Finding Solutions for Thermal Constraints

Constraints Collaboration Project

18 January 2024

ESO

Introduction

Introduction: Agenda

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Introduction: Objective

Objective of today's webinar

1. To introduce Constraints Collaboration Project (CCP), where the ESO and the rest of industry can co-create on new ways to address the costs of managing thermal constraints

2. To provide industry the opportunities to ask questions

Introduction: Objective

Objective of Constraints Collaboration Project (CCP)

1. **Provides a platform where the ESO and industry can co-create new ways of addressing the costs of thermal constraint**, focusing initially on the network boundaries with the highest volumes of thermal constraints as highlighted by the Electricity Ten Year Statement.

2. **Produce a list of market-based solutions will be assessed using our market design framework.**

3. **Generate a shortlisted set of potential solutions**, co-designed with industry, which we can quickly progress to detailed scoping and delivery phase, **with the intention to be introduced in the short term**

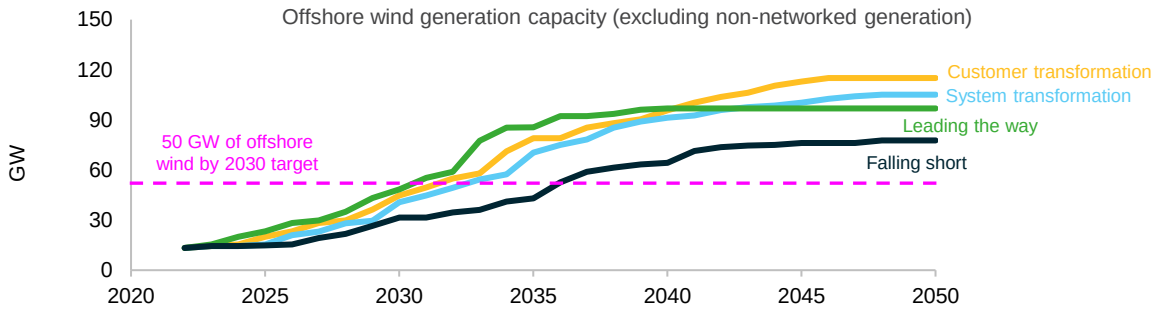
Thermal constraints, due to network congestion, are currently an expensive problem and are forecast to get worse due to increasing wind capacity in Scotland

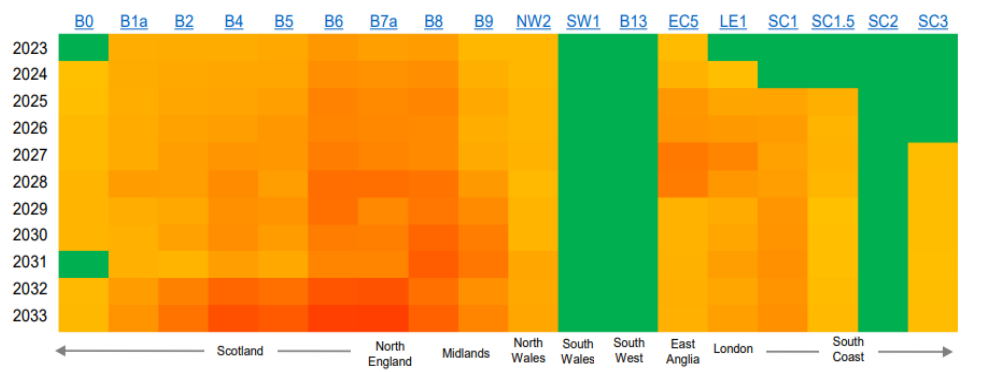
Overview of thermal constraints

Definition
Thermal constraints occur when the amount of energy that would flow naturally from one region to another exceeds the capacity of the circuits connecting two regions causing it to overheat. When a constraint is 'active' the ESO must increase/reduce generation or demand to ensure generation and demand remain in balance to ensure system security.

Whether a constraint is active or not depends on: 1) The boundary constraint limit (how much can flow) ; 2) The flow of power across the boundary.

The importance of addressing thermal constraints





Attainment of the 50 GW offshore wind by 2030 goal

FES analysis suggests that offshore wind capacity is forecast to be 31 – 45 GW by 2030 and 78 - 110 GW by 2050 in the GB system. The Government's target for 50 GW of offshore wind to be installed by 2030 is met only in Leading the Way scenario. Improved approach on thermal constraints could help the Government in meeting their ambition.

The ESO's 10-yr forecast shows increasing congestion into the 2030s

Electricity Ten Year Statement (ETYS) modelling show flows over many boundaries will exceed limits well into 2030s. Forecast costs are estimated at between £500m to £3bn annually by 2030, with significant amounts of wasted renewable energy.

Constraints costs keep increasing due to more wind planned in Scotland, more interconnection come online and slow connections process for new assets.

Source: Future Energy Scenarios (FES), Electricity Ten Year Statement (ETYS)

Thermal constraints are an expensive problem to solve and planned actions to address them have long lead times so we must explore other options

Four options to reduce constraints costs

How	Impact	Description	Example
1. Increase physical network capacity	↑ MWh	Build more wires	Centralised Strategic Network Plan (CSNP), HVDC links
			Constraint management Intertrip service
2. Increase effective network capacity	↑ MWh	Flow more through existing wires	Post fault services, dynamic ratings, TO solutions
3. Reduce overall volume of ESO actions	↓ MWh	Send signals to encourage lower constrained flow	TNUS locational component, nodal/zonal wholesale prices, wholesale market trades
4. Reduce price of ESO actions	↓ £/MWh	Pay less for balancing actions	Demand for constraints, local constraint market,, outage optimisation
			Balancing reserve, constraint boundary optimisation

ESO already takes a range of actions to address constraints through network planning, network management, and other non-network build solutions

Initiative/Activity	Network Planning and Optimisation	Commercial Mechanism	Innovation/ Control Room Activities
Constraints 5 Point Plan			
Constraint management Intertrip service	✓		
Enhanced services from TOs	✓		
Local Constraint Market (LCM)		✓	
Storage for constraint management analysis	✓		
Cost forecasting	✓		
Ongoing			
Primacy rules/ENA open networks			✓
Developing proposals for wholesale market and scheduling reform		✓	
Whole energy market strategy		✓	
Operational visibility of DER			✓
Other constraint management activity			
Software innovation			✓
Outage restrictions	✓		
Constraint optimisation engineers in the control room	✓		

Problem Scope

Over 2024, we'd like to explore, with industry, potential solutions for thermal constraints, which can be implemented and deliver results in the short term

Problem statement

- Constraint costs amounted to approx. £1.3bn in 2023 and are forecast to increase across all our Future Energy Scenarios, reaching more than £3bn in 2029 under the Leading the Way scenario
- The majority of the costs are incurred curtailing wind in Scotland, which was around 4TWh in 2023
- This means that wind is being wasted and having to be replaced by other power generation (often gas), which is closer to demand. As a result, consumers are paying more for their electricity

For the ESO to progress any new market services, the solution needs to:

Reduce volume of constraints
- Increase effective network capacity: enable more green electricity to flow through the wires
- Reduce overall volume of ESO actions: send signals to lower constrained flows to reduce volume of constrained renewable generation

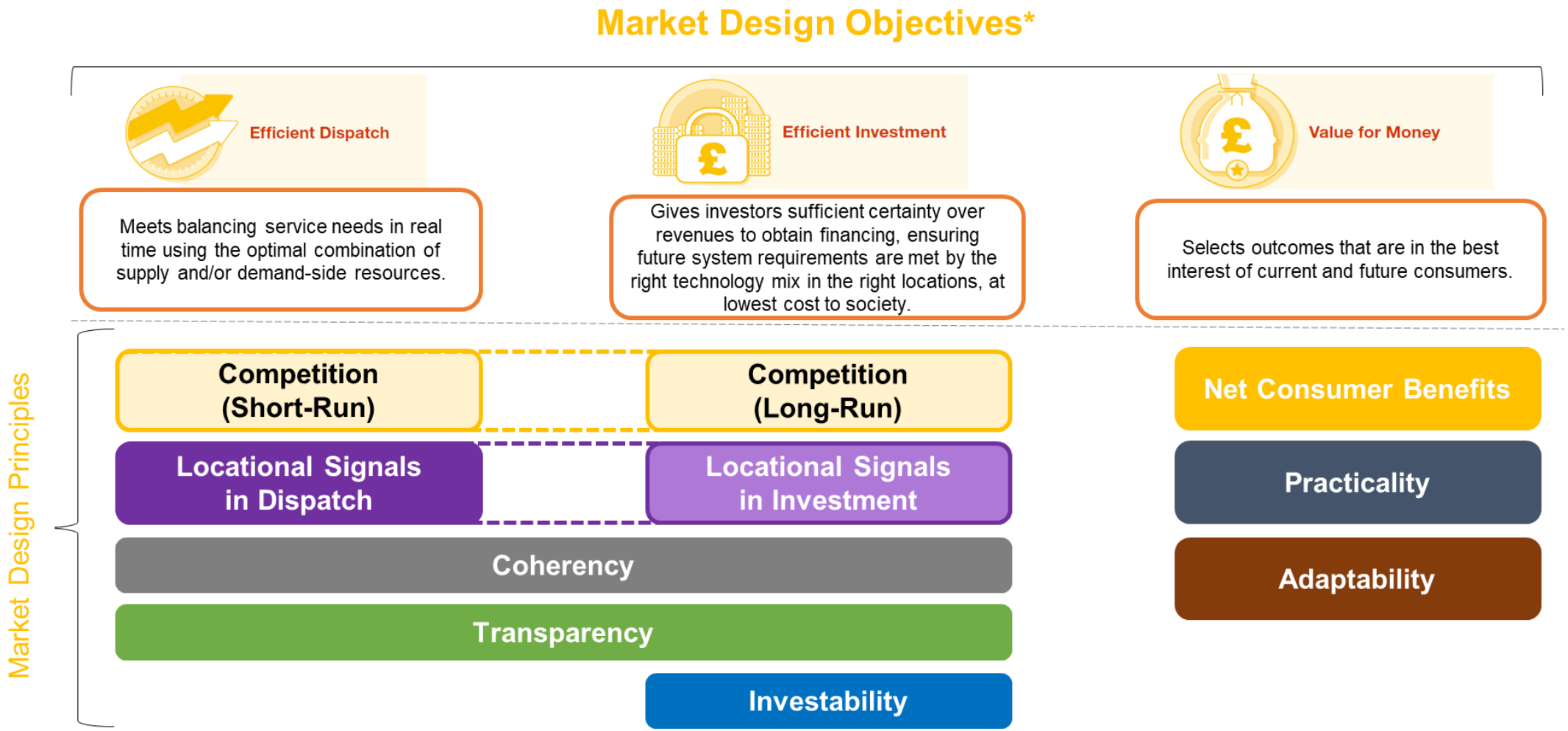
Reduce the cost of managing constraints
- Reduce price of ESO actions: pay less for balancing actions to reduce £/MWh end-consumer pays

Doable

Quick

Effective

Any solution needs to perform sufficiently well against ESO's Market Design Framework (MDF), which aims to assess the trade-offs between efficient dispatch, efficient investment and value for money



*Our market design framework can be found in the latest version of Markets Roadmap publication.

ESO proposals to address thermal constraints

Constraints Collaboration Project: an ESO and industry co creation platform

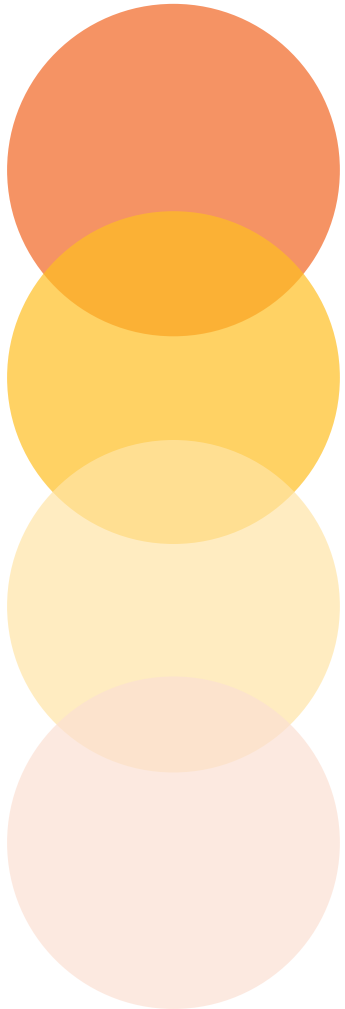
OBJECTIVES

- **Provide a platform where the ESO and industry can co-create new ways of addressing the costs of thermal constraint**, focusing initially on the network boundaries with the highest volumes of thermal constraints as highlighted by the Electricity Ten Year Statement.
- **Produce a list of market-based solutions will be assessed using our market design framework.**
- **Generate a shortlisted set of potential solutions**, co-designed with industry, which we can quickly progress to detailed scoping and delivery phase, **with the intention to be introduced in the short term**

APPROACH

- A six-week industry collaboration will run from 18th January to 29th February. The ESO and the rest of industry will be able to co-create on new ways to address the costs of managing thermal
- Use the template below to submit your new ideas on how to manage thermal constraints here by 29th February. This will help us be able to assess the proposals in a consistent way
- During the collaboration period, you will also be able to submit your views on a possible solution for thermal constraint congestion, called Demand for Constraints here
- We'll host a mid-collaboration period webinar, where we'll present ideas submitted so far and invite industry to input comments, suggestions and questions about them, to help improve and develop them

Market-based solution considerations



What is the appropriate contract length that strikes balance between investment and risk and delivers value for money?

Do we put a value on location and if so, what should this be?

Technology agnostic but how do we guarantee additionality, utilisation, BM vs traded?

How do we value other commercial parameters such as duration, expectation of delivery?

FOR ILLUSTRATION PURPOSES ONLY

Thermal constraint solution template: an example (1/2)

We'd love to hear your views on this possible solution via this form

Name:	Demand for Constraints*
Proposal by:	*ESO*
Overview	
What is the specific part of the thermal constraints problem this proposal is addressing?	*ESO analysis shows that by 2030 we're looking at over 10 TWh of constrained volumes in B6, with the boundary being constrained around 1/3 of year and an average of 4GW of constraint actions required when it is. The majority of constraint management actions taken by ESO involve curtailment of generators; with associated cost, carbon & system operability issues.* ***Demand to use the renewable electricity (instead of it being curtailed) is not currently accessible or available in the right location***
How does it solve the problem?	*This proposal would enable investment in new sources of demand, in the right locations, to use the excess electricity and reduce the volume of curtailment by* ***offering lower cost electricity*** *in those locations. New demand could be in the form of hydrogen production facility, data centre, large distillery, etc. The proposed commercial service offers a deliverable option ahead of more formal government approach via REMA, potential for sharper locational signals via TNUoS changes and would complement traditional network reinforcements.* ***It could provide a market signal for new demand in Scotland and allow the production and consumption of clean energy whilst reducing costs of constraints***
Which of the below categories does your solution fall into (you can choose more than 1 category and please elaborate if 'other') 1. Increase physical network capacity 2. Increase effective network capacity 3. Reduce overall volume of ESO actions 4. Reduce price of ESO actions 5. Other	*2) Reduce overall volume of ESO actions and 3) Reduce price of ESO actions*

*Please note that the template presented is for illustrative purposes only and does not indicate a formal or firm commitment for future commercial opportunities from the ESO.

FOR ILLUSTRATION PURPOSES ONLY

Thermal constraint solution template: an example (2/2)

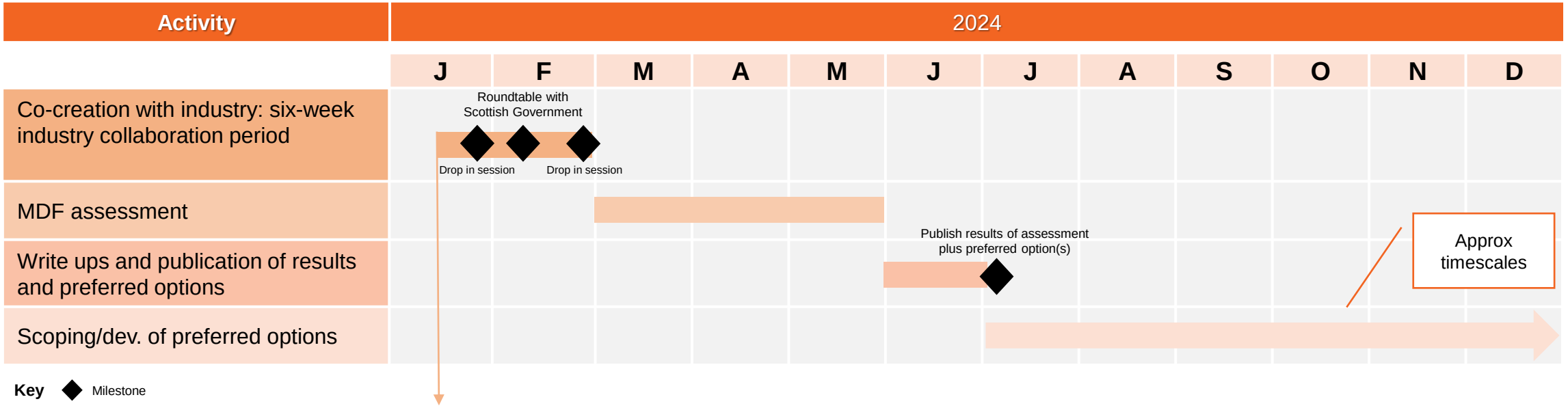
Name:	Demand for Constraints*
Value to ESO Market Design Framework	
What is the value to the consumer? (value for money)	*Limits curtailment of generators and wasted renewable energy , product could be structured to return money to the BSUoS pot providing consumer benefit*
What is the value to the control room? (efficient dispatch)	***Less curtailment** due to increased demand in the right locations*
What is the value to the service provider?(efficient investment)	***Provides longer term investment signals** (until REMA) for new demand sources to locate in constrained areas*
What is the carbon saving value? (helps 2035 target)	***Increases the use of renewable electricity** – exact carbon saving depends on the source of the demand (e.g. H_2 production facility)*
Impact and implementation	
Does this project provide other value to the system? (e.g., stability, frequency)	*Depends from whom the ESO is procuring the demand:* *– If it was a hydrogen production facility, then it could deliver whole system benefits through the contract, for example abatement of fossil fuel usage outside of the electricity system. Out of the other ancillary services, reserve may be the most likely for them – further investigation is required to determine how quickly a hydrogen facility could flex their plant.*
What are the potential challenges with implementation?	*Further investigation needed to assess the value to consumers and how the scheme could work in reality (for example with regards to eligibility and ESO licence conditions)*
When would we contract? (e.g., day ahead, T-1, T-4)	*Tender two years ahead (e.g. in 2024, for phased delivery in 2026-2029)*
How long is the contracting period?	*10 years, with sunset clause when locational pricing kicks in. Duration of 10 – 50 hours per annum (when receiving discounted electricity)*
How would prices be set?	*Tendered*
What is the lead time?	*To be confirmed: subject to administrative feasibility*
Other comments	*Still scoping the idea, looking for co-creation with industry to develop feasibiltiy*

*Please note that the template presented is for illustrative purposes only and does not indicate a formal or firm commitment for future commercial opportunities from the ESO.

Delivery Plan and Timeline

Delivery plan and timeline:

We are running a 6-week industry collaboration period to investigate other short term, market-based solutions to build on our already successful Constraints 5 Point Plan and Constraint Management Pathfinders



Instructions for filling out the industry collaboration form:

- The industry collaboration form can be found on the ESO thermal constraints web page, and the deadline for completing it is Friday, 29th February
- Please note that this collaboration form is not a formal part of any procurement process and does not indicate a formal or firm commitment to future opportunities from ESO. Submitting this collaboration form also does not commit you or your organisation to any specific course of action.
- Should you have any questions, please contact box.market.dev@nationalgrideso.com.

Q&A

ESO