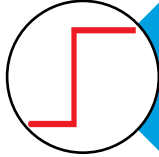
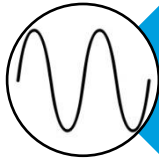


Overview of system services

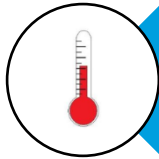




Voltage Step



Voltage Rise



Thermal Loading



Protection Issues



Reactive Power Management

Solution – Instruction Sets

Traditional ‘Static’ Instruction Set

Instruction Set	Weekdays							Weekends						
	0000	0400	0800	1200	1600	2000	2400	0000	0400	0800	1200	1600	2000	2400
0														
1														
2														
3														
4														
5														
6														
7														
8														

All Year



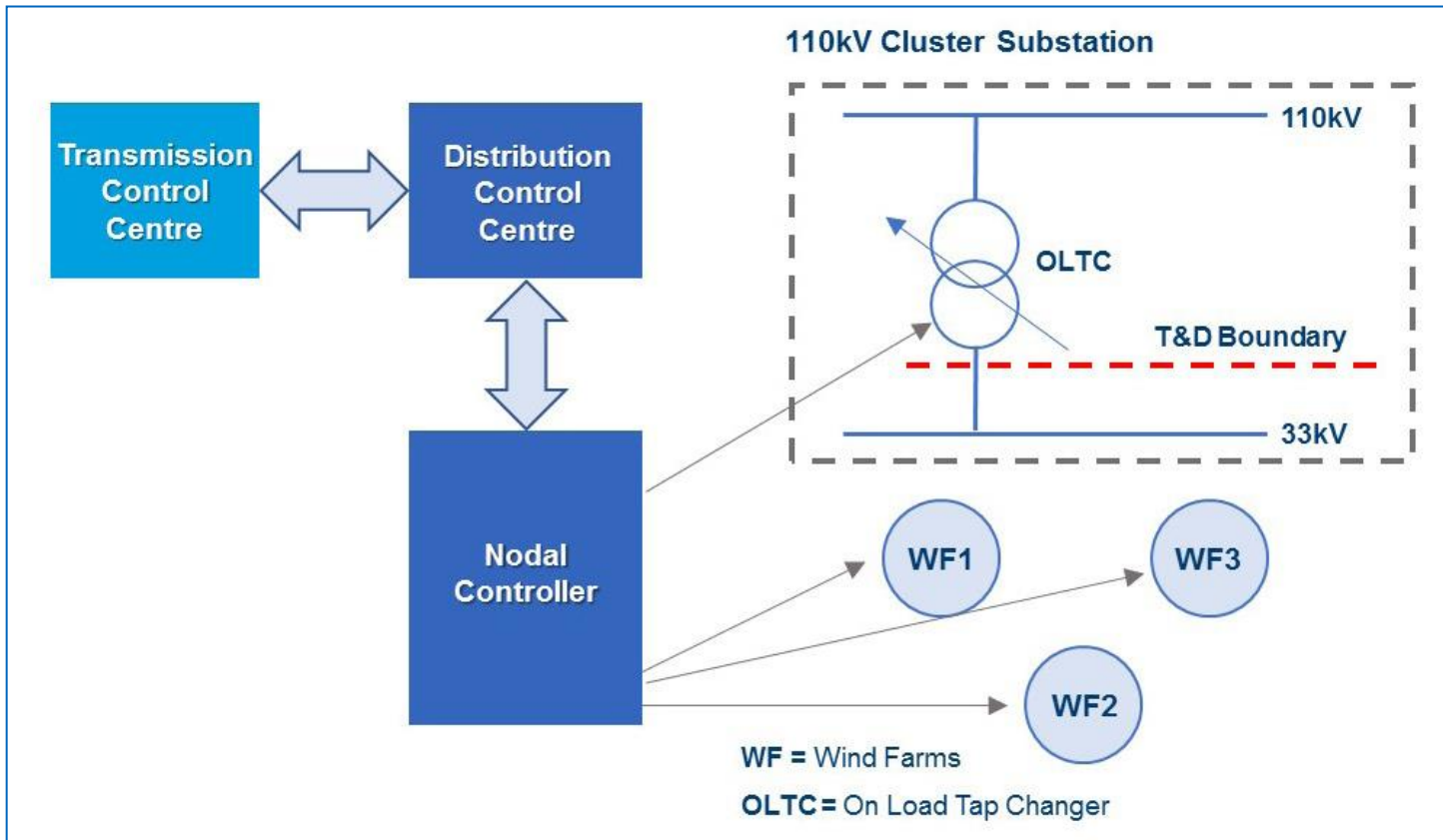
Winter



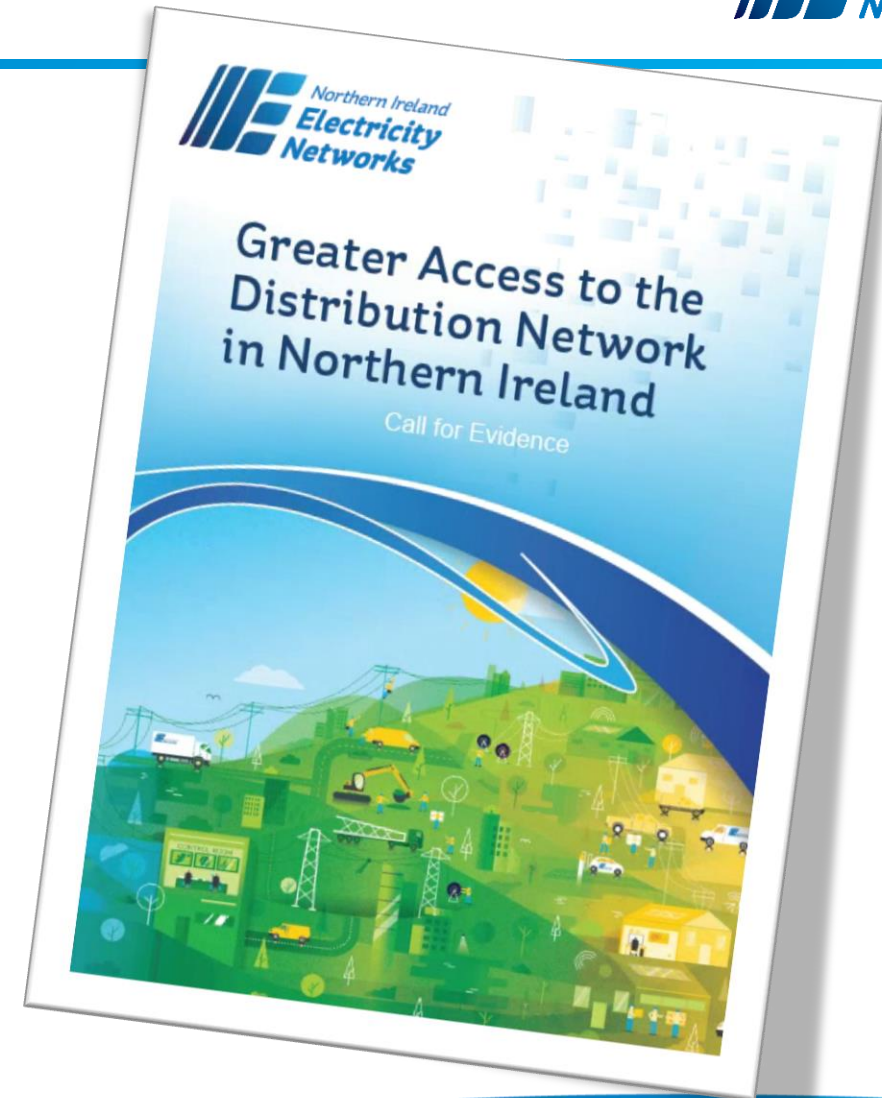
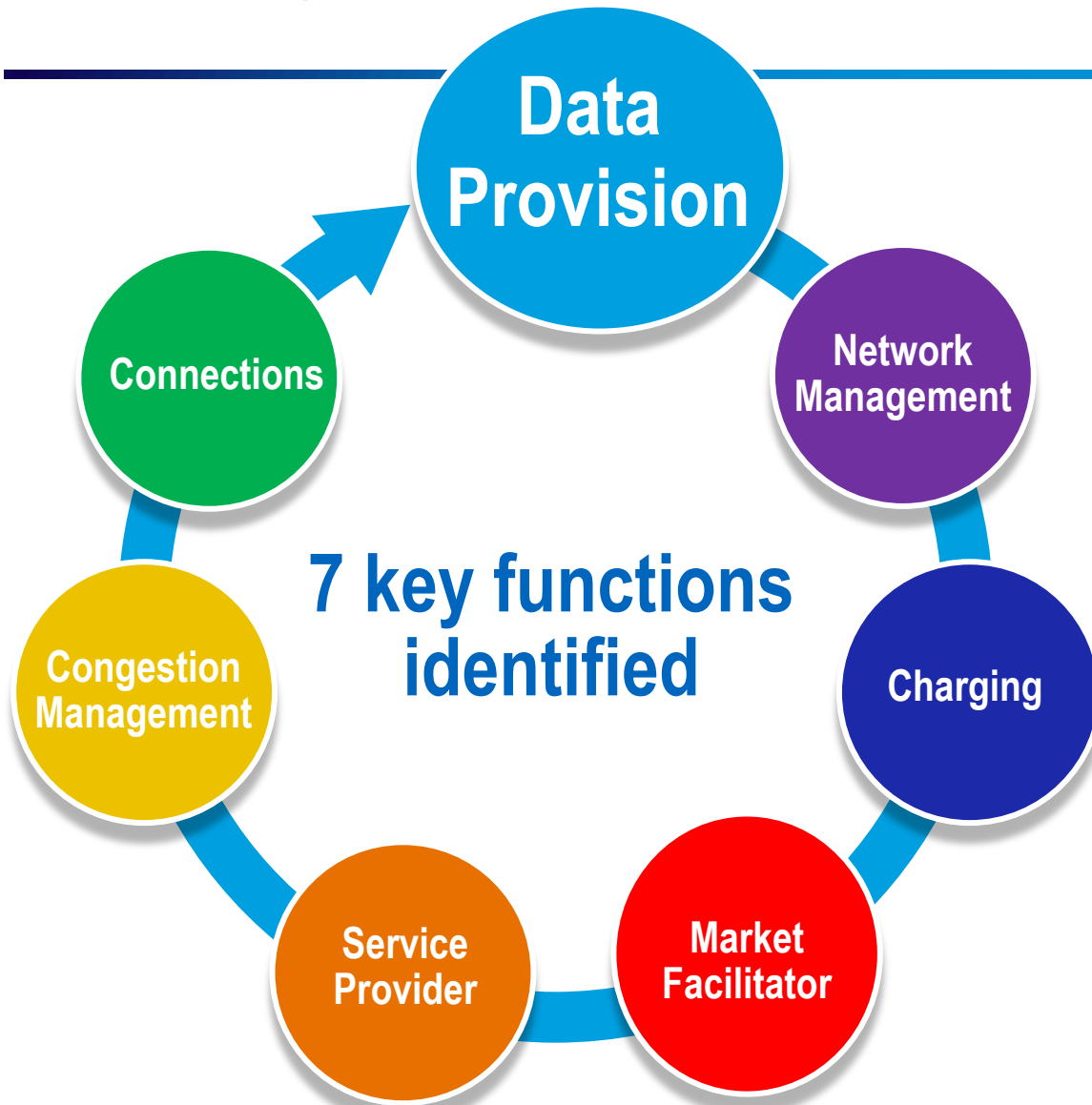
Industry wants to see improvements!

Q3 - NIE Networks currently use static annual instruction sets. Do you think NIE Networks should develop more dynamic instruction sets based on real time power flows, voltages and network topology, potentially providing system service participants with greater access to the network for the provision of system services and protecting the network from sudden changes?

Potential Future Solution – Nodal Controller

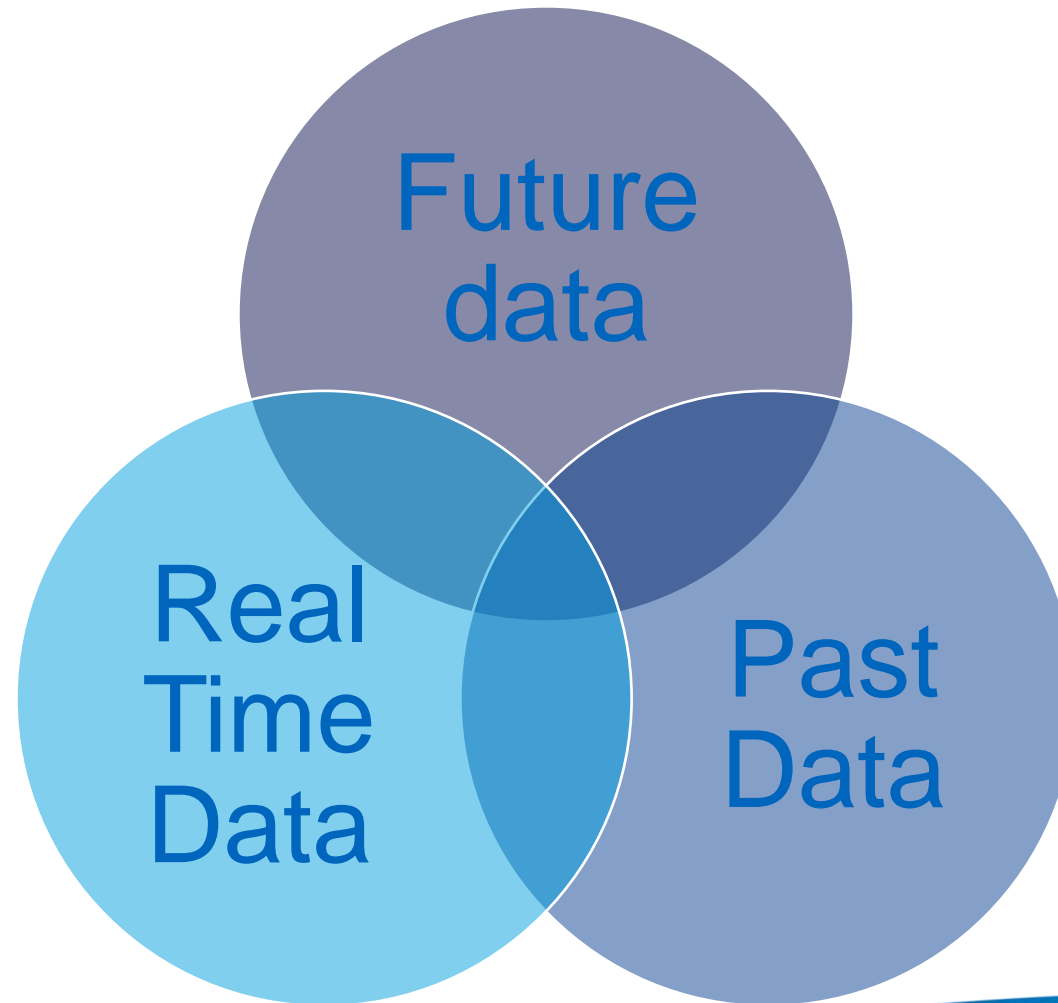


Q4 - Do you agree that NIE Networks should develop a technical solution to enable customers to participate in reactive power system services?



Limited network visibility:

- Good visibility of High Voltage network
- Limited visibility of Low Voltage network
- Real time visibility of some DERs
- Some deployment of disturbance recorders



Call for Evidence Questions

Q9 (a) – Do you agree that the DSO/TSO requires increased data to efficiently develop and operate the system to help reduce network operating costs and facilitate greater access to the network for existing and future customers?

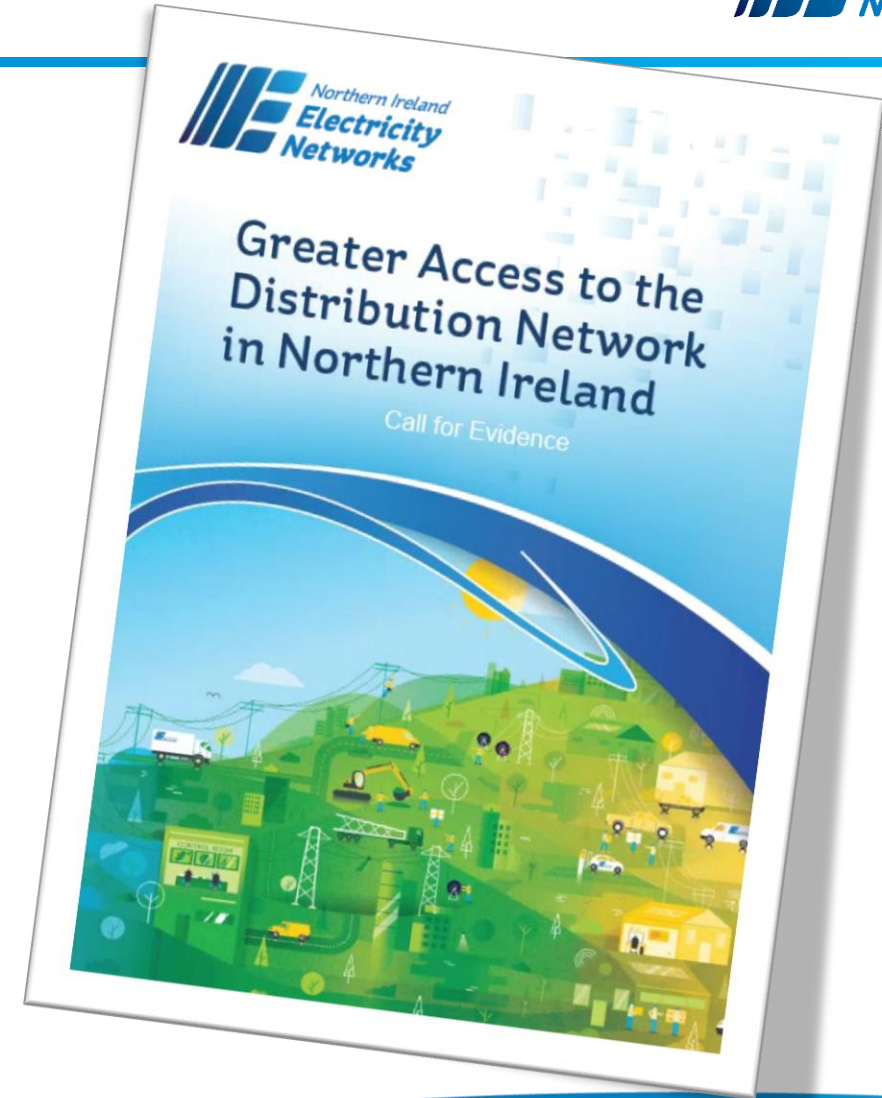
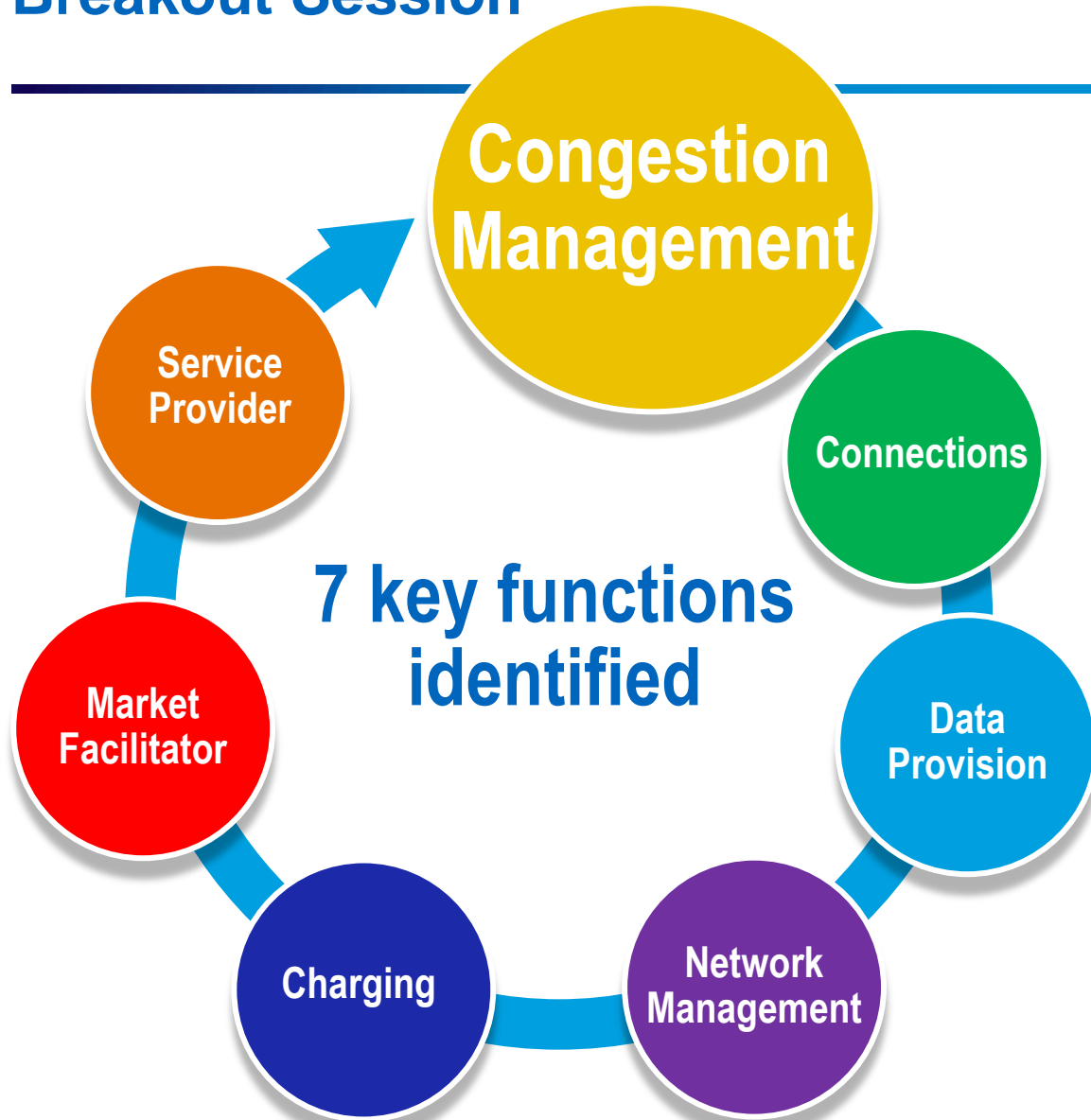
Q9 (b) - Do you agree that to achieve this, increased levels of data need to be made available in the areas identified and be efficiently transferred between the TSO and the DSO?

Q9 (c) - Are there any other areas that you believe the DSO should have visibility of?

Q10 (a) - The provision of data and visibility of the network plays a significant factor in ensuring the efficient management and operation of the electricity network to help reduce energy costs. Do you believe that greater metering functionality is required in Northern Ireland to provide the DSO with increased data? If so, please set out in detail.

Q10 (b) – Do you believe customers should have increased access to network data? If so, please set out in detail.

Thanks for Listening



Congestion Management

The Distribution Network in Northern Ireland is made up of;

- Cir. 46,000km of cables and wires across all distribution voltage levels,
- Total of 272 major substations
- Cir. 8,000 Gd. Mt. and Cir. 70,000 pole Mt. distribution transformers.

Electricity is governed by the laws of physics which places a finite limit on the capacity that can be delivered by the individual assets that make up the network.

It is this limit which places locational constraint levels across the network.

There are various forms of constraints resulting from growth in both demand and generation, including;

Thermal	Fault Level
Voltage	Power Quality

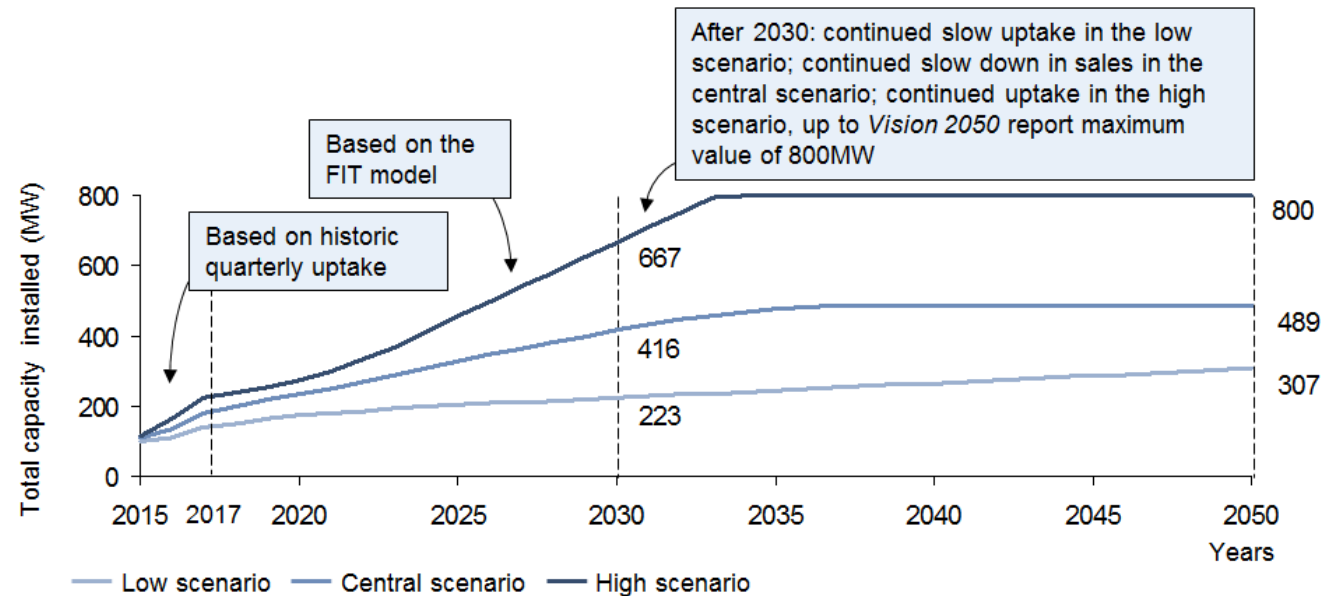
NIE Networks is responsible for planning investment to facilitate future demand and Generation growth without compromising constraint limits.

Growth in Generation



Currently c1600MW renewable generation connected with a total of 1799MW committed – Well on the way to meeting the 40% target by 2020.
Majority on-shore wind with 254MW PV

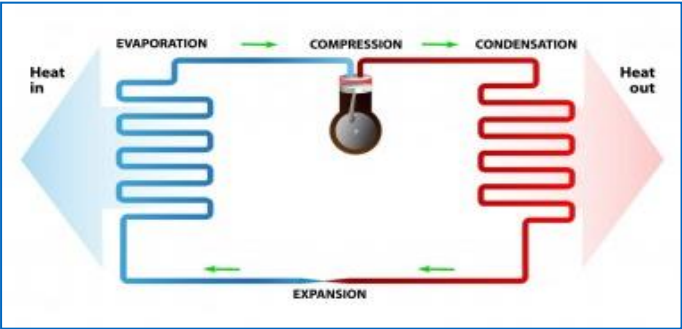
Micro generation is set to continue primarily through G83 fit and inform connections



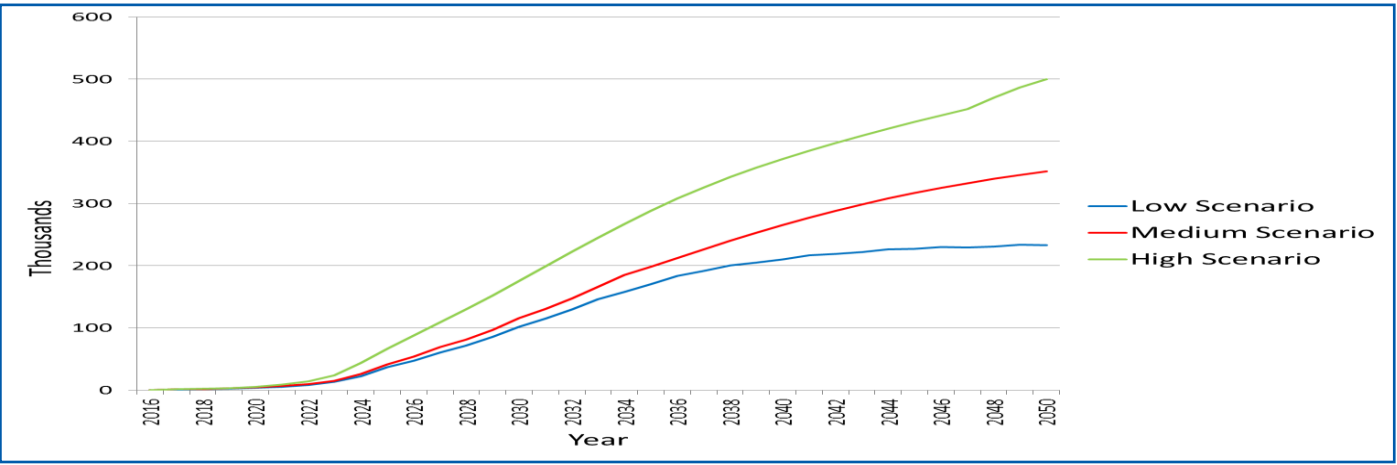
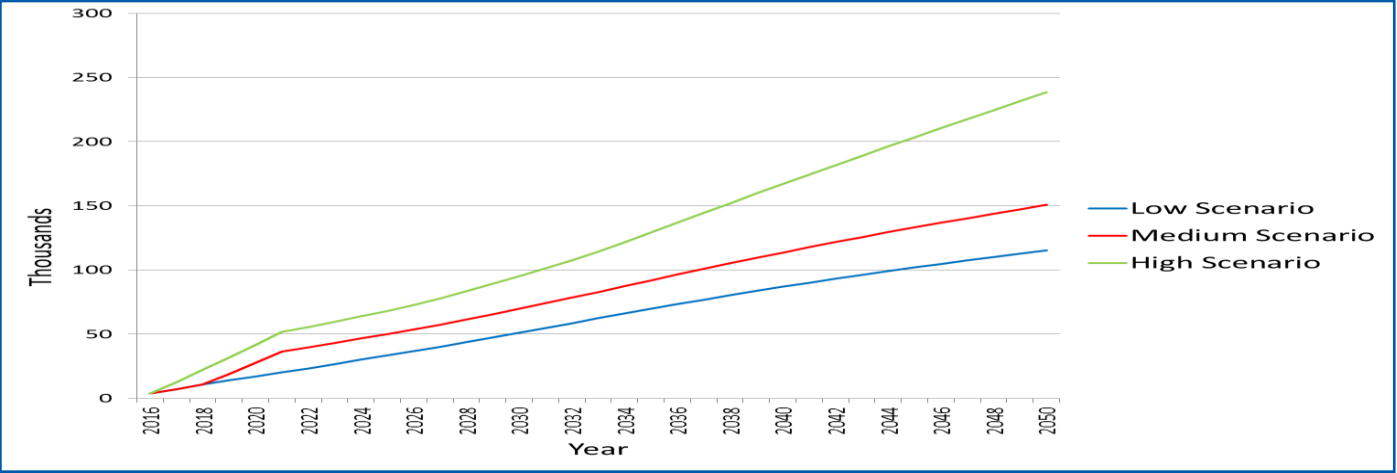
Congestion Management

Growth in Demand

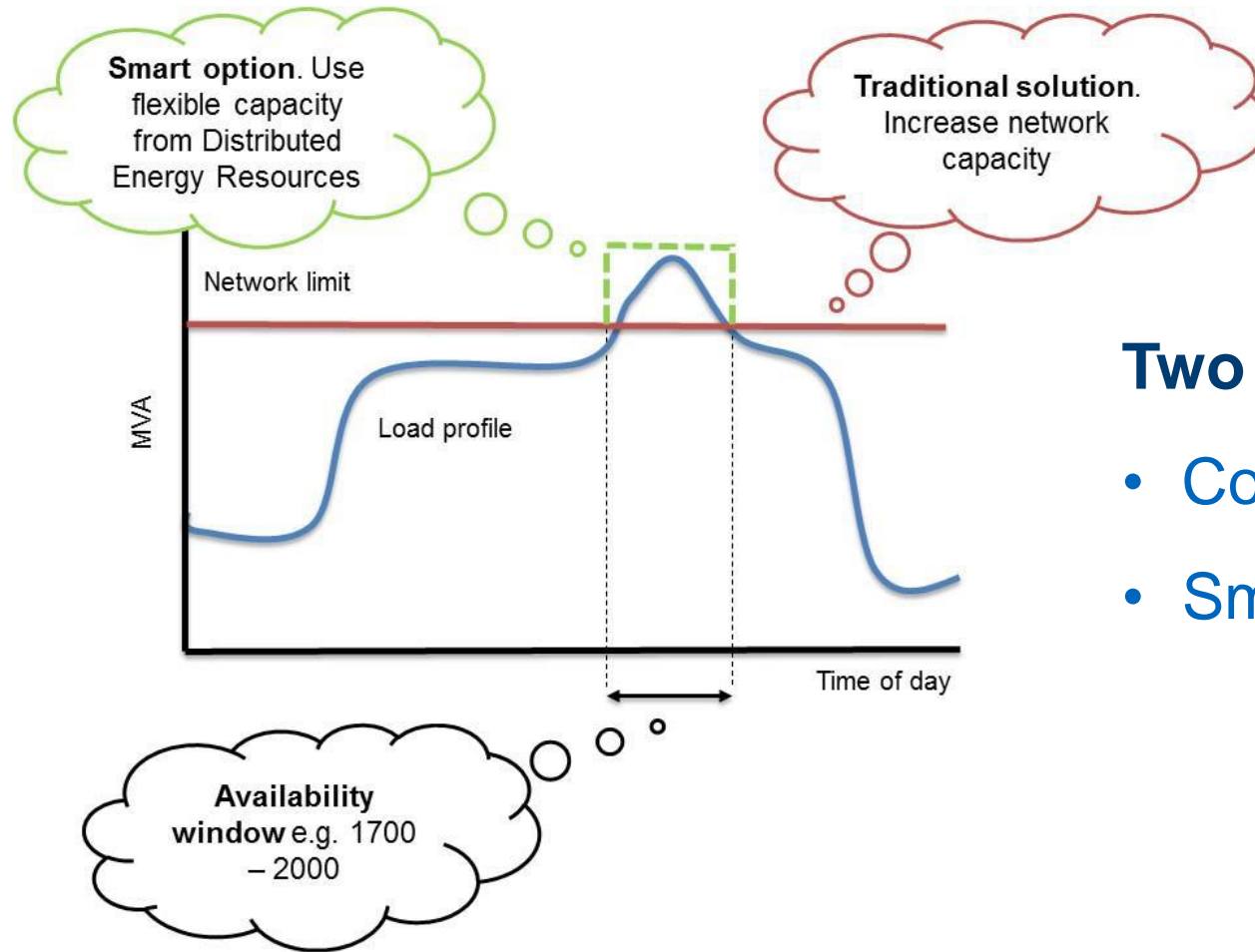
Heat Pumps



Electric Vehicles



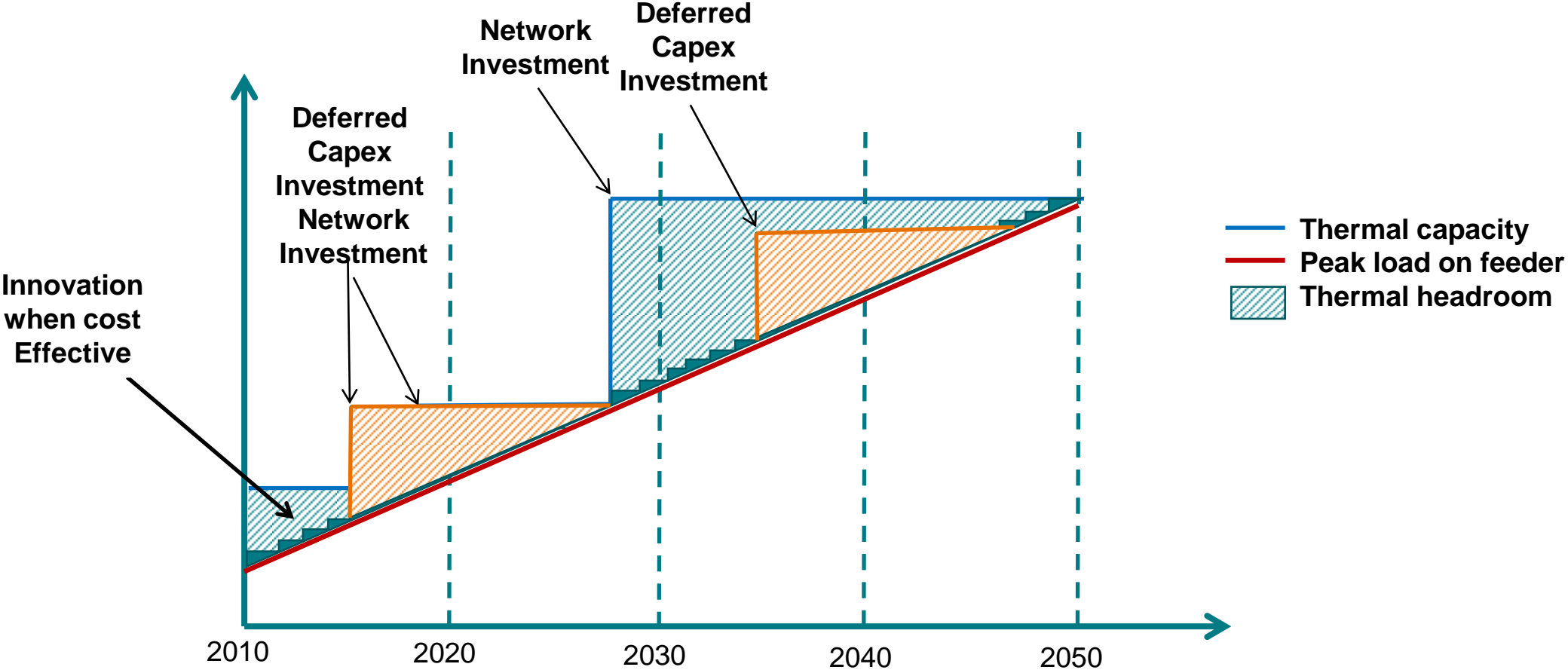
http://www.nienetworks.co.uk/documents/Future_Plans/Development-of-the-Transform-Model-for-NIE-Network.aspx

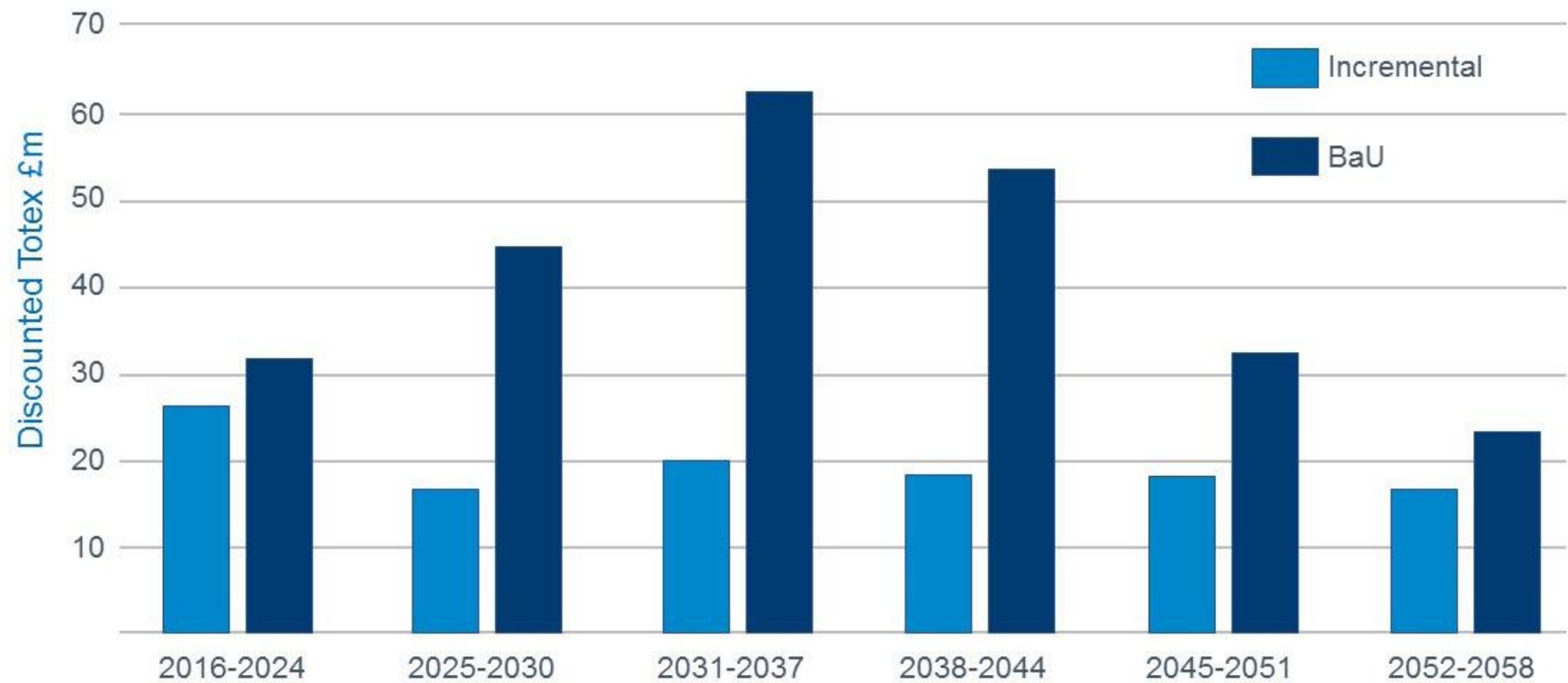


Two Investment Philosophies;

- Conventional Reinforcement,
- Smart Incremental Reinforcement

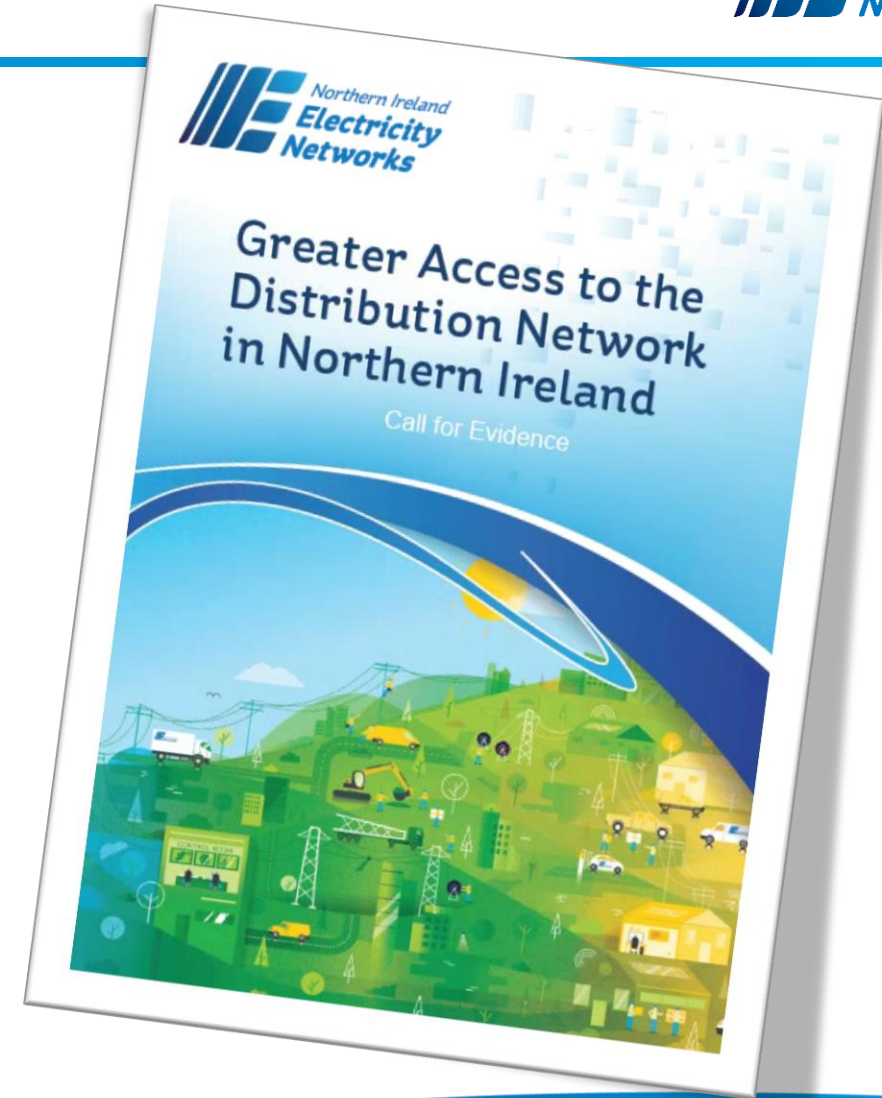
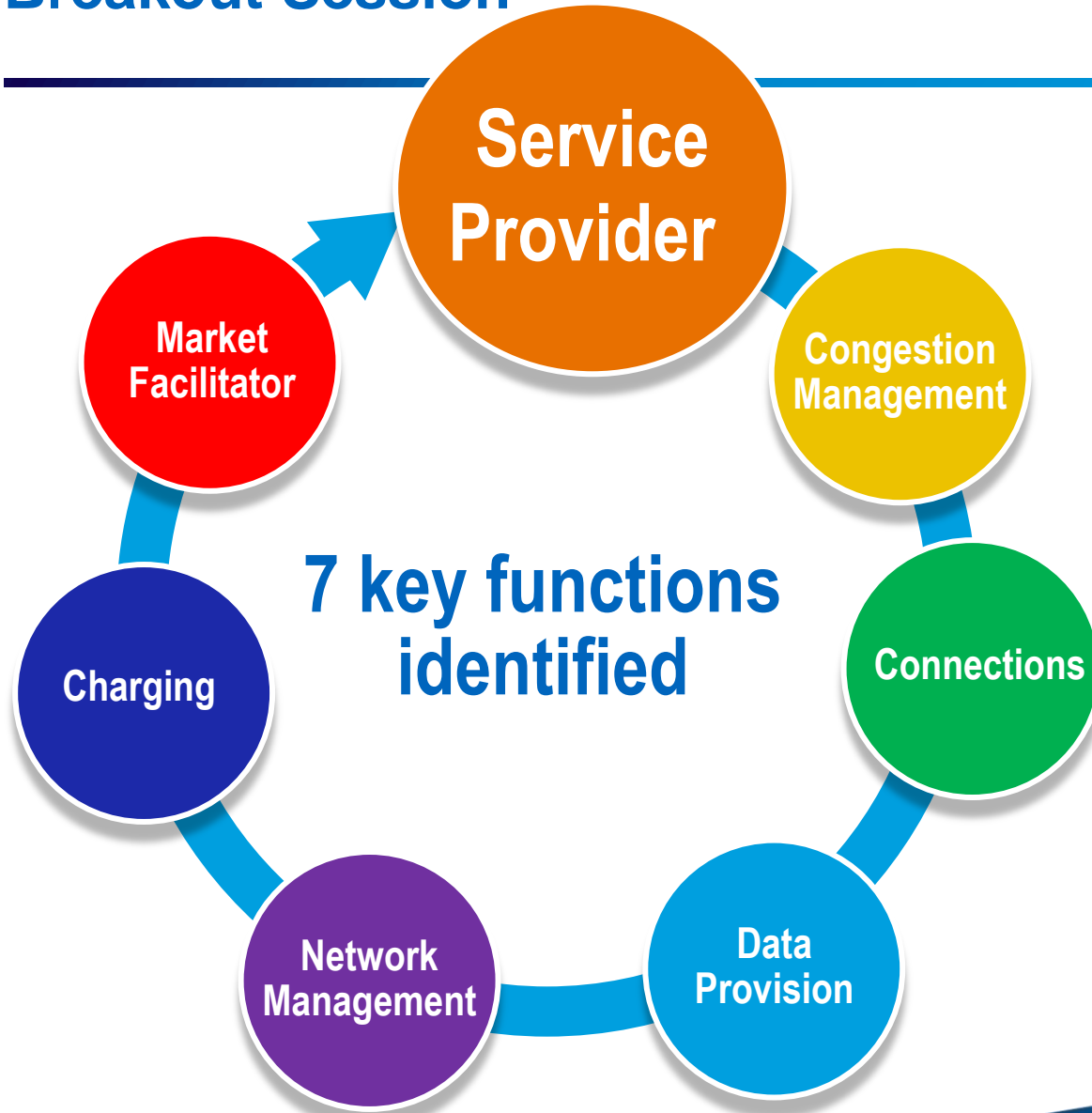
Congestion Management





Question 6: Congestion Management

Should NIE Networks continue to invest conventionally to maintain a high level of network resilience and security but at a higher cost or should they adopt and integrate smart solutions to reduce network costs and deliver the network security through a more dynamic approach to operating the network?



Distribution companies have historically provided services to the Transmission Operator

Examples include;

- **Load Shedding**
- **Step Voltage Reduction**

High Impact Low Probability - Used in response to critical events

The Distribution Network has the potential to offer other services to support the TSO in System Balancing

Low Impact High Probability – Maintaining the quality of supply delivered by D network

- **ENW CLASS Project – Providing Voltage and Frequency services to National Grid**

Flexing existing assets already paid for by the NI Customer offers a cost effective solution.

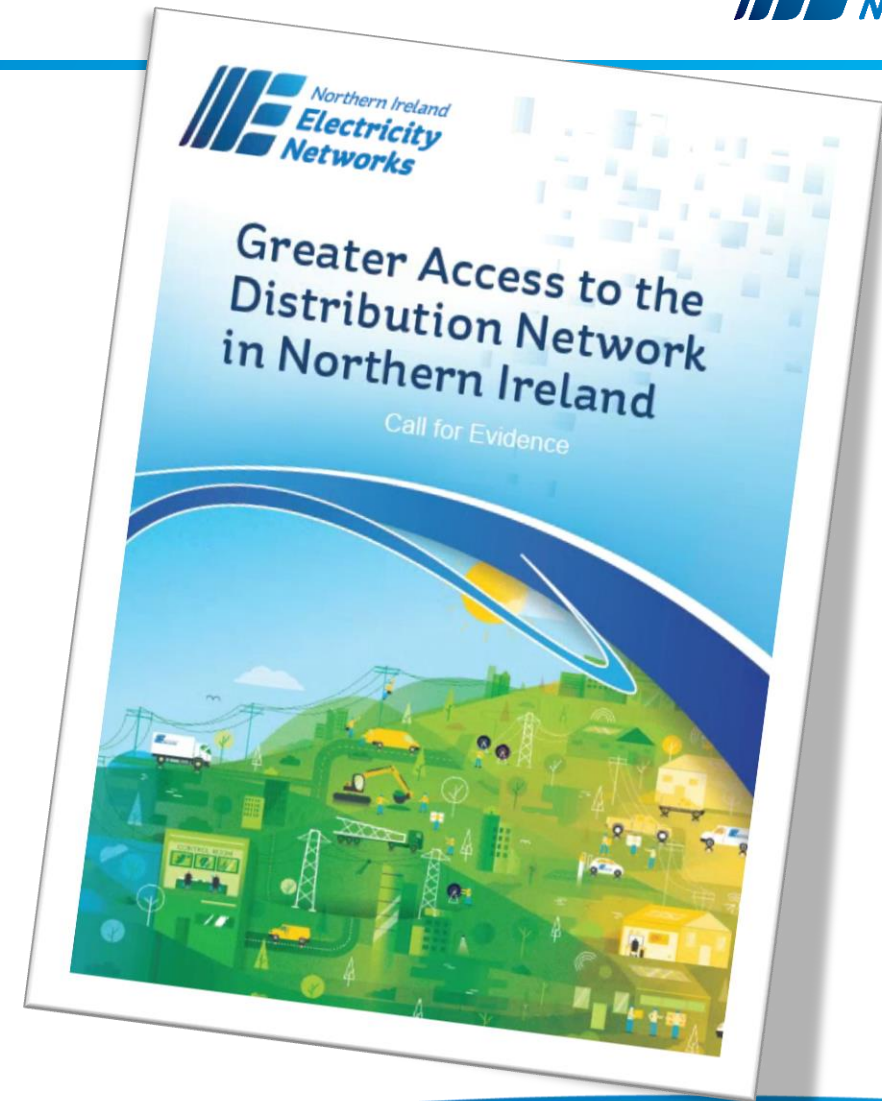
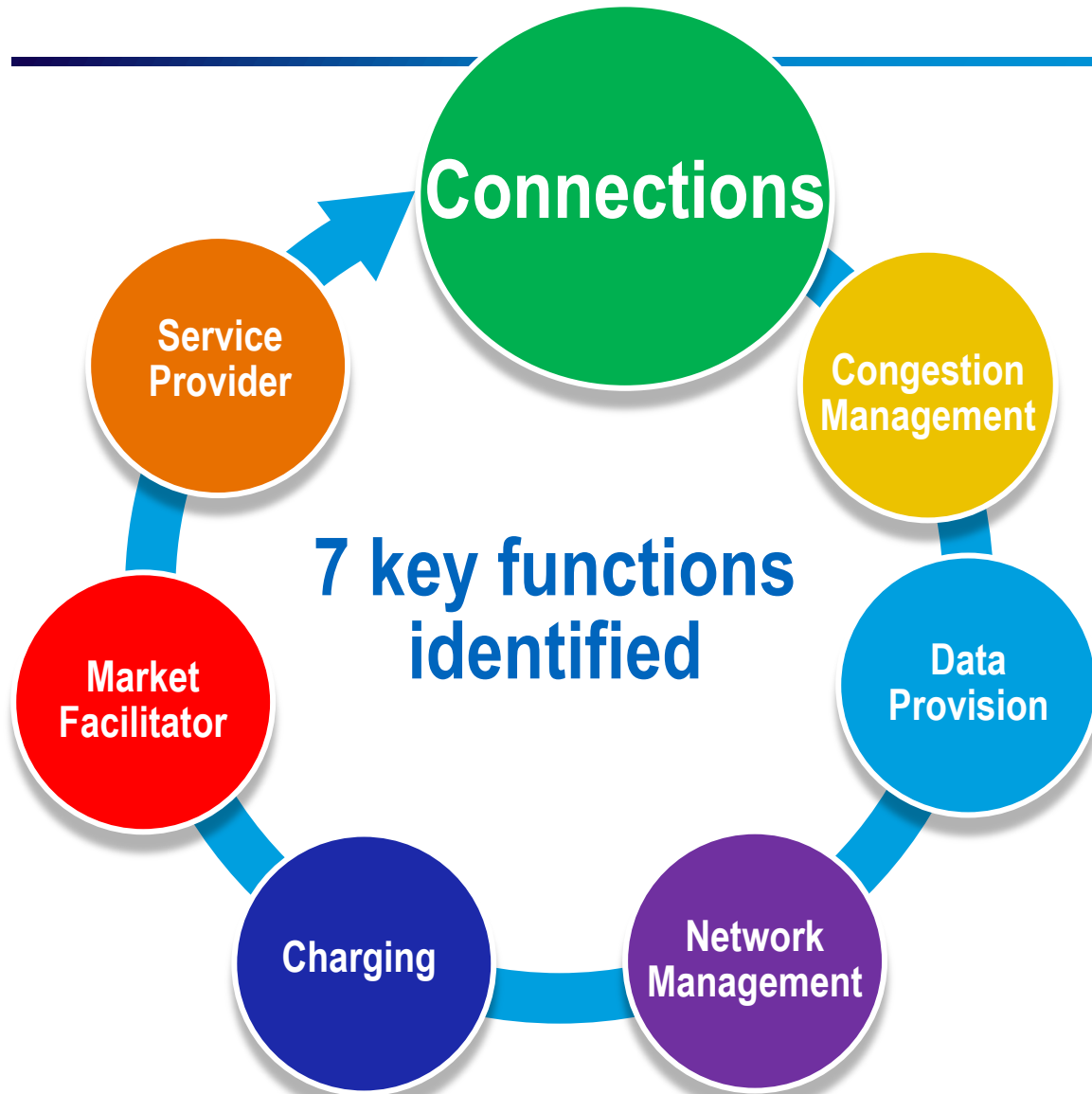
By flexing the network and managing greater risk in operating the Network, there is the potential for existing network assets to provide additional services to allow the TSO to balance the system at lower cost.

Service	Frequency Response		Voltage Control	
Delivery Method	Operation of circuit breaker to reduce voltage and therefore reduce demand (Fast Frequency Response)	Operation of tap changers to reduce/increase substation voltage and therefore reduce/increase demand (Slower Response)	Stagger transformer tap positions to induce circulating reactive power	Dispatching of smart technologies to provide reactive power (e.g. STATCOMs)

In this way all customers benefit and not just those with the technical and financial capability to participate in system services.

Question 5: Service Provider

NIE Networks has existing assets on the network which potentially have the capability of providing additional services to the TSO. Should NIE Networks be allowed to provide cost effective solutions to the TSO in balancing the network to help reduce bills for all customers (passive and active)?





DSO

A DSO enables customers to be both producers and consumers, enabling customer access to networks and markets, customer choice and great customer service.

Key Customer Groups

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

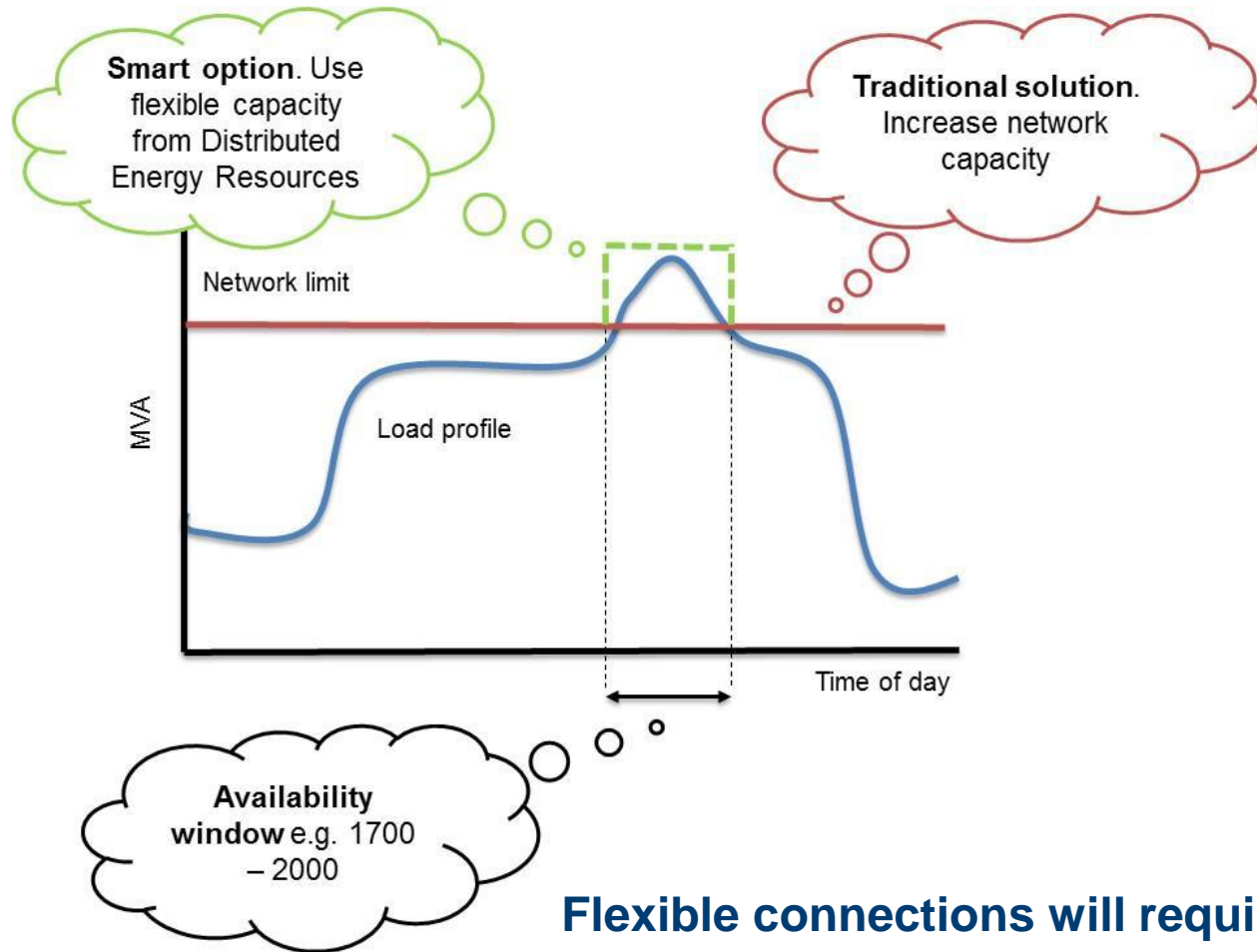
Smaller energy conscious customers who have invested in off-the shelf LCTs like heat pumps, solar PV or EVs to reduce costs.



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

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

Potential Connection Options

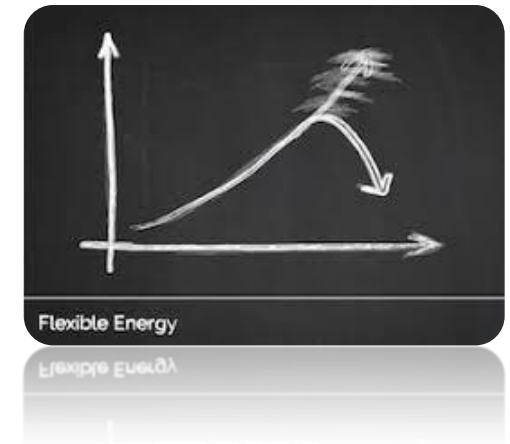


Conventional Reinforcement

- Build more network
- 24/7 Agreement

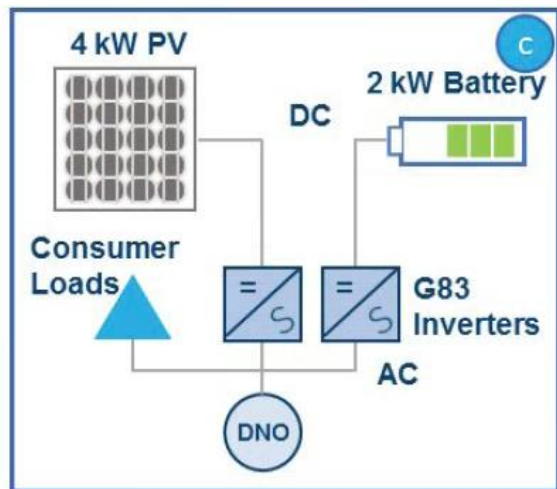
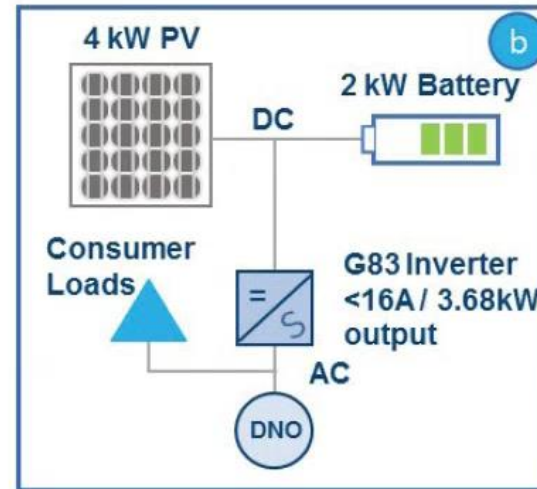
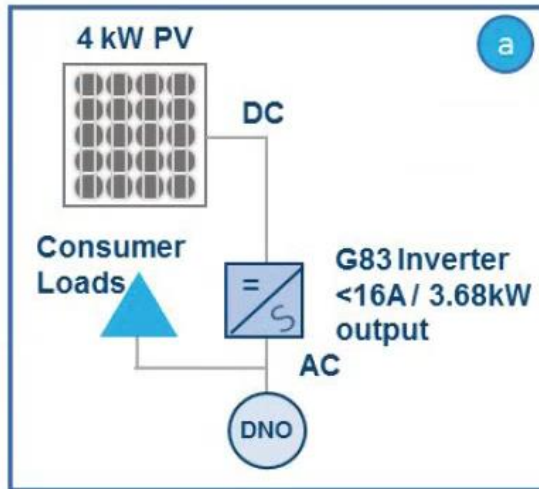
Flexible Connections

- Timed
- Managed



Flexible connections will require flexibility from the customer

Micro Generation – Next Steps



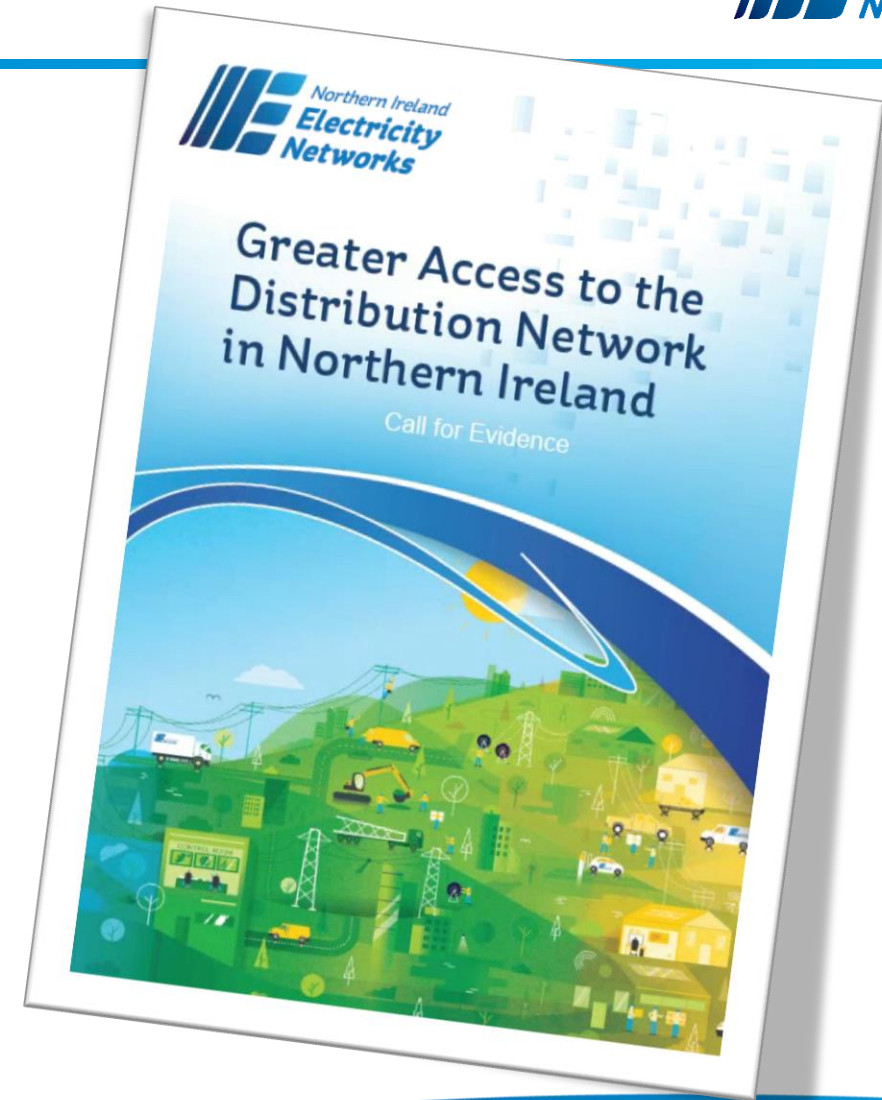
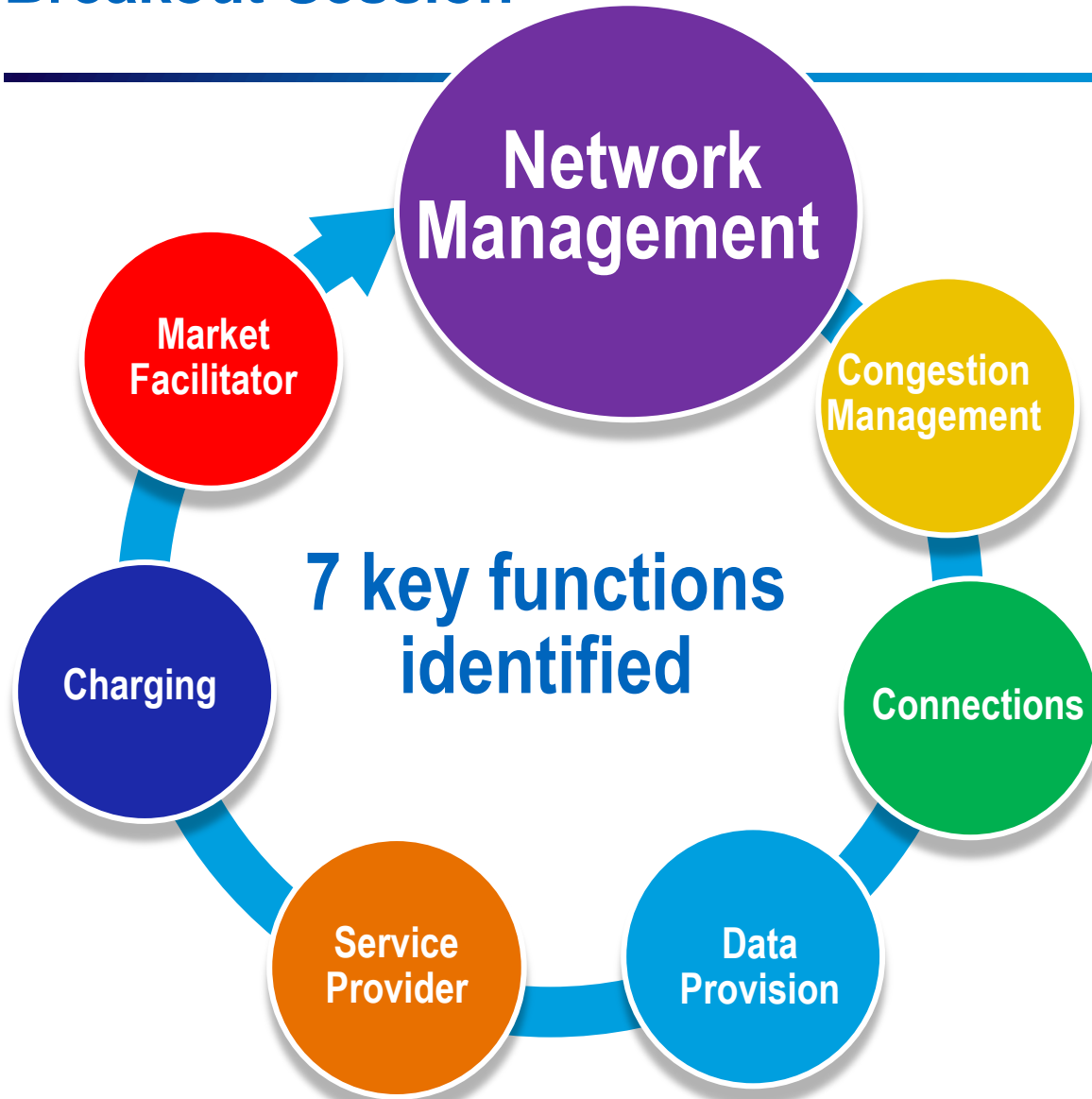
a) Typical Northern Ireland G83/1 connection installation

b) 2 sources currently G59/1 installation, should this move towards G83/1 'fit and inform'?

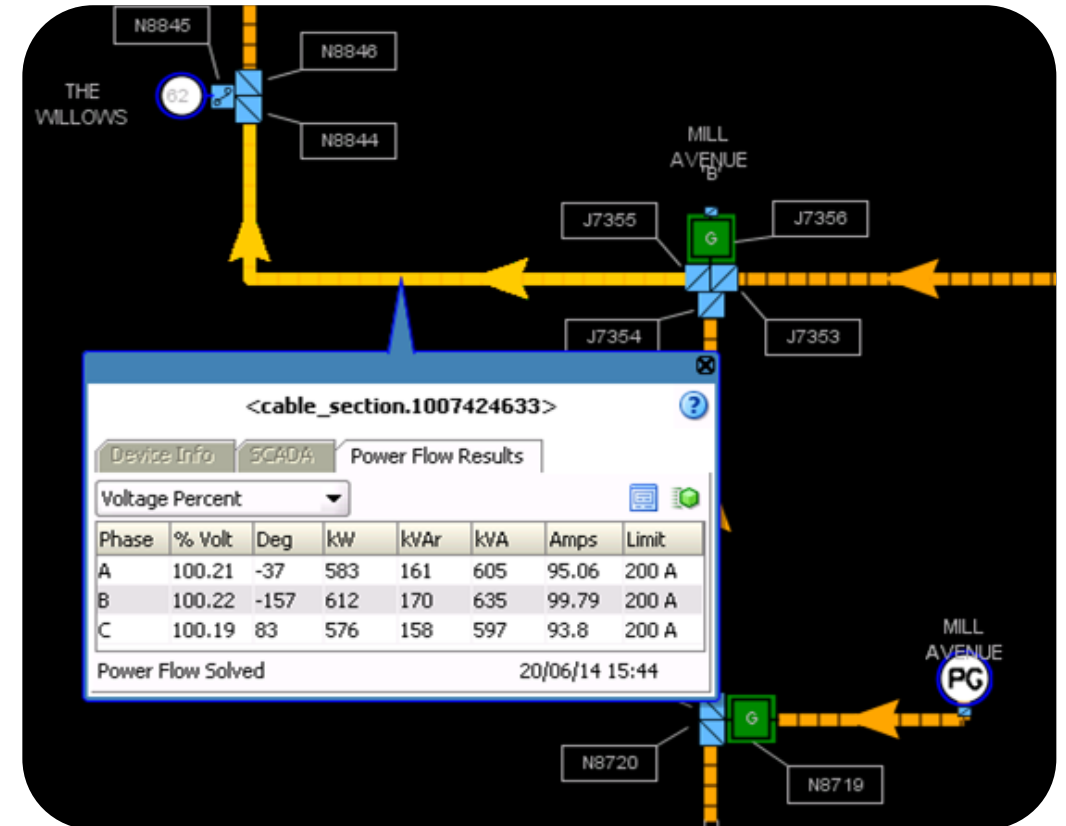
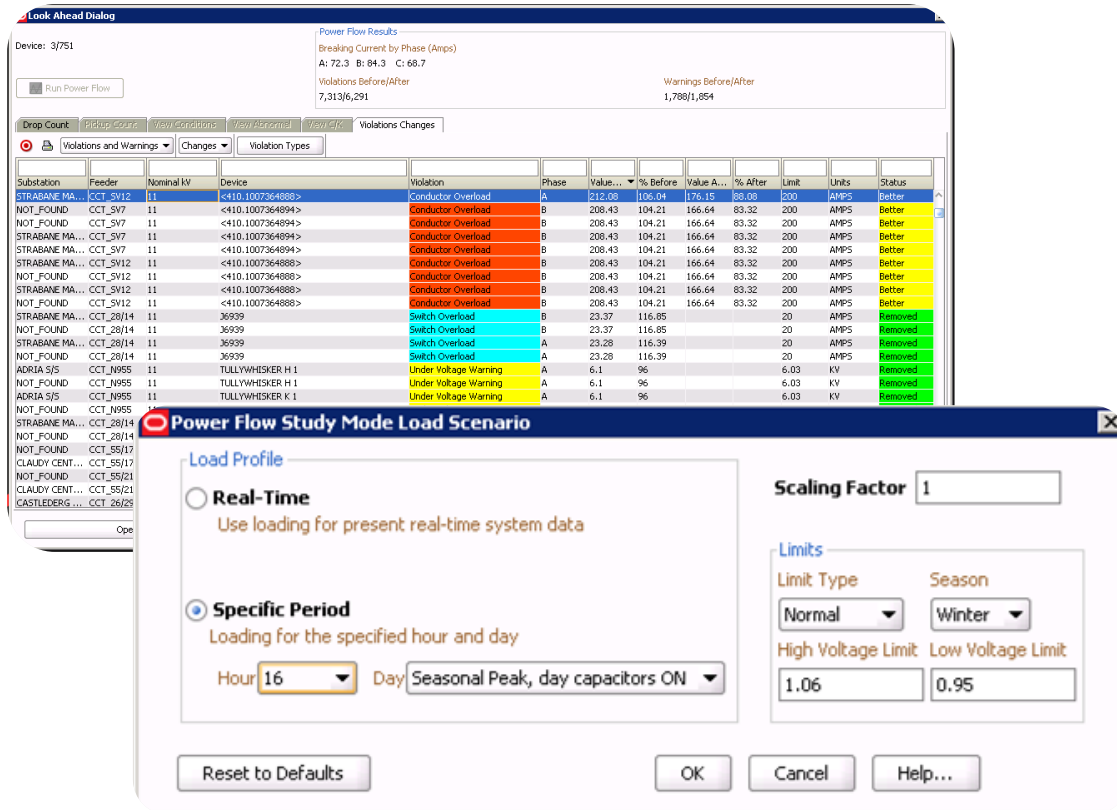
c) 2 invertors currently a G59/1 installation, should this move to G59 fast track?

Q7 - Do you believe that installations similar to that illustrated in Figure 8b, where a total energy source >16A/phase connects behind a single inverter rated at 16A/phase, should be allowed to connect under an Engineering Recommendation G83/1 arrangement on a 'fit and inform' basis? If so, please set out in detail.

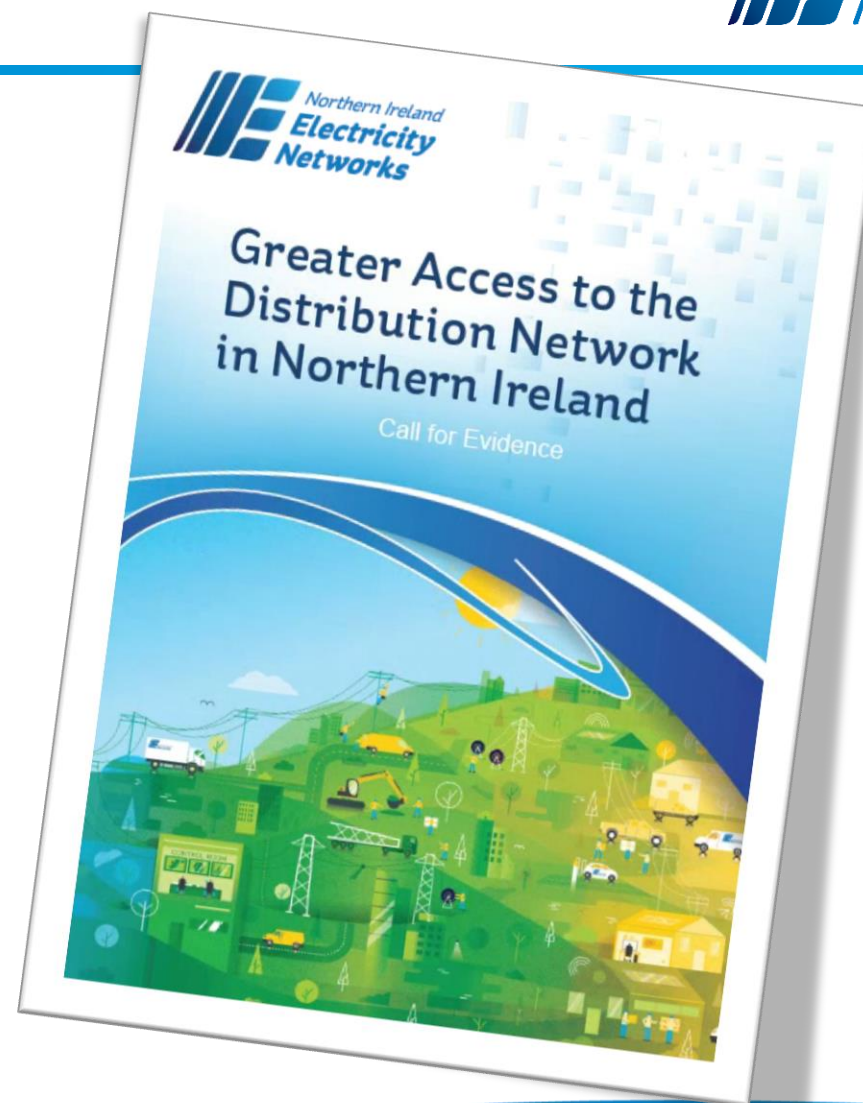
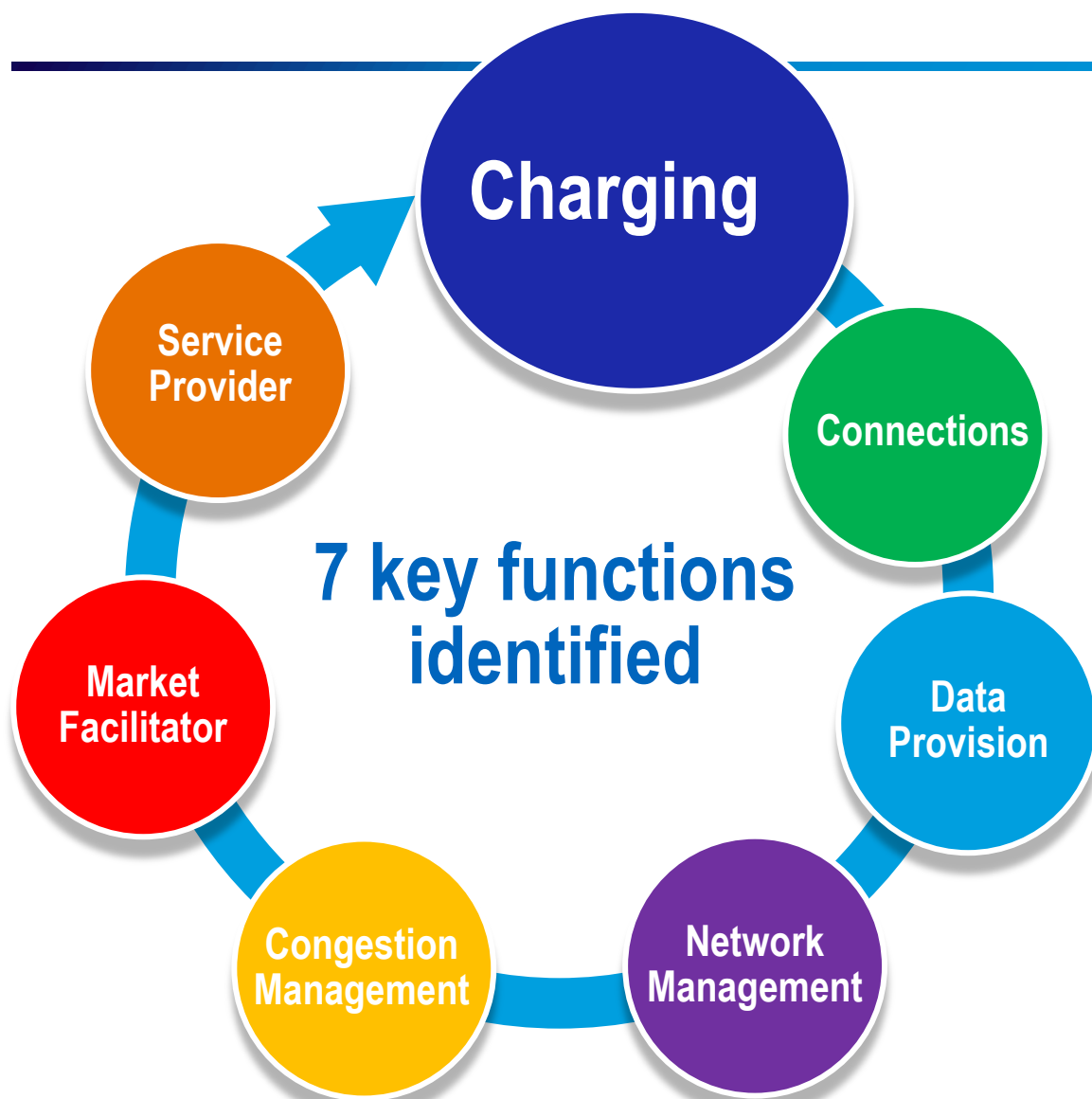
Q8 - Do you believe that installations similar to that illustrated in Figure 8c, if fitted with a G100⁹ export limiting device should be allowed to connect on an Engineering Recommendation G59 "fast track" process? In this case customers would still be required to contact NIE Networks to receive permission to connect; however, due to the reduced likelihood of considerable grid impact NIE Networks would be able to expedite any network assessment and revert to the customer, informing them that they can or cannot connect to the network in reduced timescales.



Near Time Dynamic Loadflow Analysis



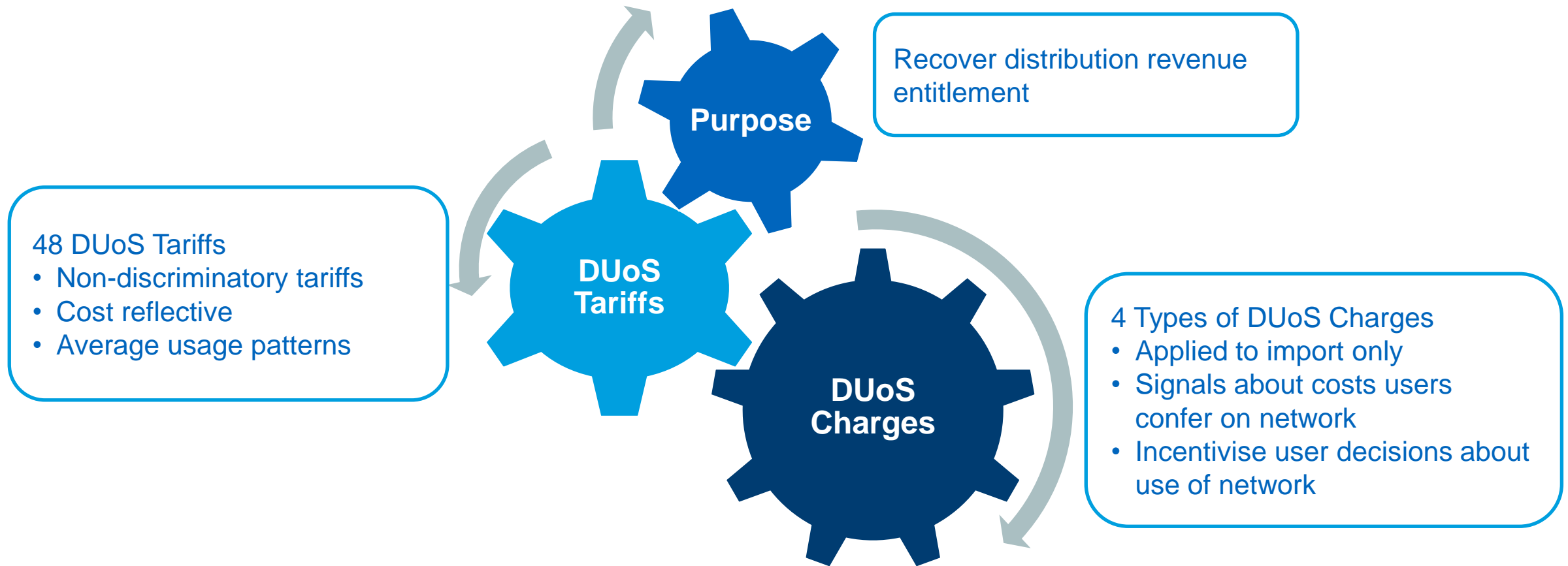
Q11 - Should NIE Networks invest in technologies to enable generation constraints on the distribution network to be reduced?



Q12 – Do you believe the existing tariffs are fit for purpose, or do they need amendment to deliver benefit to all customer types?

Q13 – Do you believe the areas of potential charging change (see section 3.7 of Call for Evidence paper) are correct? Are there other areas of change that should be considered? If so, please set out in detail.

Distribution Network Charges



Changes in customer behaviour will influence network costs for all users

Types of DUoS Charges

Standing Charges

(£/month or £/quarter)

- Fixed Charge
- Cost such as meters and meter reading

Unit Charges

(p/kWh)

- Volume based Charge
- Network capital and operational cost
- Will reflect the voltage networks used by the customer

Capacity Charges

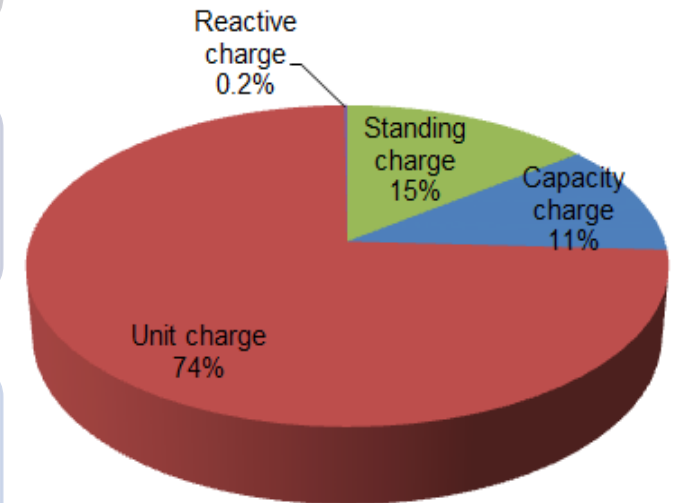
(£/kVA)

- Fixed Charge
- Charge for peak demand used in current or previous tariff year
- Half Hour metering required

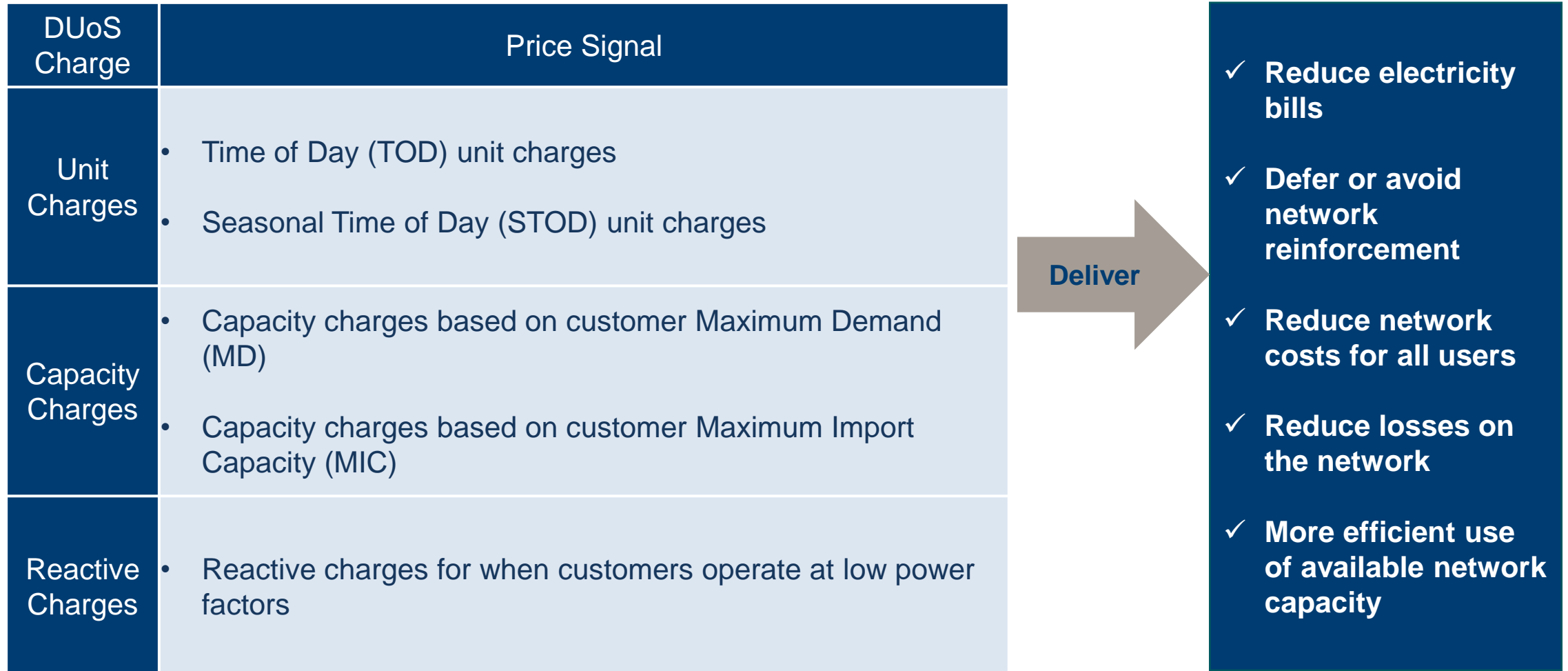
Reactive Charges

(p/kVarh)

- Volume based Charge
- Applied winter peak only (Nov to Feb, 16:00-19:00hrs Mon to Fri)
- Half Hour metering required

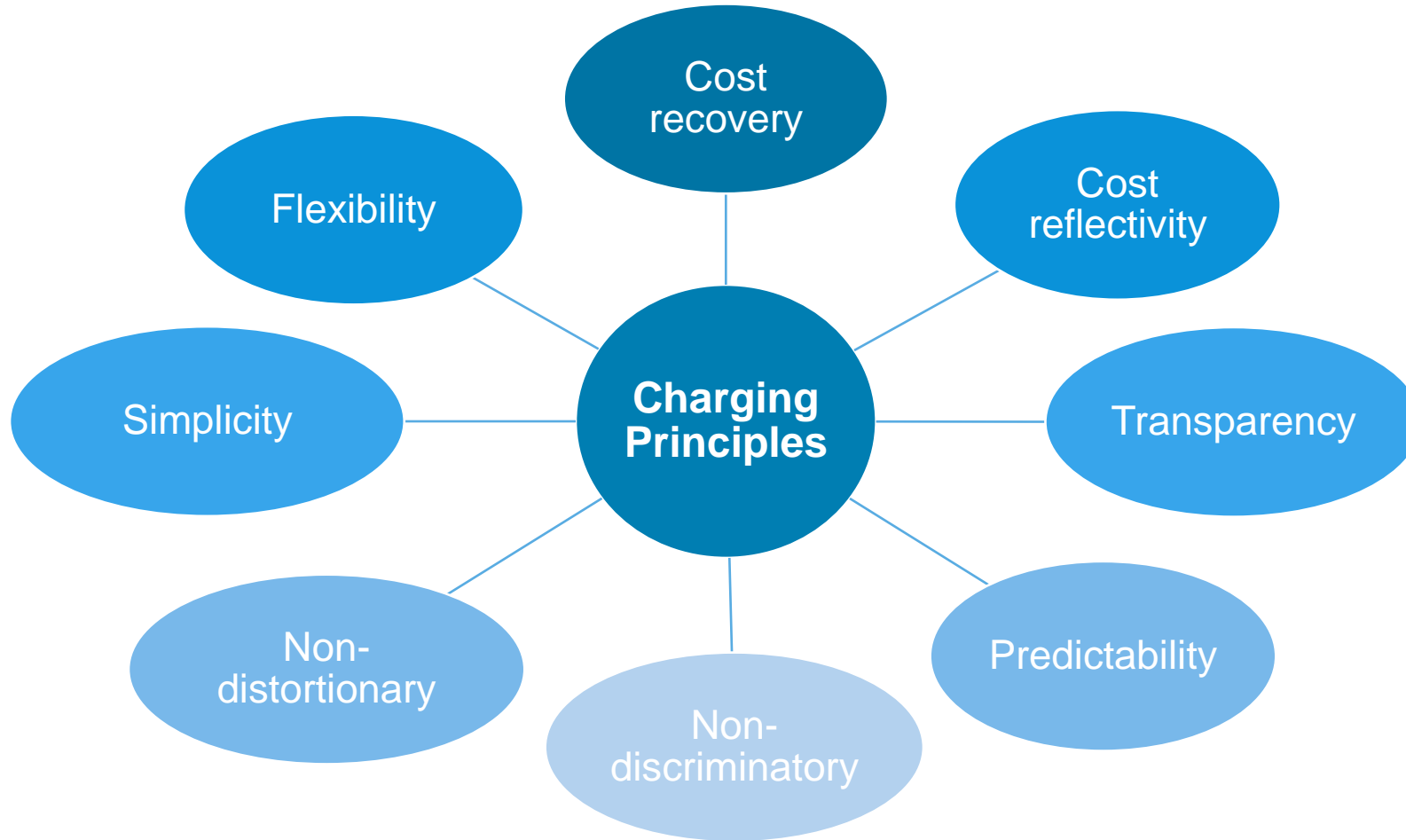


DUoS Price Signals to Influence Customer Behaviour



Types of DUoS Charges Applied to Main Customer Groups

Type of Customer	Connected Capacity	Distribution Voltage	Location	Types of DUoS Charges			
				Standing Charge (£/cust)	Unit Charge (p/kWh)	Capacity Charge (£/kVA used)	Reactive Charge (p/kVarh)
Domestic	<70kVA	LV		✓	Unrestricted TOD		
Small Business	<70kVA	LV		✓	Unrestricted TOD STOD		
Medium Business	>70kVA	LV, HV & EHV		✓	STOD	✓	✓
LEU	>1MW	LV, HV & EHV	Min & Med distance from source Sstn	✓	STOD	✓	✓
Generators	All	LV, HV & EHV		Excl connection opex costs	STOD		
Unmetered	<70kVA	LV			Unrestricted		



Increased generation
connected to the
distribution network

Electricity Storage –
for customer's own use
or export onto
distribution network

Connection of new
technologies
e.g. heat pumps and
electric vehicles

Smart technologies and
innovative business models
to adjust supply and
demand

DUoS Tariffs Need to Change so we can:

Allocate the appropriate costs to customers

- Recover costs from customers who attributed to the costs
- Appropriate tariff groups to reflect “average” customer usage patterns

Provide appropriate price signals

- Avoid distortion price signals eg balance of fixed verses volume based charges as customer units decrease
- Provide price signals to influence how and when customers use new technologies to avoid constraints

Incentivise network users

- Incentivise customer flexibility and active network management

Tariffs for the Changing World?

Rebalancing DUoS charges

- 74% of DUoS revenue recovered from volume based charges & 26% from fixed charges
- As more customers have ability to produce their own electricity, an increasing proportion of network investment costs are recovered from customers who cannot avoid network usage
- Reducing proportion of costs recovered from volume based unit charges and increasing proportion recovered from fixed capacity or standing charge, would:
 - ✓ provide a fairer and more appropriate recovery of costs
 - ✓ remove distortional pricing signals

Time of Use pricing

- < 30% small business & < 5% domestic customers on Time of Use tariffs
- More Time of Use tariffs/charges to give signals to customers to avoid using network at peak times e.g. charging electric vehicles
- Time of Use tariffs require suitable meters



Options for new tariff groups or charges

Different price structures or tariffs could be introduced to provide appropriate incentives to demand and generator users:

- Recognise common modes of behaviour e.g. PV users
- Reward customer flexibility
- Influence location of generators – close to load



Q12 – Do you believe the existing tariffs are fit for purpose, or do they need amendment to deliver benefit to all customer types?

Q13 – Do you believe the areas of potential charging change (see section 3.7 of Call for Evidence paper) are correct? Are there other areas of change that should be considered? If so, please set out in detail.