Outturn Availability and Generator Forum
4th March 2021

EIRGRID
The current. The future.

Agenda

- **Outturn Availability Process/Updates**
  - Outturn Availability Overview
  - Ex-Post 2020 Report
  - Outturn Availability Settlement

5 min break

- **Transmission Outages**
  - TOP21 Overview
  - Programme Delivery Update
  - ESB Networks Update

5 min break

- **Operational Updates**
  - EDIL Declaration Codes
  - System States
  - New Control Centre Tools and Ramp Forecast

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Generation and Transmission Outage Planning

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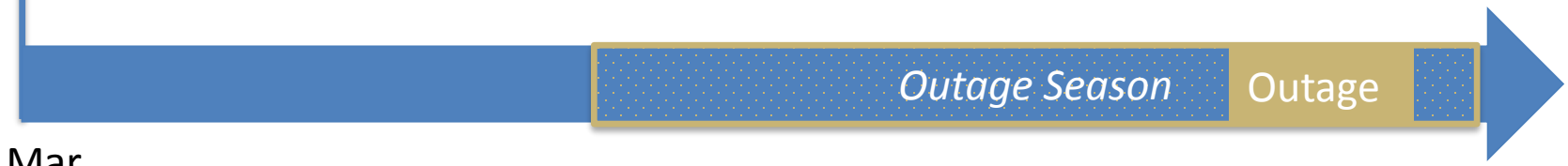
Generation Outage Planning

Generator Outage Requirements

Grid Code Requirements:

- Confirm the outage plan(s) for each Generation Unit to EirGrid for Year Y.
- Submit the provisional outage plan(s) to EirGrid for Y+1 and Y+2.



Mar
Y-1

Submission of Annual Outage Plans

Submission of Annual Outage Plans- Form GEN03

Year of Outage	Company Name	Station Name	Unit Name	# days	Proposed Start Date	Proposed End Date	Outage Reason	Additional Information

http://www.eirgridgroup.com/customer-and-industry/general-customer-information/outage-information/generation-outages/

Generator Outage Detail Form – Form GEN04 (V2.1)

Section 1 of 4: Outage Details

Section 2 of 4: Availability of supply to the Generator Transformer

Section 3 of 4: Testing

Section 4 of 4: Commissioning & Energisation Requirements

Will there been any *material* change to any of the HV equipment at the generator's site such that:	Y/N	If Yes, please provide details (including estimated dates)
An EirGrid **Energisation Instruction** (EI) will be required e.g. for invasive work on HV plant including CBs, VTs, CTs, connections, transformer, transformer auxiliaries, etc? Details of when an EI is needed are contained in the Becoming Operational Generator Customer Information Pack,		

http://www.eirgridgroup.com/customer-and-industry/general-customer-information/outage-information/generation-outages/

Generation Outage Planning: Wind

- Controllable WFPS: Grid Code requirements for outage planning apply (OC2)
- Endeavour to align maintenance with outages wherever possible
  - Greater opportunity to align if information is received in a timely manner.
  - As soon as outages are known, please submit to EirGrid.

i. **Wind Farm Outage Request Form**: for all outages greater than 5 MW
ii. **Request for Transmission Work Form**: for work requiring an ESBN operator

- Any questions, please contact your EirGrid Customers and Stakeholders account manager.

Note: Distribution connected windfarms: all communications are through the DSO except Wind Farm Outage Request Form - Send directly to TSO & copy DSO

Submission of Wind Farm Outages

Wind Farm Outa

EirGrid endeavour continuousl
the market. Full and partial
forecasts. Failure to provide ou
Grid Code will affect the forec
for wind dispatch and market s

Please complete the following
throughout the year. We requ
3 weeks in advance of the requ

Section 1: Outage Request Typ
New Complete Wind Farm Ou
New Partial Wind Farm Outag

Section 2: Wind Farm Descript	
Company	
Wind Farm	
Market ID	

Section 3: Outage Description	
Outage Reason	
MW Unavailable	
Start Date	
End Date	

Generator VO Request Form – Form GEN06

To:	From:	Date:
Subject:		

Section 1: VO Details

Item(s) of Plant on VO		
Preferred VO Timings	VO Start Time/ Date	VO Finish Time/ Date
Reason *(please provide as much detail as possible)*		
ESB Networks Required *(if yes state time, date and Station in Charge of Switching)*		

Section 2: Commissioning & Energisation Requirements

Will there been any *material* change to any of the HV equipment on site such that:	Y/ N	If Yes, please provide details *(including estimated dates)*
a Declaration of Fitness (DOF) will be required to be submitted		
an EirGrid **Energisation Instruction** (and hence		

http://www.eirgridgroup.com/customer-and-industry/general-customer-information/outage-information/generation-outages/

Generation Outage Planning

Inputs

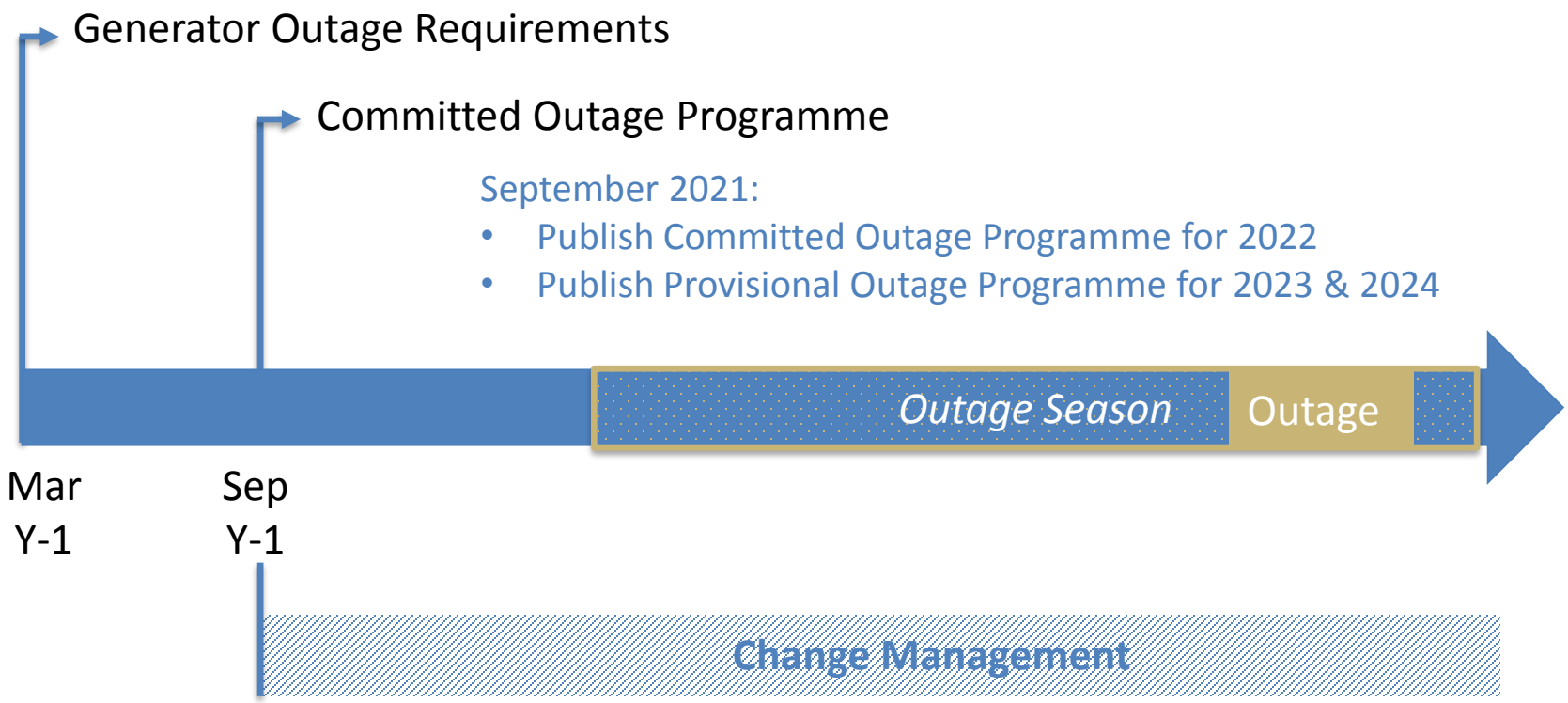
Generation outage requirements
Wind generation capacity credit
Tie-line capacity
Interconnector capacity
Forecast demand
Operational security standards

Methodology

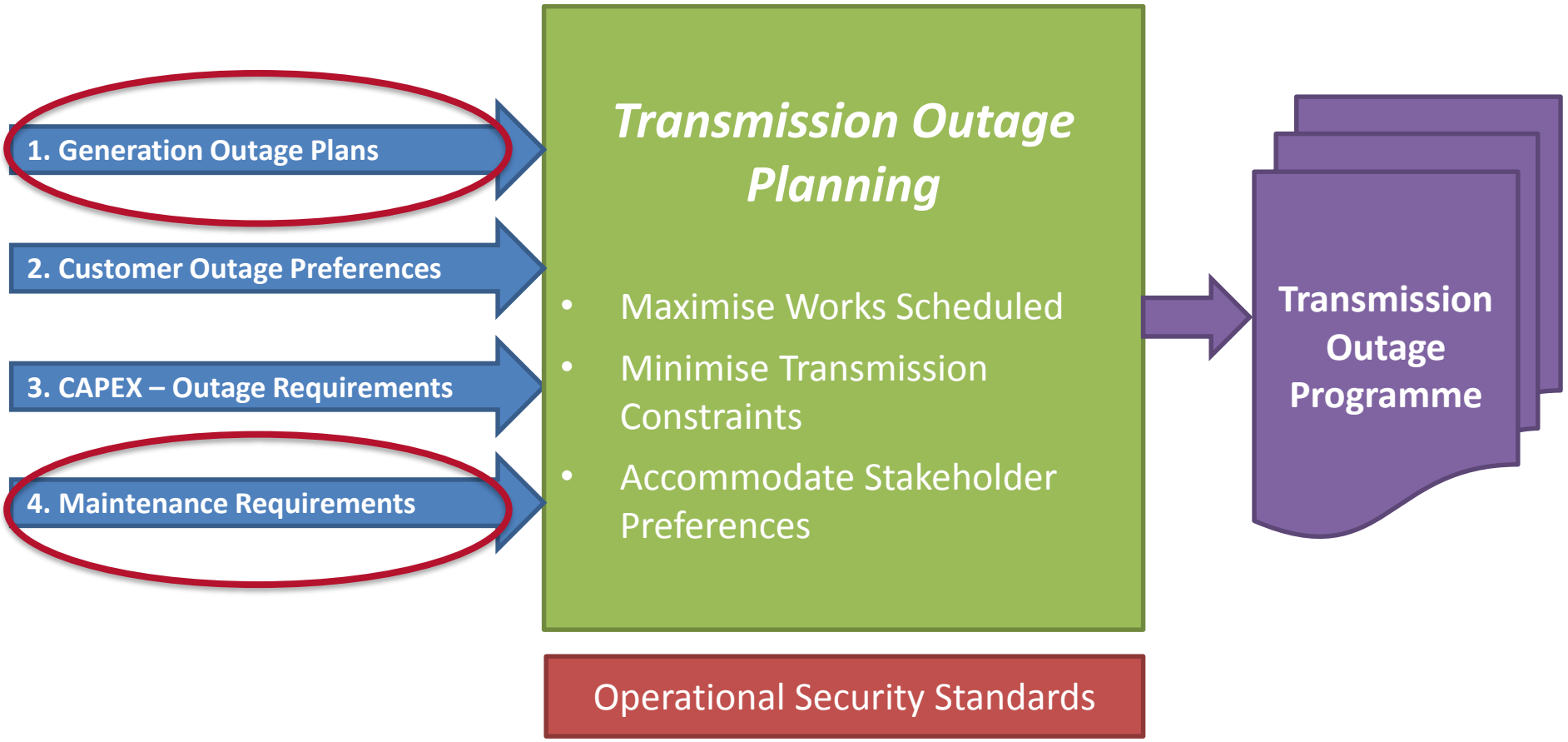
Deterministic and probabilistic analyses
A number of criteria must be satisfied:

- Minimum margin
- Maximum Loss of Load Probability
- Operational constraints
  - Replacement reserve
  - Black Start
  - Regional

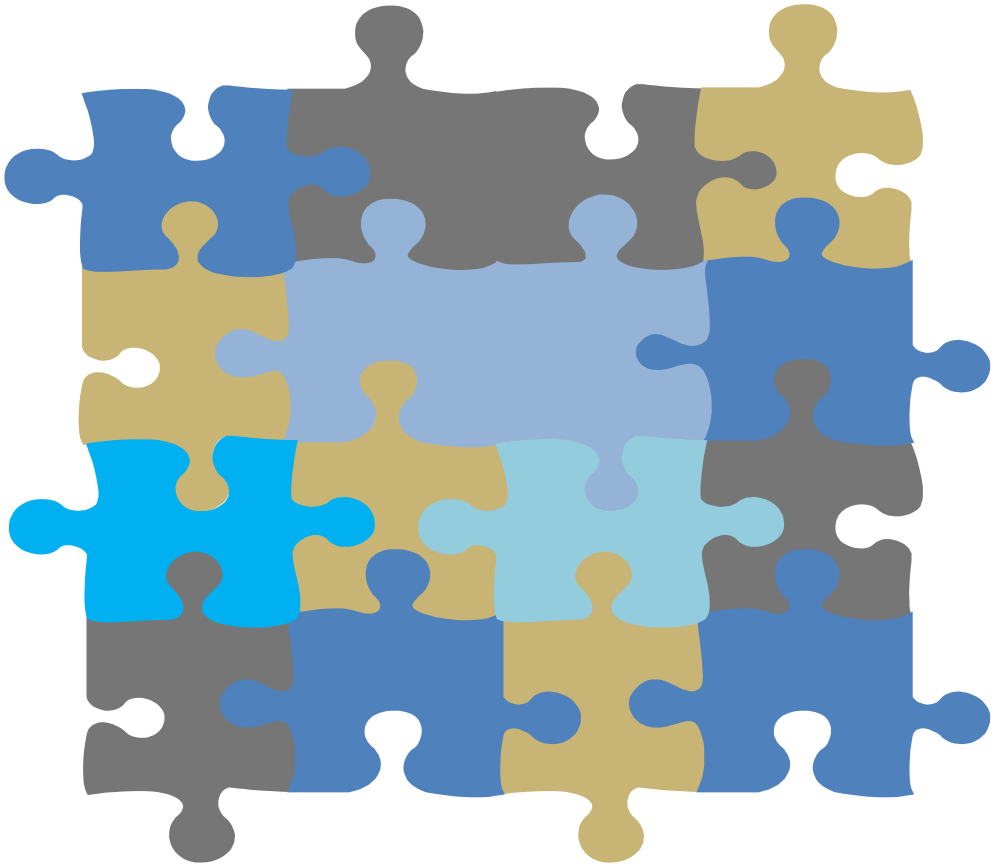
Outage Planning



Transmission Outage Planning



Transmission Outage Planning



Generator Outage

Capital Projects

Maintenance

Considerations:

- Highly Meshed Network
- Outage Conflicts
- Complimentary Outages
- Proximity Outages
- Align outages to avoid double impact on customer

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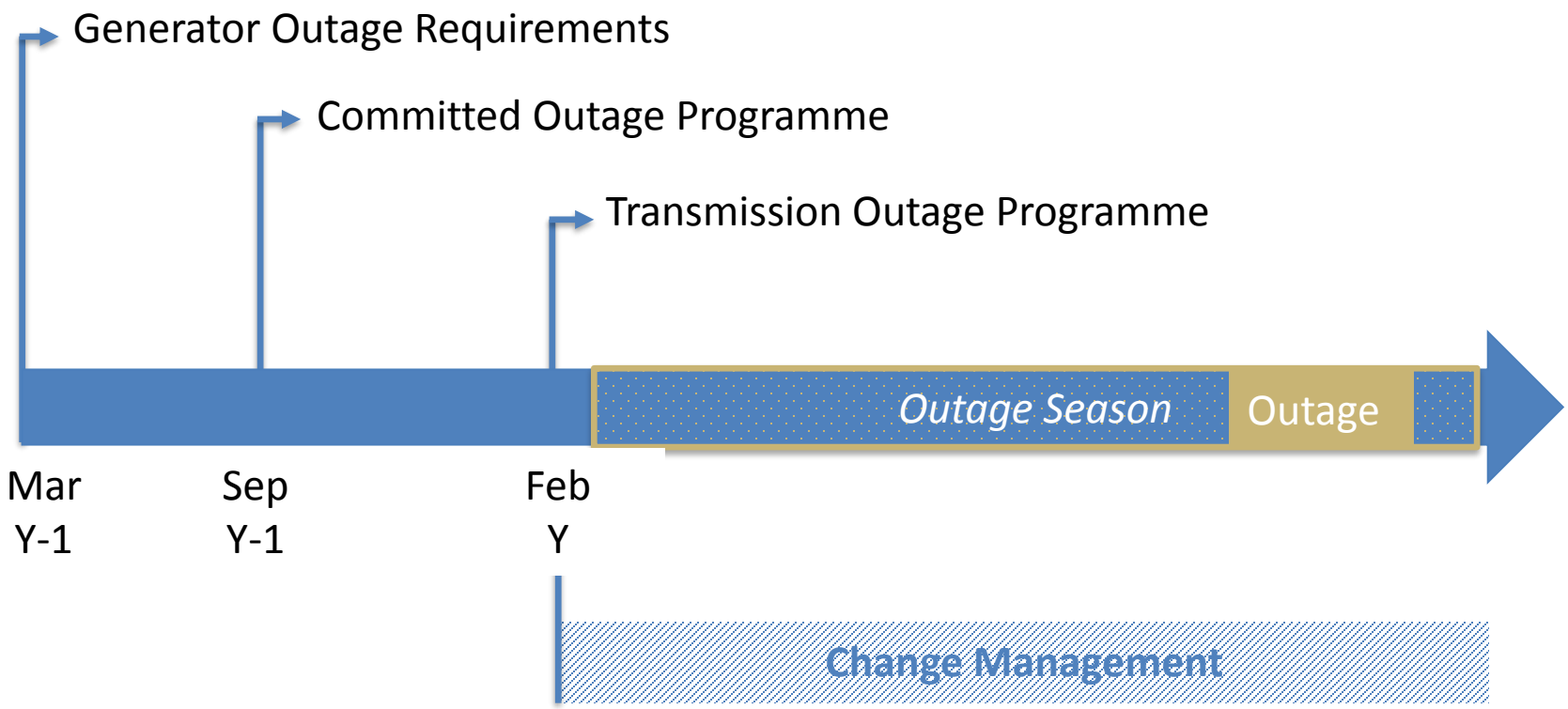
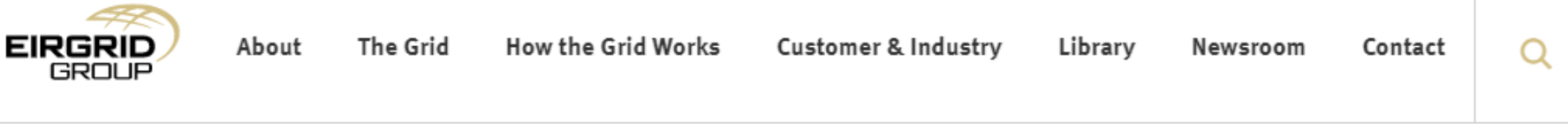
Outage Planning



Transmission Outages on EirGrid Website



Home › Customer & Industry › General Customer Information › Outage Information › Transmission Outages

Transmission Outages

Transmission Outages involve planned times when transmission infrastructure (lines, cables and substations etc.) will be maintained and not in service. It also involves times when testing, connection of new plant and decommissioning of old plant is carried out.

2021 Transmission Outage Programme

We plan and manage an annual Transmission Outage Programme. This programme includes all outages of transmission infrastructure which are planned to occur this year. You can access a list of planned outages for the remainder of 2021 at the link below. Separate tabs are provided to list outages by region. An 'Info' tab is provided to give information on the transmission outage planning process. An updated version of this document will be published in the first week of each month.

Transmission Outage Programme 2021

Annual TOP, updated monthly

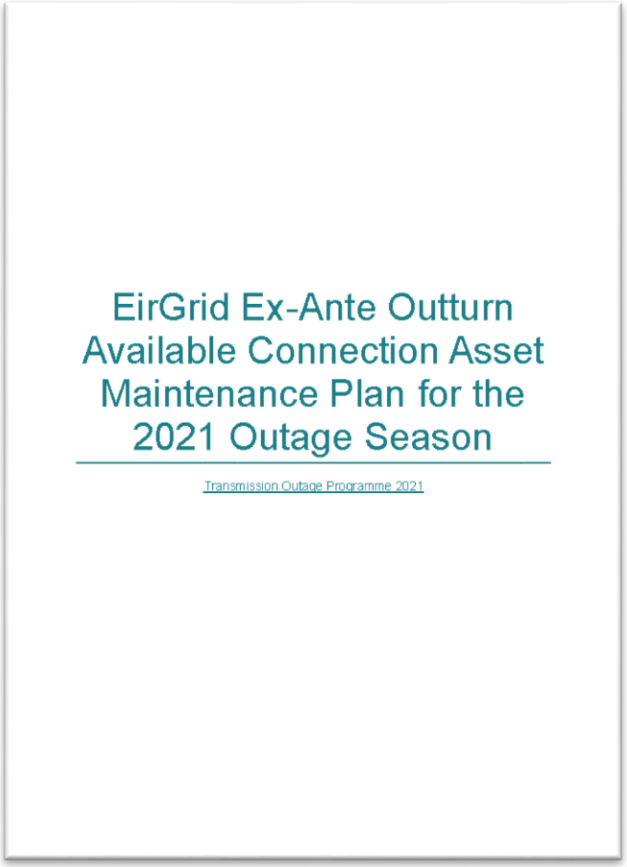
The following are the weekly documents dealing with the Transmission Outage Programme 2021.

Transmission Outage Summary 2021 (Week 8-9)

Fortnightly Look Forward

http://www.eirgridgroup.com/customer-and-industry/general-customer-information/outage-information/transmission-outages/

2021 Ex-Ante Report



- Report contains the overview of 2021 OACA Maintenance Programme.
- The Ex-Ante report is reviewed by the CRU.
- Following CRU approval it is published on the EirGrid website.
- Comments on the format and content can be sent to **OutagePlanning@EirGrid.com**

Questions?

Outturn Availability (OA) Overview

TSO implementation of Outturn Availability Decision SEM-15-071

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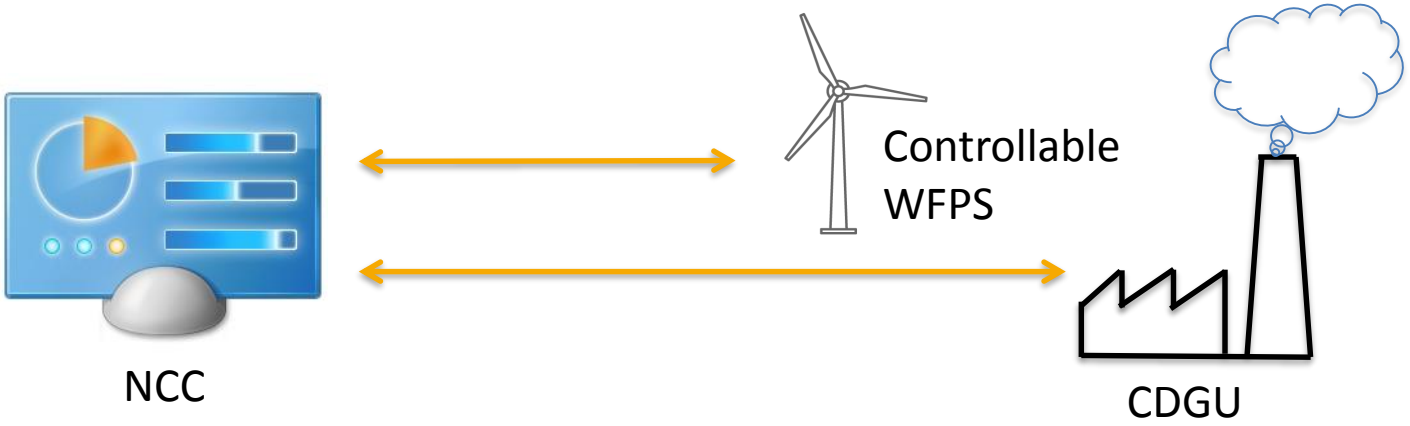
Scope of Outturn Availability

- Centrally Dispatched Generating Unit(s) (CDGUs)
- Controllable Wind Farm Power Station(s) (Controllable WFPS)
- *For disconnection of Outturn Availability Connection Asset(s)* (**OACAs**) *on the transmission system*



What is Outturn Availability?

- Applicable generation units must declare their Availability as per the relevant Grid Code
- Except for the following events where they must declare Availability as zero
  - Up to five calendar days for TSO scheduled annual maintenance work on Outturn Availability Connection Assets (OACAs)
  - Where transmission work is being carried that is related to the relevant generation unit
- The TSO will schedule Annual Maintenance to coincide with Generation Unit outages whenever possible.

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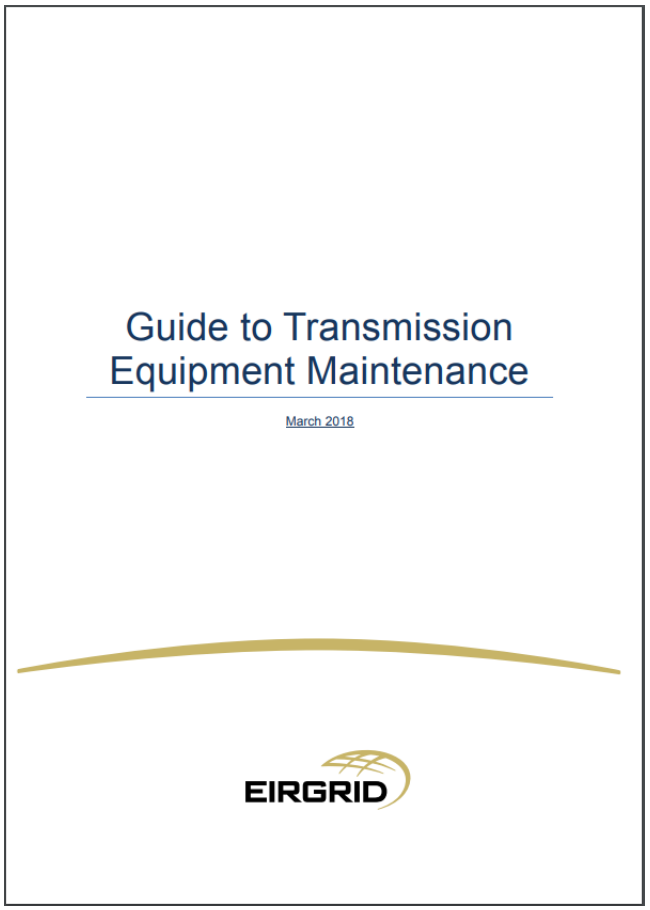
How is Maintenance Work Decided?



- Generators are disconnected for annual maintenance
- Policy requirement
- Rooted in safety/reliability
- Completed by the TAO

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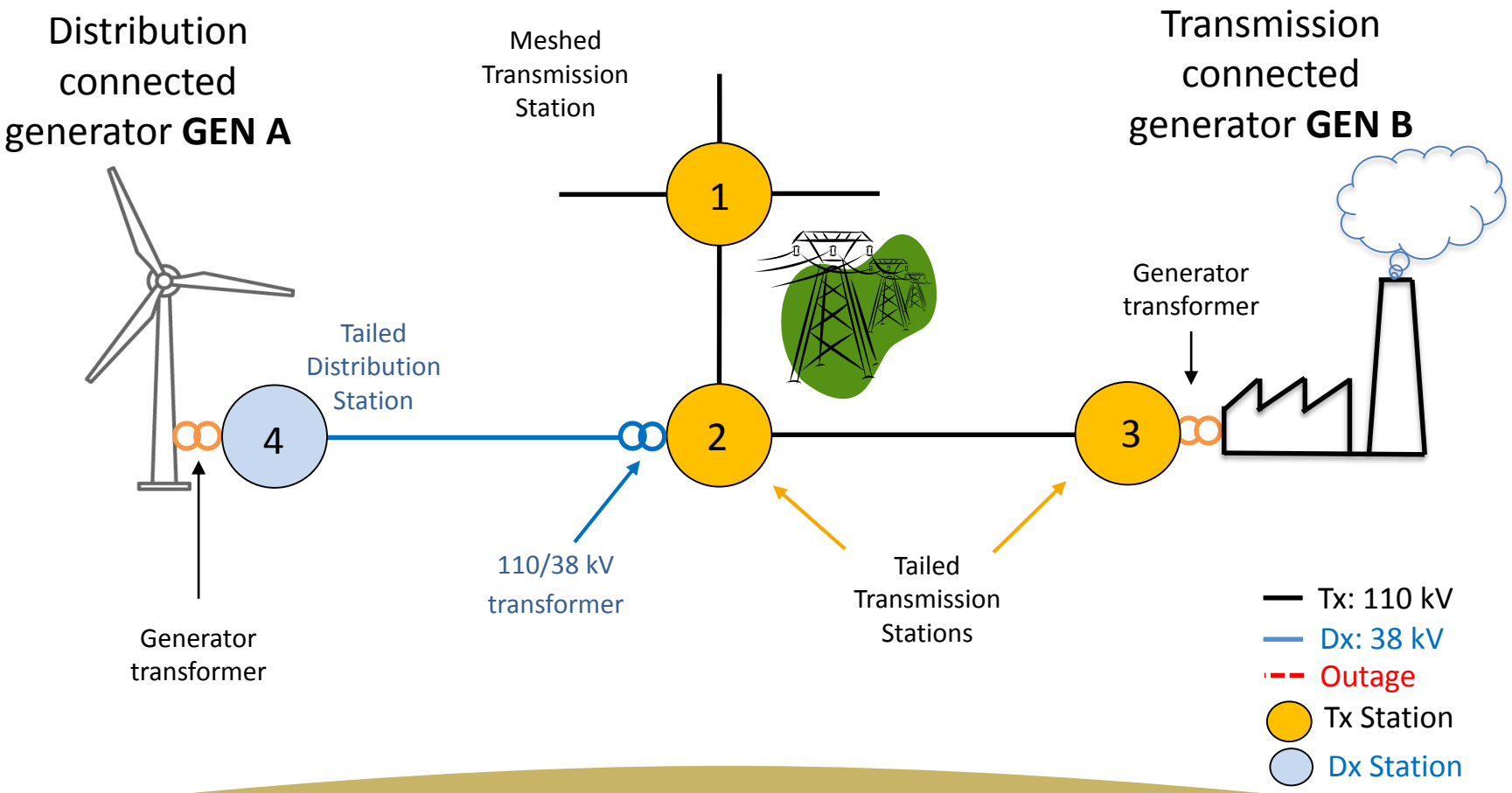
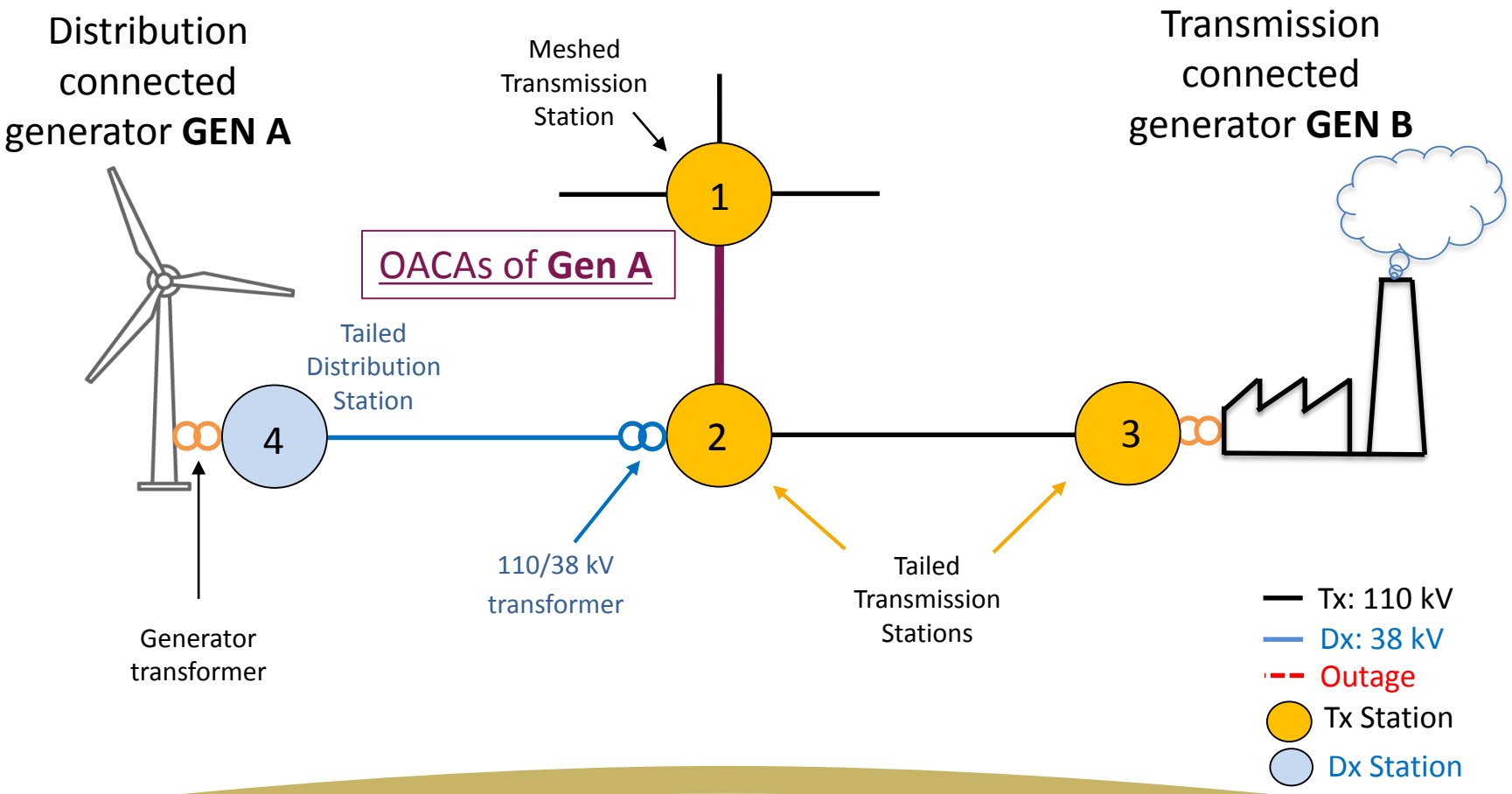
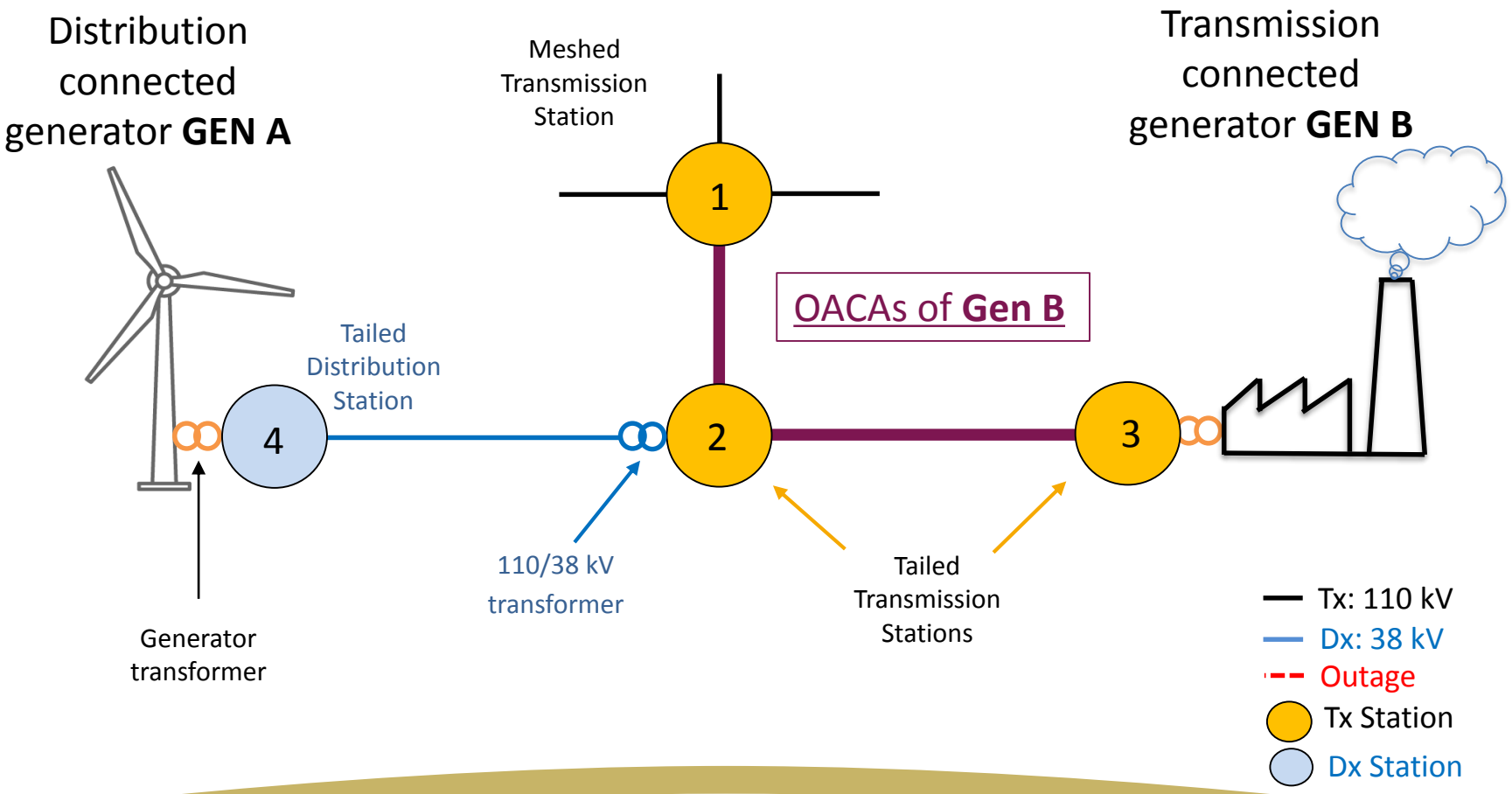
Recap: Tailed Transmission and Distribution Stations



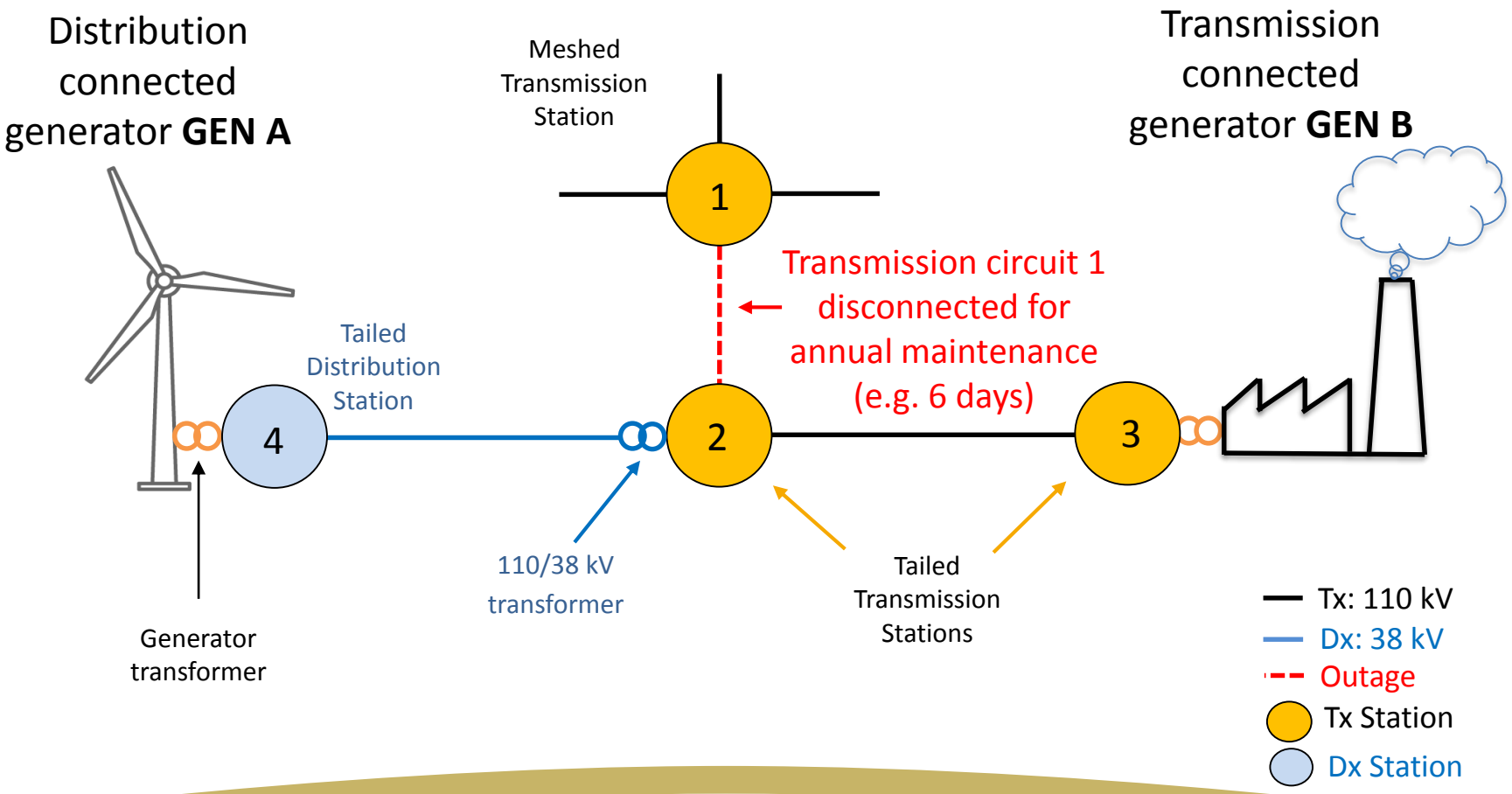
Tailed Transmission and Distribution Stations



Tailed Transmission and Distribution Stations



Tailed Transmission and Distribution Stations



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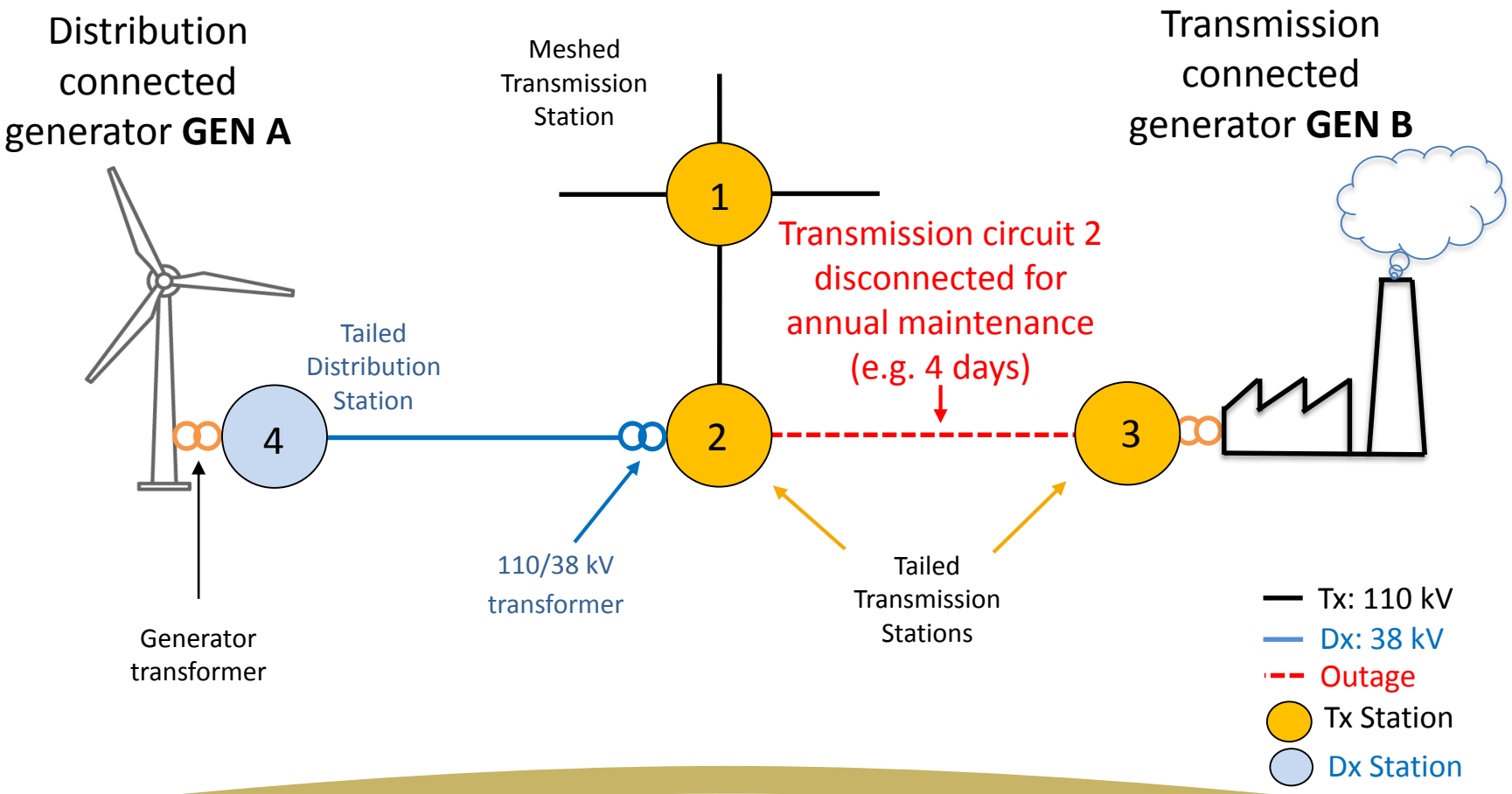
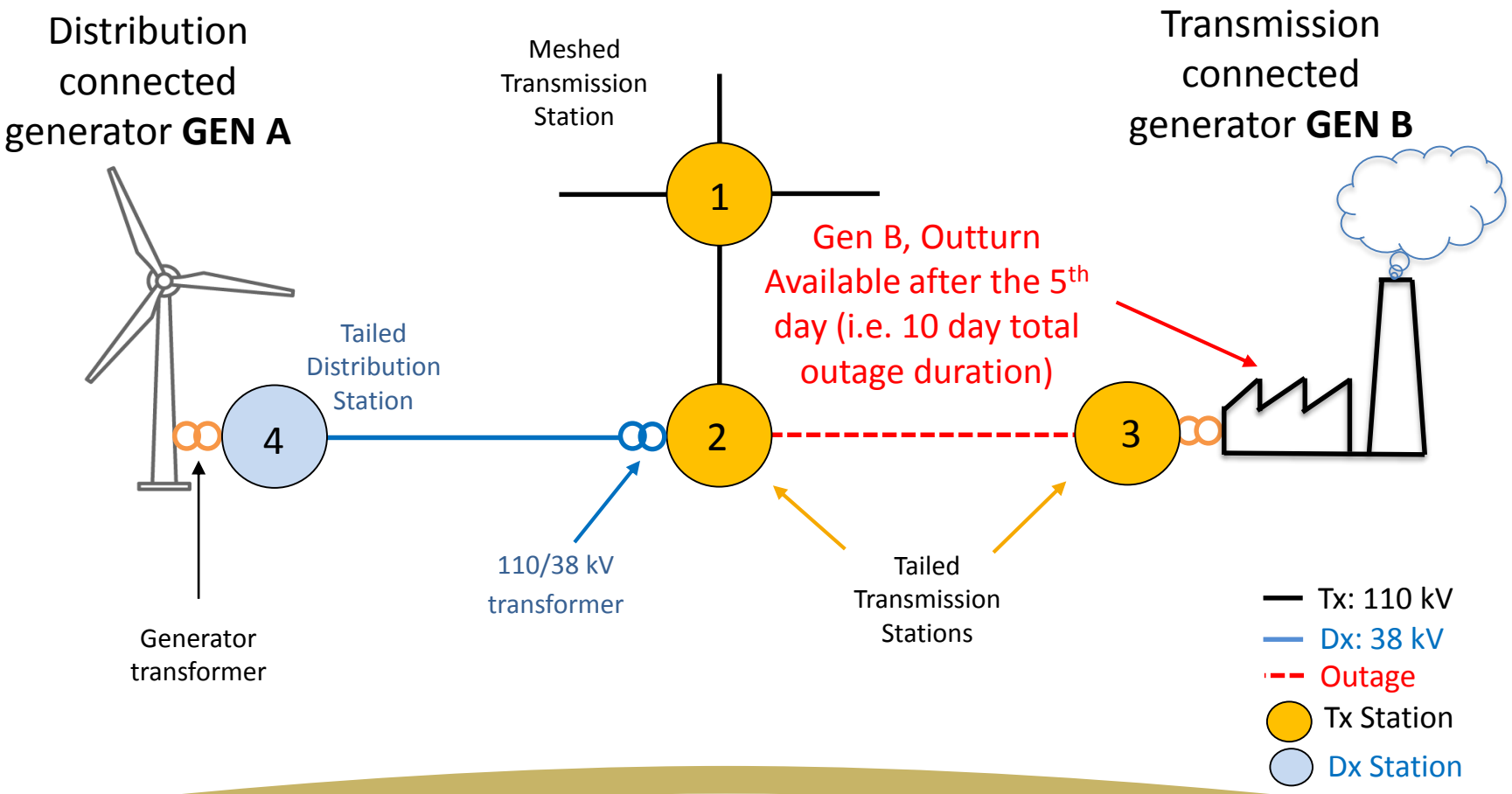
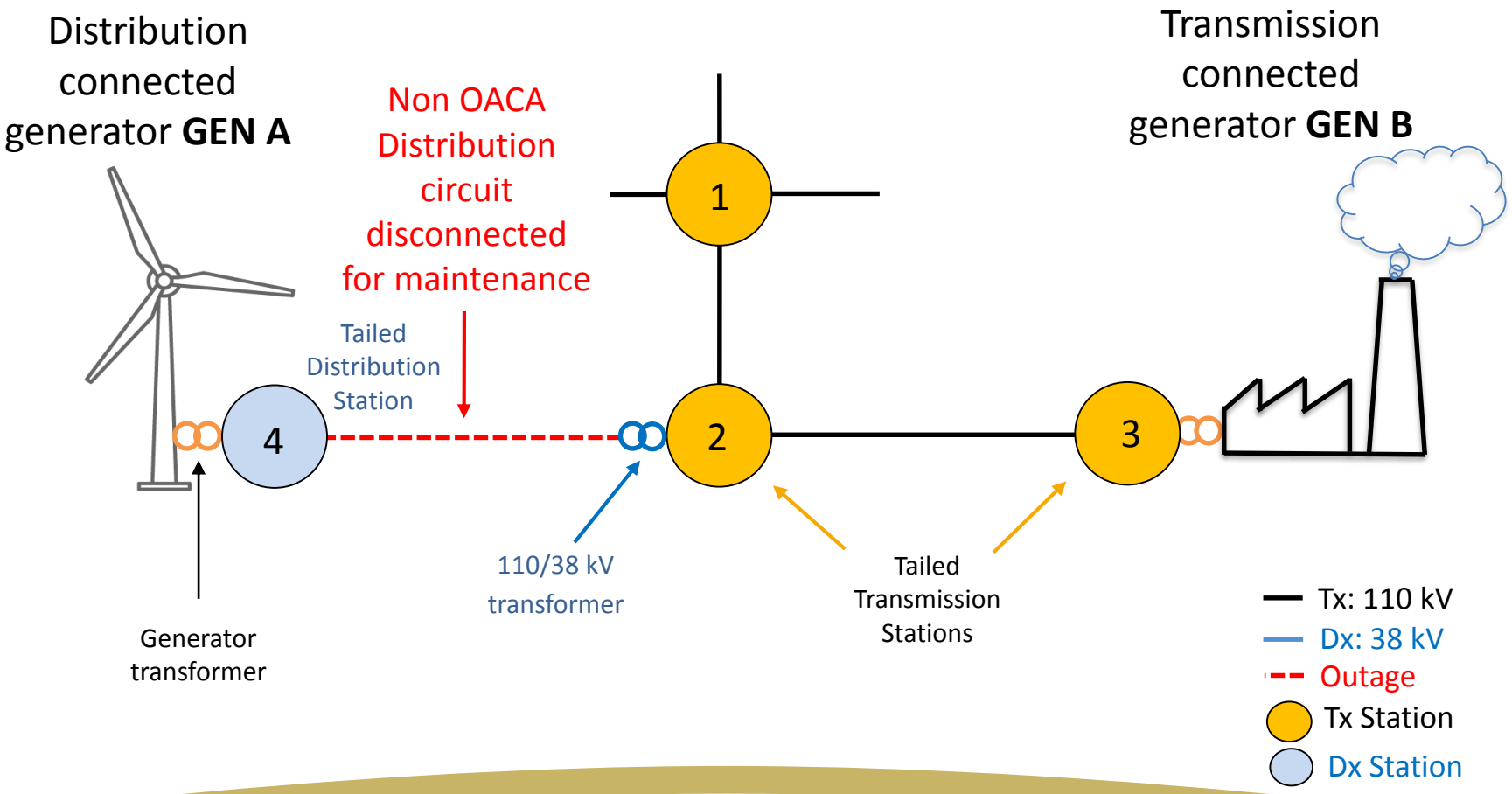


Tailed Transmission and Distribution Stations



Tailed Transmission and Distribution Stations



Assignment of 5 Designated Days

1. Will align OACA Maintenance with the Generator Outage wherever possible.
2. Schedule the maintenance as close to the beginning of the Generator Outage as possible.
3. Minimise the duration of any OACA Maintenance that is not overlapping with the Generator's Outage.
4. Generator's requests for specified dates of scheduling of OACA Maintenance that is not overlapping with the Generator's Outage shall be reflected where possible.

Provision of Windfarm Availability to SEM

- EirGrid provide a forecast of a windfarms power output, sourced from our vendors, to SEM for the period where the windfarm is outturn available but disconnected due to a transmission outage.

Questions?

Ex-Post Overview of 2020

Overview of the 2020 OACA Outage Season

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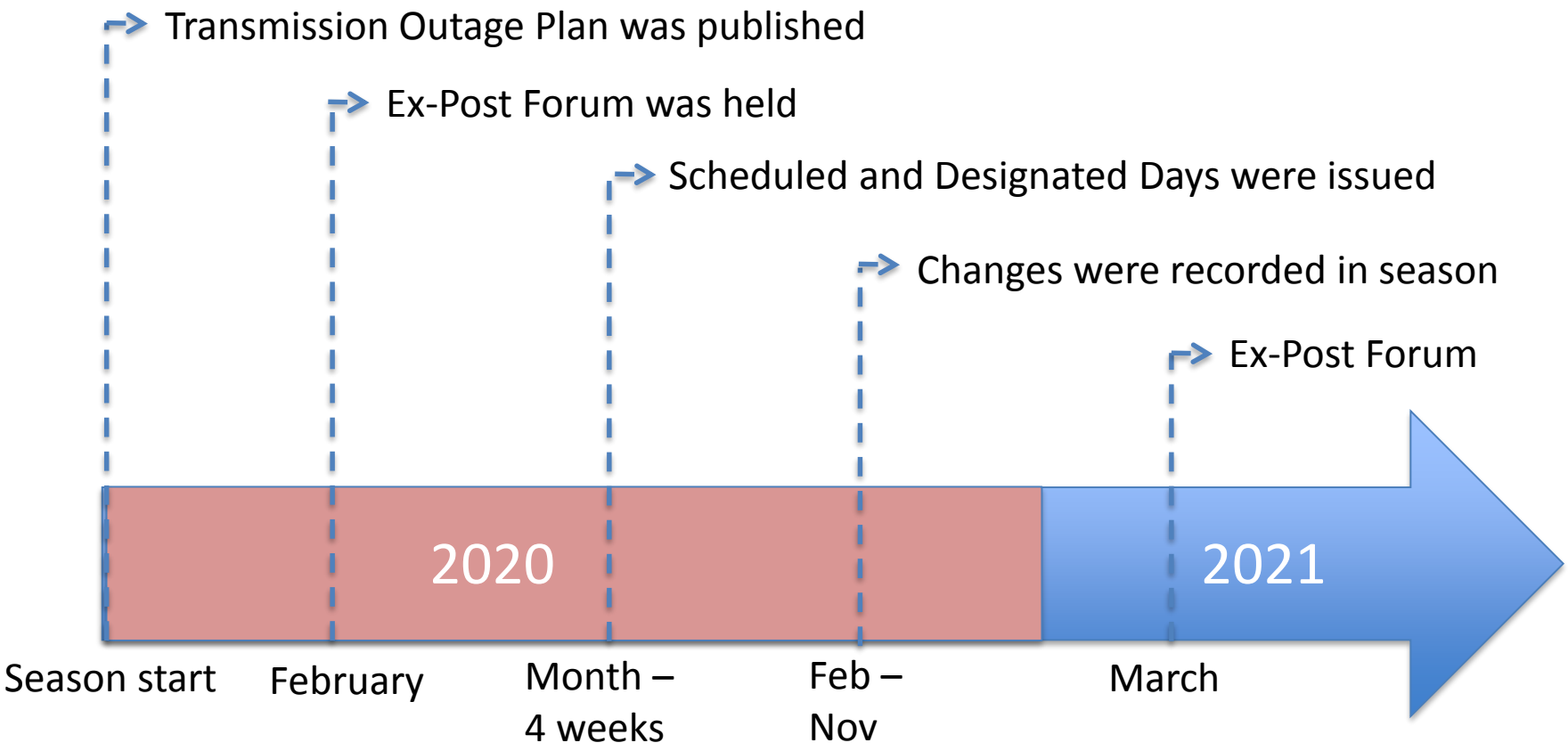
2020 Outage Season in Review



Month–4 weeks Scheduled and Designated Days

Throughout the season, each generator received details of the days scheduled for the works and the designated days for the purposes of Outturn Availability (OA).

Hello XXX,
The following works are now scheduled

GENERATOR TRANSFORMER - XXXXX

TO-XX-XX-XXXXX-XX ISO week: **17mo - 17sa** Date: **24 Apr - 29 Apr** Duration: **6 Days (5 WD)** Status: **Scheduled**

WORK	LOCATION		WORK ID	STATUS	DAYS	DESCRIPTION/COMMENTS
					6	Total Maintenance Outage Duration Requested
OS	XX			DO	5	220kV SF6 Cubicle Ordinary Service
AMCAB	XX			DO	2	Annual Insp. 400 & 220 Station OF Cable
PROT	XX			DO	1	P1 - Maintenance of the bay protection relays
CMCAB	XX		XXXX	DO	1	Replace Low & Differential Oil Alarm Gauge

The designated days are the 24, 25, 26, 27, 28 April.
Regards
Generation Outage Planning

Feb – Nov Changes recorded in season

Changes to the following were recorded in season.

#	Category	Communicated
1	Indicative window	February
2	Initial duration	February
3	Scheduled days	M-4 Weeks
4	Designated days	M-4 Weeks
5	Change to Works description	Publication of Ex-Post Report
6	Generator outage dates	Publication of COP
7	Scheduled works not completed	Publication of Ex-Post Report

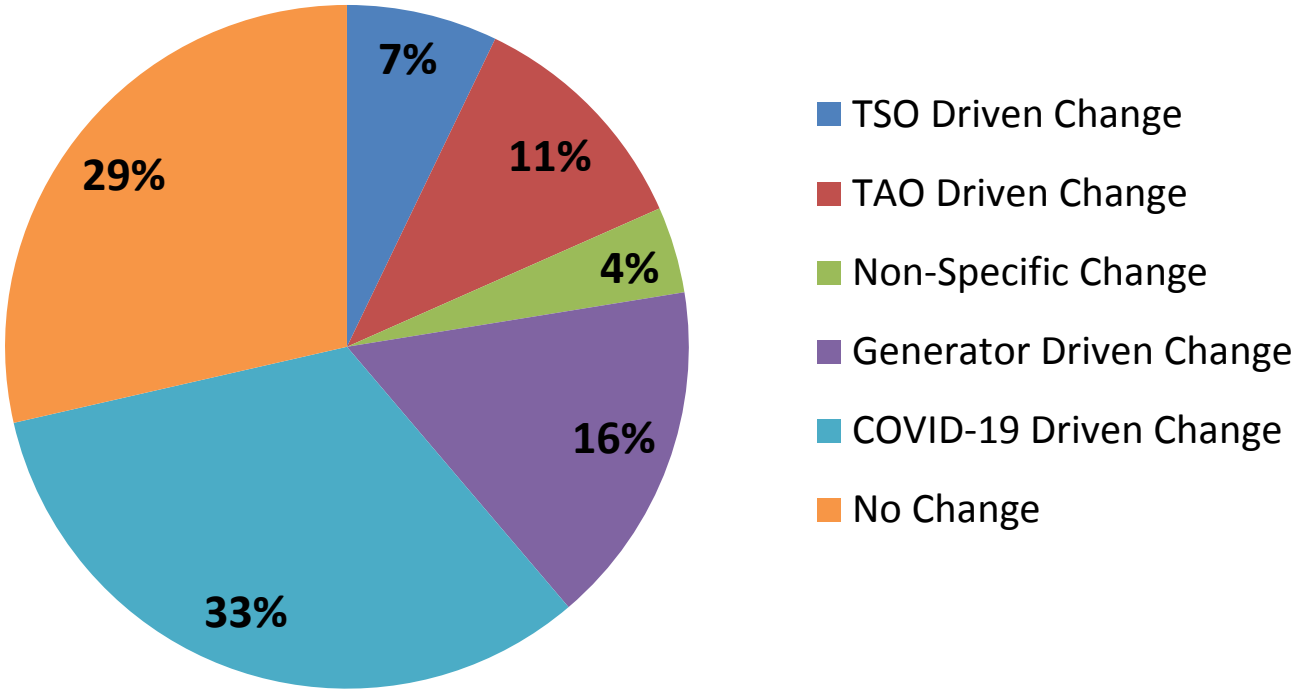
Standard Reasons for Changes Used

- Reasons were intended to be comprehensive.
- Some changes do not fit neatly into one category.
- Following the onset of the pandemic, a new COVID-19 category was created to ensure that outage programme changes driven as a direct result of COVID-19 restrictions were captured

Changed to align with capital works (TSO)	COVID-19
TSO cancellation/postponement of works	Not Applicable
Scheduled late due to uncertainty around capital works (TSO)	Corrective maintenance required to complete task and address broken cable seals
TSO requested change for system reasons	Corrective maintenance task added in season
Changed to align with generator outage (TSO)	Works not required
Changed due to TAO resourcing	Corrective maintenance task added in season/Changed as per generator request
Forced Overrun (TAO)	Changed as per generator request
TAO Requested Changed	Generator requested change to COP
Changed to align with capital works (TAO)	Works unscheduled (Gen)
TAO cancellation of works	Opportunistic Maintenance (Gen)
Changed due to network configuration	Custom: Database Omission

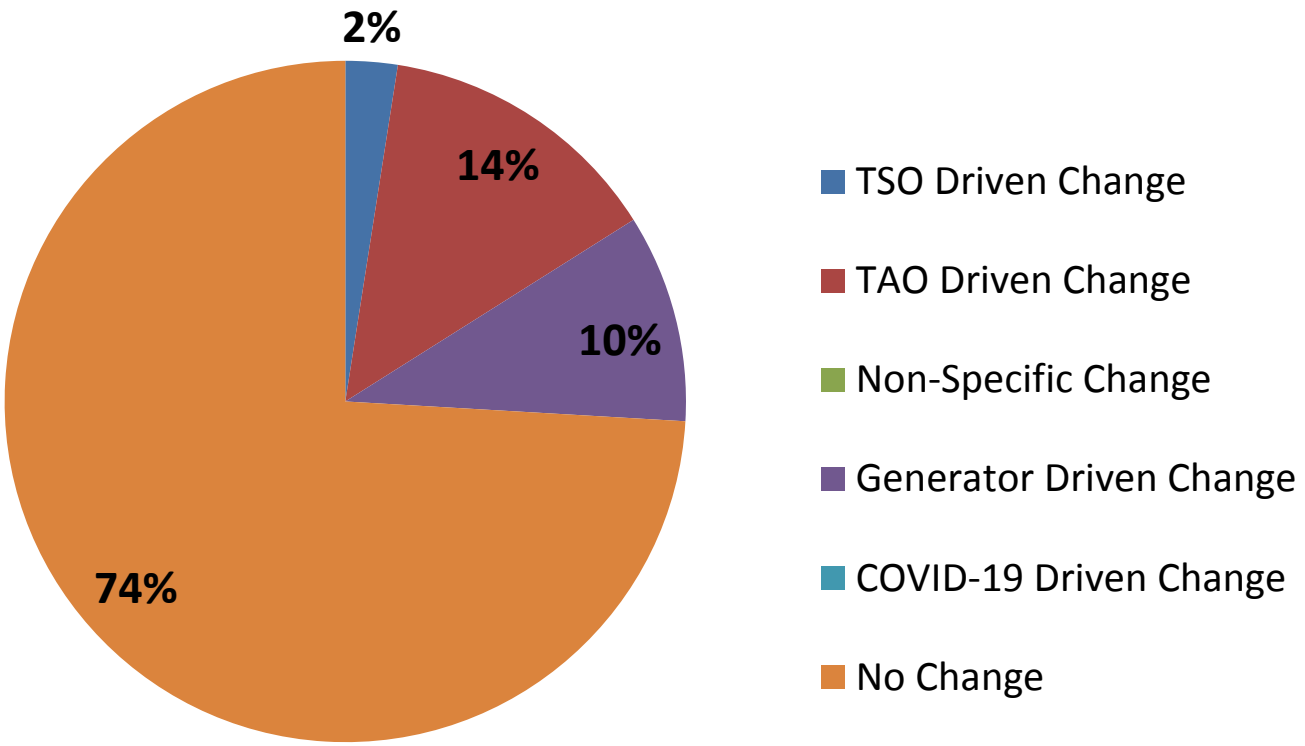
Category 1 : Indicative window communicated

Whether a change occurred to the indicative window communicated in February 2020



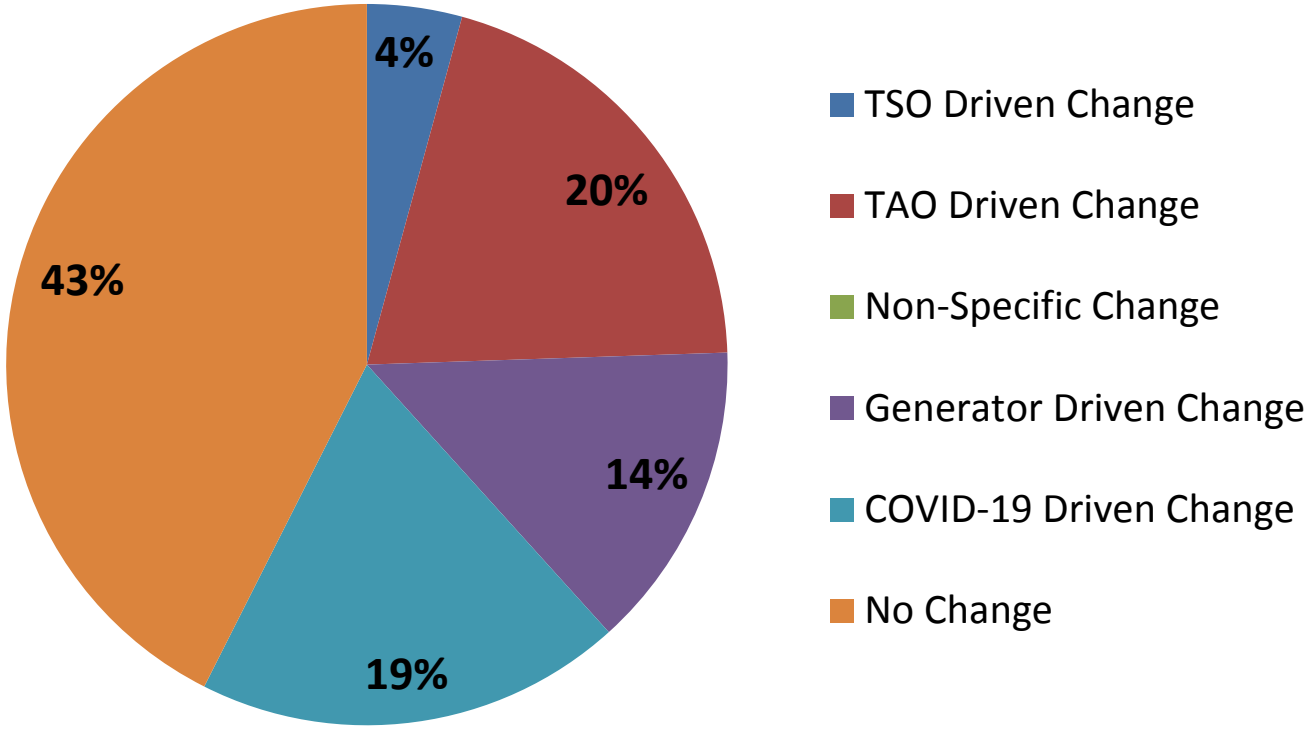
Category 2 : Initial duration communicated

Whether a change occurred to the number of days communicated in February 2020



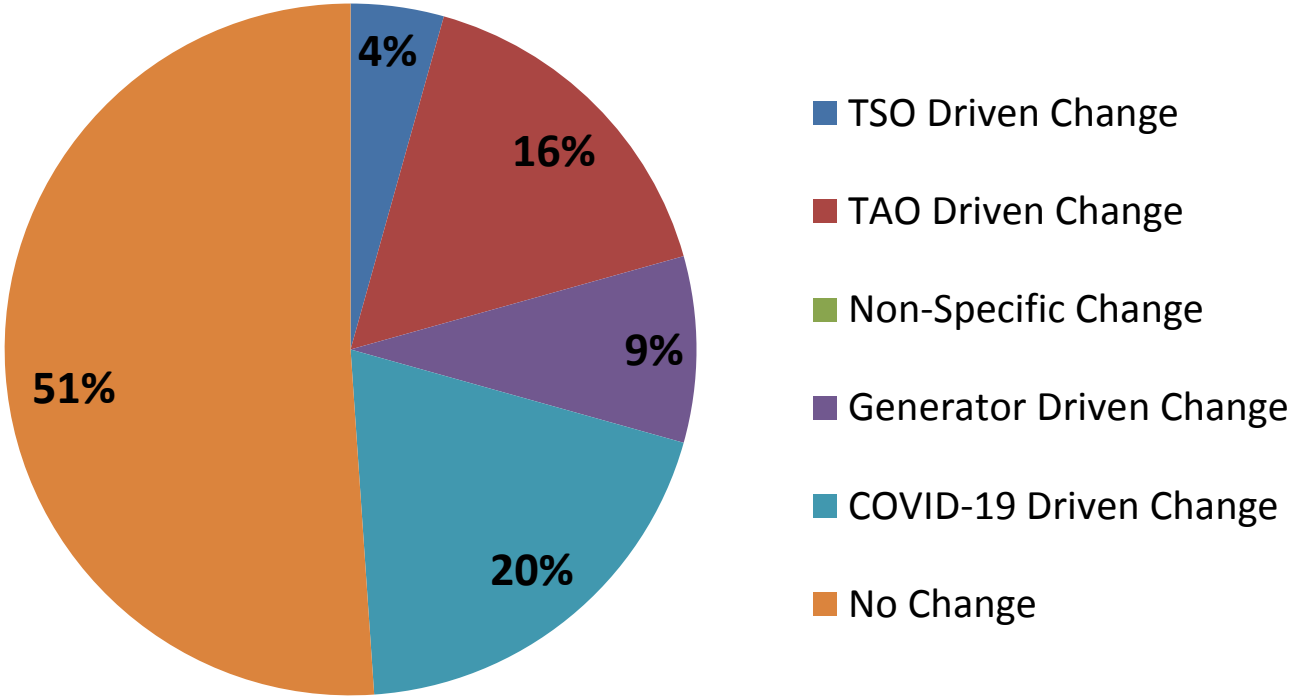
Category 3 : Scheduled days communicated

If a change occurred between the days of communication to the generator and the outage



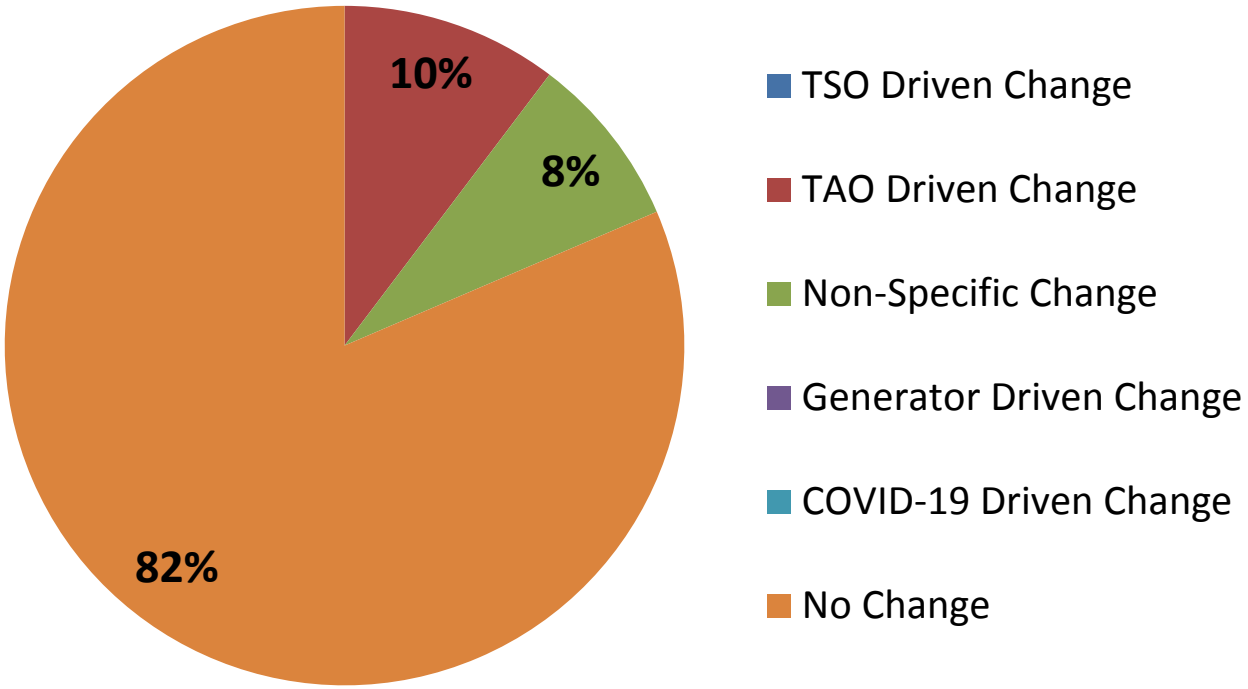
Category 4 : Designated days communicated

If a change occurred to the designated days (non-Outturn Available maintenance days) between the days of communication to the generator and the outage occurrence



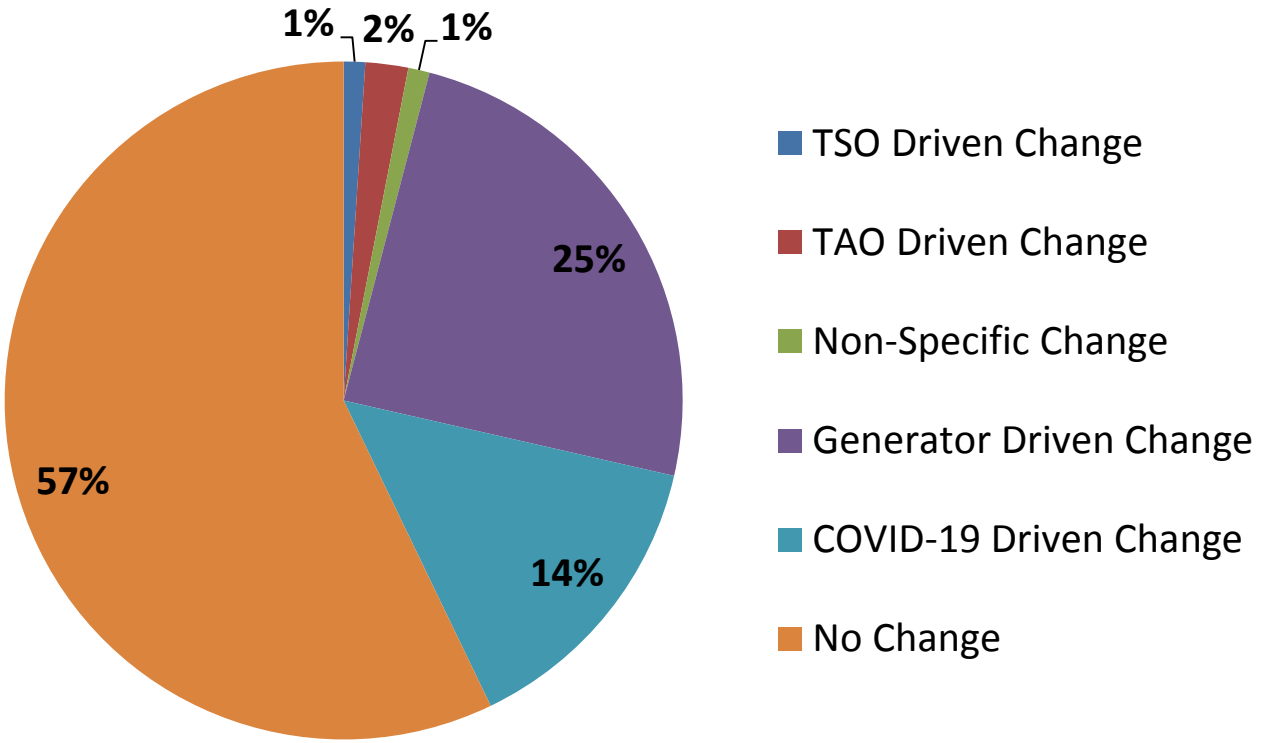
Category 5 : Works description communicated

Change to works description from those published in the Ex-Ante Report



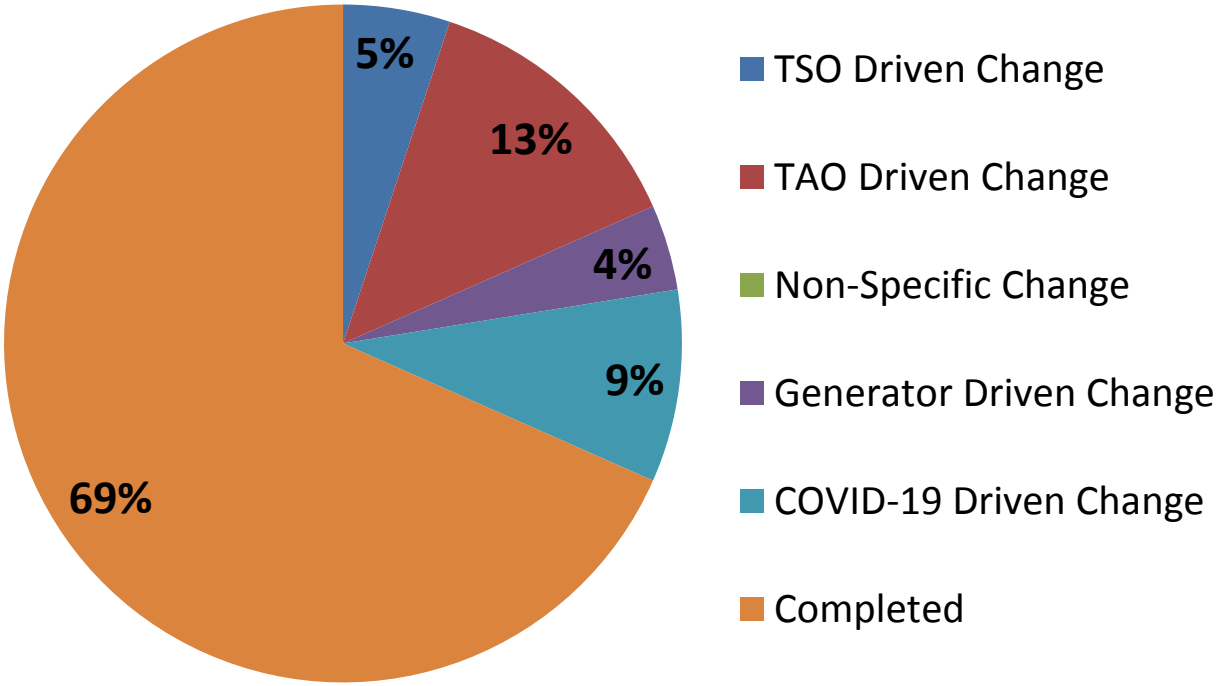
Category 6 : Generator outage dates

Whether outage dates of generators changed leading to changes in transmission maintenance works

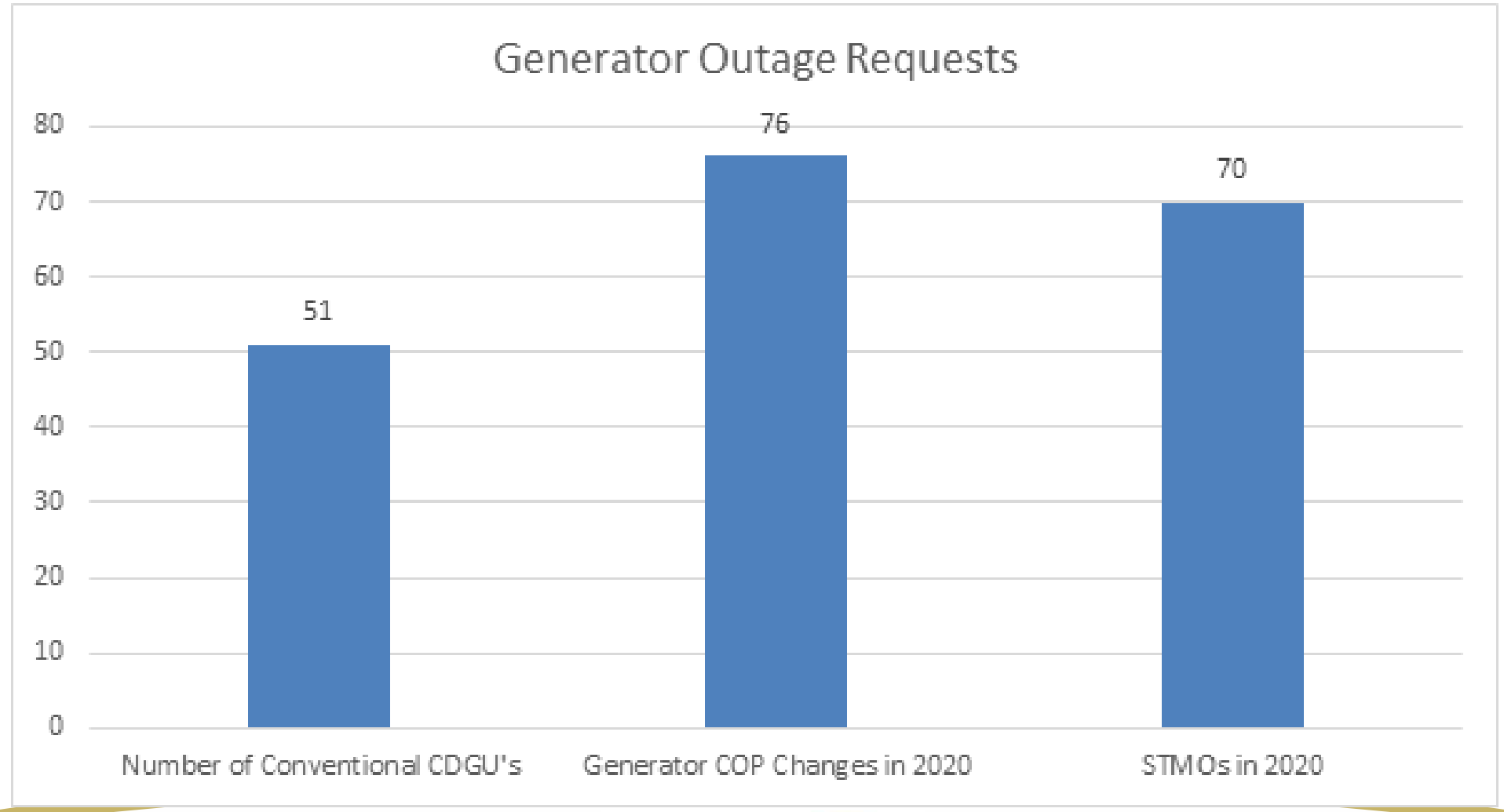


Category 7 : Scheduled Works Not Complete

Whether work items communicated in February 2020 were completed



2020 Generator Change Requests



Impact of COVID-19 Pandemic

- COVID-19 pandemic caused significant disruption to both the TOP and the GOP – particularly in the first half of 2020
- Knock on impacts for 2021 – number of generator outages, transmission maintenance and capital projects were deferred to 2021
- Clarity provided by DCCAE to industry that personnel required to carry out maintenance works on the electric grid and at generating stations are deemed essential allowing a partial bypass of Level 5 COVID-19 restrictions

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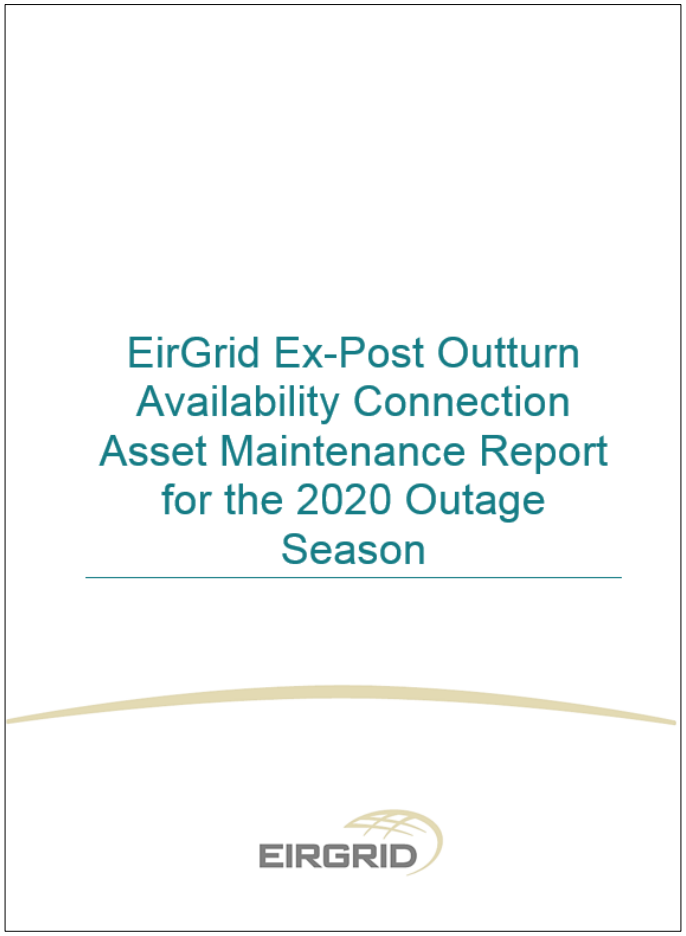
2020 Ex-Post Report



- Report contains the information presented here – This will be circulated
- The Ex-Post report will be sent to CRU for review.
- Following CRU approval it will be published on the EirGrid website.
- Comments on the format and content can be sent to **OutagePlanning@EirGrid.com**

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Forum Key Messages

1. The generator outage programme suffered from major disruption to the COVID-19 pandemic. However, despite this, where generators had an outage, transmission works affecting a unit were generally contained within the generator's own outage window.
2. The disruption to the Generation Outage Programme caused a great deal of change affecting OACA outages.
3. Despite COVID-19, similar volume of work completed on OACAs to previous outage season

Questions?

Outturn Availability Settlement

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Settlement of **not** Outturn Available Units

- For the five calendar days when a unit is **not** Outturn Available:
  - The unit will most likely not trade in the Ex-Ante markets
  - The availability will be zero
  - The unit will be dispatched to zero
  - Balancing Market settlement will be zero

Settlement of **Outturn Available** Units

- When a unit is **Outturn Available**:
  - The unit will most likely trade in the Ex-Ante markets
  - The availability will be non-zero
  - The unit will be dispatched to zero resulting in a dec action
  - Balancing Market settlement: CIMB and CDISCOUNT

Settlement of Outturn Available Units - CIMB

- **CIMB** – Imbalance Payment or Charge
- Calculated based on the units Ex-Ante Quantity (QEX) and Metered Quantity (QM)
  - Zero QM
  - Non-zero QEX
  - CIMB will be a charge

$$CIMB_{u\gamma} = PIMB_{\gamma} \times (QMLF_{u\gamma} - QEX_{u\gamma})$$

$$CIMB_{u\gamma} = PIMB_{\gamma} \times (-QEX_{u\gamma})$$

Settlement of Outturn Available Units - CDISCOUNT

- **CDISCOUNT** – payment for decremental actions
  - TSO forced to dec the unit
  - QAB (Accepted Bid Quantity) calculated between the units DQ (Dispatch Quantity) and FPN (Final Physical Notification)
  - Settled at the difference between PBOA and PIMB
  - CDISCOUNT is a payment

$$CDISCOUNT_{uy} = \sum\sum (Min(PBO_{uoiy} - PIMB_{y}, 0)_{io} \times (QABLF_{uoiy} - Min(QABBPOLF_{uoiy}, QABBIAS_{uoiy}, QABUNDEL_{uoiy}, QABNFLF_{uoiy}, QABCURLLF_{uoiy}, QABTOTSOLF_{uoiy})))$$

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Settlement of Outturn Available Units - Wind

- For wind units, net settlement in the Balancing Market is €0.
- As PBO is €0 for wind units, the unit will be paid CDISCOUNT at the Imbalance Price – this is the inverse of the CIMB charge

$$CDISCOUNT_{u\gamma} = \sum\sum (Min(PBO_{uoi\gamma} - PIMB_{\gamma}, 0)_{io} \times (QABLF_{uoi\gamma} ~~- Min(QABBPOLF_{uoi\gamma}, QABBIAS_{uoi\gamma}, QABUNDEL_{uoi\gamma}, QABNFLF_{uoi\gamma}, QABCURLLF_{uoi\gamma}, QABTOTSOLF_{uoi\gamma})))$$

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$$CDISCOUNT_{u\gamma} = \sum\sum (Min(- PIMB_{\gamma}, 0)_{io} \times (QABLF_{uoi\gamma}))$$

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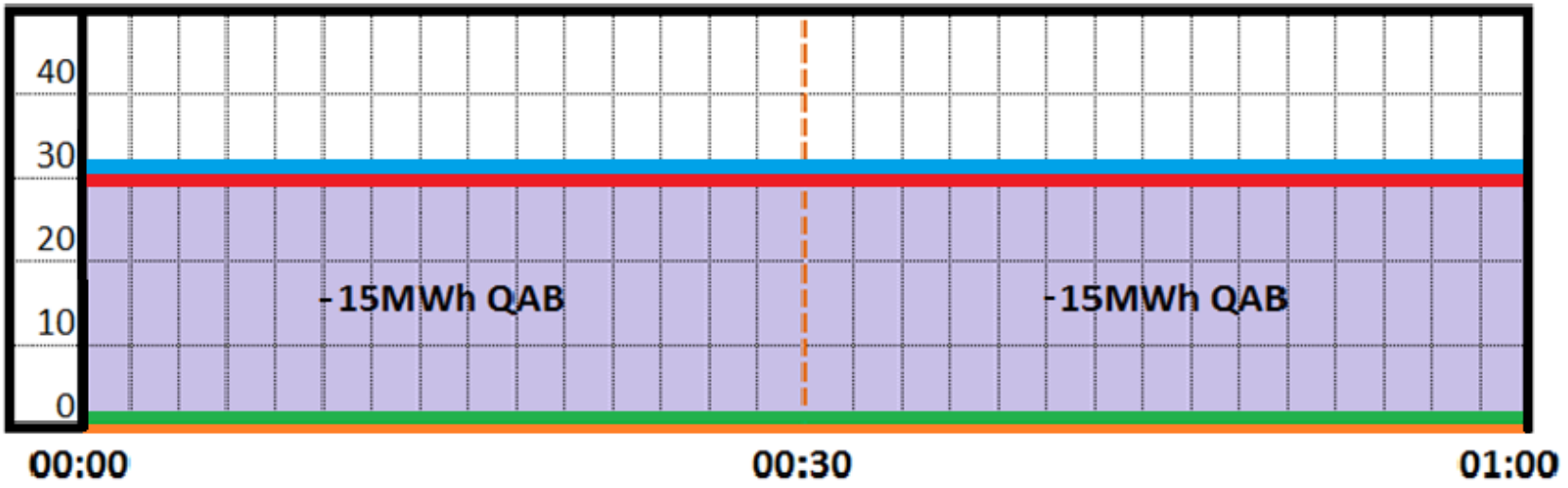
$$CDISCOUNT_{u\gamma} = \sum\sum (Min(- PIMB_{\gamma}, 0)_{io} \times (QABLF_{uoi\gamma}))$$

$$CIMB_{u\gamma} = PIMB_{\gamma} \times (- QEX_{u\gamma})$$

Worked Example



QEX

FPN

DQ

QM

QAB = DQ - FPN = -15MWh

CIMB = PIMB x (QMLF - QEX)
= PIMB x (0 - 15)
= PIMB x (-15)

CDISCOUNT = min (PBOA - PIMB, 0) x QABLF
= min (PBOA - PIMB, 0) x (-15)

Net Balancing Market settlement:

- For wind units: €0 as PBOA = €0
- For conventional units:
  - Settled at PIMB if PBOA > PIMB
  - Settled at PBOA if PBOA < PIMB

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Common Queries

- How does Firm Access Quantity (FAQ) feed into the Settlement of outturn available units?
  - Non-firm quantities are accounted for in CDISCOUNT formula through QABNF
  - If a unit trades over their FAQ, they will not receive CDISCOUNT for this volume

$$CDISCOUNT_{u\gamma} = \sum\sum (Min\,(PBO_{uoi\gamma} - PIMB_{\gamma}, 0)_{io} \times (QABLF_{uoi\gamma} - Min(QABBPOLF_{uoi\gamma}, QABBIAS_{uoi\gamma}, QABUNDEL_{uoi\gamma}, QABNFLF_{uoi\gamma}, QABCURLLF_{uoi\gamma}, QABTOTSOLF_{uoi\gamma})))$$

- What if a wind unit does not trade?
  - If the unit has not traded, QEX = 0 => CIMB = €0
  - FPN will be non-zero as this comes from the units availability
  - Discrepancies between QEX and FPN are accounted for in CDISCOUNT formula through QABBIAS

$$CDISCOUNT_{u\gamma} = \sum\sum (Min\,(PBO_{uoi\gamma} - PIMB_{\gamma}, 0)_{io} \times (QABLF_{uoi\gamma} - Min(QABBPOLF_{uoi\gamma}, QABBIAS_{uoi\gamma}, QABUNDEL_{uoi\gamma}, QABNFLF_{uoi\gamma}, QABCURLLF_{uoi\gamma}, QABTOTSOLF_{uoi\gamma})))$$

EIRGRID

Questions?

Transmission Outage Programme 2021

EIRGRID

TOP21 Overview

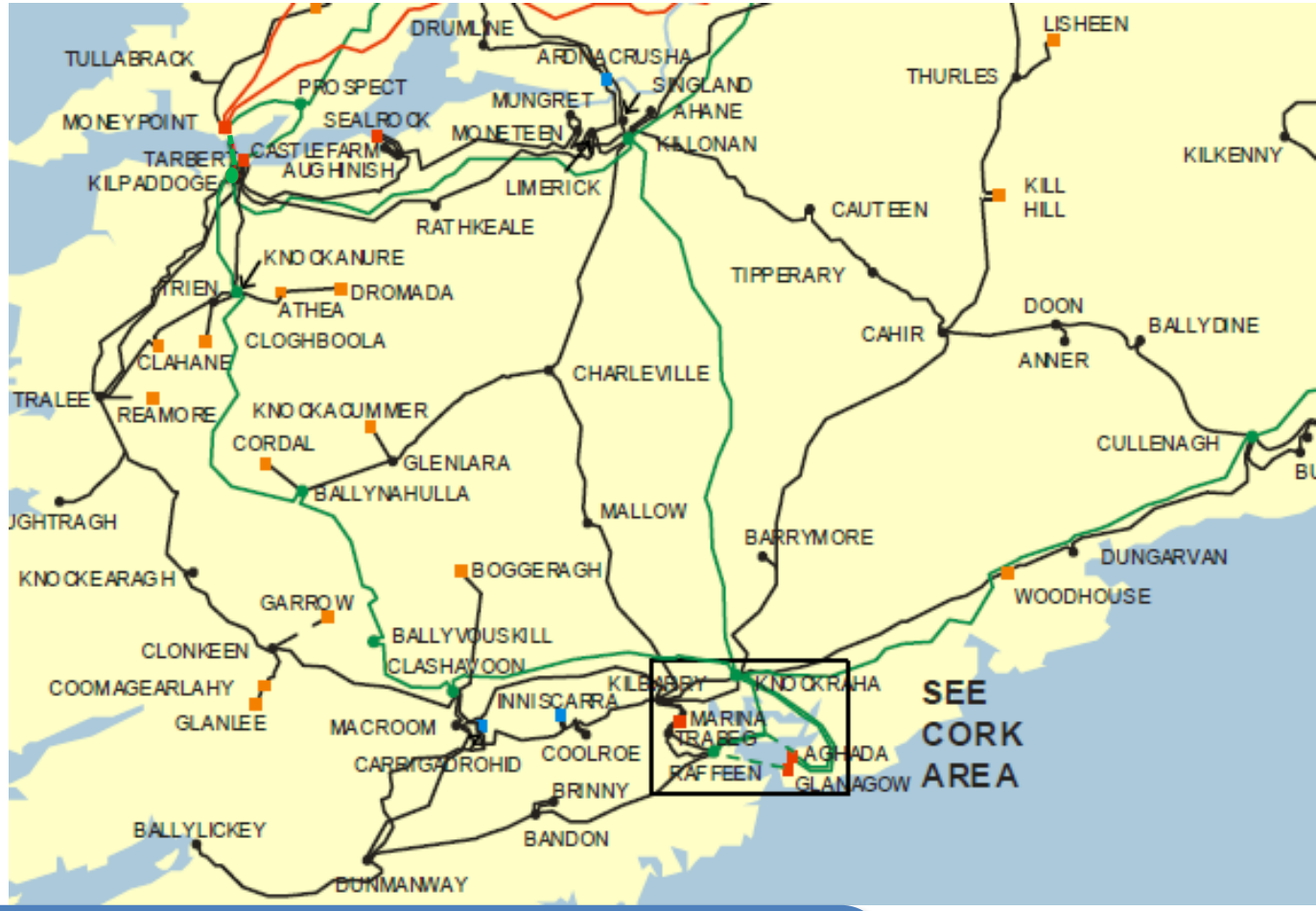
- 62 Capital Projects:
  - Associated Transmission Reinforcements (ATR)
  - Load Growth
  - Generation & Demand connections
  - Refurbishment Projects
- Maintenance
  - ~3,513 maintenance work items
- > 1,250 outages planned

400 kV Network

Major Outages

- Moneypoint – Oldstreet 400 kV: 15 WD (Jun – Jul)
- Oldstreet 400/220 kV transformer: 20 WD (Apr – May)

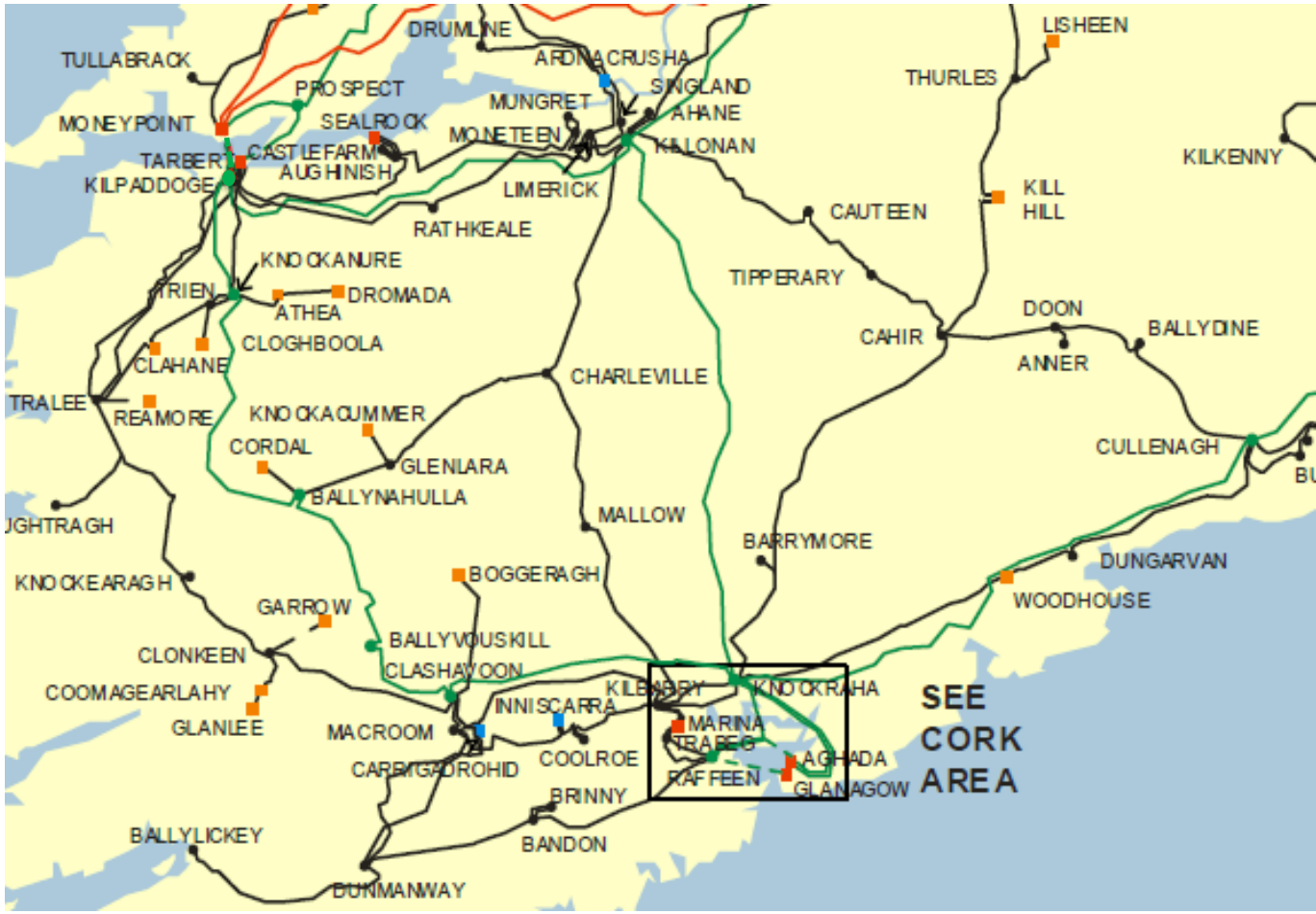
South West – Major 220 kV outages



Major 220 kV Outage

- Ballynahulla – Knockanure 220 kV: 108 WD (Mar – Jun, Aug – Oct, Nov)
- Ballyvouskill – Clashavoon 220 kV: 36 WD (Mar, Jun, Jul, Oct)
- Kilpaddoge – Tarbert 1 220 kV: 75 WD (Aug – Nov)

South West – Major 110 kV outages



Major 110 kV Outages

- Knockanure – Trien 2 110 kV: 45 WD (Sep – Nov)
- Tarbert – Tralee 1 110 kV: 40 WD (Mar – Apr)

Cork

Major Outages

- Knockraha – Raffeen 220 kV: 90 WD (Mar – Jul)
- Cullenagh – Knockraha 220 kV: 30 WD (Jun – Jul)
- Aghada – Raffeen 220 kV: 30 WD (May – July)

South East

Major Outages

- Great Island – Kilkenny 110 kV: 110 WD (May – Oct)
- Crane – Wexford 110 kV: 79 WD (Feb - Jun)
- Great Island – Wexford 110 kV: 35 WD (Jun - Aug)

Greater Dublin

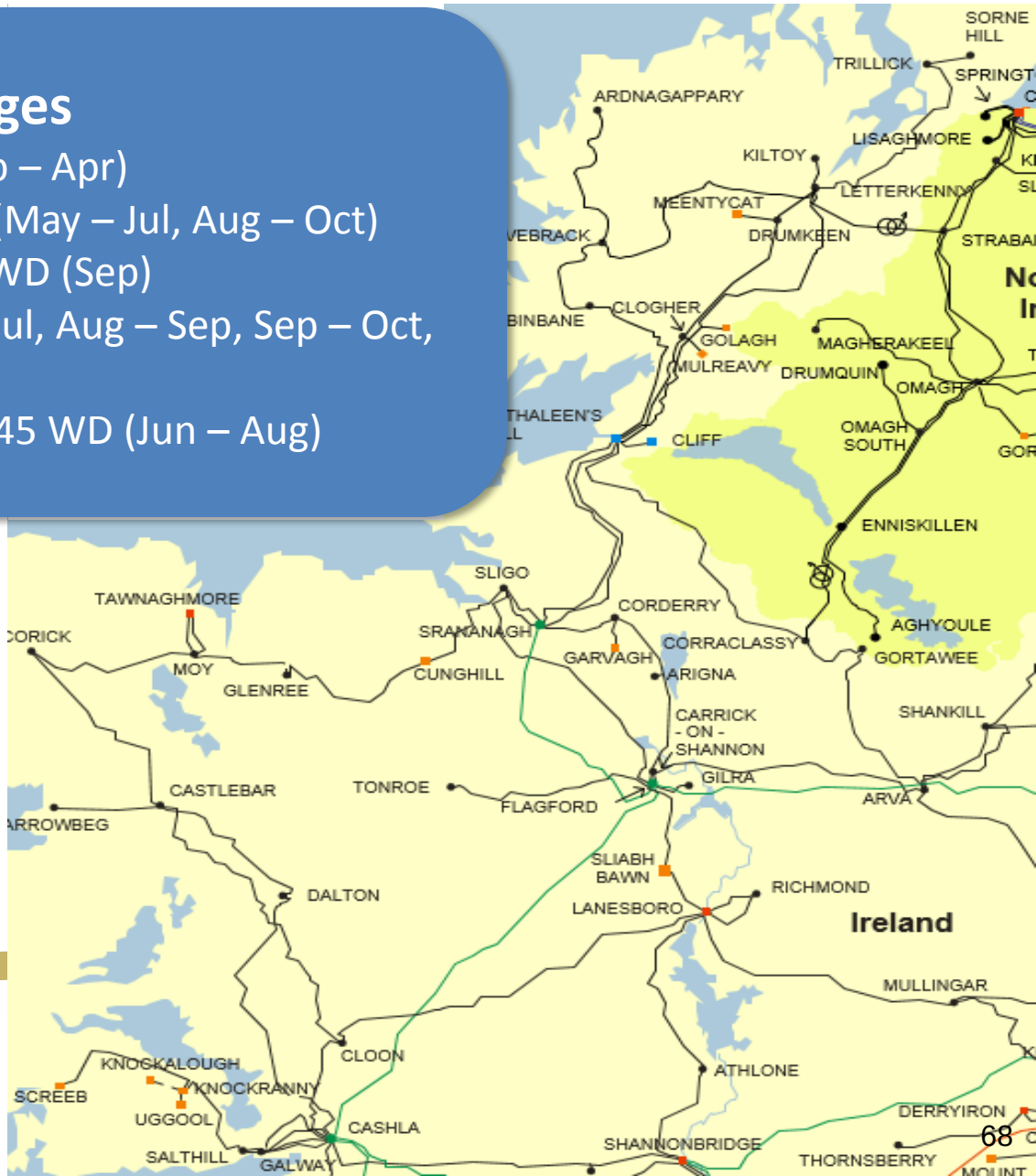
Major Outages

- Corduff – Finglas 1 220 kV: 51 WD (Feb – May)
- Finglas – North Wall 220 kV: 51 WD (May – Jul)
- Maynooth – Woodland 220 kV: 90 WD (Jul – Nov)
- Maynooth – Shannonbridge 220 kV: 30 WD (Jul - Sep)
- Clonee – Woodland 220 kV: 60 WD (Sep - Nov)

North West

Major Outages

- Flagford – Sligo 110 kV: 40 WD (Feb – Apr)
- Cloon – Lanesboro 110 kV: 67 WD (May – Jul, Aug – Oct)
- Bellacorick – Castlebar 110 kV: 15 WD (Sep)
- Bellacorick – Moy 110 kV: 29 WD (Jul, Aug – Sep, Sep – Oct, Nov)
- Binbane – Cathaleen's Fall 110 kV: 45 WD (Jun – Aug)



North East

Major Outages

- Corduff Platin 110 kV: 40 WD (Jun – Nov) x2

Grid Reinforcements Relieving Constraints

- Ballynahulla-Knockanure 220 kV circuit uprate
- Energisation of Kilpaddoge-Knockanure-2 220 kV circuit
- New Moneypoint 400/220 kV transformer
- New transformer at Clashavoon 220 kV station
- Knockraha 220 kV station reconfiguration works
- Wexford 110 kV busbar uprate
- Great Island-Kilkenny 110 kV circuit uprate
- Thornsberry 110 kV busbar uprate

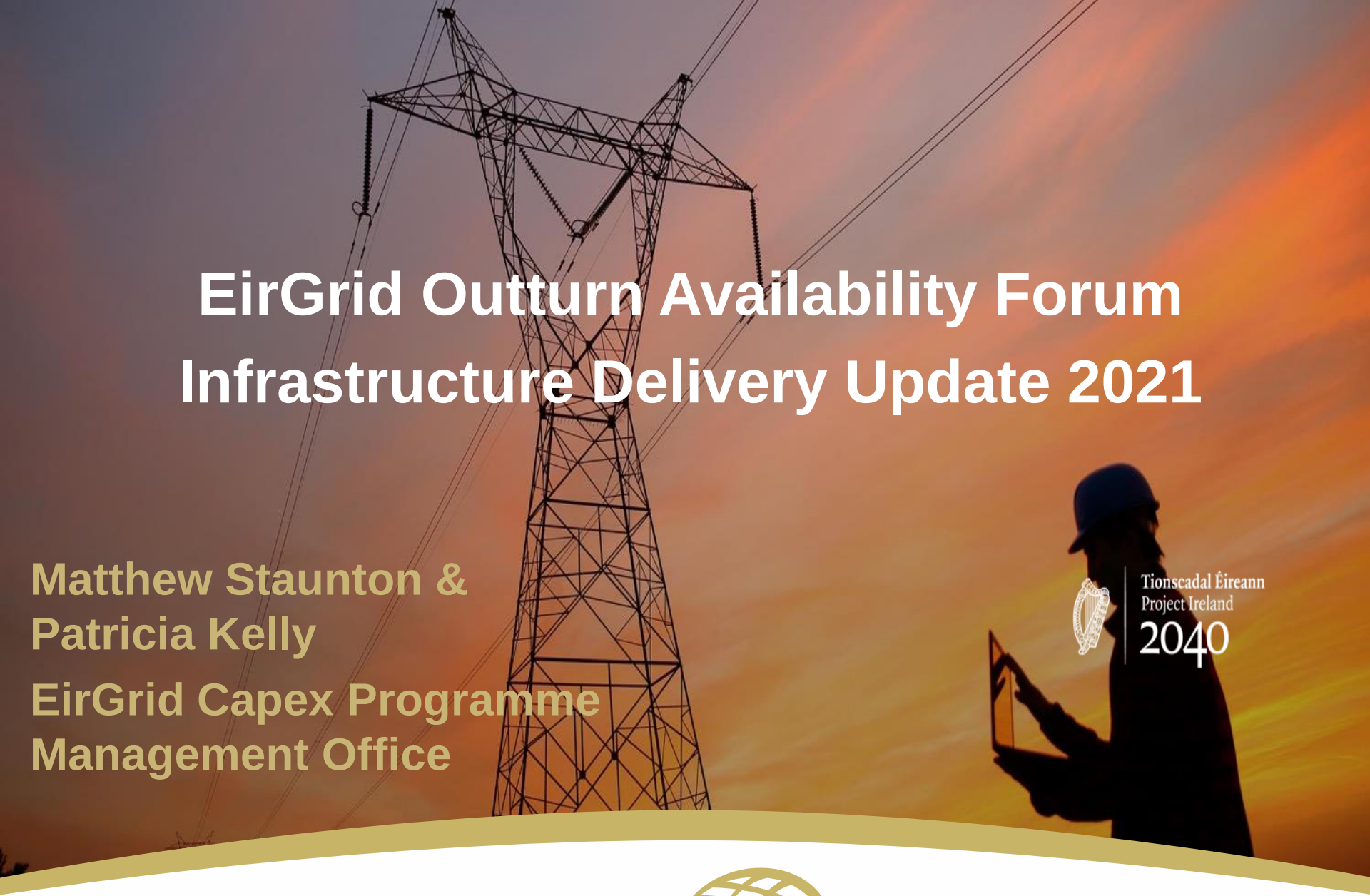
EIRGRID

Questions?

EirGrid Outturn Availability Forum
Infrastructure Delivery Update 2021

Matthew Staunton &
Patricia Kelly

EirGrid Capex Programme
Management Office



EIRGRID

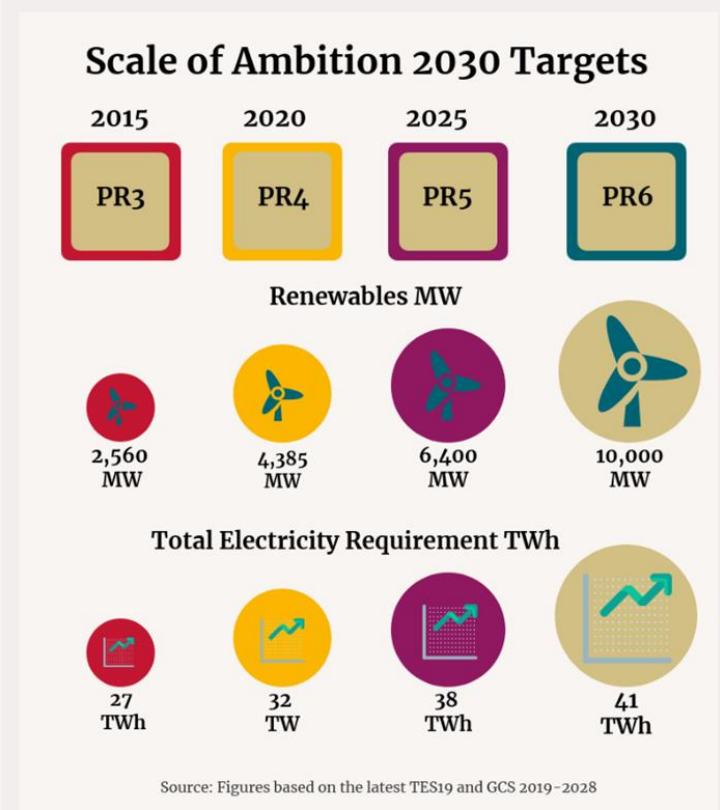
Overview

1. PR5 Scale of Shared Ambition
2. PR5 Overview
3. PR5 Context Challenges
4. PR5 Partnership with ESB Networks
5. PR5 Infrastructure Delivery Process Improvements
6. PR5 Programme Oversight
7. PR5 Investment Planning & Delivery Incentives

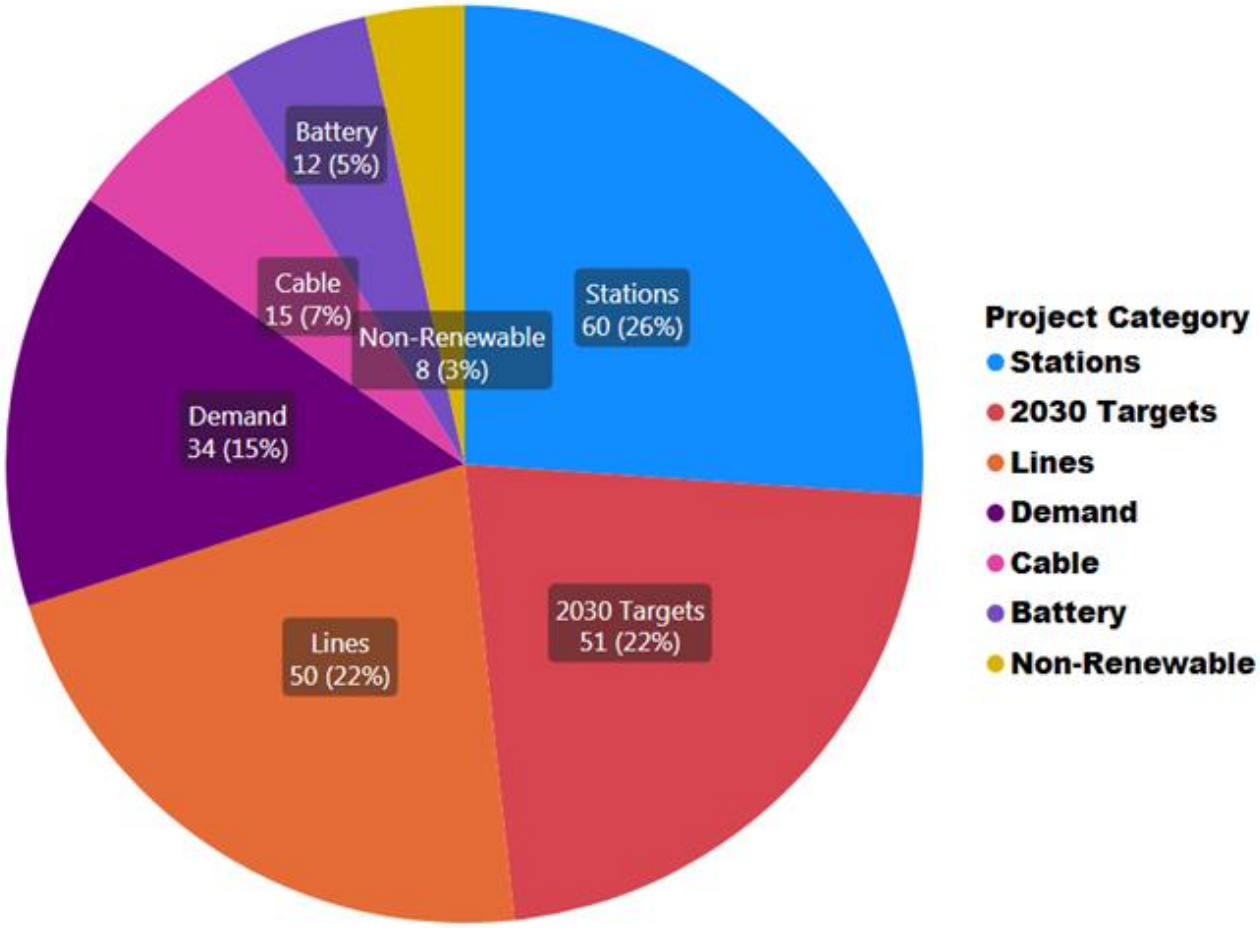
EIRGRID

PR5 Scale of Shared Ambition

1. PR5 is the **most ambitious programme of work** to be undertaken on the transmission & distribution system.
2. Programme includes **over 300 projects & 24% increase in CapEx allowance from PR4.**
3. **Enhanced process improvements** deployed to embed the **step change** in our end to end delivery.
4. **Joined-up approach and organisational alignment between EirGrid and ESB. Everything we do is focused on end-to-end delivery to 2030**.
5. PR5 provides **solid foundation and pathway to achieving 2030 targets**.



Overview of PR5 Programme by Category



Overview PR5; What's included?

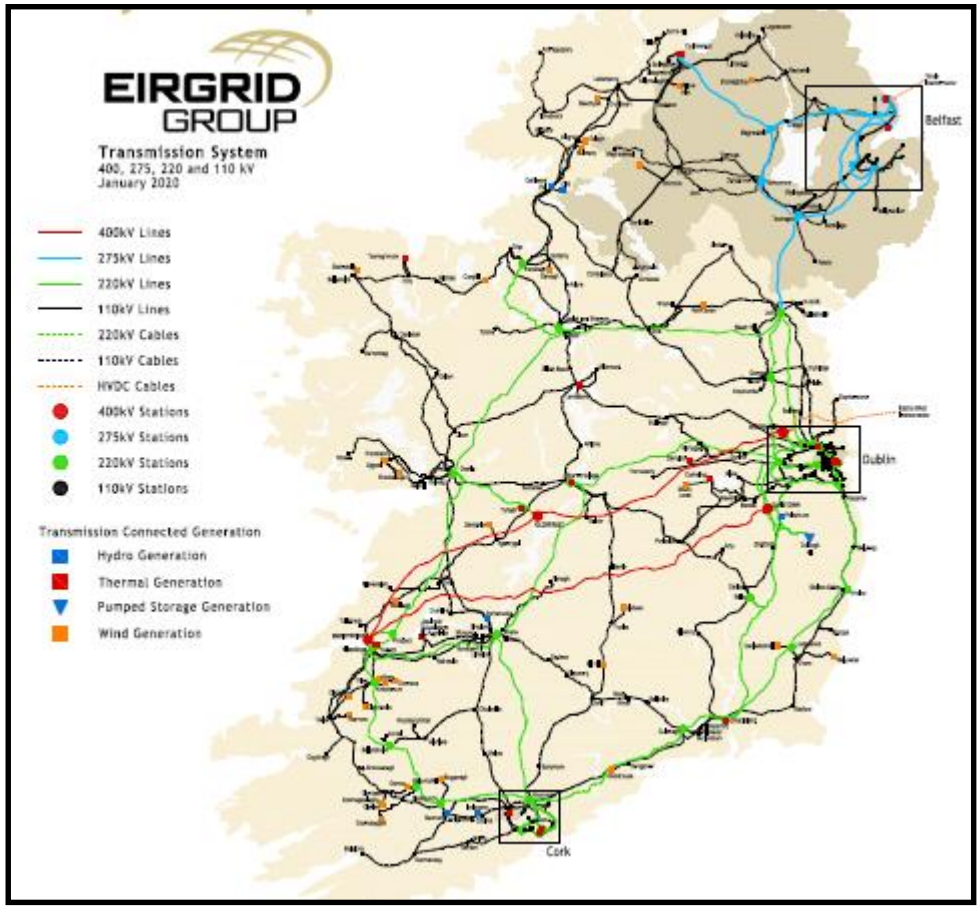
1. **PR5 Programme circa €1bn** from 2021 to 2025, similar investment scenario envisaged for PR6 to achieve 2030 targets.
2. PR5 Programme includes
    1. **Reinforcement projects** from EirGrid East Coast Opportunity Assessment included with combined cost of €233.6m with additional spend in PR6.
    2. **Deep reinforcement projects** Dublin cables, new circuits etc.
    3. **Projects required to connect legacy offshore projects** (Arklow, Codling and Dublin Array)
    4. **PR5 Customer connections** for which connection agreement in place-**€266m**.
    5. PR5 does not include any offshore assets.
3. **PR5 has mechanism to add additional projects** to PR5 & PR6 as required.

EirGrid

ESB NETWORKS

EirGrid Capital Approval Pipeline 2021/2022

SUMMARY*	NO. OF PROJECTS	KM
UPRATES / UPVOLTAGE	27	900
STATION WORKS	10	N/A
NEW CIRCUIT	4	115
CABLE UPRATE / REPLACEMENT	6	62
REACTIVE COMPENSATION	3	N/A
TOTAL SYSTEM REINFORCEMENT	45	
TOTAL REFURBISHMENT	35	
CUSTOMER CONNECTIONS	63	
TOTAL CAPITAL APPROVALS 2021/22	**143**	



- **INCLUDES 39 TIER 3/LARGE SCALE/STRATEGIC PROJECTS**

*Provided for Illustrative Purposes

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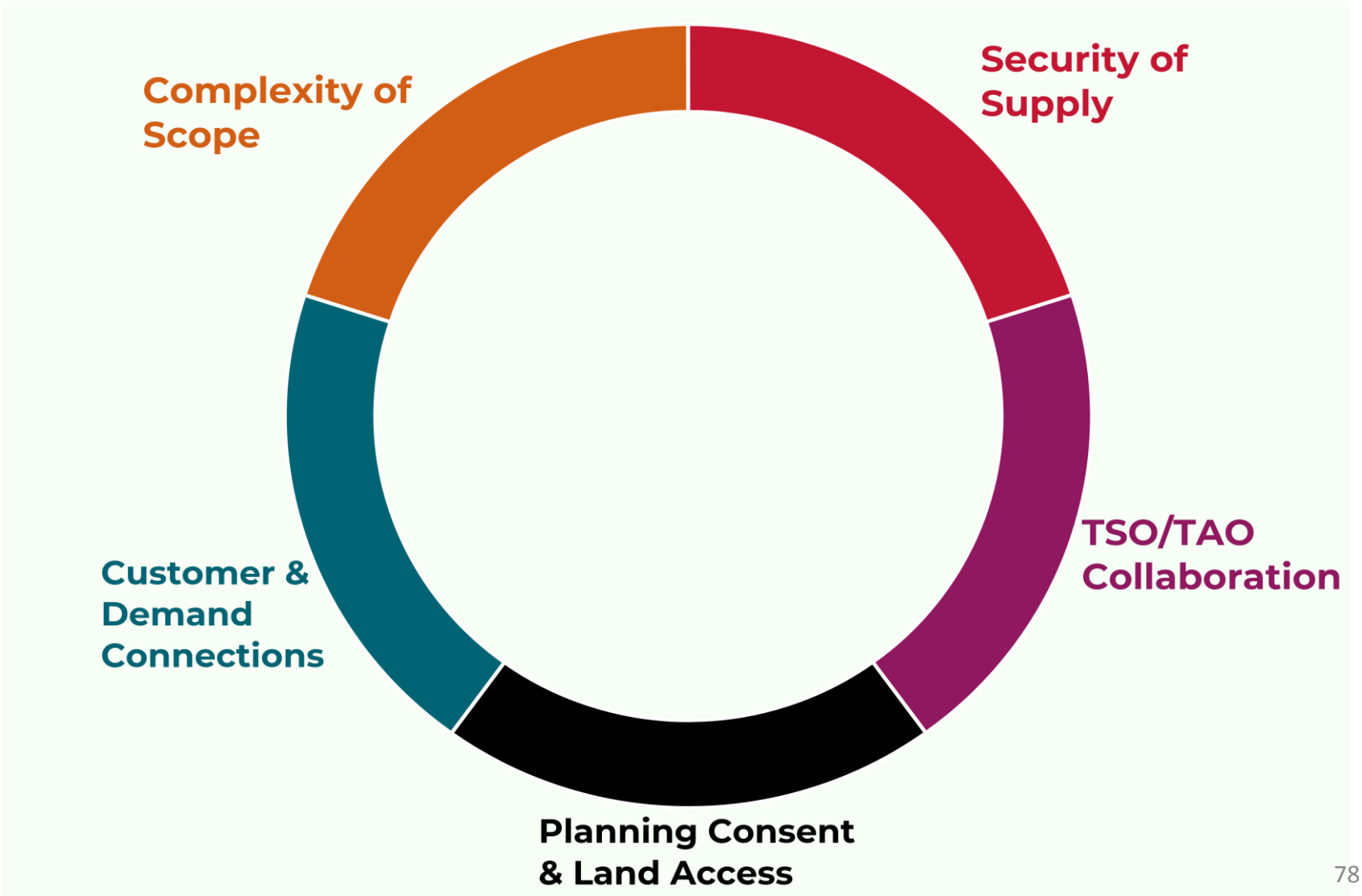
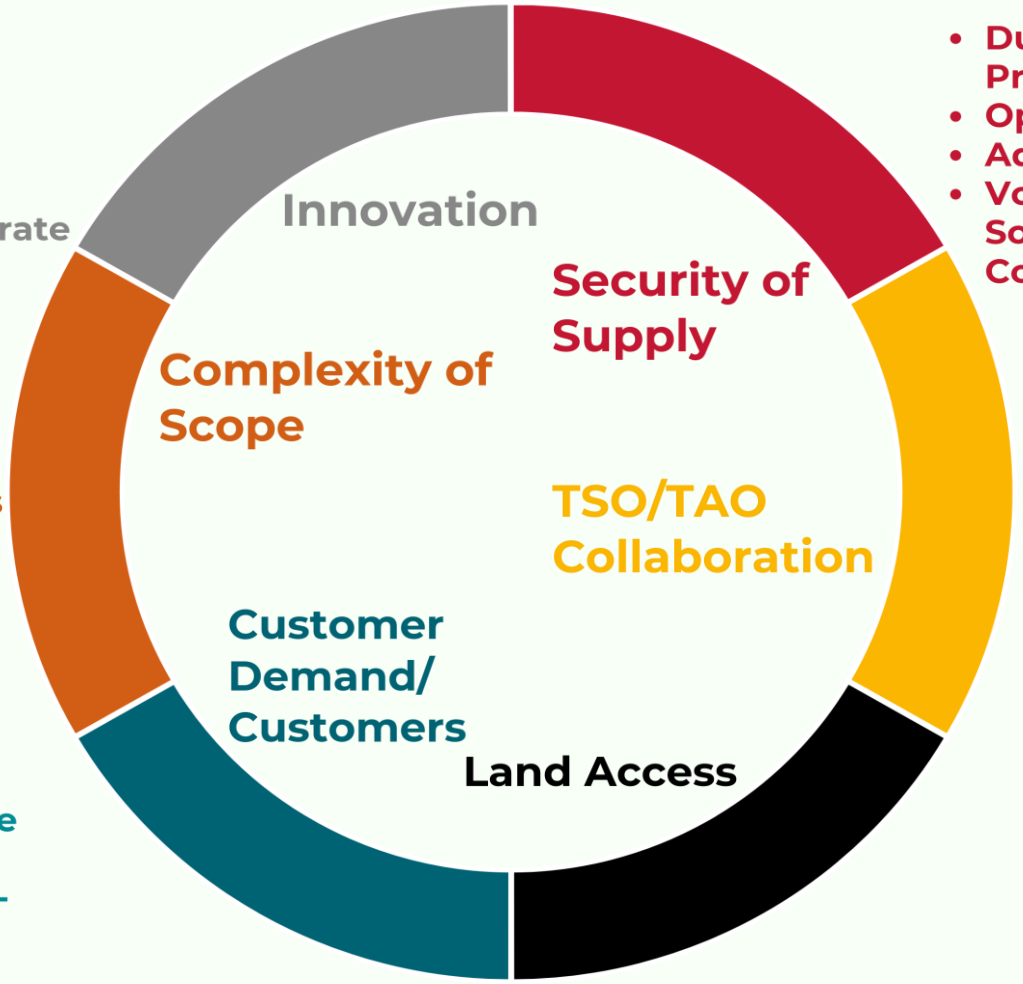
Context PR5 – Challenges & Feedback

Key Known Delivery Risks in PR4 & PR5



Key Delivery Risks and Mitigations in PR4 & PR5

- DSM
- DSR
- DSM
- Power Flow
- Composite Poles
- Tower Voltage Uprate



- Dublin Capital Works Programme.
- Operational Controls
- Additional Generators
- Voltage Stability South West Constraints

- Brownfield projects
- Increased the level of technical complexity
- Access to cross functional teams across TSO/TAO to solve issues

- Team Collaboration on projects.
- Project/Programme
- Contractor resource availability in market
- Use of EPC.

- Compressed Timeline
- Quality
- Reputational impact- Government/IDA
- Handover to ESBN

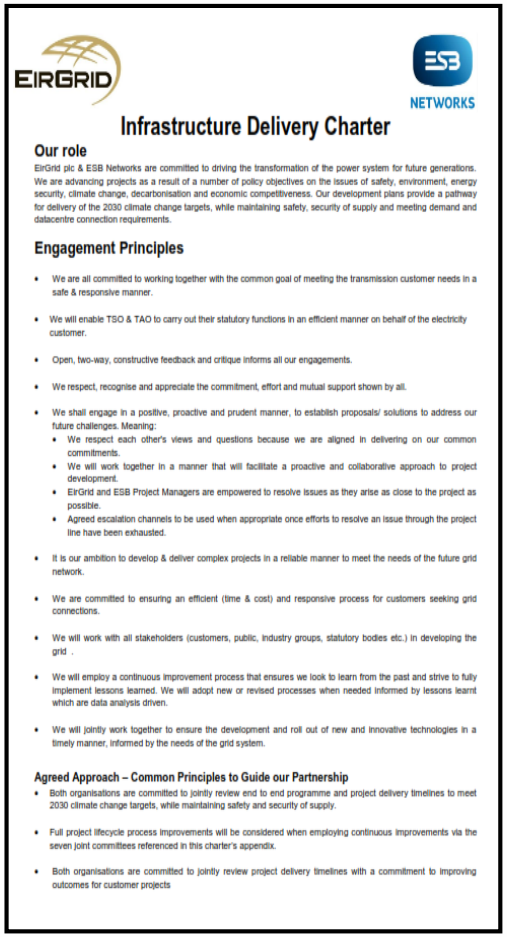
- Timely Access to Land
- Deployment of ALO/CLO to build relationships with Landowners and Reps and Communities.

Infrastructure Delivery Charter

1. Partnership approach – common principles have been agreed to guide this partnership.

2. Both organisations are committed to jointly review end-to-end programme and project delivery timelines to meet 2030 climate change targets, meeting customer expectations and maintaining safety and security of supply.

3. Full project lifecycle process improvements will be considered by joint working groups.



EIRGRID

NETWORKS

Infrastructure Delivery Charter

Our role

EirGrid plc & ESB Networks are committed to driving the transformation of the power system for future generations. We are advancing projects as a result of a number of policy objectives on the issues of safety, environment, energy security, climate change, decarbonisation and economic competitiveness. Our development plans provide a pathway for delivery of the 2030 climate change targets, while maintaining safety, security of supply and meeting demand and datacentre connection requirements.

Engagement Principles

- We are all committed to working together with the common goal of meeting the transmission customer needs in a safe & responsive manner.
- We will enable TSO & TAO to carry out their statutory functions in an efficient manner on behalf of the electricity customer.
- Open, two-way, constructive feedback and critique informs all our engagements.
- We respect, recognise and appreciate the commitment, effort and mutual support shown by all.
- We shall engage in a positive, proactive and prudent manner, to establish proposals/ solutions to address our future challenges. Meaning:
  - We respect each other's views and questions because we are aligned in delivering on our common commitments.
  - We will work together in a manner that will facilitate a proactive and collaborative approach to project development.
  - EirGrid and ESB Project Managers are empowered to resolve issues as they arise as close to the project as possible.
  - Agreed escalation channels to be used when appropriate once efforts to resolve an issue through the project line have been exhausted.
- It is our ambition to develop & deliver complex projects in a reliable manner to meet the needs of the future grid network.
- We are committed to ensuring an efficient (time & cost) and responsive process for customers seeking grid connections.
- We will work with all stakeholders (customers, public, industry groups, statutory bodies etc.) in developing the grid .
- We will employ a continuous improvement process that ensures we look to learn from the past and strive to fully implement lessons learned. We will adopt new or revised processes when needed informed by lessons learnt which are data analysis driven.
- We will jointly work together to ensure the development and roll out of new and innovative technologies in a timely manner, informed by the needs of the grid system.

Agreed Approach – Common Principles to Guide our Partnership

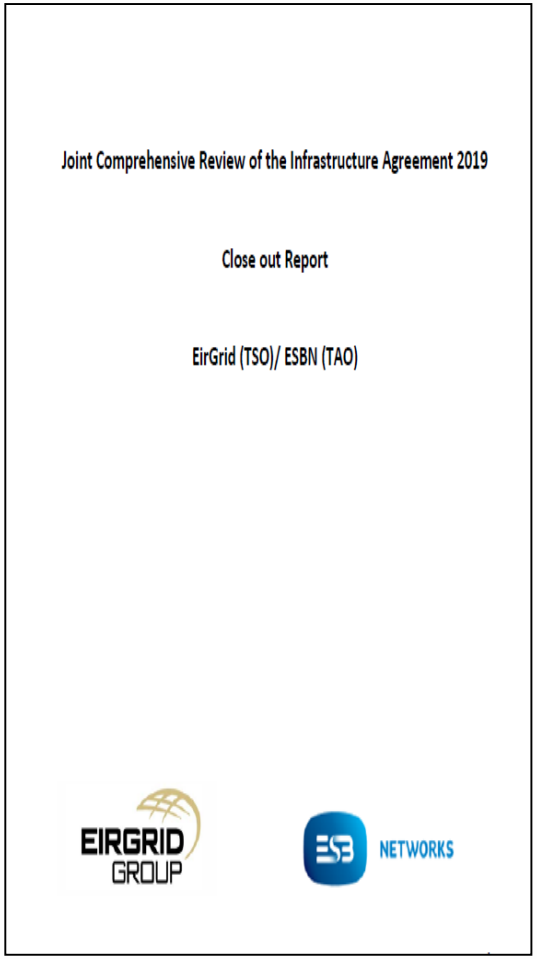
- Both organisations are committed to jointly review end to end programme and project delivery timelines to meet 2030 climate change targets, while maintaining safety and security of supply.
- Full project lifecycle process improvements will be considered when employing continuous improvements via the seven joint committees referenced in this charter's appendix.
- Both organisations are committed to jointly review project delivery timelines with a commitment to improving outcomes for customer projects

Infrastructure Agreement Review Completed

1. **An Infrastructure Agreement Review has been completed and the resulting actions agreed by both EirGrid and ESB Networks.**

2. **The Infrastructure Agreement and its underlying principles remain fit for purpose.**

3. **Both organisations are focused on the transition to a low carbon future and delivering now** on pathway to 2030 to the benefit of all users of the transmission and distribution systems.


Joint Comprehensive Review of the Infrastructure Agreement 2019

Close out Report

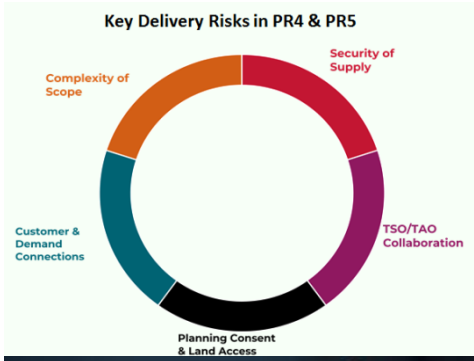
EirGrid (TSO)/ ESBN (TAO)

EIRGRID GROUP

ESB NETWORKS

PR5 Delivery Process Improvements & Step Change

1. **Key risk for PR5 Grid delivery are well known** and understood from PR4.
2. **TSO/TAO has put in place the structures and oversight across both organisations** to deliver the PR5 Programme.
3. **Structures in both organisations** have been **aligned** to improve delivery.
4. **Process improvements** on scoping, clustering etc **are already in place** and data available to support step change, with **more to come.**
5. PR5 Incentives with **oversight and reporting to monitor programme** broadly agreed with CRU.



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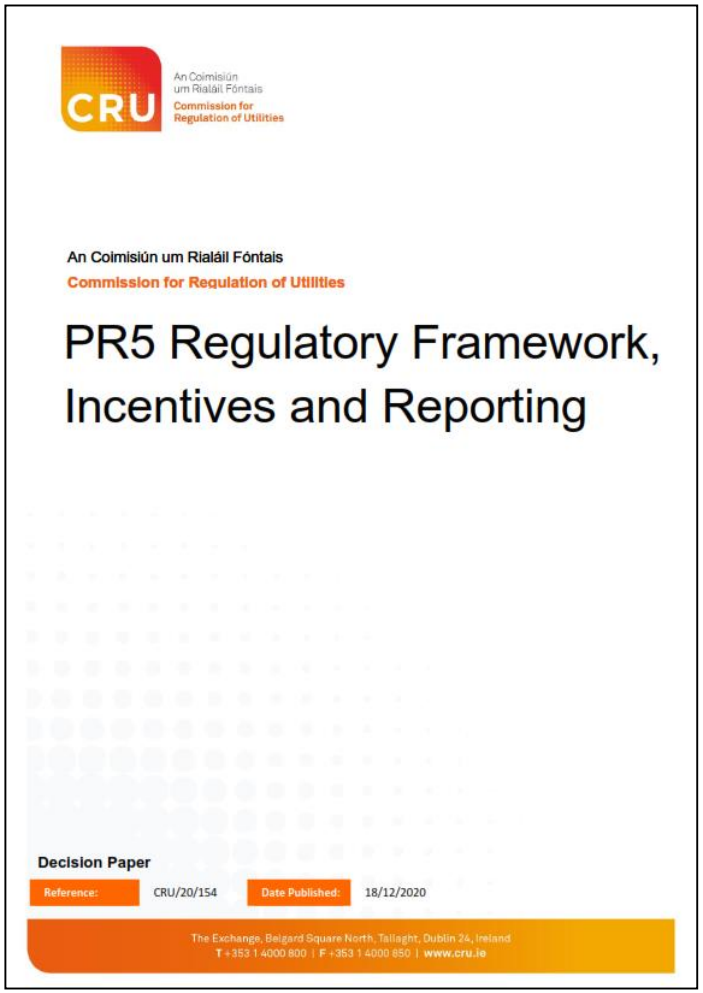
ESB NETWORKS

PR5 Programme Oversight

End to end Delivery

- PR5 Incentives and Metrics for Investment Planning and Delivery.
- Targets for 2021-2025 across the six step framework for Grid Development.
- Financial penalty/award for delivery against targets.
- Monitoring, control and reporting processes in place and subject to independent audit with report issued to CRU.



PR5 Incentives
Investment Planning & Delivery Balanced Scorecard
End to end Delivery

PR5 Balanced Scorecard – 2021 Metrics & Assessment Framework						
Area	**Metric No.**	**Weighting**	**Metrics / Outcomes**	**Number of Projects (Baseline) Jan-21**	**Projects Delivered (Actual) Dec-21**	**Audit Scoring**
Investment Planning (Key Projects) **Delivery Weighting 50%**	**1**	10%	Step 1 Approval of Need	No. of GW1 CAs TBC	Actual Delivered	Audit Assessment Scale
	2	10%	Step 2 Approval of Solution Options	No. of GW2 CAs TBC	Actual Delivered	Audit Assessment Scale
	3	30%	Step 3 Approval of Best Performing Option	No. of GW3 CAs TBC	Actual Delivered	Audit Assessment Scale
Delivery of Energisations (Key Projects) **Delivery Weighting 50%**	**4**	20%	Step 4-5 Routing & Planning Process Approval	29 CPPs Issued to TAO	Actual Delivered	Audit Assessment Scale
	5	30%	Step 6 - TOP Delivery	TOP21 baseline	Actual Delivered	Audit Assessment Scale

Subject to final approval by CRU in Q1 2021

2020 Key Projects Energised & Looking ahead to 2021 Energisations

2020

- Mountlucas - Thornsberry 110 kV Line - New Line
- Clashavoon - Dunmanway 110 kV Line - New Line
- Cashla - Salthill 110 kV Bay Conductor Uprate
- Corderry - Srananagh 110 kV Line Uprate
- Moy 110 kV Station Busbar Uprate
- Finglas - Shellybanks 220 kV Cable Diversion
- Killonan-Tarbert was transferred in 2020 making Kilpaddoge - Killonan and Kilpaddoge Tarbert 2

2021

- Tarbert – Tralee 1 110 kV loop-in to Kilpaddoge 110 kV station
- Kilpaddoge - Knockanure 220 kV cable
- Ballyvouskill - Knockanure 220 kV Line Uprate
- Ballyvouskill 50 MVAr reactor
- Knockanure 50 MVAr Reactor
- Great Island - Kilkenny 110 kV Uprate
- Wexford 110 kV Busbar Uprate
- Thornsberry 110 kV Busbar Uprate

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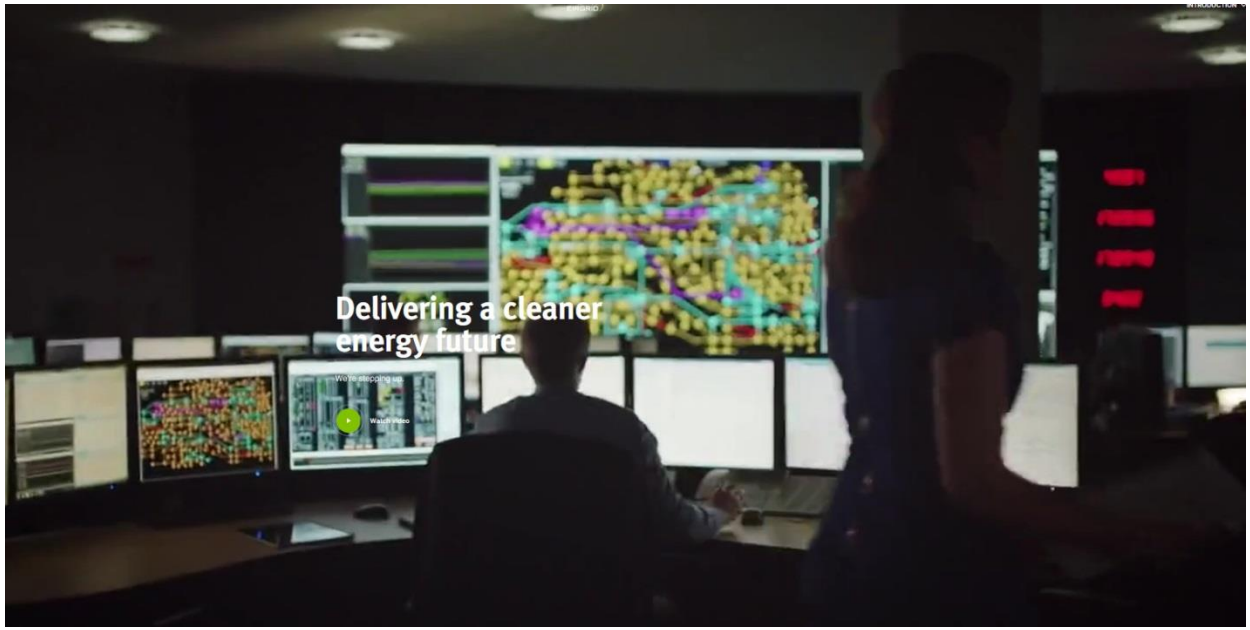
ESB NETWORKS

Recap

1. PR5 is the most ambitious programme of work ever undertaken in the transmission system with work well underway.
2. Key risks and issues for delivery of transmission are well understood and are being managed.
3. Robust level of oversight with independent audit by CRU in place.
4. EirGrid and ESB are committed to delivering the required infrastructure to meet targets and alleviate constraints.



EIRGRID

Questions?

ESB Networks Update

EIRGRID GROUP

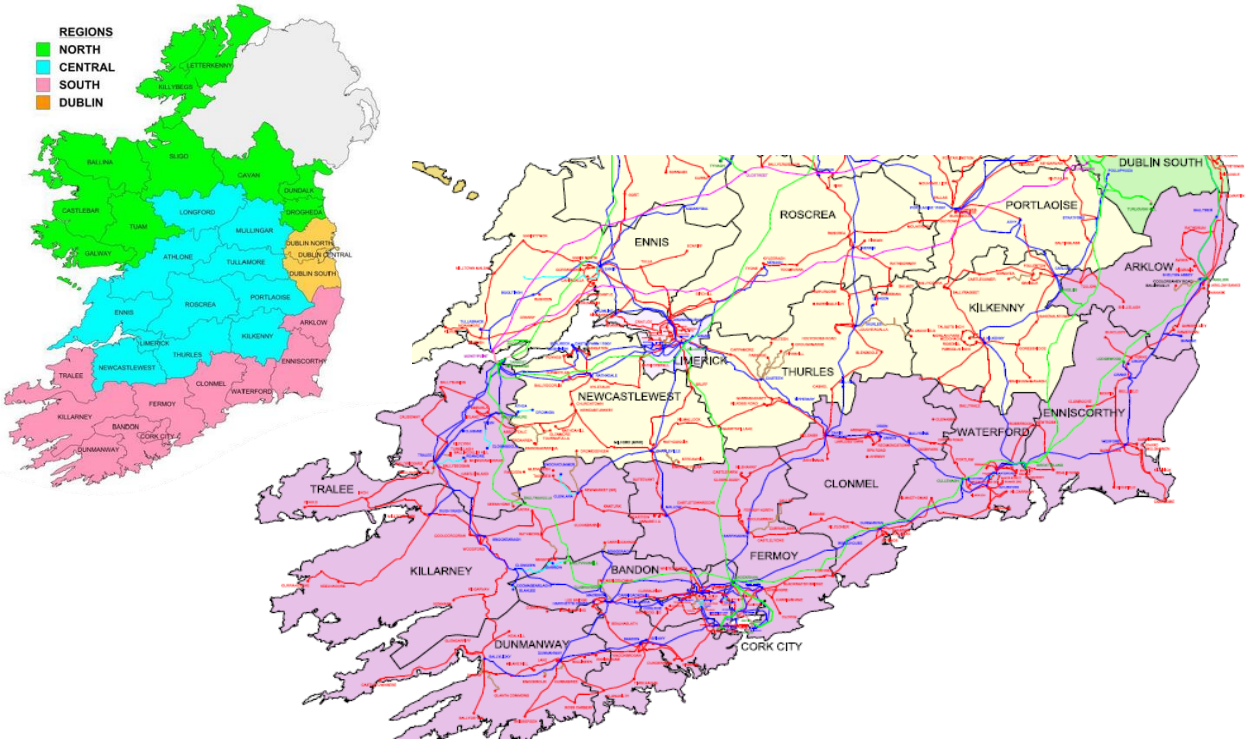
Transmission Maintenance & Outage Co-ordination

Pádraig Coughlan

Outage Co-ordinator, HV South NCD, ESB Networks

04/03/2021

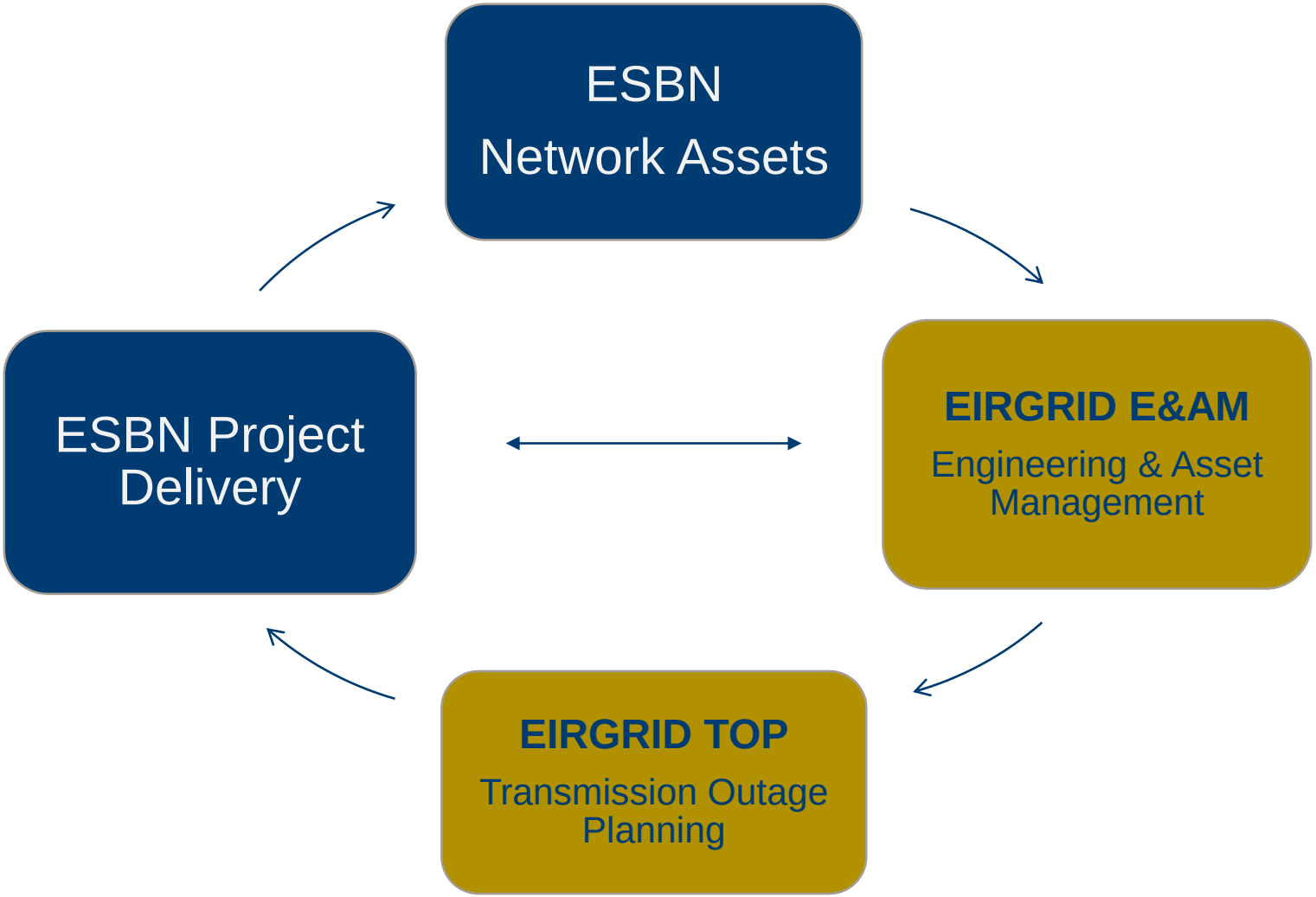
Regions & Roles of Outage Co-ordinator



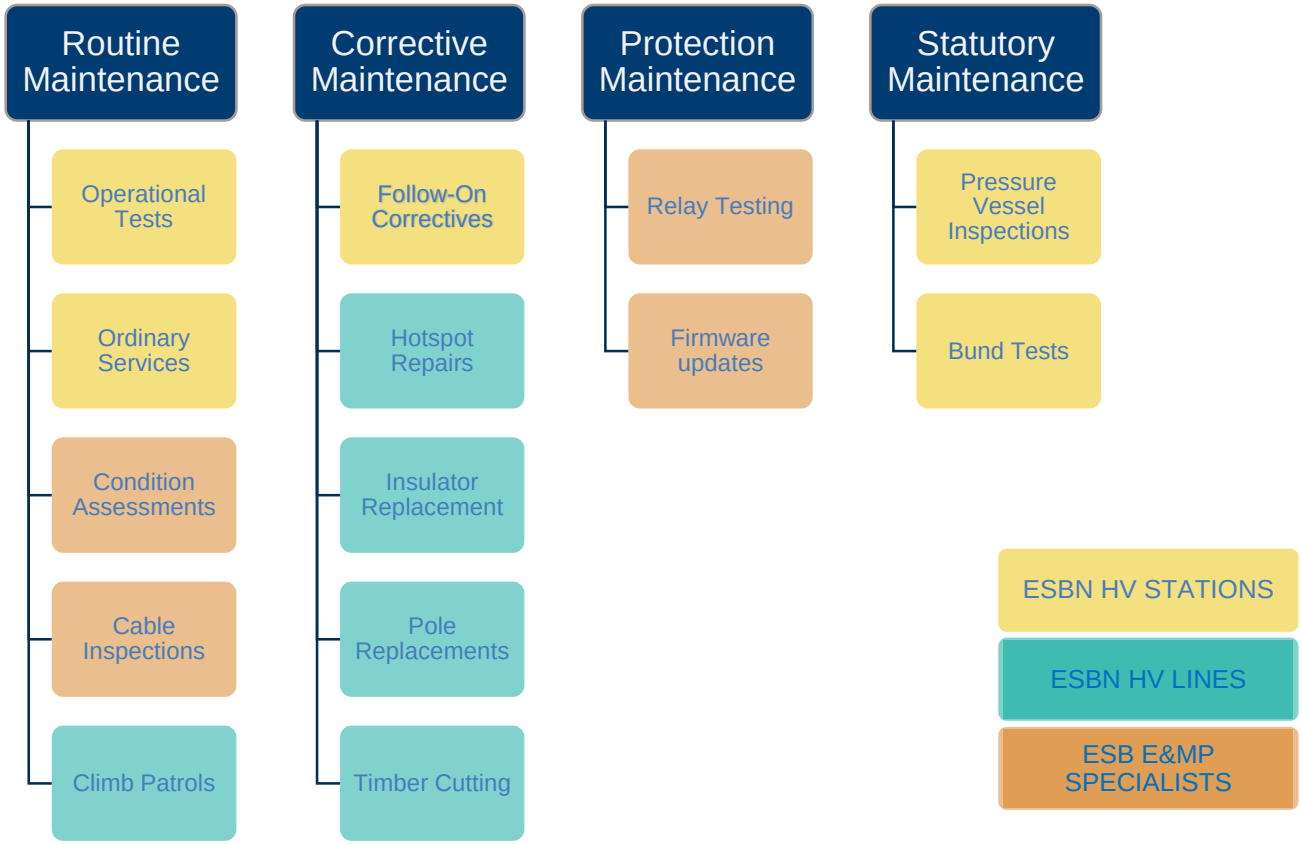
Role of Outage Co-ordinator

- Transmission/Dist Outage Coordination
- Facilitate Outage Process – Start to Finish
- EirGrid NearTime/TOP/TEM point of contact
- PL & Supervisor Support
- Transmission Maintenance

Maintenance Orders



Types of Maintenance



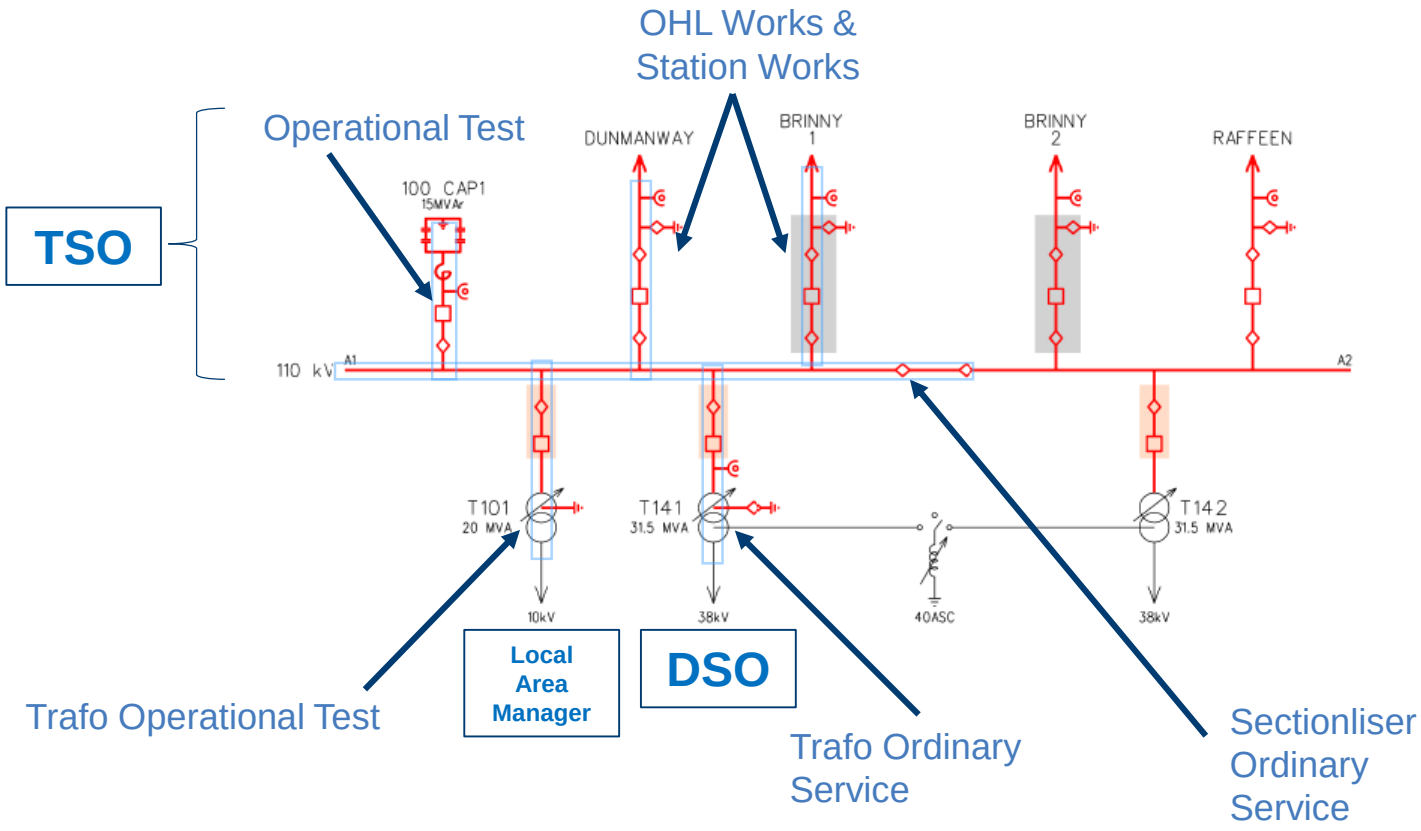
Outage Duration

TRANSFORMER - KNOCKANURE T2101

TO-21-KNR-T2101-01 ISO week: **14th - 16fr** Date: **08 Apr - 23 Apr** Duration: **16 Days (12 WD)** Status: **Proposed**

WORK	LOCATION		WORK ID	STATUS	DAYS	PRIORITY	DESCRIPTION/COMMENTS
				DO	2	2	P2 Protection maintenance of 7SA612, RET670
				DO	2	2	P2 Protection maintenance of 7SA612, RET670,
OS	KNR	110	901129751	DO	4	4	110kV GIS Cubicle Ordinary Service
OS	KNR	220	901129777	DO	4	4	220kV GIS Cubicle Ordinary Service
OS	KNR	TRAFO	901129833	DO	4	4	220/110 & 275/220 Trafo Ordinary Service
AMCAB	KNR	220	901129754	DO	2	4	Cable Insp. 400 & 220kV Feeder XLPE
AMCAB	KNR	110	901785103	DO	2	4	Cable Insp. 110kV XLPE
CORRECT	KNR	TRAFO	901125652	DO	2	4	Install protective weather cover on temperature devices.
CORRECT	KNR	TRAFO	901125653	DO	1	4	Knockanure T2101 220kV Transformer: Minitrans repair

Outage Example (Half Bar Station Outage)

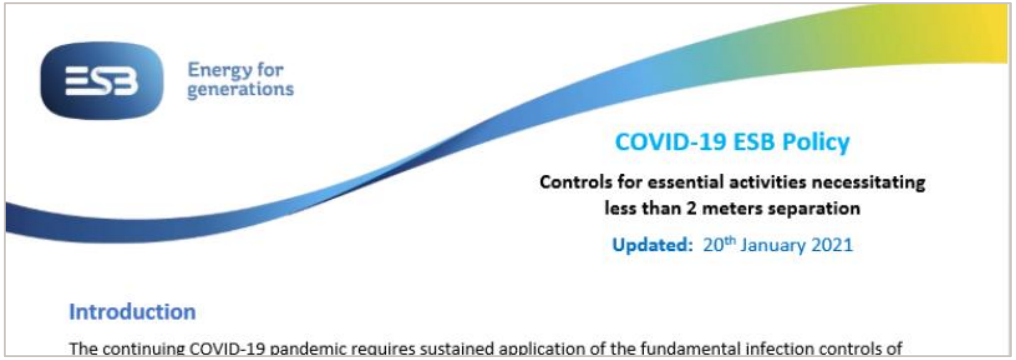


COVID-19


COVID-19
WORK FROM
HOME


2m
(6 feet)
Please Ensure
Social Distancing


MyContactLog


Energy for generations
COVID-19 ESB Policy
Controls for essential activities necessitating less than 2 meters separation
Updated: 20th January 2021
Introduction
The continuing COVID-19 pandemic requires sustained application of the fundamental infection controls of

Questions?

Distribution Outage Programme (DOP) 2021

John Whelan

Distribution Outage Programmer, HV Operations, ESB Networks

04/03/2021

The DOP

The **D**istribution **O**utage **P**rogramme (DOP) is a mechanism to capture and align DSO outages with HV Customer outages.

The following outages are included on the DOP:

- Outages of HV Customer plant (where ESBN operators are needed to create PoDs).
- All DSO/TSO outages which force a HV Customer off the system.
- All 110 / 38 kV transformers (for HV planning).
- Selected 110 / MV transformers (for portfolio management).

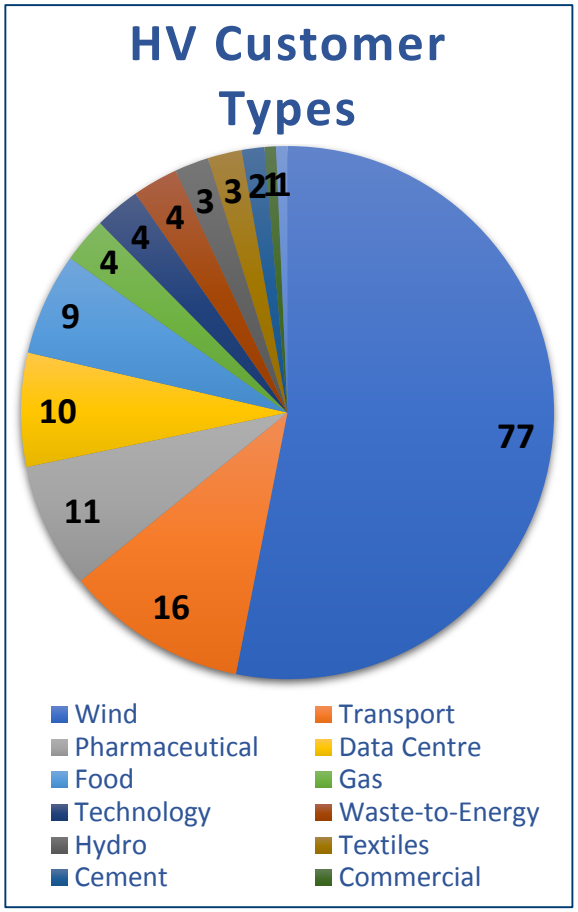


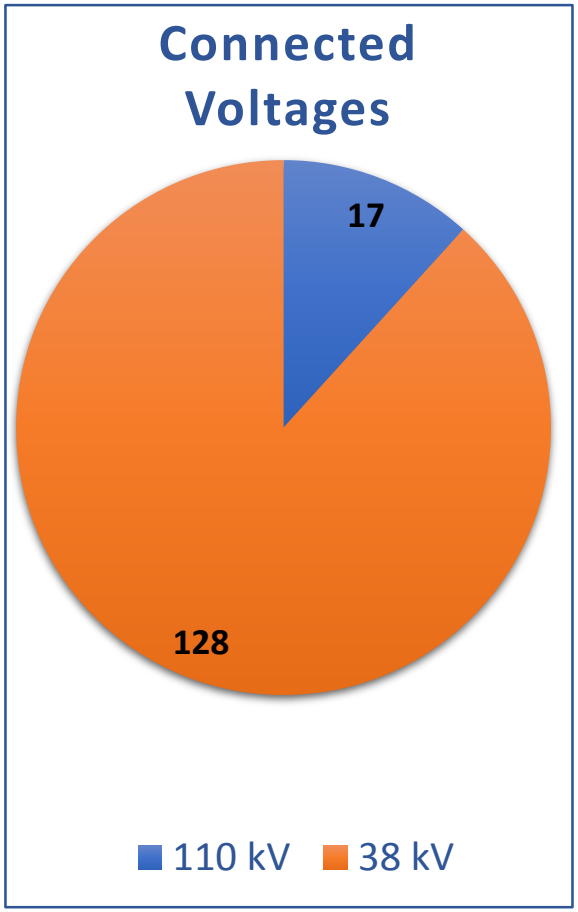


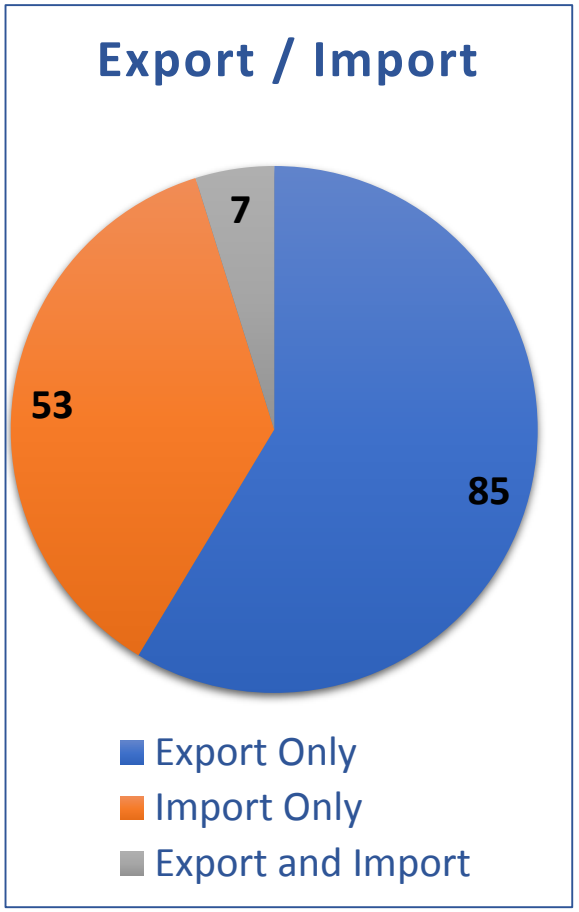
System Controllers

Voltage	System Manager	System Controller	Operator
400 kV	TSO	NCC	NCC / NTs
220 kV	TSO	NCC	NCC / NTs
110 kV	TSO/DSO	NCC / NDCC	NCC / NDCC / NTs
38 kV	DSO	NDCC	NDCC / NTs
MV	CSS	NDCC	NDCC / NTs
LV	CSS	CSS	NTs

145 HV DSO Customers







Voluntary Outages (VOs)

Outage Request Form
dsooutageprogramme@esb.ie

↓

Operator Available

↓

Align ESB Networks Work

↓

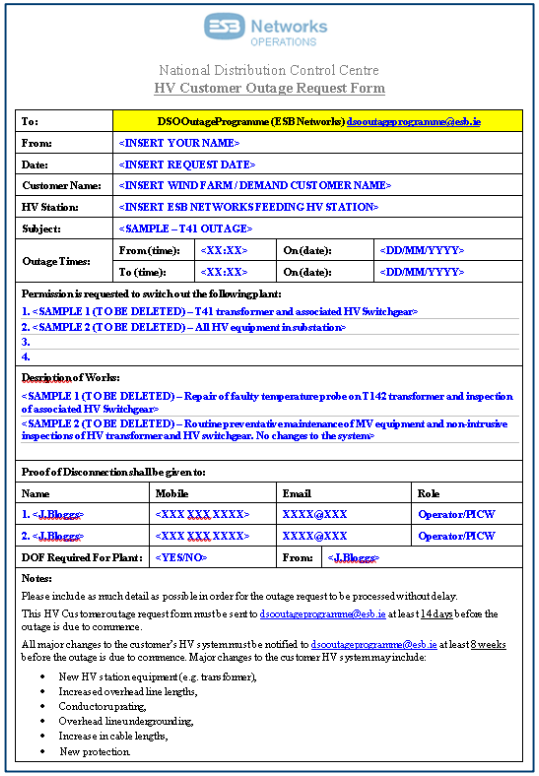
HV Planner Checks for Conflicts

↓

VO is Issued

↓

Control Room Switching Plan



Networks OPERATIONS

National Distribution Control Centre
HV Customer Outage Request Form

To:	**DSOOutageProgramme (ESB Networks) dsooutageprogramme@esb.ie**			
From:	<INSERT YOUR NAME>			
Date:	<INSERT REQUEST DATE>			
Customer Name:	<INSERT WIND FARM / DEMAND CUSTOMER NAME>			
HV Station:	<INSERT ESB NETWORKS FEEDING HV STATION>			
Subject:	<SAMPLE – T41 OUTAGE>			
Outage Times:	**From (time):**	<XX:XX>	**On (date):**	<DD/MM/YYYY>
	To (time):	<XX:XX>	**On (date):**	<DD/MM/YYYY>

Permission is requested to switch out the following plant:

1. <SAMPLE 1 (TO BE DELETED) – T41 transformer and associated HV Switchgear>
2. <SAMPLE 2 (TO BE DELETED) – All HV equipment in substation>
3.
4.

Description of Works:

<SAMPLE 1 (TO BE DELETED) – Repair of faulty temperature probe on T142 transformer and inspection of associated HV Switchgear>
<SAMPLE 2 (TO BE DELETED) – Routine preventative maintenance of MV equipment and non-intrusive inspections of HV transformer and HV switchgear. No changes to the system>

Proof of Disconnection shall be given to:

Name	Mobile	Email	Role
1. <J.Bloggs>	<XXX XXX XXXX>	XXXX@XXX	Operator/PICW
2. <J.Bloggs>	<XXX XXX XXXX>	XXXX@XXX	Operator/PICW

DOF Required For Plant:	<YES/NO>	**From:**	<J.Bloggs>

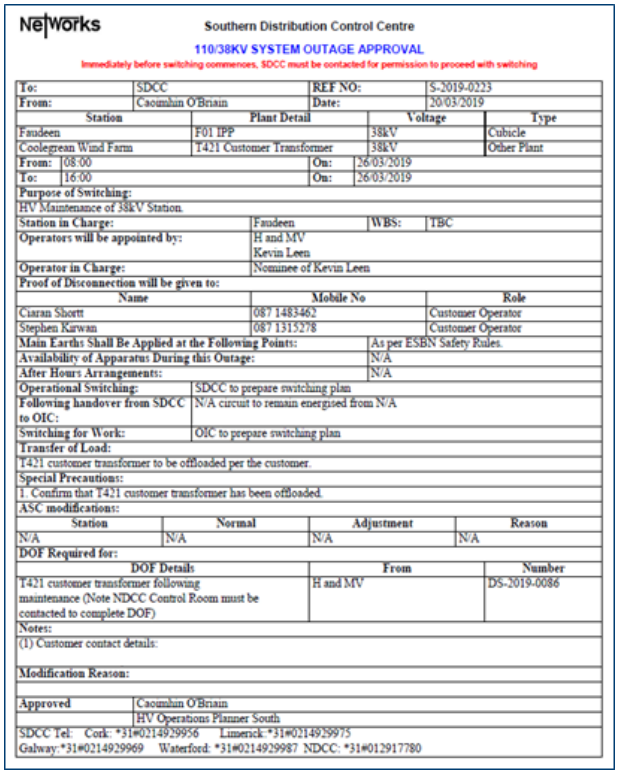
Notes:

Please include as much detail as possible in order for the outage request to be processed without delay.

This HV Customer outage request form must be sent to dsooutageprogramme@esb.ie at least 14 days before the outage is due to commence.

All major changes to the customer's HV system must be notified to dsooutageprogramme@esb.ie at least 8 weeks before the outage is due to commence. Major changes to the customer HV system may include:

- New HV station equipment (e.g. transformer),
- Increased overhead line lengths,
- Conductor uprating,
- Overhead line undergrounding,
- Increase in cable lengths,
- New protection.



Networks — Southern Distribution Control Centre

110/38KV SYSTEM OUTAGE APPROVAL

Immediately before switching commences, SDCC must be contacted for permission to proceed with switching

To:	SDCC	**REF NO:**	S-2019-0223
From:	Caomhán O'Briain	**Date:**	20/03/2019

Station	Plant Detail	Voltage	Type
Faudeen	F01 IPP	38kV	Cubicle
Coolegrean Wind Farm	T421 Customer Transformer	38kV	Other Plant

From:	08:00	**On:**	26/03/2019
To:	16:00	**On:**	26/03/2019

Purpose of Switching:
HV Maintenance of 38kV Station.

Station in Charge:	Faudeen	**WBS:**	TBC
Operators will be appointed by:	H and MV Kevin Leen		
Operator in Charge:	Nominee of Kevin Leen		

Proof of Disconnection will be given to:

Name	Mobile No	Role
Ciaran Shortt	087 1483462	Customer Operator
Stephen Kirwan	087 1315278	Customer Operator

Main Earths Shall Be Applied at the Following Points:	As per ESBN Safety Rules.
Availability of Apparatus During this Outage:	N/A
After Hours Arrangements:	N/A
Operational Switching:	SDCC to prepare switching plan
Following handover from SDCC to OIC:	N/A circuit to remain energised from N/A
Switching for Work:	OIC to prepare switching plan

Transfer of Load:
T421 customer transformer to be offloaded per the customer.

Special Precautions:
1. Confirm that T421 customer transformer has been offloaded.

ASC modifications:

Station	Normal	Adjustment	Reason
N/A	N/A	N/A	N/A

DOF Required for:

DOF Details	From	Number
T421 customer transformer following maintenance (Note NDCC Control Room must be contacted to complete DOF)	H and MV	DS-2019-0086

Notes:
(1) Customer contact details:

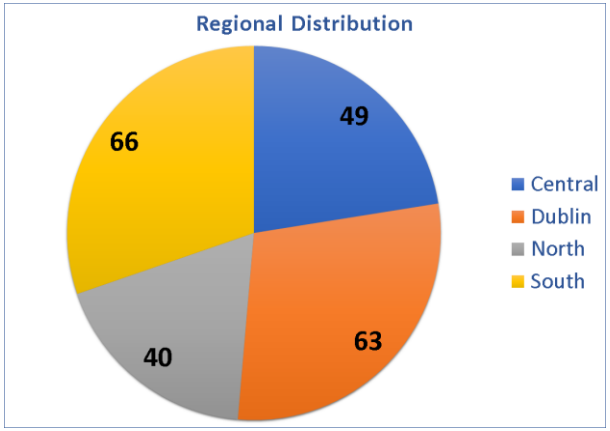
Modification Reason:

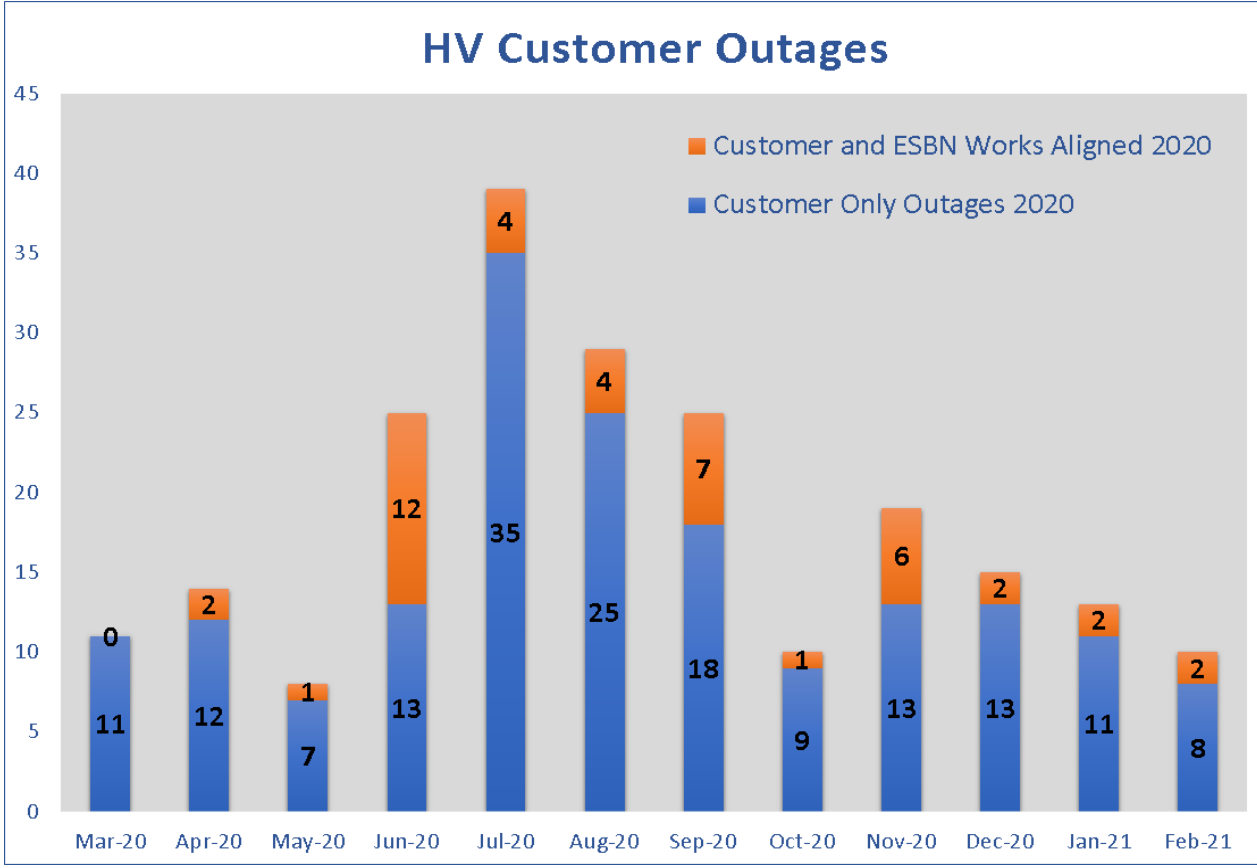
Approved	Caomhán O'Briain
	HV Operations Planner South

SDCC Tel: Cork: *31#0214929956 Limerick:*31#0214929975
Galway:*31#0214929969 Waterford: *31#0214929987 NDCC: *31#012917780

DOP Statistics 2020

- 218 Outages involving HV Customers
- 43 Cases of Aligned Works





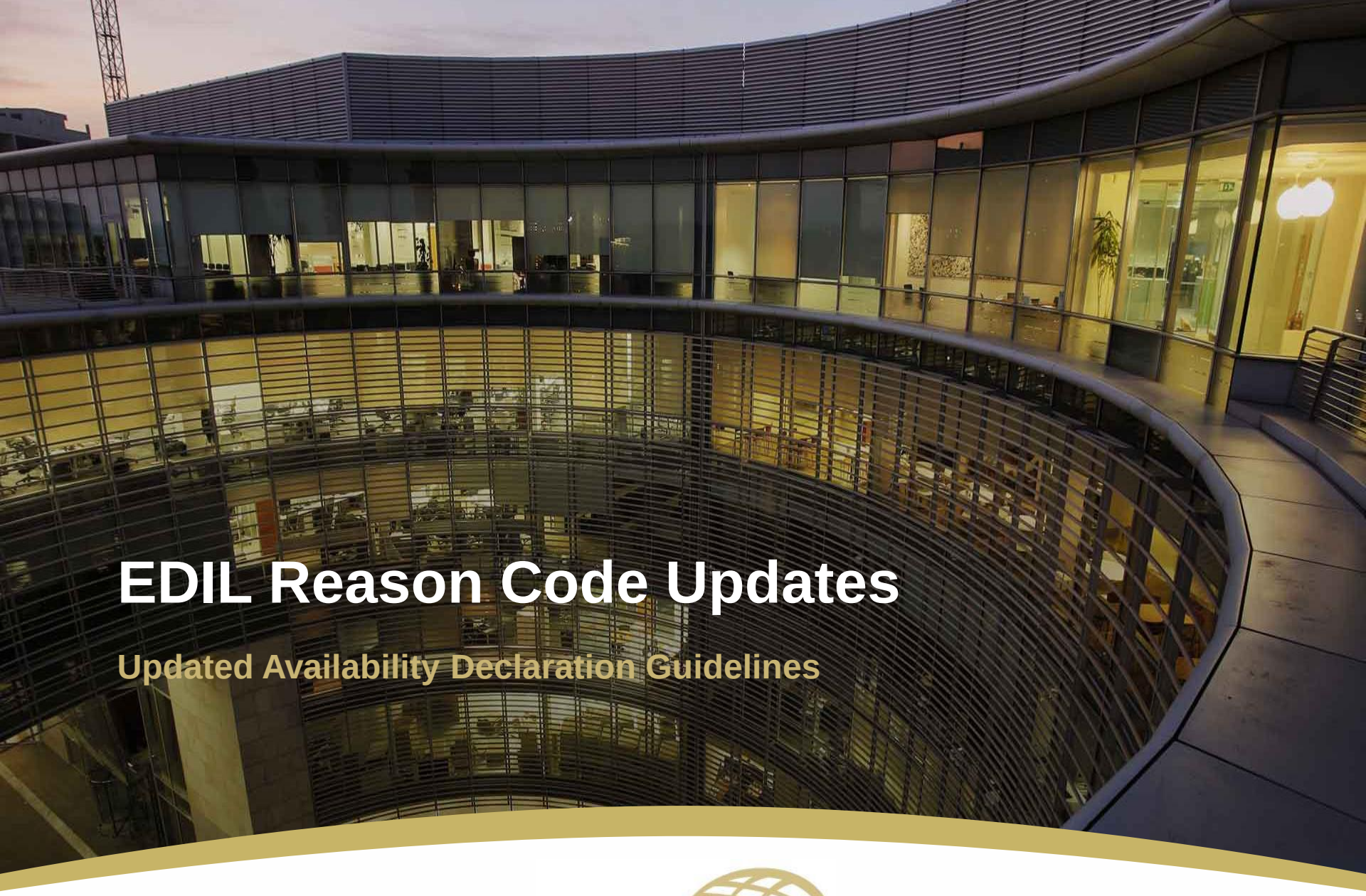
Outage Mitigation

Renewed focus in ESB Networks on Outage Mitigation for HV Customers.

- Reducing / standardising outage times.
- Keeping HV Customers online as demand customers.
- Limited export capability.
- Network changes to eliminate outage requirements.




Questions?



EDIL Reason Code Updates

Updated Availability Declaration Guidelines

EIRGRID

EDIL Reason Code Review

- Over the course of 2020 a review was conducted on availability declaration codes being used by generators in EDIL
- Noticed that incorrect codes were frequently being submitted leading to a large amount of post processing to find accurate stats
- Annual outage statistics are generated from EDIL which uses generator input declarations to calculate
- These statistics feed into capacity market so need to be accurate

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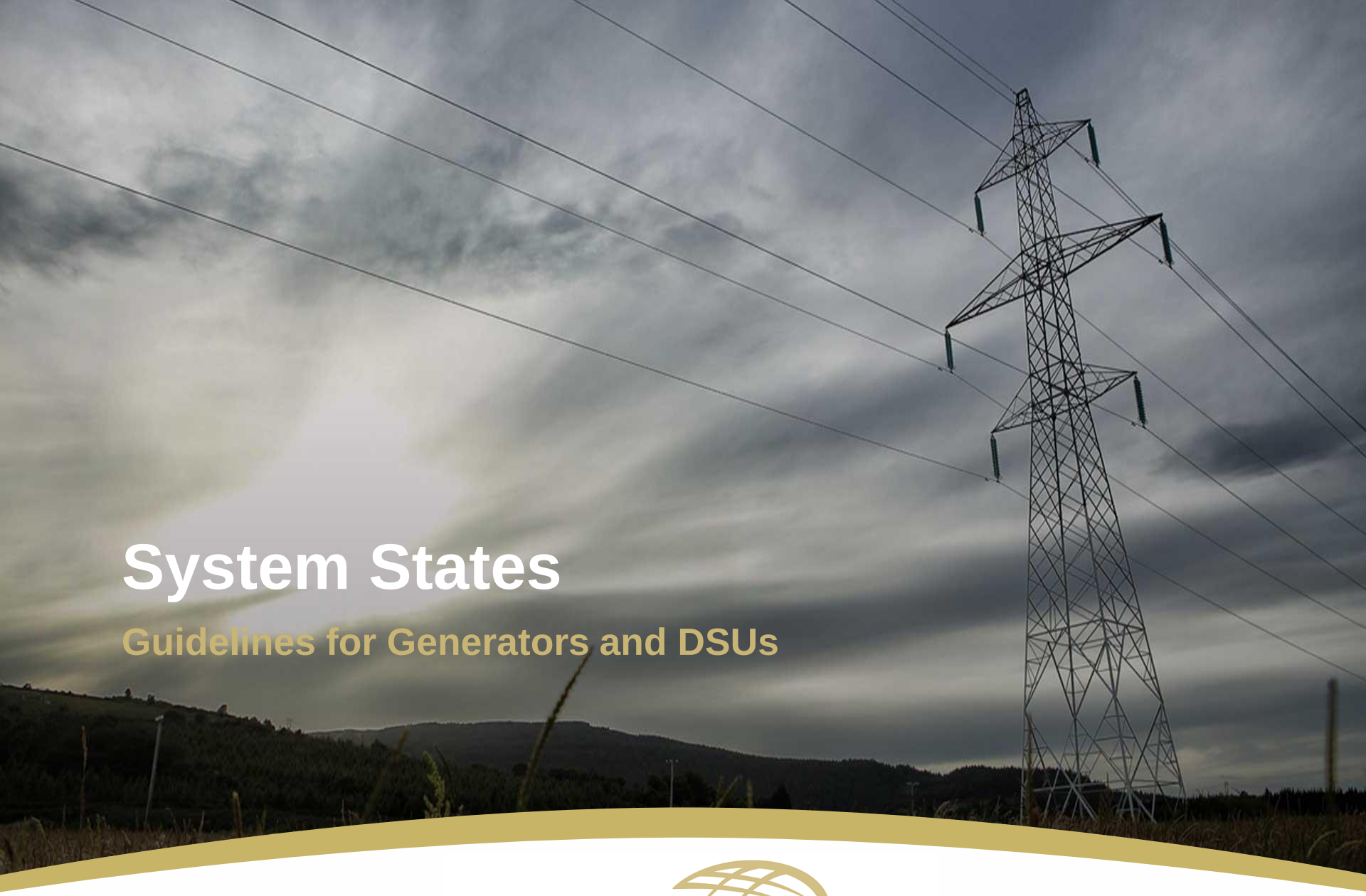
Results of Review

- Following review it was proposed to reduce the number of codes in use
- After consultation with industry it was determined that eight codes were sufficient to cover every outage scenario
- These codes were circulated in an updated guideline document in October 2020 and took effect from 1 November 2020
- Only the circulated eight codes should be used by any generator when making availability declarations in EDIL – guideline document will be circulated again following Forum

Questions?



System States

Guidelines for Generators and DSUs

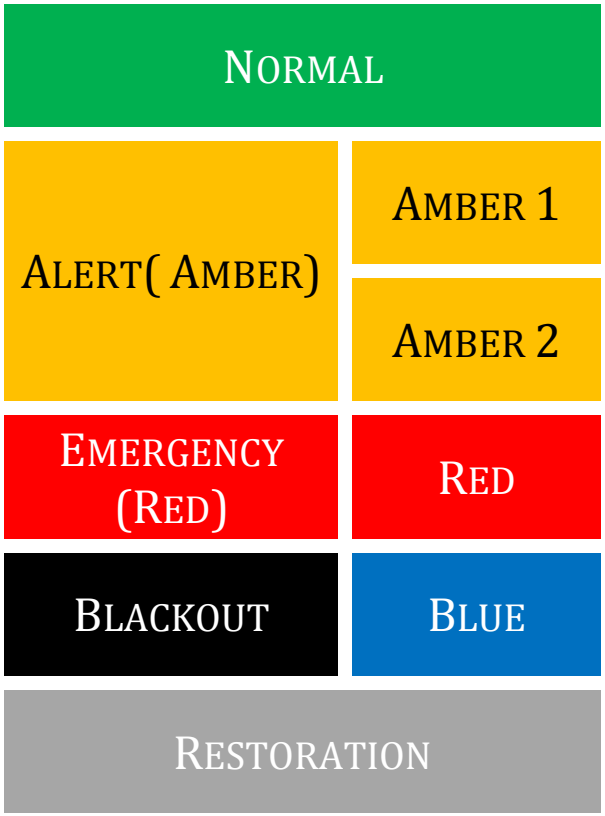
EIRGRID GROUP

Objective

- Explain the change in System States
- Describe the system state conditions
- Explain Generator Required Response
- Explain DSUs Required Response
- Discussion on Wind Farm expected response in the future

Change in System States

- European Network Codes Requirement
- Power System States are jurisdictional



Normal State

- Voltage and power flows are within limits- base case secure
- Frequency is within normal range
- N-1 secure for active and reactive power
- N-1 secure after operation of a RAS/SPS scheme

Alert State(Amber)

- Base case secure and
- Frequency meets the following criteria and the absolute value of the steady state system frequency deviation from nominal has continuously exceeded:
  - 500 mHz for a time period longer than one minute; or
  - ± 200 mHz for a time period longer than 15 minutes; or
  - ± 250 mHz for a time period longer than 10 minutes; or
- N-1 breaches security limits
- Multiple contingencies are probable because of adverse weather; or
- The All-Island reserve capacity is reduced by more than 20% for longer than 30 minutes and there are no means to compensate for that reduction in real-time system operation.

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Alert State (Amber)

The jurisdictional margin is such as the tripping of the largest set, would give rise to a reasonable possibility of failure to meet the System Demand using the following formula as a guideline:

LSI > MAR
Where:
LSI *= largest MW infeed to jurisdiction*

$$MAR = [GEN + WIND/PV +/- ICF] – DEMAND + TLS$$

GEN	=	*Readily available generation*
WIND/PV	=	*Expected generation from wind and PV*
ICF	=	*Flow on the EWIC/Moyle Interconnector*
DEMAND	=	*Expected system demand*
TLS	=	*Tie Line Support (capped by TTC), and is defined as follows*

TLS = min (TTC, +/-TL + ATLS)
where

TL	=	*Tie Line flow*
ATLS	=	*Additional Tie Line Support = surplus margin in the other jurisdiction*
TTC	=	*Total Transfer Capability (in the relevant direction)*

Emergency State (Red)

- There is at least one violation (base case) of voltage limits, short-circuit current limits, or current limits in terms of thermal rating; or
- Frequency does not meet the criteria for the normal state or alert state definitions; or
- Any of the following system defence plan measures are activated;
  - activation of UF load shedding where frequency does not recover within +/- 500mHz less than 1 minute; or
  - widespread (multiple station) UV load shedding; or
  - activation of manual demand disconnection; or
  - activation of system separation protection.
- There is a failure in the functioning of;
  - EMS / SCADA or
  - Phones (Corporate and Optel / Tetra) resulting in the unavailability of those tools, means and facilities for longer than 30 minutes.
- The "RED ALERT" signal should also be initiated by NCC or CHCC when it is likely/ imminent that in the period immediately ahead (i.e. in the next four(4) hours) there is a high risk of failing to meet System Demand.

Blackout State (Blue)

- Loss of more than 50% of demand in the concerned TSO's control area;
- Total absence of voltage for at least three minutes in the concerned TSO's control area, leading to the triggering of restoration plans.
- Restoration Plan has been activated.

Generator Response on Alert state(Amber)

- Management to be notified.
- Fax machine/e-mail/EDIL to be monitored
- Any routine operations with an associated element of risk to cease.
- On-load testing of relays, protection or other equipment to cease.
- All work on or near plant or controls or auxiliaries to cease.
- Any unauthorised minor maintenance being done on non-running but available plant to be finished and plant cleared for running.
- Review readiness to maximise.
- Operators to be on the alert for a system emergency.
- Operators to ensure that the generating units MW and Mvar declarations are attainable.
- Do not perform any fuel changeovers unless instructed to do so by NCC/CHCC
- Hydro stations should take whatever actions are necessary to increase capacity over the peak. Actual output should be agreed with NCC/CHCC based on making best use of each hydro station during the alert.
- Stations to reduce house load between 17:00 and 19:00.

Generator Response on Emergency State (Red)

- Amber Alert actions completed.
- Prepare to immediately implement MW dispatch instruction from NCC/CHCC.
- Prepare to immediately implement reactive power instruction from NCC/CHCC.
- Prepare to initiate run up if not currently on load.
- Station staff should inform NCC/CHCC as to the length of time gas turbines can maintain peaking load.

DSU Response on Alert State (Amber)

- Shift Manager to be notified.
- Fax machine/e-mail/EDIL to be monitored for further NCC/CHCC instructions.
- Any routine operations with an associated element of risk to cease.
- Any testing to cease.
- Any minor maintenance being done to be finished and DSU prepared to normal operation.
- Be ready to receive instruction via EDIL (or secondary communication channel) if requested.
- Operators to be on the alert for a system emergency.
- Operators to ensure that the Availability (and Generation Achieved) MW declarations are attainable and maximise their availability.
- Issue notification to all Individual Demand Sites (IDS) about possible Demand Response event

DSU Response on Emergency State (Red)

- Immediately implement Amber Alert responses.
- Once DSU receives instruction from NCC/CHCC, immediately instruct all IDS to delivery Energy Reduction to the last declared availability MW declaration.
- DSU Operator to prepare for possible mains loss to ensure continuous operation of their Control Centre.

Wind/PV Farms Response to System States

- Possible Responses could be
  - Stop any testing/ RTU work etc.
  - Be available via phone for instruction
  - Ensure Wind/PV Farm can respond to WDT
  - Don’t call the control room
  - Consider stopping all maintenance(any radials) and be available for MW/MVAR
- Suggestions?

Questions?

New Control Centre Tools and Ramp Forecast

James Ryan

4th March 2021

EIRGRID SONI

Agenda

- Background and Time Horizon of Existing Tools
- Look-ahead Security Assessment Tool (LSAT)
- Voltage Trajectory Tool (VTT)
- Ramping Margin Tool (RMT)
- Ramp Uncertainty Forecast

One of the last set of deliverables from DS3 Programme

PERFORMANCE MONITORING

SYSTEM SERVICES

DSM

GRID CODE

ROCOF

Change in System Performance which is incentivised by System Services

RENEWABLE DATA

VOLTAGE

FREQUENCY

Changes in System Policies which leads to increases in renewables

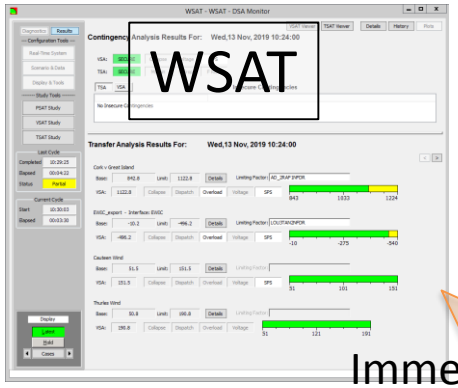
WSAT

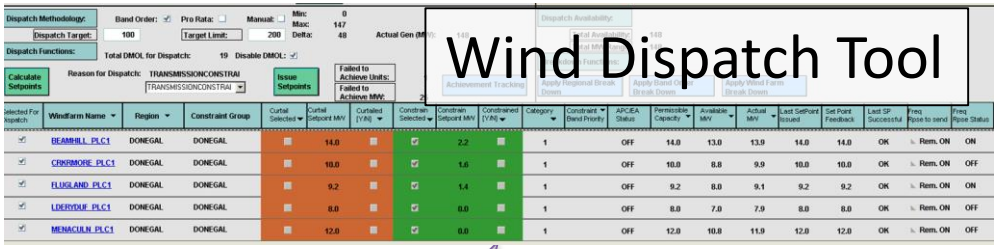
CONTROL CENTRE TOOLS

MODEL DEVELOPMENT STUDIES

System Tools enabling operational change in the Control Centres

DS3 Highlights – Control Centre Tools





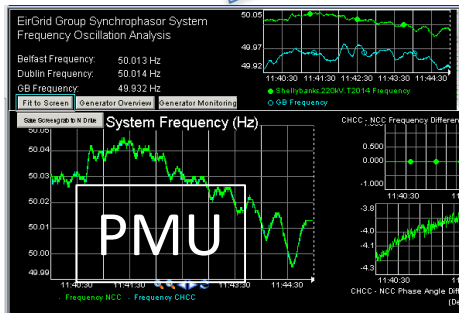
Immediate Past

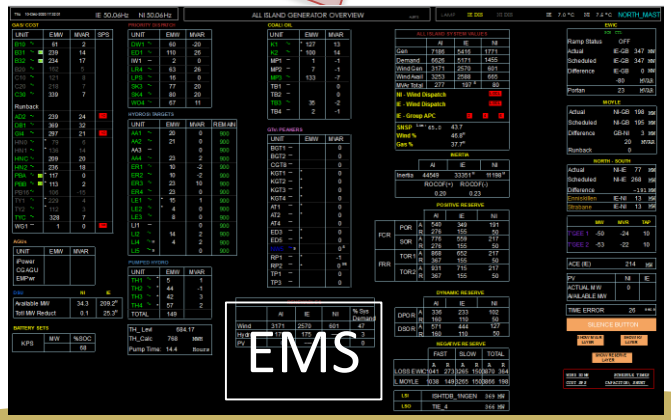
Day+1

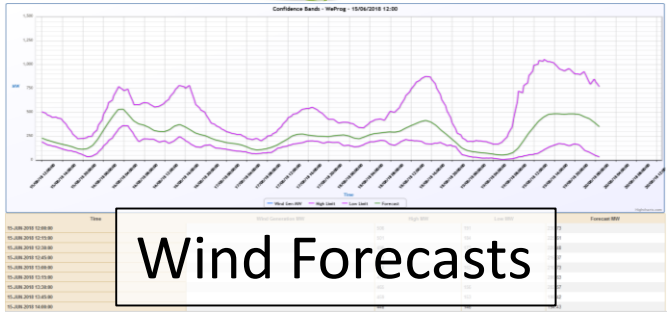
Balancing Market System

Now

Historical Analysis







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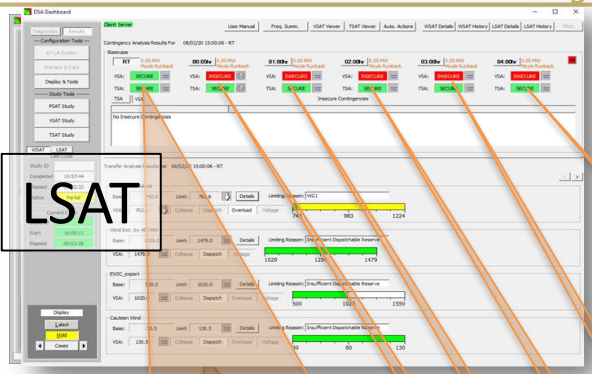
Look-ahead Security Assessment Tool (LSAT)



- Models system behaviour in response to contingency events e.g
  - Frequency traces
  - steady state voltages
- Control room roll out Dec 2020
- Enabled starting of 70% SNSP Trial

Current Operating Plan

Immediate Past

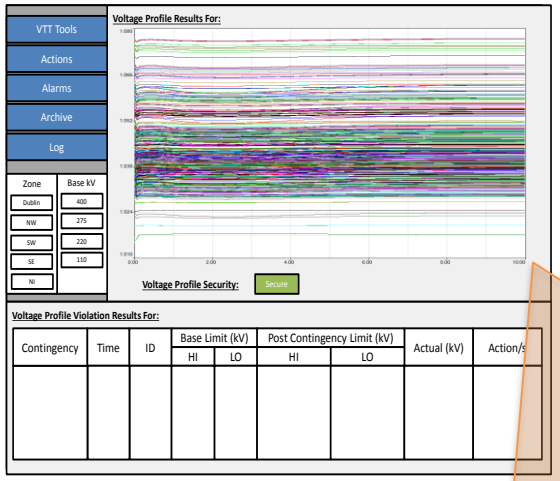
-5 mins

Now
(e.g 14:30, Day-ahead just published)

60*30min Trade periods

Day+1

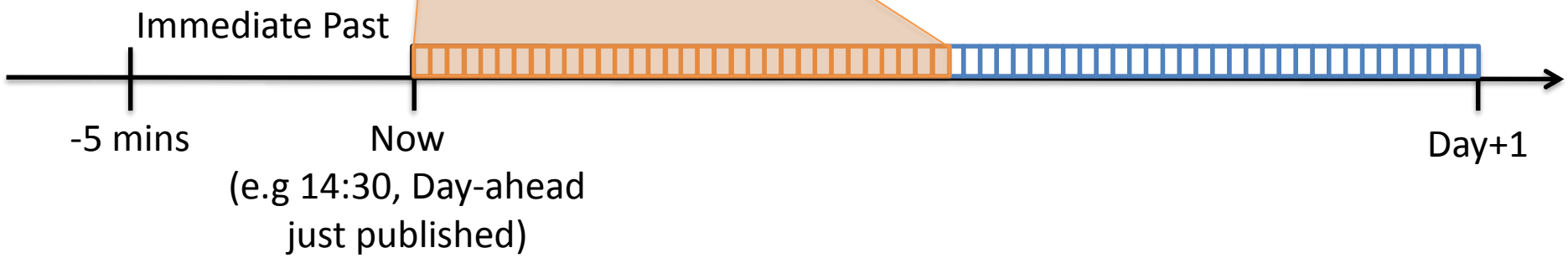
Voltage Trajectory Tool (VTT)



- Optimises reactive power setpoints over a horizon
- Expected control room roll out end of 2021
- Enabler of trials beyond 75% SNSP

Two Step Process

1. Solve Optimal Power Flow for each trade period
2. Limit the differences from one trade period to the next e.g. limit number of voltage set point instructions to be issued per time period

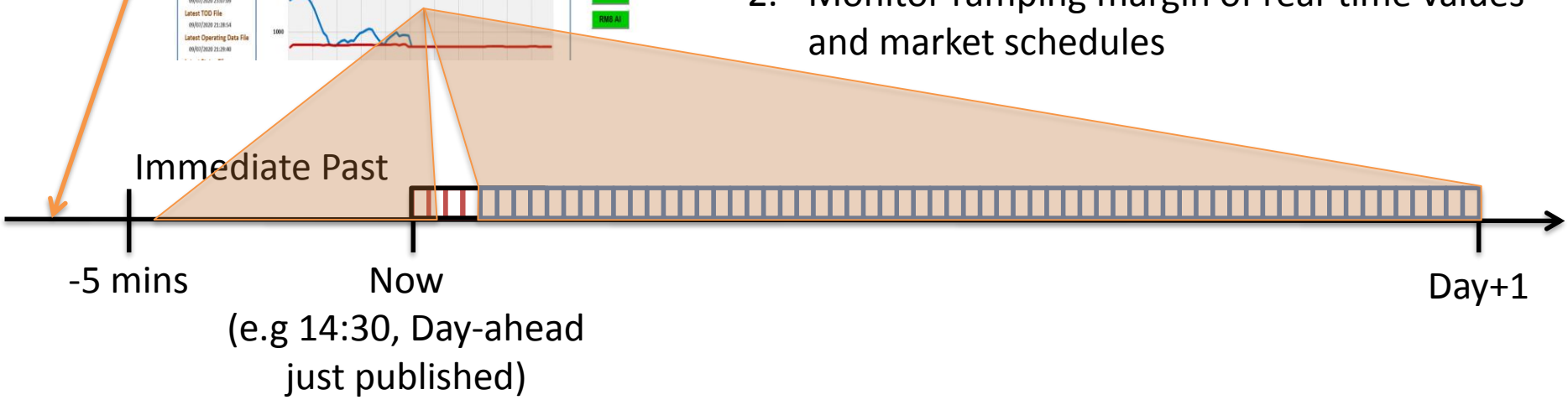


Ramping Margin Tool (RMT)

- Interim ramping margin tool go live Sept. 2020
- Enduring RMT go-live Q3 2021
- Enabled start of 70% SNSP

Two main functions

1. Submit Requirement into Balancing Market
2. Monitor ramping margin of real-time values and market schedules

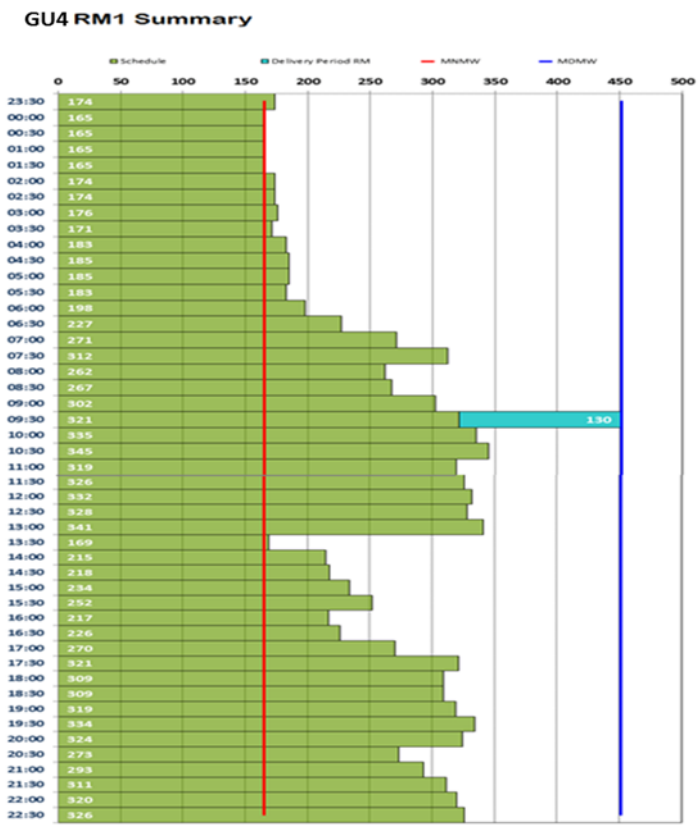


Ramping Margin Tool (RMT)

- Ramping capability is increased MW output a unit is contracted to provide and maintain within defined period- 1,3 or 8 hours
- RMT and the 3 new ramping margin reserve services to help manage imbalance risks over 1,3,8 hours
- Originally communicated formula for calculating the reserve requirements:

$$Ramping\ Reserve\ Volume\ Requirement_t = Largest\ Single\ Energy\ Source_t + 1\%Load\ Forecast_t + max\begin{cases} Largest\ offline\ reserve\ resource_t \\ fn(Wind\ Forecast_t) \end{cases}$$

- Scaling reserves based on historical properties of the power forecast resulted in large requirement
- RMT uses novel forecast that characterises current weather uncertainty.



Ramp Uncertainty Forecast

Accounting for known unknowns

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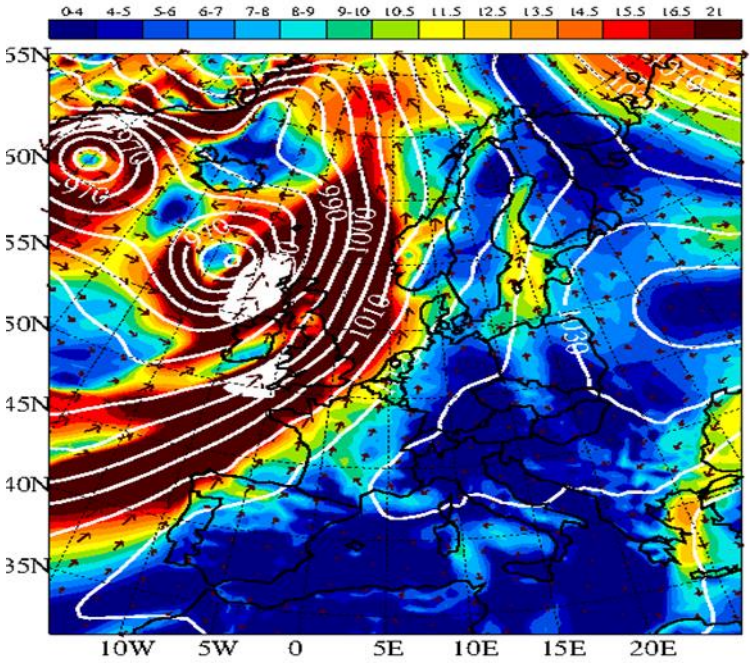
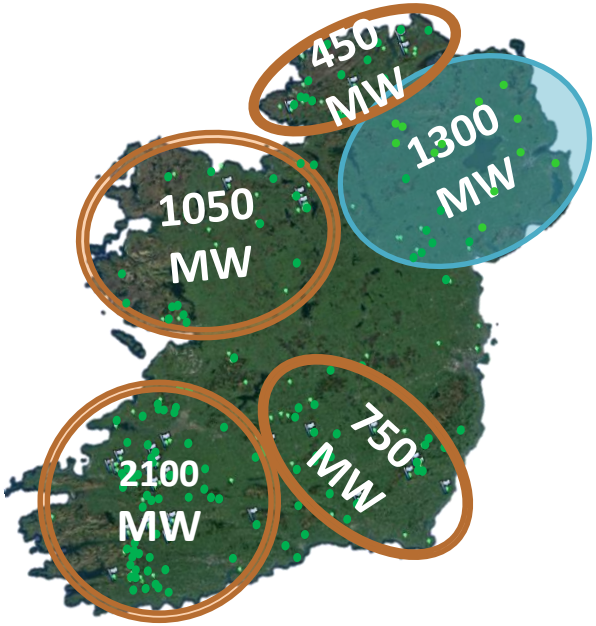
Ireland's Forecasting Challenge

Ireland's location



Wind farm clusters



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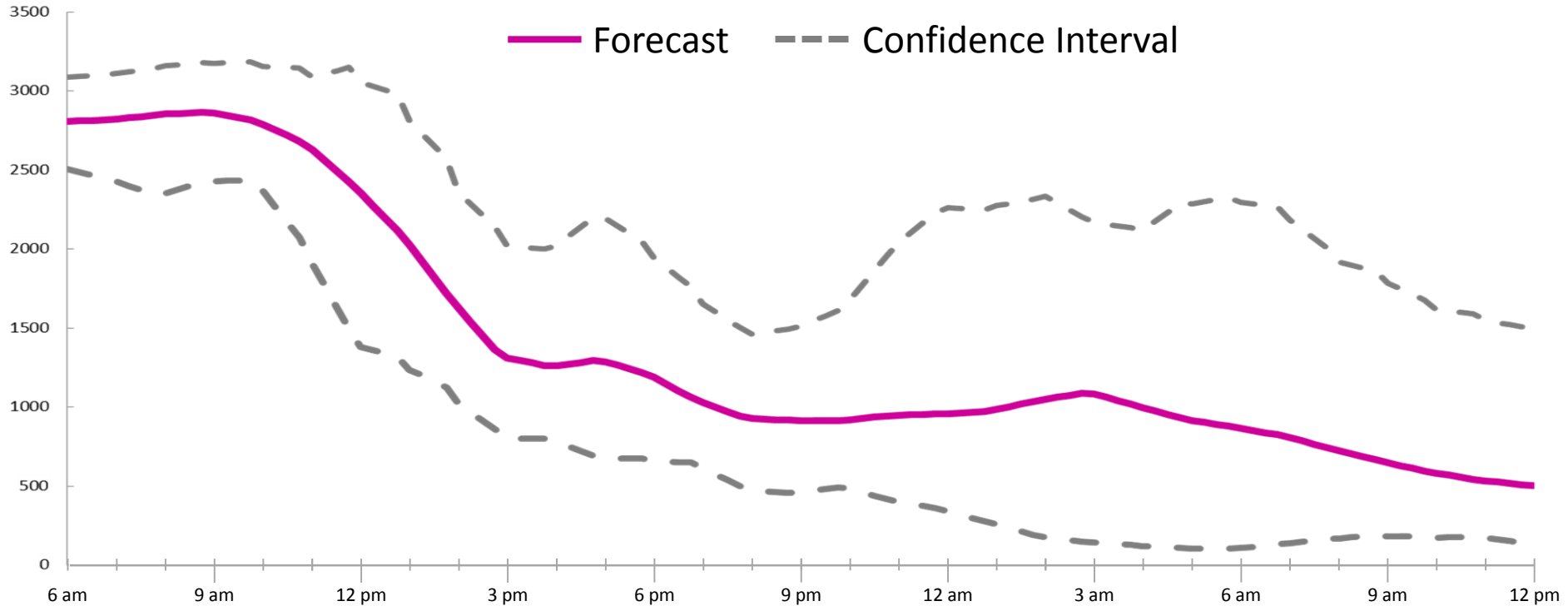
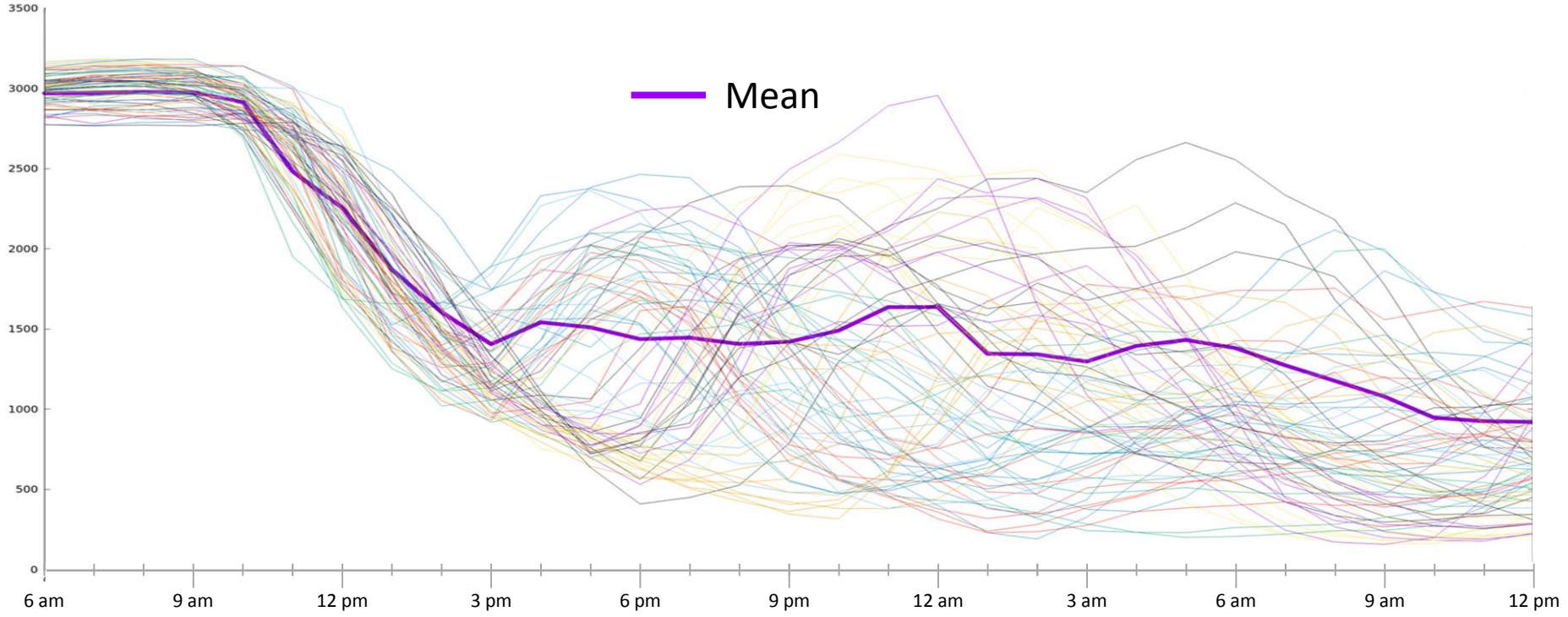
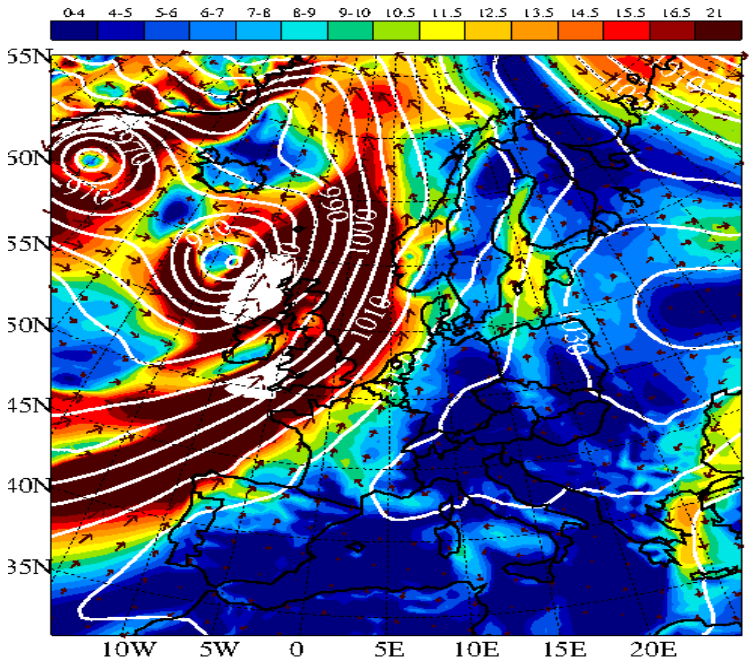
12th October 2018 -Received forecast



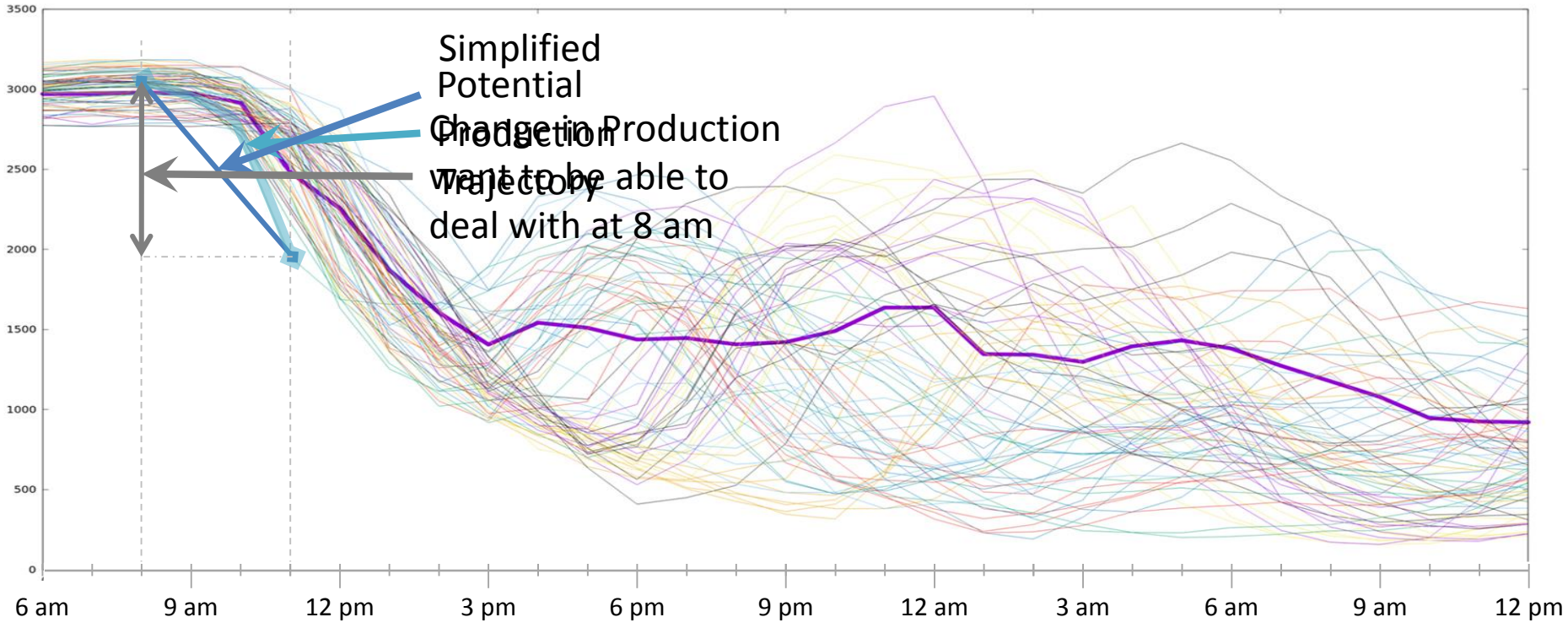
12th October 2018 -Vendor's Ensemble



12th October 2018 – Hard to predict

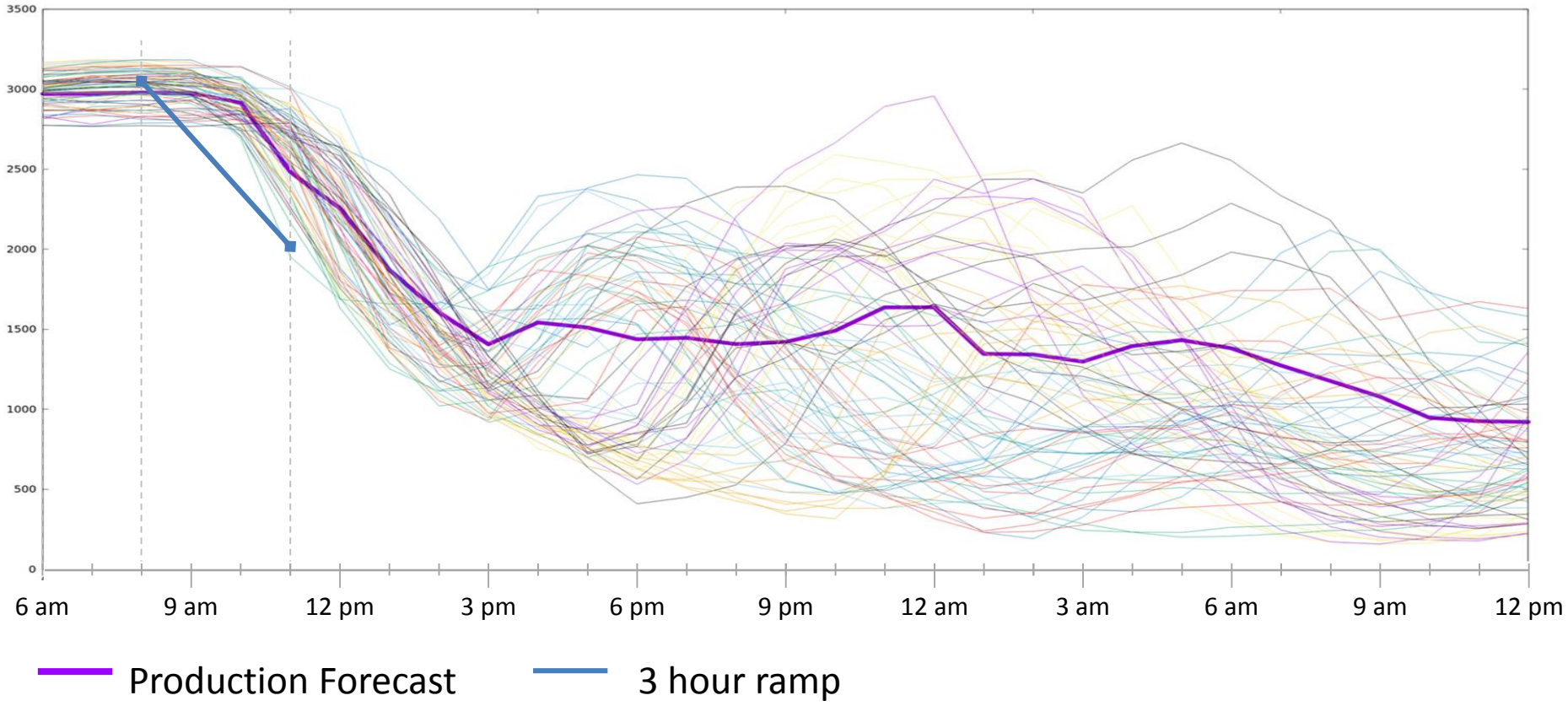


Largest* 3 hour ramp at 8 am

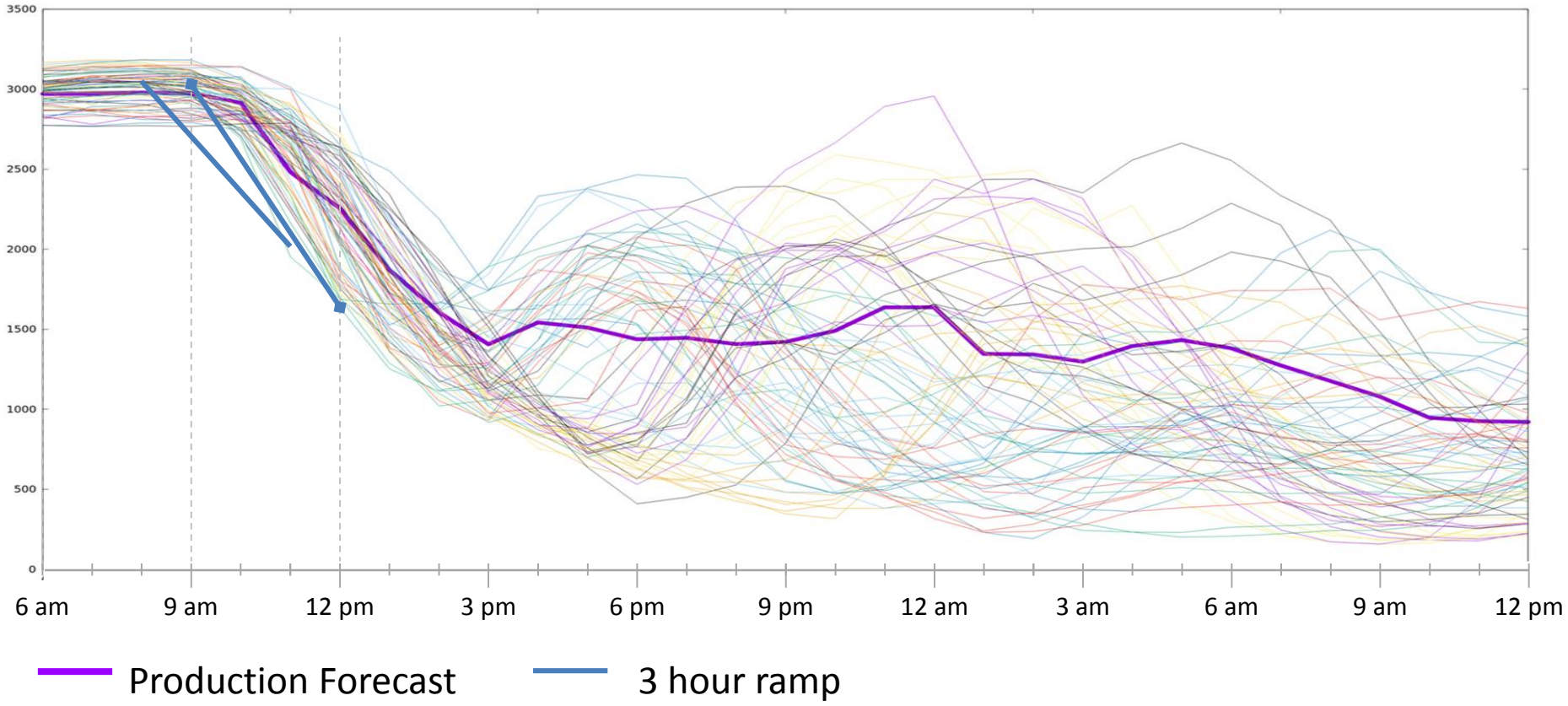


* With probability exceeding agreed threshold

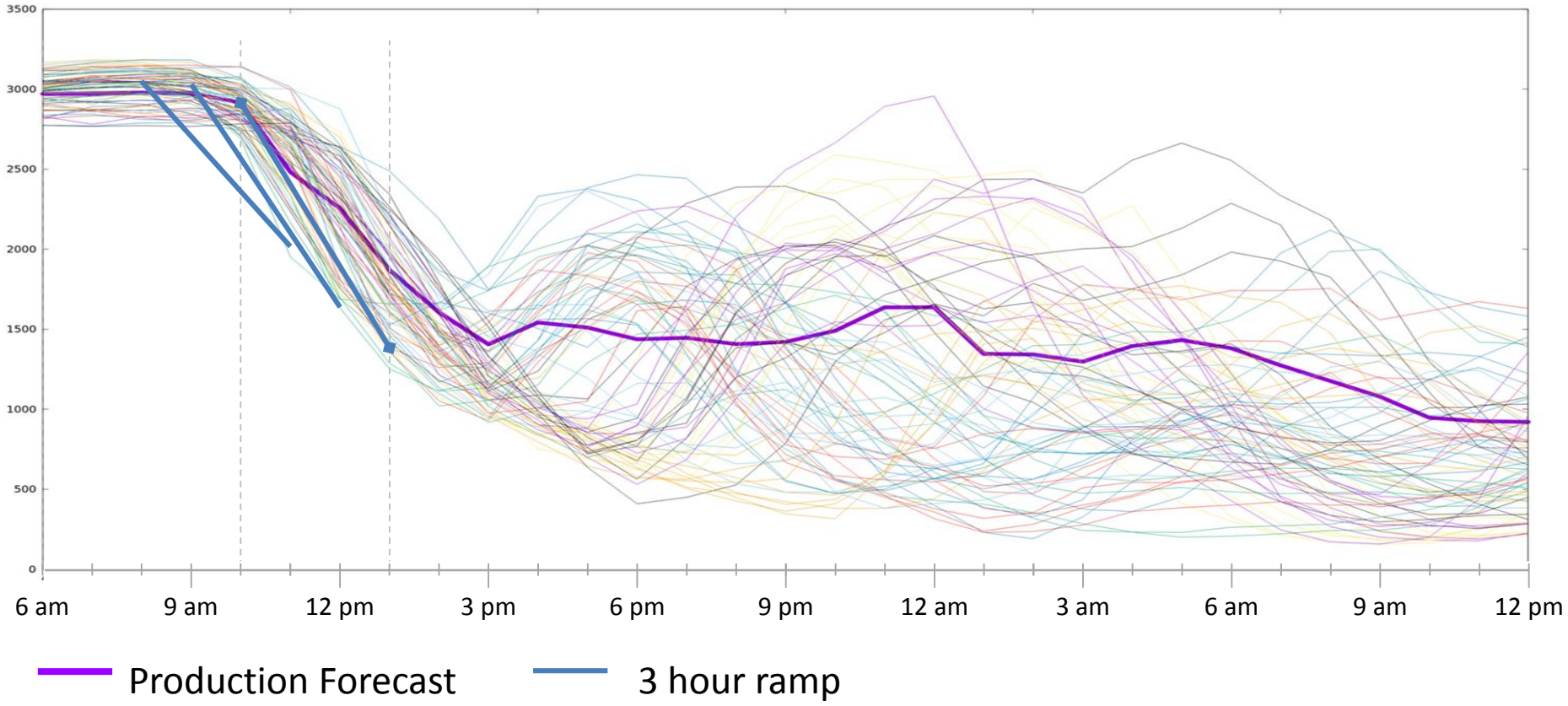
Largest* 3 hour ramp at 8 am



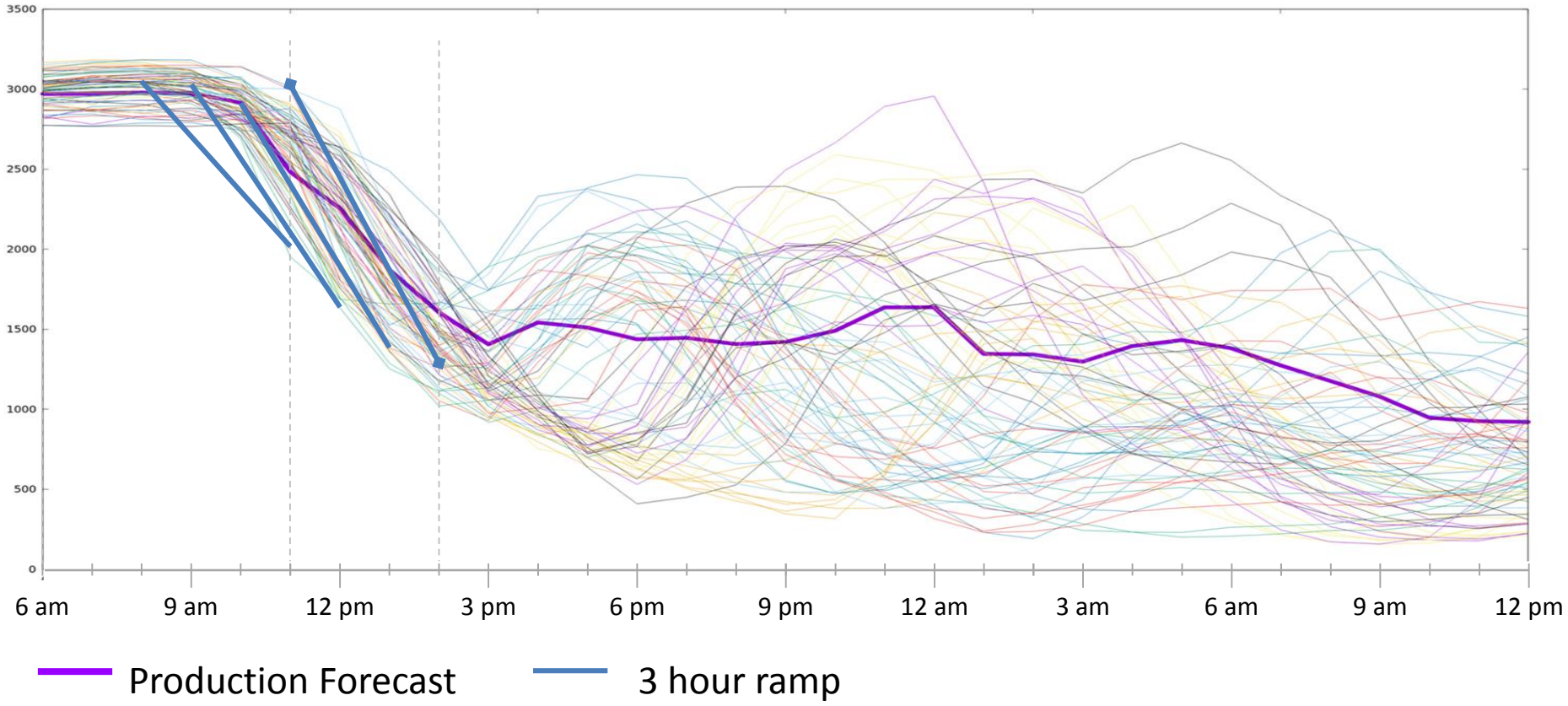
Largest* 3 hour ramp at 9 am



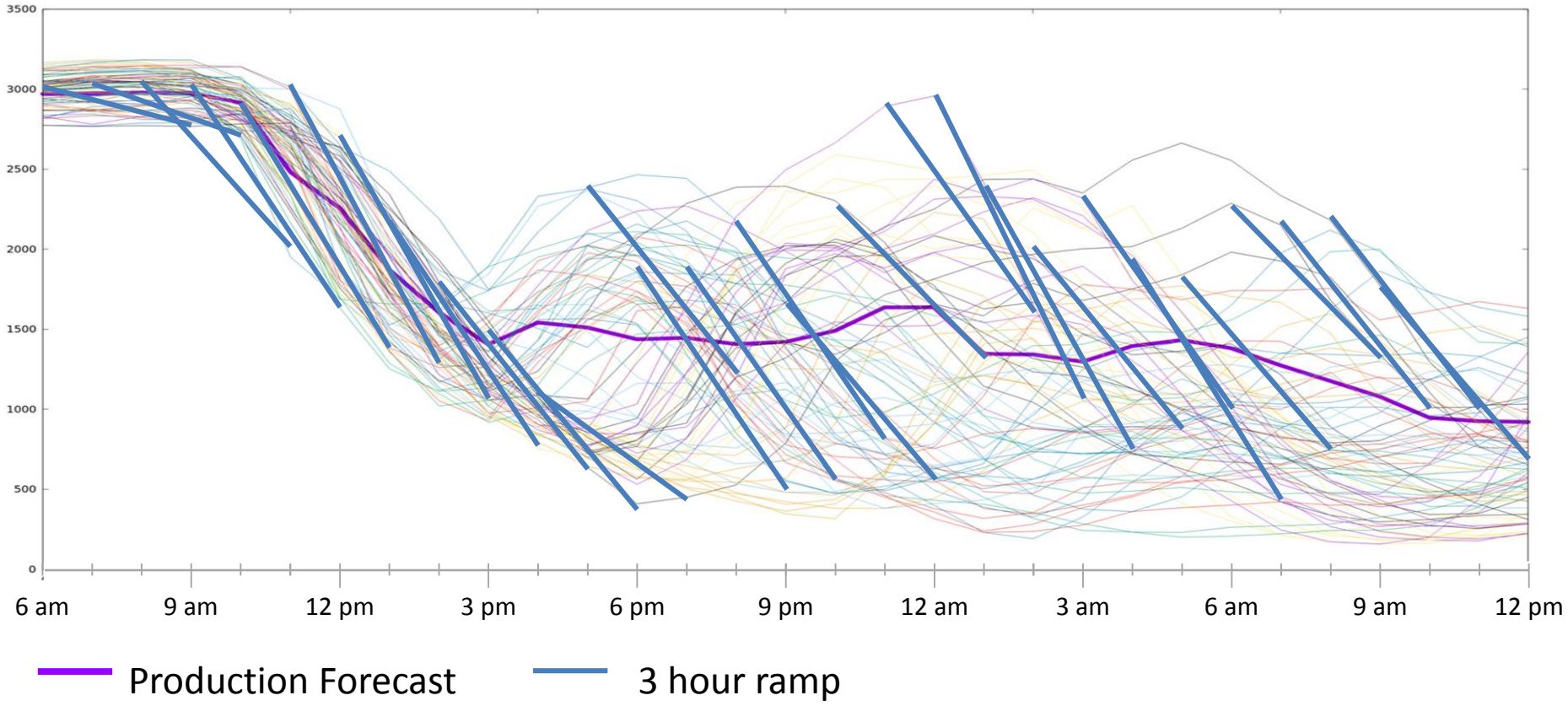
Largest* 3 hour ramp at 10 am



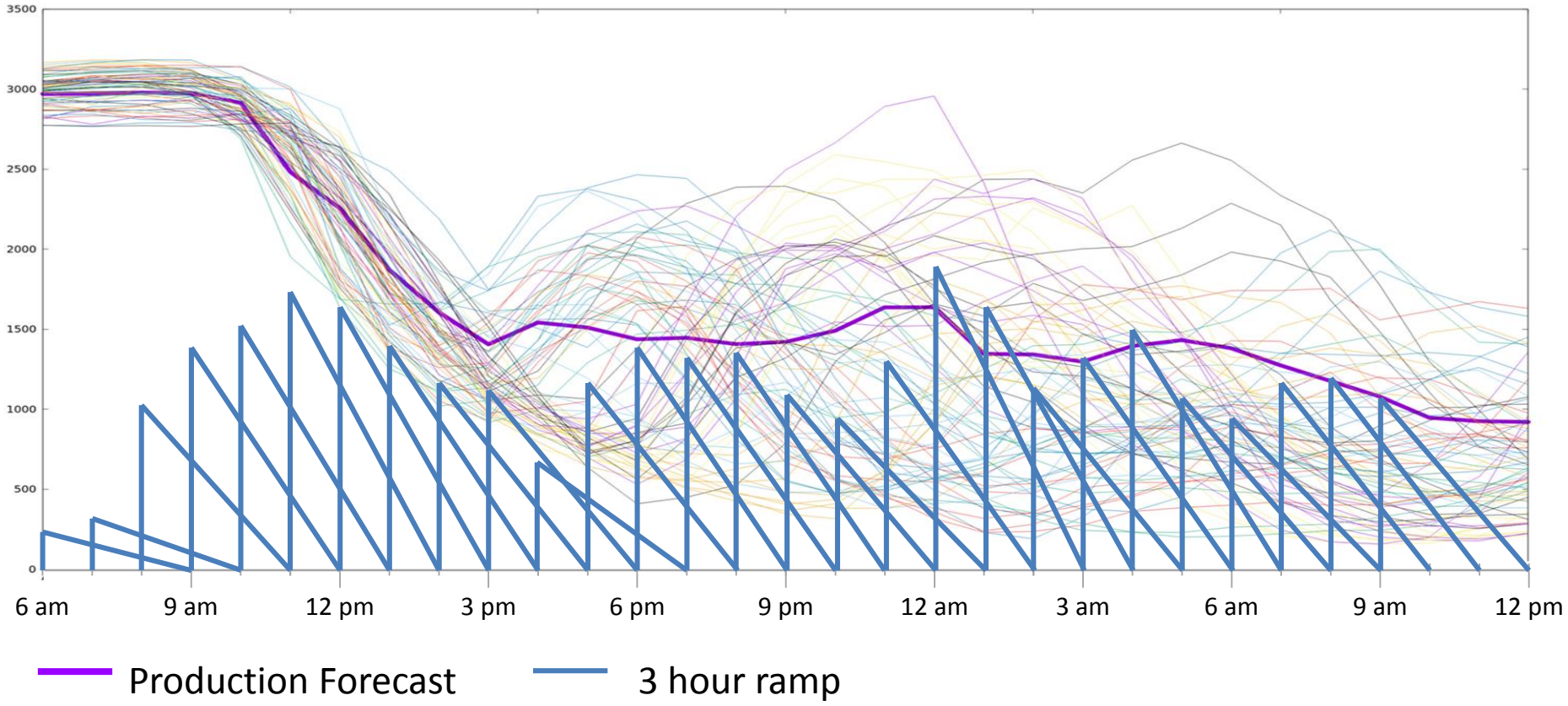
Largest* 3 hour ramp at 11 am



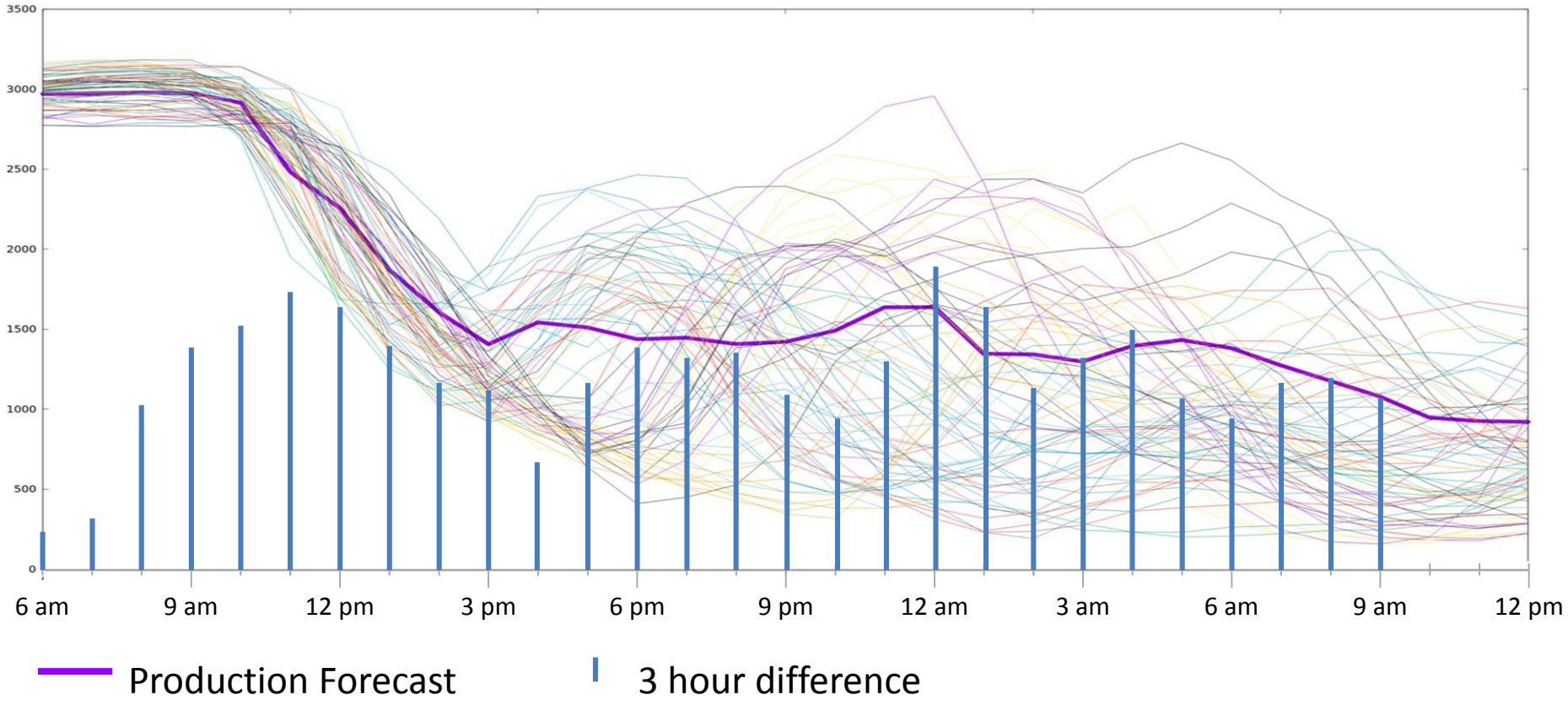
Largest* 3 hour ramp, all trade periods



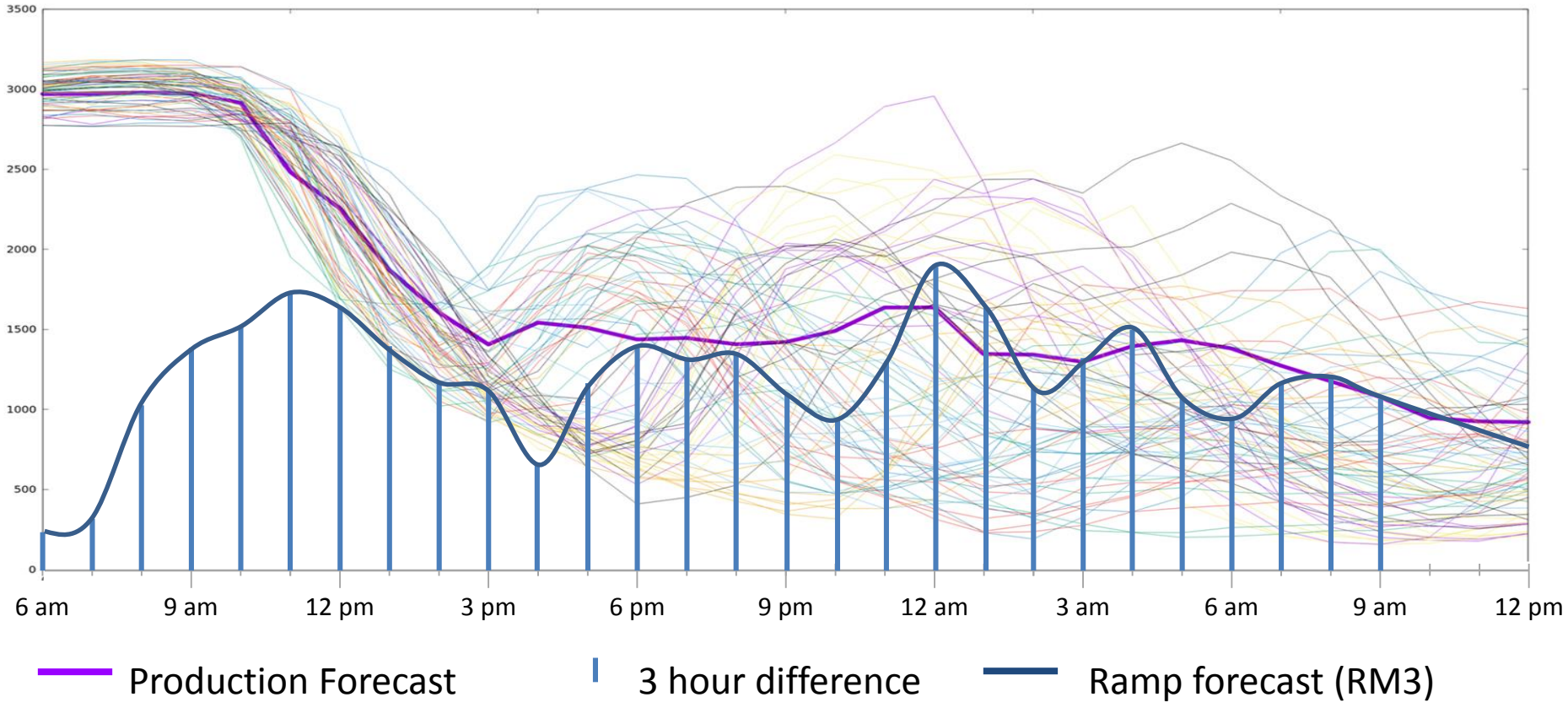
Largest* 3 hour ramp, all trade periods



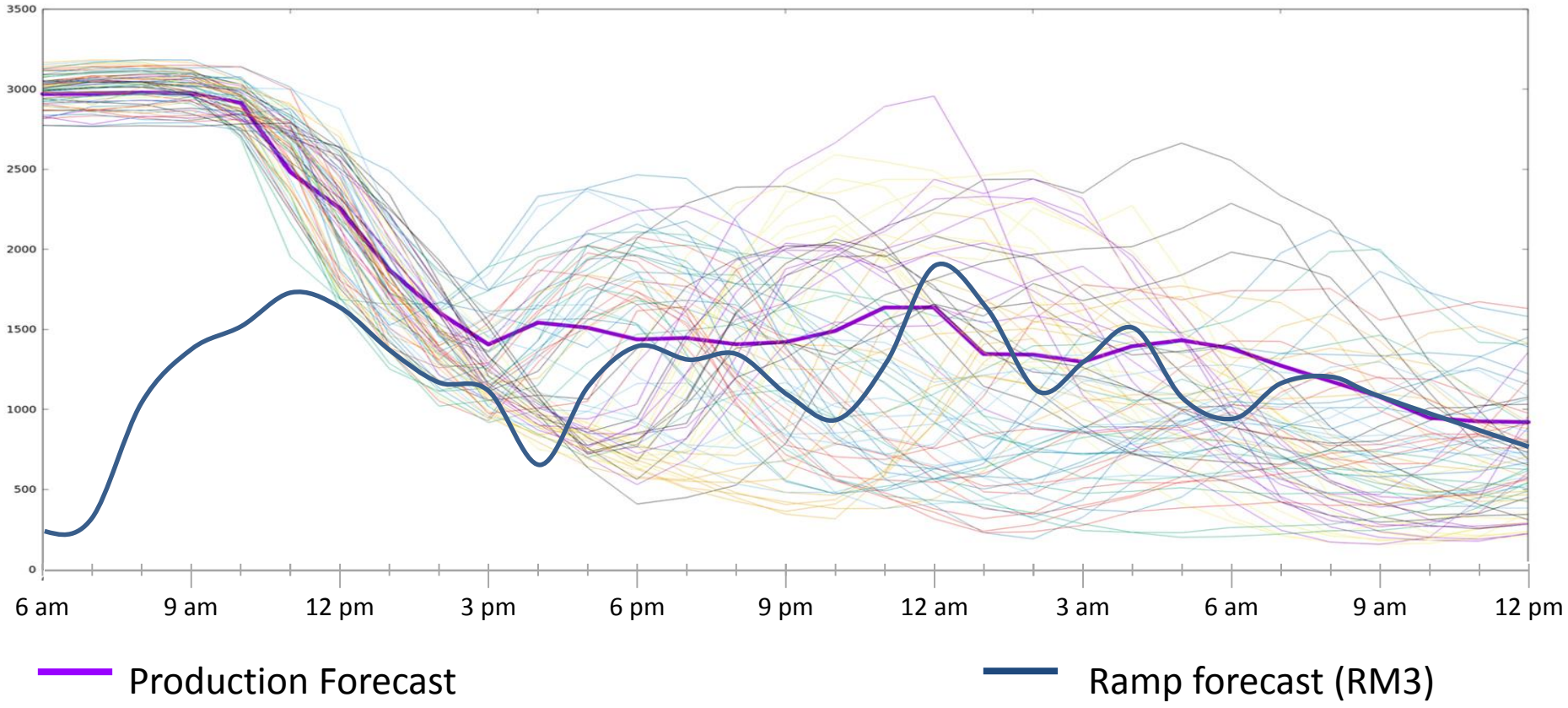
Ramp forecast in each trade period



Ramp forecast time series



Ramp forecast time series



Conclusions and Suggested Links

- We're delivering control room tools that help us manage current and future generation portfolios
- LSAT checks that current and future commitment and dispatch schedules are secure to credible contingency events, insecure schedules can be spotted in advance and corrected using the scheduling systems
- VTT ensures that the voltage pathway from one trade period to the next is feasible, again providing advanced warning of problematic periods
- RMT leverages the three new ramping margin reserve products to manage the risks imposed by possible forecast errors
- The new Ramp-Uncertainty Forecast helps minimise how much reserve is carried

Probabilistic forecasting tools for high-wind penetration areas: an Irish case study, Möhrlen, C. et. al
http://download.weprog.com/wiw2019-60_paper.pdf
Integrating multi-period supply uncertainty management reserves into the Irish balancing market, Ging, J. et. al
https://e-cigre.org/publication/download_pdf/cse019-cse-019

Additional Slides

EIRGRID SONI

Previous and Current Requirement

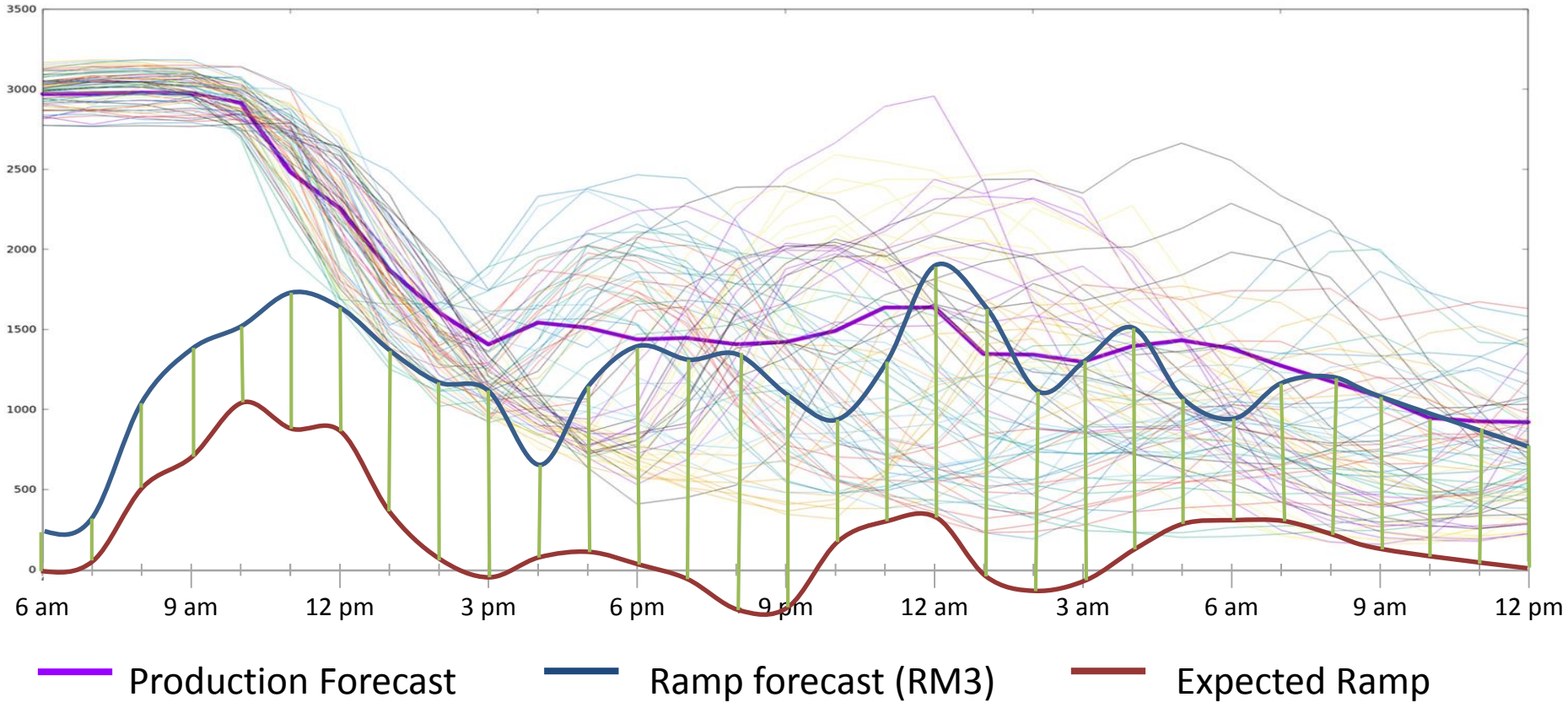
Requirement Formula, as originally communicated

$$Ramping\ Reserve\ Volume\ Requirement_t$$
$$= Largest\ Single\ Energy\ Source_t + 1\%Load\ Forecast_t$$
$$+ max\begin{cases} Largest\ offline\ reserve\ resource_t \\ fn(Wind\ Forecast_t) \end{cases}$$

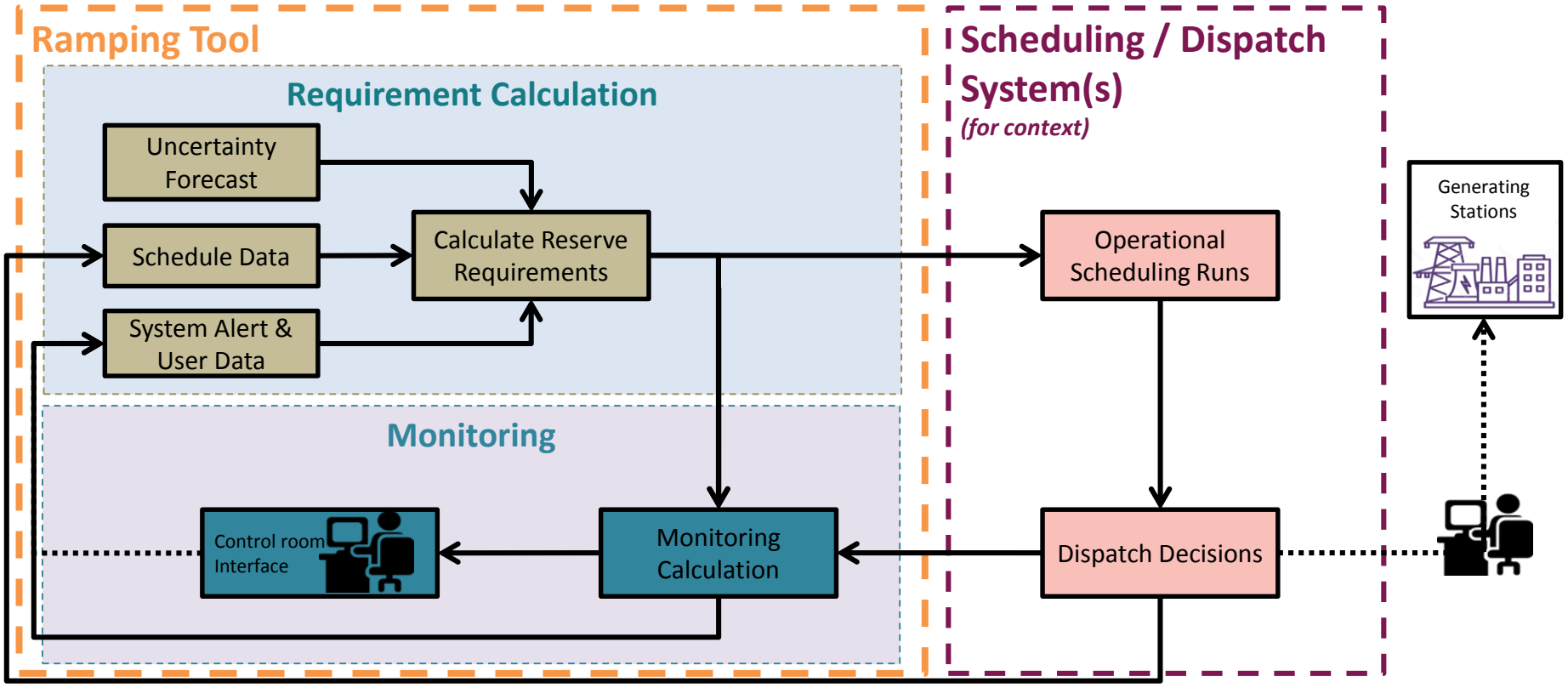
Current Requirement Formula

$$Ramping\ Reserve\ Volume\ Requirement_t\ =$$
$$Largest\ Single\ Energy\ Source_t + ReplacementReserveRequirement_t +$$
$$1\%Load\ Forecast_t + max\begin{cases} MinimumRampUncertainty \\ RampUncertaintyForecast_t \end{cases}$$

Difference series – ramp uncertainty

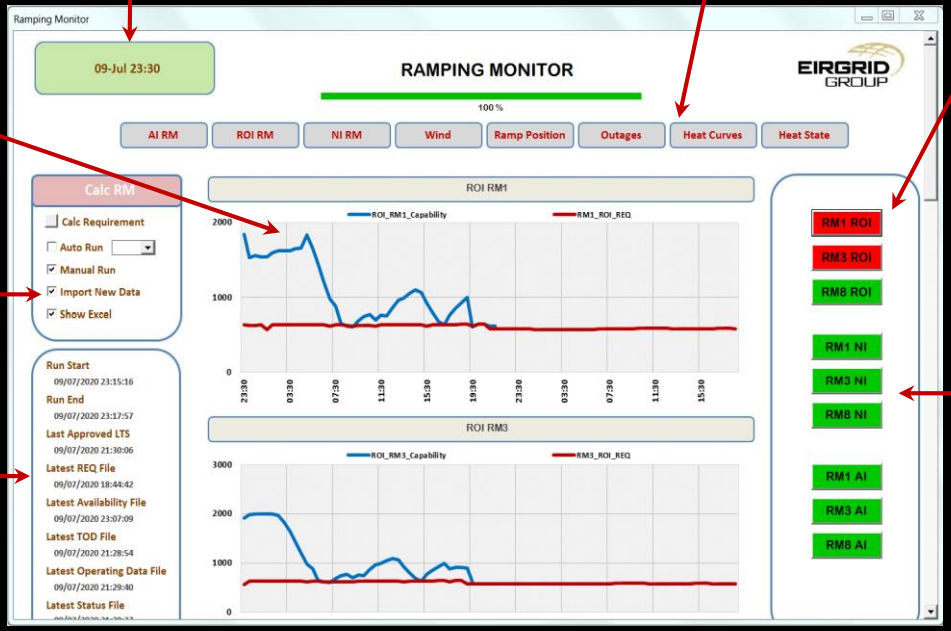


Schematic overview

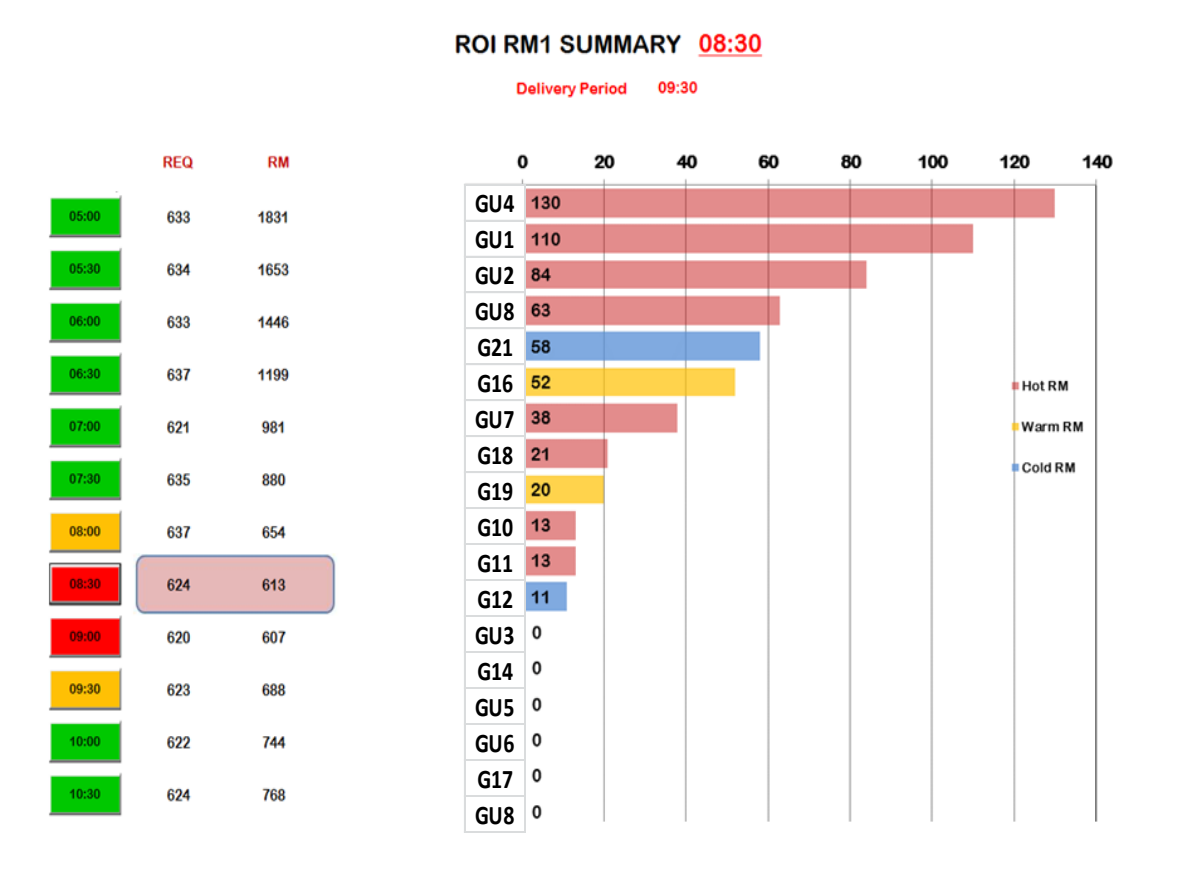


The Ramping Tool

Installed Monitor



Visualisations



Visualisations

08:30 for delivery @ 09:30

GU4 Summary

Status	On
Heat State	Hot
Status Change Time	08/07/2020 00:00
Hot State End	
Warm State End	
Notification Hot [Hrs]	1.5
Notification Warm [Hrs]	2
Notification Cold [Hrs]	5
Earliest Sync Time *	
Scheduled ON Time	
Scheduled OFF Time	
Min Down Time [Hrs]	3
Earliest Re-Sync Time	

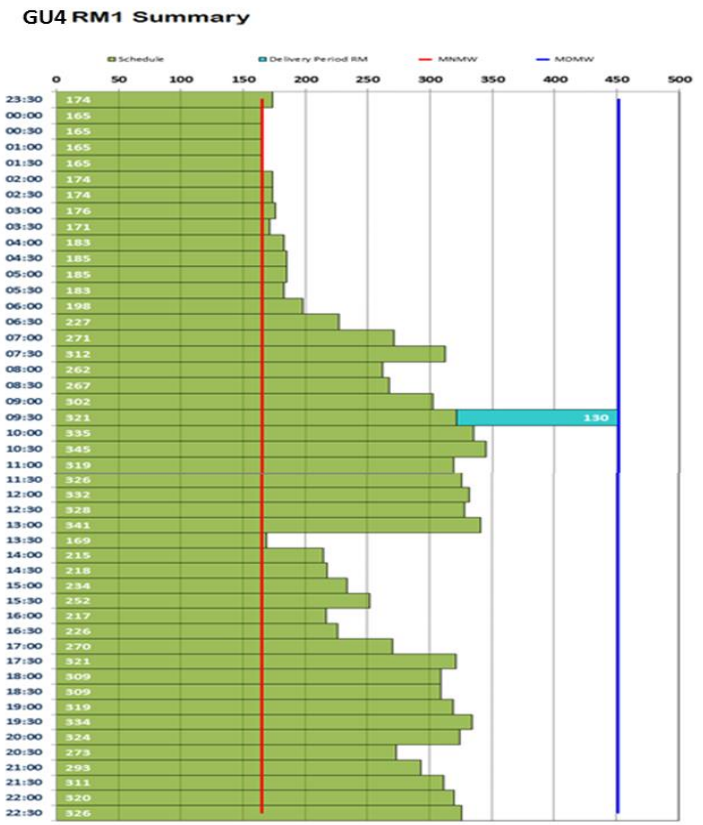
* Earliest Sync Time from

GU4 Availability

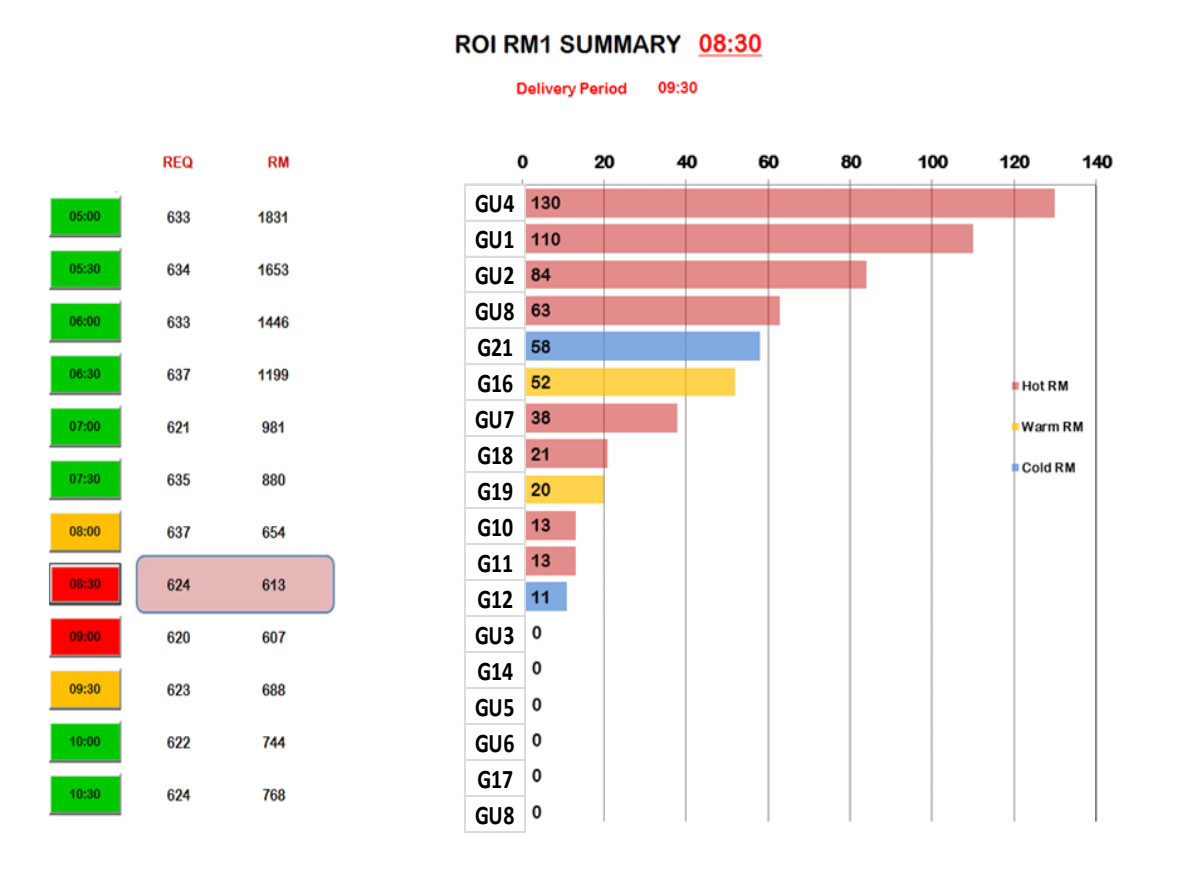
MDMW	451
MNMW	165
FFR	14
POR	23
SOR	36
TOR1	37
TOR2	45
RR	45
RM1	299
RM3	464
RM8	464

GU4 Outage/Constrained Info

Outage Start	
Outage End	
Constrained Strat	
Constrained End	
Constrained MW	

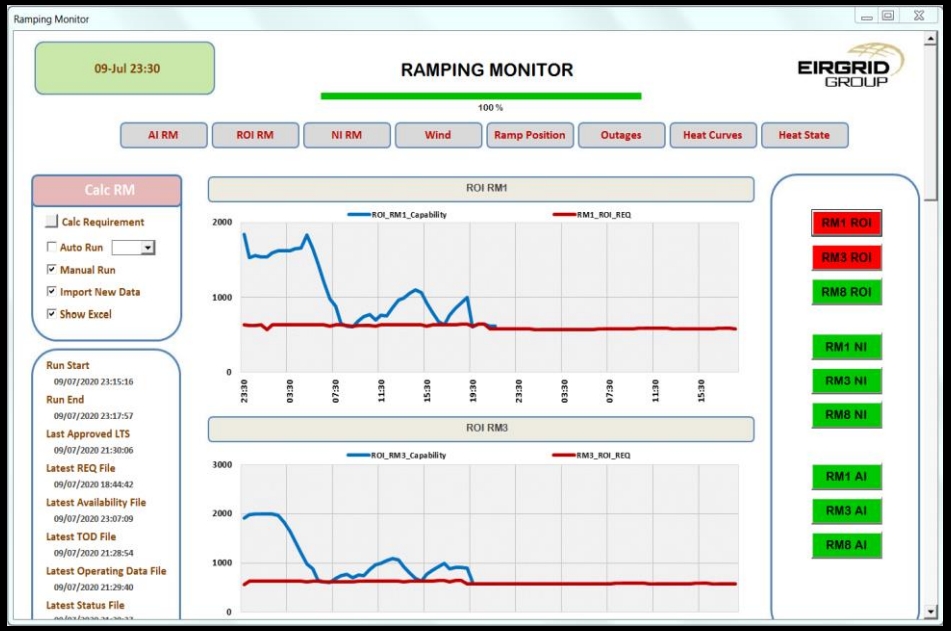


Visualisations



The Ramping Tool

Installed Monitor



Ideal vs Implemented formulation