PHOTOVOLTAIC TECHNOLOGY STATUS AND PROSPECTS
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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 Energy 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.

Provincial and Territorial government policies are now all supporting "net-metering" or "net-billing" of PV power in Canada. 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. These policies are aimed at simplifying the regulatory framework for customer 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) investment. As of December 2013, the cumulative PV installed capacity stood at 470 MW_{AC} under the Renewable Energy Standard Offer Program (RESOP), 390 MW_{AC} under the Feed-in Tariff Program (FIT) and 160 MW_{AC} under the microFIT program for a total of 1020 MW_{AC}. The total amount of installed and under development PV capacity in Ontario is approximately 2 000 MW_{AC}.

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.

The PV Innovation Research Network, funded by the Natural Sciences and Engineering Research Council (NSERC), brings together a core group of 32 academic researchers in Canada, as well as CanmetENERGY, the National Research Council, the Ontario Center of Excellence and 15 industrial partners. The network held its fourth national scientific conference at McMaster University in May 2013. The 4th Overview of PV Solar Cell R&D Capability in Canada was updated and made available on the CanmetENERGY website [2]. It reports on research efforts in Canada, including advances in innovative PV device that have the potential to leapfrog existing and established technologies.

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 T40A52 experts from 19 countries, including Canada, have documented research results and promoted practical case studies that can be replicated worldwide [3].

IMPLEMENTATION

ONTARIO'S ENERGY PLAN AND PROCUREMENT

Ontario's Feed-In-Tariff (FIT) and microFIT programs, managed by the Ontario Power Authority (OPA), are North America's first comprehensive guaranteed pricing structure for electricity production from renewable fuel sources including solar-PV, bio-energy, waterpower and wind. In 2013 in its Long Term Energy Plan (LTEP) the government reinforced its commitment to 900 MW of additional capacity including 4 years of annual procurement targets; 50 MW under microFIT (< 10 kW) and 150 MW of FIT (projects up to 500 kW). There was a further 15 MW FIT procurement in the Unconstructed Rooftop Solar Pilot (URSP) Program for projects on unconstructed buildings. Under the FIT program the removal of the domestic content requirement for locally manufactured modules and equipment is expected to continue to reduce overall system costs by opening up access to the global supply. The government also moved projects greater than 500 kW out of the FIT standard offer program and into a competitive Large Renewable Procurement (LRP) framework allocating 140 MW for both 2014 and 2015.

Figure 1: At Vine Fresh Produce Project is the largest rooftop installation in Ontario under the FIT program (2.3 MWp). This project is currently the largest system with Enphase micro-inverter in the world.

JURISDICTIONAL SCAN

In 2013, the Yukon Territory released its micro generation policy that will reimburse customers for the amount of electricity exported to the grid at a rate reflective of the avoided cost of new generation in the territory. This program will offer a tariff of 21 cents for grid connected and 30 cents on diesel 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 [4].

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 [5].

The province of Saskatchewan's net metering rebate provides up to 20 % of system costs for installations up to 100 kW for environmental preferred technologies including photovoltaics to a maximum of $20 000 per eligible net metering project for a limited period ending on November 30, 2014.

Alberta's micro generation regulation was reviewed in 2013. This in 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 utility, has initiated a Micro Renewable Energy Program to simplify the financing and installations of Solar PV residential rooftop systems [6].

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 [7].

INDUSTRY STATUS

Canada's solar sector has experienced continued significant investment over the last 4 years. Employment in PV-related areas in Canada has grown with a 2012 labour force estimated at over 3 900 compared to 2 700 jobs in 2009. The Ontario government projects 6000 jobs will be created from the four year FIT procurement targets [8]. In 2013 The Solar PV Module manufacturing industry in the Province currently accounted for over 1,900 full time direct jobs in the design, manufacturing and testing of modules, while the PV inverter industries in the Province provided an additional estimated 250 jobs. Racking, the other major segment of manufacturing accounts for approximately 700 jobs.

In 2012, a Sector Profile for Solar Photovoltaics in Canada [9] was published. It reported on the state of the PV market including various incentives in place, describing the PV supply chain, key manufacturers, economic impacts, workforce capability and the state of R&D initiatives in Canada.

MARKET

PV power capacity in Canada grew at an annual rate of 25% between 1994 and 2008. In recent years this growth was 202% in 2010, 49% in 2011 and 50 % in 2012 due to the Ontario incentive programs.

A number of building integrated PV applications have also been successfully designed and constructed across the country. Building Integrated PV (BIPV) is a very promising technology since it can simultaneously produce electricity and act as a component of the building envelope. The city of Toronto established a working group to engage both the PV and building industries. For example, Eclipsall have been working with Neudorf Glass Inc and other partners to design and install BIPV system in Canada. As the price for BIPV decreases, this application segment is predicted to grow significantly, especially in Toronto and other major cities where there is the industry capacity to design green buildings [10].

Recent information from industry suggests module pricing to be approximately 1,00 CAD per watt. This can be compared to 6,18 CAD in 2003. This represents an average annual price reduction of 20% over a 10-year period.

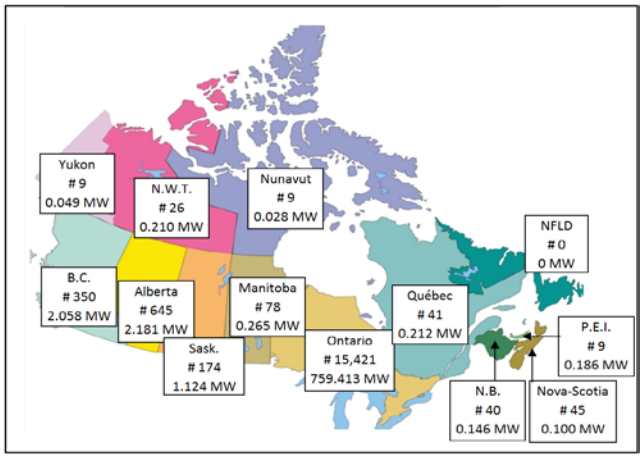

Figure 2: Map showing the Canadian provinces, the capacity (megawatt) and the number of utility interconnected PV Systems in 2012

FUTURE OUTLOOK

The Feed-In Tariff (FIT) Program in the province of Ontario is viewed by the Canadian PV industry as a major step towards developing a competitive, strong Canadian solar industry. As the cost of electricity increases and the cost of solar turn-key installations decreases, trends indicate that Solar PV power will reach grid parity in most jurisdictions in Canada by 2022.

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