

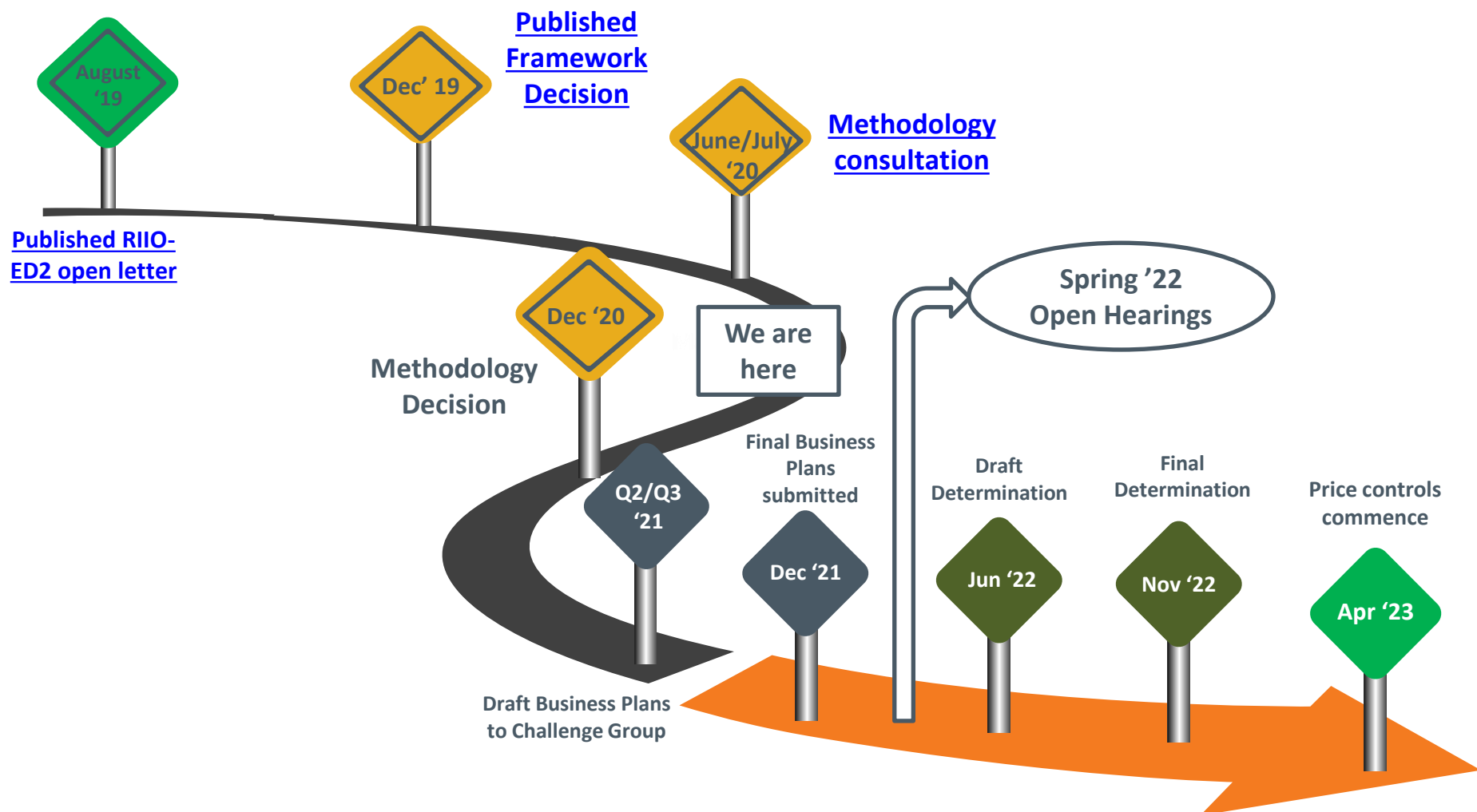
# Safety, Resilience, and Reliability Working Group

## Meeting 21 – Load Indices



**RIO Electricity Distribution**  
07/10/2020

- Welcome and introductions: 10:00-10:10
- Review of SSMC position and responses: 10:10-10:30
- Feedback from previous session: 10:30-11:00
- Review of ED1 performance: 11:00-11:30
- Interaction with BPDTs: 11:30-12:00
- Actions, Next Steps, AOB: 12:00-12:15



## **Review of SSMC position**

- In RIIO-ED1, we used Load Indices (LIs) to **assess network risk by comparing network demand with capacity**. The LIs categorise primary substations (EHV and higher) into five bands (LI1 - LI5) based on each substation's loading percentage or utilisation:

**LI Logic**

Ranking	Loading (percentage)		Duration Factor (hours)	
	Lower bound	Upper bound	Lower bound	Upper bound
LI1	0%	<80%	n/a	n/a
LI2	80%	<95%	n/a	n/a
LI3	95%	<99%	n/a	n/a
LI4	99%	n/a	0	<9
LI5	99%	n/a	9	n/a

**Risk weighting**

Ranking	Weighting
LI1	1
LI2	1
LI3	1
LI4	20
LI5	100

- This loading percentage is the percentage of the substation's firm capacity that is utilised at the point of maximum demand. **In RIIO-ED1, LIs were only applied to primary networks**, due to **limitations of secondary substation monitoring**.
- LIs help identify demand driven intervention requirements, and enable network risk to be tracked over time.** DNOs are required to deliver an equal or equivalent reduction in loading risk to substations as was forecast to be delivered by schemes (such as reinforcement activities) included in their baseline allowance.
- In RIIO-ED1, we decided not to set specific outputs for LI delivery** at the start of the price control due to the uncertainty around how they would interact with other parts of the price control. Our rationale was that given the number of factors that contribute to level of network utilisation, **setting outputs for LIs in RIIO-ED1 would not provide a robust way to measure DNOs performance over the price control**. We did however commit to using LIs as part of our assessment of efficient LRE, rather than as a standout closeout mechanism in their own right.

- For RIIO-ED2, we have identified the following priority areas on which to focus the development of LIs methodology:
  - Revision of current methodology
  - Commonality of reporting
  - Expansion of methodology
- We propose to review levels and width of the LI bandings as they are sensitive to small increases in demand and are set close to capacity limits. This makes it more difficult to assess the loading risk on network assets.
- We will continue to develop our thinking on how network risk associated with drivers other than demand are dealt with and incorporated within the LI methodology. This includes, but is not limited to, fault level, flexibility and distributed generation.
- We want to ensure consistency of approach across the sector, and propose a review of and development of further guidance for the calculation of firm capacity.
- In line with our proposals on establishing LRE requirements to meet forecast demand, we want to explore options for extending the LI methodology to cover all voltage levels, where appropriate.
- We intend to build upon the existing RIIO-ED1 arrangements, while ensuring that the outputs that we set, in relation to loading risk on the networks, are more reflective of the network investment delivered, to increase coverage and consistency of the methodology, and to enhance regulatory reporting.

- We think it should be **useful to establish Load Index (LI) measurements in RIIO-2 to measure how close the network is to operational limits**. However, we note that this is **only likely to be important in heavily constrained parts of the network** which are already likely to be closely monitored so that the DNO can operate their equipment within technical and safety limits, on both a pre-and post-fault basis.
  - It is unclear whether this should be targeted as an output to ensure that the network utilisation is maximised within technical limits, or as a limit to ensure that the network and customers are not at risk. While monitoring of network utilisation should be useful, we suggest that **more evidence is needed to justify the introduction of incentives around a Load Index output**.
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- LIs are a **very partial view of both utilisation and drivers for reinforcement** and could usefully be **supplemented in time with additional measures** that look at factors such as generation constraints.
  - One suggestion would be a simple traffic light system for loading, DG hosting capacity and fault level per substation.
  - While network risk associated with demand is covered by the current LI methodology for first circuit outages the **current methodology does not cover risk for second circuit outages (N-2)** which applies to larger demand groups (>100MW) only.
  - **Agree with the proposed retention of LIs as an overall indicator of utilisation** and also **support a review of the bandings and current weightings** to enable the approach to produce more meaningful utilisation data.

- The **SSMC does not provide extensive detail on how LIs are proposed to be used** as an output, or how this will link in with other areas of the price control. How LIs are used alongside other mechanisms needs careful consideration.
  - We are **not convinced that evidence exists to support the extension of LI to all voltage levels** on the network. The cost benefit case for this is still to be established. There may though be some merit in extending load monitoring in a targeted way to focus on areas of the network which are most likely to see investment requirements in RIIO-ED2 period owing to existing network capacity constraints.
  - There may be merit in including the output from LIs within a reported annual capacity strategy document. Focused on specific areas of the network the LI much like they operate in RIIO-ED1, can be an excellent **informer of the efficiency of load related expenditure**.
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- Support **LIs as a useful measure of how licensees are performing against the assumptions made in setting their allowances**. Recognise the value of expanded bandings/widths, fault level, flexibility, and distributed generation indices and think that a sub-working group should be set up to define them in further detail.
  - **Doubtful that genuine consistency can be achieved, or whether it is desirable**. For example assessment of firm capacity is a key area of asset management expertise, assessing the appropriate level of risk to take in light of all relevant circumstances – and if Ofgem defines how firm capacity must be measured, then the incentive to reduce costs through careful assessment of capacity will be destroyed, raising costs to energy consumers over the longer term.
  - **Support a form of fault level index being developed**, but would highlight the development work required to provide such a forecast, and the additional resource required to do this on a regulatory reporting basis. **Supportive of the development of load indices at lower voltages**, but note that the timetable for development needs to be considered in light of ongoing projects to develop LV monitoring by DNOs



- LIs are a **useful tool for demonstrating how demand changes are impacting the primary distribution networks**. They should be continued into RIIO-ED2 for two main purposes:
  - for cost assessment; and
  - to inform the operation of load related uncertainty mechanisms.
- The level of uncertainty regarding the level and rate of future demand growth and the scale of available flexibility services would make **using them for a targeted output measure for reinforcement inappropriate**.
- LIs can be developed for RIIO-ED2 to reflect the use of flexibility to manage capacity constraints, to incorporate the impact of Distributed Generation (DG), and to indicate forecast demands and the effect of planned investment.
  - Flexibility can be used either to release additional capacity or reduce demand upon the network. Propose separate identification of the impact through additional columns to adjust the maximum demand or firm capacity totals.
  - A separate index for measuring DG capacity is not warranted, however the treatment and reporting of DG (and connections) in general reinforcement may need to be reviewed following the outcome of the Network Access SCR.
  - The following adjustments to the loading percentages were proposed to make each band wider:

Current ED1 Ranking			Proposed ED2 Ranking		
LI ranking	Loading percentage	Duration factor	LI ranking	Loading percentage	Duration factor
LI1	>=0 and <80	n/a	LI1	>=0 and <75	n/a
LI2	>=80 and <95	n/a	LI2	>=75 and <85	n/a
LI3	>=95 and <99	n/a	LI3	>=85 and <95	n/a
LI4	>=99	<9 hours	LI4	>=95	n/a
LI5	>=99	>=9 hours	LI5	>=100	n/a

- There is merit in reviewing the methodologies used by the different DNO groups in completing the LI templates to ensure that there is consistency of approach.

- We believe **LIs are a very good indicator of remaining available network capacity and opportunities to deploy flexibility**. We believe mandating LIs be defined at all substations in a network either through monitoring or modelling would be a good target for DNOs.
- Having some level of network availability/efficiency of use seems like a good target in ED2. However, **using LIs as outputs must be done with caution to avoid networks flying too close to the sun to try and maximise these metrics**. Equally LIs might encourage networks not to operate a “touch the network once” reinforcement policy.
- That said LIs could be used as outputs in the below ways:
  - Rewards for defining LIs at all substations
  - Where LIs are modelled, rewards for accurate LI prediction using a hold out set
  - Rewards for reducing LIs through non-reinforcement measures
  - Penalties for failures on substations with low published LIs (to avoid inaccurate calculation/modelling of LIs)
  - Penalties for not evaluating flex solutions soon enough on critically high LI parts of the network
- For LIs to be useful for tracking and comparing how companies respond to changing load on their networks, it is **important to ensure that all companies establish firm capacities in a common manner**. Each DNO’s network will have differing levels of utilisation and capacity headroom due to historic intervention and design decisions. It is important that the LI metric identifies those networks that have been efficiently pushed harder and now may need to invest greater levels to create capacity.
- **Extension of the existing LI metric to secondary networks is not currently feasible** due to the limitations of substation Maximum Demand Indicators (MDI) data and visibility of LV network utilisation. Until sufficiently wide-scale LV network monitoring is rolled out we do not consider that a comparable secondary LI metric is appropriate.

## **Feedback from previous session**

- At our last working group on LIs on the 7<sup>th</sup> July, SPEN presented on proposed changes for ED2:

Component	Description	Comments
Load Index (LI)	Categorise the risk of max demand (latent) versus firm capacity at the LI substation/group level.	Consistent with the RIIO-ED1 measures.
Distributed Generation Index (DGI)	Categorise the risk of generation hosting capacity versus maximum observed level of generation at a substation level.	<b>New</b> components in RIIO-ED2 BPDTs & annual RRP
Fault Level Index (FLI)	Categorise the risk of the fault level duty versus equipment capability at the LI substation/group level.	
Flexibility Index (FI)	Categorise the risk associated with un-secured demand managed by flexibility	
<b>Total Load Related Risk</b>	Combine to provide an aggregate view of Load Related Risk at Substation & Group level.	

### General Feedback

- Important that the purpose of indices is determined i.e. will they just be used for cost assessment, or will they be PCDs, ODIs etc.
- Where it is proposed that indices are used for cost assessment, the use of CBAs and EJPs must also be considered if we are to avoid duplication of data and effort.
- Support review and potential recalibration of the current Load Indices and consider there is merit in developing an equivalent approach on generation. Do not support the development of an overall disaggregated load risk index and consider that Fault Level issues should be separately reviewed.
- Further clarification would be welcome regarding how the different indices would combine to create an overall Load risk measure. Would each of the risks carry the same weighting?
- A combined risk score from use of all the indices is dangerous as it runs the risk of dampening a high risk in one area when the other areas are low risk. Demand, generation and fault level can independently trigger reinforcement so it does not seem logical to combine them into a single metric.
- Useful to apply a risk scoring approach to LIs but not for DGI or FLI or FI:
  - Using DFES -central outlook/best view can predict future LI risk score and link to expected [standard reinforcement] intervention costs,
  - Normalisation is not needed, only useful for Ofgem for inter-DNO comparisons.

### **Demand Index (current Load Index)**

- Support a review of how DNOs are calculating Firm Capacities for the LIs. Need to understand if there are variances in methodologies across the DNOs, so it may be appropriate to share approaches as an initial step.
- Although DSR is mentioned in the proposal for a Generation Index, it is not included for Demand Index. Flexibility needs to be included in the demand index, so it is clear where DNOs are using flexibility to manage capacity constraints and off-set conventional reinforcement.
- We agree that the LI banding/categorisation should be reviewed as they are sensitive to small increases.

### **Generation Index**

- Generally, reinforcement for generation should be funded through the connection and not through general reinforcement, and therefore we are not convinced that the level of expenditure associated would warrant the introduction of such a new measure.
- Accept that this position may change as a result of the SCR.

### **Fault Level Index**

- Not convinced of the need to introduce a separate index for Fault Level. Locational information is available through the LTDS (Table 4) and the existing RRP (and ED1 BPDT) provides summary volumes of where there are potential fault level issues and the use of operational measures. Is there additional benefit in providing substation specific information through this index?
- Emphasis should not only be on equipment ratings but on design fault levels as this is now becoming more the issue and is more difficult to resolve.
- This index is directly related with DG and it seems unfair to count as a separate factor in the summation of all indices to calculate the total demand index; it should either be part of DGI or be a separate factor that has a 50% weighting applied to both this factor and the DGI to have equal total weighting with the LIs.

### Flexibility Index

- Support the clearer reporting of flexibility, we are struggling to see how the data in this proposed index would be used.
- Flexibility should be identified separately within the demand index, where it will show how it is being used to manage constraints.
- FI should be a measure of how much use has been made of flexibility to address demand /generation capacity issues and should be recorded in the LI information, whereas it appears the FI table is recording the solutions rather than the issue.
- We suggest that FIs need to consider MW and MWh above firm capacity (rather than expressing them as % of network capacity and delivered MWh).
- The new ECR will publish information on distributed energy resources providing flexibility to DNOs and others.

- At our last working group on LIs on the 7<sup>th</sup> July, UKPN presented on a utilisation metric:

## Background on utilisation

### **What do we mean by utilisation**

- A measure of how loaded network assets are – typically interested in the maximum
- The concept of tracking assets by utilisation is already well established at Primary level via the Load Index

### **Why an utilisation metric at the secondary level is in both our and our customers' interests**

- Ultimate aim of the DNO is to facilitate any increase in demand and new connections at lowest cost
- An utilisation metric encourages DNOs to intervene where most needed and in a consistent manner

### **How could a new utilisation metric work**

- Secondary network more complex and uncertain, it makes sense to use utilisation to justify and evidence interventions and subsequent funding
- Improved asset data can help drive decision making and evidence
- Can appropriately reflect different unit costs of interventions at different utilisation levels

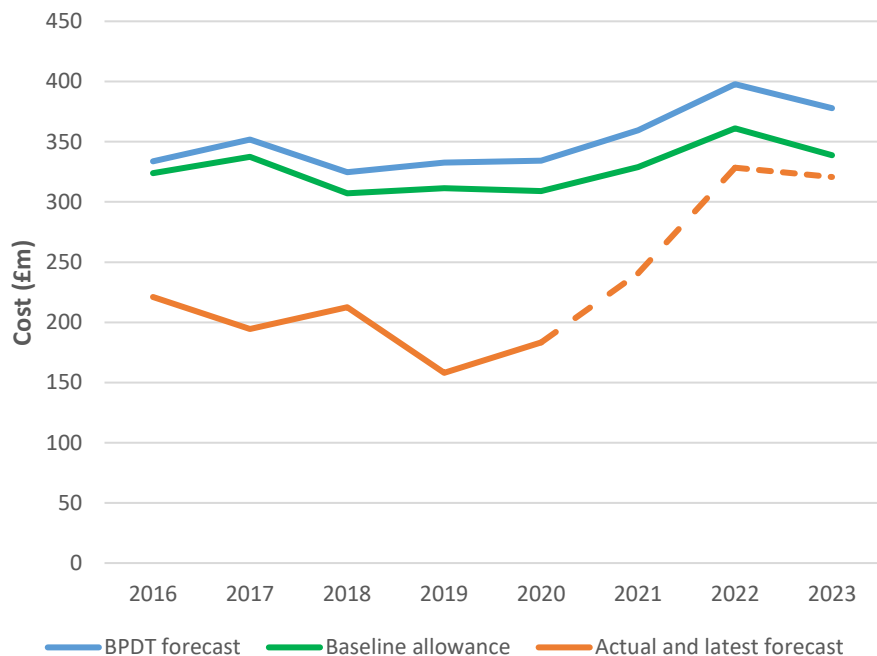


### General Feedback

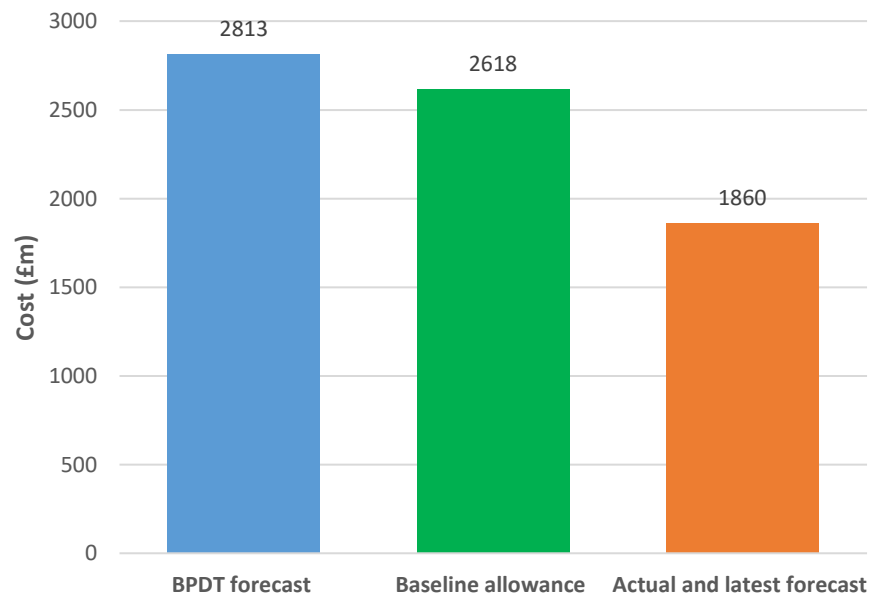
- Concerns regarding the variation of data held across the DNOs, and the impact this will have in developing a consistent and robust approach for ED2 implementation.
- No common methodology for the production of forecasts. Utilisation bands and load growth rates – only a few DNOs employ a bottom up modelling approach and have load growth rates and a utilisation value for GSP, BSP, Primary and distribution substation assets. Some DNOs are still using the FES scenarios framework and the FES GSP values shared by NGESO to determine load growth rates.
- Initial utilisation value at a distribution substation level will only be as good as the data we have on it from MDI readings?
- Capacity isn't always added incrementally and that a highly utilised current asset could be upsized significantly (in light of perceived future need and/or as part of 'touch it once') and become a very lightly utilised asset immediately post intervention.

## **Review of RIIO-ED1 performance**

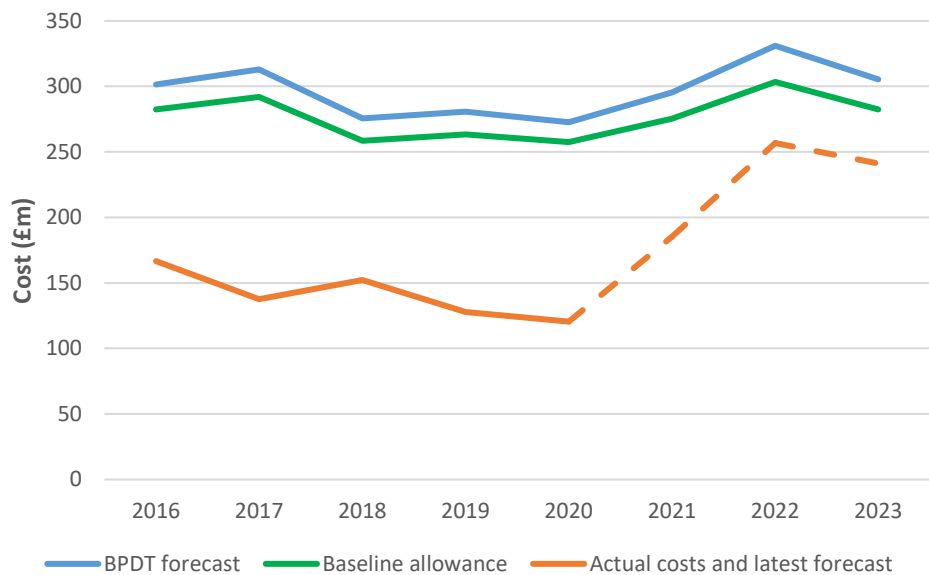
### Load-related expenditure, RIIO-ED1



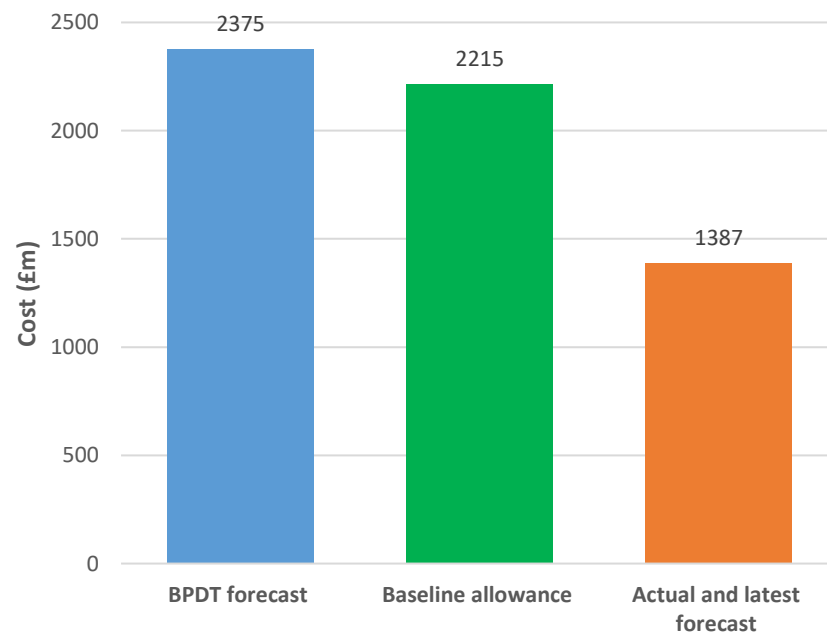
### GB aggregated load-related costs, RIIO-ED1



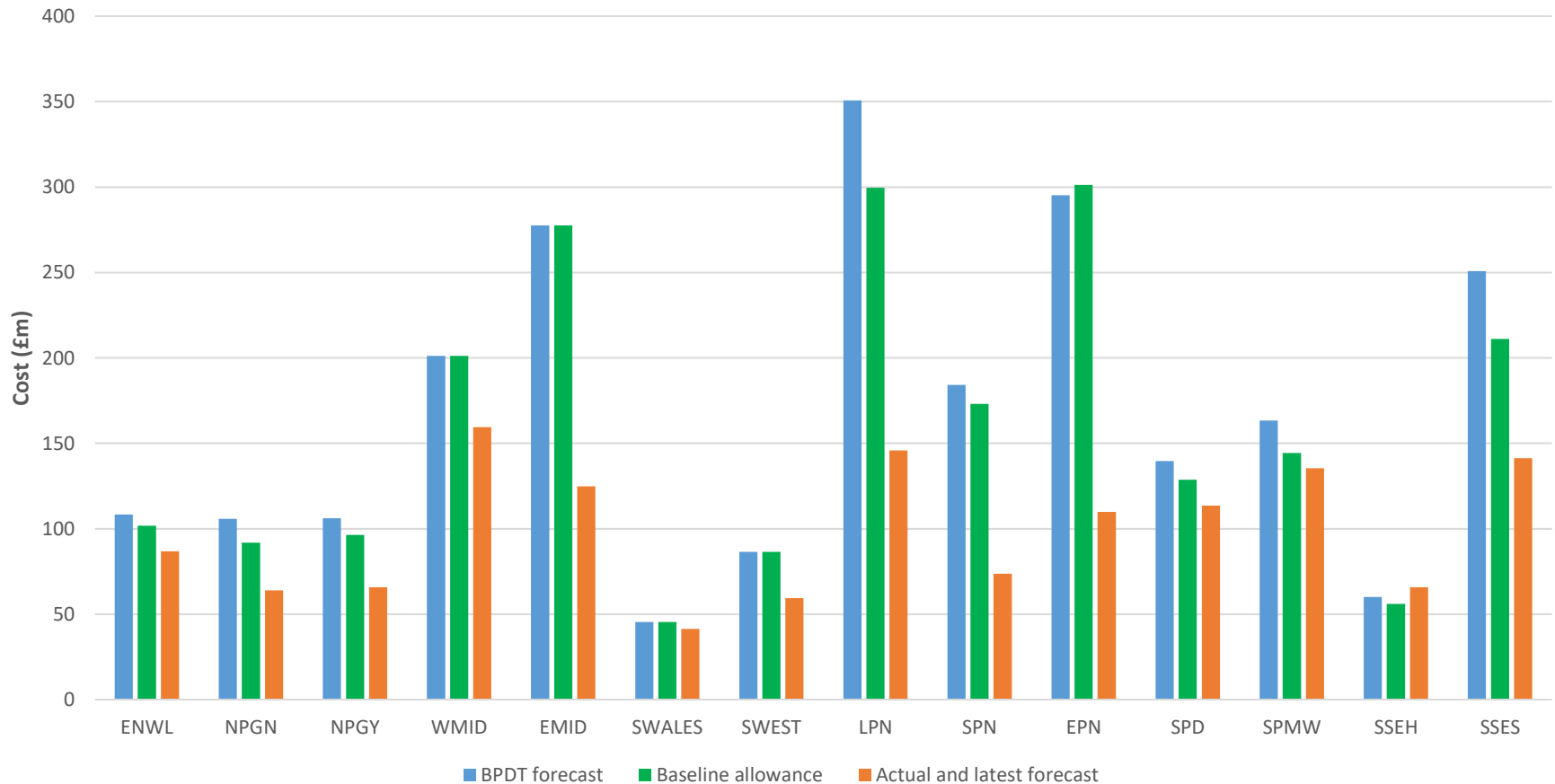
## Reinforcement costs, RIIO-ED ED1



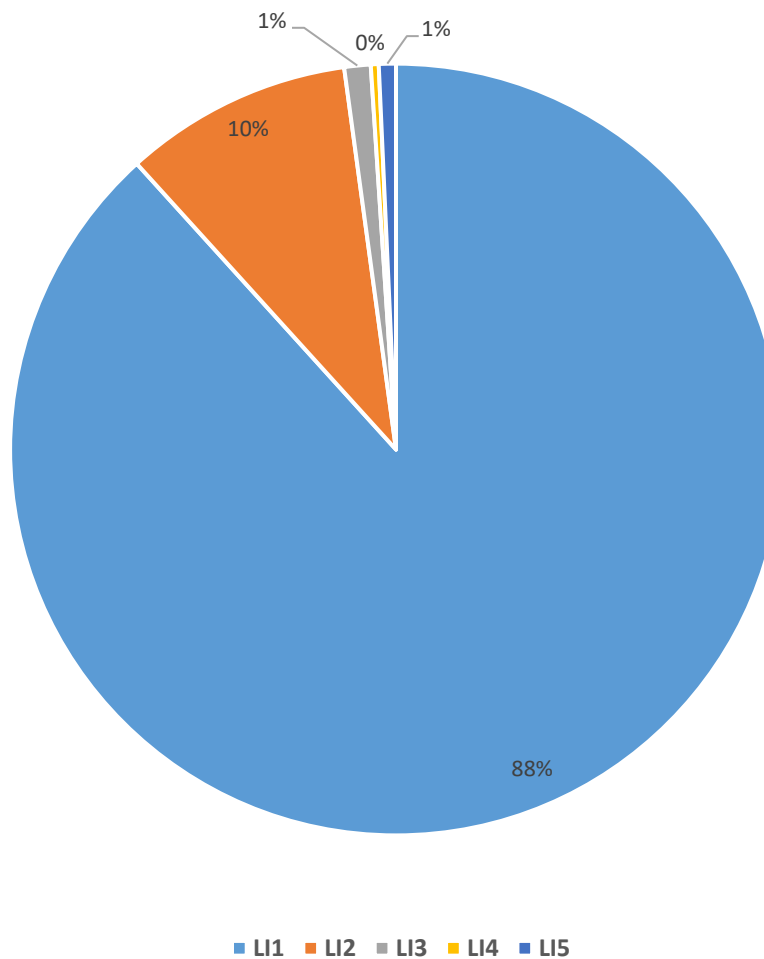
## GB aggregated reinforcement costs, RIIO-ED1



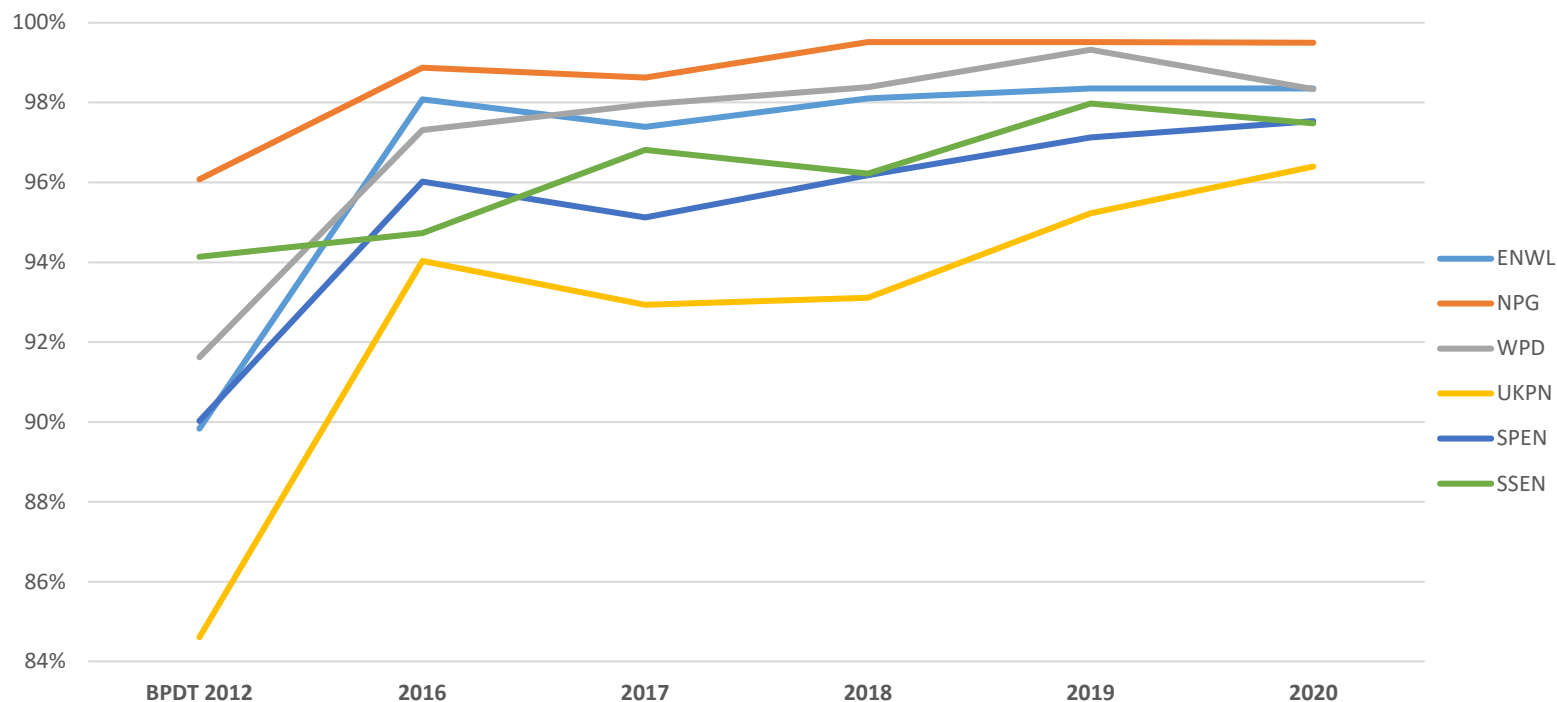
## Reinforcement costs in RIIO-ED1, BPDT forecast, baseline allowance and actual spend



2020 Average LIs Across All DNOs



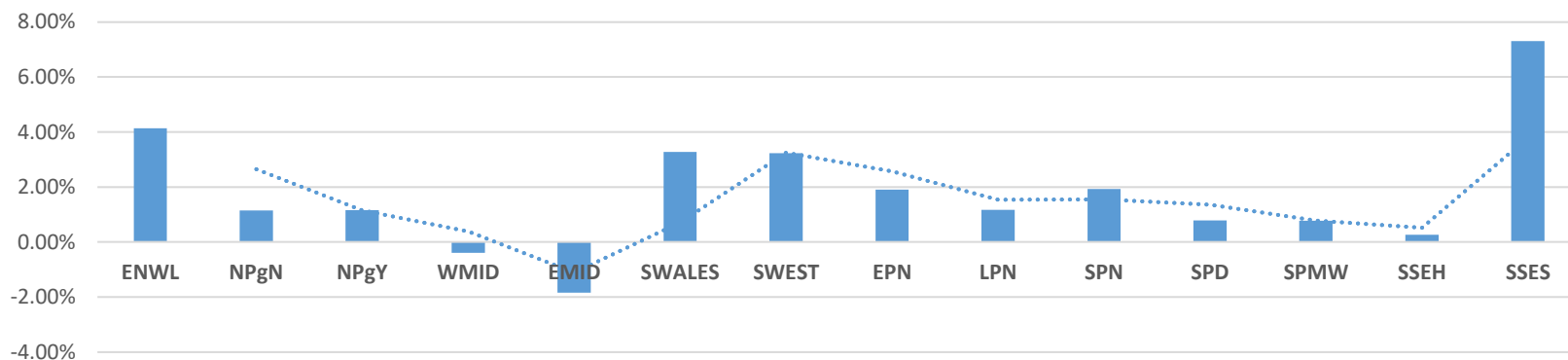
## Percentage of substations with significant spare capacity (LI1 & LI2)



	BPDT 2012	2016	2017	2018	2019	2020
ENWL	90%	98%	97%	98%	98%	98%
NPG	96%	99%	99%	100%	100%	100%
WPD	92%	97%	98%	98%	99%	98%
UKPN	85%	94%	93%	93%	95%	96%
SPEN	90%	96%	95%	96%	97%	98%
SSEN	94%	95%	97%	96%	98%	97%
<b>Average</b>	<b>91%</b>	<b>97%</b>	<b>96%</b>	<b>97%</b>	<b>98%</b>	<b>98%</b>

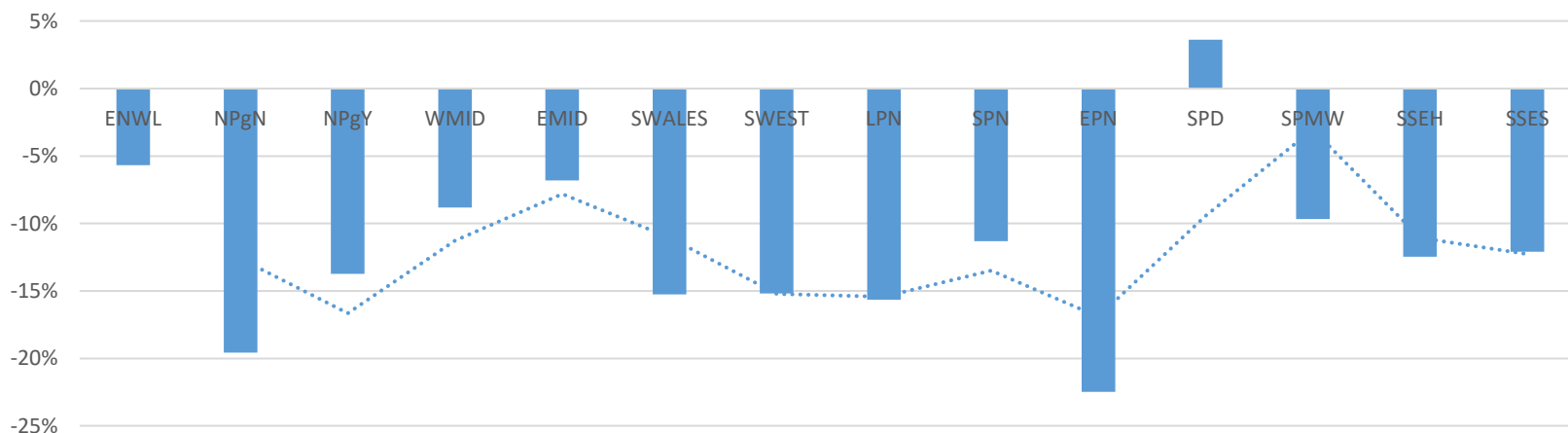
- Average forecast growth between 2019/20 to 2023/24 using LTDS data:

**Average Forecast Growth (2019/20 to 2023/24)**



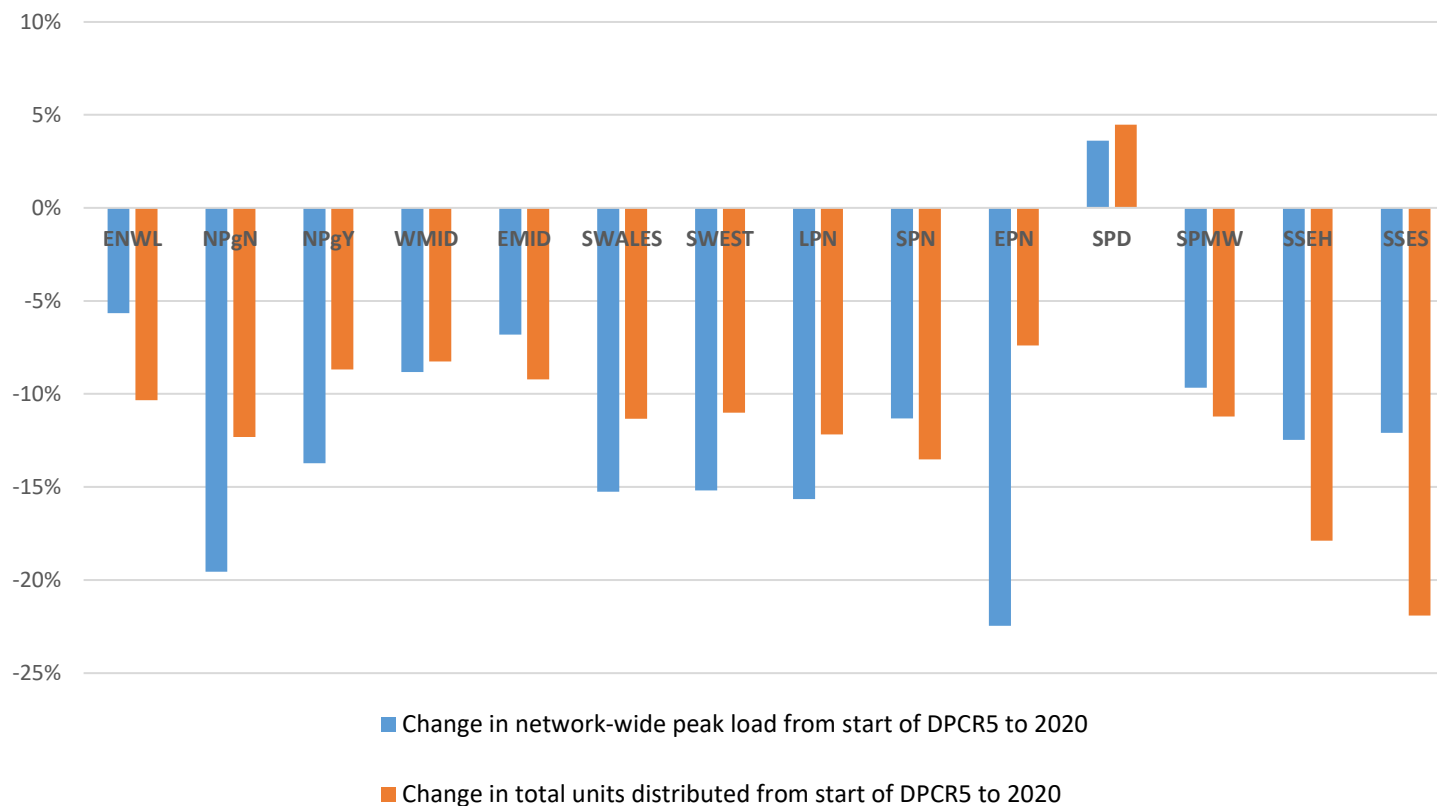
- Actual network-wide peak demand using RRP data:

**Actual Network-Wide Peak Load Growth (2011 to 2020)**

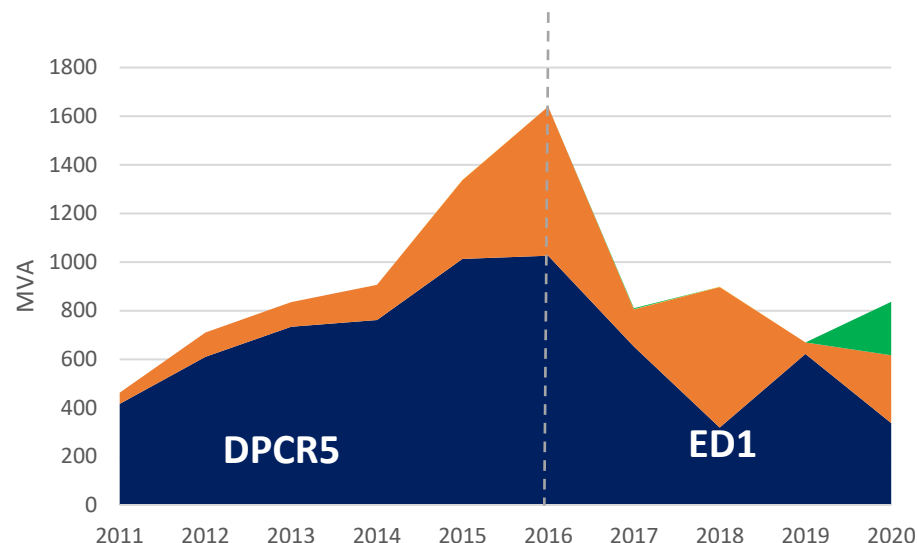
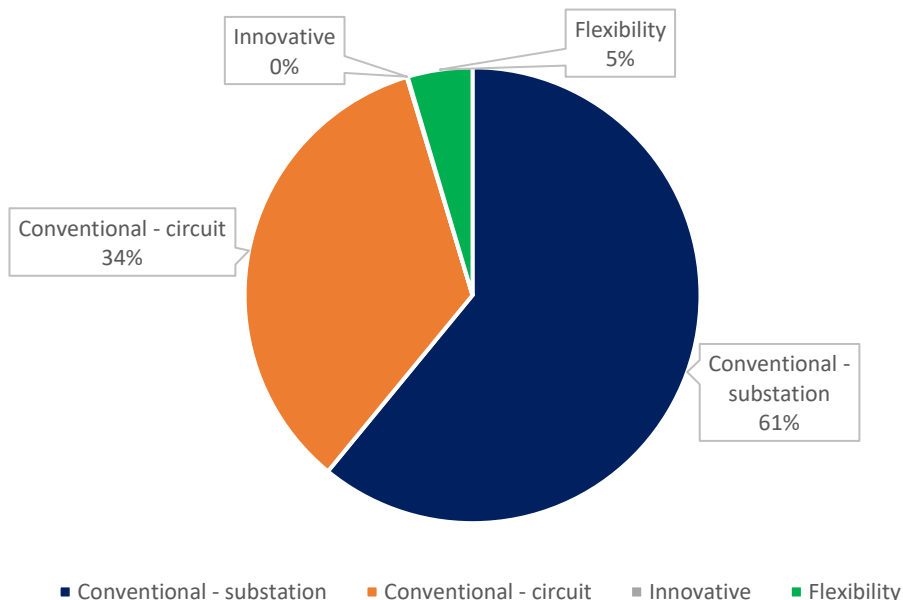


- Forecast growth in the LTDS is inconsistent with actual demand data captured in the RRP.



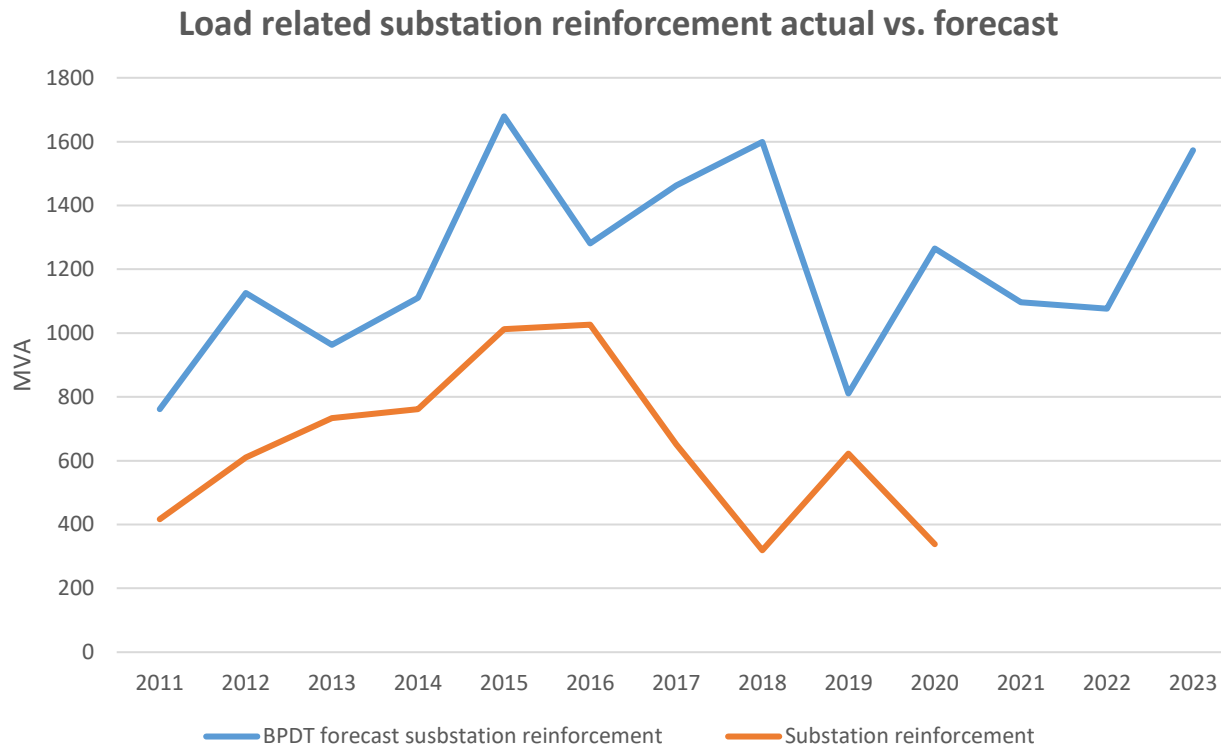


## Load related capacity constraints volume released in DPCR5 and ED1, at primary and secondary level (excluding schemes) \*



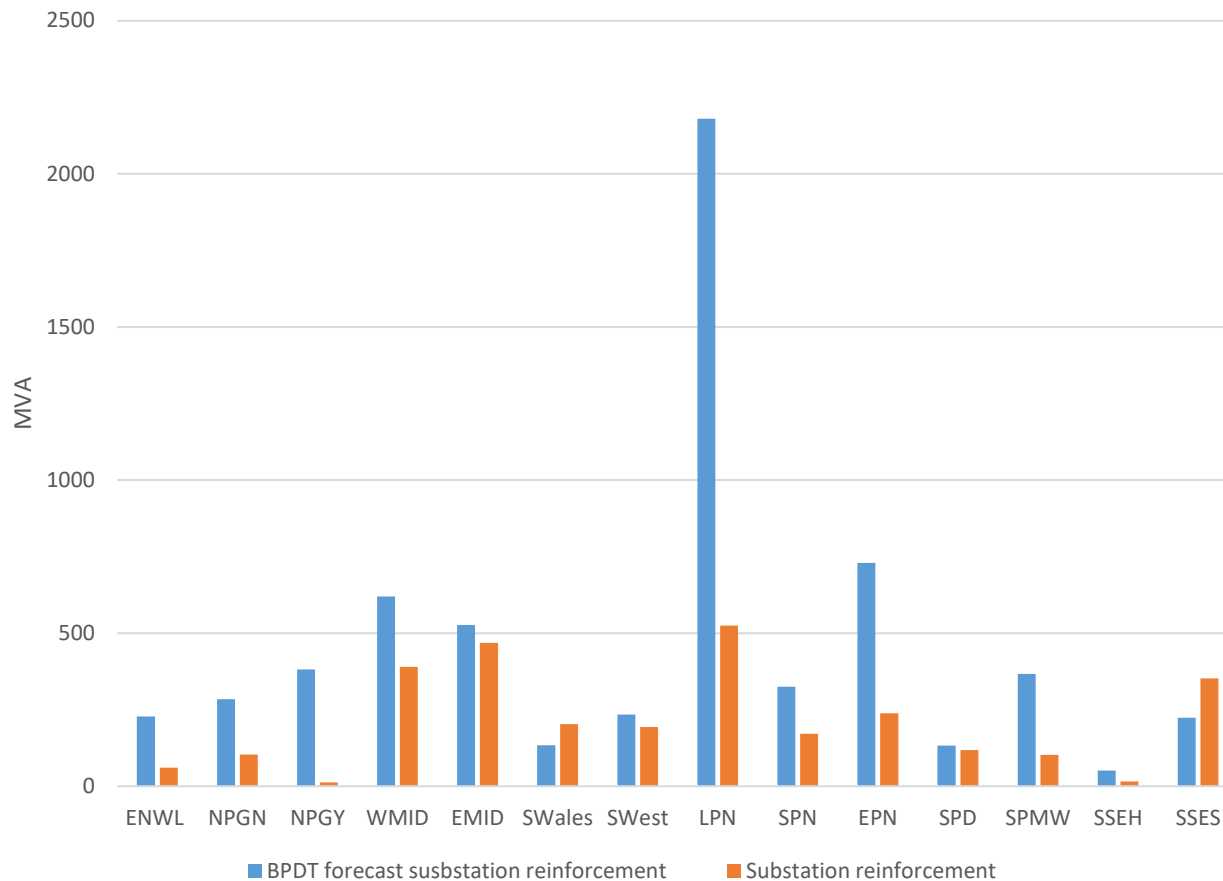
- Conventional solutions make up ~94% of the capacity added.
- Capacity added through traditional solutions to reduce constraints at substations is almost the double than that of circuits
- Capacity delivered through flexibility has significantly increased in 2020 (all WPDs networks).
- Volumes delivered through network innovative solutions have no impact.

\* this data excludes any capacity released through schemes, such as fault level schemes, or schemes in place to deal with non-capacity substation constraints. Also excludes 'Other Reinforcement activities' category, for example protections enhancements and the cost of running ANM schemes.

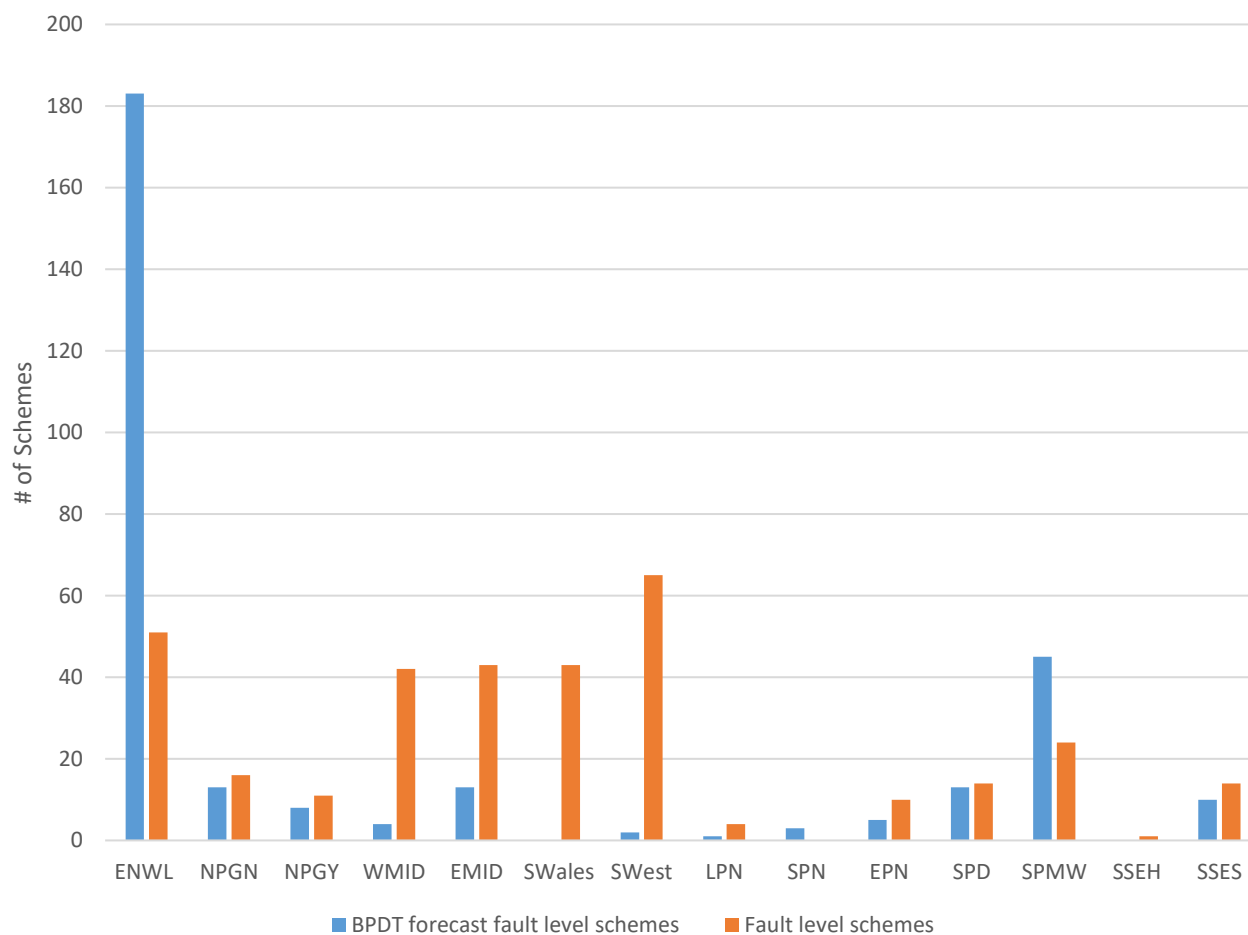


- The first few years of the BPDT forecast should be actual values, since it's early DPCR5 – why is there a gap?
- The BPDT forecast has a single MVA value for substation reinforcement.
- In the RIGs, substation reinforcement is split between 'capacity constraints' (in MVA) and 'other constraints' (in number of schemes).
- The actual value presented may only take into account capacity delivered to deal with capacity constraints.

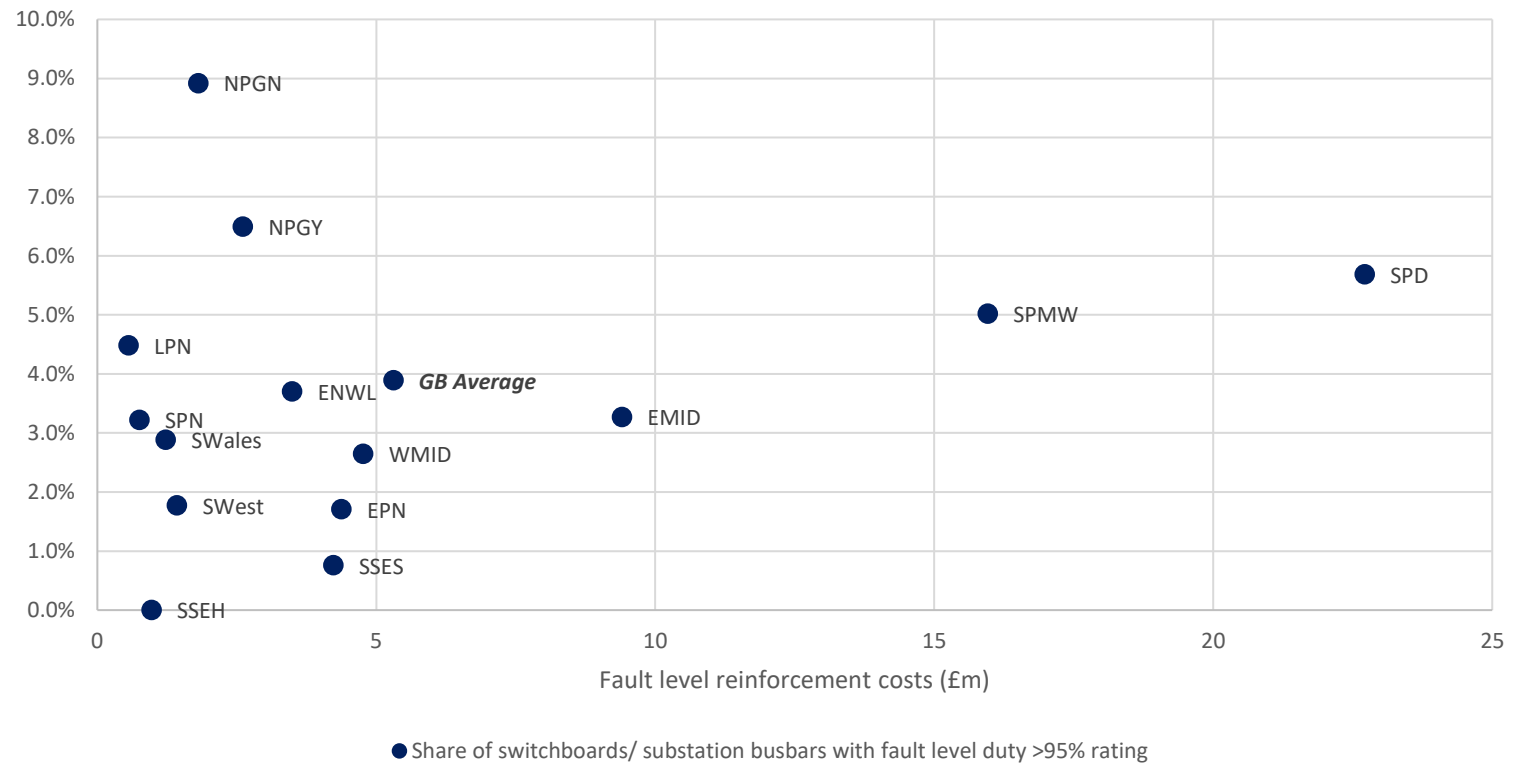
**Load related substation reinforcement in ED1 to date, actual vs. forecast**



**Load related fault level schemes in ED1 to date, actual and forecast**



**Share of switchboards/ substation busbars above 95% fault level duty rating  
against fault level reinforcement costs in ED1 to date**



- No clear correlation between the share of switchboards / substation busbars which have >95% fault level rating and costs of fault level reinforcement.

## **Interaction with BPDs**

## **Actions, next steps and AOB**



**Our core purpose is to ensure that all consumers can get good value and service from the energy market. In support of this we favour market solutions where practical, incentive regulation for monopolies and an approach that seeks to enable innovation and beneficial change whilst protecting consumers.**

**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.**