

DTU



Industrial IoT for Digitization of Electronic Assets

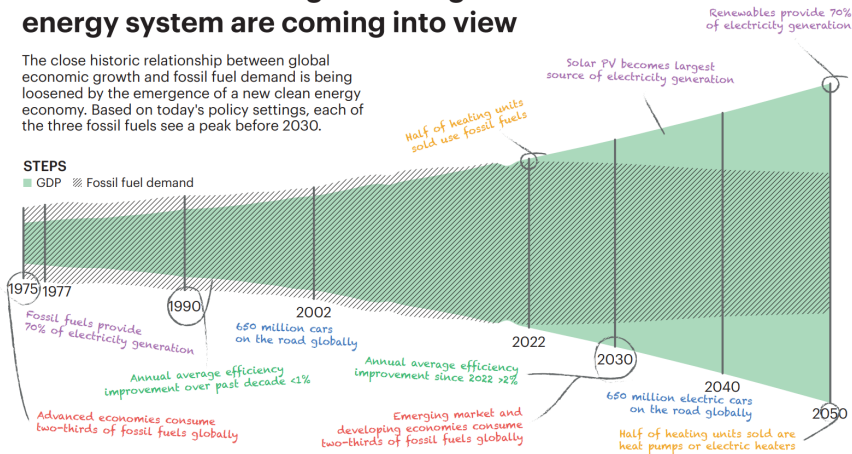
Agenda

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



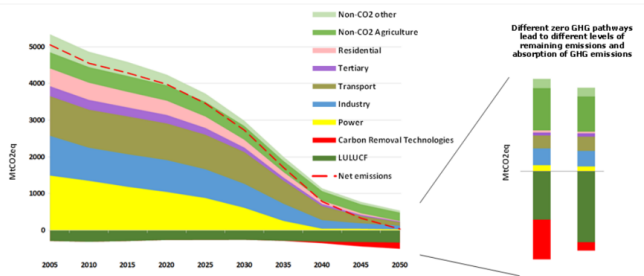
⁰World Energy Outlook 2023, iea

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

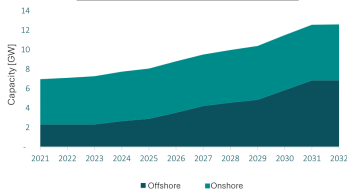


⁰European policies on climate and energy towards 2020, 2030 and 2050

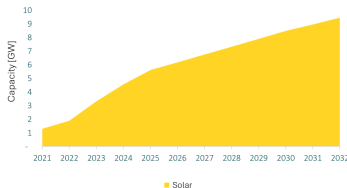
Future Projections In Denmark

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.

Expansion of Wind Capacity In Denmark*



Expansion of Solar Capacity In Denmark*



⁰Energinet. (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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- 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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