PHOTOVOLTAIC TECHNOLOGY STATUS AND PROSPECTS

CANADIAN ANNUAL REPORT 2017

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GENERAL FRAMEWORK

This report provides a brief overview of the status of photovoltaics in Canada from the perspective of industry, research, and policy. The two organizations responsible for compiling this report are CanmetENERGY and the Canadian Solar Industries Association. CanmetENERGY [1], a branch of Natural Resources Canada, is a research centre in Varennes, Québec. It the largest federal government-run energy science and technology organization working on clean energy research and deployment. Its goal is to ensure that Canada is a strong participant in the growth and transition to clean energy technologies. The Canadian Solar Industries Association (CanSIA) is a member of the International Energy Agency Photovoltaic Power Systems Program (PVPS). In addition, CanSIA is a national trade association that represents the solar industry throughout Canada and works to promote the expansion of solar technologies.

The Pan-Canadian Framework on Clean Growth and Climate Change [2], released in December 2016, charts a course for Canada to meet its obligations under the Paris Agreement, including national greenhouse gas emissions reductions of 30% below 2005 levels by 2030. In support of these policy objectives, Canada's Federal Government has committed the country to a target of 90% non-emitting electricity by 2030. Emissions reductions through fuel-switching in the transportation, industrial processes, and buildings sectors are being accelerated in order to further increase renewable energy capacity above the 65% of total national electricity demand achieved in 2016 [3].

The continued decline in the cost of generating solar electricity has resulted in it approaching “grid-parity” throughout Canada. In response, consumer demand is dramatically increasing. The province of Ontario leads the country in solar electricity generation with a cumulative installed capacity of 2 833 MW_p as of December 31, 2017 (representing more than 97% of the national total). In 2017, Alberta became the first province or territory outside of Ontario to install more than 5 MW_p in a single year (with approximately 25 MW_p of new facilities brought into service in 2017). A summary of the installed PV capacity across Canada is shown in Figure 1.

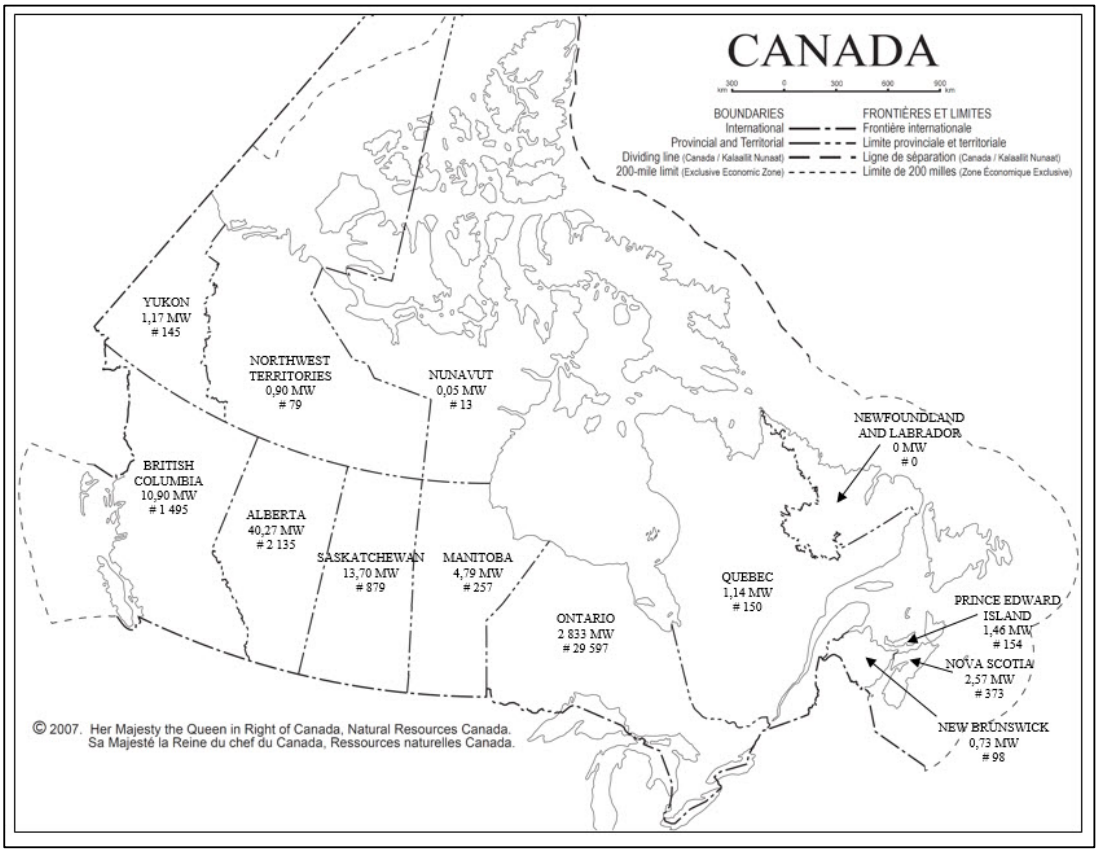

Figure 1: Map showing the Canadian provinces and territories, grid-connected PV power capacity (reported in DC megawatt peak, MW_p), and the number of utility interconnected PV systems as of December 31, 2017.

NATIONAL PROGRAMME: RESEARCH AND DEMONSTRATION

CanmetENERGY's photovoltaics research and development efforts facilitate the deployment of PV technologies throughout the country. The PV program coordinates national research projects, contributes to international committees on the establishment of PV standards, produces information that supports domestic capacity-building, and organizes technical meetings and workshops to provide stakeholders with the necessary information to make informed decisions. In 2017, research on the performance, cost and durability of PV systems in the arctic was identified as a priority to support the clean electricity program in Canadian northern territories. In addition, research focuses on the integration of PV in remote grids such as Colville Lake and Jean-Marie River (Northwest Territories), Cambridge Bay (Nunavut), and Destruction Bay (Yukon).

A government funded Network of Centres of Excellence was established in 2014 with the participation of multiple industry partners and research organizations. The Refined Manufacturing Acceleration Process (ReMAP), headquartered at Toronto-based Celestica, is developing an ecosystem for commercialization that links academics, companies and customers [4]. With access to 38 labs and manufacturing lines across the country, the ReMAP network works with participating companies from the information and

communications technologies, healthcare, aerospace, defence and renewable energy sectors to identify innovations that are most likely to succeed, and then accelerate the product to commercialization. From the photovoltaics perspective, ReMAP currently has four projects: development of PV lamination materials, module-level electronics, building integrated semi-transparent PV windows, and power transformers for wind and solar markets.

IMPLEMENTATION

Ontario: In 2017, the province of Ontario launched its new Long-Term Energy Plan [5], which sets the course for Ontario's energy sector until 2035. The province's Feed-in-Tariff (FIT) programs concluded in 2017. Once all contracted facilities are constructed, it is estimated that a total of 3,3 GW_p of solar PV capacity will have been installed. In anticipation of the conclusion of the FIT program, the province's net metering regulations have been enhanced including the removal of the cap on maximum system size and the eligibility of storage technologies. A virtual net metering demonstration pilot program was also announced. In 2017, the Ontario Government launched the Market Renewal Program [6] which is reshaping the foundation of province's $17 billion annual electricity market. This initiative will address current market design issues and look to find ways to improve the way electricity is priced, scheduled, and procured to meet Ontario's current and future energy needs at the lowest cost while striving to align with the Province's climate policies and objectives. Through the 2016 Climate Change Action Plan [7], the Green Ontario Fund was created in 2017 to help fund energy efficiency and renewable technologies to lower greenhouse gas emissions. As a result, financial incentives are expected for both solar electricity and heating technologies in 2018.

Alberta: In 2017, several new policies and programs were developed and implemented to support the province's Climate Leadership Plan and its commitment to phasing out all coal-fired electricity and tripling its renewable electricity capacity to 30% by 2030. The first round of the Renewable Electricity Program (REP) auction was launched to support 5 GW_{AC} of utility-scale renewable electricity by 2030. Solar electricity facilities were eligible to participate but were not contracted (the first round resulted in 600 MW_{AC} of wind energy contracts with a weighted average price of $37/MWh). Furthermore, the Micro-Generation Regulation, which provides the regulatory framework for behind-the-meter generation in the province, was enhanced. This included an increase in the maximum system size permissible to 5 MW_{AC}. In addition to programs for Indigenous communities and municipalities, several rebate programs were also implemented for residential and commercial consumers by a new provincial government agency called Energy Efficiency Alberta. The Alberta Utilities Commission (AUC), the province's utility sector and electricity market regulator, undertook an extensive regulatory proceeding to review the status and outlook of generation connected to the distribution system with a focus on projects at the community-scale (of a size larger than residential-scale but smaller than utility-scale). The year closed with the commissioning of the province's first utility-scale solar facility (15 MW_p) in the city of Brooks.

Rest of Canada: Throughout 2017, several other provinces and territories began to accelerate their solar electricity activities. Funding from the Federal Government initiated several projects to displace the consumption of diesel fuel for electricity generation in northern and remote communities and it was announced that Nova Scotia would be launching a residential rebate program funded in part by the Federal Government's Low Carbon Economy Leadership Fund. The province of Quebec announced that they would pursue the development of a 100 MW_p solar facility. The province of Saskatchewan held their first competitive procurement for a 10 MW_p solar facility in support of their efforts to double their renewable electricity capacity to 50% by 2030. Prince Edward Island commissioned one of Canada's largest solar-plus-storage facilities (shown in Figure 2). The province of New Brunswick explored a solar leasing program in their rate case. The province of Manitoba introduced a rebate program for their consumers.

INDUSTRY STATUS

Canada's solar sector has experienced a continued significant increase in investments since 2009 when the province of Ontario's Green Energy and Economy Act first encouraged activity in that province. Employment in PV-related areas in Canada has grown to a labour force approaching 10 000 in from an initial estimated 2 700 jobs in 2009. In Canadian dollars, annual capital investments have exceeded $1 billion.

Figure 2: Credit Union Place Smart Solar Storage System with 494 kW_p array in Summerside, Prince Edward Island.

MARKET

Total cumulative installed solar electricity generation capacity in Canada is approaching 3 GW_p. To date, more than 97% has been in the province of Ontario. Outside Ontario, provinces phasing out coal-fired electricity are expected to sharply increase demand for solar electricity.

FUTURE OUTLOOK

Closing the gap to 90% non-emitting electricity by 2030 presents a significant opportunity for solar electricity to capture an increasing proportion of total electricity market share. A combination of falling costs, climate policy, and consumer demand point to solar electricity continuing to grow in importance in Canada's electricity supply-mix.

REFERENCES

1. Natural Resources Canada, "CanmetENERGY," Government of Canada, [Online]. Available: https://www.nrcan.gc.ca/energy/offices-labs/canmet/5715. [Accessed 18 May 2018].
2. Natural Resources Canada, "Pan-Canadian Framework on Clean Growth and Climate Change," Government of Canada, [Online]. Available: https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework/climate-change-plan.html. [Accessed 18 May 2018].
3. National Energy Board, "Canada's Energy Future 2017: Energy Supply and Demand Projections to 2040," Government of Canada, [Online]. Available: https://www.neb-one.gc.ca/nrg/ntgrtd/ftr/2017/index-eng.html. [Accessed 18 May 2018].
4. Networks of Centres of Excellence of Canada, "Refined Manufacturing Acceleration Process - REMAP - $7.7 Million for 2014-2019," Government of Canada, [Online]. Available: http://www.nce-rce.gc.ca/NetworksCentres-CentresReseaux/BLNCE-RCEE/ReMAP-AAPF_eng.asp. [Accessed 18 May 2018].
5. Ministry of Energy, "Ontario's Long-Term Energy Plan," Government of Ontario, [Online]. Available: https://www.ontario.ca/page/ontarios-long-term-energy-plan. [Accessed 18 May 2018].
6. Independent Electricity System Operator, "Market Renewal," Government of Ontario, [Online]. Available: http://www.ieso.ca/en/sector-participants/market-renewal. [Accessed 18 May 2018].
7. Ministry of the Environment and Climate Change, "Climate Change Action Plan," Government of Ontario, [Online]. Available: https://www.ontario.ca/page/climate-change-action-plan. [Accessed 18 May 2018].