# PE interface to AC grid: grid forming control for a more resilient transmission grid, and a flexible DC connection of grid customers

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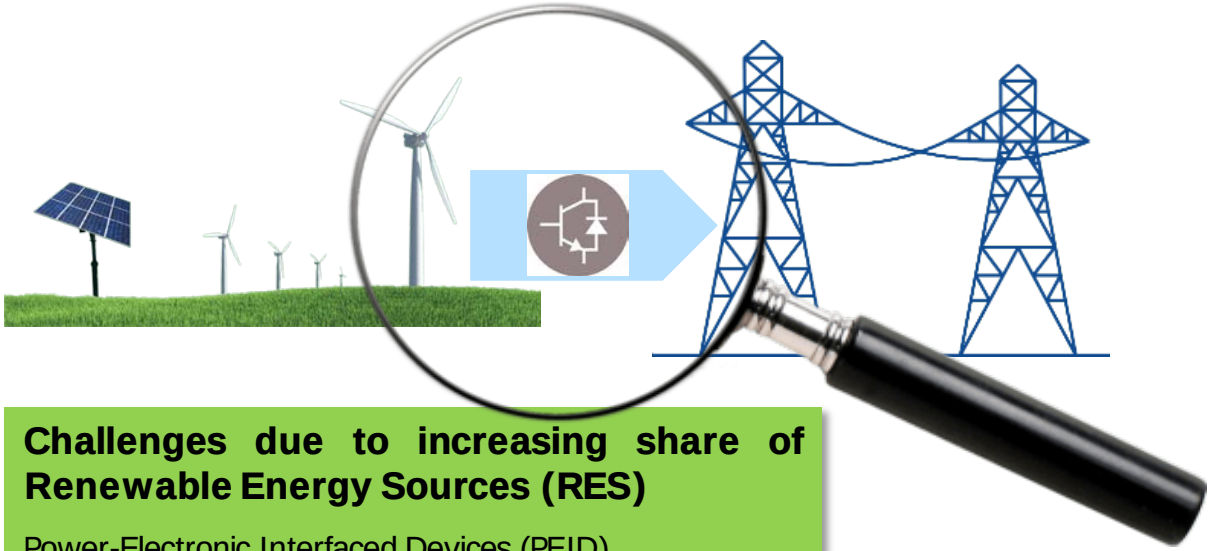
# Context

## The big picture



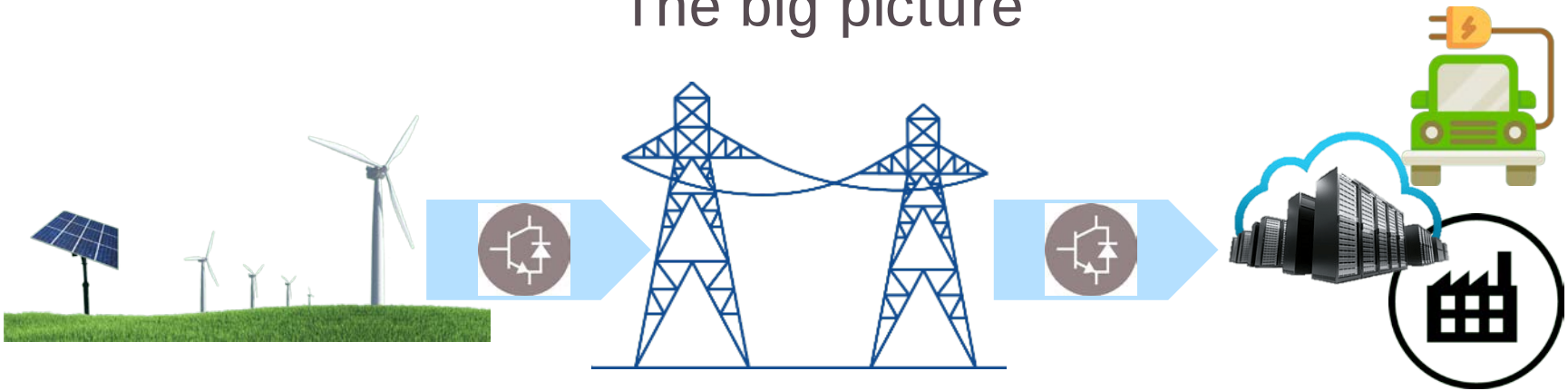
**Challenges due to increasing share of Renewable Energy Sources (RES)**

Power-Electronic Interfaced Devices (PEID)

- Synchronism and low inertia
- Control interaction
- Weaker grids
- Fault-Ride Through (FRT) capability

# Context

## The big picture



As recently demonstrated, **Power Electronics Interfaced Devices** are also an **opportunity to increase reliability** in Power Systems

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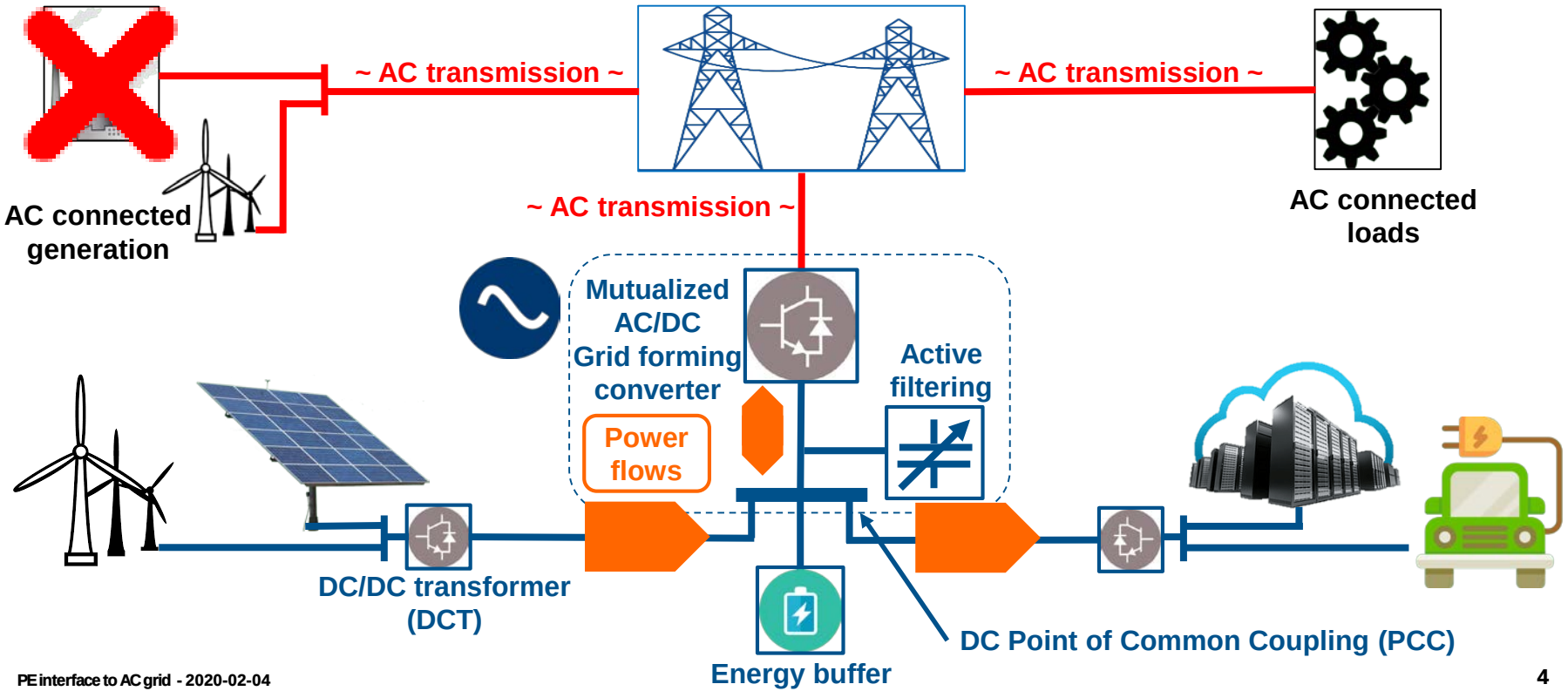
**New opportunities with loads connected to Transmission networks**

Increasing number of industrial processes based on DC, with large ratings

➔ **More and more PEID on the load side too (with similar challenges)**

# A mutualized DC connection

... to improve system stability and resiliency at best economic performance



# Drivers for a DC Point Of Common Coupling

## A few preliminary expectations

### Expected benefits of the DC PCC?

- More grid forming inverters with harmonized controls
  - ✓ Improve overall system robustness
  - ✓ Ensure resiliency in case of system split
- At transmission level for a better mutualization effect
  - ✓ reduced losses and scale
  - ✓ cost-efficient reliability
  - ✓ optimized monitoring and maintenance
  - ✓ recoverable heat losses
- Operation of a mixed AC/DC system for
  - ✓ More efficient hybrid operation
  - ✓ simplified connection for customers
  - ✓ new coordinated ancillary services (AC- and DC-side)

**Assessing the benefits of a global optimization** vs. multiple (stakeholder-driven) local optimizations **(overall efficiency and savings)**

### Expected customers?

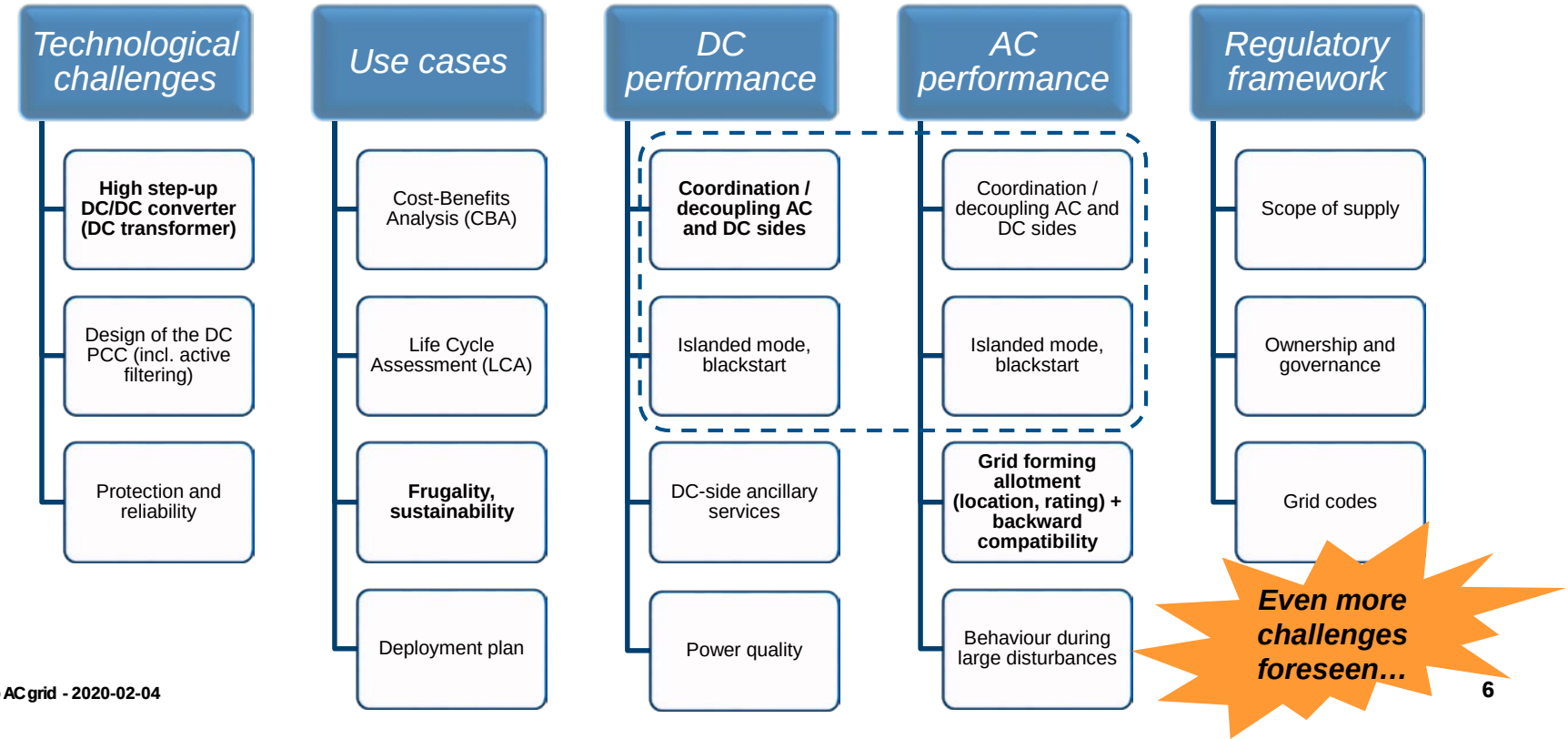
Any power-intensive customer using DC:

- PE interfaced renewable (solar, wind)
- Loads (e-mobility, data centers,…)
- … storage operators

➔ Potentially large number of beneficiaries

# Outstanding challenges

## A first set of open questions



# Relevance of the DC PCC

## A timely matter

### Paving the way toward DC grid

- Intermediate and reasonable step toward large (offshore) DC grids
- Less costly, less risky, less complex to control
- Regulatory, financing, governance aspects are simplified (less stakeholders at a time)

### Interoperability

- Adverse interactions between PE equipments already witnessed (AC and DC sides)
- No guarantee to avoid them from the specification stage
- But a methodology was outlined to address and fix them efficiently

### An improved hybrid AC and DC system

- Enhanced AC stability (grid forming controls)
- Assessing cost-effective implementation of grid forming
- Overall system efficiency (losses) and resilience (black-start, islanded operation…) expected to improve

20 20 20 Twenties
Transmitting wind

PROMOTioN
PROGRESS ON MESHED HVDC OFFSHORE TRANSMISSION NETWORKS

Best Paths
TRANSMISSION FOR SUSTAINABILITY

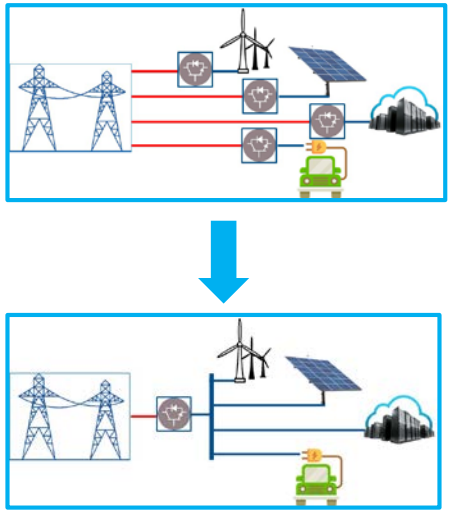
***The DC PCC builds upon earlier projects and studies***

MIGRATE

OSMOSE
OPTIMAL SYSTEM-MIX OF FLEXIBILITY SOLUTIONS FOR EUROPEAN ELECTRICITY

# Key take-away

- **Power electronics can enhance stability, robustness and resilience**
- **High power DC Point of Common Coupling: mutualization** with expected **benefits** toward **sustainability (European Green Deal**)
- **Simplified connection** for a **wide range of applications in Europe**.
- A **broadened perspective** rather than a change of R&D direction:
  - ✓ **Builds upon earlier work** (previous EU R&D projects)
  - ✓ DC PCC as **a first reasonable step toward large (offshore) DC grid**
- **Holistic assessment of benefits and investigation of related challenges is needed**
  - ✓ Requires involvement of TSOs, customers, RES developers, vendors, etc.



RTE want to raise the attention of the European community on this **new exciting opportunity!**
➔ We believe that this vision would take advantage from a **EU R&D call for project?**