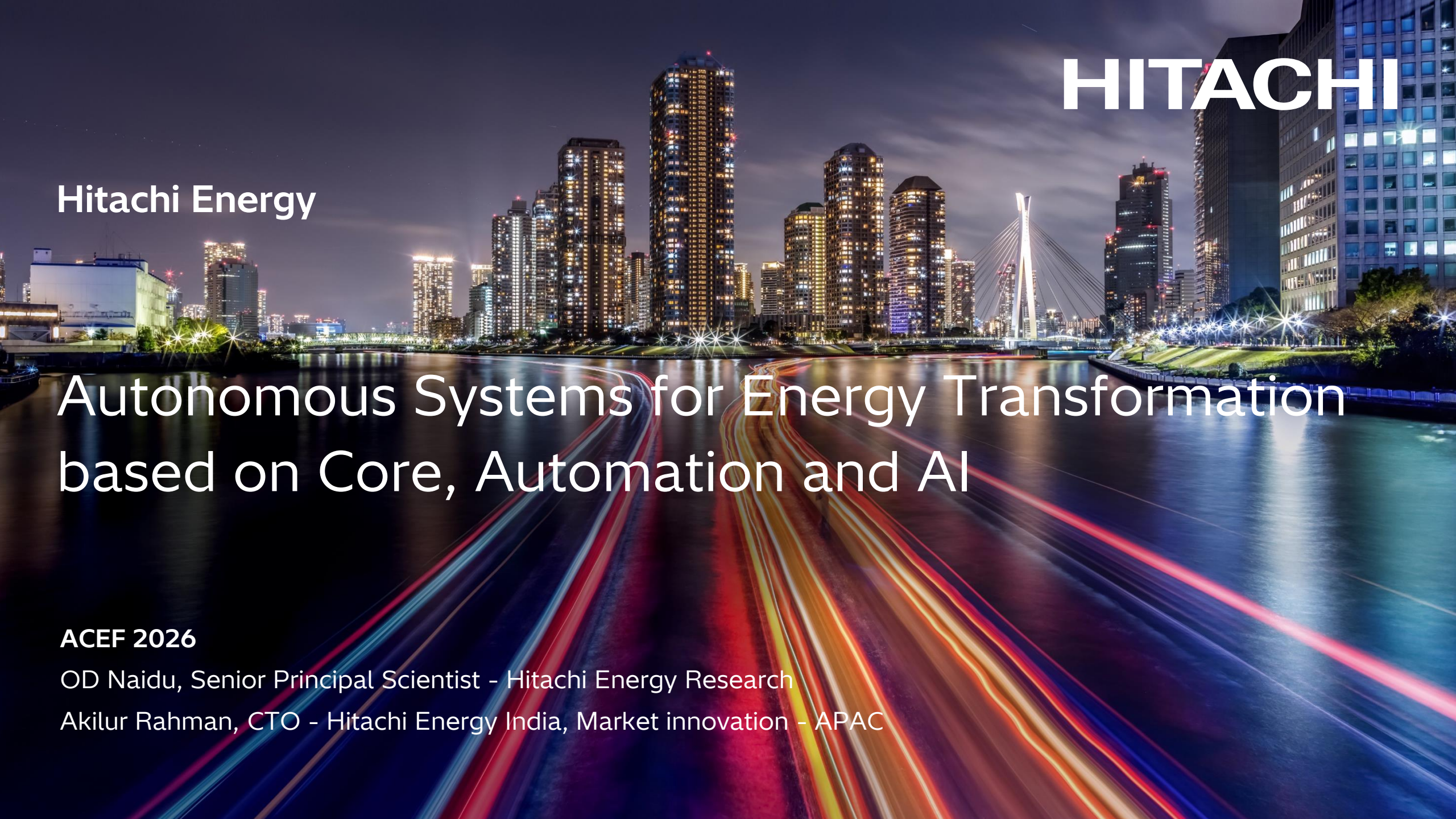


A nighttime cityscape featuring a river in the foreground with vibrant, multi-colored light trails from moving vehicles. The background is filled with illuminated skyscrapers and a modern cable-stayed bridge, all reflecting on the water's surface.

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Hitachi Energy

Autonomous Systems for Energy Transformation based on Core, Automation and AI

ACEF 2026

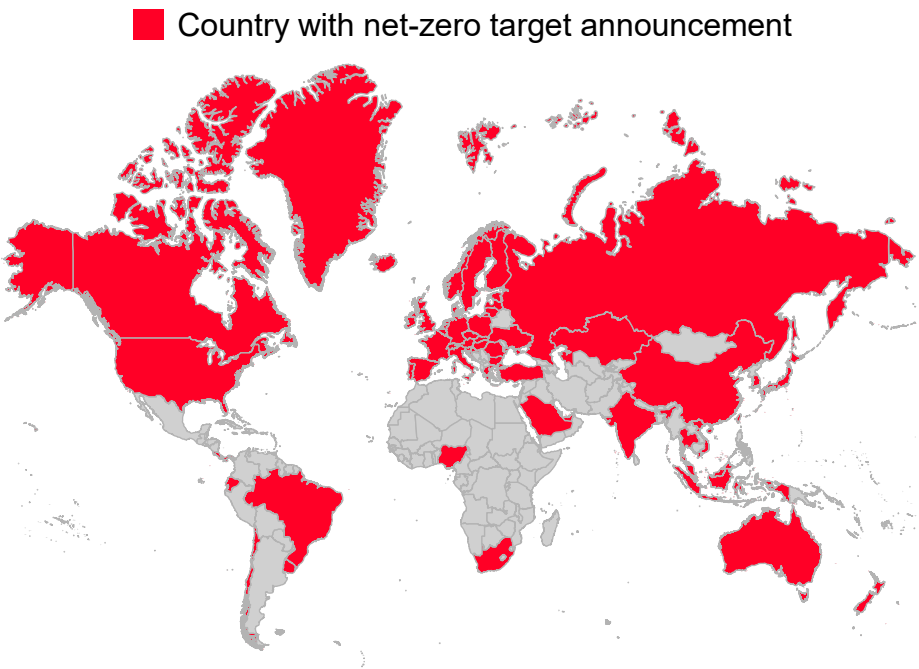
OD Naidu, Senior Principal Scientist - Hitachi Energy Research

Akilur Rahman, CTO - Hitachi Energy India, Market innovation - APAC

Pathway to a carbon-neutral energy system

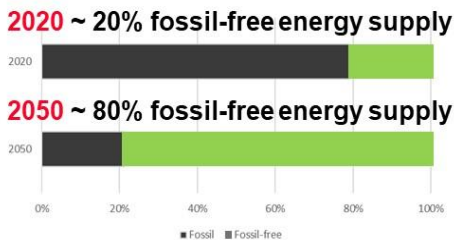
Carbon emission reduction, energy security and energy efficiency are driving electrification growth

64 countries that account for 89% of global emissions have announced net-zero targets



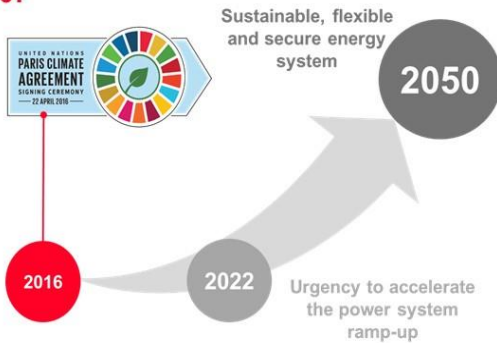
Pathway to a carbon-neutral energy system

Share of fossil-free energy:



Electricity demand growth to 2050:

- Industries doubling to >20 PWh
- Buildings growing ~50% to >15 PWh
- Transportation growing >30x to ~10 PWh (PWh: 1×10^{15} Wh)



In the global power system of 2050, we need four times of today's generation capacity and we will need to transfer three times as much electrical energy

Technologies – enabling the energy transition



Sustainable products & solutions



Power Electronics

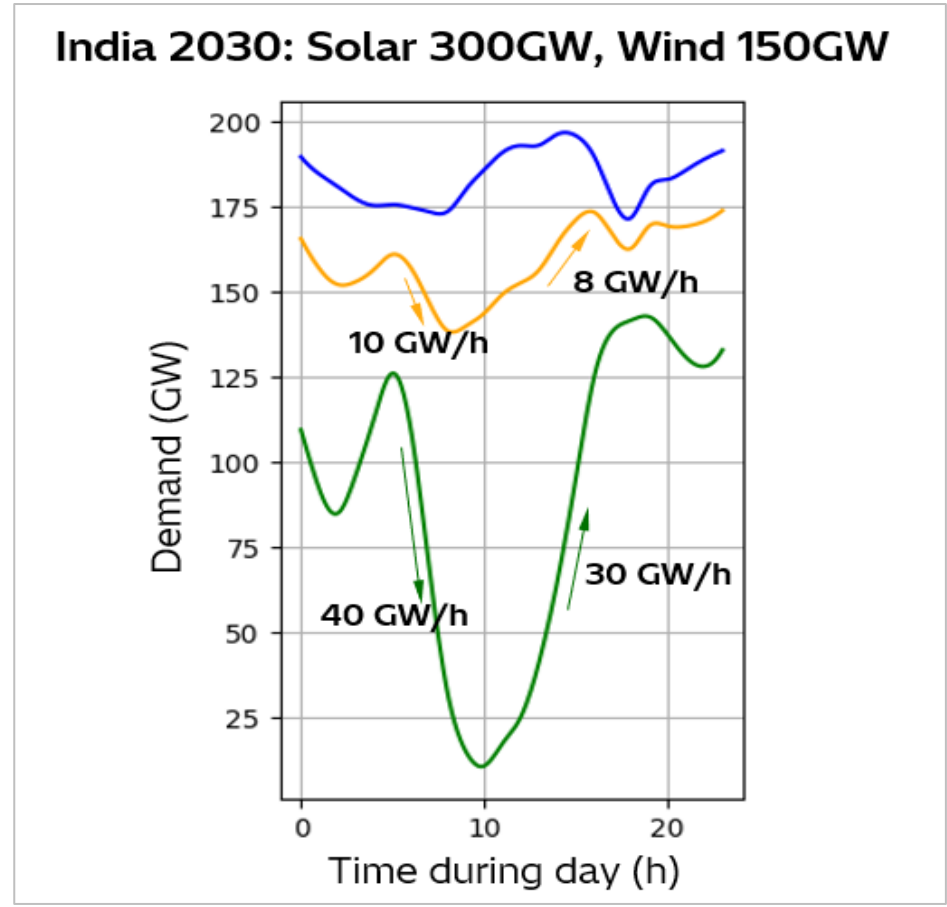
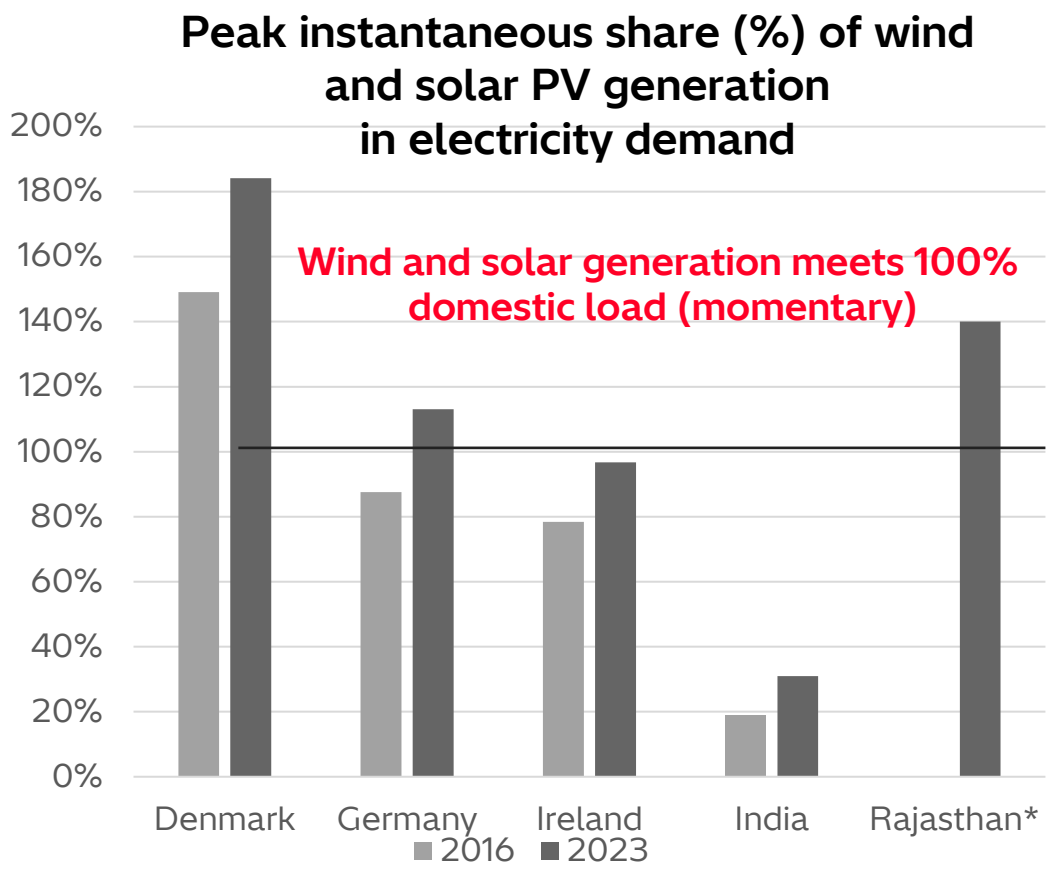
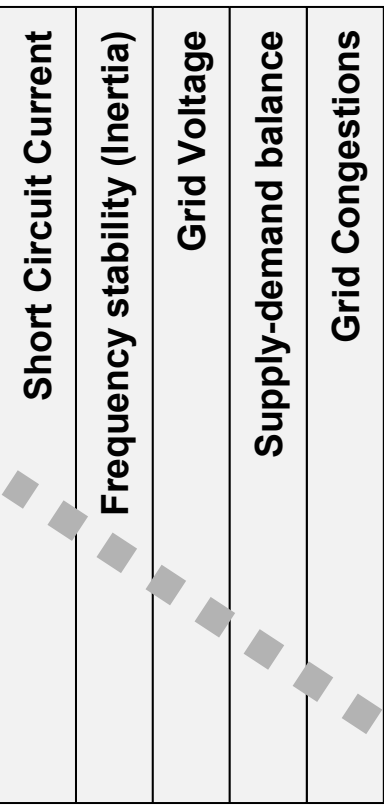


Digital technology and services

Building the foundation for a system of systems

Advancing a sustainable energy future for all

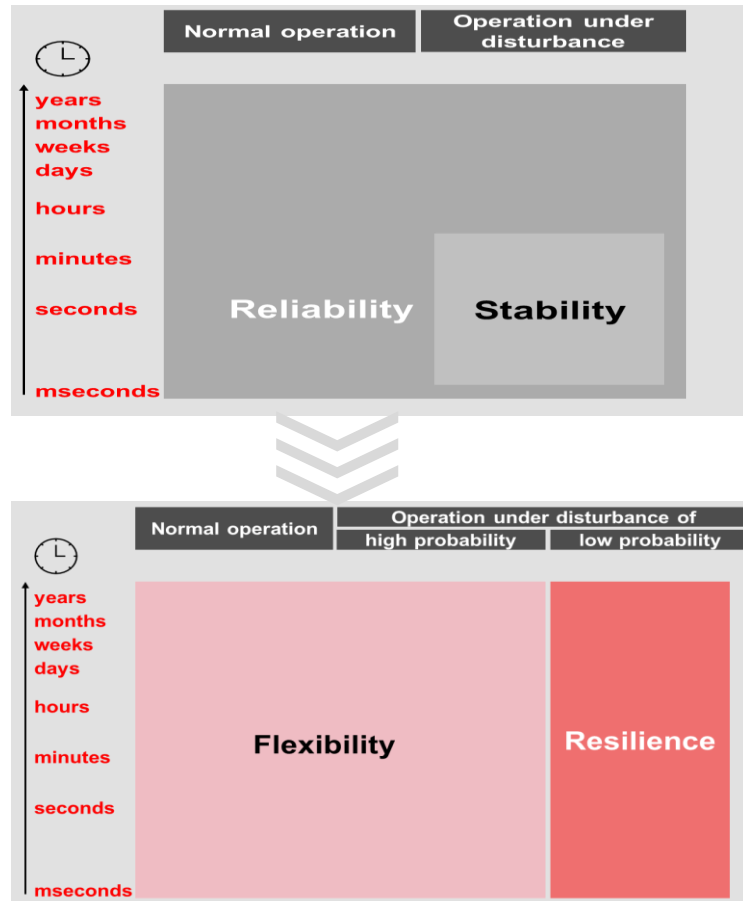
The global power system of 2050 will require four times power generation capacity and will need to transfer three times as much electrical energy compared to 2020



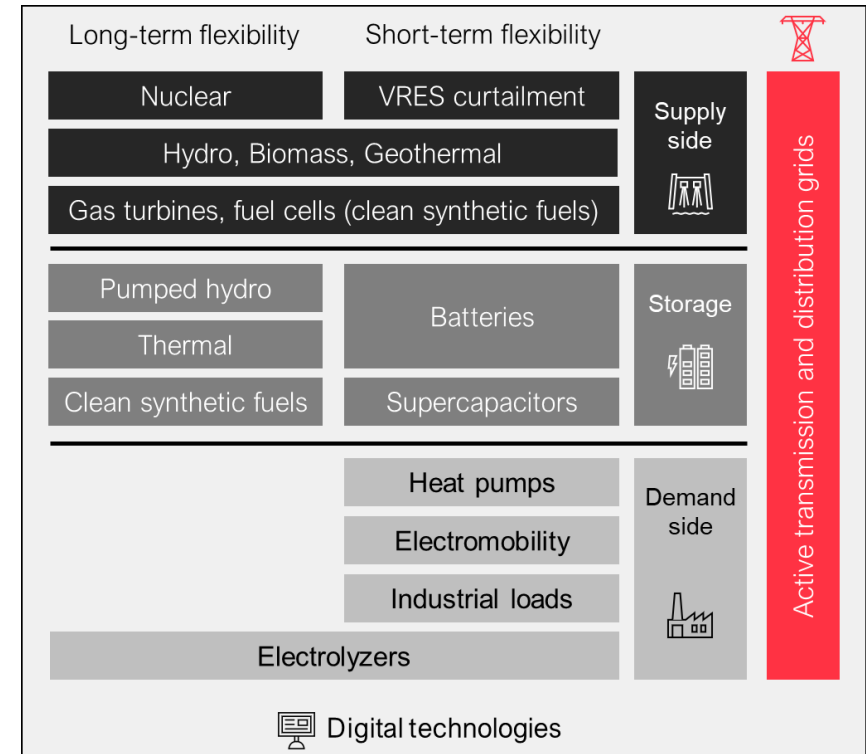
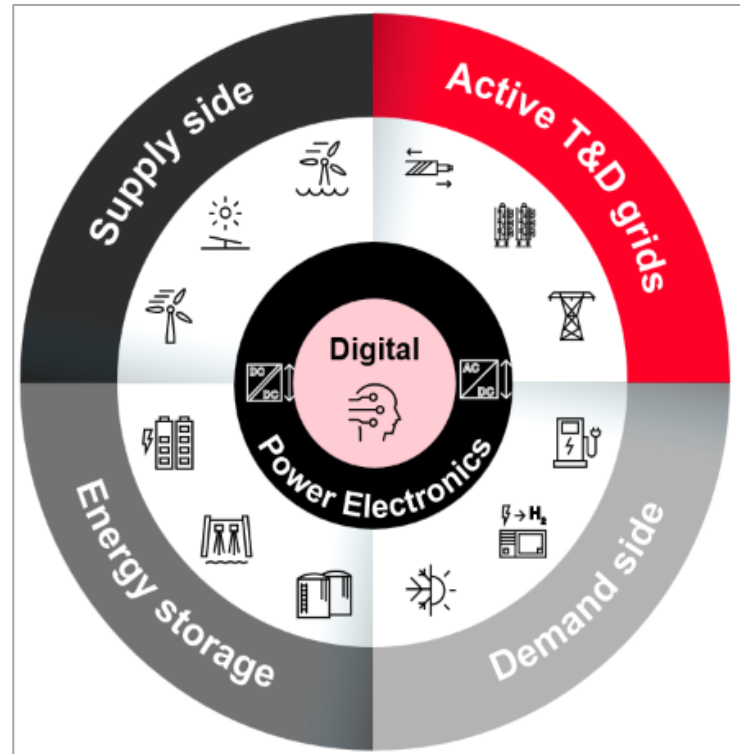
Sources: ENTSO-E transparency platform; Energy Information Administration (EIA); OCCTO
* 2023 value for Rajasthan estimated based on VRES generation profiles; VRES: Variable Renewable Energy Source

Transitioning Power System landscape

Four levers of flexibility with digital and power electronics at the core



Reliability and stability remain essential, but today's power systems also require greater flexibility and resilience.



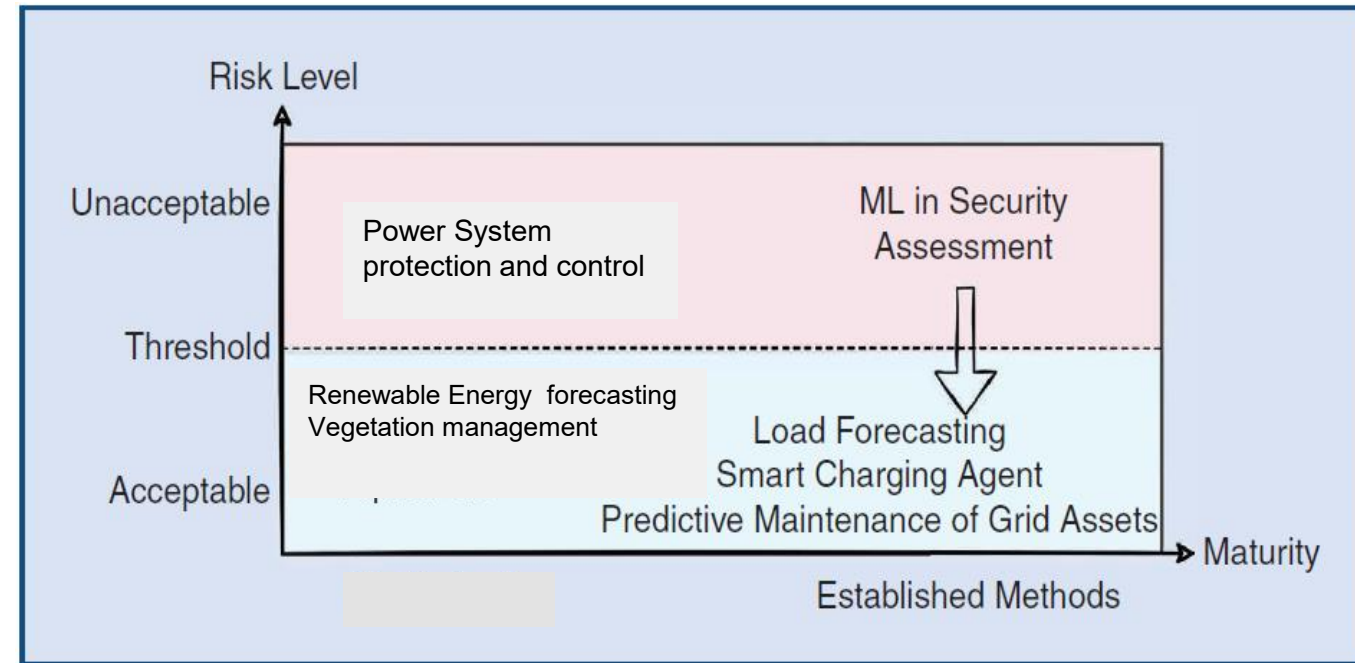
**Three fundamental technology areas for the Power System evolution:
Power Electronics, Digitalization and Sustainable Products and Solutions**

AI in Power Systems: Is It Time to Trust It?

HITACHI

The main reason for the slow adoption of AI/ML in the power industry is that most AI approaches, such as neural networks and others, are considered a black box

1. Who would trust a black box method to avoid power system blackout?
2. Who would trust to find an optimal operating point that will not violate any line loading limits?
3. What is the risk associated with using a novel method instead of a conventional one?
4. To what extent does the industry already have solutions to a problem?
5. What does it take for AI to get adopted?



Core Digital Technologies (examples)

Image & Video Analytics
Operations Research
Digital Signal Processing

Supported by Machine Learning

1. Forecasting & Trading



2. Vegetation Management



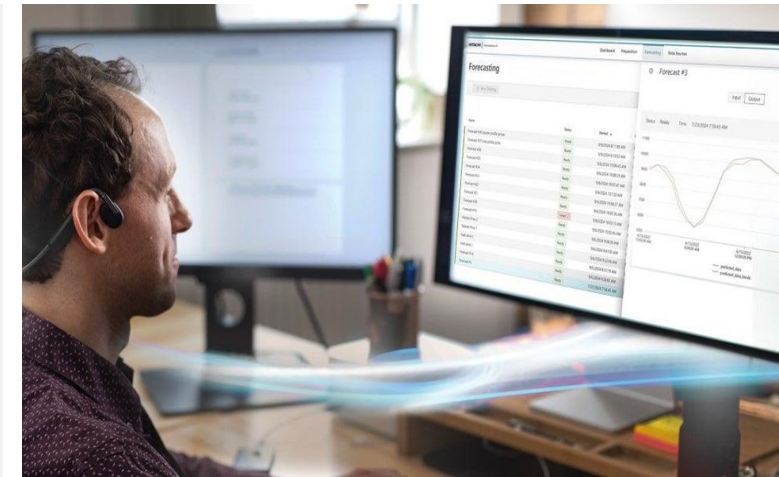
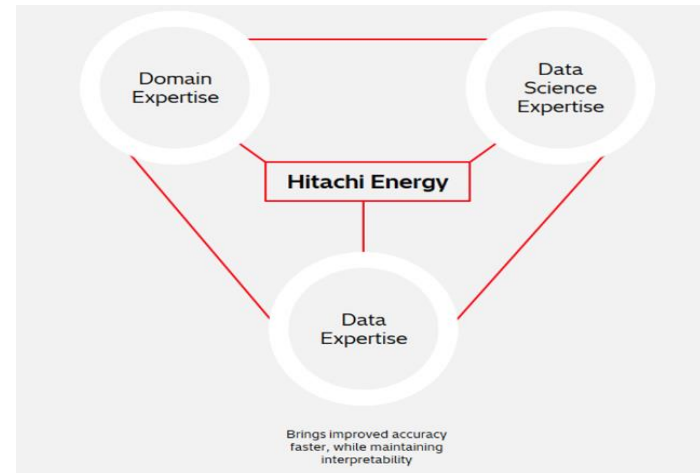
3. Asset Management



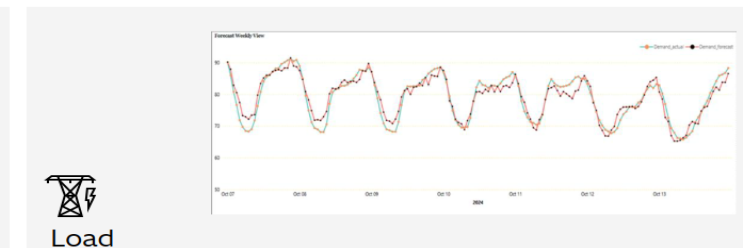
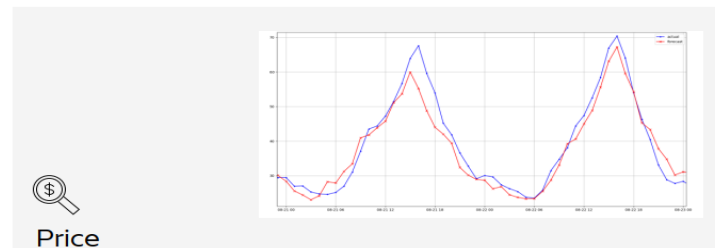
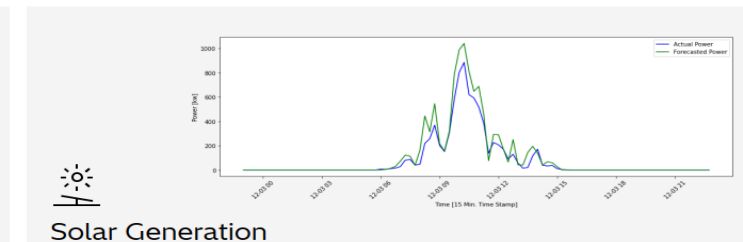
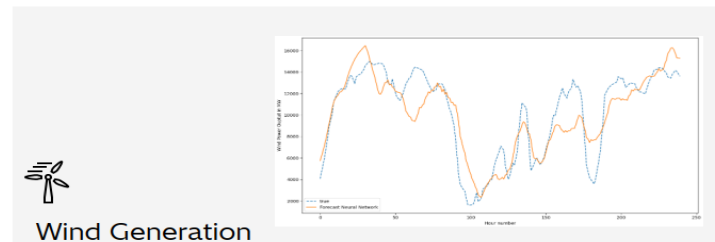
Nostradamus AI energy forecasting solution

Nostradamus AI is the energy forecasting solution specifically designed for energy markets

- Leveraging Hitachi Energy's **domain expertise** combined with data engineering and data science best practices
- Provide **high accuracy** with user-in-the loop for **control and transparent reporting**
- Highly **dynamic and scalable** to support energy forecast needs of all sizes
- Provides **pre-tuned machine learning pipelines** for specific forecasts to enable AI forecast without statistical training.



Accurate, flexible, easy-to-interpret forecasts **in minutes instead of hours**



AI enabled vegetation management- Optimize the maintenance costs

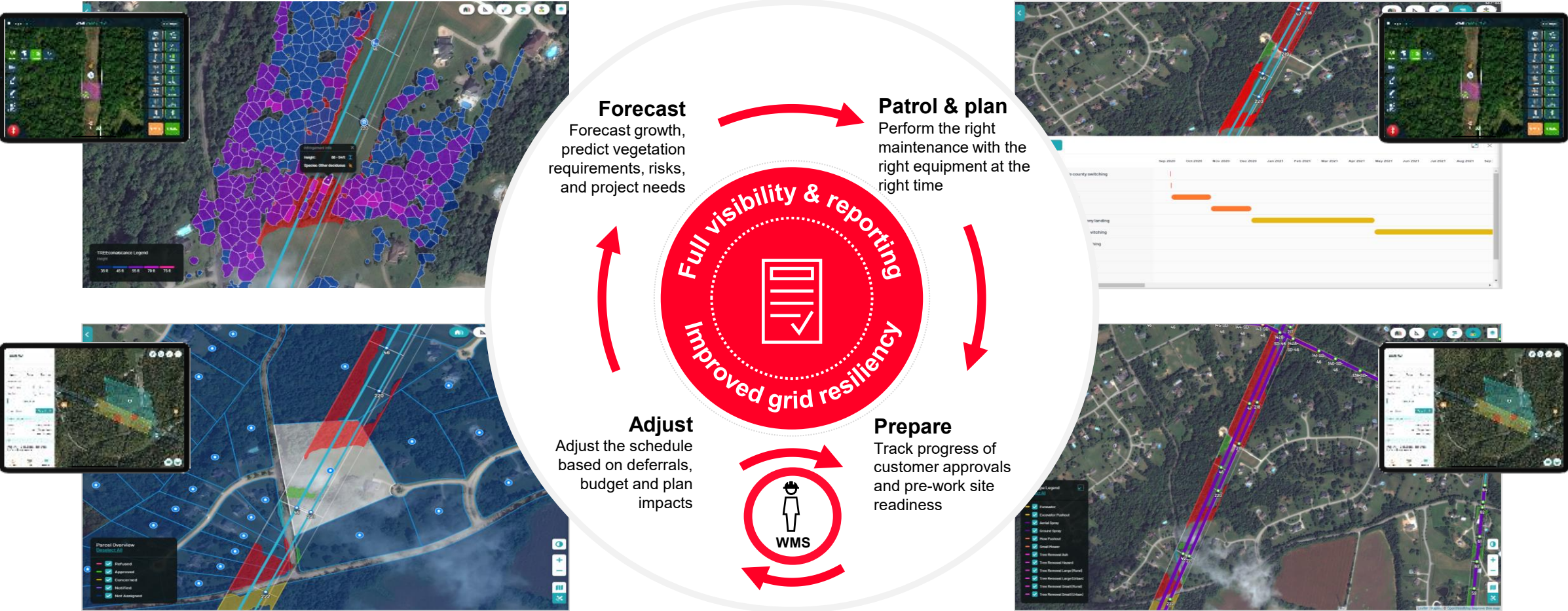
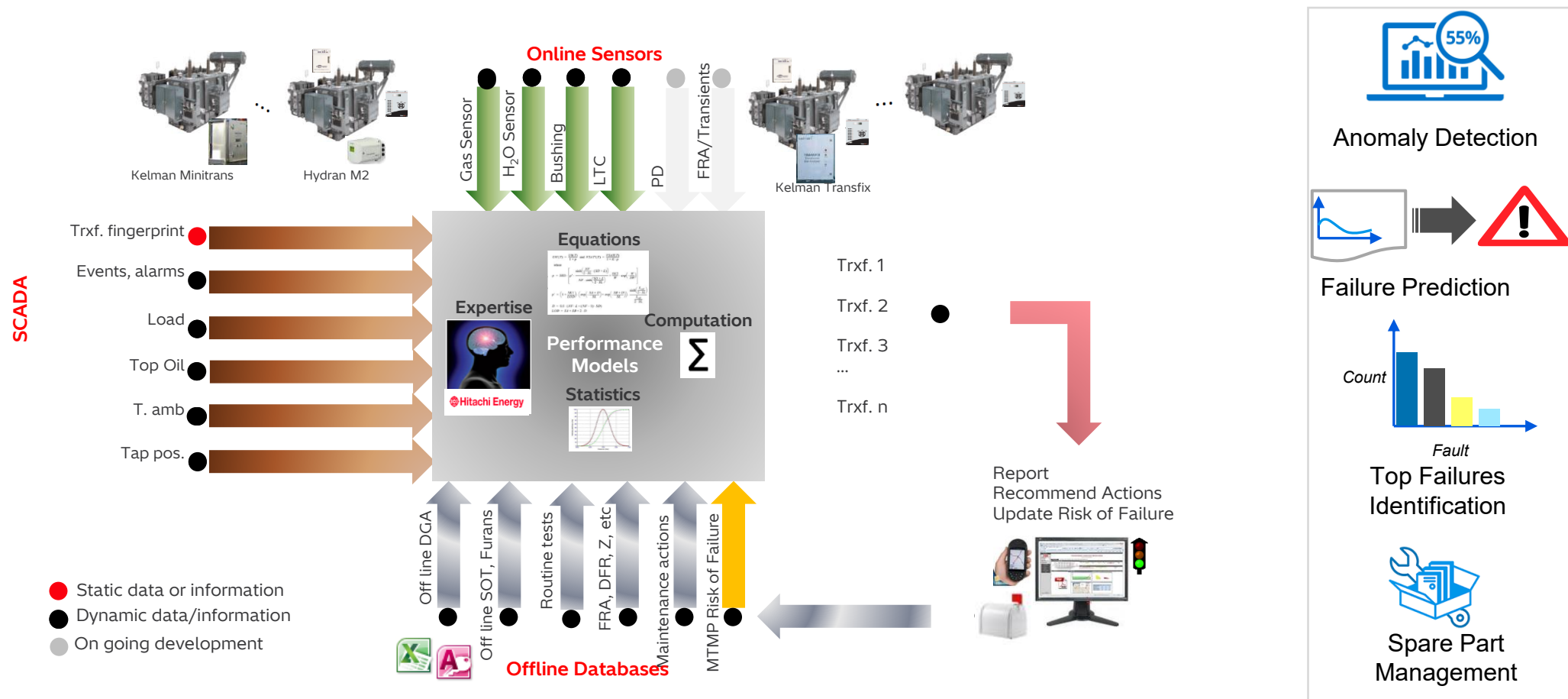


Image and video analytics, machine learning, and operations research are key technologies enabling utility digitalization

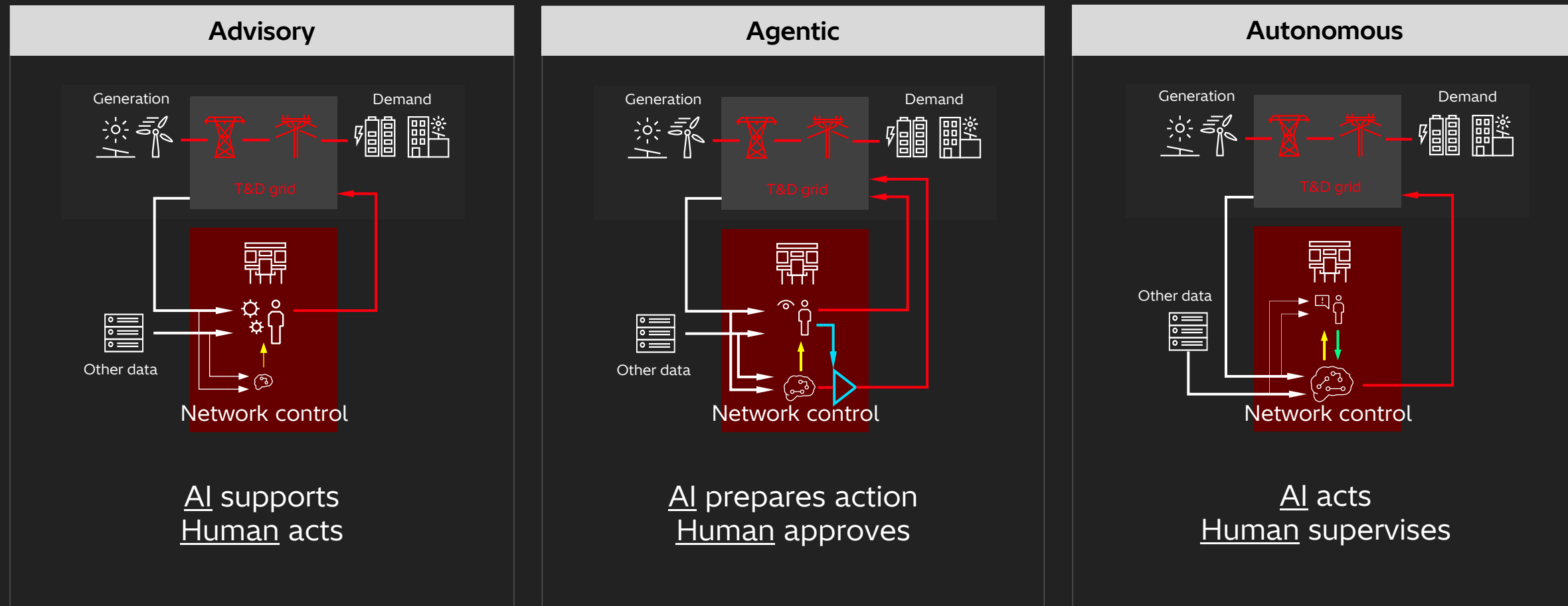
AI enabled asset management- Optimize the maintenance costs

Asset Health Index approach - Next level of asset management



Predict the Risk of failure (RoF) of Substation Assets and Optimize the maintenance costs

Physical AI Interaction Models in Power Systems



As AI maturity increases, the human role shifts from decision-maker to approver to supervisor of closed-loop physical system

Discussions

Final Remark:

**Think Big, Start Small
and Scale Fast**

Thank you:

Dr. OD Naidu

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