AI-IoT Edge-cloud and platform solutions for energy

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Internet of Things
DG CNECT
European Commission

Swarms projects workshop , 5 Sep 2024

HORIZON-CL5-2023-D3-01-15

Supporting the green and digital transformation of the energy ecosystem and enhancing its resilience through the development and piloting of AI-IoT Edge-cloud and platform solutions

- Decentralised environment in the energy sector
- Large-scale validation (+ open call) in a real environment and market uptake
- Cloud-Edge continuum, edge and swarm computing, federated AI/ML, IoT
- Innovative data-driven energy services
- Open Source solutions
- Standards
- Distributed renewable energy, bi-directional EV charging, smart buildings
- Compliant to the common European data spaces (energy, mobility)
- Based on existing EU solutions (e.g. MetaOS and swarms projects)
- Target TRL 7-8 from initial TRL 5-6
- Two projects - Odeon and Hedge-IoT

ODEON

FEDERATED DATA AND INTELLIGENCE ORCHESTRATION & SHARING FOR THE DIGITAL ENERGY TRANSITION

at a glance

5 pilot sites

Distributed in 5 different EU member states

48 months

Starting in January 2024
Ending in December 2027

34 partners

From 13 different member states

Total budget: 22.56 M€
Total funding: 17.87 M€

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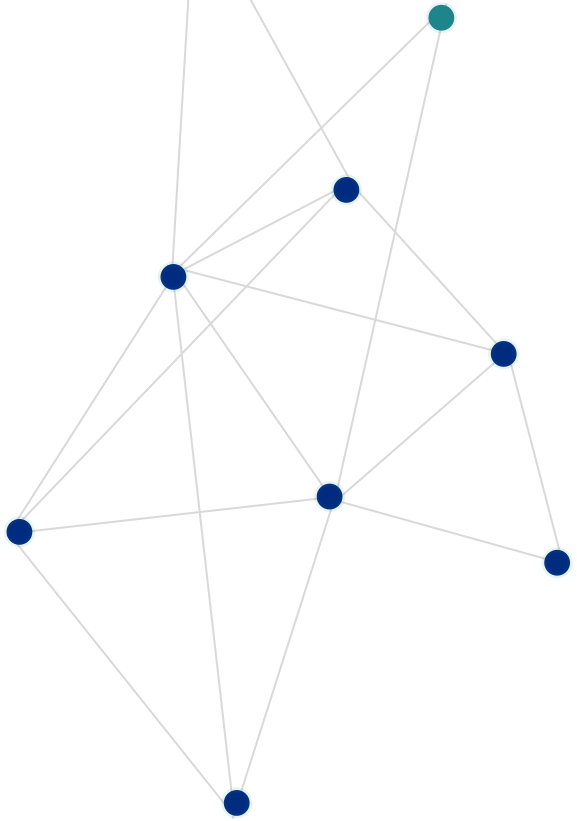

ODEON

partners

etra I+D

ΕΠΙΣΕΥ ICCS

EVIDEN

DTU

Fraunhofer FOKUS

Suite5 We Deliver Intelligence

UBITECH ubiquitous solutions

UBITECH digitizing energy

tecnalia MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

INTRACOM TELECOM

GRUPPO Maggioli

HEDNO

UPC UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

JOANNEUM RESEARCH LIFE

SPACE

Sagemcom Odit-e

circe Creating together

IES

InQbit Innovations

sicae

pi Prospex Institute

Cuerva*

vergy

Fuinneamh Oileáin Árann Aran Islands Energy

TREFOR El-net

barbara

HPΩN

INTERNATIONAL DATA SPACES ASSOCIATION

logikers

ARTHUR'S LEGAL

EWII

FundingBox

EPL TECHNOLOGY FRONTIERS

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ODEON goals

Technology innovation goals

ODEON aims to revolutionize the **Green and Digital Energy transition** through the creation of an inclusive ecosystem of stakeholders characterized by the **integration of a mesh of Data, Intelligence, Service, and Market flows in the energy system**. ODEON enables the resilient operation of the energy system considering the increased **RES integration**, and the effective orchestration of **the flexibility from assets residing at the edges of the system (edge-computing).**

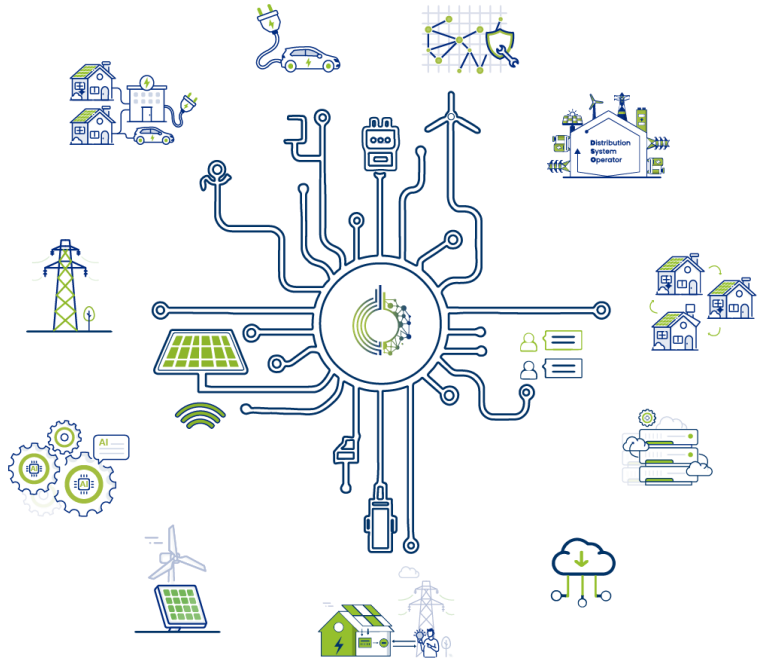
01 **To promote a highly distributed open framework for orchestrating federated data management, sharing and intelligence**

02 **To deliver innovative energy services enhancing grid resilience and decentralized flexibility**

03 **To encourage data exchanges by fostering technical and semantic interoperability**

04 **To promote a decentralized environment in the energy field**

05 **To provide intelligence-enabled solution and services driven by data to achieve energy transition goals**



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ODEON goals

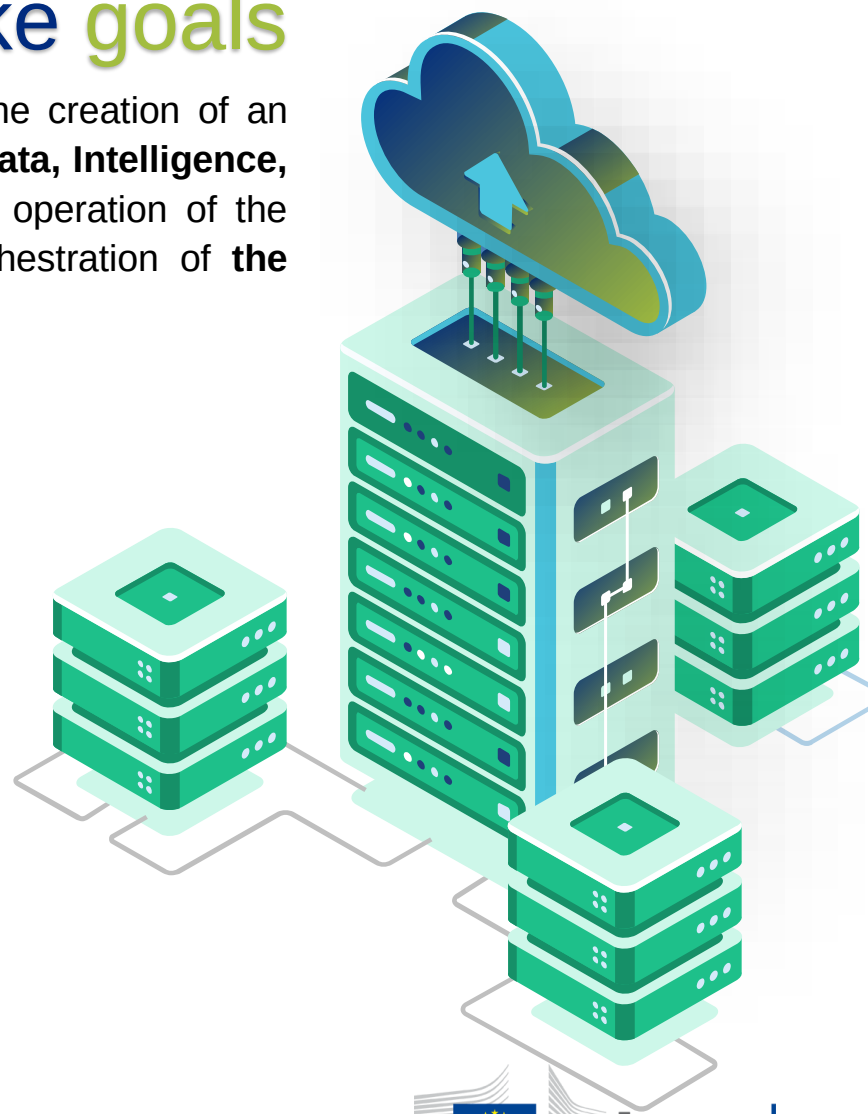
Business innovation and Market Uptake goals

ODEON aims to revolutionize the **Green and Digital Energy transition** through the creation of an inclusive ecosystem of stakeholders characterized by the **integration of a mesh of Data, Intelligence, Service, and Market flows in the energy system**. ODEON enables the resilient operation of the energy system considering the increased **RES integration**, and the effective orchestration of **the flexibility from assets residing at the edges of the system (edge-computing).**

01 **To demonstrate and validate the concept in 5 large-scale demonstrators across real-life and critical conditions**

02 **To prepare the grounds for the successful replication and market uptake**

03 **To promote ODEON as a reference Cloud-Edge Data and Intelligence enabler for the Green and Digital Transition through intense dissemination and knowledge transfer**



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ODEON innovations

ODEON Cloud-Edge Data and Intelligence Service Platform

Reference Energy Data Spaces implementation around energy data

ODEON Catalogue of AI Artefacts

Machine-Learning mechanisms for orchestration of devices

ODEON Energy services for DSO

- Flexibility-based Network Management
- Dynamic Power Flow Management and Quality restoration
- Network Planning and Reinforcement Assessment
- Asset management and Predictive maintenance

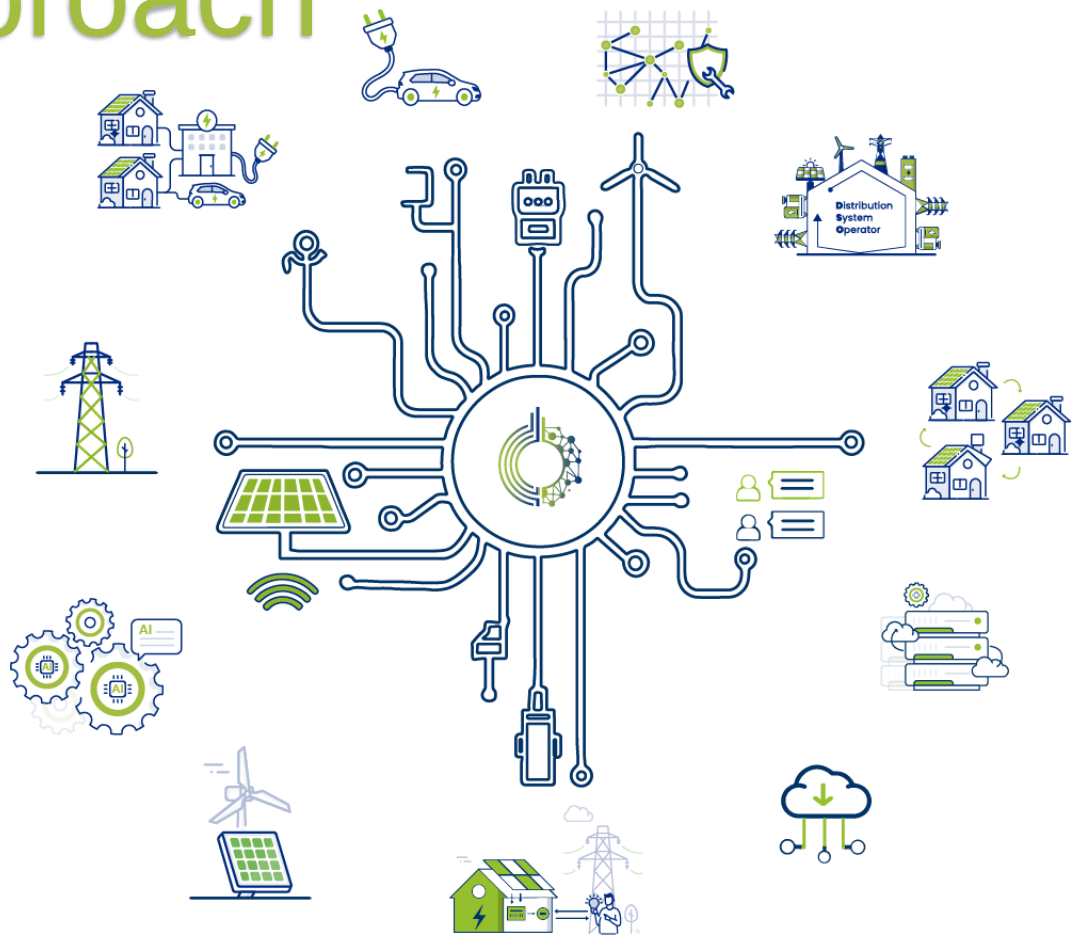
ODEON Energy Services for LECs/Aggregator

Reduction of energy costs and increase their autonomy by management in RES and flexible assets

ODEON Energy Services for Prosumers

Informed and transparent participation in flexibility and energy transactions

A Bird-eye view of the ODEON approach



SERVICE ENABLERS

- Network and Asset Management
- VPP and Demand Response
- Investment Guidance
- Self-consumption
- EV Smart Charging

INTELLIGENCE ENABLERS

- Federated AI Containers
- Pipeline design,training and execution
- Federated intelligence
- AI pre-trained artefacts

MARKET ENABLERS

- P2P Energy Trading
- Local Flexibility Trading
- Market Codes and Processes

DATA ENABLERS

- Federated Data Spaces and DataOps Orchestration
- Interoperability and Data Sharing
- Data privacy and Cyber security

DER, GRID Assets, Distributed Data Assets

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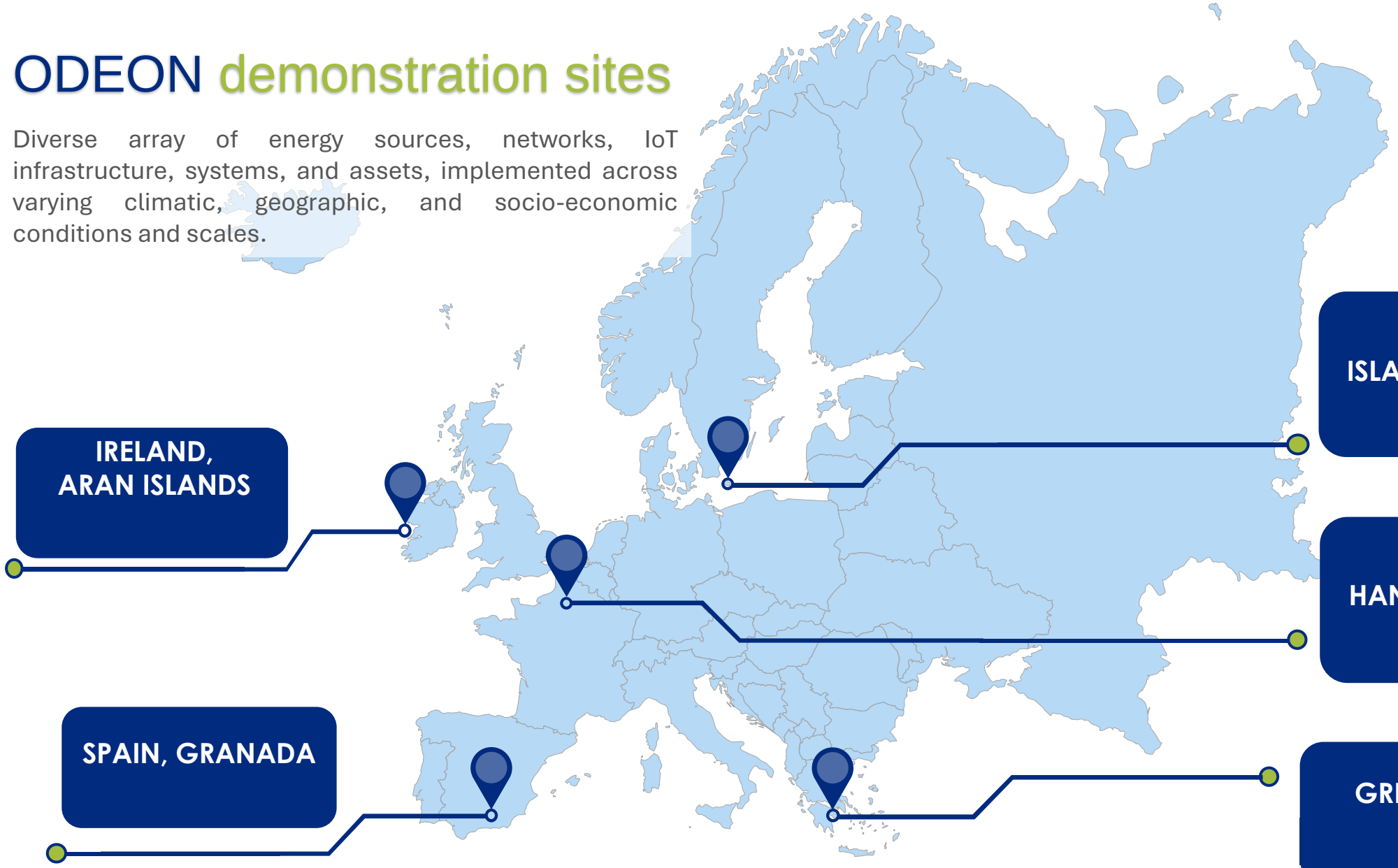
ODEON demonstration sites

Diverse array of energy sources, networks, IoT infrastructure, systems, and assets, implemented across varying climatic, geographic, and socio-economic conditions and scales.



DENMARK, ISLAND OF BORNHOLM

IRELAND, ARAN ISLANDS

FRANCE, HANGEST-EN-SANTERRE

SPAIN, GRANADA

GREECE, MESOGIA

HEDGE-IoT

- **Project Grant Agreement:** No. 101136216
- **Project Coordinator**: European Dynamics Luxembourg SA
- **Budget**: 21.9 M Euro
- **Grant**: 17.9 M Euro
- **Duration**: 42 months
- **Start Date**: 1st January 2024

Consortium members

European Dynamics

Industrial Data Space Association

University of Zagreb

REN

elergone energia

CyberEthicsLab.
Responsible Research and Innovation

Acea energia

CEVE

Jožef Stefan Institute

areti

ΔEH

ELES

OPERATO
member of ELES Group

ARNHEMS BUITEN

KONČAR
Inspired by challenge

CONTINENTE

ΔΕΔΔΗΕ
HEDNO

SOCIAL OPEN & INCLUSIVE INNOVATION
INCLUSINN

iCity
SMART CONNECTIONS, QUALITY LIVING

JÄRVI-SUOMEN ENERGIA

ipto
INDEPENDENT POWER TRANSMISSION OPERATOR

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SOCIAL OPEN & INCLUSIVE INNOVATION
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CluBE
Bioeconomy & Environment Cluster Western Macedonia

ABB

F6S

R&D
NESTER
CREATING A SMART ENERGY FUTURE

VTT

UNIVERSITATEA TEHNICĂ
DIN CLUJ-NAPOCA

Trialog

TNO innovation for life

elektro gorenjska

VU
VRIJE UNIVERSITEIT AMSTERDAM

elia
Elia Group

INESCTEC

RWTH AACHEN UNIVERSITY

ENGINEERING
THE DIGITAL TRANSFORMATION COMPANY

HEDGE-IoT

Holistic Approach towards Empowerment of the Digitalization of the Energy Ecosystem through adoption of IoT solutions

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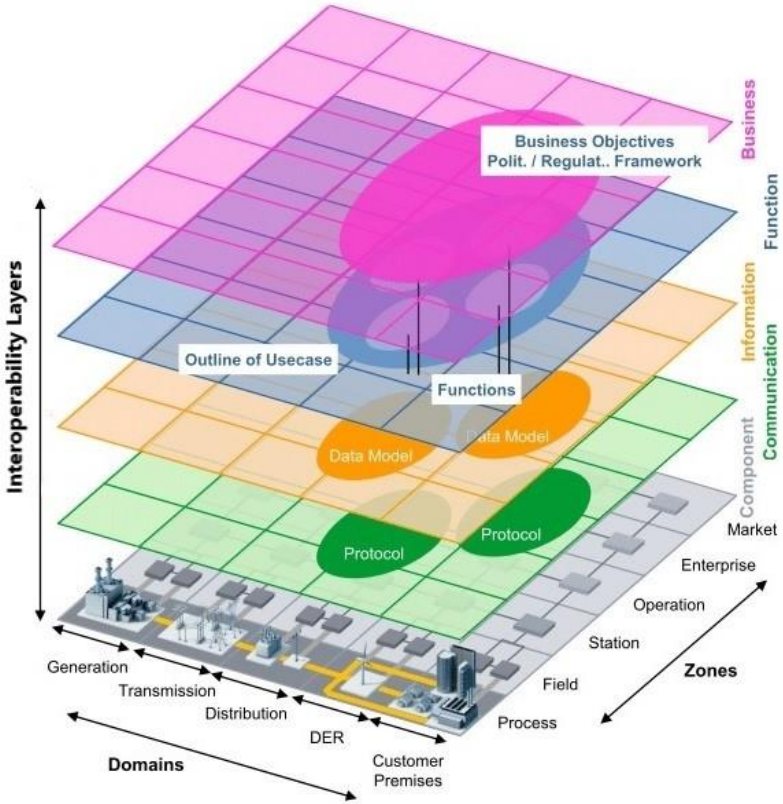
Vision

HEDGE-IoT – *Holistic Approach towards Empowerment of the DiGitalization of the Energy Ecosystem through adoption of IoT solutions* will:

- **deploy IoT assets** at different levels of the energy system (**from behind-the-meter, up to the TSO level**)
- **add intelligence to the edge and cloud layers**
- **bridge the cloud/edge continuum** introducing **federated applications** governed by **advanced computational orchestration** solutions.



Source: https://digital-strategy.ec.europa.eu/en/policies/eu-policy-digitalisation-energy

HEDGE-IoT
Holistic Approach towards Empowerment of the Digitalization of the Energy Ecosystem through adoption of IoT solutions

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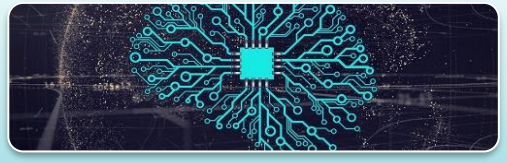
Objectives

To add local/distributed intelligence leveraging IoT solutions at the edge/fog/cloud layers establishing the edge/cloud continuum through computational orchestration



To design AI/ML tools for edge/fog/cloud services for increased flexibility, resilience and observability

INTERNATIONAL DATA SPACES ASSOCIATION

To enable extended service and semantical/ontological interoperability and interconnectivity among distributed open platforms, systems and edge devices through a decentralized IDS-compliant Interoperability Framework

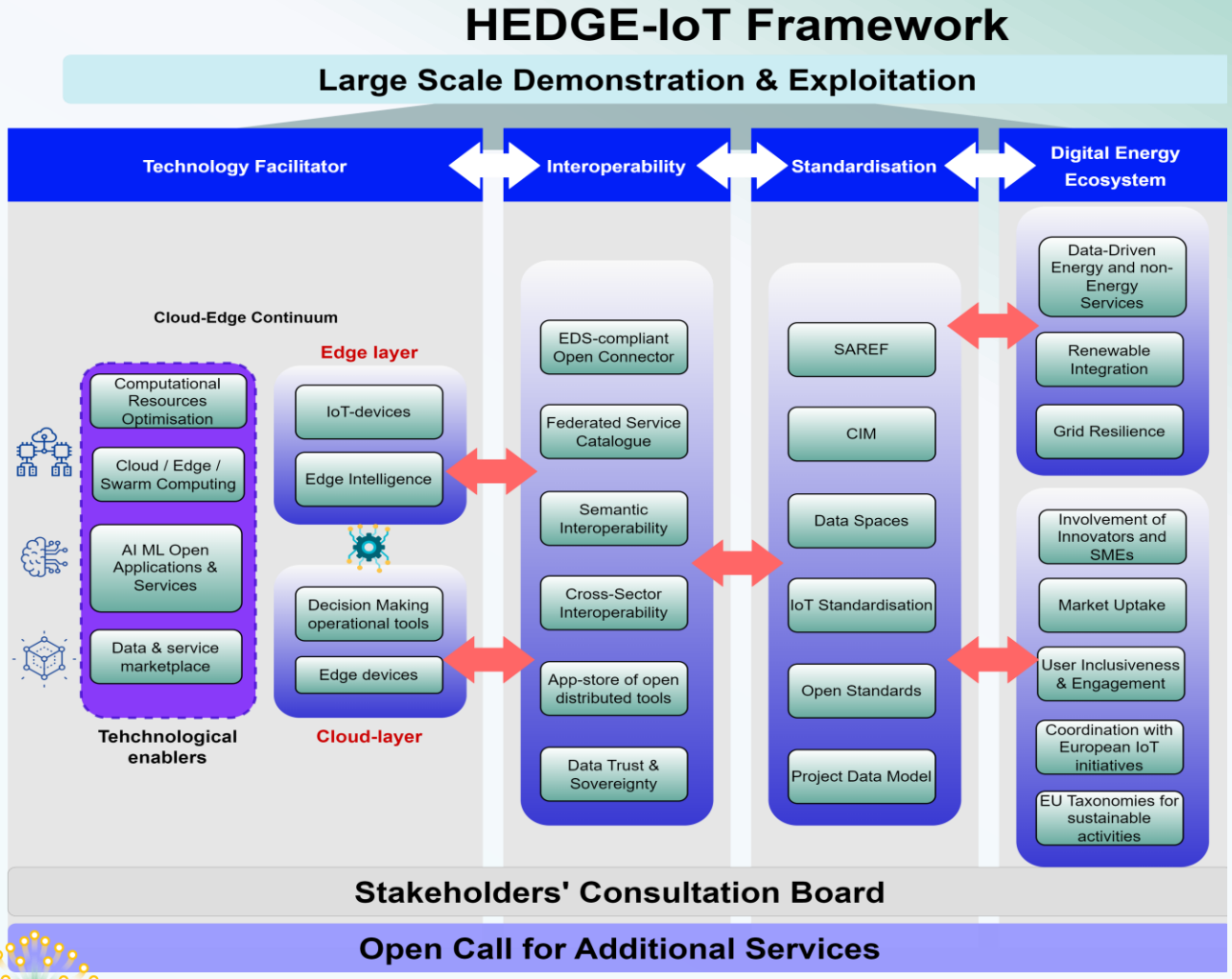
To demonstrate, validate the HEDGE-IoT solutions and frameworks in 6 Demonstrators in 6 European countries featuring different climatic, regulatory and societal conditions towards maximizing mutual learning and knowledge exchange

To apply and extend open standards for IoT, interoperability, grid and market related data exchanges and to create a set of commonly accepted standards

To facilitate the market uptake of the proposed solutions, strengthening their commercialization potential and contributing to the Digitalization of Energy Action Plan. To complement the HEDGE-IoT Framework with additional data-driven services, by 3rd parties and especially SMEs, through an Open Call campaign.

HEDGE-IoT Multi-dimensional Framework

1. Technology facilitator pillar
2. Interoperability pillar
3. Standardisation pillar
4. Digital Energy Ecosystem



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Holistic Approach towards Empowerment of the Digitalization of the Energy Ecosystem through adoption of IoT solutions

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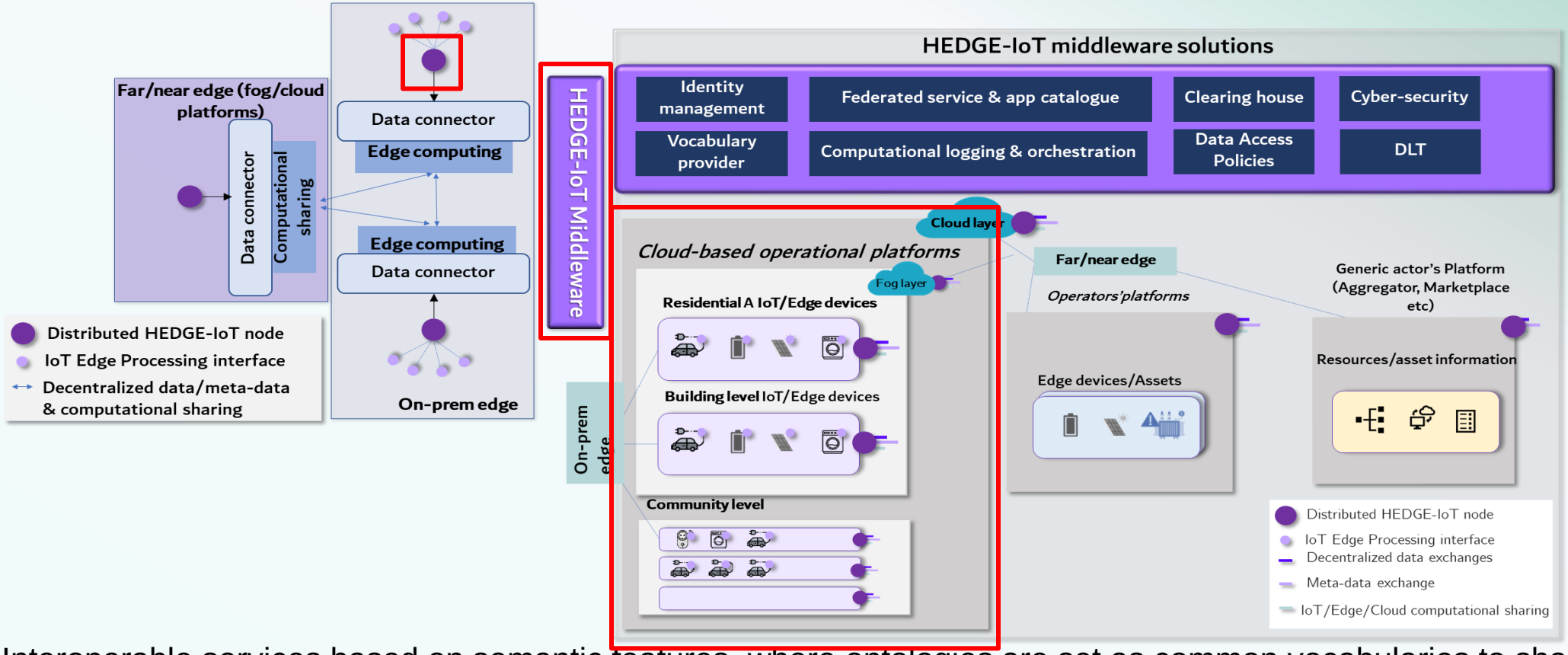
Reference Architecture



- ✓ Interoperable services based on semantic features, where ontologies are set as common vocabularies to share and integrate data that can be encoded in different specific protocols and syntactical standards.
- ✓ Seamless interconnection of IoT/edge with HEMS gateway or with upper fog/cloud platforms leveraging the basic functionality of an IDSA-based connector.

HEDGE-IoT

Holistic Approach towards Empowerment of the Digitalization of the Energy Ecosystem through adoption of IoT solutions

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Pilots

Next-generation grid automation with IoT and edge/cloud data to improve distribution grid resiliency

Leverage IoT and Edge Computing to foster Local Flexibility Markets

Digitalize ECs and EV stations to Enhance Grid Resilience, RES Hosting and Socialize Local Productions

Enhance local grid flexibility to diverse end users by digitizing energy assets and incorporating SAREFized interoperable grid monitoring and control

Living Lab for Interoperable AI-based Energy Services

Enhanced Local Flexibility Services for Improved Asset Lifetime Extension Planning

HEDGE-IoT

Holistic Approach towards Empowerment of the Digitalization of the Energy Ecosystem through adoption of IoT solutions

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Conclusions

- ✓ Challenging and ambitious project
- ✓ Main focus is the digitalization of the energy sector through wide deployment and orchestration of IoT devices
- ✓ Synergies with ODEON sister project are in place
- ✓ Interesting to examine further synergies with relevant projects covering other sectors → replication

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Thank you

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