



G-PST/ESIG Webinar Series:

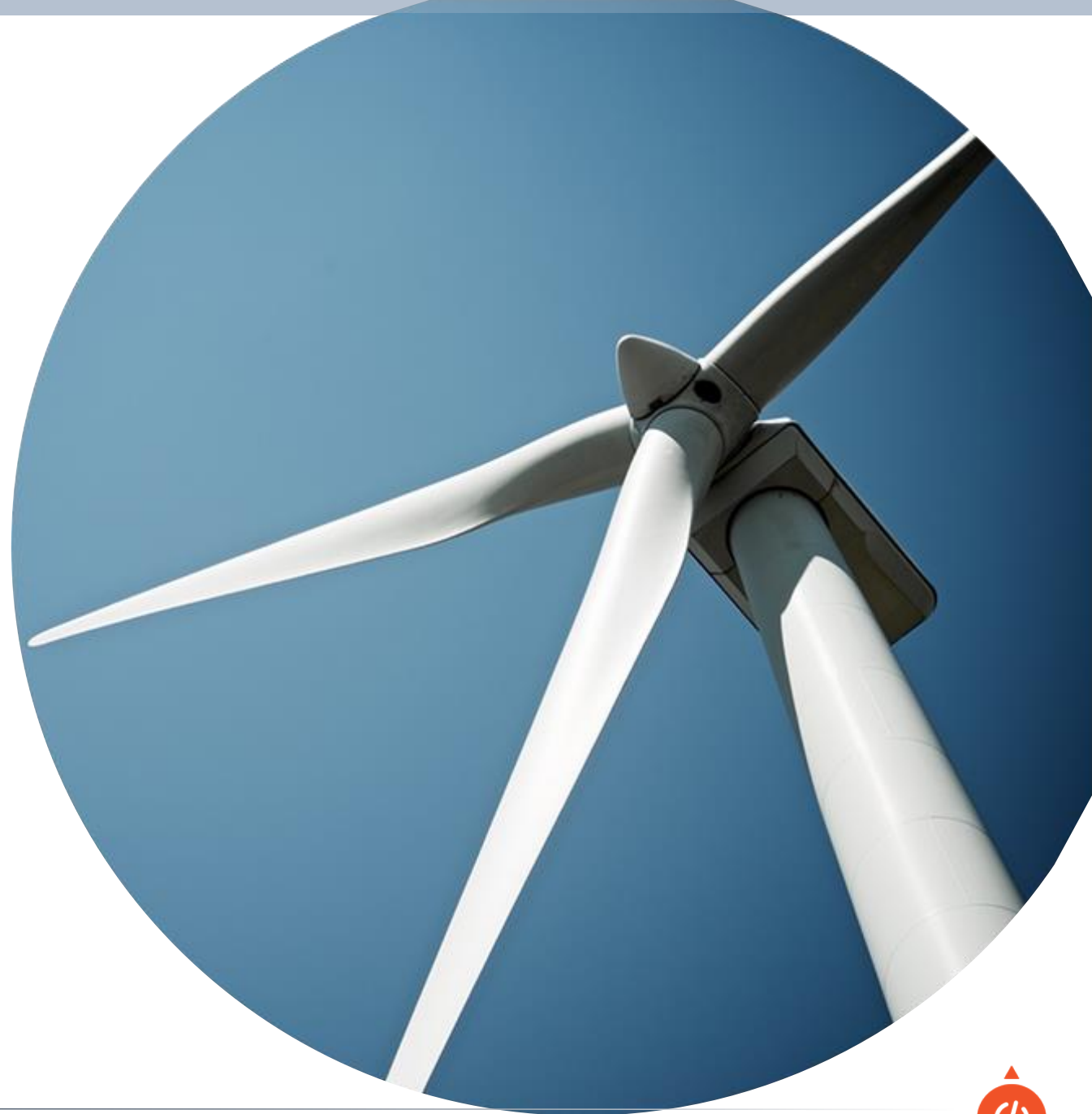
European Experience  
with “Connect and  
Manage”

November 19<sup>th</sup> 2023

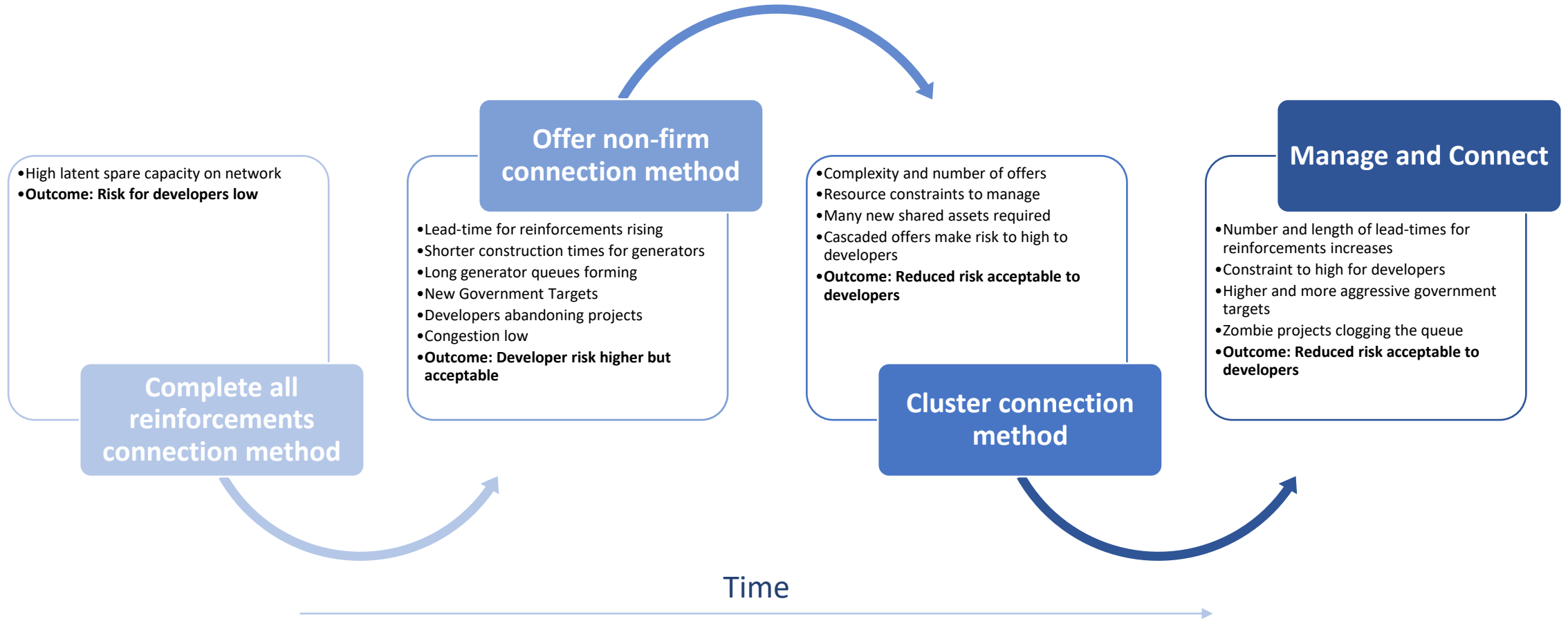


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# Justification for introduction



Typical cycle of progression through connection methods over time will vary with system conditions



# Definition of Connect and Manage

- Term 'Connect and Manage' used in this presentation
- A connection process for the connection of generation which allows firm access to the transmission network without completion of the full range of reinforcements to meet the network transmission system security planning standards
- With firm access generators if the output of a generator is changed by the transmission system operator (known as 'constraint'), then it is typically eligible for financial compensation from the market.



# Connect and Manage basic method

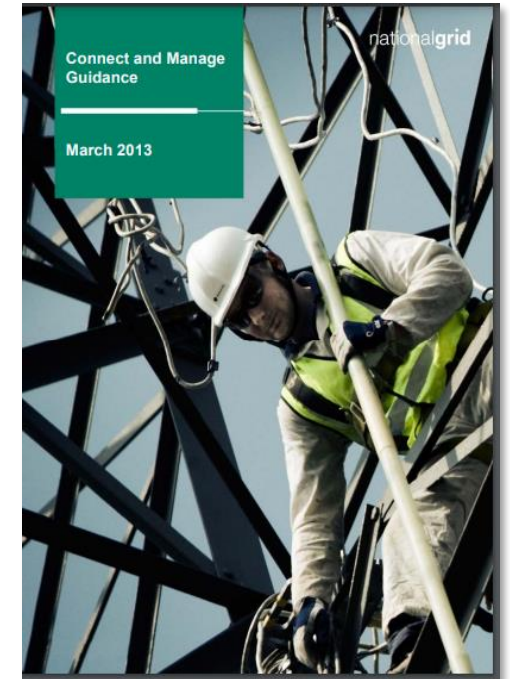
- Where used in Europe same basic approach is applied
- Two categories of works:
  - Minimum transmission reinforcement works that need to be completed before a generator can connect to and be given access to the transmission network.
  - Additional transmission reinforcement works associated to comply with the network transmission system security planning standards
- Minimum transmission reinforcement works are based on a reduced criteria for connection
- The minimum transmission reinforcements are at least the works necessary to create a physical connection to the transmission system, a new line or station, but can include additional works, e.g. for network stability reasons
- Generator connection timescale is defined by the completion of the minimum transmission reinforcement works
- Completion of the minimum transmission reinforcements provides firm access to the transmission network
- Additional transmission reinforcements will typically be completed in parallel, but often after firm access is granted



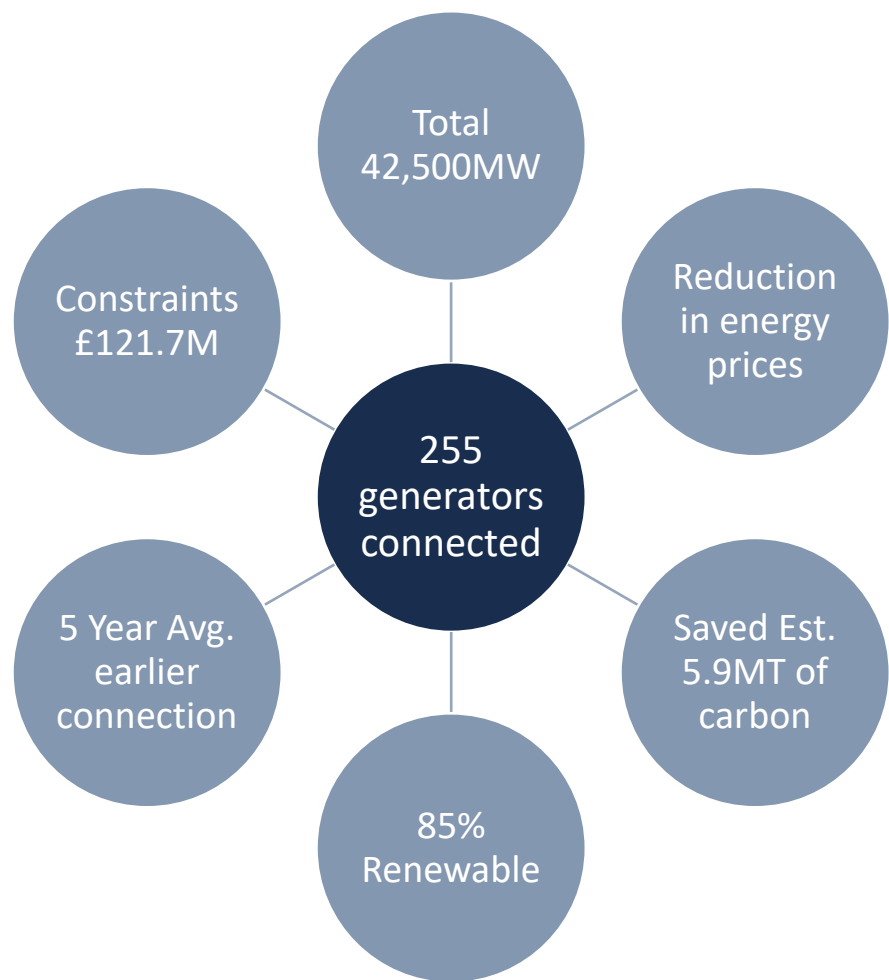


# Deeper Dive GB - 'Connect and Manage' approach

- Introduced on transmission network in 2010
- Divides works into:
  - 'Enabling Works', the minimum transmission reinforcement works which need to be completed before a generator can be connected to and given firm access to the transmission network
  - 'Wider Works' are the other transmission reinforcement works associated with reinforcing the network to accommodate the new generating station and ensure compliance with the UK transmission system security planning standards, NETS SQSS
- Enabling works can be approximated to:  
Works needed during intact network operation to:
  - Maintain network equipment within ratings;
  - Maintain voltages within limits and performance margins;
  - Maintain system instability;
  - Not create unacceptable Sub-Synchronous Oscillations.Other works needed for:
  - A fault on the transmission circuit no power loss occurs
  - A fault of a generator circuit or the loss of two transmission circuits, busbar section, no more than 1800MW power infeed is lost
  - National Electricity Transmission System to be operated in a safe manner
  - Resolution of any fault level issues
  - Meeting other statutory obligations, Grid Code and avoid any adverse impact on other Users.



# Deep Dive UK - 'Connect and Manage' impact



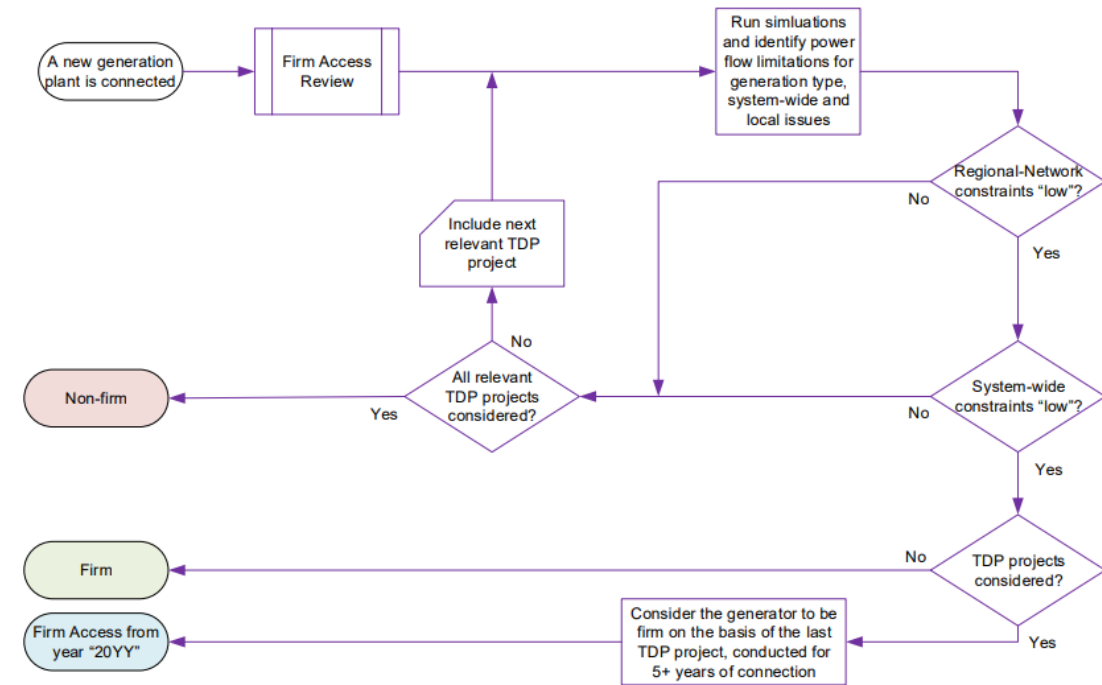
From Ofgem report covering Feb 2011 – October 2015

Region			As at September 2014	As at September 2015	Difference
England & Wales	Total number of offers, agreements and connections		40	49	+9
	MW		21,547	25,786	+4,239
	Average reduction in connection date		3	3	0
		Number of projects connected	2	3	+1
		MW connected	411	631	+220
Scotland	Total Number		161	206	+45
	MW		15,503	16,800	+1,297
	Average reduction in connection date		5.4	5.5	+0.1 years
		Number of projects connected	21	25	+4
		MW connected	997	1,267	+270
Totals	Total number of offers, agreements and connections		201	255	+54
	MW		37,050	42,586	+5,536
	Average reduction in connection date		5	5	0 years



# Deeper Dive Ireland - 'Connect and Manage' approach

- Called 'Firm Access Methodology' approach
- Decision on latest change in January 2023
- Ireland divides connection works into:
  - 'Shallow connection', refers to assets required to connect the applicant's facility to the existing Transmission System.
  - 'Deep Reinforcements' are the other transmission reinforcement works associated with reinforcing the network to accommodate the new generating station and ensure compliance with the Irish transmission system security planning standards, EirGrid TSSPS
- Most shallow works can be built by developer, all else is with System Operator & Asset Owner
- System Operator defines planned developments annually
- Firm Access is decided when constraints are low (below firm threshold), accounting for planned reinforcement
- Annual reviews of Firm Access allow for potential earlier but not later Firm Access date
  - Notably changes in queue





# Wider Europe

Other entities see that connect and manage connection methods are coming or are in the process of trialing :

- In France there is the option for the DSO to use an “Intelligent offer”, connect a generator on a primary substation/power transformer that is already fully loaded without creating any new capacity (adding additional transformers). In return, the producer is curtailed **with compensation in case of congestion**. This is limited to regulatory sandbox’s
- *Neutral market facilitators – DSOs are also required to provide non-discriminatory access to their networks for other system users, like power generators or service providers. **They will increasingly move beyond their traditional role of “building and connecting” towards “connecting and managing”.*** - Eurelectric, 2020 Distribution Grids in Europe Facts and Figures 2020
- *Alternative connection agreements should be considered .... as a **temporary instrument to connect new users that can only be connected on a firm basis once ongoing network reinforcements are realized.*** – Conclusions of CEER Paper on Alternative Connection Agreements May2023
- Whilst not the full connect and manage principle, a much wider range of ‘alternative’ connection agreements exist, which may be seen as on this pathway (Austria, Belgium, Finland, France, Hungary, Luxembourg, the Netherlands, Norway and Sweden):
  - Temporary firm connection agreements
  - Time-limited firm connection agreements
  - Shared connection agreements
  - Use-it-or-lose-it (UIOLI) or use-it-or-sell-it (UIOSI)
  - Fully flexible connection agreements
  - Combination of fully flexible and time-limited firm connection agreements
  - ‘Dynamic operating envelopes’



# Connect and Manage Key Risks

## Constraint costs

### Impact

- Constraint costs rise with Connect and Manage
- Constraint costs typically increase over time as generation increases

### Mitigation

- Offset cost of energy from lower unit price of electricity
- Avoidance of penalties for failure to deliver national targets



## Network Security

### Impact

- Higher utilization of the network assets can increase severity and quantity of failure
- Redundancy in networks is reduced system wide for same generation portfolio

### Mitigation

- Offset by more diverse generation portfolio, wind, solar, storage, etc.
- Greater number of locations with generation can off new solutions
- GETs technology can improve stability margins



# Connect and Manage Support Tools

## Grid Enhancing Technologies

### Types

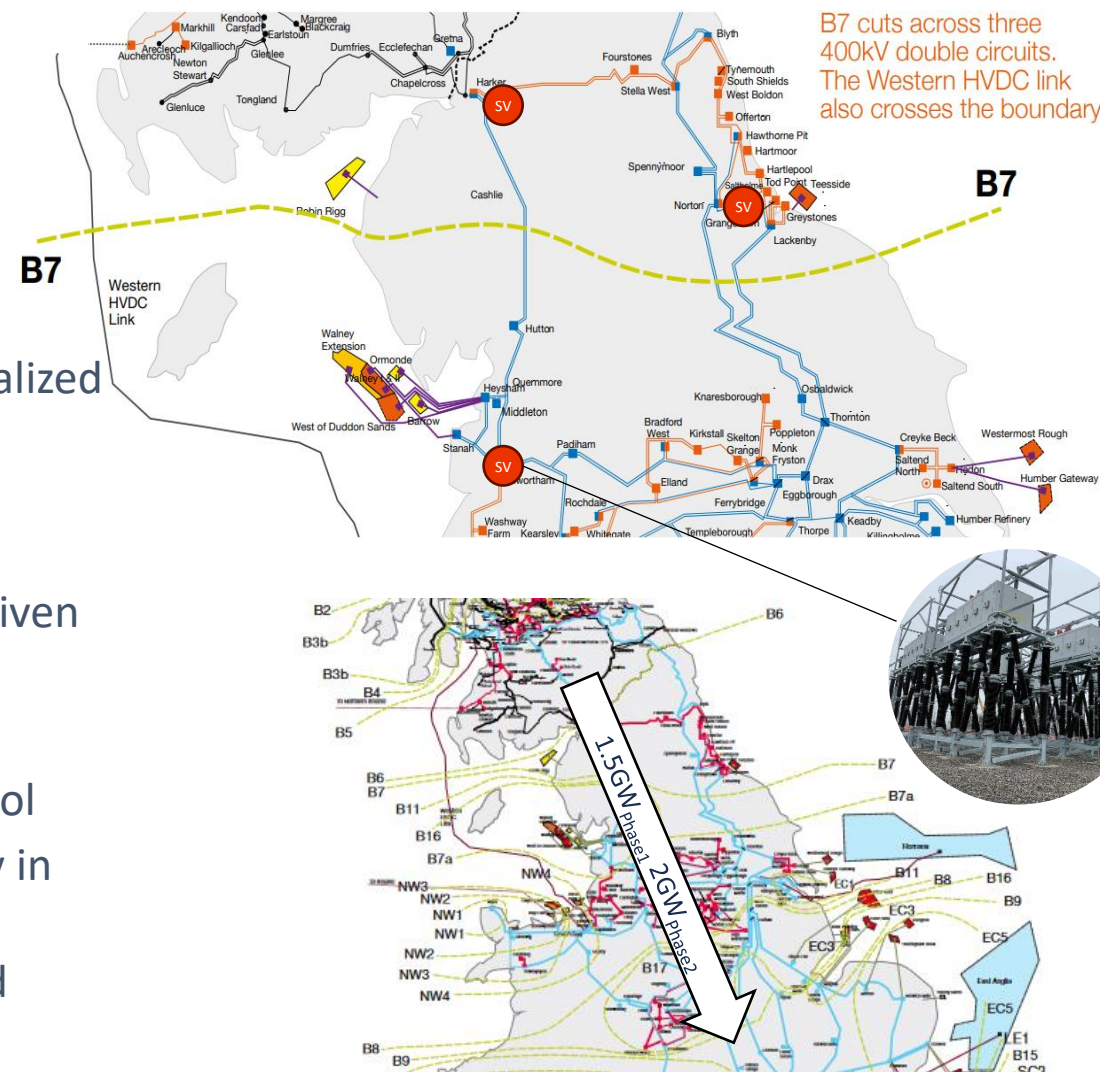
- Modular Power Flow Control, Dynamic Line Rating, Advanced Topography Optimization

### Potential

- **Fast delivery timelines** (1-2 year) of GET's counteracts the socialized constraint costs born by consumers
- **Scalable, flexible and reusable** solutions
- **Network security during high levels of uncertainty** (changes in demand, renewable generation, public planning and market driven fleet closure)

### Example

- National Grid UK and ESO are using Modular Power Flow Control
- Providing 1.5GW then rescaled to 2.0GW of additional capacity in around 2 years, more potential
- Need for capacity due to renewable generation in Scotland and network development timelines in the region



# Connect and Manage Support Tools

## Western Power Distribution 'connect and manage' for Distribution Energy Resources

- Customers with export capability of 1MW or more
- Obligated to have Automatic Network Management system, to provide
  - Control & visibility required to manage transmission constraints,
  - Distribution constraints, and to future-proof the distribution system against emerging constraints
- Market-based procurement, with 'back-stop' prices for compensating for flexibility they provide
- Developers unwilling to participate in the Connect & Manage arrangements are required to fully fund the cost of the infrastructure transmission works, and unable to connect before completion



# Best Practice Approach

- **Introduction should be considered when**
  - Exiting from the market of renewable generators due to the impacts of reinforcement lead times
  - Stalled progression in line with government target
  - Common signal: Constraints are too high for non-firm connections to achieve funding from investment
  - Common signal: Failure to develop as risk of supporting investment costs too high to shoulder over uncertain years
- **Assessing the balance of risk held by society and the generation developers**
  - Consumers with developers must share some of investment risk
  - Setting the right balance techniques
    - Progressive (EirGrid > UK) introduction of connection approach, payments from part to entire constraint period
    - Reporting and feedback – further intervention
    - Emergency stop built in
- **Justifying the societal value**
  - Cost of failure to deliver - Targeted 2050 requirements, conventional energy costs without
  - Transparency in process key given societal support
  - Open to all – not restrictive to renewables



Thanks for your attention – Any questions?

