Bay of Quinte Greens

Canada is a highly energetic nation

Canada uses a lot of energy - on a per person basis more than almost any other country in the world. In fact, about 275 kWh per person per day - about **five times** the world average.

Why is this important?

Energy is really important - it is all around us and it is part of everything we do. In fact, our lifestyles are predicated on the availability of boundless, cheap energy.

A fundamental law of nature tells us energy can neither be created nor destroyed. 'Using' energy really means converting it from one form to another. And not all energy can be converted - only high-quality energy can be converted to low-quality energy. Examples of high-quality energy are gasoline and electricity. The lowest-quality energy is heat.

Energy comes in many different forms. And our choices make a huge difference to the impact we have on our environment. When we burn any fuel - for example wood, propane or gas - it produces something useful - for example the work to move our car - and carbon dioxide as a bi-product. We all know that carbon dioxide is a greenhouse gas and impacts the climate.

Electricity is one of our major energy sources. It is a high-quality energy and we are fortunate in Ontario to produce a significant amount of clean (meaning no carbon dioxide) electricity - from hydro and nuclear power.

What are we talking about?

A definition of energy is that it is the ability to do work - in other words we define energy in terms of what it can do for us.

Scientists measure energy in joules and power (the rate at which we use energy) in watts. One watt is one joule per second. The joule and watt are part of the metric system of measurements.

Electricity providers use kilowatts (kW) because a watt is so small. A kilowatt is 1000 watts. But instead of using kilojoules for energy they use kilowatt-hours (kWh) because it is more intuitive. It is the energy of 1kW used for an hour.

There are other (non-metric) units of energy and power that are often used in everyday life.

In the early days of the industrial revolution, engineers needed a descriptive way to describe the power of a steam engine so invented the horsepower. One hp is 0.746 kW. You will know horsepower from the power of your car or truck engine.

And they needed a way to measure the amount of energy in coal so invented the British Thermal Unit. One BTU is 1055 joules and one kWh is 3412 BTUs. Propane and natural gas are sold in BTUs, which makes it hard to compare usage of gas (in BTU) with electricity (in kWh).

We use the calorie too. It is the energy needed heat a gram of water by one degree centigrade. The 'calorie' we use in our diets is actually the kilocalorie - 1000 calories. A kilocalorie is 4184 joules. As we all know, the human body requires about 2000 kilocalories per day or 2.3 kWh.

Energy is ubiquitous - it makes our planet's mass and creates the amazing life it supports. We are made of energy too and it enables our intelligence, creativity, art, science, culture, and society - our brains do it all with about a half a kWh per day.

Thinking Efficiency

Energy conversion can never be perfect - some always 'leaks'. An efficient conversion is one in which most energy is transformed into what we need.

A home furnace produces low-quality heat energy so it can be quite efficient - from 80% to over 95% depending on the furnace's complexity. But some heat will always escape in the exhaust.

Heat (or combustion) engines produce 'work' - a form of energy - to move cars, trucks, trains, or aeroplanes, or to drive machines. They can be very powerful and have transformed the way we live but they are inherently inefficient because they have to 'reject' a lot of heat. It is why cars have a cooling system - they lose about 75% of the gasoline energy put in the tank

Electric motors are far more efficient - normally over 95% - because they convert electricity directly to motion. They are also lighter, physically smaller, mechanically simpler, and less expensive to make.

An incandescent light bulb is an example of a very inefficient conversion - most of the electrical energy converts to making the bulb hot with only a small amount converted to the thing we need, light. It is why light emitting diodes (LEDs) are a much better option - they are highly efficient because they convert electricity directly to light.

How To Go Green

Why go Green? Using less energy makes sense. It also protects from rapid changes in energy prices - for example, propane used to be the low-cost heating option but its price has doubled. And our choices also have a big effect on the impact we have on the environment. A well-designed Green energy system can reduce carbon dioxide emissions, have low operating cost, long life, and be low maintenance.

Heat pumps are the place to start because of their high 'efficiency' - up to 400%.

How can anything be more than 100% efficient? Heat pumps are <u>not</u> like furnaces because they do not <u>convert</u> energy they <u>move</u> energy. As an example, if you were to move a 25L container of gasoline across your lot, in a wheelbarrow, and divided the amount of energy in the gasoline by the amount needed to move it, you would calculate a number of around 35 million percent. Clearly, this number cannot be thought of as 'efficiency'. Instead, we talk

about a ‘Coefficient of Performance’ or COP. It is the same number - the energy moved divided by the energy needed to move it - but expressed as a number instead of a percentage. A ballpark number for a heat pump is a COP of 4.0.

There are three kinds of heat pumps: ground sourced (geothermal), water sourced, and air sourced. All use a refrigerant to absorb heat in one place and move it to another - think of a refrigerant as the wheelbarrow. A fridge is a heat pump - it moves energy from inside the fridge into the kitchen.

It is helpful to think of heat pumps as trains - they are very efficient when running but difficult to get going and to stop. Heat pumps are the same - they like to operate at a steady setting to avoid having to ramp up and down, which causes wear and tear on their components. It is best not to change heat pump settings frequently.

Practical considerations:

- First choice is geothermal: is your lot large enough? Is it sandy (you will have to dig a deeper trench - 4 to 10 feet deep) or rocky (your trench can be shallower but will be more difficult to dig).
- Second, water-sourced: a closed-loop system is like geothermal but with energy being taken from or dumped into a body of water - a pond (as long as it doesn’t freeze to the bottom) or a well, even if it is non-potable water.
- Third, air-sourced: there are many commercial units, and Ontarians are now installing about as many as conventional furnaces. A key difference for air-sourced heat pumps is that the COP rapidly falls when outside air temperature gets too cold (around 0°F) - think of it as the wheel coming off the wheelbarrow. It means they need back-up heat - electric or an existing furnace - on the coldest days.

Then there is solar power. There are two kinds - photo-voltaic and thermal. Both use direct sunlight, the first to create electricity from a semiconductor (typically silicon) and the second to heat water - as in a garden hose left out on a sunny day.

Practical considerations:

- For solar, is your roof compatible, and how will you service the solar cells and repair the roof when the time comes? Will you have a single inverter (more practical) or one on each array (more efficient but they will need to be maintained)? Does a stand-alone array - not on the roof - make more sense, although it will be more costly?
- Connecting to the grid is a good thing because battery technology is not, yet mature. However, doing so can be cost restrictive.
- For thermal, if solar heat is used to heat your hot water, can it be configured so that on a very hot day it does not boil the water in your hot water tank?

In summary, going Green is more and more achievable but take care not to rush into things. Spend time and find a contractor who understands the full scope of today’s technologies and can personalize an optimum solution for your needs.

Energy Saving Tips

Our biggest use of energy is for transportation. We use liquid fossil fuels for most of our transport needs - and these are particularly harmful to the environment.

By far the least efficient form of transport is flying. Avoid flying if you can. If you have a gasoline car, driving slower and more smoothly - with gradual acceleration and braking - will significantly reduce how much gasoline you use.

Electric vehicles are a good idea in Ontario because we produce a lot of Green electricity to re-charge batteries. Offsetting this is the increasing size of EVs and the embedded carbon in their manufacture - a lot of CO2 emissions go into making a vehicle so it may be better to keep a small gasoline car, especially if you can find a way of driving less by planning trips more carefully. Hybrids are a good choice, too, if you drive short distances where you can drive mostly on the battery.

We also use a lot of energy for heating - it takes a lot to heat water and even more to heat our homes.

So for hot water - turn down the temperature on your hot water tank and add a timer. Use energy efficient appliances and set washing appliances to warm or cold. Hang clothes to dry either outside or inside to avoid using a clothes dryer.

For winter home heating, turn down the furnace and try using a portable electric heater to boost the temperature in your main living area. Wear sweaters and try electric jackets. Reduce drafts: repair caulking, seal doors, and improve insulation where you can. In the summer, use a dehumidifier in the basement and measure indoor and outdoor temperature and humidity because both contribute to your comfort.

If you can, enter your house through an anti-chamber - like a garage - so the interior of your house is not directly exposed to the outdoors - to winter cold and summer heat.

If you have a furnace, have it serviced annually, make sure the air filter is changed regularly, and use house exhaust vents (bathroom and kitchen) as little as possible because they are pumping hot or cold air out of the house. As well, keep air vents clean.

Smart thermostats are popular, but if you let your house cool down when you are away, you will need to re-heat it when you return. For short absences, it may be best to leave temperature settings alone - especially if you have a heat pump.

Join The Bay Of Quinte Greens

We hope you have found this Green energy primer useful. The Bay of Quinte Greens work hard to promote Green policies in our region - not just at election time but all the time. We keep active in supporting the protection of our environment, affordable housing solutions, and giving an opportunity for those who support a “Green and Caring Economy” to make friends and take action.

To get involved or make a donation, go to - bayofquintegpo.ca - 75% of donations up to $400 will be returned as a tax credit.