Approaches to improving the utilisation of wind energy at very high penetration levels

The example of Sal Island, Cape Verde

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In co-operation with
ECREEE, Electra and Cabeólica, Cape Verde

A project funded by

DTU Wind Energy
Department of Wind Energy
Vestas Omtanke funds projects and initiatives that, just as Vestas, take part in the fight against climate change, energy poverty and water scarcity.
Cape Verde, Denmark and DTU Wind Energy

• Cape Verde and Denmark
  – Amongst the top wind energy countries
  – High penetration of wind energy

• Collaborating for many years
  – Started back in 1980s
  – DTU Wind Energy, formerly Risø National Laboratory

• Face common challenges to power system
  – Cape Verde: autonomous island grids
  – Denmark: interconnected European grid
The challenge of high penetration

As wind energy penetration increases, systems face the challenges of

- Technical: Keeping the system stable
- Economic: Minimising the curtailed energy and ensuring investment security
- Societal: Providing energy at a cost suitable for the society

Denmark 2012
20% penetration
The challenge of high penetration

As wind energy penetration increases, systems face the challenges of

- Technical: Keeping the system stable
- Economic: Minimising the curtailed energy and ensuring investment security
- Societal: Providing energy at a cost suitable for the society

Denmark 2020
50% penetration
The challenge of high penetration

As wind energy penetration increases, systems face the challenges of

- Technical: Keeping the system stable
- Economic: Minimising the curtailed energy and ensuring investment security
- Societal: Providing energy at a cost suitable for the society

Denmark 2035
75% penetration
The project

“The approaches to improving the utilisation of wind energy at very high penetration levels”

Reason for the project:

Sal island, Cape Verde: peak load 10.6MW, wind farm capacity: 7.6MW

• Potential for very high penetration
• In 2015 approximately 50% of estimated wind production curtailed to maintain system stability

• Aims of project:
  – To understand the technical barriers to reducing curtailment
  – To recommend further studies to identify solutions to curtailment

• Initiation: May 2016
• Completion: Autumn 2016
Data collection May 2016

- System loads
- Wind power generation & stability
- Diesel generator characteristics
- Wind power forecasts
Sal system study 2007-2008: to be updated
DTU Wind Energy

A mission-oriented university department of Technical University of Denmark, DTU

www.vindenergi.dtu.dk

> 240 staff members
Including 150 academic staff members and 50 PhD students
DTU Wind Energy

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Test Station for Wind Turbines
DTU Risø Campus, Roskilde (1978)
Test Station for Wind Turbines
DTU Risø Campus, Roskilde (May 2016)
Test Station for Wind Turbines
DTU Risø Campus, Roskilde (May 2016)
A planned project activity:

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Thank you for your attention

Questions?

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