ASK THE

INSPECTOR

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I have heard a lot in the news recently about homes that use renewable energy sources that require much less of our natural resources to generate heat and power and now require much less purchased energy. What are renewable energy sources and how can they be implemented in my home?

Renewable energy sources are a supply of energy (in the form of heat or electricity) that can be used as a substitute for non-renewable fossil fuels and re-used without depleting our natural resources. Sources of renewable energy include solar, wind, water, bioenergy, hydrogen, and earth energy. For example, because the sun is essentially an enormous power plant that has an infinite amount of available energy, using solar energy to heat water in a home will not reduce the amount of solar energy that is available for others. In addition, fossil fuels generate a relatively large amount of carbon dioxide (CO_2) into our atmosphere, creating a greenhouse gas effect and global warming (climate change). Most renewable energy sources, generate significantly less greenhouse gas emissions and therefore reduce the effects of energy use on global warming.

Earth Energy Systems (EES) utilize the constant temperature of the earth (or groundwater) to provide warm (or cool) air to a home. These systems can also be used to heat a home's water. The most common residential EES is a heat pump which comes in two forms; open loop and closed loop. In an open loop system, a well and a pond, river, or second well are required, one as a supply source and one as a discharge location. The water from the supply source is pumped to the heat pump where heat is extracted from the water and the heat transfer to the interior of the home occurs. The "energy extracted" water is then pumped into the discharge location with no added contaminants, but at a slightly lower or higher temperature (depending if it is being used to heat or cool a home). A closed loop system consists of a series of pipes containing antifreeze (refrigerant) travelling through the ground (usually 1-2 m below the frost line). The heat (or cold) is supplied to the heat pump using the refrigerant, rather than the water that is used in an open loop system. These types of systems are initially more expensive to install than a typical gas, oil, or electrical heating system, however the operating costs are significantly lower and the payback on the initial investment is usually realized in a short period of time. More recently, large geothermal

power plants have been constructed to harness the earth's energy and provide heat as well as electricity to entire geographical areas.

Bioenergy refers to the solar energy that is stored in plants and trees that can be transformed into heat through combustion. This type of energy can take many forms, including as a liquid (e.g. biodiesel, bio oil), a gas (e.g. methane from landfills, ethanol from wheat or corn), or as a solid (e.g. wood, pellets). Wood is the most widely used (and residentially accessible) bio energy fuel and probably the oldest heat source in the world! It can be burned in fireplaces or stoves as a space heater or can be used to heat an entire home in a central furnace. Newer wood stoves are more efficient and cleaner burning than the older style stoves and are significantly more efficient than fireplaces. Trees are a renewable resource, however if a forest is being clear-cut to provide wood for energy, the source will eventually be depleted. If a wood source is not accessible, there are stoves that will burn other types of biofuel such as pellets consisting of wood or other biomass waste or corn grain.

Solar energy comes from the sun. The energy that is collected can be used to generate electricity or heat water for potable uses or for a pool. The sun's energy is usually harnessed for electricity generation using a photovoltaic cell, which consists of a semiconductor material (typically silicon or a silicon alloy) that is capable of transforming the sun's energy into electricity. The solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material to produce electricity.These cells are typically installed on the roof of a house and can be connected to batteries or directly into the home's electrical service to store the energy for when it is cloudy or dark outside. There are two methods of heating water – pumping water through black pipes or circulating an antifreeze through a 'collector'(a panel through which the antifreeze flows to collect the sun's energy) and then into a heat exchanger for the water requiring heating to absorb the heat. Both the pipes and the collector are typically installed on a roof facing south to maximize their effectiveness. The amount of water that is heated or electricity generated depends on the number of cells installed, the location of the cells (south facing cells will collect more energy than north facing cells) and the amount of sunlight in the area. These systems are expensive to install, however they are low maintenance and can pay for themselves in usually 10-15 years.

The harvesting of wind energy is performed using turbines that are powered by the wind. These turbines can be used to either generate electricity or perform mechanical work (i.e. run a pump). Similar to other types of renewable energy sources, location and wind speeds are important, and a back up system may be required for circumstances when there is no wind. In Canada, some of the best wind generation sites are located near large bodies of water where wind speeds and durations are typically higher.

Fuel cells are another source of energy that uses electrochemical processes to convert hydrogen into electricity. The fuel cell is twice as efficient as the internal combustion engine and emits only water vapor as a byproduct of its use. Stationary fuel cells can be installed in the basements of homes to heat, cool and generate electricity. Currently, the majority of all hydrogen is generated using natural gas (a non-renewable fossil fuel), however given its abundance, in the future wind has the potential to become the principal source of energy to generate hydrogen.

Internationally, Canada is known for one of the most common renewable energy sources- hydroelectricity. This energy resource allows Canada to generate electricity with minimal greenhouse gas emissions. Basically, flowing water creates energy that can be harnessed and turned into electricity. The most common type of hydropower plant uses a dam on a river to store water in a reservoir. Water released from the reservoir flows through a turbine, spinning it, which, in turn, activates a generator to produce electricity. The largest hydroelectric generation plant in Canada and one of the largest in the world is located in Churchill Falls, Labrador. The Churchill Falls plant generates over 5400 Megawatts of electricity annually.

Some provinces allow net metering for storing the electricity that is generated from renewable energy sources. If a home is producing electricity using a renewable energy source that is connected to the electrical grid, any surplus electricity that is produced can be 'stored' on the grid (i.e. the electrical meter installed at the home will actually turn in the opposite direction).

Canadians living in urban areas may find that installing a renewable energy system at their property is not feasible, either financially, spatially, or geographically. If this is the case, many electricity providers are now making electricity generated by renewable energy sources available for homeowners to purchase on their monthly bills. This type of electricity, although typically very environmentally friendly, is significantly more expensive due to the higher initial costs associated with implementing renewable energy source equipment.

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