University of Alberta Future Energy Systems

Saskatchewan Energy Market Profile

Measuring the Costs and Benefits of Energy Transitions

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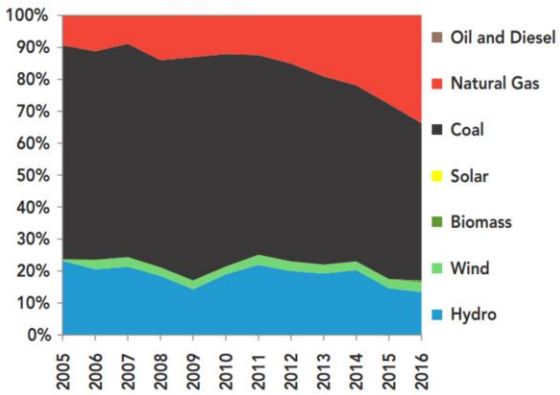
Context

Saskatchewan's electricity is primarily supplied by SaskPower, a crown corporation governed by the Power Corporation Act. First established in 1929, SaskPower acts as a generator, transmitter, and distributor. SaskPower buys power from Independent Power Producers, using long-term Power Purchase Agreements (SaskPower, 2017).



Saskatchewan's Electricity Generation
Source: NEB, 2017

As of 2017, SaskPower has a total capacity of 4,491 MW, including 949 MW purchased via Power Purchase Agreements (SaskPower, 2017). This capacity is primarily fossil fuel driven, with the 2017 capacity make-up being:

- Gas: 40%
- Coal: 34%
- Hydro: 20%
- Wind: 5%
- Other: 1%

Saskatchewan Demographics

- **Population:** 1,098,352 (6.3% increase from 2011)
- **Average Age:** 39.1
- **Working Age (15-64):** 712,240
- **Private Dwellings:** 495,582
- **Private Dwellings Occupied by Usual Residents:** 432,622

Statistics Canada (2016). Census Profile, 2016 Census.

Consumption and Trade

Saskatchewan ranked third highest in Canada for average energy consumption, at 17.6 MWh per capita in 2015. The largest energy consumers are industrial users. Saskatchewan's emissions per capita are the highest in Canada, at 66.2 tonnes CO2e compared to the national average of 20.1 tonnes CO2e (NEB, nd). Regina's average electricity bill in 2016 was $146 per 1,000 kWh, higher than the national average of $129 per 1,000 kWh (NEB, 2017). Saskatchewan is able to trade electricity with Montana, Alberta, and North Dakota and, in 2016, was a net importer (NEB, nd).

Micro-Generation

SaskPower does allow electricity generation for personal use through the Net Metering Program, using solar, wind, biomass, flare gas, heat recovery, and low-impact hydro, providing that the generator has a capacity of less than 100 kW. Participants are credited for excess energy they can sell back to the grid. SaskPower also offers a Small Power Producers Program, which allows producers to generate up to 100 kW of energy that can be either used locally or sold to the grid. In 2017, Small Independent Power Producers provide a capacity of 27 MW (SaskPower, 2017).

Goals

SaskPower has established a goal of having a generation mix of 50% renewable electricity by 2030, anticipated to be 30% wind, 15% hydro, and 5% from other sources. In order to meet this goal, SaskPower is undergoing planning and development for new renewable projects, including 60 MW of solar energy (SaskPower, nd). SaskPower is also using Carbon Capture and Storage to reduce their emissions. The majority of anticipated projects are to be continuing to grow wind and hydroelectric, while introducing utility-scale solar. SaskPower is continuing to evaluate geothermal and biomass options, but have yet to announce any projects. SaskPower is also offering rebates and support for net metering and small power producers, which usually involve renewable sources (SaskPower, nd).

Saskatchewan's Proposed Electricity Mix by 2030
Source: SaskPower (2016)

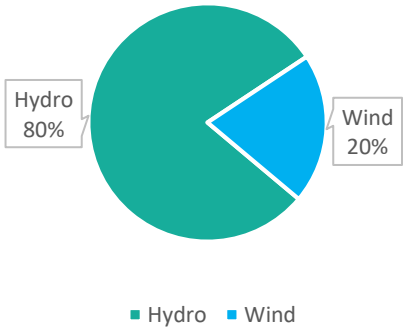
Renewable Projects

Renewable projects are primarily owned and operated by SaskPower, with the exception of the Morse Wind Power Project, the Red Lily Wind Power Project, and the SunBridge Wind Power Project, which are owned by Independent Power Producers and sell to the grid via Power Purchase Agreements, and the Regina Landfill Gas to Energy Project and the Saskatoon Landfill Gas Collection and Power Generation System, which are owned and operated by their respective municipalities via utilities corporations. As of 2018, the following list provides the renewable capacity of utility generators in Saskatchewan, accounting for operational projects and a 25 MW purchasing agreement from Manitoba for hydroelectricity:

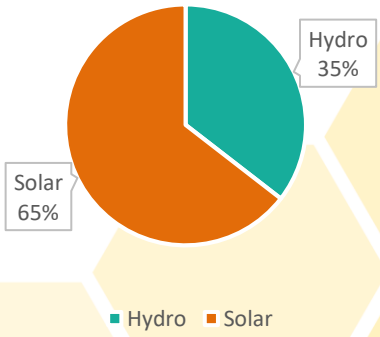
- Hydroelectricity: 889 MW
- Wind: 221.8 MW
- Solar: 0 MW
- Biomass: 2.63 MW

SaskPower is currently in the RFP and RFQ process for new solar and wind projects to meet their 50% renewable goal by 2030 (SaskPower, nd). Despite a desire to encourage more wind power than hydroelectricity, the existing energy market shows

Renewable Projects in Operation by Type



Renewable Projects in Development by Type



greater reliance on hydropower. Additionally, existing solar and biomass is not near their cumulative goal of 350 MW, even when considering anticipated projects.

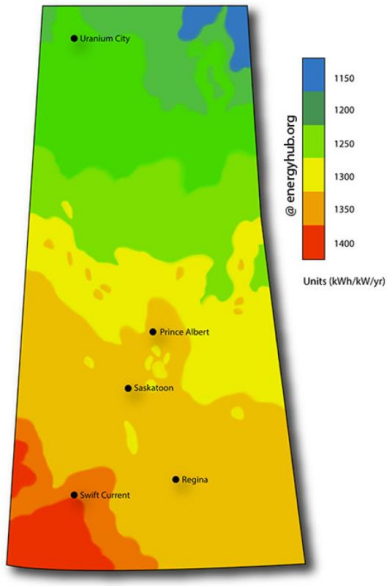
Renewable Energy Potential

Saskatchewan has significant potential to introduce more renewable energy into its electricity mix. In a report by Bigland-Pritchard & Prebble (2010), it was found that Saskatchewan could add an additional 125 MW of hydroelectric capacity by 2020. Within the same timeframe, it was also predicted that Saskatchewan could add 600 to 1,300 MW of wind energy (Bigland-Pritchard & Prebble, 2010). Finally, the report suggests the Saskatchewan could realistically add 125 MW of biomass capacity.

Solar

Saskatchewan is the sunniest province in Canada and has significant potential for both micro and utility-scale solar generation (Solar Panel Power, 2018). Small-scale solar development is encouraged through the net metering program and with a rebate.

Barrington-Leigh & Ouliaris (2015) examined the feasibility of utility-scale solar farms in Saskatchewan. Lands with the most solar feasibility were determined and excluded lands most feasible for wind generation. It was found that utility-scale solar farms could produce 56 TWh per year, accounting for 44% of the total 125 TWh per year energy demand in Saskatchewan.



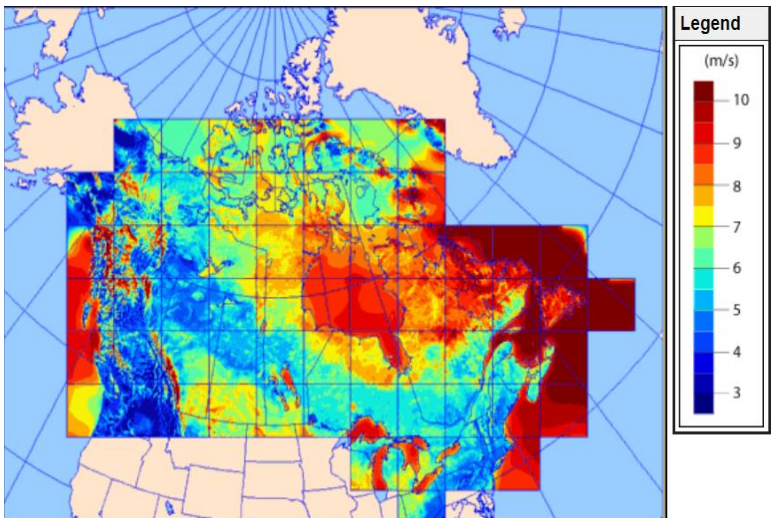
Average Annual Solar Energy Generation per kW installed
Source: https://solarpanelpower.ca/solar-power-maps-canada/

Geothermal

Saskatchewan has issued $175,000 to the DEEP Earth Energy Production Corporation to develop a geothermal demonstration plant to determine the economic feasibility of a geothermal power plant. The geothermal aquifer being explored may provide up to 500 MW of power, while the initial project is anticipated to provide 5 MW (Government of Saskatchewan, 2018). An analysis of the basal clastic sedimentary formation underlying south Saskatchewan indicates temperatures of 100°C are feasibly reached in southeastern Saskatchewan, able to support power plants of 2 MW capacity (Ferguson & Grasby, 2014).

Wind

Saskatchewan has some of the highest wind potentials in North America (SaskWind, nd). The map adjacent shows the average wind speed at 80 metres. Speeds upwards of 7 or 8 m/s are considered feasible for commercial generation.



Mean Wind Speed in Canada at 80 m Height
Source: http://www.windatlas.ca/maps-en.php

In a 2015 national study by Barrington-Leigh & Ouliaris, wind potentials across the nation were measured to determine the feasible generation. Using GIS, high wind potentials were identified using wind speeds of 7 m/s at a height of 80 m. The study excluded protected lands, inland water bodies, First Nations land, and a 5 km buffer around population centres. The remaining lands were then amended to only include lands near transmission lines (Barrington-Leigh & Ouliaris, 2015). Assuming that 25% of the remaining high potential areas are utilised, which accounts for competing land uses, Saskatchewan could generate 274 TWh per year. Of Saskatchewan's total 2015 energy demand of 125 TWh per year, wind energy could account for 219% of Saskatchewan's total energy generation (Barrington-Leigh & Ouliaris, 2015). Saskatchewan could easily meet their total energy demand using wind energy.

Hydroelectric

Barrington-Leigh & Ouliaris (2015) used the technical feasibility of river systems and applied a 60% capacity to generation factor and assumed 60% of feasible sites could be developed. Under these parameters, Saskatchewan could produce a total of 24 TWh per year, which can account for 19% of the total 125 TWh per year energy demand in Saskatchewan.

Sources

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