



# **Our Home Energy Usage and Carbon Footprint**

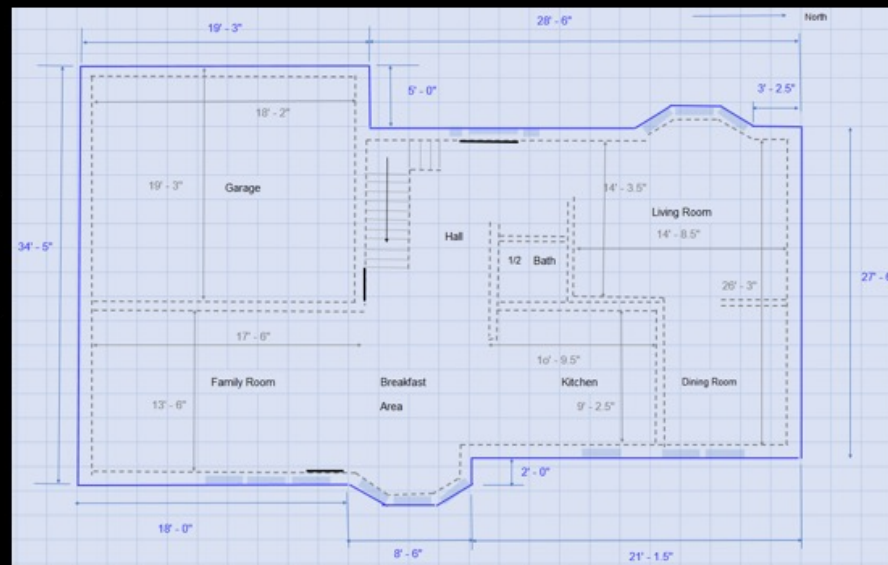
## **One family's journey**

Larry Grant  
September 2023

# Our Family Home in Ohio



Year	Home Area [ft <sup>2</sup> ]
1993	2,235
2015	2,730



# Data Gathering Methodology

- Regular reading of gas and electric meter (manually, outdoors)
- 2022 included daily readings Jan-Apr. Daily data agreed with monthly data (slopes vs degree days, etc.).
- Detailed manual data gathering allowed for additional insights into energy loss from our home.
- Carbon footprint data – relied on other experts and websites (example [carbonfootprint.com](https://www.carbonfootprint.com)).
- Matched measured data with electric bills and gas bills.

# **Summary of Results...**

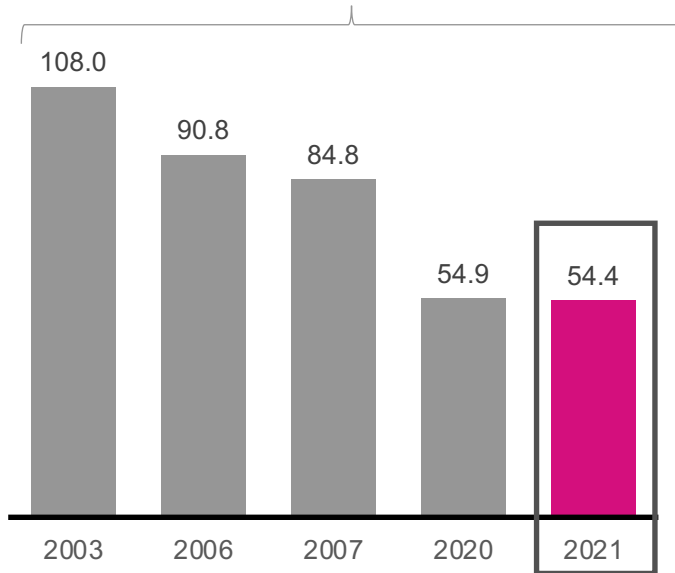
# Home Heating Efficiency and Carbon Footprint

Overall Family Carbon Footprint from 2003 to 2021 has been reduced by 24%

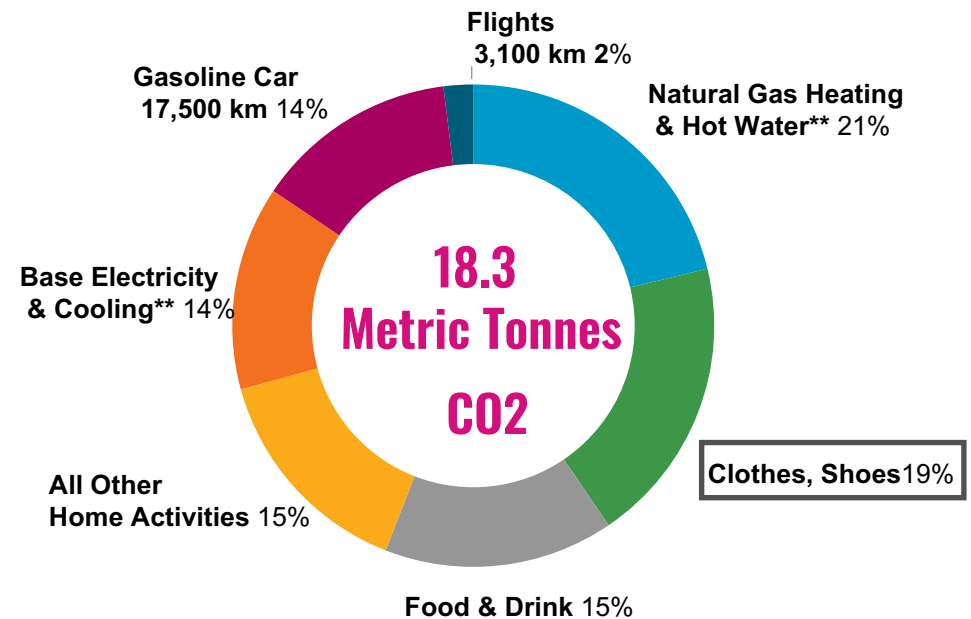
- Of this 24% reduction, 80% of it has been done by the homeowners and 20% has come from the grid.
- Key learnings for our family is the impact of clothes and food & drink. Additional home improvements may include upgraded A/C etc.

## KwH per m<sup>2</sup> Heating per Year

Home Heating Carbon Footprint has been improved by 50%



## 2021 Carbon Footprint\*



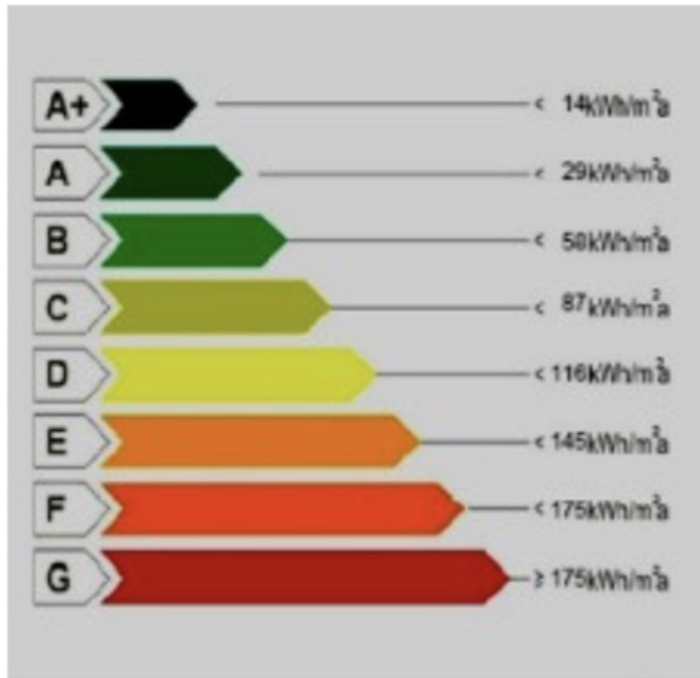
\*Sources: [carbonfootprint.com - Carbon Footprint Calculator](https://carbonfootprint.com)

Personal Home Records

\*\*Note: 2021 Combined footprint for natural gas heating & hot water plus Base Electricity & Cooling is 0.192 Kg per KWH



# European Home Heating Efficiency Standard before Oct 1 2015



Before 1 October 2015

Our Home's Performance



- ← 2021: 54 kWh/m<sup>2</sup>a (B-)
- ← 2007: 85 kWh/m<sup>2</sup>a (C)
- ← 2003: 108 kWh/m<sup>2</sup>a (D+)

Sources: European Directive EPBD 2002/91/CE and Decree 192/2005

<https://www.iea.org/policies/2526-decree-for-energy-efficiency-requirements-in-buildings-2015>

<https://www.epbd-ca.eu/wp-content/uploads/2018/08/CA-EPBD-IV-Italy-2018.pdf>



# Enerphit Criteria – varies with climate

## Energy Demand Method

The EnerPHit criteria for the energy demand method can be seen in Table 1 below. Note that unlike the certification standards for newly built Passive Houses, the heating demand (calculated using the [Passive House Planning Package PHPP](#)) for EnerPHit buildings vary with climate.

Table 1: EnerPHit criteria for the energy demand method

Climate Zone According to PHPP	Max Heating Demand [kwh/(m <sup>2</sup> a)]
Arctic	35
Cold	30
Cool-Temperate	25
Warm-temperate	20
Warm	15
Hot	-
Very Hot	-

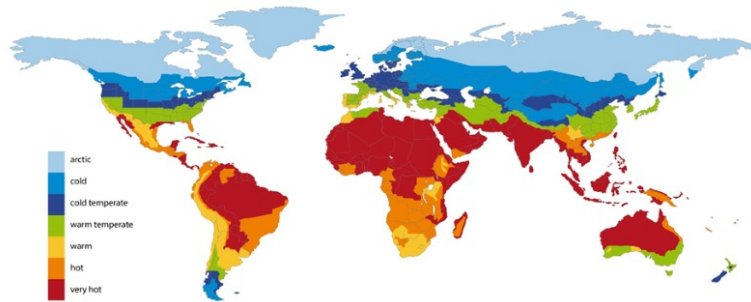


Figure 1: Rough outline of climate zones considered for Passive House buildings and components. Actual climate zone location may vary.

## Our Home's Performance



2021: 54 kWh/m<sup>2</sup>a

We live in the cool-temperate climate

Ideal Enerphit Target for our home: 25 kWh/m<sup>2</sup>a

*Possible next steps – upgraded air conditioner, air blower door test, air sealing*

# Detailed Home Energy Usage and Carbon Footprint Data

Energy USED - Single Family Home Aylesbury Drive West, Westerville Ohio 43082 USA											
Year	2003	2004	2005	2006	2007	2008	2009	2020	2021	2022	2020 to 2022 Average
Heating Efficiency [BTU/(ft <sup>2</sup> .HDD65)]	6.256	6.117	6.171	6.227	5.495	3.352	3.022	3.727	3.719	3.611	3.686
Cooling Efficiency [BTU/(ft <sup>2</sup> .CDD65)]	1.310	1.491	2.241	1.873	3.280	1.232	1.232	2.336	2.837	2.246	2.473
Enerphit Heating Efficiency [KWH/(m <sup>2</sup> .A)]	108.0	99.8	103.3	90.8	84.8	55.2	49.2	54.9	54.4	57.1	55.4
Total Home Area [ft <sup>2</sup> ]	2,235	2,235	2,235	2,235	2,235	2,235	2,235	2,730	2,730	2,730	2,730
Natural Gas Heating Energy Used [KWH]	22,420	20,720	21,453	18,844	17,614	11,453	10,224	14,419	14,300	14,994	14,571
Natural Gas Hot Water Energy Used [KWH]	12,602	12,602	12,602	12,602	12,602	10,990	10,990	7,385	7,074	7,133	7,197
Electric Cooling Energy Used [KWH]	687	783	1,735	1,114	2,204	699	704	2,183	2,674	1,833	2,230
Total Heating plus Cooling Energy Used [KWH]	23,107	21,503	23,188	19,958	19,818	12,152	10,928	16,602	16,974	16,826	16,801
Baseline Electric Energy Used [KWH]	9,449	9,709	9,709	9,709	9,709	9,709	9,709	9,192	9,242	9,166	9,200
Total Natural Gas Energy Used [KWH]	35,022	33,322	34,055	31,447	30,216	22,444	21,214	21,804	21,374	22,127	21,768
Total Electric Energy Used [KWH]	10,136	10,492	11,444	10,823	11,913	10,407	10,413	11,375	11,916	10,999	11,430
<b>Total Natural Gas + Electric Energy Used [KWH]</b>	<b>45,158</b>	<b>43,814</b>	<b>45,499</b>	<b>42,269</b>	<b>42,128</b>	<b>32,851</b>	<b>31,627</b>	<b>33,179</b>	<b>33,289</b>	<b>33,126</b>	<b>33,198</b>
<b>Heating [KWH/m<sup>2</sup>.A]</b>	<b>108.0</b>	<b>99.8</b>	<b>103.3</b>	<b>90.8</b>	<b>84.8</b>	<b>55.2</b>	<b>49.2</b>	<b>56.9</b>	<b>56.4</b>	<b>59.1</b>	<b>57.5</b>
Heating Degree Days [Base 65F]	5,472	5,172	5,308	4,621	4,894	5,217	5,166	4,835	4,806	5,189	4,943
Cooling Degree Days [Base 65F]	801	802	1,182	908	1,026	866	873	1,168	1,178	1,020	1,122
Total Degree Days [Base 65F]	6,273	5,974	6,490	5,529	5,920	6,083	6,039	6,003	5,984	6,209	6,065

Home's Carbon Footprint [Metric Tonnes CO2 per Year unless otherwise indicated]											
Year	2003	2004	2005	2006	2007	2008	2009	2020	2021	2022	2020 to 2022 Average
From Electricity	3.10	3.19	3.31	3.11	3.41	2.96	2.95	2.51	2.504	2.31	2.44
From Natural Gas	6.35	6.05	6.18	5.71	5.48	4.07	3.85	3.96	3.878	4.01	3.95
<b>From Electricity plus Natural Gas (Whole Home)</b>	<b>9.46</b>	<b>9.24</b>	<b>9.49</b>	<b>8.82</b>	<b>8.89</b>	<b>7.03</b>	<b>6.80</b>	<b>6.47</b>	<b>6.382</b>	<b>6.33</b>	<b>6.39</b>
Flight Miles	5,803	5,803	5,803	5,803	5,803	5,803	5,803	-	1,934.400	3,869	
Flights	1.09	1.09	1.09	1.09	1.09	1.09	1.09	-	0.363	0.73	
Gasoline Car Miles Driven	20,000	20,000	20,000	20,000	20,000	20,000	20,000	6,500	10,900.000	10,900	9,433
Driving a car	4.56	4.56	4.56	4.56	4.56	4.56	4.56	1.48	2.484	2.48	2.15
Clothes, Shoes	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.530	3.53	3.53
Food and Drink	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.820	2.82	2.82
All other Home Activities	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.710	2.71	2.71
<b>Grand Total</b>	<b>24.17</b>	<b>23.95</b>	<b>24.20</b>	<b>23.53</b>	<b>23.60</b>	<b>21.74</b>	<b>21.51</b>	<b>17.01</b>	<b>18.29</b>	<b>18.60</b>	<b>17.96</b>



Note that the energy usage and carbon footprint data shown in these tables is for 2 people.  
 Source: Personal data and [NOWData \(rcc-acis.org\)](http://NOWData(rcc-acis.org))



# CO2 Emissions by Year and Selected Countries (and Per Capita Data)

CO2 Emissions in Metric Tonnes per Year per Person for Selected Countries versus Year								
	Metric Tonnes per Capita	Total Millions of Metric Tonnes	Metric Tonnes per Capita	Total Millions of Metric Tonnes	Metric Tonnes per Capita	Total Millions of Metric Tonnes	Metric Tonnes per Capita	Total Millions of Metric Tonnes
Year >	1900	1900	1950	1950	2005	2005	2021	2021
United Kingdom	10.1	423	9.7	524	9.0	573	4.6	346.8
United States	8.3	704	14.8	2,670	19.5	6,140	13.0	4,712
Canada	3.8	23	11.0	150	17.0	732	13.6	670
Belgium	7.3	50	9.1	78	10.6	111	7.4	93
Germany	5.8	353	7.2	550	9.7	866	7.3	644
Austria	4.5	28	3.0	21	9.3	79	6.6	65
Russia	0.7	49	4.1	438	10.7	1,560	11.4	1,577
China		94	0.1	88	4.5	6,030	7.8	10,668
India	0.0	12	0.1	61	1.0	1,200	1.6	2,442
Other		215		1,420		12,319		15,903
<b>World*</b>		<b>1,950</b>	<b>3.11</b>	<b>6,000</b>	<b>4.52</b>	<b>29,610</b>	<b>4.69</b>	<b>37,120</b>

\*Sources:

[Top 10 Polluting Countries by CO2 Emissions \(1840-2021\) - YouTube](#)

[Greenhouse Gas Emissions Canadian Environmental Sustainability Report 2023](#)

[CO2 Emissions per Capita 1800 - 2020 - YouTube](#)

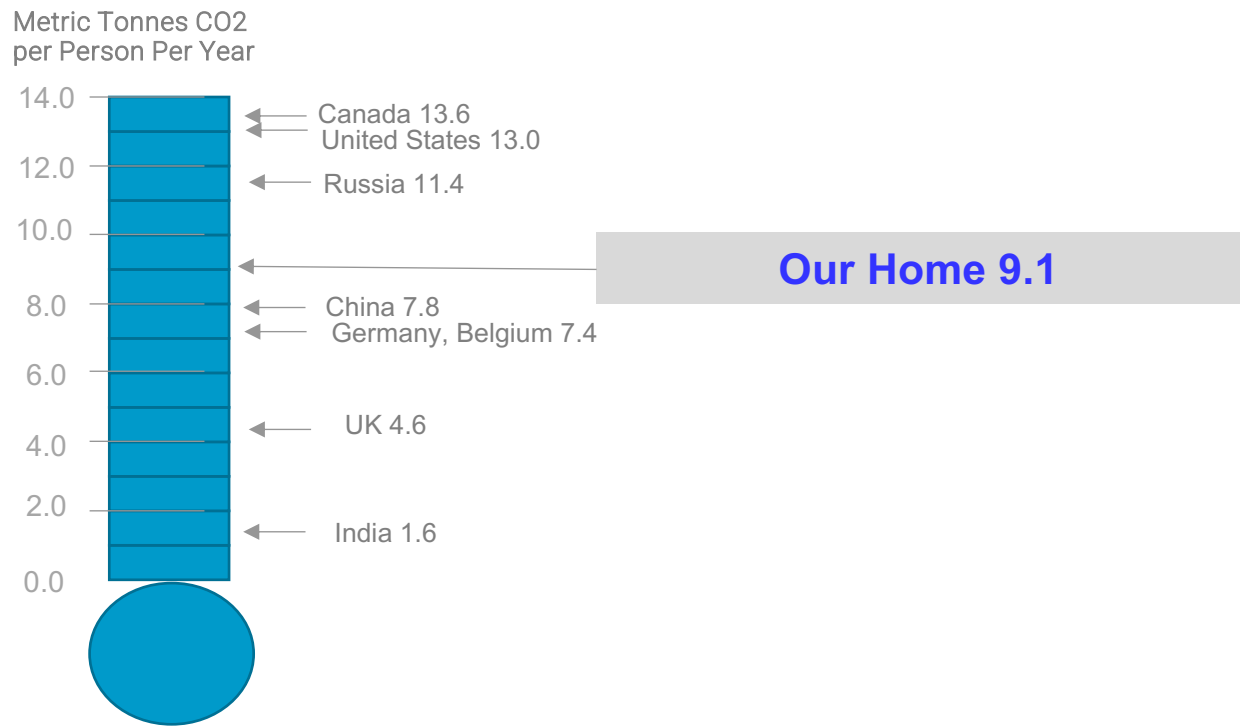
[CO2 emissions \(metric tons per capita\) | Data \(worldbank.org\)](#)

[CO2 emissions \(kt\) | Data \(worldbank.org\)](#)

[Germany: CO2 Country Profile - Our World in Data](#)



# How does our home stack up on per capita CO2 Emissions in 2021?



Our home appears to be about **30% lower** than the typical US home, but about **24% higher** than a home in Belgium

**Thanks for your time.**

**Q&A**

# Backup Slides



## Interesting Comparison of Ontario vs Ohio Emission Factors over time

	Ontario 2009	Ontario 2019	Ohio 1991	Ohio 2019	Ohio 2021
Hydro	25%	24%	0.5%	0.4%	0.4%
Uranium	55%	59%	7.5%	7.5%	7.4%
Natural Gas	10%	7%	1.5%	45.3%	49.4%
Coal and Coke	7%	0%	86.2%	40.4%	34.2%
Wind	2%	8%	0.0%	2.6%	3.8%
Biomass/GeoThermal	0.50%	1.00%	0.4%	0.5%	0.5%
Petroleum	0.50%	0.30%	3.7%	2.4%	2.2%
Solar		1.00%	0.0%	0.4%	1.7%
<b>TOTAL</b>	<b>100.0%</b>	<b>100.3%</b>	<b>99.8%</b>	<b>99.5%</b>	<b>99.6%</b>
Non Carbon Emitting		<b>81.3%</b>	<b>8.4%</b>	<b>11.4%</b>	<b>13.5%</b>
<b>Kg CO2 per KWH</b>	<b>0.043</b>	<b>0.013</b>	<b>0.298</b>	<b>0.222</b>	<b>0.208</b>

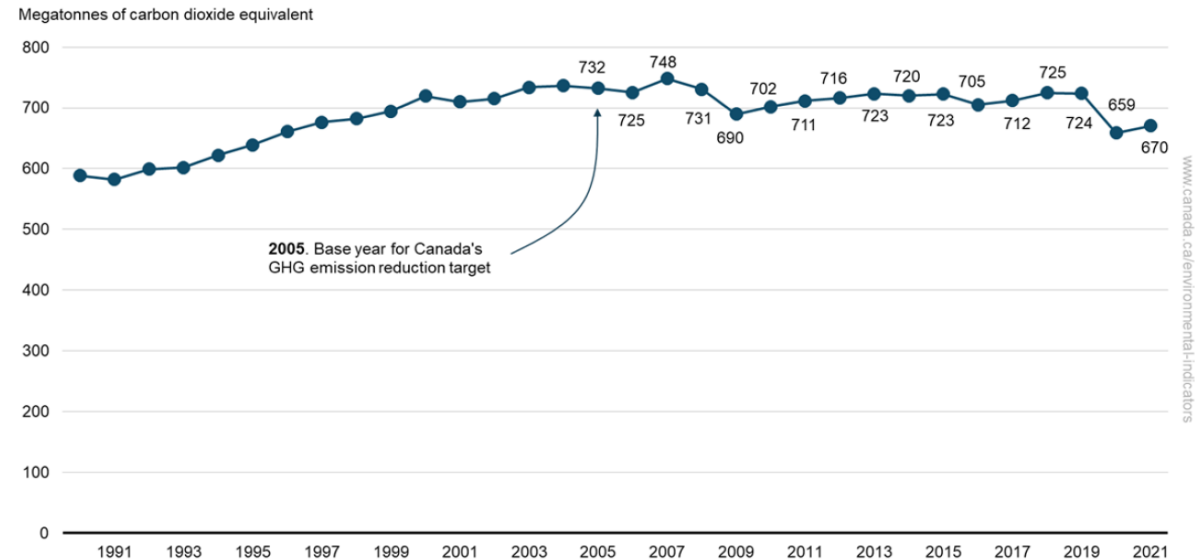
Sources: Form EIA-860, Annual Electric Generator Report. U.S. grade9student 230511 142803.pdf (opg.com)

# Canadian total GHG Emissions Trend

## Key results

- Canada's total GHG emissions in 2021 were 670 megatonnes of carbon dioxide equivalent (Mt CO<sub>2</sub> eq), a 1.8% increase from 659 Mt CO<sub>2</sub> eq in 2020
- From 2005 to 2021, Canada's GHG emissions decreased by 8.4% (62 Mt CO<sub>2</sub> eq)
- Between 1990 and 2021, Canada's GHG emissions increased by 13.9% (82 Mt CO<sub>2</sub> eq)

Figure 1. Greenhouse gas emissions, Canada, 1990 to 2021



Source:

**Suggested citation for this document:** Environment and Climate Change Canada (2023) Canadian Environmental Sustainability Indicators: Greenhouse gas emissions. Consulted on *Month day, year*. Available at: [www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html](http://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html).



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