Financing a net zero built environment

Green Finance Institute

Climate Awareness

(A potted history)

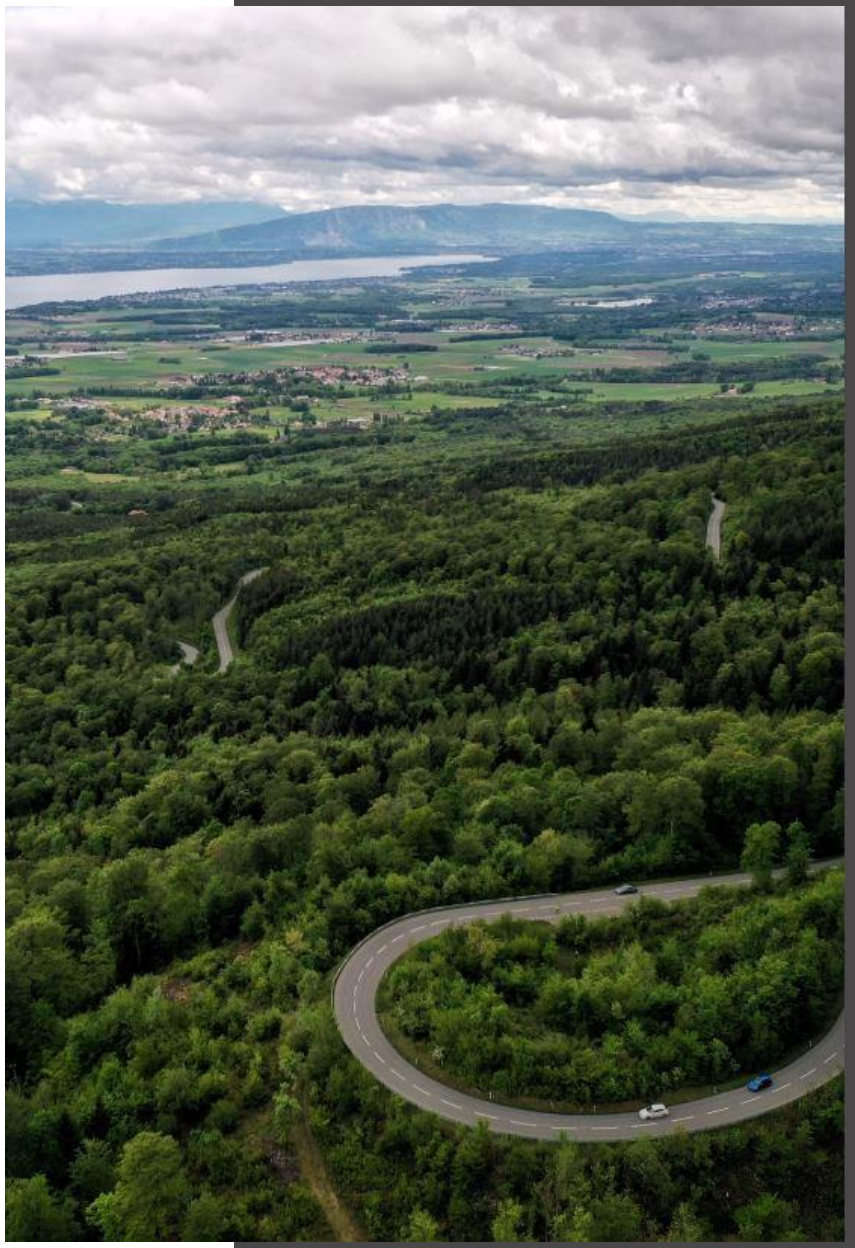
- Paris Agreement signed in 2015
- Increasing awareness and activism on climate change
- Growing focus on the business **opportunities** and **risks**

Green Finance Institute

Greening Finance

Mainstreaming climate and environmental factors as a financial and strategic imperative

- Reporting & disclosure
- Regulation & policy
- Transparency & market integrity



Financing Green

Mobilising private finance for clean and resilient growth

- Financial & product innovation
- Cross-sector collaboration
- Client engagement & education

Green Finance Institute

Climate Change & the Built Environment

Investment of **£360 billion** is needed to decarbonise UK buildings

- Buildings account for **23%** of UK total emissions
- Of these emissions, homes account for **77%** and commercial buildings for **14%**
- Construction of new buildings accounts for **28%** of global building-related emissions
- Market value of property firms could lose over **9%** due to climate impacts
- Energy efficiency has the potential to reduce GHG emissions by **7 giga tonnes** by 2040

Green Finance Institute

Coalition for the Energy Efficiency of Buildings

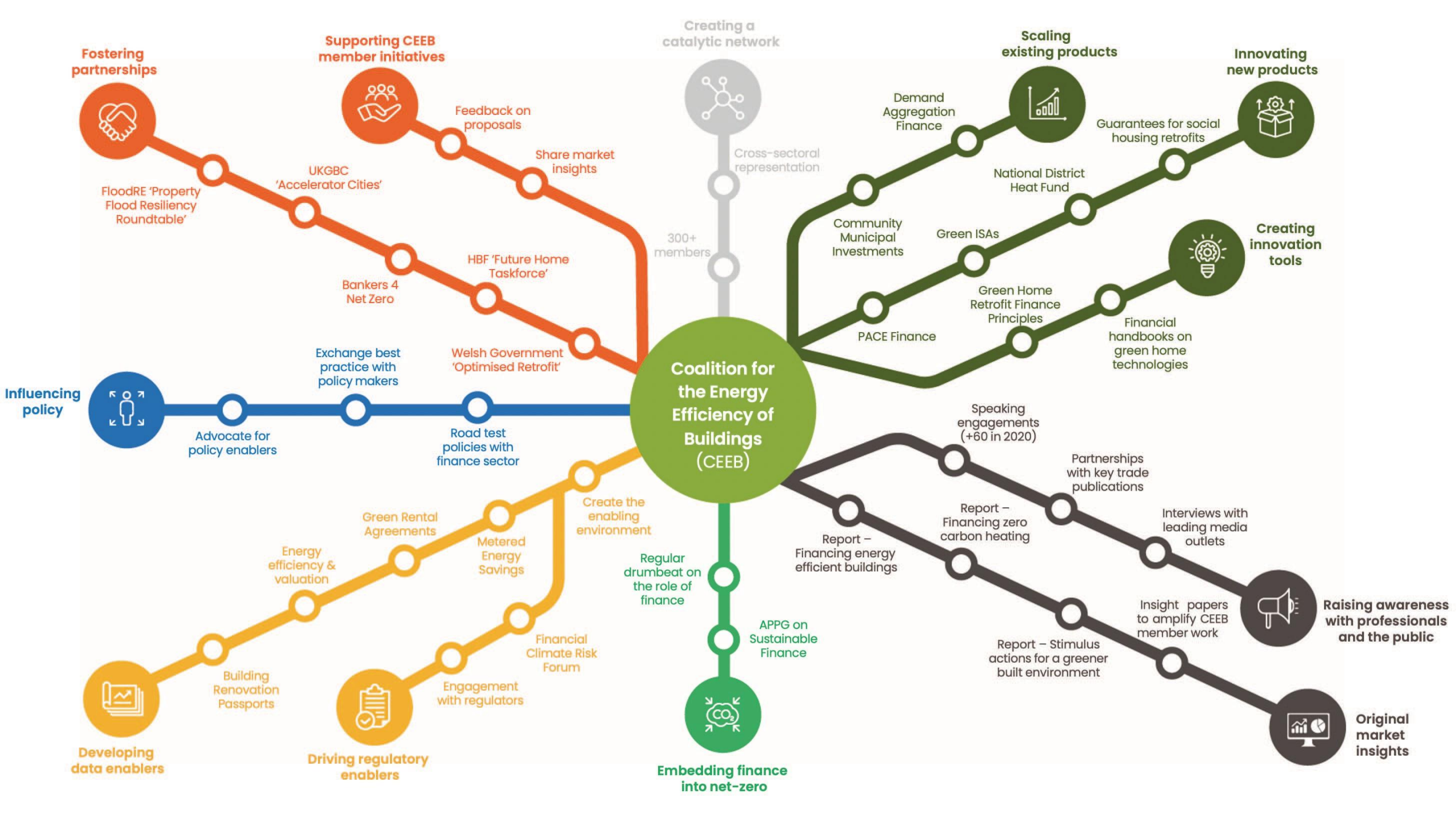
- Develop the market for financing a net-zero carbon built environment
- Identify barriers to investment
- Design financial solutions to unlock capital flows
- Develop demonstration projects to catalyse financial innovation

Over **200** members drawn from finance, property, energy, policy, academia and civil society

Financial solutions and enablers under development by the CEEB

Green Home Finance Principles	Building Renovation Passports
Property Assessed Clean Energy (PACE)	Demand Aggregation Finance
Green Rental Agreements	Lender Handbook on Retrofit Technology
Metered Energy Savings	Green ISAs

Portfolio of **30+** financial demonstration projects


Coalition for the Energy Efficiency of Buildings (CEEB)
Fostering partnerships
FloodRE 'Property Flood Resiliency Roundtable'
UKGBC 'Accelerator Cities'
Bankers 4 Net Zero
Supporting CEEB member initiatives
Feedback on proposals
Share market insights
HBF 'Future Home Taskforce'
Welsh Government 'Optimised Retrofit'
Creating a catalytic network
Cross-sectoral representation
300+ members
Scaling existing products
Demand Aggregation Finance
Community Municipal Investments
PACE Finance
Innovating new products
Guarantees for social housing retrofits
National District Heat Fund
Green ISAs
Creating innovation tools
Green Home Retrofit Finance Principles
Financial handbooks on green home technologies
Influencing policy
Exchange best practice with policy makers
Advocate for policy enablers
Road test policies with finance sector
Create the enabling environment
Green Rental Agreements
Metered Energy Savings
Energy efficiency & valuation
Building Renovation Passports
Developing data enablers
Financial Climate Risk Forum
Engagement with regulators
Driving regulatory enablers
Regular drumbeat on the role of finance
APPG on Sustainable Finance
Embedding finance into net-zero
Speaking engagements (+60 in 2020)
Partnerships with key trade publications
Interviews with leading media outlets
Raising awareness with professionals and the public
Report – Financing zero carbon heating
Report – Financing energy efficient buildings
Insight papers to amplify CEEB member work
Report – Stimulus actions for a greener built environment
Original market insights

CHIC Webinar – Zero Carbon

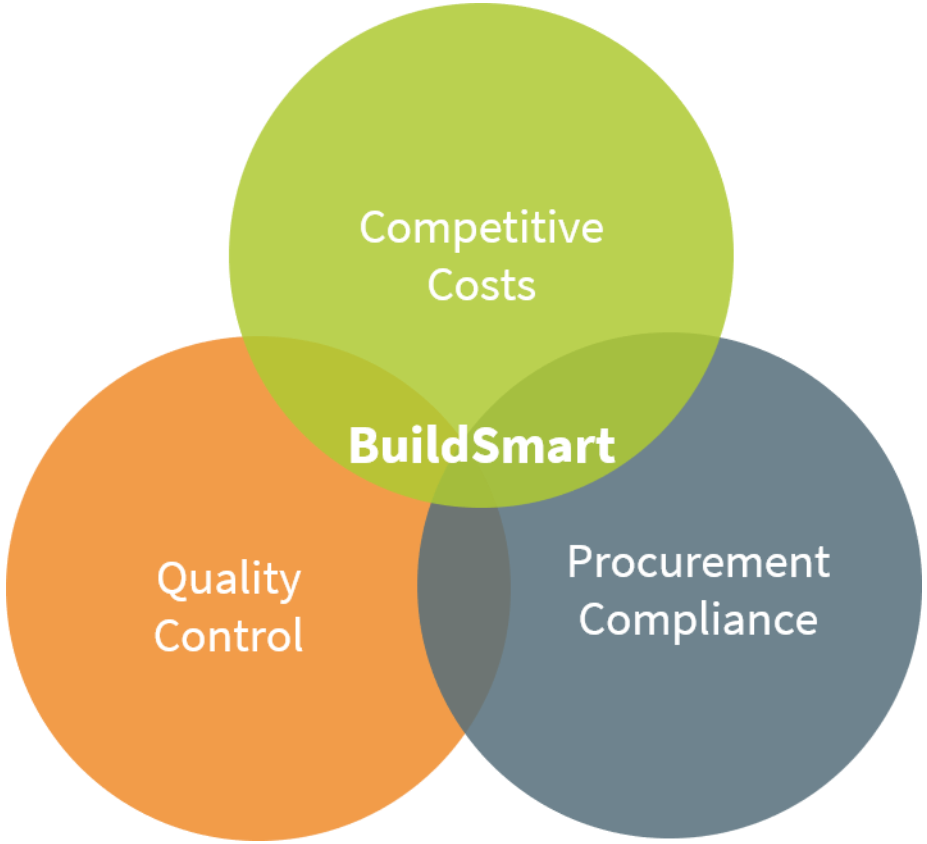
Sarah Davey, Head of Development Services

Wednesday 9th June 2021

How BuildSmart works

BuildSmart combines member order books to deliver high quality homes quickly and cost effectively:

- Long-term supply contracts with modular and timber frame manufacturers
- Turnkey contracts – where manufacturers can also act as main contractor
- Volume is key to get full value
- Access to main contractors and consultants through CHIC's Dynamic Purchasing System
- A tried and tested materials supply chain.
- All solutions provide full PCR 2015 compliance



What BuildSmart offers:

BuildSmart offers members the opportunity to become a volume housebuilder for the Affordable Housing Sector. We do this by:

- Consortium level collaboration
- Aggregated volume
- Standardisation of core products/design
- Supply chain engagement
- Utilisation of a proven materials supply chain
- Embracing modern methods of construction
- Proven and efficient MMC Product

Net Zero Carbon, Low Carbon, Climate Positive

As more and more nations, organisations and individuals take bold climate action, more and more terms describing that action are flying around. What do they mean???

Net Zero Carbon

This is not just about the end product, it is a construction journey, measuring everything from site waste to the number of site toilets. It's a change in the end users lifestyle. It is not a straight forward solution and is costly.

Low Carbon

This is more cost effective solution and can be easily achieved by making changes in build methods and using a more carbon friendly specification such as heating systems

We can help you on your Low Carbon Journey

BuildSmart has several MMC partners who can help with this journey both Timber Frame and Steel Frame as an alternative to on site traditional build.

Benefits of Off Site Manufacture & Hidden Value:

- Less Waste – none of the waste our partners generate in their factories goes to landfill. It is all recycled
- Less Carbon – using sustainable materials
- Less Defects – factory environment construction ensures a higher quality of build without the hinderance of inclement weather conditions
- Lower running costs = better insulation qualities means cheaper heating bills
- Less neighbourhood disruption – the majority of the build is undertaken off site and only the final touches are completed onsite
- Foundations are more simple due to light weight superstructure
- Earlier rental income due to quicker build programme

IMPACT CAPITAL GROUP

Low rise – Peterborough Factory

CHIC

2020 Procurement

- 15 year (5 + 5 + 5) contracts
- Modular manufacture and optional turnkey
  - Impact Modular
  - Elements Europe
  - M-AR Offsite

M-AR

Low rise – Hull Factory

ALL NOW AVAILABLE

Low & High rise – Telford Factory

CHIC's 2016 MMC Solutions
(15 Year Contracts)

1. Frame and Panel – Site Assembly

2. Fully Modular – Factory Finished

3. 2019 – Interim Contract
   – Fully Modular /
   Factory Finished

So why CHIC?

- PCR 2015 Procurement Compliance
- Tendered Costs
- Materials Supply
- Potential to Lever Bigger Volumes
- Collaborative Efficiencies

Cost of CHIC's Materials

- Free to join
- Transaction fee (<1%)
- More than recovered through materials savings

Materials can be sourced from CHIC's existing suppliers into MMC & traditional supply chains enabling members to control quality and footprint of things rather than taking what is offered

Thank You

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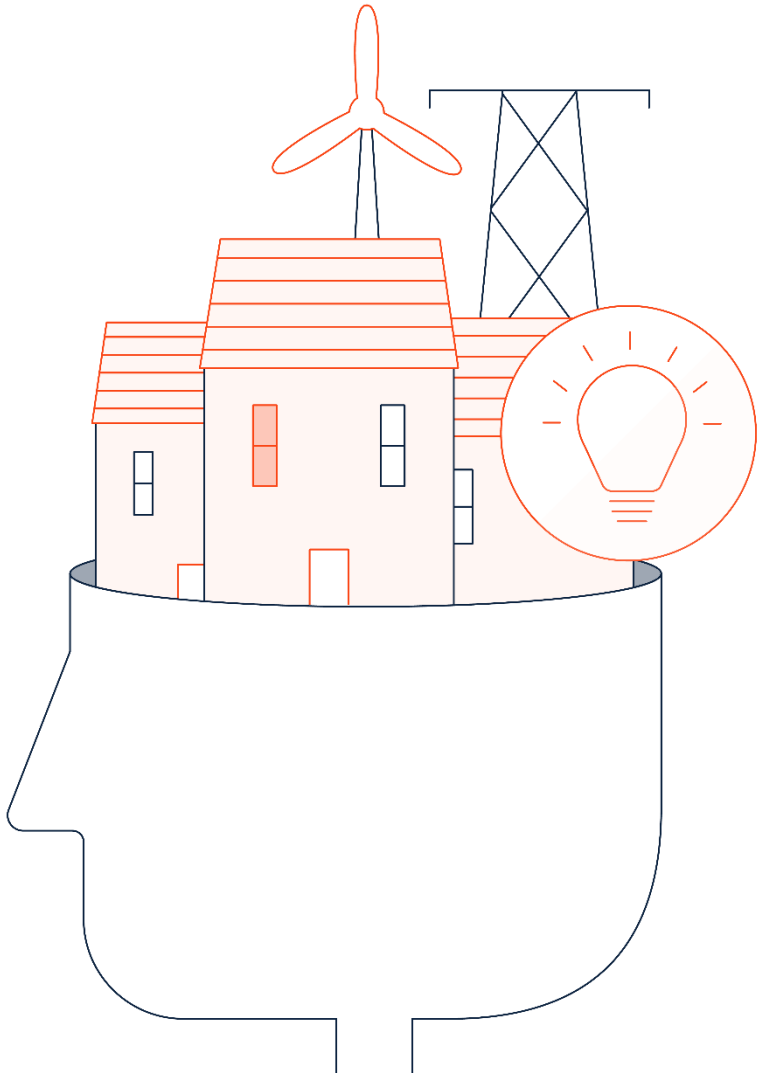
What is Net Zero?



Andy Sutton RIBA
Co-Founder & Design+Innovation Director
Email: Andy@sero.life
Tweet: @AS_architecture

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What is Net Zero?

Optimised Retrofit CPD Series

Today's Topics

- Defining Net Zero
- How this compares to current assessment schemes
- Basics of how to build/refurb Net Zero

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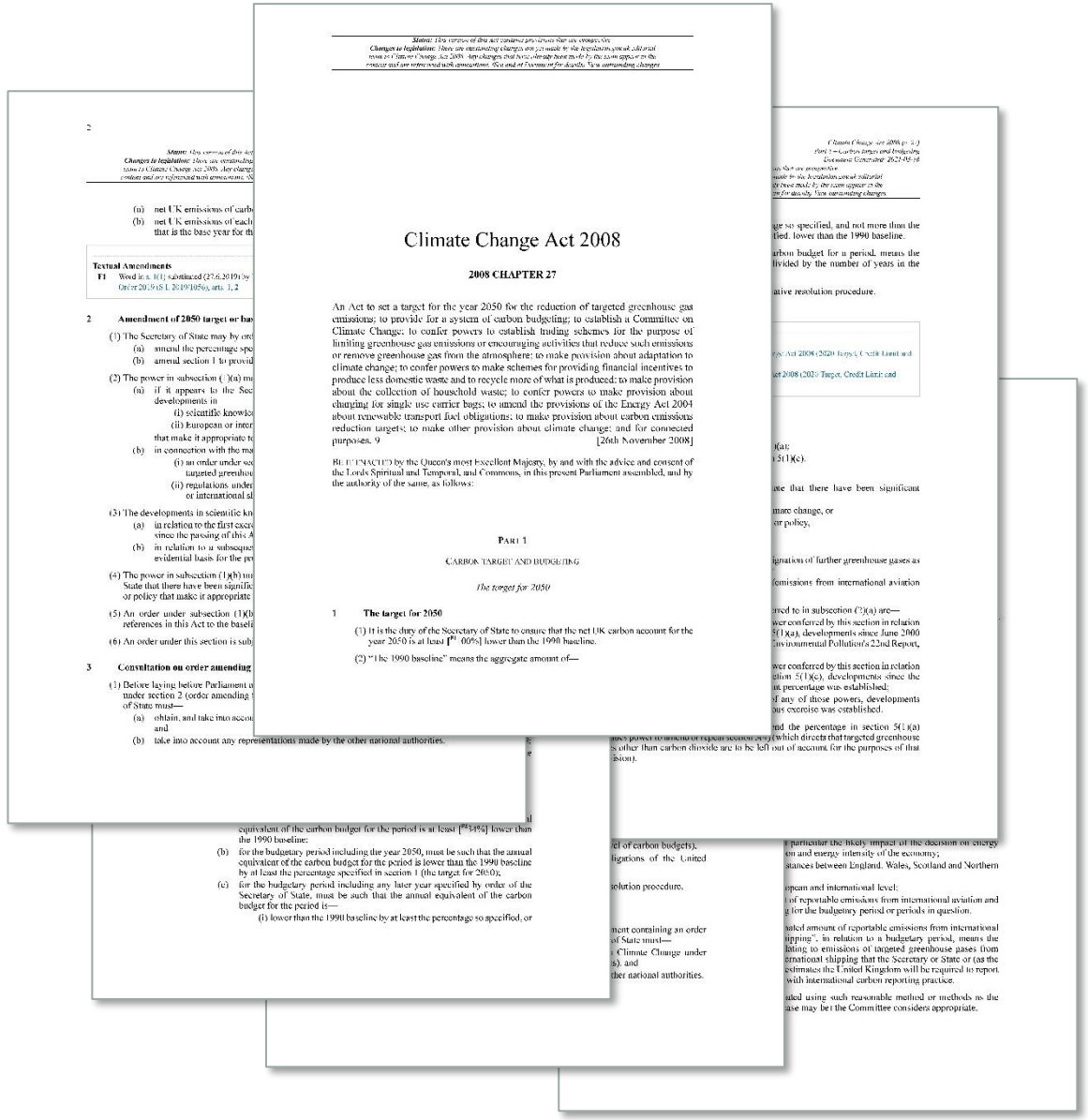
What is Net Zero?

Defining Zero

The Basics…

- There is a legal obligation to achieve Net Zero by 2050 across the whole of the United Kingdom*;
  - Created at 80% by the Climate Change Act 2008
  - Amended to 100% in 2017
- This applies state-wide, and to all industries/sectors
- Current debates are, in effect, every sector lobbying that every *other* sector should push harder to Net Zero, because their own sector can't get to Net Zero
- Based on current science, aviation, heavy industry and agriculture have genuine technical barriers to Net Zero
- Construction & the Built Environment has no significant technical barriers to Net Zero
  (this is important later)

*There's also a Climate Emergency & Biodiversity Crisis



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What is Net Zero?

Defining Zero

The Basics…

- Lots of definitions over the years, and commonly abused by construction industry with ‘greenwashing’
- The best available, and increasingly the most common, is the UK Green Building Council’s definition, published in April 2019 https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition/
- We understand Welsh Government is looking to align with the UKGBC definition for all its own activities
- UKGBC breaks Net Zero in to:
  - Net Zero Carbon Construction
  - Net Zero Carbon in Operation
- Together, these make Whole Life Net Zero Carbon

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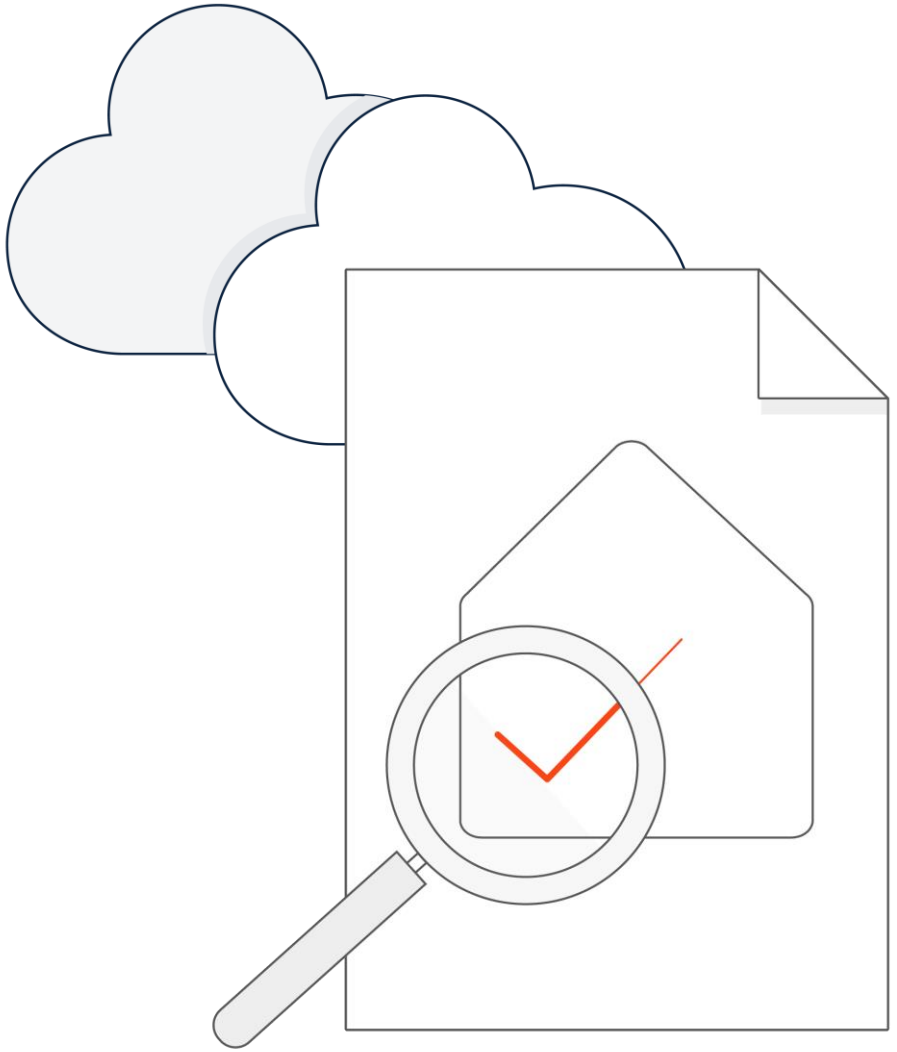
What is Net Zero?

Defining Zero

The Basics…

- Net Zero is measured in “Carbon” = CO_2^{eq}
  (this is important later)
- “Carbon” includes **c**arbon di**o**xide (CO_2), but also converts other greenhouse gases into their equivalent impact measured in carbon dioxide (hence the “eq”)
- Hence CO_2^{eq} includes methane, CFCs and much more, expressed in terms of carbon dioxide impact



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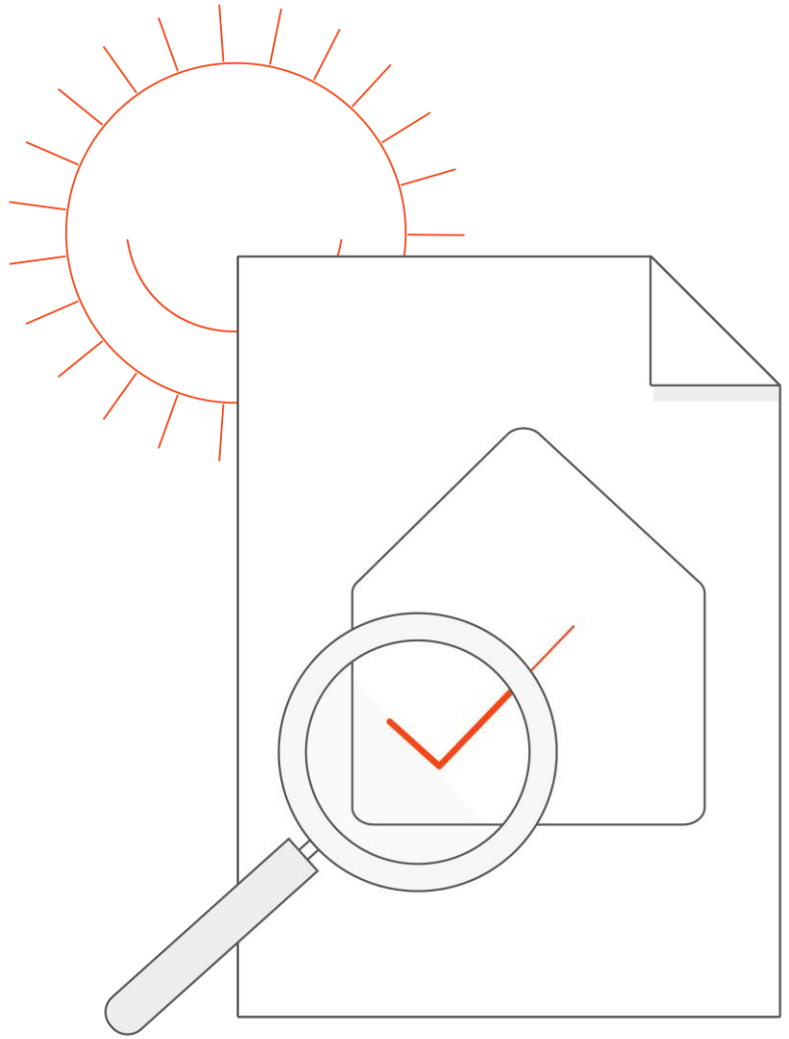
What is Net Zero?

Defining Zero

The Basics…

- Net Zero is measured over a time period;
  - Whole Life is measured over the whole life
  - Construction is measured over the construction
  - Operational is measured over an average year
- Net Zero means to emit no Carbon in total (sum) over the period of definition;
  - Carbon can therefore be emitted in the time

    but
  - Equivalent Carbon must be (demonstrably) measured as avoided or absorbed too
  - “Offsets” might form part of this avoided/absorbs
  - = The sum total must be Zero (or less), hence “Net” Zero



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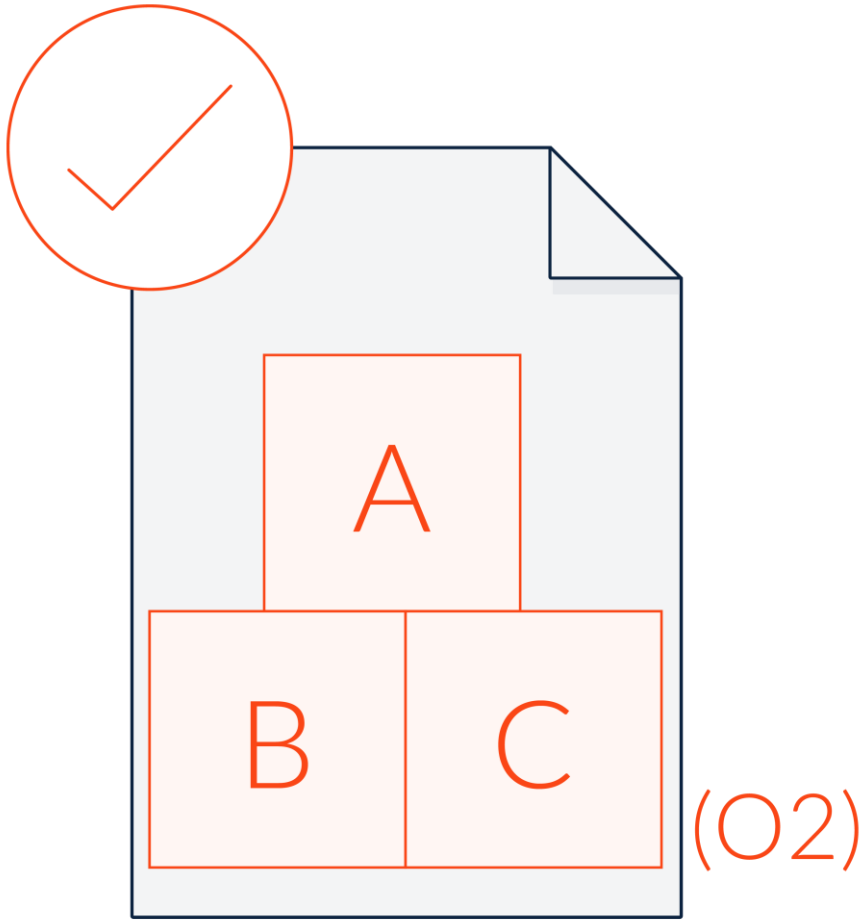
What is Net Zero?

Defining Zero

Whole Life Net Zero for Buildings

- UKGBC gave us Whole Life Net Zero Carbon, broken as:
  - Net Zero Carbon Construction
  - Net Zero Carbon in Operation
- Net Zero Carbon **Construction** is defined as:
  "When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy."
- The definition assumes the use of offsets, at least in the short term, since emissions from manufacturing products & materials (and to a lesser extent site activities & travel) are hard to completely avoid.



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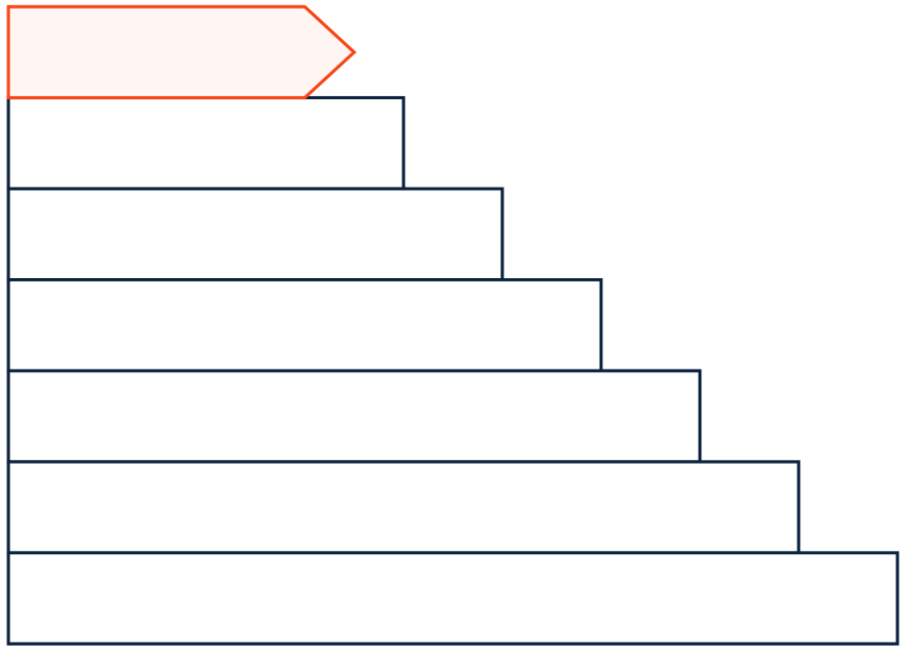
What is Net Zero?

Defining Zero

Whole Life Net Zero for Buildings

- UKGBC gave us Whole Life Net Zero Carbon, broken as:
  - Net Zero Carbon Construction
  - Net Zero Carbon in Operation
- Net Zero Carbon **Operation** is defined as:
  "When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/ or off-site renewable energy sources, with any remaining carbon balance offset."
- The definition also allows a 'last resort' of offsets



Q: Given other sectors have true technical barriers to achieving Net Zero and will have to use Carbon offsets, is it appropriate for the buildings to use some of the finite available offsets for their own avoidable emissions?

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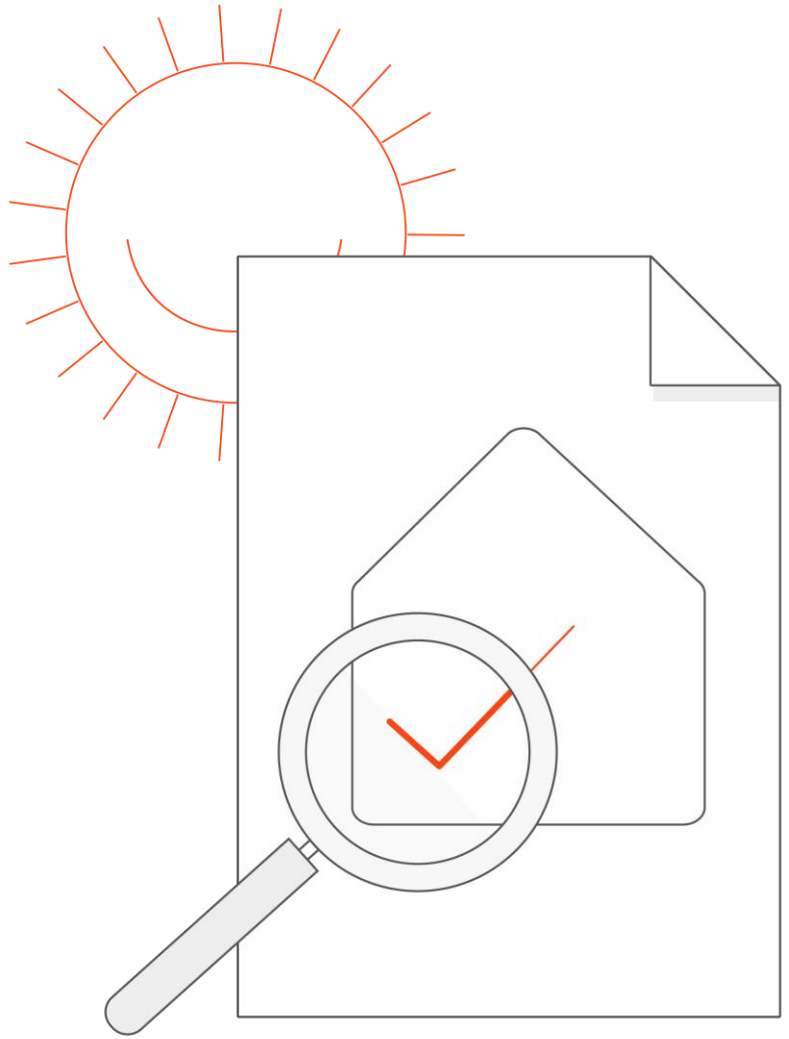
What is Net Zero?

Defining Zero

The Basics…

- Basic summary, Net Zero is;
  - A UK legal obligation
  - Applicable across all sectors/industries
  - Best defined by UK Green Building Council
  - Measured in CO_2^{eq}
  - Measured over time
  - Sum of emissions & avoids/absorbs is Zero (or less)



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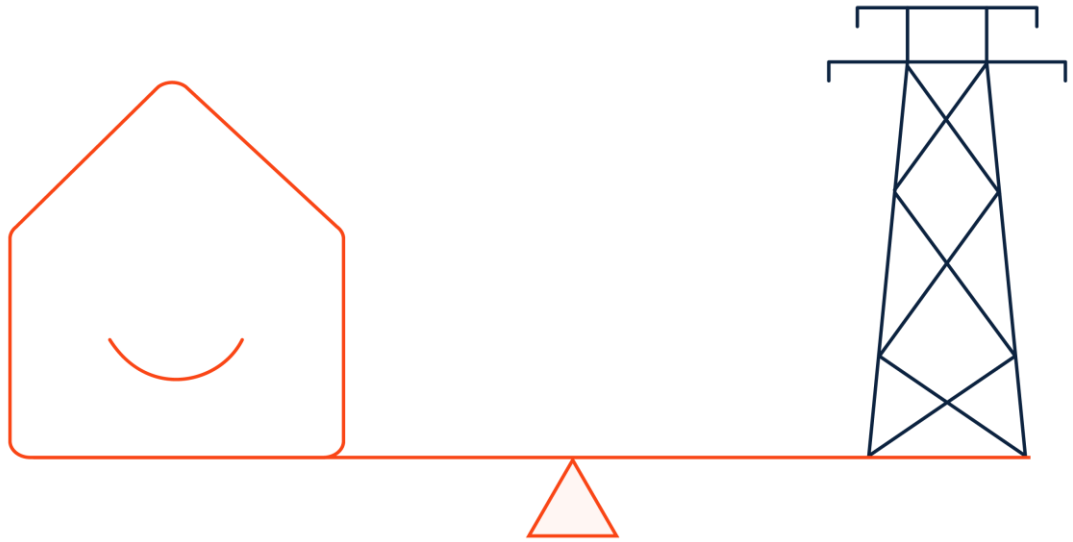
What is Net Zero?

Defining Zero

Operational Net Zero & Energy Networks

- UKGBC Net Zero Carbon Operation also gives us:
  *"**Dynamic 'time of use' emissions factors should be adopted for all carbon calculations** as these provide a greater level of accuracy.*
  These emission factors are based on the carbon intensity of the electricity grid when energy is imported (or exported). A consistent and commonly understood methodology is needed for this approach to be utilised in the framework."
- This recognition is **massively** important…

…so I'm afraid I need to talk a little bit about energy networks…



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What is Net Zero?

Defining Zero

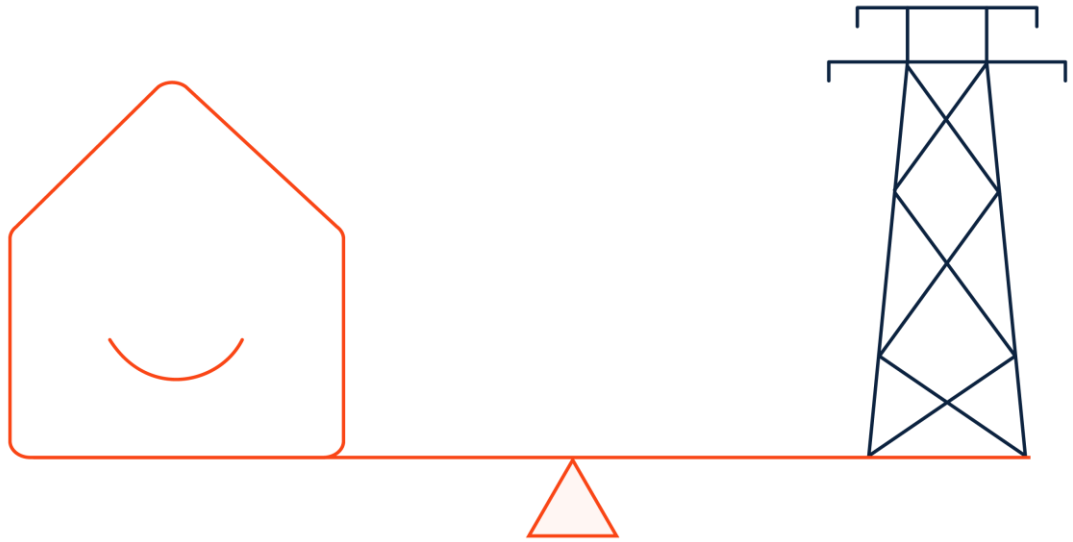
Operational Net Zero & Energy Networks

- The UK National Grid produces electrical energy (kWh) and emits carbon (CO_2^{eq}) when it does so*
- UKGBC's definition recognises that the Grid does not create a fixed amount of energy for a certain amount of carbon emissions;

  XX kWh ≠ XX CO_2^{eq}

- This is *very slightly* true of all energy sources, including mains & bottled gas, but immensely true for electricity
- In a fairly typical day, **both** these statements are true;

  1 kWh = 150g CO_2^{eq}
  1 kWh = 300g CO_2^{eq}



*nuclear power has a minimal carbon footprint, though a "clean-up" of hundreds of years to consider…

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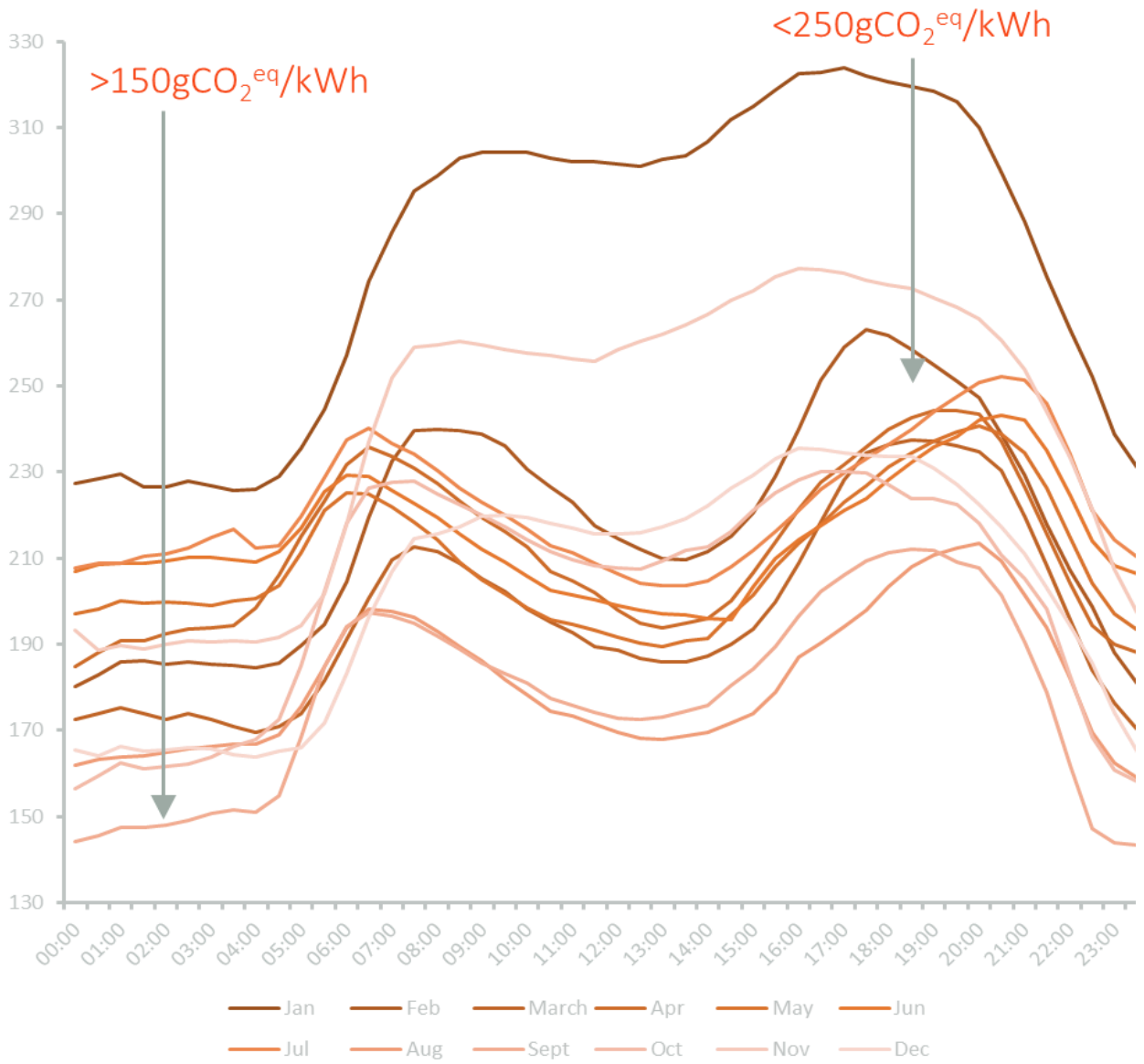
What is Net Zero?

Defining Zero

Operational Net Zero & Energy Networks

- The variation in carbon emissions for fairly typical day is 2-3 times the carbon from highest to lowest
- This is driven by supply (generation) and demand
- We have no control over renewable generation since the sun shines & wind blows when it chooses, so whilst zero carbon, we don't choose generation levels*
- With fossil fuel power stations, we primarily use gas 'peaking' stations to increase supply (generation), though these have higher carbon emissions
- Together these mean even meeting a flat level of demand, the carbon emissions of supply (generation) would vary every day, and from winter to summer

*we also have no variability with nuclear, which you cannot effectively adjust outputs over short periods



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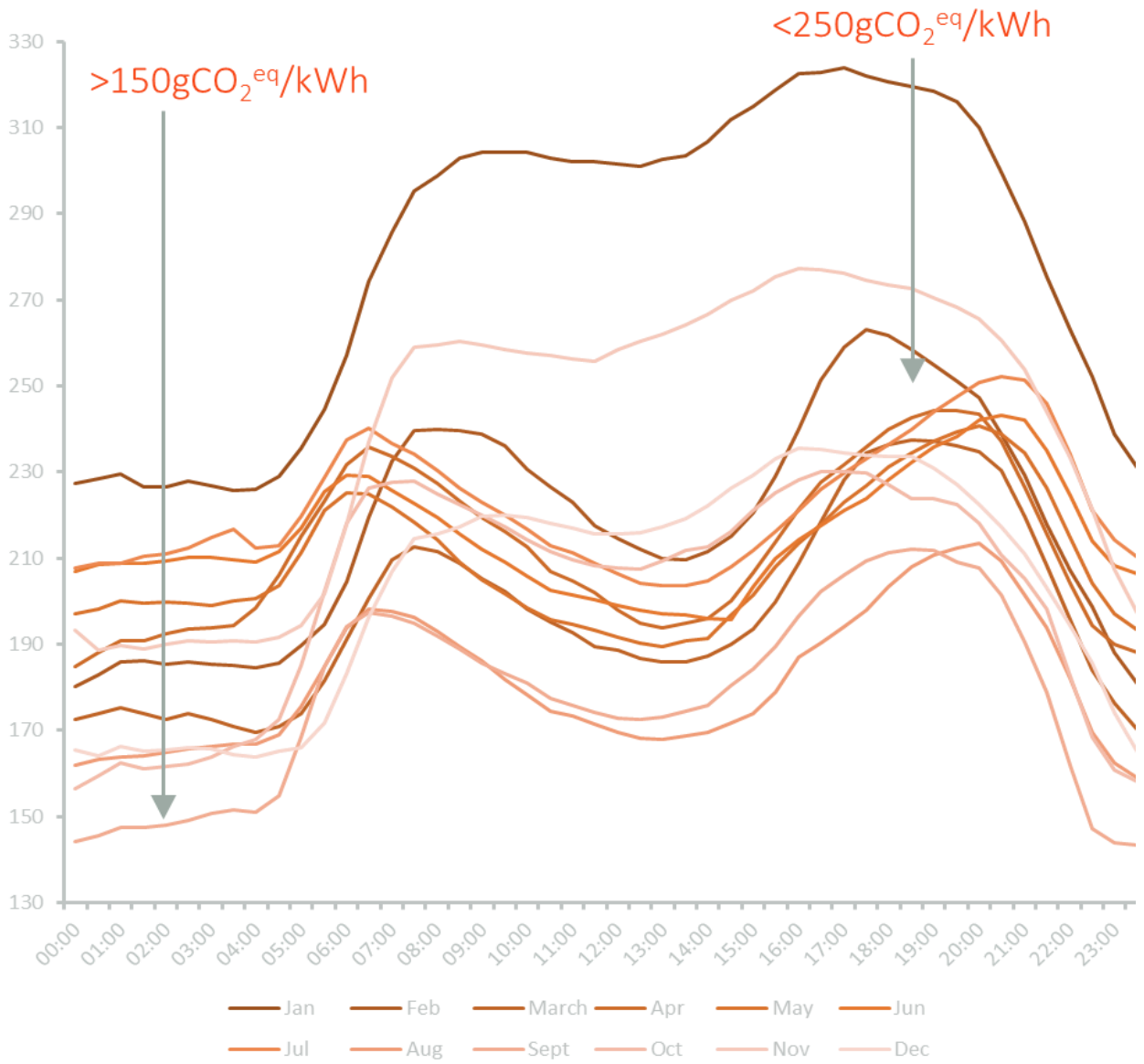
What is Net Zero?

Defining Zero

Operational Net Zero & Energy Networks

- Demand isn't flat and stable either, though
- Every 24 hours, energy demands vary second by second, typically peaking 4-8pm with a secondary demand peak in the mornings
- There are generally higher demands in the daytime, and weekends (especially Sundays) are typically a little lower than weekdays
- The residential sector (our homes) are the biggest single driver of these fluctuations
- The combination of different types of supply (generation) and the different levels of demand result in the very significant variation of kWh to CO_2^{eq}



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What is Net Zero?

Defining Zero

Operational Net Zero & Energy Networks

- For those curious to see this in action, there are various websites that show this live;
  - https://electricinsights.co.uk/
  - https://carbonintensity.org.uk/
  - https://www.mygridgb.co.uk/dashboard/
  - https://www.electricitymap.org/map
- There are also Apps, search;
  - NG ESO
  - Carbon Tracer
  - GridCarbon
- Which hopefully means you've got the message that;

$$XX\ kWh \neq XX\ CO_2{}^{eq}$$

And that this changes significantly all day, every day

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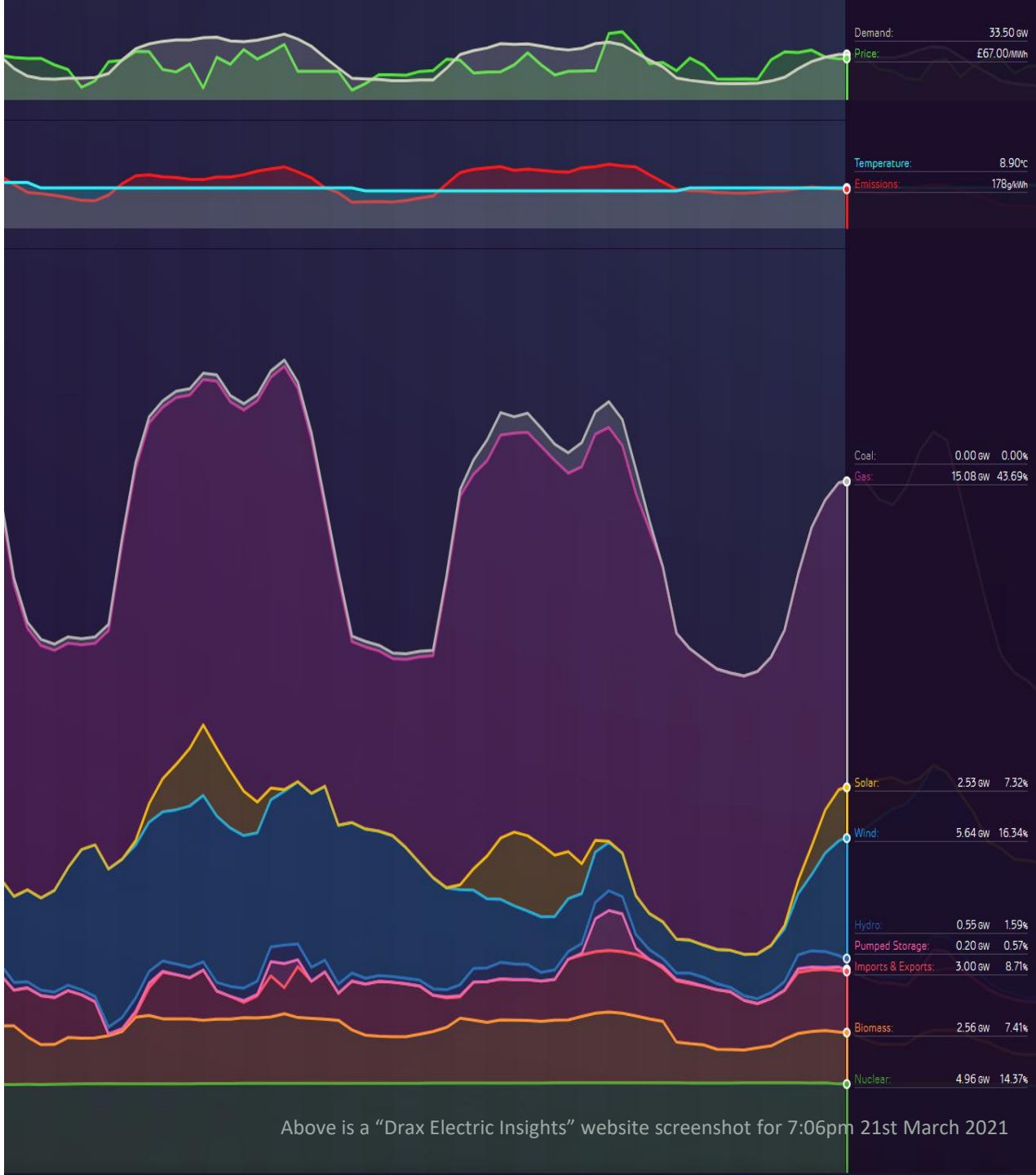

Above is a "Drax Electric Insights" website screenshot for 7:06pm 21st March 2021

What is Net Zero?

Defining Zero

Operational Net Zero & Energy Networks

- There's one more thing on energy networks…
- The National Grid has been quietly decarbonising it's energy generation for 10-15 years
  (it's something we should celebrate more than we do!)
- Average annual carbon emissions have dropped from more than 500g CO_2^{eq}/kWh in the early 2010's
- 2019 had an average of just over 200g CO_2^{eq}/kWh, and 2030 is expected to be around 100g CO_2^{eq}/kWh
- These are the annual averages – the daily and seasonal variations just discussed will continue to occur as demand and supply (generation) create imbalances

This graph shows the predicted emissions intensity of the UK Grid in grams of CO2 equivalent for each kWh of electricity supplier for the years up to 2035. The data for 2014 to 2016 comes from DEFRA, the projects from 2017 onwards were published by BEIS in January 2018

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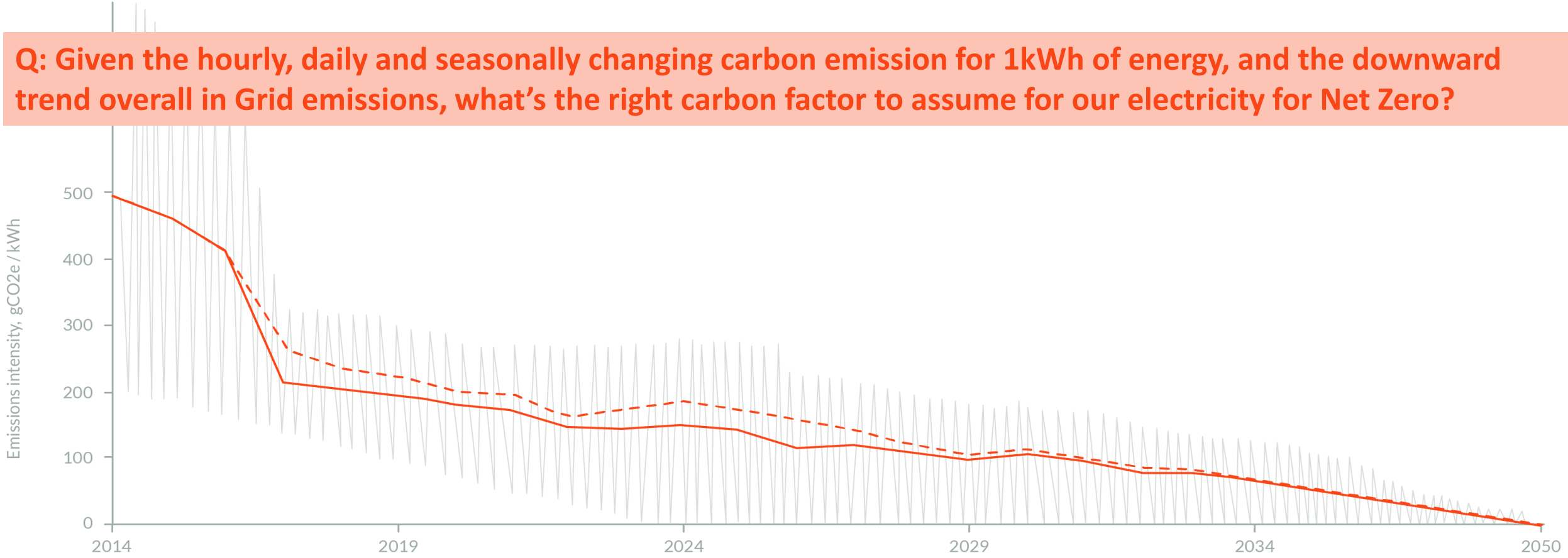
What is Net Zero?

Defining Zero

Operational Net Zero & Energy Networks

- The combination is that we have a spikey, downward line that shows the relationship of energy to carbon

Q: Given the hourly, daily and seasonally changing carbon emission for 1kWh of energy, and the downward trend overall in Grid emissions, what's the right carbon factor to assume for our electricity for Net Zero?



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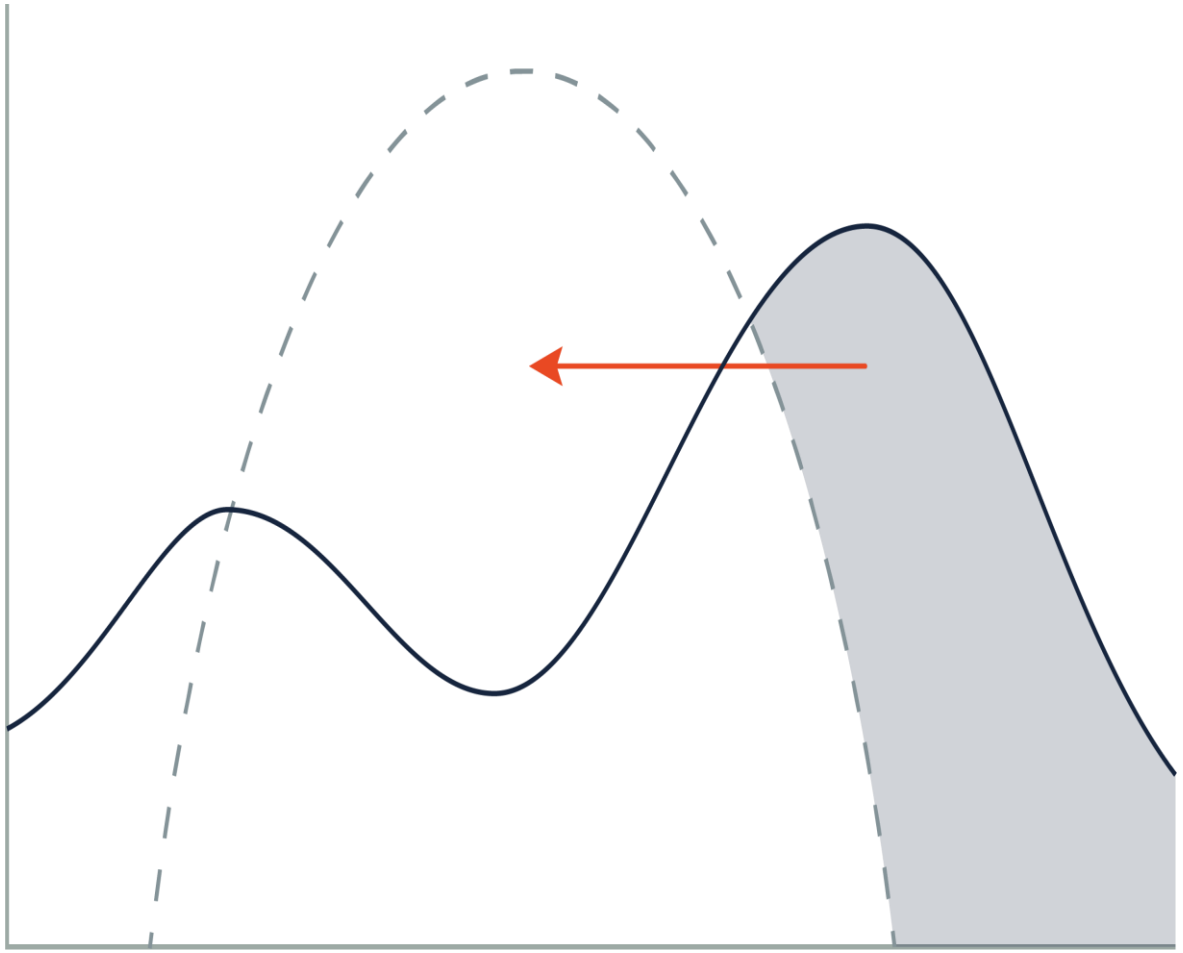
What is Net Zero?

Defining Zero

The Importance of Balance

- The right carbon factor to assume for our energy is the one that occurs as energy is drawn or fed to the grid
- This is the most accurate carbon emission per kWh, as stated in the UKGBC Net Zero Carbon Operation: *"Dynamic 'time of use' emissions factors should be adopted for all carbon calculations* ***as these provide a greater level of accuracy.***
- Using these detailed "time of use" carbon emissions give the potential to change the home's impact by simply adjusting the time energy is used;
  - draw down at times of low grid carbon emissions,
  - avoid at times of high carbon emissions
- This is **balance**, or 'demand shift'



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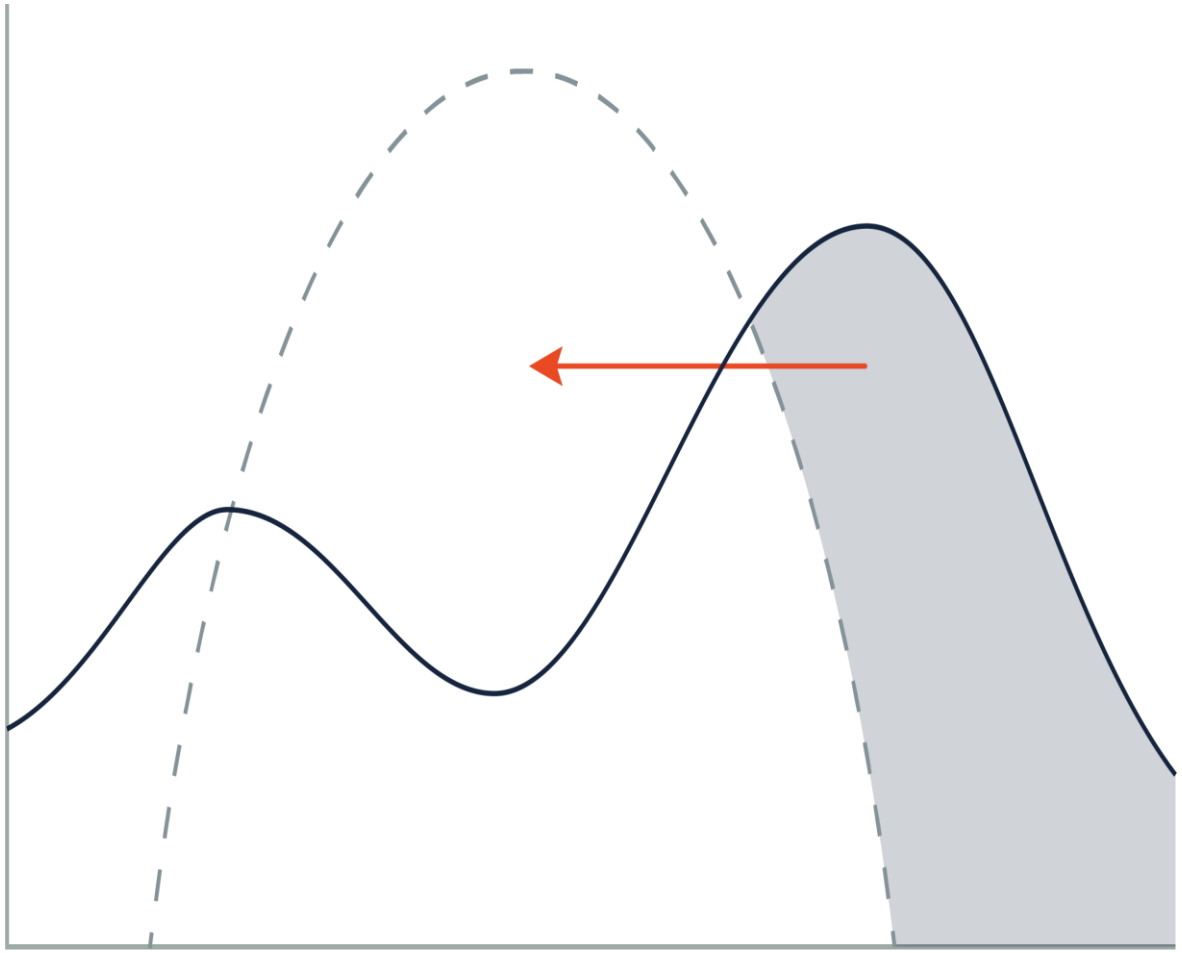
What is Net Zero?

Defining Zero

The Importance of Balance

- Balance is the missing part of the puzzle in Net Zero
- Balance can be delivered by using all forms of **energy storage** in or near the home, whether per home or for groups of homes, and whichever form of energy (heat, electricity, etc.)
- This allows a variation between when the resident demands energy and when the grid ‘feels’ the impact of that demand; it decouples supply & demand without impacting the lifestyle of the resident
- Balance helps the grid, allowing the shifting of high demand periods to align with periods of high supply (generation). This flexibility allows more and more large-scale renewables to be installed on the grid
- But there’s more…



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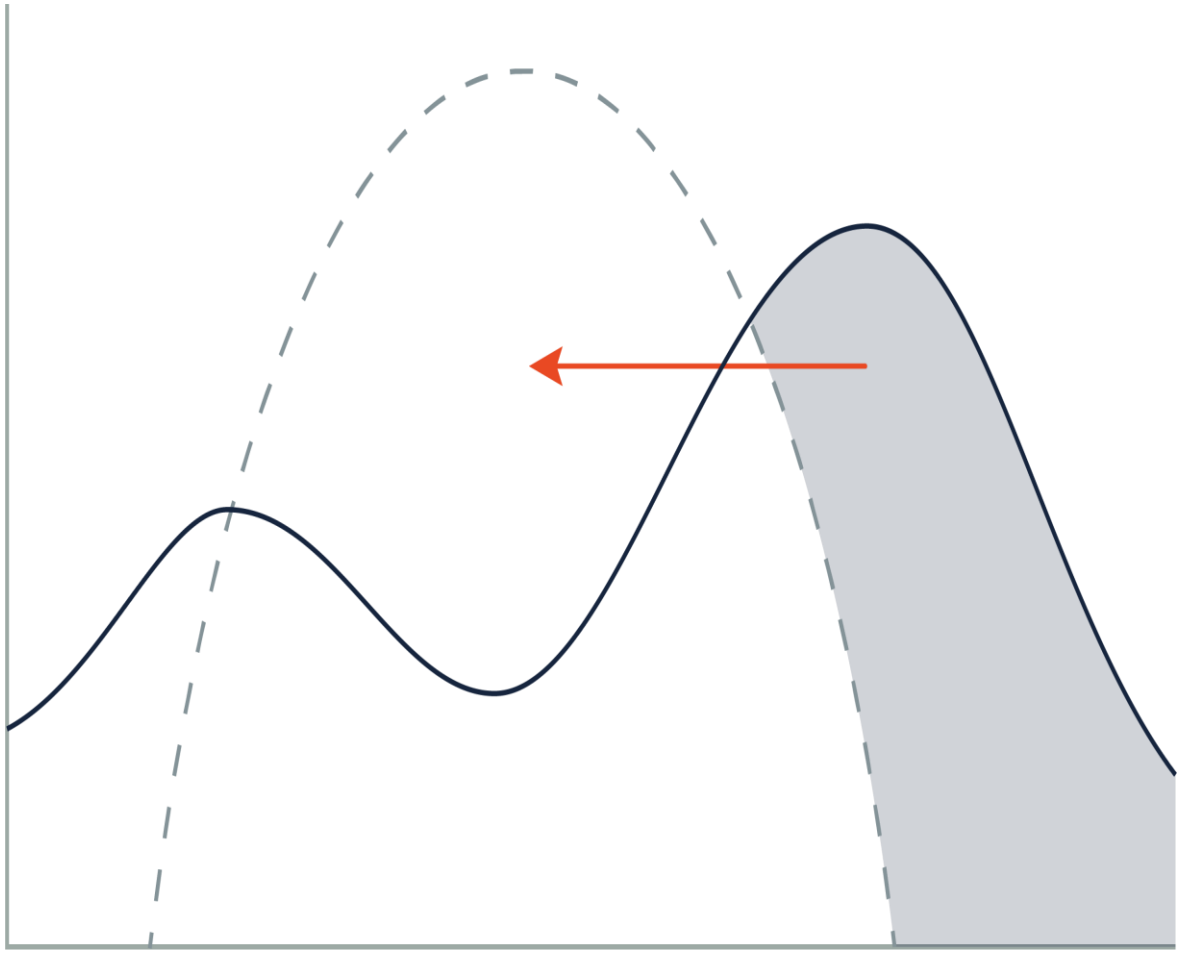
What is Net Zero?

Defining Zero

The Importance of Balance

- Balance, or ‘demand shift’, allows homes to lower their carbon footprint significantly, taking 25-50% off the emissions of the whole home by targeting use of low carbon energy from the grid
- Importantly for residents, happily balance has the same impact on bills (c.25-50% reduction)
- This can be a saving for residents, or shared to support the capital installation costs (with bill savings reduced)



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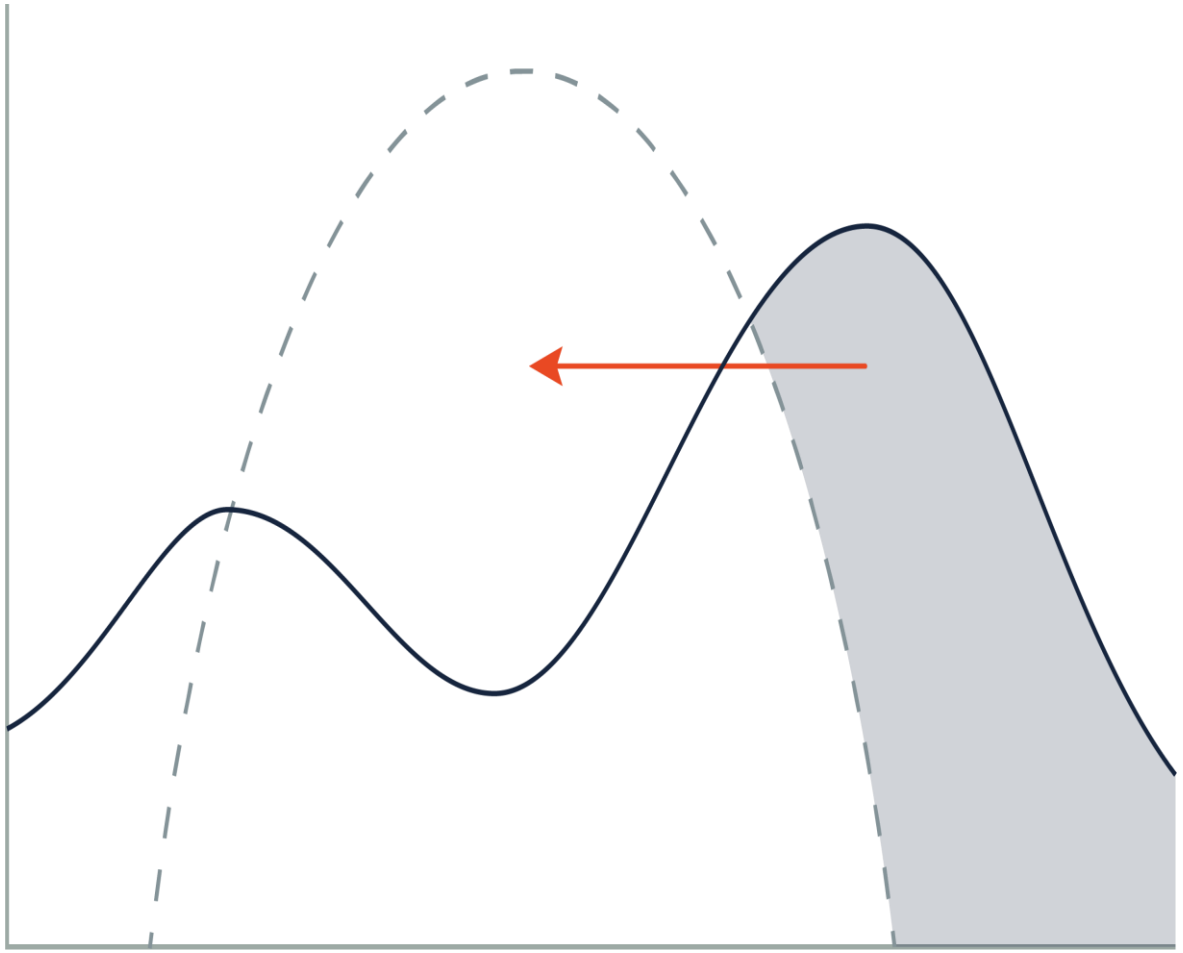
What is Net Zero?

Defining Zero

The Importance of Balance

- With sufficient balance capacity, ‘demand shift’ can achieve Net Zero on its own*
- Other measures simply makes this more affordable and practical to achieve
- This is because with sufficient balance capacity, homes can export energy back to the grid to displace high carbon emissions, meaning they create negative emissions towards their Net Zero Carbon balance
- In essence, this works as follows;
  - Buy 30kWh at 100g CO_2^{eq}/kWh (overnight)
  - Sell 15 kWh at 200g CO_2^{eq}/kWh (peak demand)
  - = Left with 15 kWh at 0g CO_2^{eq}/kWh to self-use
  - = Net Zero in Operation



*Not cheapest or recommended approach but *possible*

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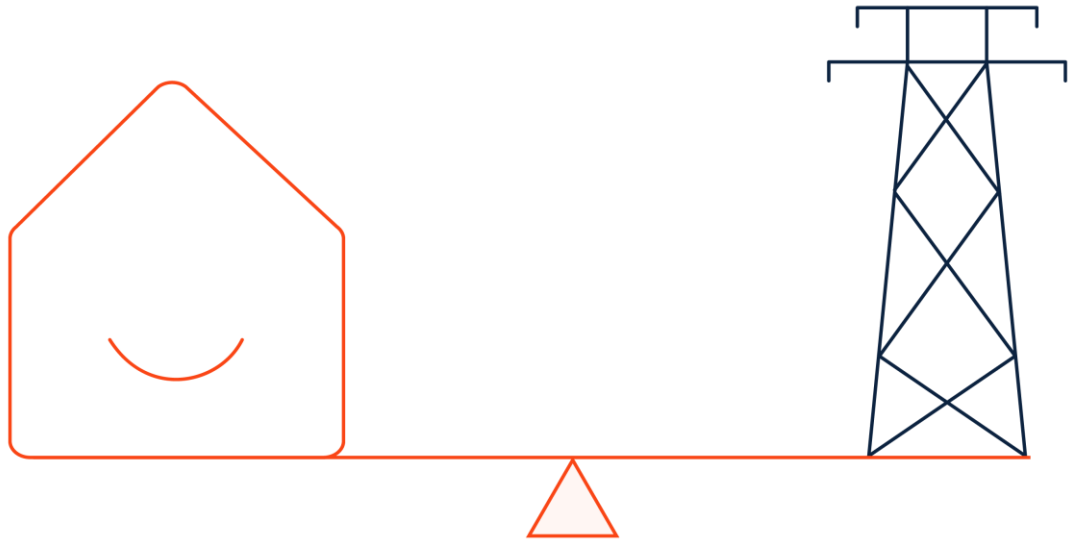
What is Net Zero?

Defining Zero

Operational Net Zero & Energy Networks

- A quick Energy Network summary is;
  - XX kWh ≠ XX CO_2^{eq}
  - Carbon emissions vary for 1kWh of electricity all day, every day, and over the seasons
  - “Time of Use” carbon factors enable reducing carbon by adjusting time of use - Balance
  - Grid carbon is reducing year on year, likely to average 100g CO_2^{eq}/kWh in the early 2030s



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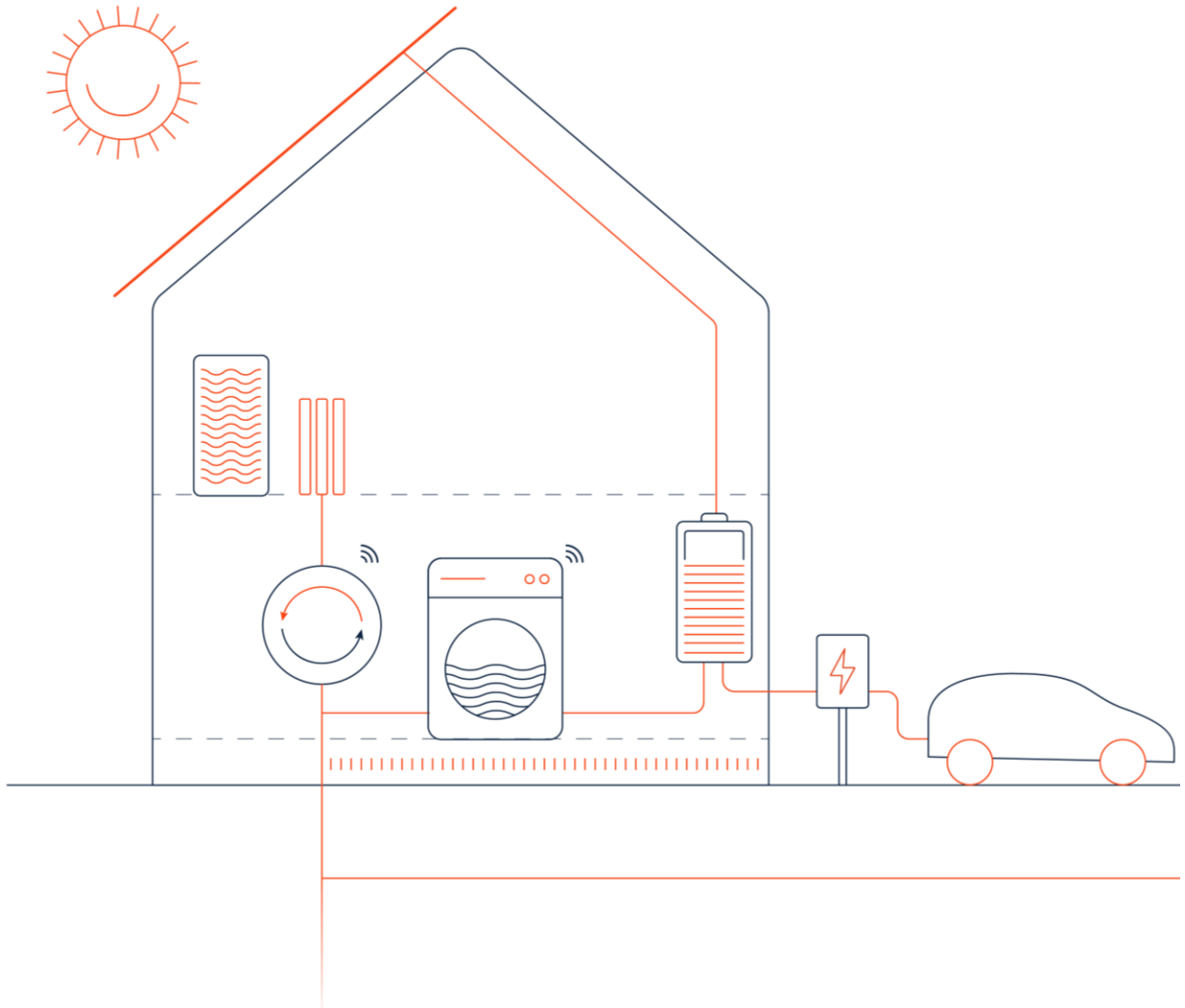
What is Net Zero?

Defining Zero

Operational Net Zero Carbon in Homes

- Back to buildings.
  You'll recall Net Zero Carbon **Operation** is defined as:
  "When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative."
- This makes no distinction between sources of carbon emissions arising from the operation
- Homes have three main ways of generating carbon emissions from occupation;
  - Space Heating
  - Hot Water
  - Plug-In Appliances (unregulated power)
- Further loads arise from regulated power (fans, pumps and fixed lights) but these are typically small



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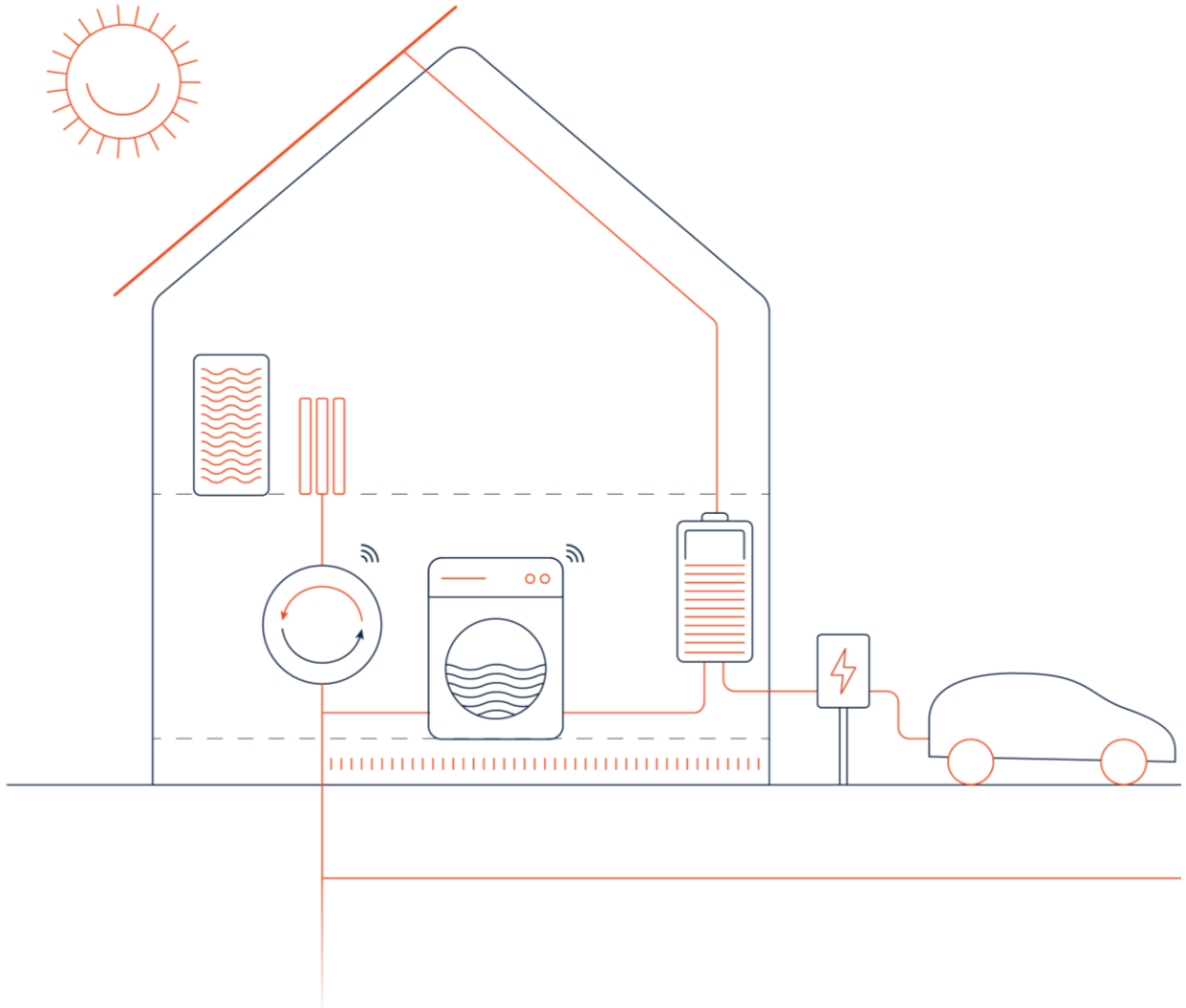
What is Net Zero?

Defining Zero

Operational Net Zero Carbon in Homes

- Modern homes, fairly crudely, emit carbon from;
  - ⅓ Space Heating
  - ⅓ Hot Water
  - ⅓ Plug-In Appliances (unregulated power)
- In carbon, that's something like;
  - ¾ tonne CO_2^{eq} Space Heating
  - ¾ tonne CO_2^{eq} Hot Water
  - ¾ tonne CO_2^{eq} Plug-In Appliances (unregulated)
  - **= 2¼ tonne CO_2^{eq} total**
- Of course, this varies on size of house and number of occupants, as well as the home design & operation
- These figures also assume typical times of usage of the energy to be able to translate this to carbon emissions



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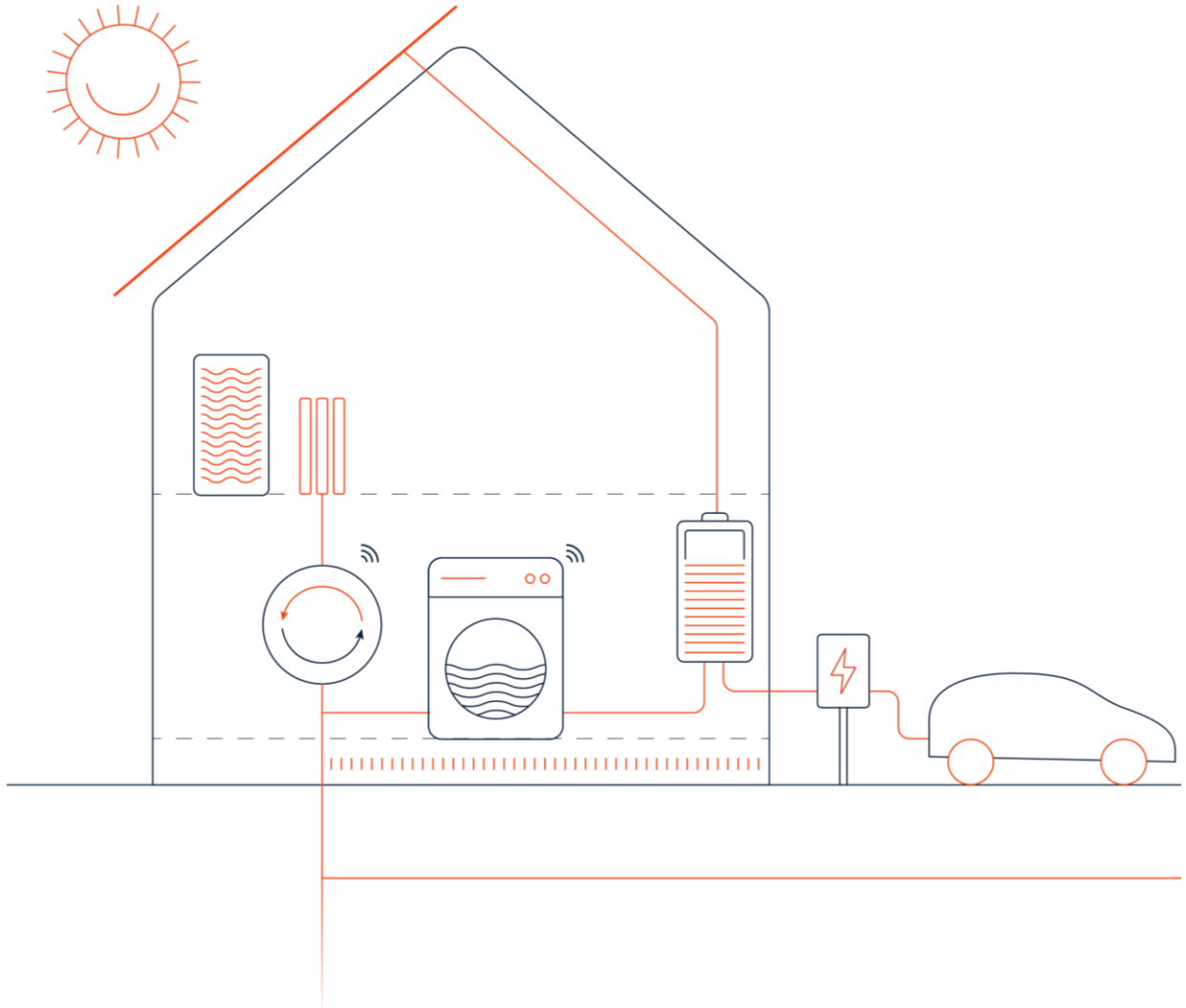
What is Net Zero?

Defining Zero

Operational Net Zero Carbon in Homes

- Older homes, again crudely, emit carbon;
  - ¾ Space Heating
  - ⅛ Hot Water
  - ⅛ Plug-In Appliances (unregulated power)
- In carbon, that's something like;
  - 4½ tonne CO_2^{eq} Space Heating
  - ¾ tonne CO_2^{eq} Hot Water
  - ¾ tonne CO_2^{eq} Plug-In Appliances (unregulated)
  - **= 6 tonne CO_2^{eq} total**
- Again, this can vary significantly and assume times of usage for the energy to equate to carbon emissions



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What is Net Zero?

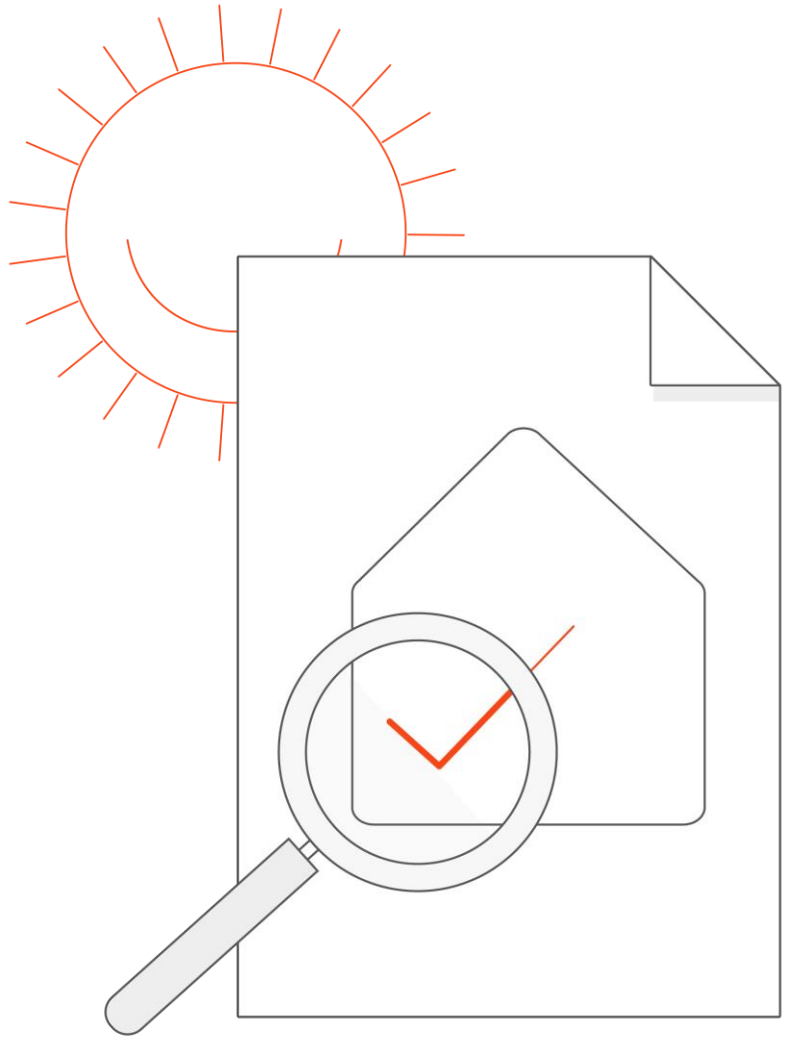
Defining Zero

Operational Net Zero Carbon in Homes

What is Net Zero?

In summary…

- Net Zero carbon is measured in carbon = [kg] CO_2^{eq}
- Is an annual sum of carbon emissions (adds & omits)
- Recognises XX kWh ≠ XX CO_2^{eq}, but is a variable in time
- Covers Space Heating, Hot Water & Plug-In Appliances



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What is Net Zero?

Comparison to Current Schemes

Popular Assessment Schemes: What is Net Zero?	SAP & rdSAP	PassivHaus	LETI	[old] CfSH
How do popular assessment methods compare…				
- Net Zero carbon is measured in carbon = [kg] CO_2^{eq}	✗	✗	✗	✗
- Is an annual sum of carbon emissions (adds & omits)	*ish*	*ish*	*ish*	*ish*
- Recognises XX kWh ≠ XX CO_2^{eq}, but is a variable in time	✗	✗	✗	✗
- Covers Space Heating, Hot Water & Plug-In Appliances	✗	*ish*	*ish*	✓

- "*ish*" recognises that these schemes allow for carbon positive factors (such as on-site renewables) as well as negative ones over the period. However, they account for these in kWh rather than in CO_2^{eq}.
- Other assessment schemes have similar issues

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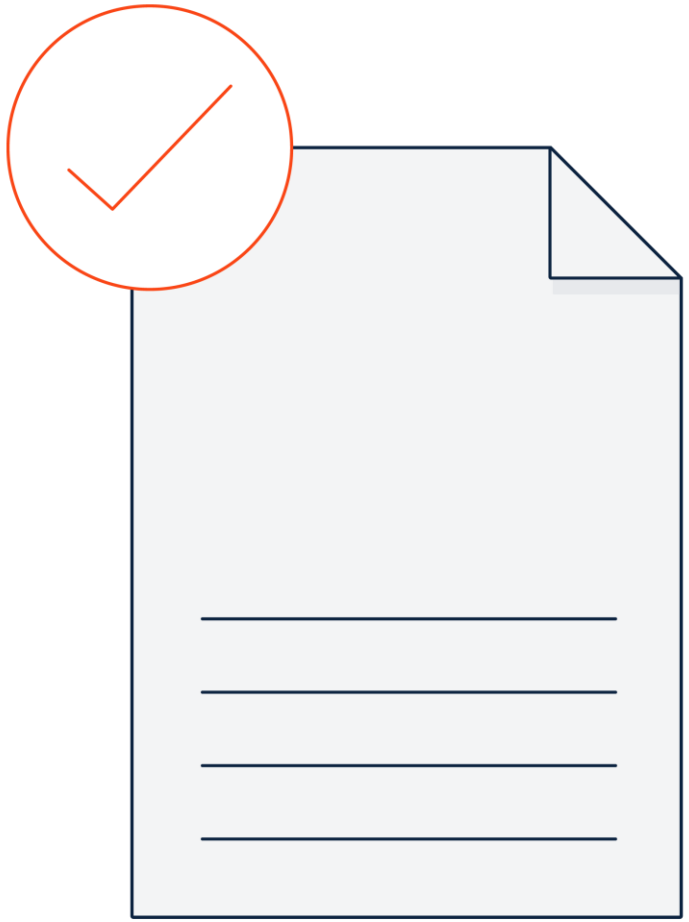
What is Net Zero?

Comparison to Current Schemes

Popular Assessment Schemes

- We therefore currently lack a widely adopted tool that actually calculates Net Zero Carbon in Operation
- This does not mean current tools aren't useful;
  - Passivhaus Planning Pack (PHPP) has arguably the most accurate energy calculation tools that will support reducing energy demands in the design
  - SAP (and baby sister rdSAP) both have energy calculations that will help reduce energy demands
  - LETI has useful advice on working toward Net Zero Carbon in construction
  - CfSH (Code for Sustainable Homes) has information on assessing unregulated energy demands



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What is Net Zero?

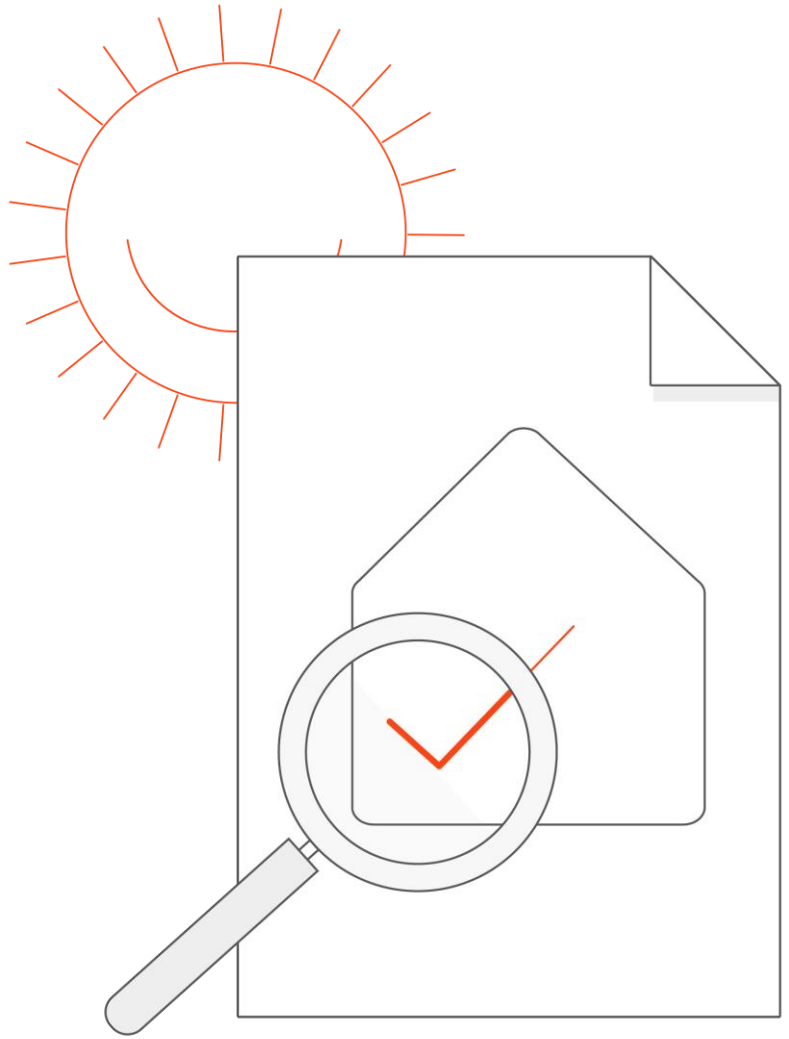
Defining Zero

Operational Net Zero Carbon in Homes

What is Net Zero?

Let's update our summary…

- Net Zero carbon is measured in carbon = [kg] CO_2^{eq}
- Is an annual sum of carbon emissions (adds & omits)
- Recognises XX kWh ≠ XX CO_2^{eq}, but is a variable in time
- Covers Space Heating, Hot Water & Plug-In Appliances
- We don't have any widely recognised assessments or certifications to measure Net Zero in Operation



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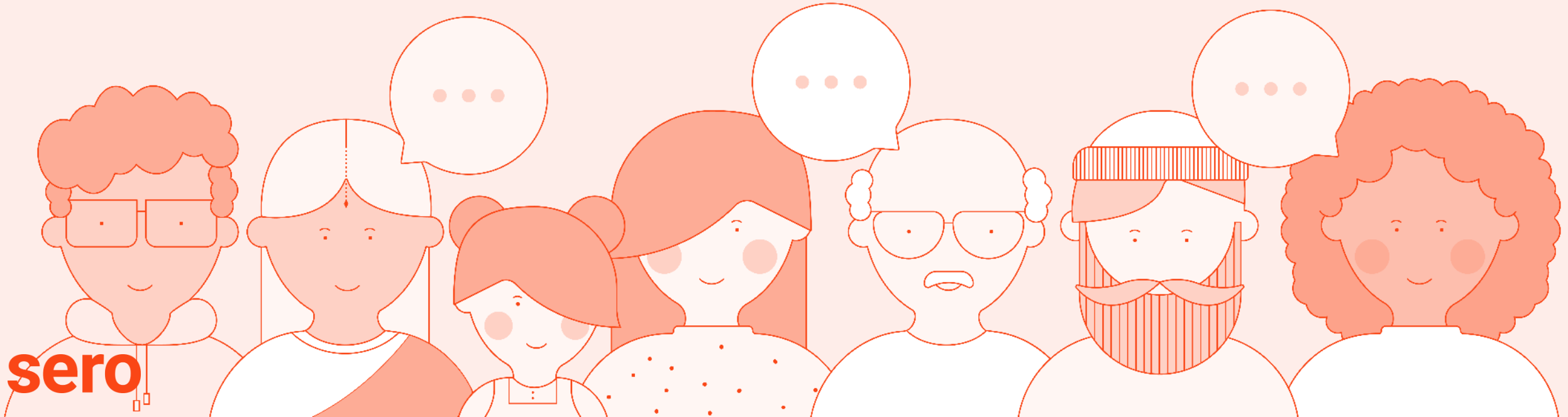
Okay, so it’s a mess.

What on earth do we do then?



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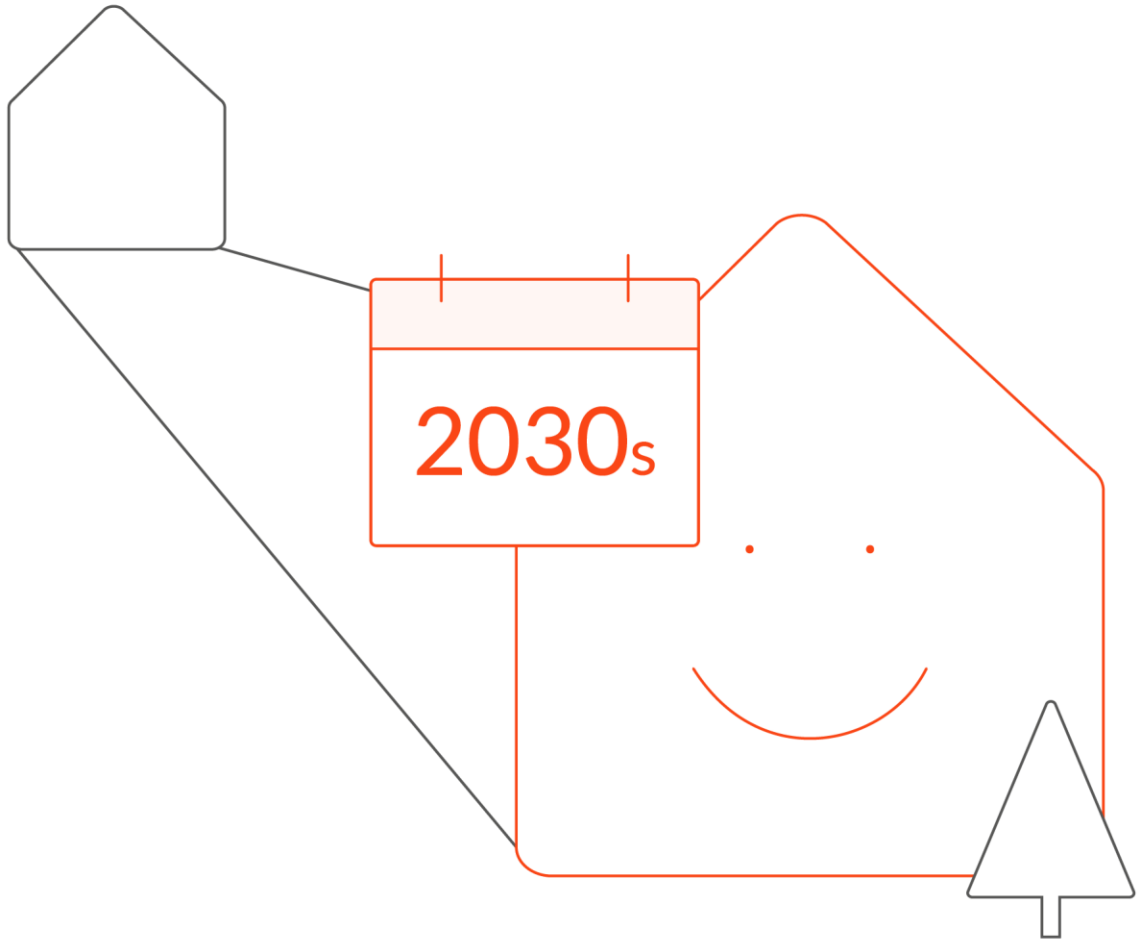
What is Net Zero?

Delivering Zero in Operation

How to Deliver Net Zero Carbon in Operation Today

- It's still possible to design & build homes that are Net Zero in Operation
- Follow these principles **in order**…
  - Pick a "Zero Carbon by" Design Year
  - **Reduce**
  - **Balance**
  - **Generate**
- We'll run through these on the following pages…



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What is Net Zero?

Delivering Zero in Operation

Zero Carbon By…

- Agree the year that you wish to target achieving Net "Zero Carbon by"
- This might be an organisation-wide declared target, a governmental requirement, or a client desire
- Selecting this sets the historic or future carbon emissions factor you are using as the basis of your conversion between kWh and CO_2^{eq}
- Setting this will mean that the building may not be Net Zero Carbon in Operation when it is built, but without physical alteration if will become Net Zero in that year
- The Active Building Centre Research Programme (ABC-RP) are shortly publishing detailed ½ hourly forecasts for grid emissions up to 2050 to support this

The practical implications are…

- The sooner the year you pick, the more expensive your construction uplift costs are likely to be;
  - 2022 could be very roughly £30-40k
  - 2032 could be very roughly £15-20k
  - 2042 could be very roughly £10-15k
- The later the year you pick, the higher the operational costs are likely to be

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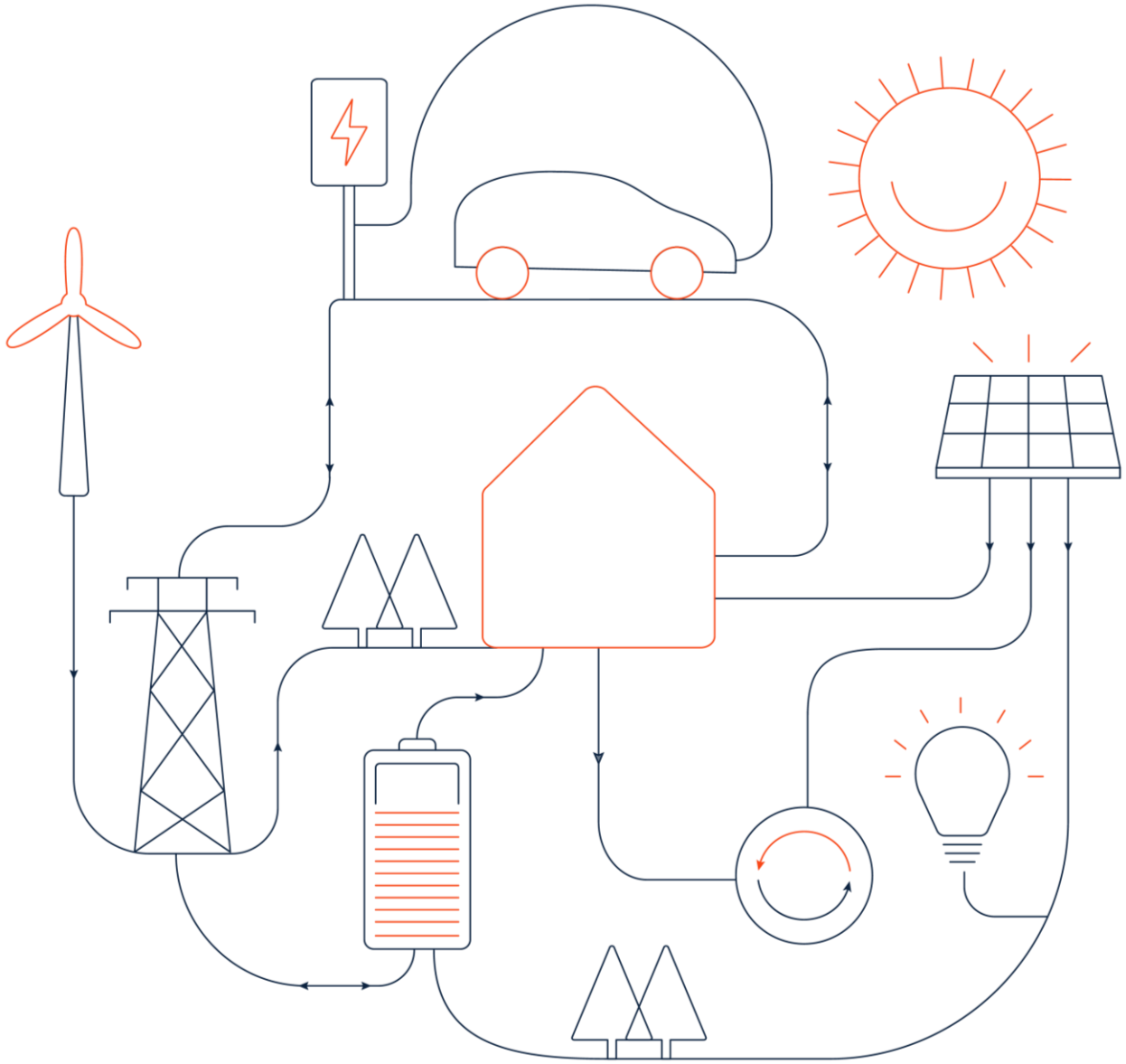
What is Net Zero?

Delivering Zero in Operation

Reduce : Balance : Generate

- With a “Zero Carbon by” date, there are 3 key steps;
  - Reduce
  - Balance
  - Generate
- Everything starts with **Reduce**…



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What is Net Zero?

Delivering Zero in Operation

Reduce

- This partly means the “Fabric First” approach;
- Surface:Volume ratios are the first step
- Suitable glazing volumes
- Limited thermal envelope penetrations
- Very low unintended air leakage (construction gaps)
- Actively design the ventilation to lose the least heat through necessary air changes
- High performance thermal envelope

The implications for “Zero Carbon by” early 2030s…

Fabric First means…

- Compact footprint tending towards a cube (or sphere!)
- c.20-25% glazing in most circumstances
- Think of thermal bridging design early, and that means self-supporting balconies, porches etc. where possible
- Airtightness at $3m^3/m^2/hr$ or lower
- Don’t just claim it “*will just work*” – model natural ventilation or allow for a form of mechanical ventilation
- Aim for U-Values of around;
  - $0.10\ W/m^2/K$ for Roofs
  - $0.13\ W/m^2/K$ for Walls
  - $0.10\ W/m^2/K$ for Floors
  - $1.00\ W/m^2/K$ for Windows & Doors

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What is Net Zero?

Delivering Zero in Operation

Reduce

- However “Reduce” is more than just Fabric First – it’s about the fuel and energy efficiency of the services
- Avoid on-site combustion
- Choose low/zero carbon fuel source
- Ensure end-to-end efficiency of network delivery
- Minimise system losses
- Maximise system efficiency

The implications for “Zero Carbon by” early 2030s…

Efficient services means…

- Combustion on site will emit carbon and/or NOx, so there goes biomass (short cycle carbon but still NOx)
- Basically, that’s electricity or hydrogen
- Oops, there goes hydrogen
- That always means;
  - Shortest possible pipework runs
  - All pipework insulated
- In almost all circumstances, that means;
  - Heat pumps (not direct electric, microwave, infrared, etc.)
  - Intelligent controls
  - Correct commissioning and quality assurance

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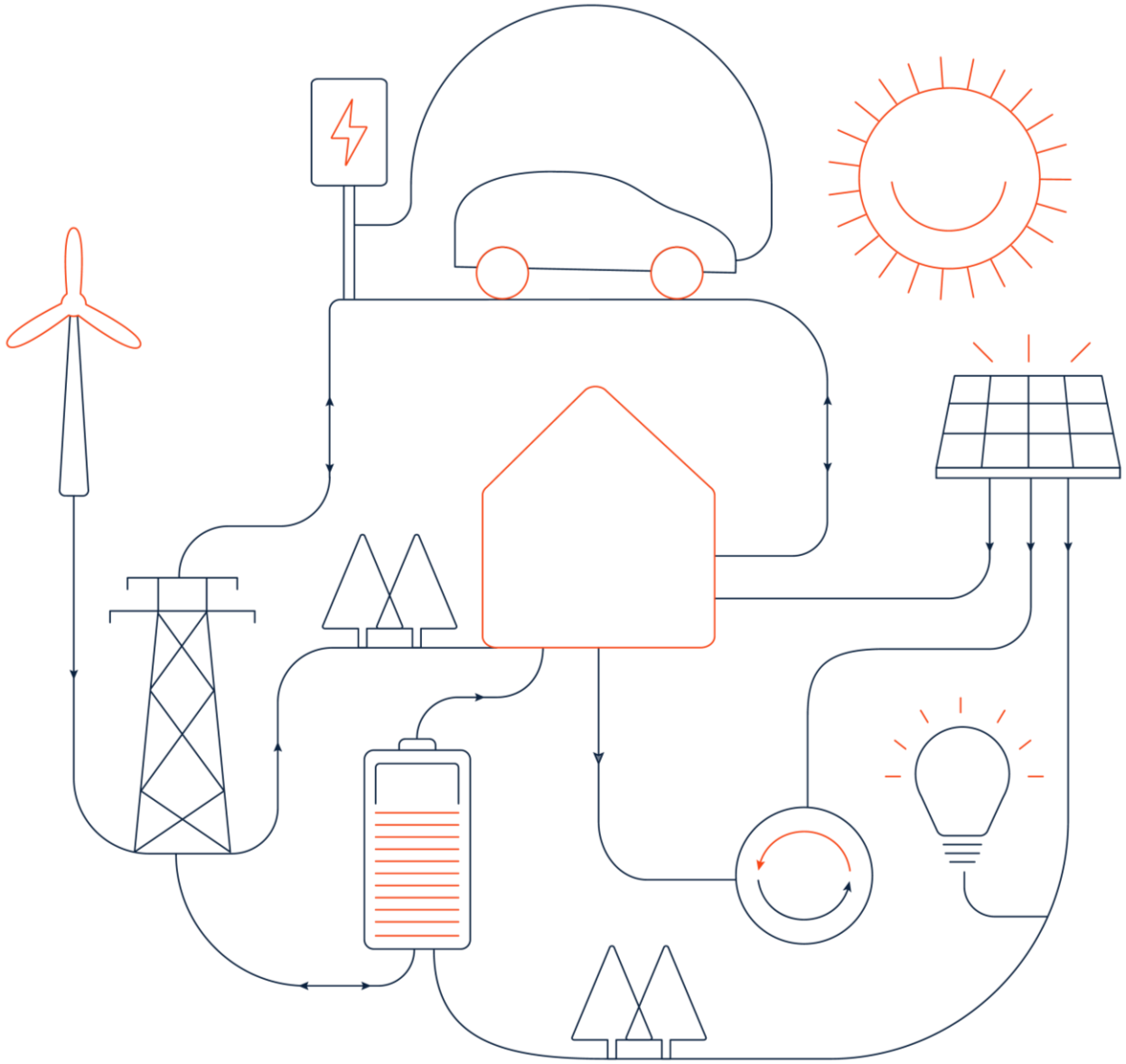
What is Net Zero?

Delivering Zero in Operation

Reduce : Balance : Generate

- Existing tools (such as PHPP or SAP) will provide mechanisms to evidence energy demand reduction
- For retrofit, thermal performance and airtightness values are likely to need to be relaxed but are still the right place to start reducing
- From the 3 key steps;
  - Reduce
  - Balance
  - Generate
- Next is **Balance**…
- Balance is the missing ingredient to delivering Net Zero



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What is Net Zero?

Delivering Zero in Operation

Balance

- Delivering balance means;
- Electrical (battery) storage in or near the home, whether per home or for groups of homes. This is to be able to ‘balance’ the Plug-In (unregulated) demands to avoid high carbon electricity, and if sized (much) larger can support heating & hot water ‘demand shift
- Thermal storage in or near the home, whether per home or for groups of homes. This can be used to ‘balance’ hot water and, in more advanced cases, space heating as well
- Including controls that operate the ‘demand shift’, at the simplest this could be a timer, at the most optimal this could be a home energy management system

The implications for “Zero Carbon by” early 2030s…

Include space & technical requirements for…

- Battery storage, we’d start sizing from around;
  - 2-2.5kWh per occupant in the home

Whilst a battery could cover all ‘demand shift’ needs, it’s more expensive (and higher embodied carbon) than splitting this alongside thermal storage, hence…

- Hot Water Tank, we’d start sizing from around;
  - 85 litres for 1 person + 35 litres per extra person
- An “Intelligent Energy System” comprising a local control Building Energy Engine (BEE) and peripheral devices to meter and monitor the home performance

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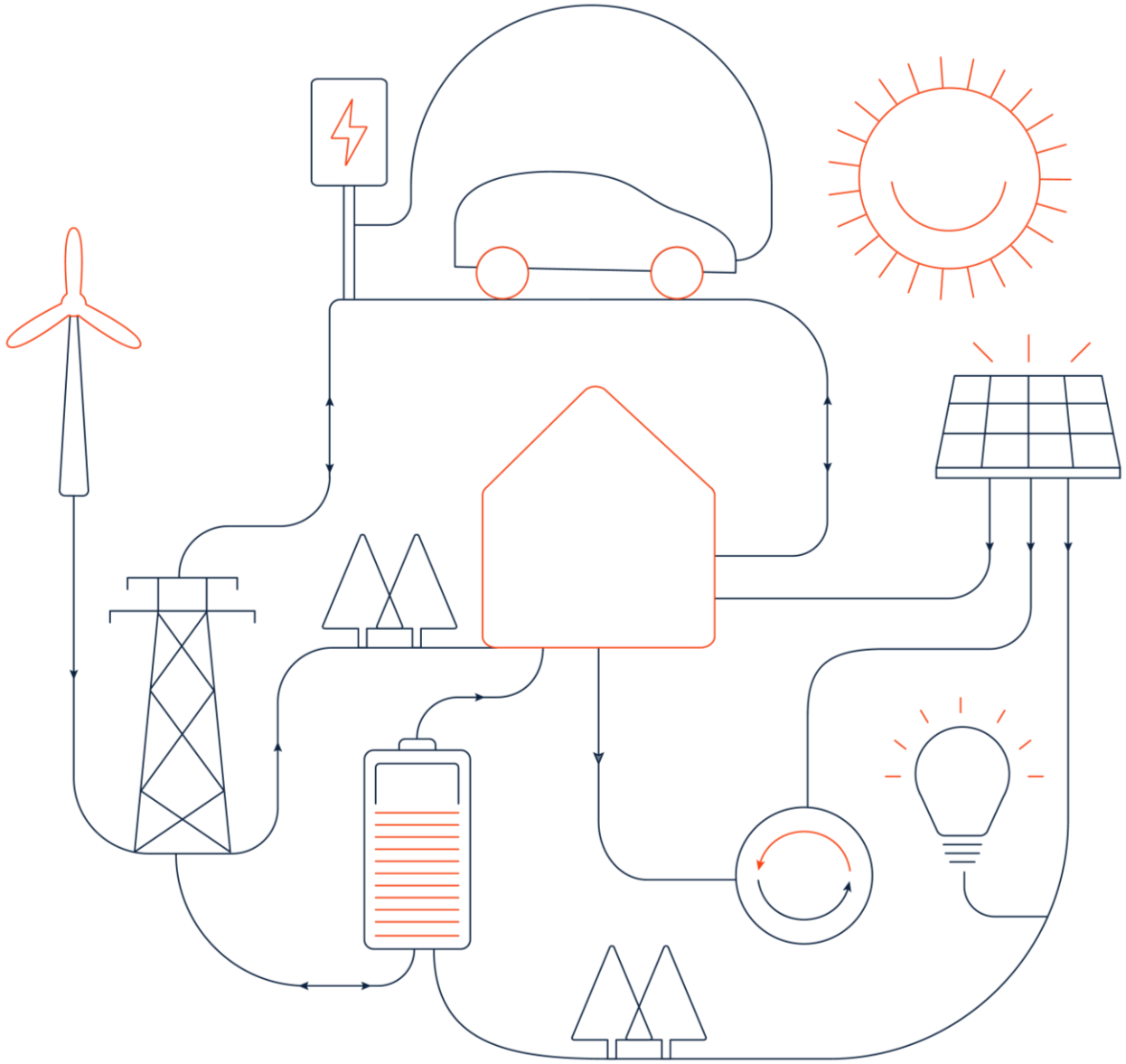
What is Net Zero?

Delivering Zero in Operation

Reduce : Balance : Generate

- Balance is the missing ingredient to delivering Net Zero
- Between Reduce & Balance, it is possible to deliver Net Zero (indeed technically possible with just Balance), however the last step remains advisable in most cases
- From the 3 key steps;
  - Reduce
  - Balance
  - Generate
- The last step is **Generate**…



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What is Net Zero?

Delivering Zero in Operation

Reduce : Balance : Generate

- Generate is on or near site generation from zero carbon energy sources
- This can be electrical generation, most typically solar but (off-building) wind or hydro are possible too
- Thermal generation is also an option (not burning stuff), with solar thermal tubes & collectors
- Generate should never be deployed without Balance; energy needs to be stored until required rather than pushed to the grid (where it can cause more issues)
- Local generation is less efficient than large-scale renewable generation (but does not suffer distribution losses to the same extent)

The implications for “Zero Carbon by” early 2030s…

Include space & technical requirements for…

- Photovoltaic Array, we’d start sizing around;
  - 1.5-2kWp per occupant in the home
- Solar thermal tubes the easiest ‘win’, solar transpired collectors should be integrated with ventilation
- Both systems should be deployed with storage; consider enlarging relevant storage systems
- Design for removal – local generation may not be replaced at it’s end of life (c.25 years) as large-scale grid generation replaces it. This might be less than 25% into the total lifespan of the building, so consider the impact this has on the remaining 75% of that lifespan

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What is Net Zero?

Delivering Zero in Operation

Things to watch out for…

- You're now more likely to overheat than be cold, so actually take avoiding this seriously
- The home will typically change temperature more slowly, some residents will notice this difference
- You'll need to ensure the quality is delivered on site, especially around ventilation, airtightness and moisture control, or you may have latent fabric issues
- You should plan for a 'whole home' commissioning of the overall building to ensure proper operation, it's advisable to leave a week before Practical Completion

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What is Net Zero?

Delivering Zero in Construction

Net Zero in Construction is next…

- There are tools and approaches for assessing construction carbon (both embodied in products & materials and emitted from site), including an ISO
- Some products & materials have EPDs, though by no means all. The robustness of these is improving
- Site carbon requires measurement or estimations from site works and activities. Again, work is ongoing

The implications for "Zero Carbon by" early 2030s…

If not using emerging tools, some simple rules…

- Use the least amount of materials you need*
- Use the least amount of baked/heated materials (bricks, steel, glass, etc. = high heat is high carbon)
- Move the least amount materials the least distance, prioritising by weight where you focus efforts (that means groundworks)
- Use timber, as locally as you can source, for everything it can be used for, it captures carbon during growth
- Use materials that can be reused, especially where these are 'short life' components of the building and where they are baked/heated/heavy/extensive

*there's a good argument this doesn't apply to timber

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What is Net Zero?

In Summary

A Net Zero in Operation Home in practice…

- Targets a “Zero Carbon by” year to achieve goal
- No emissions over a year in total, measured in carbon
- Uses “time of use” to demand shift energy needs and has intelligent controls to implement this
- Follows a **Reduce : Balance : Generate** sequential approach to achieving Net Zero

And in numbers for “Zero Carbon by” early 2030s…

- U-Values of around;
  - 0.10 W/m^2/K for Roofs
  - 0.13 W/m^2/K for Walls
  - 0.10 W/m^2/K for Floors
  - 1.00 W/m^2/K for Windows & Doors
  - Airtightness at 3m^3/m^2/hr or lower
- Battery storage, sizing from around;
  - 2-2.5kWh per occupant in the home
- Hot Water Tank, sizing from around;
  - 85 litres for 1 person + 35 litres per extra person
- An “Intelligent Energy System” for control
- Photovoltaic Array, sizing around;
  - 1.5-2kWp per occupant in the home

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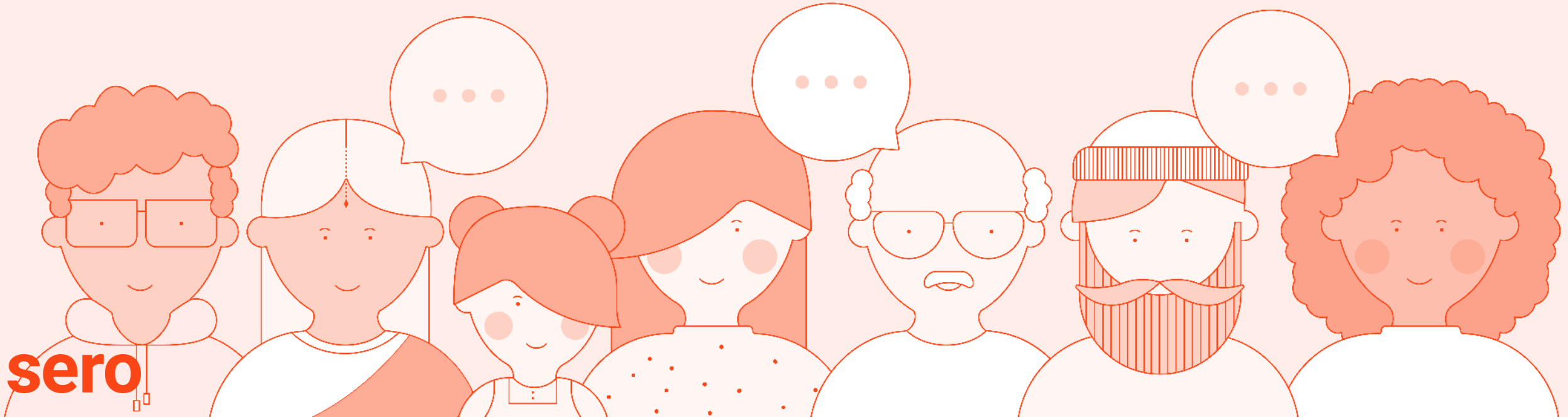
Questions?



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Thank you

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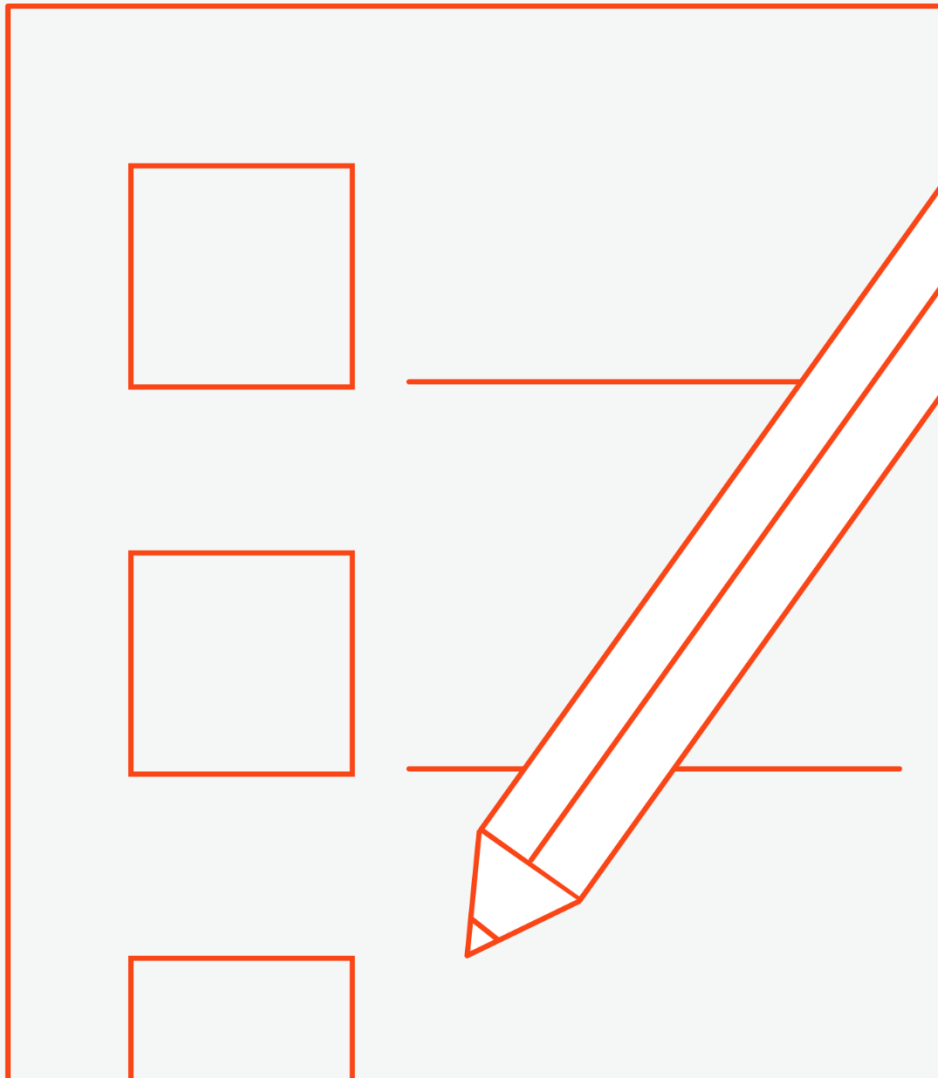


Adra Decarbonisation Strategy

Pathway to 2030 and Carbon Net Zero

Adra Decarbonisation Strategy

Introduction – Why Carbon Net Zero?

- Climate change impacts & Welsh Government climate emergency declaration
- Corporate Social Responsibility
- Legislation
- Better quality homes
- Eliminate fuel poverty
- Reduce our energy and fuel costs
- Financial penalties for failure
- **Collective and partnership approach**

Our Approach – Key Steps

- **Board and Staff Training – Carbon Literacy**

  Sets out some challenges and progress so far

- **Decarbonisation Strategy**

  Developed with the **Carbon Trust** demonstrate a pathway to decarbonisation and high level of engagement

- **Carbon Management Plan**

  Live document highlighting the actions that have and will be taken between now and 2030 to reduce emissions

- **Corporate Project**

  Project Management Structure
  Dedicated Officer

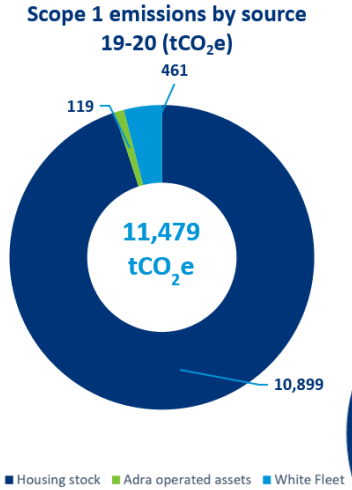
- **Regional Group – Leadership**

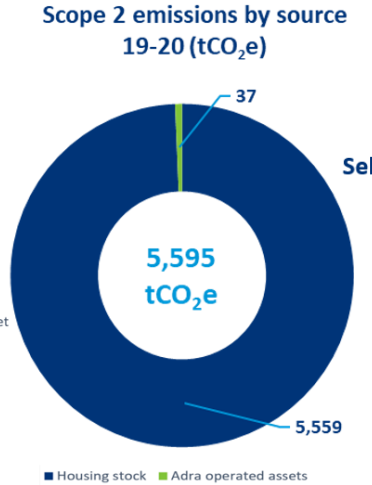
Baseline Emissions

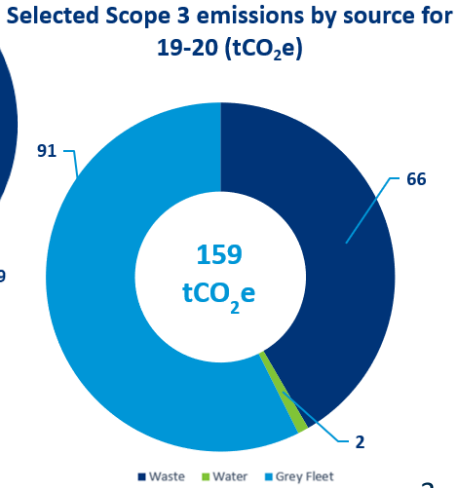
Adra's total scope 1, 2 and selected scope 3 emissions in the FY 2019/20 were approximately

17,233 tCO_2e

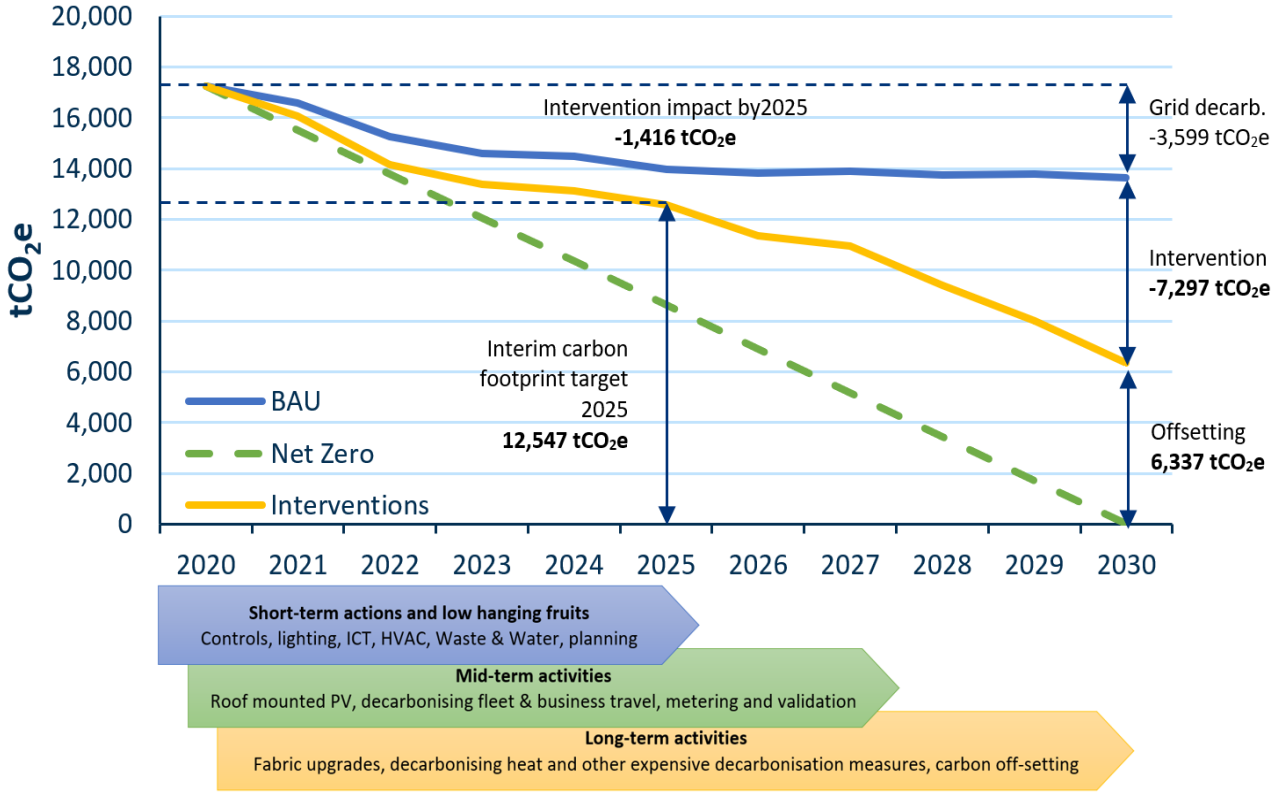
	Element
Scope 1	Adra operated properties (offices) gas consumption
	Adra fleet (vans and pool cars) fuel consumption
	Adra housing stock estimated heating fuel consumption
Scope 2	Adra operated properties (offices) electricity consumption
	Adra housing stock estimated electricity consumption
Scope 3	Waste generated in operations
	Adra staff owned vehicle mileage (business mileage) fuel consumption
	Water



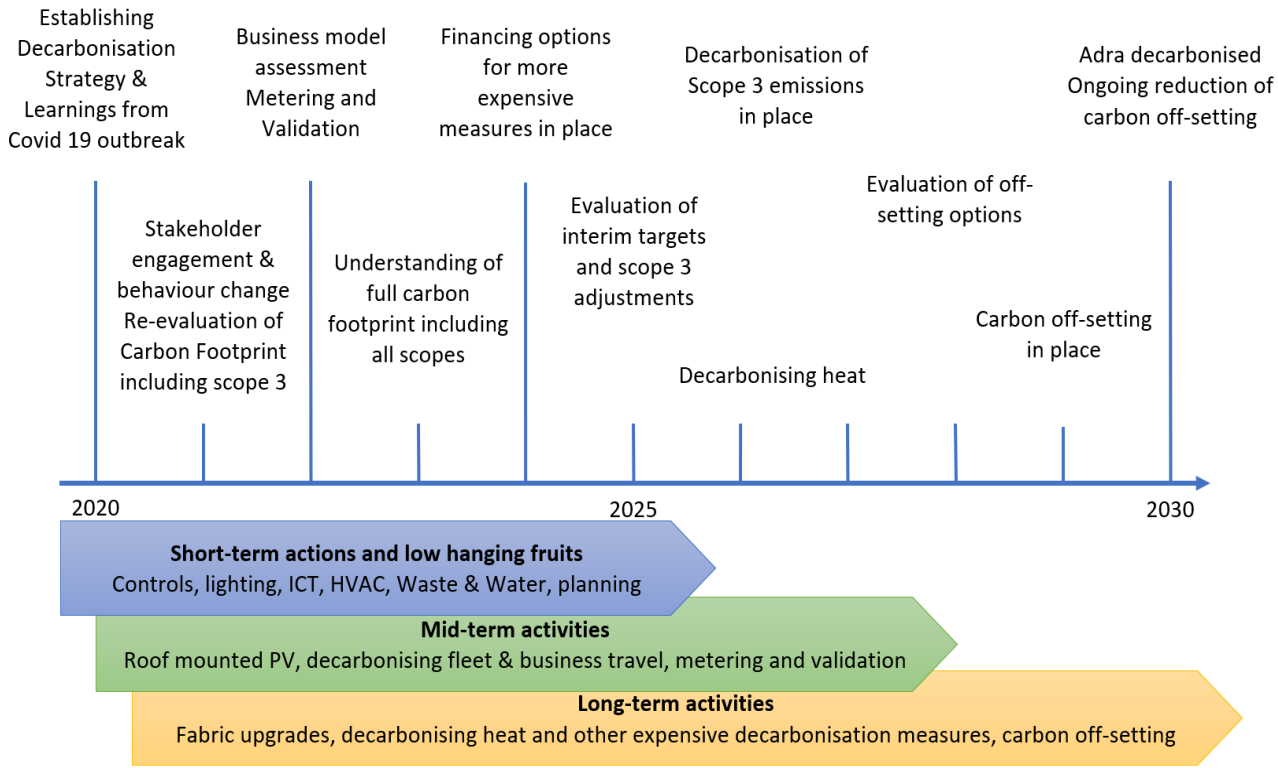




Decarbonisation Target and Impact Forecast



Decarbonisation Roadmap



Project Management

Focused on Corporate Plan delivery

Corporate Programme Board

Majority ELT membership
Meet every 8 – 12 weeks

Medium to long term structure to deliver Carbon Reduction Plan

Carbon Reduction Programme Board

Chaired by Project Sponsor
Membership made up of appropriate level officers to make decisions and give direction
Meet every 6 – 8 weeks

Stock Decarbonisation

Finance, Procurement, Fleet

Behaviour and Community Involvement

Land Development, New Build, Ecology

Shorter term project structures to deliver specific areas of work with individual project managers / leads

Regional Collaboration

- Guest Speakers
- Sharing Knowledge
- Training – Carbon Literacy
- Funding Opportunities
  - WG Funding – SERO Collaboration
  - UK Gov Funding – charging points / not all bids successful
  - 10% of fleet hybrid or electric – also looking at Hydrogen