March 28, 1979

U.S. AIDES SEE A RISK OF MELTDOWN AT PENNSYLVANIA NUCLEAR PLANT; MORE RADIOACTIVE GAS IS RELEASED

CHILDREN EVACUATED

But Governor Says Later Further Pullouts Are Not Thought Likely

CONGRESS IS BRIE[FED]

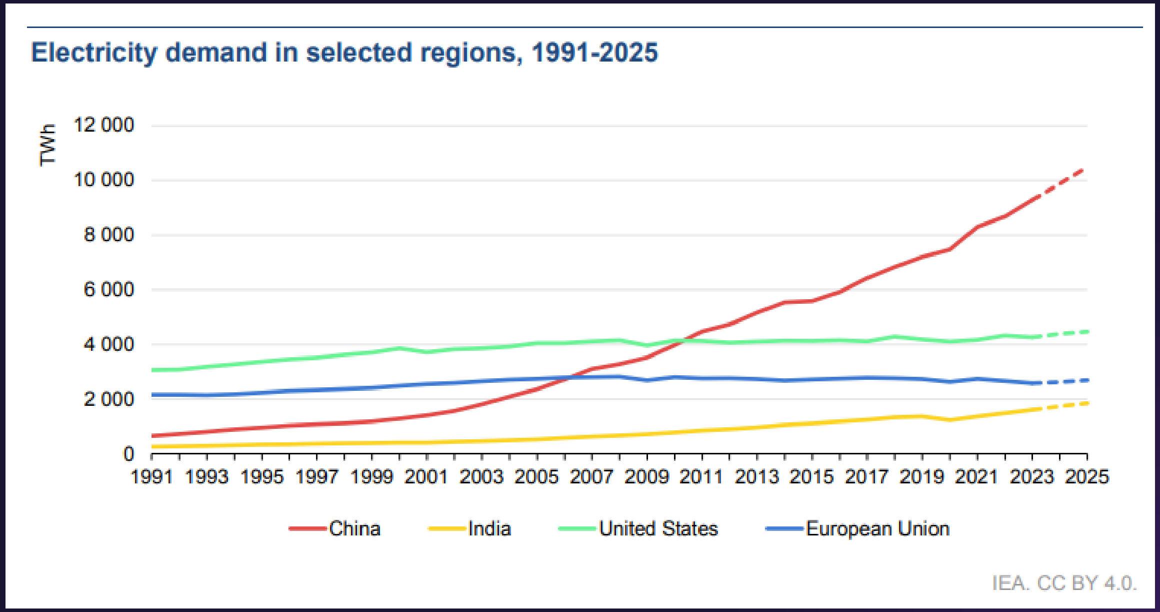
Carter Aide at Scene ... Danger to the Publ[ic] Is Believed Remot[e]

Within Sight of Stricken Plant, A Town's Main Street Is Empty

Keeping the Lights On: How AI Enables the Energy Systems of the Future

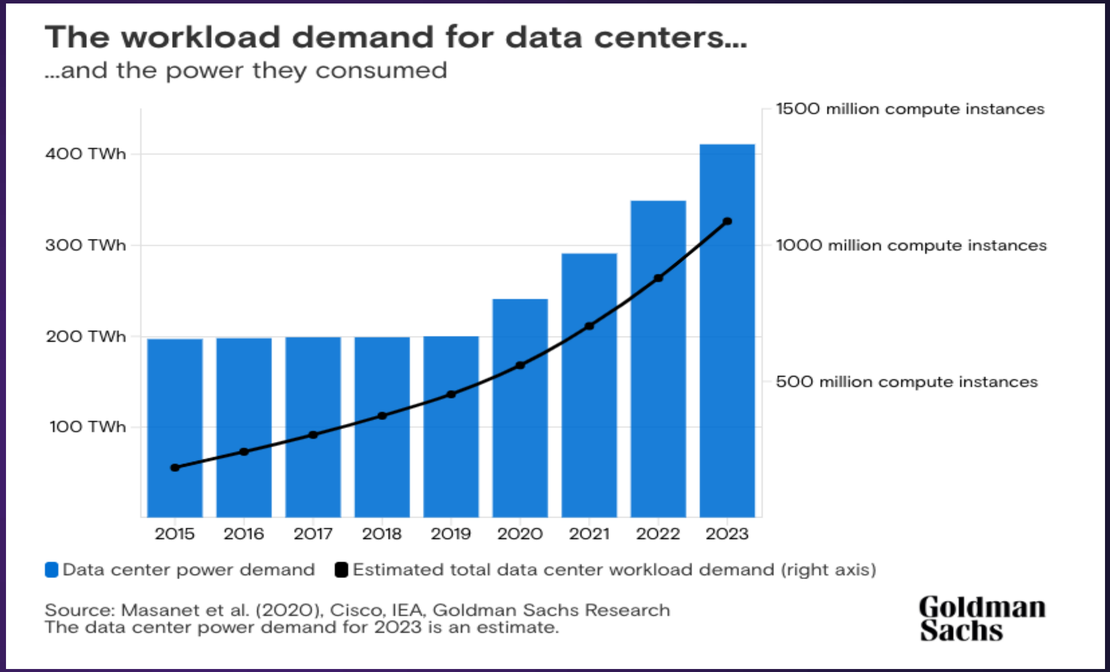
Micheline Casey

A Shifting Energy Landscape adds complexity to Energy Systems



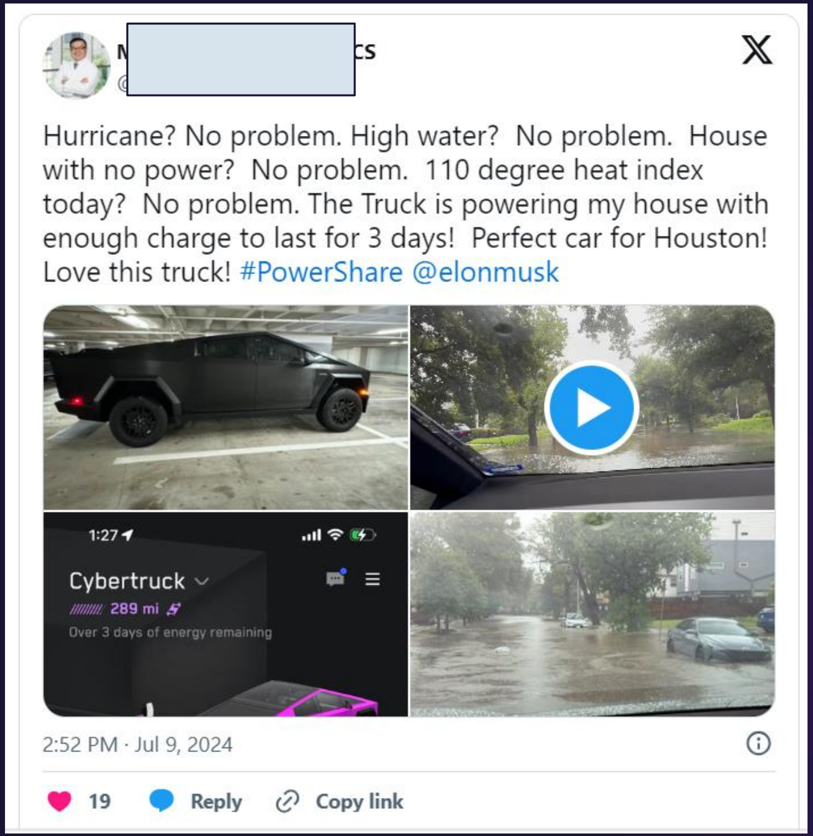
Energy demand is increasing at fastest pace in years

160% increase in data center power demand



A Shifting Energy Landscape adds complexity to Energy Systems

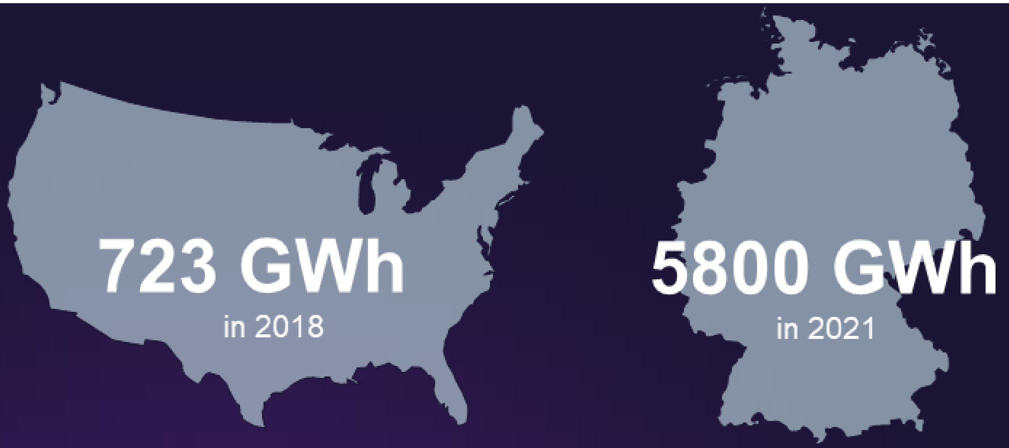
Changing energy mix adds instability to grid operations



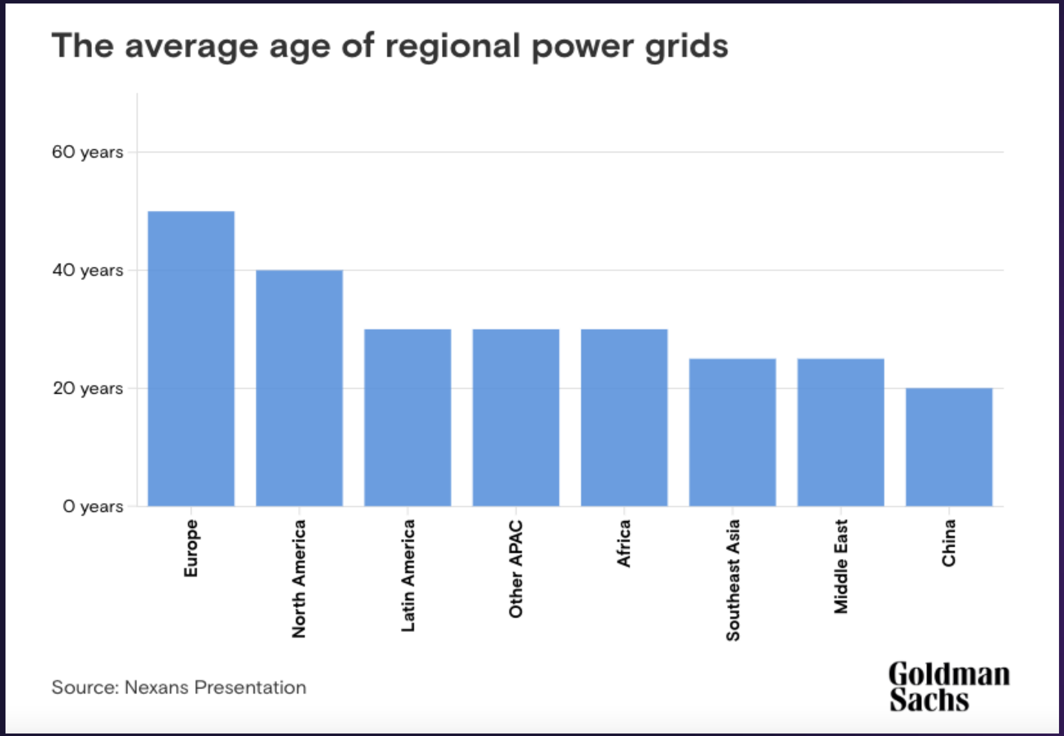
Bidirectionality injects unplanned nodes

Grid infrastructure is outdated

The integration of renewables leads to increasing grid congestion and stalls renewable projects



Curtailment of energy due to network or system reasons



United States - Over 70% of transmission lines are more than 25 years old.
Europe - 40% of its grid nearing the end of its life.

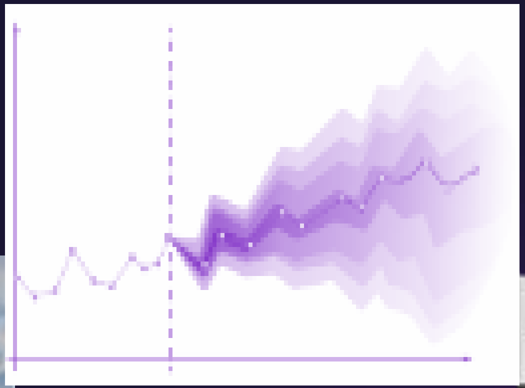
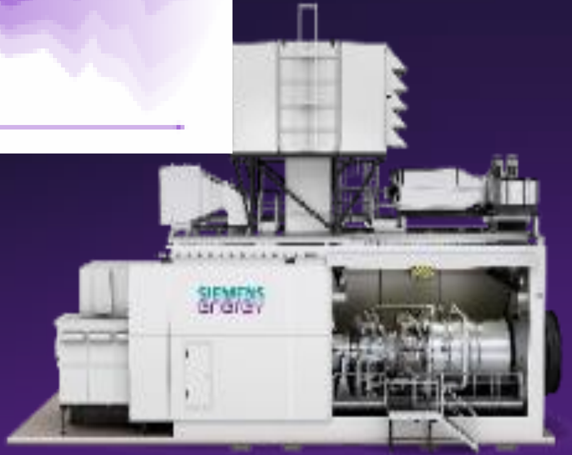
Future Energy Systems:

Digital, Connected, Smart, Adaptable, Automated

2040: Automated ,Unmanned, Configurable

The modular components are being built today

Example: Autonomous Power Plant Operations


Challenges

- Electricity price/demand forecast
- Capacity planning
- Financial Figures

Benefits

- Increased Cost Savings
- Improved customer satisfaction
- Lowered Carbon footprint

Example: Improving Grid Resiliency

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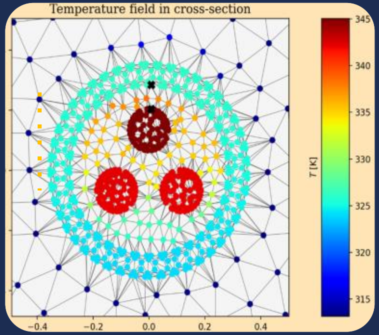
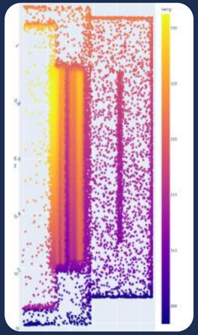
AI-based, physics informed for real time monitoring

Transformer Bushing surrogate model for real-time hot spot prediction



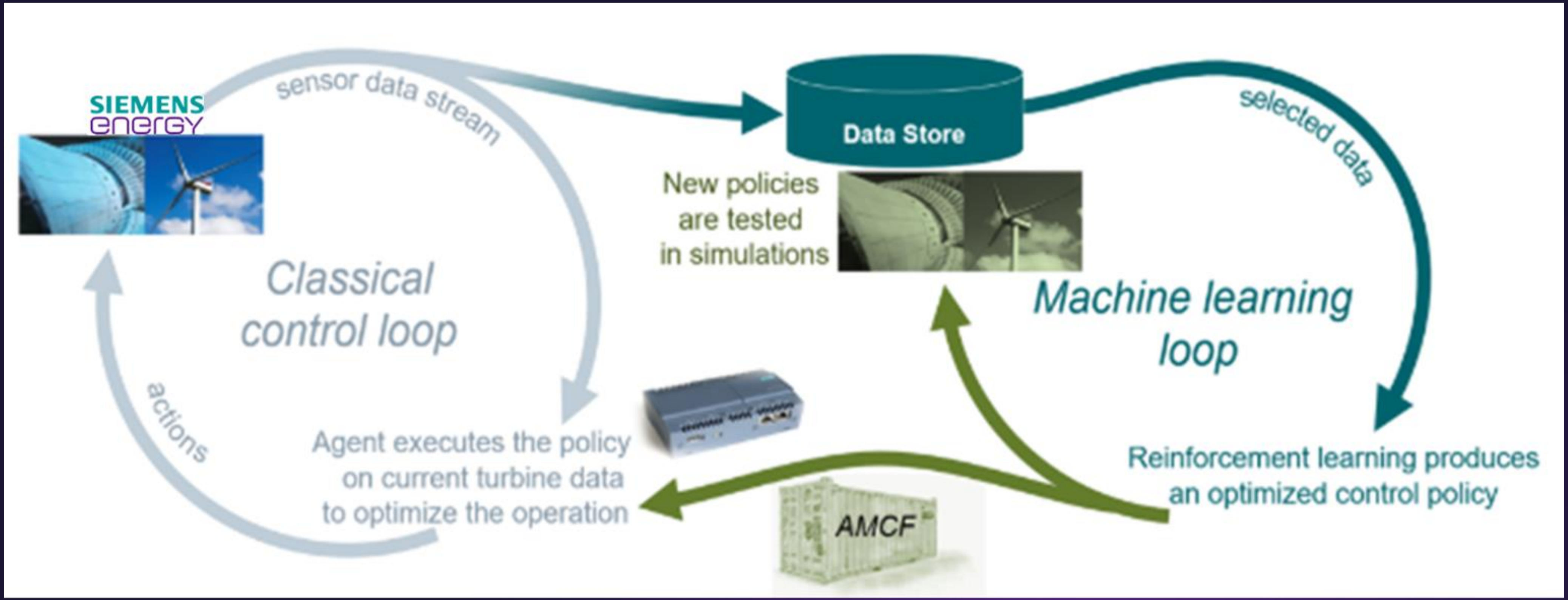
Thermal model to anticipate transient heat transfer for GIS[1] components



Thermal distribution for fluid-immersed transformer windings

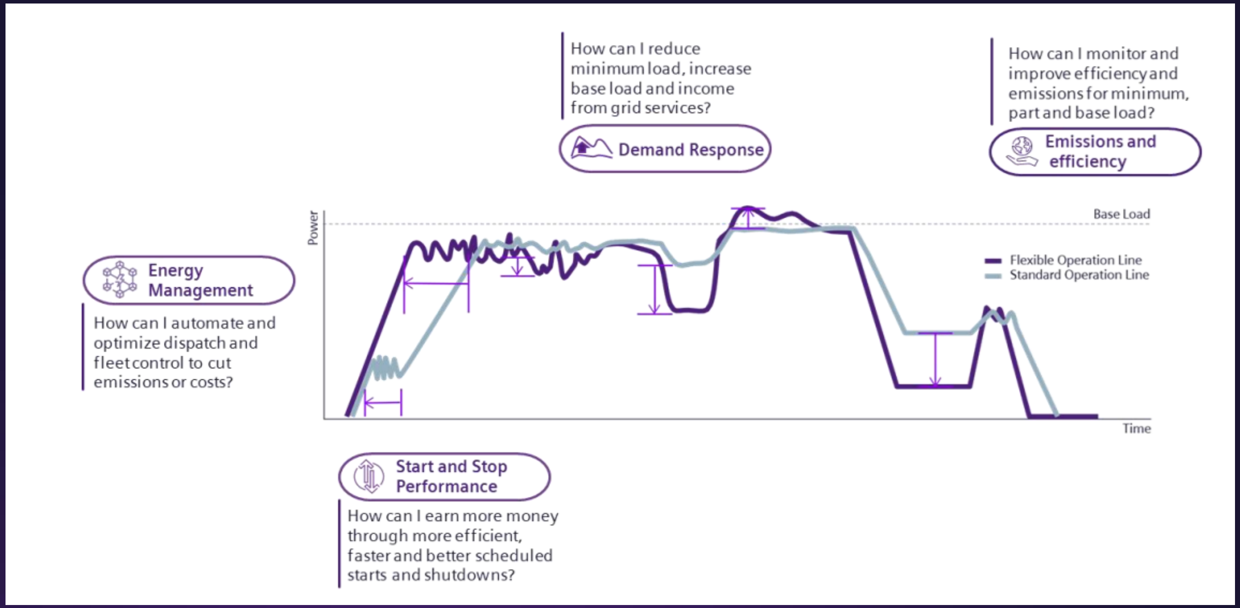
Up to ~40,000x speed-up of model response time without sacrificing precision

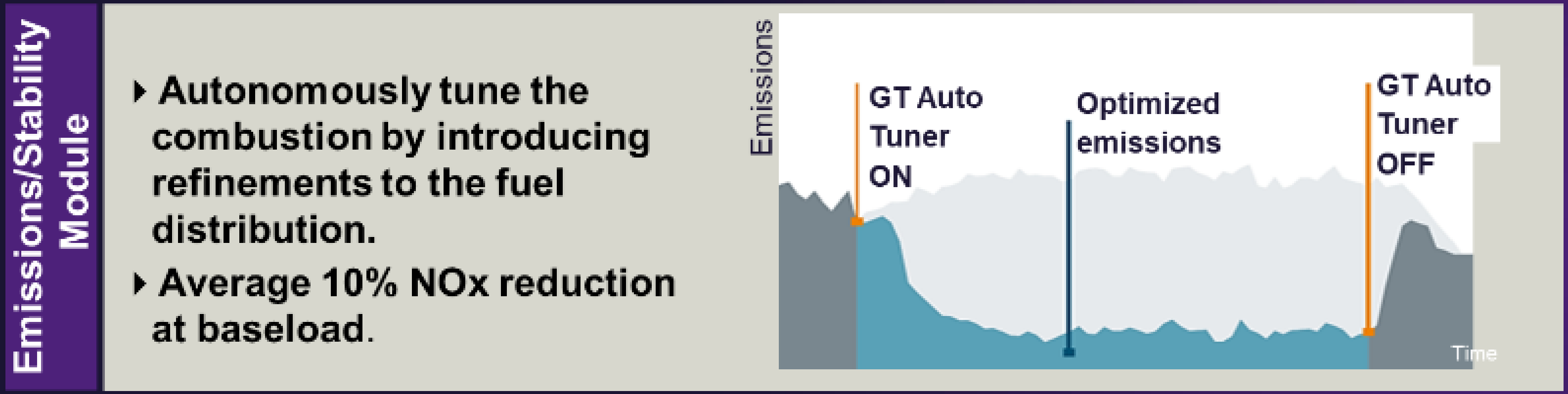
Example: Speeding Feedback Cycles and Decisions



Example: Reducing Carbon Emissions

Across cycles: reduced fuel use, optimize energy dispatch, reduce CO2 emissions





~10% lower emissions via refined fuel distribution and elimination of seasonal tuning

Use of AI and Digital Across Value Chain

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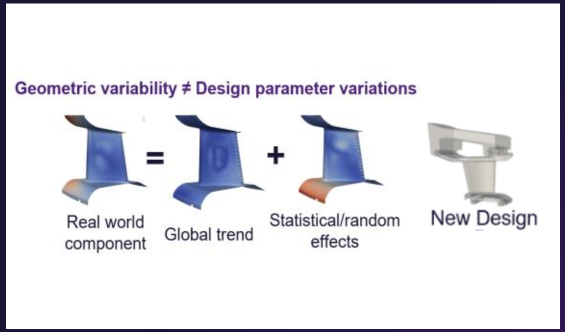
Design optimization

AI-driven surrogate-based geometry optimization…

- applied to turbine blades
- accelerates design time
- improves performance

Improved sustainability through enhanced products

Reliability modelling



Utilizing neural network-based techniques for…

- modeling of shape deviations in manufacturing
- quantifying reliability of components in the field

Facilitates reliability-based lifing and robust design

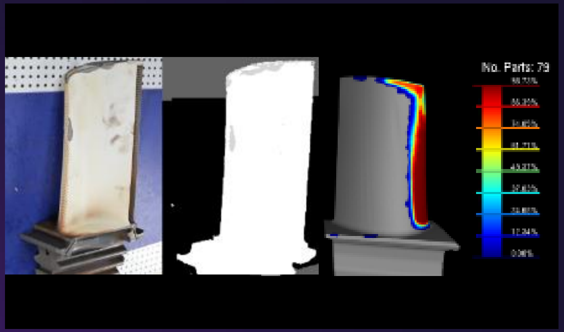
Asset monitoring

Leveraging advanced machine learning to…

- detect anomalies in asset operation (acoustic)
- monitor plant operation (computer vision)

Enables autonomous operation

Service field feedback



Utilizing computer vision for automatic…

- defect detection and classification on used parts
- Calibration of design models based on service experience

Improved maintenance and field feedback loop

AI and Energy Become Increasingly Symbiotic

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The Washington Post

Microsoft deal would reopen Three Mile Island nuclear plant to power AI

Reported: September 20, 2024

AI‘s transformative potential

Digital Twins

Optimize utilization of power assets and the grid by combining machine learning with physics-based models

Autonomous Operation

Self-operating plants which continuously adapt to changes using computer vision and time series analytics

Smart Connected Services

Maximize energy system efficiency while reducing costs with multidisciplinary optimization

Reliable Grids

Demand forecasting and production optimization using machine learning and edge computing

Supply Chain Optimization

Model supply chain risks and optimize resilience to reduce non-conformance cost and unlock buffers

Thank you!

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