

# Constraint Management Pathfinding Project

Nationalgrid ESO

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nationalgridESO



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Please note this webinar is based on a range of initial technical and economic studies for early engagement purposes with external stakeholders. Since the studies are at feasibility stage, the information in this package is not related to any Request For Information or market engagement. Also we are not recommending any specific findings of this work at this stage.



# 1. Context

2. Introduction



3. Network Constraints



4. Constraint Management Pathfinding Project



5. Commercial and Future Market Framework



Polling



6. Questions



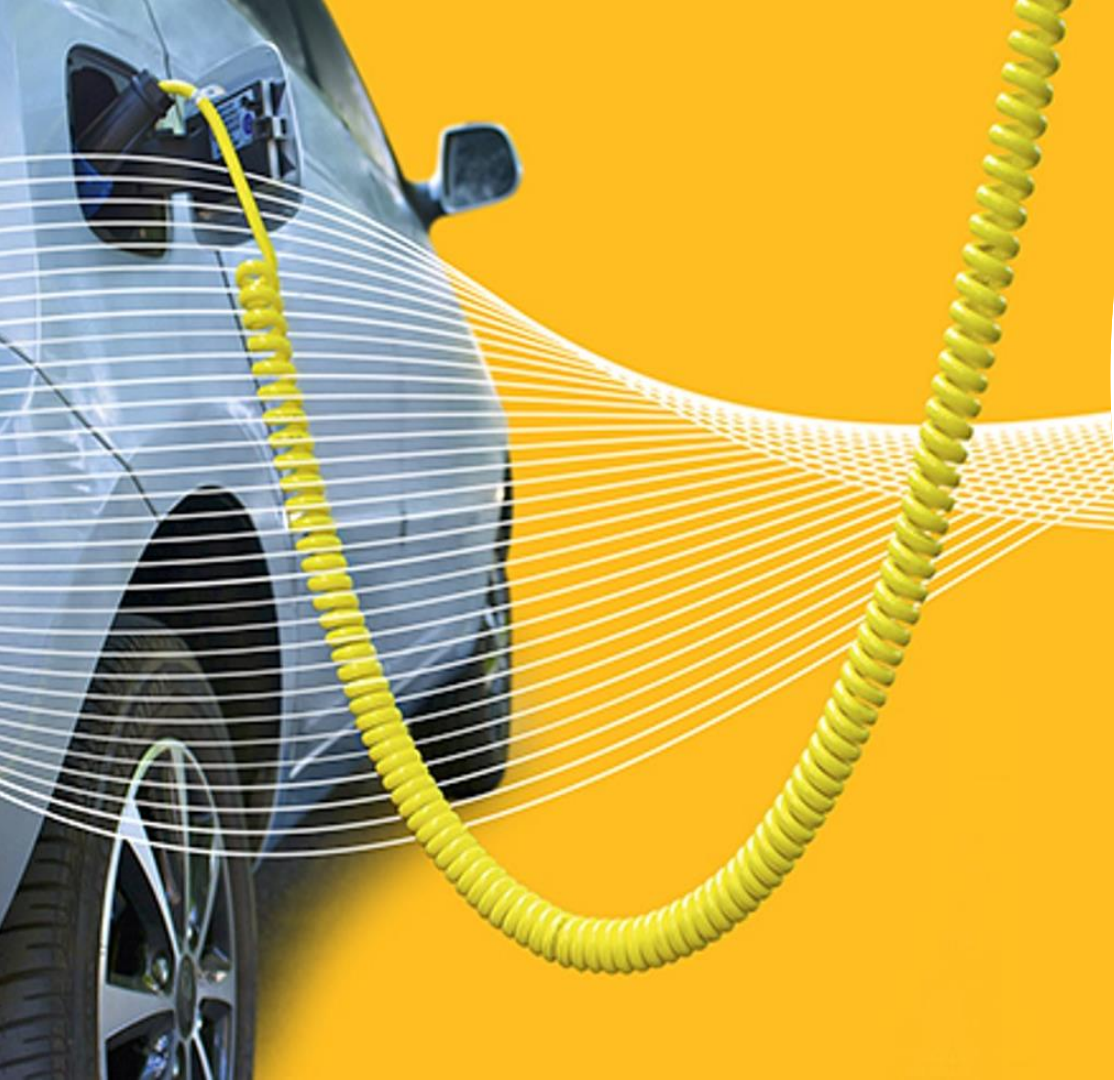


## 1.1. Aim

- The energy industry is fundamentally changing. New technologies and ways of working are bringing opportunities to deliver great value, for consumers and society.
- We are driving competition through the access of a *wider pool of solutions* to meet network needs ensuring lower network constraint costs to unlock additional consumer benefit. We need to work with market participants to manage network constraints across the network, ensuring efficient outcomes are realised for the end consumers and system security is maintained.
- As stated in our [ESO Forward Plan 2019-21](#), the ESO is conducting a pathfinding project with the ambition of providing a *long-term* commercial product to manage network constraints. This product will provide opportunities for market participants to deliver services that reduce constraint costs on the National Electricity Transmission System (NETS).
- This pathfinder process will be an opportunity for the ESO to closely engage with market participants to further understand their business strategies, technical, and economic capabilities as well as potential limitations around existing/new technologies to alleviate constraints on the network at a lower cost than the existing arrangements.



## 2. Introduction





## 2.1 Future of Energy

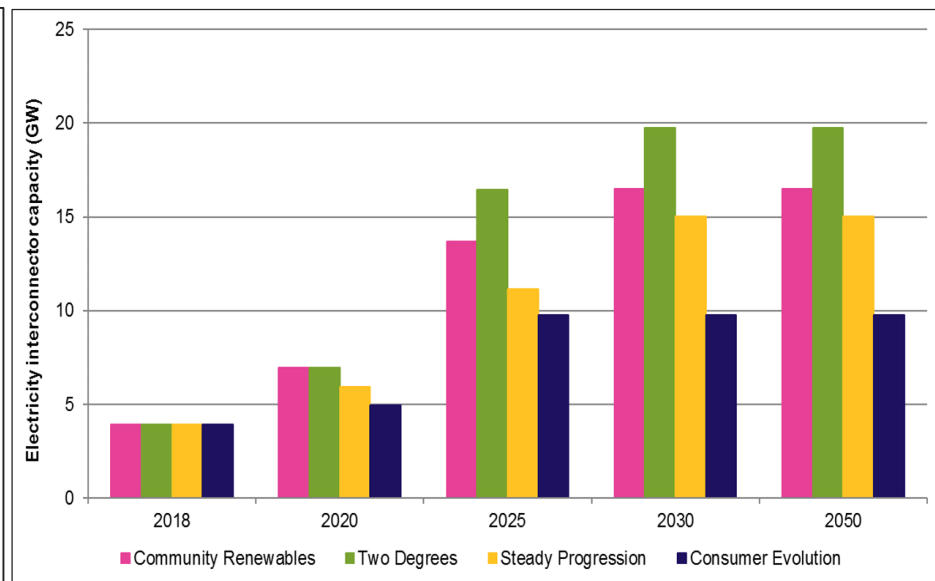
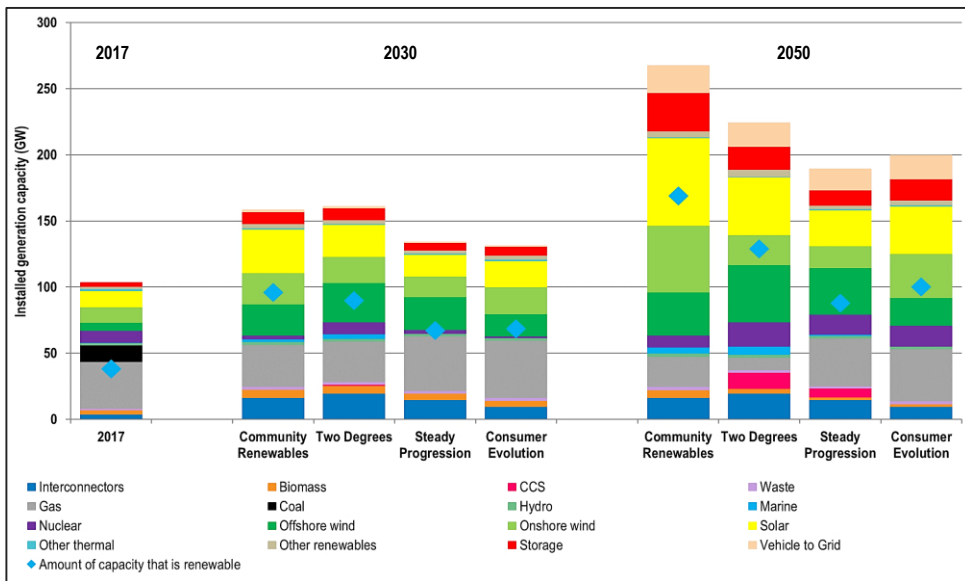
- As the ESO, we have a crucial role in facilitating the transition to a low carbon electricity industry.
- GB power system has gone an entire week without using coal to generate electricity for the first time in modern history.
- We produce our Future Energy Scenarios (FES) each year to identify a range of credible scenarios that could transpire in the future.



Future Energy Scenarios 18



## 2.2 Energy Landscape

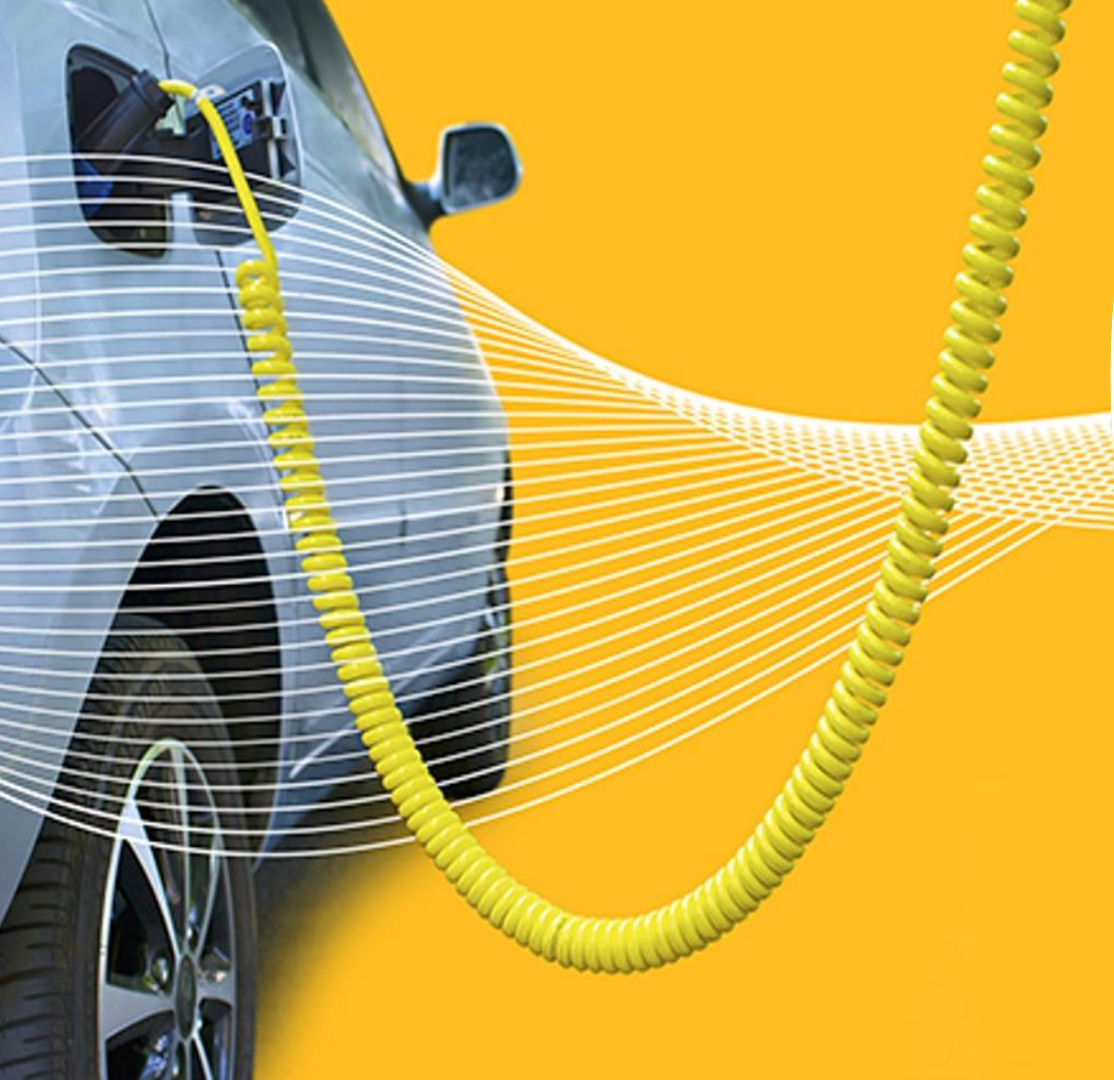


Future Energy Scenarios 18

- In all FES18 scenarios, there is an increase in the amount of renewable and low carbon electricity generation up to 2050. There is also growth in decentralised generation capacity and interconnector capacity across all scenarios.
- High levels of intermittent and inflexible generation will require high levels of new flexibility, and there may be some periods of oversupply.



### 3. Network Constraints







## 3.1 Future Challenges

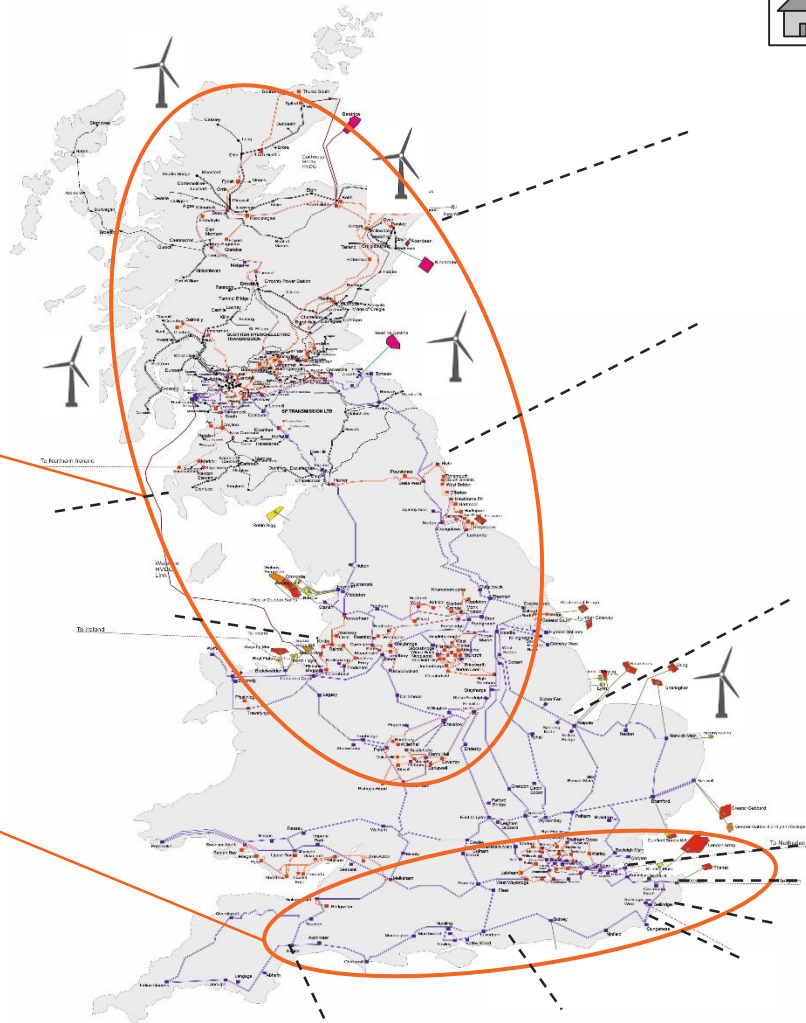
Although constraints are largely seen across many parts of the network, the characteristics and cause of local constraints can largely differ.

### Large growth in renewable generation capacity resulting in increased north-south power flows:

We face high renewable generation capacity growth in the North today and further growth of renewable generation is expected in the future. Growth in low carbon generation and new interconnectors in the north of England, combined with increased Scottish generation, will increase North-South power transfers to meet southerly demand centers.

### Growth in Embedded Generation and Interconnectors:

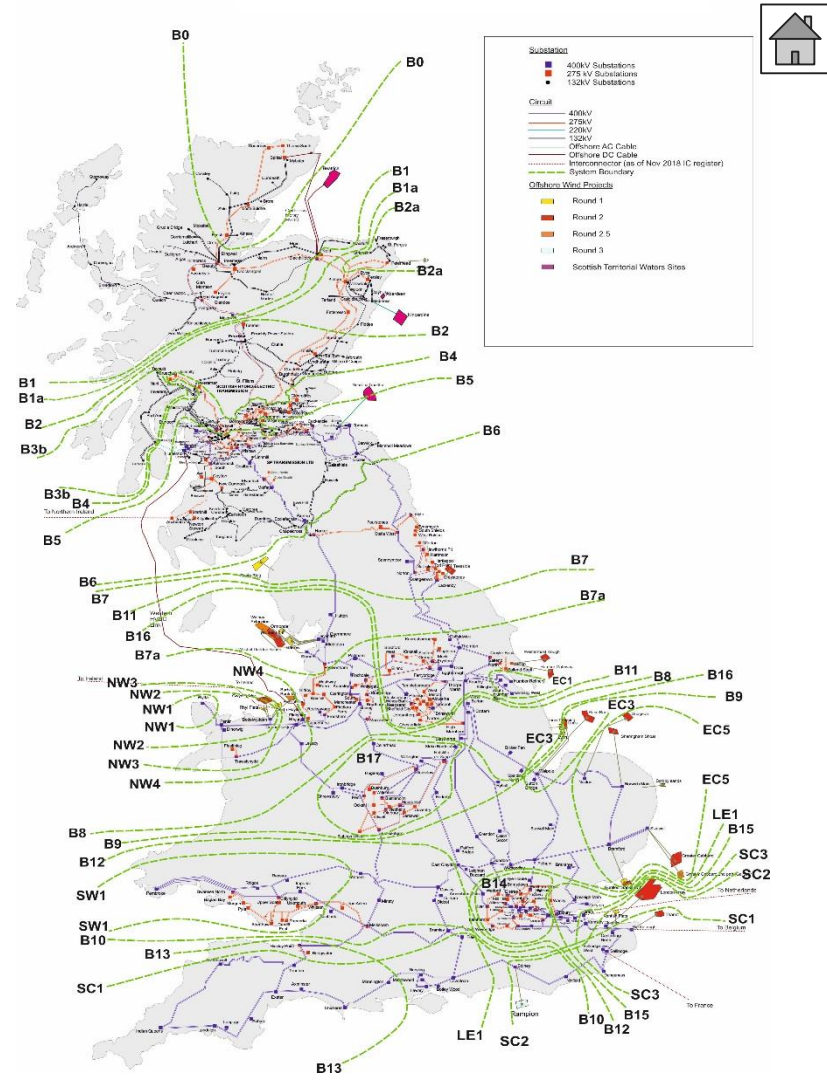
New interconnectors to the European mainland will place increased stress on an already complex area of the transmission network. Rapid growth in embedded generation such as Solar PV brings further operational challenges for today and the future.



# 3.2 GB Network - Boundaries

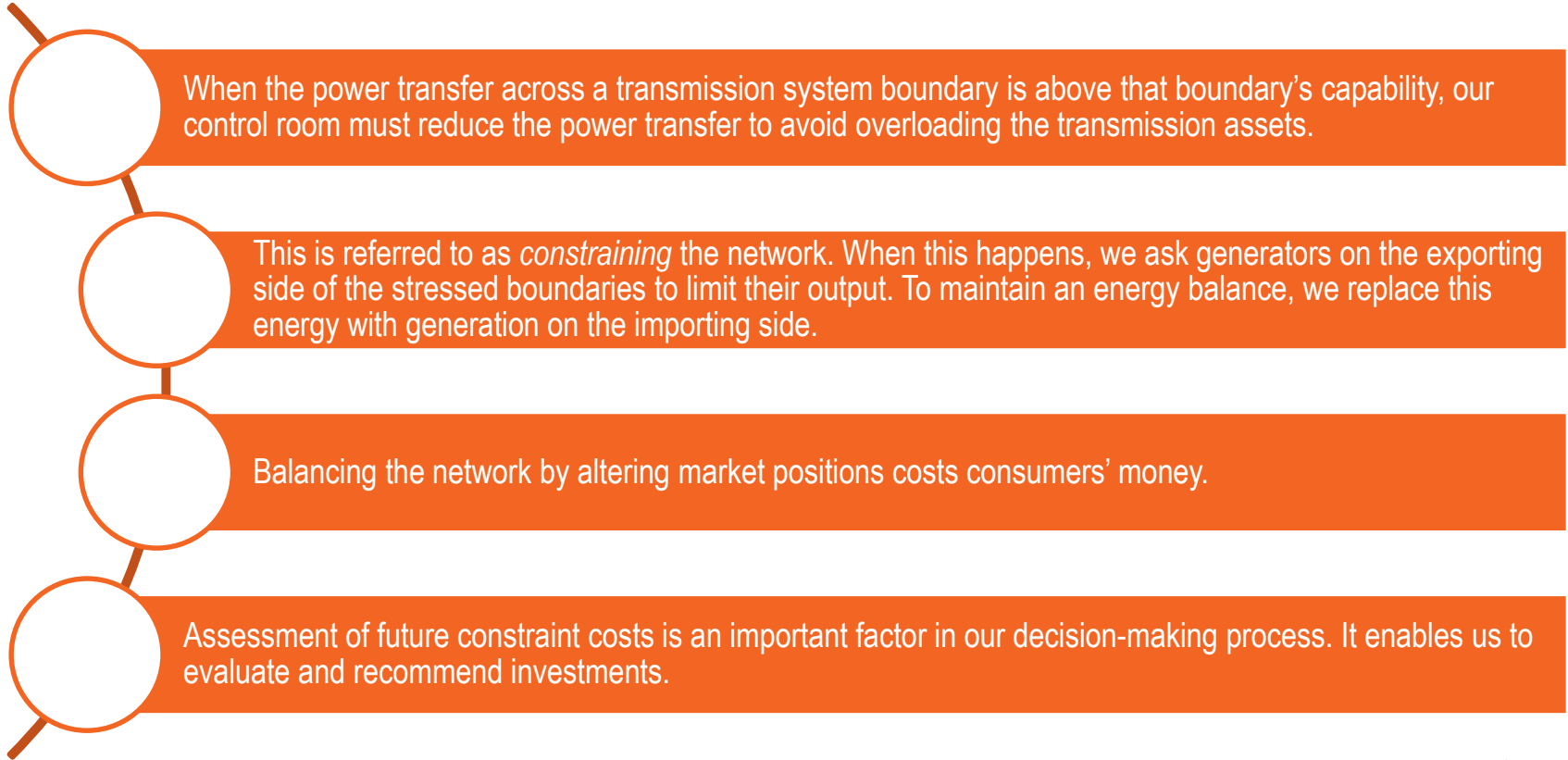
To provide an overview of present and future transmission requirements on the NETS, we use the concept of boundaries. A boundary splits the system into two parts, crossing critical circuit paths that carry power between the areas where power flow limitations may be encountered.

Running the transmission network also requires actions to protect equipment, enable access to the system, keep within the Security and Quality of Supply Standard (SQSS) and prevent the loss of large parts of the network.



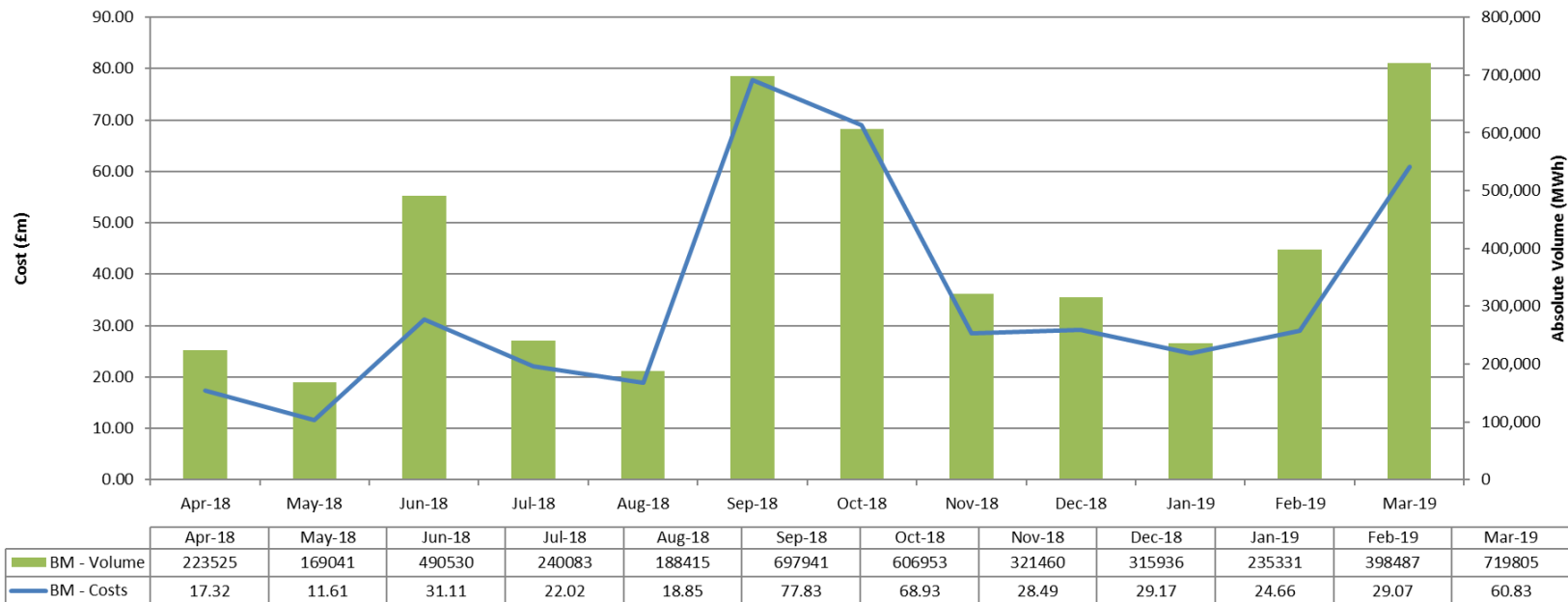


## 3.3 Mitigating Network Constraints





# 3.4 Transmission Constraint Costs

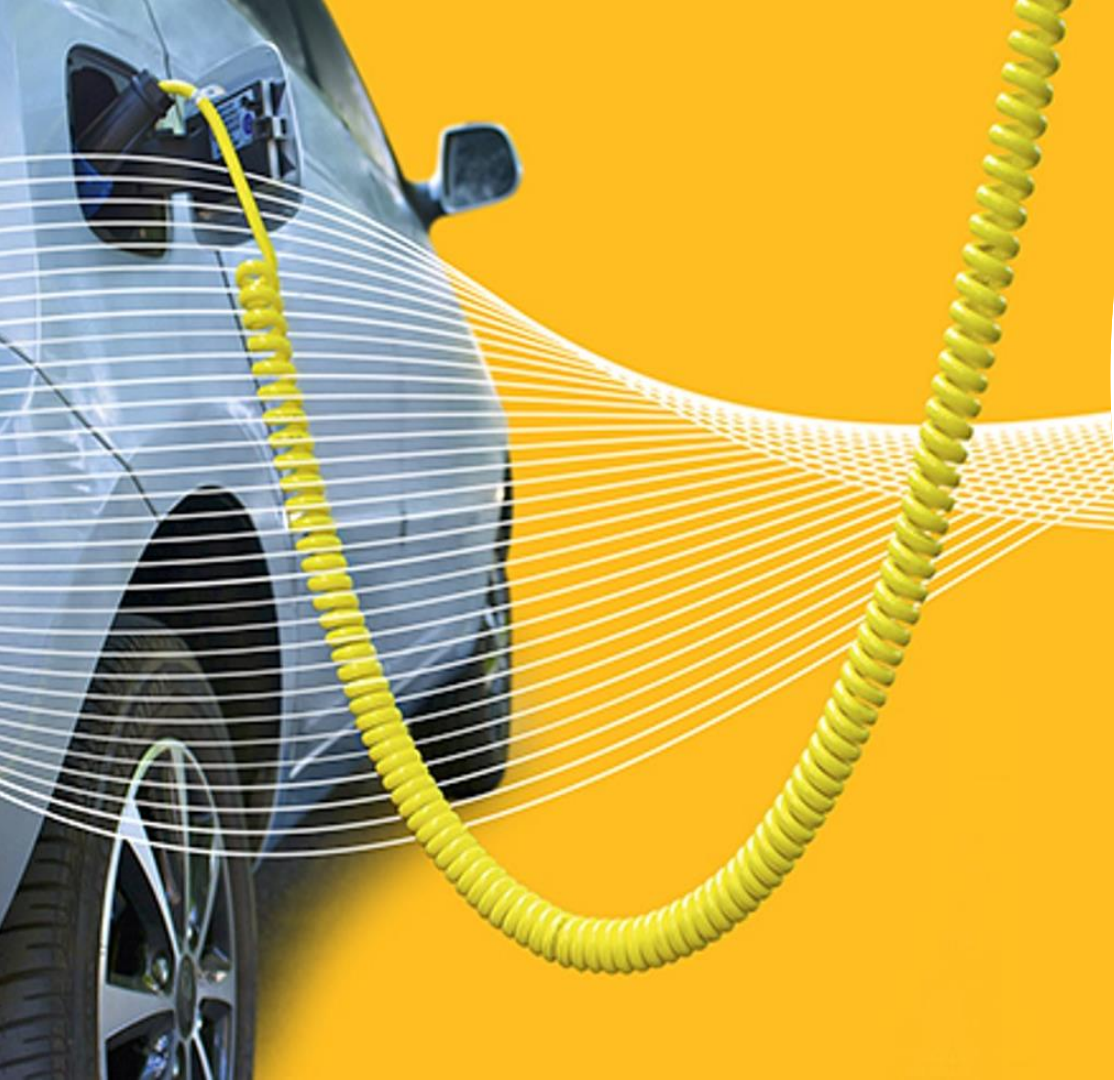


Monthly Balancing Services Summary 2018/19

- This figure shows Balancing Mechanism (BM) costs (line) and volumes (bar)
- These costs are incurred when we need to increase or decrease power flows from one part of the network to another

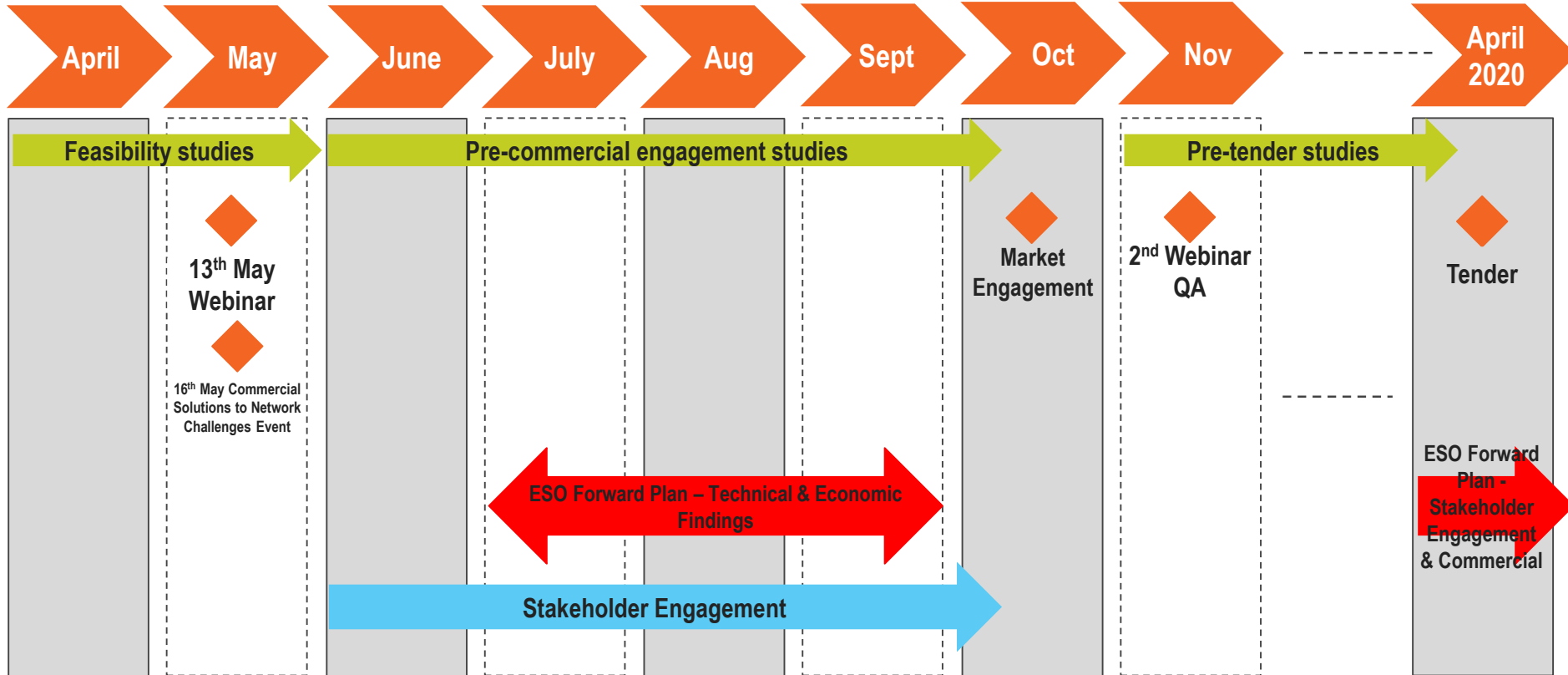


## 4. Constraint Management Pathfinding Project





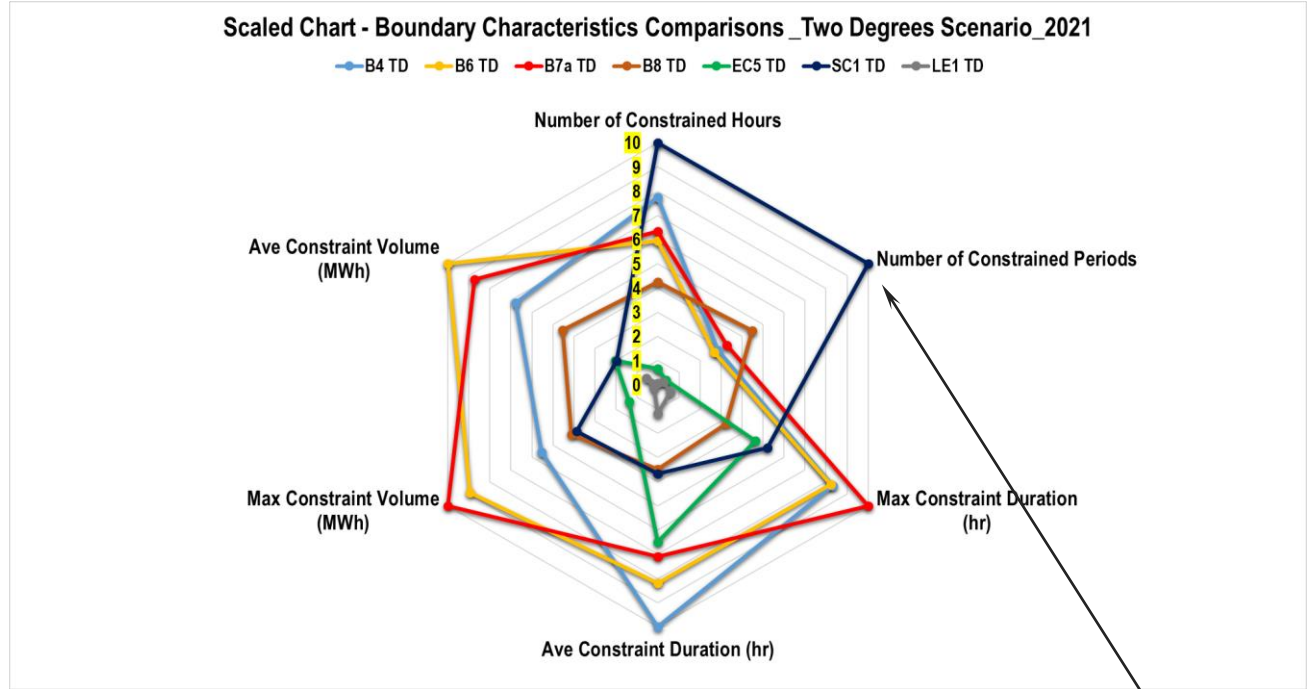
# 4.1 Constraint Management Pathfinding Plan





## 4.2 Constraint Characteristics \_ Two Degrees \_ 2021

Boundary characteristics having NOA 2018/19 recommendations in the background



*These are NOT actual numbers - relative values for comparison purposes*

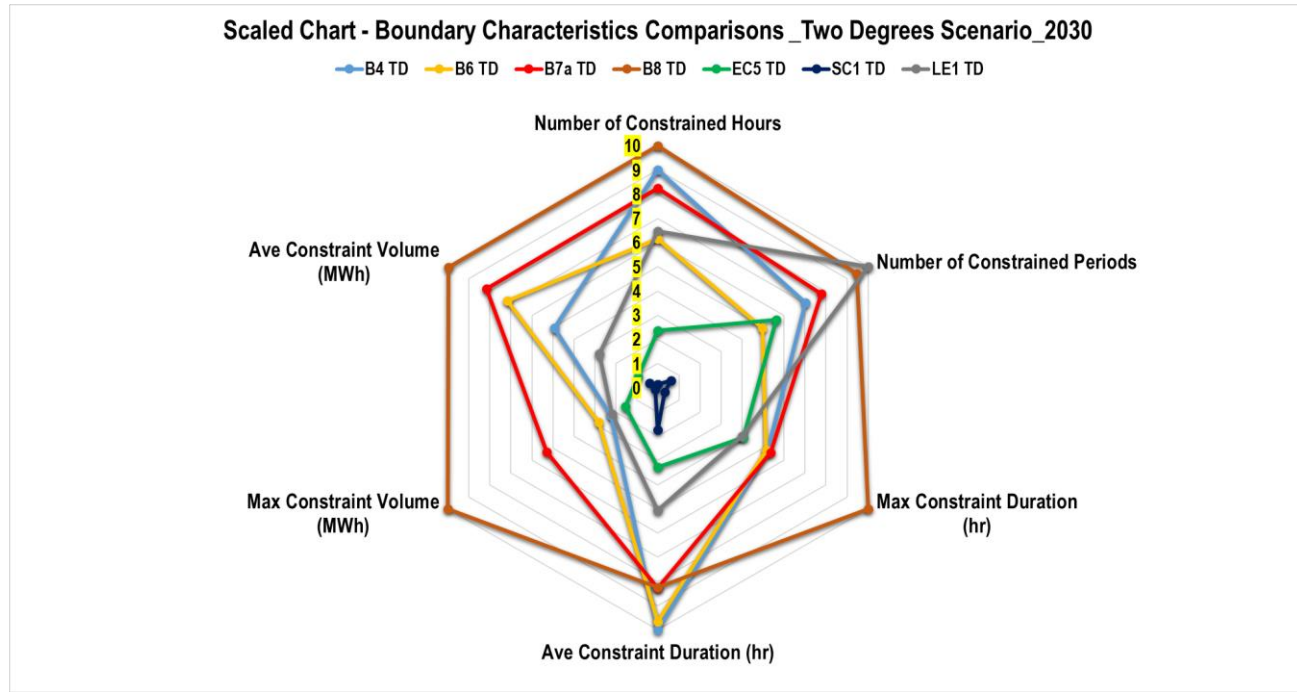
*How to read: e.g. SC1 has the highest number of constraint periods among other boundaries*

- This graph shows a range of different boundary characteristics
- '0' represents the lowest and '10' represents the highest relative value



## 4.3 Constraint Characteristics \_ Two Degrees \_ 2030

Boundary characteristics having NOA 2018/19 recommendations in the background



*These are NOT actual numbers - relative values for comparison purposes*

- We are experiencing higher number of constrained hours in northern boundaries compared to the 2021. The number of constrained periods has increased in North region, as well.
- North of England to Midlands boundary is experiencing longer duration and higher volume (MWh) of constraints.

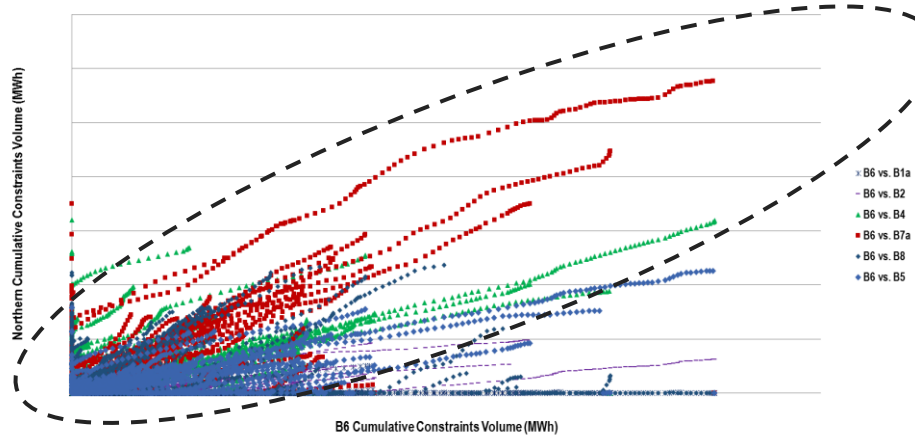




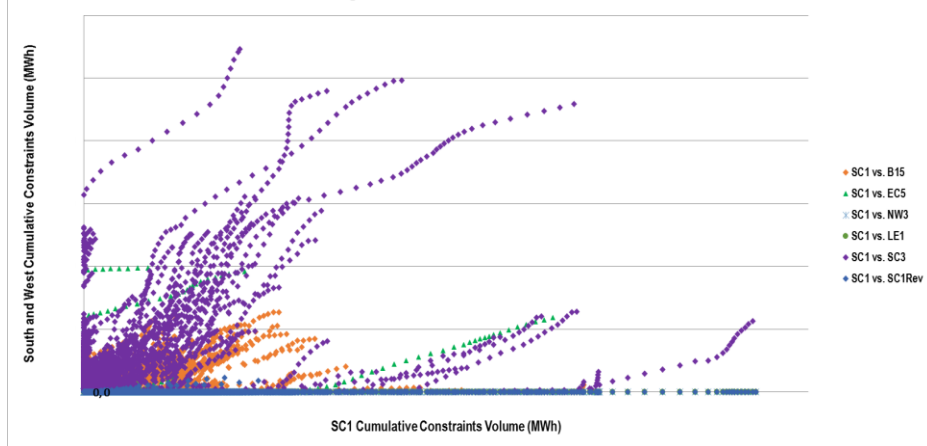
## 4.4 Correlation Analysis – Nesting Effect

- Considering a group of boundaries in each region rather and focusing on individual performance of each boundary
- Correlation analysis shows the relation between the volume of cumulative residual constraints during each hour of all constrained periods in a single year
- There is high correlation between different residual-constrained boundaries in north region comparing to the south region

North Region Boundaries Correlation\_TD Scenario\_2021



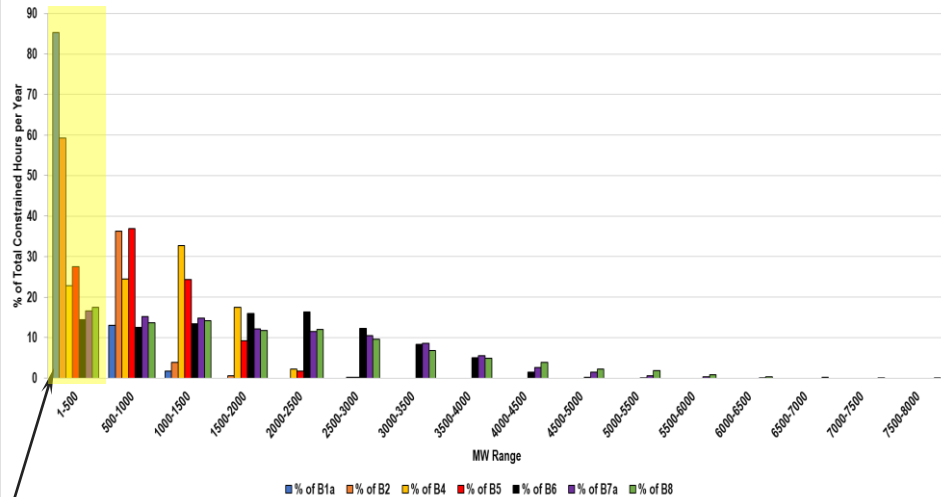
South & West Region Boundaries Correlation\_TD Scenario\_2021



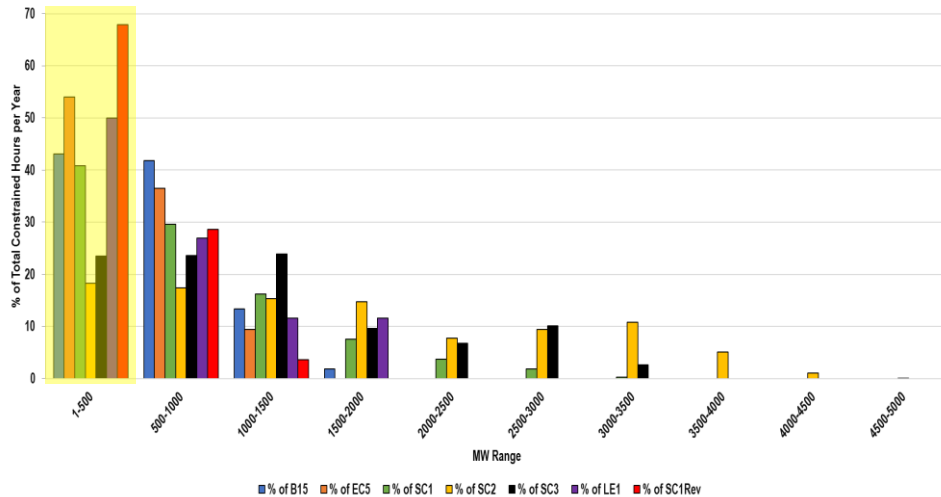


# 4.5 Distribution of Constraint Volumes by MW\_TD\_2021

Distribution of Constrained Hours\_North Region\_Two Degrees\_2021



Distribution of Constrained Hours\_South Region\_Two Degrees\_2021

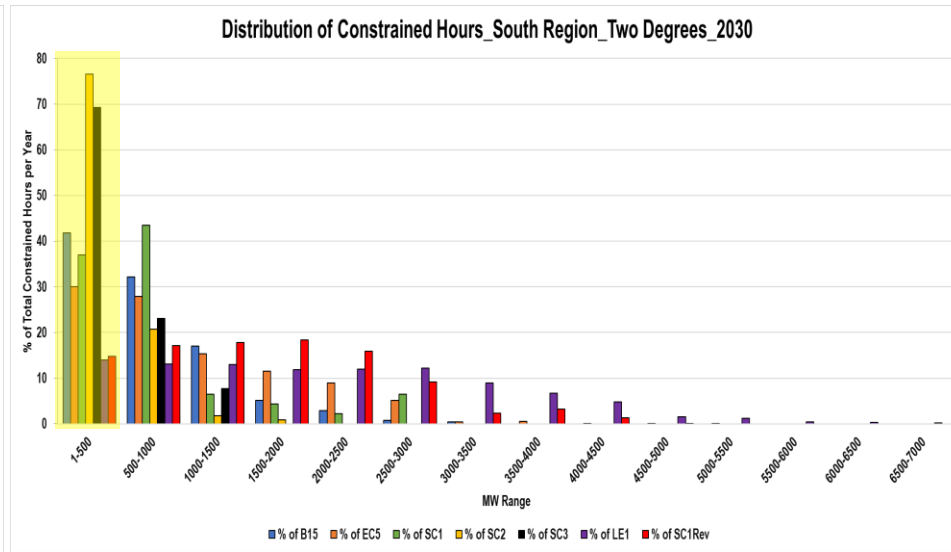
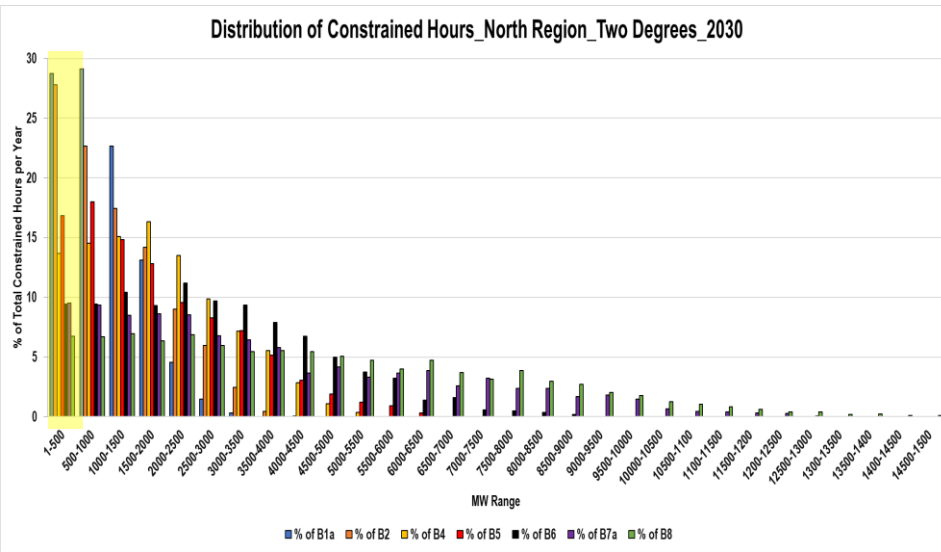


How to read: e.g. approx. 80% of constrained hours on B1a are between 1-500MW in 2021

- These charts illustrate the distribution of constraints per hour across different boundaries in north and south regions in a single year.
- The percentage values are based around the total number of constrained hours per year per boundary.
- These are *residual* constraints, which means the NOA 2018-19 optimal reinforcements are in the background.



## 4.6 Distribution of Constraint Volumes by MW\_TD\_2030

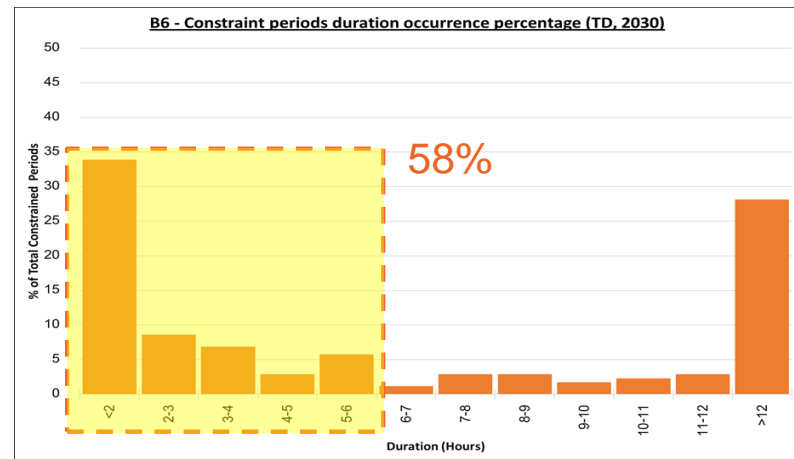
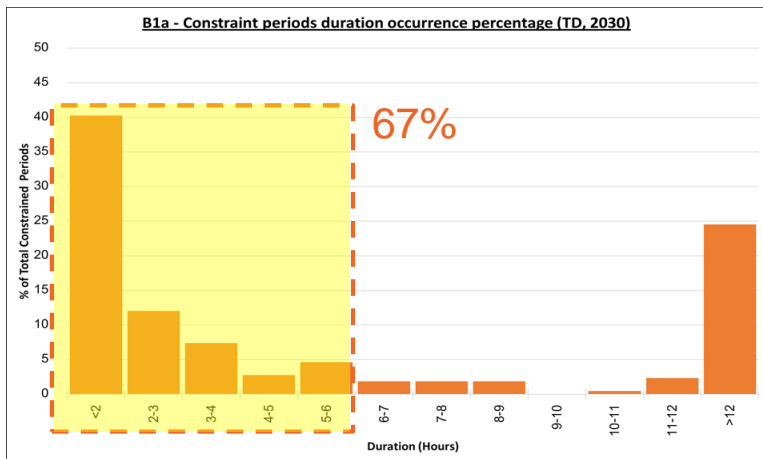
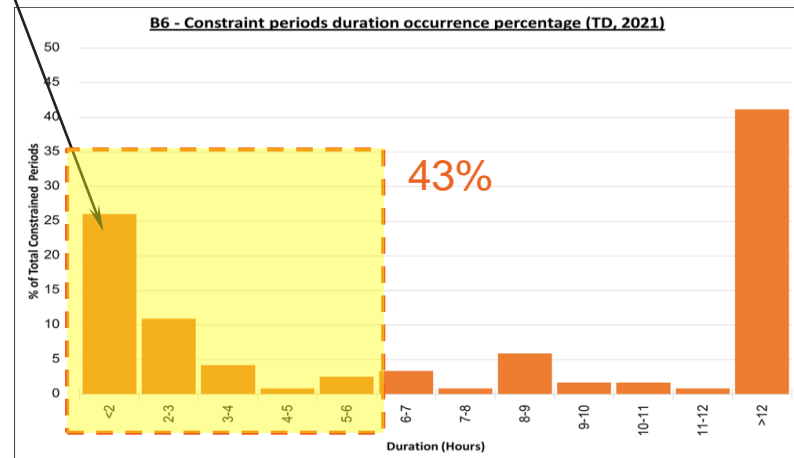
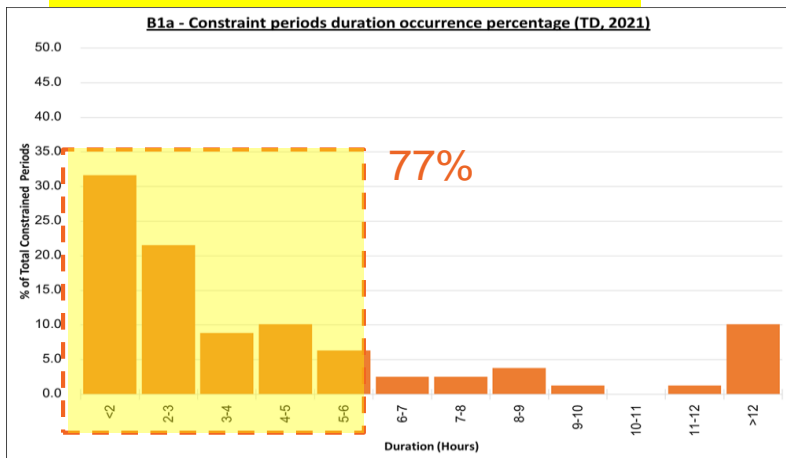


- More northern boundaries will experience higher volume of constraints on the network; however, the frequency of these constraints is less.
- The export boundaries in south region will be experiencing higher volume of constraints.



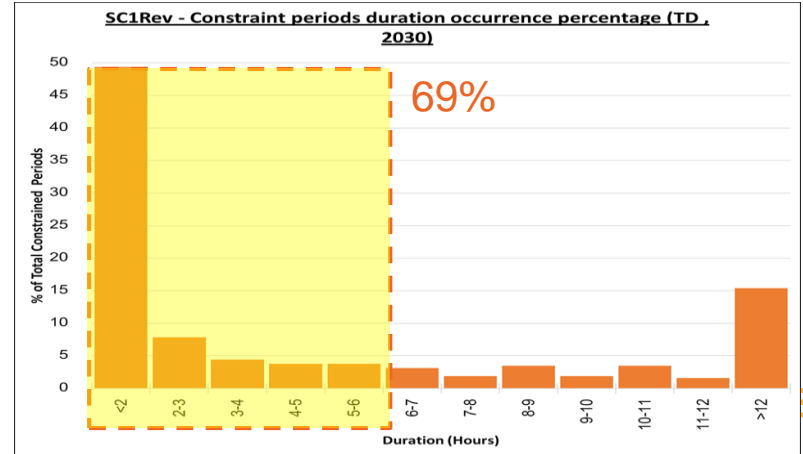
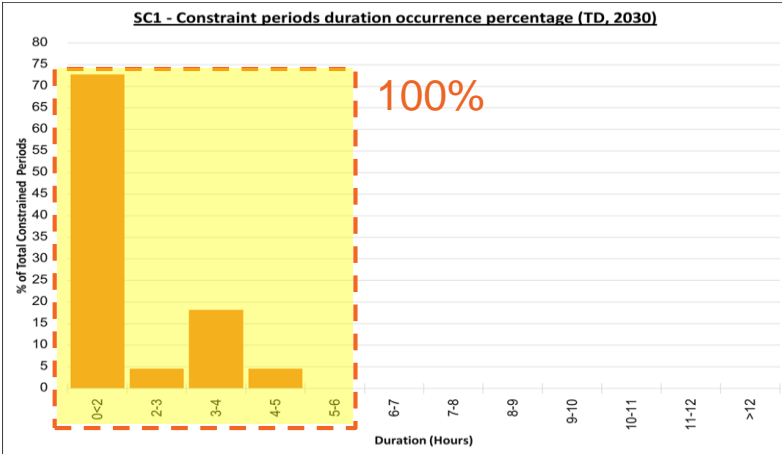
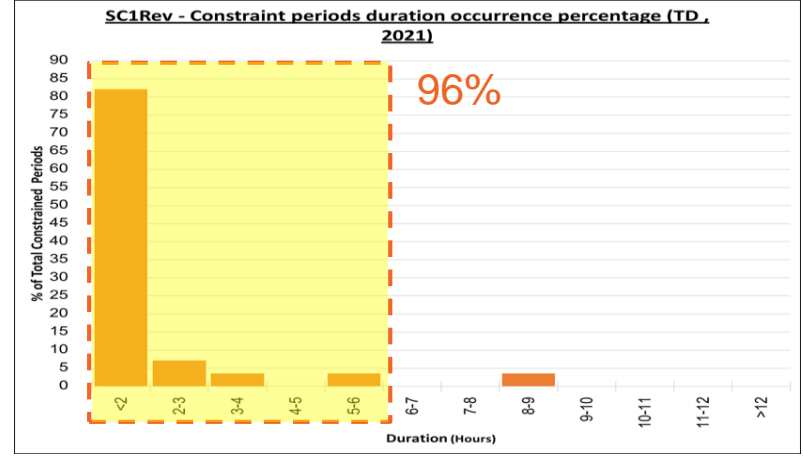
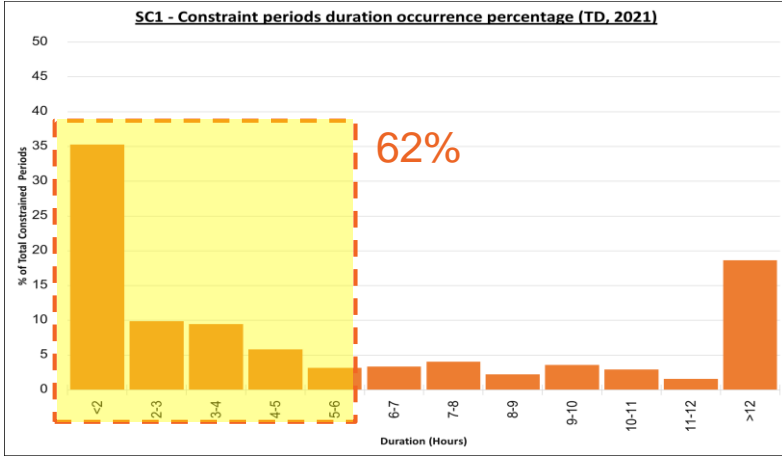
# 4.7 Constraint Duration TD North

*How to read:* e.g. approx. 25% of constrained periods duration on B6 are between less than 2 hours in 2021





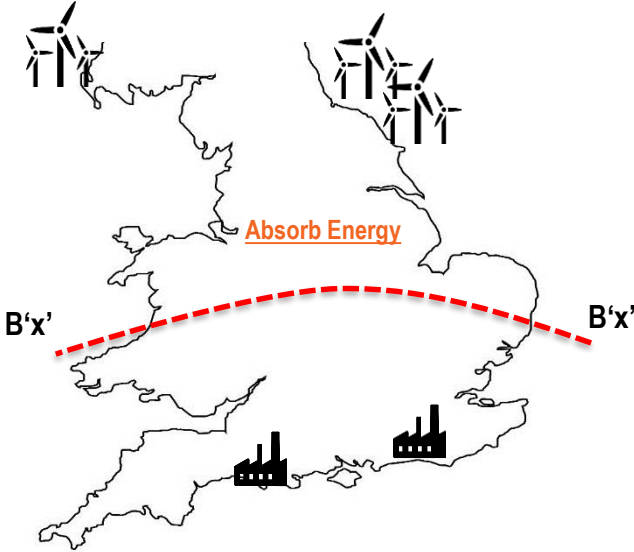
# 4.8 Constraint Duration TD South



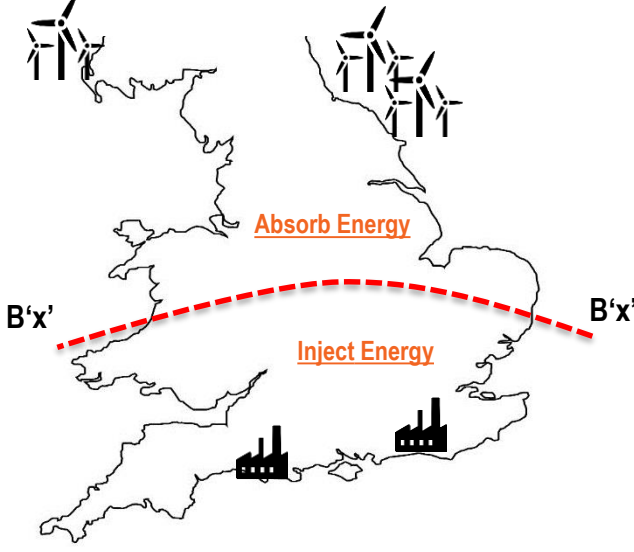


# 4.9 Operation Strategy

## Single Location Concept



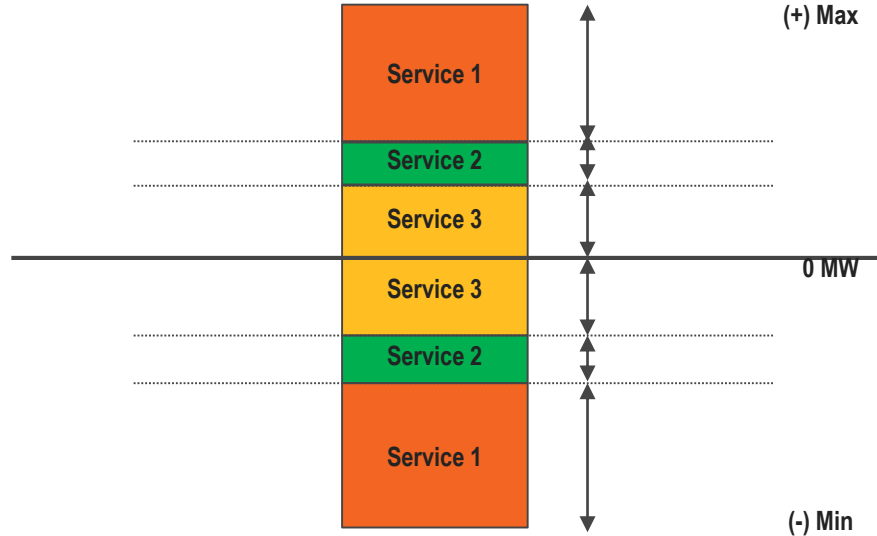
## Dual Location Concept





## 4.10 Stacking of Services

- There may be an opportunity to stack services/revenue streams.



- We need to work with you to understand the impact of stacking services whilst providing a constraint management service. We need to ensure that constraint management services are available when required.



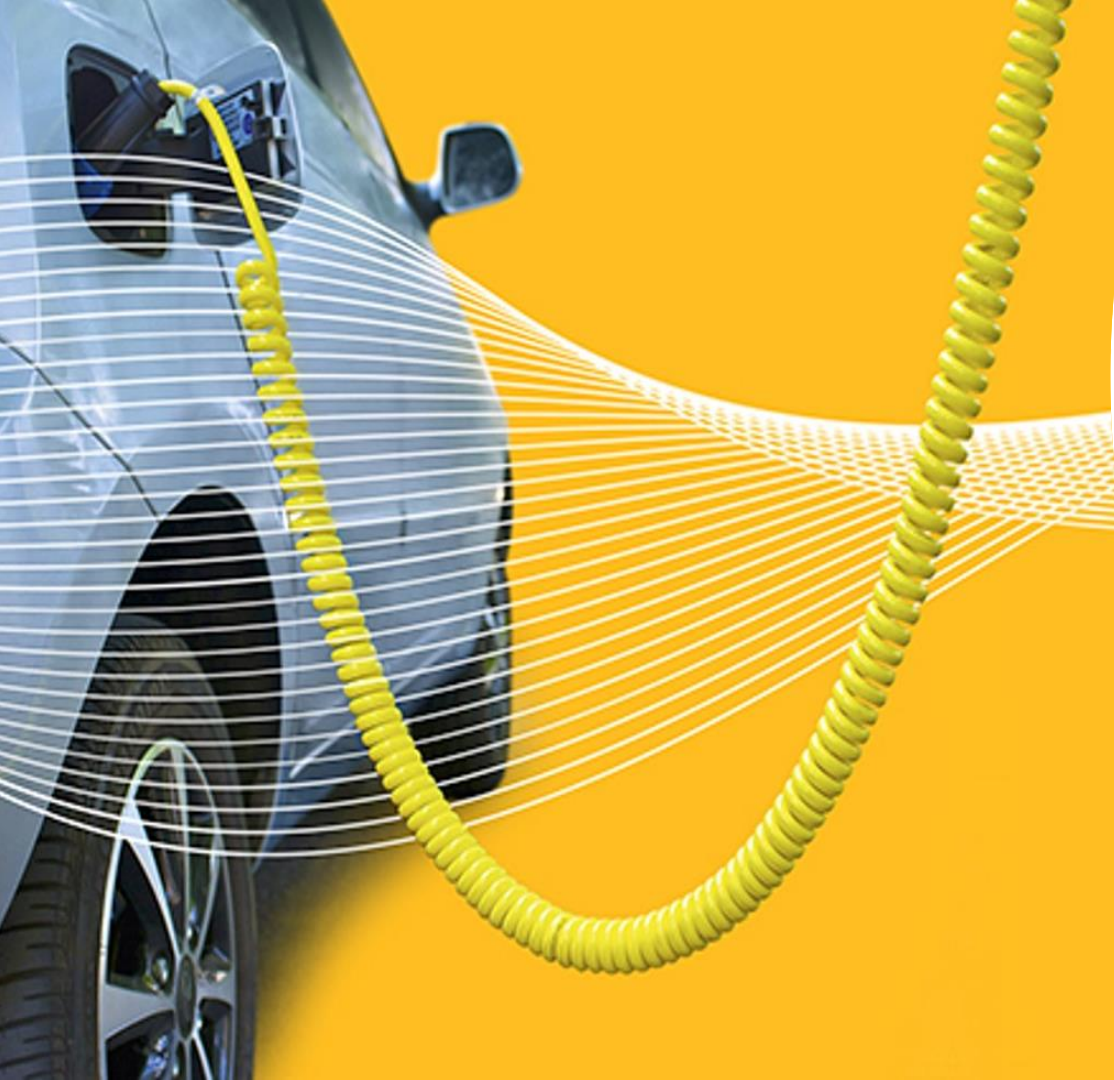
## 4.11 Summary

- Our pathfinding project is a ‘trial by doing’ approach to unlock consumer benefit.
- We are aiming to promote network competition and procure a long-term product to alleviate network constraints by focusing on a *wider pool* of solutions to reduce the constraint costs comparing to the current level.
- The nature of constraints across the network keeps changing at different time horizons. North region will experience high number of constrained hours and periods in future.
- In future, as we export electricity to the mainland Europe, export boundaries will be experiencing higher constrained periods comparing to the current level.
- There is a high correlation between residual-constraints in north region boundaries.
- A time-limited constraint management product can reduce a manageable level of the constraints across the network *but it is unlikely such a service could remove all constraints on the network*
- It is important to note that we have a range of credible FES scenarios; however, due to the time limitations in this webinar, we have presented the Two Degrees findings.





## 5. Commercial and Future Market Framework





## 5.1 Frameworks and Markets

We need to explore potential impacts on frameworks and markets in advance of (and through) the pathfinding project, relating to managing some constraints in this manner in future. Some initial, high-level, thoughts are as follows.

### Single Location Concept

- What happens to the Energy once it has absorbed to alleviate a constraint? When is it released? Who owns it? How is imbalance addressed? What is the impact on the wholesale and balancing markets when released?
- How will the costs of replacing Energy (if required) on the other side of the constraint be accounted for in the CBA?

### Dual Location Concept

- What happens to the Energy once it has absorbed to alleviate a constraint? When is it released? Who owns it? How is imbalance addressed? What is the impact on the wholesale and balancing markets when released?
- Would there be restrictions on stacking opportunities and how will this be accounted for in the CBA?



## 5.2 Contract Options

Subject to addressing the Frameworks and Markets challenges we are interested to understanding any early feedback on potential contractual options:-

### Length of Contract

- We would appreciate your feedback/thought on the optimal length of contract for such a service, acknowledging:
  - NGENSO have recently demonstrated ambition to move closer towards real-time procurement
  - Large CAPEX assets needed to provide a constraint management service, may prefer longer term contracts

### Payment type(s)

- Capability / Availability payment
- Other

### Specific Clauses

- Works programme / locational effectiveness / availability and performance monitoring / penalties



# Polling:

## Question 1

What specific information do you require from us in the future? Have we missed anything in our initial analysis?





# Polling:

## Question 2

What are the most important aspects in respect to frameworks and markets that need to be considered in the future?





## 6. Questions

Please visit our [Network Development](#) page for the latest updates on the pathfinding projects

If you have any questions please contact us:

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