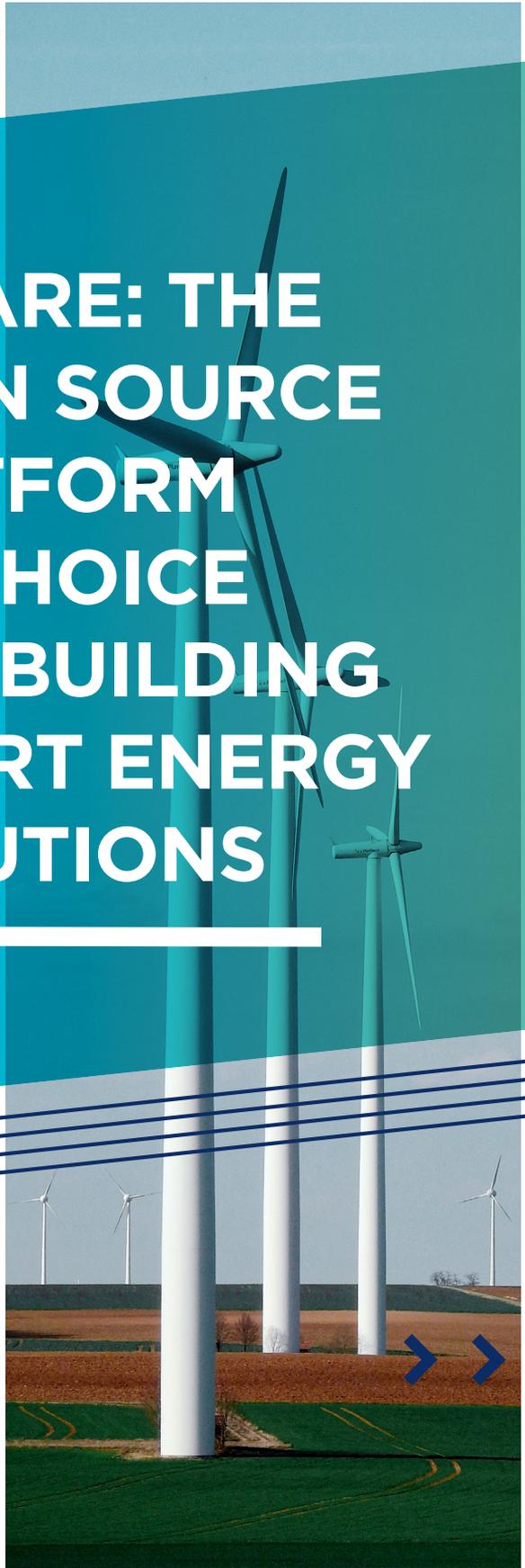




# FIWARE: THE OPEN SOURCE PLATFORM OF CHOICE FOR BUILDING SMART ENERGY SOLUTIONS



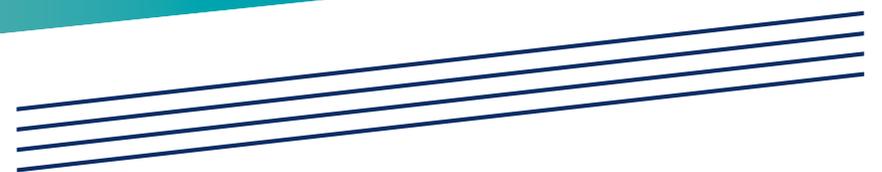
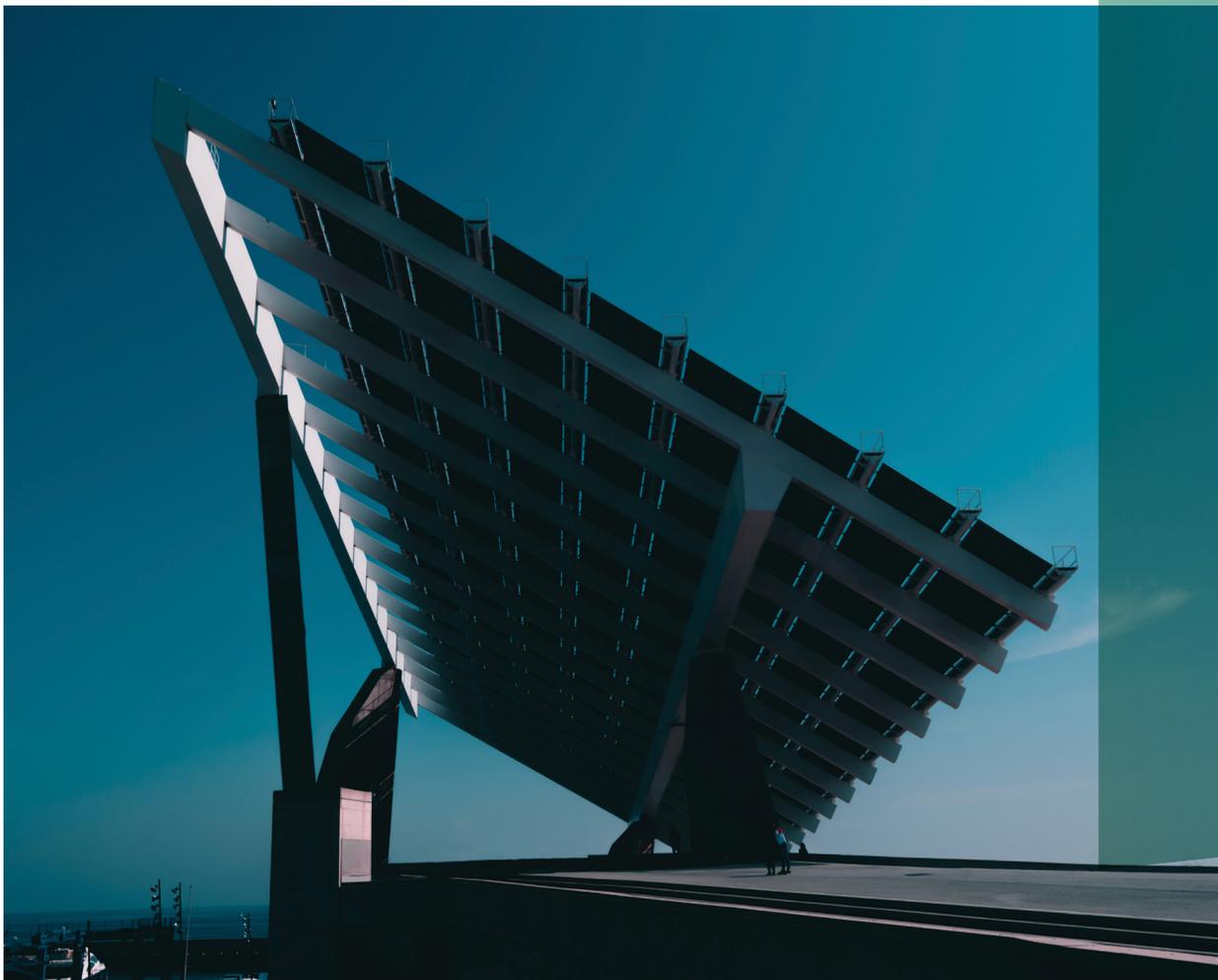
# › › › THE NEW REVOLUTION IN ENERGY

The Energy Transition: from straight supply chain to a complex ecosystem.

What was once a direct value chain is now transforming itself into complex ecosystems.

Consumers are becoming prosumers, and supply and demand are optimized in real time and at a very granular level. The need for flexibility has grown, notably with the innovations of renewable energy sources, batteries, power electronics, electric mobility, blockchain, and rapid digitalization.

At the same time, there are many business model innovations – rapid integration of distributed energy resources, decentralized markets, and Peer2Peer energy exchanges – that are driving differentiation and commodification across the energy sector leading to the electrification of everything.



## » » » CHALLENGES IN SMART ENERGY

### » TECHNOLOGICAL

- Lack of wireless broadband coverage in rural areas.
- Lack of standards regarding IoT protocols.
- Lack of standards for interoperability.
- Lack of standards for easing integration.
- Debate on data ownership and data security.
- Bringing new valuable insights from Big Data.
- Limited usability of end applications.
- Lack of cost-effective solutions.

### » ENERGY SECTOR

- Inadequacies in grid infrastructure.
- Stability concerns.
- Energy storage concerns.
- Energy management and expected massive penetration of electric vehicles.
- High capital investment.
- An urgent need to reduce losses and increase efficiency.
- Uncertainty regarding weather-related events.
- Power theft.
- Regulations and policies.

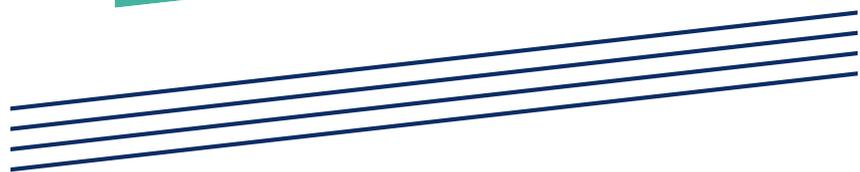
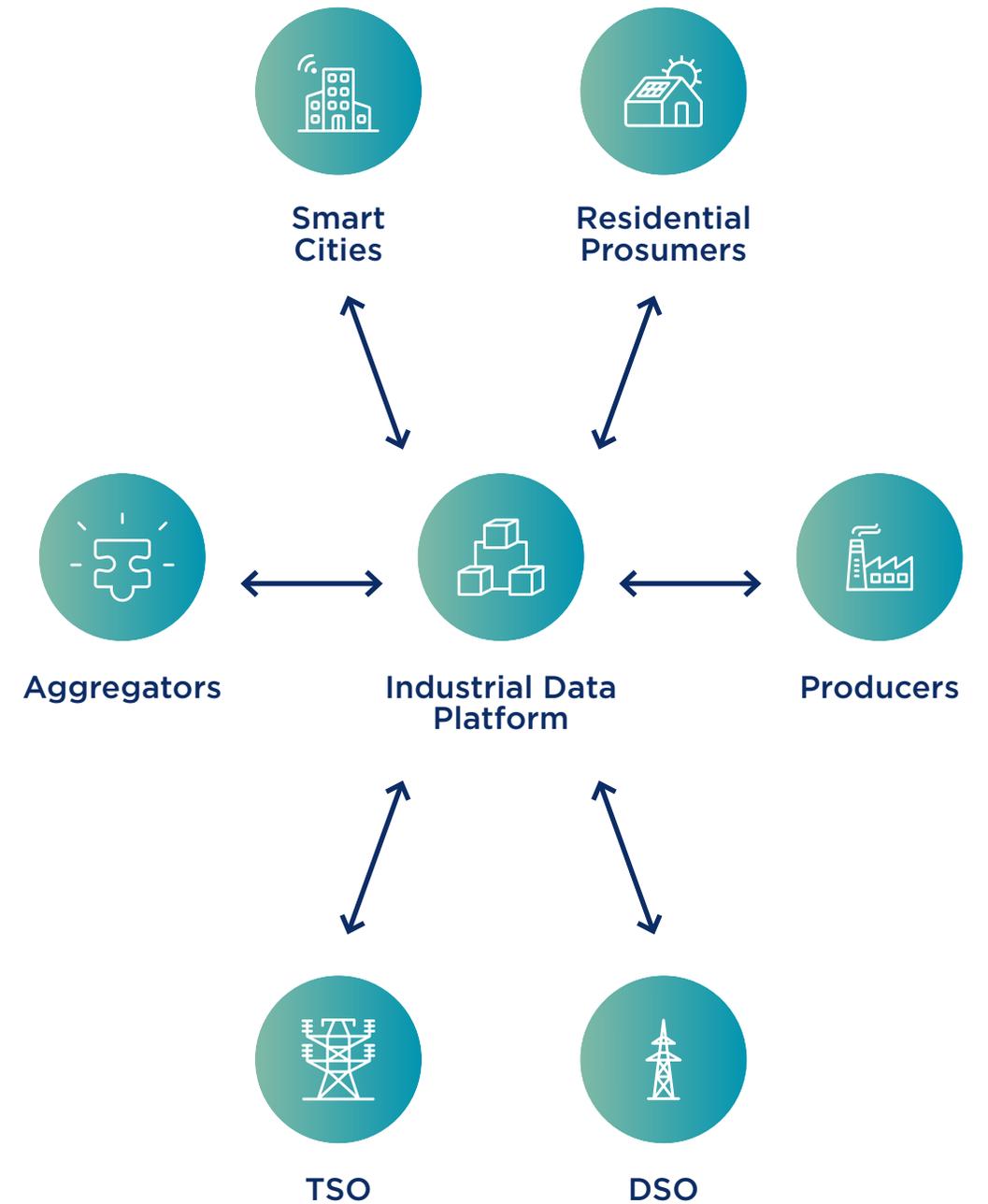


# ➤ ➤ ➤ EVOLUTION OF SMART ENERGY

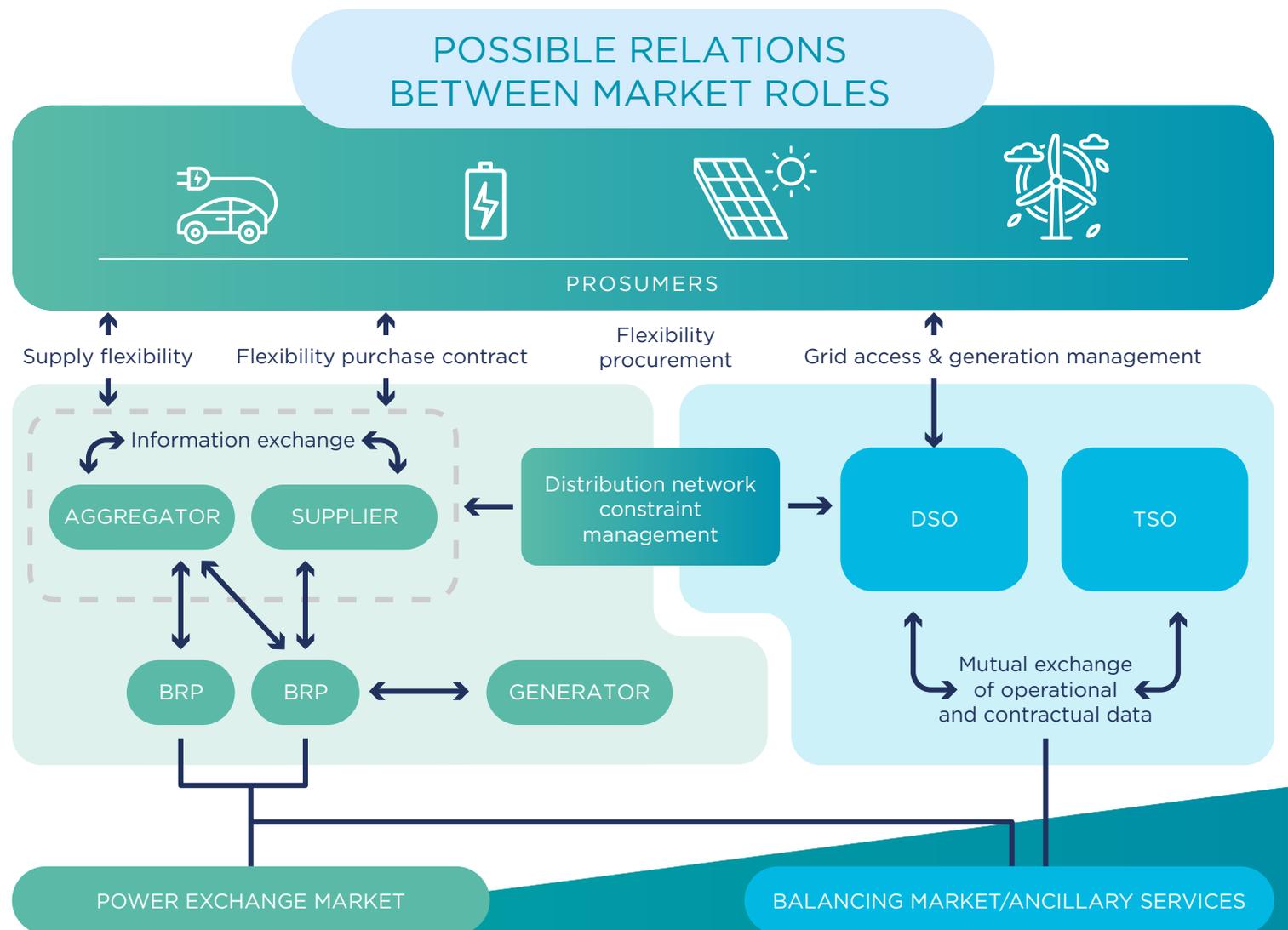
The digitalization of the energy sector demands higher levels of operational excellence with the adoption of disruptive technologies to foster cross-domain data sharing and data-driven innovation.

The following key elements in data management in support of a data economy need to be fulfilled:

- **Data model/Semantics:** Defining an appropriate data model beyond a single sector is a key ingredient for interoperability.
- **Context Information:** Defining the context is a key ingredient for bridging the gap between different verticals.
- **Data Sovereignty:** The ability of a data owner to define what a third party is allowed to do with his/her data.
- **Open APIs:** Closed solutions will not create a real open and competitive market. Open APIs offer the perfect bridge between private infrastructure spaces.



# >>> A GLOBAL ARCHITECTURE FOR SMART GRID APPLICATIONS



## IMPLEMENTATION OF SMART GRIDS

Modern grid applications need to accommodate the interaction of a variety of actors.

The main goal of a smart grid implementation is the creation of an automatic process. It is critical to define for every possible data exchange both the semantics of the information as well as the communication protocol.

## DATA FLOWS IN THE SMART ENERGY SECTOR

A number of data standards are available and many data exchanges are already formalized. New standards, emerging from the recent work of ETSI with the FIWARE Context Broker, are an important piece of the puzzle.

The increasing significance of data at customer/prosumer level requires platforms which are able to aggregate large amounts of data.

The emerging role of sector coupling like E-Mobility or Industry 4.0 with Energy makes it critical to avoid data silos.

Data platforms need to be based on open standards in order to support open competition.

# >>> USING FIWARE TECHNOLOGY FOR KEY DATA FLOWS

## AGGREGATORS VS DSO

This interface is yet to be defined, there are no dominating standards. In the FINESCE project, ESB Ireland implemented a **complete solution based on FIWARE technology**.

### *Prosumers-Retail vs Power exchange market*

A FIWARE-based platform for smart meter-based services can integrate **smart metering data** in the larger context of Smart Cities.

## SECTOR COUPLING

The main characteristics of a local energy community are the **integration of different energy vectors** to increase the level of local flexibility. Such a solution requires to go beyond the electricity sector.

Solutions such as the **FIWARE Context Broker** support a seamless merging of sectors, extending the set of contexts present in the ETSI CIM standard.

## LINK TO THIRD PARTIES

Data platforms offer the opportunity to create open interfaces that can be exploited by third-party providers, bringing innovative services to the energy domain. A complete set of APIs present in the FIWARE NGSI as well as extensions of the FIWARE Context Broker can be used to develop new energy domains.

## LINK TO SMART CITY PLATFORMS

When coupling the Energy and E-Mobility sectors, FIWARE's open API and Context Broker technology can serve as a bridge to proprietary mobility solutions.



# » » » FIWARE: A STANDARD WAY TO DEVELOP AND INTEGRATE SMART ENERGY SOLUTIONS

FIWARE is a curated framework of **open source platform** components which can be assembled together with other third-party platform components **to accelerate the development of Smart Solutions.**

The **FIWARE Orion Context Broker** is the core component of FIWARE: it gathers, manages and provides access to the information coming from different sources that describe what is going on in an Energy Ecosystem.

Building around the FIWARE Context Broker, a **rich suite of complementary FIWARE components** is available in order to facilitate:

- Interfacing with IoT sensors, meters or other devices.
- Processing of current and historical data using event rules or advanced Big Data and AI algorithms to extract valuable insights supporting smart decisions or automated smart actions.
- Creation of dashboards for monitoring the progress of processes within an Energy Ecosystem.
- Generation of valuable reports as well as the analysis and monitoring of KPIs (Key Performance Indicators).

» **The FIWARE Context Broker** technology can easily integrate with blockchain technologies to provide a trustworthy and immutable tracing of certain updates on context linked to steps in the smart energy ecosystem.

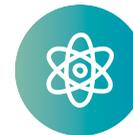
FIWARE also brings support to the potential publication of energy data for transparency or the monetization of energy data offered to third parties, enabling new sources of revenue.

» **The FIWARE Context Broker** enables the management of context information at a large scale through the **FIWARE NGSI API**, a public and royalty-free API adopted as an open industry standard by relevant organizations.



## **SIMPLE**

FIWARE NGSI provides an intuitive RESTful API using JSON readily accessible to any web developer. Any web programmer can learn how to use it in a single day.



## **POWERFUL**

FIWARE NGSI supports subscription/notification, geo-queries, federation, pagination, ... and soon the support of Linked Data (JSON-LD).



## **OPEN STANDARD**

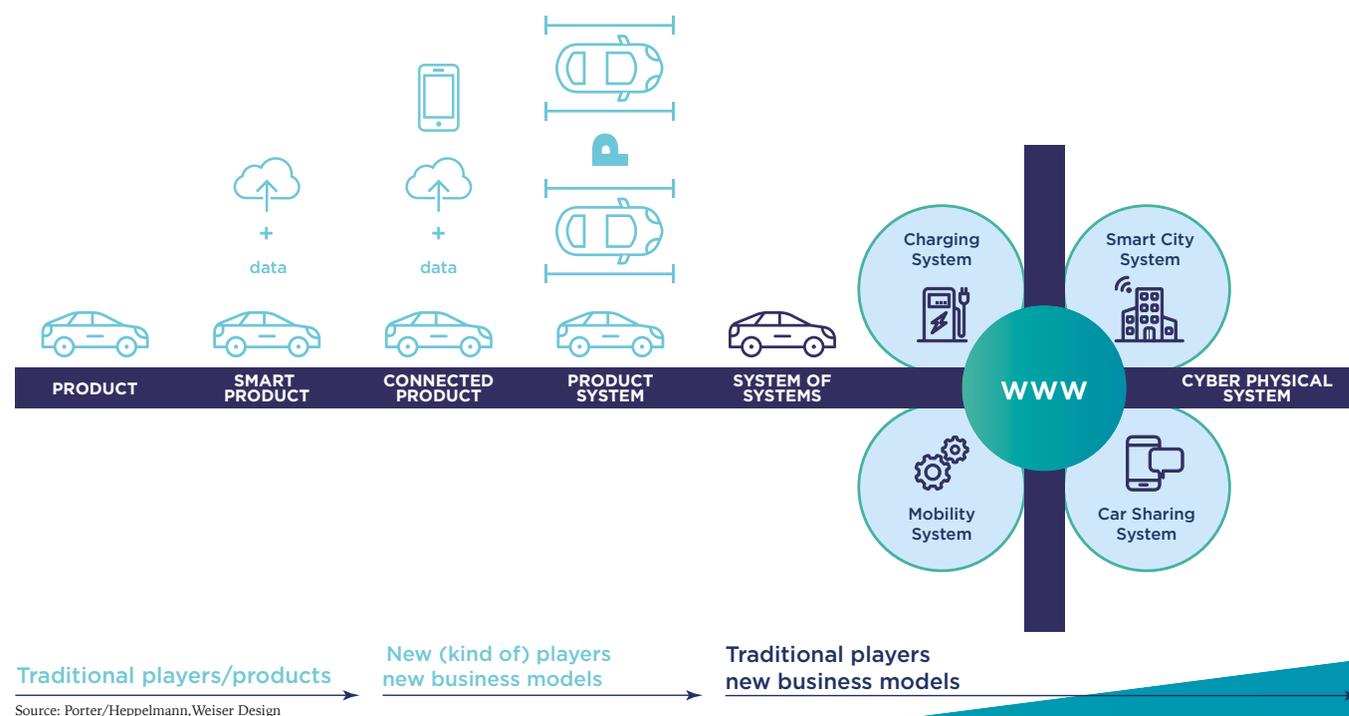
Current FIWARE NGSI specifications are public and royalty-free and they will align with the future ETSI NGSI-LD specifications.

The open standard nature of **FIWARE NGSI** offers programmers the ability to port their applications across different “Powered by FIWARE” platforms as well as a stable framework for future development.



# ➤ ➤ ➤ A SYSTEM OF SYSTEMS VISION FOR THE GLOBAL MANAGEMENT OF AN ENERGY ECOSYSTEM

## FIWARE for the creation of the System of Systems



The Reference Architecture of Smart Energy Management Systems “Powered by FIWARE” relies on a **“System of Systems”** vision. The existence of a context information management layer breaks the silos of information associated with the several vertical smart solutions, information systems and connected devices, enabling an overall management of an Energy ecosystem.

### OPEN SOURCE

- No licenses on platform components.
- Enabling contributions from multiple organizations.

### STANDARD-BASED

- Enabling an open and competitive marketplace of compatible farm management systems and vertical smart farming solutions.
- Lower costs to achieve interoperability of vertical solutions or their integration with farm management systems.
- Lower costs for integration with multiple IoT protocols, sensors, meters, etc.

### MODULAR, THEREFORE FLEXIBLE

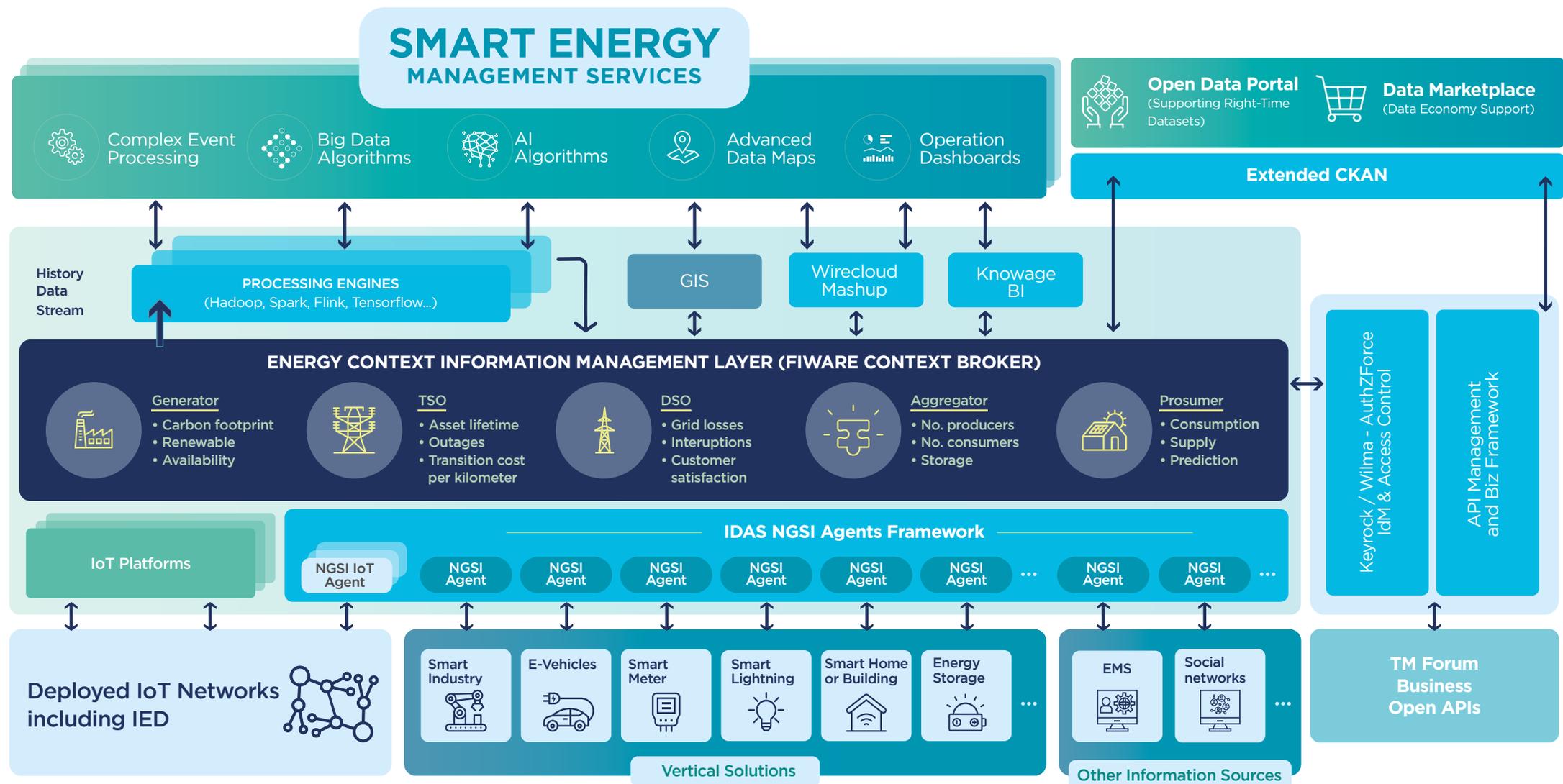
- Adding platform components parallel to business needs.
- Ability to add innovative features: blockchain-based traceability, open data publication, monetization of data and more.

### ROBUST, SCALABLE AND SECURE

- Quality Assurance testing on every component.
- Designed to get the most out of the cloud and scale on demand.
- Enabling to define and enforce compliance with data access control policies.



# >>> A REFERENCE ARCHITECTURE FOR SMART ENERGY MANAGEMENT SYSTEM POWERED BY FIWARE



- The Orion Context Broker integrates information from meters, sensors and other devices as well as vertical smart solutions and information systems, breaking information silos.
- IDAS IoT Agents connect to sensors, handling multiple IoT protocols (MQTT, CoAP/OMA-LWM2M, OneM2M,...). Alternative IoT platforms can be used for this purpose.
- ROS-2 robots are interfaced using Fast RTPS, adopted as default communication middleware in ROS-2.
- Historical data is processed using different processing engines (e.g., Hadoop, Spark or Flink) to extract valuable insights or derive smart actions. Complex Event Processing, Advanced AI or machine learning functions can be implemented on top of integrated processing engines.

- Operational dashboards are based on the Wirecloud web mashup framework.
- Knowage enables KPIs monitoring, Reporting and Business Intelligence functions.
- Part of the current and historical context data can be offered to third parties through an extended CKAN portal enabling publication of real-time data and the assignment of terms and conditions (including pricing) to data resources.
- Data/API access control functions warrant that context data is only accessible to parties owning the right privileges.
- API management and business support functions enable auditing of the system and monetization on data access.

# >>> THE FIWARE MARKETPLACE



## POWERED BY FIWARE

- **Smart Solutions** rely on FIWARE standards to manage context information at a large scale. They use the FIWARE technologies to gather and process context information coming from different and highly distributed sources.
- **FIWARE platform service providers** offer FIWARE as a Service on private and public clouds. Also, platform service providers can deploy FIWARE platform instances on premises for their customers.

## FIWARE-READY TECHNOLOGIES

- **FIWARE-ready IoT devices** come with easy-to-install drivers and instructions, accessible to end applications using the FIWARE NGSI standard.
- **FIWARE-ready software enablers** are base platform technologies, which can easily be integrated with FIWARE. This extends the basic capabilities of the platform with advanced added-value features.

### Check out: [marketplace.fiware.org/join](https://marketplace.fiware.org/join)

The Marketplace is a global one-stop shop that gives access to a wide range of **Powered by FIWARE solutions and platforms, FIWARE-ready technologies**, as well as related training, coaching, consultancy, integration and services.

The Marketplace offers everyone in the **FIWARE Community** the platform to increase visibility and attract target customers or potential investors and partners.

### FIWARE SERVICES

Online training material is available on the FIWARE Academy but many partners are offering tailored **training and coaching services**.

Finding the right experts offering **consultancy, integration or technical support services** is crucial for many projects. The FIWARE Marketplace is helping to serve this need.

- The European Commission, under its **Connecting Europe Facility (CEF)** program, recently announced the adoption of FIWARE Context Broker technology as a CEF Building Block. The CEF program supports the development of digital infrastructures enabling an European Digital Single Market.
- **GSMA** has produced a Reference Architecture for IoT-enabled Big Data Ecosystem solutions which the FIWARE NGSI API is recommended.
- **ETSI** has launched an ISG (Industry Specifications Group) on cross-cutting Context Information Management (CIM) standards which identify OMA NGSI and FIWARE NGSI as starting points for the API specs.
- **TM Forum** has also agreed to adopt FIWARE NGSI as the basis for providing right-time access to context information. Combined with FIWARE Data Marketplace components and Open TM Forum Business APIs, it can transform cities into enablers of the Data Economy.
- **OASC (Open and Agile Smart Cities)** The initiative comprises more than 110 cities in 24 countries which have decided to adopt FIWARE NGSI as the basic API for right-time access to contextual data in the cities.

## ➤ ➤ ➤ GLOBAL ORGANIZATIONS ADOPTING FIWARE



> > > **BECOME A  
MEMBER OF  
THE FIWARE  
FOUNDATION**



### ABOUT FIWARE

The FIWARE Foundation is the legal independent body providing shared resources to help achieving the FIWARE mission by promoting, augmenting, protecting, and validating the FIWARE technologies as well as bringing support to the activities of the FIWARE Community, empowering its members including end users, developers and the remaining stakeholders in the ecosystem.

The FIWARE Foundation is inclusive: anybody can join contributing to a transparent governance of FIWARE activities and rising through the ranks based on merit.

FIWARE's mission is to develop an open sustainable ecosystem around public, royalty-free and implementation-driven software platform standards that will ease the creation of Smart Applications in multiple sectors.

FIWARE - The Open Source Platform  
for our Smart Digital Future.

[fiware.org/foundation/members](https://fiware.org/foundation/members)

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