(Re-)Powering the transformation: the digitalization of the energy system

October 6, 2022
(Re-)Powering the transformation: the digitalization of the energy system
Fraunhofer Twin Transition Series

09:00 a.m.  Moderation by Verena Fennemann
Head of Fraunhofer EU-Office Brussels
Welcome and introduction by Dr. Reinhard Mackensen
Fraunhofer Institute for Energy Economics and Energy System Technology IEE

09:10 a.m.  Setting the scene by Markus Pieper
Patron of the webinar; Member of the European Parliament

09:20 a.m.  Expert presentation I “Towards an open and scalable approach to distribution grid automation”
by Prof. Antonello Monti
Fraunhofer Institute for Applied Information Technology FIT

Expert presentation II “The value of Data Spaces for a decentralized energy system” by Oliver Warweg
Advanced System Technology branch AST of Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB

09:40 a.m.  Discussion

10:00 a.m.  End of the event
Welcome and introduction

Dr. Reinhard Mackensen
Fraunhofer Institute for Energy Economics and Energy System Technology IEE
The Fraunhofer-Gesellschaft

At a glance

Applied research with a focus on key future-relevant technologies and the commercialization of findings in business and industry. A trailblazer and trendsetter in innovative developments.

> 30,000 employees

76 institutes and research units

Financing

2.9 billion

2.5 billion

Major infrastructure capital expenditure & defense research

One-third is base funding from Germany’s federal and state governments

Two thirds come from industrial contracts and publicly-funded research projects

2021
Profile

The Cluster of Excellence Integrated Energy Systems CINES addresses the central technological and economic challenges of the energy transition.


CINES - Fraunhofer Cluster of Excellence »Integrated Energy Systems«

Our Mission

Energy system analysis, global, regional and on-site analysis as compass for energy system transformation.

Technologies for system transformation: electrolysis, power electronics and the transformation of district heating networks.

Transfer to the market via various event formats, (scientific) communication in society.

Development of Fraunhofer-Institute-wide statements and policy papers for policy makers.

Qualification and promotion of young scientists for sustainable energy research.
CINES - Fraunhofer Cluster of Excellence »Integrated Energy Systems«

Fields of action

Energy System Analysis  Municipal Energy Planning  On-Site Supply  Hydrogen MENA

Digitalisation  Heat  Electrolysis  Power Electronics  Science Communication
Why is digitalization that important for the energy transition?
Complexity requires digital transformation

Challenges to face...

- Majority of energy production will be based on renewable, fluctuating sources
- Complexity rises - More Assets in production and demand
- Lack of reliable mechanisms to match energy production and demand
- The cyber-physical energy system needs a strong level of resilience

... and the way forward

- The system needs access to flexibilities on the demand side and storage
- Aggregation on different levels, implemented over different sectors (power, heat, ...)
- Fast data exchange, decisions for planning and operation, interoperability
- Communication system has to be built robust in analogy to the energy system (n-1)
Setting the Scene

Markus Pieper
Member of the European Parliament
Towards an open and scalable approach to distribution grid automation

Expert Presentation I
The new role of edge and distribution grids

More data from more points
5 Pillars are defined with the new communication of the European Commission that will open a new era in the digitalization in Europe.

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Building categories for data interfaces
Different categories, different requirements

Internal Business operation (grid planning)

Not energy related data flow (e.g., weather forecast for generation prediction)

Infrastructure operation related exchange
- TSO
- Grid monitoring and control
- Renewable integration

Market related interfaces
- Interfaces with aggregators
- Interfaces with other operators

Structuring DSO Data Exchange
Developing an overarching strategy
Making the Distribution System Operators (DSOs) digital

Requirements:

1) Data approaches must be scalable to support deployment for very large infrastructures
2) Solutions must be open and flexible to adapt to time of changes
3) Solutions should be modular to support an incremental process of digitalization
4) Compatibility with legacy system is mandatory

Challenges:

1) There is not a single solution fitting all the requirements
2) There is not a digital culture in many of DSOs
3) A process of digitalization comes with a growing risk in terms of cybersecurity
A system of systems approach for diverse requirements

Time and size as driving elements

**BUSINESS Operation Layer**
- It is more general purpose
- It can be based on wider standard
- It needs to be open (FIWARE)

**DSO Technical Platform**
- It is application specific
- It should be based application specific standard
- It needs to be open (Linux Foundation Energy)
- Interface to legacy system for continue evolution

Diagram:
- DSO Business operation (Data Lake)
  - Data intense (non real-time)
  - Interface to legacy system for continue evolution
  - Data stream (real-time or quasi real-time)
- Field, Data input, sensors
SOGNO Project in Linux Foundation Energy
A micro-service open source approach to DSO Technical Platform
ARETI and the city of Rome
A real life experience

- First real open-source DMS in Europe
- Customer engagement
- Flexibility market link
- Huge savings in network expansion
Main conclusions

- DSOs are at the center of a huge data flow
- Solutions need to be open and flexible to accommodate the changes in the transition
- Open-source software offers opportunities for sharing costs while being flexible
- Open-source communities are able to offer high quality solutions
- Solutions are ready for real market applications
The value of Data Spaces for a decentralized energy system

Expert Presentation II
What is a Data Space?
From Cloud to Data Spaces

Concentrated  Proprietary  Opaque

Distributed  Open  Transparent

Trust & Sovereignty

Users LET Control

Users GET Control

Source: GAIA-X
GAIA-X Reference Model

Connecting Data & Infrastructures Ecosystems

- **Advanced Smart Services**
  (Cross-) Sector Innovations/ Market places/Applications

- **Data Spaces**
  Interoperable & portable (Cross-) Sector data-sets and services

- **Gaia-X Federation Services**
  Federated & distributed for interoperability, Trust & Sovereignty services

- **Portability, Interoperability & interconnectivity**
  Technical: Architecture of Standards Commercial: Policies

- **Compliance**
  Legal: Regulations

Source: GAIA-X
Value of decentralized energy management system

Example: Energy Management within an urban quarter

Increasing use of local renewable energy resources (DER)

DEMS = Decentralized Energy Management System

Reduction in Energy Costs*

*Price for power: 33 ct/kWh
*Price for gas: 6 ct/kWh
Challenges for the DEMS
The Value Proposition of Data Spaces

Provide a secure and trusted way to exchange data between different stakeholders.

Provide interoperability and advanced smart services to reduce costs.

Source: Fraunhofer IOSB-AST
Building the Data Space

Next Steps
Pose your questions either directly to the speakers or write them in the chat – we will then ask the question for you!
Contact information

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For more information on the Fraunhofer Twin Transition Series:
https://s.fhg.de/TwinTransition