendations

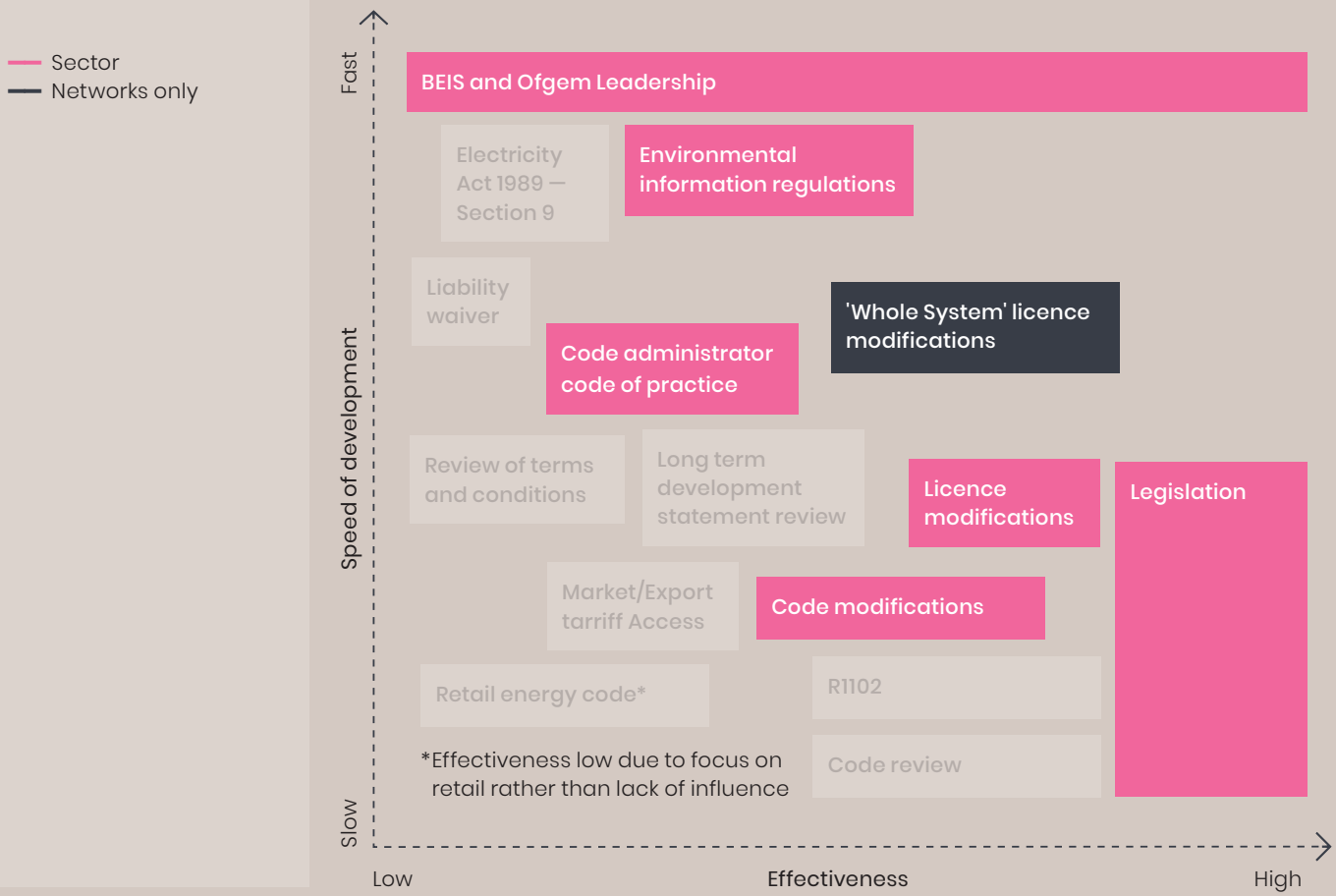
*The Taskforce recommends* that the Data Catalogue is based on the Dublin Core 'Core Elements' metadata standard. This enables a minimum level of standardisation without being overly burdensome, with the option to extend the standard over time. To compliment this there will be a common glossary to enable actors to effectively categorise their data.

*The Taskforce recommends* that the Data Catalogue should be developed and managed by an independent, trusted party with a strong track record in data management. *The Taskforce recommends* that the *Office for National Statistics (ONS)* be considered for this role. This would enable the Catalogue to benefit from the ONS's existing security, governance and quality standards and their data analysis expertise. In addition, the ONS's statutory role would enable energy data to be informed by wider economic data sets.

Work to date suggests that a Minimum Viable Product (MVP) Data Catalogue can be ready within 6 months. Government, Ofgem, Code Operators and Settlement Agencies have indicated their agreement to log data with the Catalogue. More detail in *Appendix 2*.

## Enabling recommendations

The diagram below highlights the Enabling Recommendations which could be utilised to implement Recommendation 3: Visibility of Data and implement the Data Catalogue across the sector.



Recommendation 4

# Coordination of asset registration

*The Taskforce recommends* that a sector wide *Asset Registration Strategy* should be developed and adopted to curtail the proliferation of standalone registration platforms. This should simplify the registration process for consumers, businesses and intermediaries alike, reduce the collection of duplicate data and create a more reliable asset dataset which can be used to stimulate innovation. Additional detail is included in *Appendix 3*.

A single, consolidated point of entry should be established to enable asset owners, managers and installers to register an asset once but enable it across a range of services, markets and export tariffs. This will help to address the confusion and overhead associated with registering Energy System assets and assuring information is reliable for the benefit of consumers, asset owners and system operators.

## Why is a registration strategy needed?

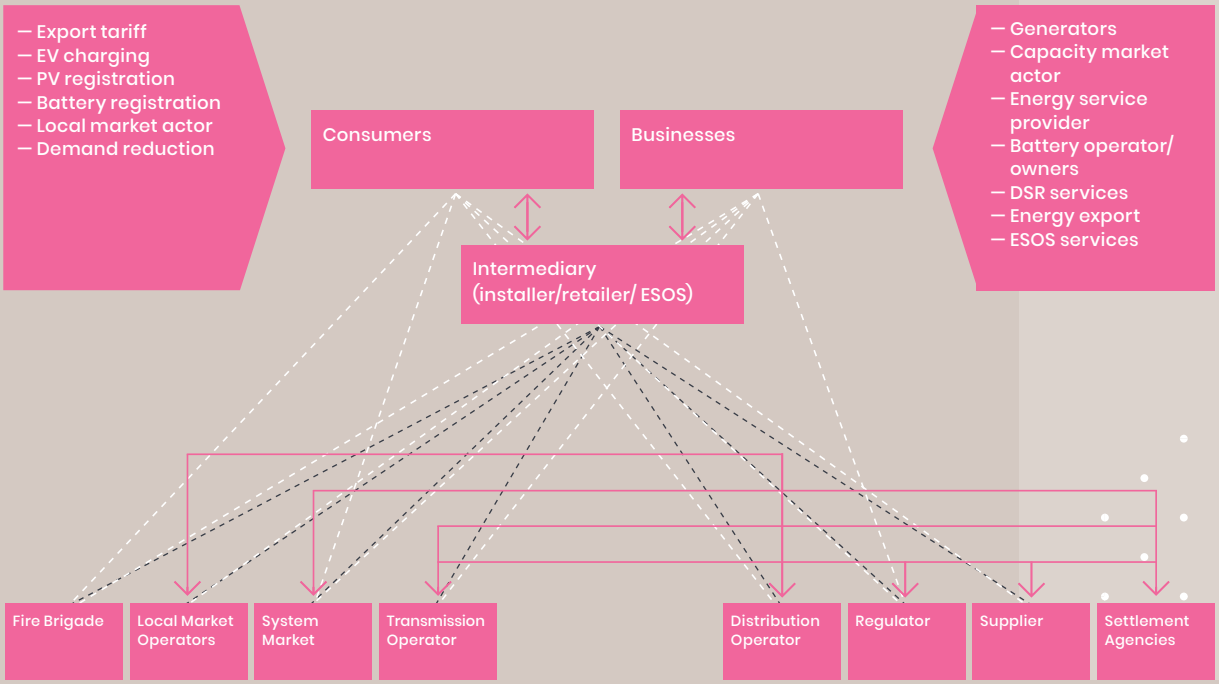
The Taskforce has identified several registration platforms for the multiple assets, services and propositions that are emerging across the sector, as outlined further in *Appendix 3*. The Taskforce also noted that the number of such platforms is increasing and expected to continue to do so. There are many Energy System actors addressing their specific data requirements; there is currently no strategy for asset registration which prioritises consumer experience and overall system benefits.

The diagram to the right illustrates the complexity of the current registration landscape. Different assets may require the consumer, business or intermediary to register in many locations. As new assets are developed there will be emerging needs to register with more organisations.

### Recommendation 4: Coordination of Asset Registration

An Asset Registration Strategy should be established to coordinate registration of energy assets, simplifying the experience for consumers through a user-friendly interface in order to increase registration compliance, improve the reliability of data and improve the efficiency of data collection.

A complex registration landscape



The current approach of multiple registration portals neither puts the consumer nor the system managers at the heart of the design and makes data interoperability and system visibility more complex. The current approach will greatly reduce the utilisation, impact and value of the data held, and in the Taskforce's view, may fail to create the incentives for asset owners to register at all. In addition, as some people will be required to register in more than one place, as outlined in the figure above, the burden placed on consumers, small businesses and intermediaries aggregating assets, will be onerous and could significantly impact the level of registration.

Developing a strategy to capture key Energy System asset information that can be shared to multiple actors is an important step in achieving a *Modern Digitalised Energy System*. It is important for all the key players across the sector:

- **System Operators:** The strategy supports ensuring there is reliable asset information with improved data quality and compliance to support system planning. *Standards, Interfaces and Structures* will need to be defined in collaboration with industry to ensure the correct data is collected and shared with relevant actors.
- **Asset Owners:** For domestic and commercial asset owners and intermediaries, the strategy seeks to ensure that information is submitted once and consent is given for its use, allowing data to be managed in accordance with the *Presumed Open* principle.
- **Regulatory bodies:** The strategy will help to provide greater oversight of Energy System assets, a solid evidence base for the development of policy and a simple method to execute future policies and regulation.

This recommendation is based on similar successful projects in other countries and across other sectors as summarised in below.

| German Marktstammdaten register | HMRC Multi-Channel Digital Tax Portal | Food Standards Agency Business Registration |
|---|---|---|
| Central registration portal for all assets and market participants in the German Energy System. | One user-friendly portal for all business sizes that integrates HMRC's 6 core functions. | Central portal for registration of all food businesses from a large supermarket chain to a small café. |

Recommendation 4: Coordination of Asset Registration — continued

## Implementation Recommendations

*The Taskforce recommends* that the Asset Registration Strategy should be driven by an organisation that is open, independent, empowered and experienced. In other countries, Asset Registration Strategy has been driven by the regulator and therefore Ofgem should be seriously considered for this role. This could present the opportunity to draw on best practice from wider Government and regulatory initiatives including the HMRC portal and the Food Standards Agency business registration process.

*The Taskforce recommends* that a programme be established to consider the strategic options including that of a unified Asset Registration Portal. A development plan should be prepared with the goal of delivering a Minimum Viable Product by mid-2020 that would demonstrate the use and benefits of a single Asset Registration Portal, should this approach be determined the best for implementing the Asset Registration Strategy. This will require the programme to work with existing registration owners to ensure all development decisions help to facilitate a coordinated portal.

Intermediary stages to delivering this could include:

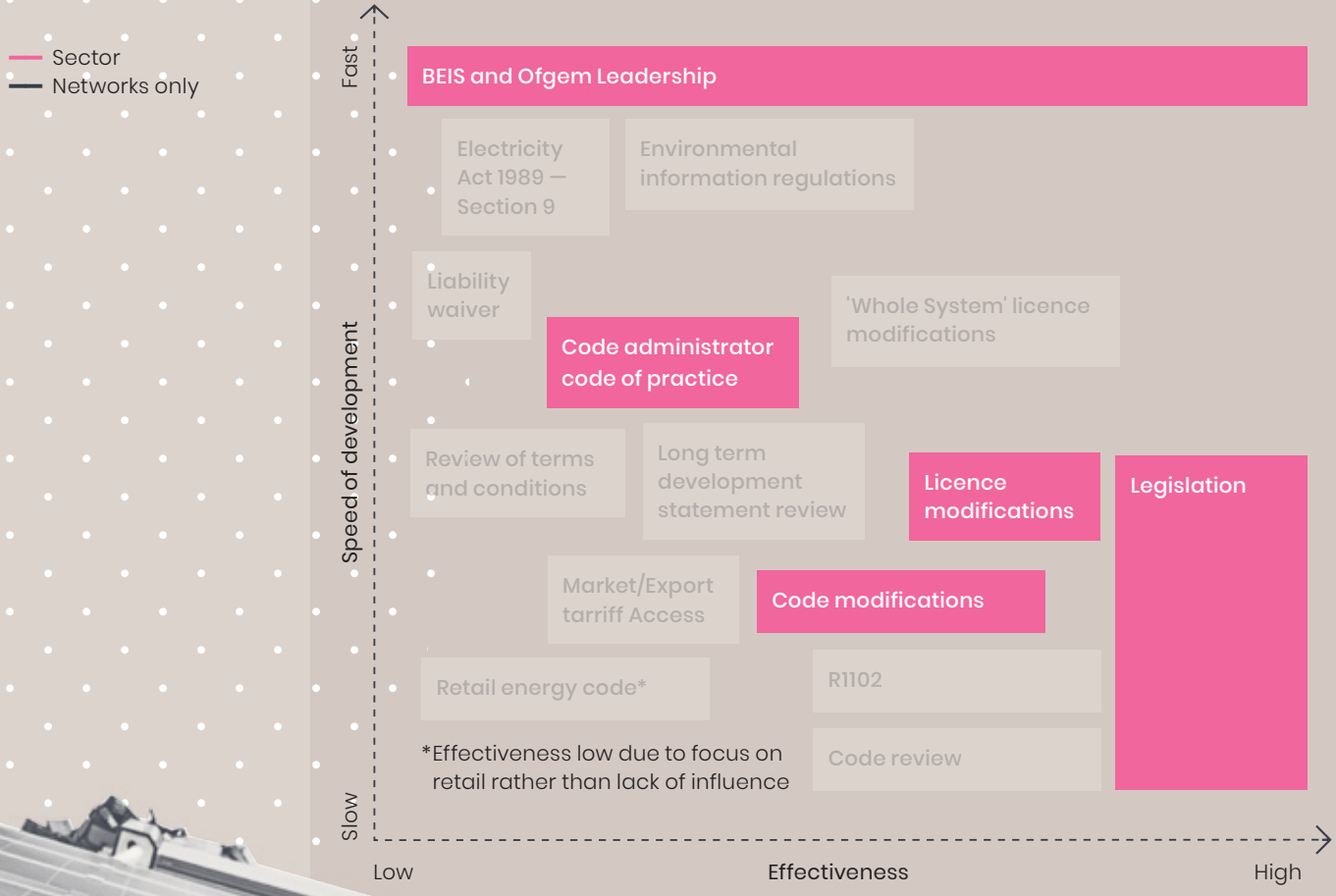
- Registration portal — register once and share with many organisations
- Back end simplification — towards standard data and process models
- Interoperable services — easy migration between service providers / procurers

## Future fit

Coordinating energy asset registration provides immediate benefit through improved user experience and increased registration conformance. Importantly, it also lays the foundation for automated approaches to asset registration (IoT and APIs) and ensures visibility of future assets and therefore increases our ability to operate the system effectively.

## Enabling recommendations

The diagram below highlights the Enabling Recommendations which could be utilised to implement Recommendation 4: Coordination of Asset Registration and implement the Asset Registration Strategy across the sector.



Recommendation 5

# Visibility of infrastructure and asset: digital system map

*The Taskforce recommends* the development of a *Digital System Map* that will help unlock the opportunities of a Modern Digitalised Energy System. This recommendation builds on those put forward by the Centre for Digital Built Britain, Digital Framework Task Group and supported by the National Infrastructure Commission which recommend that work begins on a digital system map of GB network infrastructure with the overall goal of developing a full digital twin of Energy System infrastructure. Additional detail is included in *Appendix 4*.

## Why a Digital System Map

The position of network operators as regulated monopolies has reduced the effect of market-based incentives to reduce the gap between incumbent companies with data and third party innovators seeking data.[13] Lack of visibility makes decisions riskier when procuring assets, operating of the system, identifying innovation opportunities and when implementing multi-actor system operation, see *Appendix 5*.

Independent digital maps have been developed by network companies, but these are standalone systems with different data points and are not interoperable. Without intervention, it is unlikely that industry would develop a high-quality digital system map as the costs and benefits are not evenly distributed. Additionally, without sector leadership it would be difficult to engage the range of actors required to make the project a success. Similar projects have warranted intervention, e.g. Geospatial Commission Underground Assets Register.

## The Benefits of a Digital System Map

A Digital System Map will make infrastructure data available in a coherent way. This will lower the barrier to entry and enable innovators to develop new solutions, test new business models and manage investment risk more effectively. Greater interoperability of network data will provide networks and Ofgem with efficiency benefits reducing data processing requirements.

A digital system map offers the following benefits:

- → Lower time to identify and plan renewable energy projects
- → More efficient planning of future infrastructure across energy vectors
- → Better visibility of adjacent sectors such as housing, heavy industry, waste, water, etc.
- → Enables faster testing of new business models for innovators
- → Driver of data standardisation and interoperability
- → Greater system resilience achieved through better system visibility.

**Recommendation 5: Visibility of Infrastructure and Assets**

A unified Digital System Map of the Energy System should be established to increase visibility of the Energy System infrastructure and assets, enable optimisation of investment and inform the creation of new markets.

"The (AREMI Mapping Tool) complements the forthcoming Demand Management Incentive Scheme. These initiatives should lead to creative solutions to reduce network costs and improve grid reliability."

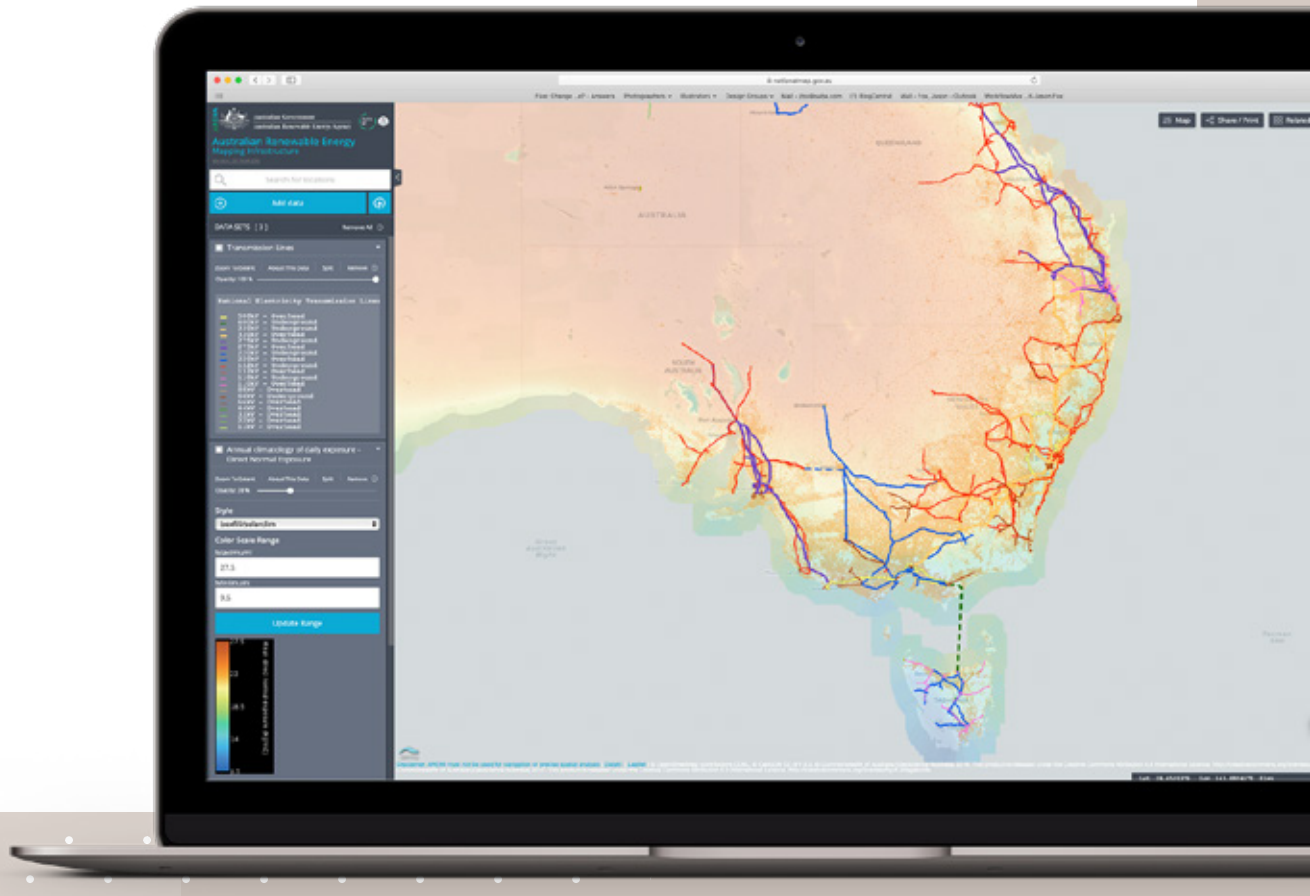
Ivor Frischknecht, CEO Australian Renewable Energy Agency

13. DECC (2015) Towards a smart Energy System
14. nationalmap.gov.au/renewables/

The Taskforce's recommendation to implement a Digital System Map draws from consideration of other countries' energy asset visibility platforms, including the experiences of Australia, Germany, Estonia and France. Other countries that have developed Digital Maps of their Energy System have been driven by the pursuit of greater system resilience and lower security risks made achievable through better visibility of infrastructure and assets.

## Australia

Australian Renewable Energy Mapping Infrastructure (AREMI) tool is funded by the Australian Clean Energy Council. It comprises transmission and distribution network maps, generation assets and renewable energy insights such as regional solar coverage. A key use case frequently cited by the AREMI developers is the planning of a new solar farm. In a few minutes a user can see average solar coverage, local transmission infrastructure, grid capacity and local buildings. This enables a user to quickly narrow down suitable sites that can then be assessed in more detail.



Recommendation 5: Visibility of Infrastructure and Asset — continued

### France

Open Data Reseaux Energies tool (ODRE) has over 80 different datasets comprising details on storage, network infrastructure and meteorology. The opening of these datasets was mandated by the French regulator and published prior to them being incorporated into the tool. Each dataset has its own documentation that empowers the user to understand what is presented more fully.

Data in the ODRE tool is presented as open to all, but registration and verification of identity are required for access to more detailed datasets for enhanced security of sensitive data. Similar use cases such as planning a solar PV development take much less time to narrow down a group of suitable sites.

### Implementation recommendations

*The Taskforce recommends* that the Government and Ofgem commission an open and interoperable Digital System Map of the Energy System. The project should utilise learning and reuse resources, including data and software, from projects such as the Geospatial Commission Underground Asset Register, network operator capacity maps and AREMI.

*The Taskforce recommends* that Energy System actors use existing data sets to build a map of current energy infrastructure using the resources in the above recommendation and that third parties share other data to further inform its enhancement and evolution towards a digital twin.

*The Taskforce recommends* that the Digital System Map should be a public good project to enable greater competition and drive investment into the sector. It therefore should be owned by an organisation with no commercial interest in the energy sector such as a university, not for profit organisation or independent IT consultancy.

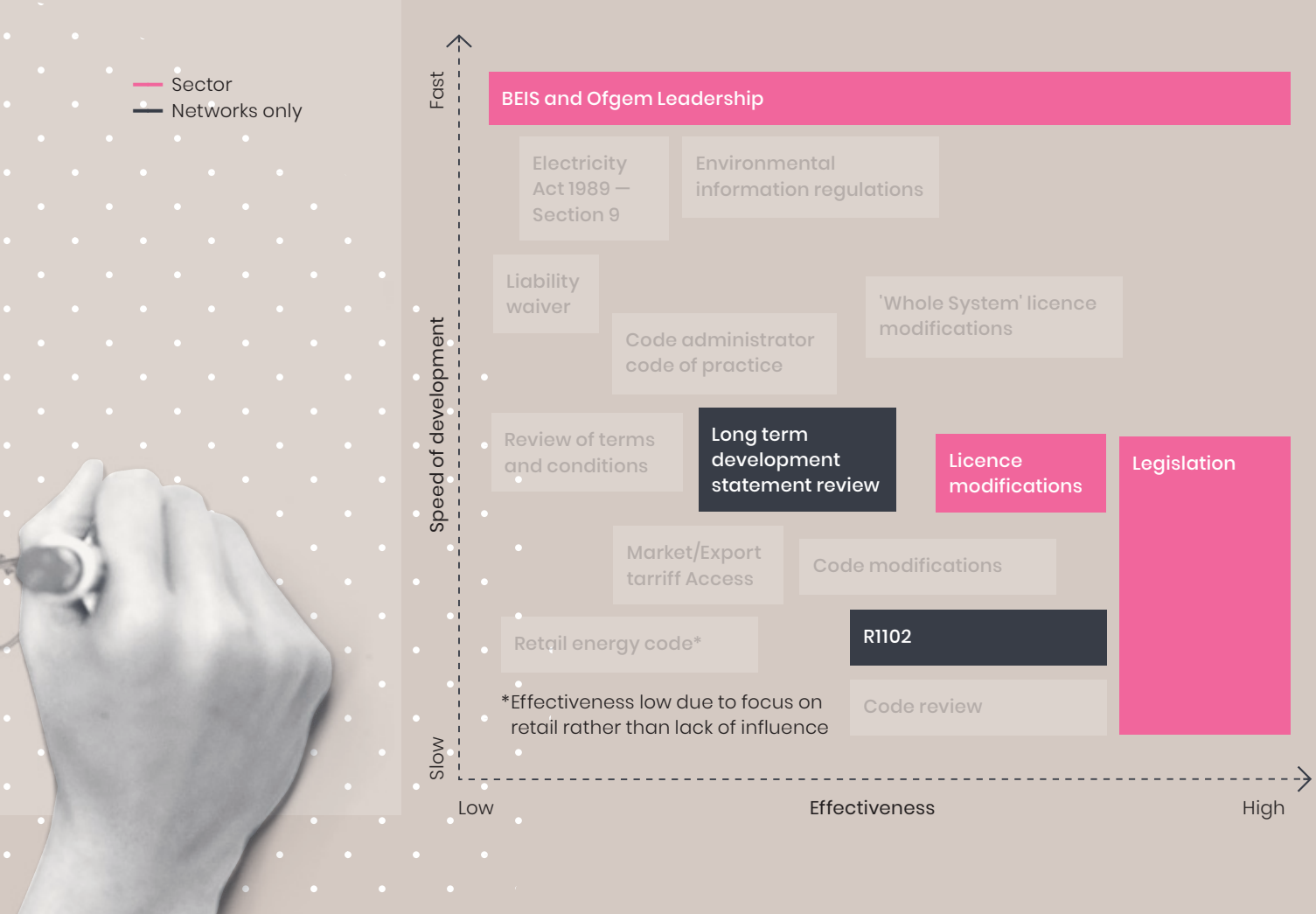
It is additionally proposed that this project is seen as a driver of interoperability between datasets held across the sector. By adopting an agile development process and best practice from related projects it should be possible to deliver a Minimum Viable Product with limited granularity of data relatively quickly. This can be evolved over time as datasets become more detailed and more information is made openly available.

## Future fit

The Digital System Map is an important use case which enables information from the Data Catalogue to be utilised and to drive standardisation. Once delivered, it may be possible to use this as the foundation for a Digital Model and ultimately, a Digital Twin.

## Enabling recommendations

The diagram below highlights the Enabling Recommendations which could be utilised to implement Recommendation 5: Visibility of Infrastructure and Asset and implement the Digital System Map across the sector.

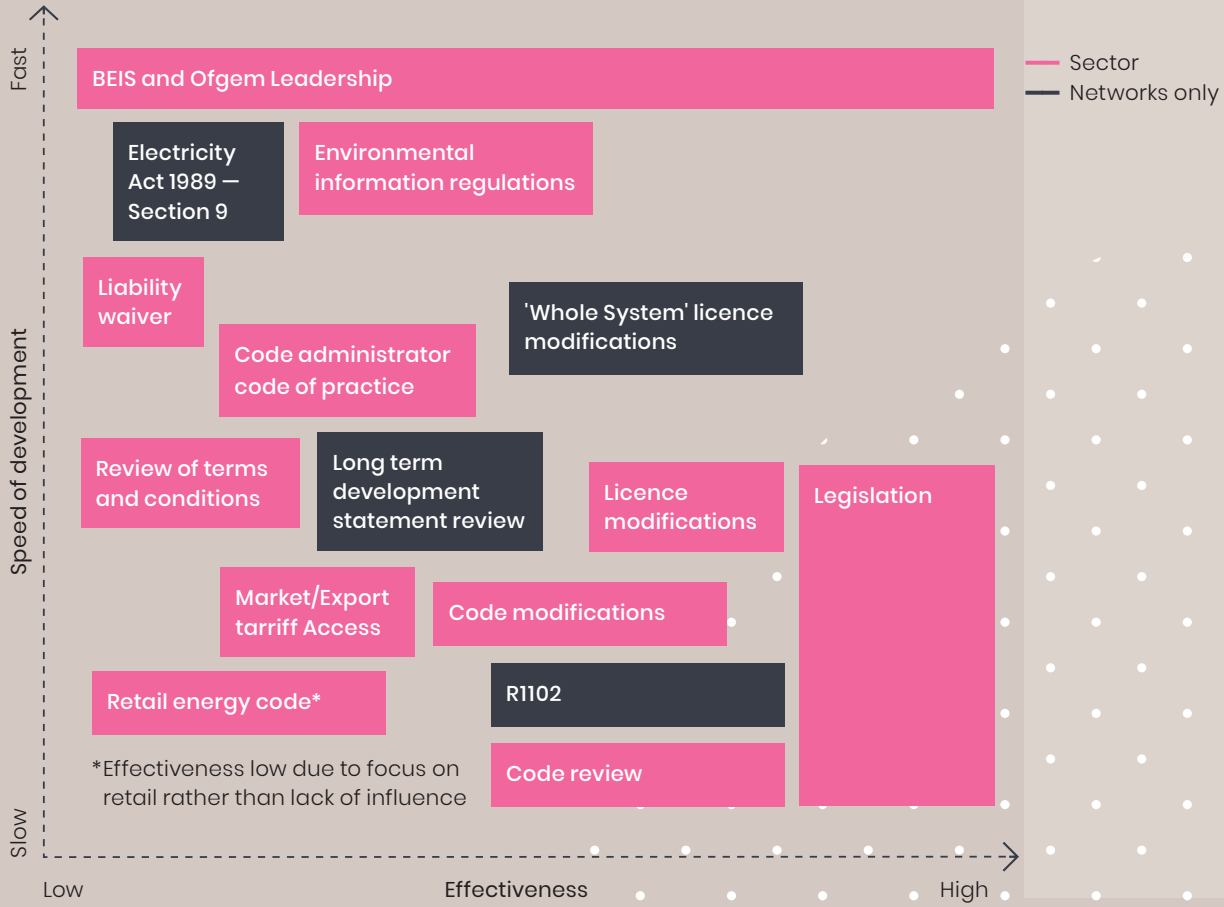


# Enabling recommendations

The principles within this report are such that they could be adopted by all organisations today. However, it is recognised that as a regulated sector there are certain measures which can be utilised to encourage, incentivise and compel organisations to adopt the right behaviours.

We are not proposing any additional mechanisms but believe that it is important that measures to support digitalisation are integrated into existing regulatory and policy levers.

In this section a range of measures which Government, Ofgem and industry can use to drive adoption of the principles and make progress towards a Modern Digitalised Energy System supported by Presumed Open data are described. The Taskforce does not expect all of the measures below to be utilised, but Government and the regulator will select the most appropriate mechanisms to achieve the desired outcomes.



- **Government and Ofgem Leadership:** *The Taskforce recommends* that Government and Ofgem explicitly endorse the principles and recommendations and be clear on their expectations of the sector through stating clear policy and regulatory intent. This will encourage many Energy System actors to participate and start the journey towards openness before regulations are in place and will increase industry confidence and drive immediate impact.
- **Environmental Information Regulation:** *The Taskforce recommends* that the sector considers utilising EIR to facilitate the release of Energy System Data, both proactive dissemination (Regulation 4) and on request (Regulation 5). All Energy System Data has an impact on carbon – its intensity, its efficiency and its mitigation, the EIR (and EISR in Scotland) provides a strong mechanism to open up data.
- **Electricity Act 1989 — Section 9:** *The Taskforce recommends* that organisations consider Digitalisation of the Energy System and Presumed Open as part of existing obligations to "develop and maintain an efficient, co-ordinated and economical system of electricity" distribution / transmission and "facilitate competition in the supply and generation of electricity".
- **Whole System Licence Modifications:** Ofgem are currently considering licence changes for electricity networks and have just concluded a consultation to which the Taskforce responded. *The Taskforce recommends* that Ofgem considers taking this opportunity to embed the Taskforce principles into the licence at this point.
- **Liability Waver:** *The Taskforce recommends* developing a set of standard waivers to help give organisations comfort regarding the release of data in circumstances where there is concern about liabilities that could arise due to data quality or completeness.

**Transport for London uses the following caveats:**

- "The Information is licensed 'as is' and TfL excludes all representations, warranties, obligations and liabilities in relation to the Information to the maximum extent permitted by law."
- "TfL is not liable for any errors or omissions in the Information and shall not be liable for any loss, injury or damage of any kind caused by its use or any inability to use the Service. TfL does not guarantee the continued supply of the Information."
- "Nothing in this Licence shall limit either TfL's or Your liability for death or personal injury caused by negligence, and/or the negligence of either TfL's or Your respective employees or agents or for fraud."

https://tfl.gov.uk/corporate/terms-and-conditions/transport-data-service

Enabling recommendations — continued

- **Code Administrator Code of Practice:** The Taskforce recommends that industry consider adopting the principles and/or integrating the Building Block projects into the CACoP in order to encourage adoption of the recommendations.
- **Long Term Development Statement Review:** The Taskforce recommends that principles proposed be considered to be embedded within the LTDS. The review can develop common standards that start to enable data interoperability across organisations and create a requirement for data that underpins network modelling in machine-readable format.
- **Review of Terms and Conditions:** The Taskforce recommends that all owners of public datasets should clarify the terms and conditions that apply to the data such that users are clear about their rights when using the data.
- **The Retail Energy Code:** The Taskforce recommends that the Retail Energy Code should be an early adopter of the principles. The code is developing a catalogue of standardised structures, interfaces and processes for industry functions which will when completed provide a consolidated view on the data that supports the operation of the retail market.
- **Licence Conditions:** The Taskforce recommends that Government and Ofgem consider using licence conditions to ensure licensed actors are compelled to register their metadata with the Data Catalogue.
- **RIIO2:** The RIIO2 price control should be treated as an opportunity to embed the core principle of Digitalising the Energy System and its supporting principles of New Data, Continuous Improvement and Digitalisation Strategies and to integrate related. specific interventions. The Taskforce recommends that Ofgem consider the following mechanisms:
  - Requirement for the network operator to submit a data strategy within their RIIO2 business plans which adopt the principles proposed by the Taskforce
  - Business as usual to be set at a new level of transparency
  - Requirements for more data relating to the networks.
  - Investment evidence to require appropriate data analysis
  - Disclosure of raw data that underpins network modelling
  - Companies recognised for innovative mechanisms for using data to provide greater infrastructure visibility and support productive collaboration
- **Codes Modifications:** The Taskforce recommends that code modifications be considered and if appropriate, implemented to increase the number and range of actors required to participate with the Data Catalogue. Discussions to date have indicated that Code Administration Code of Practice, licence modifications and Significant Code Review and the Energy Code Review could be options for embedding such requirements.

"ELEXON welcomes the Energy Data Taskforce's report and believes that it is a valuable contribution to facilitating the development of innovative products for the energy market for the benefit of the end customer."

Mark Bygraves
Chief Executive, Elexon

- **Code Review:** The Taskforce recommends that Government and Ofgem use the Energy Code review as opportunity to embed the principles. While codes can be inflexible and too rigid to incorporate the dynamic changes required to enable data and analytics, the overall code review presents an opportunity to embed these principles. However, due to the long timescale of code review, Ofgem and Government should consider the most effective mechanisms to ensure the codes comply with the principles. Discussions have indicated that Code Administration Code of Practice, licence modifications and significant code review are useful options.
- **Policy Change:** The Taskforce recommends that Government consider acting to address a number of legislative barriers to data release which could be reduced and overarching obligations which could be created. Key areas for review are:
  - Changing Ofgem/Secretary of State duties to embed requirements to explicitly promote greater transparency, develop high quality data sources and publish more data; to avoid data being deprioritised in the future.
  - Extending the general duties of network companies to reflect that data is a key component of infrastructure and should be treated as such.
  - Refining the requirement to consult only where their interests may be seriously and prejudicially affected. Reducing Ofgem burden to publish less sensitive data.
  - Modifications to the Utilities Act to enable Ofgem to share data with other regulators to enable a more efficient regulatory environment.
- **Export Tariffs and Market Access:** The Taskforce recommends that Government and Ofgem consider that in order to access an export tariff or participate in an energy market there should be a requirement for the asset to be registered via the Asset Registration Strategy. In addition, terms and conditions could include the right to share asset information and historic operational data where appropriate or where consented.

# Conclusions

## The Energy Data Taskforce has recommended a comprehensive set of principles which Government, Ofgem and industry can use to develop data sophistication in the sector.

In addition, the recommended Building Block projects identify and address specific needs that are holding the sector back and will not be delivered by the market. Finally, legislation, regulation and governance has been considered and industry approaches identified which can support the core recommendations.

The Taskforce has been greeted with significant, positive feedback from the sector for both the overall objectives of the project and the specific recommendations proposed. There is recognition that data is an important resource that needs to be cultivated and developed if it is going to deliver the full suite of benefits the future Energy System needs.

The recommendations give line of sight to viable, achievable delivery projects. The building block projects can deliver impact with early versions that it should be possible to implement relatively quickly, supported by roadmaps for increasing capability and value.

The EDTF sponsors — Government, Ofgem and Innovate UK — are very supportive of the principles and will carefully evaluate the recommendations so that they are appropriately executed.

There are two key sets of next steps:

→ **Embedding the Principales:** This requires strong leadership, support and tools for the sector, and integrating the key recommendations within existing policy and regulatory frameworks.

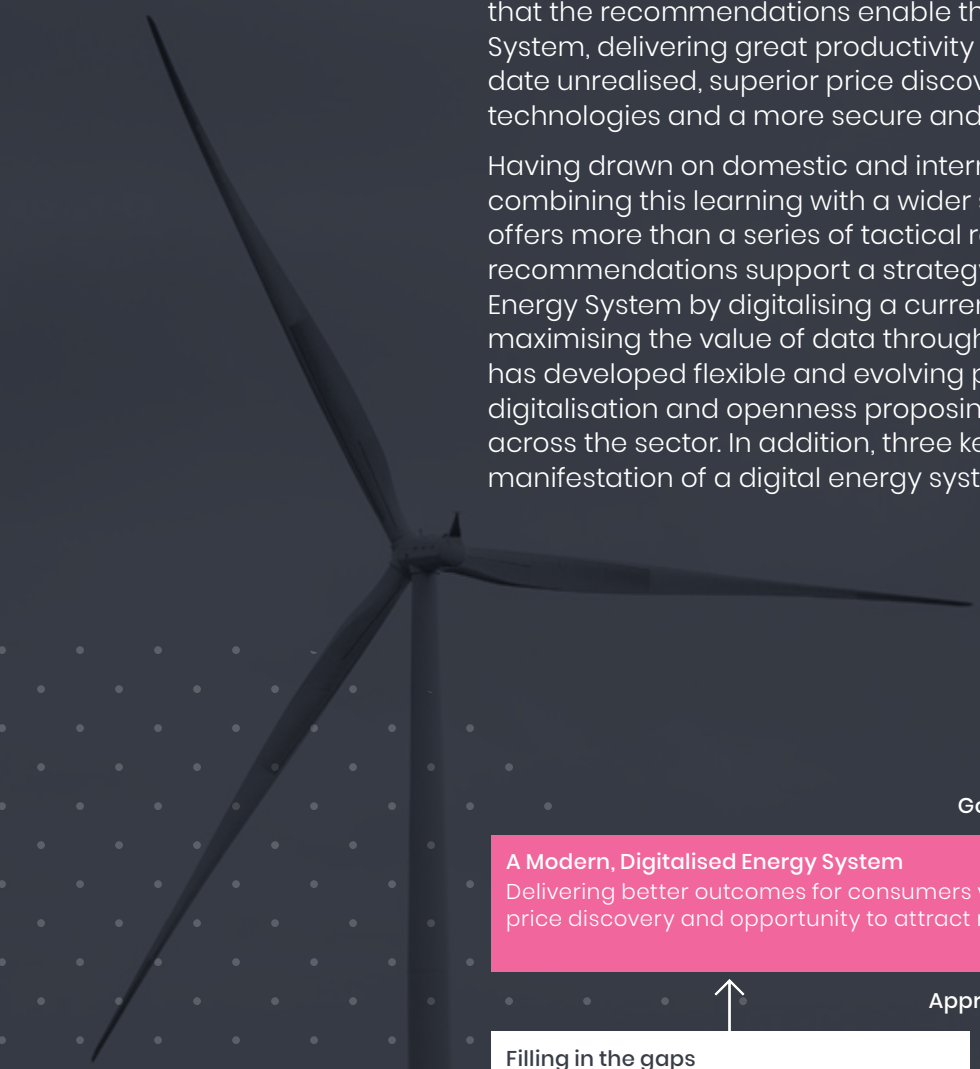
→ **Delivering the Building Blocks:** This requires resourcing and organisational focus across Ofgem, Government and Innovate UK to deliver the three key recommendations building the business case, scoping the projects and liaising with the key players within the sector.

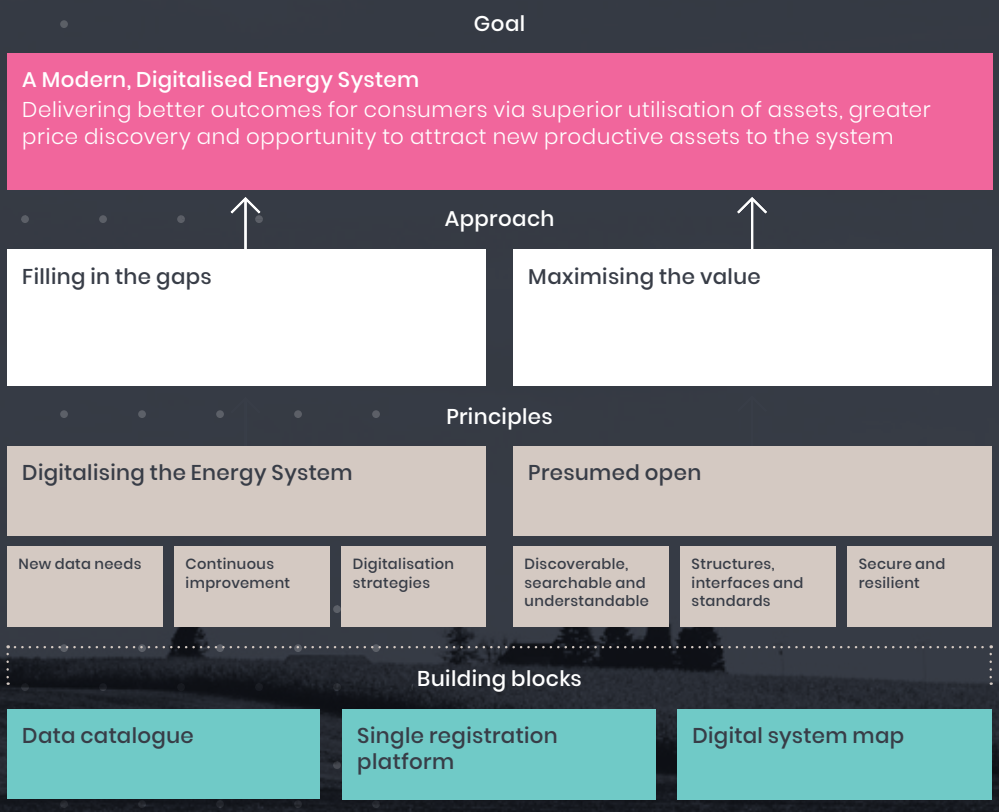
"The EDTF has managed to galvanise usually very disparate parts of the energy sector into agreeing on tangible steps that can be taken now and will be transformative in the long run."

Sian Jones, CEO
Xoserve

Digitalisation and the more sophisticated use of data is a journey. This report provides recommendations and approaches to begin that journey and offer the UK Energy System and its market participants a head start in driving the important transformation required to decarbonise and decentralise. Taskforce also believes that the recommendations enable the modernisation of the Energy System, delivering great productivity gains, cost efficiencies to date unrealised, superior price discovery of new and emerging technologies and a more secure and resilient system.

Having drawn on domestic and international best practice and combining this learning with a wider set of ambitions, this report offers more than a series of tactical recommendations. The recommendations support a strategy for the modernisation our Energy System by digitalising a currently an analogue system and maximising the value of data through openness. The Taskforce has developed flexible and evolving principles that underpin digitalisation and openness proposing that these are embedded across the sector. In addition, three key first steps that are the manifestation of a digital energy system are proposed.





## A very big thanks from the Taskforce for all the support and input

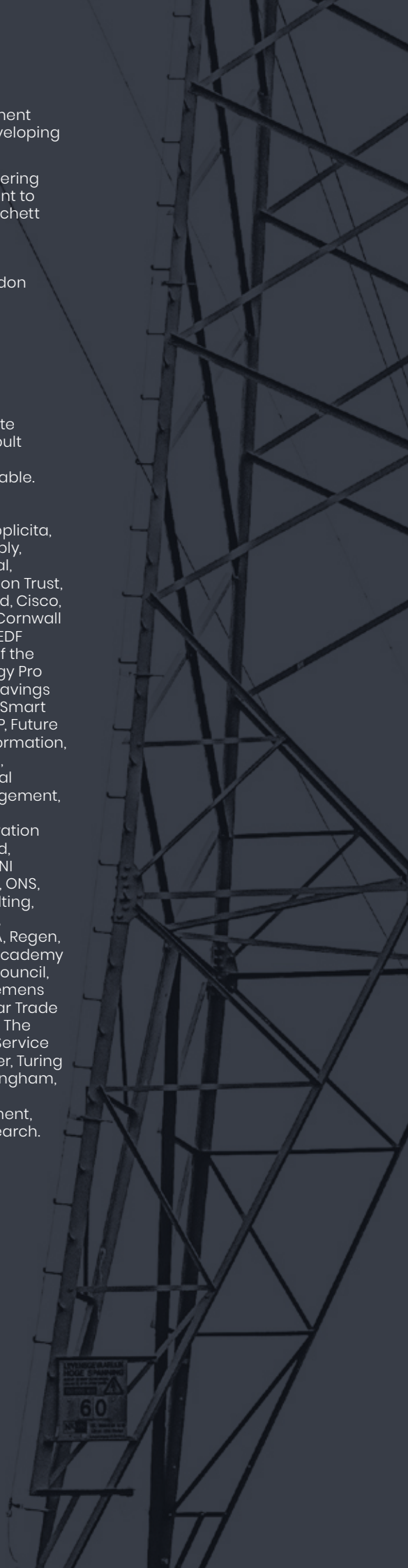
The Taskforce would like to express its thanks for the support, interest and engagement from Government, Ofgem and Innovate UK. Their input, advice and guidance in developing this report have been critical and important.

The Taskforce has greatly benefited from an excellent and very knowledgeable Steering Group that has challenged, questioned and helped shape these outcomes. We want to thank them for their time and engagement, with a particular thank you to Chris Pritchett from Foot Anstey LLP who provided important legal support and input.

Daniel Bagge — IBM
Daniel Barrett — Greater London Authority
Dinker Bhardwaj — BEIS
Sam Bowman — Fingleton Associates
Martin Crouch
Mark Enzer — Mott Macdonald
Sarah Hayes — National Infrastructure Commission
Rollo Home — Ordnance Survey
Mark Kennedy — Imperial College London
Jessica Lennard — Visa
Edward Lucas
Dominik Malaise — Transport for London
Rupert Ogilvie
Chris Pritchett — Foot Anstey LLP
Edward Reed — Cornwall Insight
David Richardson — Innovate UK
Rachel Siddell — BEIS
Steven Steer — Ofgem
Steve Smith — Lloyds Banking Group
Olivier Thereaux — Open Data Institute
Nick Winser — Energy Systems Catapult

In addition, the support from the sector has been enthusiastic and the input invaluable. We would like to thank all stakeholders, including:

3 Ideas, ABB Power Grids, Alan Turing Institute, Amazon Web Services, AMT-Sybex, Applicita, Arenko Group, Arquiva, Arup, Baringa Partners, BEAMA, Bodvoc Ltd, Brook Green Supply, BU UK, C3 Resources / Engie, Cabinet Office - Geospatial Commission, Calvin Capital, Cambridge and Peterborough LA, Cap Gemini, Carbon Limiting Technologies, Carbon Trust, Centre for Data Ethics and Innovation, Centrica, CGI, Chameleon Technology (UK) ltd, Cisco, Citizens Advice Bureaux, Clear Blue Energy, Complete Strategy, Connected Places, Cornwall Insight, Critical Insight, Culture Gov, Deepmind, Demand Logic, E3G, EA Technology, EDF Energy, Eire Utility, Electralink, Electric Storage Company, Electron, Elexon, Embassy of the Republic of Estonia, Energy Consumers Australia, Energy Facilities (UK) Limited, Energy Pro Ltd, Energy Networks Association, Energy Revolution Research Consortium, Energy Savings Trust, Energy UK, Engie UK and Ireland, EO Energy, Erda Energy Ltd, Elering, Evergreen Smart Power, Fingleton Associates, Flexible Energy, Food Standards Agency, Foot Anstey LLP, Future Motors, Gemserv, GeoSpock, Geotogether, Gilmond, GirdEdge, Global Smart Transformation, Greater London Authority, Green Sync, Hildebrand Technology, HMRC, Hoarelea, IBM, ICF, IEA, Igloo, Imperial College London, Information Junction, Intelesant, ISS Technical Services, Karslruhe Institute of Technology (KIT), Keele University, Land Quality Management, Landis+Gyr Ltd United Kingdom, Levelise Ltd, LF Energy, Living Planit, Lloyds Banking Group, Luxnova Partners, Make It Cheaper, Manchester University, Mitsubishi Corporation (International) Europe, Morrison Data Services, Mott Macdonald, N3rgy, National Grid, National Grid ESO, Neuville Grid Data, New Resource Partners, Newcastle University, NI Utility Regulator, NIC, Nottingham City Council, nPower, Octopus Energy, ODI, Ofcom, ONS, Open Climate Fix, Open Energi, Ordnance Survey, Ovo Energy, P2 Analysis, PA Consulting, Parity Projects, PCSG, Piclo, Power Data Associates (Association of Meter Operators), PowerOn Technologies, Projecting Success, Q-bots, Queens University Belfast, R-E-A, Regen, Renewable UK, Resilience Energy Technology, Resolver Group, Ripple Energy, Royal Academy of Engineering, Say Watt Ltd, Scaled Insight Ltd, Science and Technology Facilities Council, Scottish Gas Networks, Scottish Government, Sheffield Solar, Sheffield University, Siemens Energy Management, SIG, Smart DCC, Smart Energy GB, Smarter Grid Solutions, Solar Trade Association, Stark, Strathclyde University, Sustainability First, Tech UK, Tesla, The ADE, The Home Insulation & Energy Systems Quality Assured Contractors Scheme, The MCS Service Company Ltd, Transport for London, Transport Systems Catapult, Trilliant, Trust Power, Turing Institute, UCL Energy Institute, UK Community Works, UKERC, UKPN, University of Birmingham, University of Cambridge, University of Oxford, Upside Energy Ltd, UtiliGroup, Utilities Intermediaries Association, V2G-EVSE, VISA, Vodafone UK, VRM Tech, Welsh Government, Western Power Distribution, Worcestershire Council, Xoserve, Zigzag Strategy + Research.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