

PHOTOVOLTAIC TECHNOLOGY STATUS AND PROSPECTS CANADIAN ANNUAL REPORT 2015

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GENERAL FRAMEWORK

Canada's Department of Natural Resources (NRCAN) supports priorities to promote the sustainable and economic development of the country's natural resources, while improving the quality of life of Canadians. CanmetENERGY [1], reporting to the Innovation and Energy Technology Sector of NRCAN, is the largest federal energy science and technology organization working on clean energy research, development, demonstration and deployment. Its goal is to ensure that Canada is at the leading edge of clean energy technologies to reduce air and greenhouse gas emissions and improve the health of Canadians.

The Canadian Solar Industry Association (CanSIA) is a member of the International Energy Agency PVPS implementing agreement and works with industry stakeholders and government decision makers to help develop effective solar policy and identify key market opportunities for the solar energy sector.

With the significant decline in the PV system costs and a recognition of opportunities to reduce "soft costs" (non-equipment, regulatory and administrative costs), PV generation is gradually approaching grid parity. Most provincial and territorial governments have established policies aimed at simplifying the regulatory framework for customers that want to invest in their own renewable energy micro-generation as part of their overall energy conservation measures and to reduce their electricity bills.

The Province of Ontario, Canada's most populous and second largest province, leads the country in photovoltaic (PV) investments. As of June 30th 2015, the cumulative PV installed capacity stood at 474 MW_{AC} under the Renewable Energy Standard Offer Program (RESOP), 100 MW_{AC} under the Korean Consortium Power Purchase Agreement (KC), 1069 MW_{AC} under the Feed-in Tariff Program (FIT) and 181 W_{AC} under the microFIT program for a total of 1 824 W_{AC}.

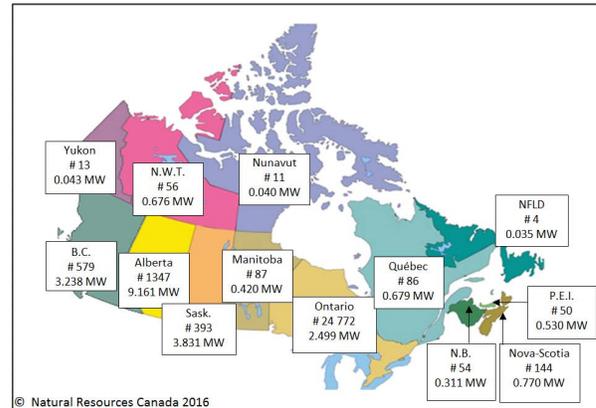


Figure 1: Map showing the Canadian provinces, the capacity (in megawatt) and the number of utility interconnected PV Systems in 2015

NATIONAL PROGRAMME

RESEARCH AND DEMONSTRATION

NRCAN's CanmetENERGY is responsible for conducting PV R&D activities in Canada that facilitate the deployment of PV energy technologies throughout the country. The PV program coordinates national research projects, contributes to international committees on the establishment of PV standards, produces information that will support domestic capacity-building and organizes technical meetings and workshops to provide stakeholders with the necessary information to make informed decisions. In 2015, 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 December 2015, Canadian and IEA PVPS experts shared the results of their research and demonstration activities at the CanSIA Solar Conference in Toronto. This focused on best practices for managing higher solar PV penetrations in electricity grids, including four panel sessions: Solar Implications for Distribution Grids; Solar Variability, Forecasting and System Operation; Smart Inverters and System Benefits; and Smart Grid Integration [2].

A new Business-led Network of Centres of Excellence was established in 2014 [3]. The Refined Manufacturing Acceleration Process (ReMAP), headquartered at Toronto-based Celestica, is developing an ecosystem for commercialization that links academics, companies and customers. With access to 38 labs and manufacturing lines across the country, the ReMAP network will work with participating companies from the information and communications technologies, healthcare, aerospace, defence and renewable energy sectors to quickly identify innovations that are most likely to succeed, and then accelerate the product commercialization and global product launch.

The NSERC Smart Net-Zero Energy Buildings Strategic Network (SNEBRN) performs research that will facilitate widespread adoption in key regions of Canada of optimized net zero energy buildings design and operation concepts by 2030. CanmetENERGY is contributing to this research effort and has been leveraging its activities through its leadership of the recently completed Task 40/Annex 52, entitled "Towards Net Zero Energy Solar Buildings" - a large international collaboration jointly managed by the IEA SHC and EBC programs. To achieve this objective, some 75 T40/A52 experts from 19 countries, including Canada, have documented research results and promoted practical case studies that can be replicated worldwide [4].

IMPLEMENTATION

ONTARIO'S ENERGY PLAN AND PROCUREMENT

The province of Ontario continued its procurements at the residential, commercial and utility-scales. Residential-scale solar (≤ 10 kW) was procured through the microFIT program which has an annual procurement target of 50 MW. Commercial-scale solar ($>10 \leq 500$ kW) was procured through the FIT program. For the first time since 2011, the province also re-launched utility-scale procurement by running an RFP for the Large Renewable Procurement (LRP) program which will competitively contract 140 MW in 2015. The Ministry of Energy of Ontario held a consultation on net-metering and self-consumption (NM/SC) that will align with its "conservation first" policy for small PV systems (under 10kW) [5]. As of June 30th 2015, the total amount of PV capacity installed and under development in Ontario was approximately 2 434 MW_{AC}. This now represents more than 1% of the electricity mix and 208 watt per capita in the province of Ontario.

JURISDICTIONAL SCAN

The Yukon Territory initiated a successful micro-generation production incentive program to reimburse customers for the amount of electricity exported to the grid at a rate that reflects the avoided cost of new generation in the territory. This program now offers a tariff of 0,21 CAD for grid

connected and 0,30 CAD generation micro grids up to 5 kW on shared transformer, 25 kW on a single transformer and up to 50 kW on a case by case approved by the local utility [6].

The Northwest Territories (NWT) has launched a Solar Energy Strategy to install solar systems with the capability to supply up to 20 percent of the average load in NWT diesel communities for 2012-2017 [7]. In 2015 a total of 55 systems and 650 kW were installed representing 14,9 watt per capita.

The province of Saskatchewan continued its net-metering rebate program which offers a one-time rebate, equivalent to 20 per cent of eligible costs to a maximum payment of \$20,000, for an approved and grid interconnected net metering project. This program is offered through the province's largest utility SaskPower but is available to all electricity customers in the province.

Alberta's micro generation regulation was reviewed in 2013. This is a non-incentivized market where the recent increase in the price of electricity (30 % over the last 6 years) and the decreasing cost of solar PV makes solar electricity nearly competitive. ENMAX, a leading energy distribution, supply and service company owned by the city of Calgary, has a program that has simplified the financing and installations of Solar PV systems in Alberta [8].

British Columbia was the first province to adopt a net metering policy in 2004. In 2013 a progress report was released that provided an update of the BC Hydro Net Metering program and a regulatory scan to benchmark /compare to similar programs across Canada and selected programs in the USA [9].

INDUSTRY STATUS

Canada's solar sector has experienced continued significant investments over the last 5 years. Employment in PV-related areas in Canada has grown with a 2014 labour force estimated at over 8 100 compared to 2 700 jobs in 2009. The PV business revenue was estimated at 1 734 M CAD in 2014. This includes 600 M CAD of revenues generated by module manufacturers. The export market accounted for 13 % of manufacturing revenues in 2014.

Seven companies were producing PV modules in 2014, all of which have their facilities located in the province of Ontario with an estimated 778 MW production, largely for the domestic market in Canada. This represents a 23 % growth in production from 2013. Of these seven manufacturers, five are Canadian companies. Canadian Solar Inc. is one of the top five module producers in the world with a global market share estimated at 7% in 2014. Its two crystalline silicon PV module manufacturing

facilities in Guelph and London, Ontario employed approximately 600 workers and had a maximum total annual production of 432 MW in 2014. The company also has additional PV module production capacity of over 2000 MW in China.

The balance of system technology manufacturing companies that have development and manufacturing facilities in Canada include Schneider-Electric (Xantrex), Eaton and Sungrow Canada. Other major brands manufacture through OEM contracts with companies such as Celestica, SAE Power and Sanmina.

MARKET

PV power capacity in Canada grew at an annual rate of 25% between 1994 and 2008. In recent years this growth was 98% in 2011, 48 % in 2012, 54% in 2013 and 52% in 2014 due to the Ontario incentive programs. PV module prices have gradually declined from 6,18 CAD/Watt in 2004 to 0,85 CAD/Watt in 2014. This represents an average annual price reduction of 22% over a 10-year period.

FUTURE OUTLOOK

Ontario has set a “50 MW annual procurement target for microFIT starting in 2014 to encourage the development of a prosumer market” [10]. The contract prices paid by the microFIT program are reviewed annually to reflect the current costs. The Ontario government "is exploring the potential for the microFIT program to be transitioned to a net metering or self-consumption program in the future" [11].

In December 2014, the Canadian Solar Industry Association (CansIA) released its solar industry roadmap to present a vision to 2020 and identify key barriers and solutions that industry leaders will address over the next 5 years [12].

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