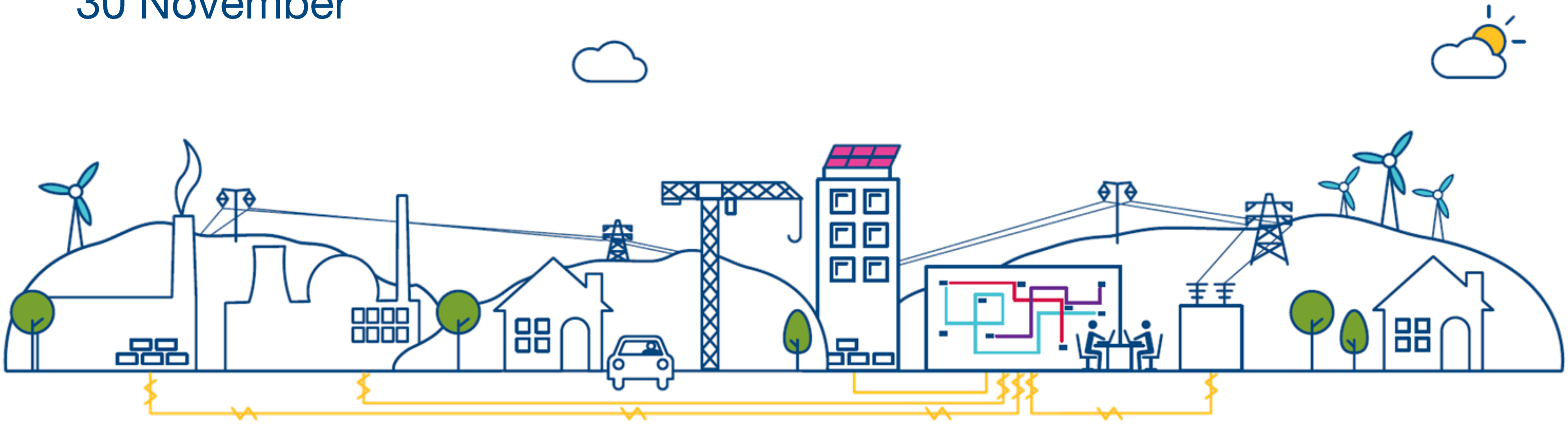
System Operability Framework 2016

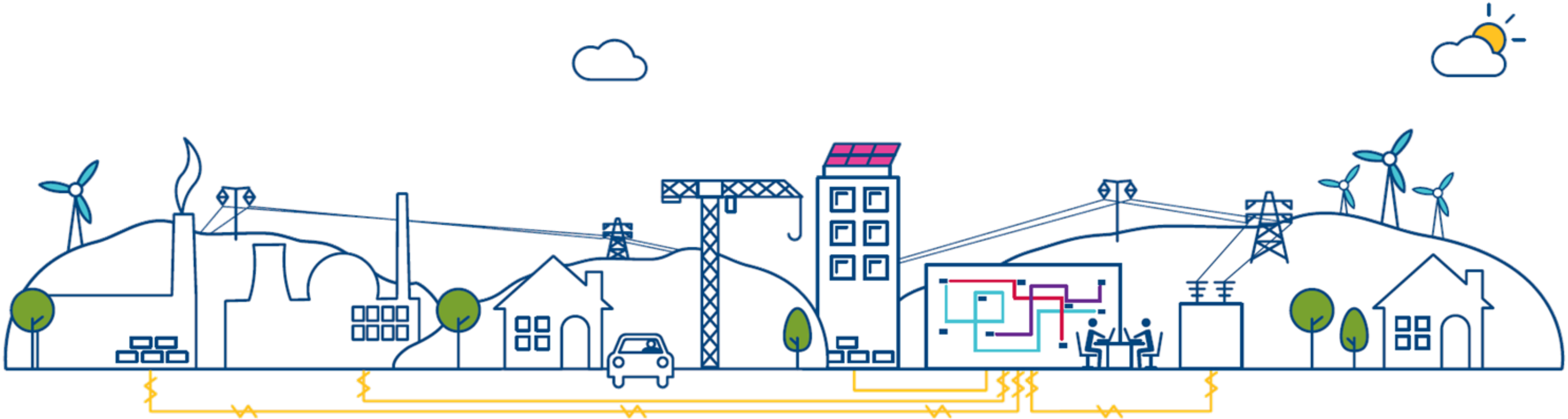
Launch Event – National Grid House, Warwick

30 November



System Operability Framework 2016

Patrick Cassels – SOF Lead, Senior Power Systems Engineer



SOF 2016 – Key messages

Generators and interconnectors will need to operate more flexibly, complimented by the growth of balancing tools and technologies such as energy storage and flexible demand.

Flexibility

A holistic approach which harnesses capabilities across energy and network resources is required to address the shortage of dynamic capabilities provided by synchronous generators.

Performance

Small generators need to deliver the system support capabilities provided by the larger generators that they displace, though are not presently asked or rewarded for the same performance.

Whole System

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We asked you

SOF 2016 structure

- Frequency Management
  - System inertia
  - Fast active power injection
  - Rate of change of frequency
  - Frequency containment
- Voltage Management
- Whole System Coordination

SOF 2016 structure

- Frequency Management
- Voltage Management
  - System strength
  - Voltage regulation
  - Voltage dips and protection
  - Voltage containment and recovery
- Whole System Coordination

SOF 2016 structure

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- Frequency Management
- Voltage Management
- Whole System Coordination
  - Visibility and coordination
  - Active network management
  - Voltage control from distributed energy resources
  - Low frequency demand disconnection
  - Black start

SOF 2016 structure

Balancing and Flexibility

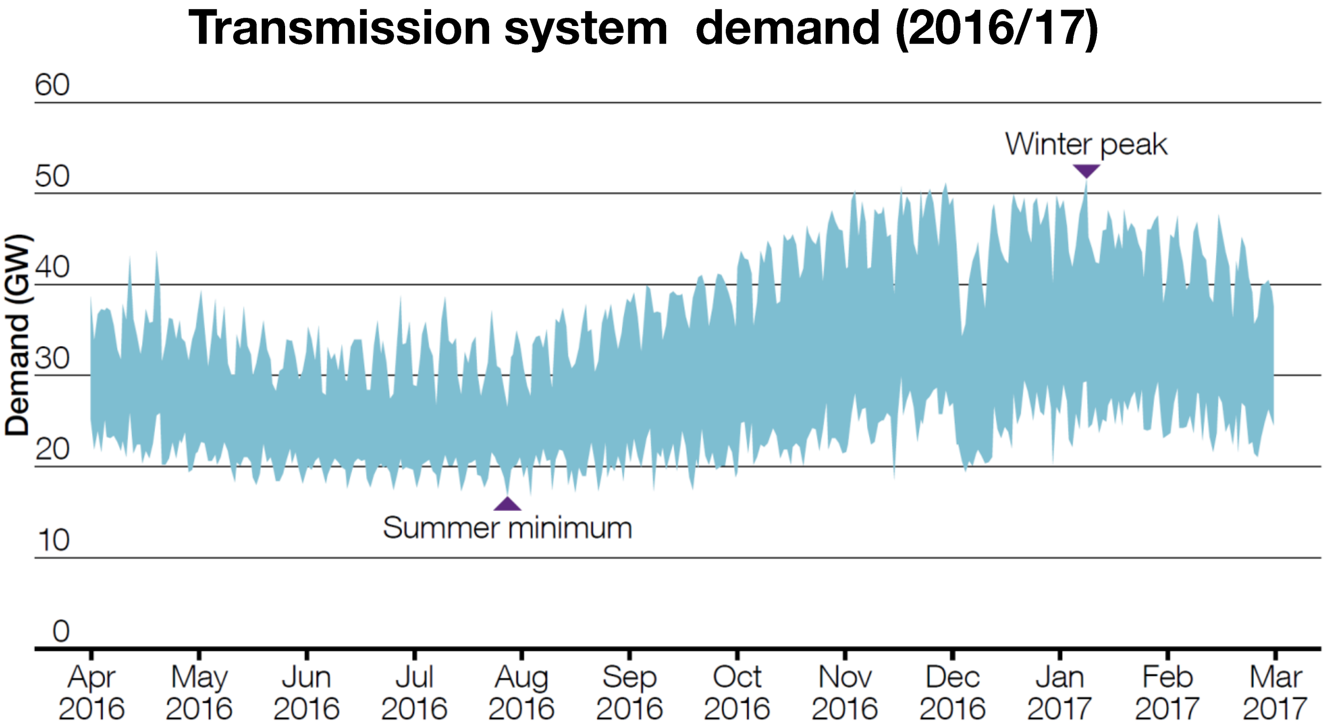
Frequency Management

Voltage Management

Whole System Coordination

- Balancing and Flexibility is a new area which addresses within day balancing over the next 10 years
- It matches generation and demand within day to a half-hour resolution to provide a credible view of unit dispatch
- A number of different flexibility sensitivities have been explored
- It enables us to answer three questions across our core operability topics:
  - What is the requirement?
  - How often it is required?
  - How does it change over time?

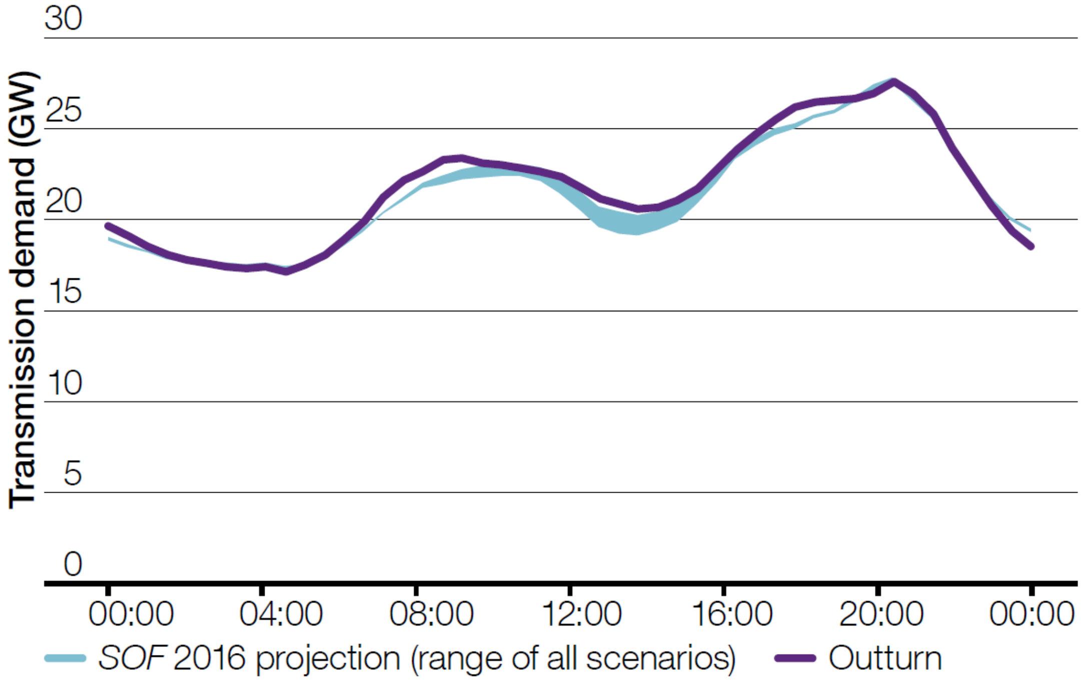
Year-round assessments



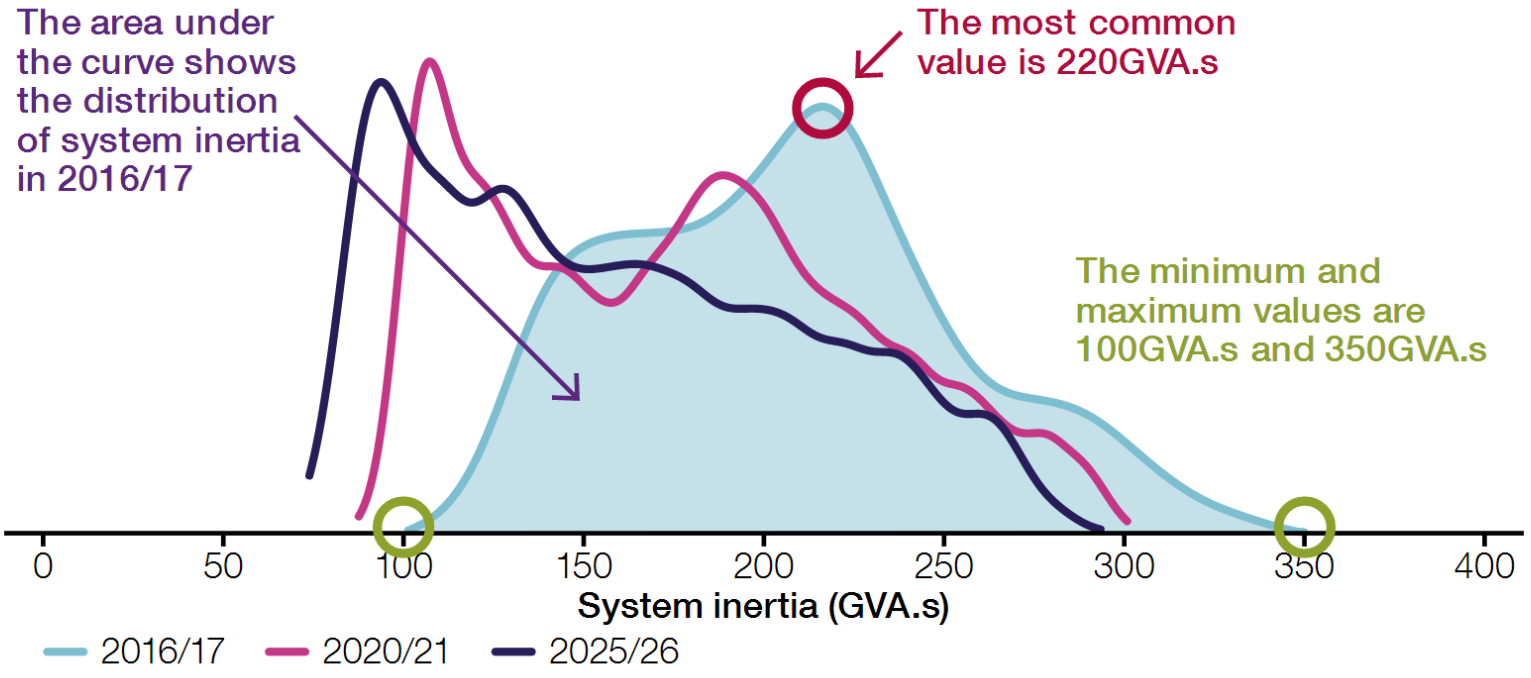
17,520 half hour periods a year
X
10 years of study
X
4 Future Energy Scenarios
X
3 flexibility cases
X
636 transmission connected generators
=
1,337,126,400 data points!

Year-round assessments

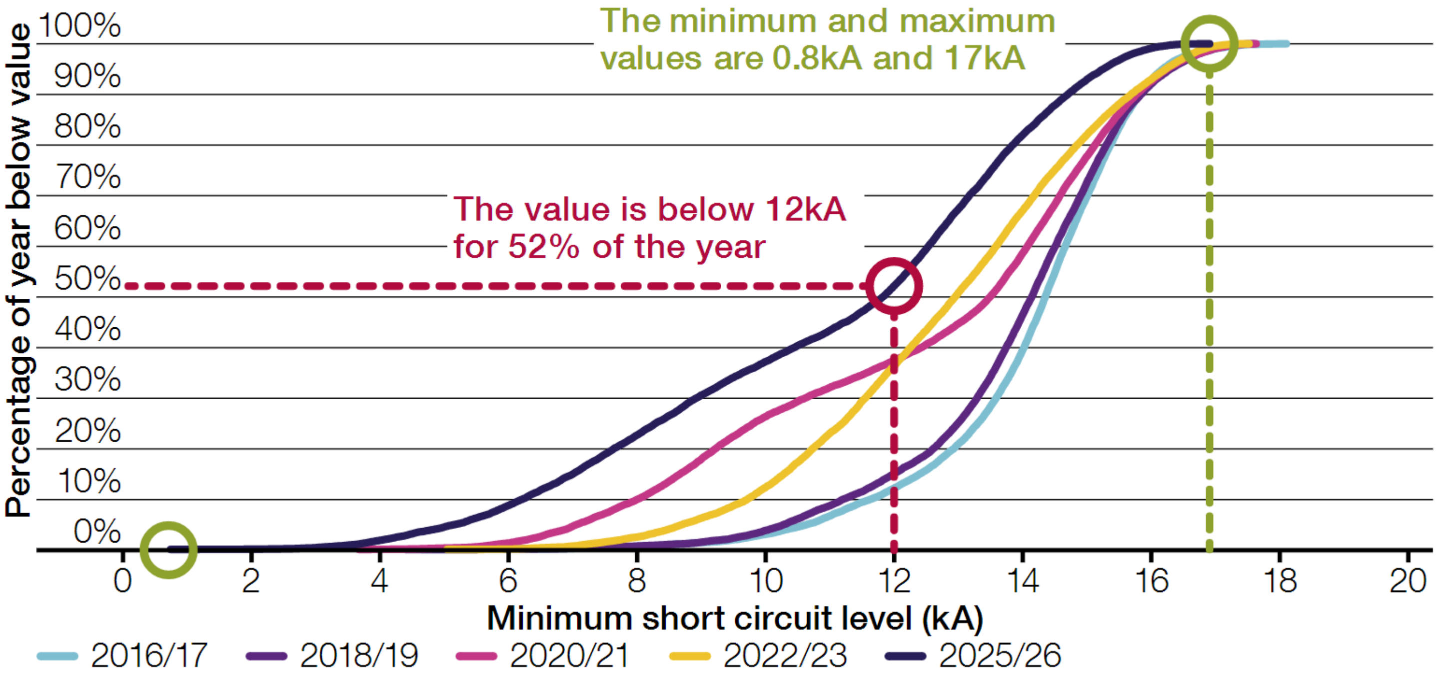
SOF 2016 summer minimum versus outturn (8th August)



Frequency management example

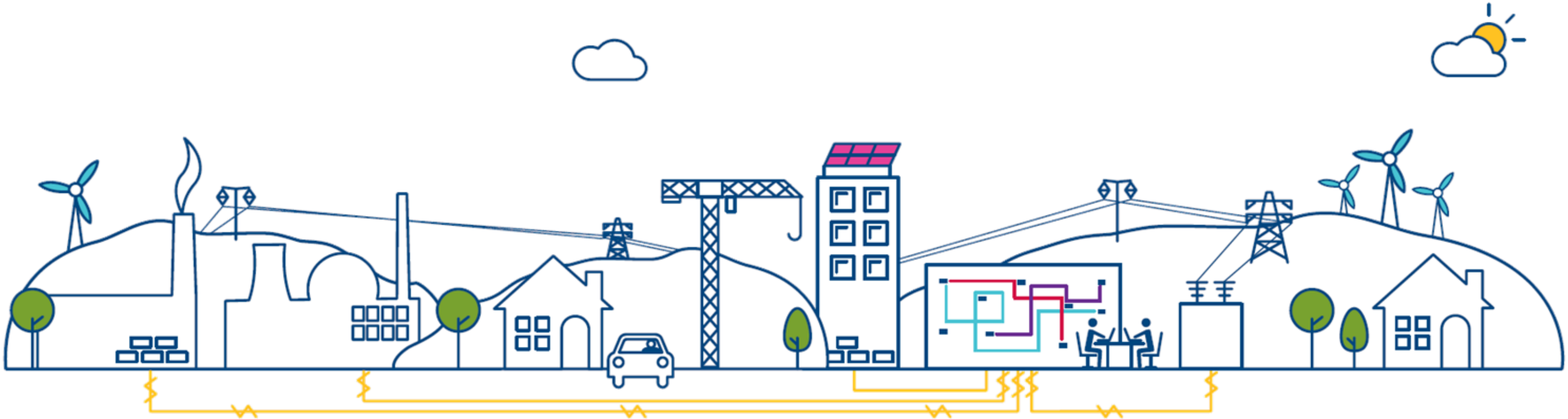


Voltage management example

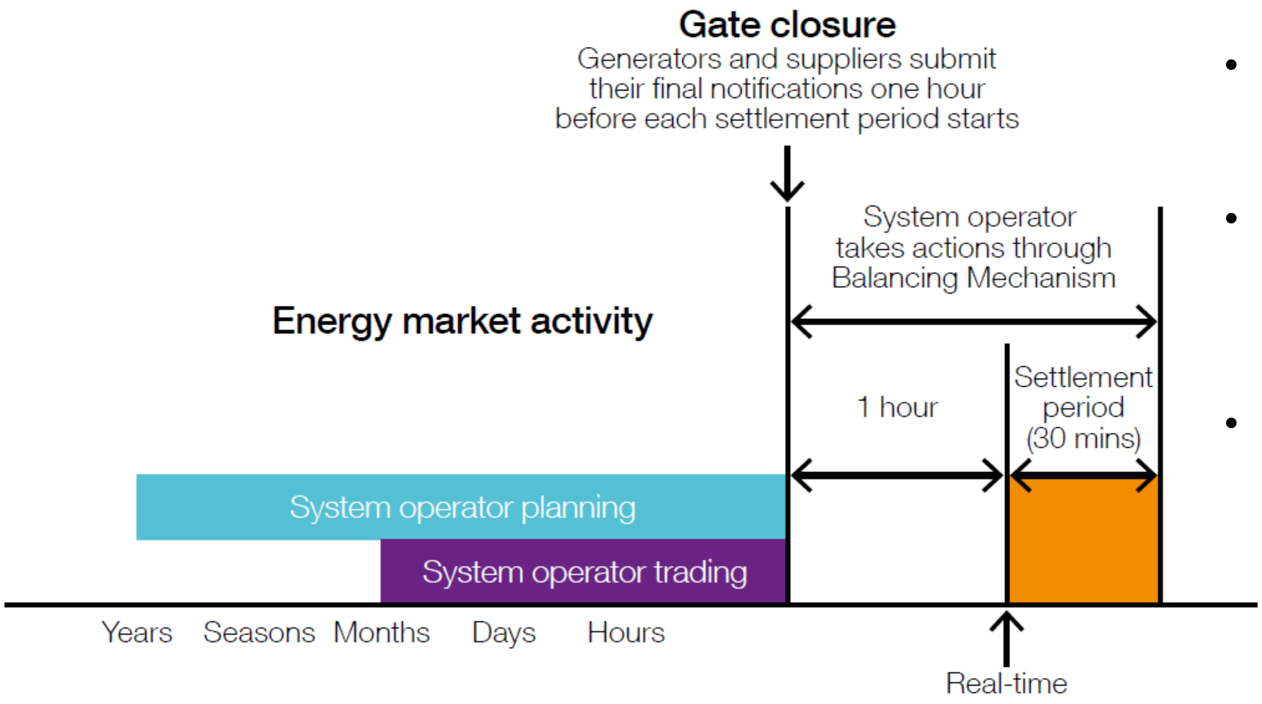


Balancing and Flexibility

William Ramsay – Power Systems Engineer

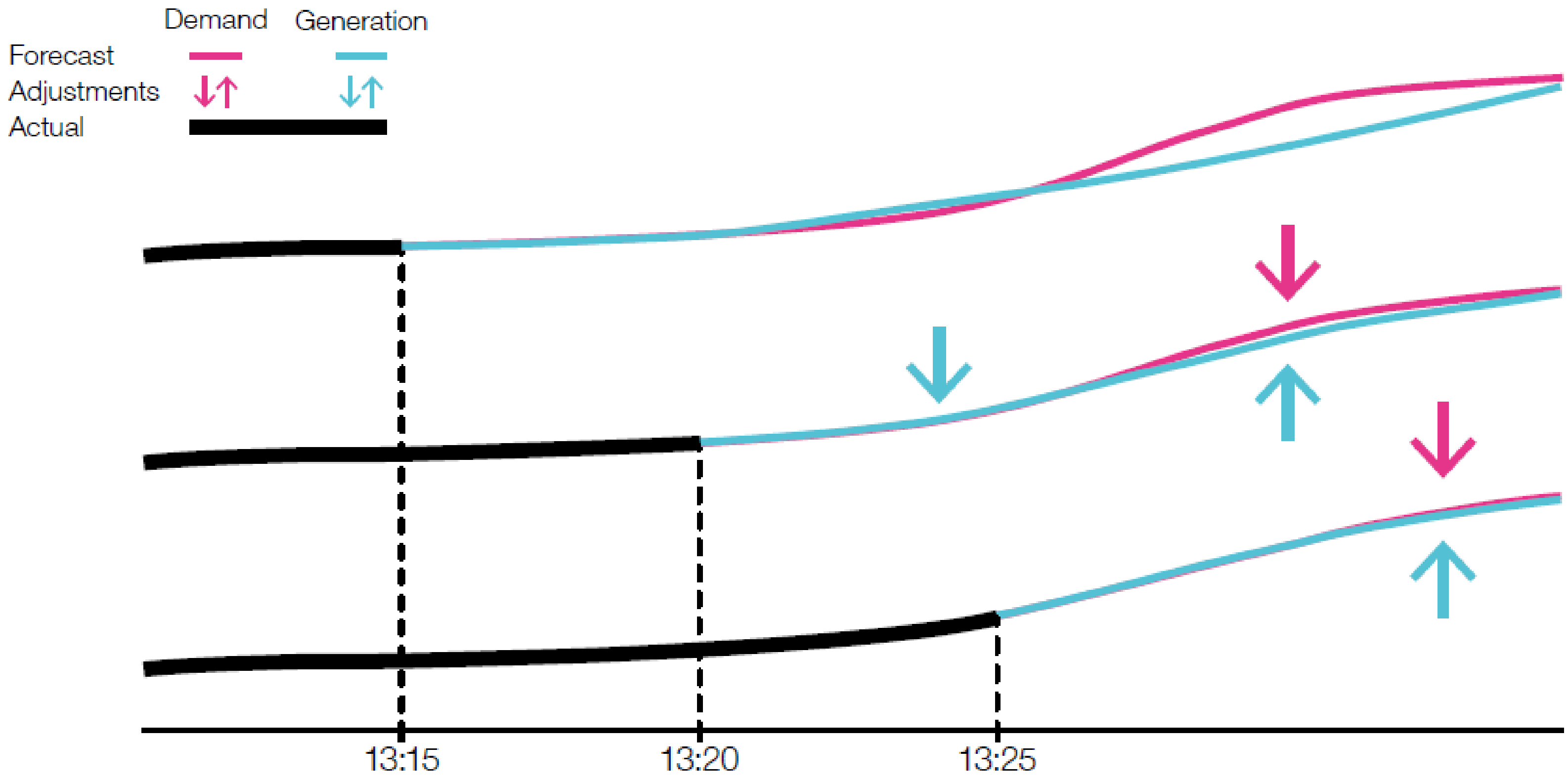


Balancing



- Investigate the evolution of daily profiles of demand
- Balance generation and demand by settlement period
- Flexibility and operability requirements between and within settlement periods

Balancing


Demand
Generation
Forecast
Adjustments
Actual
13:15
13:20
13:25

Daily transmission demand profile: Winter

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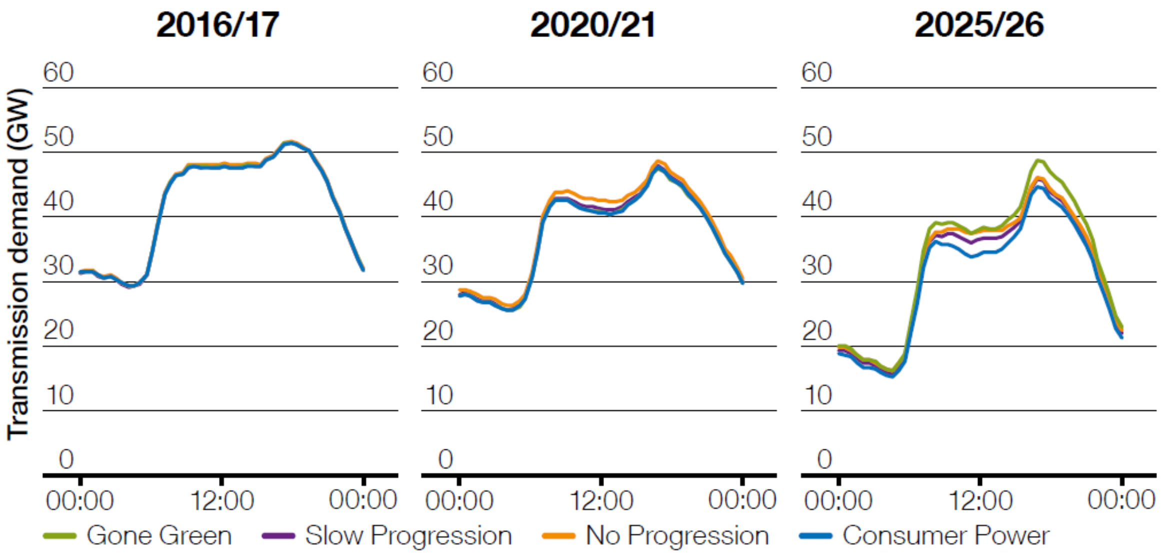
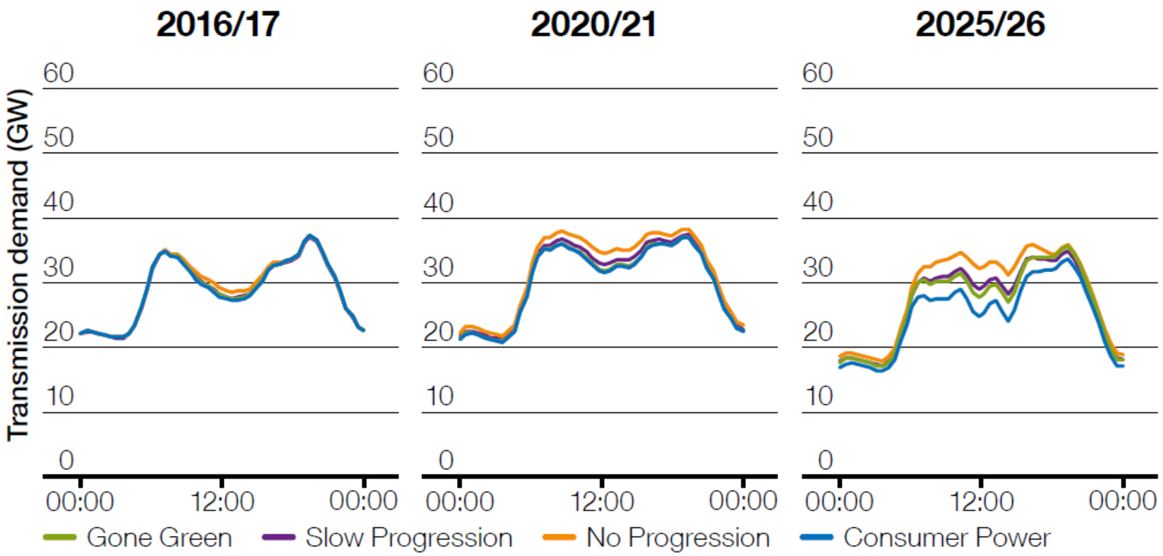


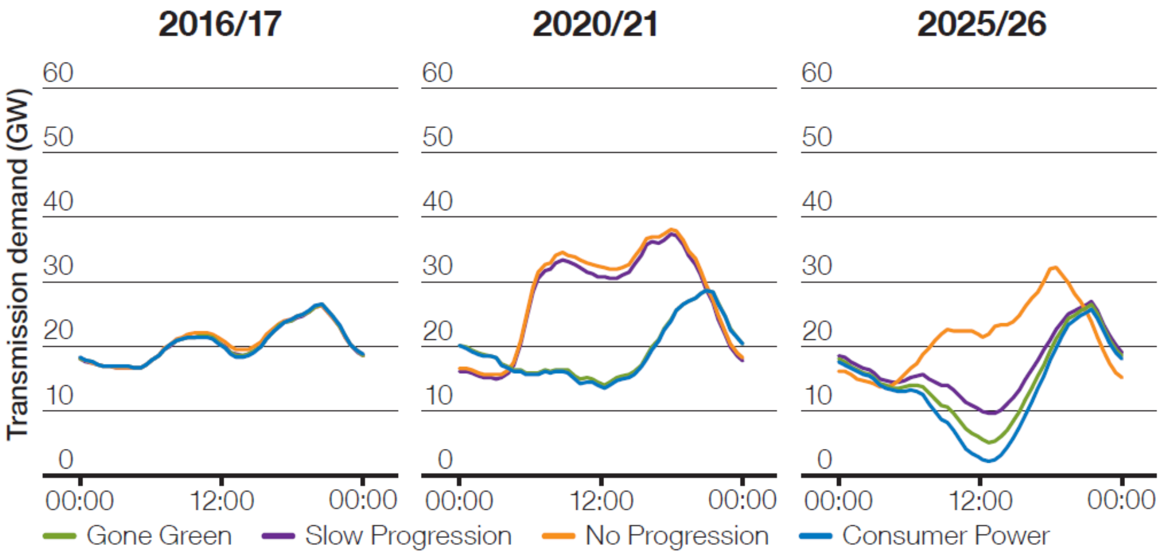
- Demand reduces at morning minimum and evening peak
- Increasing demand suppression in middle of day
- Rate of morning pick-up increases from 60MW/minute to between 80 and 100MW/minute
- Size of evening pick-up increases

Daily transmission demand profile: Spring



- First Monday of April in each year
- Demand profile is more volatile as capacities of distributed weather-sensitive generation increase

Daily transmission demand profile: Summer



- Demand suppression from distributed solar PV grows
- Time of demand minimum flips from morning to afternoon
- Size and rate of evening pick-up grows

Insights

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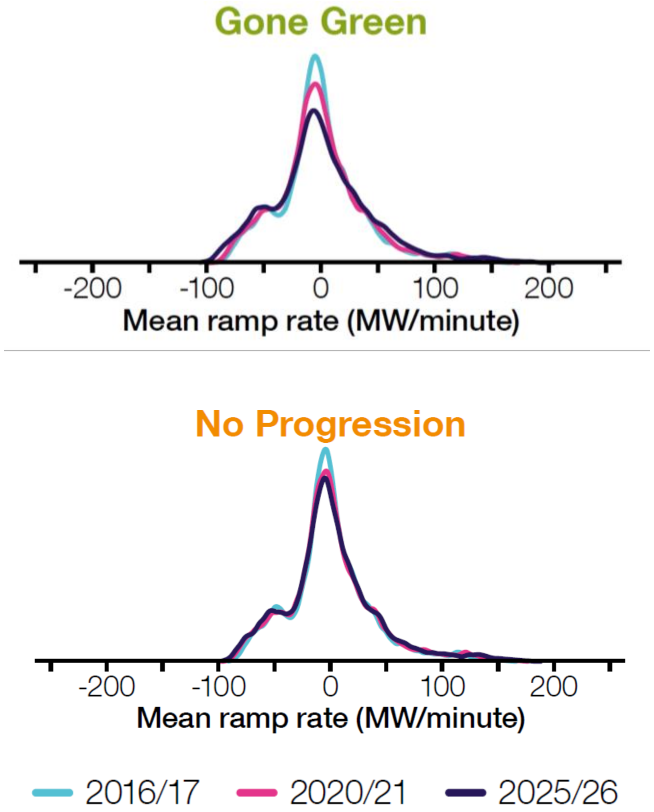
The growth in distributed generation and interconnection has an increasing impact on the operation of the transmission system.

Annual distribution of demand variation



- Mean variation between settlement periods of GB demand
- Excludes interconnector export and storage import
- Reduction in time with only small changes in demand

Annual distribution of demand

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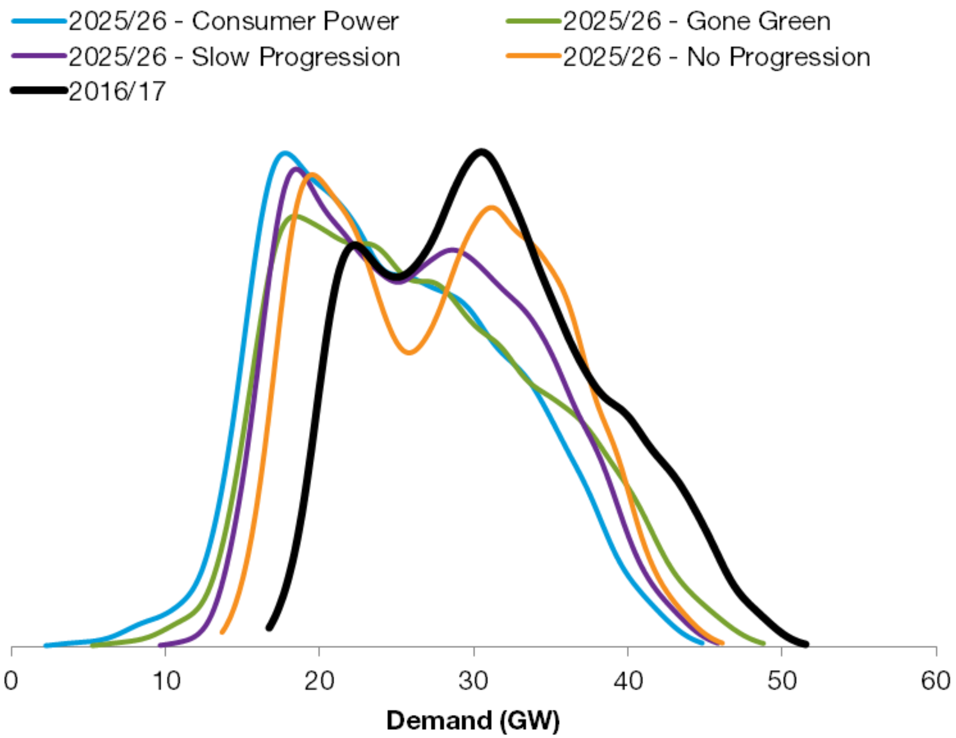
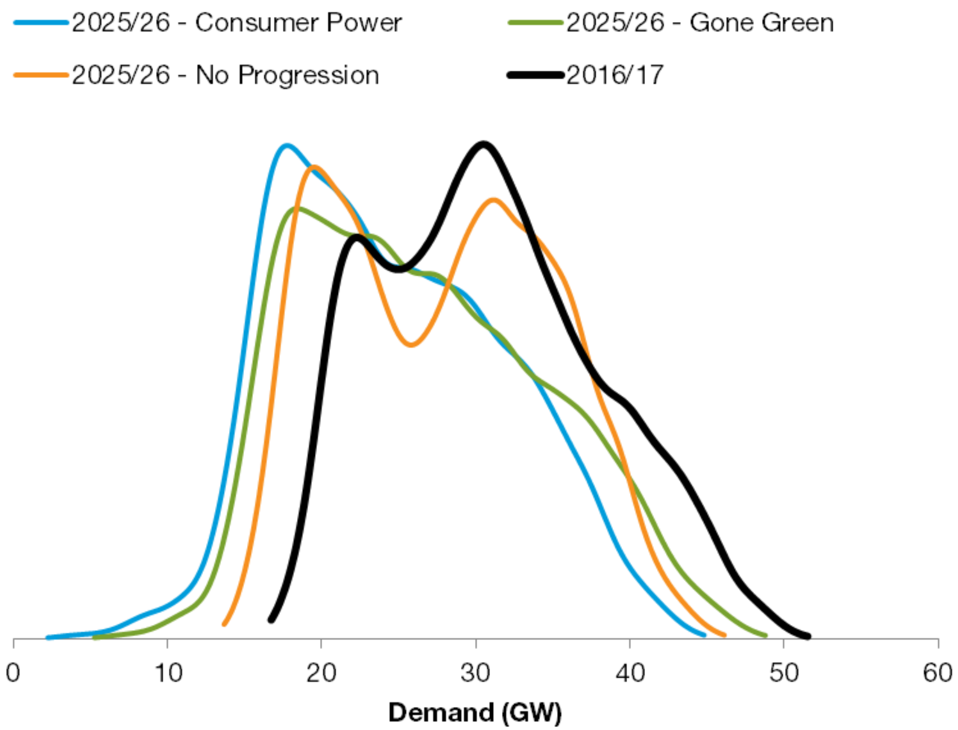


- General reduction in transmission demand
- Minimum demands become more extreme, driven growth in distributed generation
- Greater range between minimum and maximum demand
- More time spent at levels of low demand

Annual distribution of demand



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Insights

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The growth in distributed generation and interconnection has an increasing impact on the operation of the transmission system.

Transmission system demand is more variable, reaches lower minima and is lower more often.

Insights

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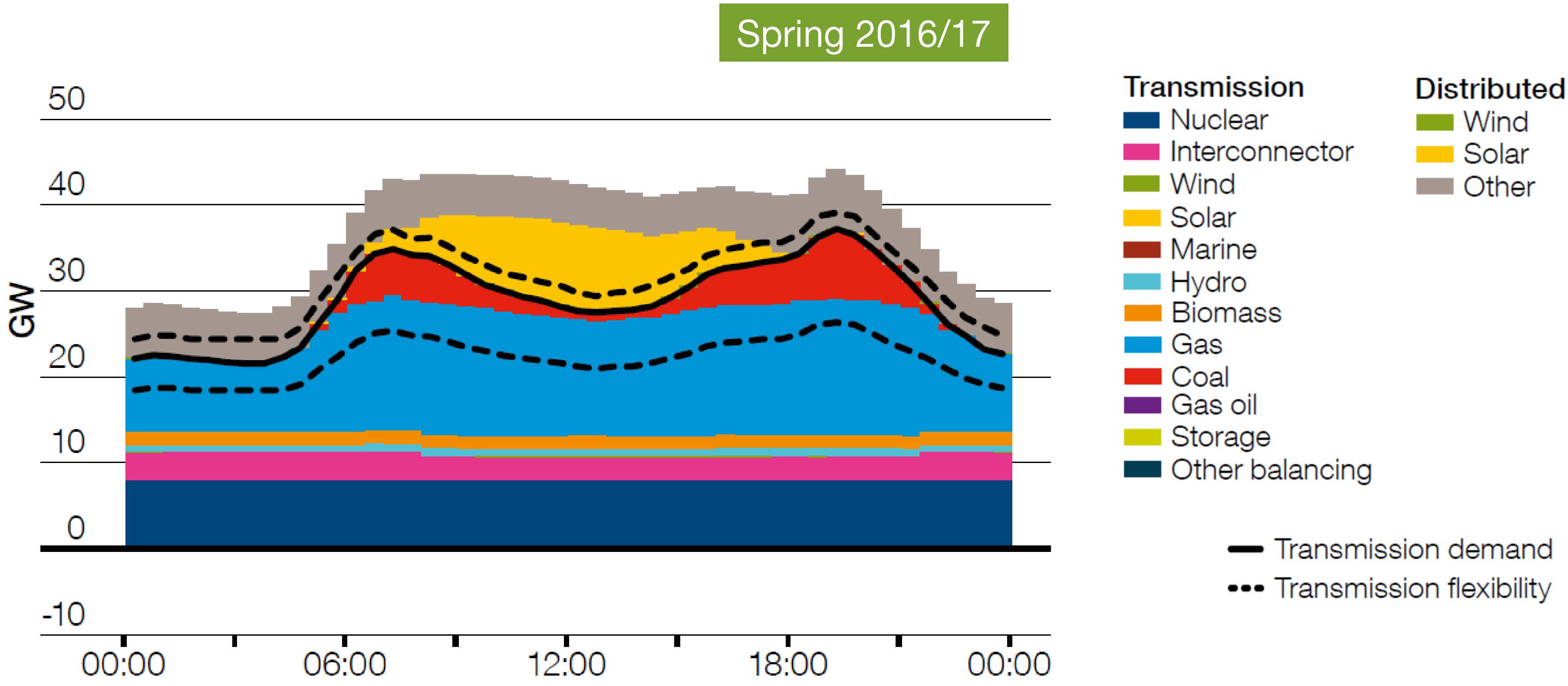
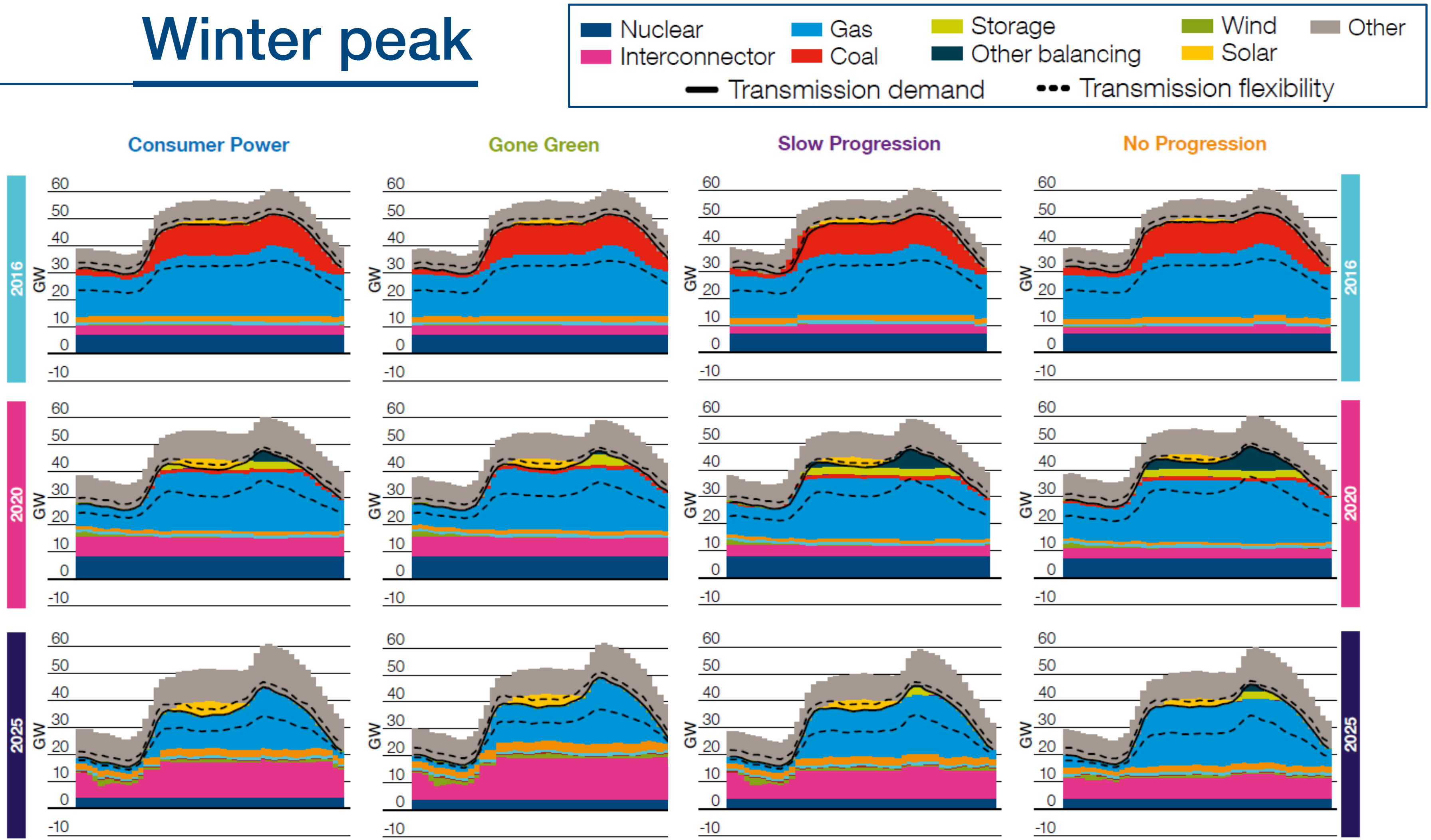
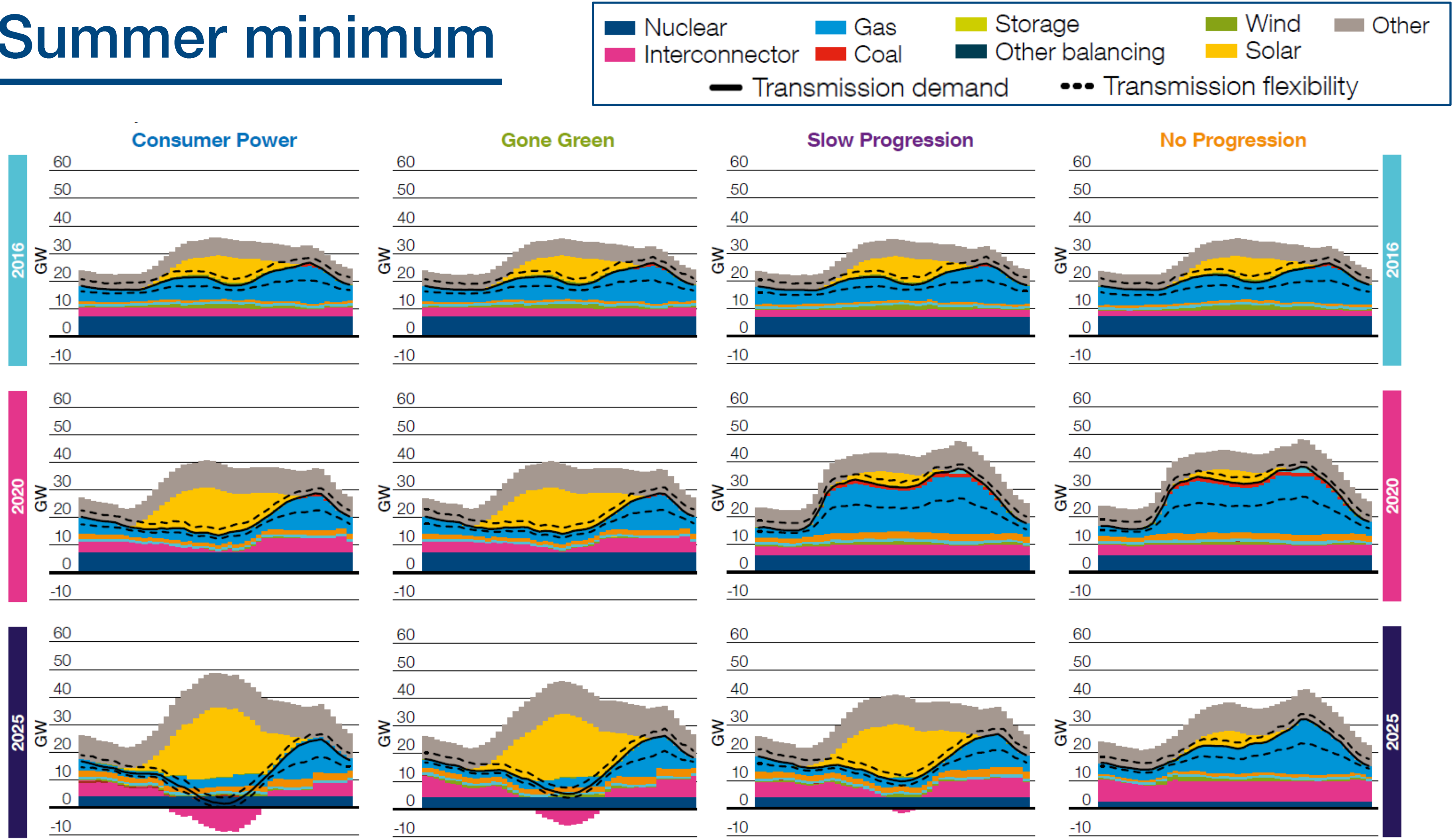


Winter peak



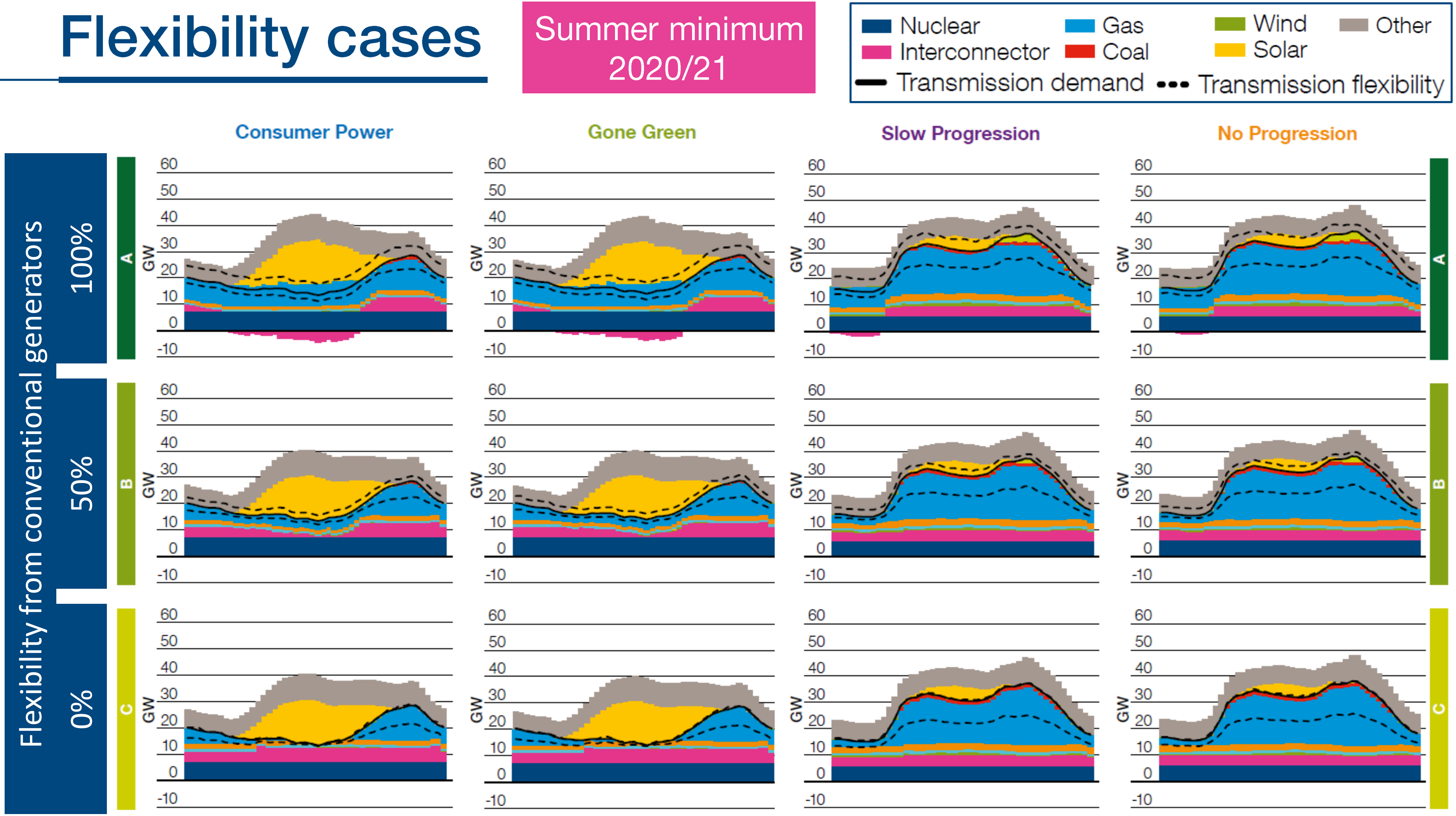
Nuclear
Interconnector
Gas
Coal
Storage
Other balancing
Wind
Solar
Other
Transmission demand
Transmission flexibility
Consumer Power
Gone Green
Slow Progression
No Progression
2016
2020
2025
GW
60
50
40
30
20
10
0
-10

Summer minimum



Flexibility cases

Summer minimum 2020/21



Insights

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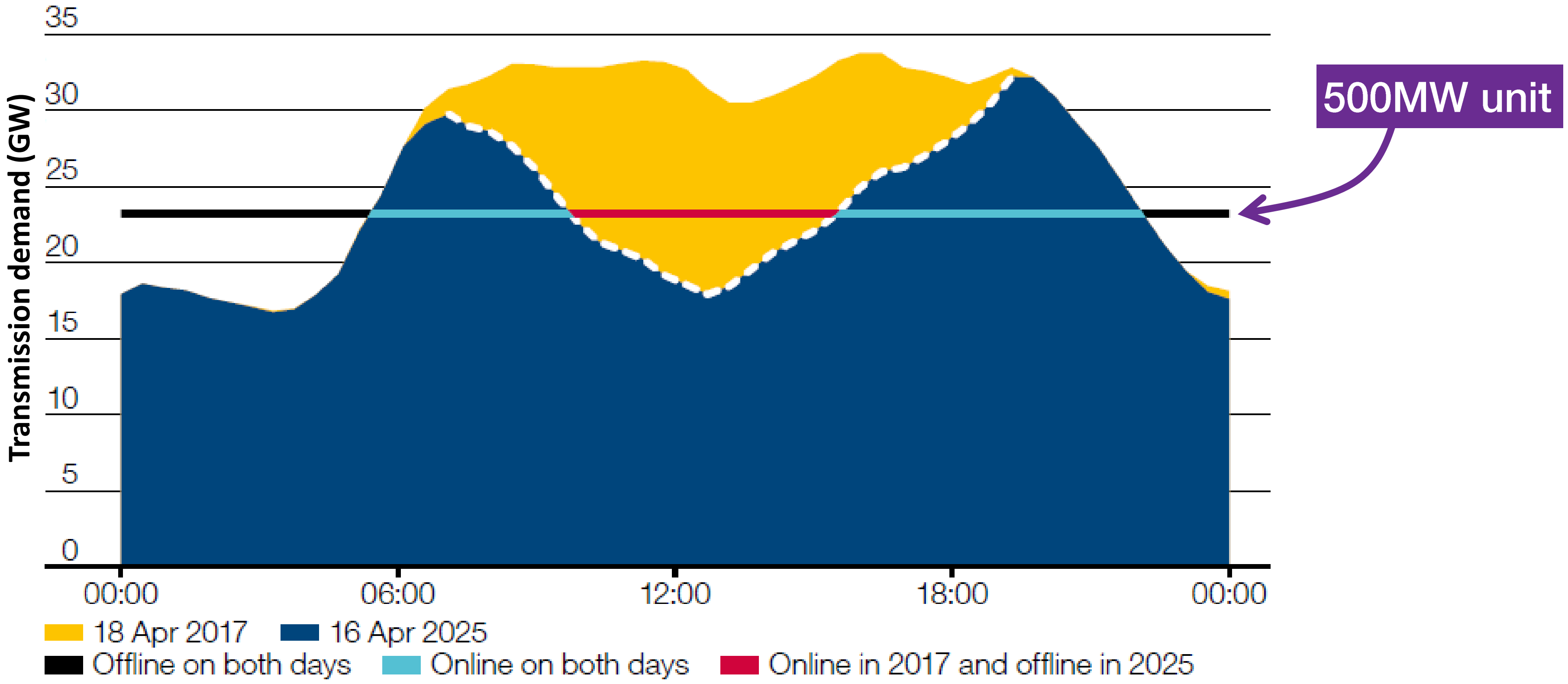
The growth in distributed generation and interconnection has an increasing impact on the operation of the transmission system.

Transmission system demand is more variable, reaches lower minima and is lower more often.

More flexibility is required from small generators, demand and interconnectors as they displace the current providers.

Insights


Transmission demand (GW)
35
30
25
20
15
10
5
0
00:00
06:00
12:00
18:00
00:00
500MW unit
18 Apr 2017
16 Apr 2025
Offline on both days
Online on both days
Online in 2017 and offline in 2025

Insights

The growth in distributed generation and interconnection has an increasing impact on the operation of the transmission system.

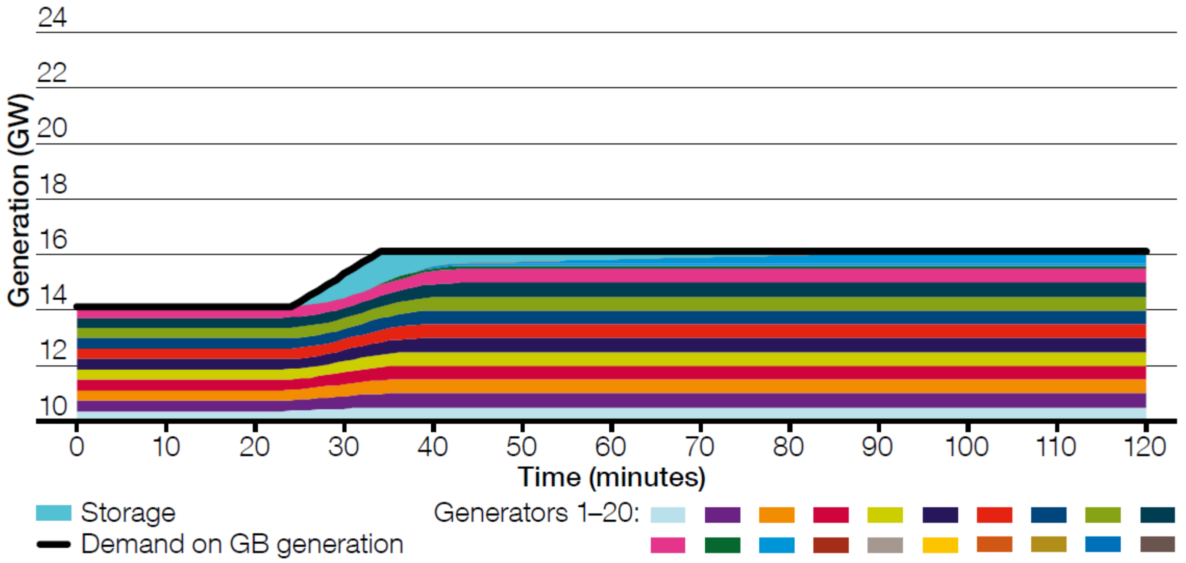
Transmission system demand is more variable, reaches lower minima and is lower more often.

More flexibility is required from small generators, demand and interconnectors as they displace the current providers.

Users of the power system must be more flexible in terms of synchronising, desynchronising and daily load profile following.

Operability: Ramp rates

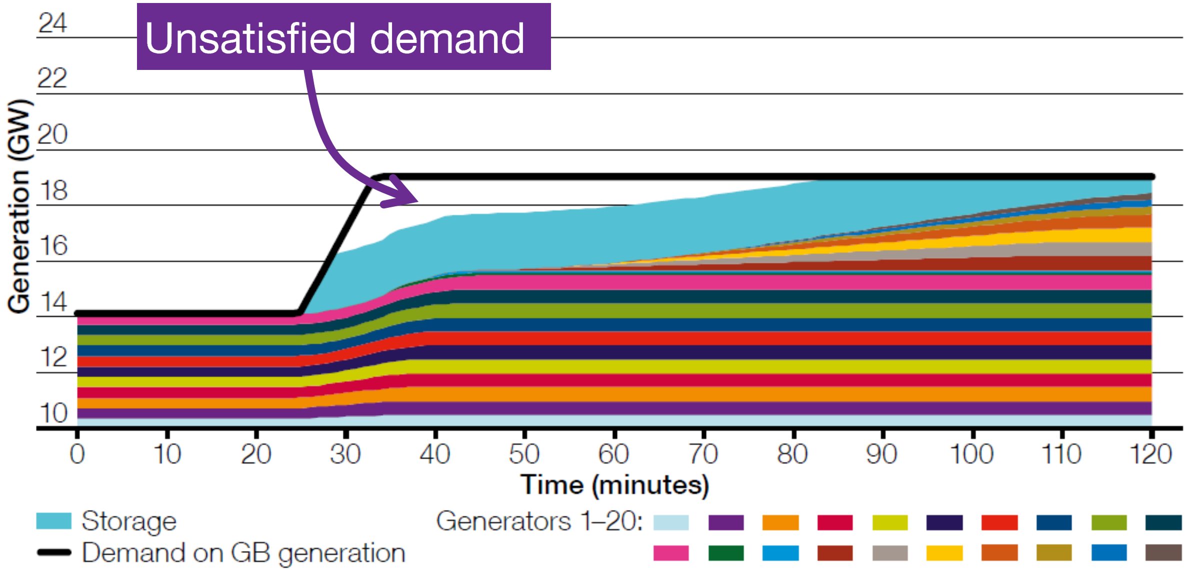
2GW ramp over two interconnectors at 100 MW/minute each = 200MW/minute for 10 minutes



- 2GW is one-third of interconnector capacity to mainland Europe in 2016/17
- Part-loaded generators are instructed to ramp-up output to meet the increasing demand
- Interconnector ramp is greater than the generators' capability
- Storage is able to fill the gap

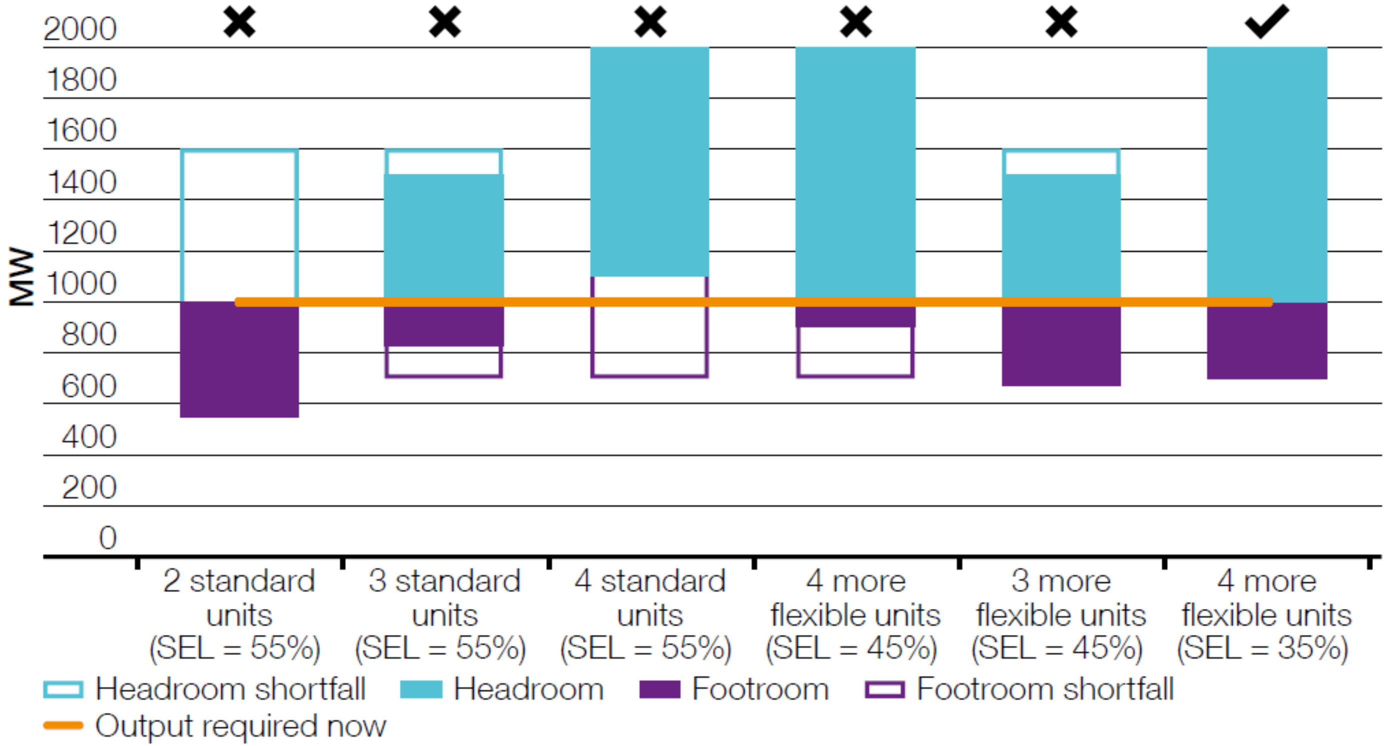
Operability: Ramp rates

4.9GW ramp over six interconnectors at 100 MW/minute each = 600MW/minute for 8 minutes



- 4.9GW is one-third of interconnector capacity to mainland Europe in 2020/21 in Consumer Power
- Ramp rate is greater than the capability of generators and storage
- This applies to any energy resources with the capability to change output rapidly, due to
  - Technology type
  - Grouped behaviours

Flexibility at low demand



Insights

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Users of the power system must be more flexible in terms of synchronising, desynchronising and daily load profile following.

Flexibility and operability must be considered holistically across active and reactive power requirements to identify efficient solutions.

Insights

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Balancing and Operability: Case Study

Mike Ryan – Trading, Structuring and Optimisation Manager

5 – 8 August 2016

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- Trading Team
- Low demand/High wind
- Operational requirements
- Actions
- Summary

Trading Team

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- Trading, contract enactment, operability
- Intraday to week ahead
- Conventional, non-synchronous, distributed, demand
- Energy and System

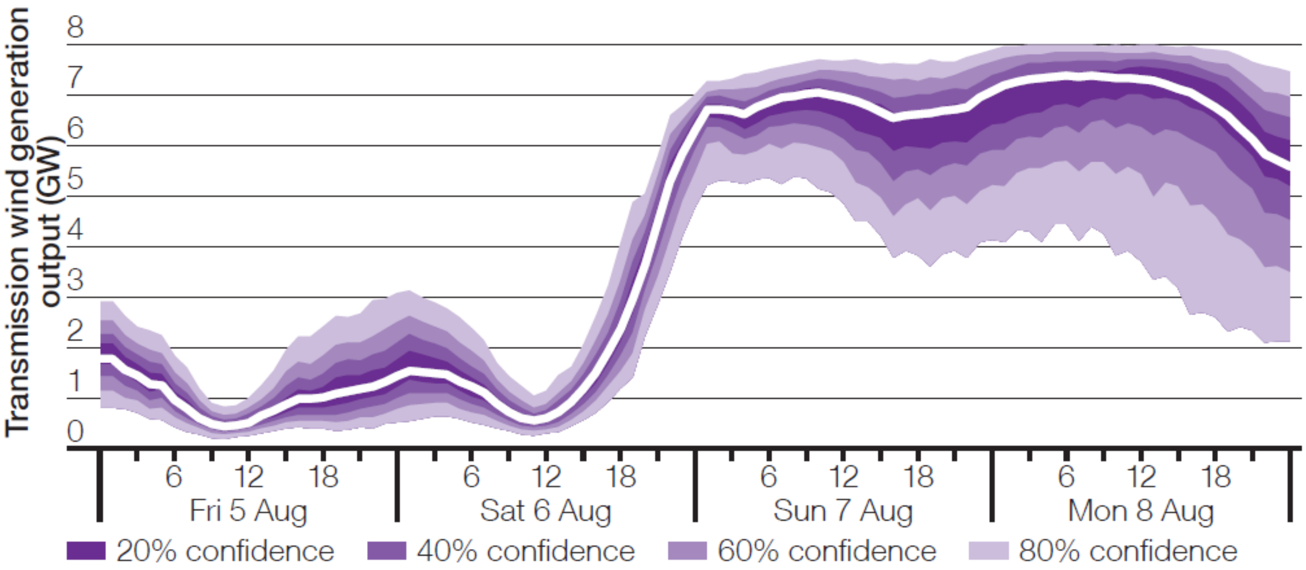
Low demand/High wind

Demand: Sunday 07 August, 04:30 16.1GW – 17.1GW

Forecast Wind:

Saturday 06 August
12:00 1GW

Sunday 07 August
00:00 7GW



Low demand/High wind

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Demand: Sunday 07 August, 04:30 16.1GW – 17.1GW

Negative Reserve Active Power Margin (NRAPM) Risk		
Date	Sunday 07 August	Monday 08 August
Forecast Minimum Demand Level (MW)	16710	18370
Risk of National NRAPM (MW)	-979	675

Operational requirements

Downward regulation:
- Desynchronise units
- Increase demand

Voltage:
- Synchronise units
- Switch out circuits

RoCoF:
- Synchronise units
- Reduce largest loss

Operational requirements

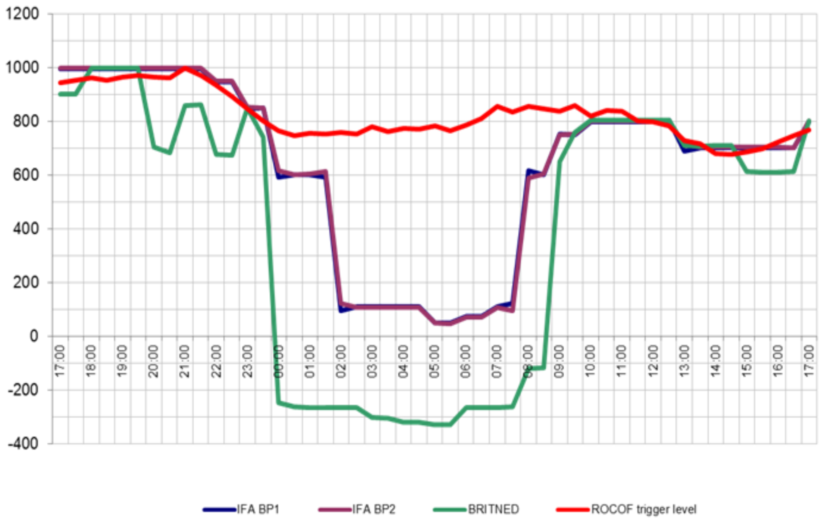
Power flow constraints:
- Scottish border flow

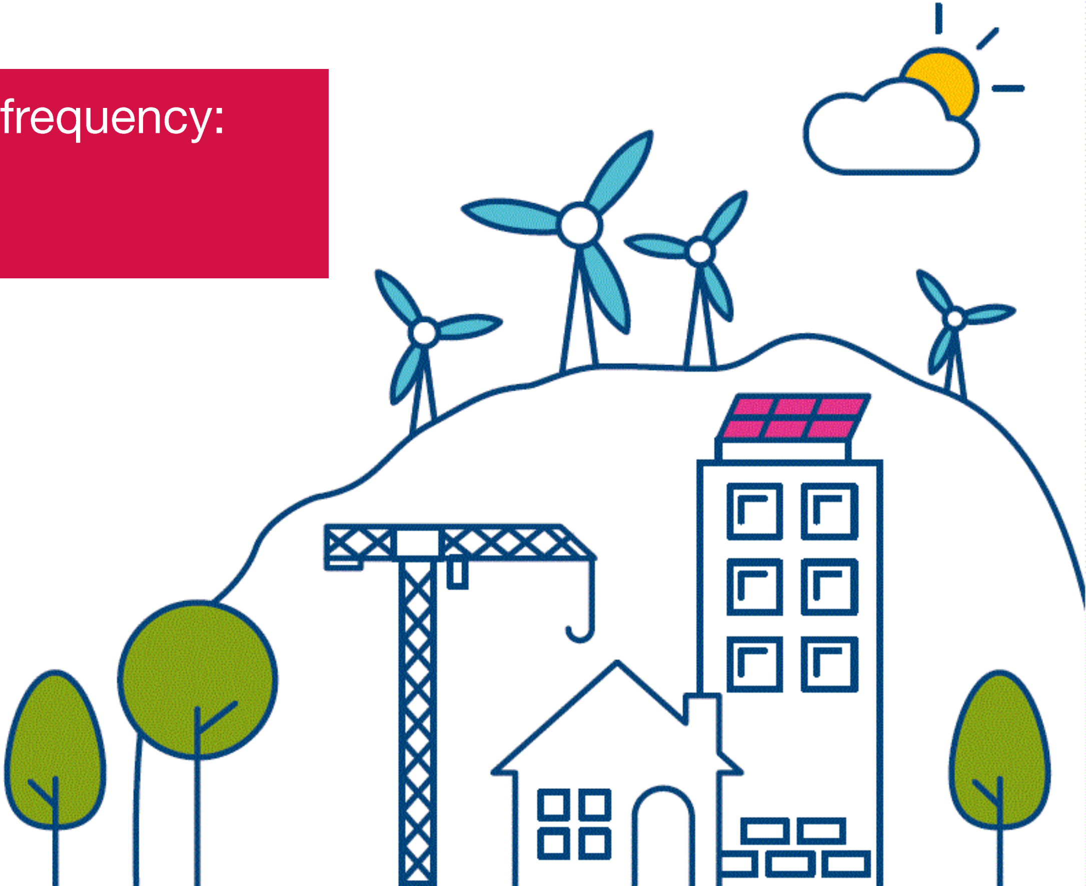
High frequency response:
- Limit largest demand loss

Actions

Downward regulation, RoCoF, High frequency:

- IFA Sell 1800MW
- BritNed Sell 1500MW





Actions

Voltage:
- 8 additional units synchronised
- 9 additional circuits switched out

Downward Regulation:
- Demand Turn Up 80MW
- SEL Reduction 200MW

Power flow constraints:
- 2GW Wind bids

Summary

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High wind, low demand means low synchronous generation

Solutions to one may exacerbate another

Use of all tools available to the System Operator

Interactive Voltage, Downward Regulation, High Frequency Response and RoCoF requirements alongside 'normal' operational challenges

RoCoF trigger level reached 678MW

At the time, the largest single generation risk was 635 MW

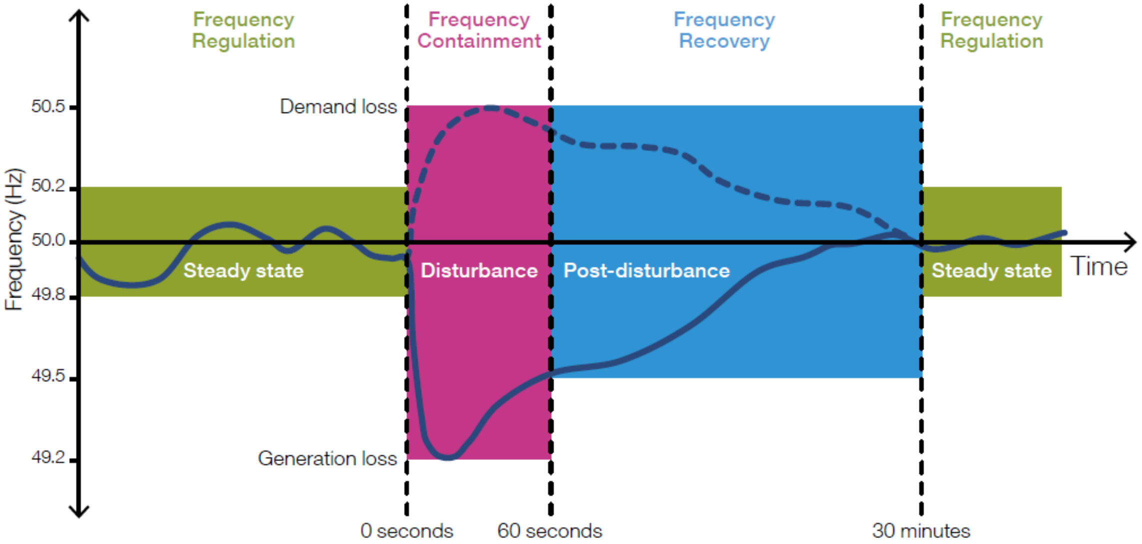
Not just a minimum problem

Lowest RoCoF trigger level reached Saturday 06 August, 14:30

Frequency Management

William Ramsay – Power Systems Engineer

Frequency management

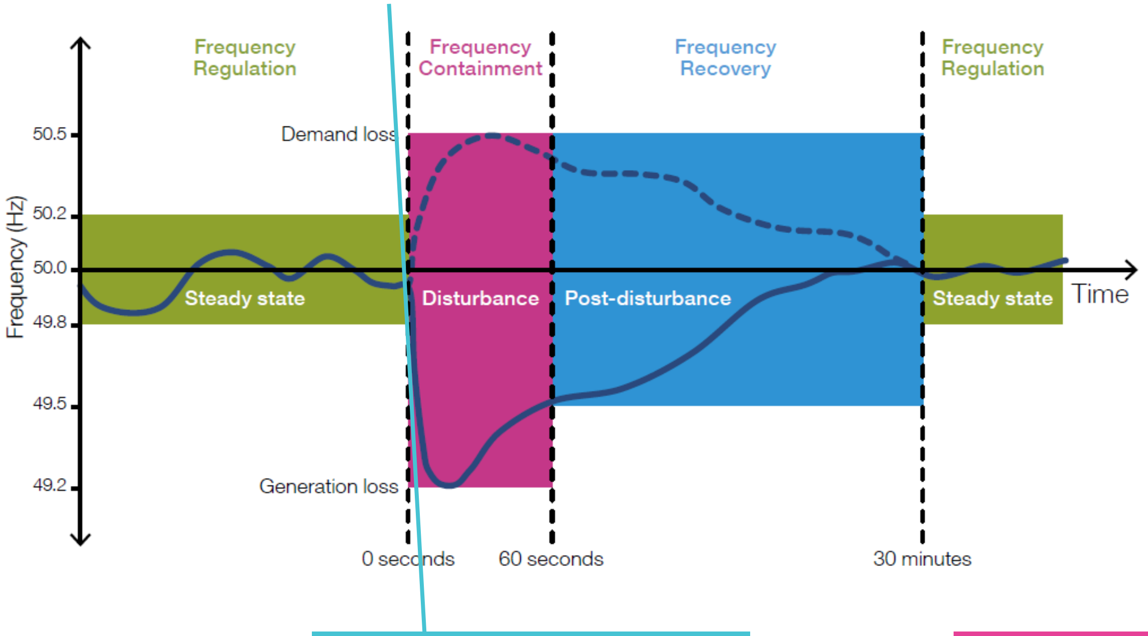


Regulation
Continuous balancing of supply and demand

Containment
Response to an unplanned disconnection of generation or demand

Recovery
Restoration of frequency to 50Hz

Frequency management



System inertia

Rate of change of frequency (RoCoF)

Frequency response service design

What is system inertia?

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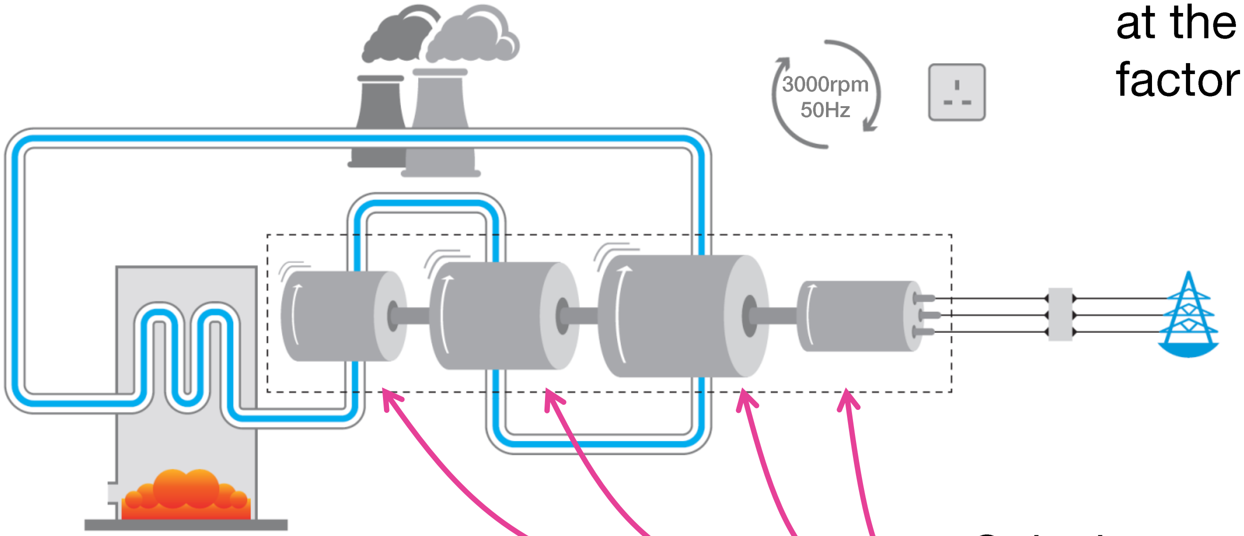
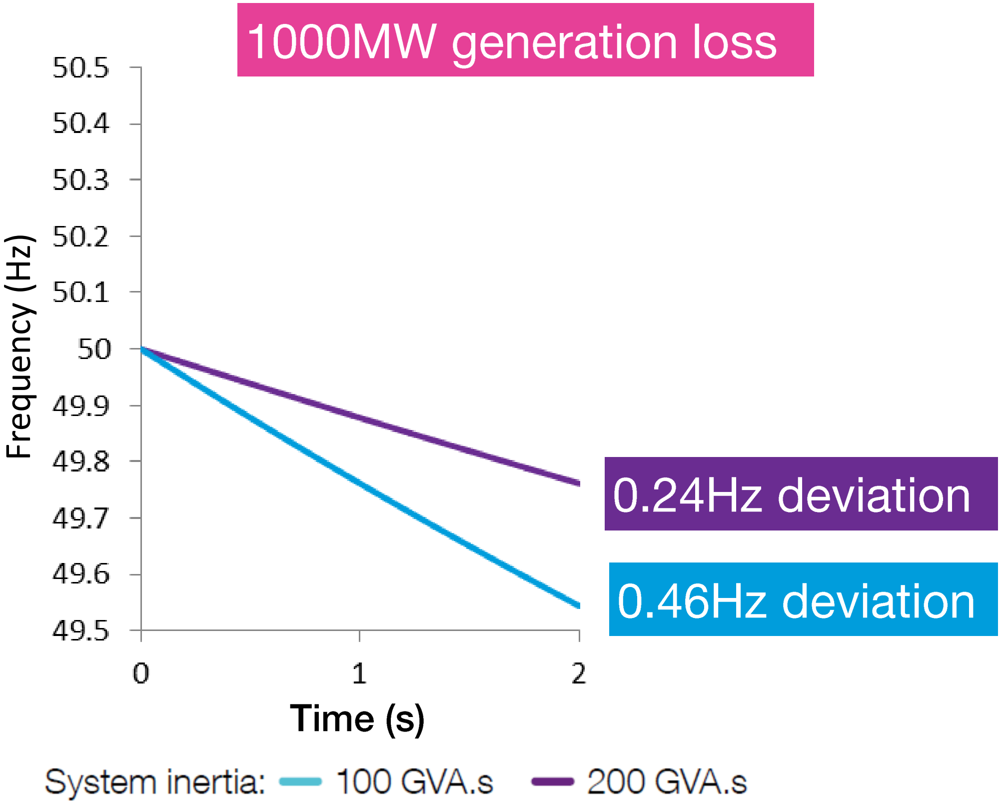
Synchronous machines rotate at the same speed as, or a factor of, system frequency



Spinning masses of turbines, generators and motors contribute to system inertia

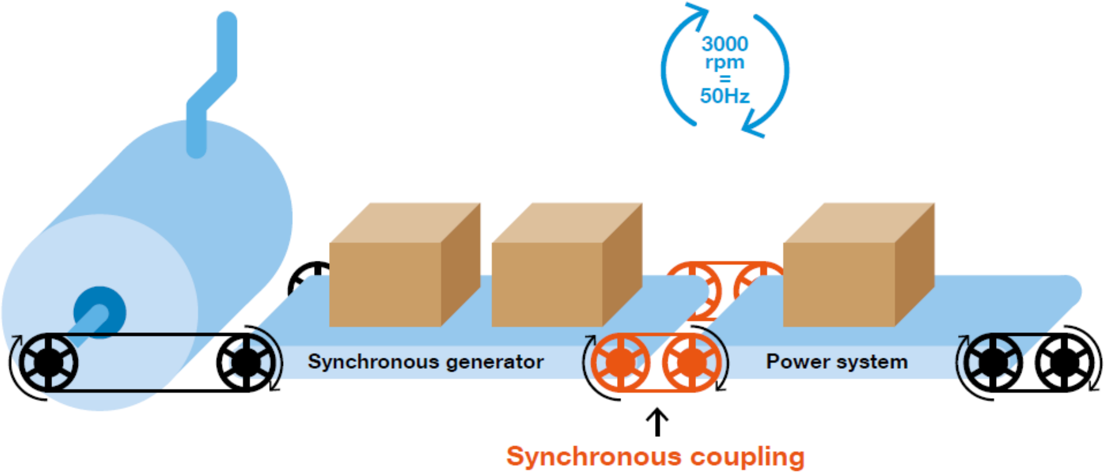
What is system inertia?



- System inertia counteracts changes in frequency, reducing the speed of frequency movements
- This occurs in steady-state as well as during a disturbance
- The rate of change of frequency (RoCoF) is inversely proportional to system inertia

$$\text{RoCoF [Hz/s]} = \frac{50}{2} \times \frac{\text{Imbalance [GW]}}{\text{Inertia [GVA.s]}}$$

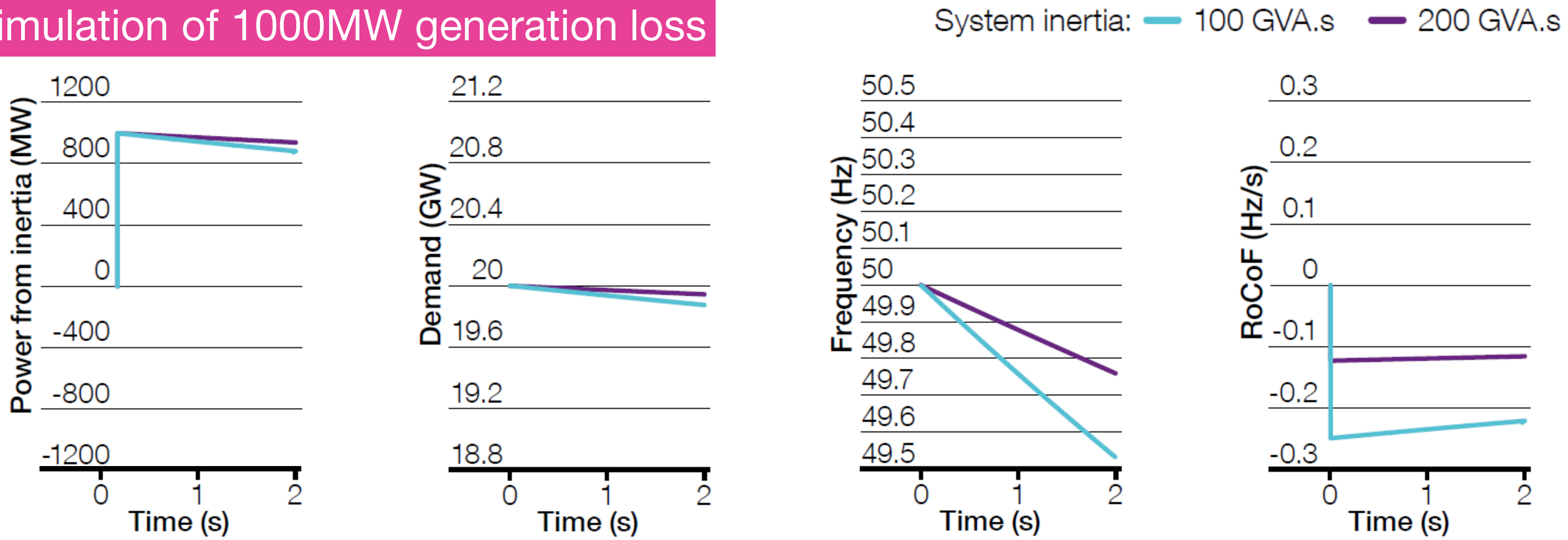
What is system inertia?



- Synchronous motors and generators are coupled to the power system
- Changes in the speed or frequency of the power system are transferred to the generator or motor
- Power system disturbances will be inherently counteracted

What is system inertia?

Simulation of 1000MW generation loss



Immediate active power response to oppose imbalance

Synchronous demand reduces load

The speed of frequency change is inversely proportional to system inertia

Impact of inertia on frequency response

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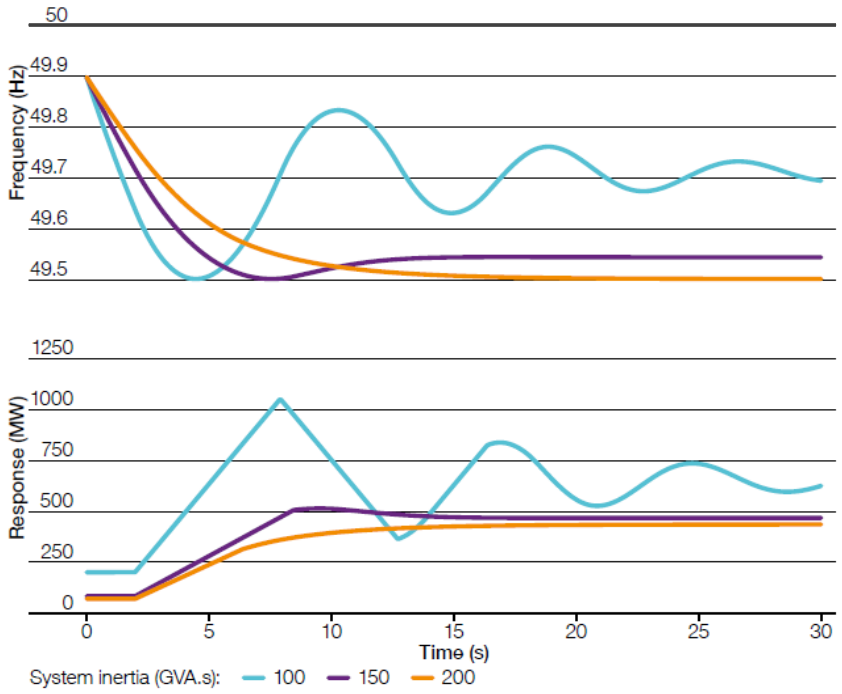
Simulation of 600MW generation loss



- Reducing system inertia requires faster delivery of response
- To an extent, this can be managed by using greater quantities of response
- Ultimately faster services are required to achieve frequency containment with acceptable dynamic performance

Unacceptable dynamic performance*

*containment modelling breaks down after 8 seconds.

Annual distributions of system inertia

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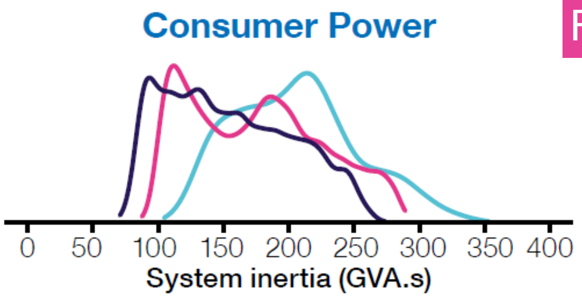
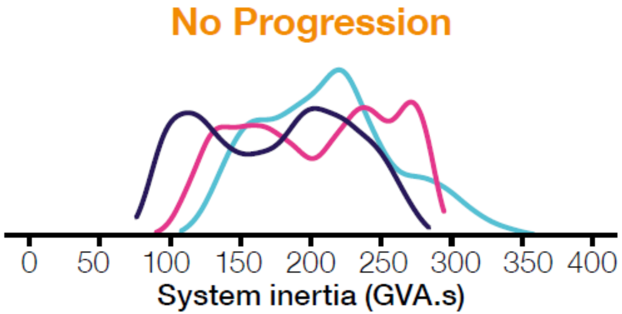
Flexibility case B





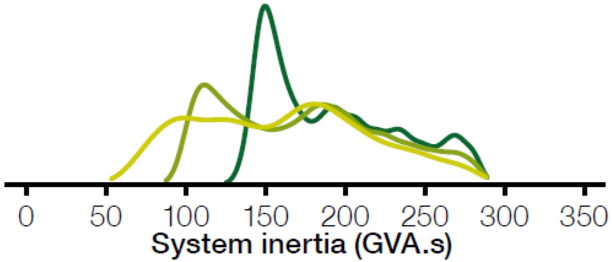
2016/17 2020/21 2025/26

- Minimum system inertia decreases
- Increasing proportion of time spent at low levels of inertia
- These effects occur with growth of non-synchronous generation

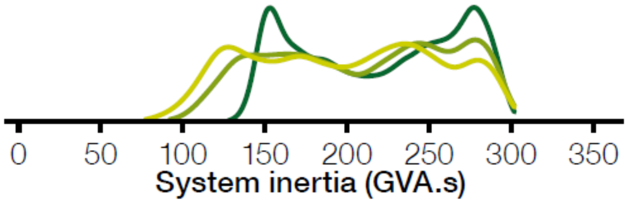
Annual distributions of system inertia

2020/21

Consumer Power



No Progression



Flexibility case: A B C

- Minimum system inertia decreases
- Increasing proportion of time spent at low levels of inertia
- These effects occur with growth of non-synchronous generation
- Flexibility requirement constrains on generators that provide contribute to system inertia

Insights

Frequency is more volatile when system inertia is low, which occurs more often.

What is system inertia?

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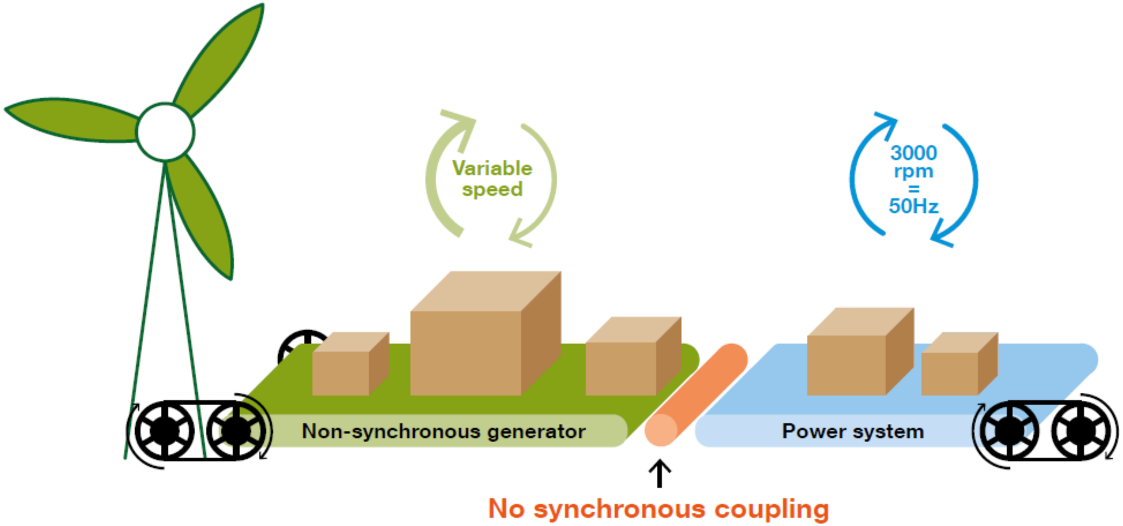
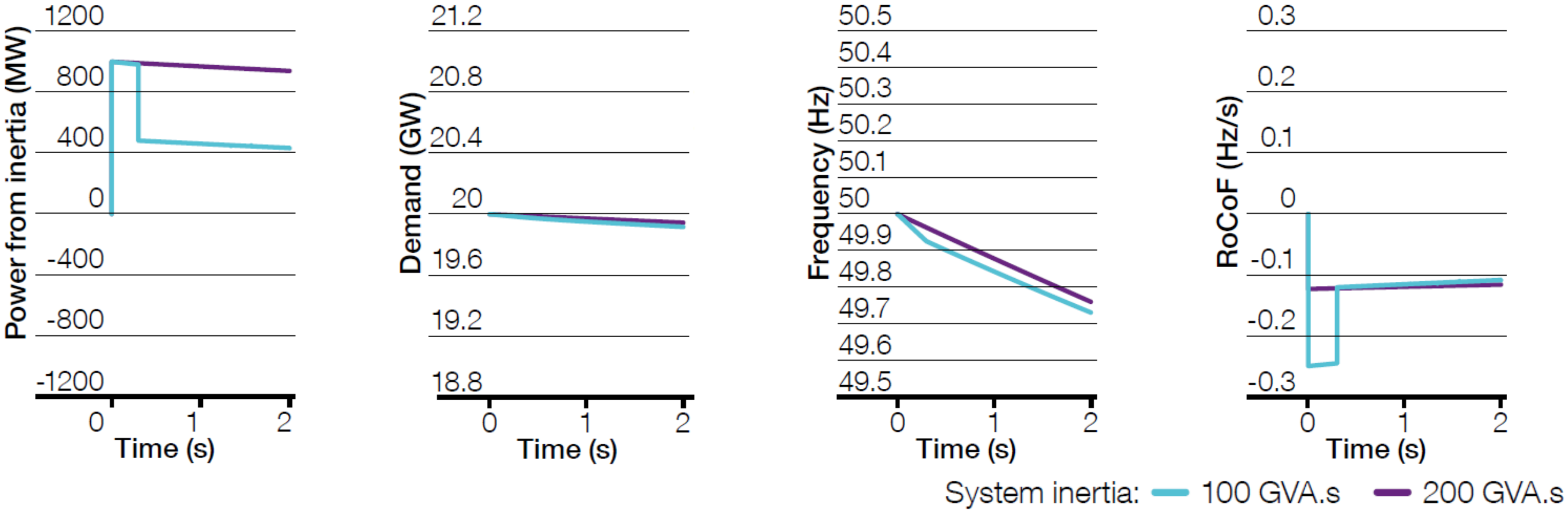


- Variable speed motors and generators are decoupled from the power system.
- Changes in the speed or frequency of the power system are not transferred to the generator.
- Power system disturbances will not be inherently counteracted.

What is system inertia?

Simulation of 1000MW generation loss with 500MW fast active power injection.



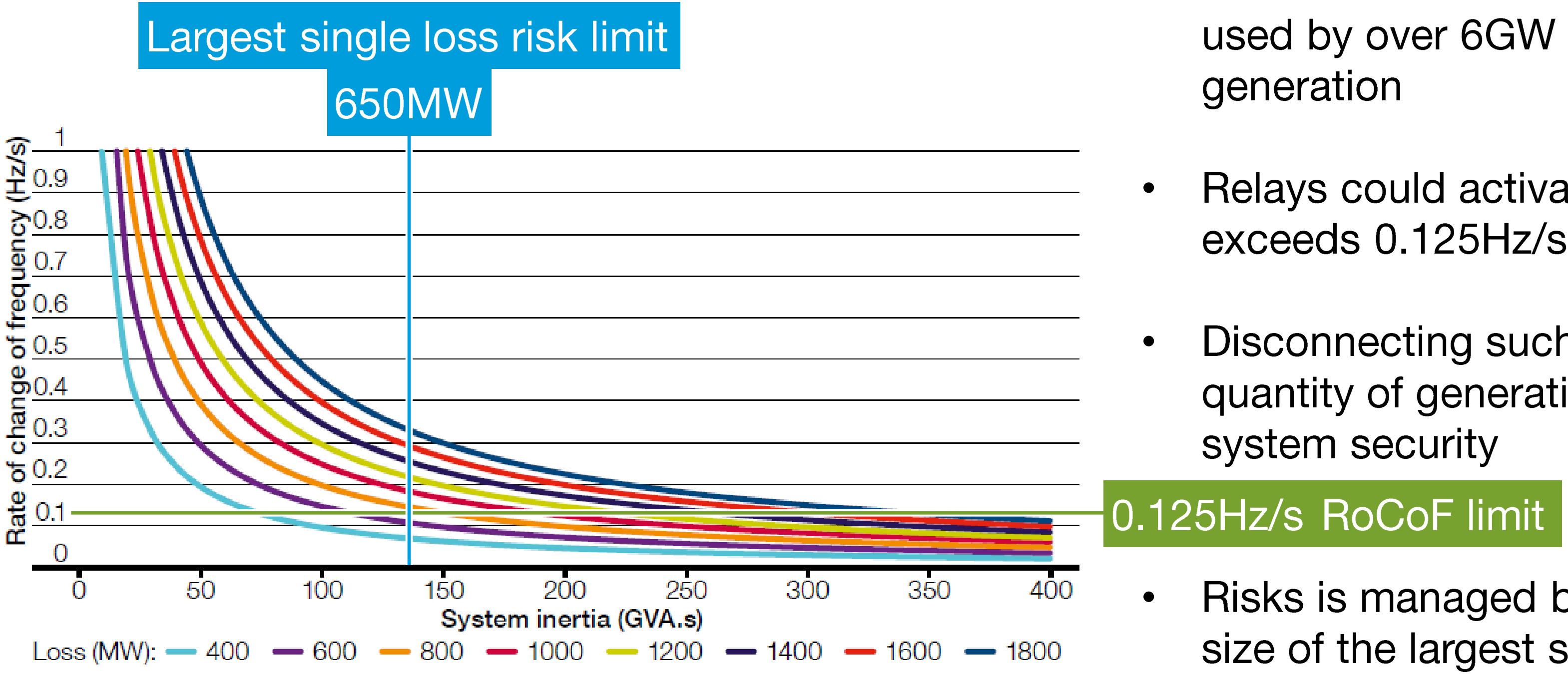
Fast active power is delivered after a delay for measurement and control processing, until which point it is inactive.

Insights

Frequency is more volatile when system inertia is low, which occurs more often.

System inertia is distinct from the fast injection of active power after a measurement delay, often referred to as synthetic inertia.

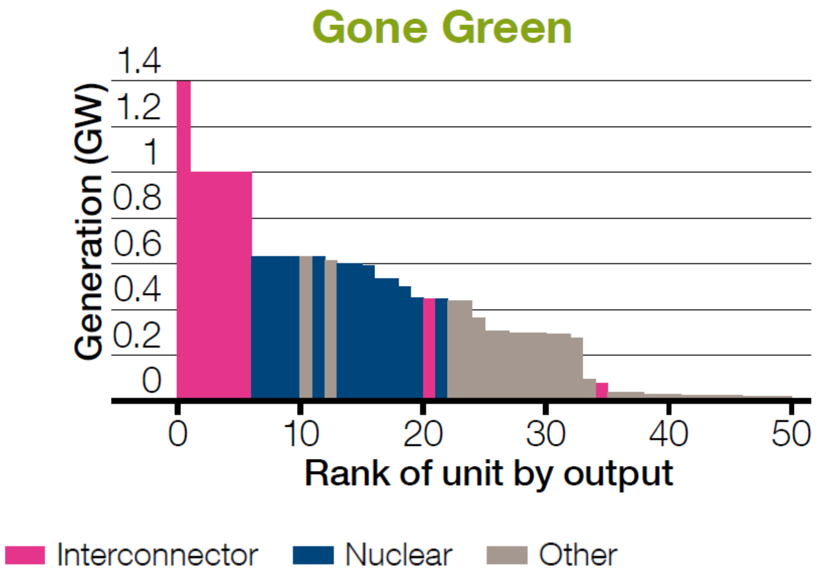
RoCoF limit



- Over-sensitive RoCoF relays are used by over 6GW of distributed generation
- Relays could activate if RoCoF exceeds 0.125Hz/s
- Disconnecting such a large quantity of generation would risk system security
- Risks is managed by limiting the size of the largest single loss risk

RoCoF limit

Largest 50 single loss risks at summer minimum in 2020/21



- There is a growth in the number and size of large single loss risks
- Greater intervention would be required to adjust interconnector flows
- After the interconnectors, the next units are mostly nuclear generators
- Flexibility from nuclear generators would be required to allow system inertia to reduce below 130GVA.s
- This is until the over-sensitive relays have been updated or replaced

Insights

Frequency is more volatile when system inertia is low, which occurs more often.

Inertia is distinct from the fast injection of active power after a measurement delay, often referred to as synthetic inertia.

Minimum system inertia is constrained by nuclear generator flexibility and over-sensitive distributed generator protection.

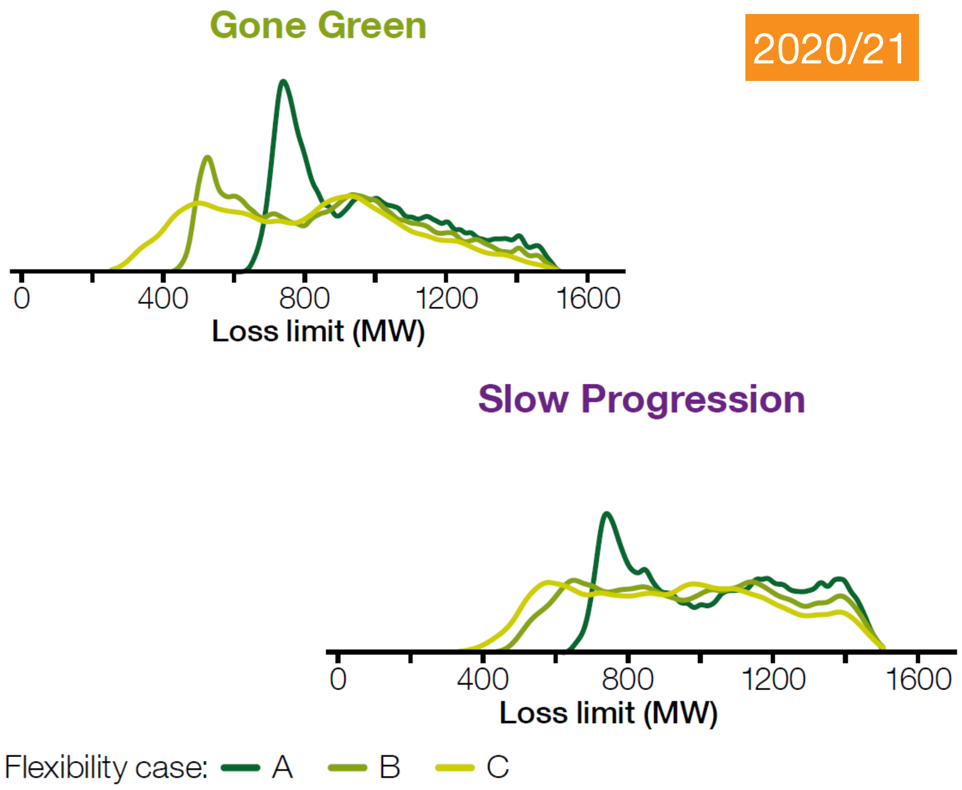
Distributions of unconstrained largest loss

Flexibility case B

- The market provides lower levels of system inertia that would allow smaller single loss risks sizes

Distributions of unconstrained largest loss

2020/21



- The market provides lower levels of system inertia that would allow smaller single loss risks sizes
- Greater levels of intervention from the system operator will be required to manage the RoCoF risk

Insights

Frequency is more volatile when system inertia is low, which occurs more often.

Inertia is distinct from the fast injection of active power after a measurement delay, often referred to as synthetic inertia.

Minimum system inertia is constrained by nuclear generator flexibility and over-sensitive distributed generator protection.

When limited large synchronous generation is running, low system inertia will require greater intervention from the system operator.

Existing frequency response definitions

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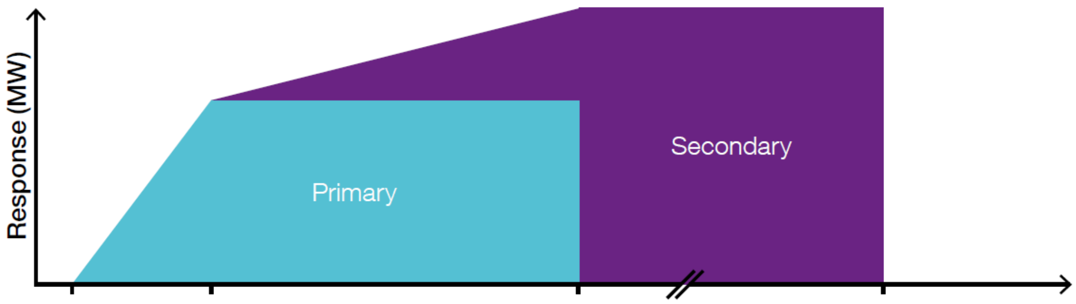

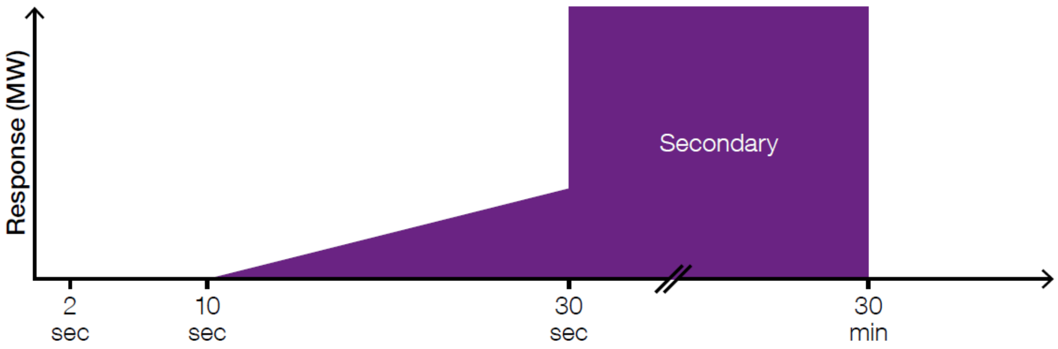

Development of Enhanced Frequency Response service

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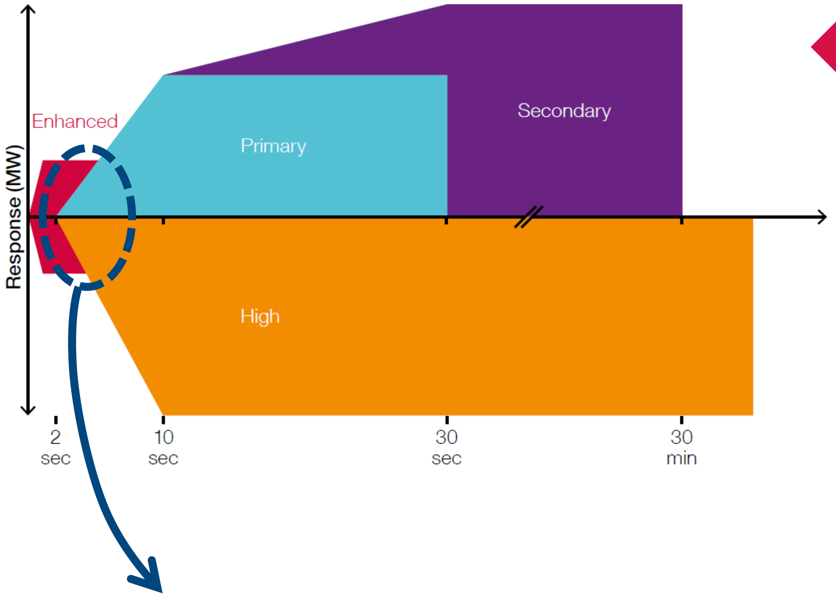
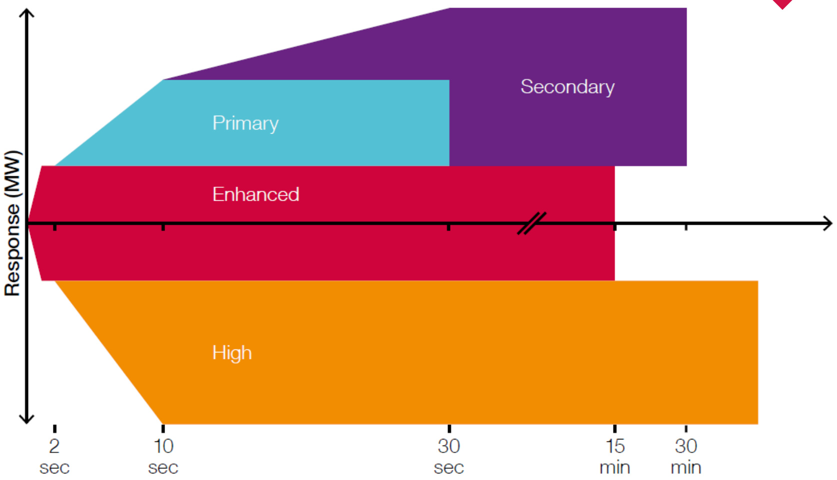


Initial response design:
Fast response, short delivery

Final response design:
Fast response, long delivery



Handover between services cannot be managed using existing systems and suite of services

Insights

Frequency is more volatile when system inertia is low, which occurs more often.

Inertia is distinct from the fast injection of active power after a measurement delay, often referred to as synthetic inertia.

Minimum system inertia is constrained by nuclear generator flexibility and over-sensitive distributed generator protection.

When limited large synchronous generation is running, low system inertia will require greater intervention from the system operator.

A review of frequency response services would facilitate more efficient development of frequency management solutions.

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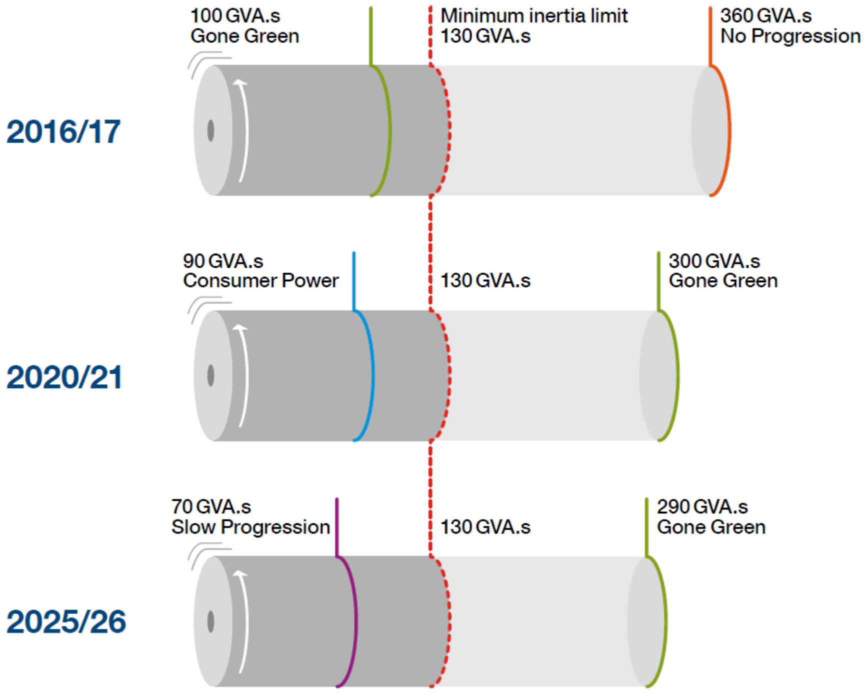
System inertia



Flexibility case B

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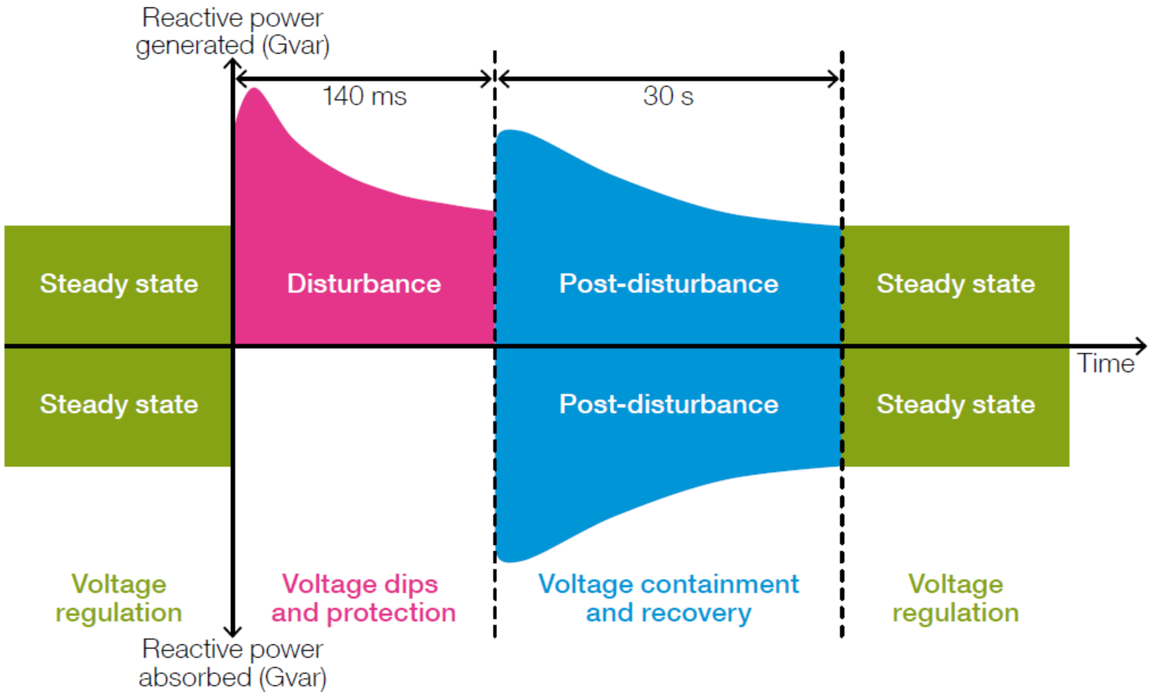
Voltage Management

Ben Marshall – Technical Specialist
Yun Li – Power Systems Engineer

Voltage management

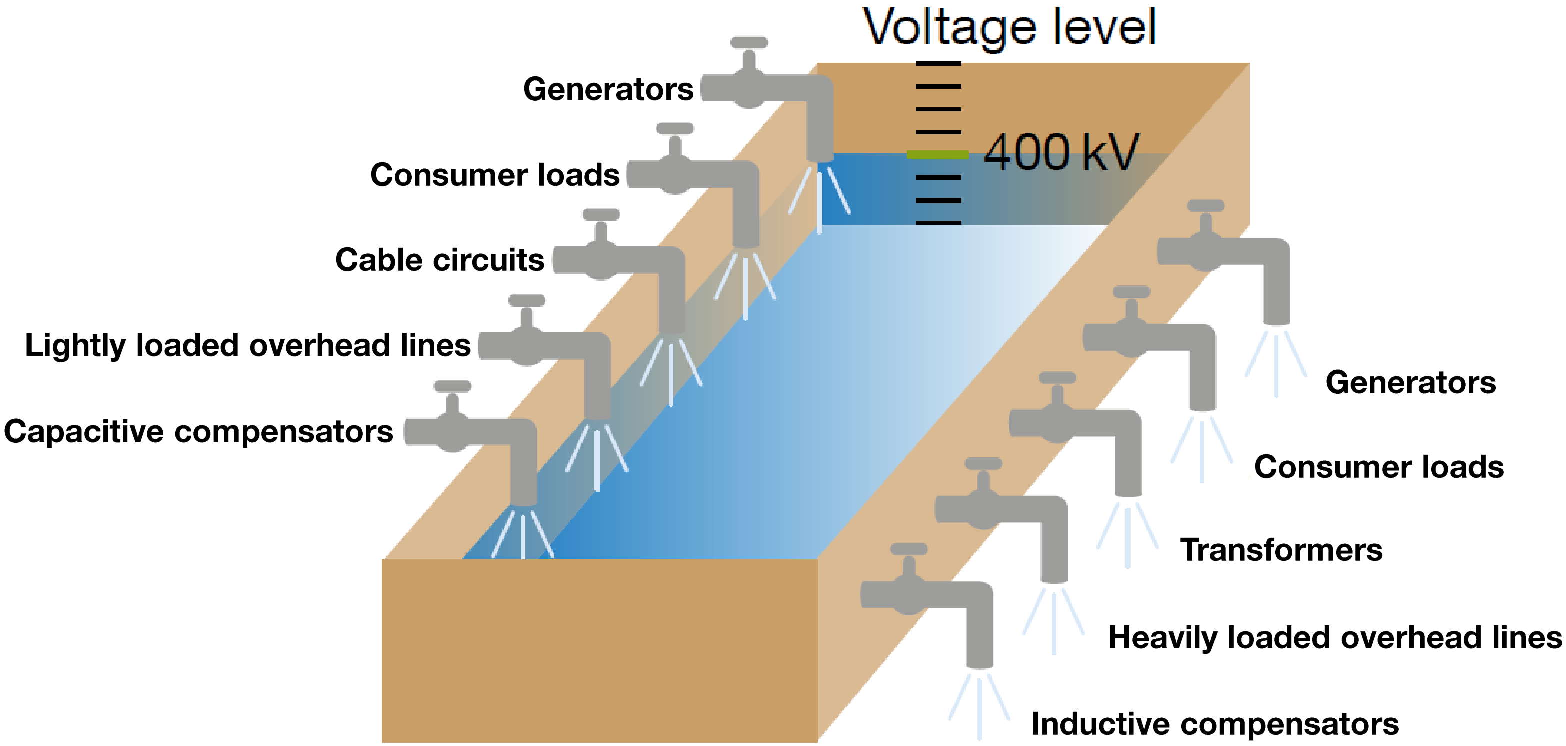


Voltage Regulation
Continuous reactive power, generation and absorption

Voltage dips and protection
Supporting voltage during fault and protection operation

Voltage containment and recovery
Immediate, dynamic and static reactive power generation and absorption

Voltage regulation



Voltage dips and protection

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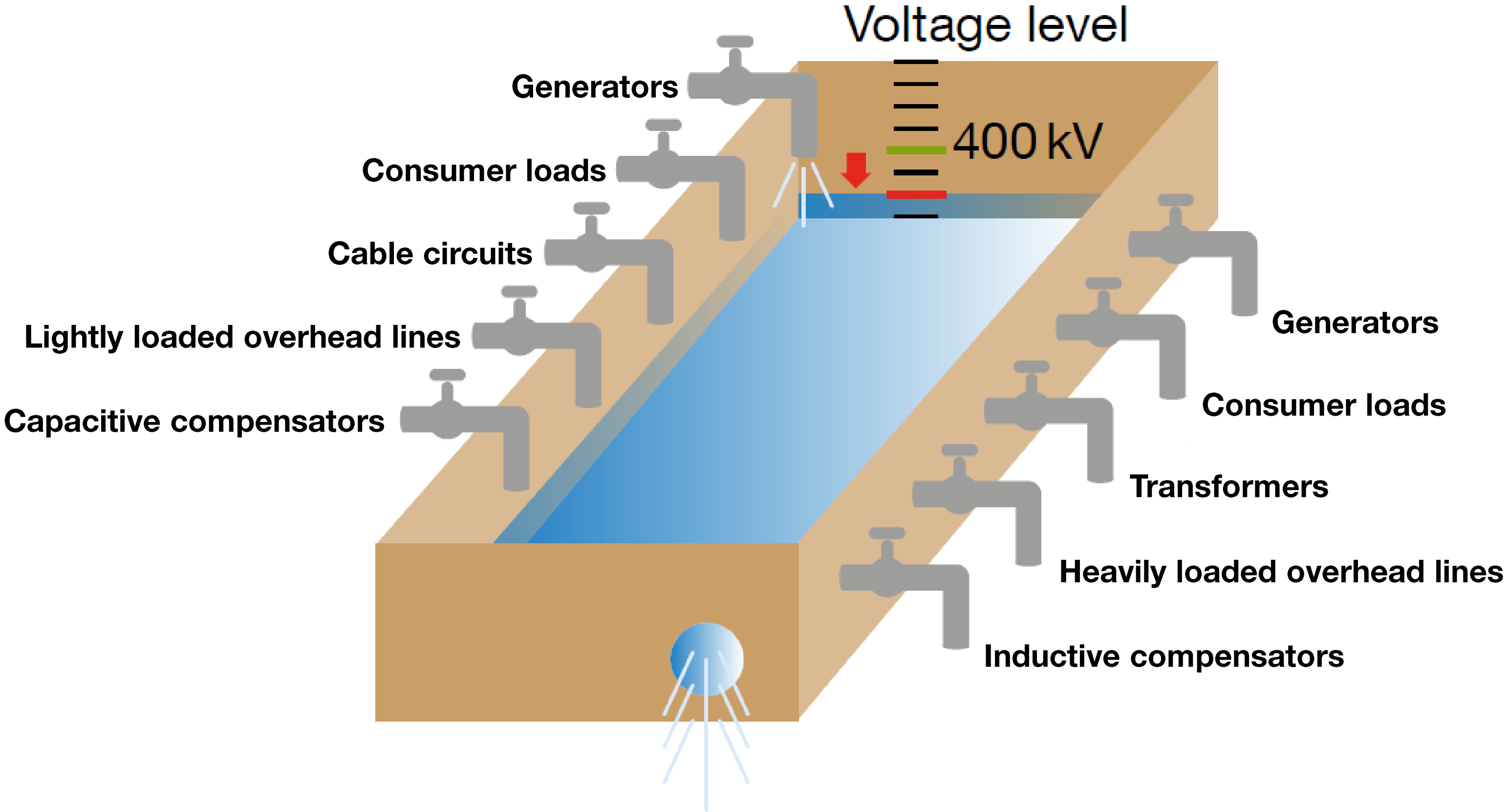
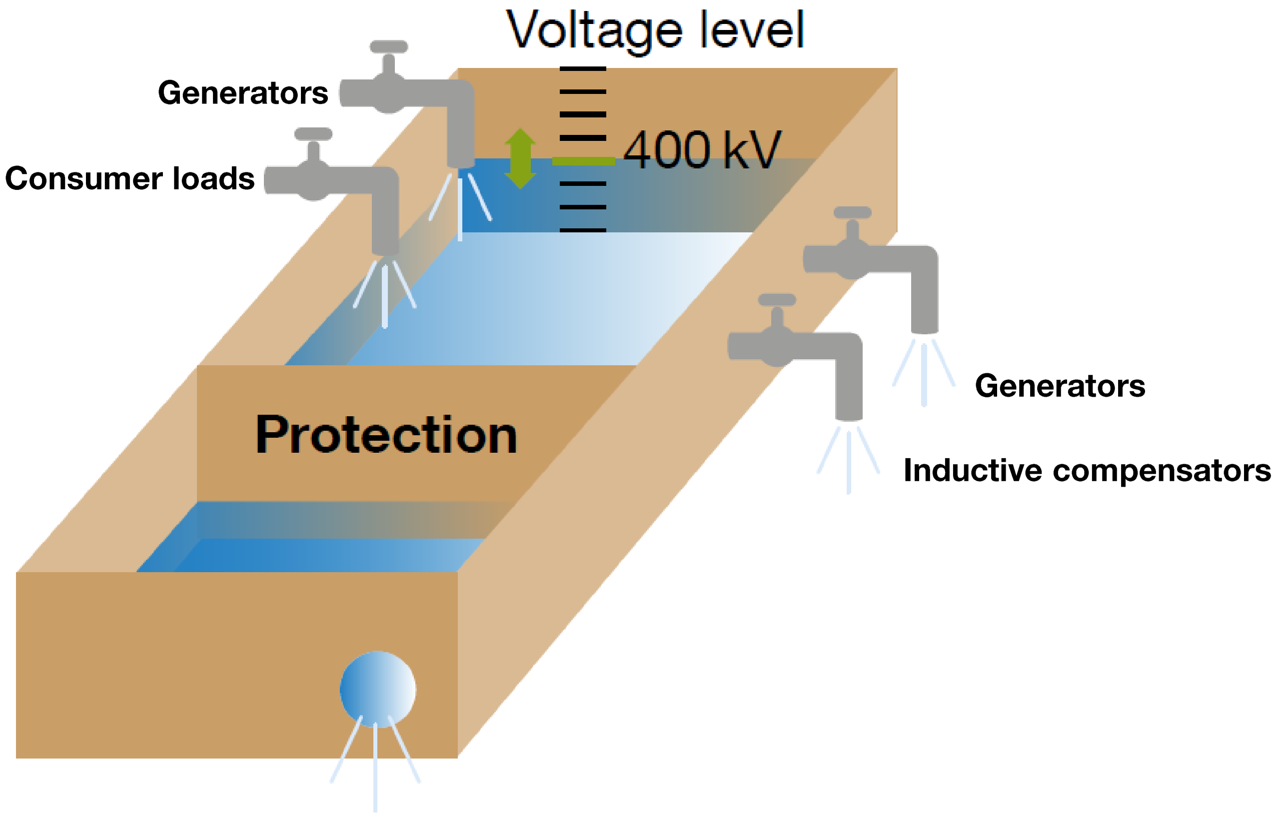
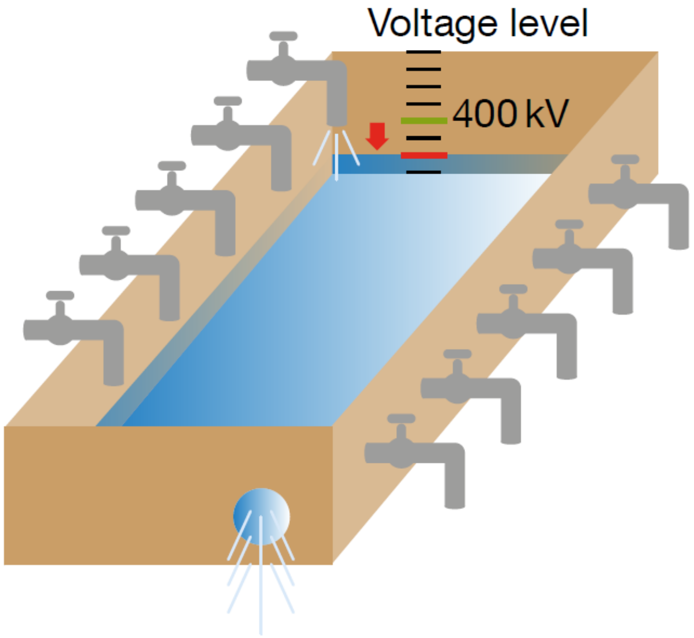


Voltage containment and recovery

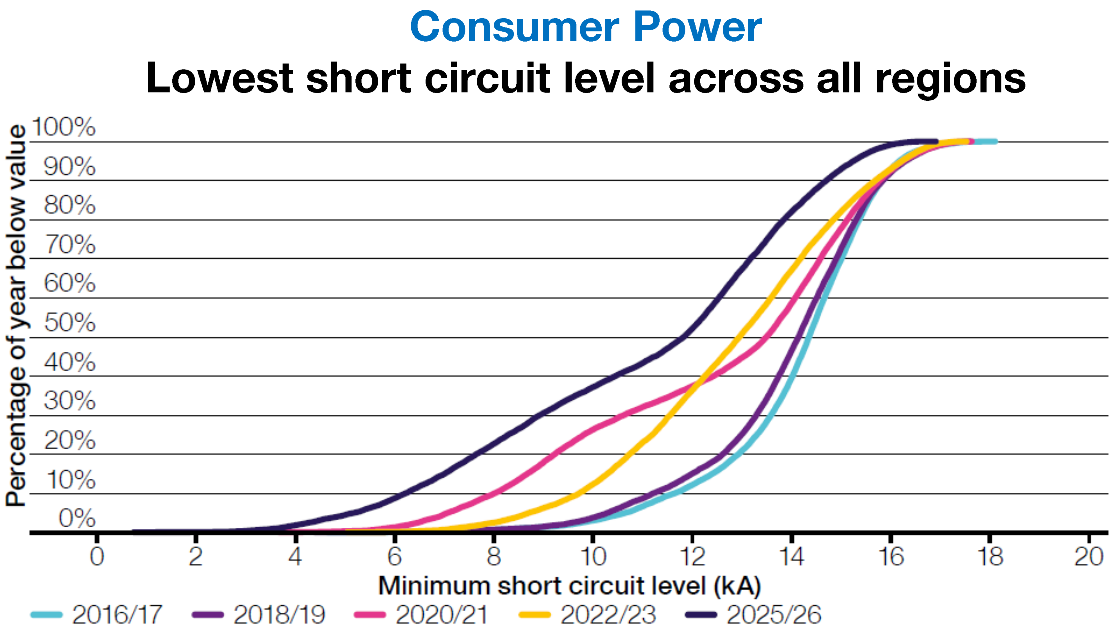


System strength



- System strength is very important to voltage management, just as system inertia is to frequency management. It indicates the system’s inherent robustness to voltage disturbances
- System strength is typically measured by short circuit level (SCL)
- System strength can be represented by the size of the tank, a bigger tank is more robust to changes in depth
- Synchronous generators are the currently the main providers of fault current and system strength
- System strength is a locational property of the network

System strength



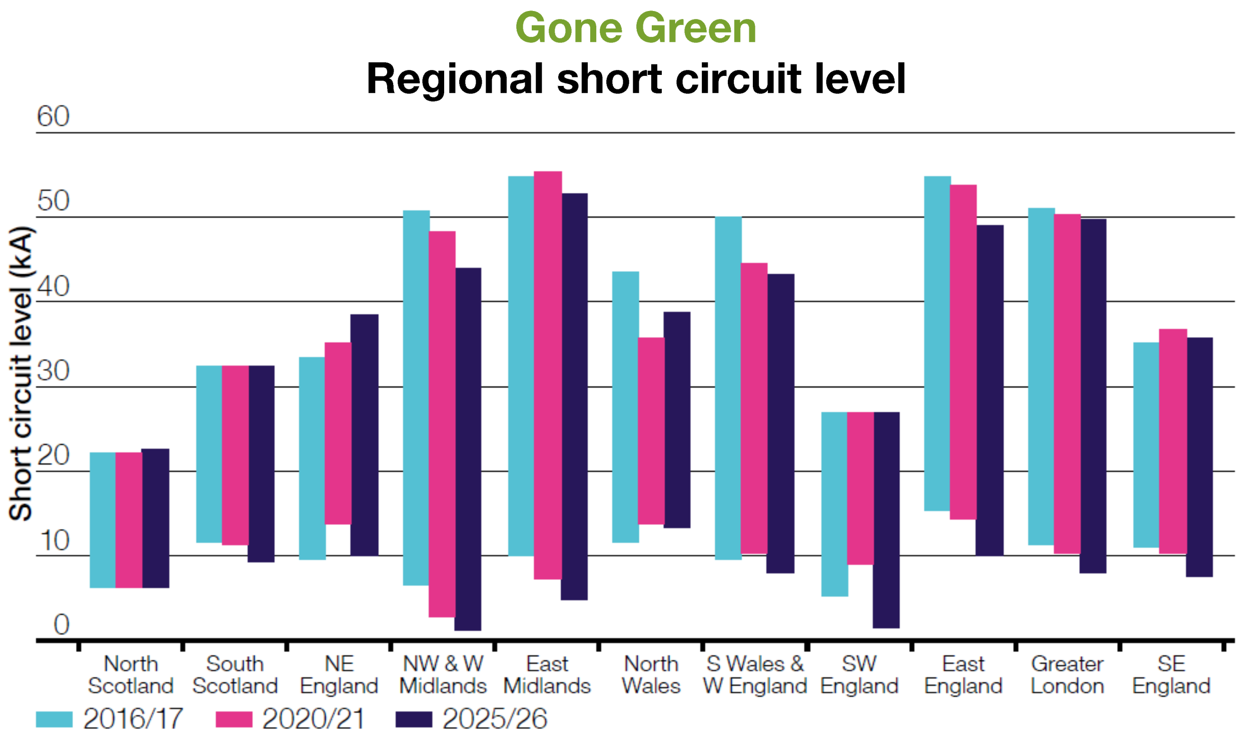
- Short circuit level shows a trend of national decrease and becomes more variable
- The proportion of the year at low strength becomes greater
- The changes manifest late in No Progression but quite quickly in Consumer Power
- The short circuit level could be further influenced by network maintenance outages

Insights

System strength will be lower and more variable when limited synchronous generation is running.

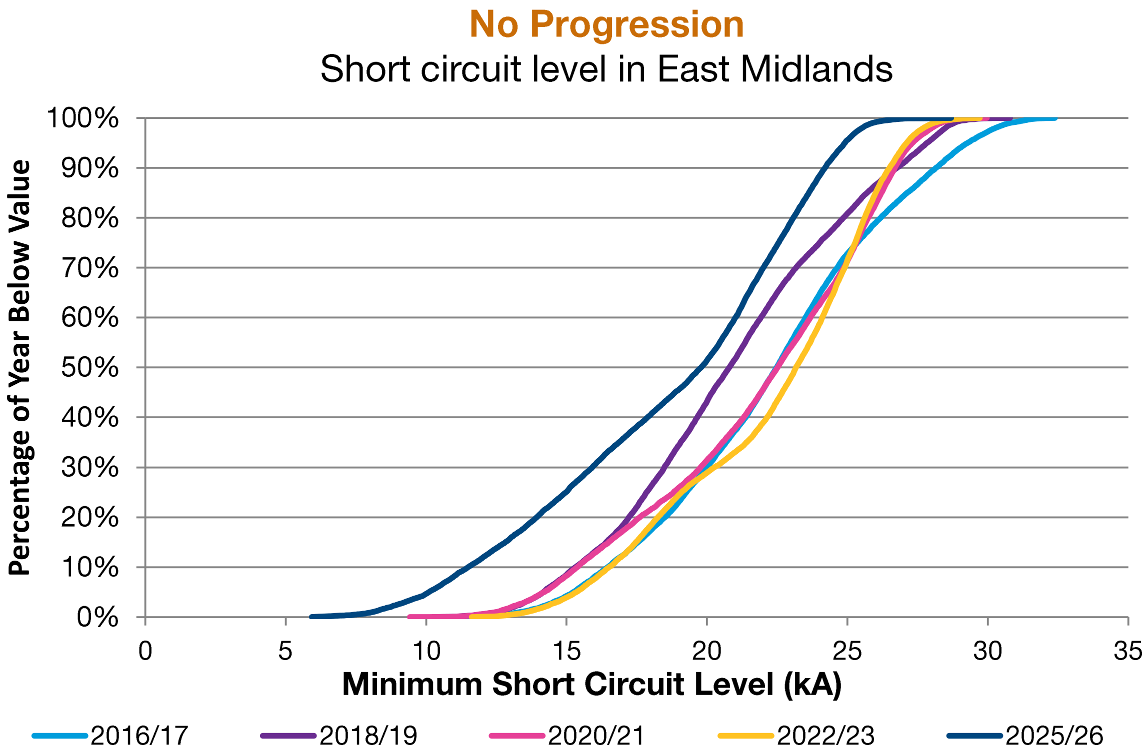
Voltage management regions

System strength – regional variation



- The trend of decrease continues regionally
- The areas showing greatest decrease align to the areas where less synchronous generation is likely to be running in the future.

System strength – East Midlands



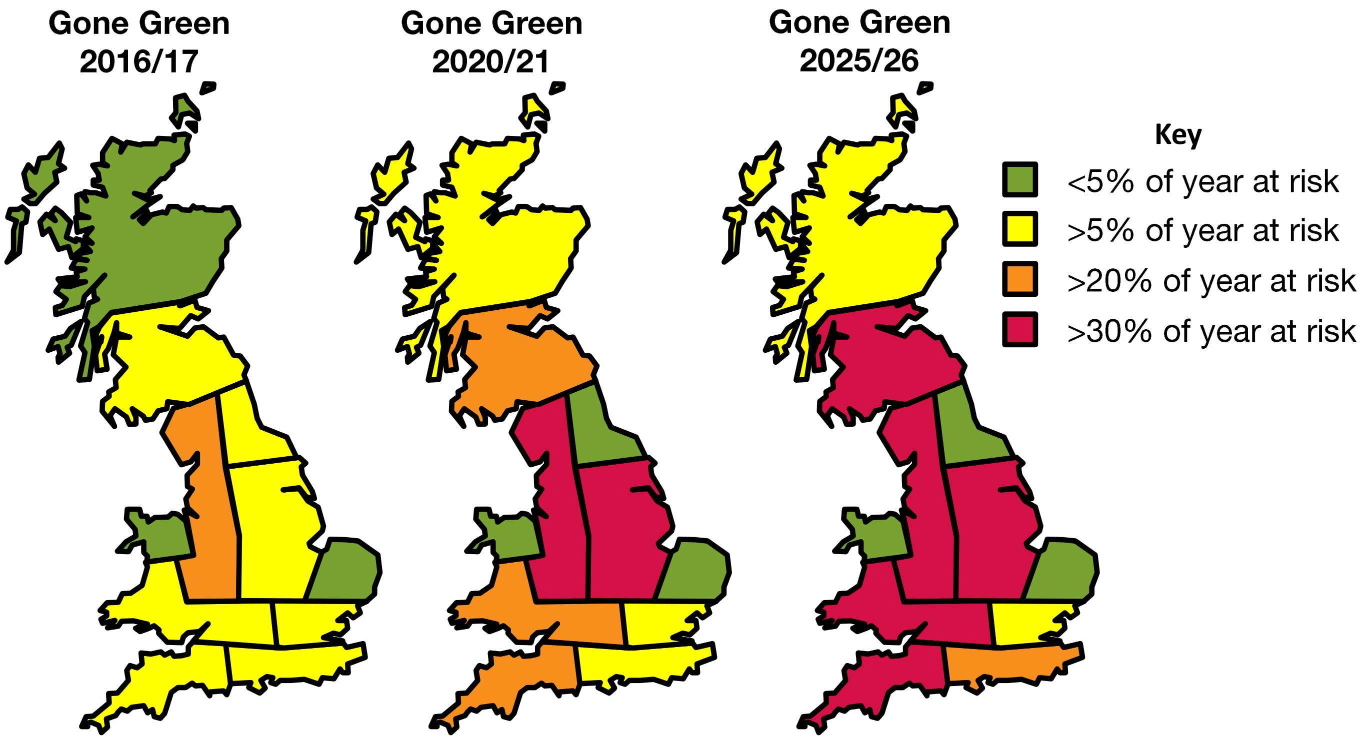
- System strength is closely related to availability of synchronous generation
- Some large plants are due to close
- Large synchronous plant may not be dispatched at low system demand
- Behaviour of large power plants affects the load duration curve

Insights

Regional system strength will be lower and more variable when limited synchronous generation is running.

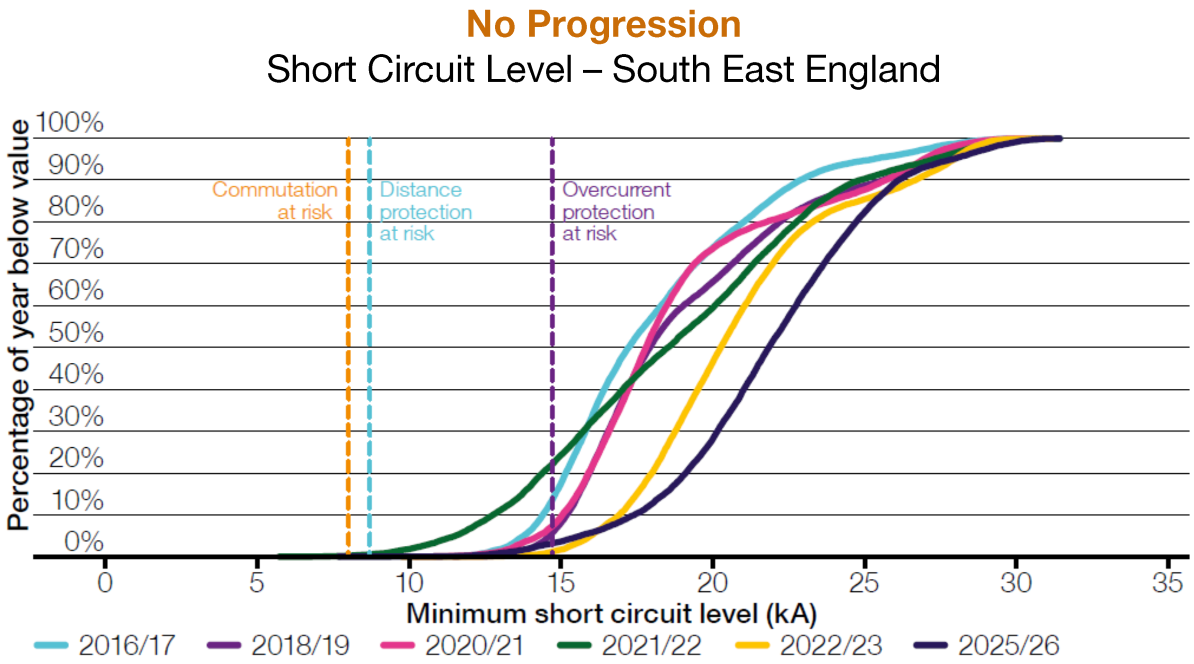
The largest decreases occur in regions where large plant is due to close or where it is unlikely to run when transmission demand is low.

Protection



- Protection analysis is based on flexibility case B
- Overcurrent protection is the most vulnerable protection type
- Protection approaches or settings need to be reviewed as short circuit level decreases

Protection



- Commutation function and other control behaviours of non-synchronous sources can be impacted by low short circuit level

- Additional equivalent fast fault current could help the stability and function of current connections to our network

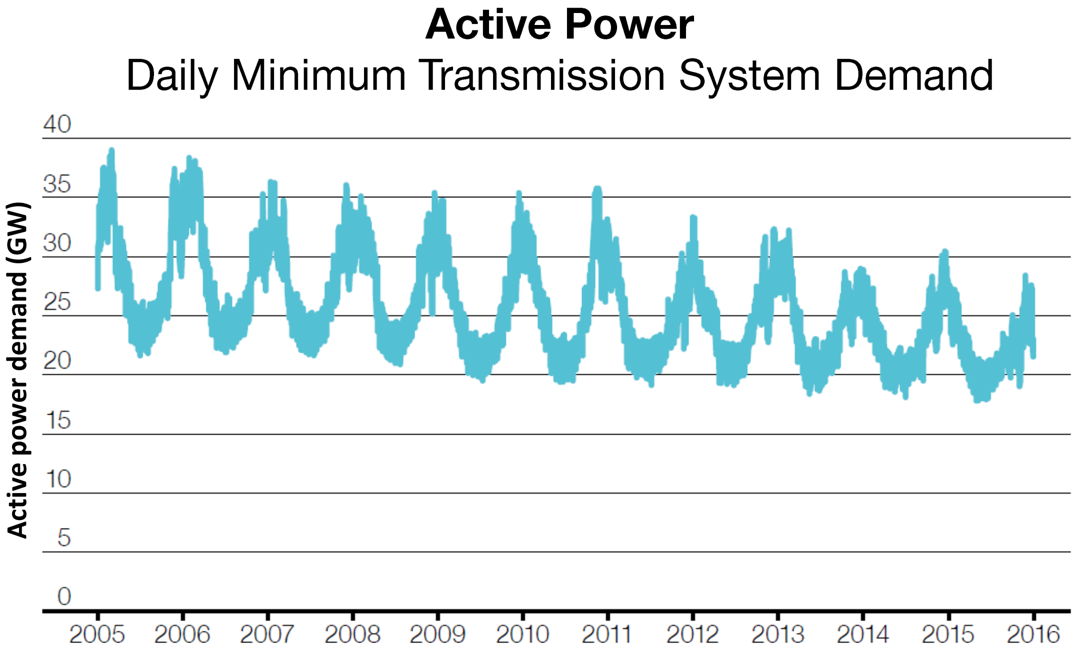
Insights

Regional system strength will be lower and more variable when limited synchronous generation is running.

The largest decreases occur in regions where large plant is due to close or where it is unlikely to run when transmission demand is low.

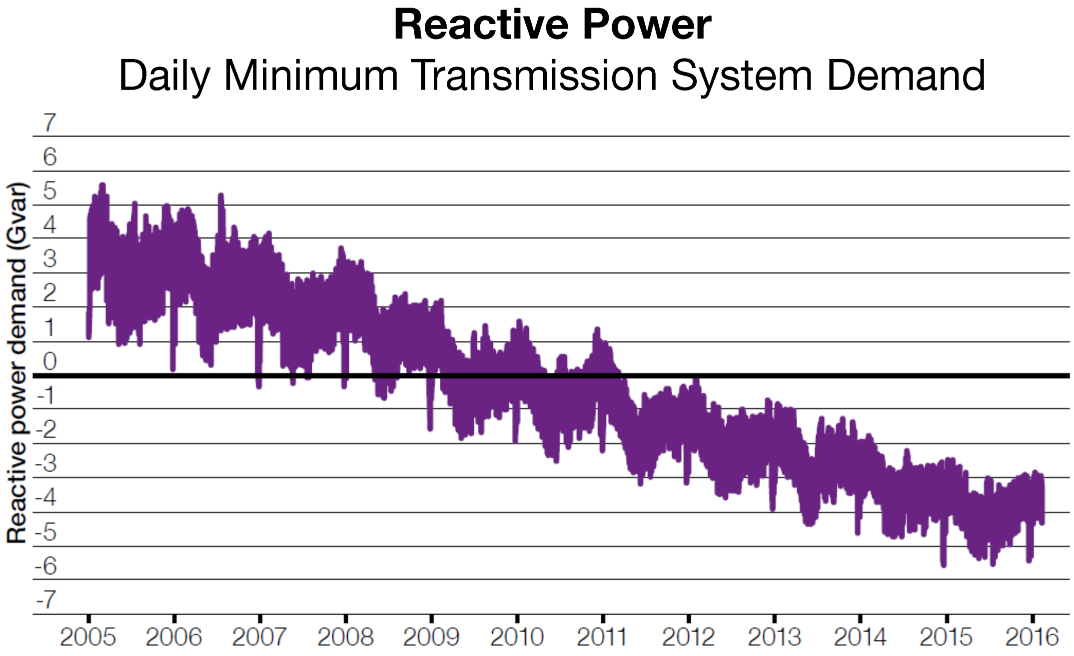
Existing network protection approaches may not be able to identify faults when system strength is low.

Demand changes



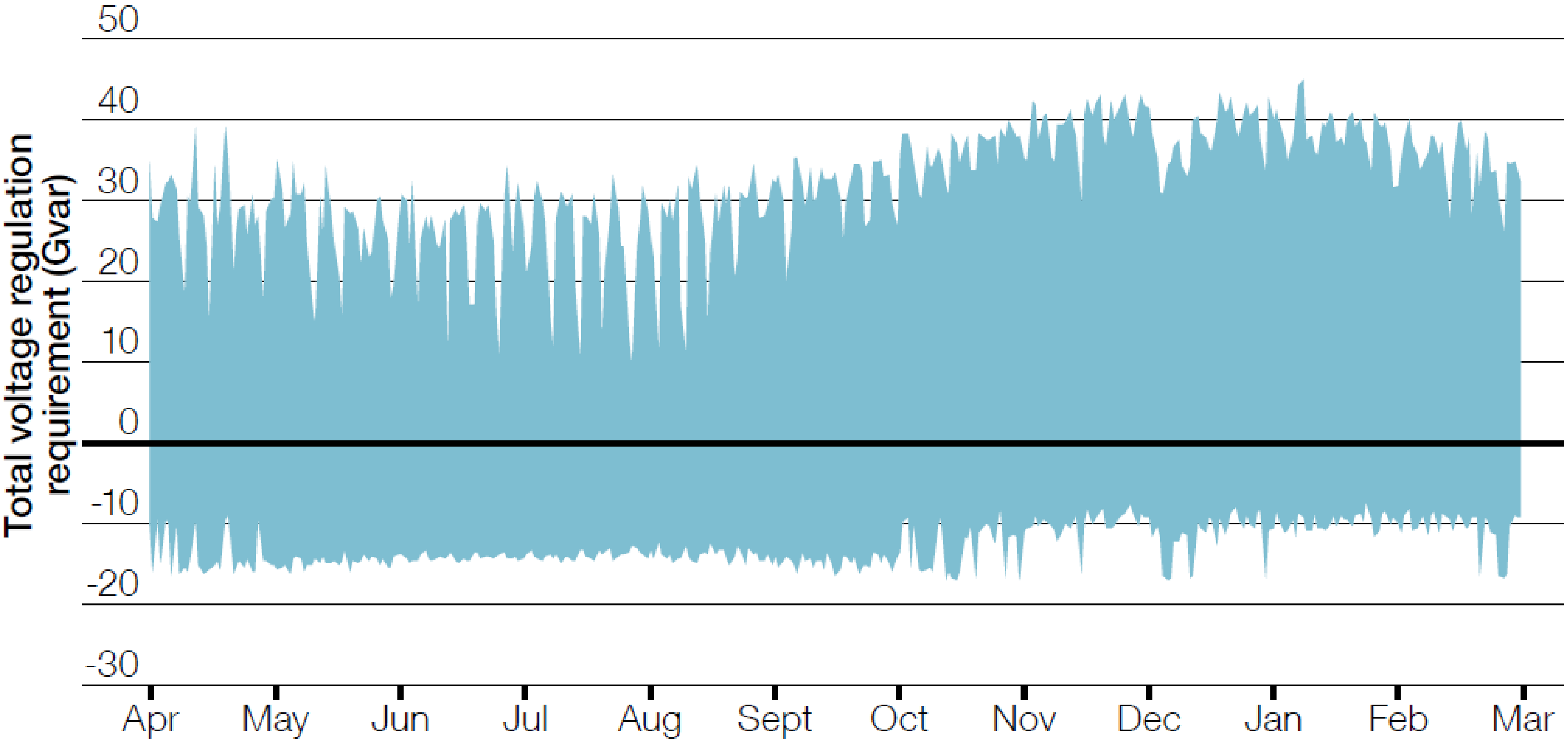
- Daily minimum active power demand has been falling, although peak demands show less change
- According to the Future Energy Scenarios, these trends are expected to continue over the next decade
- More time is spent at lower levels as the decade progresses

Demand changes

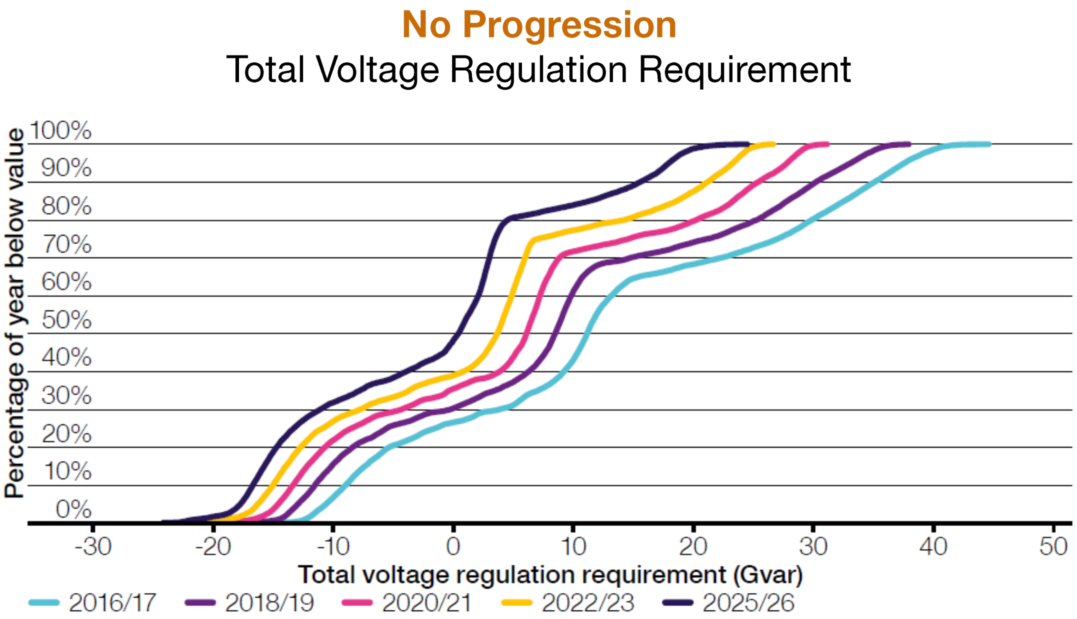


- The system moves daily between a requirement for generation of reactive power to support peak demands to absorption over periods of lower demand
- Periods where additional reactive absorption are required exceed those where reactive generation is required throughout each year.
- Reactive power absorption requirements frequently exceed the active power demand, which leads to high voltage

Reactive power regulation



Voltage regulation requirement



- The total reactive power absorption required over the next 10 years will increase
- The time at these levels increases throughout the decade when:
  - distribution of transmission connected generation changes
  - flows within distribution and transmission systems change
  - SCL is low
  - reactive power demand reduces

Insights

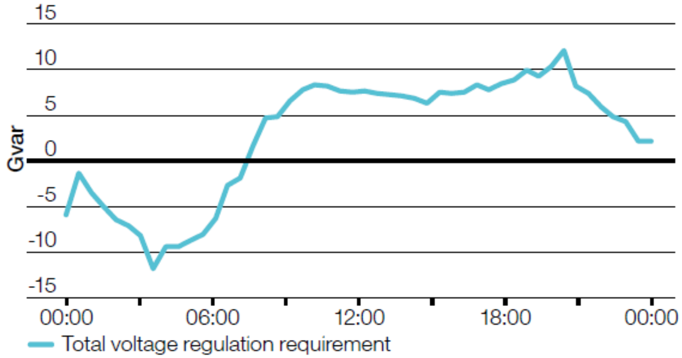
Regional system strength will be lower and more variable when limited synchronous generation is running.

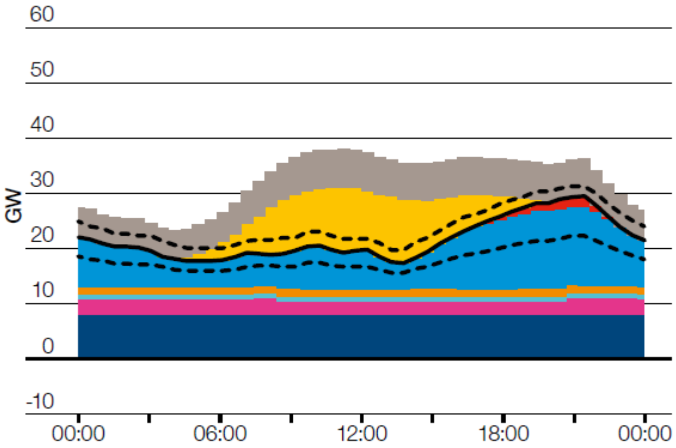
The largest decreases occur in regions where large plant is due to close or where it is unlikely to run when transmission demand is low.

Existing network protection approaches may not be able to identify faults when system strength is low.

Additional reactive power generation and absorption is required to manage wider and more volatile voltage profiles.

Voltage management example





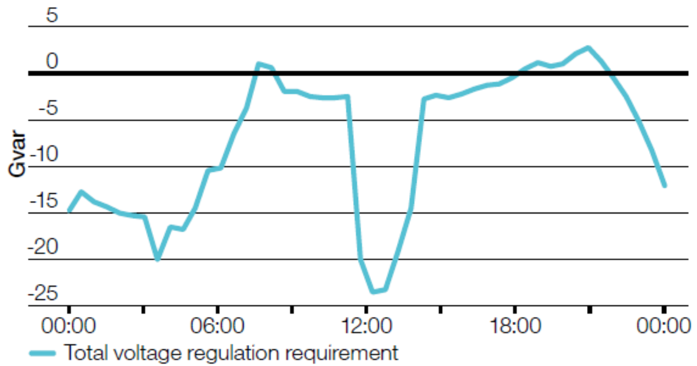
2016/17 - Summer Minimum Demand

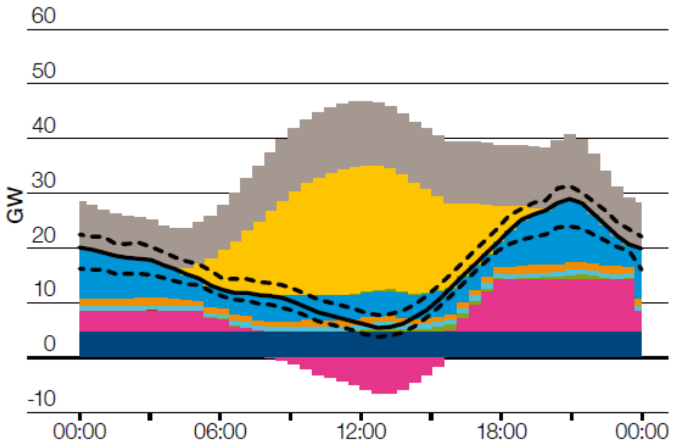
Reactive power demand moves from reactive power absorption to reactive power generation throughout the day.

It broadly following the shape of the transmission system active power demand profile.

The largest change in reactive power occurs in the morning as active power demand picks up.

Voltage management example





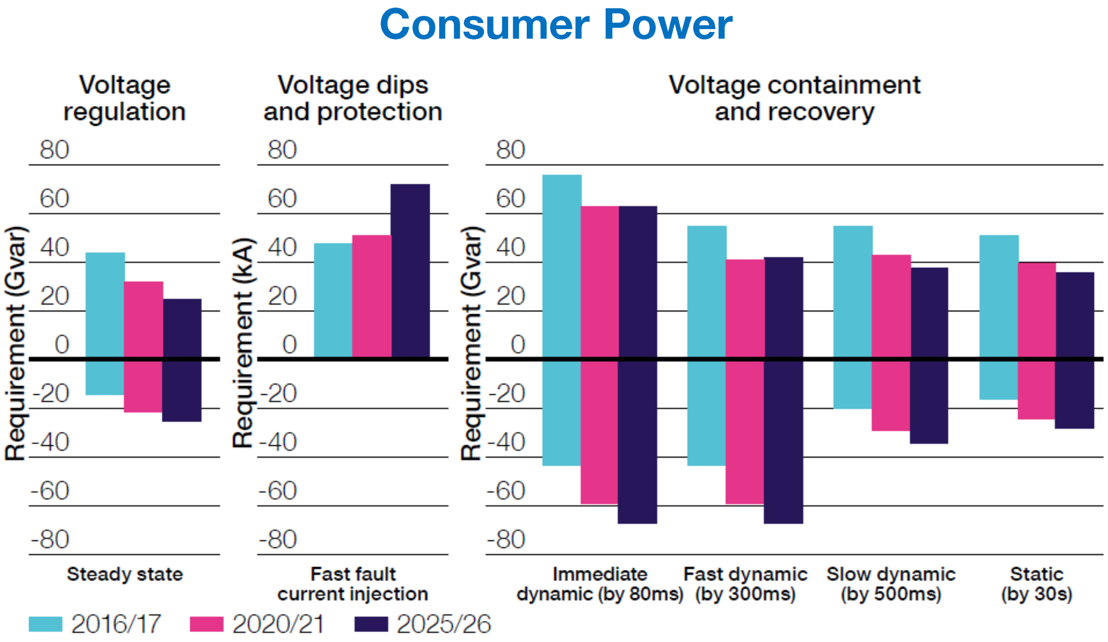
2024/25 - Summer Minimum Demand

The reactive power demand profile no longer follows the active demand profile throughout the day.

Early afternoon solar maximum leads to a rapid increase in reactive absorption support

Largest change in reactive power occurs over a 2-hour period leading up to the solar maximum.

Dynamic reactive power requirement

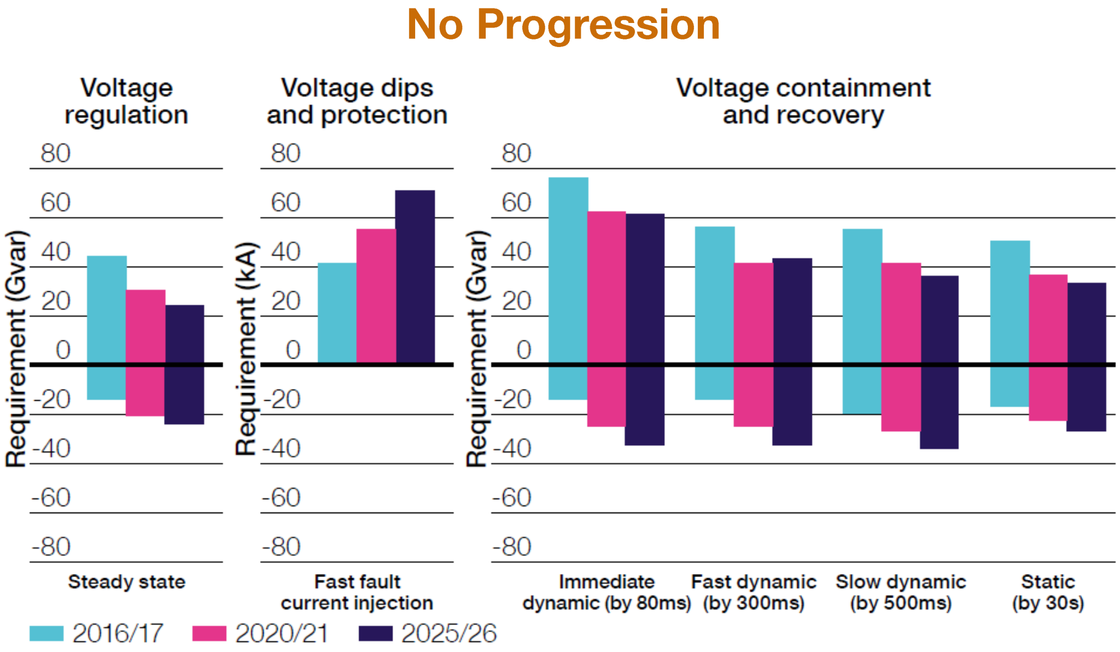


<u>Voltage regulation</u>
Increased requirement for reactive power absorption

<u>Voltage dips and protection</u>
Assess current protection approach as short circuit level declines

<u>Voltage containment and recovery</u>
Increased requirement for dynamic reactive power support

Dynamic reactive power requirement



Voltage regulation
Increased requirement for reactive power absorption

Voltage dips and protection
Assess current protection approach as short circuit level declines

Voltage containment and recovery
Increased requirement for dynamic reactive power support

Insights

Regional system strength will be lower and more variable when limited synchronous generation is running.

The largest decreases occur in regions where large plant is due to close or where it is unlikely to run when transmission demand is low.

Existing network protection approaches may not be able to identify faults when system strength is low.

Additional reactive power generation and absorption is required to manage wider and more volatile voltage profiles.

A greater proportion of the voltage control resources will need to be dynamic in the steady state, during and after disturbances.

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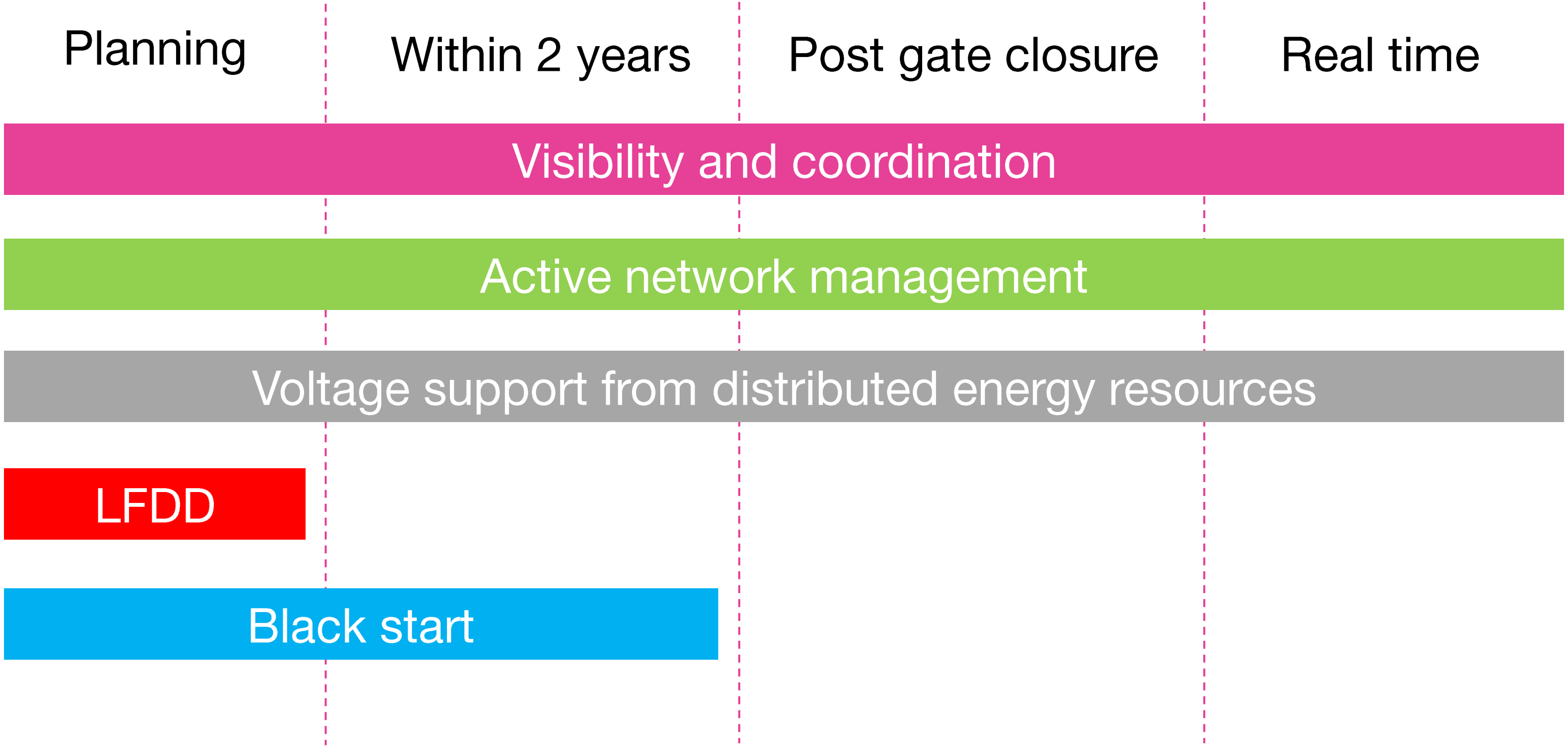
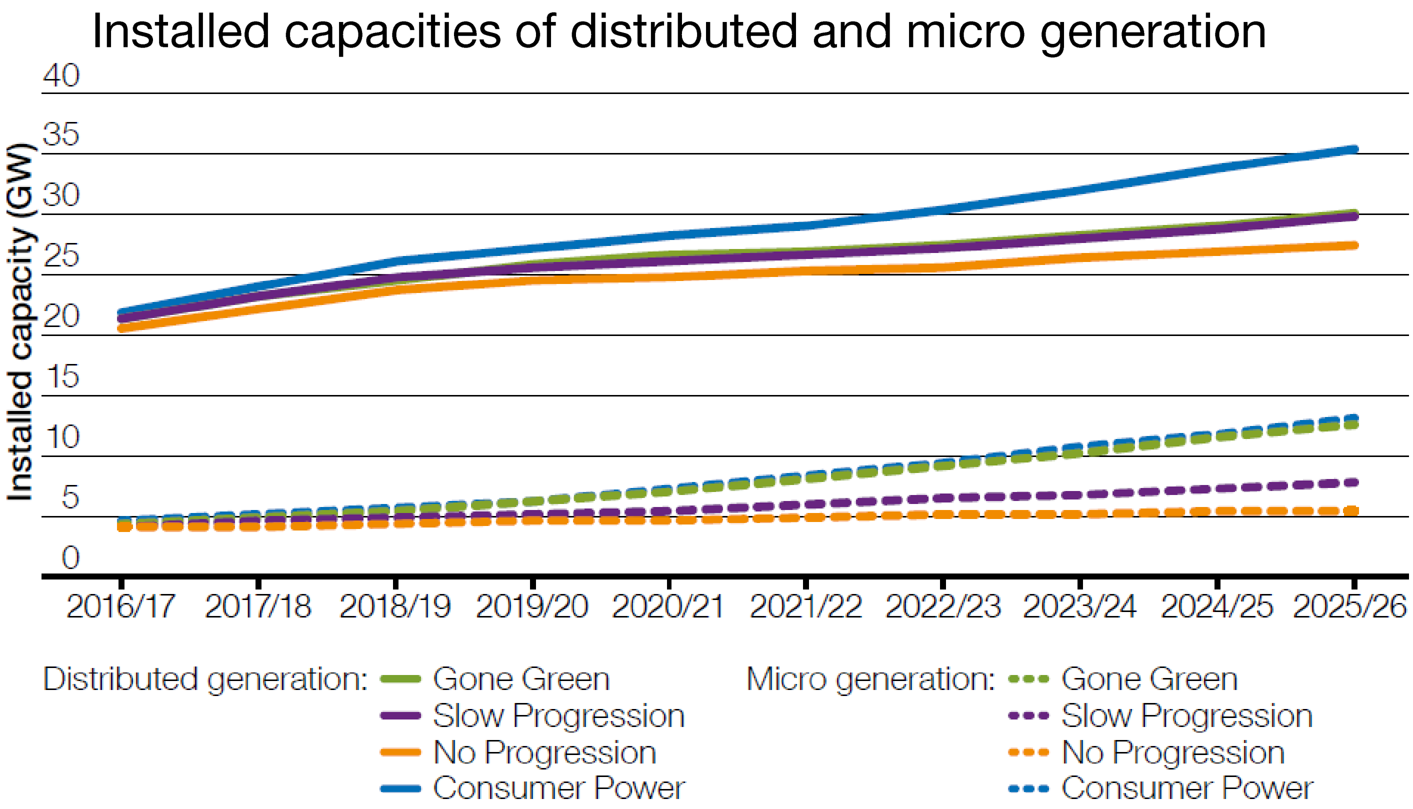
Whole System Coordination

Ben Marshall – Technical Specialist
Yun Li – Power Systems Engineer
William Ramsay – Power Systems Engineer

Whole system coordination



Visibility and coordination



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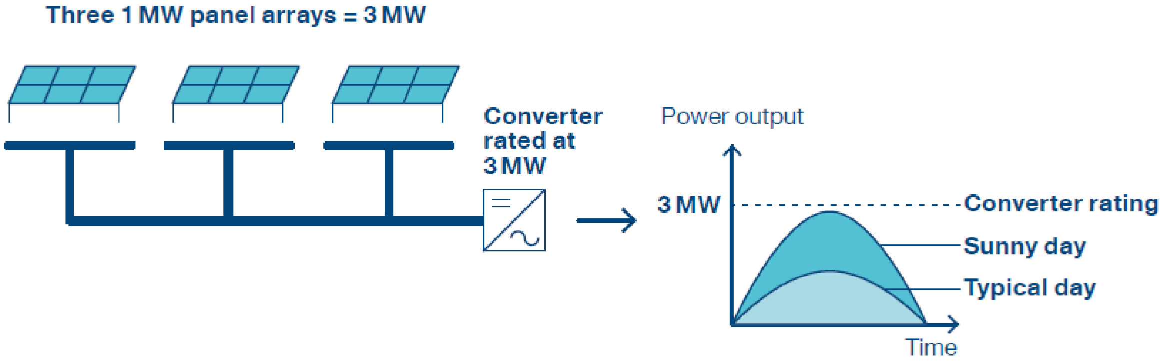
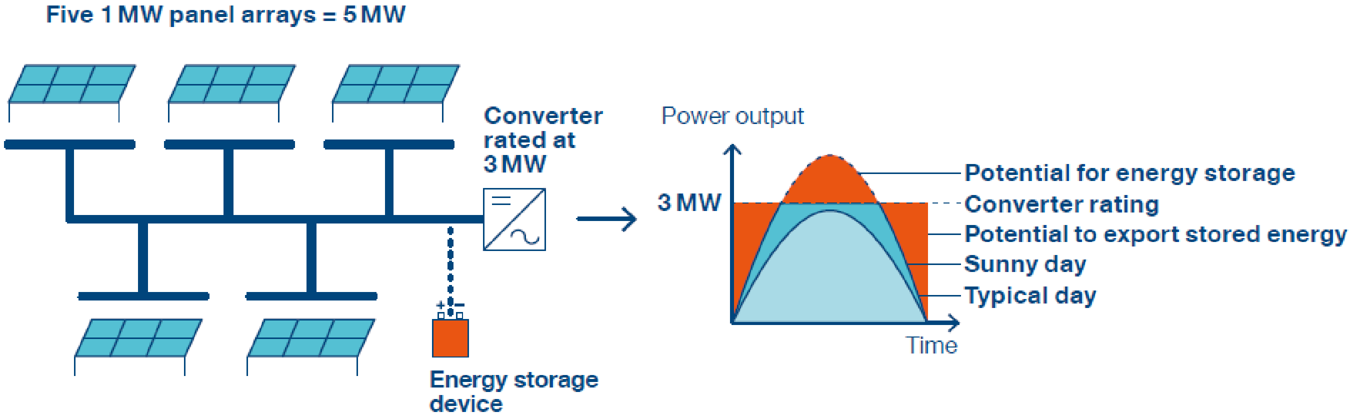
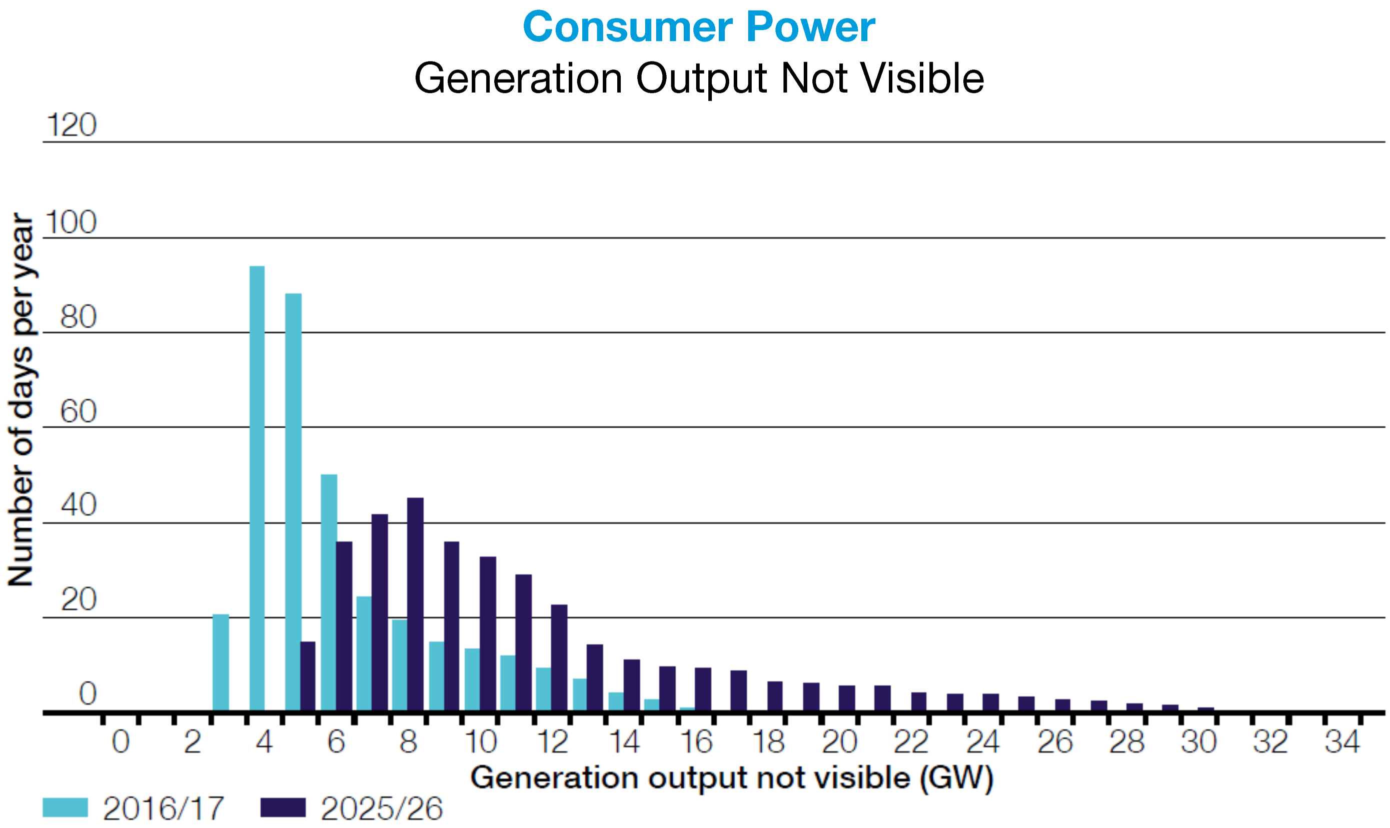
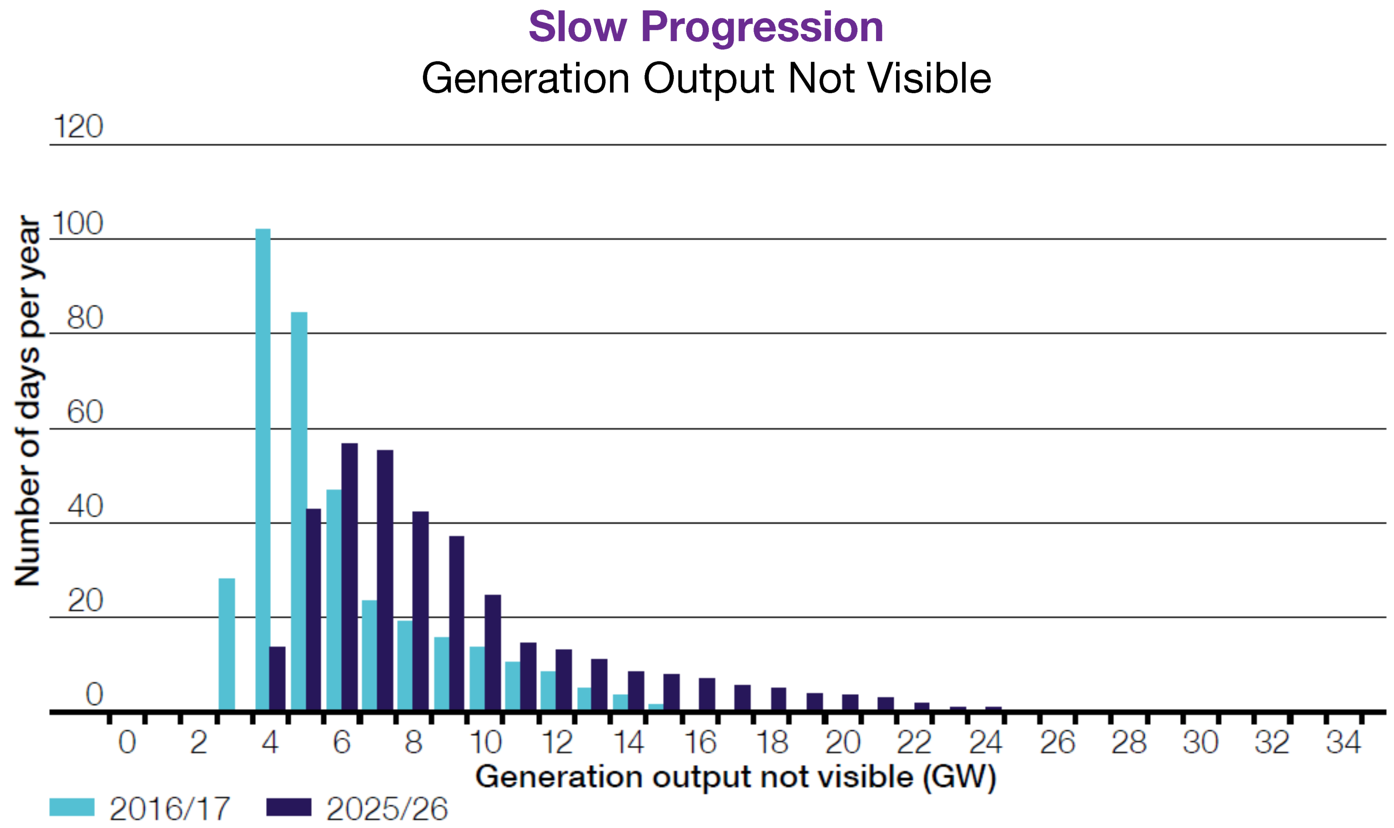




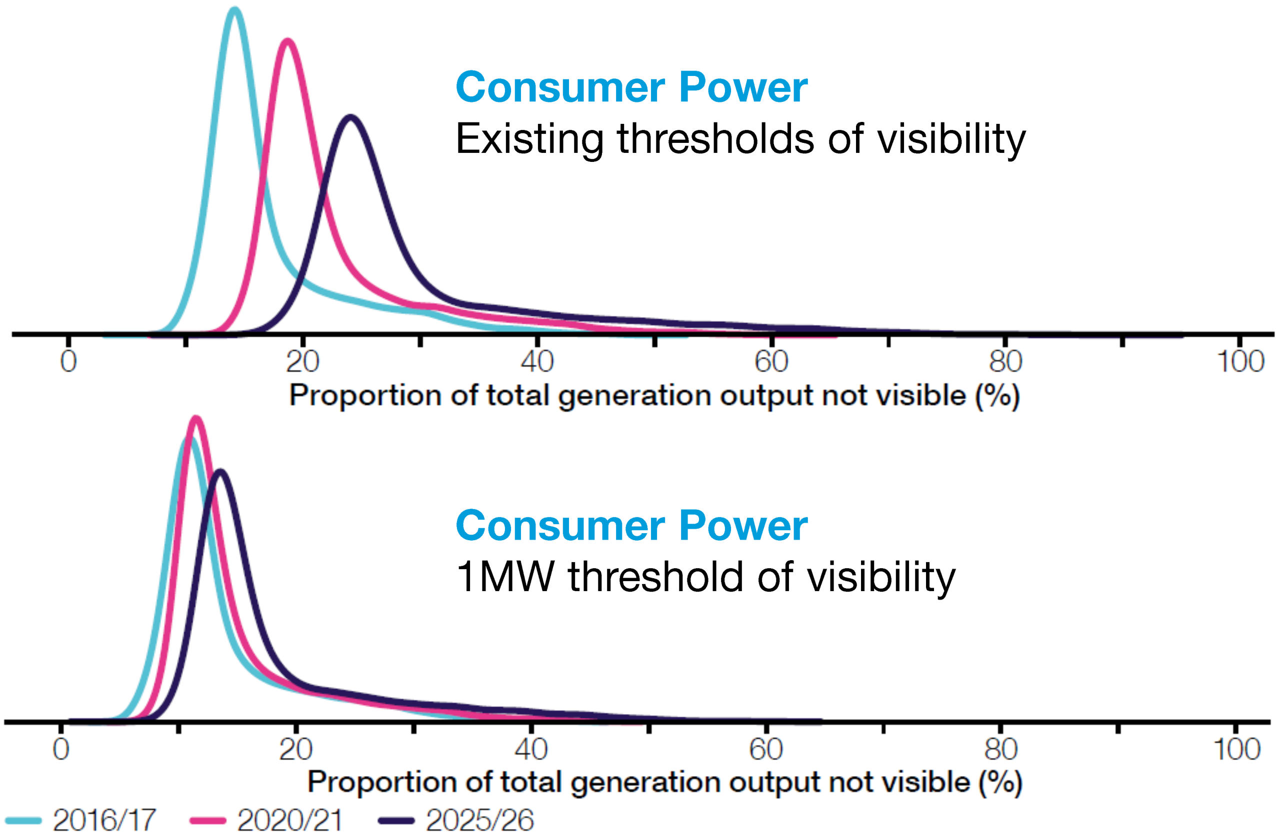
Visibility and coordination



Visibility and coordination



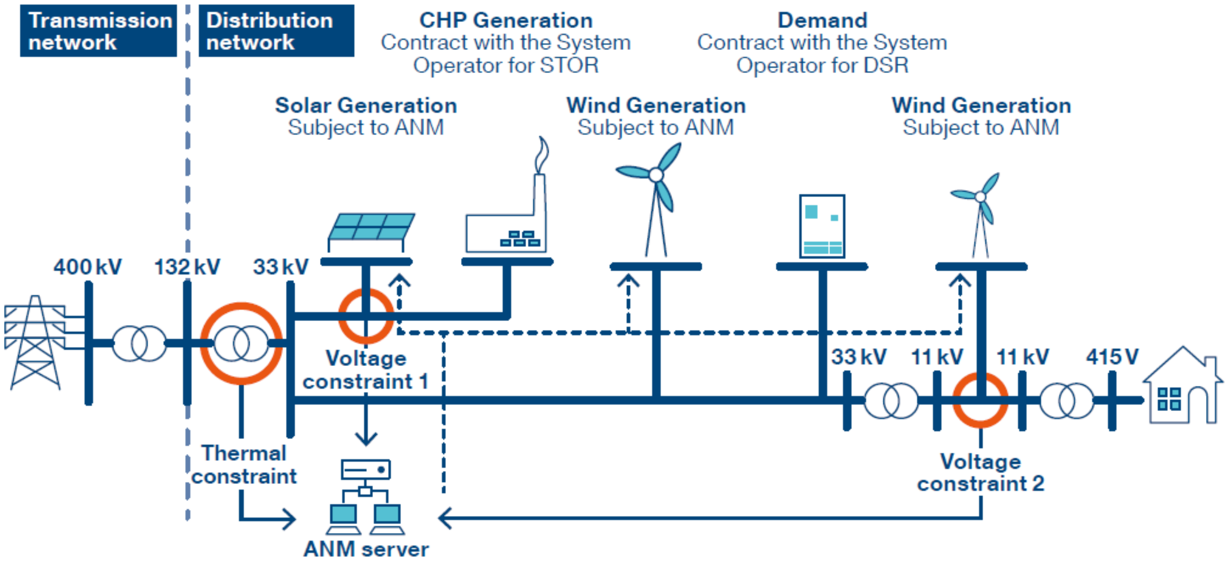
Thresholds of visibility



Insights

An increasing amount of generation is not visible to the system operator, which increases uncertainty in balancing and operability.

Active network management

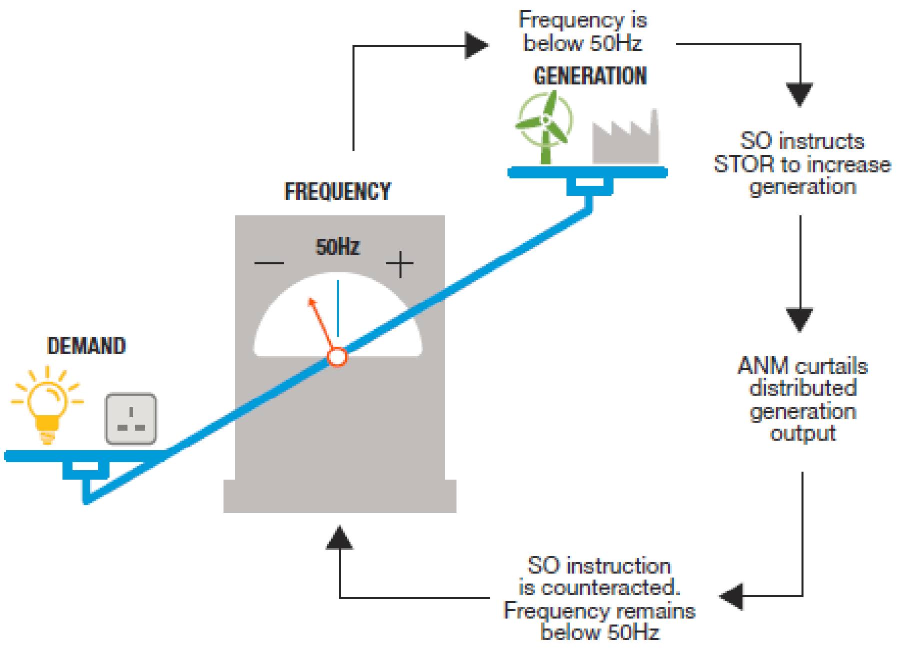


- Increasing penetration of distributed generation would trigger network reinforcement
- ANM helps to maximize network utilisation and facilitates distributed generation connection
- It controls the output of distributed generators according to the state of the network

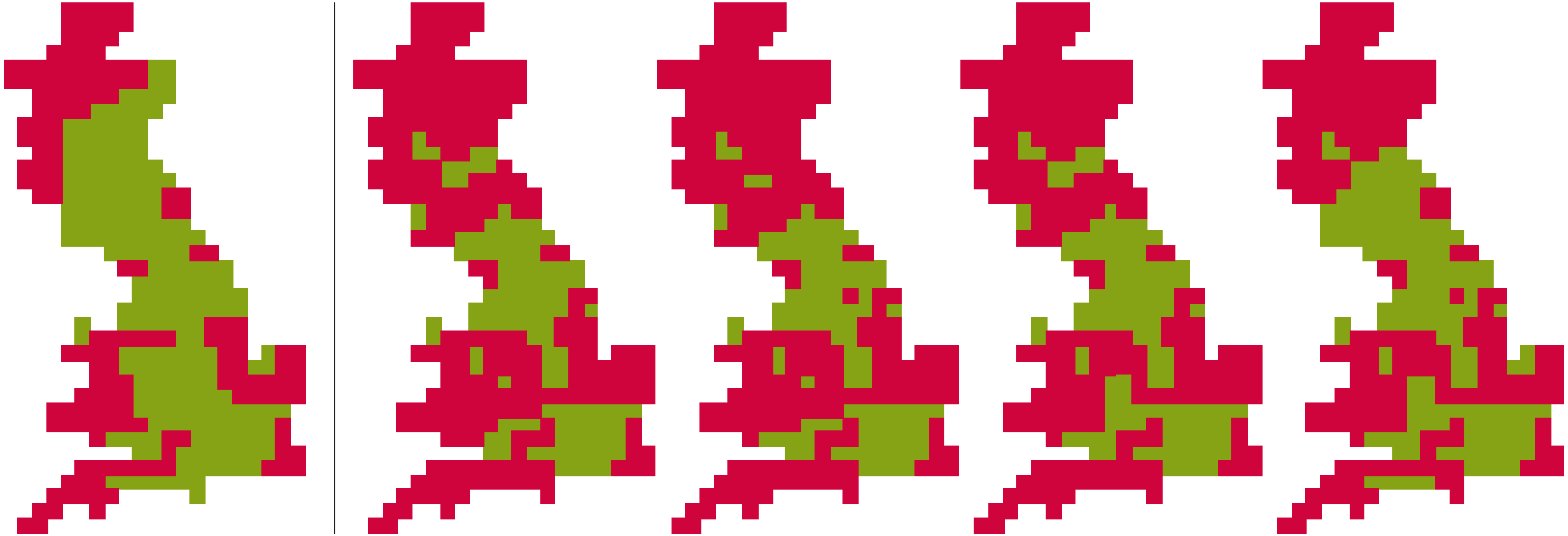
Coordination of ANM

- Without coordination, ANM will increase uncertainty in requirements and affect the balancing actions of the transmission system operator.

- Enhanced planning and operational coordination between DNOs and the transmission system operator are necessary for the future efficient development of ANM



Development of ANM



2016/17

2020/21 Gone Green

2020/21 Consumer Power

2020/21 Slow Progression

2020/21 No Progression

ANM not likely to be required

ANM likely to be required without network investment

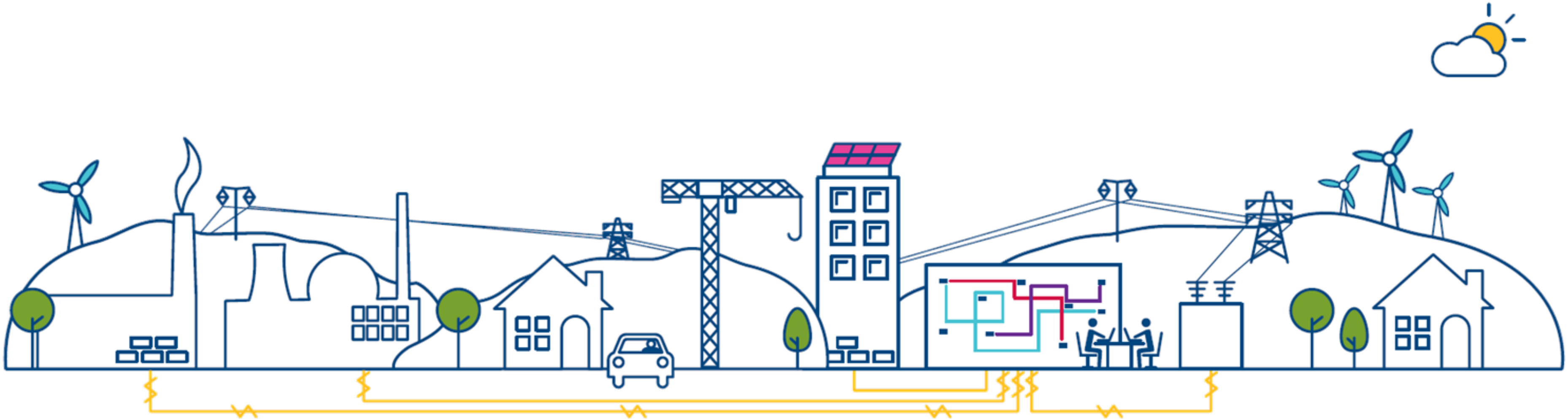
Insights

An increasing amount of generation is not visible to the system operator, which increases uncertainty in balancing and operability.

Uncoordinated Active Network Management will increase uncertainty and restrict market access for potential providers of flexibility.

Transmission and Distribution Interface 2.0 (TDI 2.0)

Biljana Stojkovska – Project Lead



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Distributed energy resources have the potential to deliver enhanced transmission system voltage control with new control approaches.

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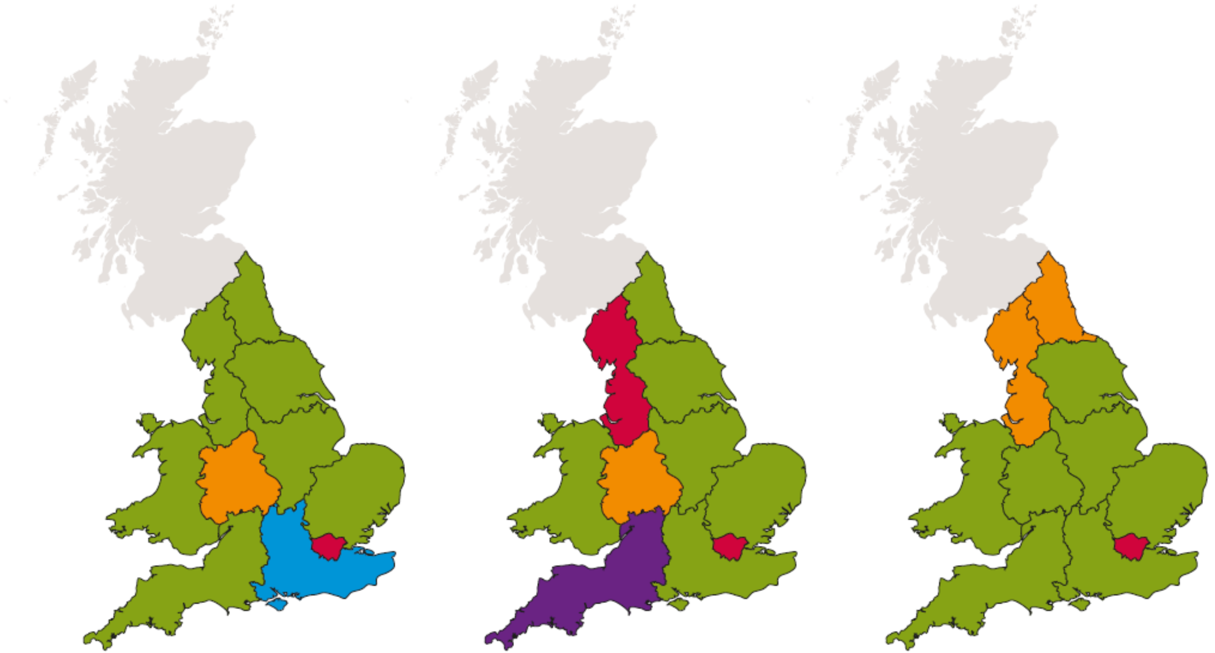
Low Frequency Demand Disconnection



Summer minimum demand | Sunny day | Windy day

Demand Disconnected:

- 45% or less
- 45% – 50%
- 55% – 65%
- 65% – 70%
- 70% or more

Insights

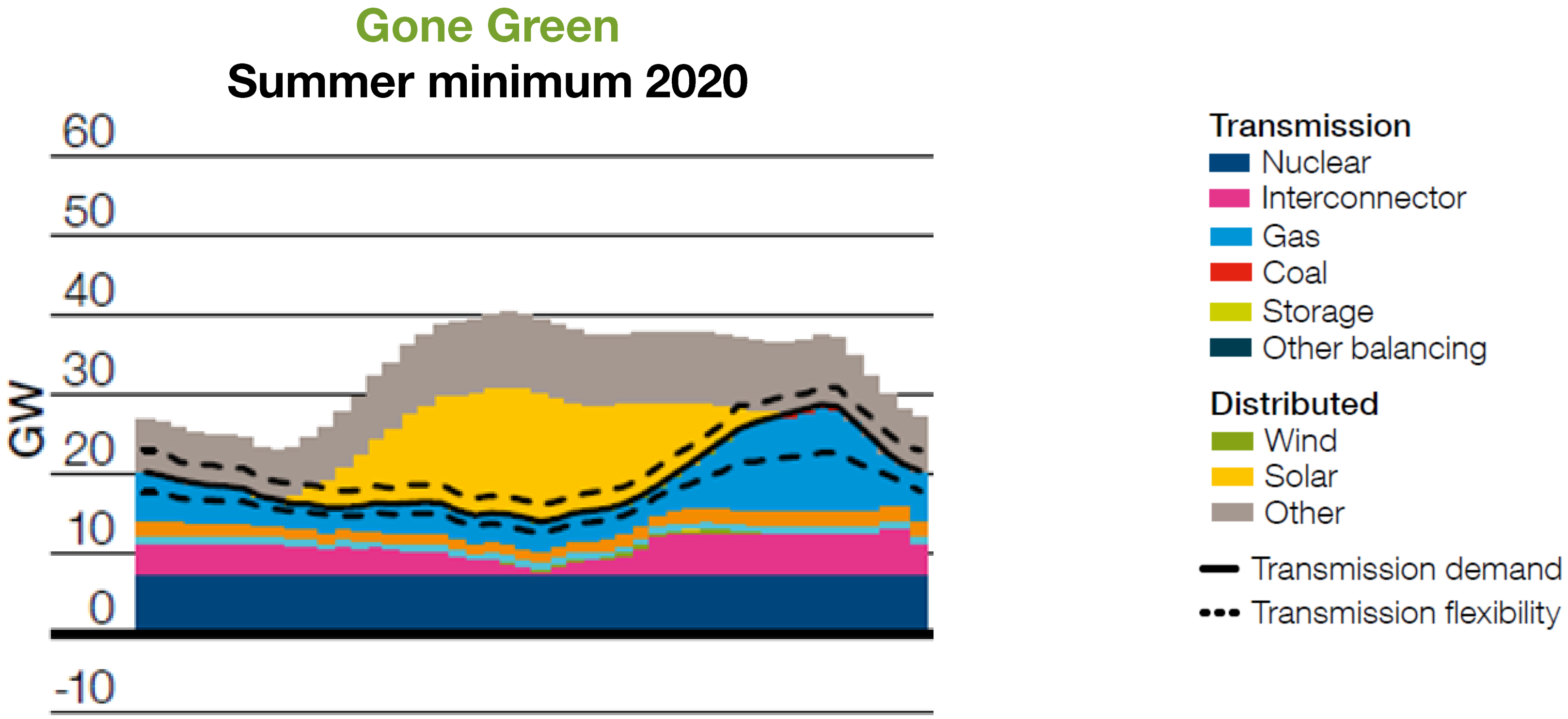
An increasing amount of generation is not visible to the system operator, which increases uncertainty in balancing and operability.

Uncoordinated Active Network Management will increase uncertainty and restrict market access for potential providers of flexibility.

Distributed energy resources have the potential to deliver enhanced transmission system voltage control with new control approaches.

Growth in distributed generation could reduce the effectiveness of the emergency strategy of low frequency demand disconnection.

Black Start



Gone Green
Summer minimum 2020
60
50
40
30
20
10
0
-10
GW
Transmission
Nuclear
Interconnector
Gas
Coal
Storage
Other balancing
Distributed
Wind
Solar
Other
Transmission demand
Transmission flexibility

Insights

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Uncoordinated Active Network Management will increase uncertainty and restrict market access for potential providers of flexibility.

Distributed energy resources have the potential to deliver enhanced transmission system voltage control with new control approaches.

Growth in distributed generation could reduce the effectiveness of the emergency strategy of low frequency demand disconnection.

There is an ongoing requirement to develop the black start strategy and consider alternative approaches to system restoration.

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Progress and Next Steps

Audrey Ramsay - Future Operability & Incentives Manager
Adam Sims – Ancillary Services Flexibility Expert

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Progress Since SOF 2015

Adam Sims – Ancillary Services Flexibility Expert

Enhanced Frequency Response

Dynamic frequency response *<1 sec frequency response*

Tender Process

37 companies submitted
64 unique sites
1.2GW

Tender Acceptance

8 tenders
201MW storage assets
£66m over 4 years

Service Delivery

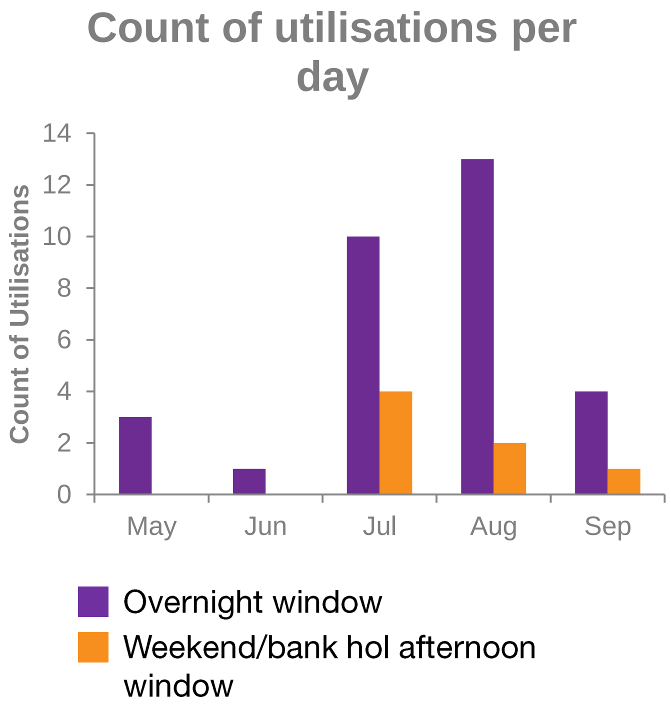
By early 2018

Coming up…

System Operability Framework 2016	*30 Nov 16*
Power Responsive Storage Working Group	*5 Dec 16*
Future service opportunities	*Spring 17*

Demand Turn Up

- Introduced for negative reserve from demand side providers
- 323 uses May-September 2016, totalling 10,800 MWh
- 4.3 hours average service delivery
- £61.41 average utilisation price
- Majority of instructions during overnight period
- Increase in usage from July as wind speeds increased
- Service shared with Western Power Distribution
- 2017 service under development



What Are We Doing in 2017?

Audrey Ramsay - Future Operability & Incentives Manager

Spring 2017 Publication

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Future and existing requirements

Interaction between requirements

Increased Transparency

Industry engagement

Road map to longer term goals

Why Are We Doing This?

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- You have told us you need:

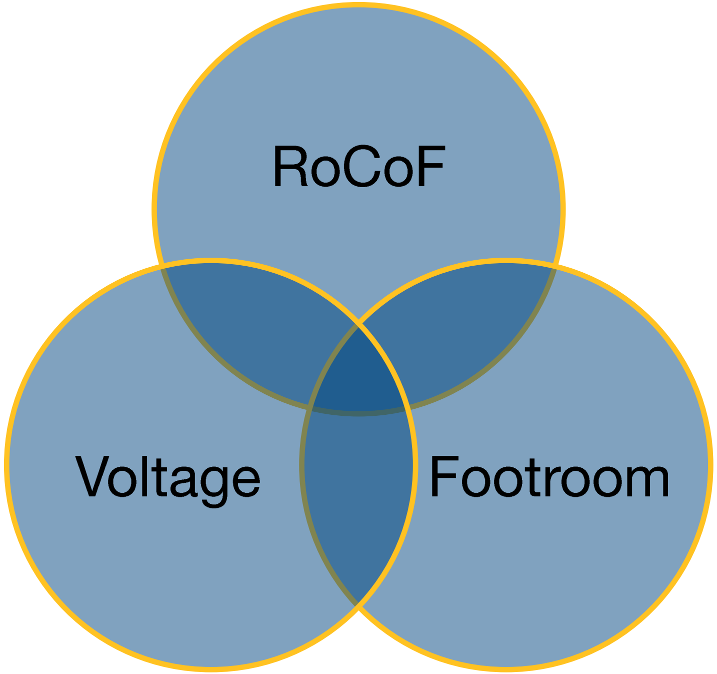
Easy access to pricing data and contractual terms and conditions to decide whether to pursue

More transparency in bilaterally contracted services - all prices should be made available for analysis

Better website and consistency in data

Summer 2017 Requirements

- RoCoF
  - Inertia provision
- Voltage
  - Increased options for footroom
  - Wind farms to provide MVARs during low wind
- Flexibility (low demand periods)
  - Visibility of Non BM generation
  - Increased options for footroom
  - Increased volume of demand turn up
  - Flexibility from nuclear plant



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2017 and Beyond

Adam Sims – Ancillary Services Flexibility Expert

2017 and Beyond – Flexibility Programme

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INVESTABLE MARKET FOR ALL

2016

Perception that market is focused on existing technologies

2021

An energy system that delivers value to the end consumer

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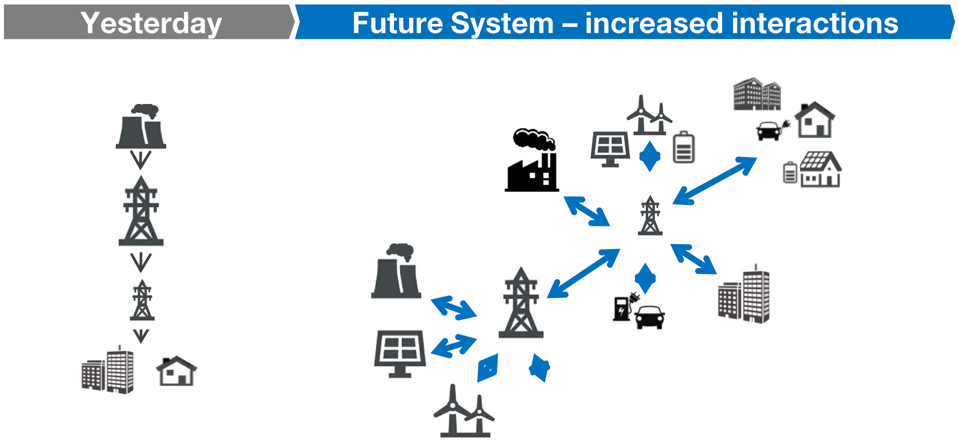
Flexibility Programme



- **Key outcome: Contributes to the creation of markets which allow all participants to effectively purchase what they need at minimum cost and deliver social welfare equilibrium**

Four areas of delivery

- **Information Provision**
- **Shared services framework**
- **Simplify product**
- **Structural market change**

Flexibility – Summary of Goals

- Greater clarity on the requirements of the system
- Lower barriers to entry for flexibility providers
- Unlocking value stacking between different market participants (e.g. SO/Supplier, SO/DNO)
- Wider range of flexibility suppliers and improved product landscape to provide better commercial signals
- Clear shared vision of the appropriate future market framework and clear road map to increased investor confidence

Continuing the Conversation

All material relating to SOF 2016 is available online:
www.nationalgrid.com/sof

Contact us via email:
sof@nationalgrid.com