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THE BIG CHALLENGE & YOUR VIEW of IT

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Introduction

Business as usual

Security of the system cannot be ensured without considering the technical capabilities of all users.

Historically large synchronous generation facilities have formed the backbone of providing technical capabilities.

Future

In 10 - 15 years time it is expected that in the synchronous areas of Ireland & GB, up to 100% of the load may be supplied by RES alone for a few hours each year.

System Integrity Limits (SIL)

Business as usual has a SIL in context of non synchronous generation of approximately 50%, not a average but in real time.

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Introduction

System Integrity Limits (SIL)

- 10% average, roughly 50% maximum
- How to move SIL from 50% towards 100%??
  - Major study published for Ireland indicated 50% of non synchronous generation is the SIL for synchronous areas.

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Introduction – OVERVIEW OF OPTIONS TO COPE WITH CONSEQUENCES OF INCREASED RES INTEGRATION (table 2)

Option	Pros	Cons
Synchronous conventional generators are required to provide the most significant services	: No significant change from today.	: Cost constraining off RES. : CO_2 emissions - RES constraint off. : 100% CO_2 free production only with nuclear and CCS. : Risk of lack of system services.
RES generators to provide their share of the system services	: No additional CO_2 emissions for voltage support services.	: RES has to be constrained (and therefore wasted). : Embedded generation needs full control.
Extensive Building of storage systems	: Only limited CO_2 emissions (from less than 100% cycle efficiency). : Supports RES integration.	: New storage systems have to be built Europe wide . : Feasibility not is all areas. : High environmental impact.
Demand facilities contribute a share of system services	: No additional CO_2 emissions. : Supports RES integration. : Services have the potential to be provided at low cost & minimum impact. : Highly reliable - risk spread. : Consumers are able to participate in market to reduce CO_2 and will pay less.	: Public perception of possible inconvenience. : Public acceptance. : DSOs need to contribute more towards managing a system with high RES (e.g. voltage).

2005 Data Re-run with 40GW Wind Installation
Three Winter Months - Dec to Feb
Net demand = Demand – Wind Output . Negative 2% of year!

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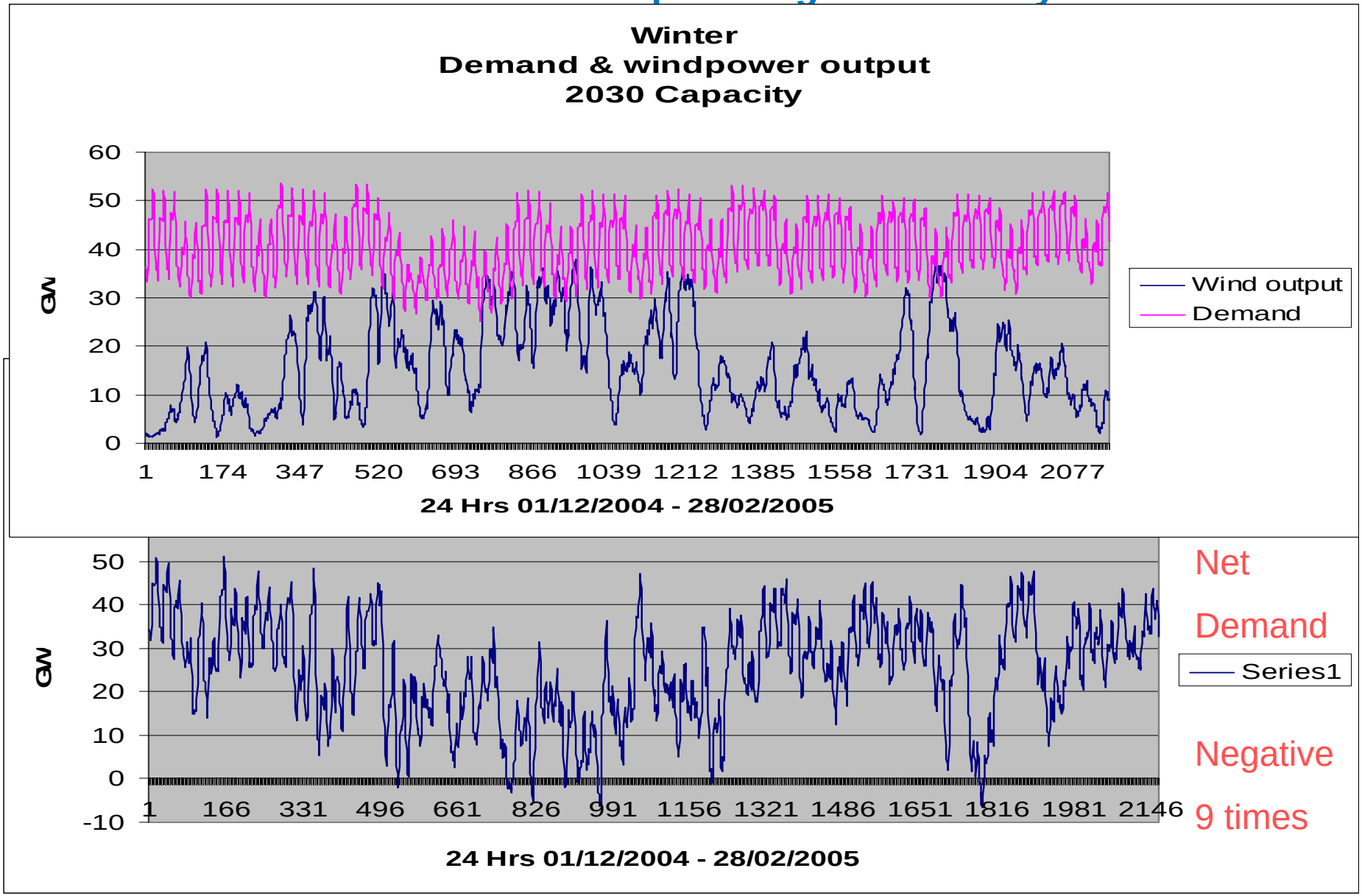

High RES Production During Modest Demand 4-6 times Higher Than Average Over Year

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Denmark – 20% on energy – 110% max instantaneous.

In GB wind is expected to dominate RES non-synchronous & converter based.

What % wind energy & max penetration in:

Year	2010	2020	2030	2040	2050
Wind Capacity (GW)	3	28	49	50	51
Wind Energy %	3%	22%	34%	28%	25%
Max Penetration (X5)	15%	110%	170%	140%	125%
Total Energy (TWh)	381	373	426	476	522
Total Capacity (GW)	80	115	147	148	158

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Questions to Stakeholders

- Do you agree there is a Big Challenge ahead**?**
- What is your view of the high level analysis in Table 2**?**
- Should demand facilities contribute a share of system services**?**

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THANK YOU for YOUR INPUT