

DTU



## Industrial IoT for Digitization of Electronic Assets

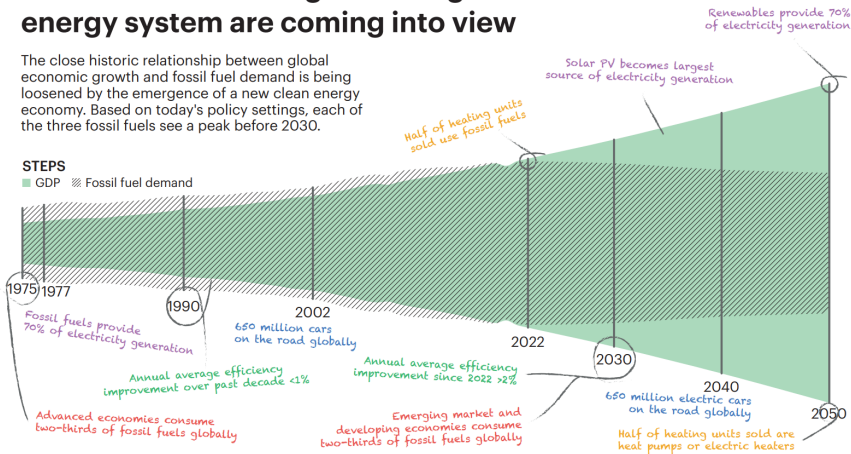
# Agenda

## Transformative changes of the global energy system are coming into view

The close historic relationship between global economic growth and fossil fuel demand is being loosened by the emergence of a new clean energy economy. Based on today's policy settings, each of the three fossil fuels see a peak before 2030.

### STEPS

■ GDP ■ Fossil fuel demand



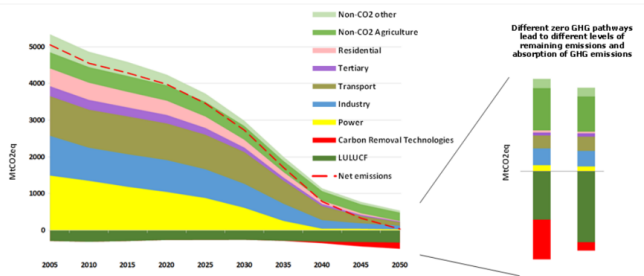
<sup>0</sup>World Energy Outlook 2023, iea

# The Green Transition and European Targets

Europe has set the goal of reducing 40% of Greenhouse Gas emissions by 2030 and the 80-95% by 2050, to reach the target of maintaining global atmospheric warming below the 2 °C. To accomplish this target, massive investment in renewables is on the way:

## Key Goals:

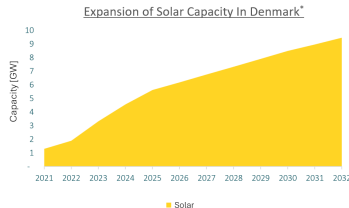
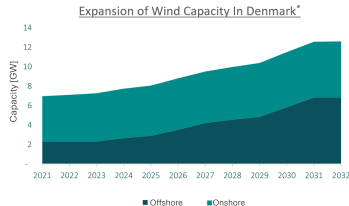
- 45% of Renewables by 2030
- **600 GW** of Solar Capacity
- **450 GW** of Wind Capacity



<sup>0</sup>European policies on climate and energy towards 2020, 2030 and 2050

# Future Projections In Denmark

World leading country in wind energy with more than 44% of the energy production from renewable sources. Carbon Neutral by 2030, with Offshore and Onshore Wind up to 13 GW and Solar up to then 10 GW.



<sup>0</sup>Energinet. (2022). SCENARIERAPPORT 2022 – 2032: Forventninger til fremtidens Systemydelser. Energinet

# Main Challenges of energy system based on Renewables



# Past and Future Challenges

- Higher chance of frequency events.
- Higher capacity of Ancillary Services.
- Tailored control strategies.
- Reduce the curtailment of energy production with BESS.



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- Higher chance of frequency events.
- Higher capacity of Ancillary Services.
- Tailored control strategies.
- Reduce the curtailment of energy production with BESS.
- Exploit flexibility of variable loads (*fans, drives, compressors*).
- Aggregate multiple presumpers.
- Data-driven modeling solutions.
- Boosting digitalization of old assets.

# Digital Twins:

## A core technology to boost the Digitalization

"A digital twin is a digital replica of a living or non-living physical entity, such as a manufacturing process, medical device, piece of medical equipment, and even a person... to gain insight into present and future operational states of each physical twin." NIH -Interagency Modeling Analysis WG (2019)

"A Digital Twin is an integrated multiphysics, multiscale, probabilistic simulation of an as-built vehicle or system that uses the best available physical models, sensor updates, fleet history, etc., to mirror the life of its corresponding flying twin"  
TA 11 (2010)

"Digital Twin -the application of interdisciplinary modeling and simulation across the product lifecycle."  
John Vickers (2021)

"A digital twin is a virtual representation of an object or a system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning and reasoning to help decision-making." -IBM (2021)

"A digital twin is a virtual replica of an object, being, or system that can be continuously updated with data from its physical counterpart."  
Purdy, MIT Sloan

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