

Hitachi Energy

Powering the Future: Market Trends and Reliability in Large Power Transformers with Hitachi Energy

Dr Poorvi Patel

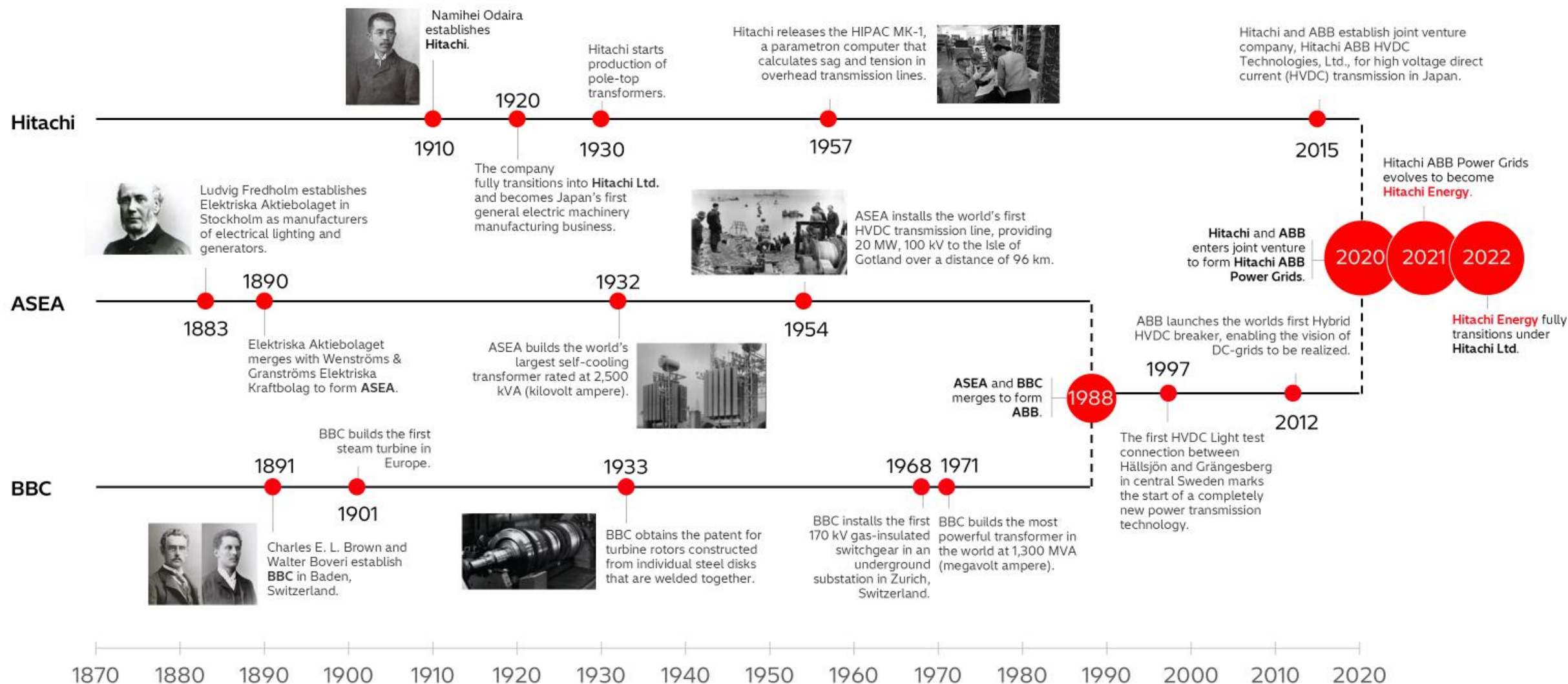
- Grew up in Sweden- all schooling in Sweden (Trollhättan, Luleå and Lund)
- Started ABB in Västerås in 1999 at ABB Corporate Research
- Worked for ABB Transformer Service from 2006- 2018
- Was part of T&D and Technology innovation @ EPRI 2018-2025
- Just 3 months back to Transformers at Hitachi Energy

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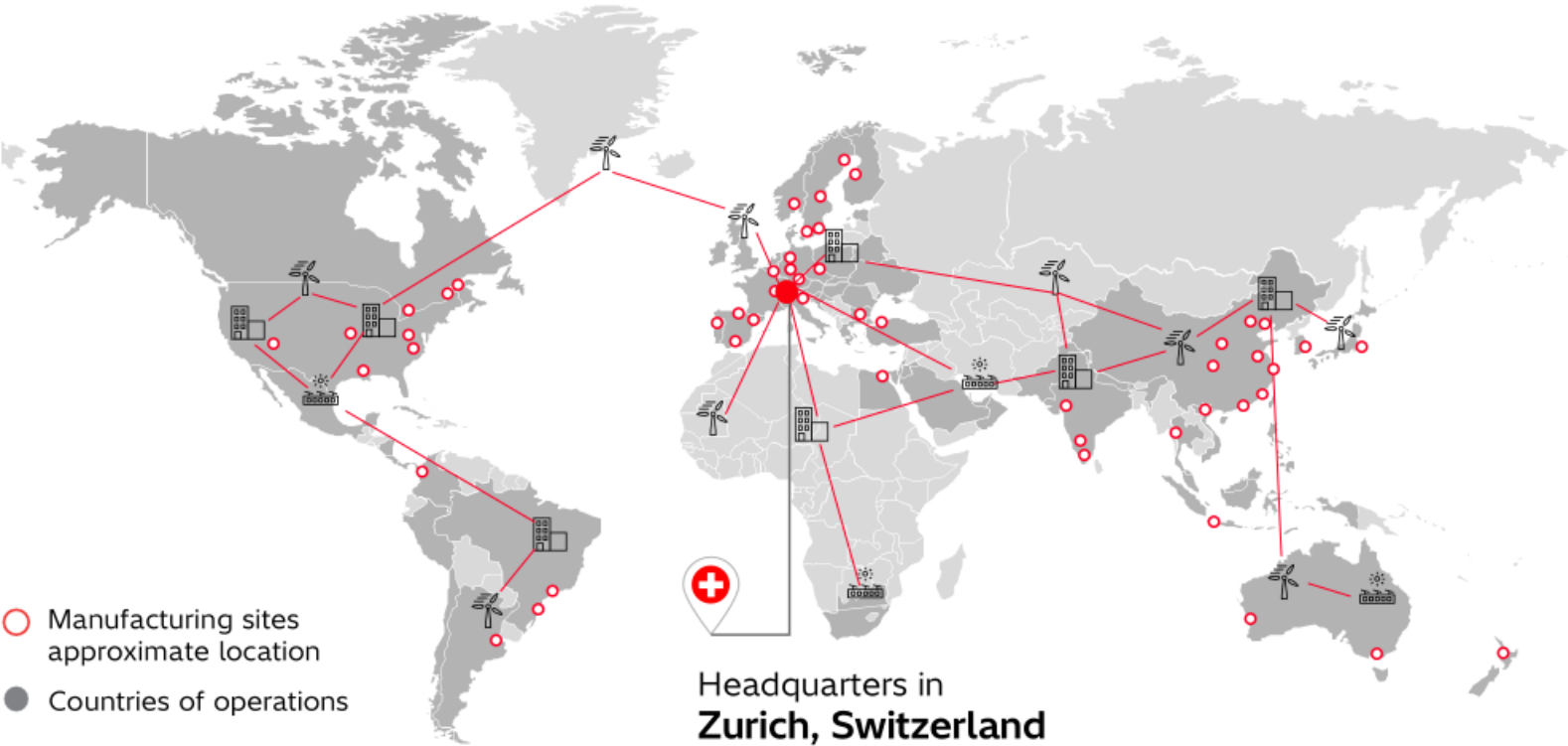
Our Story 1883 - 2022

HITACHI



About Hitachi Energy

HITACHI



~45,000 employees	150 nationalities
60 countries	250 years' heritage combined
1,800+ field engineers	2,600+ R&D experts
~\$13 billion USD business volumes	

Business Units	Grid Automation
	Grid Integration
	High Voltage Products
	Service
	Transformers

Customers



Offering

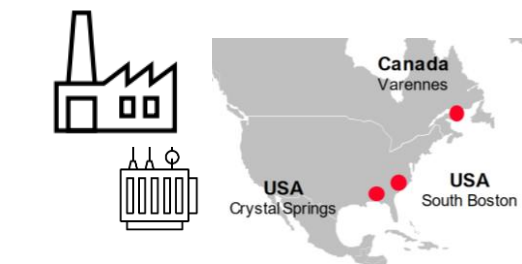


Geographies



Hitachi Energy – Power Transformers

Hitachi Energy is the world's largest power transformer manufacturer, with 1000+ units delivered annually from 13 factories worldwide.



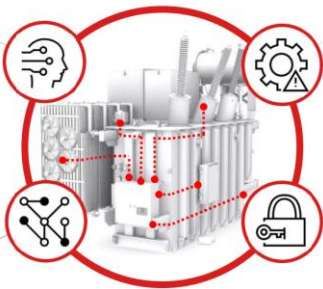
History of supply in NAM

Combined 150+ years of power transformer supply experience across three USA and Canada factories



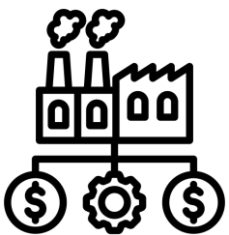
Flexibility with Global Supply

Supporting high-level demand with offshore factories using uniform design platforms and global supply chains



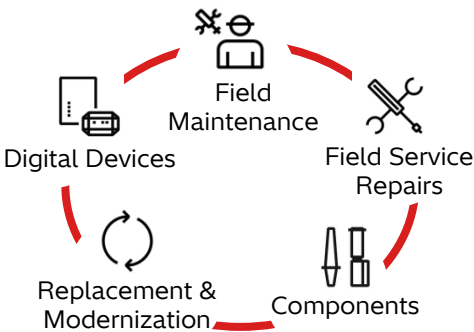
Digital Solutions

Actionable remote intelligence to increase asset life and operational performance



Investments

Announced \$2.0B in factory expansions to increase speed to market and support accelerated global demand



Service

One-stop service support for all transformer needs including installation & commissioning, routine and advanced testing, on-site repairs, sustainable disposal, and spare part management.

Public

Market Driver for Transformers

Where is the Elephant in the room?

EPRI Report May 2024

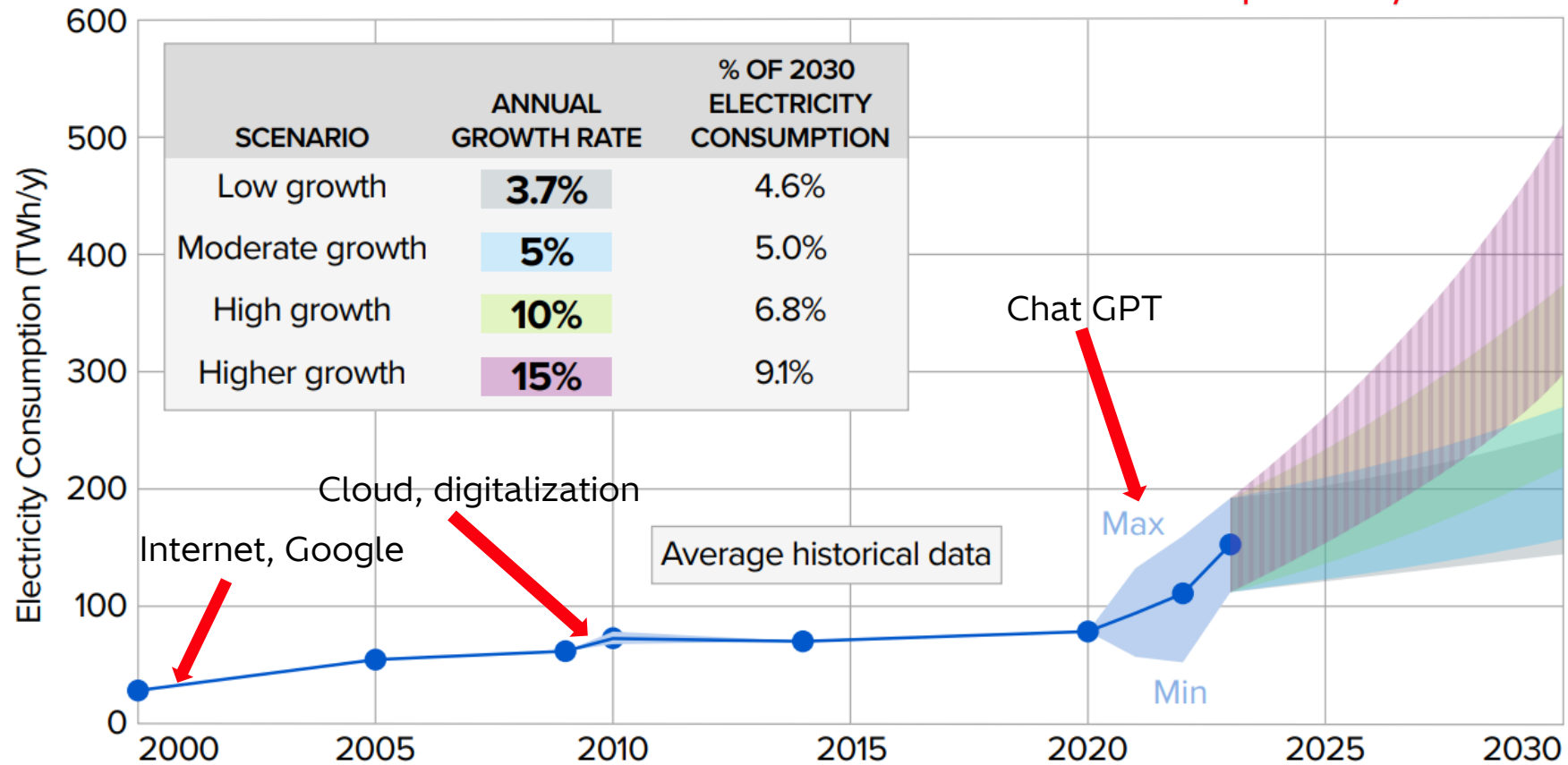
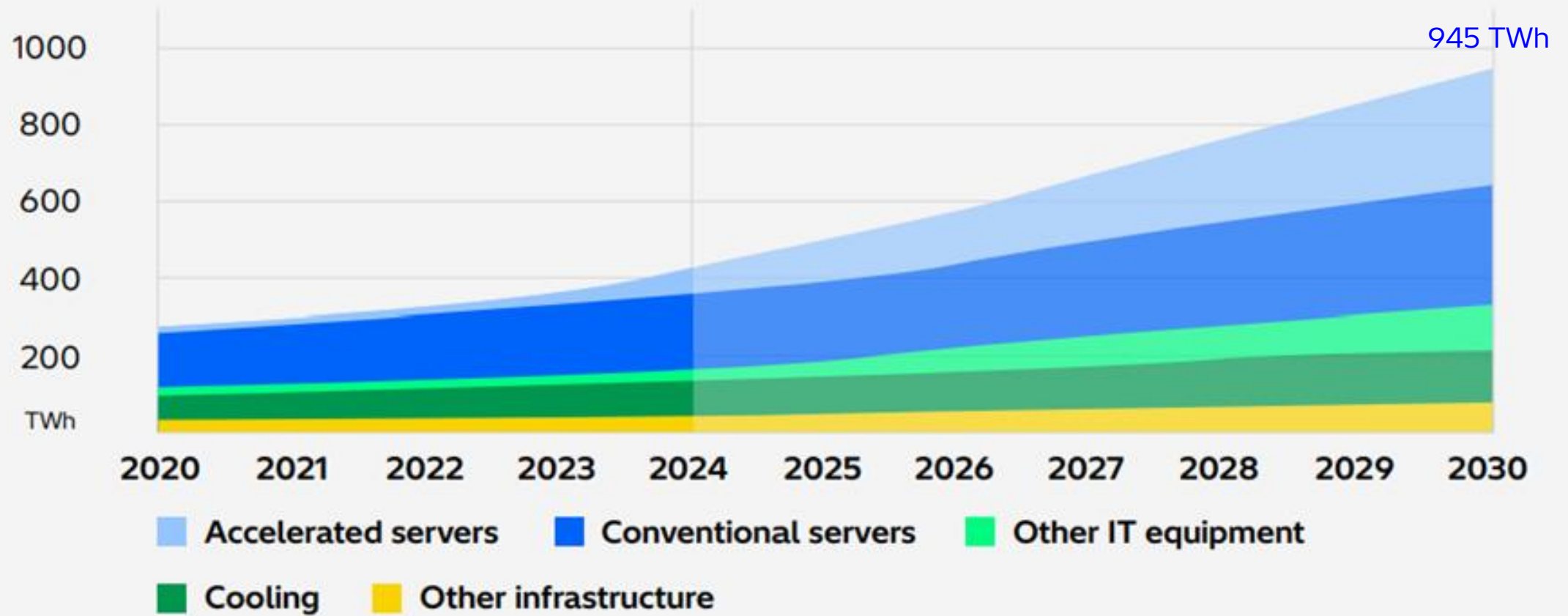


Figure ES-1. Projections of potential electricity consumption by U.S. data centers: 2023–2030 . % of 2030 electricity consumption projections assume that all other (non-data center) load increases at 1% annually.

Where is the Elephant in the room?

IEA- Energy Demand from AI and Electricity Analysis 2025



Where is the Elephant in the room?

Data Center



Projected Electric
Consumption
5200TWh in the
USA in 2030 a
25% increase from
2023*

Electric heat pumps



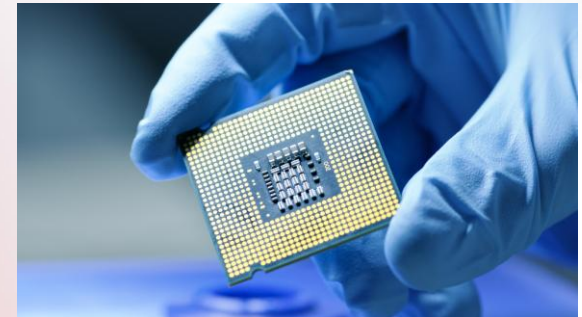
EVs



Hydrogen Generation



Re-Industrialization



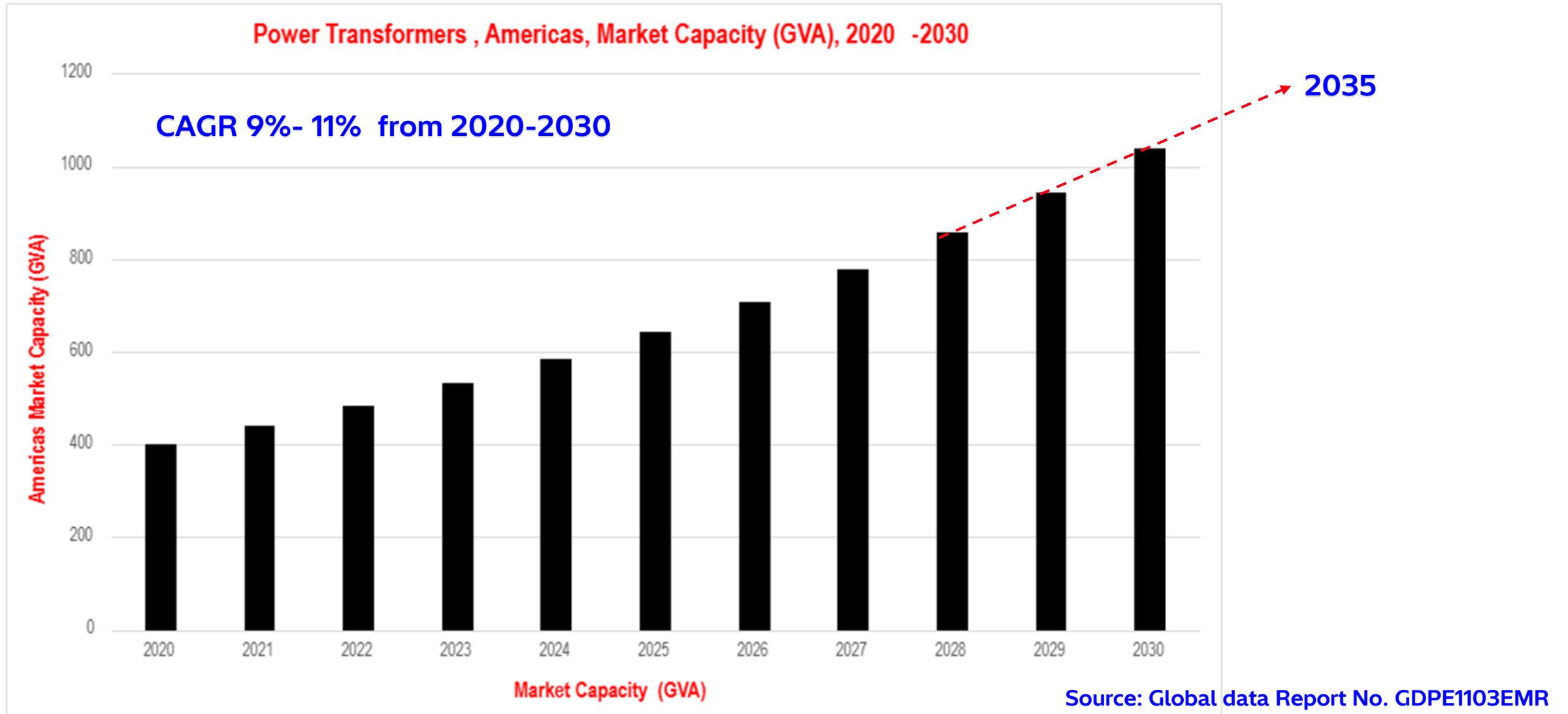
**ICF International*

Side Effects

- Generation of additional Energy
 - Creative way to produce more energy
 - Energy Storage technologies
- More Transmission lines and other infrastructure
 - What took us 100 of years to build we need to build it in 5-6 years
- More Substations
 - More substation assets
- Innovative way to make data centers more energy efficient
 - New cooling technologies
- Increased digitalization and intelligence
- Reliable and Resilience Power



Side Effects- Exponential Growth of Transformer Demand



Side Effects of increased transformer demand

- More Copper
- More Steel
- More Bushings
- More Oil
- More Insulation Material
- More Tap-changers
- More Radiators & Fans
- More Oil conservators
- More Transformer Tanks



Supply Chain challenges



Bushing and Tap-Changer Expansion

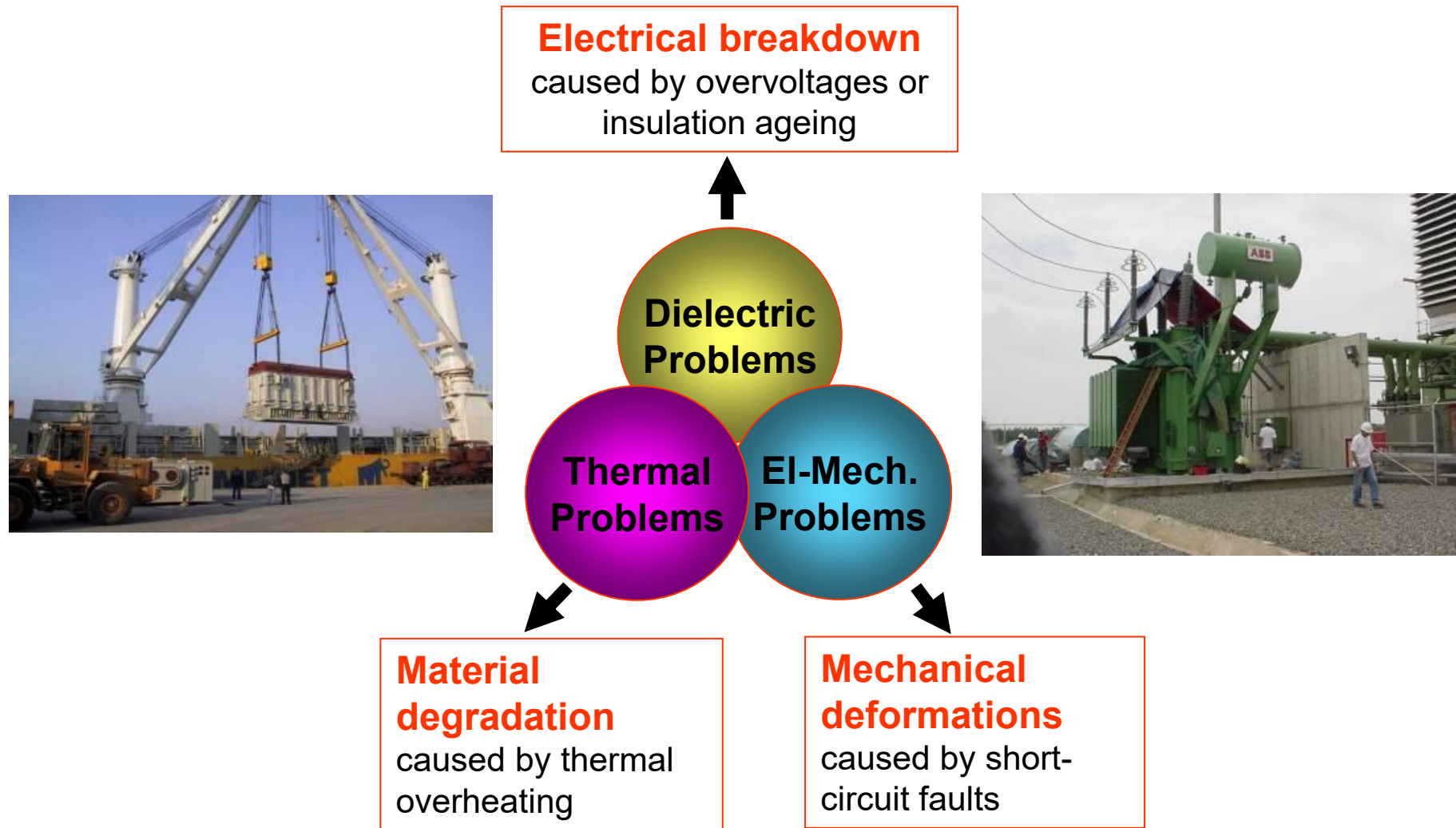


Hitachi Energy invests \$106 million USD to expand transformer component manufacturing capacity at facility in Alamo, Tennessee

Resilience, Sustainable and Reliable Power

Resilient, Sustainable and Reliable Power is a must.

Three kinds of stresses on transformers contribute to normal ageing and eventual breakdown



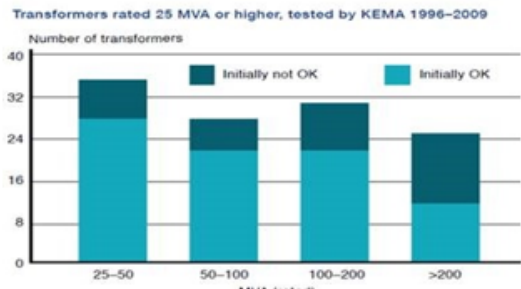
Short Circuit Proof Designs

Hitachi Energy well over industry reference

Short circuit test failure rate statistics in 2011:

TrafoStar: 11%

Overall industry [1]: 28%



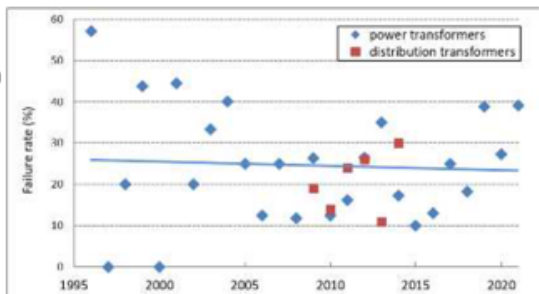
TrafoStar: 0% 14% 30% 43%

[1] KEMA report presented in Cigre and other publications

Statistics as of last five years:

TrafoStar: 11% (28 units tested)

Overall industry [2]: 30%



[2] Cigre Electra N° 323 August 2022

500MVA, 400/220/33KV, 3Ph
Auto



275MVA, 20/400KV, 1Ph
GSU



Pictures of units at short circuit labs

Resilient, Sustainable and Reliable Power is a must.

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▪ Physical Security

- Copper theft
- Intentional damage to transformers

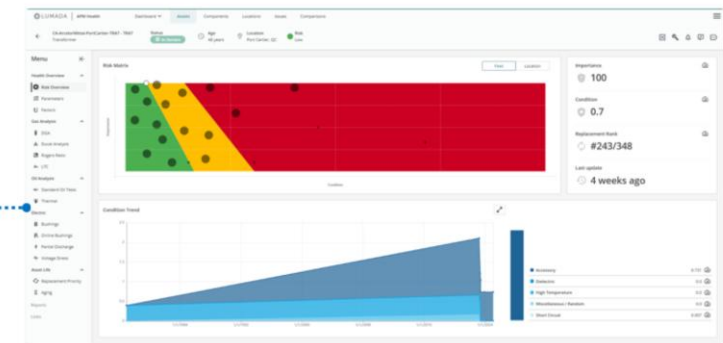
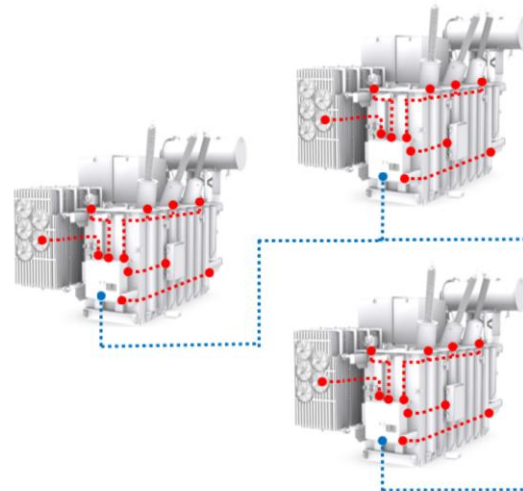
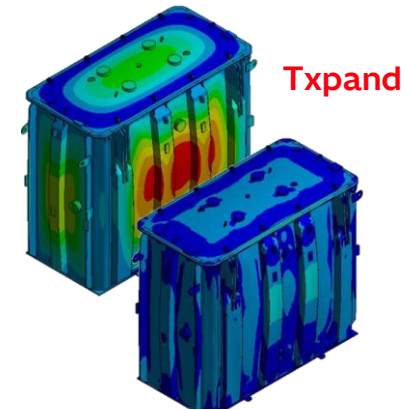
▪ Minimize Collateral Damages

- Rupture resistant tank concept
- Controlled tank deformations to absorb the arc energy
- Controlled rupture point pre-designed at the tank cover weld

▪ Increased digitalization and intelligence

- AI Tools
- On-line monitoring
- 24/7 Asset condition assessment

▪ Sustainable Transformers- LCA Analysis



What is Flexible Power Transformer in Substation?

- **Is it a Transformer that could be operated in multiple voltages?**

- Innovative solutions are need here
- Cost effective
- Flexible impedance adjustment
- Compact design

- **Is it a Modular solution?**

- Rapid deployment
- Emergency deployment
- Temporary Solution

- **Flexibility to be connected to any energy source?**

- Variable load from renewable energy sources
- Constant load from nuclear, gas etc.
- Source from batteries

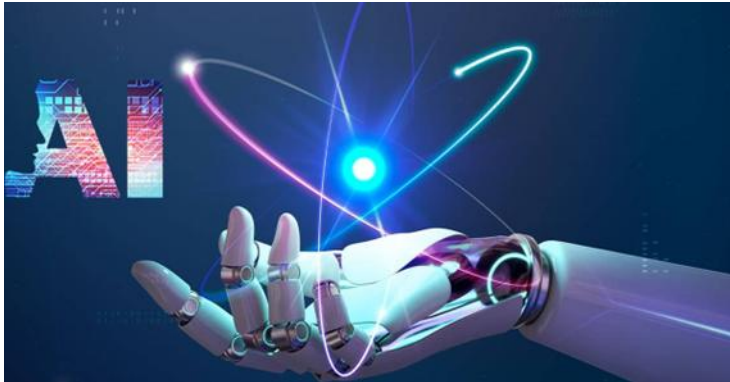
- **Flexibility in operation with increased intelligence?**

- Extend the lifetime of the transformer



Substation of the Future- Breakout Session 2

- Solid state transformers ??
- Solid State Breakers ??
- Solid State Batteries ??
- Digitalization & AI Integrated



Thank you

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