

# Residential demand response – the dynamic Time-of-Use tariff

## Session 2

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UK Power Networks & EDF Energy

# Agenda



- Before Low Carbon London
- LCL: dynamic Time of Use trial
- Results from the trials
- Survey results from participants
- Engaging with customers
- What does this mean for DNOs?

# Before Low Carbon London



- Network management
  - Economy 7 with remote teleswitching (time based / static)



Energy Demand  
Research Project



Customer-Led Network  
Revolution



Static ToU

Static ToU

Dynamic ToU

# Residential Demand Side Response

Multiple Purposes



# Low Carbon London trials

Objective: Emulate 2020 end-to-end energy supply



- Smart meter roll out
- Billing
- Balancing

Suppliers

DCC

- Data service provider
- Communications

CGI



SIEMENS

- Manage constraints on the network
- Manage smart meter data
- Topology association

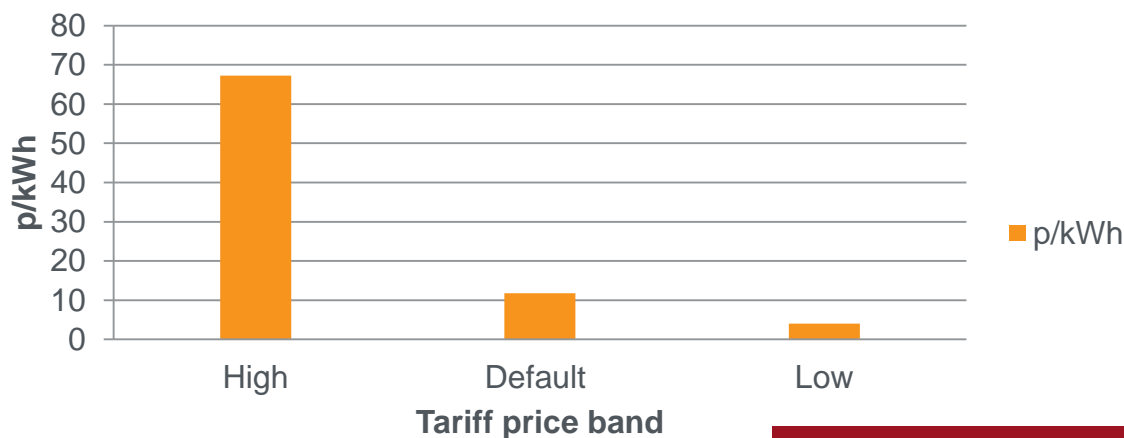
Network operators



# Economy Alert

## Tariff design and schedule

- Three price bands:



- Two applications tested:
  - Constraint Management and
  - Wind Twinning (Supply Following)

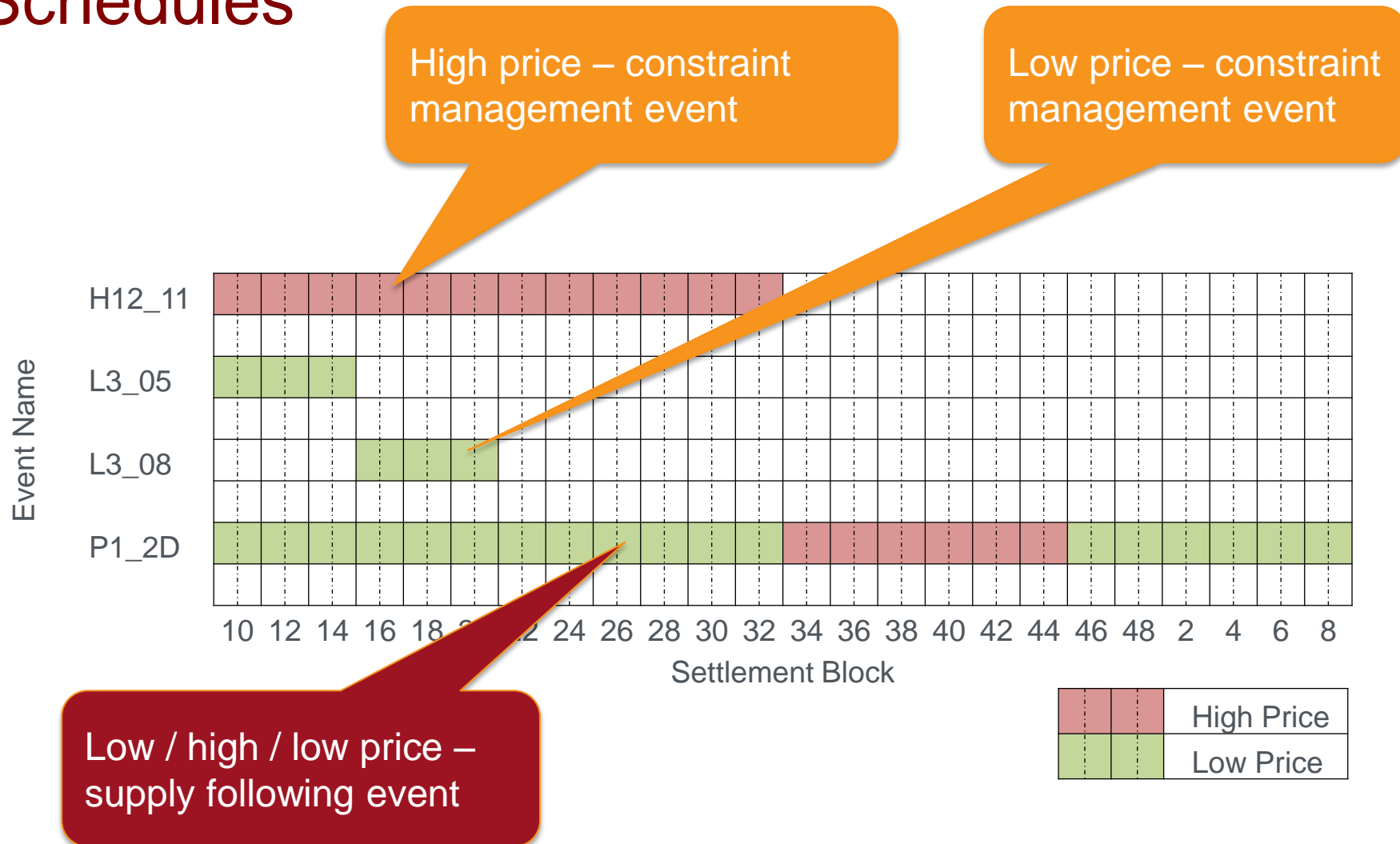
### Notification

- Day-ahead
- 8.30am

### Delivery

- In Home Display
- SMS Mobile phone

# Schedules



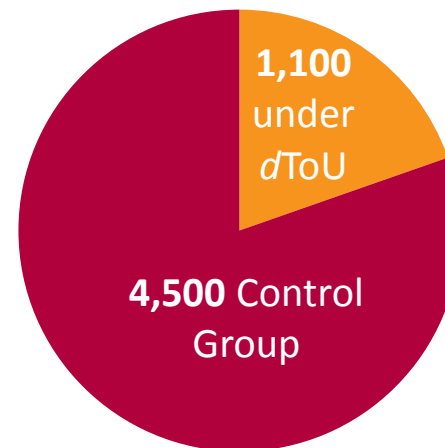
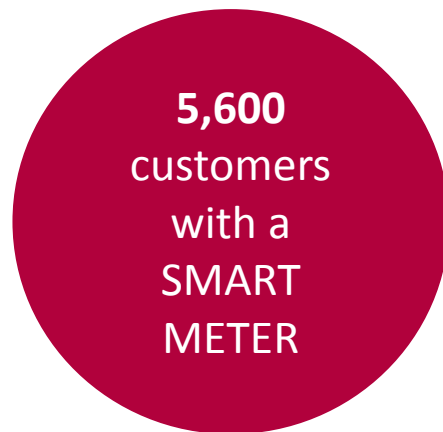
Source: LCL Report A3\*

\*J. Schofield, R. Carmichael, S. Tindemans, M. Woolf, M. Bilton, G. Strbac, "Residential consumer responsiveness to time-varying pricing", Report A3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

# The Trials

## Smart meters and dynamic tariffs

- Statistically robust results: control group of c. 4,500 households
- First appliance survey of this magnitude: survey data from 2,830 households

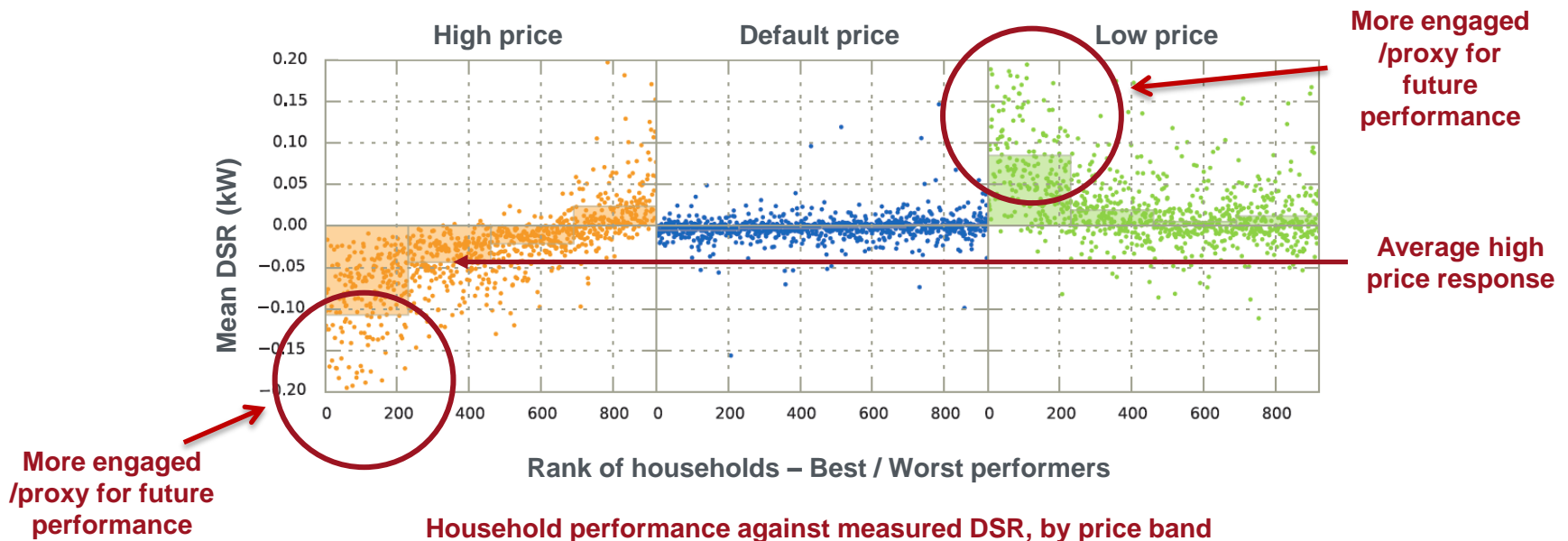




# Dynamic Time of Use Tariffs

## Results of the trials

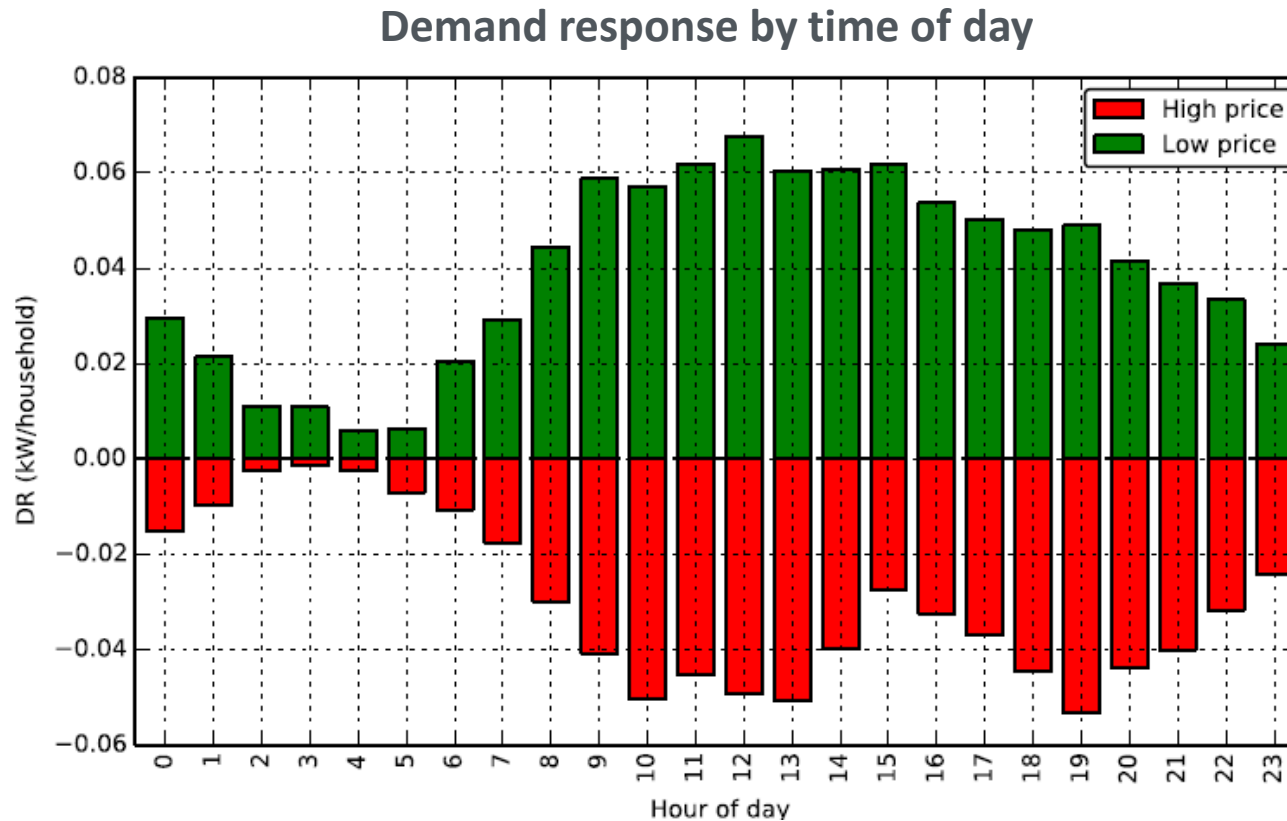
- Aggregate response in high price and low price.
- Most highly 'engaged' customers respond independently of the measured response



Source: LCL Report A3\*

\*J. Schofield, R. Carmichael, S. Tindemans, M. Woolf, M. Bilton, G. Strbac, "Residential consumer responsiveness to time-varying pricing", Report A3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

# Low Carbon London $dToU$ : Response observed



Population = 922

Source: LCL Report A3\*

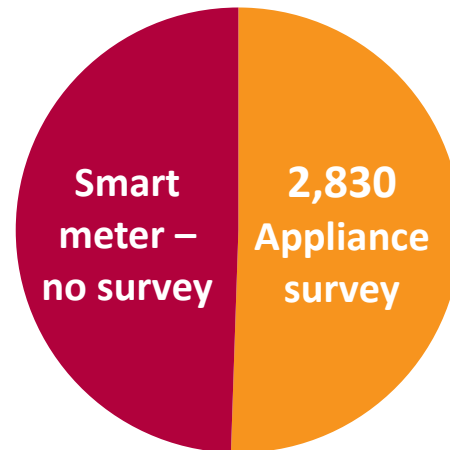
\* J. Schofield, R. Carmichael, S. Tindemans, M. Woolf, M. Bilton, G. Strbac, "Residential consumer responsiveness to time-varying pricing", Report A3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

# Low Carbon London

## Smart meters and dynamic tariffs



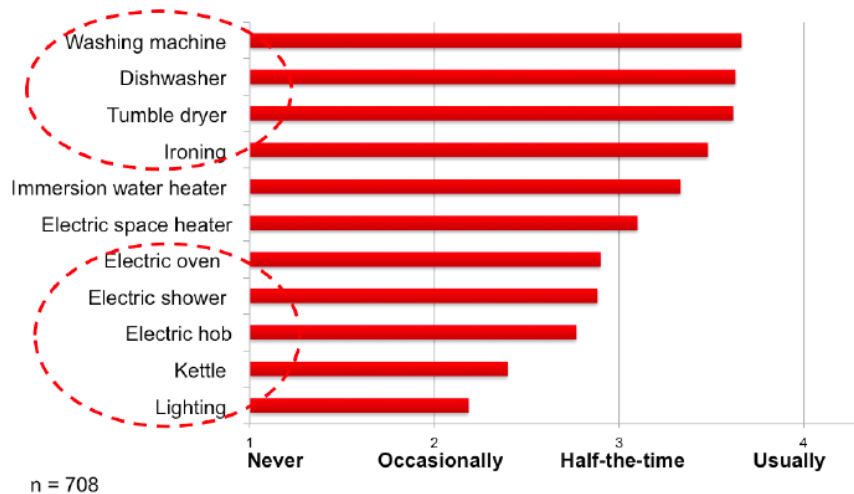
- ToU survey: 708 responses
- Post-trial survey: 418 responses
- Insight to customer perception: 37 semi-structured in-depth interviews



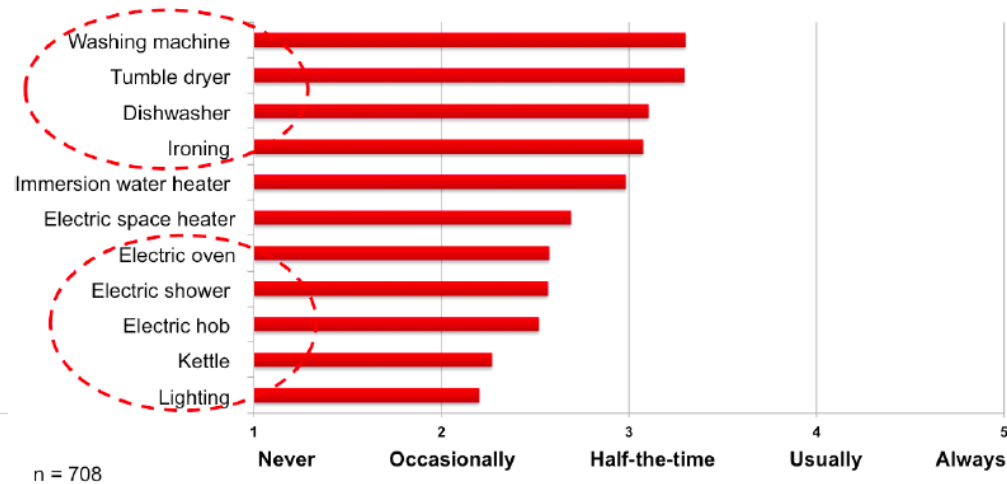
# Low Carbon London survey: Most flexible appliances

- Most customers agree that wet appliances are the most flexible appliances for both high and low price bands

Shifting demand off high rate



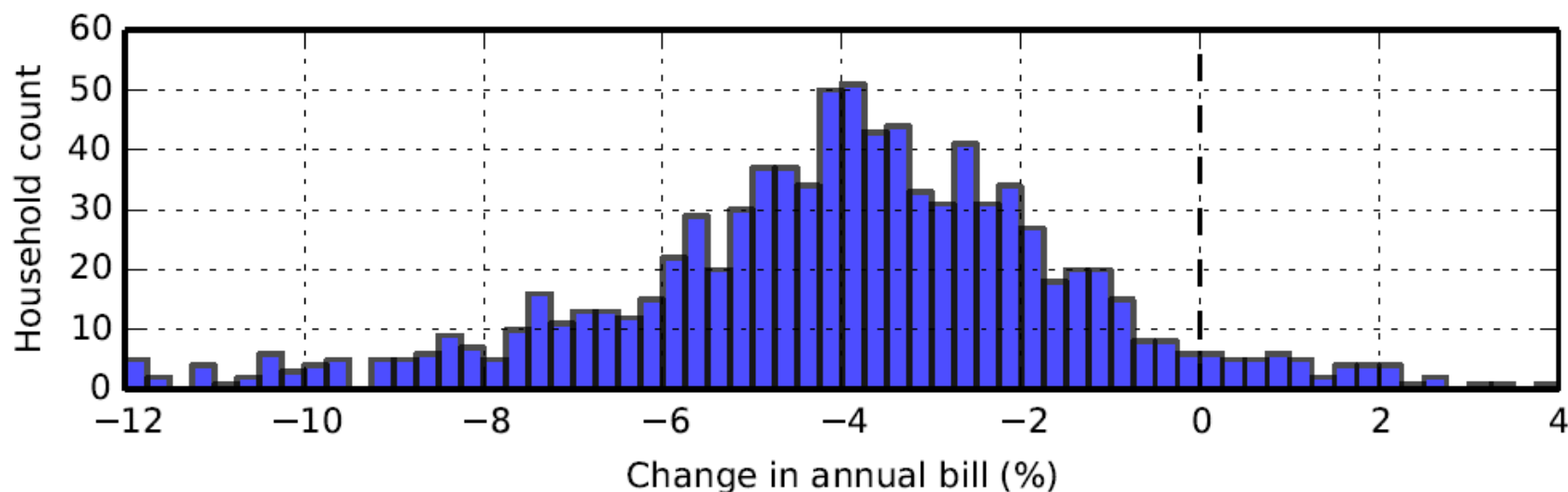
Shifting demand onto low rate



Source: LCL Report A2\*

\*R. Carmichael, J. Schofield, M. Woolf, M. Bilton, R. Ozaki, G. Strbac, "Residential consumer attitudes to time-varying pricing", Report A2 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

# Impact on the electricity bill

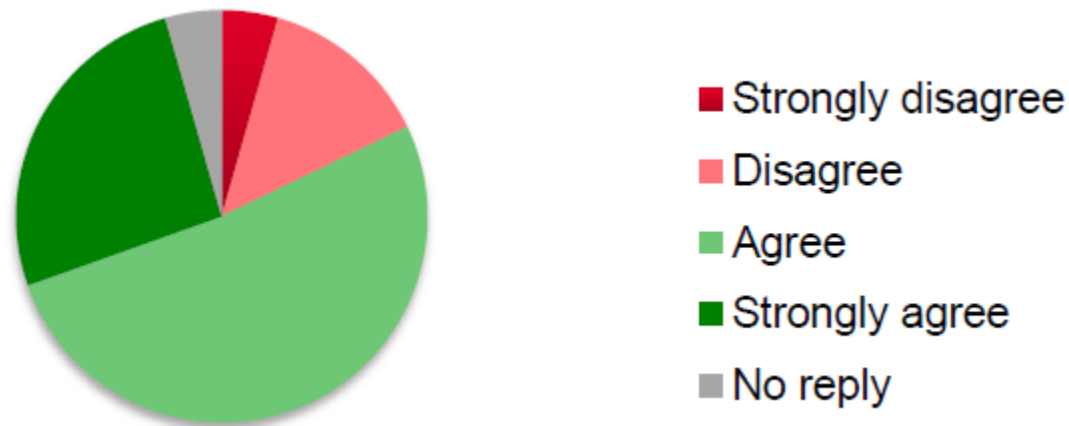


Actual savings (n = 922)	Min – Max	Mean	Median	% saving (mean)
Compared to Standard variable flat tariff	£40.21 loss £147.70 saving	£21	£16	4.31%

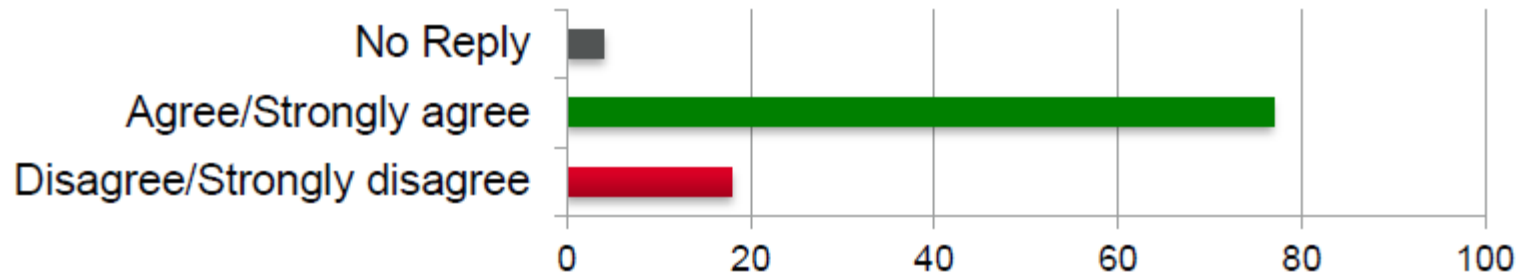
Source: LCL Report A3\*

\* J. Schofield, R. Carmichael, S. Tindemans, M. Woolf, M. Bilton, G. Strbac, "Residential consumer responsiveness to time-varying pricing", Report A3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

# Preference to remain on Economy Alert tariff



N = 708



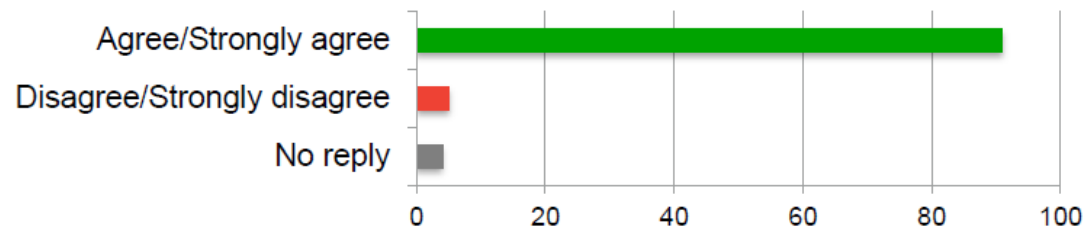
Source: LCL Report A2\*

\*R. Carmichael, J. Schofield, M. Woolf, M. Bilton, R. Ozaki, G. Strbac, "Residential consumer attitudes to time-varying pricing", Report A2 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

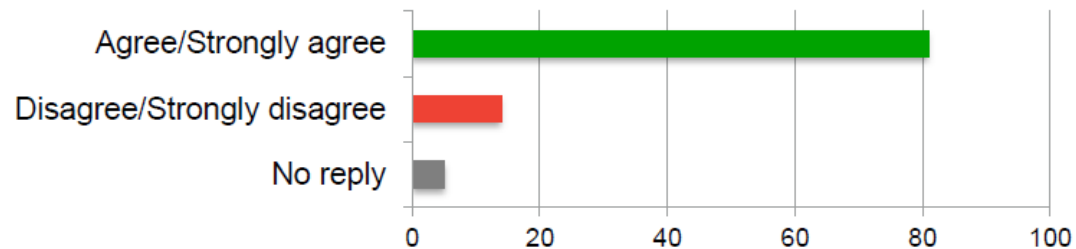


# Potential for wide-scale application

If it encourages more efficient use of electricity and resources multi-rate tariffs like Economy Alert should be offered to everyone



If it is a fairer way of charging people for the real cost of electricity at different times multi-rate tariffs like Economy Alert should be the standard tariff for everyone



Source: LCL Report A2\*

\*R. Carmichael, J. Schofield, M. Woolf, M. Bilton, R. Ozaki, G. Strbac, "Residential consumer attitudes to time-varying pricing", Report A2 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

# Dynamic Time of Use Tariffs

## Low Carbon London Results



- 71% of survey responders felt they had a greater sense of control
- 91% of survey responders agree that dTOU should be offered to everyone
- 79% of survey responders reported that Economy Alert was not complex to use on a day-to-day basis
- 77% of survey responders agree that dToU helps households in planning and organizing and 80% consider it motivates them to get chores done

# Engaging with customers

**EDF ENERGY** Low carbon LONDON Imperial College London

**INTRODUCTION** UNIQUE RESPONDENT CODE: **KXWZ85**

Dear Customer,

Thanks for taking part in the Low Carbon London Smart Meter trial.

By completing the enclosed questionnaire you'll help EDF Energy and our partner, Imperial College London, to understand energy consumption better, identify Smart Meter users and accompanying energy saving measures.

Once you've completed your questionnaire, please post the questionnaire to: OUTLOOK RESEARCH LTD, FREEPOST LONDON, LONDON W1L 9EY, using the envelope provided to avoid postage. Or you can complete the questionnaire at [www.imperial.ac.uk/lowcarbonlondon](http://www.imperial.ac.uk/lowcarbonlondon) returning it to the unique respondent code on the back.

As part of a thank you, on receipt of your completed questionnaire, we'll send you a letter with a barcode which you can use to redeem £25 from any Post Office. Once the barcode has been scanned, you'll receive the £25 from.

This questionnaire is valid until 31 December 2012 and we advise you to complete it before this date. If you have any questions, please call the Smart Hub line on 0800 015 8787.

Yours sincerely,

Samir Patel  
Customer Services Director

Before sending, please confirm the following:

(1) Have you had a smart meter installed in your household? This meter comes with a display unit (see photo above).

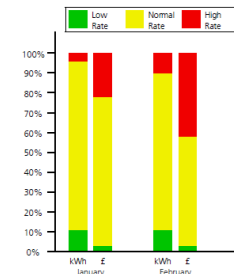
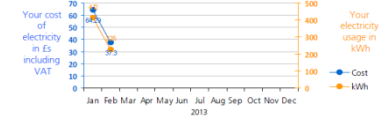
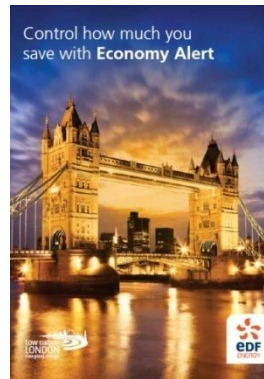
Yes ☐ No ☐ Don't know ☐

(2) Are you or have you been responsible for decisions regarding your household energy?

Yes ☐ No ☐ Don't know ☐

PLEASE ONLY COMPLETE THIS QUESTIONNAIRE IF YOU HAVE ANSWERED "YES" TO BOTH THE QUESTIONS ABOVE.

IF YOU ARE NOT RESPONSIBLE FOR ENERGY DECISIONS IN YOUR HOUSEHOLD, PLEASE PASS THIS QUESTIONNAIRE ON TO SOMEONE WHO IS.



Survey

Recruitment  
Letter

Welcome  
Pack

Incentive

Go Live

Event  
Messages

Monthly  
Feedback

End of Trial

What's more, you could receive up to £100, just for trying.

**Signing up**

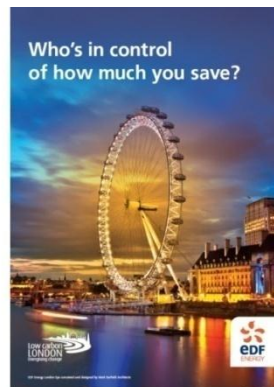
If you sign up now, and complete the application survey, we'll give you £100. And if you complete the trial we'll give you another £100! The Economy Alert that starts on 1 January 2013 will end on 31 December 2013. If you sign up to the Economy Alert trial it will take up to 2 weeks to update your account and smart meter function. The normal price band, which has a lower rate than our Standard Economy tariff will apply from 1 December 2012 until the trial start date.

It's a guarantee of full quality in the trial. It's also available to a limited number of customers and you must sign up by **15 December 2012**.

Of course, you're free to leave the trial at any time if you choose. And we're so confident that you'll have enjoyed your previous tariff, we'll even reimburse you in the unlikely event you find yourself out of pocket compared to your previous tariff.

**Sign up to Economy Alert by 15 December and call 0800 015 8787**

on receipt of a call back on [www.edfenergy.com/lowcarbonlondon](http://www.edfenergy.com/lowcarbonlondon)



**Low carbon LONDON** Energising change

Dear Customer,

Letter reference: EDF-L141001  
Your account number: 639229-111

Dear Sir/Madam,

Thank you for completing our questionnaire.

We'll be giving you £100 to help us as a thank you for completing the questionnaire we sent to you as part of the Low Carbon London Smart Meter trial. The information you gave us will help our design and our partner, Imperial College London, to understand how households benefit from smart meters and accompanying energy saving measures.

**Claim your £100 within three months**

To receive your £100, you must use the claim within three months of the date printed above, together with one form of identification from the list below to any Post Office branch. The name and address below is correct for the use of the claim.

- Recent utility bill (last three months)
- Current tax bill
- Insurance card and the bill or
- Bank or credit card statement
- Passport
- Or photo driving licence

Please remember to claim your reward within the three months, so it will expire after that and you won't be able to receive the £100.

If you have any queries, please call us free on 0800 015 8787.

Thank you again for your participation in the Low Carbon London Smart Meter trial.

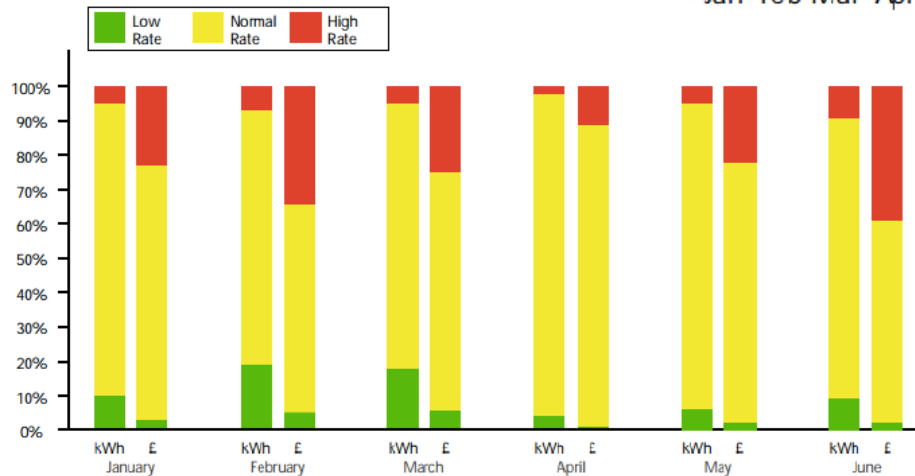
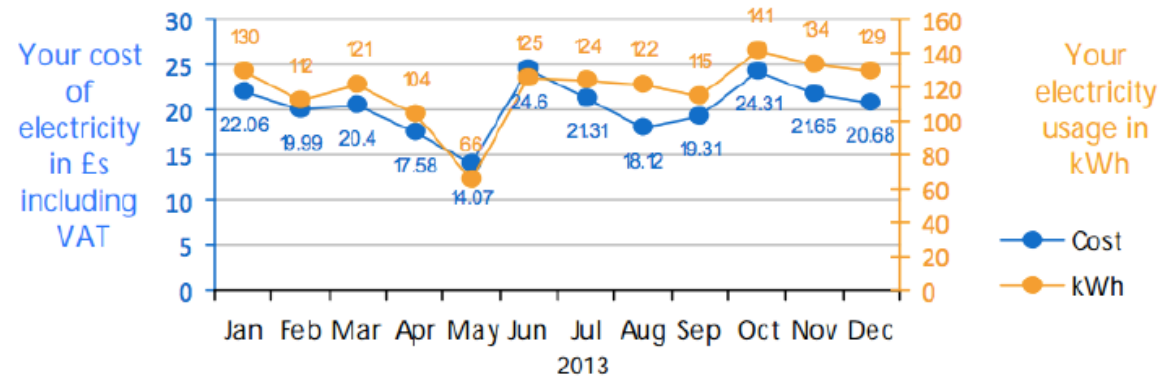
Yours sincerely,

Samir Patel  
Customer Services Director

EDF Energy  
Energy Network Services, South Road, Peterborough PE1 1UA



# Monthly feedback to customers



Source: LCL Report A2\*

\*R. Carmichael, J. Schofield, M. Woolf, M. Bilton, R. Ozaki, G. Strbac, "Residential consumer attitudes to time-varying pricing", Report A2 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

# Customer feedback

## Recommendations for new tariffs



- Provide a clear rationale and reasons for rate changes. Clearly link supply-following tariff to real-world conditions of renewable generation
- Consider carefully the effect of price points on savings and feedback
- Better savings should lead to more positive, more motivated customers
- Assess the impact this feedback has on motivation and engagement
- Improvements to the In Home Display
- Feedback available online and via smart phones.
- Include advice on load-shifting and reduction

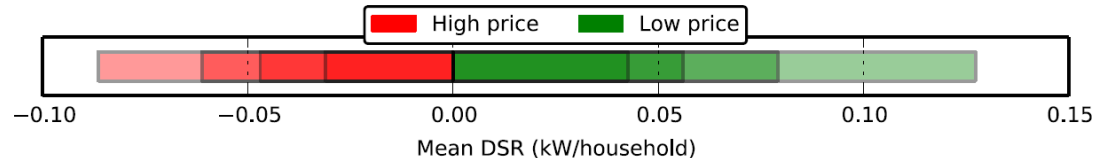
# What does this mean for DNOs?

- Constraint management response:



- Average reduction – 50W/household
- Most engaged – 150W/household

- Supply following response



Source: LCL Report A3\*

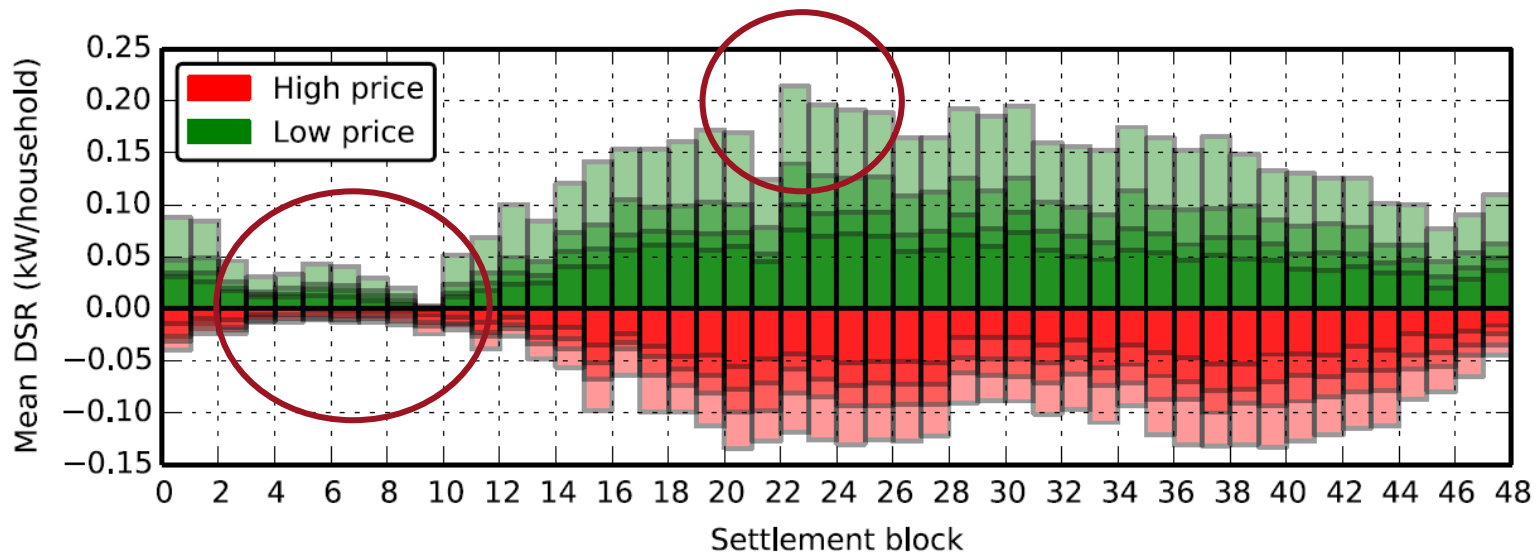
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# Other results

- Smart appliances and enhancing response in general could unlock the current unresponsive night time period
- Low price events may induce peaks in demand that are greater and happen at different times than the currently observed peaks

**Supply Following event response by time-of-day**

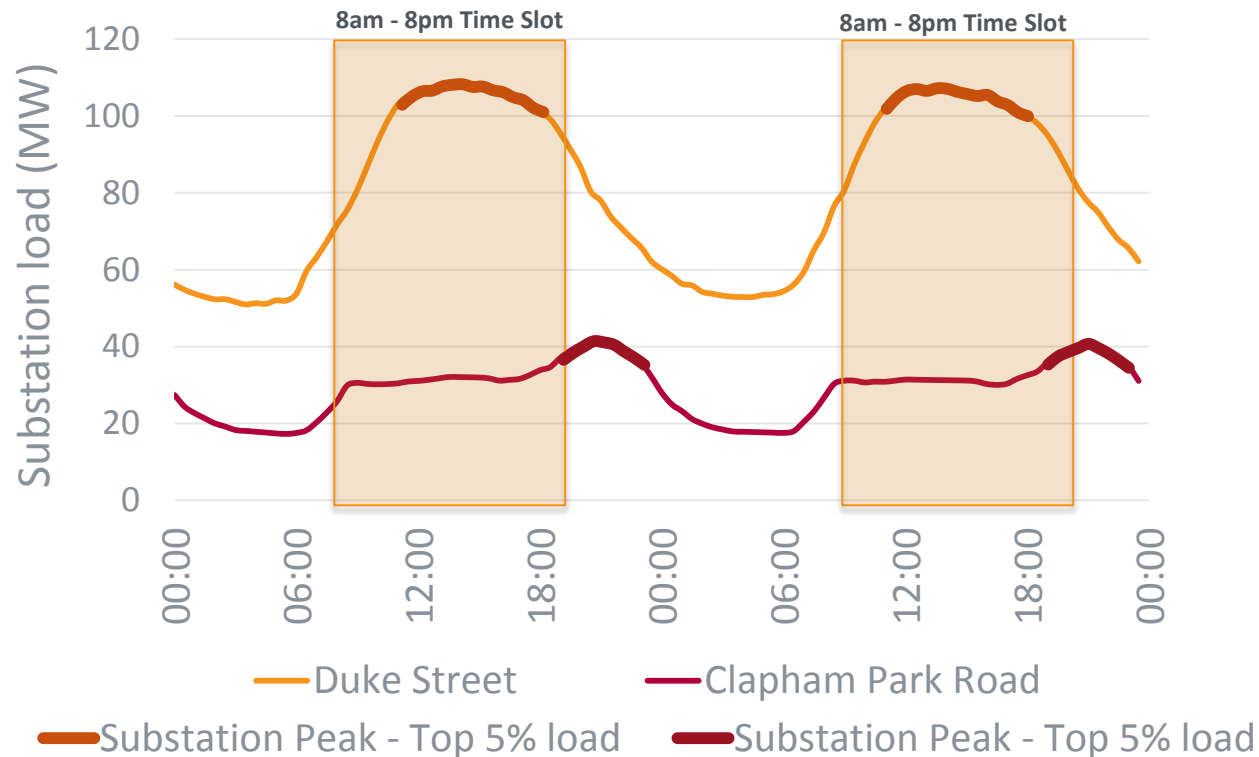


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# Time of Use Tariffs

Static time of use tariffs can present network benefits



Source: LCL Report A1

# Dynamic Time of Use Tariffs

How can DNOs deploy such a tariff?



- To evaluate the deployment of tariffs specifically by DNOs we have looked at two scenarios:
  - **Voluntary**
    - Based on uptake from LCL trial
    - A specific £/customer to deploy and recruit customers
  - **Mandatory**
    - Where all suppliers pass through a  $dToU$  price signal through DUoS charges
    - We assume 100% response from all customers

# Dynamic Time of Use Tariffs

## Whiston Road Case Study



- Whiston Road case study: 19,500 domestic customers

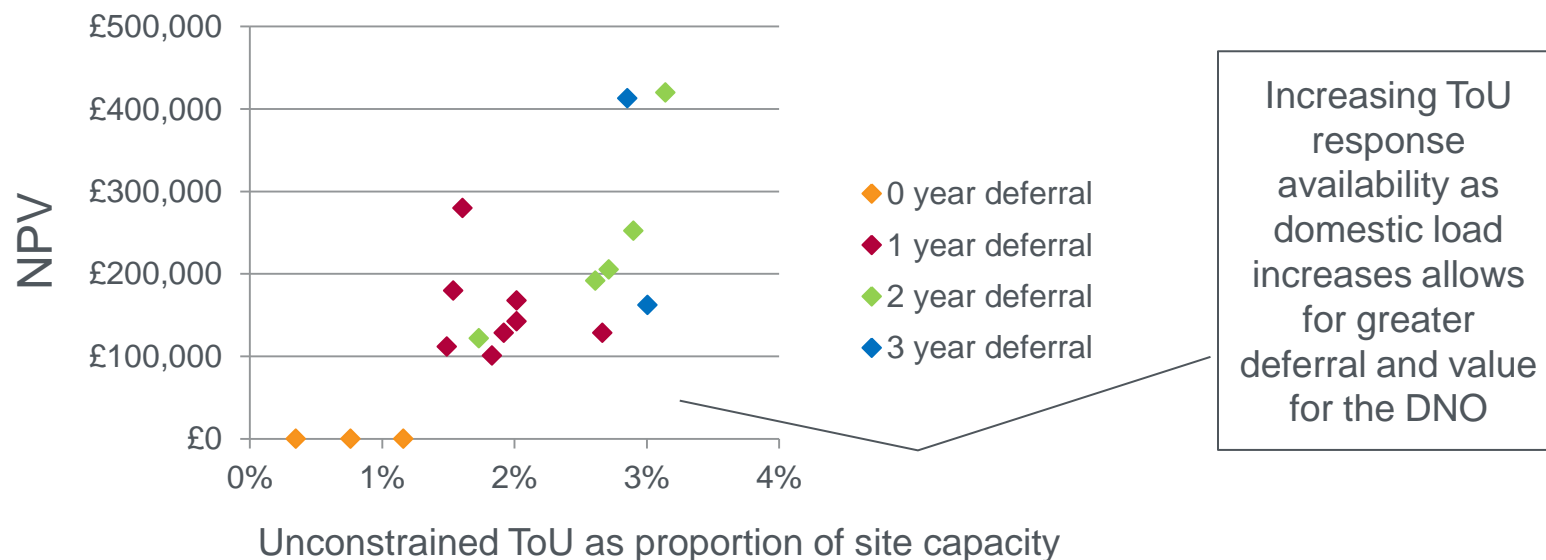
	Voluntary	Mandatory
Uptake	24%	100%
Deferral of reinforcement	No deferral	1 year

- In this specific case study, up to £25 contribution to costs could be funded by network benefits

# Dynamic Time of Use Tariffs

## Extrapolative Analysis

£2.13m of benefits could be available to the DNO through deferring reinforcement. However, this does not take into account recruitment costs.



Source: LCL Report A1

# Network benefits

When would a  $dToU$  tariff work for a DNO?



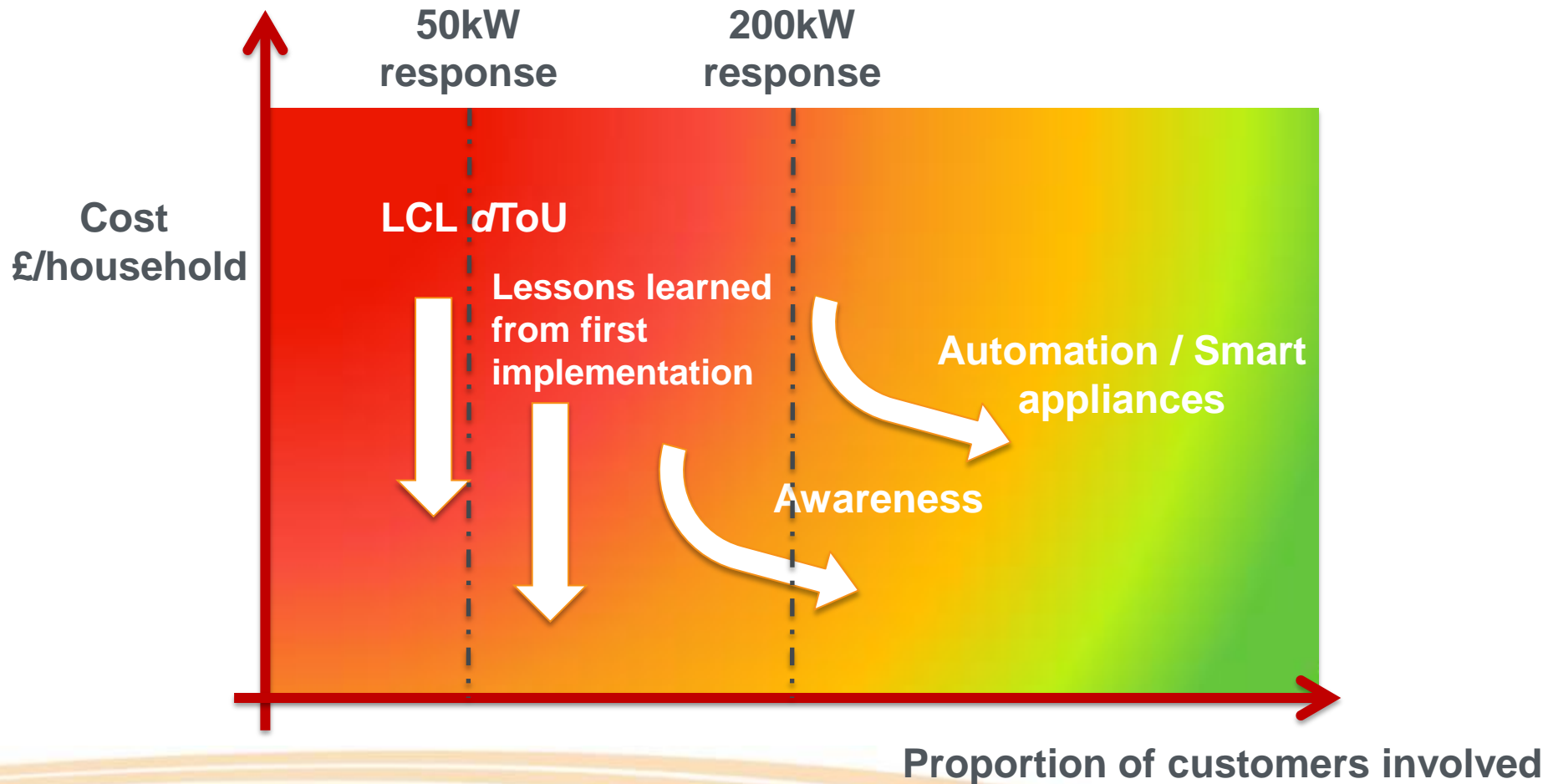
For network benefits to be realised by GB DNOs as  $dToU$  tariffs are rolled out, the value through the whole industry supply chain needs to be maximised.

Key elements to determine how effective  $dToU$  would be are:

- Uptake of the tariff (closer to 100%)
- Responsiveness as per 'more engaged'
- In-home automation leads to higher levels of response
- Other stakeholders are also able to apply  $dToU$  price signals
- Suppliers already have  $dToU$ -ready billing systems in place



# Maximising benefits of residential demand side response



# Maximising benefits of dToU: A coordinated industry approach



The findings from **Low Carbon London** represent a step change in understanding the electricity network required for a low carbon future.

If you would like to know more about our reports please email us:  
[innovation@ukpowernetworks.co.uk](mailto:innovation@ukpowernetworks.co.uk)

Partners:

