

Energy Footprint Tool 2019-21

*Results and understanding concerning the carbon
footprint for church energy use*

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Energy Footprint Tool Background

At General Synod in July 2018 there was a proposal to develop an Energy Footprint Tool for churches. A motion including this proposal was passed in February 2019. By this time a preliminary model had been successfully piloted in Truro Diocese, based on previous experience of online data collection in the Diocese of London. This tool would allow churches around the country to find out the 'carbon footprint' of their energy use, and allow them to track progress as they took action.

The Research and Statistics team offered to develop such a tool, linked in with the existing online data entry system. This would offer familiarity to those adding their church's data and ensure that wherever possible existing data could be used from other sources, to save asking for the same information twice. Funding was granted, and the Research and Statistics team started working with Brian Cuthbertson and Enid Barron from the Diocese of London to learn from their experience. Thus, the Energy Footprint Tool was born.

A prototype was swiftly created and presented at a fringe meeting at General Synod in July 2019, and subsequently at Diocesan Statistics Days run by the Research and Statistics team, in order to attain feedback on the tool. This feedback was used to develop the first live version.

In December 2019, the tool was successfully piloted in four further dioceses (Manchester, Norwich, Oxford and Rochester). This pilot led to almost 500 churches using the tool and 200 submitting their energy data. Half of those that submitted their energy data provided feedback on the tool.

In February 2020, General Synod formally recognised the climate emergency and set a target for all parts of the Church to plan towards net zero carbon by 2030. The priority of being able to accurately measure our start point, as a first step in making radical reductions, became much higher.

Based on the feedback from the pilot, changes were implemented, and we were able to officially open the tool for 2019 data collection in April 2020. Before we closed the tool in October 2020 to undertake our analysis, much happened in that six months: National press coverage, a wonderful video tutorial created by the Diocese of Manchester, and of course, a global pandemic and national lockdown.

It is with thanks to all of our diocesan colleagues and those who work and volunteer in our churches that we are able to present this report with such an impressive response rate, especially given the incredibly difficult circumstances everyone has faced in 2020.

We are aware that some dioceses are already using data from the Energy Footprint Tool to engage with their churches and to offer more targeted support to those who need it.

With General Synod setting a target of 2030 to reach net zero emissions, in 2021 the Energy Footprint Tool will become the first tool in a new Church of England Energy Toolkit, which will continue its work measuring the carbon footprint of church buildings and halls, but also start to measure other buildings (e.g. cathedrals, clergy housing, diocesan offices, education institutions).

Summary – what we have learned from the first year of the EFT

Carbon Footprints

- It is estimated that the total net carbon footprint for the Church of England's church buildings (based on energy use alone) is around 185,000 tonnes of greenhouse gases, measured in tonnes of carbon dioxide equivalent or tCO₂e.
 - This consists of 163,000 tonnes from church buildings alone (based on 44,000 tonnes recorded in the Energy Footprint Tool). An additional 22,500 tonnes is estimated for church halls and "other church buildings" (based on 3,400 tonnes recorded in the Energy Footprint Tool)
- This figure is 12.5% smaller than the comparable figure given by the Church of England carbon management project for 2006.

Church size, location and usage

- The size of the church building has a large impact on its carbon footprint: generally, the larger the church means the larger carbon footprint.
- The top 13% of church buildings by size account for almost a third of the carbon footprint for all churches.
- Churches in urban parishes have a much larger carbon footprint than those in rural parishes.
- Church usage also has a large impact on its carbon footprint: the higher usage of the buildings means the larger the carbon footprint.
- Large-sized churches and urban churches were more likely to be classified as 'high usage'.

Energy Types

- The most common types of energy used in church buildings are electricity (34%) and a mixture of electricity and gas (45%).
- A mixture of electricity and gas was the energy type associated with the largest average carbon footprint, though this was also the most common energy type used by urban, large-sized and high-usage buildings.
- Electricity alone was the energy type associated with the smallest average carbon footprint, though this was also the most common energy type used by rural, small-sized and low-usage buildings.
- 5% of churches had net zero carbon, with 99% of these having a renewable electricity tariff.
- If all electricity-using churches switched to a renewable tariff, the estimated total net carbon footprint for church buildings would be around 22% smaller (36,000 tonnes).
- 1% of churches were using on-site solar panels, while fewer than 1% of churches were using wood chips, pellets, or alternative heating technologies.

Responses

- 5,900 (38%) churches engaged with the Energy Footprint Tool in its first year.
- 4,300 (28%) churches submitted useable data, with 700 of them also providing data for an "other building" (e.g. church hall).

Contents

Energy Footprint Tool Background.....	3
Summary – what we have learned from the first year of the EFT.....	4
Response Rates	6
Nationally.....	6
Data Collection Timeline.....	6
Diocesan Breakdown	7
National Carbon Footprints of Church Buildings.....	8
Carbon Footprint of Churches.....	8
Carbon Footprint of “Other Church Buildings”	8
Comparisons with Previous Reports	9
Diocesan Net Carbon Footprint for church buildings.....	10
Further Analyses	11
Church Building Size.....	11
Urban vs Rural Churches.....	12
Church Usage.....	13
Types of Energy.....	14
Net Zero Carbon Churches and Renewables.....	14
Changes for Energy Footprint Tool 2020.....	15

Response Rates

Nationally

In the first year of the Energy Footprint Tool, collecting 2019 data, 5,900 churches (38%) engaged with the tool, 4,700 (30%) of which submitted their data.

Of the 4,700 that submitted their data, 300 (6%) could not be used in this analysis as the returns offered no data (for example, they would state that the church used electricity and gas but then write “unknown” for both kWh and annual cost of energy). This left 4,300 churches with usable data (28% of all churches).

Of the 4,300 churches with usable data, 700 (16%) suggested that they had an extra building to enter data for, however only 400 (9%) of these supplied energy data for the “other building”.

Table 1 shows a breakdown of response rates across dioceses. It should be noted that the Diocese of St. Albans has a response rate of 0. This is because the Energy Footprint Tool is housed within the national Online Parish Returns System, and the Diocese of St. Albans does not use this system. An alternative method for collecting their data was offered to the diocese of St. Albans, while it was not utilised in time for 2019 data collection, we hope this will be used to collect future data.

Data Collection Timeline

The Energy Footprint Tool officially went live in April 2020 and data collection ran until early October 2020.

Throughout this period, many dioceses made concerted efforts to contact churches and encourage take up of the EFT, which will have helped response rates in addition to national efforts. Figure 1 shows the cumulative number of responses achieved weekly during this period.

Important dates to note include:

- Weeks 4 & 20: Article within the Parish Buying Newsletter.
- Week 16: The closing date for 2019 parish finance returns, also collected using the Online Parish Returns System.
- Week 19: National Press Release
- Week 22: An e-mail to all churches on the Online Parish Returns System that had not yet submitted their Energy Footprint Tool Returns.

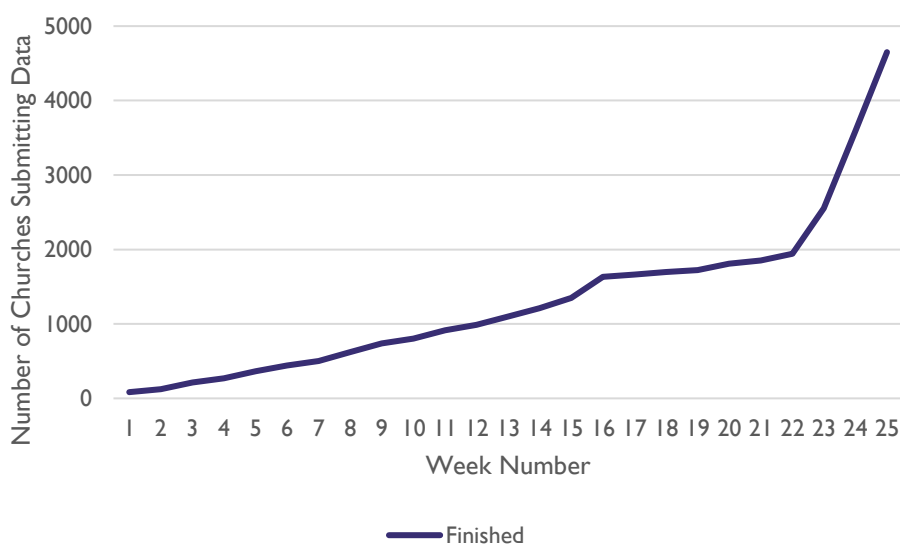


Figure 1. The number of churches submitting their Energy Footprint Tool data over time.

Diocesan Breakdown

Table 1: *Diocesan Breakdown of Response Rates across dioceses.*

Code	Diocese	Total Number of Churches	% Engaged	% Submitted
1	Bath & Wells	559	36	26
2	Birmingham	184	48	34
3	Blackburn	271	31	22
5	Bristol	201	58	50
6	Canterbury	360	45	33
7	Carlisle	330	38	31
8	Chelmsford	576	19	15
9	Chester	342	28	22
10	Chichester	475	51	36
11	Coventry	242	50	39
12	Derby	313	36	22
13	Durham	264	38	25
14	Ely	328	38	27
15	Exeter	595	36	27
16	Gloucester	381	51	39
17	Guildford	211	41	22
18	Hereford	402	38	26
19	Leicester	311	35	24
20	Lichfield	544	17	11
21	Lincoln	625	37	30
22	Liverpool	236	31	26
23	London	475	56	41
24	Manchester	316	43	26
25	Newcastle	238	49	39
26	Norwich	640	27	18
27	Oxford	811	35	23
28	Peterborough	379	32	23
29	Portsmouth	167	36	23
31	Rochester	259	44	30
32	St. Albans	407	0	0
33	St. Edms & Ipswich	479	27	19
34	Salisbury	566	39	29
35	Sheffield	208	39	35
36	Sodor & Man	39	67	56
37	Southwark	355	37	24
38	Southwell & Nottingham	296	39	29
39	Truro	301	52	43
41	Winchester	357	39	24
42	Worcester	274	60	48
43	York	582	34	23
46	Leeds	597	64	53
	Nationally	15,496	38	28

National Carbon Footprints of Church Buildings

Carbon Footprint of Churches

The 4,300 churches whose data were used from the Energy Footprint Tool had a total of 43,700 tonnes of net CO₂e. Of this selection, 200 (5%) had net zero carbon (or lower), 99% of these were churches using a 100% renewable electricity tariff.

An estimation process was used to account for the carbon footprints of churches from which we did not receive data. This process estimated carbon footprints based on a variety of factors, including diocese, building size, whether the church was rural or urban. Using this methodology, based on the data we hold from the Energy Footprint Tool, it is estimated that the total net CO₂e emitted from Church of England church buildings is around 163,000 tonnes (with around 169,000 tonnes gross CO₂e).

A diocesan breakdown of the carbon footprints within the Energy Footprint Tool data, as well as the estimated total net and gross carbon footprints for just church buildings can be found in Table 2.

Carbon Footprint of “Other Church Buildings”

As mentioned previously, 400 churches supplied data for “other buildings”. It should be mentioned that in some cases, where church buildings and an “other building” share the same meter, these “other buildings” will already be incorporated into the church building figure.

Of the 400 other buildings, a total of 3,400 tonnes of net CO₂e (3,600 gross tonnes CO₂e) was emitted. 20 buildings (5%) had net zero carbon or less.

To give a meaningful estimate for church halls and other buildings, we need to also account for the 300 churches that stated they had an “other building” but did not provide data for it. When accounting for these, it is suggested that of the 4,300 churches that supplied data, it is estimated that “other buildings” account for 6,000 tonnes of net CO₂e (6,300 gross tonnes CO₂e).

Based on this data, it would suggest that the total footprint for church halls and other buildings would be around 22,500 tonnes of net CO₂e (24,000 gross tonnes CO₂e).

This is currently the best estimate that we can make for the carbon footprint of “other buildings”, the number of church halls nationally is not known, so therefore this national estimate is less reliable than that of the church buildings, where the total number and most building sizes are known.

Comparisons with Previous Reports

The information provided on the church buildings and “other church buildings” would suggest that the total net CO₂e footprint for both nationally would be around 185,000 tonnes CO₂e. Figure 2 highlights how this compares to previous audits.

- The Church of England carbon management project¹ estimated the total footprint (both net and gross CO₂e) for the Church of England church buildings and halls to be 212,000 tonnes for 2006.
- The Energy Audit Report 2012/13² estimated the total footprint for Church of England church buildings alone to be between 237,000 tonnes and 395,000 tonnes, with church halls estimated to be between 6,000 and 11,000 additional tonnes.

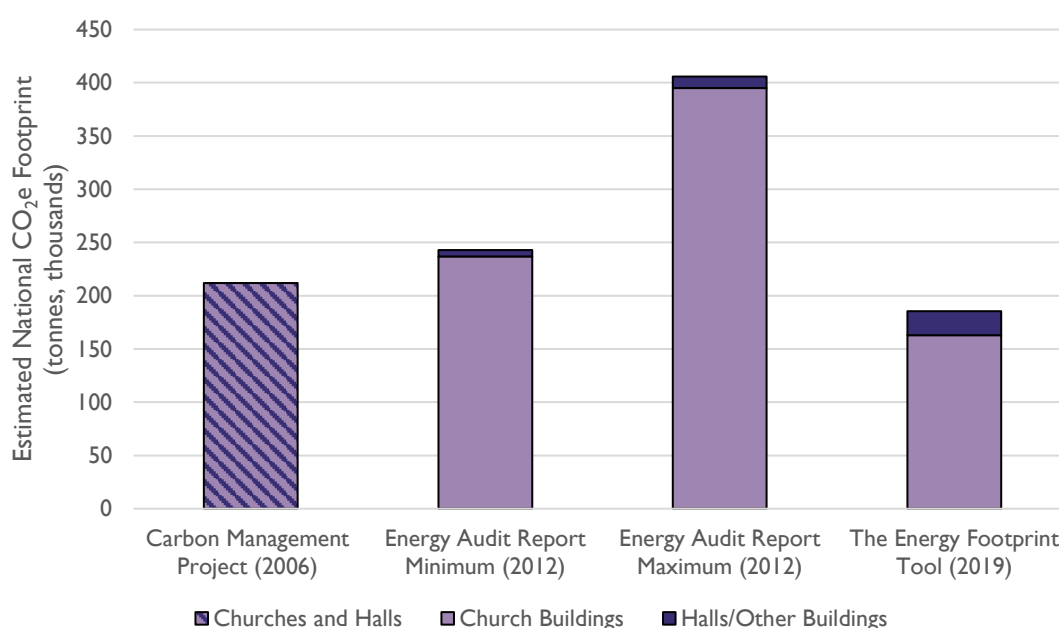


Figure 2. Estimates for the total carbon footprint of church buildings in the Church of England, compared with previous estimates.

Comparing findings from the Energy Footprint Tool to these previous reports would suggest that there has already been a decrease in the overall carbon footprint between in the lead up to 2019 (12.5% drop from 2006, a 24% drop from the minimum value in 2012 and a 54% drop from the maximum value in 2012). However, any comparisons made with the 2012 report are not likely to be robust as there are methodological issues with the data collection and estimation. For example, the estimate in the 2012/13 report was calculated with a base of just 78 churches. One example of why this is an issue can be seen with church halls and “other buildings”. Around 10% of the 78 churches mentioned a church hall or other building in the 2012/13 audit, which led to estimating that 10% of all churches possessed an “other building” – a very small sample to make a large conclusion. Even our sample of 4,300 would suggest that 16% of churches possessed a hall or “other building”, explaining why our figure for church halls in the Energy Footprint Tool presented in this report is so much larger. Until the total number of church halls and “other buildings” is known, the reliability of national estimates for these buildings will always be conjectural.

¹ Church of England carbon management project implementation plan, conducted by Faber Maunsell (2007)

² Energy Audit Report 2012/13, written by Kate Symonds as part of the Shrinking the Footprint Energy Audit. Available from https://www.churchofengland.org/sites/default/files/2018-11/CCB_Energy-Audit-Report-2012-13_Sep-2013.pdf

Diocesan Net Carbon Footprint for church buildings

Table 2: Net carbon footprints for church buildings' energy usage, calculated from EFT data and a total estimated net and gross carbon footprint by Diocese.

Code	Diocese	% Complete	EFT Footprint (Tonnes CO2)	CO2 Per Church (Tonnes)	Total Estimated Net CO2 (Tonnes)	Total Estimated Gross CO2 (Tonnes)
1	Bath & Wells	27	800	5.25	3,300	3,400
2	Birmingham	35	900	14.00	2,800	2,900
3	Blackburn	22	900	15.25	4,200	4,300
5	Bristol	50	1,200	12.39	2,500	2,700
6	Canterbury	33	1,000	8.36	2,900	3,000
7	Carlisle	31	800	7.80	2,700	2,800
8	Chelmsford	15	600	7.04	5,000	5,400
9	Chester	22	1,300	16.68	5,600	5,700
10	Chichester	36	1,800	10.78	5,700	5,800
11	Coventry	39	900	9.76	2,500	2,600
12	Derby	22	700	10.43	3,400	3,600
13	Durham	25	800	12.11	3,600	3,700
14	Ely	28	600	6.53	2,400	2,400
15	Exeter	27	1,200	7.29	5,000	5,200
16	Gloucester	39	1,000	6.83	2,600	2,700
17	Guildford	22	800	17.28	3,700	4,100
18	Hereford	26	400	3.86	1,800	1,800
19	Leicester	24	500	6.92	2,900	3,000
20	Lichfield	11	600	8.98	7,300	7,500
21	Lincoln	30	1,000	5.17	2,800	2,800
22	Liverpool	26	900	15.24	3,800	3,900
23	London	41	4,900	25.29	12,200	12,600
24	Manchester	26	1,400	16.65	5,500	5,600
25	Newcastle	40	1,000	10.41	2,500	2,500
26	Norwich	18	500	4.49	3,100	3,200
27	Oxford	23	1,600	8.67	7,300	7,700
28	Peterborough	23	500	6.06	2,600	2,700
29	Portsmouth	23	400	9.28	2,000	2,100
31	Rochester	30	900	11.81	3,200	3,300
32	St. Albans	0	N/A	N/A	4,900	5,200
33	St. Edms & Ips	19	300	2.85	1,900	2,100
34	Salisbury	29	1,300	7.57	4,600	4,700
35	Sheffield	35	1,100	15.41	3,100	3,300
36	Sodor & Man	56	200	8.77	300	300
37	Southwark	24	1,700	20.28	7,700	7,900
38	Southwell & Notts	29	900	10.82	3,400	3,500
39	Truro	43	700	5.43	1,600	1,700
41	Winchester	24	800	9.77	4,200	4,500
42	Worcester	48	1,400	10.83	2,800	2,900
43	York	23	1,000	7.98	5,500	5,600
46	Leeds	53	4,400	13.87	8,300	8,500
	Nationally	28	43,700	10.23	163,200	169,200

The very wide variation leads naturally on to a consideration of what drives these differences; the size of the church, the usage hours, urban/rural location, the fuel type (electricity, gas, and oil), and the % that are using renewables.

Further Analyses

Church Building Size

For the purpose of this analysis, a small church has been defined as under 250m², a large church as over 650m² and a medium-sized church as between those two figures.

As can be seen in Figure 3, there are unsurprisingly statistically significant differences in the average carbon footprint between the building sizes. The average carbon footprint of a small church is around 3 tonnes, a medium-sized church is around 10 tonnes and the average large church is around 25 tonnes. This is to be expected, since most churches use space-heating and a larger volume of air takes far more energy to heat than a smaller one.

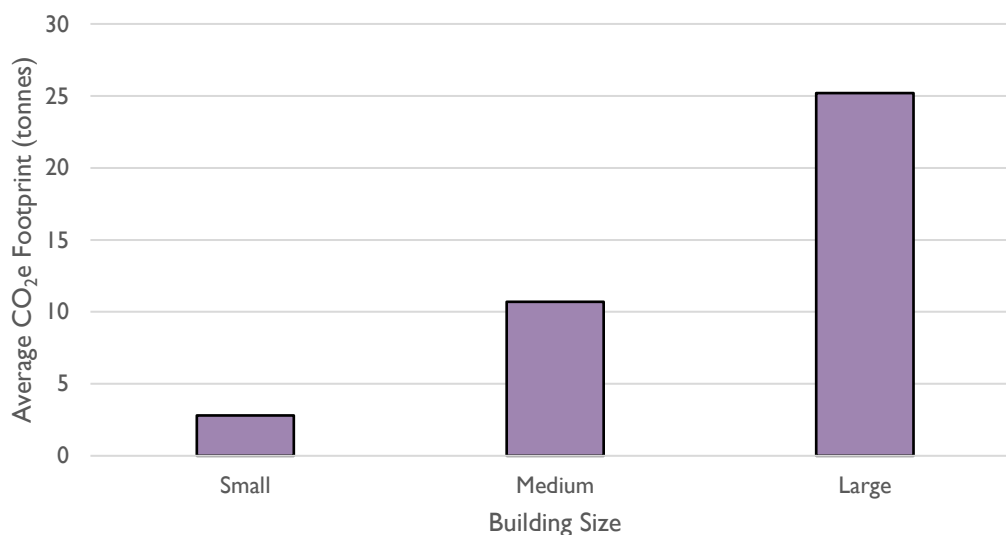


Figure 3. The average carbon footprint in the Church of England by building size

The amount each building size category contributed to the total carbon footprint of church buildings within the Church of England can be seen in Figure 4. This shows that small churches account for 7% of the total footprint, medium-sized churches account for 65%, and large churches account for 32% of the total footprint.

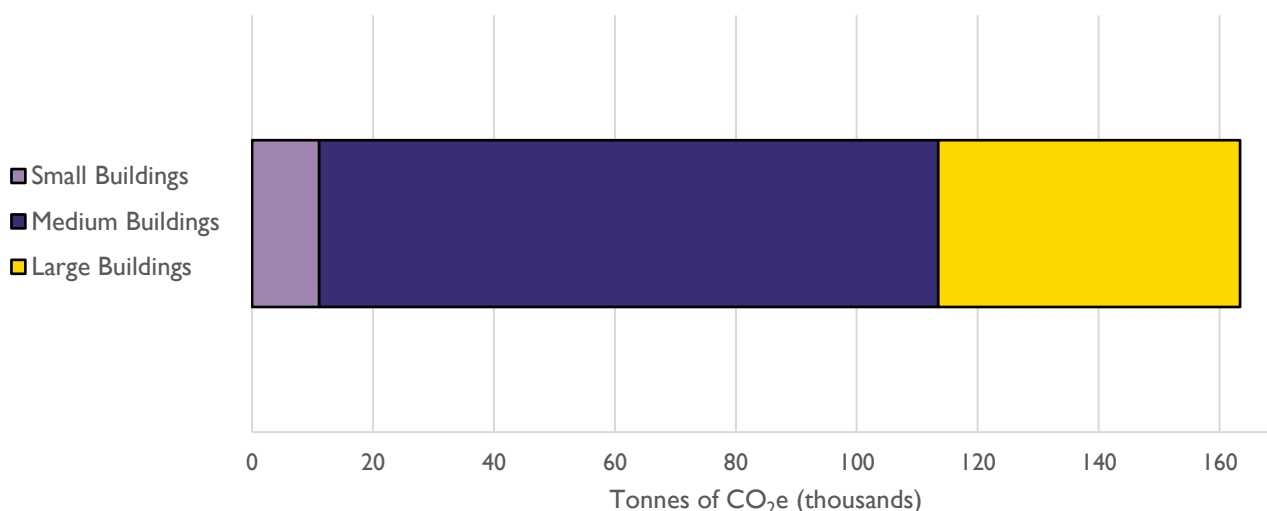


Figure 4. Proportions of total national carbon footprint in the Church of England based on building size.

Figure 5 highlights the differences between the proportions of particular building sizes and their percentage contribution to the total carbon footprint of church buildings. While only 13% of the church buildings were regarded as “large”, they account for almost one third of the total carbon footprint of church buildings in the Church of England.

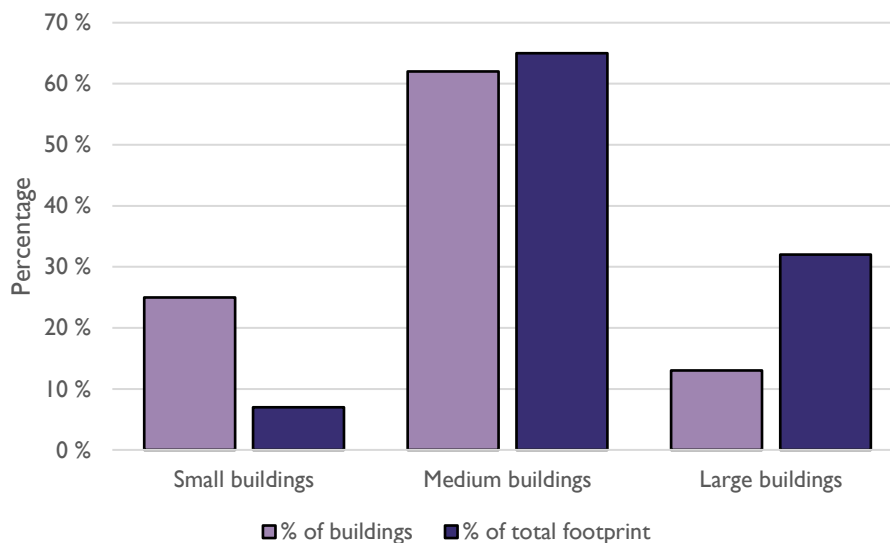


Figure 5. The proportions of church buildings sizes in the Church of England and their percentage contribution to the total carbon footprint.

Urban vs Rural Churches

Alongside the significant differences between building size, significant differences can also be found in whether the church is within a rural or urban parish. Figure 6 highlights the differences that this can make, with the average large urban church emitting almost 27 tonnes of net CO₂e, over 10 times the amount of an average small rural church, which emits just over 2 tonnes of net CO₂e.

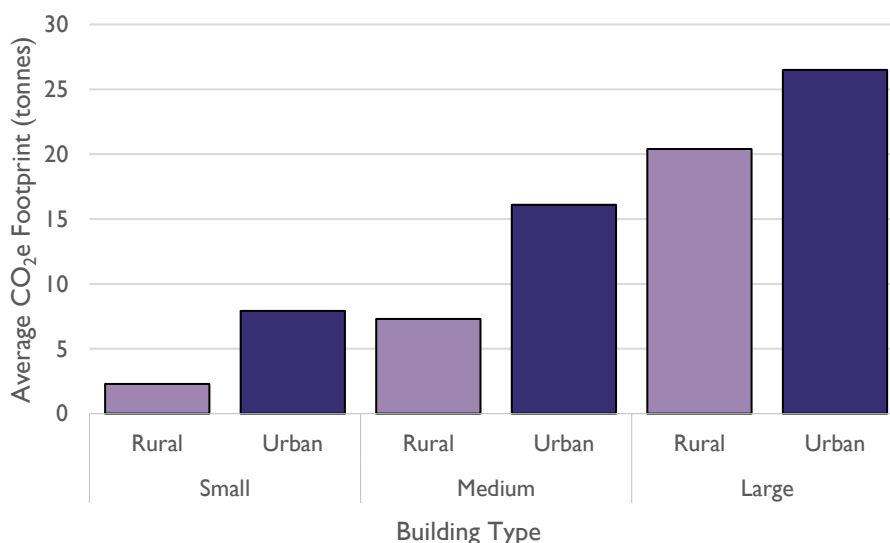


Figure 6. The average carbon footprint in the Church of England by building size and whether the church is in a rural or urban parish.

Church Usage

For the purpose of this analysis, a low-usage church has been defined as under 50 person-hours a week, a high-usage church as over 200 person-hours a week and a medium-usage church as between those two figures.

As well as effects shown by building size and whether a church is within a rural or urban parish. There are also significant effects shown in the usage of the church. A high usage church emits 24 tonnes of net CO₂e, a medium-usage church uses just under 12 tonnes, and a low usage church emits just over 3 tonnes. Figure 7 highlights the differences in emissions based on church usage, church size and whether churches are within a rural or urban parish.

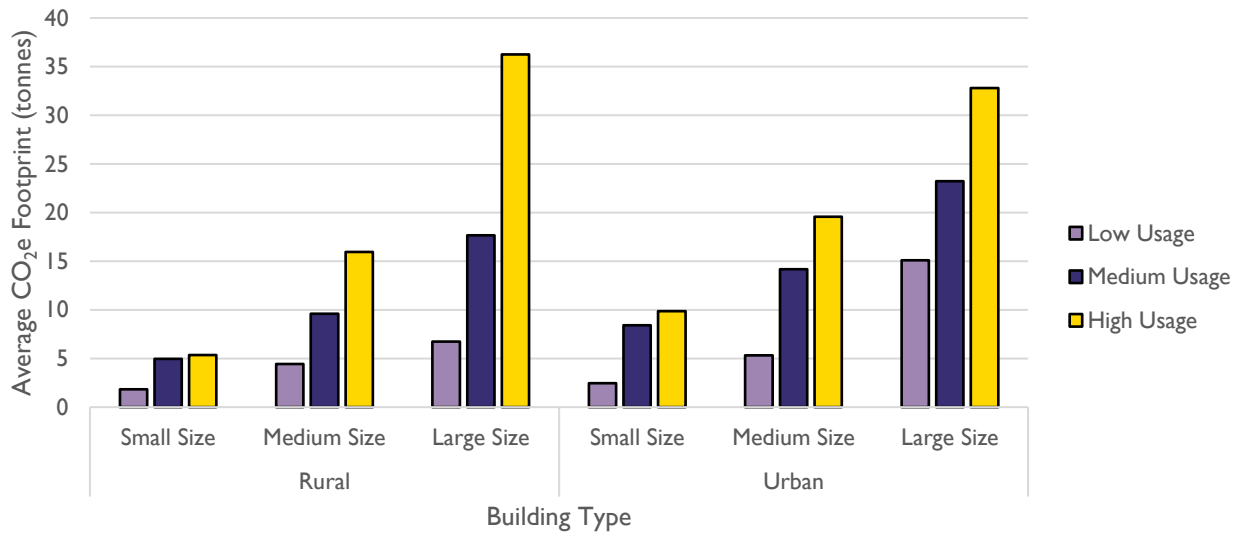


Figure 7. The average carbon footprint in the Church of England by church usage, building size and whether the church is in a rural or urban parish.

There are many expected associations between church usage and church size and whether the church is within a rural or urban parish:

- Small-size churches: 68% were classified as low-usage, 25% were medium-usage and 7% were high-usage.
- Medium-size churches: 29% were classified as low-usage, 47% were medium-usage and 25% were high-usage.
- Large-size churches: 4% were classified as low-usage, 32% were medium-usage and 64% were high-usage.
- Urban churches: 5% were classified as low-usage, 42% were medium-usage and 53% were high-usage.
- Rural churches, 54% were classified as low-usage, 37% were medium-usage and 10% were high-usage.

Types of Energy

For the purpose of this analysis, for a particular type or combination of energy to be included, there needed to be at least 50 churches that had selected it.

Table 3 shows a breakdown of the different energy types used by churches and the types of churches that use them. It can be seen that a mixture of Electricity and Gas is the most common energy type (45% of churches) and also has the largest average net CO₂e footprint. However, it is also shown that it is this energy type that is used by the vast majority of urban churches, large-size churches and high-usage churches. Electricity alone leads to the smallest average net CO₂e footprint, though this is the most common energy type rural churches, small-sized churches, and low-usage churches. Alongside this, for the 2019 Energy Footprint Tool, electricity is the only energy type where we would allow for renewable energy, which would also impact the numbers to give a slightly lower score for the energy type.

Table 3. A breakdown of different energy types used by churches and the types of churches that use them.

	Electricity	Elec + Gas	Elec + Oil	Gas	Oil
Average net CO ₂ e Footprint	1.72	17.30	9.00	14.06	10.66
% Churches with this energy	34	45	17	2	1
% Small-size churches with this energy	66	17	15	1	1
% Medium-size church with this energy	26	48	22	2	2
% Large-size churches with this energy	4	85	6	4	1
% Rural churches with this energy	48	25	24	1	2
% Urban churches with this energy	7	84	4	5	0
% Low-usage churches with this energy	60	14	23	1	2
% Medium-usage churches with this energy	20	58	18	2	2
% High-usage churches with this energy	5	87	3	5	0

Net Zero Carbon Churches and Renewables

As mentioned earlier, 200 (5% of the sample) church buildings had net zero carbon (or lower), with 99% of these using a 100% renewable electricity tariff. Of these, just 3% were in large-size buildings (with a fairly equal split between small-sized and medium-sized buildings). 10% of these were in 'high-usage' church buildings (with a fairly equal split between low-usage and medium-usage church buildings). The vast majority (84%) of these church buildings were in rural parishes.

It should be mentioned that emissions from electricity energy accounted for 22% of the total carbon footprint in the sample of church buildings (30% of "other church buildings"). This would mean that if all churches switched to renewable electricity tariffs, there would be an estimated saving of around 36,000 tonnes from church buildings (6,800 tonnes from "other church buildings").

Regarding renewables, of the sample of the data collected, less than 1% were using wood chips or pellets, less than 1% were using alternative heating technologies, and 1% were using on-site solar panels.

Changes for Energy Footprint Tool 2020

As a tool that will always be developing, there will be changes in place for the recording of 2020 energy data, to be submitted in 2021, some initial changes are listed here:

- The addition of the ability to list renewable “green” gas.
- An updated list of renewable electricity providers.
- The ability to note that energy has been offset.
- Reasonable adjustment to reflect periods of lockdown.
- The ability to compare 2020 figures

It is expected that data collection for the Energy Footprint Tool 2020 will begin in Spring 2021 and be open to use until Autumn 2021.

As mentioned in the beginning of this report, in 2021 the Energy Footprint Tool will become part of the Church of England Energy Toolkit, a program created by the Research and Statistics team to measure the carbon footprints of other facets of the Church of England, to enable the General Synod to monitor progress towards the target of net zero emissions by 2030.