

Future developments in the transmission grids –

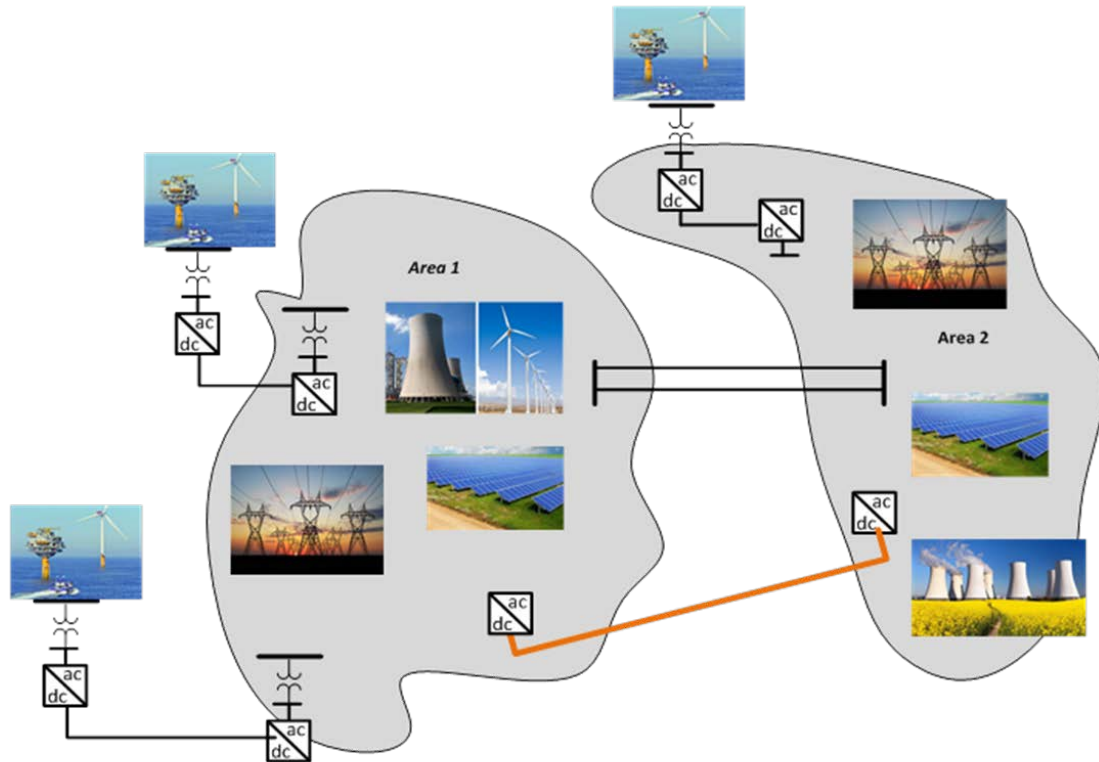
Technical challenges, system needs and the role of converters and HVDC systems

Dr. Cora Petino
Dr. Mario Ndreko
Dr. Wilhelm Winter

TenneT TSO GmbH, Germany

*entso-e RDIC,
WG2: Security and System Stability*

Change in power generation structure

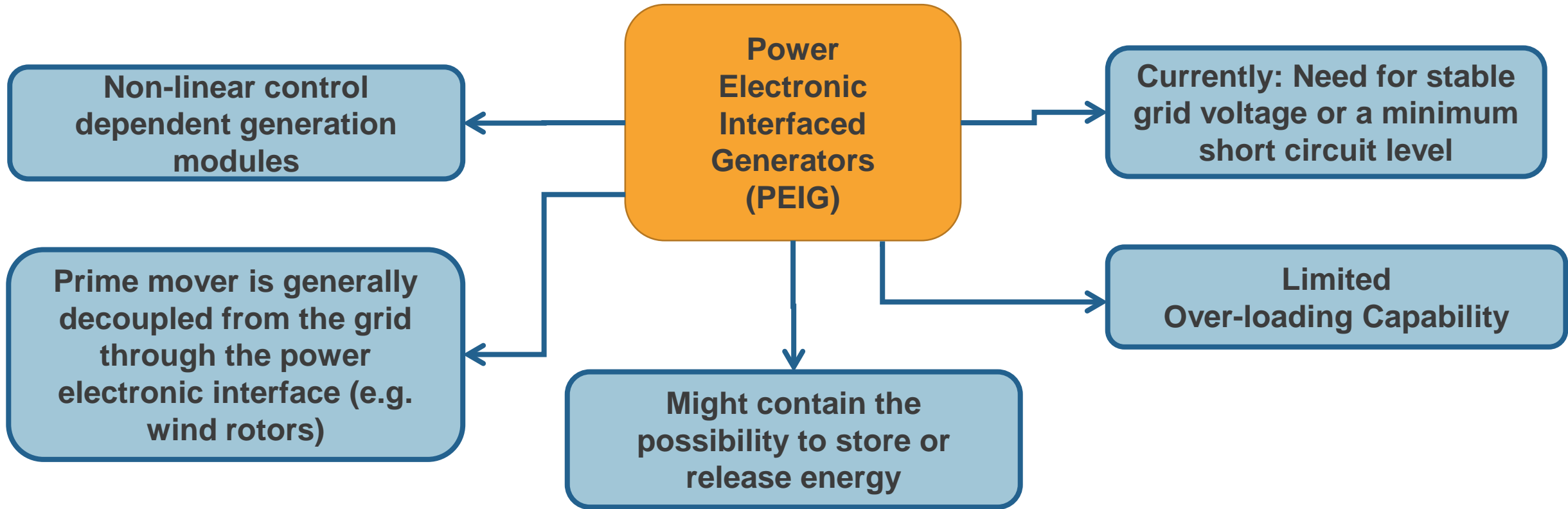


- Increasing share of power electronic interfaced generation (PEIG) in the grids due to large scale use of renewables (RE)
- Decreasing share of synchronous generation (e.g. Germany beginning 2022)
 - Decrease of system inertia
 - Increasing imbalances and frequency change rates

Key questions:

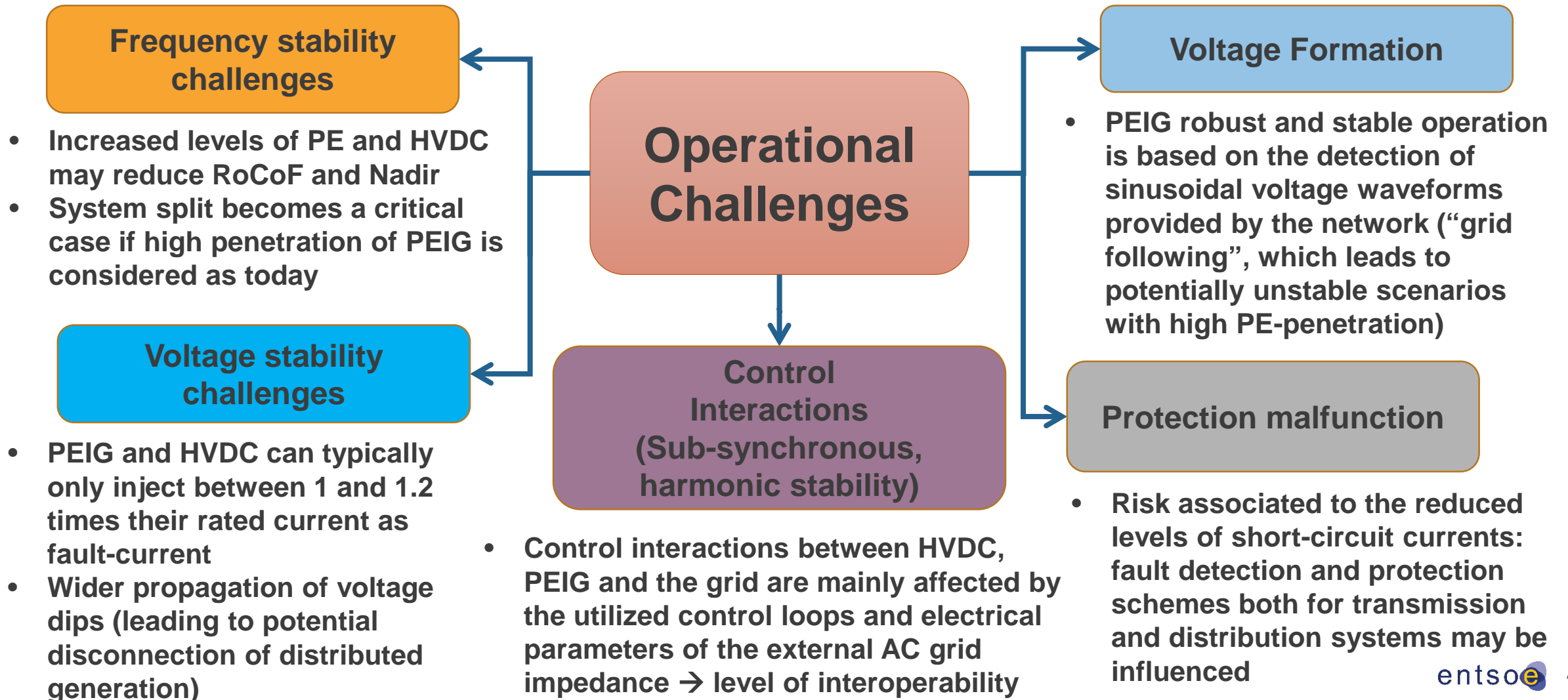
- How to accommodate more PEIG in the power system?
- What do we do to maintain the same levels of security of supply?

Why is PEIG different from conventional generation?

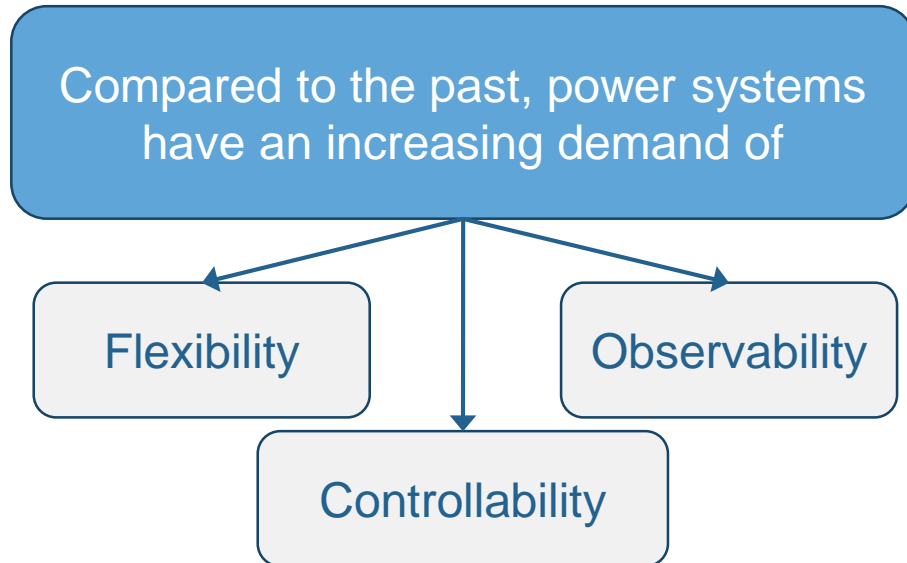


- TSOs in RDIC WG2 identified future risks and operational challenges associated with a high level of PE penetration based on the control and installations from today

Main Operational challenges due to massive penetration of PEIG



Future System Needs



PEIG and HVDC can deliver the required functionalities stabilizing the overall system operation

Potential of power electronic devices is not appropriately used yet
(e.g. HVDC is currently mainly used for pure transport tasks, due to cost reduction)

Appropriate planning required
(including utilization of new methodologies for assessing interoperability issues in the early planning stages)

Integration of HVDC and Power Electronics

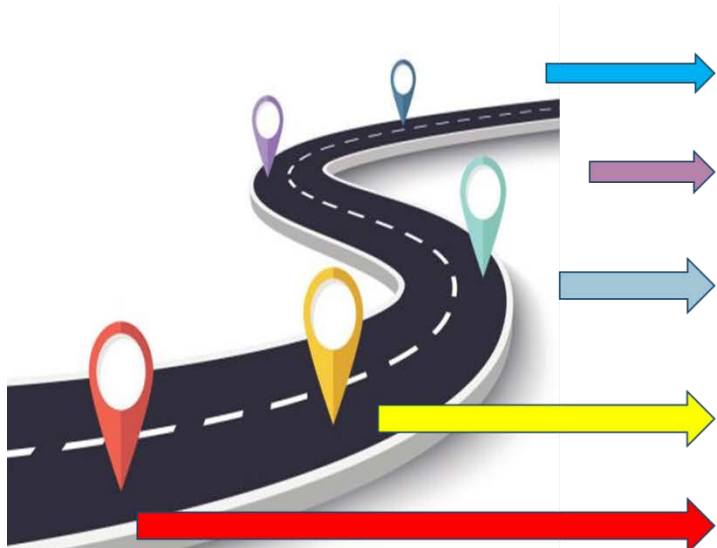
PEIG and HVDC can contribute stabilizing the AC/DC grid operation

- Converter are able to react instantaneously to dynamic events
- Converter are able to form stable voltage (grid forming) – currently predominantly grid following control implemented and used
- HVDC offers high potential for: grid stabilization, flexibilisation, advanced load flow control, reduction of re-dispatch costs, evacuation of RE

But: PEIG and HVDC need to be controlled appropriately

- Control of poorly or undamped interactions between
 - different converter control loops
 - converter and grid resonances
- Coordination of multiple controls
 - TSOs need to access the “whole picture” more intensively as nowadays
 - Robust design and parameterization of converter controls
 - Converter controls („black boxed“) need to be accessible to the relevant TSOs in the early planning stages of a project for de-risking (→ standardised control interface for converters required)

Roadmap towards PE-Dominated Power Systems (incl. HVDC)



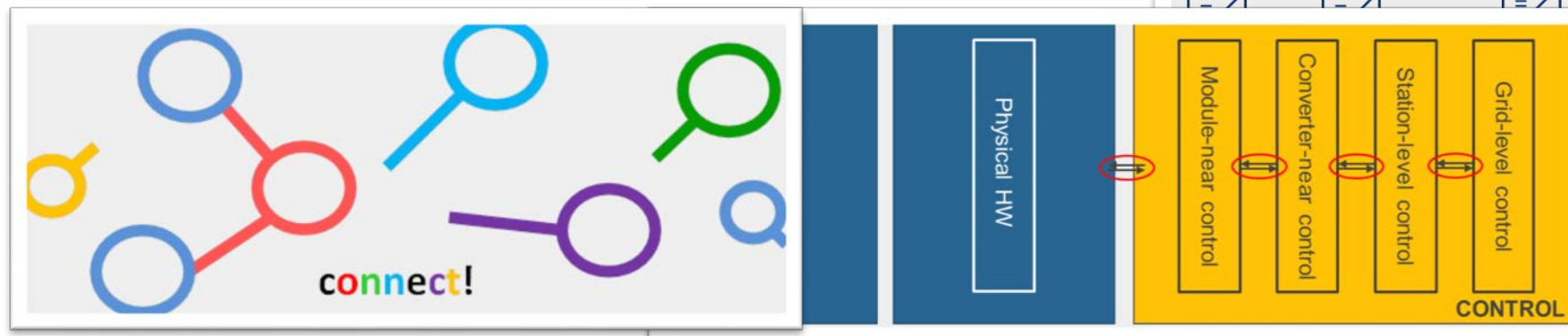
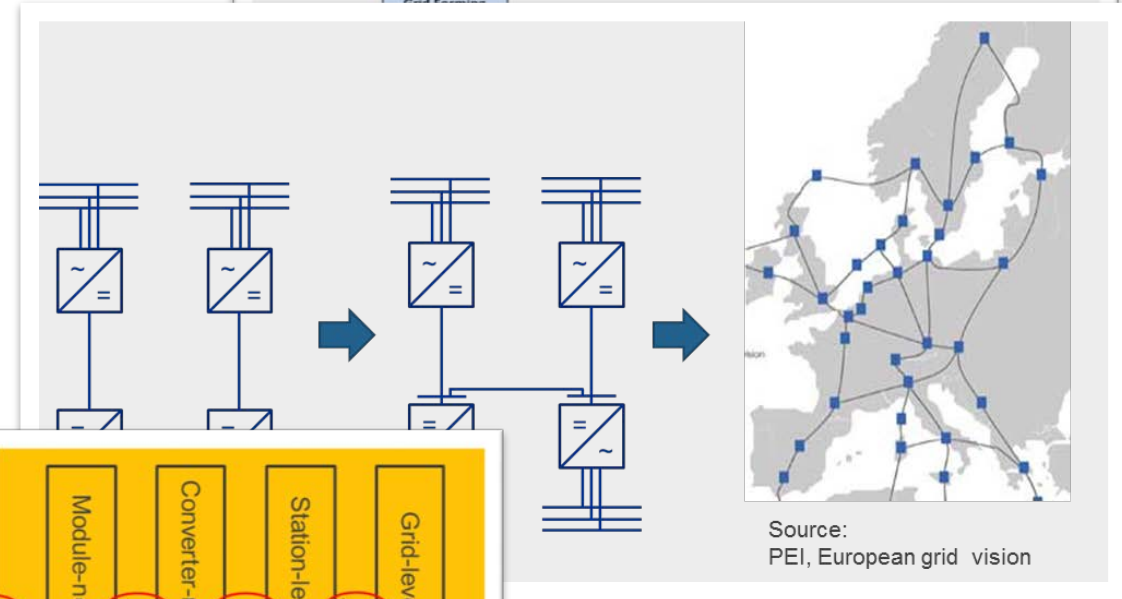
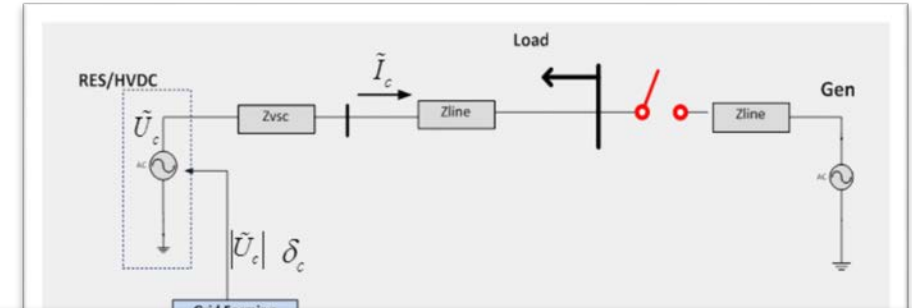
Enhancement of system stability

Enhancement of system observability

Enhancement of flexibility

Tools and advanced models

Enhancement of coordination



THANK YOU FOR YOUR ATTENTION



cora.petino@tennet.eu



+49 (921) 50740 - 2461



www.tennet.eu



TenneT TSO GmbH
Bernecker Str. 70
95448 Bayreuth,
Germany