Towards a Low-Carbon Society: Data Intelligent Integration and Storage of Wind and Solar Power

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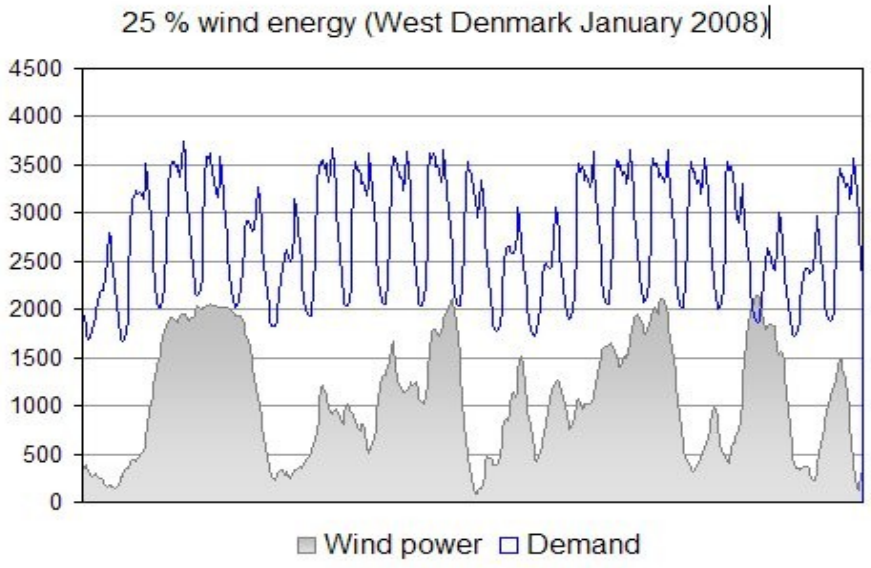
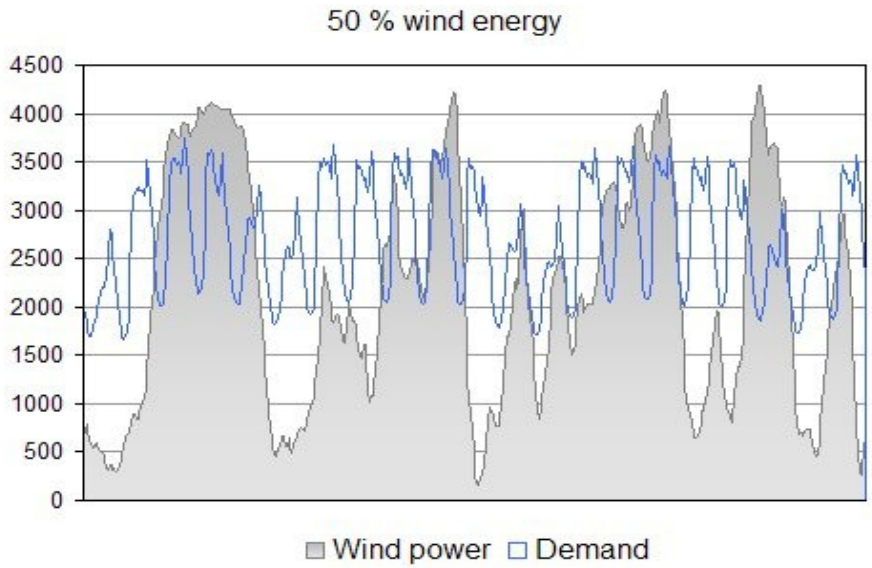
The Challenges

The Danish Wind Power Case

…. balancing of the power system



In 2008 wind power did cover the entire demand of electricity in 200 hours (West DK)



In 2017 approx 44 pct of electricity load was covered by wind power.

For several days the wind power production was more than 100 pct of the power load.

The Danish Wind Power Case

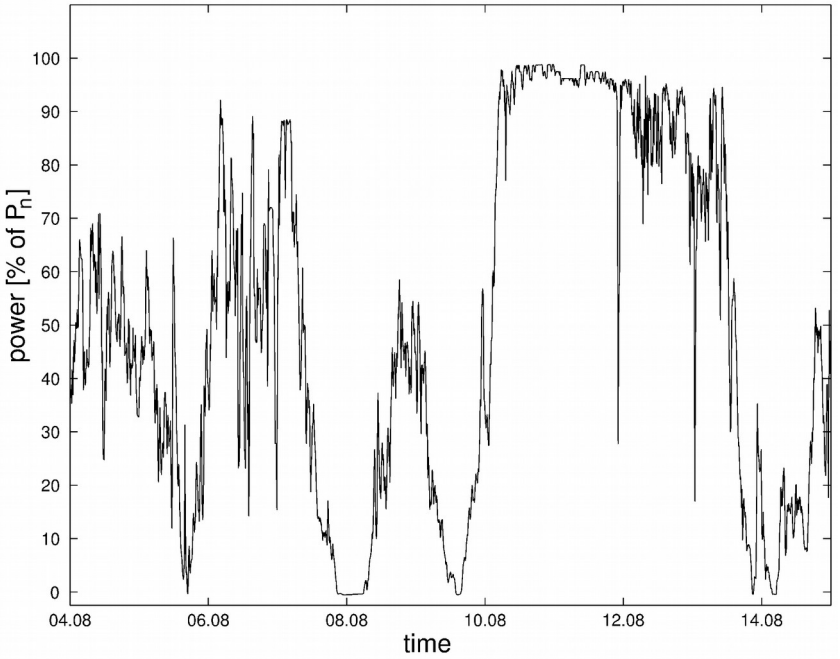
…. if we zoom in the problem gets worse

Off-shore wind power production
(Horns Rev)

Highly volatile ….

➔ We need **better** Forecasts &

➔ Batteries



Solar Power Case (Nevada)

…. if we zoom in the problem gets worse

Solar power plant with nominal output of 151 MW

(Copper Mountain Solar Plant)

Highly volatile …. same conclusion:

- We need **better** Forecasts &
- Batteries

Challenges (cont.)

Preparatory study on Smart Appliances

European Commission

Ecodesign Preparatory Study performed for the European Commission

Welcome | Project summary | Planning & Meetings | Documents | Register for website | Register for meeting | Contact & Consortium

Home > Project summary

Project Summary

The Ecodesign Preparatory Study on Smart Appliances (Lot 33) has analysed the technical, economic, market and [illegible]tal aspects with a view to a broad introduction of smart appliances and to develop adequate policy approaches supporting such uptake.

The study deals with Task 1 to 7 of the Methodology for Energy related products (MEErP) as follows:

- Scope, standards and legislation (Task 1, Chapter 1);
- Market analysis (Task 2, Chapter 2);
- User analysis (Task 3, Chapter 3);
- Technical analysis (Task 4, Chapter 4);
- Definition of Base Cases (Task 5, Chapter 5);
- Design options (Task 6, Chapter 6);
- Policy and Scenario analysis (Task 7, Chapter 7).

An executive summary of the project results can be downloaded here.

Throughout the study, new relevant aspects have come up which will be covered in a second phase of the Preparatory Study:

- Chargers for electric cars: technical potential and other relevant issues in the context of demand response.
- The modelling done in the framework of MEErP Task 6 and 7 will be updated with PRIMES data that recently became available, and with the EEA-countries.
- The development and assessment of policy options that were identified in the study will be further elaborated and deepened.

Almost no Flexibility

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AI and Storages ->
Flexible Energy Systems

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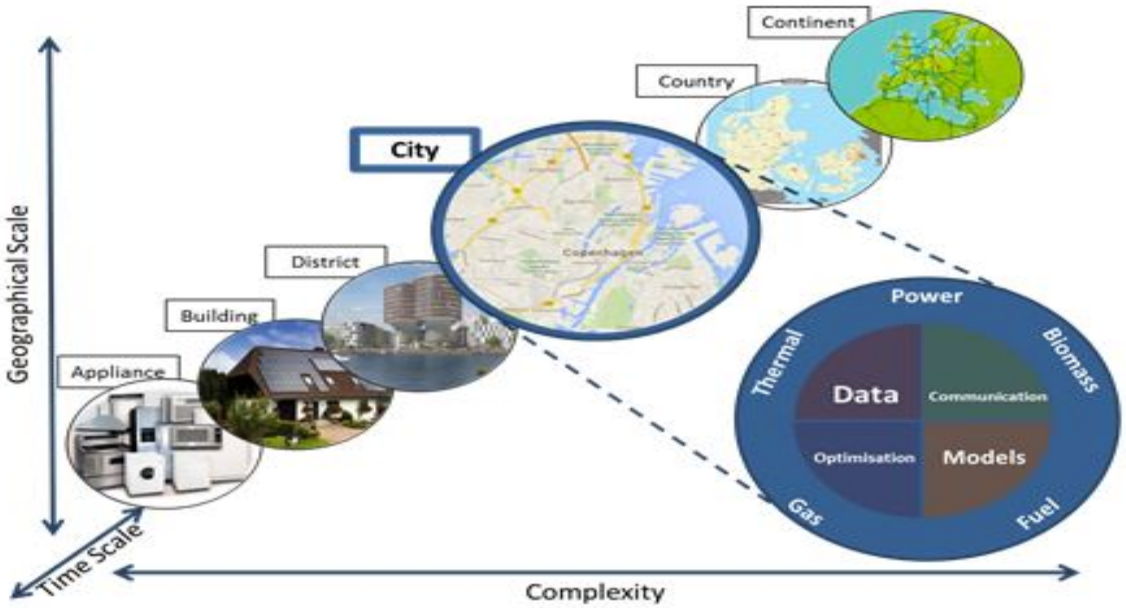
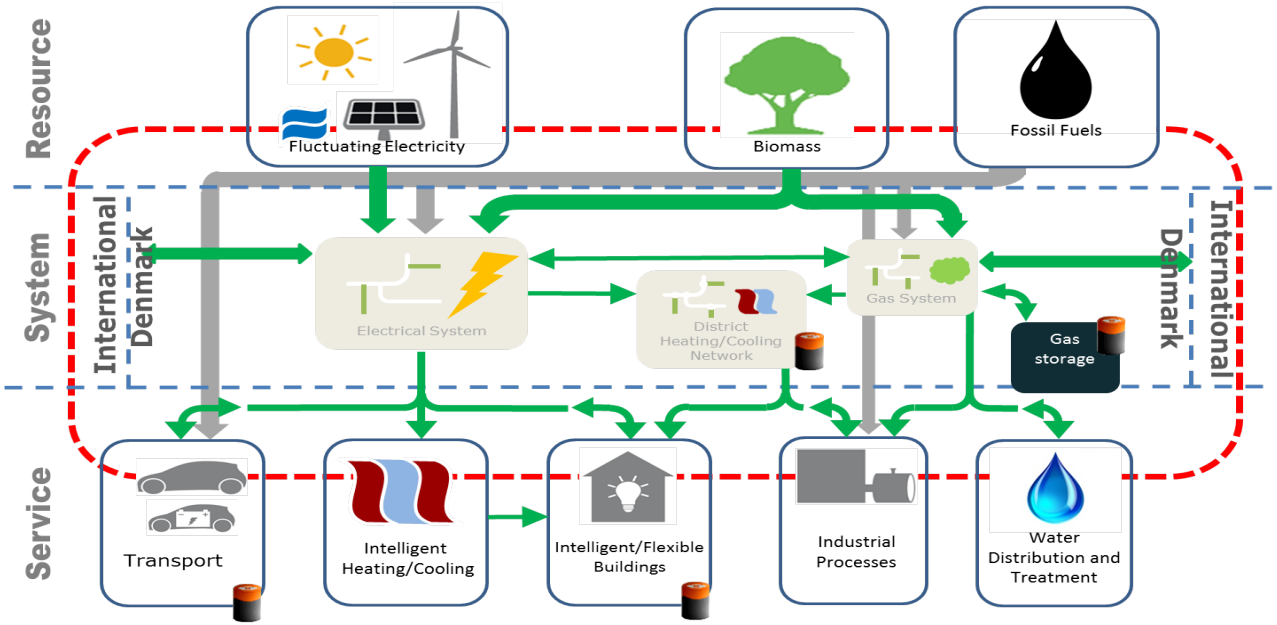
Temporal and Spatial Scales

An AI-based ***Smart-Energy Operating-System (SE-OS)*** is used to develop, implement and test of solutions (layers: data, models, optimization, control, communication) for ***operating flexible electrical energy systems*** at **all scales**.



Models, AI and Storage

Intelligent Energy Systems using **AI and storage solutions** are based on **models** **for real-time operation of flexible energy systems**



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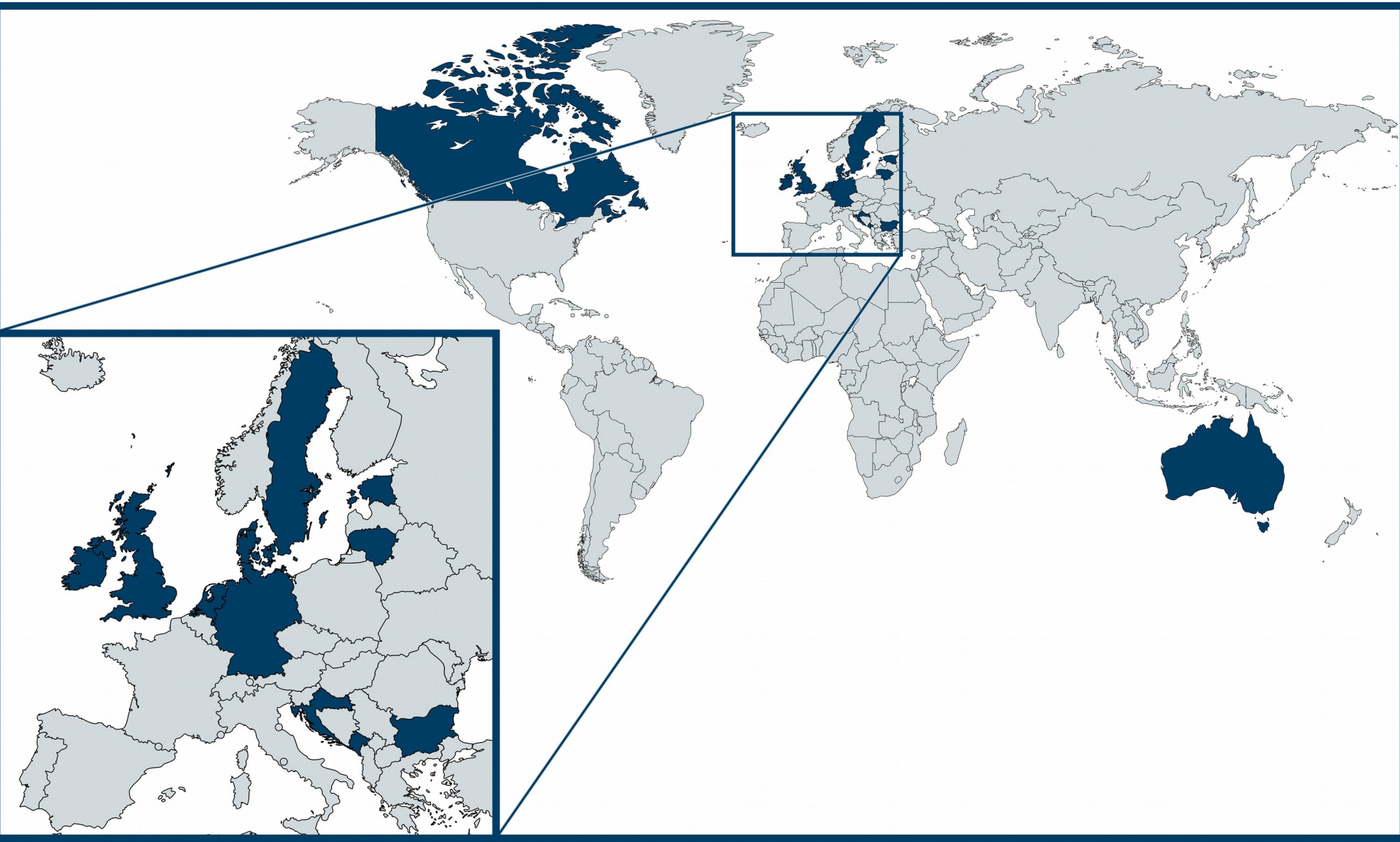
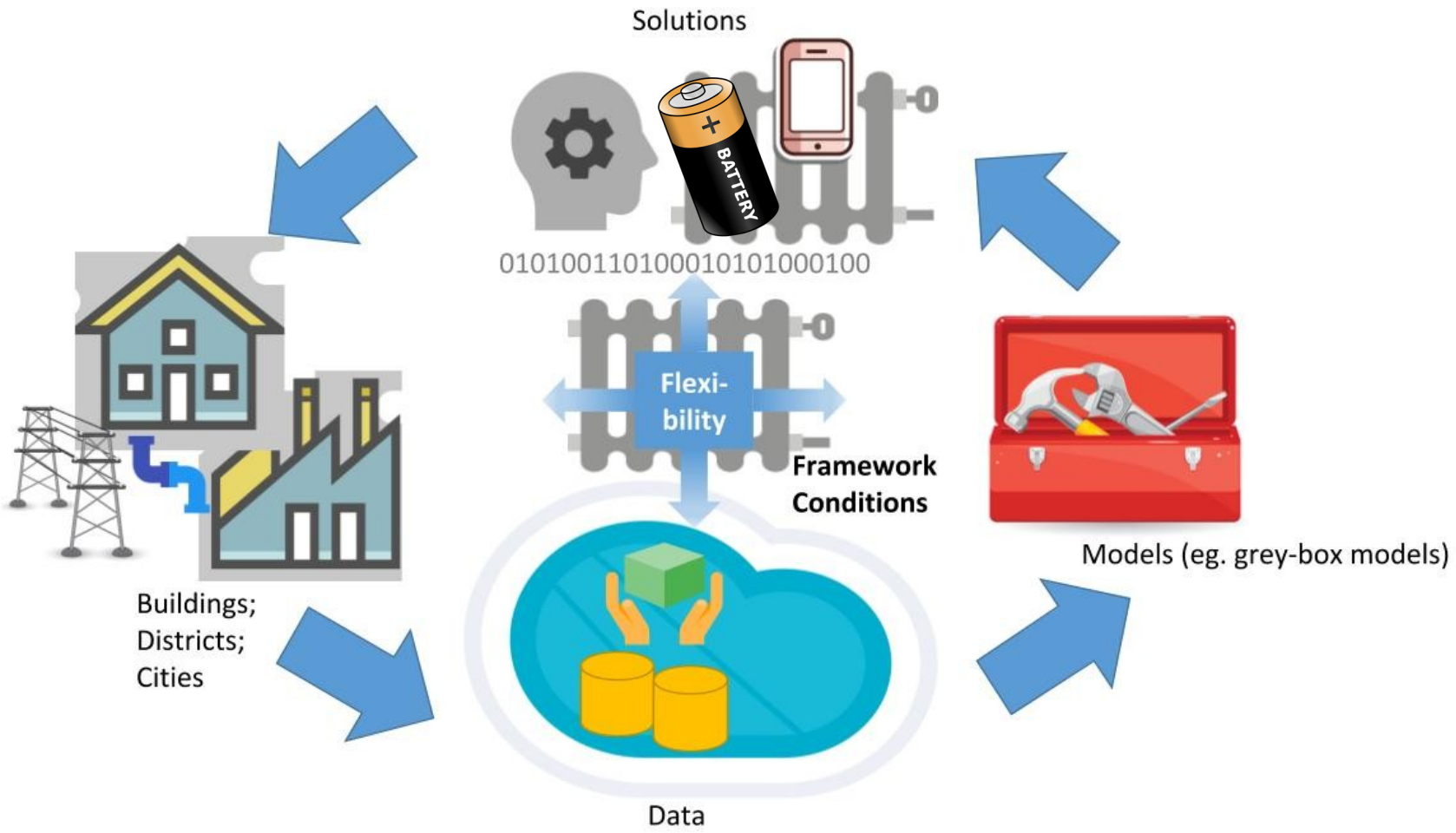
DTU Innovation:
Word-wide Operational Forecasting
(from ENFOR A/S)



AI, Batteries and PCM

Huge CO2 reductions using **AI and storage (battery and PCM) for telesites (from EnergyCOOL).**

Flexibility enabled using AI, forecasting and storage



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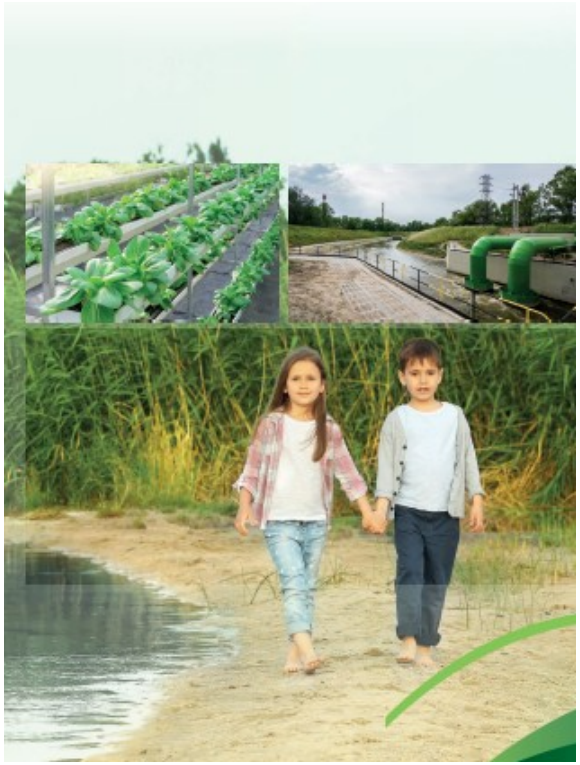
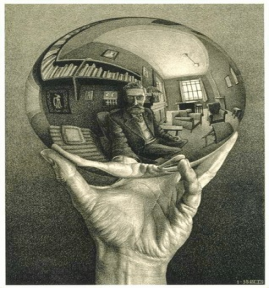
intelligent energy



Center Denmark:
Data Intelligent Energy Systems

- Automatic and self-cal. methods based on Big Data analytics and AI
- **Storage solutions are essential** – both **batteries** and PCM
- Labs – Virtual, HiL, Live
- Peer-to-peer communication (incl. blockchain)
- Nested sequence of systems – systems of systems
- Hierarchy of optimization (or control) problems
- Control principles at higher spatial/temporal resolutions
- Cloud or Fog (IoT, IoS) based solutions – eg. for forecasting and control
- Facilitates energy systems integration (power, gas, thermal, …)
- Allow for new players (specialized aggregators)
- Simple setup for the communication and contracts
- Harvest flexibility at all levels



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