An aerial photograph of a two-story house with a brown tiled roof. A large array of dark blue solar panels is installed on the right side of the roof. The house has light-colored walls and several windows. A white porch with a railing is visible on the right side. The surrounding area includes a wooden fence, some greenery, and a driveway.

**SMART SOLAR SOLUTIONS
FOR ROOFTOP ENERGY IN
NORTH AMERICA**

CANADIAN SOLAR SOLUTIONS FOR ROOFTOP ENERGY APPLICATIONS

INTRODUCTION

Canadian Solar partnered with SolarEdge - one of the top 10 global suppliers of grid-tied inverters - to deliver a unique solution for the residential market – the CS6P-260/265P-SD Smart DC Module. The Smart DC Module is a Canadian Solar polycrystalline module with an integrated SolarEdge OPJ-300LV optimizer. This unique offering combines the advantages of a high-quality solar panel with a DC buck-boost optimizer to create an easy-to-build residential solar system where multiple module orientations and shading obstacles might be a factor. Canadian Solar continuously strives to create value by pre-integrating multiple system components in the factory to ease installation efforts in the field and deliver cost savings to consumers.

RESIDENTIAL SOLAR MARKET

The residential market for PV energy requires safe, adaptable, cost-effective, and aesthetically pleasing solutions to enhance home value and generate electrical power. Canadian Solar studied the market for alternative solutions that would retain the advantages of module-level power harvesting while performing with improved reliability. SolarEdge optimizers are efficient, light, reliable, and robust for easy application in the field. The SolarEdge inverter connected to the optimizer operates at a constant string voltage. The DC buck-boost circuitry typically found inside string inverters is transferred onto the array as part of the optimizer. The optimizers perform DC buck-boost, allowing panels to run at their maximum power point of production. The inverter can have very simple and affordable constant input voltage topology. In addition, this enables longer strings, as well as the module tilt and orientation to combine in the same string. The system is robust and easy to understand with engineers offering phone support to system designers and installers.

SMART MODULES WITH SOLAREEDGE INVERTERS

The Canadian Solar CS6P-260/265P-SD Smart DC Module includes a pre-integrated SolarEdge OPJ-300-LV optimizer at the back of the module, as shown in Figure 1.



*Black frame module is also available

Figure 1: CS6P-260/265P-SD Smart DC Module with OPJ-300-LV optimizer

SYSTEM ADVANTAGES:

- Certified junction box incorporating a field-proven DC optimizer
- Module level monitoring for easy operation and maintenance
- Pass-through connector for easy module flashing and field replacement of faulty optimizers
- Module-level voltage shutdown for installer and firefighter safety when used with SolarEdge inverters
- Mismatch loss mitigation and optimization from partial shading
- Superior efficiency and up to 25% more energy harvest in shaded conditions
- Simplified system design by eliminating power optimizer-selection process
- Independent optimization technology
- Wide module-level MPPT window (5-55 V_{DC}) allows for maximum energy harvest, even from shaded or partially bypassed modules



Figure 2: Residential bungalow in Toronto, Canada

Consider a one-story bungalow dwelling located in Toronto, Ontario. The house features hip roof design and multiple tall-standing trees in close proximity. The house owner faces multiple questions in creating a cost-effective PV system to meet all local codes and requirements. He wants the solar array to enhance the value of his property and deliver continuous revenue stream. His dilemma can be reduced to a number of key considerations:

1. Fixed costs

The LDC interconnection fee, structural engineer fee, building permit, electrical design fee, drawings package, FIT contract application fee (in Ontario only), and metering equipment are several of the fixed costs that the system owner will need to pay regardless of the projected revenue stream. One of the ways to reduce these costs is to spread them out over a larger system size. This implies installing a maximum number of panels for maximum revenue generation, assuming the roof requires no reinforcement for additional structural loads. Different jurisdictions may have different process requirements.

2. Existing roof features

Exhaust vents, skylights, and chimneys are some of the roof features which make continuous streamlined installation of solar panels difficult. A rail-less racking system may be needed to economize the installation effort and cost.

3. Aesthetically pleasing appearance

The PV generation system should enhance the value of the property because it provides continuous revenue stream for the owner. This is only applicable if the system looks good. Canadian Solar offers a range of aesthetically pleasing products, including the black frame module to accommodate the unique preferences of the system owner.

4. Maximum power production for maximum revenue

Shading issues and multiple module orientations present a technical challenge. For a system owner using fewer than 10 modules, it is likely that the most cost effective solution is the micro-inverter solution. Canadian Solar is working with suppliers to deliver an AC module which combines a PV panel and a micro inverter together for improved overall system cost. For a system with more than 10 modules, the equation gradually changes in favor of the string inverter with DC optimizer solution. The Canadian Solar Smart DC Module with the integrated SolarEdge optimizer is a great solution at a solid price.

5. Installation costs

The end user should keep in mind that any field assembly requires qualified technicians working in unique conditions outdoors. Factory assembly of components is a more cost effective way of achieving the end goal. Hence, the Canadian Solar line of pre-integrated products (such as the Smart DC Module) is a cost-effective option for the system owner.

Accounting for all such considerations, the system designer invariably concludes that the Canadian Solar Smart DC Module offers the greatest value for residential rooftop solar applications. The Smart DC Module solution accounts for shading issues and multiple panel orientations. As the sun moves from east to west, the installed system will be able to adjust to the shading patterns due to module-level energy harvest topology. Appendix A illustrates shading patterns at different times of the day for the sample project.

SMART DC MODULE SAFETY FEATURES

The Canadian Solar Smart DC Module contributes to arc and fire safety by turning down the output of each module to 1 V in the event of a fault or outage when used with SolarEdge inverter. Compliance with NEC 2014 Rapid Shutdown requirements is accomplished with the Smart Module and SolarEdge inverter.

CONCLUSION

Residential customers looking to install solar PV generation on their roofs often encounter shading and multiple orientation challenges. The Canadian Solar Smart DC Module solution pre-integrates power optimizer technology with high quality solar panels to create a safe, highly flexible, economical and advantageous solution that mitigates those challenges. Customers benefit from easy, flexible and cost-effective solution that lowers the cost of their system and energy.

APPENDIX A: SHADING PATTERNS AT DIFFERENT TIMES OF THE DAY, SAMPLE PROJECT



Figure 3: Shading pattern at 9AM. Small array partially shaded.



Figure 4: Shading pattern at noon. Entire array illuminated.

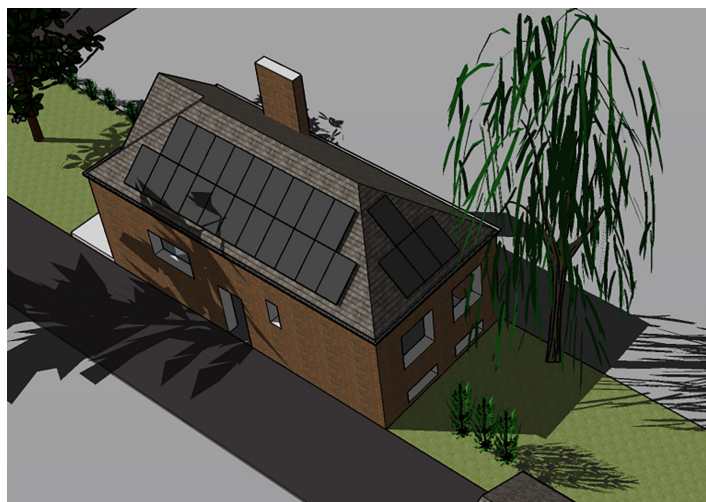


Figure 5: Shading pattern at 3PM. Large array partially shaded, small array entirely in the shadow.

CONTACT

Headquarters Canada

545 Speedvale Avenue West
Guelph, Ontario, Canada N1K 1E6
T +1 519 837 1881
F +1 519 837 2550
M sales.ca@canadiansolar.com

USA

2420 Camino Ramon, Suite 125
San Ramon, CA, USA 94583-4385
T +1 888 998 7739
F +1 925 866 2704
M sales.us@canadiansolar.com

Brazil

Morumbi Office Tower,
Avenida Roque Petroni Junior,
1089 Sala 702 / 704, São Paulo, Brazil
T +55 11 509 605 25
M sales.br@canadiansolar.com

Germany

Landsberger Straße 94
80339 Munich, Germany
T +49 (0) 89 5199689 0
F +49 (0) 89 5199689 11
M sales.eu@canadiansolar.com

Spain

Paseo de la Castellana 79, 7th floor
28046 Madrid, Spain
T +34 91 791 66 24
M sales.eu@canadiansolar.com

U.A.E.

No 115, Level-1 Incubator Building
Masdar City, 135051 Abu Dhabi
T +971 02 698 53 60
F +971 02 698 53 60
M sales.me@canadiansolar.com

UK

1 Lumley Street
London W1K 6TT UK
M sales.uk@canadiansolar.com

India

Concorde Towers, Level 14 & 15, UB City,
1 Vittal Mallya Road,
Bangalore, Karnataka 560001

South Africa

26 Coachman Close
Midstream 1652
South Africa
M sales.za@canadiansolar.com

China

199 Lushan Road, Suzhou New District>Jiangsu, China
215129
T +86 512 6690 8088
F +86 512 6690 8089
M sales.cn@canadiansolar.com

Japan

Round-Cross Shinjuku 5-Chome 8F
5-17-5 Shinjuku, Shinjuku-ku, Tokyo, Japan 160-0022
T +81 (0) 3 5312 7301
F +81 (0) 3 5312 7302
M sales.jp@canadiansolar.com

Japan - Project

Shinjuku Mitsui Building 50F
2-1-1 Nishi Shinjuku, Shinjuku-ku, Tokyo, 163-0450 Japan
T +81 (0) 3 6911 2901
F +81 (0) 3 3349 1310
M sales.jp@canadiansolar.com

Korea

201 SKHUB B/D, 431 Seolleung-ro
Gangnam-gu, Seoul, Korea
T +02 539 7541
F +02 539 7505
M sales.kr@canadiansolar.com

Singapore

101 Thompson Road
#15-03 United Square, Singapore 307591
T +65 6572 9050
F +65 6559 4690
M sales.sg@canadiansolar.com

Australia

165 Cremorne Street,
Richmond, VIC 3121, Australia
T +61 (03) 8609 1844
M sales.au@canadiansolar.com

