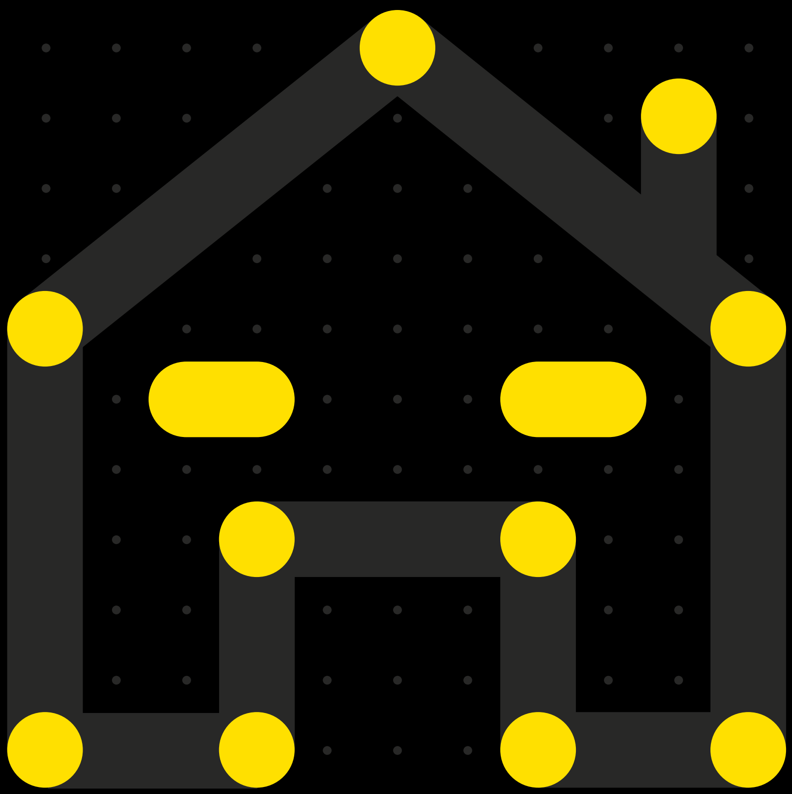
Renewing Britain

The changing landscape of home-grown energy 2008–2021



MCS has pioneered the installation of small-scale renewable energy technology across Great Britain and while we have been raising consumer confidence to invest in home-grown energy, we've also been monitoring uptake over the last 14 years.

This report outlines the journey since 2007 and shows the dramatic change in the landscape for low carbon technologies over the past 14 years. Crucially, it also provides us with insight to shape the future, showcases the many opportunities that are now open to us, and highlights the long-term policy framework needed from government to enable the sector to flourish.

We believe that small-scale renewables must play a crucial role in tackling the climate emergency and greening Britain's homes. Through raising consumer confidence and a supportive government policy framework, small-scale renewables can become the norm, and not the exception.

That's why we work to create a future where every UK home and business has renewable energy sources installed – supporting the growth of the sector, ensuring quality and helping deliver the government's commitment to Net Zero carbon emissions.

Contents

43

MCS registered installations in **2008**

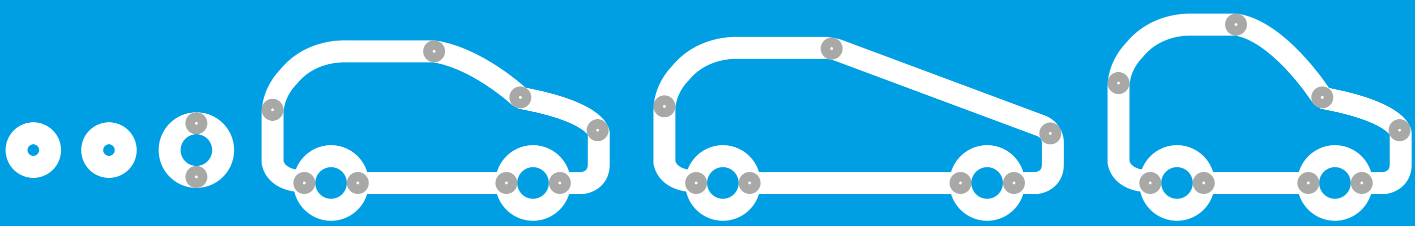
By **2020** there were 1.2m MCS registered installations

1,200,000

Since **2007**, the 1.2m MCS registered installations have saved nearly

10 million tonnes of carbon

That's equivalent to the **CO_2e emitted** by nearly



500,000 cars

every year for the past **ten years**

Our vision for the future of home-grown energy

1

Learn from successes

Particularly the success of renewables in rural areas

2

Set clear, ambitious, evidence-driven targets

To tackle gaps and drive an increase in installations

3

Devise an integrated package of support

To help households and property owners to access not just any renewable system, but the right system for them and the area they live in

4

Continuation of the redevelopment of MCS

To ensure high standards for the sector and to support new installers to become certified

5

Represent the sector

Through lobbying for issues that will support future growth in the number of people installing renewables in their homes so that it is an accessible option for everyone

6

Support initiatives that help grow the sector

Through the MCS Charitable Foundation's grants and research programme

MCS - The story so far

MCS (Microgeneration Certification Scheme) is a standards organisation at the heart of the UK's small-scale renewables sector. We support the sector to grow, and to ensure quality across all installations of low carbon technologies – whether that be Solar Photovoltaic (Solar PV), Heat Pumps, Biomass or Solar Thermal.

Since 2007, we have worked to significantly increase the uptake of small-scale renewable technologies across the UK, and to ensure quality and growth:

- Providing consumers with a quality mark and a scheme they can trust – supporting consumer confidence that their installation will meet MCS Standards
- Supporting installers through a quality assurance scheme backed by the sector's recognised Standards that allows them to differentiate their businesses
- Giving expert and unbiased information and guidance to the sector
- Representing the sector through lobbying for issues that will support future growth in the number of people installing renewables in their homes so it is an accessible option for everyone
- Enabling a zero carbon future through the work of the MCS Charitable Foundation.

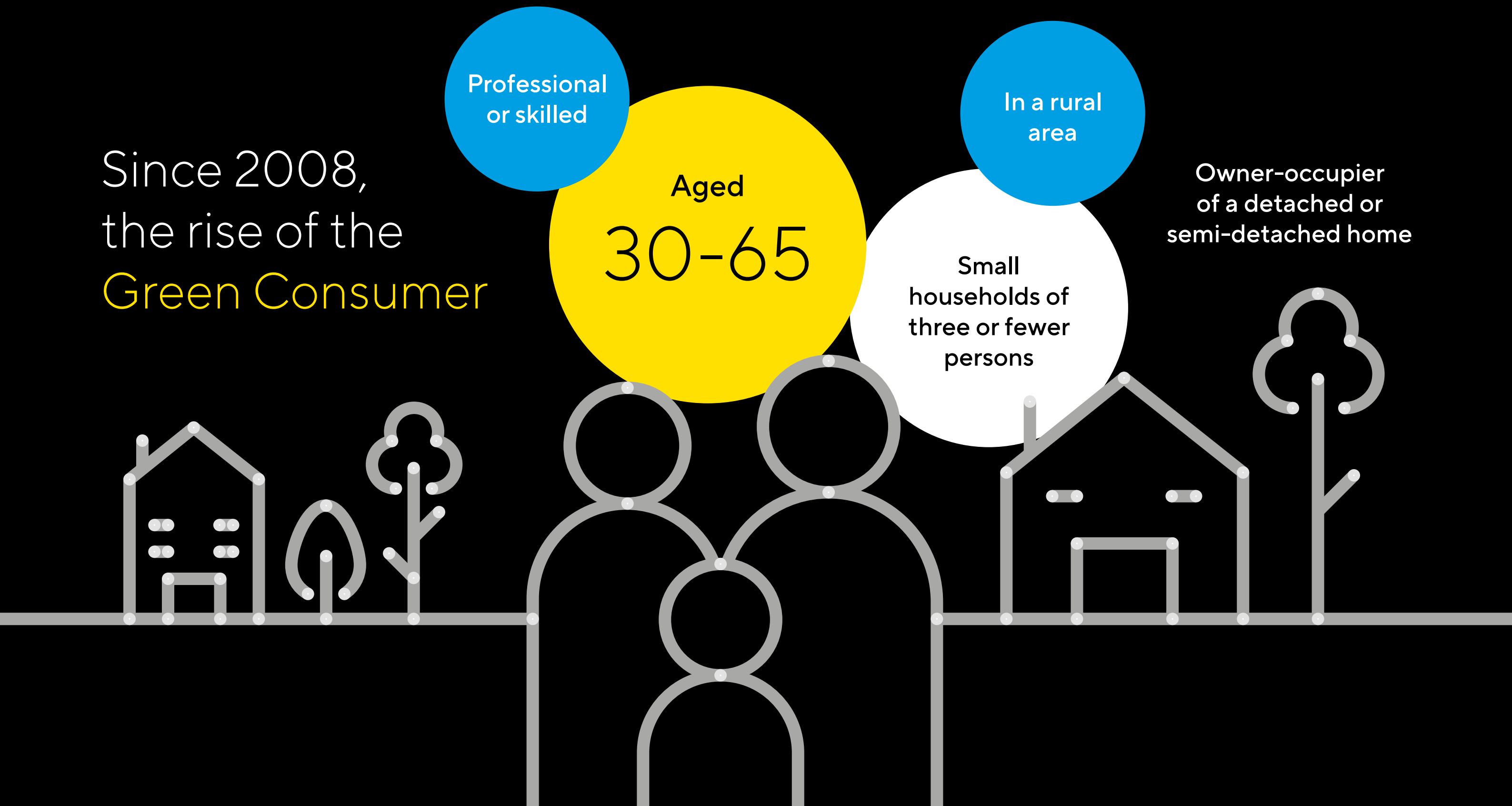
MCS is a mark of quality. Certification to MCS demonstrates adherence to the recognised industry Standards; highlighting quality, competence and compliance.

- In 2008, there were just 43 small-scale renewable installations registered under MCS. By the end of 2020, this figure had exceeded 1.2 million.
- Since 2007, MCS installations have saved nearly ten million tonnes of CO_2e
- The primary technology installed over the last 14 years is Solar PV, but in recent years we have seen a growth in the deployment of Heat Pumps.

MCS is a goldmine of data on installations of small-scale renewables in Great Britain. The MCS Installations Database (MID) holds the details of every MCS certified small-scale, low carbon installation in the UK since 2008. The Scheme is therefore in a unique position to provide data driven insights into the sector.

- MCS works together for the sector with our key partners:
  - Department of Business, Energy & Industrial Strategy (BEIS)
  - Ofgem
  - UKAS accredited Certification Bodies for the certification of manufacturers' products and installation contractors
  - CTSI approved Consumer Codes - RECC, HIES and GGF for the protection of consumers
  - Trade Associations such as Solar Energy UK, Ground Source Heat Pump Association (GSHPA), the Heat Pump Association (HPA) and Heat Pump Federation (HPF)
  - Gemserv as the previous operators of the Scheme
- Top five renewable technologies: Solar PV (86.36 % of all installations), Air Source Heat Pump (7 %), Solar Thermal (2.86 %), Ground/Water Source Heat Pump (1.67 %) and Biomass (1.58 %). Other technologies including Wind, Micro Combined Heat and Power (Micro CHP), Exhaust Air Heat Pump and Solar Assisted Heat Pump, account for less than 0.6 % of all installations.

Since 2008, the rise of the Green Consumer



Foreword

The UK domestic renewable energy sector has radically changed since MCS was formed in 2007. Since then, nearly 1.2 million homes have been fitted with renewable energy technology and the cost of Solar PV-based installations has dropped by approximately 60 per cent.

When we started out, installation numbers were very low. In fact, in 2008 there were just 43 small-scale renewable installations recorded with MCS. Before this, installations were taking place in very low numbers by the sector's pioneers and early adopters.

Our mission was to transform that landscape and make low carbon technologies the norm, and not the exception – to raise consumer awareness of the technologies available and ensure quality, compliance, and competence across the sector.

The sector has seen government policy initiatives come and go - these have had an impact on adoption rates of small-scale renewables to varying degrees of success.

There is still a lot to do to make small-scale renewables accessible and the first choice for all UK homeowners; to support the growth of the sector, ensure quality and consumer confidence, and support a zero carbon future.

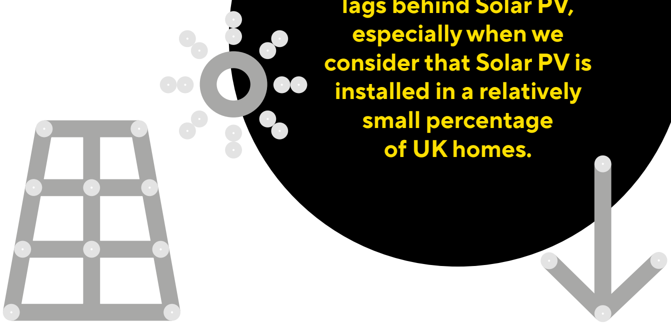
This report offers a comprehensive analysis of what has gone before. It is essential that we now consider the future of the sector in light of these findings and the important contribution that small-scale renewables can make in the fight against climate change.

What's clear is just how far renewable heat lags behind Solar PV, especially when we consider that Solar PV is installed in a relatively small percentage of UK homes. Renewable heat will need to be installed in the majority of homes for the decarbonisation of heating to make a necessary and critical contribution to achieving the UK's Net Zero carbon emission targets. It is also striking how policies such as the Feed in Tariff (FiT) have successfully stimulated market and consumer adoption. An unsubsidised market for low carbon heating will not reach the key levels of deployment. MCS is calling for a policy environment that provides longer-term support for the sector and homeowners.

> **MCS will continue to work with industry to define, maintain and improve quality – certifying products and installers to build consumer confidence in low carbon technology.**

From solar and wind, to heat pumps, biomass and battery storage, we want to inspire a new generation of home-grown energy, fit for the needs of every UK home and community.

Ian Rippin
Chief Executive Officer
MCS Service Company



What's clear is just how far renewable heat lags behind Solar PV, especially when we consider that Solar PV is installed in a relatively small percentage of UK homes.

A clear priority for all UK governments must be housing, as up to 30 per cent of carbon emissions are generated by our homes and the materials used to construct them.

MCS Charitable Foundation

Our vision is a world where everyone has access to affordable and reliable renewable energy and low carbon technologies – for the benefit of our environment, our communities and the general public. As a Foundation we work to increase public confidence, awareness and access to renewable energy and low carbon solutions across the UK. We support education and engagement programmes, fund research and facilitate innovative solutions to drive widespread adoption. We use the evidence from this work to inform our advocacy on public policy. The Foundation also oversees MCS which defines, maintains and improves quality standards for renewable energy at buildings scale.

Foreword

In the face of the climate emergency, it's imperative we take urgent action to decarbonise our society. It's clear that UK governments need to develop an integrated and transparent roadmap with timelines and milestones on how they intend to reach Net Zero in the quickest possible timeframe.

At MCS our aim is to accelerate the widespread adoption of renewable energy and low carbon technologies to help achieve a zero carbon future. We intend to support the governments across the UK to achieving Net Zero as soon as possible. A clear priority for all UK governments must be housing, as up to 30 per cent of carbon emissions are generated by our homes and the materials used to construct them.

The need to provide low carbon solutions has never been greater. We want everyone to have access to affordable and reliable renewable energy, so that we can have warm, comfortable homes as part of a resilient, zero carbon future.

MCS Charitable Foundation provided the funding to upgrade the MCS Installations Database (MID) and enable this study to take place. This report, and the MID more broadly, will be a really valuable tool to policy-makers, researchers and the renewables sector in understanding the trends and patterns of the last 14 years and setting policies to deliver the transformational change the industry needs to flourish.

The domestic renewables sector has come a long way since MCS started in 2007. This report underlines the scale of what needs to be done to transform homes and communities across the country, address the climate emergency and create a resilient and greener future.

We look forward to working with the renewables sector, other policy organisations and government to advance and promote the solutions demanded by the scale of the challenge.

Adrian Ramsay
Chief Executive Officer
MCS Charitable Foundation

MCS CHARITABLE FOUNDATION

Setting the scene

This ground-breaking report provides the very first in-depth analysis of those 1.2 million records. We looked at the data alongside various official external sources to understand the current picture, how we arrived at this point, and what lessons we might learn to maximise the contribution that renewable energy in homes could make to the UK achieving Net Zero by 2050.

MCS has worked with partners rb&m (**www.r-b-m.com**) who researched and wrote the main body of this report.

The context

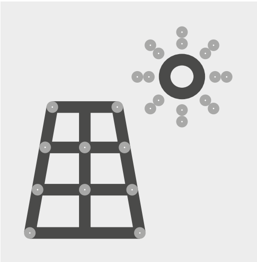
The government recognises the need for a mass roll out of low carbon heat technologies throughout the 2020s[1] to achieve its target which commentators say *'requires the rapid decarbonisation of energy use… alongside the rapid deployment of clean renewable technologies*[2].

Established subsidy schemes to incentivise the installation of small-scale renewables, like Feed in Tariff (FiT) and Renewable Heat Incentive (RHI) have either closed (FiT) or will come to an end (RHI) in March 2022. The year 2020 saw the launch of a Smart Export Guarantee in place of FiT, a Green Homes Grant to fund measures including renewables and consideration of a Clean Heat Grant Scheme to replace the RHI from 2022. With MCS at the heart of all three schemes, now is a good time to reflect on what MCS data suggests these changes might achieve.

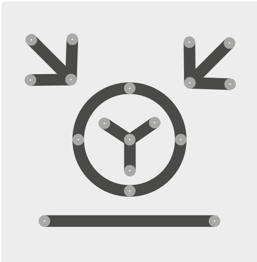
1 BEIS. Consultation Stage IA: Future Support for Low Carbon Heat. 2020. Available at: **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/881623/future-support-for-low-carbon-heat-impact-assessment.pdf** (Accessed: 12 November 2020)

2 Solar Trade Association. 2020. Smart Solar Homes. 2020. Available at: **https://www.solar-trade.org.uk/smart-solar-homes/** (Accessed: 3 November 2020)

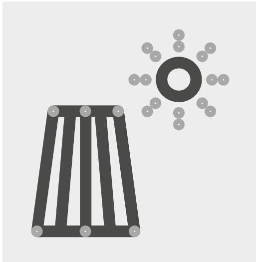
The main focus of this report is on **the five major technologies** that have been deployed at the largest scale



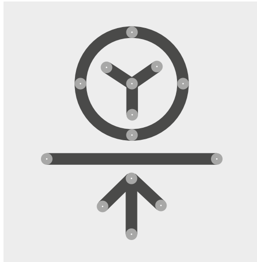
Solar PV



Air Source Heat Pump



Solar Thermal



Ground/Water Source Heat Pump

Biomass

MCS Installations Database

Since the late 2000s, MCS has been gathering data in the MID from MCS certified installers and other third parties. This has generated a wealth of information on the deployment of microgeneration in UK homes and communities. The extensive data gives a unique insight into where and when installations took place, the technologies and the individual products deployed.

Data integrity

As with all large datasets that are maintained by multiple users, we have needed to cleanse the data prior to analysis, removing anomalies and obvious outliers. As a result, a small proportion of data has been disregarded, mainly due to invalid details; for example, a missing address.

Where we've used external data to enhance our own and provide further market intelligence, we've taken care to ensure that this data matches the date range and geography of MID records as far as possible. For example, we have approximated UK census data to within a few months, instead of making a precise match to the date of every installation.

Data sources

MCS and partners rb&m, worked with data technology specialists Quanovo, to conduct the in-depth data analysis in this report. Quanovo used MID data augmented with external data from the UK Census and the Office of National Statistics (ONS). Other external datasets have also helped us tell the wider story of microgeneration uptake, based on factors such as gas network connections, rural/urban populations and gross disposable household income. Demographic and household data has also helped us to profile the green consumer i.e. the typical consumer who adopts microgeneration in their home.

Data scope

It is important to note that MCS certification is not a mandatory requirement and as such MCS data does not capture all small-scale renewable installations in the UK. However, MCS certification has been the route to government incentives such as FiT and Domestic RHI, so we are confident that the installation data represents the majority of microgeneration deployment in England, Wales and Scotland since 2007.

The new build sector over this period has not seen the same incentives as the retrofit market. MCS data extends to self-build but does not typically include new build, unless the builder chooses to register their installations with MCS. This is an area where MCS feels there is a gap in the current UK quality and assurance framework.

For the purposes of this report, we have not used MID installation data for Northern Ireland as the volume of records is very small. This is because Renewables Obligation Certificates (ROCs) payments were available under the NIRO (Northern Ireland Renewables Obligation) Scheme. ROCs payments do not mandate MCS certification, meaning that the majority of installations in Northern Ireland are unlikely to have been recorded on the MID. MCS data is therefore unlikely to provide an accurate representation of the installation uptake in Northern Ireland over the last 14 years.

The scope of technologies covered in MCS is up to 50kW for electricity generating technologies such as Solar PV, and up to 45kW for heat generating technologies such as heat pumps (up to 70kW for multiple products installed in one system). There are currently nine renewable technologies certified under the Scheme. However, the main focus of this report is on the five major technologies that have been deployed at the largest scale: Solar PV, ASHP, G/WSHP, Solar Thermal and Biomass. Other technologies recorded on the MCS database include Micro CHP, Exhaust Air Heat Pumps (EAHP), Gas Absorption Heat Pumps, and Hydro.

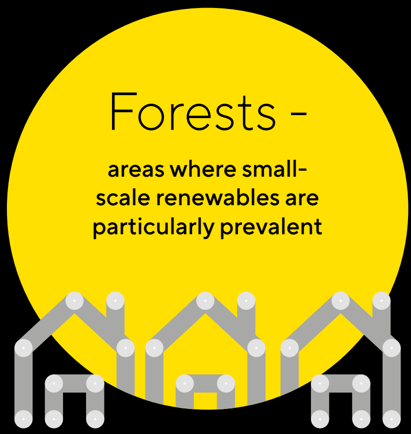
Small-scale renewables in Great Britain

An overview of the changing landscape 2008 – 2020

The landscape for small-scale renewables has changed dramatically over the past 14 years, creating forests (areas where small-scale renewables are particularly prevalent) and deserts (areas where small-scale renewables are scarce) of installations, and providing huge carbon savings.

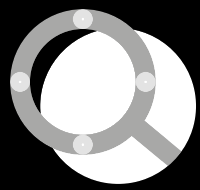
Forests –

areas where small-scale renewables are particularly prevalent



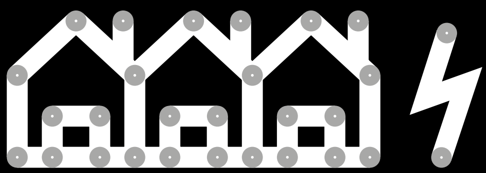
Deserts –

areas where small-scale renewables are scarce



2008 2020

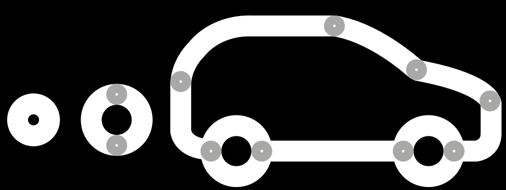
43 — Total small-scale MCS renewable installations — 1.2million



34,000GWh generated

More than **34,000GWh** of electricity and heat energy generated. That's roughly the amount of electricity 9.65 million homes use in a year.

Total generation



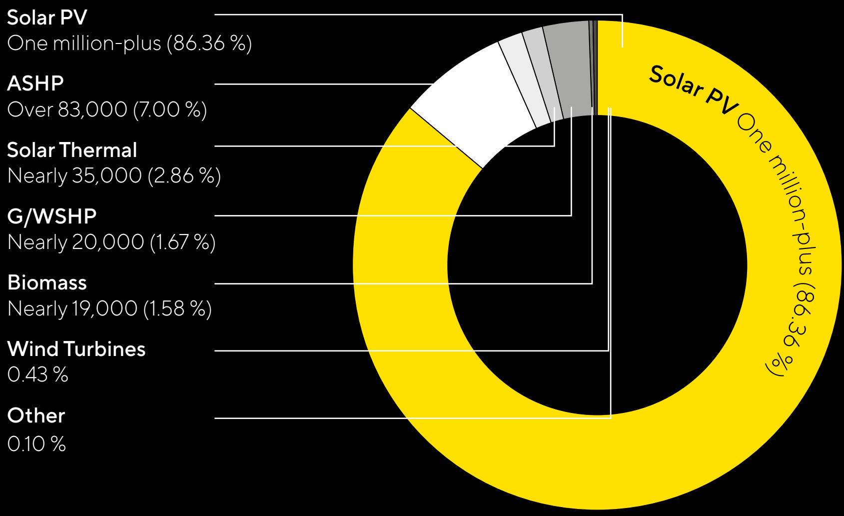
10m tonnes of CO_2e saved

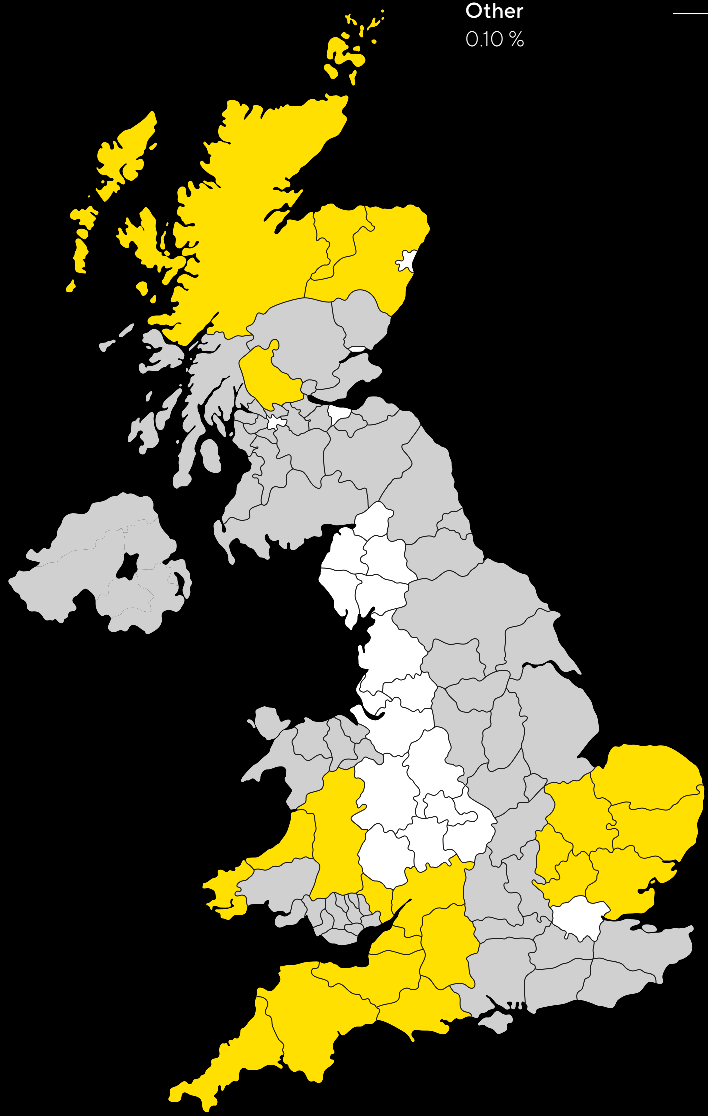
Close to ten million tonnes of carbon (CO_2e) saved: equivalent to the emissions from **4.4 million gas-fuelled homes** or the CO_2e emitted by **nearly half a million cars every year** for the past **ten years**.

Carbon savings

Small-scale renewable technologies as a percentage of total installations

- Solar PV
- ASHP
- Solar Thermal
- G/WSHP
- Biomass
- Wind Turbines
- Other





How small-scale renewables have been adopted across the country – creating forests and deserts of renewable technologies

Forests (mainly rural):

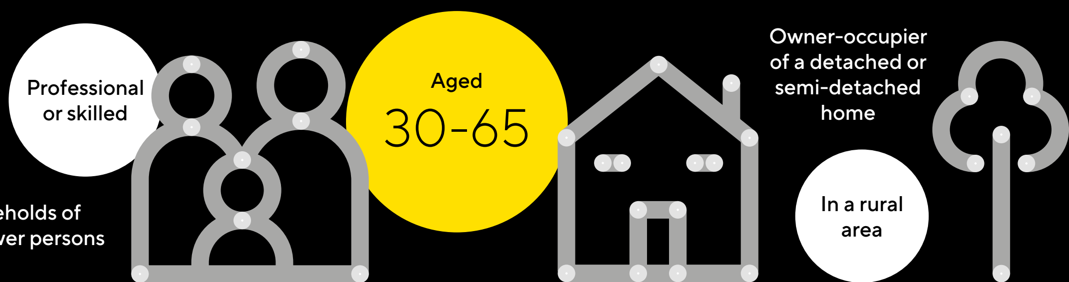
- South West, East of England, remote parts of Scotland, Wales
- Orkney Islands, Western Isles, Mid Devon, Stirling
- Cornwall, the Highlands, Aberdeenshire: relatively few homes, but high numbers of small-scale renewable installations for heat technologies, off-gas-grid homes.

Deserts (mainly urban):

- Greater London, North West, West Midlands
- Edinburgh, Glasgow, Dundee and Aberdeen.

Since 2008, the rise of the Green Consumer

The following groups have been found more likely to install small-scale renewables in their homes



The changing landscape of small-scale renewables since 2008

Our data reveals that there are small-scale renewables across Great Britain in varying degrees, with Solar PV in particular in every corner of the land. The path by which we arrived at this picture has not been a slow and steady one, nor has it resulted in an even spread of installations.

2008

Just **43 MCS certified small-scale renewable installations**, the bulk of which were Solar PV (20 installations) and GSHPs (ten). No local authority had more than two installations.

2009

2,739 installations which were relatively evenly spread.

2011

A peak of **220,965** installations with concentrations in the Orkney Islands, and broadly in the South West, Wales and East of England.

2019

A fall to **73,601** which were fairly evenly spread.

2020

A total of **51,794** installations; the majority were Solar PV and a quarter were Air Source Heat Pumps.

24,000
Cornwall

32
City of London

Which areas have adopted small-scale renewables?
In pure numbers, the picture for 2020:

- Cornwall, with more than two per cent of all small-scale renewable installations (24,000)
- Wiltshire (1.16 %, 13,044 installations)
- Highland (0.94 %, 10,587)
- County Durham, Northumberland and Peterborough all have more than 10,000.
- Sunderland, Aberdeenshire and Shropshire have more than 9,000 installations.

At the other end of the scale:

- Eight out of ten of the bottom local authorities (LAs) are London boroughs
- The Isles of Scilly have just 79 installations
- The City of London has just 32.

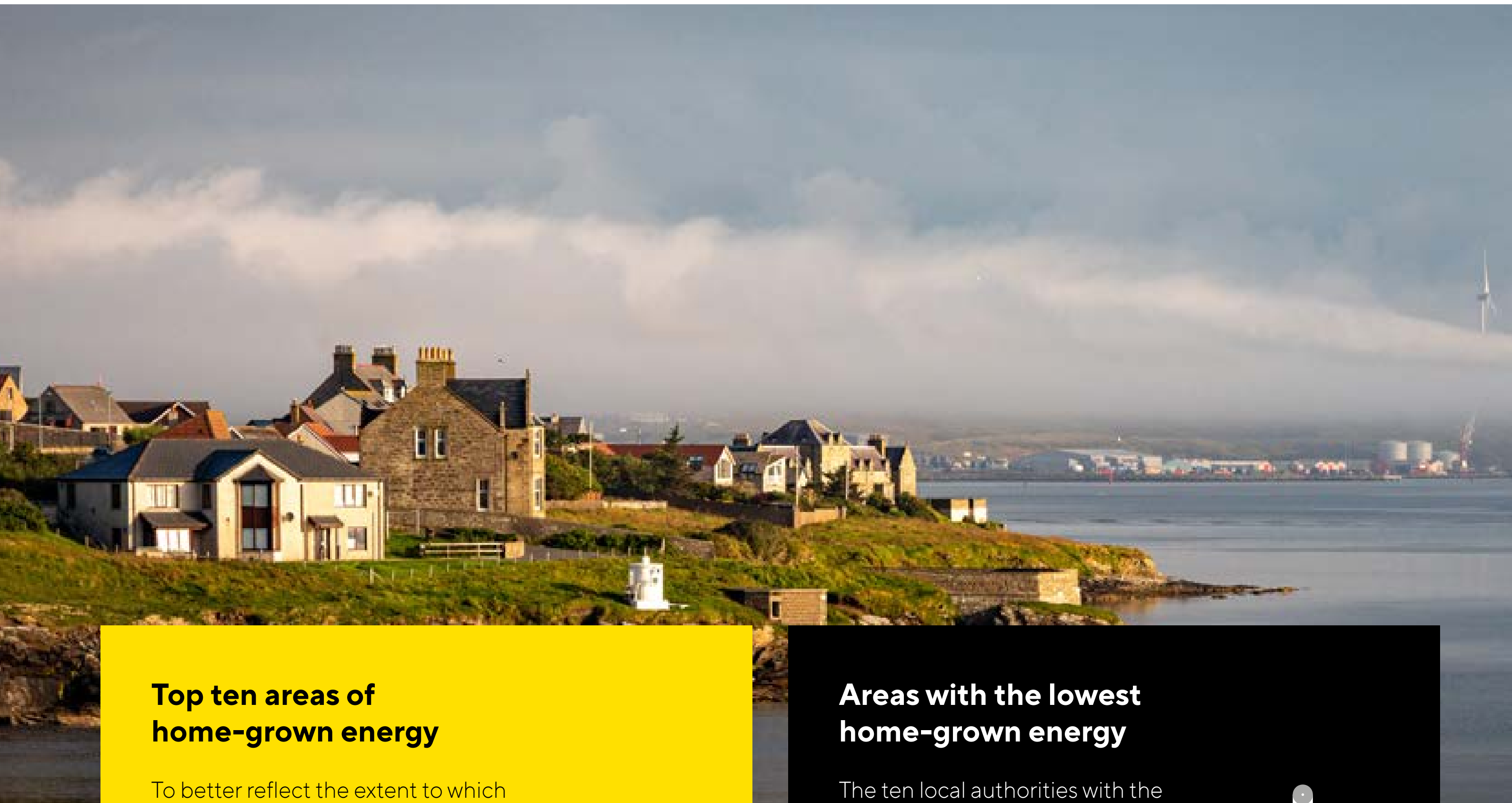
Looking at pure numbers tells us little about market penetration in an area. When we compare two local authorities with similar numbers of installations, the installation rates are very different, due to different household densities and building types:

One in 128

Hackney in London: 803
small-scale renewable installations = **one in every 128 households**

One in 13

The Shetland Islands: 799
small-scale renewable installations = **one in every 13 households** which is nearly ten times the rate in Hackney.



Top ten areas of home-grown energy

To better reflect the extent to which renewables have been adopted in an area, we calculated the number of MCS certified installations as a percentage of the number of households in a local authority since 2008.

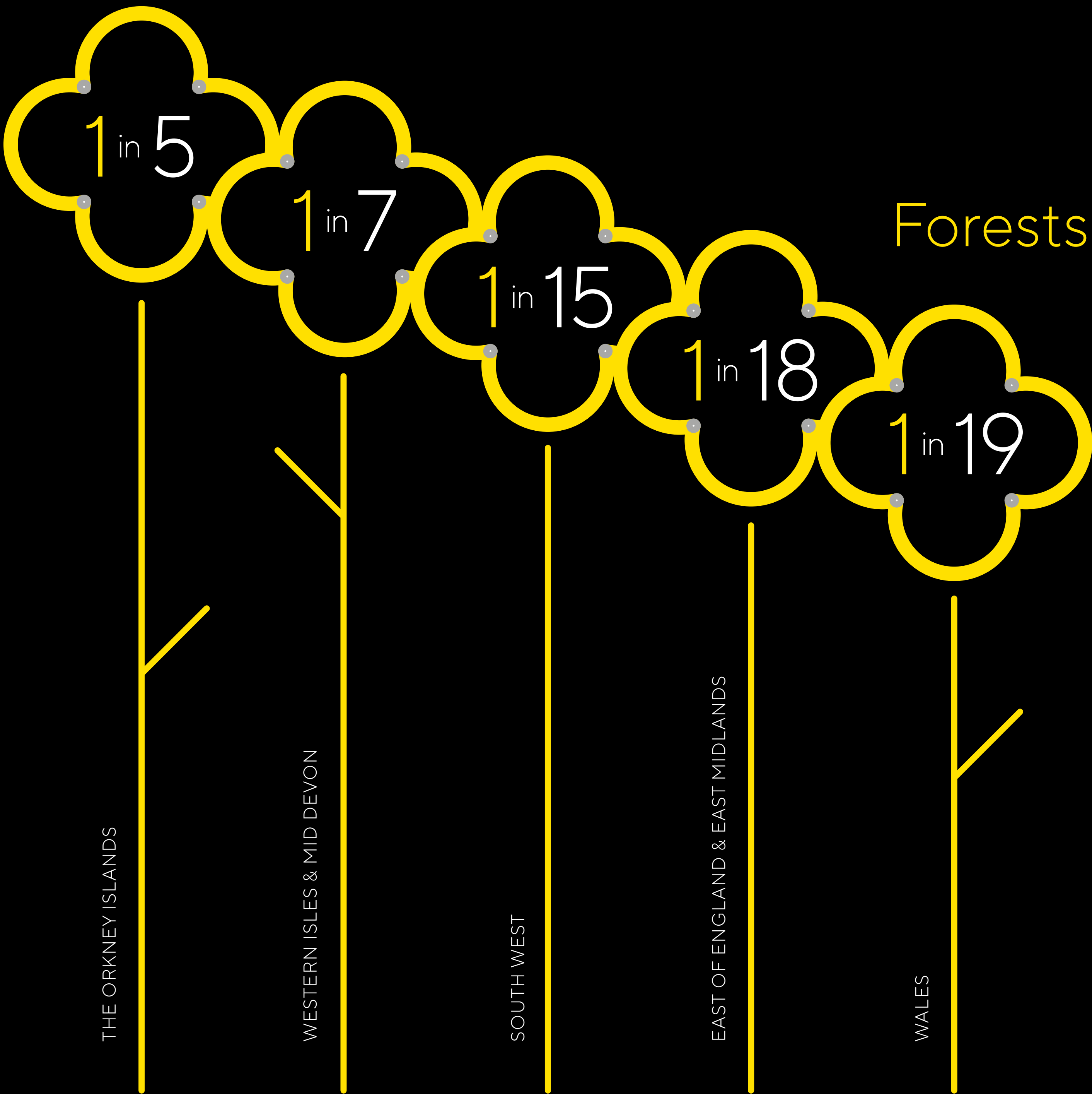
1. Orkney Islands - 20.80 %
2. Western Isles - 14.95 %
3. Mid Devon - 14.56 %
4. Stirling - 14.10 %
5. Peterborough - 13.04 %
6. South Cambridgeshire - 12.61 %
7. South Hams - 12.19 %
8. Torridge - 12.08 %
9. Mid Suffolk - 11.44 %
10. South Norfolk - 11.20 %

Areas with the lowest home-grown energy

The ten local authorities with the lowest percentage of households with an MCS certified installation.

- Wandsworth - 0.79 %
- Lambeth - 0.79 %
- Hackney - 0.78 %
- Islington - 0.75 %
- Camden - 0.73 %
- Tower Hamlets - 0.69%
- Hammersmith and Fulham - 0.61 %
- City of London - 0.58 %
- Westminster - 0.49 %
- Kensington and Chelsea - 0.30 %

Forests and deserts of small-scale renewables



The Orkney Islands - a small-scale renewable powerhouse. More than one in five households have one or more technologies.

The Western Isles and at the other end of the UK, **Mid Devon**, which both have an installation rate of around one in seven households.

Regionally, **the South West** has the highest proportion of small-scale renewables, with numbers of installations amounting to one for every 15 households (6.76 per cent).

In the **East of England** and the **East Midlands** the rate is one in every 18 households.

In Wales **one in every 19** households.

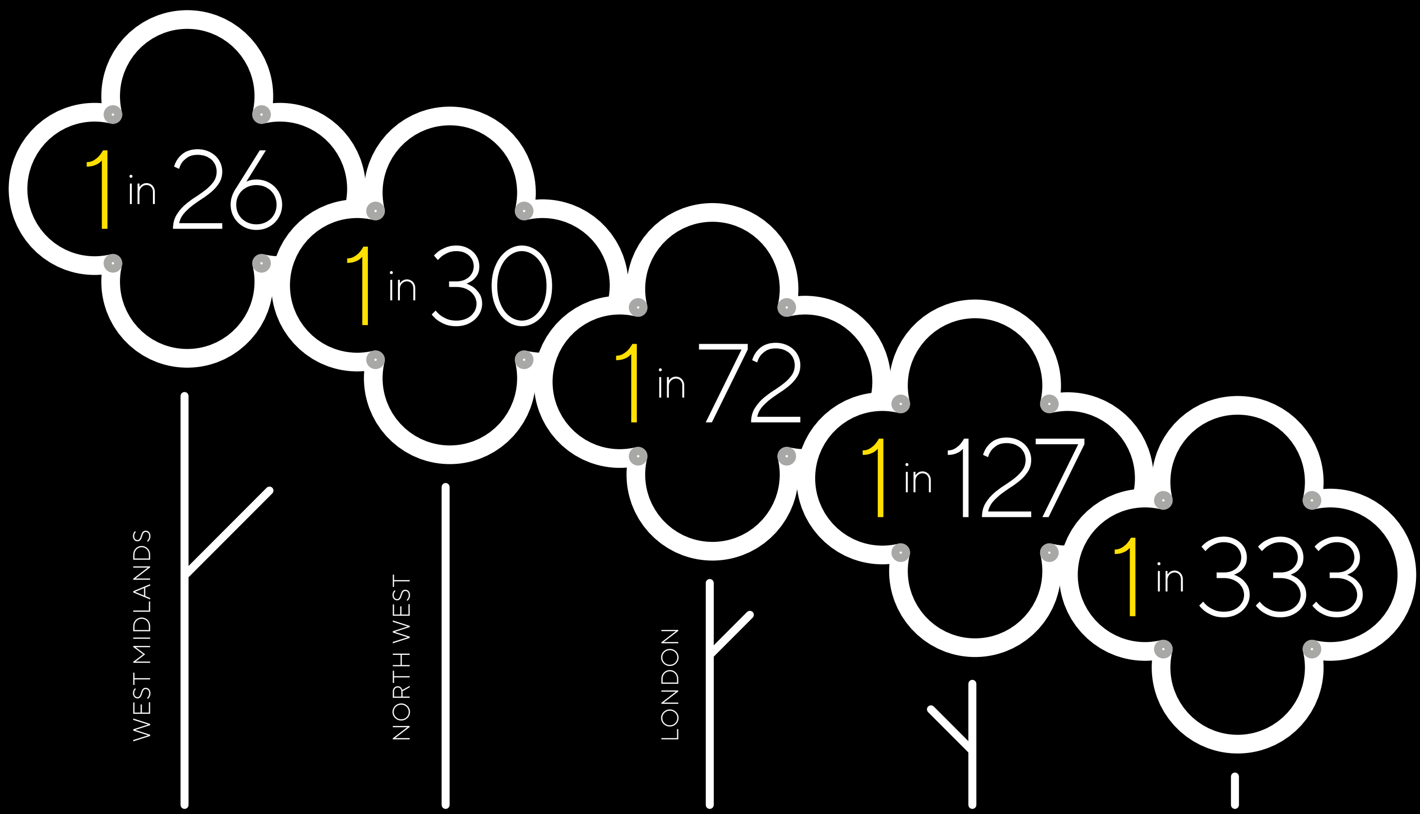
Mapping MCS data against a range of official statistics allows us to identify whether there are common characteristics of areas where small-scale renewables are particularly prevalent or absent – creating forests or deserts of renewable technologies.

Using official statistics, we compared the rate of installation with how urban or rural a local authority area is, to what extent they are on or off the gas grid, average income and levels of fuel poverty.

<5%

Many local authorities have an installation rate of fewer than five per cent of households, including most of Lancashire, West Yorkshire, the West Midlands, Greater London and South Wales

Deserts



The **West Midlands** one in every 26 households.

The **North West** one in every 30 households.

Regionally, **Greater London** is lowest (one in every 72 households).

The bottom ten LAs - with the lowest rates of small-scale renewables installation - are all **London boroughs**, with a rate of fewer than one in every 127 households with any renewable technology.

London's Kensington and Chelsea has the lowest rate of all; fewer than one in every 333 households.

How technologies have differed in urban or rural locations since 2008

Using government statistics[3][4] to classify local authorities (LAs) as predominantly rural or urban, we looked at the distribution of MCS certified installations of each technology in terms of the rural/urban split.

We found:

- A strong correlation between high installation rates and rural location (i.e. where most or many homes in a local authority are in Rural Designated Areas). Demand for microgeneration tends to be much higher in rural areas and very high in some remote locations.
- Less rural areas - Greater London, Aberdeen, Dundee, Edinburgh, and Glasgow - are small-scale renewable deserts.
- On average, in the 40 LAs with the highest rate of Solar PV installations, half of the homes are in Rural Designated Areas.
- Heat technologies, and ASHPs in particular, are most concentrated in remote rural areas, with the Scottish Island groups having the highest percentage per household.

18

18 out of the top 20 LAs by rate of small-scale renewable installations are rural or semi-rural

20

3 Office for National Statistics. (2013). Rural Urban Classification (2011) of Output Areas in England and Wales. Available at: **https://geoportal.statistics.gov.uk/datasets/rural-urban-classification-2011-of-output-areas-in-england-and-wales** (Accessed: 20 July 2020).

4 Scottish Government. (2018). Scottish Government Urban Rural Classification 2016. Available at: **https://www.gov.scot/publications/scottish-government-urban-rural-classification-2016/pages/2/** (Accessed: 21 July 2020)

Urban and semi-urban areas that buck the trend

- Stirling and Peterborough: semi-urban areas with high levels of small-scale renewables (mostly Solar PV).
- Enfield in London: 11th highest percentage of properties with G/WSHPs, fewer than one per cent of properties designated as rural.
- East Staffordshire, Calderdale, Harrogate and Stirling have a relatively high installation rate of G/WSHPs but a relatively low proportion of homes in rural areas.
- Other areas that buck the trend – South Lanarkshire, Stroud, Wrexham and Sunderland.

'On' or 'off' the mains gas grid

Across the UK, more than 80 per cent of homes have access to the gas network. Mains gas is a relatively cheap form of conventional heating compared to the alternatives, such as oil or liquid petroleum gas (LPG), and much more likely to be available in urban or semi-rural areas where housing is denser.

On the basis that renewable heat might be more attractive to those who do not have access to the UK's gas grid, we checked the data for any association between installation rates and availability of mains gas.[5] We found that renewable heat is **strongly** correlated to areas where a relatively large proportion of consumers have no access to mains gas - **but** there are important exceptions (see case studies, page 26).

Renewable heat is **strongly** correlated to areas where a relatively large proportion of consumers have no access to mains gas

5 Department of Business, Energy and Industrial Strategy. (2018). LSOA estimates of properties not connected to the gas network 2018. Available at: **https://www.gov.uk/government/statistics/lsoa-estimates-of-households-not-connected-to-the-gas-network#history** (Accessed: 21 September 2020).

How income and fuel poverty has impacted the renewables landscape

We looked for links between household income and the take up of renewable heat installations to see if areas with the highest and lowest rates of installations share any common characteristics.

Income

We examined MCS data alongside official statistics on gross disposable household income (GDHI) to check for any correlation between installation rates and income.[6]

We found:

- No evidence that higher incomes in specific areas resulted in higher installation rates
- Some evidence that areas with the highest GDHI generally have the lowest rate of installations, for example:
  - In the 40 LAs with the lowest percentage of Solar PV installations, average disposable household income is £7,000 above the national average (£21,000)
  - In the 40 LAs with the highest percentage of Solar PV installations, average disposable household income is below the national average
  - We found the same trend for all the main microgeneration technologies.

These findings do not suggest that lower income areas in general are more likely to install renewable technologies. As the next section shows, the typical consumer has a certain level of disposable income. The trend is more likely to reflect a range of other issues including the urban/rural split and local policy. It is interesting that the LAs with the fewest Solar PV installations include the wealthiest - Westminster and Kensington and Chelsea - as well as some of the poorest - Liverpool and Blackpool. The one characteristic these areas have in common is that they are all predominantly urban.

Fuel poverty

Installing small-scale renewables sometimes does (and arguably more often should) form one plank of local authority policy to reduce fuel poverty. We looked at installation rates against official estimates of fuel poverty and found evidence that installation rates are higher in some areas where there is a lot of fuel poverty:

- The Western Isles has the highest levels of fuel poverty in the UK (36 per cent) and the highest proportion of homes with ASHPs. It's unlikely that this is a coincidence.
- The five LAs in the whole of the UK with the highest rate of installations of ASHPs are all in Scotland and all have high rates of fuel poverty.[7]

There is also some evidence of an association between local authorities with the highest percentage of renewable heat installations and high rates of fuel poverty in Wales.[8] There are likely to be several reasons for this and more research is needed. For example, the exposed and colder areas of Britain tend to have higher rates of fuel poverty. But this higher demand for space heating in those areas is also likely to drive the market for better heating solutions across all income groups.

6 Office for National Statistics. (2020). Regional gross disposable household income (GDHI): all NUTS Level regions. Available at: **https://www.ons.gov.uk/economy/regionalaccounts/grossdisposablehouseholdincome/bulletins/regionalgrossdisposablehouseholdincomegdhi/previousReleases** (Accessed: 1 September, 2020)

7 Scottish Government. (2019). Scottish House Condition Survey: local authority analyses. Available at: **https://www.gov.scot/publications/scottish-house-condition-survey-local-authority-analyses/** (Accessed: 1 July 2020)

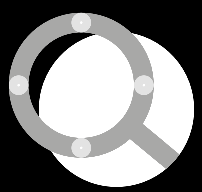
8 Welsh Government. (2020). Welsh Housing Conditions Survey (WHCS) 2017-18: Local area Fuel Poverty estimates modelling and results summary. Available at: **https://gov.wales/sites/default/files/statistics-and-research/2020-03/welsh-housing-conditions-survey-whcs-2017-18-local-area-fuel-poverty-estimates-modelling-and-results-summary-071.pdf** (Accessed: 24 June 2020)

Some evidence that areas with the **highest gross disposable household income** generally have the **lowest rate of installations**

Installation rates are **higher** in some areas where there is a **lot of fuel poverty**

Local authority case studies

Data is helping us to identify thriving markets (forests) and areas where renewables have made little or no penetration (deserts). There is a lot of research still to do, but we are beginning to uncover market drivers and barriers. We've explored three types below.



Deserts –

Areas where renewables have made little or no penetration

The Rural Resilient

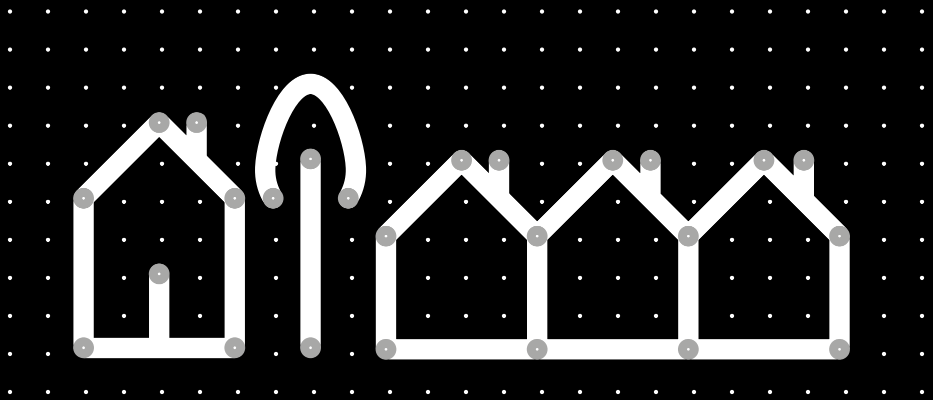
Areas of very high penetration that are often remote with a high proportion of homes off the gas grid.

Orkney

With 20 per cent of homes having an MCS certified installation, Orkney is the superstar local authority. It has the highest number of G/WSHPs and Solar Thermal installations (as a percentage of homes), it ranks second for ASHPs and it ranks seventh for Biomass. Also, seven per cent of households in the Islands have an MCS certified wind turbine. Two-thirds of homes are designated as rural and crucially, 100 per cent have no access to mains gas. Orkney has very low unemployment but, in relation to the rest of Scotland, fuel poverty is high. Overall, the average gross disposable household income (at £18,783) is significantly below the national average.

Cornwall

In terms of sheer numbers of installations, Cornwall is the pacesetter. The sunniest local authority in Britain has nearly 20,000 Solar PV installations; almost twice the number installed in the area with the second highest number (Wiltshire). More than seven per cent of homes have a Solar PV installation putting the area close to the top 20. It also ranks within the top 30 for ASHPs, 19th for G/WSHPs and is within the top 50 local authorities for both Biomass and Solar Thermal. Cornwall has similar demographics to Orkney. Just over 60 per cent of properties are designated rural and the average gross disposable household income (£18,568) is almost identical. Close to 60 per cent of homes have access to mains gas, which may partly explain why Cornwall is slower than Orkney in the uptake of renewable heat. Even so, the number of homes with no access to the gas grid in Cornwall is more than double the national average (16 per cent).



Urban and semi-urban early adopters

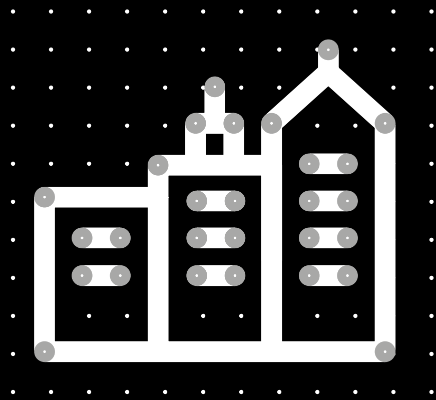
Critical areas that have bucked national trends with unexpectedly high installation rates given their characteristics. These areas provide clues about how markets can grow in areas with similar demographics.

Stroud and Wrexham

Interestingly, we discovered that installation rates tend to be higher in areas that are predominantly rural. But a few areas buck the trend, including Stroud and Wrexham. Only 28 per cent of homes in Wrexham are designated rural yet eight per cent have Solar PV installed (within the top 20). Stroud has 6.3 per cent of homes with Solar PV and 26 per cent are designated rural. Importantly, Stroud ranks 13th for the number of ASHPs installed as a percentage of homes - despite the fact that only 16 per cent of homes are off the main gas grid. Both areas have relatively low levels of fuel poverty and while the gross disposable household income is slightly above the national average in Stroud, it is significantly lower than the national average in Wrexham.

Sunderland and South Lanarkshire

Both these local authorities have very few homes designated as rural: less than one per cent in Sunderland and only 10 per cent in South Lanarkshire. Despite this, Sunderland has one of the highest Solar PV installation rates (7.6 per cent) and South Lanarkshire is ranked 14th for ASHP installations. Only 14 per cent of homes in South Lanarkshire have no access to mains gas. Sunderland's average gross disposable household income is one of the lowest in the country.

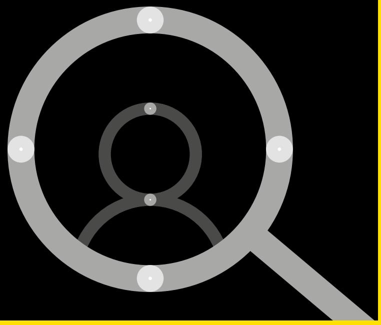


The urban and commuter disengaged

Sluggish or non-existent demand is most obvious in central and Greater London but is also a feature of most large urban areas.

Almost all of the local authorities in London have fewer than four per cent of homes with MCS certified installations. In many this figure is less than one per cent. The areas with the lowest installation rates tend to be those with the highest average gross disposable household incomes, such as Westminster, Hammersmith and Fulham, and Kensington and Chelsea. But the desert extends beyond the city in all directions to include swathes of the commuter belt. For example, less than two per cent of homes in Slough have a Solar PV installation while there are so few heat technology installations they barely register in the statistics. Surrey Heath, Sutton, St Albans and Epping Forest are similar examples and all have gross disposable household incomes that are significantly higher than average. However, there are a few exceptions. More than four per cent of homes in Thurrock have installations while Enfield ranks 11th out of all local authorities for G/WSHP installations.

The green consumer



We have researched whether consumers installing small-scale renewables, as well as the areas where they are installed, exhibit common characteristics.

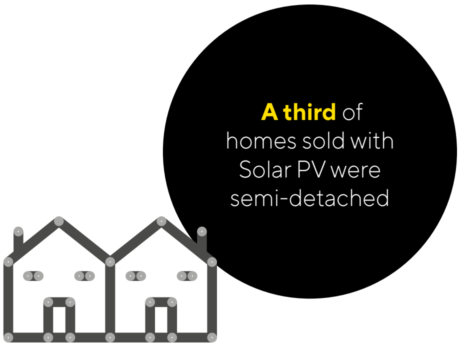
Comparing the locations of installations with census data shows that the typical green consumer of the five most popular microgeneration renewable technologies – Solar PV, ASHP and G/WSHP, Biomass and Solar Thermal - is most likely to be an owner-occupier living in a small household in a rural area, aged 30 to 65 and a professional, in a skilled trade or in another senior role.

Cross-referencing MCS certified installations with Land Registry records of properties sold to date shows small-scale renewables are most likely to be installed in (or on) detached or semi-detached houses.

- **Tenure:** Seven out of ten or more are owner-occupiers. A minority (between just 7 % for Biomass up to 16 % for both ASHP and G/WSHP) are renting from LAs or other social landlords. Private renters make up 13-14 % of all technologies except Solar PV, where they are around 11 %.
- **Household size:** The vast majority (around eight out of ten) of households installing small-scale renewables are small (three or fewer). Single-person or two-person households alone make up nearly two-thirds.
- **Age:** The majority (60 %) are aged between 30 and 65; the under-30s and the 65-plus each account for around one in five installations.
- **Employment type:** Professionals are more likely to install small-scale renewables (consistently the most likely group across all five main technologies at around 20 %). In the case of Biomass and G/WSHPs, this proportion is three times higher (similar to that in the other technologies) of those whose job is operating plant or machinery or in sales and customer service. Skilled workers and those in senior roles are also the most likely to choose small-scale renewables.

Looking at types of properties where installations have taken place, we cross-referenced properties with MCS certified installations with Land Registry records of sold properties to date.

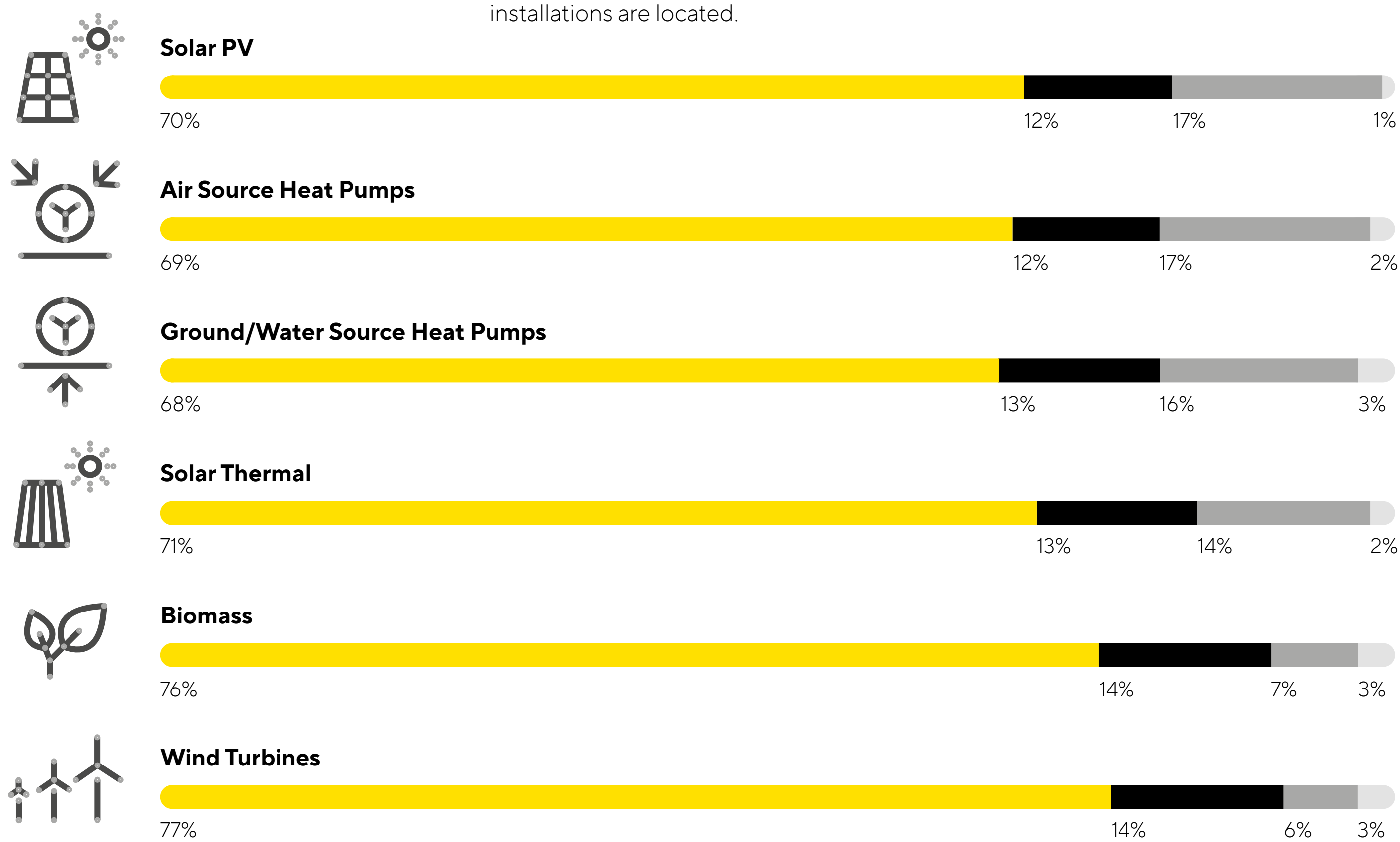
- The vast majority (three-quarters or more) are detached or semi-detached houses.
- **Detached:** More than four out of ten homes sold with renewables installed were detached. The proportion ranged from 44 % in Solar PV through 63 % for ASHPs, 64 % for Solar Thermal to seven and eight out of ten for Biomass and G/WSHPs.
- **Semi-detached:** A third of homes sold with Solar PV were semi-detached. One in five of those with Biomass, Solar Thermal or ASHPs, and just 6 % of sold homes with GSHPs were semi-detached.
- **Terraced houses:** Around one in five homes sold with Solar PV installed were terraced. For the other technologies, 13 and 14 % of homes sold with an ASHP or Solar Thermal were terraced, under 10 % of those with Biomass, and just 3 % with a G/WSHP.
- 1 % or fewer of homes sold that had these renewables installed were flats or maisonettes.



Ownership Types

Estimated per cent of total installations based on an analysis of the proportion of the tenure types in the LAs where the installations are located.

Owner-occupier
Private rented
Social rented
Living rent free



Renewable policies - the story so far

This section looks at the impact of renewables policy since 2008. It examines national policies first, and how these have impacted policies in the better performing areas within Great Britain, and then considers how Britain's policies have delivered against other countries.

National policies

When MCS was launched, national policies around small-scale renewable heat were already in place, with grants available under Clear Skies and the Low Carbon Buildings Programme.[9] In 2008, the Government proposed replacing grants with more generous tariff-based incentives to support renewable electricity and heat (extended to include ASHPs), for systems installed after 15 July 2009.

To qualify for these incentives, certified products had to be installed by certified installers. FiTs, payable for generation and export of renewable electricity from 1 April 2010, encouraged people to install electricity-generating technologies, while RHI paid similar benefits for heat-generating technologies. The domestic RHI (DRHI) was delayed so an interim grant scheme, the Renewable Heat Premium Payment (RHPP), was implemented until the DRHI launched in April 2014.

Unlike these policies, other green initiatives that might have impacted the market did not have the same focus on renewables and, unsurprisingly, have had minimal impact on the uptake of renewables in existing homes. Some led to the installation of gas boilers (ECO and its forerunners)[10] or insulation (ECO, Green Deal, Green Deal Home Improvement Fund)[11] while others applied only to new-builds (the largely voluntary Code for Sustainable Homes[12] and the Merton Rule in planning law[13]). This section focuses on the policies aimed at driving the renewables market and looks at their impact on the small-scale end of that market.

9 Clear Skies non-means-tested grants ran from 2004 to 2007 paid to consumers for ST (£400), GSHP (£1,200), BB (£1,500), PS (£600), with self-certification. The LCBP ran from 2006 to 2010, with first-come first-served grants for householders, communities and businesses towards installation of renewable heat technologies and, for householders, renewable electricity generators.

10 The Carbon Emissions Reduction Target (2008-2012) and the Community Energy Saving Programme (2009-12) respectively required certain energy suppliers to fund measures (recouped from all consumers' energy bills) to contribute to targets to cut carbon emissions and deliver energy saving measures to domestic consumers in specific low-income areas. These were the forerunners to the ECO scheme that commenced in 2013. The official 'Home Energy Efficiency Statistics' report provides information on the measures installed.

11 The Green Deal, a loan scheme repayable from savings on energy bills made as a result of installing certain measures ran from 2013 to 2015 but was not widely taken up. This and the grant-based Green Deal Home Improvement Fund mostly led to increases in insulation and other energy-efficiency measures that cost less than most renewables. The exception is in Scotland, where one firm – HELMS - installed the majority of Green Deal plans, most of which included solar panels. These have been the subject of considerable complaint.

12 The 2007 Code incorporated plans to require all new residential developments to be zero carbon by 2016. The Coalition Government from 2010 did not continue with the Code.

13 Under 2008 law, LAs must require new developments to generate at least ten per cent of their energy needs from on-site renewable energy equipment.

Solar PV and FiTs

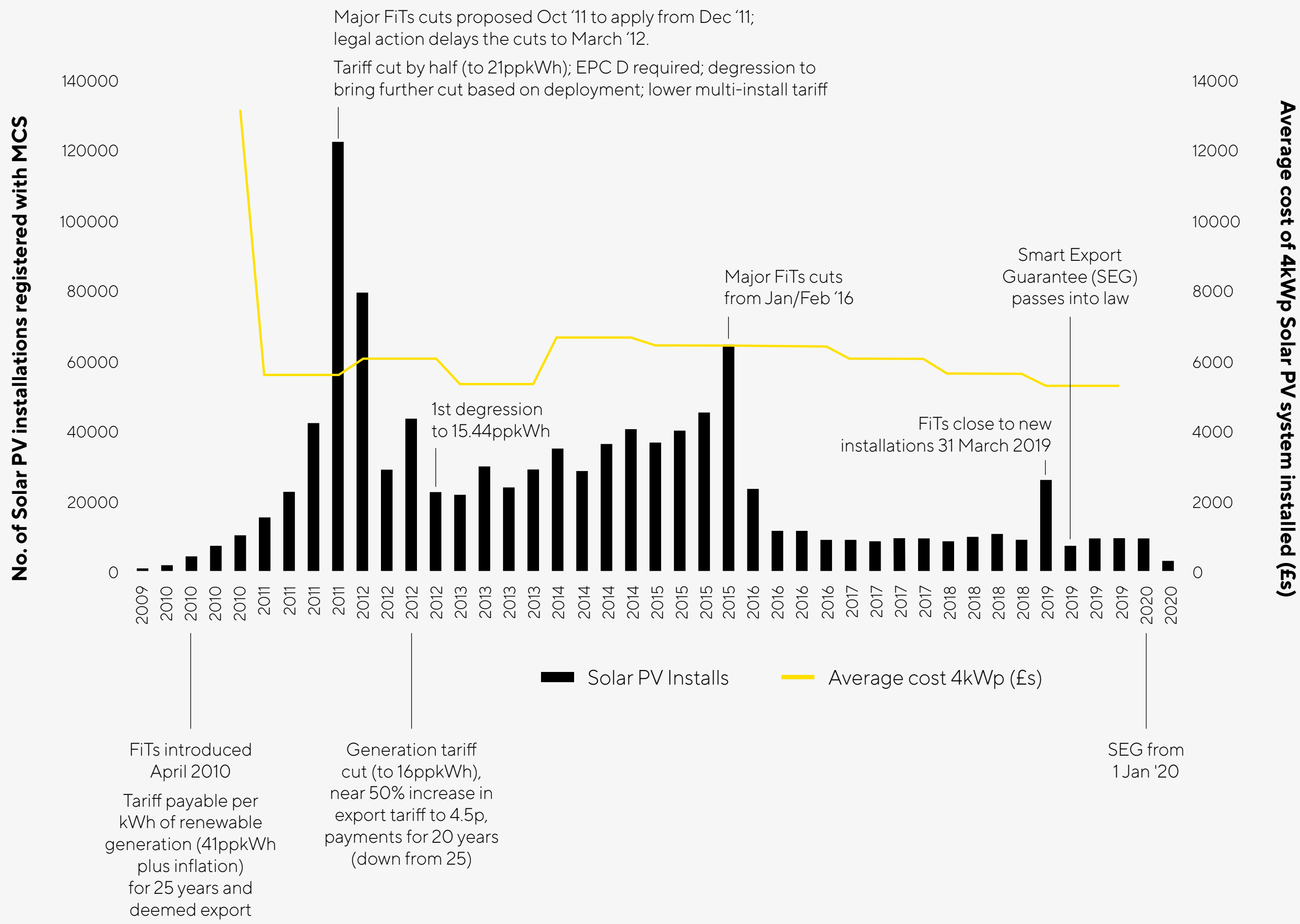
Chart 1 maps key developments in the FiTs Scheme against Solar PV installations registered with MCS. Solar PV is unique in that the upfront average cost to the consumer of installing a typically-sized system fell dramatically following the introduction of incentives. Chart 1 also shows the path of this average cost.

In summary, Chart 1 shows:

- Incentives **have** driven uptake but not on a steady path, with spikes largely reflecting policy intervention: sharp rises in numbers of installations following the introduction of the FiT and ahead of the announcement or introduction of major cuts (see Q4 2011, Q1 2012, Q4 2015) and to a lesser extent before FiTs ended
- Installation numbers typically drop off after a sharp rise
- Dramatic increases in the number of Solar PV installations mirror equally dramatic falls in the costs of a typical 4kWp-sized system in the early years of the FiT. Costs fell from just over £13,000 for 4kWp in 2010 to around £6,000 in 2011.[14]

Incentives **have** driven uptake but not on a steady path, with spikes largely reflecting policy intervention

Chart 1: Small-scale Solar PV installations 2009 – 2020



14 There is a notable blip upwards in costs in late 2013. This may reflect the EU imposition of anti-dumping tariffs on Chinese imports of panels for 2 months in Q2/3 of 2013 followed by an agreement on a minimum price floor for the Chinese panels.

Renewable heat v RHPP and RHI

Delays in the introduction of the domestic scheme led to an interim grant, the RHPP, in 2011. The tariff-based domestic scheme came into force on 1 April 2014 and remains in place, though with a number of amendments since 2015. A summary of key points of these policies are set out in Table 1. (As mentioned, very few renewable installations went into homes under other green policies such as ECO and the Green Deal, so these are not included).

Table 1:
Summary of recent small-scale renewable heat policy[15]

Policy	Type of incentive	Technologies eligible (rate)	Homes/consumers eligible	Standards
Renewable Heat Premium Payment Scheme **Phase 1** (Aug 11 – March 2012) **Phase 2** (May 2012 – March 2014)	Non-means-tested. Grant paid to consumer.	Phase 1/2: ST (£300/£600) G/WSHP (£1,250/£2,300) ASHP (£850/£1,300) Solid BB (£950/£2,000)	Installations from 15 July 2009 eligible. Targeted at off-gas homes, energy efficiency in place. Householders and landlords (separate competition for Registered Social Landlords) and a community scheme.	MCS certified installer (approved Consumer Code member; third-party certification) and products.
Domestic Renewable Heat Incentive (April 2014 – present)	Tariff payable per kWh of renewable heat generated for seven years. Rates amended over time and a cap (via a heat demand limit) introduced.	Starting tariffs (pence per kWh): ST (19.2p) G/WSHP (18.8p) ASHP (7.3p) BB (10.98p)	As above with social landlords also eligible.	

Key: **ST** - Solar Thermal **ASHP** - Air Source Heat Pump **G/WSHP** - Ground/Water Source Heat Pump **BB** - Biomass Boiler

Chart 2 shows installations of the four main domestic heat technologies registered with MCS, along with key policy dates. (See following pages for individual technologies.) The chart shows:

- Incentives **have** driven uptake but not on a steady path
- All four of the main domestic heat technologies have a spiky pattern, largely reflecting policy intervention: sharp rises in numbers of installations either following introduction (see 2011 after the RHPP was introduced and 2012 after its increase) or ahead of a reduction in availability (see 2014 Biomass spike ahead of tariff cuts in 2015).
- Installation numbers usually drop off after a sharp rise.

It's not all about incentives though:

- Most notably ASHPs and Solar Thermal systems were being installed before incentives came into effect
- ASHPs dominate heat installations, totalling over 83,000 by 2020, despite having the smallest of the grants for space-heating technologies.

Installations from 15 July 2009 were eligible for incentives which may explain some early movements. According to MCS data, typically-sized ASHPs and Solar Thermal systems were then thousands of pounds cheaper than G/WSHP and Biomass boilers:

- ASHP (10kW) £8,512, Solar Thermal (3kW) £10,678, G/WSHP (12kW) £12,849, Biomass (26kW) £13,947

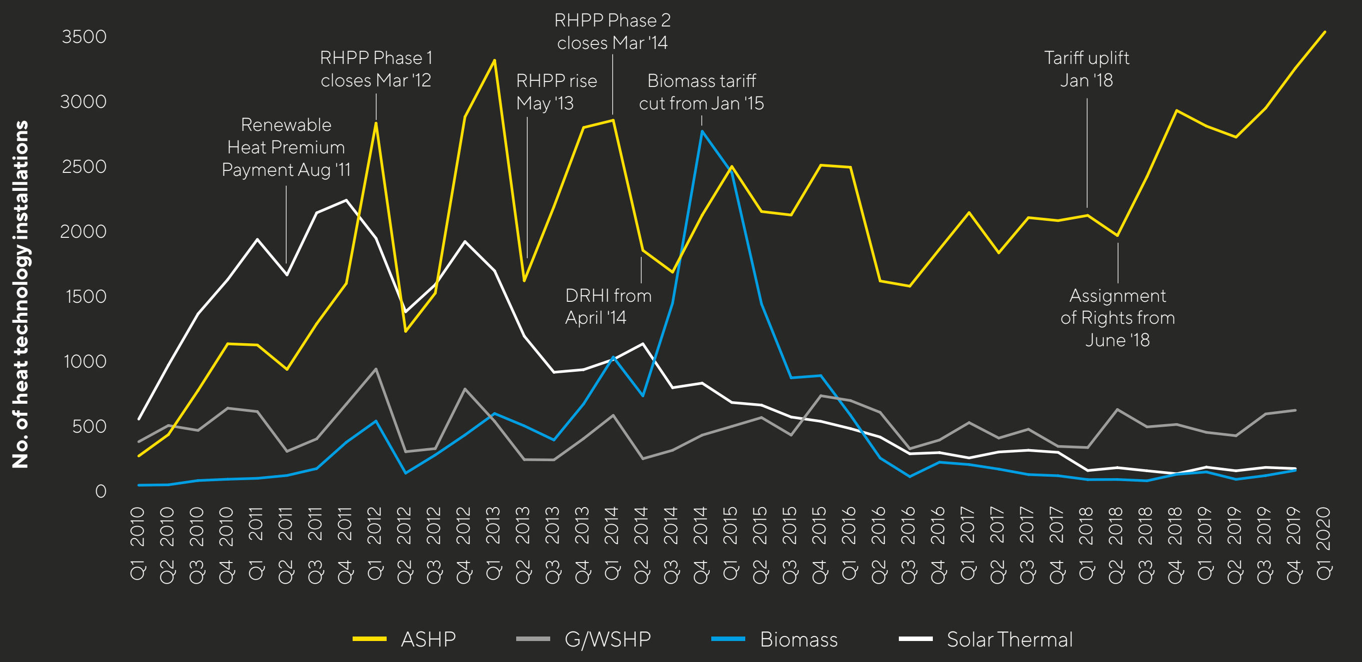
It's also worth pointing out that:

- ASHP remained the most commonly-installed renewable heat despite a near 25 per cent spike in costs in 2019 to £10,433
- Solar Thermal installations fell sharply from 2013 despite a doubled grant, then a generous DRHI tariff and falling costs (down to £4,556 by 2019).

15 Covers domestic Renewable Heat Incentive only; non-domestic RHI commenced November 2011.

ASHPs dominate heat installations, totalling over 83,000 by 2020, despite having the smallest of the grants for space-heating technologies.

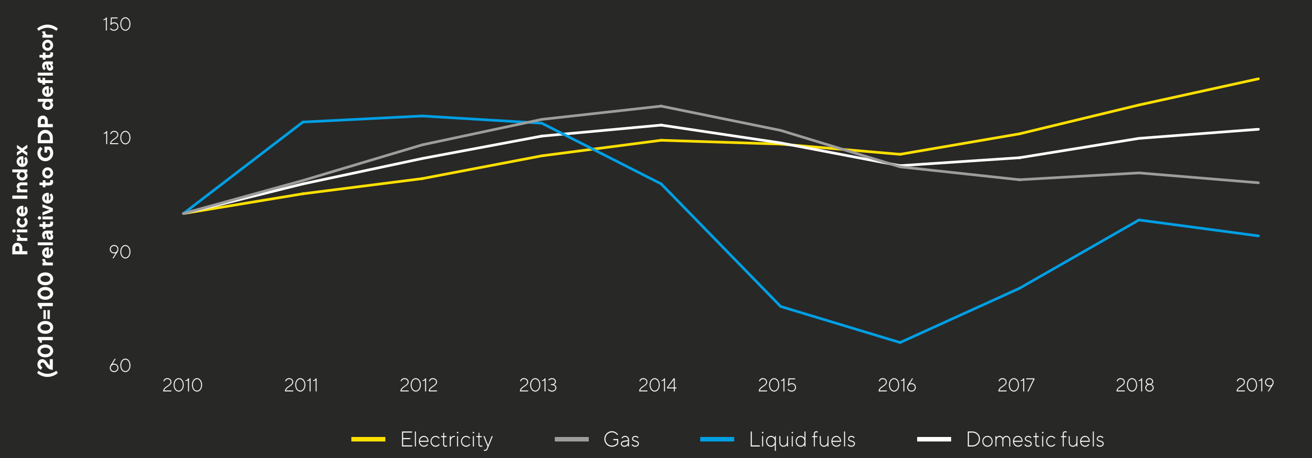
Chart 2: MCS registered small-scale renewable heat installations, 2010 – 2019



The influence of domestic gas, electricity and domestic fuel prices, which were rising sharply from 2010 to 2014, and liquid fuel prices peaking in 2012 before dropping back, may also have played a part. Consumers are telling us that reducing energy costs is a significant driver to taking up renewables. The BEIS attitude tracker reflects this: people worried about paying for energy bills peaked at 59 per cent in March 2013 (this fell to 26 per cent by March 2020).

Consumers are telling us that **reducing energy costs** is a **significant driver** to taking up renewables.

Chart 3: Real domestic fuel price index 2010 - 2019



Source: BEIS Energy Prices: domestic prices, Table 2.1.2 Consumer prices index: fuel components, real terms relative to GDP deflator, United Kingdom, June 2020

Local and regional policies

Local and Regional Case Studies

The Orkney Islands
Cornwall
Scotland
Wales
Sunderland

Government renewables policy has clearly had some success in driving up the number of small-scale renewable systems installed in Great Britain. However, that success is patchy and other, similar countries have done far better.

MID data shows that the highest rates of installation are in mainly rural areas, and, for renewable heat, in areas where significant numbers of households are off the gas grid. Even within those sorts of areas, the **Orkney Islands** (where no homes have access to mains gas) is the front runner. In more rural areas, **Cornwall** is a leader in terms of the sheer number of installations. Both these areas have low average income levels and renewables are seen as key to tackling fuel poverty. Looking at country level, both **Scotland** and **Wales** are well up the rankings for most of the technologies. And some areas buck these trends, such as mainly urban, mainly on-gas **Sunderland** in England. In this section, we highlight some of the policies that might explain their relative success.

While considering these more successful areas, it's important to bear in mind that they exist alongside virtual deserts of renewables in some urban areas. Even the much-praised 2017 Scottish Government Energy Strategy acknowledged that such deserts may be a hard nut to crack, noting: *'the main challenges we face are expanding these principles into more densely-populated and urban areas, and identifying sustainable replicable commercial models.'* We look at the relative failure in urban areas and the challenge they represent in the Technologies section (pages 51-76).

Local heroes

Many UK councils have already declared a climate emergency and set out plans that detail how they will approach the challenge.[16] MCS data shows that in some authorities, small-scale renewables already play a significant part in these strategies.

Orkney Islands

'Orkney has been pioneering the transition to a low carbon economy for decades, with a history of world firsts providing a back story that illustrates the collective ambition of the islands community.'[17]

It's important to acknowledge that the Islands now sit within an 'enabling environment' of Scottish Government policies, covered later. But their history with sustainable energy long pre-dates this: in 1951, for example, the Orkney Islands was the location of the first grid-connected Wind Turbine to operate in the UK. By 2016, Orkney was generating **120.5 per cent** of its electrical needs from renewables and set targets for 2030 to increase this to 300 per cent, and increase decarbonised energy use from 10 to 50 per cent. By 2020, the Orkney Islands is the superstar local authority with the highest rate of MCS certified installations in Great Britain (equivalent to 20 per cent of homes). It's number one for G/WSHPs and Solar Thermal, number two for ASHPs, top ten for biomass (as a percentage of homes), and seven per cent of households have an MCS certified small wind turbine.

The Orkney Islands has a long-standing commitment to sustainable energy, with more recent key elements including a series of linked programmes and strategies set out in 2016 and 2017:

- A **Sustainable Energy Strategy** 2017-2025, which will include identifying the optimal structure for energy related advice so the customer can access *'appropriate and impartial advice and support where and when it is needed'*
- A **Carbon Management Programme**
- A **Fuel Poverty Strategy** 2017- 2022 aiming to reduce it by 2022 and eradicate it in Orkney by 2032, and
- A **Skills Strategy** 2017-2022, Orkney's response to Scotland's skills investment plans to ensure the *'right skills are available in the right people at the right time.'*

> By 2016, Orkney was generating **120.5 per cent** of its electrical needs from renewables

16 Institute of Public Policy Research. (2020). Lessons from the devolved nations. Available at: **https://www.theeeig.co.uk/media/1096/eeig_report_rebuilding_for_resilience_pages_01.pdf** (Accessed: 15 September 2020). This report notes that recent studies have shown that just under 40 per cent of local councils are undertaking multiple low-carbon energy projects already.

17 Energy of Orkney (2017) Orkney Fuel Poverty Strategy 2017-2022. Available at: **https://www.oref.co.uk/wp-content/uploads/2017/10/Orkney-Sustainable-Energy-Strategy-2017-2025-1.pdf** (Accessed: 15 September 2020)

37%

of its electricity from renewables in 2018

Cornwall

'Our superb natural resources offer… distinct advantages in the fields of renewable energy; the highest levels of solar irradiation in the UK, amongst the best wind resources in Western Europe, huge potential marine energy reserve, the best geothermal resources in the UK…'[18]

The South West as a region tops the poll for the rate of MCS installations. And in terms of sheer numbers, Cornwall sits at the top of the South West tree. Appropriately enough for the sunniest part of Britain, this is largely thanks to its performance on Solar PV. In numbers, Cornwall has:

- Nearly 20,000 Solar PV installations, almost twice that of the LA (Wiltshire) with the second highest number
- Around 37 per cent of its electricity from renewables in 2018 (up from 6 per cent in 2009 and against a national average of 33 per cent). In 2020, Cornwall credited at least two-thirds of its drop in carbon emissions to the decarbonisation of electricity.
- 15 per cent of its energy from renewables by 2020 (up from two per cent in 2009).

Like Orkney, Cornwall's engagement with the low carbon agenda goes back some way: the Council viewed the low carbon economy as a lever to help bring Cornwall out of recession a full decade before the current coronavirus-induced 'Build Back Better' campaign.

It has stressed the importance of taking a *'joined-up approach, utilising the skills and capacity of partners, communities and the private sector.'* Initiatives include:

- A **Green Cornwall Programme** from 2009 to support increased use of renewables, major change in retrofitting of houses, promotion of community- and council-owned renewable energy projects and installing solar panels on some Council buildings
- A **large revolving community FiT fund** alongside loan fund support for projects including roof-mounted Solar PV from, for example, the Low Carbon Society, and
- **Cornwall's 2019 Climate Change plan** which looks broadly at what part planning, partnership and strong support of Whole House Retrofit of both social and privately-rented homes can play in helping it deliver zero carbon homes and generation.[19]

7.6%

rate of Solar PV installations

Sunderland

Sunderland is far from rural - fewer than one in every 100 homes is designated as rural – with one of the lowest average gross disposable incomes in the country. Yet it has one of the highest rates of Solar PV installations (7.6 per cent).

The City Council has an ongoing programme of installing Solar PV. Gentoo, the city's biggest social housing provider, has overseen the installation of thousands of Solar PV panels in residential households across Sunderland. By late 2016, Sunderland had 690 domestic PV installations per 10,000 households (when the GB rate mean was 279).[20]

Its Business Renewables Energy Efficiency Sunderland programme (BREEZ) offers eligible SMEs possibilities such as a **Free Initial Assessment** and a **Fully-Funded Energy Audit** or **Energy Savings Opportunities Report** setting out recommended energy-saving measures, and **in some cases 50 per cent grants** towards the cost of installing those measures such as microgeneration, insulation and heating upgrades.

18 Cornwall Council, 2010-11 Green Cornwall - Our Strategy for a greener, sustainable, low carbon Cornwall - 2011-2020 (biannual review). Available at: **https://www.cornwall.gov.uk/media/3624737/Green-Cornwall-Strategy-2011-2020.pdf**

19 The plan supports Whole House Retrofit of social homes and commits to demonstrating 'leadership in building zero carbon council homes' as well as to looking at offering loan funding for private sector landlords to help tackle the approximately 4,500 private sector rented homes in Cornwall that do not meet the Minimum Energy Efficiency Standard (MEES).

20 Dept Business, Energy and Industrial Strategy. (2020). BEIS Domestic Solar Photovoltaic Installation Statistics. Available at: **https://data.gov.uk/dataset/9238d05e-b9fe-4745-8380-f8af8dd149d1/solar-photovoltaics-deployment-statistics** (Accessed: 15 September 2020)

Scotland

It was a Scot, James Blyth, who in 1887 created what has been described as the world's first electricity generating Wind Turbine to charge a battery to light his holiday home in Marykirk. Scotland's performance in the installation of domestic renewables shows it still leads the way, with stand-out performance in terms of domestic renewable heat particularly in off-gas areas:

- Nearly nine out of ten (87 per cent) of its domestic RHI installations were installed in off-gas areas (compared to 68 per cent in England and Wales)
- Systems in Scotland accounted for approximately 20 per cent of the total number of domestic RHI-accredited systems[21]
- Compared to other regions, Scotland is a high-flyer in all but Solar PV.

The Scottish gas, electricity and oil networks are controlled by UK parliament. However, local government, including housing and planning, is devolved so the Scottish Government can influence energy generation in Scotland by approving or refusing new projects.

From the 2006 Planning Advice aimed at promoting micro-renewables, the Scottish Government has continued to promote and support renewables in an overall 'enabling environment.' Energy efficiency is a National Infrastructure Priority, and recently a £30 million investment ensured new homes in Scotland have renewable or low carbon heating. There's also a legacy of strong community engagement in local renewable generation, led by rural Scottish communities, including the Islands, and supported through the Community and Renewable Energy Scheme.[22]

Since 2017's Scottish Energy Strategy, there is a 'whole-system' approach. This means supporting and delivering local solutions to meet local needs, planned and deployed on an area-by-area basis, with Local Heat and Energy Efficiency Strategies that should help Scotland meet its new target of meeting 50 per cent of energy from renewable sources by 2030.[23] SEEP, Scotland's Energy Efficiency Programme, extends to the mid-2020s, 'establishing solutions for switching heating supplies from high to lower carbon or renewable sources for properties off the mains gas grid' and aims to make Scotland's buildings near zero carbon wherever feasible by 2050.

Against this backdrop, there are a number of initiatives designed to support small-scale renewables, through subsidy, grants and loans and, importantly, advice, including:

- The **Scottish Community and Householders Renewables Initiative (SCHRI)** operated by Community Energy Scotland. SCHRI provided advice, project support and grants for homeowners installing renewables in eligible properties[24]
- **Home Energy Efficiency Programmes for Scotland (HEEPS)** to tackle fuel poverty and improve the energy efficiency of the domestic housing stock, including retrofitting new central heating and a small number of other heating systems such as ASHPs
- The **HEEPS Equity Loan** (only available in some areas), secured on the property repayable only when the property is sold or the last applicant dies
- **Warmer Homes Scotland in-home assessments**, in most cases meeting the cost of recommended measures, including renewables, or with an interest-free loan where the customer contributes towards more expensive measures
- **Home Energy Scotland**, a national telephone advice service delivered regionally, providing a free in-home expert government-funded assessment. A gateway to the Home Energy Scotland (HES) loan scheme (see box).

21 Energy Savings Trust report 2018

22 The Community and Renewable Energy Scheme (CARES) supports community and local energy projects throughout Scotland, and aims for a considerable increase in the number of shared ownership energy installations across the country. It is delivered by Local Energy Scotland, whose network of development officers based throughout Scotland provide assistance and guidance to applicants and potential applicants. For an assessment of one CARES-supported scheme see:

van der Waal, E.C. 'Local impact of community renewable energy: A case study of an Orcadian community-led wind scheme', Energy Policy (Community and Renewable Energy Scheme 'Local impact of community renewable energy: A case study of an Orcadian community-led wind scheme', Volume 138, March 2020, 111193. **https://doi.org/10.1016/j.enpol.2019.111193**

23 The target set in 2009 was 30 per cent by 2030.

24 SCHRI grants of 30 per cent of the cost of installing renewables in eligible properties up to a maximum of £4,000 each for a maximum of two different technologies.

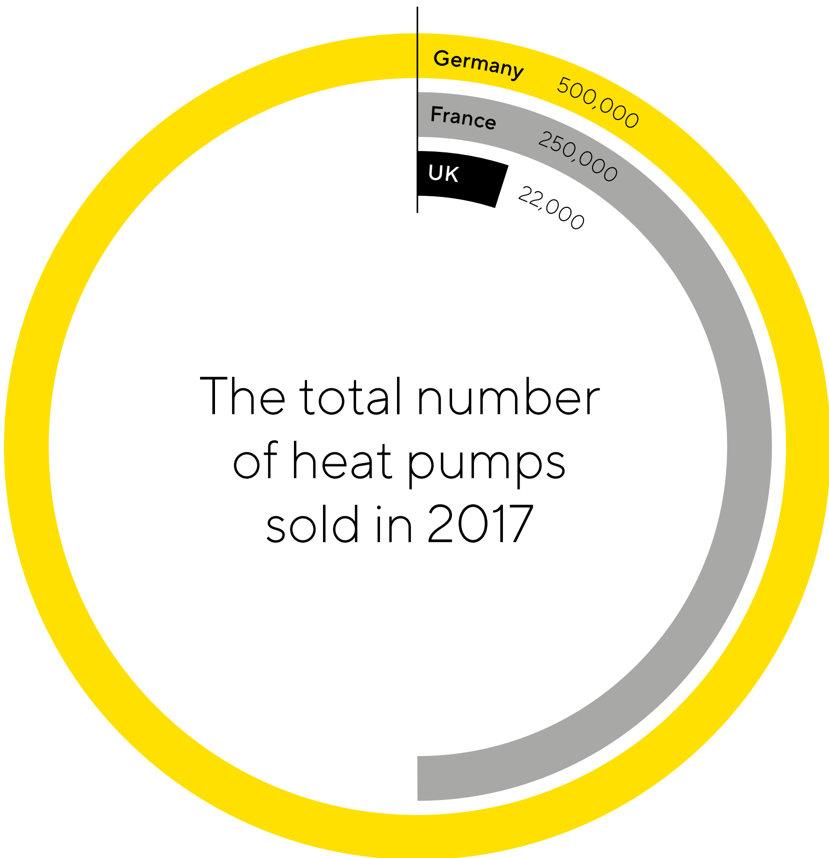
The Home Energy Scotland loan scheme

The Scheme offers interest-free loans of up to £17,500 per home to fund renewable installations by owner occupiers, eligible registered private sector landlords and self-builders in Scotland. (There are also cashback grants, but these are not available for renewables).

Loans are administered by the Energy Saving Trust, with repayment terms depending on the amount of borrowing: up to a maximum of five years to repay loans under £5,000, ten years (£5,000 - £9,999) or 12 years for more than £10,000.

The loan can fund up to two home renewables systems for each home, to a maximum of £17,500 in total, with caps on the different technologies:

- Wind or hydro turbines: £2,500
- Solar PV or solar water heating systems: £5,000
- Energy storage systems (heat or electric batteries): £6,000
- Hybrid PV-solar water heating systems: £7,500
- Heat pumps: £10,000
- Biomass boilers or stoves (**not** non-automated, non-pellet stoves or room heaters): £10,000
- Connections to a renewably powered district heating scheme: £5,000


Germany
500,000
France
250,000
UK
22,000
The total number of heat pumps sold in 2017

International policies

The UK has some ground to make up compared to the take up of renewable energy in other countries, particularly in regard to heat pumps. The total number of heat pumps sold in the UK in 2017 was less than a tenth of the quarter of a million sold in France. Germans bought half a million heat pumps[25] and the Netherlands, with more households connected to the grid than the UK, managed proportionately more heat pump sales (average annual heat pump sales per 1,000 households, Netherlands 1.1, UK 0.7).[26]

Achieving increased deployment improves the supply chain and generates efficiencies of scale and competition that can drive prices down, but this has yet to happen in the UK. The UK's Committee on Climate Change (CCC) found in 2016 that the UK's RHI is *'not sufficient in itself to create a dynamic market for heat pumps'* and the market is focused on a limited demographic that has access to capital. Our findings support this.

Some analyses blame the UK's system of energy taxes and levies for stifling the market for heat pumps, with a cascade of government policies over many years artificially inflating the cost of domestic electricity in comparison to gas, with their cumulative impact working against the electrification of heat. However, one recent study concluded that, overall, the taxes and levies imposed on the electricity retail price *'do not substantially alter the competitiveness of heat pumps against gas boilers'*.[27] It's worth noting that the CCC found that the carbon price and levy issue is just one of a complex web of barriers that combine to suppress the market.

The CCC believes one of the main reasons for the low uptake in the UK is the initial cost; international evidence shows that reducing the upfront capital outlay is a strong consumer incentive. But it's not the only barrier: in its 2019 report, the CCC identified a range of challenges, from the UK skills gap and the lack of government support for quality retrofit to a lack of consumer information, concluding: *'the low uptake of heat pumps is symptomatic of low awareness, financing constraints, concerns around disruption and difficulty in finding trusted installers with the right skills.'*[28]

France has performed much better on installations, partly due to the far greater number of off-grid homes compared to the UK. France's national-level multi-pronged approach also includes:

- A **whole-house approach** to energy efficiency, including fabrication and installation of low carbon heating systems
- A **national energy advice service** (FAIRE) that helps consumers access appropriate support
- A support mix of **subsidy**, **tax relief** and **interest-free loans**.

The French support package includes:

- Means-tested support proportionate to the cost of the technology (at least 10,000 euros for G/SWHP and 4,000 euros for an ASHP for the lowest income households, 4,000 and 2,000 euros for middle-income households)
- A non-means-tested zero per cent loan up to 30,000 euros ('eco-PTZ'), accessed through FAIRE and repayable in 10-15 years
- A reduced rate of VAT.

25 Committee on Climate Change. (2016). Next steps for UK heat policy Committee on Climate Change October 2016. Available at: **https://www.theccc.org.uk/publication/next-steps-for-uk-heat-policy/** (Accessed: 15 September 2020)

26 Greater London Authority. {2018). Low Carbon Heat: Heat Pumps in London. Available at: **https://www.london.gov.uk/sites/default/`les/low_carbon_heat_-_heat_pumps_in_london_.pdf** (Accessed: 15 September 2020)

27 Barnes, J. and Bhagavathy, S. M. (2020) 'The economics of heat pumps and the (un)intended consequences of government policy', Energy Policy. Elsevier Ltd, 138 (January 2019), p. 111198.

28 Committee on Climate Change. (2019). UK housing: Fit for the future? Available at: **www.theccc.org.uk/publications** (Accessed: 15 September 2020)

Fourteen years of generating energy and saving carbon

By looking at the performance of each of the five main technologies since 2007, we can see that energy generation and carbon savings vary over time and by technology.

34,000GWh+

electricity and heat energy has been generated by the five major MCS technologies

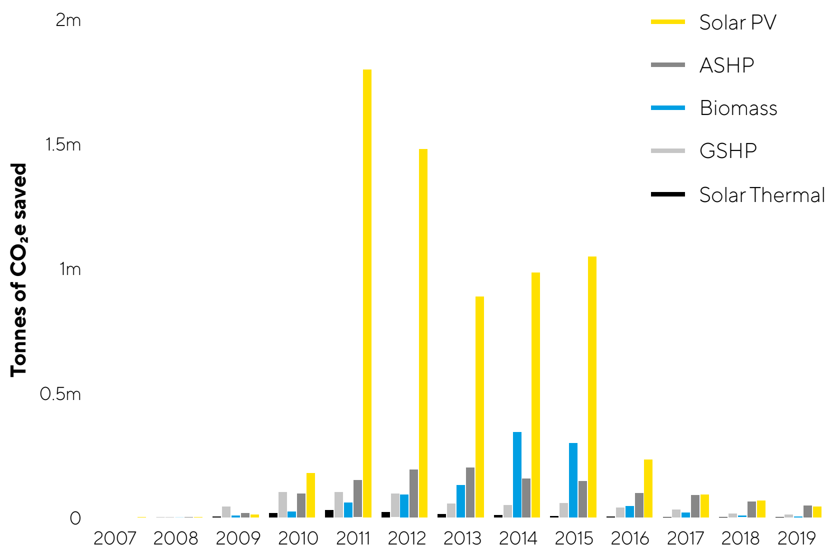
The greenhouse gas (GHG) emissions saved by an MCS installation depends on many factors such as the type of renewable technology and fossil fuel system displaced plus the carbon intensity of the UK electricity grid over time. We developed unique calculators that take all these factors into account and give robust insight into the benefits of small-scale renewables.[29] This allowed us to focus on specific areas to build a national, regional and local picture of microgeneration deployment and their contribution to Net Zero.

Since 2007:

- 34,000GWh of energy generated by the five main MCS technologies, that's roughly equivalent to the electricity consumed in 9.65 million homes annually (in London, Scotland and North West England)[30]
- Nearly ten million tonnes of CO_2e saved - roughly equivalent to the emissions from half a million cars every year for 10 years
- Solar PV has dominated total number of installations
- The four heat technologies combined have generated close to 70 per cent.

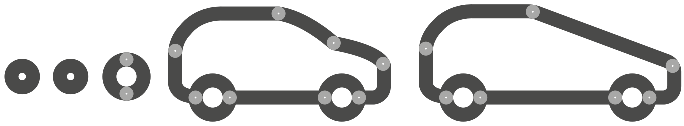
Chart 4 shows how the very high Solar PV installation rates in 2011 and 2012 have contributed a large proportion of the CO_2e savings over time. Similarly, biomass installations in 2014 and 2015 have contributed most of the savings provided by that technology. In 2017, 2018 and 2019, ASHPs contributed more CO_2e savings than Solar PV and these savings will grow substantially in the coming years.

Chart 4: Total CO_2e savings since year of installation by technology



29 See Technical Appendix.

30 BEIS. (2019. Sub-national electricity and gas consumption summary report 2018. Available at: **https://www.gov.uk/government/collections/sub-national-electricity-consumption-data** (Accessed: November 9 2020)

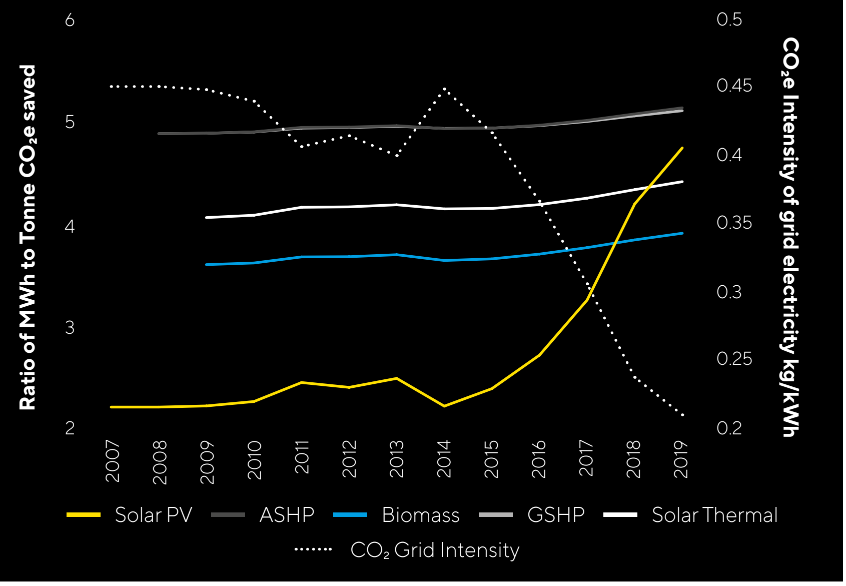


Nearly ten million tonnes of CO_2e saved - roughly equivalent to the emissions from half a million cars every year for 10 years

Ratio of MWh to CO_2e saved

The amount of CO_2e that renewable installations can save relative to the energy they generate varies by technology. It also changes over time because the carbon intensity of the grid varies from year to year. Overall, as more renewable power is added to electricity generation, the carbon intensity of the grid falls. As that happens, each unit of electricity generated using renewable power saves a little less carbon and the greater the level of generation needed to save one tonne of carbon.

Chart 5: The ratio of generation (MWh) to Tonne CO_2e saved, by technology

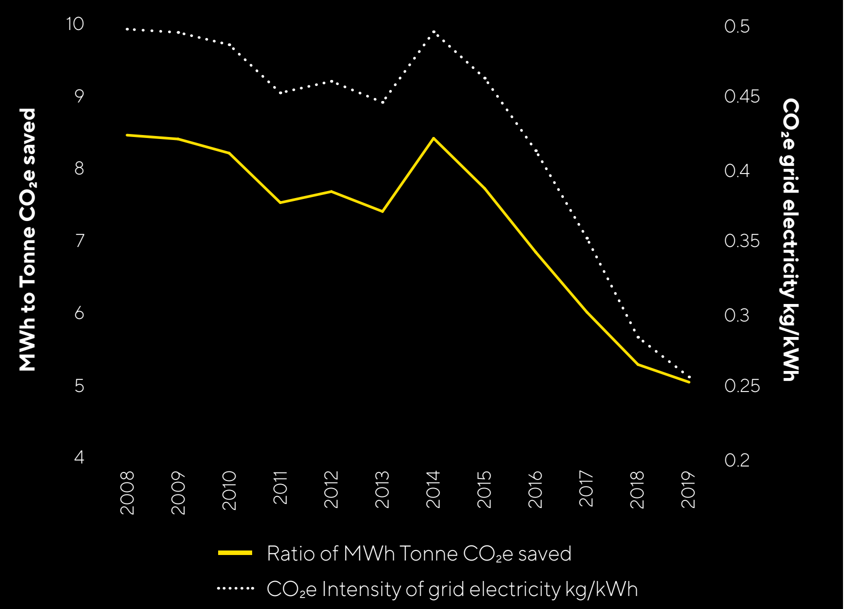


Heat pumps use some electricity to generate heat energy and therefore they have to generate more energy for every tonne of CO_2e saved than the other technologies. For example, on average, heat pumps must generate about 5MWh to save 1 tonne of CO_2e while biomass boilers only need to generate 4MWh to save 1 tonne CO_2e. The ratio for Solar PV has fluctuated to mirror the carbon intensity of the grid. As more of UK's electricity is generated using renewable power, more Solar PV generation is needed to save 1 tonne CO_2e.

Chart 6 shows that the ratio of generation (MWh) to tonne of CO_2e saved when ASHPs replace oil is improving. Because heat pumps use electricity to generate heat, when the carbon intensity of the grid was very high, ASHPs needed to generate between 7 and 8.5MWh of energy for every tonne of CO_2e saved. As the carbon intensity of the grid has fallen, this ratio has improved to 5MWh in 2019.

The opposite happens when ASHPs and G&WSHPs replace heating systems running on electricity. Between 2007 and 2015, the ratio of heat generation to CO_2e savings was 3:1. As carbon intensity has improved, the ratio increased to 5:1. When combined with the dramatic fall in the ratio when ASHPs replace oil, the overall ratio for all ASHPs is consistent.

Chart 6: Ratio of MWh to Tonne CO_2e saved compared to CO_2e intensity of grid electricity: installs displacing oil only



Summary findings

This report is published against a backdrop of a UK target to reach Net Zero by 2050 and a consensus among commentators that achieving it '*requires the rapid decarbonisation of energy use in the heating and transportation sectors, alongside the rapid deployment of clean renewable technologies.*'[31] The data examined here suggests the UK has a long way to go and an urgent need to ratchet up the pace of deployment.

What the MCS data tells us

The last 14 years have seen the birth and growth of a UK small-scale renewables market, reaching over 1.2 million installations and, in the process, saving almost 10 million tonnes of carbon (CO_2e). This potentially offsets the annual emissions of around 4.4 million gas-fuelled homes. However, our analysis suggests the pattern of this growth falls well short of what the Climate Change Committee says is needed to achieve the UK's Net Zero target.

There are clear gaps in:

What's been installed

- Solar PV dominates while heat technologies have grown at a much slower rate.
- Within the heat technologies, the number of ASHPs that have been installed alone is more than the number of G/SWHP, Biomass and Solar Thermal installations combined.
- The technologies that offer greener energy at lower cost per kW generated trail behind those that are cheaper to install upfront.

Where it's been installed

- The overall picture is one of renewables 'deserts' in urban areas and comparative 'forests' in many rural areas, particularly those with limited access to the gas grid. Contrast the Orkney Islands where an estimated 20 per cent of households have one or more renewable technology with London's Kensington and Chelsea where it's 0.3 per cent.

By whom it's been installed

- The consumers of small-scale renewables are mainly small households of owner-occupier professionals, managers and skilled tradespeople who live in detached or semi-detached homes. The analysis suggests the market rarely extends to families, renters, flat-dwellers and service workers.

The data suggests the pace of installing small-scale renewables has been achingly slow in the context of the 2050 target: 1.2 million installs over 12 years suggests a rate of 100,000 per annum, even in a period in which Solar PV boomed. With around 26.5 million households in England, Wales, and Scotland, it would take around 250 years to reach the point where all the homes currently without any renewable energy had some installed.

The analysis also shows that the path of growth has been fairly volatile, with the number of installations spiking and dropping away in line with changes in government incentives.

31 Solar Trade Association. 2020. Smart Solar Homes. 2020. Available at: **https://www.solar-trade.org.uk/smart-solar-homes/** (Accessed: 3 November 2020)

Urban deserts

Understanding which geographical areas are conducive to the deployment of these technologies is an important policy and research issue. The MCS data confirms that there is an urgent need to tackle the lack of renewables in urban areas:

- Manchester has fewer ASHP installations than West Devon (225 and 235 respectively). Taking the number of households in each LA into account, that makes Manchester's rate of installation barely a tenth of its West Country counterpart (one in 1,000 compared to one in 105).
- Kensington and Chelsea LA have 219 installations of Solar PV, equivalent to one in 400 of its households; the Western Isles has nearly 100 more (312), a rate of one in 44 households.
- The Carbon Trust says the RHI has failed in London where only 304 domestic RHI applications have been made for ASHPs from April 2014 to January 2020.[32]
- Scotland has done relatively well on renewables but even there the 'urban issue' is acknowledged:

> **'The main challenges we face are expanding these principles into more densely-populated and urban areas, and identifying sustainable, replicable commercial models.'[33]**

While the housing stock and living arrangements are obviously different in urban areas, the numbers revealed by this report suggest much more could be achieved even within those confines. As the Carbon Trust has pointed out, ASHPs, for example, can be fully internal where external space is not available, blocks of flats can share ambient loops with individual heat pumps in each flat and in dense urban areas, and large heat pumps can be used in heat networks.

The report also shows that urban areas can buck the trend: semi-urban Stirling and Peterborough have high levels of Solar PV while urban Enfield in London is close to the top ten of LAs in terms of the percentage of properties with G/WSHPs. Stroud and South Lanarkshire, for example, have relatively high installation rates in non-rural areas with good access to mains gas. These areas, and others like them, would benefit from further study.

'Off-grid': homes off the mains gas grid

The report also finds that the installation of renewable heat is **strongly** correlated to areas where a relatively large proportion of consumers have no access to mains gas. The potential carbon savings made by switching a property heated by oil to renewables is significantly higher than if switching a property heated by gas. Yet the numbers of small-scale renewable installations even in these areas amounts to a tiny proportion of the more than four million off-gas homes across England, Wales, and Scotland.

The costs of renewables may be the strongest barrier here: rural 'hard to treat' off-gas properties with higher heat loads are particularly good candidates for biomass systems, but the report shows that, while these systems are on average the cheapest heat technology per kW installed, they are the most expensive in terms of up-front cost.

The consumer gaps

The report suggests that national initiatives in relation to small-scale renewables have so far encouraged uptake mainly by those who are likely to be better off: small households of one or two people, those in professional occupations, including managers, directors and senior officials, house-dwellers rather than those who live in flats, and owner-occupiers rather than renters.

It is perhaps unsurprising that national output-related non-means-tested incentive schemes for small-scale renewables that do not address the up-front cost barrier have not reached much beyond the able-to-pay market and have done little for the 30 per cent of UK households who are tenants.

The move to up-front grants under the Green Homes Grant and the RHI-replacing Clean Heat Grant Scheme should help, but only to a limited degree, at least as currently envisaged (see below).

Interestingly, another clear trend is that those with knowledge of trades, including heating and plumbing, are more likely to install low carbon heating compared to those working in service sectors. As MCS has noted, this shows that *'renewable technology is not only more accessible to those with higher incomes, but also highlights the need to address wider consumer awareness as to the benefits of installing low carbon heating.'* The MCS Charitable Foundation 'Energising Advice Report,' published in December 2020, maps advice and information provision, providing interesting lessons for policy in this regard.

> The installation of renewable heat is **strongly** correlated to areas where a relatively large proportion of consumers have no access to mains gas.

32 Carbon Trust. Heat Pump Retrofit in London. 2020. Available at: **https://www.carbontrust.com/resources/heat-pump-retrofit-in-london** (Accessed: 3 November 2020)

33 Scottish Government. The future of energy in Scotland: Scottish energy strategy. 2017, Available at: **https://www.gov.scot/publications/scottish-energy-strategy-future-energy-scotland-9781788515276/pages/5/** (Accessed: 3 November 2020)

Small-scale renewable heat: the 'biggest challenge'

The decarbonisation of heat is, according to Ofgem *"arguably the biggest challenge facing UK energy policy over the next few decades."*[34] The UK Government recognises the need for a *"mass roll out"* of low carbon heat technologies through the 2020s as a contribution to its own legal obligation to achieve Net Zero by 2050.[35]

MCS data suggests that attempts to drive the market for low carbon heat using the RHI since 2011 have had limited success. The UK's renewable heat market remains dwarfed by that for fossil fuelled boilers. There are 26 million gas boilers used in the UK compared with fewer than 30,000 heat pumps installed annually; just two per cent of gas boiler replacement sales.[36]

The UK Government also admits that the current market for low carbon heat solutions remains small because microgeneration technologies are: *"largely unable to compete on cost with conventional heating options, such as natural gas, oil and direct electric heating."*[37]

As a result, the government has changed tack. The RHI will remain in place until March 2022 when, it is proposed a capped £100m budget will fund Clean Heat Grants to consumers of £4,000 each to be used for low carbon heating. It is expected that this will support the installation of fewer than 25,000 heat pumps.[38]

Government financial support for low carbon heat is welcome and the shift towards grants will help some consumers overcome the upfront capital hurdle that many identify as a market barrier. But, even so, the proposed £100m budget for the Clean Heat Grant strategy is drastically short of what is necessary for a viable Net Zero strategy. The Carbon Trust describes the budget as *"several orders of magnitude below the level of ambition needed."*[39]

The Committee on Climate Change calculates that between 17 and 19 million heat pump installations will be needed if the UK is to meet emissions reduction targets.[40] The body concludes that at least 2.3m will be needed by 2030 and recommends a more ambitious target of 3.3m by that target year.[41]

Those figures seem daunting but our examination of the roll-out of small-scale renewables shows that some areas of the UK are already seeing mass uptake. ASHP installation levels in the Western Isles are close to the equivalent of one in ten homes (9.7 per cent). Exceptional rates of installations are evident in other areas including the Orkney and Shetland Islands, the Highlands and Dumfries and Galloway. Other local authorities including Argyll and Bute, Forest Heath and Ceredigion have MCS certified ASHP installation rates close to or slightly above two per cent.

This year the Scottish Government has committed money to double the rate of renewable heat installations every year to increase them from 2,000 to reach 64,000 in 2025.[42] That represents a cumulative total of 126,000 homes – more than five per cent of all homes in Scotland.

Setting ambitious targets seems to be common to the more successful areas identified in this report. Setting a demonstrably achievable target of 1.5 per cent of all UK homes by, for example, 2024 would boost MCS certified ASHP installation numbers to 400,000. If the whole country matched the two per cent roll out achieved by Argyll and Bute, Forest Heath and others, then installation numbers could reach over half a million.

Target % of homes with renewable heat	1.5%	2%	5%
Number of homes in GB with installation	399,829	533,106	1,332,765

34 Ofgem. Ofgem Future Insights programme - The Decarbonisation of Heat. 2016. Available at: **https://www.ofgem.gov.uk/publications-and-updates/ofgem-s-future-insights-paper-2-decarbonisation-heat** (Accessed: 12 November 2020)

35 BEIS. Consultation Stage IA: Future Support for Low Carbon Heat. 2020. Available at: **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/881623/future-support-for-low-carbon-heat-impact-assessment.pdf** (Accessed: 12 November 2020)

36 Climate Change Committee. Reducing UK emissions: 2020 Progress Report to Parliament. Available at: **https://www.theccc.org.uk/publication/reducing-uk-emissions-2020-progress-report-to-parliament/** (Accessed: 12 November 2020)

37 BEIS. Consultation Stage IA: Future Support for Low Carbon Heat. 2020. Available at: **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/881623/future-support-for-low-carbon-heat-impact-assessment.pdf** (Accessed: 12 November 2020)

38 Consumers in England can also apply for Green Homes Grant funding of up to £5000 for low carbon heating. Green Homes Grant vouchers were launched in 2020 as a financial stimulus in response to the Covid 19 crisis. The vouchers cannot be used for newly built homes and must be used before 31 March 2022. **https://www.gov.uk/guidance/apply-for-the-green-homes-grant-scheme#eligibility**

39 Carbon Trust. Heat Pump Retrofit in London. 2020. Available at: **https://www.carbontrust.com/resources/heat-pump-retrofit-in-london** (Accessed: 3 November 2020)

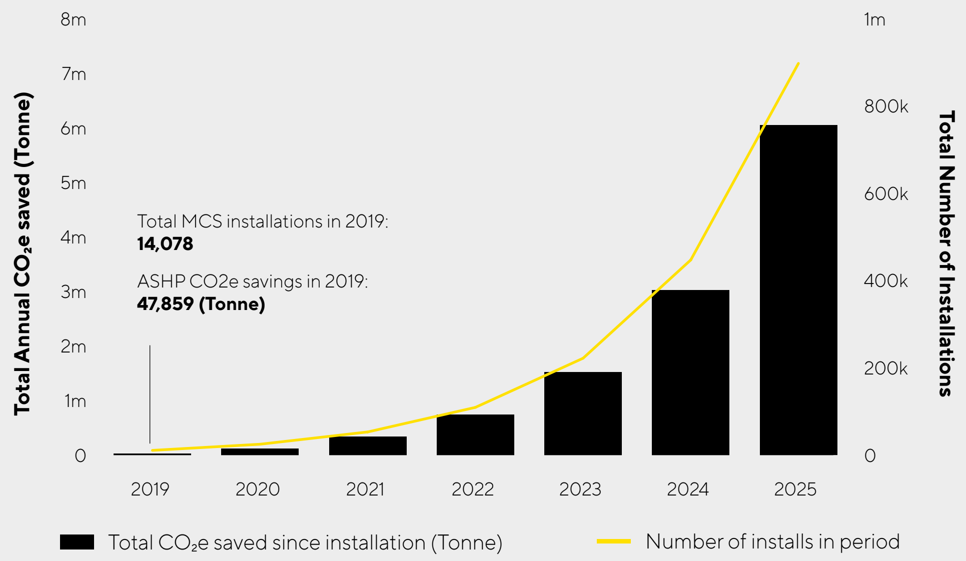
40 Climate Change Committee. Net Zero Technical Report. Available at: **https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-Technical-report-CCC.pdf** (Accessed: 7 November 2020)

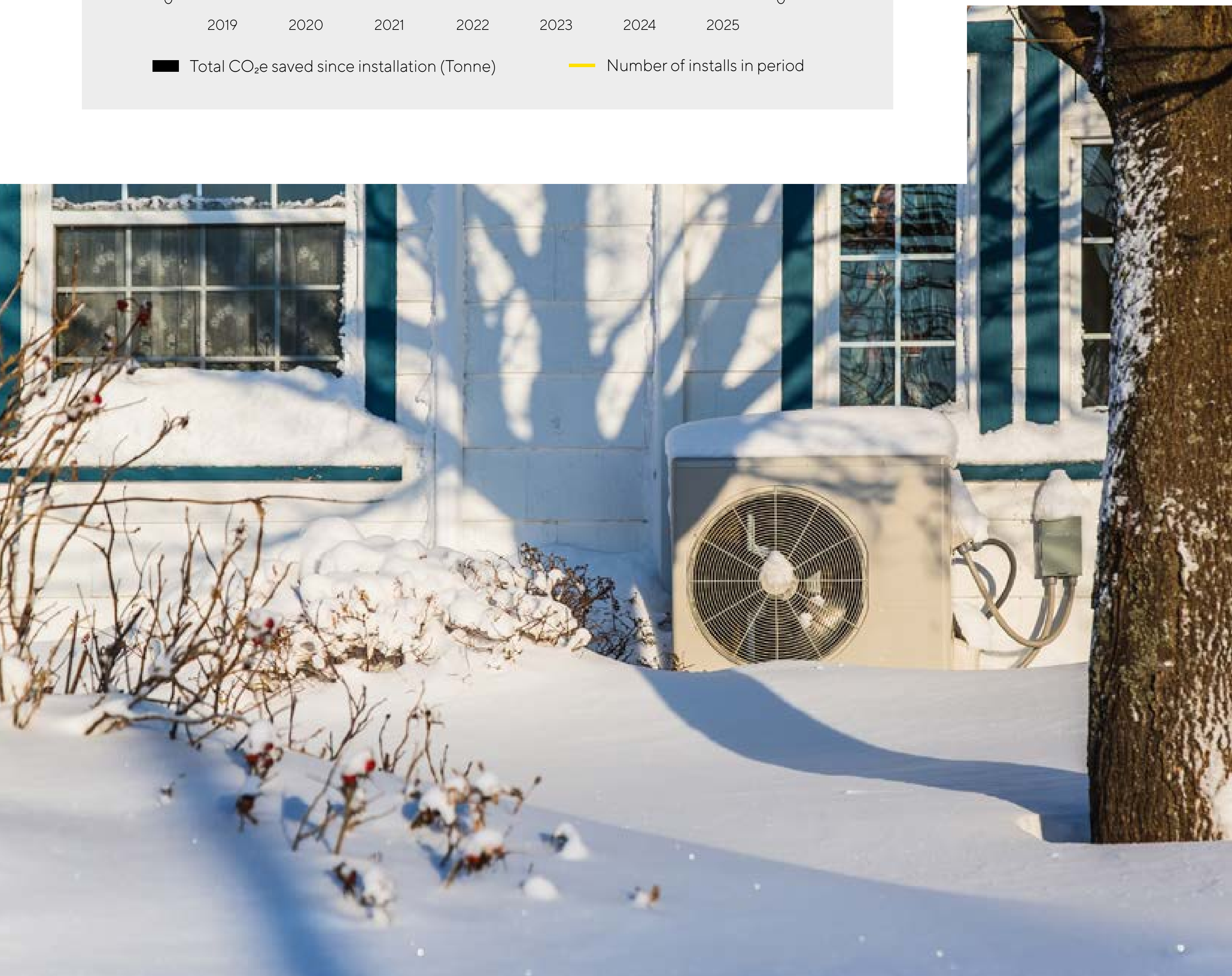
41 Climate Change Committee. Sectoral scenarios for the Fifth Carbon Budget. Available at: **https://www.theccc.org.uk/wp-content/uploads/2015/11/Sectoral-scenarios-for-the-fifth-carbon-budget-Committee-on-Climate-Change.pdf** (Accessed: 7 November 2020)

42 Scottish Government. 2020. Protecting Scotland, Renewing Scotland: The Government's Programme for Scotland 2020-2021. Available at: **https://www.gov.scot/publications/protecting-scotland-renewing-scotland-governments-programme-scotland-2020-2021/pages/5/** (Accessed: 9 November 2020)

As an experiment, we forecast the impact on the market if England and Wales mirrored Scotland's promise to double the number of renewable heat installations every year until 2025 (see **Chart 7**). Starting with just over 14,000 ASHP installations in 2019, the figure potentially jumps to more than 225,000 in 2023 and reaches 900,000 by 2025. CO_2e savings for that year alone (from all ASHP installations) would be just over six million tonnes. That eliminates the CO_2e emitted by nearly three million cars. That CO_2e saving would be higher still if biomass and G/WSHPs were to make up a significant proportion of the 900,000 installations.

Chart 7: Projected total CO_2e savings: when ASHP installations double each year to 2025





Recommendations

These recommendations are based on the data analysis outlined in this report.

1. **Learn from successes**
2. **Set clear and ambitious targets**
3. **Devise an integrated package of support**
4. **Continuation of the redevelopment of MCS**

1

Learn from successes

National government policies are obviously important but pivotal strategies are also being developed by the devolved administrations and other tiers of government and it is important to champion local successes such as those identified in this report.

The success of renewables in rural areas (particularly the Scottish Islands and Cornwall) demonstrates the importance of a raft of combined initiatives under a unified strategy (as in, for example, Scotland's Energy Efficiency Plan):

- Scotland's "whole-system" approach is planned and deployed on an area-by-area basis, with Local Heat and Energy Efficiency Strategies, small-scale renewables supported through subsidy, grants and loans and, very importantly, independent advice
- Cornwall's "whole-house" approach to retrofit takes a fabric-first focus to ensuring the most appropriate materials and insulation are in place before energy needs are addressed through small-scale renewables
- Orkney has a raft of measures including impartial advice, a Carbon Management strategy, a Fuel Poverty Strategy and a Skills Strategy.

Policy and resources might usefully match a whole-system approach at the macro-level with an area-by-area approach at the local level and a whole-house approach at the micro level.

2

Set clear, ambitious, evidence-driven targets to tackle gaps and drive an increase in installations

Short term subsidies, changes to tariffs and frequently changing new schemes, challenge consumer understanding and engagement, as well as presenting cliff edges for the sector when schemes come to an end.

Ambitious targets delivered through long-term incentives are vital to secure the contribution small-scale renewables can make towards Net Zero carbon emissions. The Future Homes Standard should assure an end to fossil-fuel heating systems in all new houses to limit the scale of the challenge.

A far greater impact and challenge will be switching the 27 million existing UK homes to low carbon heat. Both ASHP and GSHP technologies are proven, reliable and extremely efficient: thermal output from heat pumps is several times the electricity input, as long as they are installed correctly. However, the up-front costs are a significant barrier to upgrading heating systems and improving efficiency. As a result, ambitious retrofit targets need to be matched by appropriately funded incentive schemes.

Ambitious targets delivered through long-term incentives are vital to secure the contribution small-scale renewables can make towards Net Zero carbon emissions.

3

Devise an integrated and targeted package of support

The aim is to help households and property owners to access not just any renewable system but the right system for them and the area they live in.

a) Cost reduction

Renewables need to be more accessible both for those who can pay and those who cannot. As well as grants, support might take the form of:

- Cheap or interest-free loans as seen in Scotland, as well as in other countries
- Equity loans, with loans repaid upon the sale of the property. Scotland's Home Energy Efficiency Scheme provides an example.
- Boiler scrappage schemes
- Tax incentives such as council tax reductions
- Increased access to group-buying schemes that can stimulate a local area's awareness for the adoption of renewables and at the same time drive down the cost of installation
- With Brexit, consideration of reducing or even abolishing VAT on renewables.

b) Increasing awareness

'The benefits of low carbon heating need to be clear and transparent to consumers and should be coupled with awareness campaigns that aim to change their understanding about domestic energy use and technology options.'[43]

The lower rates of installation by those who work in the service sectors as against those in skilled trades, and the better rate of installation in areas where advice is part of the renewables package, indicates the important role that information can play in promoting renewables.

Householders need access to impartial independent advice if they are to access the technology that is best for their home and their circumstances. A model exists in the form of Home Energy Scotland, a national advice service delivered regionally through telephone advice, providing a free in-home expert government-funded assessment.

4

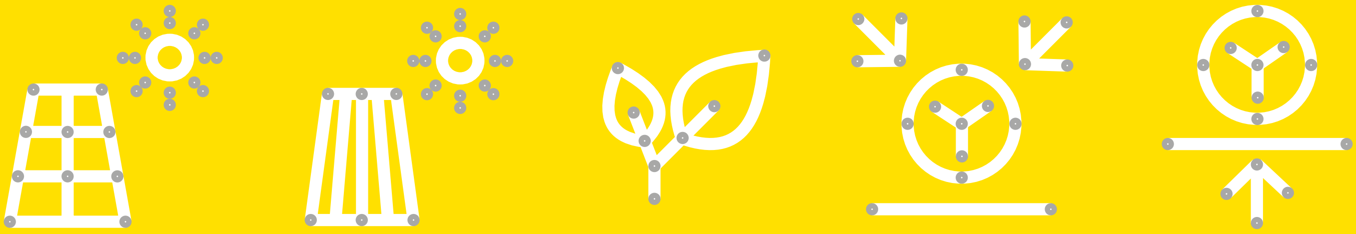
Continuation of the redevelopment of MCS

Since novation in April 2018 and under new leadership, **MCS has started to streamline its Scheme to improve compliance and enhance the consumer protection that Standards can afford. This work will continue throughout 2021 and is intended to deliver:**

- A simpler and more accessible set of MCS Standards documents, including the associated guidance, tools and calculators
- An MCS that is more accessible and in turn, drives up standards of workmanship. MCS documents will be available via a new digital platform (mobile app and website) that will enable MCS certified installers to access MCS Standards via checklists, online guides and calculators as part of their everyday onsite installation activities.
- A resetting of the Certification Scheme associated with the Standards, requiring a new working relationship between MCS and its third-party Certification Bodies
- A new Scheme Support function that can help 'new' installers with their applications for certification and subsequent compliance
- A role for MCS in determining the training and skills needs of a future workforce, critical to high quality installations, especially for renewable heating technologies.

MCS has started to streamline its Scheme to improve compliance and enhance the consumer protection that Standards can afford. This work will continue throughout 2021.

43 MCS. Full response from MCS – Clean Heat Grant Consultation. 2020. Available at: **https://mcscertified.com/full-response-from-mcs-clean-heat-grant-consultation/** (Accessed: 7 November 2020)

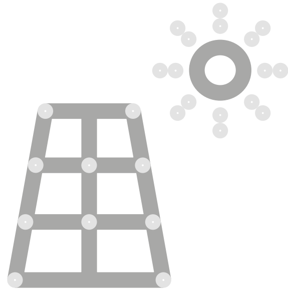


The Technologies

Solar Photovoltaic (Solar PV)

Solar PV is the success story of microgeneration. Government incentives and falling costs delivered market growth from under 100 to over one million installations in 12 years, generating tens of thousands of Gigawatts of electricity and carbon savings in the millions of tonnes.

- It's not an even picture, with peaks and troughs in installation rates, reflecting cuts to incentives
- Forests of Solar PV (high installation rates) in rural areas and some small cities and relative deserts in major conurbations
- Those installing are most likely to be owner-occupier small households of professionals in larger homes. Solar PV has made relatively little progress among larger family households, flat-dwellers and rented properties.



The Technology

Solar PV offers a clean and sustainable means of generating domestic electricity. Sunlight that hits the surface of a solar panel's photovoltaic cells generates an electric current. A device called an inverter, converts this DC electricity into 'useable' electricity.

Over a million installations of Solar PV systems registered with MCS since 2008. This changed from 20 installations in 2008 to 1,027,339 by 2019 - peaks and troughs are in line with cuts in incentives.

>1 million

60%

60 per cent fall in costs of the average 4kWp system. This is from £13,000-plus in 2010 to £5,000-plus in 2019.

20,000GWh of electricity generated. This is equivalent to the electricity consumed in 5.66 million homes annually (in London and the East Midlands).[44]

20,000GWh

7 million

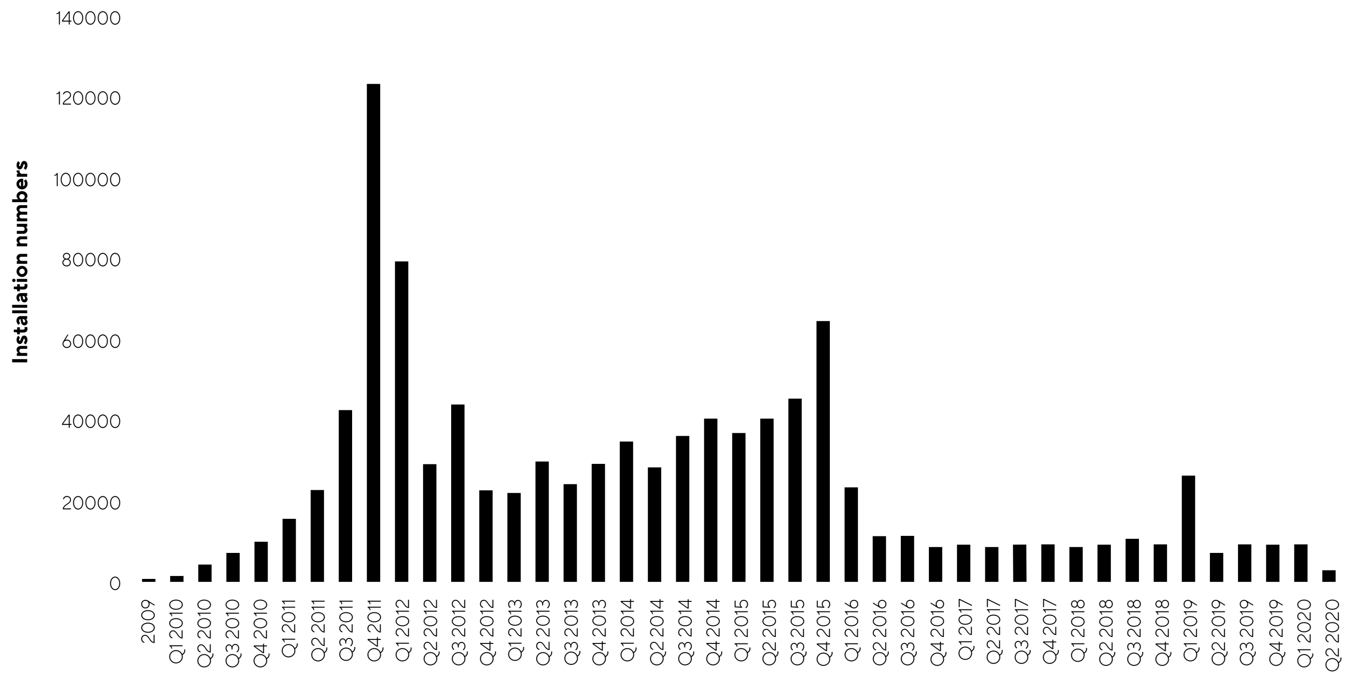
Nearly seven million tonnes of carbon (CO_2e) saved. That's close to the carbon footprint of UK's entire public sector in 2018 or 50 million flights from London to Edinburgh.

Solar PV is everywhere across Great Britain but with some forests and other relative deserts. The picture is dominated by rural local authorities in the South West of England and the East of England. Overall, people who live in rural locations are much more likely to install Solar PV. Major urban centres have proportionally low levels of Solar PV installations.

The Solar PV 'consumer' is typically an owner-occupier professional couple living in a detached or semi-detached house in a rural area.

44 BEIS. (2019). Sub-national electricity and gas consumption summary report 2018. Available at **https://www.gov.uk/government/collections/sub-national-electricity-consumption-data** (Accessed: November 9 2020)

Chart 8: Installation by Quarter - Solar PV



	Pre-FiTs		The Boom Years		A Reducing Landscape							
Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
No. of installations	20	1,198	24,015	203,872	167,762	105,386	140,984	187,550	60,005	37,215	43,110	56,222

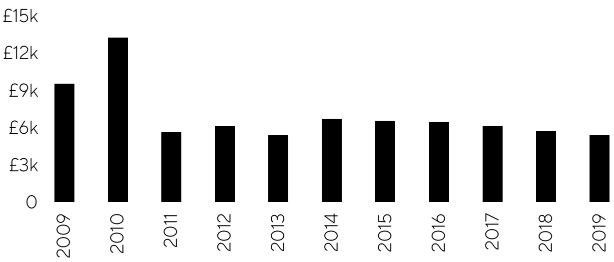
Key Dates	
2010	FiTs introduced 1 April, 4kW system costs £13,000+, with an average 2,000 installations per month
2011	'Peak Solar PV': FiT continues at high rate, 4kW system costs under £6,000, with an average of around 17,000 installations per month/800-+ per working day
2012	Government announces FiTs cuts in December 2011 which are effective March 2012
2016	Major cuts to FiTs from January/February 2016
2019	FiTs close to new installations 31 March 2019
2020	Smart Export Guarantee introduced

Falling costs drive market expansion

The launch of FiTs and resulting market expansion made the cost of Solar PV systems to consumers fall dramatically.

- Minus 30 per cent in real terms in 18 months from FiTs launch April 2010 to October 2011[45]
- Minus 60 per cent in the cost of an average 4kW system: 2010 £13,187, 2019 £5,321
- Cost per kWp installed: £3,297 per kWp in 2010, and £1,330 per kWp in 2019.

Chart 9: Average cost of 4kWp Solar PV system 2009 - 2019



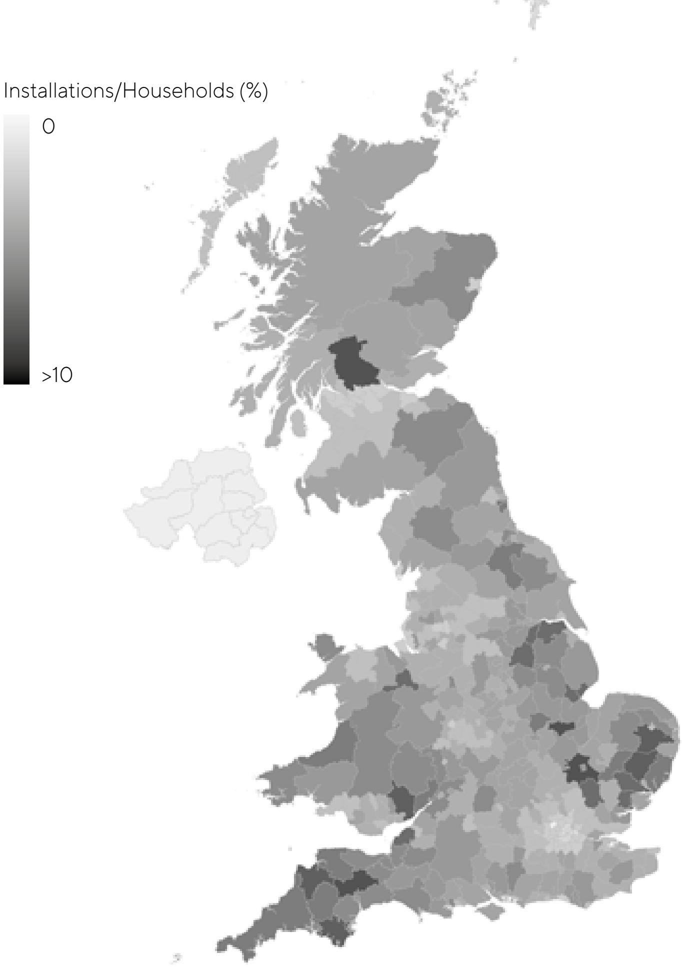
Forests and deserts

Solar PV is everywhere across Great Britain but with some PV forests and other relative PV deserts.

If we look at total numbers (not taking into account the density of households) of installations, the top installing local authorities are: Cornwall (19,271), Wiltshire (10,602), Peterborough (9,851), County Durham (9,390), Sunderland (9,310) and Birmingham (8,607). When we take into account household density, the picture is dominated by rural areas in the South West of England and the East of England.

Generally, rural areas tend to have a higher proportion of households installing Solar PV than urban areas. Interestingly, we found some evidence that areas with relatively low income are more likely to have homes with Solar PV installed. Also, the average household income is much higher than the UK average in the local authorities with the lowest percentage of Solar PV installations.

Percentage of households with MCS certified Solar PV installations per local authority 2008 – February 2020



The Solar PV forests:

Mainly, but not only, rural areas. Not necessarily well-off areas - just six of the LAs with the highest income levels have high installation rates.

Rural areas: On average, in the 40 LAs with the highest percentage of Solar PV installations, half of the homes are in Rural Designated Areas.

The South West: (includes Mid Devon, South Hams, Torridge, North Somerset and West Devon). This is the only region where more than one in every 20 households (5%) have Solar PV (in most regions between 3-5 % of households have Solar PV).

45 Department of Energy and Climate Change. (2011). Feed-in tariffs scheme: consultation on Comprehensive Review Phase 1 – tariffs for solar PV. Available at: **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/e/42831/3364-fits-scheme-consultation-doc.pdf** (Accessed: 15 September 2020)

Top 5 LAs for percentage of households with Solar PV	
1. Peterborough	12.8 % (9,851 installations)
2. Stirling	12.4 % (4,821 installations)
3. Mid Devon	12.2 % (4,143 installations)
4. South Cambridgeshire	10.8 % (6,637 installations)
5. South Hams	9.8 % (4,240 installations)
Another key area of interest	
Sunderland	7.5 % (9,310 installations)

5 LAs with the lowest percentage of households with Solar PV	
1. Islington	0.6 % (574 installations)
2. Camden	0.6 % (585 installations)
3. Hammersmith and Fulham	0.5 % (412 installations)
4. Westminster	0.3 % (324 installations)
5. Kensington and Chelsea	0.2 % (219 installations)

There are Solar PV forests in some more urban areas...

The launch of FiTs and resulting market expansion made the cost of Solar PV systems to consumers fall dramatically.

- **Sunderland:** LA with one of the highest installation rates (7.5 per cent) but almost no homes in areas designated as rural
- **Stirling in Scotland:** second highest concentration of households with Solar PV installations (12.4 per cent) and only around 30 per cent of its homes designated rural.

...and lower income areas:

- **North Lincolnshire:** in the bottom 50 of LAs in terms of Gross Disposable Household Income (GDHI), but high rates of Solar PV installation (8.4 per cent)
- **Sunderland (again):** also has a relatively low average GDHI but high install rates (7.5 per cent).

The Solar PV deserts

These are mainly, but not only, major urban areas:

- **London:** A total of 12 of the 32 London boroughs have fewer than 1,000 Solar PV installations each and have under 8,000 installations combined. Cornwall by itself has more than twice the level of Solar PV installations of the combined total of these 12 boroughs (19,721 vs. 7,997). The data shows 18 of the 20 LAs with the smallest proportion of households with PV are London boroughs i.e. all 12 of the inner London boroughs and six of the 20 outer London boroughs.
- **Urban areas:** In the 40 LAs with the **lowest** percentage of homes with Solar PV installations, a tiny minority (four per cent) of those properties (on average) are designated as rural. Other urban Solar PV deserts outside Greater London include Edinburgh, Glasgow, Dundee and Aberdeen.
- **Some Solar PV deserts are semi-rural:** East Hertfordshire and Epping Forest (near London); East Ayrshire (near central Scotland).

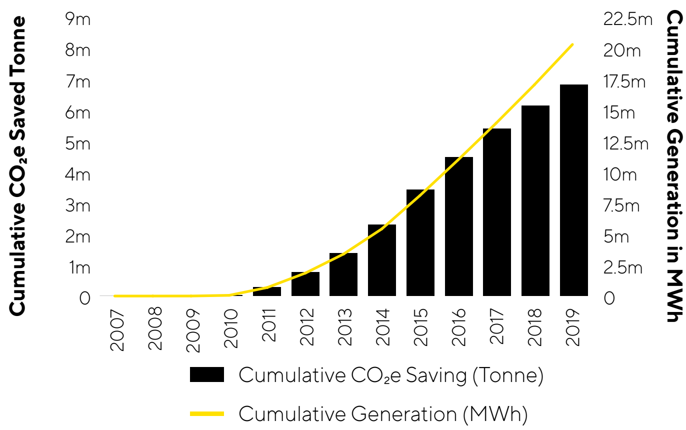
Generation

20,000 GWh of electricity generated – equivalent to the energy in 2.5 million tonnes of coal

Carbon saving

Seven million tonnes of CO_2e saved - almost equivalent to the carbon footprint of UK's entire public sector in 2018 or 50 million flights from London to Edinburgh.

Chart 10: Cumulative PV generation and CO_2e net over time.[46]



Which consumers are installing Solar PV?[47]

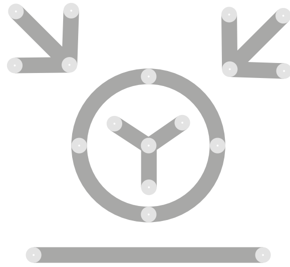
Looking at where installations have taken place, compared with Census data on those areas, of those with Solar PV installed:

- Seven out of ten are owner-occupiers
- Six out of ten are aged 30 to 64
- Two in three are single or two-person households
- Three out of four properties sold with Solar PV were detached or semi-detached
- One in five are professionals, one in every seven are skilled workers.

46 See Technical Appendix

47 Estimates derived from comparing MCS data on where installations are located with Census data, apart from property data, which is drawn from actual Land Registry-recorded sales of properties with MCS certified installations of microgeneration renewables.

Air Source Heat Pumps (ASHPs)



The ASHP is the single most installed small-scale renewable heat technology. Over 83,000 installations are generating thousands of Gigawatts of heat energy and saving over a million tonnes of carbon. And despite a rise in costs to over £10,000 for a typical system (based on today's costs), 2019 was a record year for ASHP installations.

ASHPs have made progress in areas with a high proportion of homes off the gas grid. There are installations in every local authority area in Great Britain, from just a handful of installations in some heavily-urban areas to near one in ten in households in Scotland's Western Isles.

The Technology

Devices that work in a similar way to refrigerators transfer heat that is absorbed from the outside air to an indoor space. Located outside people's homes, installing an Air Source Heat Pump is a low carbon heating solution.

Over 83,000 MCS certified Air Source Heat Pump installations by the end of 2019. This technology has grown from four in 2008 to 83,210 by the end of 2019.

>83,000

The most commonly installed microgeneration renewable heat technology.

Rising costs in 2019.

The average cost from 2008 to 2018 was £7,500 - £8,500, rising to more than £10,000 in 2019.

6,500GWh

6,500GWh of heat energy generated. This is enough to heat more than half a million typical UK homes for one year.

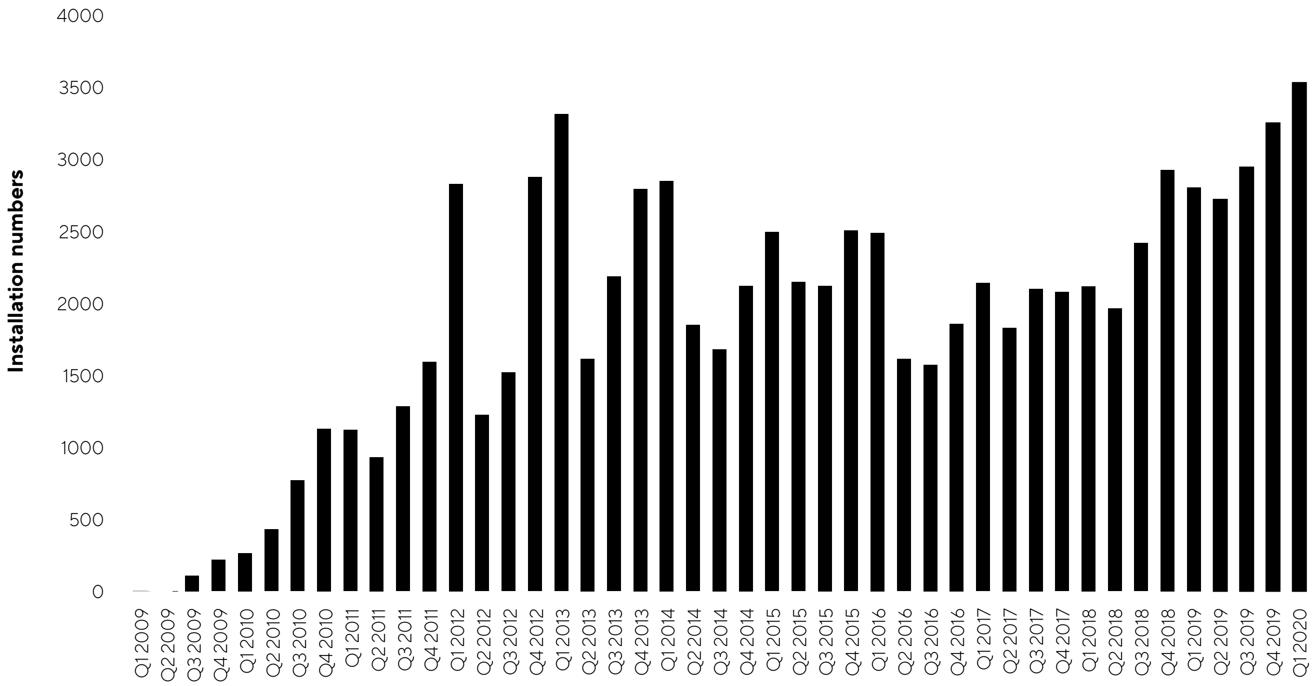
Around 1.25 million tonnes of carbon (CO_2e) saved. That's saving the carbon footprint of 566,000 homes using gas for heating in a year.

1.25 million

ASHPs are installed in every local authority, but particularly in rural areas largely off the gas grid. Remote parts of Scotland – the Western Isles and Orkney and Shetland Islands - all have the highest rates of installations.

The typical consumer is an owner-occupier professional couple living in a detached house in a rural area.

Chart 11: ASHP Installation numbers per quarter, 2009 - 2020



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
No. of installations	4	330	2,590	4,928	8,450	9,910	8,503	9,272	7,595	8,161	9,448	14,019

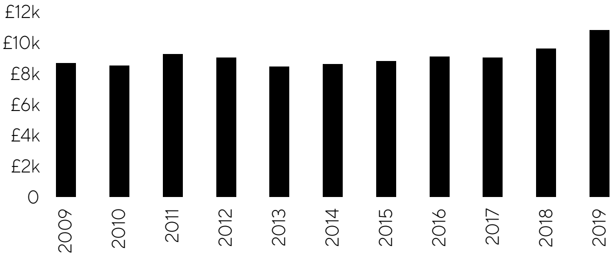
Key Dates	
2011	**August:** £850 RHPP
2013	**April:** £1,350 RHPP
2014	**April:** domestic RHI
2018	**January:** tariff uplift

Installation costs fairly stable until 2019

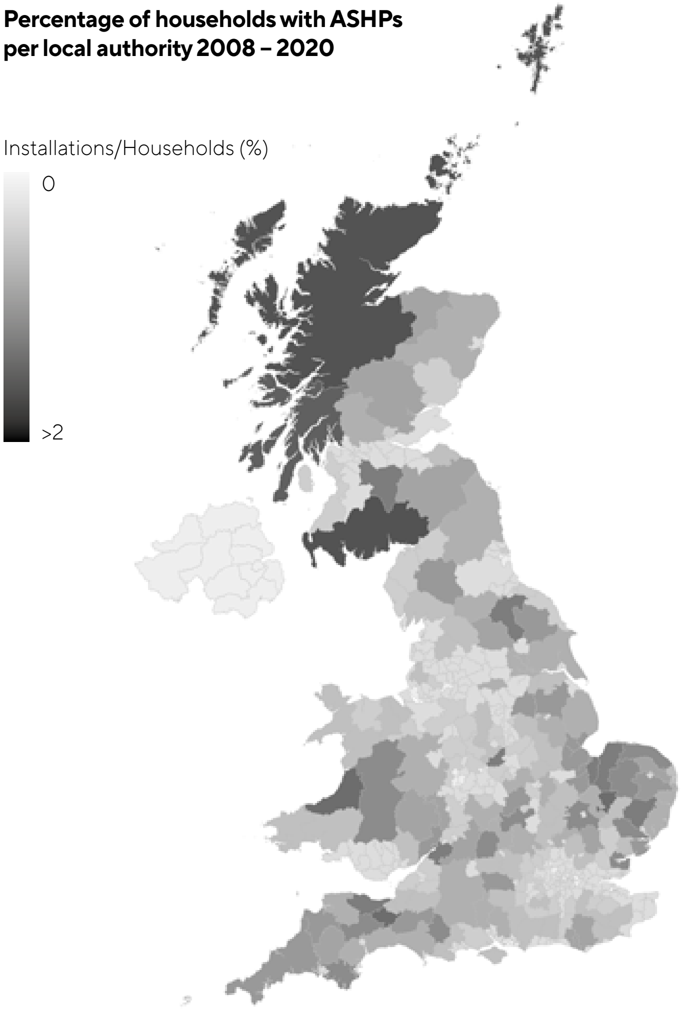
The average cost to the consumer of an ASHP installation was relatively stable from 2009 to 2018 at £7,500 - £8,500, but there was a notable rise in 2019 to £10,433.

- Average cost of a 10kW system up 23 per cent, with figures of 2009 £8,512, 2019 £10,433
- Similar rise in the cost per kW to the consumer as the typical system size was stable at 9-10kW across the period

Chart 12: Average cost of a 10kW ASHP system 2009 - 2019



Percentage of households with ASHPs per local authority 2008 – 2020



Geographical spread

There are ASHPs in every local authority area in Great Britain. In general, rates are higher in rural areas and very high in some remote locations – particularly in Scotland – while ASHPs installations are in single figures in some urban areas.

Top 5 LAs for percentage of households with ASHPs	
1. Western Isles	9.7 % (1,347 installations)
2. Orkney Islands	6.4 % (666 installations)
3. Shetland Islands	4 % (422 installations)
4. Highland	2.5 % (2,791 installations)
5. Dumfries and Galloway	2.4 % (1,724 installations)

5 LAs with the lowest percentage of households with ASHPs	
Tamworth	0.009 % (3 installations)
Sandwell	0.00 4% (5 installations)
Wolverhampton	0.004 % (4 installations)
Watford	0.003 % (3 installations)
Newham	0.002 % (2 installations)

The top three local authorities by proportion of households with an ASHP are all in the remoter parts of Scotland:

- **Western Isles:** one in 11 households (9.7 %) has an ASHP (1,347 installations)
- **Orkney Islands** are number two, with one in every 16 households (6.4 %) having an ASHP (666 installations)
- **The Shetland Islands** are number three, with one in every 25 households (4 %) (422 installations)
- **Scotland** is the champion region: one in every 166 homes has an ASHP (0.6 %)
- **The South West and East of England** regions both have around one in 200 homes with ASHPs.

In total numbers (not taking into account household density), the local authorities with the most ASHP installations are: Cornwall (3,041), Highland (2,791), South Lanarkshire (2,149), Dumfries and Galloway (1,724), Wiltshire (1,424) and the Western Isles (1,347).

At the other end of the scale:

- Fewer than one in 500 (0.2 per cent) households has an ASHP in half the local authorities in Great Britain
- Only one in 3,000 Greater London households has an ASHP (0.03 per cent)
- Seven LAs have just a handful of ASHPs installed, such as Sandwell (five), Wolverhampton (four), Tamworth (three), Watford (three) and Newham (two).

The urban-rural split

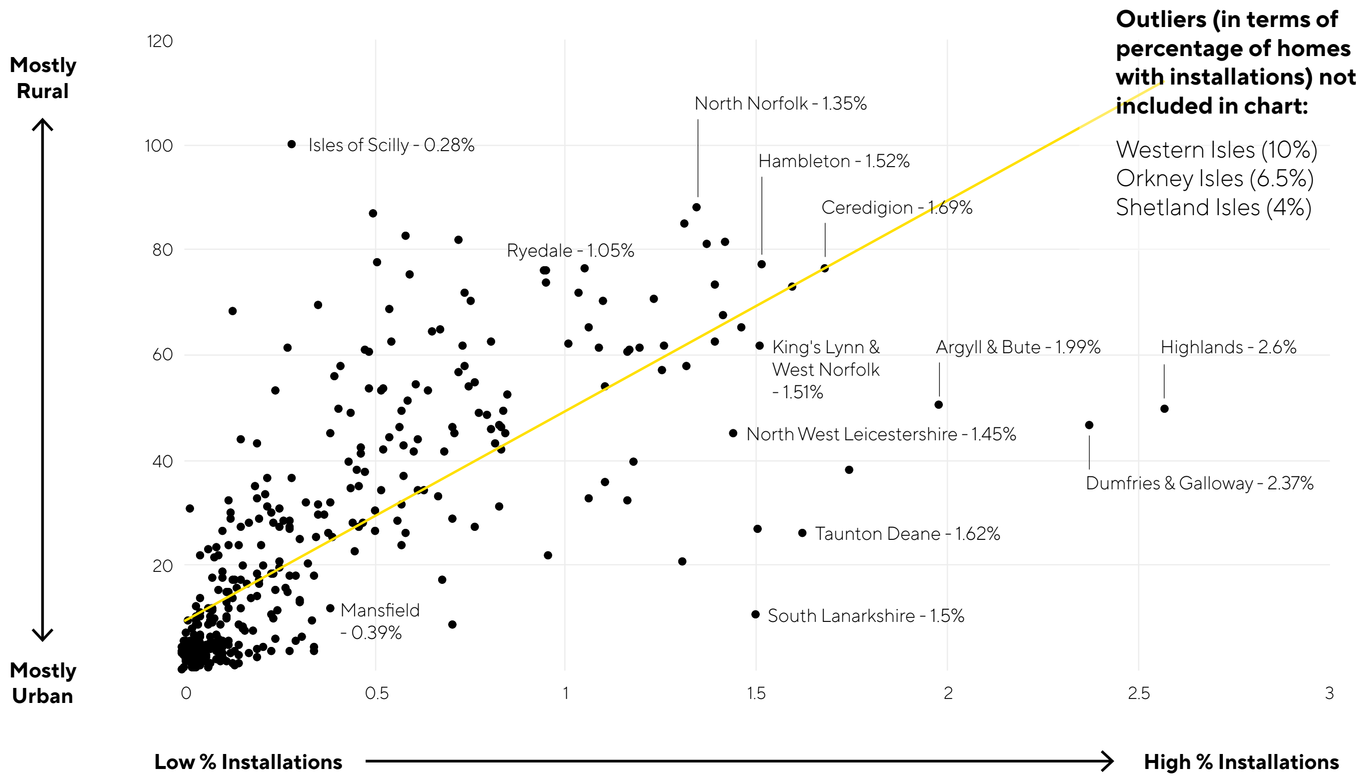
ASHP installation rates are higher in rural areas and very high in some remote locations – particularly in Scotland (percentage of households with ASHPs per local authority map). The availability (or lack) of gas grid is one likely reason.

- The LAs with the highest installation rates all have a high proportion of homes designated as rural, such as the Western, Orkney and Shetland Isles and the Highlands.
- In the 40 LAs with the highest rate of ASHP installation, the majority of properties (nearly 60 per cent) are in locations designated as rural.
- The 50 LAs with the lowest percentage of households installing an ASHP are also among the least rural, with no more than ten per cent of their properties in locations designated as rural, such as Newham in London, Wolverhampton, Portsmouth and Watford.

There are exceptions that prove it is possible for areas to buck the trend, such as:

- **South Lanarkshire:** as its position on Chart 13 shows, it is mostly urban (only ten per cent of properties designated as rural) but has relatively high rates of ASHP installations (1.5 per cent of households).

Chart 13: Correlation between rural location and installation



Income and location

In Scotland and Wales, the local authorities with a high proportion of households with ASHPs tend to be those with the highest proportion of households in fuel poverty, for example:

- The Western Isles has the highest levels of fuel poverty in the UK (at 36 per cent) and the highest proportion of homes with ASHPs
- The five LAs with the highest percentage of properties with ASHPs by far are all in Scotland and rates of fuel poverty in those areas are well above average.

We found no evidence of a link between higher disposable incomes and higher installation rates. In fact, we found:

- The average household disposable income in the 50 LAs with the highest installation rates is below the UK average, and
- The average household disposable income in the 50 LAs with the lowest percentage of ASHP installations is much higher than the UK average.

On or off the gas network

Across the UK, more than 80 per cent of homes have access to the gas network. We found that ASHP installation is strongly correlated to areas where a relatively large number of consumers have no access to mains gas:

- In the ten LAs with the highest proportion of ASHP installation, an average of 60 per cent of the homes are off-gas, including the Orkney Islands, where no property is on the gas grid, and Ceredigion in Wales, where 70 per cent of homes are off-gas
- At the other extreme, in the 50 LAs with the lowest rates of ASHP installations, a minority of homes (13 per cent) are off the gas grid.

Generation

6,500GWh of heat energy generated.

This is equivalent to:

- The heating demand of more than half a million typical UK homes for one year
- The energy in nearly 800,000 tonnes of coal.

Carbon savings

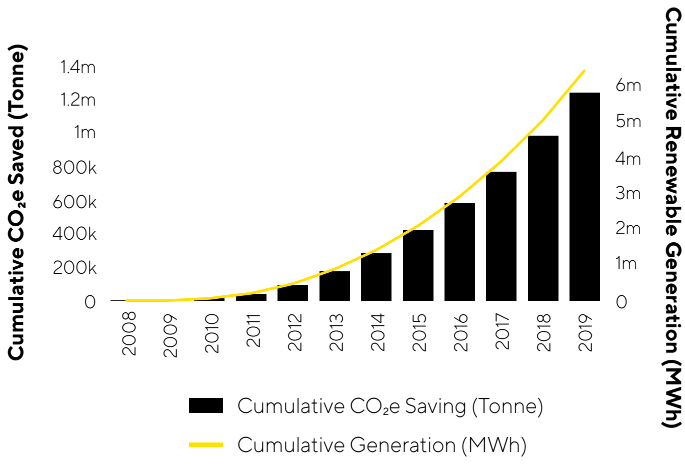
1.25 million tonnes of CO_2e saved.

That's the carbon footprint of:

- 8.5 million flights from London to Edinburgh, or 566,000 homes using gas for heating in one year.
- On average, every ASHP system saves between three and four tonnes of CO_2e emissions every year
- A typical ASHP system installed in 2010 has so far saved 36 tonnes of CO_2e.

Chart 14: Cumulative ASHP Renewable generation and CO_2e net over time[48].

An acceleration in 2019 due to a jump in installation numbers.



Which consumers are installing Air Source Heat Pumps?[49]

Looking at where installations have taken place, compared with Census data on the make-up of those areas, of those with an ASHP installed:

- Seven out of ten are owner-occupiers
- Six out of ten are aged between 30 and 64
- Nearly two-thirds are in single (30 per cent) or two-person (34 per cent) households
- Eight out of ten properties sold with ASHP installed were detached (63 per cent) or semi-detached (19 per cent) homes
- Those installing are most likely to be working as a professional (18 per cent) or a skilled worker (17 per cent).

48 See Technical Appendix.

49 Estimates derived from comparing MCS data on where installations are located with Census data, apart from property data, which is drawn from actual Land Registry-recorded sales of properties with MCS certified installations of microgeneration renewables.


MCS
CERTIFIED

Ground (or Water) Source Heat Pumps (G/WSHPs)

Around 20,000 MCS certified G/WSHPs have been installed since 2008. And there's been an uplift in 2018 and 2019, despite rising costs.

Those 20,000 installations are around a quarter of the number of ASHPs installed in the same period, but generated around half as much heat energy and saved around half the carbon.

Demand for G/WSHPs tends to be higher in rural areas and in locations that are furthest away from urban areas. The installation rate is particularly high in areas with significant numbers of homes off the gas grid. In contrast, some local authorities in urban areas have just a single heat pump installed.

The Technology

G/WSHPs collect low level heat via either underground or submerged pipework. This heat is then condensed by the heat pump to raise its temperature, which can then be used to provide heating and hot water for people's homes.

19,853

installations of G/WSHP systems registered with MCS since 2008. From just ten in 2008 to a peak of 2,332 in 2012, installation numbers then dropped until the introduction of the dRHI in 2014. Installation numbers fell slightly until the dRHI tariff uplift drove an increase in 2018 and 2019. This analysis includes a small number of water source heat pumps.

Installation costs fell during the peak installation phase in 2012 but have since risen significantly from £12,000-plus in 2009 to £19,000-plus in 2019.

3,000GWh of heat energy generated. This is equivalent to the heating demand of more than a quarter of a million typical UK homes for one year.

3,000GWh

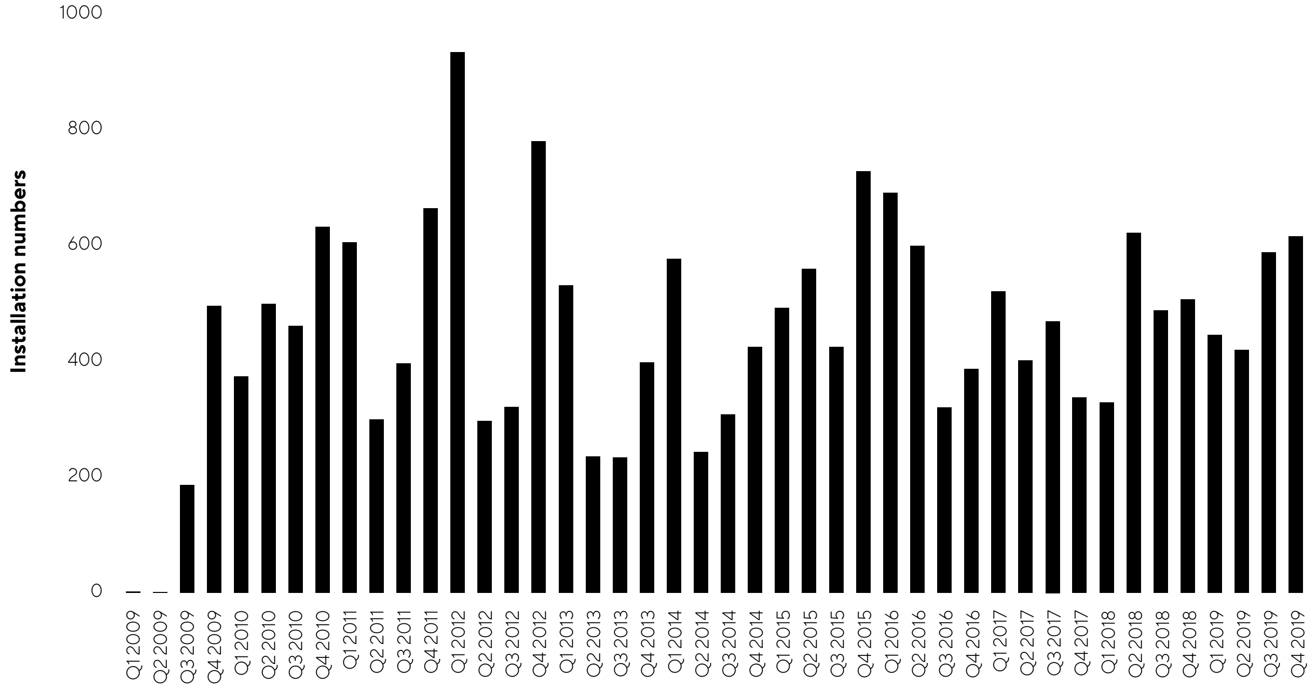
600,000

600,000 tonnes of CO_2e saved. That's the carbon footprint of more than four million flights from London to Edinburgh.

Demand for G/WSHPs tends to be highest in rural areas and remote rural areas in particular. Cornwall has the most G/WSHPs in total numbers, but when taking household density into account, the Orkney Islands has the highest percentage of households with G/WSHP installations.

The typical G/WSHP consumer is likely an owner-occupier professional couple living in a detached house.

Chart 15: MCS registered G/WSHP/WSHP installs 2009* - 2019



*There were just ten G/WSHP installations in 2008, not included in this chart

Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
No. of installations	10	687	1,966	1,956	2,332	1,399	1,553	2,205	1,998	1,731	1,946	2,070

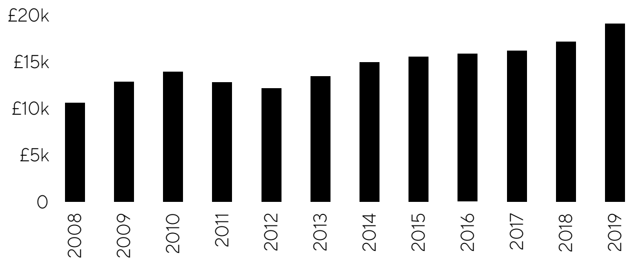
Key Dates	
2011	RHPP introduced. Non-domestic RHI starts
2012	Q1 highest quarterly installation total
2013	RHPP improved
2014	dRHI starts
2015	dRHI leads to rise in installations
2018	dRHI tariff uplift

Installation costs

Installing a typical 12kW G/WSHP system in 2019 will cost the consumer on average nearly 50 per cent more than installing the same size system in 2009.

- The average installation capacity of a G/WSHP between 2009 and 2019 was 12kW
- The average cost of a 12kW system rose 48 per cent from £12,849 in 2009 to £19,066 in 2019
- The cost per kW installed in 2019 was £1,589.

Chart 16: Cost of a 12kW G/WSHP system 2009 - 2019



Geographical spread

Percentage of households with MCS certified G/WSHP installations per local authority 2008 - 2019

Top 5 LAs for percentage of households with G/WSHPs	
1. Orkney Islands	1.12 % (116 installations)
2. East Lindsey	0.61 % (401 installations)
3. Cotswold	0.53 % (215 installations)
4. Shetland Islands	0.51 % (55 installations)
5. Eden	0.51 % (130 installations)

5 LAs with the lowest percentage of households with G/WSHPs	
Gosport	0.002 % (one installation)
Tower Hamlets	0.0008 % (one installation)
Leicester	0.0008 % (one installation)
Newham	0.0009 % (one installation)
Stoke-on-Trent	0.0009 % (one installation)

- **Highest density:** The Orkney Islands stand out as a G/WHP success story; with 116 installations, that means one in every 89 households (1.12 %) has a G/WSHP
- **Total numbers:** In total numbers (not taking into account household density), the LAs with the highest numbers of G/WSHPs are Cornwall (875), Shropshire (589), Enfield (549), Glasgow City (468), East Lindsey (401), and Highland (367).
- **The bottom five LAs:** by percentage of households with a G/WSHP, these are all urban and have just five installations between them.

The urban-rural split

Demand for G/WSHPs tends to be higher in rural areas and in locations that are furthest away from urban areas in particular. The availability (or lack) of gas grid is one likely reason.

- In addition to the Orkney Islands, the LAs with the highest percentage of installations includes Shetland Islands, Eden, East Lindsey and Ceredigion. Over half of all properties in the 40 LAs with the highest percentage of G/WSHP installations are in locations designated as rural.
- **The South West has the highest proportion of G/WSHPs** where one in every 770 households (0.13 per cent) has a GWSHP, followed by Scotland (0.11 per cent), then Wales (0.1 per cent) and the West Midlands (0.09 per cent).
- Of the 20 LAs with the highest proportion of installations, 46 per cent of homes are off the gas grid including all properties on the Orkney Islands and Shetland Islands, 87 per cent of those in the Western Isles and 70 per cent of those in Ceredigion.
- At the other extreme, and as for ASHPs, just 13 per cent of homes are off the gas grid in the 50 LAs with the fewest G/WSHP installations.
- **Urban and semi-urban exceptions.** A few areas do not fit the overall pattern of deployment. For example, Enfield in London has the 11th highest percentage of properties with G/WSHPs, yet fewer than one per cent of properties there are designated as rural. East Staffordshire, Calderdale, Harrogate and Stirling also have a relatively high installation rate but a relatively low proportion of homes in rural areas.

G/WSHP deserts

- **Cities:** In Greater London fewer than one in 5,000 households has a G/WSHP. This is not surprising given that a typical horizontal system requires around 700 square metres of land. Most of the bottom 20 LAs for G/WSHPs are in urban areas, five are in Greater London and four are in the Midlands.

Income and location

There's a link between fuel poverty and G/WSHP installation in some areas, and in Wales in particular. For example:

- The LAs in Wales with the highest rates of fuel poverty (Ceredigion, Powys and the Isle of Anglesey) all have relatively high installation rates
- On the other hand, almost all of the LAs in Wales with low levels of fuel poverty have relatively few installations and most homes in those areas have good access to mains gas
- In Scotland, the LAs with the highest percentage of installations tend to be those with the highest number of people who are in fuel poverty.

Generation

3,000GWh of heat energy generated

MCS certified G/WSHP systems have generated heat energy equivalent to:

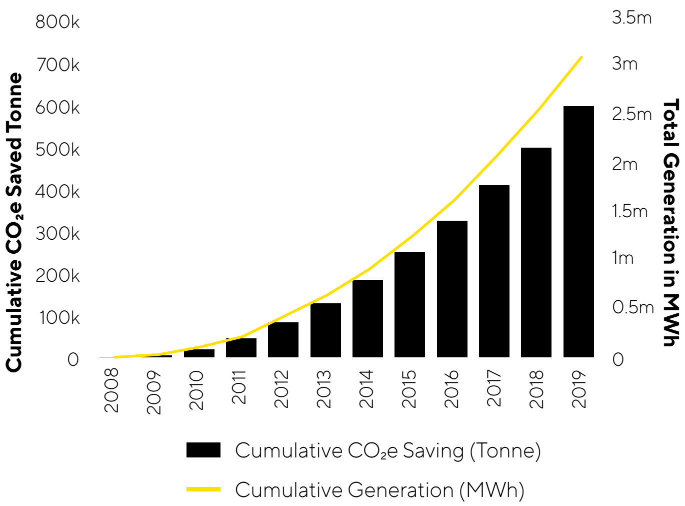
- The heating demand of more than a quarter million typical UK homes for one year.

Carbon savings

600,000 tonnes of CO_2e saved

That's the carbon footprint of more than four million flights from London to Edinburgh or equivalent to the CO_2e emitted from 270,000 typical homes heated by gas in one year.

Chart 17: Cumulative generation and CO2e net over time[50]



Which consumers are installing G/WSHPs?[51]

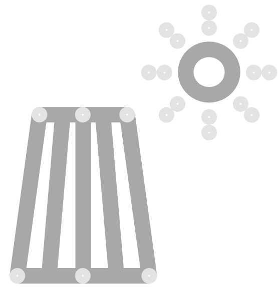
Looking at where installations have taken place, compared with Census data on the make-up of those areas, of those with a G/WSHP installed:

- The vast majority (68 per cent) are owner-occupiers; social renters are the next highest group (16 per cent), with private renters accounting for 14 per cent
- The majority (60 per cent) are aged between 30 and 64; the under-30s and the 65-plus each account for around one in five installations
- Most properties sold with a G/WSHP installed were detached houses (81 per cent); fewer than one in ten in semi-detached (six per cent) or terraced (three per cent) homes
- Nearly two-thirds are in single or two-person households (29 and 34 per cent respectively)
- Those installing a G/WSHP are much more likely to be professionals or skilled workers (19 and 18 per cent respectively) than those whose job is operating plant or machinery or in sales and customer service (each account for seven per cent).

50 See Technical Appendix

51 Estimates derived from comparing MCS data on where installations are located with Census data, apart from property data, which is drawn from actual Land Registry-recorded sales of properties with MCS certified installations of microgeneration renewables.

Solar Thermal



Solar Thermal is most common in rural areas, typically in owner-occupier detached homes. It is the second most installed small-scale renewable heat technology, but that's largely down to years of early strong growth.

The number of installations has fallen year-on-year from a peak of nearly 8,000 installs in 2011 to less than a tenth of that in recent years. That is despite both the launch of the dRHI and significant falls in the cost to the consumer.

The Green Homes Grant may give the sector a boost: by September 2020, the number of MCS certified Solar Thermal installers had more than doubled from its 2019 low.

The Technology

Solar Thermal systems convert sunlight into heat instead of electricity. Utilising outdoor modules that carry a mixture of water and antifreeze, they use the power of the sun to generate hot water but can also contribute to heating.

34,390

Installations rose from 952 in 2009 to a peak of 7,962 in 2011 and down to by 671 by 2019. The introduction of the dRHI in 2014 did not drive growth in the market for Solar Thermal. In fact, the number of installations declined year-on-year until 2018.

A fall of 57 per cent in the installation costs to the consumer of the average 3kW system. This went down from £10,000-plus in 2009 to £4,000-plus in 2019.

457GWh of heat energy generated. This is equivalent to the heating demand of nearly 40,000 typical UK homes for one year.

457GWh

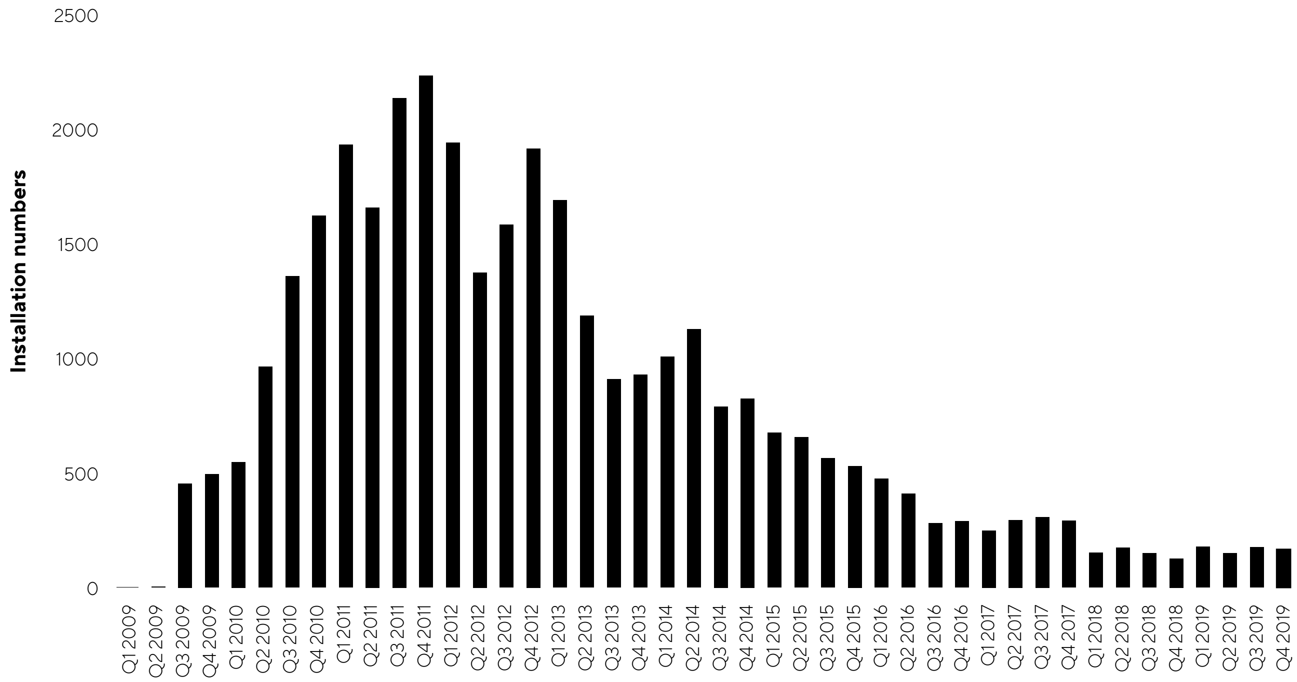
100,000

100,000 tonnes of CO_2e saved. This is the carbon footprint of more than 718,000 flights from London to Edinburgh.

There are concentrations of Solar Thermal in Scotland and Wales. Cornwall has the highest number of installations in absolute numbers, but when we take density of households into account, the Orkney Islands have the highest level: one in every 120 households. Overall, people who live in rural locations are much more likely to install Solar Thermal.

The typical Solar Thermal consumer is likely to be an owner-occupier professional couple living in a detached house in a rural area.

Chart 18: Solar Thermal Installation numbers per quarter, 2009* - 2019



*There were no Solar Thermal installations before 2009

			RHPP			dRHI					
Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
No. of installations	952	4,494	7,962	6,816	4,715	3,750	2,427	1,456	1,144	603	671

Key Dates	
2009	**31 July:** eligibility for future dRHI
2011	**August:** £300 RHPP grant introduced
2013	**April:** RHPP grant up to £600
2014	**April:** dRHI launched, 19.2ppkWh
2015-18	Small annual increases in tariffs
2019	**April:** dRHI tariff now 21.09 ppkWh

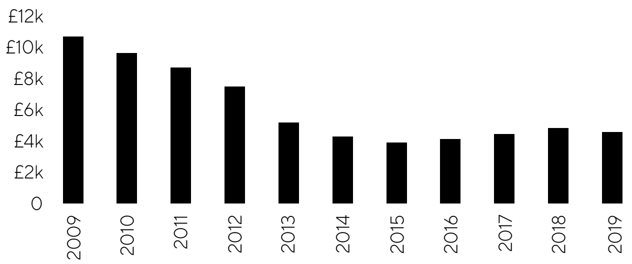
Unlike the other heat technologies, Solar Thermal installations didn't increase on introduction of the dRHI. In fact, it looks like the main effect of the dRHI in Solar Thermal was to increase the average size of installation, which remained above its pre-RHPP level even as total numbers of installations fell.

Falling costs

The cost to consumers of installing a typical 3kW Solar Thermal system more than halved between 2009 and 2019.

- The average cost of a 3kW system fell from £10,678 in 2009 to £4,556 in 2019
- The average cost per kW more than halved from £3,559 in 2009 to £1,519 in 2019
- On average, Solar Thermal was the most expensive of all the major technologies, per kW installed over this period.

Chart 19: Average cost of a 3kW Solar Thermal System 2009* -2019



*There were no MCS registered Solar Thermal installations before 2009

Geographical spread

Solar Thermal is everywhere across Great Britain, but at a much lower density than Solar PV.

Percentage of households with MCS certified Solar Thermal Installations per local authority 2008 - 2019

Top 5 LAs for percentage of households with Solar Thermal	
1. Orkney Islands	0.83 % (86 installations)
2. Ceredigion	0.80 % (277 installations)
3. Western Isles	0.74 % (103 installations)
4. Powys	0.71 % (456 installations)
5. Highlands	0.70 % (784 installations)

5 LAs with the lowest percentage of households with Solar Thermal	
Rossendale	0.01 % (four installations)
Glasgow City	0.008 % (23 installations)
Barking and Dagenham	0.008 % (six installations)
Kingston upon Hull	0.007 % (eight installations)
Harlow	0.006 % (two installations)

- **Highest density:** The Orkney Islands in Scotland and Ceredigion in Wales are the only LAs where more than one in 125 (0.8 per cent) of households have a Solar Thermal system.
- **Total numbers:** Not taking into account density per household, the highest number of Solar Thermal installations is in Cornwall (843), followed by Highland (784), Fife (626), Wiltshire (538), Powys (456) and Central Bedfordshire (456).
- **Rural areas:** Highest demand for Solar Thermal tends to be in rural areas farthest away from urban locations. For example, the five LAs with the highest percentage of installations are the Orkney Islands, Ceredigion, Western Isles, Powys and the Highlands.
- Exceptions that show high installation rates are possible in urban and semi-urban locations. Sunderland, Spelthorne and Warrington all have relatively high installation rates (within the top 40 LAs) yet have very few properties that fall within rural areas.
- **On or off the gas network:** One reason why demand for Solar Thermal tends to be highest in rural areas is because mains gas (the cheapest fossil fuel for heating) is much more likely to be available in urban or semi-rural areas where housing is more dense. In the ten LAs with the highest proportion of Solar Thermal installations, over 50 per cent of homes are off the gas grid (on average). At the other end of the scale, in the 40 LAs with the fewest Solar Thermal installations, under ten per cent of homes are off the gas grid.
- **Regionally:** The South West of England has the highest proportion of Solar Thermal installations, where one in every 455 households (0.22 per cent) has a Solar Thermal system, followed by Wales (0.21 per cent), then the South East (0.18 per cent) and East of England (0.17 per cent).
- **Solar Thermal deserts:** Regionally, the North West and Yorkshire and The Humber have fewer than one in every 1,167 (0.06 per cent) of households with Solar Thermal and in London it is fewer than one in every 2,500.

Income and location

There is a weak link between fuel poverty and Solar Thermal installation in some areas (Wales and Scotland in particular). For example, the local authorities with the highest rates of fuel poverty (Ceredigion, Orkney Islands, Western Isles and the Highlands) tend to have relatively high installation rates.

Generation

457GWh of heat energy generated

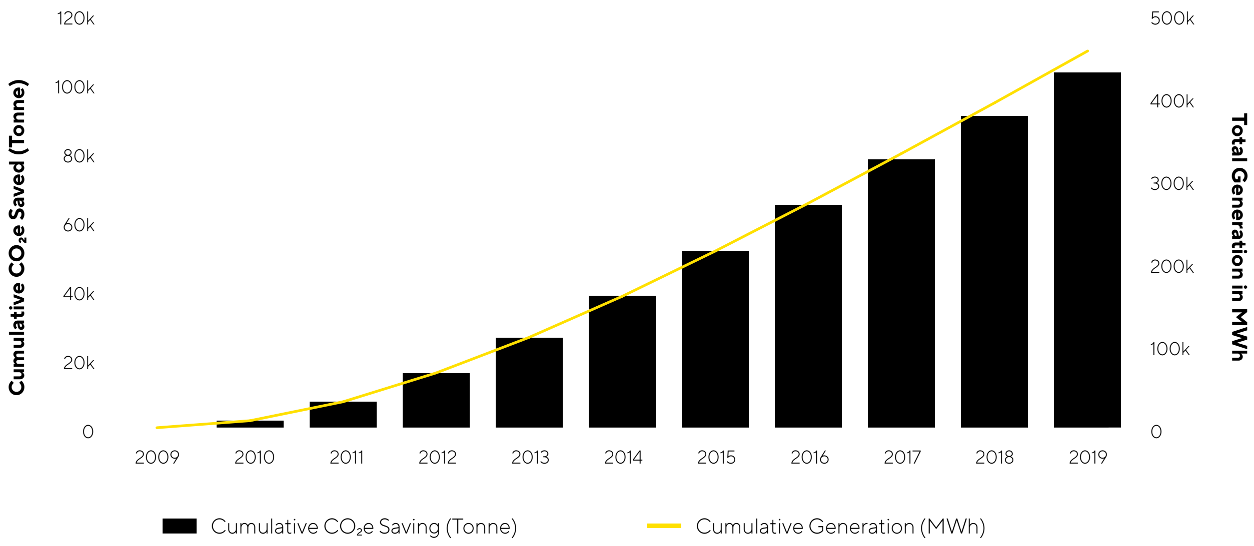
This is enough heat to meet the heating demand of 38,000 typical UK homes for one year.

Carbon savings

More than 100,000 tonnes of CO_2e saved

That is the carbon footprint of more than 718,000 flights from London to Edinburgh and the equivalent to the CO_2e emitted from 47,000 typical homes heated by gas in one year.

Chart 20: Cumulative generation and CO_2e net over time[52]



What sort of consumer has Solar Thermal installed?[53]

Looking at where installations have taken place, compared with Census data on the make-up of those areas, of those with Solar Thermal installed:

- Seven out of ten (71 per cent) are owner-occupiers
- The majority (60 per cent) are aged between 30 and 64
- Nearly two out of three are in single or two-person households (30 and 34 per cent respectively)
- More than eight out of ten of homes sold with Solar Thermal installed were detached (64 per cent) or semi-detached (20 per cent)
- Professionals account for 21 per cent, managers (as well as directors and senior officers) and skilled workers make up around 15 per cent each.

52 See Technical Appendix

53 Estimates derived from comparing MCS data on where installations are located with Census data, apart from property data, which is drawn from actual Land Registry-recorded sales of properties with MCS certified installations of microgeneration renewables.

Biomass

Biomass reached a peak of nearly 6,000 MCS certified installations in 2014, driven by the introduction of the dRHI. But expansion was short-lived, and despite having the lowest cost per kW, Biomass remains the major small-scale renewable technology with the lowest number of installations.

Biomass is most common in rural off-gas areas and typical consumers are owner-occupier small households with larger homes.

The Technology

Biomass systems burn pellets, logs or chips to provide a sustainable source of hot water and central heating. They represent an ideal solution for people living in rural areas, being more environmentally friendly than using LP gas or oil.

19,000

Nearly 19,000 installations of Biomass systems registered with MCS since 2008. Rising from 69 installations in 2009 to a peak of nearly 6,000 in 2014, the dRHI drove a short-lived expansion in the market for small-scale Biomass. Installations fell to under 400 by 2018, before recovering a little in 2019.

The installation cost of an average 26kW system rose 22 per cent in 11 years. This increased from c. £14,000 in 2009 to c. £17,000 in 2019.

4,000GWh of heat energy generated. This is equivalent to the heat needs of more than a third of a million typical UK homes for one year.

4,000GWh

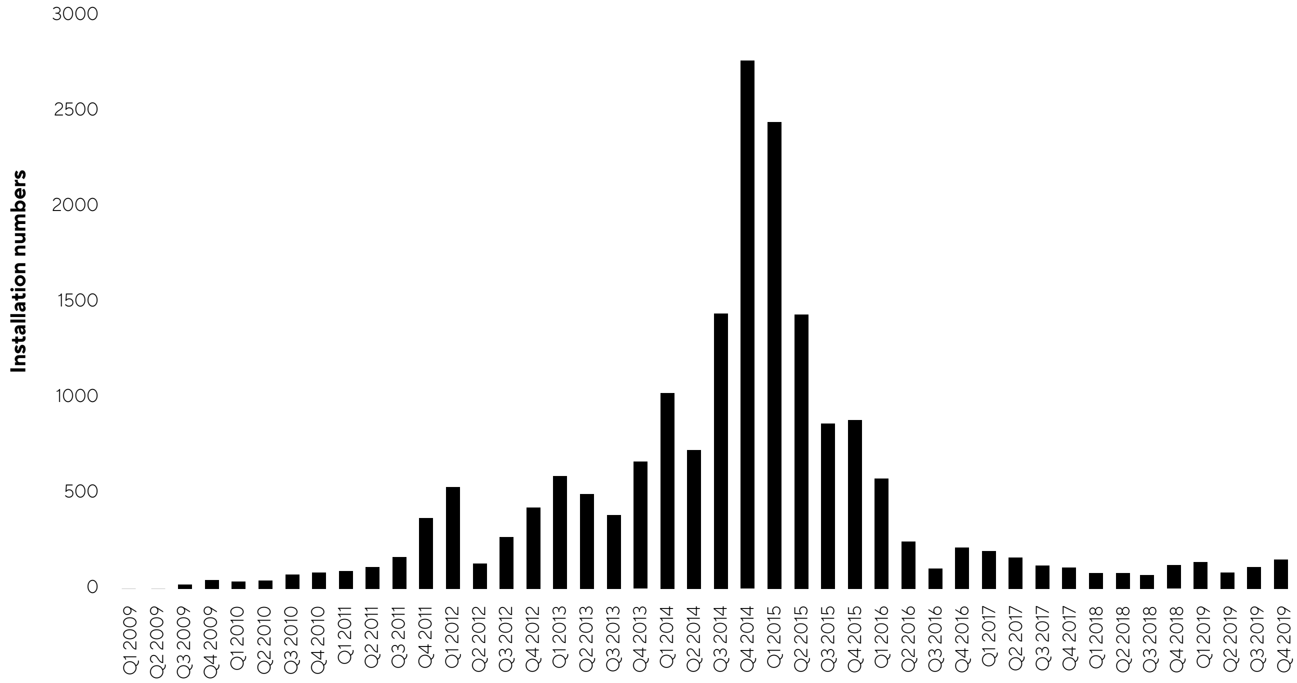
One million

One million tonnes of CO_2e saved. That is the carbon footprint of more than 1.2 million long haul economy class flights from London to New York JFK.

The Highlands of Scotland stand out as the Biomass success story with the highest installation rate (percentage of households with a system). Scottish areas, along with Cornwall, also have the highest number of installations.

The typical Biomass consumer is an owner-occupier professional couple aged between 30 and 64, living in a detached house in a rural area (particularly rural Scotland).

Chart 21: Biomass Installation numbers per quarter, 2009* - 2019



*There were no Biomass installations before 2009

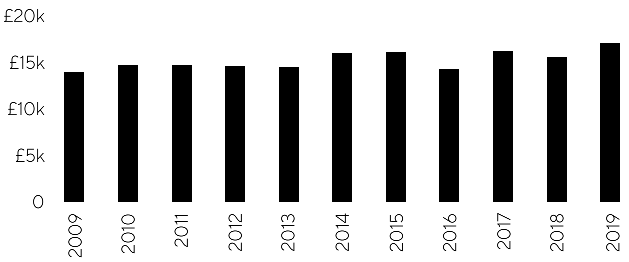
	Pre-RHPP		**RHPP from Aug 2011**			**dRHI**	**Tariff cuts**			**Tariff uplift**	
Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
No. of installations	69	242	744	1,364	2,140	5,960	5,630	1,148	595	362	492

Key Dates	
2011	**August**: £950 (RHPP) grant introduced
2014	RHPP £2,000 to March, dRHI from April. Q4 spike ahead of January cuts.
2015	Quarterly tariff cuts from January. By October, dRHI near-50 per cent of 2014 level.
2016	Q1 and Q3 cuts, to under 5ppkWh
2018	Tariff uplift to 6.54ppkWh

Rising installation costs, low cost per kW

- Costs of an average 26kW Biomass installation increased 22 per cent from 2009 to 2019: from £13,947 to £16,991
- The cost per kW of the average installation rose gradually from £536 in 2019 to £653 in 2019
- Sub-£700 per kW makes small-scale Biomass the cheapest per kW of all the technologies installed. The average cost per kW installed is less than half that of a typical Solar PV or GSHP system. However, due to the size of boiler required for an average Biomass system, it's the most expensive system to install.

Chart 21: Average cost of a 26kW Biomass System 2009 -2019



Geographical spread

Biomass is not a widely spread technology, with many local authorities having just a handful of installations. It's more common in rural areas, particularly rural Scotland and Wales.

Percentage of households with MCS certified Biomass installations per local authority 2008 – 2019

Top 5 LAs for percentage of households with Biomass	
1. Highland	1.17 % (1313 installations)
2. Eden	1.13 % (288 installations)
3. Western Isles	0.88 % (122 installations)
4. Scottish Borders	0.7 % (395 installations)
5. Ryedale	0.64 % (160 installations)

6 LAs with the lowest percentage of households with Biomass	
Lewisham	0.0007 % (one installation)
Southwark	0.0008 % (one installation)
Wolverhampton	0.0009 % (one installation)
Wellingborough	0.003 % (one installation)
Thanet	0.002 % (one installation)
Gloucester	0.001 % (one installation)

- **Highest density:** The Highlands stands out as the Biomass success story – both in numbers (1,313 installations) and having the highest percentage of households with a Biomass system (one in every 85 households or 1.17 per cent).
- **Total numbers:** In absolute numbers (not taking into account number of households), the top five LAs were Highland (1,313), Cornwall (504), Aberdeenshire (435), Scottish Borders (395), Dumfries and Galloway (384) and Northumberland (358).
- **Rural areas:** There is a strong link between high Biomass installation rates and rural location. Over 55 per cent of all properties in the 40 LAs with the highest percentage of Biomass installations are in areas designated as rural.
- **Urban areas:** There are a few urban exceptions to the general trend: Stirling, East Ayrshire, East Lothian, Angus and South Ayrshire are all in the top 40 LAs with the highest proportion of installations but all of them have only one third or fewer of their properties designated as rural.
- **Regionally:** Scotland has the highest proportion of Biomass where one in every 500 households (0.2 per cent) has a Biomass installation followed by Wales (0.12 per cent), the South West (0.1 per cent) and Yorkshire and The Humber (0.07 per cent).
- **Biomass deserts:** Regionally, Greater London and the South East have the fewest Biomass installations with one in every 3,333.
  - Seven out of the 20 local authorities with the fewest percentage of households with Biomass are in London.
  - 63 per cent of all local authorities in Great Britain have fewer than 0.1 per cent (one in every 1,000) of households with a Biomass installation.
- **On or off the gas network:** Mains gas is much more likely to be available in urban or semi-rural areas where housing is denser. Biomass is unsurprisingly in higher demand in areas that have a significant proportion of households off the grid. In the 50 LAs with the highest percentage of Biomass installations nearly 40 per cent of properties are off the gas grid.

Income and location

There is a weak link between fuel poverty and Biomass installation in some areas (Wales in particular). For example:

- The LAs in Wales with the highest rates of fuel poverty (Ceredigion and Powys) all have relatively high installation rates
- In Scotland, the LAs with the highest percentage of installations (Highlands, Western Isles and Orkney Islands) also tend to have a very high proportion of people in fuel poverty.

Generation

4,000 GWh of heat energy generated

That's the heat energy equivalent to:

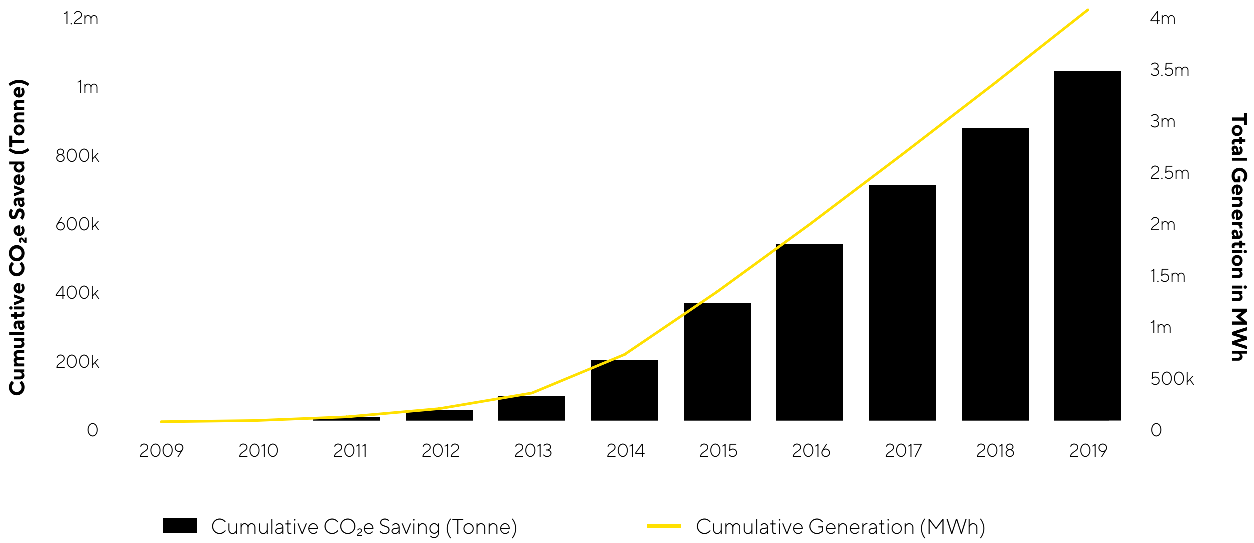
- The heating demand of more than a third of a million typical UK homes for one year
- The energy in 490,000 tonnes of coal.

Carbon savings

One million tonnes of CO_2e saved

- This carbon saving is equivalent to the carbon footprint of more than seven million flights from London to Edinburgh or the CO_2e emitted from 463,000 typical homes heated by gas in one year
- On average, every Biomass system saves around 9.5 tonnes of CO_2e emissions every year
- A typical Biomass system installed in 2010 has so far saved around 92 tonnes of CO_2e.

Chart 23: Cumulative generation and CO_2e net over time[54]



Which consumers are installing Biomass?[55]

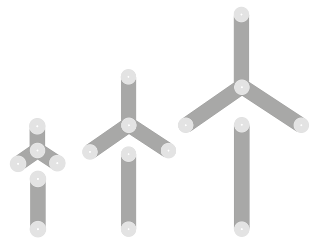
Looking at where installations have taken place, compared with Census data on the make-up of those areas, of those with Biomass installed:

- Three-quarters are owner-occupiers (76 per cent)
- The majority (60 per cent) are aged between 30 and 64
- Nearly two-thirds are in single or two-person households (31 and 34 per cent respectively)
- Close to nine out of ten homes sold with Biomass installations were detached (69 per cent) or semi-detached (18 per cent) homes
- Those in professional occupations and in skilled trades each account for one in five Biomass installations to 2020 (20 per cent each), more than three times the proportion accounted for by those who work in sales and customer service (six per cent).

54 See Technical Appendix

55 Estimates derived from comparing MCS data on where installations are located with Census data, apart from property data, which is drawn from actual Land Registry-recorded sales of properties with MCS certified installations of microgeneration renewables.

Wind Turbines



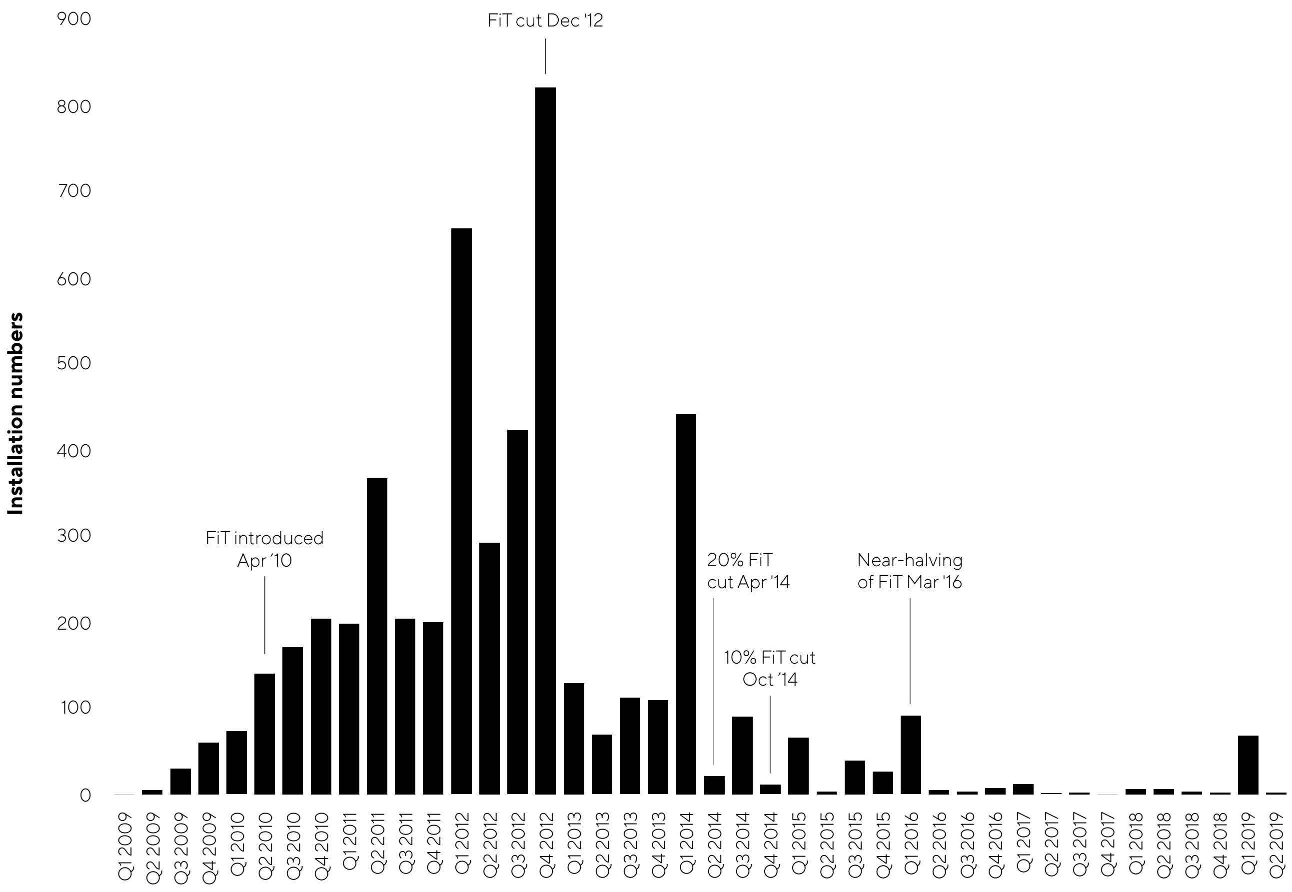
Over 5,000 small-scale Wind Turbines have been installed, the majority in the years immediately following the introduction of the FiT. Rising costs and reducing incentives have seen numbers of installations fall away since, albeit with an increase in early 2019 ahead of FiTs coming to an end.

Almost half of installations are in Scotland, particularly the island groups. The Orkney Islands alone have 14 per cent of Great Britain's small-scale Wind Turbines.

The Technology

Micro wind works by utilising turbines that capture the power of the wind, converting it into electricity. Small turbines use blades that spin in the wind, powering a generator that creates electricity, ready for use in the home.

Chart 24: MCS registered Wind Turbine installations 2009-2019



Cost

The average cost for a typical-sized system and average cost per kW covers the period 2013 to 2019 only, due to a lack of data on capacity installed in the early years of the FiT.

The cost of installing a wind turbine increased by 15 per cent between 2013 and 2019

The average install capacity over this period was 10kW:

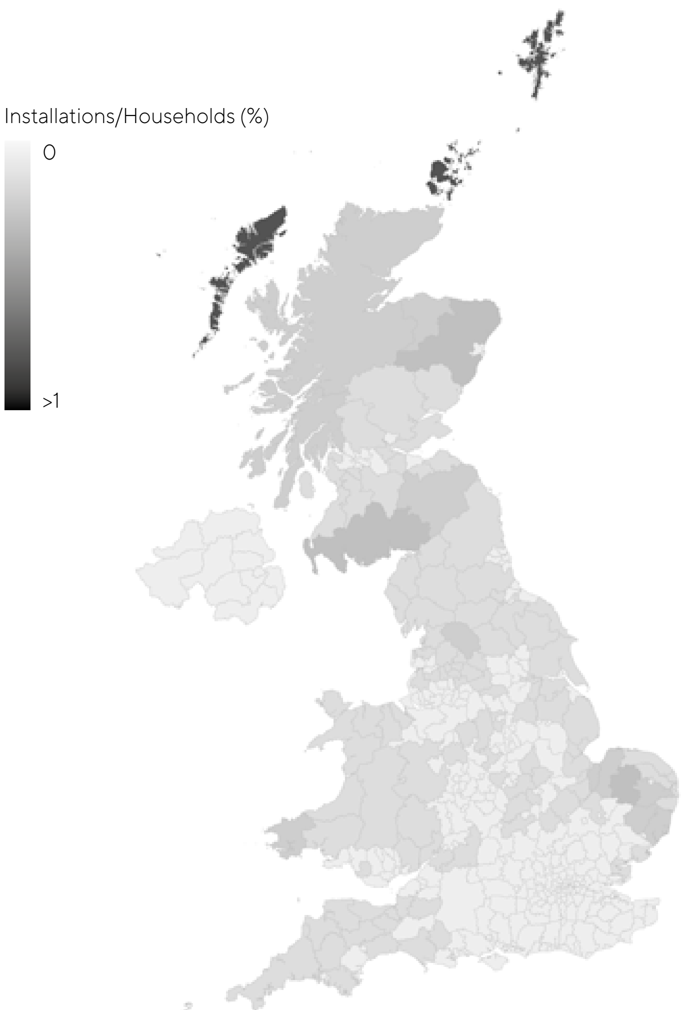
- In 2013, a 10kW wind turbine would have cost £32,666
- In 2019, a 10kW wind turbine would have cost £37,645.

The average cost per kW installed of a wind turbine over this period was £3,468, (compared to £1,501 for Solar PV or £917 for an ASHP over the same period).

Geographical spread

Small-scale Wind Turbines are particularly concentrated in Scotland, especially the island groups: 14 per cent of all small-scale Wind Turbines are in the Orkney Islands.

Percentage of households with MCS certified Wind Turbines per local authority 2008 – 2020



Top 5 LAs for percentage of households with Wind Turbines	
1. Orkney Islands	6.5 % (673 installs)
2. Shetland Islands	1.9 % (212 Installs)
3. Western Isles	0.3 % (142 installs)
4. Breckland	0.3 % (176 installs)
5. Dumfries and Galloway	0.3 % (208 installs)

- **Highest Concentration:** Comparing numbers of Wind Turbines with number of households in each LA shows the highest rate of installation in the Scottish Islands (seven per cent of all households in the Orkney Islands and two per cent of households in the Shetland Islands). Ten out of the top 20 LAs by percentage of households with a small-scale Turbine are in Scotland.
- **Total numbers:** Not taking into account density of households, the highest number of small-scale Wind Turbine installations is in the Orkney Islands (673 installs), followed by Aberdeenshire (293), Shetland Islands (212), Dumfries and Galloway (208) and Breckland, Norfolk (176).
- **Rural areas:** Unsurprisingly, the highest demand for Wind Turbines tends to be in rural areas farthest away from urban locations, demonstrated by the high proportion of installations in the Scottish Islands and the Breckland area of Norfolk.
- **Regionally:** Almost half of MCS certified small-scale Wind Turbines are in Scotland (48 per cent). Outside of Scotland, the rate of installation is much lower, down to the West Midlands and the South East of England where the proportion of households drops to less than one in every 25,000.

What sort of consumer has a Wind Turbine installed?

- One in four of those installing small-scale Wind Turbine systems are likely to be in skilled trades (24 per cent); a slightly higher proportion than for other technologies and three times the proportion in process plant and machine operative jobs or in sales and customer services. Professionals are also among the most likely (18 per cent) to install these, followed by managers and others in senior positions (13 per cent).
- The majority (59 per cent) are aged between 30 and 64. Close to one in four are aged 18 to 29, a slightly higher proportion than with other technologies, and around one in five are 65-plus.
- The vast majority (around eight out of ten) households installing Wind Turbines are small households of three or fewer. Single person or two-person households alone make up nearly two-thirds.
- The number of homes with Wind Turbines recorded as sold at the Land Registry is too small to be a guide to the typical kind of property, but by its very nature, the technology is suitable only for a minority of homes in Great Britain.

Other technologies

The remaining technologies on the MCS database are Micro Combined Heat and Power (CHP), Exhaust Air Heat Pumps (EAHPs), Hydro and a single Solar Assisted Heat Pump. Taken together, these technologies represent around one in every 1,000 small-scale renewable installations in Great Britain between 2008 and 2019.

Micro Combined Heat and Power (CHP)

Micro CHP is the simultaneous generation of both heat and electricity. Micro CHP installations are sized for individual properties and, even though they are usually powered by fossil fuels such as mains gas or liquid petroleum gas (LPG), they are a low carbon option because they are much more efficient than fossil fuel boilers.

Micro CHP with total installed electrical capacity of 2kW or less was eligible for the FiT, limited to 30,000 units. In practice, numbers installed reached nowhere near the limit.

- **656 Micro CHP systems were installed** between 2011 and 2019 (no registered installations before 2011).
- **Seven out of ten installations were registered in 2011 and 2012:** half in 2011 (331) and a further fifth in 2012 (116) following the introduction of FiTs in April 2010. An increase in the FiT for MicroCHP from 31 March 2013 did not boost numbers and annual installations did not approach three figures after 2012.
- **Since 2012, numbers of installations in a year did not rise above 50 until 2019 (52).** The low point was 2017, with just nine Micro CHP installations registered.

Regionally, most Micro CHP systems are in Wales and then the South East, but this represents fewer than one system for every 33,000 households.

Local authorities with the highest concentration of Micro CHP installations: Rhondda Cynon Taf in Wales (23), Basingstoke and Dean (19) and Gwynedd in Wales and Manchester (both 15).

Exhaust Air Heat Pumps (EAHPs)

EAHPs absorb the heat energy from the warm air that is vented out of a building. The heat pump then transfers some of the energy from the 'exhaust air' to provide ventilation, space heating and hot tap water. EAHPs need some electricity to run but, because they can generate more energy than they use, they emit less CO_2e than gas or oil boilers. Some EAHPs can be used on their own or in combination with other heat generators such as solar thermal water heating.

438 EAHPs were installed between 2010 and 2019 (there were no registered installations before 2010).

- **Nearly nine out of ten of all EAHP installations were registered in either 2011, 2012 or 2014** (166, 129 and 91 installations respectively).
- **EAHPs have mainly been installed in two regions: Scotland and London.**
- **More than a third of the total (36 per cent) were in the Orkney Islands (some 157).** A further fifth were in Brighton and Hove (87 installs or 20 per cent), and nearly half of the remainder were in London's Greenwich and Hackney boroughs (53 and 31 installations respectively).

Technical appendix

Generation and carbon savings

A range of factors are important when calculating the cumulative GHG emissions saved by microgeneration installations over time. Most importantly:

- The GHG emissions saved depends on the fuel types displaced. For the heat technologies, these were allocated using Government figures for the fuel displaced by RHI approved installations.[56] For example, 22 per cent of ASHP installations have replaced oil.
- The carbon intensity of grid supplied electricity. We used the Government's GHG conversion factor reports, the most recent of which is 2019.[57]
- The carbon intensity of other fuels such as heating oil and mains gas.
- The assumed efficiency of replaced boilers. These were obtained from MCS default assumptions used in performance estimate calculations.
- GHG emissions associated with microgeneration occur due to, for example, the manufacturing process which can be energy intensive and, for heat pumps, the electricity consumed. Our analysis allows for a reasonable estimate of gCO_2eq/kWh based on available research. The CO_2e savings described on page 42 and in The Technologies section represents the *net* benefit.
- Specific assumptions were used to estimate carbon costs associated with microgeneration installation. Heat pumps were assumed to perform with an SPF of 3 and the electricity consumed calculated using the carbon intensity of the grid supplied electricity as above. The carbon cost of Solar PV, Solar Thermal and Biomass was estimated on the basis of: gCO_2eq/kWh using sources cited in the Intergovernmental Panel on Climate Change report: 'Climate Change 2014: Mitigation of Climate Change'[58] and various other recent sources.

We calculated cumulative generation and carbon savings using the relevant carbon conversion factors for the individual years covered. This allowed us to calculate generation and carbon savings for each year and for each annual cohort of installations over time.

Fuel poverty

In Scotland and Wales, the local authorities with the highest percentage of renewable heat installations tend to have a high proportion of households in fuel poverty. But more investigation is needed before we can know if it is fuel poverty that is driving demand or a range of other factors. For example:

- In some areas, all income groups have a greater financial incentive to switch to renewable heating. For example, the space heating demand for a typical home in North West Scotland (and the Scottish islands) is 45 per cent higher than for a similar home in Bristol.[59] Those areas also tend to have high rates of fuel poverty.
- Access to the gas grid is also important. In Scotland and Wales high installation rates are associated with fuel poverty in areas where access to the gas grid is limited. Areas with good access to the gas grid and high levels of fuel poverty (such as Dundee and Inverclyde) tend to have relatively few heat technology installations.

The link between high rates of fuel poverty and renewable heat is therefore likely to be part of a complex picture that is also likely to involve local policies to encourage installation. It's important to note that both Wales and Scotland define fuel poverty as a household that needs to spend more than 10 per cent of its income on household fuel in order to maintain a satisfactory heating regime. This definition means that people can be 'fuel poor' but have incomes above the poverty threshold. In fact, research by the Scottish Government has found that nearly one third of people defined as 'fuel poor' are not 'income poor'.[60]

In contrast, households are defined as fuel poor in England if their fuel costs are above average and, if those costs are met, the households are left with residual incomes that are below the poverty threshold. As a result, far fewer households in England are identified as living in fuel poverty compared to Scotland and Wales. We found no clear link between fuel poverty and ASHP installation in England.[61]

56 Department for Business, Energy and Industrial Strategy. (2020). Non-Domestic and Domestic Renewable Heat Incentive (RHI) monthly deployment data (Great Britain) January 2020. Available at: **https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-january-2020** (Accessed: 1 May 2020). Table S2.2.

57 Department for Business, Energy and Industrial Strategy. (2020). Greenhouse gas reporting: conversion factors 2019. **Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019** (Accessed: 15 June 2020)

58 Source 3: Intergovernmental Panel on Climate Change. (2014). Climate Change 2014: Mitigation of Climate Change. Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: **https://www.ipcc.ch/report/ar5/wg3/** (Accessed: 13 June 2020)

59 The Chartered Institution of Building Services Engineers, Environmental Design, CIBSE Guide A

60 Scottish Government. (2020). Scottish House Condition Survey: 2018 Key Findings Available at: **https://www.gov.scot/publications/scottish-house-condition-survey-2018-key-findings/** (Accessed: 1 July 2020)

61 Dept Business, Energy and Industrial Strategy. (2020). Sub-regional fuel poverty England 2020 (2018 data). Available at: **https://www.gov.uk/government/statistics/sub-regional-fuel-poverty-2020** (Accessed: 13 June 2020)

Glossary of terms

BEIS - Department for Business, Energy & Industrial Strategy

CCC - UK Committee on Climate Change

CHP - Combined Heat and Power

CTSI - The Chartered Trading Standards Institute

Deserts - rural and urban areas where small-scale renewables are particularly scarce

dRHI - Domestic Renewable Heat Incentive

EPC - Energy Performance Certificate

FAIRE - the French national energy advice service

FiTs - Feed in Tariff scheme

Forests - rural and urban areas where small-scale renewables are particularly prevalent

GDHI - Gross Disposable Household Income

GGF - The Glass and Glazing Federation

GHG - Greenhouse gas

Green consumer - people who are more likely to install small-scale renewables in their homes

GSHPA - Ground Source Heat Pump Association

HEEPS - Home Energy Efficiency Programmes for Scotland

HES - Home Energy Scotland

HIES - Home Insulation and Energy Systems Contractors scheme

HPA - Heat Pump Association

LPG - liquid petroleum gas

MCS - Microgeneration Certification Scheme

NIRO - Northern Ireland Renewables Obligation scheme

ONS - Office of National Statistics

RECC - The Renewable Energy Consumer Code

RHI - Renewable Heat Incentive

RHPP - Renewable Heat Premium Payment

ROC - Renewables Obligation Certificate

Rural area - where most or many homes in a local authority are in Rural Designated Areas

Rural Resilient – areas of very high penetration that are often remote with a high proportion of homes off the gas grid

SCHRI - Scottish Community and Householders Renewables Initiative

Semi-urban area - partly urban; between urban and rural

UKAS - United Kingdom Accreditation Service

Urban area - an area with a population of over 10,000

Thank you to the organisations we have worked with across the years, and who have provided data for this report.

Thank you to our partners at rb&m (**www.r-b-m.com**) who researched and wrote the main body of this report and our data analysis partners at Quanovo (**www.quanovo.com**)

And special thanks to Alex Hughes and Hannah Tweedle – MCS Operations Analysts

Environmental Credentials

Cover:

Extract

A pioneering paper made from disposable paper coffee cups. 90% of the waste from each cup is converted back into FSC certified paper fibre, with the remaining 10% of waste - which is plastic - becoming something else entirely. It is a completely zero waste process.

Paper:

Nautilus SuperWhite

100% Post-consumer recycled paper
FSC Recycled and
EU Ecolabel Certified

Print:

Printed on HP Indigo –

HP Indigo develops presses and inks that enable printers and converters to comply with regulations that meet industry standards and environmental credentials.

WORLD LAND TRUST™
www.carbonbalancedpaper.com
CBP005983

19109900589
Printed on Carbon Captured paper

Designed by Future designbyfuture.co.uk

Find out more at
www.renewingbritain.com

T: 0333 103 8130
E: hello@mcscertified.com

mcscertified.com

Company no. 07759366

MCS CHARITABLE FOUNDATION

E: info@mcscharitablefoundation.org

mcscharitablefoundation.org

Charity no. 1165752