

Renewable energy — what you need to know

Alberta has some of the best renewable resources in Canada. There are significant opportunities to supply the majority of Alberta households and industries with reliable, cheap and clean electricity.

With the falling costs of solar and wind energy, our electricity sector has entered a new reality where renewable generation is the most economical source of new electricity generation for the province. As more citizens, community groups, local governments and businesses express interest in taking advantage of renewable energy, several questions come up repeatedly. This document aims to answer those common questions.

What is renewable electricity?

Renewable energy comes from natural sources that are replenished after use. Renewable sources include solar, wind, hydro, geothermal, and sustainably-managed biomass.

How much renewable electricity does Alberta generate?

In 2019, 10% of Alberta’s electricity was supplied by wind and hydro. Solar generation has increased rapidly over the last few years and some biomass-fired power stations complete Alberta’s renewable energy mix.

The Government of Alberta set a target of generating 30% renewable power in the province by 2030.¹ In 2017 and 2018, the Government of Alberta also secured the construction of 1,360 MW of wind power through the Renewable Electricity Program (REP).² These wind farms, which are being constructed between 2019 and 2021, will generate enough electricity to power 555,000 homes.

The Government of Alberta also contracted new solar projects to match over half of the demand from government operations. The new solar farms will generate over 145,000 MWh per year.”³

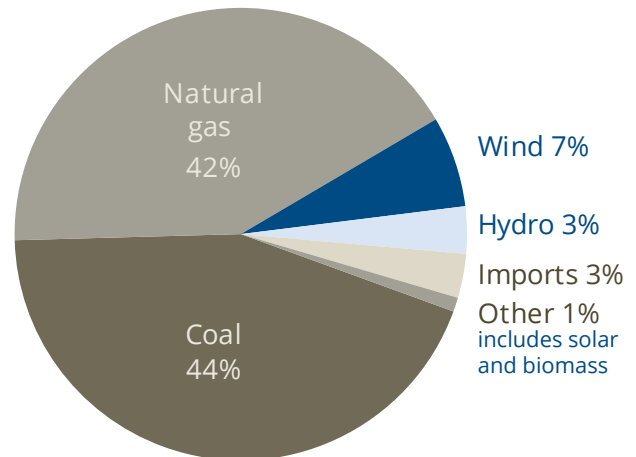


Figure 1. Electricity generation in Alberta in 2019 by technology

Data source: Alberta Electric System Operator⁴ NOTE: Data excludes electricity that is generated and used directly on-site without being sent to the grid.

How abundant are renewable resources in Alberta?

Alberta has some of the best wind and solar resources in Canada (Figure 2). In the southern half of the province, solar resources are equivalent to those of Rio de Janeiro and Miami.⁵

Additionally, Alberta’s world-class wind resources led to

the development of projects that will generate electricity at record-low costs (see the following question).

Although they make up only a small portion of electricity generation in 2019, hydro, geothermal and sustainable biomass also have potential for growth in Alberta.

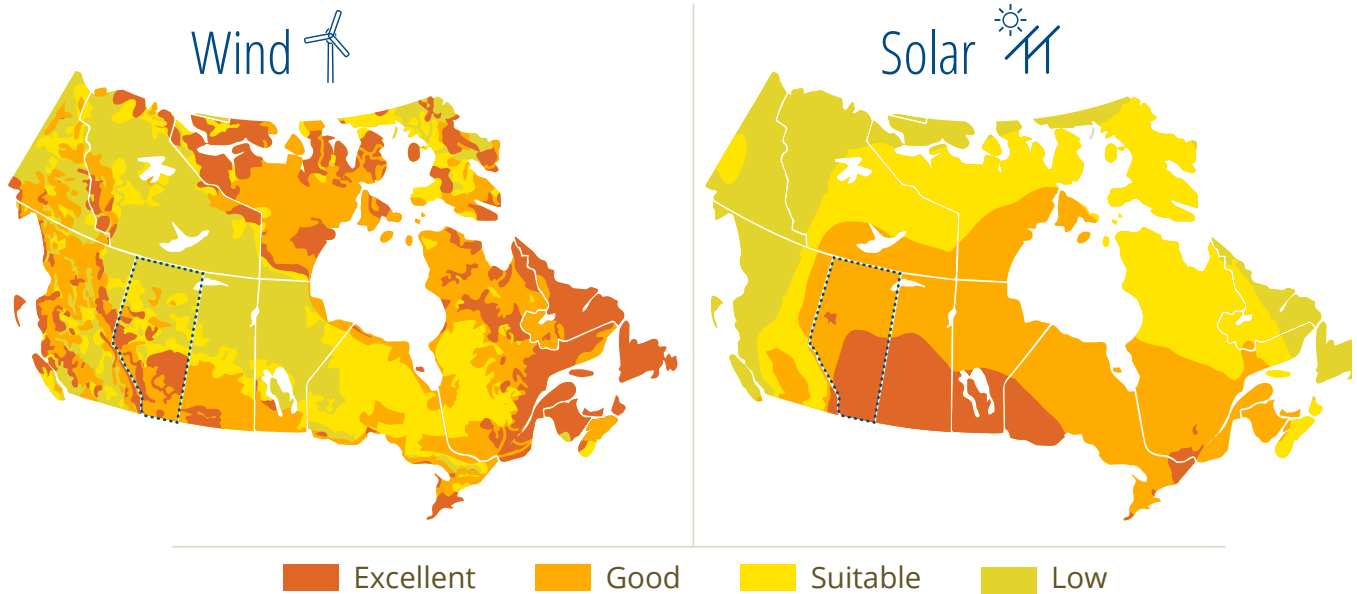


Figure 2. Map of renewable resources in Canada

Source: Pembina Institute⁶

How do renewable electricity costs compare to other types of generation?

Renewables are currently among the cheapest options for electricity in Alberta, with costs expected to continue falling over the next two decades (Figure 3).

Recent project announcements put Alberta on the map for the most cost-competitive renewable energy electricity projects in the world. As seen in Figure 4, the wind and solar projects that won the competitive Renewable Energy Program (REP) rounds organized by the Government of Alberta came in at prices lower than fossil fuel generation. With the projected decrease in renewable energy costs globally, the potential of future projects to

keep electricity affordable is promising.

Moreover, electricity from natural gas generators is subject to carbon pricing, which will likely continue to increase over time, and to fluctuating gas commodity prices that are currently at all-time lows, but could increase in the future. The cost of the fuel is a significant driver of the overall costs of coal- and gas-generated electricity, whereas the “fuel” for solar and wind power is free. Renewable energy thus reduces some uncertainty in electricity costs.

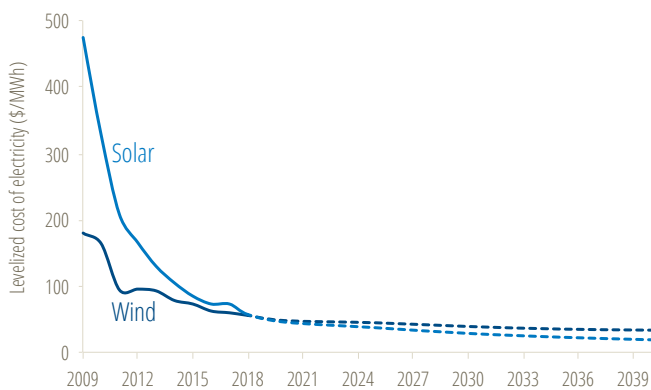


Figure 3. Historical and projected cost of power from new onshore wind and solar photovoltaic projects

Data sources: Lazard and Bloomberg NEF⁷

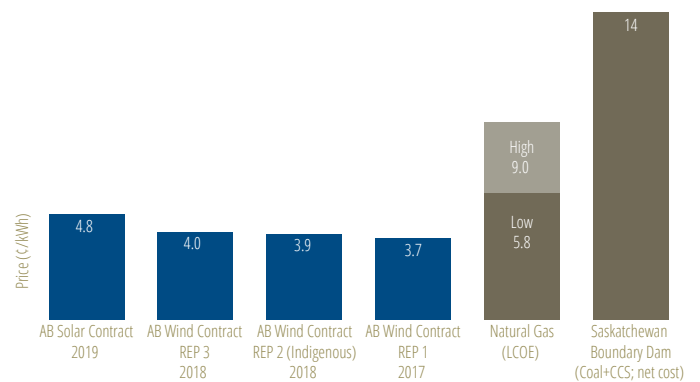


Figure 4. Renewable energy contract prices in Alberta compared with fossil fuel-fired electricity costs

Date sources: Government of Alberta, AESO, Lazard and Dolter⁸

Is renewable energy new in Alberta?

One of the first commercial wind farms in Canada was installed in Alberta in 1993.⁹ The province has had decades of experience dealing with the installation of renewable power plants, as well as managing the electricity grid with variable output coming from new wind farms.

Large-scale solar power is newer in Alberta but is undergoing rapid growth. The first large-scale solar farm that sells power on the wholesale electricity market was built in 2017; it generates over 20,000 MWh per year.¹⁰ Several more solar projects have secured funding

Did you know?

100,000 MWh is enough to power 15,700 homes in Alberta for an entire year

and are scheduled to be built between 2020 and 2022, including what will become Canada's biggest solar farm.¹¹ In addition, as of February 2020, there were over 3,500 smaller solar installations in the province, including residential and commercial systems, delivering over 70,200 MWh.¹²

What benefits come to communities hosting large-scale renewable projects?

Establishing wind projects requires extensive consultation, and project developers must negotiate agreements with local landowners. More investment in renewable energy means more activity for local businesses, as well as additional revenue for landowners through lease payments.

These projects also contribute tax revenue to municipalities and provide opportunities to build new infrastructure needed by both the project and the

community, such as roads, bridges and high-speed internet.¹³ The resulting economic activity generates direct jobs locally for project construction and operations, as well as indirect jobs in support services.¹⁴

There is sometimes an opportunity for local ownership in the project as well. For example, the second round of Alberta's Renewable Electricity Program (REP) in 2018 also required bidders to propose projects with a minimum 25% Indigenous equity ownership.¹⁵

What does renewable energy mean for utility bills?

In Alberta's deregulated market, the system operator chooses electricity from the lowest-bidding power producers first, working its way up to more expensive bidders until demand is met. The most expensive generator chosen sets the hourly price at which all

selected producers are paid. As renewable have no fuel costs, their producers bid at \$0/MWh, and are selected first. Therefore, adding more renewables has the effect of drawing down electricity prices (Figure 5).

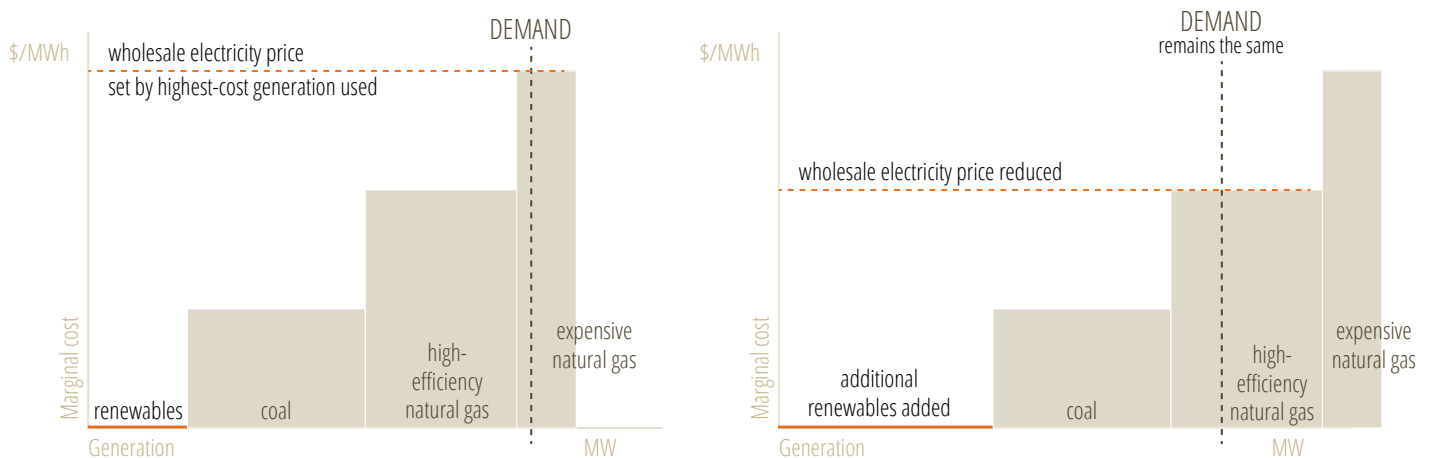


Figure 5. When cheap renewable energy options are added to the electricity market, electricity prices fall

What kind of job impact do renewable energy projects have?

Renewable energy projects involve a variety of direct job opportunities, including mechanical, electrical, civil and design engineers; technicians; and construction workers.¹⁶ The wind farms near Medicine Hat, Pincher Creek, and Hanna, built as a result of the REP Round 1, created 740 jobs.

Is renewable energy reliable?

Solar and wind are variable sources of electricity, with production depending on weather. Wind production can be forecasted with enough accuracy to plan around fluctuations,¹⁸ while solar production varies consistently with daytime and winter hours, making it easier to predict both from year to year.

Interestingly, however, the same phenomena that impair conventional power plants correlate with high levels of renewable generation. There are well-documented cases of wind power helping to prevent blackouts in the U.S. during the recent “polar vortex,” when coal piles froze

Reaching the provincial target of 30% renewable electricity by 2030 would create 9,300 more jobs in 10 years.¹⁷ The REP Round 2 requirement for a minimum 25% Indigenous equity ownership could bring employment opportunities to Indigenous communities.

solid and demand for gas for home heating skyrocketed, disabling a dramatic numbers of coal and gas-fired power stations.¹⁹

Furthermore, solar panels and wind turbines are proven to be very reliable. They require less maintenance and undergo fewer unplanned outages than coal and gas-fired power stations.²⁰ Combined with other technologies such as energy storage and demand-side management, wind and solar can contribute to a clean portfolio that can provide a reliable supply of electricity to the grid at all times.

How do renewables affect the reliability of the electricity system?

Critics of renewable energy question if it can match steady “baseload generation” that large-scale conventional power plants can provide. However, the need for baseload is increasingly becoming an outdated concept. As consumers adopt more technologies such as electric vehicles and smart heating that can draw electricity at traditionally off-peak times (such as at night), the grid needs to become more flexible to adapt to this new demand profile. Inflexible generation from large generators such as centralized coal plants can now be a liability, because power sources need to be able to respond quickly to changes in demand. Instead, a mix of different types of generation that can be brought online as needed can better meet demand at any given time.²¹

According to the Alberta Electric System Operator, the reliability of the electricity grid is not at risk as Alberta transitions to 30% renewable electricity by 2030 and phases out coal.²² In fact a portfolio of clean energy solutions — comprising renewables, energy efficiency, storage, and demand-side management — can provide the same or more reliability characteristics than fossil fuel generation (Figure 6).²³ For example, solar provides power at times when demand is the highest (during the day in

the summer); battery storage can respond in less than a second to sudden changes in demand; energy efficiency and demand flexibility can reduce peak demand. Moreover, reliability comes at a lower cost with a clean energy portfolio than with natural gas technologies.

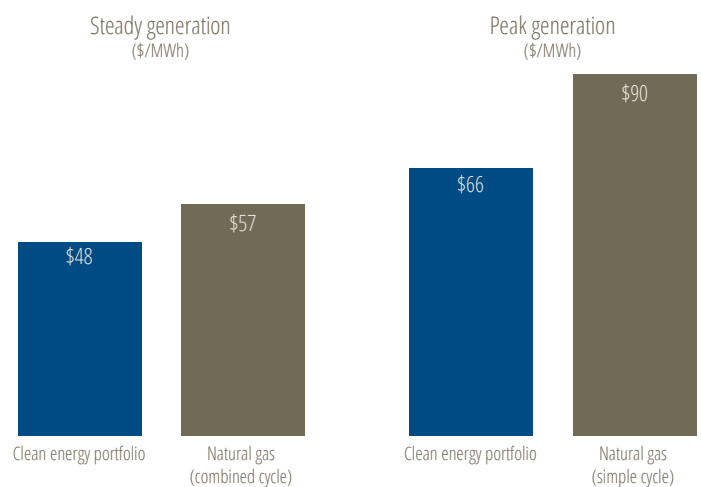


Figure 6. Cost of steady and peak electricity generation by natural gas plants and by a clean energy portfolio

Source: Pembina Institute²⁴

Does renewable energy require more transmission lines?

The Alberta Electric System Operator (AESO) — the manager and operator of the provincial power grid — plans for upgrades of the transmission line network to meet the projected demand for electricity and to ensure electricity is delivered from where it is produced to where it is consumed. As with all new electricity generation, total costs may increase if new projects require new transmission infrastructure, and the pace of growth of renewables can be restricted by the planning of transmission upgrades. However, it is

expected that hundreds of megawatts of new renewables can be developed using the significant transmission infrastructure already in place, while AESO has also planned several transmission upgrades over the coming years that will allow competitive renewable power generated in the south and central regions to supply electricity to consumers across the province.²⁵ In addition, construction of transmission lines between provinces could enable even higher levels of renewable energy development.

How do renewable energy projects reduce carbon pollution?

Wind and solar facilities have one of the lowest life-cycle environmental footprints of any electricity-generating technology (Figure 7). Life-cycle emissions take into account all the emissions caused by the building, operation, and decommissioning of the generator, including the footprint associated with the extraction of its materials.

Reaching its legislated 30% renewable energy target by 2030 will result in a reduction of 7 Mt CO₂e in Alberta; electricity emissions in the province in 2015 were 46 Mt CO₂e.²⁶

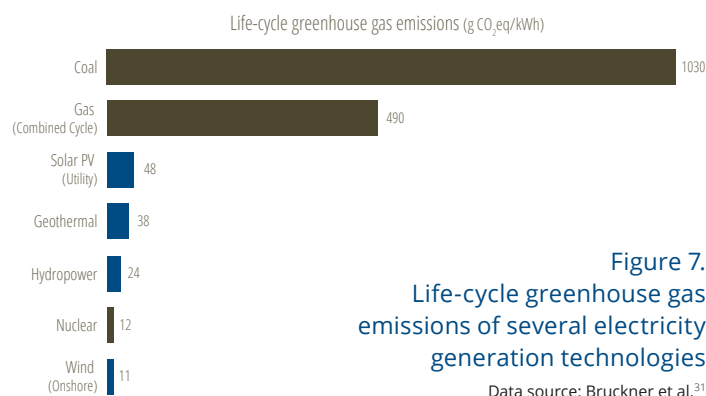


Figure 7.
Life-cycle greenhouse gas emissions of several electricity generation technologies

Data source: Bruckner et al.³¹

What is happening to coal generating stations?

In addition to causing negative health impacts from air pollution — responsible for 92 premature mortalities and \$461 million of health costs per year in Alberta at 2015 coal-generation levels²⁷ — coal-fired generating stations are becoming increasingly uneconomic. A substantial fraction (42%) of coal plants in the world are currently running at a deficit.²⁸

In 2012, the federal government legislatively limited the lifespan of existing coal plants to 50 years. In 2016, Alberta implemented a provincial coal phase-out by 2030, accelerating the retirement of six of 18 power stations.

To accelerate health, economic and climate benefits nationally, in 2018 the federal government implemented a national coal phase-out regulation retiring all remaining coal-fired power stations that are not equipped with effective carbon capture technology by the end of 2029.²⁹ As is the case in most parts of the world, coal-fired plants in Alberta are being replaced by cheaper renewables as well as natural gas. Several coal plant operators in Alberta have committed to shut down or convert their plants to natural gas several years earlier than the regulated schedule.³⁰

What type of support is needed to enable renewable energy growth?

Renewable energy costs are already competitive with or lower than coal or natural gas plants (Figure 4). To attract investors and financing, however, the renewable industry needs policy certainty. Governments can create such certainty through means like competitive bids for long-term contracts, firm commitments to a renewable

energy target, rebates for solar installations and loan guarantees. Another key mechanism is a regulatory framework and market that allows renewables, energy efficiency and storage to monetize the services they provide for the grid (such as frequency regulation, voltage control, reducing peak load or avoiding infrastructure costs).

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