



HITACHI

ABB

Requirements and Solutions for Grid Supporting Converter Control

SCCER-FURIES Annual Conference 2020

POWERING GOOD FOR SUSTAINABLE ENERGY

2020-10-28, Mats Larsson, Hitachi ABB Power Grids Research

HITACHI ABB POWER GRIDS

© Hitachi ABB Power Grids 2020. All rights reserved

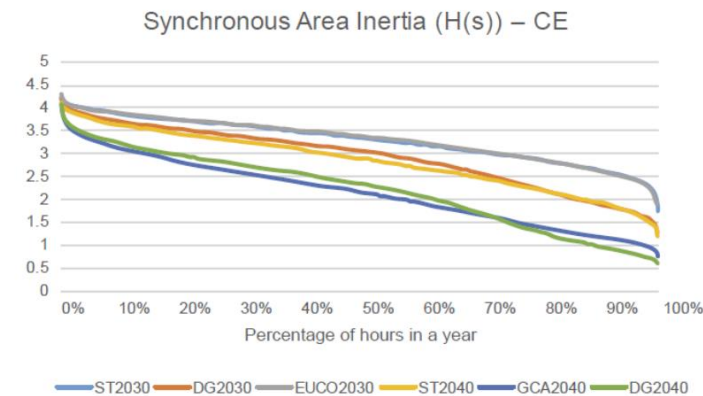
The key issue

Power system operation relies on a few key properties of synchronous machines for stable operation, e.g.

- Self-synchronization
- Inertia support and fast frequency response
- Fault current injection
- Low-frequency oscillation stabilization through PSS

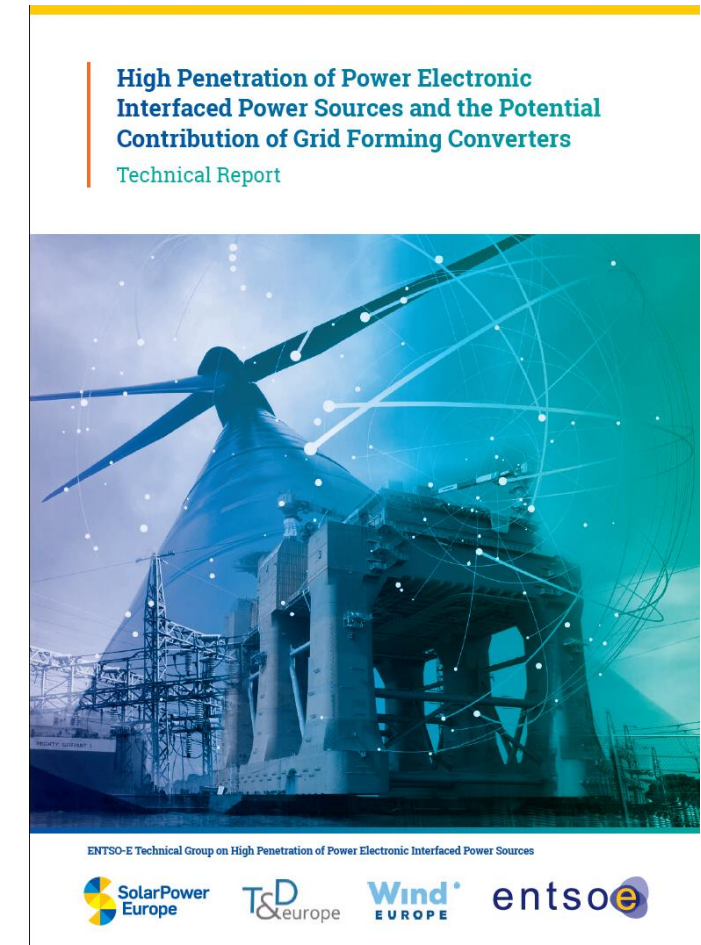
Energy Transition: Synchronous machine based generation are being phased out in favour of renewables

- Converter connected generation
- Many grid connected converter systems are still controlled in a grid following (non-grid supporting) manner

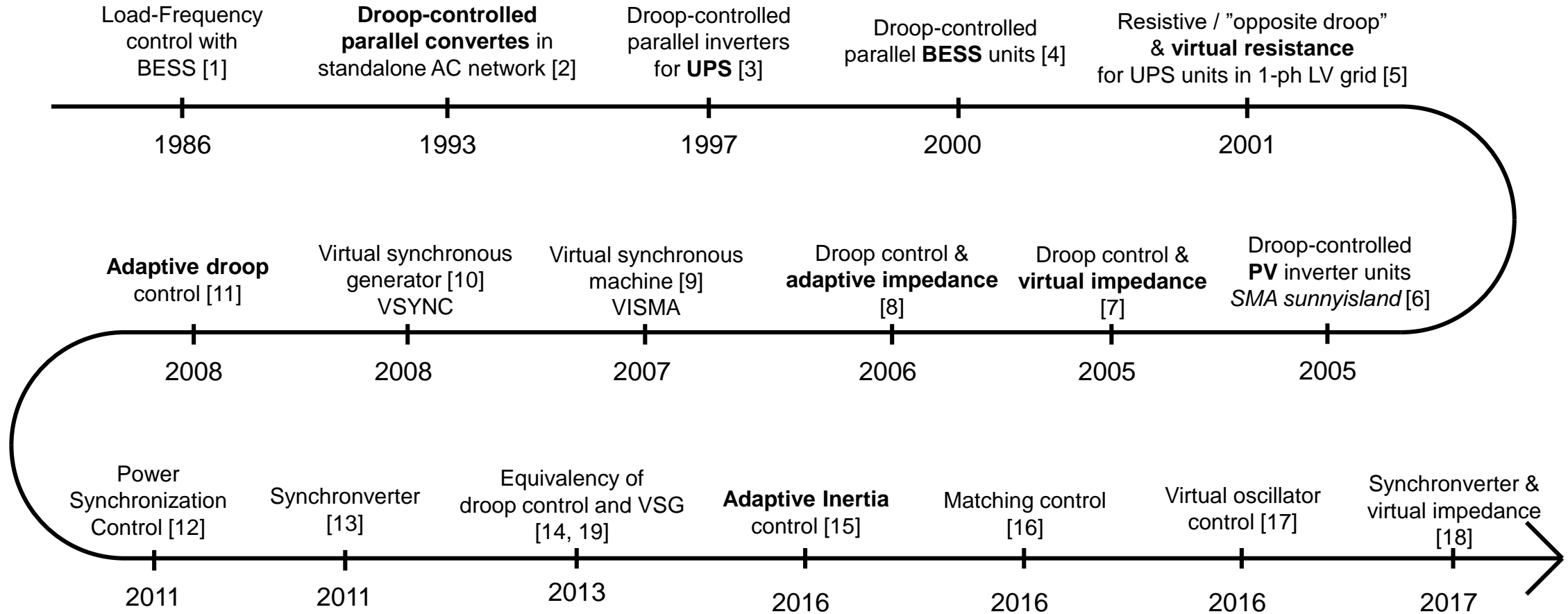


Source: ENTSO-E

- Creating system voltage
- Contributing to fault level
- System survival to allow effective operation of Low Frequency Demand Disconnection (LFDD)
- Sink for harmonics
- Sink for unbalance
- Contribution to inertia
- Preventing adverse control interactions
- Black start

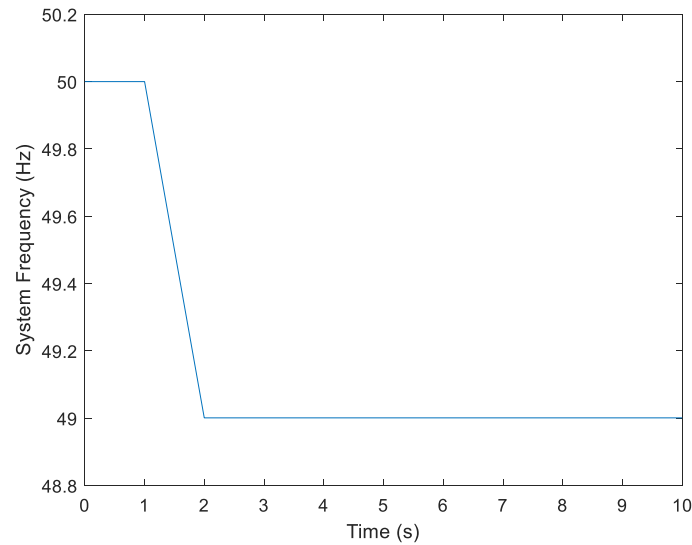


Overview of Grid Forming Control Approaches

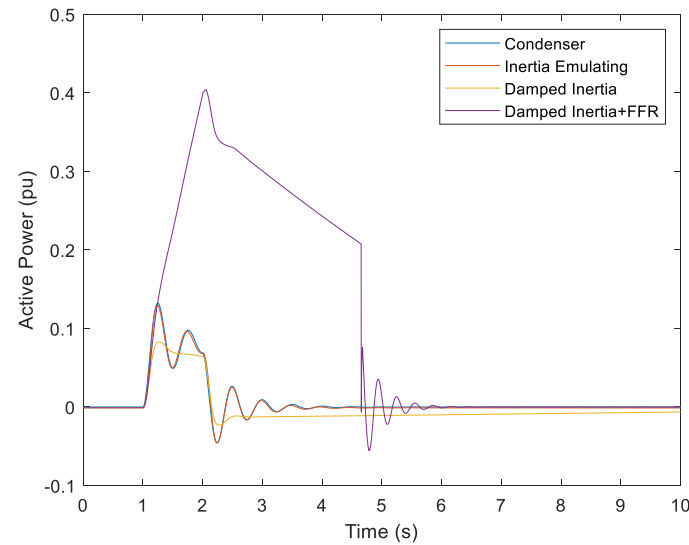


Source: M. Schweizer, Corporate Research, ABB Switzerland Ltd.

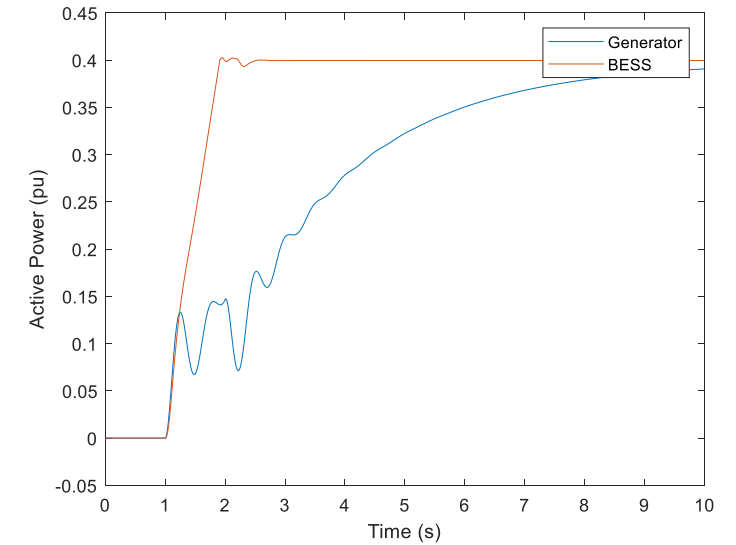
Underfrequency Event



Small Storage (seconds)

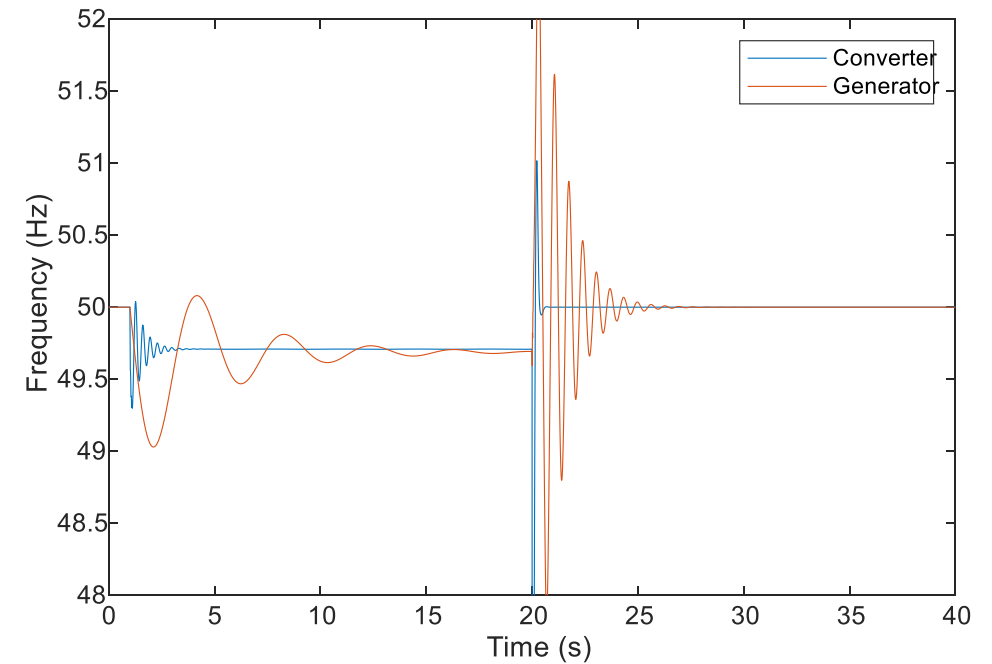
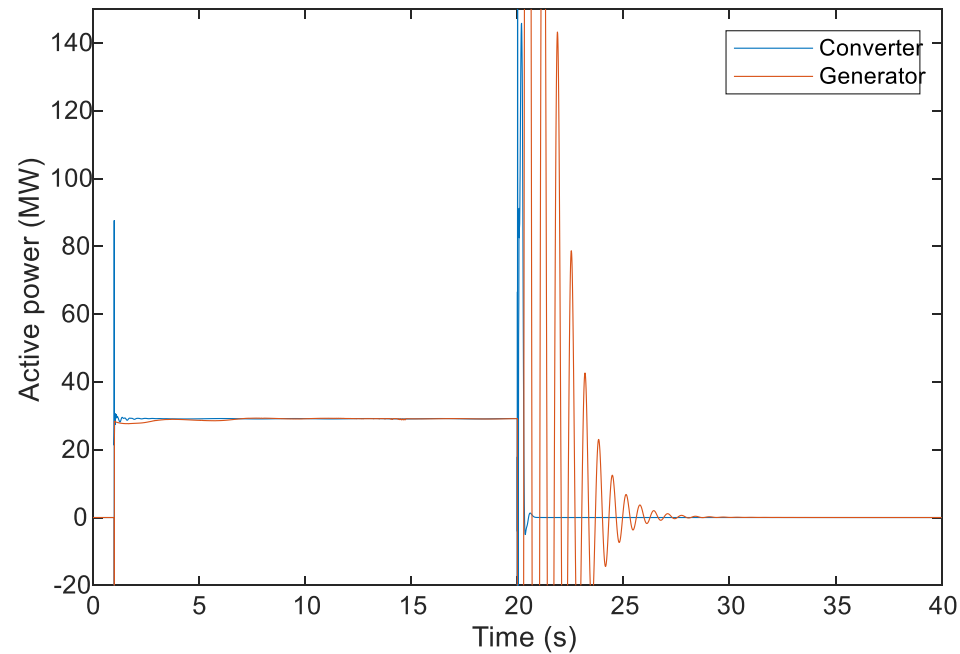
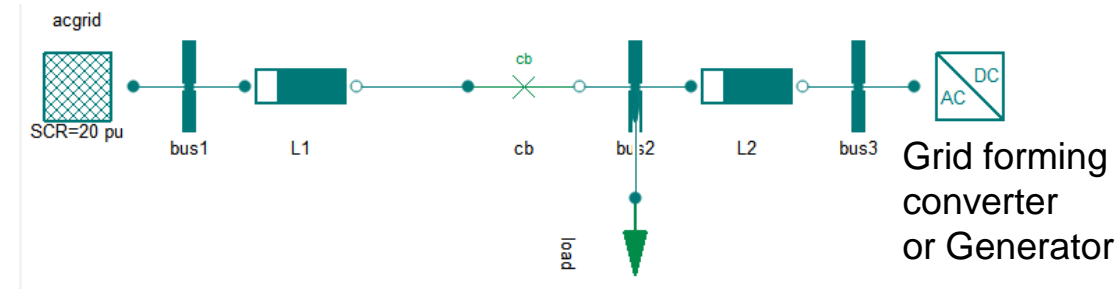


Large Storage (>minutes)



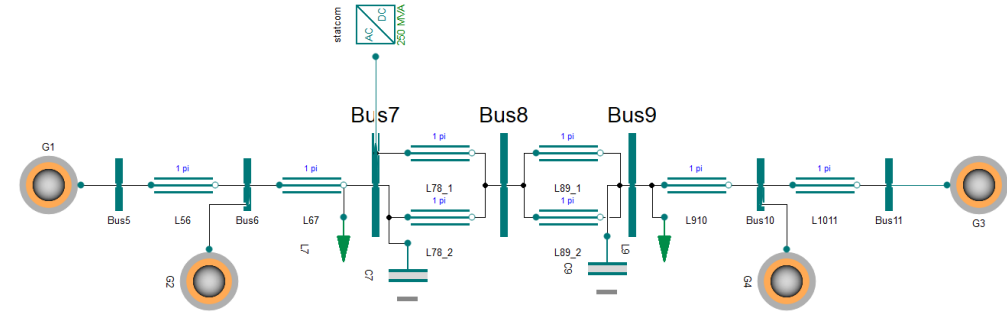
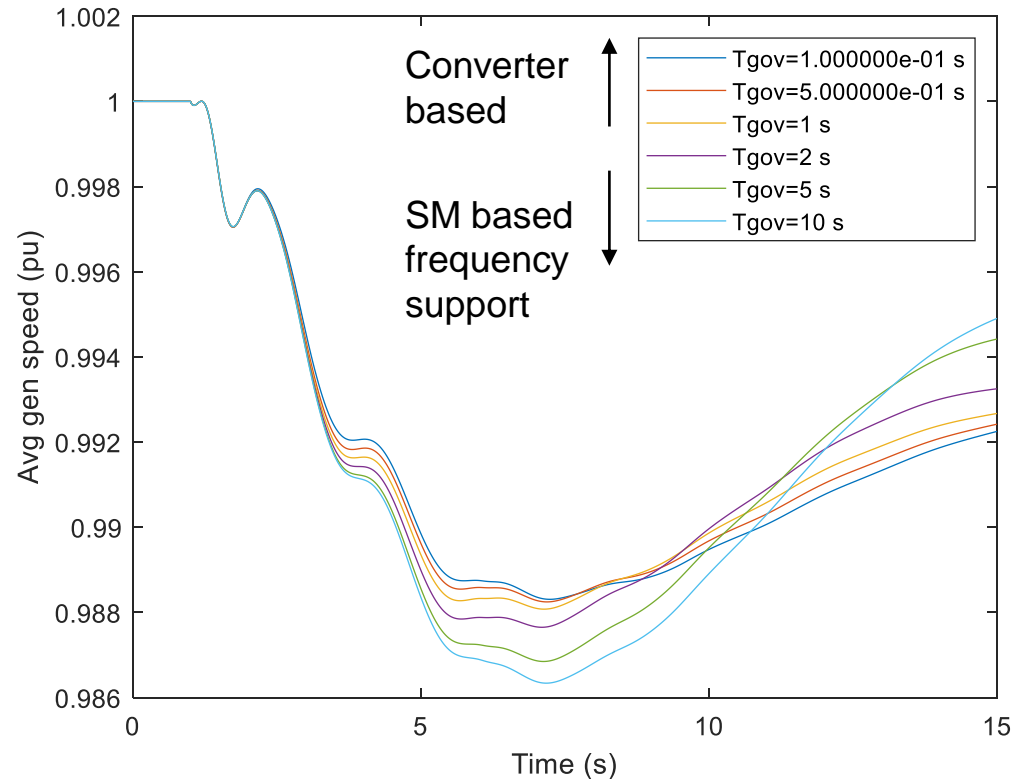
Converter Based Storage and Generation can Emulate Inertial Response of Synchronous Machines

Transition between Grid connected/Islanded mode



Converter Based Storage and Generation Can Respond Smoother and Quicker in Islanding and Resynchronization

System Average Frequency



250 MW Inverter based fast frequency response

4 x 900 MVA Generators

Converter based storage with first order governor type response

Converter Based Storage can Respond Quicker to Frequency Events (if storage technology allows)

Power system operation relies on a few key properties of synchronous machines for stable operation

The amount of grid connected synchronous machines is steadily decreasing

Grid forming and supporting converters are able to meet those challenges through:

Surpassing synchronous machines in terms of

- Fault-ride through and transients
- Inertial response
- Islanding and resynchronizations
- Fast frequency response

Large fault current injection largely still unresolved issue

Even non-sustained support is useful for grid support

HITACHI

