Canadians for Affordable Energy

The Value of Energy – Ontario

Canadians for Affordable Energy: Household Research Series

NOVEMBER 2017

Canadians for Affordable Energy

Canadians for Affordable Energy is a national non-profit organization. We promote the benefits of affordable energy by informing Canadians about it, advancing policies that encourage it, and building a national constituency to support it. Keeping energy services affordable must be an ongoing public policy priority.

Household Research Series – Ontario Notes

The energy price and cost data contained in this Ontario Household Research Report are approximate and represent how much residential customers might pay for various energy products, using timely data from credible sources, including the Ontario Energy Board (electricity and natural gas) and the Ministry of Energy (gasoline).

Energy price and cost data includes Ontario's cap-and-trade program, the federal government's mandate that sets the tax on carbon dioxide emissions at $50 a tonne by 2022, and Ontario's *Fair Hydro Plan* to reduce consumer hydro rates by extending energy infrastructure financing costs over a longer period of time.

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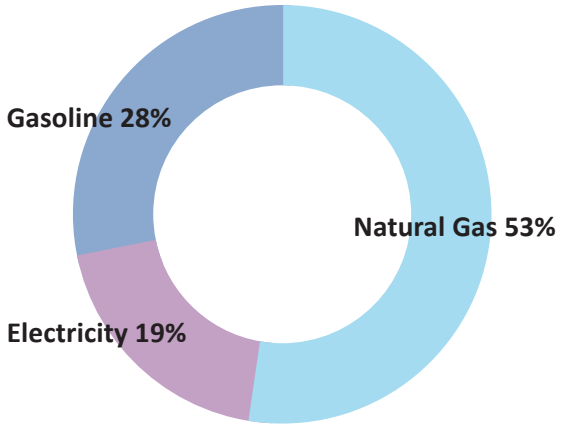
The Value of Energy Research Series illustrates energy use, value and bills for typical households

Values shown in this report are approximate and represent how much a typical residential customer might pay or use for various energy products, using timely data from credible sources, including the Ontario Energy Board (electricity and natural gas) and the Ministry of Energy (gasoline).

To give us an idea of The Value of Energy, let's look at Ontario's overall energy uses

The chart shows where a typical customer might get their energy:

- Electricity provides 19%
- Gasoline provides 28%
- Natural gas provides 53%



But not every household has this breakdown – this is an estimate based on a household that uses natural gas for heating, drives a car occasionally and uses appliances and electronics.

There are 5.2 million households in Ontario and approximately 3.755 million of those – nearly ¾ of the total – use natural gas for heating. The remaining 1.441 million homes rely on electricity, oil, propane, coal, wood or some combination for heat.

See page 5 for household figures that heat with electricity or oil.

We use natural gas in

- Furnaces to warm our homes
- Stovetops to cook our food
- Hot water tanks for laundry and showers
- Industries and as a key input fuel

We use gasoline to fuel

- Vehicles (cars and trucks) to get around and deliver goods and services
- Recreational motorbikes, boating and skidoos

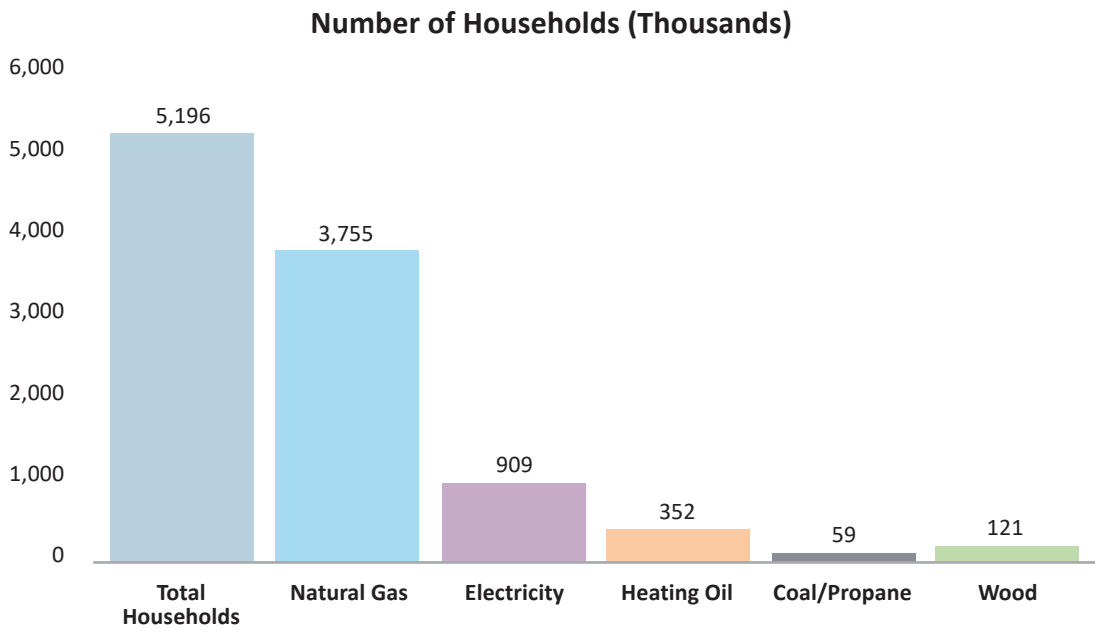
We use electricity to power

- Illumination to light the night
- Appliances for convenience
- Electronics for education and entertainment
- Smartphones to stay connected
- Electric heating in much of rural Ontario

How do Ontario households heat their homes?

Virtually every household uses electricity to power their electronics and appliances – televisions only run on electricity. But when it comes to heating, there are a number of different fuels households put to use.

As shown in the chart, about 3.755 million households heat their homes with natural gas, 909,000 households primarily use electricity, and 352,000 heat their homes with heating oil. Other households use coal, propane and wood for their heating needs.[1]



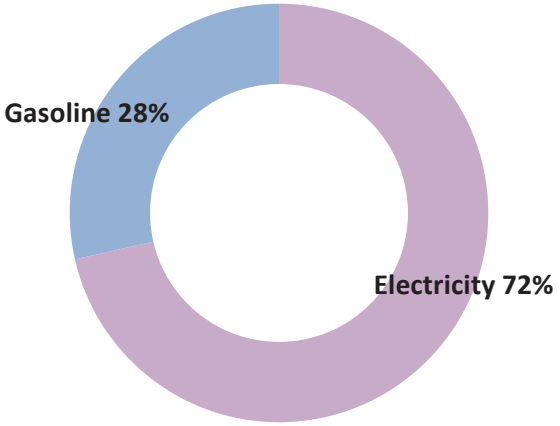
1. NRCan Comprehensive Energy Use Database. Ontario Residential Table 14: Total Households by Building Type and Energy Source. Data is from 2014, accessed in March 2017: http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=on&rn=14&page=0.

Energy Use Profiles for households heated with electricity or oil[2]

The majority of Ontario household energy use is for space and water heating, so how we heat our homes has a big influence on energy use profiles and household budgets.

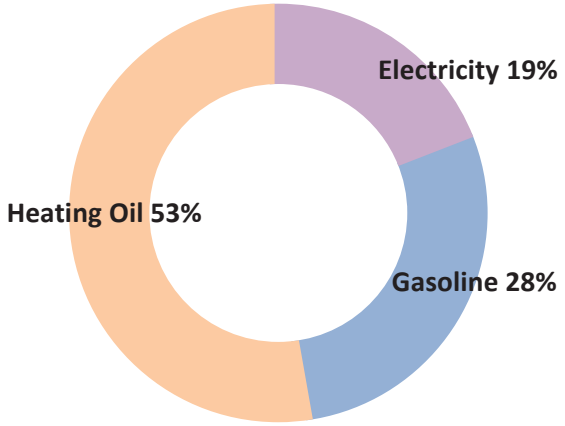
Heating with Electricity:

Over 900,000 Ontario households rely on electricity for heating as well as for their appliances and electronics. A household with baseboard electric heating might have an energy use profile matching the pie chart below, with electricity providing 72% and gasoline 28%.



Heating with Oil:

Over 350,000 Ontario households rely on heating oil to keep their houses warm. A household with an oil furnace might get 53% of energy from heating oil, with electricity providing 19% and gasoline 28%.

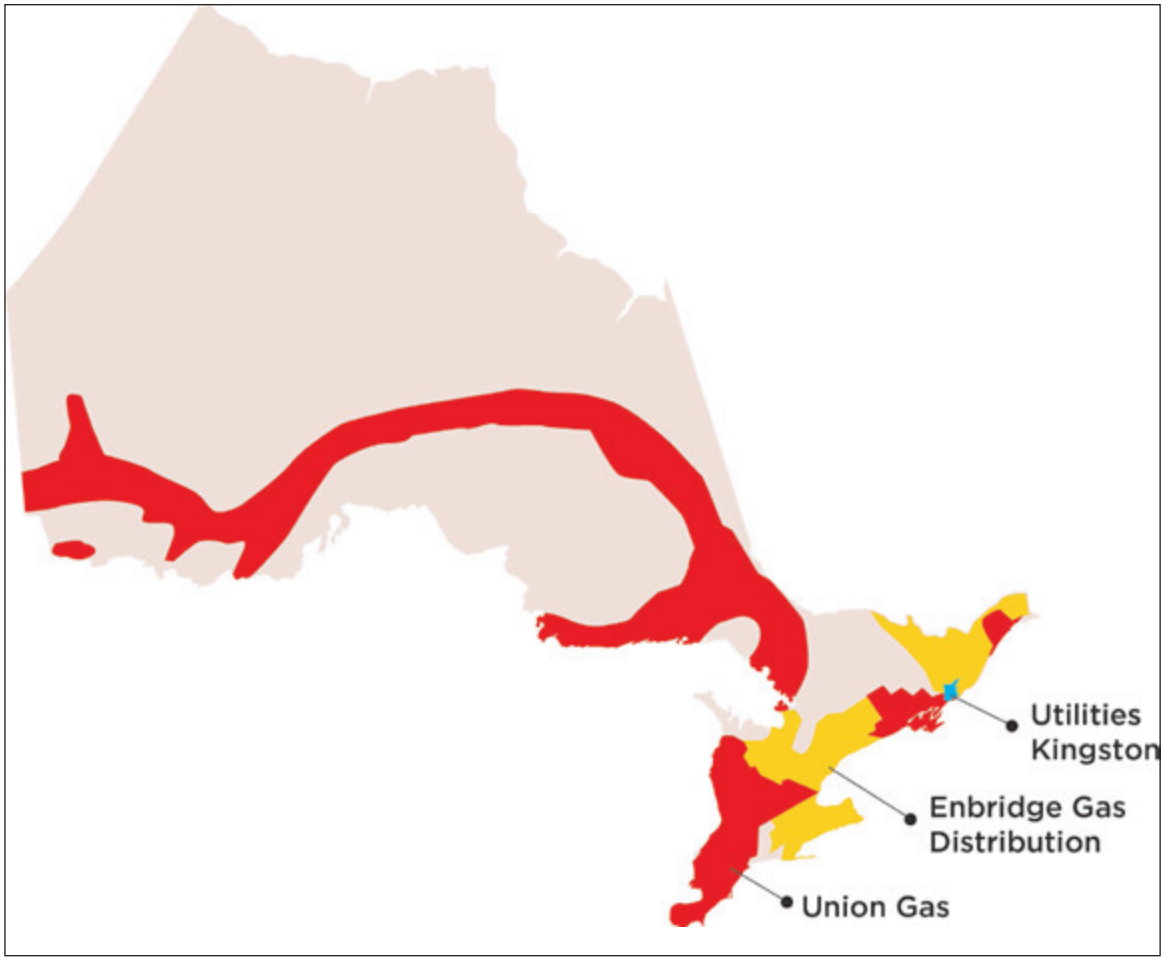


2. NRCan Comprehensive Energy Use Database. Ontario Residential Table 14: Total Households by Building Type and Energy Source. Data is from 2014, accessed in March 2017: http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=on&rn=14&page=0.

Which Ontario households have natural gas service?

Ontario's natural gas distribution system covers urban areas and some rural communities, but many agricultural, low density and remote communities do not have natural gas service.

The map of Ontario shows areas of the province with and without natural gas service.



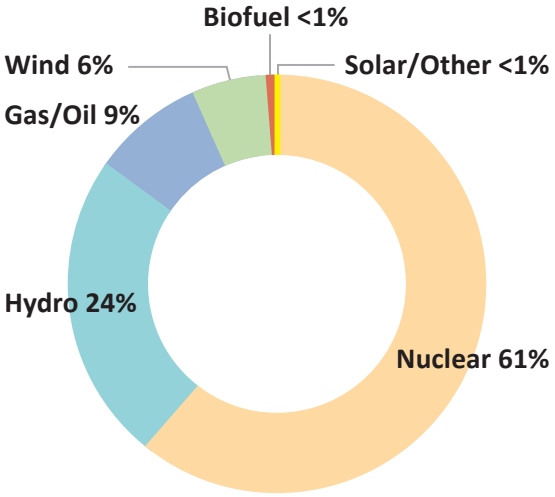
Where does Ontario's electricity (power) come from?

Ontario households and businesses use electricity that is generated from a variety of different sources.

The pie chart shows the fraction of electricity generated by different technologies and fuels in 2016, and the table on the right shows the actual electricity generated in terawatt-hours (TWh).[3]

For example, nuclear plants generated 61% of our electricity in 2016, hydro 24%, natural gas 9%, wind 6%, and biofuel and solar both came in under 1%.

Note that the pie chart figures might not total 100% due to rounding.



Nuclear	91.7 TWh or 61%
Hydro	35.7 TWh or 24%
Gas/Oil	12.7 TWh or 9%
Wind	9.3 TWh or 6%
Biofuel	0.49 TWh or <1%
Solar/Other	0.46 TWh or <1%

3. Independent Electricity System Operator (IESO). Yearly Energy Output by Fuel Type – 2016 Data. Supply Overview, Transmission Connected Generation. Accessed March 2017: http://ieso.ca/power-data/supply-overview/transmission-connected-generation.

Typical Ontario household bills and energy use

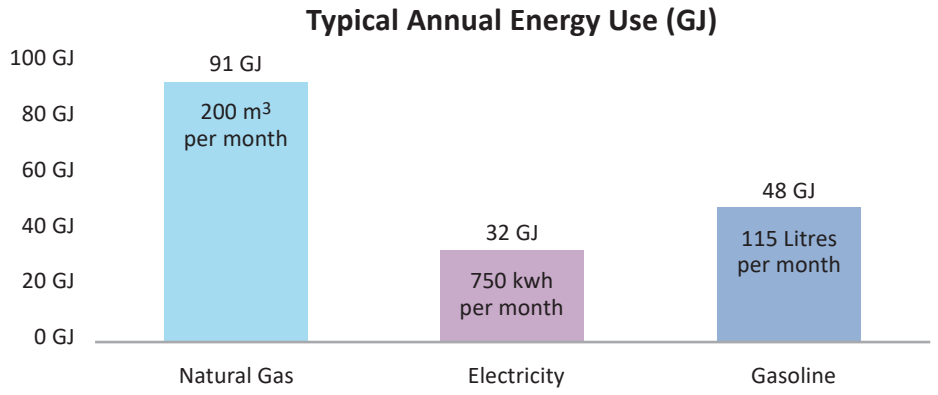
Here's the breakdown of how much energy a typical Ontario household might use every year. This works out to be approximately 200 cubic meters (m3) of natural gas, 750 kilowatt-hours (kWh) of electricity, and 115 litres of gasoline a month.

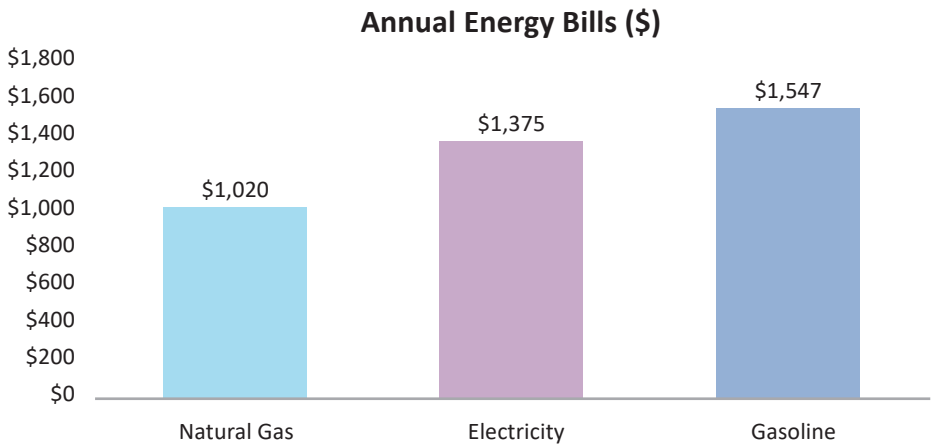
To show them together, we measure the energy used in Gigajoules (GJ) per year, a common unit useful for comparing different fuels on an "apples to apples" basis. A Gigajoule is equivalent to 1 billion Joules, roughly the amount of energy it takes to power a 30 Watt light bulb throughout an entire year.

And here's how much that same typical household might pay for energy every year.

A typical Ontario household spends more money on gasoline and electricity, even though they get more of the energy they use from natural gas.

These bills have been generated using a blend of utility rates based on Ontario Energy Board data. Some households will pay more and some will pay less.[4/5/6]



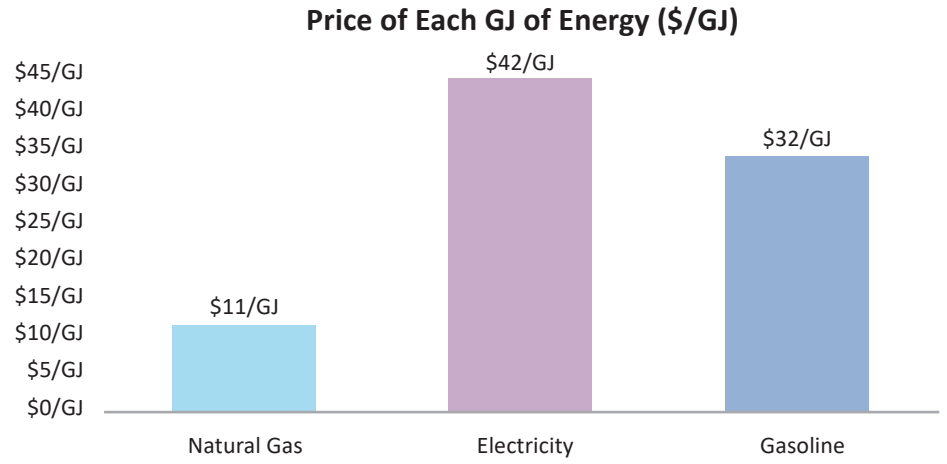


4. Electricity: Ontario Energy Board. Your Electric Utility: http://www.ontarioenergyboard.ca/oeb/Consumers/Electricity/Your%20Electricity%20Utility.
5. Natural Gas: Ontario Energy Board. Your Natural Gas Utility: http://www.ontarioenergyboard.ca/OEB/Consumers/Natural+Gas/Your+Natural+Gas+Utility.
6. Gasoline Costs: Ontario Ministry of Energy Gasoline Report for Week ending October 10, 2017.

The Value of Energy for Ontario households

Now that we know how much energy we use and how much we pay for it, we can put together a better picture of the Value of Energy.

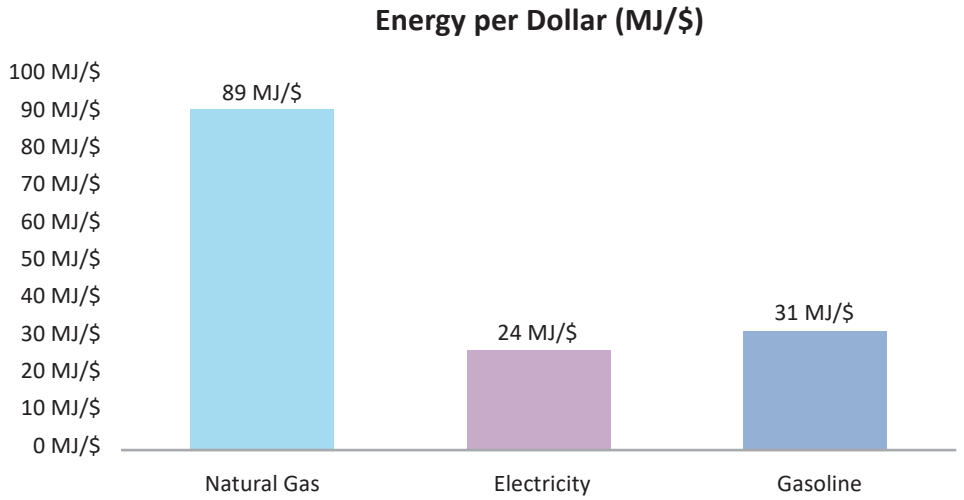
The chart shows how much a typical customer pays for each unit of energy – this is the price of energy (in dollars per Gigajoule) and helps describe the relative value of different energy sources.



Another way to describe the Value of Energy is to show how much energy a household gets for each dollar spent on their energy bill.

The chart shows the value households get for their energy dollar (in megajoules per dollar).

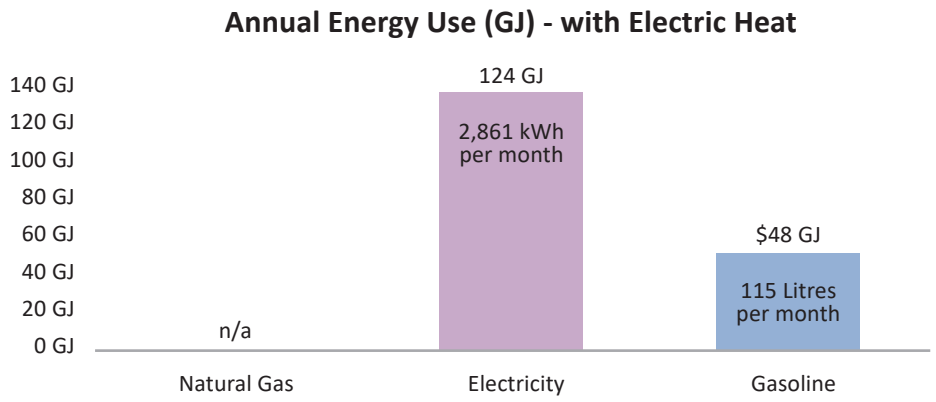
1 GJ = 1,000 MJ



A typical bill and household Value of Energy for Ontario's 908,900 families that rely on electricity for heat

Ontario households that rely on electricity for heat consume a lot of electricity compared to those that heat with natural gas or other fuels. Winter months would be higher but on average a household that heats with electric baseboards might use about 2861 kWh of electricity and 115 litres of gasoline a month.

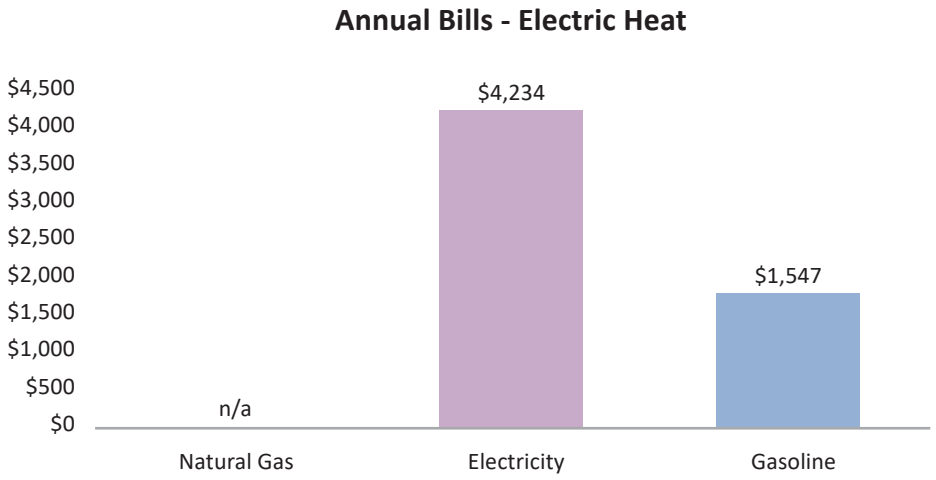
The charts describe the household energy used in terms of Gigajoules (GJ).



And here's how much a household with electric heat might pay for energy every year.

An Ontario household with electric heat would spend a lot on energy bills because heating requires a lot of energy, and because the price of electricity is higher than other fuels.

These bills have been generated using a blend of utility rates where no natural gas service is available, based on Ontario Energy Board data. Some households will pay more and some will pay less.

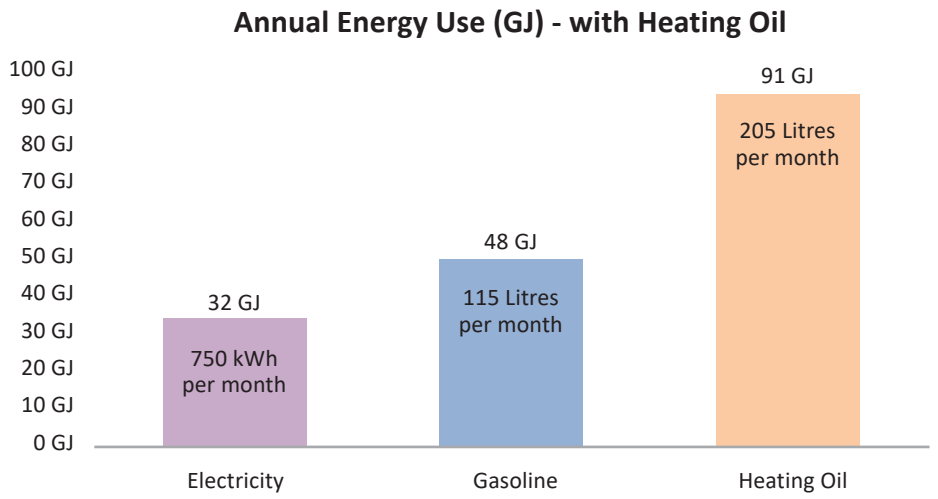


A typical bill and household value of energy for Ontario's 352,200 families that rely on heating oil for heat

An Ontario household that relies on heating oil would have a similar looking picture to the typical household that relies on natural gas, except their fuels used for heating would be different.

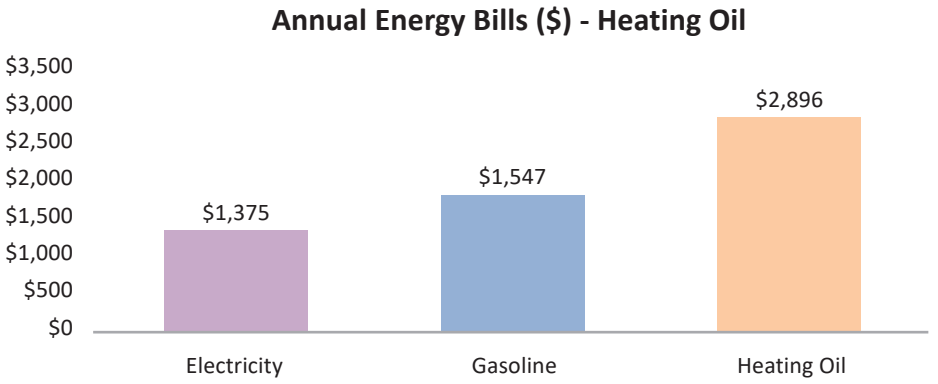
A household that uses heating oil for space and water heating might use an average of about 750 kWh of electricity, 115 litres of gasoline and 205 litres of heating oil a month.

To show them all on the same chart, we've described the energy used in terms of Gigajoules (GJ).



And here's how much a household that relies on heating oil for home heating energy might pay per year.

Heating oil costs about the same per litre as gasoline.

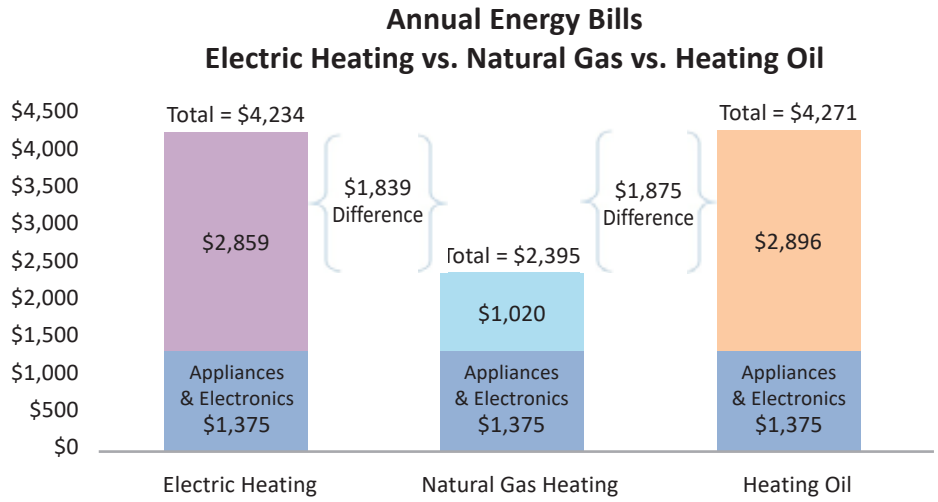


Comparing the costs of different fuels in Ontario

Not everyone has the same breakdown in fuel use as the typical customer. In fact, some households don't use these fuels at all.

As an example, the chart compares three households that use a similar amount of energy: all use electricity for appliances and electronics, but they heat their houses differently. One house uses electric baseboards, another uses a natural gas furnace, and the third household uses heating oil in a furnace.

The difference in annual bills between the households heated with natural gas and those heated with electricity and heating oil is over $1,800. This is because the price of each unit of energy from electricity and heating oil is so much higher than from natural gas.



Value of Energy for different Ontario customers

Looking at a typical customer is helpful but to get an even better picture of The Value of Energy, let's take a closer look at how much energy different households use and pay for each month.

Presented here are four Ontario customers, representing different demographics and lifestyles, along with a comparison of how much they use and pay for energy.

Young Urban Single

Toronto

Uses less energy and has lower bills

- Small condo -> less natural gas
- Fewer devices and appliances -> less electricity
- Compact car and occasional driver -> less gasoline

Suburban Family

Burlington

Uses more energy and has higher bills

- Large house -> more natural gas
- More devices and appliances -> more electricity
- Two car commuters -> more gasoline

Small Town Retirees

Parry Sound

Moderate energy use and has moderate energy bills

- Medium sized house -> moderate natural gas
- Some devices and appliances -> moderate electricity
- One car or light truck -> moderate gasoline

Rural Couple

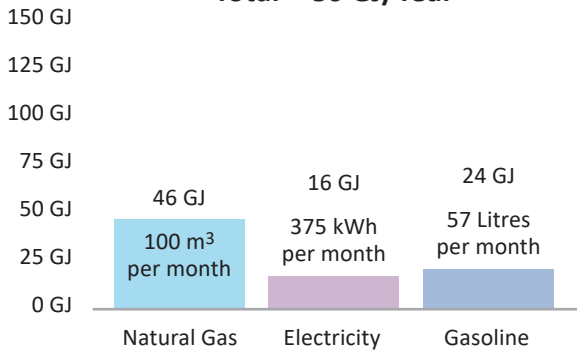
Kawartha Lakes

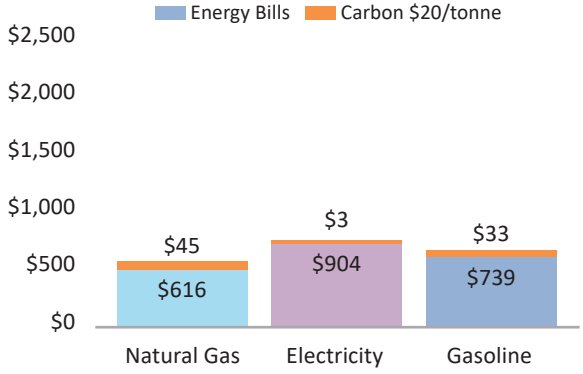
Moderate energy use and has higher energy bills

- Natural gas service unavailable
- Electric heating with some devices and appliances -> very high electricity
- One truck -> more gasoline

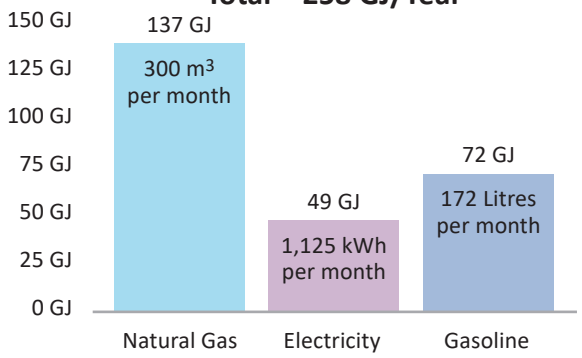
Value of Energy Customer Snapshot (Ontario), which includes tax on carbon dioxide emissions ($20/tonne[7])

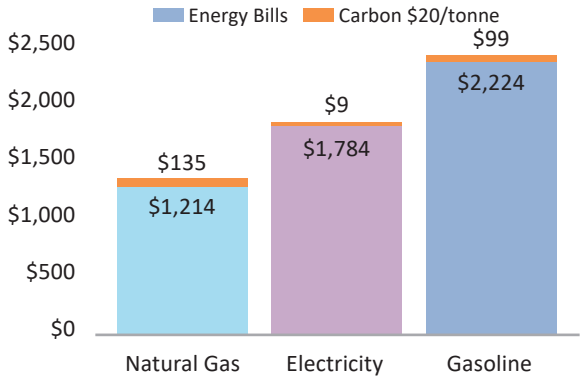
Young Toronto Urban Single





Suburban Burlington Family



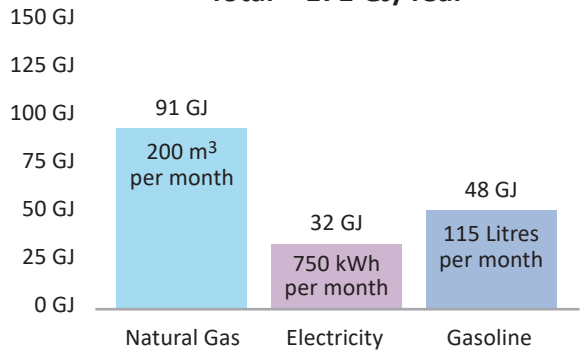


7. A tax on carbon dioxide emissions (aka carbon tax, carbon price) has a direct cost impact on energy bills derived from fossil fuels because these sources emit CO_2. It also has an indirect effect on the prices of other goods and services in an economy since carbon-based energy is used in the production and delivery of goods and services, making them more expensive. We model it at $20 per tonne, which is the approximate price of Ontario's cap-and-trade system. The federal government has mandated a carbon price of $50/t by 2022.

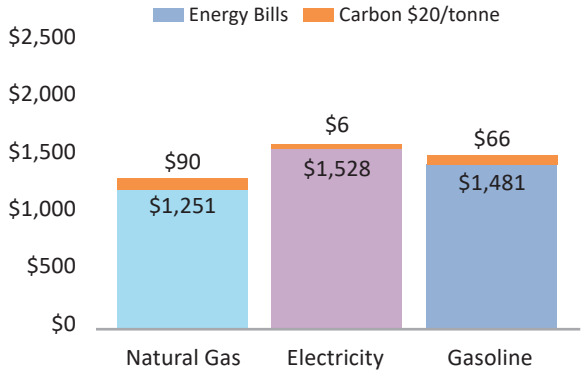
Value of Energy Customer Snapshot (Ontario), which includes tax on carbon dioxide emissions ($20/tonne)

Small Town Parry Sound Retirees

Annual Energy Use (GJ)
Total = 171 GJ/Year

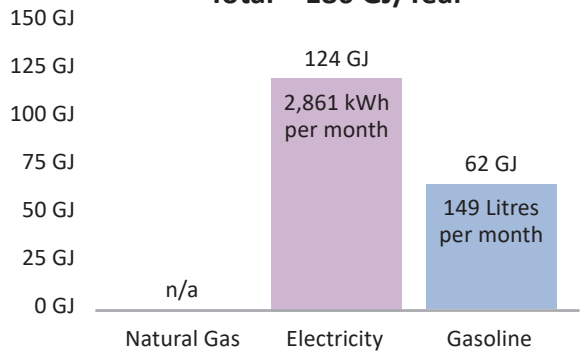


Annual Energy Bills ($) Total = $4,422

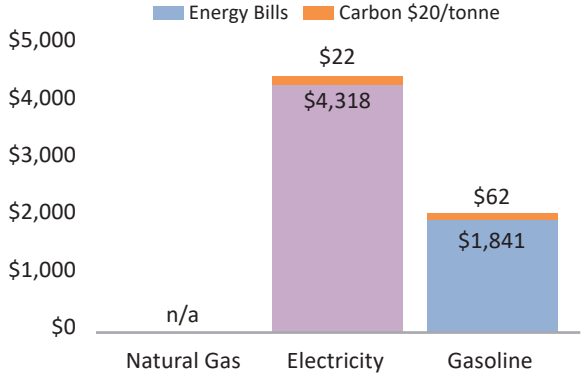


Rural Kawartha Lakes Couple

Annual Energy Use (GJ)
Total = 186 GJ/Year



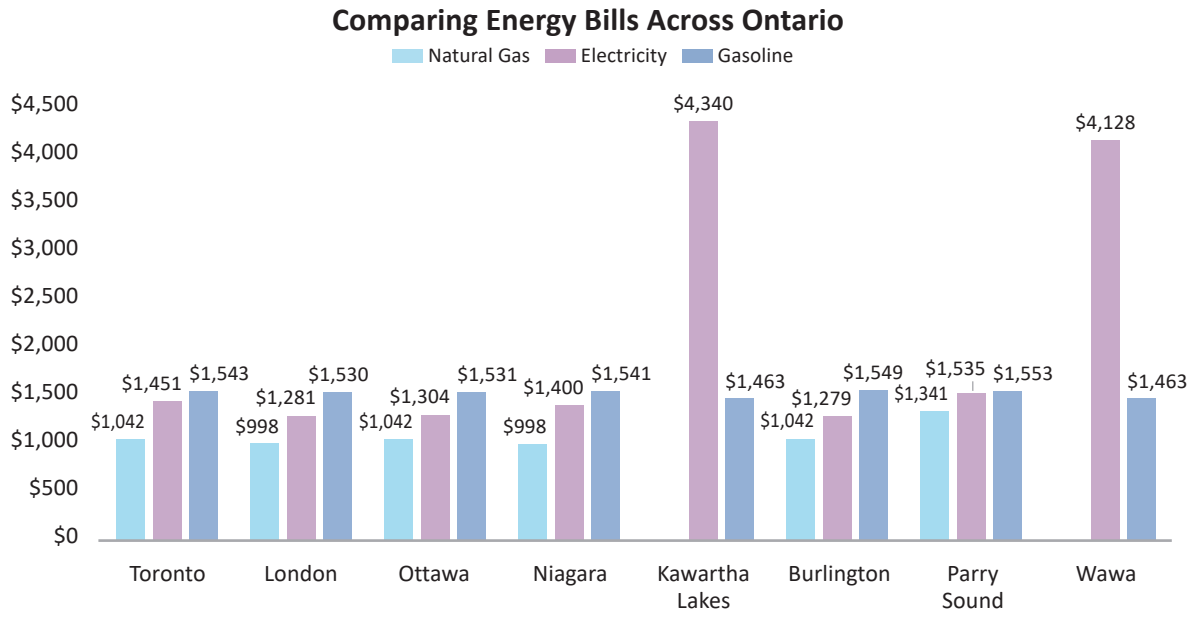
Annual Energy Bills ($) Total = $6,242



Value of Energy – Location impacts costs

The following chart shows some of the different annual energy costs depending on location. [8/9/10]

- Toronto is served by Toronto Hydro, Enbridge Gas
- London is served by London Hydro, Union Gas
- Ottawa is served by Hydro Ottawa, Enbridge Gas
- Niagara Falls is served by Niagara Peninsula Energy, Union Gas
- Kawartha Lakes is served by Hydro One Networks (Low Density R2), with no natural gas service
- Burlington is served by Burlington Hydro, Union Gas
- Parry Sound is served by Lakeland Power, Union Gas (North East District)
- Wawa is served by Algoma Power, with no natural gas service



8. Electricity: Ontario Energy Board. Your Electric Utility: http://www.ontarioenergyboard.ca/oeb/Consumers/Electricity/Your%20Electricity%20Utility.

9. Natural Gas: Ontario Energy Board. Your Natural Gas Utility: http://www.ontarioenergyboard.ca/OEB/Consumers/Natural+Gas/Your+Natural+Gas+Utility.

10. Gasoline Costs: Ontario Ministry of Energy Gasoline Report for Week ending October 10, 2017.

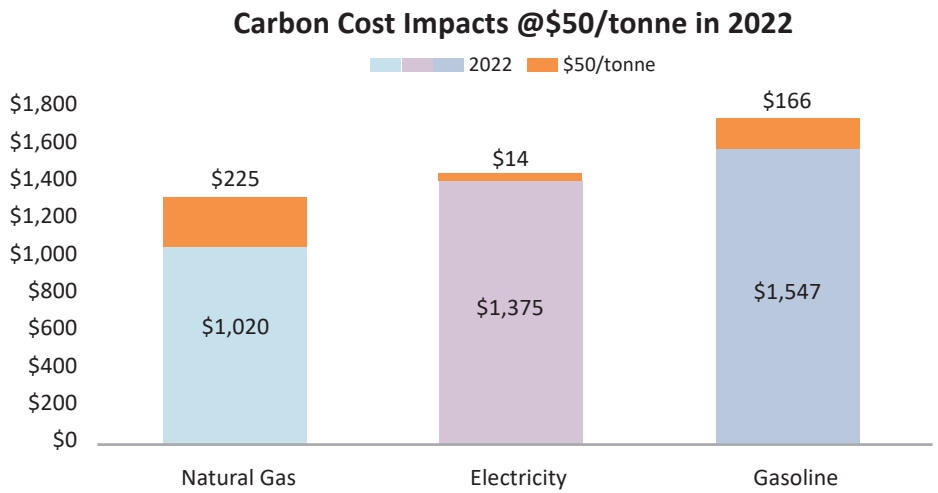
Impact of a rising national carbon dioxide emissions tax (aka carbon tax, carbon price)

The federal government has announced they will introduce a national price on carbon that will gradually reach $50/tonne of CO_2 in 2022.

The chart shows the impact of a $50/tonne tax on carbon in the year 2022 for a typical Ontario household.

A $50 tax on carbon dioxide emissions will increase total natural gas costs by 22%, electricity by 1% and gasoline by 11%. (Carbon pricing for natural gas appears to be relatively higher because the energy costs for natural gas are relatively low.[11])

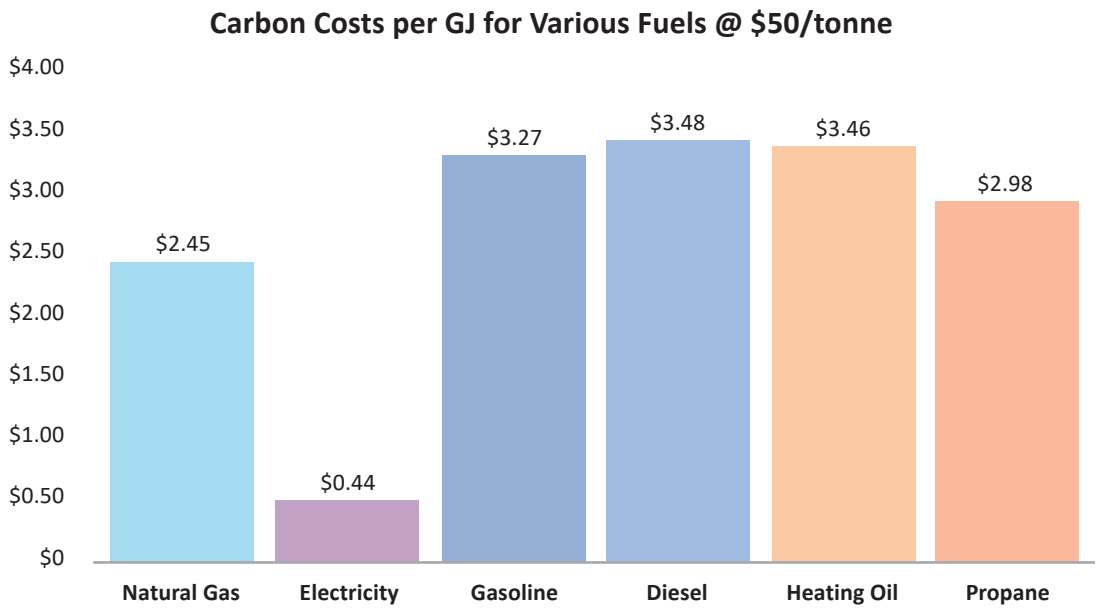
Note: The energy prices in this chart assume constant commodity prices.



11. For example, a GJ of gasoline contains more carbon than a GJ of natural gas, and so carbon costs are higher for each GJ of gasoline than natural gas. However, the energy (commodity) costs of gasoline are higher than natural gas, and so the carbon costs for natural gas appear higher when comparing monthly bills.

Carbon dioxide emissions costs for different fuels[12/13]

Fuels vary in their energy and carbon dioxide content. For example, burning a Litre of gasoline will produce a different amount of energy and CO_2 emissions when compared to burning a cubic metre of natural gas. In order to compare carbon costs, the following chart normalizes the most popular fuels on an energy-equivalent basis – that is their carbon dioxide content per gigajoule (GJ), and multiplies this by a carbon tax/price of $50/tonne of CO_2.



12. Ministry of Environment and Climate Change. Guideline for Greenhouse Gas Emissions Reporting. December 2015: http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2015/012-4549_d_Guideline.pdf. The carbon costs of electricity are based on an 80 grams of CO_2 per kWh.

13. Independent Electricity System Operator (IESO) Conservation and Demand Management (CDM) mid-term review, revised climate summary. September 21, 2017: http://www.ieso.ca/sector-participants/engagement-initiatives/engagements/conservation-framework-mid-term-review.

Conclusion

It should now be apparent that energy comes from a variety of sources, and households consume energy from difference sources. Energy prices vary based on geography as well as the type of energy that is available or used. Of Ontario's 5.2 million households, about 3.755 million heat their homes with natural gas, 909,000 households use electricity, and 352,000 heat their homes with heating oil. Other households use coal, propane and wood for their heating needs.

Household budgets are affected by their energy use. Ontario families with the lowest energy prices typically access multiple sources.

Typical Ontario households that rely on electricity for heating and appliances as well as electronics pay $4,234 a year for energy. Those that use a combination of heating oil and electricity for appliances typically pay $4,271. And households that have access to natural gas – representing 75% of Ontario homes – spend $2,395 each year.

Not everyone has the same breakdown in fuel use as the typical customer, but these figures demonstrate the variances within Ontario.

Government energy policymakers have a significant impact on household energy budgets. Changes to Ontario's energy infrastructure and mix should be done prudently since decisions made today will have lasting consequences on the supply of energy and its long-term affordability.

The public is concerned about climate change and addressing this challenge requires lawmakers to be honest about mitigation costs and the impact of polices on household budgets and businesses. If we hope to maintain our high quality of life, an all electrical or all renewable energy future remains, at best, an aspirational goal in a distant future. Questioning government policies that could negatively impact Canadians does not make the examiner a climate skeptic, merely a responsible and concerned citizen.

The starting point to any discussion on energy policy begins with measurable facts, which this report hopes to provide and give readers an understanding of the energy landscape in Ontario, Canada's largest province and our country's manufacturing heartland.

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Ontario Household Research Report

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