CLASS – ENWL LCNF Project

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LCN Fund
Low Carbon Networks

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Agenda

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CLASS
Customer Load Active System Services

Background to CLASS project	Project extension	How CLASS works
Summary of CLASS services	Next steps	Q&A

Background to CLASS Project

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Purpose

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Is seeking to demonstrate that electricity demand can be managed by controlling voltage…

…without any discernible impacts on customers

CLASS
Customer Load Active System Services

Customer Load Active Systems Services

Back to school for a moment…

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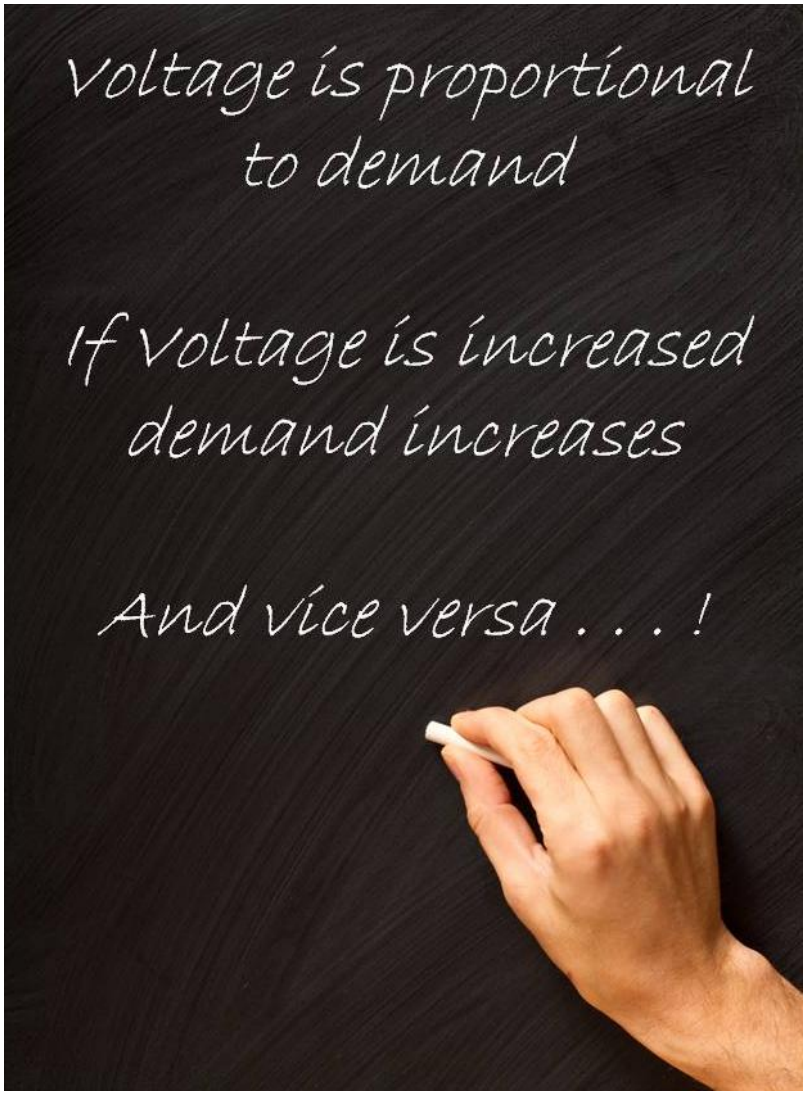
This fundamental relationship is at the heart of CLASS

But how will it change over time as customers adopt new devices?

How could we use this relationship in a smart way to benefit customers?



CLASS project overview

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Objectives	Reduction of peak demand	Frequency response and voltage support	Voltage and demand relationship	No effect on customers
What?	Baseline measure: Spring 2014 Monitoring waves: Summer 2014 to Spring 2015 All **390 000** customers in test area received letter **696** customers recruited at **baseline** **1,357 monitoring** interviews			
Customer hypothesis	**“CLASS will be indiscernible to customers”** Customers will not see / observe / notice an impact on their supply quality when these innovative techniques are applied			

Background to CLASS Project (2)

CLASS trial results overview

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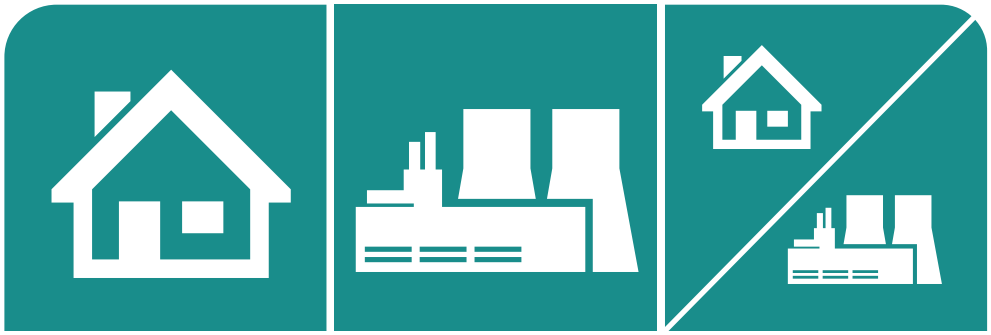
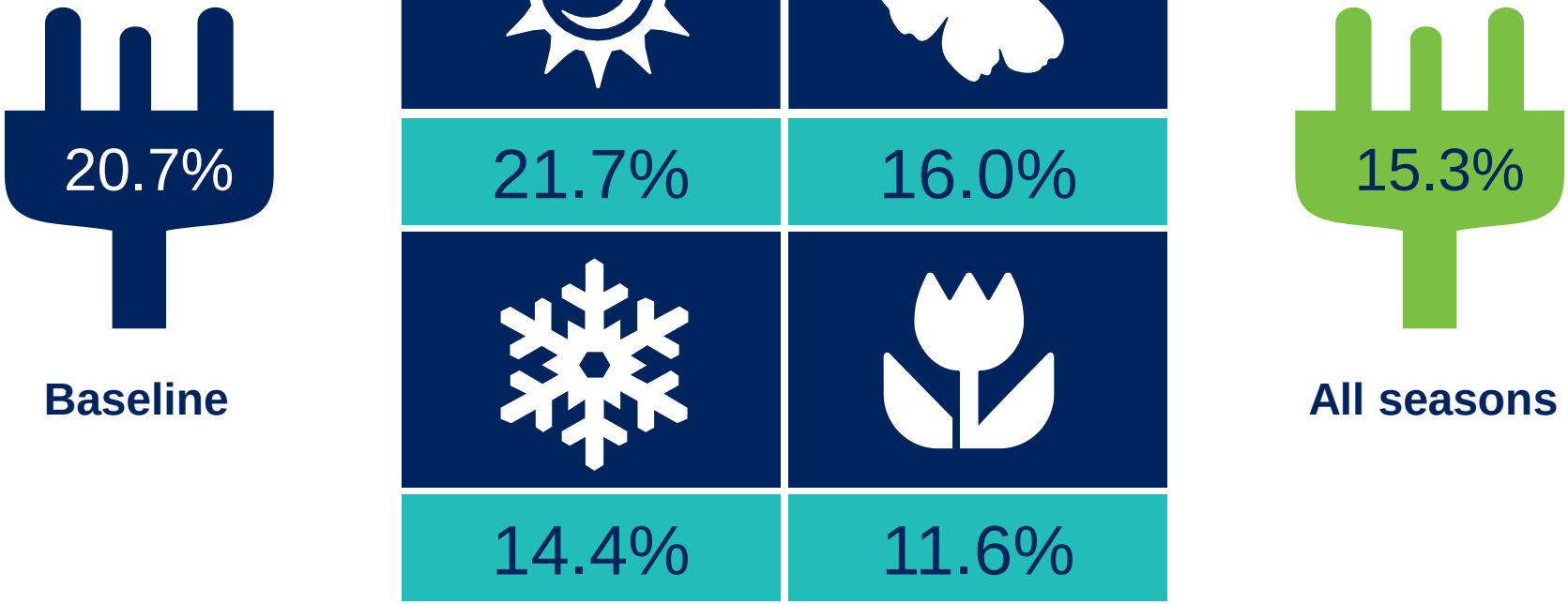
Average voltage/demand relationship

Four seasonal, average week day and weekend, voltage/demand relationship matrix for every half hour interval for three load types



Mainly domestic	Mainly industrial/ commercial	Mixed
V ~ P 1 ~1.36%	V ~ P 1 ~1.1%	V ~ P 1 ~1.1 / 1.2

Changes to appliances or lighting



Customers who said they noticed a change in performance to at least one appliance or to their lighting in the last seven days was **significantly lower than the baseline**

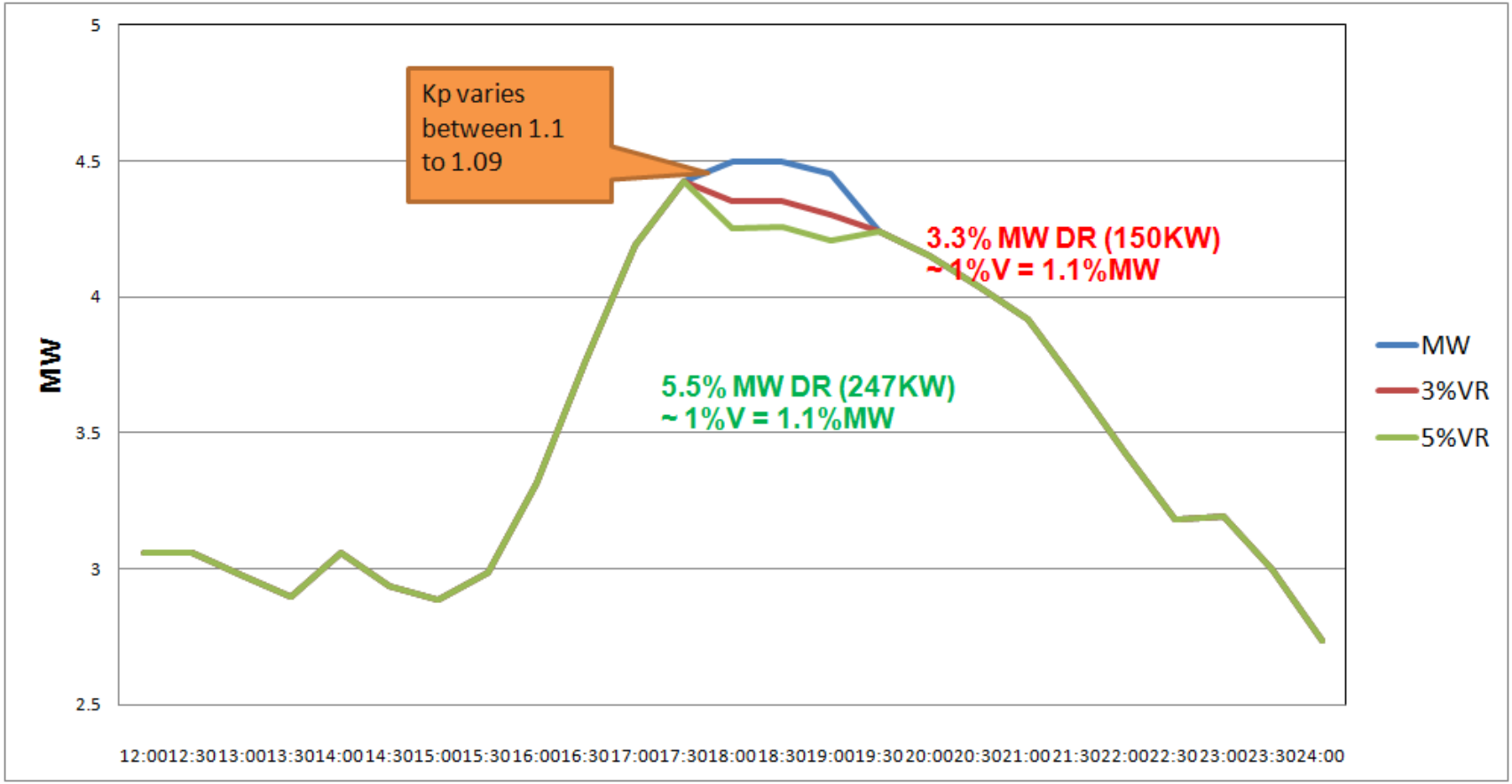
No complaints about power quality

Complaints about power quality or service received at the customer contact centre or to Impact Research team likely to be caused by CLASS trials

= 0

Network deferral

Demand reduction – Romiley winter mid-week



Demand reduction (DR)

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Great Britain 5% VR = 6%DR		Great Britain 6% VR =7.2%DR	
			
Summer Minimum demand response = 1120MW	Winter maximum demand response = 3150MW	Summer Minimum demand response = 1340MW	Winter maximum demand response = 3780MW

£000,s / MW	CLASS	~ 20	Current	~ 150 pa
	Storage	~1400	DSR	~ 20 pa

Reactive power absorption

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Great Britain

Spring	Summer	Autumn	Winter
1430MVAr to 1880MVAr	1520MVAr to 1760MVAr	1450MVAr to1760MVAr	1530MVAr to1940MVAr

Traditional 200MVAr ~ £3-5M in a fixed location to just resolve SO reactive issues versus £80M for all CLASS services

CLASS Project Results Summary

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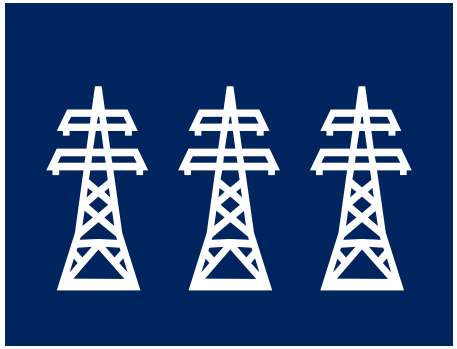
Statistical findings are that domestic customers did not notice the CLASS functions



Lessons have been learned during the installation phase, that can be integrated into any future ‘rollout’

CLASS has provided National Grid with the ability to use an ICCP link which provides them with a demand response during a system frequency event

CLASS has shown a predictable relationship between voltage and demand

Potential applications for CLASS

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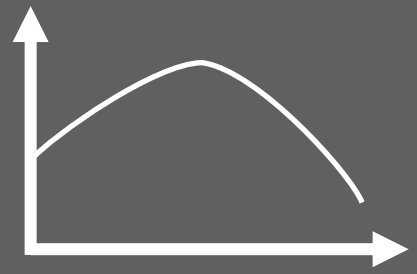
Today	Tomorrow	Future
High peak demand	Respond and reserve	Wind following
		
Reduces peak demand Faster LCT connections Lower network cost	Primary and secondary frequency response Allows more renewable generation Flexible reactive power absorption	Facilitates demand boost lower energy costs Mitigates inertia issues

CLASS extension objectives

To assess the market for each CLASS service	To assess the impact for each CLASS service	To determine the benefits for GB customers for each CLASS service
Market structure, entry qualifications and service price	Market structure and service price	Costs and benefits for GB customers
Size of market in 2015 and potential size annually to 2025	Competitors – number, type and size of players	Potential winners and losers in each market
Current and potential future competitors – no, type and size of players		Whole market impact

How CLASS works

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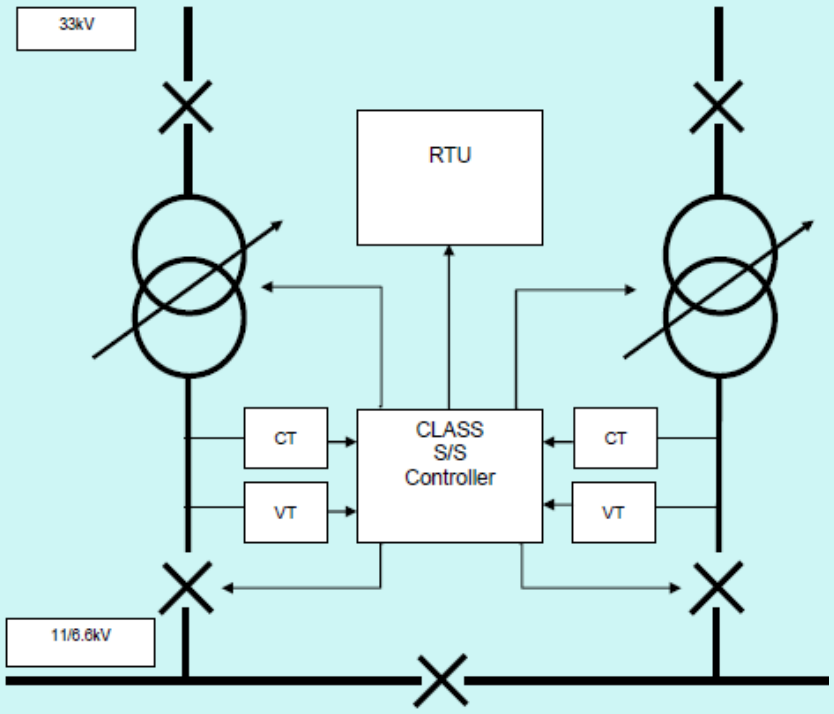
Standard arrangements at primary substations



Primary Frequency Response	LV circuit breaker opens when frequency falls below a set threshold S/S controller performs system checks before opening circuit breaker Circuit breaker will normally be re-closed after 30s CLASS S/S controller will measure performance
Secondary Frequency Response	LV target voltage reduced when frequency falls below a set threshold Tap changers operate to reduce voltage Target voltage will reset to normal after 30 minutes. CLASS S/S controller will measure performance
Demand Response/ Fast Reserve	LV target voltage reduced when local demand reaches local capacity or to provide service to SO Tap changers operate to reduce voltage Target voltage will reset to normal when local demand reduces or SO service finished CLASS S/S controller will measure performance
Reactive Power Services	Tap stagger between the transformer pair to absorb reactive power Effect to be measured at the GSP

Summary of CLASS services (1)

Context: NGET's Response and Reserve services

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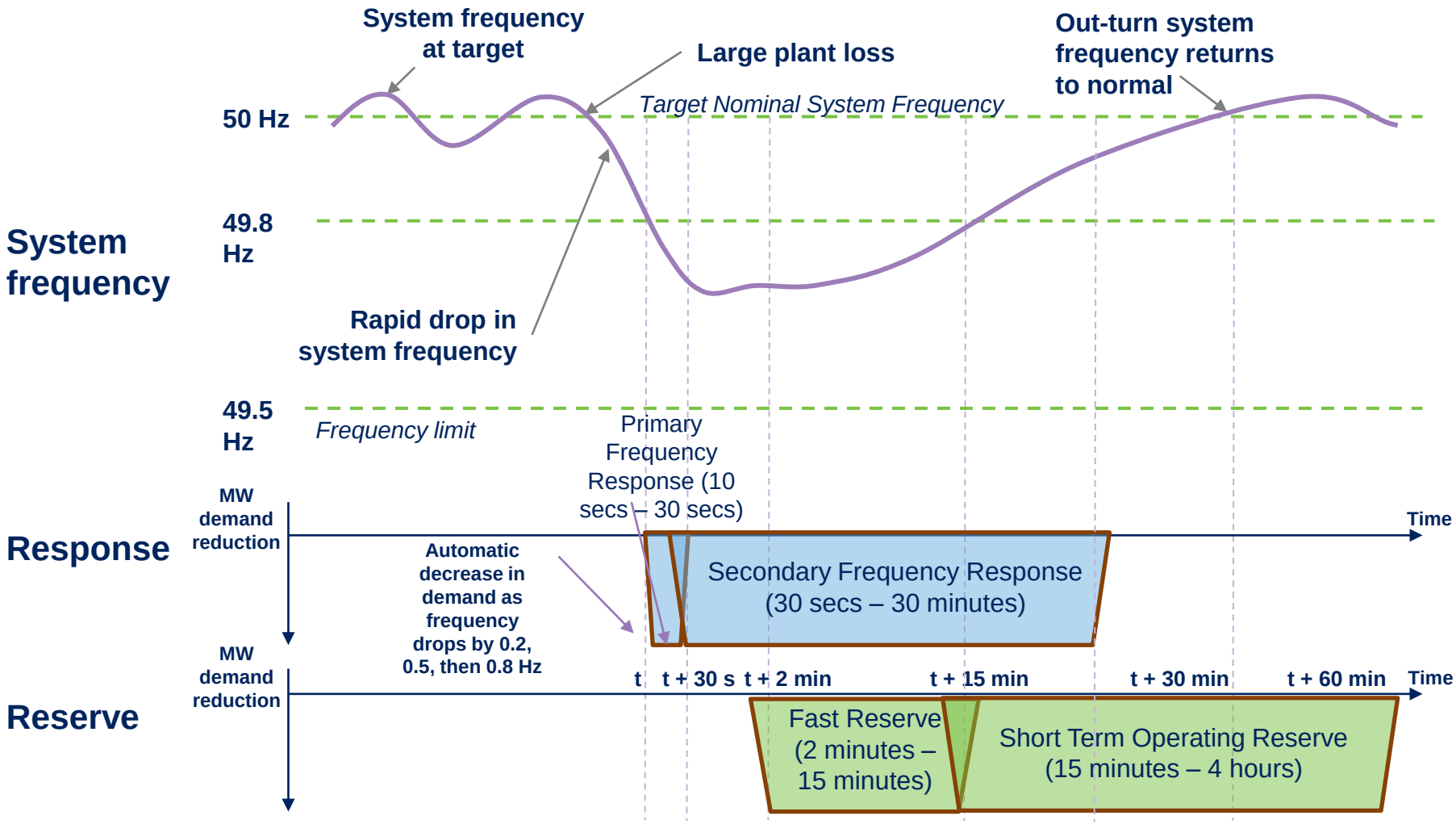

Summary of CLASS services (2)
Response-type CLASS services

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#	Name of CLASS service	Action	Effect	Time to effect onset	Effect duration	Measurement
1a	Primary Frequency Response (PFR)	Circuit breaker trip on falling frequency	Active power reduction	< 0.5s	Extended period. Reverse after 30s	Recorded at each substation with the results aggregated to show overall response. Response determined as difference between demand prior to and post response.
1b	Secondary Frequency Response (SFR)	Tap up on falling frequency	Active power reduction	20-30s (depends on tap changer)	Extended period. Reverse after 30 mins	

Participation in existing services

Our initial thoughts are that these CLASS services could potentially participate in **Firm Frequency Response (FFR):**

- Service 1a) seems suited to a **Primary Low service**
- Service 1b) seems suited to a **Secondary Low service**

Summary of CLASS services (3)

Reserve-type CLASS services

#	Name of CLASS service	Action	Effect	Time to effect onset	Effect duration	Measurement
2a	Demand reduction (System balancing)	Tap down on request	Active power reduction	20-120s	Extended period	Recorded at each substation with the results aggregated to show overall response. Response determined as difference between demand prior to and post response.
2b	Demand boost (System balancing)	Tap up on request	Active power increase	20-120s	Extended period	

Participation in existing services

Our initial thoughts are that service 2a (Demand reduction) could be used in either **Fast Reserve** (especially given the short ramping time) or **STOR** – much as Demand Side providers are encouraged to do so today on the STOR runway programme.

Summary of CLASS services (4)

Voltage management-type CLASS services

#	Name of CLASS service	Action	Effect	Time to effect onset	Effect duration	Measurement
3	Voltage management	Tap stagger on request	Reactive power absorption	20-120s	Extended period	Measurement needed at each GSP

Participation in existing services

This CLASS service could be suited to National Grid's **Enhanced Reactive Power Service**, which can be provided by static compensation equipment.

Next steps

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Market Analysis	Deployment	NGET	Business Case	DNOs
Baringa continuing to work on market assessment and CBA for GB customers	Ofgem/ DECC looking for significant deployment for winter 16/17 if possible. Discussions with suppliers on options	Ongoing discussions on services to be provided	Planning to take Business Case for deployment to ENWL Board beginning April	Ongoing engagement with other DNOs to support deployment by them

QUESTIONS & ANSWERS

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