

# Electricity Charging Seminar – Level Playing Field

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Radisson Blu, Glasgow  
21<sup>st</sup> July 2016

# Overview of Transmission Charging

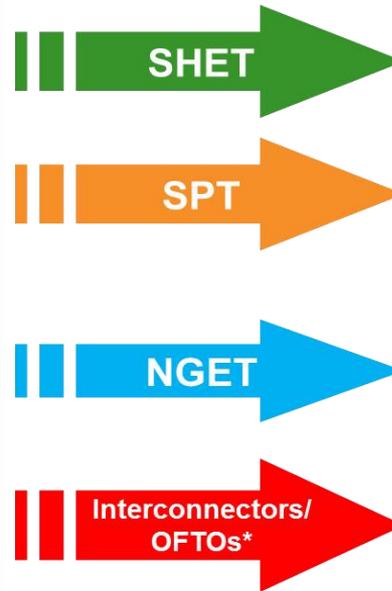
Damian Clough, Senior Commercial Analyst



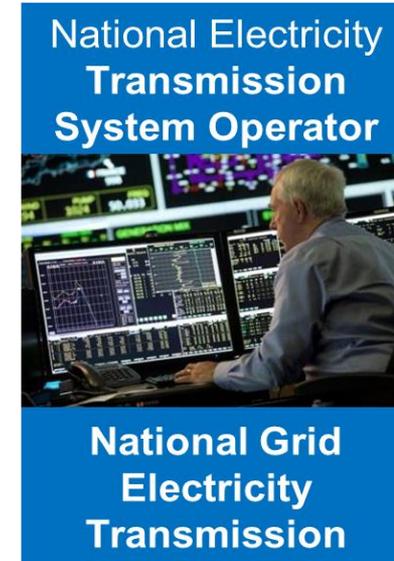
# Transmission Network & System Operator



## Multiple TOs



## One TSO



**\*Offshore Transmission Owner – OFTO**

An independent licenced owner of transmission assets connecting offshore wind farms (generators) to the GB onshore transmission network.

# Transmission Owner

## Transmission Use of System Charge (TNUoS)

£2.7bn

- Recovers the cost of all shared assets
- Tariffs include locational and non-locational elements
- Tariffs are set annually, in advance
- Charges split between G(16.7%) D(83.3%) – 2016/17
- Generation tariffs are capped by a €2.50/MW limit set by the EU
- Generations charges are charged against transmission entry capacity (TEC)
- Demand charges charged based on usage:
  - HH – Triad demand
  - NHH – Annual usage between 16:00 & 19:00

## Connection Charges

£210m

- Recovers the cost of single user assets
- Charges are set directly from the cost of single user assets built for customers' connections

# System Operator

## Balancing Services

~£1bn

## Use of System Charge (BSUoS)

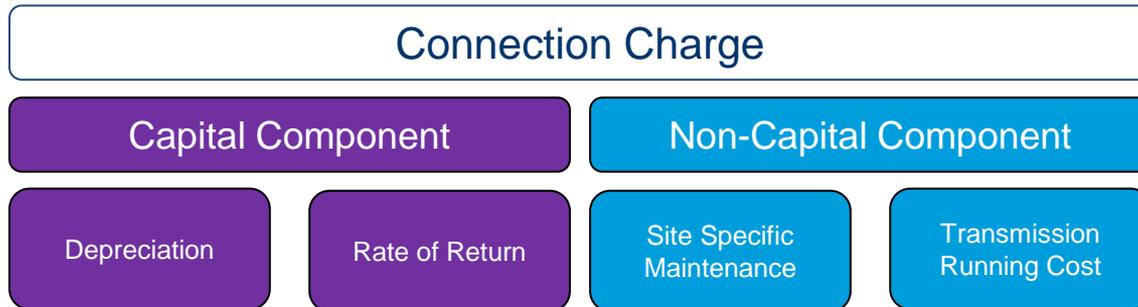
- Recovers the cost of operating the system
- Tariffs are non-locational
- Charges are split between G(50%) D(50%)
- Tariffs are calculated and invoiced ex post
- Charges are based on MWh usage in each half hourly period

# Connection Charges

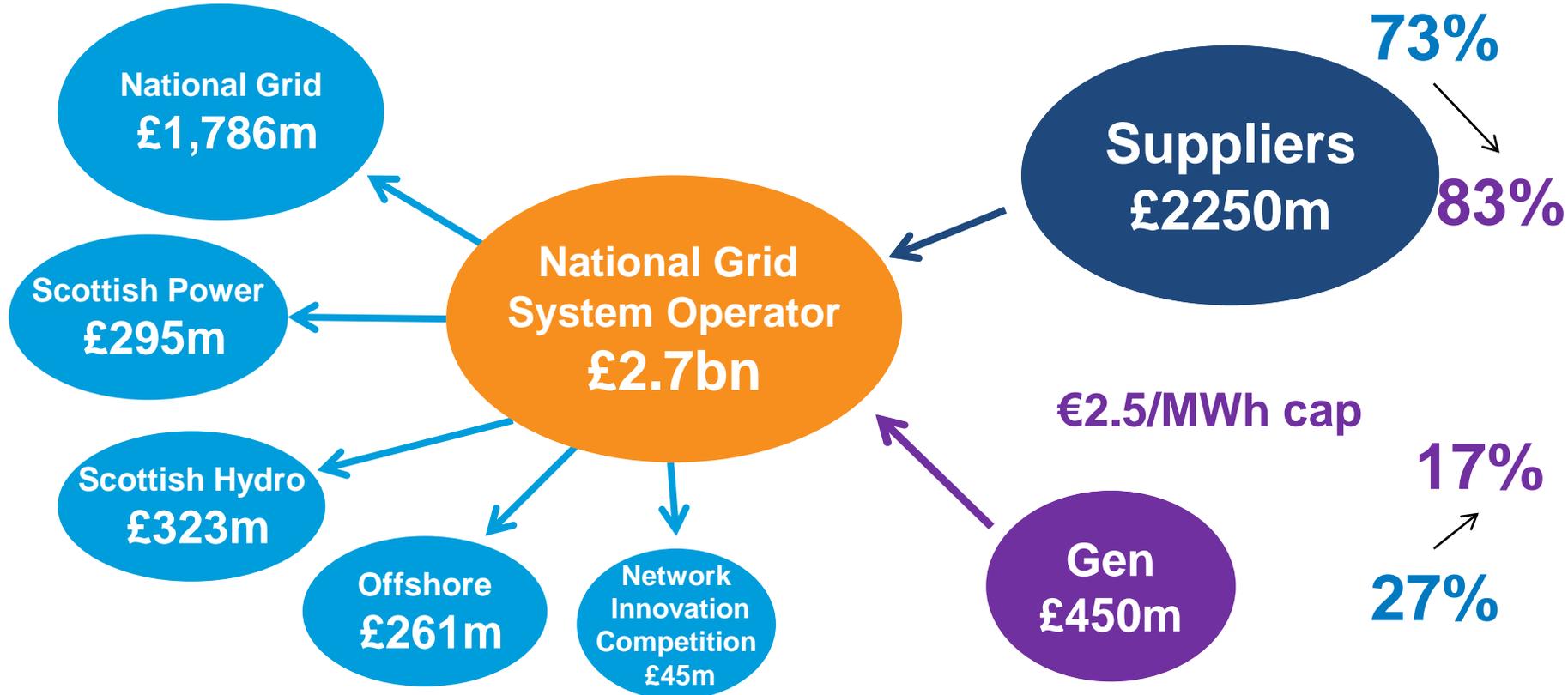
- CUSC 14.2.5:

*“assets installed solely for and only capable of use by an individual User”*

- Due to the location of the ownership boundary at the substation, generators do not generally pay connection charges
- Classed as a shallow connection charge regime

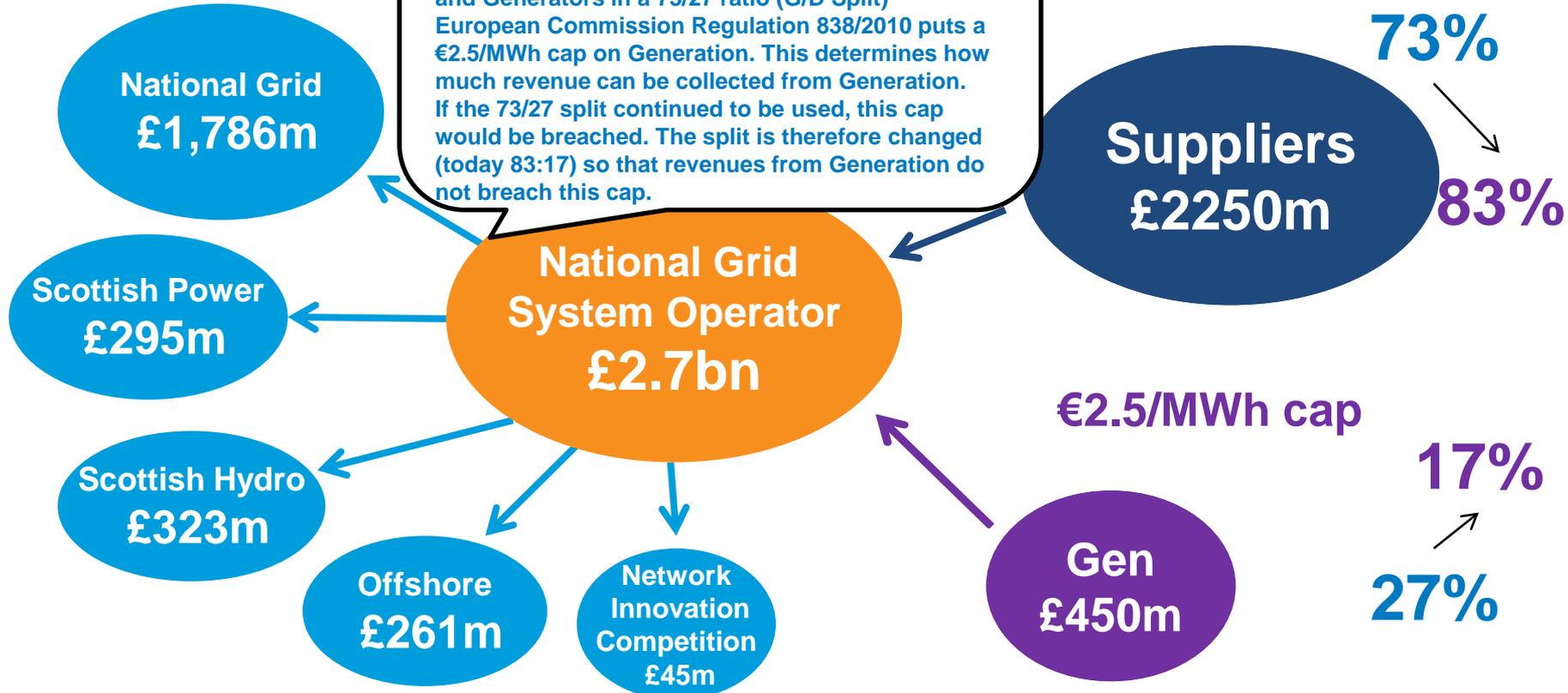


# TNUoS allocation

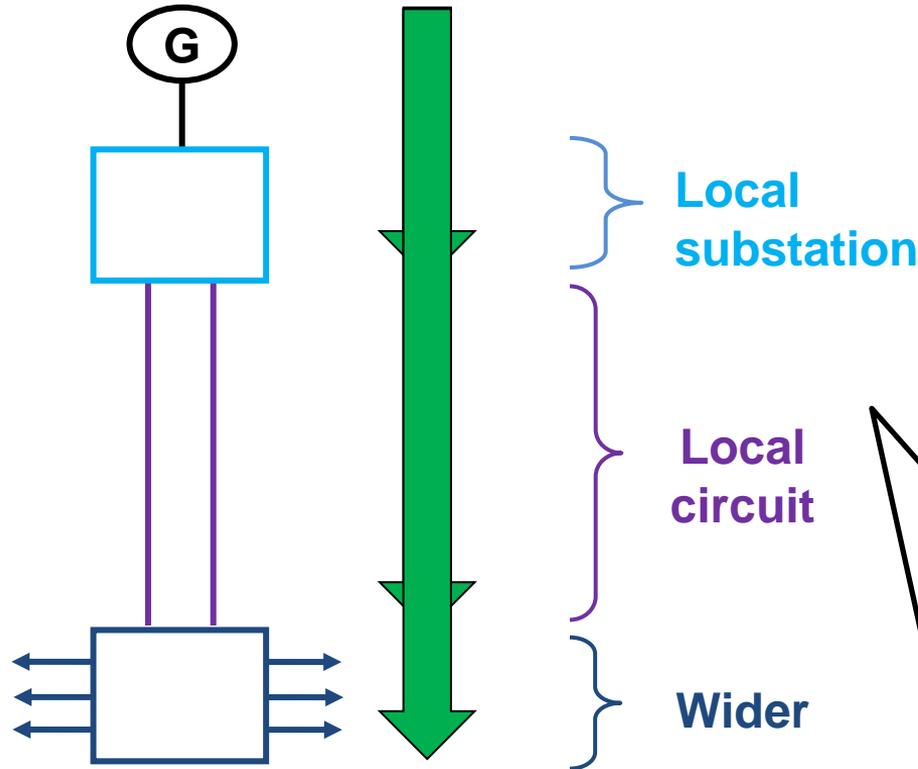


The bubbles on the left, highlight the revenues the System Operator collects from Suppliers and Generators on behalf of the various Transmission Owners.

Historically revenues were collected from Suppliers and Generators in a 73/27 ratio (G/D Split) European Commission Regulation 838/2010 puts a €2.5/MWh cap on Generation. This determines how much revenue can be collected from Generation. If the 73/27 split continued to be used, this cap would be breached. The split is therefore changed (today 83:17) so that revenues from Generation do not breach this cap.



# Structure of Directly Connected Generation TNUoS Charges



As flows come onto the system the Generator pays the following charges

**Local Substation:** This charges covers the provision of shared use assets at the substation the Generator connects into. Charge is dependent on the voltage, size and type of substation and is calculated at the start of each price control

**Local Circuit:** This charge covers the cost of building and maintaining Tx Circuits which connect the local substation to the nearest Main Integrated Transmission Substation (MITS) substation (Wider System). The charge is dependent on the length and type of circuit built and for Tee'd in connections the direction of flows along these circuits. If the connection is at the MITS then no local circuit charge is paid.

**Wider:** This charge is a Zonal tariff based on the affect of adding an incremental 1MW of Generation at the connection point and seeing the affect this has on Total System Flows

# TNUoS Wider Charges

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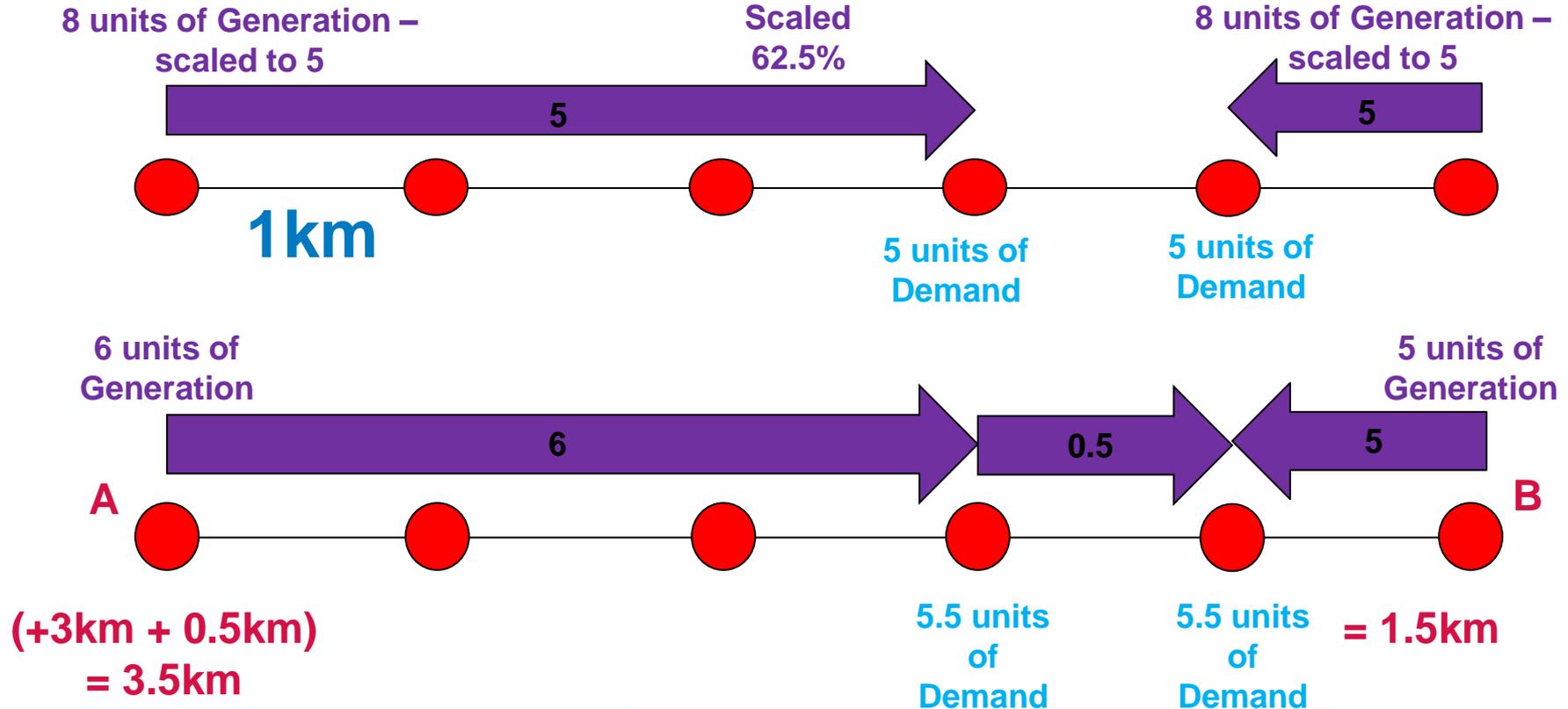
- The Wider Charge contains two main elements
  - A **locational** element to reflect the incremental cost of adding new Generation at that point in the System
  - A **residual** element to ensure we collect the allowed amounts of revenue from Generation and Demand according to proportions decided by the G/D split as discussed earlier

# TNUoS Wider Charges

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- Principles of TNUoS charges:
  - Cost reflectivity/recovery,
  - price signal for efficient investment
- Charged to all Directly Connected generation
  - Plus >100MW Embedded Generation
- Wider Zonal Charge x Transmission Entry Capacity (TEC) = Liability
  - Conventional with a load factor of 70% = £-7 to £19
  - Intermittent with a load factor of 30% = £-5 to £17
- Locational charge for demand is opposite of Generation
  - Half Hourly Location tariffs = £-2 to £2

# TNUoS Wider Charges - Generation



# TNUoS Wider Char

8 units of Generation – scaled to 5



1km

6 units of Generation



A



(+3km + 0.5km) = 3.5km

This slide shows how the concept of incremental flows works.

We use a forecast of Demand from the Distribution Networks, and actual contracted Generation. We then scale back generation to match demand. This creates a balanced system. We then see the flows on the system.

of Generation – scaled to 5



We want to see how flows change on the system by adding (incremental) a unit of Generation at A. To balance the system we add a unit of Demand as well. An extra unit of Generation at location A increases flows on the System. Node B increases flows less as it is nearer demand. If we added Generation at Node B (i.e. new power station) Node A would become cheaper, and Node B more expensive. Have a go yourself

ts of and

5 units of Generation



B

of Demand of Demand = 1.5km

# TNUoS Charges - Residual



- How much overall revenue we can collect from Generation and demand is decided by the G/D Split and allowed revenues
- **The Generation and Demand residual** adjusts the wider charges to collect the remaining revenue not collected from **locational charges**
  - For Demand: this is very high due to the low range of the locational element
  - For Generation: this is very low due to the different number of locational elements plus offshore revenue

# TNUoS Charges - Residual

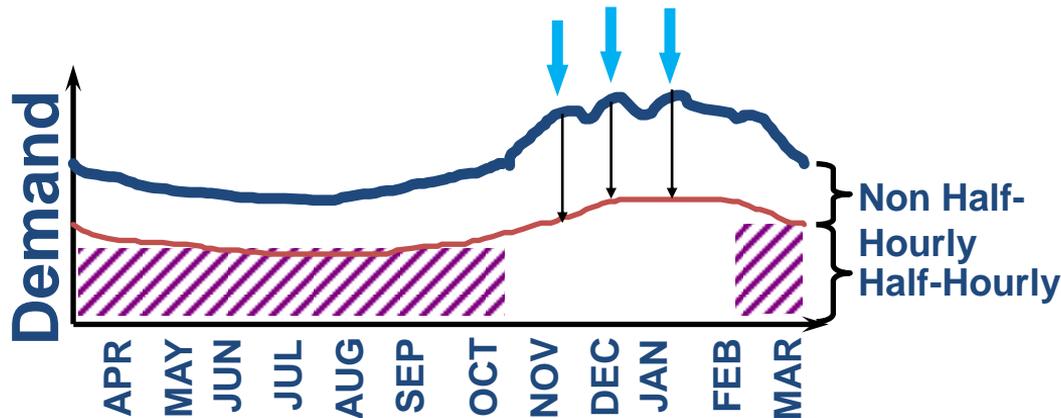


- Once we have the revenues to be recovered we then divide by the amount of forecasted Generation and Demand
- **Generation Revenue (32m) / Contracted Gen (63GW's)**
  - Generation Residual 0.51 £/kW
- **Demand Revenue £2249m / Demand (49.5GW's)**
  - Demand Residual 49.5 £/kW
  - 2013/14 Demand Residual 30.05 £/kW

Once we have set the locational elements of the charge we multiply these by forecasted Generation and Demand.

This gets us to a certain amount of revenue from both Generation and Demand. A residual is then applied to get us to the revenues requested from Transmission Owners whilst maintaining the G/D split ratio

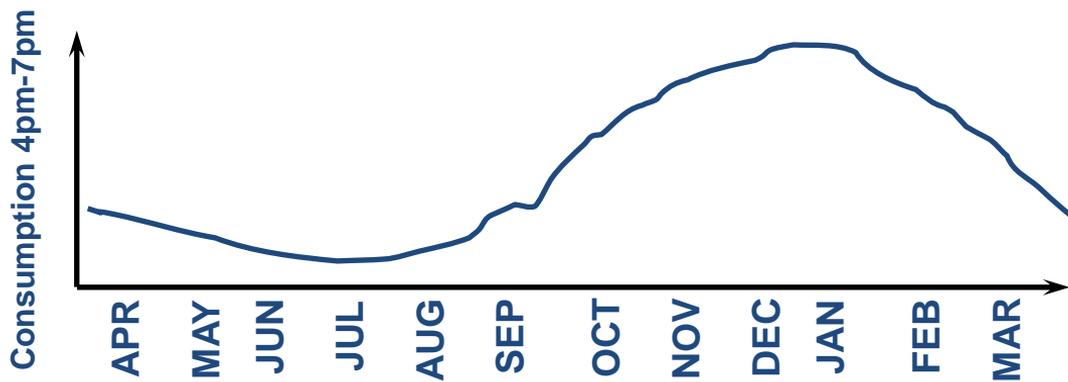
# Half Hourly (HH) Demand Charges (£600m)



Of the 50GW peak around 20-30% is Half Hourly

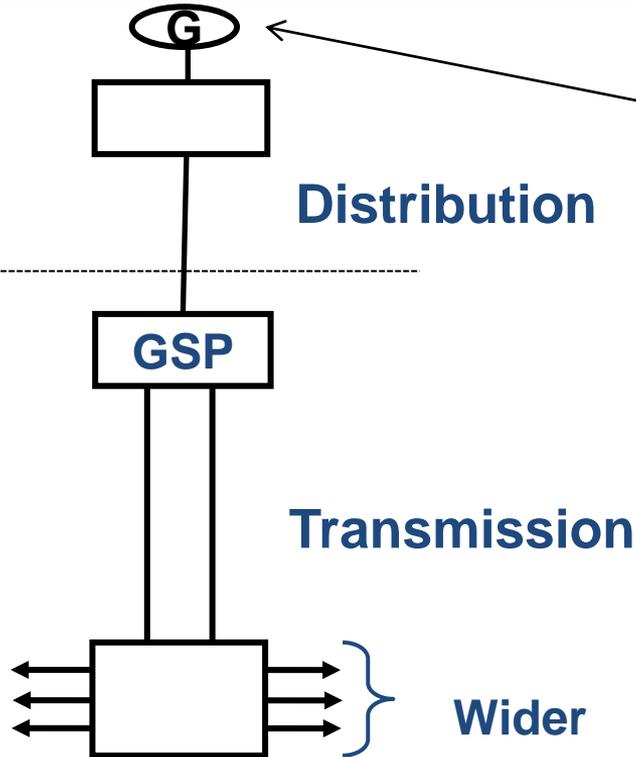
# Non Half Hourly (NHH) Energy Charges (£1650m)

Non-Half-Hourly Metered Demand →  $\left[ \text{Energy Consumption between 4pm- 7pm each day (kWh)} \right] \times \left[ \text{Zonal Energy Tariff (p/kWh)} \right] / 100$



The overall £2250m not collected through HH is collected from NHH

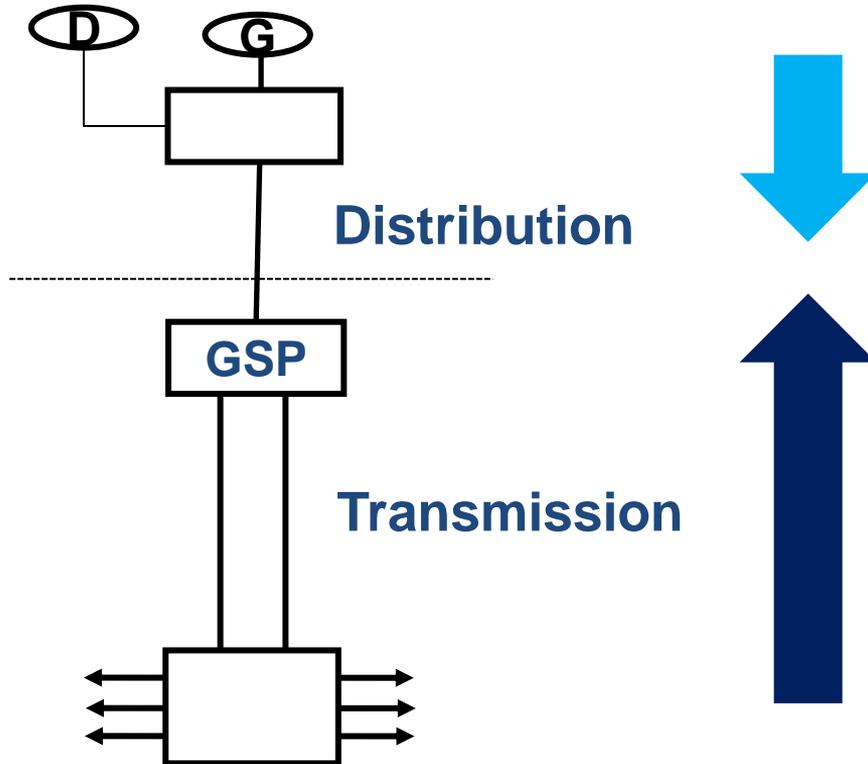
# Embedded Benefits



If an Embedded Generator generates over the Triads the Generator either receives a payment directly or reduces a Suppliers liability

Wider >100MW pay the Wider Tariff

# Embedded Benefits



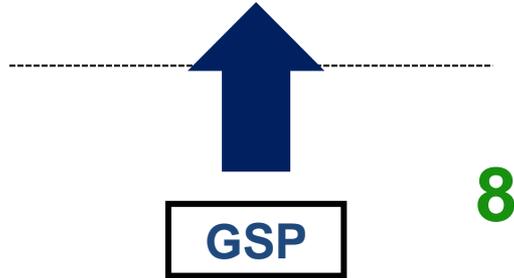
**Reduces flows on  
the TO network  
Reduces overall  
Peak demand**

# Net Charging vs Gross Charging



The demand recorded at the GSP is apportioned to each Supplier by Data Aggregators and is a collation of actual demand, Embedded Generation plus profiled Non Half Hourly Meters.

Distribution



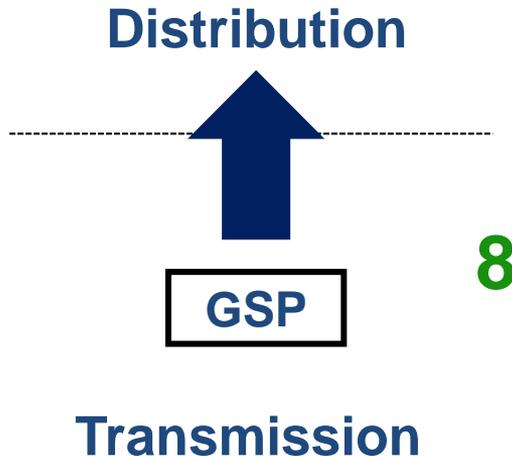
Net Charging. National Grid invoices suppliers based on aggregated demand at the Grid Supply Point (GSP). The meter at the GSP will show (8) units of demand.

Transmission

# Net Charging vs Gross Charging



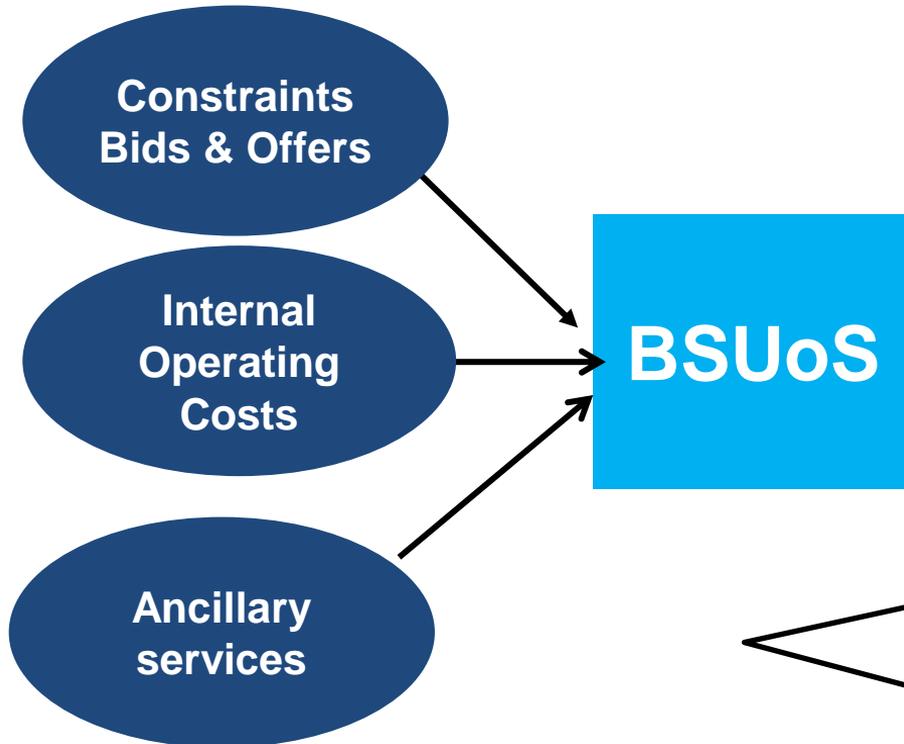
The demand recorded at the GSP is apportioned to each Supplier by Data Aggregators and is a collation of actual demand, Embedded Generation plus profiled Non Half Hourly Meters.



Gross Charging would split up Imports (2) and Exports (10) and potentially charge them differently.

\*Includes Losses from the GSP to actual meter

# Balancing Services Use of System



- Charges based on costs incurred per half-hourly settlement period
- Paid 50/50 between Net Generation and Demand
- A flat tariff (not locational)

National Grid as System Operator is responsible for balancing the system. The costs of doing this are recovered through a BSUoS charge. 3 key cost components

**Constraints:** The overall system may be in balance but locational problems on the System may require National Grid to take balancing actions

**Internal Operating Costs:** These costs cover fixed costs such as staff, computer systems and control rooms

**Ancillary Services:** The purpose of ancillary services is to provide support across the whole of the electricity system to ensure that the system remains stable at all times. For example Black Start services, Frequency response



# UK Power Networks Distribution Charges



# UK Power Networks

Energy distributed: circa 80 TWhs

- Enough energy to power 20 million homes
- Used by 7½ million homes and ½ million businesses – our 8 million ‘customers’
- 140,000 embedded generators
- circa 8 TWhs exported
- Requires circa £1.4 billion per annum to ensure maintenance and development of an efficient and reliable network



# Distribution charges

## Connection Charge

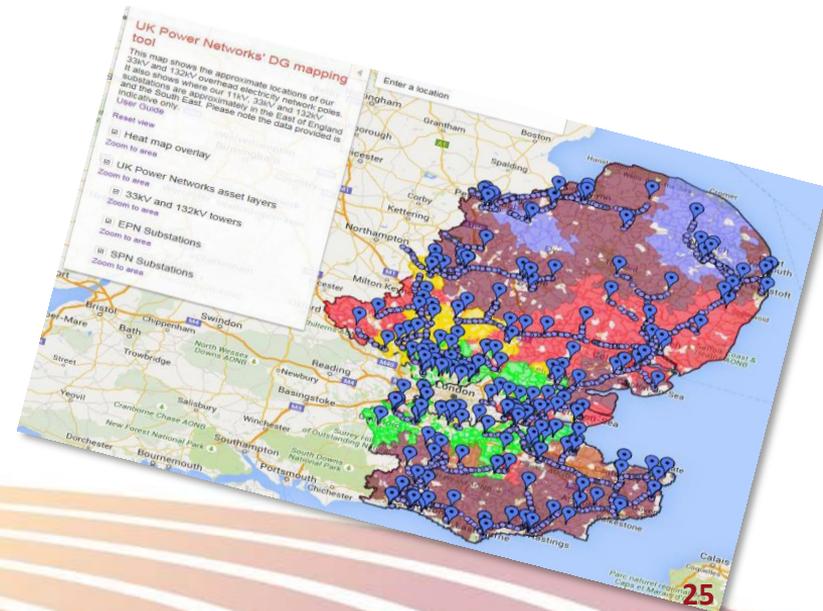
- One off charge
- Paid for building network connection
- Covers network extension to site and (if needed) a share of upstream reinforcement
- Based on location 'minimum design' requirements
- Additional charges for enhanced design

## Use of System Charges

- Ongoing charge
- Paid for ongoing use of the shared network
- Also covers operation, repair and maintenance of sole use assets
- Level of charge set through 'Allowed Revenue'
- Additional charges for enhanced security

# Connection charges

- Costs can vary considerably depending on nature of connection
- Connectee able to choose connection provider for contestable work
- UKPN can provide 'flexible' connections to enable connection in constrained areas
- Connection agreements may include profiled restriction to enable connection at lowest cost and/or earliest opportunity



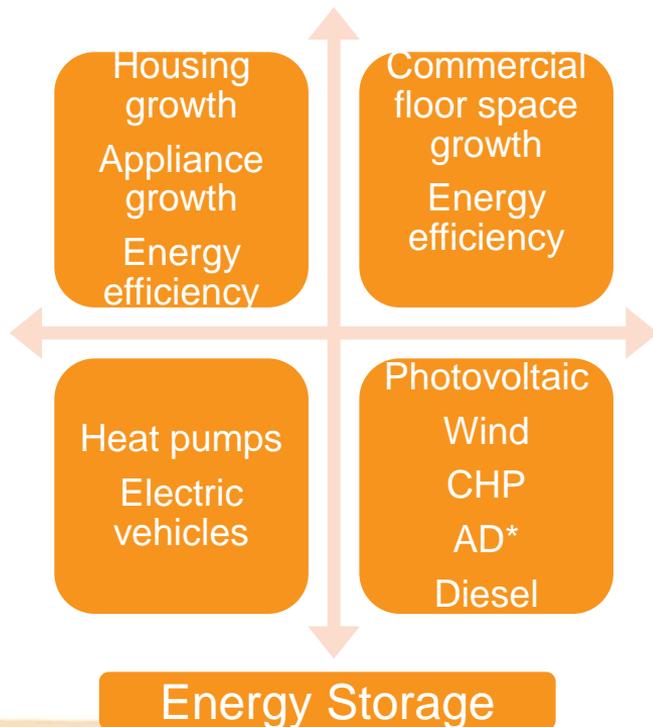
# Drivers impacting connections

Domestic demand

Commercial demand

New low carbon  
demand sources

Generation

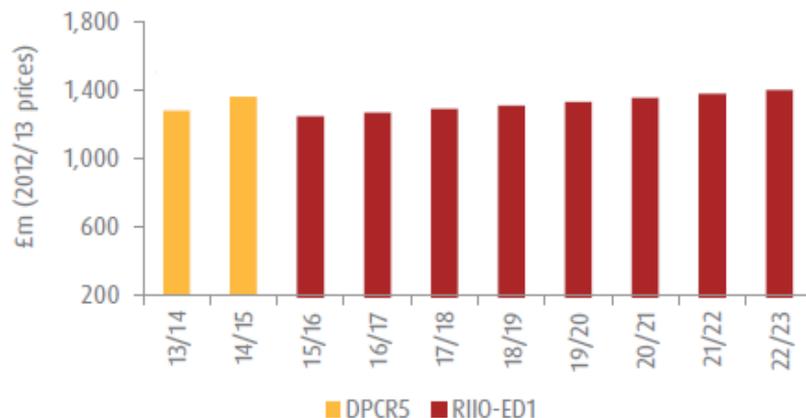


\* anaerobic digestion

**Distribution system impacts**

# Establishing use of system income

- DUoS income or 'Allowed Revenue' allowance is a separate amount for each of our three areas. The calculation provides us with annual 'target' revenue that we then use to set charges.
- The target revenue includes:
  - Base revenues
  - Uncertainty mechanisms
    - MOD
    - RPI
    - Pass-through items
    - Incentive outcomes
- 'Scaling' process to align yardstick tariff values with forecast volumes to match target revenue



# Setting use of system prices

- The ‘target’ revenue is recovered across all customers
- Setting prices is charge allocation
  - How we should ‘slice the cake’
  - Not the size of the cake
- Consequently, if somebody pays more then somebody else pays less
- Allocation methodology based on licence objectives – predominately:
  - Cost reflectivity
  - Facilitating competition
  - Encouraging development of an efficient network



# Use of system charging methodology

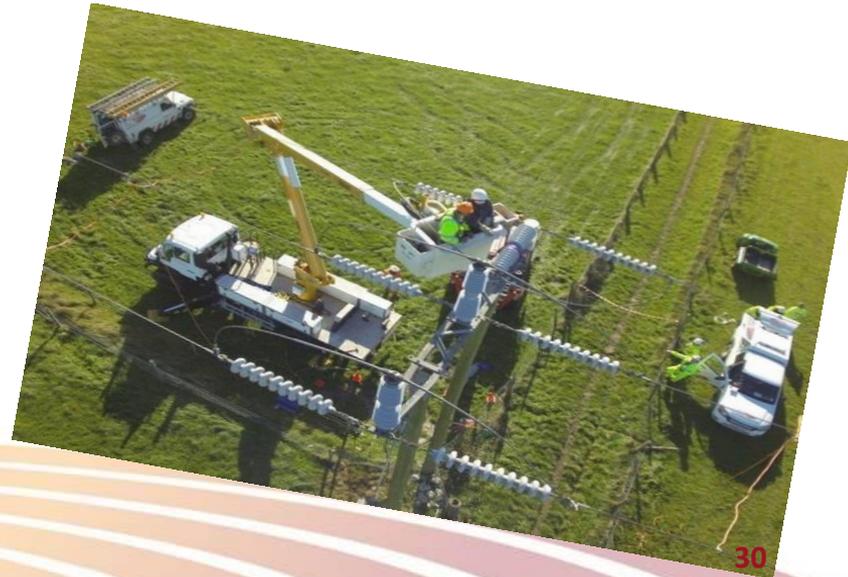
- There are two 'common' charging methodologies used by all DNOs
  - CDCM – Generic tariff model used for HV & LV
  - EDCM – Site specific model used for EHV
- CDCM calculates 19 demand and 8 generation tariffs for 8 million\* sites
- EDCM calculates circa 330\* individual site specific charges

\* UKPN areas



# Modelling inputs

- DNO specific to allow for topography and demographics
- Network costs
- Load profile data – tariff impact on network
- Network constraints
- Volume forecasts
- Locational costs (EDCM only)



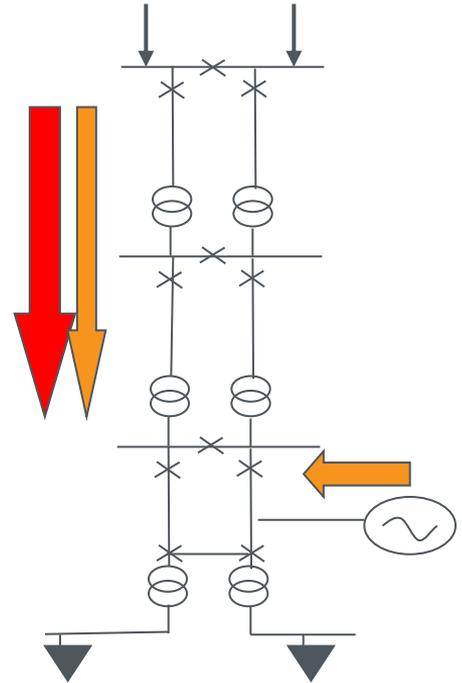
# Tariff structures

- Non-half hourly and aggregated HH metered (domestic and business)
  - Fixed charge – p/day
  - Unit charges – p/kWh
    - Time bands determined by meter configuration or set by UKPN for aggregated HH
- Half hourly metered sites
  - Fixed charge – p/day
  - Capacity charge – p/kVA/day
  - Unit charges – p/kWh
    - Time bands set by UKPN
    - CDCM – Three time bands – TOD
    - EDCM – One ‘super red’ time band – STOD



# Generation 'charges'

- Methodologies 'reward' distributed generation for the benefit they can bring to the network
- Conceptually, distributed generation reduces upstream demand
- LV & HV generation tariffs have a credit which is paid to suppliers
- EHV credits are dependant on location and generation type
- UKPNs' role to facilitate 'benefit' cash flow between demand and generation



# Methodology development

- The CDCM, EDCM & CCCM methodologies are governed in DCUSA
- All DNOs and network 'users' are party to DCUSA
- Methodology change proposals can be raised by any party
- Currently circa 30 change proposals in progression
- UKPN participate in all relevant working groups
- DNOs facilitate quarterly Distribution Charging Methodology Forum (DCMF) to discuss charging issues



Thank you





# National Grid Charging Seminar

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**Distribution Charging**  
**21<sup>st</sup> July 2016**



# Distribution Charges

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## Connection charges

- One off charge
- Paid for building network connection
- Covers network extension to site and (if needed) a share of upstream reinforcement
- Based on 'minimum design' requirements
- Additional charges for enhanced design

## Use of System charges

- Ongoing charge
- Paid for ongoing use of the shared network
- Also covers operation, repair and maintenance of sole use assets
- Level of charge set through 'Allowed Revenue'
- Additional charges for enhanced security

# Connection Charges

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## Connections designed in accordance with Minimum Scheme Principles

- The Scheme with the lowest overall capital cost (as estimated by us), solely to provide the Required Capacity, subject to:
  - accepted industry standards;
  - the status and configuration of the Relevant Section of Network;
  - standard sizes and types of equipment currently used by us;
  - maintaining our ability to minimise regulatory penalties; and
  - our statutory and licence obligations including the requirement to develop, maintain and operate an efficient, co-ordinated and economical electricity Distribution System.

# Connection Charges

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## Cost Allocation

The costs to be charged to you as a Connection Charge may be split into three categories:-

- Costs for providing the connection which are to be paid in full by you;
- Costs for providing the connection which are to be apportioned between you and us; and
- Costs to be paid by you in respect of works that have previously been constructed or are committed and are used to provide the connection.

# Connection Charges

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## Transmission Costs / Securities

Our charges to you may also include:

- Charges to assess the potential impact on the transmission system of your connection
- Costs associated with transmission system works where these are required by NGET as a condition of your connection.

Where security requirements or cancellation charge liabilities are applied by NGET we will pass these on to you on a basis equivalent to that applied to generators directly connected to the transmission system.

Pre-Trigger 100%, Post-Trigger 45% (pre-consent) and 26% (post-consent).

# Use of System Charges

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- DUoS income or 'allowed revenue' is a different for each of our two areas.
- The calculation provides us with an annual 'target' revenue which is used to set tariffs.
- The target revenue is recovered across all customers.
- Setting prices is based on cost allocation
  - Allocate costs based on type and usage of customer
  - Scale up or down based on allowed revenue
- Consequently, if somebody pays more then somebody else will pay less
- Allocation methodology based on licence objectives, predominately:
  - Cost reflectivity
  - Facilitating competition
  - Encouraging the development of an efficient network

# Use of System Charging Methodology

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- There are two 'common' charging methodologies used by all DNOs
  - Common Distribution Charging Methodology (CDCM) – a generic tariff model which calculates charges for HV & LV customers
  - EHV Distribution Charging Methodology (EDCM) – a site specific model which calculates site specific charges for EHV designated properties
- CDCM calculates 19 demand and 8 generation tariffs for 3.6 million sites\*
- EDCM calculates circa 330 individual site specific charges\*

\* SPEN areas

# Generation Use of System Charges

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- Methodologies 'reward' distributed generation for the benefit they can bring to the network
- Conceptually, distributed generation reduces upstream demand
- LV and HV generation tariffs have a credit which is paid to suppliers
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