#IDEALNetZero

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Accelerating Net Zero – Decarbonising Heat

25 February 2021

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Accelerating Net Zero

A series of monthly events exploring how innovation can accelerate the transition to net zero carbon emissions

EDF

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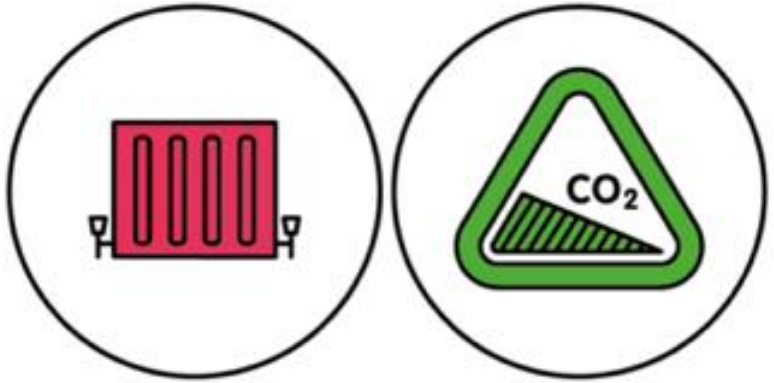
CAPITAL ENTERPRISE

Hosted by

NovAzure



Decarbonising Heat

- Heating accounts for about 37% of total UK carbon emissions
- Challenges to reach net zero:
  - Tough net zero targets – most buildings needs to become net zero
  - The size of the challenge – only 5% of UK houses have low carbon heating
  - No one size fits all
  - Poor energy efficient housing
  - No knowledge, nor incentives

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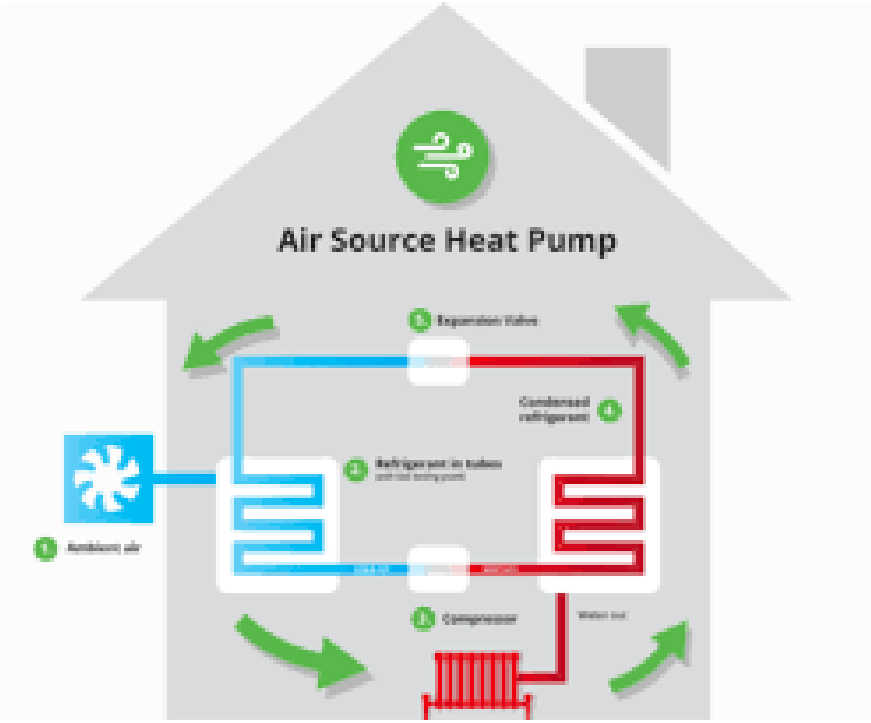
In today´s event we shall explore…

- How to install 600.000 heat pump installations per year by 2028
- The obstacles of achieving this transition
- Innovative business models and propositions to speed up transition
- Alternative technologies that should be considered
- Lessons learned from other countries



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Agenda

10:00	Welcome – Chris Gruen, MD, NovAzure Consulting
10:10	Expert Overview – Rox Pieterse, Research Manager – Delta-EE
10:20	Business Showcase • Johan du Plessis, CEO – Tepeo • Kenny Cameron, Managing Director – Connected Response
10:40	Panel Discussion and Q&A – led by Chris Gruen, MD, NovAzure Consulting • Chris Connon, Senior Manager of Proposition Innovation – EDF • Rox Pieterse, Research Manager – Delta-EE • Professor Robert Lowe, Chair of Energy and Building Science – UCL • Scott Blance, Policy Advisor – Sustainable Energy Association
11:20	Closing Messages – Chris Gruen, MD, NovAzure Consulting
13:30	Close

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About Delta-EE

We enable organisations to develop the best strategies, business models and customer propositions for the energy transition. Our breadth & depth of expertise spans:

New Energy Business Models

Identify and understand the alternative and new business models for the energy transition

EVs & Electricity

Understand the opportunities and challenges from sector coupling between electricity and transport

Flexibility & Energy Storage

Take advantage of the opportunities emerging from an active demand side

Heat

How channel disruption, sector coupling and new technologies are changing the heat sector

Distributed Power

Global market insight & expertise into the growing role of decentralised generation

Digital Energy

Opportunities in the connected home market and how digitalisation is changing the energy customer relationship

Delta-EE provides:

Subscription Research Services

Provided by dedicated research teams that get under the skin of 'new energy' markets in Europe and globally, and understand future market direction.

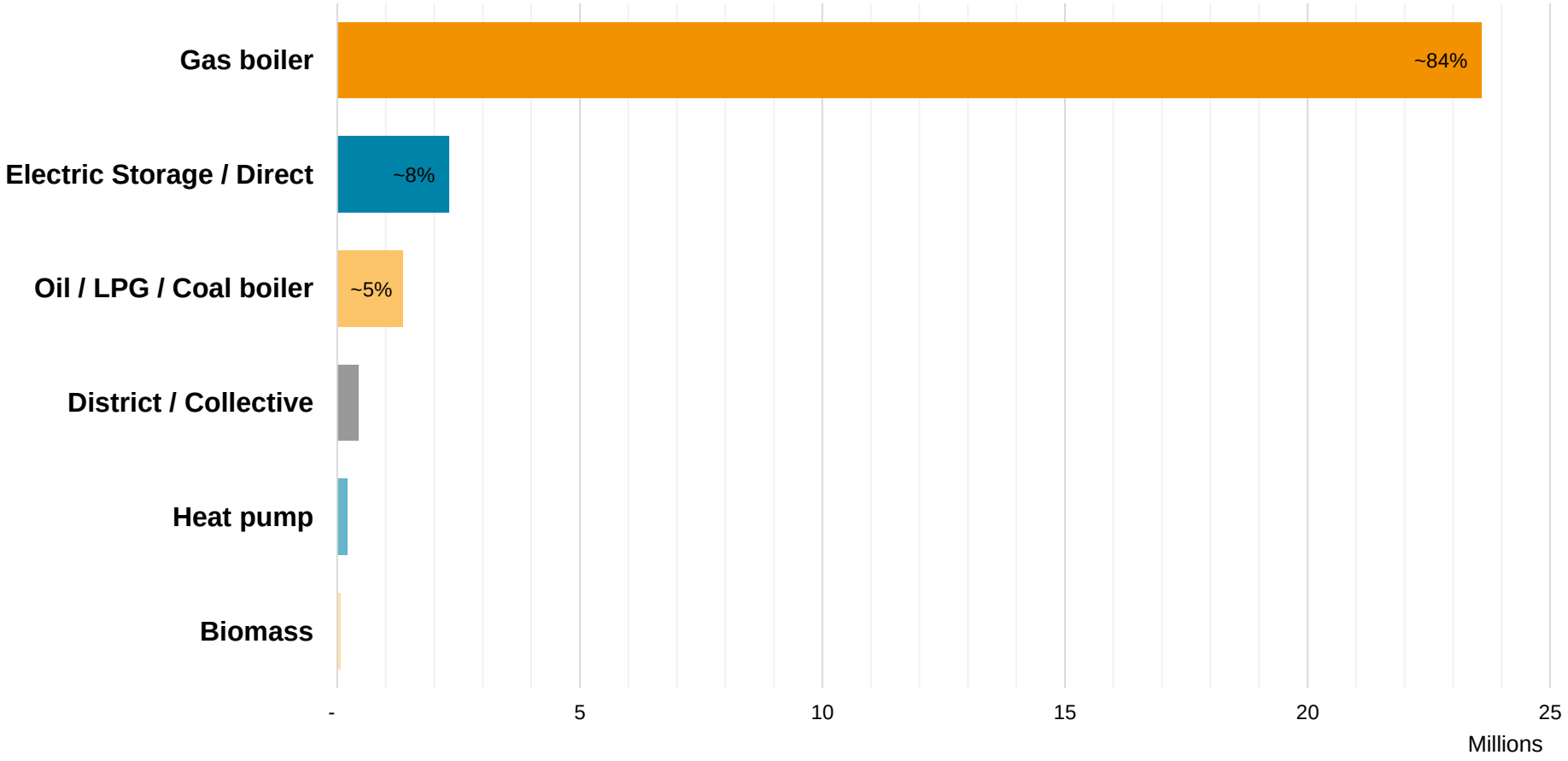
These Services bring Delta-EE's subscribers deep expertise on all the topics of 'new energy' and access to experts for ongoing support.

Consultancy

Delta-EE's consultancy team provides clients with bespoke confidential research and insight to answer the critical questions which are impacting their business.

Our consultancy levers knowledge from our Subscription Services to provide tailored support and advice.

Over 80% of homes are currently heated by gas boilers



Sources: English, Scottish and Welsh Housing Surveys, ADE, EHPA, Delta-EE

There are several lower carbon alternatives to natural gas

Green Gas

Biomethane / Hydrogen

- Gas boiler
- Thermally driven heat pump
- Micro CHP

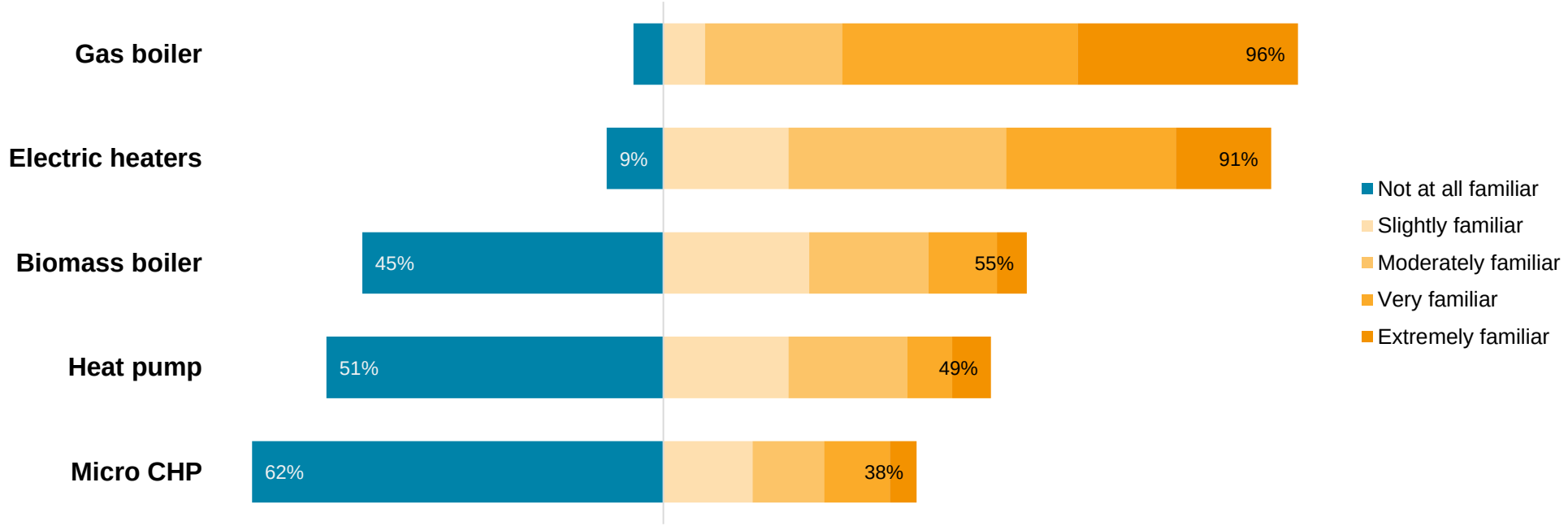
Electricity

- Heat pump
- Direct electric
- Electric storage

Biomass

- Biomass boiler

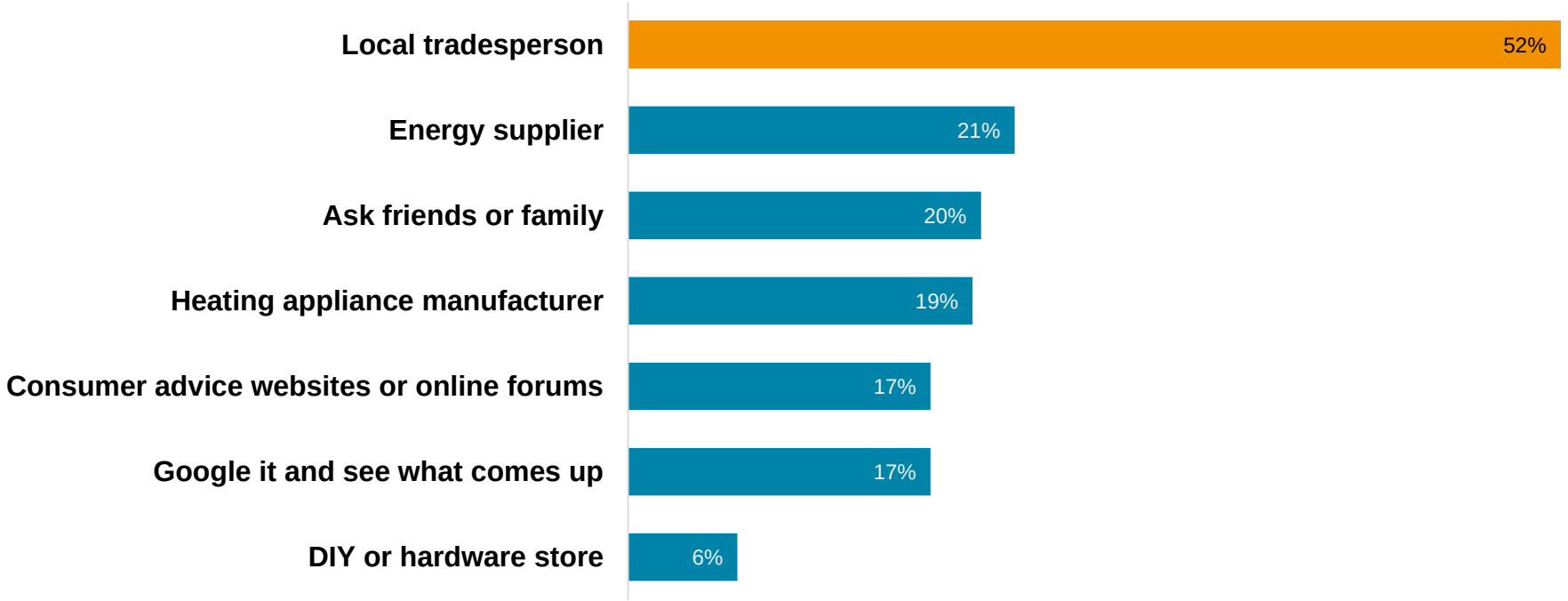
There are barriers to overcome in the electrification of heat, both on the demand side…



For the following types of heating/energy technologies, how familiar would you say you are with each, based on any knowledge you have of them or your experience using them? (UK homeowners, n=223)

Source: Delta-EE

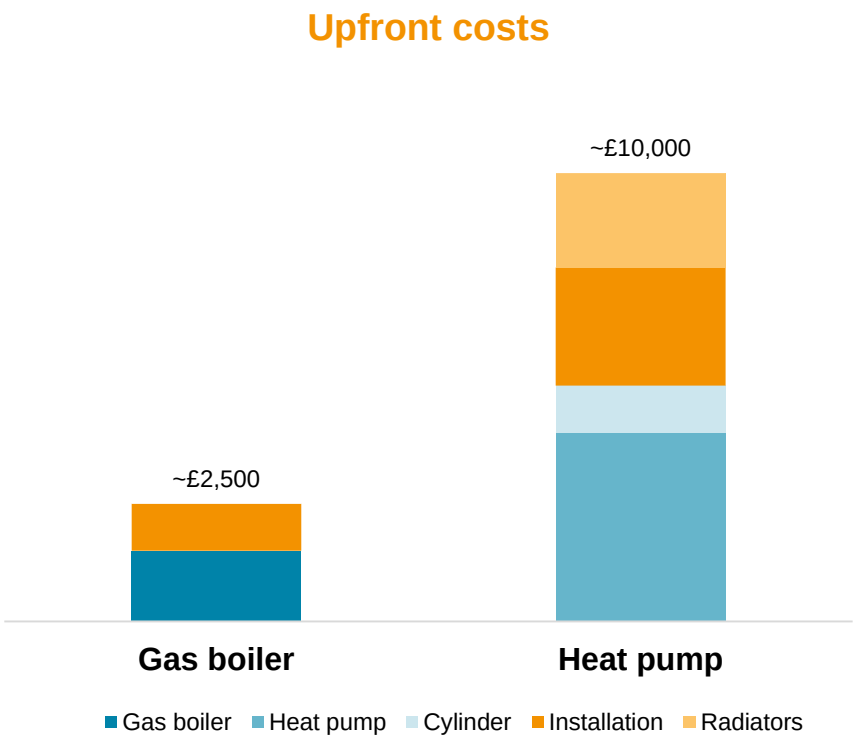
There are barriers to overcome in the electrification of heat, both on the demand side…

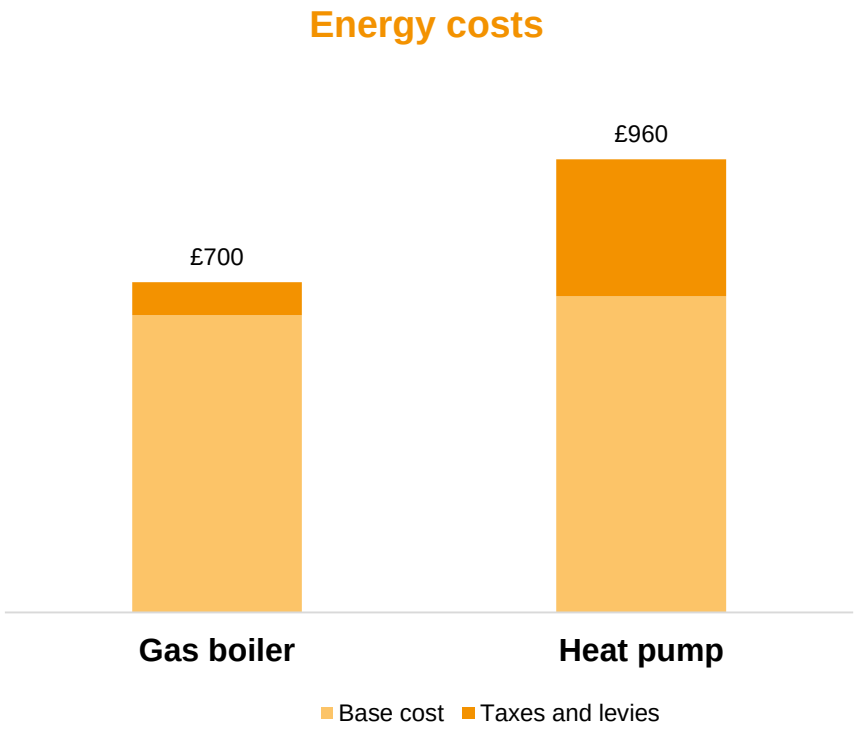


If your heating system was reaching the end of its life and you knew it would need to be replaced soon, which of the following sources would you use for information about replacing your heating system? (UK homeowners, n=215)

Source: Delta-EE

There are barriers to overcome in the electrification of heat, both on the demand side…



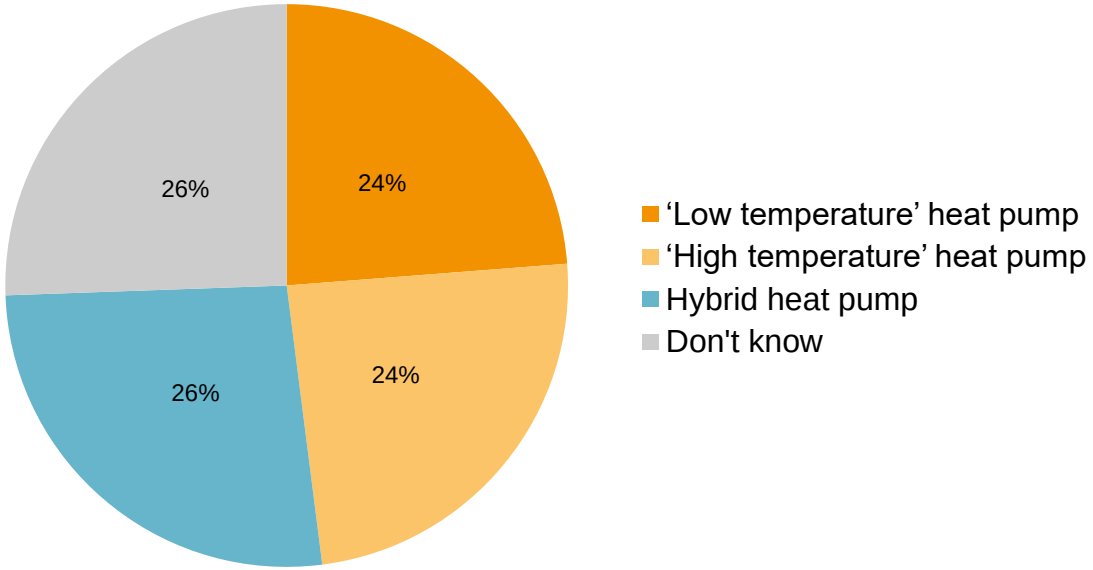


Source: Delta-EE

There are barriers to overcome in the electrification of heat, both on the demand side…

DELTA-EE

Trading off costs, convenience and carbon emissions



Which type of heat pump would you choose? (UK homeowners, n=223)

"The inconvenience of replacing radiators is off-putting and would prefer to keep gas cooker"

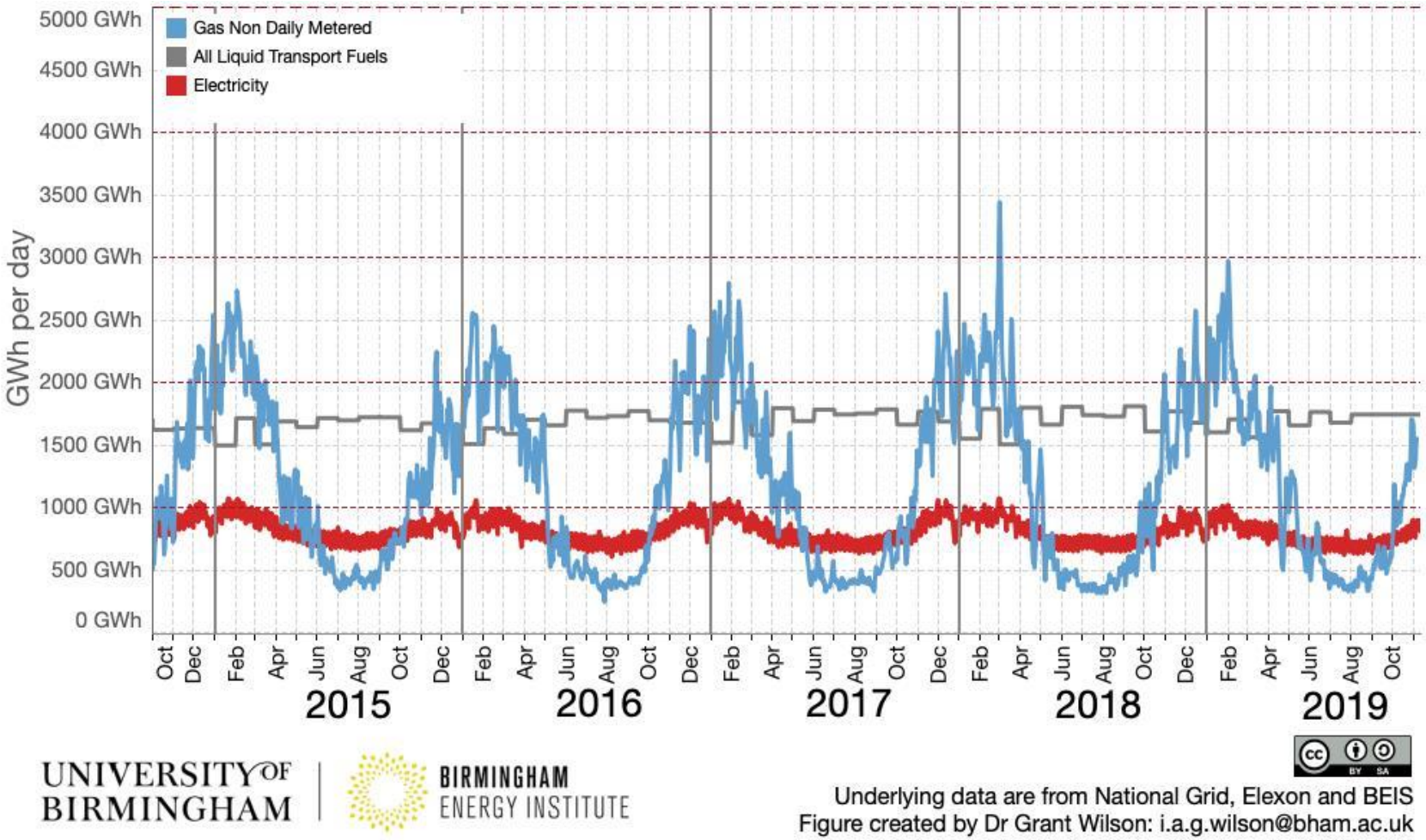
"I do not want to change my radiators"

"least disruption reasonable costs"

Awareness → Installer → Costs → **Hassle**

Source: Delta-EE

… and on the supply side



Source: http://energy-charts.org/

What is driving the transition today, and what more can still be done?

DELTA-EE

Incentives

- Renewable Heat Incentive
- Green Homes Grant
- Clean Heat Grant
- Green finance

Restrictions

- New build regulations
- Retrofit standards
- EPC methodology
- CO_2 tax
- Boiler bans

Supply chain

- Manufacturing capacity
- Installation skills

Technologies

- Hybrid heat pumps
- High temperature heat pumps
- Compact thermal storage
- Smart electric storage heating

Business models

- One-stop-shop
- as-a-Service
- Demand response

Existing

In development

Undeveloped

ZEB™

February 2021

tepeo

Almost all of us still burn oil or gas to heat our homes…

Heating uses lots of energy…

30% • 30% of all energy use in the UK is in our homes

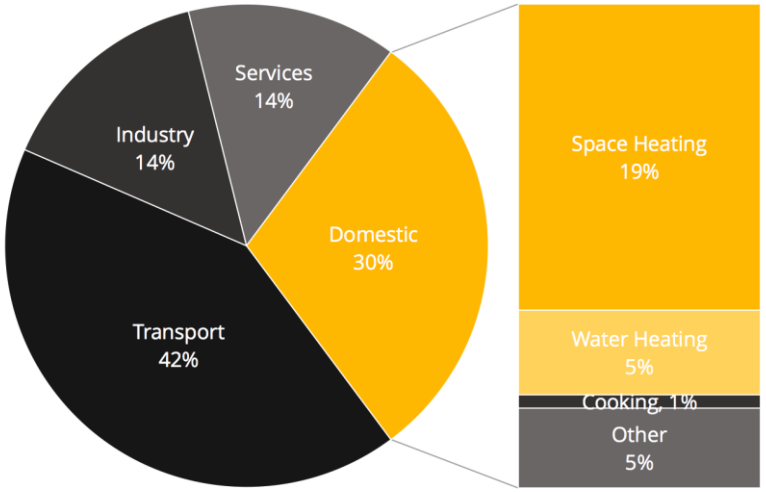
25% • Quarter of all energy use in the UK goes purely to heating and hot water in our homes

80% • 80% of home energy consumption is for space & water heating

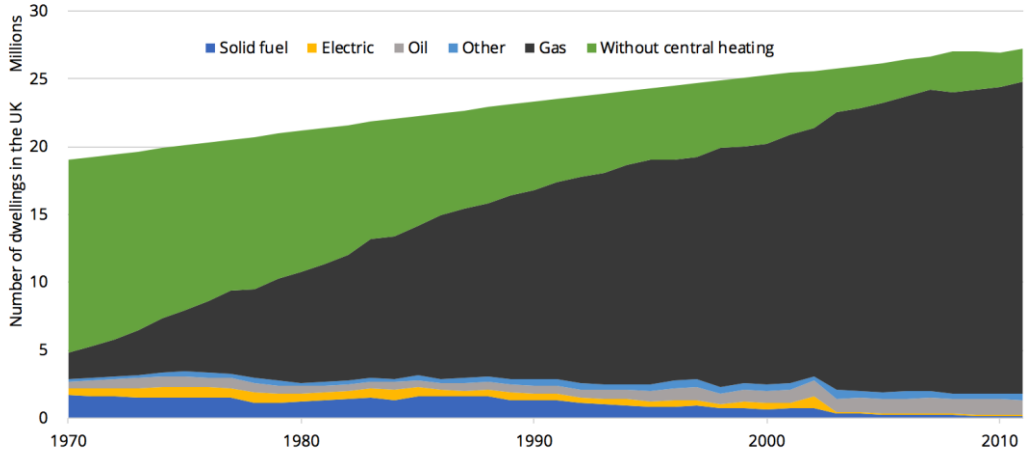
… which in 2021 still almost all comes from fossil fuels

97% • 97% of homes with central heating use oil (1m) or gas (23m) boilers

20% • These boilers are responsible for about 20% of UK carbon emissions



UK Energy Consumption by End Use, 2018
Ref. ECUK 2018



Central heating by fuel source in UK, 2013
Ref. BEIS UK Housing Fact file 2013

… but how will you heat your home when boilers are banned?

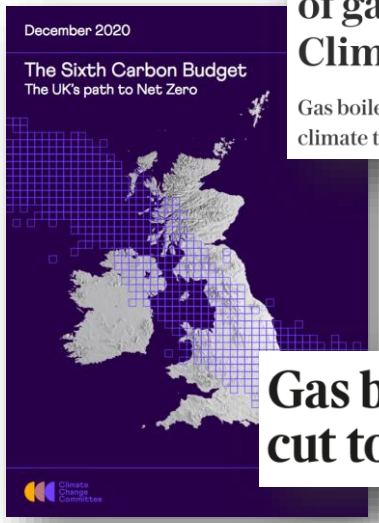
We must stop using fossil fuel boilers…

- 2025 boilers are banned in new homes and likely in all homes by some time in the 2030's…

…and move towards electrification of everything

- Electricity is becoming greener all the time. Carbon intensity has dropped 50% in just 8 years

50%



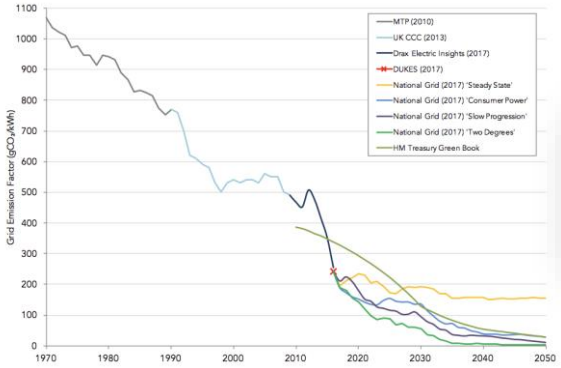
'We need to be more ambitious': Ban sale of gas boilers by 2033, says Committee on Climate Change

Gas boilers must be banned in the next 12 years or the UK will miss its net-zero climate target by 2050

Gas boilers in firing line as PM vows cut to emissions

Climate Adaptation

U.K. Utilities Looking to a Future Without Gas to Heat Homes



Climate change

How Britain decarbonised faster than any other rich country

That was the easy bit. Now the hard stuff starts

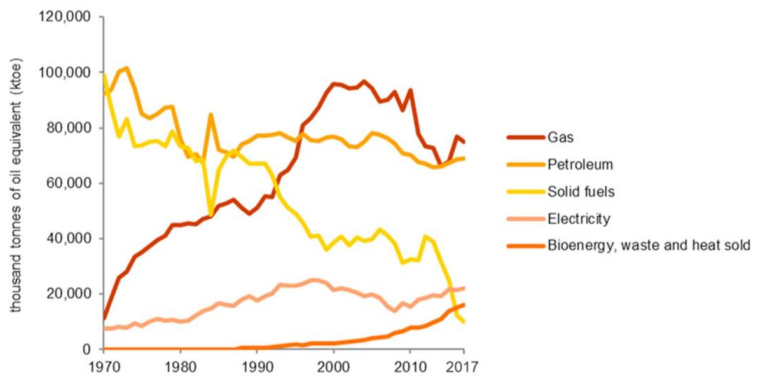
Everything points to the **electrification** of heat but:

1. There are significant challenges to managing an ultra low carbon electricity grid as we electrify everything
2. Progress will continue to be very slow if the only technology in the policy makers arsenal is a heat pump. We will not get there with heat pumps alone.

There are 4 key challenges to a zero carbon grid…

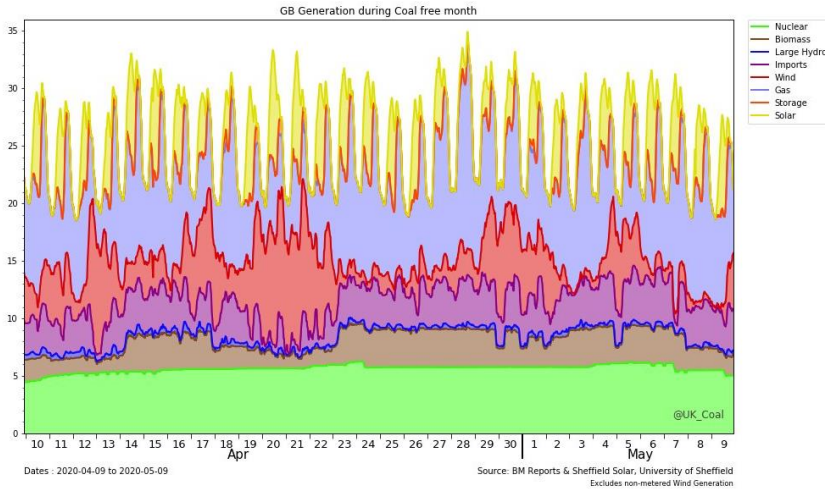
1. Volume

Chart 1.06: Final energy consumption in primary energy equivalents by fuel type



Source; BEIS ECUK Table 1.10

2. Flexibility



3. System stability & inertia

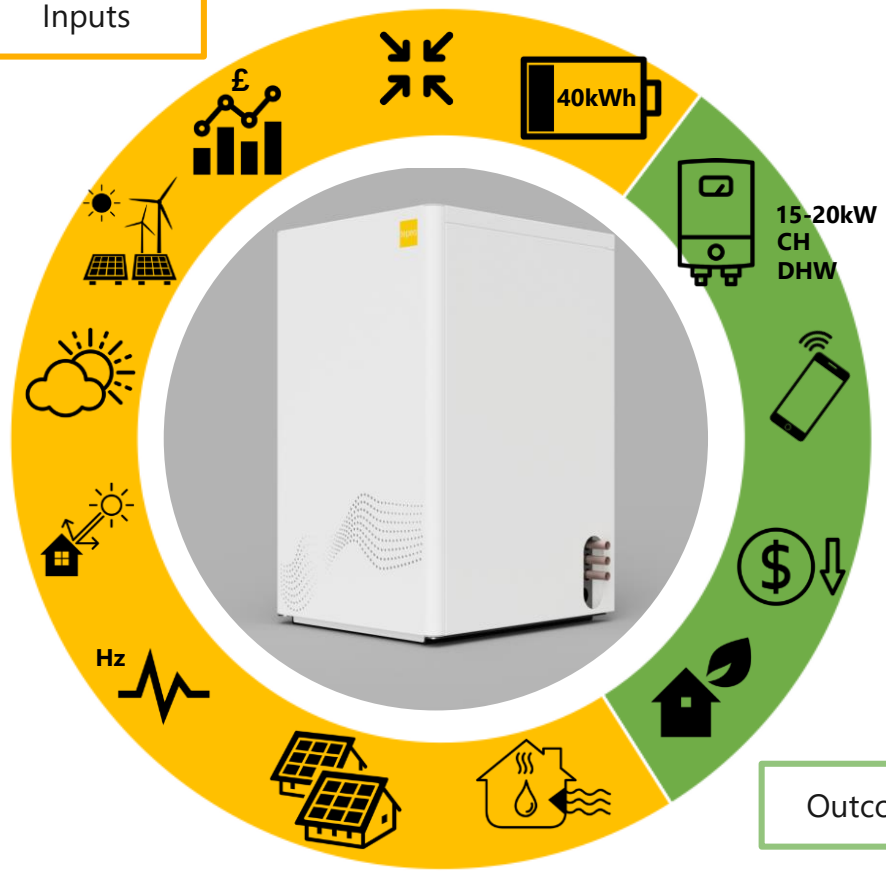
4. Network constraints

Zero Emission Boilers (ZEB™) will enable rapid decarbonisation of heating while supporting a low carbon grid

A ZEB is a "plug 'n' play" boiler replacement…

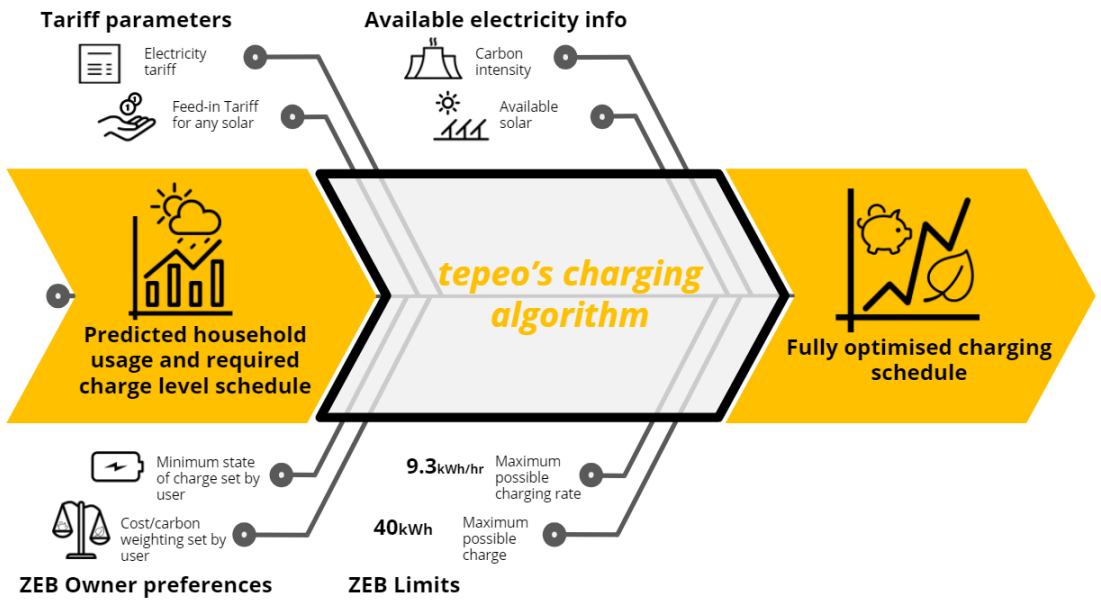
- Direct boiler replacement – "Plug 'n' Play"
- Electricity & patent pending ultra-high density thermal storage technology
- IoT and Machine Learning tech optimises charging for carbon, cost, user preference etc.
- Self-consumption of solar PV & renewables
- Frequency response and grid services

…which provides the same heating but decarbonizes the home and supports the grid

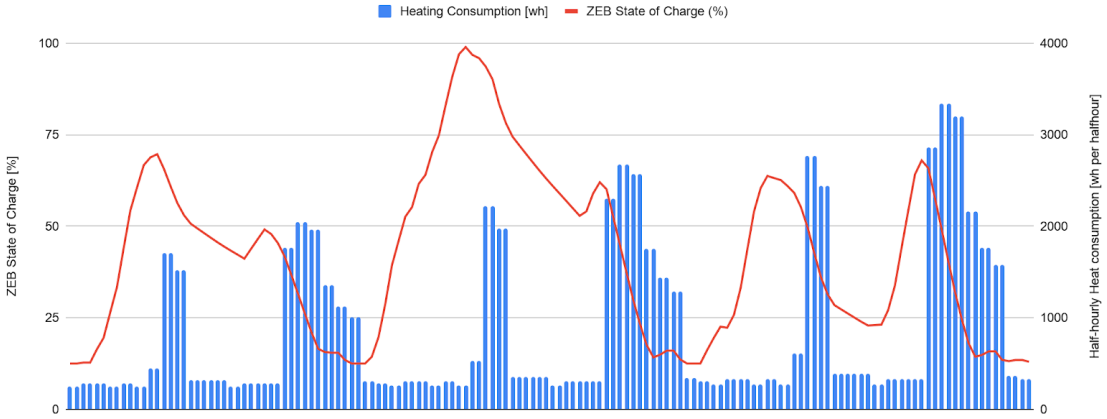


What happens inside a ZEB's brain?

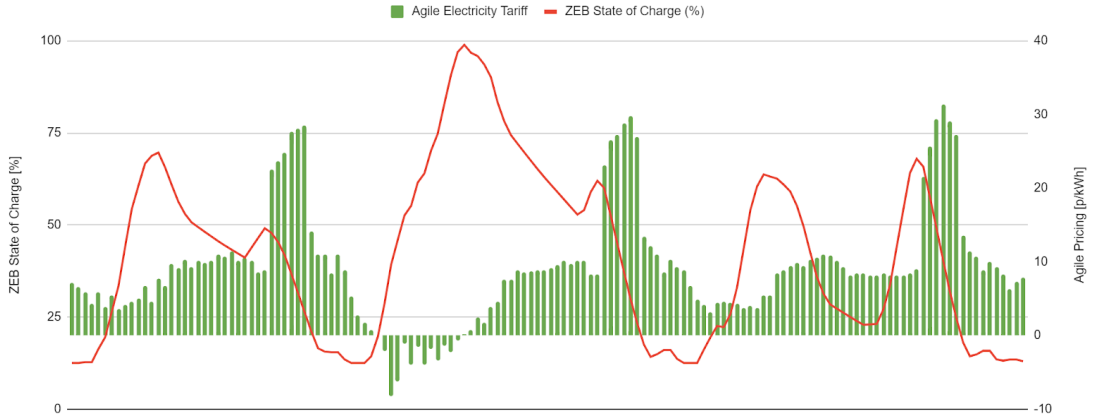
- Every ZEB connects over the internet to our cutting edge serverless IoT infrastructure
- Machine learning used to forecast demand and optimise when to consume electricity
- Customers can choose how carbon or cost conscious they are
- Units can be aggregated into "Fleets" to deliver services to grid operators and/or energy suppliers



The ZEB ensures it has enough energy stored to meet your heating demands.



The ZEB manages its State of Charge by charging during the most cost effective times.



Why is ZEB™ technology the missing piece of the puzzle?

Cost & Convenience

- Easy install / minimal disruption
- Low customer barriers & easy to understand
- Minimal retraining of existing boiler installers
- Up to 50% cheaper upfront than a heat pump **50%**
- Up to 20% lower running costs than heat pump **20%**
- Well suited to smaller homes when other solutions are often not possible

Carbon

- Zero local emissions – no fossil fuel combustion
- Up to 20% lower indirect carbon emissions from heating vs ASHP **20%**
- Supports self-consumption of locally generated renewables
- Estimated. 4 tonnes CO_2eq saved per home per year vs a gas boiler**

Society

- Enables more of society to be involved decarbonisation
- Approx. £4bn per year in GB energy system benefits from distributed thermal storage* **£4bn**
- Fleets of ZEBs support a low carbon grid by providing:
  1. System balancing & flexibility
  2. System resilience, stability & inertia
  3. Reducing network upgrades / managing constraints

*see Imperial College & CCC modelling 2018

**based on independently validated Carbon Impact Forecast

Regulatory change and new service models are creating the perfect environment for the ZEB™

Market size & opportunity

An enormous and timely market opportunity…

- 1.7m gas and 100k oil boilers are sold every year in the UK – globally it's 12.7m

1.8m

- UK Government is banning fossil fuel boilers in new homes from 2025 and probably for existing homes in the 2030's

2025

Routes to market

- Low volume B2C - prosumers and climate advocates
- Mass market B2B2C leveraging energy supplier access to customers and their existing sales/marketing channels
- Work ongoing with OVO, EDF, Octopus Energy, SOEnergy

Proposition & pricing

- Initial target one-off installed cost approximately £5000
- Option for new models like "heat-as-a-service"

Upfront cost (or financed)
- ZEB Unit
- Installation

Ongoing monthly payment
- IoT & ML Optimisation
- Grid Balancing Services
- Maintenance & Servicing

ZEBs are heating local homes today…

What's the latest?

Programmes, initiatives & awards

Tech Nation

- First Net Zero Cohort of fastest growing clean tech companies

Energy Systems Catapult

- Innovation Support Platform

Impact-Forecast

- ZEB Impact validated as significant and positive

EDF Pulse Challenge

- Winners! People's vote

SME Climate Hub

- Net Zero as we grow

Proud members of:

Latest developments

- Highly experienced and growing team – 12 FTE
- Large R&D facility - 4 fully-functional test bays - 24/7 testing
- 10 domestic **trial installations** completed and heating homes
- Product certification and commercialisation ongoing
- Product launch **autumn 2021**
- Other models to be launched in 2022

Investment position

- £1.65m equity raised to date
- £1.2-2m raise to complete in summer 2021 from our existing investors with space for 1 or 2 strategic institutional investors

Appendices

tepeo

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connectedresponse

Accelerating Net Zero

Decarbonising Heat

Transforming Lives

Retrofit technology to optimise electric storage heating and hot water

Connected Response at IDEALondon 25th February 2021

Kenny Cameron (kennycameron@connectedresponse.co.uk) 07770 597231

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The Problem

Industry barriers
- -Market inertia
- -Charging Regimes/Tariffs

Who is affected?
- -1.5m homes in urban flats and rural off-gas areas
- -30% Social/ 36% Owners/34% Private Renters
- -Much more likely to be fuel poor

40 years of night-charging-only → poor heating experience

Impact on lives
- *-"Too warm in the morning, Cold in the evening"*
- *-"I go to bed at teatime in winter"*
- *-"We plug in an electric fire in the evening"*

The Opportunity

Smart charging → Dynamic/Flex charging

- Improve Comfort and Reduce Bills
- Alleviate Fuel Poverty
- Improve Health

- Matching flexible load with transient renewable energy
- NG-ESO spend £500m pa curtailing wind

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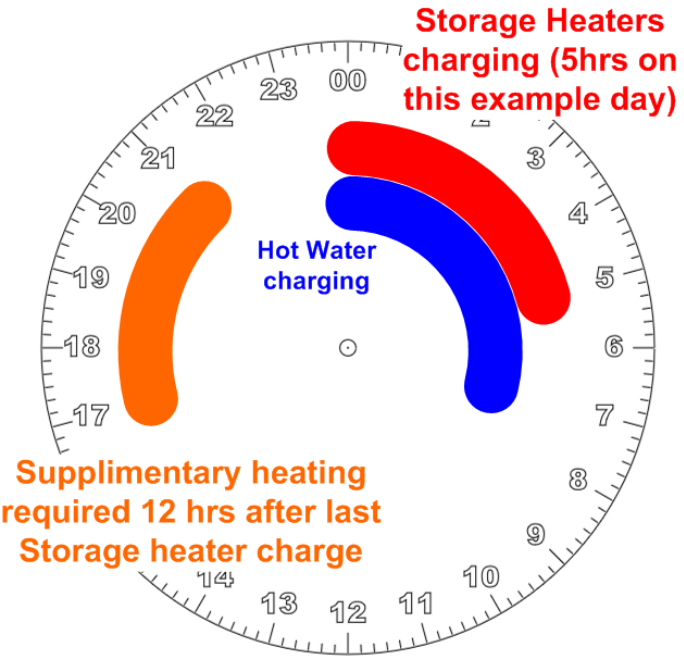
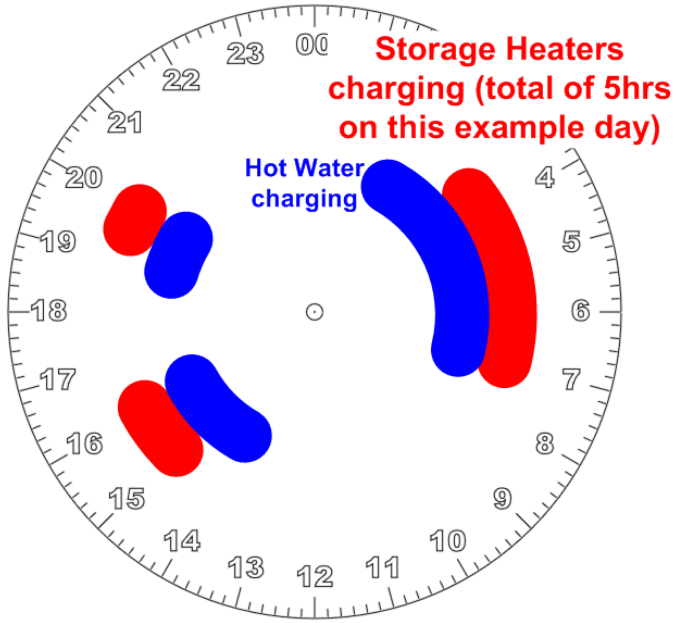
The Solution



- **Current heating** is simple night time charging, maximum 7 hours.
- Heat gone by afternoon
- Switch on expensive supplementary heating or go cold
- The fuel poverty dilemma.



- **Change to smart charge heating** and hot water at better times
- Multiple in-day charging periods that can be dynamically timed
- Choice
- Heaters charged in line with:
  - Resident needs - “How warm and when”
  - Local Weather forecast
  - Living Room Temperature
  - Wholesale Prices (optional)
  - Local Renewable Energy (optional)

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Origins

- Martin Ade-Hall – Technical Director
- Developed our technology at Energy Assets 2012-18
- Developed award-winning aggregated metering solution in Westminster 2015
- Adapted for SmartFintry community energy scheme in 2016
- Kenny Cameron – Managing Director
- Developed the vision for Energy Assets with four London landlords 2014
- First UK employee of VCharge (US start-up that became Kaluza/OVO) 2015-18
- Conceived first major social housing project with Scottish Government 2016-18
- Connected Response formed as a spin-out from Energy Assets in 2018
- Apply learnings to deliver a low cost solution that transforms lives

How does it work?

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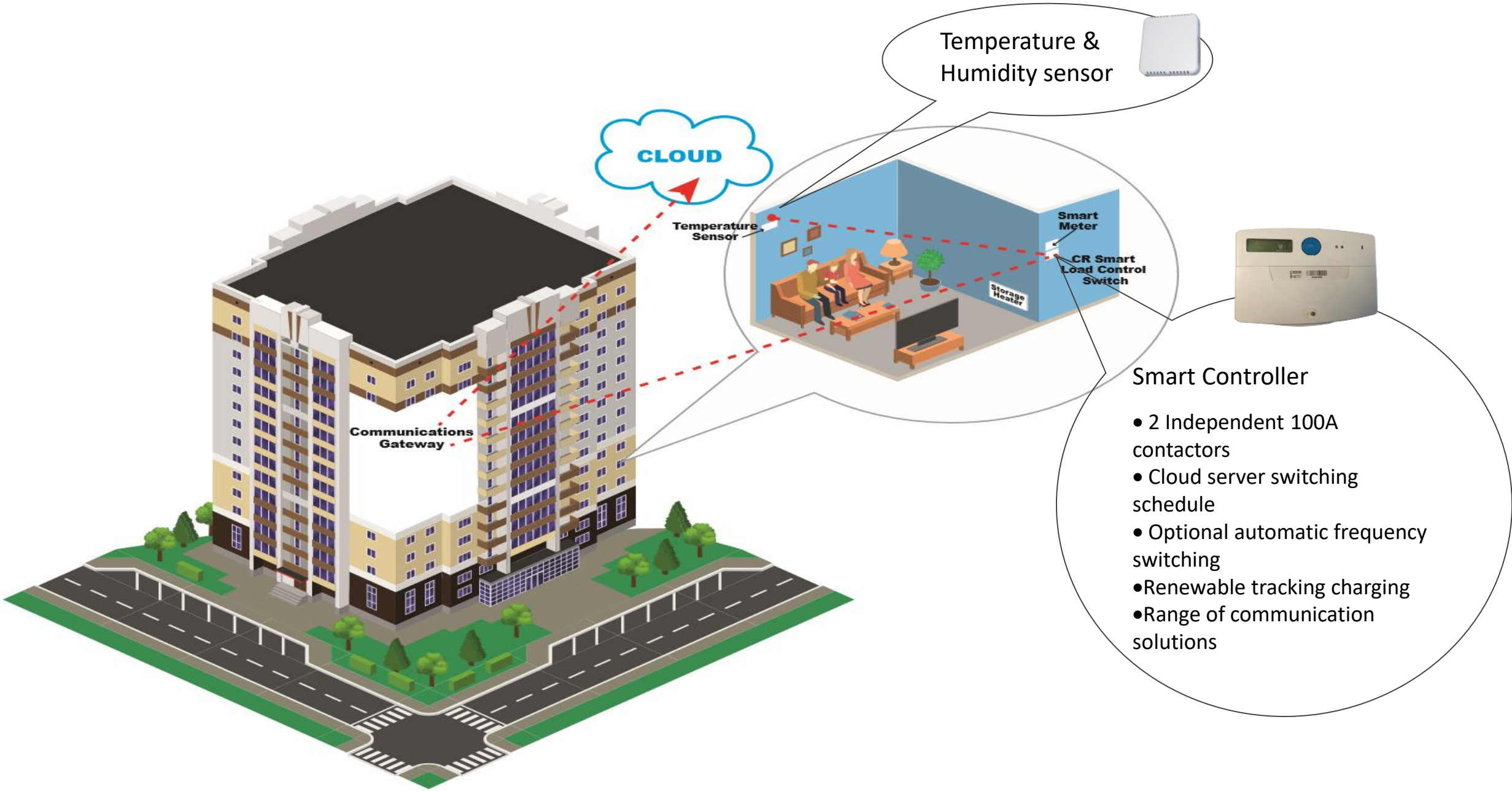

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Case Study 1: Royal Borough of Kensington & Chelsea
Heat-with-Rent payment model

Social Housing Landlord
Heat-with-Rent contract

Energy supply contract

Heating Retrofit Supply and Service

EDF

API interface to enable Wholesale Price
Optimisation and Flexibility Services

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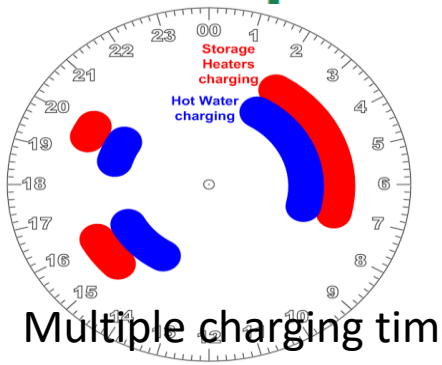

Multiple charging times

Case Study 2: Wheatley Group
Tenant-Pays Payment Model

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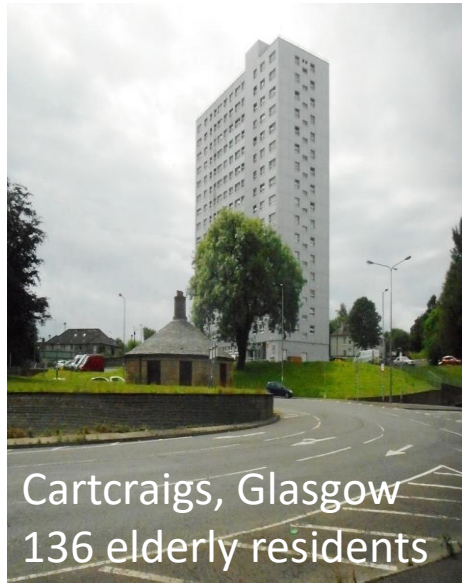


Glasgow Housing Association
(11,500 SH&HW flats)

NG - ESO

Opportunity to align charging with otherwise curtailed wind

Coordinating tenant EV strategy

SP Energy Networks

Heating Retrofit Supply and Service
1. 196 flats Dec 2020
2. 136 flat tower Mar 2020

Installed cost per flat ~£550

connectedresponse

Retrofit 5 year roll-out starts April

Energy Suppliers include Scottish Power and Utilita

Product Roadmap

connectedresponse

Communications in MDUs using ZigBee Mesh as proven in Westminster towers since 2015 for aggregated metering

Develop Smart Controller and Temperature sensor to give individual households customised heating – Retrofit

Developed CAD to provide real time consumption data from SMETS meters for community energy schemes

Develop enhanced communication options Smart Controller-GSM and LoRa radio

Service Development

Service: Flex charging to match dynamic TOU prices

Service: Use the Demand Side Response functionality in the switch - configurable in large or small groups to provide services to DSOs and ESO

Service: Adapt Smart Controller to dynamically access otherwise curtailed wind and provide metering “proof”

nationalgridESO

connectedresponse

Scottish & Southern Electricity Networks

passivSYSTEMS

4D Heat

Using domestic heat to address wind constraints

DELTA-EE

everoze

"What is the maximum volume of wind energy that the ESO could avoid having to curtail, by incentivising electric residential heating turn up at times of wind curtailment?"

"In the year 2030, up to 9% of constrained wind, equivalent to 540GWh/year, could be absorbed by domestic off-gas grid electric heating across Scotland by exploiting the flexibility in heating. This delivers a £24m/year saving in wind constraint payments and a further £2m/year in environmental and societal benefits, providing a net benefit to the system and consumers"

"The analysis demonstrates that a reduction in curtailed wind of up to 17% (222 GWh) in 2020 and 9% (540 GWh) in 2030 is achievable. This corresponds to CO2 savings of up to 42Gt in 2020 and 26Gt in 2030"

"The modelling assumes a curtailed wind use tariff discount set at a constant value of 4.494p/kWh for both 2020 and 2030"

“Don’t throw the baby out with the bath water”

connectedresponse

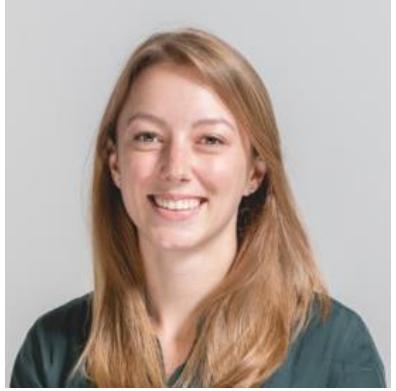
Win-Win-Win……..Benefits to Fuel Poor households and all network participants

Panel Discussion and Q&A

Chris Gruen
MD, NovAzure Consulting

Chris Connon
Senior Manager of Proposition Innovation, EDF

Professor Robert Lowe
Chair of Energy and Building Science, UCL



Rox Pieterse
Research Manager - Delta-EE

Scott Blance
Policy Advisor - Sustainable Energy Association

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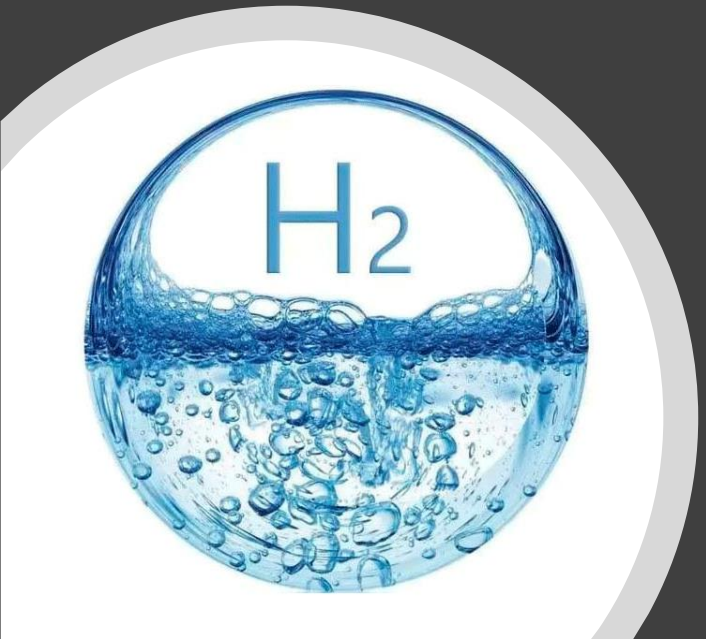

Accelerating Net Zero: Upcoming Events

- Electric Mobility – 25 March 2021
- Storage, Batteries & Flexibility – April 2021
- Hydrogen – May 2021

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Poll: What's Next – Your Choice!

- Choose whichever topics you are interested in
- NOT anonymous – so we can follow up with a targeted invite for the next session

- ❑ Renewable Generation
- ❑ Empowering people to make better choices
- ❑ Circular Economy / Waste / Recycling
- ❑ Smart Homes
- ❑ Sustainable Investing
- ❑ Food
- ❑ Green Consumer Financing

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Closing Messages

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- Feedback form and recording via email
- Tell us about your solution of how to accelerate the net zero journey
- 'IDEALondon Accelerating Net Zero' LinkedIn group
- IDEALondon virtual membership for startups www.idealondon.co.uk/membership/
- Contact NovAzure for support to grow your startup

Contact: Shirin.Shah@edfenergy.com, Justine@capitalenterprise.org, F.Rayner@ucl.ac.uk, Info@novazure.com

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The Next Session:

Electric Mobility

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