

TSO Facilitation of Renewables Studies

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Overview

- Context and Background
 - All Island 2020 Grid Study
- Objectives and Areas of Study
 - What and why
- Indicative Time Lines
 - What and when



All Island 2020 Grid Study

- First comprehensive assessment of the ability of the power system to absorb large amounts of energy from renewable sources
- Five part study including:
 - Screening study
 - Resource assessment
 - Dispatch Study
 - Network Study
 - Cost Benefit Study

“However, in particular within the high penetration portfolios, a number of limitations of the studies methodologies have to be acknowledged.”

“The focus of technical follow up studies should be on the dynamic behaviour of the system accommodating high portions of renewable generation.”



TSO Renewable Facilitation Studies

Objectives:

- Increase our understanding of the behaviour of the power system with large amounts of renewable generation
- Identify any potential technical issues
- Develop mitigation measures
- Wrap it all up in a comprehensive strategy for the operation of the power system with large amounts of renewables

Outcome will inform:

- Future operational policies
- Grid code and standards
- Discussions on remuneration regimes for all generation

Areas of Study

- Dynamic Stability
- Fault Levels
- Congestion Management
- Reactive Power and Voltage Control
- Flexibility needs of the system
- Frequency Response of the system

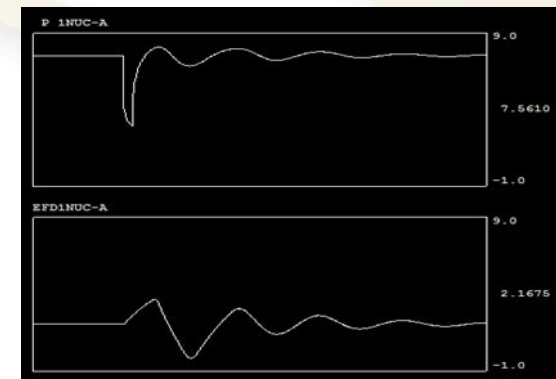
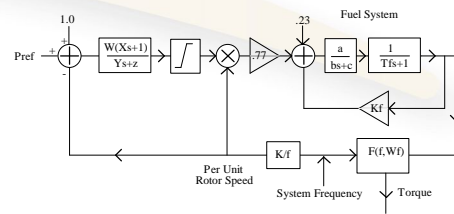
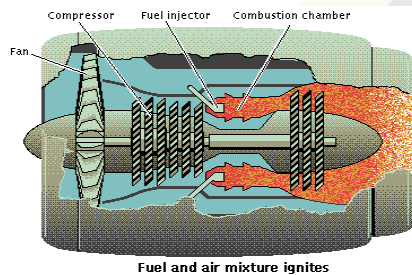


Dynamic Stability

How will machines and load respond and interact in the event of a system disturbance?

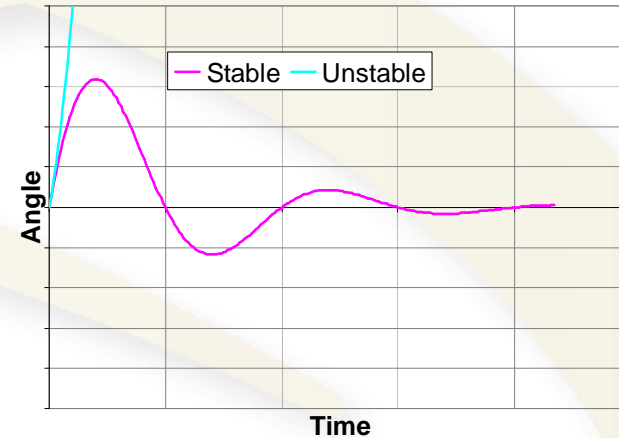
"...then we started another engine and threw them in parallel. Of all the circuses since Adam was born, we had the worst then! One engine would stop, and the other would run up to about a thousand revolutions, and then they would see-saw. The trouble was with the governors."

From "Edison, His Life and Inventions" by Frank Lewis Dyer



Dynamic Stability

- Investigations will cover three main areas of dynamic stability
 - Transient Stability (0 to 10 seconds)
 - Rotor angle stability
 - Dynamic Stability (0 to 1 minute)
 - Critical clearance times
 - Protection operation and philosophy
 - Small Signal Stability (steady state)
 - Steady state analysis
 - Under-damped modes?
 - Inter-area modes?



Fault Levels

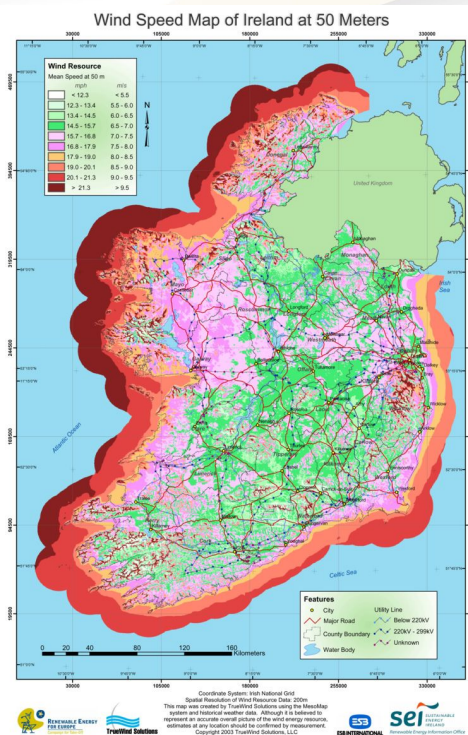
Will single and three phase faults at different points on the network be cleared safely and will protection operate correctly?

- With large amounts of wind power, fault levels, in general, will decrease.
- Will single and three phase faults at different points on the network be cleared safely and reliably and will protection operate correctly?
- What is the impact of increased levels of wind power on fault levels and protection operation?



Geographic Variability of Wind Generation

Will geographic variances in wind power lead to significantly increased congestion and how often is this likely to occur?



Studies will involve:

- Analysis of historical geographical wind patterns to identify potentially problematic geographical wind patterns
- Load flow studies to identify issues
- Probabilistic analysis to identify likelihood of occurrence

Image Credit: www.surfacepower.com

EIRGRID

SONi
System Operator for Northern Ireland

Flexibility Requirements

What are the flexibility needs of the system in 2020 resulting from increased uncertainty and variability of demand and generation?

Sources of Variability

- Demand
- Electric Vehicles
- Variable Generation

Sources of Uncertainty

- Demand forecast error
- Forecast error of variable generation sources
- Generator forced outages

Flexibility Requirements

- Reserve
 - Regulation Reserve
 - Primary Operating Reserve
 - Secondary Operating Reserve
 - Tertiary Operating Reserve
 - Replacement Reserve
 - Substitute Reserve
- Additional Reserve Products?
- Total ramping capability in MW/Min
- Minimum synchronous generation

Reactive Power and Voltage Control

What are the reactive power needs of the system in 2020, how will voltage be controlled and what role will wind generation play?

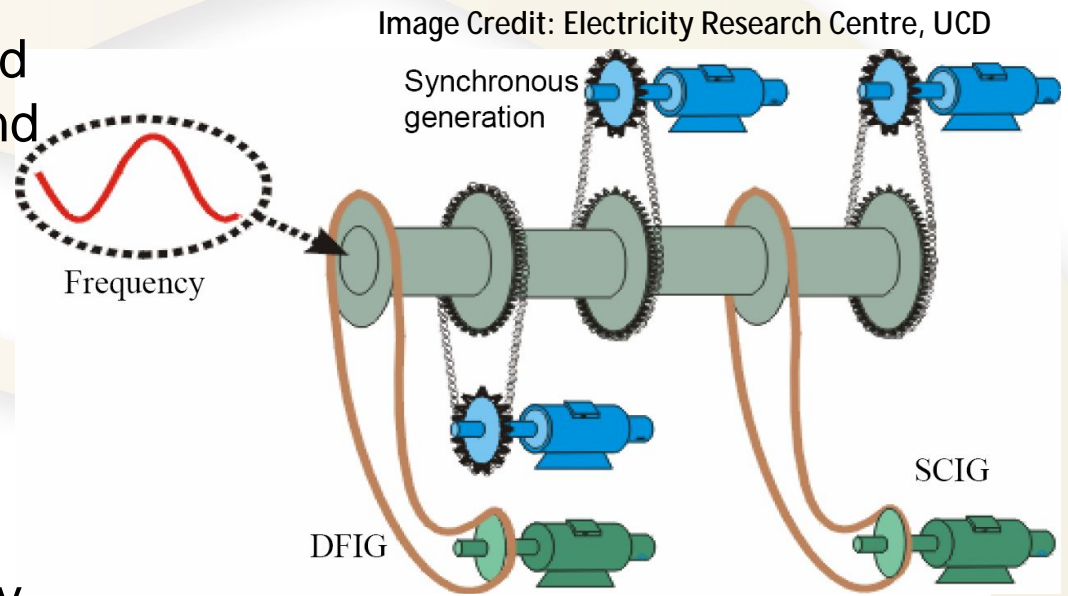
- Reactive power compensation requirements for the power system in 2020
- Voltage control regimes with large amounts of wind power connected to the distribution system
 - Utilisation of distribution wind farm reactive power capability
 - Voltage control regimes for wind farms and/or wind farm clusters
- Voltage control strategy



Frequency Performance

In the event of a generation or load loss event, will system frequency performance be adequate with large amounts of wind power?

- How will the system respond in a variety of generation and load loss events with large amounts of wind power?
- Is a minimum level of synchronous generation required?
- What role can wind generation play in frequency control



Wrapping it All Up

- What are the technical issues?
- How do we solve or mitigate them?
- What are the impacts on:
 - Real time dispatch and control
 - Forecasting and its role in decision making
 - Codes and standards
 - Ongoing studies and planning

Towards a comprehensive operational strategy backed up by study and analyses of all the technical issues



Approximate Timelines

- April 2009: RFP Issue
- June 2009: Contract Commencement
- August 2009: Interim Reports
- December 2009: Final Report



Thanks for your attention.

Questions?

