

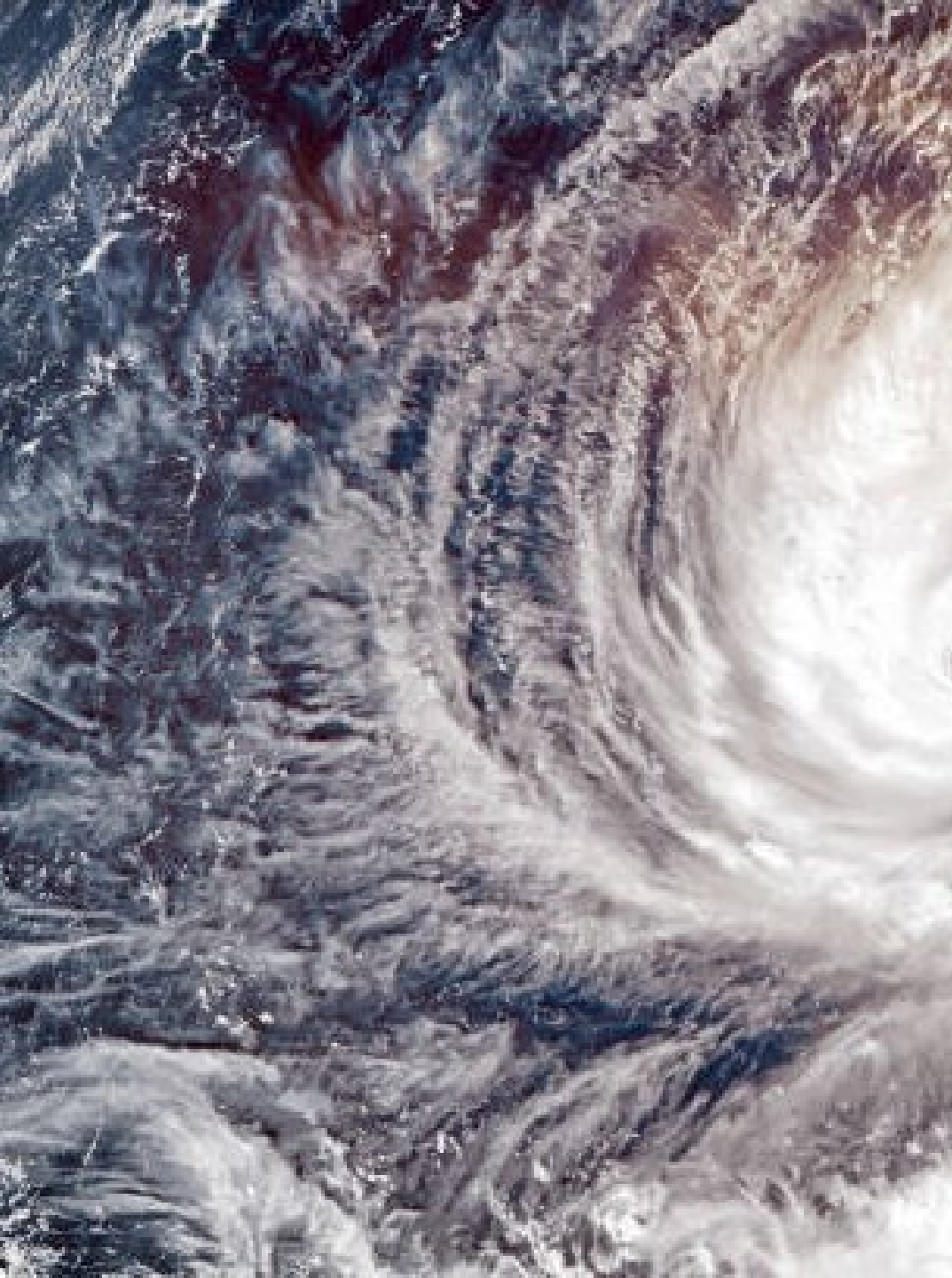
The role of DC for modern utilities

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- The first electricity grid of the world was established at Pearl street, Manhattan in 1882
 - It started with 85 customers, providing electricity to 400 lamps with Direct current (DC) technology
 - Generator was dismantled in 1895
 - After the war of current electricity grids were built up using AC

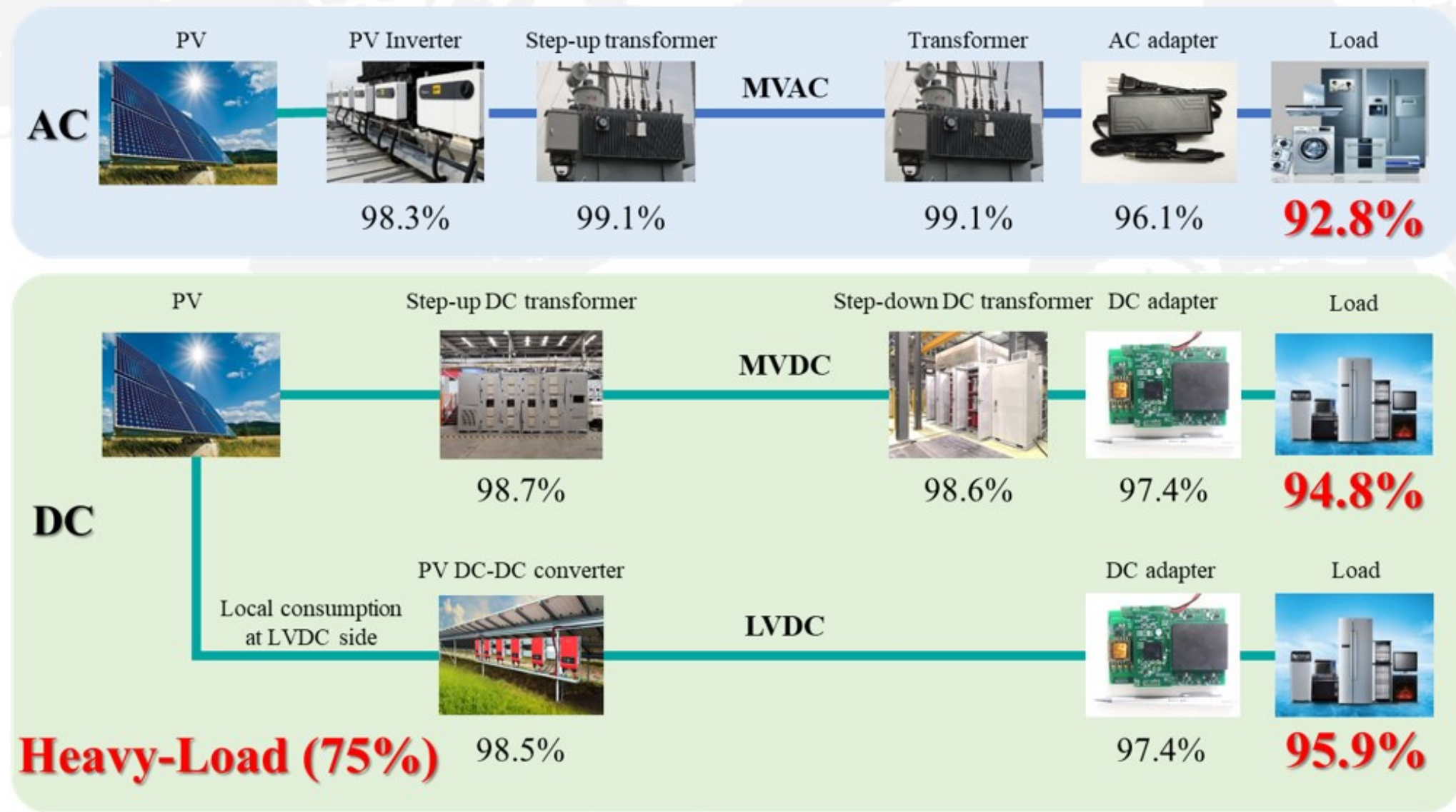
So, Why are we now talking on DC grids again?





Is the perfect storm coming?

- Energy transition goals
- Millions of DC devices working in field (EV, Renewable generators, Storage, ...) connected to distributions grids
- Prosumer versus traditional consumers living in actives houses with a lot of DC appliances
- Huge energy losses in AC/DC and DC/AC conversions
- Need for grid flexibility due intermittency of generation and a new way to provide ancillary services to the AC system



Comparison of efficiency in DC/AC system



Meanwhile...

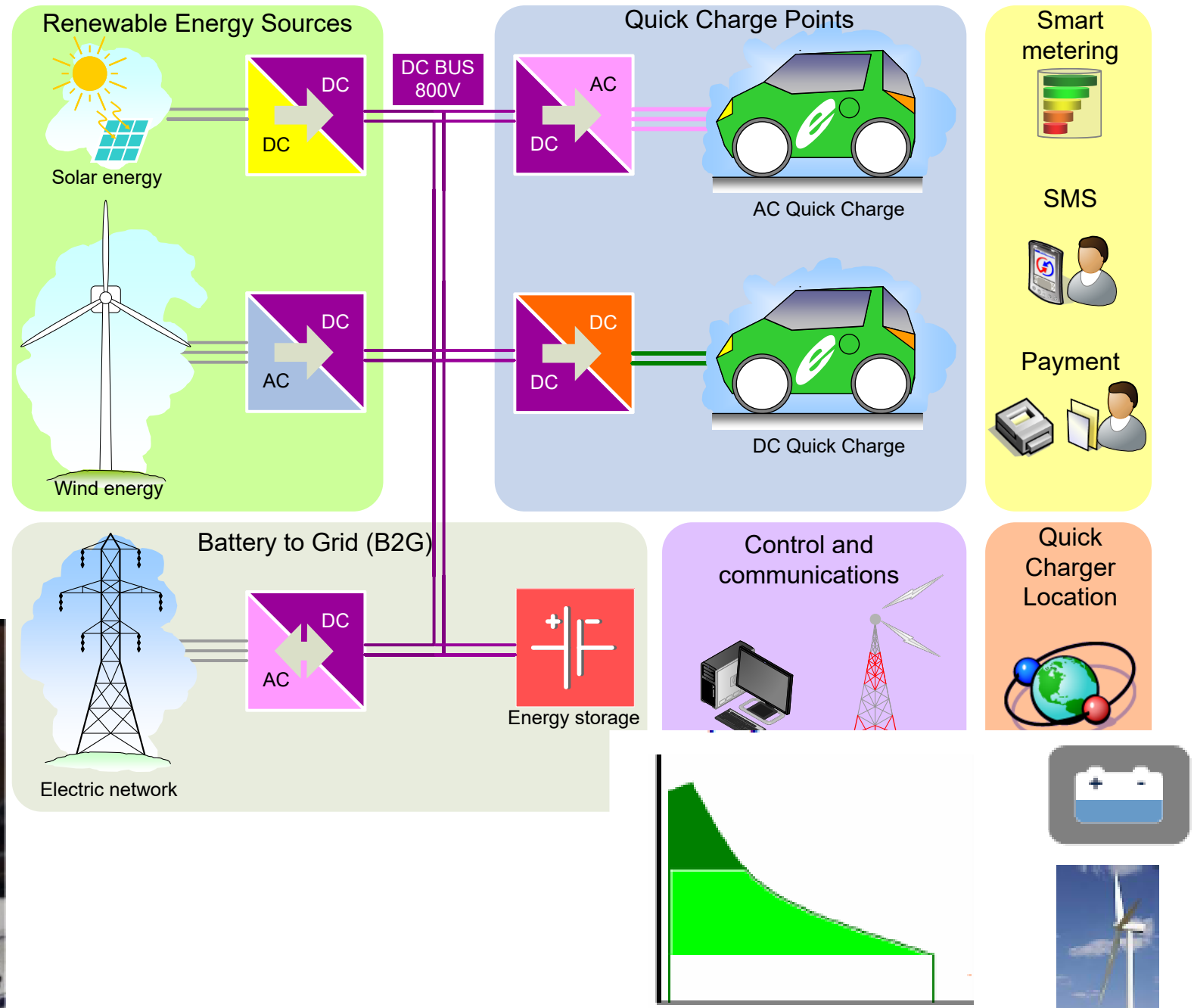
- Use DC buses for:
 - microgrids, specific installations as energy stations, industries and buildings,
 - Back-to-back / Statcom devices
 - Transport Grids Renewable integration (railways and trams)
 - LV DC links
- Use cases studied by Endesa:
 - CRAVE
 - Malaga microgrid
 - Vehicle 2 Home
 - Control strategies for grid stabilizations



INTERNAL

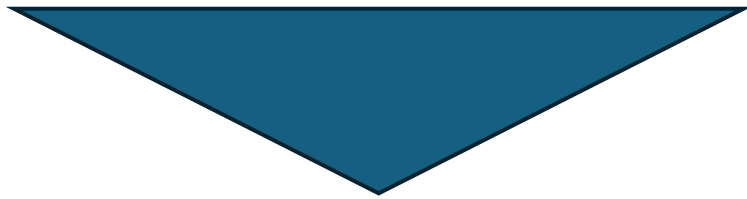
Charging stations
with storage & ren generation

Use case:
Fast charging services for rural
areas, weak or saturated grids



R&D challenges

- DC connectors, switches & protections
- Metering and QoS devices
- Standardization
- Evolution and hybrid networks: Use cases
- Integration LV DC links in LV distribution grids



Commercial equipment's availability



Image credit: freepik

LVDC GRIDS Standardization & USE CASES



- <https://www.iec.ch/blog/iec-seeks-input-online-lvdc-surveys>
 - +30 technical committees that can define DC standards
 - Systemic approach: SyC LVDC Low Voltage Direct Current and Low Voltage Direct Current for Electricity Access
(https://www.iec.ch/dyn/www/f?p=103:7:13183360066596:::FSP_ORG_ID,FSP_LANG_ID:20447,25)
 - WG2: Use-cases for public LVDC distribution

