Solar Photovoltaic Standards: Research, Development and Harmonization in Canada

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INTRODUCTION

Standards are publications that define practices, technical requirements and adopted terminologies for products, services and systems. They allow to improve the quality, safety and efficiency of methods and products. Standards are of increasing importance for photovoltaics. The rapid growth of production is one reason for this, but standards are equally important in ensuring the quality and durability of installed systems, which have a profound impact on acceptance of the technology in the expanding marketplace.

This project provided S&T support to the Working group 2 of the International Electrotechnical Commission Technical Committee 82 (IEC TC82 WG2) for the development of standards for terrestrial photovoltaic modules. It involved the review, evaluation and development of new test procedures for standard testing, gathering of scientific information to support these activities, the adoption of relevant international standards at the national level, and supported Canadian representation on the international standards development committee. New PV technologies that included novel materials were evaluated for their performance through this international standard committee effort.

The outcome of this project will contribute to the successful entry of high quality PV products into the marketplace and lead to the improved reliability and safety of PV systems adapted to Canadian climate and conditions. Ultimately, this project will also contribute to a global PV product conformity assessment, the reduction of non-tariff trade barriers, and the development of improved PV products at lower costs. This project is well aligned with the government's Clean Air Agenda and clean energy imperatives and is an essential component of CanmetENERGY's Integration of Renewable and Distributed Energy Resources program mandate that aims to facilitate the development and deployment of PV electricity in Canada.

ACTIVITIES & RESULTS

The project was broken down into three main tasks:

1- PV module standard research

Under this activity, new PV technologies that included novel materials were evaluated for their performance through this international standard committee effort. The national photovoltaic laboratory at CanmetENERGY-Varennes research facility includes a large scale solar simulator and outdoor test platforms and the staff was tasked with the research aspects of this project. This included the performance assessment of the following PV technologies available on the Canadian market: Unisolar's triple-junction amorphous silicon, Sunpower's single crystalline silicon back contact cells, Sanyo's heterojunction intrinsic thin film silicon and BP Solar's laser-grooved buried junction. In addition, the expert team also tested experimental methods and energy rating methodologies for photovoltaic modules.

2- IEC TC 82 WG2 collaboration

As chair of the Canadian National Committee to the IEC TC 82 on the development of standards related to PV systems and components, CanmetENERGY provided and coordinated the Canadian input to the preparation and review of draft standard documents, the organization and participation to IEC standard development meetings, and the coordination of technical transfer that led to the development of 11 new or updated editions of IEC PV module standards. This activity maintained CanmetENERGY's leadership position related to PV standard development in Canada.

3 - National PV Module Standard Review and Adoption

CanmetENERGY collaborated with the Standard Council of Canada and Canadian Standard Development Organizations such as CSA and ULC to adopt relevant IEC PV module standards. This led to the national adoption of two PV module *performance* standards (*CAN/CSA-C61215:08 and CAN/CSA-C61646:10*) and to the development of a national strategy for the adoption of a PV module *safety* standard to be put into place during the next research cycle.

IMPACT AND ACCOMPLISHMENTS

The activities undertaken in this project resulted in the development and update of 11 IEC PV module standards:

IEC 61646 Thin film PV modules – Design qualification and type approval
IEC 61701 Salt mist corrosion of PV modules
IEC 61853-1 Irradiance and temperature performance measurements and power rating
IEC 61853-2 Spectral Response, Incidence Angle and Module Operating Temperature Measurements
IEC 62108 Concentrator photovoltaic modules and assemblies - Design qualification and type approval
IEC 60891 Procedure for temperature and irradiance correction
IEC 60904-3 Measurement principles for PV devices
IEC 60904-4 Traceability of primary reference solar cells
IEC 60904-7 Computation of spectral mismatch error
IEC 60904-9 Solar simulator performance requirements
IEC 60904-10 Linearity measurements

The adoption of 2 Canadian PV module performance standards:

CAN/CSA-C61215:08 Crystalline silicon PV modules – Design qualification and type approval
CAN/CSA-C61646:10 Thin film PV modules – Design qualification and type approval

The publication of 2 scientific research papers on PV module performance assessment and energy rating methodologies comparison (see references below).

Ultimately, this project will contribute to the successful entry of high quality PV products into the marketplace and lead to the improved reliability and safety of PV systems adapted to Canadian climate and conditions. It will also contribute to a global PV product conformity assessment, the reduction of non-tariff trade barriers, and the development of improved PV products at lower costs.


IEC 61646
Edition 2.0 2008-06
INTERNATIONAL STANDARD
NORME INTERNATIONALE
Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval
Modules photovoltaïques (PV) en couches minces pour application terrestre – Qualification de la conception et homologation
INTERNATIONAL ELECTROTECHNICAL COMMISSION
COMMISSION ELECTROTECHNIQUE INTERNATIONALE
PRICE CODE CODE PRIX X
ICS 27.160
ISBN 2-8318-9746-7

IEC 61646 Ed.2 thin film PV module international performance standard published in May 2008


Presented at the 23rd European PV Solar Energy Conference and Exhibition, Valencia, Spain, Sept. 1-5 2008
A COMPARISON OF ENERGY RATING METHODOLOGIES USING FIELD TEST MEASUREMENTS
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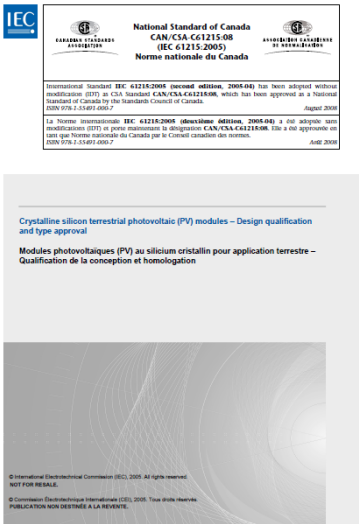
ABSTRACT: The aim of this work is to compare two types of energy rating methodologies in terms of their accuracy and their usefulness for guiding module selection for a given location. The IEC 61853 methodology currently under development was compared to the simpler ESTI-JRC methodology proposed by the European Union Joint Research Center (JRC). Four PV module technologies (triple junction a-Si, laser grooved c-Si, back contact c-Si and heterojunction fil) were characterized in the field to obtain the input parameters required by the two energy rating methodologies. Local weather conditions (direct, diffuse, global and in-plane irradiances and PV module and ambient temperatures) were monitored over a year at a test location near Montréal, Canada. These were combined to PV module inputs to calculate their energy output over different days and over extended time periods, using both methodologies. The two methodologies were found to have comparable accuracies both for daily and for extended periods. While the median absolute errors for the more complex IEC 61853 method were generally lower (2% for extended periods, as opposed to 2.8% for the JRC method), it is not clear whether the gain in accuracy would justify the added cost in complexity of measurements and calculations involved. Both methods were useful in predicting specific yield rankings for the four modules under study. However, differences between the modules were often of the same order as the predictive error of the methods.
Keywords: Energy rating, energy performance, PV module
1 INTRODUCTION
2 ENERGY RATING METHODOLOGIES
2.1 ESTI-JRC/RC

Scientif paper presented at a plenary session of the 23rd European PV Specialist Conference


National Standard of Canada
CAN/CSA-C61215:08
(IEC 61215:2005)
Norme nationale du Canada
International Standard IEC 61215:2005 (second edition, 2005-04) has been adopted without modification (fiff) as CSA Standard CAN/CSA-C61215:08, which has been approved as a National Standard of Canada by the Standards Council of Canada.
ISBN 978-1-55491-000-7
August 2008
La Norme internationale IEC 61215:2005 (deuxième édition, 2005-04) a été adoptée sans modifications (fiff) et porte maintenant la désignation CAN/CSA-C61215:08. Elle a été approuvée en tant que Norme nationale du Canada par le Conseil canadien des normes.
ISBN 978-1-55491-000-7
Août 2008
Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval
Modules photovoltaïques (PV) au silicium cristallin pour application terrestre – Qualification de la conception et homologation
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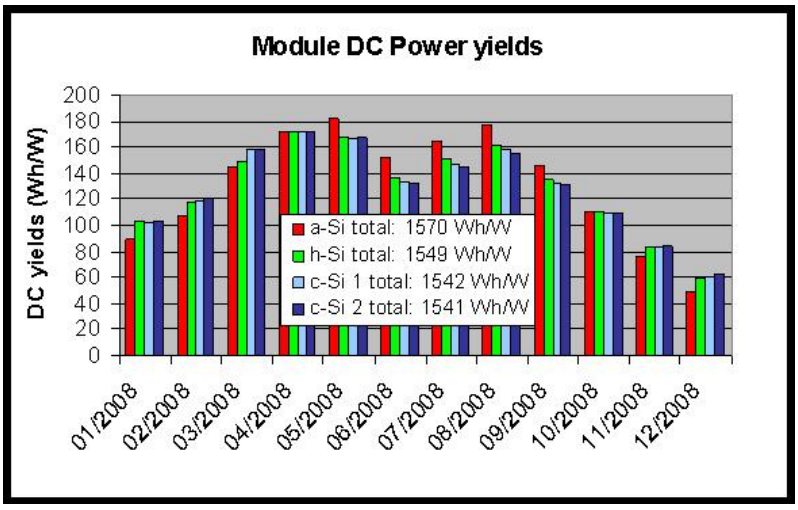
Can/CSA-C61215-08 crystalline Silicon performance standard adopted in Canada in August 2008



Monthly PV module DC production for different technologies in 2008

PV module outdoor test platform
CanmetENERGY research facility, Varennes

DISCUSSION & NEXT STEPS

As of January 2010, Canada had adopted two PV module performance standards. The next task is to develop a PV module safety standard that will replace the current ULC/ORD-C1703 document set to expire in July 2011. Harmonization with the US and other countries will be a key objective as Canadian PV module manufacturers need to be able to export part of their module production. The IEC 62109 Electrical safety of static inverter and charge controllers for use in PV power systems should also be adopted in Canada once it is published. Finally, an expert group within IEC TC82 WG2 has been put together to accelerate the development of the long-awaited IEC 61853 on Performance testing and energy rating of terrestrial PV modules. CanmetENERGY has contributed to the development of this standard and is well positionned to provide the research support required for its completion over the next research cycle.

Photovoltaic standards are numerous and deal with many aspects of PV systems, thus reflecting the maturity of the technology. However as photovoltaic technologies evolve, new standards need to be developped and existing ones need to be updated to ensure the quality and safety of PV products entering the Canadian market .

BUDGET

F11.003 (2007-2011)

PERD	Other Federal	External in-kind	External Cash	Leverage
424 k	-	464 k	-	109%

PROJECT TEAM

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Candace Sellar / CSA – Project Manager for the adoption of national standards
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    Class 5311-10 (POWER SUPPLIES-PV Modules and Panels)

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