

# NTS Transportation Model

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## Introduction

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- This presentation provides an overview of the NTS Transportation Model used for setting
  - NTS Exit Capacity Charges and
  - NTS Entry Capacity Reserve Prices

All references to “National Grid” in this presentation refer to National Grid Gas plc in its role as holder of the Gas Transporter Licence in respect of the NTS (the “Licence”).

# The Transportation Model

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The NTS Transportation Model comprises:

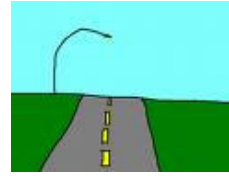


**The Transport Model**, which calculates the Long Run Marginal Costs (LRMCs) of transporting gas from each entry point to a “reference node” and from the “reference node” to each relevant offtake point.



**The Tariff Model**, which;

- i) adjusts the LRMCs to maintain an equal split of cost between Entry and Exit points to obtain Entry Auction Reserve Prices
- ii) calculates a required Revenue Adjustment Factor to recover the Target Exit Revenue



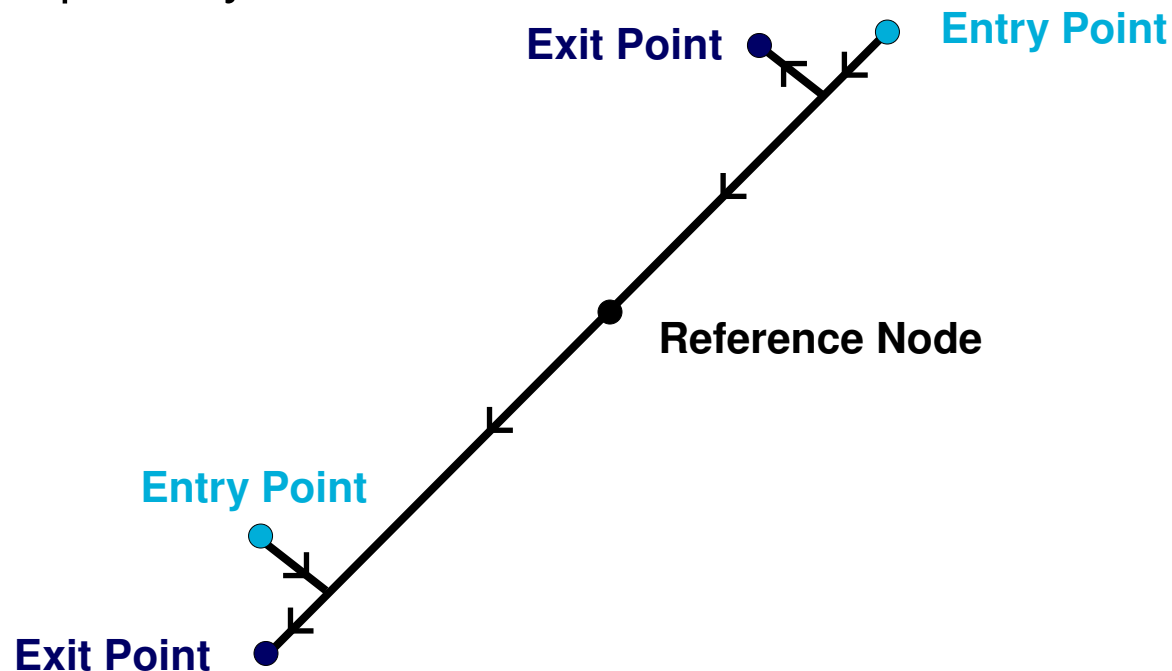
# The Transport Model

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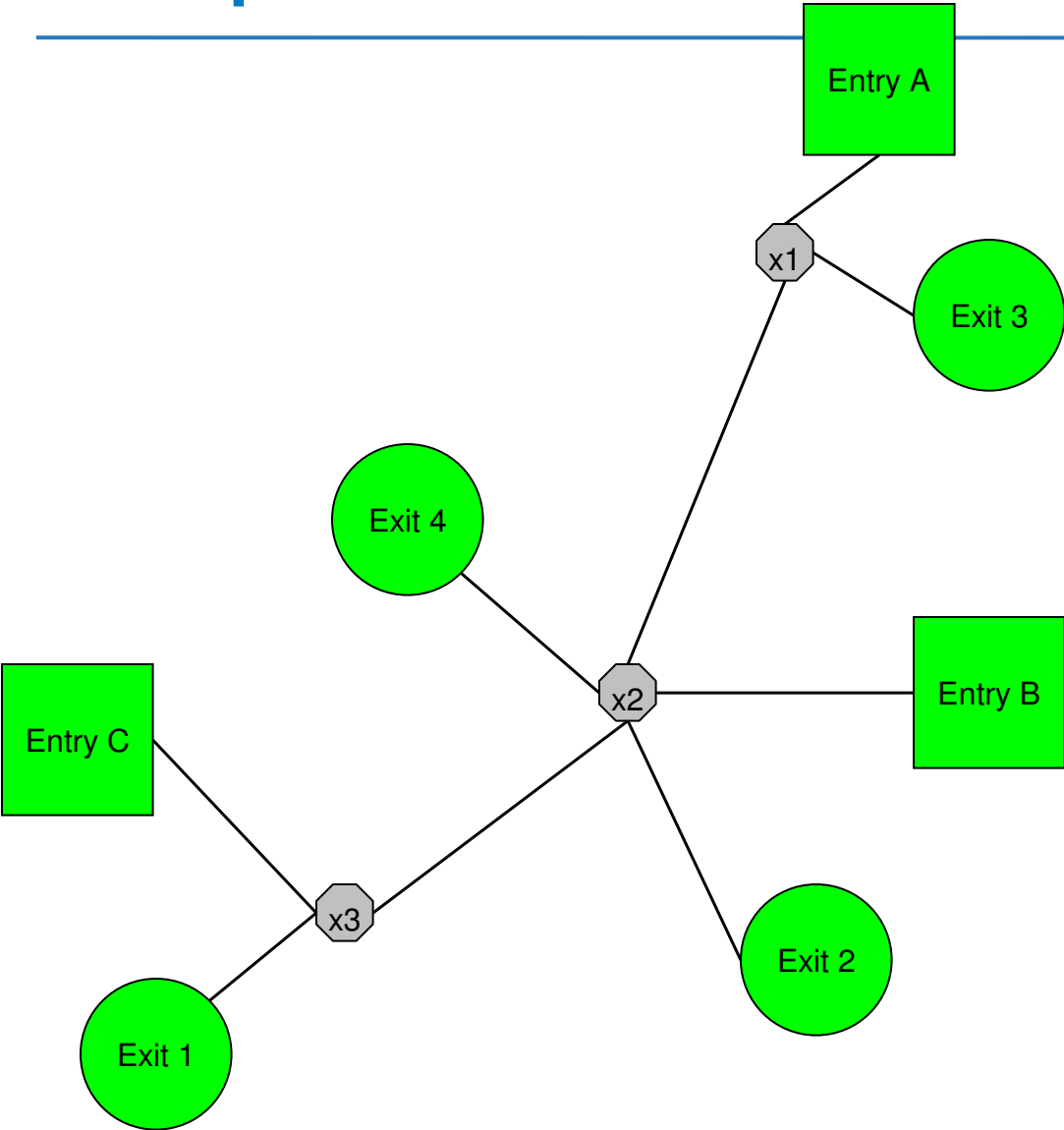
**The Transport Model** calculates the LRMCs of transporting gas;

- from each entry point to a “reference node” and
- from the “reference node” to each relevant offtake point.

The reference node does not affect the final charges and is included in the Model for transparency.



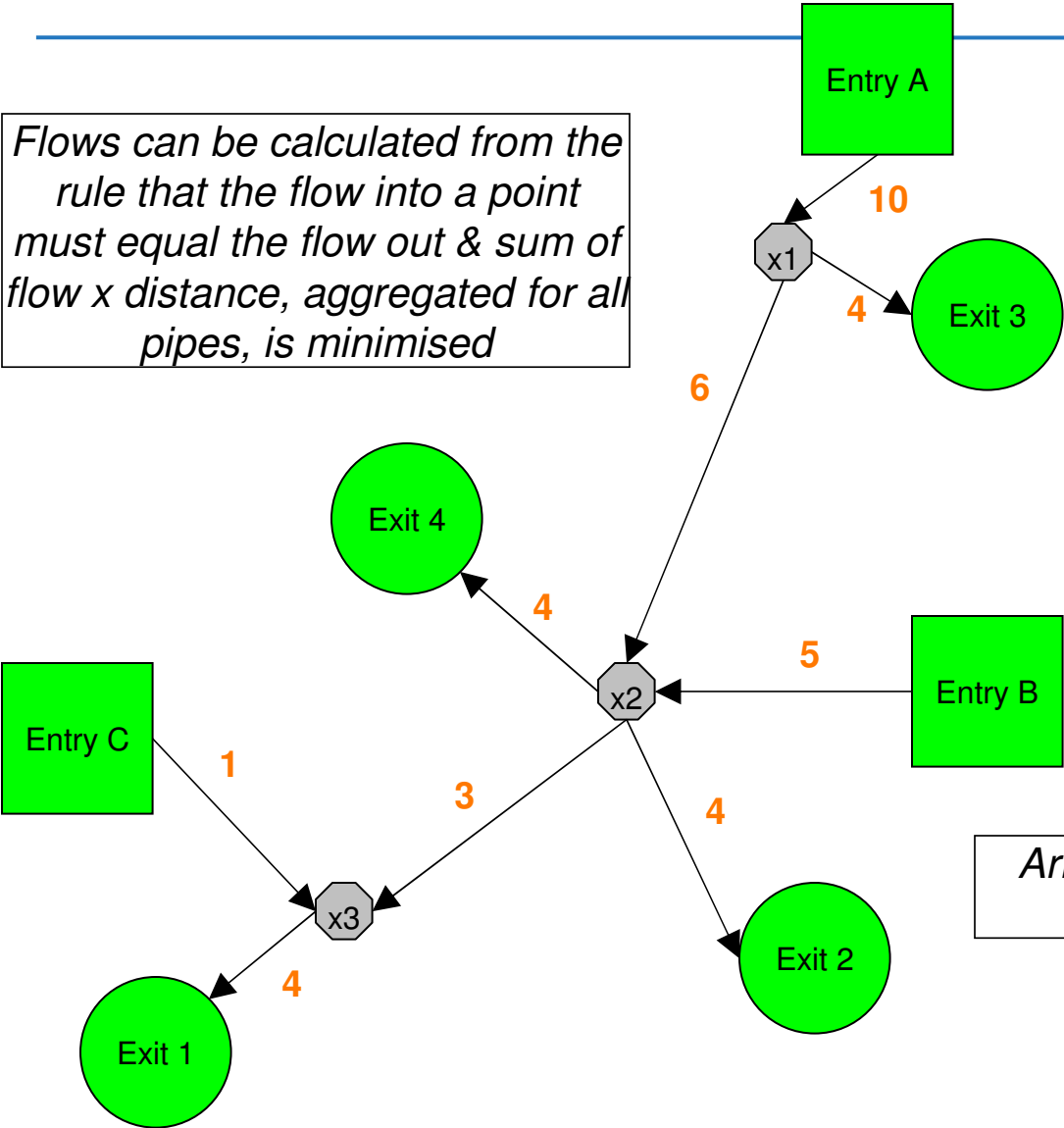
# Example Network



# Example Network

## Step 1: Calculate flows from Supply & Demand Data

*Flows can be calculated from the rule that the flow into a point must equal the flow out & sum of flow x distance, aggregated for all pipes, is minimised*



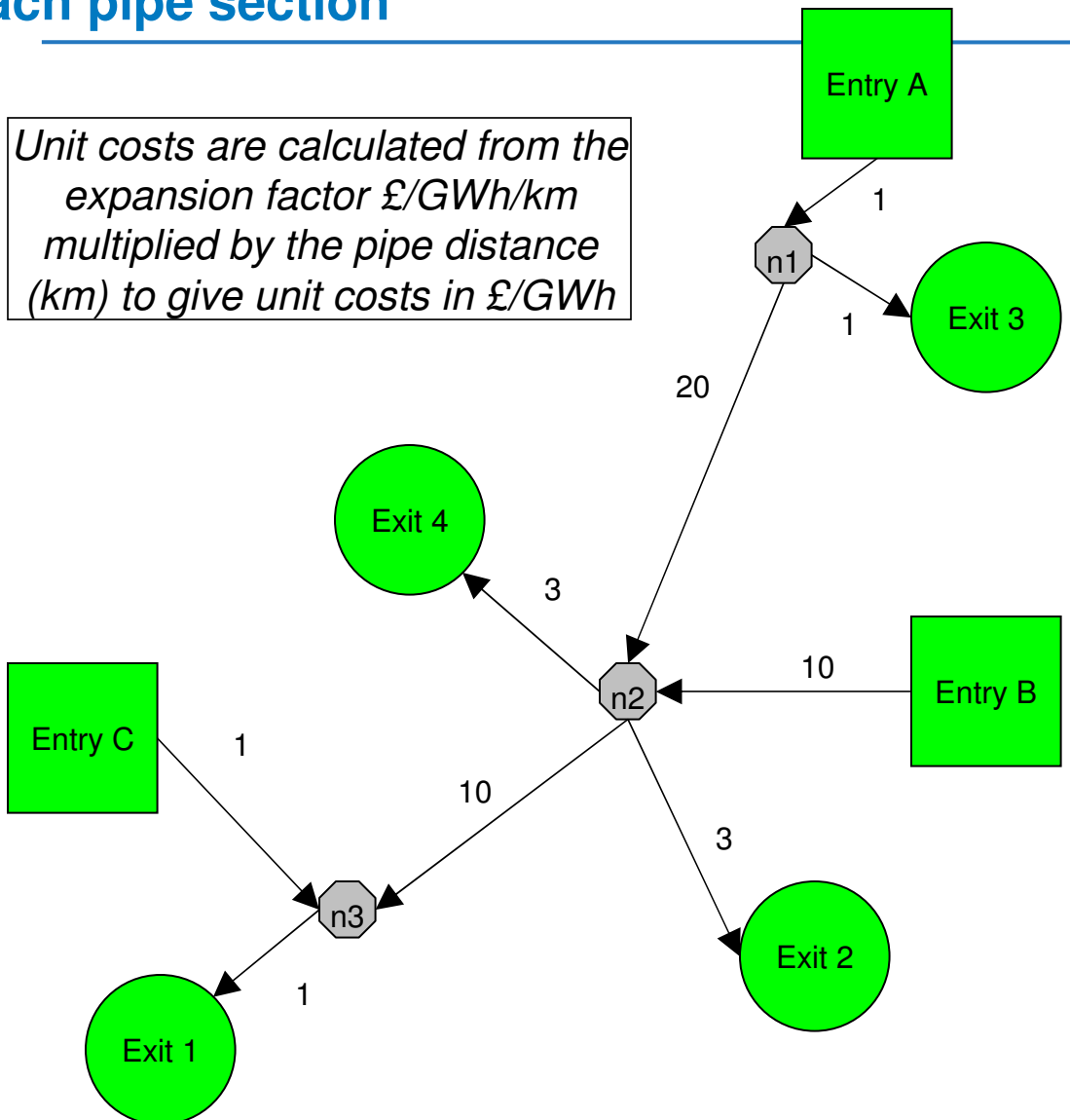
Entry Point	Peak Flow (GWh)	Exit Point	Peak Day Flow (GWh)
A	10	1	4
B	5	2	4
C	1	3	4
		4	4

*Arrows show direction of flow based on peak flow*

# Example Network

Step 2: calculate reinforcement cost (£/GWh/day) for each pipe section

*Unit costs are calculated from the expansion factor £/GWh/km multiplied by the pipe distance (km) to give unit costs in £/GWh*



Pipe	Node 1	Node 2	Cost (£/peak day GWh)
1	Entry A	n1	1
2	n1	Exit 3	1
3	n1	n2	20
4	Entry B	n2	10
5	n2	Exit 2	3
6	n2	n3	10
7	n2	Exit 4	3
8	Entry C	n3	1
9	n3	Exit 1	1

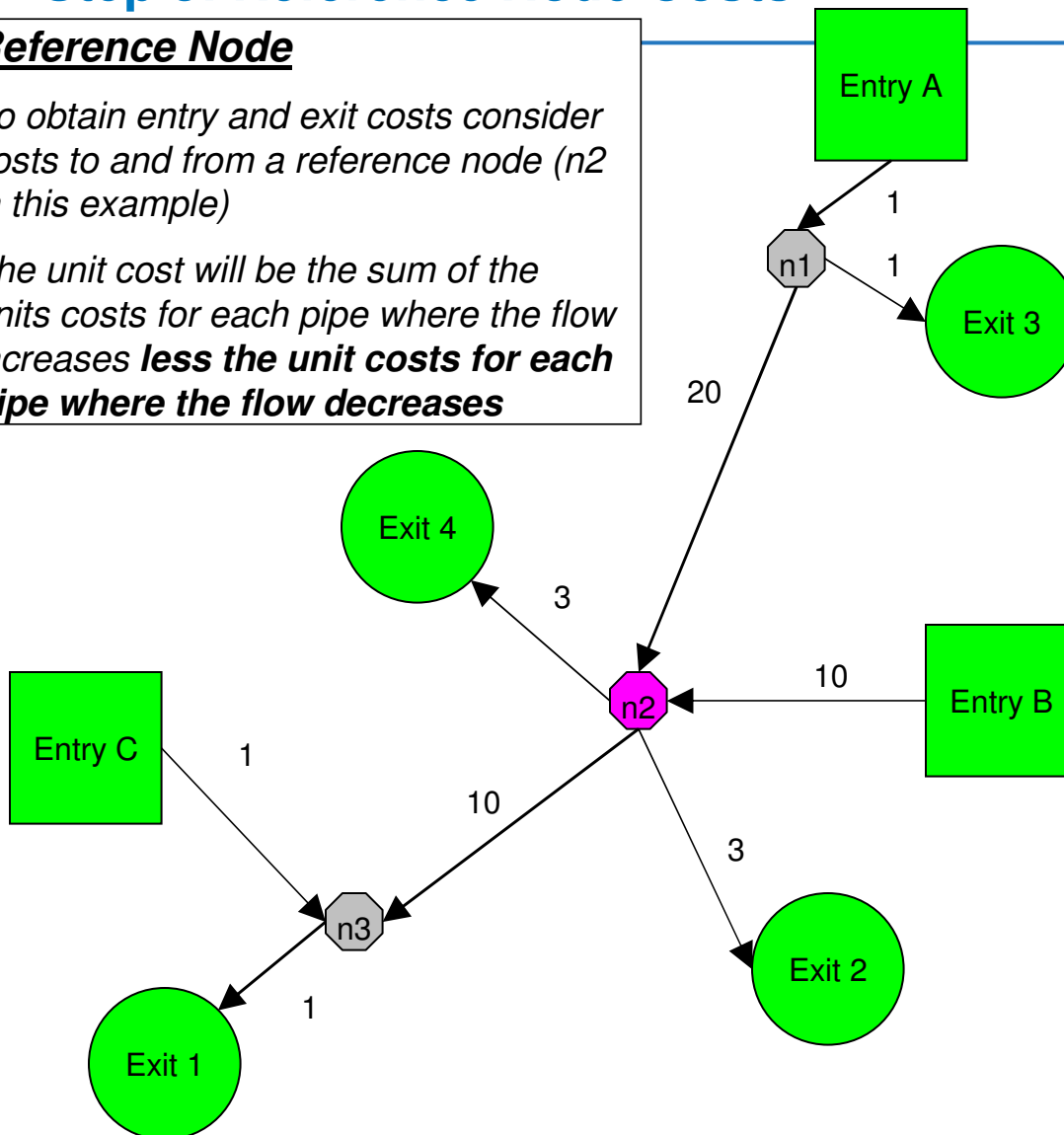
# Example Network

## Step 3: Reference Node Costs

### Reference Node

To obtain entry and exit costs consider costs to and from a reference node (n2 in this example)

The unit cost will be the sum of the units costs for each pipe where the flow increases **less the unit costs for each pipe where the flow decreases**



	Entry A	Entry B	Entry C
Exit 1	21	10	-9
Exit 2	11	3	-19
Exit 3	3		3
Exit 4			

## Negative Marginal Costs

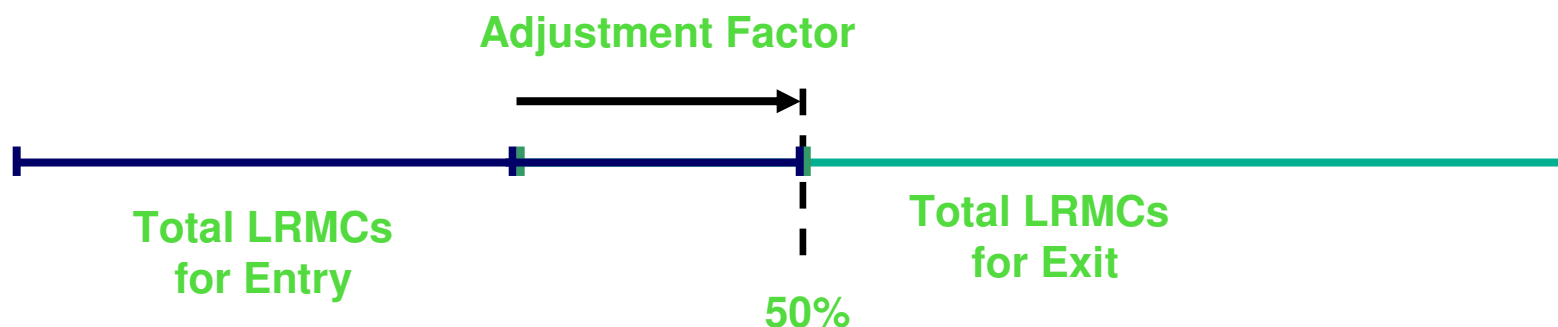
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- The Transportation Model generates negative marginal costs, but these implied costs savings are only relevant if flows are guaranteed, and cannot be used to set capacity prices.
  - Negative costs are removed in the tariff model.
- The negative LRMCs are reflected in the Charging Methodology for Constrained LNG (CLNG) payments.
  - These are payments to shippers holding gas in strategic LNG facilities to meet peak demand when demand is in excess of pipeline capability
  - There is an obligation on shippers to hold CLNG gas in store and hence flows can be guaranteed.



## The Entry Tariff Model

- Adjusts the LRMCs to maintain an equal split of cost between Entry and Exit users to obtain Entry Capacity auction reserve prices
  - An additive constant Adjustment Factor is calculated, which when added to each LRMC, gives a revised marginal distance for each supply and for each demand. The calculation simultaneously removes the negative marginal distances by collaring the LRMCs at zero.



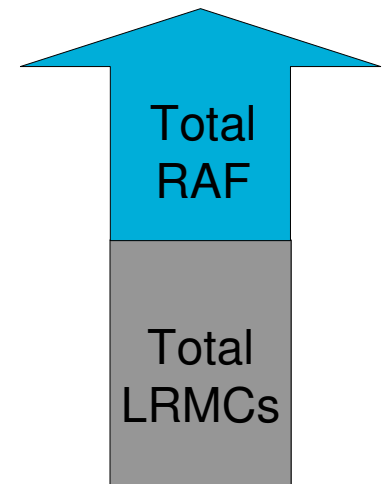
- Converts cost into prices via the annuitisation factor

# The Exit Tariff Model

## Administered Exit Charges



- Calculates the required Revenue Adjustment Factor to recover the Target Exit Revenue
  - A single additive constant Revenue Adjustment Factor (RAF) is calculated, which when added to the LRMC at each demand, gives a revised marginal distance for each demand, such that the total revenue to be recovered from exit charges equals the target revenue.
- The calculation simultaneously removes the negative marginal distances by collaring the revenue to that level implied by the minimum price of 0.0001 p/kWh.

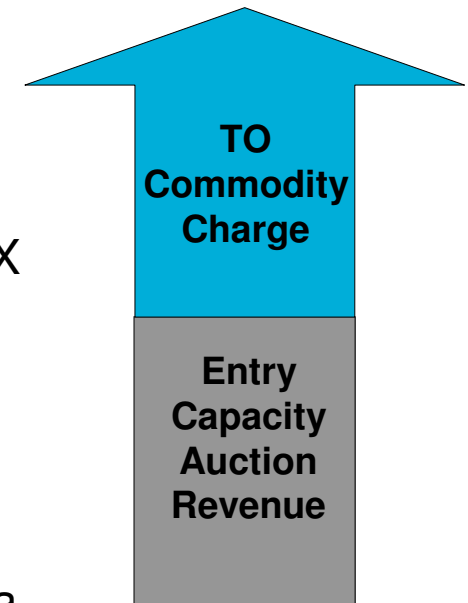


# The Entry Tariff Model

## Entry Capacity Reserve Prices



- The auction reserve prices are obtained by the Tariff Model from LRMCs (no adjustment for allowed revenue) leading to both TO & SO revenue.
  - Where National Grid forecasts that the TO entry capacity auction revenue will be below the target revenue a TO Commodity charge is applied.
- The Price for each ASEP and each price step is calculated with the relevant ASEP flowing at the relevant (obligated or incremental) flow level
  - $\text{Marginal Cost} = \text{marginal distance} \times \text{Expansion Factor} \times \text{CV correction factor}$ 
    - The expansion factor is calculated at a planning CV
  - $\text{Reserve Price} = \text{Marginal Cost} \times \text{Anuitisation Factor}$
- Reserve price are calculated such that they are collared at a minimum value of 0.0001 p/kWh/day.



## Summary

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- All NTS Capacity Prices set using the Transportation Model which is available to the industry
- Key sensitivities:
  1. Level of entry prices driven by obligated level and expansion factor
    - NB entry prices are not adjusted for allowed revenue
  2. Level of exit prices driven by allowed revenue
  3. Locational sensitivity of both entry and exit driven by Supply & Demand assumption
    - Supplies are more variable and hence more significant
  4. Locational differentials for both entry and exit driven by network flow patterns and expansion factor

# Questions?

For information on how to access the NTS Transportation Model:  
<http://www.nationalgrid.com/uk/Gas/Charges/Tools/>

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