Transforming the Housing Technology Mindset

MITSUBISHI ELECTRIC | ecodan® Renewable Heating Technology

Transforming the Housing Technology Mindset

Martin Fahey

Head of Sustainability

Twitter **@Green_Gateway**

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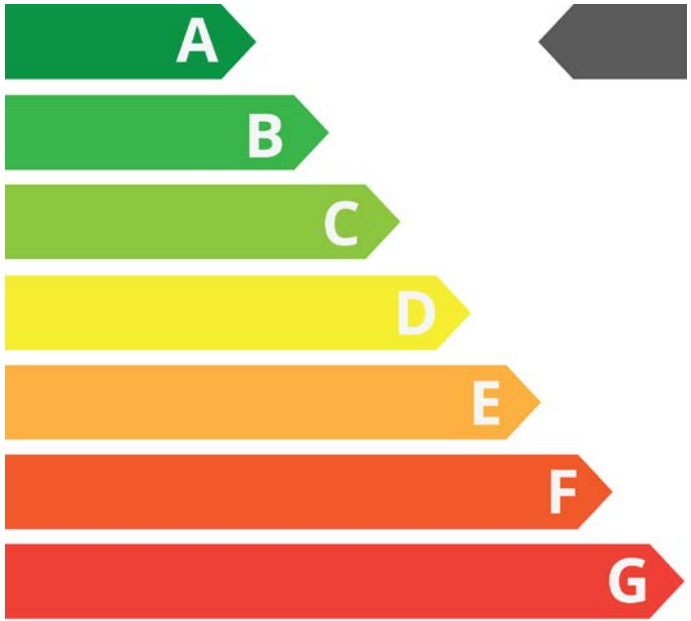


We need to change the way we heat our buildings in the UK?

Fossil fuel is not the future at a building level

That is why we feel the future is the Electric Economy

The history of home heating

Heat Pumps ‘101’

Source

AIR

WATER

GROUND

Destination

AIR

WATER

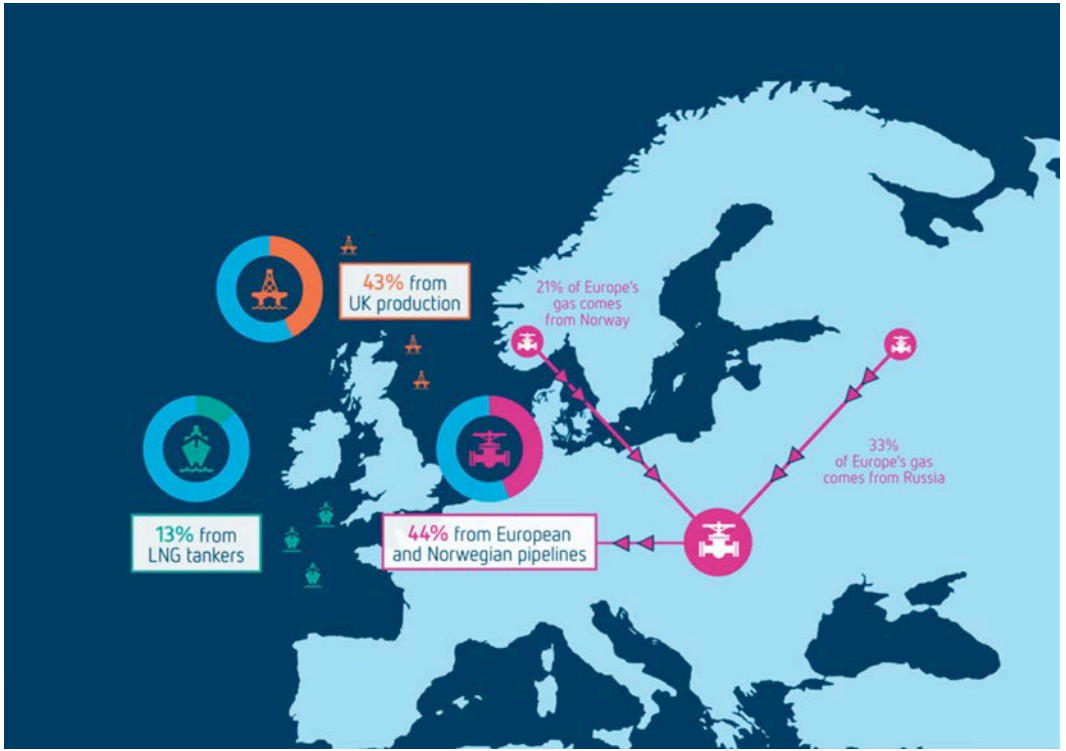
Heat Pumps ‘101’

Source

Destination

Where does the UK gas come from?

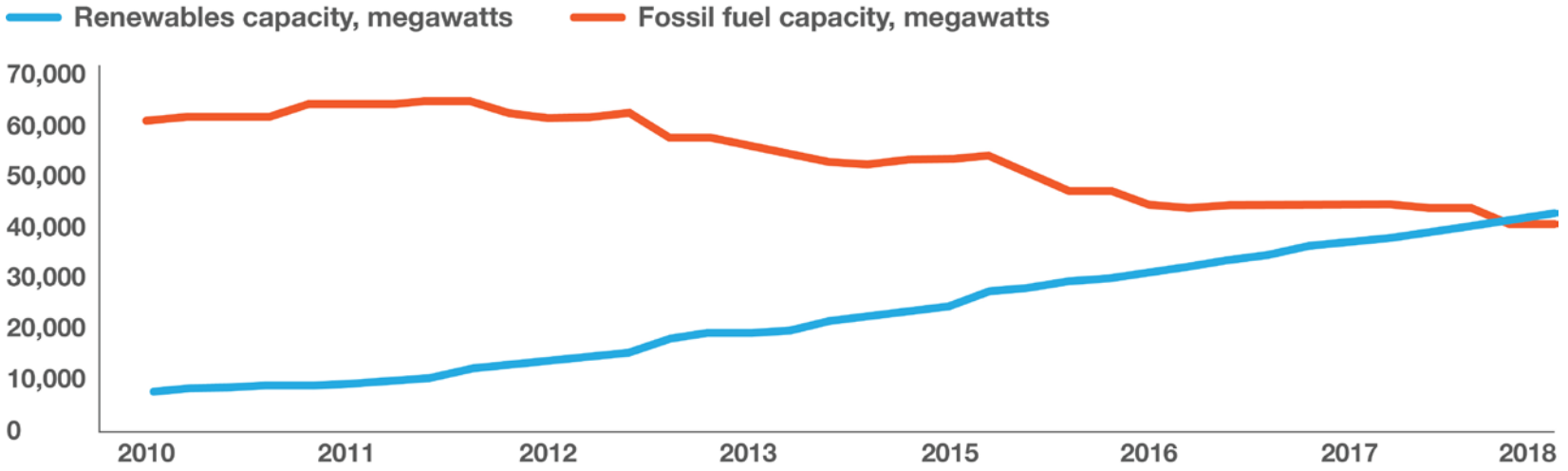
In 2014 our total demand for gas was 70 billion cubic metres, but where did the gas come from?



https://www.centrica.com/file/oi-uk-gas-infographic-bodyjpg

Supply and Demand

Renewable energy capacity has overtaken fossil fuels in the UK

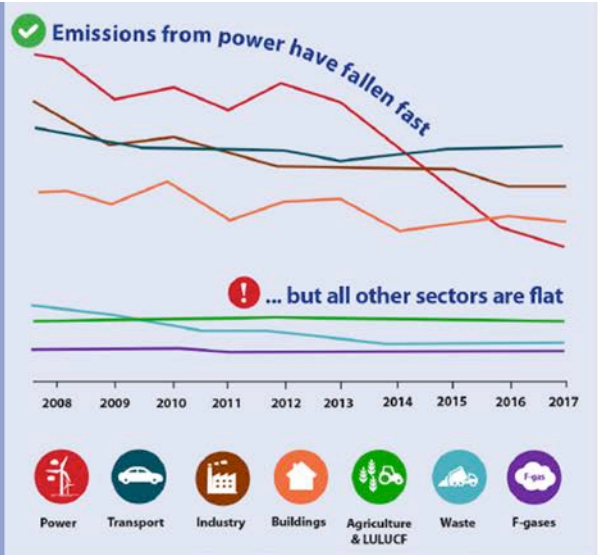


Guardian Graphic. Source: Imperial College London / Drax

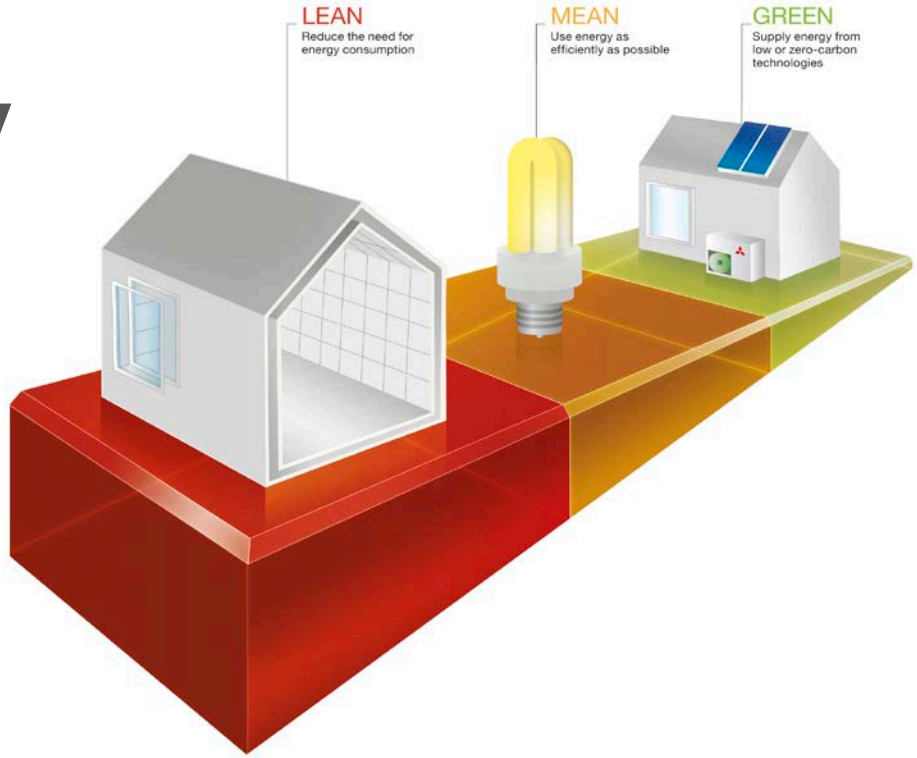
Good progress made, but

Excellent progress in reducing emissions from electricity generation masks failure in other sectors

The UK's greenhouse gas emissions have reduced by 43% compared to 1990 levels, on the way to a target of at least an 80% reduction by 2050.



Energy Hierarchy

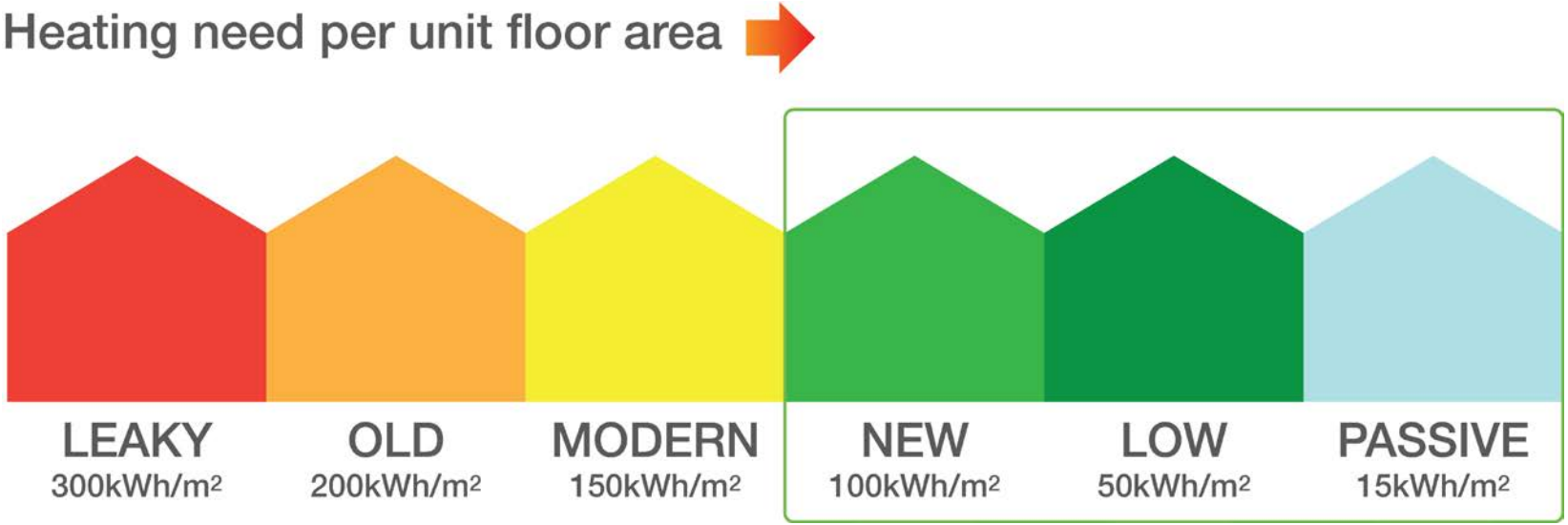


Old Buildings / Low Refresh Rates

Refurbish (insulate)

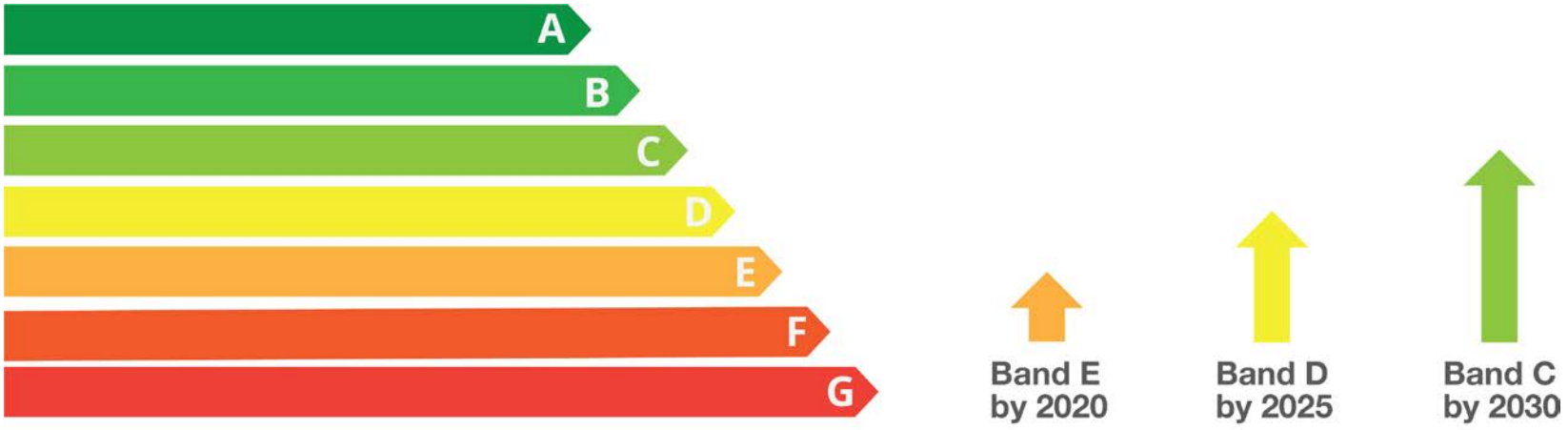
https://www.ovoenergy.com/guides/energy-guides/how-much-heating-energy-do-you-use.html

New Build


Heating need per unit floor area
LEAKY
300kWh/m2
OLD
200kWh/m2
MODERN
150kWh/m2
NEW
100kWh/m2
LOW
50kWh/m2
PASSIVE
15kWh/m2

Fuel Poverty

Move as many fuel poor homes as is reasonably practicable to a minimum of…



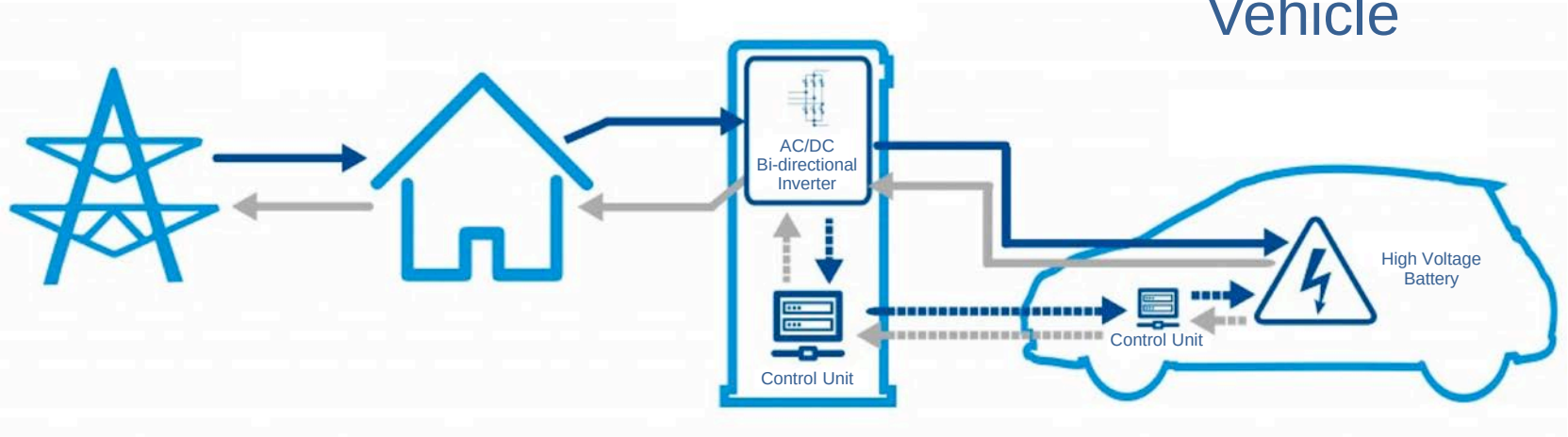
Energy Flows

Energy Flows

Grid

V2G Unit

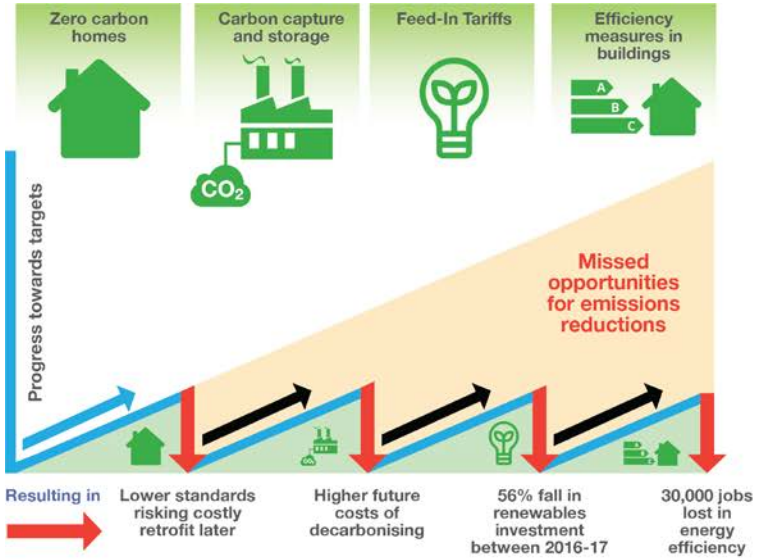
Electric Vehicle



https://www.fleetcarma.com/latest-vehicle-grid-v2g-charging/

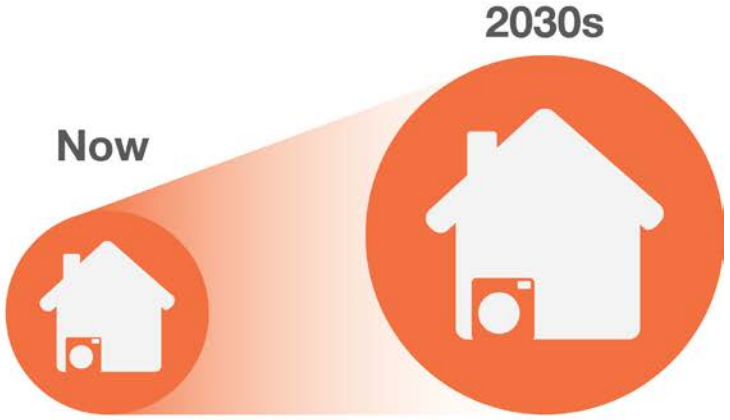
Energy Flows

Recent policies to reduce emissions have been cancelled….



Committee on Climate Change 2018 Report to Parliament

Heat Pumps



Heat pumps will be crucial to decarbonising heat in UK buildings

Properties off the gas grid should move to technology such as heat pumps very soon, by 2030 according to The Committee on Climate Change

https://watsonfuels.co.uk/farm/ and https://www.lowcostliving.co.uk/1331/save-money-on-lpg-how-we-saved-over-1000-on-our-gas-supply/

Action on heat is essential and needs to gather pace in the 2020s to meet carbon reduction targets

A mix of low carbon heating solutions and better thermal efficiency of buildings is needed

National Grid – Future Energy Scenarios - 2018

What this means

Decarbonising heat is crucial but needs to address significant technical and commercial challenges.

A balance of technologies is needed to meet the heat challenge.

Development of hydrogen and the rollout of heat pumps need to be driven by clear policy and supportive market arrangements.

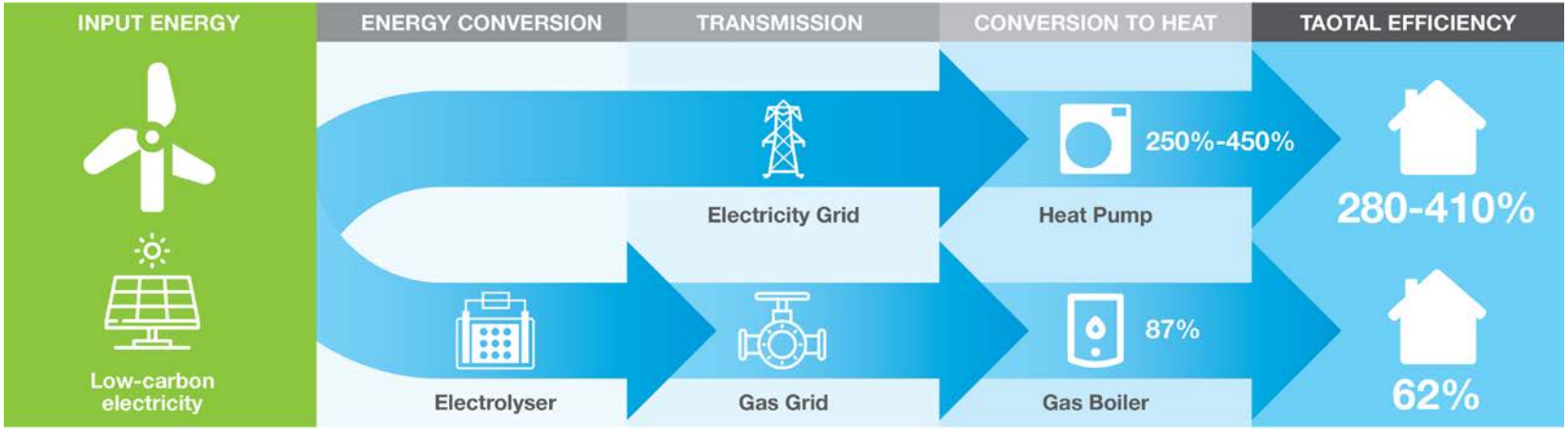
There are different ways to decarbonise heating.

Up to 60%
of homes could be using heat pumps by 2050.

Or hydrogen could heat **one third** of homes by 2050.

National Grid – Future Energy Scenarios - 2018

Relative efficiency of heating: electricity in heat pumps vs. electrolytic hydrogen in boilers

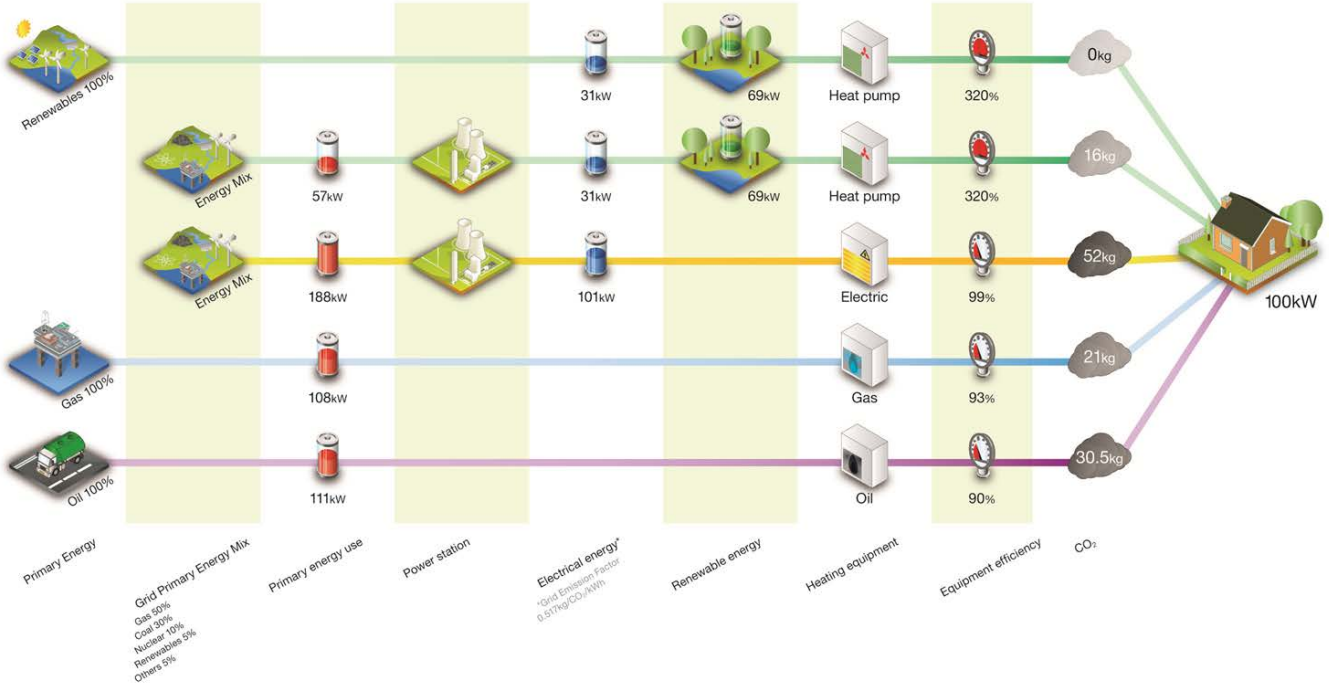


% indicates conversion efficiency at each stage.

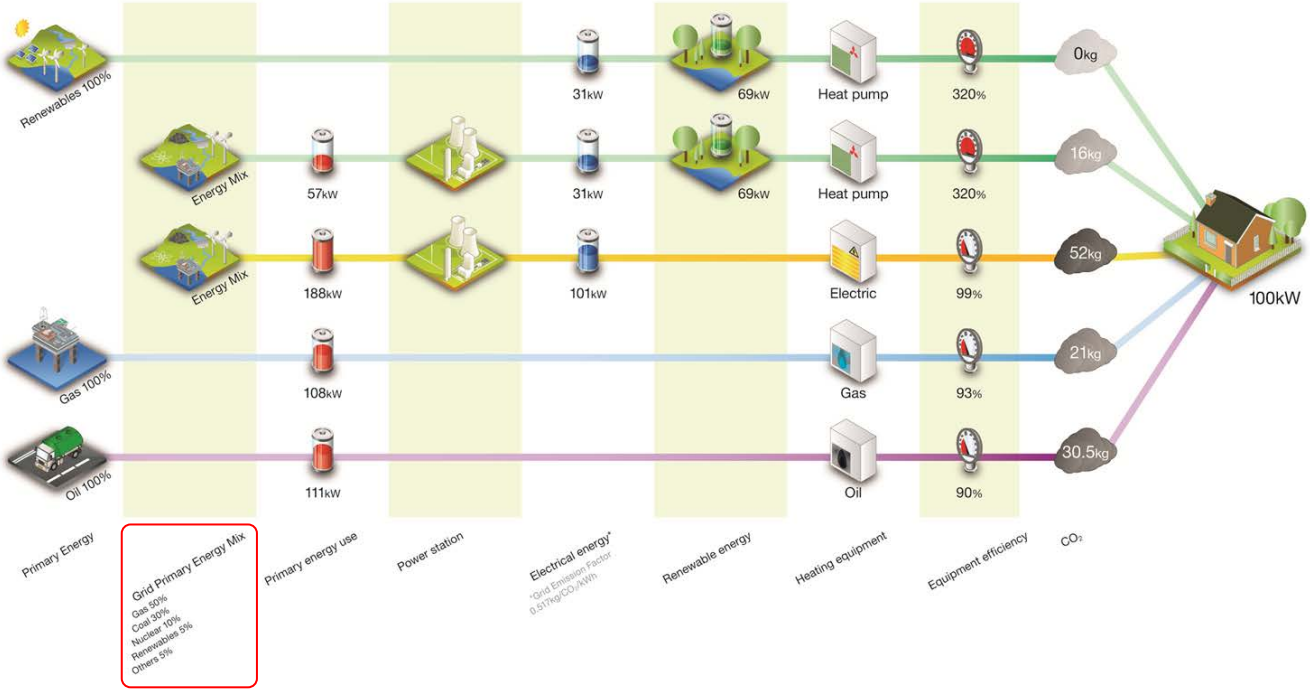
Source: CCC analysis

Notes: The diagram shows the indicative efficiency of using a given amount of zero-carbon electricity in delivering heat for buildings. Whilst in practice each of the efficiency numbers could vary, this would not be sufficient to change the conclusion that heat pumps provide a much more efficient solution for providing heat from zero-carbon electricity than use of electrolytic hydrogen in a boiler.

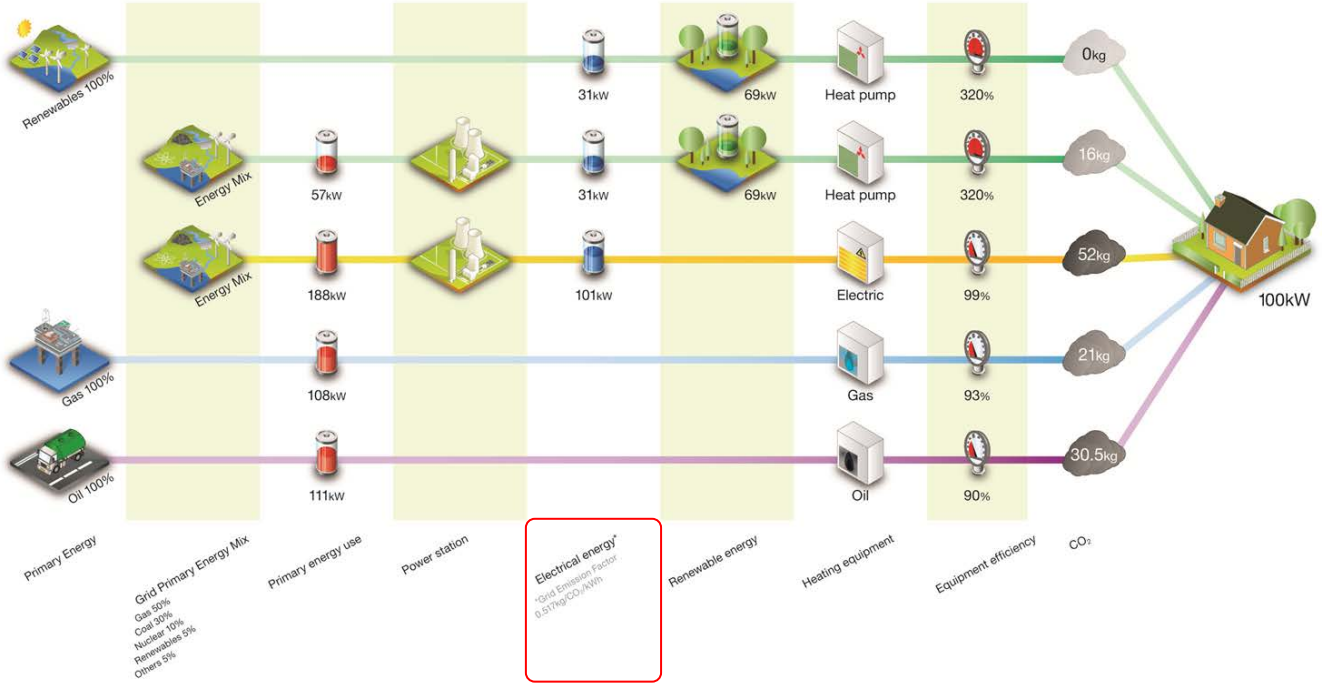
The full story



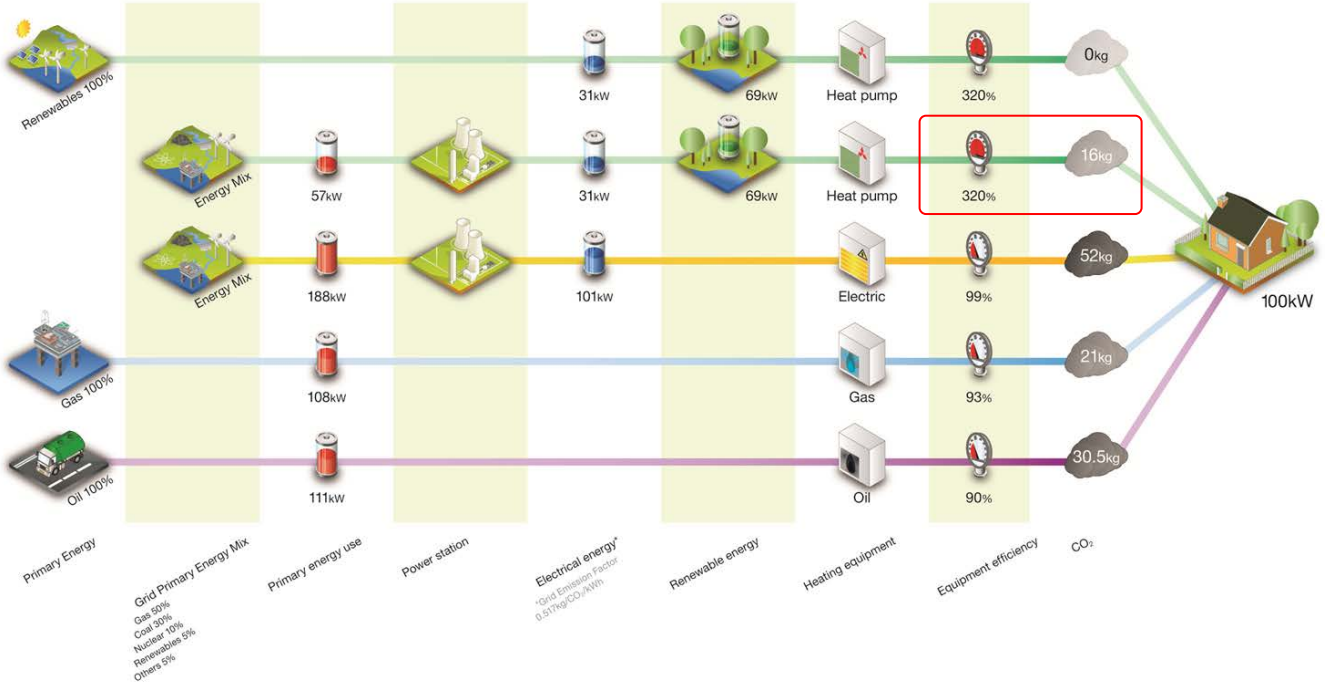
SAP10 - Changing energy mix



SAP10 - Cleaner Grid - 0.233 kg/CO_2/kWh



SAP10 - Reduced emissions - 250% - 9kg CO_2



So what does the future look like?

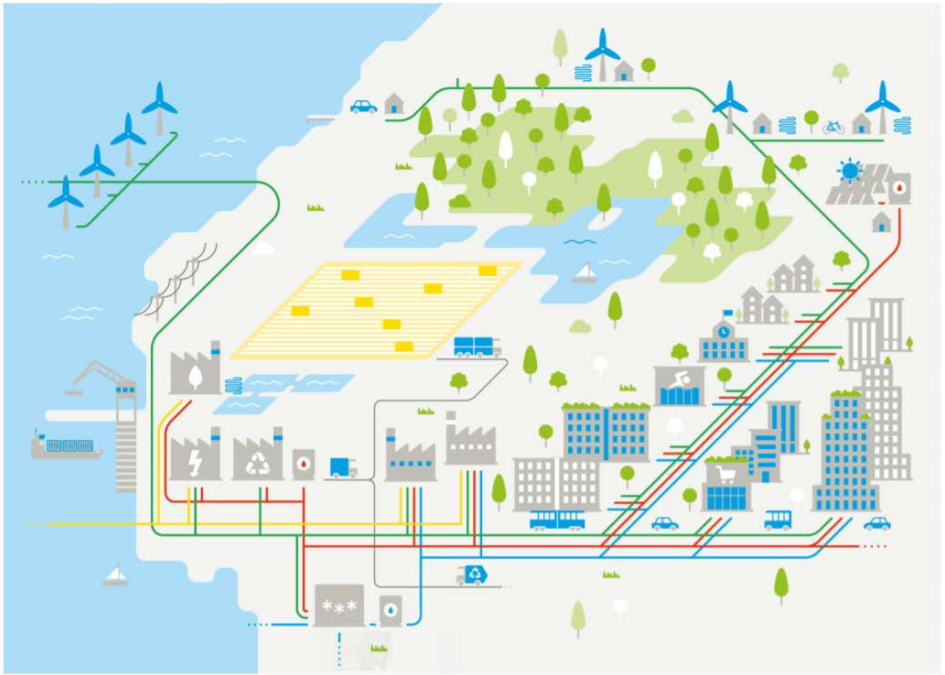
Healthy homes….

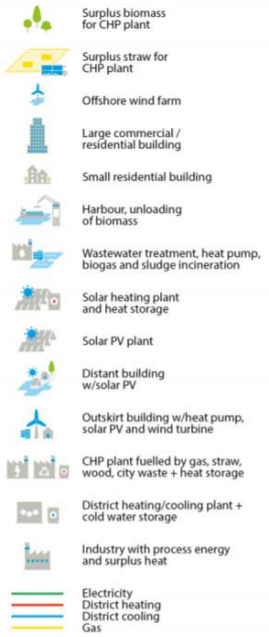
- Energy efficient, low carbon systems
- Good indoor air quality
- Resilience to future occupants and climate change
- User friendly controls
- Monitoring of indoor conditions
- Safe and secure
- Stimulating environment
- Connected to local amenities
- Light
- Sound insulation
- Functional living space
- Provisions to avoid moisture and mould

As part of healthy communities

https://www.worldgbc.org/news-media/green-building-improving-lives-billions-helping-achieve-un-sustainable-development-goals

4th Generation District Schemes





https://ramboll.com/ingenuity/how-to-build-a-smart-energy-system

...and smart

https://www.gemalto.com/iot/inspired/smart-cities

Building IOT

https://www.memoori.com/portfolio/internet-things-smart-commercial-buildings-2018-2022/

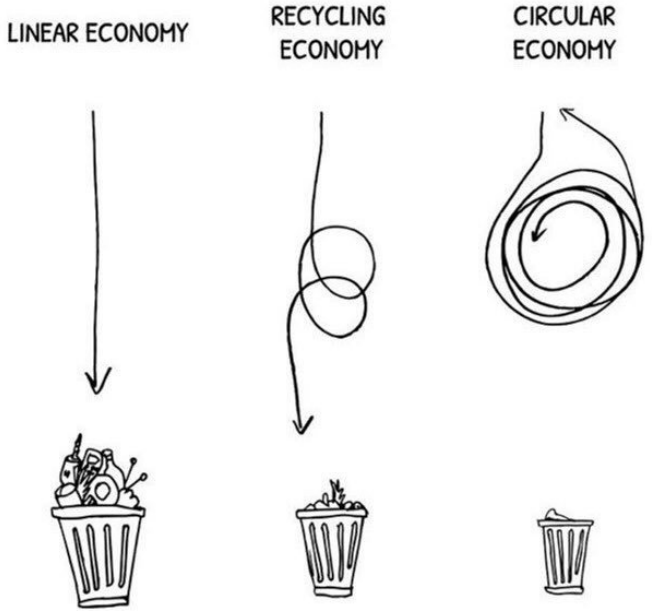
Modular / Offsite

Is the UK construction industry having its ‘Uber moment’?

Off-site modular manufacturing seen as the solution to sector’s productivity problem

Imagine a world where….

- Property investors own no physical assets
- Demolition does not exist
- Manufacturers sell services not products
- Construction materials are leased
- Buildings are restoring the natural environment



Summary

We need to change the way we heat our buildings in the UK?

Fossil fuel is not the future at a building level

That is why we feel the future is the Electric Economy

Influence

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Thank You

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Transforming the Housing Technology Mindset

A Brief History of Ecodan

Max Halliwell

Communications Manager, Heating and Ventilation Department

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3 Stories to tell you…

Ecodan
A brief history

Living with an
Ecodan

Product
Overview

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ecodan®

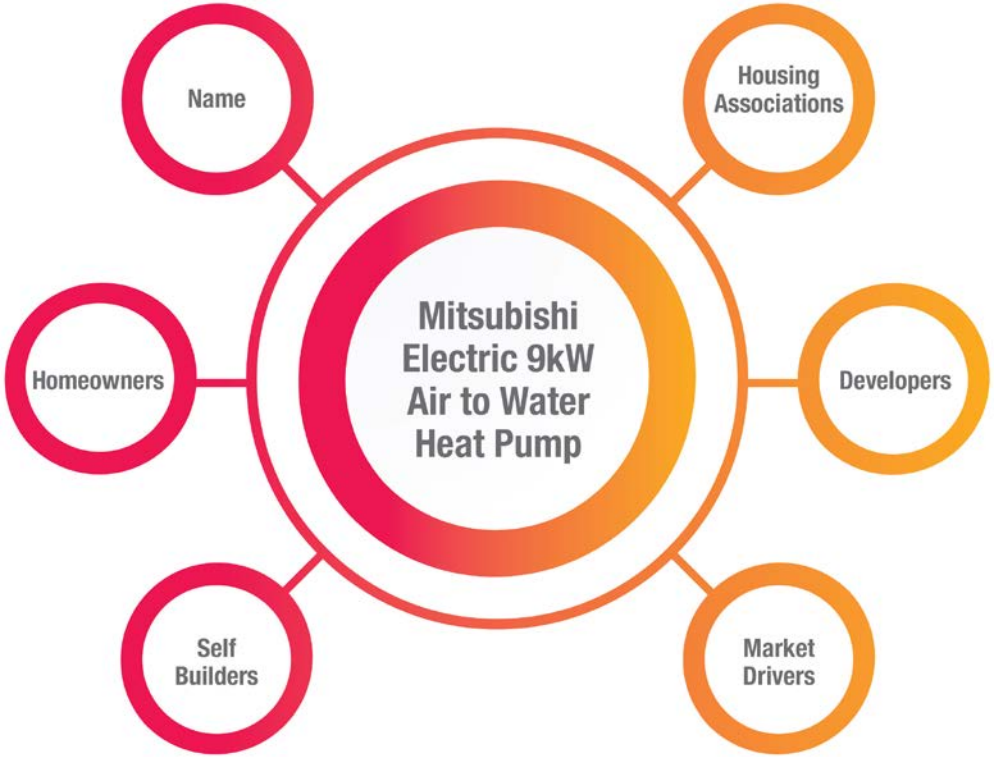
Renewable Heating Technology

A brief history

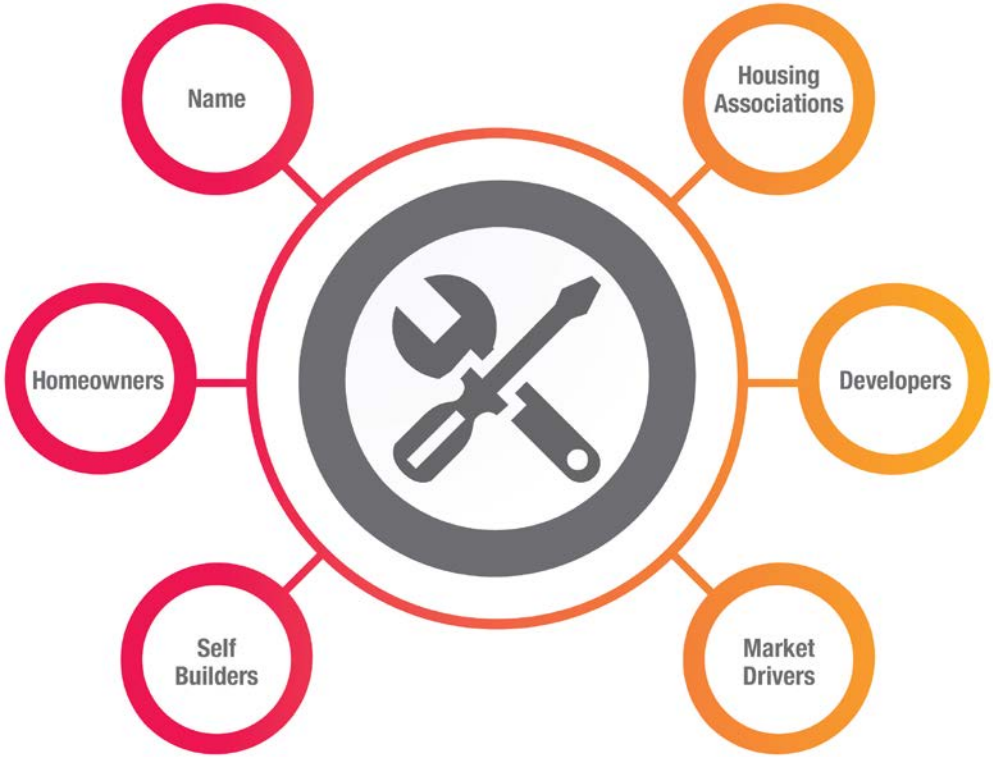
The UK market 10 years ago

- Full of many small manufacturers - fixed speed compressors
- Perceived as a **back of the garden shed** type industry
- We came with the technology already well established from our air con

Small beginnings -
2007 first memories


Name
Housing Associations
Homeowners
Mitsubishi Electric 9kW Air to Water Heat Pump
Developers
Self Builders
Market Drivers

Penetrating the UK market



A brief history - What’s in a name?

A brief history

Ecodan launch

bre

"Mitsubishi Electric is challenging everyone involved in the built environment to reduce their energy consumption and it is therefore excellent to welcome a manufacturer of this stature into the scheme”

Richard Hardy
Director of Sustainability
BRE Global

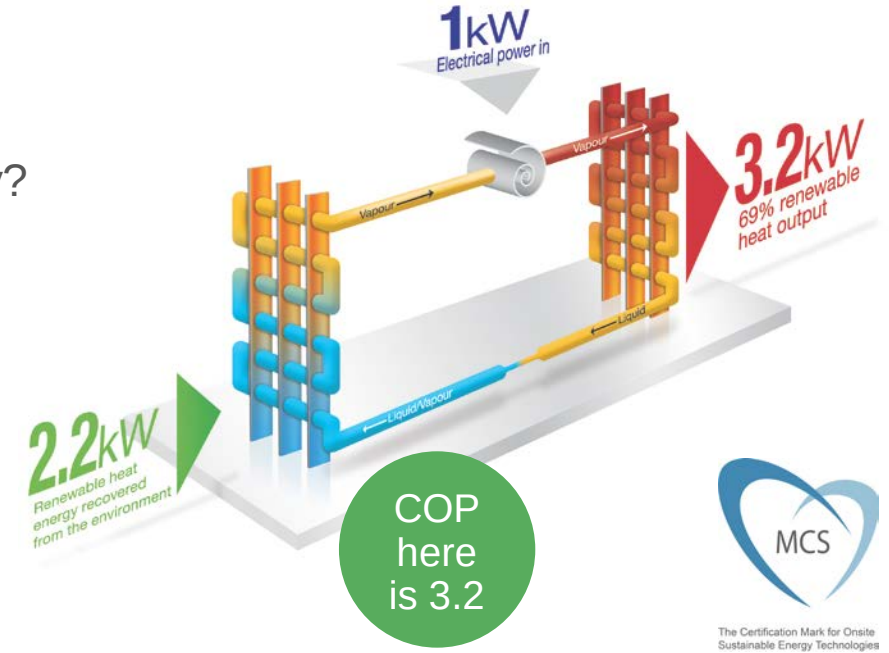
The Certification Mark for Onsite Sustainable Energy Technologies

Recognition under MCS is important as it helps the industry and the public have faith in heat pumps as a viable alternative to gas and oil heating

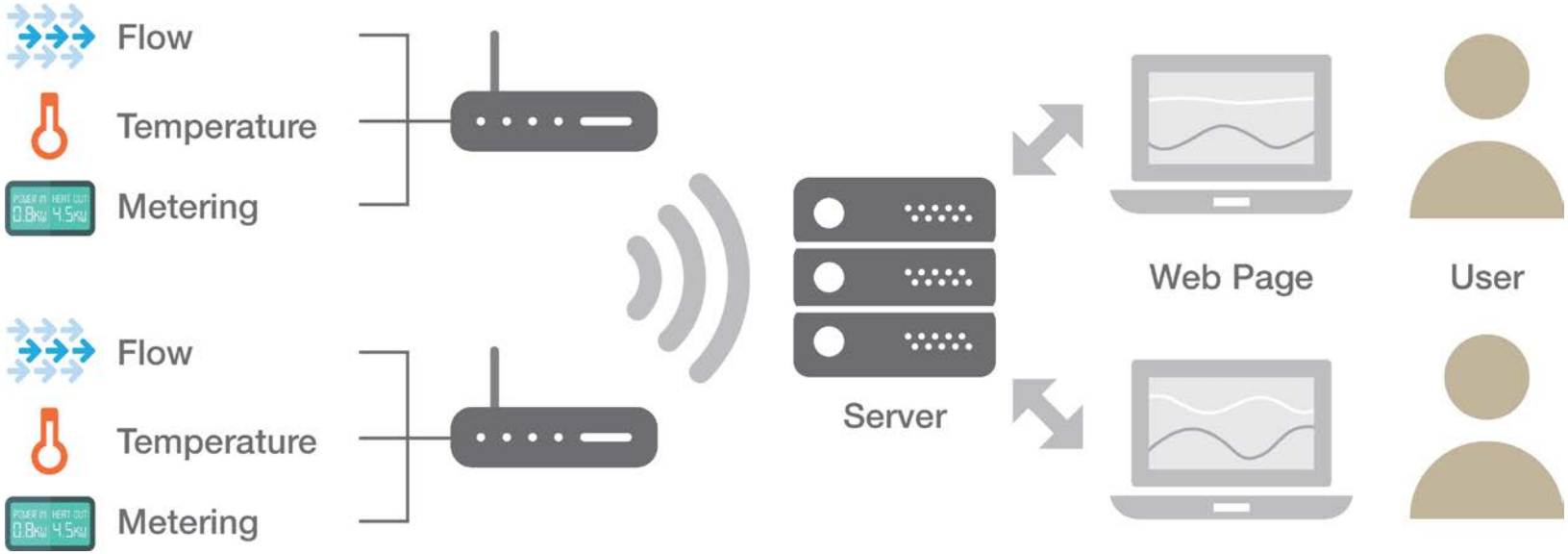
The Certification Mark for Onsite Sustainable Energy Technologies

Suspicious minds

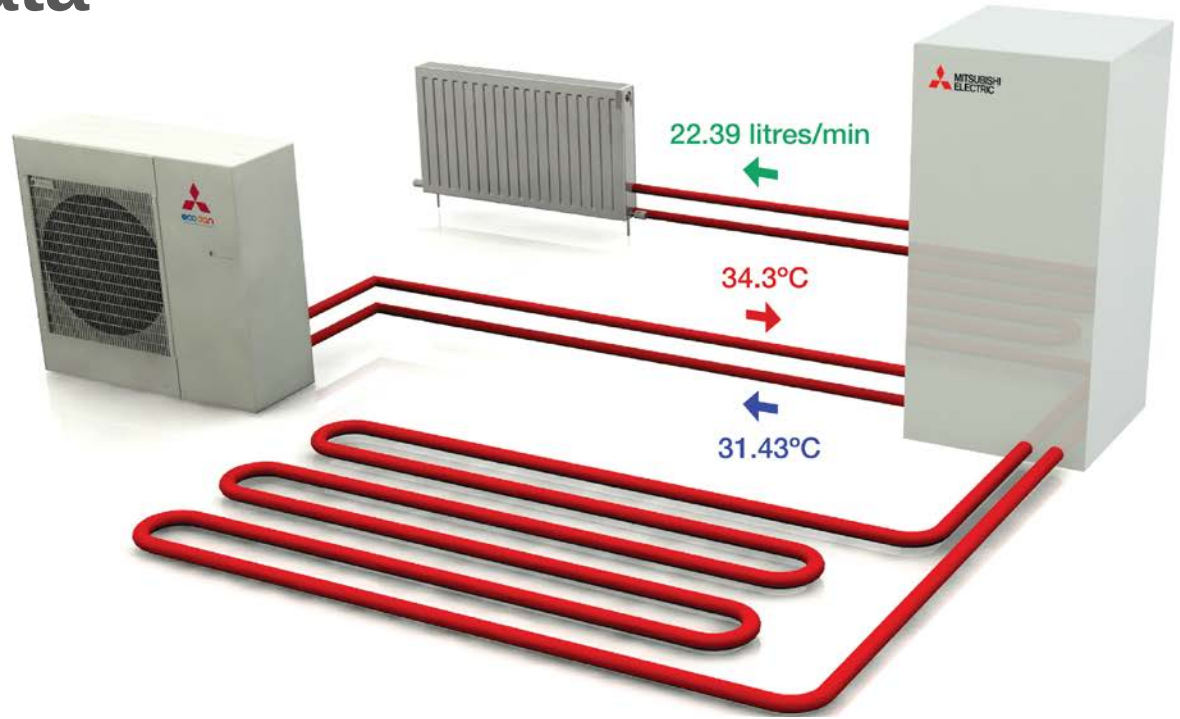
- MCS helped but didn’t solve - why?
- Proof of yearly performance
- SCOP versus COP
- Monitoring & case studies



How did we monitor Ecodan?



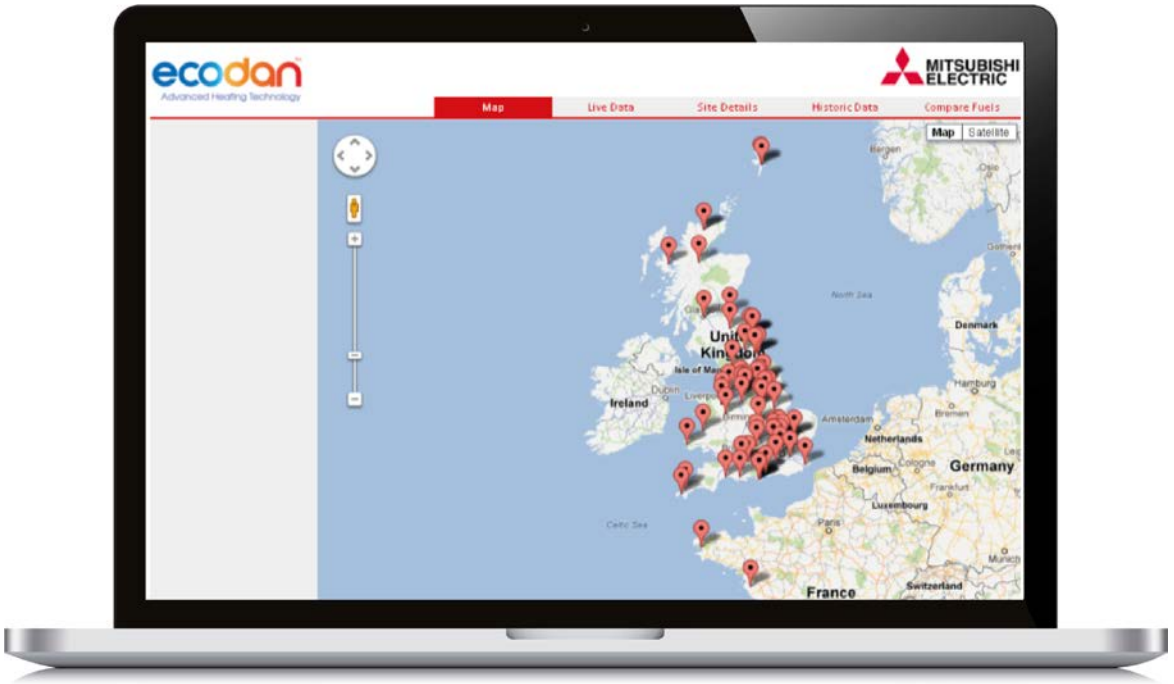
Real time data



- Power in: **0.8kW**
- COP: **5.6**
- Heat Out: **4.5kW**
- Indoor Unit: **0kW**

Outside: **8.98°C**
Inside: **21.9°C**

Ecodan Dashboard Map



1 Bedroom end terrace bungalow, Castle Eden, County Durham

2 Bedroom mid terrace house, Isle of Raasay, Scotland

3 Bedroom semi detached house, Berkhamsted, Herfordshire

3 Bedroom semi detached house, Chale, Isle of Wight

5 Bedroom mid terrace house, Kendal, Cumbria

5 Bedroom detached house, Congleton, Cheshire

3 Bedroom semi detached house, Oswestry, Shropshire

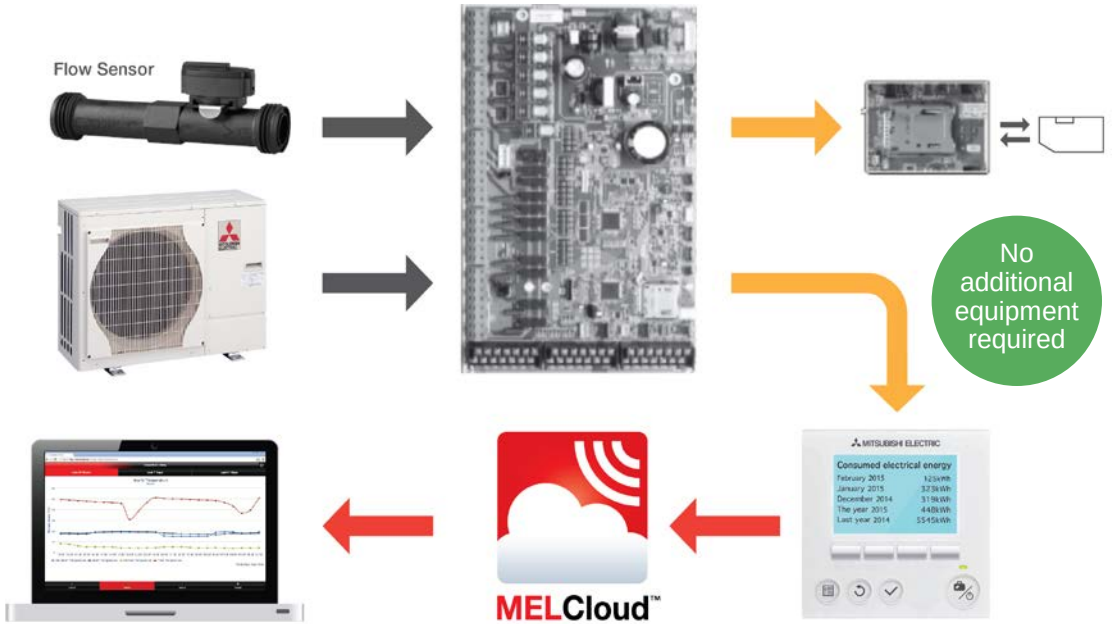
3 Bedroom semi detached house, Langford, Bedfordshire

4 Bedroom detached house, Argol, France

2 Bedroom flat, Toryglen, Glasgow

4 Bedroom detached house, Pembrokeshire, Wales

Energy Monitoring standard with every Ecodan



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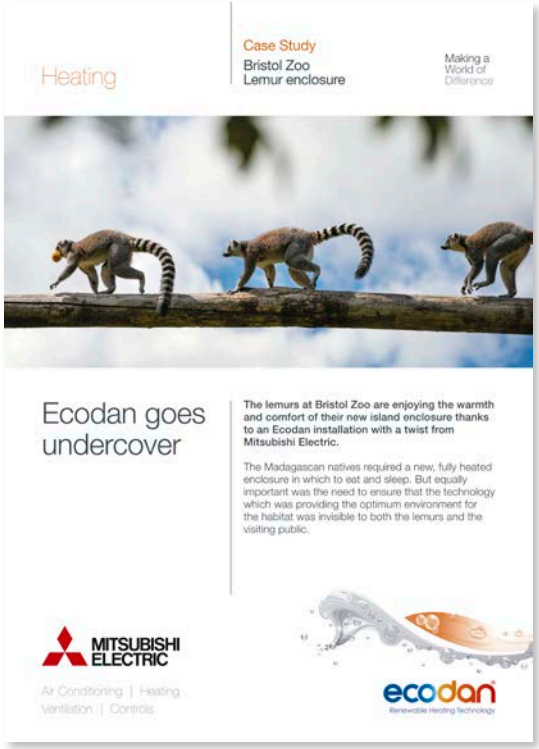
ecodan
Renewable Heating Technology

Transforming the Housing Technology Mindset

Hundreds of Case Studies

- Agriculture
- New Build
- Refurbishment
- Housing Association
- Housing Developer
- Community Heating Schemes
- Schools
- Offices
- Unique
- Isle of Man



Product Roadmap

ecodan
Renewable Heating Technology

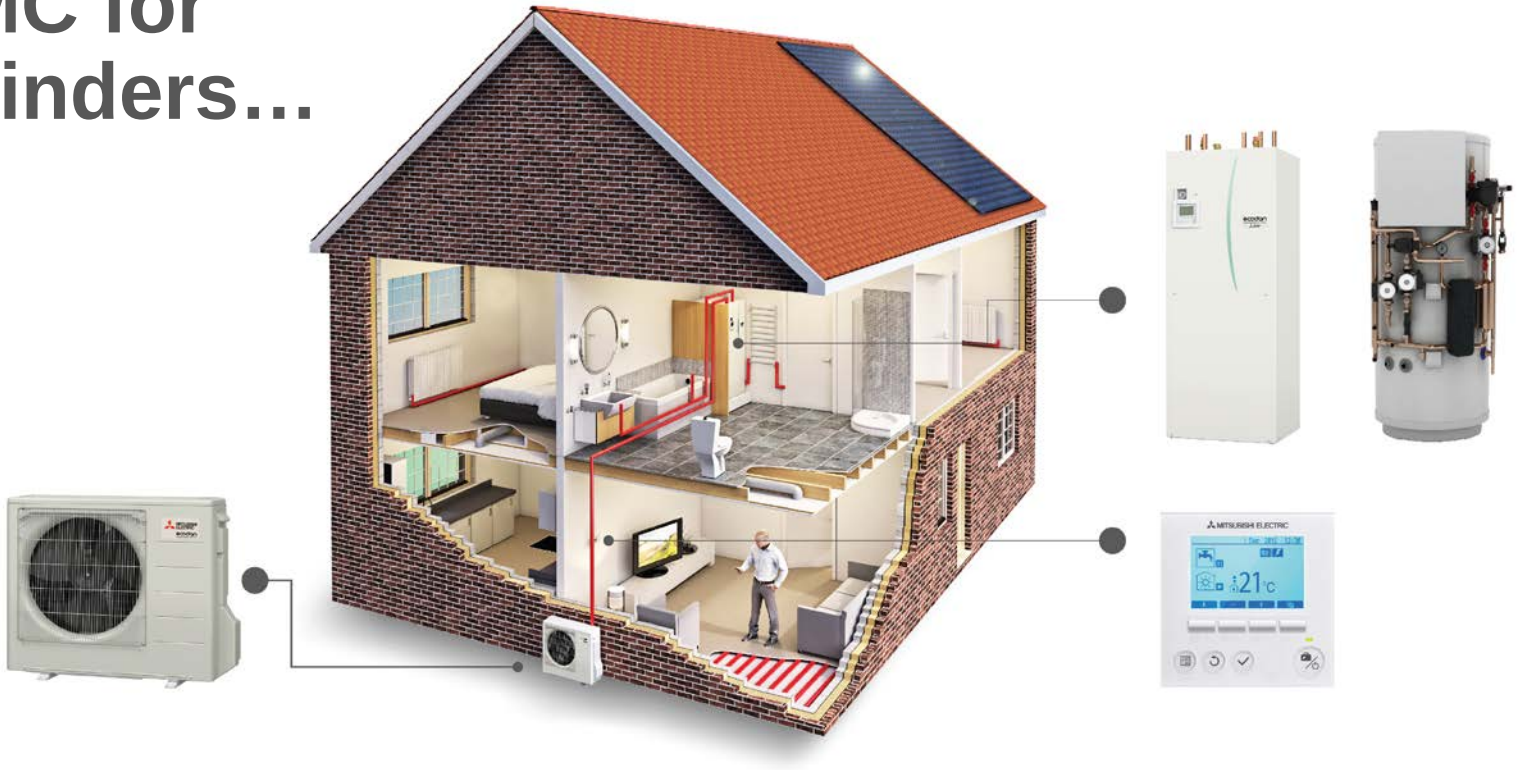
First UK Install Model PUHZ-W90

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

MCS of first Ecodan

5 generation of controls

MMC for cylinders…



Last piece of the puzzle

ecodan
Renewable heating technology

First UK Install Model PUHZ-W90

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

MCS of first Ecodan

5 generation of controls

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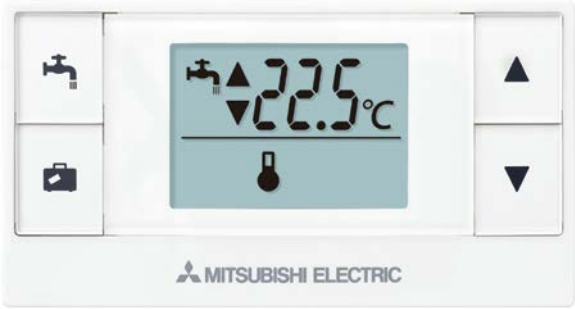
Living with an

ecodan®

Renewable Heating Technology

Living with an Ecodan



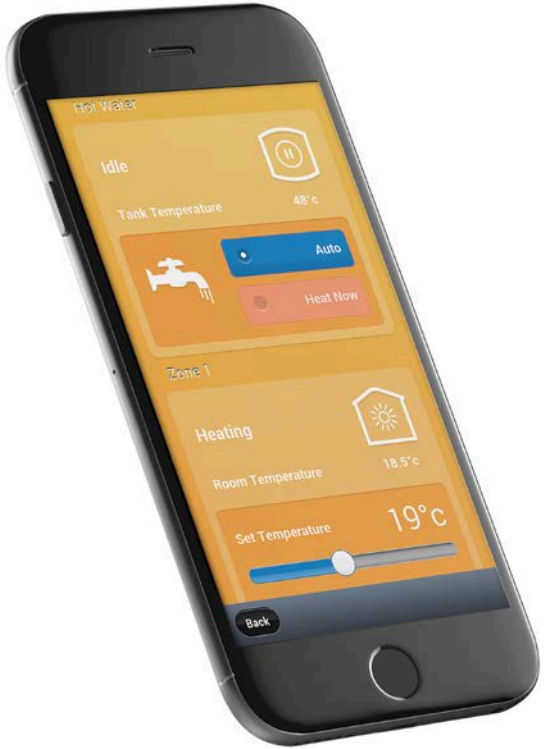
Transition to an Ecodan, a families view …

Family Survey

- Master H (now 23) said:
  “I’ve noticed no difference, we always have loads of hot water”

- Mrs H: “It’s a nice constant temperature throughout the house, I noted when we were on gas we would get bursts of heat which could get uncomfortable at times”

MELCloud - full control anywhere, anytime!



MELCloud

MITSUBISHI ELECTRIC

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Renewable Heating Technology

Product Overview

4kW to 680kW





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MCS

The Certification Mark for Onsite Sustainable Energy Technologies

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QUIET MARK

Ultra QUIET Ecodan

Preparing for future growth

UK Manufacturing

Ultra QUIET Ecodan

The **NEW LOW NOISE** air source heat pump, designed to provide a home with reliable, trouble-free renewable heating and hot water

Designed specifically for UK homes

REFINED USING OVER **10** YEARS OF KNOWLEDGE

The journey continues

RHI 2018

- Incentivised Growth
- 33% tariff increase
- Assignment of Rights

SAP UPDATE

- Compliance Growth
- Effective in 2018
- 55% reduction in grid emissions

The journey continues

55% Reduction In Grid

Change in CO_2 emissions factors

	Emissions kg CO_2e per kWh		
	SAP 2012	Draft SAP 2012	Draft SAP 10
Mains Gas	0.216	0.2077	0.210
Electricity	0.519	0.398	0.233

The SAP 10 emission factors for electricity are a three-year projection for 2018-2020. They are now closer to figures for grid electricity published by other official bodies, such as the Government GHG Conversion Factors figure of 0.283 for CRC reporting, and the BRE projected figure for 2019/21 of 0.302.

The history of home heating

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Ultraquietecodan.co.uk

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Transforming the Housing Technology Mindset

Delivering Renewable Heat
The perfect balance

Stuart Bell

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Opportunity for change…

Which are we looking at focusing on?

How many people came today wanting to support the notion of ASHP as a long term solution?	How many people feel they have already made up their mind that ASHPs are not for you?	Finally how many people WANT to be convinced?
Maintain	Transform	Convince

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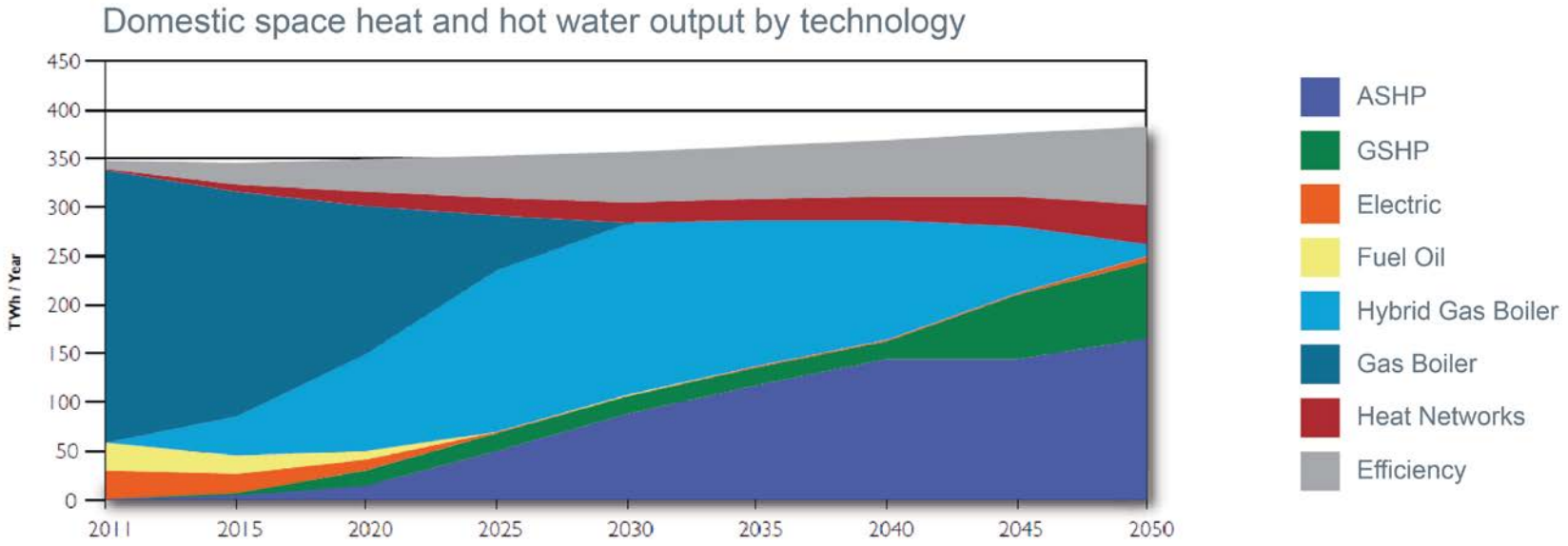
Transforming the Housing Technology Mindset

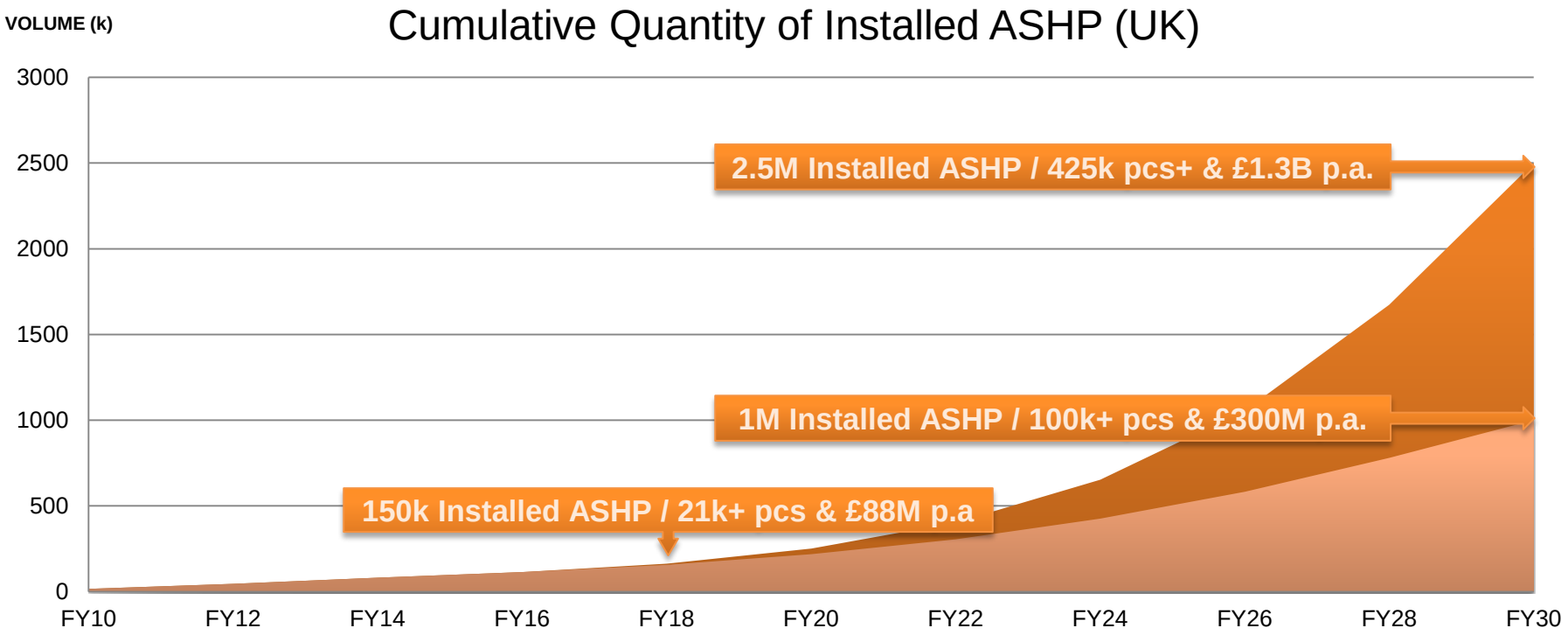
The Carbon Plan

- Published Government Strategy

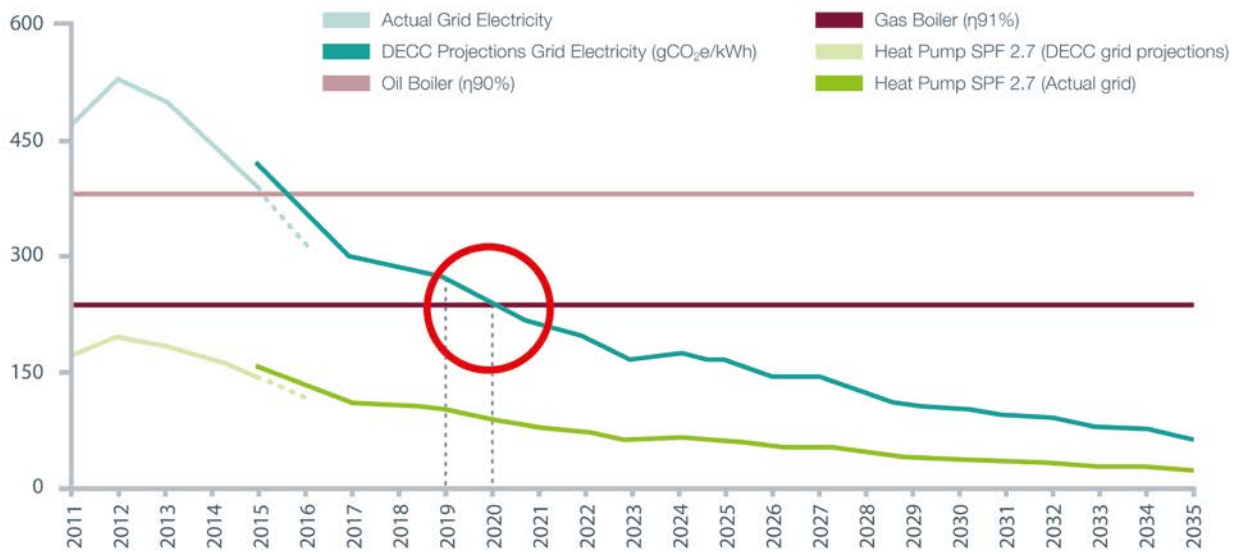


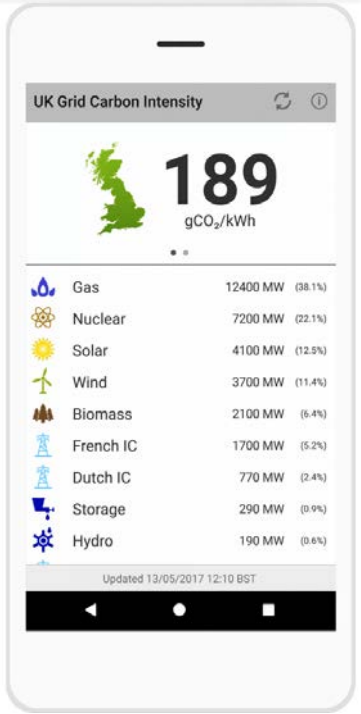
Meeting the Challenge (Source: DECC)

Market predictions



Changing Emissions

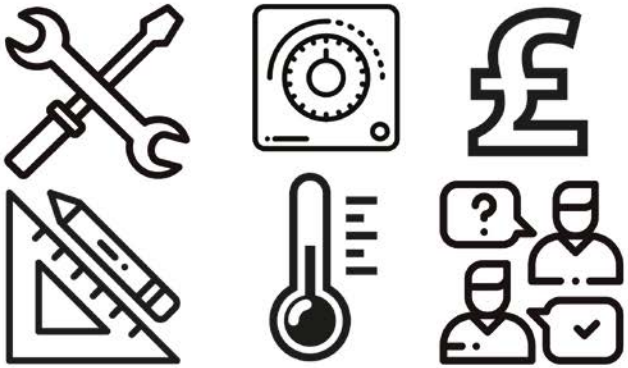




Grid electricity, DECC projections, gas and heat pumps

Start of my ASHP Journey

It was all about the box



Box

Delivery

Successful Delivery

Client

Manufacturer

Installer

End User

Successful Delivery

- Design & MCS Standards - All applications
- Trained Installers - unsung heroes…
- Education & Handover
- Support & Maintenance

Install requirements for Ecodan ASHPs






Install requirements for Ecodan ASHPs

- Outside
- Condensate Removal
- Single Phase Electric Supply
- Insulate Pipes
- Isolator - Electricity
- Isolator – Pipework + TW
- Vibration Pads
- Position / (airflow)
- Air Outlet Guide Extra
  reduce to 500mm in front

Trained Installers - Unsung Heroes

- Ecodan Part 1
  Design & Application (ED&A)
- Ecodan Part 2
  Installation & Commissioning (EI&C)
- Ecodan Part 3
  Fault Finding & Maintenance (F&M)

Successful Delivery

Retro Drivers

- Off gas no alternatives
- Inconsistent delivery of Heat Storage Radiators
- Delivery of fuel inconvenient
- Fuel Poverty - Easy to budget
- Environmental Impact
- EPC improvement
- Maximum control - Home or Away
- Renewable Heat Incentive

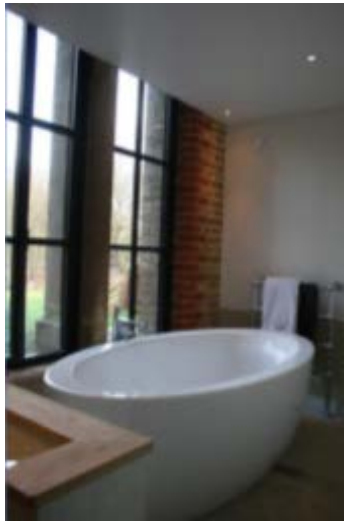
New Build Drivers

- One utility to site
- Renewable - aspirational to end user
- Renewable energy contribution on site
- Exceeds SAP requirements TER - DER
- Environmental impact
- EPC improvement
- Maximum control & support - Home or Away
- Renewable Heat Incentive - Self build only
- Improved Safety - no combustible fuel In property

Private Market




Private Market

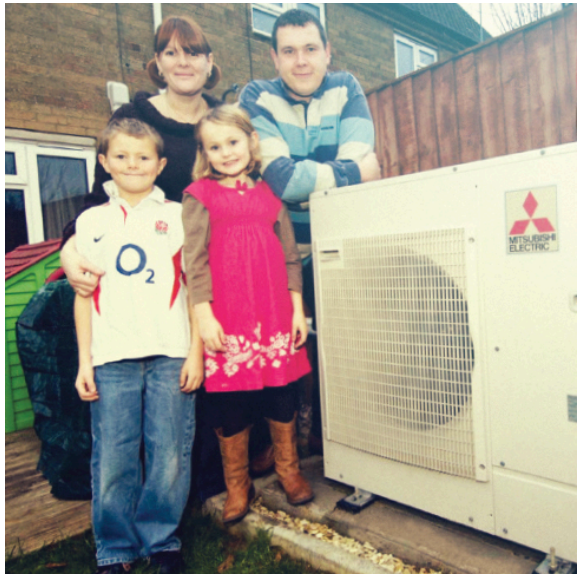


Private Market

Social Housing Retrofit

Social Housing Retrofit

- Electrical 6.56 tonnes of CO_2 per year
- Solid fuel coal 2.89 tonnes of CO_2 per year
- Total Carbon footprint: 9.45 tonnes of CO_2
- Carbon reduction of 65% - 3.3 tonnes of CO_2
- Heating Running Costs
  Before: **£765** I After: **£384**
- Installed 250 Heat Pumps - Ongoing

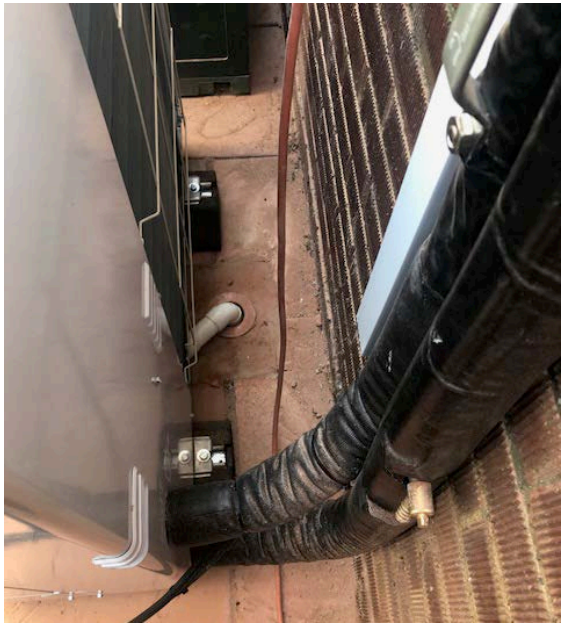


Social Housing Retrofit

- South Lanarkshire
- 1700 units installed
- BRB were highly commended at the Heating & Renewable Awards as Air Source Heat Pump Installer of the Year

Social Housing Retrofit

- Project - 360 units
- Installed by BSP - AP Faulkners
- Installed within a 12 month program
- Using new AA chassis
- Surveys carried out by Grand Union using MEUK Sizing Tool
- All Wi-Fi ready



Social Housing Retrofit

- Project - 170 units
- Installed by BSP - Blue Flame
- Installed within a 18 month programme
- Soft Landings
- Surveys carried out by Blue Flame using MEUK Sizing Tool
- All Wi-Fi ready
- Successful Warmer Homes Funding bid

Social Housing Retrofit

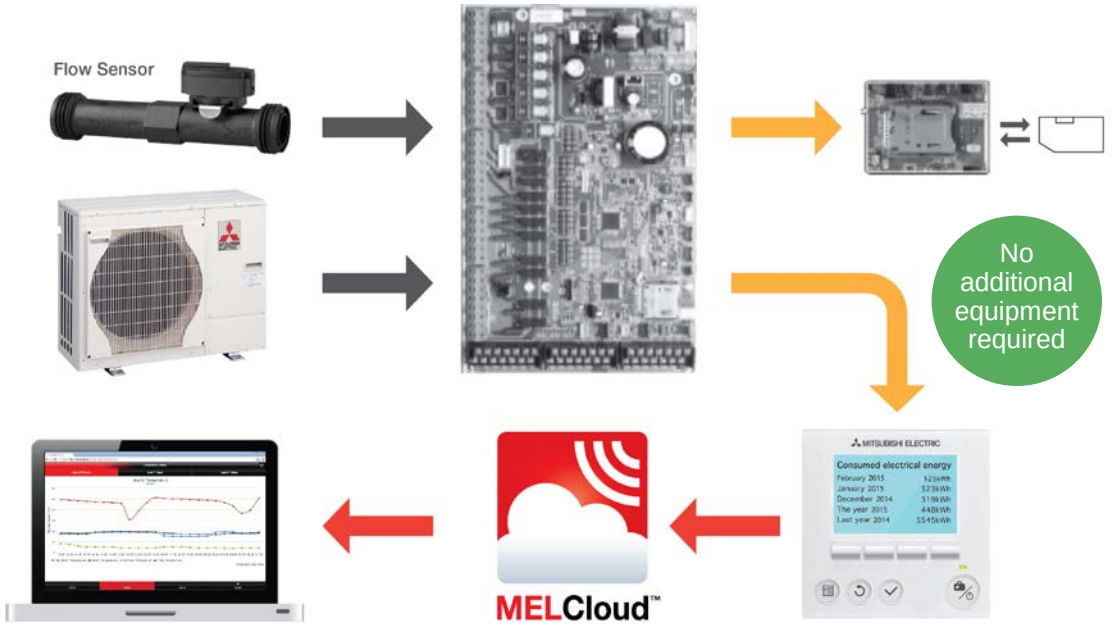
- Project - 18 ASHPs
- 3 weeks programme
- QUHZ installed on balconies
- Replaced storage heaters
- DHW was equal to the heating load
- Sound performance quietest in Europe

Social Housing Retrofit

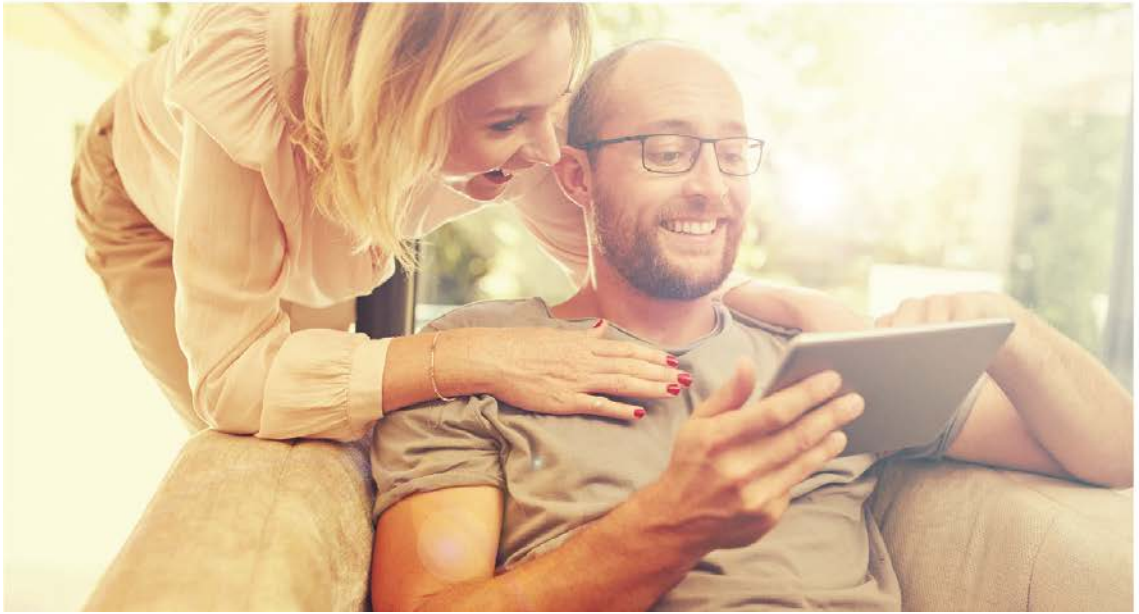
- Project - 300 ASHPs
- Installed within a 24 month RHPP programme
- Helen McCarthy Funding
- Community Schemes
- Feedback on Health and Financial benefits

The product took gold in the charity/non profit category of the nationwide Green Apple awards for environmental best practice and sustainable development

Energy Monitoring standard with every Ecodan



Domestic Renewable Heat Incentive



Domestic Renewable Heat Incentive

Energy Performance Certificate

HM Government

1, Hilltop Road, BERKHAMSTED, HP4 2HL

Dwelling type:	Ground-floor flat	**Reference number:**	0188-5027-6286-5835-6920
Date of assessment:	08 June 2015	**Type of assessment:**	RdSAP, existing dwelling
Date of certificate:	09 June 2015	**Total floor area:**	47 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

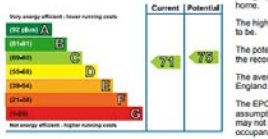
Estimated energy costs of dwelling for 3 years:	**£ 1,539**
Over 3 years you could save	**£ 249**

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£ 186 over 3 years	£ 99 over 3 years	
Heating	£ 1,092 over 3 years	£ 930 over 3 years	
Hot Water	£ 261 over 3 years	£ 261 over 3 years	
Totals	**£ 1,539**	**£ 1,290**	You could save £ 249 over 3 years

These figures show how much the average household would spend in this property for heating, lighting and hot water and is not based on energy used by individual households. This excludes energy use for running appliances like TVs, computers and cookers, and electricity generated by microgeneration.

Energy Efficiency Rating



The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

The EPC rating shown here is based on standard assumptions about occupancy and energy use and may not reflect how energy is consumed by individual occupants.

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years
1 Floor insulation (solid floor)	£4,000 - £6,000	£ 174
2 Low energy lighting for all fixed outlets	£40	£ 75

To find out more about the recommended measures and other actions you could take today to save money, visit www.gov.uk/energy-grants-calculator or call **0300 123 1234** (standard national rate). The Green Deal may enable you to make your home warmer and cheaper to run.

Summary of this home's energy performance related features

Element	Description	Energy Efficiency
Walls	Cavity wall, filled cavity	★★★★☆
Roof	(another dwelling above)	–
Floor	Solid, no insulation (assumed)	–
Windows	Fully double glazed	★★★☆☆
Main heating	Boiler and radiators, mains gas	★★★★☆
Main heating controls	Programmer, room thermostat and TRVs	★★★★☆
Secondary heating	None	–
Hot water	From main system	★★★★☆
Lighting	Low energy lighting in 11% of fixed outlets	★★☆☆☆

Current primary energy use per square metre of floor area: 233 kWh/m² per year

The assessment does not take into consideration the physical condition of any element. 'Assumed' means that the insulation could not be inspected and an assumption has been made in the methodology based on age and type of construction.

Low and zero carbon energy sources

Low and zero carbon energy sources are sources of energy that release either very little or no carbon dioxide into the atmosphere when they are used. Installing these sources may help reduce energy bills as well as cutting carbon. There are none provided for this home.

Your home's heat demand

For most homes, the vast majority of energy costs derive from heating the home. Where applicable, this table shows the energy that could be saved in this property by insulating the loft and walls, based on typical energy use (shown within brackets as it is a reduction in energy use).

Heat demand	Existing dwelling	Impact of loft insulation	Impact of cavity wall insulation	Impact of solid wall insulation
Space heating (kWh per year)	4,631	N/A	N/A	N/A
Water heating (kWh per year)	1,659			

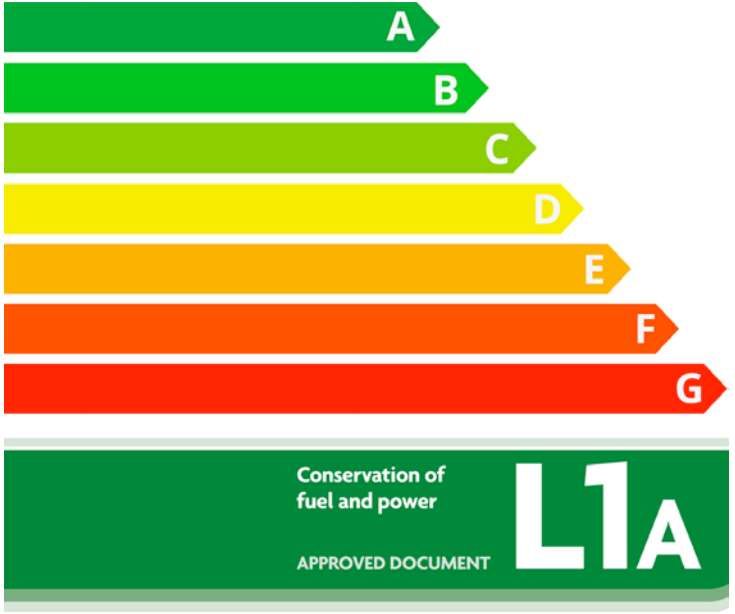
You could receive Renewable Heat Incentive (RHI) payments and help reduce carbon emissions by replacing your existing heating system with one that generates renewable heat, subject to meeting minimum energy efficiency requirements. The estimated energy required for space and water heating will form the basis of the payments. For more information, search for the domestic RHI on the www.gov.uk website.

Domestic Renewable Heat Incentive

- The amount you can earn from the RHI depends on how much energy your home uses Energy Performance Certificate (EPC)
- Your RHI payments will be dependent on the efficiency of the heat pump
- An optional Metering and Monitoring Service Package (MMSP) will increase RHI by £1610 over the term of the RHI

Property type	Space heating load kWh	DHW load kWh	Total kWh	Annual RHI payment 10.49p assuming SPF of 3.55 (EPC total x(1-1/SPF)) *0.1049	Total payment over 7 years	Optional MMSP payment	Total over 7 years including MMSP payments
2 Bed Flat (1960)	4631	1659	6290	£473.96	£3,317.69	£1,610.00	£4,927.69
3 Bedroom Terrace (1970)	7923	2593	10516	£792.39	£5,546.72	£1,610.00	£7,156.72
4 Bed Semi (1950)	11983	2876	1459	£1,119.64	£7,837.45	£1,610.00	£9,447.45
5 Bedroom Detached (1980)	16055	2847	18902	£1,321.88	£9,253.16	£1,610.00	£10,863.16

New Build

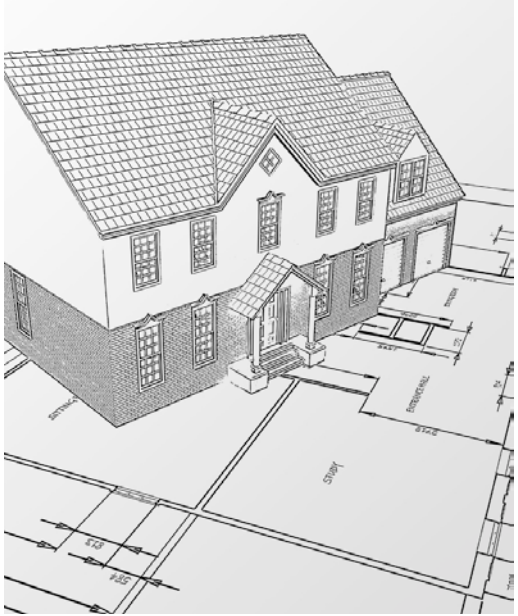

A
B
C
D
E
F
G
Conservation of fuel and power
APPROVED DOCUMENT
L1A

New Build

- 11 years ago
- Project - 19 Bellhomes
- Withington
- No gas
- CfSH requirement Level 3

New Build

- Expectations - SAPs & designs received
- Room by room heat losses + radiator schedule + ASHP specification + flow rates
- Issued to Developer
- Developer issues to UFH manufacturer - designs emailed to developer & Mitsubishi Electric to verify
- Pre Tender meeting with all concerned
- MEUK issues quote to client and any tendering Installers - Training offered



New Build

- 1st fix meeting on site
- Order placed by installer with project's schedule for heating
- Delivery direct to site from MEUK
- 1st assisted commissioning with installer by MEUK engineer
- Handover packs delivered for new homeowners
- Service and Maintenance offered by MEUK or supporting contractor

New Build

- Project - 540 plots
- Joint Venture Anderson Group & L&Q
- ASHP part of planning requirement
- Reduced the requirement for 2nd utility

MELConsole - New level of support

MELConsole example ›

Tenant calls Housing Authority to complain about lack of heating or hot water

→ Housing Authority calls **Ecodan Helpdesk** → **Helpdesk** interrogates system remotely & fixes issue

→ Housing Authority arranges for **engineer** to visit tenant → **Engineer** has to arrange suitable time with tenant → **Engineer** has to leave to get appropriate replacement part → **Engineer** revisits tenant - perhaps on another day to resolve issue

Functionality that can be accessed via MELCloud ›

- Initial Settings
- Hot water operation
- Heating Operation
- Holiday Mode
- Operation Settings
- Service Menu
- Energy Monitoring Settings

Time for Change

Transforming the Housing Technology Mindset

MITSUBISHI ELECTRIC | ecodan® Renewable Heating Technology

Transforming the Housing Technology Mindset

buildoffsite

Offsite Construction and Housing

Nick Whitehouse

MITSUBISHI ELECTRIC | ecodan® Renewable Heating Technology

MITSUBISHI ELECTRIC

buildoffsite

An industry wide organisation enabling collaboration in offsite construction

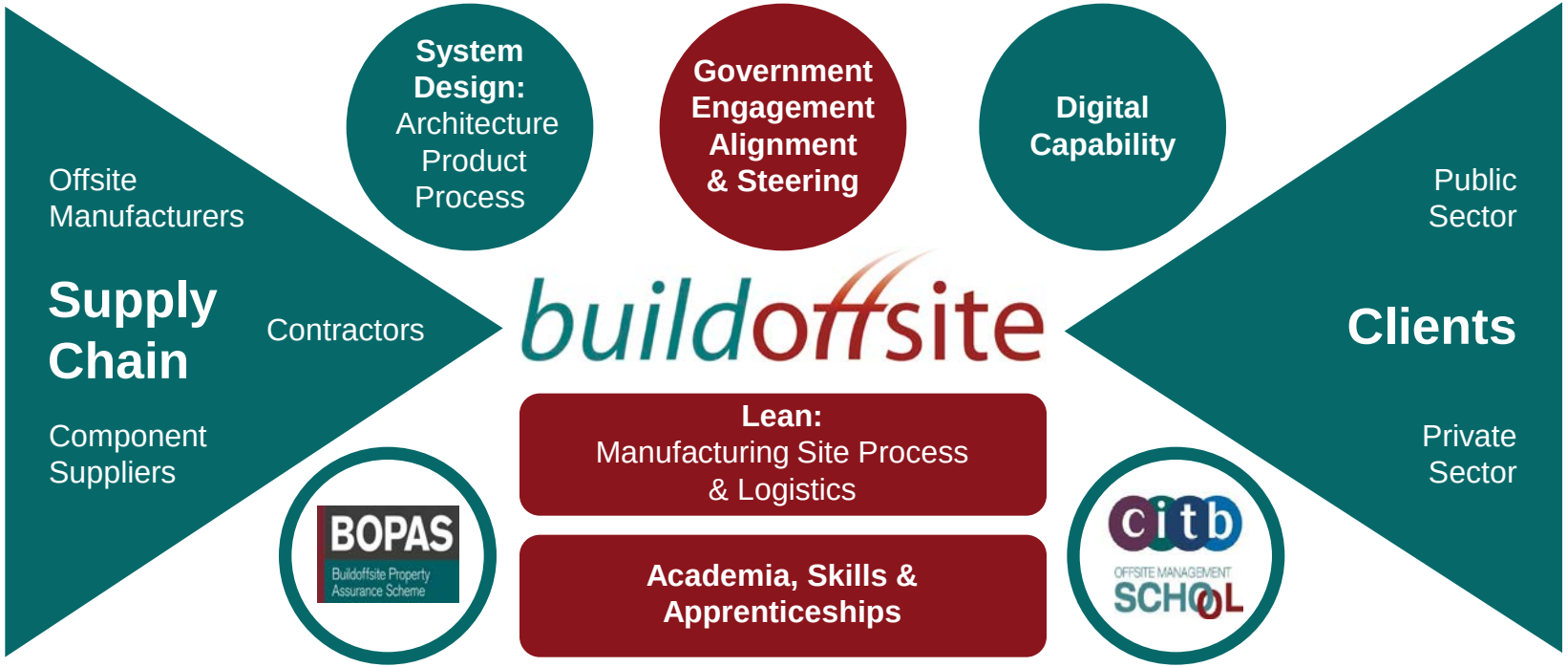
MITSUBISHI ELECTRIC

buildoffsite

- Voice of UK Offsite Construction
- Business-to-Business Networks
- Membership Organisation

Enabling the construction industry to deliver greater project value

Across The Value Chain



Buildoffsite Membership

CLIENTS

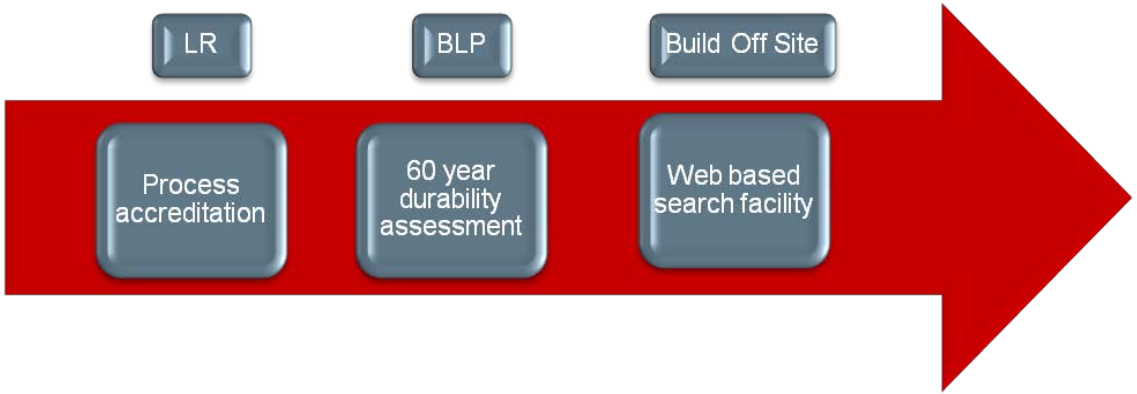
Anglian Water
ASDA
AstraZeneca
B&Q
Berkeley Modular
Cherwell D.C.
Circle Health
GlaxoSmithKline
Heathrow
HS2
John Lewis
KFC
Legal & General
Marks & Spencer's
Met. Police
Ministry of Justice
Moat Homes
Northumbrian Water
Sainsbury's
Scottish Water
TfL / London Underground
UK Power Networks
United Utilities
University of Cambridge
Yorkshire Water

Housing

- Shortfall
- Location
- Mix
- Land cost
- Performance
- Appearance and communities
- Is MMC the answer?

BOPAS

Buildoffsite Property Assurance Scheme



Lloyd's Register EMEA

Buildoffsite Property Assurance Scheme (BOPAS)

This is to certify that

SIG Building Systems

has been awarded BOPAS Accreditation to the closed panel structural timber system

The scope of approval comprises:
Constructor,
Designer,
Manufacturer and
60 year durability and maintenance assessment.

This Approval is subject to:
Satisfactory Surveillance Assessments

Approval Number: COV1524075
Date of Issue: 26/10/2015
Date of Expiry: 01/09/2018

buildoffsite
Property Assurance Scheme

Tefy Mundy
UK Business Manager
Lloyd's Register EMEA
A subsidiary of Lloyd's Register Group Limited

MITSUBISHI ELECTRIC

BOPAS
Buildoffsite Property Assurance Scheme

Owners

buildoffsite

Lloyd's Register Energy

BLP BUILDING DEFECTS INSURANCE

Approved Providers

VISION MODULAR SYSTEMS

FUSION Building Systems

elements europe

elliott An ALGECO SCOTSMAN Company

SIG

INSULSHELL

STEWART Milne GROUP

CIDARK

B&K STRUCTURES OPTIMISED HYBRID SOLUTIONS

enegroup

SIP Build UK SUSTAINABLE BUILDING SYSTEMS

Jade Global Group

Supporters

Nationwide building business with you

Santander

RBS The Royal Bank of Scotland

Legal & General

HBOS plc

buildoffsite

cml Council of Mortgage Lenders

Building Societies Association

RICS the mark of property professionalism worldwide

Government push for MMC

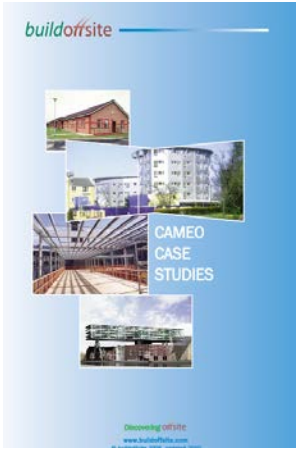
- BOPAS delivers.....
- Lending valuation and insurance
- Equity retention
- Database

Publications & Thought Leadership

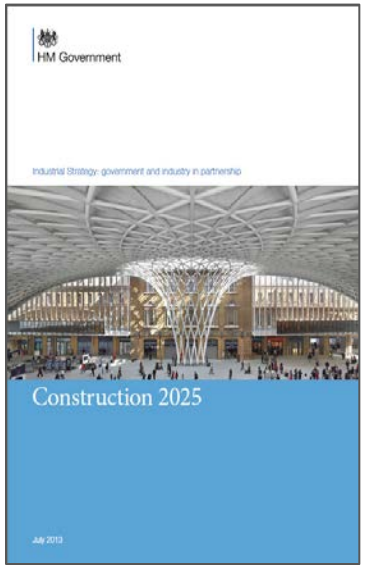
Buildoffsite Glossary of terms

What is offsite?

- Modular
- Volumetric
- LGSF
- Timber
- Pre-cast concrete
- Panelised
- Foundation solutions



Our industry challenge:



Lower costs **33%**

Faster delivery **50%**

Lower emissions **50%**

Improvement in exports **50%**

- People
- Smart
- Sustainable
- Growth
- Leadership

Why Buildoffsite?

Enabling *production* not construction

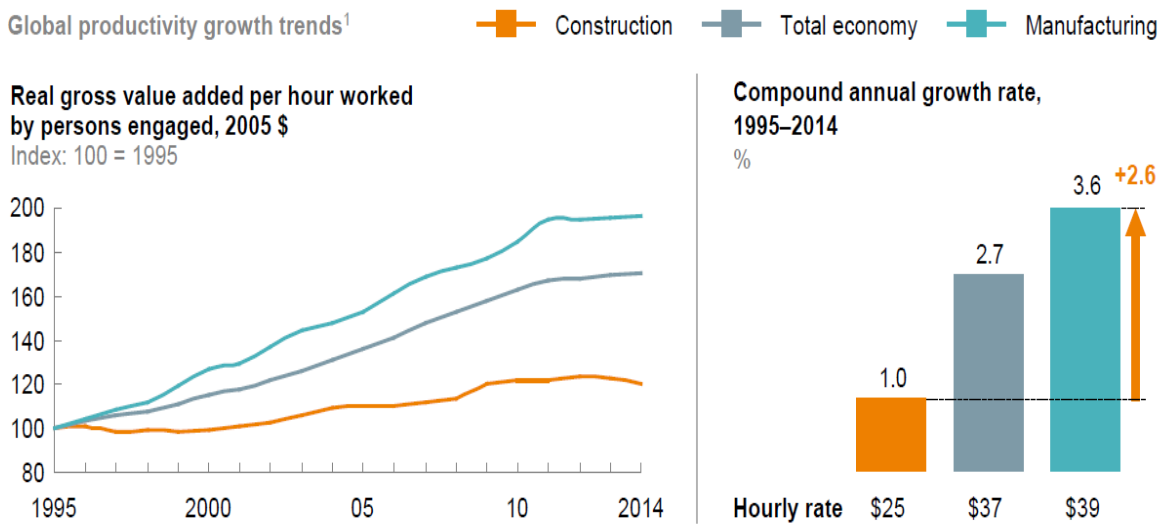
Potential barriers in housing

- Volume surety and volatility
- Homes and Houses
- Housing sub sectors and the different commercial and social drivers
- Planning and land availability
- Infrastructure

Manufacturing Productivity Vs. Construction Productivity

Globally, labor-productivity growth lags behind that of manufacturing and the total economy

Global productivity growth trends[1]



1 Based on a sample of 41 countries that generate 96% of global GDP

Source:
OECD; WIOD; GGCD-10, World Bank; BLS; national statistical agencies of Turkey, Malaysia, and Singapore; Rosstat; McKinsey Global Institute analysis

UKCES says so too…

Why Build Offsite?

Examples:

North West Cambridge Development

Using traditional building systems

Same time onsite using offsite solutions

GRAHAM CONSTRUCTION

Innovation

Dalston Lane project, Ramboll

- Tallest CLT building & by volume the largest CLT project globally
- 121 unit residential development in London
- Saved 2,400 tonnes of carbon, compared to an equivalent concrete frame
- Its 3,852 cubic metres of CLT will entirely make up the external, party/core walls, floors & stairs.
- High Speed 1 and Crossrail pass underneath, so CLT perfect for lighter construction weight, enabled smaller foundations & added two stories on to the building

New Materials

- Old materials new processes
- Composites
- Intelligent materials
- Smart and Active Buildings

Oxford Brookes University and other research organisations

- POE post occupancy evaluation
- Testing and modelling systems and components
- Structures
- Thermal performance
- Air leakage

Harmonisation

- Standard Process, flexible products
- Enable the supply chain JIT. Lean process
- BIM CAD/CAM
- Carbon and the Circular Economy

Process driven

- Flexible product standard process

MITSUBISHI ELECTRIC

MITSUBISHI ELECTRIC

Heat pump long term success

- Award winning energy efficiency (20yrs+)
- Flexible and reconfigurable
- Robust and popular with tenants and maintenance
- An example of M&E “offsite”

- Electricity - the future energy source?
- Heat pumps - efficiency and green credentials
- Comfort - more hot nights and leisure style
- Life style - home as a work place or as shared place
- Circular economy - redundancy and flexibility transient patterns
- **Mitsubishi Electric**

Thank You

Transforming the Housing Technology Mindset

MITSUBISHI ELECTRIC | ecodan® Renewable Heating Technology


GEORGE CLARKE
- Architect
- Builder
- Home Obsessive

Where I lived inspired me

There’s no place like home

MITSUBISHI ELECTRIC

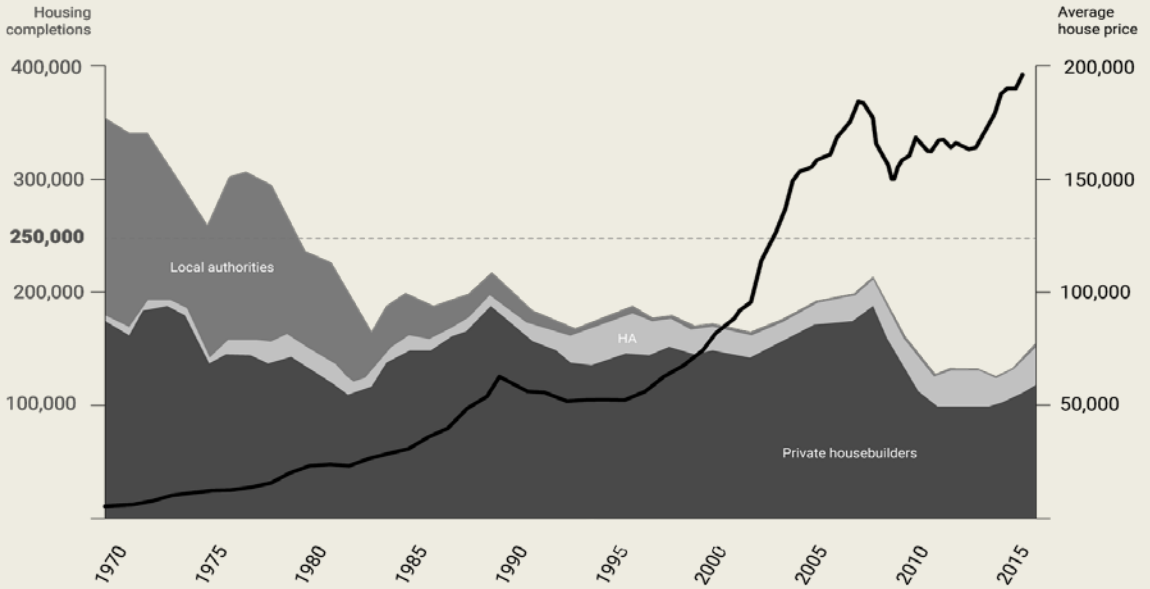
CONTENTS

MOBIE
Ministry of Building Innovation and Education

THE PROBLEM

1. LACK OF SUPPLY
2. LACK OF PEOPLE & SKILLS
3. LACK OF DESIGN QUALITY
4. LACK OF INNOVATION

MOBIE
Ministry of Building Innovation and Education



The Housing and Affordability Crisis

- Housing demand is way beyond the current level of supply
- We need to build **A LOT** of new homes
- But how on earth are we going to build 300,000 **GOOD QUALITY** homes in the UK every year for the next 10 years?

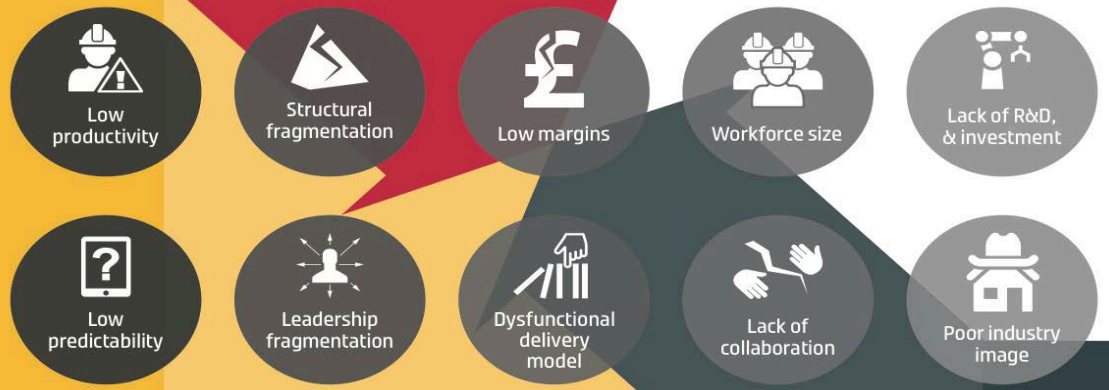
THE PROBLEM

1. FARMER SAID IT BEST

MOBIE
Ministry of Building Innovation and Education

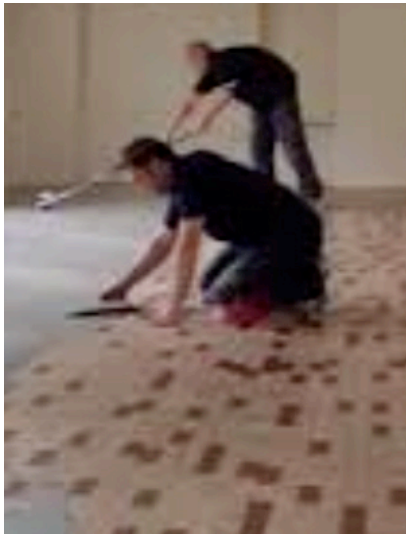
Mark Farmer said it best..

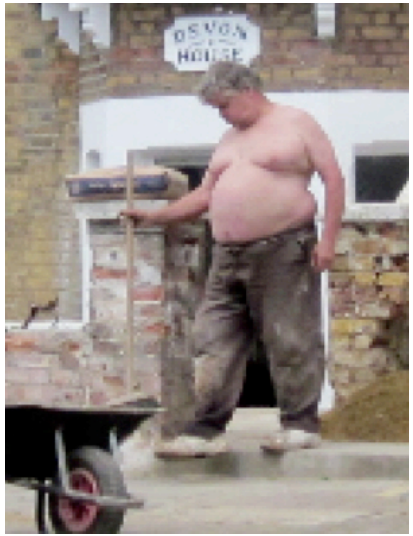
THE FARMER REVIEW OF THE UK CONSTRUCTION LABOUR MODEL



MODERNISE OR DIE

But what are we going to build? Is this really the best way?





New Build

Everything looks the same… and it's really boring

Densification of populations

Excessive and poor quality design

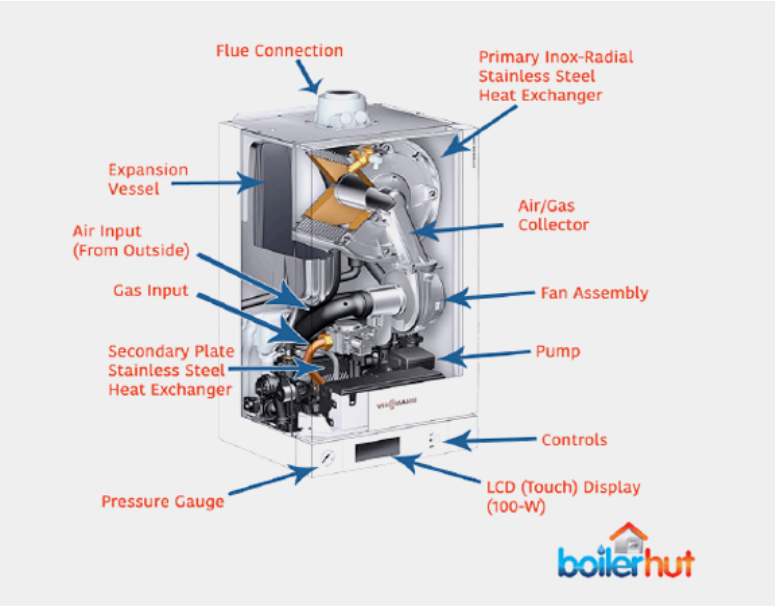
Our inefficiency and wastefulness has an impact

The boundary between our homes and nature is becoming more extreme

Is this really the best we can do?

No innovation. No quality. No sense of community. No placemaking. No ecology!

We need to Think Green!



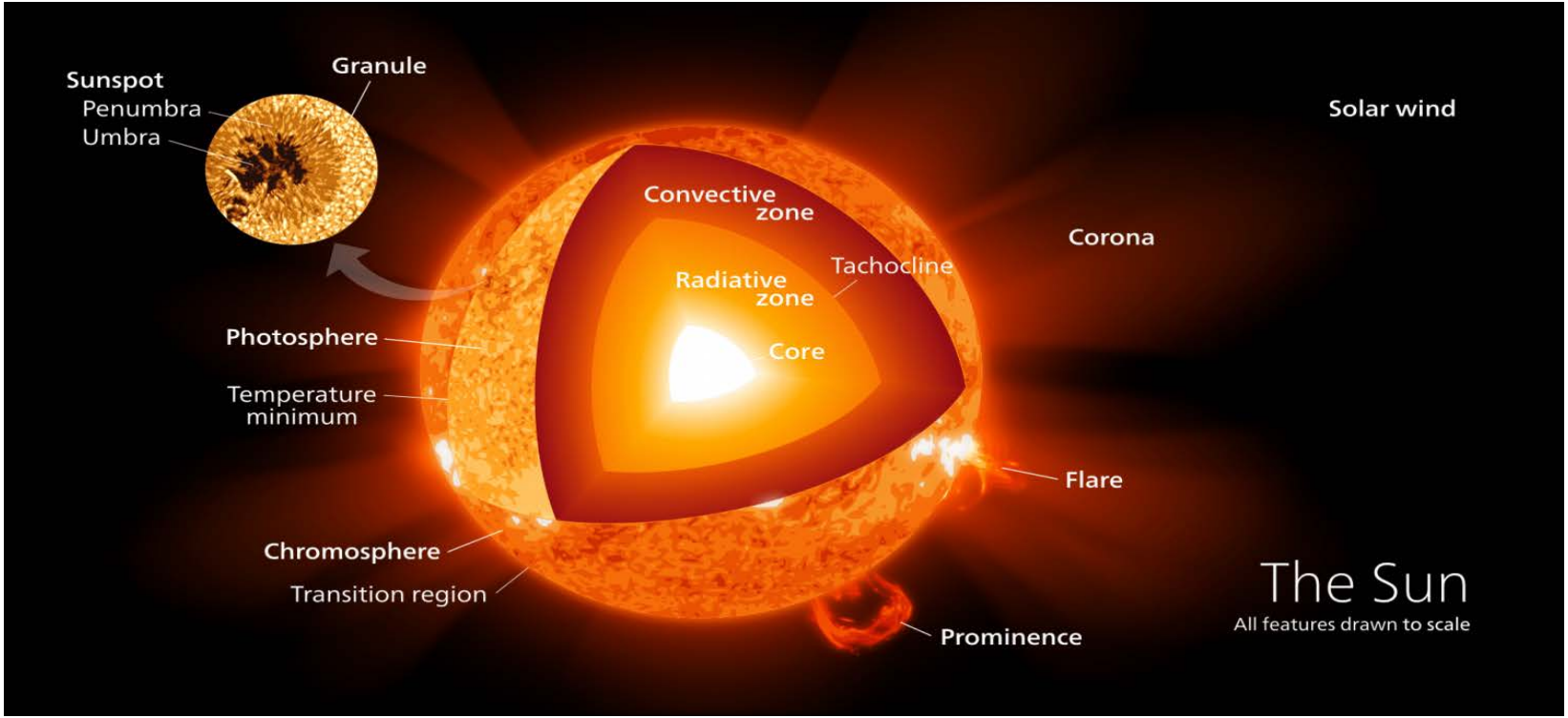
Environment V’s Comfort

- But why can’t we have high levels of comfort without damaging the environment?
- Well… we can
- If anything its better and cheaper!
- But we need to stop thinking short-term.
  Our homes and the environment need a long-term investment strategy. Clean and Green!

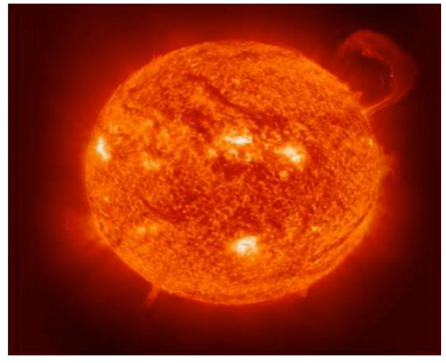
So how do we **Think Green**
and do things differently?

Healthy Living
Healthy Planet
Healthy Home

Health, Happiness, Well-being


Sunspot
Penumbra
Umbra
Granule
Solar wind
Convective zone
Corona
Tachocline
Radiative zone
Photosphere
Core
Temperature minimum
Flare
Chromosphere
Transition region
Prominence
The Sun
All features drawn to scale

Radiation of the Sun and the Earth



SOLAR RADIATION
Shorter Wavelength
(higher frequency) emits
MORE ENERGY

TERRESTRIAL RADIATION
Longer Wavelength
(lower frequency) emits
LESS ENERGY

- What is the best way to harness energy from Nature and then store it?
- More power from the sun hits the Earth in a single hour than humanity uses in an entire year!
- Yet solar only provided 0.39% of the energy used in the US last year
- If solar is 20% efficient at turning solar energy into power, we'd only need to cover a land area the size of Spain in solar panels to power the earth renewably in 2030

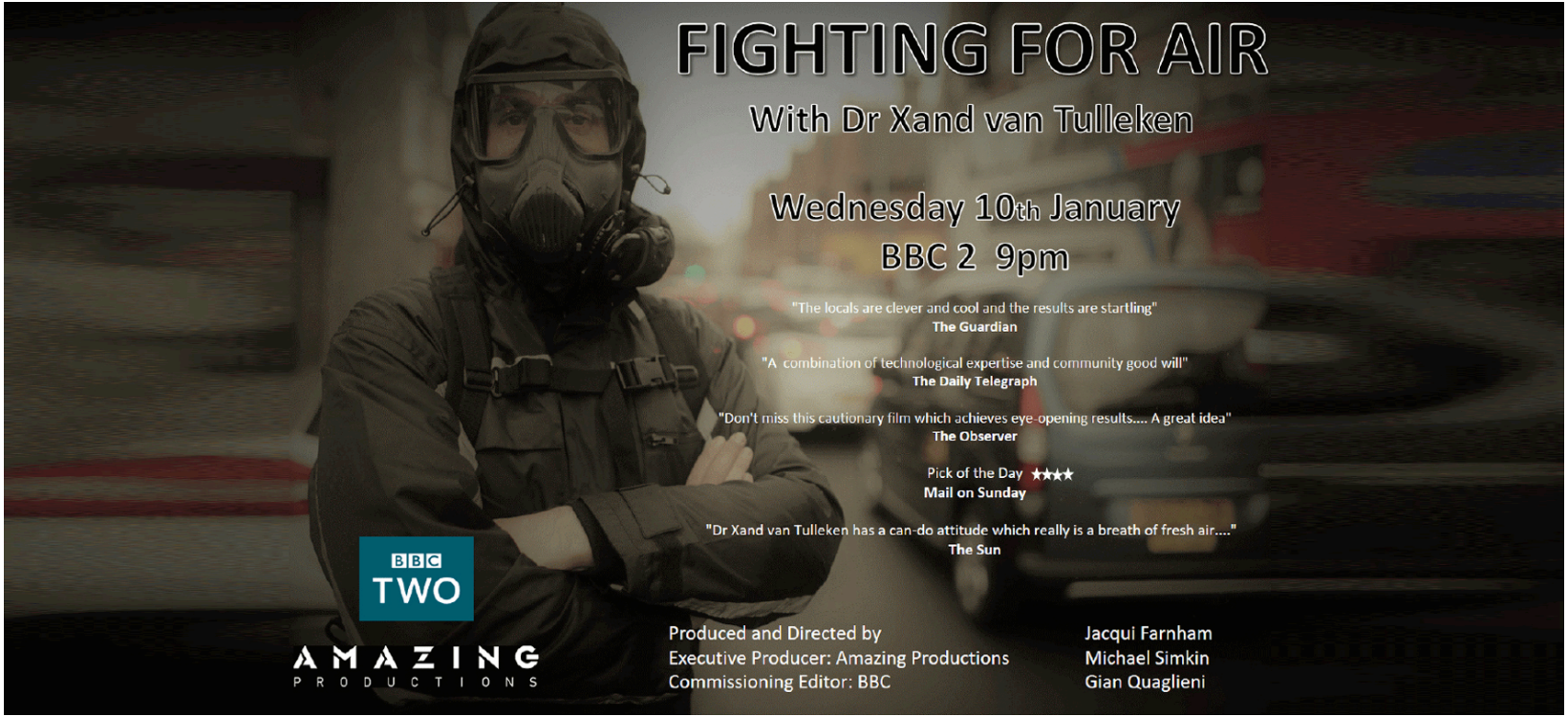
- To figure this out, the folks at Land Art Generator did the following math:

- **678 quadrillion Btu** (the US Energy Information Administration's estimation of global energy consumption by 2030) **= 198,721,800,000,000 kilowatt-hours** (simple conversion) **divided by 400 kilowatt-hours of solar energy production per square meter of land** (based on 20% efficiency, 70% sunshine days per year and the fact that 1,000 watts of solar energy strikes each square meter of land on Earth) **= 496,805 square kilometres of solar panels** (191,817 square miles)

All of the squares are about the size of Spain. Land Art Generator Initiative

- Think about how long it has taken us to change our mindset with cars, fossil fuels + emissions and we SEE this stuff everyday!

- We've hardly started with homes…but we need to **START** and **NOW!**

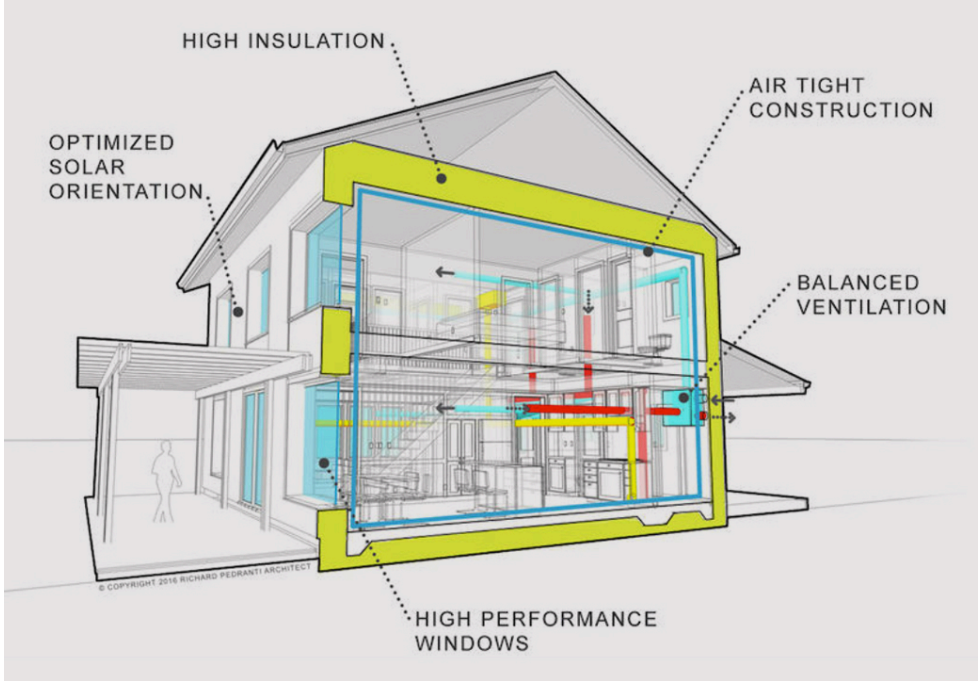

FIGHTING FOR AIR
With Dr Xand van Tulleken
Wednesday 10th January
BBC 2 9pm
"The locals are clever and cool and the results are startling"
The Guardian
"A combination of technological expertise and community good will"
The Daily Telegraph
"Don't miss this cautionary film which achieves eye-opening results.... A great idea"
The Observer
Pick of the Day ★★★★
Mail on Sunday
"Dr Xand van Tulleken has a can-do attitude which really is a breath of fresh air...."
The Sun
BBC TWO
AMAZING PRODUCTIONS
Produced and Directed by
Executive Producer: Amazing Productions
Commissioning Editor: BBC
Jacqui Farnham
Michael Simkin
Gian Quaglieni

MITSUBISHI ELECTRIC

We want better batteries

Heating Our Homes

- Super Thick Walls
- Super High Performance Insulation
- Triple Glazing



Renewable heating solutions for Housebuilders and Developers

The need for sustainable homes

There is currently a substantial under supply of housing stock in the UK. In order to meet the demand for new homes, the housing sector is set to increase its build rate.

This means that by the year 2050, over a third of the UK's housing stock will have been built inside of four decades. The Government is therefore focused on using this growth as the ideal opportunity to cut energy use in homes and is introducing legislation and guidelines in support of this.

Space heating and hot water account for almost three quarters of the total energy consumed in UK homes, so this is an obvious area to target to help combat rising energy bills and reduce CO_2 emissions.

Therefore the construction of hundreds of thousands of new homes is the ideal opportunity to change our approach to how we heat and provide hot water in a home. The use of heat pumps will help the UK fulfil its carbon emission obligations, as well as help consumers reduce their fuel bills.

Air Source Heat Pumps

- A clean and quiet revolution just waiting for us to wake up to!

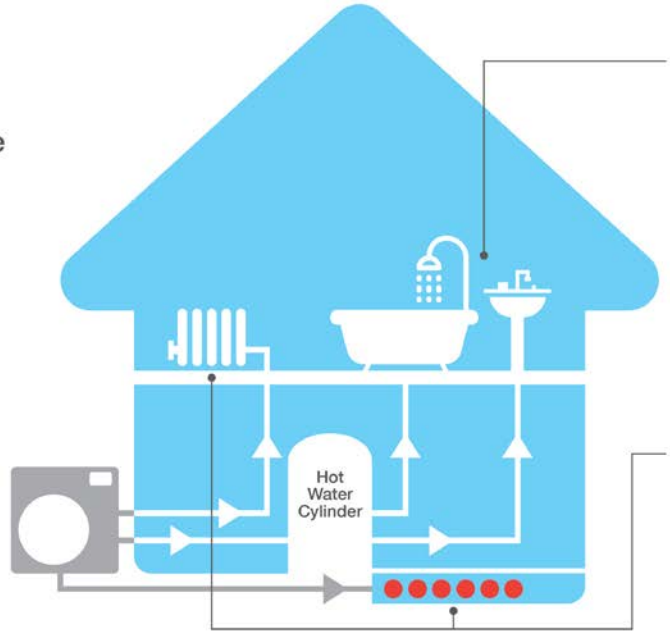
Air Source Heat Pumps

1

Air source heat pump takes in air from outside

2

Using electricity, the pump compresses the air and releases it at a higher temperature

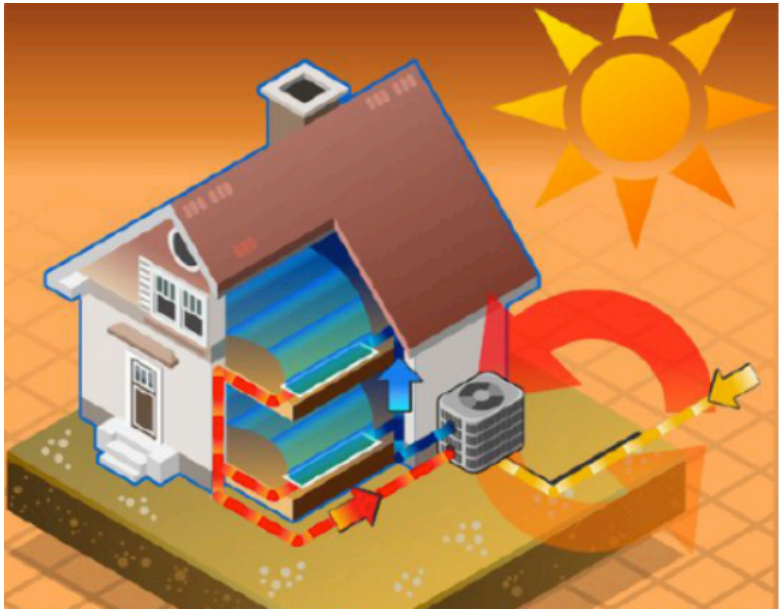


4

Stored hot water can be used for showers, baths and taps

3

Heat is sent to radiators and/or underfloor heating - the remainder is stored in a hot water cylinder



Ecodan - suitable for both new and existing homes

The Government is focused on the need for housing growth as an ideal opportunity to cut energy use in homes and continues to introduce legislation and guidelines to support this.

Buildings account for 44% of all UK CO_2 emissions (more than industry or transport)*4. As a nation we are now creating new low carbon houses, yet around 75% of existing homes will still be in use in 2050, so to a large extent our future housing stock is already built. If we can find ways of easily improving the efficiency of existing buildings we can make a dramatic difference to both CO2 emissions and energy use.

Ecodan provides a proven, efficient way of heating homes. The Government's Department for Business, Energy & Industrial Strategy (BEIS) will now pay for the generation of renewable heat through the Domestic Renewable Heat Incentive (RHI).

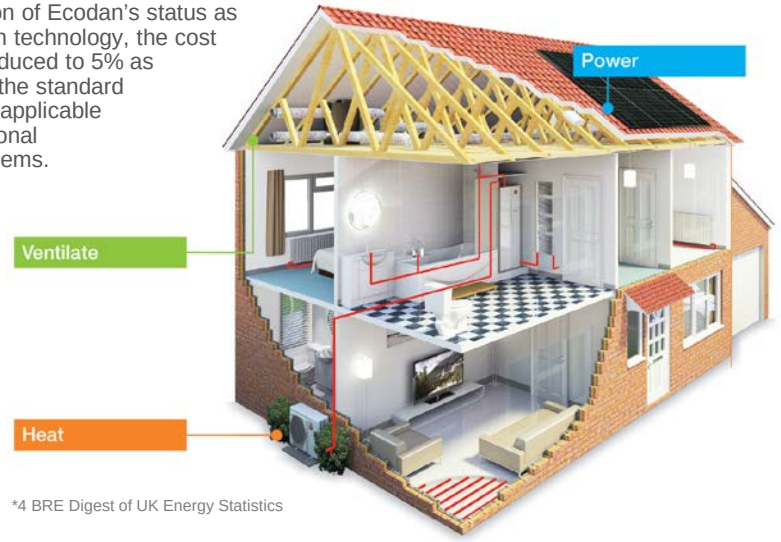
This has been designed to level the playing field between the cost of renewable and traditional fossil fuel systems.

Air source heat pumps are also covered by Permitted Development legislation because they can improve the efficiency of existing buildings, although noise levels must be taken into account.

Ecodan is recognised by the Noise Abatement Society and has received its prestigious Quiet Mark accreditation.

Before considering any heat pump, Mitsubishi Electric strongly recommends that basic thermal improvements are undertaken in these properties to provide the highest levels of thermal efficiency. These can include cavity wall insulation, loft insulation and double glazing.

In recognition of Ecodan's status as a low carbon technology, the cost of VAT is reduced to 5% as opposed to the standard rate of VAT applicable on all traditional heating systems.



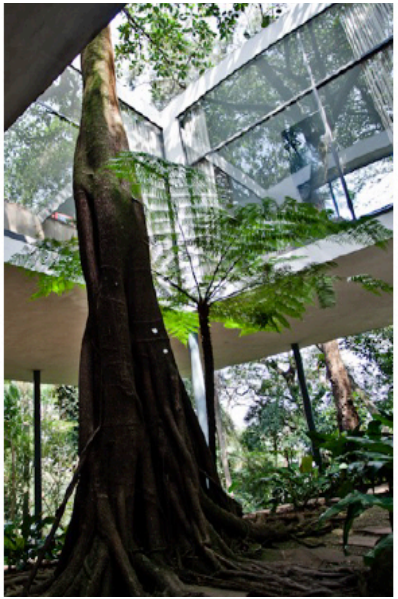
*4 BRE Digest of UK Energy Statistics

Buildings, materials and homecare products need to be part of a new **Circular Economy**

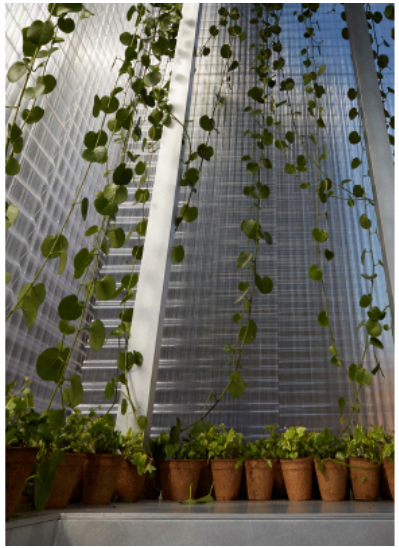
- Designing homes so they can be **‘made and made again’**
- Powering the home with renewable energy
- Creativity and innovation in **HOME** design can build a **‘Restorative Economy’**

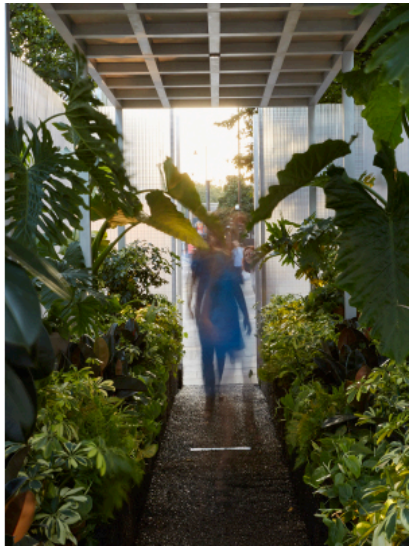
Respectfully integrating our ways of living with the environment

Engaging and responding to the natural environment

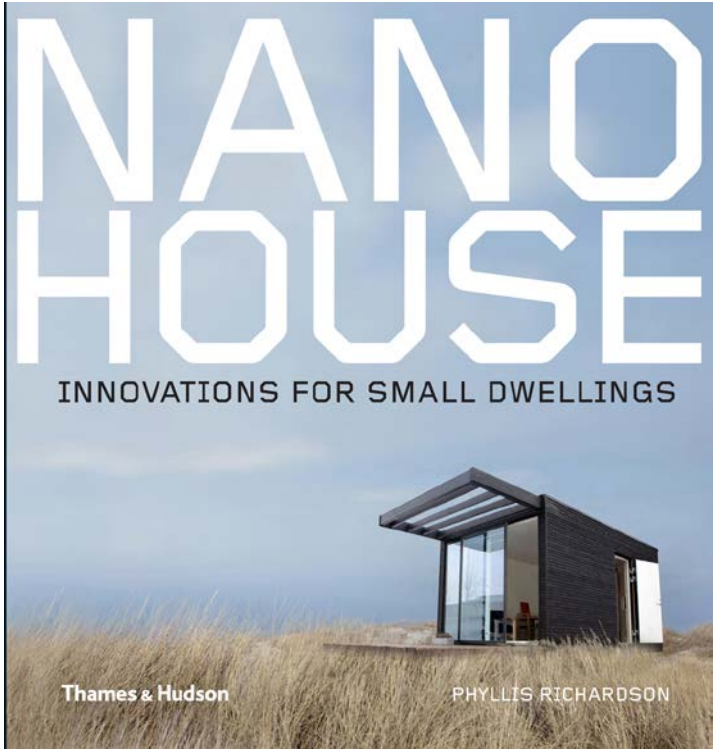



Green spaces in urban environments
Psychological wellbeing as well as health benefits



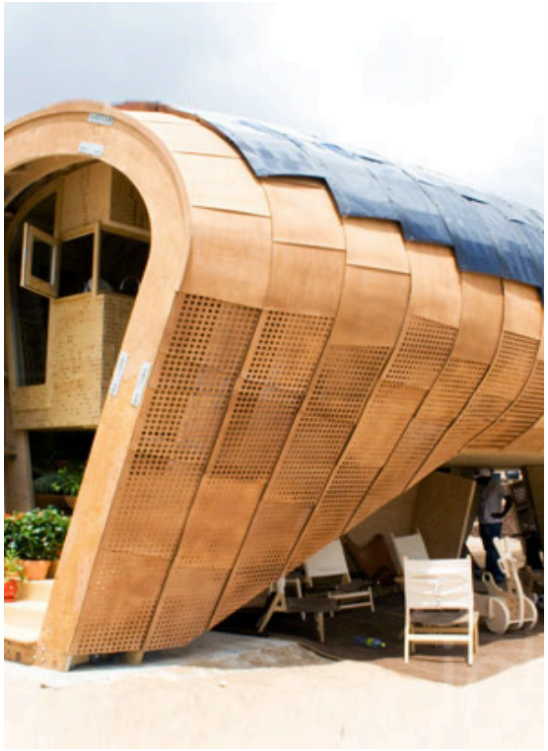

GEORGE CLARKE'S
amazing spaces


NANO
HOUSE
INNOVATIONS FOR SMALL DWELLINGS
Thames & Hudson
PHYLLIS RICHARDSON

Small can be beautiful!

Less to build, less cost, less volume to power and heat

Innovative, high quality, efficient but more importantly… **affordable!**



- We live in a time where people want to get more creative with space and how it works - pushing the boundaries of home design!

- The younger generations want to be **greener**… they want to live differently **SO** we need to design and build differently

WHY DON’T we build homes the same way we build cars?

How would mass housing change if one of these guys built a housing estate?

You know it wouldn't look like this!

MITSUBISHI ELECTRIC

INNOVATION + **EDUCATION**

Are vital to the creation of better quality homes

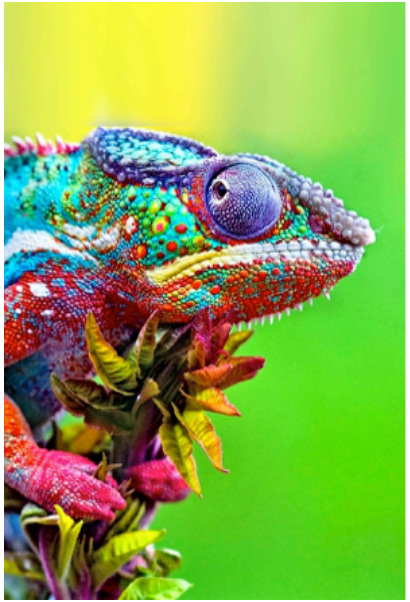
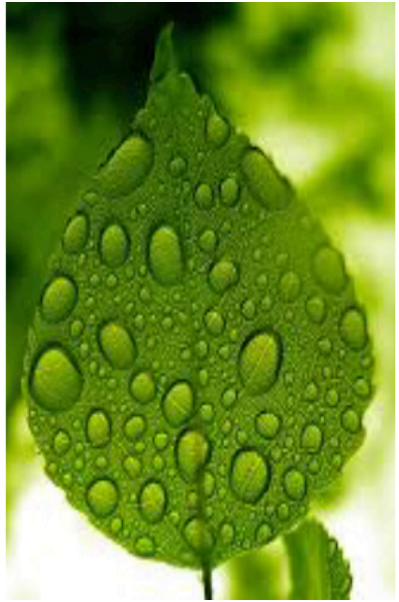
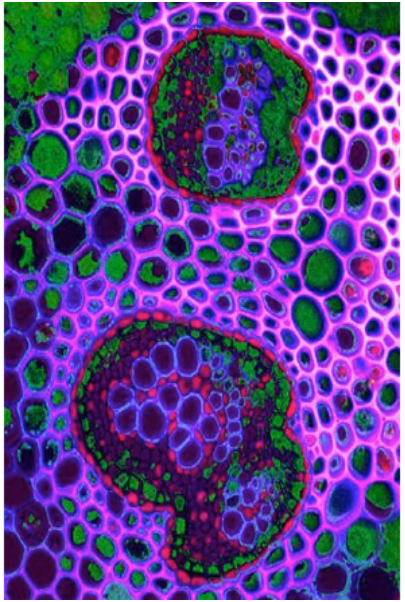
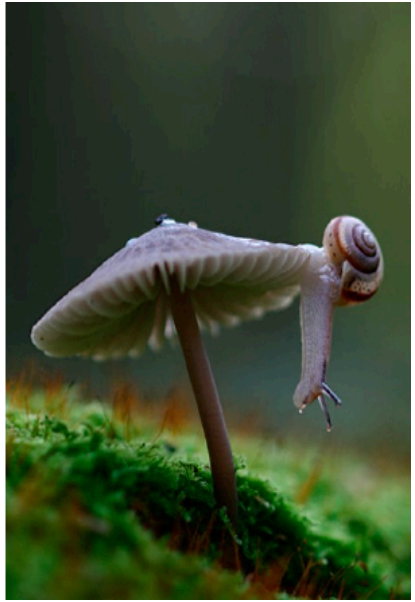
Working with **nature** rather than destroying it

Advanced, forward thinking...
Driving **Green Innovation**

Technology ‘replicating’ **nature**

Mother Nature - she’s pretty amazing!

Inspiration from Nature

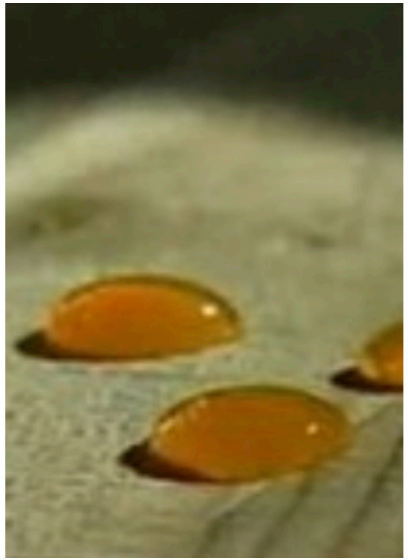





This might look good but its ecologically dumb. Why can't it have a responsive skin?

Nanotechnology surface coatings are going to transform our homes - R+D in surface design is moving fast

Can innovation in surface and material technology make everything harness energy?






And make our homes more intelligent, healthier and greener places to be

MITSUBISHI ELECTRIC

MOBIE

Ministry of Building Innovation and Education

Registered Charity No. 1175536

Registered with HMRC as a charity

What is MOBIE?

1. HOME
2. EDUCATION
3. INNOVATION
4. **NEW WAYS OF MAKING**

MOBIE
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What we do now

1. INSPIRING
2. INNOVATION
3. **RESEARCH + DEVELOPMENT**
4. SOCIAL MOBILITY
5. PARTNERING
6. TRAINING + RETRAINING
7. HOME BUILDING

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R+D

What we do now

1. INSPIRING
2. **INNOVATION**
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7. HOME BUILDING

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FE+HE COURSE

What we do now

1. INSPIRING
2. INNOVATION
3. RESEARCH + DEVELOPMENT
4. SOCIAL MOBILITY
5. PARTNERING
6. TRAINING + RETRAINING
7. **HOME BUILDING**

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INNOVATE IN BUILDING

What we do

1. INSPIRING
2. INNOVATION
3. RESEARCH + DEVELOPMENT
4. SOCIAL MOBILITY
5. PARTNERING
6. TRAINING + RETRAINING
7. **HOME BUILDING**

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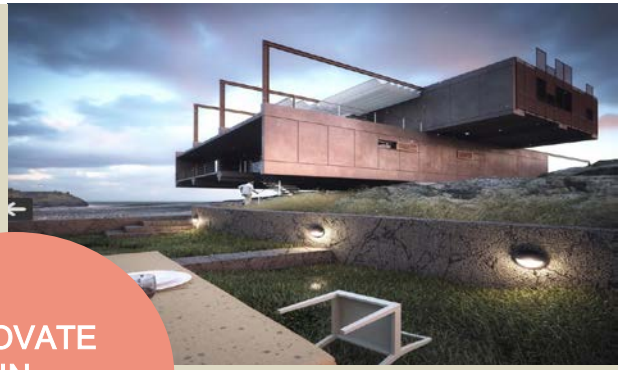

INNOVATE IN DESIGN

MITSUBISHI ELECTRIC

1. **INSPIRING**
2. INNOVATION
3. RESEARCH + DEVELOPMENT
4. PARTNERING
5. TRAINING + RETRAINING

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MOBIE KIDS

What we need to do to bring about change

CURRENT NATIONAL HOUSE BUILDING (BM:BEFORE MOBIE)

SLOW
UNINSPIRING

NO R+D

FUTURE OF INTERNATIONAL HOUSE BUILDING (AM:AFTER MOBIE)

HIGH-SPEED → R+D INTENSE → INSPIRING

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What we need to do to bring about change

GOOGLE search engine
launched September 1998

The **EGAN REPORT**,
rethinking construction
published November 1998

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MITSUBISHI ELECTRIC

How we design, build, heat, power and recycle our homes will be very different in the future… but the future needs to be today!

MITSUBISHI ELECTRIC

Thank you

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