Promoting choice and value for all gas and electricity customers

Reliability & Safety Working Group

14 June 2012

Today's agenda

- Action log update
- Overview of the arrangements for Load-related expenditure in DPCR5
- Applicability of DPCR5 approaches for RIIO-ED1
  - Load Index
  - Load-related expenditure model
- Areas likely requiring development / further thinking
  - Extension of Load Index to LV
  - Application of LIs to generation centred substations
  - Treatment of DSR for Load Index
  - Common assessment methodology

Load-related expenditure - Overview of DPCR5 approach to expenditure benchmarking - 1

- General reinforcement modelling – split up by cost driver
  - General reinforcement: primary network (132kV – EHV excl. N-2 & London)
  - General reinforcement: primary network (N-2 & London)
  - General reinforcement: secondary network (HV – LV)
- Customer specific (ie: connections)
  - High Volume Low Cost
  - Low Volume High Cost
- Fault level reinforcement

Load-related expenditure - Overview of DPCR5 approach to expenditure benchmarking - 2

General reinforcement: primary network (132kV – EHV excluding N-2 & London) benchmarking:

- Ratio of capacity to be added to forecast maximum demand (‘MD’) growth on individual schemes listed for reinforcement
- Ratio of forecast cost per MVA of capacity to long run average cost per MVA of capacity
- Scheme specific costs ran through asset replacement model

Average of DNO actuals used to set benchmarks (unless company specific factors accepted where DNO was above mean)

(A starting point for discussions with DNOs)

DNOs were required to reconcile Load Index deliverable in line with Ofgem’s baseline

General reinforcement: primary network (N-2 & London) & High Value Projects

- Separately assessed based on scheme-by-scheme expert review and trend analysis

Load-related expenditure - Overview of DPCR5 approach to expenditure benchmarking - 3

General reinforcement: secondary network (HV – LV) benchmarking:

- High correlation between localised economic Gross Value Added (GVA) and secondary network demand growth confirmed (UK R^2 = 0.96)
- Given a presumed similar economic outlook in DR5 as in DR4, trend analysis/ run-rate analysis used
- Strong evidence required to support any substantial rise from DPCR4 levels

Fault level reinforcement

- Scheme-specific expenditure assessed against existing fault level issues and component ratings

Load-related expenditure - Overview of DPCR5 approach to expenditure benchmarking - 4

Connections Baseline:

High Volume Low Cost connections:

- Small-scale LV and other LV only: DNO forecast volumes x lowest of industry median/ DNO own gross unit cost of each subset
- LV w/ HV: DNO forecast volumes x lowest of industry UQ/ DNO own gross unit cost
- Net to gross ratio set based lowest of industry UQ/ DNO own ratio
- Baseline based on DNO volumes: volume driver true-up will amend DNO revenue
- Ex-post assessment of net to gross ratio could amend baselines

Low volume High Cost connections

- All connection expenditure forecast at EHV+: ex-ante allowance set based on projects in progress/ projects in planning stage for DPCR5 and projects forecast to be carried out by ICPs/ IDNOs
- Net to gross ratio set based lowest of industry UQ/ DNO own ratio

Load-related expenditure - Overview of DPCR5 approach to expenditure benchmarking - 5

Load Related Expenditure Reopener:

- Materiality threshold: Standard 1% of base revenue plus additional hurdle of 20% above/ below DPCR5 baselines for expenditure areas eligible for reopener
- Efficient expenditure above thresholds eligible after IQI factor is applied

	Analysis undertaken			Outputs	Uncertainty mechanism	
	Modelled / benchmarked	Scheme review / expert	Trend/ runrate analysis	Tied to secondary deliverable	Eligible for volume driver	Expenditure eligible for Load related reopener
General reinforcement modelling						
Primary network (132kV – EHV excl. N-2 & London)	√			LI		net efficient expenditure above/ below Ofgem baseline, subject to materiality criteria
Primary network (N-2 & London)		√		LI		net efficient expenditure above/ below Ofgem baseline, subject to materiality criteria
Secondary network (HV – LV)			√			net efficient expenditure above/ below Ofgem baseline, subject to materiality criteria
Customer specific (ie: connections)						
High Volume Low Cost	√				√	
Low Volume High Cost		√				net efficient expenditure above/ below Ofgem baseline, subject to materiality criteria
Fault level reinforcement		√				

LI and Reinforcement in RIIO-ED1

Within RIIO-ED1 there is likely to be greater uncertainty around the scope and scale of DNO reinforcement in DPCR5:

- Potential changes to load profiles, specifically at lower voltages
- Uncertainty over take up rate of LCT
- Potential for increased use of "non-conventional" techniques

ESSENTIAL QUESTION: Where does this manifest itself within the Regulatory Framework? [i.e.: wrt DPCR5 approaches: What still works? What needs to be changed? What needs to be replaced?]

Load Index

Nature of any changes to/ developments of Load Index for RIIO-ED1 will be determined by the role we see it playing and its interactions with the work developed in FCWG

1. Should/ could the Load Index be used as a measure of system utilisation and if so, what level of detail would be required. Operating as a more nuanced and sophisticated reinforcement output (see slides from WPD (10-32) and ENWL(33-43)

2. Should/ could the Load Index be used in combination with a "Time to connect" and IIS incentive on DNOs to ensure that at a system-wide level, substations remain loaded at an appropriate level. (see slide 44)

Load Indices and Network Utilisation Measures

14th June 2012

Phil Mann – Planning & Regulation Special Projects

Load Indices and Network Utilisation Measures

- Measurement Of Utilisation In A Network:
  - Assessment of capacity at a point on the network
  - Examining utilisation of individual components
- Extending Load Indices To Measure Network Utilisation

Requirement for Utilisation Measure

- A requirement for a utilisation measure is under discussion in FCWG as part of the 'time to connect' incentive.
- The utilisation measure would recognise investment by DNOs in network capacity to facilitate performance over the 'time to connect'

Requirement for Utilisation Measure (2)

- The existing Load Indices were not conceived as a network utilisation measure.
- The existing Load Indices reflect the requirement for intervention/ reinforcement and may be viewed as a measure 'load at risk'.

Measurement Of Utilisation In A Network

- Consideration of the utilisation of a network requires comparison of:-
  – the actual level of usage; with
  – the capacity of the network (i.e. the maximum level of usage that can be achieved without exceeding network limitations)
- Measurements of ‘usage’ and ‘capacity’ need to consider the running arrangements under which the network is required to perform (e.g. credible events considered under ER P2/6)

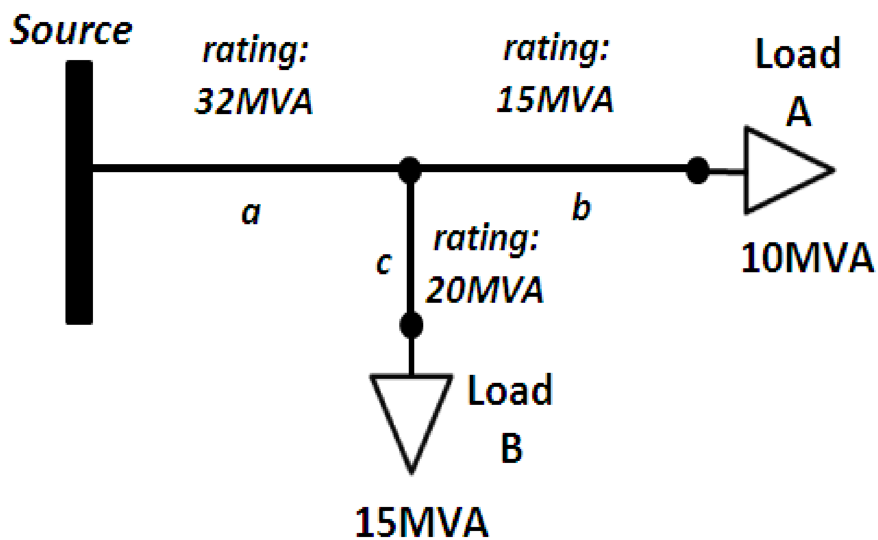
Measurement Of Utilisation In A Network (2)

- Utilisation of a network could be considered by:-
  - comparing
    - the ‘demand’ (either load or generation, as applicable) at a given point on the network; with
    - the capacity to support ‘demand’ at the same point on the network.

  or:-
  - examining the utilisation of individual network components under existing demand conditions
- Load Indices compare the maximum demand at a given point on the network against the firm capacity available at that location.

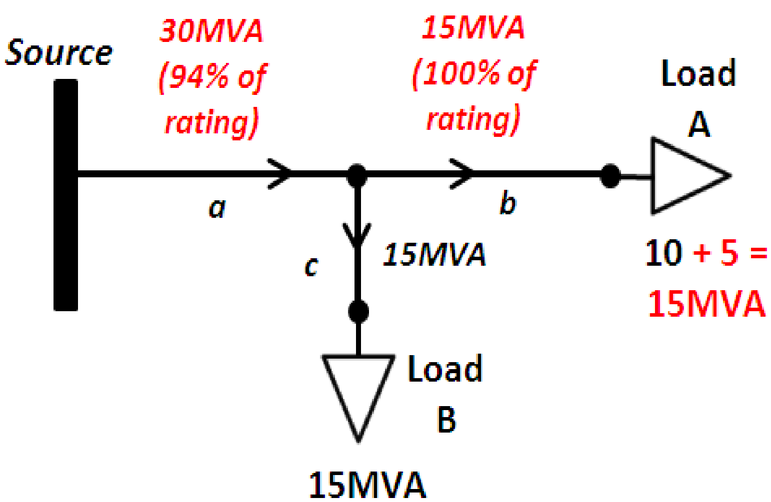
Assessment Of Capacity At A Point On The Network (1)

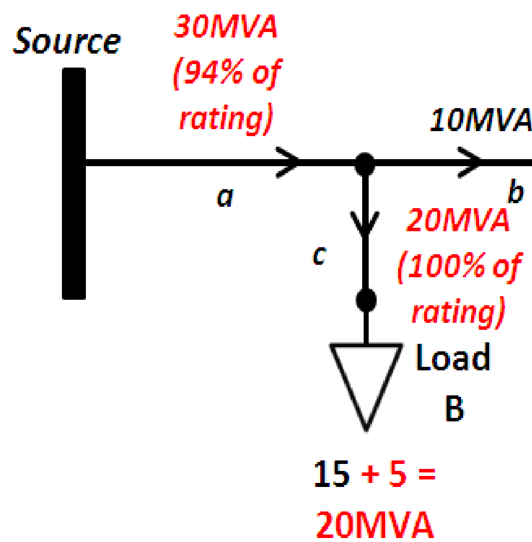
Consider a simple radial network, comprising two loads (A & B) and three branches (a, b & c):-



Assessment Of Capacity At A Point On The Network (2)

The capability to supply load at each location is independently assessed.



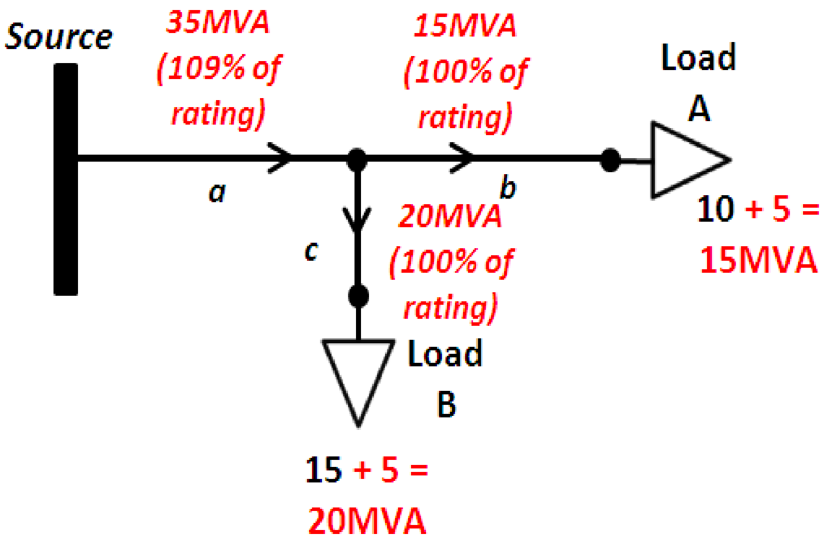


Branch	Rating
a	32 MVA
b	15 MVA
c	20 MVA

	Existing Load	Capacity	Utilisation
A	10 MVA	15 MVA	67%
B	15 MVA	20 MVA	75%

Assessment Of Capacity At A Point On The Network (3)

- Under this type of assessment, the available capacity at one point on the network may be dependant upon the demand at other points on the network.



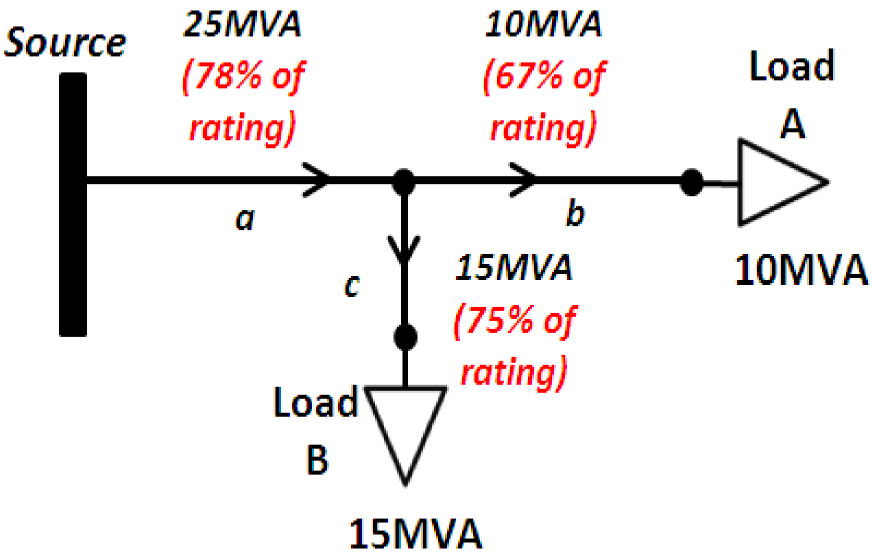
Branch	Rating
a	32 MVA
b	15 MVA
c	20 MVA

Assessment Of Capacity At A Point On The Network (4)

- Utilisations determined in this way:-
  - can recognise voltage limitations etc;
  - could consider capacity for connection of load or generation (using separate analysis for each)
  - do not provide a measure of utilisation of most network components, only the identified limitation;
  - provide no indication of the 'size' of the limitation (e.g. short length of cable, or entire circuit);
  - cannot be aggregated to create an overall utilisation of the network (or 'headroom' for additional demand), due to the interdependencies between different points on the network.

Examining Utilisation Of Individual Components (1)

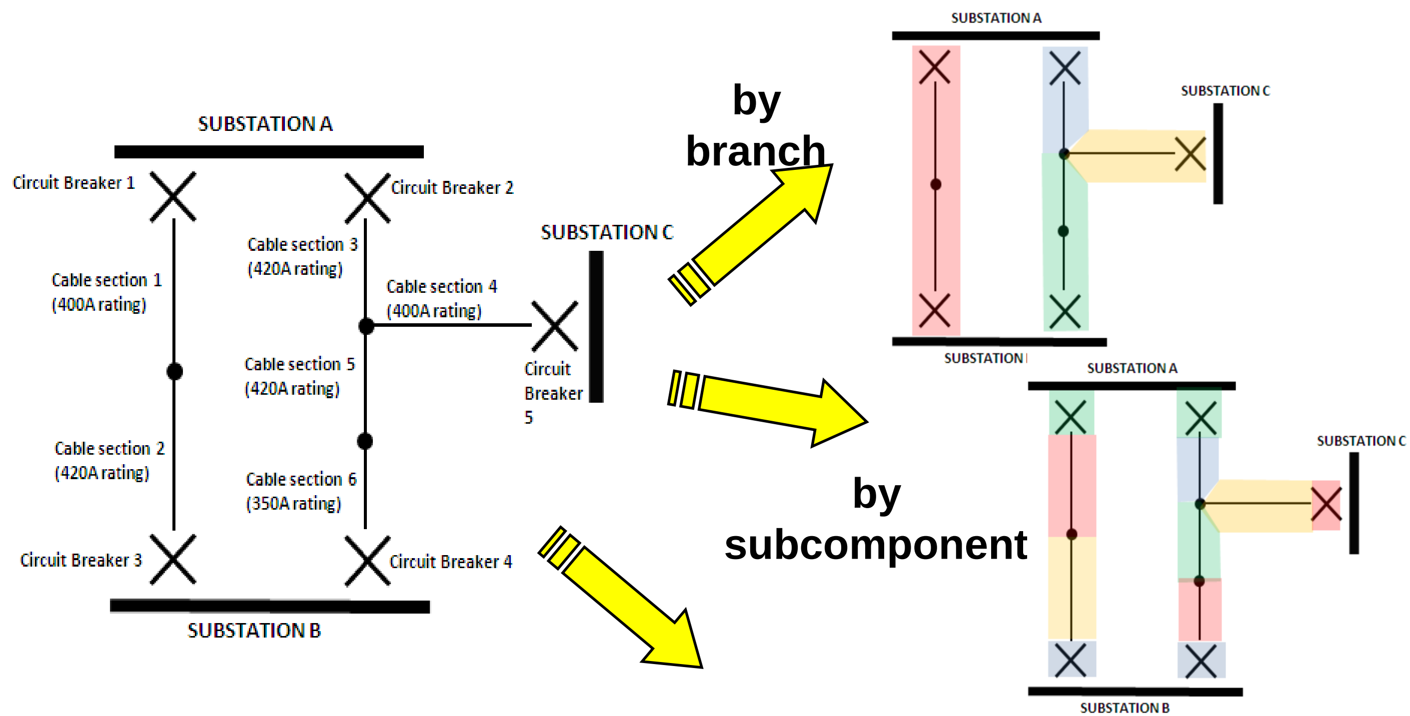
- As an alternative, the utilisation of each network component could be seen as a simple comparison of the maximum power flow with the appropriate rating, under existing demand conditions.



Branch	Rating
a	32 MVA
b	15 MVA
c	20 MVA

Examining Utilisation Of Individual Components (2)

The granularity of the measure is determined by the definition of an ‘individual component’.



by circuit??? (only possible where power flow is the same throughout the circuit)

WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Examining Utilisation Of Individual Components (3)

- Different components within a circuit are likely to have different levels of utilisation.
- In order to quantify overall network utilisation, aggregation is possible, provided some form of weighting to be attached to each individual component – but is this a meaningful measure?
- Does not reflect the capability to connect additional demand, load or generation, without reinforcement
- This measure does not provide a measure of constraints, such as voltage considerations, that relate to the overall network parameters, rather than individual components in isolation.

Measuring Network Utilisation

- Detailed network analysis is required to:-
  - examine the utilisation of individual components within circuits (particularly EHV circuits between substations, HV or LV feeders etc.); or
  - consider the limitations of the whole network, in determining utilisation by consideration of the capability to support demand at a given point on the network
- Requires powerflow analysis to calculate the power flowing through individual components/ voltages around the network (rather than measure).

Extending Load Indices To Measure Network Utilisation (1)

- In the majority of cases, the firm capacity currently used in producing existing Load Indices, for 132kV & EHV substations, is likely to be based upon consideration of the local circuits only (due to the analysis required to examine interdependencies elsewhere in the network).
- The max. demand used, will be based on actual measurements (corrected for abnormal running).
- Existing Load Indices can be produced, in this way, without extensive network analysis.

Extending Load Indices To Measure Network Utilisation (2)

- A simple measure of utilisation of HV/LV transformers could be produced by comparison of:-
  - the estimated demand at the substation (based on either MDI readings or estimates from customer numbers/ consumptions/ profiles etc.); with
  - the transformer rating.
- This is a simple comparison limited to certain individual components, requiring no detailed network analysis.

Extending Load Indices To Measure Network Utilisation (3)

- Where reinforcement is required to accommodate future demand on HV or LV networks (EV, heat pumps, PV etc.), this is likely to:-
  – include reinforcement of significant proportions of HV or LV circuit components, or
  – be driven by voltage considerations (along a circuit).

  Therefore, any measurement of utilisation aimed at identifying the effects of reinforcement etc., at HV or LV, needs to consider the circuits themselves.

Extending Load Indices To Measure Network Utilisation (4)

What may be required to introduce network utilisation measures?

Network Level	Covered by Existing LIs	How can utilisation measure be produced?
132kV network	Partially	Network analysis required
132kV/ EHV transformation	Yes	Existing measure of max. demand against firm cap.
EHV network	Partially	Network analysis required
EHV/ HV transformation	Yes	Existing measure of max. demand against firm cap.
HV network	No	Network analysis required
HV/ LV transformation	No	Simple measure of max. demand against cap.
LV network	No	Network analysis required

Extending Load Indices To Measure Network Utilisation (5)

- Network analysis requires use of network models comprising:-
  - circuit/ section component data;
  - demand/ consumption data;
  - Connectivity
- Analysis also requires identification of credible running configurations.

Extending Load Indices To Measure Network Utilisation (6)

- Within WPD:-
  - 132kV & EHV network models are maintained, that may be suitable for some form of analysis of network utilisation.
  - HV connectivity models are maintained. Allocation of load within these models is performed ‘ad-hoc’, where required for specific studies.
  - LV network models are created ‘ad-hoc’, where required for specific studies.

Extending Load Indices To Measure Network Utilisation (7)

- Assuming a requirement to determine a simple measure of the existing utilisation of individual HV and LV network components, by comparing existing loading against rating, an estimate can be created for the likely resource requirement (assuming a 'one off exercise')
- HV networks:-
  – No. of primaries within WPD = approx. 1250
  – Assumed time to set up & analyse HV network associated with a primary = approx. 1 man day
  – Total resource = approx. 5-6 man years

Extending Load Indices To Measure Network Utilisation (7)

- LV networks:-
  - No. of HV/LV GM substations within WPD = approx. 65,000
  - Assumed time to set up & analyse LV network associated with a HV/LV GM substation = approx. 0.4 man day
  - No. of HV/LV PM substations within WPD = approx. 150,000
  - Assumed time to set up & analyse LV network associated with a HV/LV PM substation = approx. 0.1 man day
  - Total resource = approx. 185 man years

Extending Load Indices To Measure Network Utilisation (8)

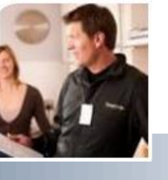
- Points for discussion:-
  - Are the existing LIs a suitable utilisation measure for use as part of an incentive?
  - Can more detailed analysis produce meaningful utilisation measures?
  - Is the cost of performing more detailed analysis proportionate to the requirement for a utilisation measure for use as part of a ‘time to connect incentive’?
  - Are utilisation measures Network Outputs?

LI Methodology

Methodology and Assumptions

Paul Bircham & Steve Cox

May 2012

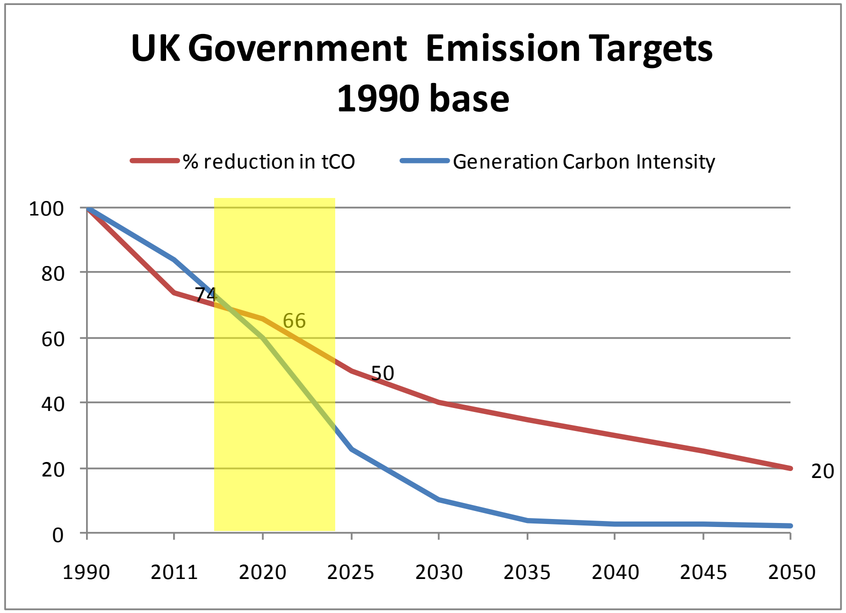


Agenda

- Background and objectives
- Overview of demand forecasting
  - Base forecast
  - LCT forecast
  - Secondary network LIs
- Output metrics
  - Definition of a Problem
  - Estimation of volumes of Problems
  - Benchmarking of resolution costs
  - Measurement of actual Problems

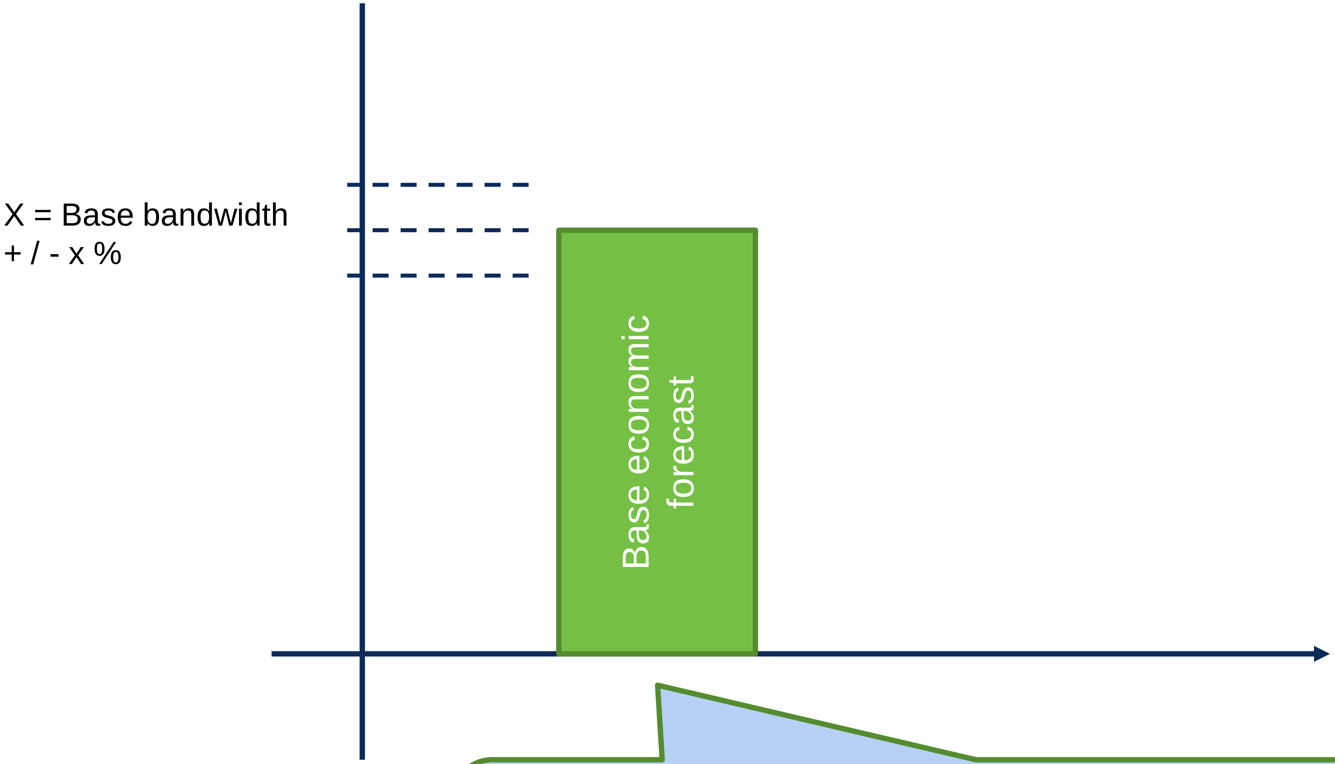
Load related Reinforcement - background

- 2011 Position 1/3rd Electricity, 1/3rd Gas, 1/3rd Oil
- 2023 **34%** Reduction in CO_2
  - 40% from Wind / PV & new Nuclear
  - 5% Transport 120,000 EV / Hybrid
  - 26M Smart Meters fitted
- 2050 **80%** Reduction in CO_2
  - Doubling in electricity demand



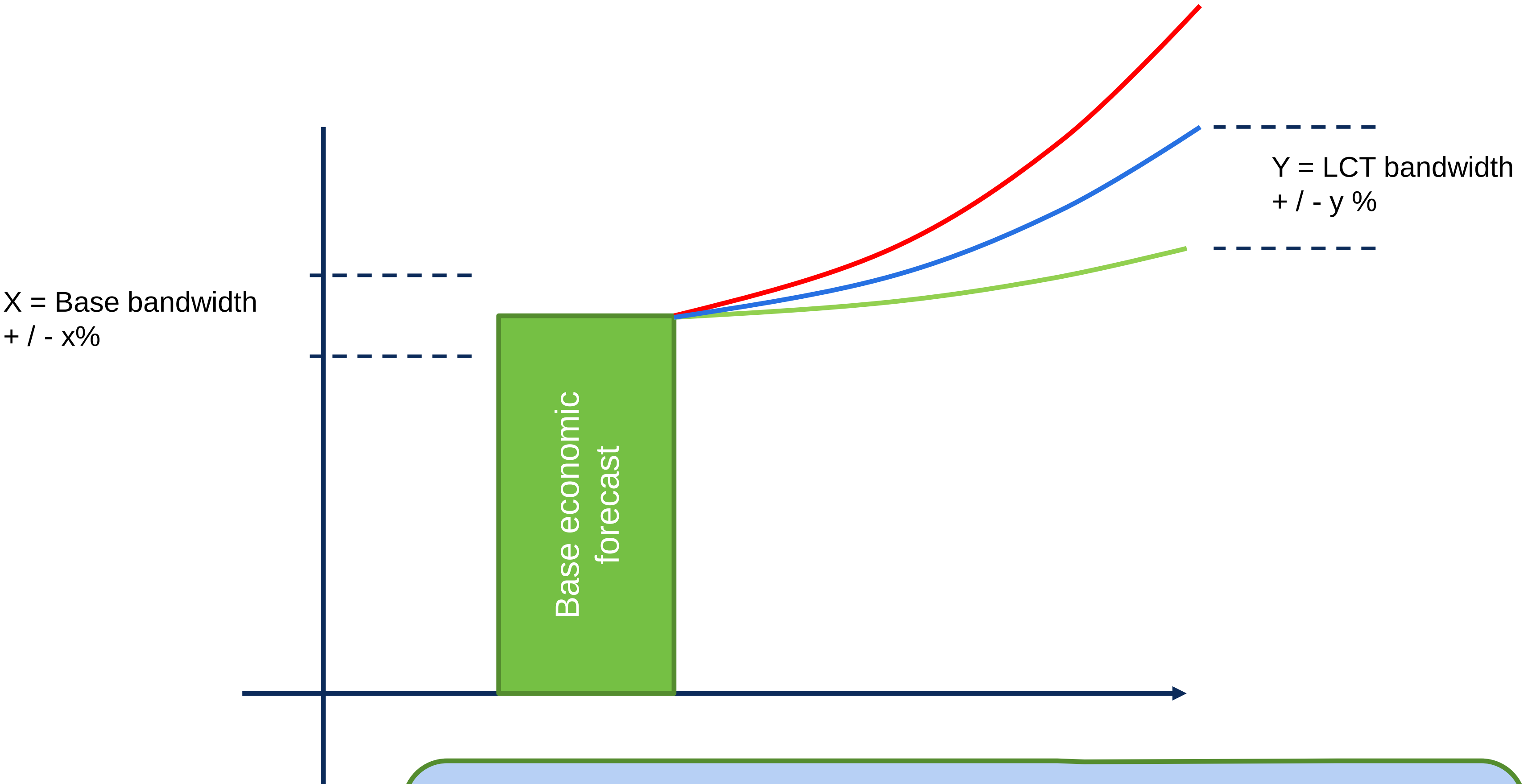
- Challenges
  - Where will this growth occur in ED1?
  - How will future demands be provided efficiently?
  - How do we set associated allowances and incentives?

Load Forecast - Overview



1. Base forecast - rolling load forecast incorporating energy efficiency assumptions on appliances, population and GDP growth.
2. Appropriately disaggregated and scaled to regional and national forecast
3. Projected out to 2023 / 2024

Load Forecast - Overview



1. Range of LCT scenarios considered and applied to 2023 / 2024 base.
2. Total reinforcement therefore comprises three elements of uncertainty
   a) Economic activity ~ DPCR5
   b) LCT which is new and in the main driven by external policy and incentives
   c) The value or discount available from Smart solution sets ~ WS3 output

WS3 Work Structure

Network model

•Construct an average network model to represent vanilla UK topology 6EHV, 7HV 19 LV.

•Load network based on uniform average load level

LCT allocation

•Aggregate adoption of LCT allocation as per UK plan with broad regional weightings compliant with DEC medium case

•Develop load curves and project future demand

Solution Sets

- Establish a library of transitional and smart solution sets.
- Establish typical traditional solution costs
- Establish potential Smart solution costs

Solution Sets

- Apply solution set to identified interventions (eg 20% of LV type 1 feeders)
- Establish minimum 5 year SSS life cycle
- Establish cost benefit case for traditional / SSS

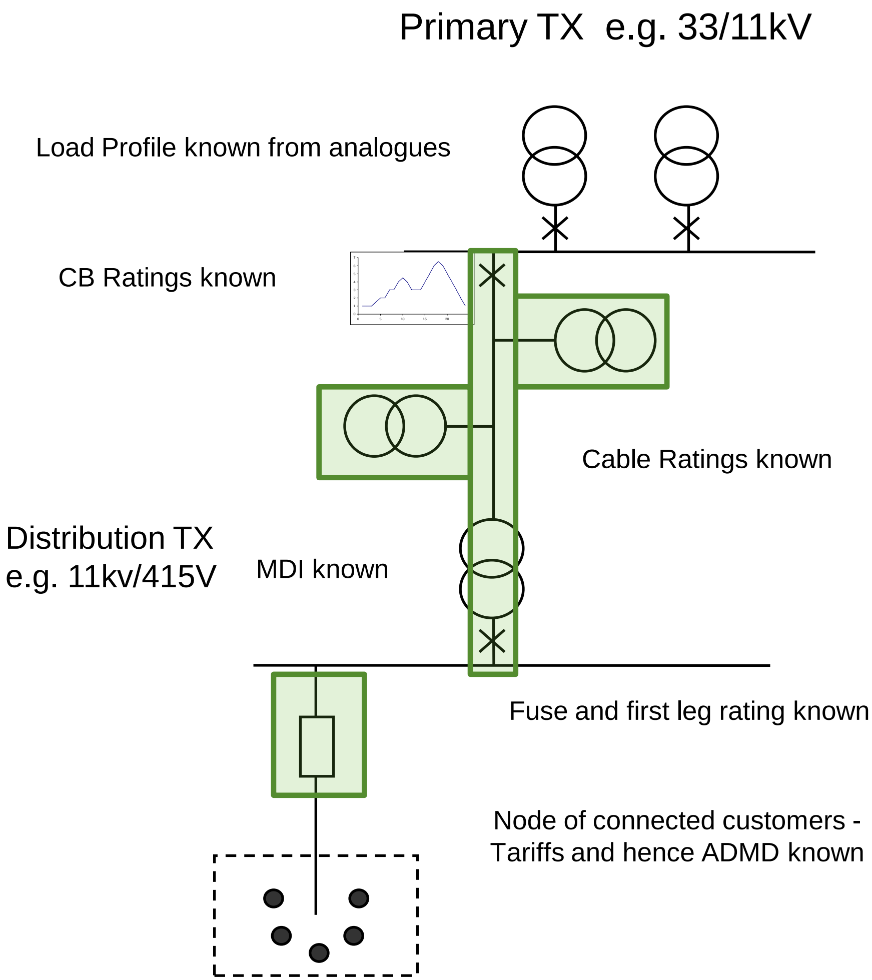
- Output
  - Barometer for regional demand growth & LCT adoption levels
  - Indicative balance of traditional v SSS volumes and costs

Smart solution set is at TRL 5 and adoption in investment forecasts requires considerable work.

Most SSS require considerable enabling investment eg Level 3 NMS, EDMS, mirco RTUs and associated comms.

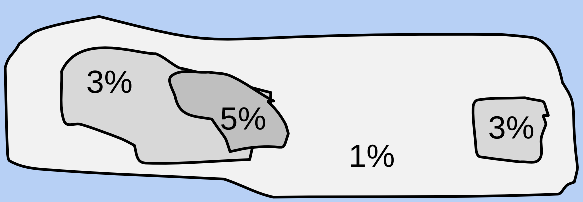
Cost benefit modelling requires development.
Optionallity and No Regrets overlap this module

How could we derive LIs in the secondary network

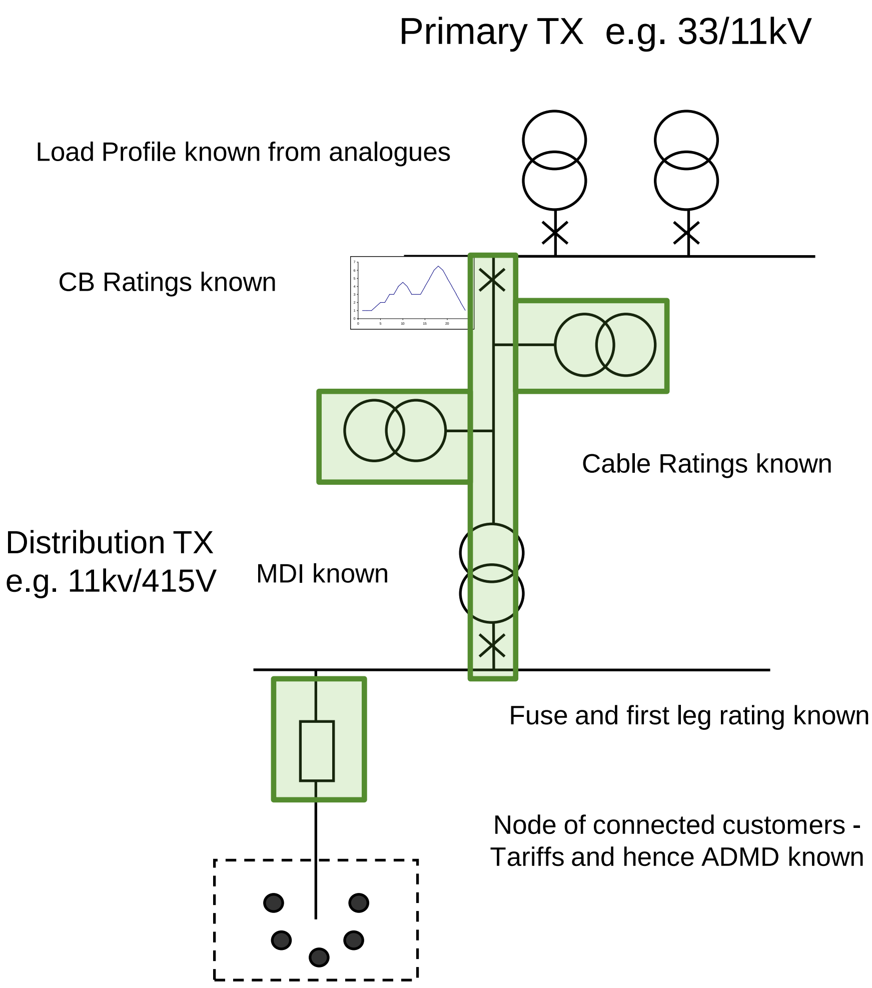


Load Allocation

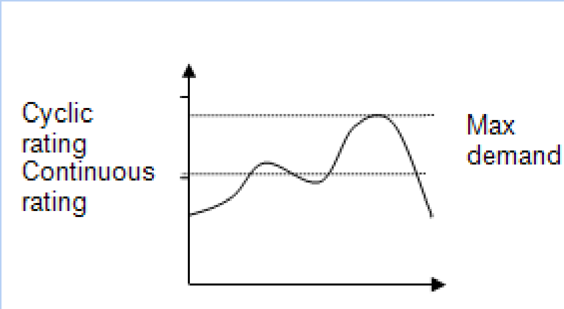
- LV Fdr load profiles assembled from MPAN class, HH &TMS connectivity.
- TX demand derived from MDI and sense checks to scale LV Feeder data.
- TX demands in turn scaled to match know HV feeder profiles.
- Base case & LCT growth applied in line with LA stakeholder plans scaled to selected scenario
- Able to select level of peak shaving DSM used
- LCT Clustering applied by LA area
- Spatial distribution combines X% take-up in each local authority, with semi-random clustering (may be income or attitude linked.



How could we derive LIs in the secondary network

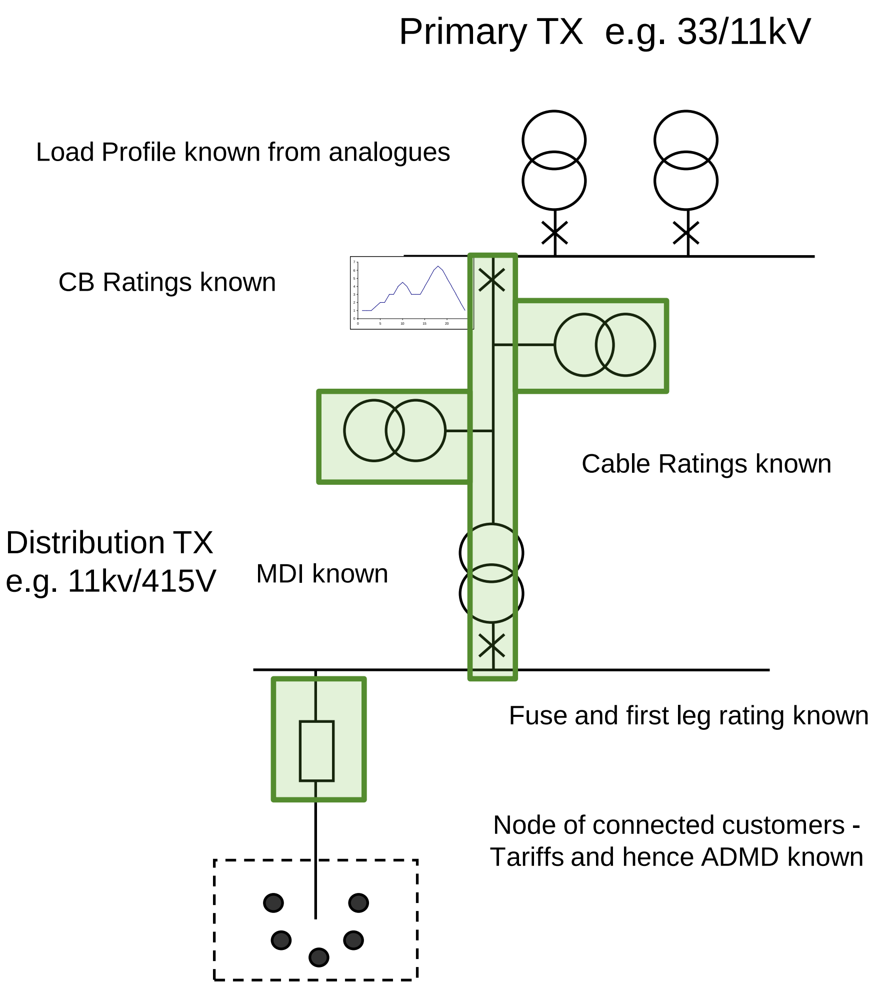


Complex Feeder / TX ratings



- Resultant network component load curve derived and appropriate rating selected
- Output is an assessment of load against LVFdr / TX / HV sub feeder rating ~ LI
- Identifies thermal interventions = LI_t
- LI_h & Li_v ~ % penetration level

How is load converted into an investment forecast



Other interventions

- Penetration thresholds set for voltage and harmonic interventions.
- Thresholds can be set by LCT type e.g. 20 kW on an asset, or % of rating.
- Uses same spatial distribution of EV, HP and PV in the thermal model.
- LI_h & Li_v ~ % WS3 penetration level

Outputs

- Count HV feeder sections, Dist TX and LV feeders which exceed thresholds
- LI_h & Li_v LI_t – volume of likely interventions
- Output can be contrasted against vanilla WS3 model
- Caters for DNO specific preloading and stakeholder plans versus WS3 vanilla assumptions.

How could we measure Problems Solved ?

- WS3 modelling provides a common set of thresholds that allow definition of a ‘problem’.

- LI model provides a planning assumption for volumes by asset type that are likely to require an intervention.

- WS3 model provides two alternate methods of intervening
  - Traditional Solution Set
  - Smart Solution Set
  - Both have associated costs.

- Subject to agreeing the solution valuation assessment criteria these predict a ‘benchmark’ solution cost.

- Benchmark cost x volume ~ allowance for a given set of assumptions

How could we measure Problems Solved ?

- What if the assumptions are wrong ?
  - Growth
  - Penetration levels
  - Clustering
  - Government policy
  - Disruptive technologies

- How can we measure actual problems ?
  - HP connections via MCS web site notifications of Mpans for RHI
  - EV connections process now passed to ENA HPWG
  - Annual re runs of WS3 models updated with actual penetration levels
  - Residual balance to attain latest UK Gov forecast makes up balance

- Data on actual TSS and SSS costs informs benchmark as technologies become mature.

Using LIs in tandem with other incentives

- Perhaps the Load Index could operate as a backstop behind the IIS reliability incentive and connection incentive developed through FCWG
  - Shift in emphasis to maintaining appropriate levels of substation loading and prevention of system-wide over investment to chase connection incentive. Operates as a proxy for system utilisation levels
  - Tolerance band around delivery level signed up for by DNO can strengthen IIS/ Connections incentive to penalise under or over investment

  WORK THAT WOULD BE REQUIRED:
  - Extension of LIs to LV (and defining capacity at LV)
  - Determine treatment of DSR
  - Determine treatment of Generation dominated substations
  - Develop common LI scoring criteria

Moving towards a consistent assessment methodology

- Summary of methodologies used in DPCR5:
- In terms of LI4 & LI5, table below suggests that there is a reasonable level of consistency

	ENWL	NPG	WPD	UKPN	SP	SSE
1	0-90%	0-90%	0-70%	0-70%	0-90%	0-79.9%
2	90-95%	90-99%	70-85%	70-85%	90% - 99.9%	80-89.9%
3	95-103%	100-115%	85-98%	85-100%	100% - 120%	90-99.9%
4	95-103% >9 hours >103% <9 hours	100-115% >24 hours	>98% 8hrs or less>100	>100% <500MVAh	100% - 120% 48 - 720hrs	>100% <54hrs
5	>103% >9 hours	100-115% > 672 hours	>98% 8hrs	>100% >500MVAh	100% - 120% >720hrs	>100%>54hrs
		>115%	100%+		>120%	

Load Priority Index (LPI) Example

RSWG 14 June 2012

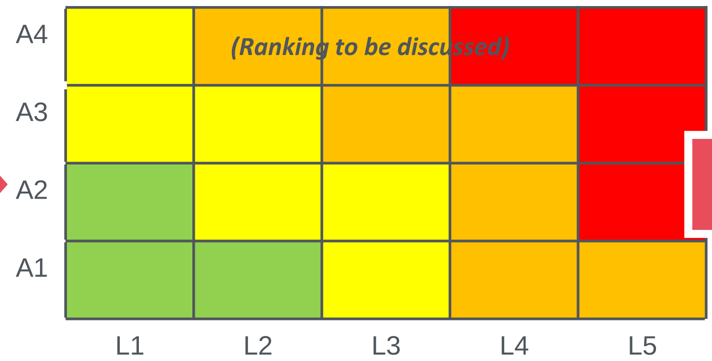
UK Power Networks

The Load Priority Index has a strong anticipatory and geographical element

The Load Priority Index is a weighting of the established Load Indices with an Activity Index. The Activity Index seeks to provide a measure of where headroom will be used up more quickly on the network based on the anticipated (regional) activity on the network.

Load Priority Index (anticipated need) = asset loading x anticipated activity

Load Index	Activity Index
L5 (High)	A4 Very high
L4	A3 High
L3	A2 Medium
L2	A1 Low
L1 (Low)	



No. of years before action
0-2 years
2-5 year
5-10 year
>10 year

- The Activity Index is a reflection of both speed of change as well as predictability of change
- The Measure will reflect ability to deliver new capacity (adds to uncertainty)
- This measure complements the new Load Related Model, developed with Asset Management and Imperial College, which has the ability to forecast network activity down to Local Authority level.

Capturing anticipated activity in reliable metrics

The activity Index will be based on internal and external metrics, such as network connection activity, regional economic activity, related supply chain and customer activity.

Internal

Network Activity

Initial thinking: connection requests, Feed-In Tariff (FiT) applications, regional demand growth, etc.

External

Economic Activity

Initial thinking: Gross Value Add (GVA), Gross Regional Domestic Product (GRDP), floor space increase, employment growth, value of lost load, planning, etc.

Supply Chain activity

Initial thinking: EV sold, heat pumps sold (inclusive of cooling?), PV sold, market growth, supply chain capacity growth, etc.

Market Activity

Initial thinking: Consumer attitudes, number of FiT and Renewable Heat Incentive (RHI) related service offerings, number of EV models in show rooms, market interventions (e.g., incentives), price parity EV and petrol cars?, etc.

Activity Index

Example Load Priority Index Assessment

Substation	Start %	Start MVAh	Start LI	End %	End MVAh	End LI	Network	Economic	Low Carbon / Supply chain	Low Carbon / Market Drivers	Activity Score	Actvity rating	Priority
				Firm Forecast									
A	119%	2200	**LI5**	122%	3700	LI5	5	5	1	1	25	**A2**	**P3**
B	108%	900	**LI5**	111%	2000	LI5	10	5	1	1	50	**A3**	**P2**
C	110%	800	**LI5**	110%	820	LI5	1	1	1	1	1	**A1**	**P5**
D	113%	1000	**LI5**	119%	3000	LI5	10	5	1	1	50	**A3**	**P2**
E	116%	1400	**LI5**	118%	2000	LI5	5	5	5	1	125	**A4**	**P1**
F	115%	1200	**LI5**	154%	3200	LI5	10	5	1	1	50	**A3**	**P2**
G	121%	1700	**LI5**	124%	2700	LI5	5	5	1	1	25	**A2**	**P3**
H	110%	340	**LI4**	112%	750	LI5	5	1	1	1	5	**A1**	**P5**
I	105%	90	**LI4**	112%	900	LI5	5	1	5	1	25	**A2**	**P4**
J	109%	200	**LI4**	114%	670	LI5	1	5	1	1	5	**A1**	**P5**
K	108%	200	**LI4**	112%	600	LI5	5	10	1	1	50	**A3**	**P3**
L	108%	300	**LI4**	120%	5000	LI5	10	10	1	1	100	**A4**	**P2**
M	112%	500	**LI4**	120%	1500	LI5	5	5	1	1	25	**A2**	**P4**
N	108%	100	**LI4**	114%	600	LI5	5	1	1	1	5	**A1**	**P5**
O	101%	10	**LI4**	118%	2000	LI5	10	5	1	1	50	**A3**	**P3**

- We based the example on existing LI4 and LI5 substations
- applied example activity index scores to each
  - Scores not weighted in this example
- A priority can then be assigned to each site
- Approach can be extended to HV and LV networks using appropriate Load models and disaggregated forecasts

Example Load Priority Index Matrix

Activity Score		LI1	LI2	LI3	LI4	LI5
100	A4				L	B
50	A3				K,O	D,E,F
25	A2				I,M	A,G
5	A1				H,J,N	C
		0-70%	70-85%	85-99%	100%+	
					<500MVAh	>500MVAh

LI Rating at Assessment Point

Example of building up the Activity Index

More forward looking
Increased uncertainty

Category	Metric (all per Local Authority)	Rating (A1 to A5)	Source	Weight
Network	Load growth per primary	-5% 0% ……… >15%	Asset Management	25%
	Growth connection requests	-2% 0% ……… >5%	Connections	25%
	…			
Economic	Growth regional Gross Value Add	-2% 0% ……… >5%	Government	15%
	Growth housing stock	-2% 0% ……… >10%	Councils	
	…			
Supply Chain	% Electric Vehicles (EV) sales forecast for next 2 years by large car manufacturers	0% 0.5% …….>10%	Third parties	10%
	% Heat pump sales forecast in comparison to conventional heat	0% 0.5% ……>10%		5%
	…			
Market	% EVs of models currently in showroom	0% 1% …….>		5%
	% consumers responding 'likely to highly likely' to consider an EV	0% 10% ……		5%
	…			

As metrics become less 'hard' or certain, the impact on the Activity Index is less through the individual weighting

National forecasts need to be **disaggregated to** local authority; need to consider demographics, wealth, etc. External parties such as Experion can provide this service.

- Activity Index metrics will have to be disaggregated to a sufficient level, e.g. Local Authority or Primary station

Next Steps

- LPI framework supports a well justified investment plan
  - Investment decisions may include
    - Reinforce existing site
    - Introduction of new sites
    - Load transfers

- Develop consistent activity index framework
  - Measureable components
  - Systematic approach
  - Complexity / granularity

- Extension of LPI framework to include or address DG

Cost Assessment Model

- Both from a Totex and a more detailed cost assessment perspective Ofgem will need to develop a suitable load model for Riio-ED1.
  - Is the DPCR5 model (EHV+) a logical starting point? Key questions that this model addresses are:
  1. Ratio of growth in maximum design: capacity installed (forecast vs. historic)
  2. Cost of capacity installed (forecast vs. historic)
- Are these still the questions that need to be addressed (accepting that the answers may be different) or do we need to start again from first principles?

Back to key questions for today - What still works? What needs to be changed? What needs to be replaced?

Cost Assessment Model

- Key areas that need to be addressed within the development of model:
  - Interaction between Load-related expenditure forecast and Load Index/ outputs and secondary deliverables
  - Ensure that the model accounts for where reinforcement is required purely from growth in generation
  - Common approach for reinforcement at LV
  - Non-discrimination between “conventional” and “innovation” solutions

Managing uncertainty of impact on network reliability

- An alternative approach to tackling the impact on network reliability of LCT connection uptake and clustering could be to:

1. Ex-ante allowance to reactively mitigate and manage impact of clustering etc across network
   - DNOs forecast % of substations/ feeders requiring intervention
   - DNOs forecast indicative cost of likely works
   - Ofgem set ex-ante allowance
2. Ex-ante allowance to proactively pre-empt and target locations
   - DNOs carry out similar analysis as above but also set out in their business plan how the works will be prioritised and shift to changing locational and technological priorities

Benefit of this approach is that it can separate the areas of deep uncertainty from the areas of certainty, although it could create boundary issues ofgem

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