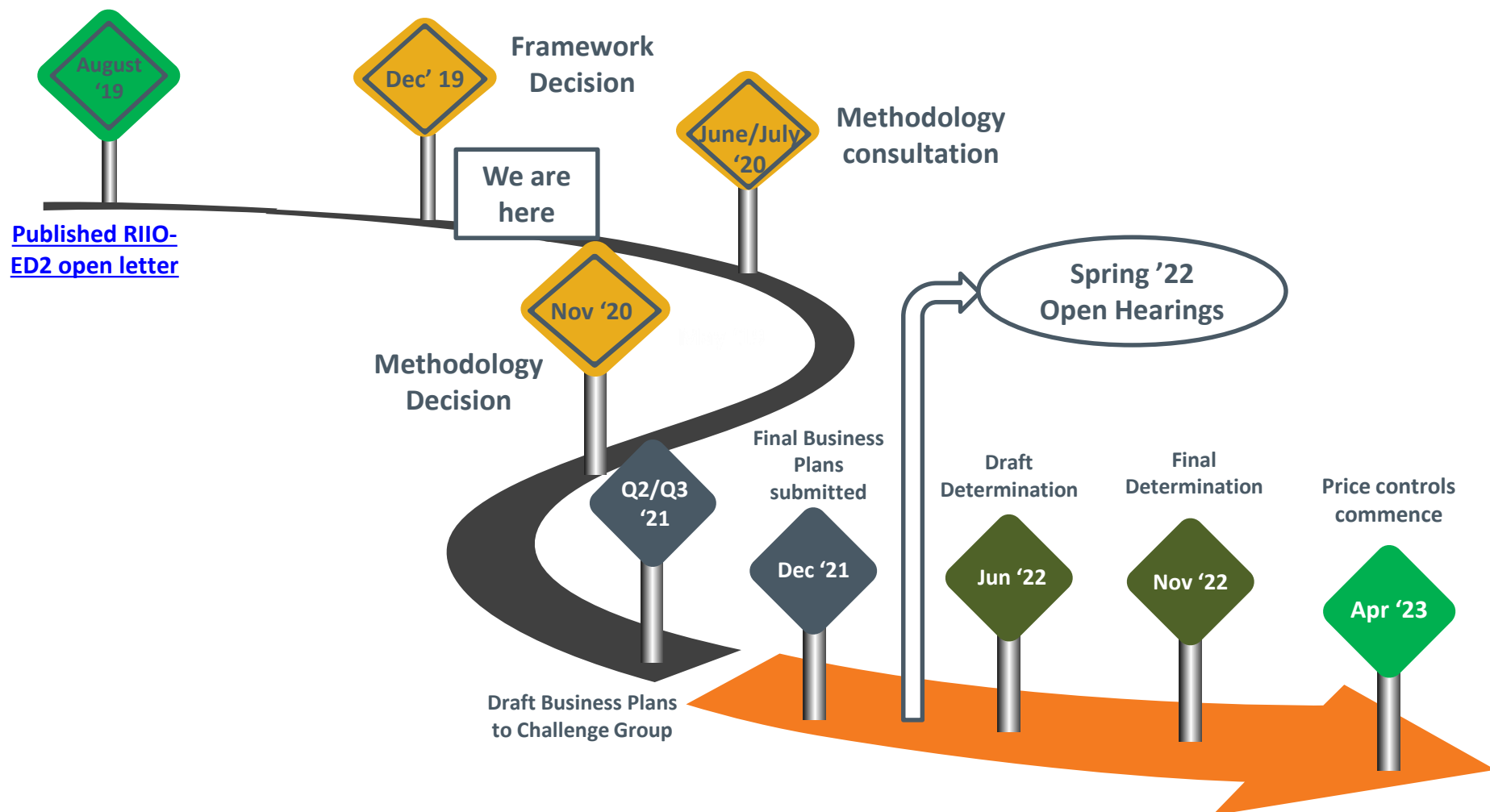


Safety, Resilience, and Reliability Working Group - Resilience



30/01/2020

- Introductions
- Workstream timelines
- ED1 performance to date
- Measures for ED2 (ENWL Presentation)

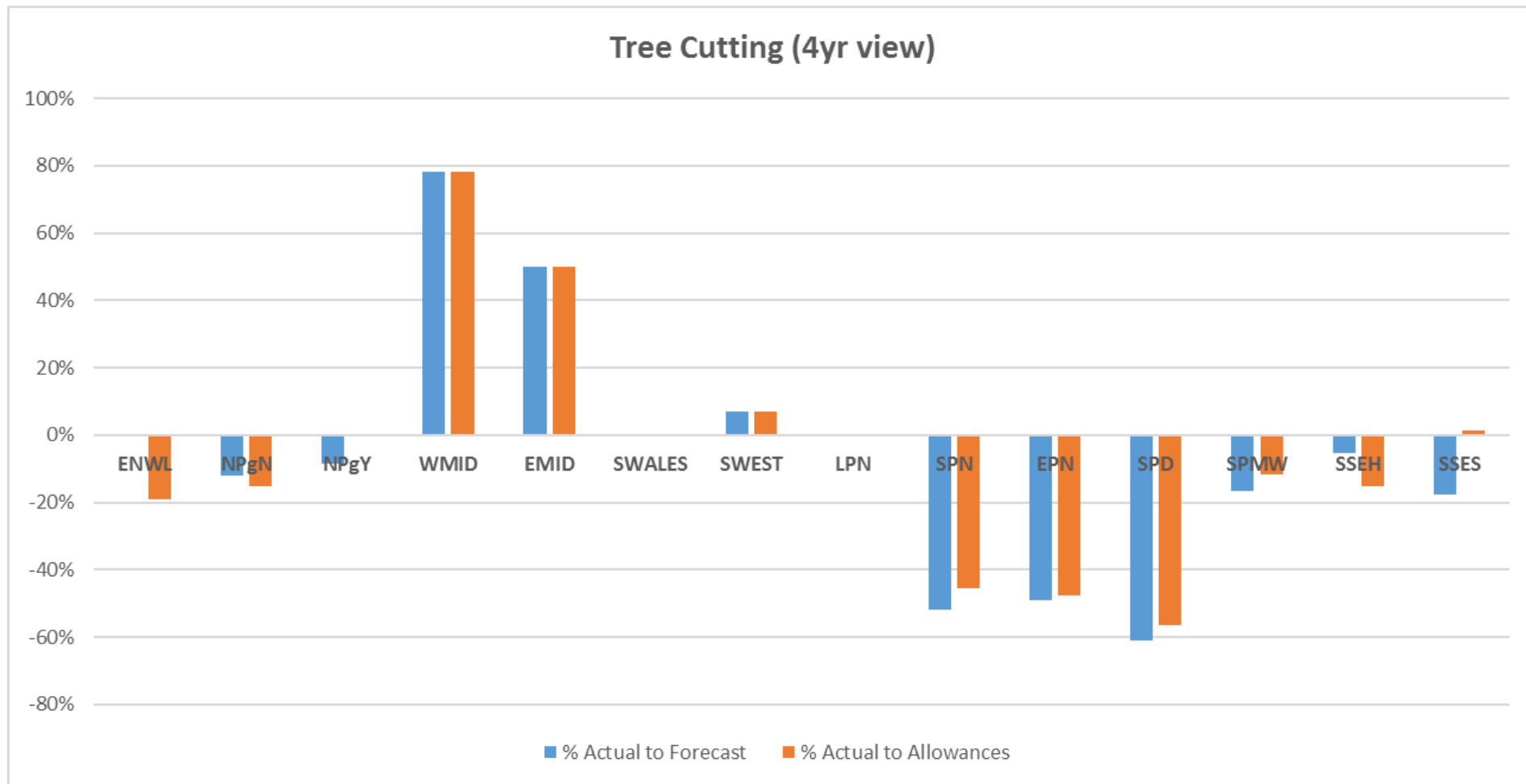


- Other workstreams of the SRRWG are now up and running, with progress being made in each.
- All workstreams are meeting over the next few months – important to have sight of when topics will be covered

Date	Location	Workstream	Items to cover (indicative)
30-Jan-20	London	Resilience	Tree cutting, flooding, black start, physical site security, climate change adaptation
12-Feb-20	London	NARM/CNAIM	Harmonisation of assets, Non NARM assets
18-Feb-20	London	Quality of Supply	Exceptional Events, WSC, Short Interruptions, IIS Targets
03-Mar-20	Glasgow	Resilience	Workforce resilience, cyber resilience, climate change adaptation
18-Mar-20	London	NARM/CNAIM	TBC
31-Mar-20	Glasgow	Quality of Supply	TBC
07-Apr-20	London	Resilience	TBC

Tree Cutting

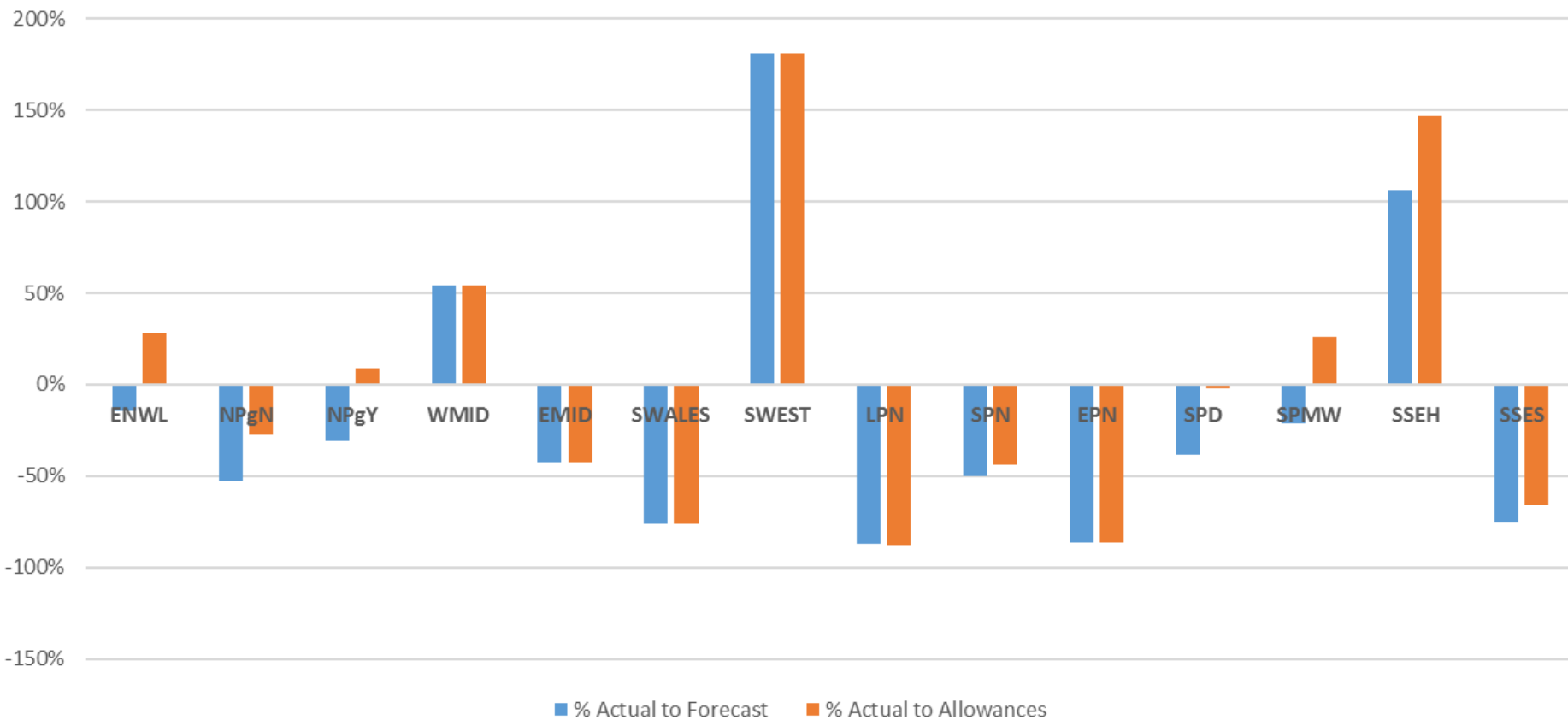
- Allowances provided to maintain vegetation around overhead lines, for both 'normal' and 'storm' resilience.
 - Reducing the risk of vegetation coming into contact with overhead lines means customers are less likely to experience an interruption and the network does not need to be repaired as frequently.
-
- Total tree cutting allowance for ED1: £863m
 - Forecast tree cutting expenditure for ED1: £860m



Flood resilience

- Allowances provided to protect substations against flooding from rivers, surface water, or the sea.
 - The risk for each site is assessed based on information from the EA/SEPA, combined with the number of customers supplied by the substation. Appropriate solutions are designed/determined based on the risk, cost, and nature of the network (i.e. how interconnected it is, design of the site).
 - Periodic updates to modelling and/or requirements mean solutions need to be reassessed.
-
- Total flooding allowance for ED1: £101m
 - Forecast flooding expenditure for ED1: £77m

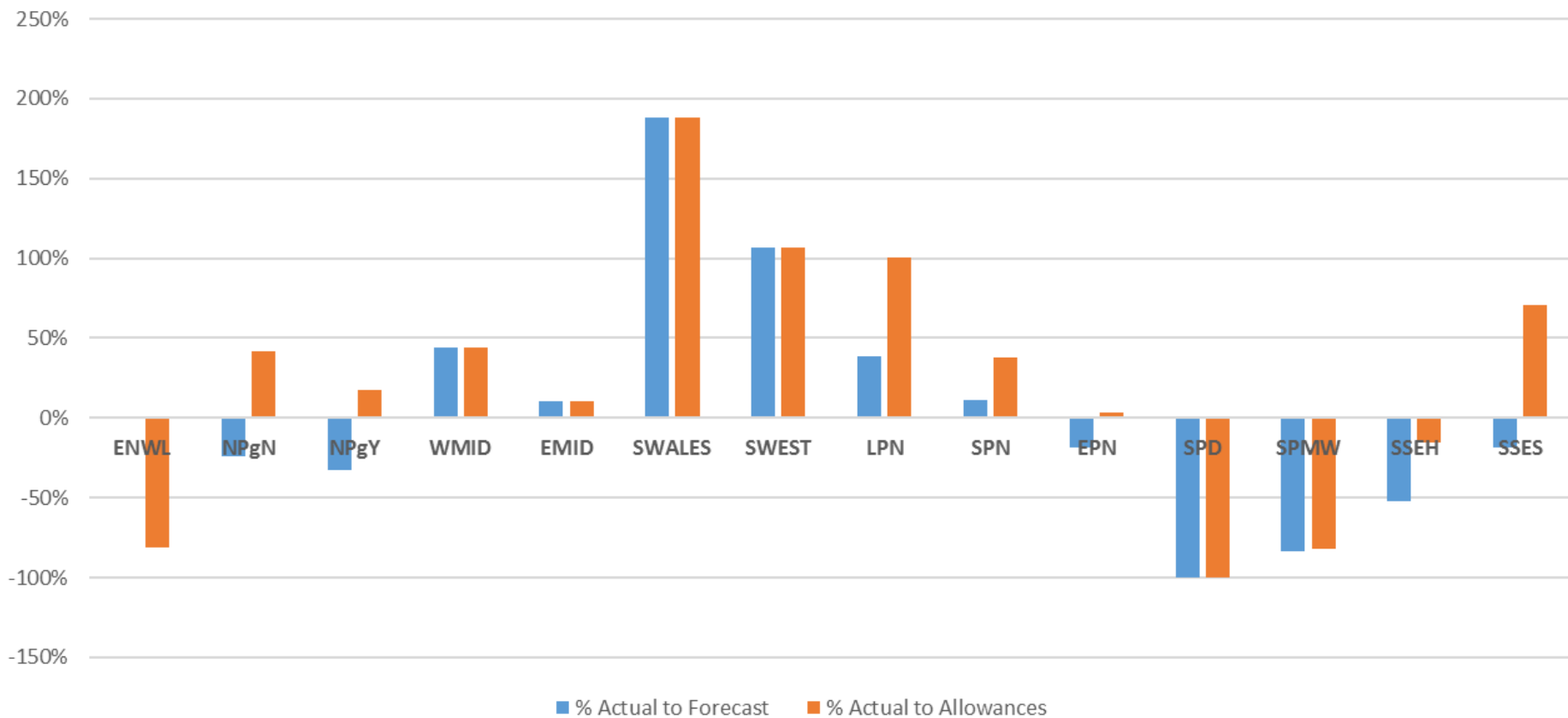
Flooding (4yr view)



Black Start

- Allowances provided to ensure the distribution network can recover from a full or partial shut down of the electricity system.
- Total Black Start allowance for ED1: £33m
- Forecast Black Start expenditure for ED1: £63m

Black Start (4yr view)





Resilience measures for RIIO-ED2

- An Introduction

SRR Working Group

30 January 2020

Stay connected...



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- Current industry arrangements
- Resilience investment in RIIO-ED1
 - Black Start
 - Flooding
 - Critical National Infrastructure (CNI)
 - ETR132 Tree Cutting
- Cost assessment at RIIO-ED1
- Climate Change Adaptation reporting
- Summary & next steps



- Resilience measures are put in place to mitigate the relevant risks, primarily to loss of electricity supply
- 12 risks on the Overall National Security Risk assessment are identified as potentially having a significant impact on energy networks

OFFICIAL Energy Networks Association Emergency Planning and Business Continuity				
Overall National Security Risk Assessment:				
Loss of, or major disruption to, electricity supply to >10,000 people for >18hrs	Loss of, or major disruption to, electricity supply to >100k people for >18hrs	Loss of, or major disruption to, electricity supply to >300k consumers for >18hrs	Loss of, or major disruption to, electricity supply to 1m people for >18hrs	National loss of electricity supply for any period. Regional loss of, or major disruption to, electricity supply for >1 week
R74-DEFRA Reservoir/Dam R82-DEFRA Fluvial flooding R83-DEFRA Surface water flooding R84-DEFRA Drought R90-MO Heat wave R91-MO Low - Temperatures and heavy snow	R77-BEIS Failure of gas supply infrastructure R92-MO Severe space weather	R81-DEFRA Coastal flooding R93-MO Storms	R76a-BEIS Regional failure of the electricity network	R76-BEIS Failure of a national electricity transmission systems

Source : 2019 National Security Risk Assessment Essential Services Dimension register matrix for the electricity sector only

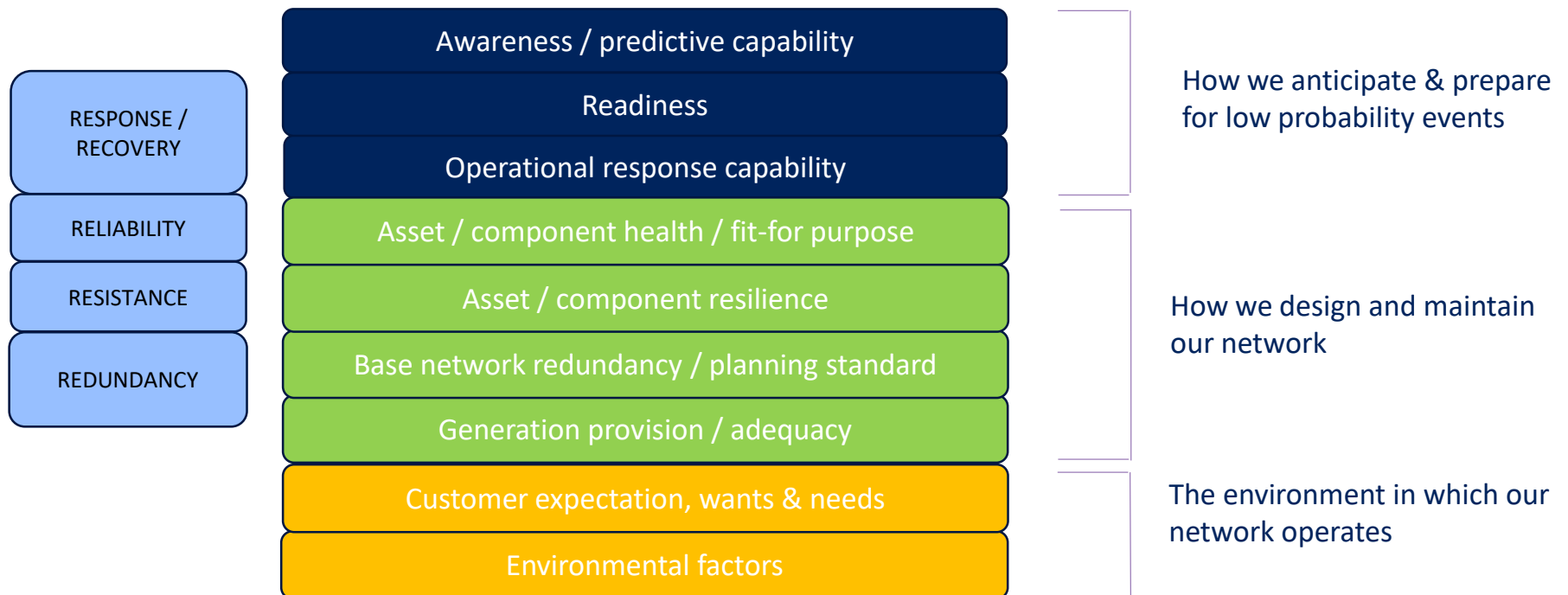


- The sector has established and tested methods of managing emergencies and developing resilience strategies

Emergency Planning & Co-ordination	Programmes	Future	Documentation
Emergency Planning Managers Forum	Ash Die Back Task Group	Climate Change Adaptation Reporting Group	P2/7 Network Planning standard
Rota Load Disconnect Task Group	ETR138 Flooding Resilience Working group	Infrastructure Operators Adaptation Forum	EREP 4 Storm Preparedness
NEWSAC			ETR132 Improving Resilience of overhead networks
Strategic Telecoms Group (Resilience)			ETR138 Substation Flooding resilience
Cyber Security Task Group			NEWSAC
Energy Emergencies Executive (E3C) + sub-groups – multi-agency			National Security Risk Assessments



- These contribute to a tiered model of resilience provision





Area	Function	Current trends & factors for RIIO-ED2
Awareness	Knowledge of the overall resilience position, strengths/weaknesses etc.	
Readiness	Operational planning, testing, maintaining currency. Ability to appropriately react to individual events. Knowing when to press 'go'.	Improvements in forecasting tech & analytics
Operational response	To maintain the capacity to respond if events breach the defensive layers below. Include provision of resources, contracts, materials etc.	Simulations & scenarios. Long-term contraction in overall pool of skilled resource?
Asset health	The health of the assets as a function of stewardship and management policies	Increasing sophistication in assessing health of individual components and linking to risk assessment
Asset resilience	The resilience of the individual components of the network, ie the spec to which they are built	Criticality assessments
Network design	The basic level of resilience built into the network through its fundamental architecture, eg n-1, n-2	More flexible networks, eroding spare capacity through more flexible connections, P2 review etc.
Generation adequacy	Ie that part of the load that we don't need to provide	Increasing penetration of generation capacity, frequently with low load factors
Customer	Customer expectations and demands on the required level of resilience	Increasing expectations & intolerance of service failure, 'always on' culture, minimal resilience at the individual customer level
Environment	The core environmental setting in which our assets are installed and our network operates	Climate change trends as assessed through adaptation reporting etc.



- Resilience programmes tended to be front-end loaded in ED1 due to urgency of need; also accelerated by 2015 flood events
- Due to company redactions, not possible to identify ETR132 elements from tree-cutting data via datashare
- Data below relates to cost of discrete ‘resilience’ investment programmes only

Area	Table	FY16-19 actuals (£m)	FY20-23 forecasts (£m)	RIIO-ED1 total (£m)
Black Start	CV12	37.5	25.3	62.8
Flooding	M1	46.5	30.9	77.4
CNI	C3	0.6	6.1	6.8
Other		-	-	-
TOTAL		84.6	62.3	146.9
Trees (incl. ETR132)	CV29	323.8	454.1	777.9

Costs and forecasts are taken from table M16 and are in 2012-13 money. Companies may have chosen to also redact information in that tables so figures should be treated as indicative rather than definitive.



- Aim is to achieve compliance with BEIS requirement for Black Start-compatible networks by December 2020
- Current programmes are focused on installing battery backup capacity at major substation sites
- BEIS recently consulted on future Black Start standards; industry provided indicative costings; currently with Minister*

DNO Group	Sites resolved by FY19 (no.)	Sites outstanding at FY19 (no.)	FY16-19 actuals (£m)	FY20-23 forecasts (£m)	RIIO-ED1 total (£m)
ENWL	11	275	0.6	3.6	4.2
NPg	199	150	7.5	2.2	9.7
UKPN	365	674	9.0	9.0	18.0
WPD	358	578	15.8	4.9	20.7
SPEN	0	0	0.4	5.5	5.9
SSEPD	43	0	4.2	0.0	4.2
TOTAL	976	1677	37.5	25.3	62.8

* The current BS Strategy published by NGESE maintains a planning assumption of an average restoration time across the year of 36 hours to restore 60% of national demand, and 100% restored within 7 days.



- Current programmes are focused on achieving ETR138-compliant levels of flood protection to major substations
- ETR138 revised in 2018 to include recommendations from NFRR
- Work completed FY16-19;

DNO Group	Sites	Customers impacted	FY16-19 actuals (£m)	FY20-23 forecasts (£m)
ENWL	42	759,914	8.0	5.3
NPg	157	Requires individual assessment	24.7	10.3
UKPN	40		1.9	6.7
WPD	63		5.6	1.9
SPEN	21		1.1	0.4
SSEPD	31		5.0	6.2
TOTAL	354		46.5	30.9

HM Government

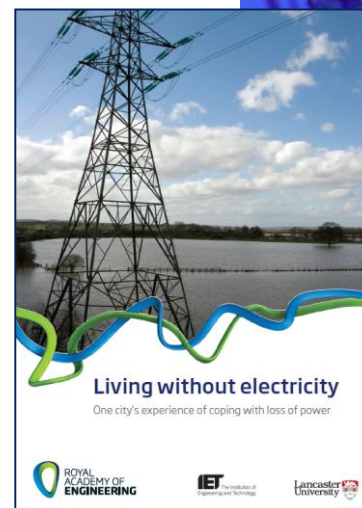
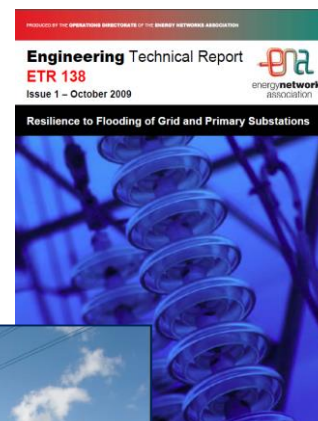
National Flood Resilience Review



September 2016



- ETR138 was developed by a working group co-ordinated by the Energy Networks Association (ENA)
- Largely deterministic approach to flood risk management
- Identifies three different levels of acceptable flood risk
 - Level 1: most important grid substations (typically supplying 50,000 to 500,000 customers) - likelihood of flooding should be no more than 1 in 1000 annual probability
 - Level 2: other primary substations (typically supplying 5,000 to 30,000 customers) - likelihood of fluvial flooding no more than 1 in 100 annual probability and 1 in 200 annual probability for sea flooding.
 - Level 3: for sites where level 1 or 2 cannot be justified – other flood resilience measures.





- Physical security works to harden key strategic sites as advised by CPNI
- Definitions and classifications held outside the industry
- Requirements change hence re-opener provision included within RIIO-ED1

DNO Group	FY16-19 actuals (£m)	FY20-23 forecasts (£m)	RIIO-ED1 total (£m)
ENWL	-	-	-
NPg	0.4	4.3	4.7
UKPN	0.2	-	0.2
WPD	-	-	-
SPEN	-	1.8	1.8
SSEPD	-	-	-
TOTAL	0.6	6.1	6.7



- Current programmes are focused on progressive compliance with ETR132 storm resilience standards
- Essentially clear fell areas around overhead lines to minimise storm damage risk
- Current BEIS guidelines require 0.8% compliance p.a.
- Work completed FY16-19;

DNO Group	Cumulative length cleared by FY19 (km)	Achievement of standard by FY19 (%)	FY16-19 Actuals (£m)
ENWL	863km	6.9%	1.1
NPg	Source data table redacted from datashare		
UKPN			
WPD			
SPEN			
SSEPD			
TOTAL			



- Limited assessment of volumes undertaken
- Unit costs generally based on lesser of DNO and average
- Flooding unit costs based on no. customers protected

Table 3.1: Key changes in approach from draft to final determinations

Area/activity	Draft determinations approach	Final determinations approach
Flood resilience	Risk-based approach. Risk point delta calculated for each substation before and after intervention. Unit cost of each risk point reduced/maintained the lower of the DNO's own and the industry LQ. Unit cost applied to the delta.	No change, except correction of error in calculation.
CNI	Costs accepted as submitted.	No changes to approach but changes to CNI sites from draft determinations.
Black start	Volumes: no greater than unprotected primary substations. Unit costs: industry median using 8 years of forecast data.	No change.
Tree cutting	43-8 - regression using spans cut and inspected as cost driver and 8 years of RIIO-ED1 data. ETR 132 – volumes: accepted. Unit costs: lower of modelled (industry median using 8 years of data) or submitted. NPg excluded due to different approach (qualitative assessment)	43-8: No change. ETR 132: only change is removal of ratchet for unit cost assessment.



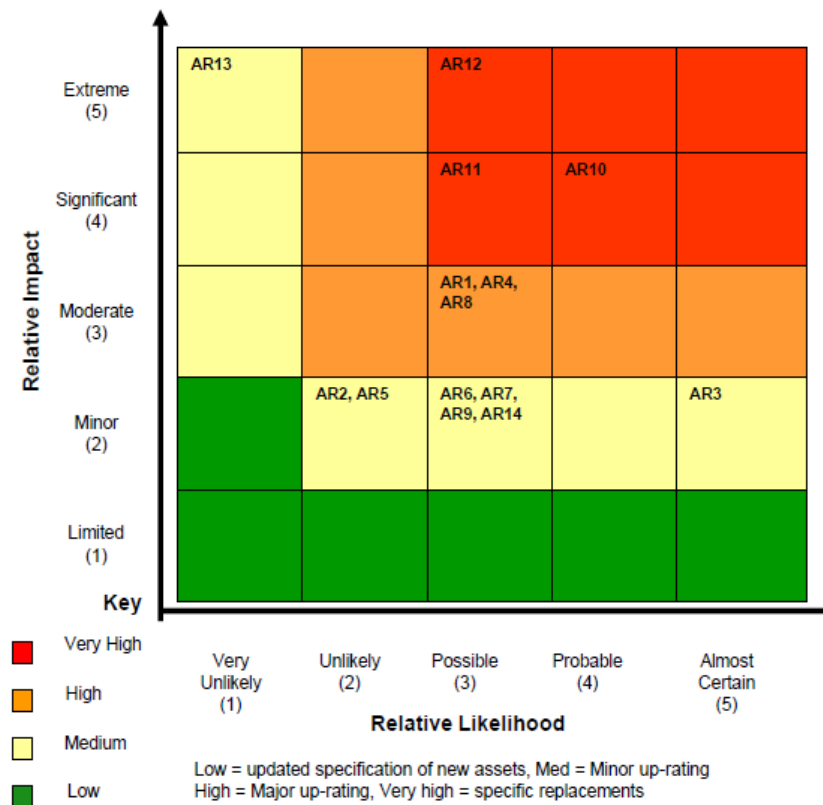
- DNOs are Reporting Authorities under the Climate Change Act of 2008
- In 2011 and 2015 DNOs submitted company reports to Defra, incorporating an industry document for electricity distribution and transmission developed through an ENA working group
- Defra issued invitations to take part in the third round of reporting in November 2018. Energy network companies are planning to submit in spring 2021





- Top three risks are:
 - AR10 - river flooding
 - AR11 – pluvial flooding
 - AR12 – sea flooding

Risk Matrix Showing Overall Impact (Refers to UKCP09 projections for the end of the century assuming a High Emissions Scenario and 90% probability level and no adaptation measures taken)



AR1 Overhead line conductors affected by temperature rise, reducing rating and ground clearance.
 AR2 Overhead line structures affected by summer drought and consequent ground movement.
 AR3 Overhead lines affected by interference from vegetation due to prolonged growing season.
 AR4 Underground cable systems affected by increase in ground temperature, reducing ratings.
 AR5 Underground cable systems affected by summer drought and consequent ground movement, leading to mechanical damage.
 AR6 Substation and network earthing systems adversely affected by summer drought conditions, reducing the effectiveness of the earthing systems.
 AR7 Transformers affected by temperature rise, reducing rating.
 AR8 Transformers affected by urban heat islands and coincident air conditioning demand leading to overloading in summer months.
 AR9 Switchgear affected by temperature rise, reducing rating.
 AR10 Substations affected by river flooding due to increased winter rainfall.
 AR11 Substations affected by pluvial (flash) flooding due to increased rain storms in summer and winter.
 AR12 Substations affected by sea flooding due to increased sea levels and/or tidal surges.
 AR13 Substations affected by water flood wave from dam burst.
 AR14 Overhead lines and transformers affected by increasing lightning activity.

What will be the major impacts?



- In both reports, the following potential impacts were noted:
 - Flooding
 - Increase in temperature
 - Increased vegetation growth
 - Resilience to extreme events
- With the exception of flooding we expect that the impacts on our business from climate change will be gradual, largely indistinguishable from other factors, and that we will be able to deal with them with a long term approach.
- We will continue to regularly assess our vulnerability to climate change.
- Following the first round of reporting WPD implemented a policy of installing taller poles to cater for the potential increase in conductor sag.



Third reporting round

- Energy network companies are working together to produce a joint industry report, scheduled for spring 2021
- The risks highlighted in the first two reports still remain, but we are looking at new risks to the electricity network, which include:
 - Very dry weather may lead to increased earth movement, which may cause damage to cables;
 - Very dry weather makes it easier for fires to spread on moorlands, such as those seen in 2018, presenting a threat to networks; and
 - As networks become 'smarter' we will rely increasingly on communications networks to monitor and control an active electricity network. This presents a new set of risks to be assessed.



Summary

- The industry has well established strategies to ensure a resilient network
- These range from operational preparedness through specific investment programmes to fundamental design standards
- Current investment programmes are in response to specific risks or previous events
- Additional resilience investment will be required through RIIO-ED2, particularly as user dependence on and expectations of reliable supply increase
- Suggested future topic areas;
 - New Black Start requirements
 - Cyber resilience
 - Wider review of tree-cutting incl. ENATS 43-8, diseased trees & ETR132
 - Future flooding programmes



How do we ensure the networks are investing wisely for future resilience?

- Identify appropriate framework to validate and support likely future resilience-driven investment programmes
- Recognise resilience benefits in cost benefit analyses
- Recognise increasing level of resilience-driven costs in base indirect costs
- Review related incentive arrangements, eg exceptional event mechanism for IIS to ensure resilience risk appropriately managed

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We will ensure that Ofgem will operate as an efficient organisation, driven by skilled and empowered staff, that will act quickly, predictably and effectively in the consumer interest, based on independent and transparent insight into consumers' experiences and the operation of energy systems and markets.