

Energy and Climate Change:

An introduction to relevant terms

The closely-linked topics of “climate change” and “energy” are issues of interest to many citizens. A [recent survey](#) shows that 74% of Edmontonians are concerned about climate change and 75% agree that we need to take action now.

The City of Edmonton is addressing climate change in its operations and is working with its citizens and businesses to become climate resilient. To support these efforts, the City has developed several important documents that examine climate issues, including how we use energy, the role energy plays in our day-to-day lives, our sources of energy and what we can do to become more energy efficient. In addition to mitigating climate change, the City is also concerned about the impacts we already feel from a changing climate and we are now on a path to adapt to climate change.

This reference guide looks at some of the key terms related to energy and climate change and how these two topics are connected. Its purpose is to help those who are new to the concepts read and understand relevant materials produced by the City, including the [Energy Transition Strategy](#) and [Climate Resilient Edmonton: Adaptation Strategy and Action Plan](#).

A web-based version of this PDF can also be found [online](#).

Resilience

This term can be applied in any number of ways, but in the context of a city, resilience is the capacity of a system to survive and thrive under changing conditions, and to maintain its functions during change. Resilience is the outcome the City is striving for, which can be achieved by thoughtful implementation of identified adaptation and mitigation actions.

Risks related to climate change and energy include our 95% dependency on fossil fuels, our reliance on a centralized electrical system and challenges we face when severe weather events occur.

As you read through this document, think about the city as a system and how you would rate its resilience and how your choices affect resilience at an individual, neighbourhood and city-wide level.

Climate

What is climate change?

Climate change is the long-term change in weather patterns (e.g., an increase or decrease in extreme weather events, such as hurricanes, droughts or floods) over periods of time ranging from decades to millions of years. The terms “climate change” and “global warming” are often used interchangeably. However, global warming pertains only to the average increase in the Earth’s surface temperature, while climate change covers a wide range of potential changes in weather patterns, including changes in temperature and precipitation.

Among other impacts, climate changes can negatively affect habitat by creating changes in average temperatures and precipitation that may make it difficult for plants, animals and humans to survive. Greenhouse gases produced by humans, mainly through the burning of fossil fuels (e.g., coal, oil and petroleum products like gasoline), are a significant contributor to modern climate change.

What is the difference between climate and weather?

Climate is the average weather over a long period of time. It is long-term, covers a wide area, changes gradually and is an average of weather over many years, typically assessed at 30-year intervals.

Weather is the current or short-term state of the atmosphere. Weather includes temperature, precipitation, humidity and wind, among other conditions.

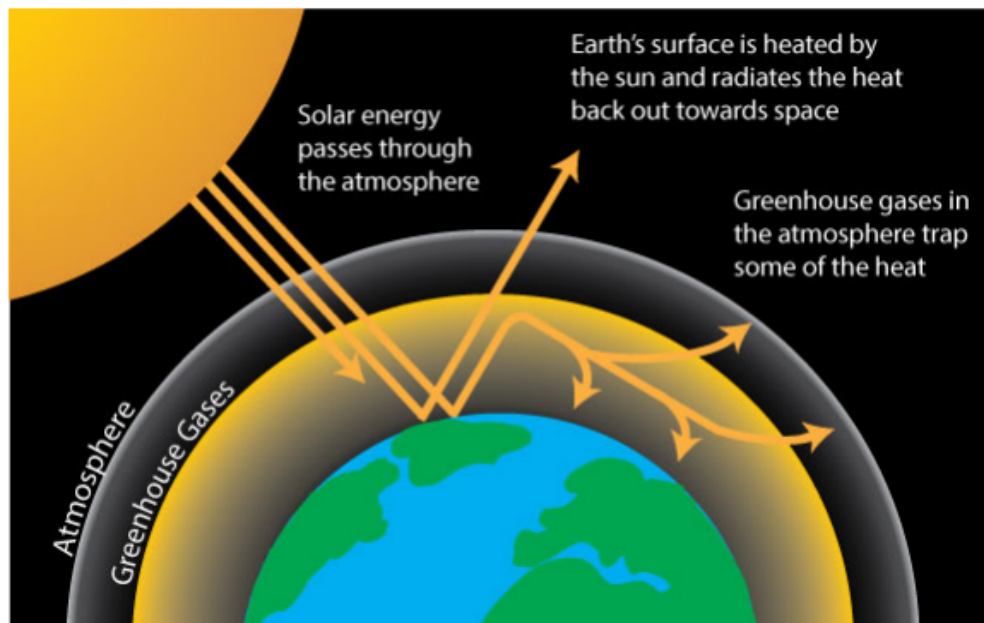
What is a greenhouse gas (GHG)?

Greenhouse gases (GHGs) are gases that absorb and trap heat in the atmosphere. Carbon dioxide (CO₂) is the main naturally-occurring GHG. The most common human-produced GHGs are CO₂, methane (CH₄) and nitrous oxide (N₂O). GHG emissions result from the burning of fossil fuels for residential and industrial purposes (producing mainly CO₂), from agricultural and oilfield activities (mainly CH₄), and from vehicle emissions (mainly CO₂ and N₂O).

GHGs are also emitted from natural sources such as volcanoes and forest fires. Water vapour is another important GHG. All GHGs released to the atmosphere contribute to the greenhouse effect, regardless of where in the world they are emitted.

What is the greenhouse effect?

The **greenhouse effect** is a naturally occurring phenomenon in which GHGs in the atmosphere absorb and trap heat energy that is radiated back from the Earth’s surface – like wrapping a blanket around the Earth to keep it warm and habitable. However, human activities are adding more GHGs to the atmosphere, interfering with the natural carbon balance, increasing the greenhouse effect and raising the Earth’s temperature. These increased temperatures can lead to more frequent and extreme weather events, which can be associated with climate change.



What does it mean to be carbon neutral?

Being **carbon neutral** means balancing the amount of CO₂ emitted to the atmosphere with actions to reduce or offset these emissions in other places, so the net effect is zero carbon emissions. For example, a community might plant trees to absorb GHG emissions that are produced as we heat and power local buildings. Thus, although GHGs are emitted, actions are being taken to reduce the net emissions, moving us closer to being carbon neutral. When talking about carbon neutrality, the terms carbon, carbon dioxide and greenhouse gas emissions are often used interchangeably.



What is climate mitigation?

Climate mitigation refers to efforts that slow climate change by reducing or preventing the release of greenhouse gases to the atmosphere. Efforts can include reducing the use of fossil fuels, increasing the use of

renewables and reducing energy use, overall. Edmonton's mitigation plan is outlined in [Edmonton's Energy Transition Strategy](#).

What is climate adaptation?

Climate adaptation is about lowering the risks and negative impacts, and embracing potential opportunities associated with climate change so that communities and ecosystems are prepared to cope with new climate conditions. [Climate Resilient Edmonton: Adaptation Strategy and Action Plan](#) examines the resilience of Edmonton, its people and services, to climate change.

Energy

What is energy?

Energy is power that can be used for many purposes. Its many usable forms include heat (thermal), electrical, nuclear, chemical and mechanical energy.

Where does energy come from?

There are two broad types of energy: non-renewable and renewable.

Non-renewable energy comes from sources that are used up and cannot be replenished. Examples are fossil fuels such as coal, oil and natural gas. In Alberta, most of our energy comes from non-renewable sources. In Edmonton, approximately 95% of energy is from non-renewable sources.

Renewable energy comes from sources that can be naturally replenished at a rate that is equal to or greater than their rate of use. An example is biomass energy, which commonly refers to plants such as corn, sugar cane and others that are grown for use as biofuel. Byproducts of the forest industry, including wood chips, sawdust and bark, are also used as biomass. Biomass is material derived from living organisms, both plants and animals. Biofuel is an energy resource made from biomass, or in Edmonton's Waste-to-Biofuels facility, from municipal waste that cannot be recycled or composted.

Renewable energy also comes from continuing natural energy flows, such as solar radiation, wind, flowing water and geothermal sources. Geothermal energy is accessible heat energy stored in the Earth's interior, and is used to generate electricity or to supply heat.

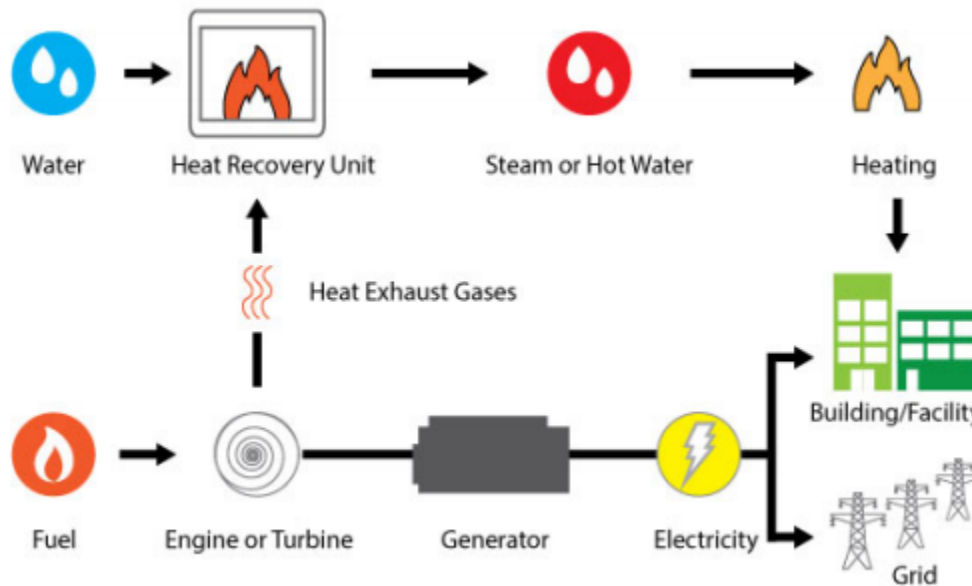
There is some debate about how to define the term "alternative energy," but usually it refers to an energy source other than fossil fuels, such as the renewable energy sources listed above.

How is energy related to greenhouse gases (GHGs)?

Producing energy by burning fossil fuels such as coal and natural gas creates GHGs by releasing stored carbon back into the atmosphere as CO₂. Different energy sources and energy production systems produce differing amounts of GHGs. Generating renewable energy, such as from solar, wind and geothermal sources, produces few, if any, GHGs.

What is co-generation?

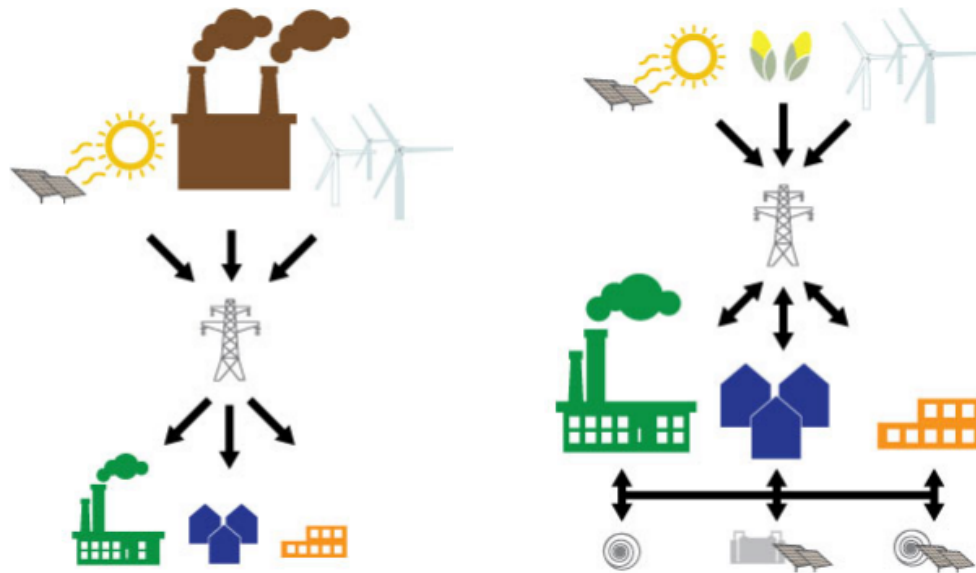
Co-generation is also called “combined heat and power” (CHP). When electricity is generated, particularly through the burning of fossil fuels, heat is also produced. Rather than dispersing the heat energy through cooling towers or other means (and thereby wasting it), co-generation captures and uses it for heating water or for space heating. The captured heat can be used on-site or transmitted elsewhere.



What is centralized energy?

In a **centralized energy** supply system, electricity is usually produced far from where the electricity is used. Centralized systems can use a variety of inputs, including coal, natural gas and even hydro (water). Hydro generation occurs in many Canadian provinces, including British Columbia, Manitoba and Quebec, but is not common in Alberta. Typically, electricity in a centralized system is produced on a large scale and is transmitted over a large geographic area to supply the needs of many. The coal-fired plants west of Edmonton are an example of centralized energy, producing electricity for many end-users in Edmonton and far beyond.

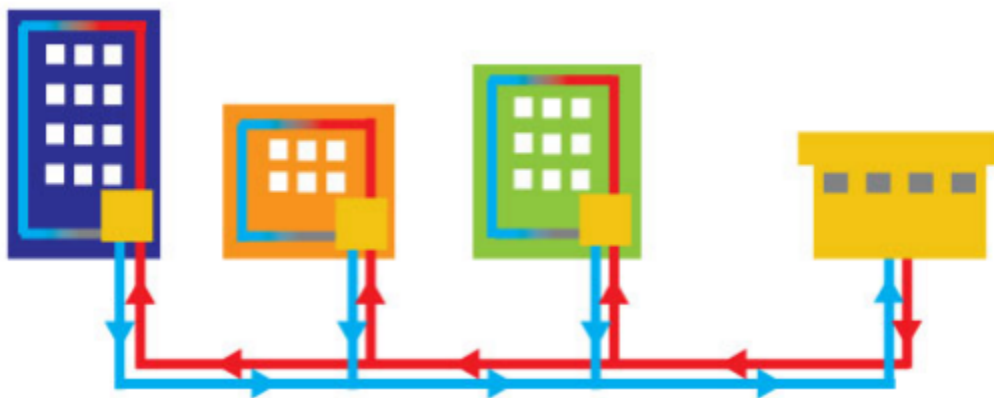
In a **decentralized energy** system, the energy is produced close to where it will be used.



What is a district energy system?

District energy usually refers to systems in which a single energy provider supplies several nearby end-users. For example, rather than every building on a block having its own furnace, one very large furnace or boiler would be installed and energy sent through a distribution system of pipes to nearby users. By sharing the costs for installation and maintenance of the heating and cooling system, everyone enjoys cost savings. Although not entirely interchangeable, sometimes people will use the term distributed energy when they really mean district energy.

Co-generation is popular in district energy systems. The University of Alberta's main campus is a great example of district energy system, one of the largest in North America.



What is micro-generation?

Micro-generation refers to small-scale generation of electricity (less than one megawatt, or 1,000 kilowatts) by a homeowner, small business or a community. Rooftop solar panels are an example of micro-generation. The energy might be stored on-site or, as is often the case in an urban setting, be fed into an existing electrical grid.

What is energy mapping?

Energy mapping is done to identify energy used within a specific geographic area. It helps identify energy requirements and opportunities for improving energy efficiency in the mapped area (e.g., a neighbourhood).

What does it mean to “build green”?

This is the practice of creating structures and using processes that are environmentally responsible and use resources efficiently throughout a building’s life cycle. When “building green,” these practices are applied to all stages of design, construction, operation, maintenance, renovation and demolition.

What is the difference between energy efficiency and energy conservation?

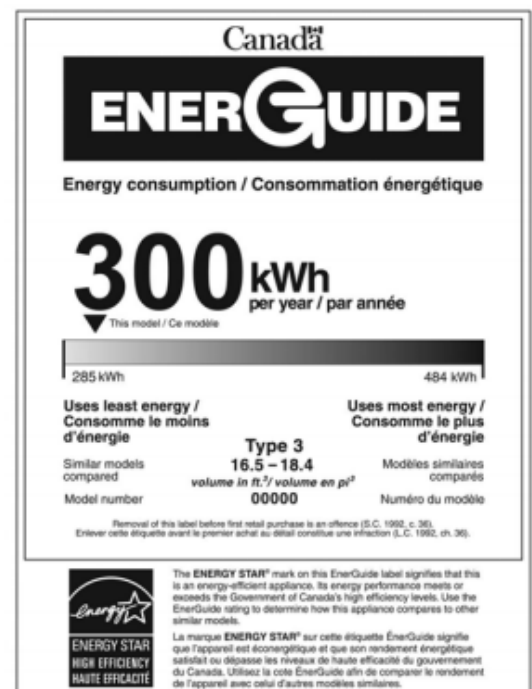
Energy efficiency means less energy is used to perform the same service. For example, compact fluorescent lights (CFLs) and light emitting diode (LED) bulbs use less energy than an incandescent bulb to provide the same amount of light, thus making them more efficient.

Energy conservation means reducing energy consumption (e.g., turning off a light, turning down the furnace and wearing a sweater, or walking or cycling instead of driving).

Both energy efficiency and energy conservation contribute to reducing GHG emissions.

What are energy ratings?

Energy ratings help consumers choose products that use energy most efficiently. For example, Canada’s **EnerGuide® labels** appear on appliances, heating and cooling equipment, houses and vehicles. This label allows consumers to compare energy use of similar products when making a purchase. **ENERGY STAR®** is the international symbol of premium energy efficiency. Products that display the Energy Star symbol have been tested according to prescribed procedures and have been found to meet or exceed higher energy efficiency levels without compromising performance.



How is energy use measured?

Your household electricity use is measured in kilowatt hours (kWh). As electricity is used, the meter measures the amount in kWh. The natural gas used to heat our homes is measured in gigajoules (gJ) by a different meter.

How do I read my electricity meter?

Visit www.epcor.com/meters/Pages/meters.aspx for information on how electricity meters work and how to read yours.

How do I read my natural gas meter?

Visit www.atco.com/en-au/for-home/natural-gas/gas-meter.html for information on how natural gas meters work and how to read yours.

Climate Change Adaptation

What is adaptation?

Adaptation is lowering the risks and negative impacts and embracing potential opportunities associated with climate change so that communities and ecosystems are prepared to cope with climate conditions. When combined with mitigation efforts (actions to slow climate change by reducing or preventing the release of greenhouse gases to the atmosphere), we can become resilient.

What is a "climate shock" or "climate hazard"?

Acute, short-term shocks, called "climate hazards," are severe weather events that already occur, but may happen more frequently and with greater intensity as a result of climate change, such as flooding, freezing rain, hail and high winds. Sometimes they are referred to as "sudden-onset."

What is slow, onset climate stress?

Chronic, slow onset stresses occur only because of climate change, and include glacial retreat (melting glaciers) and ecosystem shifts (defined as a change in habitats, species types, migration and so on, that result from a changing climate).

What is sudden-onset climate shock?

See climate shock or hazard, above.

What is an ecosystem shift?

An **ecosystem shift** is defined as a change in habitats, species types, migration and so on, that result from a changing climate. An example is that with the models showing a drier, hotter Edmonton in the 2050s, this northern city will be better suited for plants and trees that require less water and can thrive in higher temperatures than the vegetation that grows here now.



What are assets and service areas?

Assets and service areas are terms often used when describing how climate change might impact Edmonton, or any other community. **Assets** are the infrastructure, or physical pieces of equipment and buildings required for the city to run smoothly. Roads, street lights, power lines, pipes, storage buildings, recreation centres, sports fields, and so on are all considered to be assets.

Service areas might be described more as how a city functions, such as ensuring social services are accessible, people have access to recreation, access to clean drinking water, etc. The services are usually tied very closely to the assets, for example, having an emergency management plan that can be implemented will rely on having assets such as communication lines, accessible roads, fueling stations, vehicles—to name a few—to ensure the plan can be acted on.

Learn more

Find more definitions and acronyms in the final pages of Edmonton's mitigation and adaptation strategies:

[Energy Transition Strategy: Building a Climate Resilient Edmonton](#)

[Climate Resilient Edmonton: Adaptation Strategy and Action Plan](#)