GE VERNOVA

LOAD BALANCER FOR RAIL ELECTRIFICATION

Power Conversion & Storage solution to improve grid power and stabilize catenary power.

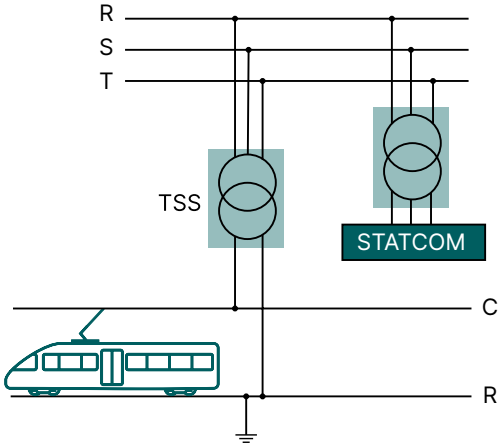
Due to climate and environemental concerns, reducing carbon emissions has become a more pressing issue. Populations are seeking ways to decrease their growing travel emissions. Electric railways are recognized as the optimal solution because of their superior energy efficiency, reduced emissions, and lower operating costs.

As the energy mix integrates increasingly renewable energy to meet the growing need for clean, carbon free electricity, it results in a reduction of grid peak power capacity. As a consequence, network operators are pushing for stringent constraints for railway operators.

Catenaries are powered by single-phase voltage. Traditionally, this single-phase voltage is derived from a three-phase grid using transformers. When the grid is robust, a single-phase transformer can be employed by connecting the primary voltage between two phases. For less powerful networks, Scott or LeBlanc transformers are employed. However, in all cases, the voltage and power balance on the grid side is not perfectly managed. To enhance grid voltage balance, load balancers can be utilized.

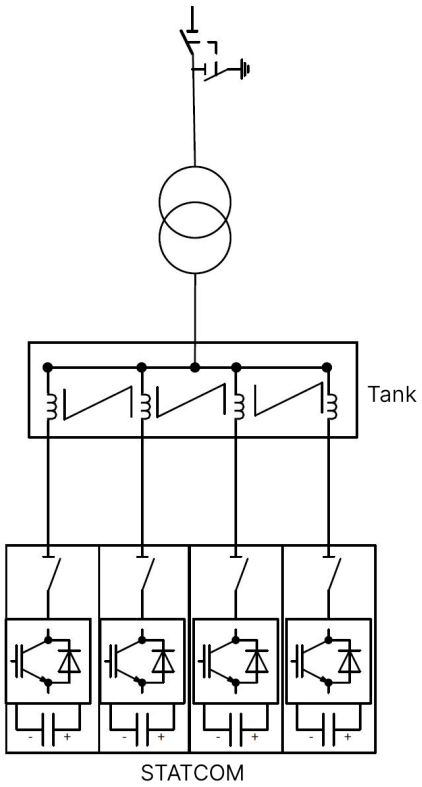
A load balancer connects to the supply grid and typically includes a three-phase Static VAR Compensator (SVC) or an MMC-based STATCOM. It mitigates negative sequence currents by injecting power between phases to counteract voltage imbalance and can equalize the load across the three phases. Different solutions exists depending on power range. Three-level type converters or MMC products can be used.

Grid distribution network



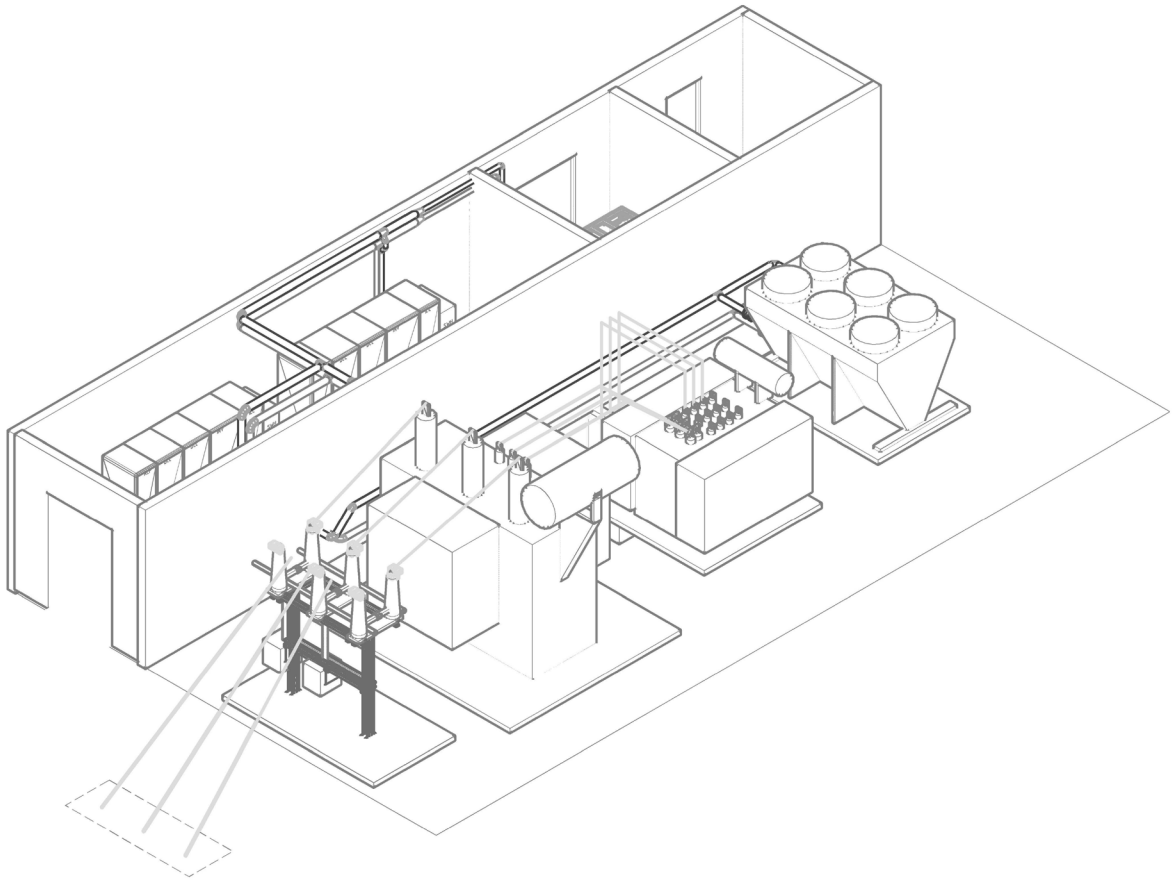
BENEFITS

- **Peak power density** – MV7000 product range features converter units capable of delivering up to 15 MW/MVA using only 18 IGBTs, which is equivalent to a power density of 1.5 MVA/m³. Additionally, several units can be combined to achieve up to 80 MVA.
- **High reliability** – over 10 million hours in operation across an installed base of over 8.5 GW.
- **Power scalability** with *à la carte* option packaging than can be adapted to a wide range of applications.
- **Incoming power dip ride-through** – The MV7000 provides incoming power loss ride-through maintaining drive operation without tripping.
- **Under voltage operation** – The MV7000 operates continuously and provides power to the grid according to its maximum output current capabilities at lower input power supplies.



Load Balancer - GE Vernova's scope of supply
Indoor: MV7000 converters and disconnector switches, control cubicles and cooling unit
Outdoor: ITR reactors, dry cooler, STATCOM transformer, disconnector switch

Load Balancer on site installation



Typical Load Balancer isometric diagram

TECHNOLOGY

Type	9-level STATCOM
Installation	Indoor
Output frequency	50-60 Hz
Typical negative sequence current	< 7 %
Typical negative sequence voltage	< 0.05 %
Total voltage distorsion rate	< 0.8 %
Degree of protection	IP00, indoor use
Noise level	< 85 dB(A)@1m per converter inside building
Cooling type	Deionized water

About GE Vernova's Power Conversion & Storage business

GE Vernova's Power Conversion & Storage business combines advanced energy conversion and storage systems to meet the electrification needs of utilities and industries. With a focus on power stability, energy storage, and industrial electrification solutions, Power Conversion & Storage empowers customers by addressing their most complex electrification challenges and accelerating their transition to a sustainable, decarbonized future.

For more information, please visit
gevernova.com/power-conversion

Glossary

IGBT	Insulated-gate bipolar transistor
MMC	Modular multilevel converter
STATCOM	STATic synchronous COMpensator
PMU	Phasor management unit
TWFL	Travel wave form localization
SVC	Static VAR Compensator
FB	Full-bridge
HB	Half-bridge

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