Capacity to Customers Dissemination Event

27 January 2015

LCN Fund
Low Carbon Networks

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Steve Cox

Head of Engineering

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Housekeeping

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Mobile phones

Breaks

FIRE

Fire alarms

Main Q&A
at end of day

Connecting the North West

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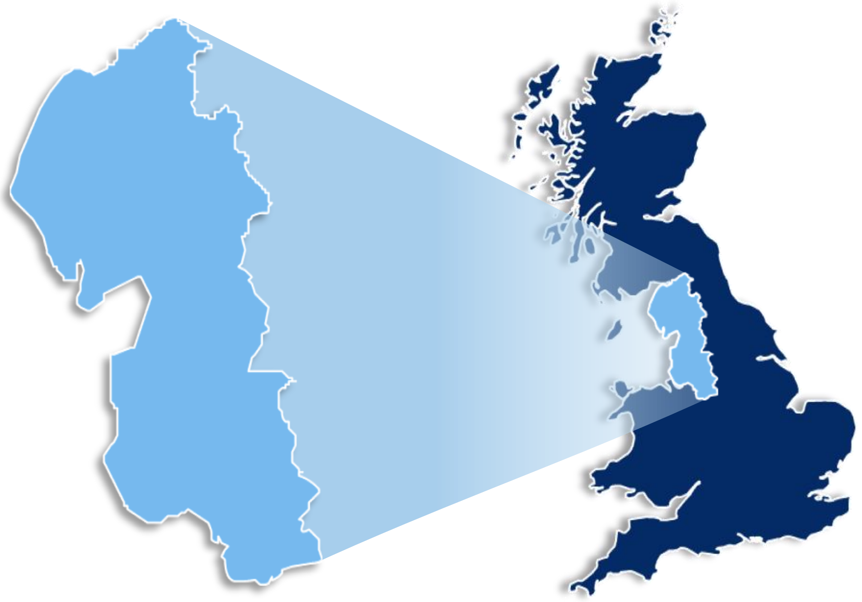
£12 billion of network assets

4.9 million

2.4 million

25 terawatt hours



Our innovation strategy

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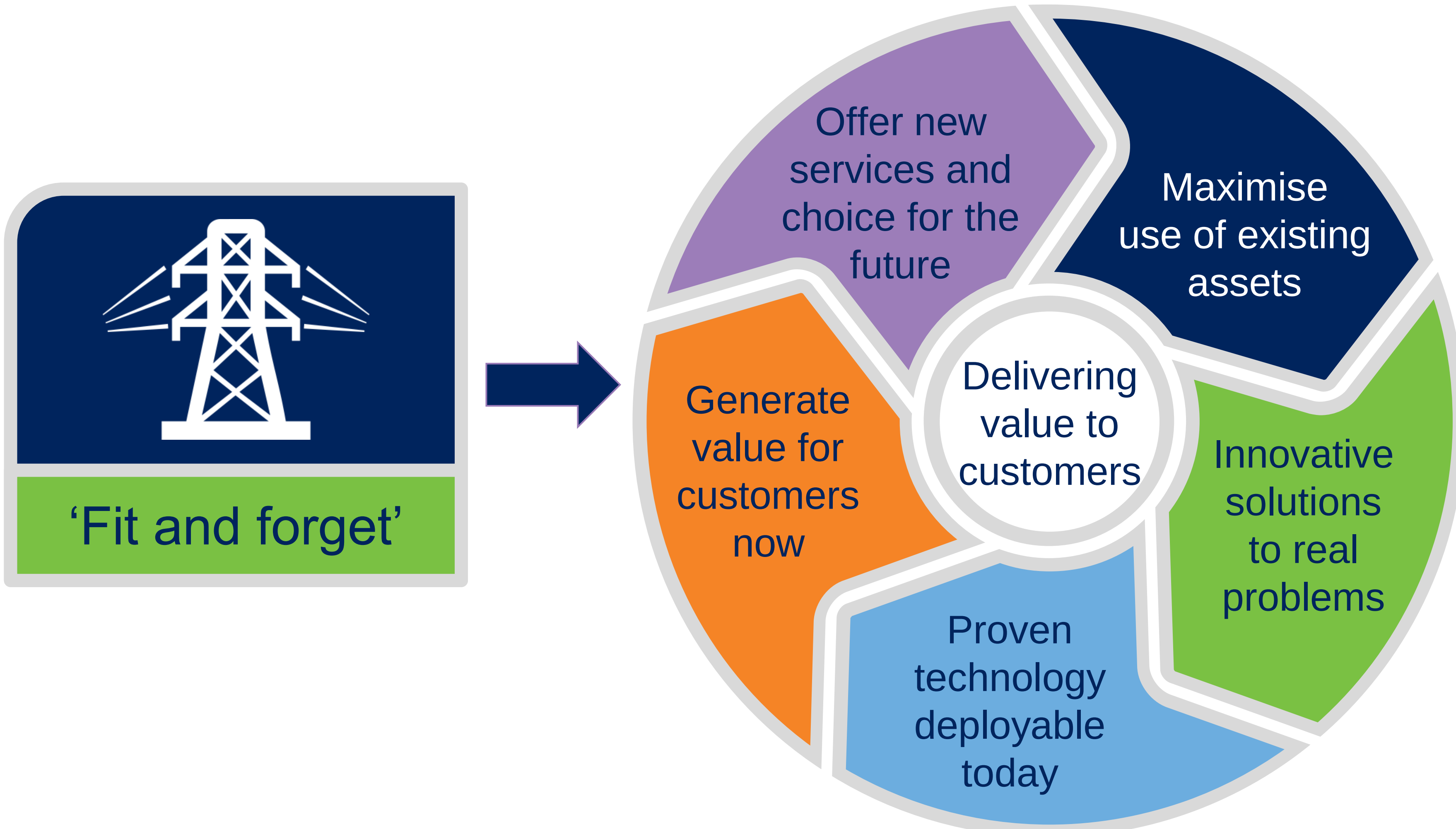

Our smart grid development

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Leading work on developing smart solutions

Deliver value from existing assets

Customer choice

LCN Fund Low Carbon Networks — Four flagship products (second tier) £36 million

C2C Capacity to Customers

CLASS

SMART STREET

RESPOND

C_2C, CLASS and Smart Street demonstrate demand response

Agenda

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C2C

Introduction

Technical and academic overview

Customer research (technical impact)

Lunch

Customer research (commercial)

Commercial review and case studies

Summary and next steps

What is Capacity to Customers?

Capacity to Customers unlocks latent capacity on the electricity network

Capacity to Customers	=	Technical innovation	+	New commercial contracts
Utilised capacity		Current demand Latent capacity		
Combines proven technology and new commercial contracts		Remote control equipment on HV circuit and close the NOP		Innovative demand side response contracts
Facilitates connection of new demand and generation without reinforcement		Enhanced network management software Effectively doubles the available capacity of the circuit		Allow us to control a customer’s consumption on a circuit at the time of fault

C_2C structure and partners

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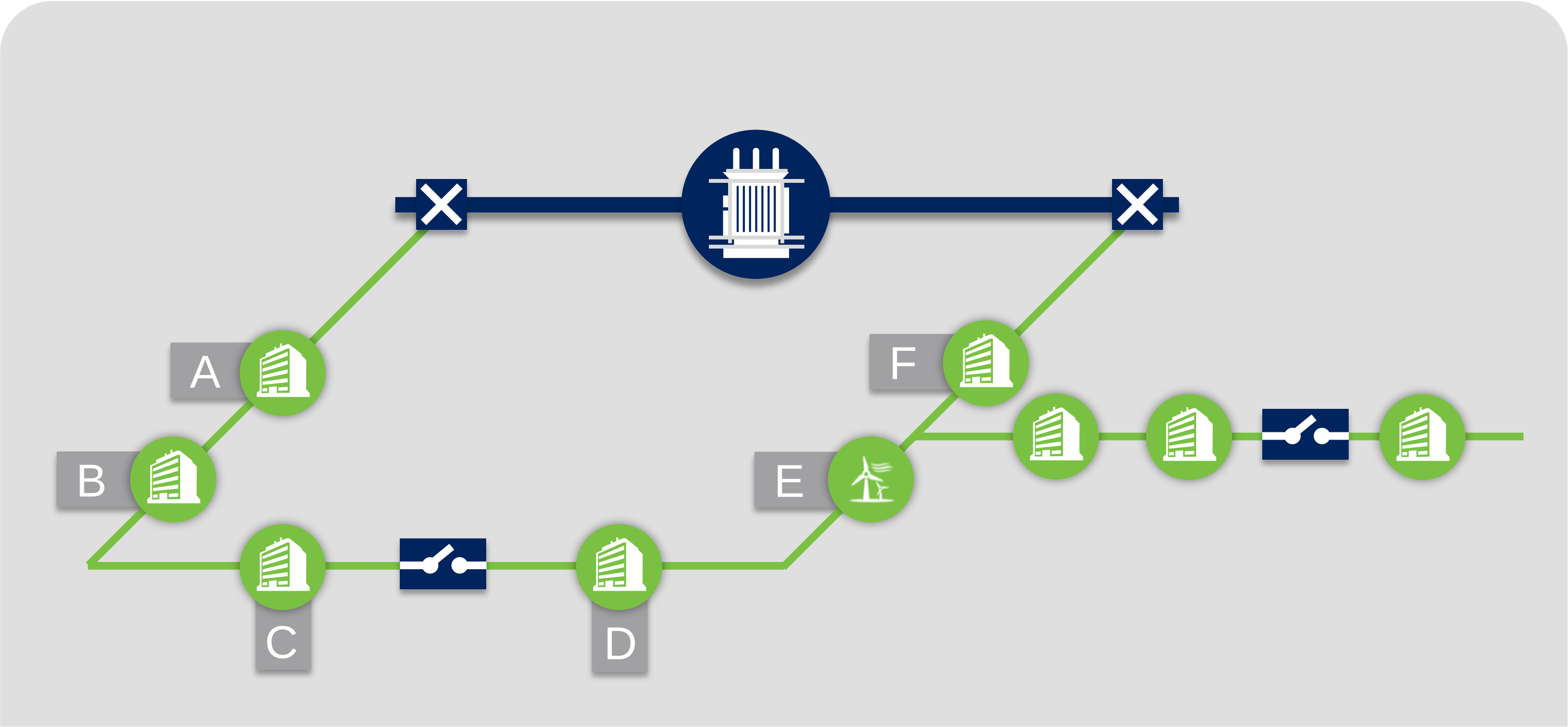
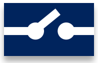
Technology build	Trials and research	Customer engagement
Parsons Brinckerhoff	Manchester 1824	npower
nationalgrid	University of Strathclyde	flexitricity – Unlocking smart grid revenue
GE	nationalgrid	Impact Research

Learning and dissemination

Traditional network design



 Normal open point

C_2C network design

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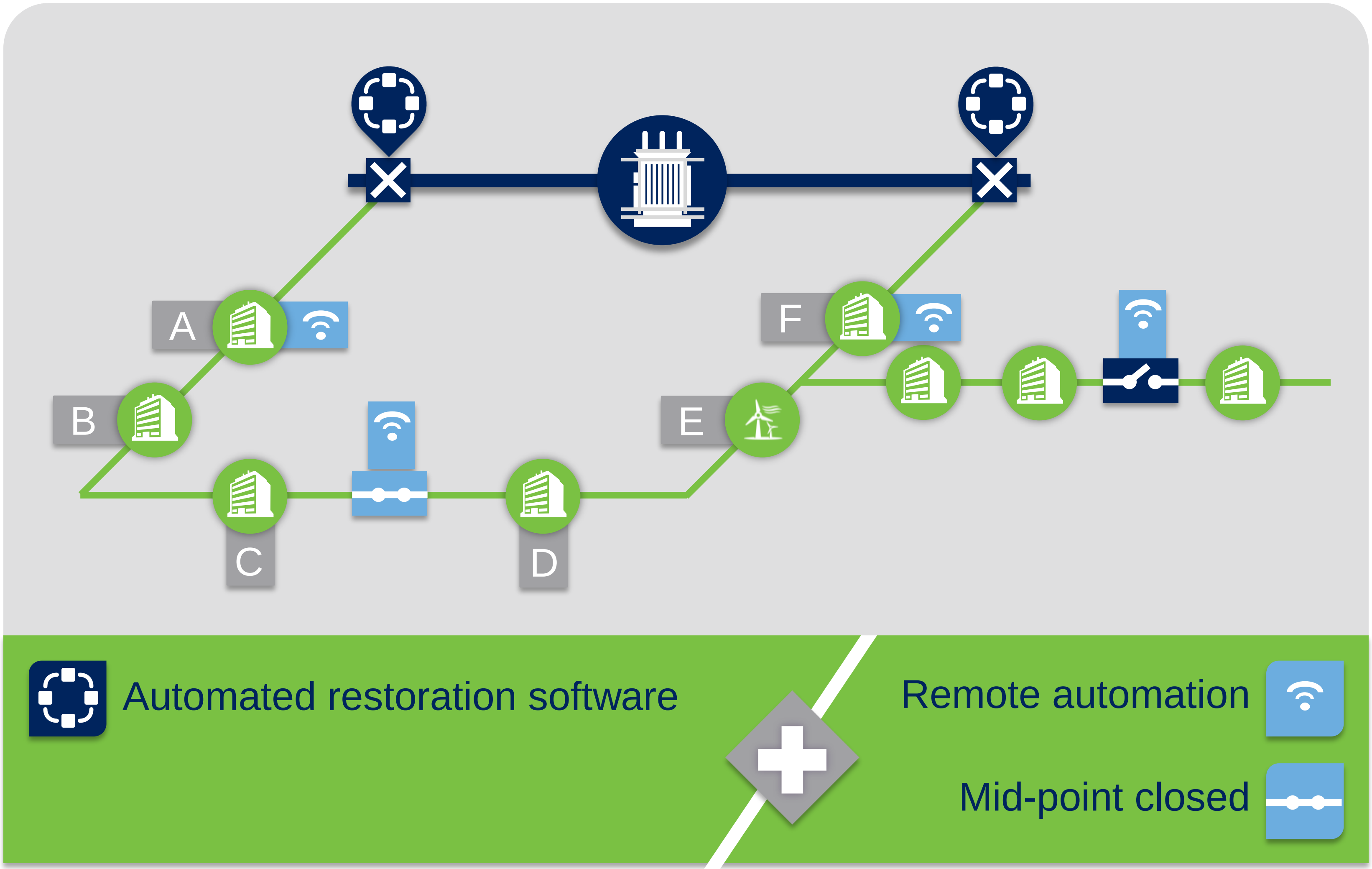
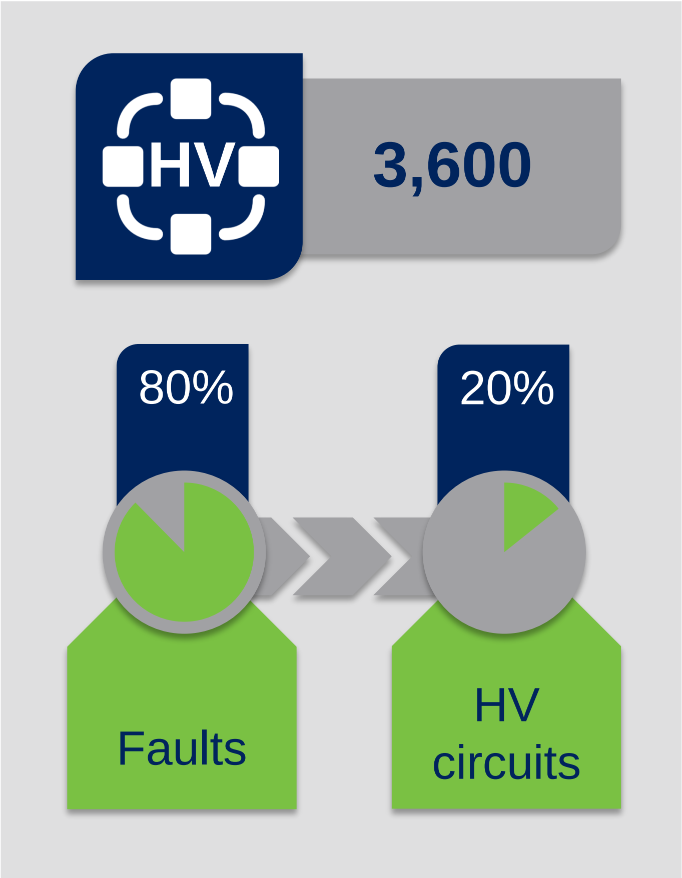
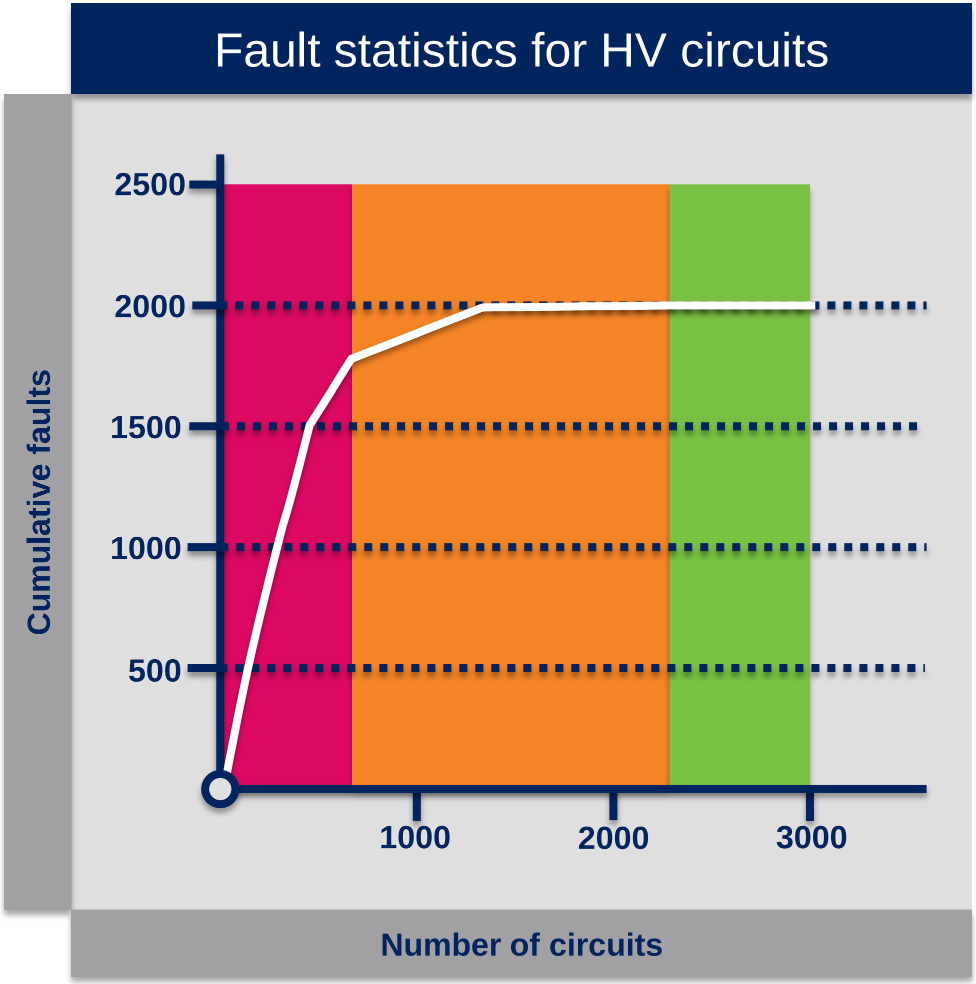
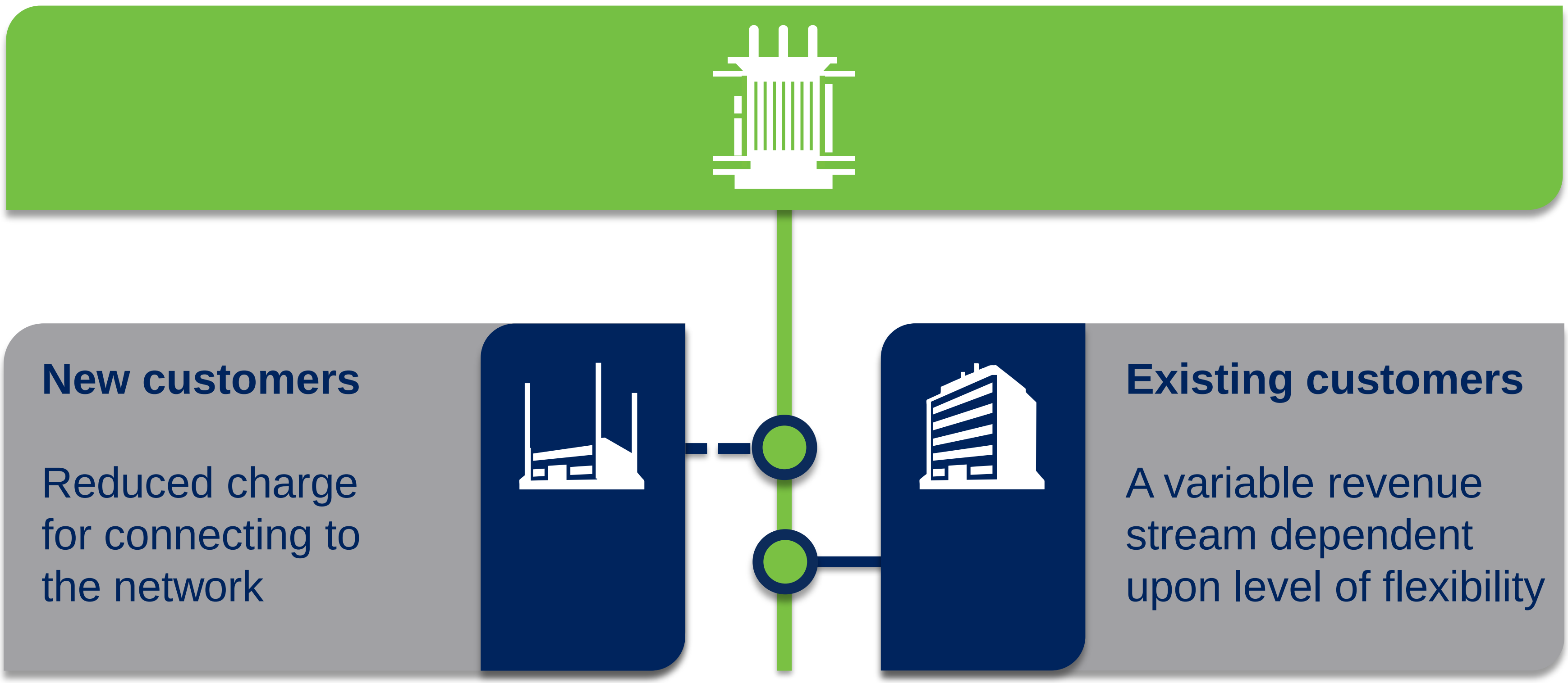


Quality of supply innovation





The C_2C concept



Key hypotheses

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Demand reduction	Active network management	Efficiency	Domestic customers	Commercial customers
Creates a post fault demand response capability	Network automation creates self healing capability and facilitates capacity release	Defers/ optimises reinforcement and reduces carbon intensity	Closed ring configuration is acceptable to customers	Existing or new customers can directly benefit financially by providing the demand response

QUESTIONS

&

ANSWERS

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Paul Turner

Programme Manager

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Agenda

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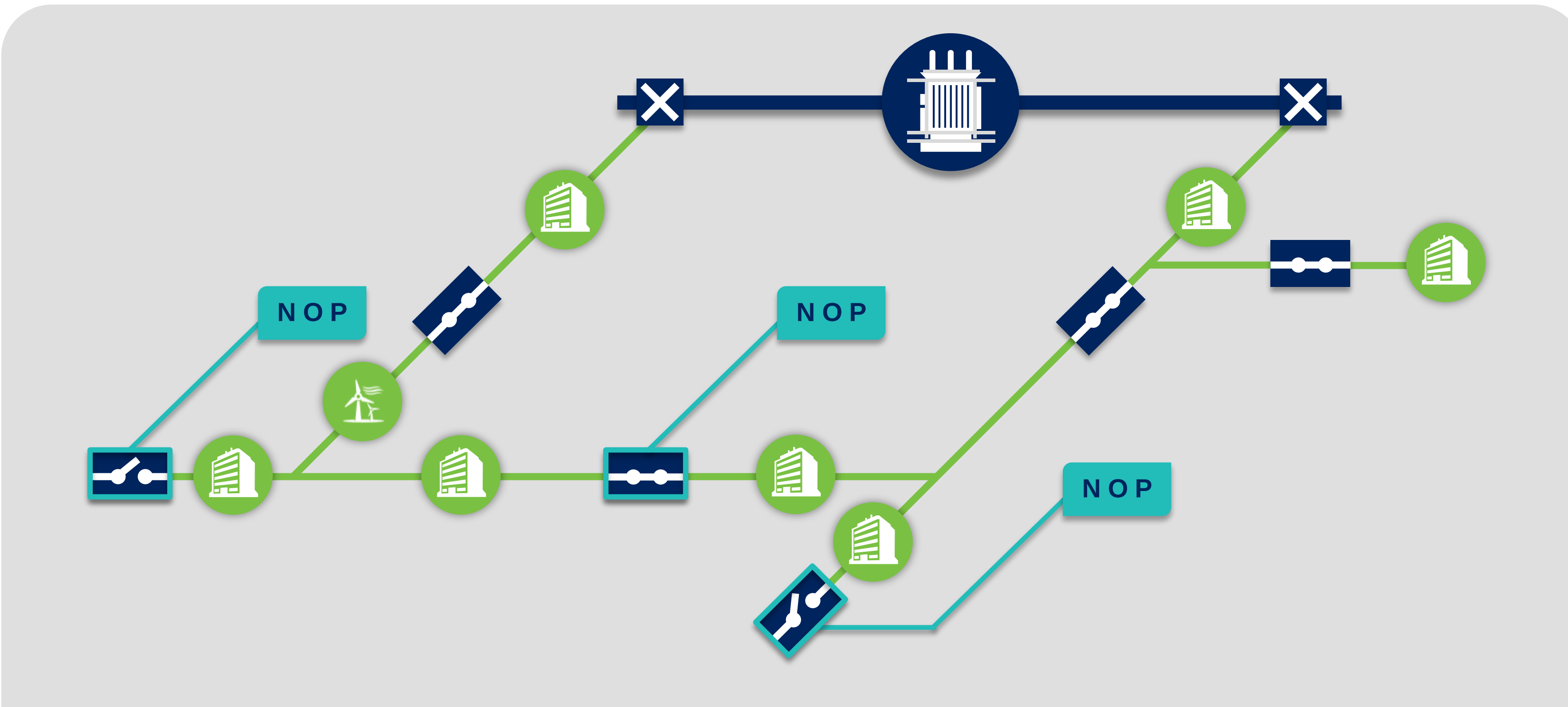
C2C Introduction	Technical and academic overview	Customer research (technical impact)
Customer research (commercial)	Commercial review and case studies	Summary and next steps

How C_2C fault management works



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How C_2C fault management works

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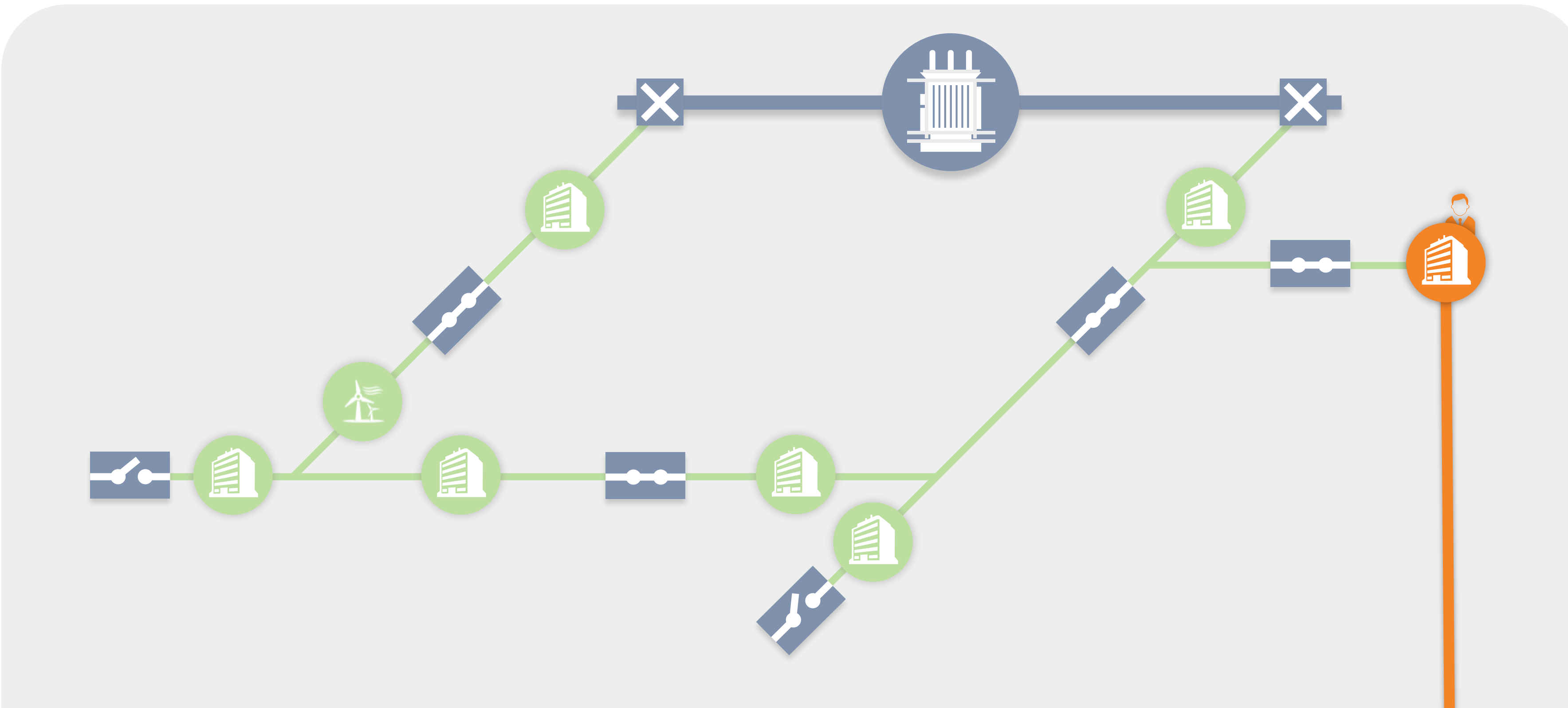

C_2C events per year:	2	Protected day:	1 day, on Friday, August 10, 2014
Maximum duration per event:	8 hours	Protected time:	09:00 to 17:00
C_2C event start time:	15 minutes	Current events per year:	0

How C_2C fault management works

How C_2C fault management works

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How C_2C fault management works

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How C_2C fault management works

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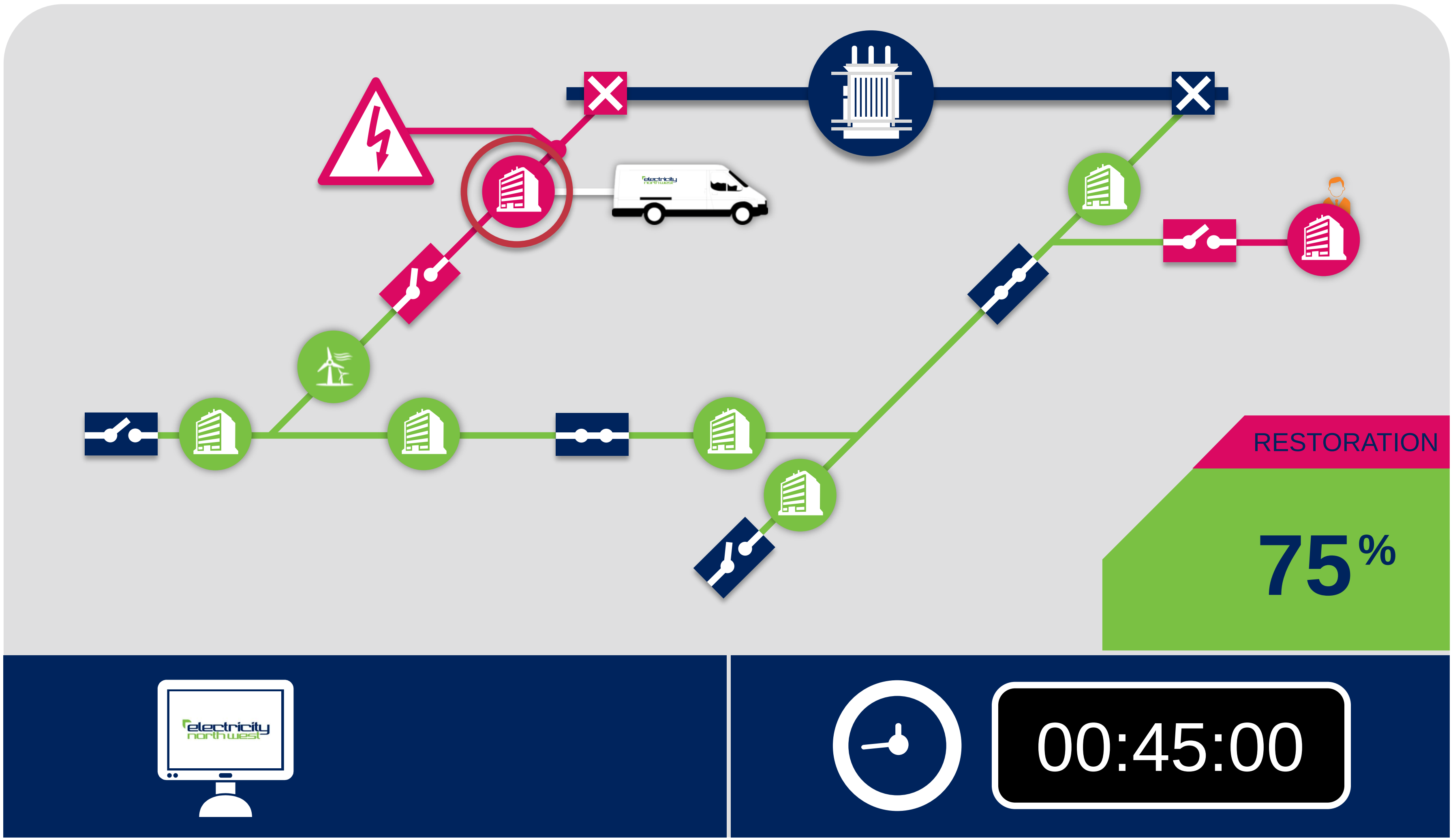
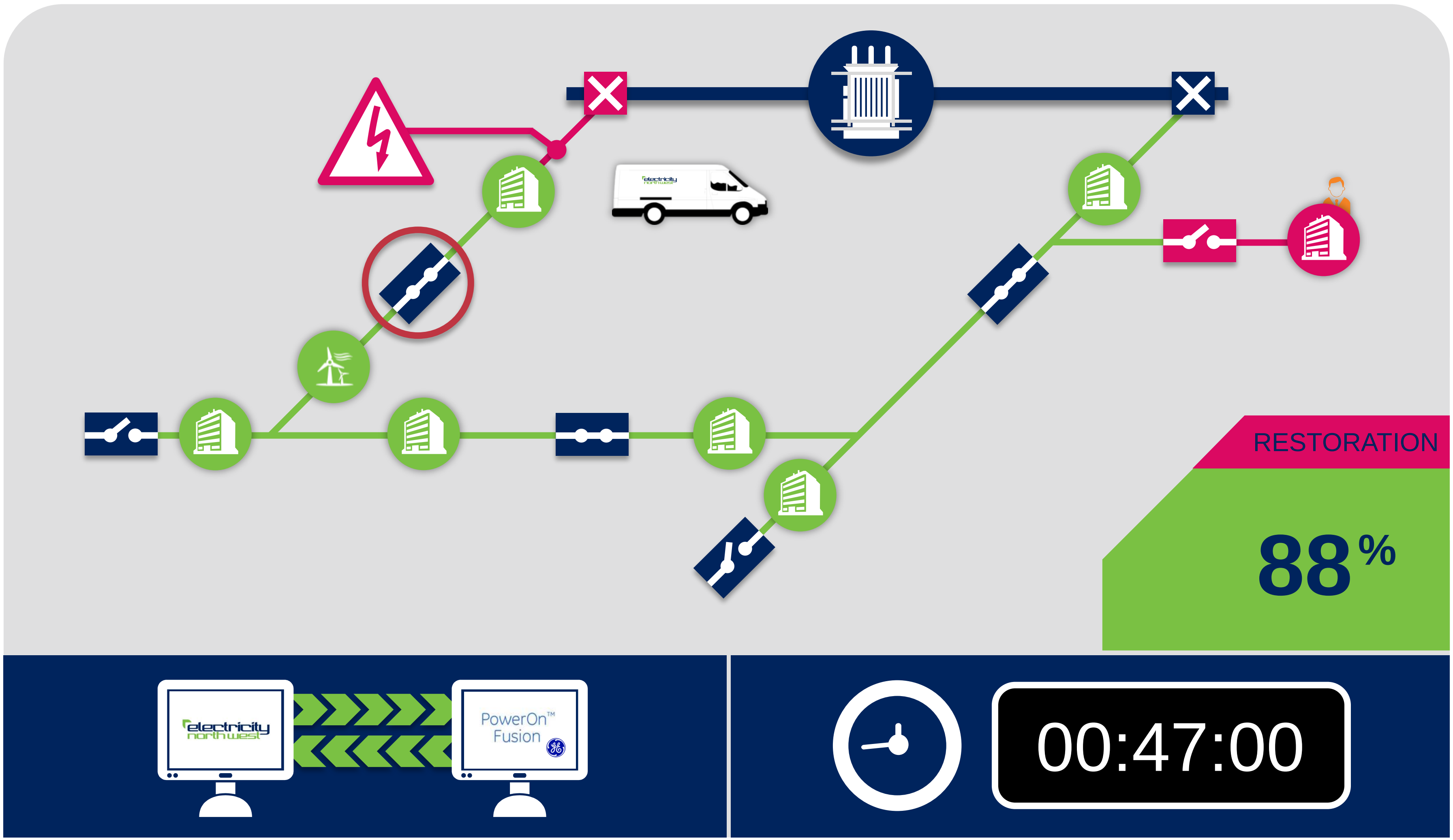


How C_2C fault management works



How C_2C fault management works

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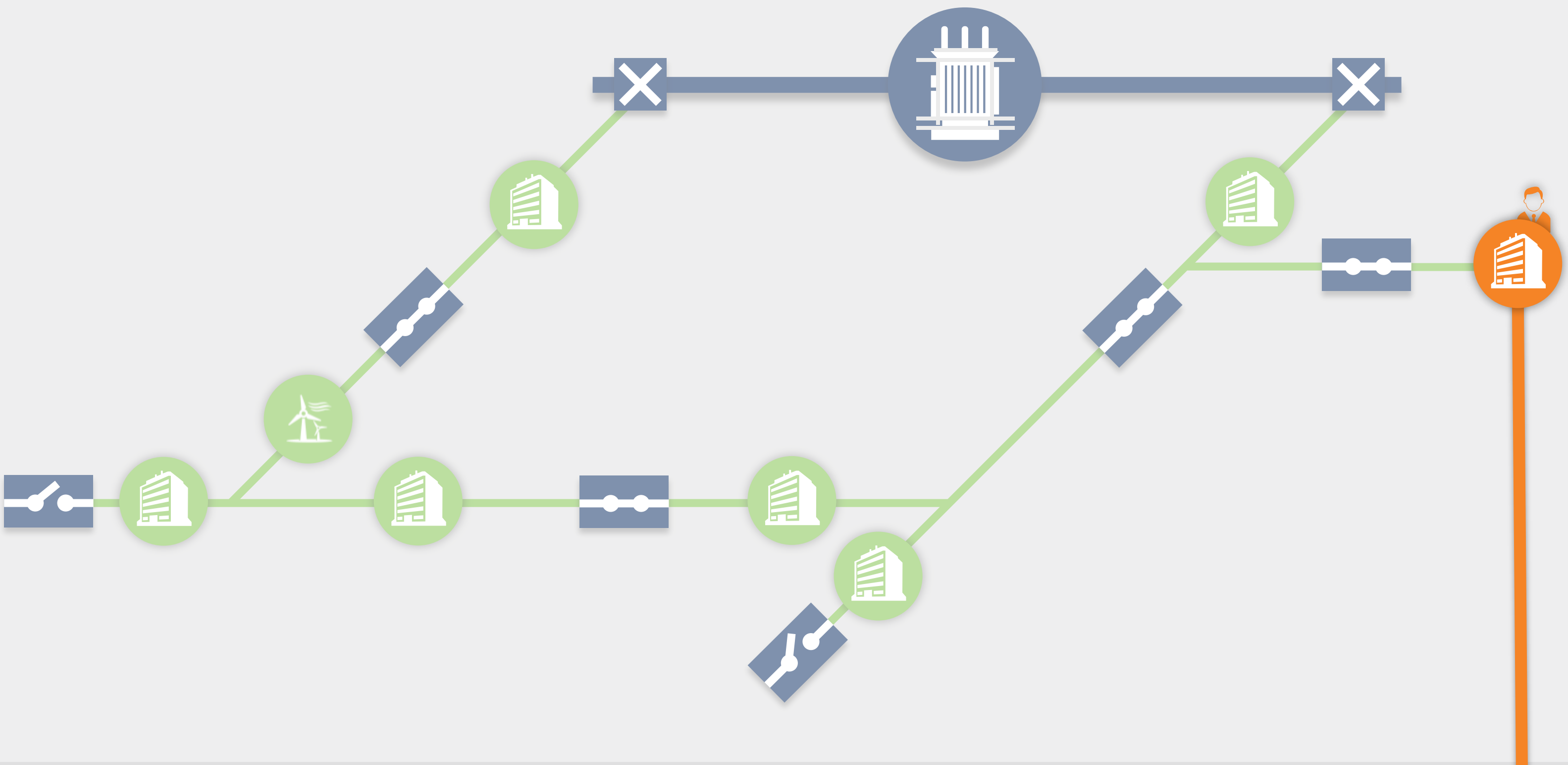
How C_2C fault management works

How C_2C fault management works



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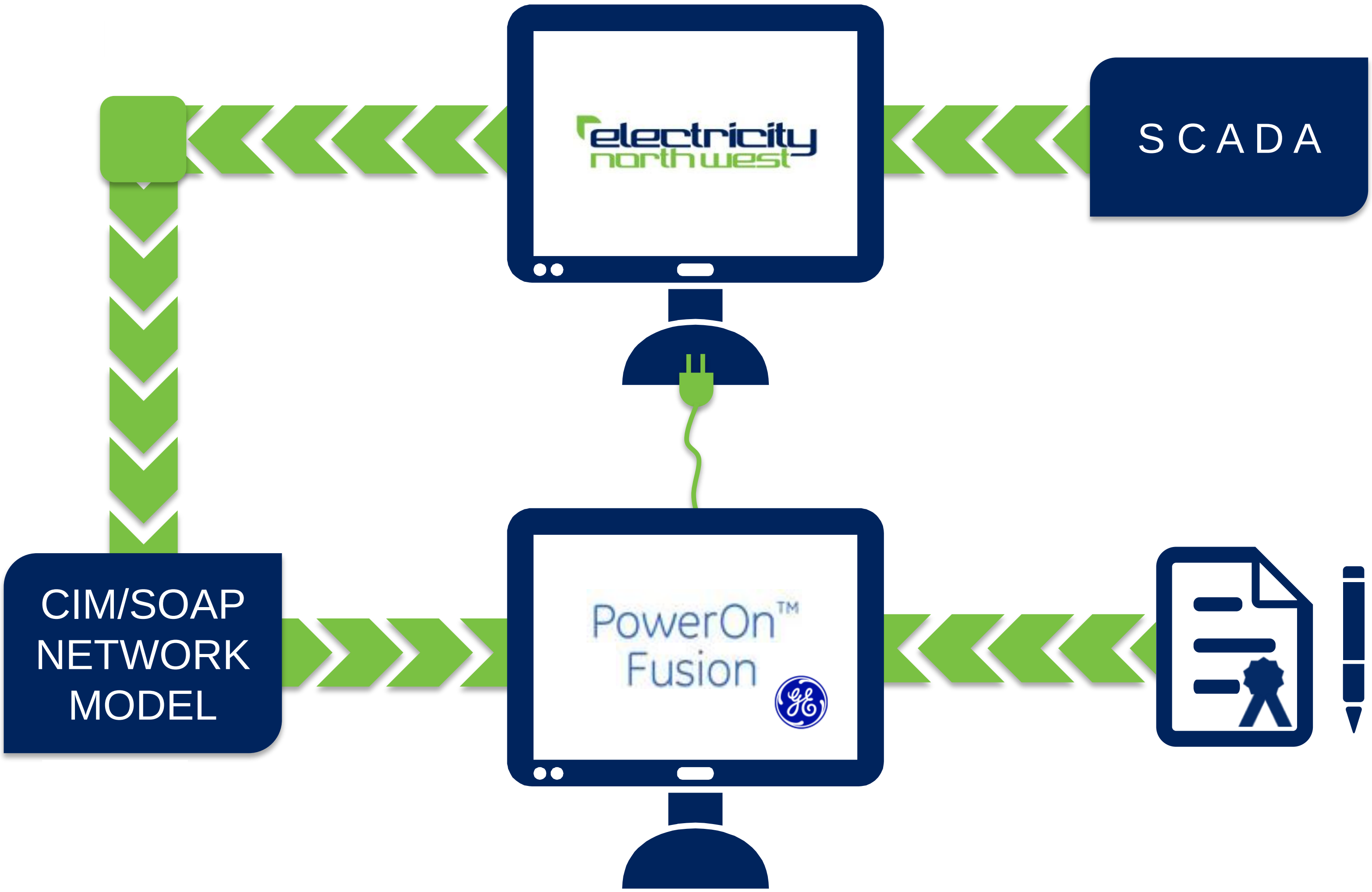
Protected day:	**1 day, on Friday, August 10, 2014**
Protected time:	**09:00 to 17:00**
Current events per year:	**1**

Restoration time

NUMBER OF CUSTOMERS	RESTORATION TIME	RESTORATION
	00:01:00	38%
	00:03:00	75%
	00:47:00	88%
	00:50:00	100%

Architecture



P2/6 change consultation

Mixed views …

from all DNOs regarding
the need for this derogation

C_2C academic research

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How …	When …	What …
… does the network perform ... ?	… is it cost effective ...?	… is the carbon impact ... ?
University of Strathclyde	MANCHESTER 1824 The University of Manchester	TyndallManchester Climate Change Research

CO_2

Steven Blair

University of Strathclyde

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Network performance results overview

Main objectives – C_2C hypotheses

Overview of results and analysis

Demand capacity	DG capacity	Losses	Power quality	Fault levels

Applicable C_2C hypotheses

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Customers	Reduces power losses	Quality
Release significant capacity to customers from existing infrastructure	Reduce like-for-like power losses initially but this benefit will gradually erode as newly released capacity is utilised	Improve power quality resulting from stronger electrical networks

Assessing the base case

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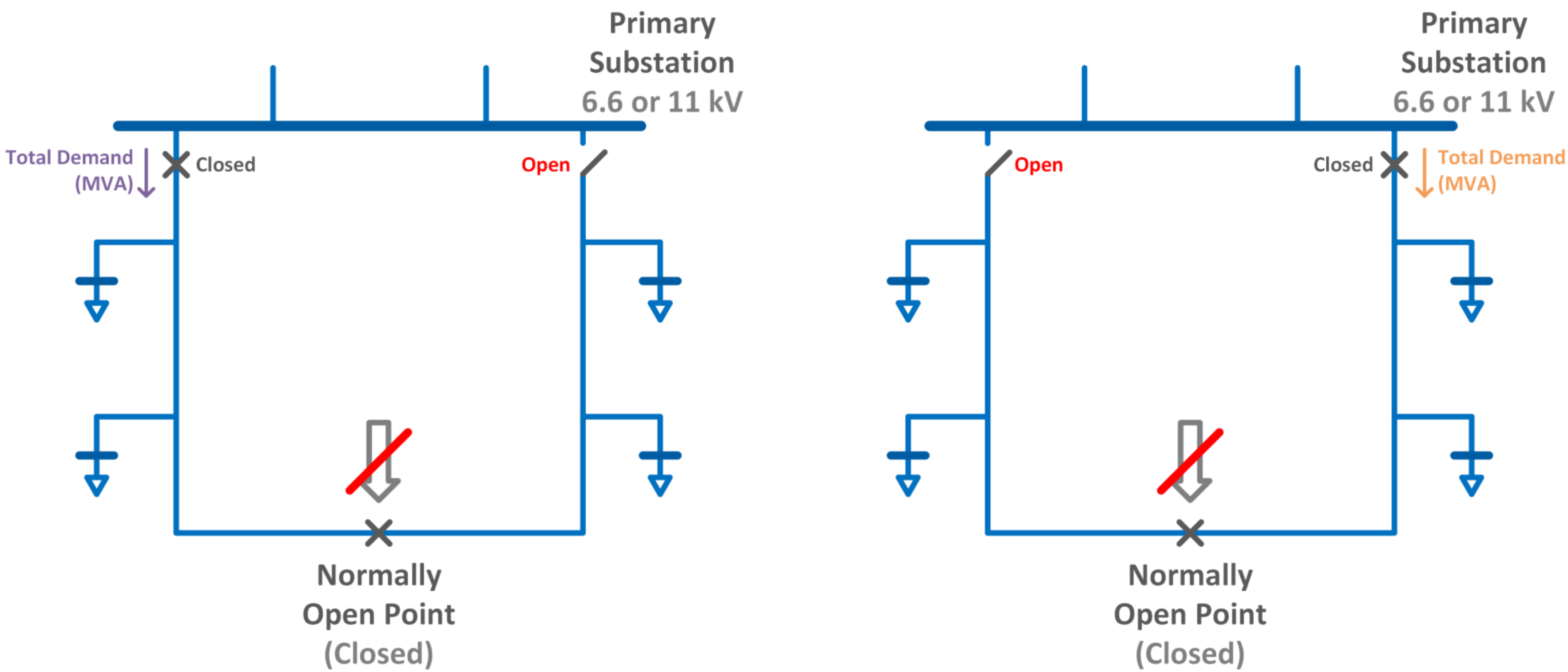

Assessing impact of network configuration

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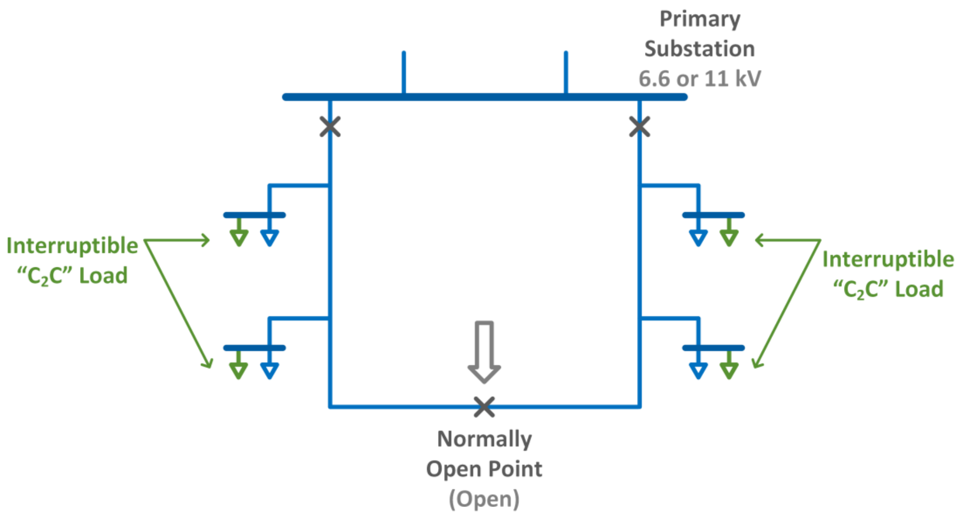
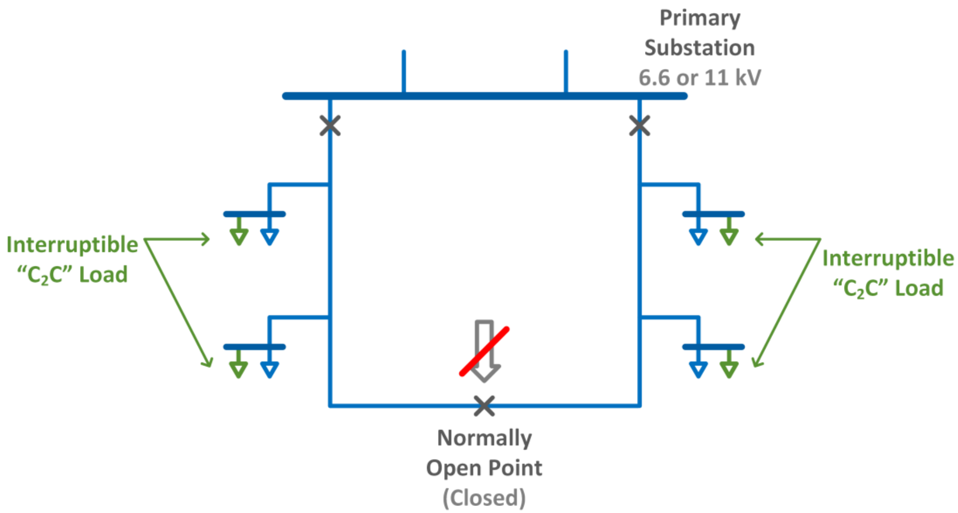
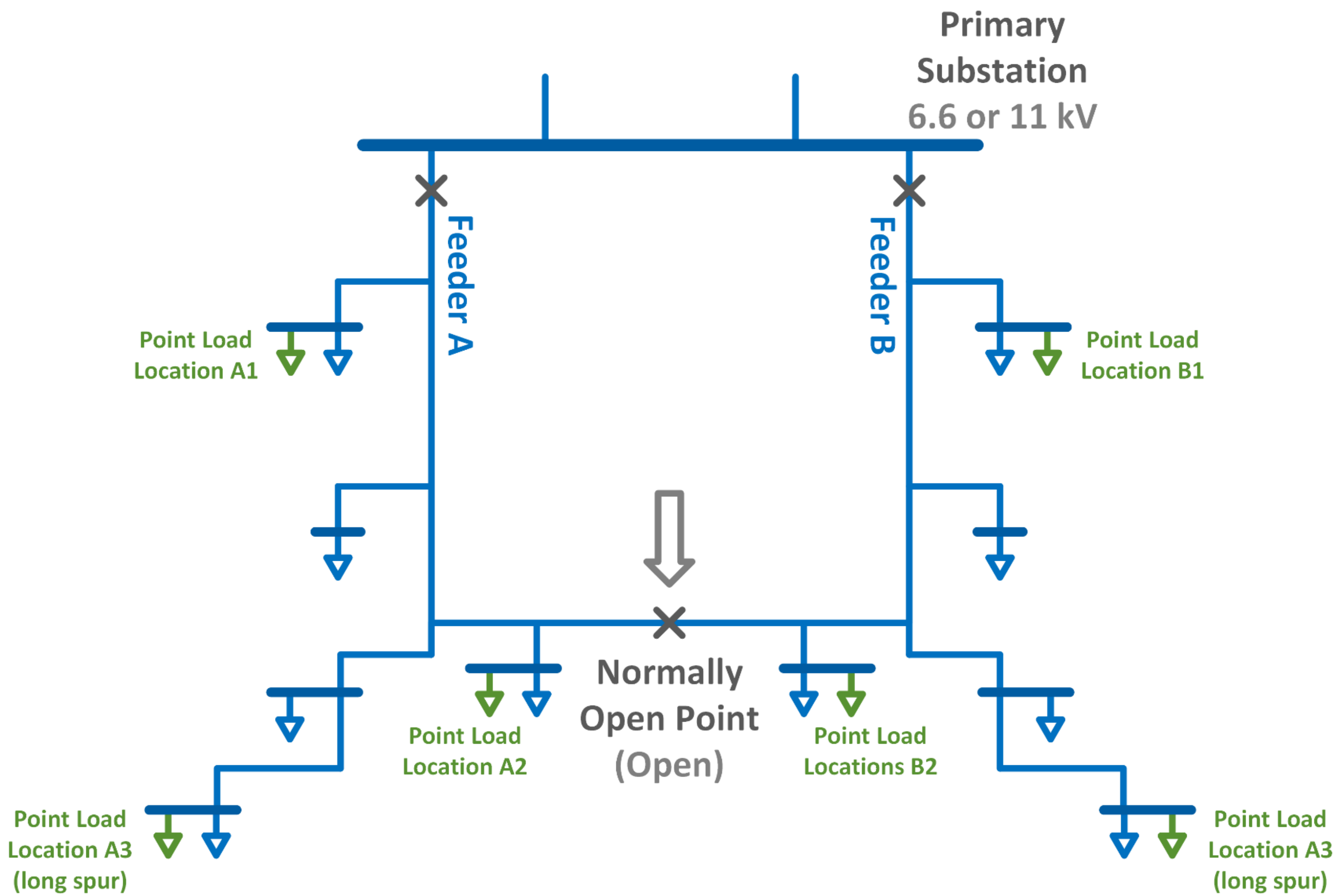
Radial C_2C



Interconnected C_2C



Assessing the impact of demand growth



C_2C demand capacity – uniform growth

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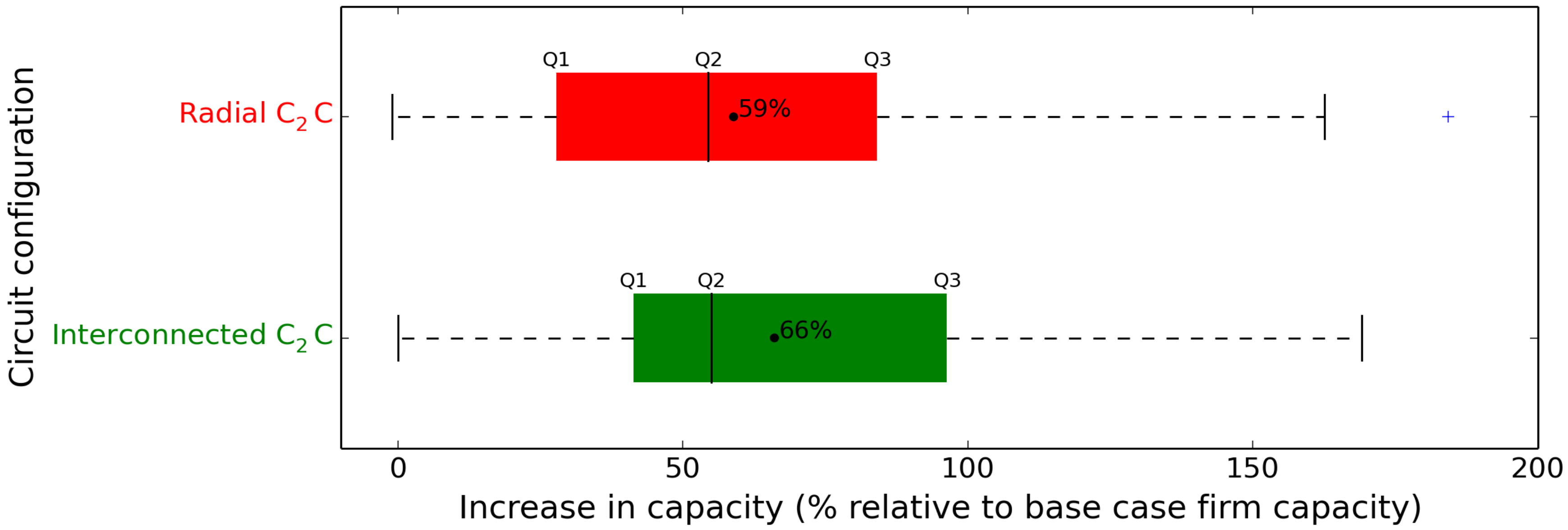
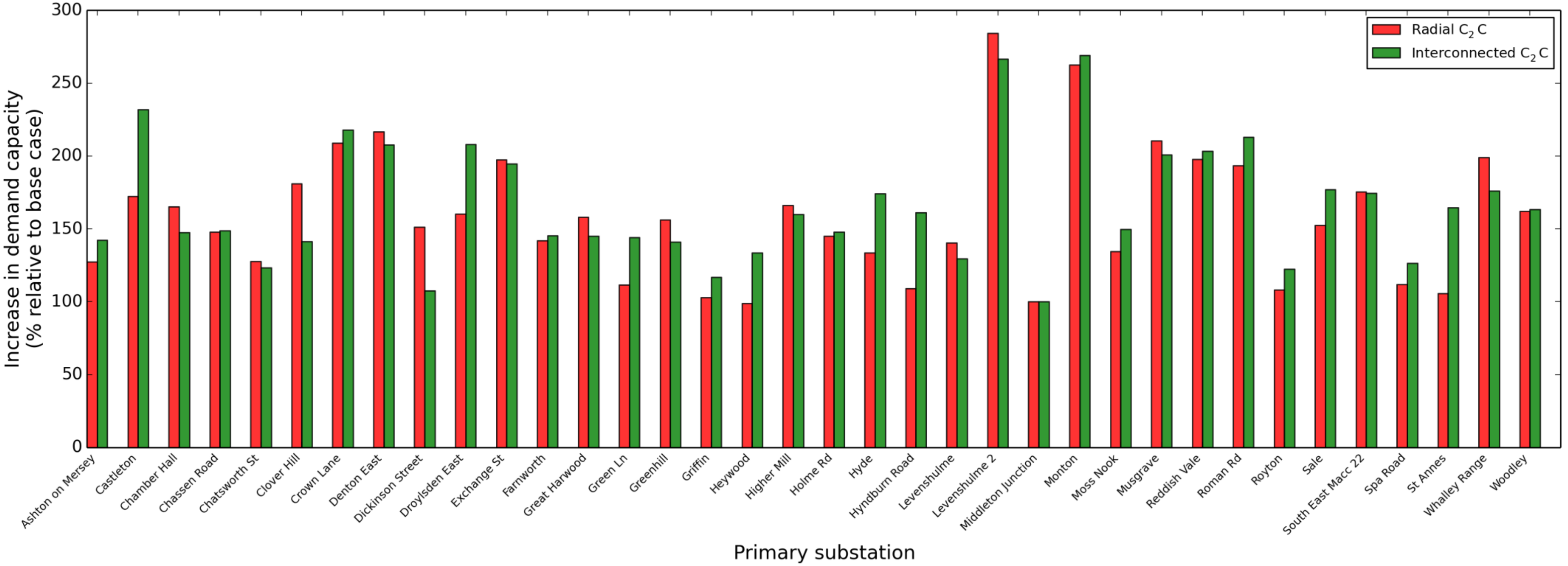


C_2C demand capacity – uniform growth



Average increase in demand capacity:

+ 59% radial
+ 66% interconnected

C_2C demand capacity – "point" load growth

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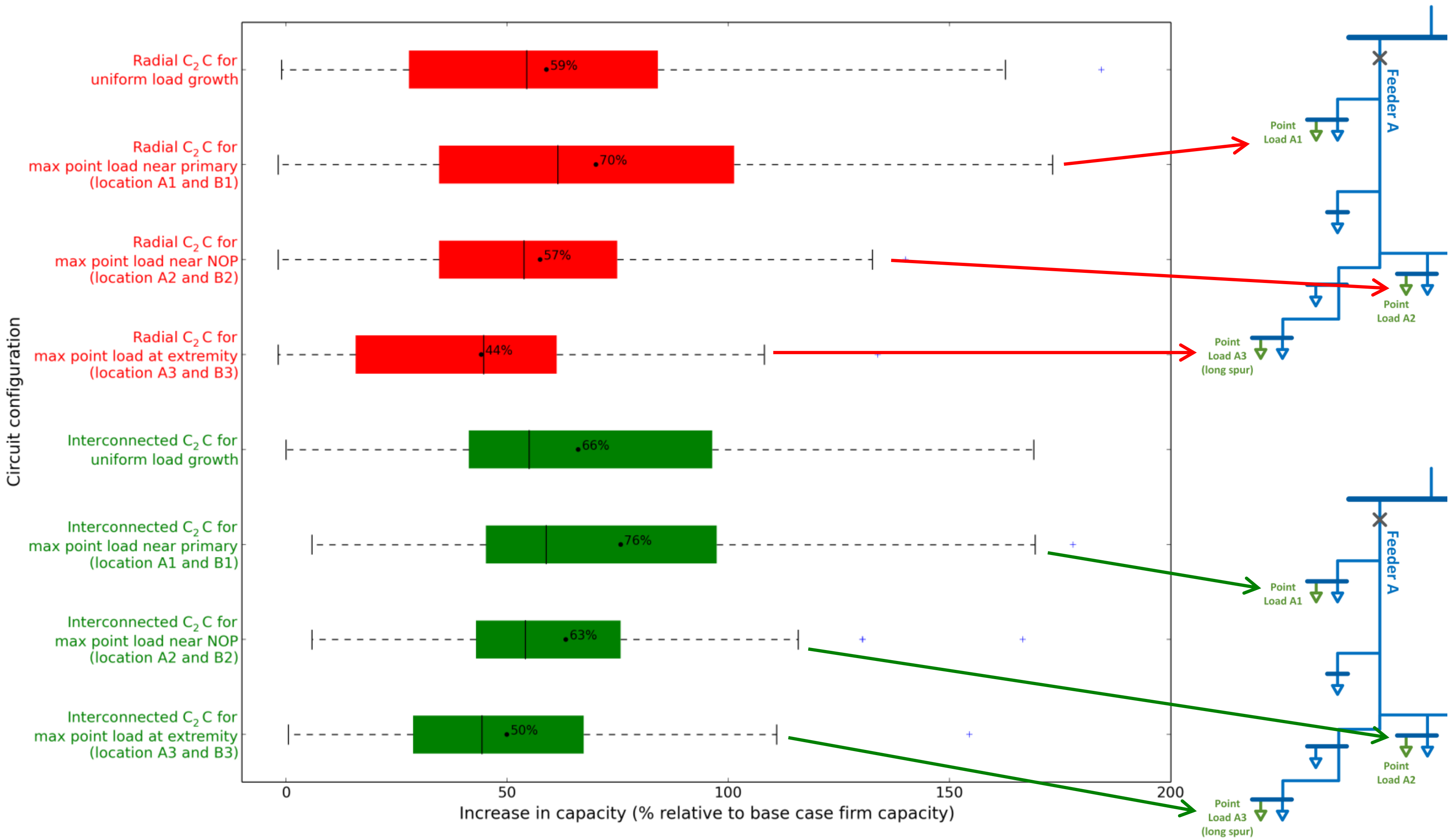
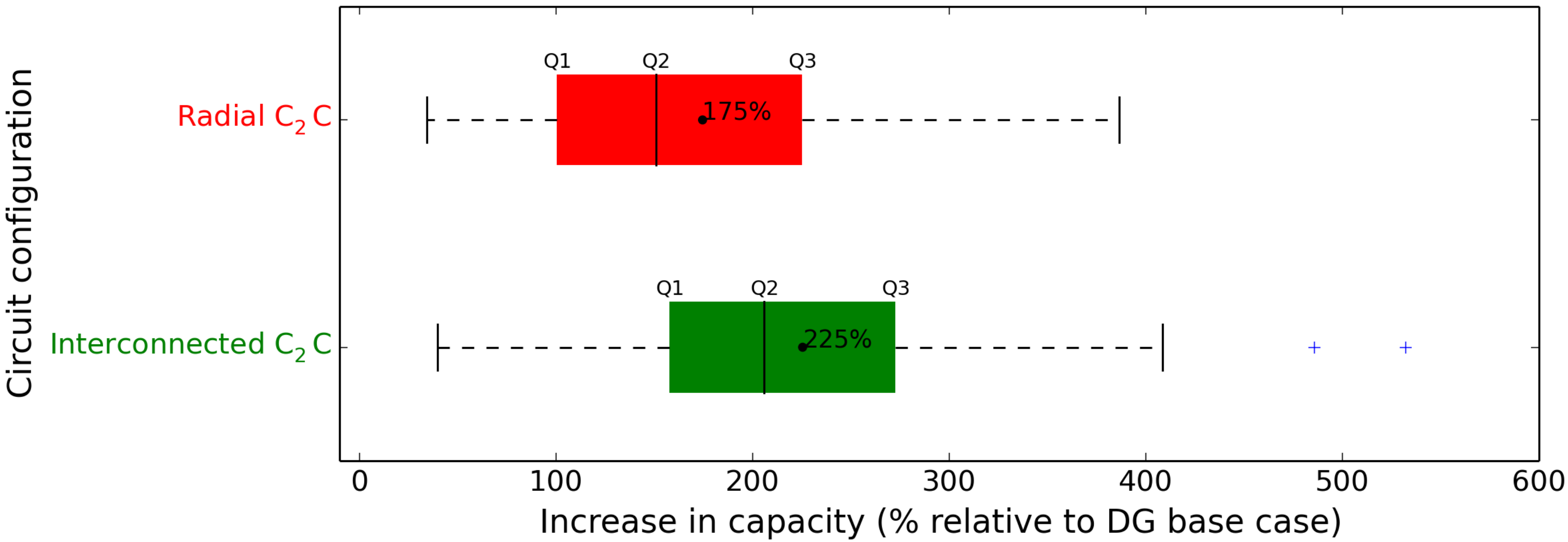
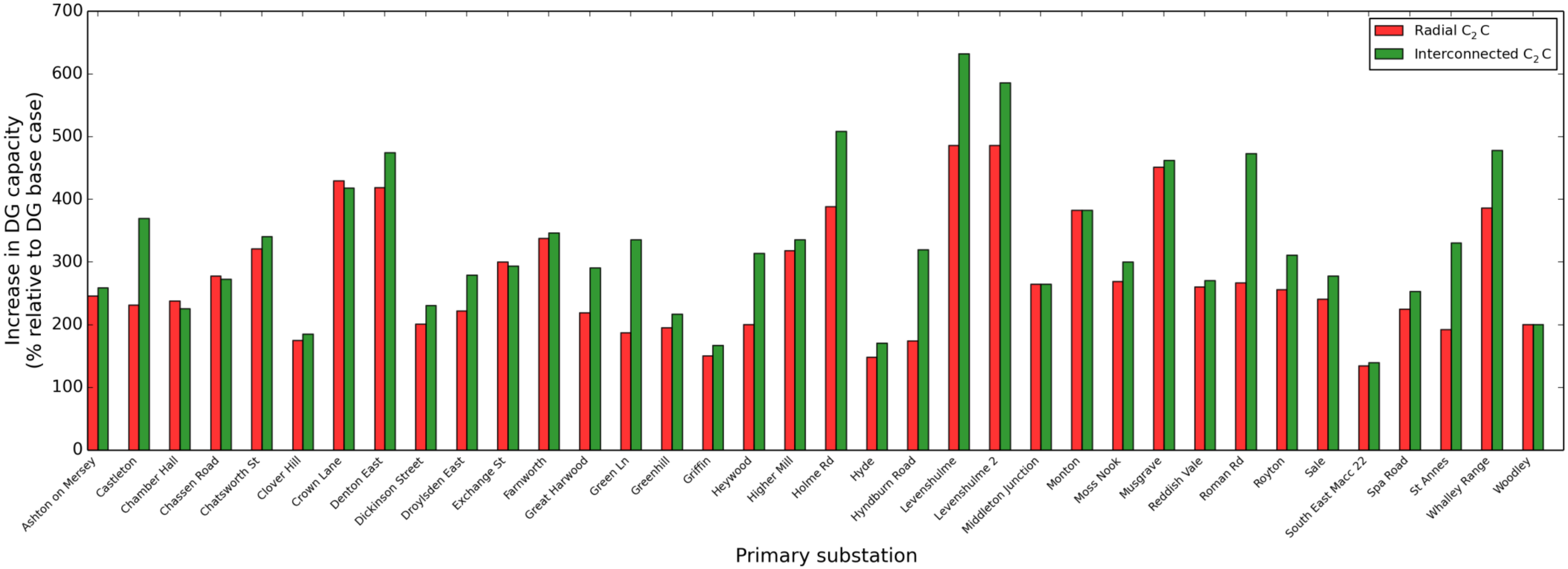


C_2C DG capacity



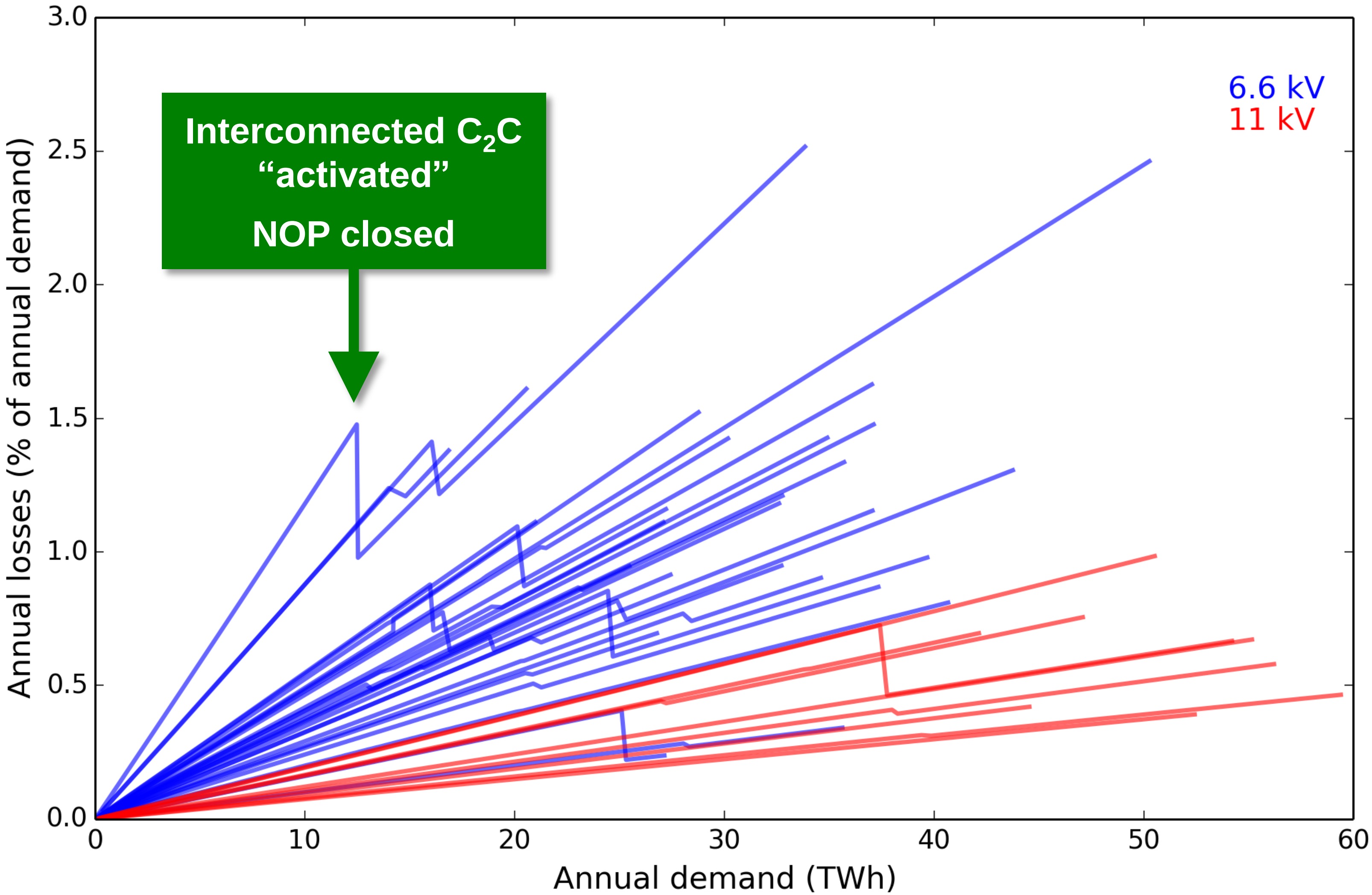
C_2C DG capacity



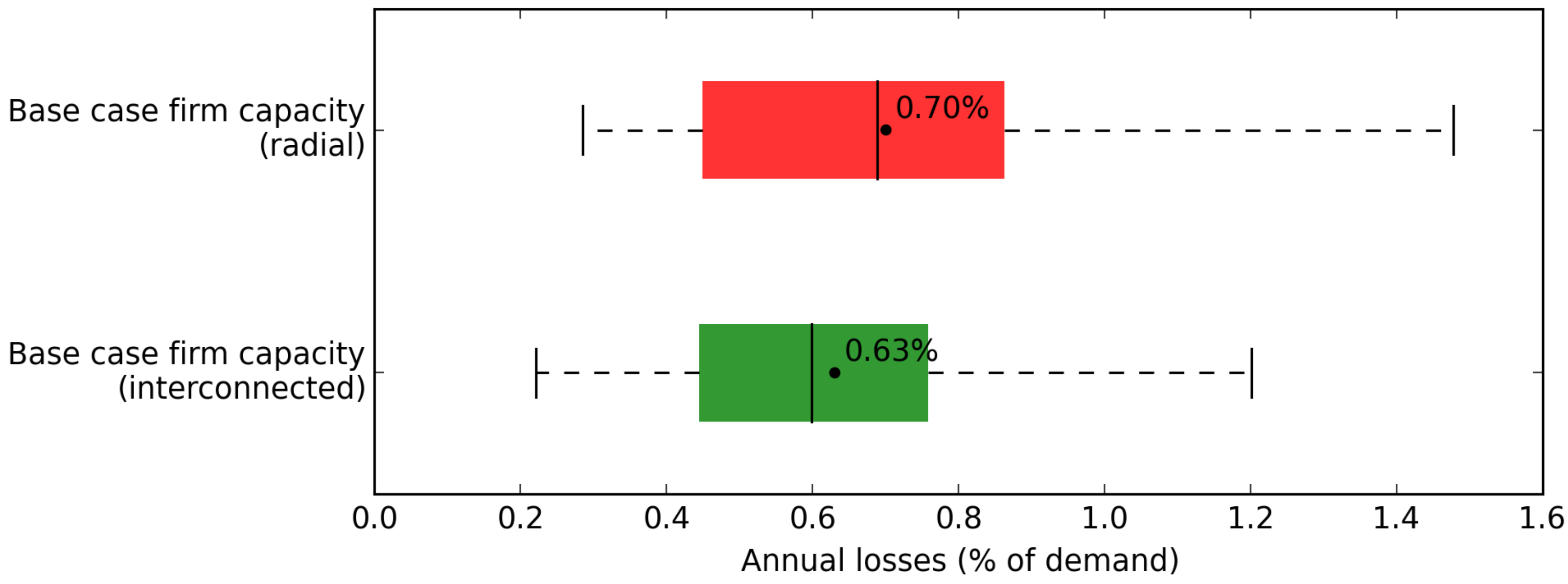
Average increase in DG capacity:

+ 175% radial
+ 225% interconnected

Losses – as demand increases



Losses – effect of network configuration



Losses – summary of results (for maximum connected demand)

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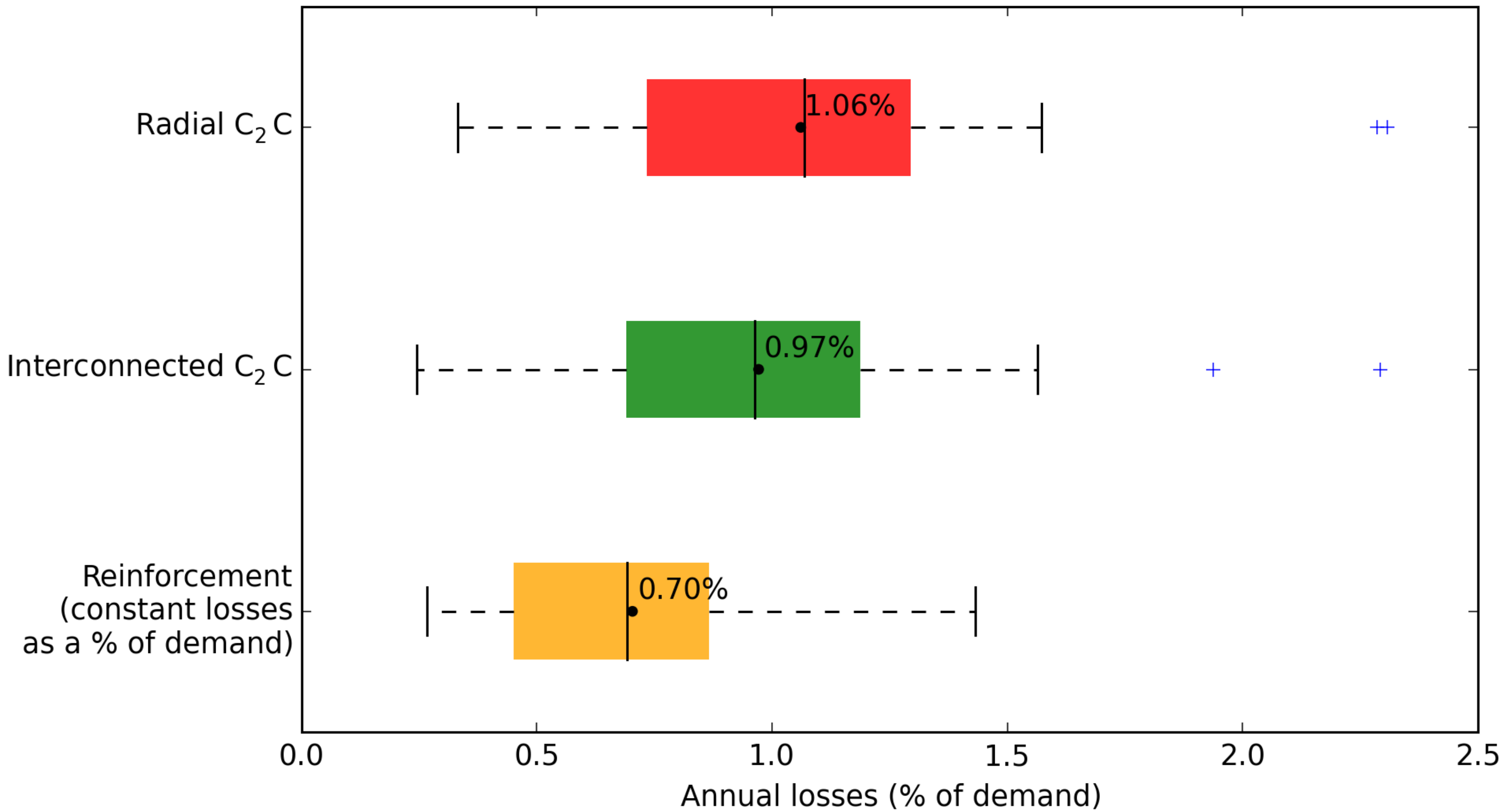
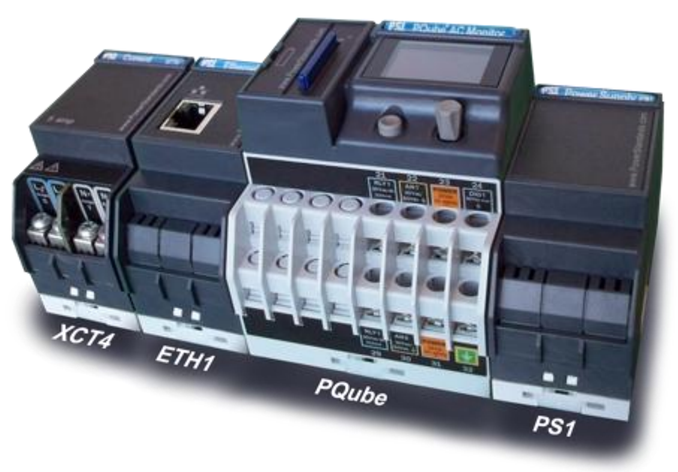


Power quality monitoring



77 "PQube" devices installed for C_2C trial

Three-phase voltage and current measurements

THD and flicker

Objectives

- Validate data
- Compare radial vs. interconnected operation
- Can C_2C operation affect power quality?

Quantifying impact of C_2C on power quality

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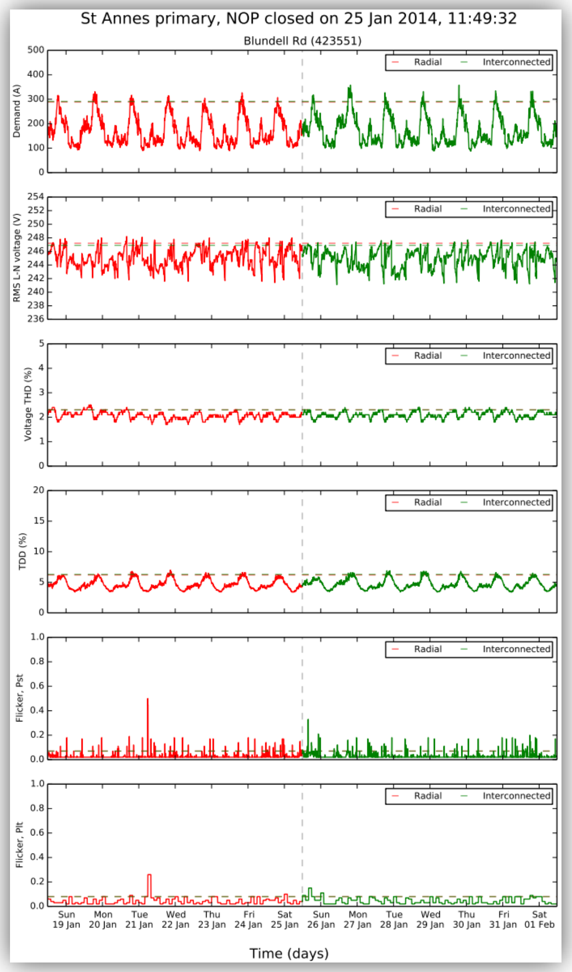
Validate time synchronisation

Find observation windows for fair comparison

Ensure data windows are complete



C_2C: change in power quality?

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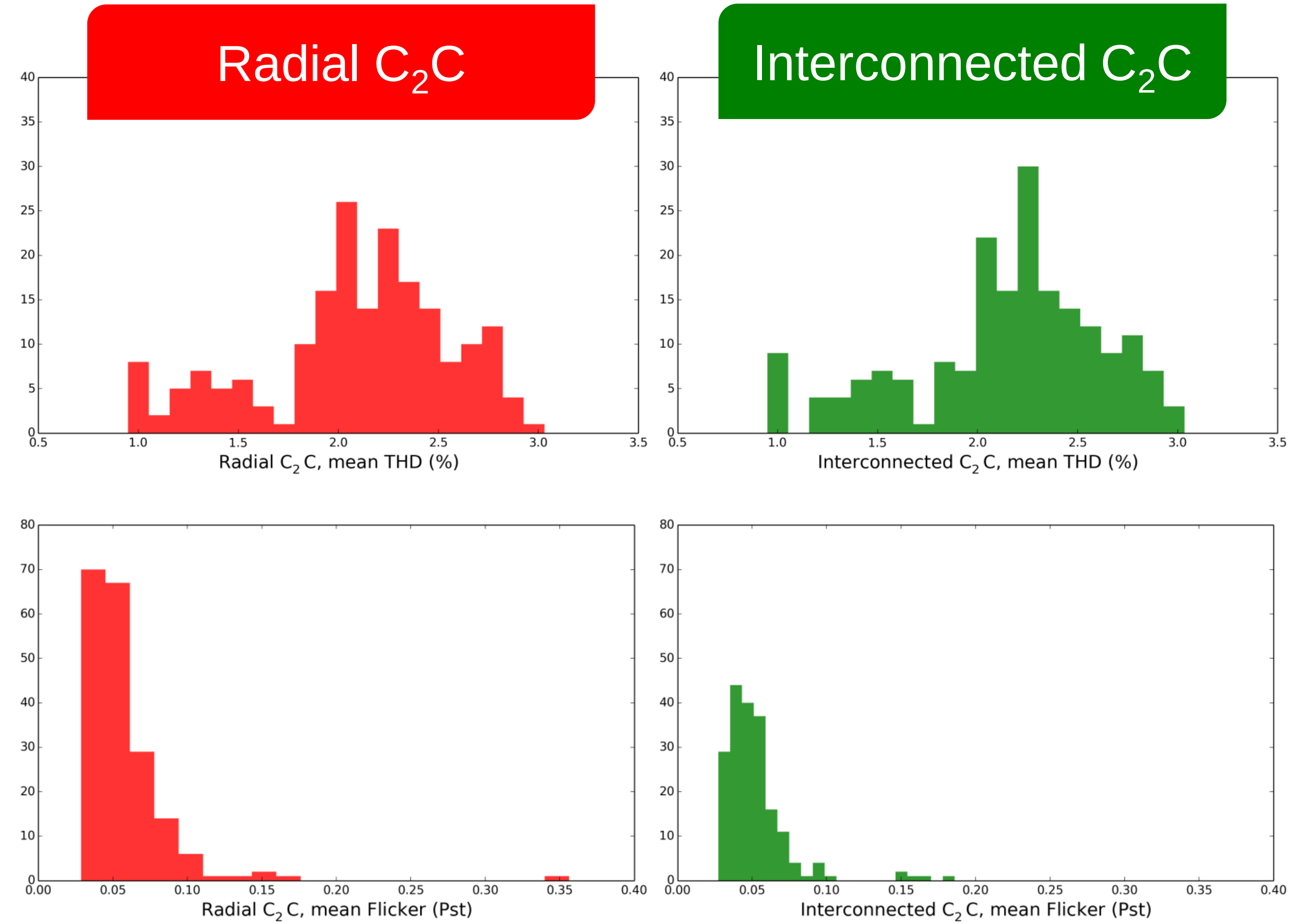
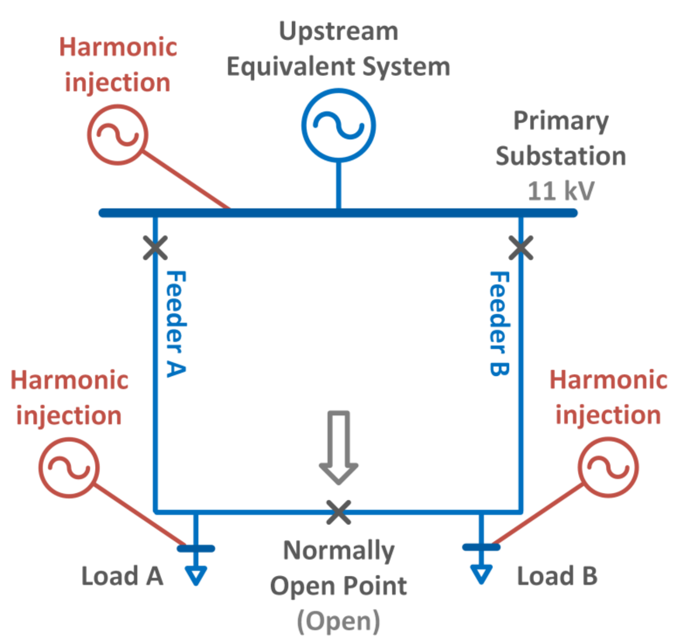
THD

Flicker (Pst)



Minor impact on THD and flicker

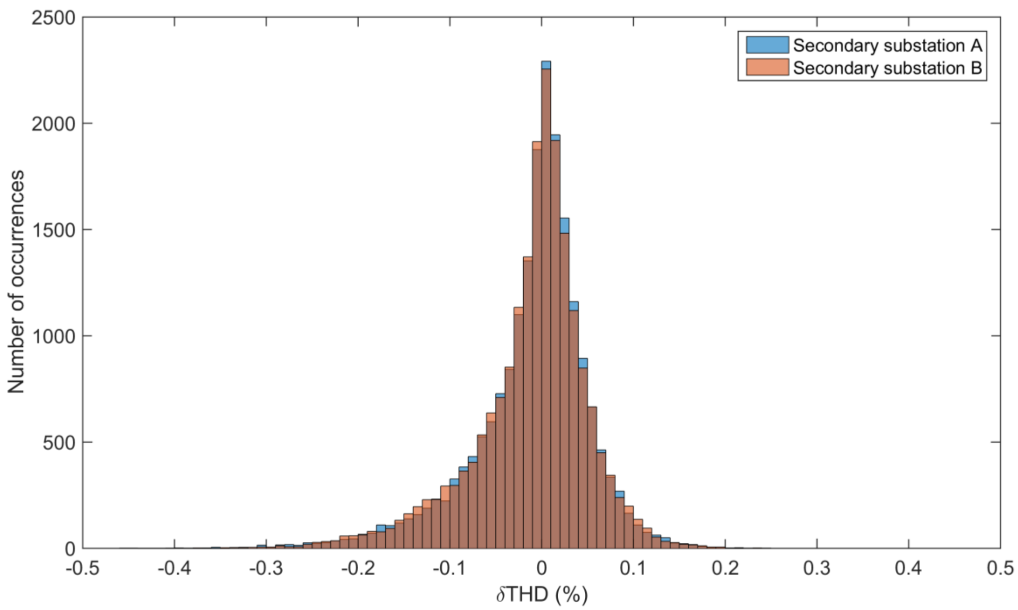
Change in THD: theoretical results



Monte Carlo simulations

Randomised:

- Feeder impedances
- Harmonic injection
- Demand



Fault levels for C_2C operation

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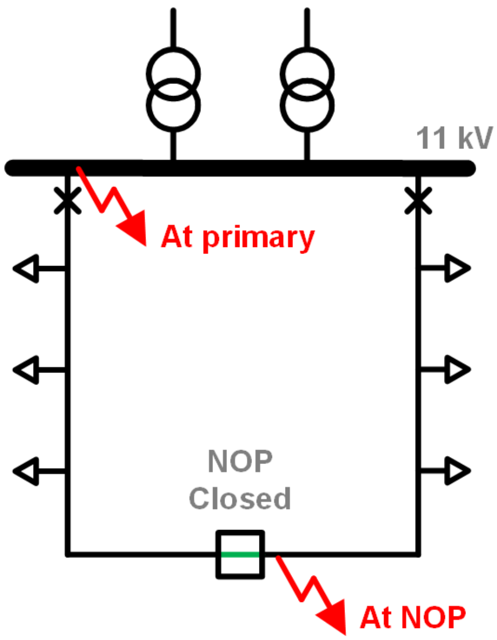
Three causes of potential increase in fault level:



Fault-contributing demand growth (motors)

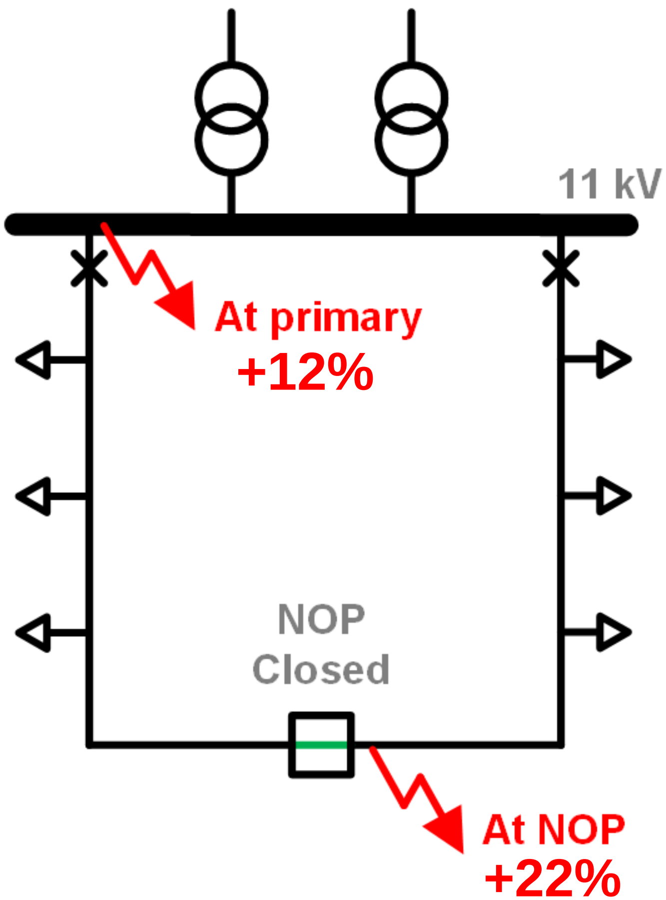
DG growth

Interconnection – reduced fault path impedance

Must investigate increase at:

- Primary substations
- NOPs

Fault level increase



Interconnected operation	**~1%** at primary **~12%** at NOP
C_2C adds, at most	**+12%** at primary **+22%** at NOP
As of 2014, most circuits at	**60%** of design rating at primary **10-50%** of design rating at NOP
HV design fault level	250 MVA

Conclusions

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Up to 66% increase in demand capacity

Up to 225% increase in DG capacity

Interconnected C_2C operation generally releases more capacity than Radial C_2C

Reduction due to Interconnected C_2C operation

Maximum ~0.3% increase in losses (as % of demand)

C_2C has very little observable impact on power quality

Fault levels are unlikely to constrain C_2C adoption

Results depend significantly on circuit topology and load/DG locations

There are no “typical” circuits

Visualisation of C_2C monitoring data

http://c2c.eee.strath.ac.uk/

Eduardo Martinez-Cesena
University of Manchester

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Objectives and outline

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Objectives		Outline
Present the developed distribution network expansion assessment framework and underlying results	Highlight the conditions that allow C_2C to be applied	**Background**: Traditional distribution planning and the C_2C method
		Investment assessment: Ofgem's CBA framework
		Methodology: Proposed CBA framework
		Results: The 36 TRIAL networks

Current distribution planning paradigm

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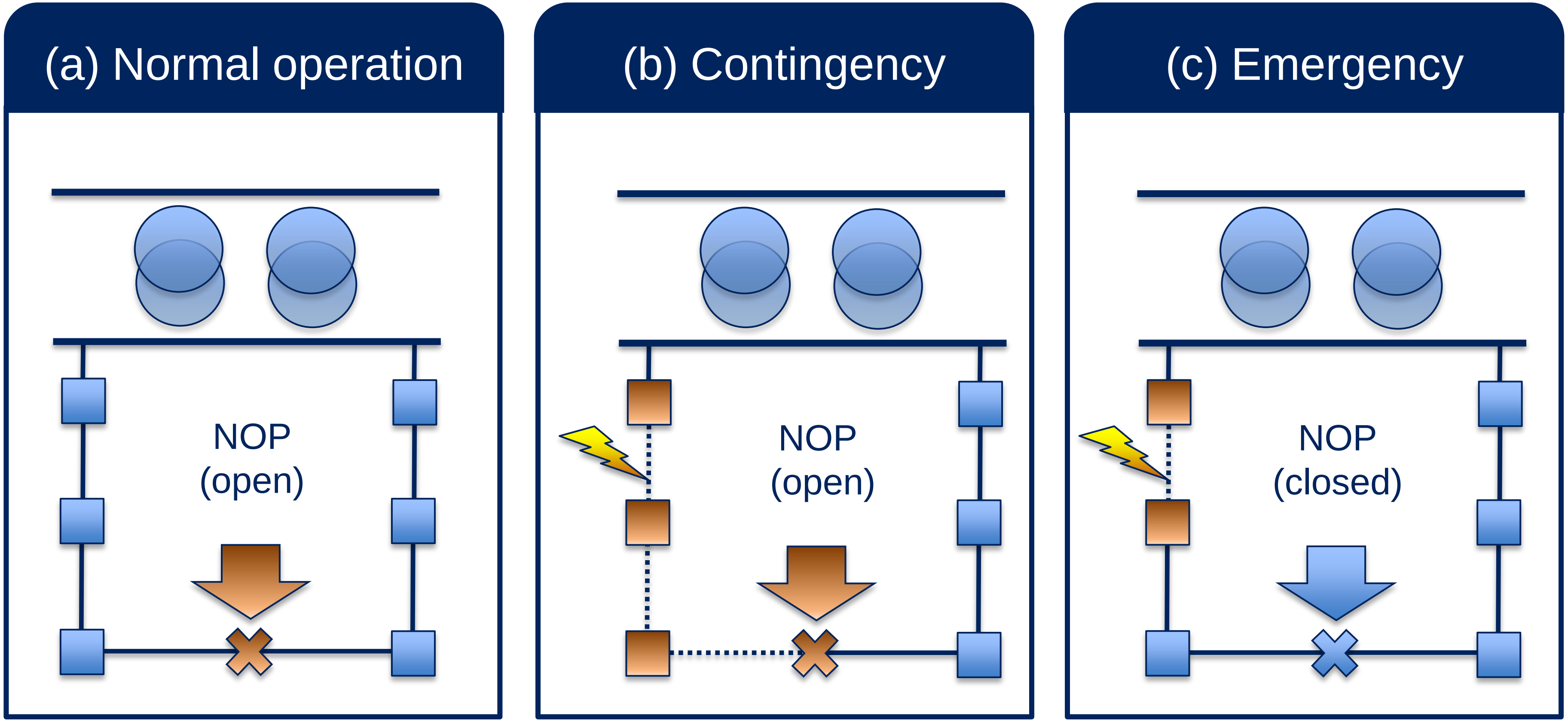
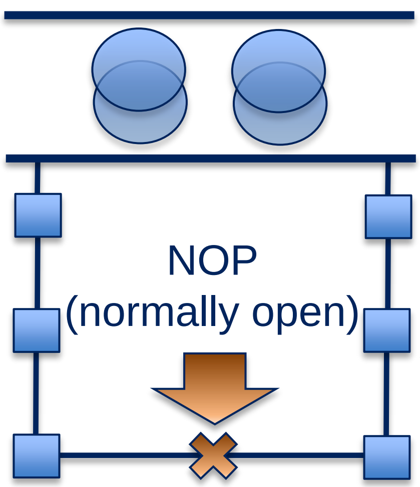


Traditional practices lead to costly investments in spare capacity to comply with security criteria ● This spare capacity is seldom used

The C_2C method – overview

Traditional

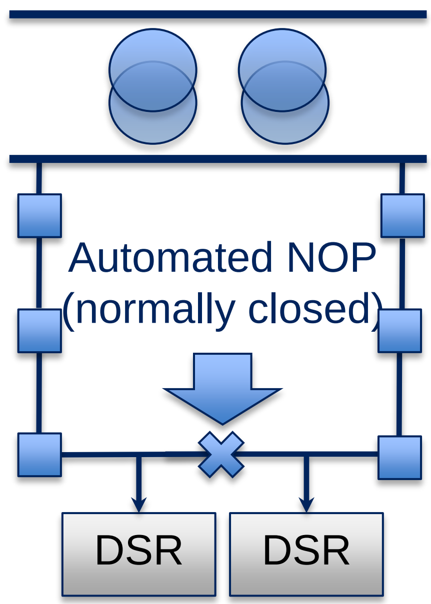


Loads:
Inflexible

Constraints:
Preventive security
Thermal
Voltage

Expectations:
–

C_2C



Loads:
Inflexible
Interruptible

Constraints:
Corrective security
Thermal
Voltage

Expectations:
Increased capacity
Lower CI and CML
Reduced power losses

The C_2C method facilitates the evolution from passive and preventive to active and corrective distribution networks

CBA – Overview and drawbacks

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Ofgem released a Cost Benefit Analysis (CBA) framework for the assessment investments at the distribution level

Facilitates consistent assessment and comparison of different investment options, such as reinforcements and the C_2C method

CBA is deterministic

Assessment is dependent on scenario characteristics of the solution objectives

No systematic approach to formulate a baseline or other investment strategies is provided

CBA methodology – generalities

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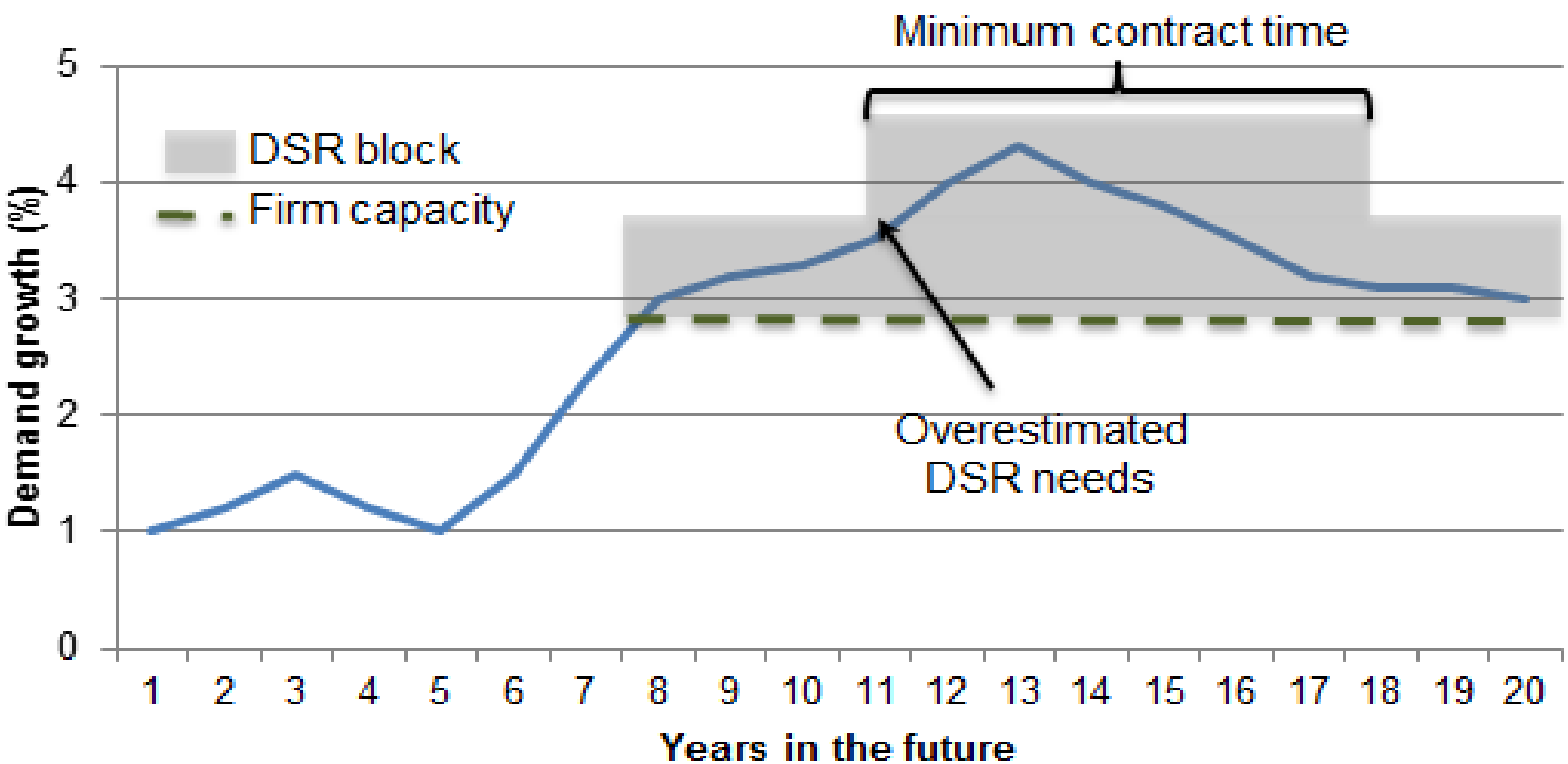
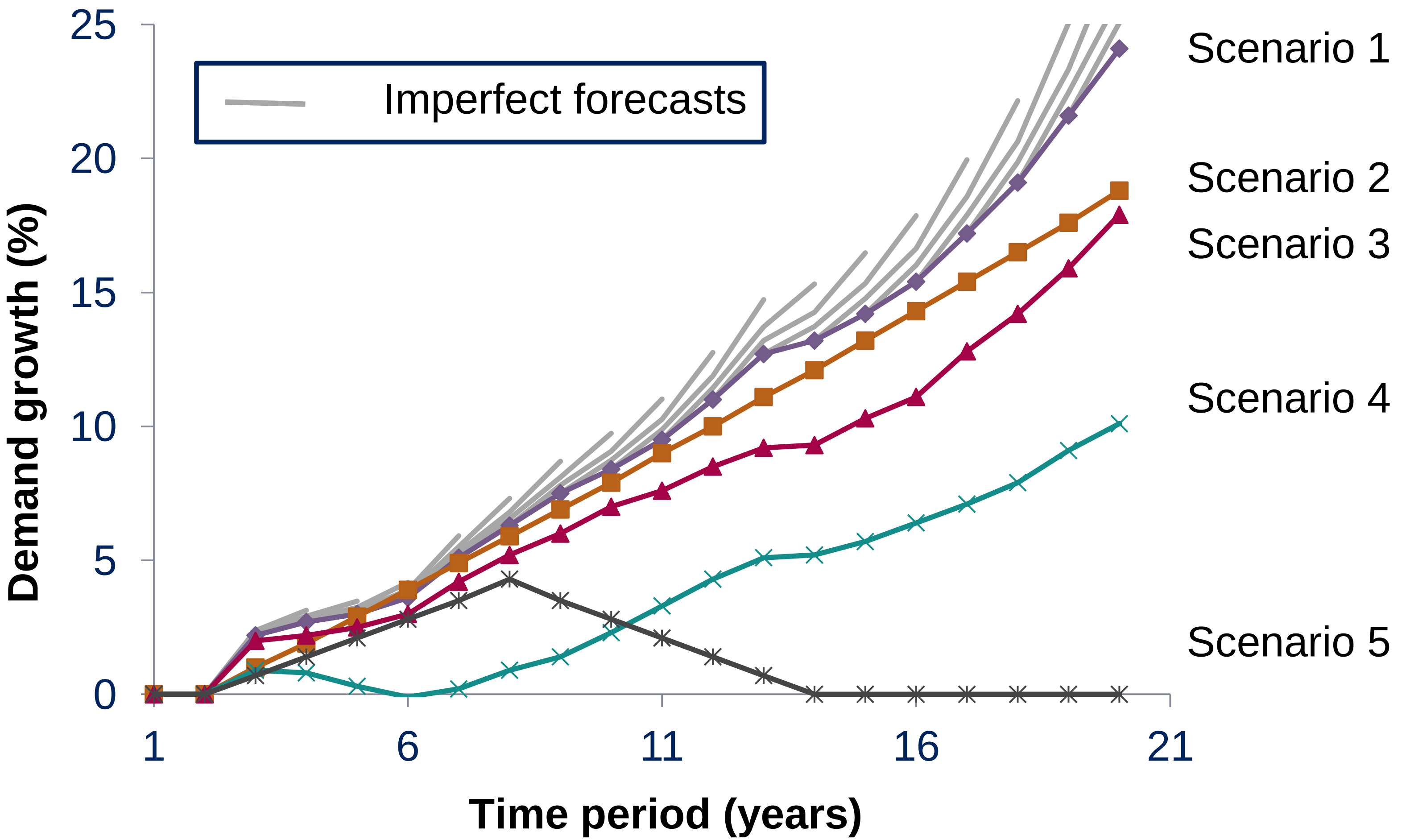
The proposed approach is based on Ofgem's CBA, detailed DSR models, demand growth scenarios and bespoke simulation and optimisation engines



Methodology – Imperfect forecasts



Simulated investment strategies

Baseline

Traditional line and substation reinforcements needed whenever firm capacity is approached

C_2C

Closure of NOP and investments in network automation and DSR needed to defer or avoid investments recommended by the baseline and traditional reinforcements only when DSR has been exhausted

Optimised investment strategies

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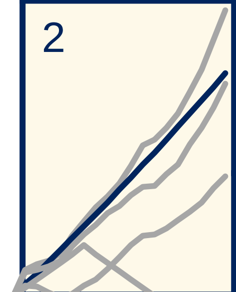
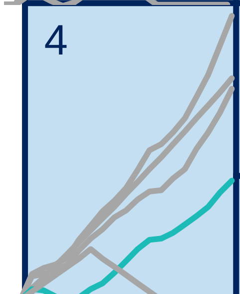
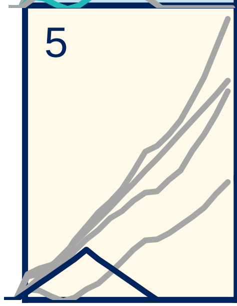
NPC_I	NPC_{I+S}
OSI (Optimal investment Scheme based on the NPC_I): Optimal combinations of traditional line and substation reinforcements and C_2C interventions to minimise investment costs	**OSS (Optimal investment Scheme based on the NPC_{I+S}):** Optimal combination of traditional line and substation reinforcements and C_2C interventions to minimise investment and social costs

Simulation and optimisation engines

Scen.	Baseline		C$_2$C		OSI		OSS	
	Upgrade	Year	Upgrade	Year	Upgrade	Year	Upgrade	Year
2 	Line1-2 Substation Line2-3	4 5 15	C_2C Substation Line1-2	5 17 17	C_2C Line1-2 Substation	5 17 17	C_2C Line1-2 Substation	1 17 17
	NPC_I:669 k£ *NPC_{I+S}:1265 k£*		*NPC_I:623 k£* *NPC_{I+S}:1053 k£*		*NPC_I:**606** k£* *NPC_{I+S}:1232 k£*		*NPC_I:626 k£* *NPC_{I+S}:**1021** k£*	
4 	Line1-2 Substation	9 10	C_2C	10	C_2C	10	C_2C	1
	NPC_I:452 k£ *NPC_{I+S}:1039 k£*		*NPC_I:241 k£* *NPC_{I+S}:712 k£*		*NPC_I:**226** k£* *NPC_{I+S}:853 k£*		*NPC_I:247 k£* *NPC_{I+S}:**645** k£*	
5 	Line1-2	5	C_2C	6	C_2C	6	C_2C	1
	NPC_I:227 k£ *NPC_{I+S}:780 k£*		*NPC_I:55 k£* *NPC_{I+S}:468 k£*		*NPC_I:**39** k£* *NPC_{I+S}:632 k£*		*NPC_I:59 k£* *NPC_{I+S}:**428** k£*	

C_2C study results

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All demand profiles were scaled up to trigger line reinforcements after an additional 3% demand growth

The substation is assumed to have a headroom of 3%, 8%, 18% and 40%

Line reinforcement costs were assumed to be 100%, 50% and 25% of their calculated value

DSR availability was assumed to be 1, 2 or 5 blocks (0.5 MW each block)

Assessment of the 36 trial networks

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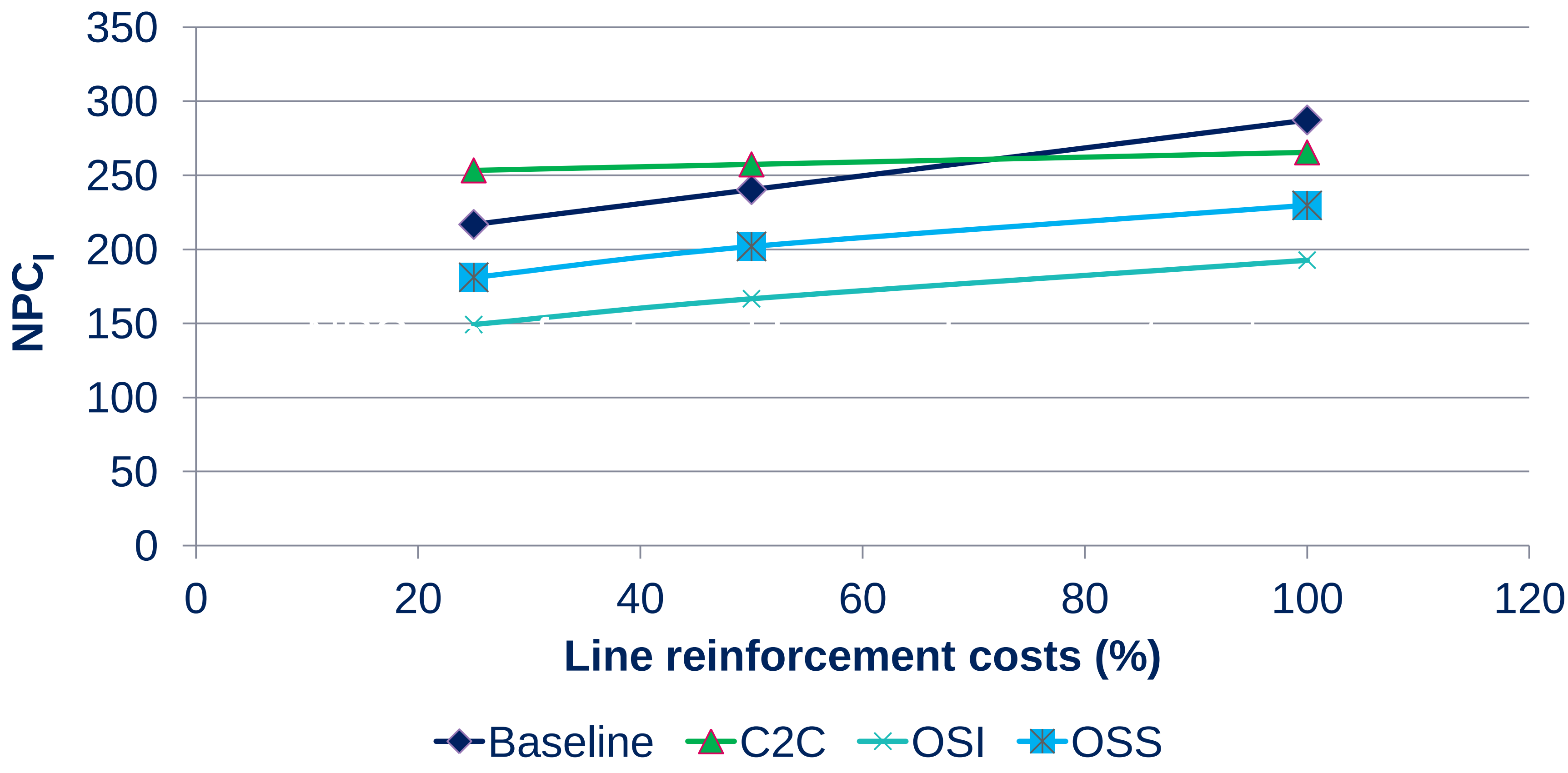
NPC$_l$ as a function of line reinforcement costs



Assessment of the 36 trial networks

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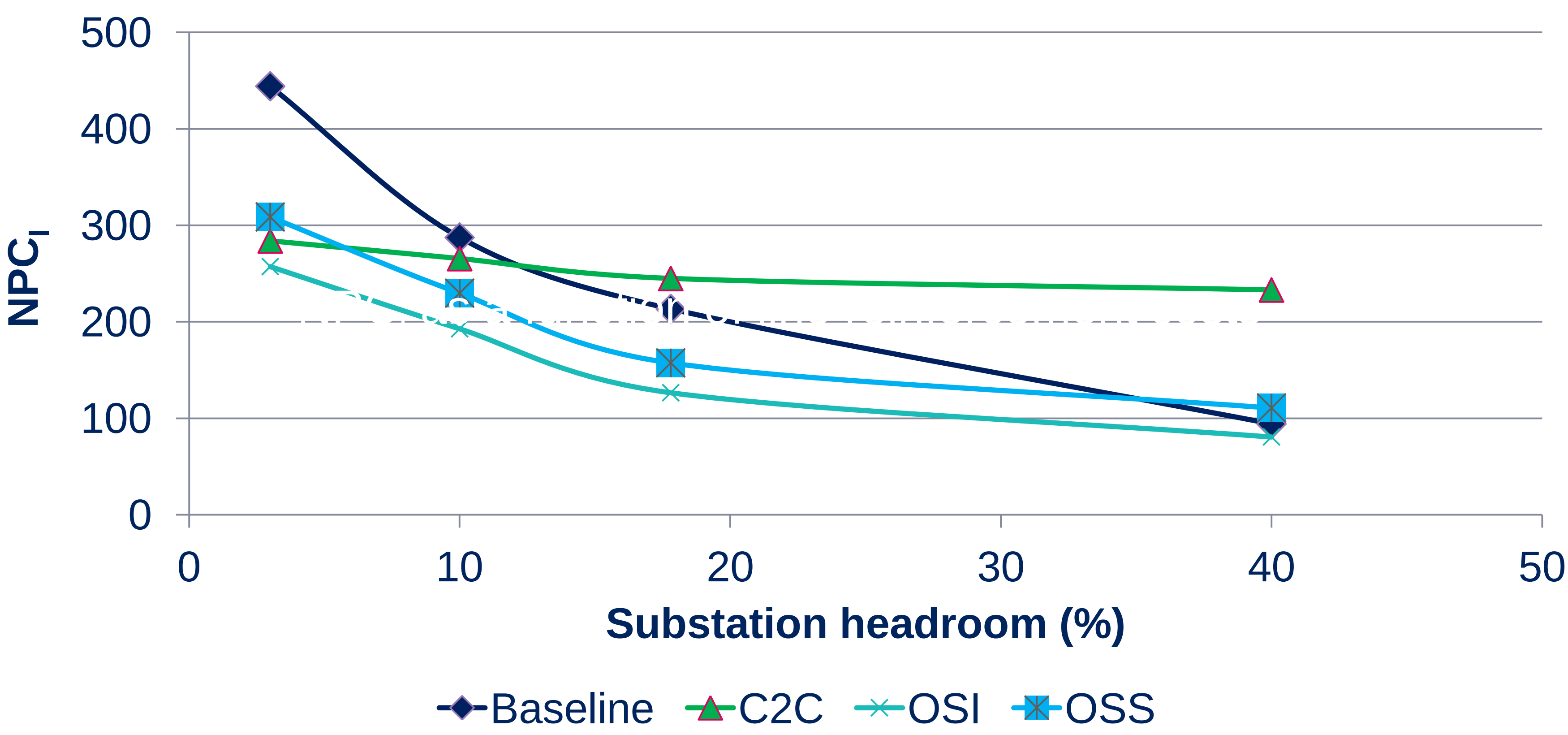
NPC_l as a function of substation headroom



Assessment of the 36 trial networks

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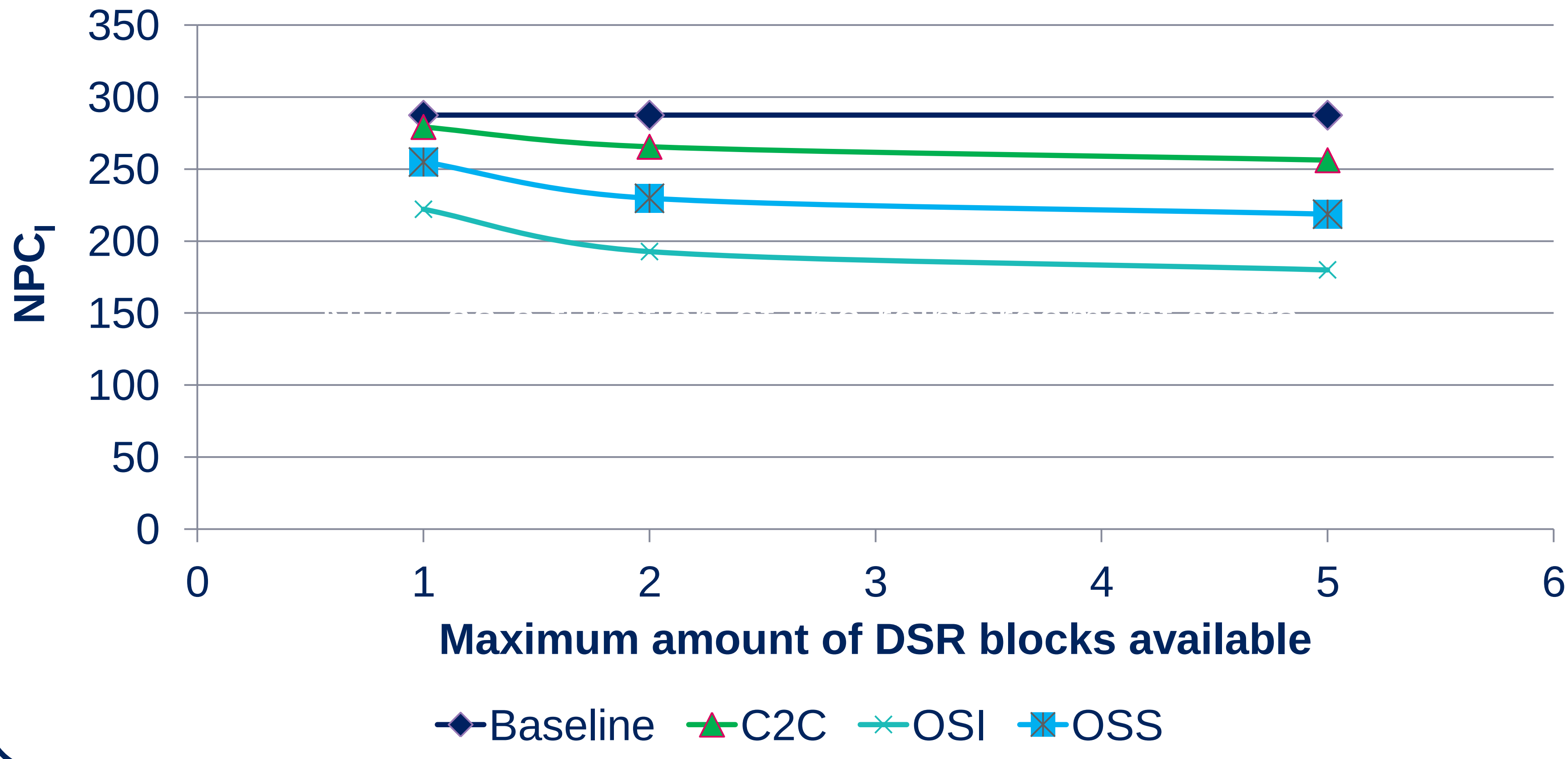
NPC$_l$ as a function of DSR availability



Concluding remarks

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C_2C based investment strategies tend to outperform the baseline when reinforcement costs are significant and, particularly, when a substation reinforcement is nigh

The optimised investment strategies (ie, OSI and OSS) tend to outperform other strategies in most cases by combining C_2C an traditional interventions

Under the baseline assumptions, the C_2C based and optimised strategies generally outperform the baseline by 14% NPC_I (6% NPC_{I+S}) and 33% NPC_I (30% NPC_{I+S}), respectively

Assessment of the 36 trial networks

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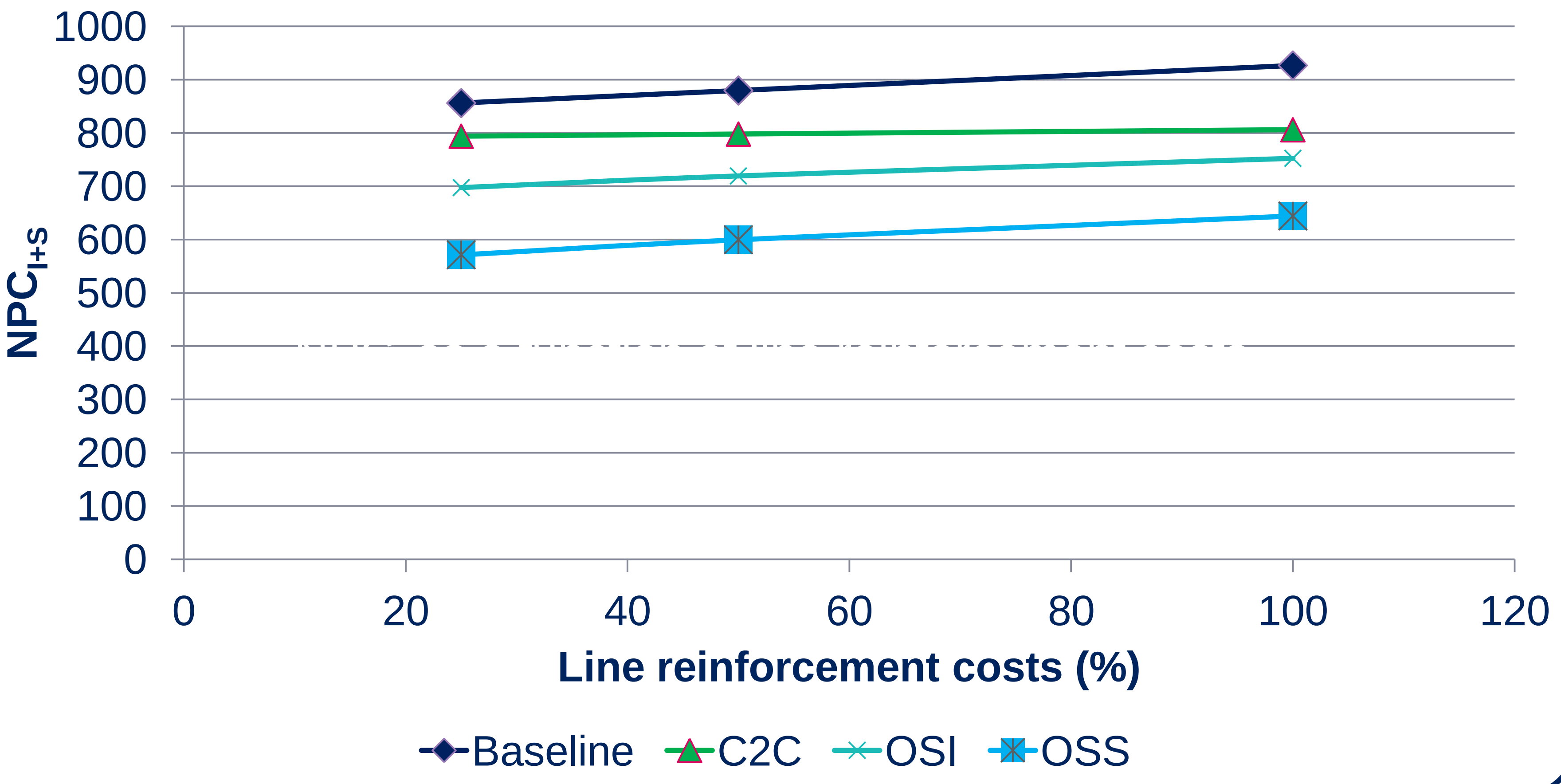
NPC$_{I+S}$ as a function of line reinforcement costs



Assessment of the 36 trial networks

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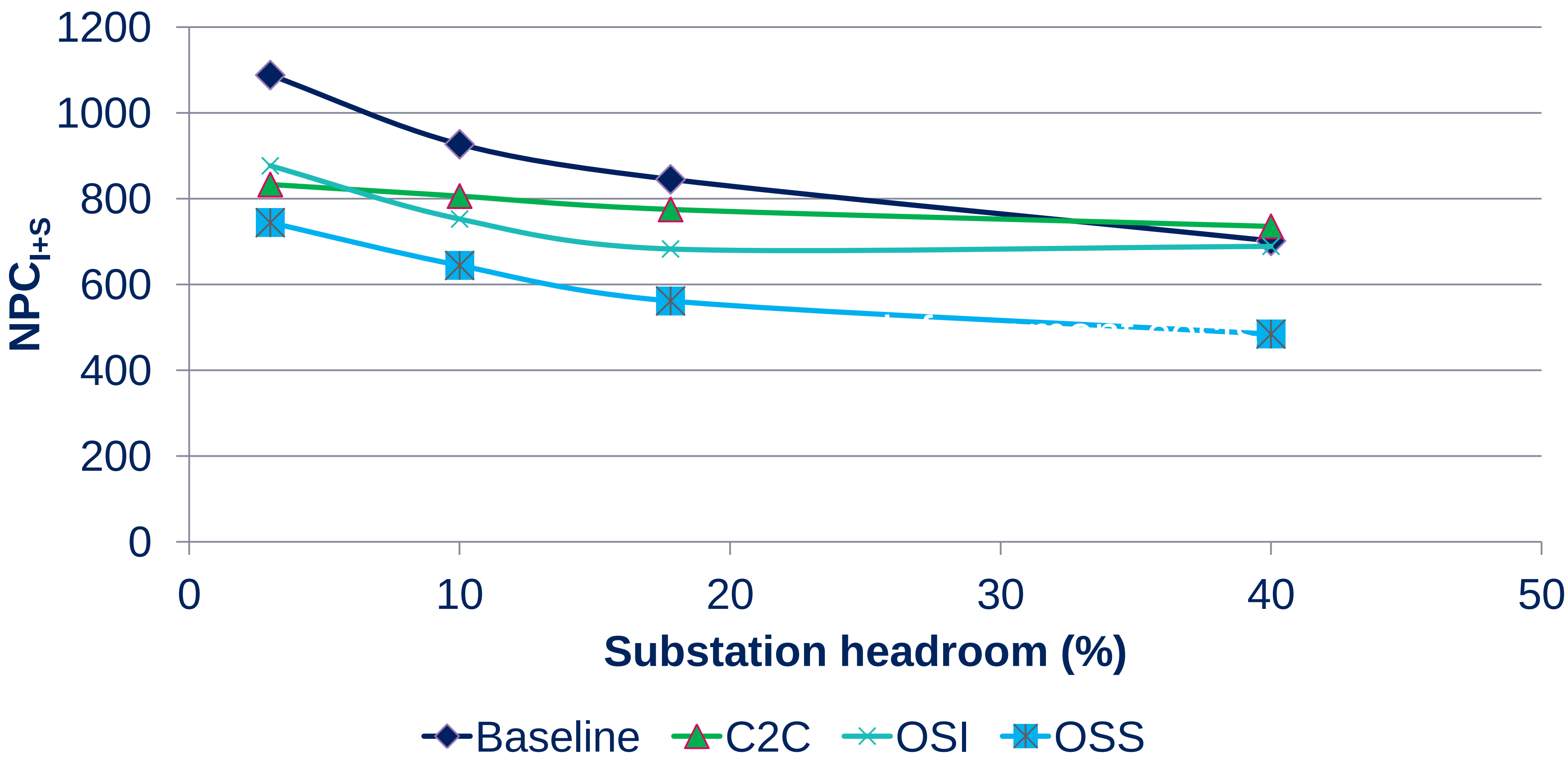
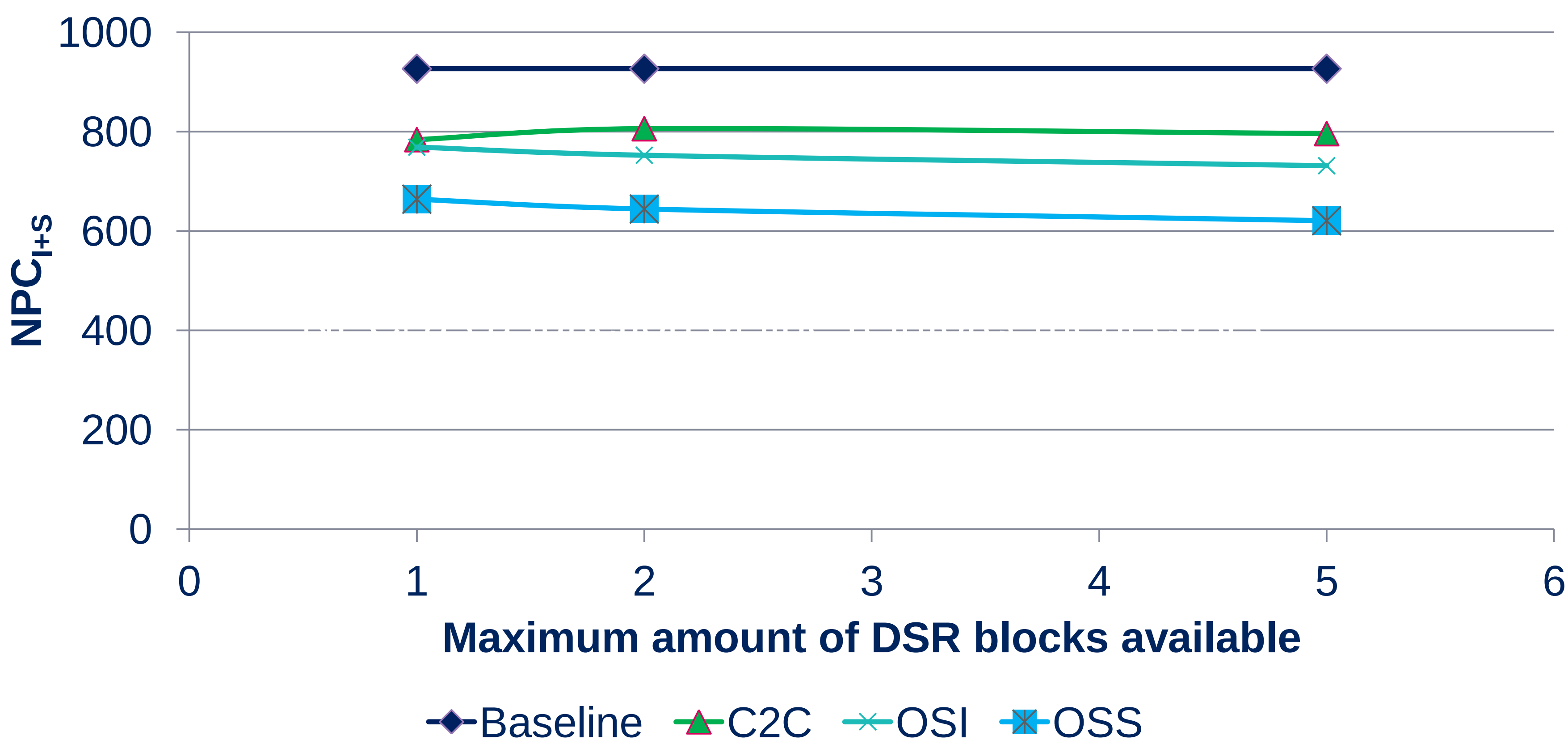
NPC_{I+S} as a function of substation headroom



Assessment of the 36 trial networks

NPC$_{I+S}$ as a function of DSR availability



John Broderick
The Tyndall Centre

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What are the carbon impacts of C_2C?

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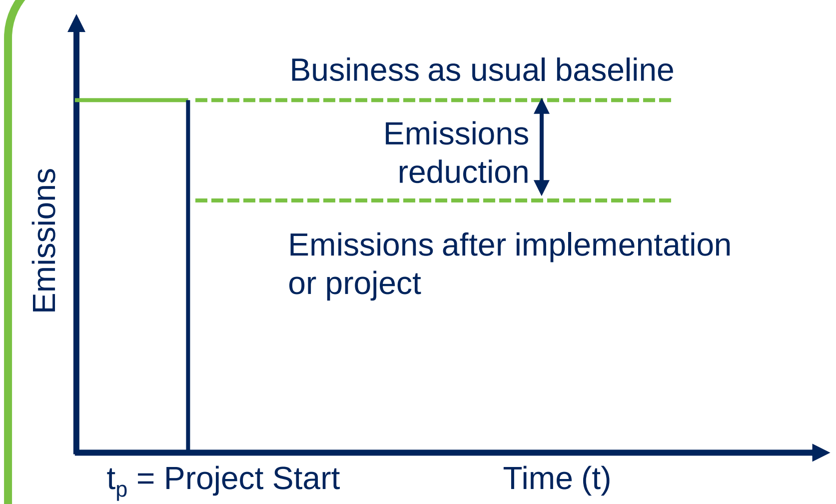
Increased network capacity key to decarbonising UK energy systems

What does C_2C offer over traditional reinforcement?



CO_2

Approach based on UN Clean Development Mechanism

$$CI = \sum_{y=0}^{45} BE_y - C2CE_y$$

Headlines

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C_2C substantially reduces the immediate carbon impact of additional network capacity, potentially up to 250 tCO2e per circuit

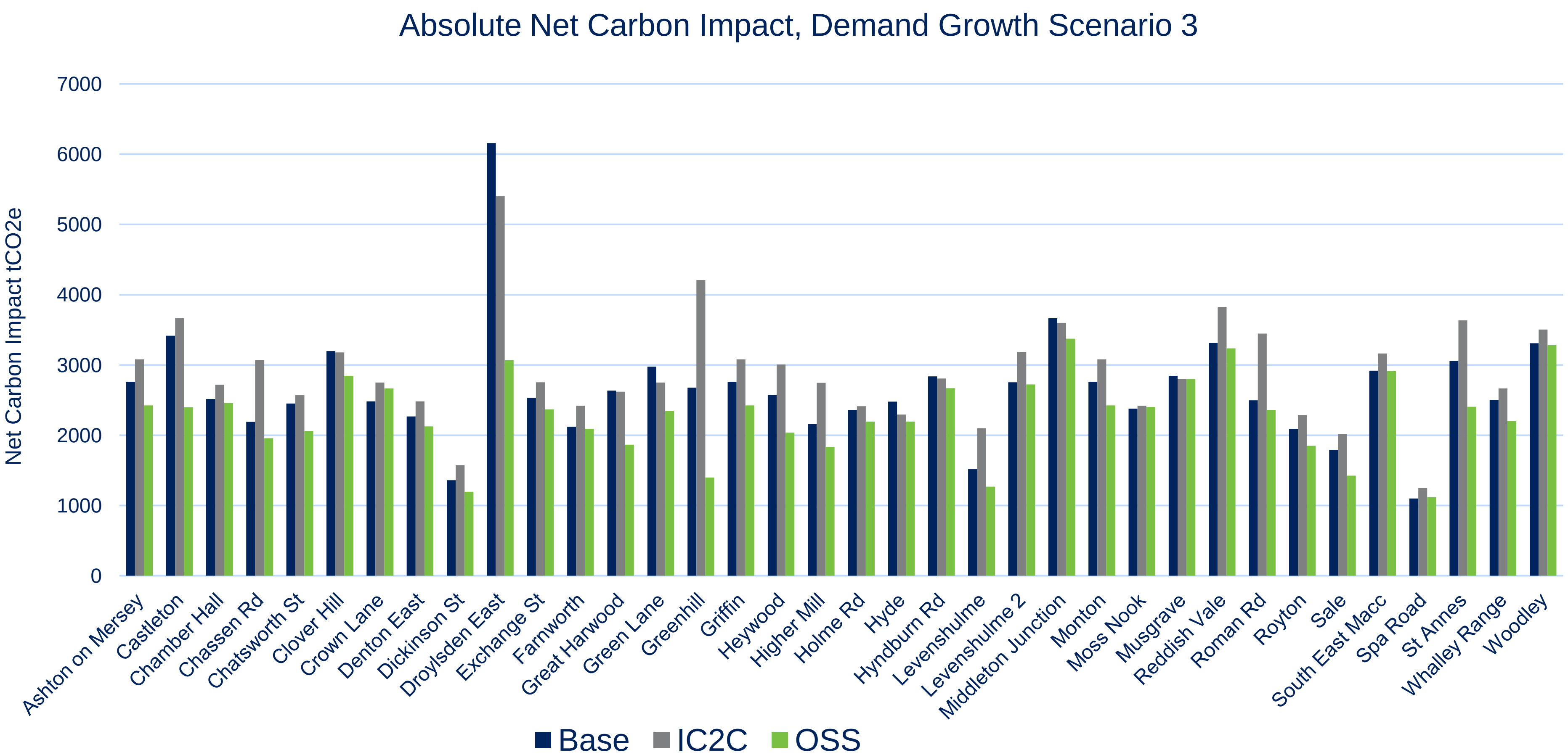
Optimum reinforcement with a combination of C_2C and traditional asset upgrades would be least cost and deliver a lower carbon system than C_2C alone

Savings of up to 55% of carbon impact over a 45 year time frame observed in some circuits, although median benefit is ~10%

Facilitated reductions can be substantial but are usually smaller than benefit of losses reduction

Net carbon impact

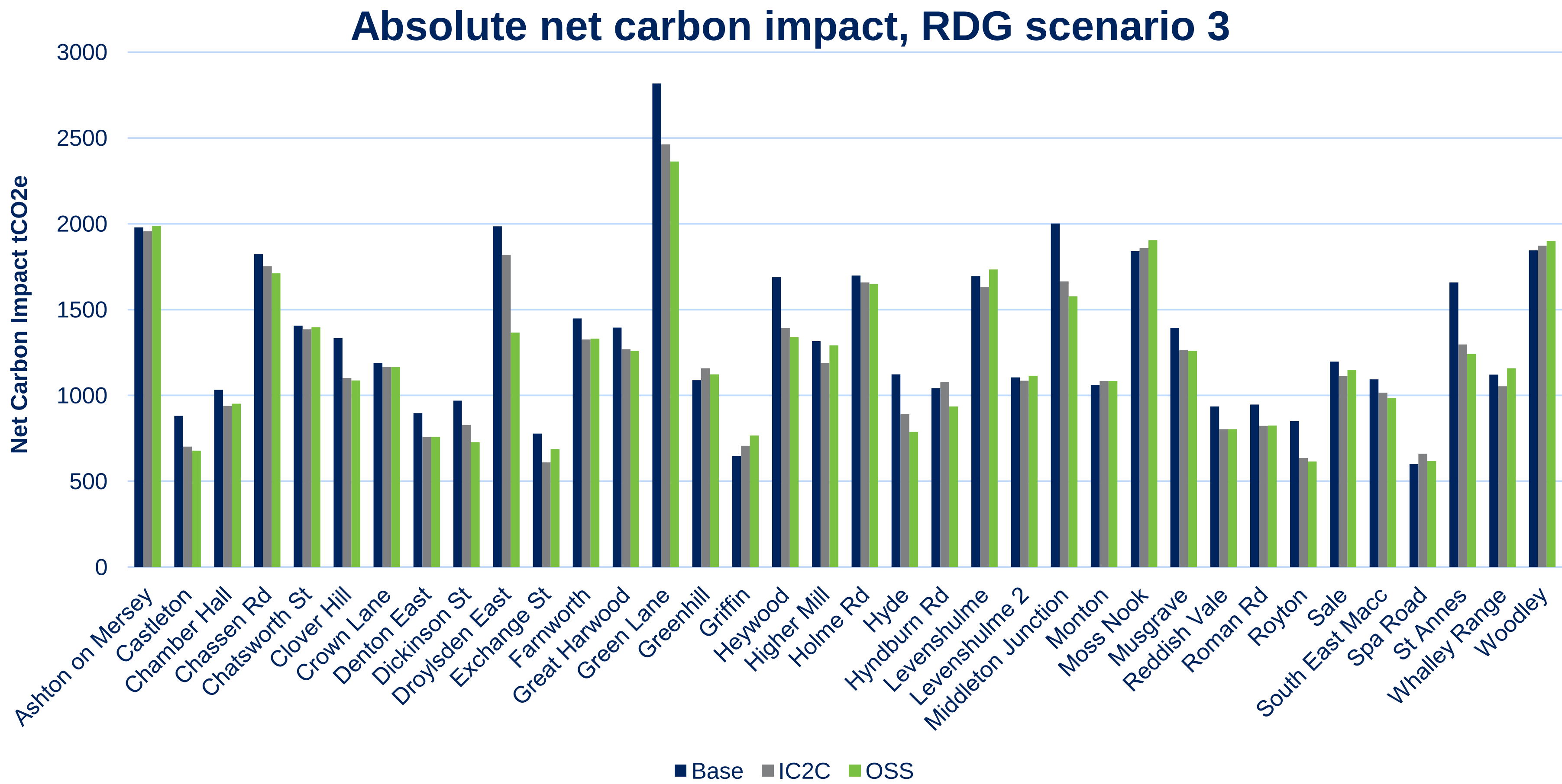
Emissions impacts (reductions and increases) over 45 year period are modest, typically ±10%, and vary substantially between circuits



Net carbon impact

Impacts are lower if reinforcement is assumed to be driven by the growth of renewable DG

The C_2C method is more beneficial in these circumstances



What are the carbon impacts of C_2C?

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Scope and classification of impacts	Adopt GHG Protocol core principles for calculating emissions reductions
"Asset carbon" discrete measure of emissions embodied in materials and construction	Relevance
	Completeness
"Operational carbon" continuous measure of indirect emissions from changes in losses, related to the UK grid carbon intensity	Consistency
	Transparency
"Facilitated reductions" indirect effects on low carbon generators or consumers due to quicker release of capacity	Accuracy

What are the carbon impacts of C_2C?

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Calculation approach and data sources

Assets	Operations	Facilitated reductions
Trial customer quotations indicate type of assets used in each example Databases for emissions factors: Bath University ICE v2.0, EcoInvent v2.2, Institute of Civil Engineers (ICE) CESMM3 Carbon & Price Guidebook (2011) Cost Benefit Analysis modelling for network reinforcement under multiple scenarios	Network power flow modelling for quantities of losses OfGEM, DECC and National Grid Future Energy Scenarios for grid emissions factor	Assumptions on low carbon technology performance from literature

Asset carbon findings

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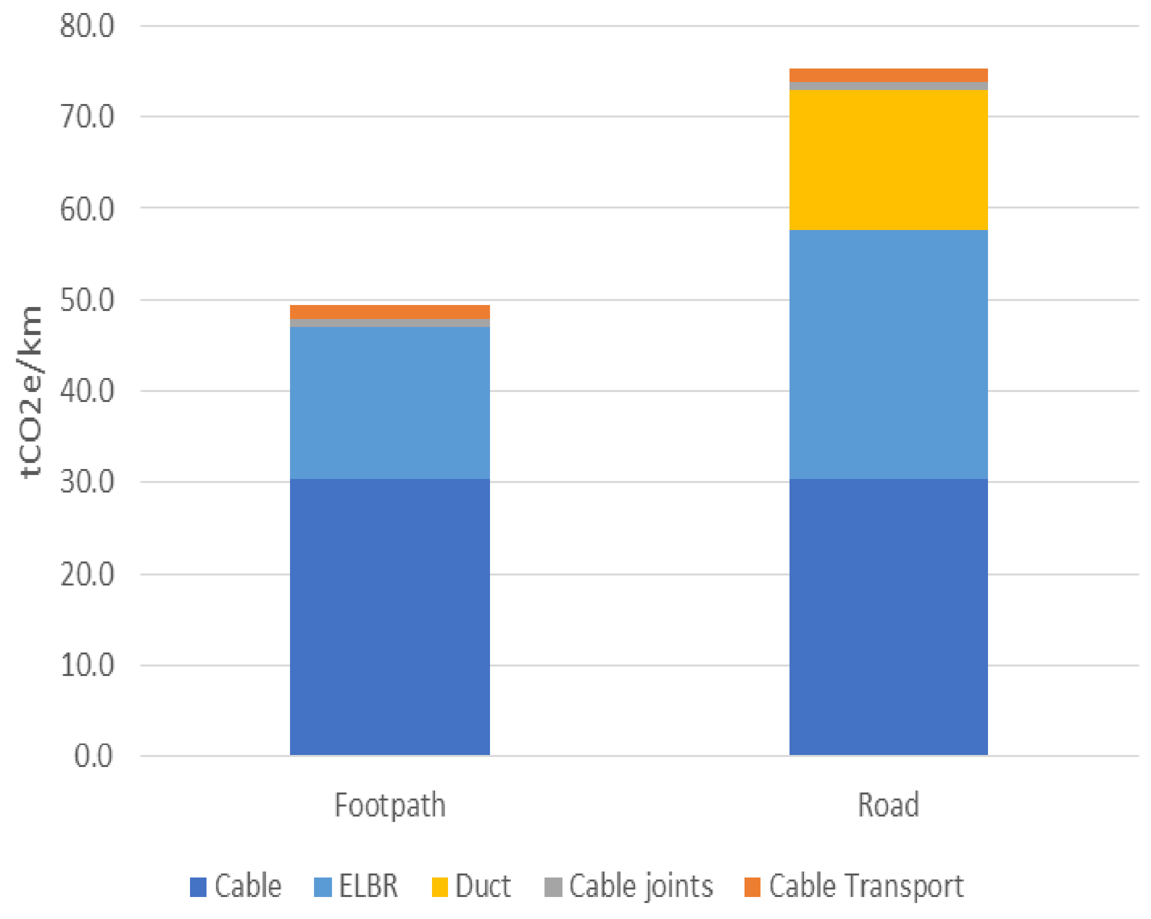
Cable is not the only source of asset carbon in network reinforcement

Emissions from civil works are overlooked but substantial, especially when under carriageways

Impacts are at least seven times greater than Turconi et al's estimate of ~7 tCO_2e/km

GHG emissions per km HV cable installed



Asset carbon findings

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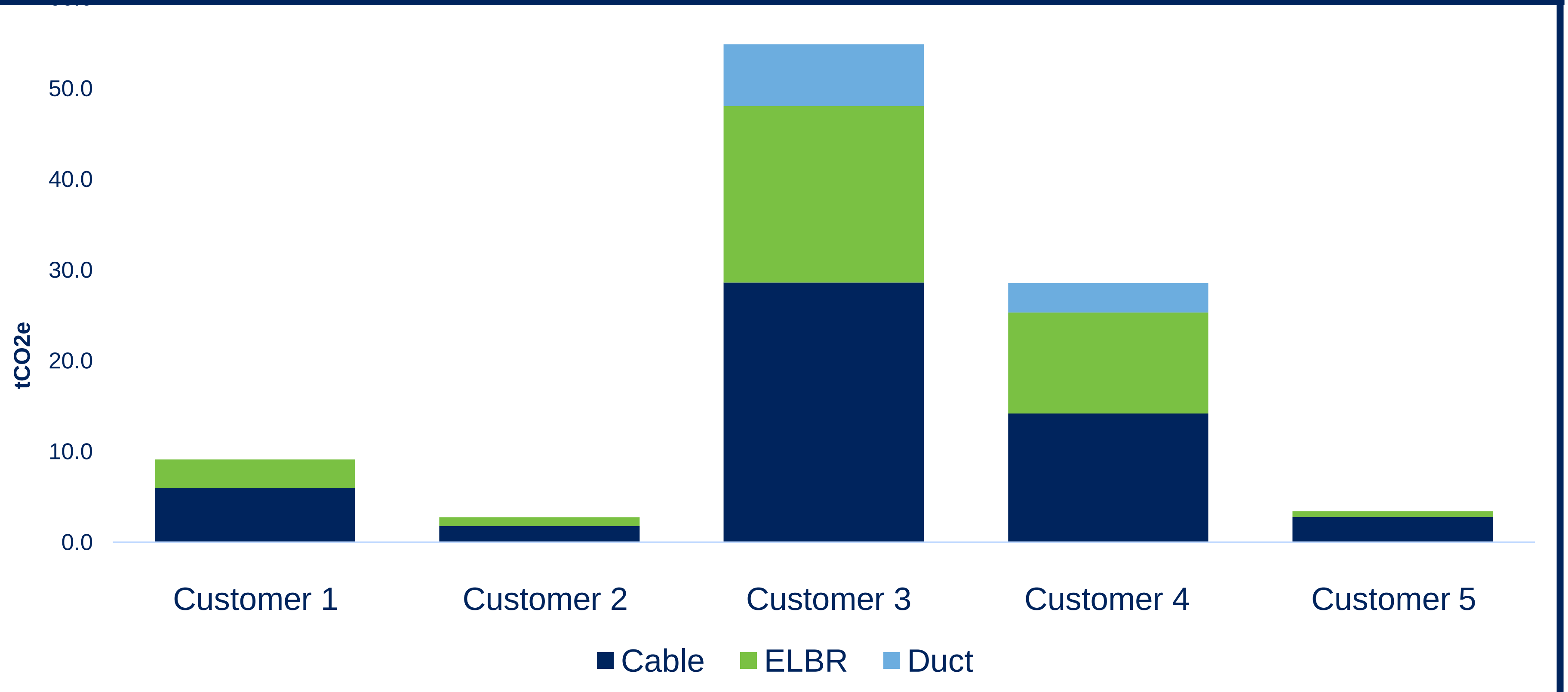
Emissions embodied in assets for traditional reinforcement at potential C_2C sites



Trial quotations illustrated the scale and proportion of assets likely to be deployed at single sites ● Data was fed into scenario modelling

Asset carbon approach

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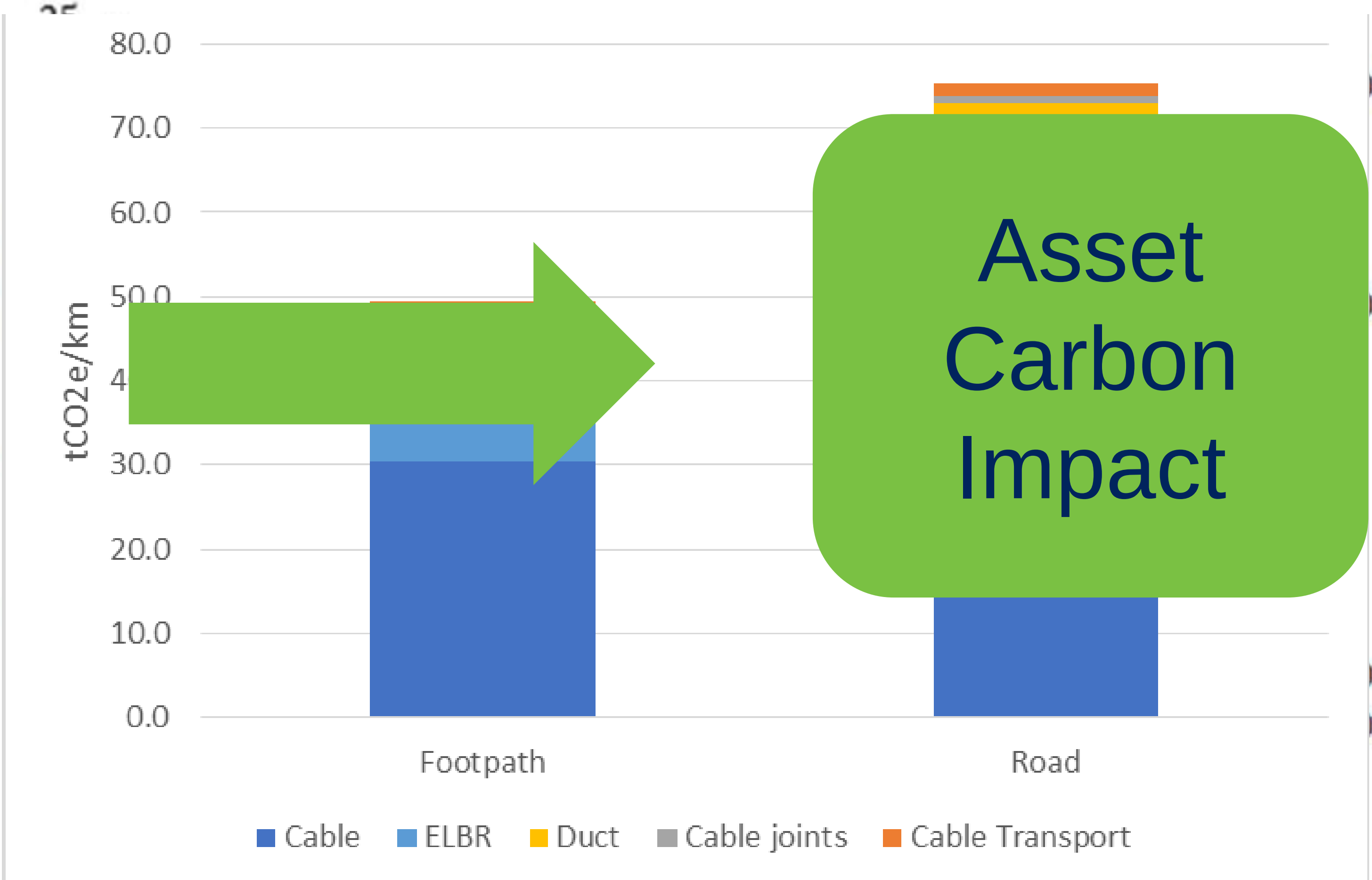
GHG emissions per km HV cable installed



Asset carbon findings

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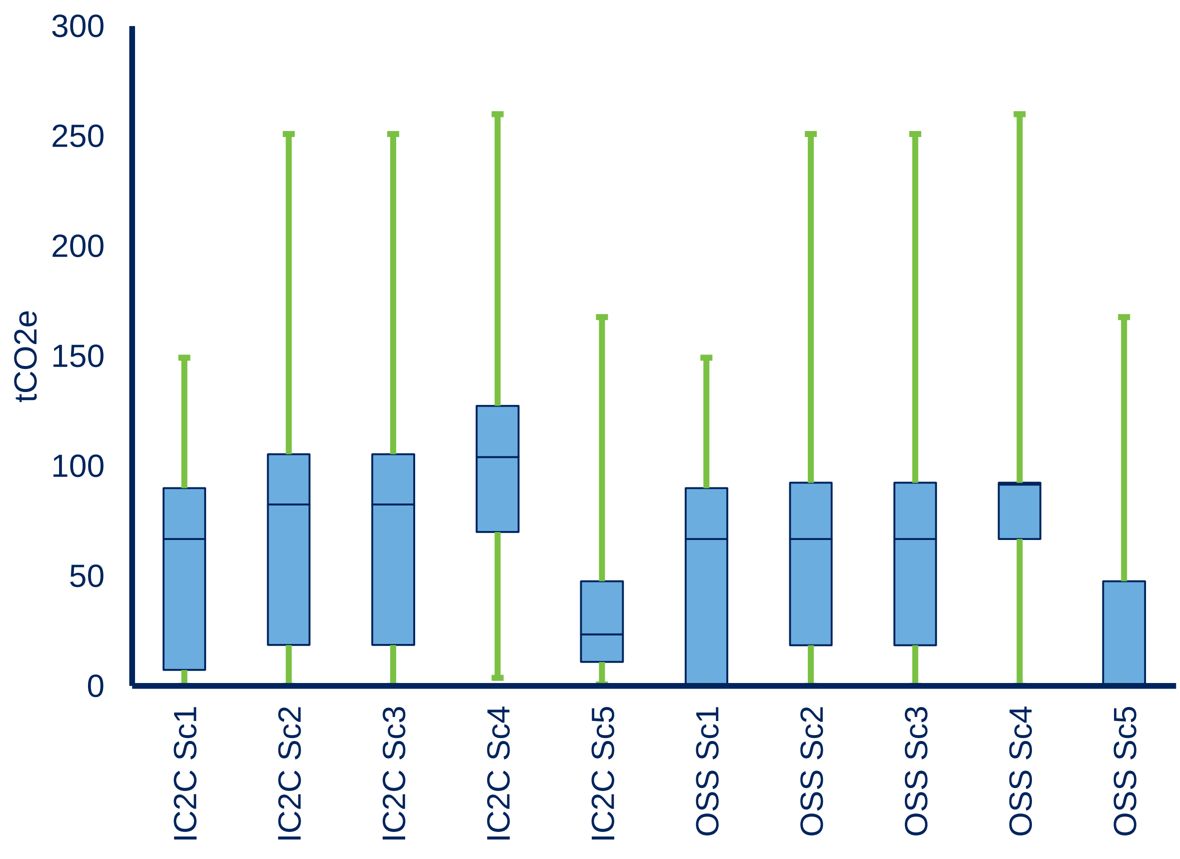
Across the 36 circuits and five demand growth scenarios, asset carbon savings are up to 260tCO_2e

For 8% of cases the same physical investments as traditional reinforcement are required to deliver the necessary capacity but at a later date

Box plot of asset carbon reduction



Operations carbon approach

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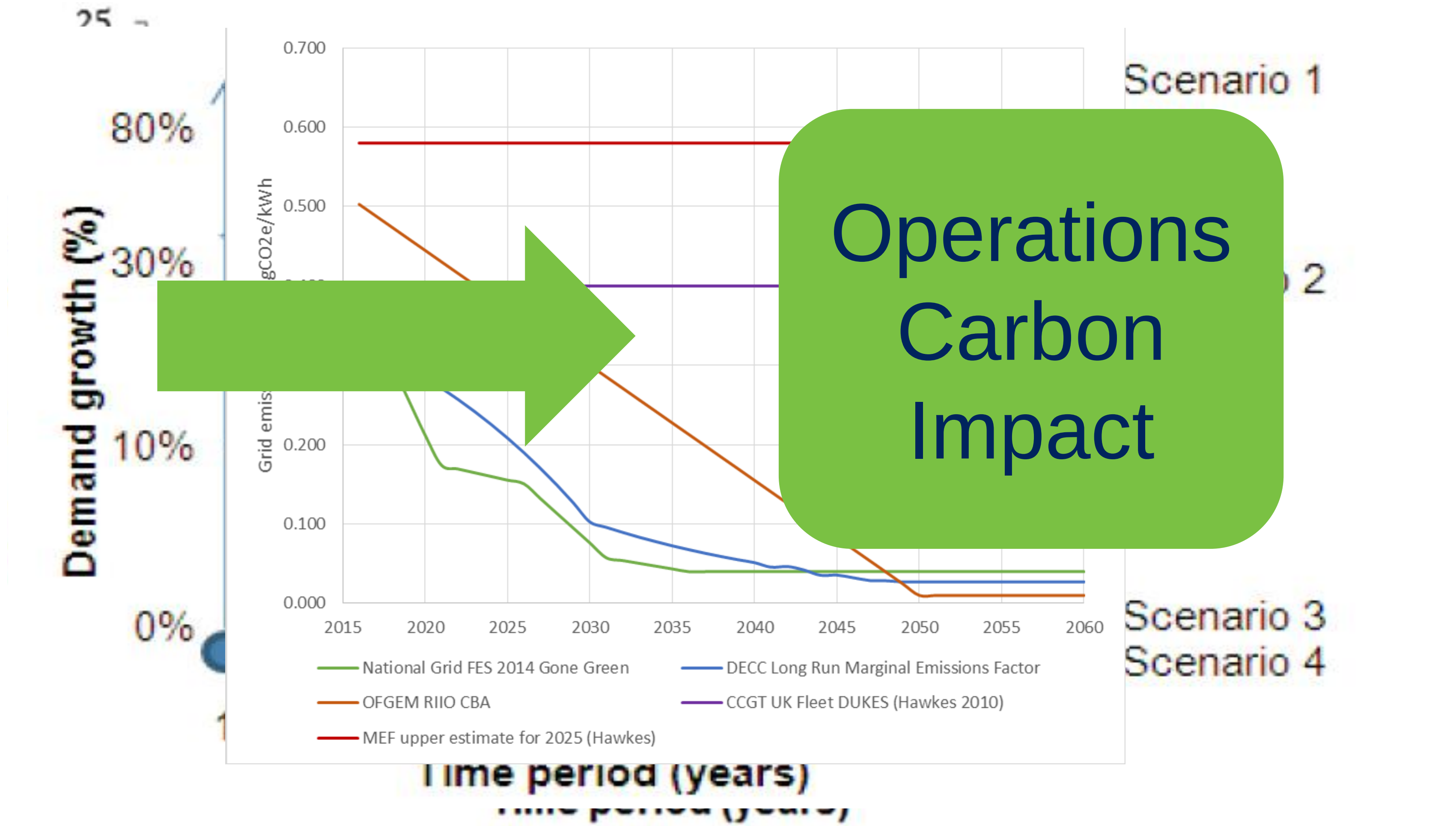
Carbon content of grid electricity scenarios



Operations carbon findings

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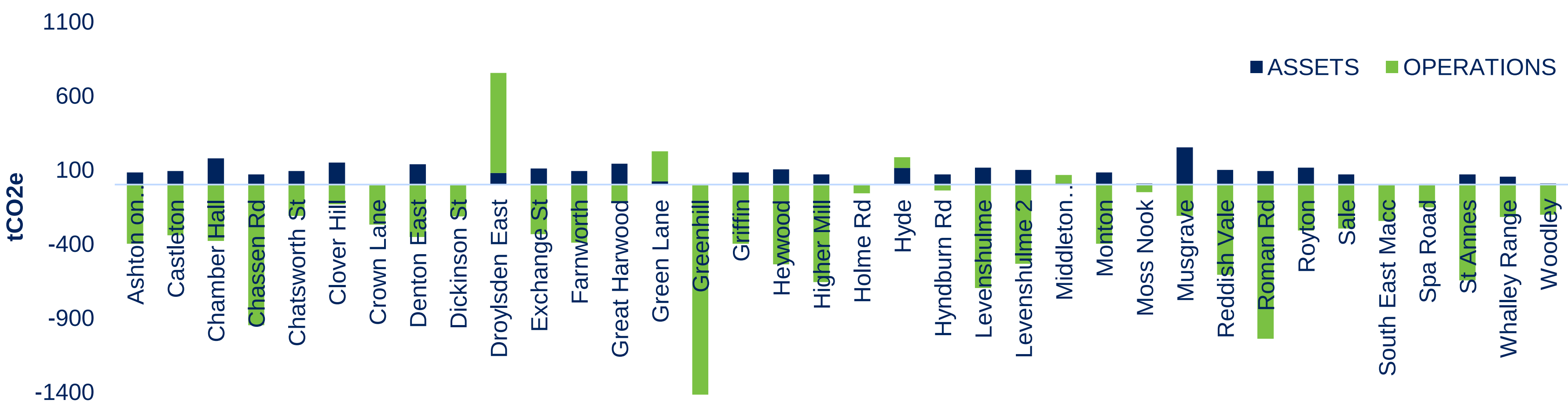
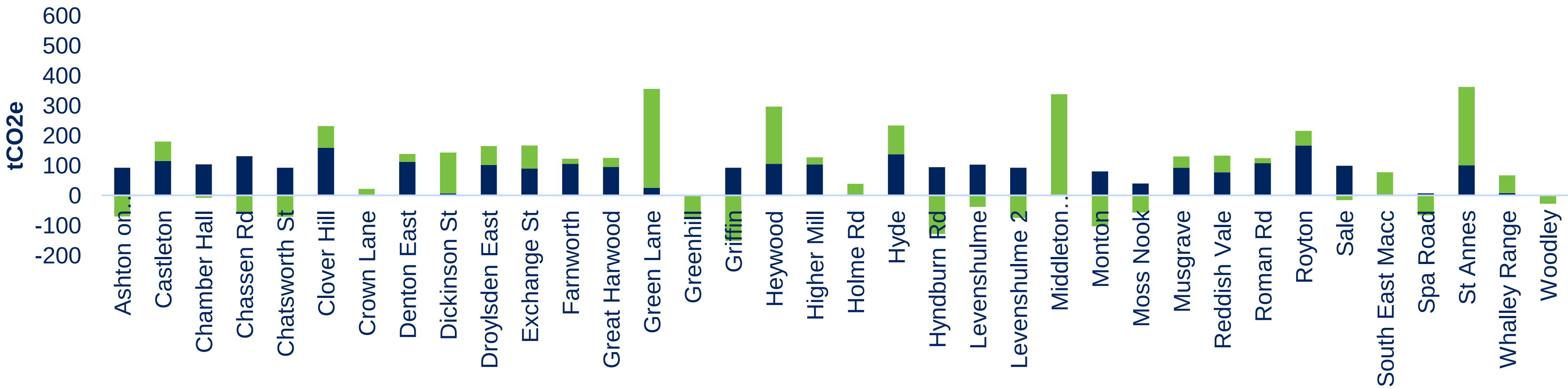
IC_2C carbon reduction – demand growth scenario 3



IC_2C carbon reduction – renewable distributed generation scenario 3



Operations carbon findings

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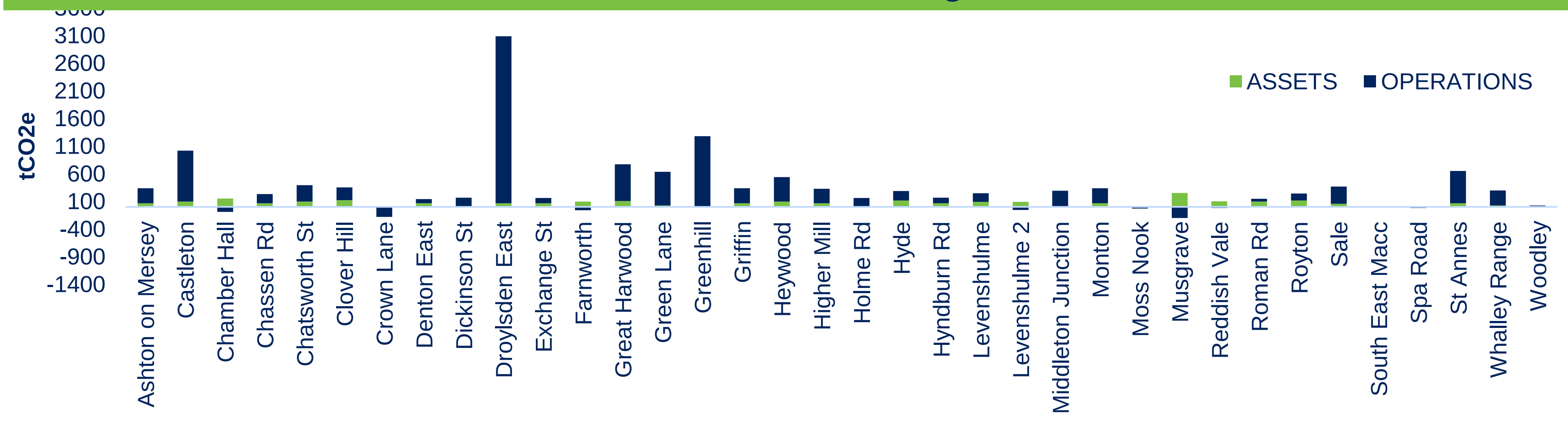
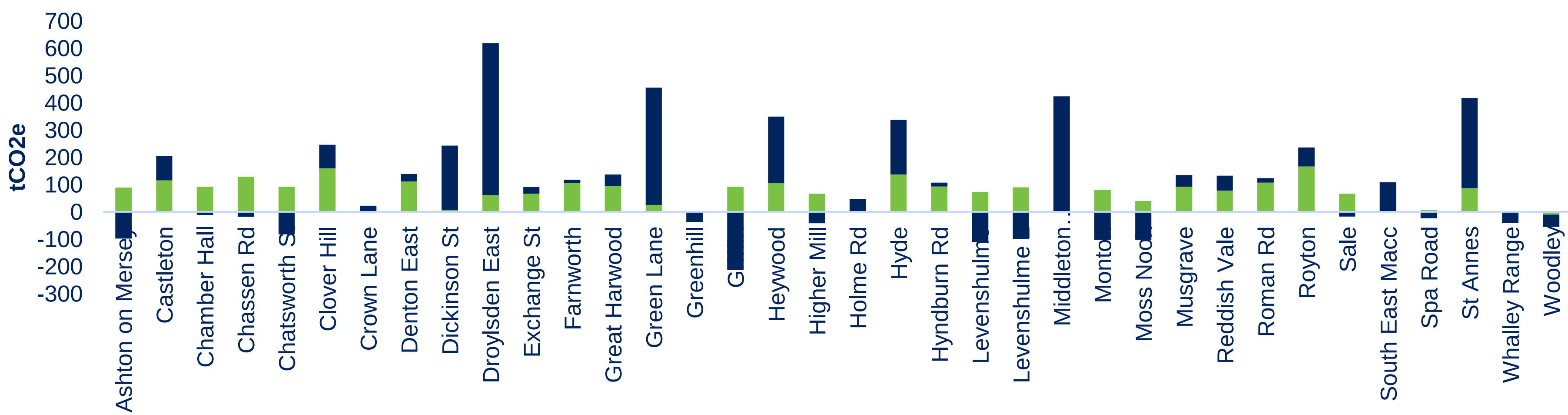
OSS carbon reduction – demand growth scenario 3

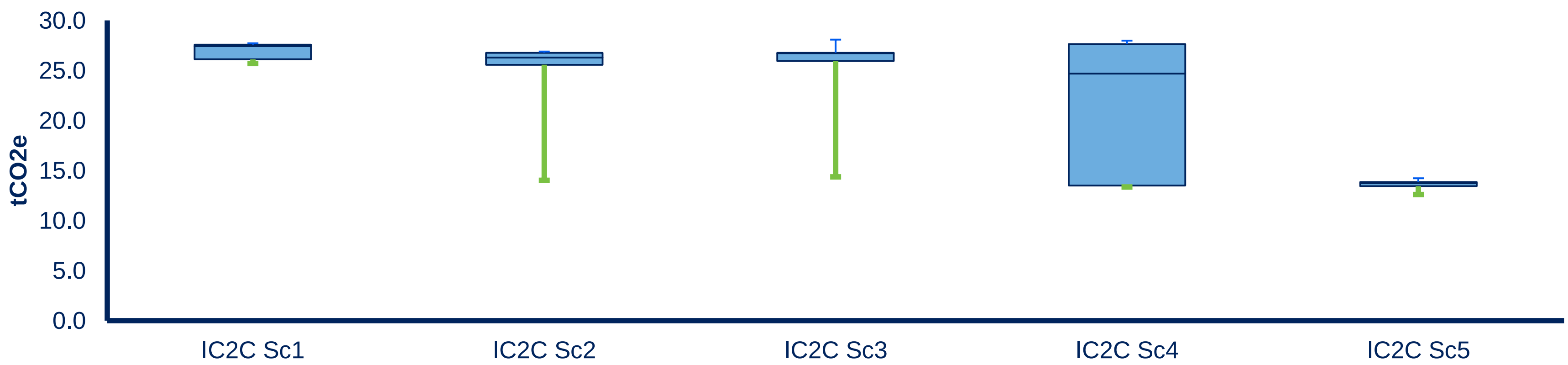


OSS carbon reduction – renewable distributed generation scenario 3

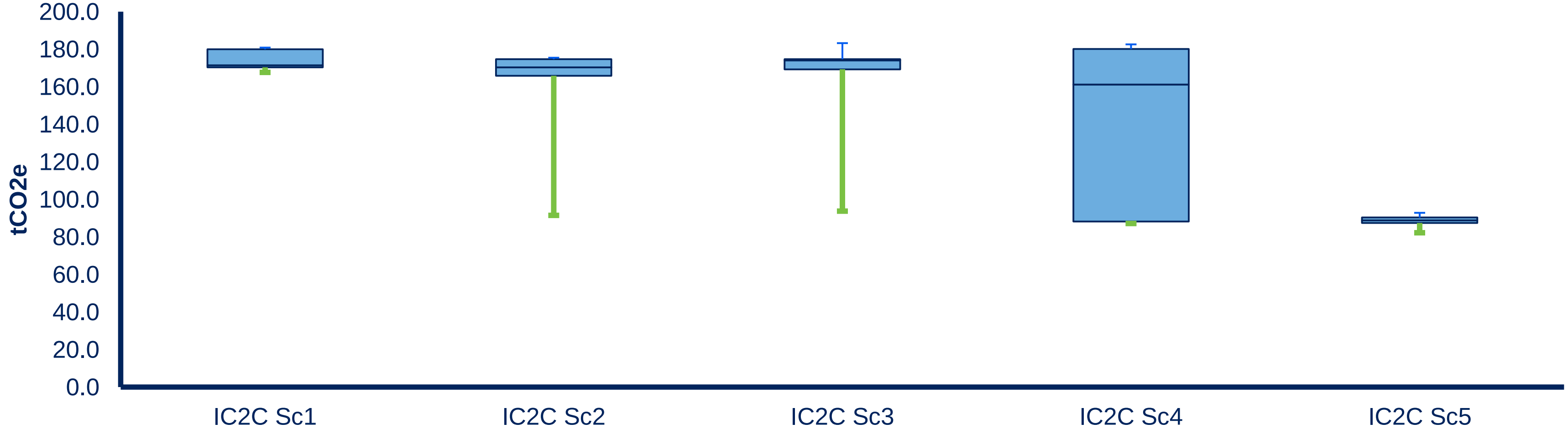


Facilitated reductions

Facilitated carbon reduction for EV demand growth



Facilitated carbon reduction for renewable distributed generation



Sensitivity to scenario assumptions

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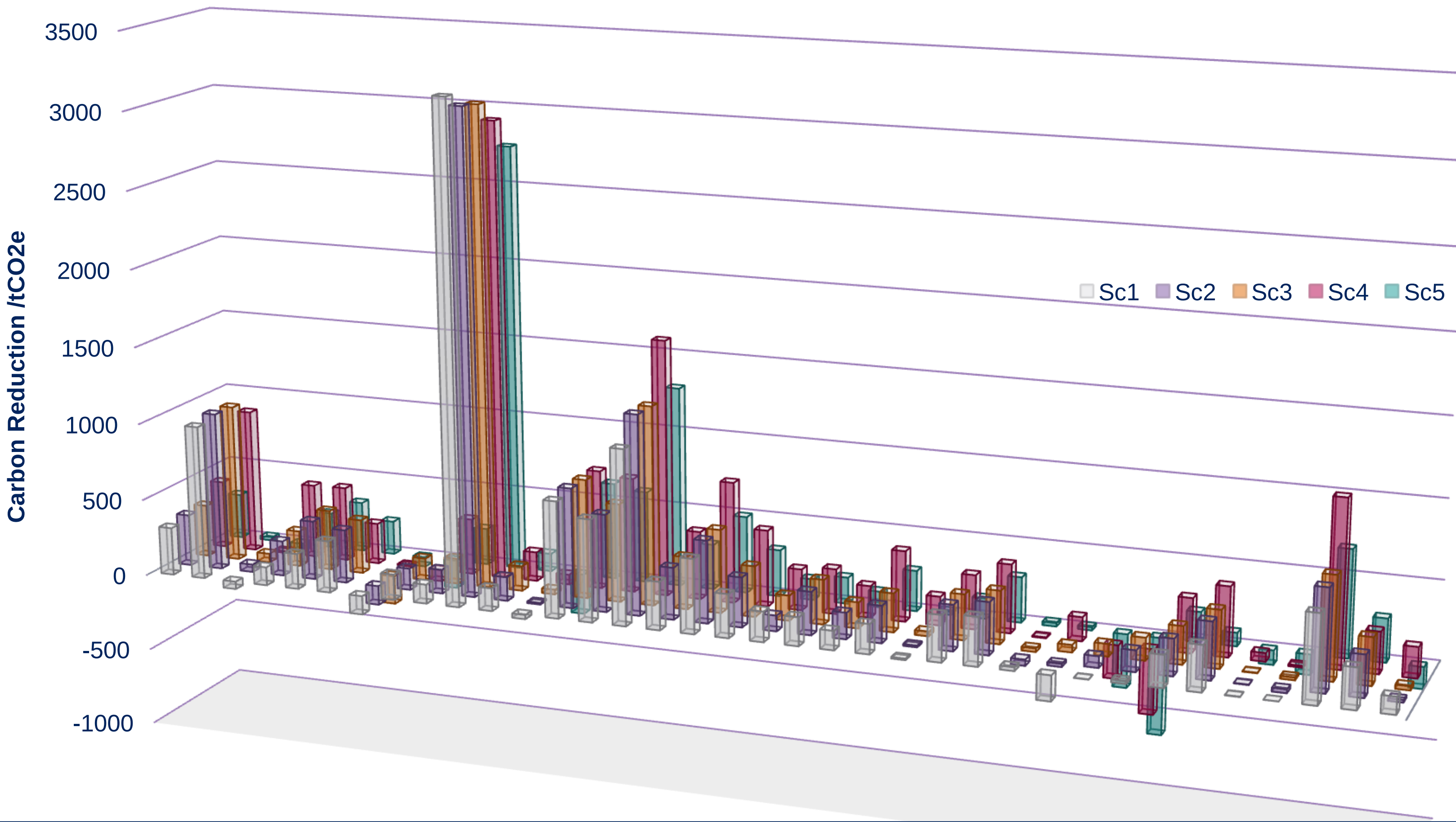
Demand Growth Scenarios OSS Approach



Largest benefit generally under Scenario 4 ● Least under Scenario 1

Sensitivity to scenario assumptions

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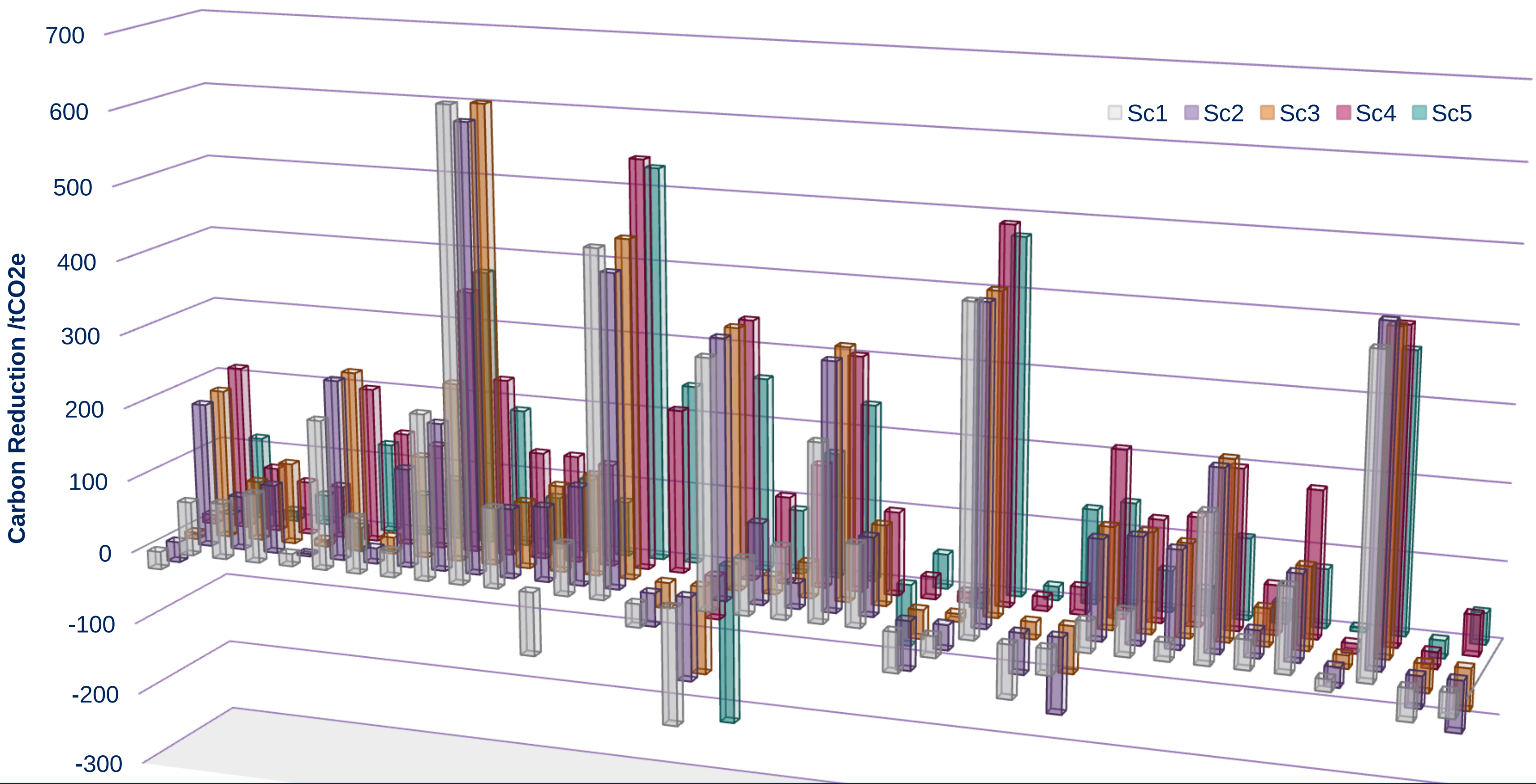
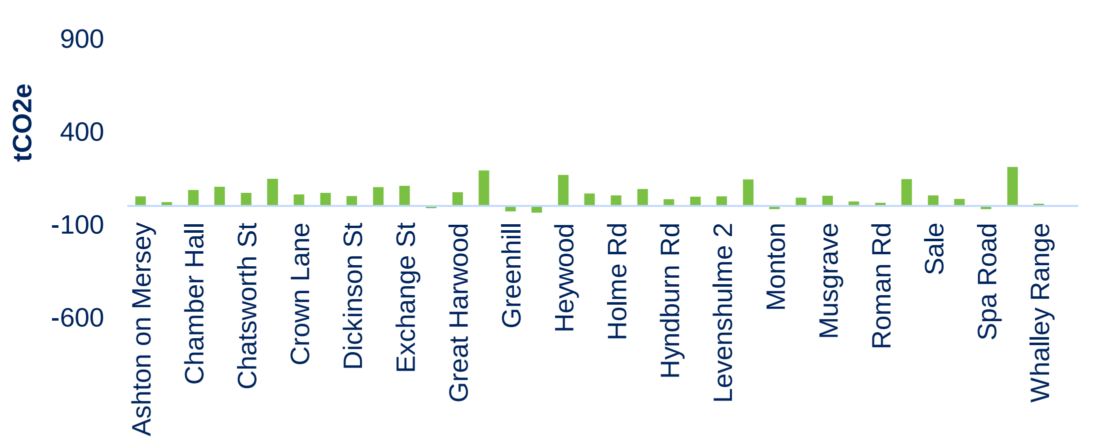
Renewable Distributed Generation Scenarios OSS Approach



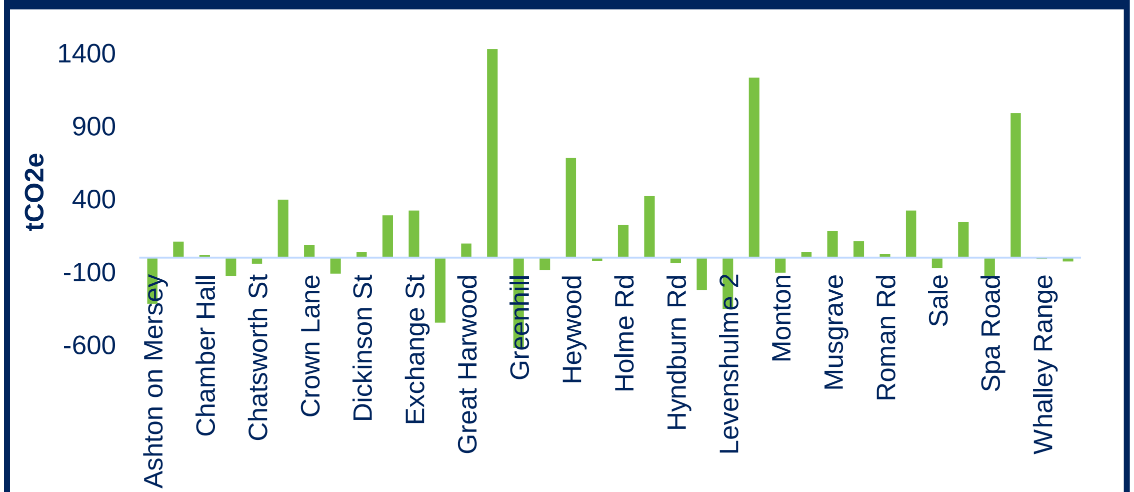
Renewable DG less consistent but largest benefit also generally under Scenario 4 and least under Scenario 5

Sensitivity to scenario assumptions

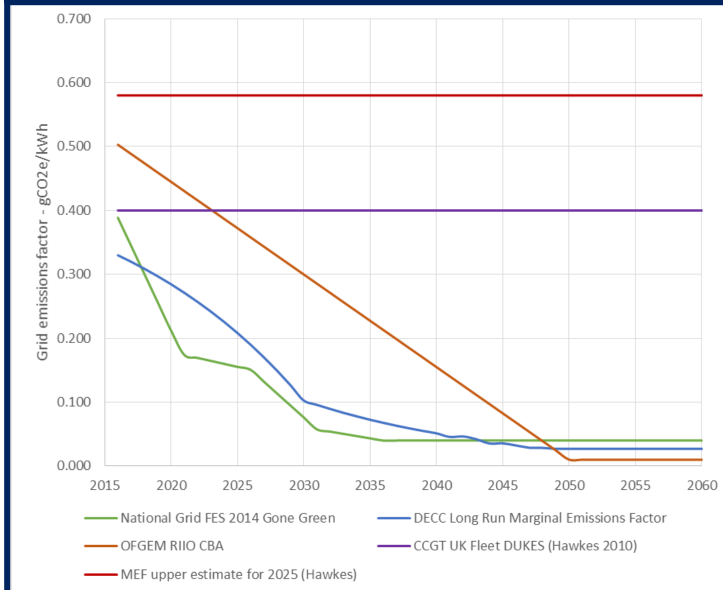
IC_2C Gone Green net carbon reduction (RDG scenario 1)



IC_2C CCGT net carbon reduction (RDG scenario 1)



Carbon content of grid electricity scenarios

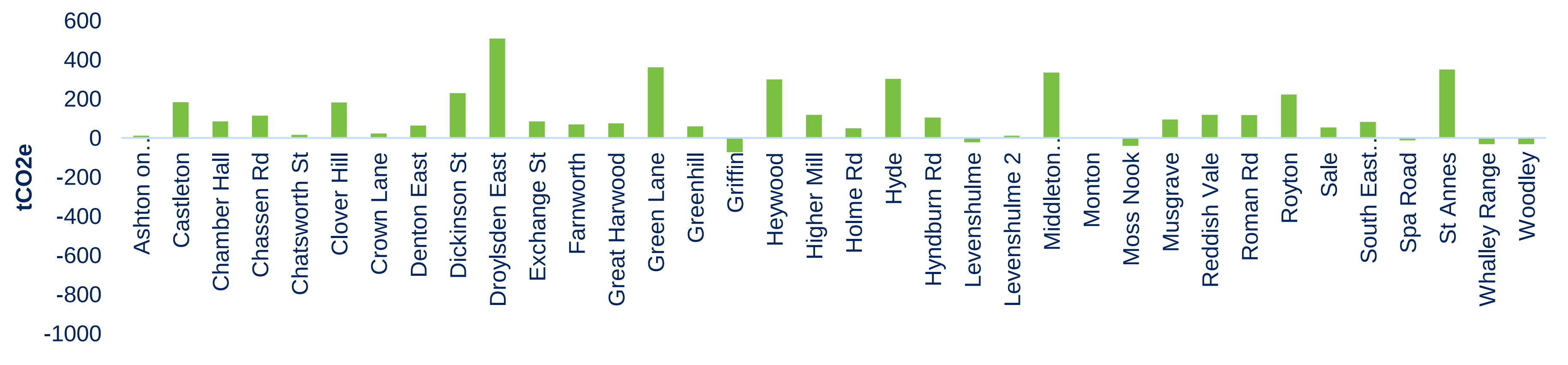


Grid emissions factors assumptions make a larger difference than variation between growth scenarios

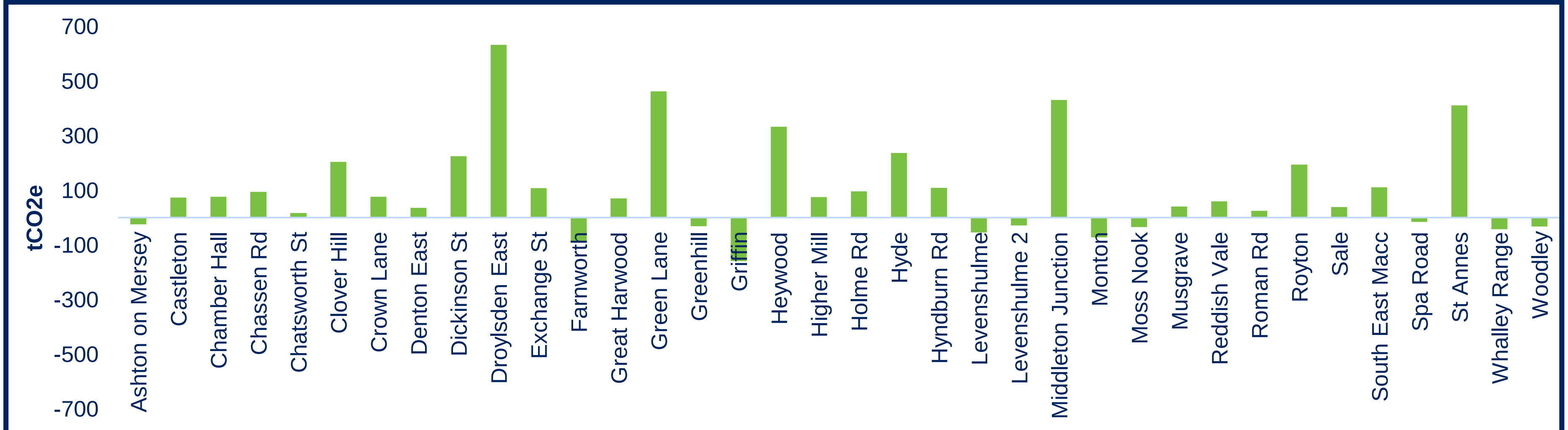
Reductions in losses are more significant if they are assumed to come from a high carbon source

Sensitivity to scenario assumptions

20 years OSS net carbon reduction (demand growth scenario 1)



45 years OSS net carbon reduction (demand growth scenario 1)



Conclusions

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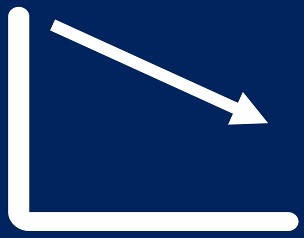
A new methodology has been demonstrated finding

C_2C substantially reduces the immediate carbon impact of additional network capacity, potentially up to 250 tCO2e per circuit

More detail and understanding than simple “capacity release” measures is possible and worthwhile

Circuits are currently not optimised for losses minimisation. Combination of C_2C and traditional asset upgrades would be least cost and deliver a lower carbon system



With optimum combination, savings of up to 55% of carbon impact over 45 years have been observed although median benefit is ~10%.

Assumed grid emissions factors pay a large role in determining the quantitative but not qualitative outcomes

QUESTIONS

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ANSWERS

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Kate Quigley
Future Networks
Customer Manager

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Agenda

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- Introduction
- Technical and academic overview
- **Customer research (technical impact)**
- Customer research (commercial)
- Commercial review and case studies
- Summary and next steps

Customer hypotheses and objectives

Customer group	Hypothesis
Domestic customers	Closed ring configuration is acceptable to customers
Commercial customers	Existing or new customers can directly benefit financially by providing the demand response

- To engage with domestic customers about C_2C
- To understand the impact of C_2C on customers' supplies
- To communicate C_2C to industrial and commercial (I&C) customers
- To explore the appeal of C_2C and the uptake of C_2C contracts

Customer hypotheses and objectives

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Domestic customers

Closed ring configuration is acceptable to customers

To engage with domestic customers about C_2C

To understand the impact of C_2C on customers' supplies

Commercial customers

Existing or new customers can directly benefit financially by providing the demand response

To communicate C_2C to industrial and commercial (I&C) customers

To explore the appeal of C_2C and the uptake of C_2C contracts

Engaged customer panel

- Carlisle - domestic
- Manchester - domestic
- Manchester – I&C

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- Cross section of customers
- Three phases of research
- 3 x 90 minute focus groups

Objective: to identify the optimum method of communicating C_2C in a simple manner to **domestic customers** on trial circuits

ECP recommendations

Should we communicate with customers on trial circuits?	
Why should we do so?	mation with good news electricity supply
What format should the communication take?	et
What should it say?	efits of C_2C, power cut e register, contact details
When should it be delivered?	before trial started in April
To whom should it be delivered?	circuits

Lesson learned – domestic customers

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- Relationship between DNO and supplier still confusing
- Customers are supplier focussed
- C_2C is too complex for many customers to understand
- Customers think it's their right to know about changes to their supply, particularly if message is positive
- Information should be simple and informative
- Customers want to know more about their DNO
- Customers want to know what to do in a power cut

Understanding impact on customers

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Objective: To understand the impact of C_2C on customers' supplies

Measure customers' perceptions of power quality

Compare perceptions with customers not on trial circuits

Dissemination

David Pearmain
Advanced Methods Director
Impact Research

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Summary of surveys completed

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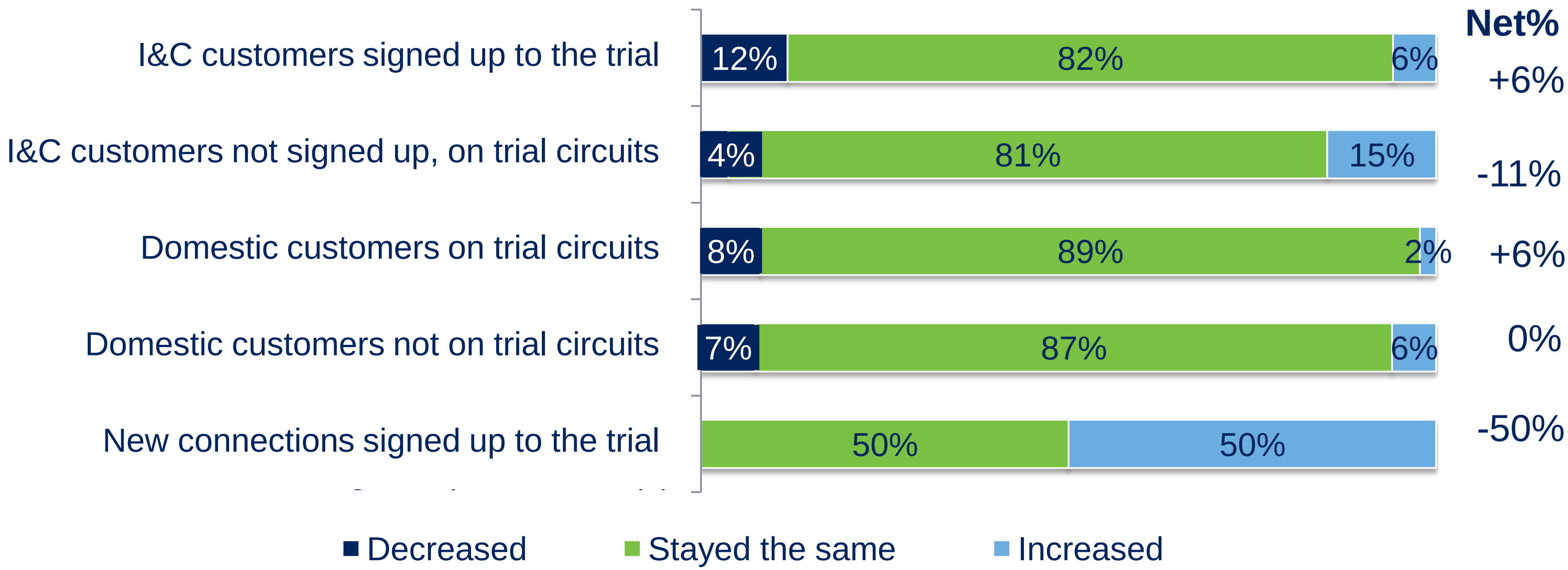
656 quantitative interviews

5 groups of customers

I&C customers who have signed up to the trial	• Target of 10 interviews per wave • Completed 17 interviews in YTD
I&C customers who have not signed up to the trial but are on trial circuits	• Target of 10 interviews per wave • Completed 30 interviews in YTD
Domestic customers who are on trial circuits	• Target of 100 interviews per wave • Completed 312 interviews in YTD
Domestic customers who are not on trial circuits	• Target of 100 interviews per wave • Completed 301 interviews in YTD
New connections who have signed up to the trial	• Target of 10 interviews per wave • Completed 2 interviews in YTD

Power cut frequency

Do you feel the *frequency* of power cuts has increased, decreased or stayed the same since April/start of C_2C? YTD

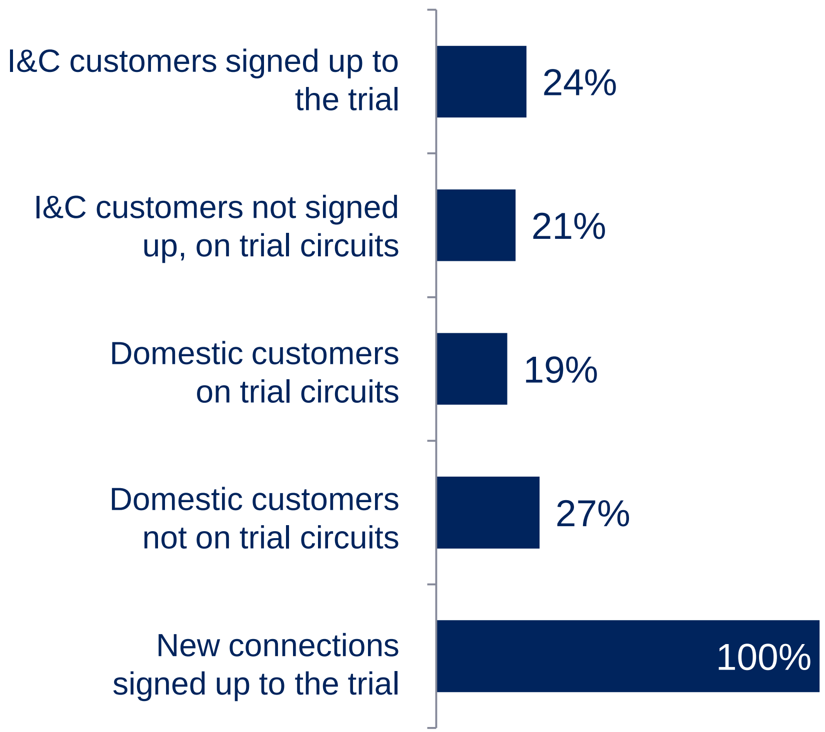


The majority of customers claim there has been no change in the frequency of power cuts since the trial started

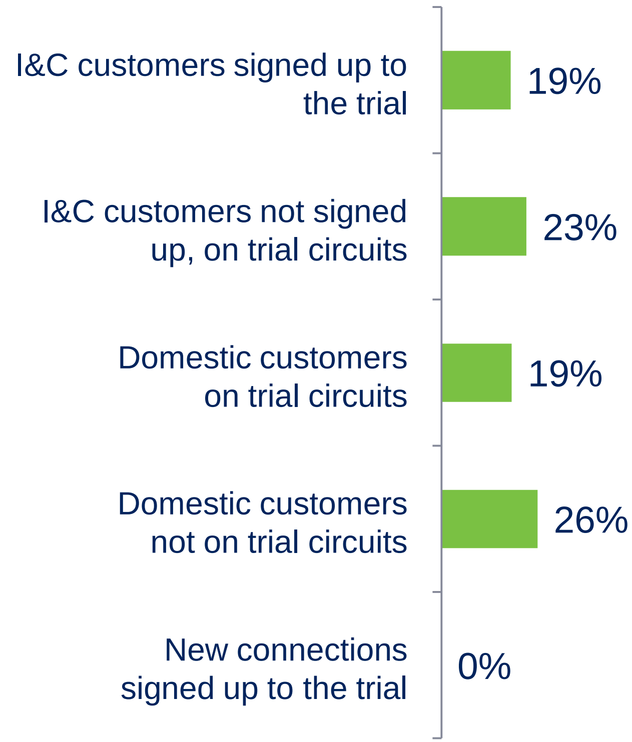
If a change has been detected on C_2C circuits, overall it is a positive one

Power cuts on trial circuits

Have you experienced a ***power cut*** at your property **since April 2013**? YTD



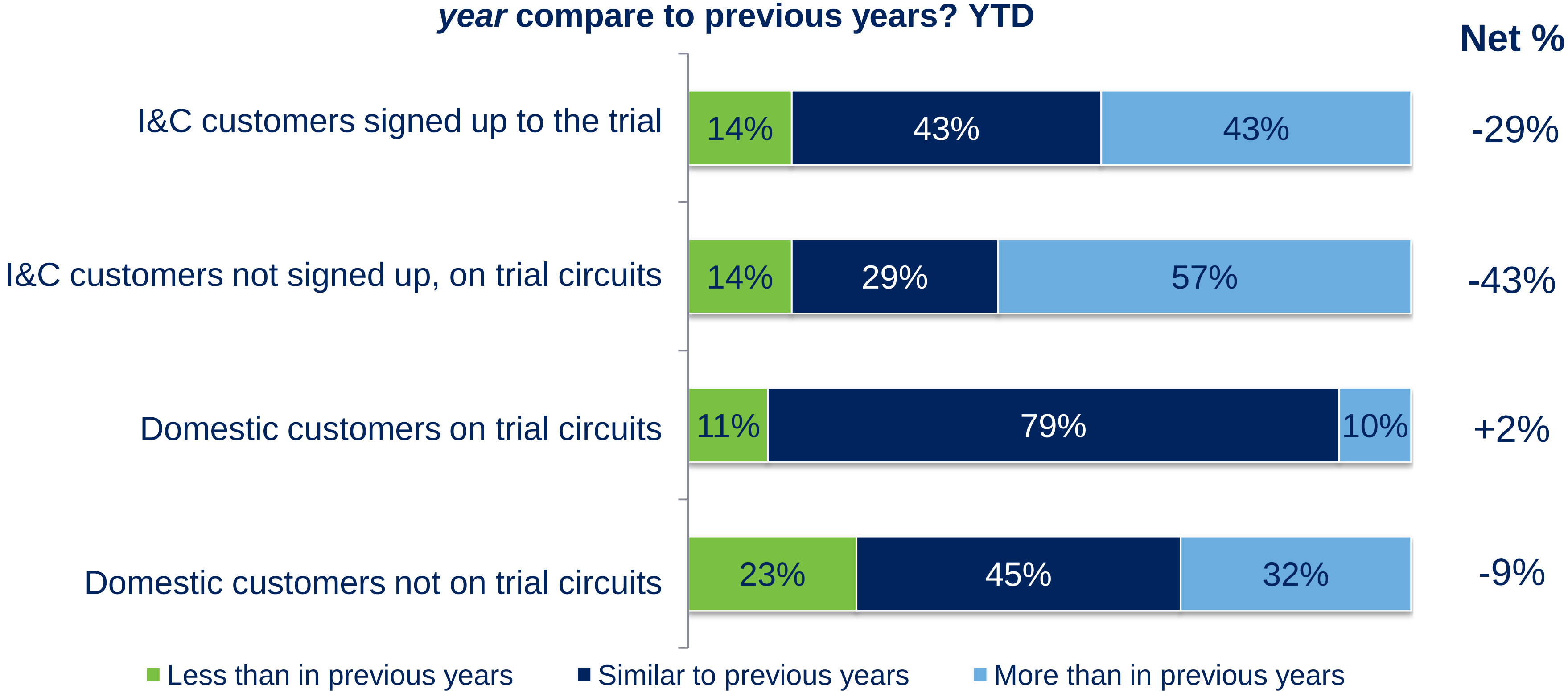
Have you recently noticed any ***dips or spikes*** in your power from time to time? YTD



The proportion of domestic customers who claim to have experienced a power cut since C_2C began is significantly lower for those on trial circuits

Power cut comparison

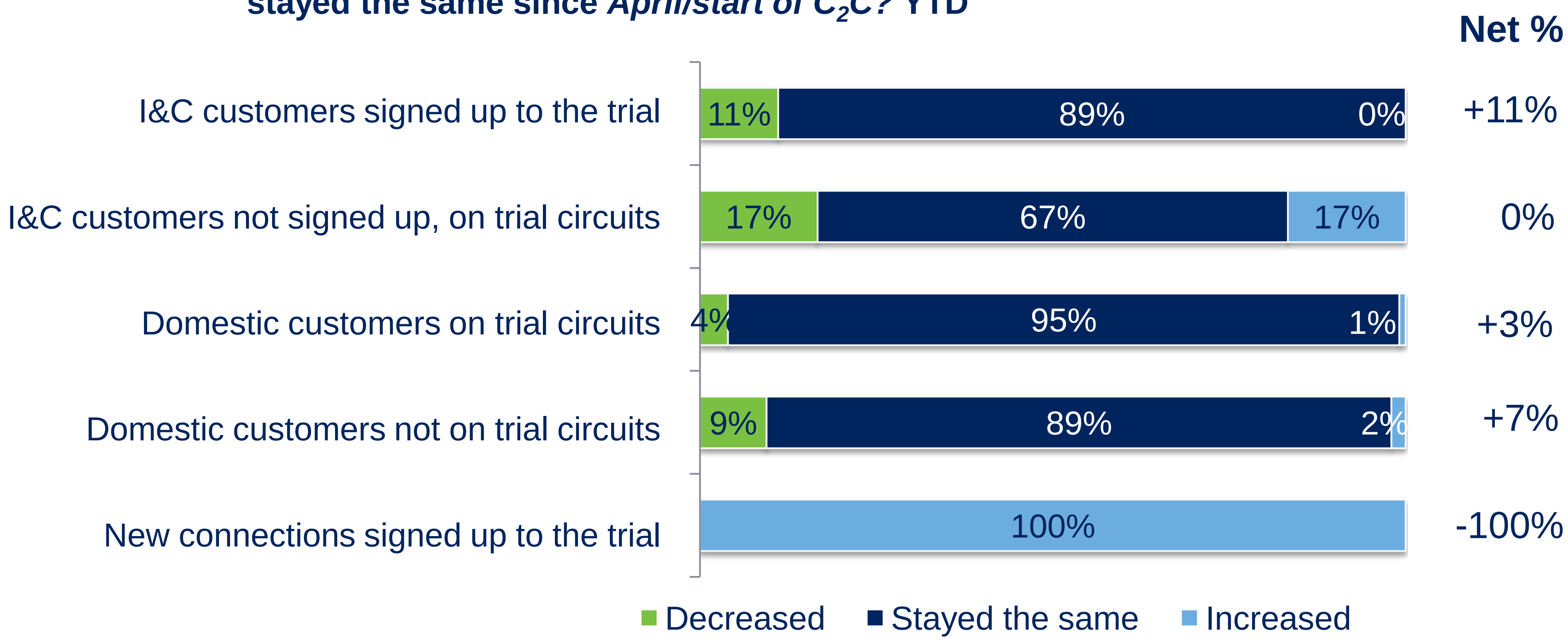
How does the total number of power cuts you have experienced *in the last year* compare to previous years? YTD



Domestic customers on non-trial circuits are more likely to have noticed changes in the number of faults they have experienced over the last year

Power cut duration

Do you feel the *duration* of power cuts has increased, decreased or stayed the same since *April/start of C_2C?* YTD



Domestic customers on non-trial circuits are more likely to feel fault durations have decreased since the start of C_2C

Length of power cut

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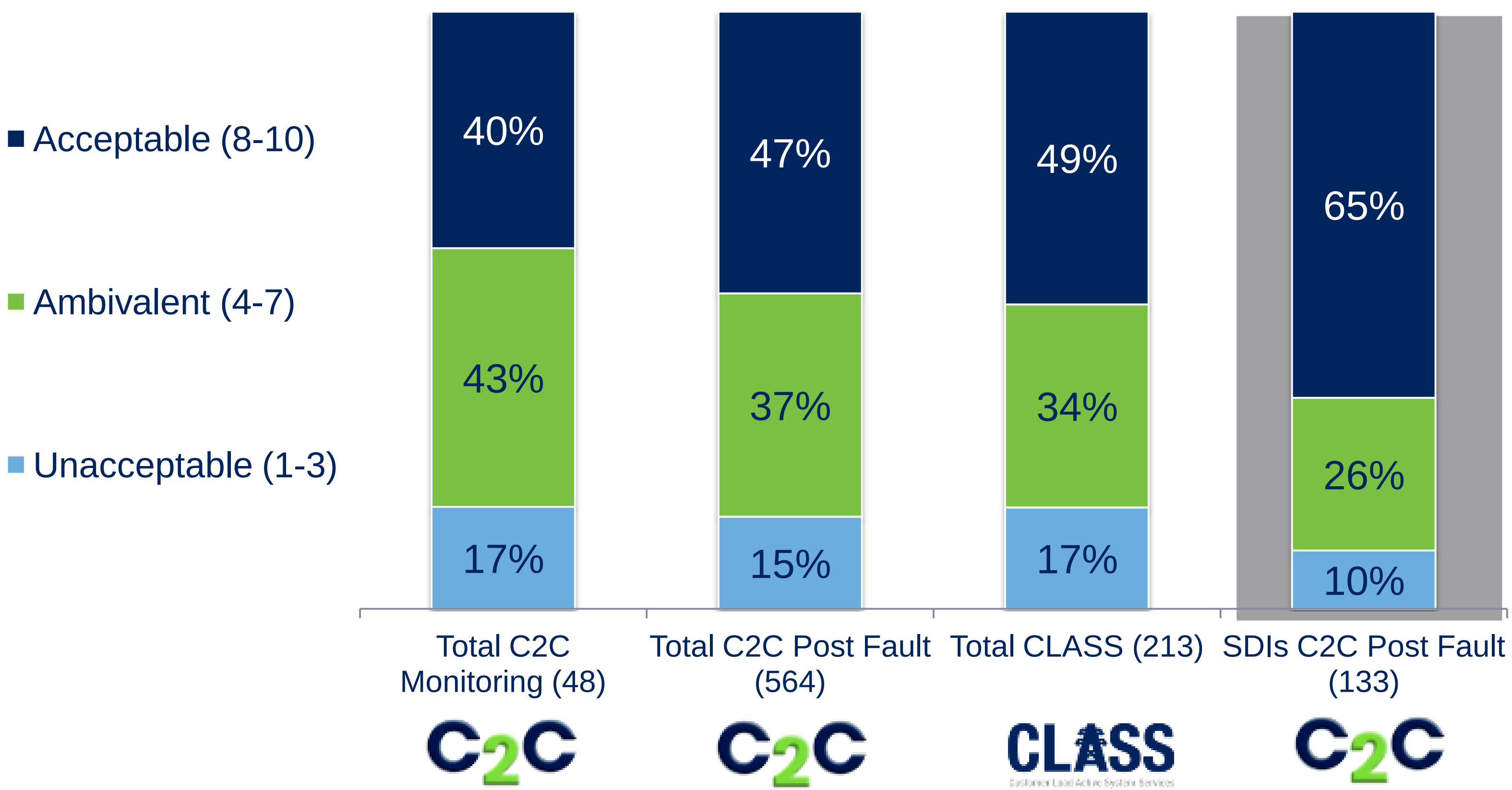
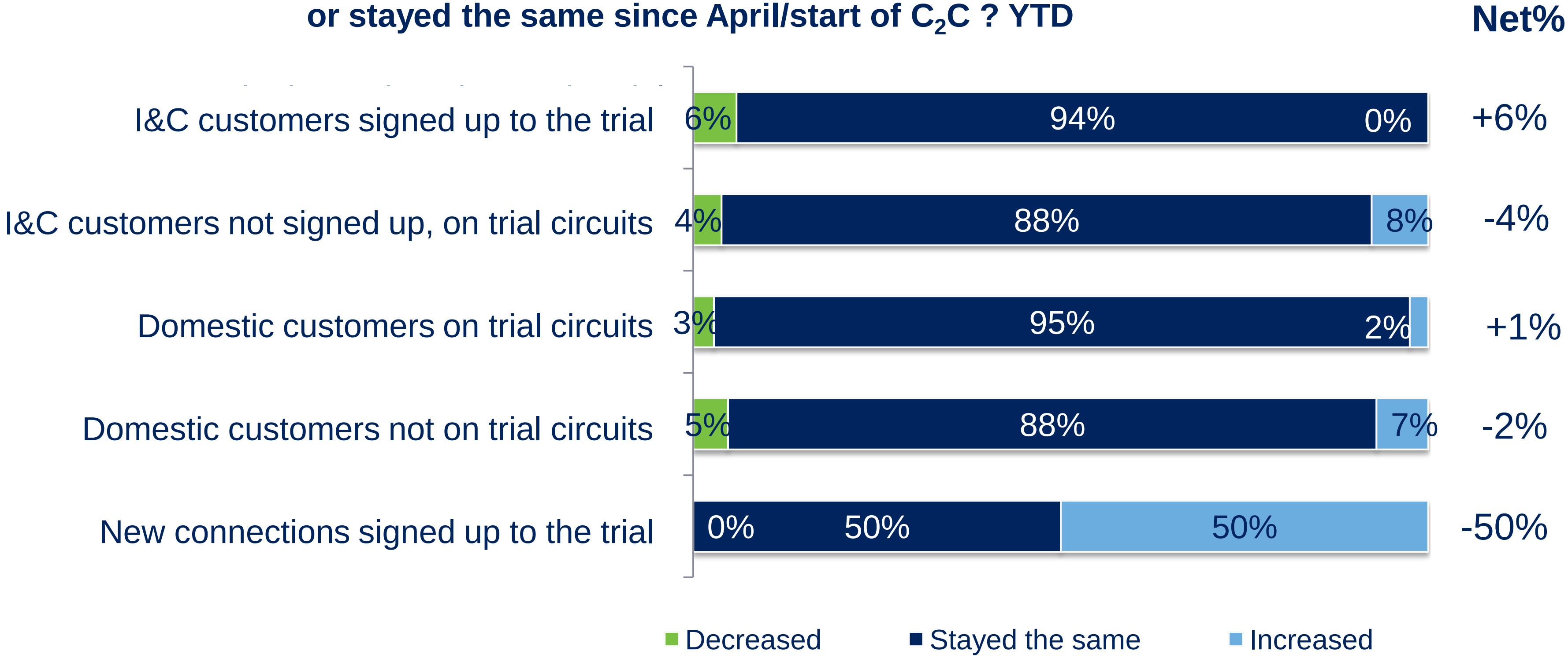
To what extent did you find the length of the power cut acceptable?



Our reactive *post fault* survey has indicated that where SDIs are detected on C_2C circuits they enhance power quality perception

Dips and spikes

Q20 – Do you feel the number of *dips and spikes* has increased, decreased or stayed the same since April/start of C_2C ? YTD



Customers on C_2C circuits are also less likely to have noticed any variations in dips & spikes

Comparing perception of faults to reality

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Trial Circuits

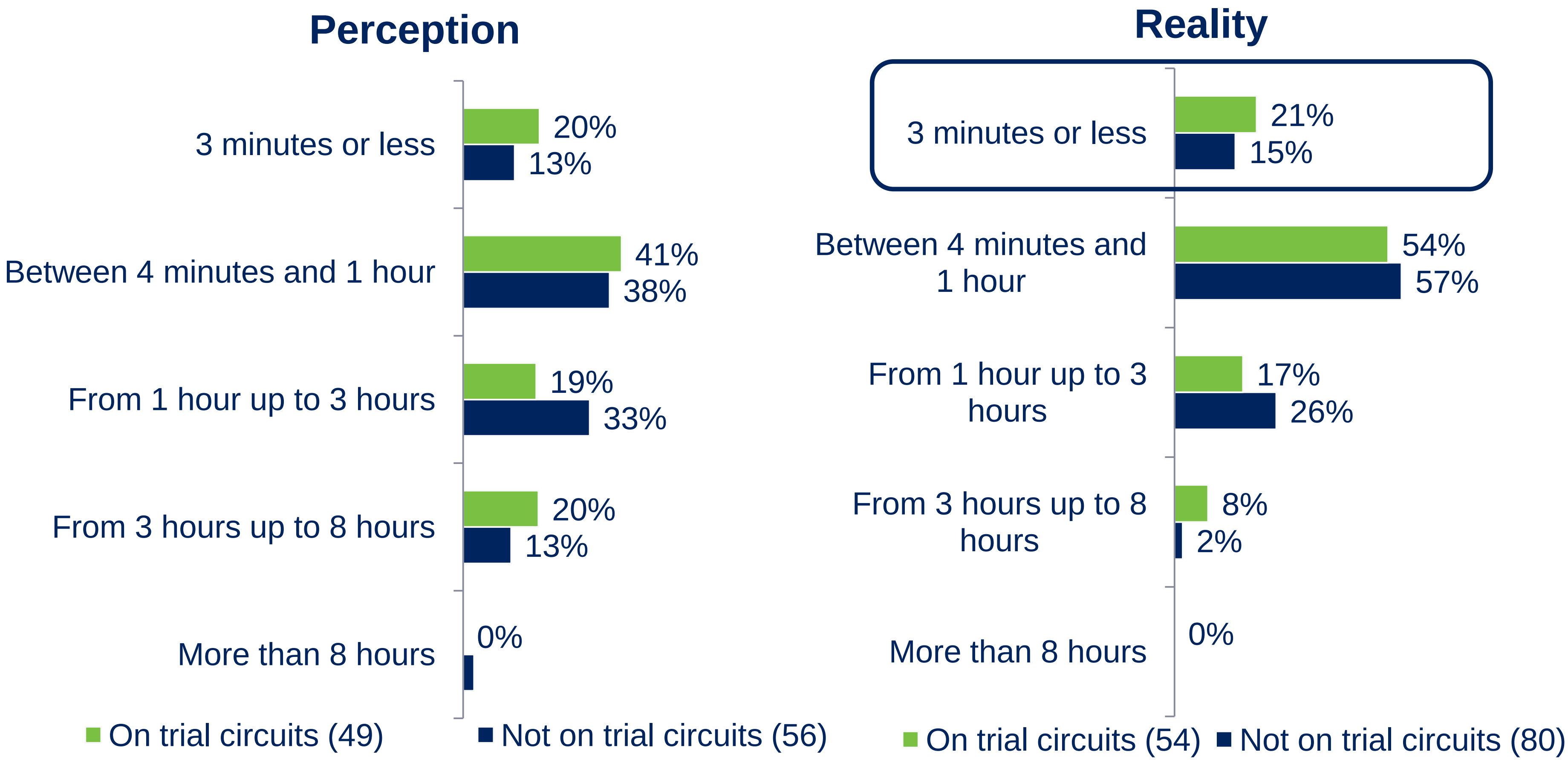
	Reality – Had a fault	Reality – Didn't have a fault
Perception – Had a fault	3%	15%
Perception – Didn't have a fault	12%	70%

Control Circuits

	Reality – Had a fault	Reality – Didn't have a fault
Perception – Had a fault	4%	20%
Perception – Didn't have a fault	20%	56%

Significantly more customers on control circuits misattribute observations of faults

Comparing perception of faults to reality



There were a greater number of SDI faults under C_2C conditions

Post fault surveys

14% Cumbria

59% Lancashire

27% Manchester & Peak

703 surveys conducted between April 2013 and July 2014

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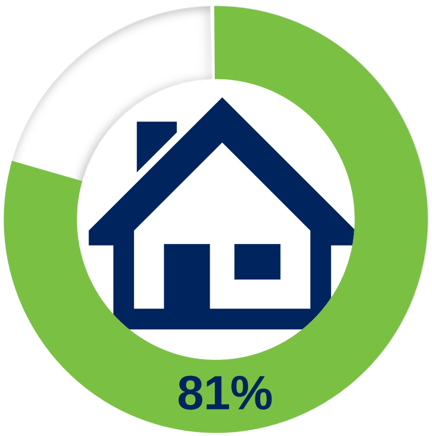
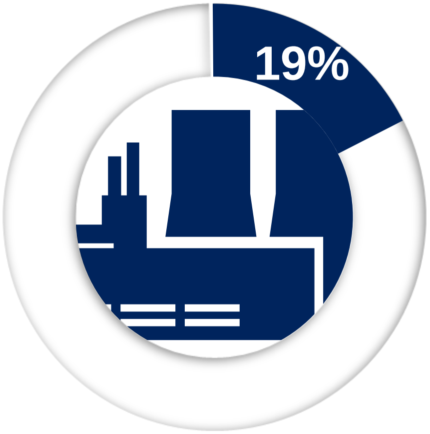
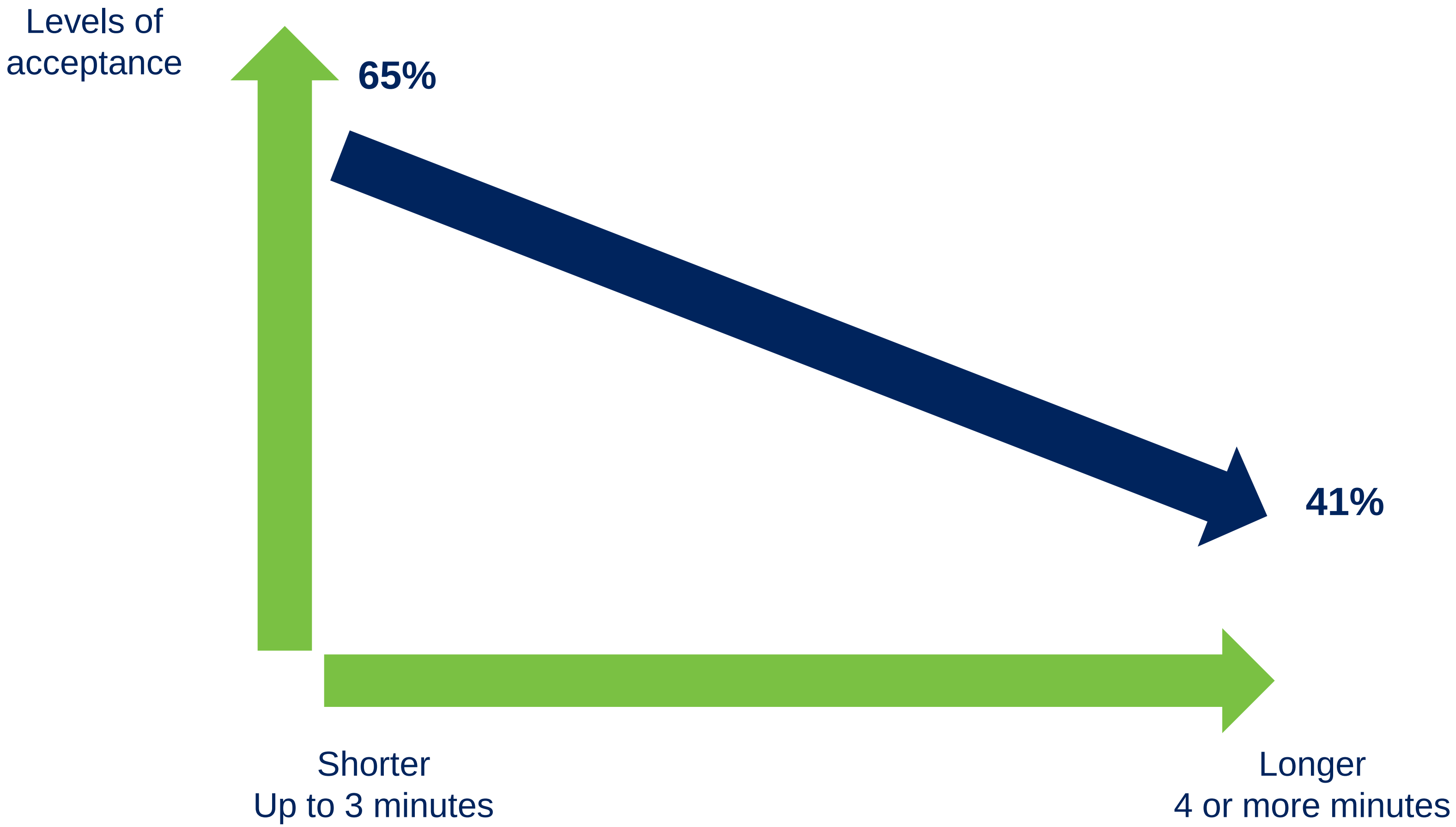
Domestic



Commercial



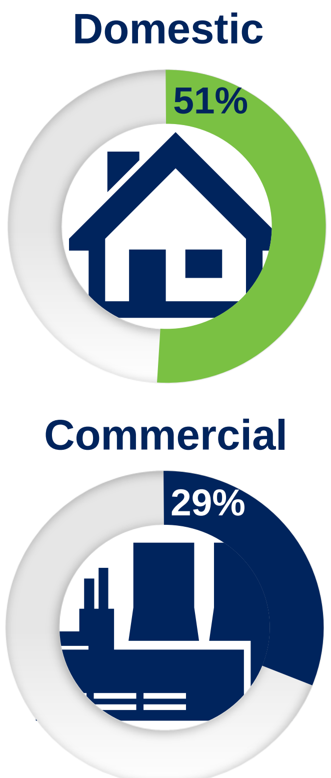
Acceptability of faults



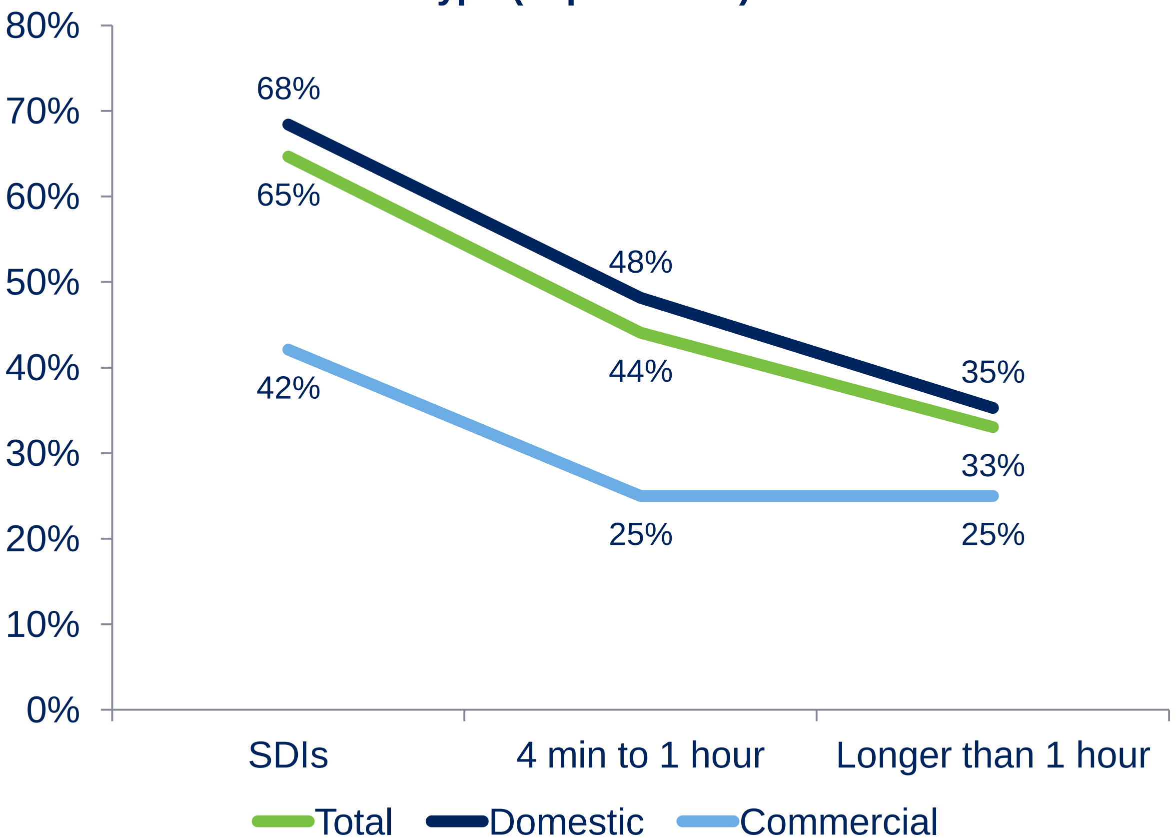
Our reactive *post fault* survey has indicated that where SDIs are detected on C_2C circuits they enhance power quality perception

Acceptability of fault duration

Acceptability of all durations



Acceptability of power cut durations by customer type (Top 3 box %)



Commercial customers are less tolerant of faults
SDIs significantly improve levels of acceptance for all customers

Priority service customers post fault surveys

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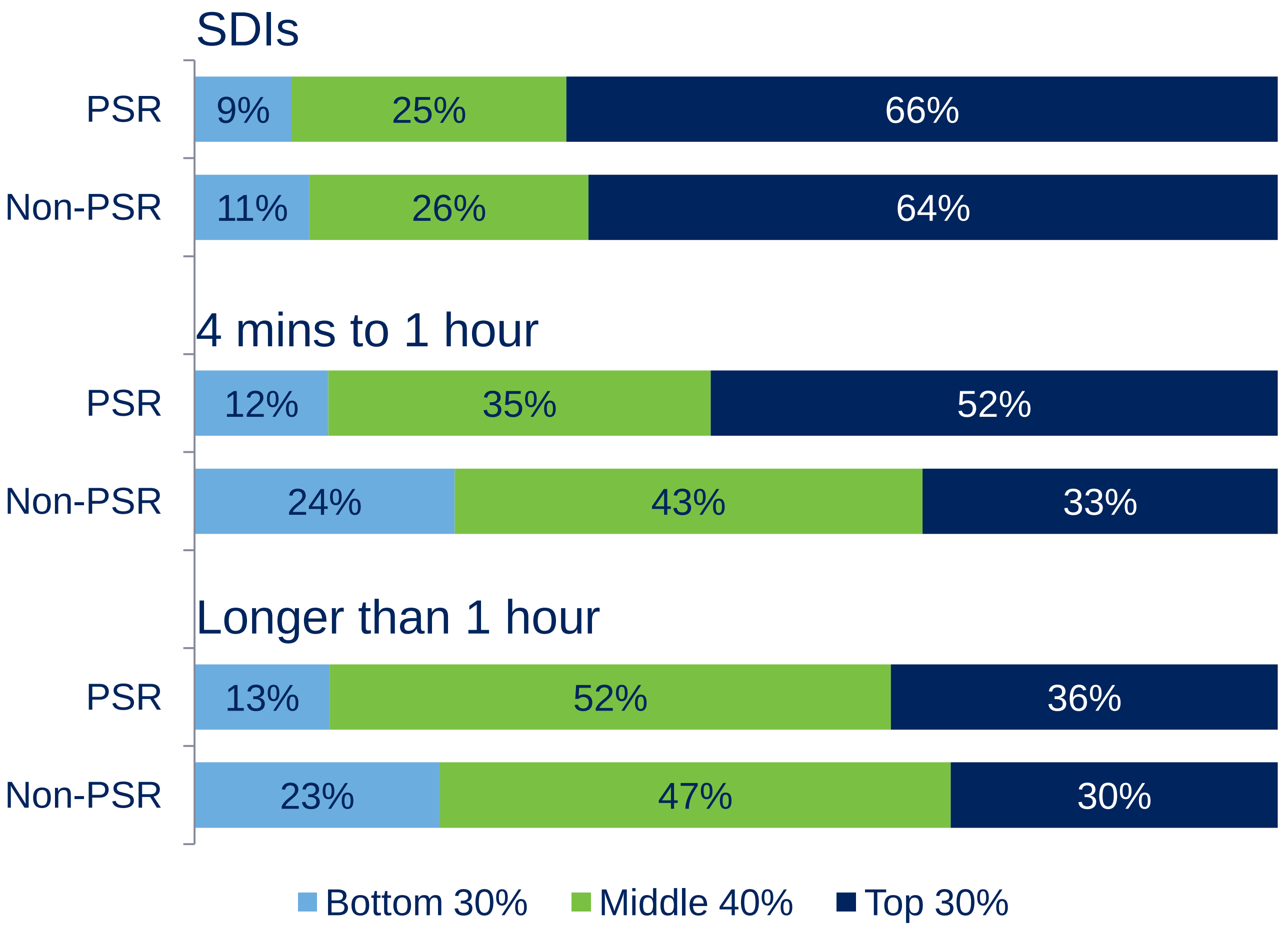
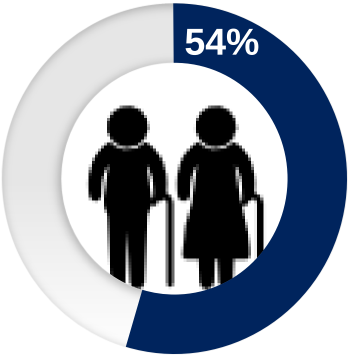
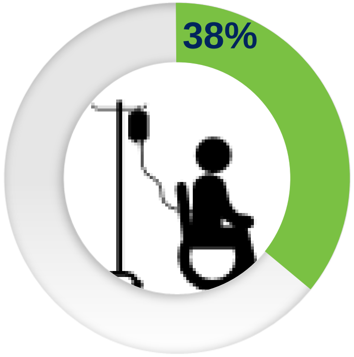




65+ year olds are generally more understanding and accepting of power cut durations



Customers with medical equipment are least likely to find length of power cuts acceptable

There is no evidence to suggest that rolling out C_2C would have any adverse effect on PSR customers

Post fault survey conclusions

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2 in 5 customers remember when the fault occurred unprompted	Changes in fault frequency are more discernible to customers
Commercial customers are more sensitive to faults	Duration drives power quality perception
Those who experience SDIs notice improvement in their fault quality	PSR/older customers are more accepting of faults
SDIs are more acceptable, but less so for longer duration faults	C_2C can affect the wider business - less strain on contact centre

Customer engagement

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Lessons Learnt

- Overall, customers are not observing material changes in their power supply quality
- Power quality perception is consistent across our trial and control groups
- The last fault duration is more likely to be an SDI on trial circuits (enhancing perception)
- Faults under C_2C conditions are not having an adverse effect on power quality perception

QUESTIONS

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ANSWERS

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LUNCH

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Agenda

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C2C

Introduction	Technical and academic overview	Customer research (impact)
Customer research (commercial)	Commercial review and case studies	Summary and next steps

Customer hypotheses and objectives

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Domestic customers	Closed ring configuration is acceptable to customers

- To engage with domestic customers about C_2C
- To understand the impact of C_2C on customers' supplies

Commercial customers	Existing or new customers can directly benefit financially by providing the demand response

- To communicate C_2C to industrial and commercial (I&C) customers
- To explore the appeal of C_2C and the uptake of C_2C contracts

Communications with I&C customers

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Objective: To explore the appeal and potential uptake of C_2C to I&C customers

Targeted mailshot to I&C customers on C_2C circuits

Seminar for new connections customers

Project video

Project video

I&C customer survey

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- 181 quantitative interviews
- Phone recruitment + online questionnaire
- Fieldwork 12 July – 10 August 2012
- Respondents to have responsibility for electricity supply

Is there an appetite in the I&C market for C_2C?

What is the level of interest by sector?

What contract elements will make C_2C attractive?

Is there an appetite for C_2C

52%

of customers found the C_2C concept appealing

31%

would recommend opting into a C_2C contract pre-contract

26%

of customers would recommend opting into a C_2C contract post-contract

What is the level of interest by sector?

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Key interest metric	All customers % (180)	Manufacturing & processing % (82)	Other sectors % (98)
Appeal	52	49	54
Recommend (pre-contract)	31	**25**	**35**
Recommend (post-contract)	26	**21**	**31**

Level of appeal is slightly lower for manufacturing & processing

Gap is more significant for recommendation (10%)

What makes C_2C contracts attractive?

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Contract	Key days	Reward	Value of reward
Length of contract has the biggest single influence on take up	Safeguarded days significantly increase take up rates	The variation in reward is important, but not as critical as the other components	Much higher levels of reward are required to significantly drive up participation

Barriers to C_2C contracts

Uncertainty
regarding disruption or multiple disruptions

Appeal
of value added offerings

Effects
on the customer's business

Flexible
protected days and option for protected circuits

Maximum
outages per annum and duration to be defined

Understand
price level

Summary of I&C customer engagement

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Appeal

C_2C is appealing to I&C customers

Contracts signed

Barriers

Greatest barrier is customer uncertainty about reliability of supply

Tailored contracts important

Length of contract had biggest influence

Safeguarded days increase take up

Higher levels of reward drive up participation

Appeal lower for manufacturing & processing

Post acceptance surveys

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Decision to accept	Benefits of signing up
Financial rewards **56%**	Financial rewards **69%**
Frequency of interruptions **19%**	Environmentally friendly **25%**
Protected days/times **19%**	Minimise disruption **19%**

Surveys confirm importance of rewards and minimising disruption

QUESTIONS

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ANSWERS

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Simon Brooke

Smart Metering
Programme Manager

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Agenda

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Introduction	Technical and academic overview	Customer research (technical impact)
Customer research (commercial)	**Commercial review and case studies**	Summary and next steps

Objectives

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Commercial customers

Purchase a demand response from existing and new customers thereby creating a new market

Network operation

Promote the use of commercial solutions to address network constraints

- To develop contract templates for purchasing C_2C demand response
- To discover a purchase price for C_2C demand response
- To evaluate the channels to purchase C_2C demand response
- To purchase C_2C demand response within trials

Development of customer proposition

1. Understanding our customers
2. Commercial arrangement development
3. Trial purchase of C_2C demand response
4. Trial results and lessons learnt

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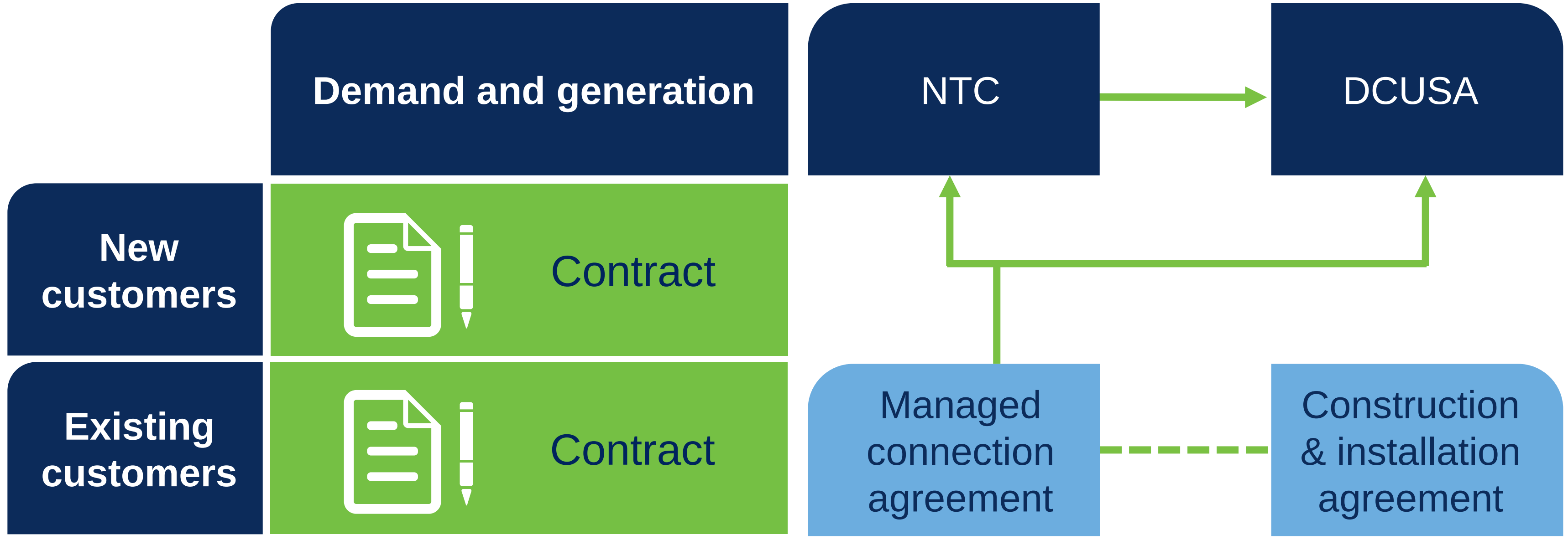
1 Understanding our customers

Lessons Learnt

- **Uncertainty** regarding disruption or multiple disruptions
- **Maximum** outages per annum and duration to be defined
- **Flexible** protected days and option for protected circuits

Contract arrangements

2 Commercial arrangement development



Contract arrangements

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Lessons Learnt

- Simplified contract templates
- Optional elements based on customer feedback
- Separate agreement for controllable switch

Purchase demand response

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3 Trial purchase of C_2C demand response (existing customers)

- Customer survey contact list evaluated
- Engagement materials developed
- Small manufacturers targeted first
- Customers on trial C_2C networks invited to seminars
- Npower & Flexitricity contacted potential trial participants
- An individual working with key account manager

Price model demonstration

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Customer interface developed for presentation purposes

Presentations crucial to customer's understanding of the C_2C product

Purchase demand response

Lessons Learnt

- One point of contact throughout contact and negotiations
- Key is understanding customer's business and potential impact
- Market price discovery through negotiations – options less important
- Discuss implementation approach

Purchase demand response

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3 Trial purchase of C_2C demand response (new customers)

C_2C trial area and application process published

Potential customers invited to seminars

All applications evaluated for C_2C solution

Qualifying customers received standard and C_2C offers

Meeting offers made to talk through both solutions

Purchase demand response

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Lessons Learnt

- Both offers delivered together within Guaranteed Standard timescales
- Customers valued meetings for explaining C_2C solution
- Again key to securing contract is helping customer understand potential impact
- Higher acceptance for customer engaged early (in seminars)

4 Trial results and lessons learnt

Achieved

- Ten C_2C demand response contracts with existing customers
- Direct contact with our customers is the most effective
- C_2C demand response purchase price defined
- Ten C_2C demand response contracts with connection customers

Demand response results (existing)

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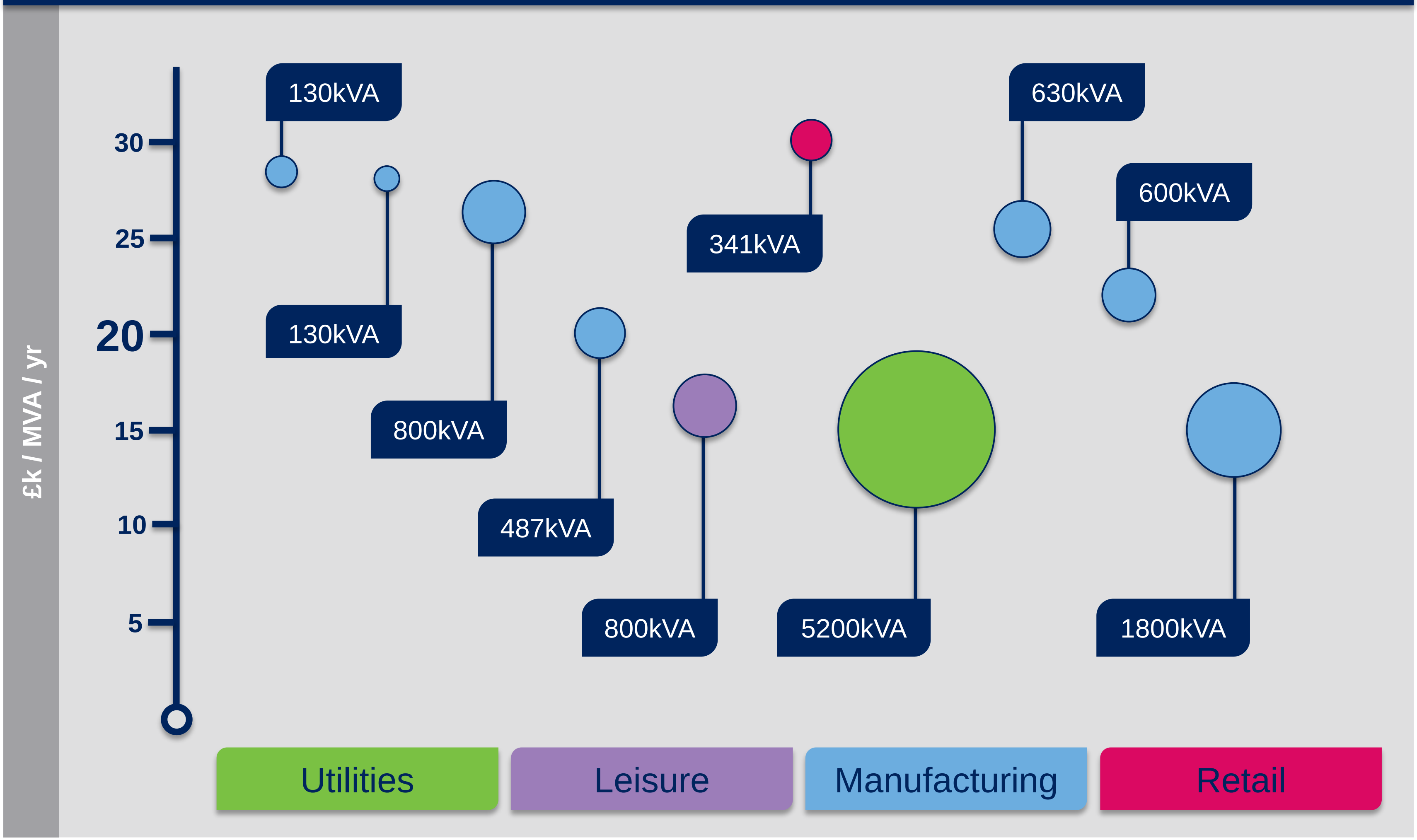
Size, sector and price of DR from existing customers

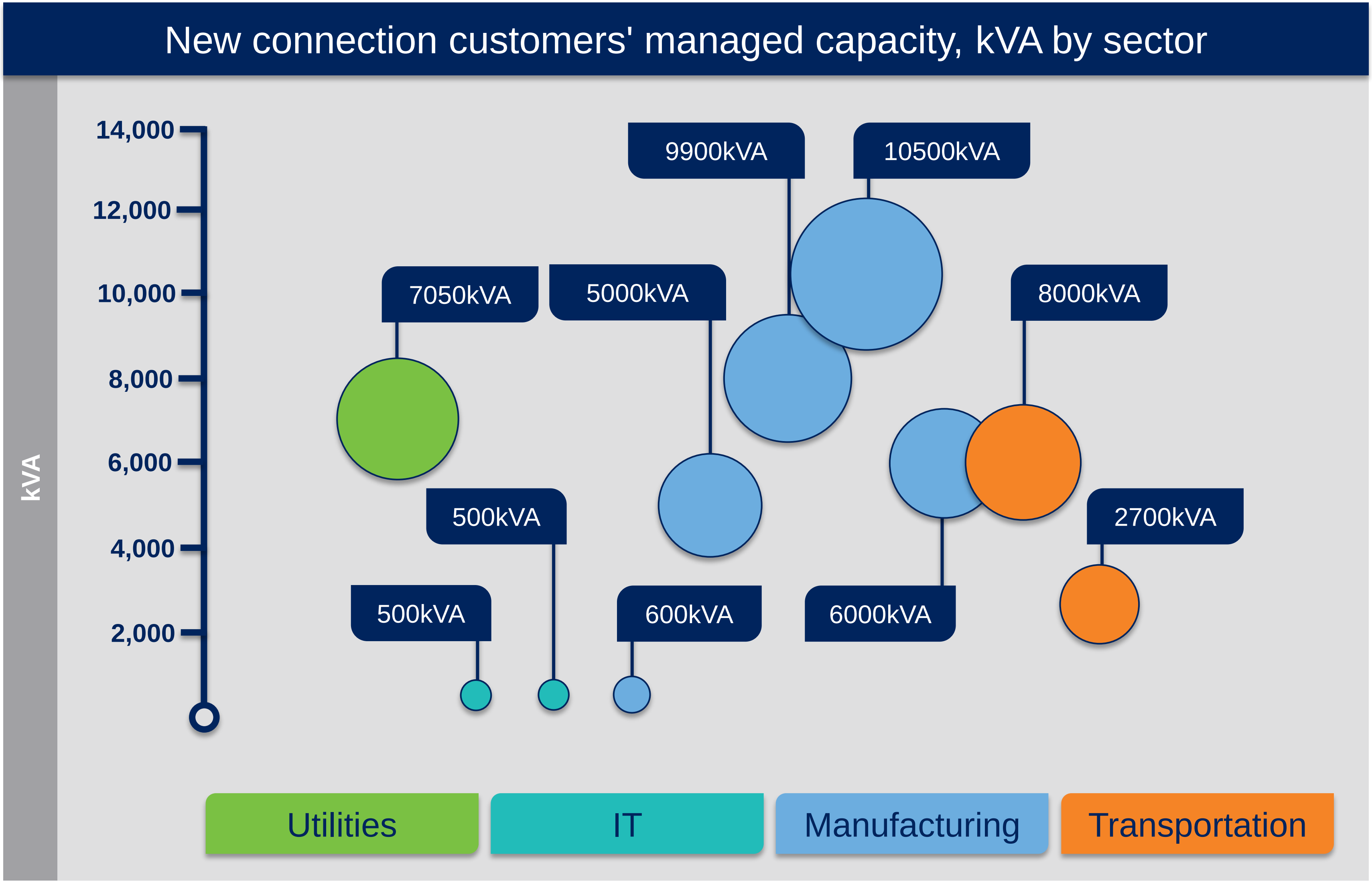


Demand response results (existing)

Lessons Learnt

- Post fault response is attractive to customers and Electricity North West
- Wide range of trial participants, appears most favourable to small manufacturers
- Very attractive to multiple site operators

Demand response results (new)



Demand response results (new)

Lessons Learnt

- Good range of enduring post fault DR capacities
- New DR predominantly from small manufacturers again
- Post fault DR can operate in with other DR programmes

QUESTIONS

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Agenda

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C2C

Introduction

Technical and academic overview

Customer research (technical impact)

Customer research (commercial)

Commercial review and case studies

Summary and next steps

Project benefits summary

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Full set of results and learning from Capacity to Customers will be included in closedown report available on our website in March 2015

Rapidly deployable solution	Reinforcement deferral	Develops new DR market	Cost deferral	Carbon reduction
Will better exploit existing assets, thus cost-effective and quickly implemented	Releases network capacity for use by customers' LCTs	Creates post fault demand response market which is less intrusive to customers	Can defer reinforcement costs and the time taken to complete the associated works	Minimises carbon-intensive infrastructure

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Thank you for your time and attention