Grid Stability Enhancement by LVRT Retrofitting of Existing Wind and Solar Power Plants

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Contents

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+65%

of the global offshore capacity is equipped with our solutions.

*Source: MAKE Consulting

+35

Years of experience

Building on more than 35 years of experience, KK Wind Solutions is a strong partner in electrical systems for wind turbines

Grid Code regulation for wind

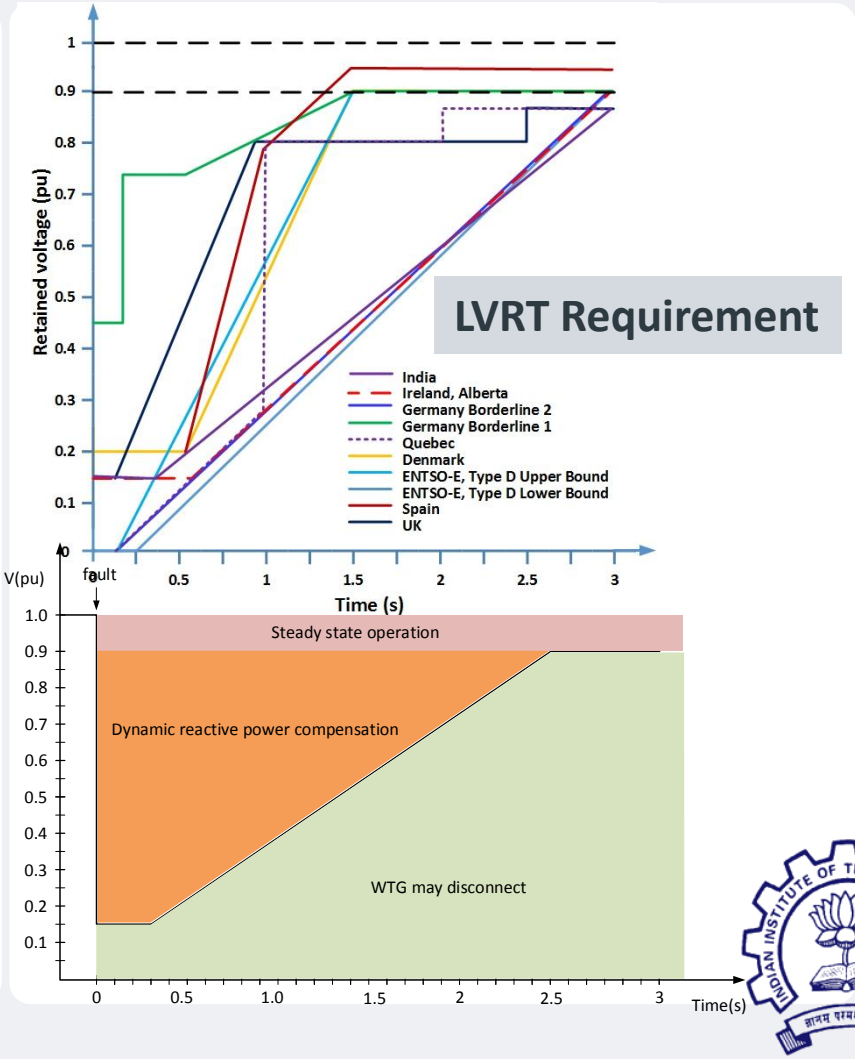
Grid code determines how a generator or a customer load should react to a grid disturbance, with its objective being secure and stable operation of power system

Grid code in the past

- Old technology, limited controllability and no observability
- Allowed simple ON/OFF operation

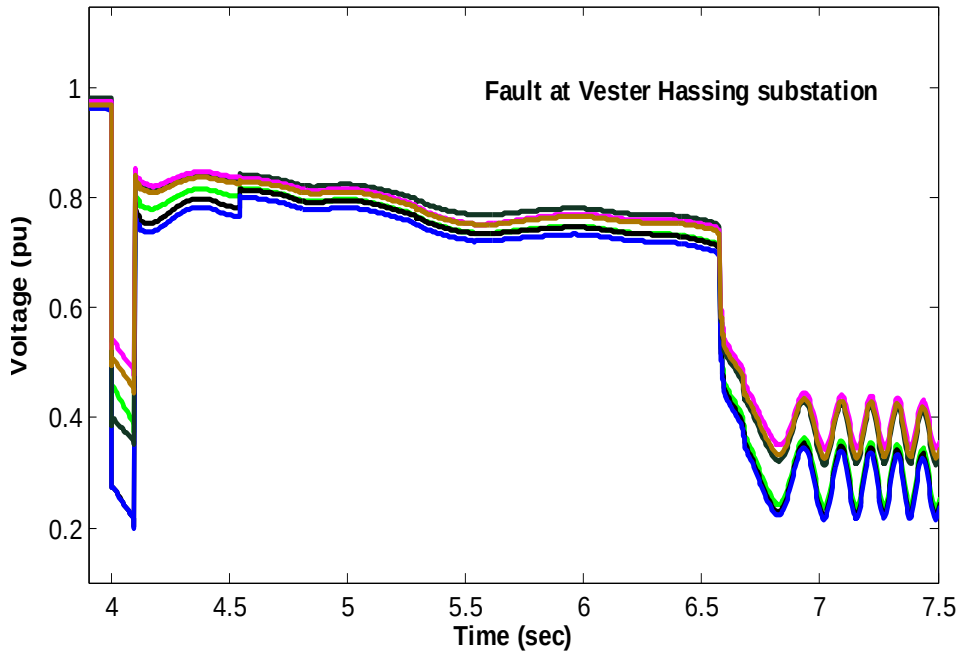
Impact at higher peneteration

- A severe fault in the grid can lead to outage of significant wind power generation, potentially leading to a blackout
- Due to a sudden frequency event, generation of as high as 50% can trip

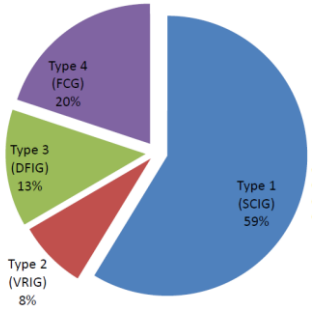


Impact on grid stability

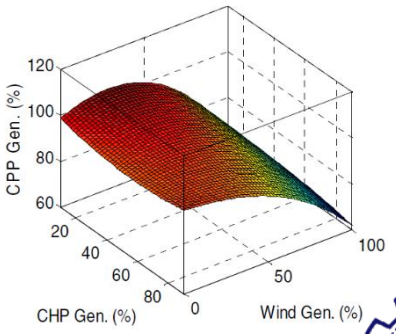
A Danish Case Study



Onshore capacity per technology



Impact on grid security



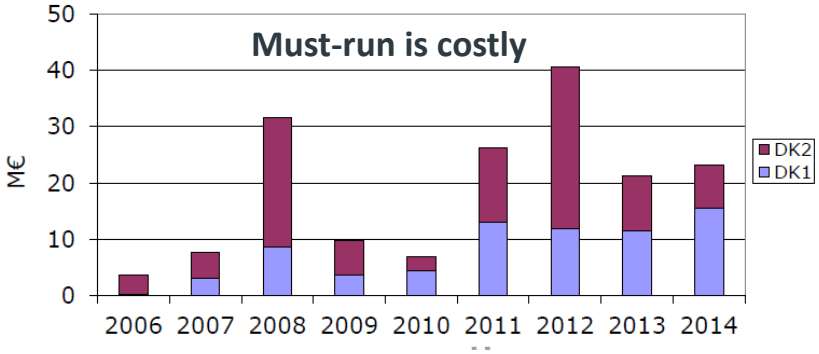
Possible solutions

to address diminishing reactive power

1. Must run conventional power plants (interim measure)

- Short circuit power
- Dynamic voltage control
  - Reactive power consumption from old wind turbines and commutation of HVDC LCC
- Continuous voltage control

(Active power reserves are bought in separate markets and do not give rise to must-run)



Source: Energinet.dk (Danish TSO)

2. Synchronous condensers (new and refurbished)

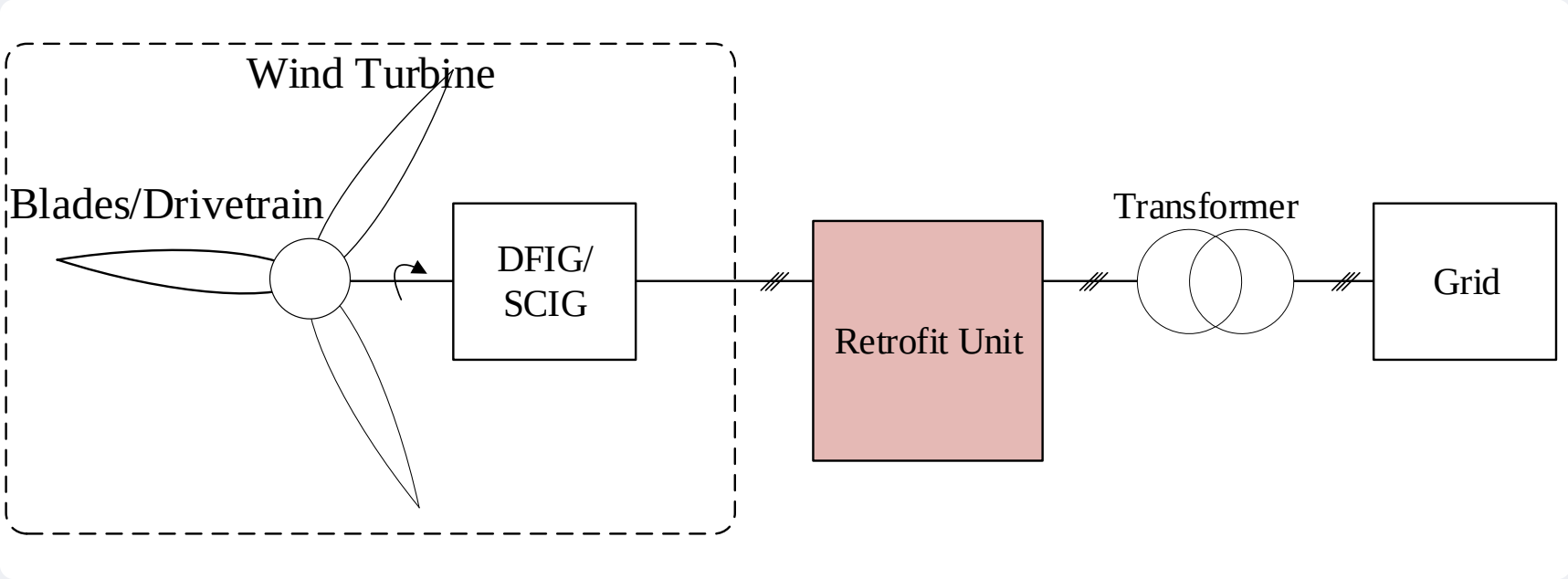
3. FACTS devices (STATCOM, SVC etc)

4. More stringent grid code regulation

5. Retrofitting of wind turbines

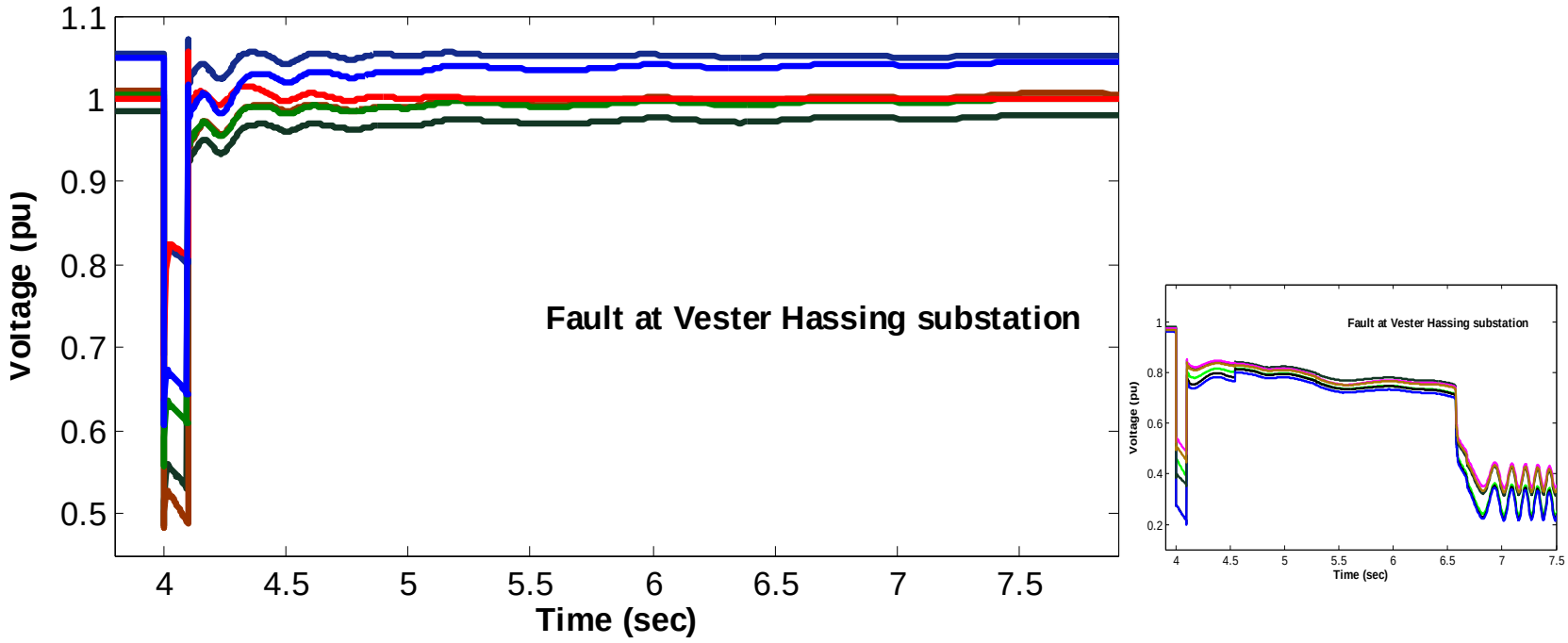
- Help in LVRT grid code compliance
- Dynamic reactive power support
- Ancillary services

Retrofitting of wind turbines



Dynamic voltage stability

considering dynamic reactive power compensation



Conclusions

Wind integration leads to diminishing sources of dynamic reactive power in the grid thus voltage instability/insecurity

Retrofitting of wind turbines can be a potential cost effective solution to address the grid stability issue by:

- Grid code compliance of wind turbines, particularly old ones
- Supplying dynamic reactive power beyond grid code requirement
- Supplying grid support ancillary services (steady state and dynamic reactive power)

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