Community and locally owned renewable energy in Scotland, June 2012

A report by the Energy Saving Trust for the Scottish Government
Final report

February 2013

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About the Energy Saving Trust

The Energy Saving Trust is Scotland and the UK's leading impartial organisation helping people save energy, reduce carbon emissions and use water more sustainably. We do this by directly supporting consumers to take action, helping local authorities and communities to save energy, using our expert insight and knowledge and providing quality assurance for goods and services.

This work was carried out by the Energy Saving Trust on behalf of the Scottish Government. The report draws on various sources of data from the Energy Saving Trust and other organisations working in Scotland, and was written by Rachel Carss with input from Elaine Waterson. Help with data collection was provided by Cate Lyon.

With thanks to:
Community Energy Scotland
Carbon Trust Scotland
Forestry Commission Scotland
AEA Technology
The Development Trusts Association Scotland
Big Lottery Fund
Highlands and Islands Enterprise
SEPA
Keep Scotland Beautiful
Scottish Renewables
Community and local authority support officers, Energy Saving Scotland advice centres
And all other organisations and individuals who helped with time or information.

Please note: the methodology used in this report to calculate renewable capacity and output may not necessarily be in line with that required by the EU Renewable Energy Directive and as such the figures should not be used for any reporting purposes associated with this Directive.

Contents

1. Summary of key findings

In June 2011 the Scottish Government set a target of 500 MW of community and locally-owned renewable energy capacity in place by 2020.[1] Subsequently, the Energy Saving Trust was asked by the Scottish Government to produce a database of all community and locally owned renewable energy installations in Scotland, and to produce a short report of the findings. The database was to record the status of installations as at end of June 2011. The report was to see the progress towards the target, and was to include, as far as possible, all installations known to be either operating, currently under construction or in earlier stages of development. The database has now been updated and records the status of installations as at the end of June 2012. This database is similar to the renewable heat database which the Energy Saving Trust also maintains for the Scottish Government[2]
For this second version of the database and report, 'community and locally owned' is defined in the same way as in the first version i.e. the installed capacity owned by: community groups; charities, including faith organisations; public bodies; further and higher education establishments; local authorities; housing associations; local Scottish businesses; and Scottish farms and estates.

This work found that, at the end of June 2012, an estimated minimum of **204MW** of community and locally owned renewable energy capacity was operational in Scotland, which is a 39% increase on June 2011. These figures spread over a total of over **5,000** individual renewable energy installations[3]. This 204MW of total capacity was split between 88MW of electrical capacity (MWe) and 117MW of thermal (heat) capacity (MWth)[4]. Over a year, community and locally owned renewable installations could be expected to produce around **489GWh** of renewable energy, consisting of 233GWh of electricity and 256GWh of heat.

There has been an overall increase in the number of installations in Scotland since the last report and this accounts for some of the increase in capacity seen between June 2100 and June 2012. However, it is important to note that some of the increase in capacity is likely to be due to an increase in the amount of data collected and being provided by the different owners, such as housing associations.

A further **647MW** of community or locally owned renewable energy capacity is estimated to be in different stages of development (under construction/consented but not built/in planning/in scoping).

The largest proportion of operational capacity is on Scottish farms and estates (68MW, or 33%). Community groups own 13% of total operational capacity (26MW) (figure 1).

Of the renewable energy capacity still in development (i.e. not yet operational), 68MW is under construction; 266MW has been granted planning permission but construction has not yet started ('consented not built')[5]; 172MW is in the planning system waiting for a planning decision to be made ('in planning'), 126MW is in the scoping stage and 15MW has an unknown status. Projects have been given an 'unknown' status if we know they exist but have not been able to find evidence of how far along the process they are.

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[1] http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Communities

[3] This number of installations includes the total number of individual wind turbines in any multi-turbine development.
[4] Throughout this report, totals may not equal sums due to rounding.
[5] Of which 167MWe is the Shetland Charitable Trust's portion of the Viking wind farm

Based on 204MW of capacity in operation at the end of June 2012, and the further 647MW identified as in development, it would appear that Scotland is on-track to meet its target of 500MW of community and locally owned renewable energy by 2020. However this situation will need to be monitored with regards to the conversion rate of installations from developmental stages to operational capacity.

Figure1. Capacity of operational installations at June 2012 by ownership

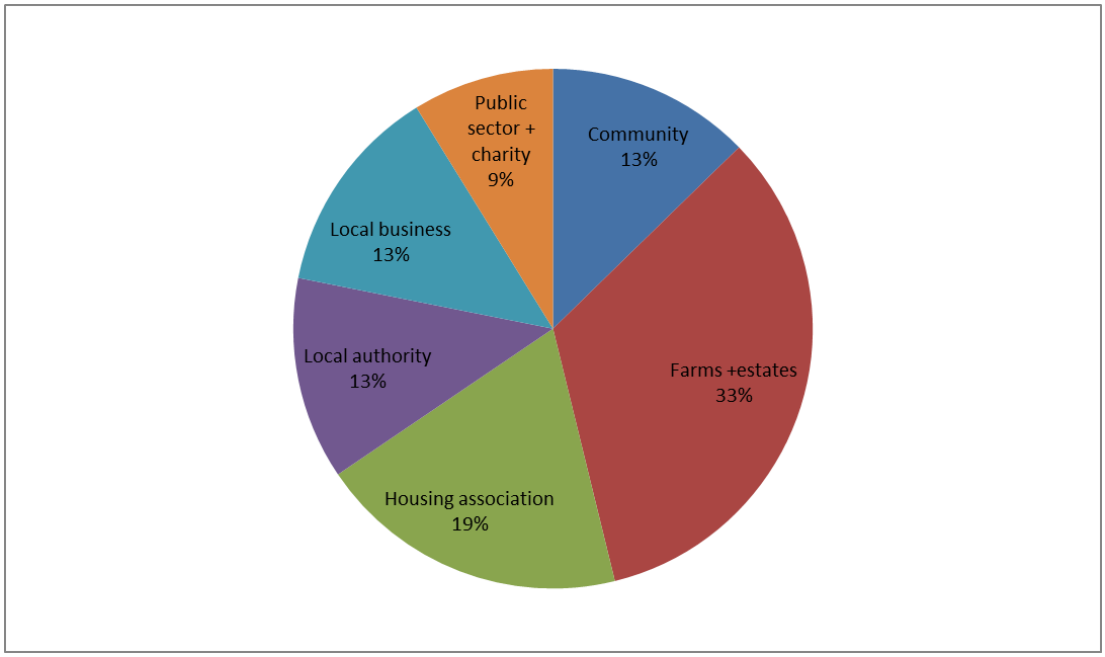
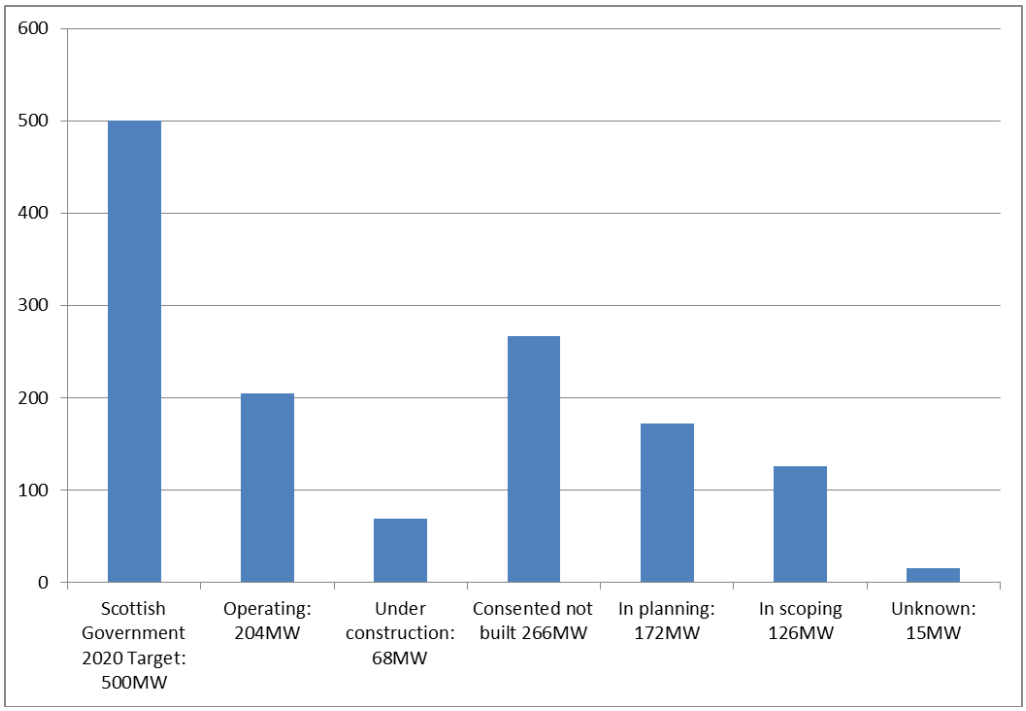


Figure 2. Community and locally owned renewable energy capacity in different stages of development, June 2012



2. Methodology

2.1 Definition of 'community and locally owned'

As with the first version of the database, the Scottish Government has requested that for this second version 'community and locally owned renewable energy' be defined as technologies producing heat or electricity from a renewable source, where the owner of the installation is in one of the following categories:

- A community group
- 'Other public sector and charity', including:
    - charities, including faith organisations
    - public bodies or publicly owned companies
    - further or higher education establishments such as universities and colleges
    - recipients of Scottish Community and Householder Renewables Initiative (SCHRI) grants under the community stream of the programme (not recipients of grants under the householder stream)
    - recipients of Community and Renewable Energy Scheme (CARES) grants.
- A local Scottish business
- A farm or estate
- A local authority
- A housing association

'Ownership' has not been restricted to cases where the organisation owns the entire renewable installation. It also includes cases where, for example, a community group or farmer has helped to meet part of the cost of developing and installing a renewables system in return for some benefit, such as a share in the income generated other than community benefit payments (see below). 'Ownership' does not include cases where the only benefit to the farmer or community group is a land rental payment from the owner or developer of the installation.

Renewable energy installations that generate community benefit payments but are owned by another body, for example a wind farm owner, have not been included in the definition of 'community and locally owned renewable energy'. The Scottish Government has established a register of community benefits from renewable energy projects[6] in order to help communities and renewable energy developers negotiate appropriate levels of community benefit payment.

There is naturally some overlap between the different categories of owners. For example, some community groups have charitable status, as do many housing associations; and many farms could also be considered as Scottish businesses. However, the following logic has been used to define which category an installation belongs to:

Communities have been defined as communities of place, i.e. based around a sense of shared location. They often have charitable status. In some instances, the renewable technology and/or income from it may be owned by a trading subsidiary, which may be registered as a separate company.

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[6] http://www.communityenergyscotland.org.uk/register/community_benefits

Charities have been defined as charitable organisations which are not also a community group, e.g. the RNLI (Royal National Lifeboat Institution) or the Scottish Wildlife Trust. 'Charity' has also been taken to include leisure trusts[7], and churches and other religious organisations. Organisations other than housing associations and community groups receiving funding under the Scottish Community and Householder Renewables Initiative (SCHRI) and Community and Renewable Energy Scheme (CARES) grants have also been included in this category.

Public bodies are those listed in the National Public Bodies Directory[8] , including NHS health boards. Also included in this category, although not strictly public bodies, are other publicly-owned organisations such as the fire and rescue services and the police forces.

Further or higher education establishments are the colleges and universities who are members of the Association of Scotland's Colleges (ASC)[9] or Universities Scotland[10].

Local Scottish businesses are Scottish businesses, excluding farms. 'Scottish' means registered with Companies House at an address in Scotland. Businesses receiving funding from the Scottish Biomass Support Scheme, Scottish Biomass Heat Scheme, Scotland Rural Development Programme and loans from the Community and Renewable Energy Scheme (CARES) have been included in this category.

Farms or estates are those organisations where the renewable technology is installed on land currently used for agricultural purposes, or on buildings that are part of a farm or estate layout. Estate ownership is often difficult to establish. Farms and estates receiving funding from the Scottish Biomass Support Scheme, Scottish Biomass Heat Scheme, Scotland Rural Development Programme and loans from CARES have been included.

Local authorities are the 32 unitary local authorities represented by the Convention of Scottish Local Authorities (COSLA)[11].

Housing Associations are providers of social housing within Scotland, other than local authorities.

2.2 Renewable energy technologies included

The following renewable energy technologies are included in the database:

- **Wind (including wind to heat)**
- **Hydro**
- **Wave and tidal (marine)**
- **Solar photovoltaics (PV)**
- **Biomass (wood) primary combustion (including for district heating)**

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[7] Leisure trusts supply sports facilities to local communities, often on behalf of unitary authorities. For example, see: http://www.edinburghleisure.co.uk/list-116
[8] http://www.scotland.gov.uk/Topics/Government/public-bodies/about/Bodies
[9] http://www.scotlandscolleges.ac.uk/About-Us/about-us.html
[10] http://www.universities-scotland.ac.uk/
[11] www.cosla.gov.uk/

- **Waste incineration (organic or putrescible fraction)**
- **Heat pumps (ground source, air source and water source, including ASHP incorporating exhaust air heat recovery or EAHR)**
- **Solar thermal panels**
- **Solar air/solar ventilation system**
- **Anaerobic digestion producing electricity and/or heat**[12]
- **Landfill gas capture producing electricity and/or heat**

Descriptions of these technologies are provided in Appendix 1.

The following technologies were not included as they are not considered to generate heat or electricity from a renewable source:

- **Combined heat and power (CHP), including micro-CHP, using mains gas or another fossil fuel**
- **Exhaust air heat recovery (unless part of an air source heat pump)**
- **Passive renewable heating or cooling**

Descriptions of these technologies are also provided in Appendix 1.

Information was collected on biogas and biofuel production plants. The decision was made that these projects would not be included in the database because there was little evidence of the capacity and annual output and lack of information about where the fuel was being used.

Note on the units used in this report:

Capacity refers to the maximum instantaneous power output of a renewable energy system, in either electricity or heat. The capacity of electricity-producing technologies is usually measured in kilowatts of electricity (kWe) or megawatts of electricity (MWe), depending on the size of the installation. The capacity of heat-producing technologies is measured in kilowatts-thermal (kWth) or megawatts-thermal (MWth), again depending on the size of the installation. Where this report refers to capacity from both renewable heat and renewable electricity technologies, the figures are given simply in kW or MW. One megawatt is equal to one thousand kilowatts.

Combined heat and power units have figures for electrical capacity and heat capacity. Where such installations are referenced in this report the total capacity in MW (MWe + MWth) is reported. However, the supporting database provides both figures (electrical capacity and heat capacity). Solar PV capacity can also be referred to in kilowatt-peak, or kWp, which is interchangeable with kWe.

Estimates of yearly **energy output** are reported in megawatt-hours (MWh) or gigawatt-hours (GWh). One gigawatt-hour is equal to one thousand megawatt-hours.

More information about the assumptions made is given in section *2.4 Assumptions Used*.

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[12] Excludes heat produced only for maintenance of the digestion process

2.3 Approach taken and data sets used

The approach taken for the compilation of this version of the database and report was in line with that for the first database and report and is detailed below.

Due to the large number of different organisations and different technologies covered by the definition 'community and locally owned renewable energy', information had to be sought from a variety of different sources. This included organisations administering Scottish Government or other public funding streams, local authorities and planning authorities, public bodies (e.g. SEPA and Highlands and Islands Enterprise) and likely renewables owners themselves. In many cases, organisations were able to provide information about installations in more than one ownership category, and for each ownership category there were a number of different information sources. The approach taken to collect data from each source is in line with the approach taken to produce the first version of the database and report, and is outlined below.

- **Data from funding and delivery organisations**. There have been a variety of funding sources available in recent years to promote the uptake of renewable energy generation among different groups, such as communities and businesses. Therefore an important source of information for this database was information on the organisations who have received such funding, which was provided either by the funding organisation themselves (e.g. Scottish Government) or delivery organisations (e.g. Community Energy Scotland, Carbon Trust Scotland, Forestry Commission Scotland).

- **Data from local authorities and housing associations.** A survey was sent by email to all local authorities, and a large number of housing associations in Scotland[13], enquiring about renewables on council-owned or housing association-owned buildings.

- **Data from the UK Renewable Energy Planning Database**. The UK Department for Energy and Climate Change shared information from their Renewable Energy Planning Database[14], which is maintained on their behalf by AEA Technology. This database aims to track the progress through the UK planning system of all renewable electricity-generating technologies with an electrical generation capacity of 0.01MWe (10kWe) and greater. It does not record details of ownership.

- **Data from planning authorities**. A further email survey was sent to all local planning authorities within Scotland asking for information about all renewable heat and electricity technologies (of all size) progressing through the planning system in Scotland.

- **Data from the Energy Saving Scotland advice centres (ESSacs).** The ESSacs (managed by the Energy Saving Trust on behalf of the Scottish Government) employ a

[13] As some social housing providers in Scotland may be based in other parts of the UK, finding a definitive list of all housing associations with buildings in Scotland was difficult. The email survey was sent to all housing associations who were members of the Scottish Federation of Housing Associations, plus others who had been in contact with the Energy Saving Trust's Local Authority and Housing Association Support Service (previously known as 'Practical Help').

[14] https://restats.decc.gov.uk/cms/

number of community and local authority support officers who work throughout Scotland. Their knowledge of local and/or community renewable energy projects was sought by email and telephone contact. They were able to provide information on installations smaller than those captured by the Renewable Energy Planning Database, and on renewable energy installations that were in community or local ownership but which might not require planning permission.

The main data sources that were used in compiling the community and locally owned renewable energy database, including the organisations they were provided by, are given in Appendix 2.

Further information sources used included:

- Information from individual installation owners, where necessary to confirm details such as capacity or ownership in response to telephone or e-mail contact
- Information available on Community Energy Scotland's website[15] and in its newsletters
- Individual community group, charity or housing association websites[16]
- Information from the Development Trusts Association, Scotland in response to email contact
- Information received from Energy4All[17]
- Planning authority websites
- LEADER grant online case studies[18]

Wherever possible, the information sought included:

- Name of the project
- Ownership (organisation, and type of organisation)
- Where appropriate, the name of the subsidiary trading company owning the renewable technology on behalf of the community group/charity
- Location, including local authority area, address, and a postcode or grid reference
- Technology type
- Number and installed capacity of the technologies installed
- Operational status as at June 2011 (operating/under construction/consented not built/in planning/in scoping), including where possible date on which generation commenced for operational projects
- Where appropriate, the building type associated with the renewable energy installation, to aid cross-checking with other sources, help clarify organisation type, and to estimate yearly energy output.
- %-age ownership by the community group etc, in cases where the organisation did not have full ownership of the installation
- Whether public grant or loan funding was received, to aid cross-checking with information received from bodies administering those funds

[15] http://www.communityenergyscotland.org.uk/
[16] For example: http://neilstonwindfarm.org/ourwindfarm.html
[17] Energy4All is a company which works to expand the number of renewable energy co-operatives in the UK. For more information, see: http://www.energy4all.co.uk/
[18] Various. For example: http://www.cairngorms-leader.org/leader-programme.asp

2.3.1 Data quality

Not all the required information was available from all sources. In particular, location data was often missing or incomplete. In the case of projects still in scoping, location had not always been decided at the time of data collection. As far as possible, local authority area has been identified for each installation.

The quality of data that was provided varied considerably. In particular, installed capacity was often not provided, and operational status was sometimes unclear[19]. Technology type was sometimes also unclear (for example 'solar', which does not indicate whether the installation is solar PV, generating electricity, or solar thermal, generating hot water).

Data received from the local planning authorities and from DECC's Renewable Energy Planning Database (REPD) provided very good location data and operational status, but did not contain information on ownership, which had to be sought from other sources.

Given the large number of renewables installations covered by the community and locally owned renewables database, it was not possible to contact each project individually, or to track down all missing details from other sources. Priority was given to ensuring the database contained the correct information with regards: technology type; operational status; installed capacity; and local authority area.

In certain circumstances assumptions have been made about the operating status. If information for a project has been found in previous years but no further information has been found for the June 2012 update the following assumptions have been made.: If a project has been previously recorded as 'in scoping' and no further information has been found, then the assumption has been made that it is still at the same stage of development. Projects that have had planning permission granted but there is no further information the status is 'consented but not built'. Projects that were 'under construction' in June 2011 have remained in the same status if no evidence that the project is operation has been found. There are some projects recorded in the database that have no evidence of status, these are classed as unknown.

2.3.2 Other data sources not used in this version of the database:

For the first version of the database and report the information sources listed below were investigated but found to contain either information captured elsewhere or insufficient detail for this project. For further details about these information sources please see section 2.3 of the first report.

- **Carbon Reduction Commitment (CRC) Energy Efficiency Scheme**
- **The feed-in-tariff central FIT register** from Ofgem[20]
- **Installations registered for the Renewables Obligation (Scotland), the Climate Change Levy, and Renewable Energy Guarantees of Origin**
- **The Low Carbon Buildings Programme**
- **Scotland's Climate Change Declaration**

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[19] For example grant and loan schemes frequently record the stage of the application for funding, but not the stage of installation itself e.g. under construction or operational.
[20] http://www.ofgem.gov.uk/Sustainability/Environment/fits/Pages/fits.aspx

2.4 Assumptions used

All of the assumptions used for this second version of the database and report are in line with those used for the first version, and are detailed below, and in Appendix 3.

2.4.1 Capacity estimates where not available

As noted in section 2.3, not all required information was available for all renewable energy installations. In some cases, the installed capacity was one of the figures not available.

Every effort was made to confirm capacity with the owners of installations. However, because of the large number of installations covered in this work it was not possible to obtain this information for all installations, within available resources.

For installations where a value for capacity was not provided an estimate was made for likely installed capacity, based on technology type, ownership category and building type (where appropriate). These were derived from similar installations where capacity was known, or using other assumptions as given below. A note of the values assumed for capacity are given in Appendix 3.

For some installations, a value for capacity was not supplied but an estimate of yearly energy output was. In those cases, installed capacity was estimated using the assumptions detailed in section 2.4.3.

Information on solar thermal panels and solar PV panels was sometimes provided in area (m^2) of panel. In such cases, the conversion factors used to estimate capacity are given in table 1.

Table 1: Assumptions used to estimate capacity of solar thermal and solar PV panels where information was provided on size, but not capacity, of panels.

Technology	Value used	Units	Information source
Solar thermal panel, average capacity per m^2	0.7	$kWth/m^2$	Solar Trade Association
Solar PV panel, average capacity per m^2	0.14	kWp/m^2	Energy Saving Trust Solar Energy Calculator tool assumptions[21]

2.4.2 Share of capacity in community and local ownership

As noted earlier the definition of 'ownership' used in this analysis was not restricted to cases where the organisation owns the entire renewable installation. It also included cases where, for example, a community group or farmer helped to meet part of the cost of developing and installing a renewable energy technology in return for some benefit, such as a share in the income generated.

[21] Scottish average. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Solar-panels-PV/Solar-Energy-Calculator

Such instances are normally wind energy developments, where perhaps the best-known example is the wind turbine 'owned' by Fintry Renewable Energy Enterprise, the trading subsidiary of Fintry Development Trust[22], that is part of the larger Earlsburn Wind Farm. In this case, the turbine owned by Fintry has a capacity of 2.5MWe, so Fintry Development Trust's entry in the community and locally owned database lists one turbine of 2.5MW, although the full capacity of Earlsburn wind farm is much larger (around 35MW).

There are other examples in the database, such as the Neilston Development Trust's joint venture with a commercial partner to develop a community wind farm in East Renfrewshire[23]. In this case, the community secured loans to finance a 28% stake of the project. Therefore the 'community and locally owned renewable energy' capacity of the Neilston wind farm has been calculated in the database at June 2012 as 28% of the total expected installed capacity of the development.

Energy4All wind farms were a special case for consideration. Energy4All works to help establish wind energy co-operatives in the UK, and this work includes the establishment of four operational wind farm co-operatives in Scotland[24]. Members of the local community can buy shares in the developments. In these cases, information on the percentage of community ownership was received from Energy4All, and the percentage applied to the total installed capacity of the site to estimate the MWe in community and local ownership.

2.4.3 Yearly energy output

The assumptions used to estimate yearly output in MWh of energy from community and locally owned renewable energy sources are given in Table 2.

For solar thermal panels and solar PV panels, yearly energy output was estimated using the following method:

Total installed capacity (kW), divided by capacity per m^2 (kW/m^2), multiplied by factor for yearly output per m2 ($kWh/m^2/yr$) = yearly energy output (kWh)

For all other technologies, the formula used was:

Total installed capacity (kW), multiplied by estimate of peak load hours per year (h) = yearly energy output (kWh)

Table 2. Assumptions used to calculate yearly energy output

[22] http://www.fintrydt.org.uk/index.php?page=about
[23] http://www.neilstontrust.co.uk/what-we-do/go-neilston/community-windfarm.html
[24] http://www.energy4all.co.uk/scotland/

Technology	Value used	Units	Information source
Solar thermal panel, yearly heat output per m^2	340	$kWh/m^2/yr$	Derived from SAP2009[25] calculations
Solar PV panel, yearly electricity output per m^2	99	$kWh/m^2/yr$	Energy Saving Trust Solar Energy Calculator tool assumptions[26]
Yearly peak load hours for **small wind turbines** (10kW and under)	1,664	hours/yr	Energy Saving Trust field trial of domestic small-scale wind turbines
Yearly peak load hours for **larger wind turbines** (over 10kW)	2,365	hours/yr	Scottish Renewables
Yearly peak load hours for **hydro**	3,500	hours/yr	various[27]
Yearly peak load hours for **anaerobic digestion** (electricity production)	5,256	hours/yr	RESTATS (AEA Technology on behalf of DECC)[28]
Yearly peak load hours for **heat pumps** or **biomass**, providing **space heating for one category of building** (excl. low usage buildings e.g. community halls). Includes **district heating providing space heating to one category of building** e.g. all domestic properties.	2,500	hours/yr	As used for estimating output in Renewable Heat in Scotland[29]

(With thanks to Scottish Renewables for providing guidance on estimates of capacity factors for many of the electricity-generating technologies.

3 Community and locally owned renewable energy in 2012

[25] http://www.bre.co.uk/filelibrary/SAP/2009/SAP-2009_9-90.pdf

[26] Scottish average. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Solar-panels-PV/Solar-Energy-Calculator

[27] Hydro output is highly site-specific. The following sources were used, which indicated that a reasonable assumption to use would be 3,500 peak hours per year, equivalent to 40% load factor. However, estimates of output from hydro should be treated with caution.

- Garrad Hassan report on renewable energy potential for Scottish Renewables
- The British Hydropower Association's mini hydro guide (2005), http://www.british-hydro.org/mini-hydro/infopage2e19.html?infoid=370
- Scottish Hydropower Resource Study for FREDS, Aug 2008, http://www.british-hydro.org/UK%20Hydro%20Resource/Scottish%20Hydro%20Resource%20Study%20Aug%202008.pdfhttp://www.british-hydro.org/UK%20Hydro%20Resource/Scottish%20Hydro%20Resource%20Study%20Aug%202008.pdf

[28] https://restats.decc.gov.uk/cms/regional-renewable-statistics/#Data

[29] DECC uses an estimate of 1,314 peak load hours per year (equivalent to a 15% load factor) as the tier-break point between tier 1 and tier 2 prices paid for heat from small and medium non-domestic biomass under the Renewable Heat Incentive. However this is noted by DECC as being a reasonable estimate of a minimum level of usage that could be expected. Therefore 2,500 peak load hours has been used here, in keeping with estimates of renewable heat in Scotland, as an estimate of total peak load hours for space heating in Scotland. http://www.decc.gov.uk/en/content/cms/meeting_energy/Renewable_ener/incentive/incentive.aspx

3.1 Results for June 2012: operational capacity

At the end of June 2012, an estimated minimum 204MW of community or locally owned renewable energy capacity was operational in Scotland, spread over a total of around 5,000 individual renewable energy installations[30].

A breakdown of operational capacity by ownership category is given in table 3 and illustrated in figure 3. The largest proportion of operational capacity is on Scottish farms and estates (68MW, or 33%). Community groups own 13% of total operational capacity (26MW).

The largest numbers of individual installations (over 4,000) are in local authority and housing association ownership, together accounting for over 81% of individual installations. Housing associations are the owners of the largest number of individual installations, around 3,300, or over 65% of all individual installations recorded.

The difference between which organisations own the majority of installations, and which own the majority of operating capacity, stems from the different mixes of renewable technologies found in the different ownership categories. Housing associations own large numbers of solar thermal panels and heat pumps (around 3,000 individual installations of these two technologies). However, as the majority of these are on individual domestic properties, each individual installation typically has a small capacity[31]. Therefore housing associations actually have a relatively small share (about 19%) of Scotland's total operating renewable capacity.

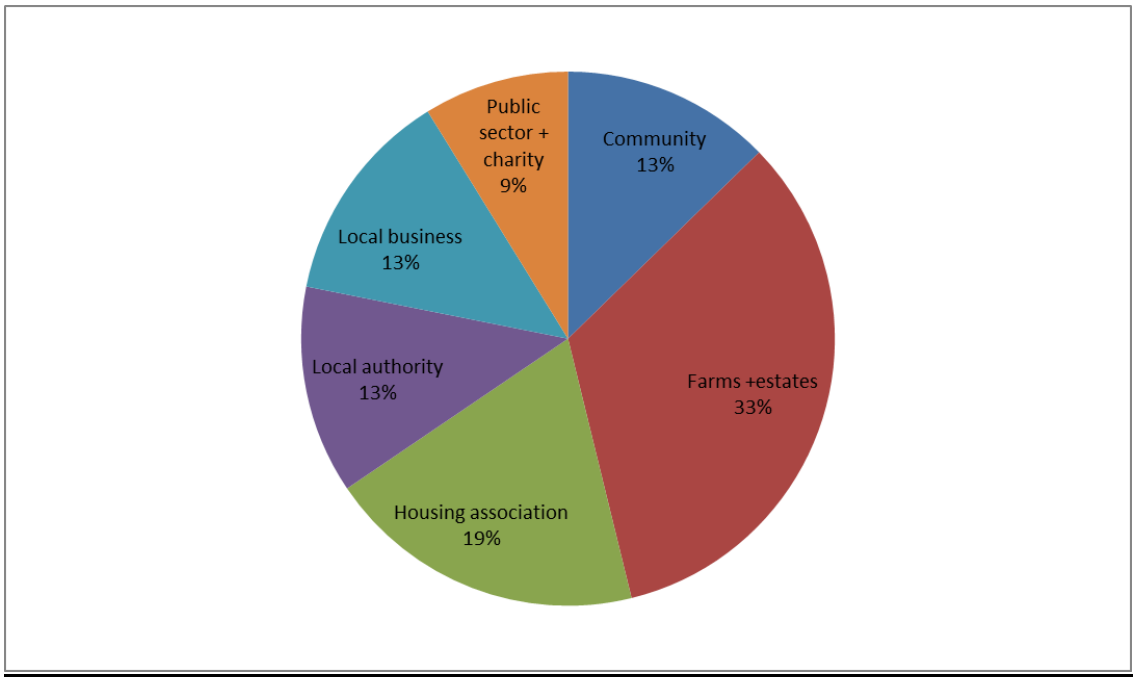
Among farms and estates, the largest numbers of renewable technologies owned are wind turbines and biomass (wood) boilers, accounting for 75% of operating installations in this sector. Installations of these biomass boilers and wind turbines on farms and estates typically have very large capacities[32], leading to farms and estates owning the largest share of installed operational capacity at June 2012.

Table 3. Estimated number and capacity of operational installations at June 2012 by ownership category

[30] This number of installations includes the total number of individual wind turbines in any multi-turbine development.
[31] Typical domestic solar thermal panel size is around 3.4m^2, or about 2.3kWth (0.0023MWth). Domestic heat pumps in housing association homes are typically around 7kWth (0.007MWth), or 4kWth (0.004MWth) for an ASHP with exhaust air heat recovery. See Appendix 2 for more details.
[32] Farm and estate biomass (wood) heating systems had a typical size of 150kWth capacity. See Appendix 1 for more details. Farm and estate wind turbines varied greatly in size, from 1kWe (0.001kWe) to 2.3MWe (2,300kWe), however most were over 300kWe in size.

	Number of operating installations	% of operating installations	Operating capacity	% of operating capacity
Community	366	7%	26MW	13%
Farms +estates	166	3%	68MW	33%
Housing association	3351	65%	40MW	19%
Local authority	830	16%	26MW	13%
Local business	266	5%	27MW	13%
Public sector + charity	169	3%	18MW	9%
Grand Total	**5,148**	**100%**	**204 MW**	**100%**

Figure 3. Capacity of operational installations at June 2012 by ownership

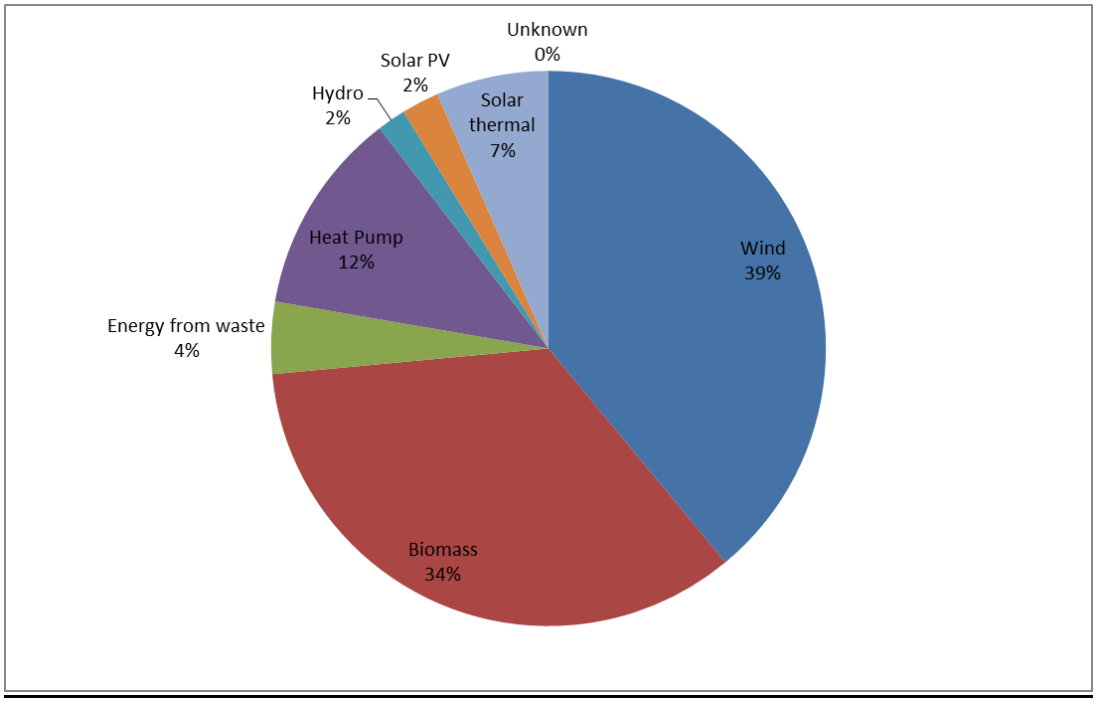


The majority of capacity in operation at June 2012 was from wind turbines, at about 80MWe (which includes 0.3MWe wind to heat). The second largest category was biomass (wood) primary combustion, at 71MWth. These two technologies between them account for about 74% of operational capacity at June 2012. A breakdown by technology type is given in table 4 and illustrated in figure 4.

Table 4. Number and capacity of operational installations at June 2012 by technology

	Operating capacity	% of operating capacity	Number of operating installations	% of operating installations
Wind	80 MW	39%	382	7%
Biomass	71 MW	35%	373	7%
Energy from waste	9 MW	4%	9	0%
Heat Pump	24 MW	12%	2177	42%
Hydro	3 MW	2%	57	1%
Solar PV	4 MW	2%	474	9%
Solar Thermal	13 MW	7%	1641	32%
Unknown	0 MW	0%	35	1%
TOTAL	**204MW**	**100%**	**5148**	**100***

Figure 4. Capacity of operational installations at June 2012 by technology



3.2 Estimate of yearly energy deliverable with June 2012 capacity

Over a year, 204MW of community and local owned renewable energy capacity could be expected to produce around 489GWh of renewable energy, consisting of around 233MWh of electricity and 256MWh of heat. A breakdown by ownership category is given in table 5. The assumptions used to calculate yearly output are specific to each technology, and detailed in section *2.4 Assumptions Used.*

This assumes that all energy from waste is used to generate heat whereas in reality some will be used to generate electricity.

Table 5. Estimated number and capacity of operational installations at June 2012 by ownership category

	Operating capacity	% of operating capacity	Estimated yearly energy output	% of output
Community	26 MW	13%	56 GWh	11%
Farms +estates	68 MW	33%	169 GWh	34%
Housing association	40MW	19%	74 GWh	15%
Local authority	26 MW	13%	65 GWh	13%
Local business	27 MW	13%	81 GWh	16%
Public sector + charity	18 MW	9%	45 GWh	9%
TOTAL	**204 MW**	**100%**	**489 GWh**	100%

4. Further community and locally owned renewable energy capacity in development

In addition to the 204MW of community and locally owned renewable energy capacity estimated to be operational at end of June 2012, a further 647MW of community or locally owned renewable energy capacity is estimated to be in various stages of development (under construction/consented but not built/in planning/in scoping), consisting of about 1,900 individual installations[33].

Of the renewable energy capacity still in development, 68MW is under construction; 266MW has been granted planning permission but construction has not yet started ('consented not built'); 172MW[34] is in the planning system waiting for a planning decision to be made ('in planning'); and a further 68MW is under consideration, or at the stage where preparation is being made to apply for planning permission ('in scoping'). About 15MW of capacity in the database is unclear in terms of development stage. The breakdown by is illustrated in figure 5, and a breakdown by technology type is given in table 6.

[33] This number of installations includes the total number of individual wind turbines in any multi-turbine development.

[34] Readers should be aware that of the 266MW community and locally owned renewable energy capacity that had been granted planning permission but construction had not yet started at June 2012, 167MWe is the Shetland Charitable Trust's portion of the Viking wind farm. http://www.vikingenergy.co.uk/

Figure 5. Community and locally owned renewable energy capacity in different stages of development, June 2012

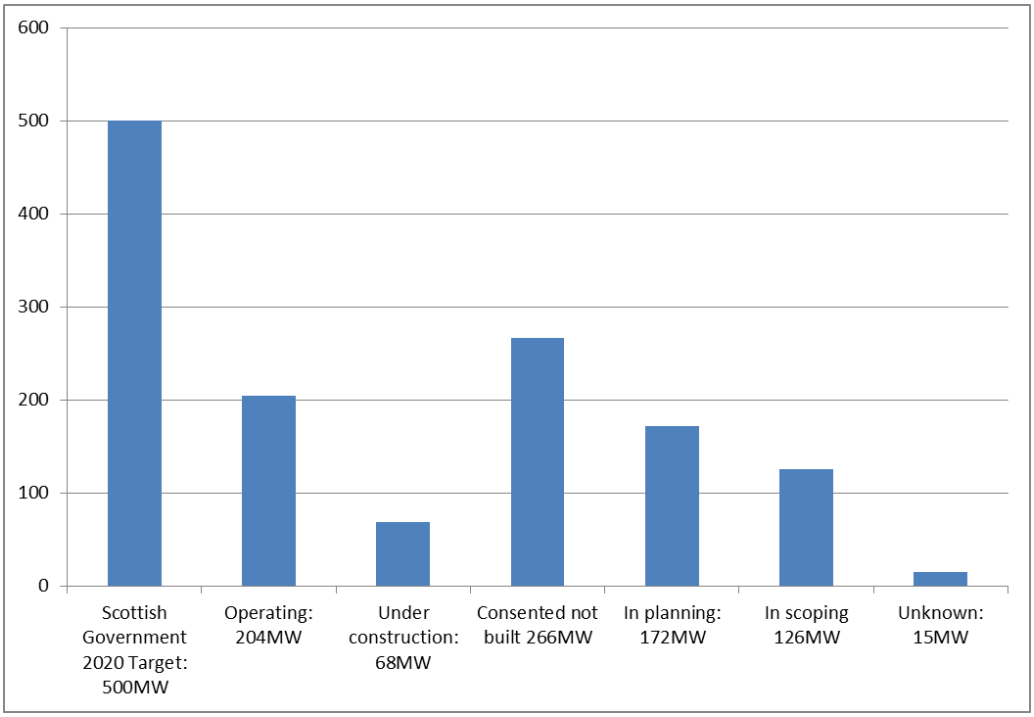


Table 6. Estimated capacity in development at June 2012 by development stage and technology

	Under construction MW	Consented not built MW	In planning MW	In scoping MW
Wind	33.5	265.1	153.6	83.9
Biomass	3.1	0.0	7.8	25.6
Energy from waste	0.0	0.3	0.0	0.5
Heat Pump	22.7	0.2	1.0	0.7
Hydro	0.1	0.9	0.0	13.4
Solar PV	7.5	0.1	5.0	0.1
Solar Thermal	1.3	0.0	4.2	0.2
TOTAL	**68.4**	**266.5**	**171.6**	**124.4**

4.1 Progress towards the 2020 target

Based on an estimated minimum of 196MW of capacity in operation at the end of June 2012, and the further 647MW identified as in development, it would appear that Scotland is on-track to meet its target of 500MW of community and locally owned renewable energy by 2020. However this situation will need to be monitored with regards to the conversion rate of installations from developmental stages to operational capacity.

A large proportion of the projects that have been granted planning permission but not yet started construction are made up of the 103 wind turbines at Viking Wind Farm. This project was granted planning permission on the 4th April 2012 and will provide a capacity of 167MW.

5. Uncertainty associated with the methodology

In any analysis of this kind where data are gathered from a variety of different sources, total data coverage may be incomplete. This is for a number of reasons: 1) incomplete information may be received on some installations, and 2) the number of sectors and technologies the database covers means there is a chance that some installations may have been missed altogether.

Large capacity renewables installations are typically higher profile projects, and more likely to require planning permission (and planning records are a very good source of reliable information). So issues with data collection are more likely for smaller capacity installations such as heat pumps and solar thermal.

The opposite problem (double-counting installations) is also a potential issue, although efforts have been made to de-duplicate the information in the database as necessary. Due to the large number of data sources and the varying level of detail provided by different organisations there remains a risk that some double-counting of installations or their capacity may have occurred. Again, as large capacity renewables installations are typically higher profile projects, and more likely to require planning permission, this is most likely for smaller capacity installations such as heat pumps and solar thermal The actions taken and assumptions used to try to ensure minimal gaps in the information contained in the community and locally owned renewable energy database are described in section *2 Methodology*, with further information provided in the Appendices.

However, some points for particular consideration in relation to data coverage and data quality are:

1. **Information received from local authorities**

In the course of compiling the database, the Energy Saving Trust sent an email survey to all 32 local authorities in Scotland, asking them to provide information on all renewable technologies on council-owned stock. However, due to the large numbers of different building types for which councils have responsibility (social housing, council offices, schools, waste collection facilities) and the large number of different council departments which are involved in maintaining these, we could not always guarantee a response that gave a full picture of all council-owned stock. In total, we received a reply from 14 of the 32 local authorities. As the amount of renewable capacity reported for local authority stock varied greatly, no attempt was made to scale up known capacity to account for non-respondents. Information received from respondents indicated that the most common technologies installed on council stock at June 2012 were air source heat pumps and solar thermal panels on council managed housing, which typically have small capacities.

2. **Information received from housing associations**

The Energy Saving Trust sent an email survey to all members of the Federation of Scottish Housing Associations, plus other housing associations known to have buildings in Scotland who had contacted the Energy Saving Trust's Local Authority and Housing Association Support Service. In total, 198

housing associations were emailed, from which we received 32 replies[35]. 13 of the housing associations who replied provided information on renewable capacity they had installed since June 2011, and 18 replied to say they owned no renewable energy capacity or had not installed anything new since June 2011. Given the range of reported installed capacity per housing association, no attempt was made to scale up known capacity to account for non-respondents. As per local authorities, information received from respondents indicated that the most common technologies installed on housing association buildings at June 2012 were air source heat pumps and solar thermal panels on domestic properties, which typically have small capacities.

3. **Projects in scoping**

Clearly, projects which are still in the early development stages are hard to gain information on, particularly where applicants are not eligible for financial support from the funding organisations the Energy Saving Trust contacted while compiling this database. This will be particularly true of intentions to install farm and estate wind turbines, which typically have large capacities. Therefore the figures presented here for installations in scoping are likely to be an underestimate.

4. **Projects in planning**

In compiling the database, information received from local planning authorities and from DECC's REPD were a source of good quality information on renewable energy installations where the owner had applied for planning permission. Many smaller capacity renewable energy installations (such as solar panels on domestic properties, and ground source heat pumps used for space heating in small buildings) do not require planning permission and so will not be captured by these information sources. However, larger capacity renewables do require planning permission in most cases and so will have been captured from this data.

5.1 Recommendations for assessing future progress towards the 500MW target.

In our report published in April 2011 we made a series of recommendations to the Scottish Government. These recommendations are still relevant and can be found in section 5 of the 2011 report.

[35] Although this appears a low response rate, other email surveys conducted by the Energy Saving Trust among local authorities and housing associations suggests that these response rates were actually higher than might normally be expected.

Appendix 1. Individual technology descriptions

Renewable energy technologies:

The following renewable technologies have been included in the database:

- **Wind (including wind to heat)**

Wind turbines use blades to catch the wind. When the wind blows, the blades are forced round, driving a turbine which generates electricity. They may be pole-mounted or building-mounted, and may be connected to the national electricity grid, a local distribution grid, or stand-alone. Wind to heat installations ('wind to heat') where the turbines produce electricity which is used to directly charge electric storage heaters for space heating have also been included. In 'wind to heat' cases the recorded capacity is that of the turbine.

- **Hydro**

Where a flow of water falling from a higher level to a lower level (and not from waves or tides) is used to drive a turbine which generates electricity.

- **Wave and tidal (marine energy)**

Where the action of waves or tides is used to drive a turbine, which generates electricity.

- **Solar photovoltaics (PV)**

Panels or modules normally fixed to the roofs of buildings, which produce electricity when exposed to sunlight (either direct or indirect).

- **Biomass primary combustion**

Biomass is burnt to directly produce space or water heating. Here 'biomass' has been taken to mean wood products, in chips, pellets or logs. It is also possible (as in the Lerwick district heating scheme in Shetland) for other organic or putrescible matter, such as food waste, to be burnt to produce heat, but in such cases the installation has been classified as 'energy from waste' (EfW).

- **Solar thermal panels**

Panels normally fixed to the roofs of buildings, which produce hot water using the sun's heat. Occasionally these systems are designed so that the hot water produced also contributes to space heating demand ('solar space heating').

- **Heat pumps**

Technologies to extract low-grade heat from the external environment (the ground, air or a water source) and through a compression system produce heat for space or water heating. Although heat pumps rely on electricity to operate, their high co-efficient of performance (COP) means they extract more heat energy from the environment than they use in electricity. 'Exhaust air heat pumps' (which in addition to extracting heat from the external air, also draw warmth from warm stale air leaving a building) have been included within the category air source heat pumps.

Units which are purely exhaust air heat recovery and that do not also extract heat from the air outside (EAHR without the ASHP) have not been included.

- **Energy from waste technologies:**

Anaerobic digestion (AD)
Organic matter is broken down in the absence of oxygen to produce methane gas. This is then burnt to generate heat and/or electricity. Some of the heat produced is usually used to warm the AD digestion process itself.

Landfill gas capture
Landfill gas (methane from rotting organic matter in landfill) is captured and burnt to produce heat or used in a combined heat and power unit.

Waste incineration
Municipal or industrial waste can be burnt to provide space heating. A proportion of the total capacity equal to the %-age of biodegradable matter in the waste is taken to be 'renewable' energy capacity.

Had examples been found two other technologies could have been included in the database. These were:

- **Biomass CHP**

Biomass is burnt in order to generate electricity. Heat is produced as a by-product, which can then be used for process heat, or for supplying space/water heating. Again, this biomass could either be wood products, or waste material with an organic component, such as municipal waste, in which case the installation could be considered energy from waste. No examples were found of community and locally owned biomass CHP installations.

- **Fuel cell biomass**

Fuel cells running on biomass could be used to produce electricity and useful heat. However, none were identified in Scotland for this report.

Technologies which were not included in the database, as they do not produce energy from renewable sources, are:

- **Non-biomass CHP**

Combined heat and power units running on gas (or other fossil fuels) to produce electricity and heat. CHP (or tri-generation) units can represent an efficient use of fuel as they achieve high efficiencies. However, as the energy from such units is generated from fossil fuel sources, it has not been counted towards 'renewable' energy targets in this report.

- **Exhaust air heat recovery (EAHR)**

Systems for recovering the heat from warm stale air leaving a building, which is then used to warm incoming air. This can help to reduce space heating requirements. However, because the heat being recovered for the building will normally have been generated by fossil fuels in the first instance, rather than being drawn from a renewable source, these systems do not provide renewable heat. Some heat pumps have been included which are classed as 'exhaust air heat recovery', but only where it was possible to ascertain that they also provided heat taken from the air outside the building (which is renewable heat).

- **Passive renewable heating or cooling**

This is where building design is used to ensure buildings benefit from heating or cooling without relying on mechanical means, for example through features such as solar gain through large areas of south-facing glazing, or 'natural ventilation'. Such design features can successfully help a building meet its heat demand, however they have not been included in this report or in the database, as the heat resource is virtually impossible to measure.

Appendix 2. List of main data sets used

The following table lists the main data sources used in the community and local owned renewable energy database, by ownership category and data provider.

Ownership category	Organisation contacted/providing data	Dataset
Community	*Community Energy Scotland*, on behalf of the Scottish Government, and of Highlands and Islands Enterprise (HIE)	Scottish Community and Householder Renewables Initiative (SCHRI) grant recipients Community and Renewable Energy Scheme (CARES) grant recipients; Community and Renewable Energy Scheme (CARES) loan recipients; Community Renewable Energy Support Programme (CRESP) grant recipients
	Highlands and Islands Enterprise	Community projects funded via HIE (various funding schemes)
	Energy Saving Trust, on behalf of the Scottish Government.	Scottish Community and Householder Renewables Initiative (SCHRI) grant recipients Energy Efficiency Design Awards (EEDA) funding recipients; The Scottish Government's District Heating Loan Fund; Energy Saving Scotland Small Business Loans recipients
	Energy Saving Trust, on behalf of the Department for Energy and Climate Change (DECC), UK Government	Low Carbon Buildings Programme (LCBP) stream 2a (communities)[36]

[36] No installations were recorded in Scotland for LCBP stream 1 Communities or stream 2b Communities.

	Big Lottery Fund	Growing Community Assets grant recipients; Investing in Ideas grant recipients
	Keep Scotland Beautiful on behalf of the Scottish Government	Climate Challenge Fund grant recipients
	Forestry Commission Scotland	Scottish Biomass Support Scheme grant recipients
	SportScotland on behalf of Scottish Government	SportScotland funding recipients
Other public sector and charity	*Community Energy Scotland*, on behalf of the Scottish Government	Scottish Community and Householder Renewables Initiative (SCHRI) grant recipients; Community and Renewable Energy Scheme (CARES) grant recipients; Community and Renewable Energy Scheme (CARES) loan recipients
	Energy Saving Trust, on behalf of the Scottish Government.	Scottish Communities and Householders Renewables Initiative (SCHRI) grant recipients; Energy Saving Scotland Small Business Loans recipients
	Forestry Commission Scotland	Scottish Biomass Support Scheme grant recipients; Scottish Biomass Heat Scheme grant recipients
	SportScotland on behalf of Scottish Government	SportScotland funding recipients
Farms and Estates	*Scottish Government*	Scotland Rural Development Programme (SRDP) grant recipients
	Community Energy Scotland, on behalf of the Scottish Government	Community and Renewable Energy Scheme (CARES) loan recipients
	Energy Saving Trust on behalf of the Scottish Government	Energy Saving Scotland Small Business Loans recipients; The Scottish Government's District Heating Loan Fund;
	Energy Saving Trust, on behalf of the Department for Energy and Climate Change (DECC)	Low Carbon Buildings Programme (LCBP) stream 2a (communities)
	Forestry Commission Scotland	Scottish Biomass Support Scheme grant recipients;

		Scottish Biomass Heat Scheme grant recipients
SME	*Forestry Commission Scotland*	Scottish Biomass Support Scheme grant recipients; Scottish Biomass Heat Scheme grant recipients
	Energy Saving Trust on behalf of the Scottish Government	Energy Saving Scotland Small Business Loans recipients; The Scottish Government's District Heating Loan Fund;
	Scottish Government	Scotland Rural Development Programme (SRDP) grant recipients
Local authority	Individual local authorities	Responses to an Energy Saving Trust e-mail survey of all local authorities, using contacts from the Energy Saving Trust Local Authority and Housing Association support service
	Community Energy Scotland, on behalf of the Scottish Government	Scottish Community and Householder Renewables Initiative (SCHRI) grant recipients; Community and Renewable Energy Scheme (CARES) grant recipients
	Carbon Trust Scotland	Extract from the Carbon Trust Carbon Management Plan outcomes Carbon Trust Biomass Accelerator grants
	Energy Saving Trust on behalf of the Scottish Government	Scottish Community and Householder Renewables Initiative (SCHRI) grant recipients; Energy Saving Trust renewable heat pilot participants
	SportScotland on behalf of the Scottish Government	SportScotland funding recipients
Housing association	Individual housing associations	Responses to an Energy Saving Trust e-mail survey of all local authorities, using contacts from the Energy Saving Trust Local Authority and Housing Association support service
	Forestry Commission Scotland	Scottish Biomass Heat Scheme grant recipients
	Community Energy Scotland, on behalf	Scottish Community and Householder

	of the Scottish Government, and of Highlands and Islands Enterprise	Renewables Initiative (SCHRI) grant recipients; Community and Renewable Energy Scheme (CARES) grant recipients; Community Renewable Energy Support Programme (CRESP) grant recipients.
	Energy Saving Trust on behalf of the Scottish Government	Scottish Community and Householder Renewables Initiative (SCHRI) grant recipients; The Scottish Government's District Heating Loan Fund; Energy Saving Trust renewable heat pilot participants; Energy Saving Scotland Small Business Loans recipients
	Big Lottery Fund	Growing Community Assets grant recipients
ALL	*AEA Technology*, on behalf of the Department for Energy and Climate Change (UK)	Extract from the Renewable Energy Planning Database
	Scottish Local Planning Authorities	Responses to an Energy Saving Trust e-mail sent to all Planning Authorities in Scotland

Appendix 3. Capacities assumed for individual installations where information was not available

The following assumed capacities were used in the community and locally owned renewable energy database where information on capacity was not available.

Ownership category	Building type	Technology	Estimate of likely installed capacity	Derived from:
Community	Community buildings	Solar PV	8kWp	Average for other community PV installations recorded in the database
	Community buildings	Wind (including Wind to heat)	6kWp	Average for other community wind installations

				recorded in the database[37]
	Community buildings	Heat pumps (ASHP and GSHP)	16kWth	Average for other heat pumps in public sector, LA non-domestic and community buildings recorded in the database
	All	Biomass	45kWth	Average for other community biomass installations recorded in the database
	All	Biomass district heating	250kWth	Average for other community biomass district heating installations recorded in the database
Other public sector and charity	All	Solar thermal	13kWth	Average for other public sector and charity solar thermal installations recorded in the database
	All	Wind	6kWe	Average for other public sector and charity wind installations recorded in the database[38]
	All	Heat pumps (ASHP and GSHP)	16kWth	Average for other heat pumps in public sector, LA non-domestic and community

[37] This average excludes large-scale wind developments, and was used as the assumed capacity for wind turbines installed under SCHRI or CARES grant schemes (where this information was not provided), and in cases where other information provided indicated that the turbine was associated with a community hall or other small building, rather than being part of a larger development.

[38] This average excludes large-scale wind developments, and was used as the assumed capacity for wind turbines installed under SCHRI or CARES grant schemes (where this information was not provided), and in cases where other information provided indicated that the turbine was associated with a small building, rather than being part of a larger development.

				buildings recorded in the database
	All except hospitals	Biomass	150kWth	Average for other public sector and charity biomass installations, excluding hospital installations, recorded in the database
	Hospitals	Biomass	1.7MWth (1,700kWth)	Average for other hospital biomass installations recorded in the database.
Farms and Estates	All	Biomass	150kWth	Average for other farm and estate biomass installations recorded in the database
	All	Biomass district heating	150kWth	Average for other farm and estate biomass district heating installations recorded in the database
	All (SRDP recipients only)	Hydro	9kWe	Average for other farm and estate hydro installations recorded in the database[39]
Local businesses	All	ASHP	16kWth	Average for other local business ASHP's recorded in the database
	All	GSHP	30kWth	Average for other local business GSHP's recorded in the database
	All	Biomass	200kWth	Average for other local business biomass recorded

[39] Based on information received on size of hydro capacity installed under SRDP, therefore only used for other SRDP hydro installations where capacity was not known.

				in the database
	All	Biomass district heating	150kWth	Average for other local business biomass district heating recorded in the database
Local authority	Domestic properties	Solar thermal	3.4m^2	Analysis of Energy Saving Scotland home renewables grants[40]
	Domestic properties	Solar PV	2.8kWp	Analysis for installations registered for FITs in Scotland[41]
	Domestic properties	Heat pumps (ASHP and GSHP)	7kWth	Average for other LA- and HA-owned heat pumps in domestic properties recorded in the database
	Schools	Solar thermal	7kWth	Average for other school solar thermal installations recorded in the database
	Schools	Solar PV	8kWp	Average for other school solar PV installations recorded in the database
	Schools	Wind	6kWe	Average for other school wind installations recorded in the database
	Schools	ASHP	10kWth	Average for school ASHP installations recorded in the database
	Schools	Biomass	200kWth	Average for other school biomass

[40] Energy Saving Scotland home renewables grants (no longer available) were grants for domestic renewables, administered by the Energy Saving Trust on behalf of the Scottish Government.
[41] Central FIT's register, Ofgem. http://www.ofgem.gov.uk/Sustainability/Environment/fits/Pages/fits.aspx

				boiler installations recorded in the database
	Other buildings	Heat pumps (ASHP and GSHP)	16kWth	Average for other heat pumps in public sector, LA and community buildings, recorded in the database
Housing Association	Domestic properties	Solar thermal	3.4m^2	Analysis of Energy Saving Scotland home renewables grants[42]
	Domestic properties	Solar PV	2.8kWp	Analysis for installations registered for FITs in Scotland[43]
	Domestic properties	Heat pumps (ASHP and GSHP)	7kWth	Average for other LA- and HA-owned heat pumps in domestic properties, recorded in the database
	Domestic properties	ASHP - EAHR[44]	4kWth	Average for other LA- and HA-owned ASHP-EAHR's in domestic properties, recorded in the database

[42] Energy Saving Scotland home renewables grants (no longer available) were grants for domestic renewables, administered by the Energy Saving Trust on behalf of the Scottish Government.
[43] Central FIT's register, Ofgem. http://www.ofgem.gov.uk/Sustainability/Environment/fits/Pages/fits.aspx
[44] ASHP - EAHR = air source heat pump with exhaust air heat recovery. Such heat pumps draw heat from both air outside a building, and heat from stale air leaving the building or extracted from rooms such as kitchens and bathrooms within the building, to provide space and water heating to the building.

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