# Efficient Implementation of Weather-driven Energy Systems


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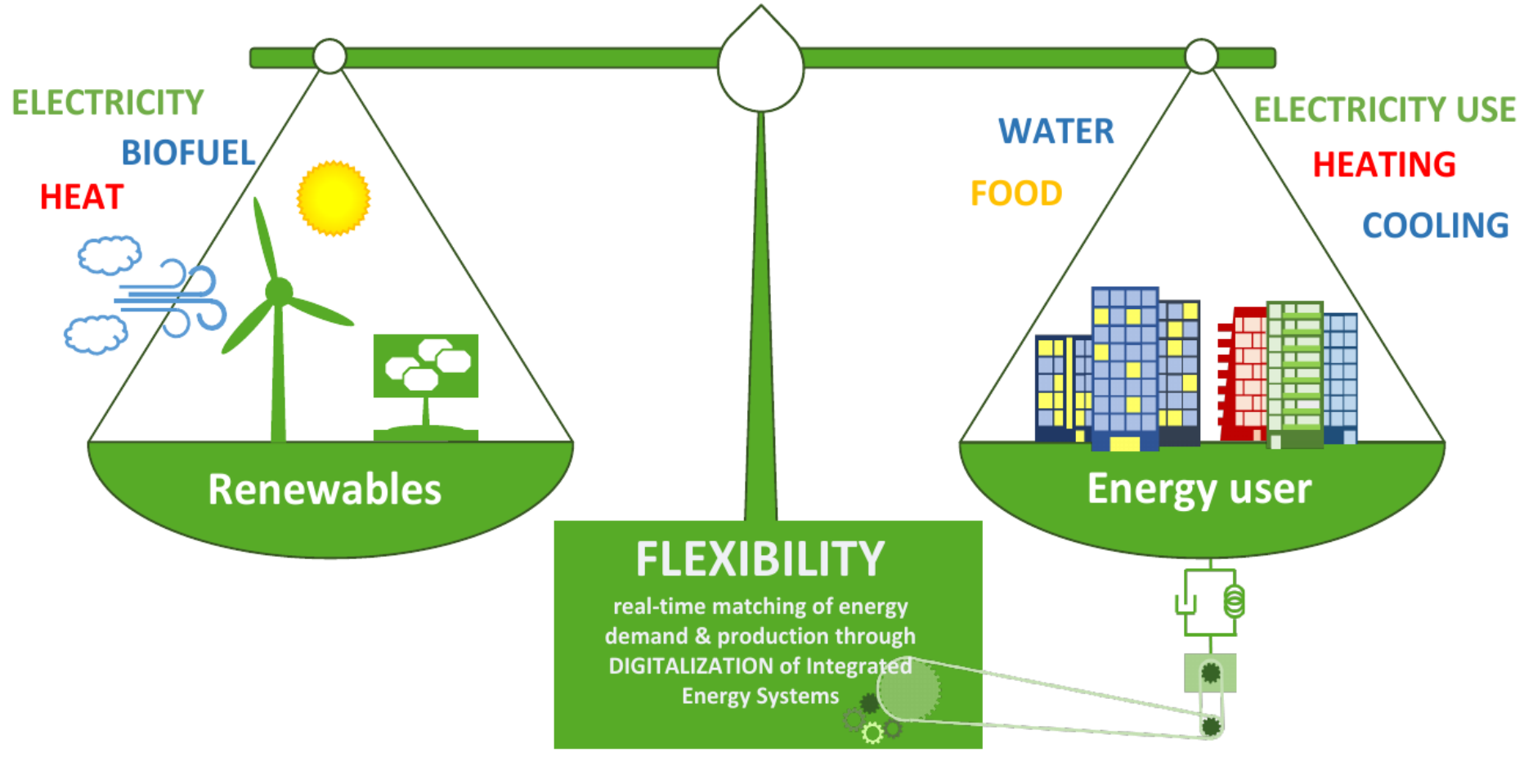
# The Challenge: Denmark Fossil Free 2050



# Data-Intelligent and Flexible Energy Systems

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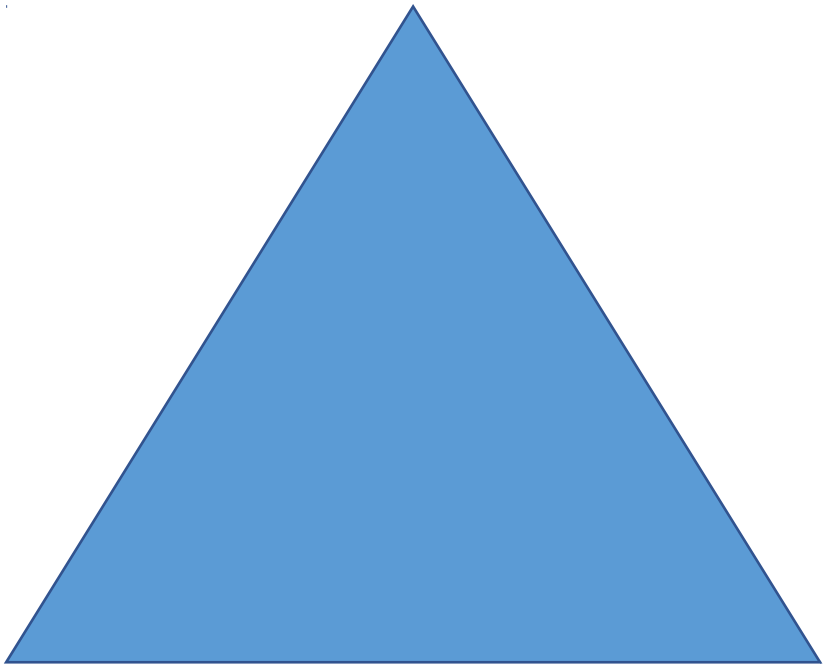
# Space of Solutions

**Flexibility**

(enabled by **Energy Systems Integration, PtX, AI, IoT, Big Data, ...)**

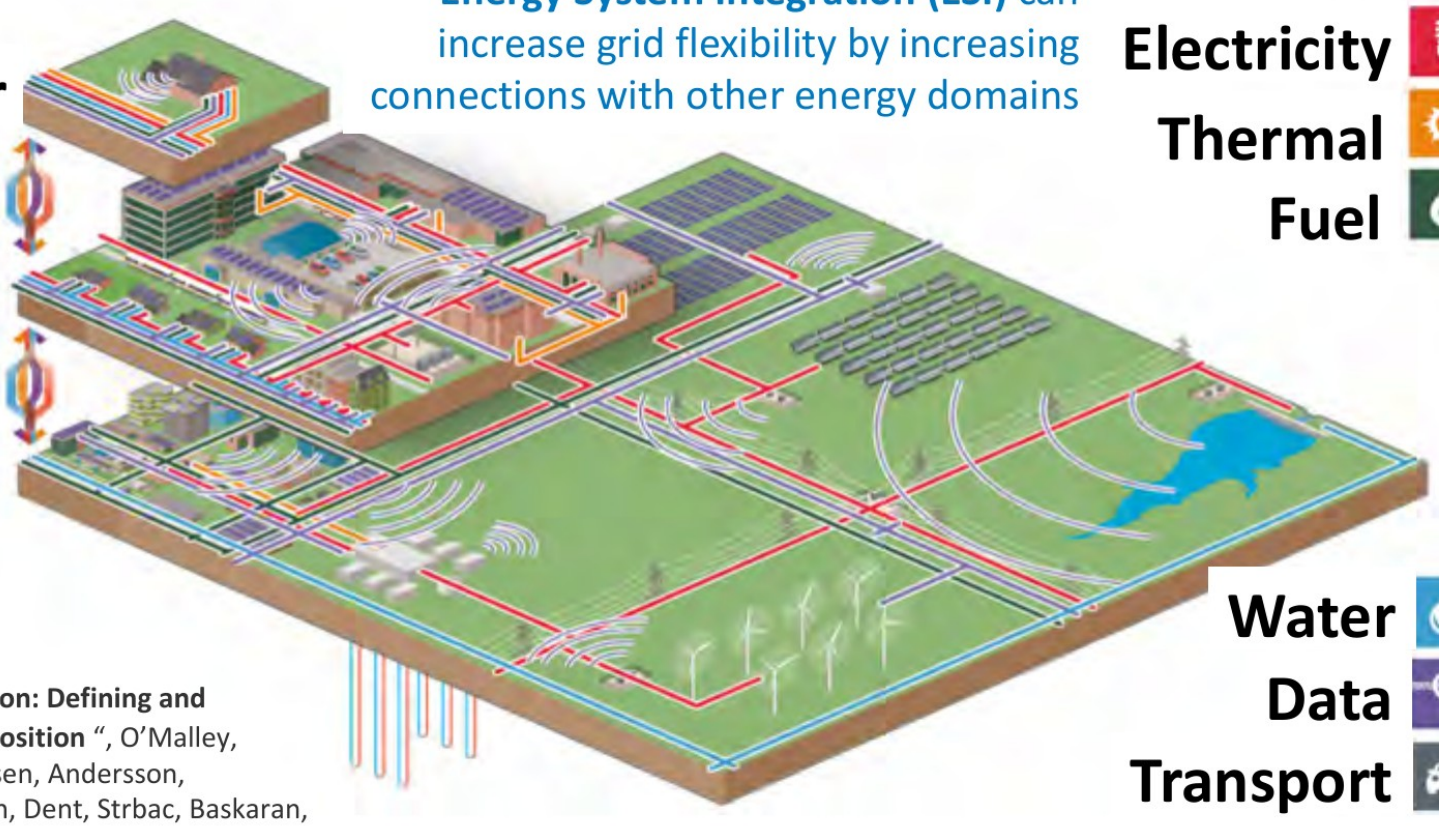


**(Super) Grids**

**Batteries**

# Energy Systems Integration

**Energy System Integration (ESI)** can increase grid flexibility by increasing connections with other energy domains




"**Energy Systems Integration: Defining and Describing the Value Proposition** ", O'Malley, Kroposki, Hannegan, Madsen, Andersson, D'haeseleer, McGranaghan, Dent, Strbac, Baskaran, Rinker., NREL/TP-5D00-66616. June 2016



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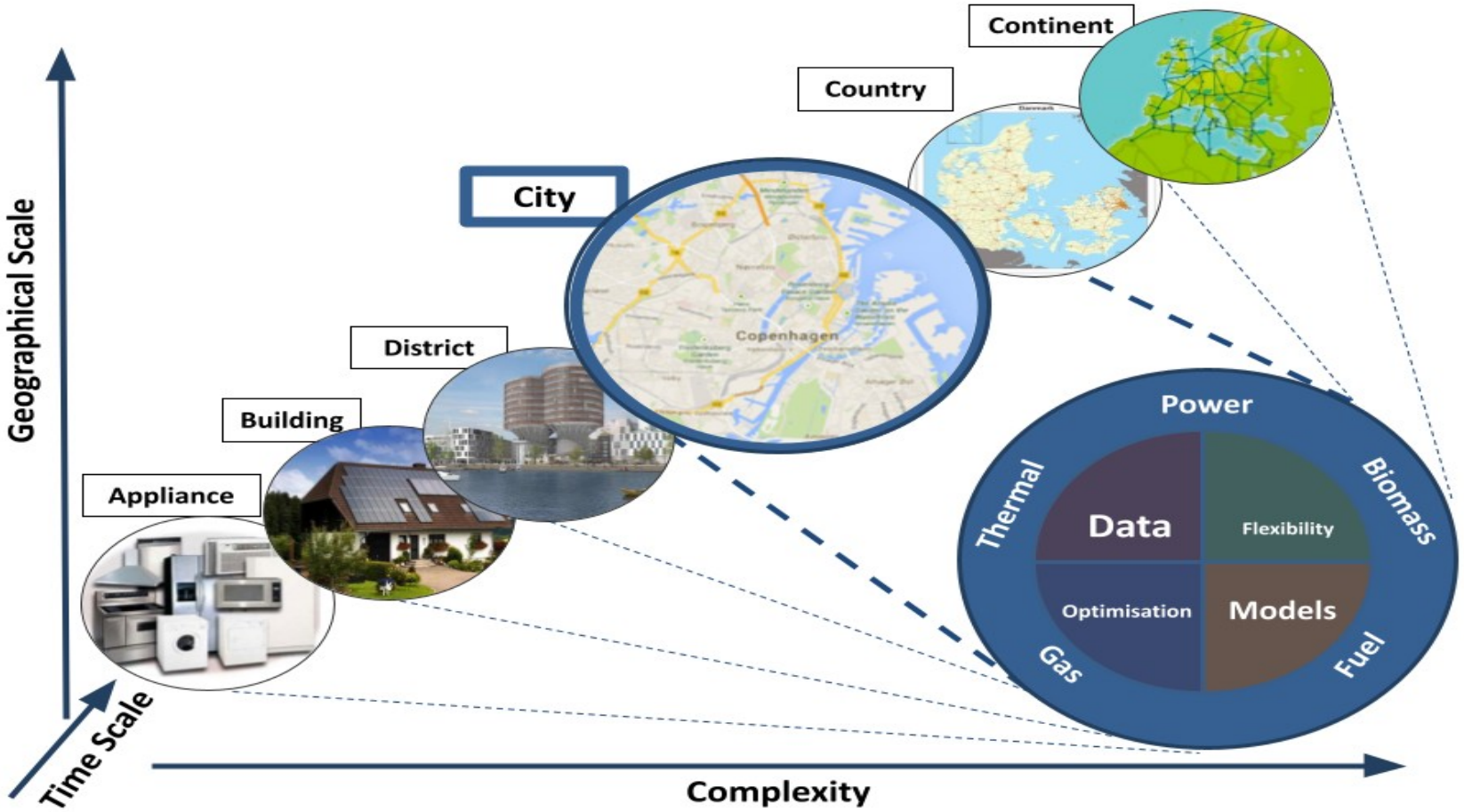
# Temporal and Spatial Scales



# Center Denmark

## National and Int. Digitalization Hub for Accelerating the Green Transition

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# Connect networks and data for a green world


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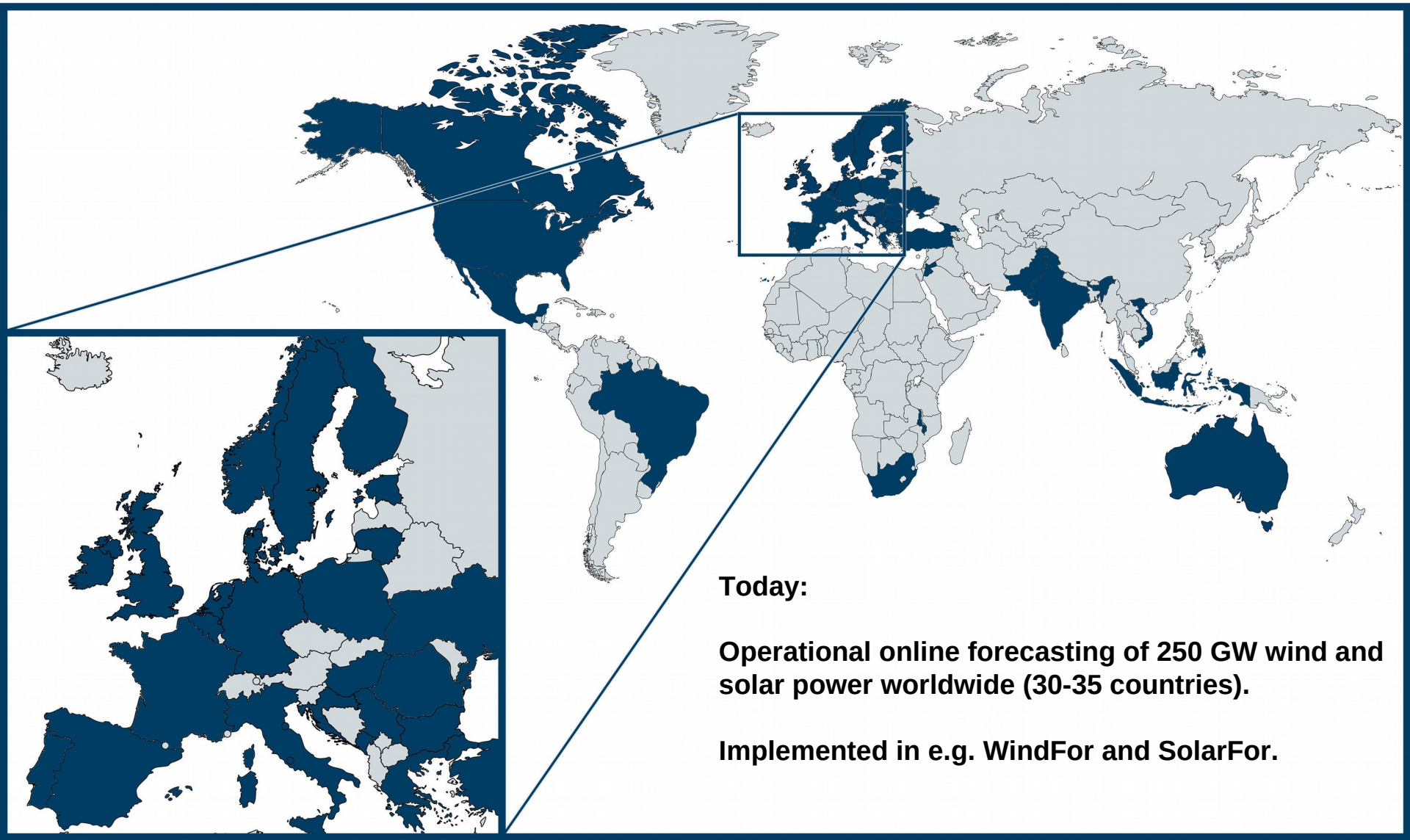
# Center Denmark – Control Room

## Spatial–Temporal thinking

# Wind Power Forecasting Using API's developed at DTU

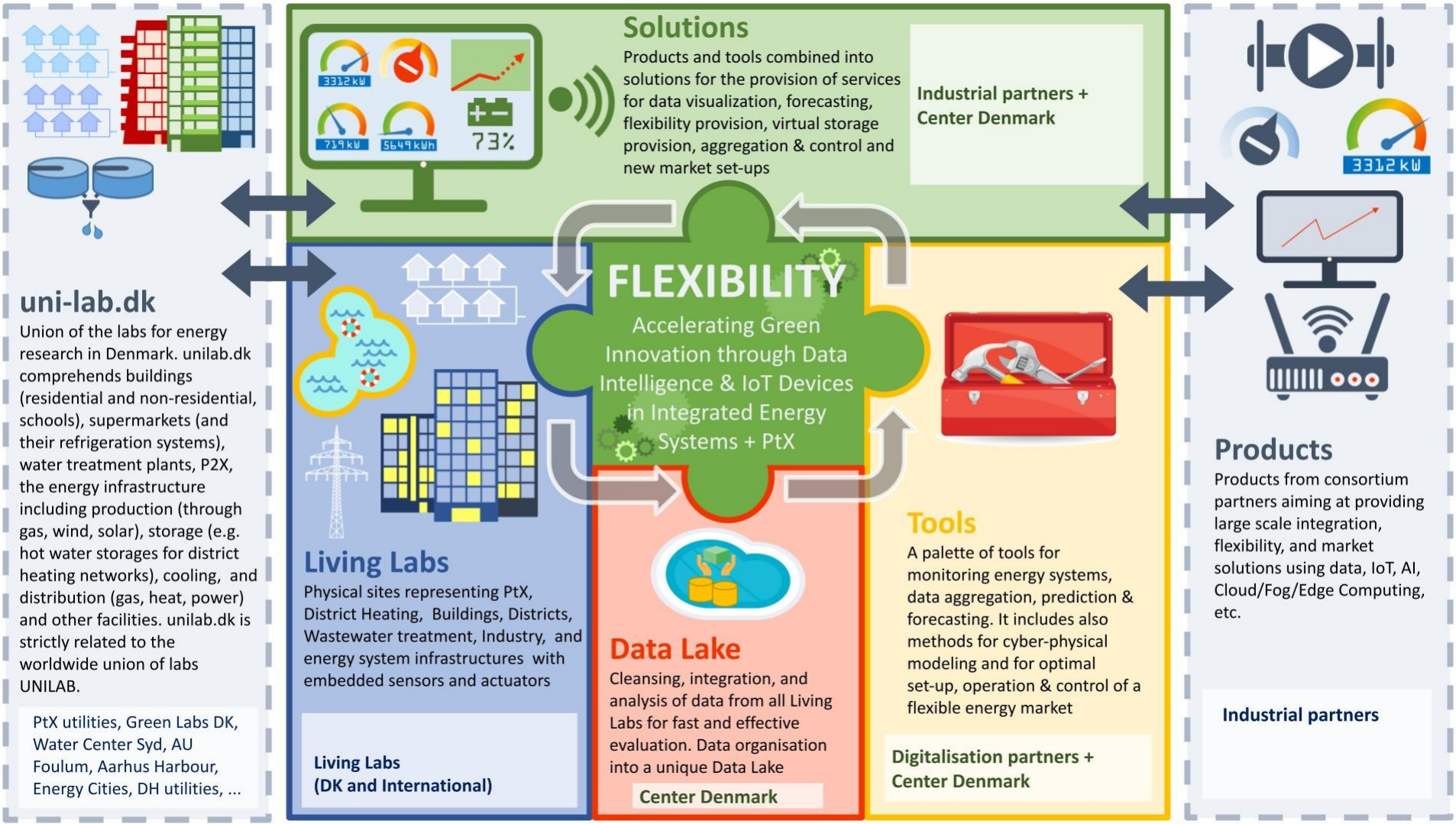


**Today:**

**Operational online forecasting of 250 GW wind and solar power worldwide (30-35 countries).**

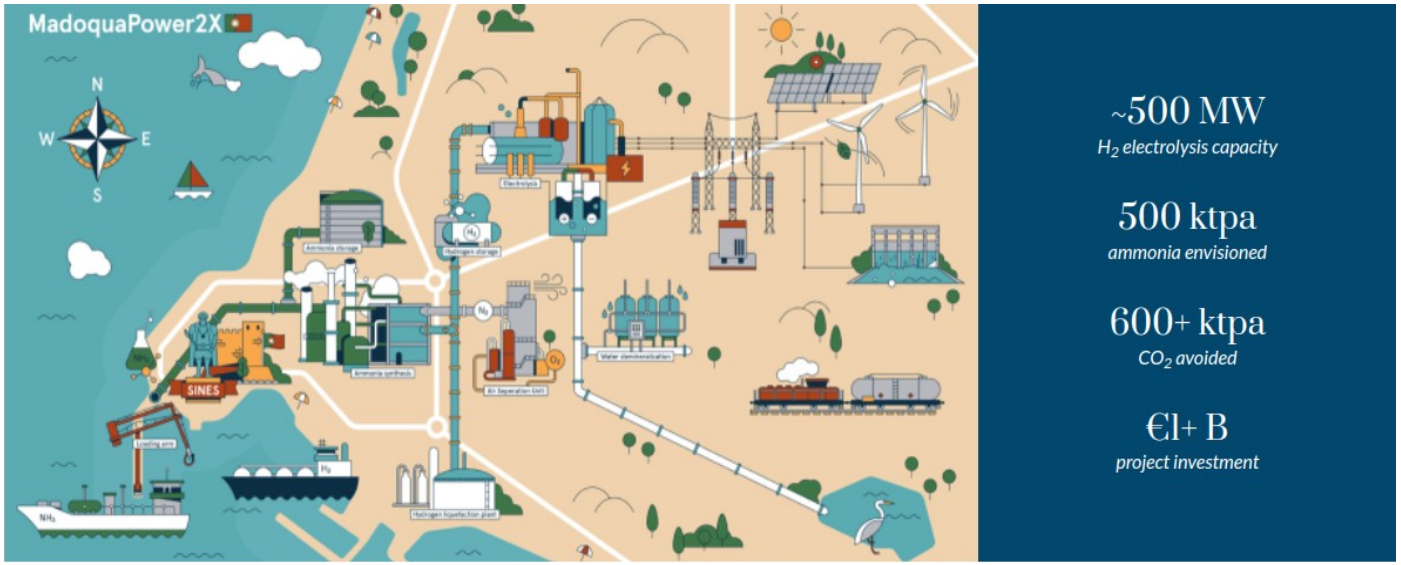
**Implemented in e.g. WindFor and SolarFor.**

# Business Ecosystem and TRL Progression

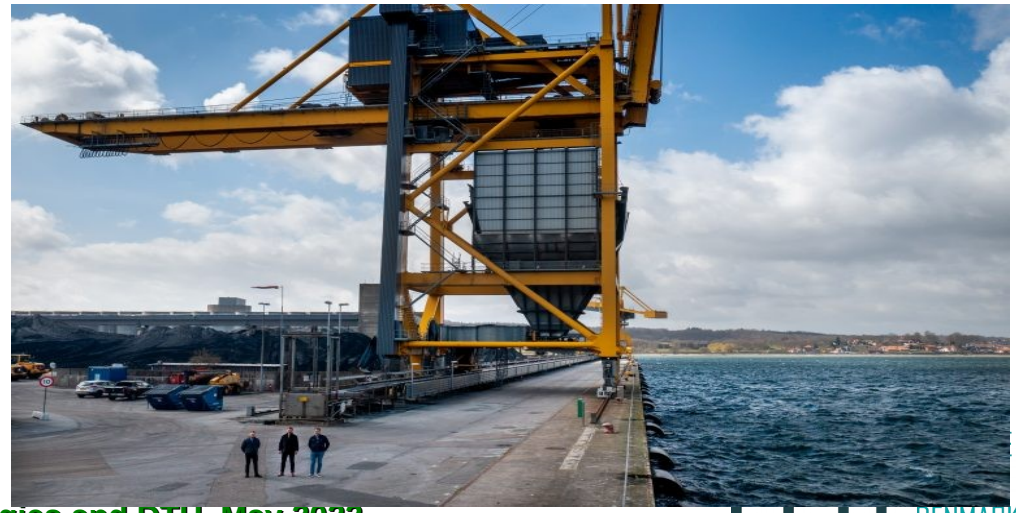


# New projects (Examples)

- +1B Euros, Port of Sines (ELEXIA project)




- +800 Mio DKK
  Port of Aabenraa
  (+100 MW H2 capacity)
  (DynFlex project – IM2)



# Summary

- The future weather-driven energy system calls for **disruptions**.
- We need **deep digitalisation** (AI, IoT, Cloud/Fog/Edge Computing, etc.)
- We need large scale **Energy Systems Integration** and **PtX**.
- We need **transparent**, **safe** and **democratic** solutions.
- We need **data hubs** for energy related streaming data services.
- We need roadmaps for **TRL progression** and a **Business Ecosystem** with **Living Labs**