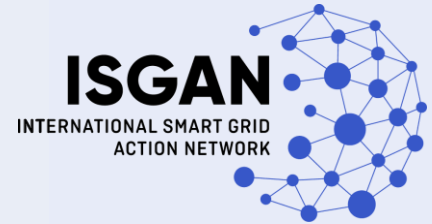


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ISGAN Working Group 9 – Case studies of data and digitalisation as an enabler for energy flexibility

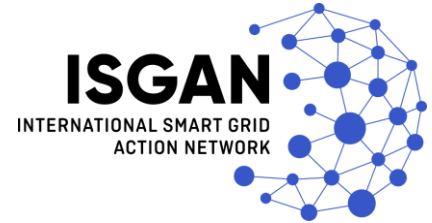
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Background

- This Data and digitalisation case studies gathering was prepared by the Energy Systems Catapult UK on behalf of the Department for Energy Security and Net Zero (DESNZ), UK under the ISGAN Working Group 9 Task on Interoperability. Energy Systems Catapult acts as the UK Alternate Delegate for ISGAN and manages Working Group 9 on behalf of DESNZ.

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ISGAN: <https://www.iea-isgan.org>

Department for Energy Security and Net Zero:

<https://www.gov.uk/government/organisations/department-for-energy-security-and-net-zero>

Energy Systems Catapult: <https://es.catapult.org.uk>

Introduction

- [ISGAN](#), the International Smart Grid Action Network, seeks to investigate ways in which smarter electricity grids can be developed across the world. One of the key enablers of smarter electricity grids, is their ability to facilitate energy flexibility, crucial when considering the influx of inherently intermittent low carbon generation and increasingly distributed resources into the system, each essential to reach Net Zero.
- [Working Group 9](#) on Flexibility Markets is tasked with identifying the biggest barriers to achieving effective energy flexibility, whilst also highlighting where the gaps and opportunities may be for countries to innovate and invest in solutions able to tackle the barriers.
- Digitalisation is a key enabler in enabling energy flexibility, and throughout 2023/24 Working Group 9, led by the UK, conducted research to identify best practice and examples of innovative projects where data and digitalisation were being applied to help achieve energy flexibility.
- This document highlights some of the best practice projects being carried out in the UK, where digitalisation is used to build the infrastructure necessary for enabling energy flexibility. It also highlights the innovation projects in digitalisation happening in other ISGAN countries.

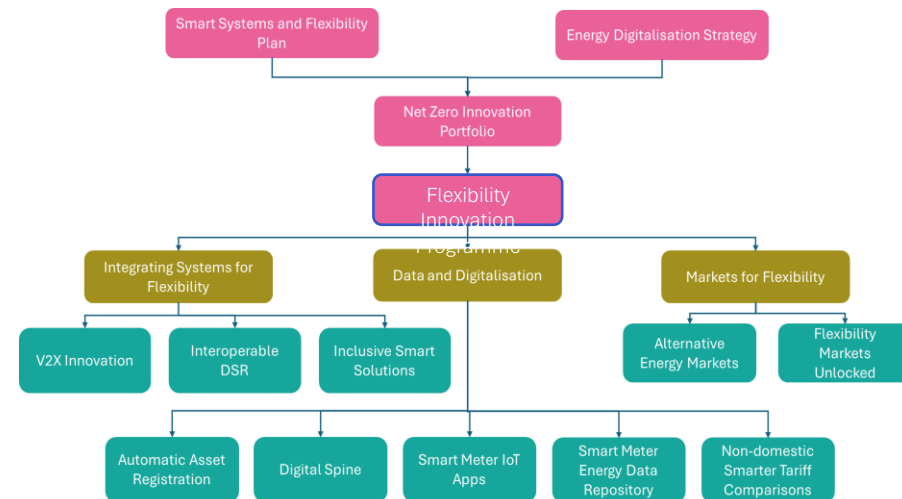
The UK's Digital Landscape

“For rapid progress towards Net Zero to be made, much greater digital capabilities and interconnected data and information are vital to enhancing our national energy system. Ultimately, the requirement is to connect parties and assets in a vast system-of-systems across the Net Zero economy”

Delivering a Digitalised Energy System – Energy Systems Catapult (Annex 3)

Although not the sole enabler of energy system flexibility, data and digitalisation solutions provide the key infrastructure needed to support the large-scale energy flexibility required for us to truly meet net zero emissions.

UK Flexibility Innovation Programme (FIP) offers funding for innovation projects across a range of smart energy applications. These projects seek to answer some of the most complex challenges raised when transitioning to a net zero energy system, providing funding for exploration into increased data sharing, market infrastructures for flexibility and interoperability.



Flexibility Innovation Programme Landscape, UK

Methodology

For this task, we engaged with members of the ISGAN working group 9 to determine categories of data and digitalisation seeking to aid in the development of energy flexibility throughout Europe. These categories are outlined below;

Digital Infrastructure

These are projects developing platforms able to underpin the processes and activities happening throughout the energy sector

Applications able to leverage the data or digital approaches to solve more specific problems

Projects developing solutions able to better harness data and utilise it alongside digital systems to better approach issues within the energy system

Data Sharing Portals and Repositories

Projects seeking to facilitate the increased sharing of data through the development of more centralised data platforms supported by robust data standards and interfaces

Digital Twins

Digital twin projects are developing solutions that can utilise more real-time flows of data to facilitate two-way information flows and automate decision making in the energy system

Platforms for facilitating the buying and selling of energy

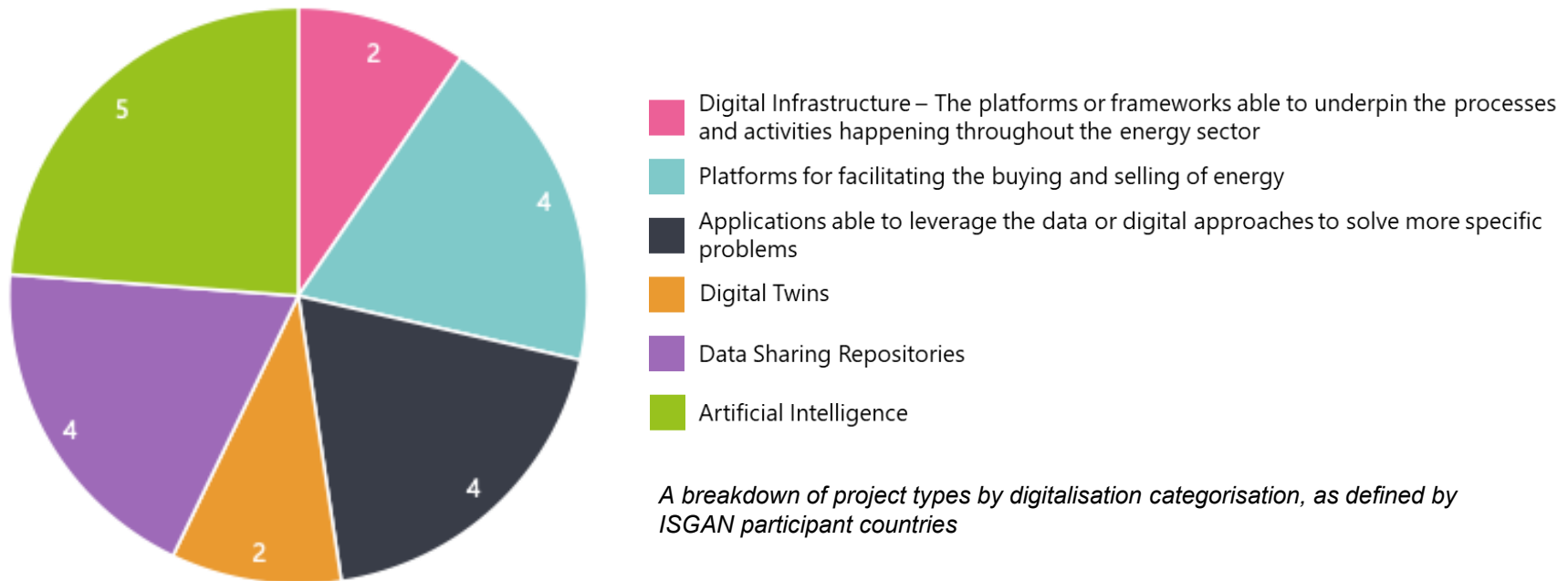
Pivotal to the success of a future, flexible energy system are the markets that stand it up. These are projects seeking to determine the constraints of energy trading and establish ways to provide secure energy

Artificial Intelligence

Alongside increased datasets, we need methods and tools in place that can quickly, effectively and ethically handle them and help make appropriate decisions in short timescales where needed

Methodology

The UK and four Working Group 9 member countries participated in this activity. These countries are Austria, Belgium, Canada and Spain. The projects falling under UKs Flexibility Innovation Portfolio and case studies from participating members are presented next.

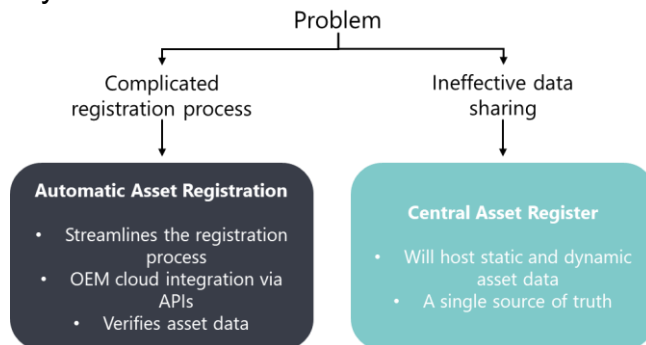


UK Best Practice Projects

Automatic Asset Registration

Generating increased visibility of data is incredibly important for giving an accurate view of the makeup of the energy system. [The Automatic Asset Registration \(AAR\)](#) puts the onus on asset installers and owners to ensure relevant, up to date information about assets is stored on the Central Asset Register (CAR). The CAR acts as a 'single source of truth' data repository for all relevant data of a registered LCT, making it a credible and reliable source of asset data.

The CAR has the potential to be an essential piece of digital infrastructure, enabling the secure exchange of asset data to support multiple use cases, including flexibility services.



Categories project covers:

- Data Sharing Portals or Repositories
- Digital Infrastructure – The platforms or frameworks able to underpin the processes and activities happening throughout the energy sector

UK Best Practice Projects

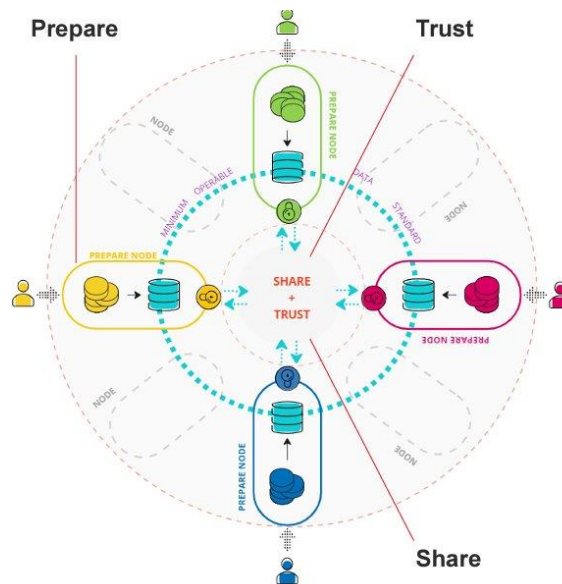
UK Cross Sector Data Sharing Infrastructure,

The Data Sharing Infrastructure is sought to act as a key data exchange mechanism between the regulator and various network companies, able to enhance decision making and breakdown the historically siloed view of the energy system. The concept was first outlined by the Energy Digitalisation Taskforce and defines the technical processes and governance needed to allow the secure exchange of data between organisations

Prepare: Aligns data to minimum operable standard

Trust: Implements the data sharing rules via verification and assurance

Share: Deploys and operates technical systems which enable sector-wide data sharing



Categories project covers:

- Digital Twins
- Digital Infrastructure – The platforms or frameworks able to underpin the processes and activities happening throughout the energy sector
- Data Sharing Portals or Repositories

UK Best Practice Projects

Smart Meter Based IoT Applications

Moving to a system where consumers pay for outcomes rather than units of energy requires a significant change in how offerings are structured and managed compared to today's market. From a digital perspective, service providers will need access to consumer data for both developing their propositions and validating the outcomes against which they are selling. There will need to be a change in the way in which consumers needs are gathered and met through the provision of service-based products.

The [Smart Meter System Based IoT Applications](#) programme looks to fund projects **delivering innovative applications, able to be applied directly alongside smart metering through IoT based sensors.** Projects progressing to phase 2 have **developed solutions required to better harness smart meter data for the provision of providing energy system flexibility.**

The 2 projects progressing to phase two are looking at the **benefits of additional sensing in homes**, such as temperature and humidity, to generate greater insights, as well as transferring this sensor data through the secure smart meter network.

Categories project covers:

- Applications able to leverage data or digital approaches to solve more specific problems

UK Best Practice Projects

Smart Meter Energy Data Repository

Moving to a system where consumers pay for outcomes rather than units of energy requires a significant change in how offerings are structured and managed compared to today's market. From a digital perspective, service providers will need access to consumer data for both developing their propositions and validating the outcomes against which they are selling. There will need to be a change in the way in which consumers needs are gathered and met through the provision of service-based products.

The [Smart Meter Energy Data Repository](#) is looking to support innovative projects **investigating the technical and commercial feasibility of a repository for smart meter data**. Delivering in 2 phases, the programme is funding projects providing **proof-of-concept designs of a data repository**, able to demonstrate the key features of the proposed technical solution.

The project progressing to phase 2, Anonymisation Enhanced Smart Meter Data Repository, is currently seeking to place data security and privacy at the heart of the design, **exploring new tools to protect personal data**, whilst still being able to **share anonymised insights**.

Categories project covers:

- Data Sharing Portals or Repositories

UK Best Practice Projects

Non-Domestic Smart Tariff Comparisons

Moving to a system where consumers pay for outcomes rather than units of energy requires a significant change in how offerings are structured and managed compared to today's market. From a digital perspective, service providers will need access to consumer data for both developing their propositions and validating the outcomes against which they are selling. There will need to be a change in the way in which consumers needs are gathered and met through the provision of service-based products.

The [non-domestic smart tariff comparisons](#) aims to **incentivise the development of innovative solutions able to provide tailored advice and recommendations for energy tariff products** able to be utilised within smaller, non-domestic organisations. These projects should be able to **signpost organisations to the best tariff options** for them, **encouraging wider engagement and uptake of these ToU tariffs** within these organisation types.

Projects progressing to the latter phases of this programme are now looking to **develop prototype tools to challenge the barriers to microbusinesses access to smarter tariff options**

Categories project covers:

- Applications able to leverage data or digital approaches to solve more specific problems

Featured Case Studies by Participating WG9 Member Countries

Canada, PowerShare

PowerShare is a project seeking to establish local distribution company Essex Powerlines (EPL) as the first fully integrated Distribution System Operator (DSO) in North America. Supported by the Independent Electricity System Operator Grid (IESO) Innovation Fund, the project seeks to test the provision of wholesale grid services, outside of the pre-existing IESO-administered market. It'll also develop local market rules and set testing for transmission-distribution coordination protocols.

One key project outcome of PowerShare is its use of **digital twins to help identify distribution needs** within the system are and **determine what buying and selling of energy is needed to help facilitate this.**

The project will address constraints on the local distribution networks and could even help to balance energy demand regionally, helping to provide stability of the network and provide energy security.

<https://powershare.energy/>

Categories project covers:

- Digital Infrastructure – The platforms or frameworks able to underpin the processes and activities happening throughout the energy sector
- Platforms for facilitating buying and selling of energy
- Applications able to leverage data or digital approaches to solve more specific problems
- Digital Twins

Featured Case Studies by Participating WG9 Member Countries

Spain, OneNet

OneNet seeks to provide solutions to enable an energy system able to harness seamless integration of near real-time integration of all actors across Europe. The vision is to create conditions for a synergised operation of market and network that enables an open and fair market structure to all participants, maximises the consumer capabilities wishing to participate in the system and optimise the ways in which the overall energy system is managed.

The main aim of OneNet is to **investigate the optimal conditions for future grid services** that are able to help **facilitate demand response, energy storage and distributed generation**, whilst also ensuring that the offerings are fair, transparent and open to all consumers.



Definition of a common
market design for Europe



Definition of a common
IT Architecture and
common IT Interfaces



Verification of the
proposed solutions in
large field tests

Categories project covers:

- Platforms for facilitating buying and selling of energy
- Digital Sharing Repositories

<https://www.onenet-project.eu/project-brief/>

Featured Case Studies by Participating WG9 Member Countries

Spain, BeFlexible

BeFlexible looks to increase the flexibility capabilities of the energy system, improve coordination between DSOs and TSOs and facilitate the participation of prosumers in the system.

BeFlexible has the main objective of **increasing energy system flexibility** and looks to do so via;

- Design of **cross-sectoral business models** to increase flexibility
- **Cost benefit analysis of flexibility options** carried out to ensure profitable business models
- Define, assess and understand **regulatory alternatives**
- **Foster local flexibility platforms** to integrate DSO-TSO coordination platform
- Contribute and develop **recommendations from aligning projects**
- Generate **consumer-centric services** to be designed and deployed
- Increase **consumer engagement** and acceptance
- Maximising project impacts and **empowering consumers**

Categories project covers:

- Applications able to leverage data or digital approaches to solve more specific problems

<https://beflexible.eu/what-does-beflexible-do/>

Featured Case Studies by Participating WG9 Member Countries

Belgium, SmarThor

SmarThor is a high performant central cloud data platform built on MS Azure that collects and stores relevant data related to the Open Thor Living Lab environment. It is developed & maintained by VITO & KU Leuven. The goal of SmarThor is to support research and innovation by making the data of the Open Thor Living Lab available in a secured way (API's, dashboards) for different kinds of stakeholders: Researchers, Policy Makers, Facility Managers, Industry.

The SmarThor platform has gone through a lot of development since its initiation in 2015, from research in the initial stages to more recently **integrating new technology types, standardisation of outputs and integration of wider, more context rich data sources** and initiatives, such as surveys and workshops. From 2024, SmarThor has been looking to further **understand how the OpenThor Living Lab can add value to the energy sector** through the **testing the behaviour of new devices** before they are integrated into the wider energy sector.

Categories project covers:

- Data Sharing Portals or Repositories
- Platforms for facilitating buying and selling of energy
- Artificial Intelligence

<https://www.openthor.be/en/projects/smarthor>

Featured Case Studies by Participating WG9 Member Countries

Belgium, Flemish AI Research Programme

The Flemish AR research program (FAIR) is a structural 12M€/year initiative of the Flemish government that funds basic AI research, stimulates the uptake of AI in companies, and sets up AI education initiatives. The consortium composes of the five Flemish universities and the six Flemish research centres. The FAIR program mainly provides funding for PhD students, which all collaborate both to the AI work packages and one or more use cases.

The Flemish AI programme is being split into 25 use case in 4 application areas, with energy having 2 use cases – **decision support for the low voltage distribution grid** and **renewable energy production**.

Low voltage distribution grid use cases focuses on the **novel methods needed to support digital twin capabilities for the low voltage grid** and the **requirements for increased data ingestion** to fulfil the use case.

Renewable energy generation use case focuses on the **novel AI methods that are required to forecast and control offshore wind** in combination with localised hydrogen production.

Categories project covers:

- Data Sharing Portals or Repositories
- Platforms for facilitating buying and selling of energy
- Artificial Intelligence
- Digital Infrastructure – The platforms or frameworks able to underpin the processes and activities happening throughout the energy sector
- Digital Twins
- Applications able to leverage data or digital approaches to solve more specific problems

<https://www.flandersairesearch.be/en>

1/10/2024

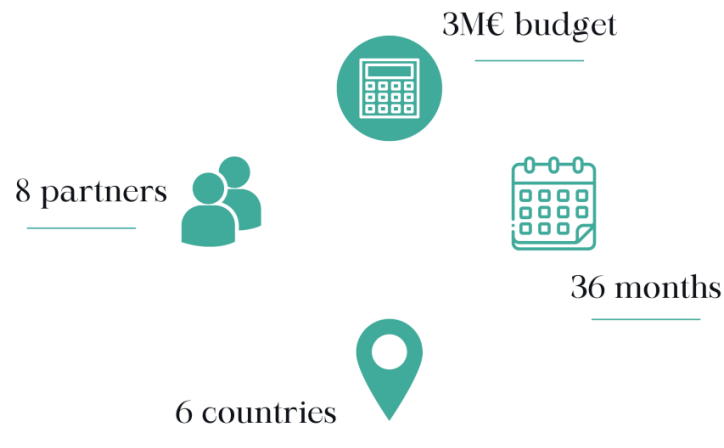
ISGAN, DIGITAL BEST PRACTICE CASE STUDIES

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Featured Case Studies by Participating WG9 Member Countries

Austria, PAREMINIDES

PARMENIDES aims to develop a new ontology, with a focus on the electricity and heating domain for buildings, customers and energy communities. The project seeks to specifically tackle challenges for energy communities and the usage of Hybrid Energy Storage Systems to provide flexibility (e.g. for grid-support or to optimise self-consumption)



Categories project covers:

- Applications able to leverage data or digital approaches to solve more specific problems
- Artificial Intelligence

<https://parmenides-project.eu/>

Featured Case Studies by Participating WG9 Member Countries

Austria, INFRADAPT

Rising temperatures and increases in cold spells caused by climate change are increasing the demand for electricity for both air conditioning and electric heating systems, respectively. Due to the energy system becoming increasingly complex with the additions of distributed resources and prosumers, advances in fields such as artificial intelligence (AI) offer great opportunity for use in tackling complexities in the energy system.

The goal of the project is to develop a machine-learning-based Grid Capacity Management (GCM) which can be used in any low-voltage grid in Austria without further training or adaptation. The GCM will use the available flexibilities for grid-support (in case violation (e.g. voltage violation) are been expected).

The methods used in INFRADAPT are developed and trained for use in real-time and can therefore be used regardless of the network topology.

Categories project covers:

- Artificial Intelligence

<https://project-infradapt.eu/>

Featured Case Studies by Participating WG9 Member Countries

Austria, FLEDGED

An increase in Low Voltage, decentralised resources being incorporated into the grid raises the complexity in ensuring that the energy system is managed in a secure way. One way in which this can be achieved is through grid expansions, but this is extremely costly and can take a vast amount of time to come into fruition. Ensuring flexibility within the energy system will help to manage the way in which these new resources are incorporated, whilst also negating the need for costly grid expansions. Artificial intelligence solutions offer a scalable approach to this problem, whilst also giving the flexibility in solution needed in a vastly changing energy system.

The FLEDGED project looks to improve services by using local high-resolution data in its dependent machine learning algorithms. These seek to improve and aid in the rollout of flexibility services in a way that still provides grid stability, whilst also negating the need for expensive grid reinforcements.

Categories project covers:

- Artificial Intelligence
- Data sharing portals or repositories

<https://projekte.ffg.at/projekt/4677519>

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Thank you

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