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PHOTOVOLTAIC (PV) TESTING FACILITY
NRCAN'S CANMETENERGY LABORATORY IN VARENNES, QUEBEC, CANADA

NRCan's CanmetENERGY laboratory facility located in Varennes, Quebec, conducts applied research aiming to facilitate the integration of distributed renewable energy sources to the electricity grid and to net-zero energy buildings in partnership with industry and utilities. To perform this work, the laboratory can benefit from its solar photovoltaic (PV) testing facility.

SOLAR PHOTOVOLTAIC ARRAY AND MODULE TESTING FACILITY

The roof of Varennes' laboratory is equipped with a rack-mounted PV array, a complete weather station with solar irradiance measurements and a PV module testing rig allowing to compare the performance of PV modules using different cell technologies. The information collected on the roof is used to validate PV performance models and solar resource forecasting predictions and to test PV module rating methodologies. As new technologies and products enter the market, adequate performance rating of PV modules is a topic in constant evolution in national and international standard committees. Also, as more large-scale systems are being built, the accurate forecasting of PV systems electricity production is essential for developers to design their systems appropriately and obtain financing. In addition to this outdoor testing facility, CanmetENERGY also has an indoor PV testing facility, a Large Area Pulsed Solar Simulator (Flash Tester) that can be used to characterize the current-voltage curves of PV modules under different irradiance and temperature conditions in a controlled environment. This facility is used to test various performance rating methods for PV modules and is complementary to the outdoor PV testing facility.

PHOTOVOLTAIC/THERMAL TESTING FACILITY

The photovoltaic/thermal (PV/T) testing facility is used to characterize the electrical and thermal performance of photovoltaic modules or building-integrated photovoltaic modules (BIPV/T) with heat recovery where air is used as the heat transfer fluid. Recovering the heat from PV modules to produce both thermal and electrical energy using the same surface area is a very promising technology. This is especially true in the context of net-zero energy buildings where only a limited amount of roof and façade area is available for solar energy harvesting. This test bench is used to develop performance characterization methods for PV/T and BIPV/T technology and assess its cost benefits. It aims at removing some of the barriers to the market uptake of this technology such as the absence of standards. It also improves the capacity of industry to develop innovative building integrated PV products.

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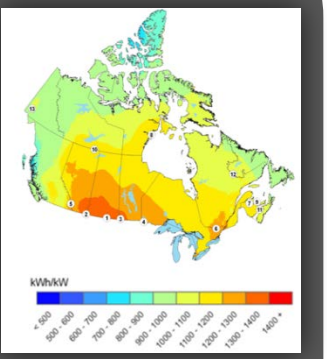
Grid-Simulator and Power Conversion Equipment Test Facility

This facility is used to test power conversion products, evaluate their performance and investigate their power quality and safety issues when they are interconnected to the grid. Safety issues related to protection and disconnection with respect to inverter-based distributed power sources operating in parallel with the grid are of main concern for utilities. The test bench features a 120 kVA three-phase utility grid simulator, 60 kW of DC power supplies, a set of grid-connected inverters and high performance power analyzers. The test facility was designed to support the development of new power conversion equipment and to perform side-by-side evaluations of the quality of commercial inverter products sold in Canada. It also provides an open development platform to investigate new control strategies to alleviate specific interconnection issues. CanmetENERGY participates in the development of national and international standards to eliminate technical barriers and promote the adoption of reliable products suitable for Canadian climatic conditions.

Canadian Solar and Photovoltaic Maps and High-Resolution Solar Radiation Time Series Dataset

Since 2006, CanmetENERGY has been developing and supporting the Photovoltaic Potential and Solar Resources Maps of Canada website [1]. This recently updated website provides information about the long-term average monthly and annual solar resource and PV potential for different surface orientations for more than 3500 Canadian municipalities. The maps were developed to share information in a simple-to-use format. As a result, they are being used by a wide variety of people, from homeowners interested in the solar potential of their location to actual PV system owners who want to validate the performance of their system, and even large-scale PV system developers assessing different design scenarios. In order to provide further guidance related to solar irradiance measurements, CanmetENERGY has also produced a comprehensive list of publicly available solar irradiance data for Canada [2].



Currently, CanmetENERGY is gathering a high spatial and temporal resolution solar radiation time series datasets in order to conduct power system simulations of the impact of short-term resources fluctuation of a power plant or neighbourhood. Our researchers are exploring solar variability prediction models, such as the wavelet and dispersion factor methods. By developing methods and starting to fill the knowledge gap, this research effort will support the development of smart power conversion products that will offer solutions and address concerns of electricity distribution system operators. The goal is to support the development of new control strategies and products in order to integrate higher levels of renewable energy resources on the electricity distribution system in Canada.

[1] http://pv.nrcan.gc.ca

[2] http://www.nrcan.gc.ca/energy/renewable-electricity/solar-photovoltaic/14390

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