Demand scenarios and innovation projects at Electricity North West

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Introducing Electricity North West

Future demand

Rising to the challenge with innovation
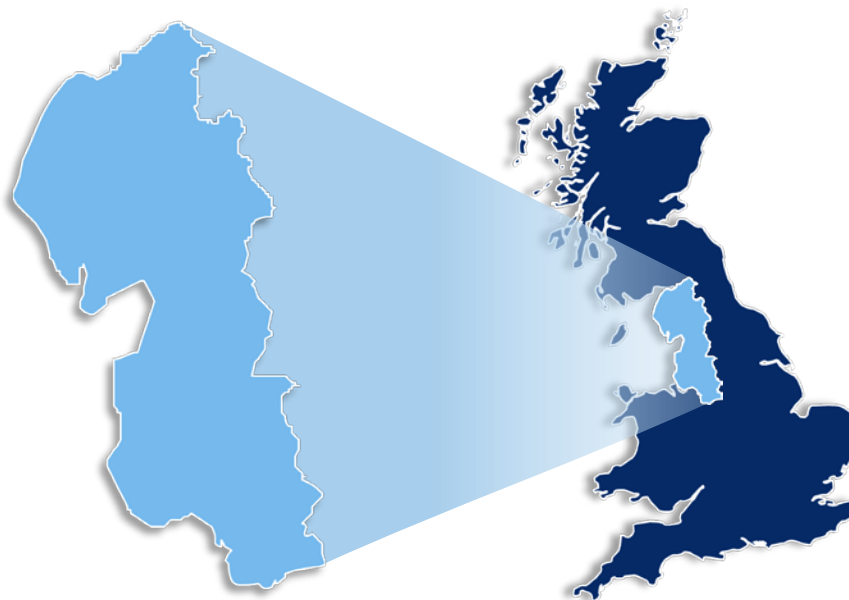
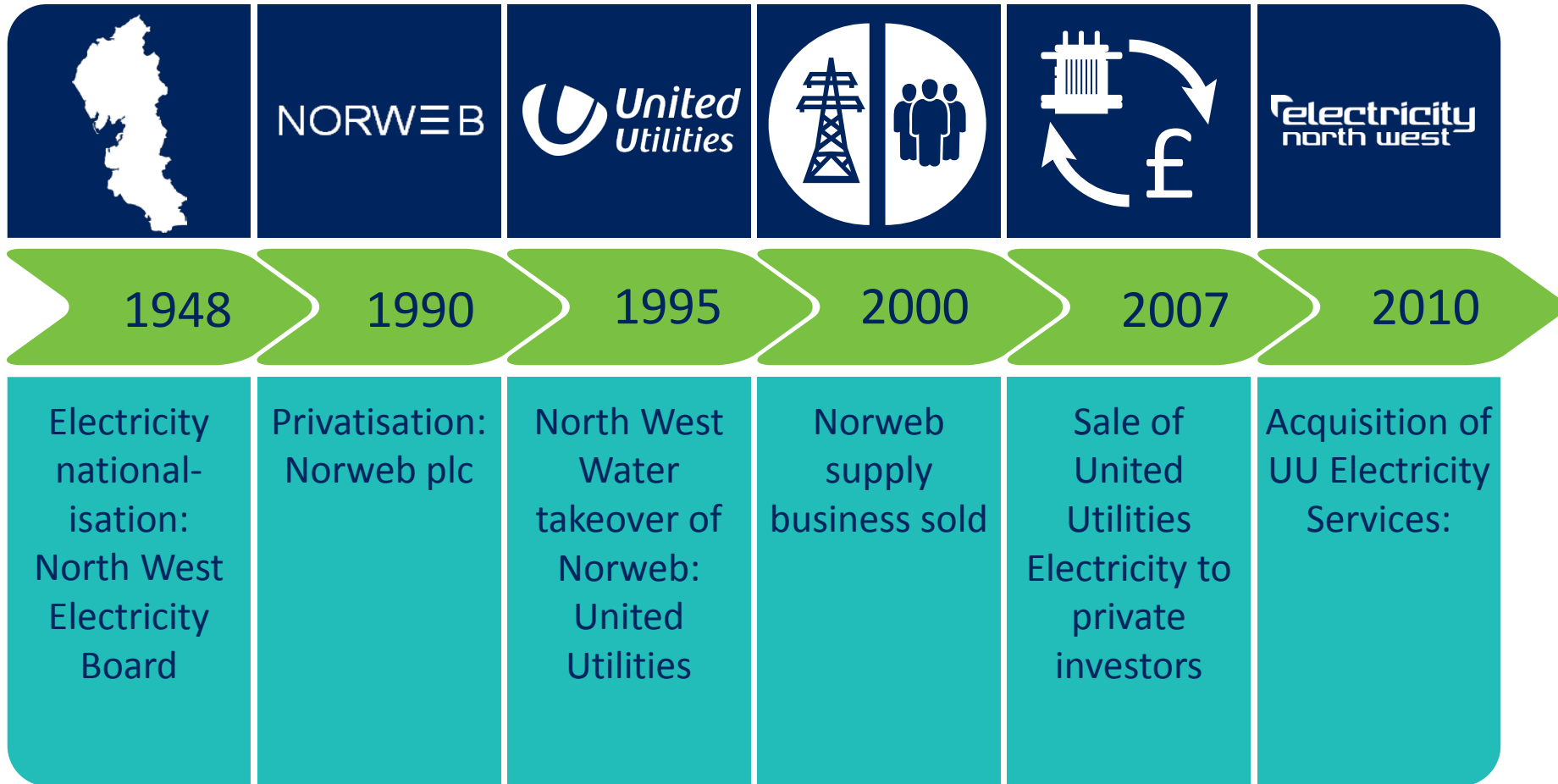Summary and questions

4.9 million

2.4 million

25 terawatt hours
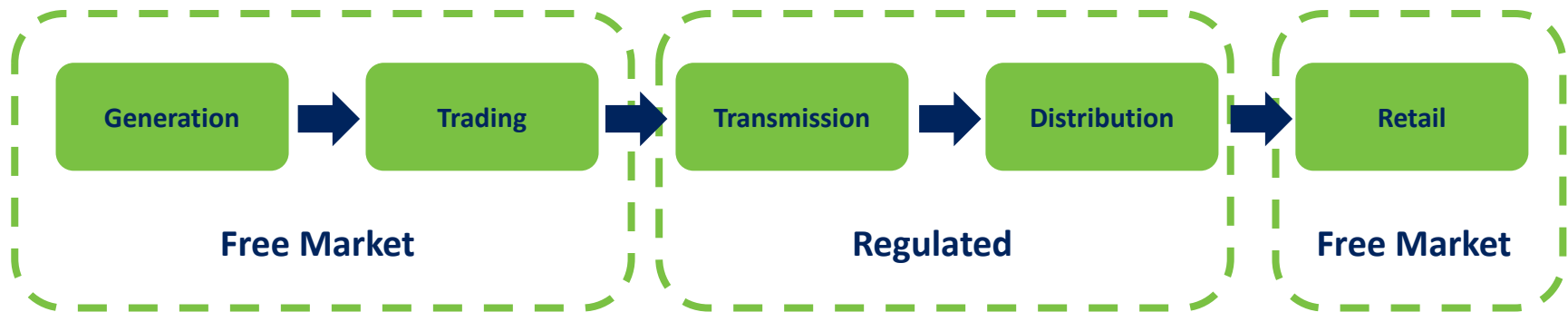
£12 billion of network assets

56 000 km of network ● 96 bulk supply substations
363 primary substations ● 33 000 transformers

Our heritage

1948	1990	1995	2000	2007	2010
Electricity national-isation: North West Electricity Board	Privatisation: Norweb plc	North West Water takeover of Norweb: United Utilities	Norweb supply business sold	Sale of United Utilities Electricity to private investors	Acquisition of UU Electricity Services:

The GB energy market

All large generators, suppliers and networks are regulated

| Generation | → | Trading | → | Transmission | → | Distribution | → | Retail |

Free Market | **Regulated** | **Free Market**

But network businesses are the only ones with <u>price</u> regulation

ofgem
Making a positive difference
for energy consumers

RIIO regulatory framework

RIIO =

Revenue = Incentives + Innovation + Outputs

ED1 = Electricity Distribution

14 DNO areas

Eight years

£1.8 BILLION Total to be spent on the network 2015 - 2023

£24.6 BILLION Total to be spent on the network 2015 - 2023

£10 Resulting annual average savings in consumer bills

8% The power distribution part of a dual fuel bill

Almost 800k The length of our power network

30% Network reliability increase since 2002

Some of our output commitments in RIIO

Customer service	Environment	Social	Safety	Reliability
90% complaints resolved in one day	Reduce carbon footprint by 10%	Improve services for vulnerable and priority service register customers	Site security investment	Maintain overall network health Improve overall reliability

How big should our network be?

Understanding the past
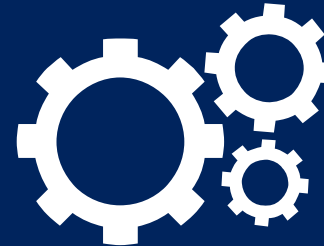
Feeding into the business

Future scenarios

Big issues in the next year

Understand past peak demand

GSP, BSP and primary substations	Rest of network = HV feeders, distribution subs, LV feeders
Metered load in each half hour Affected by weather and generation Manually identify the 'normal' annual peak	The 'Load Allocation' system *estimates* load in each half hour

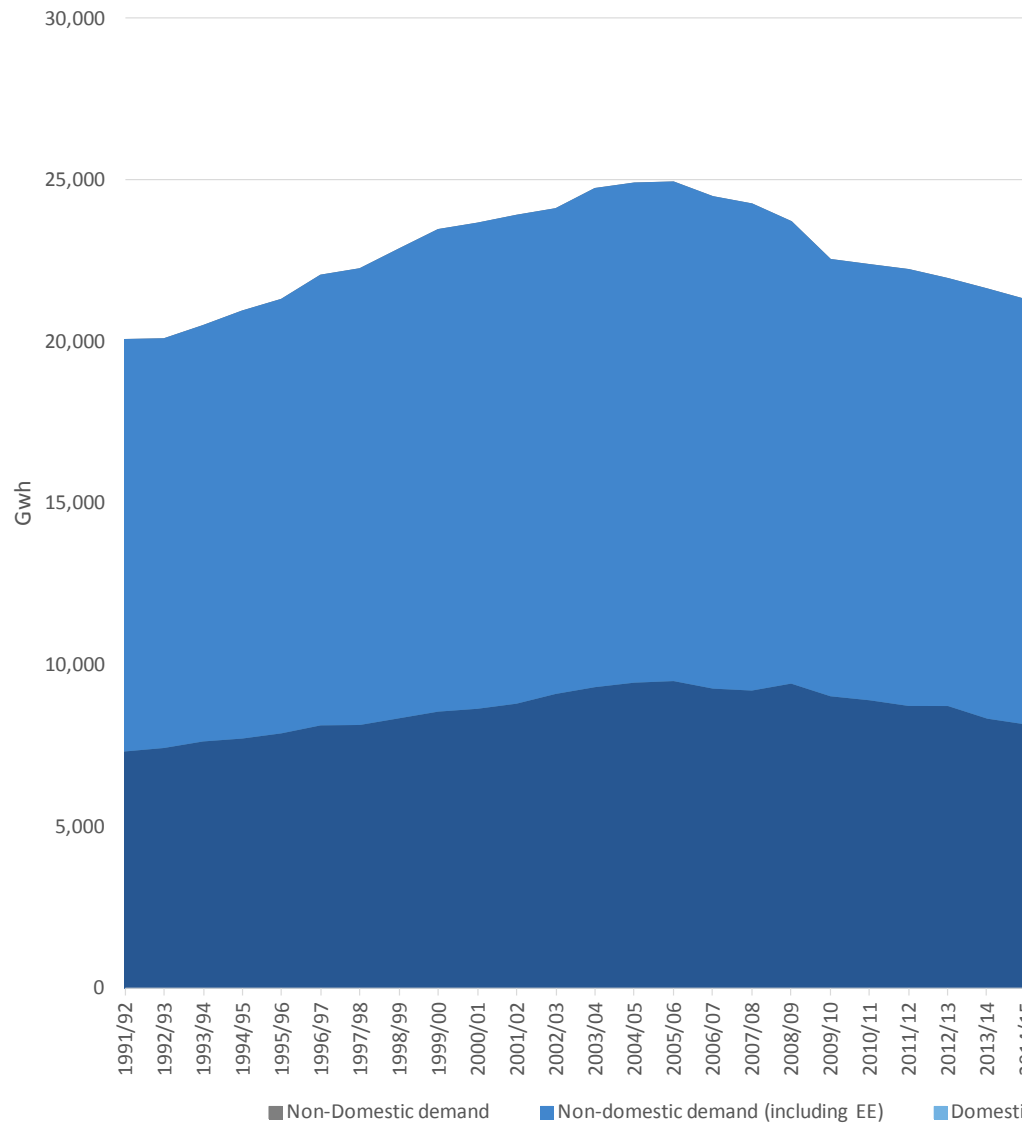## Why could demand go up?

Why could demand fall?

Past electricity demand (energy)

… And 2015 central projection

Scenarios for future peaks

Today 🏠 + ⛽ + 🔥 = 2kW

Future 🏠 + 🚗 + ❄ = 15kW
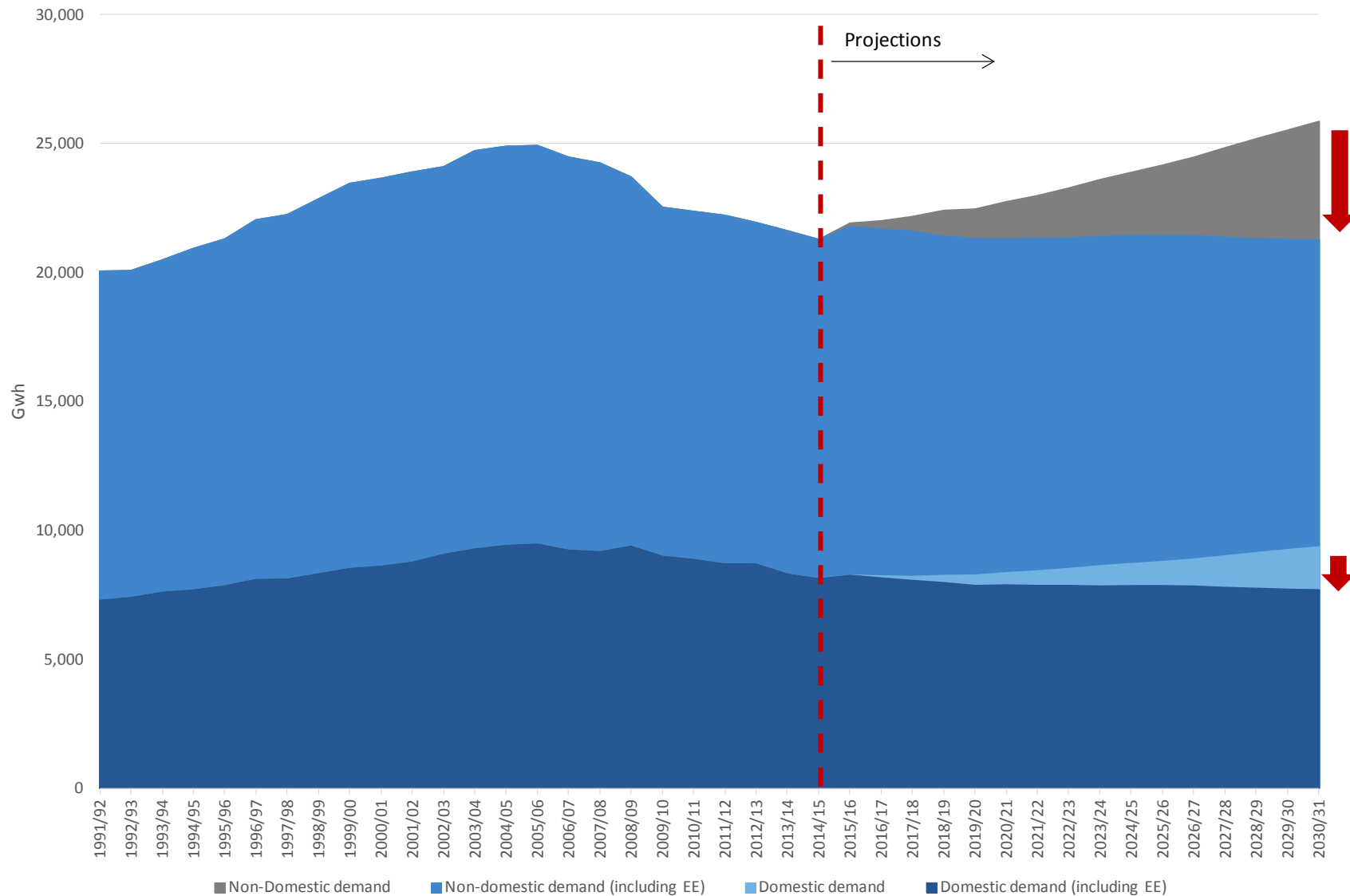
Significant uncertainty,

so not just a single best-view

Plausible combination of:

Background trends – econometric and policy analysis

Incremental effect of electric vehicles and heat pumps

Electricity North West scenarios 2016

Aggregate of weather-corrected annual BSP peak demands
History and scenarios

Legend:
- Measured demand (corrected for weather, but not DG)
- True demand (corrected for weather and exporting DG)
- Active Economy – 2016 scenario
- Green Ambition – 2016 scenario
- BEST VIEW – 2016 scenario
- Focus on Efficiency – 2016 scenario
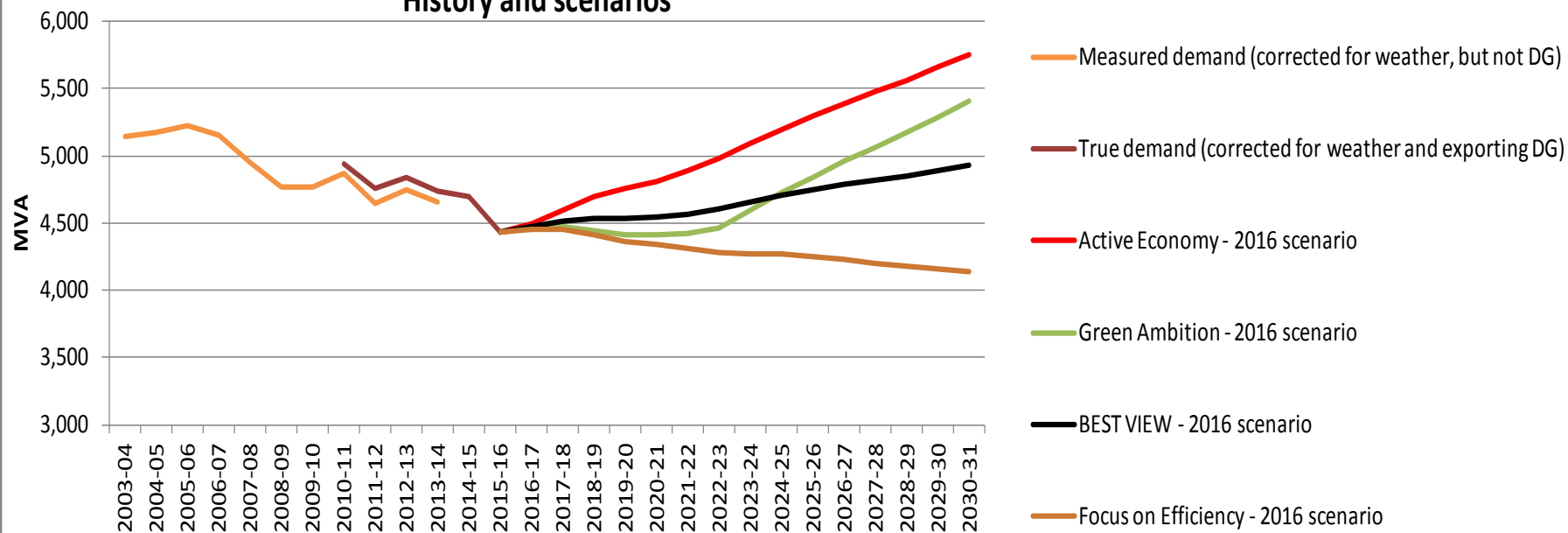
Annual update requirement – methodologies being updated

'ATLAS' project expanding beyond focus on peak demand

The need for our network

Views of future demand and generation affect our plans for network capacity

Thermal ratings of equipment – forward and reverse power flows	Allowed range of voltage around statutory limits – demand, generation, reactive	Fault-level ratings for network protection
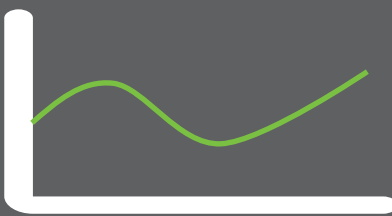
Standards of security of supply including asset redundancy, automation, generation contribution and demand response → Many ways to meet customers' capacity needs

Ageing asset base

Age profile of assets

Chart: Current replacement cost (£m) vs. Estimated year of installation, showing bars from 1920 to 2015. Values peak around the mid-1960s reaching approximately 420.
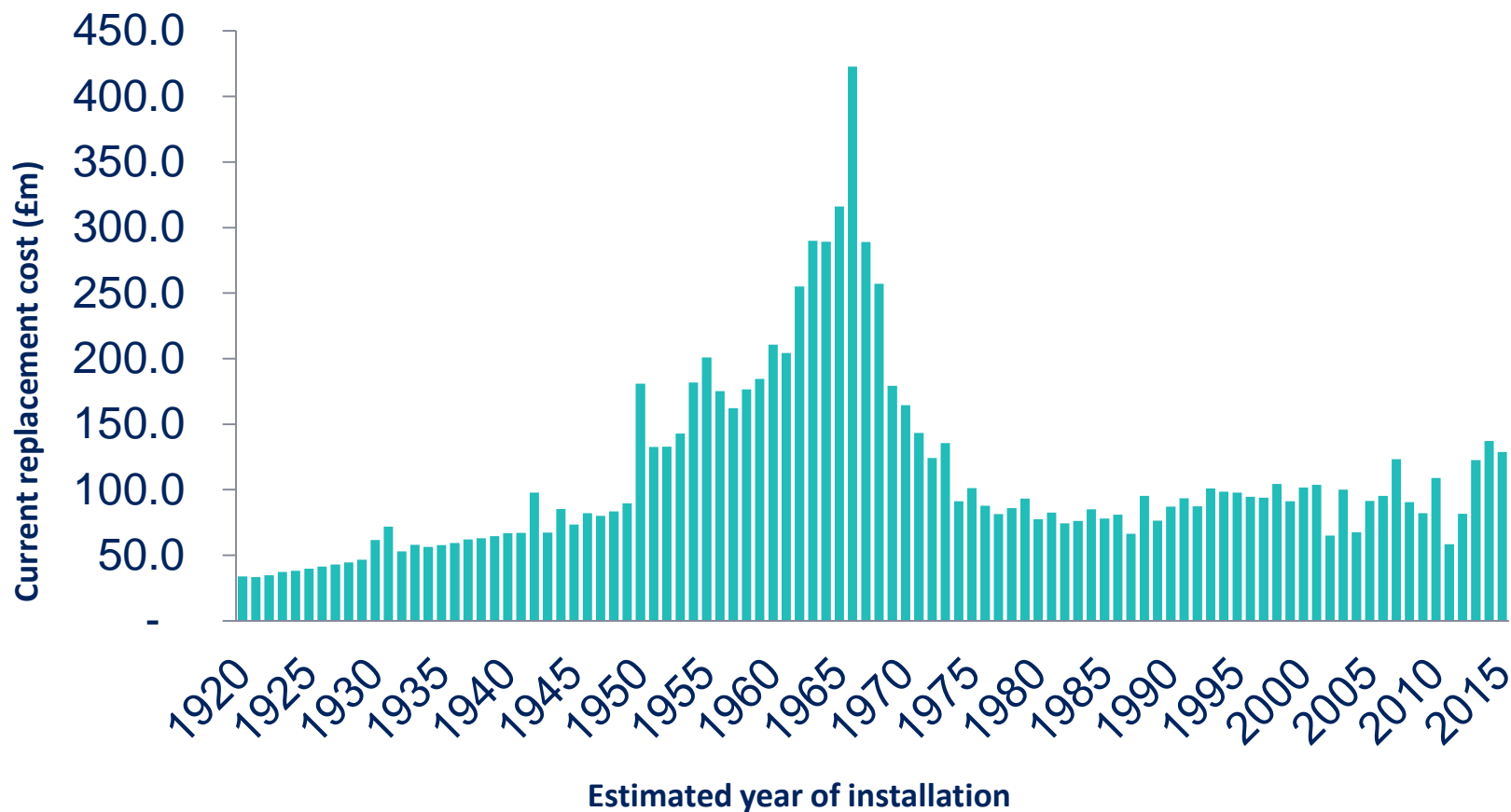
Why innovate – what's the problem?

● The network operator 'Trilemma' ●

Resilience of the network to keep the lights on

Reliability

Connecting low carbon generation and electrification of heat and transport

Sustainability

Smart Solutions

Affordability

Network costs and solutions to fuel poverty and vulnerable customers
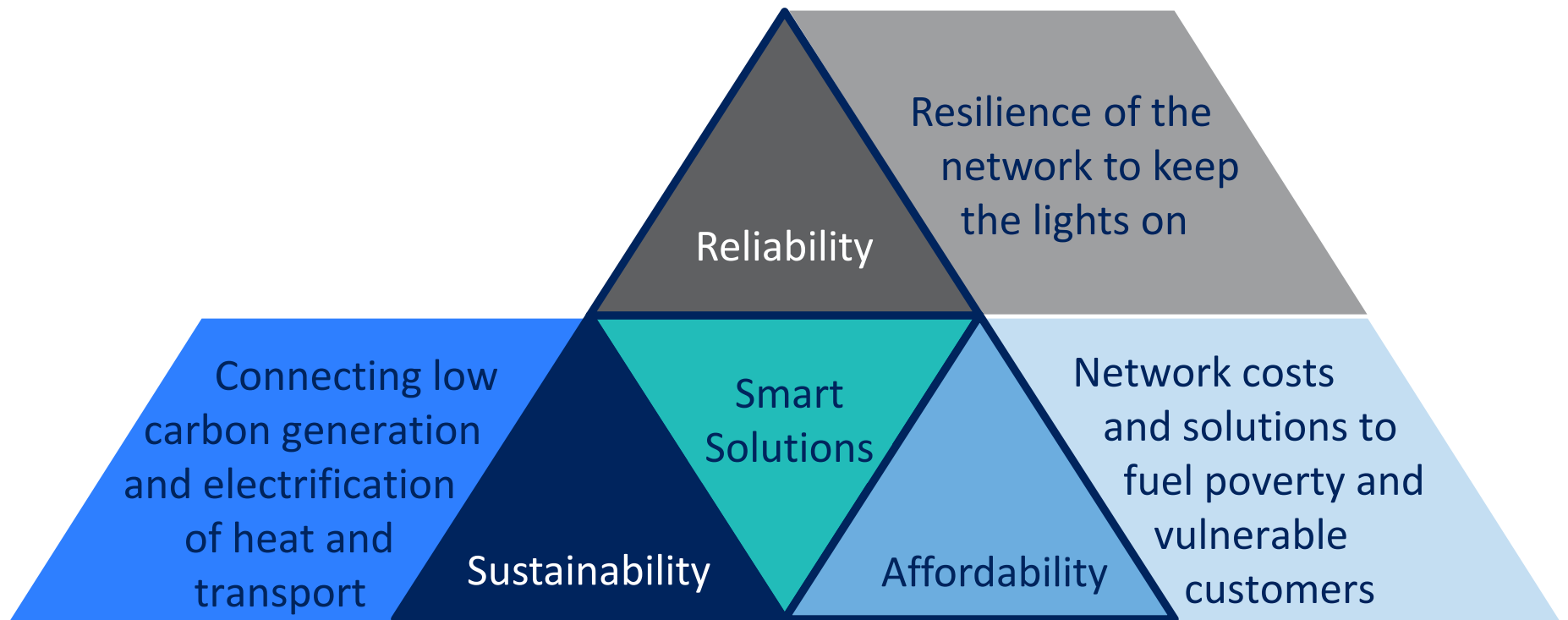
● Smart solutions are the key to unlocking this puzzle ●

Innovation funding

Before RIIO-ED1			RIIO-ED1	
Innovation Funding Incentive	**Low Carbon Networks Fund Tier 1**	**Low Carbon Networks Fund Tier 2**	**Network Innovation Allowance**	**Network Innovation Competition**
0.5% of price control turnover (£2m/pa)	0.5% of price control turnover Small scale demonstration	Central fund for big projects	Replace IFI & LCN Fund T1 0.7% turnover (£3m/pa)	Central fund for big projects

Number of projects →

Discretionary Award	TIER 2 / NIC	TIER 1 / NIA	Innovation Funding Incentive

← **Value and oversight**
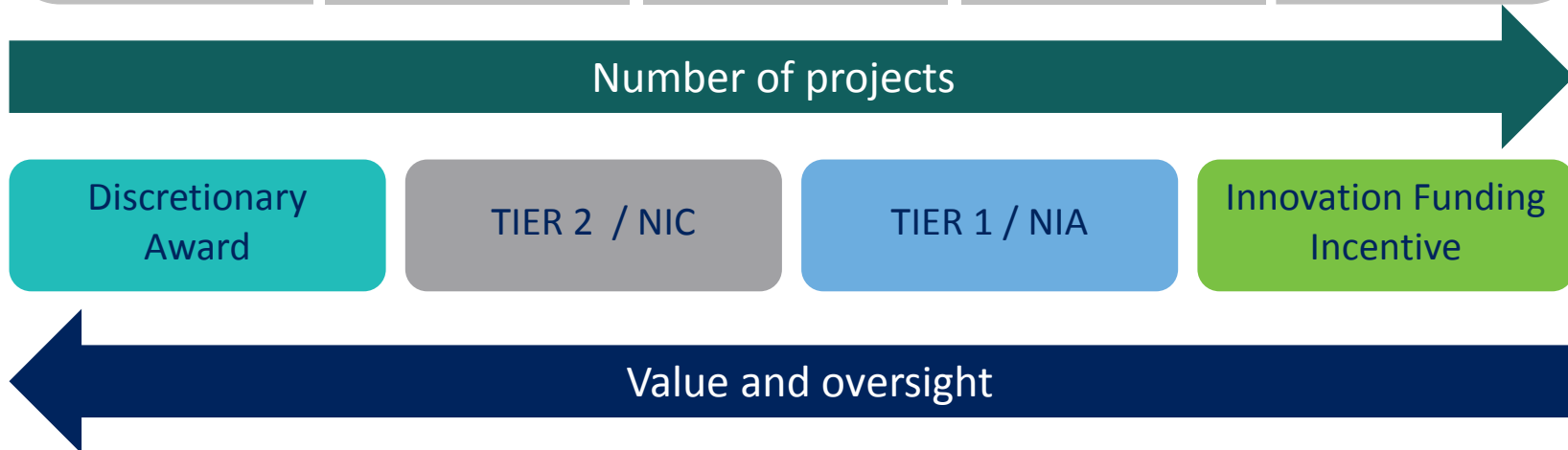
Our innovation strategy

'Fit and forget'

Offer new services and choice for the future

Maximise use of existing assets

Generate value for customers now

Delivering value to customers

Innovative solutions to real problems

Proven technology deployable today
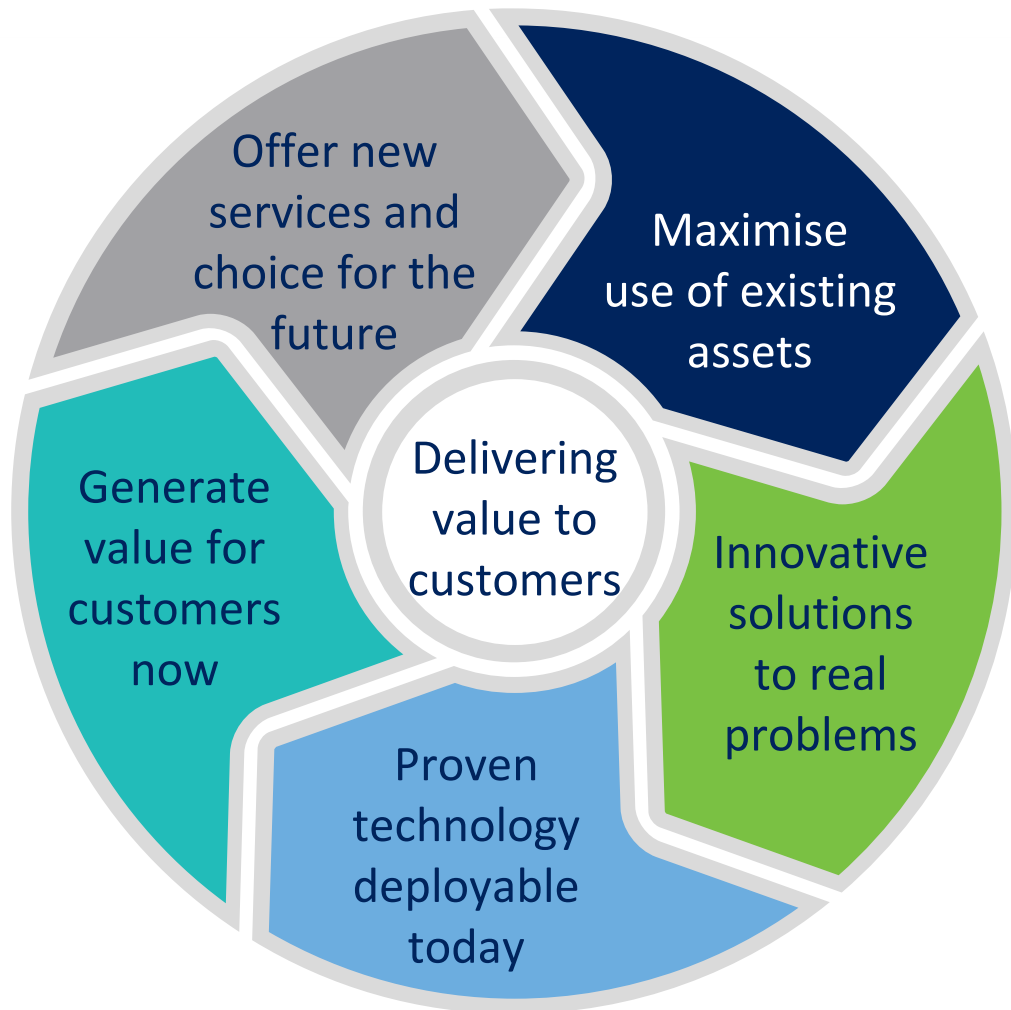
Five consecutive successful second tier / NIC bids

£

Only DNO to spend all of our innovation allowance
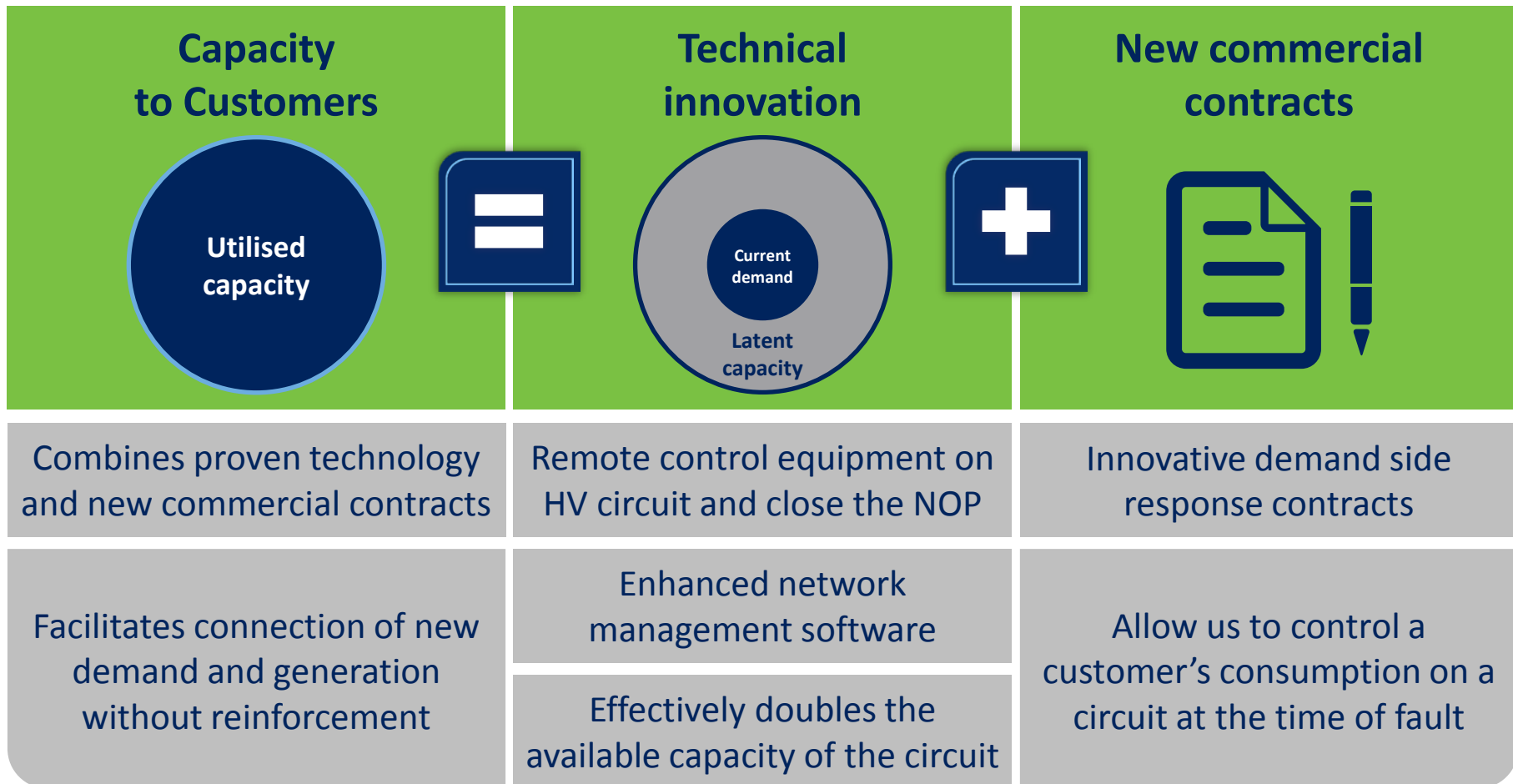
Leading our industry to a low carbon future

CO_2

Stimulating supply chain development

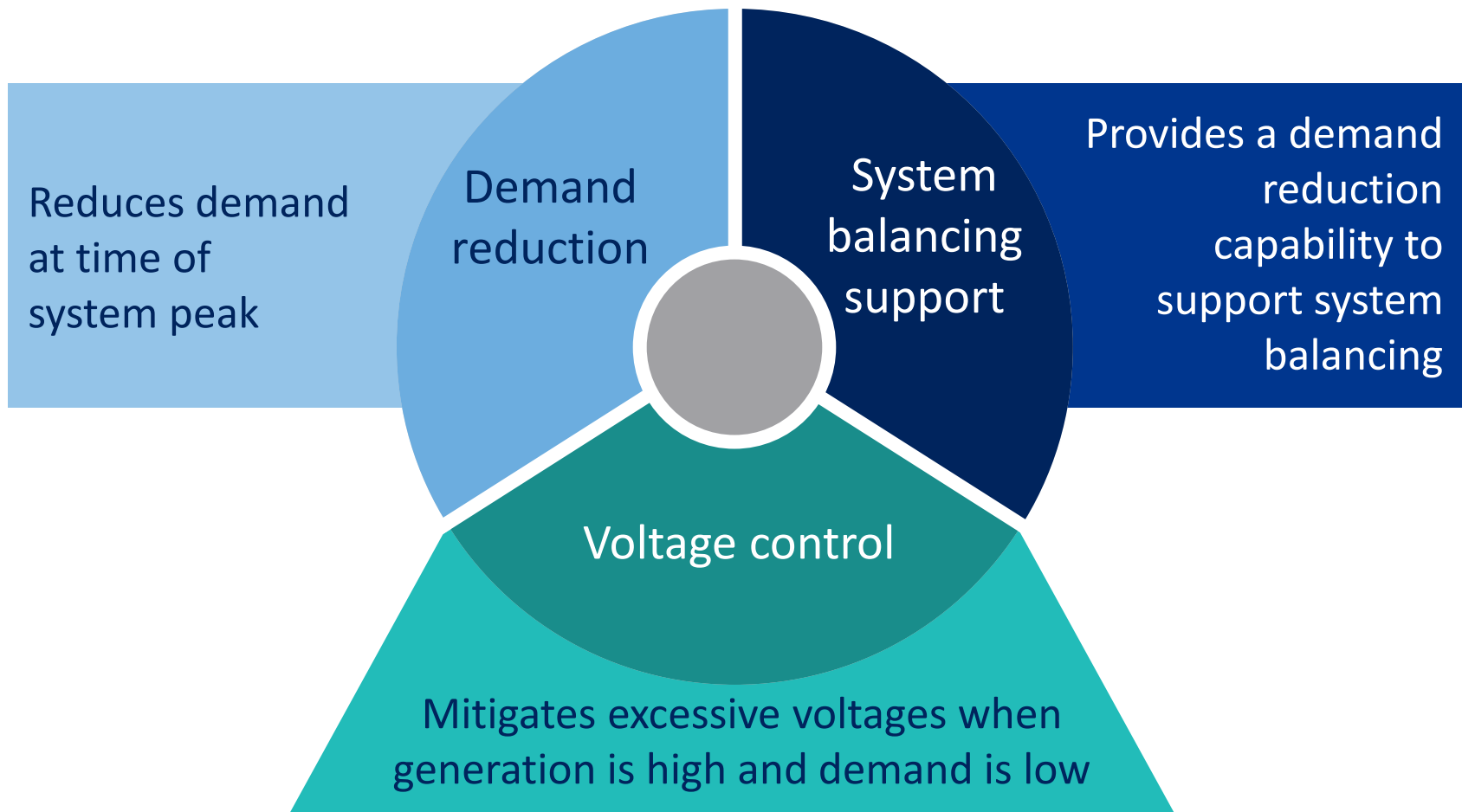Collaborative partnerships with SMEs, universities and National Grid

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	Allow us to control a customer's consumption on a circuit at the time of fault
	Effectively doubles the available capacity of the circuit	

Customer Load Active System Services

CLASS is seeking to demonstrate that electricity demand can be managed by controlling voltage…without any discernible impacts on customers

Reduces demand at time of system peak

Demand reduction

System balancing support

Provides a demand reduction capability to support system balancing

Voltage control

Mitigates excessive voltages when generation is high and demand is low

Smart Street

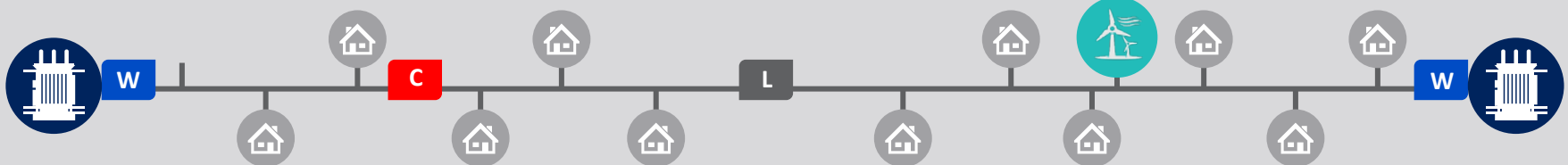New controllable switching devices stabilise voltage

Allows us to lower voltage levels
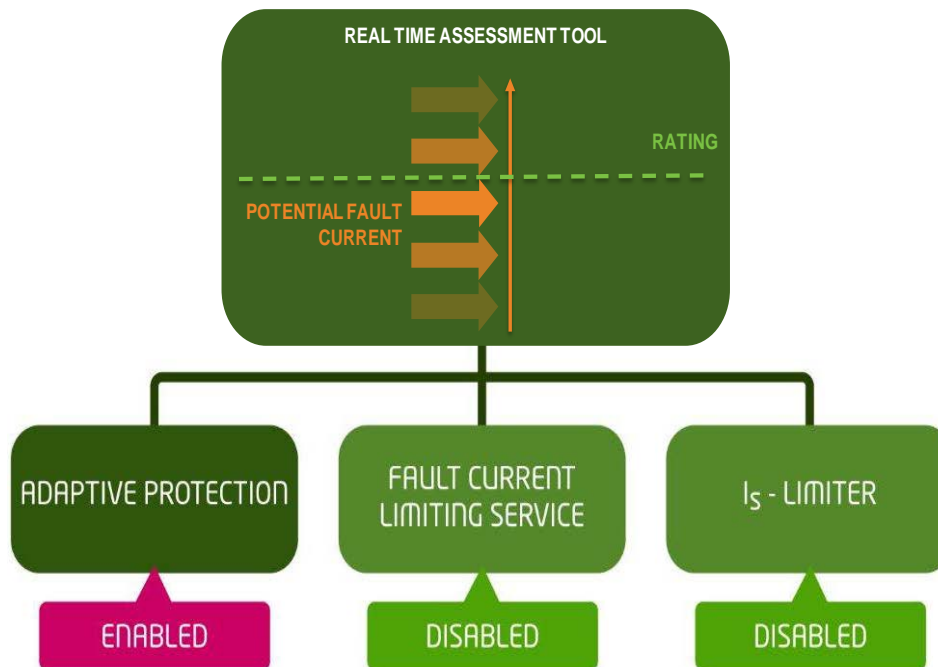
Enables networks and appliances to work in harmony

Low cost ● Quick fit ● Minimal disruption ● Low carbon ● Low loss
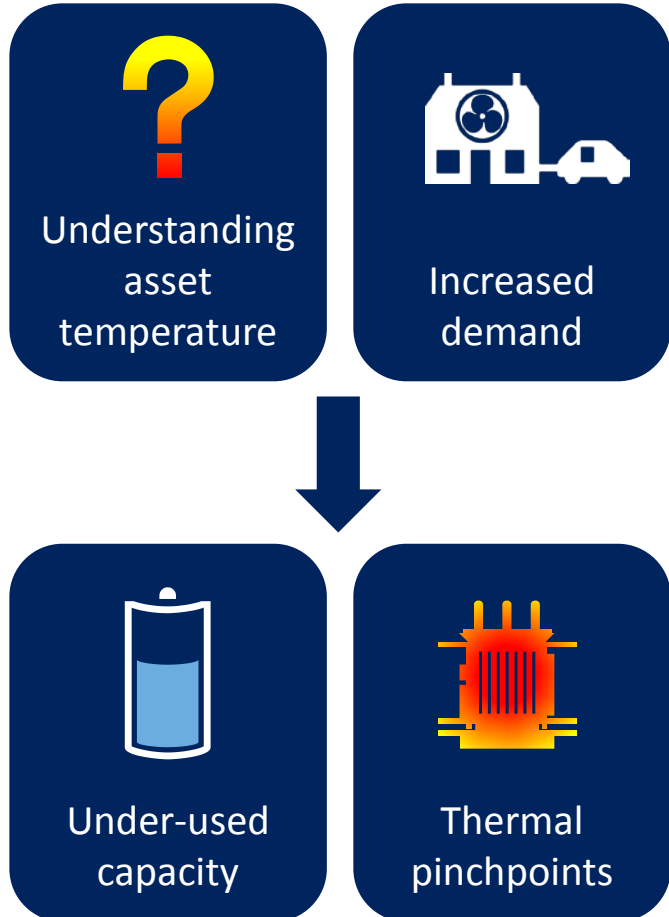● Invisible to customers ● Faster connection of low carbon technologies

Respond is the first UK demonstration of an active fault level management solution that avoids traditional network reinforcement
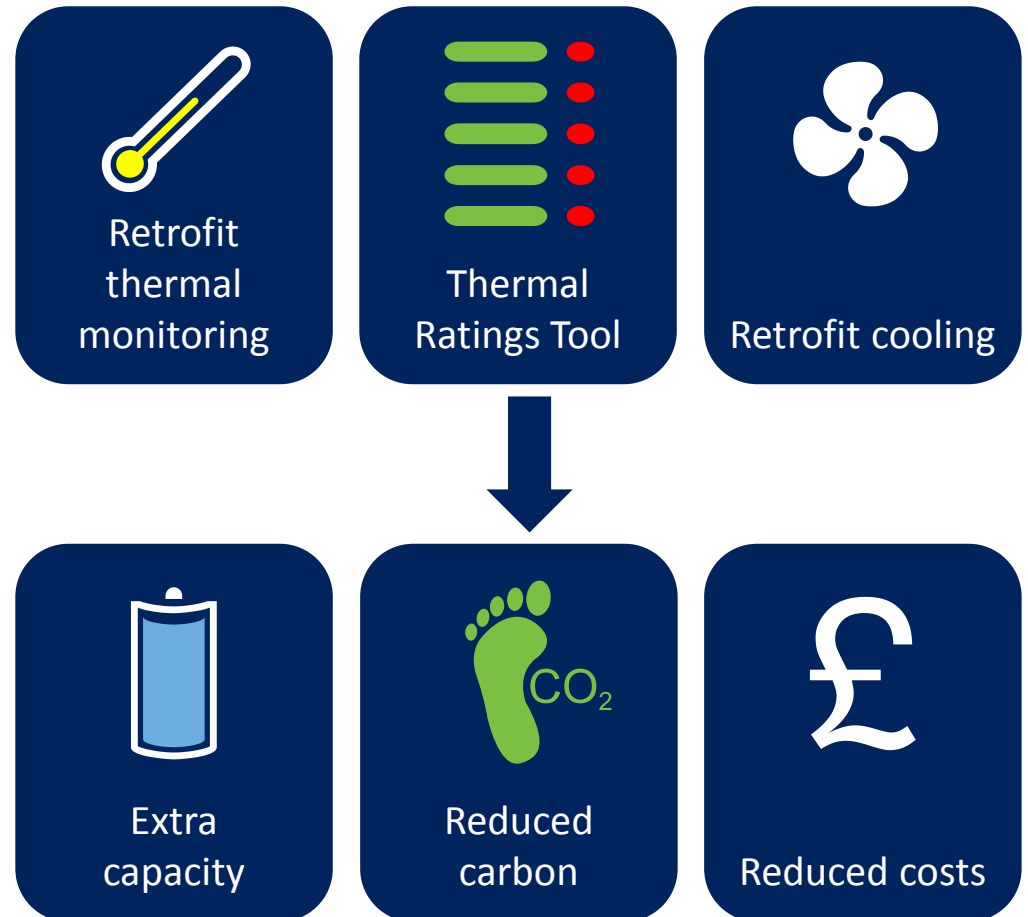

World first in commercial fault level management services

Celsius

Problem

Understanding asset temperature

Increased demand

Under-used capacity

Thermal pinchpoints

Celsius Solution

Retrofit thermal monitoring

Thermal Ratings Tool

Retrofit cooling

Extra capacity

Reduced carbon CO_2

Reduced costs

First tier projects

Seven smaller scale projects – £6 million invested

- Low voltage network solutions
- Voltage management on low voltage busbars
- The 'Bidoyng' smart fuse
- Low voltage integrated automation
- Low voltage protection and communications
- Fault current active management
- Combined online transformer monitoring

Network Innovation Allowance (NIA) projects

Leading or supporting £16 million of NIA projects so far

Asset risk optimisation

Combined on-line transformer monitoring

Demand scenarios / ATLAS

Distribution asset thermal modelling

Sentinel

Avatar

VOLL

Smart Grid Forum work stream 7

Overhead line ratings

Bidoyng smart fuse - single-shot auto-recloser

KELVATEK

WEEZAP - world leading LV vacuum circuit breaker

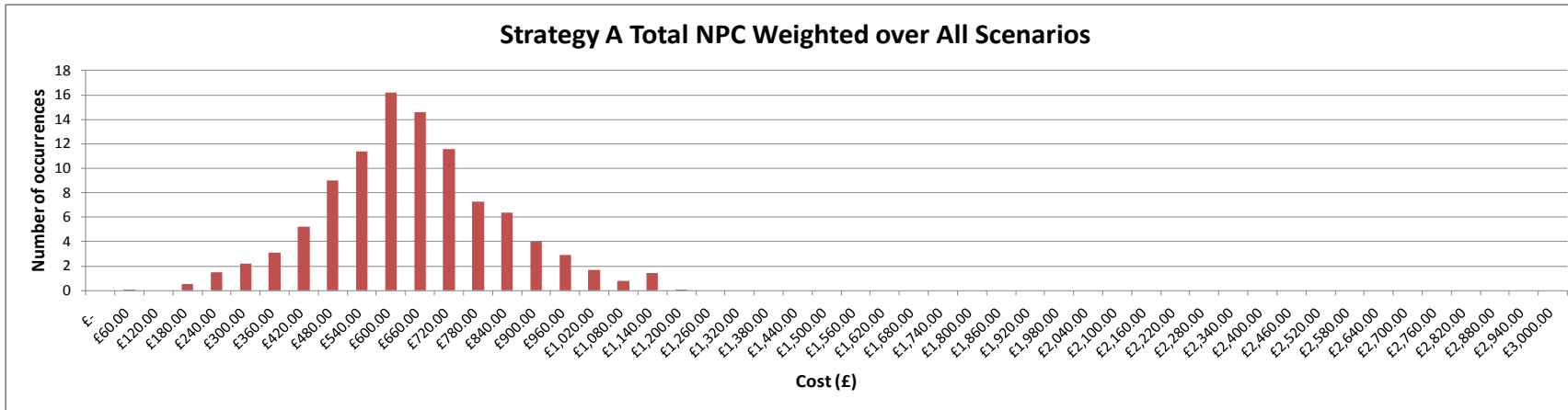When is C_2C cost effective …?

… or when should we reinforce?

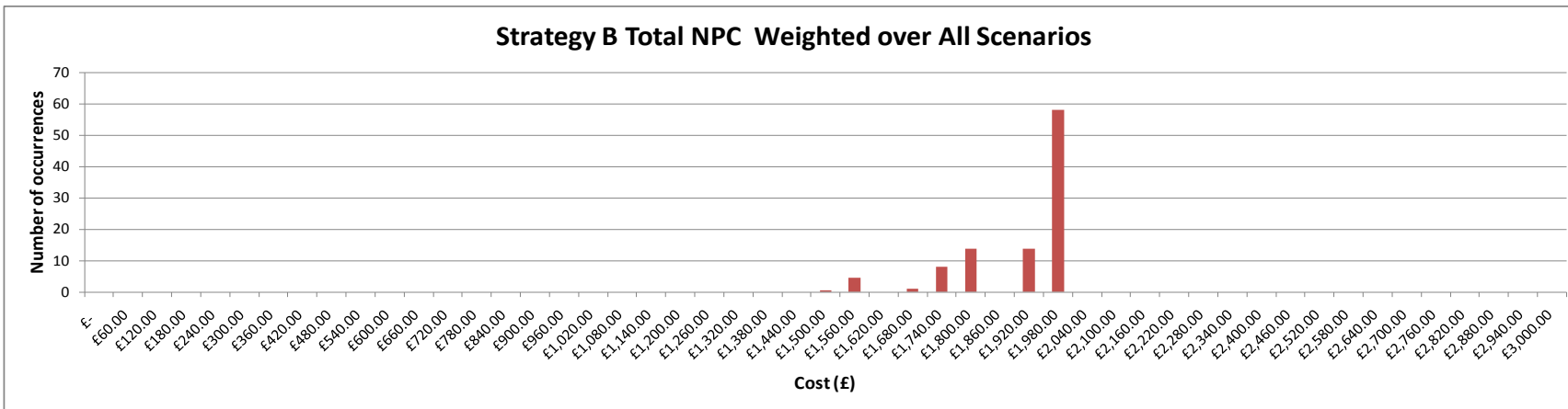Working with University of Manchester to develop economic methodology

Example outputs (hypothetical case)

Net present cost (x- axis is cost, y-axis is probability)

DSR

Strategy A Total NPC Weighted over All Scenarios

Reinforcement

Strategy B Total NPC Weighted over All Scenarios

DSR is always cheaper, but with greater uncertainty in total cost (width of distribution)

Want to know more?

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