

**Facilitation of Renewables Next Steps:
Programme for a Secure, Sustainable Power System**

January 2011

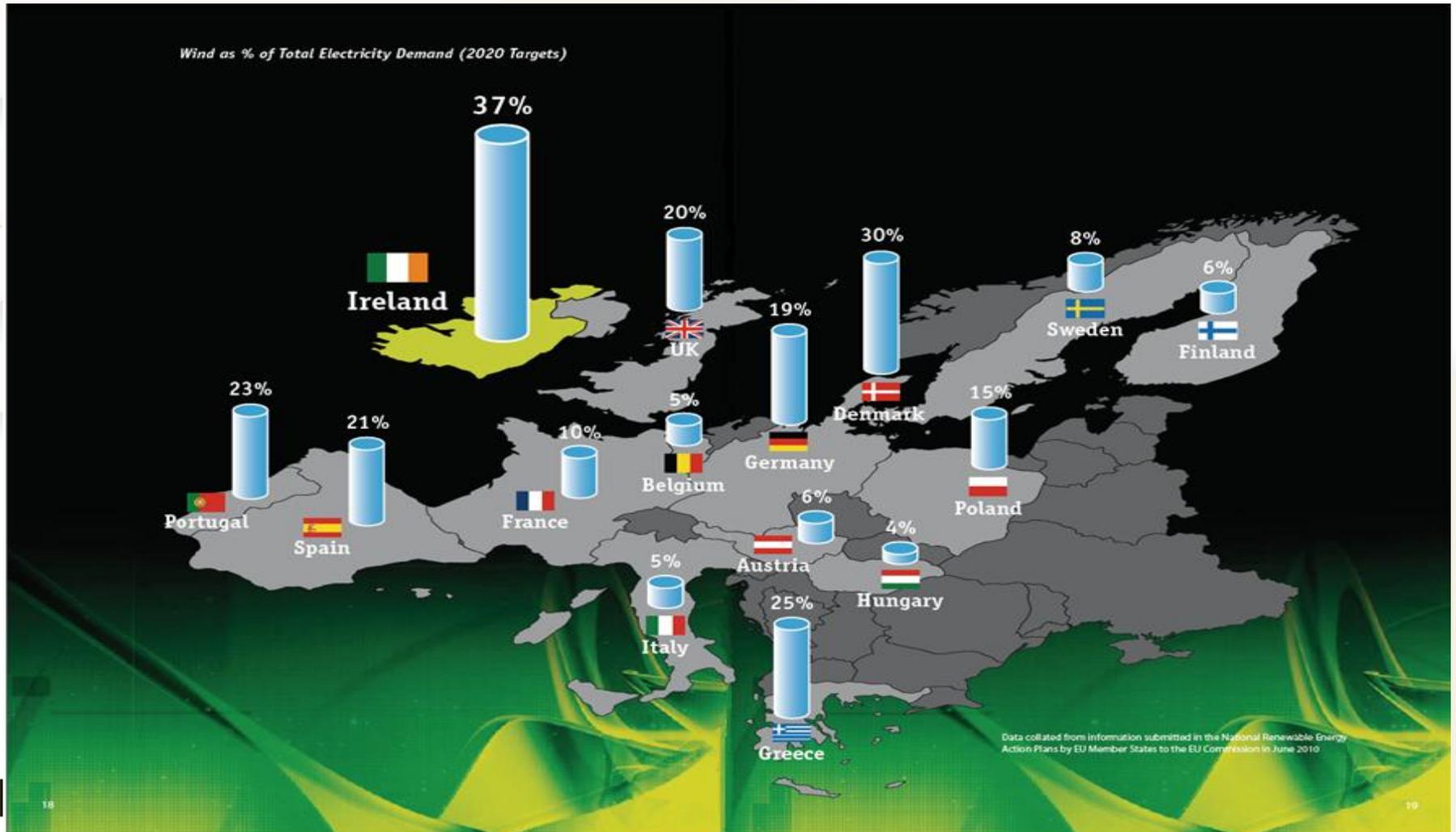
Yvonne Coughlan



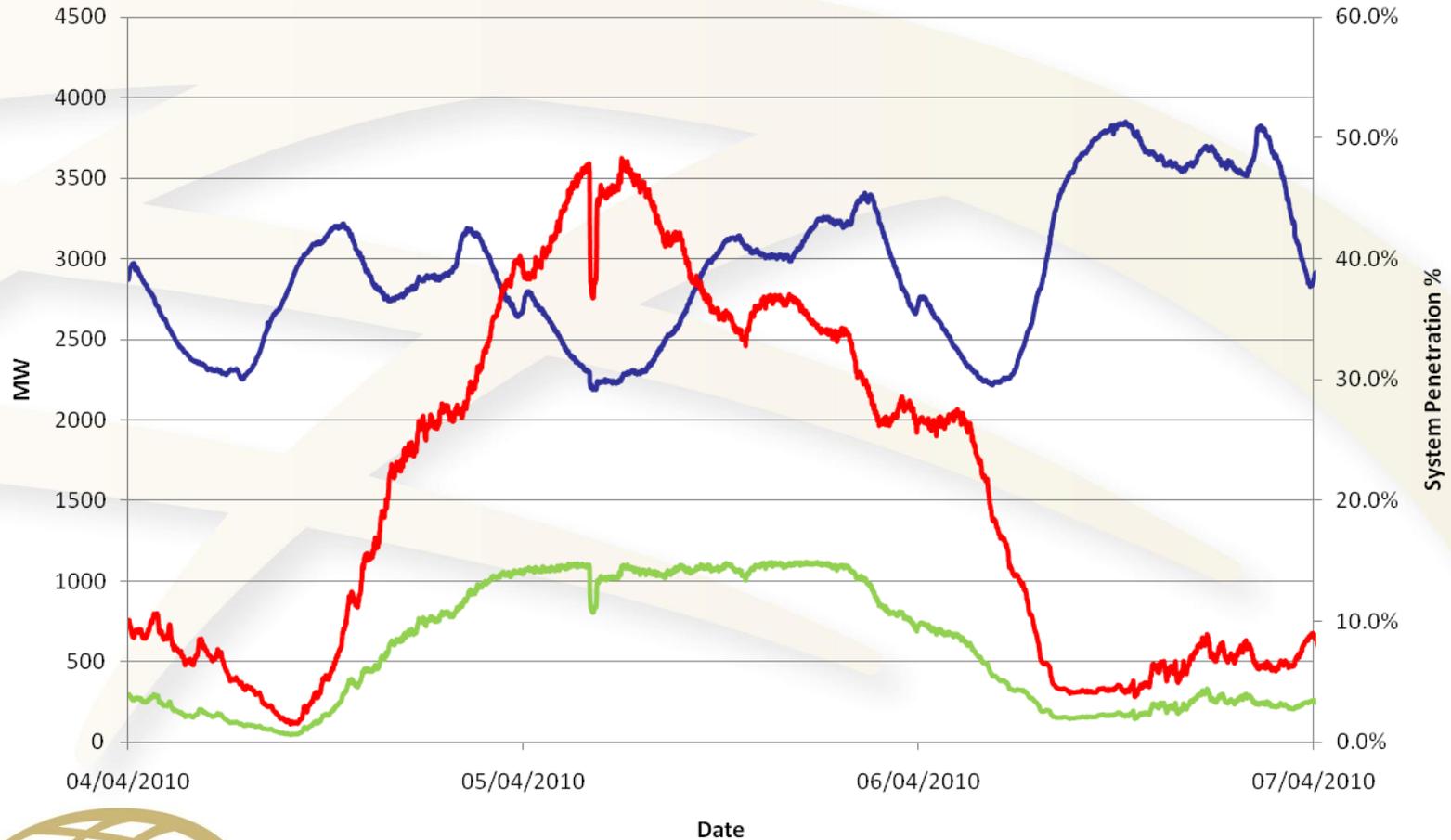
Ireland and Northern Ireland Wind Statistics

	Ireland	Northern Ireland
Installed	1416 MW	340 MW
Maximum Output	1259 MW	314 MW
Highest Instantaneous %	52.3 %	50 %
Highest Daily Energy	37%	29%
Annual Output % 2010	10%	7.2%

European NREAP 2020 Wind Figures



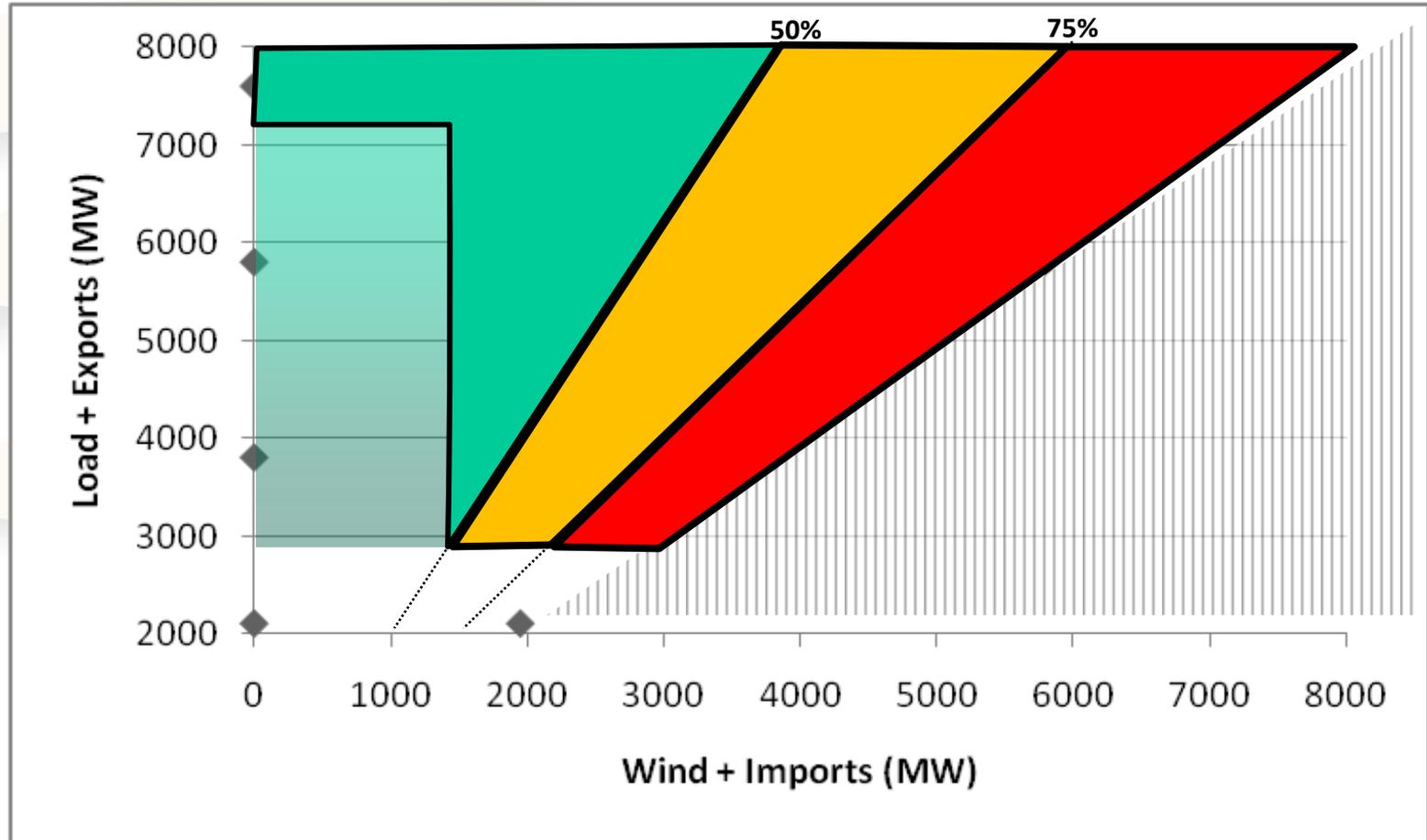
Instantaneous penetration of Wind in Real Time



— Wind — Demand — %

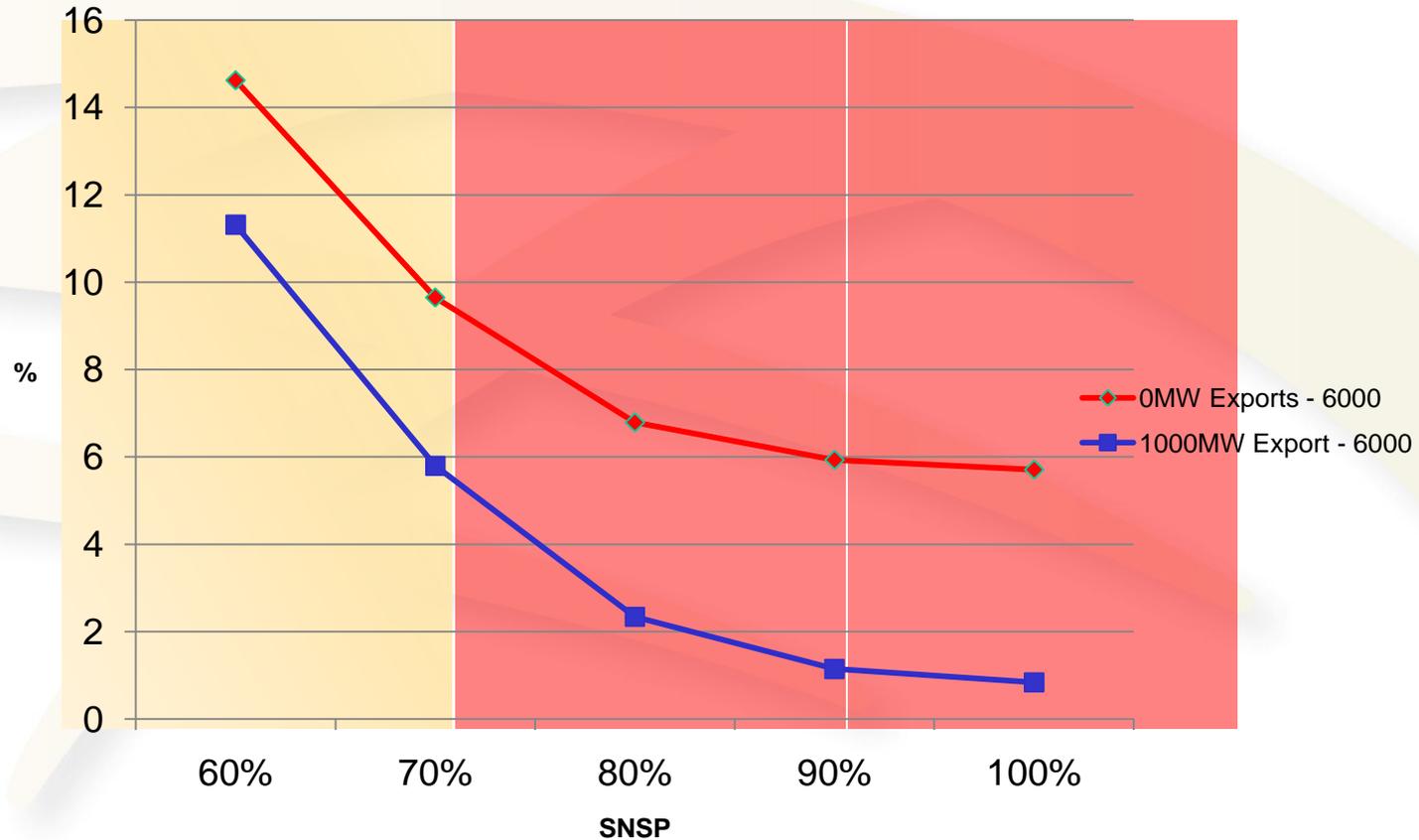
Operational Boundaries

System Non-Synchronous Penetration (SNSP)

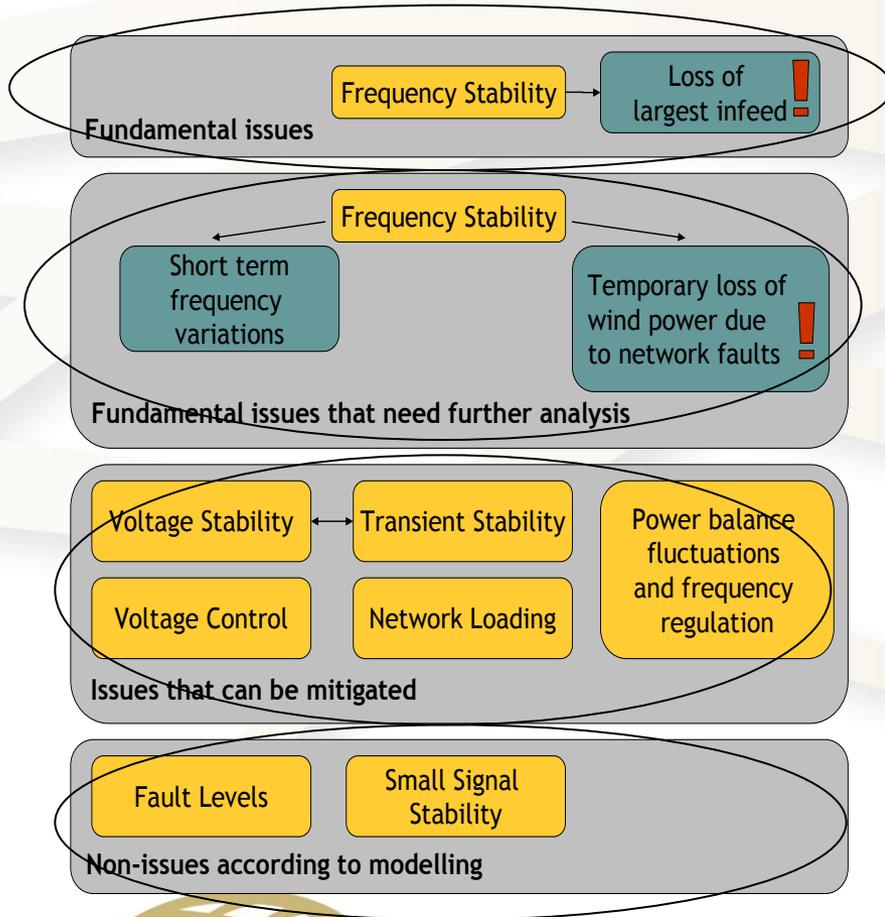


Curtailment and SNSP

Pushing the operational envelope



Key findings and actions to address each

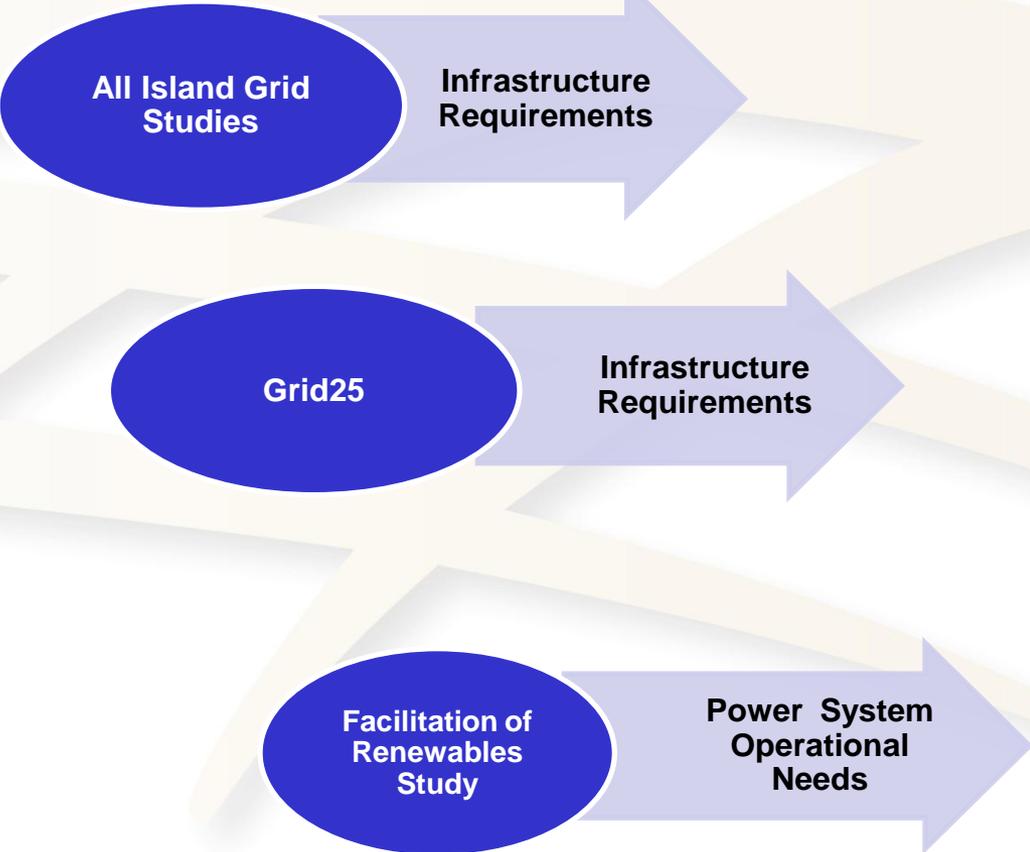


- RoCoF capability and protection
- Conventional Generator Reserve performance
- Wind farms controllability and reactive power capability
- Enhance and develop operating procedures including embedded wind farms

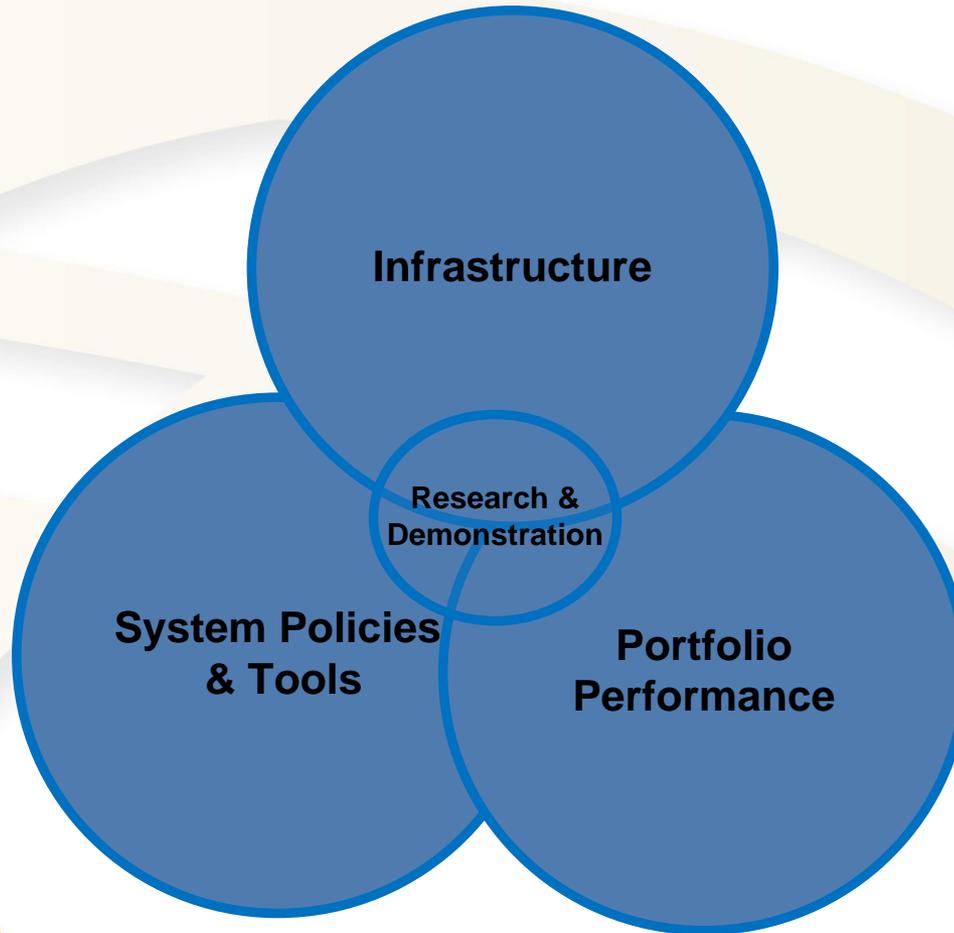
Key actions arising from FoR studies

- Review the **RoCoF capabilities** of generators and distribution protection.
- Recommend **full enforcement of all appropriate Grid Codes** standards universally.
- Recommend developing new standards where the industry currently consider standards inappropriate and enforcing those.
- Develop new **operational practices and enhance existing practices.**
- Review **market and support mechanisms.**

Programme for a Secure Sustainable Power System



Programme for a Secure Sustainable Power System

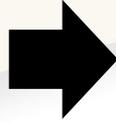


Infrastructure

Power System Access

Transmission reinforcement solutions

Renewable Generation Constraints



Plan

Building the infrastructure

- Ensure the delivery of the necessary **transmission and distribution infrastructure** to facilitate access to the power system for significant renewable generation e.g. Gate 3 Programme of Offers
- Ensure the delivery of the necessary transmission infrastructure i.e. **Grid 25 Implementation Plan and Northern Ireland Plan** and continue to investigate new technologies

Infrastructure

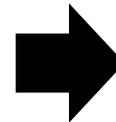
Power System Access

Transmission reinforcement solutions

Renewable Generation Constraints



Facilitate Cross Border Trading Opportunities



Plan

Building the infrastructure

- Ensure the delivery of the necessary transmission and distribution infrastructure to facilitate access to the power system for significant renewable generation e.g. Gate 3 Programme of Offers
- Ensure the delivery of the necessary transmission infrastructure i.e. Grid 25 Implementation Plan and Northern Ireland Plan and continue to investigate new technologies

Interconnection

- Ensure the delivery and successful operation of the EWIC and continue to investigate opportunities for further interconnection



Infrastructure

Power System Access

Transmission reinforcement solutions

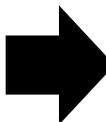
Renewable Generation Constraints



Facilitate Cross Border Trading Opportunities

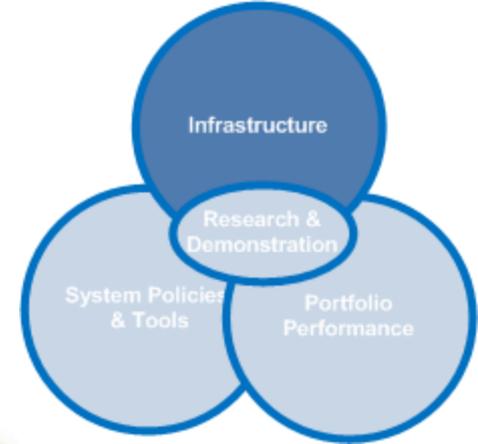


Investigate offshore Grid



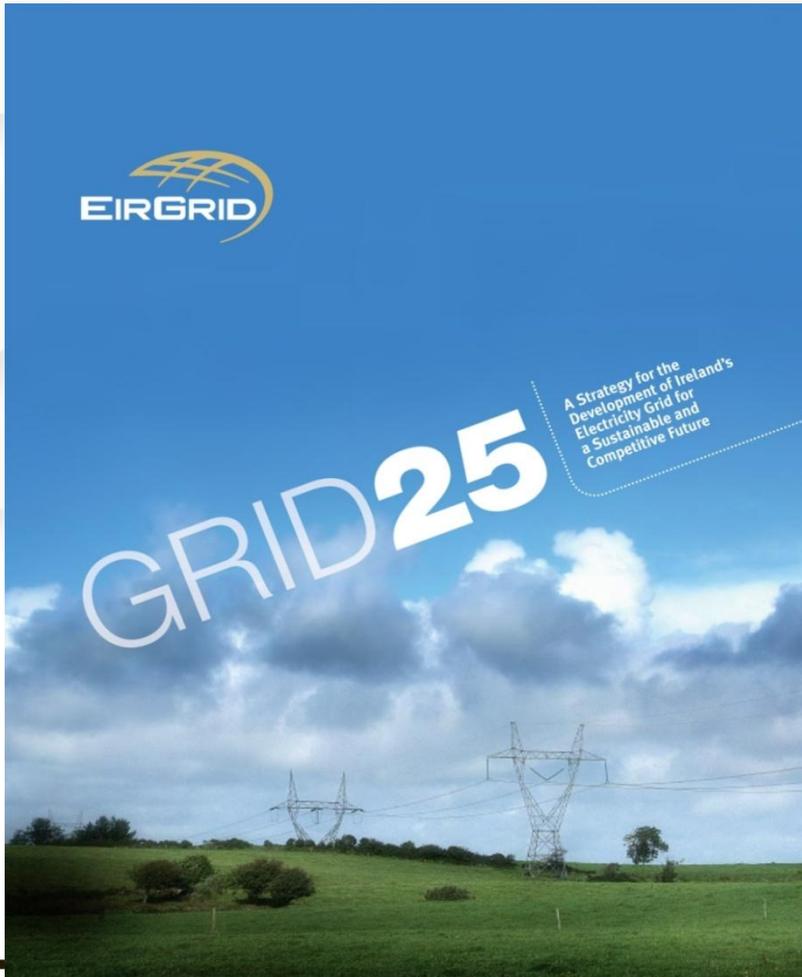
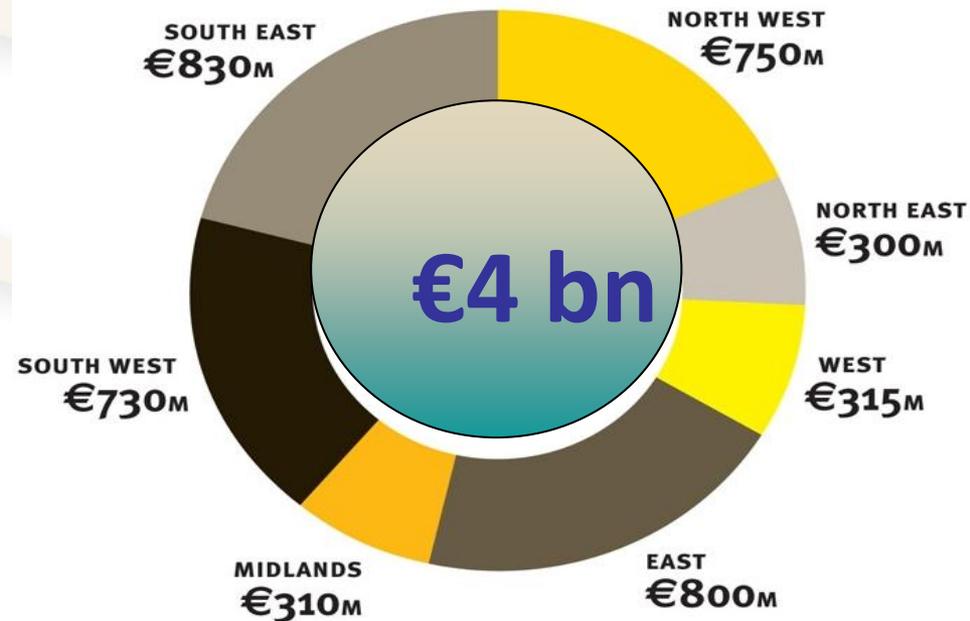
Plan	
Building the infrastructure	<ul style="list-style-type: none"> • Ensure the delivery of the necessary transmission and distribution infrastructure to facilitate access to the power system for significant renewable generation e.g. Gate 3 Programme of Offers • Ensure the delivery of the necessary transmission infrastructure i.e. Grid 25 Implementation Plan and Northern Ireland Plan and continue to investigate new technologies
Interconnection	<ul style="list-style-type: none"> • Ensure the delivery and successful operation of the EWIC and continue to investigate opportunities for further interconnection
Offshore Grids	<ul style="list-style-type: none"> • Input into various Offshore Grid Initiatives

Developing the Grid



2,200 km Upgrades

1,150 km New Build



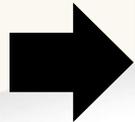
Report is available for download at <http://www.eirgrid.com/aboutus/publications/>

System Policies

Frequency Stability/Transient Stability

RoCoF protection relays

System Non Synchronous Penetration (SNSP)



Plan	
System Security	<ul style="list-style-type: none">• Ensure the continued secure operation of the all island power system with high levels of variable renewable generation.• Includes monitoring ongoing reserve needs of power system, system inertia requirements and the frequency response of the system.



System Policies

Frequency Stability/Transient Stability
RoCoF protection relays
System Non Synchronous Penetration (SNSP)

Voltage Control
Grid Code Compliance of the wind portfolio

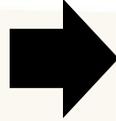


Plan	
System Security	<ul style="list-style-type: none">Ensure the continued secure operation of the all island power system with high levels of variable renewable generation. Includes monitoring ongoing reserve needs of power system, system inertia requirements and the frequency response of the system.
Reactive Power	<ul style="list-style-type: none">Derive and implement an all island Reactive Power Management Strategy for both transmission and distribution connected plant. Includes clarification of existing standards.



System Tools

Management variable renewable
generation in real time



Plan	
Wind Dispatch	<ul style="list-style-type: none">• Enhance the Wind Dispatch tools and capability in the Control Centres



System Tools

Management of significant variable renewable generation in real time



Transient Stability/ Voltage Stability
Real Time Monitoring
Controllability



Plan	
Wind Dispatch	<ul style="list-style-type: none">Enhance the Wind Dispatch tools and capability in the Control Centres
Control Centre Tools & Capabilities	<ul style="list-style-type: none">Enhance the operational capability of the Control Centres through tools such as dynamic online wind assessment tool (WSAT) and enhanced remote control facilities.



System Tools

Management of significant variable renewable generation in real time



Frequency Stability & Voltage Stability

Real Time Monitoring

Controllability



Management of resource variability

System Non -Synchronous Penetration



Plan	
Wind Dispatch	<ul style="list-style-type: none">Enhance the Wind Dispatch tools and capability in the Control Centres
Control Centre Tools & Capabilities	<ul style="list-style-type: none">Enhance the operational capability of the Control Centres through tools such as dynamic online wind assessment tool (WSAT) and enhanced remote control facilities.
Forecasting	<ul style="list-style-type: none">Continue to ensure that the best in class forecasting tools are used by the Control Centres.Investigate potential alternative forecasting methods and options for unit commitment



System Tools

Management of significant variable renewable generation in real time



Frequency Stability & Voltage Stability
Real Time Monitoring
Controllability



Management of resource variability
System Non -Synchronous Penetration



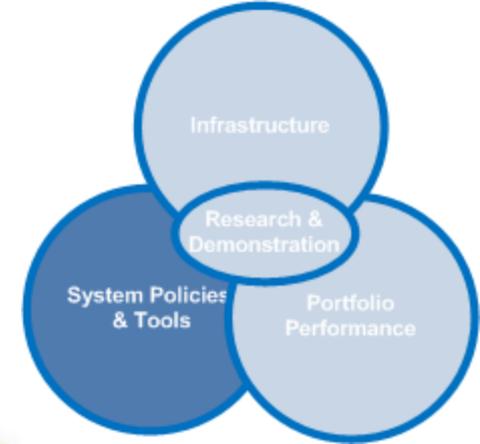
Model Refinement
System Frequency Stability, Frequency Response & Voltage Stability



Plan	
Wind Dispatch	<ul style="list-style-type: none"> Enhance the Wind Dispatch tools and capability in the Control Centres
Control Centre Tools & Capabilities	<ul style="list-style-type: none"> Enhance the operational capability of the Control Centres through tools such as dynamic online wind assessment tool (WSAT) and enhanced remote control facilities.
Forecasting	<ul style="list-style-type: none"> Continue to ensure that the best in class forecasting tools are used by the Control Centres. Investigate potential alternative forecasting methods and options for unit commitment
Studies	<ul style="list-style-type: none"> Continue to study the response of the power system with significant renewable penetration levels. Improve the accuracy of modelling of all plant and carry out further investigations on the SNSP levels

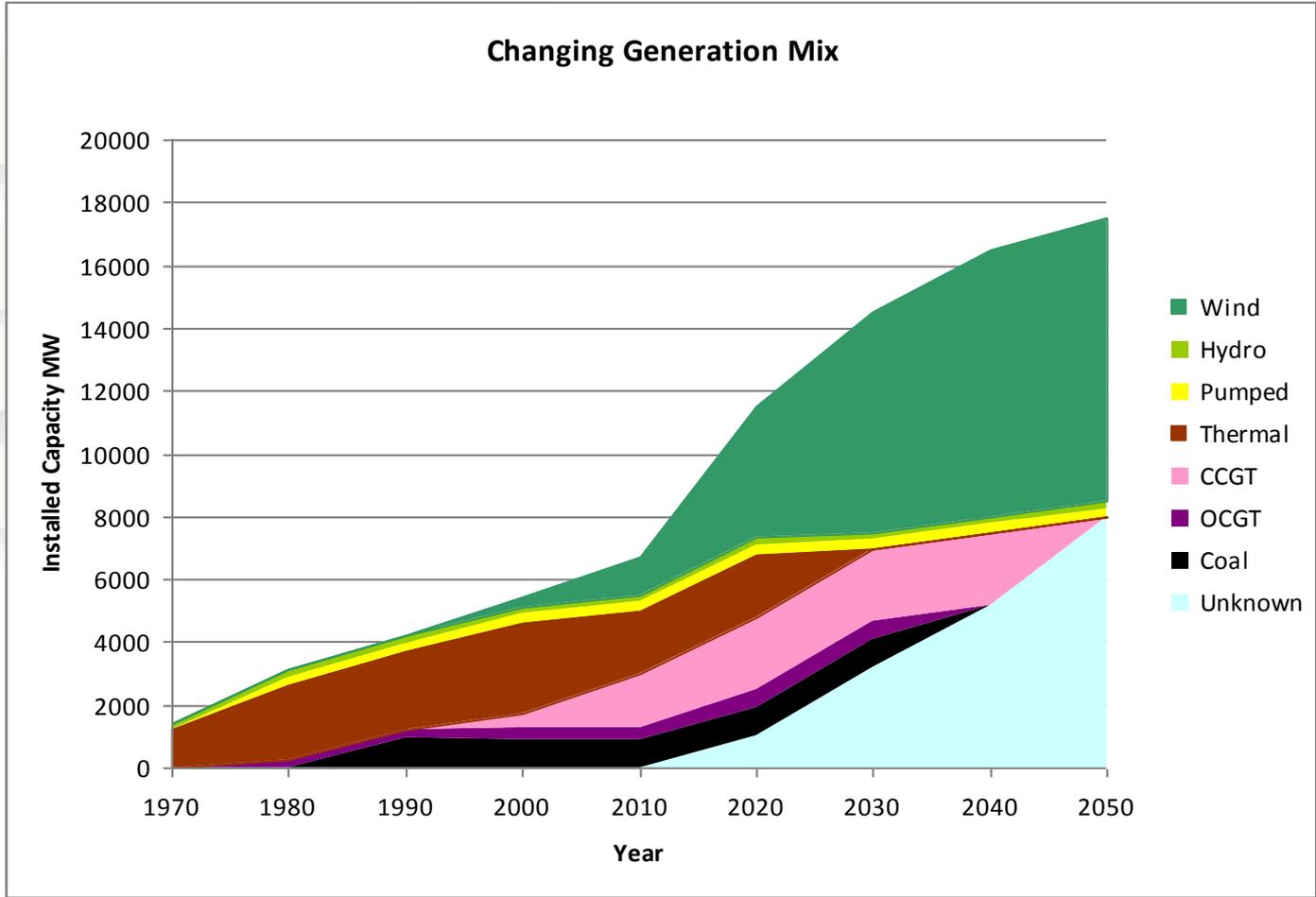
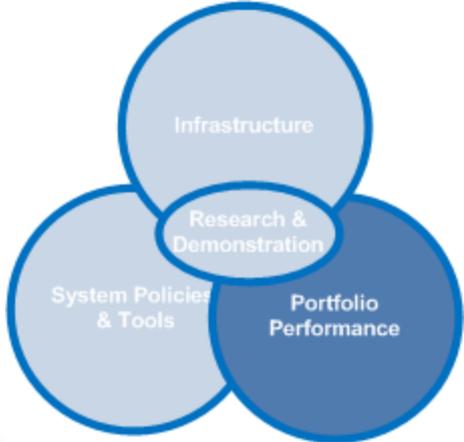
System Policies & Tools

Pushing the operational envelope



- Real-time status and analysis of system stability and integrity
- On-line dispatch of wind farms
- Remote control facilities across critical transmission assets
- Advanced forecasting and commitment support tools
- Identification of secure SNSP operational levels

Portfolio Performance: Changing Portfolio



Source: O’Riordan, Government White paper and assumptions on plant life length

Portfolio Performance

Accurate knowledge of System Performance

System Policies



Plan	
Performance Standards	<ul style="list-style-type: none">• Ensure the performance of all plant to the required standards through enhanced performance monitoring and extension of generator performance incentives.



Portfolio Performance

Accurate knowledge of System Performance

System Policies

Credible Grid Code Compliance of the entire plant portfolio

System Non-Synchronous Penetration

Plan

Performance Standards

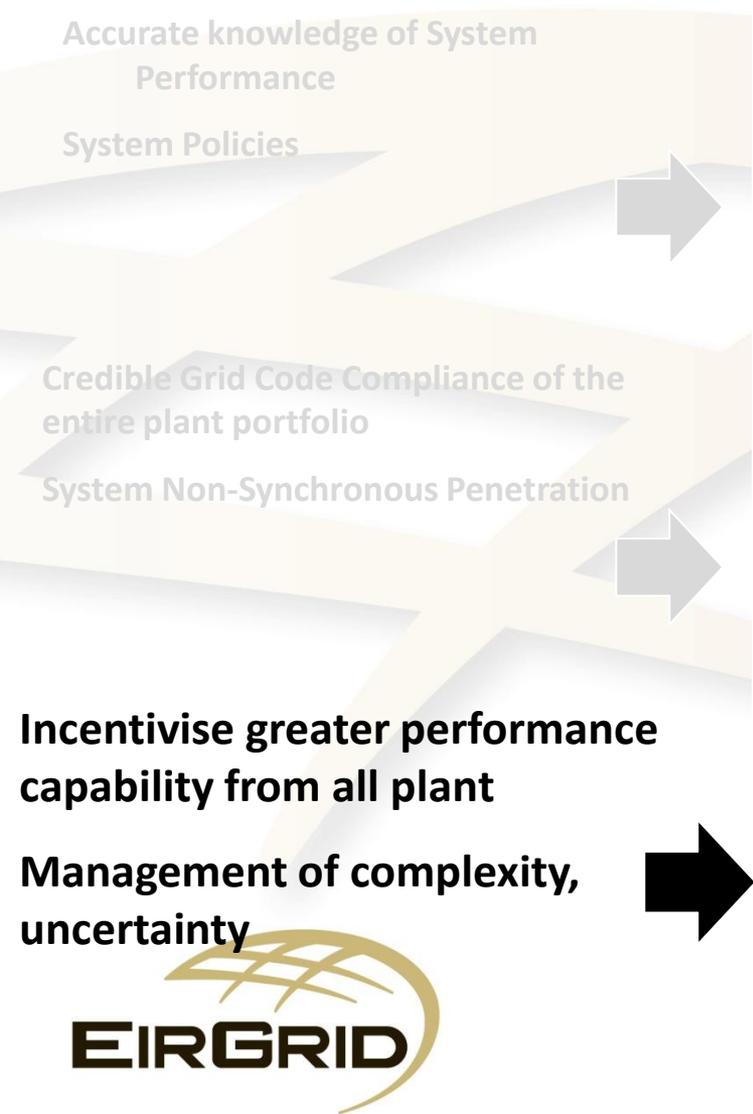
- Ensure the performance of all plant to the required standards through enhanced performance monitoring and extension of generator performance incentives.

Grid Code

- Development of Grid Code to include clarification of existing standards and development of standards for new technologies. Input into European Grid Code Development

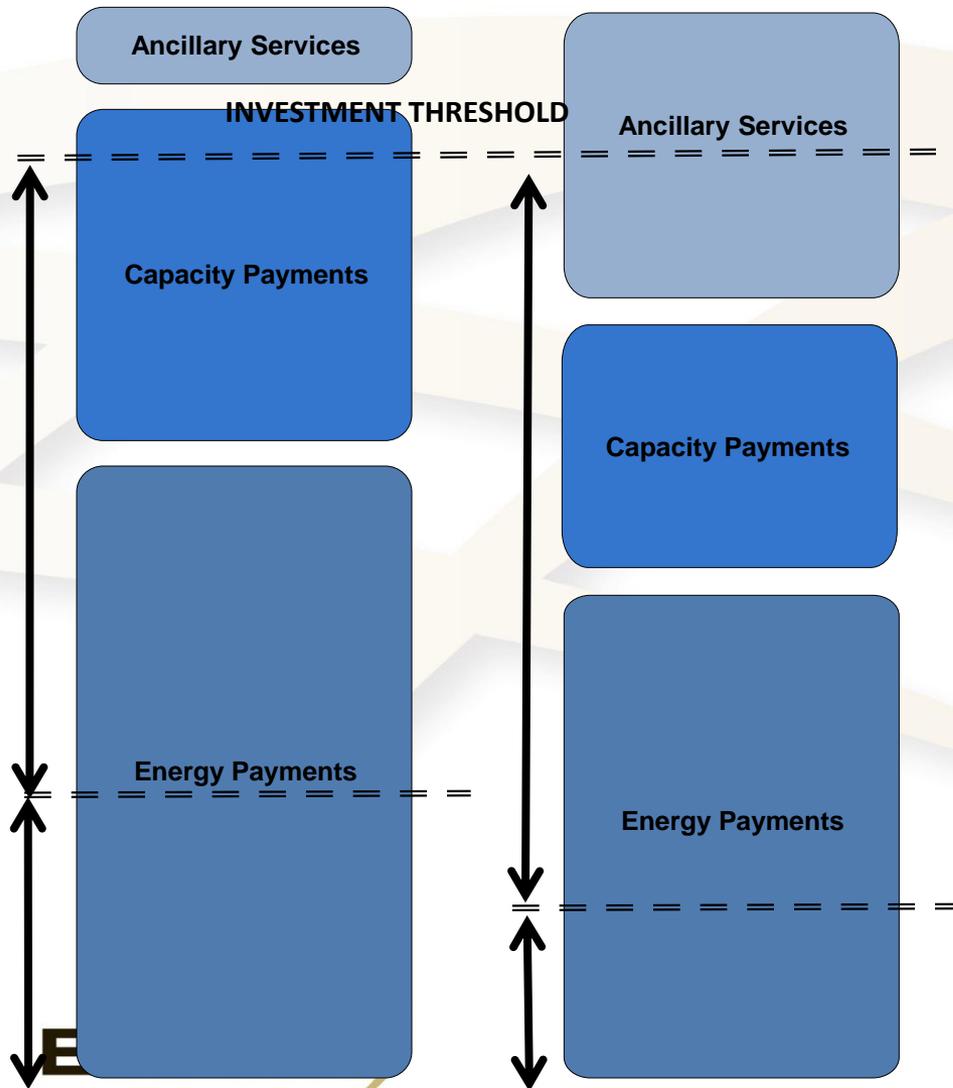
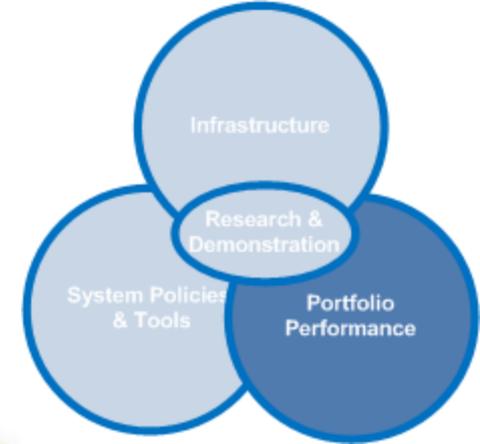


Portfolio Performance



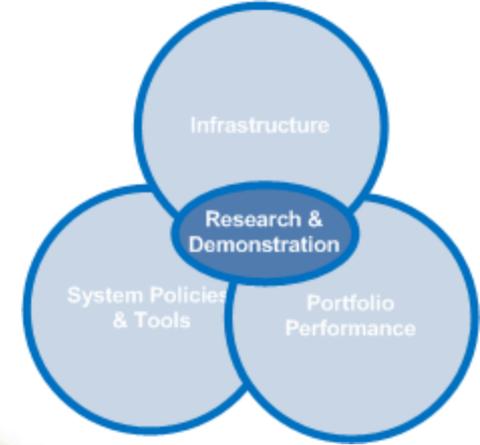
Plan	
Performance Standards	<ul style="list-style-type: none">• Ensure the performance of all plant to the required standards through enhanced performance monitoring and extension of generator performance incentives.
Grid Code	<ul style="list-style-type: none">• Development of Grid Code to include clarification of existing standards and development of standards for new technologies. Input into European Grid Code Development
Commercial	<ul style="list-style-type: none">• Provide the necessary commercial incentives/mechanisms to ensure the delivery of a sustainable and efficient plant portfolio that meets the needs of the system

Incentivising Portfolio Performance



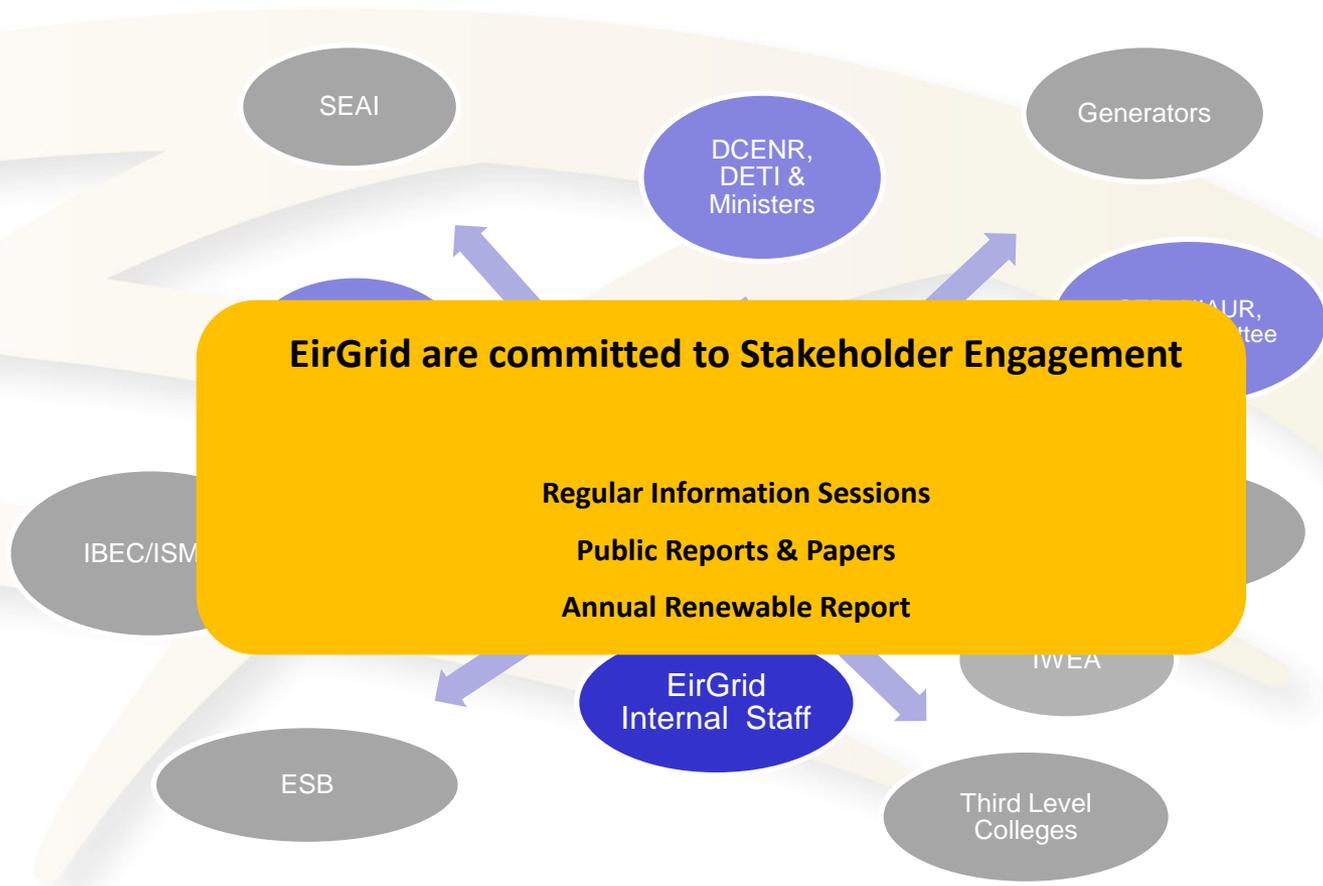
- Financial Mix will move to higher capital lower variable cost technologies
- Obtaining the plant mix that matches the system requirements and achieves the policy objectives

Research & Demonstration



- Engage with universities on research areas of interest
- Steer research projects based on experience
- Identify opportunities for demonstration of concepts/new policies

Stakeholder Map



Questions and Answers

