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International Experience in Transmission Planning and Delivery

ITPR:

Challenges and Options for future GB transmission arrangements

Goran Strbac, Michael Pollitt, David Newberry, Richard Green, Christos Vasilakos Konstantinidis, Rodrigo Moreno, Ioannis Konstantelos

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Content

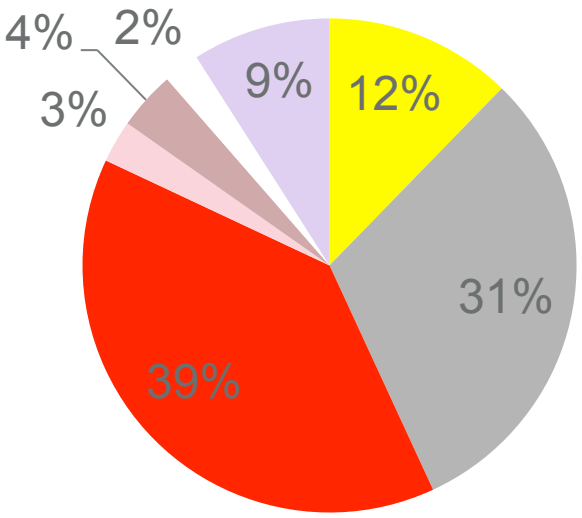
- Context: Implications of UK Government policy on GB transmission network
- Summary of GB Transmission Regimes
- Key objectives of *Integrated Transmission Planning and Regulation* (ITPR) Project
- Options for future GB transmission arrangements
- Agenda for the workshop

GB Electricity System

Total installed capacity : **81 GW**

Peak demand in 2011: **58.1GW**

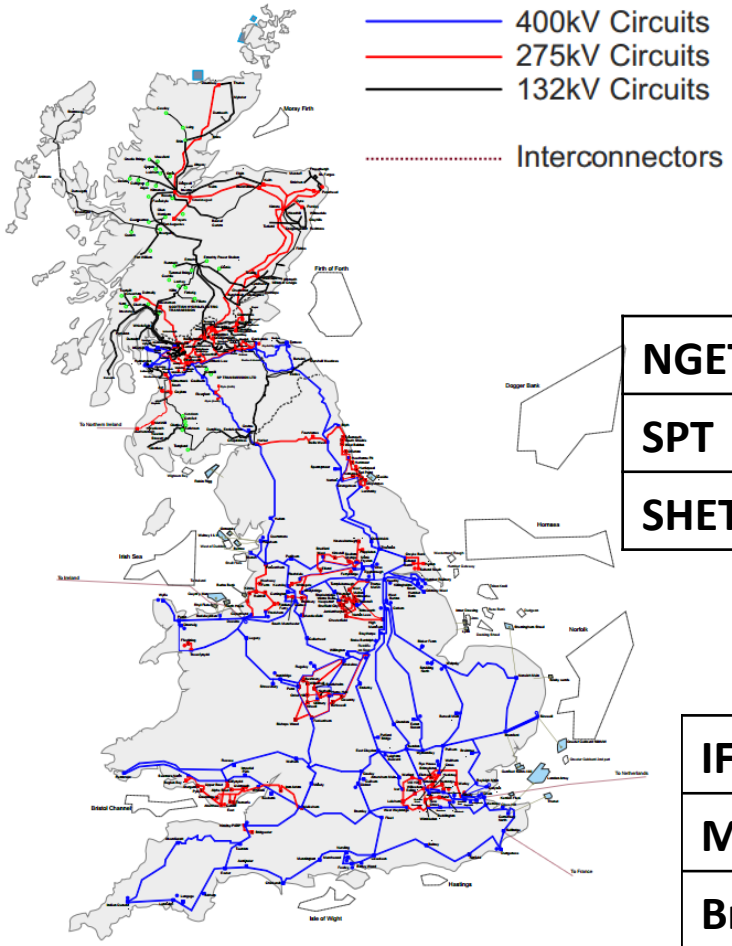
Installed Capacity Mix



Nuclear	10 GW
Coal	25 GW
Gas / CHP	31.5 GW
Offshore Wind	2.2 GW
Onshore Wind	3.1 GW
Other Renewables	1.9 GW
Other (Oil / Pumped)	7.3 GW

Source: National Grid, 2012 Ten Year Electricity Statement

GB Transmission Network



GB Onshore TOs

	OHL (km)	Cable (km)	Peak Demand (GW)	Connected Generation (GW)
NGET	14,000	700	52.4	70
SPT	3,700	300	4.1	7.5
SHETL	5,000	70	1.6	3

Interconnectors

IFA	GB – France	2000 MW
Moyle	GB – Northern Ireland	450 MW
BritNed	GB – Netherlands	1000 MW
East-West	GB – Republic of Ireland	500 MW

Source: National Grid, 2012 Ten Year Electricity Statement

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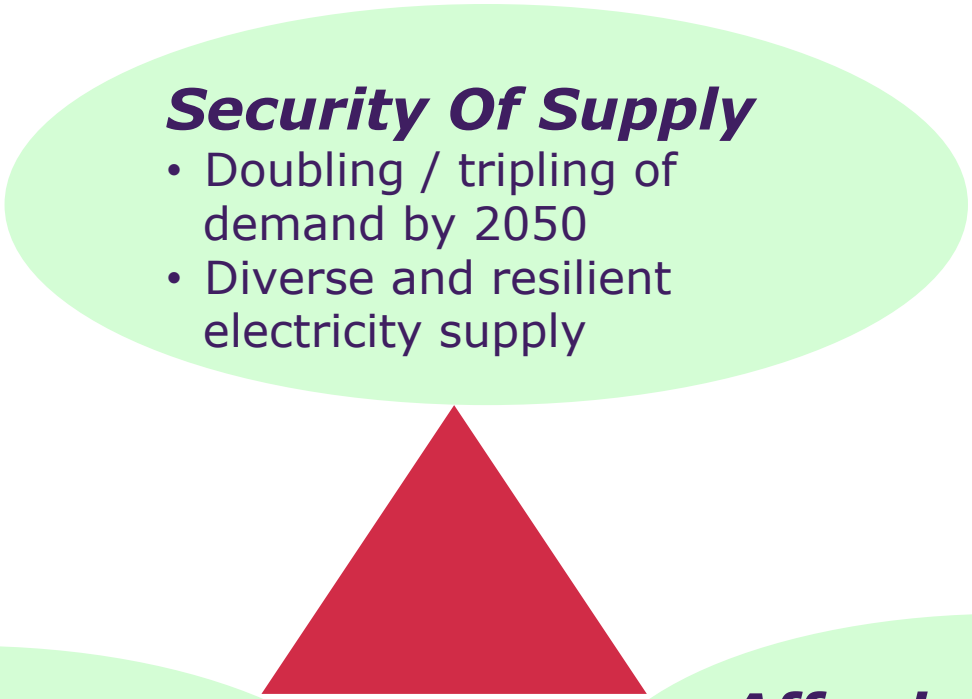
UK Government energy policy objectives and Energy Market Reform



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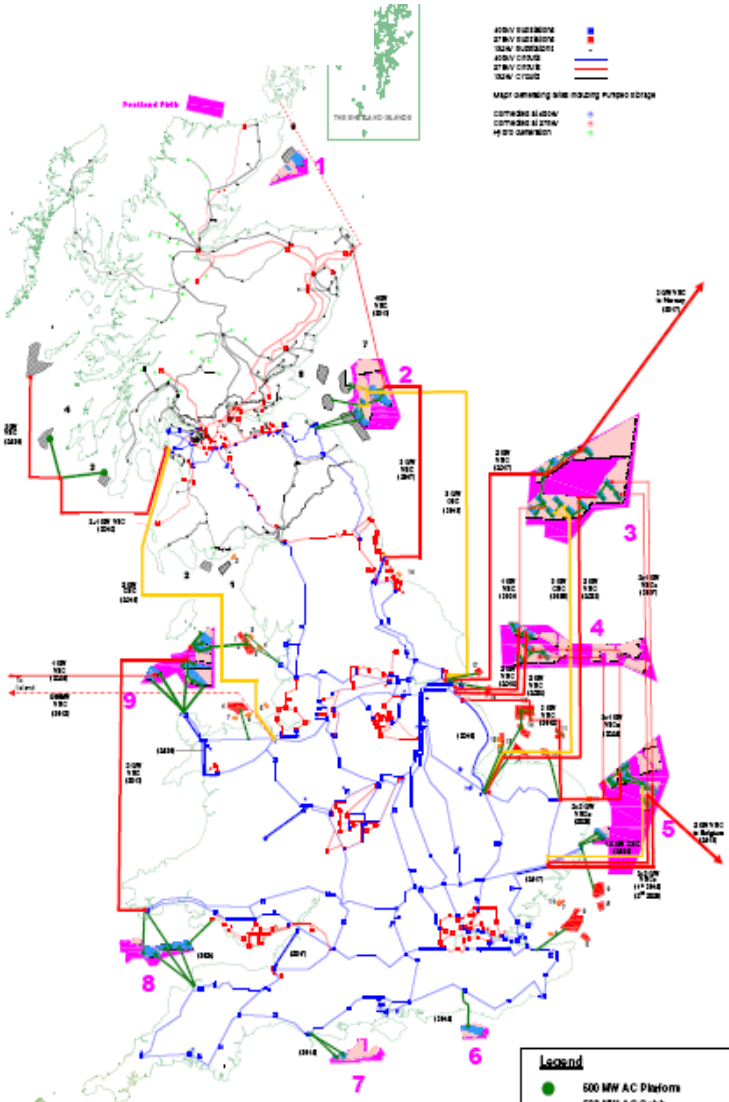
UK Response to Climate Change Challenge

- 2020: 30% of all electricity demand to be met by renewable generation
- 2030+:
  - Largely decarbonised electricity generation, while……
  - Electrifying segments of transport and heat sectors

…in order to reduce CO2 emissions by 80% by 2050



Scale of expected investment and role of UK Energy Market Reform

Investment in Electricity Infrastructure by 2020:

1. Generation £75bn

2. T & D Networks £35bn

Energy Market Reform:

1. Long Term Contracts for Low Carbon Power (CfD)

2. Capacity Mechanism

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Where are we now?

Planning : Decentralised

- **System operator:** real time operation and balancing
- **Transmission owners:** devise plans based on grid users commitment, some strategic planning possible
- **Interconnection:** developed by third parties in discrete projects

Q: Why do we do this?
A:User commitment – the users decide … Drives efficiency, reduces stranding. Optimises network according to need. Multiple inputs guide network build out

Delivery: Multiple Choices

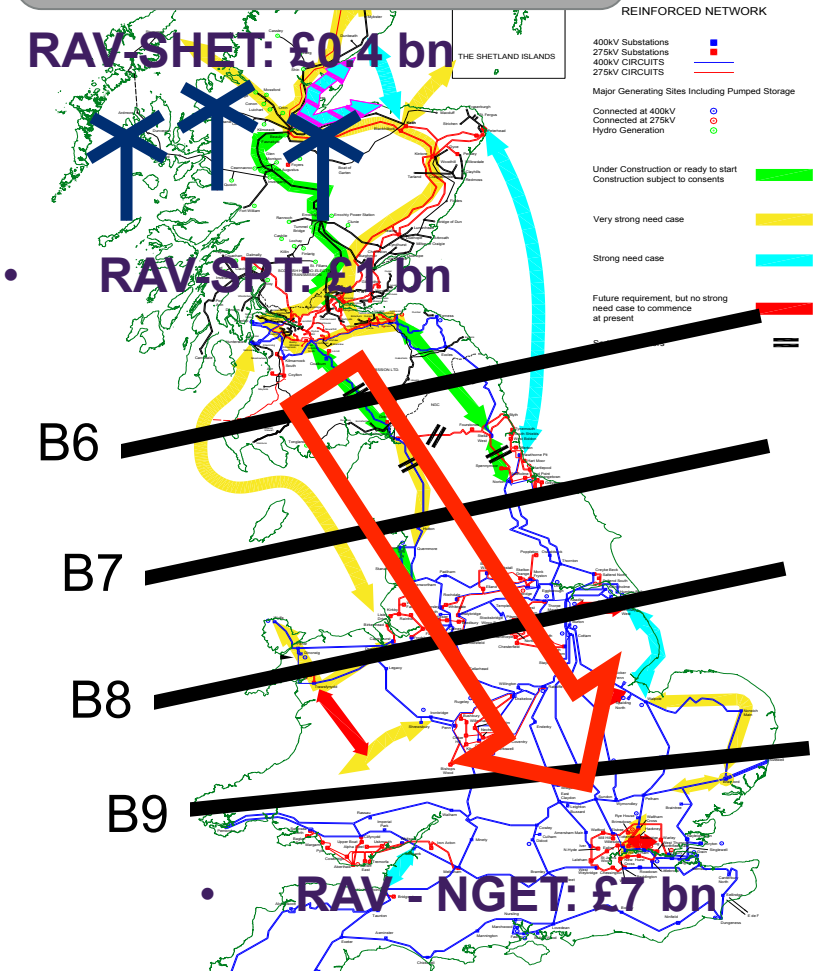
- **Onshore** – Monopoly regulated TOs
- **Offshore** – Competitive tender for reg revenue stream
- **Cross-Border** – Third party contestable

Q: Why do we do this?
A: Capitalise on differences in infrastructure profiles. Drive efficiencies by allowing alternatives to financing, construction, ownership and operation

Source: Ofgem

Onshore transmission network development and investment

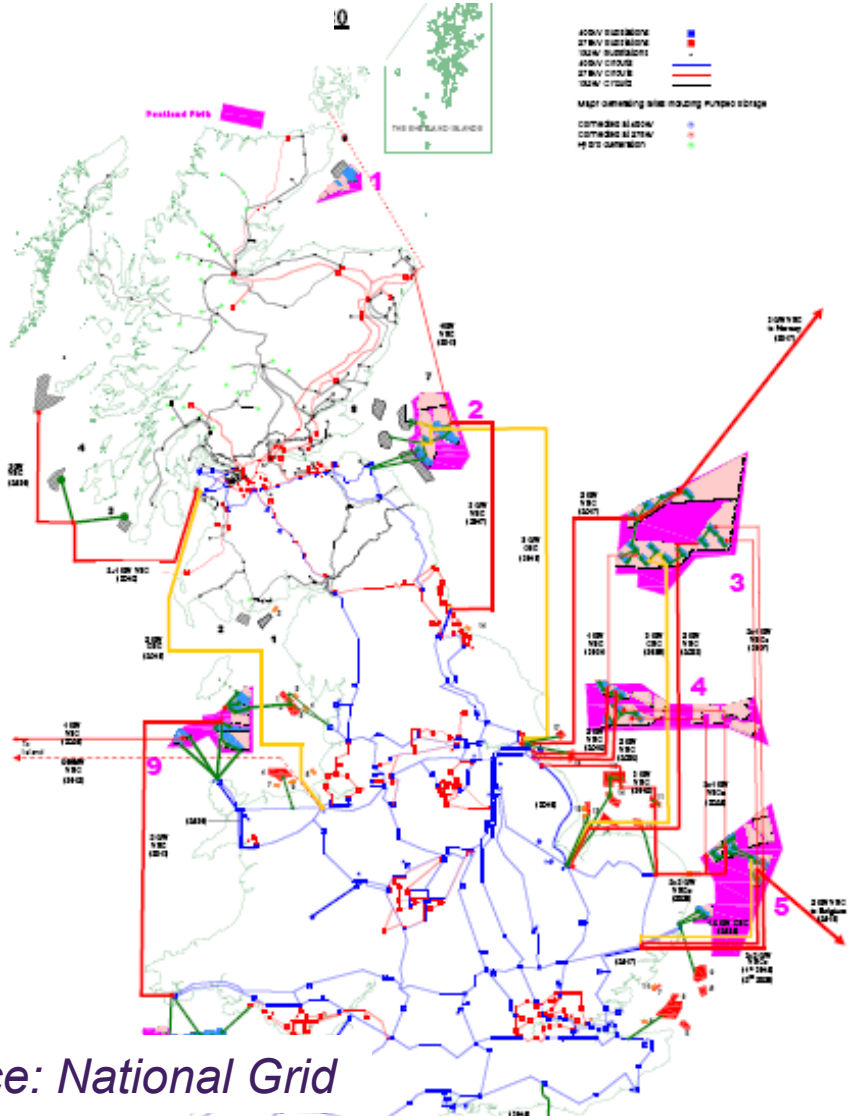
Scotland: 7-13GW



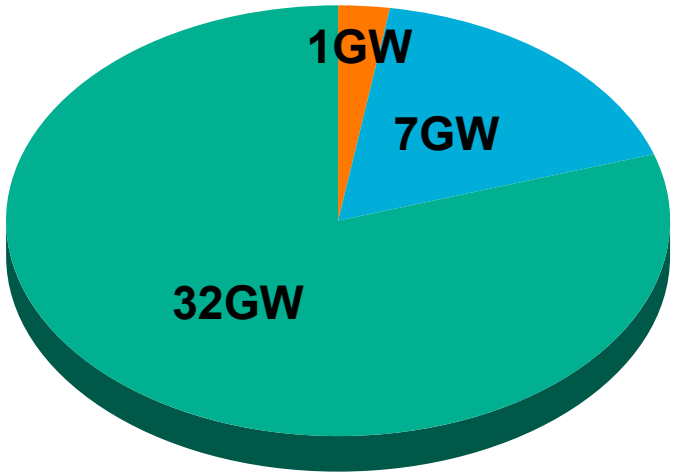
- **RAV-SHET: £0.4 bn**
- **RAV-SPT: £1 bn**
- **RAV - NGET: £7 bn**

- **Investment: 4bn - £7bn**

Offshore transmission network development and investment



Offshore wind capacity



Round 1 Round 2 Round 3

Investment: £12bn-25bn

Source: National Grid

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Interconnection development

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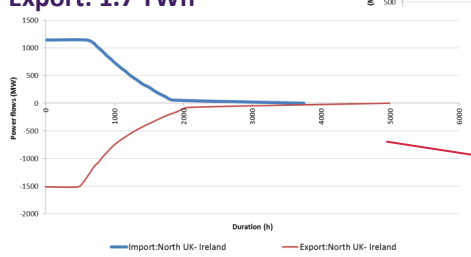
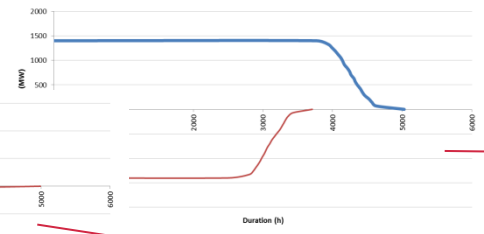
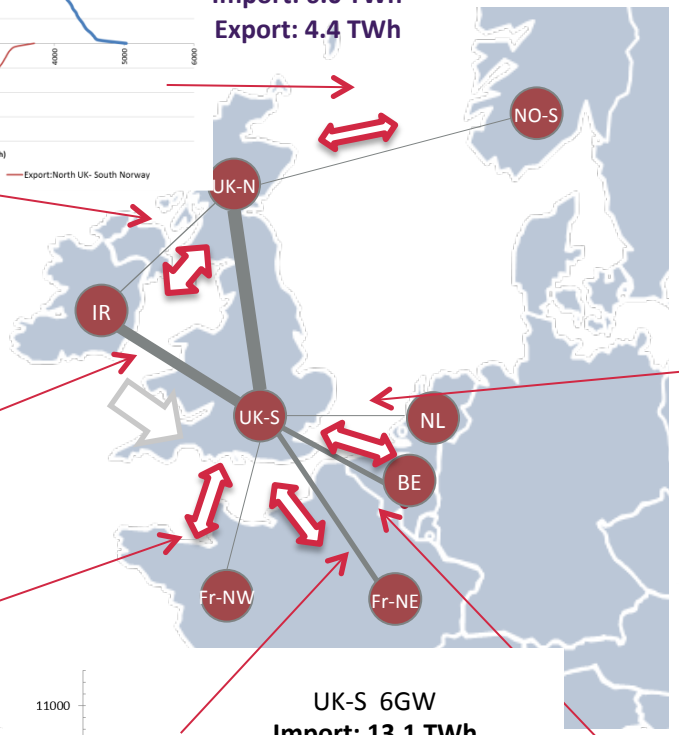
UK-NI 1.5GW
Import: 1.4 TWh
Export: 1.7 TWh





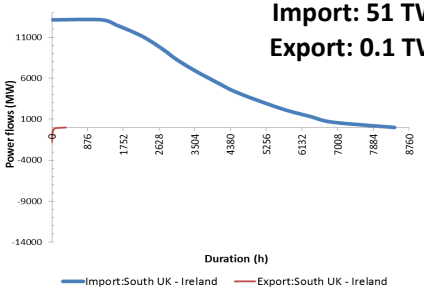
UK-N 1.5GW
Import: 6.0 TWh
Export: 4.4 TWh



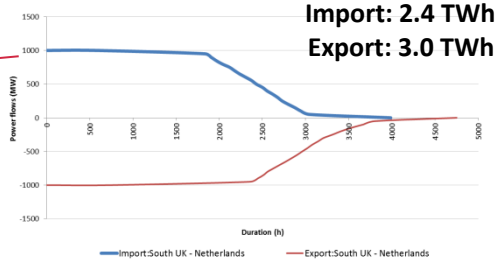
>8 – 20 GW of new interconnection

Investment £8bn – £20bn

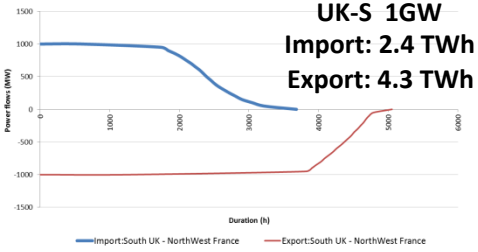
UK-S 13GW
Import: 51 TWh
Export: 0.1 TWh



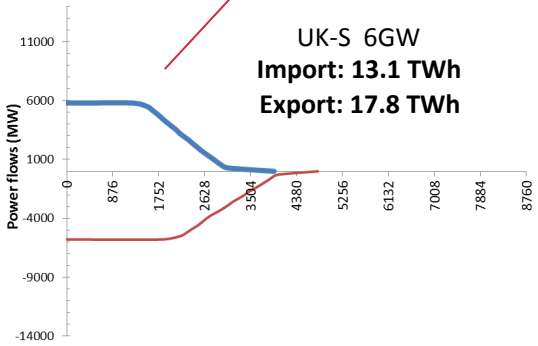
UK-S 1GW
Import: 2.4 TWh
Export: 3.0 TWh



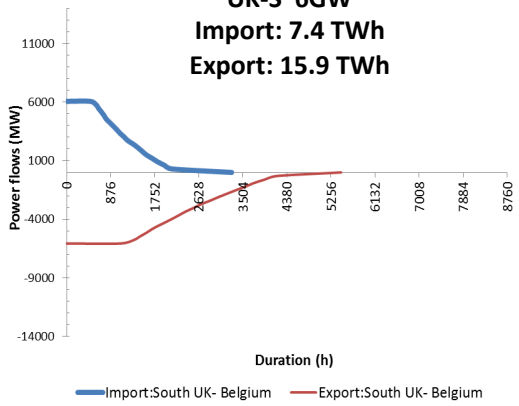
UK-S 1GW
Import: 2.4 TWh
Export: 4.3 TWh



UK-S 6GW
Import: 13.1 TWh
Export: 17.8 TWh



UK-S 6GW
Import: 7.4 TWh
Export: 15.9 TWh



Concerns with the present regimes....

- **Onshore**: Investment proposals cannot be scrutinised; Incentives for asset heavy solutions, risk of overinvestment is on consumers; insufficient coordination between TOs; insufficient signals for efficient location of new generation; conflict of interest
- **Offshore:** Incremental rather than strategic / coordinated network development; no onshore-offshore coordination; conflicts of interest
- **Interconnectors**: No co-ordination between onshore development and interconnectors; risk of conflict of interest for NETSO; how to coordinate co-existence of regulated and merchant;

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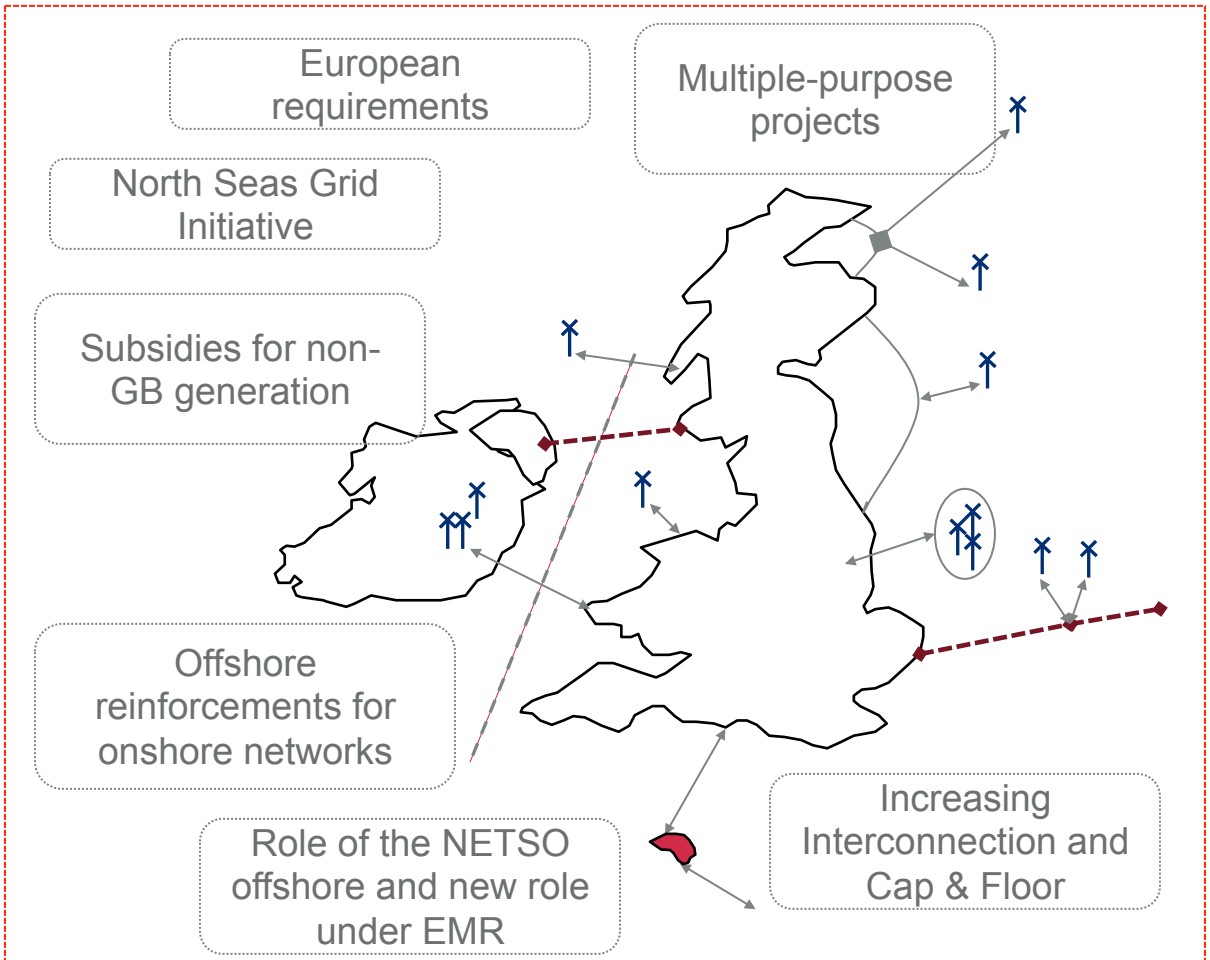
Drivers for ITPR

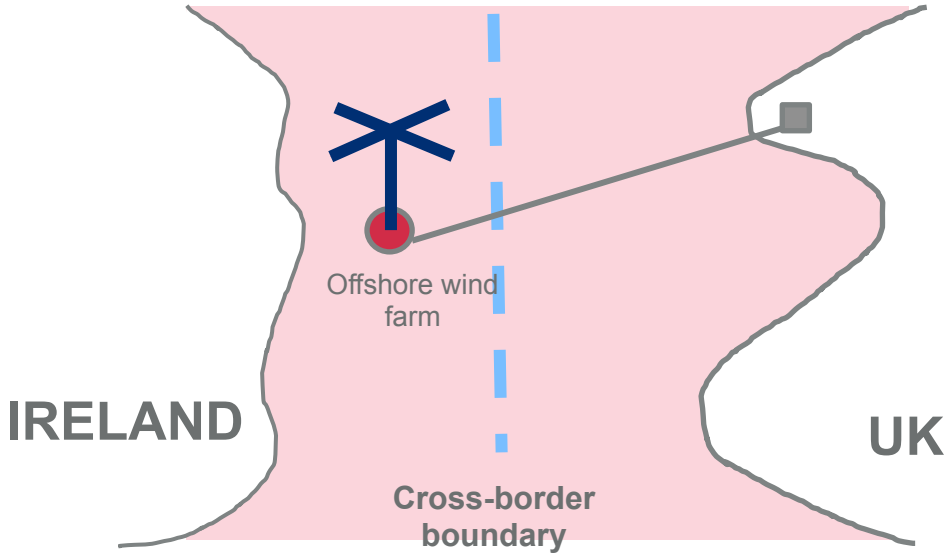
Can the current arrangements deliver it effectively?

Largest investment in GB transmission networks reinforcement since post WW II expansion



Source: Ofgem

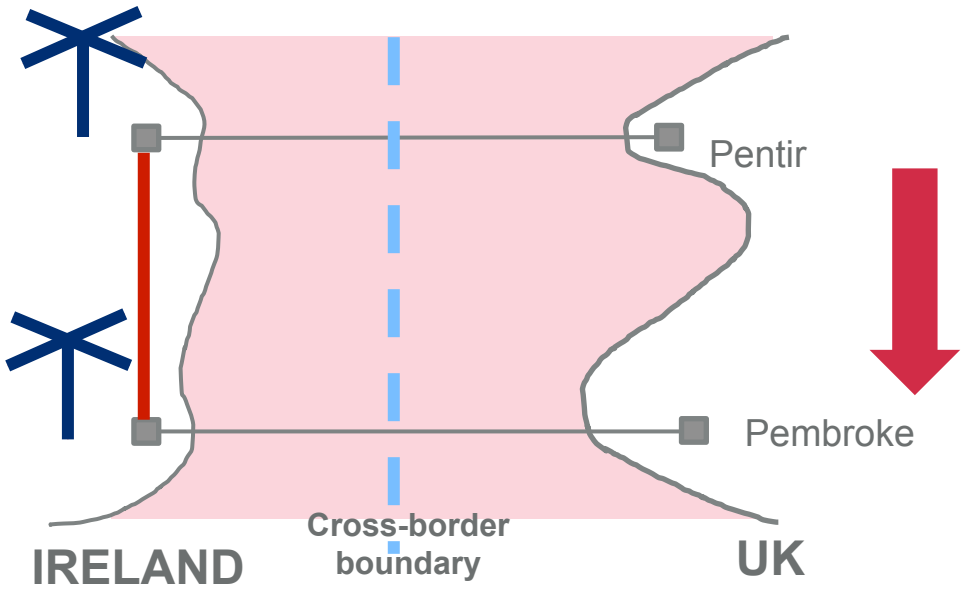
Example Case 1: Offshore windram in Irish territorial waters to connect to GB



- Interconnection or OFTO?
- Can the wind-farm access GB subsidy (ROC/FiTs)?
- If yes, will the transmission line be considered as IC and not pay TNUoS or fall under OFTO regime and pay TNUoS?

Example Case 2: Combining Offshore, Interconnection and Onshore regimes

OFTO or interconnector regime?



- Irish onshore wind not connect to the Irish grid and seeks to export to GB through offshore transmission

- **Who decides/plans this project?**
  - ***Unlikely that such a project would be undertaken under the current regime, even if optimal***
- **How it is delivered?**
- **Who pays?**
- **Which TNUoS charges do wind generators?**

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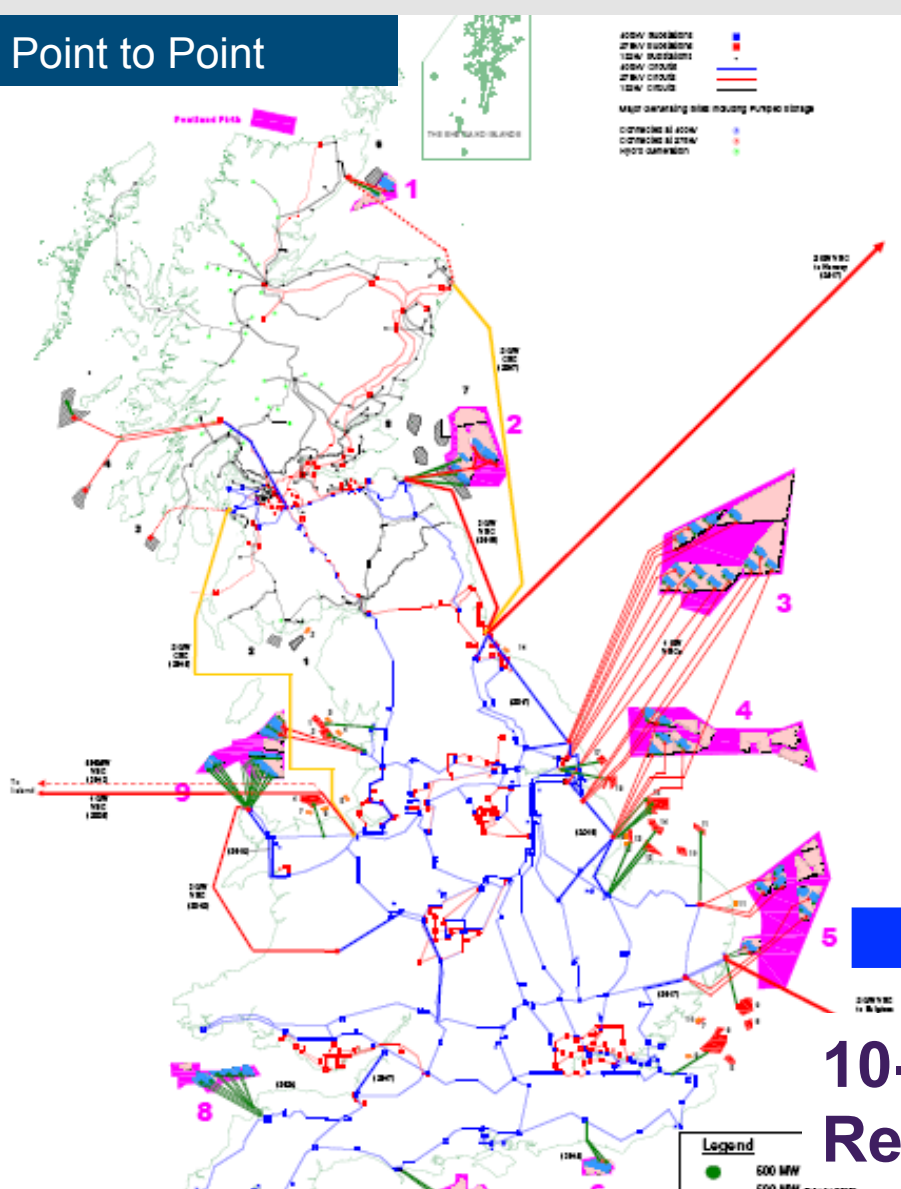
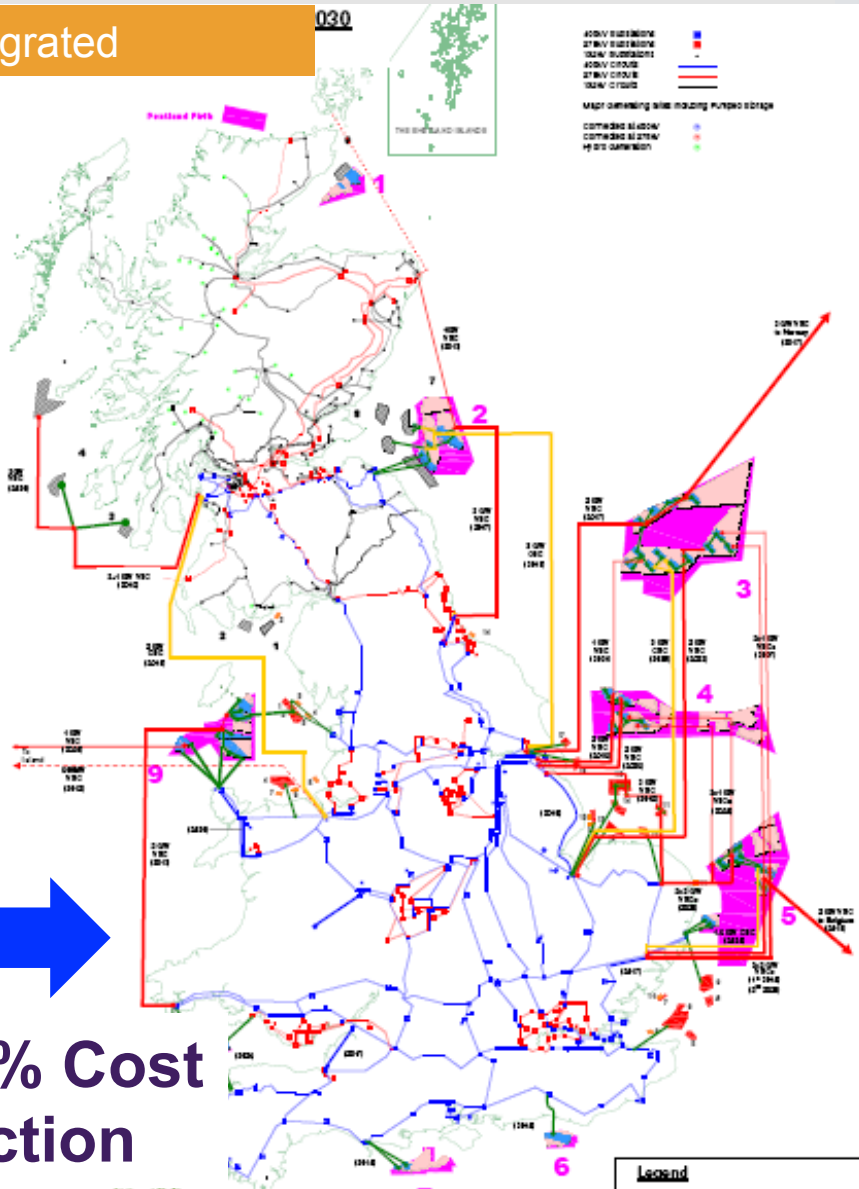
How important Is the coordination?

Point to Point

Integrated





10-20% Cost Reduction

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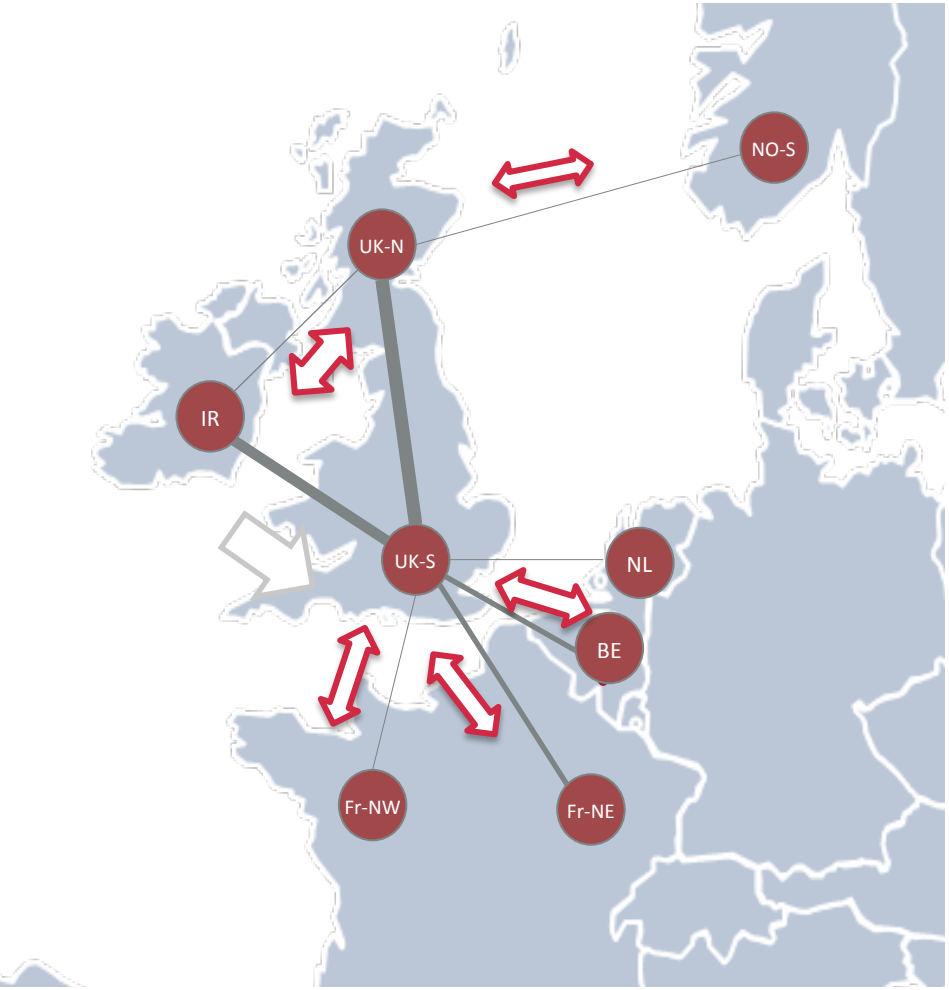
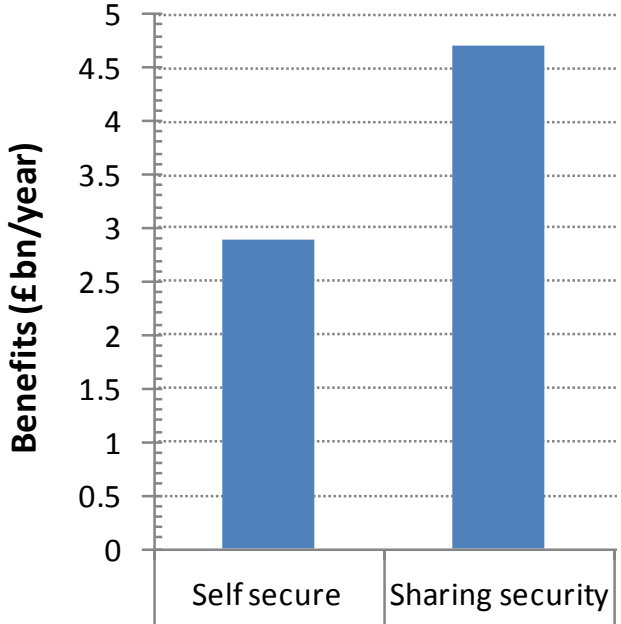
Role of Interconnection in UK Capacity Mechanism



Can you really trust …… when it comes to security of supply?



ITPR

Project objectives:

- SYSTEM **PLANNING**: To set out the roles and responsibilities to realise coordinated system planning across the transmission network; and
- **DELIVERY** OF INVESTMENT: To provide clarity on the interfaces between the existing regulatory regimes to enable delivery of an efficient and coordinated transmission network that includes multi purpose projects.

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ITPR … back to the first principles

- **What ensures that transmission investments are necessary? Should we / how to take into account interest of future consumers?**
  - ***Who decides and on what basis?***
- **What ensures that transmission investments are delivered at least cost?**
  - ***Regulated or competitive delivery? Delivery of service or delivery of specific projects?***

(1) What are the pre-requisites for establishing necessity of investment and efficient delivery?

(2) What are the implications on market design?

(3) What are the options for implementation?

(Extreme) Options for GB

	Option 1	*Option 2*
Planning	ISO - Design Authority	TSO – ISO (regulator approval)
Delivery	Competition (market based)	Regulated

What are the pre-requisites for establishing necessity of investment and efficient delivery?

Is the TO / ISO separation emerging?

- **Onshore RAV:**
  - NGET: £7 bn + SPT: £1 bn: SHET: £0.4 bn
  - Reinforcement: £4bn- £7bn
- **Offshore**
  - R_1: £1.1bn + R_2: >£2bn (+ EndR: £15 bn)
- **Interconnection**
  - £4bn (+ >£5b)

Two additional questions….

- **Who will facilitate development and implantation of effective non-network solutions for network problems?**

- **Are the historic reliability standards cost effective?**

System Integration concerns: degradation in asset utilisation and role of flexible balancing technologies

2020: Wind generation will displace energy produced by conventional plant but its ability displace capacity will be limited: more than 35% of conventional generation operating at less than 10% load factor

2030+: Electrification of segments of transport and heat sectors: increase in peak demand disproportionally higher than increase in energy

Year	Utilisation
2010	**55%**
2020	**35%**
2030+	**<25%**

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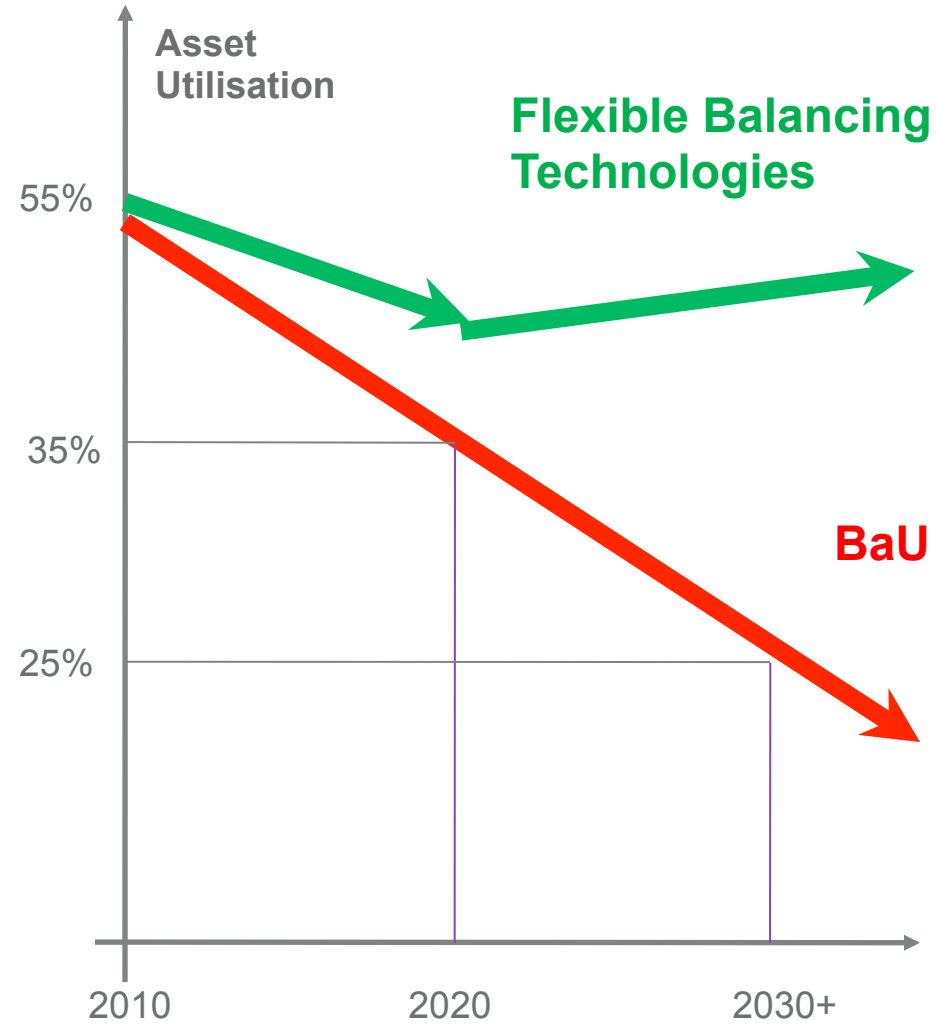
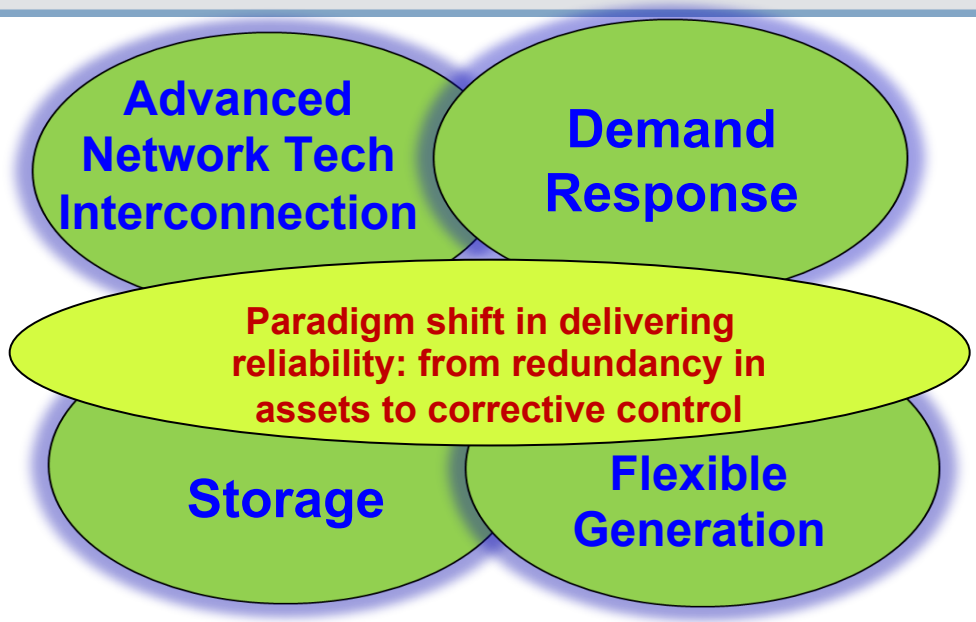
Low carbon system integration challenge: degradation in asset utilization





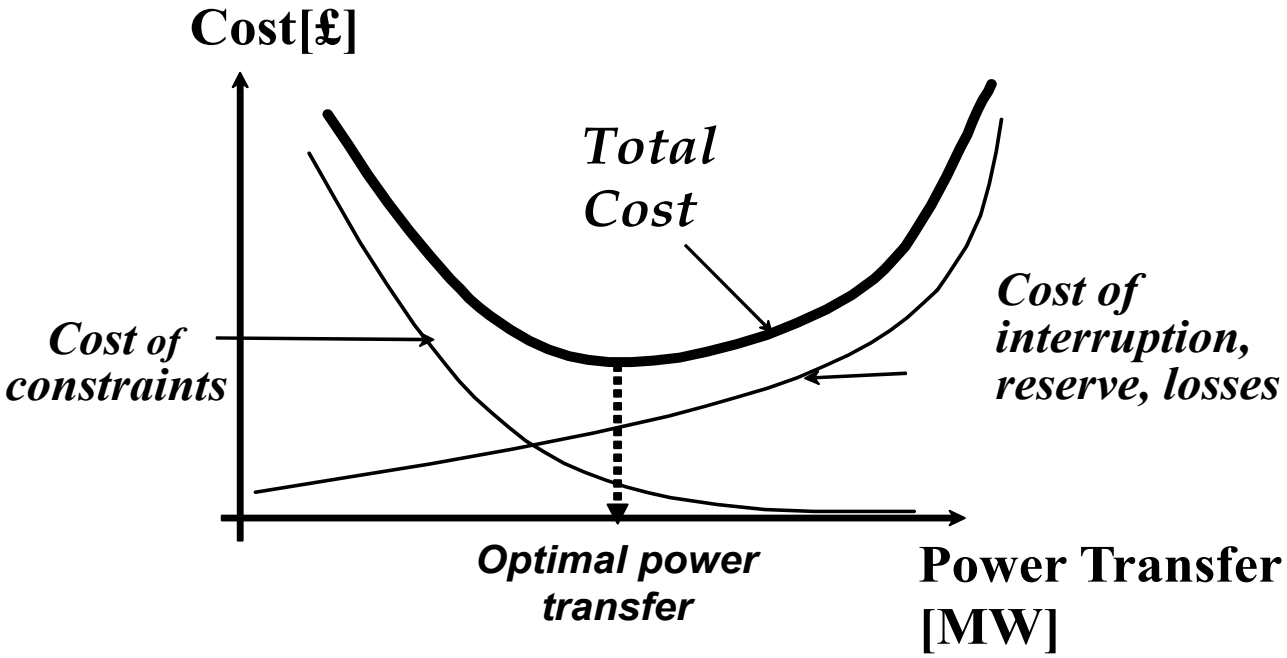
Volume of the market for flexible balancing technologies >£60b

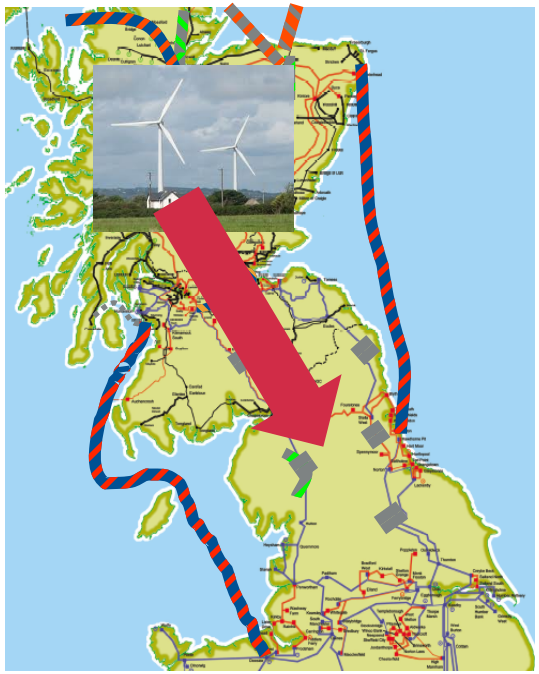
System integration costs in low carbon European system may exceed €500b

Industry Business Model?

Reliability standards: Is the transmission network delivering good value for money to users?

- ***Operation***: How much network capacity is released to network users? Are the costs and benefits balanced?
- ***Investment***: Is the network investment efficient? Is the benefit of a network investment greater than the cost? But how do measure this?





Does the network deliver good value for money to network users?

- ***How much network capacity is released to network users?***
- ***What VoLL justifies the existing network security standards?***

Wind output	Fair Weather Condition	Adverse Weather Condition
5.5 GW	3,000,000 £/MWh	100,000 £/MWh
>7.5 GW	27,000,000 £/MWh	810,000 £/MWh

Role of Ofgem to change? /1

- Discontinue performing role of "single buyer"?
  - »Independent design planning authority (or ISO) to establish a fully transparent CBA planning framework
- Focus on (1) coordination and (2) interests of existing and future consumers

  (1) sharing risks in network investment between industry and consumers

  (2) Design of joint consumer – merchant project (under development in the interconnection regime)

Role of Ofgem to change? /2

- Facilitate stronger user involvement and choice in network planning an delivery
  - Users to assess the options for delivery of service needed based on performance and cost
  - Define minimum user commitment + future consumer commitment => green light for project
  - Interconnection in the EU context to be considered
  - Implications on market design
    - More locationally specific network charges
    - Keep open the option of introducing Locational Marginal Pricing

Workshop programme

- *Dealing with conflicts of interest for parties undertaking transmission planning and delivery*
- *Regime interface for transmission related multi-purpose projects and co-existence of merchant and regulated assets.*
- *Criteria and prerequisites for adopting alternative regimes for planning and delivery*
- *Options for GB: (1) extend the onshore regime offshore and X-border (2) extend the offshore regime onshore and X border*

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