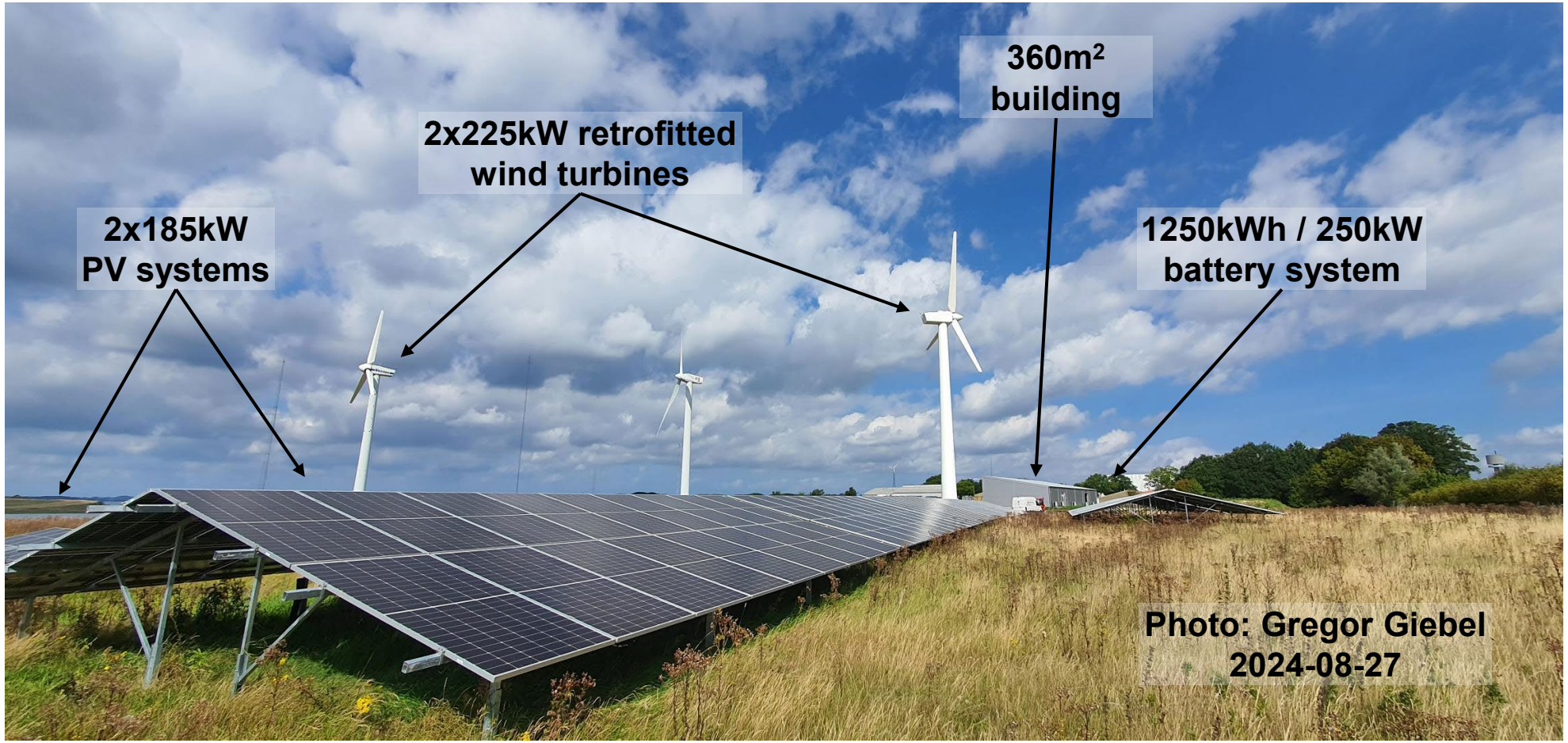
Poul Sørensen

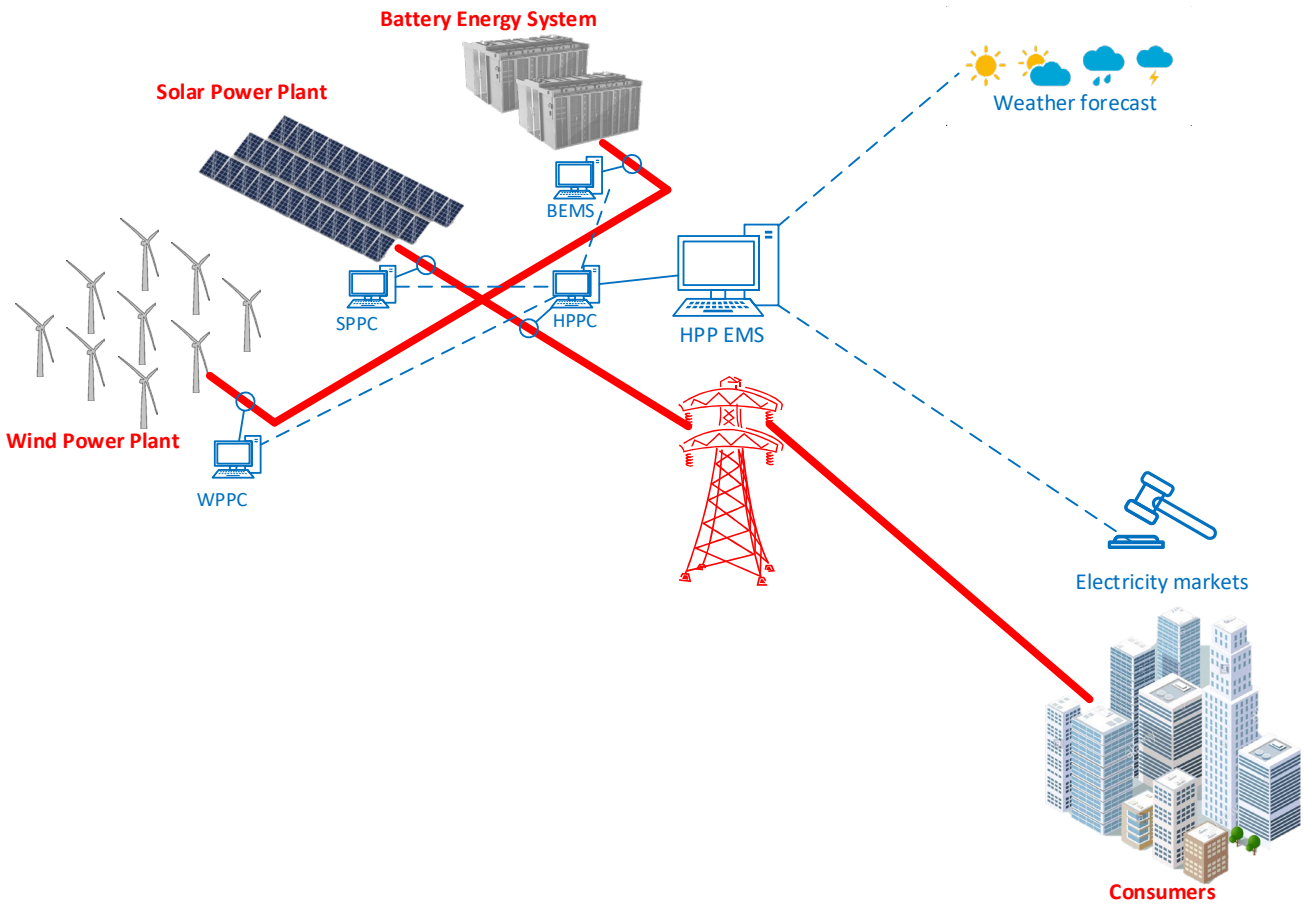
Using grid emulators in standardization of RES model validation

Risø HPP – currently on site

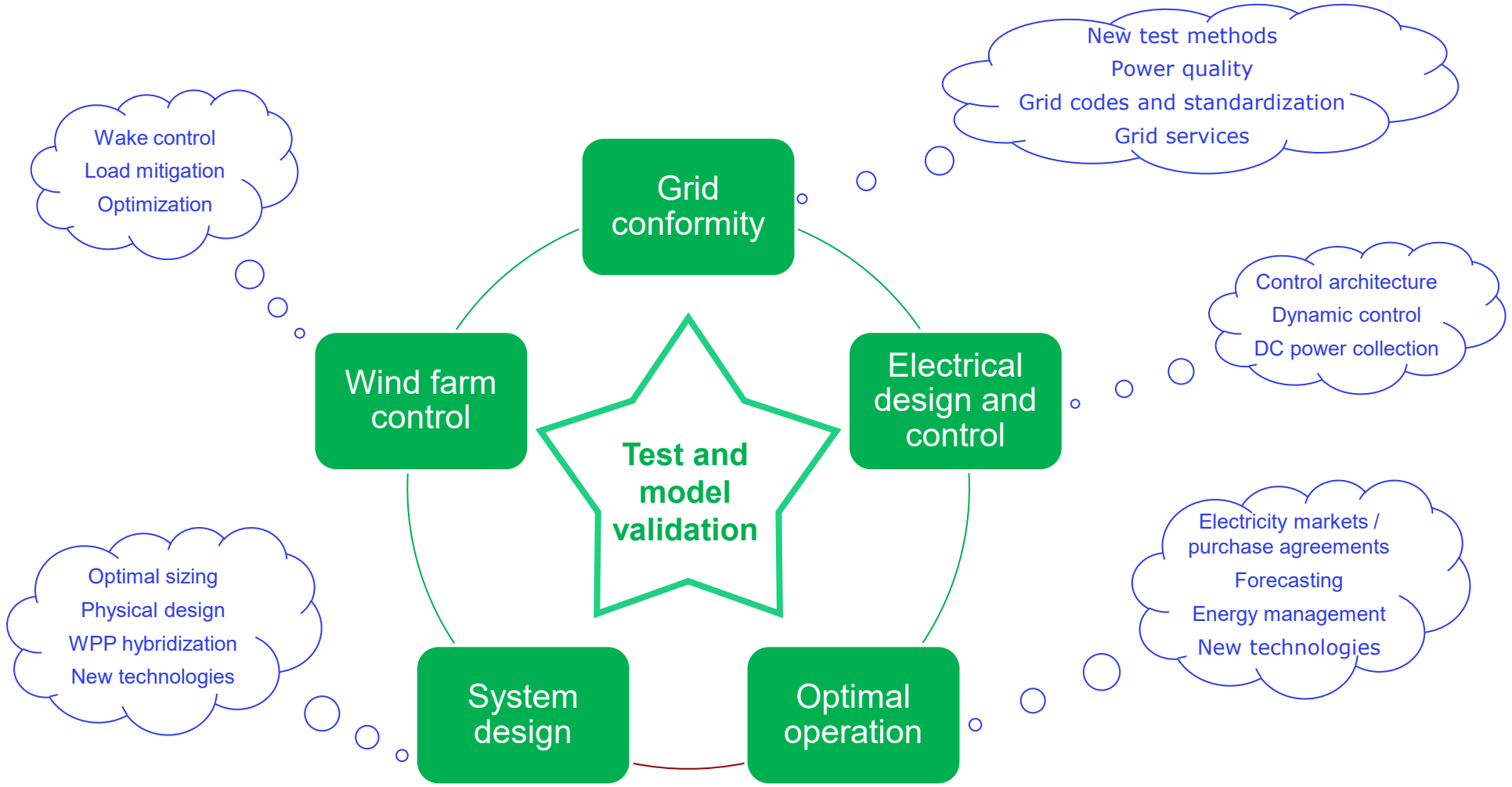


Why utility scale hybrid power plants?

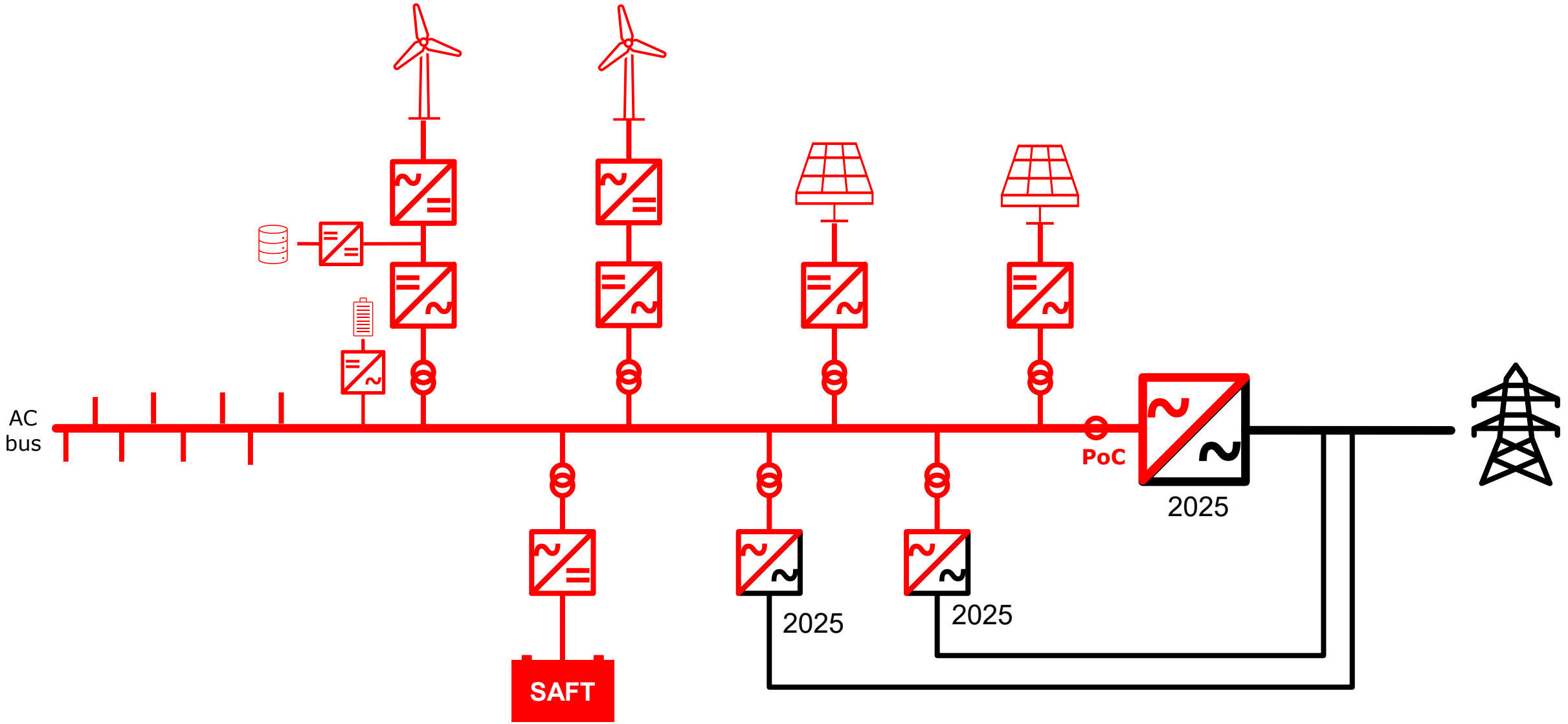
- High-level control of hybrid (mixed technology) power plant
  - better utilization of the grid (more renewables can be connected to grid with limited capacity)
  - storage provides enhanced flexibility in trade on energy markets and reserve markets



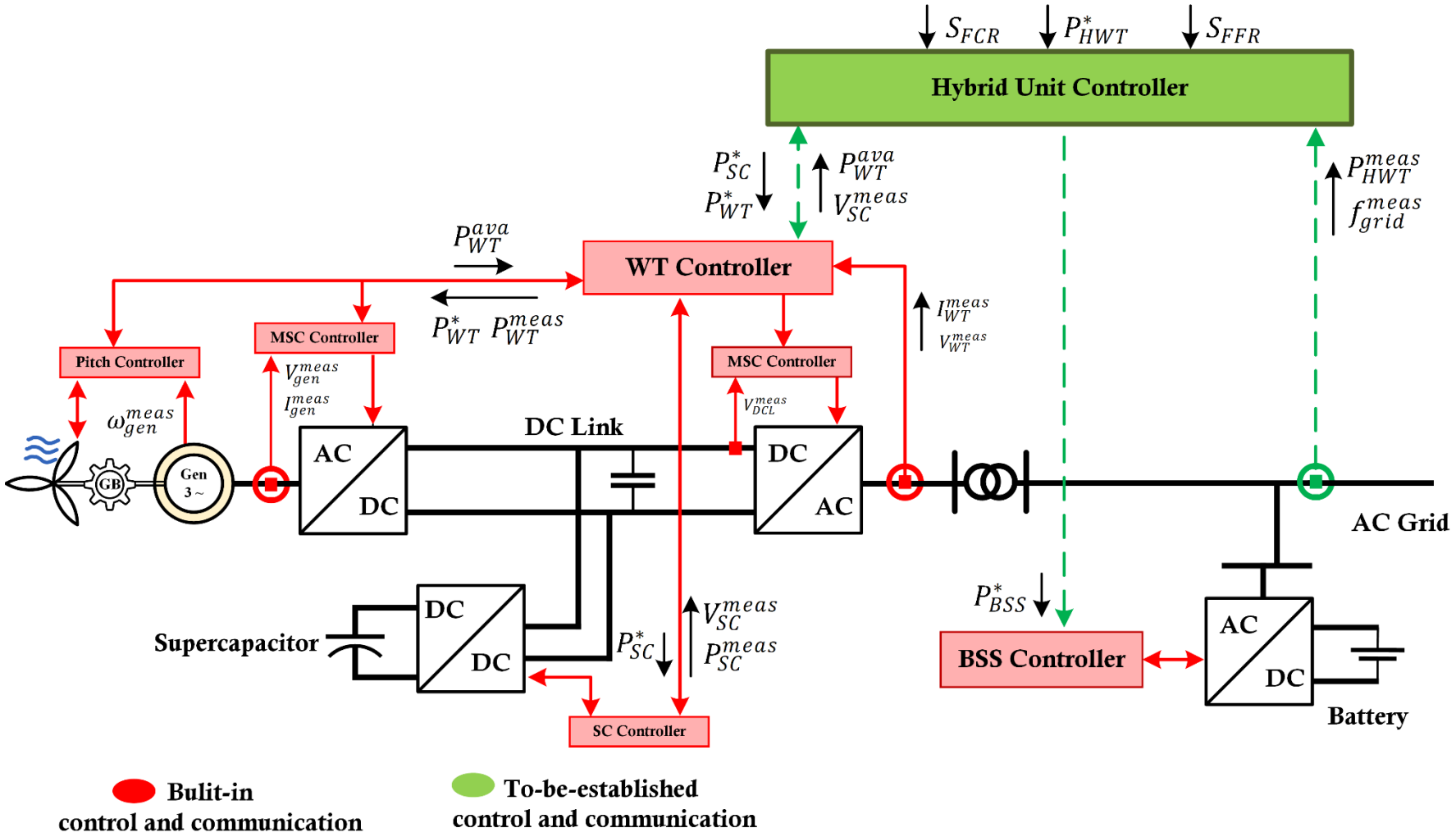
R&D perspective of Risø HPP facility



Phase 1

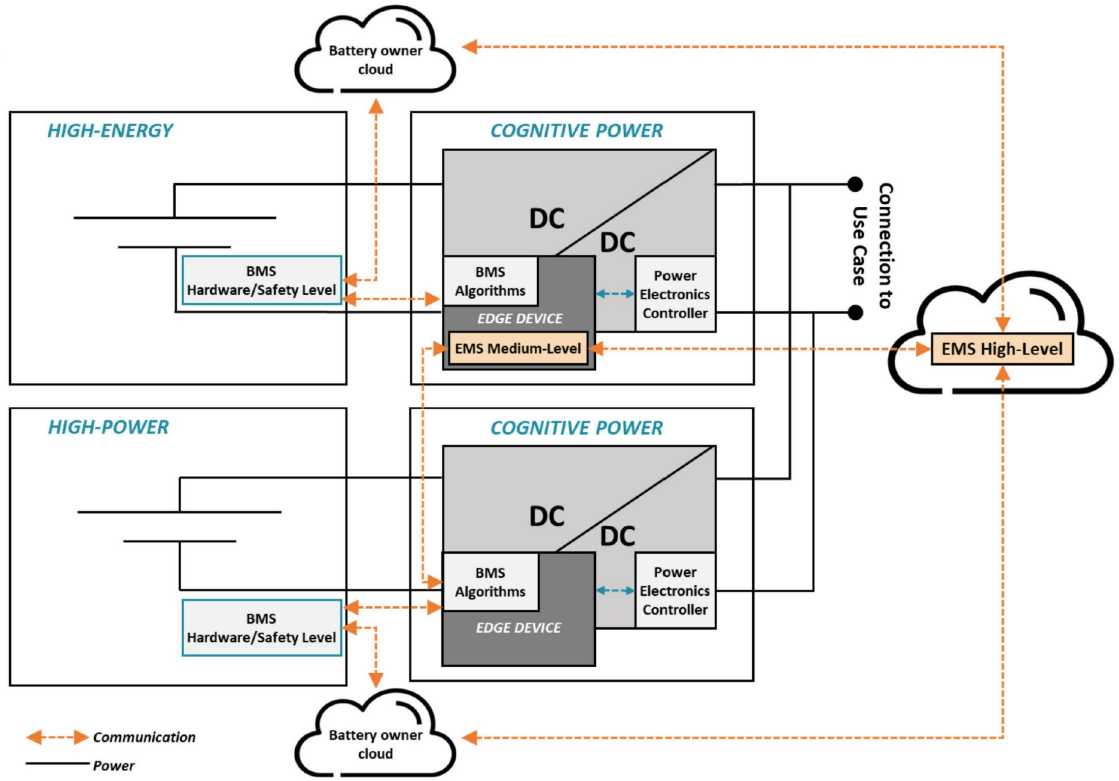


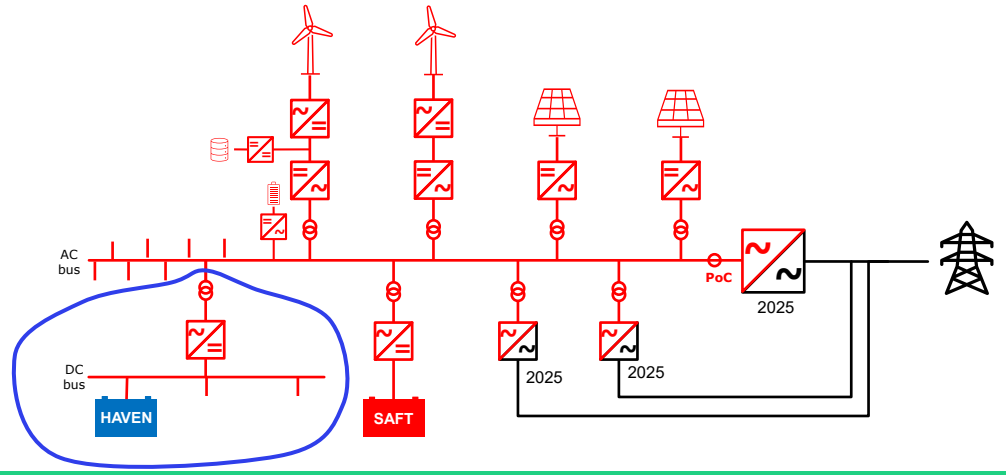
Hybrid wind turbine



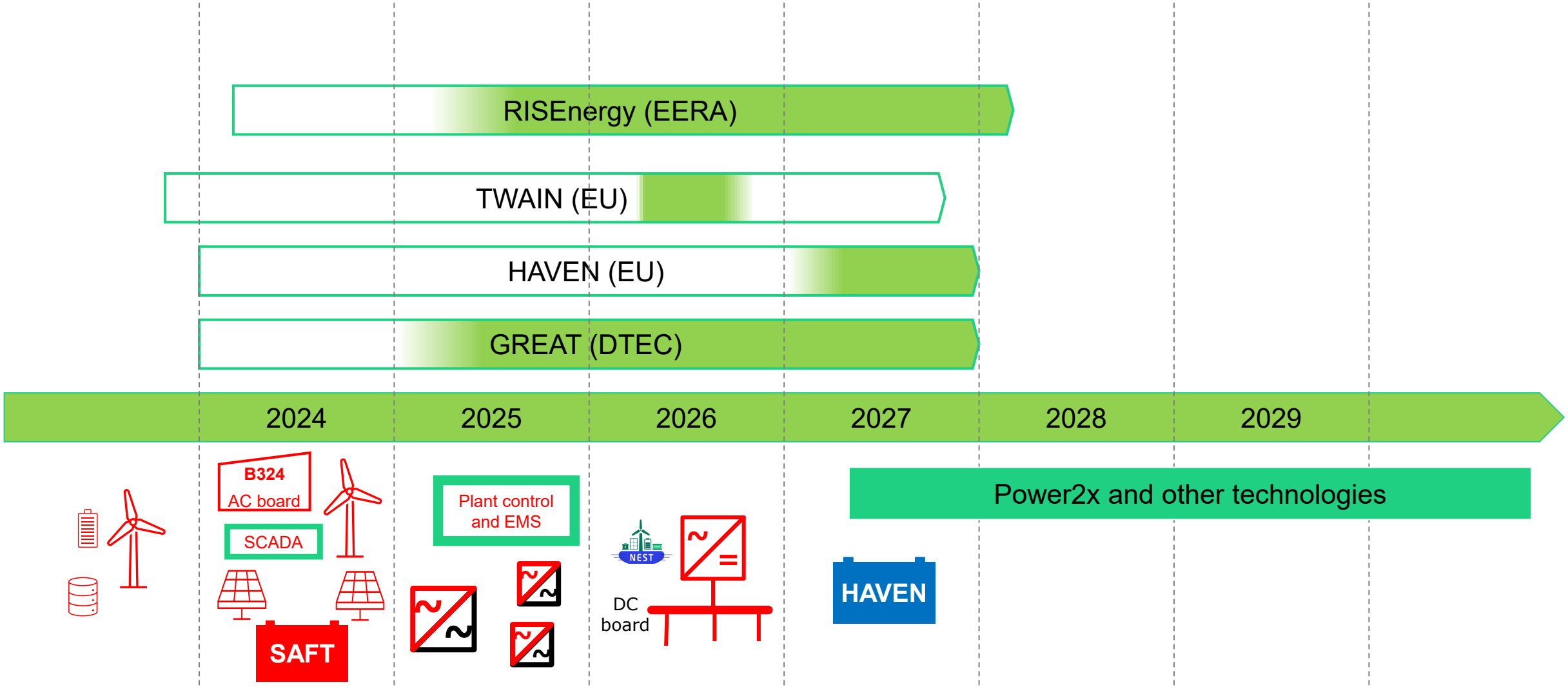
EU HAVEN

- Design and build hybrid storage system (2024-2026)
  - High energy battery: BiTech (BE)
  - High power battery: IMECAR (TR)
  - Power converters: Fraunhofer (DE)
  - EMS: BRING (BE)
- Demonstration of hybrid storage system (2027)
  - Factory, PV & EV-charge (IMECAR, TR)
  - Office, PV, Geothermal & EV-charge (Solitek, LT)
  - HPP (DTU, DK)



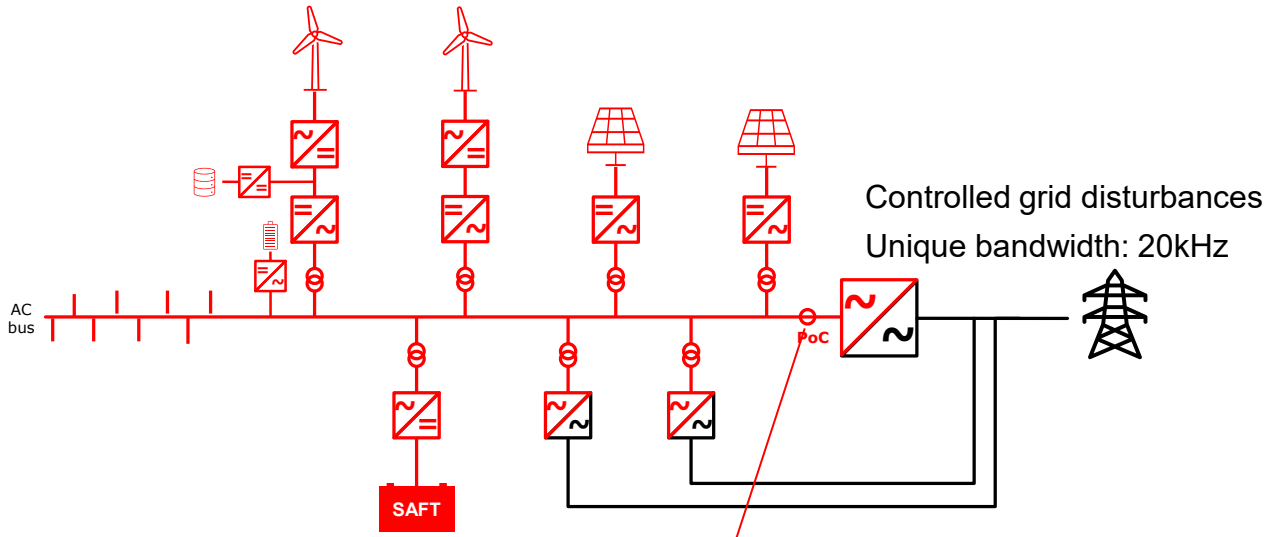


Timeline Risø HPP



GREAT (WP4)

- Advanced modelling of HPP and its components
  - low resolution time series simulation models (ms RMS)
  - high resolution time series simulation models (µs EMT)
  - frequency domain modelling (50 Hz waveform distortion 0-20kHz – “harmonics”)



Individual units tests

HPP level tests

Assets and collection system models

RMS, EMT,

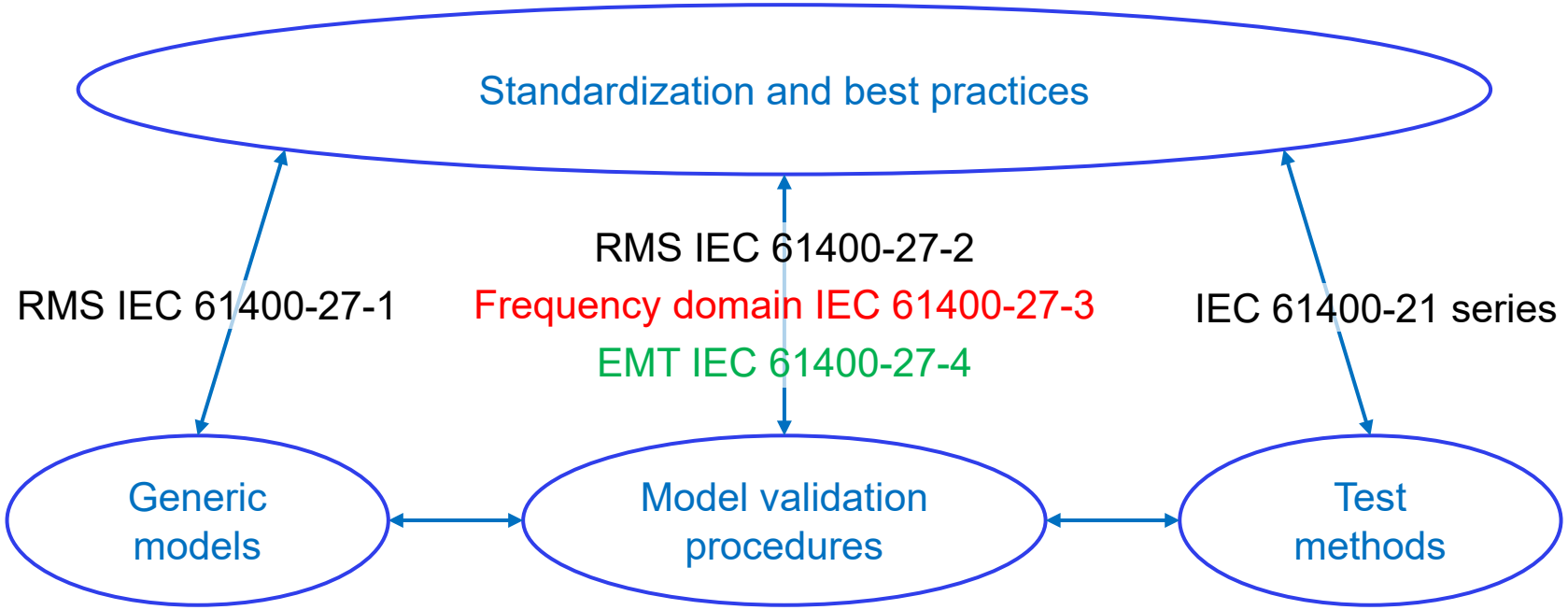
frequency domain

Model validation

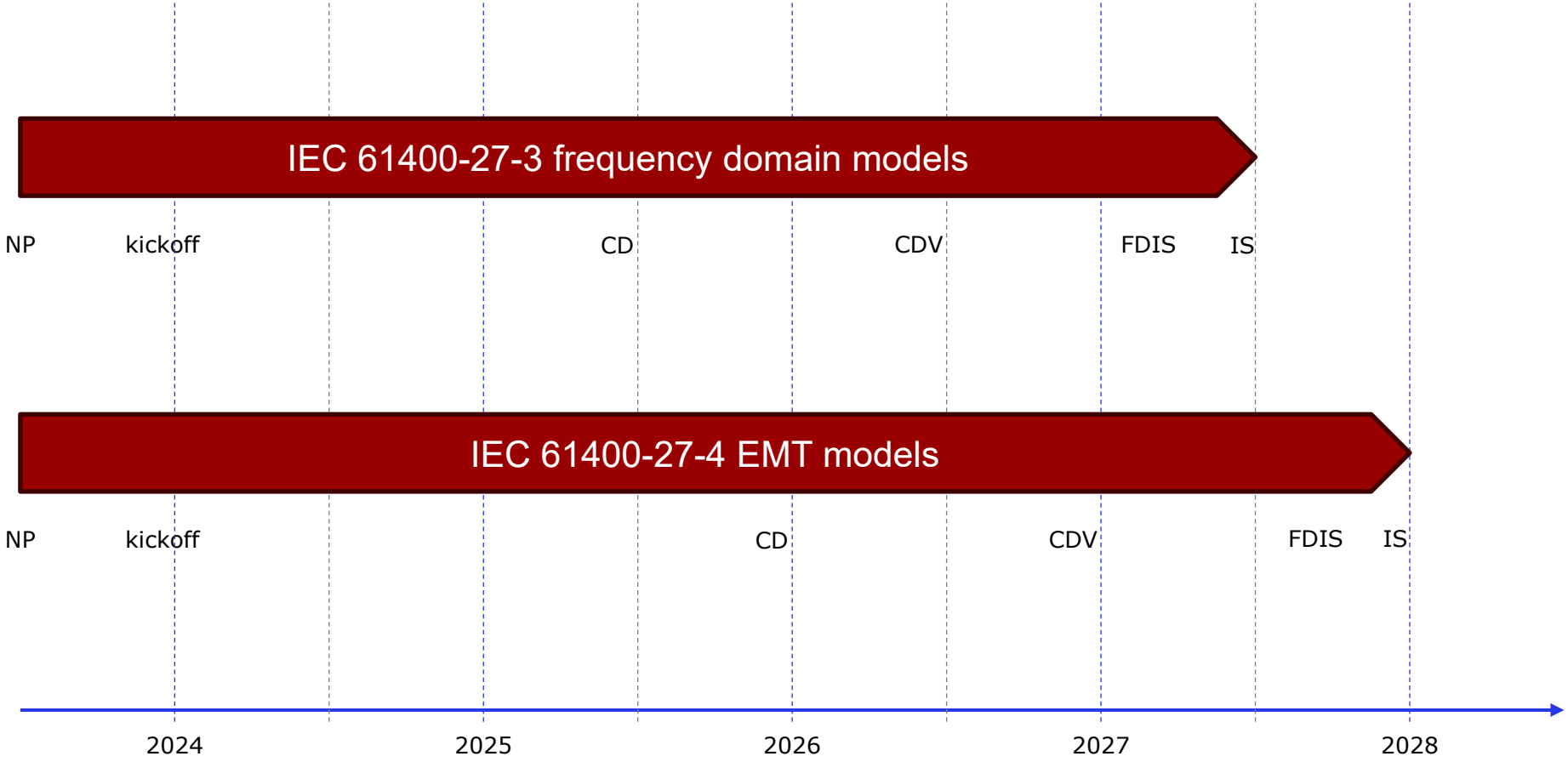
Performance and test data

IEC standardization

- IEC 61400-27-3 Structure and validation procedure of frequency domain models for harmonic propagation studies
- IEC 61400-27-4 Structure and validation procedure of Electromagnetic Transients (EMT) models



IEC 61400-27 new standards timeline




DTU