Community and locally owned renewable energy in Scotland at June 2018

A report by the Energy Saving Trust for the Scottish Government

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Energy Saving Trust

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.

With thanks to:

Home Energy Scotland advice centres
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We would also like to extend our thanks to the many other organisations and individuals who also 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.

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1 Background

In 2011, 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 on the information it contained. The objective of this work was to monitor progress towards the target set by the Scottish Government of 500 MW of community and locally owned renewable energy capacity operating in Scotland by 2020[1]. This target was exceeded in 2015 and subsequently the Scottish Government increased their target to 1 GW of community and locally owned renewable energy capacity by 2020, and 2 GW by 2030. This database has been updated annually since 2011 and this is the eighth iteration of its associated report. The database includes, as far as possible, all installations known to be operating, under construction, or in earlier stages of development as of June 2018. Since 2016, and as storage technologies have become more common, the report has also included findings on the capacity and type of community and locally owned energy storage systems.

'Community and locally owned' is defined as the installed capacity owned by:

- Community groups
- Local authorities
- Housing associations
- Other Scottish public bodies
- Charities, including faith organisations
- Further and higher education establishments
- Local businesses
- Scottish farms and estates

[1] https://www.gov.scot/policies/renewable-and-low-carbon-energy/local-and-small-scale-renewables/

2 Summary of key findings

The findings from this work are that at the end of June 2018:

- An estimated **697 MW**[2] of community and locally owned renewable energy capacity was operational in Scotland.
- This is a **6% increase** on the operational capacity in the last report (capacity at June 2017), when the operating capacity was estimated at 655 MW[3].
- The Scottish Government has now set new targets of 1 GW of community and locally owned energy by 2020 and 2 GW by 2030. The estimated operating capacity of 697 MW was 70% and 35%, respectively, towards these new targets.
- The operating capacity resulted from a total of around **18,830** individual renewable energy installations[4]. This is a 10% increase in number of installations compared to the 2017 report.

This 697 MW of total capacity is split between:

- 432 MW of electrical capacity (MWe)
- 256 MW of thermal (heat) capacity (MWth)
- 7 MW of combined heat and power (CHP) capacity
- 2 MW of capacity attributable to 'unspecified' technologies or energy categories[5,6]

Over the course of a year, community and locally owned renewable energy installations identified here could be expected to produce around **1,755 GWh** of renewable energy, consisting of approximately:

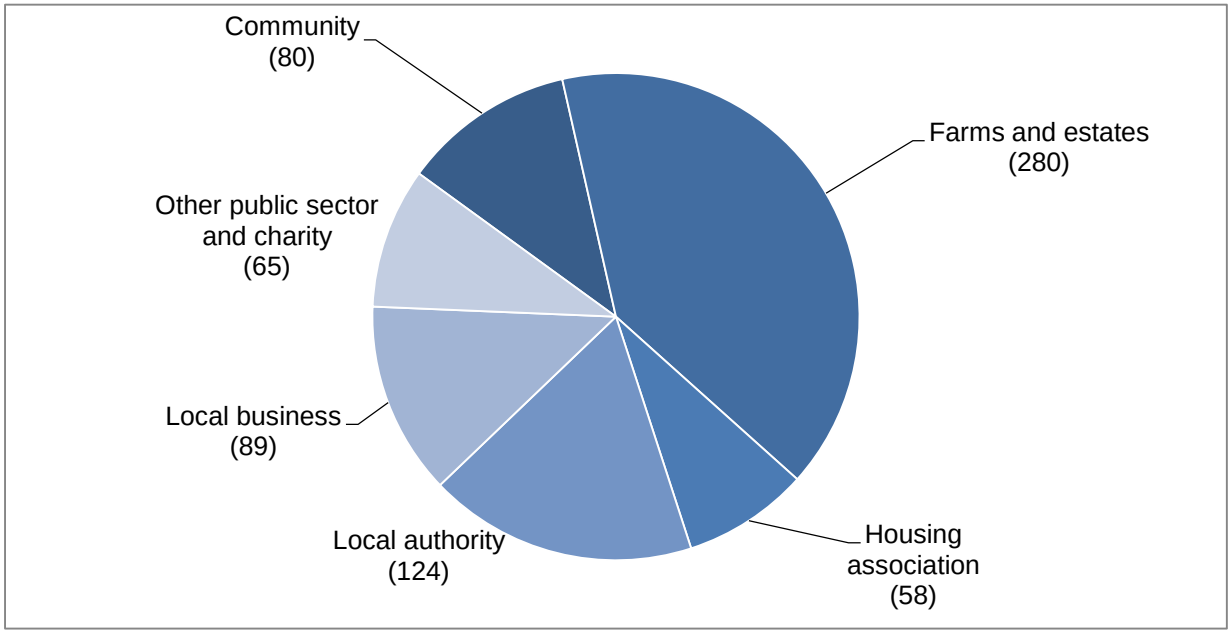
- 1,051 GWh of electricity
- 656 GWh of heat
- 36 GWh of combined heat and power generation
- 11 GWh of output from unspecified energy categories[7]

As in previous years, the largest proportion of operational community and locally owned capacity was on Scottish farms and estates (280 MW or 40%). The next largest ownership capacity was local authorities (124 MW or 18%) followed by local businesses (89 MW or 13%). Since June 2017 the

[2] Every reasonable effort has been taken to identify operational renewable capacity in community or local ownership; however, it is possible that some projects, particularly where planning permission is not required, will not be recorded in the database.
[3] This is a revised figure for June 2017 and is lower by approximately 11 MW than what was previously reported. All figures revised for 2017 are discussed in more detail later and can be found in full within appendix 1.
[4] This number of installations includes the total number of individual wind turbines in any multi-turbine development and has been rounded to the nearest 10.
[5] An 'unspecified' energy category refers to energy generated by energy from waste projects where the energy output (electricity/heat/combined heat and power) is unknown.
[6] Throughout this report, data has been rounded for ease of reading, hence some sub-totals may not precisely equal summed figures.
[7] This 11 GWh of output is from energy from waste projects where the energy output (electricity/heat/combined heat and power) is unknown.

largest proportional increase in operational capacity has been in the local business ownership category, with capacity increasing by 15%. Amongst local authorities, Highland Council and South Lanarkshire Council held the highest shares of local authority owned renewable energy capacity with 23 MW and 19 MW[8] of operational capacity installed respectively.

Figure 1. Capacity of operational installations at June 2018, by ownership category (MW)



A further **882 MW** of community or locally owned renewable energy capacity was estimated to be in different stages of development as of June 2018, an increase of 271 MW on last year's report[9]. Of this 882 MW:

- 54 MW was under construction
- 421 MW had been granted planning permission but construction had not yet started ('consented not built')[10]
- 94 MW was waiting for a planning decision to be made ('in planning')[11]
- 58 MW was in the scoping stage
- 1 MW was in an unknown stage of development
- 254 MW is under discussion for potential shared ownership between renewable developers and local community groups ('shared ownership under discussion')

Projects have been given an 'unknown' status when they are known to be in development but it has not been possible to establish what stage of the process they are at. We have been able to attribute almost all projects to an appropriate stage by using planning information resources. Where there

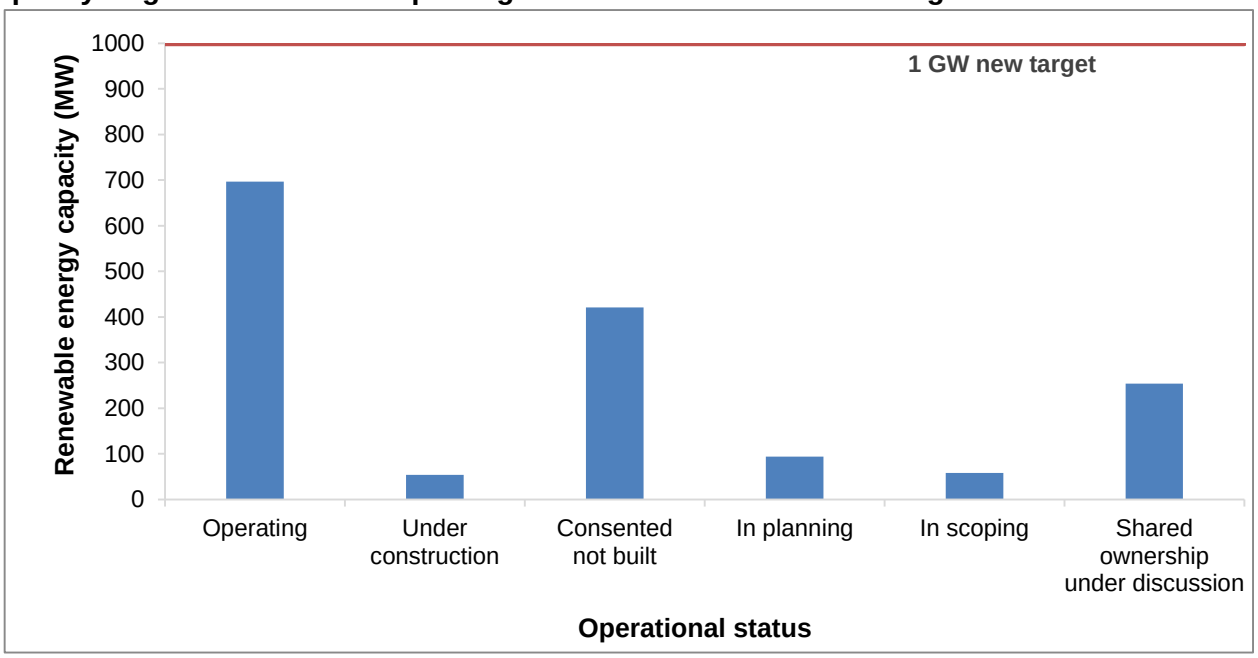
[8] The 19 MW figure reported here for South Lanarkshire is lower than that reported for June 2017 (24 MW). Last year's figure has been revised downwards by 6 MW. All revised figures used are discussed in more detail later and can be found within appendix 1.
[9] See appendix 4 for a full list of information sources
[10] Applies only to installations which require planning permission.
[11] Applies only to installations which require planning permission.

has been no evidence of a project having applied for planning permission, but there is evidence of the intent to take the project forward (for example in a carbon management plan), the project has been labelled as 'in scoping'. There was also approximately 2.44 MW of capacity currently recorded as being 'non-operational'[12]. For these projects, we have been informed that the construction of the installation is complete but that the installation is currently not operating.

86 of the projects included in the database are in or under discussion for shared ownership; more than double last year's count of 40 and follows an extensive exercise in 2018 to identify as many potential shared ownership schemes as possible. Of these, **37** were operational as of June 2018 with the remaining **49** in various stages of development. The operational shared ownership projects account for **58 MW** (8%) of community and locally owned renewable capacity and the 'in development' shared ownership projects make up a further 474 MW[13]. **1** additional project, contributing 2.6 MW of operational capacity, was previously included under shared ownership but has since been sold by the local community with the proceeds of the sale benefiting the community. By 2020, the Scottish Government ambition is to ensure that at least half of newly consented renewable energy projects have an element of shared ownership[14].

For the third year since the database began, energy storage capacity in community and local ownership has been recorded. At the end of June 2018 there was an estimated **7.26 MWh** of installed energy storage capacity in community and local ownership in Scotland with an additional **2.95 MWh** in development. The majority of operational storage (4.4 MWh) is heat storage.

Figure 2. Progress towards the 2020 1 GW community and locally owned renewable energy capacity target for all ownership categories and renewable technologies as at June 2018



[12] The 2.44 MW of non-operational capacity is not included in the "operational" or "in development" capacity totals.
[13] This figure includes the Viking Energy Wind Farm, of which the community and locally owned portion of the total site capacity is 167MW.
[14] https://www.gov.scot/publications/scottish-energy-strategy-future-energy-scotland-9781788515276/

3 Methodology summary

A full methodology is provided in Appendix 2. The following section provides an overview of the main points.

3.1 Definition of 'community and locally owned'

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

- A community group
- A local Scottish business[15]
- A farm or estate
- A local authority
- A housing association
- '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 that programme (but not recipients of grants under the householder stream)[16]
    - Recipients of Community and Renewable Energy Scheme (CARES) support[17]

'Ownership' has not been restricted to cases where the organisation owns the entire renewable installation as it also includes cases where 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. In such cases, only the percentage of the installation's capacity equal to the share owned by the community or local owner is counted towards the target.

'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, or installations that generate community benefit payments but that are fully owned by another organisation (for example a utility company). We have included renewable developments where an element of shared ownership is under discussion.

[15] Note that this excludes Scottish businesses whose main purpose is to develop renewable energy projects on land they do not fully own, at a site distant from their office.
[16] Scheme funded by the Scottish Government which offered grants, advice and project support to assist the development of new community and household renewable energy schemes in Scotland.
[17] Scheme currently funded by the Scottish Government to support the development of locally-owned renewable energy projects which provide wider community benefits.

3.2 Renewable energy technologies included

The following renewable energy technologies are included in the database:

- Wind (including wind to heat)
- Hydroelectric
- Wave and tidal (marine)[18]
- Solar photovoltaics (solar PV)
- Biomass (wood) primary combustion (including for district heating)
- Biomass (wood) gasification for the production of electricity and/or heat
- Waste incineration (organic or putrescible fraction) for production of electricity and/or heat
- Heat pumps (ground source, air source and water source) including air source heat pumps (ASHP) incorporating exhaust air heat recovery (EAHR)
- Solar thermal panels
- Solar air/solar ventilation systems
- Anaerobic digestion producing electricity and/or heat[19]
- Landfill gas capture producing electricity and/or heat
- Geothermal

The following energy storage systems are included in the database:

- Electrical battery storage
- Heat battery storage (using phase change materials)
- Thermal stores
- Hydrogen storage

Full descriptions of these technologies are provided in Appendix 3.

3.3 Approach taken and data sets used

The approach taken for data collection and processing for this version of the database and report was broadly in line with the approach taken for the previous reports. A full methodology is provided in Appendix 2.

For this year's report a full database update was carried out for the period from June 2017 to June 2018.

A full list of the main data sources used, and the organisations that provided them, is given in Appendix 4.

[18] There are currently no wave technologies in the database, but these could be added in future
[19] Excludes the heat produced only for maintenance of the digestion process.

3.4 Information collected

Wherever possible, the information collected for each installation 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 and/or grid reference.
- Technology type.
- Number, installed operational capacity and installed storage capacity as appropriate for the technology.
- Operational status as at June 2018 (operating/under construction/consented not built/in planning/in scoping/planning not granted/non-operational/decommissioned/shared ownership under discussion).
- The date on which generation commenced (for operational projects).
- Percentage ownership by the community group etc., in cases where the organisation did not have full ownership of the installation.
- Where appropriate, the building type associated with the renewable energy installation.
- Whether public grant or loan funding was received.

3.5 Revised Figures for the June 2017 report

Some of the figures provided in last year's report for June 2017 have been revised due to improvements in the quality of the data collected and as part of the annual data cleansing process. The headline changes to the June 2017 report are as follows:

- The known total of in operation capacity was reduced from 666 MW to 655 MW. This reduction was split between the community (2.6 MW), housing association (2.1 MW) and local authority (6 MW) categories.
- The total yearly output in GWh has also been revised down from 1,664 to 1,638. This can be broken down by category into 6.1 GWh of community, 5.4 GWh of housing association and 15 GWh of local authority output.
- All reductions by category came from a singular project and technology: wind for communities, biomass for housing associations and heat pumps for local authorities.
- The total number of known operational installations also fell by around 890 from 17,950 to 17,060. All of these installations, bar two, were heat pumps from the local authority category.
- All local authority revisions were for the South Lanarkshire council area.

To improve the accuracy and reliability of the figures and trends presented here, all subsequent comparisons between June 2017 and June 2018, including percentage differences, utilise the revised 2017 figures. The full set of revisions can be found within appendix 1.

4 Community and locally owned renewable energy operational in 2018

4.1 Results for June 2018: operational capacity

At the end of June 2018 an estimated 697 MW of community or locally owned renewable energy capacity was operational in Scotland. This was spread over a total of 18,830 individual renewable energy installations[20].

A breakdown of operational capacity by ownership categories is given in table 1 and illustrated in figure 3. The largest proportion of operational capacity was on Scottish farms and estates (280 MW, or 40%), followed by local authorities (124 MW, or 18%) and local businesses (89 MW, or 13%). Community groups owned 11% of total operational capacity (80 MW).

The largest numbers of individual installations (16,650) were in local authority and housing association ownership, together accounting for 88% (by number) of individual installations. Housing associations were the owners of the largest number of individual installations, at around 9,710 installations (approximately 52% of all individual installations recorded). The number of operational local authority installations now recorded is 6,940. The number of housing association owned installations recorded as being operational increased by approximately 3% between June 2017 and June 2018, whilst the number of local authority owned installations recorded as operational rose by 25%. Heat pumps and solar PV are the most used technologies in these ownership categories, with heat pumps accounting for 36% of the installations in housing association and local authority ownership and solar PV accounting for 44%. Solar PV overtook heat pumps as the most installed technology by installation count for the first time this year. The majority of the heat pumps and solar PV systems in these ownership categories are installed on domestic properties[21].

The local business category has seen the largest proportional increase (15%) in operational capacity since the June 2017 report, overtaking community groups to become the third largest category for operational capacity.

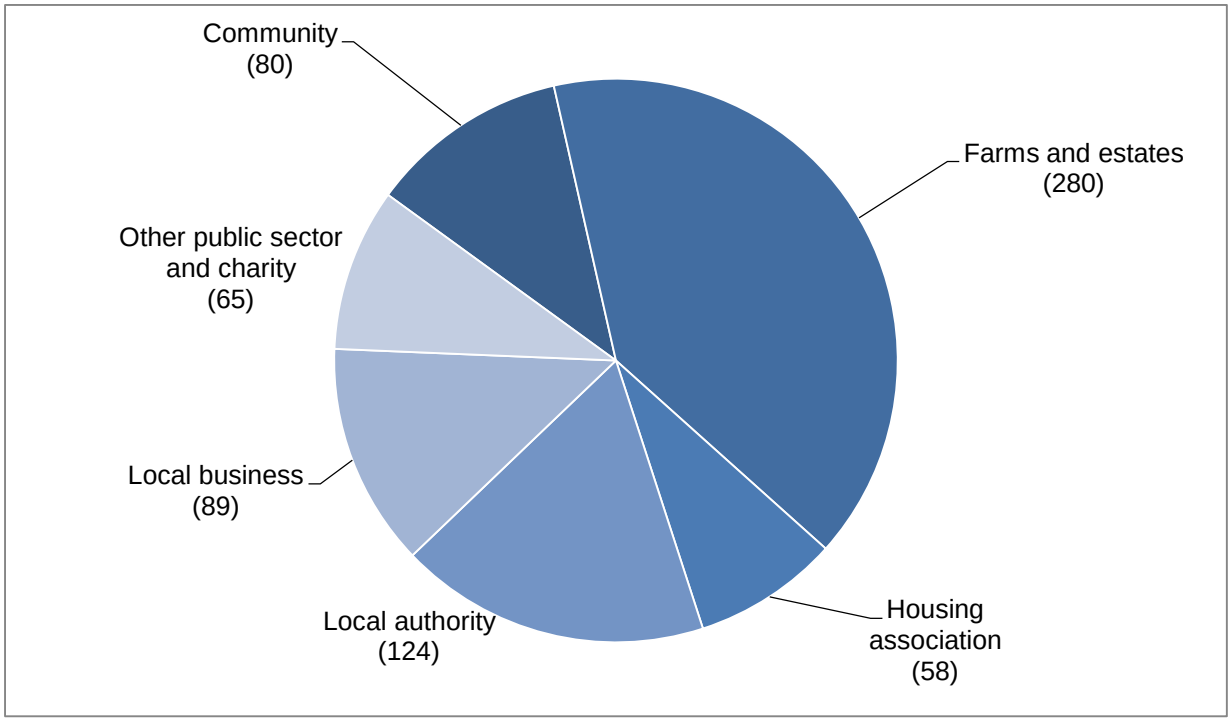
[20] This number of installations includes the total number of individual wind turbines in any multi-turbine development. Figure rounded to the nearest 10.
[21] All installation figures in this report are rounded to the nearest 10.

Table 1. Estimated number and capacity of operational installations as of June 2018 by ownership category

Ownership category	Operational capacity (MW)	% of operational capacity	% increase in capacity compared to 2017	Number of operational installations [22]	% of operational installations	% increase in installations compared to 2017
Community	80	11%	2%	540	3%	1%
Farms and estates	280	40%	5%	620	3%	3%
Housing association	58	8%	3%	9,710	52%	3%
Local authority	124	18%	9%	6,940	37%	25%
Local Business	89	13%	15%	550	3%	2%
Other public sector and charity	65	9%	5%	470	2%	4%
Total[23]	**697**	**100%**	**6%**	**18,830**	**100%**	**10%**

Operational capacity rounded to nearest MW and number of installations rounded to nearest 10, which could mean the totals or proportions do not add.

Figure 3. Capacity of operational installations as of June 2018 by ownership category (MW)



[22] Rounded to the nearest 10; for wind farms, each turbine is counted as one installation.
[23] Throughout this report, data has been rounded for ease of reading, hence some sub-totals may not precisely equal summed figures.

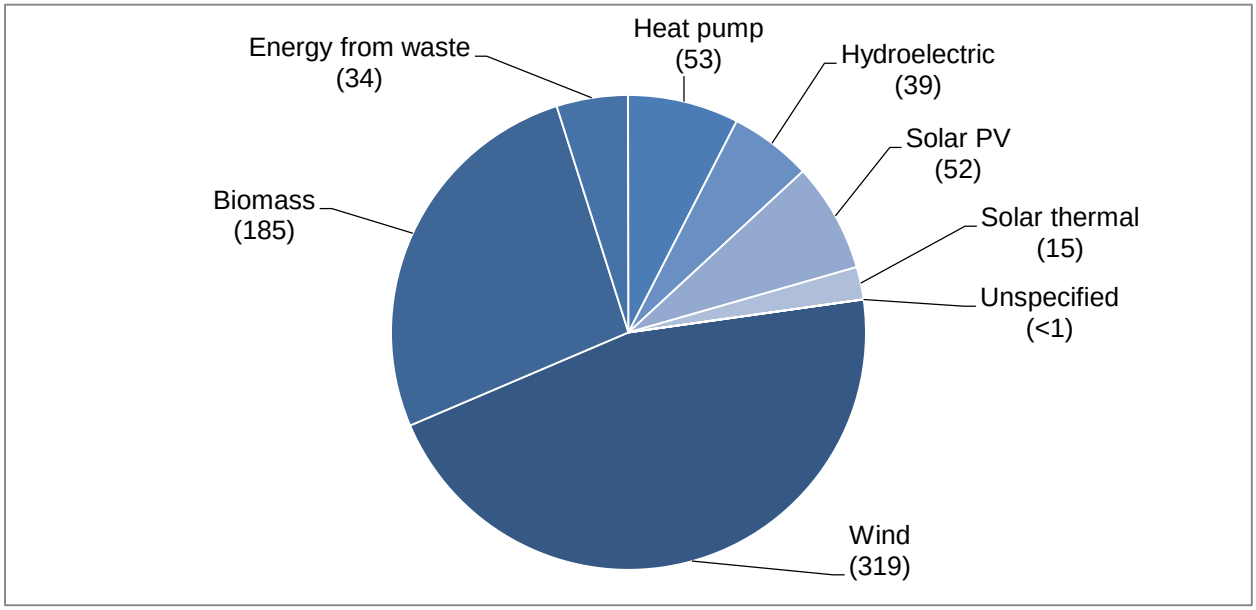
Wind was the category with the largest capacity in operation (319 MW) as of June 2018 with an approximate 9 MW increase since the 2017 report. The second largest category was energy from biomass (185 MW) which also had an increase in operational capacity of approximately 9 MW compared with June 2017. These two technologies account for 72% of operational capacity as at June 2018. A breakdown by technology type is given in table 2 and illustrated in figure 4.

Table 2. Number and capacity of operational installations as of June 2018, by technology

Technology	Operational capacity (MW)	% of operational capacity	Number of installations[24]	% of operational installations
Wind	319	46%	730	4%
Biomass	185	27%	930	5%
Energy from waste	34	5%	30	<1%
Heat pump	53	8%	6,330	34%
Hydroelectric	39	6%	170	1%
Solar PV	52	7%	7,570	40%
Solar thermal	15	2%	3,070	16%
Unspecified[25]	<1	<1%	1	<1%
Total[26]	**697**	**100%**	**18,830**	**100%**

[24] Rounded to the nearest 10 unless there are less than 10 installations within the database; for wind farms, each turbine is counted as one installation.
[25] 'Unspecified' technologies are those where the existence of a renewable technology in community or local ownership is known but the technology type has not been provided to the Energy Saving Trust. Whilst the majority of 'unspecified' technologies reported as being in operation are known to be solar installations, the type of solar technology has not been provided.
[26] Throughout the report, data has been rounded for ease of reading, hence some sub-totals may not precisely equal summed figures.

Figure 4. Capacity of operational installations as of June 2018 by technology type



The largest proportional increase in capacity by technology category has been in energy from waste, with operational capacity increasing by 58% since the June 2017 update and absolute operating capacity increasing by around 12 MW. Nearly all of this increase, with the exclusion of less than 1 MW, comes from a single large energy from waste installation.

The difference between the organisations that own the majority of installations and those that own the majority of operating capacity stems from the mix of renewable technologies found in the different ownership categories. Housing associations own large numbers of solar PV panels, heat pumps and solar thermal panels. However, as the majority of these are on individual domestic properties, each individual installation typically has a small capacity[27]. Housing associations thus have a relatively small share (about 8%) of Scotland's total operating community and locally owned renewable capacity despite owning 52% of all operating installations.

For farms and estates, wind turbines and biomass boilers are the main renewable technologies owned. Installations of biomass boilers and wind turbines on farms and estates typically have very large capacities[28], leading to farms and estates owning the largest share (40%) of installed operational capacity as of June 2018 despite a relatively small share of the total installs (3%).

[27] Typical domestic solar thermal panel size is around 2.8 kWth (0.0028 MWth). Solar PV panel size is around 4 KWe (0.004 MWe). Domestic heat pumps in housing association homes are typically around 7 kWth (0.007 MWth). See Appendix 4 for more details.

[28] Farm and estate biomass (wood) heating systems sizes range between 15 kWth and 900 kWth, with two thirds of the projects having a capacity of between 100 kWth and 300 kWth. See appendix 4 for more details. Farm and estate wind turbines varied greatly in size, from 1 kWe (0.001 MWe) to 2.5 MWe (2,500 kWe), however most were over 300 kWe (0.3 MWe) in size.

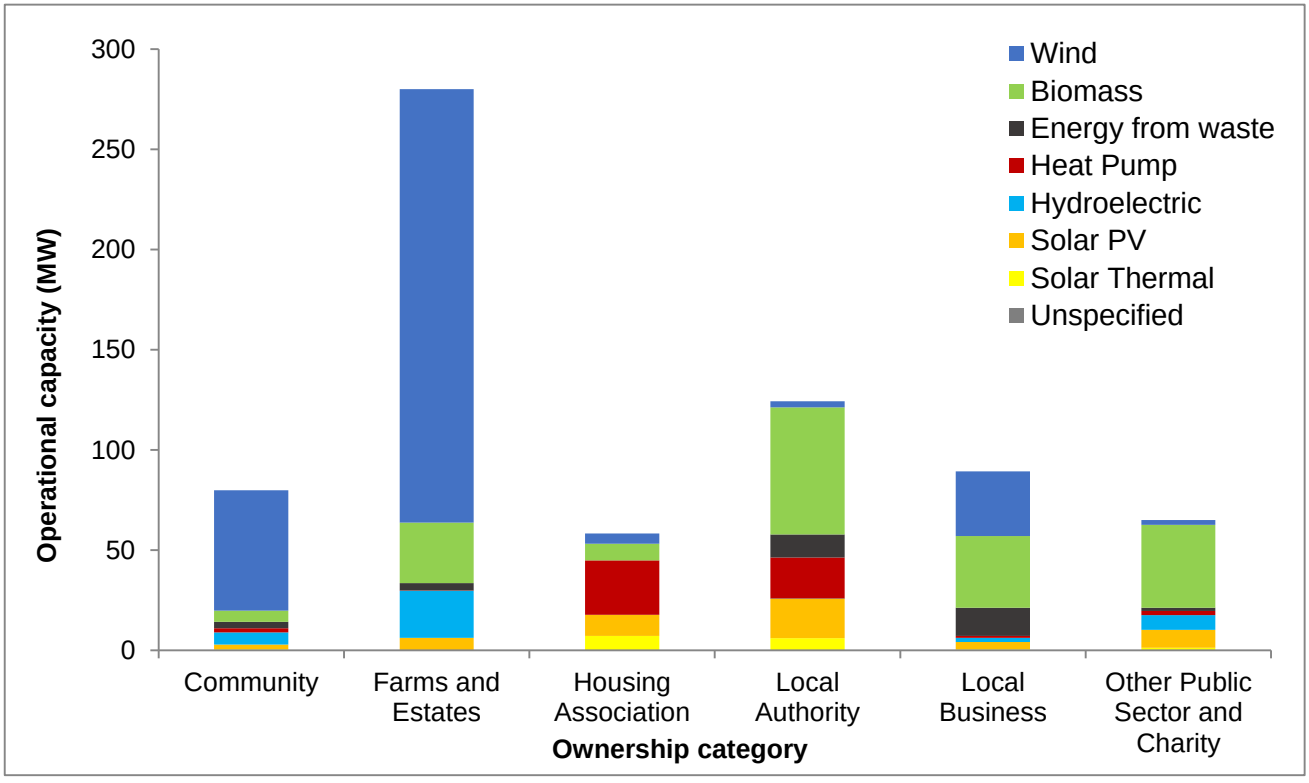
A breakdown of operational capacity by technology and by ownership category is given in table 3 and illustrated in figure 5.

Table 3. Operational capacity as of June 2018, by technology and ownership category

Technology	Community (MW)	Farms and estates (MW)	Housing associations (MW)	Local authorities (MW)	Local businesses (MW)	Other public sector and charity (MW)
Wind	60	216	5	3	32	3
Biomass	6	30	8	63	36	41
Energy from waste	3	4	-	11	14	2
Heat pump	2	<1	27	20	1	2
Hydroelectric	6	23	-	<1	2	7
Solar PV	2	6	11	20	4	9
Solar thermal	<1	<1	7	6	<1	1
Unspecified	-	-	-	<1	-	-
TOTAL	**80**	**280**	**58**	**124**	**89**	**65**

Figures are rounded to the nearest 1 MW, therefore totals may not add up

Figure 5. Operational capacity as of June 2018 showing technology by ownership category



Local authorities

Highland and South Lanarkshire councils held the largest shares of local authority owned renewable energy capacity with 23 MW and 19 MW of operational capacity installed respectively. There was an absolute increase of approximately 5 MW to Highland Council's operational capacity from June 2017. Highland Council reported at least an additional 94 previously unknown projects, although, the resulting increase in overall capacity is not representative of the last reporting year as a number of these projects were operational before 2018. Using the revised figures for 2017, South Lanarkshire's known capacity has grown by 2% (<1 MW) since June 2017.

Stirling and South Lanarkshire councils continue to have the largest numbers of installations, with 2,260 and 1,780[29] individual installations respectively as of June 2018. This is an approximate increase of 675 installs for Stirling and 170 for South Lanarkshire in comparison to the revised 2017 figures. The majority of the South Lanarkshire Council installations are heat pumps while the Stirling Council installations are predominantly solar PV systems. A more detailed breakdown of operational capacity, number of installations and technology type can be seen in figure 10, and in tables 4 and 5.

[29] Figures are rounded to the nearest 10.

Table 4: Operational capacity in local authority ownership by technology[30] and area[31], June 2018

Local Authority	Biomass (MW)	Energy from waste (MW)	Heat pump (MW)	Solar PV (MW)	Solar Thermal (MW)	Wind (MW)	Total (MW)
Aberdeenshire	6	-	<1	1	<1	<1	**7**
Angus	2	-	<1	<1	<1	<1	**2**
Argyll and Bute	3	-	<1	1	-	<1	**5**
City of Edinburgh	1	-	-	<1	2	<1	**3**
Dundee City	1	5	<1	<1	<1	-	**6**
Fife	<1	5	<1	<1	2	1	**8**
Highland	21	-	1	1	<1	<1	**23**
Moray	<1	-	3	<1	<1	<1	**4**
North Ayrshire	3	-	-	2	<1	<1	**5**
North Lanarkshire	2	1	<1	2	<1	<1	**5**
Perth and Kinross	7	-	<1	-	<1	-	**7**
South Lanarkshire	7	-	10	1	<1	<1	**19**
Stirling	1	<1	<1	8	<1	<1	**8**
West Dunbartonshire	<1	-	1	<1	<1	-	**1**
West Lothian	3	-	<1	1	<1	-	**3**
All other areas	6	<1	4	4	1	2	**18**
Total	**63**	**11**	**20**	**20**	**6**	**3**	**124**

Figures are rounded to the nearest 1 MW therefore totals may not add up

[30] Hydroelectric and unspecified technology capacities and are not shown for ease of display; Shetland has one hydroelectric system (0.016 MW) and there is 0.02 MW of 'unspecified' operational capacity. These figures in particular have been omitted due to their small impact on the overall figures displayed.
[31] Only the top 15 local authority areas (by operational capacity) have been shown in detail for ease of display.

Table 5. Number of operational systems in local authority ownership by technology[32] and area[33], June 2018

Local Authority	Biomass	Energy from waste	Heat pump	Solar PV	Solar Thermal	Wind	Total
Aberdeenshire	15	<5	10	20	5	<5	55
Angus	10	-	15	20	60	<5	105
City of Edinburgh	5	-	-	25	25	<5	55
Dumfries and Galloway	10	-	<5	20	5	-	35
Fife	5	5	30	250	535	10	830
Highland	90	-	30	85	15	<5	225
Midlothian	<5	-	-	<5	195	-	200
Moray	5	-	515	<5	25	<5	545
North Ayrshire	15	-	-	25	5	<5	45
North Lanarkshire	5	<5	10	65	5	<5	90
Orkney	-	-	100	75	<5	15	195
South Lanarkshire	50	-	1,450	215	60	<5	1780
Stirling	5	<5	5	2,245	5	<5	2,260
West Lothian	5	-	5	90	5	-	100
Western Isles	-	<5	10	20	10	5	45
All other areas	50	<5	95	175	45	20	385
Total	**265**	**10**	**2,270**	**3,335**	**995**	**60**	**6,935**

Figures are rounded to the nearest 5, therefore totals may not add up

4.2 Estimate of yearly energy produced based on installed capacity, June 2018

Over a year, the 697 MW of operational community and locally owned renewable energy capacity could be expected to produce up to 1,755 GWh of renewable energy. This consists of around 1,051 GWh of electricity, 656 GWh of heat, 36 GWh of energy from combined heat and power installations and 11 GWh of 'unspecified' energy[34] (see figure 6). A breakdown by ownership category is given in table 6. The assumptions used to estimate yearly output are specific to each technology and are detailed in Appendix 2.

[32] Hydroelectric and unspecified technology capacities and are not shown for ease of display; Shetland has one hydroelectric system (0.016 MW) and there is one installation with 'unspecified' technology in Midlothian.
[33] Only the top 15 local authority areas (by number of installations) have been shown for ease of display.
[34] This 11 GWh of output is from energy from waste projects where the energy output (electricity/heat/combined heat and power) is unknown.

Figure 6. Estimated yearly energy output by technology category

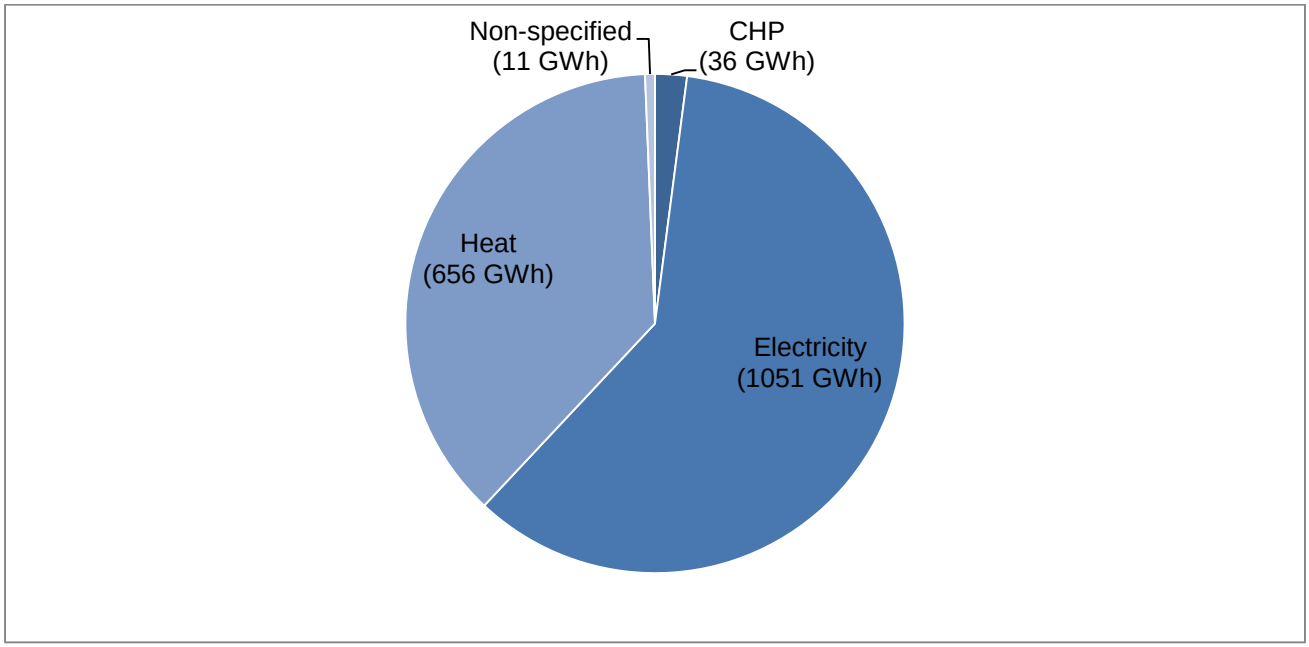


Table 6. Estimated capacity and yearly energy output of operational installations at June 2018 by ownership category

Ownership category	Operational capacity (MW)	% of operational capacity	% increase in capacity compared to 2017	Estimated yearly energy output (GWh)	% of output	% increase in output compared to 2017
Community	80	11%	2%	203	12%	3%
Farms and estates	280	40%	5%	698	40%	5%
Housing association	58	8%	3%	114	6%	2%
Local authority	124	18%	9%	288	16%	12%
Local business	89	13%	15%	281	16%	20%
Other public sector and charity	65	9%	5%	172	10%	0%
TOTAL	**697**	**100%**	**6%**	**1,755**	**100%**	**7%**

4.3 Maps of operating capacity by ownership category

The following maps (figures 7 to 12) illustrate, by ownership category, the distribution of operational community and locally owned renewable energy capacity throughout Scotland at June 2018.

Each circle indicates the location of a renewable energy installation, or installations if there is more than one system (of the same technology) owned by the same organisation at the same postcode or grid reference. The size of each circle indicates the capacity of the installation in MW, and the colour indicates the technology type. In cases where less than 100% of the installation is owned by a community or local owner, the size of the circle indicates the renewable capacity owned by the community or local owner rather than the full size of the installation. In the case of the amount of renewable capacity in local authority ownership, the local authority areas have been shaded to indicate the areas with the most capacity; tables 3 and 4 provide additional detail as to the technologies deployed in each local authority area.

Some notable trends that can be seen on the maps are the cluster of large wind turbines installed by farms and estates installed in Aberdeenshire in the north east of Scotland and the number of community wind turbines installed across the Scottish Islands.

Please note that these maps show only 90% of the operational renewable energy projects held in the database. This is because postcodes or grid references could not be obtained for the remaining 10% of installations.

Figure 7. Known operational renewable energy projects owned by Scottish community groups, as at June 2018.

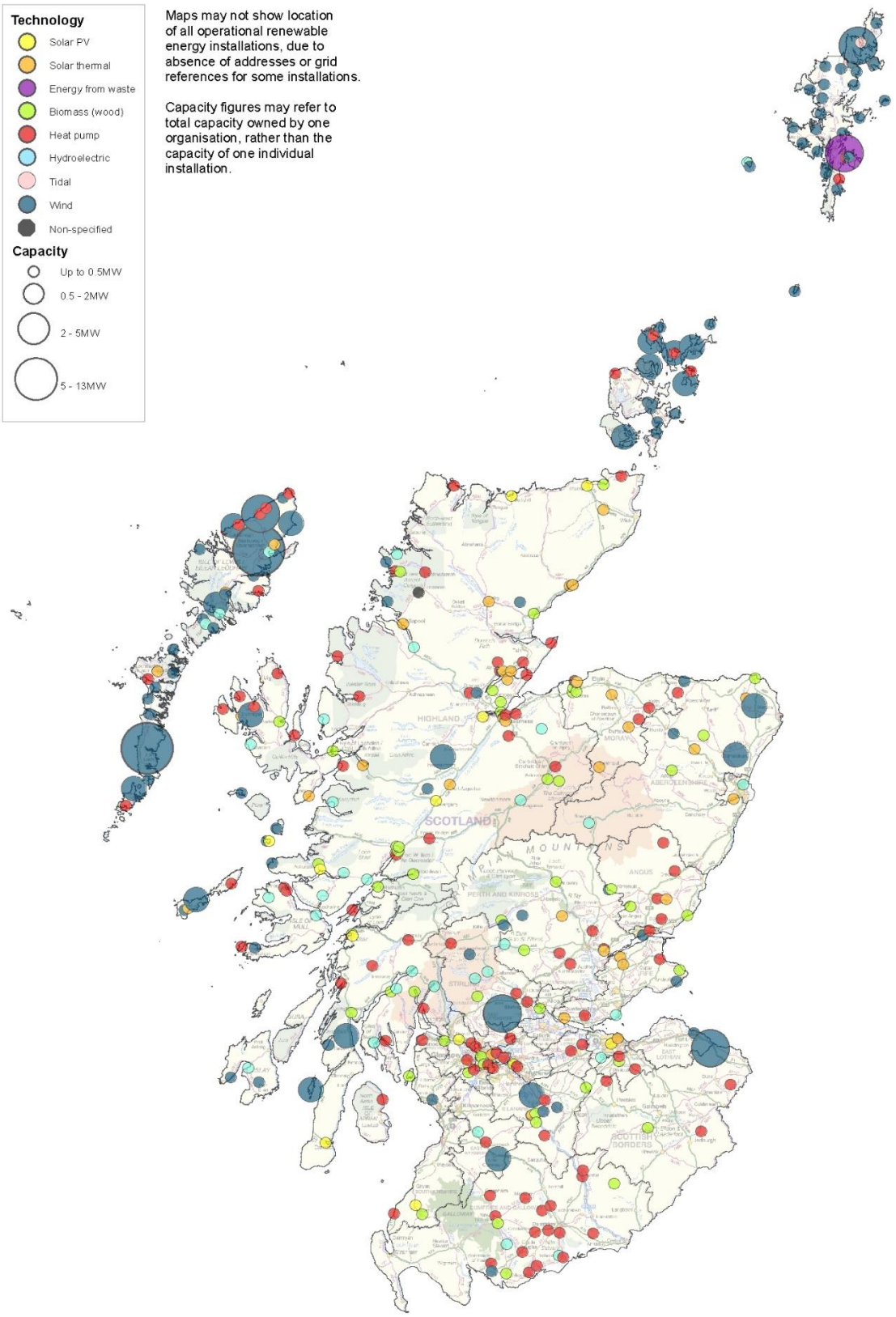


Figure 8. Known operational renewable energy projects owned by Scottish farms and estates, as at June 2018

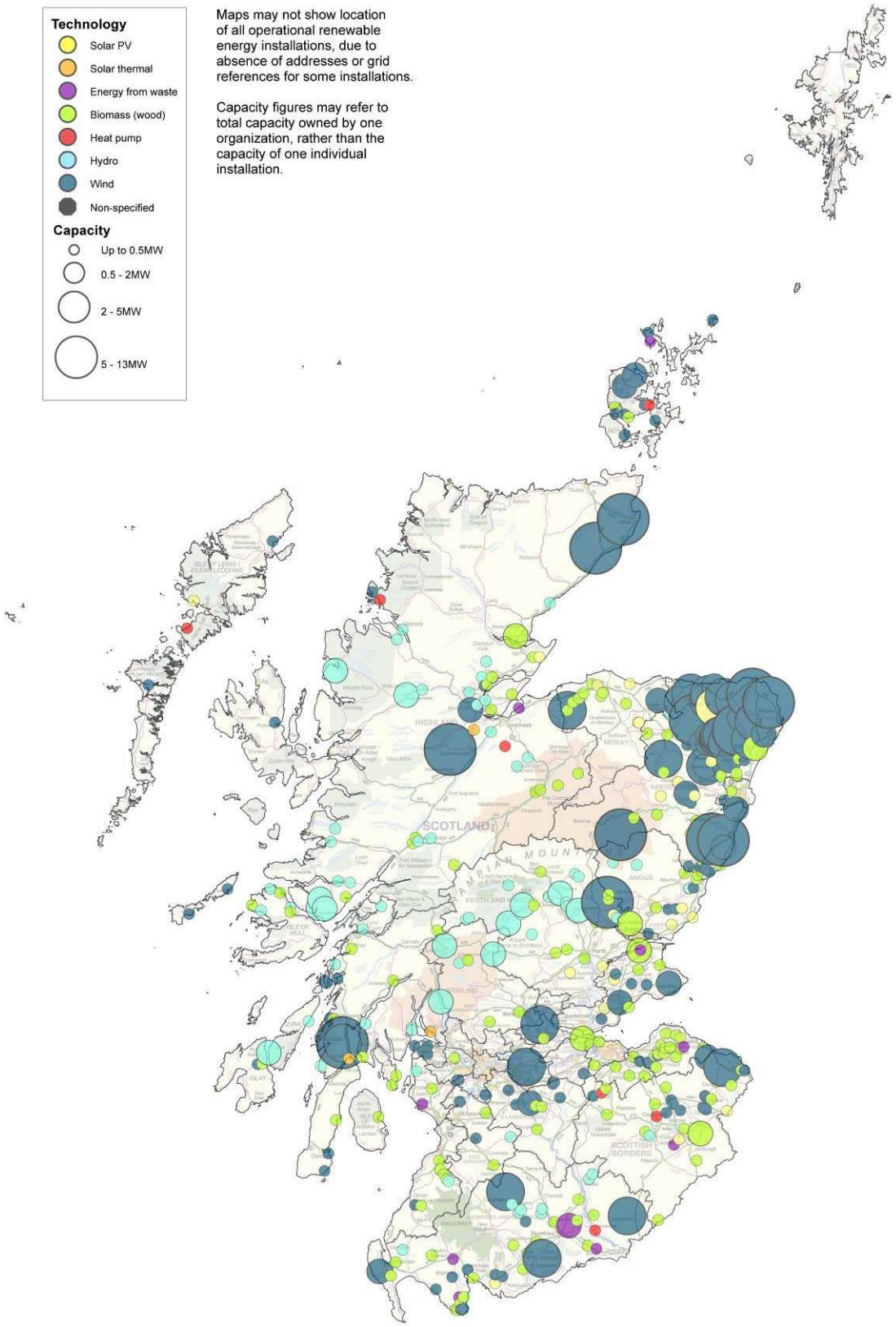


Figure 9. Known operational renewable energy projects owned by Scottish housing associations, as at June 2018

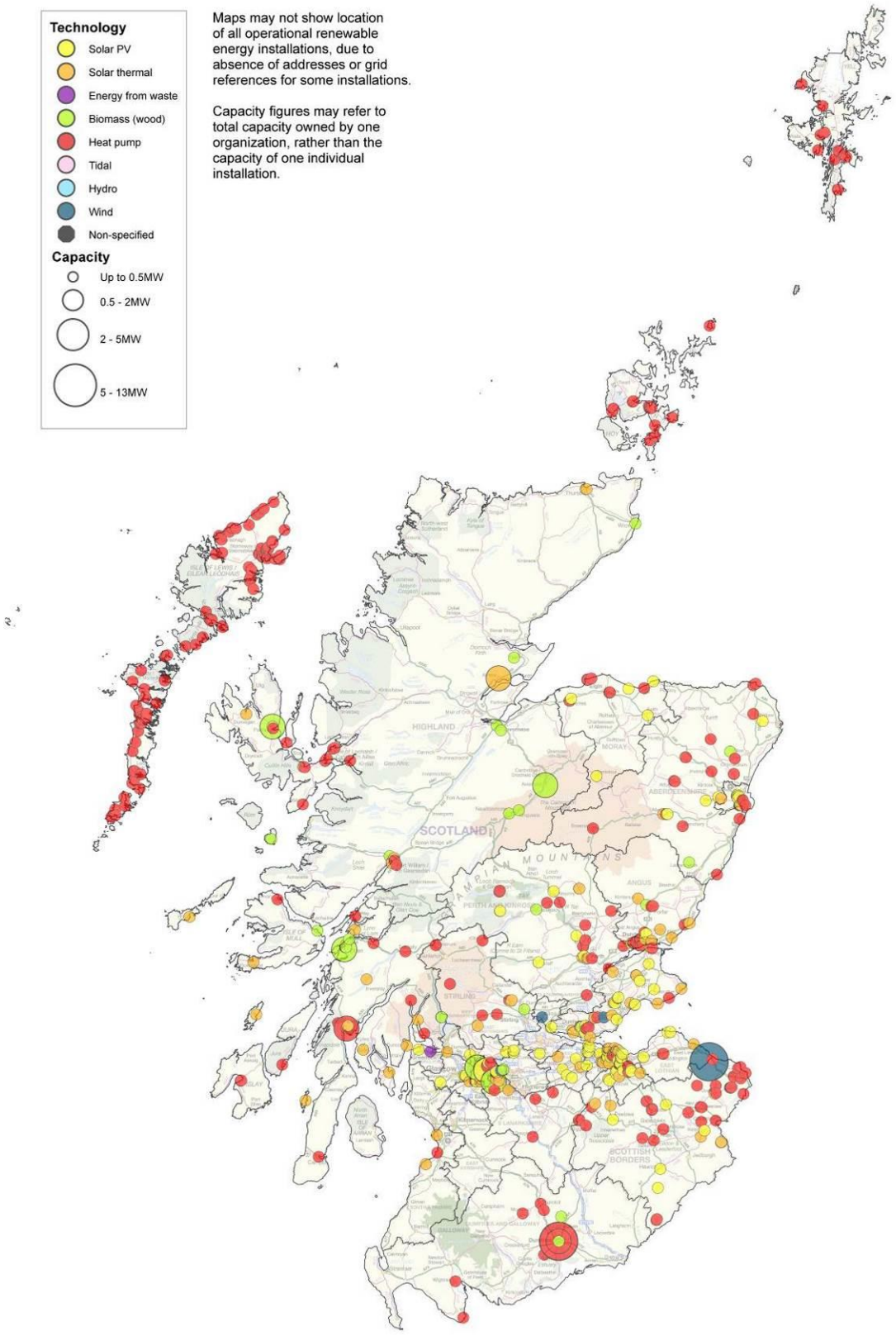


Figure 10. Known operational renewable energy projects owned by Scottish local authorities, as at June 2018

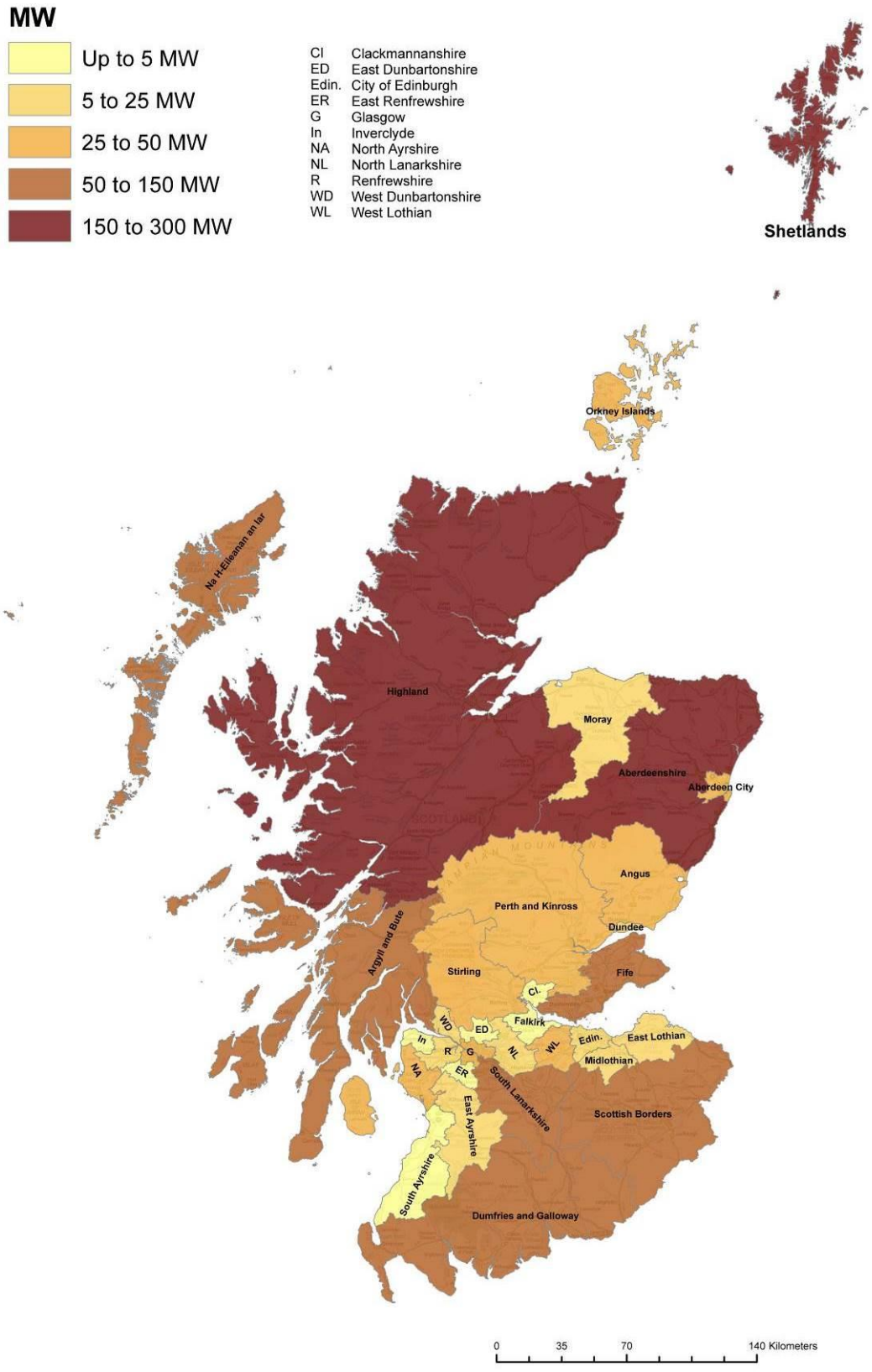


Figure 11. Known operational renewable energy projects owned by Scottish businesses, as at June 2018

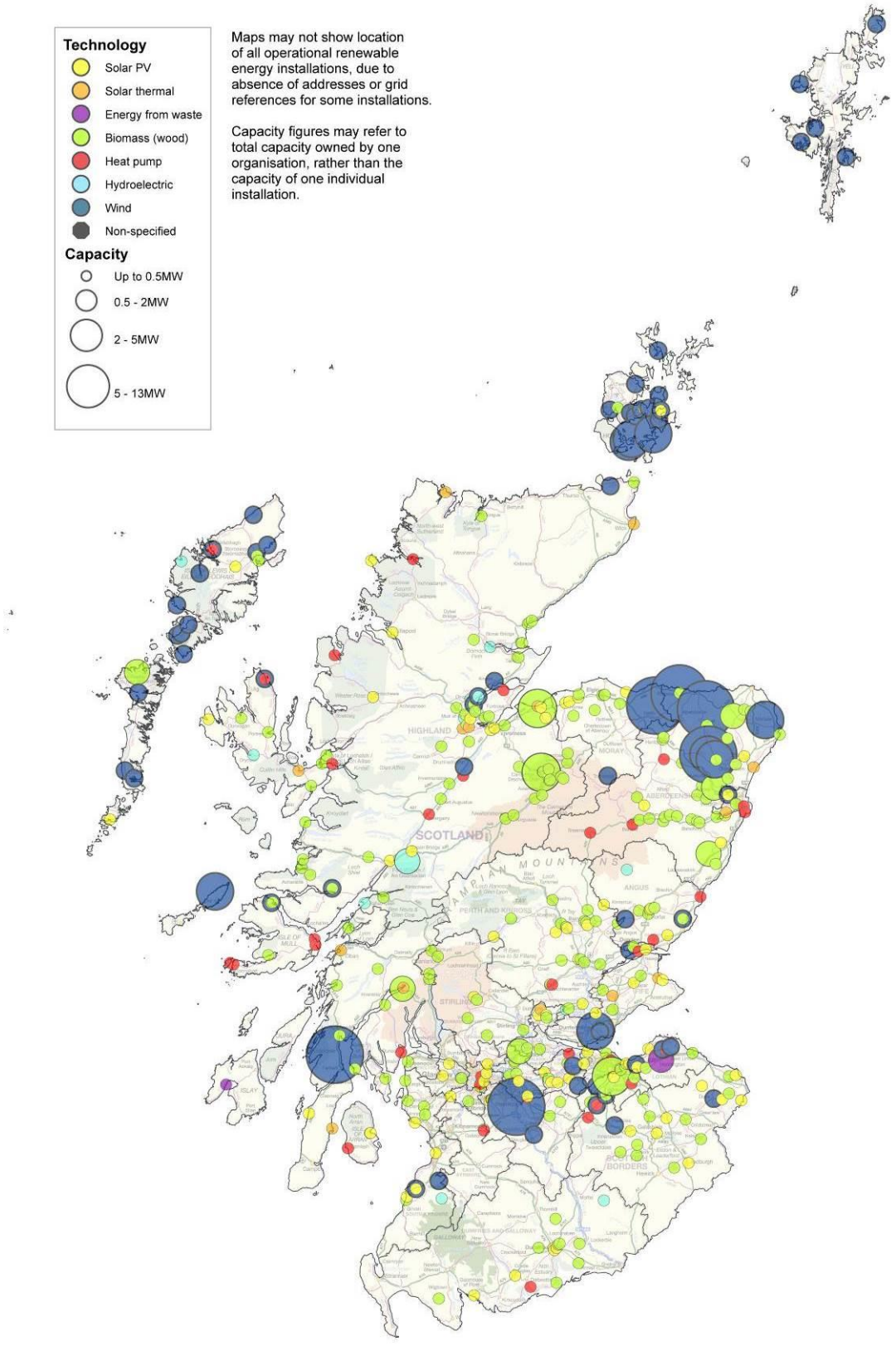
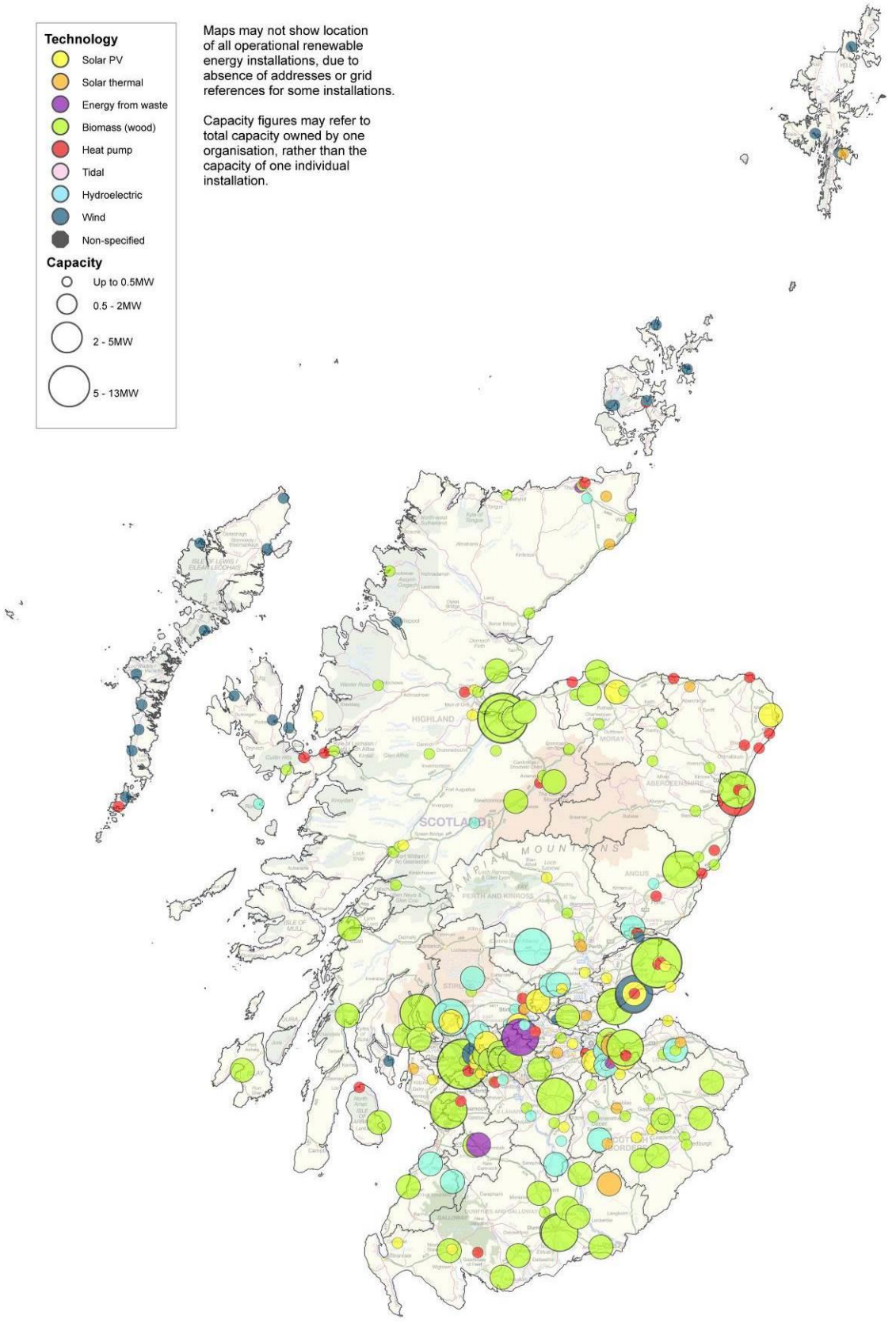


Figure 12. Known operational renewable energy projects owned by Scottish public sector and charity organisations, as at June 2018



5 Further community and locally owned renewable energy capacity in development

5.1 Results for June 2018 capacity in development

In addition to the 697 MW of community and locally owned renewable energy capacity estimated to be operational at the end of June 2018, a further 882 MW of community or locally owned renewable energy capacity was estimated to be in various stages of development (under construction/consented but not built/in planning/in scoping/shared ownership under discussion). There was also approximately 2.44 MW of installed non-operational capacity[35].

Of the renewable energy capacity estimated to be in development:

- 54 MW was under construction.
- 421 MW had been granted planning permission but construction had not yet started ('consented not built')[36].
- 94 MW was in the planning system waiting for a planning decision to be made ('in planning')[37].
- 58 MW was being considered, or was at the stage where preparation was being made to apply for planning permission ('in scoping').
- 1 MW of capacity in the database was unclear in terms of development stage.
- 254 MW is under discussion for potential shared ownership between renewable developers and local community groups ('shared ownership under discussion')

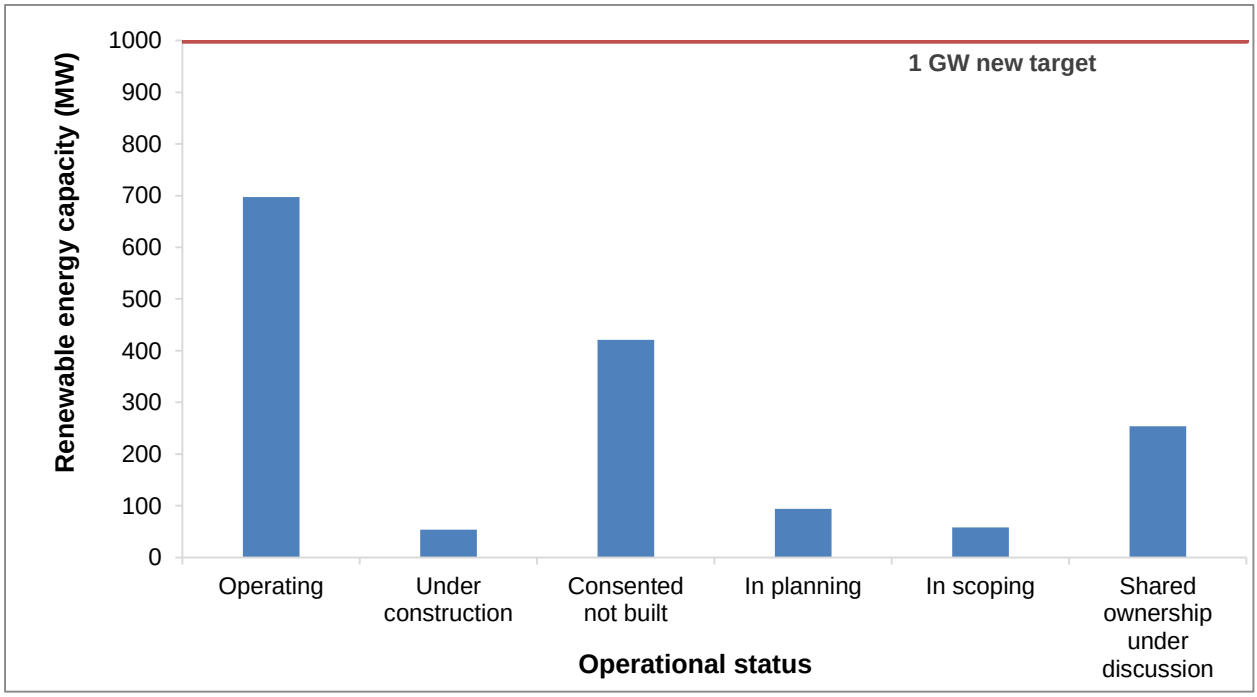
This breakdown is illustrated in figure 13, and a breakdown by technology type is given in table 7.

[35] The majority of the 'non-operational' capacity is made up of installations which have been installed but are not yet in use and installations which have failed and are awaiting repair or replacement.
[36] Applies only to installations which require planning permission.
[37] Applies only to installations which require planning permission.

Table 7. Estimated capacity in development as of June 2018 by development stage and technology

Technology	Under construction (MW)	Consented, not built (MW)	In planning (MW)	In scoping (MW)	Shared ownership under discussion (MW)
Wind	20	293	82	21	252
Biomass	1	1	4	6	-
Energy from waste	1	41	-	-	-
Heat pump	26	2	2	1	-
Hydro	3	6	2	6	1
Solar PV	3	67	4	20	-
Solar thermal	<1	<1	<1	<1	-
Tidal	-	10	-	<1	-
Geothermal	<1	-	-	4	-
TOTAL	**54**	**421**	**94**	**58**	**254**

Figure 13. Progress towards the 2020 1 GW target for community and locally owned renewable energy capacity for all sectors and renewable technologies as at June 2018



5.2 Shared ownership projects

A number of projects have ownership which is either shared between a community or local owner and a developer, or where multiple community or local owners have come together to share ownership.

For this year's report, we have included projects where shared ownership is under discussion but where any partnership has not yet been formalised between renewable developers and local community groups. This new status was included to better track the progress being made towards the Scottish Government's ambition to ensure that by 2020, at least half of newly consented renewable energy projects will have an element of shared ownership. Projects were identified as being under discussion by CARES through their engagement with local groups and developers with an extensive exercise undertaken in 2018 to update this information. As shared ownership agreements are finalised as we progress through the next reporting year, these projects currently classed as under discussion will move into the other stages of development. Where any such agreements do not come to fruition, the projects will be removed from the database. Note that the under discussion status also includes a small number of sites which are already operational but where the owners are looking to refinance to include a component of shared ownership. CARES will continue to work closely with all groups involved to monitor the active shared ownership pipeline and the progress will be reported here annually.

As at June 2018, there were 86 unique projects recorded in the database with either shared ownership or where shared ownership is under discussion. Of these 86 projects, 8 were in shared ownership with other community or local project partners. The ownership of the remainder is split between a community or local group and a private developer of renewable sites. 37 of these 86 projects were operational as at June 2018 and accounted for 58 MW of community and locally owned capacity between them. The remaining 49 projects were in various stages of development and account for 474 MW of the in development capacity. This figure includes the 167 MW attributable to the Viking Energy Wind Farm which is still in the 'consented, not built' phase of development.

One of the shared ownership projects, Neilston Community Wind Farm, has been removed from the community and locally owned statistics as the community sold their share of the project. This reduced the known operational capacity by around 2.6 MW. It should be noted that, in addition to the income from electricity generated whilst the project was under shared ownership the community also benefited from an approximate £2m from the sale of project.

64 of the 86 projects have at least one project partner in the 'communities' category (see Appendix 2 for a description of this category). Tables 8 to 11 show this breakdown in more detail. The numbers recorded in the 'number of records' and 'number of projects' columns in tables 8 and 9 differ as each 'community or local' owner (see Appendix 2 for ownership category descriptions) is recorded individually in the database. This is to allow for appropriate allocation of capacity between the ownership categories. So, for example a project may be owned by a number of different organisations that fall into different ownership categories. This will mean that there will be multiple

records in the database for that particular project. As such, there are 98 records in the database, covering 86 unique projects.

The vast majority of the shared ownership operational capacity in operation (54 MW) and under development (527 MW) is generated by wind turbines.

Table 8. Number of records in the database reported as having shared ownership of a community or local renewable energy project, by category and status

Ownership category	Operational	Under construction	Consented, not built	In planning	In scoping	Completed, not operating	Shared ownership under discussion
Community	21	1	11	-	-	-	31
Farms and estates	11	-	-	-	-	-	-
Housing association	12	-	-	1	1	1	-
Local authority	2	-	-	1	-	-	-
Local businesses	1	-	2	2	-	-	-
Other public sector and charity	-	-	-	-	-	-	-
TOTAL	**47**	**1**	**13**	**4**	**1**	**1**	**31**

Table 9. Number of projects that are recorded as having shared ownership, where at least one owner is a community group or local organisation by status

Operational status	Number of projects
Operating	37
Under construction	1
Consented, not built	11
In planning	4
In Scoping	1
Completed, not operating	1
Shared ownership under discussion	31
TOTAL	**86**

Table 10. Capacity of community or locally owned renewables projects in shared ownership, by category and status[38]

Ownership category	Operational (MW)	Under construction (MW)	Consented, not built (MW)	In planning (MW)	In scoping (MW)	Shared ownership under discussion (MW)
Community	14	<1	217	-	-	254
Farms and estates	31	-	-	-	-	-
Housing association	6	-	-	<1	<1	-
Local authority	3	-	-	<1	-	-
Local businesses	4	-	<1	3	-	-
Other public sector and charity	-	-	-	-	-	-
Total	**58**	**<1**	**217**	**3**	**<1**	**254**

Figures are rounded to the nearest 1 MW, therefore totals may not add up

Table 11. Capacity of community or locally owned renewables projects in shared ownership, by technology and status

Technology	Operational (MW)	Under construction (MW)	Consented, not built (MW)	In planning (MW)	In scoping (MW)	Shared ownership under discussion (MW)
Wind	54	-	217	3	-	252
Biomass	<1	-	-	<1	<1	-
Energy from waste	1	-	-	-	-	-
Heat pump	<1	-	-	<1	-	-
Hydro	1	<1	<1	-	-	1
Solar PV	1	-	-	-	-	-
Solar thermal	<1	-	-	-	-	-
Total	**58**	**<1**	**217**	**3**	**<1**	**254**

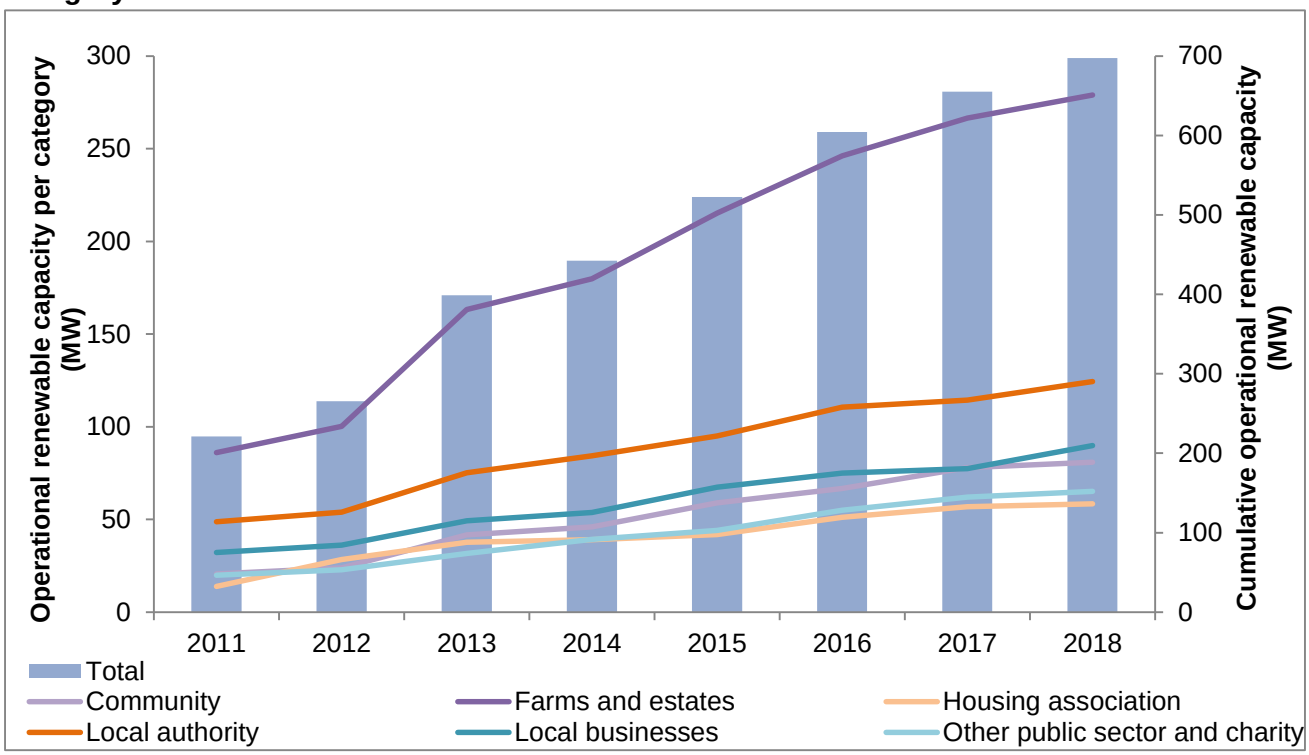
Figures are rounded to the nearest 1 MW, therefore totals may not add up

[38] Capacity in this table has not been double counted as only the capacity attributable to the respective project partner is reported. Data has been rounded for ease of reading, hence some sub -totals may not precisely equal summed figures.

5.3 Assessing future progress towards 1GW

Since 2011 the Energy Saving Trust has been compiling the community and locally owned renewables in Scotland database and producing the accompanying report. In this time valuable information has been gathered that provides a strong indication of the growth in community and locally owned renewable energy generation; this is shown in figures 14,15 and 16.

Figure 14. Operational capacity increase from June 2011 to June 2018, by ownership category[39]



[39] Operational capacity recorded in the June 2017 version of database. Figures differ from figures in previous iterations of this report.

Figure 15. Increase in the number of installations from June 2011 to June 2018 by ownership category (housing associations and local authorities)[40]

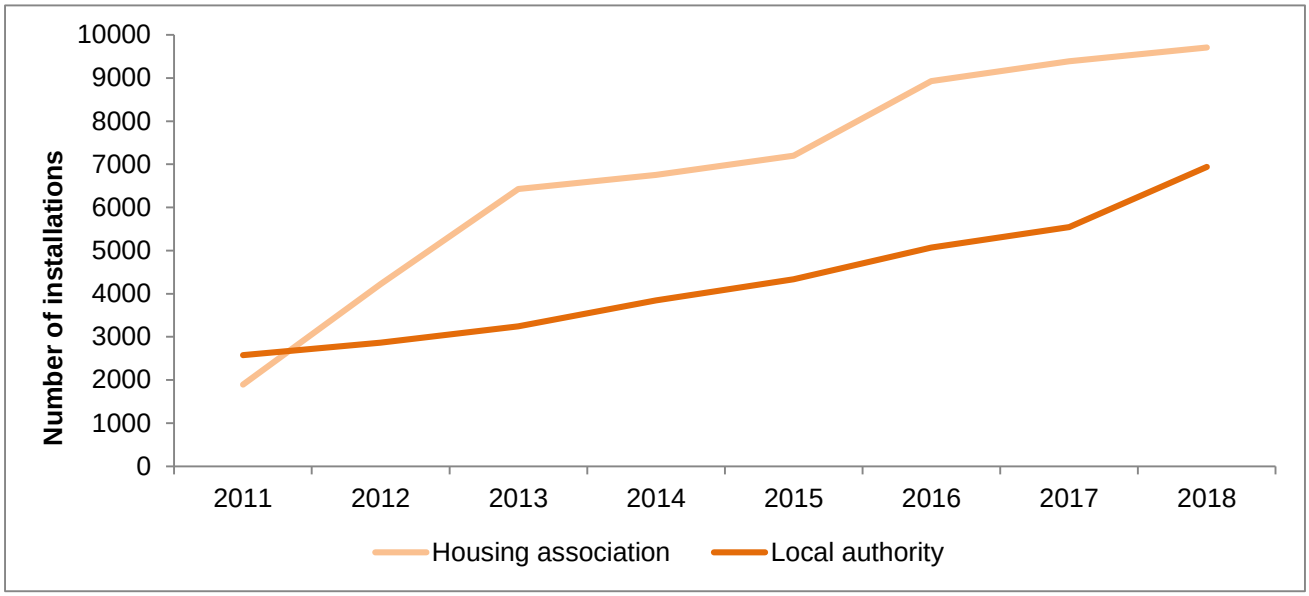
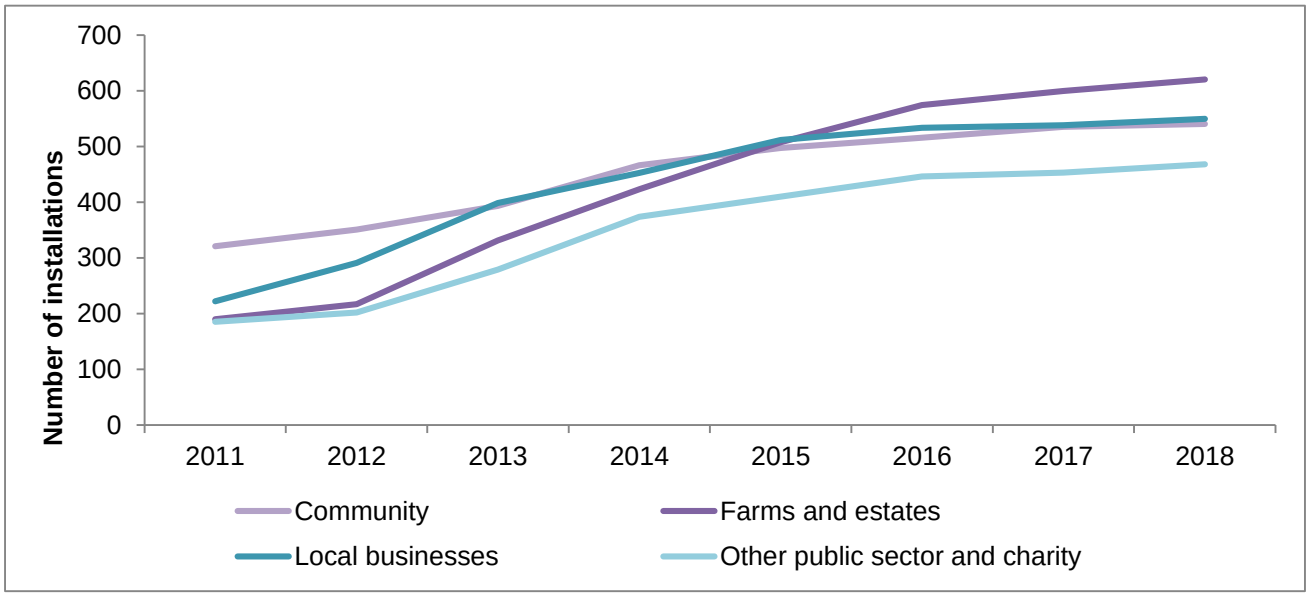


Figure 16. Increase in the number of installations from June 2011 to June 2018, by ownership category (communities, local businesses, farms and estates, other)[41]



[40] Number of installations recorded in the June 2017 version of database. Figures differ from figures in previous iterations of this report.
[41] Number of installations recorded in the June 2017 version of database. Figures differ from figures in previous iterations of this report.

Whilst the latest data shows continued growth for community and locally owned renewable energy in Scotland year on year with significant pipeline capacity identified, it is an uncertain time for the sector with the likely removal of subsidies at a UK Government level. The Scottish Government remains committed to supporting progress with new targets of; 1 GW (1,000 MW) of community and locally owned renewable energy to be operational by 2020 and 2 GW (2,000 MW) to be operational by 2030. There is also an intention to ensure that by 2020 at least half of newly consented renewable energy projects have an element of shared ownership.

The database will continue to monitor progress and updates will be provided in annual reports and on the Local Energy Scotland community and locally owned renewable project map[42] which was launched in November 2015 and is updated regularly throughout the year as updates are made to the database[43]. The map provides details of community and locally owned renewable energy projects in Scotland and tracks the total renewable operational capacity in community and local ownership in Scotland[44].

The regular updates to the map allow progress to be monitored more closely than in previous years. It is important to note that these map updates do not represent complete database updates because some aspects of the database update can only be carried out on an annual basis due to the data collection process. As such, whilst some sources can be updated regularly throughout the year, others can only be updated annually and this means any mid-year map updates will not contain additional installations from these sources.

[42] www.localenergyscotland.org/projects
[43] The community and locally owned renewable energy map is updated at least once every three months however can be updated more regularly as projects are added to the database or updated.
[44] Only projects with capacities of over 50 kW that can be shared publically will be published on the map. Projects not published on the map are still counted towards the overall total renewable energy operational capacity in Scotland.

6 Community and locally owned energy storage in 2018

6.1 Results for June 2018: installed capacity

At the end of June 2018, there was an estimated **7.26 MWh** of installed energy storage capacity in community or locally owned ownership in Scotland. This was spread over approximately 860 installations.

Of the 7.26 MWh of energy storage capacity known to be installed there was an estimated:

- **1.43 MWh** of electrical storage capacity
- **4.4 MWh** of heat storage capacity
- **1.43 MWh** of hydrogen storage capacity

All of the 0.49 MWh growth in locally owned storage capacity since June 2017 can be attributed to electrical storage systems installed by local authorities. The breakdown of electrical storage capacity as of June 2018 was 0.79 MWh in community ownership and the remaining 0.64 MWh in local authority ownership. The community owned electrical storage was made up of six individual storage installations across five Scottish islands not connected to the mainland UK electricity grid. The islands rely on generators and renewable energy systems for their electricity and the installed battery storage systems allow communities to better manage discrepancies between periods of electricity supply and demand. The local authority owned electrical storage capacity consists of 84 small-scale installations in domestic buildings installed by Stirling Council.

The 4.4 MWh of installed heat storage capacity is all in housing association ownership. Over 765 heat batteries are installed across two housing associations (East Lothian Housing Association and Castle Rock Edinvar) and these are part of the EASTHEAT project run by Sunamp Ltd and funded through the Local Energy Challenge Fund (LECF). The aim of the project is to reduce fuel bills by combining the use of heat batteries and renewable technologies[45].

6.2 Further energy storage capacity in development

In addition to the 7.26 MWh of community and locally owned energy storage capacity estimated to be installed in Scotland as of the end of June 2018, a further 2.95 MWh was estimated to be in development. Of this 2.95 MWh of energy storage capacity in development:

- **2.54 MWh** was **under construction.** This is all electricity storage capacity
- **0.4 MWh** was **in scoping.** This is all thermal storage capacity

Of the 2.54 MWh of electrical storage capacity under construction, 1.68 MWh is from the Gigha Battery Project; this is a community owned large scale battery storage system that will be connected to the Gigha wind farm. The remaining 0.86 MWh was split between the island of Canna and Fair

[45] http://www.localenergyscotland.org/funding-resources/funding/local-energy-challenge-fund/capital-demonstration-projects/eastheat/

Isle. Together these projects continue the trend of electrical storage development for off-grid island communities.

6.3 Uncertainty levels associated with energy storage capacity estimates

There are currently very few data sources that include information on energy storage in Scotland. It is therefore possible that the total installed storage capacities presented in this report are an underestimate. The majority of the energy storage data has been sourced from the surveys completed by local authorities and housing associations and from the Global Energy Storage Database[46] which tends to hold information on larger scale energy storage systems. Small scale energy storage projects not in local authority or housing association ownership are much less likely to have been captured in the data collection process.

[46] http://www.energystorageexchange.org/

Appendix 1: Full revised figures for June 2017 report

Due to improvements in the quality of the data captured and as part of the annual data cleansing process, the following figures for June 2017 have been revised:

Table 12. Previously reported and revised category figures for June 2017

Ownership category	Previously reported figures for June 2017			Revised figures for June 2017		
	Operational Capacity (MW)	Number of operational installations	Estimated yearly energy output (GWh)	Operational Capacity (MW)	Number of operational installations	Estimated yearly energy output (GWh)
Community	81	530	203	78	530	197
Housing association	59	9,390	117	57	9,390	112
Local authority	120	6,440	272	114	5,550	257
Total[47]	**666**	**17,950**	**1,664**	**655**	**17,060**	**1,638**

Table 13. Previously reported and revised technology figures for June 2017

Technology	Previously reported figures for June 2017		Revised figures for June 2017	
	Operational Capacity (MW)	Number of operational installations	Operational Capacity (MW)	Number of operational installations
Wind	313	720	310	720
Biomass	178	30	176	30
Heat pump	58	7,060	52	6,230

Table 14. Previously reported and revised local authority figures for June 2017

Local Authority	Previously reported figures for June 2017		Revised figures for June 2017	
	Operational Capacity (MW)	Number of operational installations	Operational Capacity (MW)	Number of operational installations
South Lanarkshire[48]	24	2,505	18	1,610

[47] Only those categories whose figures were revised are included. Therefore, the table 'total' row does not equal the sum of the category rows above.
[48] All South Lanarkshire revisions were for heat pump technology.

Appendix 2: Full methodology

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 below.

Definition of 'community and locally owned'

As with previous versions of the database, the Scottish Government has requested that 'community and locally owned renewable energy' be defined as technologies producing heat and/or electricity from a renewable source[49], where the owner of the installation is in one of the following categories:

- A community group
- A local Scottish business[50]
- A farm or estate
- A local authority
- A housing association
- '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 (but not recipients of grants under the householder stream)
    - Recipients of Community and Renewable Energy Scheme (CARES) grants and loans

'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 renewable system in return for some benefit, such as a share in the income generated. In such cases, a percentage of the installation's capacity equal to the share owned by the community or local owner is counted towards the target.

'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, or installations that generate community benefit payments but are owned by another organisation (for example a wind farm owner). The Scottish Government has established a register of community benefits from renewable energy projects[51] in order to help communities and renewable energy developers negotiate appropriate levels of community benefit payment.

[49] A full description of each eligible technology is given in Appendix 2.
[50] Note this excludes Scottish businesses whose purpose is to develop renewable energy projects.
[51] http://www.localenergyscotland.org/view-the-register/

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 farms and estates could also be considered Scottish businesses. For the purposes of this report, the following definitions have been used to determine which category each 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.

- **Charities** have been defined as charitable organisations which are not also a community group, e.g. the Royal Society for the Protection of Birds (RSPB). 'Charity' has also been taken to include leisure trusts[52], and churches and other religious organisations.

- **Public bodies** are those listed in the National Public Bodies Directory[53], including NHS health boards. Other publicly-owned organisations such as the fire and rescue services and the police forces are also included in this category, although they are not strictly public bodies.

- **Further or higher education establishments** are the colleges and universities who are members of the Association of Scotland's Colleges (ASC)[54] or Universities Scotland.[55]

- **Local Scottish businesses** are small or medium-sized enterprises (SMEs) registered with Companies House[56] at an address in Scotland. Businesses receiving funding through the Community and Renewables Energy Scheme (CARES) or through Resource Efficient Scotland (RES) SME loans have been included. Note this definition excludes Scottish SMEs whose purpose is to develop renewable energy projects at a location significantly removed from their registered office, and where the business does not own the land where the installation will be built[57].

- **Farms or estates** are those organisations where the renewable technology is installed on land currently used for agricultural or other farming purposes, or on buildings that are part of a farm or estate layout; and (where the installation needs planning permission) where the person or organisation listed as the applicant in the planning application gives their address as being in Scotland. Estate ownership is often difficult to establish, but where possible publicly available information has been used to establish whether estate owners are

[52] Leisure trusts supply sports facilities to local communities, often on behalf of unitary authorities.
[53] http://www.scotland.gov.uk/Topics/Government/public-bodies/about/Bodies
[54] http://www.scotlandscolleges.ac.uk/about-us/
[55] http://www.universities-scotland.ac.uk/
[56] http://www.companieshouse.gov.uk/
[57] For example, an SME established to build and operate a renewable energy project could count as a 'local Scottish business' for the purposes of the target if it was registered with Companies House at an address in Scotland, and either a) owned all the land where the installation was to be built, or b) if it did not own all the land, if its registered address indicated that it was physically located close to the address of the proposed installation.

normally resident on the estate where the installation is to be built. Farms and estates receiving funding through Local Energy Scotland have been included.

- **Local authorities** are the 32 unitary local authorities.
- **Housing associations** are providers of social housing within Scotland, other than local authorities.

Any source of renewable energy generation, such as electricity, heat, combined heat and power or other unspecified energy categories, i.e. energy from waste projects, or types of energy storage, such as electricity, heat and hydrogen, which fell into the ownership categories listed above were included in the database.

Note on the units used in the report

When referring to renewable energy installations *"capacity"* refers to the maximum instantaneous power output of the 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 attempts to provide both figures (electrical capacity and heat capacity).

Solar PV capacity can be referred to in kilowatt-peak, or kWp, which is interchangeable with kWe.

"Energy output" is total energy of any type (electricity, heat etc.) produced during a particular time period. In the database, energy output is estimated for each technology on an annual basis. Energy is reported in megawatt-hours (MWh) or gigawatt-hours (GWh). One gigawatt-hour is equal to one thousand megawatt-hours.

When referring to energy storage systems *"capacity"* refers to the maximum amount of energy that the system can store at one time and is measured in kilowatt hours (kWh) or megawatt hours (MWh).

Approach taken and data sets used

The approach taken to collect data from each source is broadly in line with that taken to produce the previous versions of the database and report and is outlined below.

During the previous year's database update the data collection period was from June 2016 to June 2017. For this year's report a full database update was also carried out for data correct as of June 2018, to be in line with most previous reports, which have reported figures correct as of June of each year.

A significant amount of time has been spent reviewing records for which detailed information has been previously hard to find and checks have been undertaken to assure quality and accuracy of data. To further improve quality, the final dataset used to compile the figures detailed in this report have been through an internal quality check. Despite the measures taken to ensure the accuracy of the data there are still uncertainties associated with the methodology used to compile the data. These are discussed later in this section.

Due to the large number of different organisations and different technologies covered by the Scottish Government's definition of 'community and locally owned renewable energy', information is sought from a variety of sources. This includes organisations administering Scottish Government or other public funding streams, local authorities and planning authorities, public bodies (e.g. NHS and Highlands and Islands Enterprise) and other groups of organisations which we believe are likely to be renewables owners themselves. In some 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 used:

- **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 farms. 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 and administration organisations (e.g. Local Energy Scotland, Energy Saving Trust and Ofgem).

- **Data from local authorities**

A survey was sent by email from Home Energy Scotland, on behalf of the Energy Saving Trust, to all 32 Scottish local authorities enquiring about renewable energy and energy storage technologies fully or partly owned by local authorities. Completed surveys were received from 11 local authorities, representing a 34% response rate. As this survey has now been undertaken seven times for annual updates of the community and locally-owned database, we now have some information on all 32 local authorities. Following the introduction of a new survey layout two years ago, the quality of the data received from local authorities has continued to improve.

- **Data from housing associations**

An online survey was sent by email from the Energy Saving Trust and the SFHA on behalf of the Scottish Government to all SFHA members. This survey asked about renewable technologies fully or partly owned by housing associations. Surveys were returned from 21 of the 134 housing associations contacted, representing a 16% response rate. The majority of the housing associations that responded had not participated in the previous year's survey. As data about the renewable energy generation and energy storage technologies fully or partly owned by housing associations

has now been collected seven times for annual updates of this report, we now have information for 86 different housing associations in our database.

- **Data from the UK Renewable Energy Planning Database**

The UK Department of Business, Energy and Industrial Strategy (BEIS) shared information from the Renewable Energy Planning Database (REPD)[58], which is maintained on their behalf by Eunomia. The REPD tracks the progress through the UK planning system of all renewable electricity-generating technologies with an electrical generation capacity of 0.01 MWe (10 kWe) and greater, and of some heat-generating installations. However, it does not record details of ownership. From October 2014 the REPD ceased tracking installations that are smaller than 1 MWe. This has made the tracking of smaller installations more challenging and means the number of smaller installations in operation and in various stages of development may now be underestimated.

- **Data from planning authorities**

Information from BEIS's REPD was used in conjunction with publicly available information from Scotland's planning authorities to determine ownership of installations.

- **Data from Scottish Enterprise**

Scottish Enterprise provided information on renewable projects that had received support from the Renewable Energy Investment Fund (REIF). While the majority of the projects listed were already recorded in the database from other sources, the data from Scottish Enterprise provided updates on key details such as operating status and installation size.

- **Low Carbon Infrastructure Transition Programme (LCITP)**

The Scottish Government provided data on projects that had received funding through the Low Carbon Infrastructure Transition Programme (LCITP), which was launched in 2015.

Further information sources 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[59] and in its newsletters.
- Individual community group, charity or housing association websites.

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 and/or grid reference.

[58] https://restats.decc.gov.uk/cms/
[59] http://www.communityenergyscotland.org.uk/

- Technology type.
- Number and installed capacity of the technologies installed.
- Operational status as at June 2018 (operating/under construction/consented not built/in planning/in scoping/ non-operational/ decommissioned), including where possible the date on which generation commenced for operational projects.
- Percentage ownership by the community group etc., in cases where the organisation did not have full ownership of the installation.
- Where appropriate, the building type associated with the renewable energy or storage installation, to aid cross-checking with other sources, help to clarify organisation type, and to estimate yearly energy output.
- Whether public grant or loan funding was received, to aid cross-checking with information received from bodies administering those funds.

Other data sources not used in this update of the database

The information sources listed below were investigated for the first version of the database and report, but the publically available information on these was found to contain either information captured elsewhere or insufficient detail for this project.

- Carbon Reduction Commitment (CRC) Energy Efficiency Scheme (administered in Scotland by SEPA on behalf of DECC).
- The Feed-in Tariff (FIT) scheme (administered by Ofgem on behalf of BEIS).
- The Renewable Heat Incentive (RHI) (administered by Ofgem on behalf of BEIS).
- Installations registered for the Climate Change Levy, and Renewable Energy Guarantees of Origin (administered by Ofgem on behalf of BEIS).
- Scotland's Climate Change Declaration.

Data quality

Not all the required information was available from all sources. Given the large number of 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 to: technology type; operational status; installed capacity; and % community or local ownership share.

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 2018 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 where there is no further information have been assigned the status 'consented but not built'. The status of projects that were 'under construction' as of June 2017 has remained the same if no evidence has been found that the project is operational.

The quality of data provided varied considerably. In particular, installed capacity was often not provided, and operational status was sometimes unclear[60]. Technology type was sometimes also unclear (for example 'solar', which does not indicate whether the installation is a solar PV panel generating electricity, or a solar thermal panel generating hot water). In these cases, we have recorded as much information as has been provided by the data source but have not made assumptions on the technology or size of system. In some cases, a known capacity has been recorded, but the technology type is unknown. As the annual output assumptions used are dependent on technology type, the annual output for these systems cannot be estimated.

Data received from BEIS'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 (mostly the planning authorities).

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. Local authority area has been identified for each project.

Uncertainty levels associated with the methodology

In any analysis of this kind where data is gathered from a variety of different sources, total data coverage may be incomplete. This is for a number of reasons for example:

- Incomplete information may be received on some installations.
- The number of sectors and technologies that 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). Issues with data collection are therefore more likely for smaller capacity installations such as heat pumps and solar thermal and solar PV panels.

The double-counting of installations is also a potential issue, although efforts have been made to avoid this. 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, double-counting is most likely for smaller capacity installations such as heat pumps and solar thermal panels, and so less likely to significantly affect the overall figures.

Some points for particular consideration in relation to data coverage and data quality are:

[60] For example, grant and loan schemes frequently record the stage of the application for funding (loan offered or paid), but not the stage of the renewable technology itself e.g. under construction or operational.

- **Information received from local authorities**

In the course of compiling the database, Home Energy Scotland sent an email survey to all 32 local authorities in Scotland on behalf of the Energy Saving Trust and Scottish Government, asking them to provide information on all renewable technologies fully or partly council-owned. As this is the seventh time the survey has been conducted for the community and locally-owned database, we now have some information from all of the 32 local authorities. 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 that the response received provided a full picture of all council-owned stock. For this report, a survey response was received from 11 of the 32 local authorities. As renewable capacity reported for local authority stock varied greatly no attempt was made to scale up known capacity to account for non-respondents, meaning that the local authority capacity totals presented in this report are likely to be underestimates.

- **Information received from housing associations**

The Scottish Federation of Housing Associations (SFHA) and the Energy Saving Trust sent an email survey on behalf of the Scottish Government to all members of the SFHA. 21 housing associations responded to this year's survey. Again, given the range of reported installed capacity per housing association, no attempt was made to scale up known capacity to account for non-respondents. The housing association capacity totals presented in this report are therefore likely to be underestimates.

- **Projects in the scoping phase of development**

It is difficult to gain information on projects which are still in the early development stages, particularly if the 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 farms and estates intending to install wind turbines, which typically have large capacities as we would not be aware of these projects until they enter the planning process. Therefore, the figures presented here for installations in scoping are highly likely to be an underestimate.

- **Projects in the planning phase of development**

In compiling the database, information received from BEIS's REPD was a source of good quality information on renewable energy installations of >1 MWe where the owner had applied for planning permission. As previously mentioned, smaller (<1 MWe) renewable energy installations are no longer included in the REPD so will no longer be captured by this information source. For this reason, the figures presented here for installations in planning are likely to be an underestimate.

- **Energy storage projects**

When compiling the database, it was difficult to collect data on energy storage systems because very few data sources that hold this information were found. The majority of the energy storage data has been sourced from surveys completed by local authorities and housing associations and from the Global Energy Storage Database[61] which tends to hold information on larger scale energy

[61] http://www.energystorageexchange.org/

storage systems. It is therefore highly likely that the figures presented in this report are underestimates. In particular, small scale energy storage projects not in local authority or housing association ownership are much less likely to have been captured in the data collection process.

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 system in return for some benefit, such as a share in the income generated. In such cases, a percentage of the installation's capacity equal to the share owned by the community or local owner is counted towards the target.

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[62], which is part of the larger Earlsburn Wind Farm. In this case, the turbine owned by Fintry has a capacity of 2.5 MWe, so Fintry Development Trust's entry in the community and locally owned database lists one turbine of 2.5 MW, although the full capacity of Earlsburn wind farm is much larger (around 35 MW).

Energy4All wind farms were a special case for consideration. Energy4All works to help establish wind energy co-operatives in the UK, and this work has included the establishment of four operational wind farm co-operatives in Scotland[63]. 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. No new Energy4All projects have been added to the database since the June 2016 updates.

Capacity estimates where values were not available

As previously noted, not all required information was available for all renewable energy installations. In some cases, the installed capacity was one of the figures that were unavailable.

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 always 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 is given in Appendix 5.

[62] http://fintrydt.org.uk/about/
[63] http://energy4all.co.uk/

For some installations, an estimate of annual energy output was supplied instead of a value for capacity. In those cases, installed capacity was estimated using the assumptions detailed in table 16.

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 15.

Table 15: Assumptions used to estimate capacity of solar thermal and solar PV 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.[64]

Annual 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 16.

For solar thermal panels and solar PV panels, annual 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 annual output per m2 (kWh/m^2/yr) = annual energy output (kWh).

For all other renewable technologies, the following formula used was:

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

[64] Scottish average calculated using data from: http://www.energysavingtrust.org.uk/scotland/tools-calculators/solar-energy-calculator

Table 16. Assumptions used to estimate annual energy output.

Technology	Value used	Units	Information source
Solar thermal panel, annual energy output per m^2.	441	kWh/m^2/year	Derived from MCS calculations recreated using EST standard assumptions for occupancy and panel size.
Solar PV panel, annual electricity output per m^2.	111	kWh/m^2/year	Energy Saving Trust Solar Energy Calculator tool assumptions.[65]
Annual peak load hours for small (≥10 kWe) wind turbines.	1,664	hours/year	Energy Saving Trust field trial of domestic small-scale wind turbines.[66]
Annual peak load hours for larger (>10 kWe) wind turbines.	2,365	hours/year	Scottish Renewables
Annual peak load hours for hydroelectric installations.	3,500	hours/year	Various[67]
Annual peak load hours for anaerobic digestion (electricity production).	5,203	hours/year	RESTATS[68]
Annual peak load hours for biomass combined heat and power (electricity production).	8,000	hours/year	Energy Saving Trust expert assumption
Yearly peak load hours for tidal electricity generation.	3,066	hours/year	Scottish Renewables
Yearly peak load hours for heat pumps or biomass providing space heating for one type of building (excluding low usage buildings e.g. community halls). Includes district heating that provides space heating to only one category of building e.g. only domestic properties.	2,500	hours/year	As used for estimating output in Renewable Heat in Scotland.[69]

[65] Scottish average. http://www.energysavingtrust.org.uk/scotland/tools-calculators/solar-energy-calculator

[66] http://www.energysavingtrust.org.uk/sites/default/files/reports/Location_Location_Location_field_trial_small-scale_wind_report%20%282%29.pdf

[67] The following sources were used, which indicated that a reasonable assumption to use would be 3,500 peak hours per year, equivalent to a 40% load factor.

- Garrad Hassan report on renewable energy potential for Scottish Renewables
- The British Hydropower Association's mini hydro guide (V3), http://www.british-hydro.org/wp-content/uploads/2018/03/A-Guide-to-UK-mini-hydro-development-v3.pdf
- Scottish Hydropower Resource Study for FREDS, Aug 2008, https://www2.gov.scot/Resource/Doc/917/0064958.pdf

However, estimates of output from hydroelectric installations should be treated with caution because it is highly site specific.

[68] https://www.gov.uk/government/collections/renewables-statistics#Data

[69] Energy Saving Trust for the Scottish Government: http://www.energysavingtrust.org.uk/sites/default/files/Renewable%20Heat%20Report%20%202018.pdf

Yearly peak load hours for heat pumps or biomass providing space heating for low usage buildings e.g. community halls and churches.	250	hours/year	As used for estimating output in Renewable Heat in Scotland.[70]
Yearly peak load hours for biomass providing heat for a commercial process (where the installation is sized between 45kW and 1MW), or providing space heating via district heating for more than one type of building.	5,000	hours/year	As used for estimating output in Renewable Heat in Scotland.[71]
Yearly peak load hours for biomass providing heat for a commercial process (where the installation is sized 1MW or over).	8,000	hours/year	As used for estimating output in Renewable Heat in Scotland.[72]

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

[70] Energy Saving Trust for the Scottish Government. http://www.energysavingtrust.org.uk/sites/default/files/Renewable%20Heat%20Report%20%202018.pdf
[71] Energy Saving Trust for the Scottish Government. http://www.energysavingtrust.org.uk/sites/default/files/Renewable%20Heat%20Report%20%202018.pdf
[72] Energy Saving Trust for the Scottish Government. http://www.energysavingtrust.org.uk/sites/default/files/Renewable%20Heat%20Report%20%202018.pdf

Appendix 3: Individual technology descriptions

The following renewable technologies have been included in the database:

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

Wind turbines have blades which are turned by 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.

- **Hydroelectric**

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)**

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 light (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 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 these cases the installation has been classified as 'energy from waste' (EfW).

- **Biomass combined heat and power (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 and/or water heating. Again, this biomass could either be wood products; or it could waste material with an organic component, such as municipal waste, but in such cases the installation would be classed as 'energy from waste'.

- **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 body of water) and produce heat for space and/or water heating, using a compression system. 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 air source heat pumps category. Units which are purely exhaust air heat recovery (EAHR) and that do not also extract heat from the air outside have not been included.

- **Geothermal**

Heat from deep underground is extracted by pumping water into a deep well, allowing it to heat up using the heat of the rocks, then abstracting the water via another well.

- **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 help maintain 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 to generate electricity and heat.

  - **Waste incineration**

Municipal or industrial waste can be burnt to provide heat. A proportion of the total capacity that is equal to the percentage of biodegradable matter in the waste is taken to be renewable energy capacity.

Another technology which could have been included in the database if examples had been found was:

- **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 version of the database.

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

- **Non-biomass CHP**

Combined heat and power units fuelled by fossil fuel 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) only**

Systems which recover the heat from warm stale air leaving a building and use it 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, 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) via a heat pump component.

- **Passive renewable heating or cooling**

The building design is used to ensure 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 very difficult to estimate.

The following energy storage solutions have been included in the database:

- **Electricity battery storage**

Deep-cycle batteries that store electricity when it is generated and provide power when it is needed. The most common types of battery storage are lead acid batteries and lithium ion batteries. Batteries can be charged from a range of technologies including wind turbines, solar PV panels, hydroelectric systems and diesel generators.

- **Thermal stores**

A well-insulated buffer or accumulator tank (holding water) and designed to store and manage renewable heat until it is needed. A thermal store can store water for space and or water heating.

- **Heat batteries**

Heat batteries take generated electricity or heat and use phase change materials (PCMs) to store this energy. This energy can later be used to heat water on demand.

- **Hydrogen storage**

Hydrogen can be stored as either a gas (at a high pressure) or a liquid (at a low temperature) before being used as a fuel.

Appendix 4: List of main data sets used

Table 17 lists the main data sources used in this update of the community and locally-owned renewable energy database, by ownership category and data provider. Details of the data sources used for previous versions of the database can be found in the relevant reports.

Table 17. Main data sets used

Organisation(s) contacted/providing data	Dataset(s)	Ownership categories
Local Energy Scotland, on behalf of the Scottish Government	The Community and Renewable Energy Scheme (CARES); Local Energy Challenge Fund (LECF)	Communities; Farms and estates; Local businesses[73]
Energy Saving Trust, on behalf of the Scottish Government	The district heating loans fund	Local authorities; Housing associations;[74] Communities;[75] Farms and estates; Local businesses
Energy Saving Trust, on behalf of the Scottish Government	The Warm Homes Fund	Local authorities; Housing associations[76]
Energy Saving Trust	CESP- and ECO-funded renewable energy projects in Scotland	Local authorities; Housing associations
Resource Efficient Scotland, on behalf of the Scottish Government	Resource Efficient Scotland small and medium-sized enterprises loans scheme	Local businesses
Community Energy Scotland	Operational revenue generating community energy projects database	Communities
Forestry Commission Scotland	Wind and hydroelectric schemes on the National Forest Estate (publicly available information)	Communities; Other public sector and charity organisations; Farms and estates; Local businesses
NHS National Services Scotland	Operational renewable energy installations on the NHS Scotland estate	Other public sector and charity organisations

[73] Local businesses must also be rural businesses to be eligible for CARES funding.
[74] The district heating loans fund is also open to other registered social landlords.
[75] Communities must be legally constituted community groups to apply for the district heating loans fund.
[76] The Warm Homes Fund is also open to other registered social landlords, and to energy services companies (ESCOs) set up by housing associations, local authorities or registered social landlords.

Individual local authorities, via Home Energy Scotland	Responses to an Energy Saving Trust e-mail survey of all local authorities, using contacts from the Home Energy Scotland advice network.	Local authorities.
Individual housing associations, via the Scottish Federation of Housing Associations (SFHA)	Responses to an SFHA and Energy Saving Trust e mail survey to all SFHA housing association members in Scotland.	Housing associations.
Eunomia, on behalf of the Department for Business, Energy and Industrial Strategy (BEIS)	Extract from the Renewable Energy Planning Database.	Local authorities; Housing associations; Communities; Other public sector and charity organisations; Local businesses; Farms and estates.
The UK Government's Department for Energy and Climate Change	Renewable Heat Premium Payment (publicly available information).	Local authorities; Housing associations.
Renewable UK	UK Wind Energy Database.	Farms and estates; Communities; Other public sector and charity organisations.
Ofgem	Renewables and CHP Register.	Public sector and charity organisations; Communities; Local businesses; Farms and estates
Scottish Enterprise, on behalf of the Scottish Government	Renewable Energy Investment Fund (REIF).	Communities.
The Scottish Government	Low Carbon Infrastructure Transition Programme (LCITP).	Communities: Local Authorities; Public Sector and charity organisations
Scottish Water	Renewable installations owned by Scottish Water	Public Sector.
Sandia National Laboratories, on behalf of the United States Department of Energy	Global Energy Storage Database	Communities.

Appendix 5: Capacities assumed for individual installations where information was not available

Table 18 shows the assumed capacities that were used in the community and locally owned renewable energy database where information on capacity was not available.

Table 18. Assumptions for capacity by technology and building type (where other information was not available)

Ownership category	Building type	Technology	Estimate of likely installed capacity	Derived from
Community	Community buildings	Solar PV	8 kWe	Average of other community PV installations recorded in the database.
	Community buildings	Solar thermal	6 kWth	Average of other community solar thermal installations recorded in the database.
	Community buildings	Wind (including wind to heat) – grant funded	6 kWe	Average of other community wind installations recorded in the database.[77]
	Community buildings	Heat pumps (ASHP and GSHP)	7 kWth	Average of other heat pumps in public sector, LA non-domestic and community buildings, recorded in the database.
	All	Biomass	60 kWth	Average of other community biomass installations recorded in the database.
	All	Biomass district heating	175 kWth	Average of other community biomass district heating installations recorded in the database.
Other public sector and charity	All	Solar thermal	13 kWth	Average of other public sector and charity solar thermal installations recorded in the database.

[77] 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. Revenue-generating wind projects (which are typically not grant funded) are more variable in size. However as these tend to be large in size (typically 800 kW and over), effort has been made to determine the exact size of each installation for non-grant funded community wind projects.

	All	Wind – grant funded	6 kWe	Average of other public sector and charity wind installations recorded in the database[77]
	All	Heat pumps (ASHP and GSHP)	7 kWth	Average of other heat pumps in public sector, LA non-domestic and community buildings recorded in the database.
	All except hospitals	Biomass	110 kWth	Average of other public sector and charity biomass installations, excluding hospital installations, recorded in the database.
	Hospitals (large)	Biomass	1.4 MWth (1,400 kWth)	Average of large hospital biomass installations recorded in the database.
	Hospitals (small)	Biomass	200 kWth	Average of small hospital biomass installations recorded in the database
Farms and estates	All	Biomass	150 kWth	Average of other farm and estate biomass installations recorded in the database.
	All	Biomass district heating	150 kWth	Average of other farm and estate biomass district heating installations recorded in the database.
	All – Scotland Rural Development Programme (SRDP) grant Recipients only	Hydro-electric	9 kWe	Average of other farm and estate hydroelectric installations recorded in the database[78]
Local businesses	All	ASHP	12 kWth	Average of other local business ASHP's recorded in the database.
	All	GSHP	30 kWth	Average of other local business GSHP's recorded in the database.
	All	Biomass	140 kWth	Average of other local business biomass recorded in the database.

[78] Based on information received on size of hydroelectric capacity installed under SRDP, therefore only used for other SRDP hydroelectric installations where capacity was not known. Revenue-generating hydroelectric projects (which are typically not grant funded) are more variable in size. However as these tend to be large in size (typically 100kW and over), effort has been made to determine the exact size of each installation for non-grant funded hydroelectric projects.

	All	Biomass district heating	140 kWth	Average of other local business biomass district heating recorded in the database.
Local authority	Domestic properties	Solar thermal – installed in 2011, 2012 or 2013	3.4 m^2	Analysis of Energy Saving Scotland home renewables grants.[79]
	Domestic properties	Solar thermal – installed in 2014, 2015, 2016, 2017 or 2018	4 m^2	Analysis of Energy Saving Scotland home renewables loans paid in 2014.[80]
	Domestic properties	Solar PV – installed in 2011 or 2012	2.8 kWe	Analysis of installations registered for FITs in Scotland.[81]
	Domestic properties	Solar PV – installed in 2013	3.6 kWe	Analysis of installations registered for FITs in Scotland.[82]
	Domestic properties	Solar PV – installed in 2014, 2015, 2016 or 2017	4.0 kWe	Analysis of installations registered for FITs in Scotland.[83]
	Domestic properties	Solar PV – installed in 2018	**4.5** kWe	Analysis of installations registered for FITs in Scotland[84]
	Domestic properties	Heat pumps (ASHP and GSHP)	7 kWth	Average of other LA- and HA-owned heat pumps in domestic properties recorded in the database.
	Schools	Solar thermal	7 kWth	Average of other school solar thermal installations recorded in the database.
	Schools	Solar PV	11 kWe	Average of other school solar PV installations recorded in the database.
	Schools	Wind – grant funded	6 kWe	Average of other school wind installations recorded in the database.
	Schools	ASHP	6 kWth	Average of school ASHP installations recorded in the database.

[79] 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.
[80] Energy Saving Scotland home renewables loans are loans for domestic renewables, administered by the Energy Saving Trust on behalf of the Scottish Government.
[81] Central FITs register, Ofgem. https://www.renewablesandchp.ofgem.gov.uk/
[82] Central FITs register, Ofgem. https://www.renewablesandchp.ofgem.gov.uk/
[83] Central FITs register, Ofgem. https://www.renewablesandchp.ofgem.gov.uk/
[84] Central FITs register, Ofgem. https://www.renewablesandchp.ofgem.gov.uk/

	Schools	Biomass	200 kWth	Average of other school biomass boiler installations recorded in the database.
	Other buildings	Heat pumps (ASHP and GSHP)	7 kWth	Average of other heat pumps in public sector, LA and community buildings, recorded in the database.
Housing association	Domestic properties	Solar thermal – installed in 2011, 2012 or 2013	3.4 m^2	Analysis of Energy Saving Scotland home renewables grants.[85]
	Domestic properties	Solar thermal – installed in 2014, 2015, 2016, 2017 or 2018	4 m^2	Analysis of Energy Saving Scotland home renewables loans paid in 2014.[86]
	Domestic properties	Solar PV – installed in 2011 or 2012	2.8 kWe	Analysis of installations registered for FITs in Scotland.[87]
	Domestic properties	Solar PV – installed in 2013	3.6 kWe	Analysis of installations registered for FITs in Scotland.[88]
	Domestic properties	Solar PV – installed in 2014, 2015, 2016 or 2017	4.0 kWe	Analysis of installations registered for FITs in Scotland.[89]
	Domestic properties	Solar PV – installed in 2018	4.5 kWe	Analysis of installations registered for FITs in Scotland.[90]
	Domestic properties	Heat pumps (ASHP and GSHP)	7 kWth	Average of other LA- and HA-owned heat pumps in domestic properties, recorded in the database.
	Domestic properties	ASHP – EAHR[91]	7 kWth	Average of other LA- and HA-owned ASHP-EAHRs in domestic properties, recorded in the database.

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[86] Energy Saving Scotland home renewables loans are loans for domestic renewables, administered by the Energy Saving Trust on behalf of the Scottish Government.
[87] Central FITs register, Ofgem. https://www.renewablesandchp.ofgem.gov.uk/
[88] Central FITs register, Ofgem. https://www.renewablesandchp.ofgem.gov.uk/
[89] Central FITs register, Ofgem. https://www.renewablesandchp.ofgem.gov.uk/
[90] Central FITs register, Ofgem. https://www.renewablesandchp.ofgem.gov.uk/
[91] 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.

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