Northern Ireland Electricity Networks

NIE Networks Overview

14 September 2018

NI Electricity Market Structure

Generation

Large thermal

Renewables
Interconnectors

Generators sell energy into the SEM wholesale market

Transmission

Distribution

Northern Ireland Electricity Networks

SONI System Operator for Northern Ireland

Transmission system:
Owned by NIE Networks
Operated by SONI

NIE Networks transports energy from Generators to end customers

Supply

power ni your kind of energy

budgetenergy Northern Ireland's Electricity Company

sse Airtricity

energia Switched on

firmus energy

electric Ireland

Others

Suppliers buy energy from the wholesale market & sell to customers

Customers

NIE Networks Overview

Customers Staff Contractors	c880,000 c1200 c800
Annual Electricity Demand	c8 TWh
Transmission Network	c2,200 km
Distribution Network	c47,000 km
Substations	c300 major
Price Control Total Expenditure (October 17– March 2024)	**c£1.2bn**

Regulatory Price Control 6 (RP6)

RP6 period - October 2017 to March 2024
Programme of c.£1.2Bn over 6.5yrs

When developing our plan we considered:

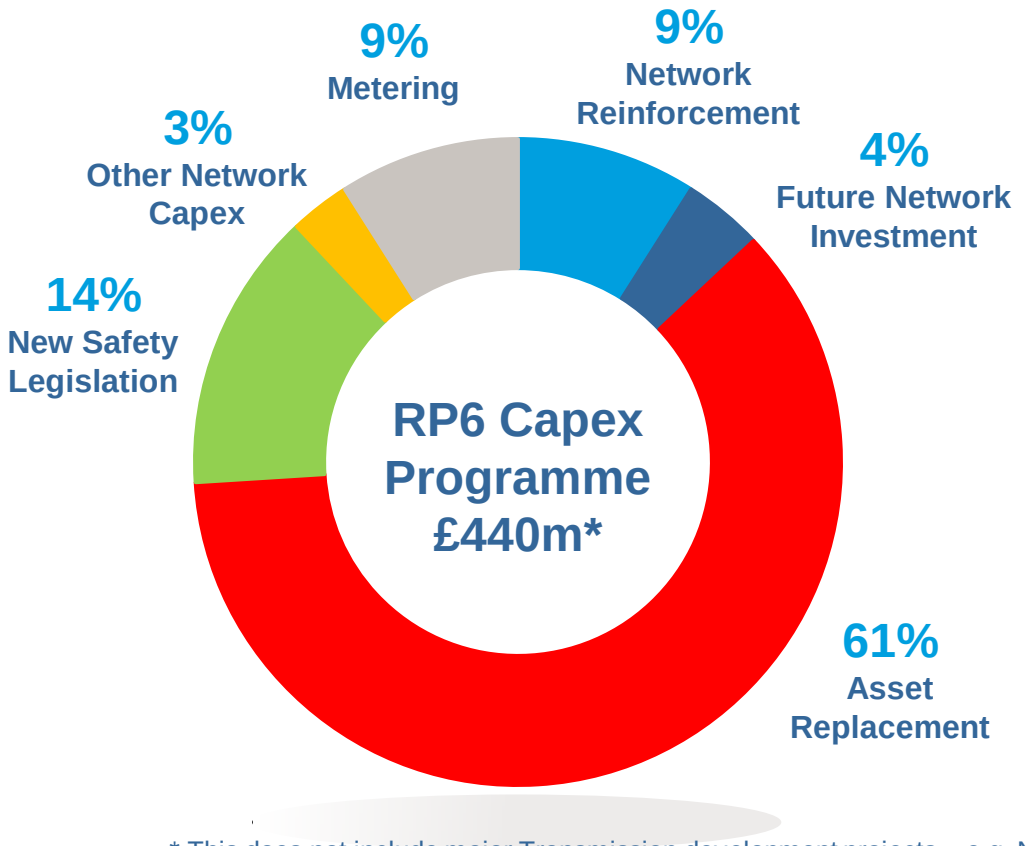
- Ensuring a safe and reliable network
- Delivering the required services at least cost
- Balancing the needs of current and future customers
- Significant engagement with customers & stakeholders

Investment Programme:

- Spend - c. £440 million in CAPEX to replace older network assets, improve safety and prepare us for a low carbon future
- Also potentially c.£200 million transmission load projects (includes North-South Interconnector)

Impact on Customers' Bills:

- Costs associated with network investment are paid for by customers over 40 years reflecting the long term value of network assets.
- We will reduce our costs to customers over the period of RP6.

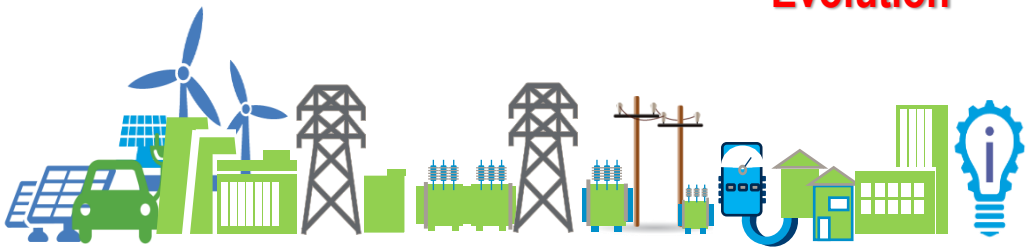


* This does not include major Transmission development projects – e.g. North-South IC, which are approved on a case by case basis

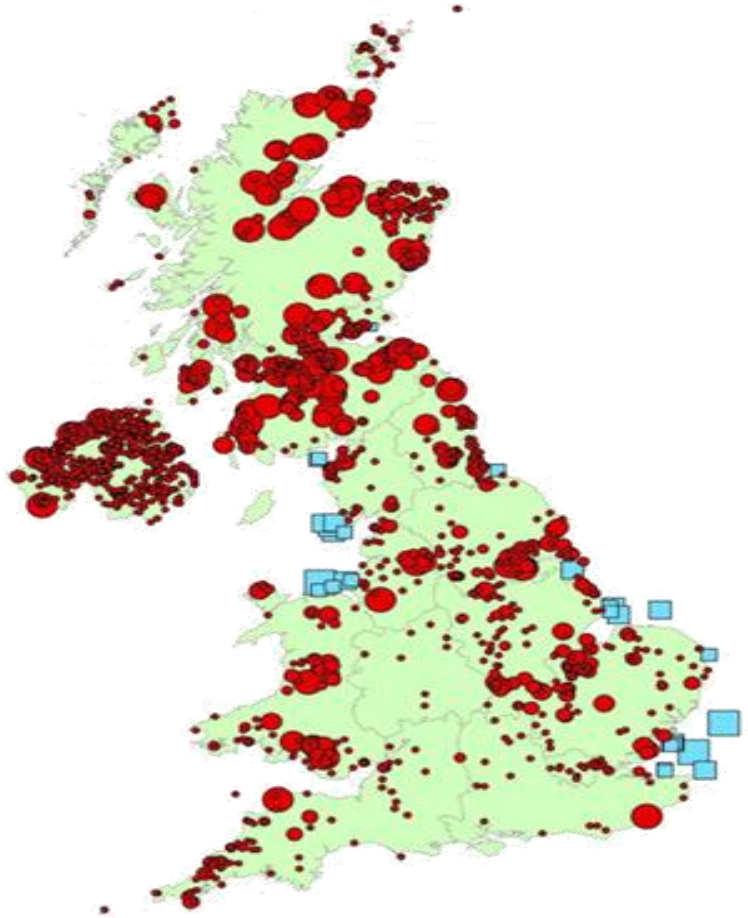
RP6 – Key Business Challenges

- Competition in Connections
- Deliver Efficiency Savings
- Deliver Investment Programme
- Improve network performance and customer service
- Look to the Future – beyond RP6

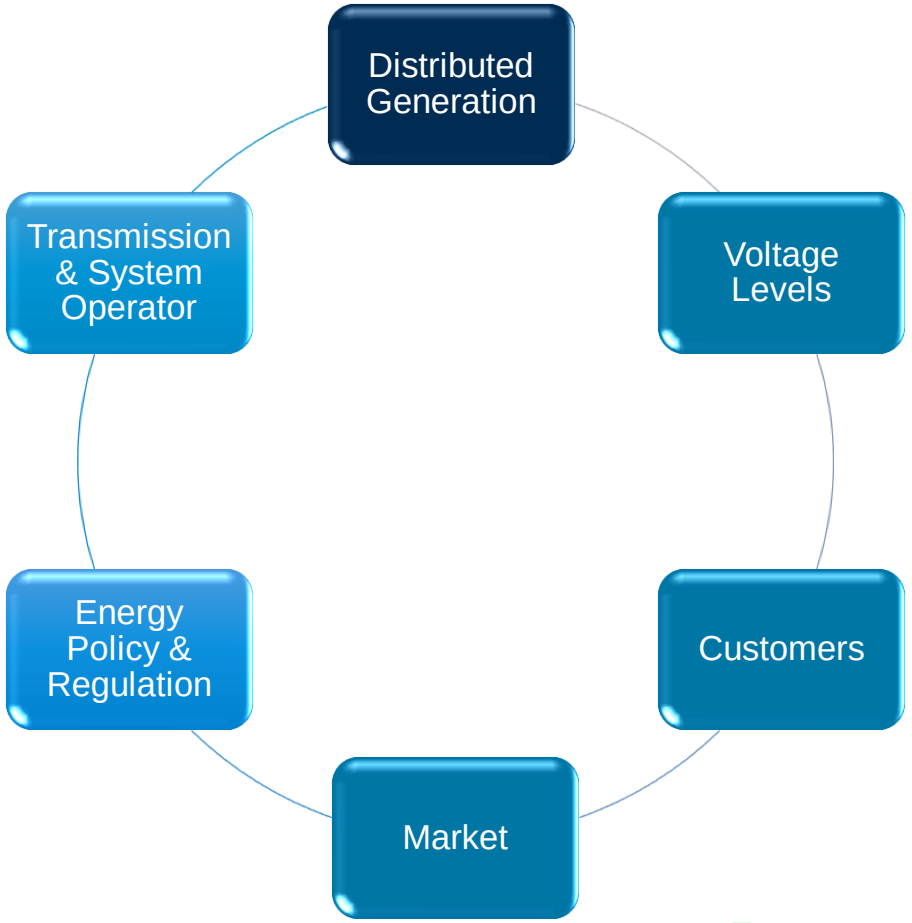
DNO/DSO Evolution



The need for an NI specific evolution

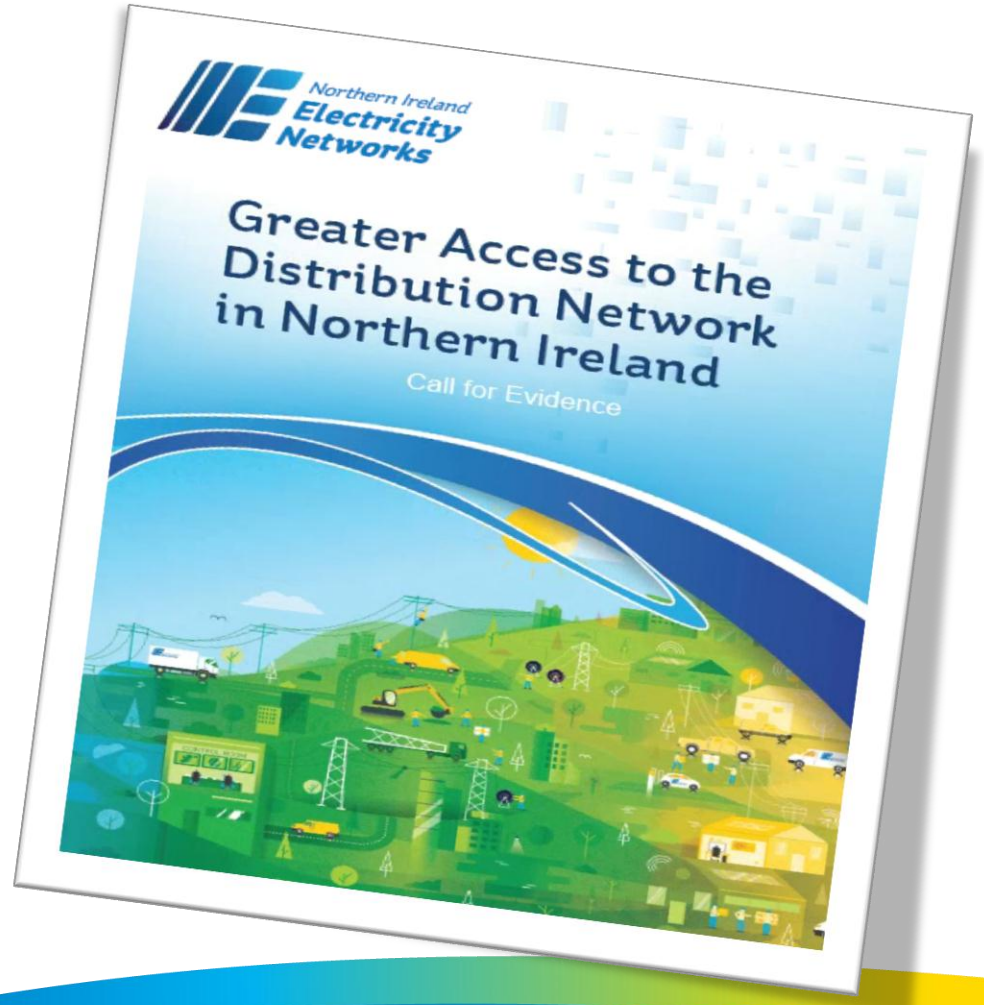


www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes#2017



Call for Evidence

NIE Networks Call for Evidence (CfE) seeks to obtain a NI perspective on what fundamental changes are required to be made to the DNO functions and to the future operation of the electricity network to deliver benefits to customers.



CfE workshop 14th Sep

CfE closes 2nd Oct

Consultation Q4 2018

Northern Ireland Electricity Networks

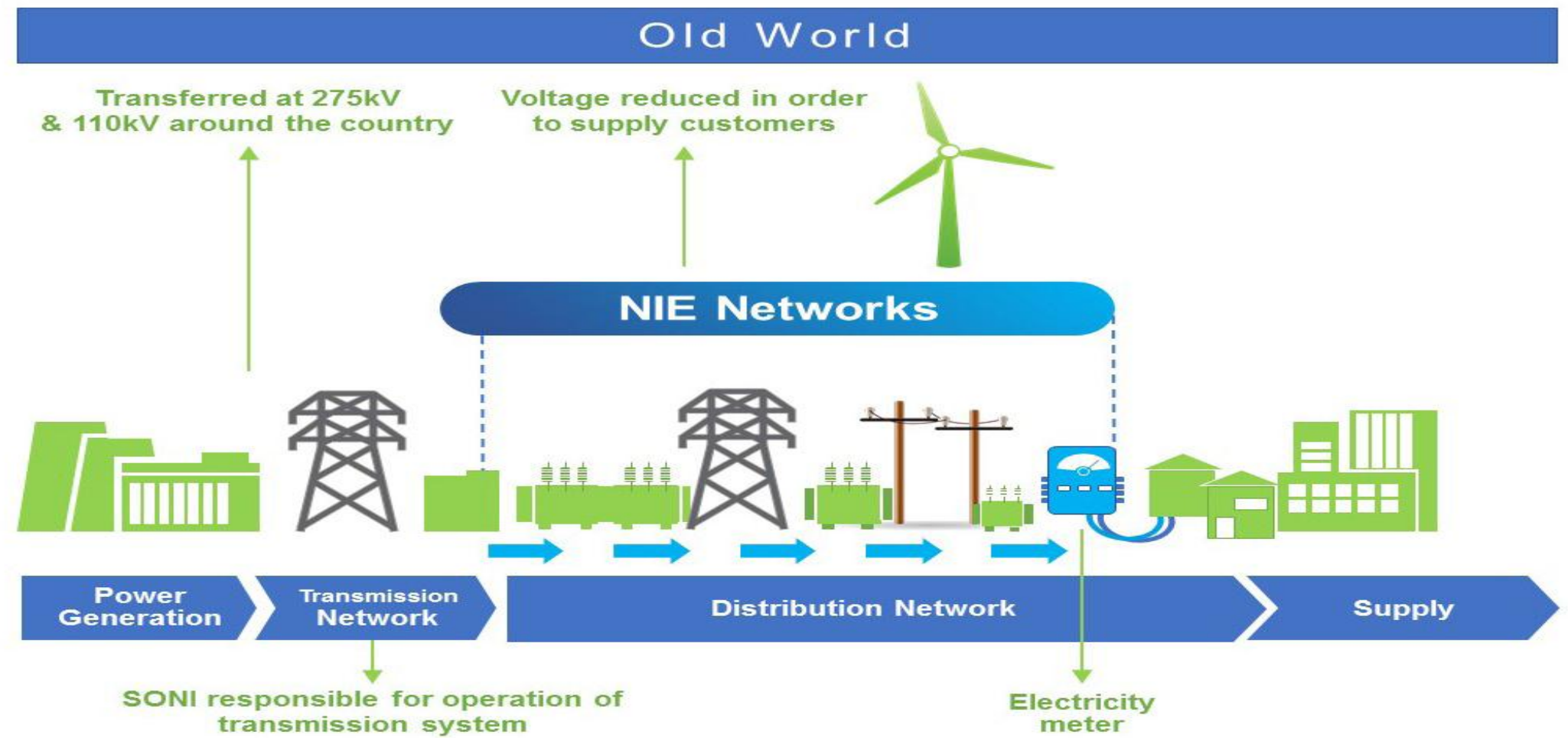
Thank you

Greater Access to the Distribution Network in Northern Ireland

Call for Evidence

Ian Bailie
Call for Evidence Workshop
14/09/2018

DNO Old World

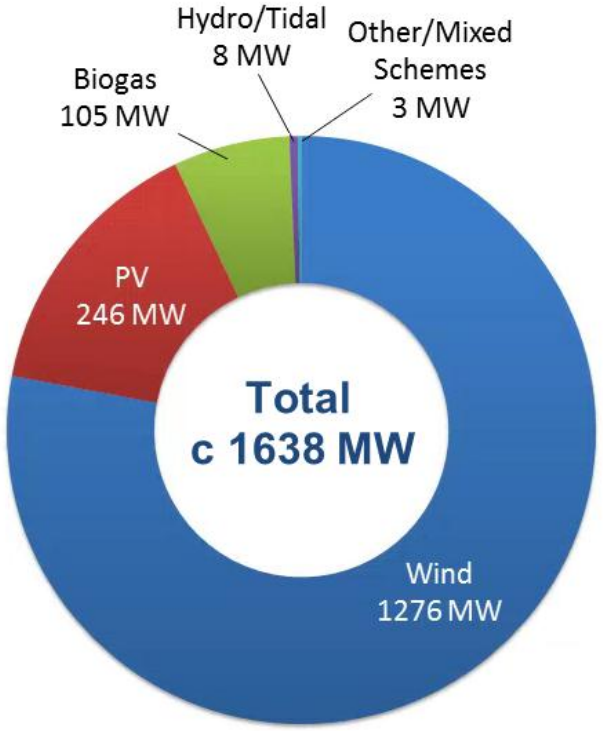


Drivers for Change

- **It is the customers who are driving the change in how the Electricity Network will be used in the future.**
- **The way we use energy is changing**

Downward Pressure on Costs	The use of innovative solutions to defer higher cost investment
Distributed Generation	Environmental concerns driving the growth in renewable energy
Low Carbon Technologies	The growth of Heat Pumps & Electric Vehicles
Consumers becoming Prosumers	Customers who wish to both consume and produce electricity.

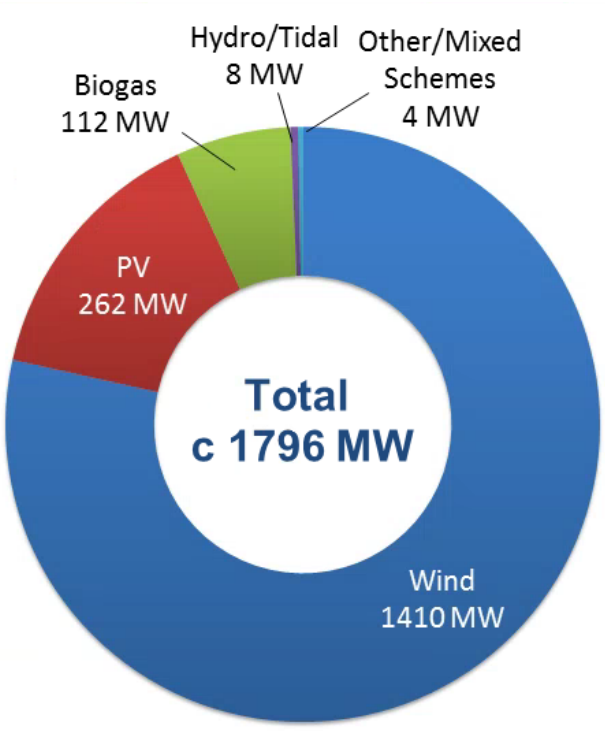
Drivers for Change – Distributed Generation



NI Connected Renewable Generation Technology Mix

+158 MW Committed

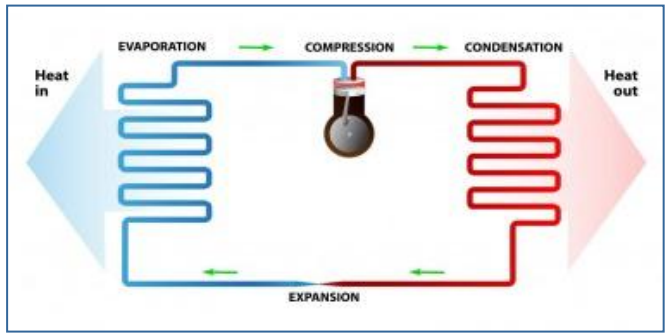
As per 31 Aug 2018

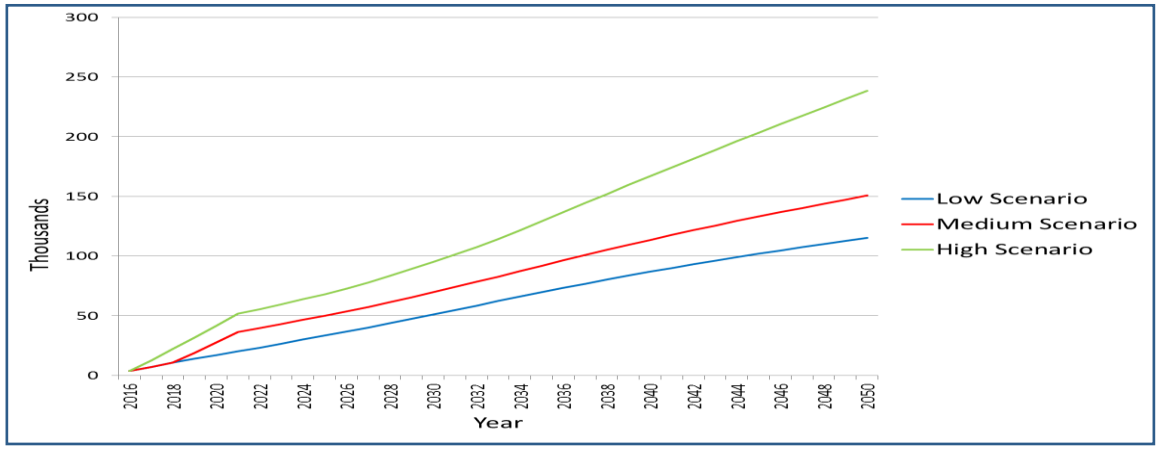


NI Connected + Committed Renewable Generation Technology Mix

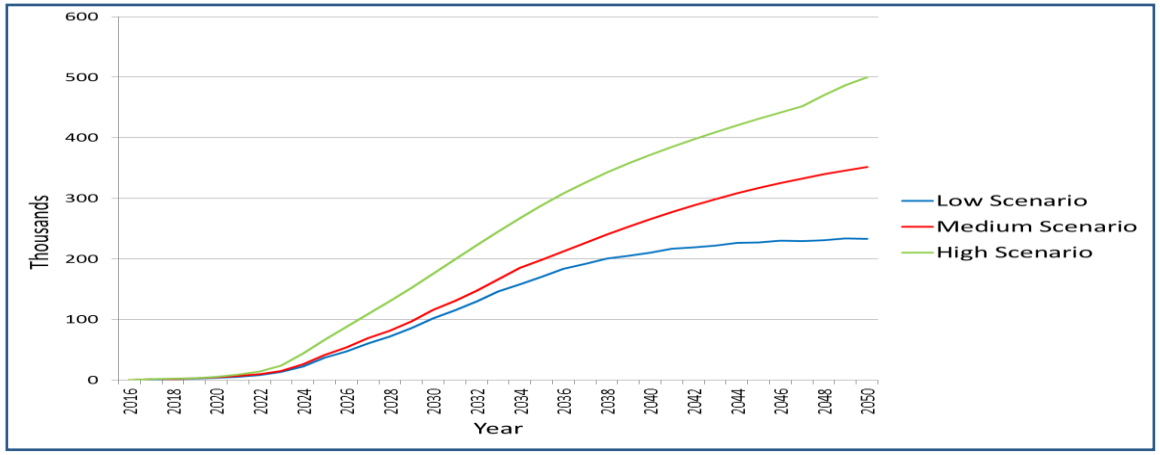
Drivers for Change – Low Carbon Technologies

Heat Pumps





Electric Vehicles

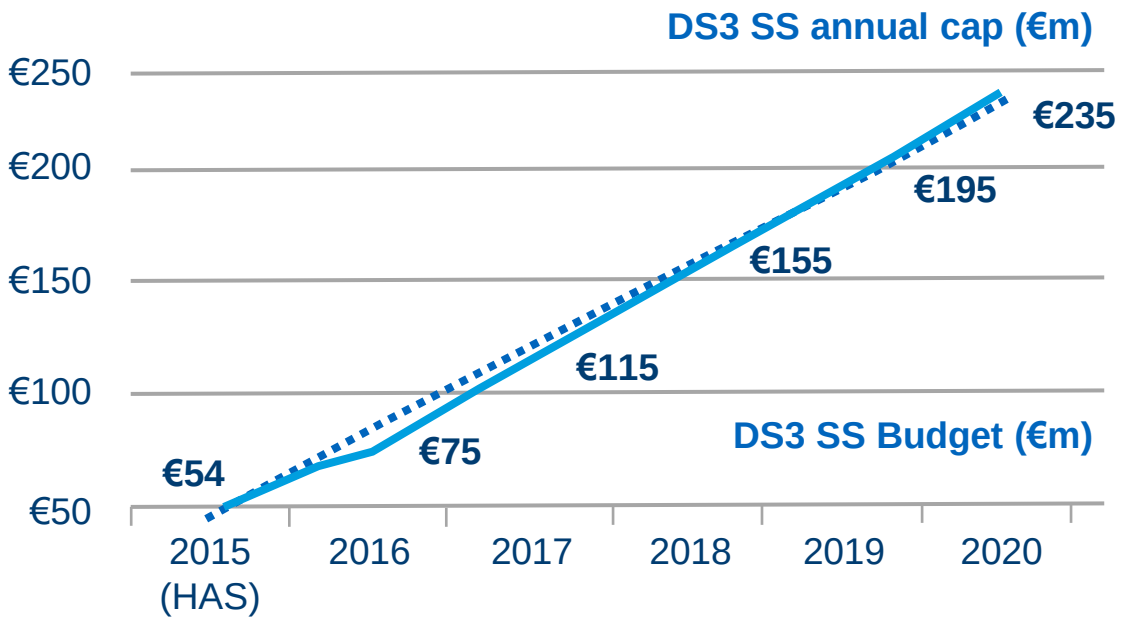


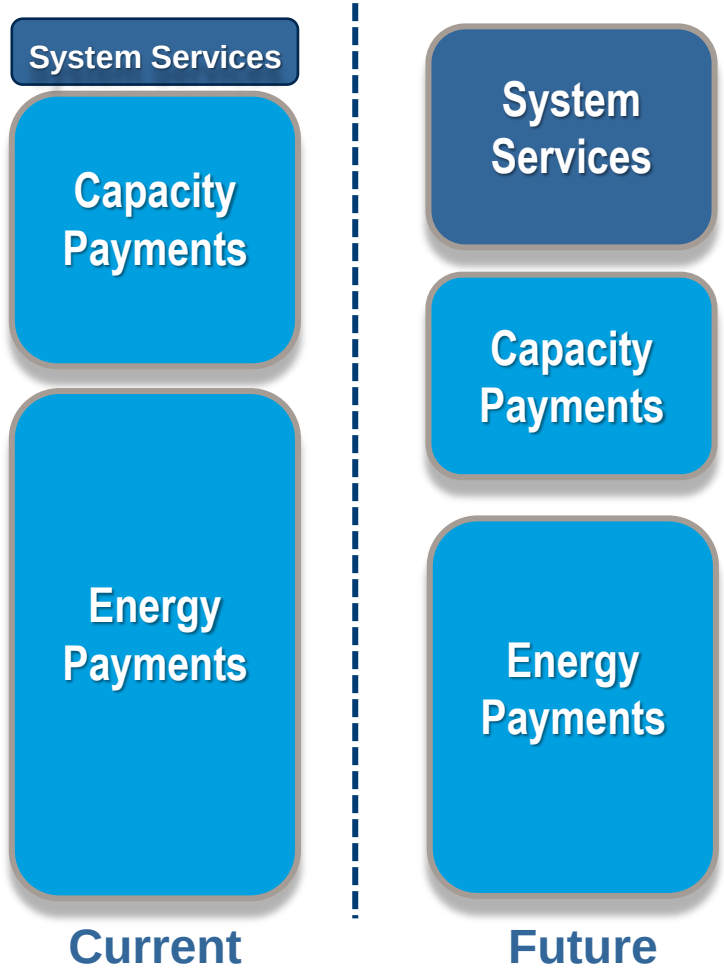
Drivers for Change – Consumers becoming Prosumers

DS3 System Services

Vast majority of System Service Participants

will be connected to the Distribution Network





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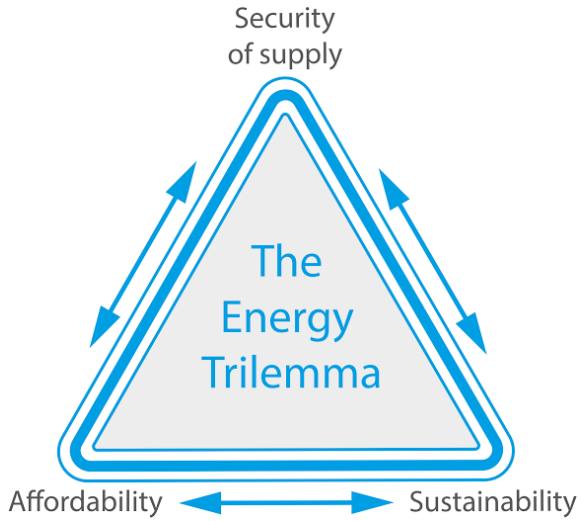
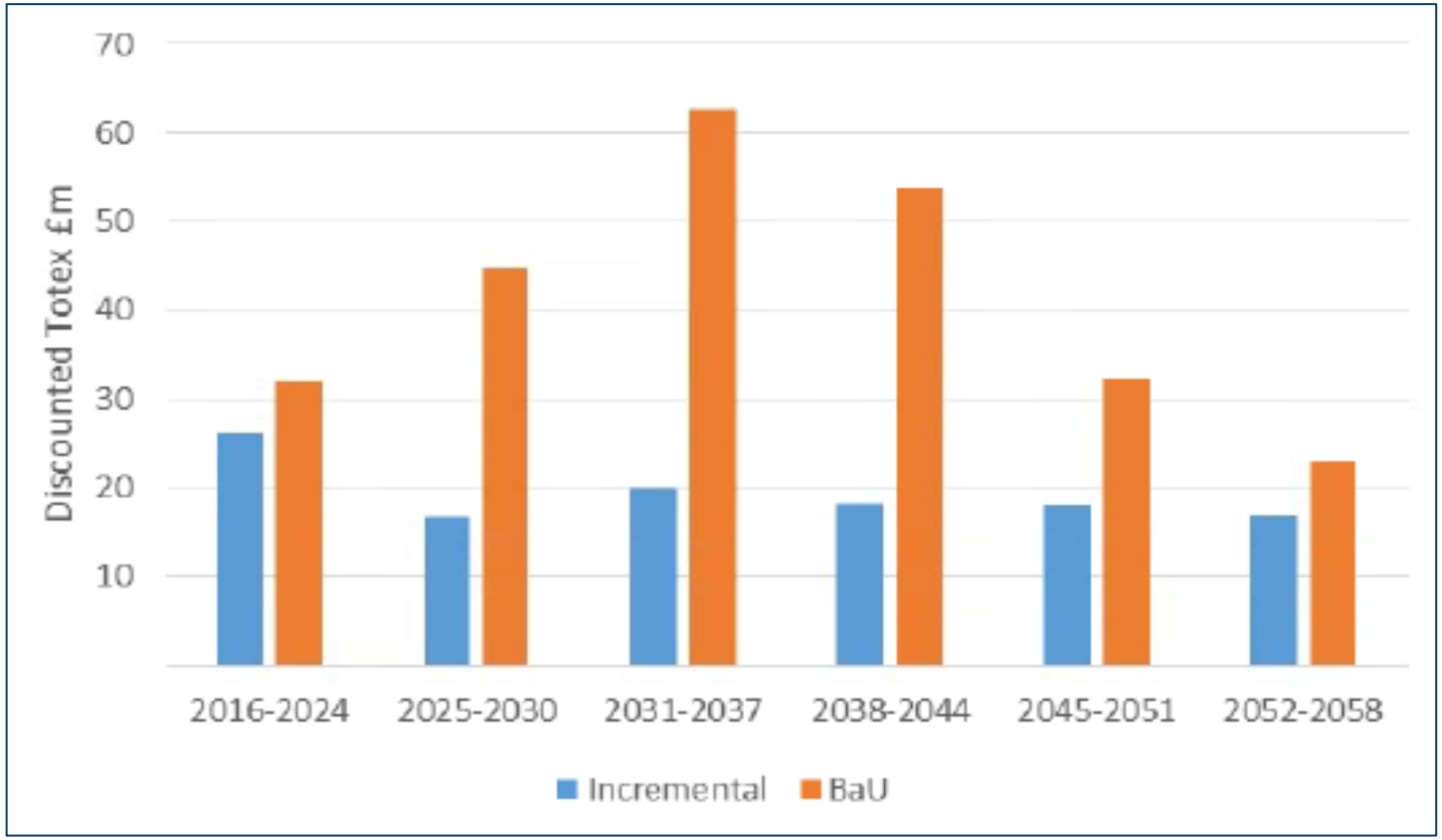
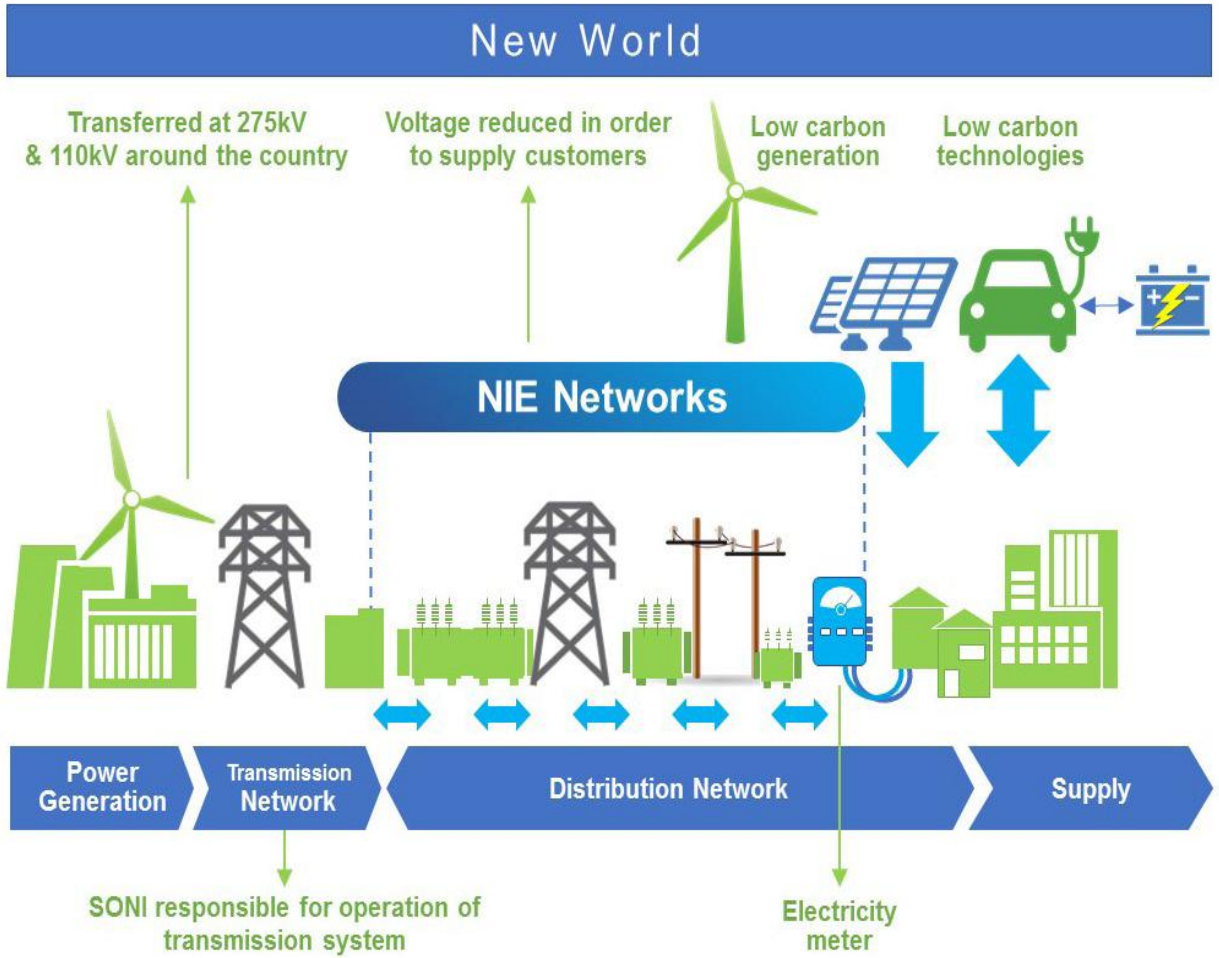
Drivers for Change – Downward pressure on Costs





New World



What is a DSO?

"A Distribution System Operator (DSO) securely operates and develops an active distribution system comprising networks, demand, generation and other flexible distributed energy resources (DER). As a neutral facilitator of an open and accessible market it will enable competitive access to markets and the optimal use of DER on distribution networks to deliver security, sustainability and affordability in the support of whole system optimisation. A DSO enables customers to be both producers and consumers; enabling customer access, customer choice and great customer service."

NIE Networks are not alone…

Key Customer Groups

System Service Providers;
Customers who opt to sell system support services to the TSO/DSO.
Participate in the energy market and provide system services.

Active Participant;
Customers who have invested in DERs, demand side management or LCTs.
Participate in the energy market but do not provide system services.

Passive Participant;
Smaller energy conscious customers who have invested in off-the shelf LCTs like heat pumps, solar PV or EVs to reduce costs.

Passive Consumer;
Normal domestic or smaller non-domestic demand customers with little or no interest in the flexible energy market or LCTs.

Overview of CFE – Key Functions

DSO Function	Description
Market Facilitator	Enabling DERs to participate in TSO markets whilst respecting distribution network integrity and maintaining a neutral market position.
Service Provider	Utilisation of network assets to provide services to help the TSO to balance the system.
Congestion Management	Enabling smart solutions and market based solutions to be deployed as alternatives to conventional reinforcement.
Connections	Providing customers with options in how they connect to the network and utilising innovation to connect customers in a heavily congested network.
Data Provision	Provision of detailed data between the TSO and DSO to enable more efficient system development and operation.
Network Management	Development of new tools and operational procedures to improve operational processes and efficiencies.
Charging	Charging reform to provide opportunities and appropriate incentives to both demand and generator network users.

Thanks for listening

Safer, Stronger, Smarter Networks

The impact of system services on NIE Networks' distribution system

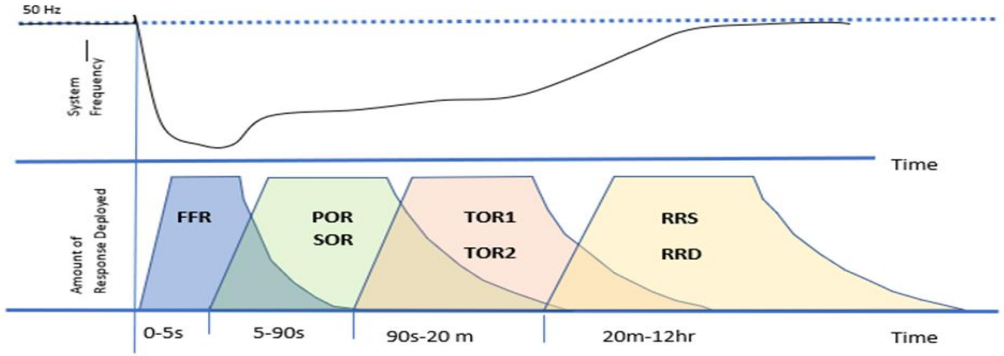
Mark Sprawson

14th September 2018

What are system services?

- System services used to regulate and restore system frequency
  - Frequency responsive services (i.e. FFR, POR, SOR, TOR) stabilise and restore the system frequency
  - Reserve services (i.e. RRD, RRS) recover the response and complete the frequency restoration

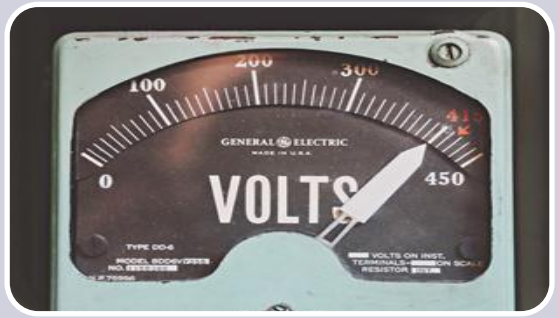
- System services can be delivered by:
  - Increasing generation output
  - Increasing battery storage system output
  - Decreasing power consumption

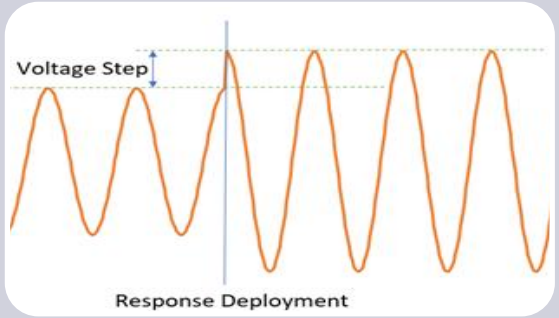


- Service providers are instructed to hold reserve/response in readiness to be deployed
- Some services are frequency responsive and some deployed in response to an event or an imbalance between generation and demand
- Services can be delivered under the auspices of an aggregator which would see deployment across a geographic area

Capacity to host system services?

Deployment of system services has effects in three major areas





Delivered Voltage

Deployment of services raises local voltage

NIE Networks is obliged to deliver voltage within statutory levels

Voltage Step

Deployment of services creates an upwards step change in local voltage

NIE Networks is obliged to keep voltage step change to within acceptable levels

Network Loading

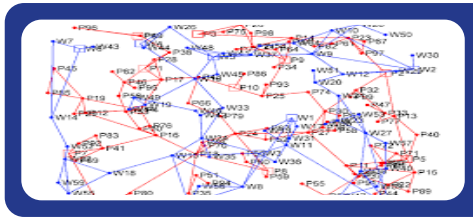
Deployment of services pushes power backwards up the network

NIE Networks is obliged to ensure all circuits remain within ratings in all situations

Failure to correctly manage system services will reduce the safety, quality and security of supplies to customers

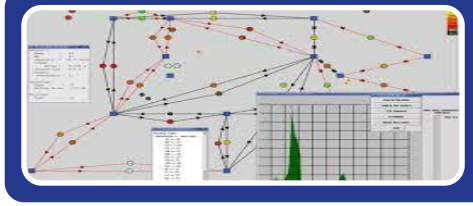
Approach

NIE Networks commissioned an independent study to consider influences on a capacity management strategy



To give a representative insight, this investigation needed to simulate seven representative networks

Process had to overcome key uncertainties, yet remain technologically agnostic



A network simulation was conducted to calculate remaining capacity headroom under multiple network conditions

Observations

Capacity is finite

1. Overall network capacity is finite
   - Rural 11 kV feeders and generation dominated groups are particularly congested.
   - Generation and system services providers are competing for the same capacity

2. Some parts of the network are already considered full up

3. If traditional “passive network management” approaches continue to be used, some parts of the network will need to be considered as full up to new generation AND system services provision

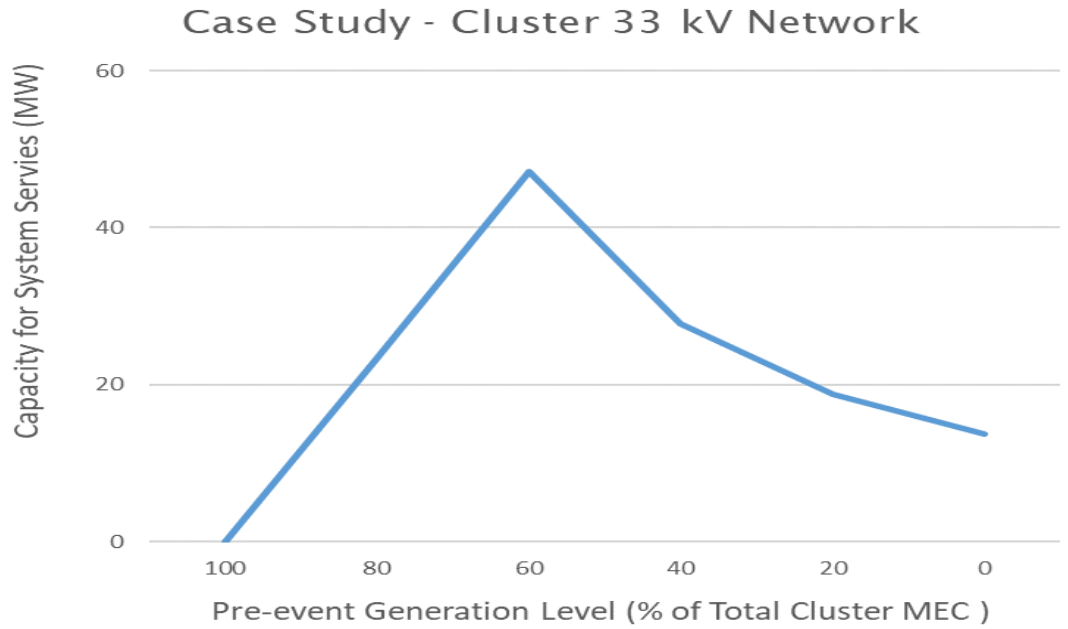
4. What process should be used to decide how much capacity is available?
   - Static capacity allowances, based on a fixed view of the future?
   - Dynamic capacity analysis based on conditions observed close to real time?

Influence of customer behaviour

- The available capacity is influenced by the electrical demand being consumed
- The electrical power consumed by end customers varies over daily and seasonal cycle
- Passive network management has limited resolution in this area
- Allowance for variance in the daily and seasonal load cycle would open up capacity to host systems services
  - Case studies demonstrate that this has the potential to increase capacity for system services by 10MW in some network groups

Influence of generation output

- Dynamic system services and static generation are competing for the same capacity, but static generation does not always operate at 100% output
- Overall Capacity may be limited by a number of network quality measurements (i.e. network loading, or voltage or step change in voltage)



- Passive capacity management would declare this network full
- Depending on the generation output, Dynamic capacity management could offer up to 45MW of capacity

Effect of network outages

Network conditions change – we need to cover all eventualities

Each network outage has a different effect on the available capacity for system services

Passive network management would assume 100% pre-event generation and declare the network as full up

The amount of capacity is dependent on circuit status but also other variables

Remember, some outages are unplanned, but network limits need to be respected at all times

Which limit should be applied under normal system conditions and when?

Bringing it all together

- System services were traditionally connected to the Transmission Network where capacity was actively managed
- All DNOs have traditionally tended towards passive capacity management
- Passive capacity management uses conservative assumptions which limits system access. Some parts of the network are now considered full.
- All DNOs are finding that increasing volumes of system services make the network more complex to manage, especially if passive capacity management is used
- We've shown that dynamic capacity calculation, which takes account of time varying variables can remove barriers to capacity access
- What approach should this dynamic capacity management take?

Thank you

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