GE VERNOVA

Power Dense, Efficient and Integrated Power Electronics

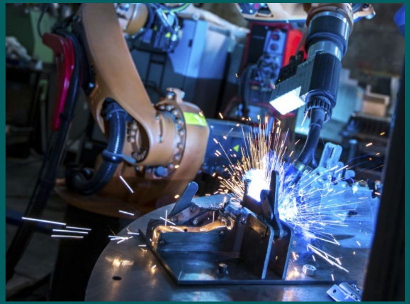
Topic-III: Integrated Power Electronics

Rajib Datta, Chief Engineer

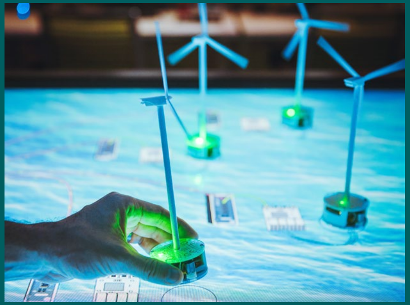
GE VERNOVA ADVANCED RESEARCH

05/07/2024



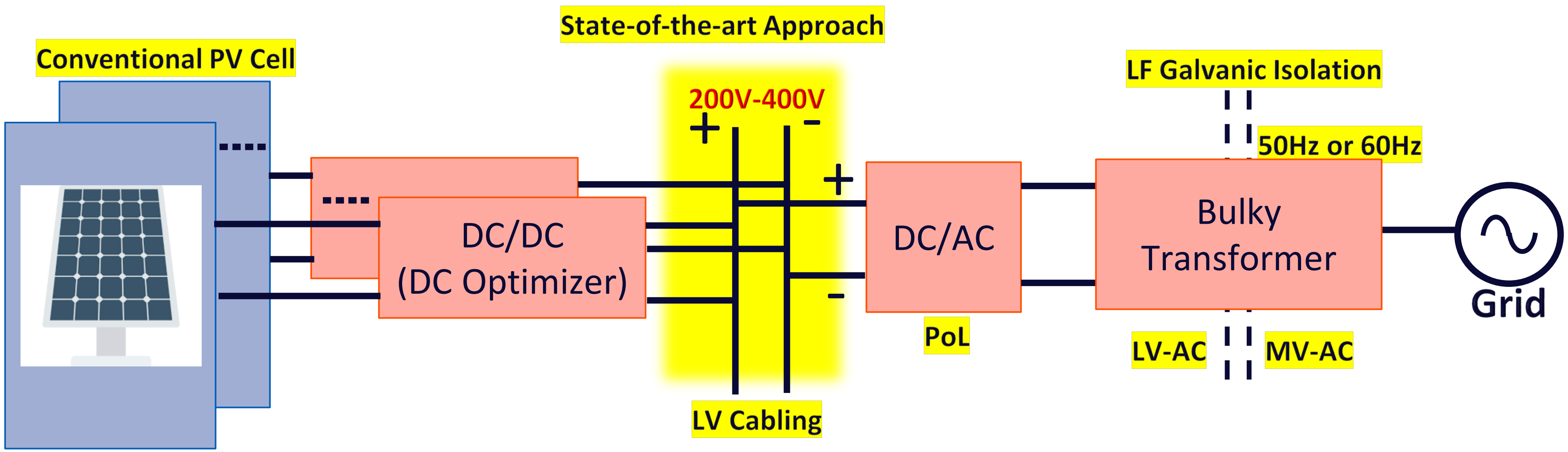




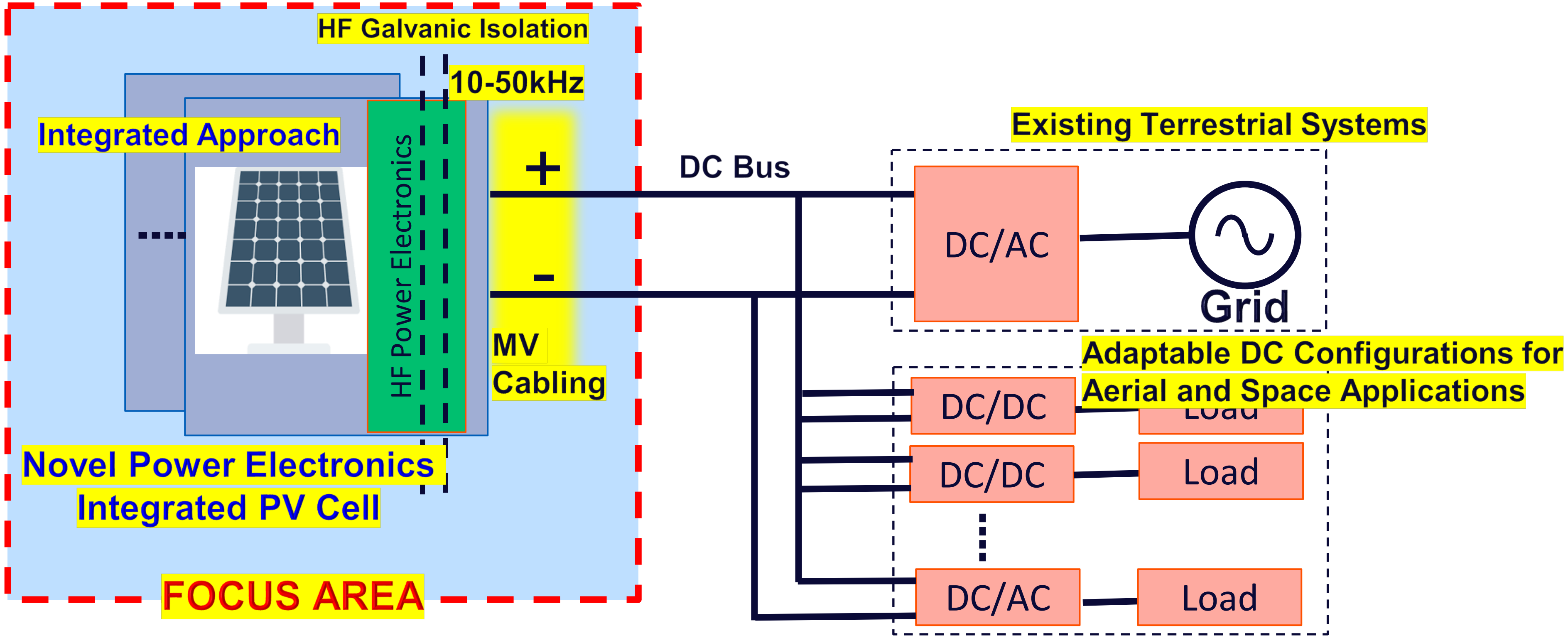
State-of-the-art and Shortcomings

GE VERNOVA



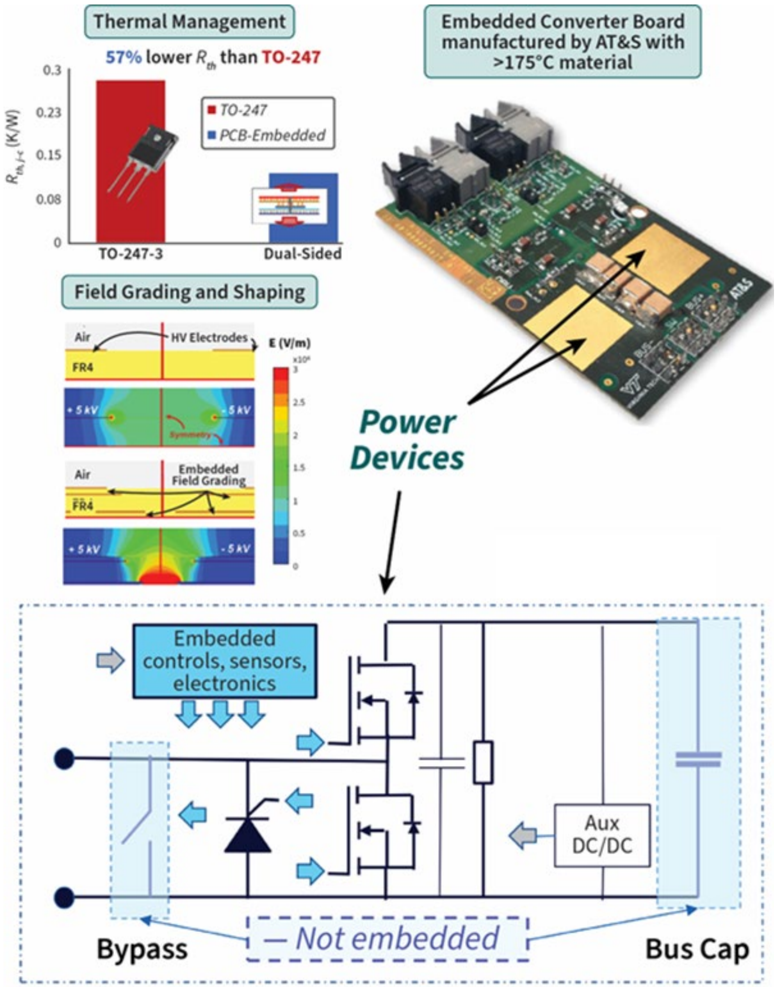
- Dependence on low frequency (LF) based **galvanic isolation**, making them **huge size and volume**
- **Low Voltage (LV) cabling** is both **cost and size intensive**
- Multiple power conversion systems in the loop yields in **low round-trip efficiency, specific power, and power density**
- Cascaded approach limits **system flexibility and adaptation options**

Potential Advanced Integration Approach



- **High frequency (HF) magnetics** can result in **highly power dense solutions with improved specific power**
- **Medium Voltage (MV) cabling** can improve overall system architecture **viability, copper requirements and cost**
- **Support existing AC infrastructure** with huge potential of **DC system applications and DC-microgrid**
- **Highly adaptable** to different DC-configurations and **improved flexibility**
- **Modularity and rapid Installation**

Technical Challenges



Example circuit with integrated die on PCB

- Design of high frequency magnetics for isolation with MV standards (ex: **MV Clearances, thermal ratings**, etc.)
- Integrated HF magnetics with **planar transformer approach**
- Boosting the PV panel voltage from LV to MV level, requires **high gain** power conversion system
- **Regulating MVDC voltage**
- PV integrated **low profile** power electronics
- **Passive thermal management scheme** to operate over a wide range of temperature

GE VERNOVA