



CENTER DENMARK & UNI-LAB.DK

By Henrik Madsen, DTU Compute



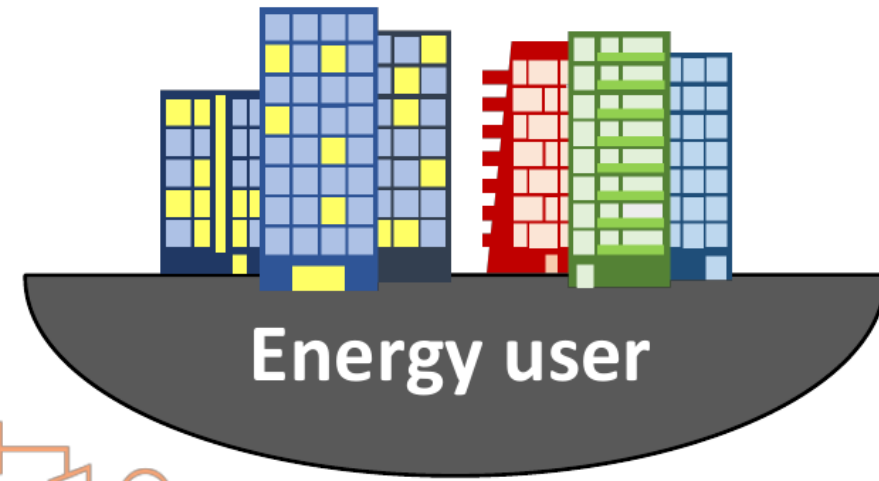
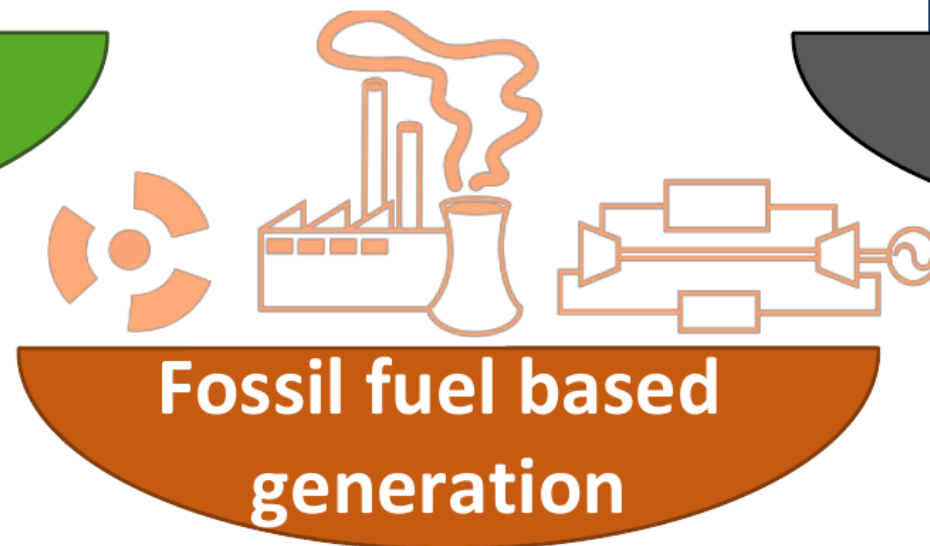
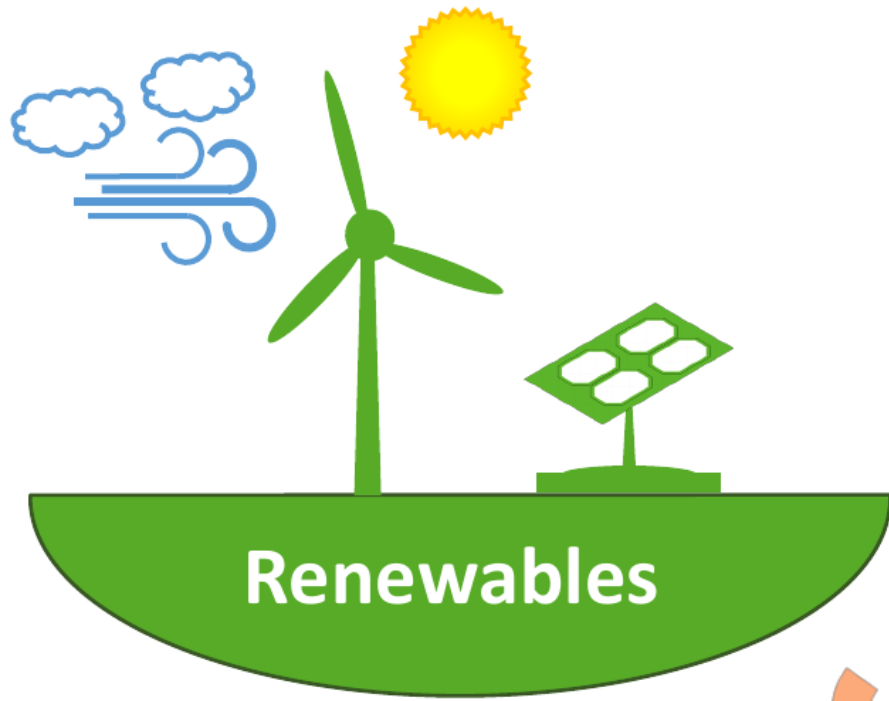
Innovation Fund Denmark

FED FLEXIBLE
ENERGY
DENMARK

The challenges



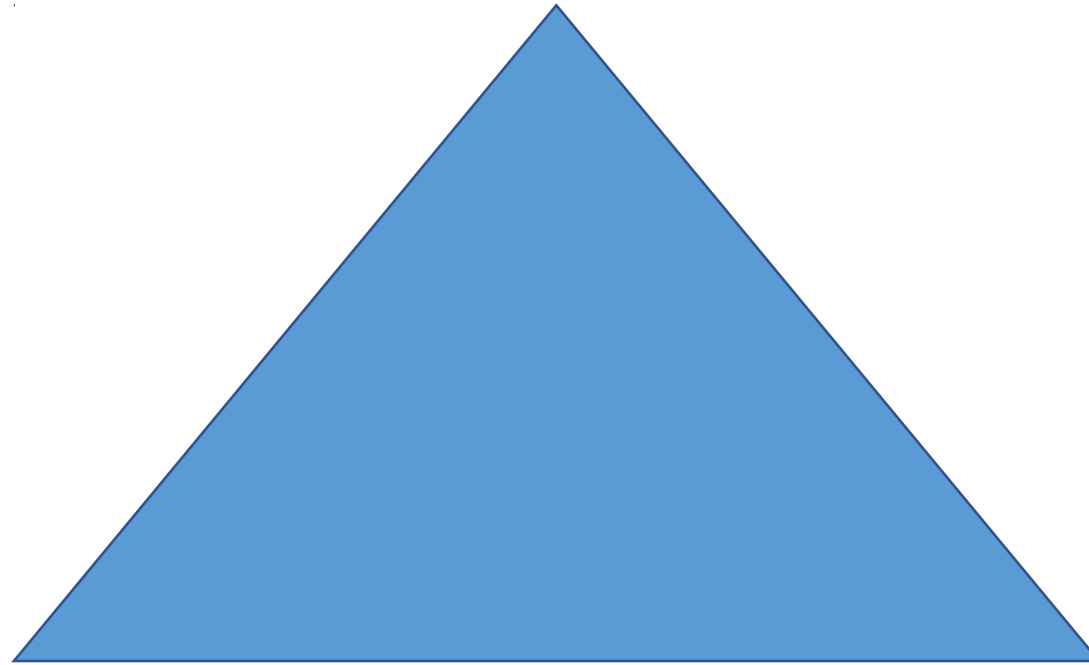
The Challenge: Denmark Fossil Free 2050



Space of Solutions

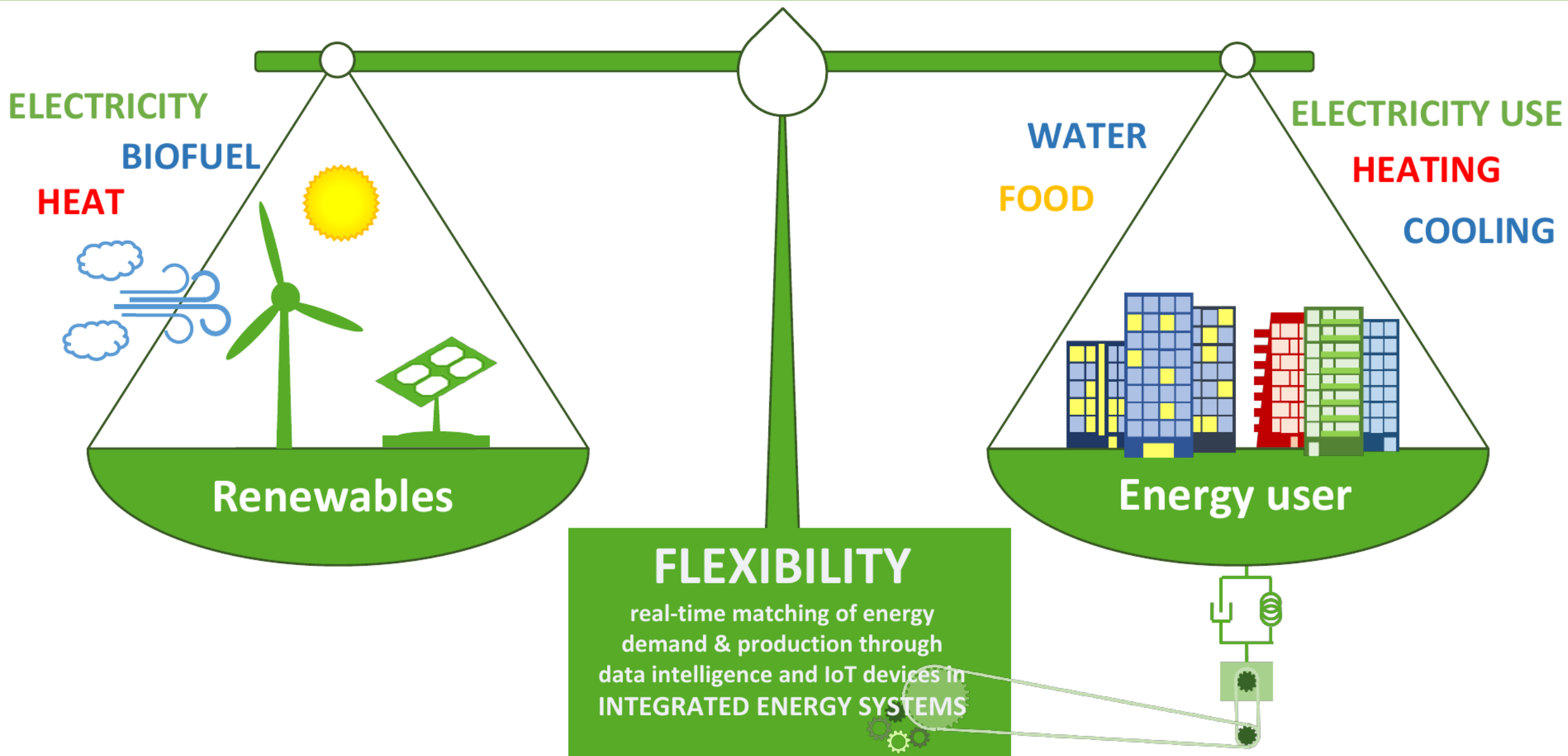
Flexibility (enabled by AI and Energy Systems Integration)

(Super) Grids



Batteries

The Challenge: Denmark Fossil Free 2050



Center Denmark



Danish National center for R&D, test & demonstration and education with focus on **data intelligence and integrated energy systems:** Identifying and utilize flexibilities on demand side across energy systems



Supported by:

Board of directors:



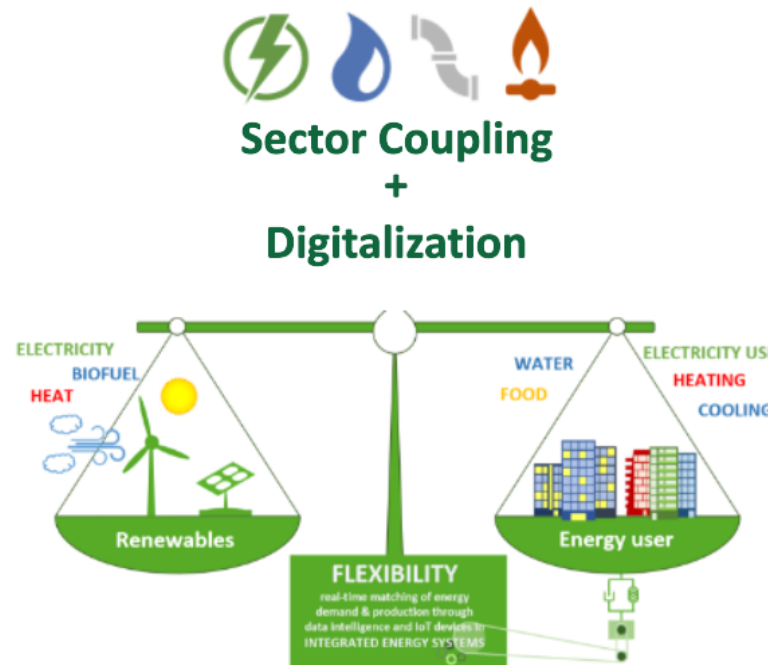
European Commission



Vision: Center Denmark will **accelerate the green transition towards 100 % renewable energy** in DK through **digitalization** and **sector coupling** and thereby unlocking flexibilities and utilize digital opportunities at all levels across energy systems

Mission

- A. Utilize RE production capacity in full by demand response and avoid down-regulation of production
- B. Save investments in infrastructure / avoid bottlenecks in the grids by peak shaving
- C. Bring continuity into research and provide access for commercial use and market implementation
- D. Strengthen digital competences within energy industry supporting new digital business models



Energy effectiveness vs. System efficiency

Services

1. Trusted Data Sharing platform with 24/7 access to energy related data and tools – Bi-directional.
2. Test and demonstration in representative and scalable settings
3. Digital Innovation Hub (DIH) for knowledge transfer services (*Access point for commercial services*)
4. Inkubator for digital business models aimed at new data driven services for the energy sector

Digital Innovation Hub (DIH) by EU Commission: Trusted Data Sharing Platform



DATA BROKER INFRASTRUCTURE that provides our partners with a 'one API-access' to a wide range of data sources in real time. Real-Life energy consumption data from Electricity, heat, water and gas. Related data from BBR (Building Register), Weather, North Pool, Energinet Data Service etc. Bi-directional communication channels shall make the platform a functional tool for controlling energy consumption.



VISUALIZATION of energy data in a spatiotemporal environment. With the use of open IoT platform, Center Denmark support setting energy data free and make them available for the industry. In the digitalization process, data will be gathered from meters in collaboration with utility companies, and sensor data in collaboration with all partners. Cyber security is part of this service.



SIMULATION environment for new digital business models and technologies in a digital representation of the energy ecosystem.



Digital Real-time **DECISION TOOLS** for controlling energy consuming units intelligently through IoT platforms for limited environmental impact, economic incentives and grid capacity constraints. This could e.g. be integrating Model Predictive Control based on forecasting models from the data platform.

Trusted Data Sharing Platform

Data Exchange Facilities Market provide neutral (infrastructure and rules) mechanisms in the background for controlled, trusted and secure data transactions.

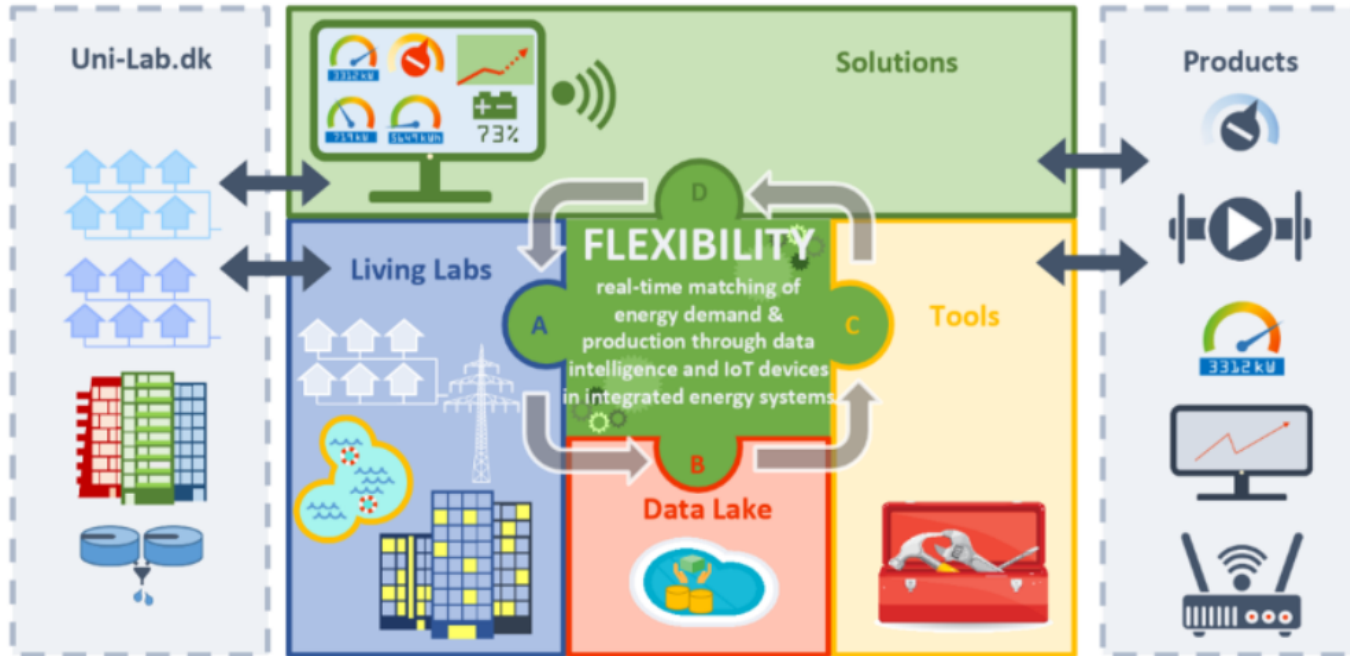
Participants accepting the market rules benefit from the exchange mechanisms and shape together an open market for data.



This is how we work together

FED FLEXIBLE ENERGY DENMARK

Innovationsfonden



Center Denmark role:

- Develops infrastructure to host Data Lake with bi-directional communication. User authentication system and access rights to specific partners to share data on right aggregated levels
- Responsible for data ingestion from Living Labs and providing legal framework for easy data sharing – Data Broker Infrastructure
- Host tools and solutions for easy access from commercial partners to utilize new digital tools for data driven products and services
- Hosting Uni-Lab.dk for a shared umbrella for representative and scalable real-life test environments

Digital Energy Hub Denmark

Incubator for digital energy technologies



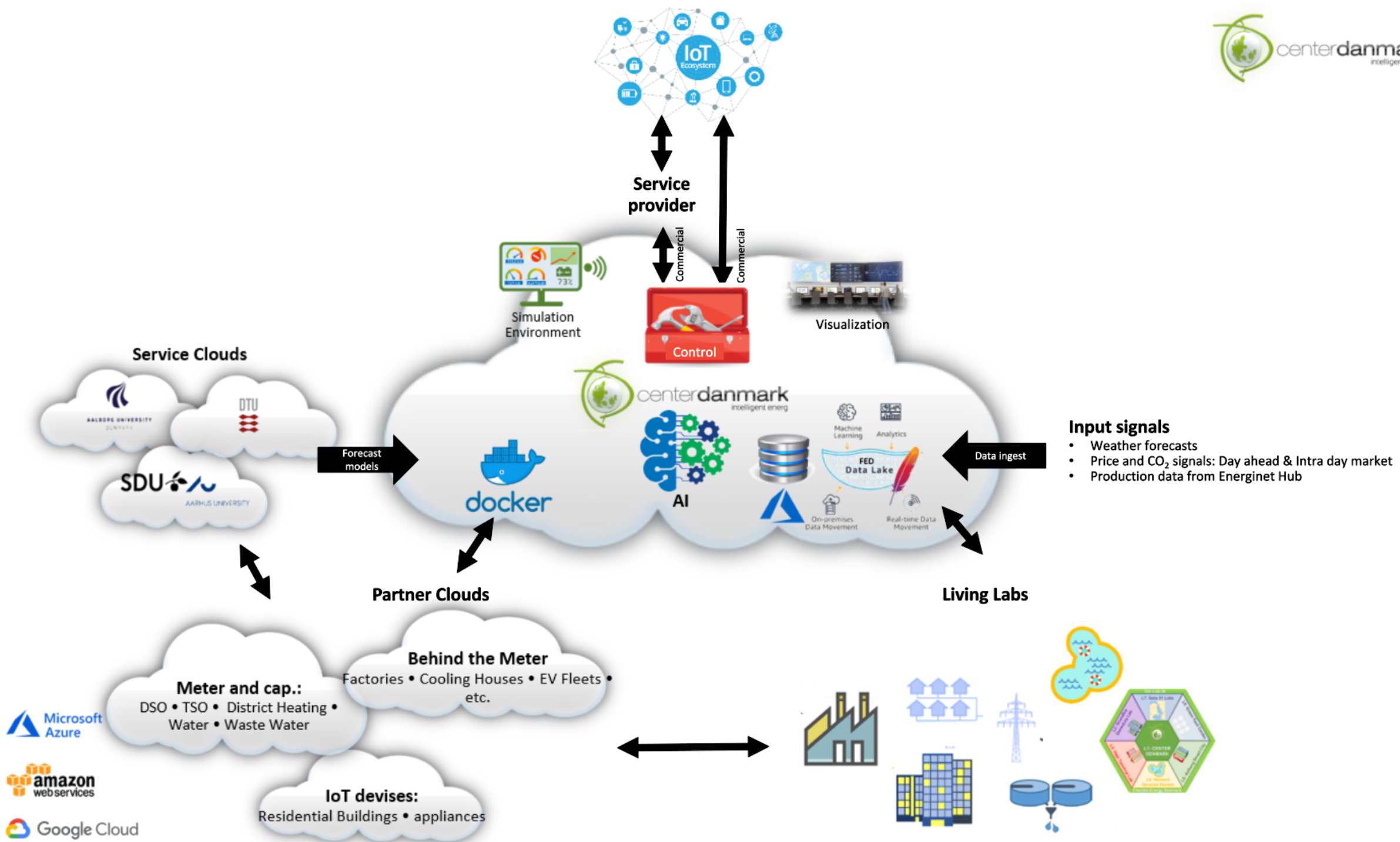
Join a technical inspiring business environment:

- Option of accessing the Trusted Data Sharing Platform with all the innovative new tools from research. Energy Data Cockpit with spatio temporal map-view of energy data. Use for simulating new business models
- Access to Uni-Lab.dk
Network of universities and Living Lab in the research area around digitalization and energy technologies
- Daily networking with other partners of Center Denmark: Energy Cluster Denmark, Universities, Energinet (TSO) and DSO's, start-ups, small to large companies and public organizations.
- Join facilitated innovation processes in collaboration with DSO's and TSO – e.g. Open Door Lab.
- Get close to matchmaking processes facilitated by Energy Cluster Denmark
- Join new R&D and technology projects
- Take part in technical inspiring events hosted by Center Denmark



Center Denmark - Control Room





Uni-Lab.dk



Uni-lab.dk:

A gathering point for living labs
and test labs working with
sustainable technologies

> [Read more](#)

Climate change calls for a strong, joint action
from research, industries and from the citizens.



About Uni-lab.dk

Climate change calls for a strong, joint action from research, industries and from the citizens. With uni-lab.dk we aim at **bringing together all living labs and test labs in Denmark** in order to enhance their cooperation among each other and with Danish industry.

Uni-lab.dk can **help universities in Denmark find a suitable lab** where they can develop their next sustainable solutions related to their particular research field. But it can also **help the Danish companies find the right partners** for the development, test and demonstration of their next-generation products.

Uni-lab.dk is built upon Center Denmark, a national hub for the digitization of the Danish energy systems.

Our cooperating partners include:

- [Annex 74](#)
- [AppliedEnergy UNILAB](#) >
- [Center Denmark](#)
- [Flexible Energy Denmark](#)

Uni-lab.dk structure

The figure below shows the structure of uni-lab.dk and how it interacts with a wide range of national and international partners.

Around Center Denmark, we can find the several living labs established within the "FLEXIBLE ENERGY DENMARK" project. (The core of uni-lab.dk).

On the outer circle, all Danish and Northern European living labs, used for deployment, testing and demonstration of measures to mitigate CO2 emissions in the built environment, are included.

Uni-lab.dk interacts with the international UNILAB consortium (**left side of the figure**), international partners (**right side of the figure**), and with strategic international platforms and communities (**bottom of the figure**), e.g. with initiatives from the International Energy Agency.

Uni-Lab.dk

uni-lab.dk

Home

About Uni-lab.dk

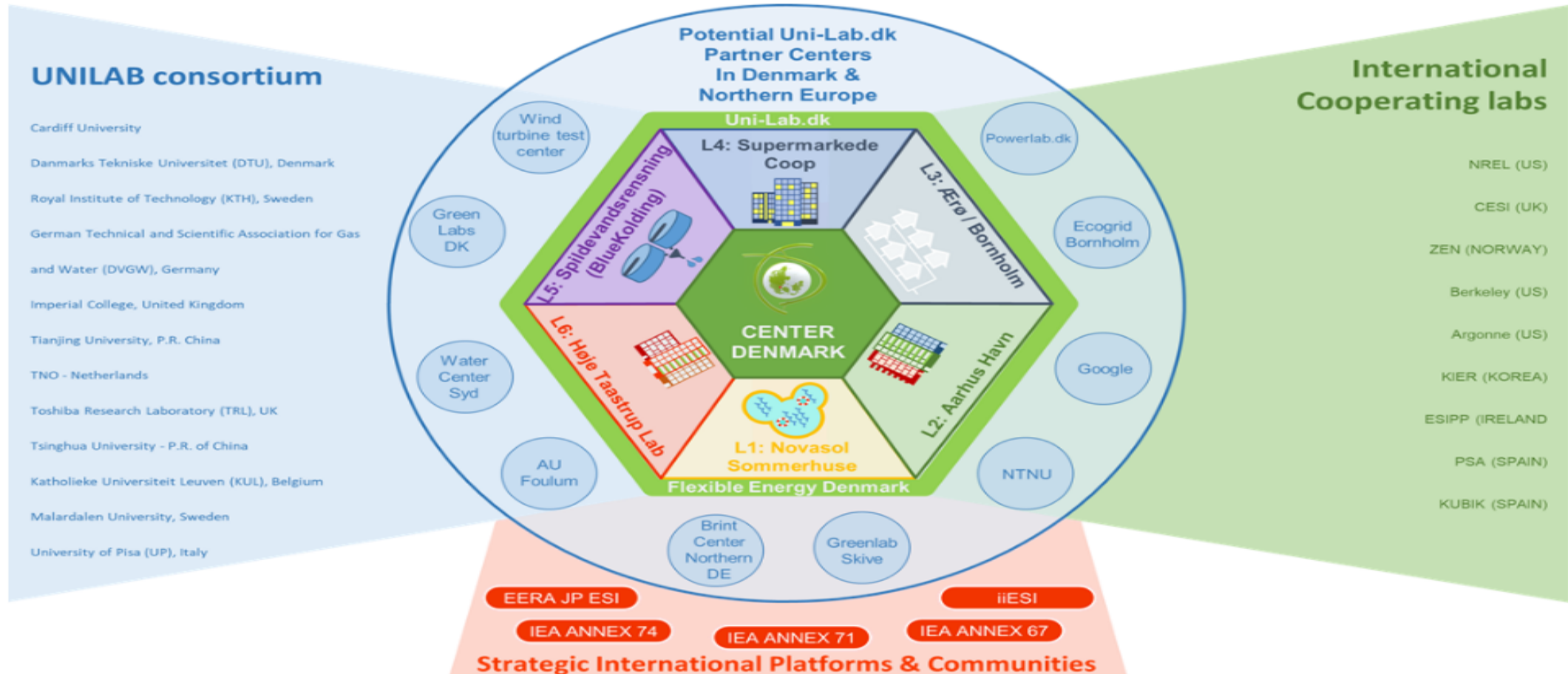
Living Labs

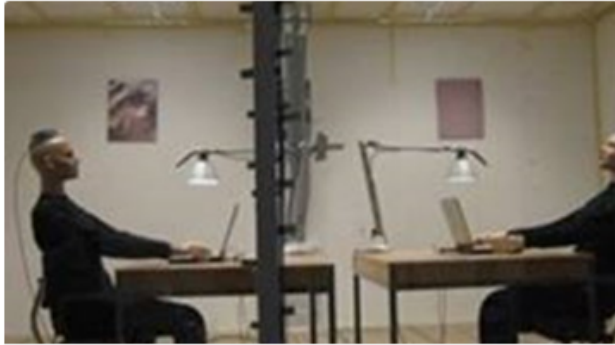
Test Labs

Center Denmark

Join Uni-lab.dk

Contact





ICIEE - International Center for Indoor Environment and Energy

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ProjectZero

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SDU-OU44

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Høje Taastrup Living Lab: Borgerskolen

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TREFOR Power Grid Living Lab

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KONSTANT Living Lab: Power Grid in Eastern Jutland

[Read More](#)

Join Uni-lab.dk

Why should your lab be part of uni-lab.dk?

uni-lab.dk offers a **unique visibility of your lab** to the scientific community, particularly in the Nordic Countries, as well as to a broad spectrum of companies.

Uni-lab.dk accelerates partnerships and hence facilitates the **creation of new projects**.



Are you a **test lab owner**?

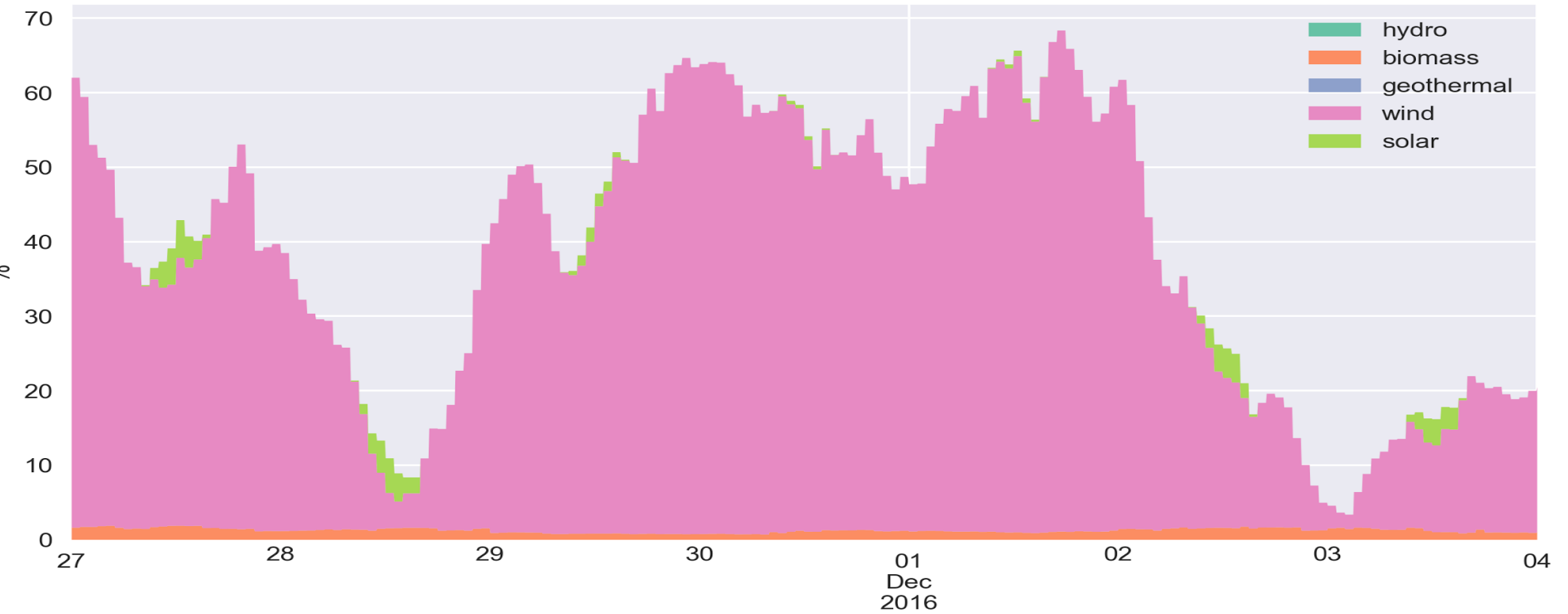
Uni-lab.dk can **connect you directly to companies** developing new products and technologies, and hence open new collaboration chances to your lab and your research.



Living Labs (example: Novasol)



Share of electricity originating from renewables in Denmark Late Nov 2016 - Start Dec 2016



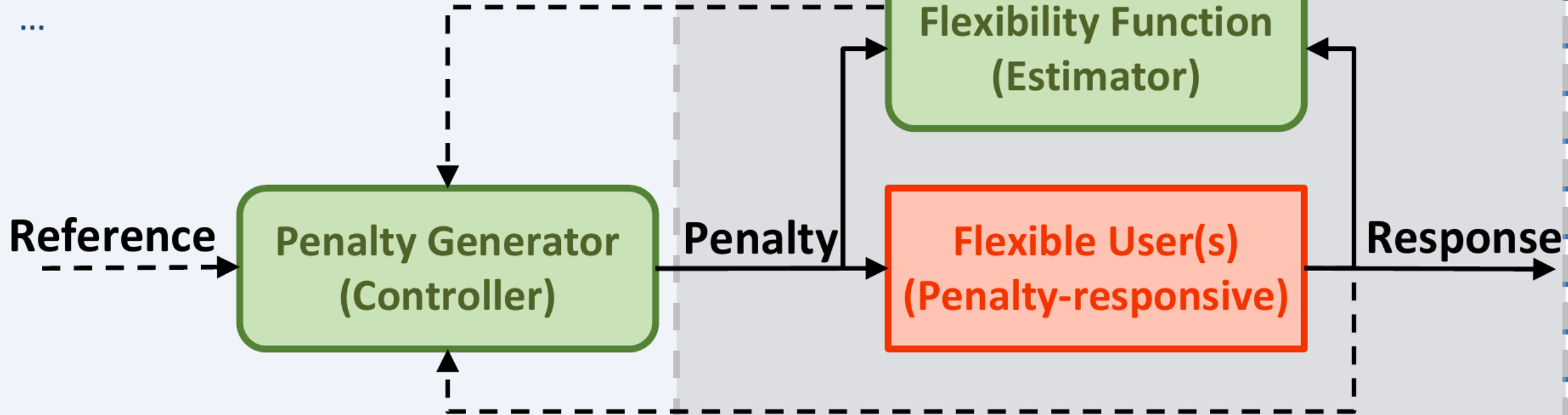
Source: pro.electricitymap.org



A FED example: Flexible Users and Penalty Signals

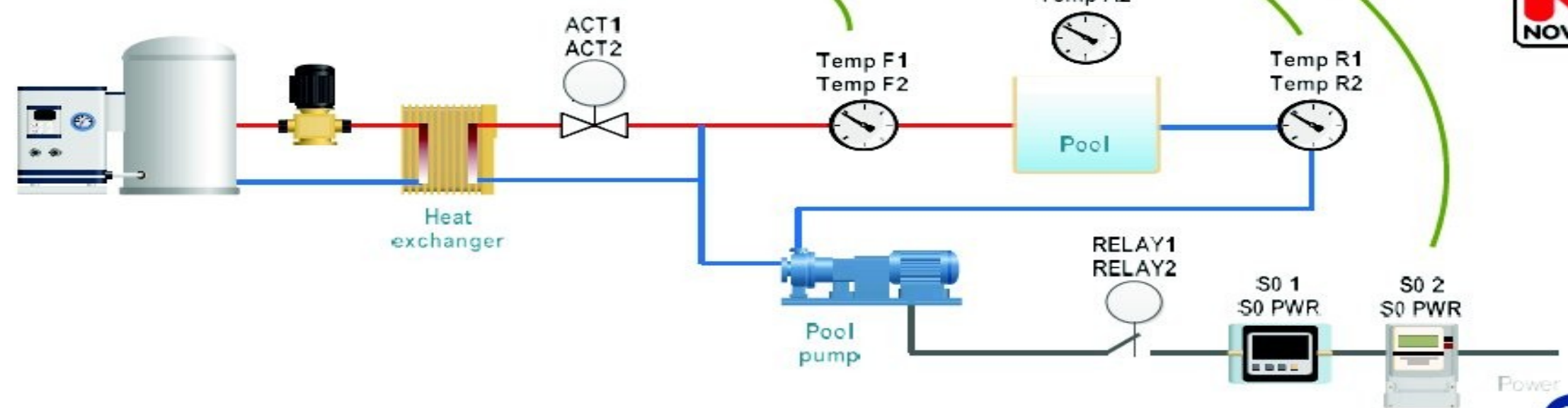
Penalty Generator for, e.g.:

Voltage Control,
Balancing,
Congestion Management
...



How does it work?

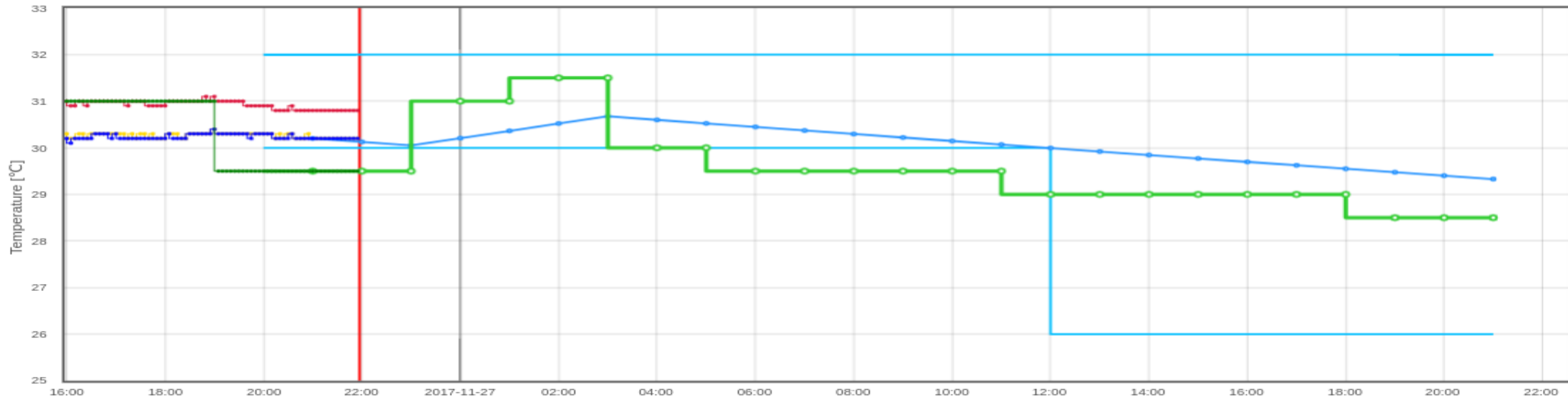
Data measurement and information gathering



Example: CO2-based control (approx. 15 pct savings)

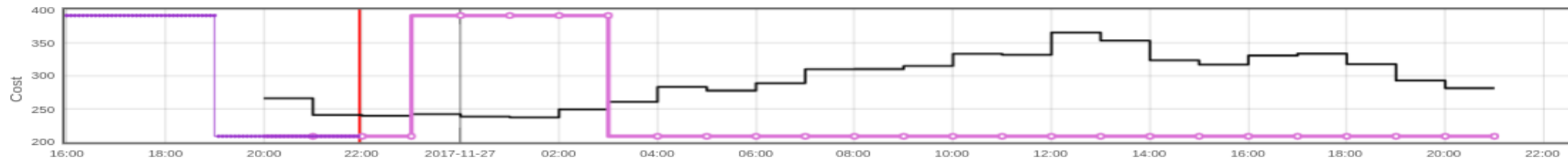
D7811 Controller

Cost: co2intensity [g/kWh]



- me-5m / WaterTemperatureForward
- me-5m / AirTemperature
- pre / WaterTemperatureReturnMinLimit
- pre / WaterTemperatureReturnMaxLimit
- pre / WaterTemperatureReturn
- me-5m / WaterTemperatureReturn
- pre / WaterTemperatureSetpoint
- me-5m / WaterTemperatureSetpoint

Download



- pre-inp / CostPre co2intensity [g/kWh]
- pre / ValveState
- me-5m / ValveState

Download

Center Denmark



CENTER
DENMARK



Connect networks and data
for a green world

Danmarks nationale Center

Fremme den grønne omstilling.
Samle og bygge bro, mellem
forskning, teknologi, natur og formidling,
på tværs af interesseorganisationer,
virksomheder, skoler og
universiteter.

Partnership

Sign-up here:

<https://www.centerdenmark.com/en/join-us/partnership/>

- Join a strong network for digital energy and sector coupling
- Access to a nationwide data platform with energy data
- Simulation environment for framework conditions and business models
- Focused research and demonstration program
- Access Incubator environment for business development and laboratories
- Access promotion show room

