

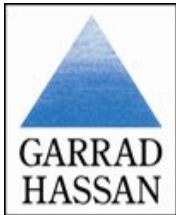
# Smart Grids: The case of wind power

Paul Gardner, Brussels 29 June 2009

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Renewable Energy Experts  
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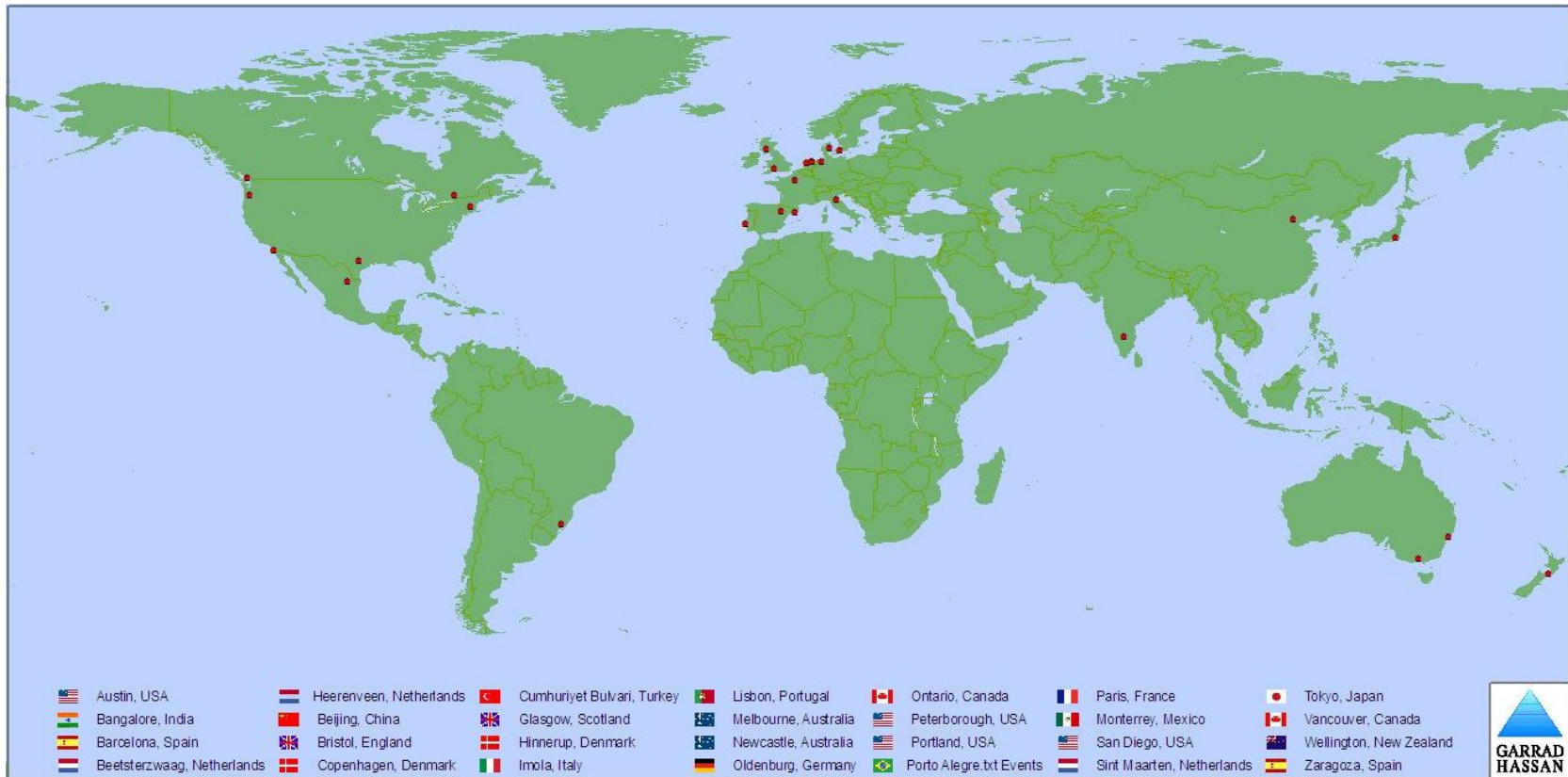
# Relevant work elsewhere

- **Technology Platform Wind (TP Wind)**
  - [www.windplatform.eu](http://www.windplatform.eu)
  - Running since 2007
  - Working Group 3: Wind Energy Integration
- **Tradewind study 2006-2008**
  - [www.trade-wind.eu](http://www.trade-wind.eu)
  - Power flows across Europe with very high wind penetration
  - UCTE, Nordel, GB and Ireland systems
- **European Wind Integration Study**
  - [www.wind-integration.eu](http://www.wind-integration.eu)
  - 15 European TSOs
  - Interim report in January 2009
- **Wind Energy the Facts**
  - [www.wind-energy-the-facts.org](http://www.wind-energy-the-facts.org)
  - Published 2009





# The Garrad Hassan view of grid integration of wind generation





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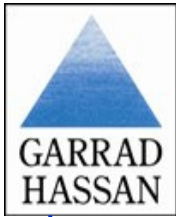
- The old view:
  - ‘Wind is the worst thing you can do to a power system’
- But modern wind turbine technology now has very useful characteristics:
  - Large power electronic converter
    - 100% of generator capacity (FC turbine)
    - ~30% of generator capacity (DFIG turbine)
  - Ample computing capability for control purposes
  - Often located on weak parts of the network



# What could be done?

- In principle, wind generation can:
  - When generating:
    - Contribute to frequency control (at some cost)
    - Provide an inertia function to respond to major disturbances
  - At all times:
    - Act as harmonic filter
    - Act as voltage compensator, to remove voltage dips
    - Remove voltage imbalance
    - Contribute to voltage control, by controlling reactive power very rapidly, over a wide range
    - Provide measurements of voltage, active and reactive power flows etc in real time from remote parts of the network

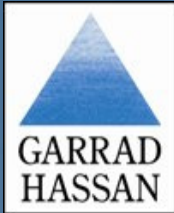




# The message for regulators

- Wind generation could provide services, widely spread across transmission and distribution networks, which avoid the need for network reinforcement or devices such as SVCs and Statcoms
- To achieve this, we need:
  - Clear statement of technical requirements for each function
    - not technology-specific
    - standardised where possible
  - Contractual framework to guarantee that the wind generation delivers these services to TSOs and DSOs
  - Payment for these services
  - Methodologies to allow TSOs and DSOs to include these capabilities in their network planning and operation.
- This may require ‘firm’ network connections.





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