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Community and locally owned energy in Scotland

2020 report

Report produced for the Scottish Government by Energy Saving Trust

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Contents

1. Introduction 3
2. Summary of key findings 5
3. Methodology summary 8
3.1. Definition of 'community and locally owned' 8
3.2. Renewable energy technologies included 8
3.3. Approach taken and data sets used 9
3.4. Information collected 9
4. Community and locally owned renewable energy operational in 2020 11
4.1. Results for December 2020: operational capacity 11
4.1.1. Operational capacity and number of installations by ownership category 11
4.1.2. Operational capacity and number of installations by technology 14
4.1.3. Operational capacity and number of installations by ownership category and technology 16
4.1.4. Operational capacity by local authority area 18
4.2. Estimate of annual output from reported total capacity 26
5. Further community and locally owned capacity in development 28
5.1. Results for December 2020, capacity in development 28
5.2. Shared ownership projects 30
5.3. Progress towards the 1GW target 32
5.4. Impact of the Covid-19 health emergency 34
6. Community and locally owned energy storage in 2020 36
6.1. Results for December 2020: energy storage capacity 36
6.2. Further energy storage capacity in development 36
Appendix 1 Full methodology 37
Appendix 2 Individual technology descriptions 48
Appendix 3 List of main data sets used 51
Appendix 4 Capacities assumed for individual installations where not known 53

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1. Introduction

Energy Saving Trust was asked in 2011 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 having 0.5GW of operational renewable energy capacity in community or local ownership by 2020.[1] This target was exceeded in 2015 and subsequently the Scottish Government doubled the target to 1GW of operational community and locally owned renewable energy capacity by 2020 and set a further target of 2GW by 2030.

This database has been updated annually since 2011 and this is the ninth 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 31 December 2020.

Since 2016, and as storage technologies have become more common, we have also included findings on the capacity and type of community and locally owned energy storage systems. As energy storage systems do not generate renewable energy, the capacities of energy storage technologies are not included in the progress towards the 1GW target but are presented to provide additional information on the growth of community and locally owned energy systems.

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

- A community group
- A farm or estate
- A housing association
- A local authority
- A local Scottish business[2]
- A public sector or charitable organisation, 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)[3]
    - Recipients of Community and Renewable Energy Scheme (CARES) support[4]
- Social housing where it is not possible to identify if it is owned by a local authority or a housing association, hereafter referred to as 'undetermined social housing[5]

[1] www.gov.scot/policies/renewable-and-low-carbon-energy/local-and-small-scale-renewables/
[2] Note that this excludes Scottish businesses whose main purpose is to develop renewable energy projects on land they do not own, at a site distant from their office.
[3] Scheme previously 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.
[4] Scheme currently funded by the Scottish Government to support the development of community owned renewable energy projects or locally owned projects which provide wider community benefits.
[5] These are properties that according to the Scottish domestic energy performance certificate (EPC) register are socially let and have renewable energy systems installed but we do not know if they are owned by a housing association or local authority because EPCs do not distinguish between the two.

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With thanks to

The report draws on various sources of data from Energy Saving Trust and other organisations working in Scotland and has been compiled with thanks to:

- Community and local authority support officers
- Scottish Federation of Housing Associations (SFHA)
- All of the Scottish housing associations who responded to our survey
- All of the Scottish local authorities who responded to our survey
- NHS Scotland
- Eunomia, who prepare the Renewable Energy Planning Database (REPD)[6]
- Scottish Forestry (previously Forestry Commission Scotland)
- Scottish Water
- UK Department of Business, Energy and Industrial Strategy (BEIS)
- Community Energy Scotland
- Scottish Renewables

We would also like to extend our thanks to the many other organisations and individuals who helped with time or information.

For any questions or comments relating to the Community and Locally Owned renewable energy database, or accompanying analysis and report, please contact RenewableReporting@est.org.uk.

[6] www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract

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2. Summary of key findings

The findings from this work are that at the end of December 2020:

- An estimated 853MW of community and locally owned renewable energy capacity was operational in Scotland[7]
- There has been a 16.7% increase in operating capacity compared to June 2019 when the operating capacity was estimated at 731MW
- The operating capacity resulted from approximately 25,830 individual renewable energy installations[8]
- There has been a 25.6% increase in the number of installations compared to June 2019
- The Scottish Government has achieved progress of 85.3% towards their 2020 target of 1GW and 42.6% towards their 2030 target of 2GW
- This is the equivalent to 170.6% of the original target of 0.5GW by 2020. This target was set in 2011 and was exceeded by 2015. The Scottish Government subsequently doubled the target to 1GW by 2020 and also set a target of 2GW by 2030

The 853MW of total operational capacity is split between:[9]

- 443MW of electrical capacity (MWe)
- 351MW of thermal (heat) capacity (MWth)
- 59MW of combined heat and power (CHP) capacity (MWe + MWth)

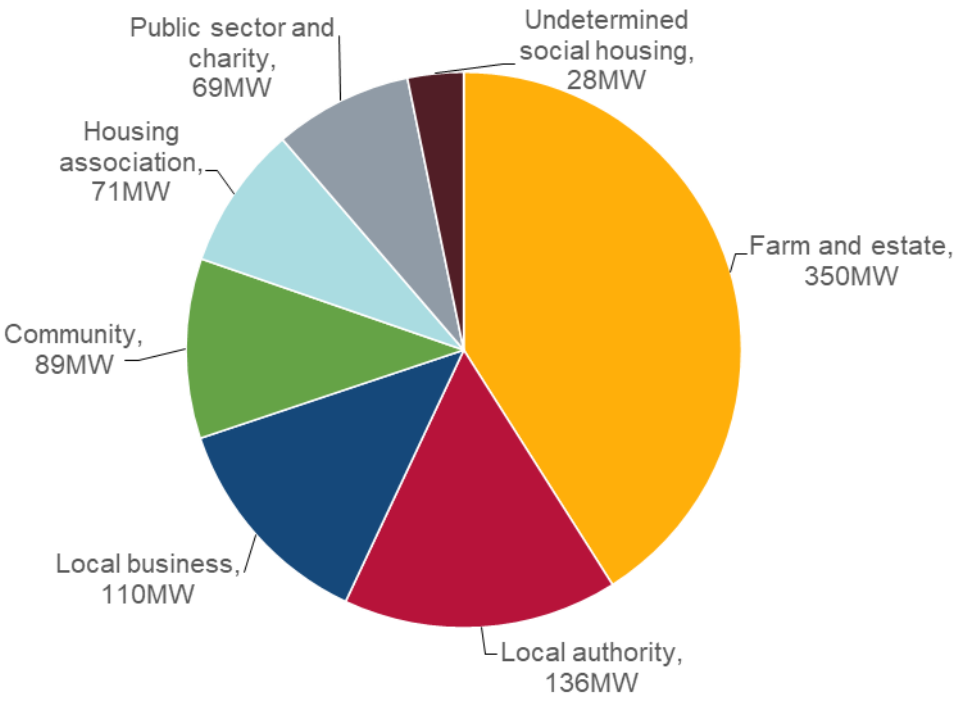
Over the course of a year, the community and locally owned renewable energy installations identified could be expected to produce around 1,851GWh of renewable energy, consisting of approximately:

- 993GWh of electricity
- 654GWh of heat
- 205GWh of electricity and heat from CHP

Figure 1 shows the breakdown of community and locally owned operational renewable energy capacity by the categories of ownership used in this report. As in previous years, the largest proportion was on Scottish farms and estates (41.0%). The second largest owner of capacity were the Scottish local authorities (16.0%) followed by local businesses (12.9%). Since June 2019, the largest proportional increase in recorded operational capacity has been under farm and estate ownership (20.7%). Most of this increase can be attributed to newly recorded biomass installations some of which were already in operation prior to 2020 but where publicly accessible information on them has only recently become available.

[7] 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.
[8] Throughout this report, all references to number of installations includes the total number of individual wind turbines in any multi-turbine development and have been rounded to the nearest 10 unless otherwise stated.
[9] Throughout this report, figures may not equal summed totals or percentages due to rounding.

Figure 1. Operational community and locally owned renewable energy capacity by ownership category



Analysis of community and locally owned energy by local authority area has shown that the local authorities with the most operational capacity were Aberdeenshire (218MW) and Highland (104MW). For comparison, the local authorities with the most renewable energy capacity owned by the councils themselves were Highland council (23MW) and South Lanarkshire council (20MW).

Farms and estates were the most frequent top contributor to local authority area capacity totals, with this occurring in 10 out of 32 local authority areas. This was followed by local authorities being the top contributor in eight of the local authority areas, and public sector and other charitable organisations in six.

A further 914MW of community or locally owned renewable energy capacity was estimated to be in different stages of development as of 31 December 2020, an increase of 15.1% (120MW) from June 2019. Of this 914MW:

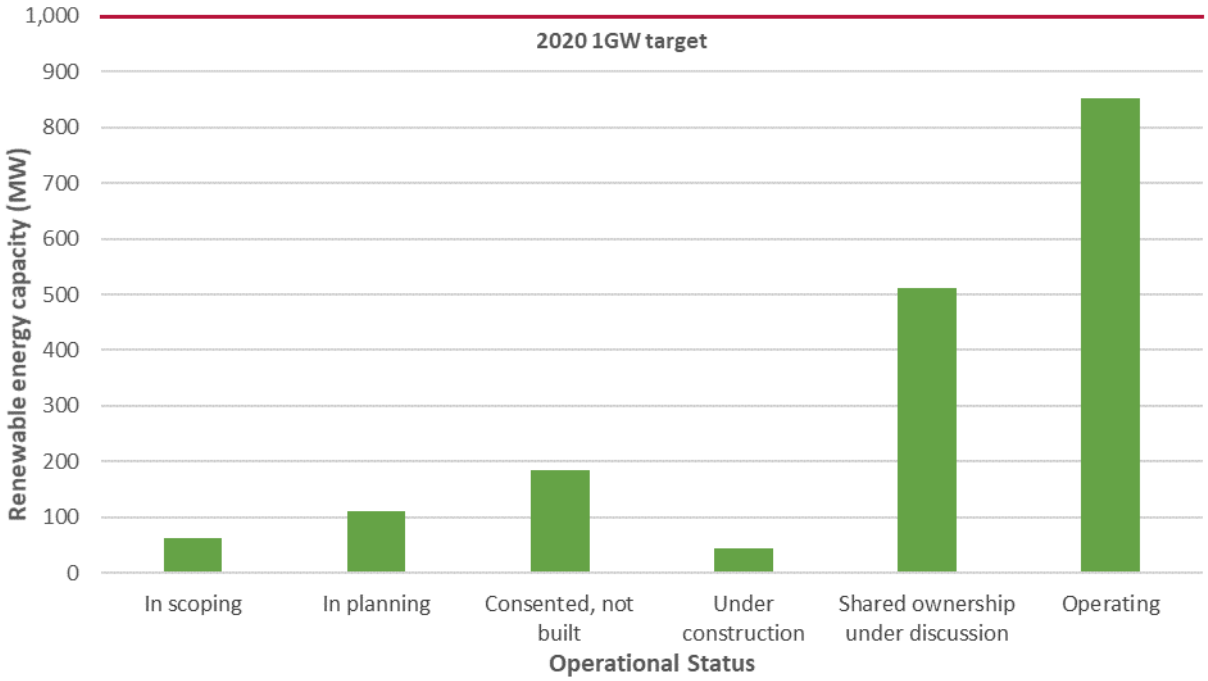
- 63MW was in the scoping stage
- 111MW was waiting for a planning decision to be made ('in planning')[10]
- 184MW had been granted planning permission but construction had not yet started ('consented not built')[11]
- 44MW was under construction
- 511MW is under discussion for potential shared ownership between a renewable developer and a local or community group ('shared ownership under discussion')[12]
- 2MW was in an unknown stage of development

[10] Applies only to installations which require planning permission.
[11] Applies only to installations which require planning permission.
[12] Note that the majority of projects which have the 'under discussion' status are in various stages of development with a small proportion of them already operational but where the owners are looking to refinance to include a component of shared ownership.

There was approximately 4MW of capacity recorded as being 'non-operational'.[13] For these projects, we have been informed that construction is complete but that they are currently not operating.

The total capacity in each stage of development held within the community and locally owned renewable energy database is shown in Figure 2.

Figure 2. Community and locally owned renewable energy capacity in each stage of project development



There are 115 projects included in the database that are in, or under discussion for, shared ownership. This could be shared ownership between a renewable developer and a community or local organisation or shared ownership between different community or local organisations. Of the 115 projects, 54 were operational as of 31 December 2020 with the remaining 61 in various stages of development. The operational shared ownership projects account for 67MW (7.8%) of community and locally owned renewable capacity and the 'in development' shared ownership projects make up a further 511MW. By 2020, the Scottish Government ambition was to ensure that at least half of newly consented renewable energy projects have an element of shared ownership.[14]

At the end of December 2020 there was an estimated 9.1MWh of installed energy storage capacity in community and local ownership in Scotland with an additional 0.6MWh in development. The majority of operational energy storage (5.6MWh) is heat storage.

[13] The 4MW of non-operational capacity is not included in the "operational" or "in development" capacity totals.
[14] www.gov.scot/publications/scottish-energy-strategy-future-energy-scotland-9781788515276/

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3. Methodology summary

A full methodology is provided in Appendix 1. The following section provides a summary 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
- A farm or estate
- A local authority
- A housing association
- 'Public sector and charity', including:
    - Charities, including faith organisations
    - Public bodies or publicly owned companies
    - 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)[15]
    - Recipients of Community and Renewable Energy Scheme (CARES) support[16]

'Ownership' has not been restricted to cases where the organisation owns the entire renewable installation as it also includes cases where for example a community group or farmer has helped to meet part of the cost of developing and installing a renewables system in return for some benefit, such as a share in the income generated. 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 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). Renewable developments where an element of shared ownership is under discussion are included.

3.2. Renewable energy technologies included

The following renewable energy technologies are included in the database:

- Wind
- Hydroelectric
- Wave and tidal (marine)
- Solar photovoltaics (solar PV)
- Biomass primary combustion (including for district heating)
- Biomass gasification for the production of heat or heat and electricity (CHP)

[15] Scheme previously 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.
[16] Scheme currently funded by the Scottish Government to support the development of community owned renewable energy projects or locally owned projects which provide wider community benefits.

- Waste incineration (organic or putrescible fraction) for production of electricity and/or heat[17]
- Heat pumps (ground source, air source and water source) including air source heat pumps (ASHP) incorporating exhaust air heat recovery (EAHR)
- Solar thermal panels
- Anaerobic digestion producing electricity and/or heat[18]
- 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)
- Hydrogen storage
- Pumped hydroelectric storage

Full descriptions of these technologies are provided in Appendix 2.

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 1.

For this year's report a full database update was carried out for the period from June 2019 to December 2020.[19]

A full list of the main data sources used, and the organisations that provided them, is given in Appendix 3.

3.4. Information collected

Wherever possible, the information collected for each installation includes:

- 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 of installations and installed operational capacity
- Operational status as at the end of December 2020:[20]
    - Operating
    - Under construction
    - Consented, not built

[17] In line with the assumptions used in the BEIS RESTATS methodology, approximately 50% of the feedstock of municipal solid waste (MSW) is considered to be bio-degradable and therefore any installation using MSW will have 50% of its heat capacity and output recorded as renewable. Clinical waste is considered non-biodegradable and therefore non-renewable. These assumptions have been applied to all energy from waste sites known to be using such fuels.
[18] Excludes the heat produced only for maintenance of the digestion process.
[19] We have covered the last 18 months instead of the usual 12 because we are moving to report on community and locally owned energy by calendar year instead of the June to June year that was reported on previously.
[20] Additional operating statuses included within the database but not referenced in this report include: Decommissioned and Cancelled. These statuses are used to exclude projects from the final analysis.

    - In planning
    - In scoping
    - Non-operational
    - Shared ownership under discussion[21]
- The date on which generation commenced (for operational projects)
- Percentage ownership by the community or local group in cases where the organisation does 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

[21] Note that the majority of projects which have the 'shared ownership under discussion' status are in various stages of development with a small proportion of them already operational but where the owners are looking to refinance to include a component of shared ownership.

4. Community and locally owned renewable energy operational in 2020

4.1. Results for December 2020: operational capacity

At the end of December 2020 an estimated 853MW of community or locally owned renewable energy capacity was operational in Scotland. This was spread over a total of 25,830 individual renewable energy installations.

4.1.1. Operational capacity and number of installations by ownership category

A breakdown of operational capacity by ownership category is given in Table 1 and illustrated in Figure 3. A breakdown of the number of operational renewable energy installations by ownership category is given in Table 2 and illustrated in Figure 4.

Table 1. Operational community and locally owned renewable energy capacity by ownership category

Ownership category	Operational capacity (MW)	% of operational capacity	% change from June, 2019
Farm and estate	350	41.0%	20.7%
Local authority	136	16.0%	5.0%
Local business	110	12.9%	18.7%
Community	89	10.5%	8.8%
Housing association	71	8.4%	2.1%
Public sector and charity	69	8.1%	2.9%
Undetermined social housing	28	3.3%	N/A[22]
Total	**853**	**100.0%**	**16.7%**

[22] The undetermined social housing ownership figures were derived from analysis of the Scottish domestic energy EPC register which is new to this year's methodology and so there are no previous figures to compare with.

Figure 3. Operational community and locally owned renewable energy capacity by ownership category

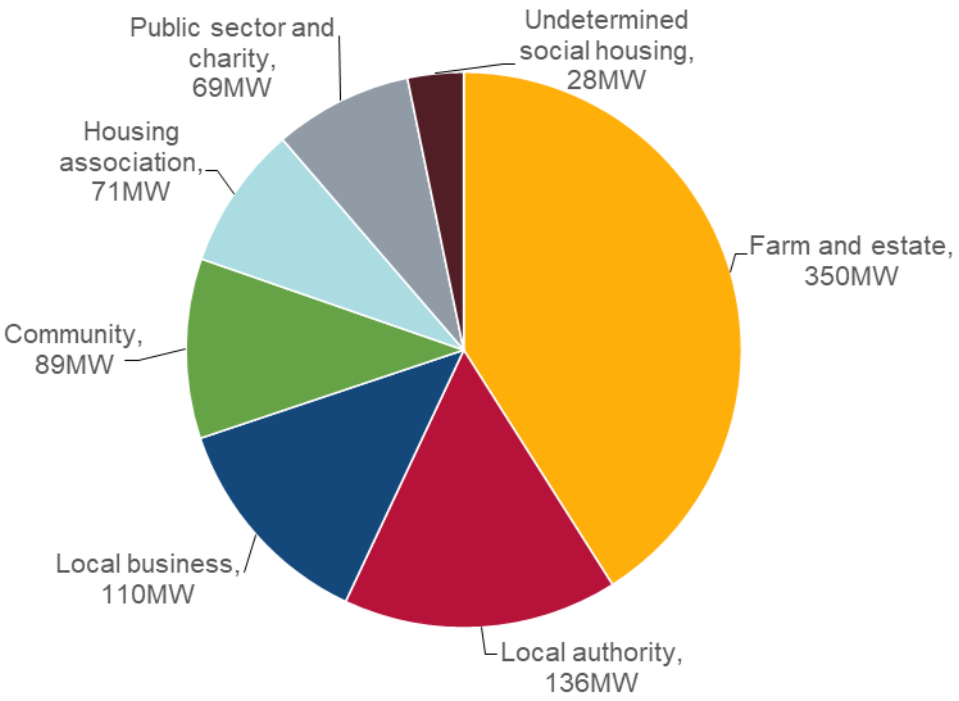
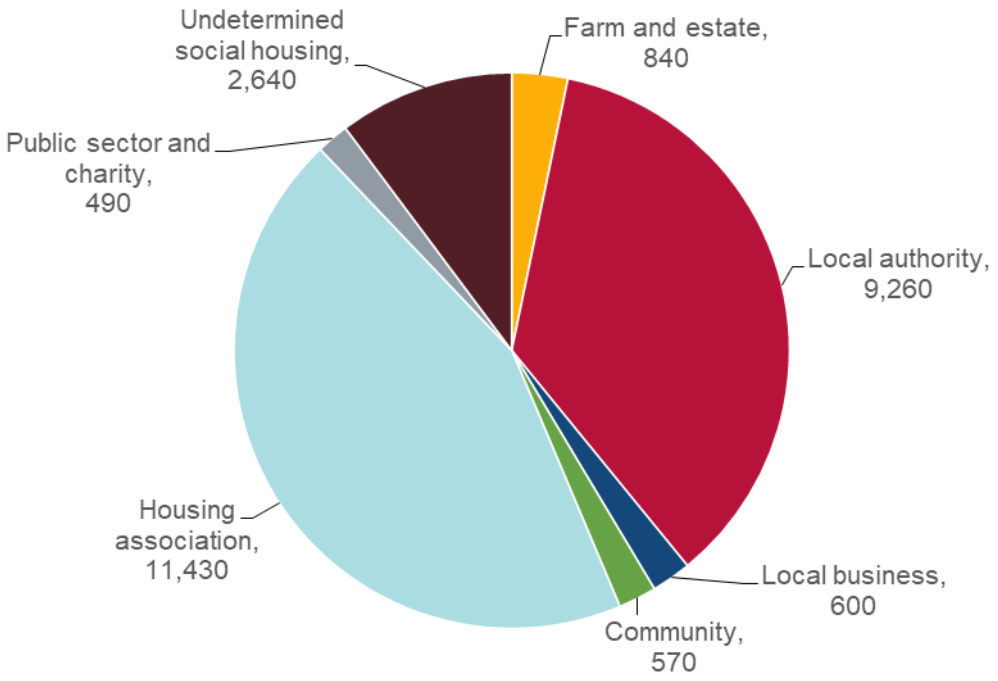


Table 2. Number of operational community and locally owned renewable energy installations by ownership category

Ownership category	Number of installations	% of installations	% change from June, 2019
Farm and estate	840	3.2%	29.6%
Local authority	9,260	35.8%	29.9%
Local business	600	2.3%	3.6%
Community	570	2.2%	3.9%
Housing association	11,430	44.3%	2.3%
Public sector and charity	490	1.9%	1.5%
Undetermined social housing	2,640	10.2%	N/A
Total	**25,380**	**100.0%**	**25.7%**

Figure 4. Number of operational community and locally owned renewable energy installations by ownership category



The largest proportion of operational capacity was on Scottish farms and estates (41.0%), followed by local authorities (16.0%) and local businesses (12.9%). Community groups owned 10.5% of total operational capacity (89MW).

The largest numbers of individual installations from the database were in local authority and housing association ownership, together accounting for 90.3% (by number) of individual installations. Housing associations were the owners of the largest number of individual installations, at 11,430 installations (approximately 44.3% of all individual installations recorded). The number of operational local authority installations now recorded is 9,260, which is an increase of 29.9% between June 2019 and December 2020, whilst the number of housing association owned installations recorded as operational rose by 2.3%. There were also a further 2,640 installations in social let properties where ownership between housing associations or local authorities could not be determined.

Heat pumps and solar PV are the most common technologies in housing association or local authority ownership, with heat pumps accounting for 32.9% and solar PV accounting for 48.7%. The majority of the heat pumps and solar PV systems in these ownership categories are installed in domestic properties with a smaller proportion in non-domestic properties.

The farm and estate category has seen both the largest proportional (20.7%) and absolute (60MW) increase in recorded operational capacity since June 2019. However, a considerable amount of this is from retrospective planning applications where the installation has already been operating for a number of years prior to reporting but was unknown to us from the sources available at the time of installation. Where a retrospective planning application included a historical operating date, we have allocated the operational capacity to the corresponding year. A revised time series is presented in the figures of Section 5.3. “Progress towards the 1GW target”.

4.1.2. Operational capacity and number of installations by technology

A breakdown of the operational capacity by the technology installed is shown in Table 3 and is illustrated in Figure 5. A breakdown of the number of operational renewable energy installations by technology installed is given in Table 4 and illustrated in Figure 6.

Table 3.Operational community and locally owned renewable energy capacity by technology

Technology	Operational capacity (MW)	% of operational capacity	% change from June, 2019
Wind	330	38.7%	1.5%
Biomass	260	30.5%	34.7%
Heat pump	72	8.4%	26.1%
Solar PV	71	8.3%	27.0%
Energy from waste	62	7.3%	37.7%
Hydroelectric	42	5.0%	6.7%
Solar thermal	16	1.9%	5.3%
Total	**853**	**100.0%**	**16.7%**

Figure 5. Operational community and locally owned renewable energy capacity by technology

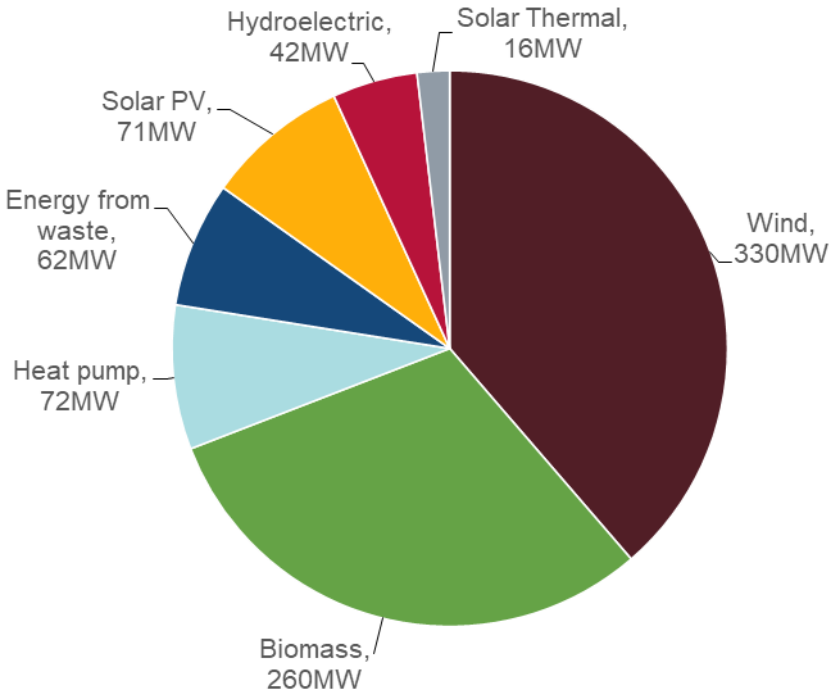
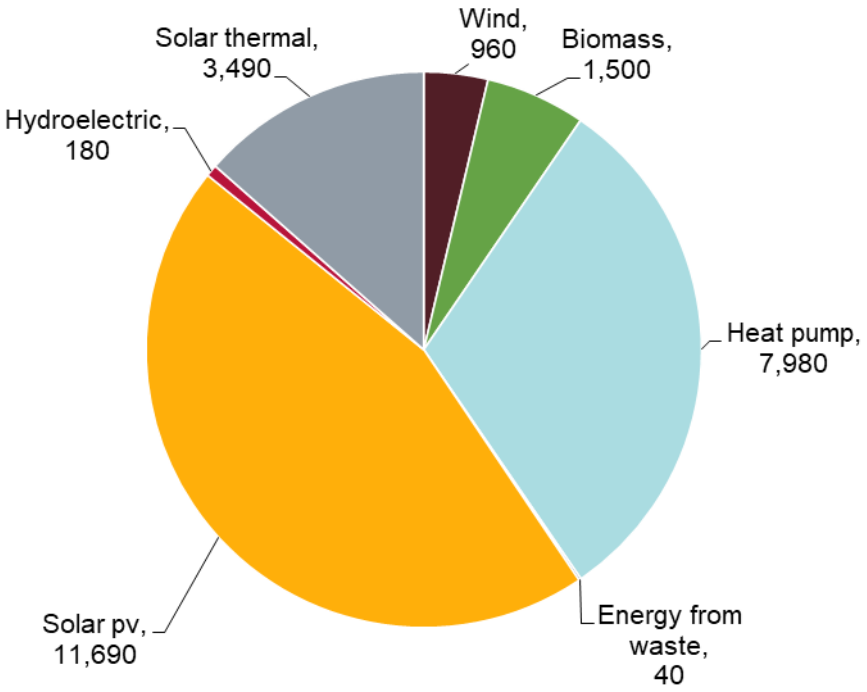


Table 4. Number of operational community and locally owned renewable energy installations by technology

Technology	Number of installations	% of installations	% change from June, 2019
Wind	960	3.7%	29.8%
Biomass	1,500	5.8%	56.8%
Heat pump	7,980	30.9%	16.4%
Solar PV	11,690	45.2%	35.1%
Energy from waste	40	<1%	2.8%
Hydroelectric	180	<1%	2.3%
Solar thermal	3,490	13.5%	11.1%
Total	**25,830**	**100.0%**	**25.7%**

Figure 6. Number of operational community and locally owned renewable energy installations by technology



Wind is the category with the largest share of capacity in operation (38.7%) at the end of December 2020 but with the smallest increase (1.5%) in recorded capacity since June 2019. The second largest technology category was biomass with a 30.5% share of the total capacity. Biomass had a significant increase in the reported capacity since June 2019 with a 34.7% gain. The majority of this increase can be found on Scottish farms and estates but, as discussed earlier, not all of this growth can be attributable to the 2019 and 2020 calendar years because many of the installations identified for this report were already operating prior to 2019.

Together, wind and biomass technologies account for 69.1% of operational capacity at the end of December 2020 despite only contributing 9.5% of the number of operational installations. Biomass and wind installations typically have a much higher capacity per install than the other technologies because wind turbines are designed to be taller and larger to capture stronger wind at higher altitudes more efficiently to maximise electricity generation; and biomass installations often require large capacities in order to provide sufficient heat for industrial processes or for agricultural usage on farms and estates.

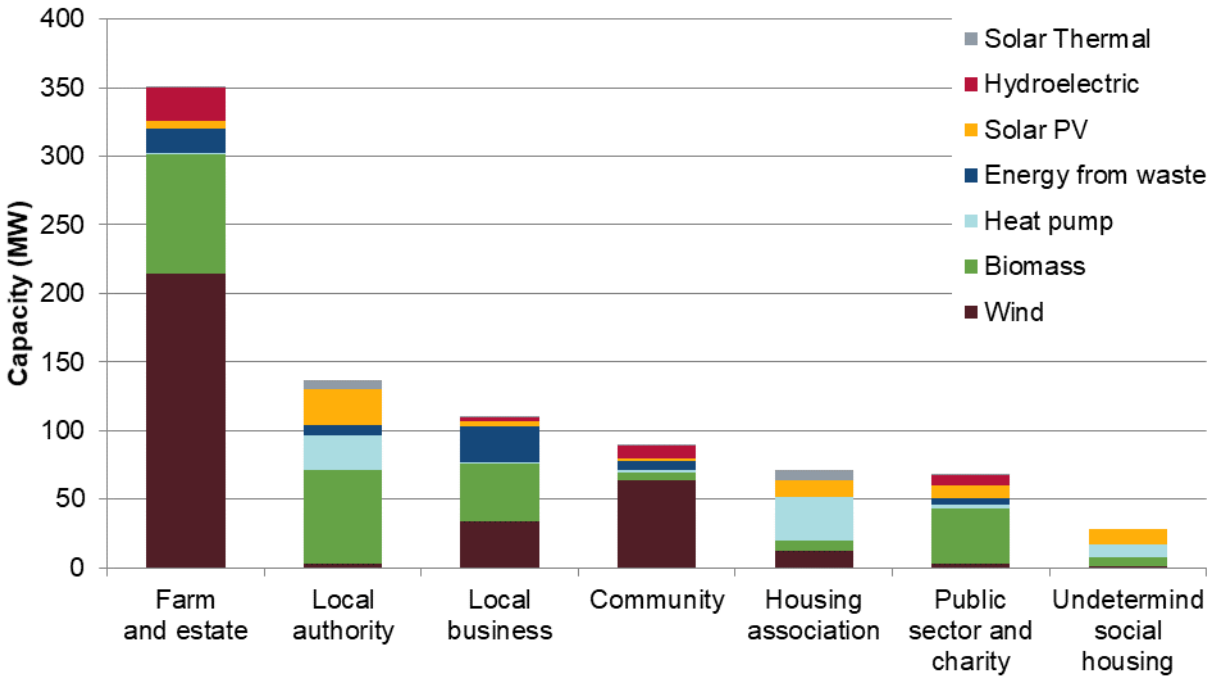
In contrast, solar thermal, heat pump and solar PV installations all have higher percentage contributions to the total number of installations than they contribute to the capacity totals. These technologies are more commonly found in domestic or low-usage non-domestic situations where large capacities are not required.

Energy from waste includes the incineration of municipal solid waste, the combustion of biogas produced from anaerobic digestion and the combustion of gases collected from landfill, sewage and wastewater. There was a 37.7% increase in the capacity associated with this technology group, however, this was due to improvements to the data available allowing us to include both the electrical and thermal capacities of some CHP installations in our reported totals instead of just the electrical capacities, with the latter more commonly quoted than the former in some of the sources reviewed for this publication.

4.1.3. Operational capacity and number of installations by ownership category and technology

Figure 7 shows the breakdown of operational renewable energy capacity by both the ownership category and the technology.

Figure 7. Operational community and locally owned renewable energy capacity by ownership category and technology



There are several reasons why some technologies are more prevalent in some ownership categories over others.

Farm and estate capacity totals tend to be dominated by wind (64.7%) and biomass (22.0%) with some energy from waste (4.0%) and hydroelectric (7.1%) capacity as well. These technologies may be desirable on farms and estates where the natural resources required to produce electricity, such as suitable bodies of water or areas of high speed, unobstructed wind, may be more readily available. Moreover, farm and estates are typically in rural and off-gas grid areas so there may be significant appeal for biomass installations through a combination of wishing to move from more expensive fossil fuels to using more local woodchip or agricultural waste from on site to generate heat with. Farms may also have quite large heat demands related to agricultural activities, such as drying grain or heating greenhouses, which is why the biomass capacities tend to be much larger on farms and estates than ones commonly found in other non-domestic and domestic settings.

Local authorities own a significant amount of biomass capacity, contributing 50.2% of the total local authority owned operational capacity. The majority of these biomass installations tend to be relatively large and can be found in non-domestic properties with a high and relatively steady heat demand such as schools. The biomass installations are concentrated in the more rural local authorities where there is likely to be better access to locally produced woodfuel. Local authorities also have a large amount of their capacity coming from heat pumps (18.0%) and solar PV (19.0%). These installations are located in both non-domestic and domestic properties but with the majority in domestic settings. As local authorities have responsibility for waste management in their areas, some councils also own energy from waste installations which make use of by-products from landfill or recycling centres to produce heat or CHP output. The three local authorities with the greatest capacity totals are Highland (23MW), South Lanarkshire (20MW) and Perth and Kinross (12MW). Together these local authorities contribute 40.2% of the total local authority owned capacity recorded.

The greatest contributing technologies to the local business capacity totals are biomass (38.5%), wind (30.4%) and energy from waste (24.4%). Similar to farms and estates, the majority of local business operational capacity can also be found in rural and off-gas grid areas where there are good wind resources or where biomass may an attractive alternative to existing fuels used. The relatively large percentage of energy from waste capacity in local business ownership, in comparison to the other ownership categories, can be attributed to businesses who are involved in the management of waste and therefore have a readily available supply of waste to consume for energy.

The majority of community owned renewable capacity utilises wind (71.0%) and hydroelectricity (10.5%) technologies. Both are often attractive investments to local community groups either to make use of natural resources within their local area or as part of shared ownership offers from renewable developers.

Housing associations have a mixture of technologies making up their total capacity and are mostly installed in domestic settings. Heat pumps (43.7%), solar PV (17.9%) and solar thermal (10.3%) installations make up the majority of housing association installations because these technologies are well suited to providing heat or electricity for meeting domestic heating, hot water and electrical demand. Therefore, each installation typically has a very small (<10kW) capacity.

The public sector and other charitable organisation category capacity total also has a significant biomass technology contribution (59.6%) with smaller contributions coming from solar PV (14.3%), hydroelectricity (10.7%), energy from waste (5.9%), heat pumps (4.0%) and wind (3.7%). The mixture of technologies may be attributable to the variety of organisations found within this category, ranging from NHS hospital Trusts to Scottish Water, to further education establishments.

4.1.4. Operational capacity by local authority area

The following maps (Figures 8 to 14) illustrate, by ownership category, the distribution of operational community and locally owned renewable energy capacity throughout Scotland at the end of December 2020.

Please note that these maps show more than 96.5% of the reported total capacity. A small percentage has been omitted because we cannot allocate them to specific local authority areas.

Figure 8. Operational renewable energy capacity in farm and estate ownership by local authority area, as of 31 December 2020

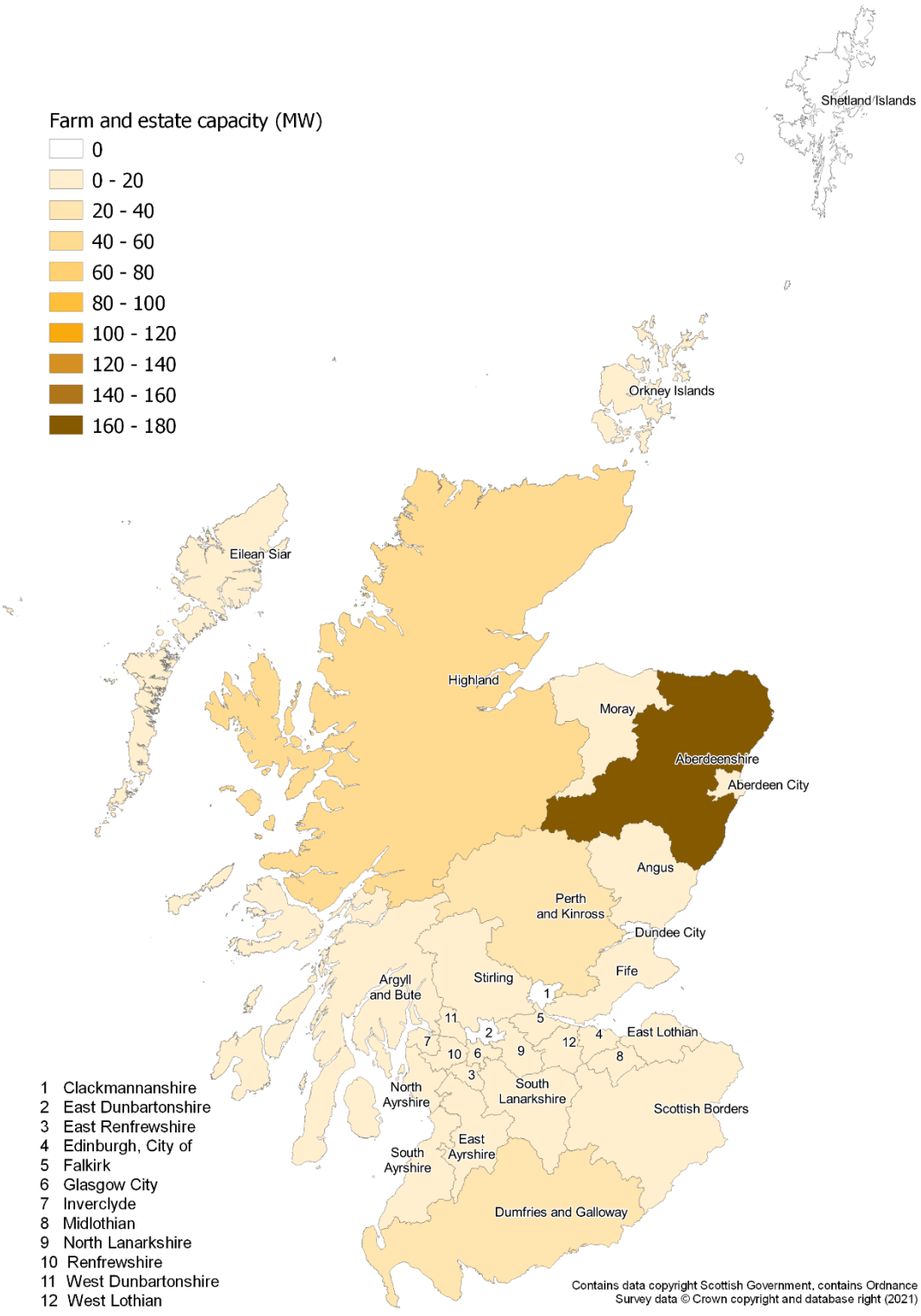


Figure 9. Operational renewable energy capacity in local authority ownership by local authority area, as of 31 December 2020

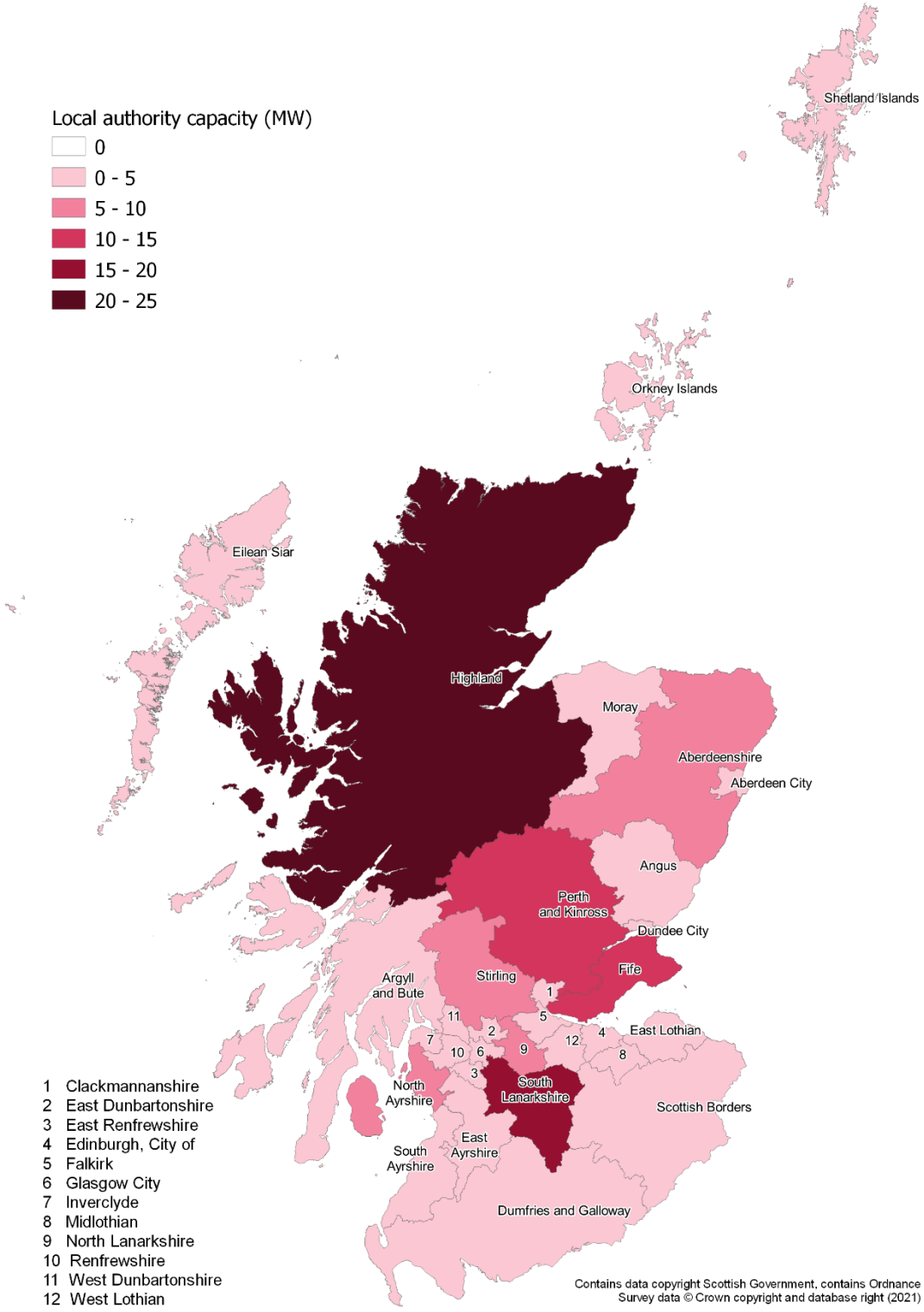


Figure 10. Operational renewable energy capacity in local business ownership by local authority area, as of 31 December 2020

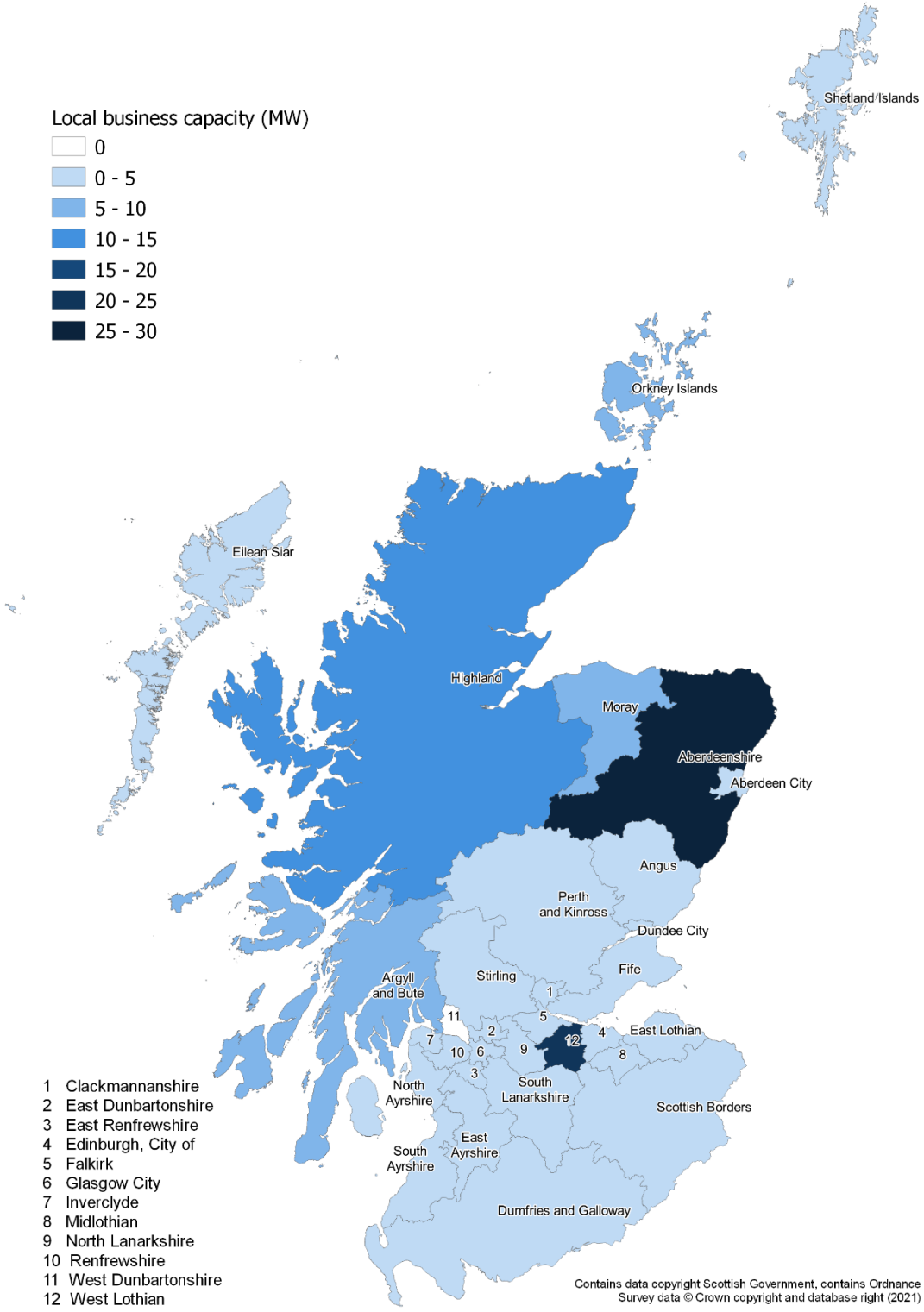


Figure 11. Operational renewable energy capacity in community ownership by local authority area, as of 31 December 2020

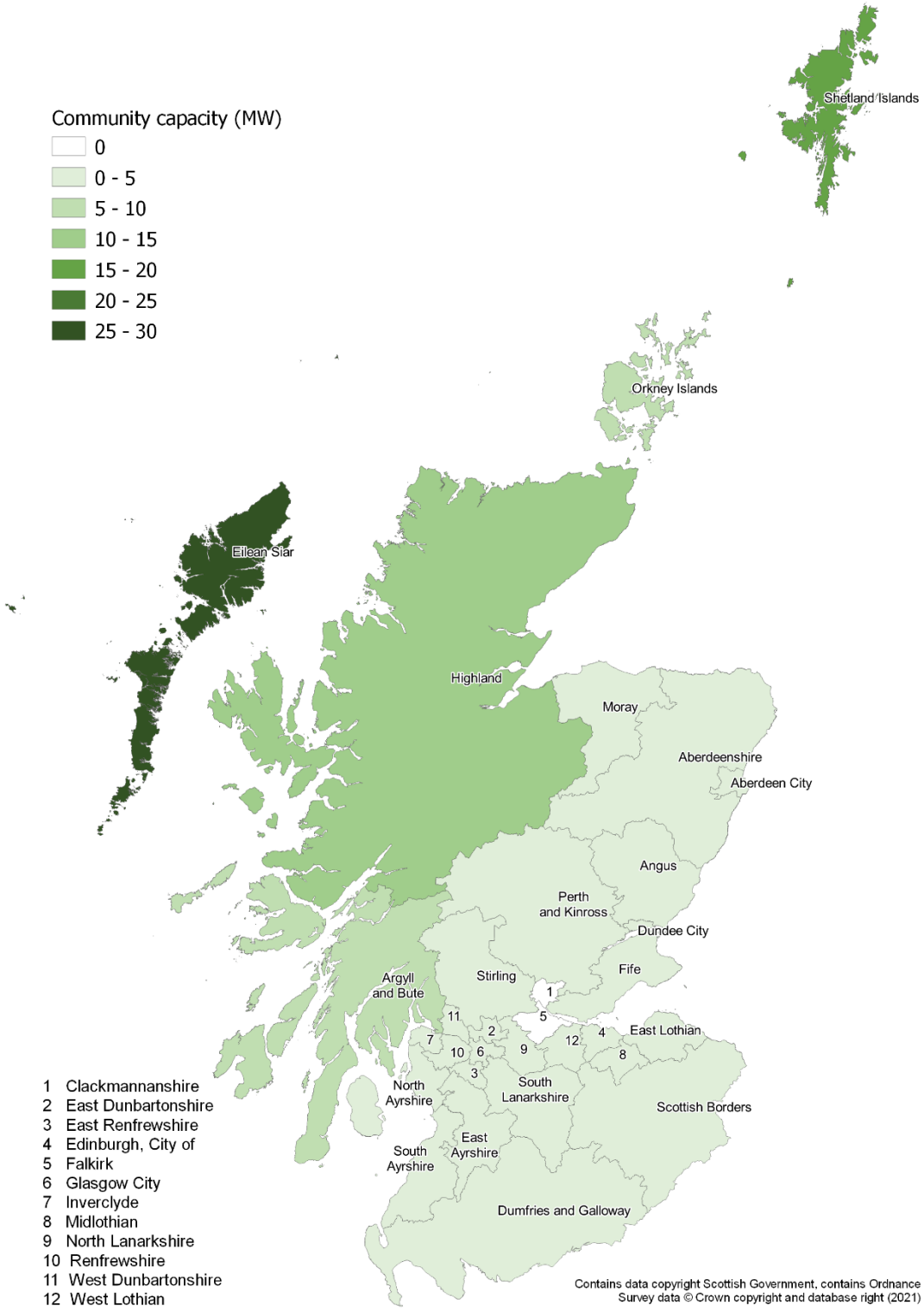


Figure 12. Operational renewable energy capacity in housing association ownership by local authority area, as of 31 December 2020

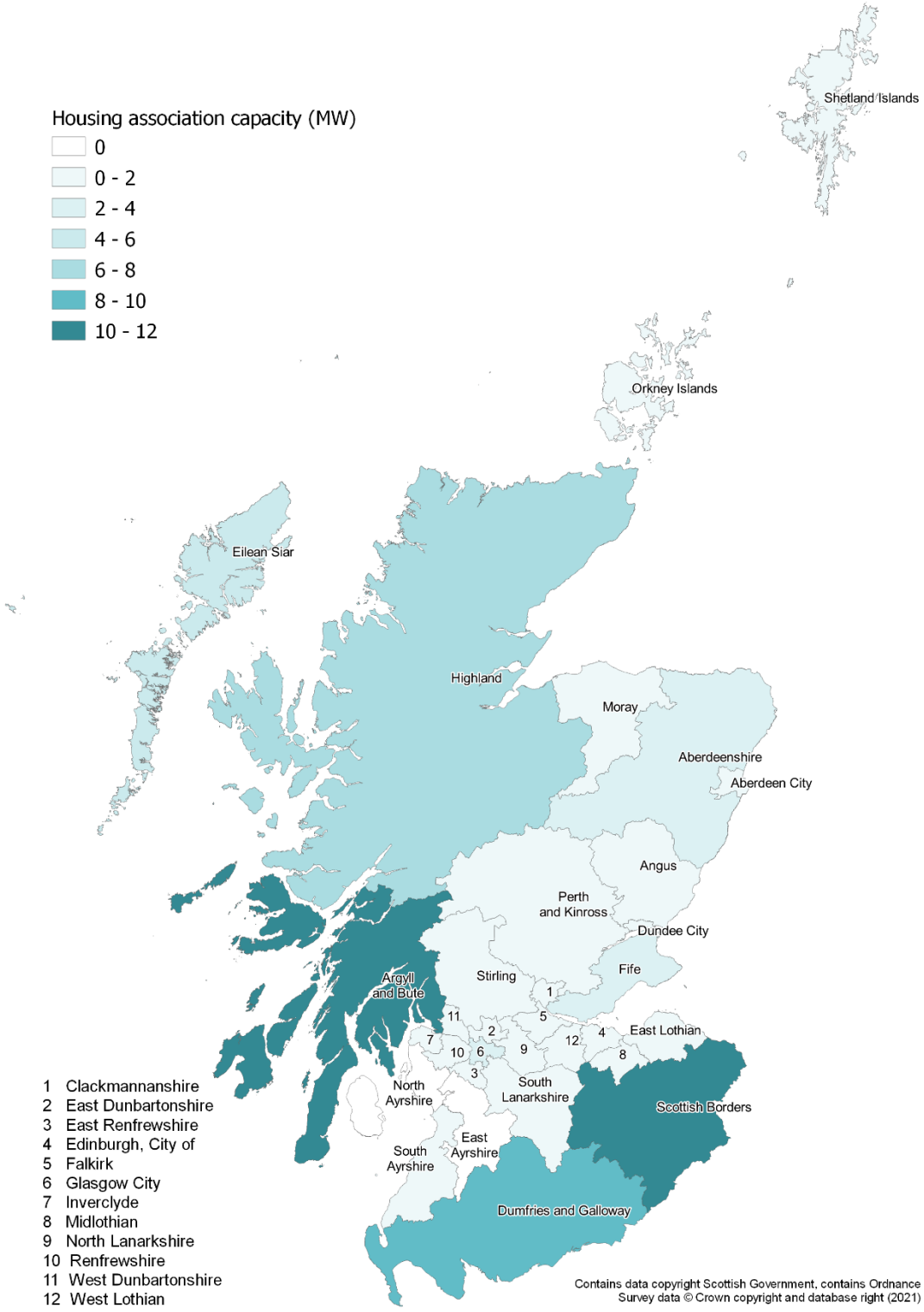


Figure 13. Operational renewable energy capacity in public sector and charity ownership by local authority area, as of 31 December 2020

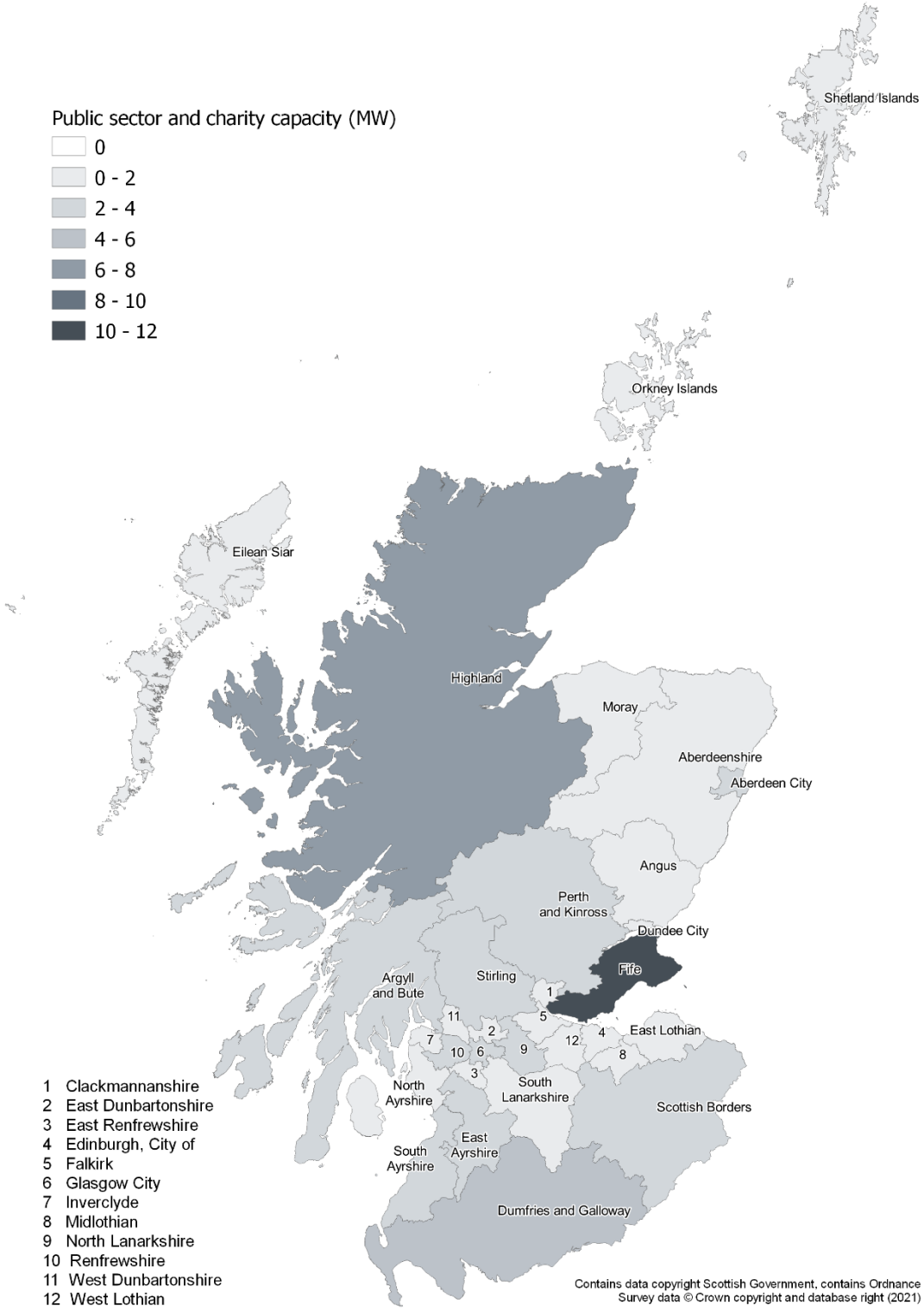
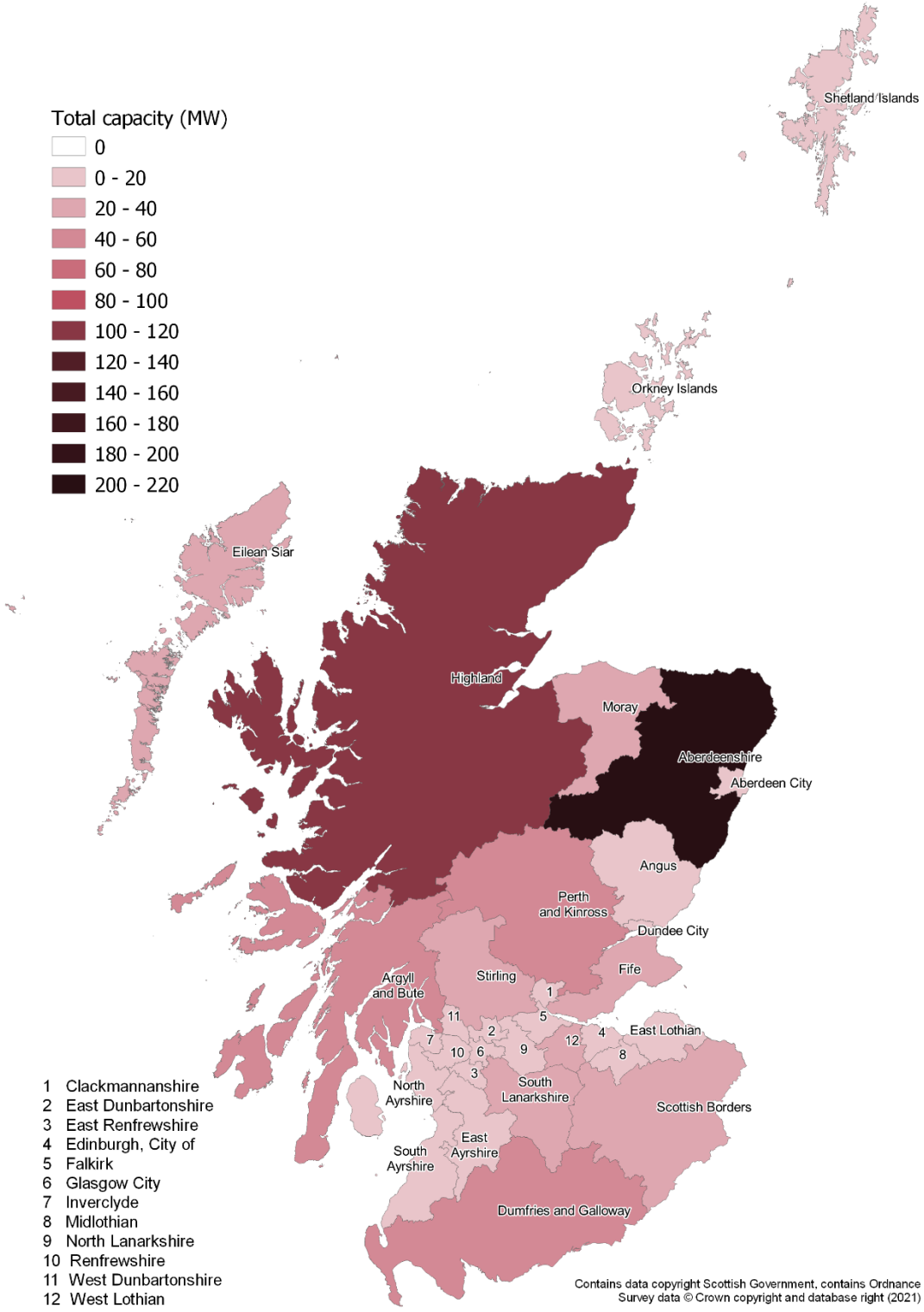


Figure 14. Total operational renewable energy capacity in community or local ownership by local authority area, as of 31 December 2020



4.2. Estimate of annual output from reported total capacity

Over a year, the 853MW of operational community and locally owned renewable energy capacity could be expected to produce up to 1,851GWh of renewable energy. This consists of around 993GWh of electricity, 654GWh of heat and 205GWh of energy from CHP installations.

The breakdown of total output into electrical, heat or CHP output is shown in Figure 15. A further breakdown by ownership category is given in Table 5.

Figure 15. Operational community and locally owned renewable output by energy type

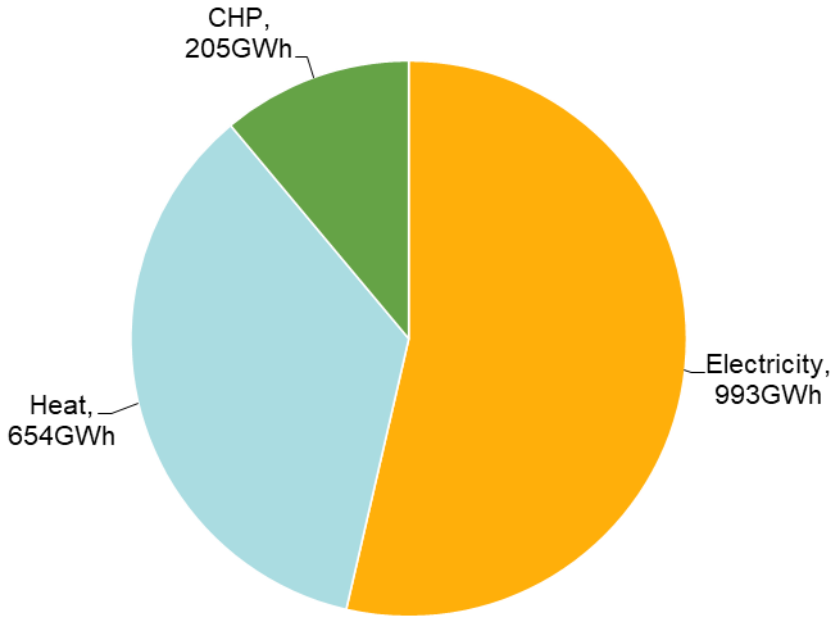


Table 5. Operational community and locally owned renewable output by ownership category

Ownership category	Operational output (GWh)	% of operational output	% change from June, 2019
Farm and estate	817	44.1%	11.0%
Local authority	219	11.8%	27.6%
Local business	278	15.0%	4.8%
Community	220	11.9%	5.4%
Housing association	119	6.4%	-14.3%
Public sector and charity	161	8.7%	-3.1%
Undetermined social housing	39	2.1%	N/A
Total	**1,851**	**100.0%**	**2.0%**

Some ownership categories are showing a reduction compared with last year's reported figures. However, this reduction is due to methodological changes for renewable heat installations – we have reduced the assumed running hours per year to bring them more in line with the analysis of non-domestic RHI data for the Renewable Heat in Scotland report.[23]

[23] www.energysavingtrust.org.uk/report/renewable-heat-in-scotland-2019

5. Further community and locally owned capacity in development

5.1. Results for December 2020, capacity in development

In addition to the 853MW of community and locally owned renewable energy capacity estimated to be operational at the end of December 2020, a further 914MW was estimated to be in various stages of development.

Of the renewable energy capacity estimated to be in development:

- 63MW was in the scoping stage.
- 111MW was waiting for a planning decision to be made ('in planning').[24]
- 184MW had been granted planning permission but construction had not yet started ('consented not built').[25]
- 44MW was under construction.
- 511MW is under discussion for potential shared ownership between a renewable developer and a local or community group ('shared ownership under discussion').
- 2MW was in an unknown stage of development.

There was also approximately 4MW of capacity currently recorded as being 'non-operational'.[26] For these projects, we have been informed that the construction of the installation is complete but that the installation is believed to be currently not operating.

The total capacity in each stage of development held within the community and locally owned renewable energy database is shown in Figure 16, and a breakdown by technology type is given in Table 6.

[24] Applies only to installations which require planning permission.
[25] Applies only to installations which require planning permission.
[26] The 4MW of non-operational capacity is not included in the "operational" or "in development" capacity totals.

Figure 16. Community and locally owned renewable energy capacity in each stage of project development

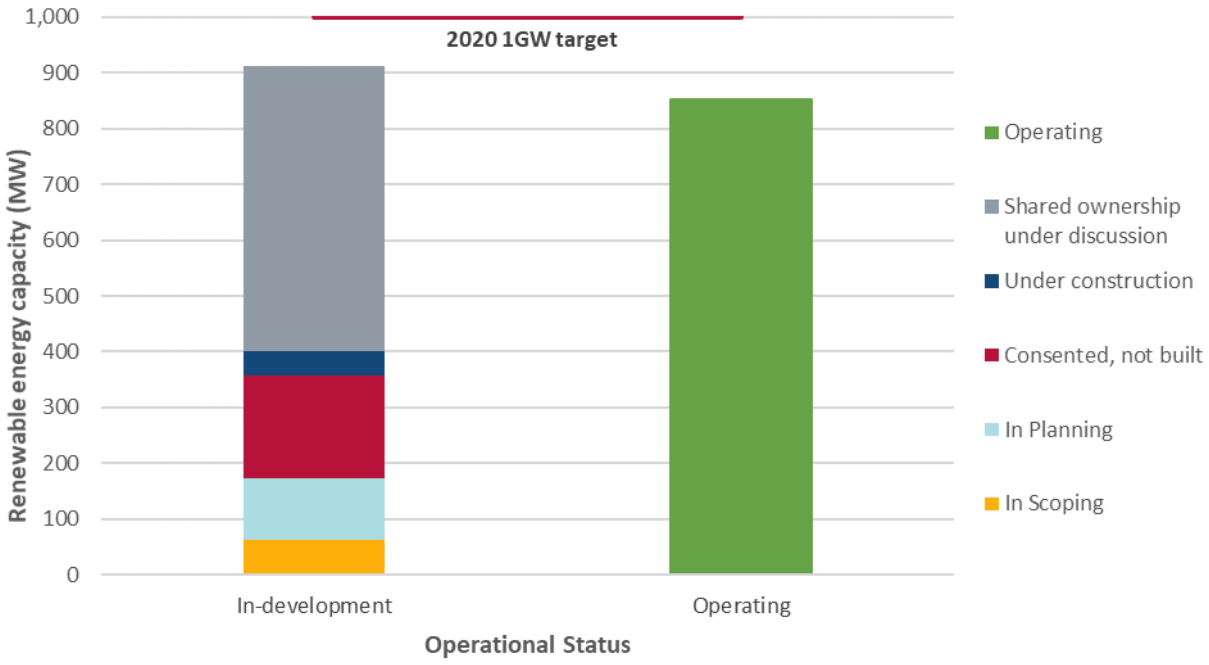


Table 6. Community and locally owned renewable energy capacity (MW) in each stage of development by technology[27]

Technology	In scoping	In planning	Consented, not built	Under construction	Shared ownership under discussion
Wind	21	77	78	12	509
Biomass	4	3	2	1	0
Heat pump	1	4	4	24	0
Solar PV	27	5	53	2	<1
Energy from waste	<1	0	29	0	<1
Hydroelectric	5	2	7	3	2
Solar thermal	<1	<1	<1	<1	0
Geothermal	4	0	0	<1	0
Tidal	<1	20	10	0	0
Total	**63**	**111**	**184**	**44**	**511**

[27] For ease of reading the 2MW of capacity classed under an unknown stage of development have been omitted from this table.

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.

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 information is included to better capture in-development community and locally owned energy as well as to indicate 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' through CARES engagement with local groups and developers.

As shared ownership agreements are finalised, those 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. We will continue to work closely with all groups involved to monitor the active shared ownership pipeline and the progress will be reported here annually.

At the end of December 2020, there were 115 unique projects recorded in the database with either shared ownership or where shared ownership is under discussion; out of which 54 were operational at the time of reporting. These operational projects accounted for 67MW of community and locally owned capacity between them. The remaining 61 projects were in various stages of development and account for 511MW of the in-development capacity.

Tables 7 and 8 show the breakdown of shared ownership projects in development split by ownership category and technology. The numbers recorded in the 'number of records' and 'number of projects' columns in Tables 7 and 8 are different because each 'community or local' owner (see Appendix 1 for ownership category descriptions) is recorded individually in the database. This is to allow for appropriate allocation of capacity between the ownership categories. 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 125 records in the database covering 115 unique projects.

Wind turbines make up the vast majority of the shared ownership operational capacity in operation (53MW) and under development (509MW).

Table 7. Number of records in the community and locally owned renewable energy database with shared ownership by ownership category and development status

Ownership category	Operational	In scoping	In planning	Consented, not built	Under construction	Shared ownership under discussion
Farm and estate	14	0	0	0	0	0
Local authority	2	0	1	0	0	0
Local business	1	0	0	1	0	0
Community	28	0	0	0	0	68
Housing association	12	1	0	0	0	0
Public sector and charity	1	0	0	0	0	0
Total	**54**	**1**	**1**	**1**	**0**	**68**

Table 8. Number of projects in the community and locally owned renewable energy database with shared ownership and where at least one of the owners is a community or local organisation

Development status	Number of projects
Operational	44
In scoping	1
In planning	1
Consented, not built	1
Under construction	0
Shared ownership under discussion	68
Total	**115**

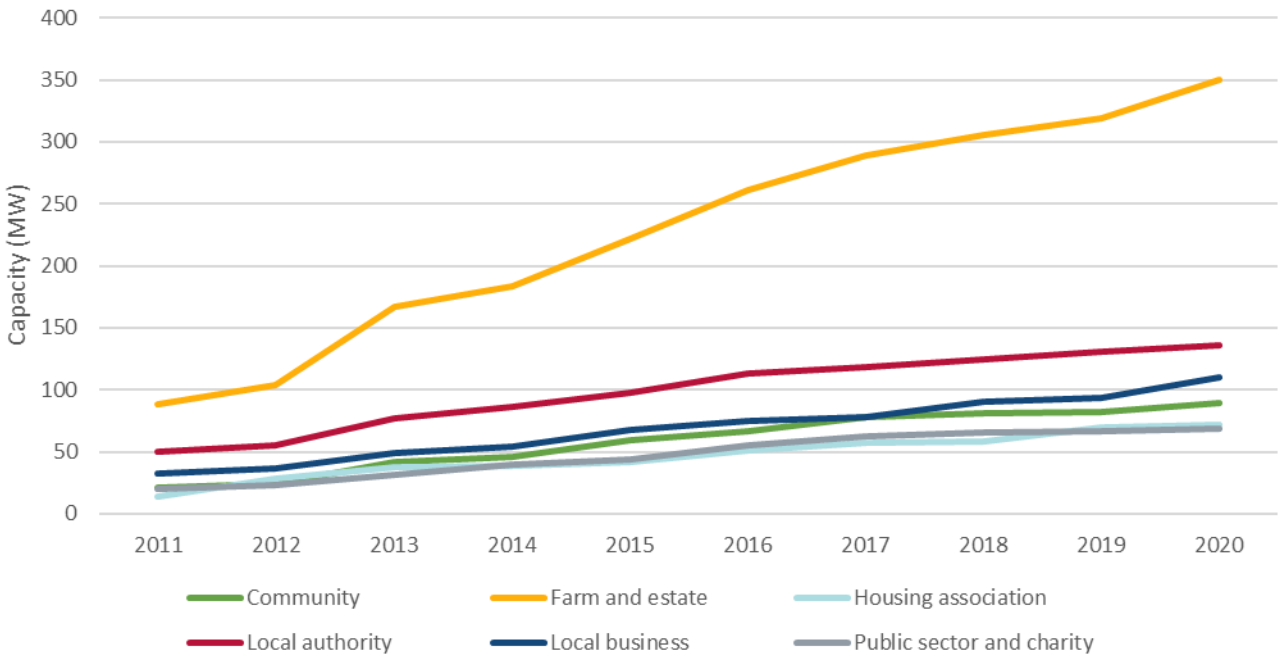
5.3. Progress towards the 1GW target

At the end of December 2020, which was the deadline date for having 1GW of operational community and locally owned renewable energy capacity, the Scottish Government has progressed to 85.3% of their goal. The original Scottish Government target, set in 2011, was to have 0.5GW of capacity in operation by 2020 and this was met in 2015. The 2020 target was subsequently doubled to 1GW by the Scottish Government. The 853MW of community and locally owned energy capacity in operation at the end of 2020 equates to 170.6% of the original 0.5GW target.

Since 2011, Energy Saving Trust has been helping the Scottish Government monitor progress towards this target by compiling the community and locally owned energy database and writing the accompanying report. During this time, valuable information has been gathered that provides an indication of the growth in community and locally owned renewable energy generation and the progression towards the 1GW target; this is shown in Figures 17, 18 and 19.[28]

Progress towards the 1GW target has been relatively steady across most ownership categories although there can be significant step changes in any given year should a small number of larger projects become operational or a significant shared ownership stake be secured.

Figure 17. Operational community and locally owned renewable energy capacity by ownership category from 2011 to 2020



Farms and estates have shown the greatest and most consistent annual growth in operational renewable energy capacity. A greater number of farms operating in Scotland in comparison to the number of organisations in the other ownership categories may be a significant factor but, as discussed earlier, this trend may also be due to farms and estates having more opportunities to utilise natural resources on land they own as well as opportunities to use the heat and electricity

[28] The totals visible on the graph for each year may differ slightly to the figures published in previous reports because of efforts to back date installations which were found in this reporting year but known to be operational in years previous.

generated on site. Both elements could help to improve the financial viability of any potential renewable energy installations.

Financial viability and the financial support available appear to be key drivers in the growth of renewable energy. Uptake of renewable energy capacity was highest between 2013 and 2016 which coincides with significant number of accreditations to the UK Government's RHI and Feed in Tariff (FiTs) schemes, which subsidised renewable heat and renewable electricity respectively. During this period, the scheme tariffs were at their highest, but have gradually decreased since then. In 2019 the FiT scheme closed to new applications, limiting the financial feasibility of potential new electricity generating installations. In 2020, the Smart Export Guarantee (SEG) scheme was launched by the UK Government which guarantees that small scale electricity exporters will be paid greater than £0.00 per unit exported to the grid, however, the financial returns from exports under SEG are lower than what they were under FiTs. The reduction, and temporary removal, of tariff subsidies for generated renewable energy is likely one of the most significant causes of the slowing uptake of new renewable capacity between 2016 and 2020.

The Scottish Government has maintained financial support for community and locally owned renewable energy throughout the last decade through various funding and support schemes, including:

- Community and Renewables Energy Scheme (CARES)
- Resource Efficient Scotland Small and Medium Enterprise Loan (RES SME loan)
- Low Carbon Infrastructure Transition Programme (LCITP)
- Energy Investment Funding (EIF)/Renewable Energy Investment Funding (REIF)

These programmes constitute some of the best data available on the growth in community and locally owned renewable energy in Scotland and the majority of installations funded through them can be found in our database (excluding any organisations not considered community or local organisations by the definitions set out in this report).

Figure 18. Number of operational renewable energy capacity installations by community, farm and estate, local business and public sector and charity ownership categories, from 2011 to 2020

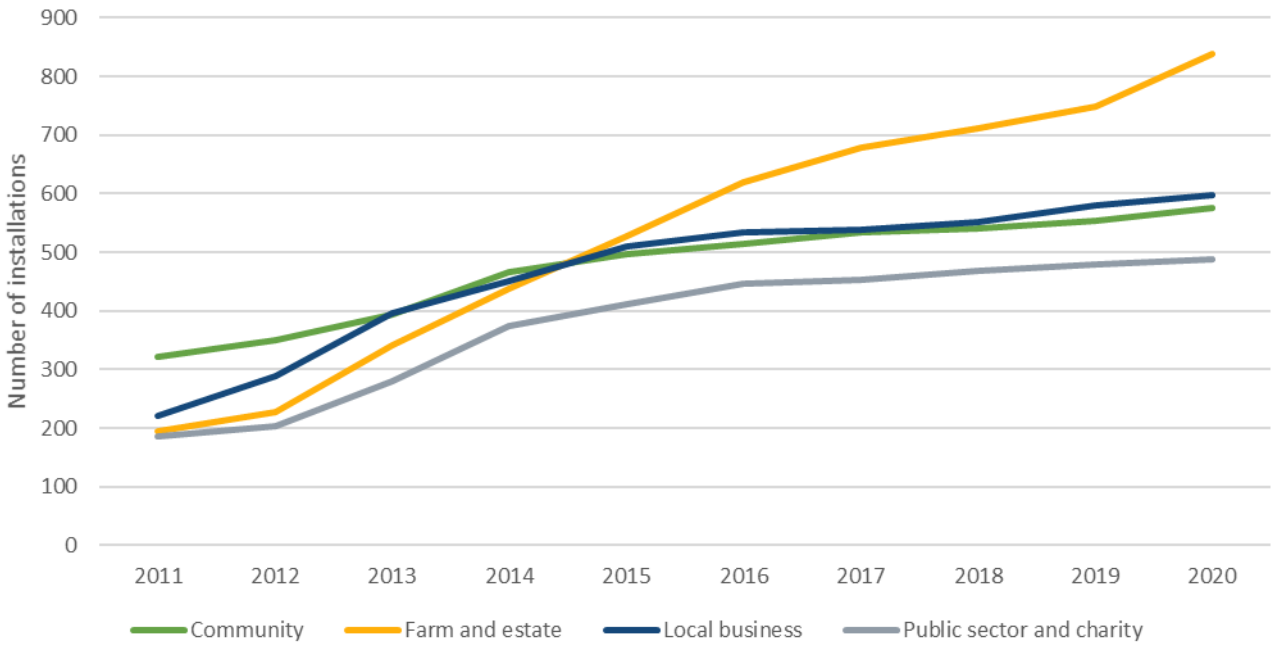
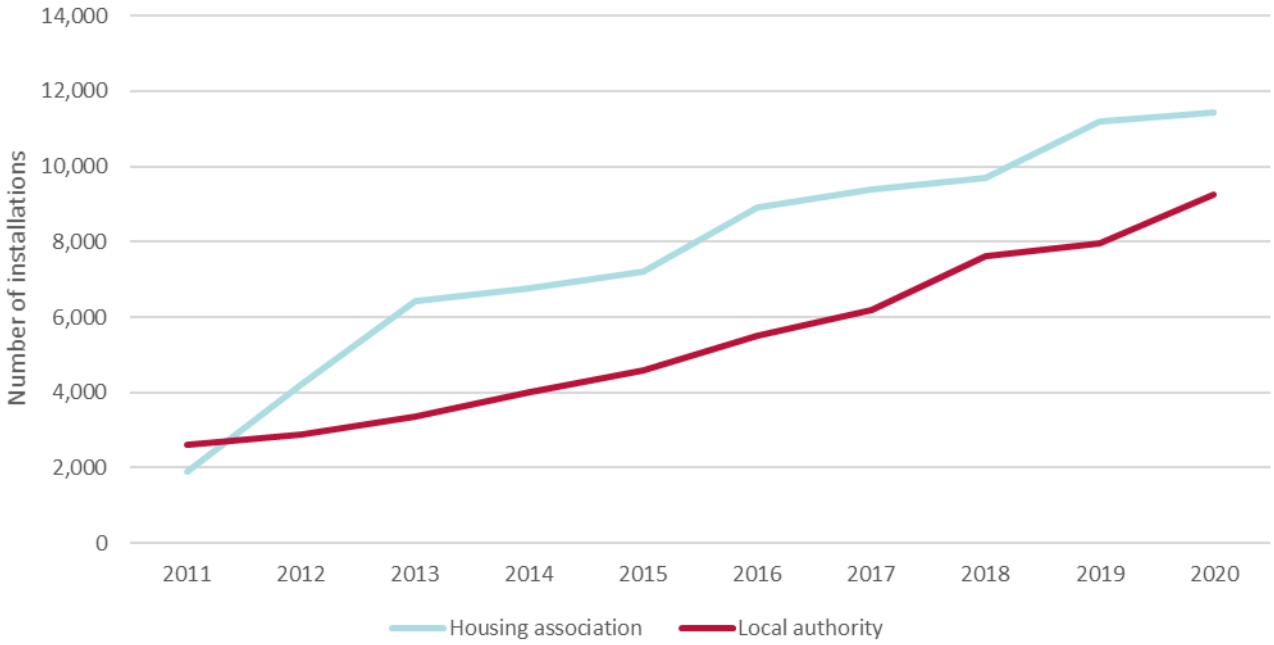


Figure 19. Number of operational renewable energy capacity installations by housing association and local authority ownership categories, from 2011 to 2020



The uptake of renewable energy installations are also encouraged through the minimum Energy Efficiency Standards for Social Housing (EESSH) regulations, enacted by the Scottish Government in 2014. These regulations stipulate that where feasible to do so, all social let properties should reach an EPC band of D or C (average energy efficiency or above) by 2020 and an EPC band B (high energy efficiency) by 2032. Whilst it may be possible to meet the 2020 standards in a large number of properties without installing renewable technologies, because an efficient fossil fuel heating system and good levels of insulation may be sufficient, installing renewable technologies is one way of reaching the minimum standards set. Renewable technologies are also very likely to be needed in most of the existing housing stock in order to meet the stricter 2032 standards. We expect to continue to see the steady uptake of renewable technologies in social housing over this timeframe.

5.4. Impact of the Covid-19 health emergency

Analysis of the publicly available RHI data for Scotland[29] shows that there was a significant decrease in the number of accreditations to the scheme around the time of the first national UK lockdown. During the months of May to August 2020, the number of accreditations to the domestic RHI scheme were roughly half what they were during the same months in 2019. This suggests that the number of small-scale renewable heat installations taking place had been impacted. However, the rest of the months in 2020 year showed similar, if not greater, amounts of accreditations than in 2019 leading to the total number of 2020 accreditations being only slightly less than those of 2019. The longer-term impact upon small scale installations has therefore not been significant on the figures reported here.

We carried out the same analysis on the public FiT register,[30] however, as the scheme closed in 2019 the number of accreditations was already decreasing it is therefore harder to discern any

[29] www.gov.uk/government/collections/renewable-heat-incentive-statistics
[30] cfr.ofgem.gov.uk/#/reports

potential impact from the health emergency. A small number of accreditations to the scheme did take place throughout 2020 suggesting that some work was still occurring. Ofgem recently announced that the FiT scheme would be extended by a further year, citing the health emergency, to give applicants who pre-registered with the scheme before it closed sufficient time to complete their accreditations. Thus, the risk of delay has been recognised by the scheme manager and further accreditations are likely to be forthcoming.

For larger scale installations, there is no significant data to draw conclusions from on the impact of the health emergency, however, our expectations are that projects would have continued wherever the organisations involved felt it safe, and where it was legal at the time to do so.

It is therefore very likely that the Covid-19 health emergency will have had some effect upon the figures presented in this report, however, we feel that the significance of this impact has been fairly limited.

6. Community and locally owned energy storage in 2020

6.1. Results for December 2020: energy storage capacity

At the end of December 2020, there was an estimated 9.1MWh of installed energy storage capacity in community or locally owned ownership in Scotland. This was spread over approximately 1,070 installations.

Of the 9.1MWh of energy storage capacity known to be installed there was an estimated:

- 2.1MWh of electrical storage capacity
- 5.6MWh of heat storage capacity
- 1.4MWh of hydrogen storage capacity

The growth in energy storage capacity since June 2019 was split between electrical storage (0.7MWh) and heat storage (0.5MWh). All of the new heat storage capacity was in local authority ownership and all of the 5.6MWh of currently operational heat storage is under local authority or housing association ownership. The new electrical storage capacity was shared between community organisations (0.1MWh) and housing associations (0.6MWh).

The community owned electrical storage includes 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.

6.2. Further energy storage capacity in development

In addition to the 9.1MWh of community and locally owned energy storage capacity estimated to be installed in Scotland at the end of December 2020, a further 0.6MWh was estimated to be in development. Of this 0.6MWh of energy storage capacity in development:

- 0.1MWh was under construction. This is all electricity storage capacity.
- 0.5MWh was in planning. This is all heat storage capacity.

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Appendix 1 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,[31] where the owner of the installation is in one of the following categories:

- A community group
- A local Scottish business[32]
- A farm or estate
- A local authority
- '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[33] in order to help communities and renewable energy developers negotiate appropriate levels of community benefit payment.

There is naturally some overlap between the different categories of owners. For example, some community groups have charitable status, as do many housing associations; and 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

[31] A full description of each eligible technology is given in Appendix 2.
[32] Note this excludes Scottish businesses whose purpose is to develop renewable energy projects when the installation is at a distance from their own properties or where ownership and management of the installation is provided as an energy service company (ESCO).
[33] www.localenergyscotland.org/view-the-register/

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,[34] and churches and other religious organisations.
- **Public bodies** are those listed in the National Public Bodies Directory,[35] including health bodies such as NHS health boards and public corporations such as Scottish Water. 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. This category also includes further or higher education establishments who are members of Association of Scotland's Colleges (ASC)[36] or Universities Scotland.[37]
- **Local Scottish businesses** are small or medium-sized enterprises (SMEs) registered with Companies House[38] at an address in Scotland. Businesses receiving funding through 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.[39]
- **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 normally resident on the estate where the installation is to be built. Farms and estates receiving funding through CARES 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.

[34] Leisure trusts supply sports facilities to local communities, often on behalf of unitary authorities.
[35] www.scotland.gov.uk/Topics/Government/public-bodies/about/Bodies
[36] www.scotlandscolleges.ac.uk/about-us/
[37] www.universities-scotland.ac.uk/
[38] www.companieshouse.gov.uk/
[39] 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.

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. For ease of reading, the capacity totals presented in this report are all given in gigawatts (GW). One gigawatt is equal to one thousand megawatts or one million kilowatts.

Combined heat and power units have figures for electrical capacity and heat capacity. Where such installations are recorded in the database, the total installed capacity in MW (MWe + MWth) is recorded. 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 or both) produced during a particular time. 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 accompanying report and is outlined below.

The data collection period was from June 2019 to December 2020. The data collection period covered 18 months instead of the usual 12 because the community and locally owned energy report series is moving to reporting on calendar years instead of the June to June reporting years used previously. This is to better align the community and locally owned energy report with other Scottish Government statistics and publications. The figures reported in this publication are correct as of 31 December 2020.

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 renewable energy 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 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 17 local authorities, representing a 53% 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 from all 32 local authorities.

- **Data from housing associations**

A survey was sent by email from the Scottish Federation of Housing Associations (SFHA) on behalf of Energy Saving Trust and the Scottish Government to all SFHA members. This survey asked about renewable technologies fully or partly owned by housing associations. Surveys were returned from 11 of the housing associations contacted.

- **Data from the Scottish domestic Energy Performance Certificate (EPC) register**

As the housing association and local authority surveys are voluntary, they are likely to provide an incomplete picture of renewable energy measures installed in social let properties. We have extracted a list of EPCs for all social let properties in Scotland, that had at least one renewable technology listed, for analysis. Please see the later ‘Operational capacity in social housing’ appendix section for more information.

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

The UK Department of Business, Energy and Industrial Strategy (BEIS) publishes the Renewable Energy Planning Database (REPD),[40] 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 0.01MWe (10kWe) 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 1MWe. 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 was collected from 18 of the 32 Scottish local authority planning portals for any planning application which involved a renewable technology being installed, and where the applicant could be confirmed to be a community or local organisation and the owner of said installation(s).

- **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

[40] www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract

recorded in the database from other sources, the data from Scottish Enterprise provided updates on key details such as operating status and capacity.

- **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[41] 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 or charity.
- Location, including local authority area, address, and a postcode and/or grid reference.
- Technology type.
- Number and installed capacity of the technologies installed.
- Operational status as at 31 December 2020 (operating/under construction/consented not built/in planning/in scoping/ non-operational), including where possible the date on which generation commenced for operational projects.
- Percentage ownership by the community or local organisation 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 and to better 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 publicly available information on these was found to contain either information captured elsewhere, insufficient detail for this project or were unavailable for access.

- Carbon Reduction Commitment (CRC) Energy Efficiency Scheme (administered in Scotland by the Scottish Environmental Protection Agency (SEPA) on behalf of BEIS).
- 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.

[41] www.communityenergyscotland.org.uk/

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 renewable energy 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 percentage community or local ownership share. The status of projects that were under development as of June 2019 has remained the same if no evidence has been found that the project has progressed as of 31 December 2020.

The quality of data provided varied considerably. In particular, installed capacity was often not provided, and operational status was sometimes unclear.[42] 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 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.

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 renewable energy 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 renewable energy installations are typically higher profile projects, and more likely to require planning permission, double-counting is most likely to occur for smaller capacity installations such as heat pumps and solar thermal panels, and are therefore less likely to significantly affect the overall figures.

[42] 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.

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

- **Information received from local authorities**

Due to the large numbers of different building types for which councils have responsibility (for example: 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. 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 SFHA sent an email survey on behalf of Energy Saving Trust and the Scottish Government to all members of the SFHA. 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. However, analysis of the Scottish domestic EPC register was conducted to get an idea of how many renewable energy installations in social housing may be missing from the collated surveys. Please see the later 'Operational capacity in social housing' appendix section for more information.

- **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 Energy Saving Trust contacted while compiling the database. This will be particularly true of farms and estates intending to install wind turbines or biomass systems, 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 >1MWe where the owner had applied for planning permission. This was supplemented by checks of a number of local authority planning portals directly for any applications made in the last two years which include the installation of a renewable energy technology. However, only a section of local authority planning portals could be checked in time for this report and therefore the figures presented here for installations in planning are likely to be an underestimate.

- **Projects in all stages of development**

Best efforts are made to identify the development status of the project upon initial entry into the database and this is often possible using the sources and methodology described above. However, after entry into the database there is no guarantee that there will be a subsequent update on the status of the project through any of the sources used. As a result, some projects can remain in an in-development limbo and recorded as in scoping, in planning, consented not built or under construction for a considerable, and perhaps unrealistic, amount of time. As such, we may be over-estimating the amount of renewable energy capacity in the various stages of development to some extent, although, this may be negated by the fact that some projects in development are likely to be missing from the database altogether due to the sources used.

- **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[43] which tends to hold information on larger scale energy storage systems. It is therefore highly likely that the energy storage 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.

Operational capacity in social housing

We have already discussed the operational capacity in local authority and housing association ownership which is primarily collected through surveys. The total number of housing association and local authority owned renewable energy installations currently held within our database is 20,000 (excluding any installations for energy storage). Limiting this count to the number of installations with a capacity of less than 45kW, to represent installations that could plausibly be domestic and to exclude those which are for non-domestic local authority and housing association properties, there were 19,450 potential domestic installations.

However, it was not clear until recently to what extent this collated information represented the full growth of renewable energy in social let properties. In order to address any potential limitations of the surveys, we have conducted analysis of the Scottish domestic EPC register to estimate the number of active EPCs on the register, i.e. those which are not historical or otherwise flagged not for use, that were for social let properties and had one or more renewable technologies listed.

This analysis has found that there are 20,670 EPCs for social let properties listing a minimum of 21,530 renewable energy installations. Subtracting our own collected data, that leaves 2,030 previously unaccounted for renewable energy installations. Unfortunately, the EPC data rarely gives an indication of the capacity of the system, so we have multiplied the number of each technology found from the EPC data by our assumed capacities for each technology in domestic settings (please see Appendix 4 for more information on these assumptions). The result was that these 2,030 newly found installations are estimated to add a further 25MW of operational capacity to the reported totals.

There are, however, some potential issues with this analysis worth exploring to put the reported figures in best context:

- Domestic EPCs indicate the tenancy of the property as owner occupied, private rented or social rented. The social rented classification on a domestic EPC does not distinguish whether the social landlord is a local authority or a housing association, and we are therefore unable to breakdown this 25MW of operational capacity into the exact community or local ownership categories used in this report.
- Some of the older EPCs may no longer be up to date and there is a risk that some of the social housing with renewable technologies installed are now in private ownership or demolished or the renewable energy installation has been decommissioned. Hence, there may be some degree of overcounting.
- We have not been able to verify the installation totals derived from the EPC register data by cross-checking them against any other datasets, including our community and locally owned renewable energy database. Therefore, there may be a risk of some double counting occurring.
- As we are assuming the capacity of the renewable installations found on the EPCs using the average capacities of installations known to us through the local authority and housing

[43] www.energystorageexchange.org/

association surveys, we are therefore assuming that the installations from the domestic EPC analysis are similar to those collected through the surveys.

- The domestic EPCs list each renewable technology present but do not give an indication of how many installations of each technology there may be within a property. We have therefore assumed that there is only one of each technology listed on an EPC in the premises, however, in a small number of cases this may be incorrect.

We will continue to refine this methodology over the next reporting year to better integrate the undetermined social housing figures within the community and locally owned energy database and accompanying report.

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

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.[45] 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.

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 by using other assumptions as given below. A note of the values assumed for capacity is given in Appendix 4.

[44] fintrydt.org.uk/about/
[45] energy4all.co.uk/

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 9.

Table 9. Assumptions used to estimate capacity of solar thermal and solar PV panels from array size

Technology	Value used	Unit	Information source
Solar PV	0.7	kWp/m^2	Solar Trade Association
Solar thermal	0.14	$kWth/m^2$	Energy Saving Trust Solar Energy Calculator tool assumptions[46]

Annual energy output

The assumptions used to estimate yearly output in MWh of energy from community and locally owned renewable energy sources, where the output was is unknown, are given in table 10.

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

Total installed capacity (kW) multiplied by estimate of output per kW of capacity (kWh/kW/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).

[46] Scottish average calculated using data from: www.pvfitcalculator.energysavingtrust.org.uk/

Table 10. Assumptions used to estimate annual energy output

Technology	Assumption	Value used	Unit	Information source
Solar PV	Annual energy output per m^2	441	kWh/m^2/year	Derived from MCS calculations recreated using Energy Saving Trust standard assumptions for occupancy and panel size
Solar thermal	Annual energy output per m^2	111	kWh/m^2/year	Energy Saving Trust Solar Energy Calculator tool assumptions[47]
Wind	Annual peak load for small (<=10kWe) wind turbines	1,664	Hours/year	Energy Saving Trust field trial of domestic small-scale wind turbines
Wind	Annual peak load for large (>=10kWe) wind turbines	2,365	Hours/year	Scottish Renewables
Hydroelectric	Annual peak load	3,500	Hours/year	Various[48]
Anaerobic digestion	Annual peak loads for electricity generation	5,203	Hours/year	Digest of UK Energy Statistics (DUKES)[49]
Biomass	Annual peak loads	Not disclosed[50]	Hours/year	Analysis of unpublished non-domestic RHI data
Heat pumps	Annual peak loads	Not disclosed	Hours/year	Analysis of unpublished non-domestic RHI data
Tidal	Annual peak loads	3,066	Hours/year	Scottish Renewables

[47] Scottish average calculated using data from: www.pvfitcalculator.energysavingtrust.org.uk/

[48] 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), 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, 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.

[49] www.gov.uk/government/statistics/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes

[50] We have not disclosed the biomass or heat pump running hours assumptions used in this iteration of the report because they have been calculated from unpublished non-domestic RHI data provided by BEIS for the Renewable Heat in Scotland Report. www.energysavingtrust.org.uk/report/renewable-heat-in-scotland-2019

Appendix 2 Individual technology descriptions

The following renewable technologies have been included in the database:

- **Wind**

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.

- **Hydroelectric**

A flow of water falling from a higher altitude to a lower altitude (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 woodfuel, such as wood chips, pellets or logs, or other plant matter including straw and energy crops. 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 be waste material with an organic component, such as municipal waste, but in such cases the installation would be classed as EfW.

- **Solar thermal panels**

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

- **Heat pumps**

Technologies to extract low-grade heat from the external environment (the ground, air or a 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**

CHP 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.

- **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.

- **Pumped Hydroelectric storage**

Water can be pumped up to a higher elevation and then allowed to flow downwards at times of high electrical demand. The water is used to drive a turbine which generates electricity as per other hydroelectric installations which do not have pumped storage capabilities.

Appendix 3 List of main data sets used

Table 11 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 11. Main datasets used

Organisation(s) contacted/providing data	Dataset(s)	Ownership category
Local Energy Scotland, on behalf of the Scottish Government	Community and Renewable Energy Scheme (CARES); Local Energy Challenge Fund (LECF)	Communities; farms and estates; local businesses[51]
Energy Saving Trust, on behalf of the Scottish Government	District Heating Loan Fund (DHLF); Scottish EPC register	Local authorities; housing associations;[52] communities;[53] farms and estates; local businesses
Resource Efficient Scotland, on behalf of the Scottish Government	Resource Efficient Scotland Small and Medium-sized enterprise loan	Local businesses
Scottish Forestry (previously Forestry Commission Scotland)	Wind and hydroelectric schemes on the National Forest Estate (publicly available information)	Communities; public sector and other charities; farms and estates; local businesses
NHS National Services Scotland	Operational renewable energy installations on the NHS Scotland estate	Public sector and other charities
Individual local authorities via survey	Responses to an Energy Saving Trust email survey	Local authorities
Individual housing associations via SFHA	Responses to an SFHA email survey	Housing associations
Eunomia, on behalf of BEIS	Extract from the Renewable Energy Planning Database (REPD)	Local authorities; housing associations; communities; public sector and other charities; local businesses; farms and estates
Ofgem	Renewables and CHP register (publicly available)	Public sector and charities; communities; local businesses; farms and estates
Scottish Enterprise, on behalf of the Scottish Government	Energy Investment Fund (EIF) and Renewable Energy Investment Fund (REIF)	Communities
The Scottish Government	Low Carbon Infrastructure Transition Programme (LCITP)	Communities; local authorities; public sector and other charities

[51] Local businesses must also be rural businesses to be eligible for CARES funding.
[52] The district heating loans fund is also open to other registered social landlords.
[53] Communities must be legally constituted community groups to apply for the district heating loans fund.

Scottish Water	Renewable installations owned by Scottish Water	Public sector and other charities
Local authorities, collected by Energy Saving Trust	Planning applications on local authority planning portals which include renewables	Local authorities; housing associations; farms and estates; local businesses; public sector and other charities; communities

Appendix 4 Capacities assumed for individual installations where not known

Table 12 shows the assumed capacities that were used in the community and locally owned renewable energy database where information on capacity was not available.

Table 12. Assumptions for capacity by technology and building type (where the capacity was not known)

Ownership category	Building type	Technology	Assumed capacity (kW)	Source
Community	All non-domestic	Air source heat pump	16	Average of known community air source heat pump capacities held in the database
	N/A	Hydroelectric	285	Average of known community hydroelectric capacities held in the database
	All non-domestic (excluding district heating)	Biomass	60	Average of known community biomass installations recorded in the database
	District heating	Biomass	175	Average of known community district heating biomass installations recorded in the database
	All non-domestic	Solar PV	23	Average of known community solar PV capacities held in the database
	All non-domestic	Solar thermal	6	Average of known community solar thermal capacities held in the database

	All non-domestic	Wind	6	Average of known community wind capacities held in the database[54]
Farm and estate	All non-domestic (including heat networks)	Biomass	233	Average of known farm and estate biomass capacities held in the database
	N/A	Hydroelectric	9	Average of known farm and estate hydroelectric capacities held in the database
	All non-domestic	Solar PV	8	Average of known farm and estate solar PV capacities held in the database
	N/A	Wind	133	Average of known farm and estate wind capacities held in the database
Local authority	All non-domestic (except schools)	Air source heat pump	10	Average of known local authority non-domestic heat pump capacities held in the database
	School	Air source heat pump	62	Average of known local authority school air source heat pump capacities held in the database
	All non-domestic (except schools)	Biomass	168	Average of known local authority non-domestic biomass capacities held in the database

[54] 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 800kW and over), effort has been made to determine the exact size of each installation for non-grant funded community wind projects.

	School	Biomass	239	Average of known local authority school biomass capacities held in the database
	Schools	Solar PV	11	Average of known school solar PV capacities held in the database
	Schools	Solar thermal	7	Average of known school solar thermal capacities held in the database
	Schools	Wind	6	Average of known school wind capacities held in the database
Local authority and housing association	Domestic properties	Heat pump	8	Average of known local authority and housing association domestic heat pump capacities held in the database
	Domestic	Solar thermal installed between 2012 and 2014	2.45	Analysis of Energy Saving Scotland home renewables grants[55]
	Domestic	Solar thermal installed between 2014 and 2020	2.8	Analysis of Energy Saving Scotland home renewables loans paid in 2014[56]
	Domestic	Solar PV installed in 2011 or 2012	2.8	Analysis of installations registered for FITs in Scotland[57]
	Domestic	Solar PV installed in 2013	3.6	Analysis of installations registered for FITs in Scotland[58]

[55] Energy Saving Scotland home renewables grants (no longer available) were grants for domestic renewables, administered by Energy Saving Trust on behalf of the Scottish Government.
[56] Energy Saving Scotland home renewables loans are loans for domestic renewables, administered by Energy Saving Trust on behalf of the Scottish Government.
[57] Central FITs register, Ofgem. www.renewablesandchp.ofgem.gov.uk/
[58] Central FITs register, Ofgem. www.renewablesandchp.ofgem.gov.uk/

	Domestic	Solar PV installed between 2014 and 2017	4	Analysis of installations registered for FITs in Scotland[59]
	Domestic	Solar PV installed in 2018 or 2019	4.5	Analysis of installations registered for FITs in Scotland[60]
	Domestic	Solar PV installed in 2020	4	Analysis of installations registered for FITs in Scotland[61]
Local business	All non-domestic	Air source heat pumps	19	Average of known local business air source heat pump capacities held in the database
	All non-domestic	Ground source heat pumps	30	Average of known local business ground source heat pump capacities held in the database
	All non-domestic	Biomass	190	Average of known local business biomass capacities held in the database
Public sector and charity	All non-domestic (excluding hospitals)	Biomass	110	Average of known public sector and other charity biomass capacities held in the database
	Large hospitals	Biomass	1,400	Average of known large hospital biomass capacities held in the database
	Small hospitals and other health centres	Biomass	200	Average of known small hospital and other health centre biomass capacities held in the database

[59] Central FITs register, Ofgem. www.renewablesandchp.ofgem.gov.uk/
[60] Central FITs register, Ofgem. www.renewablesandchp.ofgem.gov.uk/
[61] Central FITs register, Ofgem. www.renewablesandchp.ofgem.gov.uk/

Public sector and charity; local authority; community	Public buildings[62]	Ground source heat pump	34	Average of known public building ground source heat pump capacities held in the database

[62] Includes community halls, sports and leisure centres, museums, places of worship, and other buildings open for public use.