GREEN POWERED FUTURE
MISSION

Pillar 3

Data and Digitalisation

Factsheet P3-01

Data and Digitalisation for System Integration

The future global electricity system will consist of a huge amount of low-carbon and renewable infrastructure, significantly transforming how energy is generated and consumed. This evolution will be accompanied by a significant increase in the number of 'smart' digital assets and interactions between them. The industry currently lacks mechanisms for interoperable and secure data management and exchange, presenting significant challenges in an increasingly complex energy system.

This factsheet highlights 6 innovative projects from GPFM members which are addressing these challenges and working towards maximising the potential of a modern, digitalised power sector.

GPFM Innovation Priorities in scope:

- **IP 3.1.1** - Data discovery, access and licensing
- **IP 3.1.4** - Data security standards and data privacy
- **IP 3.3.1** - Interoperable markets, devices and data

6 Case studies reported in the factsheet

26 Projects covering these IPs are reported in the GPFM National Pilots report

For further details on **GPFM Innovation Priorities (IPs):**

GPFM Roadmap **Action Plan 2022-2024**

National Pilots Report

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Case studies

Case Study #1 Eco-synergy Data and Tech Integration Platform for Solar & Wind Power System

An integrated ecological synergy technology platform has been built to facilitate the collaborative planning, design, operation, and monitoring of solar and wind power systems, while focusing on ecological protection. This platform aims to optimize costs, enhance power generation efficiency, and improve the environment. It has been developed for demonstration sites that include a wind farm, two photovoltaic power stations, and a solar thermal power plant. Key features of the platform comprise remote data collection and analysis, energy-efficient design optimization, and ecological intelligent warning systems. By utilizing this platform, the optimization of design, intelligent operation, and ecological coordination of the solar and wind power generation systems can be effectively achieved.

Link to case study's detailed description

China

Case Study #2 Open Energy

Open Energy enables the discovery and usage of data across the sector. Governance-led, it streamlines data sharing and automates compliance through a multilateral, collaborative process. Distribution network operators, startups, researchers, and related stakeholders can deliver compliance, drive efficiencies and unlock innovation while avoiding centralising data. Operated by IB1, it is funded by public and private sectors, for and on behalf of the sector. IB1 is an independent non-profit making data work harder to deliver net zero. Open Energy helps underpin an open market design for data governance in national data infrastructure.

Link to case study's detailed description

Icebreaker One

25 billion

Predicted number of smart devices connected to the power system globally in 2030

Predicted savings in grid investment that digital technologies could bring by 2050 (USD)

1.8 USD trillion

Source: *IEA*

Case Study #4 The Virtual Energy System Programme

In 2021, to tackle decarbonisation challenges and leverage the potential of digitalisation, the ESO launched the Virtual Energy System. This ambitious programme's vision is to enable an ecosystem of connected digital twins of the entire GB energy landscape, working in parallel to the physical system. The ESO is imminently starting a pilot phase to test the solution, focusing on an outage planning use case. This pilot will be followed by a minimum viable product (MVP) phase throughout 2025 focusing on a use case of strategic planning. This is a truly transformative piece of innovation in the data sharing world.

Link to case study's detailed description

National Grid ESO

Case Study #5 DATA CELLAR

DATA CELLAR aims to create a federated energy dataspace that will support the development and management of local energy communities in the EU. The data space population will be facilitated via an innovative rewarded private metering approach, with a focus on easy onboarding and interaction, guaranteeing a smooth integration with other EU energy data spaces, providing LEC stakeholders with services and tools for developing their activities. DATA CELLAR will develop a dynamic, interoperable data platform to support the uptake of the Energy Communities leveraging a blockchain-based tokenization scheme for the remuneration in data and pre-trained AI models provisioning/acquisition cycle. DATA CELLAR will support the need for common dataspaces, focusing on user-friendliness for non-experts thanks to the availability of a data marketplace.

Link to case study's detailed description

Spain

Key metrics

Global investment in digital electricity infrastructure and software has grown by over 20% annually since 2014, reaching USD 47 billion in 2016.

An interoperable, digital power system can unlock flexibility and huge cost reductions

Effective use of data helps to improve energy efficiency and security

https://www.iea.org/energy-system/decarbonisation-enablers/digitalisation

Case Study #3 AI techniques to detect cyber attacks to electrical infrastructures

AI-based algorithms applied to cyber security would make it possible to detect attacks that are difficult to block with conventional strategies. This is particularly important to improve defence measures against cyber attacks to electrical infrastructure since they are carried out by syntactically and semantically but not operationally correct instructions. This case study involves the application of five AI algorithms for the classification of DoS-type cyber attacks. The results showed that the applied methodology produced models with an accuracy in line with literature results trained with the same dataset. This allows replicability of the developed methodology in view of selecting the best model to use.

Link to case study's detailed description

Italy

Case Study #6 Interoperable Domestic Flexibility: Standards and Innovation

To help promote innovation and uptake of smart technologies, the UK sponsored the development a technical specification (PAS1878:2021), led by the British Standards Institution, and guided by the core principles of delivering interoperable, cyber-secure domestic demand side response (DSR), whilst respecting data privacy and maintaining grid stability. An innovation programme was launched in parallel to develop and test the first energy smart appliances and DSR service platforms built to this specification. Learnings from the innovation programme are now being used to iterate the standard, demonstrating how innovation and standards development can work together to accelerate the development and uptake of smart products and services for energy flexibility.

Link to case study's detailed description

United Kingdom

Key findings

These case studies show that the transition to a digitalised power system is essential for improving flexibility, reliability, and sustainability in the energy sector. Enhanced system flexibility allows faster response to fluctuations in supply and demand, and consumers benefit from improved services and greater access to real-time data, empowering them to adopt sustainable practices.

As the digital revolution accelerates, the volume of data generated from smart devices is rapidly increasing. To fully harness this data's potential, it is crucial to establish robust standards, security measures, and interoperability among devices and systems, ensuring better integration within the power system. Data and technology can also be utilised to strategically integrate new solar and wind farms with the surrounding environment.

In conclusion, the global power sector must embrace data-driven approaches and digitalisation by leveraging innovative technologies and strategies to ensure a sustainable future.

- Digital technology can be used to efficiently plan and operate renewable energy systems while improving the integration with the ecological environment
- Establishing standards frameworks for data accessibility and compatibility is vital, alongside innovative strategies to address cybersecurity threats
- A robust digital infrastructure, at national level and beyond, is necessary to navigate the complexities of an interconnected, net-zero power system

About GPFM

The Green Powered Future Mission (GPFM), launched within the second phase of the global initiative Mission Innovation (MI2.0), is a public-private partnership with members from MI countries, private sector companies and international organisations. It aims to demonstrate that by 2030, power systems in different geographies and climates can effectively integrate up to 100% variable renewable energies, like wind and solar, in their generation mix, and maintain a cost-efficient, secure and resilient system.

https://explore.mission-innovation.net/mission/green-powered-future/

GPFM Coalition