Investigating the effects of a changing climate on siting of renewables

Dr Merlinde Kay
Energy Meteorology

• Energy Forecasting investigates how climate and weather influence the energy sector. My research group uses the connection between energy and meteorology to develop models that lead to promotion of cost-effective and sustainable weather and climate risk management strategies for the Energy industry
  – Resource assessment
  – Siting and planning
  – Forecasting and optimisation
  – Assist in technology design
  – Building optimisation
Ongoing Projects at UNSW

- Utilising weather models for building energy management optimisation
- Wind forecasting and assessment
- Hybrid forecasting and optimisation of battery storage
- Distributed Forecasting
- Aerosol modelling/forecasting for CST
Characterising Variability

• Analysing weather data and insolation
  – Identifying weather patterns that correlate to periods of high and low power production
  – Predictability of these weather events at appropriate levels of aggregation
Total change in DNI from 1990-2012

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Where should new wind and solar energy sites be located to avoid climate and financial risk?

• The aim of this project is to minimise the risk in investing in potential wind and solar energy sites.
• How will climate change affect the choice of future renewable sites?
• Where would investments be most or least risky? Can we identify sites that will remain optimal and economically viable in 20 years’ time as weather and climate change?

A/Prof Jason Evans, Dr Abhnil Prasad and Prof Andy Pitman
Regional Climate Projections

- We use a regional climate ensemble and separately downscale four global climate models (MIROC3.2-medres, ECHAM5, CCCMA3.1, and CSIRO-Mk3.0) using the Weather Forecasting and Research (WRF) modeling system version 3.3.

- This created a 12-member ensemble for three time periods:
  - present (1990–2009),
  - near future (2020–2039),
  - far future (2060–2079). All future simulations used the SRES A2 emissions scenario.


Extractable Wind Power (EWP)

- The amount of power that can be extracted from wind turbines – 80m hub height
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Levelised Cost of Electricity (LCOE)

- Minimum cost at which a generator must sell the produced electricity in order to break even*

Comparison between Existing and proposed sites

Existing wind farms

Proposed wind farms

LCOE ($/MWh)

NSW  VIC  SA  NQLD  CQLD  QLD  WA  TA

UNSW AUSTRALIA
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Future Projections

- Future generation traces for solar

Thank You