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EHV 765kV Vendor Workshop

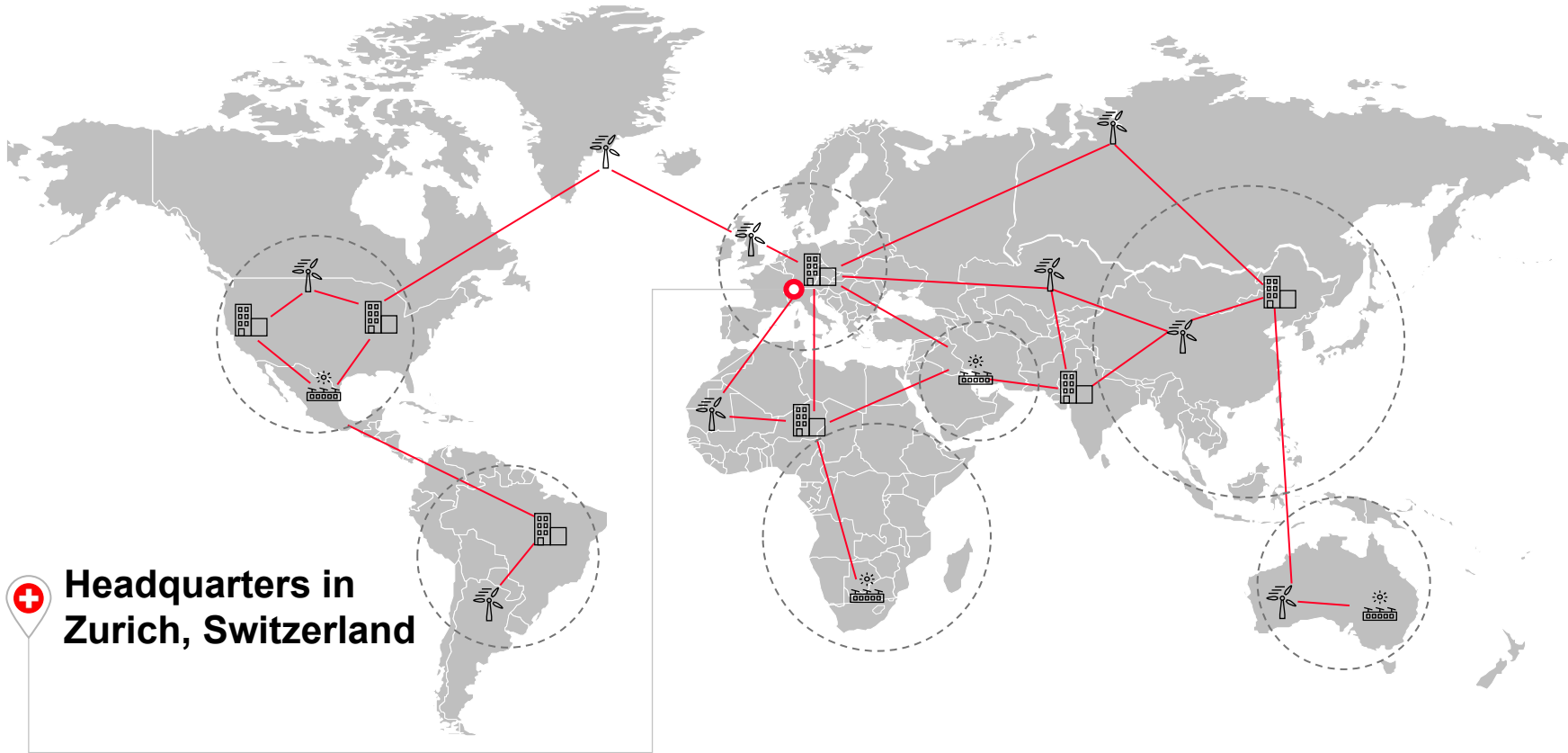
ERCOT Austin, 8000 Metropolis (Building E), Suite 100

Jerzy Kazmierczak - Manager of Application Engineering

2024-09-18

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 **Hitachi Energy**



45,000 employees

90+
countries with
200 offices

~250
years' heritage
combined

5,500
sales employees
& field engineers

2,000
engineers &
scientists in R&D

4 Business Units

**Grid
Automation**

**High Voltage
Products**

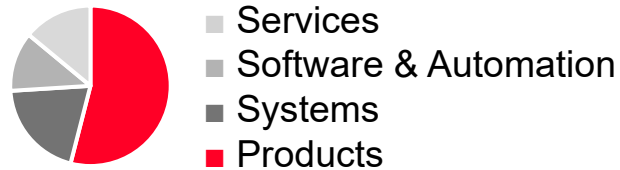
Grid Integration

Transformers

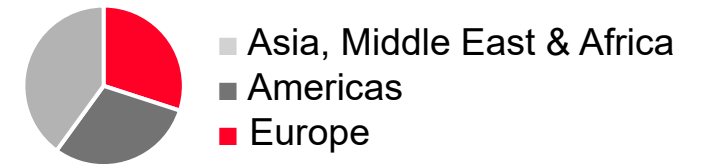
Customers



Offering



Geographies



Production and service units

Americas

- Brazil, Canada, Colombia, USA

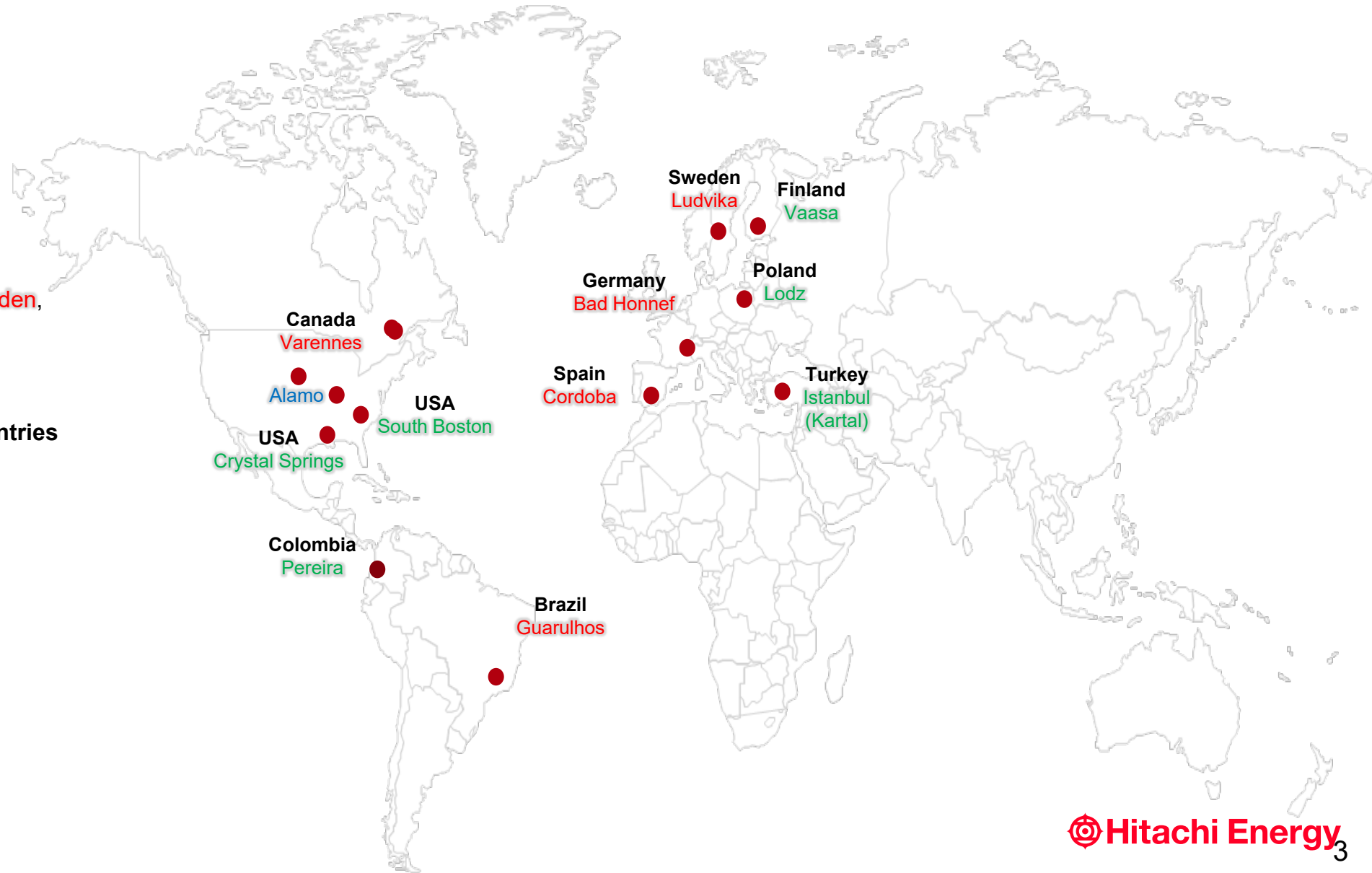
Europe

- Finland, Germany, Poland, Spain, Sweden,

AMEA

- Turkey

Global sales network in about 100 countries



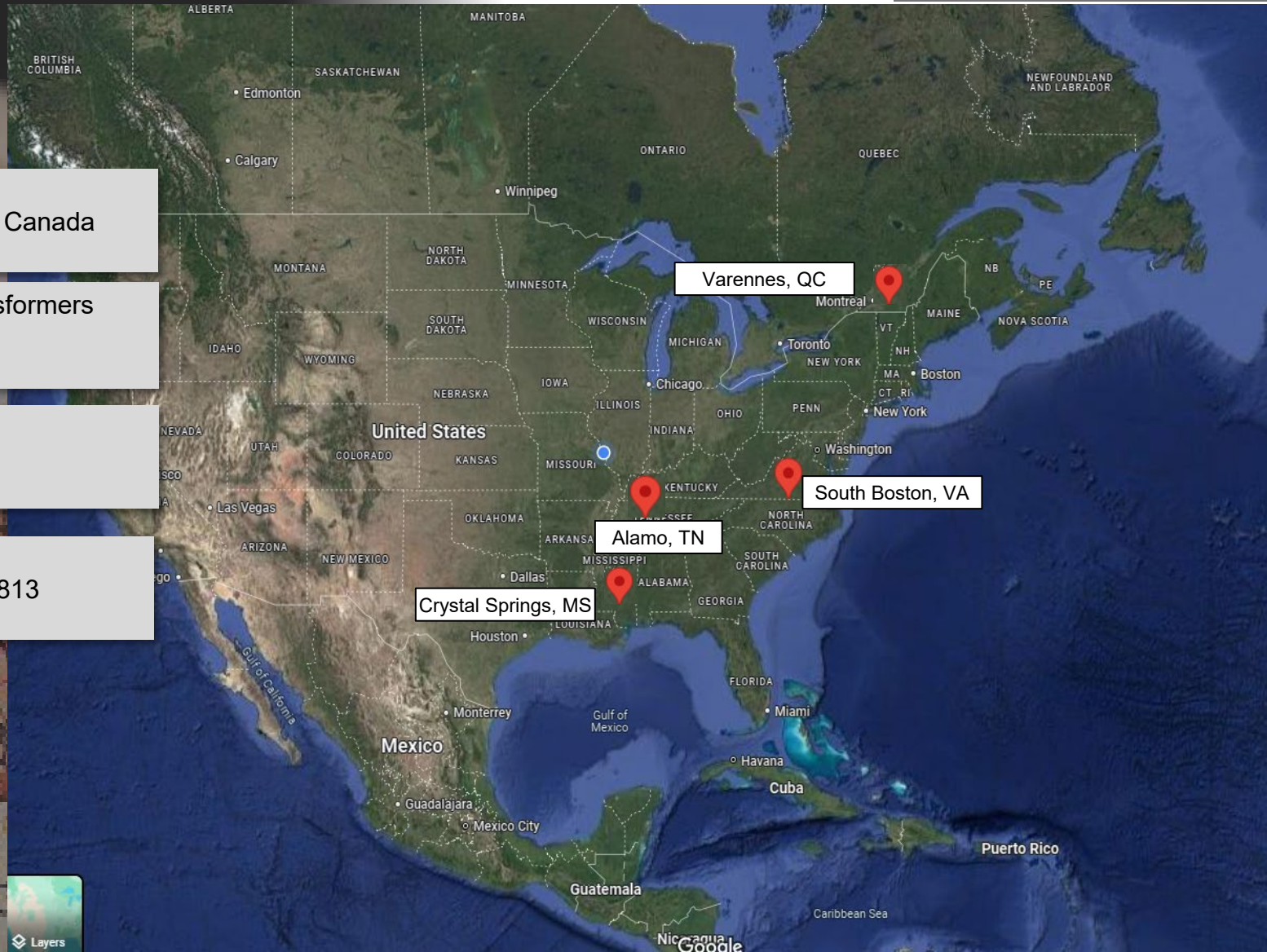
North America – Power Transformer Factories

Varenes, QC – Large Power Transformers
1600 boul. Lionel Boulet, Varenes, Quebec J3X 1S4, Montreal, Canada
Airport: YUL – 1 hr from factory

South Boston, VA – Distribution Transformers and Power Transformers
2135 Philpott Road, South Boston, VA 24592
Airport: RDU – 1 hr 30 min from factory

Crystal Springs, MS – Small Power Transformers
101 Kuhlman Drive, Crystal Springs, MS 39059
Airport: JAN – 34 min from factory

Alamo, TN – Transformer Components
1133 South Cavalier Drive, Alamo, Tennessee U.S. 38001-3813
Airport: MEM – 1 hr 34 min from factory



Hitachi Energy to invest additional \$1.5 billion to ramp up global transformer production by 2027

- Capacity expansion will increase speed to market to meet accelerating global demand, address long-term customer investments and create over **4,000 jobs**.
- Investments span across Europe, the Americas, and Asia leveraging existing global footprint.

Hitachi Energy today revealed investments of over \$1.5 billion to ramp up its global transformer manufacturing capacity to keep pace with the growing demand and support the long-term plans and electrification efforts.

[Hitachi Energy to invest additional \\$1.5 billion to ramp up global transformer production by 2027](#)

Hitachi Energy to invest additional \$4.5 billion by 2027 to accelerate the clean energy transition

Hitachi Energy will invest an additional \$4.5 billion in:

- manufacturing,
- engineering,
- digital, R&D and partnerships by 2027,
- HVDC & HV products
- doubling the investments done in the last three years

6000 new jobs

[Hitachi Energy to invest additional \\$4.5 billion by 2027 to accelerate the clean energy transition](#)

- The first 765kV units were produced in the 1970s, legacy of Westinghouse and ASEA
- Over 500 units of 735-765kV AC transformers have been delivered
- All production facilities utilize a single TrafoStar design and manufacturing technology since mid 1990's.

- Hitachi Energy's 765kV transformers are designed and manufactured across major power transformer plants worldwide
- Our 765kV technology is the result of our own research, development, and manufacturing, which makes us unique in the industry
- Factory in Varennes, Canada built over 100 units with the HV rated 735-765kV

- Since 1960, we have delivered more than 3,000 shunt reactors to 70 countries worldwide
- All Hitachi Energy factories utilize the common design platform giving us best-in-class experience, consistency, and repeatability

Most oil-immersed shunt reactors manufactured by Hitachi Energy are based on the so-called gapped core concept. This technical concept is based on the core type of technology that has been used within Hitachi Energy since the beginning of the 1970s. Over 200 units rated for voltage of 735-800kV

Product scope

	1-phase	3-phase
Reactive power*	150 Mvar	300 Mvar
Voltage*	Up to 800 kV	Up to 800 kV

* only as a reference, limitations on voltage and reactive power may vary according to the capabilities of the test facilities

Specification Requirements

- Maximum rated capacity
- Single or three phase
- Voltage Ratio
- Service Conditions
- System requirements for Short circuit and Insulation levels
- Need for Tertiary winding
- Overload requirements
- Resiliency
 - Physical security
 - Cyber Security
 - GIC - Capability for Geomagnetically Induced Currents
- Rupture resistance tank design

Design & Technology

- Existing technology
- Experience in 765 kV Projects
- Fixed or Variable Reactor
- Available components
 - Tap changers
 - Bushings
 - Lead exists and bushing connection
- Monitoring system
- Size and weights limitations
- Shipping limitations

Manufacturing, Testing and Installation

- Available production slot
- Same factories involved in HVDC projects
- Factory experience and readiness
- Backup factory
- Test requirements
- Test capabilities of the factory
- Shipping
- Site installation and processing
- Local support and expertise

Defining properly technical requirements for new 765 kV equipment considering physical, manufacturing and components limitations is critical

Limited number of suppliers with proven technology

Prototype unit designed and produced in advanced

Same factories produce HDVC, Reactors and Transformers, long term partnership, forecast and reservation of production capacity

Several projects for 765 kV units, HVDC, phase shifters



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Dead Tank Circuit Breaker Overview

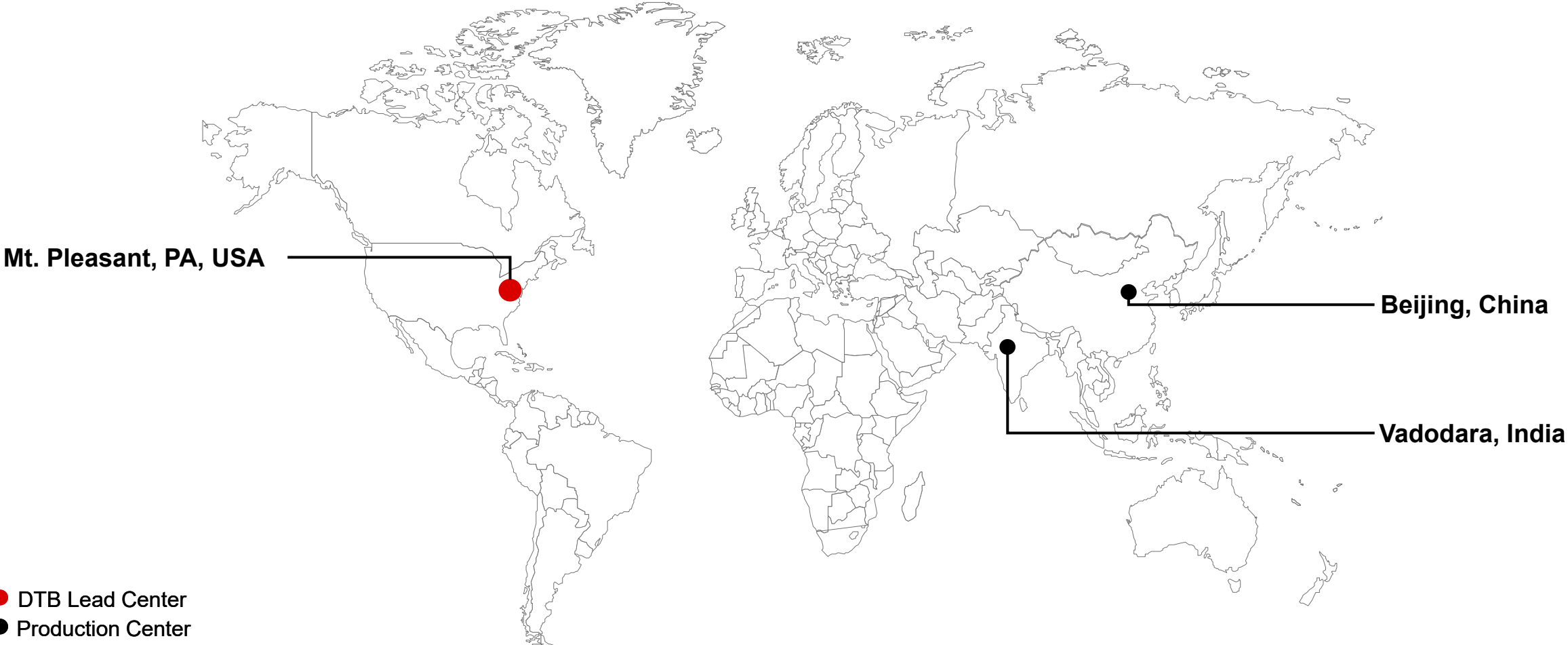
800 kV Products

2024-09-18

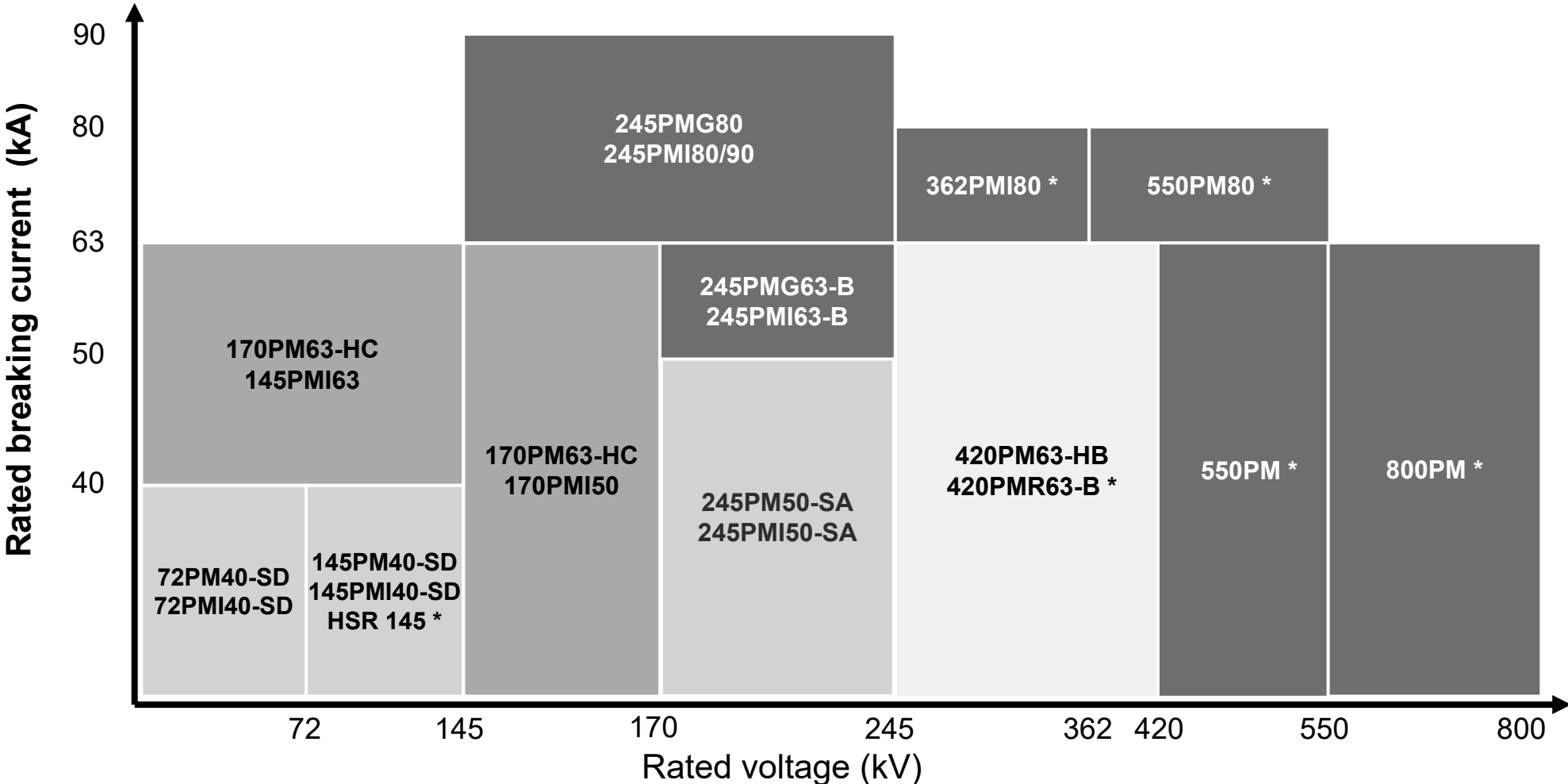
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 **Hitachi Energy**

Dead Tank Circuit Breakers – Global Footprint



Dead Tank Circuit Breakers – Product Portfolio



History and References

- World's first installed 800 kV dead tank circuit breaker
 - First installation in 2001
- Over 250 units delivered



Type 800PM Dead Tank Circuit Breaker

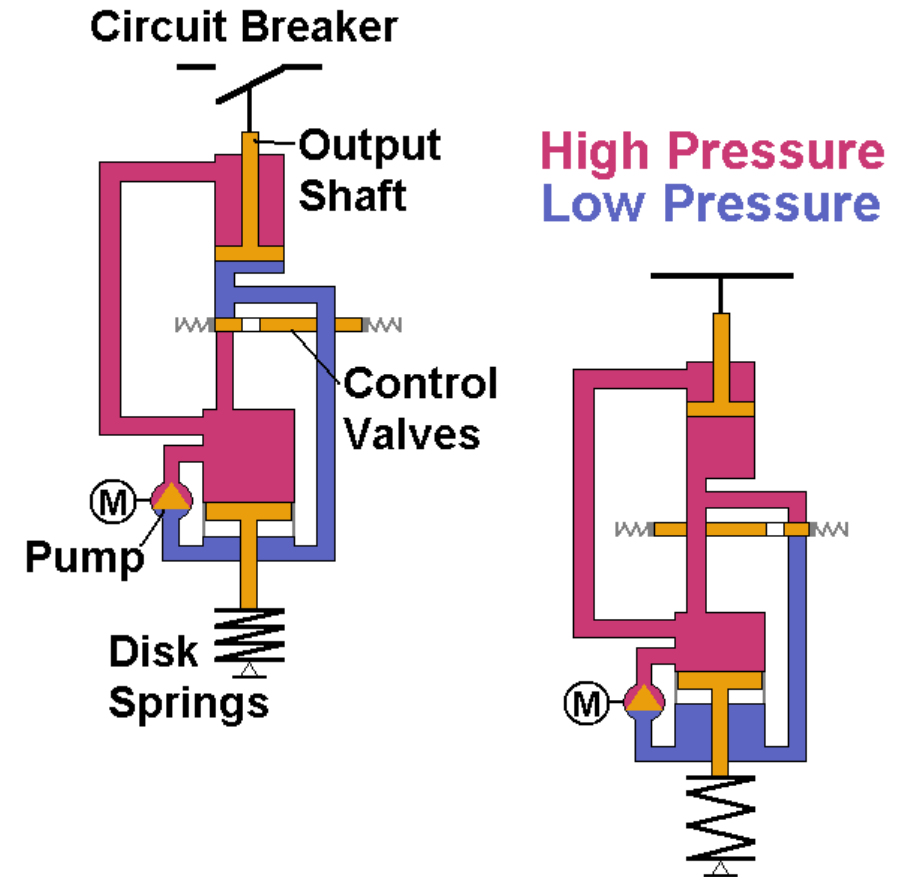
Primary Ratings

Rated maximum voltage	800 kV
Rated short-circuit current	40 / 50 / 63 kA
Rated continuous (normal) current	3000 / 4000 / 5000 A
Rated frequency	50 and 60 Hz
Rated interrupting (break) time	2-cycles
Rated mechanical endurance Class	M2
Rated capacitive switching Class	C2
Independent (single) pole operation	HMB-8
High creep silicone rubber insulators	≥ 25 mm/kV
Optional closing resistance	Various resistance values
Tested per relevant standards	IEEE and IEC
ASME pressure vessel certified	



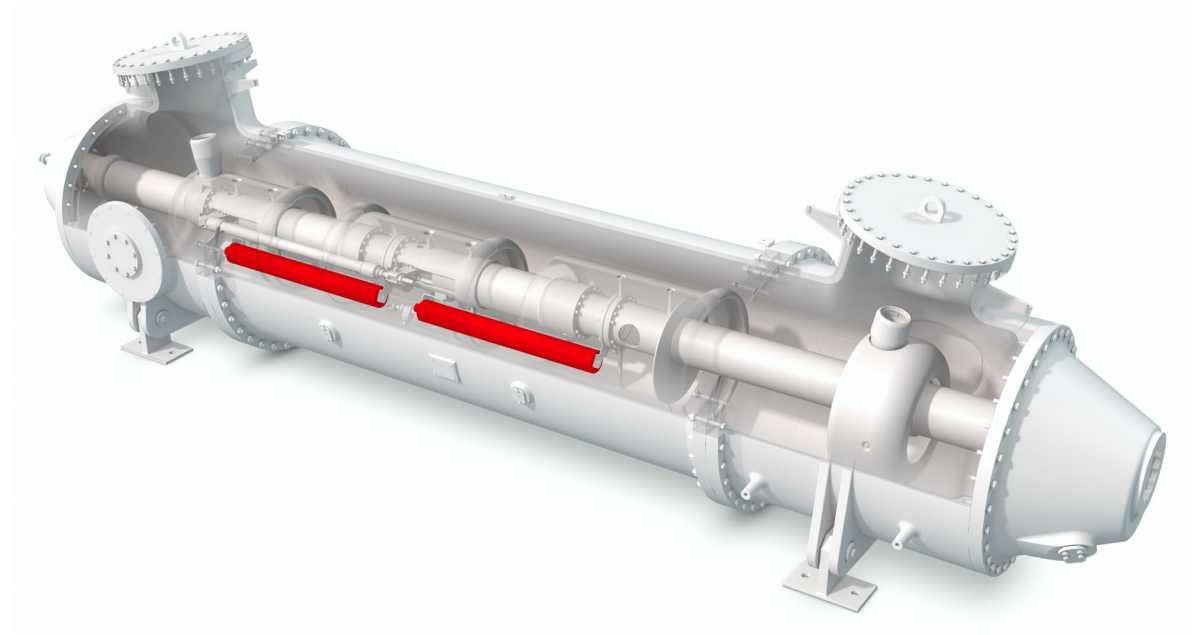
Spring-hydraulic Operating Mechanism Principle

- Energy stored in disc springs
- Hydraulic pump charges the springs
- Control valves operate to impress, or remove, oil pressure on the output shaft piston
- Output shaft moves the circuit breaker contacts



MOV Application - Internal

- Internally mounted MOV available on all multi-break designs
- Mounted internally across the interrupter
 - Similar mounting as internal grading capacitor
- Limits transient voltage across the breaking chambers during switching events
- Proven and tested internal installation





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