

RIPUC Use Only

Date Application Received: / / /
Date Review Completed: / / /
Date Commission Action: / / /
Date Commission Approved: / / /

**GIS Certification #:
175228**

RENEWABLE ENERGY RESOURCES ELIGIBILITY FORM

The Standard Application Form

**Required of all Applicants for Certification of Eligibility of Renewable Energy Resource
(Version 9 - April 19, 2021)**

STATE OF RHODE ISLAND PUBLIC UTILITIES COMMISSION

Pursuant to the Renewable Energy Act

Title 810, Chapter 40, Subchapter 05, Part 2 et. seq. of the General Laws of Rhode Island

NOTICE:

- When completing this Renewable Energy Resources Eligibility Form and any applicable Appendices, please refer to the State of Rhode Island Public Utilities Commission Rules and Regulations Governing the Implementation of a Renewable Energy Standard [810-RICR-40-05-2 \(RES Rules\)](#) , and the associated RES Certification Filing Methodology Guide. All applicable regulations, procedures and guidelines are available on the Commission’s web site: www.ripuc.ri.gov/utilityinfo/res.html.
- Please submit one original of the completed Application Form, applicable Appendices, and all supporting documentation to the Commission at the following address:
Rhode Island Public Utilities Commission
Attn: Luly E. Massaro, Commission Clerk
89 Jefferson Blvd
Warwick, RI 02888
- Electronic submittals are also required and should be sent to Res.filings@puc.ri.gov.
- In addition to filing with the Commission, Applicants are required to send an electronic copy of the application and supporting documents to the service list located at <http://www.ripuc.ri.gov/utilityinfo/reslist.doc>
- Keep a copy of the completed Application for your records.
- The Commission will notify the Authorized Representative if the Application is incomplete.
- Pursuant to RES Rules Section 2.6(A)(3), the Commission shall provide a thirty (30) day period for public comment following posting of any administratively complete Application. All information submitted with the Application is considered to be a public record unless the Commission deems some portion of the application confidential after consideration under [Rules of Practice and Procedure 810-RICR-00-00-1](#), Section 1.3(H)(3). It is the applicant’s responsibility to request confidential treatment and to provide redacted copies to the Commission and the service list.
- Questions related to this Renewable Energy Resources Eligibility Form can be submitted to Res.filings@puc.ri.gov

SECTION I: Identification Information

1.1 Name of Generation Unit (sufficient for full and unique identification, and consistent with the Generation Unit name listed on the NEPOOL GIS, if currently listed):

Sunnova - Rhode Island Aggregation

1.2 Type of Certification being requested (note: if the Generation Unit has not yet achieved Commercial Operation, check Prospective Certification/Declaratory Judgement):

Standard Certification

Prospective Certification (Declaratory Judgment)

1.3 This Application includes: (Check *all and only* those that apply)

Appendix A: Authorized Representative Certification for Individual Owner

Appendix B: Authorized Representative Certification for Non-Corporate Entities Other Than Individuals, including Limited Liability Companies (LLC) *Note: Please refer to Section 6.1, Corporations, for required evidence certifying Authorized Representative.*

Appendix C: Existing Renewable Energy Resources

Appendix D: Special Provisions for Aggregators of Customer-sited, Off-grid Generation, or RI-sited Remote Net Metered Facilities

Appendix E: Special Provisions for a Generation Unit Located in a Control Area Adjacent to NEPOOL

Appendix F: Fuel Source Plan for Eligible (including Unlisted) Biomass Fuels

1.4 Primary Contact Person

Name and title: **Clayton Borgmeyer, Renewable Portfolio Analyst**

Address: **20 Greenway Plaza Suite 475 Houston, TX 77046**

Phone: **3149528459**

Email: **renewables@sunnova.com**

1.5 Backup Contact Person

Name and title: **Tarnisha Robinson, Renewable Portfolio Analyst**

Address: **20 Greenway Plaza 540 Houston, TX 77046**

Phone: **832-508-4682**

Email: **renewables@sunnova.com**

1.6 Authorized Representative (the individual responsible for certifying the accuracy of all information contained in this form and associated appendices, and whose signature will appear on the application):

Name and title: **Michael Grasso, Executive VP**

Company: **Sunnova Energy International Inc**

Address: **20 Greenway Plaza 540 Houston, TX 77046**

Phone: **281-832-0504**

Email: **renewables@sunnova.com**

Appendix A or B, or Corporate Authorization (as appropriate) completed and attached?

Yes No

1.7 Owner

Name and title: **Sunnova Energy Corporation, Corporation**

Company: **Sunnova Energy International Inc**

Address: **20 Greenway Plaza Suite 475 Houston, TX 77046**

Phone: **2818320504**

Email: **renewables@sunnova.com**

1.8 Owner business organization type (check one):

Individual

Partnership (including Limited Liability Company and other Non-Corporate Entities)

Corporation

Other:

1.9 Operator

Name and title: **Sunnova Energy Corporation, Corporation**

Company: **Sunnova Energy International Inc**

Address: **20 Greenway Plaza 475 Suite Houston, TX 77046**

Phone: **2818320504**

Email: **renewables@sunnova.com**

1.10 Operational business organization type (check one):

Individual

Partnership (including Limited Liability Company and other Non-Corporate Entities)

Corporation

Other:

SECTION II: Generation Unit Information, Fuels, Energy Resources and Technologies

- 2.1 NEPOOL GIS Identification Number (if assigned yet, along with appropriate MSS, NON or IMP designation): **NON170647**

For facilities enrolled in the RI Renewable Energy Growth Program: National Grid will provide the participant with an MSS ID.

- 2.2 Nameplate Capacity (list AC, and DC if applicable): **2384 kW AC 2762 kW DC**
- 2.3 Maximum Demonstrated Capacity (list AC, and DC if applicable): **2384 kW AC 2762 kW DC**
- 2.4 Please indicate which of the following Eligible Renewable Energy Resources are used by the Generation Unit: (Check ALL that apply) – *per RES Rules Section 2.5*

- Direct Solar Radiation
- The wind
- Movement of or the latent heat of the ocean
- The heat of the earth
- Small hydro facilities
- Biomass facilities using Eligible Biomass Fuels (*per RES Rules Section 2.3(A)(7)*)
- Biomass facilities using unlisted biomass fuel (*per RES Rules Section 2.3(A)(7)(a)*)
- Fuel cells using a renewable resource referenced in this section

- 2.5 For small hydro facilities, please certify that the facility's aggregate capacity does not exceed 30 MW. – *per RES Rules Section 2.3(A)(32)*

- <-- check this box to certify that the above statement is true
- N/A

- 2.6 For small hydro facilities, please certify that the facility does not involve any new impoundment or diversion of water with an average salinity of twenty (20) parts per thousand or less. – *per RES Rules Section 2.3(A)(32)*

- <-- check this box to certify that the above statement is true
- N/A

- 2.7 For biomass facilities: Appendix F completed and attached?

- Yes (Please specify fuel or fuels used or to be used in the unit:)
- N/A

- 2.8 Has the Generation Unit been certified as a Renewable Energy Resource for eligibility in another state's renewable portfolio standard?

- Yes
- No

If "Yes," a copy of each state's certifying order is attached?

- <-- check this box to certify that the above statement is true

SECTION III: Commercial Operation Date>

Please provide documentation to support all claims and responses to the following questions:

- 3.1 Date Generation Unit first entered Commercial Operation or, if not yet in operation, the anticipated Commercial Operation Date:

08/27/2020

If the Commercial Operation date is after December 31, 1997, please provide independent verification, such as the utility log or metering data, showing that the meter first spun after December 31, 1997. For facilities located in Rhode Island, a copy of National Grid's Authorization to Interconnect letter would also be sufficient. This documentation is needed in order to verify that the facility qualifies as a New Renewable Energy Resource.

Documentation of Commercial Operation Date attached?

Yes

No

N/A

- 3.2 Is there an Existing Renewable Energy Resource located at the site of Generation Unit?

Yes

No

- 3.3 If the date entered in response to question 3.1 is on or earlier than December 31, 1997 or if you checked "Yes" in response to question 3.2 above, please complete Appendix C. Appendix C completed and attached?

Yes

No

N/A

- 3.4 Was all or any part of the Generation Unit used on or before December 31, 1997 to generate electricity at any other site?

Yes

No

- 3.5 If you checked "Yes" to question 3.4 above, please specify the power production equipment used and the address where such power production equipment produced electricity (attach more detail if the space provided is not sufficient):

SECTION IV: Metering

4.1 Please indicate how the Generation Unit's electrical energy output is verified:

- ISO-NE Market Settlement System
- Other, including Self-Reported to the NEPOOL GIS Administrator (please specify below and complete Appendix D):

Independent Verifier reports production quarterly

For "Other," Appendix D completed and attached?

- Yes
- No
- N/A

For facilities enrolled in the RI Renewable Energy Growth Program: National Grid will be reporting output to the ISO-NE Market Settlement System.

4.2 Please check one of the following that apply to the Generation Unit:

- Grid Connected Generation
 - Connected directly to a utility transmission or distribution system with only station load at the unit site
 - Units participating in the RI Renewable Energy Growth Program fall in this category.
- Off-Grid Generation
 - Not connected to a utility transmission or distribution system
- Customer-Sited Generation
 - Connected on the end-use customer side of a retail electricity meter in such a manner that it displaces all or part of the metered consumption of the end-use customer, other than station load
 - Traditional behind-the-meter net metering falls in this category.
 - Units located outside Rhode Island with this configuration will be deemed ineligible by PUC (see RES Rules Section 2.6(H)(1) (see also Order No. 23710, <http://www.ripuc.ri.gov/eventsactions/docket/4858-4891-Kearsarge%20Ord23710%2011-12-2019.pdf>
- Remote Customer-Sited Generation
 - Connected directly to the local electric utility distribution grid with only station load
 - All or some of the electrical energy from the unit is designated for use in displacing all or part of the retail electricity metered consumption of one or more end-use customers (including through a transfer of bill credits)
 - "Virtual" and "remote" front-of-the-meter net metering falls in this category.
 - Units located outside Rhode Island with this configuration have been found ineligible by the PUC (see Order 23710, <http://www.ripuc.ri.gov/eventsactions/docket/4858-4891-Kearsarge%20Ord23710%2011-12-2019.pdf>

SECTION V: Location

5.1 Generation Unit address:

237 WILSON AVE, RUMFORD RI 02916

5.2 Please provide the Generation Unit's geographic location information:

A. Universal Transverse Mercator Coordinates:

B. Longitude/Latitude: **41.84395, -71.356469**

5.3 The Generation Unit is located: (please check the appropriate box)

In the NEPOOL control area

In a control area adjacent to the NEPOOL control area

In a control area other than NEPOOL which is not adjacent to the NEPOOL control area <-- *If you checked this box, then the generator is ineligible.*

5.4 If you checked "In a control area adjacent to the NEPOOL control area" in Section 5.4 above, please complete Appendix E.

Appendix E completed and attached?

Yes

No

N/A

SECTION VI: Certification

- 6.1 Please attach documentation, using one of the applicable forms below, to demonstrate the authority of the Authorized Representative provided in Section 1.6.

Corporations

The Authorized Representative of the Corporation shall provide **either**:

- (a) Evidence of a Board of Directors' vote granting authority to the Authorized Representative to execute the Renewable Energy Resources Eligibility Form, **or**
- (b) A certification from the Corporate Clerk or Secretary of the Corporation that the Authorized Representative is authorized to execute the Renewable Energy Resources Eligibility Form or is otherwise authorized to legally bind the Corporation in like matters.¹
- Evidence of Board Vote provided?

Yes

No

N/A

Corporate Certification provided?

Yes

No

N/A

Individuals

If the Owner is an Individual, that Individual shall complete and attach Appendix A, or a similar form of certification from the Owner, duly notarized, that certifies that the Authorized Representative has authority to execute the Renewable Energy Resources Eligibility Form.

Appendix A completed and attached?

Yes

No

N/A

Non-Corporate Entities

(Limited Liability Companies - LLCs, Proprietorships, Partnerships, Cooperatives, etc.) If the Owner is neither an Individual nor a Corporation, it shall complete and attach Appendix B or execute a resolution indicating that the Authorized Representative named in Section 1.6 has authority to execute the Renewable Energy Resources Eligibility Form or to otherwise legally bind the non-corporate entity in like matters.

Appendix B completed and attached?

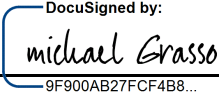
Yes No N/A

¹ If the Corporation has only one sole Officer, it is acceptable for that Officer to provide signatory certification of same as Authorized Representative.

RI RES Application Authorized Representative Certification and Signature

I hereby certify, under pains and penalties of perjury, that I have personally examined and am familiar with the information submitted herein and based upon my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties, both civil and criminal, for submitting false information, including possible fines and punishment. My signature below certifies all information submitted on this Renewable Energy Resources Eligibility Form. The Renewable Energy Resources Eligibility Form includes the Standard Application Form and all required Appendices and attachments. I acknowledge that the Generation Unit is obligated to and will notify the Commission promptly in the event of a change in a generator's eligibility status (including, without limitation, the status of the air permits) and that when and if, in the Commission's opinion, after due consideration, there is a material change in the characteristics of a Generation Unit or its fuel stream that could alter its eligibility, such Generation Unit must be re-certified in accordance with RES Rules Section 2.6(E). I further acknowledge that the Generation Unit is obligated to and will file such quarterly or other reports as required by the Rules and the Commission in its certification order. I understand that the Generation Unit will be immediately de-certified if it fails to file such reports.

To be completed by Authorized Representative:

SIGNATURE:  9F900AB27FCF4B8...

Printed Name of Signatory: Michael Grasso

DATE: June 13, 2023



State of Rhode Island
Department of State | Office of the Secretary of State
Nellie M. Gorbea, Secretary of State

CERTIFICATE OF GOOD STANDING

I, Nellie M. Gorbea, Secretary of State and custodian of the seal and corporate records of the State of Rhode Island, hereby certify that:

SUNNOVA ENERGY CORPORATION

is a Business Corporation formed under the laws of **DELAWARE**

that qualified to conduct business in this state on **July 30, 2015.**

I further certify

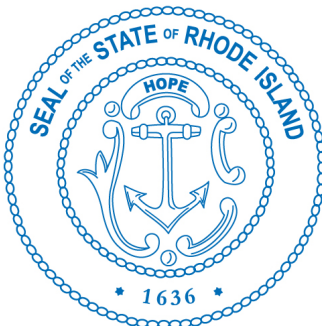
that revocation proceedings are not pending; a certificate of withdrawal has not been filed; all annual reports are of record and the corporation is active and in good standing with this office.

This certificate is not to be considered as a notice of the corporation's tax status, financial condition or business practices; such information is not available from this office.

SIGNED and SEALED on

August 19, 2022

Secretary of State



Certificate Number: 22080086040

Verify this Certificate at: <http://business.sos.ri.gov/CorpWeb/Certificates/Verify.aspx>

Processed by: aalbert

SUNNOVA ENERGY CORPORATION

SECRETARY'S CERTIFICATE

MAY 30, 2023

The undersigned hereby certifies that he is the Secretary of the Company and, acting in his capacity as such officer on behalf of the Company and not in his individual capacity, further certifies as follows:

Michael Grasso holds the office of Executive Vice President, Chief Revenue Officer per the Company Resolution dated February 22, 2023, and is authorized and empowered to take or cause to be taken any and all such actions and to enter into, execute and deliver any and all such acknowledgments, agreements, certificates, contracts, instruments, notices, statements and other documents.

{Signature page follows}

IN WITNESS WHEREOF, I have hereunto set my hand as of the date and year first set forth above.

Margaret C. Fitzgerald
Name: Margaret C. Fitzgerald
Title: Senior Vice President,
Deputy General Counsel and Secretary

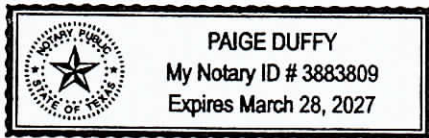
State of Texas

County of Harris

This instrument was acknowledged before me on May 30, 2023 by Margaret C. Fitzgerald, Senior Vice President, Deputy General Counsel and Secretary of Sunnova Energy Corporation, a Delaware corporation, on behalf of said corporation.

Paige Duffy
Notary Public's Signature

(Personalized Seal)



APPENDIX D
(Revised 4/19/2021)
(Required of Applicants Seeking Eligibility for Customer-Sited and/or Off-Grid
Generation Facilities, Rhode Island-Located Remote Net Metered Facilities, and
Associated Aggregations)

Customer-sited, remote net metered, and off-grid Generation Facilities (see Section IV) physically located in Rhode Island may be certified as an Eligible Renewable Energy Resource if their NEPOOL GIS Certificates are created from the verified electrical generation of a single Rhode Island-sited Generation Unit, or by way of a Commission-certified aggregation of Generation Units located in Rhode Island that use the same generation technology. Please complete the following and attach documentation, as necessary to support all responses:

- D.1 For eligible aggregations, please identify the location(s) in Rhode Island of each Generation Unit in the aggregation (provide attachments if extra space is needed), or if the application is for a single Rhode Island-sited Generation Unit, please provide the name and location of the single Generation Unit site.

- D.2 Please propose procedures under which the aggregate Generation Unit(s) will operate (“Aggregation Agreement”). In accordance with RES Rules Section 2.6(H)(4), the proposed Aggregation Agreement shall contain the following information:

- (a) Name and contact information of the Aggregator (or single site) Owner, to which these regulations and stipulations of certification shall apply, and who shall be the initial owner of any NEPOOL GIS Certifications so certified;

Name and title: _____

Company: _____

Address

Phone: _____

Email: _____

- (b) Name, contact information, and qualifications of the Verifier. Qualifications shall include any information the applicant believes will assist the Commission in determining that the Verifier will accurately and efficiently carry out its duties. After receipt of the application, the Commission may require additional evidence of qualifications;

Name and title: _____

Company: _____

Address

Phone: _____

Email: _____

Qualifications: _____

- (c) A declaration of any and all business or financial relations between Aggregator (or single site) Owner and Verifier, which the Commission will use to evaluate the independence of the Verifier.¹

- (d) Please identify the type of technology that will be included in the aggregation (or single-site generation unit), and a statement that the aggregation will include only individual Generation Units that meet all the requirements of these regulations, for example physical location, vintage, etc. (All generators within the aggregation must be of the same technology and fuel type);

¹ Reasons for ruling that a Verifier is not sufficiently independent include, but are not limited to: i) If one entity owns, directly or indirectly, or if a natural person so owns, 10% or more of the voting stock or other equity interest in the other entity; ii) If 10% or more of the voting stock or other equity interests in both entities are owned, directly or indirectly, by the same entity or a natural person; or iii) If one entity is a natural person, and such entity or a member of such entity's immediate family is an officer, director, partner, employee or representative of the other entity.

- (e) Please describe the proposed operating procedures for the aggregation (or single-site generation unit), by which the Aggregation Owner shall ensure that individual Generation Units in the aggregation comply with all eligibility requirements and that the NEPOOL GIS Certificates created accurately represent generation;²

- (f) Please describe how the Verifier will be compensated for its services by the aggregator. In no instances will an aggregation be certified in which the Verifier is compensated in a manner linked to the number of NEPOOL GIS Certificates created by the aggregation;

- (g) Please confirm and describe how, no less frequently than quarterly, the Verifier will directly enter into the NEPOOL GIS the quantity of energy production in the applicable time period from each Generation Unit in the aggregation. The entry of generation data by the Verifier must be through an interface designated for this purpose by the NEPOOL GIS and in accordance with NEPOOL GIS Operating Rules applicable to Third-Party Meter Readers, and to which the Aggregation Owner shall not have access.³

² At a minimum, these procedures will: i) require a determination by the Aggregation Owner that the Generation Unit is in compliance with these Renewable Energy Standard rules and the Aggregation Agreement as approved by the Commission, and an independent determination by the Verifier that the Generation Unit exists; ii) require a meter reading procedure that allows the Verifier to read meters on the Generation Units; meter readings may be manual or remote and via the aggregators own system or via an independent system, but in all cases shall comply with NEPOOL GIS Operating Rules regarding metering; iii) require confirmation that Verifier will be entering the quantity of energy production in to the NEPOOL GIS system as described in paragraph (g) for NEPOOL GIS to create NEPOOL GIS Certificates; and iv) include a procedure for the Verifier to report to the Commission on the results of their verification process.

³ Such generation data shall not include any generation data from previous time periods, except as provided for in this section. Output of less than one MWh by any single Generation Unit within the aggregation may be applied to the entire aggregation's generation, and generation of the aggregation less than one full MWh may be applied to the subsequent quarter in accordance with NEPOOL GIS Operating Rules.

D.3 Applicant must acknowledge that:

(a) any changes to or deviations from the Aggregation Agreement will be considered a change in generator status, and will require recertification by the Commission;

- ← please check this box to acknowledge this requirement
- N/A or other (please explain)

(b) the Commission will be promptly notified of any changes to or deviations from the Aggregation Agreement; and

- ← please check this box to acknowledge this requirement
- N/A or other (please explain)

(c) in the event that notice of such changes or deviations is not promptly given, all Generation Units in the aggregation may be de-certified.

- ← please check this box to acknowledge this requirement
- N/A or other (please explain)

D.4 Applicant must certify that:

If the Generation Unit (or aggregation of generation units) is a Customer-sited (behind-the-meter) or Off-grid Generation Facility, as defined in RES Rules Sections 2.3(5) and 2.3(26), respectively, or a Customer-sited (grid connected) or Remote Net Metered (grid connected) Generation Facility, the associated Generation Attributes have not otherwise been, nor will be sold, retired, claimed or represented as part of electrical energy output or sales, or used to satisfy obligations in jurisdictions other than Rhode Island.

- ← please check this box to certify that this statement is true
- N/A or other (please explain)

Registering to NEPOOL GIS Production Tracking System from the Monitoring Platform - Application Note

Contents

Registering to NEPOOL GIS Production Tracking System from the Monitoring Platform - Application Note	1
Version History	1
Introduction	1
Selecting NEPOOL GIS in the SolarEdge Monitoring Platform	2

Version History

- Version 1.0, May 2019 - First version of this document
- Version 1.1, June 2019 - Added eligible meters supported
- Version 1.2, January 2021 – Added eligible meter supported
- Version 1.3, February 2021 – Added eligible meters supported
- Version 1.4, July 2021 – Included Massachusetts as an additional state for NEPOOL reporting, added eligible meters supported for Massachusetts
- Version 1.5, September 2021 – Updated eligible meters supported in Table 1

Introduction

SolarEdge is an approved Independent Verifier with NEPOOL GIS, and offers reporting service for eligible SolarEdge PV systems with revenue grade meter in the states of New Hampshire, Vermont, Maine, and Massachusetts. Independent Verifiers are third party reporters that report energy generated by eligible PV systems to NEPOOL. For compensation and SREC trading questions talk to your aggregator. A SolarEdge approved revenue grade meter is required to enroll in this service; SolarEdge offers a variety of meters that support NEPOOL GIS tracking capabilities:

Eligible Meter Part Numbers	New Hampshire	Maine	Vermont	Massachusetts
RWNC-3D-240-MB ¹	✓	✓		
RWND-3D-240-MB	✓	✓	✓	✓
SE-RGMTR-1D-240C-A	✓	✓	✓	✓
RWND-3D-480-MB	✓	✓	✓	
RWND-3D-208-MB	✓	✓	✓	
SE-RGMTR-1D-240C-B	✓	✓	✓	✓
SE-RGMTR-3Y-208V-A	✓	✓	✓	✓
SE-RGMTR-3D-208V-A	✓	✓	✓	✓
SE-RGMTR-3Y-480V-A	✓	✓	✓	✓
WND-WR-MB ²	✓	✓	✓	✓

Table 1: Eligible Meters for Production Tracking System to NEPOOL GIS

¹Valid for PV systems with up to 10kW nameplate capacity as required per NEPOOL meter accuracy requirements. For any related questions, contact NEPOOL.

²WND-WR-MB is valid for revenue metering with class 0.2 and class 0.3 current transformers. For any questions related to meter and current transformers, contact Continental Control.

Selecting NEPOOL GIS in the SolarEdge Monitoring Platform

The system installer must enable the automated reporting for a system through their installer account with the SolarEdge Monitoring Platform.

To enable the feature, follow the steps, as shown in Figure 1 below.

1. Go to the site's Admin tab in the Monitoring Platform.
2. Under the Meter Reporting tab, choose NEPOOL GIS from the Production Tracking System dropdown list.
3. Review and agree to the Terms and Conditions.
4. Enter the NEPOOL GIS ID, as provided by the NEPOOL association, excluding the "NON" (example: NON123456 should be entered as 123456) and click Save.

(For any questions related to your NEPOOL ID, contact NEPOOL GIS.)

5. Click Save. The system will validate the system ID with the reporting service.

The screenshot displays the SolarEdge Monitoring Platform interface. At the top, there is a navigation bar with icons for Dashboard, Layout, Charts, Reports, Alerts, and Admin. The Admin icon, which is a red gear, is highlighted with a red box. Below the navigation bar is a search bar with the text "Choose a site (insert at least 3 letters to search):" and a dropdown menu. Below the search bar is a horizontal menu with tabs for Site Details, Meter Reporting, Site Access, Revenue, Logical Layout, and Physical Lay. The Meter Reporting tab is highlighted with a red box. Below the horizontal menu is a form titled "Automatic Energy Reporting". The form contains a dropdown menu for "Production Tracking System" with "NEPOOL GIS" selected. Below this is a checkbox with the text "This feature is provided to you as a convenience only. SolarEdge makes no guarantees regarding its accuracy or availability. Our liability is limited as set forth in our terms and conditions. [Terms and Conditions](#)". Below the checkbox is a text input field for "NEPOOL GIS ID: *" with a red asterisk. At the bottom right of the form are two buttons: "Cancel" and "Save".

Figure 1: Meter Reporting tab under Admin on SolarEdge Monitoring Platform

I-V Curve Tracing vs. SolarEdge Real Time Monitoring

Version History

- Version 1.0 (Nov 2018) – Initial release

Introduction

PV system performance is often tested as part of the manufacturing, installation and commissioning of a newly constructed solar energy system. Testing allows designers, system owners and installers to verify proper installation and identify module defects and underperformance, such as bypass diode failures, potential induced degradation (PID), and micro cracks.

In traditional string inverter systems this is typically done using I-V curve tracing, while in a SolarEdge system there is no need to employ this costly method which provides partial data only. Instead real-time module-monitoring can be used for comprehensive performance data at any given time, including immediate installation verification.

I-V Curve Tracing

I-V curve tracing is a performance verification method used in PV systems with traditional inverters. Performance verification is done by measuring current and voltage while varying an electrical load connected to a PV module string. This method has several limitations:

- **No real-time monitoring** - the procedure reports data from a single point in time. It is therefore heavily dependent on environmental conditions at the time of data capture and is not reproducible
- **Diagnostic information is not continuous** - defects or underperformance can go undetected for long periods of time (until the next I-V curve tracing). Data presented is partial and unrepresentative of the long term health of the PV system.
- **No module-level analysis** - in PV systems with traditional inverters, modules are not analyzed individually, but are bundled with neighboring modules in the array. This lack of granularity leads to inaccuracies in error detection.
- **Requires costly labor & equipment** – if I-V curve tracing indicates a possible fault, without real-time and continuous diagnostic information, technicians are sent to the site to search for the problem with little direction or guidance. This search becomes more difficult and costly as installation size increases. Additionally, expensive thermal imaging (IR) cameras and portable electro-luminescence (EL) equipment will have to be deployed to detect the reduced output power of a single solar module.

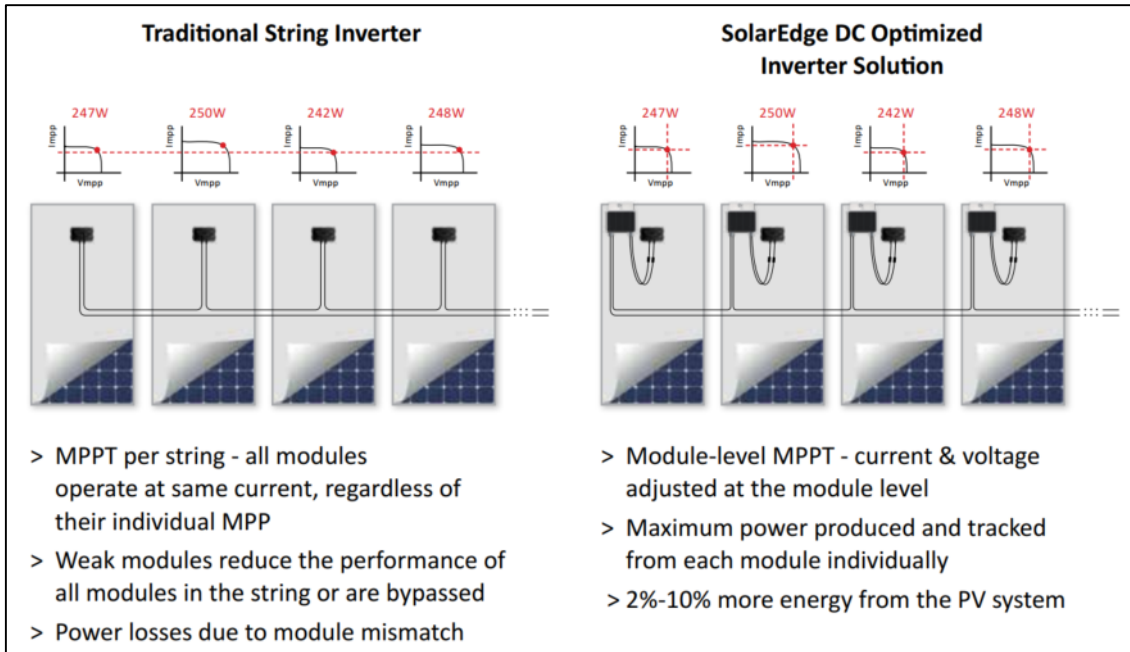
The SolarEdge System Architecture

The SolarEdge innovative system architecture mitigates IV curve tracing limitations. SolarEdge's monitoring platform enables precise, continuous, real time monitoring of each PV module separately – resulting in a more accurate PV installation and performance verification procedure.

In PV systems, each module has an individual maximum power point (MPP). With traditional string inverter systems, the weakest module negatively impacts the performance of all the other modules in the string.

SolarEdge eliminates this issue by allowing each module to perform to the best of its ability at all times. Each module's MPP is tracked independently and real-time current and voltage adjustments are applied to achieve the optimal working point of each PV module.

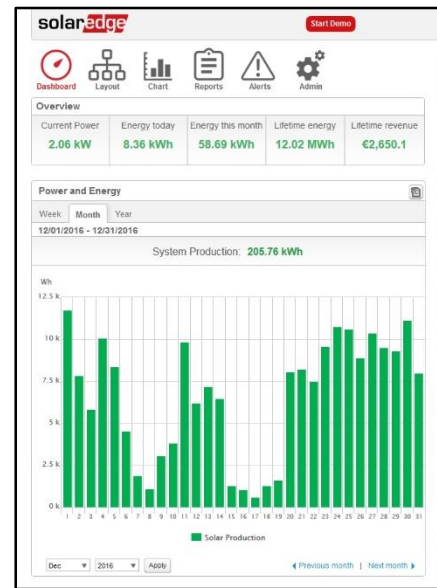
By enabling each module to continuously produce its maximum power independently of other modules in the same string, SolarEdge eliminates the impact of module mismatch, minimizes partial shading losses and improves power production.



The SolarEdge Monitoring Platform

SolarEdge’s system architecture also enables precise, continuous, real-time tracking of individual module performance to evaluate its initial and ongoing performance. The monitoring receiver is integrated in the inverter and aggregates performance data from each PV module connected to it. This data is then transmitted to the monitoring platform in near real-time and accessed via computer, smartphone or tablet for performance analysis, fault detection and troubleshooting of PV systems. The platform reduces maintenance costs throughout a system’s lifetime.

The dashboard provides a quick look at the current performance of the solar system, provides access to historical data, and displays metrics for comparison.



Dashboard - Energy production is displayed with weekly, monthly and yearly resolution

The Designer tool allows an installer or system owner to upload the array’s module layout to the monitoring platform for a true physical representation that is then populated with data per module in the layout. This allows for easy and quick evaluation of solar asset performance in order to decide if action is necessary to fix a problem.



The charting is where the SolarEdge monitoring really shines – some examples can be seen below. Each module’s voltage and current can be charted to see if the string is performing as expected. One module can be compared to another in the same string, a single module can be analyzed to determine if a bypass diode has failed, or strings can be compared to each other. All of this takes place in near real-time resolution.

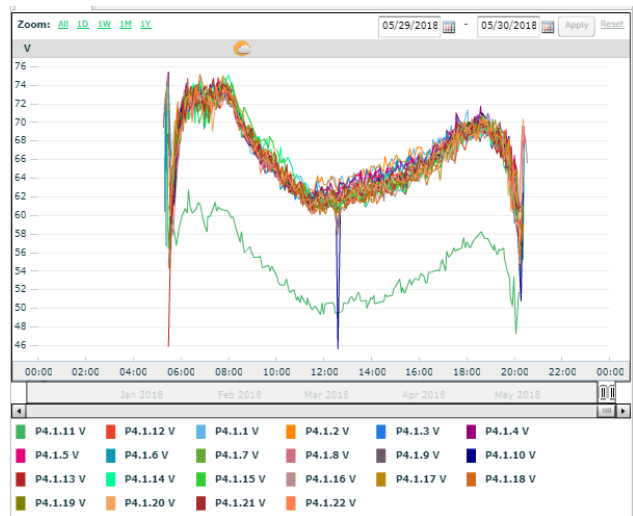
Site Commissioning with the Monitoring Platform

The monitoring platform can be used to verify that all components are properly installed, configured, and communicating. By generating a site commissioning report installers can check that the inverters, power optimizers and any other optional SolarEdge devices installed at the site (e.g. Energy Meter, Commercial Gateway) are properly connected and communicating with the monitoring platform. The report is built into the monitoring platform and can be easily generated and used for site approval.

Identification of Possible Defects and Underperformance - Examples

Defective Bypass Diode

The screenshot shows the voltage profile for each module in a string of 44 modules over the course of one day; every two modules are connected to a single power optimizer. The voltage of module 4.1.11 (green line) is approximately 15% lower than the other modules in the string, indicating that a bypass diode has been activated for this module.

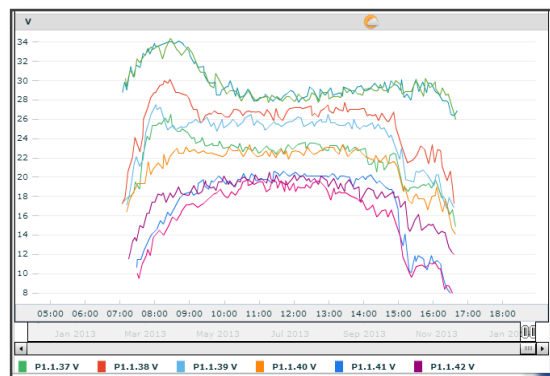
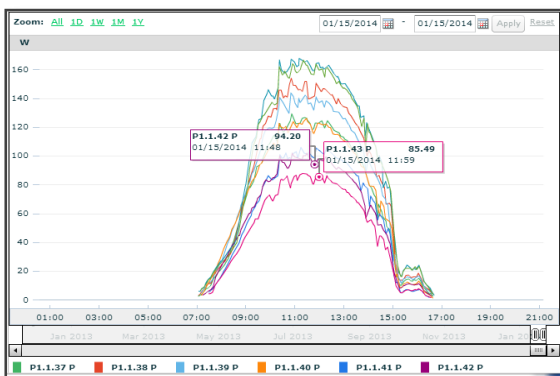


Potential Induced Degradation (PID)

Potential Induced Degradation (PID) is a phenomenon that can significantly degrade the power output of solar modules with power losses as high as 70%. However, PID can be difficult to detect in traditional systems.

Using the SolarEdge monitoring platform it’s easy to identify PID. The monitoring platform can provide accurate module-level identification of PID using historical voltage and power output measurements of each individual module.

An example is shown below. It is clear that the degradation is more dominant towards the string’s negative pole. Moreover, in such cases it is possible to complete a thorough analysis without sending a technician to the site to measure the modules’ voltage, rather it can be done remotely.



Micro Cracks

Solar cell micro cracks can reduce the effective lifetime of a solar module due to accelerated degradation of output power. Micro cracks can occur during the manufacturing process, during shipping and handling, or during operation. Micro cracks are difficult to diagnose and detect since the effects are at the cell level. When using standard string I-V curve tracing it is difficult to detect the reduced output power of a single solar module. Expensive thermal imaging (IR) cameras and portable electro-luminescence (EL) equipment must be deployed.

With the SolarEdge monitoring platform it is possible to view the historical output of individual modules and to compare one module to another, making the detection of module degradation due to micro cracks easy

Summary

The SolarEdge innovative system architecture can naturally mitigate the limitations of I-V curve tracing. SolarEdge's system architecture and monitoring platform offer more visibility, more granularity, continuous real-time module-level tracking with historic data for accurate installation and performance evaluation.

The SolarEdge performance verification procedure is simple, does not require special tooling and can be done remotely from any computer, smartphone or tablet.