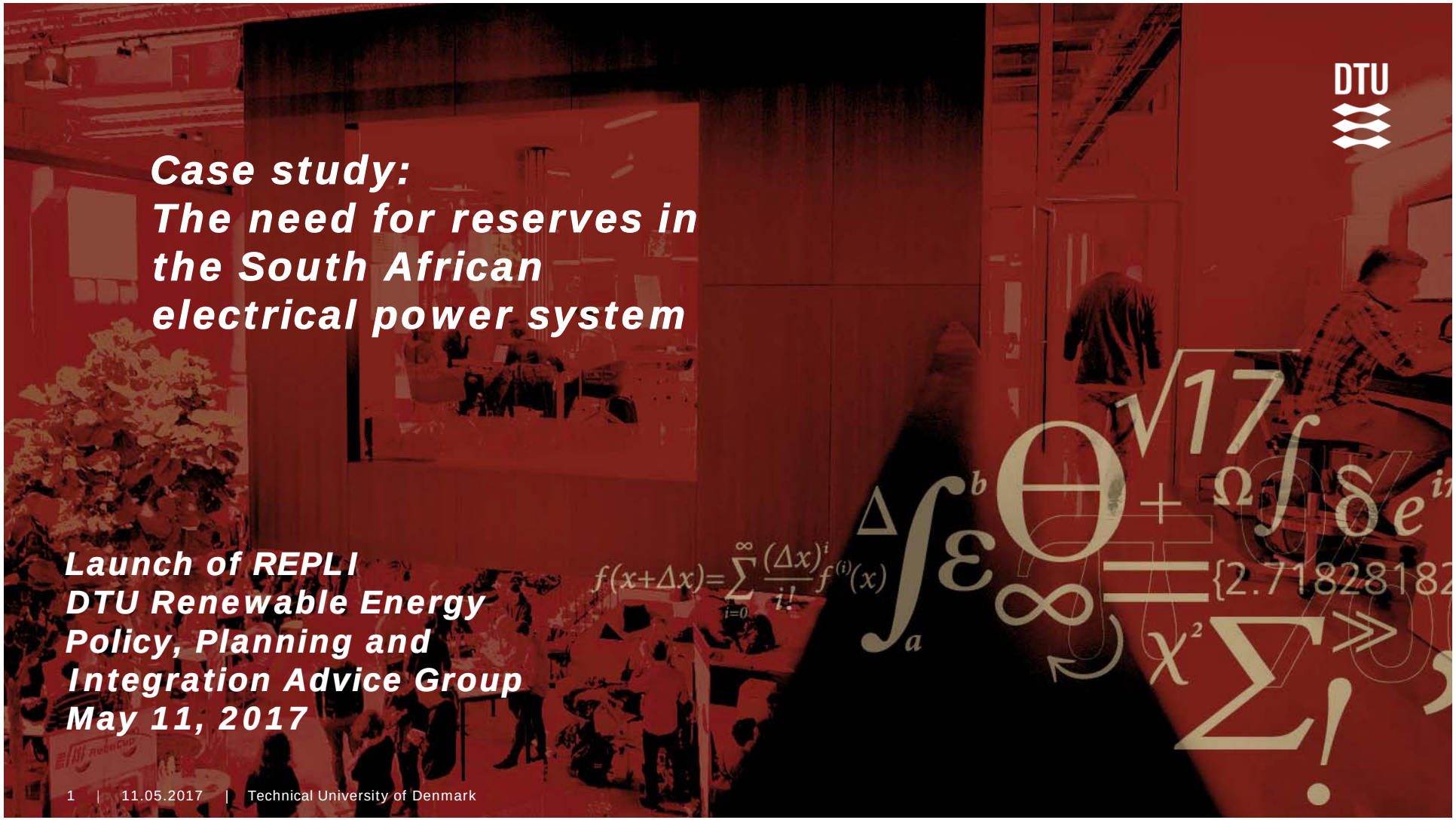


Case study: The need for reserves in the South African electrical power system

Launch of REPLI
DTU Renewable Energy
Policy, Planning and Integration Advice Group
May 11, 2017

Outline

Case study:

- ***The need for reserves in the South African electrical power system***

Outline:

- *Project*
- *Wind power development cases*
- *Approach*
- *Impact on needs for reserves*

Project

Reliability with renewable energy

- ***System Adequacy and Reserve Margin with Increasing Levels of Variable Generation***

Partners:

- *Ea Energy Analysis (DK)*
- *EOH Enerweb (SA)*
- *DTU (Wind Energy and Electro) (DK)*
  - *The need for reserves in the South African electrical power system*

Grid operators (TSOs):

- *Energinet.dk (DK)*
- *ESKOM (SA) [end user]*

Funding:

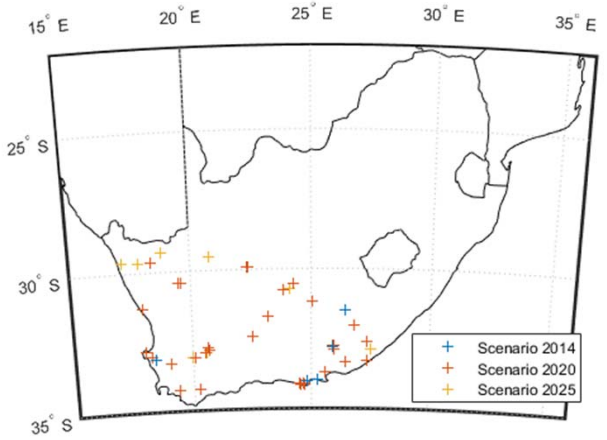
- *Danish Support to RE development in SA*

REPLI - DTU Renewable Energy Policy, Planning and Integration Advice Group, www.repli.dtu.dk

Wind power development cases

Cases

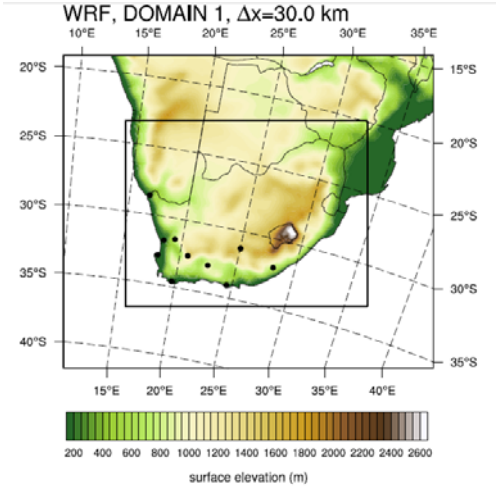
- 2014 Reference (Past) case
- 2020 Planned development case.
- 2025 Future for grid development planning.



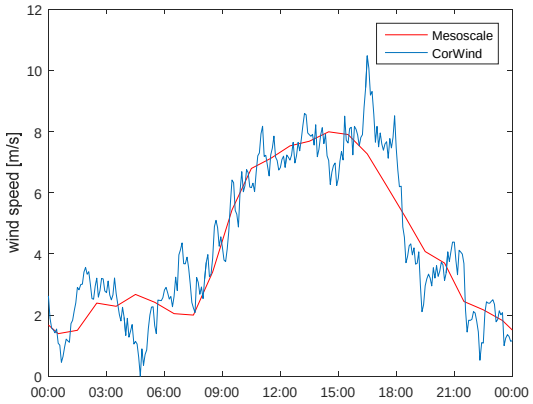
Case year	2014	2020	2025
Installed wind power capacity [MW]	460	3800	7400
Consumption [TWh/y]	231	356	404
Penetration [%]	0.5	2.9	4.9

Simulation approach – wind power fluctuations

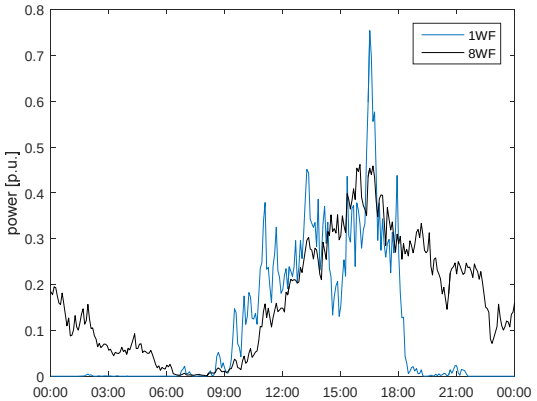
CorWind software developed at DTU Wind Energy



Mesoscale wind speeds



Add wind speed fluctuations



Wind to power (and smoothening)

Results - Impact on reserves

- *Focus on impact on expensive automatic reserves*
- *ESKOM considers impact of **load ramp rates** on need for those reserves*

  [Ancillary Services Technical Requirements 2015/16 – 2019/20. Rev. 1 ESKOM 28-10-2014.]

- *We used wind power simulations to assess impact of **residual load ramp rates**:*

  residual load

  = consumption load – wind generation

- With ***present*** South African wind penetration cases, the resulting ***increase is very small***
- ESKOM will consider variable generation in future requirements

Variable	Season	2014	2020	2025
Consumption variations [MW]	Summer	400	550	700
	Winter	500	650	800
Wind variations [MW]	-	29	106	155
Wind penetration	-	0.5	2.9	4.9
Total variations [MW]	Summer	401	560	717
	Winter	501	659	815
Increase due to wind [%]	Summer	0.3	1.8	2.4
	Winter	0.2	1.4	1.9

Use in REPLI

- Weather dependent variable generation and consumption:
  - Wind power
  - Solar PV

  : have power simulation tools
  - Hydro power
  - Heat and cooling

  : have correlated weather data
- Uses of variable RES generation time series:
  - Energy system planning
  - Network development planning
  - Power system reliability – adequacy
  - Needs for reserves