

INTERNAL

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Inspire the Next

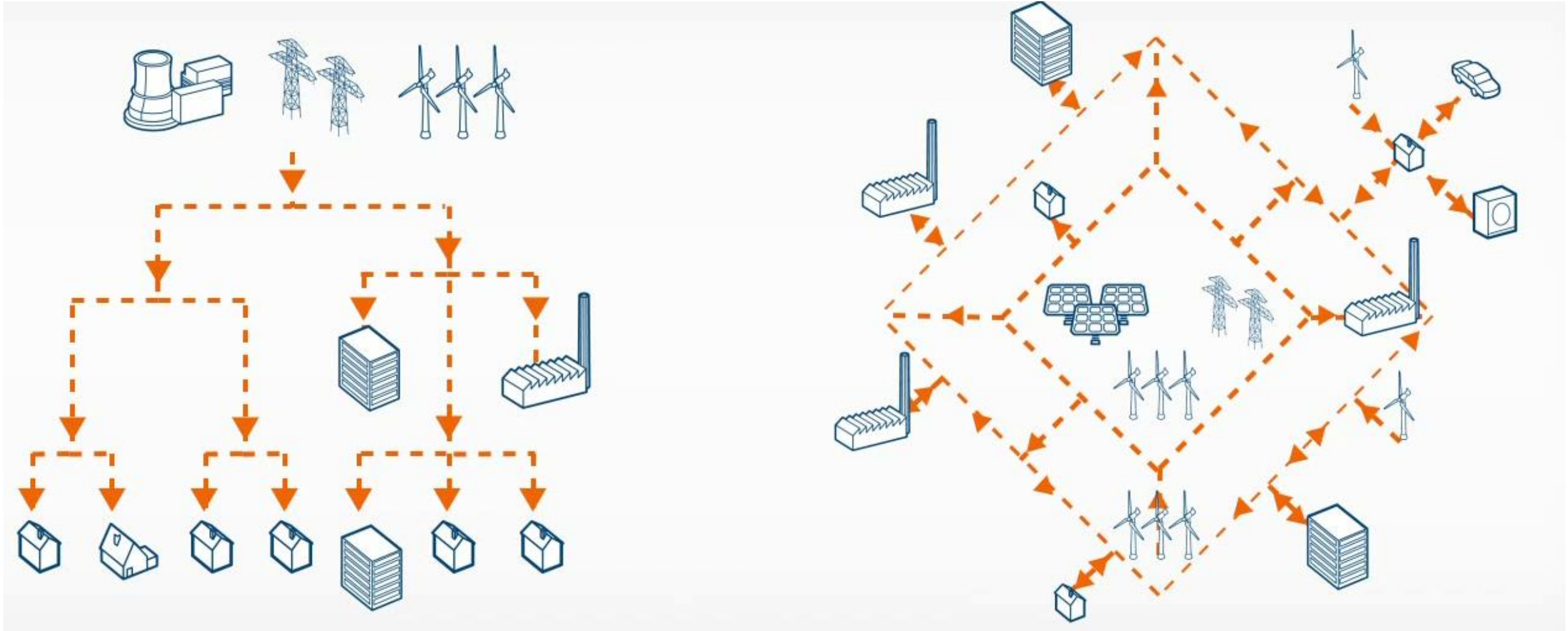


Hitachi Energy – CET Italy

MVDC, SST & Grid interties. Technologies and applications in distribution grids

The grid is changing

The grid is changing.



Applications for DC grids

The grid is changing.

The grid is changing

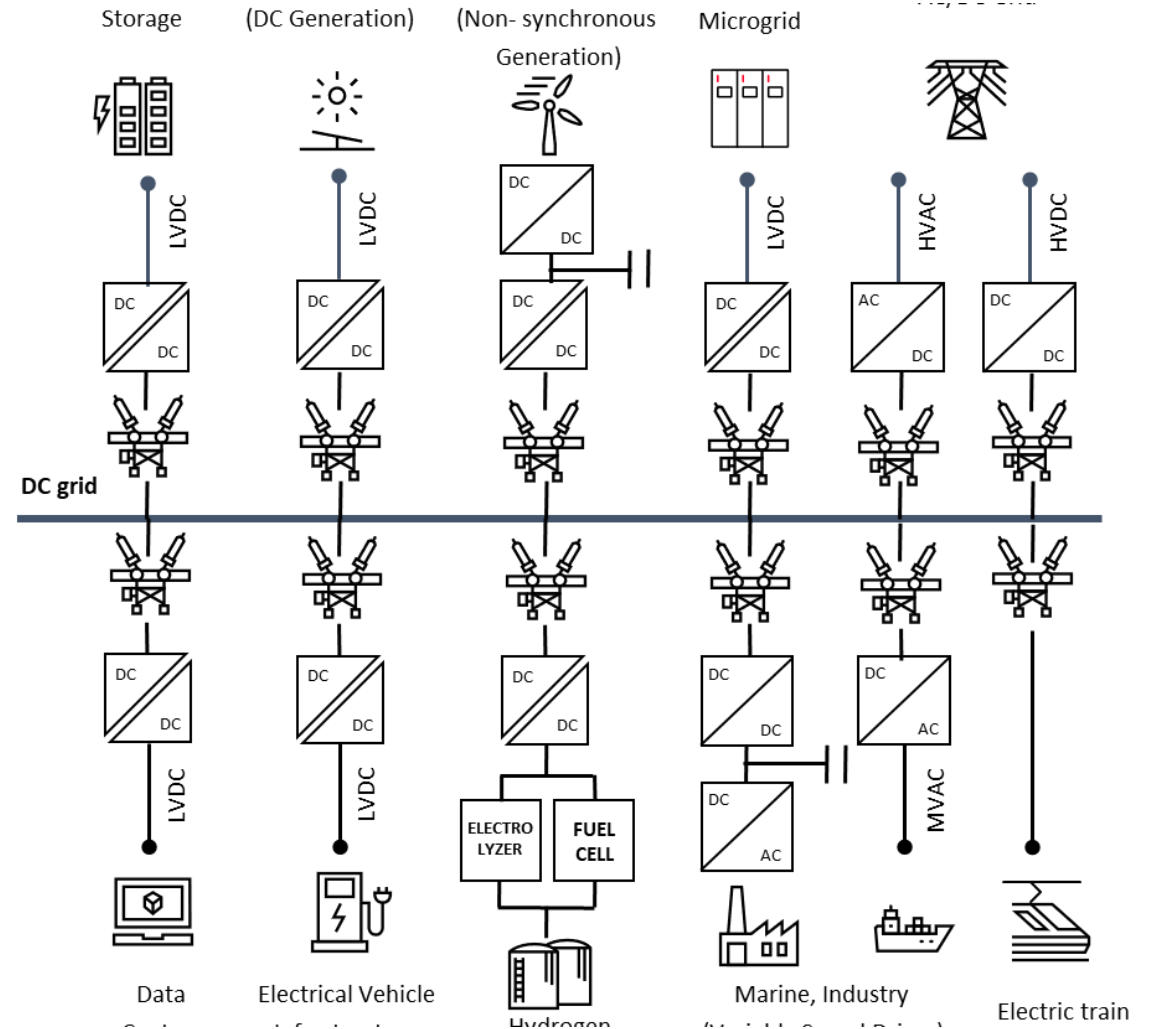
Looking at MVDC is not about a general replacement of MVAC, but evaluating, for which applications MVDC could provide **advantages** for the user.

Potential areas of interest for MVDC with DC load/sources:

- BESS
- Data center
- EV charger
- Solar panels,
- Interconnection with HVDC
- Electrolysis plants, fuel cells

Loads/power sources fed by VSIs:

- Variable speed drives and generators.
- Soft coupled grids (utility and industrial distribution)



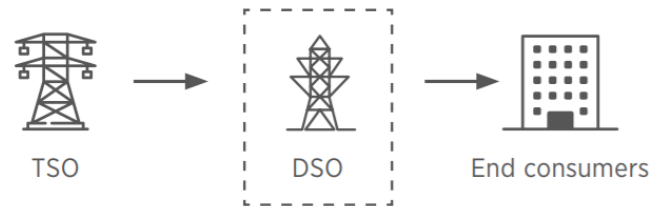
AC / DC hybrid grid

Emergence of D-VRES and D-ESS

- The emergence of distributed variable renewable energy sources (D-VRES) including rooftop solar and electric vehicles
- Battery energy storage systems (ESS) which are becoming active participants in the electricity system
- **The increasing penetration of D-VRES could lead to a less predictable flow of power in the system, which affect the traditional planning and operation of distribution and transmission networks.**
- **Increased deployment of D-VRES is expected to cause congestion, voltage variations** and further challenges in the distribution grid, which must be actively managed. This raises the need for a change in the role of the DSOs that have conventionally planned, maintained and managed networks and supply outages.
- DSOs could deepen their role as active system operators, in addition to their role as network operators. Distribution system operators could procure flexibility services from their network users, such as voltage support and congestion management to defer network investments.
- **With the increase in D-VRES a new role of the DSOs will have a significant impact on the way the power system operates**

New role of DSOs

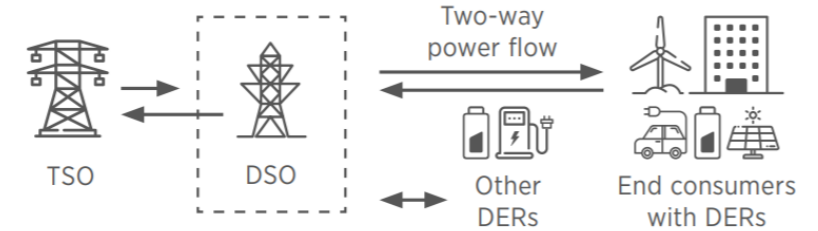
Traditional power system structure



Conventional roles of DSOs

- 🔗 Connection and disconnection of DERs
- 📋 Planning, maintenance and management of networks
- 🏠 Management of supply outages
- 💰 Energy billing (only if vertically integrated)

Power system structure with DER deployment



Emerging additional roles of DSOs

- 🏭 Peak load management through D-VRES
- 🌐 Network congestion management
- ⚡ Provide reactive power support to TSOs
- ⚡ Procure voltage support
- ✓ Technical validation for power market

Will the change be so, that the role of the DSO is significantly more complex for most of the DSOs ?

Many companies with different rules ¹

The Distribution System Operators¹, (DSO's) share of **overall network investments is estimated to grow to almost 75% by 2035, and to 80% by 2050.**

