Welcome

The webinar will begin shortly after 2pm

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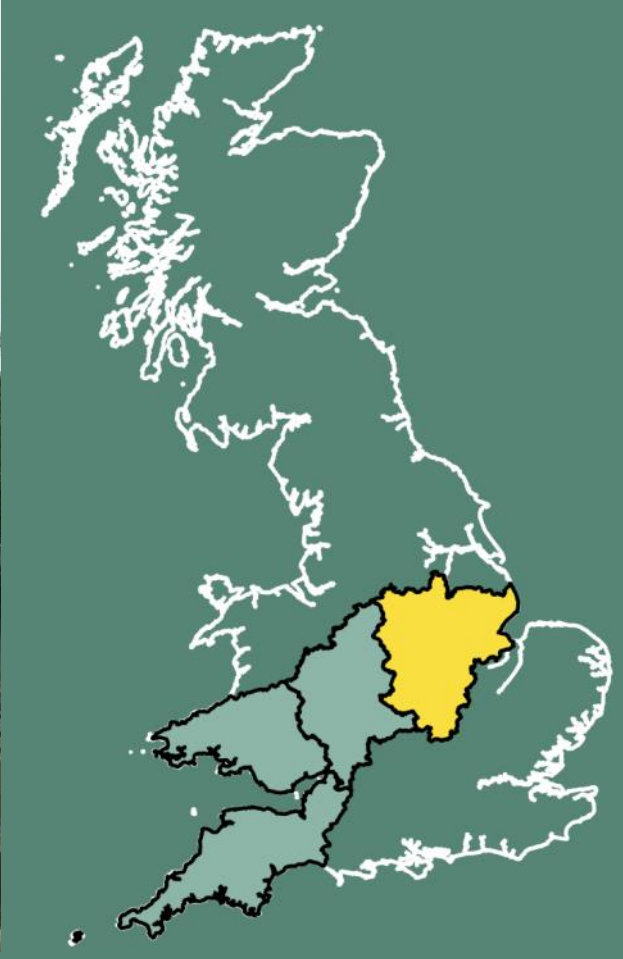

Shaping Subtransmission to 2030

East Midlands
2017 studies

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Agenda

- Welcome & Questions
- Study Objectives
- East Midlands Background
- Scenarios and Modelling
- Results
- Recommendations
- Looking to the Future

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Objectives

- Forecast growth of demand and generation over four economic and environmental scenarios;
- Assess the thermal and voltage constraints under these scenarios that will limit the ability of new demand and generation connections to take place;
- Better understand fault level trends by undertaking high level studies;
- Assess options for reinforcement;
- Provide stakeholders with advance notice of likely constraints; and
- Provide recommendations for ‘low regret’ investment.

Background

- Network designed for demand
- Current maximum demand above 5GW and minimum demand below 1.9GW
- Unprecedented growth of DG in East Midlands:

	Connected [MVA]	Accepted [MVA]	Offered [MVA]	Enquired [MVA]	Total [MVA]
Energy Storage	-	278	222	883	**1,384**
Photovoltaic	1,249	477	74	526	**2,325**
Wind	600	118	42	-	**759**
All Other Generation	1,467	1,090	537	596	**3,689**
Grand Total	**3,316**	**1,962**	**874**	**2,005**	**8,157**

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Background

- Significant usage of inherent capacity by connected and contracted generation
- Due to both cost and timescales for reinforcement, alternative connection arrangements or connections elsewhere increasingly preferred by generation
- Both distribution reinforcement requirements and Statement of Works (SoW) process have caused uncertainty and difficulties for generation customers to commit investment in their projects
- Whilst volumes of applications for large scale connections have fallen the cost of the technology continues to go down and, excluding significant grid reinforcement costs, price parity for large (>10MW) solar could be reached by 2020

Committee on Climate Change report June 2016

- Key message – while sufficient progress in low carbon generation has been made to meet the committee's indicators for 2020,
  - '*longer term development of low carbon capacity is at risk and not consistent with achieving carbon intensity below 100gCO_2/kWh by 2030*'
  - '*To reduce emissions at lowest cost, policy should provide a route to market for onshore wind and solar, ensuring that cost effective projects are able to compete fairly with other technologies and obtain long-term contracts at a price that implies no additional subsidy'*

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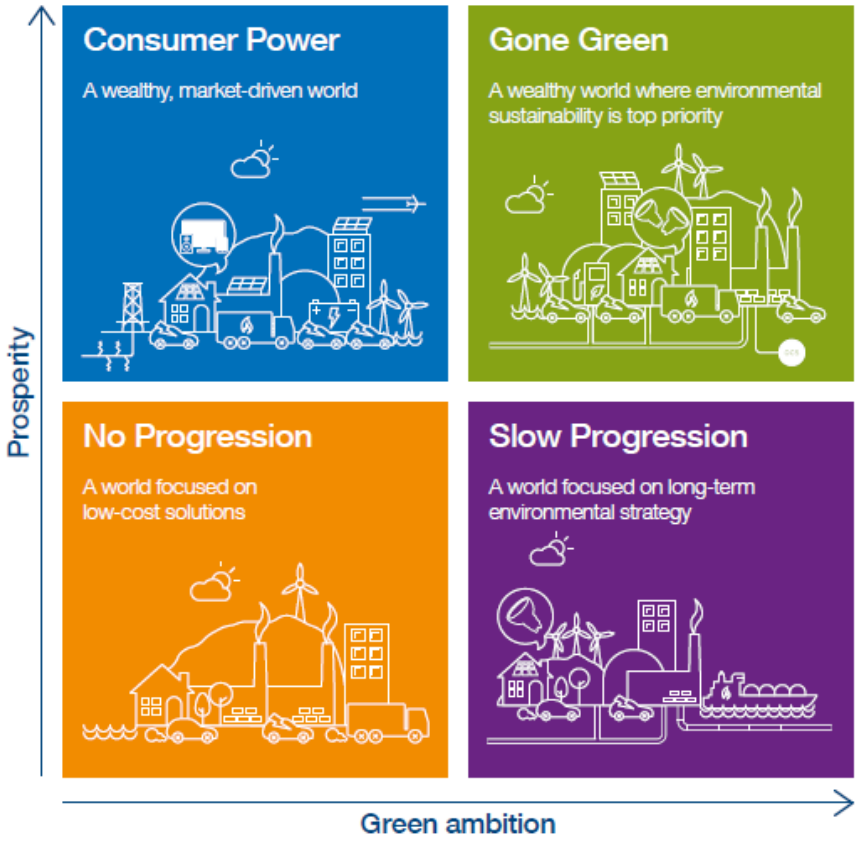
Scenarios

- Growth of:
  - Domestic, industrial and commercial demand
  - Distributed generation (DG)
  - Heat pumps (HPs)
  - Electric vehicles (EVs)
  - Battery storage

  in East Midlands forecast by Regen SW from 2016 to 2030
- Four scenarios corresponding to NGT FES:
  - Gone Green
  - Consumer Power
  - Slow Progression
  - No Progression



Graphic from National Grid's Future Energy Scenarios in five minutes, July 2016

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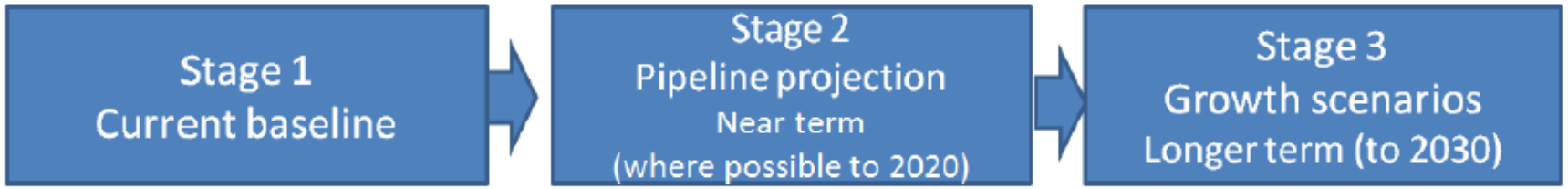
Scenarios – methodology



Current data
Use and validate existing DG capacity and demand data to set baseline

Pipeline projection
DG projects w/connection agreement and in planning system
Growth estimate for small scale FIT and new projects
Demand projection

Long term energy potential
- Long term energy assessment
- Developable resource
- Market Assessment
- Demographics
- New technology potential

Analysis by:
1) Technology type
2) BSP Areas
3) GIS mapping
4) Historic growth trend

Constraints/ factors:
1) Grid constraints
2) Policy - RO/CFD/FIT cap and subsidy
3) Planning system
4) Technology (TRL)

Apply future energy growth scenarios factors:
1) Gone Green
2) Consumer Power
3) Slow Progression
4) No Progression

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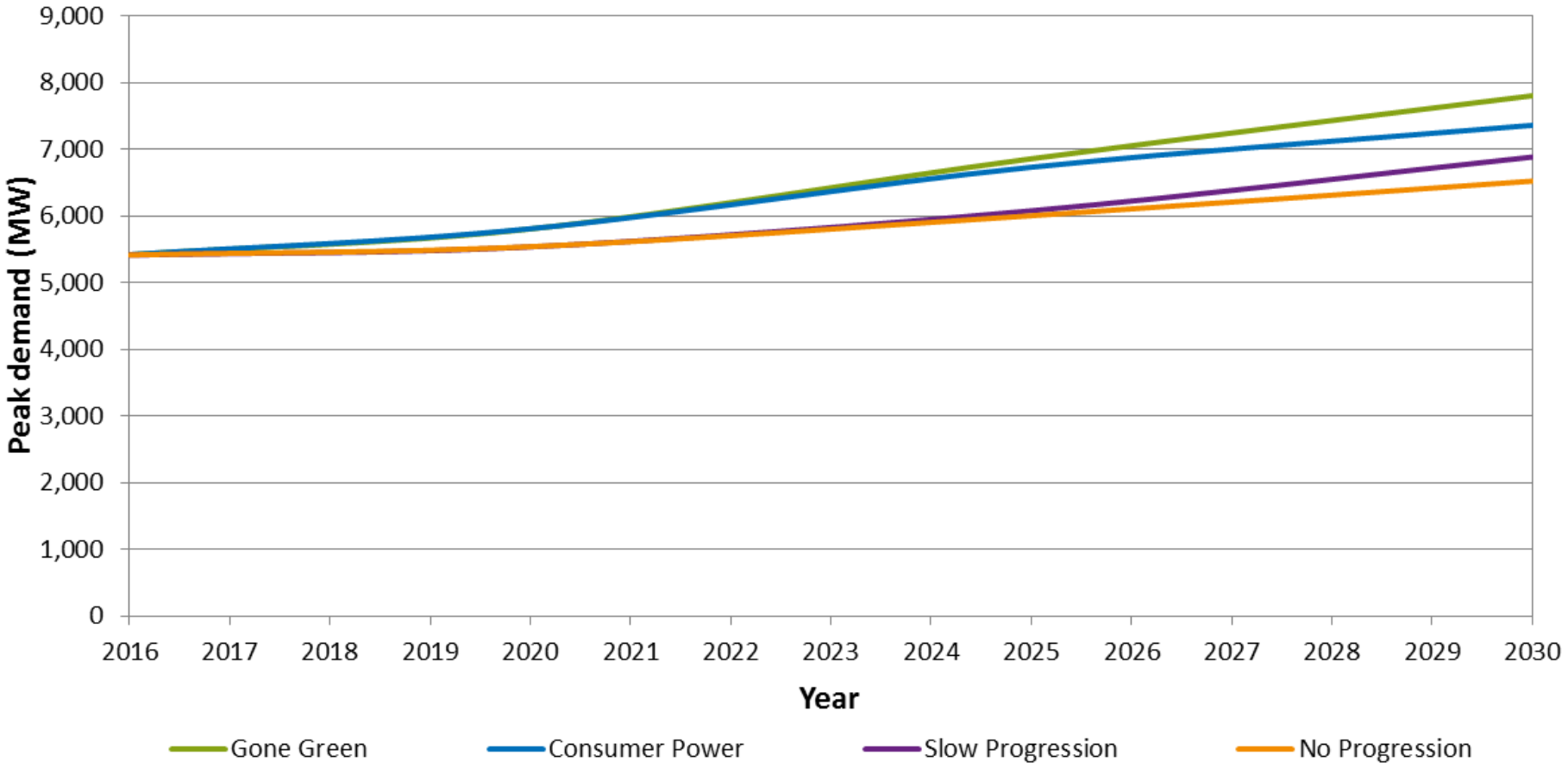
Scenarios – Demand Growth



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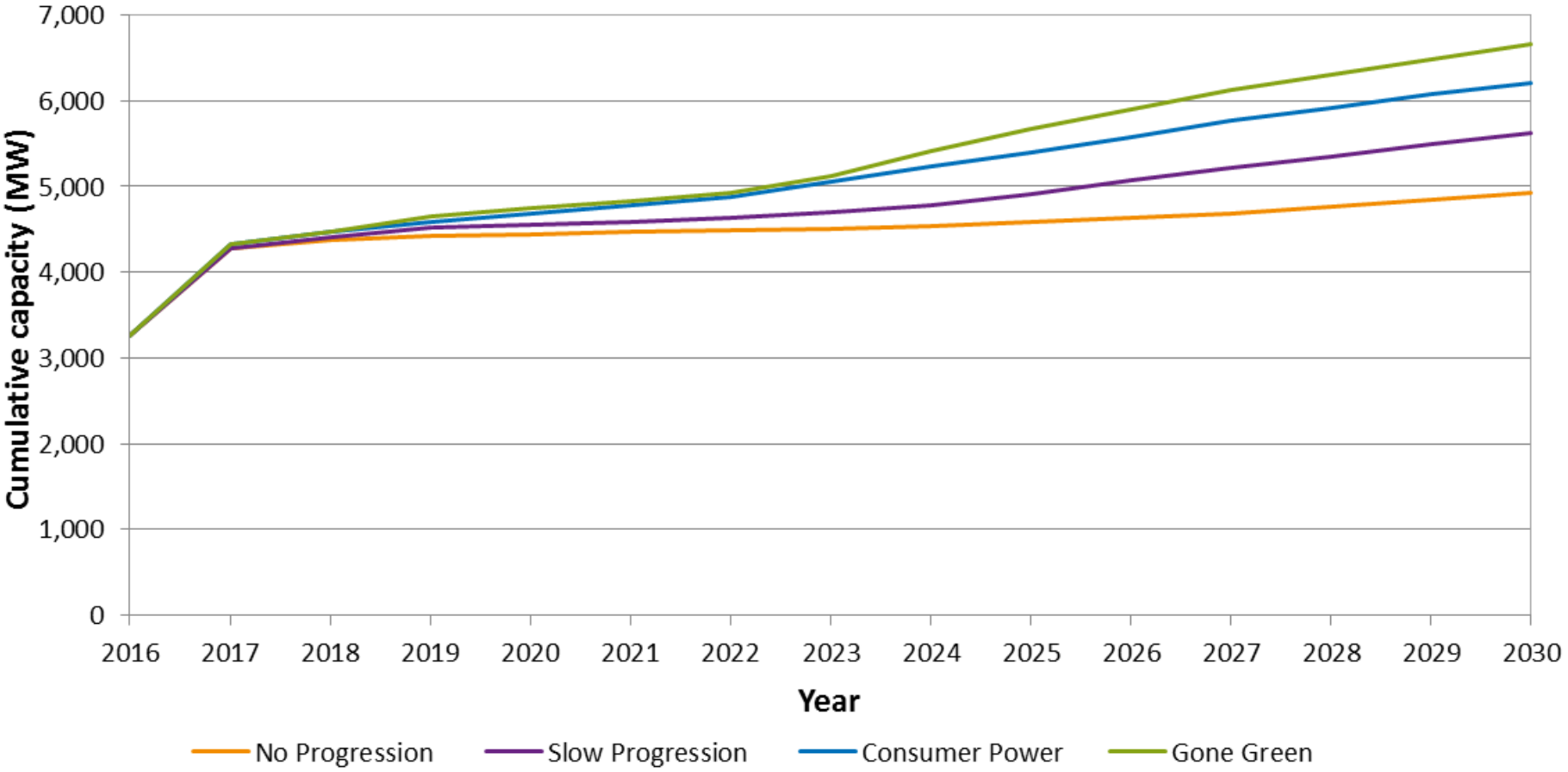
Scenarios – DG Growth



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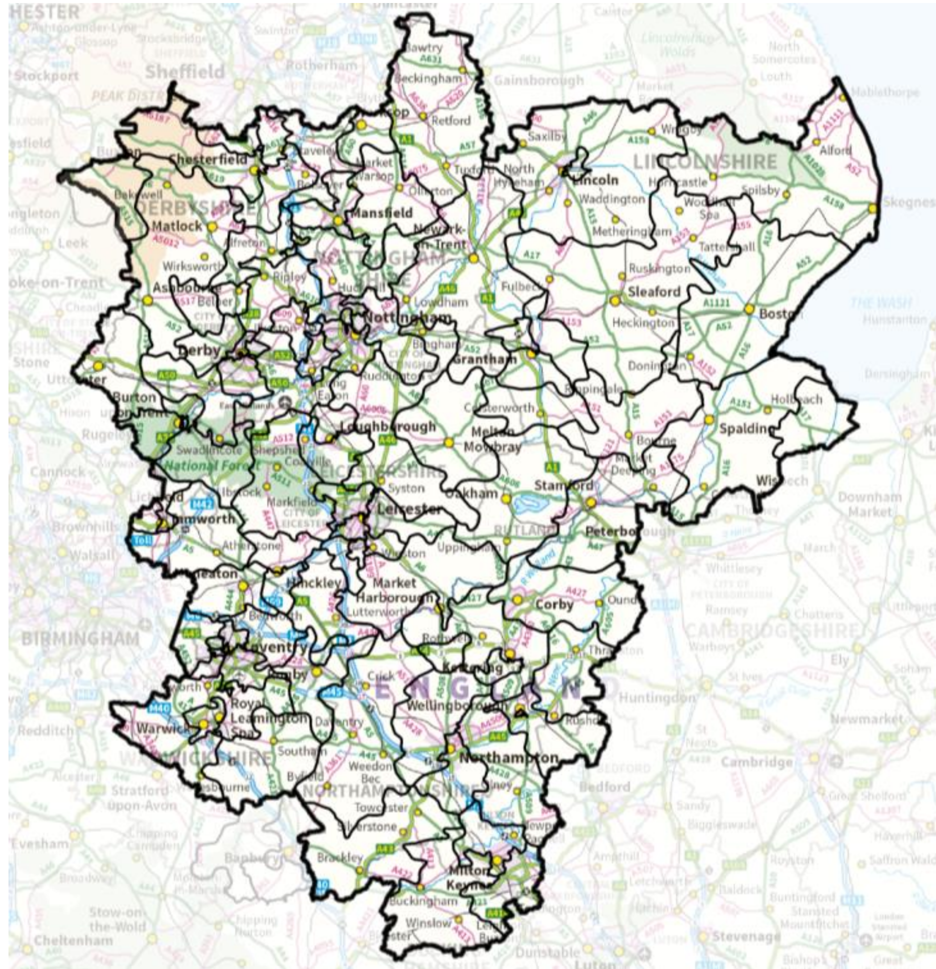
Network modelling

- East Midlands divided into Electricity Supply Areas (ESAs):
  - 132/33kV BSPs
  - 132/11kV BSPs
  - 132kV customers
- Scenarios developed at ESA granularity to provide link between geographical position of developments and WPD's network



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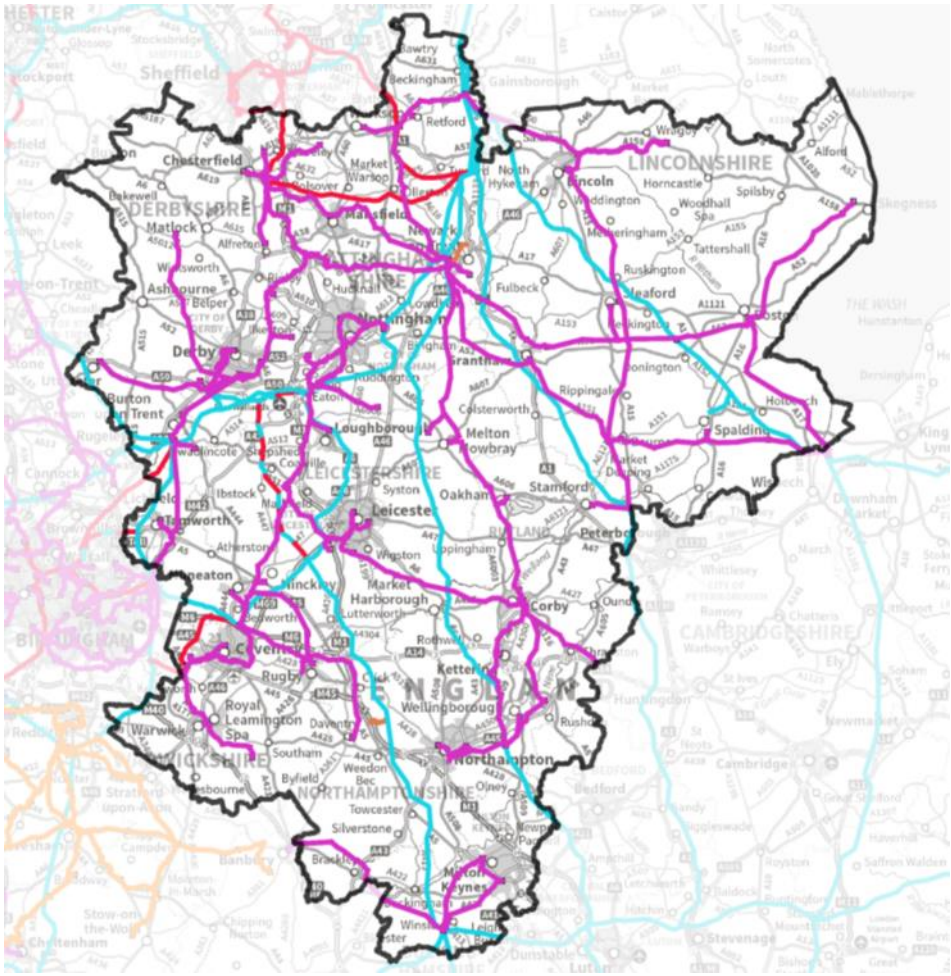
Network modelling

- Focus on the subtransmission network consisting of:
  - GSPs (400 or 275kV to 132kV)
  - 132kV network
  - BSPs (132/33kV and 132/11kV)
- Subtransmission reinforcement often protracted and expensive; requires long-term planning



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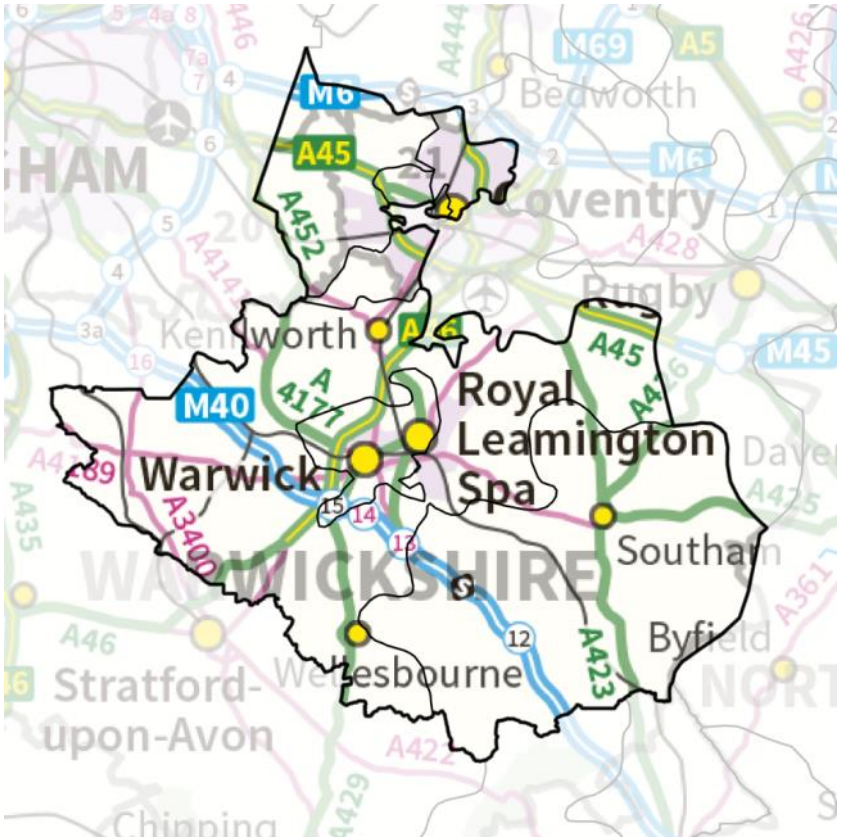
Network modelling

- Traditional analysis has focused on the expected peak/minimum demand conditions. This study modelled each half-hour for:
  - Summer day (DG dominated)
  - Winter day (demand dominated)
  - Typical spring/autumn day
- Intact network, first-circuit outages, second-circuit outages and busbar outages analysed
- Profiles of generation/demand were determined using a combination of historic data logging data modified for technology additions according to the scenario
- Network automation such as intertripping and overload management was modelled
- Analysis was undertaken for the baseline of 2016 and then the scenarios for 2020, 2025 and 2030

Results – Berkswell GSP



- Demand-driven reinforcement
- Hotspots:
  - SGT capacity
- Ongoing:
  - Project ENTIRE
- Proposed:
  - 132kV overhead line reconductoring
  - 132kV cable overlays
  - Potential fourth SGT in 2025

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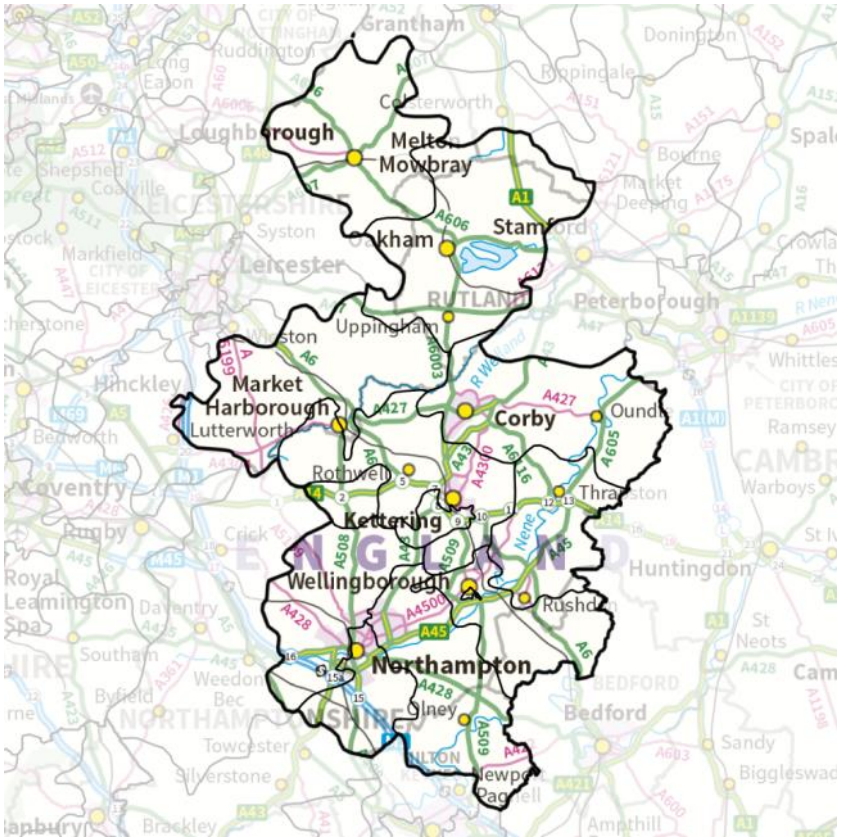
Results – Grendon GSP



- Demand- and DG-driven reinforcement
- Hotspots:
  - SGT capacity (demand and generation)
  - Northampton area (demand)
  - Corby area (generation)
- Ongoing:
  - 132kV overhead line reconductoring
  - 132kV cable overlays
  - ANM
- Proposed:
  - Replant Grendon 132kV to run solid
  - New 132kV circuits to Northampton
  - Potential new GSP in 2025

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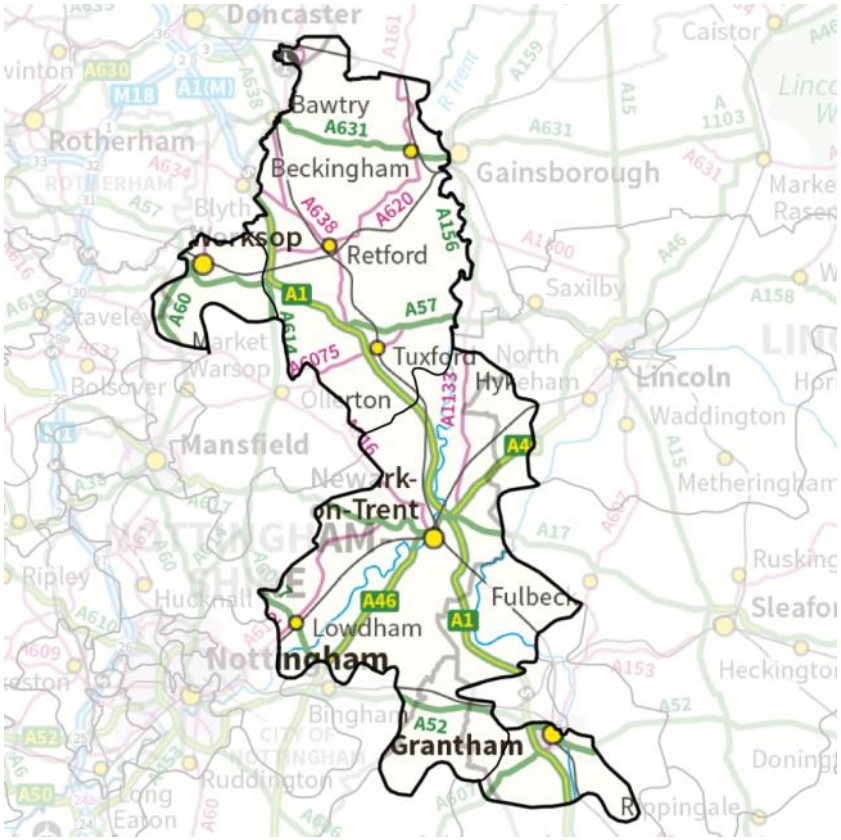
Results – Staythorpe GSP



- Demand- and DG-driven reinforcement
- Hotspots:
  - SGT capacity (demand)
  - Checkerhouse BSP (generation)
  - Hawton BSP (demand)
  - TZ-route (demand and generation)
- Proposed:
  - Third SGT and complete Staythorpe C
  - Larger and additional GTs
  - 132kV overhead line reconductoring
  - 132kV cable overlays

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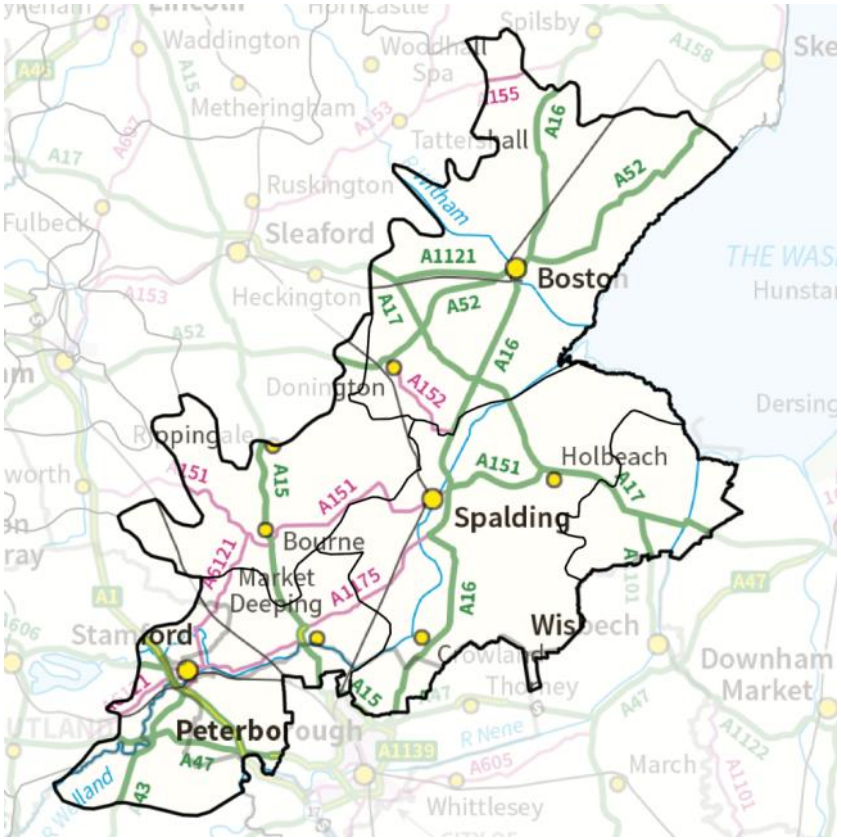
Results – Walpole GSP



- Demand- and DG-driven reinforcement
- Interdependence with UKPN Peterborough network – joint study proposed
- Hotspots:
  - Bourne area network
- Ongoing:
  - Bourne 132kV rebuild
- Proposed:
  - 132kV overhead line reconductoring
  - Additional 132kV switchgear
  - Additional GT

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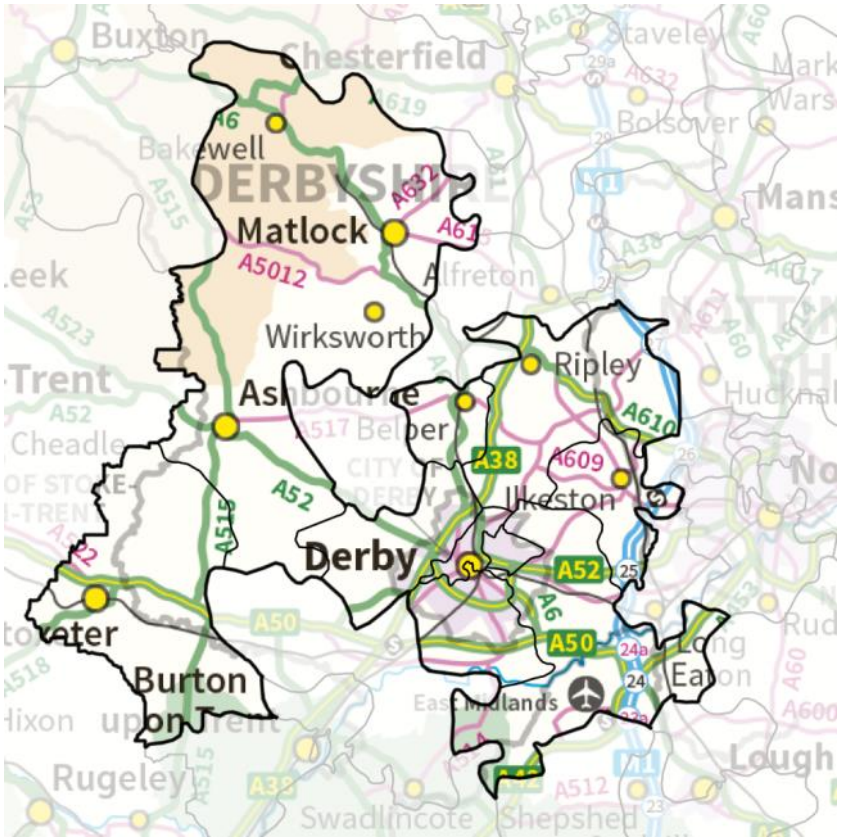
Results – Willington GSP



- Demand-driven reinforcement
- Hotspots:
  - SGT capacity
  - Spondon area
  - Stanton BSP
- Proposed:
  - Replant Willington 132kV to run solid
  - 132kV overhead line reconductoring
  - Larger and additional GTs
  - 132kV cable overlays
  - Larger SGT
  - New 132kV circuit

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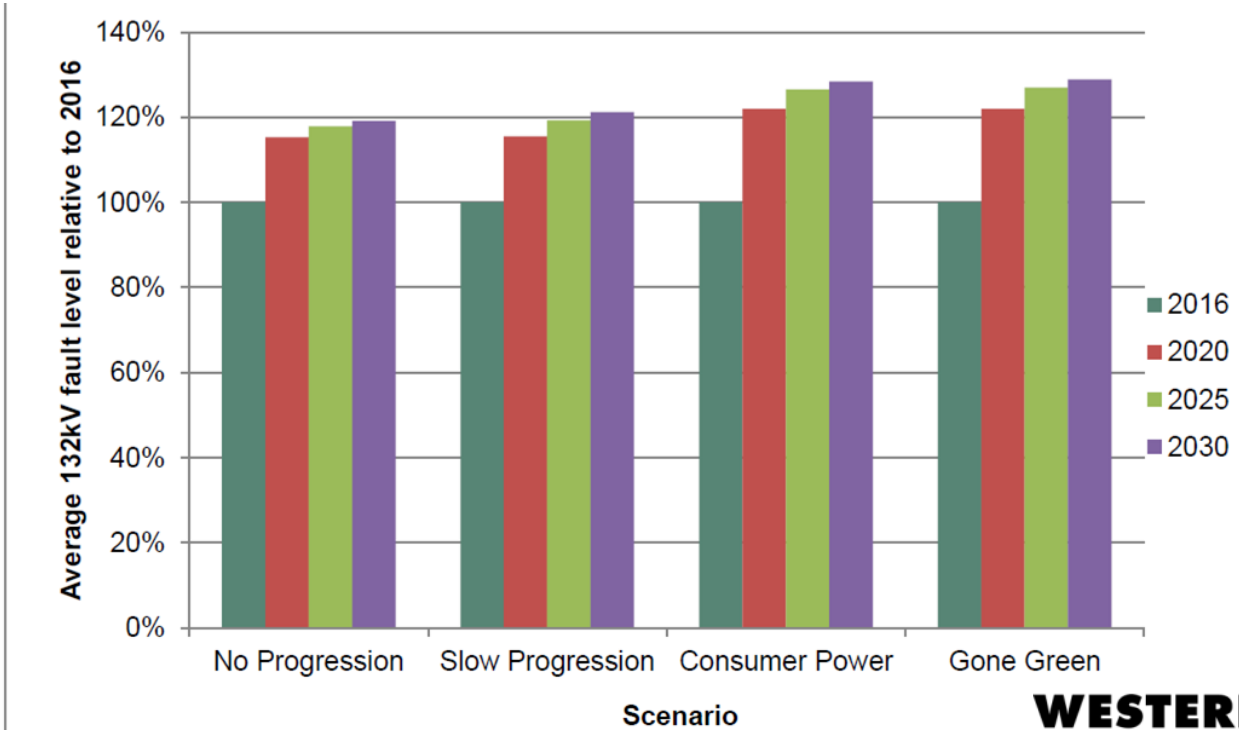
Results – Summary

- Heavily scenario dependent
- Requirements also identified in:
  - Bicker Fen GSP
  - Chesterfield GSP
  - Coventry GSP
  - Drakelow GSP
  - East Claydon GSP
  - Enderby GSP
  - Ratcliffe GSP
- Most reinforcement demand-driven, but some DG-driven
- Interaction between demand and DG: response to DG growth can cause demand non-compliance and vice versa

Results - Fault level

- Fault level studies show a general trend for increasing levels on the distribution network
- Variations expected on the transmission network as the generation mix changes



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Recommendations

- Develop and build 2020 reinforcement as necessitated by the actual growth of demand and DG:
  - Berkswell GSP SGT capacity and associated transfer capacity to Coventry GSP;
  - Alfreton BSP GT capacity;
  - Coventry GSP SGT capacity under busbar fault conditions;
  - Enderby GSP SGT capacity and associated transfer capacity to Grendon GSP;
  - Leicester 132kV rings;
  - Grendon GSP SGT capacity and associated fault level constraints;
  - Northampton group 132kV circuits;
  - Staythorpe GSP SGT capacity and associated fault level constraints;
  - Hawton BSP GT and transformer-feeder capacity;
  - Checkerhouse BSP GT capacity;
  - Bourne 132kV network circuit capacity and associated transfer facilities to Staythorpe GSP;
  - Willington GSP SGT capacity/Spondon 132kV network capacity and associated transfer facilities to Staythorpe GSP; and
  - Stanton BSP GT capacity.

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Recommendations

- Develop options for 2025 reinforcement including new GSPs and SGTs
- Revisit studies with National Grid and UKPN
- Further work on the technical limits of network management and automation
- Repeat studies in two years

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Looking to the Future

- WPD has published its DSO Strategy document: https://www.westernpower.co.uk/About-us/Our-Business/Our-network/Strategic-network-investment/DSO-Strategy.aspx

- We welcome feedback on our plans and to understand the priorities for our customers

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Looking to the Future

HM Government

ofgem
Making a positive difference for energy consumers

Upgrading Our Energy System

Smart Systems and Flexibility Plan

July 2017

Building our Industrial Strategy

- We will be ensuring our DSO strategy aligns with the recently published Smart Systems and Flexibility Plan

- We will remove barriers to smart technology
- We will help business and homes become smarter
- We will facilitate markets which work for flexibility

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Network management and automation

ANM can avoid expensive reinforcement, however there are:

- Commercial limits on acceptable curtailment
  - High percentage of time curtailment is unlikely to be acceptable to generators
- Technical limits on abilities of ANM scheme and network
  - Complexity – implementation across large interconnected networks leads to high levels of forecast constraint due to overlapping causes of constraint
  - Equipment rating under sustained high loading need careful consideration
  - Operating times vs equipment short term ratings and protection operation – pre curtailment of generation under certain operating or load conditions can solve this but high level of constraint often result

Whole System Co-ordination

- As highlighted by the Statement of Works/Modification Application process, we have also reached the limit of parts of the transmission system in the East Midlands
- WPD is currently working with National Grid to develop a Regional Development Programme that would carry out transmission/distribution interface studies. This is currently limited to a trial covering WPD's South West licence area.
- We are becoming more active with exchanging data and collaborating with the GBSO to deliver cost effective and efficient networks for our customers

How should works be financed?

- We will continue to apply the charging methodology approved by Ofgem i.e. where a connection triggers reinforcement, a contribution towards the cost of that reinforcement will form part of the connection charge, however
- It is becoming increasingly difficult to clearly determine the cause of reaching the limit for the network as:
  - There is a slow but steady reduction in demand levels (a combination of efficiency at the customer level and behind the meter generation)
  - Connections at HV and LV do not contribute to 132kV reinforcement works – whilst we can delay their connection the economic timing of 132kV works depends on the confidence that EHV connections will proceed
  - We're obliged to offer connections up to the limit of the network capability, hence we can suddenly reach the point where there is no capacity for lower voltage connections
- We have reached the point where certain reinforcements are being classed, or largely classed, as general reinforcement due to not being able to attribute to specific connections

Other issues to address

- Abnormal operating conditions – whilst our connection agreements are clear that we have the right to constrain generation under abnormal operating conditions, it is not possible to accurately define the risk that this imposes on a generator.
- Better defining commercial rights and hence conditions for compensation is likely to be the best long term way to address this
- P2 review – the current conclusion of the P2 review process is that there is no economic case for a security of supply for groups of generation below 1320MW.
- Distribution System Operability Framework – some of the issues highlighted while undertaking this study will be incorporated into a D SOF currently being worked on
- It is likely that the current NGET produced System Operability Framework will evolve into a ‘whole system’ SOF

D SOF

- Whilst in the early stages of development, some of the areas being assessed are:

Networks	Performance	Customers
Network modelling *What further modelling capability needs to be added?*	Arc Suppression Coils *At what point will ASC earthing in Cornwall need to be replaced?*	Power Quality *How will new technology types and demand growth affect our power quality?*
Network monitoring *What additional monitoring of the network is required?*	Fault Levels *What are the effects of rising and falling fault levels on our network?*	Dispatch Coordination *Between DNO/DSO and SO, suppliers and customers for demand/generation dispatch or curtailment?*
Active Network Management *What are the limitations of current and proposed ANM systems used by WPD and NGET?*	Low Frequency Demand Disconnection *To what extent are generation dominated networks degrading LFDD?*	Customer Demand Profiles *How will changing customer demand profiles affect how we design and operate our network?*

Summary

- First time we have undertaken such a long term comprehensive analysis of the network in the East Midlands
- Significant envelope of potential change in generation and demand assessed and issues arising and potential solutions identified
- Further work with NGET and UKPN recommended
- Issues needing consideration under a ‘D SOF’ also highlighted
- Work underway to repeat for the West Midlands network incorporating lessons learnt during the East Midlands, South Wales and South West studies
- This is part of a long term cycle of assessment of the network

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Any questions?

If you have any questions, please use GoToWebinar's chat feature to ask them now.

What else can we do/should we do?

Any missing stakeholders?

Can we do more to stimulate consortium approaches?

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Further information

- Reports/presentations are available from:

https://www.westernpower.co.uk/About-us/Our-Business/Our-network/Strategic-network-investment/East-Midlands.aspx

- Further questions/enquiries via:

wpdnetworkstrategy@westernpower.co.uk

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