

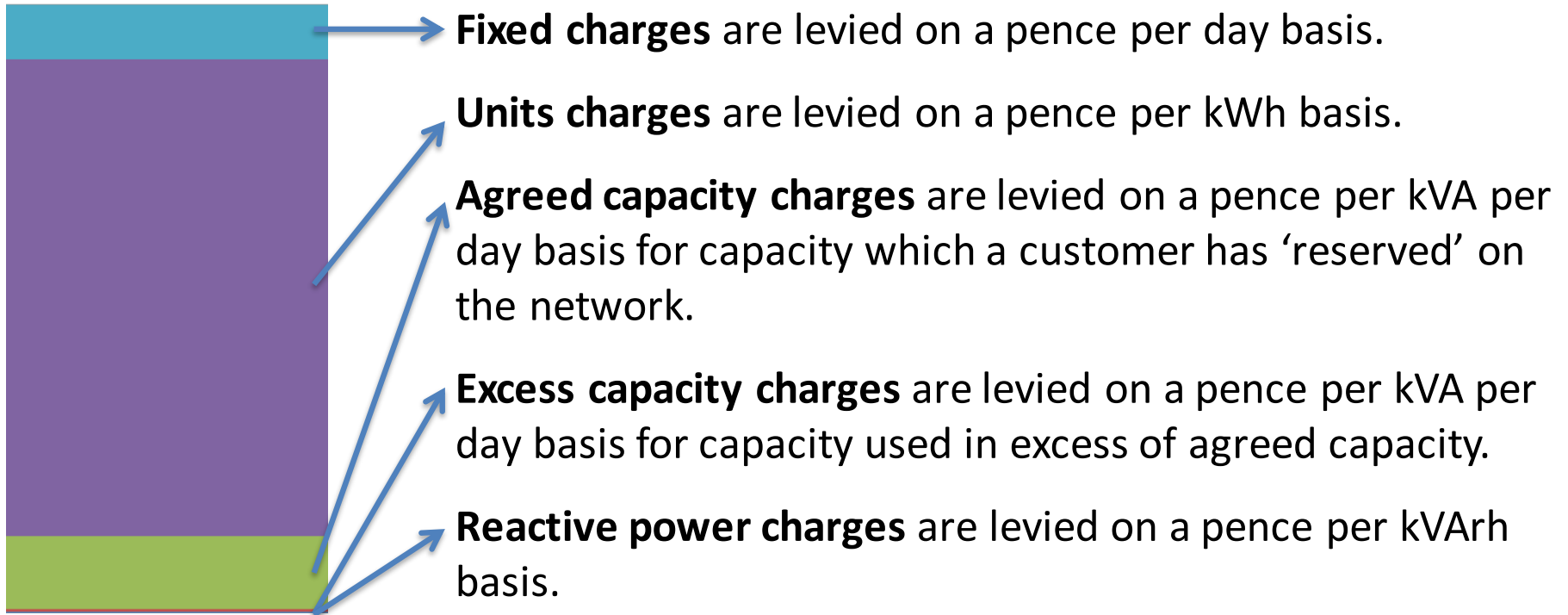


CDCM and EDCM Model training March 2020

Agenda

- Quick overview
- CDCM model
- EDCM model
- Q+A (throughout and final session)

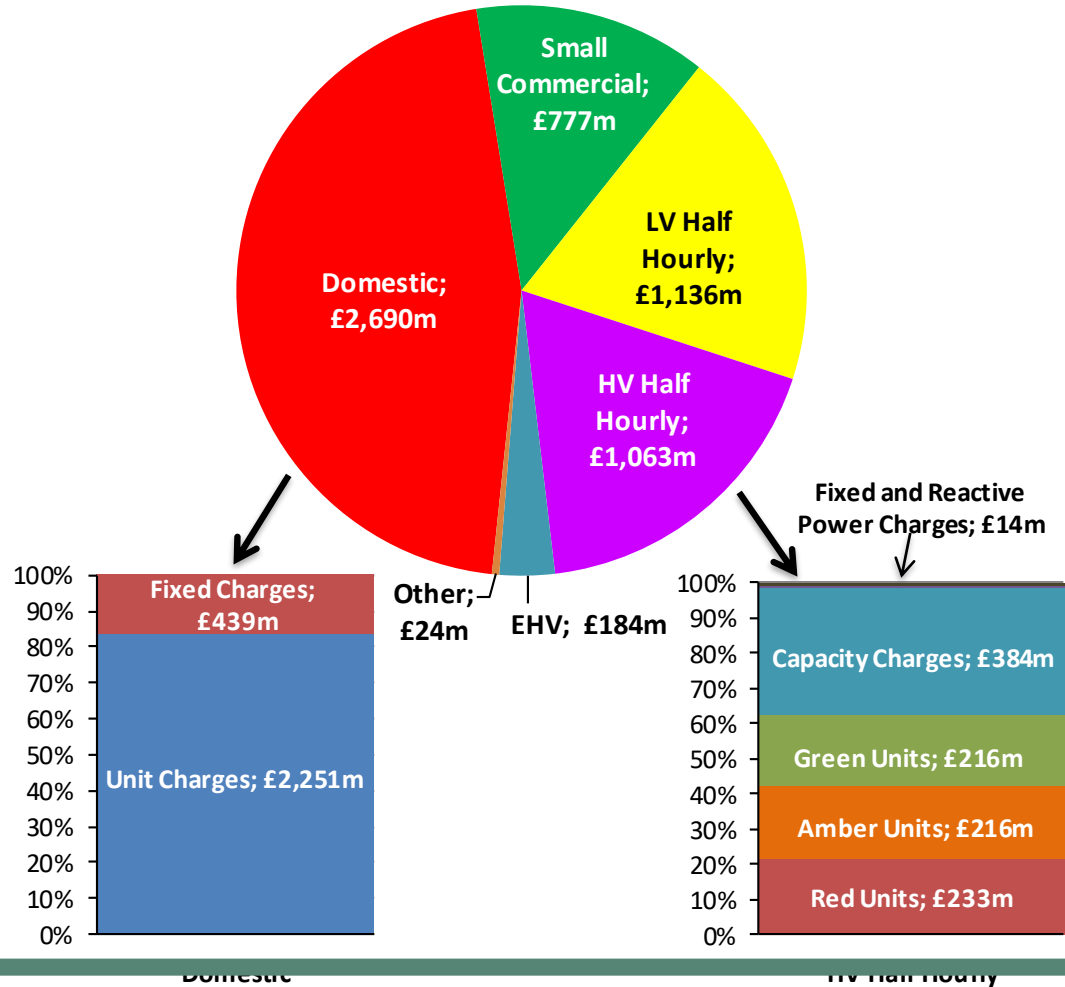
All DUoS charges consist of up to five tariff elements



Not all customers are subject to all charging elements, e.g. domestic customers do not have an agreed capacity so face no explicit agreed capacity charge

Revenue recovery is dominated by domestic customers and by unit charges

- For 2018/19 DUoS charges, for GB as a whole the 'cake' was £5.9bn.
- The biggest 'slice' of the 'cake' relates to domestic customers.
- The biggest 'layer' of the HV Half Hourly 'slice' relates to the unit charges, followed by capacity charges.
- Fixed charges (including capacity) account for 20% of the 'layers'.
- Unit charges (including reactive power) account for the remaining 80%.



CDCM Detail

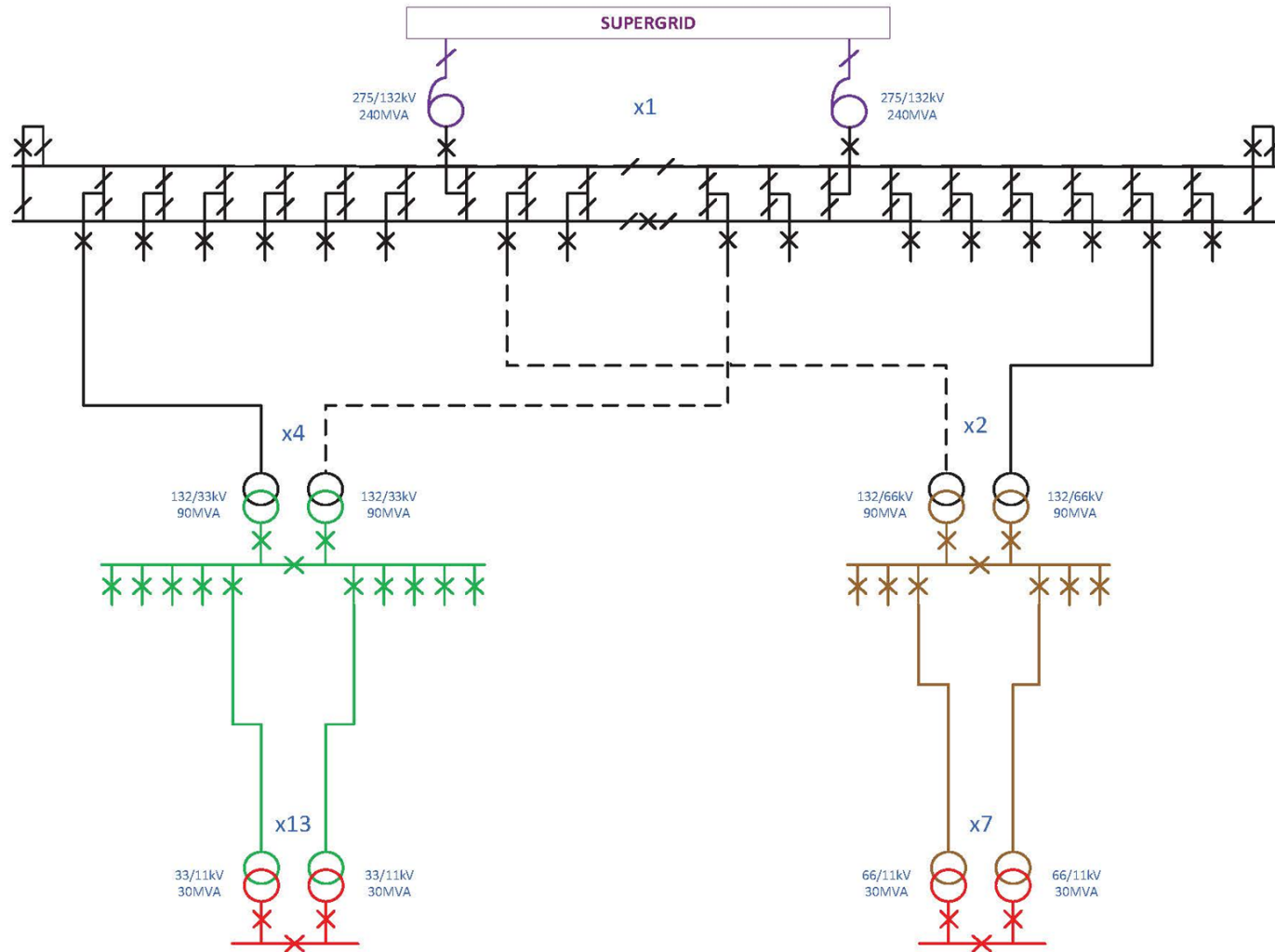
CDCM Overview

- The CDCM model calculates a set of charges for HV and LV connected customers
 - Includes demand and generation
 - Includes IDNOs charges using PCDM discounts
 - Allows each DNO to recover their allowed revenue
- Tariffs and tariff structures in the CDCM are intended to reflect the costs and cost drivers of providing distribution services.
 - The CDCM model charges are based on a 500 MW network reinforcement

The 500MW model

- The costing model underpinning the CDCM is commonly called the '**500MW Model**'.
 - In the CDCM model this is labelled '**Gross asset cost by network level**'.
- Each DNO calculates the cost of developing a hypothetical 500MW increment to their network to serve typical demand in their region.
 - 500MW roughly represents the demand at a typical grid supply point.
- The cost is calculated at each network level.
 - This starts at 132kV (the highest voltage assets a DNO owns) and ends with the LV main and excludes LV services – it only includes assets used by more than one customer.
 - It includes transformation separately (i.e. the cost of 132kV/EHV transformation is separate to 132kV and EHV cables).

500MW model example



Input SHEET 1 – Tariff Specific Inputs

- Load Factor
 - Uses 365 by 48 data for NHH and HH data aggregated by tariff type
 - Average usage divided by the max usage of the tariff type
 - 3 year average
- Coincidence Factor
 - Uses 365 by 48 data for NHH and HH data aggregated by tariff type
 - Usage by Tariff type at system peak divided by the max usage of the tariff type
 - 3 year average
- Volume forecast
 - WPD uses an in house bespoke system to create volume forecasts
 - Extracts historical data straight from the billing system
 - Data is normalised for e.g. weather correction, working days and total days
 - Create forecasts using uplifts from rolling 12/ 24 month average trends
 - Override when needed
 - Apply adjustments for other factors e.g. economic/ tariff movements

Input SHEET 1 – Tariff Specific Inputs

- Service Models
- Domestic
 - Cost for Domestic uses 20 standard customers and is divided by 20
 - Idea is to replicate a street
- Non – Domestic
 - LV and HV Uses equipment depending on the size of the customer
 - Both LV and HV use costs for sample U/G and O/H customers and split proportionately by number of customers

Input SHEET 2 – Network Level Specific Inputs

- Diversity Allowance
- Losses
 - Based on October Losses submission to Elexon
- Average KVAR by KVA
 - Uses power factors at given voltage level
 - Only affects the reactive power price
- Customer contributions
 - Represents the % contributed to at the time of connection for each voltage of connection by network level
 - Formula created at the beginning of the CDCM
 - Uses historical data
 - DCP to update the method of calculation was rejected
- 500 mw models
 - Cost of creating 500mw increment to the network
 - Costs within the models change

Input SHEET 2 – Network Level Specific Inputs

- Peaking probabilities
 - Uses the data from a version of table 3 LTDS
 - Apportion the max at each GSP/ BSP/ Primary into red/ black amber green time bands
 - Add up time band totals for the GSPs, BSPs and Primaries separately
 - Calculate the weighted proportion of each of the GSPs occurring in each time band
 - Calculate the weighted proportion of each of the BSPs occurring in each time band
 - Calculate the weighted proportion of each of the Primaries occurring in each time band
 - This then creates a probabilistic method of determining the future occurrence of peaks in the time bands
 - Averaged over 3 years

Input SHEET 3 – General Inputs

- Hours in time band
 - These are black yellow green and red amber green
 - Black is the same as red except between November and February
 - These are the actual number of hours in the charging year
- LDNO Discounts
 - Straight output from the PCDM
- CDCM Revenue
 - Close to the DCP66A allowed revenue format
 - EDCM revenue comes direct from the EDCM model
- Real pre-tax cost of capital

Pre tax cost of capital	=	(Gearing assumption * CDE)	+	$\frac{((1 - \text{gearing assumption}) * \text{Post tax cost of equity})}{(1 - \text{Corporation Tax rate})}$
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Input SHEET 3 – General Inputs

- Transmission Exit Charges
 - Forecast Exit charges for the charging year
- Direct and Indirect Costs
 - Taken from the M16 report
 - Forecast for the charging year
- Network rates
 - Forecast business rates for the charging year

CALCULATION SHEET 1 - Standing charge factors

- Standing charge factors determine the proportion of unit costs allocated to capacity or fixed charges rather than unit rates.
 - Specific to each customer category and vary by network level.

	Domestic Aggregated	Domestic Aggregated (Related MPAN)	Non-Domestic Aggregated	Non-Domestic Aggregated (Related MPAN)	LV Site Specific	LV Sub Site Specific	HV Site Specific	Unmetered Supplies
Transmission exit	0%	0%	0%	0%	0%	0%	0%	0%
GSPs	0%	0%	0%	0%	0%	0%	0%	0%
132kV	0%	0%	0%	0%	0%	0%	0%	0%
132kV/EHV	0%	0%	0%	0%	0%	0%	0%	0%
EHV	0%	0%	0%	0%	0%	0%	20%	0%
EHV/HV	0%	0%	0%	0%	0%	0%	100%	0%
132kV/HV	0%	0%	0%	0%	0%	0%	0%	0%
HV	0%	0%	0%	0%	20%	100%	100%	0%
HV/LV	0%	0%	0%	0%	100%	100%	0%	0%
LV circuits	100%	100%	100%	100%	100%	0%	0%	0%

CALCULATION SHEET 2 – Load & Loss Characteristics

- This is an interim calculation sheet
- The first section of this sheet has two functions:
 - To calculate cumulative diversity allowances, by network level.
 - To adjust coincidence, diversity, loss adjustment and network use factors for the share of load going through 132kV/HV transformation, by network level and customer category.
- The second section of the sheet calculates:
 - user loss factors (i.e. the loss adjustment factor based on the network level at which customers are connected); and
 - the ratio of user loss factor to network loss factor (used to adjust load measured at a user's entry/exit point to an equivalent load at each network level).

CALCULATION SHEET 3 – Customer Contributions

- Maps each customer category to the network level at which they are supplied
- Maps customer contributions by network level of supply
- Maps estimated customer contributions for each customer group by network level

	132kV	132kV/EHV	EHV	EHV/HV	132kV/HV	HV	HV/LV	LV circuits
Domestic Aggregated	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
Domestic Aggregated (Related MPAN)	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
Non-Domestic Aggregated	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
Non-Domestic Aggregated (Related MPAN)	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
LV Site Specific	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
LV Sub Site Specific	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>0%</u>
HV Site Specific	<u>0%</u>	<u>67%</u>	<u>67%</u>	<u>100%</u>	<u>0%</u>	<u>100%</u>	<u>0%</u>	<u>0%</u>
Unmetered Supplies	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
LV Generation Aggregated	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
LV Sub Generation Aggregated	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>0%</u>
LV Generation Site Specific	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
LV Generation Site Specific no RP Charge	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>95%</u>
LV Sub Generation Site Specific	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>0%</u>
LV Sub Generation Site Specific no RP Charge	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>81%</u>	<u>0%</u>	<u>81%</u>	<u>95%</u>	<u>0%</u>
HV Generation Site Specific	<u>0%</u>	<u>67%</u>	<u>67%</u>	<u>100%</u>	<u>0%</u>	<u>100%</u>	<u>0%</u>	<u>0%</u>
HV Generation Site Specific no RP Charge	<u>0%</u>	<u>67%</u>	<u>67%</u>	<u>100%</u>	<u>0%</u>	<u>100%</u>	<u>0%</u>	<u>0%</u>

CALCULATION SHEET 4 – Volume Adjustments

- Applies LDNO discounts to volumes for all customer categories
- Uses mapping of customers to LDNO discount categories specified in the Fixed inputs sheet.
- Discounted volumes are then used throughout the CDCM model
- E.g.

Unit rate 1		Domestic Unrestricted
All the way customers	MWh	396,000.00
LDNO LV	MWh	2,299.84
LDNO HV	MWh	6,536.87
LDNO LV discount rate applied	%	<u>38%</u>
LDNO HV discount rate applied	%	<u>58%</u>
LDNO LV, discounted	MWh	1,424.85
LDNO HV, discounted	MWh	2,739.54
Total after discounting	MWh	<u>400,164.39</u>

CALCULATION SHEET 5 – Pseudo Load Coefficients

- Step 1: calculate ratio of coincidence to load factor assuming units evenly spread within time bands, and peak falls in Red period
- Step 2: calculate correction factor
 - Load coefficient divided by ratio to load factor
 - Load coefficient is Coincidence to peak divided by load factor
- Step 3: calculate ratio of coincidence factor (to network asset peak) to load factor, given peaking probabilities, multiplied by correction factor
 - Ratio of coincidence factor is Peaking probabilities for network level divided by proportion of hours in time band
- Step 4: Calculate Pseudo load coefficients
 - Correction factor multiplied by ratio of coincidence factor

CALCULATION SHEET 5 – Pseudo Load Coefficients

E.g. Domestic Unit Rate 1 For the GSP

- Step 1: calculate ratio of coincidence $1.24 = 7.42\% \times 8760 \text{ (Hours in the year)} / 522 \text{ (Hours in red period)}$
- Step 2: calculate correction factor $1.7 = (91\% \text{ (coincidence to peak)} / 43\% \text{ (Load Factor)}) / 1.24$
- Step 3: calculate ratio of coincidence factor $15.48 = 92\% \text{ (peaking probabilities at GSP)} / (522 / 8760)$
- Step 4: Calculate Pseudo load coefficients $26.34 = 15.48 \times 1.7$

- Simple way of looking at them
 - Peaking probs X coincidence factor / Load Factor / % usage in red period
 - The higher the numerators the higher the charge
 - and the higher the denominators the lower the charge

CALCULATION SHEET 6 – System Peak Demand

- Calculates system peak load that is used to allocate other operating costs and calculate unit costs in other parts of the model.
- Firstly calculates the unit rate contribution to system peak load
 - Pseudo load coefficient X Discounted volumes divided by hours in a year for each tariff for each unit rate (loss adjusts this figure)
 - Aggregates the units together
 - Aggregates the tariffs together
- Secondly calculates the capacity contribution to system peak
 - Standing charge factors X Estimated capacity (for NHH) or Actual Capacity (for HH) divided by (1 + Diversity) (loss adjusts this figure)
 - NHH estimated capacity is total discounted load divided by (Hours in year X Load Factor)
- Thirdly aggregates the unit and the capacity contribution

CALCULATION SHEET 7 – Service Model Assets

- Calculates the total notional value of service model assets - split by LV and HV customers.
- Multiplies the service model values per unit by the equivalent volumes for each customer category (e.g. per MPAN or per MWh for UMS customers).
- Total service model notional asset values are exported to the 'Unit cost' sheet.

CALCULATION SHEET 8 – Unit Costs

- The unit cost sheet calculates the two main unit costs used throughout the rest of the model:
 - Asset costs (£/kW/year), based on the annuitised cost of assets required for reinforcing the network to meet a 500 MW increment of demand.
 - Other operating costs (£/kW/year), captures the cost of other operating expenditure and transmission exit charges.
- The first section of the sheet calculates **asset unit costs** using three basic steps:
- Calculates additional simultaneous load at each network level from an increment of 500MW at GSP
 - Adjusts 500 in 500MW for losses and diversity between top and bottom of network level.
- Divide the cost of assets required to meet the 500 MW of incremental demand by additional simultaneous load at each network level.
- Multiply the result of step 2 by the annuity factor, which is based on assumptions of the DNOs' allowed real rate of return and an assumed network asset life

CALCULATION SHEET 8 – Unit Costs

- To calculate unit costs for **other operating unit costs**.
 - The first step is to calculate a notional asset value for each network level based on estimated system peak demand and annuitized asset costs for each network level.
 - Notional asset values are then combined with service model asset values.
 - Uplift 500mw model to simultaneous max demand
- Operating costs are then allocated based on the share of total notional asset value at each network level, and divided by system peak demand, to give a £/kW cost for other operating costs.

CALCULATION SHEET 9 – Initial Unit Rates

- The Initial unit rates sheet calculates unit rate 1, unit rate 2 and unit rate 3 for demand and generation customers
- **[p/kWh from network model assets]** = $100 * [\text{network level } \text{£/kW/year}] * [\text{user loss factor}] / [\text{network level loss factor}] * [\text{pseudo load coefficient}] * (1 - [\text{contribution proportion}]) / [\text{days in charging year}] / 24$
- **[p/kWh from operations]** = $100 * [\text{transmission exit or other expenditure } \text{£/kW/year}] * [\text{user loss factor}] / [\text{network level loss factor}] * [\text{pseudo load coefficient}] / [\text{days in charging year}] / 24$

CALCULATION SHEET 10 – Service Model Charges

- Calculates charges at the LV customer and HV customer network levels to reflect operating and maintenance costs associated with dedicated service model assets.
- Calculated by multiplying service model asset value by the overall ratio of “other operating costs for allocation” to “notional asset value”.
- The cost of the assets themselves are not charged for,
 - Assumed to be entirely customer-contributed.
- Service model costs are recovered through the fixed charge for all customer categories which have one.

CALCULATION SHEET 11 – Units Rate Charges

- Adjusts unit rates 1, 2 and 3 to account for costs that will be recovered through fixed or capacity charges instead.
- Multiplying unit rates by (1 - [standing charge factors])
 - Calculation done by network level
- Initial unit rates are sourced from the 'Initial unit rates' sheet for all network levels except LV customers. This network level includes operating costs associated with service model assets for unmetered supply customer categories.
- Unit rates 1, 2 and 3 (pre revenue matching) are summarised at the bottom of the sheet for each customer category, aggregating over network levels.

CALCULATION SHEET 12 - Reactive power charges

- Reactive power charges = yardstick charges X (1- standing charge factors) X (KVARs by KVA) X power factor
 - Yardstick demand charges are from initial unit rates
 - Yardstick generation charges
 - Loss adjusted unit costs minus customer contributions

CALCULATION SHEET 13 - Capacity charges

- Allocates For demand users (other than UMS), unit rates to capacity charge elements (p/kVA/day)
- Loss adjusted, diversity adjusted, power factor adjusted unit costs X standing charge factor X (1 – customer contributions)
 - NHH is added to fixed charge
- Excess capacity charge does not have the adjustment for customer contributions

CALCULATION SHEET 14 - Fixed charges

- Brings in the service model element of the fixed charges and the capacity element for NHH customers together

Revenue from pre-scaled tariffs

- Pre-scaled tariffs would be very unlikely to recover the DNO's allowed revenue if left unaltered.
 - This is because the underlying cost basis of the 500MW model is (intentionally) very different to the cost basis which is used to make up revenue allowances.
 - Revenue allowances include significant elements of sunk costs which are not included in the forward-looking 500MW model.
- The revenue which would be derived from pre-scaled tariffs is determined by taking the DNO's forecast of usage for each customer group and applying the pre-scaled tariffs.

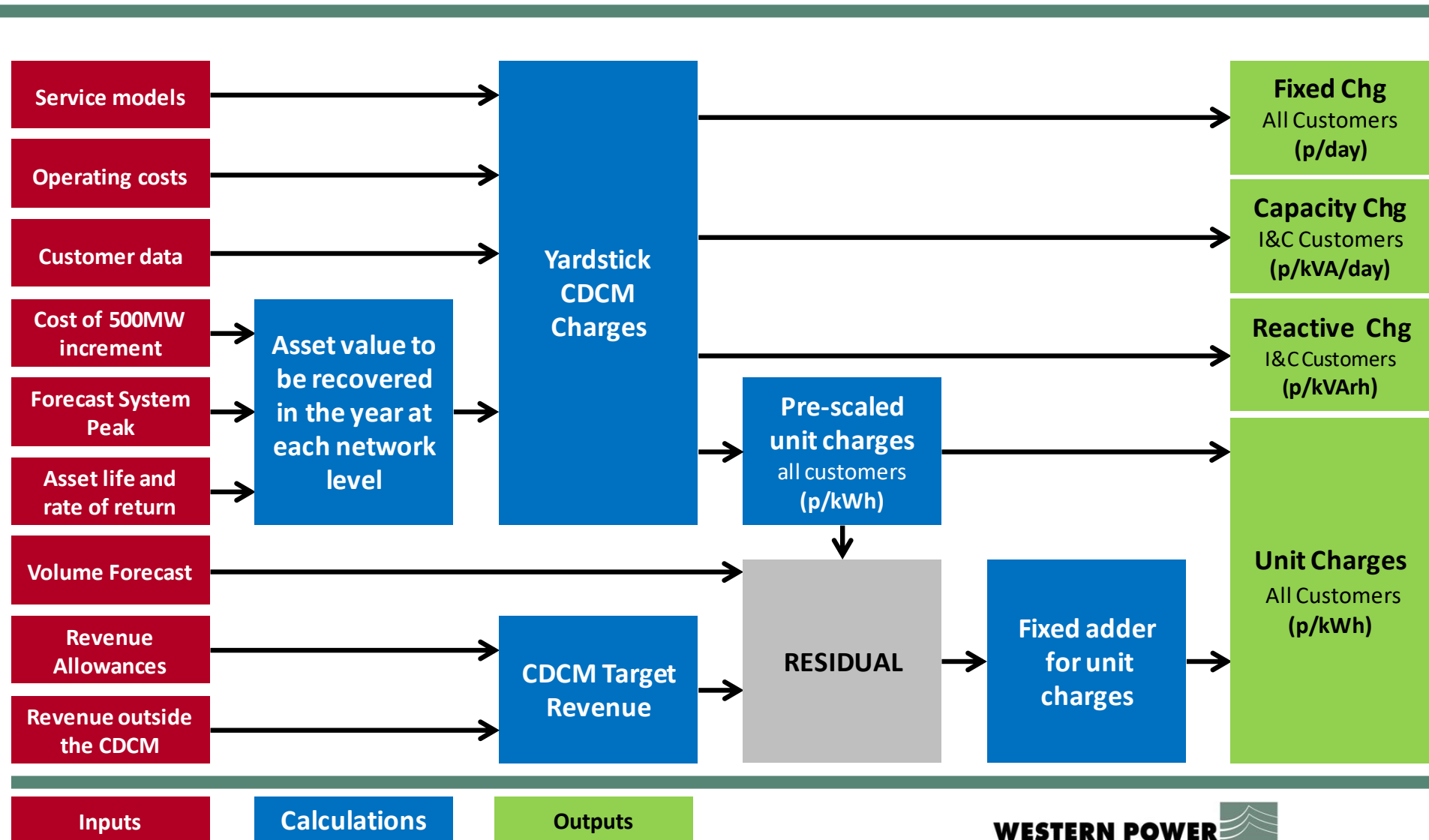
Determination of the residual

- CDCM target revenue is determined by taking total revenue allowances and deducting any revenue recovered elsewhere – i.e. revenue recovered in the EDCM.
- The residual is the difference between CDCM target revenue and the revenue which would be derived from pre-scaled tariffs.

Application Of Residual

- Tariff scaling is achieved through the use of a fixed adder.
- Apply the same p/kWh adjustment to every unit rate
- Where tariff scaling is negative this could result in negative unit rates for demand – so tariffs are capped at zero and the fixed adder adjusted to ensure sufficient negative scaling still takes place after the capping.
 - Generally, all licensees except the London region have positive scaling with London having negative scaling.
- This makes scaling look very complicated in the models – where positive scaling is being applied it is as simple as residual divided by total unit forecast.
- Following the TCR decision the method of scaling will change and be recovered by a fixed charge
 - Due to be implemented in April 2022 prices

Disaggregation of the CDCM



CDCM Scenario Analysis

		HV Site Specific															
		Price							Change In Price								
	Transformation	Unit rate 1 p/kWh	Unit rate 2 p/kWh	Unit rate 3 p/kWh	Fixed charge p/MPAN/ day	Capacity charge p/kVA/d ay	Exceede d capacity charge p/kVA/d ay	Reactive power charge p/kVArh	Unit rate 1 p/kWh	Unit rate 2 p/kWh	Unit rate 3 p/kWh	Fixed charge p/MPAN/ day	Capacity charge p/kVA/d ay	Exceede d capacity charge p/kVA/d ay	Reactive power charge p/kVArh		
Base Case		6.084	1.484	1.368	95.3	2.95	6.74	0.054	0	0	0	0	0	0	0		
Scenario2	Increase Load factor to 100%	4.878	1.459	1.373	96.03	2.97	6.76	0.04	-1.206	-0.025	0.005	0.73	0.02	0.02	-0.014		
Scenario3	Increase Coincidence factor to 100%	7.424	1.512	1.362	94.49	2.92	6.72	0.07	1.34	0.028	-0.006	-0.81	-0.03	-0.02	0.016		
Scenario4	Double rate one units	3.862	1.408	1.347	95.43	2.95	6.75	0.054	-2.222	-0.076	-0.021	0.13	0	0.01	0		
Scenario5	Double rate two units	7.926	1.41	1.245	93.4	2.89	6.68	0.054	1.842	-0.074	-0.123	-1.9	-0.06	-0.06	0		
Scenario6	Double rate three units	8.157	1.41	1.24	93.89	2.91	6.7	0.054	2.073	-0.074	-0.128	-1.41	-0.04	-0.04	0		
Scenario7	Double MPANs	6.077	1.484	1.368	95	2.94	6.73	0.054	-0.007	0	0	-0.3	-0.01	-0.01	0		
Scenario8	Double capacity	5.941	1.478	1.366	88.43	2.74	6.53	0.053	-0.143	-0.006	-0.002	-6.87	-0.21	-0.21	-0.001		
Scenario9	Double excess capacity	6.082	1.484	1.368	95.26	2.95	6.74	0.054	-0.002	0	0	-0.04	0	0	0		
Scenario10	Double reactive	6.083	1.484	1.367	95.3	2.95	6.74	0.054	-0.001	0	-0.001	0	0	0	0		
Scenario11	Double service model value	6.077	1.484	1.368	189.74	2.94	6.73	0.054	-0.007	0	0	94.44	-0.01	-0.01	0		
Scenario12	Double Diversity	6.208	1.483	1.364	97.27	2.33	5.25	0.056	0.124	-0.001	-0.004	1.97	-0.62	-1.49	0.002		
Scenario13	Double KVAR	6.081	1.482	1.366	95.3	2.95	6.74	0.109	-0.003	-0.002	-0.002	0	0	0	0.055		
Scenario14	Increase customer contributions to 100% for HV and be	6.16	1.56	1.444	95.3	2.95	6.74	0.054	0.076	0.076	0.076	0	0	0	0		
Scenario15	Zero customer contributions	5.757	0.724	0.584	95.3	6.74	6.74	0.061	-0.327	-0.76	-0.784	0	3.79	0	0.007		
Scenario16	Double 500mw values	7.957	1.126	0.955	51.44	3.23	10.82	0.081	1.873	-0.358	-0.413	-43.86	0.28	4.08	0.027		
Scenario17	Peaking probs Move 20% from yellow primaries to red	6.215	1.462	1.367	94.94	2.94	6.73	0.054	0.131	-0.022	-0.001	-0.36	-0.01	-0.01	0		
Scenario18	Timebands Move 500 yellow hours to red	5.452	1.493	1.254	73.71	2.29	6.09	0.048	-0.632	0.009	-0.114	-21.59	-0.66	-0.65	-0.006		
Scenario19	Double allowed revenue	8.993	4.393	4.277	95.3	2.95	6.74	0.054	2.909	2.909	2.909	0	0	0	0		
Scenario20	Double Real pre-tax cost of capital	7.102	1.27	1.124	95.3	2.99	9.02	0.069	1.018	-0.214	-0.244	0	0.04	2.28	0.015		
Scenario21	Double Transmission exit charge	6.655	1.424	1.3	95.3	2.95	6.74	0.061	0.571	-0.06	-0.068	0	0	0	0.007		
Scenario22	Double Direct cost	6.368	1.169	1.035	125.57	3.87	7.66	0.062	0.284	-0.315	-0.333	30.27	0.92	0.92	0.008		
Scenario23	Double Indirect cost	6.543	0.975	0.83	144.19	4.43	8.23	0.066	0.459	-0.509	-0.538	48.89	1.48	1.49	0.012		
Scenario24	Double Network Rates	6.233	1.319	1.193	111.19	3.43	7.22	0.058	0.149	-0.165	-0.175	15.89	0.48	0.48	0.004		

EDCM Detail

EDCM Background

- EDCM - EHV Distribution Charging Methodology.
- EDCM was introduced in April 2012 for Demand Customers and April 2013 for Generation Customers.
- Introduced to meet Ofgem's requirement for a forward looking site specific methodology to encourage efficient use of the network
- Methodology uses Long Run Incremental Cost (LRIC) approach or Forward Cost Pricing (FCP) depending on DNO
- EDCM calculates a Site Specific charge for each Customer connected at either EHV or at HV Substation.

EDCM Tariff Structures

- Import fixed charge (p/day)
- Import capacity charge (p/kVA/day)
- Exceeded import capacity charge (p/kVA/day)
- Super-red import unit charge (p/kWh)
- Export fixed charge (p/day)
- Export capacity charge (p/kVA/day)
- Exceeded export capacity charge (p/kVA/day)
- Export super-red unit rate (p/kWh)

EDCM Tariff Structures

- The 'Super Red' rate applies from Monday to Friday around tea time between November and February.
 - In LPN there is also an additional 'Super Red' period 11.00 to 14.00 Monday to Friday between June and August.
 - In the South West And South Wales areas the super red does not apply in the two weeks around Christmas
- An EDCM **Generation** Customer may receive a unit rate credit, depending on them supporting the network and being non-intermittent
- The addition (or removal) of a Customer from any part of our network can have a significant impact upon other EDCM customers connected in the same area, this can increase or decrease their charges for the following year even if they have made no changes themselves

Long Run Marginal Cost

- The LRIC methodology calculates nodal incremental costs
 - represent the deferred reinforcement costs caused by the addition of demand or generation at each network node.
 - AC power flow analysis is used to take account of how a change in connectee behaviour affects the network.
 - calculations of the time needed before reinforcement is required at different points on the network and subsequently the net present value (NPV) of the future costs of reinforcement.
- LRIC power flow method produces a £/kVA/year local “Charge 1” and a remote “Charge 1” for each location
 - local charge refers to the local network
 - remote charge refers to higher voltage levels.
- Each LRIC location may have a “linked location”, in order to define clusters of up to eleven locations which are processed together.

Forward Cost Pricing

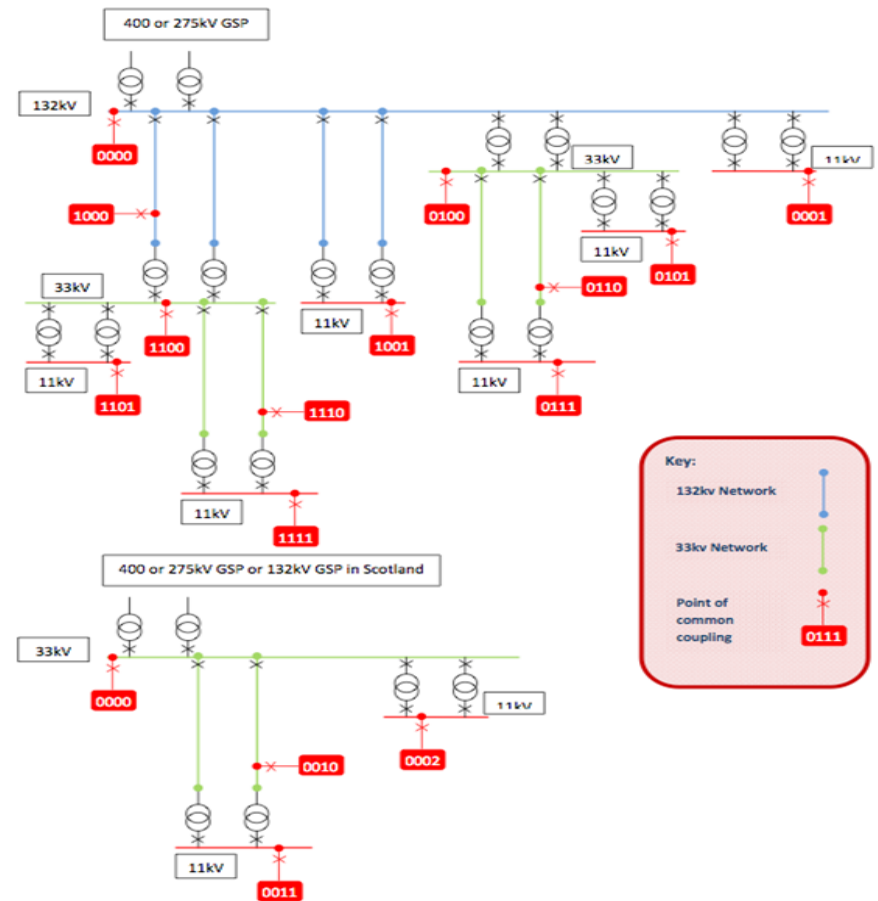
- The FCP methodology separates the network into a number of ‘Network Groups’.
- The FCP demand price is calculated by assessing network reinforcement cost to support a maximum of 15% demand increment for each network group over the next 10 years.
- The potential reinforcement cost is calculated and averaged at each voltage level within the same network group such that the total revenue recovered equals to the forecasted reinforcement cost plus a certain level of investment return.
- The FCP charges within a network group are the same for all the customers connected to that group.
- The outputs of the FCP power flow method are a £/kVA/year “Charge 1” for every group defined in the DNO’s network. A group is either;
 - • 132 kV and similar circuits (a “level 1” group)
 - • 132 kV/33 kV and similar substations with 33 kV and similar circuits (a “level 2” group)
 - • 132 kV/11 kV or 33kV /HV primary substations (a “level 3” group).
- Each group may also have “parent group” associated with it. The parent group of a parent group is referred to as a “grandparent group”.

Network Use Factors

- Network use factors (NUF) are a measure of the relative value of assets used by customers at different locations within the EHV network.
- Every customer may have a NUF defined for each of the five network levels considered within the EDCM.
- NUFs are used in order to determine unique network asset rates for every customer associated with their access to capacity and usage of the network.
- Network use factors are used in the calculation of “asset-based” elements of the import capacity charges.
 - network rates direct operating costs
 - asset-based residual revenue element.

Customer categories

- Customer categories determine the allocation of upstream asset components
- Network use factors then determine the allocation of costs for those assets



Customer Categories

Category	Use of voltage level				
	132kV	132kV/EHV	EHV	EHV/HV	132kV/HV
0000	0	0	0		0
1000	1	0	0		0
1100	1	1	0		0
0100	0	1	0		0
1110	1	1	1		0
0110	0	1	1		0
0010	0	0	1		0
0001	0	0	0	0	1
0002	0	0	0	1	0
1001	1	0	0		1
0011	0	0	1		1
0111	0	1	1		1
0101	0	1	0		1
1101	1	1	0		1
1111	1	1	1		1

EDCM Scenario Analysis Tariff Inputs

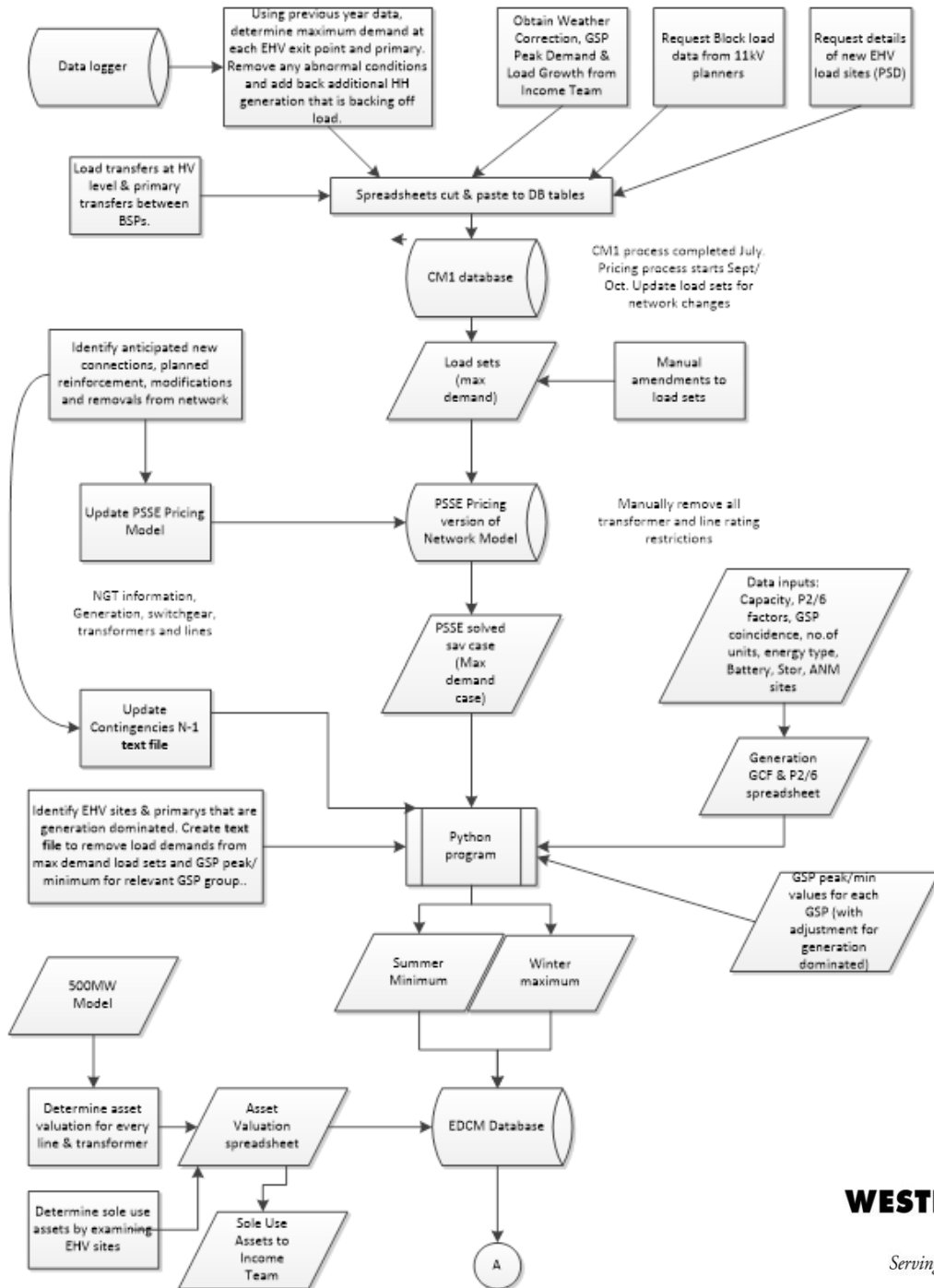
	Local charge 1	Remote charge 1	Maximum import capacity	Proportion exposed to indirect cost allocation and fixed adder	Non-exempt post-2010 export capacity	Proportion eligible for charge 1 credits	Super-red units exported	Super-red kW import divided by kVA capacity	Sole use asset MEAV	132kV circuits	132kV/E HV	Import super-red charge	Import fixed charge	Import capacity charge	Export super-red	Export fixed charge	Export capacity charge
Base Case	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	1.0	0.658	1,246.34	4.05	-1.316	623.17	0.05
Scenario2	2.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	1.0	0.658	1,246.34	4.31	-1.974	623.17	0.05
Scenario3	1.000	2.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	1.0	1.316	1,246.34	4.04	-1.974	623.17	0.05
Scenario4	1.000	1.000	20,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	1.0	0.658	1,495.07	4.06	-1.316	373.77	0.05
Scenario5	1.000	1.000	10,000	0.5	5,000	1.0	10,000	0.5	500,000	1.0	1.0	0.658	1,246.34	3.41	-1.316	623.17	0.05
Scenario6	1.000	1.000	10,000	1.0	20,000	1.0	10,000	0.5	500,000	1.0	1.0	0.658	623.17	4.05	-1.316	1,246.34	0.05
Scenario7	1.000	1.000	10,000	1.0	5,000	-	10,000	0.5	500,000	1.0	1.0	0.658	1,246.34	4.05	-	623.17	0.05
Scenario8	1.000	1.000	10,000	1.0	5,000	1.0	20,000	0.5	500,000	1.0	1.0	0.658	1,246.34	4.05	-1.316	623.17	0.05
Scenario9	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.1	500,000	1.0	1.0	0.658	1,246.63	1.89	-1.316	623.31	0.05
Scenario10	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	1,000,000	1.0	1.0	0.658	2,492.41	4.06	-1.316	1,246.20	0.05
Scenario11	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	2.0	1.0	0.658	1,245.99	5.68	-1.316	623.00	0.05
Scenario12	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	2.0	0.658	1,246.25	4.29	-1.316	623.12	0.05
Change From Base Case																	
Scenario2	2.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	1.0	-	-	0.26	-0.658	-	-
Scenario3	1.000	2.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	1.0	0.658	-	-0.01	-0.658	-	-
Scenario4	1.000	1.000	20,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	1.0	-	248.73	0.01	-	-249.40	-
Scenario5	1.000	1.000	10,000	0.5	5,000	1.0	10,000	0.5	500,000	1.0	1.0	-	-	-0.64	-	-	-
Scenario6	1.000	1.000	10,000	1.0	20,000	1.0	10,000	0.5	500,000	1.0	1.0	-	-623.17	-	-	623.17	-
Scenario7	1.000	1.000	10,000	1.0	5,000	-	10,000	0.5	500,000	1.0	1.0	-	-	-	1.316	-	-
Scenario8	1.000	1.000	10,000	1.0	5,000	1.0	20,000	0.5	500,000	1.0	1.0	-	-	-	-	-	-
Scenario9	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.1	500,000	1.0	1.0	-	0.29	-2.16	-	0.14	-
Scenario10	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	1,000,000	1.0	1.0	-	1,246.07	0.01	-	623.03	-
Scenario11	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	2.0	1.0	-	-0.35	1.63	-	0.17	-
Scenario12	1.000	1.000	10,000	1.0	5,000	1.0	10,000	0.5	500,000	1.0	2.0	-	-0.09	0.24	-	0.05	-

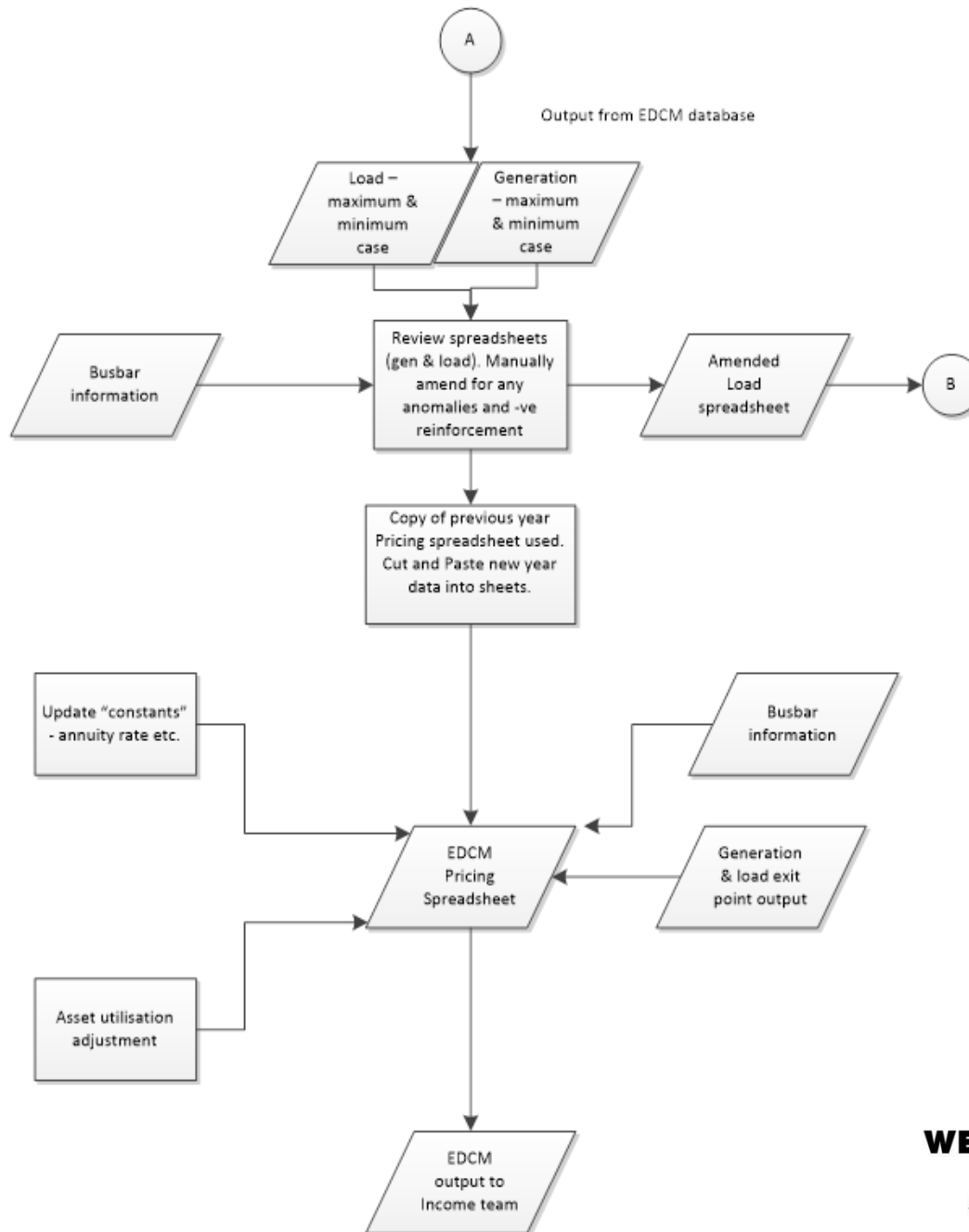
EDCM Scenario Analysis General Inputs Pricing

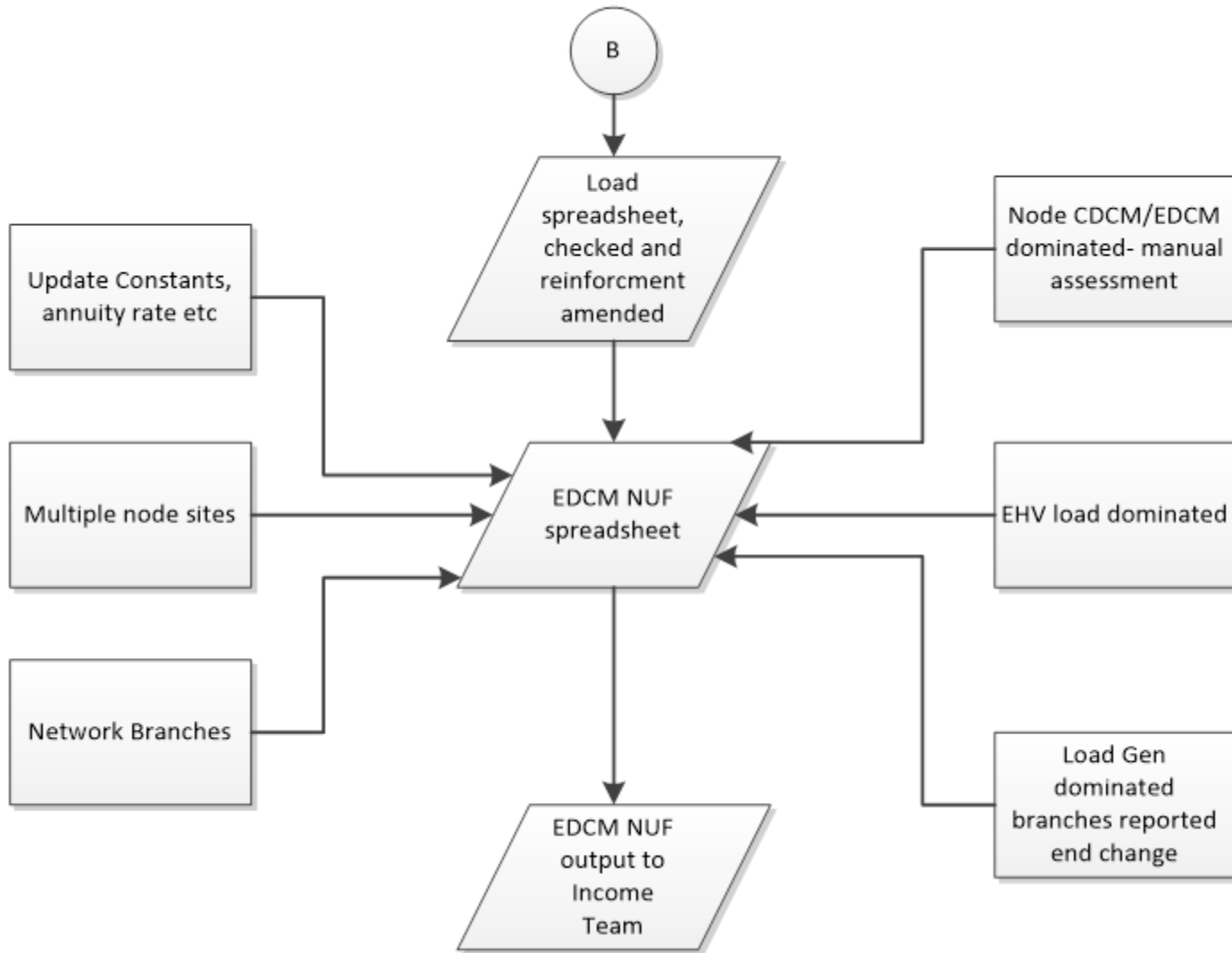
Import super-red charge	Import fixed charge	Import capacity charge	Export super-red	Export fixed charge	Export capacity charge	Scenario
0.658	1,246.34	4.05	- 1.316	623.17	0.05	Base Case
0.658	1,983.44	3.87	- 1.316	991.72	0.05	Double Direct cost
0.658	1,246.34	3.67	- 1.316	623.17	0.05	Double Indirect cost
0.658	1,755.60	4.01	- 1.316	877.80	0.05	Double Network rates
0.658	1,246.34	8.65	- 1.316	623.17	0.05	Double Amount of money DNO wants to raise from use of system charges
0.658	1,246.34	4.41	- 1.316	623.17	0.05	Double Transmission exit charges
0.658	1,246.83	3.96	- 1.316	623.42	0.05	Double Diversity allowance between level exit and GSP Group
0.658	1,251.48	2.04	- 1.316	625.74	0.05	Double System simultaneous maximum load
0.658	629.47	3.92	- 1.316	314.74	0.05	Double Assets in CDCM model
0.658	1,246.34	4.01	- 1.316	623.17	0.05	Double Maximum network use factor
0.658	1,246.34	3.56	- 1.316	623.17	0.05	Double Minimum network use factor
n Base Case						
-	737.10	- 0.18	-	368.55	-	Double Direct cost
-	-	- 0.38	-	-	-	Double Indirect cost
-	509.26	- 0.04	-	254.63	-	Double Network rates
-	-	4.60	-	-	-	Double Amount of money DNO wants to raise from use of system charges
-	-	0.36	-	-	-	Double Transmission exit charges
-	0.49	- 0.09	-	0.25	-	Double Diversity allowance between level exit and GSP Group
-	5.14	- 2.01	-	2.57	-	Double System simultaneous maximum load
-	- 616.87	- 0.13	-	- 308.43	-	Double Assets in CDCM model
-	-	- 0.04	-	-	-	Double Maximum network use factor
-	-	- 0.49	-	-	-	Double Minimum network use factor

EDCM Scenario Analysis General Inputs Revenue

Scenario	Import capacity charge revenue per customer	Revenue from adjusted super-red unit rate	Revenue recovered from import sole use charge	Revenue from export capacity charge	Revenue from super-red units	Revenue recovered from export sole use charge	Revenue recovered from import and export charges	Revenue recovered from import charges	Revenue recovered from export charges	Charge 1 capacity charge	Transmission exit charge	Network rates and direct costs charge	Import capacity based indirect charge	Asset based residual revenue charges	Import capacity based fixed adder
Base Case	147,825	5,001	4,549	913	- 132	2,275	160,430	157,375	3,055	9,999	17,087	21,531	37,490	51,760	9,958
Double Direct cost	141,255	5,001	7,240	913	- 132	3,620	157,896	153,495	4,401	10,002	17,092	34,274	37,500	35,548	6,839
Double Indirect cost	133,955	5,001	4,549	913	- 132	2,275	146,560	143,505	3,055	9,998	17,085	21,528	74,970	8,699	1,674
Double Network rates	146,365	5,001	6,408	913	- 132	3,204	161,759	157,774	3,985	9,996	17,081	30,317	37,476	43,187	8,309
Double Amount of money DNO wants to raise from use of system charges	315,725	5,001	4,549	913	- 132	2,275	328,330	325,275	3,055	9,995	17,080	21,522	37,474	192,599	37,054
Double Transmission exit charges	160,965	5,001	4,549	913	- 132	2,275	173,570	170,515	3,055	9,996	34,161	21,523	37,475	48,483	9,328
Double Diversity allowance between level exit and GSP Group	144,540	5,001	4,551	913	- 132	2,275	157,148	154,092	3,056	10,005	17,097	21,357	36,261	50,487	9,333
Double System simultaneous maximum load	74,460	5,001	4,568	913	- 132	2,284	87,094	84,029	3,065	9,989	8,659	10,799	24,364	17,317	3,332
Double Assets in CDCM model	143,080	5,001	2,298	913	- 132	1,149	152,308	150,378	1,930	10,005	17,097	21,761	32,237	51,980	10,001
Double Maximum network use factor	146,365	5,001	4,549	913	- 132	2,275	158,970	155,915	3,055	9,994	17,078	21,114	37,469	50,757	9,953
Double Minimum network use factor	129,940	5,001	4,549	913	- 132	2,275	142,545	139,490	3,055	9,986	17,064	16,306	37,440	39,199	9,945
Double Direct cost	- 6,570	-	2,690	-	-	1,345	- 2,534	- 3,880	1,345	3	5	12,743	10	- 16,212	- 3,119
Double Indirect cost	- 13,870	-	-	-	-	-	- 13,870	- 13,870	-	1	2	3	37,481	- 43,061	- 8,284
Double Network rates	- 1,460	-	1,859	-	-	929	1,328	399	929	4	6	8,786	14	- 8,573	- 1,649
Double Amount of money DNO wants to raise from use of system charges	167,900	-	-	-	-	-	167,900	167,900	-	4	7	9	15	140,839	27,096
Double Transmission exit charges	13,140	-	-	-	-	-	13,140	13,140	-	4	17,074	8	14	- 3,277	- 630
Double Diversity allowance between level exit and GSP Group	- 3,285	-	2	-	-	1	- 3,282	- 3,283	1	6	10	174	- 1,229	- 1,272	- 625
Double System simultaneous maximum load	- 73,365	-	19	-	-	9	- 73,337	- 73,346	9	10	8,429	- 10,732	- 13,125	- 34,443	- 6,626
Double Assets in CDCM model	- 4,745	-	2,252	-	-	- 1,126	- 8,122	- 6,997	- 1,126	6	9	230	- 5,253	220	42
Double Maximum network use factor	- 1,460	-	-	-	-	-	- 1,460	- 1,460	-	5	9	417	- 20	- 1,003	- 5
Double Minimum network use factor	- 17,885	-	-	-	-	-	- 17,885	- 17,885	-	13	23	- 5,225	- 50	- 12,561	- 13







Questions?