DNV

SOLAREDGE – SOLAREDGE OPTIMIZER, INVERTER AND BATTERY TECHNOLOGY REVIEW

Technology Review Report

SolarEdge Technologies Ltd.

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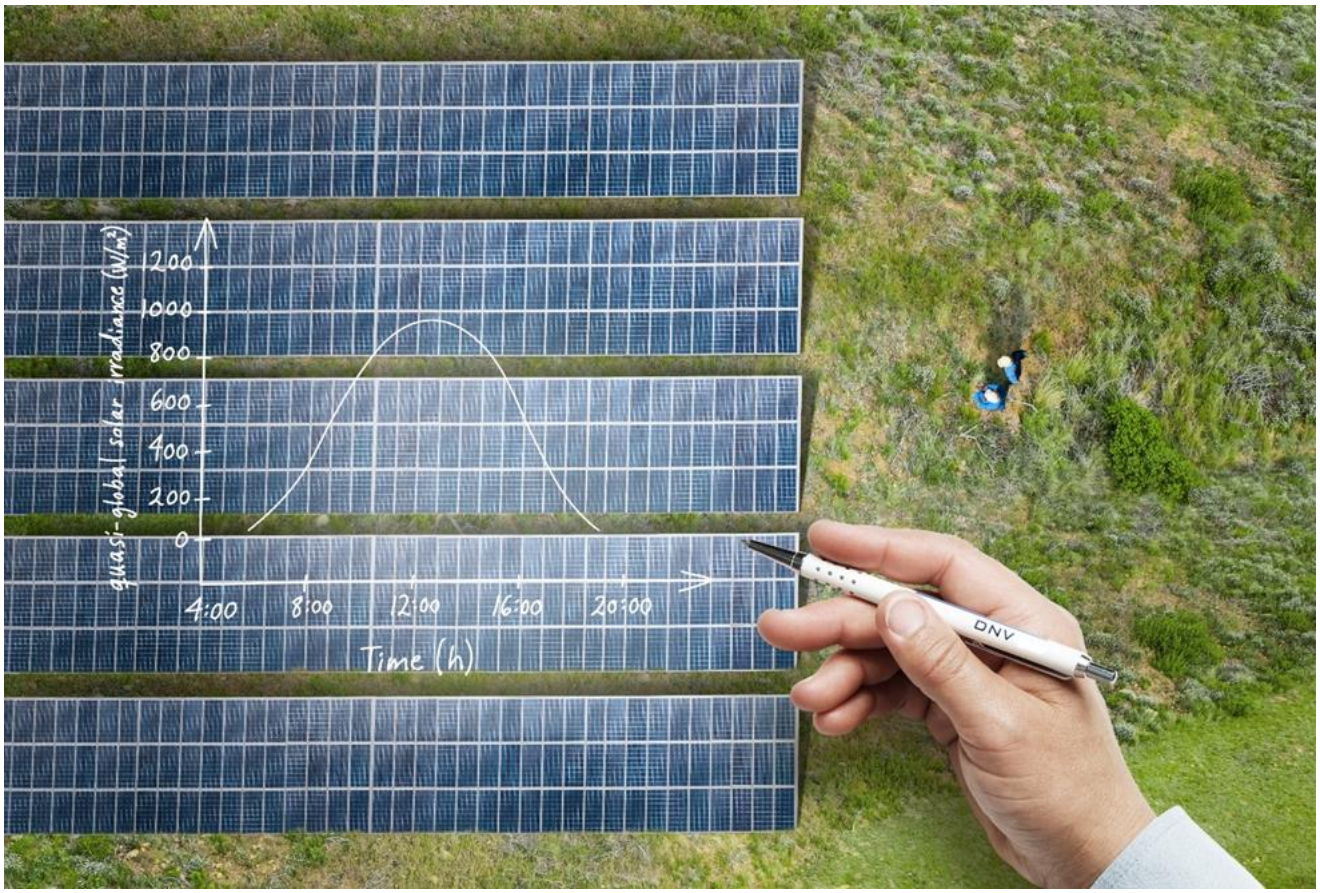

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Report title:	Technology Review Report SolarEdge – SolarEdge Optimizer, Inverter and Battery Technology Review	DNV Energy USA Inc. 155 Grand Ave., Suite 600, Oakland, CA, 94612 USA Tel: +1 510 891 0446 Enterprise No.: 23-2625724
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Task and objective:
This report presents the results of analysis conducted by DNV on behalf of SolarEdge Technologies Ltd..

Prepared by:	Verified by:	Approved by:
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List of abbreviations

Abbreviation	Meaning
Ac	alternating current
AFCI	arc fault circuit interrupter
ALT	Accelerated life test
ATP	acceptance test procedure
CAN	controller area network
CEC	California Energy Commission
DNV	DNV Energy USA Inc.
DVT	design verification test
Dc	direct current
EHS	Environmental, Health, and Safety
EMI	electro-magnetic interference
EOL	end of line or end of life
ERP	Enterprise Resource Planning
ESD	electrostatic discharge
ESG	Environmental, social, and governance
ESS	energy storage systems
FMEA	failure modes and effects analysis
HALT	highly accelerated life testing
IEEE	Institute of Electrical and Electronics Engineers
IEC	International Electrotechnical Commission
IGBT	Insulated gate bipolar transistor
MPPT	maximum power point tracking
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NRTL	Nationally Recognized Testing Laboratory
O&M	operation and maintenance
PV	photovoltaic
PVEL	PV Evolutions Laboratory in Berkeley, California
PID	potential induced degradation
PCB	printed circuit board
QMS	quality management systems
RSS	rapid shutdown system

RMA	return material authorization
SMT	surface mount technology
UL	Underwriters' Laboratories

1 INTRODUCTION

SolarEdge Technologies Ltd. (“SolarEdge”) retained DNV Energy USA Inc. (“DNV”) to perform an independent technology evaluation of their PV optimizer, hybrid inverter and battery energy storage models listed in section 1.2. This report presents the results of DNV’s analysis.

The report provides new and updated information to enhance previous DNV Technology Review reports covering several SolarEdge products, including updated information on the company as well as adding technical due diligence information on the SolarEdge’s newer models. Also, previews of the upcoming utility scale inverter, optimizer, and battery models are included.

Comments related to earlier products are included in several places for reference purposes and to illustrate the SolarEdge PV inverter history.

1.1 Executive summary

Throughout the report, DNV highlights aspects of SolarEdge as a company, including experienced management and technical teams, advanced manufacturing approach, proactive IP strategy, and most significantly, a large global installed base. This 5th update report by DNV on the SolarEdge Power Optimizers, Single and Three phase Inverters was expanded to include their new product offerings, including the Home Battery home battery storage.

Overall, DNV is impressed with SolarEdge as a company and the technology and products that are being deployed. Table 1-1 provides a summary of DNV’s review findings.

Table 1-1 Evaluation Summary

DNV key findings	
Company evaluation	• Ranked #1 manufacturer in the US residential inverter market with a 45.7% share. Leader in the PV optimizer field.
	• Long track record in developing residential and commercial PV solar inverters and optimizers.
	• Five manufacturing plants around the world for optimizers and inverters including their own production facility in Israel. SolarEdge and contract manufactures are certified to ISO 9001:2015 and ISO 14001:2015.
	• Expansion of product offerings with continual investment in R&D.
	• 5th update by DNV of SolarEdge and its products.
Product evaluation	• Wide variety of inverter and optimizer products for residential, commercial and utility scale applications, with extensive compliance testing and regulatory certifications to allow for installation in global PV markets.
	• Thorough approach to product reliability following the best industry practices that includes design for reliability, reliability testing, and objective analysis of field failure data for product reliability improvements.
	• Detailed design process, repeatable manufacturing processes and effective quality systems are in place.
	• Optimizers enable module level MPPT, monitoring, and diagnostics options to improve overall PV plant performance. They also provide built-in rapid shutdown capability.
	• Optimizers and inverters are equipped with safety systems to detect overtemperatures caused by improper connections and damage.
	• Effective service approach in supporting PV systems installations with software, product manuals and white papers. Equipped with communications systems for PV module level monitoring and remote troubleshooting.
	• 5+ years of field reliability data for the optimizer and inverters under review in this report indicates reliability trending towards good as the number of units fielded increased
	• The optimizer and inverter warranties are in line with PV industry standards.

1.2 Scope of review

DNV has reviewed the SolarEdge power optimizers and inverters multiple times, as the product offering grew in size. In this report, DNV reviewed new product offerings as well as updated specification sheets and performance data for many of the previously reviewed products. DNV also previewed upcoming SolarEdge products in this report.

In this report, the following new products are reviewed in detail:

- Optimizer models reviewed in this report: S440, S500, S500B, S1200, P300, P320, P340, P370, P400, P404, P405, P500, P505, P600, P650, P730, P800p, P850, P860, P960, P1101 and M2640.
- The following single phase Home Hub (aka Energy Hub) inverters reviewed in this report: SE3000H-US, SE3800H-US, SE6000H-US, SE7600H-US, SE10000H-US and SE11400H-US, SE3000H-XXX, SE4000H-XXX, SE5000H-XXX, SE6000H-XXX, SE8250H-XXX and SE10000H-XXX.
- The following single phase HD-Wave inverters reviewed in this report: SE2200H, SE2500H, SE3000H, SE3000H-US, SE3500H, SE3680H, SE3800H-US, SE4000H, SE4600H, SE5000H, SE5000H-US, SE6000H, SE6000H-US, SE7600H-US, SE8000H, SE10000H, SE10000H-US and SE11400H-US
- Three Phase Inverters with SetApp: SE3K, SE4K, SE5K, SE6K, SE7K, SE8K, SE9K, SE10K, SE12.5K, SE15K, SE16K, SE17K, SE25K, SE27.6K, SE25K, SE30K, SE33.3K, SE9KUS, SE14.4KUS, SE17.3KUS, SE20KUS, SE30KUS, SE33.3KUS, SE40KUS, SE5K-AUB, SE7K-AUB, SE8.25K-AUB and SE10K-AUB.
- Three Phase Inverters with Synergy Technology: SE50K,SE66.6K, SE90K, SE100K, SE120K, SE50KUS, SE80KUS, SE100KUS, SE110KUS and SE120KUS.

In addition to the optimizer and inverter models, the following SolarEdge products are also reviewed in this report:

- Energy Net, SolarEdge wireless plug-in device.
- SetApp, SolarEdge app for inverter commissioning.
- Home battery storage: Home Battery Gen1 5kWH model.

DNV also previewed the following upcoming SolarEdge products in this report:

- H1300, utility-scale optimizer.
- SE3330K, utility-scale inverter.

1.3 Methodology

This report is presented by DNV as an independent technology review of the optimizer, inverter, battery storage products, plus associated peripheral devices.

In general, this report contains information that would be included in a project Independent Engineering review intended for financial institutions, customers, and project developers. DNV is well qualified to conduct this study due to its extensive background and experience in solar and energy storage independent engineering and technology due diligence work. The report is directed to the audience of PV project developers and financiers.

Where applicable some of the information presented in this review was derived from previous technology reviews on SolarEdge products. This report includes the results of extensive information provided by SolarEdge. Previous reports included information from meetings at the SolarEdge headquarters facility in Herzliya, Israel, and a visit to the contract

production facility in Zalaegerseg (“Zala”), Hungary. No additional factory or headquarter visits were conducted in the production of this update.

Information was aggregated from multiple SolarEdge sources and provided to DNV for generation of this report by:

- Meir Adest – Chief Product Officer, Founder
- Uri Bechor – Chief Operating Officer
- Ronen Faier – Chief Financial Officer
- David Lachman – AVP, Reliability
- Alon Shapira – Vice President, Quality & Reliability
- Aharon Rochman – Quality and Reliability VP
- Ido Ginodi – Vice President, Product Management
- Stass Tsirulnik – Bankability and Business Development Manager

A significant objective of this report is to assess factors that would affect the inverter’s performance and longevity in the field and SolarEdge’s ability to deliver and service the products. Such factors will include the inverter design, product performance, regulatory compliance, reliability, service organization, and the manufacturing and quality control processes.

1.4 Assumptions

This report summarizes DNV’s assessment of the technology and relies on the accuracy of the information provided by SolarEdge. SolarEdge has been open and forthcoming in providing the data that DNV has requested.

This report is based on some information not within the control of DNV. DNV assumes that the information provided by others is true, correct, and reasonable for the purposes of this report. An independent analysis or verification of the validity of such information is beyond the scope of this report. DNV does not guarantee the accuracy of the data, information, or opinions provided by others.

In preparing this report and the opinions presented herein, DNV has made certain assumptions with respect to conditions that may exist, or events that may occur in the future. DNV believes that these assumptions are reasonable for purposes of this report, but actual events or conditions may cause results to differ materially from forward-looking statements.

2 COMPANY EVALUATION

2.1 SolarEdge overview

SolarEdge was founded in August of 2006 and is headquartered in Herzlia Israel, near Tel Aviv. The SolarEdge headquarters building is shown in Figure 2- below. The North American headquarters is in Milpitas, California. SolarEdge has the international subsidiaries and sales/support offices as shown Table 2-1. According to the 2022 SolarEdge Report; since beginning commercial shipments in 2010, SolarEdge has shipped approximately 31.6 Gigawatts (GW) of capacity of its DC optimized inverter systems worldwide.

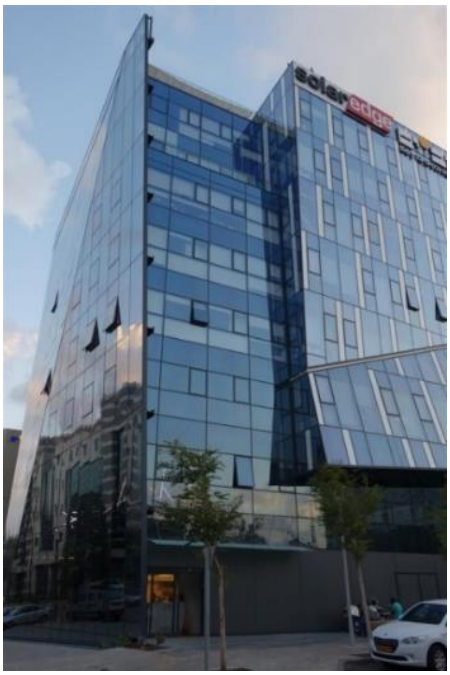


Figure 2-1 SolarEdge Headquarters in Israel

Table 2-1 SolarEdge Technologies subsidiaries around the world

Name	Location
SolarEdge Technologies Ltd.	Israel
SolarEdge Manufacturing Ltd.	Israel
SolarEdge Technologies GmbH	Germany
SOLAREDGE TECHNOLOGIES (CHINA) CO., LTD	China
SolarEdge Technologies (Australia) PTY LTD	Australia
SolarEdge Technologies (Canada) Ltd.	Canada
SolarEdge Technologies (Holland) B.V.	The Netherlands
SolarEdge Technologies (Japan) Co., Ltd.	Japan
SolarEdge Technologies (France) SARL.	France
SolarEdge Technologies (UK) Ltd.	United Kingdom
SOLAREDGE TECHNOLOGIES ITALY S.R.L.	Italy
SolarEdge Automation Machines s.p.a.	Italy
SolarEdge e-Mobility s.p.a	Italy
SolarEdge Investment srl	Italy
SolarEdge Technologies (Bulgaria) Ltd.	Bulgaria
Guangzhou SolarEdge Machinery Technical Consulting Co., Ltd	China
SOLAREDGE TEKNOLOJİ A.Ş.	Turkey
SolarEdge Technologies (Belgium) SPRL	Belgium

SolarEdge Technologies SRL.	Romania
SOLAREDGE TECHNOLOGIES (INDIA) PRIVATE LIMITED	India
SolarEdge Technologies (Sweden) AB	Sweden
SolarEdge Technologies Taiwan Co., Ltd.	Taiwan
SolarEdge Technologies Korea Co., Ltd.	South Korea
Kokam Limited Company	South Korea
SolarEdge Critical Power U.K. Limited	United Kingdom
SOLAREDGE DO BRASIL SERVIÇOS DEMARKETING E APOIO AO CLIENTE LTDA.	Brazil
SolarEdge Technologies (Vietnam) Company Limited	Vietnam
SolarEdge Technologies (Hungary) Kft.	Hungary
SolarEdge Technologies (Poland) Sp. Z o.o	Poland
SolarEdge E-Mobility Germany GmbH & Co. KG	Germany
SolarGik, Ltd.	Israel
SolarEdge Technologies Mexico S.DE R.L. DE C.V.	Mexico

The Wood Mackenzie Report published for Q4 2021 lists SolarEdge as the #1 manufacturer in the US residential inverter market with a 45.7% share.

As of May, 2022, SolarEdge directly employed over 4,100 full-time employees located largely in Israel, Korea, U.S., China, and Germany. SolarEdge has five manufacturing plants around the world for optimizers and inverters including their own production facility in Israel. SolarEdge's Sella 1 manufacturing plant started production in Q1 2021. SolarEdge has manufacturing contract agreements with two – Tier 1 electronic contract manufacturers. These manufacturers are Flextronics Inc. (Flextronics) in Hungary and Mexico and Jabil Circuit Inc. (Jabil) in China and Vietnam. DNV visited the Flextronics facility in Hungary as part of an earlier review, as a representative production site. DNV has previously visited other Jabil electronics manufacturing facilities. DNV recognizes Flextronics and Jabil as leading electronics contract manufacturers. DNV did not visit SolarEdge's new Sella 1 manufacturing locations, however, DNV expects SolarEdge to follow the same manufacturing and quality practices in the Sella 1 facility that were put in place in their other contract manufacturing locations. SolarEdge opened a new 1.7GWH battery cell manufacturing facility in South Korea named Sella 2 in May 2022.

The world-wide geographic distribution of SolarEdge operations as provided to DNV is shown in Figure 2- below.

Figure 2-2 SolarEdge global operations

2.2 Company financials and sales revenues

In 2015, SolarEdge successfully completed an initial public offering, and is now a publicly traded company, symbol SEDG, on NASDAQ. Significant additional information can be found on the company website as part of their information filings associated with an exchange-listed company.

The following are the financial highlights as of December 31, 2021 (note that the SolarEdge financial year runs through June 30):

- Annual FY revenues of $1.963 billion.
- Year-over-year growth of 34.6%.

The chart in Figure 2- indicates a Compound Annual Growth Rate (CAGR) of 26.5% for the last five years (2017 to 2021.)

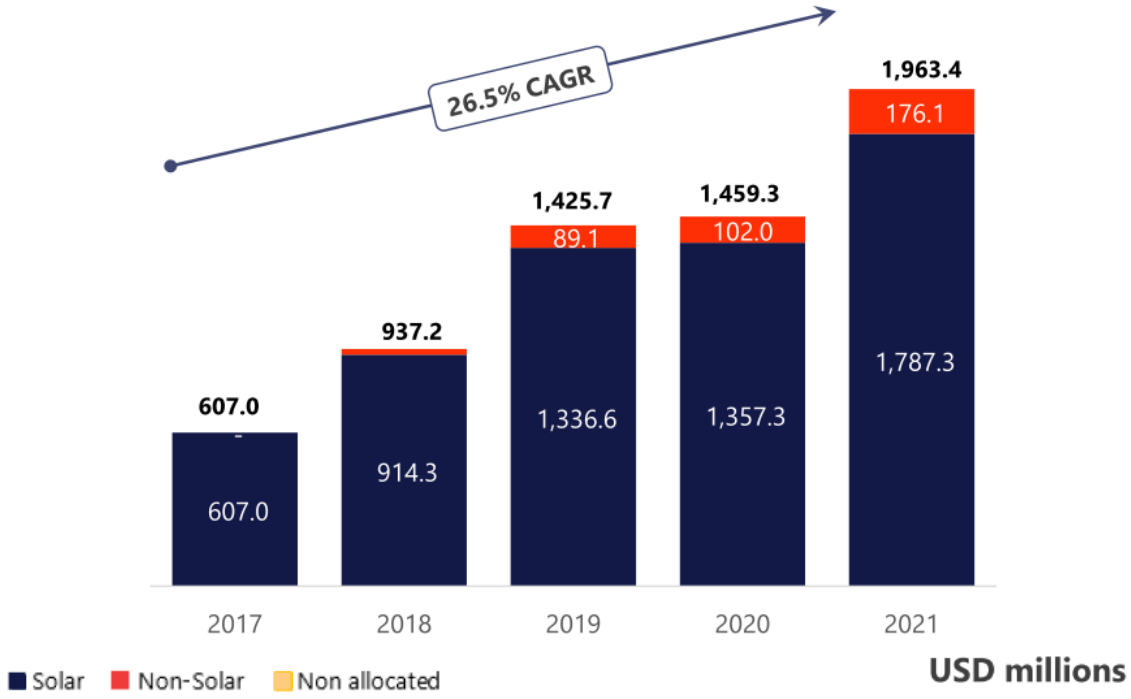


Figure 2-3 SolarEdge CAGR

The SolarEdge management team brings significant experience from the solar, semiconductor, communications, and defense industries in Israel, Europe, and the USA. DNV found the SolarEdge team to be very professional and knowledgeable. SolarEdge has several strategic partnerships across the PV value-chain including module manufacturers, distributors, and integrators, as seen in Figure 2-.

Figure 2-4 SolarEdge's global reach

DNV views SolarEdge as a leader in the PV optimizer and inverter field. The large number of optimizer and inverter units shipped to date provides a significant positive indicator contributing toward SolarEdge's continued growth and success.

2.3 SolarEdge Milestones

Figure 2- shows SolarEdge's significant milestones achieved since 2006. SolarEdge provided the following significant milestones achieved since DNV's previous review in 2019.

2020: SolarEdge Enhances Solar-Plus-Storage Experience with Launch of Home Hub (aka Energy Hub) Inverter.

2021: SolarEdge Home Battery residential 9.7 kWh, DC coupled battery, launched in North America.

2022: Announced the launch of SolarEdge Home Product Portfolio, an innovative home energy management solution that allows homeowners to optimize their solar energy production, usage and storage. Designed for both single and three-phase applications

2022: SolarEdge Opens 2GWh New Battery Cell Facility in South Korea to Meet Growing Demand for Battery Storage

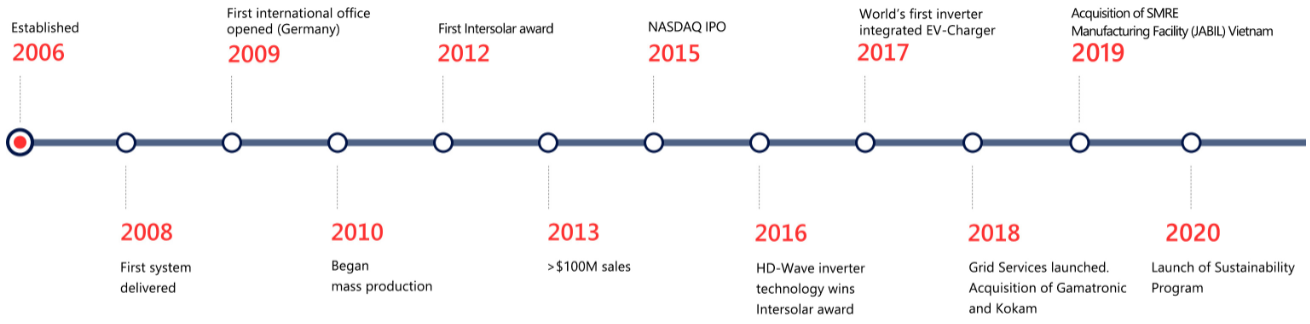


Figure 2-5 SolarEdge milestones

2.4 Intellectual property (IP) evaluation

SolarEdge is focused on protecting the IP that it has developed for their optimizer and inverter products. DNV reviewed the overall SolarEdge company IP strategy through a number of discussions. SolarEdge works with the well-recognized Banner & Witcoff, a specialized intellectual property law firm located in Washington, D.C. DNV understands that SolarEdge conducts routine reviews of patents in its field in order to protect its patents and to gauge the state of the existing IP in their product areas.

As of June 30, 2022, SolarEdge held 226 issued U.S. patents, 198 international patents, 166 patent applications pending for examination in the U.S., and 259 additional patent applications pending approval in other countries. DNV does not review patents for potential issues of infringement. DNV finds the patent efforts by SolarEdge to be significant.

3 TECHNICAL EVALUATION

Since DNV's previous review in 2019, SolarEdge's product offering for residential and commercial applications has increased. Figure 3- shows the range of SolarEdge products for residential applications. New additions include the Home Hub inverter, dc coupled battery storage, EV chargers, smart energy management systems etc. SolarEdge is also offering higher power rated optimizers and three phase inverters for commercial and utility scale applications.

The SolarEdge system components under review in this report consist of the following primary components:

- Power Optimizers.
- Single Phase Home Hub and HD-Wave Technology Inverters.
- Three Phase Inverters with SetApp and Three Phase Inverters with Synergy Technology.
- Energy Net, SolarEdge wireless plug-in device.
- SetApp and other software tools from SolarEdge.
- Home Battery Storage System.

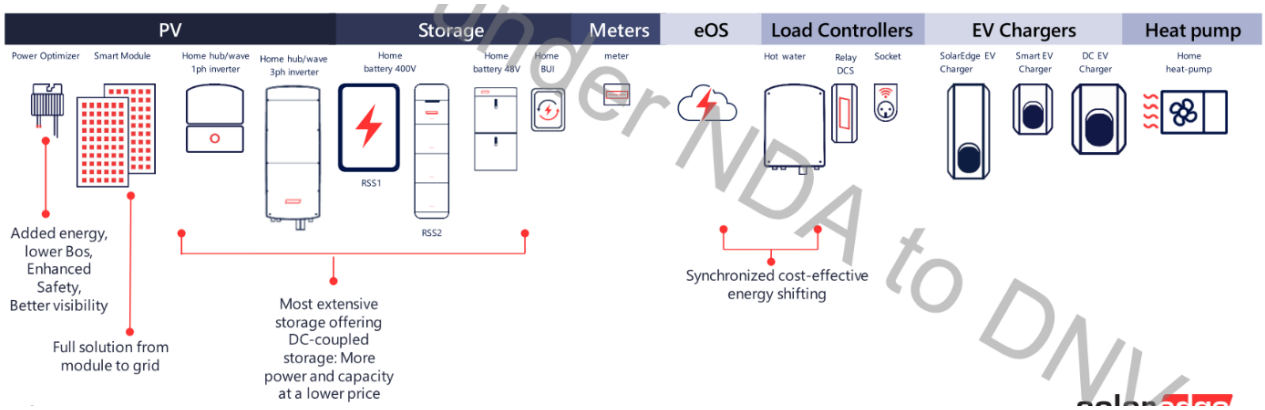


Figure 3-1 SolarEdge residential system components

A high-level diagram of the configuration used by a SolarEdge PV system is shown below. An optimizer is connected to each PV module and the optimizer outputs are connected into series strings. These strings are connected to a SolarEdge inverter which provides the interface to the utility grid.

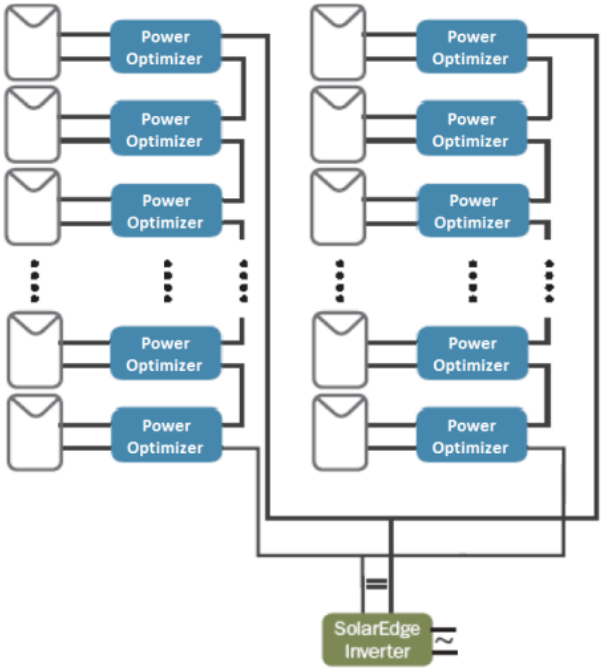


Figure 3-2 SolarEdge PV System Diagram

The complete SolarEdge system architecture consists of PV module power optimizers which perform module-level maximum power point tracking (MPPT), solar PV inverters, and a user interface portal for module-level monitoring and energy yield assessment.

The power optimizer is connected by system installers to each PV module. The MPPT algorithm deployed in each optimizer controls the dc power at each PV module to be kept at maximum power point which potentially increases energy capture by reducing losses due to module mismatch, non-uniform module degradation, or partial shading conditions. Performing MPPT on a per module basis allows for flexible system design with support for multiple module orientations, tilts and module types in the same string.

The full string voltage is maintained at a fixed point by the inverter for the dc to ac conversion, regardless of the string length (within limits) or environmental conditions. This fixed string voltage enables system design flexibility with optimizers by supporting the paralleling of uneven string lengths and allowing module locations on multiple roof facets for better roof utilization. It also allows for the optimization of the inverter design to produce maximum efficiency at the fixed dc voltage level. SolarEdge has captured this benefit by coordinating the design of their inverters with the optimizer characteristics.

An important intended benefit of deploying the SolarEdge Power Optimizer is that each PV module is operated at its individual maximized power point (MPP) to optimize the energy capture within a series string of PV modules. This function can compensate for PV module operating at condition differences such as partial shading or soiling and differing module performance characteristics within a series string, or modules operating at different temperatures. With the use of this feature, inverters can operate at a fixed input voltage thereby increasing their efficiency. The SolarEdge system advantages also include safety benefits and the ability to monitor the performance of each PV module in detail.

A significant majority of deployed systems utilizing SolarEdge Optimizers include SolarEdge Inverters. SolarEdge Optimizers do have a mode known as “IndOP” which allows for the Optimizers to function with PV inverters from other manufacturers. Further detailed information on this feature is available from SolarEdge. DNV views this as a benefit as a potential contingency plan allowing for retrofitting existing systems with SolarEdge Optimizers without changing the inverters.

The power optimizers continuously measure and communicate a range of module-specific data. Performance data is transmitted from the power optimizer to the inverter over the existing DC string wires using power line communications (PLC) techniques. In the inverter, a built-in communication gateway with several connectivity options enables connection to a remote monitoring server.

The SolarEdge inverters perform the function of converting the DC output of the string optimizers to AC power to the utility grid in either a single-phase or three-phase configuration. The inverter must meet several important standards for the grid interactivity. These standards vary by region.

It should be noted that the overall net efficiency of a system based on SolarEdge components includes the combined efficiency of both the optimizers and the inverters.

This report section hereafter includes separate discussions of the performance and characteristics of both the optimizer and inverter products. Additionally, a discussion of the overall system performance is provided.

3.1 Optimizers

The new SolarEdge Power Optimizers under review in this report are models S440, S500, S500B, S1200, P860, P960 and P1101. DNV has previously reviewed P300, P320, P340, P370, P400, P404, P405, P500, P505, P600, P650, P730, P800p, P850 and the single-phase inverter with optimizer, the M2640. Datasheets and performance parameters of these previously reviewed are updated this report.

3.1.1 SolarEdge Power Optimizer application

A SolarEdge Power Optimizer model is chosen to operate with the PV module output characteristics to which it will be connected. Each unit is connected to the PV module output leads via one of several approved industry standard quick connectors. Figure 3-3 illustrates the SolarEdge Power Optimizer enclosure and cables. The device must be mounted to either the module frame or mounting structure. The SolarEdge manual has the following stipulation: “If installing directly on the module or module frame, first consult the module manufacturer for guidance regarding location and the impact on the module warranty.” DNV notes that this is important to follow to ensure that the module warranty is not impacted by the use of the optimizer.

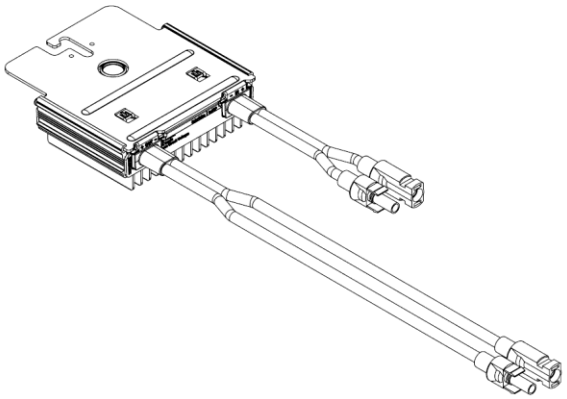


Figure 3-3 SolarEdge Power Optimizer

The metallic enclosure of the power optimizer must have an equipment grounding connection. This is implemented either by using the provided star washers (for grounded array structures) or optionally by bonding a ground conductor to the ground lug on each device.

The length of the PV series string can vary:

- Single phase inverters: between 8 and 25 modules
- Lower rated (120/208/240 V) three phase inverters: between 8 and 25 modules
- Higher rated (up to 480 V) three phase inverters: between 18 and 50 modules

Strings of different lengths can be combined in parallel. This allows for enhanced system layout flexibility which is enabled by the power optimizer's ability to support the fixed string input voltage of the inverter. Each power optimizer unit therefore adjusts its individual output within a given string so that the overall string voltage equals the impressed voltage from the SolarEdge inverter.

If the SolarEdge Power Optimizers are not connected to the inverter, or when the inverter is not operating, each SolarEdge Power Optimizer will output only 1V per module during installation (when the associated module has sufficient irradiation). A string with properly connected power optimizers should produce 1 V per SolarEdge Power Optimizer in the string. For example, if 10 power optimizers are connected in a string, then 10 V should be produced at the string terminals. This enables a series string, regardless of string length if it is below 50 modules, to produce an open circuit voltage of less than 50 Vdc. It also provides a method for validating the number of optimizers in a string by measuring the voltage with a voltmeter. The optimizers essentially shut down the output dc voltage when the connected inverter is not operating. DNV views this as a significant safety feature in the SolarEdge system architecture. It also can support efficient troubleshooting of the system through the ability to easily determine the number of active optimizers in a string.

3.1.2 SolarEdge Power Optimizer circuit topology

The SolarEdge series of Power Optimizers evaluated in this report use a cascaded buck/boost dc/dc power converter. This topology allows for the output voltage to be raised or lowered with respect to the input voltage. The Power Optimizer does not provide electrical isolation. A high-level block diagram of the SolarEdge Power Optimizer is given in Figure 3-4. DNV believes that this topology is appropriate for the SolarEdge Power Optimizer.

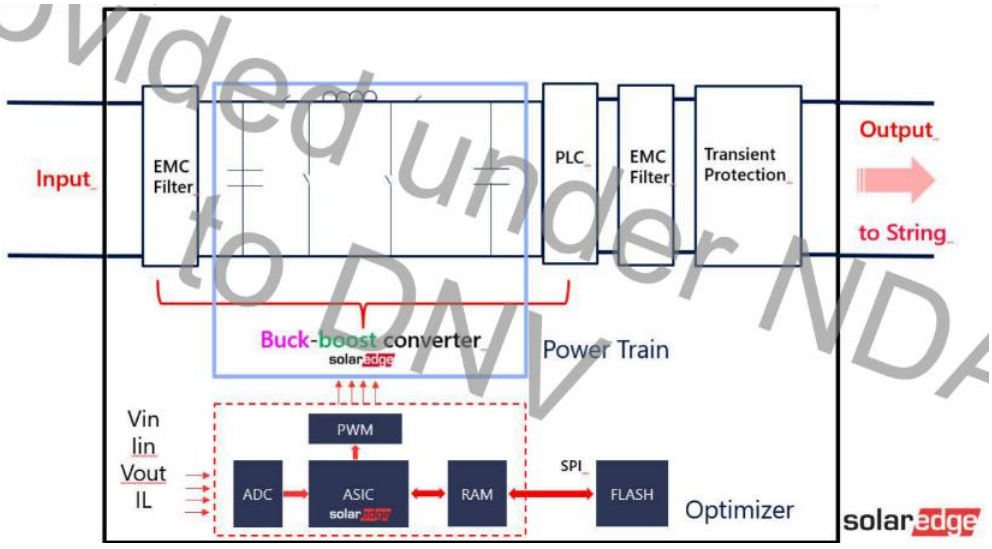


Figure 3-4 SolarEdge Power Optimizer block diagram

The center section with the switch symbols is the "Power Train" (PT), a non-isolated buck-boost DC-DC converter that handles harvesting and transferring the PV module's power. The controller section contains the main control and

supervisory functionality of the SolarEdge Power Optimizer. It is comprised of an analog to digital interface, proprietary Application Specific Integrated Circuit (ASIC). ASIC and PWM controller as shown. The ASIC supervises and controls the entire optimizer functionality. It implements a fully digital Pulse Width Modulation (PWM) control scheme. This full digital control is an advantage for the SolarEdge Optimizer products.

Both input and input voltages and currents are provided to the ASIC by the ADC block. It converts the input voltage supplied by the PV module to the working power supply voltages required by the various circuit elements in the optimizer. The “PLC” block implements the power line communication with the Inverter, both receiving system directives and sending optimizer data to the Inverter. The “By-Pass” section (not shown) contains the output by-pass diode and voltage equalization during wakeup. Note that this allows for the continued operation of a string of modules with SolarEdge Power Optimizers even in the case where an individual optimizer is not operational.

A key element of SolarEdge’s Power Optimizer product design, and one that potentially increases product reliability, is the use of a proprietary ASIC. This is a significant potential differentiator relative to other products which typically do not have this level of integration and contain a larger number of discrete components. The SolarEdge ASIC (currently third generation in P-series optimizers and fourth generation in the new S-series optimizers) is manufactured with a fabrication process used for automotive-grade electronics and, according to proprietary design rules, specifically defined to facilitate the long 25-year useful life of the optimizer. Extensive analysis and testing have been performed by SolarEdge to assure the ASIC package is robust enough to handle the mechanical and electro-chemical stresses experienced over 25 years of daily thermal cycling.

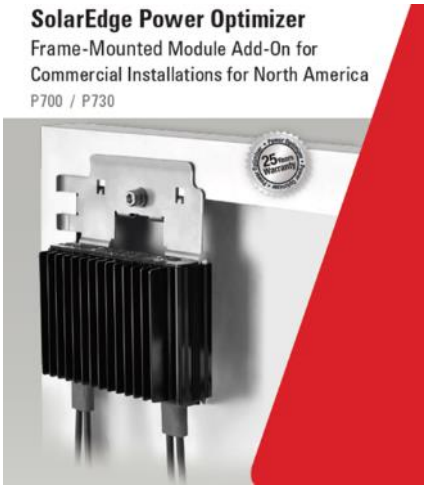
DNV views the use of ASICs in the SolarEdge Power Optimizers very favorably. It is recognized that their use leads to future product design changes possibly requiring the development of new ASIC parts. SolarEdge has in-house ASIC design capability and DNV believes that this is beneficial to the product development process.

3.1.3 SolarEdge Power Optimizers models

The table below shows the different optimizer models and number. Note that for optimizer models, the number associated with the product name indicates the power rating in watts.

North America Optimizer models: • S440 • S500 • S500B	

North America Optimizer model: • S1200	
North America Optimizer models: • P300 • P400* • P405 * Model is being phased out by SolarEdge.	
North American models: • P370 • P401 • P485 • P505	

North American models: (Compatible with Zep Groove framed modules) • P320-ZEP • P400-ZEP	
Commercial North American Optimizer models: • P700* • P730* * Model has been discontinued by SolarEdge.	
Commercial North American Optimizer model: • P860 • P960 • P1101	

Commercial North American Optimizer model: • M2640	
International Optimizer models: • P370 • P401 • P404 • P485 • P500 • P505 • P601	
European Optimizer models: • P605 • P650 • P701* • P730 • P800p • P801* • P850 • P950 • P1100 * Model is being phased out by SolarEdge.	

3.1.4 S-series optimizers

DNV as previously reviewed the P-series optimizer family in 2019. S-series models are the latest generation of residential power optimizers from SolarEdge. They share many common features with the previous generation optimizers with few significant developments as explained below. SolarEdge has provided datasheets and reliability calculation reports for these models. DNV performed a detailed technical analysis based on the information provided. Calculated MTBF reports are reviewed in section 4.2.3.1.

As mentioned previously, the following new optimizer models are reviewed in this report:

- S440/S500/S500B
- S1200

3.1.4.1 New developments

Sense Connect

With S-series models, SolarEdge is introducing a new safety feature called Sense Connect that is designed to prevent electric arcs and overheating connectors. It is achieved my monitoring connector temperatures and detecting abnormal temperature increase caused by electric arcs, improperly installed connectors, mechanical damage etc. Temperature increase caused by connector wear and tear that may occur over a system's lifetime are also detected. When abnormal temperatures are detected, inverter shutdown in initiated and the end user or installer is notified of the fault location through the SolarEdge monitoring platform and App. This enables installers to quickly react to reduce system downtime. DNV considers this an important development that can significantly improve safety and reliability of a PV system.

Cable management

With S-series models, SolarEdge improved cable management during installation by reducing the lengths input and output cables. Figure 3-5 shows the comparison of cable layouts between older generation P-series and S-series optimizers. The output cables are of different lengths preventing the connectors from dangling on the roof and being exposed during wet weather. The input cables are shorter and are now closer to the Power Optimizer unit. It can help in reducing the installation time.

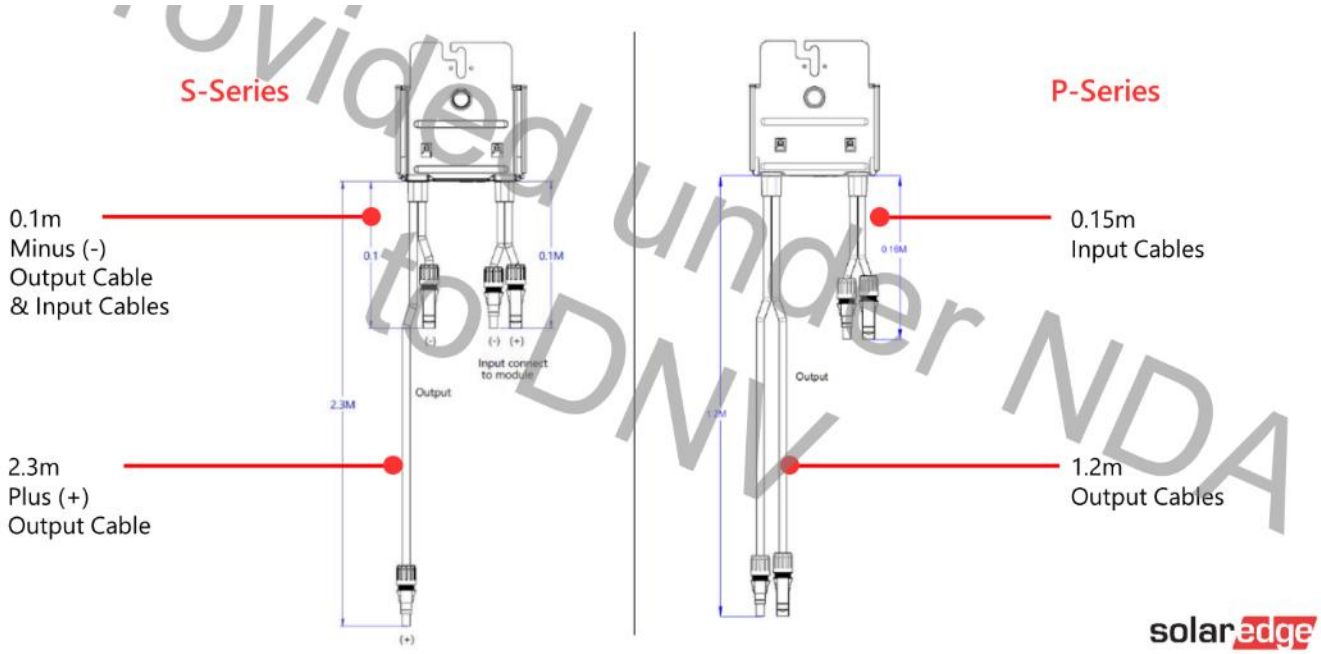


Figure 3-5 Cable layout comparison of S-series and P-series optimizers

Logistics

SolarEdge is streamlining PV project design and ordering with the S-series line up with higher power rated Optimizers and fewer models. S-series Optimizers support higher input current, bifacial and higher power M10 and G12 modules. Table 3-1 shows SolarEdge's transition plan for P-series models (rated for up to 500W). With fewer models to choose from, project design is simplified and less safety stock is needed for replacements. For commercial and large field installations, SolarEdge is introducing higher power S1200 and S1201 models rated at 1200W.

Table 3-1 Transition plan for phased out P-Series models

P-series model	Notes	S-series equivalent model
P320, P340, P370, P401	-	S440
P500	For modules rated 400 – 440W with Voc < 60V	
P505	For modules rated 400 – 440W Voc < 60V and Isc > 10.1A	
P500	For modules rated 440 – 500W Voc < 60V	S500
P505	For modules rated 440 – 500W Voc < 60V and Isc >10.1A	
P400	For modules with 60V < Voc <80V	S500B
P404	-	
P500	For modules with Voc > 60V	
P505	For modules with 60V < Voc <80V	
P485	-	

3.1.5 Technical specifications

3.1.5.1 S440/S500/S500B optimizer models

Detailed technical specification of S440/S500/S500B models is attached in Section A.1. As with previous generation P-series models, the number associated with the product name indicates the power rating in watts. The S440 and S500 models are rated for maximum input voltage of 60Vdc and S500B is rated for 125Vdc. Maximum PV module short circuit current rating is higher compared to the P-series models. S440 model is rated for a maximum short circuit current of 14.5A and S500/S500B models are rated for 15A.

The ambient temperature rating of these models is -40ºC to +85ºC. Output power is derated when the ambient temperature exceeds +70ºC. System designers should consult SolarEdge on details regarding power deratings. Efficiency, humidity and enclosure ratings are the same as previous P-series models. S-series efficiency curves are attached in Appendix B. The S-series models are compliant with PVRSS (rapid shutdown system). SolarEdge notes it is not allowed to mix P-series and S-series in new installations. However, for existing installations, the S-series optimizers can be used to replace RMA'd units. This is important to note for installers as SolarEdge is phasing out the P-series models.

3.1.5.2 Model S1200 optimizer

The detailed technical specification of the S1200 optimizer model is attached in section A.2. This model is targeted towards commercial and large field installations. The model is rated for 1200W and is compatible with high input current and bifacial PV modules. The optimizer support connections of two PV modules in series enabling reduction in overall system costs. S1200 is rated for ground mount installations only in North America.

The S1200 model is rated for maximum input voltage of 125Vdc and the maximum system voltage rating is 1000Vdc. Maximum PV module short circuit current is 15A. Ambient temperature rating of these models is -40ºC to +85ºC. Output power is derated when the ambient temperature exceeds +70ºC. System designers should consult SolarEdge on details regarding power deratings. Maximum efficiency is rated at 99.5%. Relative humidity rating is 0-100% and the enclosure is rated as NEMA 6P for North American applications.

3.1.6 Environmental characteristics

The enclosure for the SolarEdge Power Optimizers is rated at a full outdoor and NEMA 6P/IP68 level of protection for the reviewed products. The SolarEdge Power Optimizer is waterproof when the input and output cable connectors are mated and has no need for additional covering. An important environmental specification for the SolarEdge Power Optimizers is that they are rated for 100% Relative Humidity (RH) that is condensing. This is accomplished using potting, which is a process of filling the complete assembly with a non-conducting compound. The SolarEdge Power Optimizer can be placed in any physical orientation, meaning there is no “up” side.

DNV views the high level of environmental protection that is designed into the SolarEdge Power Optimizer positively.

3.1.7 Thermal performance

Temperature derating table of SolarEdge optimizer models is shown in Table 3-2. The optimizer models operate at full power and full current up to the temperatures listed in the table. The details of this de-rating were not provided.

Table 3-2 Optimizer temperature derating table

Optimizer model	Temperature
P960	131°F/55°C
H1300, S1200	149°F/65°C
P404, P485, P505, P600, P601, P605, P650, P700, P701, P730, P800s, P800p, P801, P850, P950, P860	158°F/70°C
P400, P500, P1100	167°F/75°C
M2640	176°F/80°C
S440, S500, P300, P350, P320, P340, P370, P375/P395/P401, P405	185°F/85°C

Not included in the data sheets is the altitude rating for the optimizers. However, based on an IEC 62109-1 Test Report prepared by Bureau Veritas, the SolarEdge optimizers are approved for an altitude of up to 4000 meters. DNV views it positively that testing at high altitude has been performed. It is recommended that the altitude rating be included in the product documentation.

The SolarEdge manual states that “the power optimizer should be mounted in a location that is either ventilated or that has a free space of air around it for heat dissipation.” This requires a minimum of 1-inch space around the Power Optimizer. Many of the commercially available PV modules on the market today are rated for temperatures as high as 85 ºC to 90 ºC. Many of the applications for the SolarEdge Power Optimizers will be mounted flush with the roof for residential applications, and as such, could see temperatures in excess of their ratings in hot desert climates, which could potentially lead to over

temperature issues. The requirement of a 1-inch space around the Power Optimizer helps minimize this issue as it will help facilitate a lower ambient temperature exposure.

3.1.8 Performance evaluation for SolarEdge Power Optimizers

3.1.8.1 Product efficiency

Efficiency is a key metric of the SolarEdge Power Optimizer performance. Table 3-3 shows the maximum and weighted efficiencies of SolarEdge models reviewed in this report. The maximum efficiency of all SolarEdge optimizer models is listed as 99.5%. The is achieved during by-pass mode when the optimizer is neither boosting nor bucking. S-series models and P-series models rated P600 or higher are shown to operate with a weighted efficiency of 98.6%, while lower rated models operate with a weighted efficiency of 98.8%. The optimizer efficiency is listed in the data sheets, included in Appendix A of this report.

Table 3-3 Optimizer maximum and rated efficiencies

Optimizer model	Maximum efficiency	Weighted efficiency
P300, P400, P405, P370, P401, P485, P505, P320-ZEP, P400-ZEP, M2640, P404, P500, S1200	99.5%	98.8%
S440, S500, S500B, P700, P730, P860, P960, P1101, P601, P605, P650, P701, P800p, P801, P850, P950, P1100	99.5%	98.6%

There is no standard method for defining the efficiency of PV module level conversion electronics such as the SolarEdge Power Optimizers. The efficiency depends both on the input and output voltages as well as the power level. SolarEdge provided the optimizer efficiency graph for the S440/S500 models as shown in Figure 3-6 below. The efficiency curve remains flat above 150W output power. Efficiency curves for other optimizer models are included in section Appendix C.

DNV views the SolarEdge Power Optimizer efficiency to be high. It is complex to determine the actual losses for a given real-world system. The most important aspect of system performance is the energy production based on the given site specifics of the individual projects and DNV believes that this analysis should be done in the determination of the benefits of implementing the SolarEdge system.

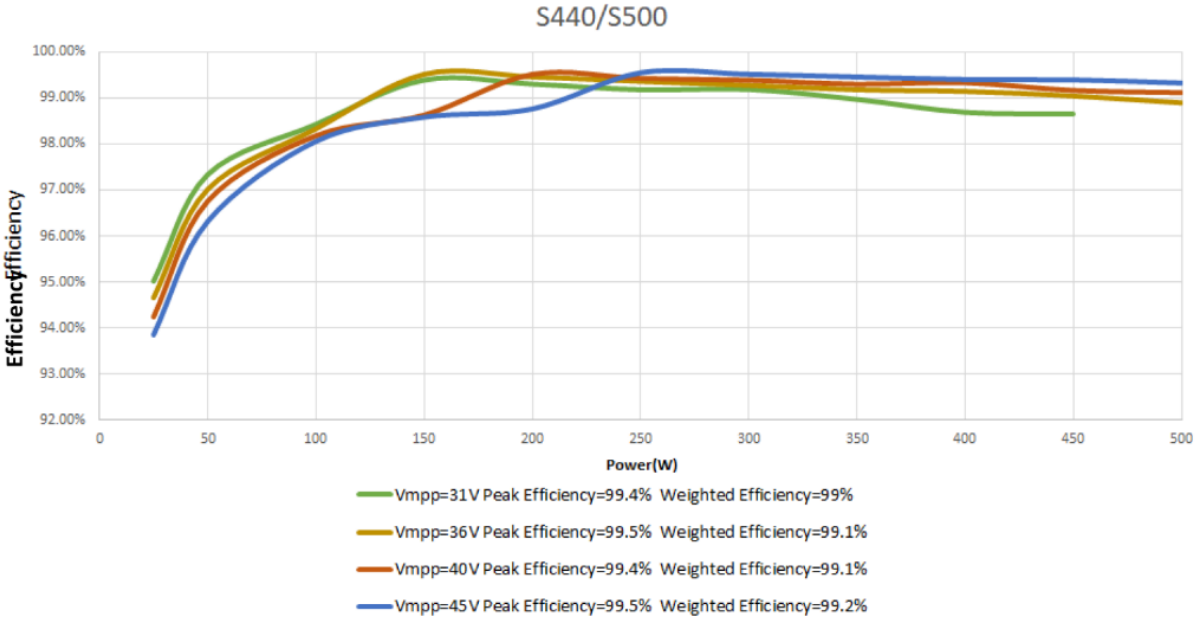


Figure 3-6 SolarEdge optimizer efficiency at increasing power levels

3.1.8.2 Maximum Power Point Tracking (MPPT) algorithm

The module level MPPT algorithm implemented by SolarEdge in the optimizer has been described to DNV as a Perturb and Observe (P&O) method with added features to overcome the disadvantages and achieve better power optimization. The typical P&O algorithm is used in many PV applications for MPPT functionality and is most commonly included in the inverter instead of at the module level. SolarEdge indicated that an MPPT update period in the millisecond range is being used, which is relatively fast. This can provide for good dynamic performance to changing irradiance conditions. DNV understands that SolarEdge also employs additional methods to confirm that the operating point is the global maximum power point. Figure 3-7 provides an example of where a P&O algorithm without additional methods for finding the maximum power point can readily get stuck on the wrong point.

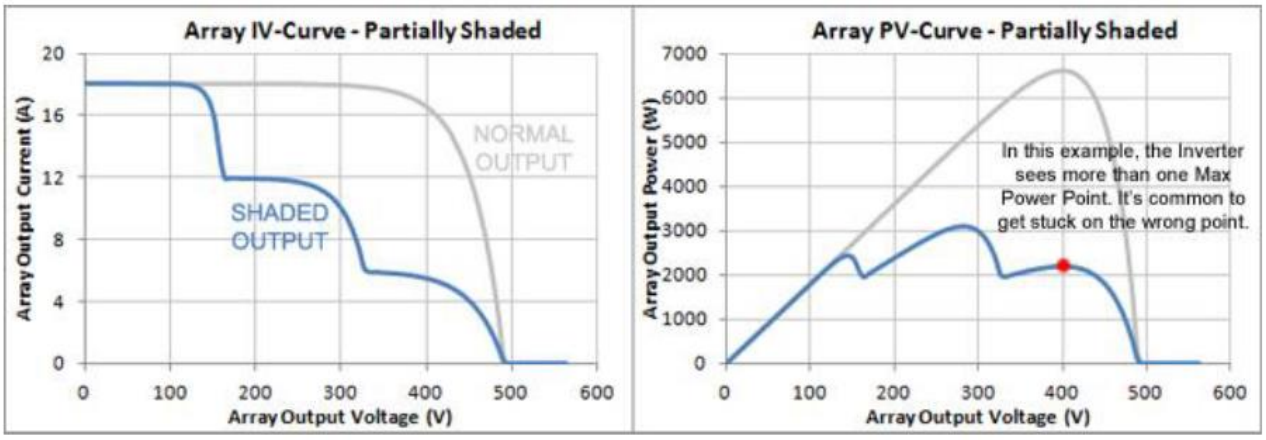


Figure 3-7 Example of partially shaded panels

For a previous DNV report update, SolarEdge had provided four reports with supporting Excel spreadsheet data as evidence of MPPT validation testing. Additionally, DNV observed the MPPT operating properly during the site visits that are described in Section 9.1 of this report. DNV views positively the MPPT approach taken by SolarEdge.

Also, as part of an earlier update, SolarEdge had provided four test reports with associated data for the optimizer MPPT test results that including shading tests. The reports reviewed represent ongoing efforts by SolarEdge to validate the MPPT functionality.

3.2 H1300 utility-scale optimizer

In addition to the optimizer models reviewed in previous section, DNV is also previewing the H1300 optimizer model in this report. SolarEdge is introducing the 1500Vdc rated H1300 optimizer model for large utility scale PV applications. It is compatible with the new SE330k utility scale inverter discussed in Section 3.7. Connection topologies are also reviewed in that section. Both the optimizer and inverter models are currently undergoing compliance certification tests.

The detailed technical specification is attached in Section A.30. H1300 optimizer is rated for 1300W with no derating of the operating temperature range of -40ºC to +65ºC. Maximum efficiency is rated at 99.5%. Similar to other optimizer models, the relative humidity rating is 0-100% and the enclosure is rated as NEMA 6P for North American applications. H1300 is suitable for connection to two PV modules. SolarEdge provides two options for output wires lengths.

3.3 SolarEdge Home Hub inverter technology

3.3.1 Home Hub (aka Energy Hub) inverter overview

This review includes SolarEdge Home Hub Inverter models for North America and for Australia/New Zealand. The North American models include SE3000H-US, SE3800H-US, SE6000H-US, SE7600H-US, SE10000H-US and SE11400H-US inverters. The Australia/New Zealand models include SE3000H-XXX, SE4000H-XXX, SE5000H-XXX, SE6000H-XXX, SE8250H-XXX and SE10000H-XXX inverters. Home Hub inverters are previously known as Energy Hub inverters.

DNV has previously reviewed SolarEdge single-phase inverters with HD-Wave technology (section 3.4). These were introduced as compact and higher efficiency inverters for solar only grid-tied applications. For Solar + battery backup power applications, Solaredge offered StorEdge inverters without the HD-Wave technology. With the new Home Hub inverters, SolarEdge integrated the HD-Wave and StorEdge technologies into a single platform along with additional features as described below:

- In addition to being a PV inverter, it is capable of dc-coupled storage when installed with approved battery solutions. Home Hub inverters are compatible with SolarEdge Home Battery and LG RESU Prime batteries. When PV system is installed with storage, up to 200% dc/ac ratio can be achieved. This is realized because the system PV and storage are coupled on the dc side of the inverter. During peak production hours, instead of clipping, surplus PV energy can be used to charge the batteries.
- Up to three Home Hub inverters can be connected in parallel with Home Hub technology. With multi-inverter support, full home backup power can be achieved in event of grid failure.
- Figure 3- shows the various connection interfaces of the Home Hub inverter. The interface options include:
    - Level 2 EV charger ac output.
    - Built-in consumption monitoring.

- Backup generator connection (for when PV energy production is not enough to charge the batteries).

- Equipped with Prism technology software platform for smart energy devices and future add-ons.

There are other additional features and capabilities that will be not be reviewed in this report. System designers should consult SolarEdge for guidance. DNV considers the Home Hub inverter as a timely addition to SolarEdge product line up.

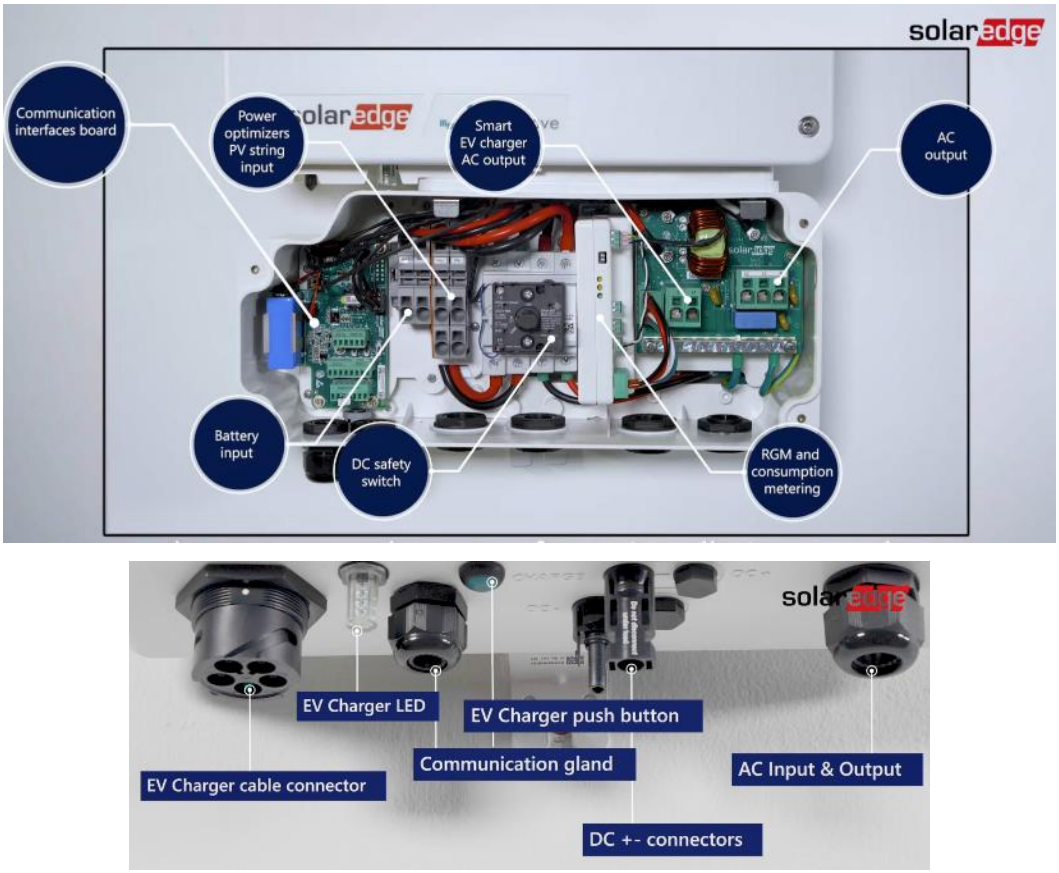


Figure 3-8 Home Hub connection unit interfaces

3.3.2 Home Hub inverter models

The table below describes the different types of Home Hub single-phase inverter models. Note that the number associated with the product name indicates the power rating in watts.

Home Hub single-phase inverter models for North America: • SE3000H-US • SE3800H-US • SE6000H-US • SE7600H-US • SE10000H-US • SE11400H-US	
Home Hub single-phase inverter models for Australia and New Zealand: • SE3000H-XXX • SE4000H-XXX • SE5000H-XXX • SE6000H-XXX • SE8250H-XXX • SE10000H-XXX	

3.4 Single Phase Inverter with HD-Wave Technology

3.4.1 HD-Wave inverter overview

This review includes SolarEdge HD-Wave Inverters for both North American and Rest of the World (ROW) models, or international models, which includes the SE2200H, SE2500H, SE3000H, SE3000H-US, SE3500H, SE3680H, SE3800H-US, SE4000H, SE4600H, SE5000H, SE5000H-US, SE6000H, SE6000H-US, SE7600H-US, SE8000H, SE10000H, SE10000H-US, and the SE11400H-US inverters.

Figure 3-9 SolarEdge HD-Wave Inverters – North American (left) and ROW (right)

The SolarEdge HD-Wave Inverter products were introduced in 2016 and implement new technology as a means for reducing the size and weight of the inverter, while increasing the efficiency. Inverters with this technology have been operating in the field for up to six years with low failure rates as reviewed in section 4.

As introduced previously, the complete SolarEdge system architecture consists of module power optimizers which perform module-level maximum power point tracking (MPPT), solar PV inverters (called the HD-Wave), and a user interface portal for module-level monitoring and energy yield assessment. In Figure 3-10, the internal components in the HD-Wave inverter are displayed.

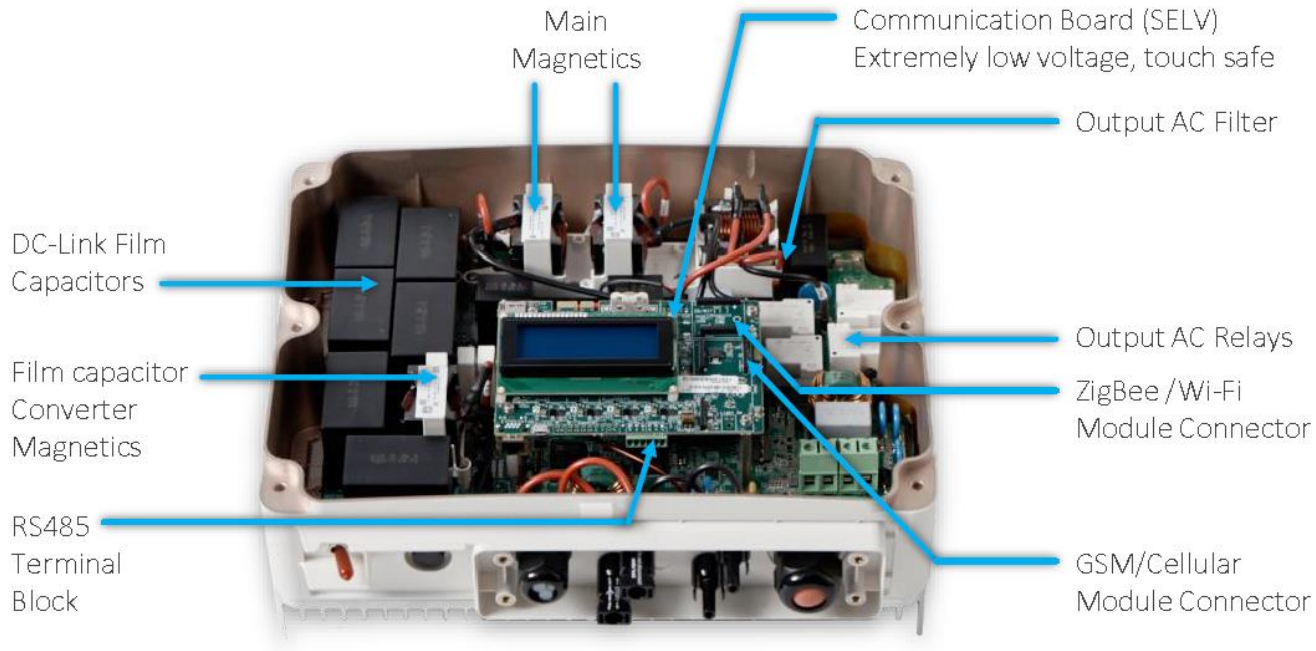


Figure 3-10 HD-Wave components

The SolarEdge HD-Wave Inverter is transformerless, with no galvanic isolation from dc input to ac output. This architecture helps to increase the inverter efficiency. Since the Power Optimizers also are non-isolated, grounding either of the dc side current carrying conductors is prohibited. The SolarEdge system does not allow for the PV modules to be installed with either the positive or the negative output connected to ground. Some PV module brands require a grounded connection to avoid Potential Induced Degradation (PID). This needs to be considered in the module selection when using any ungrounded inverter system.

To detect ground faults, the inverter performs an isolation test prior to startup, and continuously monitors the residual current while operating. In this manner, the inverter detects and reports any ground fault conditions that may occur prior and during online operation.

In Figure 3-11, the block diagram illustrates that the major technology development for the HD-Wave Inverter was achieved in the main power electronics section highlighted in blue.

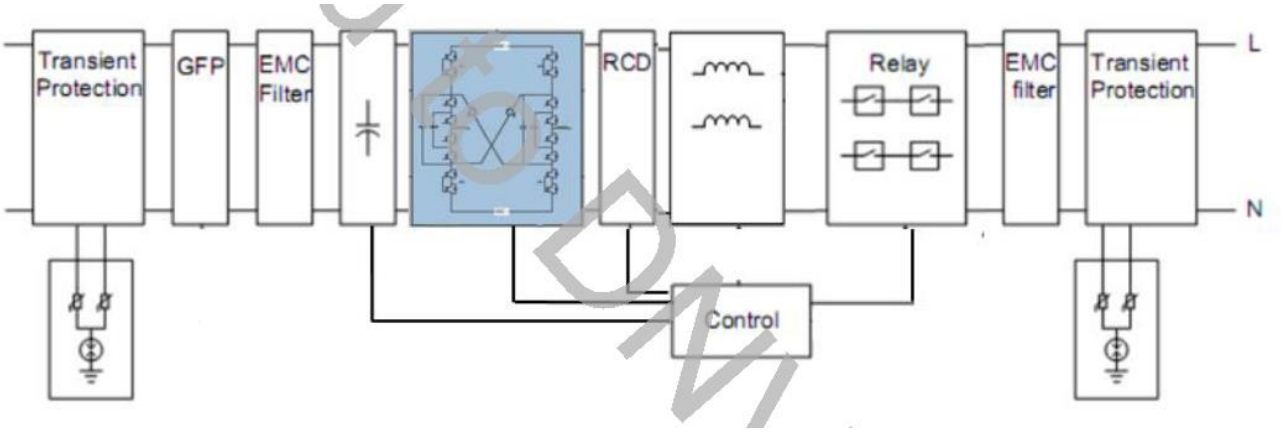


Figure 3-11 HD-Wave Block Diagram

The HD-Wave design is described as a distributed-voltage interleaved 4-bridge switching topology that requires a smaller ac line filter at the output. The SolarEdge HD Wave inverters make use of multiple switching devices to produce the ac output waveform more efficiently and with lower harmonic content, when contrasted to typical 2-level power conversion topologies.

DNV notes the advantages stated are achieved with a more complex topology that requires high-speed digital control. As with any new technology, there are risks associated with introducing new designs into the field environment. Such risks are mitigated through a comprehensive lab and field-testing program. The following sections of this report will comment further on the product validation testing performed by SolarEdge for the HD-Wave inverters.

3.4.2 SolarEdge single phase inverter models

The table below describes the different types of single-phase inverter models. Note that the number associated with the product name indicates the power rating in watts.

Single-phase inverter models for North America: • SE3000H-US • SE3800H-US • SE5000H-US • SE6000H-US • SE7600H-US • SE10000H-US • SE11400H-US	
International single-phase inverter models: • SE2200H • SE3000H • SE3500H • SE3680H • SE4000H • SE4600 (not shown) • SE5000H • SE6000H	
Single-phase inverter models for Australia: • SE2500H (not shown) • SE3000H • SE4000H • SE5000H • SE6000H • SE8000H • SE10000H	

3.5 Three Phase Inverter Technology

3.5.1 Three phase inverter overview

This review includes the following SolarEdge three phase inverters models with SetApp for International markets, North America, Europe and models for Australia/New Zealand.

The International models include:

- SE3K, SE4K, SE5K, SE6K, SE7K, SE8K, SE9K, SE10K
- SE12.5K, SE15K, SE16K, SE17K, SE25K, SE27.6K
- SE25K, SE30K, SE33.3K
- SE66.6K, SE90K, SE100K, SE120K

The North American models include:

- SE9KUS
- SE14.4KUS, SE17.3KUS
- SE20KUS, SE30KUS, SE33.3KUS, SE40KUS
- SE50KUS
- SE80KUS, SE100KUS, SE110KUS, SE120KUS

The Europe models include:

- SE25K, SE30K, SE33.3K
- SE50K, SE66.6K, SE90K, SE100K, SE120K

The Australia/New Zealand models include:

- SE5K-AUB, SE7K-AUB, SE8.25K-AUB, SE10K-AUB
- SE25K, SE30K, SE33.3K
- SE50K, SE66.6K, SE82.8K, SE100K

The SolarEdge three phase inverter uses a three-level power conversion topology as shown in Figure 3-12.

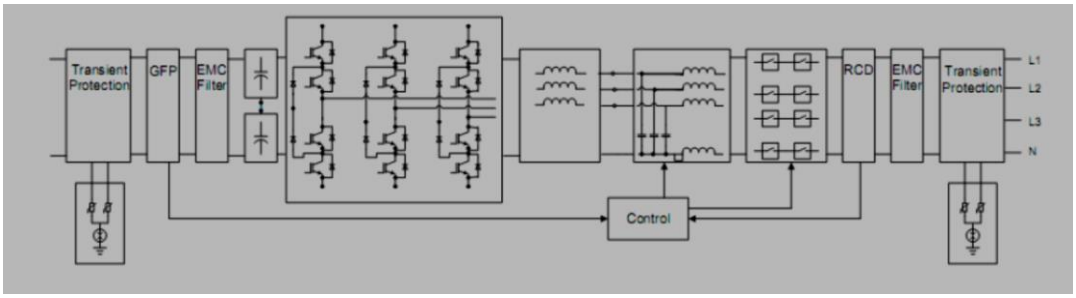


Figure 3-12 SolarEdge Three Phase Inverter topology

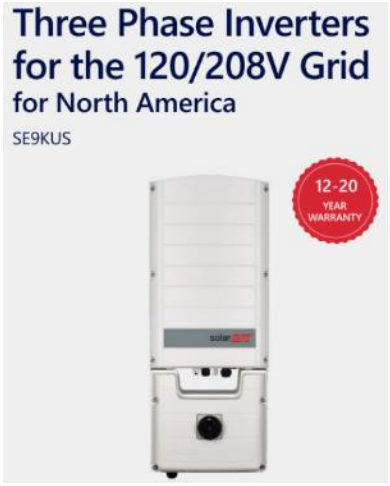
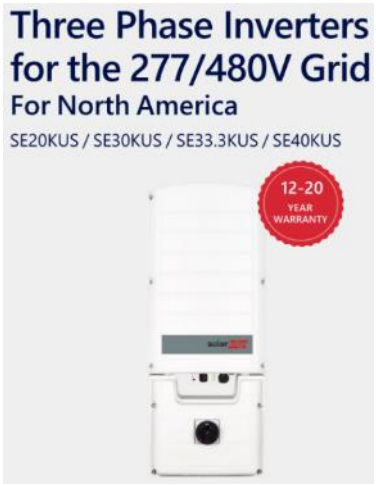
For higher power level commercial installations, SolarEdge uses Synergy technology shown in Figure 3-13. Synergy inverters rated up to 120kW are available. The inverter is comprised of two or three Synergy units (depending on the model) accompanied by an external Synergy Manager unit. The Synergy units are connected to the Synergy Manager via ac, dc and communication cables. Each Synergy unit operates independently and continues to work in case others stopped operating. A chain of up to 31 inverters can be set to operate together via Modbus on RS485 communication.

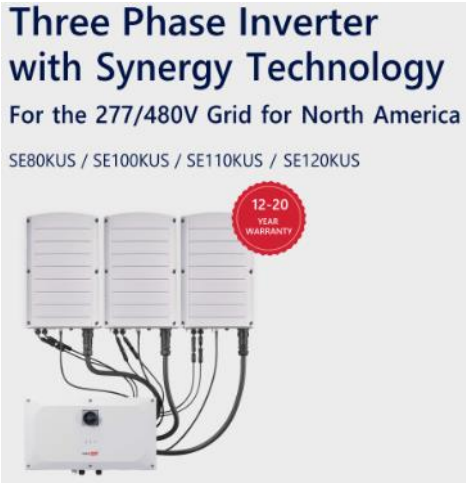
Compared to the lower power three phase inverters, some distinguishing features of Synergy inverters are:

- Installers can pre-commission the inverter with a 60W (20V, 3A) rated USB-C Home Battery and SolarEdge SetApp mobile application. It can be used to verify wiring and configure system components during the site installation process prior to grid connection.
- Similar to the new S-series Optimizers, the ac/dc terminal blocks in Synergy inverters are equipped with thermal sensors to detect faulty terminations and wiring problems.
- Synergy inverters can offset the effects of PID (potential induced degradation) loss with the nighttime PID mitigation feature.

Figure 3-13 Synergy Manager with three Synergy Units

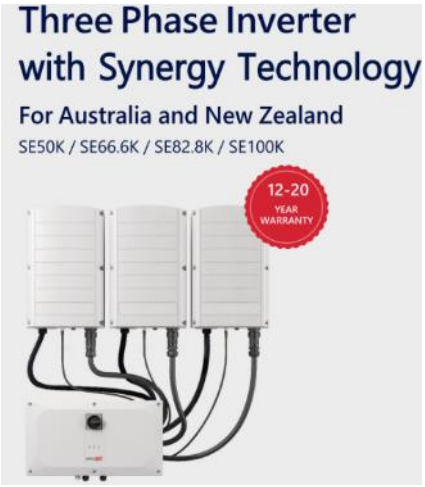
3.5.2 SolarEdge three phase inverter models

North American three phase inverter: • SE9KUS	
North American three phase inverter: • SE14.4KUS • SE17.3KUS	
North American three phase inverter: • SE20KUS • SE30KUS • SE33.3KUS • SE40KUS	

North American three phase inverter: • SE50KUS	
North American three phase inverter: • SE80KUS • SE100KUS • SE110KUS • SE120KUS	
International three phase inverter models: • SE3K • SE4K • SE5K • SE6K • SE7K • SE8K • SE9K • SE10K	

International three phase inverter models: • SE12.5K • SE15K • SE16K • SE17K • SE25K • SE27.6K	
International three phase inverter models: • SE25K • SE30K • SE33.3K	
International three phase inverter models: • SE66.6K • SE90K • SE100K • SE120K	

Europe three phase inverter models: • SE25K • SE30K • SE33.3K	
Europe three phase inverter models: • SE50K • SE66.6K • SE90K • SE100K • SE120K	
Australia and New Zealand three phase inverter models: • SE5K-AUB • SE7K-AUB • SE8.25K-AUB • SE10K-AUB	

Australia and New Zealand three phase inverter models: • SE25K • SE30K • SE33.3K	
Australia and New Zealand three phase inverter models: • SE50K • SE66.6K • SE82.8K • SE100K	

3.6 SolarEdge inverter application and performance evaluation

3.6.1 Inverter application

Series strings employing the SolarEdge Power Optimizers are connected in parallel combinations through traditional PV system combiner hardware. The connections to the SolarEdge inverter can be made through the dual dc input terminals at the inverter ac/dc safety switch installed on the bottom of each Inverter (note that this switch is included in the US models and is optional for other products). The ac/dc safety switch is a manually operated switch for connecting and disconnecting the ac and dc power of a SolarEdge inverter.

The SolarEdge inverter is typically mounted on a wall or other support structure. For reference a representation of the SolarEdge single phase inverter is shown in Figure 3-14 with the AC/DC safety switch located in the lower wiring enclosure.

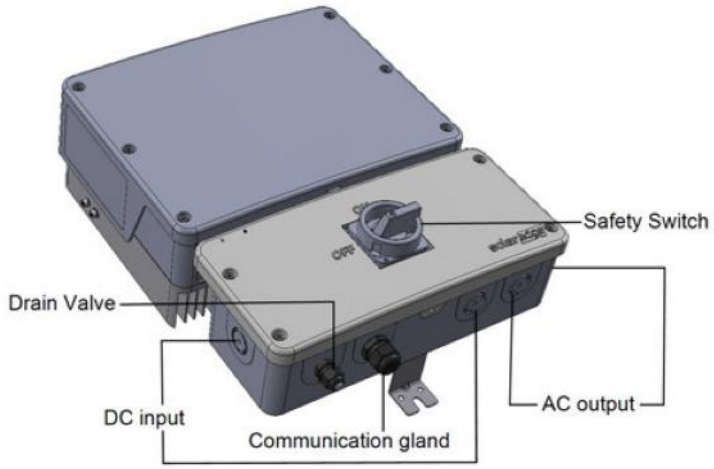


Figure 3-14 SolarEdge inverter features

The SolarEdge inverter can be connected to a variety of ac system configurations. Typical connection options for a 240Aac grid are shown in Figure 3-15. AC grids supported by SolarEdge inverters installed in North America are illustrated in Table 3-4. 400V/480V Delta connected ac grids are supported by SolarEdge inverter models above 25K with the following P/N format: SEXXK -XXXXIBXX4. Supported models for ROW ac grids can be found on SolarEdge website.

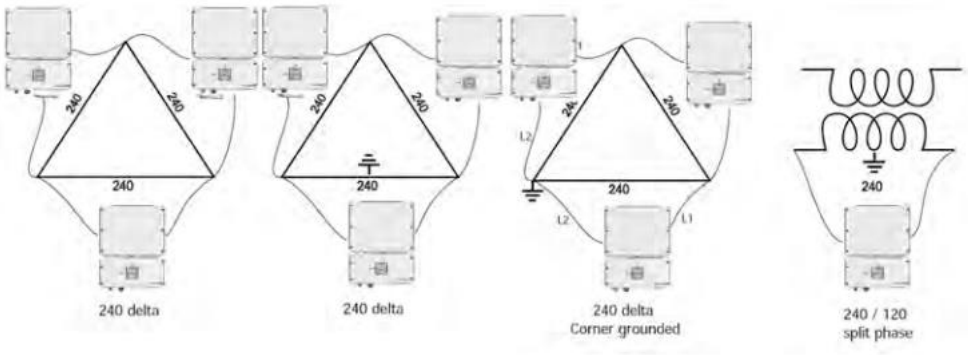
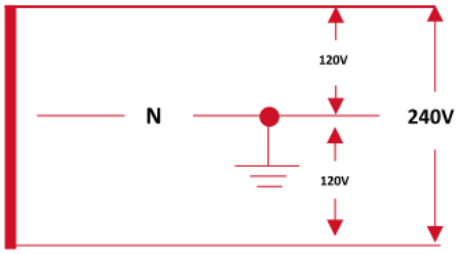
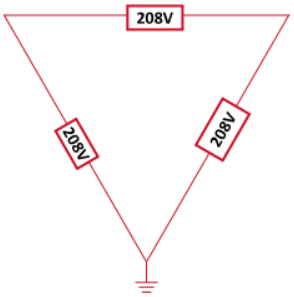
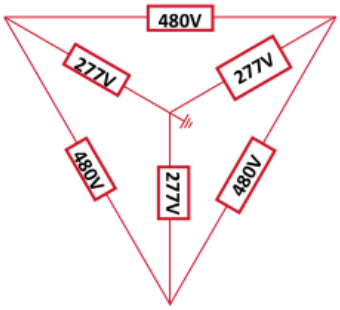


Figure 3-15 SolarEdge single-phase inverters ac connection options for 240Vac grid

Table 3-4 Grids supported by SolarEdge inverters in North America

<table>
<tr>
<td>Supported single phase inverters models:
SE3000H-US
SE3800H-US
SE5000H-US
SE6000H-US
SE7600H-US
SE10000H-US
SE11400H-US</td>
<td>120V – Split Phase
 
</td>
</tr>
<tr>
<td>Supported single phase inverters models:
SE3800H-US
SE6000H-US
SE11400H-US
Supported three phase inverters models:
SE9K-US
SE14.4K-US
SE17.3K-US
SE43.3K-US
SE50K-US</td>
<td>208V Delta
 

L-L: 208V</td>
</tr>
<tr>
<td>Supported three phase inverters models:
SE20K-US
SE30K-US
SE40K-US
SE66.6K-US
SE80K-US
SE100K-US
SE120K-US</td>
<td>480V/277V WYE
 

L-N: 277V
L-L: 480V</td>
</tr>
</table>

The SolarEdge inverter can be configured in the field for the site-specific conditions, including ac voltage. This is done using the inverter's LCD and control buttons, or by using the SolarEdge SetApp mobile application. Any field adjustments should be compliant with certification and local utility requirements. The SetApp application also allows for setting up the communications parameters. DNV notes that newer SolarEdge inverters without LCD screen cannot be commissioned without SetApp mobile application.

As required per NEC 690.35 (C) all SolarEdge inverters incorporate a listed internal Ground Fault Circuit Interrupter (GFCI) to protect against possible electrocution and fire hazard in case of a malfunction in the PV array, cables or inverter. All SolarEdge single and three phase inverters are now certified to UL1699B – Standard for Arc-Fault Circuit-Interrupters. SolarEdge was able to meet the requirements of this standard by including arc fault detection and interruption compliant with NEC section 690.11.

The SolarEdge inverter does not provide electrical isolation. This architecture helps to increase the inverter efficiency. Since the Power Optimizers also are non-isolated, grounding either of the DC side current carrying conductors is prohibited. The SolarEdge system does not allow for the PV modules to be installed with either the positive or the negative output connected to ground. Some PV modules require a grounded connection to avoid potential induced degradation (PID). This needs to be considered in the module selection when the SolarEdge system is used. As mentioned in other sections of this report, three-phase Synergy inverters and SE330K inverter are equipped with nighttime PID mitigation feature to reverse the negative effects of PID.

3.6.2 Power Quality

DNV previously reviewed harmonic test data for the international inverter models manufactured by SolarEdge. Detailed harmonics data up to the 99th harmonic were supplied by SolarEdge for the single and three-phase inverters. Additionally, the same types of data were provided for the complete family of three-phase inverters. DNV found all inverters to be within the 5% total demand distortion requirement established by IEEE 519, Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

3.6.3 Environmental Characteristics

The enclosure for the natural convection cooled single phase Home Hub and HD-Wave inverters is rated at an outdoor NEMA 4 and NEMA4X level of protection respectively. Enclosure rating of fan-cooled three phase inverters is NEMA 3R level of protection. DNV understands that the electronics portion of the inverter enclosure is rated at NEMA 4X (IP65) however the DC disconnect is rated at NEMA 3R, which is common for inverters. The official overall product rating is based on the lowest of the enclosure ratings it employs. This approach of enclosing the electronic equipment more completely than other components is viewed positively by DNV. This high level of environmental protection allows for the SolarEdge inverter to be installed in an outdoor location without the requirement of an additional enclosure or building to provide environmental protection against rain, sleet, or ice which may form on the enclosure.

DNV views the level of environmental protection that is designed into the SolarEdge inverters to be appropriate.

One item that is not addressed in the SolarEdge inverter data sheets is the maximum elevation for rated power operation. An application note, "Installation of SolarEdge Inverters at High Altitudes" specifies that all SolarEdge inverters can be installed at altitudes up to 2000 meters. The application note further explains that the single and three phase inverters shown in Table 3-5 can be operated at an altitude of up to 3000 meters.

Table 3-5 SolarEdge inverters capable of operation at up to 3000 meters

	North America	Europe & APAC
Single phase inverters	SE3000H-US-SE7600H-US, SE3000A-US, SE11400A-US	SE2200-SE6000, SE2200H-SE6000H
Three phase inverters	SE9KUS, SE14.4KUS, SE43.2KUS	SE3K-SE27.6K, SE50K, SE55K and SE82.8K

For SolarEdge inverter models SE25K, SE27.6K, SE50K, SE55K and SE82.8K installation at up to 3000 meter is allowed after coordinating the inverter startup with SolarEdge. DNV acknowledges that as the altitude increases, in general the ambient temperature decreases. However, dielectric strength also decreases with altitude. Therefore, DNV agrees that SolarEdge should be consulted by high altitude installations.

SolarEdge inverters and power optimizers can be installed at a minimum distance of 50m from the shoreline or other saline environment if there are no direct saltwater splashes on the inverter or the power optimizer. For inverters installed at 200m or closer to the shoreline, special brackets purchased separately from SolarEdge and SS304 stainless screws are required.

3.6.4 Thermal Performance

The SolarEdge smaller single phase inverters are cooled using natural convection while the larger single phase and three phase inverters use cooling fans. The single-phase inverters operate at full power and full currents up to an ambient temperature as shown in Table 3-6. The inverters may be used above this temperature with reduced power output ratings. This is an automatic feature and is implemented to protect the inverter while allowing for limited energy capture to continue at high ambient temperature conditions.

Table 3-6 SolarEdge single phase inverter temperature ratings

Inverter Model	Temperature
SE2200, SE3000, SE3500, SE4000,SE4000-16A, SE5000, SE6000, SE3500H, SE3680H, SE4000H,SE5000H, SE6000H, SE8000H, SE8250H, SE9200H SE3000-US, SE3800-US, SE5000-US, SE6000-US, SE7600-US, SE10000-US, SE11400-US, SE5000H-US, SE6000H-US, SE7600H-US, SE10000H-US	120°F/50°C
SE2200H, SE3000H, SE3000H-US, SE3800H-US	140°F/60°C

The derating curves of SolarEdge single phase inverters for North America market is shown in Figure 3-16. Derating curves of other single phase inverters are attached in section B.1 DNV views the derating feature of the SolarEdge inverters positively as it starts at a higher temperature than is commonly implemented in PV inverter products. The low-end temperature range for the standard SolarEdge single phase inverters varies based on the model, with the highest rating of -20°C, however, all models can be ordered rated -40°C, either standard or as an option. This low temperature operating range down to -40°C is appropriate for PV inverters to be installed outdoor at most locations.

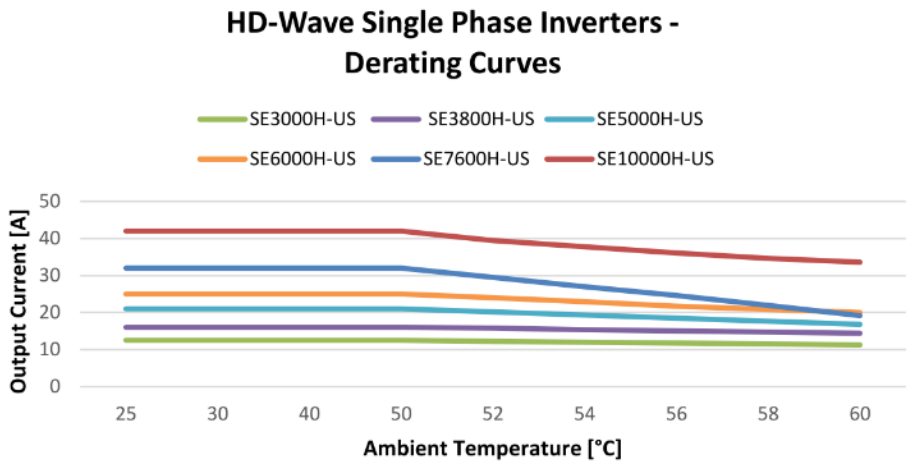


Figure 3-16 Single phase HD-Wave inverter temperature de-rating curves

SolarEdge three phase inverters operate at full power and full currents up to an ambient temperature as shown in Table 3-7. and operate with reduced ratings up to 140°F/60°C. This is an automatic feature and is implemented to protect the inverter while allowing for limited energy capture to continue at high ambient temperature conditions.

Table 3-7 SolarEdge three phase inverter temperature ratings

Inverter Model	Temperature
SE3K, SE4K, SE5K, SE6K, SE7K, SE8K, SE9K, SE10K, SE12.5K	140°F/60°C
SE8K, SE8.25K	135.5°F/57.5°C
SE25K, SE50K	127°F/53°C
SE9K, SE9KUS, SE10K, SE10KUS, SE15K, SE16K, SE17K SE14.4KUS, SE17.3KUS, SE20.1K, SE27.6K, SE30K, SE30KUS, SE33.3K, SE33.3KUS, SE40K, SE40KUS, SE43.2KUS, SE55K, SE66.6K, SE66.6KUS, SE75K, SE80K, SE80KUS, SE82.8K, SE90K, SE100K, SE100KUS, SE120K, SE120KUS	120°F/50°C
SE330K	120°F/50°C

For low temperature conditions, all SolarEdge three phase inverters can be ordered with an option to operate at -40°C if the model is not already rated for -40°C operation as a standard feature. The specification sheets should be referred to for temperature rating information, and system integrators should be cautious to fully understand both the inverter ratings and the temperature extremes at proposed sites.

Thermal derating charts for SolarEdge three phase Synergy Technology inverters for 277/480V grids is shown in Figure 3-17. The output current rating of Synergy Technology inverters derates linearly to 100% to 0% from 50 ºC to 60ºC ambient

temperature. Derating curves for other three phase inverters are attached in section B.2. DNV views the temperature performance of SolarEdge three phase inverters positively.

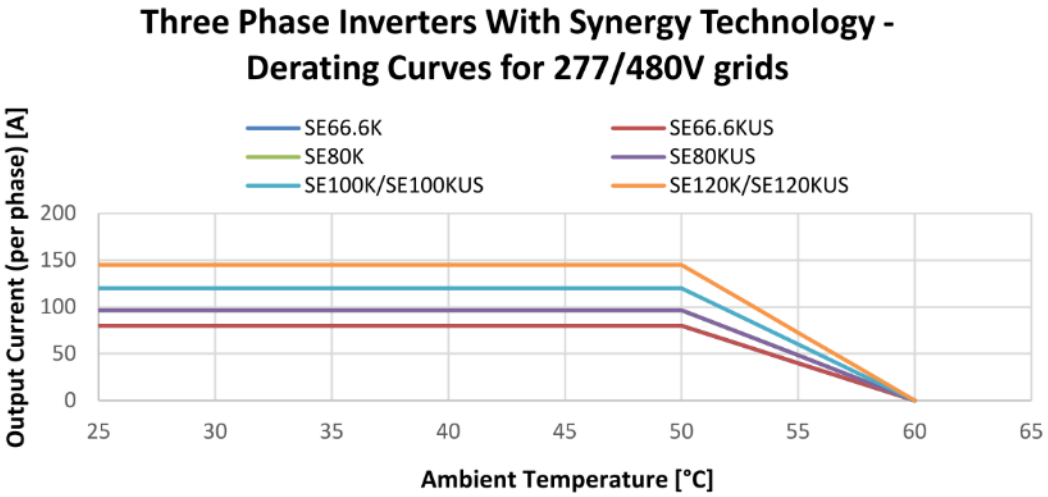


Figure 3-17 Three phase Synergy Technology inverter temperature de-rating curves

SolarEdge did not provide the temperature derate charts for all inverter models. DNV suggests contacting SolarEdge for questions regarding inverter derating, including for installations where a combination of factors may include temperature and elevation.

The SolarEdge three inverter models can be installed horizontally, with a tilt of 10° or more (as shown in Figure 3-18), as well as vertically, allowing installations that save roof space and minimize shading. SolarEdge inverters can be installed side by side, one above the other, or in diagonal layout. To allow proper heat dissipation and prevent power reduction due to excessive temperature, minimum clearances described in “SolarEdge Installation Guide” and application notes should be followed. SolarEdge also recommends limiting exposure to direct sunlight to prevent heat conduction to the inverter.

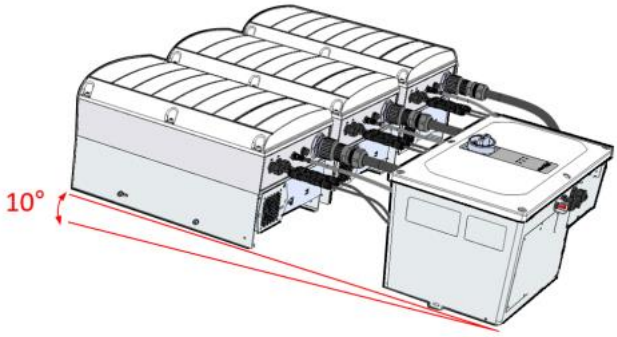


Figure 3-18 Horizontal mounting of three phase Synergy Technology inverters

3.6.5 Inverter Efficiency

One of the key metrics for PV inverters is the operating efficiency over the full range of output power levels and across the range of typical dc input voltages. Generally, the conversion efficiency is not constant but depends on the actual power level and dc voltage. Higher efficiency is generally an indicator of good design practices.

3.6.5.1 Product Efficiency – European and ROW

Weighted inverter efficiency measurements are calculated by measuring the inverter efficiency at various power levels, operating conditions and weighing them per irradiance conditions based on geographical location. European weighting formula, optimized for irradiance conditions in Europe is shown below.

European Weighted Efficiency = 0.03 x Eff5% + 0.06 x Eff10% + 0.13 x Eff20% + 0.1 x Eff30% + 0.48 x Eff50% + 0.2 x Eff100%.

Due to the fixed string voltage of SolarEdge inverters, the European weighted efficiency is evaluated at one dc input voltage level. Tables below show the inverter efficiencies of all European and ROW models reviewed in this report. The European efficiency graphs for the SolarEdge inverters are available on SolarEdge website at https://www.solaredge.com/sites/default/files/application_note_solaredge_inverters_efficiency.pdf

Table 3-8 Australia and New Zealand Single Phase Home Hub Inverter Efficiencies

Inverter	SE3000H-XXX, SE4000H-XXX	SE5000H-XXX, SE6000H-XXX, SE8250H-XXX, SE10000H-XXX
Maximum Efficiency	99.2%	99.2%
European Weighted Efficiency	98.8%	99%

Table 3-9 International Single Phase HD-Wave Inverter Efficiencies

Inverter	SE2200H	SE3000H, SE3500H, SE3680H, SE4000H	SE5000H, SE6000H
Maximum Efficiency	99.2%	99.2%	99.2%
European Weighted Efficiency	98.8%	98.8%	99%

Table 3-10 Australia Single Phase HD-Wave Inverter Efficiencies

Inverter	SE3000H, SE4000H	SE5000H, SE6000H, SE8000H, SE10000H
Maximum Efficiency	99.2%	99.2%
European Weighted Efficiency	98.8%	99%

Table 3-11 International Three Phase Inverter Efficiencies

Inverter	SE3K	SE4K, SE5K, SE6K	SE7K	SE8K, SE15K	SE9K	SE10K	SE12.5K, SE16K, SE17K,	SE25K, SE27.6K, SE25K, SE30K, SE33.3K,	SE66.6K, SE90K, SE100K	SE120K
Maximum Efficiency	98%	98%	98%	98%	98%	98%	98%	98.3%	98.3%	98.1%
European Weighted Efficiency	96.7%	97.3%	97.4%	97.6%	97.5%	97.6%	97.7%	98%	98%	98%

Table 3-12 Europe Three Phase Inverter Efficiencies

Inverter	SE25K, SE30K, SE33.3K	SE50K, SE66.6K, SE90K, SE100K	SE120K
Maximum Efficiency	98.3%	98.3%	98.1%
European Weighted Efficiency	98%	98%	98%

Table 3-13 Australia and New Zealand Three Phase Inverter Efficiencies

Inverter	SE5K-AUB	SE7K-AUB	SE8.25K-AUB	SE10K-AUB	SE25K, SE30K, SE33.3K	SE50K, SE66.6K, SE82.8K, SE100K
Maximum Efficiency	97.8%	97.8%	97.8%	97.8%	98.3%	98.3%
European Weighted Efficiency	96.3%	97%	97.1%	97.4%	98%	98%

3.6.5.2 Product Efficiency – US models

SolarEdge reports their inverters maximum efficiencies (as tested by an independent lab) for each of the US inverter models. As seen in previous section, the maximum efficiencies are high when compared to industry standards. This reflects the benefit of the ability to optimize the inverter design for operation at a fixed DC voltage level, and the design efforts of SolarEdge. DNV views the weighted efficiency used in California to be a preferable measure of efficiency as it considers a range of power levels.

California Energy Commission (CEC) Ratings

A major incentive program for solar energy in the United States is in place in California. The California Senate Bill 1 (SB 1) directs the California Energy Commission to establish eligibility criteria, conditions for incentives, and rating standards for projects applying for ratepayer funded incentives for solar energy systems deployed in the State of California.

Three specific expectations established by SB 1 must be met for the ratepayer funded incentives:

- High quality solar energy systems with maximum system performance to promote the highest energy production per ratepayer dollar.
- Optimal system performance during peak demand periods.
- Appropriate energy efficiency improvements in the new and existing home or commercial structure where the solar energy system is installed.

The inverter test protocol developed by the Energy Commission to determine inverter performance data shall be used along with the UL certification for safety and reliability. The inverter test protocol ensures that the reported performance data of efficiency at the full range of operating conditions (power and efficiency at the full range of possible voltages) along with the nighttime tare loss for each inverter provides full performance information and enables hourly estimating of the overall performance of the system.

Eligible inverters are listed with the Energy Commission.

The following are inverter eligibility requirements:

- Inverters shall be certified to UL 1741 standards by a Nationally Recognized Testing Laboratory (NRTL).
- Performance data (Maximum Continuous Output Power, Conversion Efficiency, and Tare Losses) tested in accordance with “Performance Test Protocol for Evaluating Inverters Used in Grid Connected Photovoltaic Systems by a NRTL shall be reported for each inverter.

CEC weighted efficiency is calculated as shown below:

CEC Efficiency = 0.04 x Eff10% + 0.05 x Eff20% + 0.12 x Eff30% + 0.21 x Eff50% + 0.53 x Eff75%. + 0.05 x Eff100%.

The measured CEC weighted efficiency data reported in the provided data sheets are shown below.

Table 3-14 SolarEdge Single Phase Home Hub Inverter CEC Efficiencies

Inverter	208V	240V
SE3000H-US	99%	99%
SE3800H-US	99%	99%
SE6000H-US	99%	99%
SE7600H-US	99%	99%
SE10000H-US	99%	99%
SE11400H-US	98.5%	99%

Table 3-15 SolarEdge Single Phase HD-Wave Inverter CEC Efficiencies

Inverter	208V	240V
SE3000H-US	99%	99%
SE3800H-US	99%	99%

SE5000H-US	99%	99%
SE6000H-US	99%	99%
SE7600H-US	99%	99%
SE10000H-US	99%	99%
SE11400H-US	98.5%	99%

Table 3-16 SolarEdge US Three Phase Inverter CEC Efficiencies

Inverter	208V	277/480V
SE9KUS	96.5%	-
SE14.4KUS, SE17.3KUS	97.5%	-
SE20KUS	-	98.0%
SE30KUS, SE33.3KUS, SE40KUS	-	98.5%
SE50KUS	97%	-
SE80KUS, SE100KUS, SE110KUS, SE120KUS	-	98.5%

These CEC efficiency numbers, for the inverter portion of a SolarEdge system, are high and DNV views them positively. It should be kept in mind that the net efficiency of the SolarEdge system must include both the inverter and the SolarEdge Power Optimizers.

It can be noted that a number of SolarEdge products that are listed on the CEC web site are not offered at this time, which is a common occurrence as products are kept on the list for historic reference purposes. The efficiency curves are available directly from the CEC website at https://www.energy.ca.gov/. Additionally, the curves can be requested directly from SolarEdge.

As an example of a typical curve for a SolarEdge inverter, the CEC efficiency curves shown in Figure 3-19 with a weighted average of 99% for the SE3000H-US model.

Manufacturer: SolarEdge Technologies Ltd
Model #: SE3000H-US
Serial #: FSE00912415
Insulation Value: High
Maximum Continuous Output Power: 2.962 kW
Tare Loss: 0.00 W
Vmin: 360 Vdc Vnom: 395 Vdc Vmax: 480 Vdc

		Power Level (%; kW)						
		5%	10%	20%	30%	50%	75%	100%	
Input Voltage (Vdc)			0.3	0.6	0.9	1.6	2.1	2.8	Wtd
Vmin	360		95.67	98.01	98.63	99.01	99.19	99.19	98.89
Vnom	395		95.39	97.88	98.54	98.96	99.16	99.16	98.83
Vmax	480		95.93	98.04	98.57	99.00	99.08	99.17	98.83

Peak Efficiency: 99.2 % Nominal Average Efficiency: 99.1 %

CEC Efficiency = 99.0%

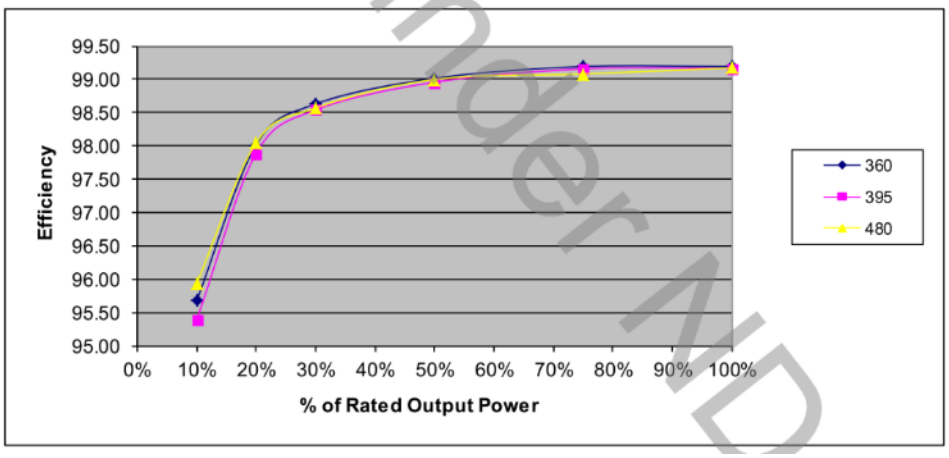


Figure 3-19 CEC Inverter Performance Summary for SolarEdge SE3000H-US Inverter

3.6.6 System Energy Performance

As discussed throughout this report, the key metric for evaluating the performance of a PV system is the energy production. This depends on many factors related to the specific site conditions and system design. DNV believes that it is important to evaluate equipment such as the SolarEdge Power Optimizers and Inverters based on the system level energy production.

The degree to which the SolarEdge Power Optimizers (or other module level electronics) can provide increased energy harvest is very site and condition specific. There is no hard-fast rule or general percentage increase that can be given as there is no standard level of mismatch in a given installation (e.g., different PV module brands, module mismatch, incremental shading, non–uniform environmental soiling, temperature mismatch within strings, etc.).

A reference for the energy production improvements possible with a SolarEdge based system was given in Photon Magazine in their October 2011 issue. This article is titled “Convincing Performance: SolarEdge makes a positive impression in tests conducted by PHOTON Lab.” A system with SolarEdge components is compared to a standard string inverter configuration under a variety of test conditions which varied the shading and soiling. This was done in a laboratory with efforts made to represent real-world conditions as realistically as possible. The published test results are given in summary form in Table 3-17. The percentages represent the relative additional energy capture during the test of a system using

SolarEdge Optimizers and Inverters compared to a system with a typical string inverter. It must be noted that this is applicable only to the configuration tested.

Table 3-17 Photon Magazine Test Results of Improved Energy Capture with SolarEdge System

Configuration	Two parallel strings of seven modules	One string of fourteen modules
Unshaded	1.5%	1.7%
Dormer	4.4%	1.2%
Horizon	4.8%	30.6%
Pole	10.7%	9.7%
Reduced Irradiance (soiling)	3.5%	4.7%

DNV views the results published by Photon magazine to be a positive indication of the energy production benefits of the SolarEdge system. The article is available on the SolarEdge web site for reference.

SolarEdge provided DNV with the Engineering Study Report produced by PV Evolution Labs (PVEL) in September 2013. PVEL collaborated with the National Renewable Energy Laboratory (NREL) to develop a repeatable test procedure for simulating partial shading scenarios of typical residential rooftop photovoltaic (PV) systems. This shading test is particularly useful in evaluating the impact of different power conversion topologies, including microinverters and DC power optimizers, on overall system performance.

PVEL performed the shading test on a 6.24 kW SolarEdge system alongside a comparable microinverter system and a reference system that used central string inverter (from SMA). The results of the test shown in Table 3-18 indicate that on an annualized basis, approximately 24.8% of the energy lost due to shading in a central inverter system can be recovered with the use of the SolarEdge system. By comparison, the microinverter system demonstrated a 23.2% shading recovery.

Table 3-18 PV Evolution Lab Shading Test Results

Parameter	Shading Level Category		
	Light	Medium	Heavy
Amount of System Shading	7.6%	19.0%	25.5%
Available Energy [kWh/m^2]	1813	1893	1784
SolarEdge Energy [kWh/m^2]	1728	1611	1431
SMA Energy [kWh/m^2]	1697	1539	1328
Shade Mitigation Factor	26.7%	20.3%	22.7%
Average Shade Mitigation Factor	23.2%		

This testing shows the potential energy production benefits from the use of the SolarEdge optimizers. This will be highly dependent on the specific site conditions and should be evaluated on a case-by-case basis.

Additionally, SolarEdge provided DNV with reports on the performance of fielded systems in the Eastern USA where a comparison to the energy capture with string inverters was performed. DNV did not independently verify the results present in the reports. One report was for the area of Long Island, New York and included 562 systems of which 321 are SolarEdge and 241 are string inverters from multiple manufacturers. This analysis showed a 7.2% increase in energy delivered by the SolarEdge systems. The other report was for systems in Massachusetts and claimed a 6.7% energy capture benefit for SolarEdge. DNV suggests that these reports be reviewed in detail for further information. It is possible that the SolarEdge benefit is due to the installer selecting SolarEdge for sites where the Optimizer benefits are more pronounced (such as

partial shading being present). DNV does believe that there is a likely benefit to the energy capture for SolarEdge based systems where mismatch is present compared to string inverter systems.

3.7 SolarEdge SE330K, Utility Scale Inverter

SolarEdge provided preliminary datasheets and reliability test reports for SE330K, their upcoming utility scale three phase inverter. Preliminary datasheet of SE330K inverter is attached in section A.30. The inverter is intended for utility scale outdoor PV and dc coupled battery storage installations. It is designed to be used conjunction with H1300 power optimizer previewed in section 3.2. The SE330K unit is currently undergoing compliance certification tests. SolarEdge should be contacted on the status of certification tests and availability.

The SE330K is rated for 1500Vdc maximum applications. The nominal dc operating voltage is 1250Vdc. The operating temperature range is from -40°C to +60°C (with derating) The allowable humidity range is 0-95%. The inverter cabinet is rated as NEMA 4X. These environmental characteristics are adequate for installations in most North American locations.

The SE330K inverter has a maximum ac output rating of 330kVA up to 50°C and derates linearly to 0kVA at 60°C as shown in Figure 3-20. The nominal ac output voltage of 690Vac. Power factor is adjustable in the range of 0-100% leading or lagging within the kVA rating of the inverter. The inverters are rated in kVA, not kW, meaning that the plant operator can apply the kVA rating to produce real power, reactive power, or a combination of both. The inverter also has 'VAR at night' feature that enables the plant operator to control reactive power at night without PV input power. Total harmonic distortion (THD) at nominal power is less than 3%. Due the fixed dc voltage design of SolarEdge inverters, SE330K is expected to achieve a CEC weighted efficiency of 99%.

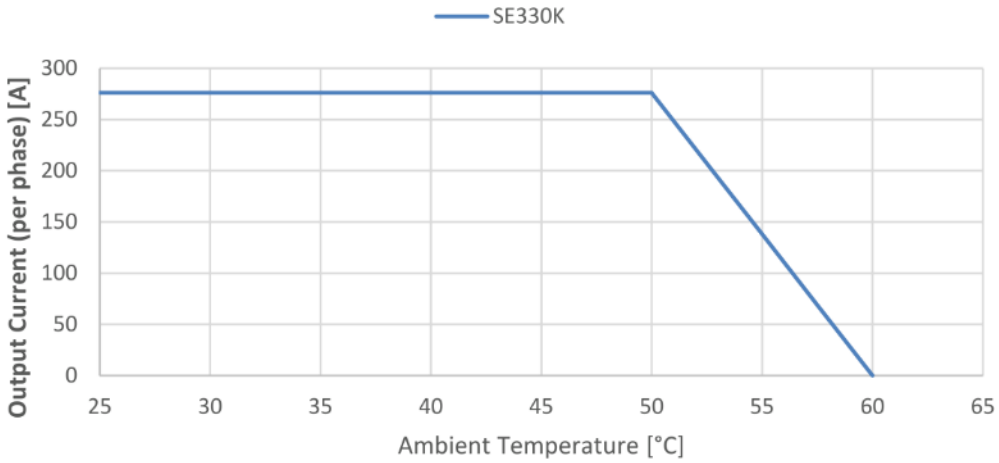


Figure 3-20 Temperature derating curve of SE330K inverter

Figure 3-21 shows the block diagram of SE330K inverter unit with single dc input option. An optional dc input system with MC4 connectors supporting up to 20 strings is also available. As shown in the block diagram, the SE330K inverter is a transformerless inverter with floating (ungrounded) dc terminals. This can be a concern for PV modules that required the negative side to be grounded to mitigate PID loss, especially at higher dc operating voltages of the SE330K inverter. The SE330K is equipped with PID rectifier that can offset these effects with nighttime PID mitigation feature. DNV recommends system designers to consult SolarEdge for guidance.

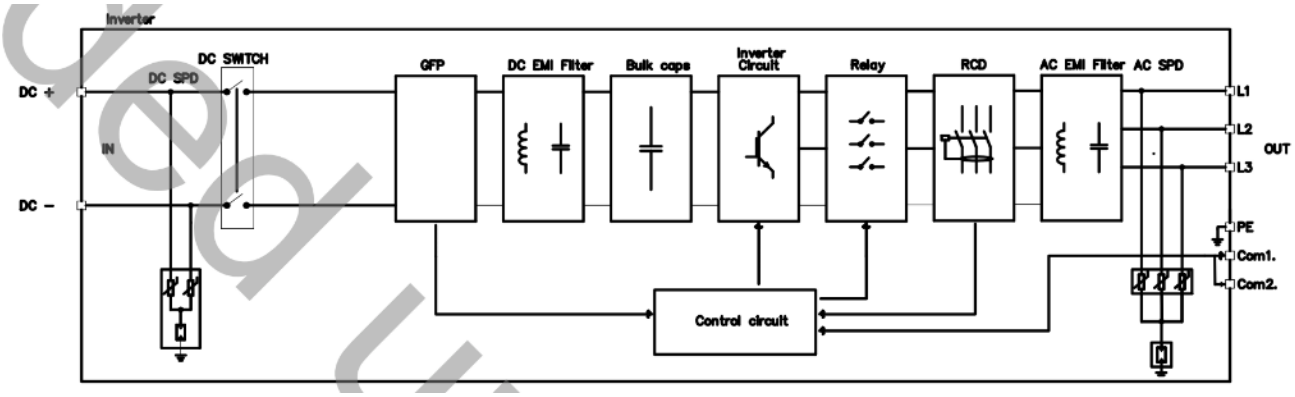
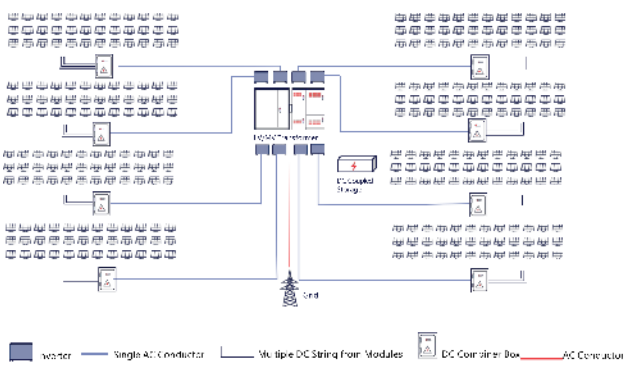


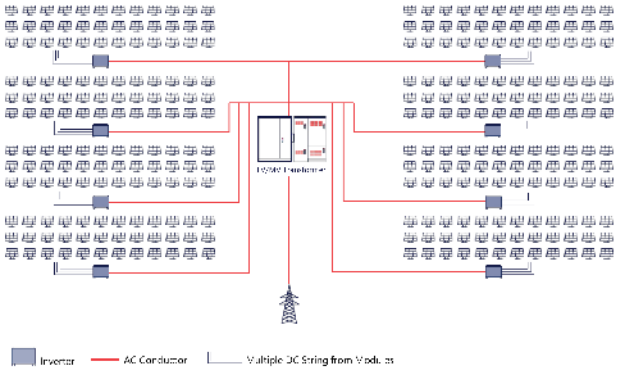
Figure 3-21 Block diagram of SE330K inverter with single dc input option

Like three phase Synergy inverters, the SE330K inverter has built-in ac and dc terminal block temperature sensors to detect faulty wiring and overheating connections. It can be pre-commissioned with power from PV modules to validate system components and wiring prior to grid connections. As SE330K inverter is designed to be used in dc coupled storage applications, it allows system designers to use dc/ac ratios of up to 200%. DNV views this positively. SolarEdge provided preliminary MTBF calculations for the SE330K inverter. They are reviewed in section 4.2.3.1.

Figure 3-22 shows two potential deployment strategies with SE330K inverter and H1300 optimizer units. They can be installed as a 'virtual central topology' where the inverters are installed in a central location or as a 'distributed topology' that eliminated the need for combiner boxes but may increase ac cabling costs. DNV recommends system designers to consult SolarEdge for guidance.



Virtual central topology



Distributed topology

Figure 3-22 Deployment topologies with SE330K inverter and H1300 optimizer units

3.8 SolarEdge Home Battery Low Voltage System

3.8.1 Battery System Review

DNV reviewed datasheet (see Figure 3-24) and specifications for SolarEdge home battery with the model number BAT-05K48 . Each SolarEdge home storage system consists of a bidirectional inverter, a Li-ion battery module with a DC/DC converter and battery management system (BMS), a thermal management system, and communication connections. The battery module is comprised of prismatic cells assembled in series arrays. The enclosure can be wall or floor mounted and is IP55 rated. The cells in the module are interconnected in an efficient method and serviced by thermal management cooling, DC connections, and associated cell sensing.

Battery packs are rated for usable energy capacity of 4.6 kWh. The battery module and power electronics are rated for continuous charge and discharge at 2.8 kW and 4 kW respectively. The nominal voltage is 48V. The data sheet states the operational voltage range. The battery's peak power is mandated by the inverter, which has peak power output of 7.5 kW for 10 sec. The inverter's continuous power is 5 kW. SolarEdge claims 100% depth of discharge for rated capacity. SolarEdge's DC Home Battery is designed for use with a single phase, stand-alone DC/AC inverter for system interconnection. Additional SolarEdge inverters (without batteries) can be connected over RS485. In addition, multiple battery modules can be stacked per inverters up to a maximum energy capacity of 23 kWh. DNV notes that these specifications are widely observed across the industry, and DNV takes no exceptions to it.

Figure 3-23 SolarEdge Home Battery

SolarEdge Home Battery 48V

For Europe

BAT-05K48

	BAT-05K48 (1)	UNITS
BATTERY MODULE SPECIFICATION		
Usable Energy (100% depth of discharge)	4600	Wh
Continuous Output Power (Charge/Discharge) – for a single module	2825/4096	W
Continuous Output Power (Charge/Discharge) – for multiple modules	5000/5000	W
Peak Roundtrip Efficiency	>94.5	%
Warranty (2)	10	years
Voltage Range	44.8 – 56.5	Vdc
Communication Interfaces	RS485 between modules, CAN bus to inverter	
Modules per Inverter	Up to 5 connected in parallel	
Battery Type	Li-Ion	
Supporting Inverter models	https://www.solaredge.com/sites/default/files/se-compatibility-matrix-for-solaredge-three-phase-inverters-and-batteries-application-note-eng.pdf	
STANDARD COMPLIANCE		
Safety (cell level)	IEC62619, UN38.3, UL9540A	
Safety (Module level)	UN38.3, IEC62619, IEC63056, IEC62040-1, VDE-AR-E 2510-50 (3)	
Emissions	IEC61000-6-1, IEC61000-6-2, IEC61000-6-3, IEC61000-6-4, 61000-3-12	
MECHANICAL SPECIFICATIONS		
Dimensions (W x H x D)	540 x 500 x 240	mm
Weight	54.7	kg
Mounting	Floor stand and wall attach	
Operating Temperature (4) Discharge/Charge	-10 to +50	°C
Storage Temperature (12 months between recharge)	-10 to +45	°C
Maximum Altitude	2000	m
Enclosure Protection	IP65 / NEMA 3R - indoor and outdoor (water and dust protection)	
Cooling	Natural convection	
Noise (at 1m distance)	<25	dBA

(1) Specification applies to PN "BAT-05K48S0B-01"
(2) For warranty details, please refer to the SolarEdge Home Battery Limited Warranty.
(3) Designed to meet VDE-AR-E-2510-50
(4) Derating applies. Please note that operating the SolarEdge Home Battery at extreme temperatures for extended durations of time may void the Battery warranty coverage. Please see the SolarEdge Home Battery Limited Product Warranty for additional details.

SOLAREDGE HOME BATTERY - ACCESSORIES (PURCHASED SEPARATELY)	
DESCRIPTION	**PN**
Accessory residential battery, top cover (1 required per tower)	IAC-RBAT-5KMTOP-01
Accessory residential battery, cable set battery to Hub inverter (PN SE*K-RWB48)	IAC-RBAT-5KCINV-01
Accessory residential battery, cable set battery to Wave inverter (PN SE*K-RWS)	IAC-RBAT-5KCINV-02
Accessory residential battery, cable set battery to battery	IAC-RBAT-5KCBAT-01
Accessory residential battery, cable set tower to tower	IAC-RBAT-5KCTOW-01
Floor stand (optional)	IAC-RBAT-5KFSTD-01
Accessory 10 * Spare connector kit for "Battery to Inverter" connection, SolarEdge Home Battery, 48V	IAC-RBAT-5KCNCT-01
Accessory 10 * Spare connector kit for "Tower to Tower" connection, SolarEdge Home Battery, 48V	IAC-RBAT-5KCNCT-02

Figure 3-24 Datasheet for SolarEdge Home Battery

3.8.1.1 Efficiency

When tested at BOL, the specification states that the peak round-trip efficiency of an individual Home Battery unit is approximately 94.5% or greater. Round trip efficiency is measured from PV to battery to grid. In the test report supplied by SolarEdge, observed AC RTE for all three manufacturers were greater than 94.4%. DNV has not reviewed details on the temperature, voltage, and other operating conditions which were in place during this round-trip efficiency measurement.

DNV has also not reviewed data on round trip efficiency curves measured against different power levels at beginning of life (BOL) and end of life (EOL) at standard operating conditions. DNV can therefore not opine on either of those. However, the test report results do put the RTE above the specifications laid out by SolarEdge.

Manufacturer	$\eta_{BAT,RTE}$ - %	Criteria - %	Spec Criteria - %	Result
MFG1	95.44	$\eta_{BAT,RTE} > 95$		Pass
MFG2	96.0	$\eta_{BAT,RTE} > 95$		Pass
MFG3	95.29	$\eta_{BAT,RTE} > 95$	$\eta_{BAT,RTE} > 94\|_{0.2C,\ T=25ºC}$	Pass

Figure 3-25 Test Results for Round Trip Efficiency

3.8.1.2 Cycle life and capacity retention

The Home Battery is designed for a minimum 10-year life. DNV received clarification that SolarEdge's warranty is based on an aggregated throughput, which is the total amount of energy that has been cycled through the Home Battery. DNV considers the battery warranty as par with industry leaders.

3.8.1.3 Environmental Requirements

To perform to claimed operational specifications, SolarEdge assumes the following stated environmental requirements are met: Per the specification sheets provided, the Home Battery system is capable of operation in ambient temperatures from -10°C to 50°C. When storage of the system is necessary, an Home Battery will withstand temperatures of -10°C to 45°C with 12 months between recharges. DNV considers the operating temperature range as industry standard.

The enclosure is wall or floor mounted and carries an IP65 and NEMA 3R intrusion rating. IP65 rating stipulates that the system is dust tight and protected against water projected from a nozzle. NEMA 3R stipulates the system is weather-resistant and can be used outdoors on ship docks, in construction work, and in tunnels and subways. DNV considers IP65 rating which implies protection from windblown dust as industry leading.

The Home Battery is cooled via natural convection, which DNV finds reasonable given outdoor installation or indoor installation with the required clearances. Based upon data received from SolarEdge, the Home Battery unit and battery pack integration appear to be a well thought out, efficiently designed assembly.

3.8.1.4 Battery Modes of Operation

SolarEdge provides for 3 main Energy Control methods: 1. Maximize self-consumption (MSC) 2. Time-of-Use (TOU) 3. Backup Only Maximize self-consumption (MSC). DNV notes that provision of these three modes are standard across the industry. In the MSC mode, the systems uses PV production for self-consumption, then charges/discharges battery as needed to maximize self-consumption. When a system is set to MSC mode, it will operate in this mode until a different mode is set. MSC mode is most suitable for scenarios when grid export tariffs are low, or export is not allowed.

In the Time-of-Use (TOU) mode, the system operates according to a configurable charge/discharge profile, for example for time of use arbitrage (charge the battery from the PV/grid when tariffs are low and discharge the battery when tariffs are

high). A charge/discharge profile is created from a yearly calendar, repeated for 20 years as long as no profile changes are made. The yearly calendar is divided into segments, with one of seven charge/discharge modes assigned to each segment.

In the Backup Only mode, the system fully charges the battery when on-grid and discharges the battery only for backup purposes. When a system is set to Backup Only mode, it will operate in this mode until a different mode is set. Backup Only mode is most suitable for scenarios where the system was purchased only for its backup capabilities.

DNV takes no exceptions to the modes of operation.

3.8.2 Battery Safety Review

Certifications are specific to certain component model numbers. DNV strongly recommends verifying certifications against component model numbers used in any project.

DNV reviewed documentation SolarEdge provided for their BAT-05K48 battery. This low voltage LFP residential battery, intended for distribution in Europe, has a nominal unit capacity of 5 kWh and contains 100 Ah prismatic cells with LFP chemistry. Each unit contains 16 cells in series (16S configuration).

DNV has reviewed safety documentation provided for the individual battery cells, as well as the SolarEdge BAT-05K48 unit. A summary of relevant certificates is shown in Table 3-19.

Table 3-19 Regulatory Compliance

Standard	Description	Component	DNV Review
UL 1741:2010 Ed.2(Supplement SA) +R:15Feb2018	Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for use with Distributed Energy Resources	Inverter	Certificate Received
UL 1973:2018 (2nd Ed.)	Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications	Battery Cells	Certificate Received
UL 9540: 2020	Energy Storage Systems and Equipment	Complete System	Not certified
UL 9540A (4th Ed.)	Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems	Battery Cells	Test Report Received
UL 9540A (4th Ed.)	Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems	Battery Module	Not seeking testing
UL 9540A (4th Ed.)	Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems	Battery Unit	Not seeking testing
UN 38.3	UN Transportation Testing for Lithium Batteries	Battery Unit	Certificate Received

DNV notes that SolarEdge has stated that the BAT-05K48 is intended exclusively for the European market. SolarEdge has further stated that they do not intend to conduct UL 9540A testing at the module or unit level. This will prevent achievement of UL 9540 certification, which is required for BESS installations in most of North America. An ESS certified to UL 9540 is primarily comprised of a UL 1973-certified stationary battery that is then evaluated together with a power conversion system, such as a UL 1741-certified inverter. Regardless of intended market, DNV recommends that the complete battery unit undergoes fire and explosion testing by a certified testing laboratory to ensure potential safety risks are evaluated and mitigated.

DNV has reviewed a draft evaluation report from TUV SUD, dated 15 March 2022, indicating the BAT-05K48 complies with the following IEC standards regarding electromagnetic compatibility:

- EN IEC 61000-6-1:2019
- EN IEC 61000-6-3:2021
- EN IEC 61000-6-2:2019
- EN IEC 61000-6-4:2019
- EN IEC 61000-3-11:2019
- EN 61000-3-12:2011

While this report is in draft form, it is seen as a low risk due to the report indicating this certification is a model number change to BAT-05K48 from an already certified product.

SolarEdge also indicates compliance to several additional standards on the product specifications sheet. DNV has reviewed a certificate issued by TUV SUD on 20 May 2022 for the BAT-05K48, indicating testing was performed according to IEC 62040-1, IEC 62619, and IEC 63056. DNV has also reviewed the IEC 62619 certificate issued by TUV Rheinland on 27 September 2019 for the battery cells used in the BAT-05K48. DNV has not been provided with the VDE-AR-E 2510-50 certificate, but SolarEdge has stated that testing will be completed in October 2022. DNV will review the certificate when available.

3.8.2.1 UL 9540A testing

UL 9540A testing is a destructive test method used for evaluating the thermal runaway impacts in a BESS and gathering data to assist in assessing or developing mitigation measures for the failure event, propagation of the failure, or consequences of an event, such as an explosion or fire. The test, which does not have pass/fail criteria, can be performed on a cell, module, or unit level. UL 9540A is ANSI accredited and is currently considered to be the most appropriate published methodology to provide comprehensive, consistent, and reliable third-party data for battery failure testing.

UL 9540A is currently in its 4th edition, with added reporting and data collection throughout the stages of the test. Furthermore, the 4th edition of UL 9540A has improved on the thermal runaway methodology that is carried out at the modules and unit (repeat of module test set up) levels when compared to the 3rd edition UL 9540A test standard. As such, assessments regarding cell-to-cell thermal runaway propagation are more comprehensive within the improved test methodology of the 4th edition.

DNV has received 4th edition testing of the cells utilized in the SolarEdge BAT-05K48. In August 2020, the battery cell OEM tested their Li-ion cell to the 4th edition of the UL 9540A test methodology. Table 3-20 provides an overview of the key components of the test report that DNV has reviewed.

Table 3-20 UL 9540A Cell-level test results

Test parameter	Data collected
Thermal Runaway Methodology	External surface heat at 4 °C/min to 7 °C /min up to thermal runaway (External heating method with mica heater with metal enclosure, rated 220 V, 500 W)
Upper Cutoff Voltage	3.344 V
Average Cell Surface Temperature Gas Venting	300.7 °C
Average Cell Surface Temperature at Thermal Runaway	387.2 °C
Gas Volume (STP):	43.4 L
Gas Composition (vol %)	21.41 % Hydrocarbons 32.13 % CO_2 6.59 % CO 39.80 % H_2
Lower Flammability Limit	6.2 % @26 °C (ambient temperature) 4.6 % @200 °C (cell venting temperature, limited to 200 °C by ASTM E918 scope)
Maximum Explosion Pressure (P_{max})	1.58 MPa
Burning Velocity (S_u)	0.610 m/s

Examination of the cell-level UL 9540A results indicate a thermal cell venting temperature of 300.7 °C and a thermal runaway temperature of 387.2 °C, both of which are higher than typically seen for LFP cells. A higher thermal runaway temperature is seen as positive and indicates a robust cell chemistry which shows that the battery cells display great resiliency to heat.

The cell vent gas composition was examined and falls in line with other LFP cells, with the hydrogen gas concentration being on the lower end of what is typical. This hydrogen content has likely driven the LFL higher and the P_{max} lower when compared to LFP averages, however a detailed quantitative analysis of this data would be necessary to determine the impact of this.

Cells were capable of thermal runaway and the vent gas produced could present a flammability hazard when mixed with air at both ambient and venting temperature. As a result, a module-level test is required, per the UL 9540A methodology. Large-scale fire testing in accordance with UL 9540A can allow for decreased separation distances between adjacent units, depending on test results. SolarEdge has indicated that they will not test at the module and unit levels of UL 9540A.

UL 9540A testing is a requirement for UL 9540 certification, which is required for installations in most of North America. DNV sees the incomplete UL 9540A and lack of UL 9540 certification as a barrier for product adoption in the North American market. SolarEdge has stated that they intend to only offer the BAT-05K48 for sale in Europe.

3.8.2.2 Safety Features

The SolarEdge BAT-05K48 is protected by safety features built into the battery management system (BMS). The BMS protects the battery against:

- Cell over/under voltage
- Battery pack over/under voltage
- Charging/discharging over current
- High/low ambient temperature
- Low state of charge (over discharge)
- Short circuit
- Charging over voltage
- Cell charging/discharging high/low temperature
- MOSFET high temperature

While the battery does not contain an integral fire suppression system, DNV notes that this is typical of small battery units intended for residential installations. DNV does however view the lack of fire and explosion testing of the complete BAT-05K48 system as a potential fire safety risk.

3.9 SolarEdge Energy Net

SolarEdge Energy Net is a sub-GHz wireless mesh communication platform that connects devices within the SolarEdge Smart Energy Management ecosystem. The Energy Net plug-in card is used to connect SolarEdge inverters with other products such as an Home Battery, Energy Meter, EV Charger and smart energy devices. Figure 3-26 shows the mesh network topology of the Energy Net plug-in. Each device in the mesh network acts as a repeater providing extended range. Energy Net reduces installation time by eliminating wired connections and hub installations required in earlier communication models. This platform replaces SolarEdge's previous generation wired/wireless systems using ZigBee and RS485 connections to connect to smart devices.

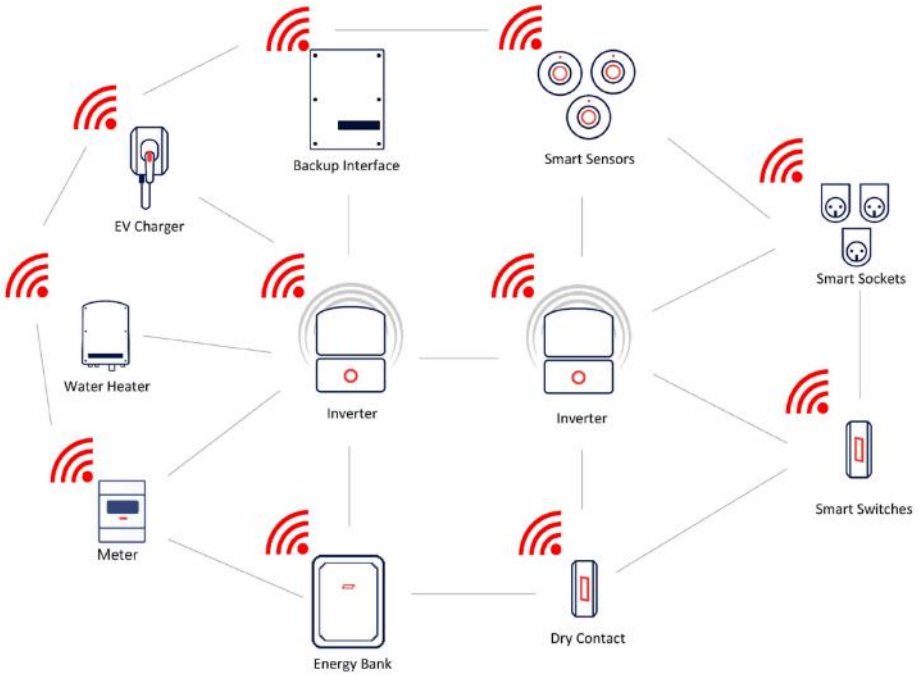


Figure 3-26 SolarEdge Energy Net Plug-In mesh network

Datasheet of Energy Net plug-in is attached in A.31. The plug-in card is installed inside the inverter cabinet and the antenna needs to be mounted externally. As seen in the datasheet, there are three variations of the plug-in card depending on the inverter type. New devices in the mesh network are detected automatically during power up. Installers can use the SolarEdge SetApp to add devices into the system. It must be noted that Energy Net plug-in has 5-year warranty from SolarEdge.

3.10 SolarEdge SetApp

SolarEdge SetApp is a mobile device application for system installers for activating, commissioning, and configuring a PV system with SetApp enabled inverters. It can be downloaded for both Android and iOS mobile devices. For Single-phase HD-Wave and three-phase inverters with SetApp, connection to utility grid is required for activation. Three-phase inverters with Synergy Technology can be commissioned with connection to utility grid or pre-commissioned off-grid using a 60W (20V, 3A) rated USB-C power bank as shown in Figure 3-27. Pre-commission can reduce time spent onsite allowing installers to check system components and wiring prior to installation. DNV views this positively.

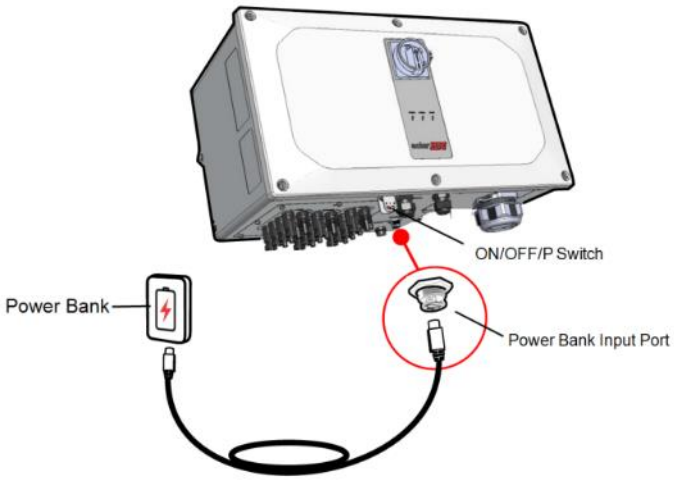


Figure 3-27 Pre-commissioning (off-grid) a SolarEdge Synergy inverter with a USB-C power bank

After the inverter is turned ON, SetApp is used to scan QR code on the side of the inverter and create a Wi-Fi connection to the inverter. SetApp then upgrades the inverter firmware to the latest version and activates the unit. During the commissioning process, the inverter discovers and communicates with all connected components such as optimizers, peripheral communication devices and other linked inverters. After configuring the inverter and grid parameters, SetApp is used to pair the inverter with optimizers. The pairing process must be done where there is adequate sunlight to turn on the optimizers. Pairing is required before inverter can start producing power. SetApp is used to configure communication settings for the monitoring platform and to setup communication to other peripheral devices.

Once the commissioning process is complete, installers are also able to view real-time inverter status and measurements using SetApp to validate the installation. Homeowners can view real-time and archived historical data using SolarEdge monitoring application. It must be noted that newer SolarEdge SetApp enabled inverters do not have an LCD display screen and cannot be commissioned or configured without SetApp. Also, internet connection is required to download the latest firmware prior to commission the inverters. System installers should consult SolarEdge for additional details.

4 QUALITY, RELIABILITY AND REGULATORY

4.1 Reliability Evaluation

Reliability of power conversion equipment used in PV systems is a key aspect of their performance. Historically, reliability of inverters has been a significant issue for PV systems, due primarily to the circuit complexity necessary to perform power conversion. The inverter therefore receives a significant amount of attention from buyers of inverters and investors in PV power generating systems. Since the SolarEdge Power Optimizer is attached to the PV module, it must generally be as reliable as the module itself and can withstand the same environmental conditions to which the module is exposed. As such, there is a concern with respect to module level electronics over the effect of so many more potential “points of failure.”

It should be noted, that although having an electronic device on every module decreases a system’s potential reliability, it does not necessarily equate to a decrease in system “availability”, especially regarding harvested energy over the lifetime of the system as is typically determined in a cost of energy calculation. This is primarily because a failed SolarEdge Power Optimizer may only impact the energy output of a single module and not bring down the series string in which the optimizer operates. This contrasts with standard systems where a single module failure can cause loss of most of the power of the specific string. Without an optimizer, a single failed module could potentially reduce the system energy by the total of all the modules in that string. In traditional systems, a failed module (or even a string in larger systems) may go un-noticed for some time. Since the SolarEdge Power Optimizers monitor their own performance they essentially self-report a failure, giving the user a means to make an informed decision on the cost-effectiveness and timing of addressing the failure. DNV believes it will be important to differentiate between reliability and availability from a marketing standpoint yet underscores the need for a thorough assessment of the reliability of both the optimizers and inverters.

SolarEdge presented their approach to achieving high reliability for the optimizer and inverter products to DNV. DNV was very impressed by the thorough treatment of this important area as was demonstrated in SolarEdge Reliability Handbook provided to DNV for review.

The reliability requirements as summarized in the Executive Summary section of the SolarEdge Reliability Handbook include the following message: PV module manufacturers provide 25-year warranties on their performance. For the SolarEdge solution to be a well-received in the market, it must provide an equivalent warranty and similar level of reliability performance. The SolarEdge Power Optimizer design was targeted to function continuously for over 25 years without maintenance in potentially harsh outdoor conditions with extremely low failure rates.

The SolarEdge Reliability Handbook provided outlines an overview of the reliability process used in order to reach the reliability and quality levels required for the SolarEdge products to be successful in the marketplace. The reliability process outlined spans all stages of design and production – from requirements, through design, component testing, production and sub-contractor evaluation, and finally stress testing to validate the overall reliability of the system.

The SolarEdge Reliability Handbook demonstrates a firm grasp of the general industry wide understanding of basic reliability concepts as depicted in the traditional reliability “bathtub” curve which it includes and is given in Figure 4-.

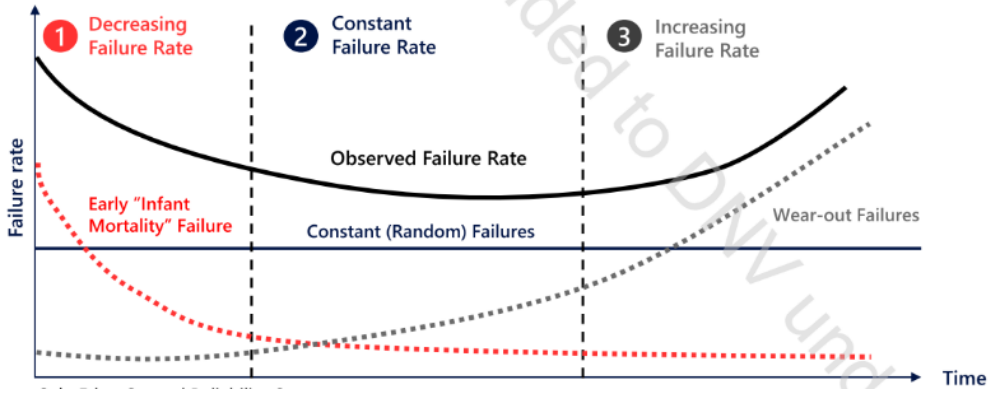


Figure 4-1 SolarEdge general reliability curves

4.2 SolarEdge reliability methodology

The chart shown in Figure 4- illustrates the reliability process used at SolarEdge where feedback from the installed base provides the data required to implement constant improvement in the product design.

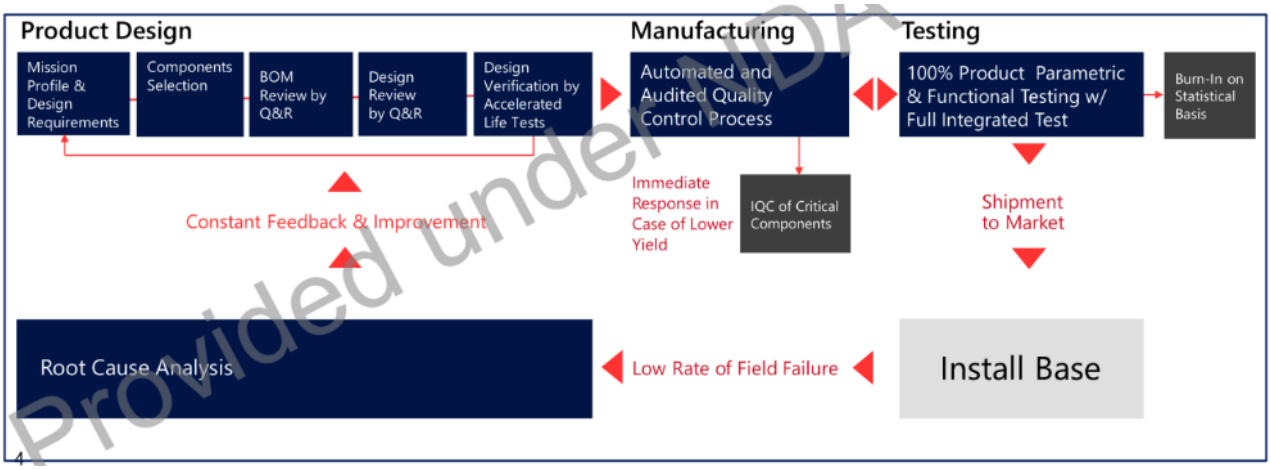


Figure 4-2 Product reliability life cycle

Key elements of the SolarEdge reliability methodology include:

- Setting reliability goals
- Choosing components large design margins
- Verifying the design with theoretical calculations
- Verifying the design with Accelerated Tests

4.2.1 Setting reliability goals

SolarEdge has established a reliability goal for the optimizers of a 20 Failures in Time (FIT) rate. The steps for achieving the 20 FIT are summarized in Figure 4-. The FIT rate is used to calculate Mean Time Between Failure (MTBF). Based on calculations provided by SolarEdge, with a FIT rate of 20, the calculated MTBF is 5700 years, or stated in another way, for every 450 power optimizers installed, the calculation would predict only one to fail over a 25-year lifetime. Figure 4- shows how the theoretical calculations come together with the experimental results to support the goal of a FIT rate of 20.

DNV cautions that MTBF calculations are not intended to calculate product life, since MTBF represents product reliability in the short term, without the long-term effects of aging. DNV does acknowledge that the FIT rate of 20 is an aggressive goal.

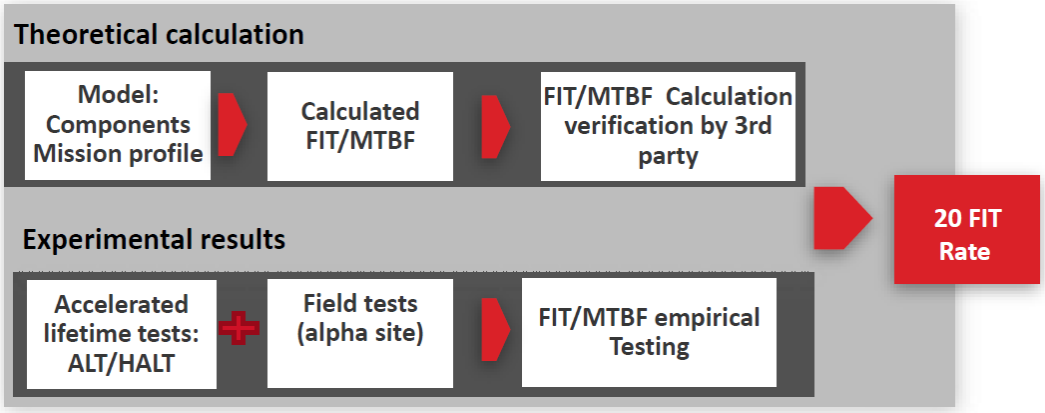


Figure 4-3 SolarEdge's Method for Achieving 20 FIT

DNV views positively that SolarEdge has defined a thorough approach to reliability and has set detailed targets.

The SolarEdge inverters are more complex with more parts than the optimizers. Other challenges with the size and construction of the inverter make achieving very high reliability more difficult. SolarEdge has established a similar design goal for the inverter of 300 FIT. The FIT of 300 represents a 6.6% failure rate for SolarEdge inverters after 25 years of field operation. DNV considers the FIT goal of 300 to also represent an aggressive design goal. In Figure 4-, the complete design cycle including the initial steps of component selection are presented within the method for achieving a FIT of 300.

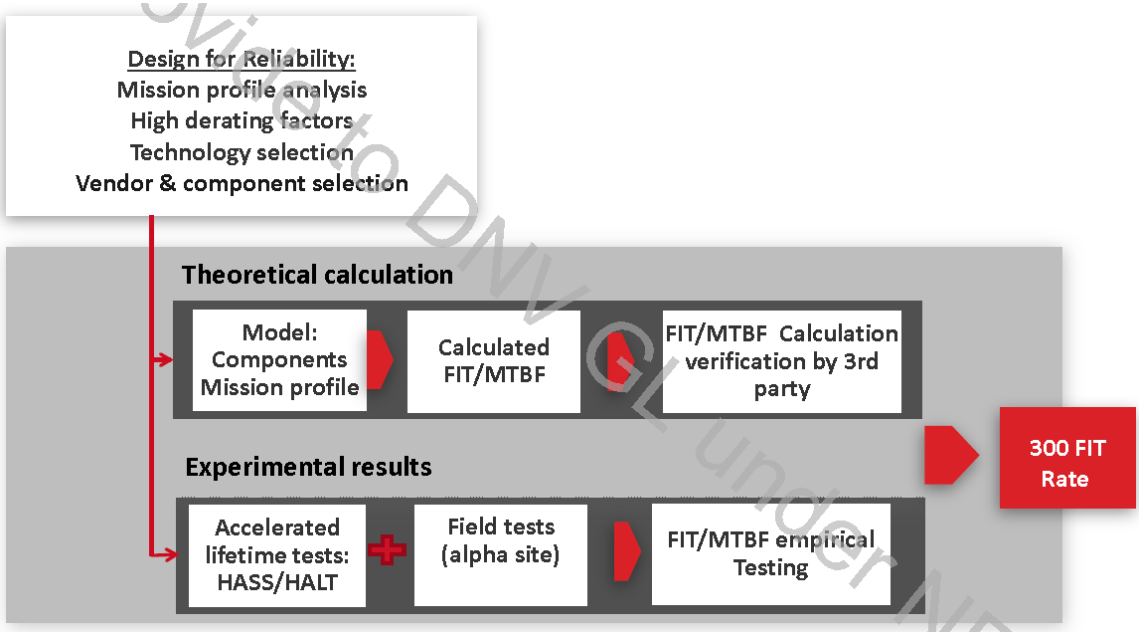


Figure 4-4 SolarEdge method for achieving 300 FIT for inverter

4.2.2 Choosing components large design margins

SolarEdge provided their internal guidelines for component selection and application that support their lifetime expectations for optimizers and inverters. To achieve long product life, SolarEdge strives to use only components rated at 85°C or higher, for commercial components. Where possible, SolarEdge uses components with a higher voltage rating to reduce voltage stresses. This approach is particularly effective in electrolytic capacitor selection, where the voltage applied can accelerate aging.

Since component temperature is the primary attribute for accelerating aging, SolarEdge strives to design the optimizers and inverters such that ample temperature margin between component's maximum temperature rating and the operation temperature is maintained. The electrolytic capacitors are applied with an attention to voltage, operating temperature and ripple current in efforts to assure greater than 25-year useful life.

4.2.3 Verifying the design with theoretical calculations

4.2.3.1 Mean Time Between Failure (MTBF) Reliability Modeling

For modeling reliability, SolarEdge acquired the services of BQR Reliability Engineering Ltd. in Israel. BQR utilized the CARE (Computer Aided Reliability Engineering) software package. This software implements several standard methodologies for MTBF calculation and is used to calculate the expected MTBF of SolarEdge Power Optimizer and inverter products. The MTBF is calculated by including all the parts in the unit and the stress that each individual component is under to assign a Failure In Time (FIT) rate for the system. The standard used by BQR for the optimizer and inverter MTBF calculation is based on Parts Stress method of BellCore (also known as TELCORDIA) SR-332 Issue 3. DNV is comfortable with the use of these methodologies for MTBF calculations for the SolarEdge products.

For this report, SolarEdge provided MTBF calculations of P-Series/S-Series optimizers, SE3800H single phase inverter, new control board for three phase inverter and SE330K utility scale inverter. DNV reviews of MTBF calculations from earlier reports are removed from this report.

SolarEdge provided the results of the P860/P960 power optimizer MTBF calculation at 30°C and GF (Ground Fixed, Uncontrolled) environmental conditions. GF refers conditions with some environmental stress and limited maintenance, subject to shock, vibration, temperature, or atmospheric variations. The calculation is based on a serial model, which assumes that any failure of any component results in a system failure. The calculation resulted in a MTBF of 13,516,719 hours. This result is given in Table 4-1.

Table 4-1 SolarEdge P860/P960 power optimizer MTBF calculation results

Level	PART Number	Description	Fail. Rate (F/10^6HRS)	MTBF(HRS)	MTBF(Years)	Env	Temp [°C]	Qty
.1.....	AS9034-AO-E7BS	Optimizer Gen3 960W/60V In=Dual 1.6 &1.6m MC4;Out=MC4/2.3m/NAM/Flat [with D1254FD]	0.073982	13,516,719	1543.0	GL	30.0	1
..2....	AP1254F-AO-121-SV-FW5	PCBA+FW for Gen3 Optimizer SV Vin=60v Vout=80v Power=960w LV303 ROM634 IndOP=Disabled Comments =EMI support 23A [with D1254FD]	0.072930	13,711,869	1565.3	GL	30.0	1
..2....	MCI-CB-00762-B1	Output Cable for Gen3, MC4 ,UL PV Cable 4mm², L=2.3m,105°C,1000V	0.000014	72,495,849,786	8275781.9	GL	30.0	1
..2....	MCI-CB-01225-A	Input Cable for Gen3, MC4 ,UL PV Cable 2.5mm² ,Split cable 1.6m,105°C,1000V	0.001039	962,334,289	109855.5	GL	30.0	1

The calculation in Table 4-1 is based on an average ambient temperature of 30°C with continuous operation (24 hours/day). Higher average temperatures will shorten the product life, as shown in Figure 4-.

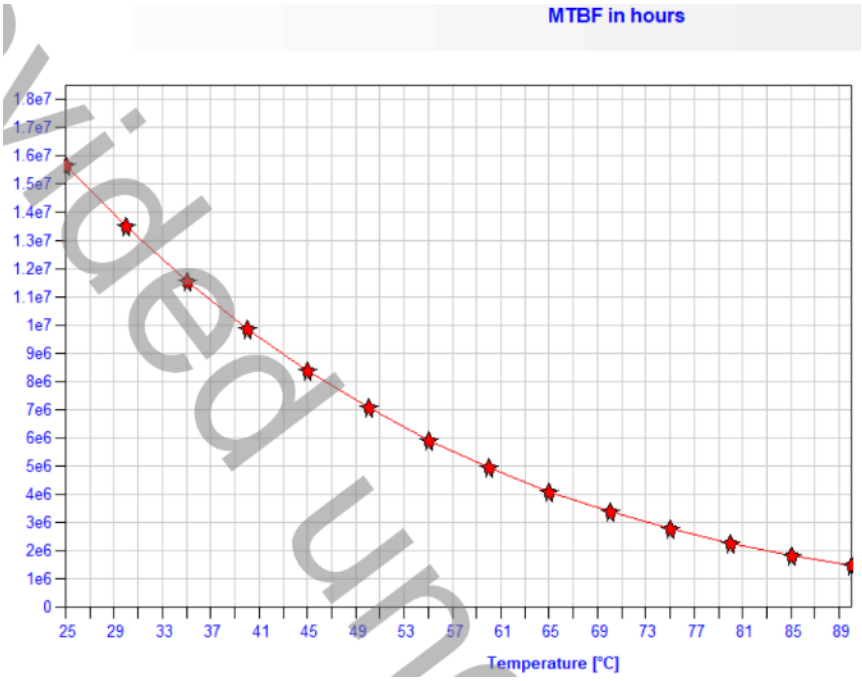


Figure 4-5 SolarEdge P860/P960 power optimizer MTBF calculation based on ambient temperature

It is the view of DNV that the primary benefit of making MTBF calculations is to identify the parts with the highest contribution to the failure rate and then updating the design to improve the reliability. The exact calculated number is less important than the consistent use of a rigorous methodology and that the results are used to improve the design.

The MTBF calculation for the single-phase inverter model, SE3800H is shown in Table 4-2, resulting in a system MTBF level of 1,207,616 hours at 38°C, with the MTBF for key components and assemblies shown below. In Figure 4-, the single-phase inverter MTBF calculation is adjusted for higher average ambient temperatures.

Table 4-2 SolarEdge single phase SE3800H inverter MTBF calculation results

Level	PART Number	Description	Fail.Rate (F/10^6HRS)	MTBF(HRS)	MTBF(Years)	RF*DC	Qty
0.....	System	SE3800H	0.828078	1,207,616	137.9	1.000	1
.1.....	SE3800H-Portia Board	Portia Board	0.170679	5,858,938	668.8	0.500	1
.1.....	SE3800H-Main Board	Main Board	0.656397	1,523,468	173.9	0.500	1
.1.....	SE3800H-Auxilary Board	Auxiliary Board	0.001001	998,575,787	113992.7	0.500	1

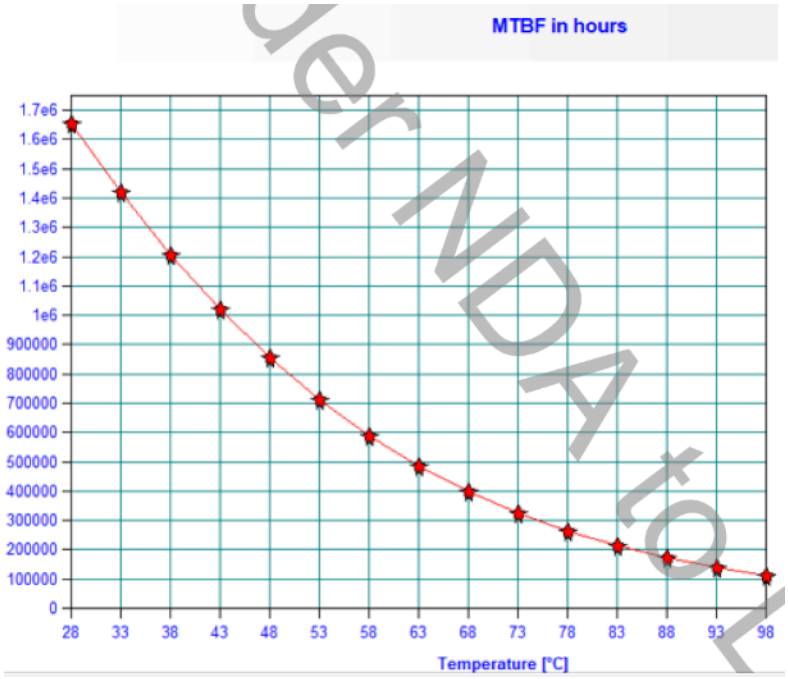


Figure 4-6 SolarEdge single phase inverter SE3800H MTBF calculation based on ambient temperature

The MTBF calculation for the higher voltage and higher-power 10KW single phase inverter model is shown in Table 4-3, resulting in a system MTBF level of 1,210,965 hours at 37°C. Figure 4- provides the MTBF calculation at higher ambient temperatures.

Table 4-3. SolarEdge high-power, 10kW single phase inverter model MTBF calculation results

Level	PART Number	Description	Fail.Rate (F/10^6HRS)	MTBF(HRS)	MTBF(Years)	RF*DC	Env	Temp [°C]	Qty
0.....	System	System	1.069750	934,797	106.7	1.000	GF1	37	1
.1.....	D1180B	PCB for Portia Venus-III	0.215294	4,644,814	530.2	0.500	GF1	37	1
.1.....	ECO	Venus 3 10KW	0.854457	1,170,334	133.6	0.500	GF1	37	1

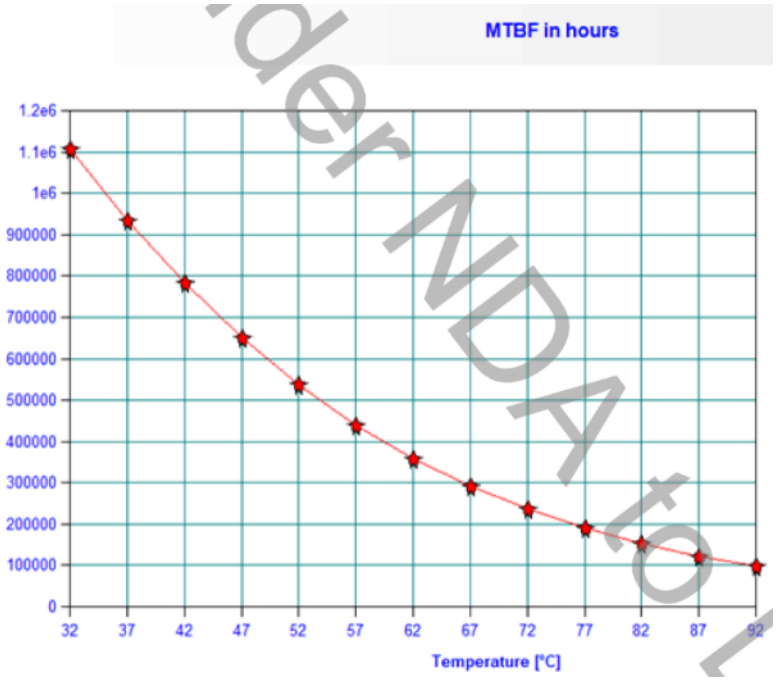


Figure 4-7 SolarEdge high-power, single-phase inverter MTBF calculation based on temperature

In Table 4-4, a similar MTBF calculation is presented for the SolarEdge three phase inverter, resulting in a system MTBF level of 624,418 hours at 45°C. Since the MTBF calculation for both optimizers and inverters use the component count method, it is reasonable that the MTBF calculations for both the single phase and three phase inverters resulted in lower calculations when compared to the less complex optimizers. Additionally, the MTBF calculation based on ambient temperature for the three-phase inverter, shown in Figure 4-, is quite like the same graph for the single-phase inverters.

Table 4-4 SolarEdge three phase inverter MTBF calculation results

Level	RefDes	PART Number	Description	Fail.Rate (F/10^6HRS)	MTBF(HRS)	MTBF(Years)	RF*DC	Temp [°C]	Qty
.1.....	Jup+I	Jup+I	Jup+I	1.601490	624,418	71.3	1.000	45	1
..2....	DC_board	AP1163F-DC-09	PCBA for DC-Board Jupiter-Plus Improved	0.224679	4,450,788	508.1	0.500	45	1
..2....	Digital board	AP1288A-DG-28	PCBA for 3PH Digital Board for Jupiter Plus Improved (D1288AD)	0.226256	4,419,779	504.5	0.500	45	1
..2....	Portia	AP1186B-PT-80	Portia Linux for Jupiter Improved, JJ Improved	0.235002	4,255,290	485.8	0.500	45	1
..2....	Power board	AP1160G-PB-10	PCBA for Jupiter-Plus Improved Power-board	0.915554	1,092,235	124.7	0.500	45	1

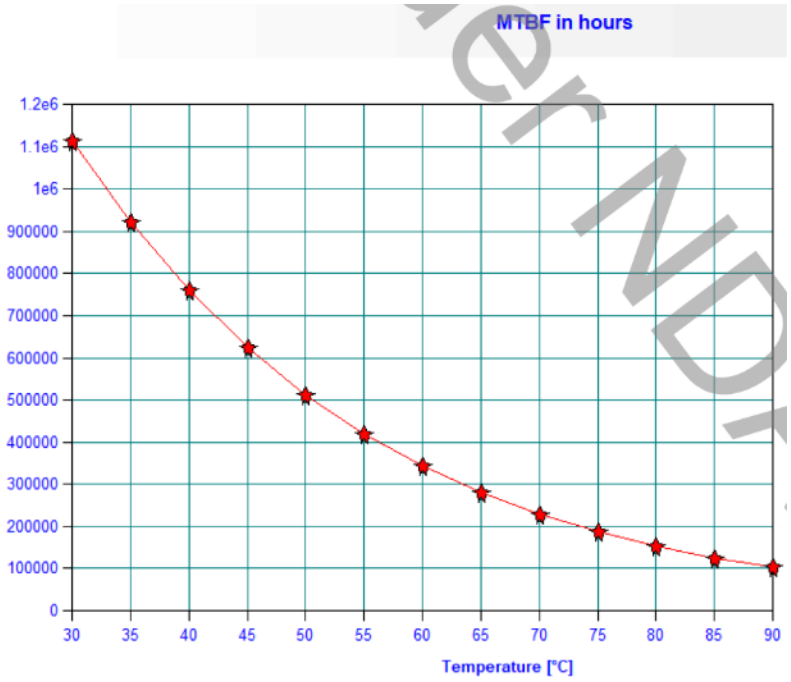


Figure 4-8 SolarEdge three phase inverter MTBF calculation based on ambient temperature

SolarEdge also provided MTBF calculations of the upcoming S-series power optimizers, H1300 power optimizer and SE330K utility scale three phase inverter.

The MTBF calculation for the S500B power optimizer is shown in Table 4-, resulting in a system MTBF level of 9,985,916 hours at 36°C, with the MTBF for key components and assemblies shown below. In Figure 4-, MTBF calculation is adjusted for higher average ambient temperatures. Adjusted for temperature, the MTBF for the new S-series optimizer is similar to the P-series optimizes that have an established track record.

Table 4-5 SolarEdge S-Series S500B power optimizer MTBF calculation

Level	PART Number	Description	Fail.Rate (F/10^6HRS)	MTBF(HRS)	MTBF(Years)	DC	Env	Temp [°C]	Qty
.1.....	AS9008-AO-C8C	Optimizer Gen4 500W/80V [S500B] In=MC4 Out=MC4/2.4m[2.3+0.1m]/DCC [with D1262AB]	0.100141	9,985,916	1139.9	1.0	GL	36.0	1
..2....	AP1262A-AO-05-EV-FW1	PCBA+FW for Gen4 Optimizer EV Vin=125v Vout=80v Power=500w LV452 BL 001.4	0.100067	9,993,328	1140.8	0.5	GL	36.0	1
..2....	MCI-CB-01955-C	Output Cable for Gen4 (with Marking), MC4 ,UL PV Cable 4mm², L=2.3m / L=0.1m,105°C,1000V	0.000037	26,923,734,528	3073485.7	0.5	GL	36.0	1
..2....	MCI-CB-02011-A1	Input Cable for Gen4 (with Marking), MC4 ,UL PV Cable 4mm², L=0.1m,105°C,1000V	0.000037	26,923,734,528	3073485.7	0.5	GL	36.0	1

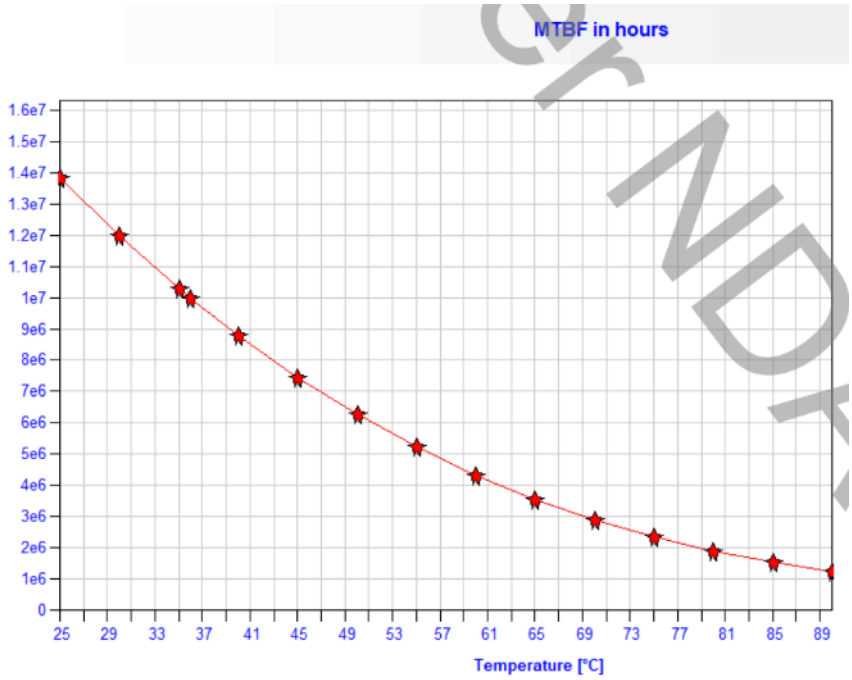


Figure 4-9 SolarEdge S-Series S500B power optimizer MTBF calculation based on ambient temperature

The MTBF calculation for the H1300 utility scale power optimizer is shown in Table 4-6 , resulting in a system MTBF level of 9,596,122 hours at 36°C, with the MTBF for key components and assemblies shown below. In Figure 4-10, MTBF calculation is adjusted for higher average ambient temperatures.

Table 4-6 SolarEdge H1300 power optimizer MTBF calculation

Level	PART Number	Description	Fail. Rate (F/10^6HRS)	MTBF(Hrs.)	MTBF(Years)	DC	Env	Temp [°C]	Qty
.1.....	H1300-1GMLMRU-NM01	Optimizer 1300W/125V In=MC4 L,Out=MC4/2.6m NAM	0.104208760	9,596,122	1095.4	1.000	GL	36.0	1
..2....	AS9027-AO-E8AR	Optimizer Gen4 1300W/125V In=Long MC4 Out=MC4/2.6m[5.1+0.1m]/NAM [with D1266AD]	0.104208760	9,596,122	1095.4	1.000	GL	36.0	1
...3...	AP1266A-AO-07-SV-FW1	PCBA+FW for Gen4 Optimizer SV Vin=125v Vout=75v Power=1300w LV452 Boot 001,IndOP Enable Comments= support 2 PWM TX [with D1266AD]	0.104171618	9,599,544	1095.8	0.500	GL	36.0	1
...3...	MCI-CB-03218-20	Input Cable for Gen4, MC4 (with Marking) ,UL PV Cable 4mm², L=1.7m / L=0.1m,105°C,1500V	0.000018571	53,847,469,057	6146971.4	0.500	GL	36.0	1
...3...	MCI-CB-03219-20	Output Cable for Gen4, MC4 (with Marking), UL PV Cable 4mm², L=5.1m / L=0.1m,105°C,1500V	0.000018571	53,847,469,057	6146971.4	0.500	GL	36.0	1

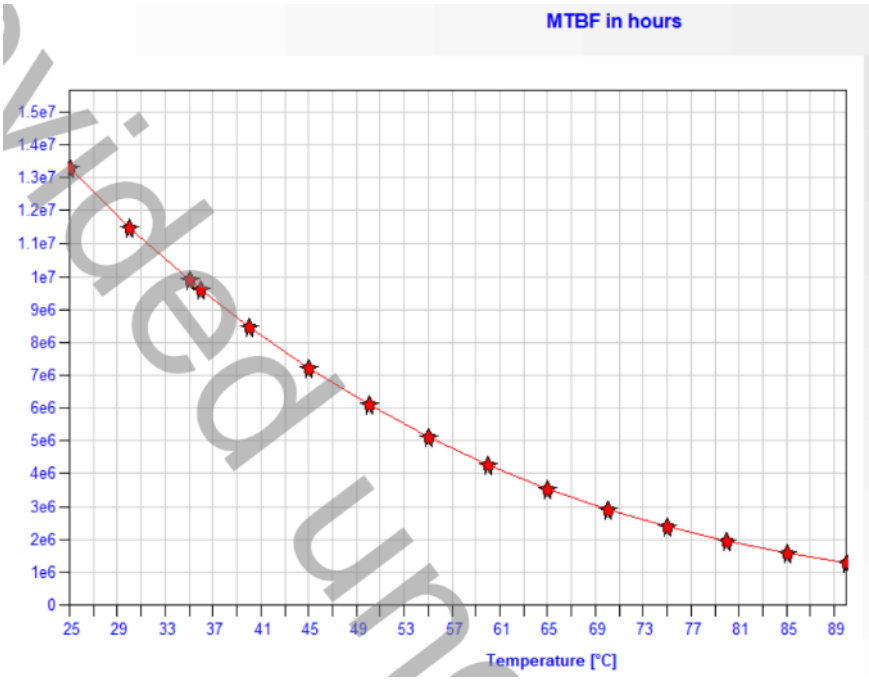


Figure 4-10 SolarEdge H1300 power optimizer MTBF calculation based on ambient temperature

The preliminary MTBF calculation for the upcoming utility scale three phase inverter, SE330K model is shown in Table 4-7, resulting in a system MTBF level of 229,642 hours at 45°C, with the MTBF for key components and assemblies shown below. In Table 4-8, preliminary MTBF calculation is adjusted for higher average ambient temperatures. A higher parts count for larger, higher power inverters results in a lower MTBF compared to lower power inverters.

Table 4-7 SolarEdge SE330K three phase inverter preliminary MTBF calculation

Level	PART Number	Description	Fail.Rate (F/10^6HRS)	MTBF(HRS)	MTBF(Years)	RF*DC	Temp [°C]	Qty
..2....	AS3601-RW1-01	Orion Inverter 3PH LH, ROW	4.354606	229,642	26.2	1.000	45.0	1
....3...	AP1551C-PS-01	PCBA for Auxiliary Power Supply board for Orion inverter	0.883630	1,131,696	129.2	0.500	45.0	1
....3...	AS0002-POB	Portia BOX Assembly for Orion	0.418532	2,389,305	272.8	0.500	45.0	1
....3...	AS0003-RLY-1	Relay Holder Sub-Assembly for Orion	0.011054	90,467,229	10327.3	0.500	45.0	1
....3...	AS0005-CAP-1	Capacitor Sub-Assy for Orion	0.406429	2,460,457	280.9	0.500	45.0	1
....3...	AS0019-SW-1	Switch Bracket Sub-Assy for Orion	0.017139	58,347,737	6660.7	0.500	45.0	1
....3...	AS0021-PTR-1	Power Train Sub-Assy w/ Heatsink	2.577718	387,940	44.3	0.500	45.0	1
....3...	AS0032-FAN	External Four Fans on Front Panel Sub-Assembly, for Orion	0.000985	1,015,475,047	115921.8	0.500	45.0	1
....3...	AS0033-FAN	External single Fan on Front Panel Sub-Assembly, for Orion	0.000246	4,061,900,187	463687.2	0.500	45.0	2
....3...	AS0034-FAN	Internal FAN Sub-Assy for Orion NFront Panel	0.000246	4,061,900,187	463687.2	0.500	45.0	1
....3...	AS0035-FAN	Internal FAN Sub-Assy for Orion (second)	0.000246	4,061,900,187	463687.2	0.500	45.0	1
....3...	SEMACA001-B	AC plate Sub-Assy for Orion (produced at Jabil-China Magn. line ENE)	0.001179	848,423,504	96852.0	0.500	45.0	1
....3...	SEMDCA001-B	DC plate Sub-Assy for Orion (produced at Jabil-China Magn. line ENE)	0.002848	351,071,795	40076.7	0.500	45.0	1
....3...	SEMORN001-B	3PH Power Choke for Orion 380	0.000589	1,696,847,009	193704.0	0.500	45.0	3
....3...	MCI-CB-04077-01	Orion Cable Assy, 6 Wires 24AWG, Two 6 pins connec, L=20cm	0.000739	1,353,966,729	154562.4	0.500	45.0	1
....3...	MCI-CB-04078-01	Orion Cable Assy, 8 Wires 24AWG, Two 16 pins Connec & one 5 pin Connec, L=22cm + 30cm	0.002277	439,124,345	50128.3	0.500	45.0	1
....3...	MCI-CB-04095-01	Orion Cable Assy,12 Wires 20AWG, Black, L=190cm	0.001477	676,983,364	77281.2	0.500	45.0	1
....3...	MCI-CB-04098-01	Orion Cable Assy, Toggle Switch, L=43cm	0.014923	67,011,044	7649.7	0.500	45.0	1
....3...	MCI-CB-04102-03	Orion Cable Assy, Portia to digital, D-SUB 15 pin to 10 pin connector, L=50cm	0.001539	649,904,030	74190.0	0.500	45.0	1
....3...	MCI-CB-04482-03	Orion Cable Assy, Fan Harness	0.002954	338,491,682	38640.6	0.500	45.0	1
....3...	MCI-CB-04618-01	Orion Cable Assy, for Diff Choke, 20AWG 1000V, 18 pins Connec to Ring Terminals	0.001108	902,644,486	103041.6	0.500	45.0	1
....3...	MCI-CB-04619-01	Orion Cable Assy, Cable for relays, 20AWG, 9 pins Connec to Ring Terminals	0.000554	1,805,288,972	206083.2	0.500	45.0	1
....3...	MCI-CB-04825-02	Orion Cable Assy, 4 wires 24AWG, L=50cm	0.000492	2,030,950,093	231843.6	0.500	45.0	1
....3...	MCI-CB-05037-01	Orion Cable Assy, Portia D-SUB Female 15 pin to extender, L=50cm	0.001539	649,904,030	74190.0	0.500	45.0	1
....3...	MCI-CB-05054-01	Orion Cable Assy, 8 wire, Black, 24AWG (INT fans cable), L=35cm	0.001231	812,380,037	92737.4	0.500	45.0	1
....3...	MCI-CB-05058-01	Orion Cable Assy, for Relay, 24 wire, 24AWG, L=25cm + 39cm + 55cm	0.002954	338,491,682	38640.6	0.500	45.0	1
....3...	MCI-CB-05065-01	Orion Cable Assy, for AC sense, 20AWG, 9 pins Connec to Ring Terminals, L=135cm	0.000554	1,805,288,972	206083.2	0.500	45.0	1

Table 4-8 SolarEdge SE330K three phase inverter preliminary MTBF calculation based on ambient temperature

Temperature [°C]	Failure Rate [F/10^6Hrs]	MTBF [Hours]	MTBF [Years]
25	2.03818	490635	56.01
30	2.44555	408907	46.68
35	2.95012	338970	38.70
40	3.57635	279615	31.92
45	4.35461	229642	26.21
50	5.32242	187885	21.45
55	6.52603	153232	17.49
60	8.0222	124654	14.23
65	9.88034	101211	11.55
70	12.185	82068.2	9.37
75	15.0387	66495	7.59
80	18.5656	53863.1	6.15
85	22.9149	43639.7	4.98

SolarEdge performs MTBF calculations for all families of optimizer and inverters. DNV has reviewed MTBF calculations provided by SolarEdge beyond the examples given in this section, and views positively that SolarEdge is making detailed MTBF calculations using well established methods.

4.2.3.2 Failure Mode Effects and Criticality Analysis (FMECA) Analysis

FMECA is an important tool used in the design of electronic products to help assure high reliability. DNV has reviewed multiple FMECAs prepared by SolarEdge for their products. As part of this study, DNV reviewed the FMECA created by SolarEdge for the HD-Wave inverter series. Although the studies analyzed only a limited number of failure modes, the modes were chosen to focus on the more likely failure scenarios, with resulting improvements or changes implemented for most potential failure modes. DNV views this type of failure analysis positively.

4.2.4 Verifying the design with Accelerated tests

4.2.4.1 HALT Testing

As part of a previous study, DNV reviewed the HALT Test Reports for the Gen3 P350 optimizer, for the single-phase inverter and for the three phase inverters. The procedure stages for HALT indicated by QualiTech are given in Table 4-9. As seen, the tests include vibration and temperature shock cycling tests among other tests. The purpose of these tests is to determine the operation limits of the device under test. A photo of the SolarEdge Power Optimizers in the HALT test fixture is provided in Figure 4-. Note that the SolarEdge Power Optimizers are operating during the test stages. The performing of the HALT is indicative of SolarEdge's commitment to ongoing new product testing to accelerate failure modes.

Table 4-9 SolarEdge Power Optimizer HALT Stages

Step No.	Test Name	From	To	Step Description	Period
1.	Low Temperature	0 °C	-70 °C or until stops functioning	Reduction of -10 °C intervals.	Dwell time: at least 10 minutes in each step.
2.	Cold Start	0 °C	-70 °C or until: 1. UUT does NOT turn-on successfully. 2. Performance degradation.	- Reduction of -10 °C intervals at Each step. - Operate the UUT for at least 10 Minutes. - Power off the UUT for 10 Minutes. - Power on the UUT and wait one Minute for an operation sign. - In case of failure, increase the temperature at 20 °C and operate The UUT.	
3.	High Temperature	0 °C	+130 °C or until stops functioning	Increase of +10 °C intervals.	Dwell time: at least 10 minutes in each step.
4.	Vibration	5 gRMS	30 gRMS or until stops functioning	20% increments between steps.	10 minutes at each load.
5.	Temperature Shock Cycling	Step 1 extreme point	Step 2 extreme point	Rate of up to 30 °C per minute.	
6.	Temperature Cycling and Vibration	Step 1 extreme point	Step 2 extreme point	Rate of up to 30 °C per minute and vibration level as identified in step 3.	
7.	Temperature Cycling and Vibration test at a lower intensity than step 5 (Detection test).	Step 1 extreme point + (+10) °C	Step 2 extreme point - (-10) °C	Rate of up to 30 °C per minute and vibration level half from the identified value in step 3. During this cycle, a functional test is performed to identify flaws. Dwell time: 10 minutes at each extreme point.	

Figure 4-11 SolarEdge power optimizers in HALT test chamber

The results of this testing are shown in Table 4-10.

Table 4-10 Summary of P350 optimizer HALT tests

Test	Meaning	Characteristics
MOLT	Minimum Operating Limit Temperature	-50ºC
MOLT	Maximum Operation Limit Temperature	110ºC
MOLV	Maximum Operation Limit Vibration	24.0 gRMS
MOLCS	Maximum Operation Limit Cold Start	-40ºC

SolarEdge also provided HALT reports of single phase inverter, three phase inverter and the Synergy Manager Box models. The HALT procedure stages for the single phase inverter is the same as Table 4-9. For three phase inverters, the temperature cycling is done at 40ºC per minute instead of 30ºC per minute. The HALT procedure stages for Synergy Manager Box are shown in Table 4-11. The results of the HALT tests of these units are summarized in tables below.

SolarEdge has communicated to DNV that HALT tests are done on every new or significantly revised product. DNV views the use of HALT by SolarEdge as a positive indicator of the product reliability.

Table 4-11 SolarEdge Synergy Manager Box HALT Stages

Step No.	Test Name	From	To	Step Description	Period
1.	Low Temperature	0 °C	-70 °C or until stops functioning	Reduction of -10 °C intervals.	Dwell time: at least 10 minutes in each step.
2.	Cold Start	0 °C	-70 °C or until: 1. UUT does NOT turn-on successfully. 2. Performance degradation.	- Reduction of -10 °C intervals at each step. - Operate the UUT for at least 10 minutes. - Power off the UUT for 10 minutes. - Power on the UUT and wait one minute for an operation sign. - In case of failure, increase the temperature at 20 °C and operate the UUT.	
3.	High Temperature	0 °C	+130 °C or until stops functioning	Increase of +10 °C intervals.	Dwell time: at least 10 minutes in each step.
4.	Vibration	5 gRMS	18 gRMS	20% increments between steps.	10 minutes at each load.
5.	Temperature Shock Cycling	Step 1 extreme point	Step 2 extreme point	Rate of up to 40 °C per minute.	

Table - Summary of 7.6kW single phase inverter HALT tests

Test	Meaning	Characteristics
MOLT	Minimum Operating Limit Temperature	-60ºC
MOLT	Maximum Operation Limit Temperature	90ºC
MOLV	Maximum Operation Limit Vibration	21.4 gRMS
MOLCS	Maximum Operation Limit Cold Start	-60ºC

Table 4-12 Summary of SolarEdge three phase inverter HALT tests

Test	Meaning	Characteristics
MOLT	Minimum Operating Limit Temperature	-60ºC
MOLT	Maximum Operation Limit Temperature	90ºC
MOLV	Maximum Operation Limit Vibration	20.0 gRMS
MOLCS	Maximum Operation Limit Cold Start	-60ºC

Table 4-13 Summary of SolarEdge Synergy Manager Box HALT tests

Test	Meaning	Characteristics
MOLT	Minimum Operating Limit Temperature	-60ºC
MOLT	Maximum Operation Limit Temperature	90ºC
MOLV	Maximum Operation Limit Vibration	15.0 gRMS
MOLCS	Maximum Operation Limit Cold Start	-60ºC

4.2.4.2 High Temperature Operating (HTO) test

The High Temperature Operating test (or Burn-in test) is described by SolarEdge as intended to wear out electronic components by exposing them to high ambient temperature, based on the theoretical work originally done by Arrhenius. This type of accelerated aging is particularly useful for certain types of components as well as plastic materials, adhesives, paint and coatings, based on SolarEdge documentation. The SolarEdge minimum qualification test for Burn-in is 2000 hours, which when considering the temperature applied, represents a life acceleration of 36 years for even the hottest locations, based on calculations by SolarEdge.

SolarEdge provided example test documentation for the P960 optimizer and for a three phase inverter unit.

The P960 optimizer HTO was performed from September 2020 and March 2021. 20 optimizer units were connected in string model to a three phase inverter producing 7.75kW. Test specifications are shown in Table 4-14. No failures occurred during the test. Based on 30ºC average field operating temperature, SolarEdge estimated that the test specification shown below is equivalent to simulating 50 years of lifetime operation of the inverter.

Table 4-14 P960 optimizer HTO test specifications

#	Parameter	Definition	Reason
1	Condition (+T)	BI 85°C	Max temp, defined by R&D
2	Test duration	4840 hours	Equivalent to 50 year
3	Sample size	20	Common string size
4	Reference sample?	No	Not required
5	Configuration	String	As working in the field
6	Electrical conditions (P, V, I, Load)	MW V_{out}= 50V, I_{out}=9A, P=450W, Load= Grid	NA
7	Test points (time)	NA	Run to fail or end of test
8	Measurements	I_{in} = ~11.3A	Tested by current clamp at start of test
9	Success criteria	Pout = 7.75KW +/-3%	Accepted drift
10	Monitoring	Pout = 7.75KW	Change in power production indicate a malfunction
11	Scheduled end point		
12	Premature end point	NA	
13	Start date	3/9/2020	
14	End date	24/3/2021	

4.2.4.3 Thermal Cycling (TC)

Thermal cycling accelerates aging in adhesion interfaces, solder joints and connectors, and is therefore often used for printed circuit board assemblies. SolarEdge estimates the aging process using the Coffin-Mason equation. SolarEdge provided test thermal cycling test reports for the P960, S440 and S1200 optimizers. DNV also reviewed thermal cycling test reports for 7.6kW single phase model and 100kVA three phase inverter model.

Thermal cycling test specifications for the S440 optimizer unit is shown in Table 4-15. Two strings with 20 and 14 optimizer units were connected to a three phase inverters to evaluate the Buck and Boost modes of the optimizer. The system ran in temperature chamber for 600 cycles and the temperature was cycled between -40ºC and +85ºC. Based on a field temperature delta of 35ºC, SolarEdge estimated that the test specification shown below is equivalent to simulating 70.5 years. Similarly designed thermal cycling tests were conducted on single phase and three phase inverters.

Table 4-15 S440 optimizer TC test specifications

#	Parameter	Definition	Reason
1	Condition (+T)	TC -40°C/85°C	Standard TC test conditions
2	Test duration	600 cycles (43 days)	Equivalent to 70.5 year
3	Sample size	34	
4	Reference sample?	No	
5	Configuration	2 Strings, 20 and 14 Opts.	Buck and Boost respectively
6	Electrical conditions (P, V, I, Load)	Vin=44V, Iin=5A, P=220W Load = Jup 20KW	Fault check over time
7	Test points (time)	NA	
8	Measurements	Current consumption by current clamp	Verified by current clamp at the start of the experiment
9	Success criteria	Pout = 6.4KW +/-3%	
10	Monitoring	Pout by reading telemetry	A change in power can indicate a malfunction
11	Scheduled end point		
12	Premature end point	NA	
13	Start date	19/01/2021	
14	End date	04/03/2021	

4.2.4.4 Damp Heat (DH)

Life acceleration by applying damp heat will affect plastic materials, adhesives, and insulation materials, according to SolarEdge. DH test report was provided for a three phase inverter model as an example of a typical test where the temperature was maintained at 65°C and the humidity was maintained at 85% relative humidity, for a period of 1000 hours, for six units under test. Peck's Power Law is applied to calculate the impact of 1000 hours of exposure to the Damp heat test, an equivalent of 9.9 years of field operation. The test was passed with no significant changes in the efficiency of all the inverters.

4.2.4.5 Full assembly Accelerated Life Test (ALT)

ALT is typically performed on a statistically significant population of inverters at elevated temperature. Inverters are typically operational, at rated power, but may be de-rating in power output due to the high ambient temperature. Some manufacturers introduce humidity as an additional accelerator, and the product of the temperature and humidity accelerations are used to calculate the product life impact.

It is the view of DNV that ALT performed with only thermal acceleration applied to a large sample group of inverters is effective in estimating product life, if the test is continued until the calculated accelerated equivalent life simulated exceeds the manufacturer's inverter design life. The use of both temperature and humidity accelerators simultaneously, that result in

test acceleration factors of greater than 25 are less likely to achieve the acceleration goals, when compared to only temperature accelerated tests of much longer duration.

5 MANUFACTURING EVALUATION

As of July 2022, SolarEdge has five manufacturing facilities around the world. Optimizer, inverter and battery production capacities for 2022 is shown below. SolarEdge ceased production in Celestica, Romania since Q2 2019.

- Jabil in HuangPu, China
  - 1,667 inverters and 30,688 optimizers produced per day in Q1 2022.
- Jabil in Ho Chi Minh, Vietnam
  - 785 inverters and 9,526 optimizers produced in per day Q1 2022.
- Flextronics in Zala, Hungary
  - 18,159 optimizers produced in per day in Q1 2022.
- Flextronics in Guadalajara, Mexico
  - Production started in Q1 2022.
  - 11 inverters and 571 optimizers produced in per day in Q1 2022.
- Sella 1, Israel
  - Located is Israel and operated by SolarEdge. Production started in Q1 2021.
  - 706 inverters and 15,204 optimizers produced in per day in Q1 2022.
- Sella 2, South Korea
  - Located in the Eumseong Innovation City of Chungcheongbuk-Do, South Korea. Opened in May 2022.
  - Annual capacity of 1.7 GWh of NMC battery cells.

DNV did not visit the factories for this report update. DNV previously reviewed a set of nine manufacturing documents that describe the optimizer and inverter assembly and tests processes. The manufacturing facilities are all contract manufacturers with current certifications to ISO 9001:2015 standard for Quality Management Systems (QMS), the ISO 14001:2015 for Environmental Management Systems (EMS) and the ISO 45001:2018 Occupational Health and Safety (OH&S) Management Systems.

SolarEdge manages the work performed in the contract manufacturing facilities by issuing assembly instructions and tests procedures that detail the steps required to fabricate the inverters and optimizers, with multiple test functions during and after assembly. In the description of the factory visit below, the manner in which SolarEdge controls the manufacturing and test processes is described.

5.1 Manufacturing overview

Note: Factory visits were performed by DNV for SolarEdge technology reviews prior to this report.

SolarEdge employs a strategy of utilizing electronic contract manufacturers to produce their products. The two contract manufacturers that SolarEdge uses are Flextronics and Jabil. DNV is experienced with these two companies and views these electronics manufacturers as being Tier-1. DNV has not visited the new Sella 1 manufacturing facility in Israel, owned and operated by SolarEdge. DNV expects SolarEdge to follow the same manufacturing and quality practices that were put in place in their contract manufacturing locations.

DNV visited the Flextronics facility in Zalaegerseg, Hungary as part of an earlier review as discussed in section 5.3. DNV has previously visited Jabil manufacturing facilities and believes a visit to the China location is not necessary at this time. DNV understands that the processes used by both contract manufacturers are the same. They are both very well suited to produce the SolarEdge products.

SolarEdge works closely with their contract manufacturers to optimize the product and production process. SolarEdge is fully responsible for the product design and test processes that are used. This includes oversight of the bill of materials (BOM) and approved vendor list. The contract manufacturer may make component and supplier recommendations; however, they must be approved by SolarEdge. SolarEdge provides the equipment that is used in the product functional testing. DNV understands that SolarEdge representatives are on site at each of the contract manufacturers (and met with them in Hungary) to monitor the production process and interface with the facility personnel. SolarEdge has monitoring capabilities at the company headquarters in Israel to gather data on the contract manufacturer's performance as shown in the displays provided in Figure 5-.

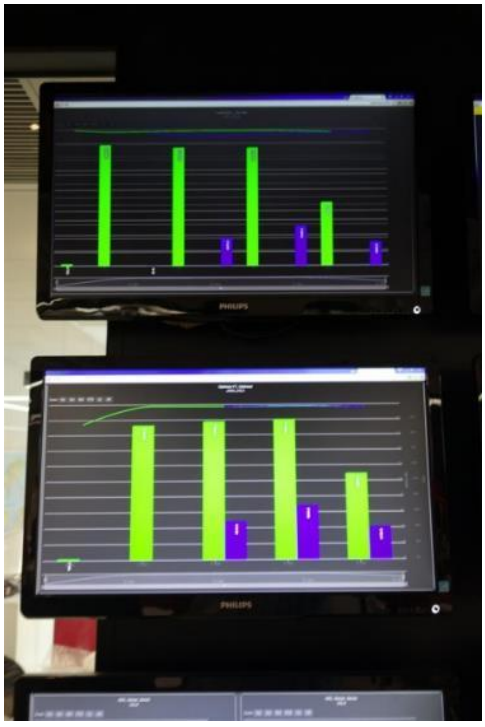


Figure 5-1 Production Monitoring at SolarEdge Headquarters

5.2 Manufacturing Process

The manufacturing process employed for the SolarEdge Power Optimizers and Single-Phase Inverters includes two major elements: assembly and testing. These are discussed in the following sections.

5.2.1 Product Assembly

The assembly process for SolarEdge Power Optimizers as described to DNV generally involves the following four main process steps:

- Receiving material
- Printed Circuit Board (PCB) Assembly
- Mechanical Top-Level Assembly
- Packing and Shipping

The receipt of materials includes an incoming inspection process to ensure that the components conform to those specified in the design BOM and are provided by approved vendors. PCB assembly includes the application of solder paste on the circuit board, installation of surface mount (SMT) components on the board and a reflow soldering process. This takes place using automated equipment for the SolarEdge PCBs. Additional components are inserted manually and then electrically connected to the board by a wave soldering process. Testing occurs at several steps during the manufacturing process (as described in the following section) and the final product is packaged for shipment. Key production quality gates and capabilities include:

- IQC
    - Incoming goods and material QC tests at WH
    - Mechanical parts screening
    - Extra test for specific parts – glands, PEMs, chokes
- Testers: workmanship level, board level, product level, system level
- Advanced (non-human) QC tools
    - Automatic screwdrivers with screw counting & torque control
    - Automatic dispensers
    - Automatic optical assembly controls
- Multiple QC stations
    - QC is performed at multiple stations from good receiving (WH) till packaging
- Batch sampling
    - Full 'Out of Box' inspection and disassembly
    - Burn In

Optical inspections of the PCBs and mechanical assembly are critical quality steps. The optical inspection of the circuit boards is done through an automated tester. SolarEdge additionally employs an “out of box” (OOB) final sampling inspection of a percentage of the units to verify that the proper equipment and materials are included in the shipping containers. DNV views the assembly methods, including in-process inspections, used for the SolarEdge products to be in line with industry best-practices and include the proper process checks.

5.2.2 Manufacturing Testing

Critical to the successful production of SolarEdge Power Optimizers and Inverters is the testing that occurs throughout the manufacturing process. The key manufacturing testing steps are given in the flow diagram in Figure 5-.

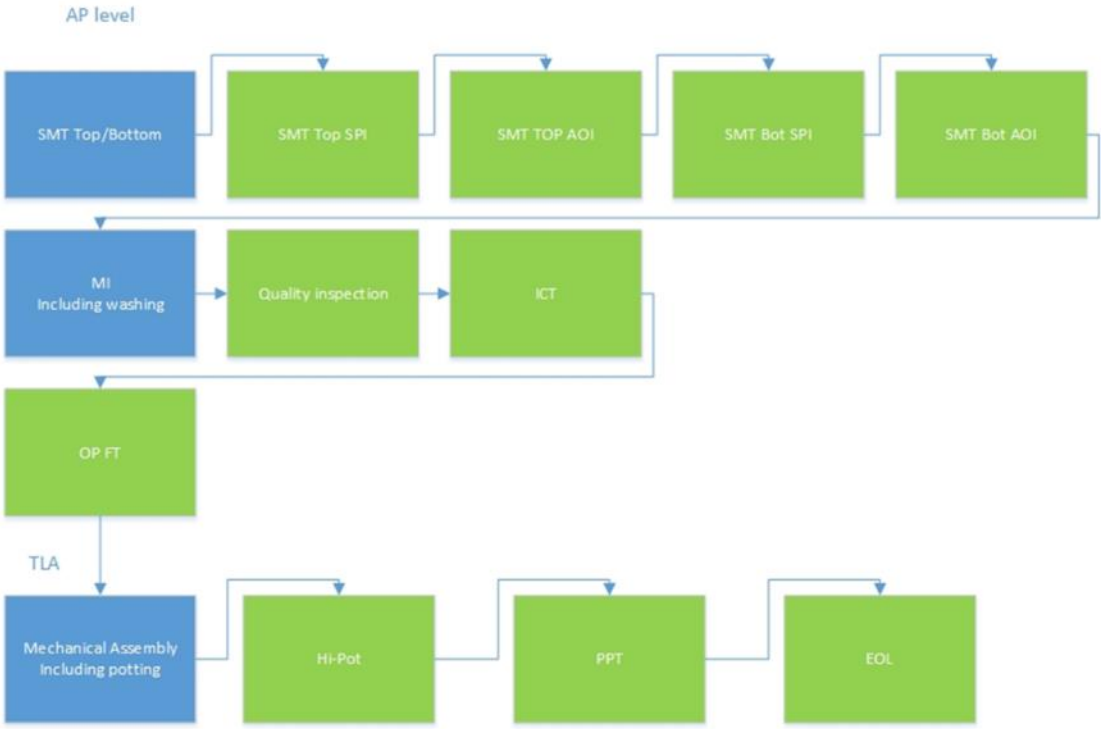


Figure 5-2 SolarEdge Optimizer Manufacturing Test Steps

DNV views the in-circuit testing (ICT) of the completed PCBs and the functional testing to be the most critical tests. The ICT occurs using a “bed of nails” type of automatic test equipment that provides a very high coverage of over 97% of the board.

The functional testing is an automated test that operates the optimizer or inverter throughout its operating range and checks all functionality. SolarEdge develops the functional test fixtures and provides it to the contract manufacturer. This allows SolarEdge to have full control of this critical testing process which is consistent with best industry practices.

SolarEdge utilizes burn-in for inverters at a 1% sample rate, after End-of-Line (EOL) tests, for 48 hours at an ambient temperature of 50°C. After burn-in, inverters are retested through the EOL tests, and upon passing, the sample group of inverters from which the tested inverter was randomly chosen are released for shipment. A failure causes multiple corrective actions to take place, and the sample group of inverters is held until resolution of the failure mode is reached.

Additionally, every day SolarEdge optimizers are tested applying the long burn-in procedure of operating a total of 25-50 optimizers with the appropriate inverters for a period of at least 30 days at elevated temperature. Failure of an optimizer or inverter will trigger multiple corrective actions to determine the root cause and to implement any corrective action changes.

SolarEdge provided detailed test plans and sample results for each of these important manufacturing tests which DNV reviewed and found to be thorough.

5.3 Manufacturing Facility Visit

DNV visited the Flextronics facility in Zalaegerseg, Hungary that produces SolarEdge products, for a previous SolarEdge report. The building is shown in below. DNV met with appropriate Flextronics staff and toured through all stages of manufacturing. SolarEdge manufacturing and quality representatives were present on site and participated. The manufacturing facility was clean, organized, and attention was clearly given to both quality and safety. As noted above, it is understood that the manufacturing process and testing is the same at the Jabil facility in China and DNV is comfortable with the Flextronics inspection as being representative of both production processes.

Figure 5-3 Flextronics Facility

Several steps in the process are shown in the photos for reference.

Incoming materials and completed SolarEdge units are stored at the warehouse shown in Figure 5-.

Figure 5-4 Flextronics Warehouse

An example of incoming inspection is shown in. DNV witnessed Flextronics personnel appropriately checking incoming materials to be used in SolarEdge products.

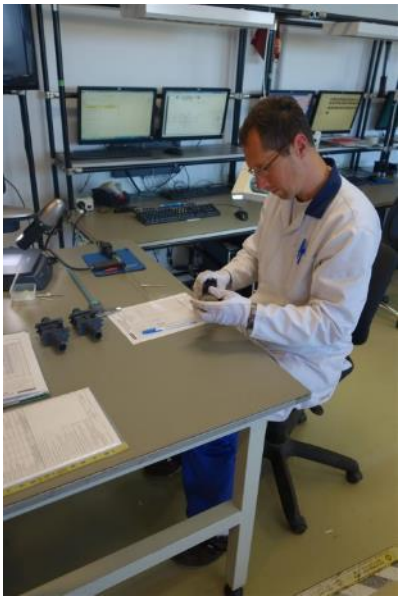


Figure 5-5 Flextronics Incoming Inspection

An overview of the area of the factory where SolarEdge Optimizers and inverters are assembled and tested is shown in Figure 5-.

Figure 5-6 Overlook of SolarEdge Manufacturing Area

DNV viewed the PCB assembly line which is shown in Figure 5-. Optical inspection equipment is included in the process. The same equipment is used for the PCB assembly for Optimizers and inverters. Larger components are inserted manually. The process and equipment being used is considered by DNV to be appropriate for the SolarEdge products.

Figure 5-7 Printed Circuit Board Component Assembly Equipment

Figure 5- shows an example of the manufacturing process monitoring displays and information communications bulletin boards in the Flextronics factory. There are many of these displays positioned along the manufacturing line. DNV observed the tracking of key components through barcoding.

Figure 5-8 Process Monitoring and Communications

Optimizers undergoing integrative testing are shown in the racks in Figure 5-.

Figure 5-9 Optimizers Undergoing Integrative Testing

Inverter Top Level Assembly (TLA) is shown in Figure 5-. Larger components are installed manually. Work instructions were visible on computer screens at the assembly stations.

Figure 5-10 SolarEdge Inverter Assembly

Inverters undergoing functional testing are shown in and the packaging for a completed inverter is shown in Figure 5-.

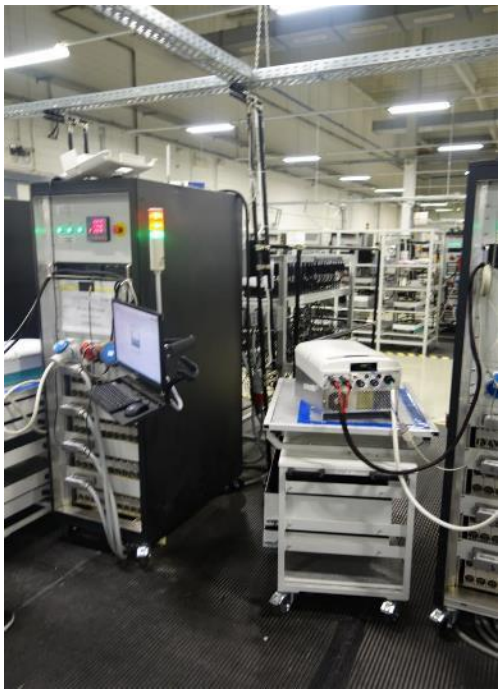


Figure 5-11 SolarEdge Inverters Undergoing Manufacturing Test

The inverters are shipped in a customizable state and are localized at the SolarEdge “Hubs” in each global region.

Figure 5-12 Packaging of SolarEdge Inverter

DNV finds the manufacturing assembly and test processes being utilized to be well suited for the SolarEdge products.

At the time of the DNV visit to the Flextronics factory, the installation of an additional Optimizer production line was underway. This new Automatic Assembly Center line will eliminate the manual assembly steps in Optimizer production. It is shown in Figure 5- below. It is an example of continual process improvement by SolarEdge.

Figure 5-13 Installation of Automatic Assembly Center Under Installation

6 FIELD RELIABILITY HISTORY

SolarEdge routinely analyzes field failure data as a means of tracking reliability. All significant failure modes are analyzed to determine the root causes. SolarEdge reports that of the failures reviewed, none represent component wear-out. The data presented to DNV was for a period starting in July 2019 through December 2021, and represents the products described in this report.

6.1 Field Failure Data

The first chart shown in Figure 6- represents the entire family of SolarEdge optimizers. This includes the new S-series optimizers.

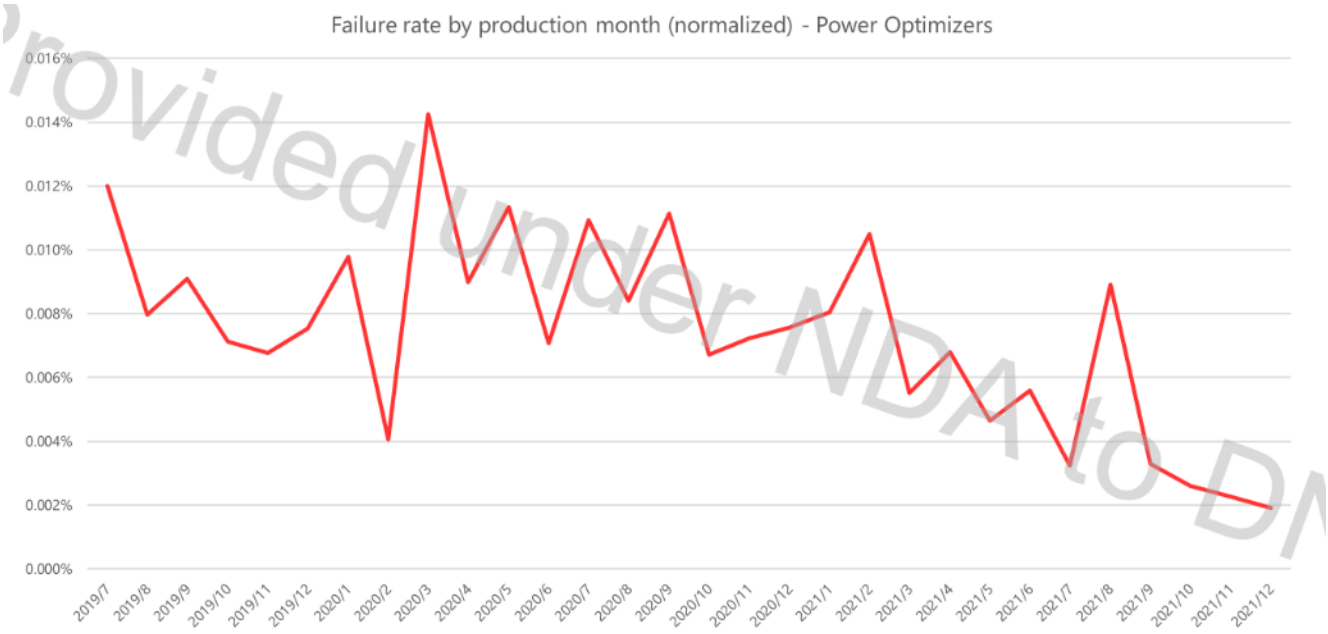


Figure 6-1 SolarEdge Power Optimizer failure rate (normalized) by production month

The data in the above figure represents the normalized field failure rate, where the monthly calculations are based on the following formula, provided by SolarEdge:

Normalized Monthly Failure Rate *= (# of units failed) / ((# of units produced) * (# of months since first production))*

This formula provides a calculation that is useful when reviewing the failure rate of a growing population, however, because the number of months since the production date for each inverter is included in the denominator, the resulting failure rate calculation can become very low as the early inverters accumulate months of relatively failure-free operation, and if more recently manufactured optimizers experience far fewer failures. This appears to be the case where the failure rate of recent SolarEdge optimizers is much improved.

Independent of the method used to display the data, the chart in Figure 6- indicates that the failure rate is quite low. For a time period in 2019 and 2020, the optimizer normalized failure rate peaked at 0.014%. Within approximately the last one-year period, the failure rate has improved significantly and is trending in the right direction, more in alignment with

SolarEdge's own failure rate expectation of only 0.44% optimizer failure rate after 25 years of operation. The failure rate expectation of 0.44% is quite low when compared to competing technologies.

In Figure 6-, SolarEdge provided the details regarding the types of field failures experienced. Tracking the causes of field failures provides valuable information that SolarEdge uses to improve their products.

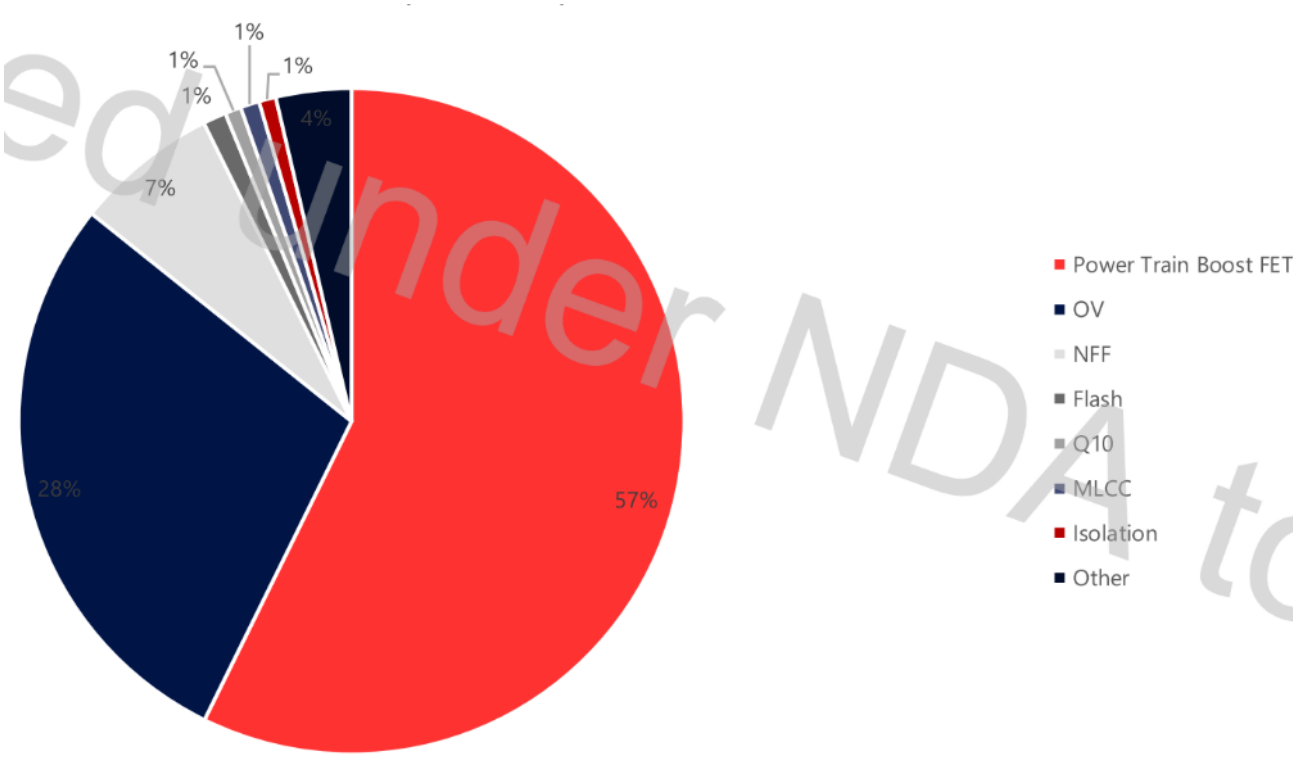


Figure 6-2 SolarEdge Optimizer field failure pareto chart

The most common occurrences were the 'Power Train Boost FET' and 'OV' faults. SolarEdge described the 'Power Train Boost FET' failure type as a software issue resulting in cross-conduction during wakeup/sleep modes. SolarEdge revised the software and updated the effected units remotely. 'OV' fault was caused by a hardware issue. SolarEdge changed the hardware in new production units.

The new S-series optimizer units became available in December 2021. During this period SolarEdge manufactured 7.5M S-series optimizer units compared with 40M P-series optimizer units. SolarEdge provided the chart shown in Figure 6-3 comparing the monthly failures rates of both optimizer series during this period. As seen the failure rate of the new S-series model is significantly lower than the P-series models.

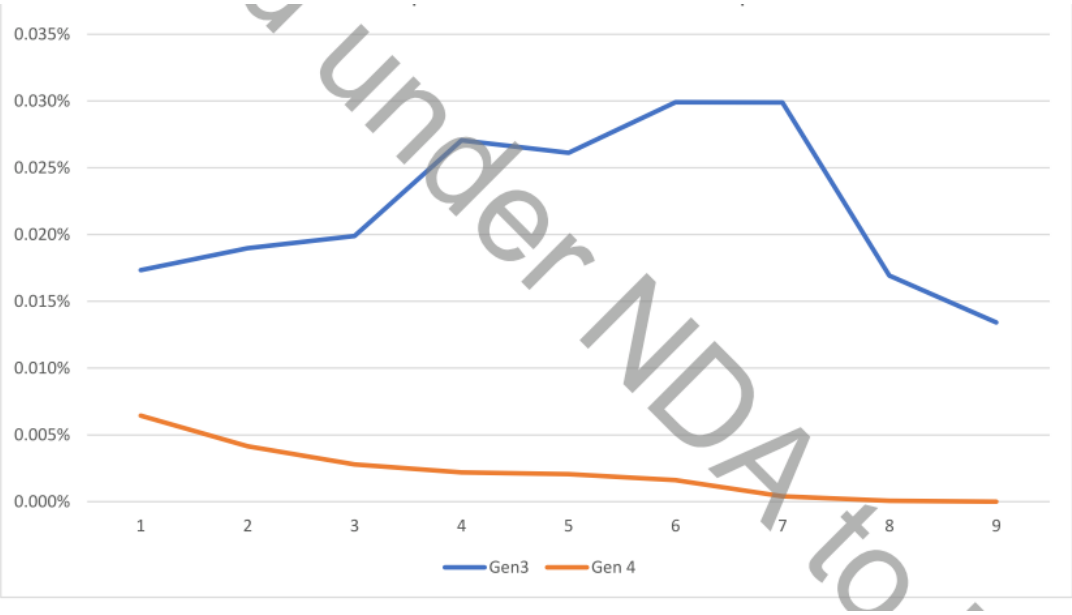


Figure 6-3 Failure rate comparison of P-series (Gen3) and S-series (Gen4) Power Optimizers

The chart in Figure 6-4 shows the normalized monthly failure rate for the family of single phase HD-Wave inverters. SolarEdge reports that the majority of the failure modes, shown in Figure 6-5, were due to component failures and manufacturing process issues that resulted in failures early in inverter life. 'Vcap/power train failure' issue was caused by cracked capacitors due to manufacturing issues. SolarEdge changed board width to increase the mechanical strength as well as changed the capacitor supplier to address this failure mode. Similar component and assembly process changes were made to other dominant failure modes. The changes implemented as a result of the internal review by SolarEdge resulted in the reduced failure rate shown in Figure 6-4.

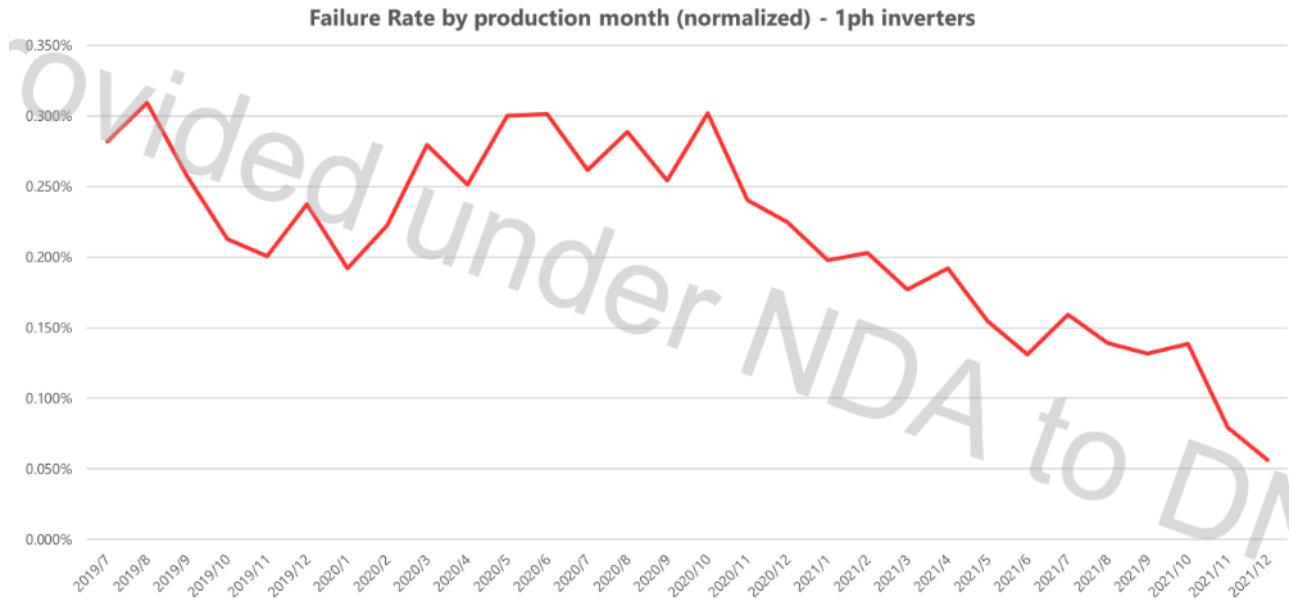


Figure 6-4 HD-Wave single phase inverter failures by production month

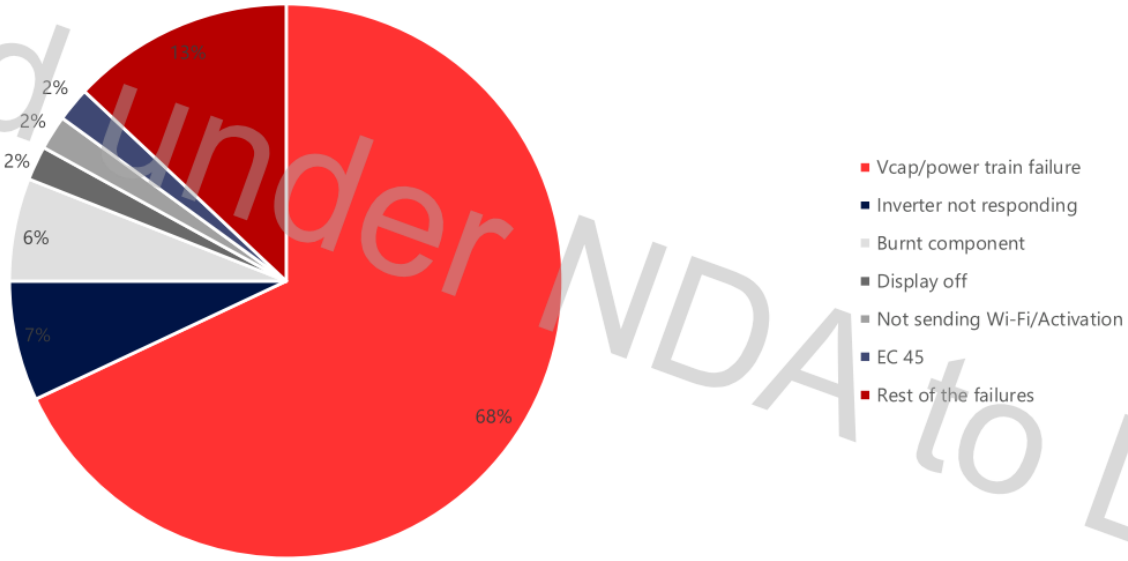


Figure 6-5 HD-Wave single phase inverter field failure pareto chart

The three phase inverter failure rate, as shown in Figure 6-6. Like optimizer and single phase inverters, it demonstrates continuing improvement in reliability, however, the initial failure rate was higher, peaking at around 0.2% where 0.1% or less was expected. Similar to the single phase inverters, the three phase inverters experienced issues due to component failures and manufacturing process issues that were address over time, bringing the monthly normalized failure rate more in-line with SolarEdge expectations.

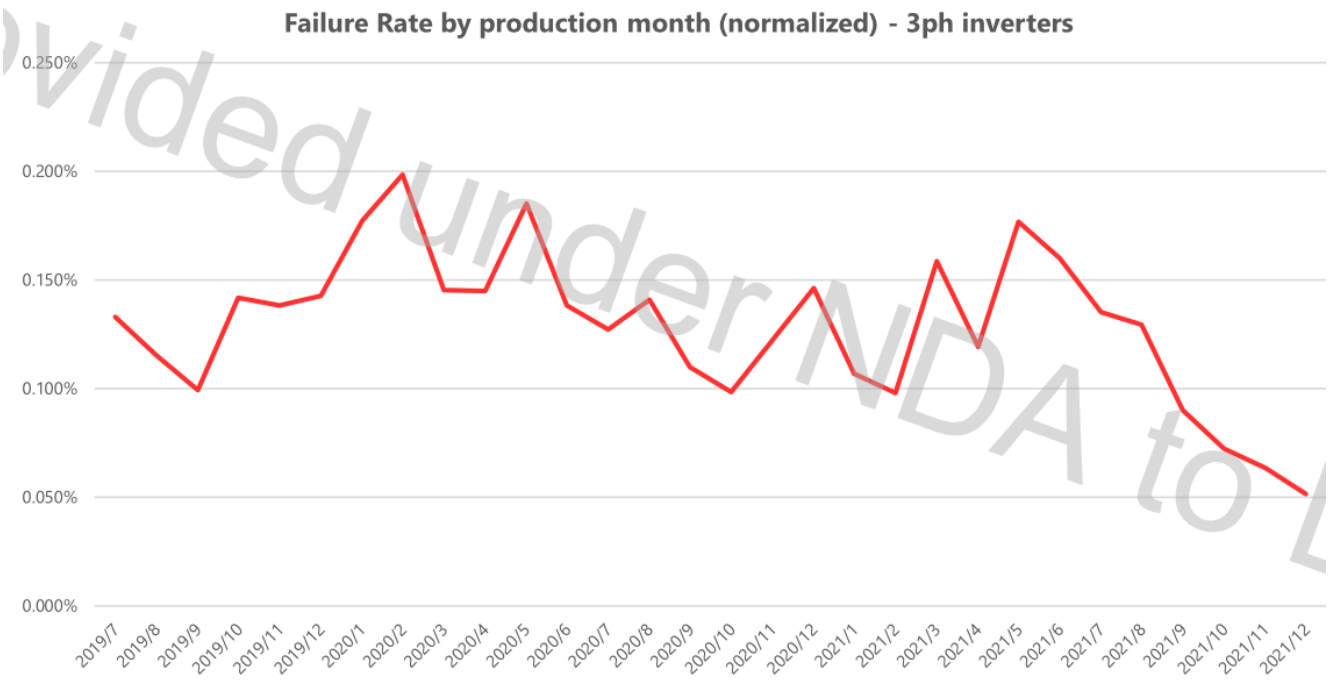


Figure 6-6 Three phase inverter failures by production month

The chart shown in Figure 6-7 provides insight into the types of failures experienced in the three phase inverters, with power train issues causing 36% of the problems. SolarEdge reported that power train issues were caused by insufficient thermal paste application under IGBTs and poor thermal dissipation around ac connector area. Both issues have been addressed and resolved. Filter capacitor issue was caused in increase in ESR of some capacitors due to humidity. SolarEdge addressed the failure mode by replacing the capacitor.

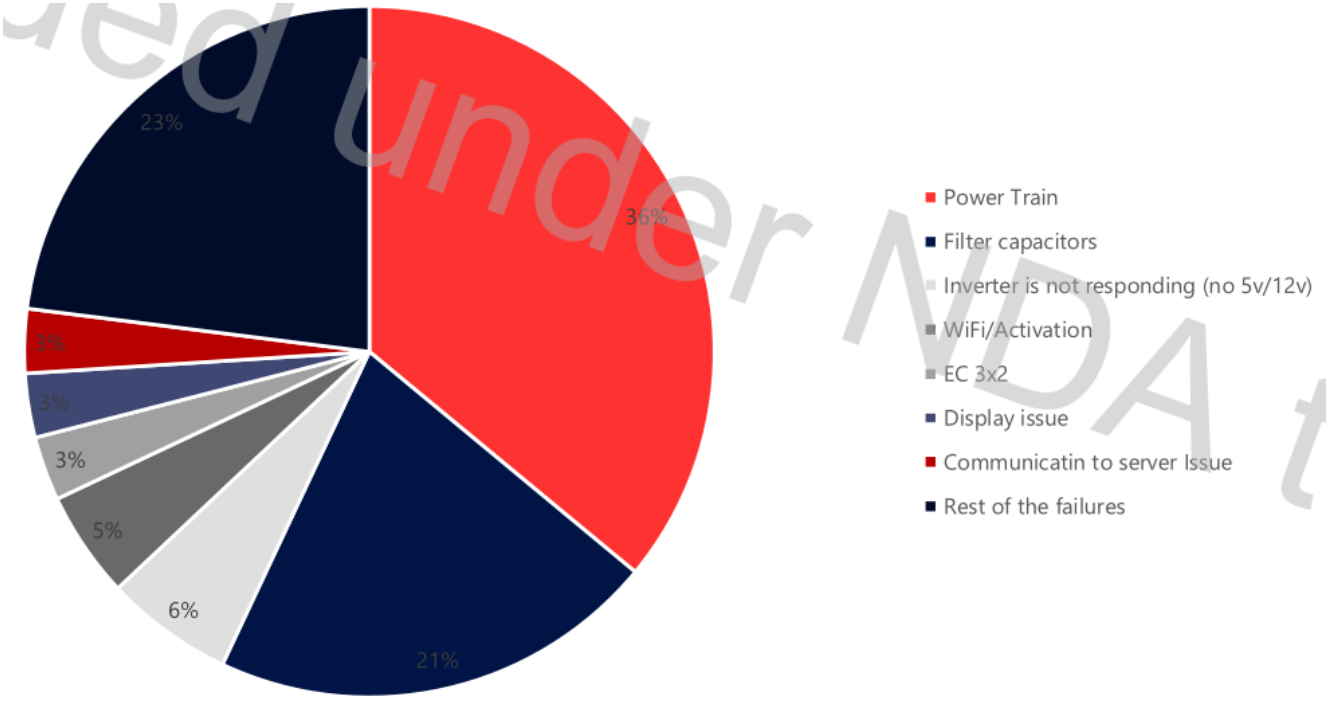


Figure 6-7 SolarEdge three phase inverter pareto chart

DNV views it positively that SolarEdge is thoroughly analyzing the field data as part of their product reliability improvement efforts. To provide clarity to the issue of SolarEdge product infant mortality, SolarEdge provided the graph shown in Figure 6-8. The graph is not intended to provide failure rate data but to illustrate the overall improvement trend, year over year, broken down by annual manufacturing series. In the graph, the failures are counted based on the age (in months) of all units shipped, independent of date of manufacture. In this manner, the monthly failure rate of all units is displayed, with the three lines indicating year of manufacture. The graph shows a reduction in failure rate, from 2019 through 2021. Additionally, the data indicate that for a group of units, for example – shipped in 2019, the monthly failure rate decreased over time. This decreasing failure rate support the perspective that these are infant mortality issues that impacted a percentage, but not all the total units installed each year. This is typical of problems described as infant mortality where variations in components and manufacturing processes create failures in a limited number of units manufactured.

Similar failure rates curves were provided by SolarEdge as part of previous DNV reviews. During the 2019-2020 timeframe, the failure rates clearly were greater than in 2021. However, the data demonstrates that these issues have been addressed, and future units of these same models are expected to be more reliable.

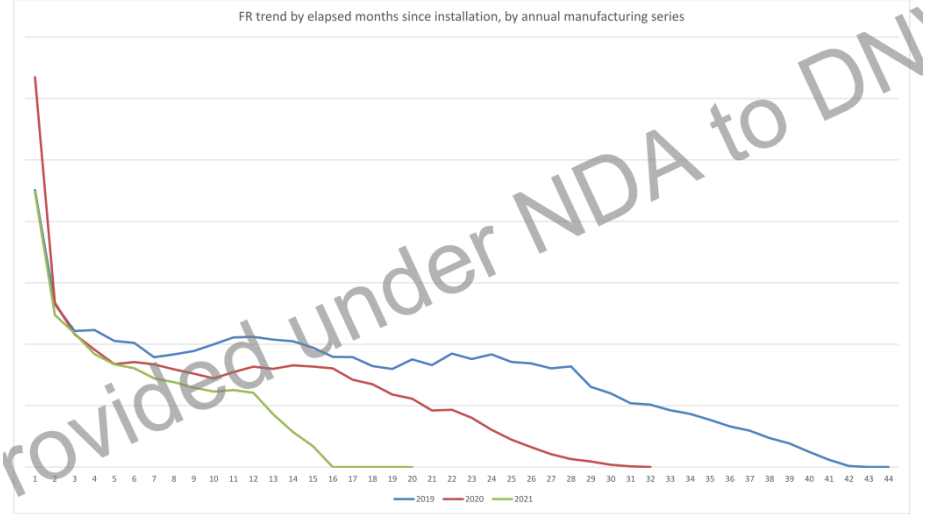


Figure 6-8 Failure rate for all SolarEdge shipped units by year

6.2 Failure Analysis

During previous technology reviews of SolarEdge by DNV, SolarEdge described their process of failure analysis as presented in their Reliability Handbook as follows: Starting with their field tests phase, every failure of units installed in the field was analyzed by the SolarEdge reliability group only, to avoid bias from the designer in failure investigation. Every failure was investigated until the root cause was found, corrected and led to an appropriate Engineering Change Order (ECO). A “Proof of Failure Mechanism” technique was incorporated in which hypothetical failure mechanisms were simulated in the lab in order to prove that root cause of the failure was understood completely. In some cases, SolarEdge outsourced help from external consultants and tier-one failure analysis (FA) labs in Israel and abroad.

Below in Table 6-, Table 6- and Table 6-are the breakdowns of failure types further illustrating the results of their failure analysis process for the power optimizers, single phase inverters and three phase inverters respectively. Some of the information presented in these tables was discussed in previous section.

Table 6-1 SolarEdge Optimizer failure analysis and status

Optimizers: TOP-4 (93%) of Failures – Fixed or Improved

Failure	Failure Type	Failure Cause	Status
Power Train Boost FET	Software issue	Software issue resulting in cross-conduction under Wakeup/Sleep time	Fixed in Production and remotely
OV	HW Issue	Output high voltage relate to low protection Threshold	HW Changed
NFF	HW Issue	Optimizers were replaced due to wrong diagnosis	Improved troubleshooting process
Flash	HW Issue	Parameter are erased due to corrupt Flash	Changed flash memory syupplier

Table 6-2 SolarEdge HD-Wave single phase inverter failure analysis and status

1ph inverters: TOP-4 (85%) of Failures – Fixed or Improved			
Failure	Failure Type	Failure Cause	Status
Vcap/power train failure	Component failure	Cracked capacitors due to manufacturing issues	Boards width has been changed to 2mm to increase the mechanical strength; changed capacitors supplier
Inverter not responding	Assembly	Portia CMC burnt	updated CMC , IR LED 3x2 reported as not responding - updated washing jig
Burnt component	Component failure	Cracked capacitors due to manufacturing issues	Boards width has been changed to 2mm to increase the mechanical strength; changed capacitors supplier
Display off	Component failure	LCD manufacturing issues	Old product, not selling those anymore. SolarEdge product no longer support LCDs
Not sending Wi-Fi/Activation	Assembly and SW	Multiple root causes (e.g. QR code problem, antenna setting problem)	Adding antenna tests at CM, updated SW and guidance and tool for support to handle configuration issues in field

Table 6-3 SolarEdge three phase inverter failure analysis and status

3ph inverters: TOP-4 (77%) of Failures – Fixed or Improved			
[illegible]	Failure Type	Failure Cause	Status
Power Train	Assembly	Insufficient thermal paste in IGBT module and poor thermal dissipation around AC connector area	Moved to new product - JPI with better thermal dissipation
Filter capacitors	Component design	Some of the capacitors to increase ESR and to over-heat due to humidity	We changed the caps to BM THB that to eliminate the problem
Inverter is not responding (no 5v/12v)	Assembly	Portia CMC burnt	Updated CMC , IR LED 3x2 reported as not responding - updated washing jig
WiFi/Activation	Assembly, component and SW	Multiple root causes like (e.g. QR code problem, antenna setting problem)	Added antenna tests at the CM facility, updated SW and guidance and tool for support to handle configuration issues in field
EC 3x2	Assembly	IR LED 3x2 issue reported as not responding or Manager DSP param reset	Improved washing that caused the IR issue, updated SW for the reset problem
Display issue	Component	LCD manufacturing issues	Removed LCDs from all products
Communication to server Issue	SW	LTE BG96 modem failures due to network antennas issues ,Flash corruption issues, SIM activation issues	1. Bug fixes in SW prevented flash corruption in Portia 2. Wifi had corruption on power off. Mechanism for prevention implemented 3. Fulfilment process improved such that no un-registered SIM cards is provided anymore

A review by DNV of a 14-page overview of circuit failures and corrective actions presented by SolarEdge found that the failures were largely caused by the processes of soldering, washing, assembly, and thermal grease application, in addition to issues with vendor-supplied components. Many of the issues appear to be of the type that become readily apparent only after manufacturing a significant number of units. Characteristics of the failures align with “infant mortality” of electronic assemblies during volume, serial production ramp-up. Comparing the table shown above to the failure data reviewed by DNV in 2019, it is clear that the improvements made by SolarEdge have significantly improved the reliability of their products.

DNV views SolarEdge’s approach to product reliability to be thorough and following good engineering practices. These include design for reliability, reliability testing, and analysis of field failure data. While the processes at SolarEdge are strong and reflect good engineering practices, it is unfortunate that relatively minor issues in manufacturing impacted product reliability.

7 FAILURE RATE MODELING

DNV has generated a model of expected reliability of the SolarEdge optimizer and inverter products. This is presented and discussed in the following sections.

7.1 SolarEdge Optimizer failure rate model

The DNV projection of the expected failure rate of the SolarEdge optimizers to be considered for service and economic modeling is given below in Table 7-1. Note that this is for the presently shipping versions of the Optimizer products as discussed in this report and future versions may have different reliability performance. The model does not address the reliability of installed SolarEdge optimizers. The Base Case Failure Rate column is derived from the DNV analysis of the SolarEdge data and calculations provided. The Conservative Failure Rate column of the table uses a multiplicative scale factor of 150% above the base case in the first 15 years and then the scale factor is increased to 167% for the following 10 years. This is based on the information provided and DNV's experience with solar electronics reliability. This conclusion includes the expectation that there are no significant changes to the product and that there are no serial defects.

Failure percentages shown reflect the failure expectations annually for a population of optimizers installed at approximately the same time. For the purposes of this table, the total population used in the denominator was not reduced by the number of previously failed units, therefore the number shown is the likelihood of failure relative to the population initially installed. Subsequent failures would be modeled by applying the failure rates again to capture the expected failure rates for replacement units.

For this update report, the base-case optimizer failure rate was based on the expected optimizer failure rate looking forward, as new units are manufactured. The failure rate projection is based on expected reliability after the recent corrective actions were implemented into the manufacturing process. The recent field experience was taken into consideration, however, the projections in Table 7-1 are not an extrapolation of only the recent experience. Note that the base-case and conservative failure rates for the first five years of field operation were the only projections adjusted. The changes increased these two rates, to be in-line with other DNV projections that include "infant mortality" issues. The multiplicative scale factor of 150% for the conservative-case failure rate was then applied to the base-case.

Table 7-1 SolarEdge Optimizer Annual Failure Rate Projections

Year of Operation	Base Case Failure Rate	Conservative Failure Rate
1-5	0.36%	0.54%
6-10	0.15%	0.23%
11-15	0.2%	0.3%
16-20	0.33%	0.55%
21-25	0.55%	0.92%

DNV recommends that customers of SolarEdge Optimizers consider both the Base Case Failure Rate and the Conservative Failure Rate in budgeting for typical operations and maintenance costs. While there is relatively limited historical field failure data to do a full statistical analysis, the base case and conservative case could be considered (for discussion purposes) to be "P50" and "P90" values, respectively.[1]

[1] P-values refer to a "probability of exceedance" and are commonly used in the renewable energy industry in the context of confidence limits for energy estimates. "P90" means that there is a 90% confidence that the numbers will be equal to or lower than the listed values.

This DNV projection reflects the design for reliability approach and extensive reliability testing that SolarEdge has performed. The field performance data provided covering operation of the optimizers to date is key to this projection. As further data become available in the future, these conclusions can be updated.

SolarEdge has stated that the expected lifetime of the Optimizers is 25 years. The data provided are consistent for a 25 year or greater product life for the Optimizers. The failure projection by DNV is not intended to predict reliability beyond 25 years, since long-term optimizer reliability data to compare to are simply not available for the PV industry.

Another consideration is that the failure of a single optimizer will not completely remove the associated module from power production, rather that it will not be at its maximum power production point. The impact on the entire string can be relatively small. This fact should be included in the expected system performance model.

7.2 SolarEdge HD-Wave Inverter failure rate model

DNV has also generated a model of expected reliability for the SolarEdge HD-Wave Inverter products. In creating the model, DNV took into consideration the many aspects of inverter reliability discussed in this report, in addition to component-level reliability efforts by SolarEdge.

During previous studies of SolarEdge, DNV reviewed in detail the reliability data provided by SolarEdge for the following components:

- Switching Power Modules
- Film Capacitors
- Power Relays
- Insulated Gate Bipolar Transistors (IGBTs)

SolarEdge analyzes component data and performs reliability tests to select parts which will perform well in the application. DNV agrees that such component evaluations are critical for achieving the goal of long product life. Also, the use of film capacitors in the HD-Wave inverters reduces concerns about capacitors aging and reaching early end-of-life.

The DNV projection of the expected failure rate of the SolarEdge Single-phase Inverters to be considered for service and economic modeling is given below in Table 7-2. As with the optimizers, future inverter versions may perform differently depending on their specific design. The Base Case Failure Rate column is derived from the DNV analysis of the SolarEdge data and calculations provided, and the Conservative Failure Rate column of the table uses a multiplicative scale factor of 150% above the base case. These conclusions do reflect the expectation that there are no significant changes to the product.

As part of previous review, the model was adjusted to take into consideration the “infant mortality” issues addressed by SolarEdge for the HD-Wave inverters. Since the projection is forward-looking and provide guidance for inverters currently in manufacturing, and inverters of the same models to be manufactured in the future, the model provides failure rates for inverters with the necessary corrective actions already implemented. Therefore, the adjustment to the model was to take into consideration the possibility of problems of unforeseen origins in future units manufactured. The relationship of past performance to future predictions is one of the core assumptions in the DNV failure rate modelling. Also, because the problems encountered were associated with manufacturing process and appeared as “infant mortality,” the adjustment to the model was made during the first two years of field operation. The experience of infant mortality in the 2017-2018 timeframe was within the failure rate projection, on an annual basis.

Table 7-2 SolarEdge HD-Wave Inverter Annual Failure Rate Projection

Year of Operation	Base Case Failure Rate	Conservative Failure Rate
1	3%	4.5%
2	2%	3.0%
3	1%	1.5%
4	1%	1.5%
5	1%	1.5%
6	1%	1.5%
7	1%	1.5%
8	1%	1.5%
9	1%	1.5%
10	1%	1.5%
11	1%	1.5%
12	1%	3.8%
13	1%	7.5%
14	3.8%	17.5%
15	7.5%	25%
16	17.5%	17.5%
17	28.5%	7.5%
18	17.5%	0.2%
19	7.5%	
29	1.7%	

The table of projected failure rates was built based on SolarEdge's design for reliability methodology, reliability testing, and field history combined with DNV adjustments. The first years in the base-case scenario was heavily influenced by the field history. The conservative-case failure rate is again created by increasing the base-case by 150%. After 14 years, the base case model predicts a cumulative failure of 19.8% of the inverter installed.

The projected failure rates for the base-case support a typical inverter life of slightly above 16 years, with the peak failure rate occurring in year 17. For the conservative-case, the average life is slightly greater than 14 years, with the peak failure rate at 15 years, as shown in Figure 7-1.

DNV recommends that customers of SolarEdge Inverters consider both the Base Case Failure Rate and the Conservative Failure Rate in budgeting for typical operations and maintenance costs. While there is relatively limited historical field failure data to do a full statistical analysis, the base case and conservative case could be considered (for discussion purposes) to be "P50" and "P90" values, respectively.

The standard warranty period offered by SolarEdge for their inverters is 12 years.

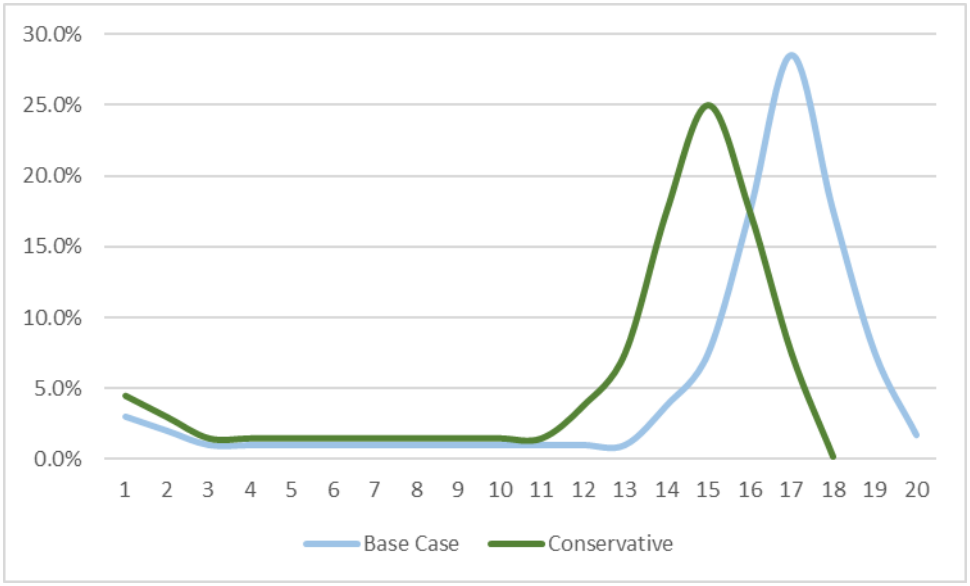


Figure 7-1 SolarEdge single-phase inverter annual failure rates

7.2.1 SolarEdge Three phase Inverter failure rate model

Table 7-3 shows similar failure rate projections for the three-phase inverters, with the accompanying chart in Figure 7-. The three-phase life projection is very similar to the single-phase, with slightly higher failure rates during the flat part of the curve, before wear-out begins, due to the increased complexity of three-phase inverters. The base case inverter life is again approximately 14 years with 20.8% of inverters failing by the end of year 12. This three phase useful life projection is unchanged by DNV since the last report. The infant mortality issues encountered in the 2017-2018 timeframe were accounted for in the year 1 failure rate of the original model. A first-year increase is typical for all DNV failure rate projections.

Table 7-3 SolarEdge Three-phase Inverter Annual Failure Rate Projection

Year of Operation	Base Case Failure Rate	Conservative Failure Rate
1	2%	3%
2	1.5%	2.3%
3	1.5%	2.3%
4	1.5%	2.3%
5	1.5%	2.3%
6	1.5%	2.3%
7	1.5%	2.3%
8	1.5%	2.3%
9	1.5%	2.3%
10	1.5%	3.8%
11	1.5%	7.5%
12	3.8%	17.5%
13	7.5%	25%
14	17.5%	17.5%
15	29%	7.3%
16	17.5%	
17	7.7%	

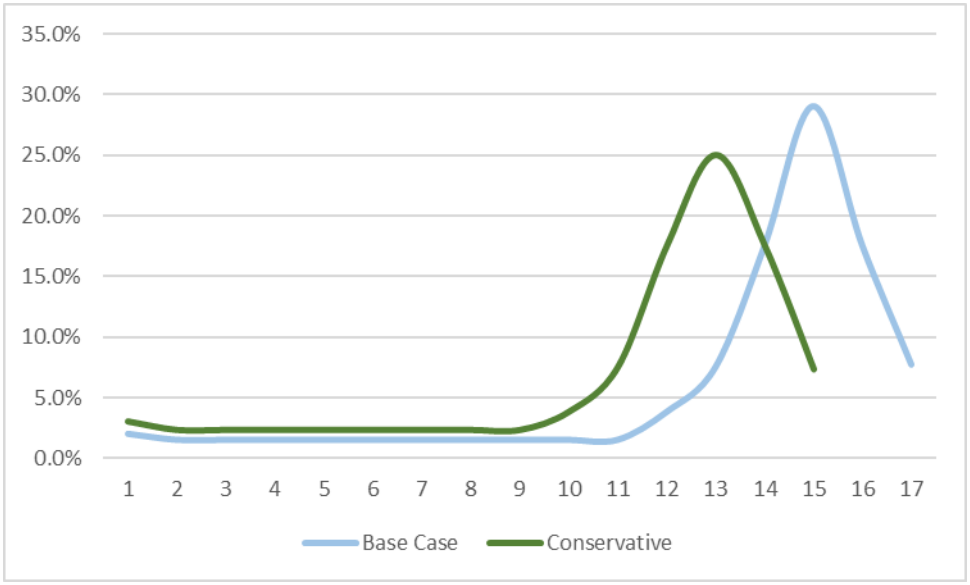


Figure 7-2 SolarEdge Three-phase Inverter annual failure rates

7.2.2 Failure rate summary

The life models shown were based on the strong product developmental program, good validation testing, and the recent field history presented by SolarEdge. SolarEdge provided detailed reliability analysis and test results for several key inverter components. Internal life projections by SolarEdge indicate longer life than DNV's opinion, based largely on the internal calculations combined with component-level analysis and accelerated testing.

The life models predict failure rates for units currently in production and future units of the same models. The life models are not intended to represent the optimizers and inverters that recently experienced infant mortality issues during production ramp-up. These units are expected to be adequately reliable going-forward, since early infant mortality issues will have already resulted in failure and replacement for the limited number of units affected. All optimizers and inverters shipped in the 2017-2018 time period are under warranty. SolarEdge is financially stable, and in a position to fully honor their warranties.

Additionally, information provided by SolarEdge indicates that the vast majority of issues have been resolved, with field failure rates becoming more in-line with SolarEdge product expectations.

7.3 Regulatory and Standards Evaluation

7.3.1 Applicable Standards

Table 7-4 below provides the most important standards for PV power conversion equipment to be certified to for access to the North American market.

Table 7-4 Important North American PV Power Conversion Equipment Standards

Standard	Title
UL 1741	Standard for Safety Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
UL 1741 SA	Supplement specifications for Grid Support Utility Interactive Inverters
IEEE 1547	Standard for Interconnecting Distributed Resources with Electric Power Systems
CSA 22.2 No. 107.1-01(Revised 2006)	Safety Requirements for General Use Power Supplies (Canada)

The UL 1741 Standard is the “Standard for Safety - Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources.” It is based on the IEEE 1547 “Standard for Interconnecting Distributed Resources with Electric Power Systems.” Compliance with UL 1741 is typically accepted as covering the IEEE 1547 requirements. A UL1741 listing is generally required for all PV inverters that connect to the utility grid in North America and employed in residential or commercial sized systems. UL 1741 Supplement A (“UL 1741 SA”) provide additional requirements that ensure reactive power and advanced grid functionality. It is also required for electronics such as the SolarEdge Power Optimizer. Certification to this standard involves a series of design inspections and tests. Especially challenging are the Anti-Islanding, grid protection, surge, and EMI testing requirements.

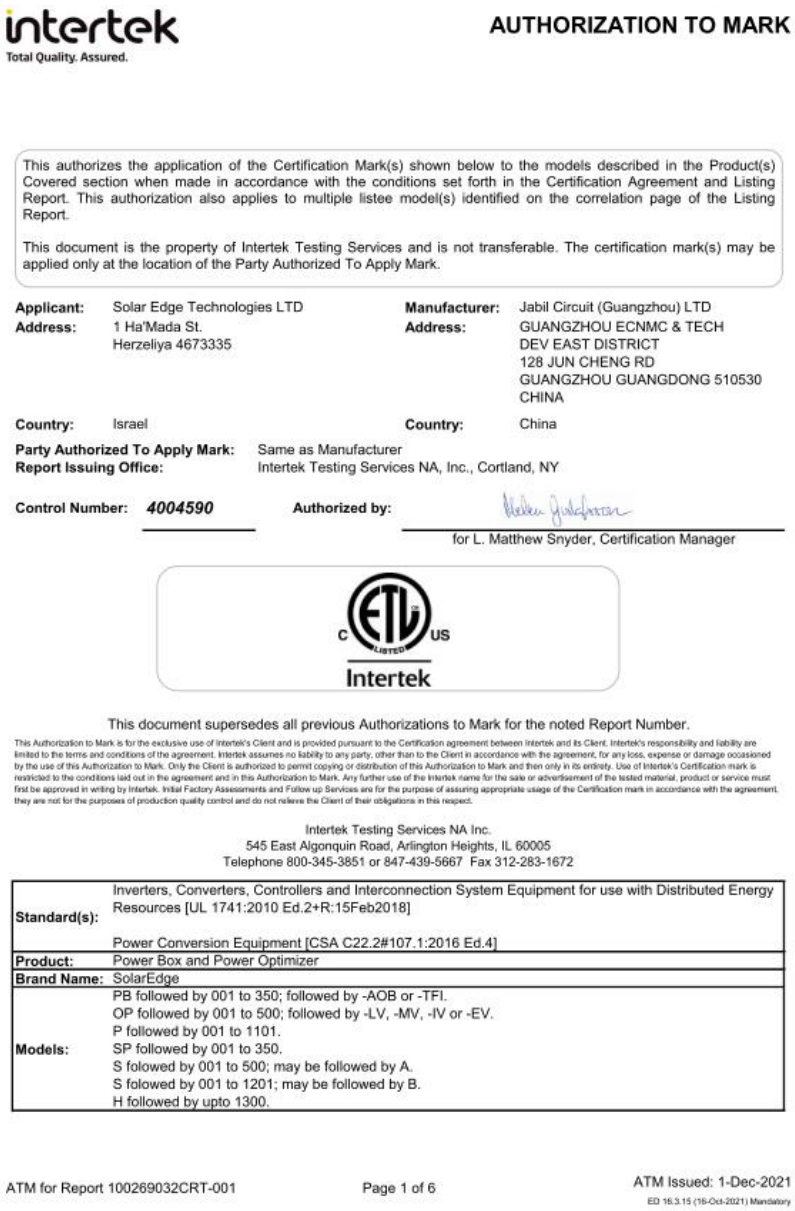
The U.S. Federal Communications Commission (FCC) requires that all telecom equipment and radio communication equipment meet minimum compliance standards. Part 15 of the FCC rules requires emissions testing to prevent harmful radio interference. These Standards have been applied to Solar PV inverters and related converter products as well.

DNV notes that the SolarEdge inverter products that are used internationally are certified to a number of other important international standards including IEC 62109-1 and VDE 0124-100.

7.3.2 Regulatory Test Reports

SolarEdge has provided DNV documents that show compliance from Intertek test labs and using ETL as the authorized marks for the line of inverters given in the data sheets. This includes UL 1741 and CSA 22.2 No. 107.1. SolarEdge has also provided DNV documents that show compliance to those standards for the Power Optimizers. DNV views these regulatory approvals to be appropriate for the SolarEdge Power Optimizers and Inverters.

Figure 7- is one example of a Letter of Authorization to Mark, authorizing SolarEdge to apply the Intertek mark. Such letters signify the successful completion of a battery of safety and performance tests overseen by Intertek, the US-based Nationally Recognized Testing Laboratory (NRTL).



intertek
Total Quality. Assured.

AUTHORIZATION TO MARK

This authorizes the application of the Certification Mark(s) shown below to the models described in the Product(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to multiple listee model(s) identified on the correlation page of the Listing Report.

This document is the property of Intertek Testing Services and is not transferable. The certification mark(s) may be applied only at the location of the Party Authorized To Apply Mark.

Applicant:	Solar Edge Technologies LTD	**Manufacturer:**	Jabil Circuit (Guangzhou) LTD
Address:	1 Ha'Mada St. Herzeliya 4673335	**Address:**	GUANGZHOU ECNMC & TECH DEV EAST DISTRICT 128 JUN CHENG RD GUANGZHOU GUANGDONG 510530 CHINA
Country:	Israel	**Country:**	China

Party Authorized To Apply Mark: Same as Manufacturer
Report Issuing Office: Intertek Testing Services NA, Inc., Cortland, NY

Control Number: *4004590* **Authorized by:**
for L. Matthew Snyder, Certification Manager

C ETL LISTED US
Intertek

This document supersedes all previous Authorizations to Mark for the noted Report Number.

This Authorization to Mark is for the exclusive use of Intertek's Client and is provided pursuant to the Certification agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this Authorization to Mark. Only the Client is authorized to permit copying or distribution of this Authorization to Mark and then only in its entirety. Use of Intertek's Certification mark is restricted to the conditions laid out in the agreement and in this Authorization to Mark. Any further use of the Intertek name for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. Initial Factory Assessments and Follow up Services are for the purpose of assuring appropriate usage of the Certification mark in accordance with the agreement, they are not for the purposes of production quality control and do not relieve the Client of their obligations in this respect.

Intertek Testing Services NA Inc.
545 East Algonquin Road, Arlington Heights, IL 60005
Telephone 800-345-3851 or 847-439-5667 Fax 312-283-1672

Standard(s):	Inverters, Converters, Controllers and Interconnection System Equipment for use with Distributed Energy Resources [UL 1741:2010 Ed.2+R:15Feb2018] Power Conversion Equipment [CSA C22.2#107.1:2016 Ed.4]
Product:	Power Box and Power Optimizer
Brand Name:	SolarEdge
Models:	PB followed by 001 to 350; followed by -AOB or -TFI. OP followed by 001 to 500; followed by -LV, -MV, -IV or -EV. P followed by 001 to 1101. SP followed by 001 to 350. S followed by 001 to 500; may be followed by A. S followed by 001 to 1201; may be followed by B. H followed by upto 1300.

ATM for Report 100269032CRT-001 Page 1 of 6 ATM Issued: 1-Dec-2021
ED 16.3.15 (16-Oct-2021) Mandatory

Figure 7-3 Example Intertek Authorization to Apply the UL 1741 Mark to Optimizers

SolarEdge also indicates on the product data sheets that the power optimizers and the inverters meet the requirements of FCC Part 15 Class B. SolarEdge provided DNV test reports from QualiTech EMC Lab for their Optimizer and the inverter products. The Certificate of Compliance (COC) for the Optimizers is given in Figure 7- below and the COC for the single phase HD-Wave inverters is shown in Figure 7-. The conformance to Class B is appropriate in the view of DNV for equipment that can be installed in residential systems.

Certificate of Compliance

Product name

Power Optimizer

Models: Pxxx where xxx is any number, 0-9 to a maximum up to xxx=960

Manufactured by

SolarEdge Technologies Ltd.

1 HaMada Street, Herzeliya 4673335, Israel

Tel: +972-9-9576620

A sample of the above product has been tested by our Laboratory in March 2020 and found to be compliant with relevant sections of the following standards:

FCC CFR 47 Part 15 Subpart B, ANSI C63.4:2014 (Radiated Emissions)

Refer to Test Report SED 100520 for detailed test results

Certificate No.: SED 100520

QualiTech

QualiTech EMC Laboratory
30 Hasivim Street,
Petah-Tikva, 49517, Israel
Tel: 972-3-926 6994 Fax: 972-3-928 7490

Rami Nataf, EMC Lab. Manager
May 10, 2020

ilac-MRA

ACCREDITED
Certificate 1633.01
Electrical Testing

Figure 7-4 Certificate of Compliance for SolarEdge optimizers to FCC Class B

Certificate of Compliance

Product name

Solaredge Single Phase HD-wave Inverter
Model: SE3000H-US, SE3800H-US, SE5000H-US, SE6000H-US, SE7600H-US

Manufactured by
SolarEdge Technologies Ltd.
Hamada 1, Herzliya, Israel
Tel: +972-9-9576620

A sample of the above product has been tested by our Laboratory in 2016 and is found to be in compliance with the relevant sections of the following standard:

FCC CFR 47 Part 15 Subpart B

Refer to Test Reports SGD 090516 & SED 151116 for detailed test results.

Certificate No.: SED 151116

QualiTech EMC Laboratory
30 Hasivim Street,
Petah-Tikva, 49517, Israel
Tel: 972-3-926 6994 Fax: 972-3-928 7490

Rami Nataf, EMC Lab. Manager
May 23, 2017

Figure 7-5 Certificate of Compliance for SolarEdge single phase inverters to FCC Class B

7.4 Quality System Evaluation

DNV reviewed the “Integrated Quality, Environmental, Occupational health and Safety, Laboratory Management Systems (QESHI-MS) Manual” provided by SolarEdge. It covers the requirements of the ISO 9001:2015 standard for Quality Management Systems (QMS), the ISO 14001:2015 for Environmental Management Systems (EMS), the ISO 45001:2018 Occupational Health and Safety (OH&S) Management Systems and the ISO 17025:2017 for General requirements for the competence of testing and calibration laboratories. This document was dated in May 25 2021 to integrate the ISO 17025 standard. The document originated in September 2011, and as of May 2021 was released at Revision 7.0. DNV reviewed this document and found it to be thorough.

SolarEdge QMS is formally certified to the ISO 9001:2015 standard by the registrars IQC (Institute of Quality & Control (IQC). The same registrars provide the certification of the SolarEdge EMS to the ISO 14001:2015 standard. The ISO certificates are provided in Figure 7- and Figure 7-. The initial SolarEdge certifications to these standards occurred in December 2011.

Institute of Quality & Control

CERTIFICATE

NO. I21676

This is to certify that
the Quality Management System of

Solaredge Technologies Ltd

1 Ha'mada St. Herzeliya, Israel-Offices
10 Tzela Ha-Har St. Industrial Zone, Modiin, Israel-Offices, Factory
2 Hamerkava St. Industrial Zone, Tziporit, Israel-Manufacture

Was audited by IQC and found to be
in compliance with the requirements of the standard:

ISO 9001:2015

This certificate is valid for
the following scope of activities:

Design, development according to ISO 90003:2014 guidelines, Design, Development, Production, Sales and Services of solar power electronic, monitoring systems, UPS, power supplies, voltage/supply stabilizers and power converters for the general & solar photovoltaic market.

This certificate is valid until:	20.12.2023
Certification cycle will end on:	20.12.2023
Date of first approval:	(21.12.2011) 05.01.2015

This certificate is subject to the continuing satisfactory operation of the Management System and periodic auditing by IQC

15.12.2020
Issue date

Nir Halpern, CEO

Institute of Quality & Control Ltd.
6 Ravnitzky St., Petah Tikva 4900617, Israel
Tel: 03-9313555, Fax: 03-9044406
E-Mail. info@iqc.co.il, www.iqc.co.il

IAF MGMT. SYS. RvA C 560

Figure 7-6 SolarEdge ISO 9001 certificate

Figure 7-7 SolarEdge ISO 14001 and ISO 45001 certificates

DNV views this third party QMS and EMS verification as favorable to SolarEdge.

Additionally, SolarEdge provided the ISO certificates for all their contract manufacturers. The certificates for Jabil are shown in Figure 7- and Figure 7- below.

ZERTIFIKAT • CERTIFICATE • 認證證書 • СЕРТИФИКАТ • CERTIFICADO • CERTIFICAT

UCB_F_12.03 2012-02

America

CERTIFICATE

The Certification Body of
TÜV SÜD AMERICA INC.

hereby certifies that

Jabil Inc.

Has implemented a Quality Management System in accordance with:

ISO 9001:2015

The scope of this Quality Management System includes:

Provision of Contract Design Services, Manufacture, Prototyping, Assembly, Injection Molding, Warehousing, Servicing, Repair and Distribution of Circuit Board Assemblies and related Accessories, System Assemblies, High Precision Mechanical Components, High-Level Assemblies and Finished Products for use in the Computer, Networking, Data Storage, Servers, Telecommunication, Consumer, Automotive, Defense, Aerospace, Instrumentation, Industrial and Medical sectors

Note: The QMS for the whole organization is certified

The participating location:

No. 1 Branch, Jabil Circuit (Guangzhou) Ltd.
388 Lian Yun Road, East Section
Guangzhou Economic and Technological Development District
Guangdong Province, P.R. China 510530

Unified social credit code/Organization code: 91440101677778375A

Has site specific activities that include:

1. Contract Manufacture, Assembly and Distribution of Circuit Board Assemblies and System Assemblies for use, but not limited to the Computer, Networking, Servers, Telecommunication, Consumer, Automotive, Industrial and Medical Sectors.
2. Assembly of Computer Output Electronic Equipment including Integration of Printing, Copying, Scanning and Fax Equipment.
3.Manufacture of Plastic Injection Molding Products

Certificate Expiry Date: August 17, 2023

Certificate Registration No: 951 08 4837-A1
(In conjunction with certificate no: 951 08 4837)

Issue Date: January 30, 2021

Reissue Date: N/A

The validity of this certificate is dependent on the validity of the main certificate

Information about this certificate can be inquired at the official website of Certification and Accreditation Administration of the People's Republic of China (www.cnca.gov.cn) The certified organization shall undergo and pass the regular surveillance audit to maintain the validity of this certificate.

Greg Bates
Director Business Assurance America

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Figure 7-8 Jabil ISO 9001 Certificate

ZERTIFIKAT · CERTIFICATE · 認證書 · СЕРТИФИКАТ · CERTIFICADO · CERTIFICAT

America

CERTIFICATE

The Certification Body of
TÜV SÜD AMERICA INC.

hereby certifies that

JABIL

Jabil Inc.

Has implemented an Environmental Management System in accordance with:

ISO 14001:2015

The scope of this Environmental Management System includes:

Provision of Contract Design Services, Manufacture, Prototyping, Assembly, Injection Molding, Warehousing, Servicing, Repair and Distribution of Circuit Board Assemblies and related Accessories, System Assemblies, High Precision Mechanical Components, High-Level Assemblies and Finished Products for use in the Computer, Networking, Data Storage, Servers, Telecommunication, Consumer, Automotive, Defense, Aerospace, Instrumentation, Industrial and Medical Sectors

The participating location:

Jabil Circuit (Guangzhou) Ltd.
128 Jun Cheng Road, East Section,
Guangzhou Economic and Technological Development District,
Guangdong Province, PRC 510530

Unified social credit code/Organization code: 91440101725649376F

Has site specific activities that include:

Contract Manufacture, Assembly and Distribution of Circuit Board Assemblies and System Assemblies for use, but not limited to the Computer, Networking, Servers, Telecommunication, Consumer, Automotive, Industrial and Medical sectors

Certificate Expiry Date: August 18, 2023

Certificate Registration No: 951 08 4838-A1
(In conjunction with certificate no: 951 08 4838)

Issue Date: December 4, 2020

Reissue Date: NA

The validity of this certificate is dependent on the validity of the main certificate

Information about this certificate can be inquired at the official website of Certification and Accreditation Administration of the People's Republic of China (www.cnca.gov.cn) The certified organization shall undergo and pass the regular surveillance audit to maintain the validity of this certificate.

Greg Bates
Director Business Assurance America

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America

CERTIFICATE

The Certification Body of
TÜV SÜD AMERICA INC.

hereby certifies that

JABIL

Jabil Circuit (Guangzhou) Ltd.
128 Jun Cheng Road, East Section,
Guangzhou Economic and Technological Development District
Guangzhou City, Guangdong Province, P.R. China
Postal Code: 510530

(see page 2 for additional locations)

Has implemented an Occupational Health and Safety Management System in accordance with:

ISO 45001:2018

The scope of this Management System includes:

Contract Manufacture, Assembly and Distribution of Circuit Board Assemblies and System Assemblies for Use, but not limited to the Computer, Networking, Servers, Telecommunication, Consumer, Automotive, Industrial, Medical Sectors, Printing, Copying, Scanning and Fax Equipment, Plastic Mechanical Parts of Printer, Manufacture of Plastic Injection Molding Products

Certificate Expiry Date: July 5, 2024

Certificate Registration No: 951 20 5200

Issue Date: July 6, 2021

Reissue Date: N/A

Greg Bates
Director Business Assurance America

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Figure 7-9 Jabil ISO 14001 and 45001 Certificates

8 PRODUCT SUPPORT

8.1 Service Infrastructure Evaluation

SolarEdge takes a multi-tiered service approach to its optimizer and inverter products. Support centers are in 27 countries including Israel, the United Kingdom, Italy, Germany, Greece, Australia, Japan, USA, France, Belgium, South Africa, Brazil and India. There are regional field engineers in these 27 countries. The North American support locations are shown below in Figure 8-.

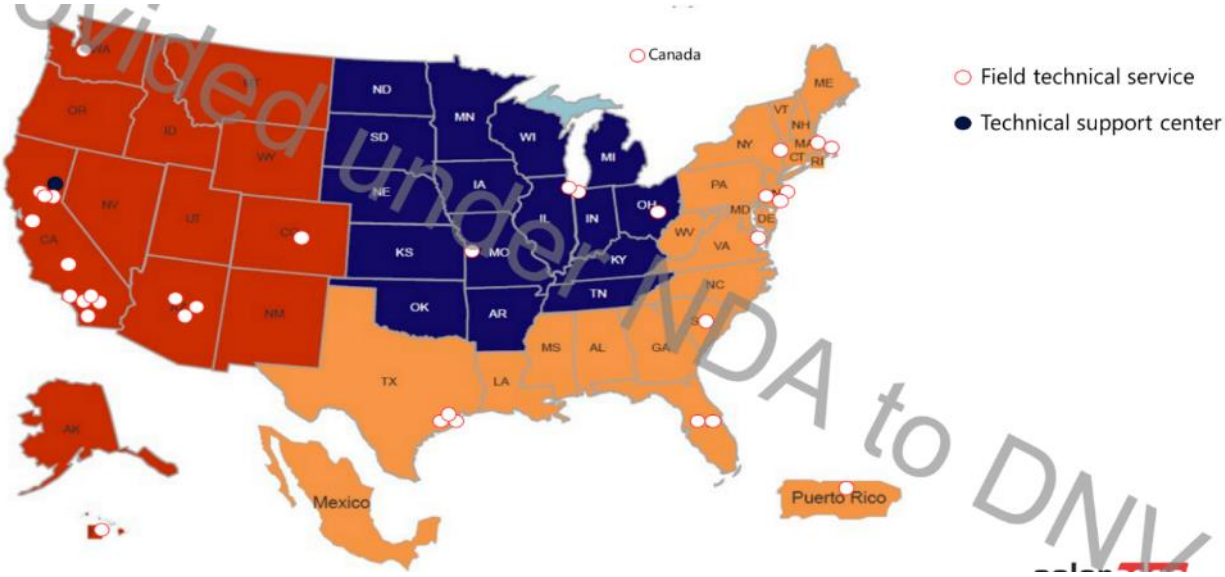

Figure 8-1 North American Support Locations

Service can be provided by SolarEdge personnel or by trained and qualified installers. Two-day training programs are conducted in training centers in Israel, Germany, and the USA. Training can also be performed on-site for organized groups. The SolarEdge service team also offers weekly informational webinars.

The present SolarEdge Support Organization Functional Structure is given in Figure 8- below. DNV expects that this will continue to evolve and expand as SolarEdge grows its installation base.

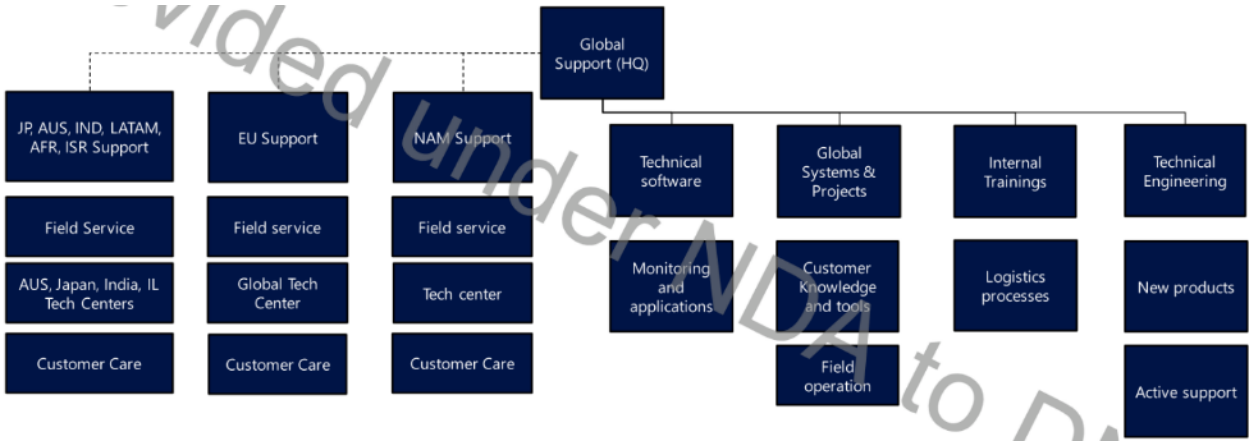

Figure 8-2 SolarEdge Customer Support Organization

The SolarEdge service team provides on-site, web service portal, email or phone support, before, during and after the installation. SolarEdge Learning Central (EDGE Academy) portal offers online training to solar installers through self-paced learning modules.

SolarEdge indicated that they strive to provide a call back in less than 3 operating hours and a service first response in less than six hours. In the event of a Return Merchandise Authorization (RMA) part dispatch, the response goal is shipment in less than 48 hours. SolarEdge expressed their view that 60% to 70% of the cases can be solved remotely. Qualified installers can also perform a 'No-Call RMA' to remotely troubleshoot and submit an RMA without having to go to the customer site.

SolarEdge's technology enables the support team to offer in-depth remote troubleshooting for real-time problem solving using the monitoring portal. The remote monitoring portal also enables initial product configuration as well as software upgrades; however, this capability is restricted in North America due to UL certification limitations.

Figure 8- shows an example of the capabilities provided by the cloud based SolarEdge monitoring system including module level data, battery data and alerts.

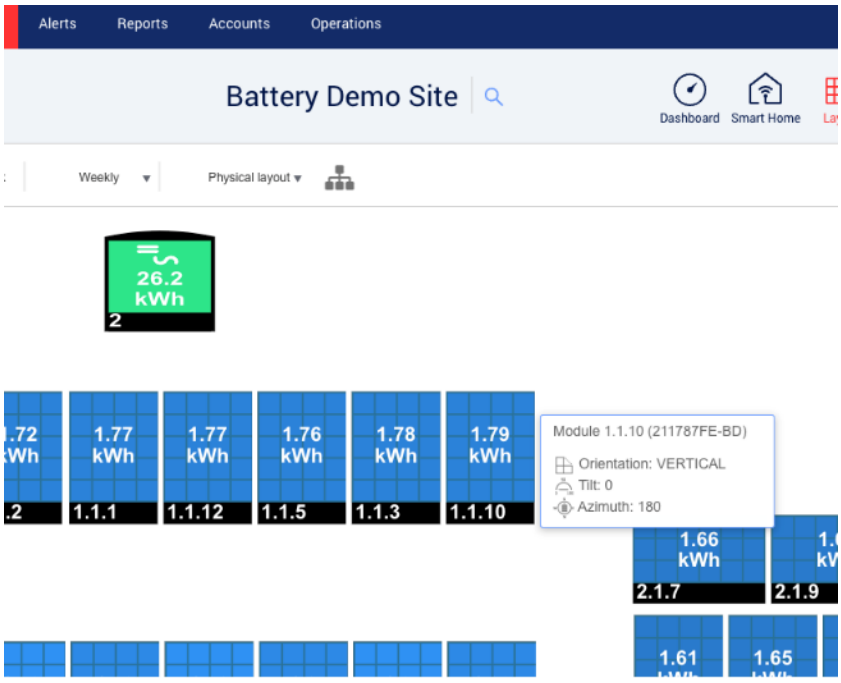

Figure 8-3 SolarEdge Cloud Based Monitoring

In Figure 8-, the enhanced troubleshooting capabilities provided by detailed power monitoring across an entire day are presented. This can be very helpful for troubleshooting system issues.

The capabilities of other tools in for installers and system owners in SolarEdge software suite is discussed in more detail in section 8.4.

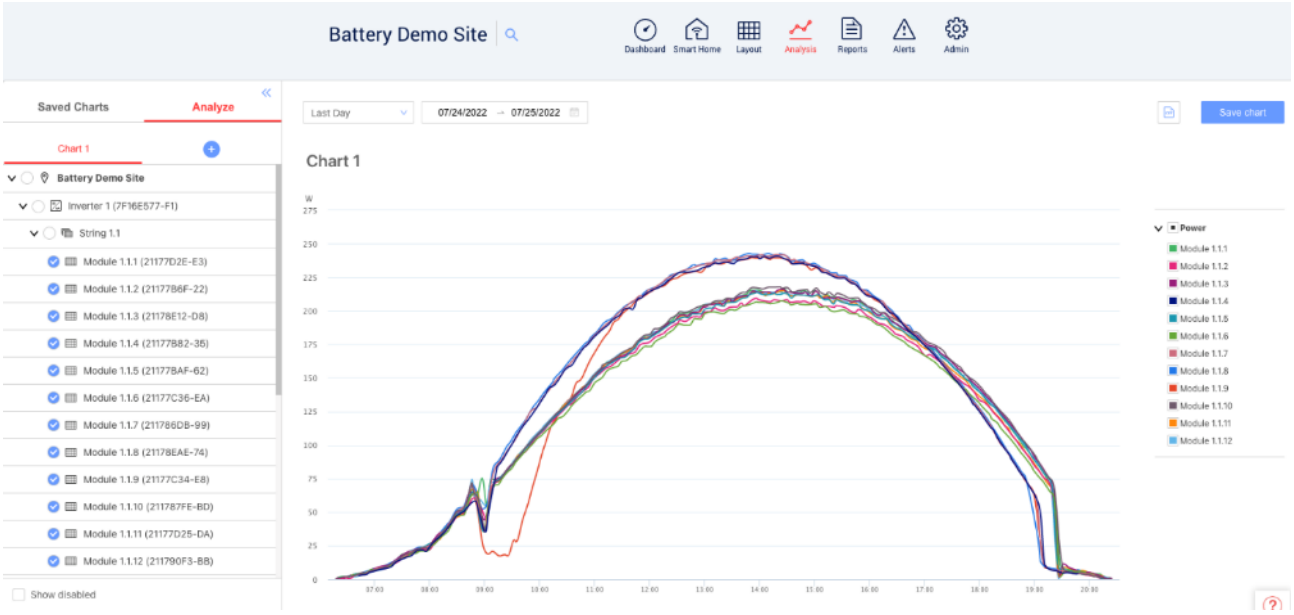

Figure 8-4 Detailed Performance Monitoring

DNV believes that the overall service approach being employed by SolarEdge is effective in supporting PV systems based on their products. It will be critical that the support organization continues to expand appropriately as the number of units in the field increases.

8.2 Warranty Evaluation

SolarEdge has a comprehensive approach to the PV power optimizer and inverter warranty products that are offered to their customers.

The standard warranty covering the SolarEdge Power Optimizers is 25 years. This is consistent with the power warranty of most PV modules. However, the warranty time frame does not exceed the module warranty of the PV module with which the optimizer device is installed.

The standard warranty covering the SolarEdge inverters is 12 years, except in some countries outside of the US, where SolarEdge has reduced the warranty period to 7 years. (The list of countries is available on SolarEdge's website: http://www.solaredge.com/us/warranty_exceptions) This inverter warranty exceeds the length of most similar size residential scale inverters in the US market. SolarEdge also offers an option to extend the inverter warranty to 20 years. The warranty for SolarEdge communications, monitoring products and energy meter is 5 years.

The warranty terms for both the SolarEdge Power Optimizer and Inverter products include three options.

- Repair the Product at SolarEdge's facilities or on-site; or
- Provide Buyer with replacement units for the Product; or
- Issue a credit note for the defective Product in an amount up to its actual value at the time buyer notifies SolarEdge of the defect, as determined by SolarEdge, for use toward the purchase of a new Product.

DNV understands from SolarEdge that currently, units are most commonly replaced as the primary approach to honor warranty claims. DNV notes that the first and second options are preferable to the third option from a customer's point of view. The warranty document notes that replacement parts are generally shipped within 48 hours.

If any equipment needs to be shipped while under warranty, SolarEdge covers the shipment costs both ways. DNV views this positively.

In the case where SolarEdge determines that the failed parts will be repaired under warranty, DNV notes: "In addition, SolarEdge shall bear shipping costs in respect to the foregoing, as set out above. All other costs, including, without limitation, travel and boarding costs of SolarEdge service personnel that are incurred for repairs of Products on-site, as well as costs related to buyer's employees and contractors repair or replacement activities, are not covered by the Limited Warranty and, unless otherwise agreed in writing in advance by SolarEdge, shall be borne by the buyer." This condition should be considered in valuing the warranty.

There are several important warranty exclusions:

- damaged as a result of misuse, abuse, accident, negligence or failure to maintain the Product;
- damaged as a result of modifications, alterations or attachments thereto which were not pre-authorized in writing by SolarEdge;
- damaged due to the failure to observe the applicable safety regulations governing the proper use of the Product;

- installed or operated not in strict conformance with the Documentation, including without limitation, not ensuring sufficient ventilation for the Product as described in SolarEdge installation guide;
- opened, modified or disassembled in any way without SolarEdge's prior written consent;
- used in combination with equipment, items or materials not permitted by the Documentation or in violation of local codes and standards;
- damaged by software, interfacing, parts, supplies or other product not supplied by SolarEdge;
- damaged as a result of improper site preparation or maintenance or improper installation;
- damaged or rendered non-functional as a result of power surges, lightning, fire, flood, pest, damage, accident, action of third parties, direct exposure to sea water or other events beyond SolarEdge's reasonable control or not arising from normal operating conditions; or
- damaged during or in connection with shipping or transport to or from buyer where buyer arranges such shipping or transport.

Many of these exclusions are typical for PV equipment warranties and they should be considered when applying SolarEdge products and evaluating the warranty coverage.

DNV was informed by SolarEdge that a financial warranty reserve is taken for units shipped in an amount determined by the best available information about the expected failure rate. Further information can be found in the SolarEdge company financial report filings.

DNV appreciates the comprehensive range of product warranties that SolarEdge is offering for the optimizer and inverter products. The warranty terms are generally in line with industry standards and the length of coverage is at or beyond the competitive product offerings. As with all product warranties, this warranty should be reviewed in detail and evaluated considering the financial backing behind it.

The Home Battery is designed for a minimum 10-year life which in in line with industry standard. SolarEdge's warranty is based on an aggregated throughput, which is the total amount of energy that has been cycled through the Home Battery.

8.3 Product Manuals

For this product review, SolarEdge delivered the manuals for the following products:

- Installation Guide: Three Phase Inverter with SetApp Configuration
- Installation Guide: Three Phase Inverters with Synergy Technology
- Installation Guide: Single Phase Inverter with HD-Wave Technology
- Installation Guide: Single Phase Inverter with HD-Wave Technology with SetApp Configuration

All the above manuals are written in the same style and format as SolarEdge manuals previously reviewed by DNV, with adequate details and good supporting graphics.

Previously, SolarEdge provided the following manuals for review:

- Single Phase Inverter with HD-Wave Technology Installation Guide
- Installation Guide for Europe and Asia Pacific (APAC) v3.1

- SolarEdge Inverter Installation Guide North America v4.0
- Single and Three Phase Installation Guide v3.1
- SE Inverter Installation Guide v3.1
- SolarEdge Monitoring Portal User Guide v1.2

Using ‘Single Phase Inverter with HD-Wave Technology with SetApp Configuration’ document as an example, the installation manual is quite comprehensive and includes much more information than just that related to the installation process. It includes the following chapters and appendixes:

- Chapter 1: Introducing the SolarEdge Power Harvesting System
- Chapter 2: Installing the Power Optimizers
- Chapter 3: Installing the Inverter
- Chapter 4: Connecting the AC and the Strings to the Safety Switch
- Chapter 5: Activating, Commissioning and Configuring the System
- Chapter 6: Setting Up Communication to the Monitoring Platform
- Appendix A: Errors and Troubleshooting
- Appendix B: Mechanical Specifications
- Appendix C: Replacing and Adding System Components
- Technical Specifications - Single Phase Inverters with HD-Wave Technology
- Support Contact Information

The documents were reviewed by DNV and found to be thorough and well written, making use of clear language and helpful graphics.

8.4 SolarEdge Software Suite

This section provides an overview of SolarEdge software suite that is comprised of various web and smartphone apps for system installers and homeowners. The software tools support installers with design optimization, installation/commission and maintenance of sites. SolarEdge also provides software tools for homeowners to monitor as well as control storage and consumption activities. Brief description of tools in SolarEdge software suite is provided in following sections.

8.4.1 Software for Planning and Proposals

8.4.1.1 SolarEdge Designer

SolarEdge Designer is a web-based solar system design app for generating proposals. It provides installers and system designers the tools required to design a PV system, forecast system costs as well as provide recommendations for additional products. Below are some utilities in the SolarEdge Designer:

- Supports satellite or custom site imagery, reducing the need for site visits prior to initial design. Designer also supports automatic roof detection to reduce design time. Installers can draw trees and other obstacles to simulate

the shading for more accurate PV production calculations. The designs can be later exported to the SolarEdge monitoring platform.

- Designer is equipped with automated design features such as auto-stringing, instant design validation, multiple obstacle detection and bulk Power Optimizer barcode mapping. Installers can use auto-stringing to separate areas on a site and string specific module groups together, such as multiple roofs or different facets on commercial sites, reducing design time for large sites.
- Designer helps installers with PV module placement for optimal energy productions. It provides financial analysis features to forecast the system costs and summarize potential energy savings.
- Integrates with AutoCAD and other design tools. Installers can also export designs to tools such as PVsyst for advanced analysis.
- Designer can provide battery storage and backup recommendations to installers. Installers can use the generated graphics in their proposals. An example is shown in Figure 8-5.

SolarEdge updates the web-based application periodically and warrants Designer-created designs for 25 years. DNV views this positively.

Figure 8-5 Screen capture of SolarEdge Designer app

8.4.2 Software for PV installation

8.4.2.1 SolarEdge SetApp

SolarEdge provides SetApp mobile application to installers for commissioning their products. It is previously reviewed in this report in section 3.10.

8.4.2.2 SolarEdge Mapper

Mapper is a mobile application for installers to register the physical layout of new PV sites in the SolarEdge monitoring platform. Installers can use Mapper to scan optimizer and inverter barcodes, creating a virtual map of the PV site in the monitoring platform for remote diagnostics. For large commercial sites, Mapper offers parallel mapping that enables a team of installers to work together on mapping out a site. Mapper can take snippets from each team member and later merge it into a map which builds out the entire site.

8.4.3 Software for Operation and Maintenance

8.4.3.1 PV Monitoring Platform

The Monitoring Platform is SolarEdge's proprietary O&M platform that allows installers to manage, monitor and troubleshoot their PV fleet. It is available as a web-based and mobile application. Installers have full visibility into system status, production and consumption data, and have access to real-time module-level data required for remote trouble shooting. Installers can utilize interactive charts and automatic reports feature to analyze and troubleshoot underperforming systems. Below are additional capabilities of PV monitoring platform:

- Site-level and fleet-level reporting with an option to save automatic reports.
- System administrators can define access rights for different stakeholders and control their levels of visibility.
- Installers can fully customize alert notifications on a per-site basis in their fleet. Impact indicators on specific alerts automatically prioritize alerts based on overall energy loss. This significantly helps installers prioritize their maintenance schedule based on severity.

8.4.3.2 mySolarEdge

mySolarEdge is a self-service mobile app catering to SolarEdge system owners. System owners can view real-time module-level data as well as manage Smart Energy devices in the system. It allows system owners to troubleshoot inverters when needed or connect to with SolarEdge technical support. When used with Home Hub inverters and storage, it can be used to change battery reserve settings, schedule EV charging during off-peak hours etc.

9 PRODUCT INSTALLATIONS

Note: The following are sites visited by DNV as part of a previous review of SolarEdge.

9.1 Site Visit Overview

DNV visited two PV power plant sites in Israel that employ SolarEdge Power Optimizers and Inverters. The first installation is an early site using older SolarEdge Power Optimizer technologies and the second incorporates present technologies. DNV also visited a third site located at PVUSA in Davis, California to observe the operation of the three phase inverters.

9.2 Green Tops Site

The first site visit was to a 50 kW system called Green Tops/Oshri which is in Kfar Vitkin, Israel on top of a barn at a dairy farm. It is shown in the photo in Figure 9-. This system was installed in January 2010 and employs Schott Solar 220W poly-crystalline modules. Each module has a SolarEdge Power Optimizer rated at 250W connected to it as illustrated in Figure 9-. The inverters are the SolarEdge 6 kW single-phase inverters which are shown in Figure 9-.

Figure 9-1 SolarEdge 50 kW System at Green Tops Site

Figure 9-2 Early Generation SolarEdge Power Optimizer at Green Tops Site

Figure 9-3 Solar Edge inverters at Green Tops Site

DNV viewed the production remotely, from the SolarEdge HQ, using the SolarEdge monitoring system. A screen print from that check is shown in Figure 9- below.

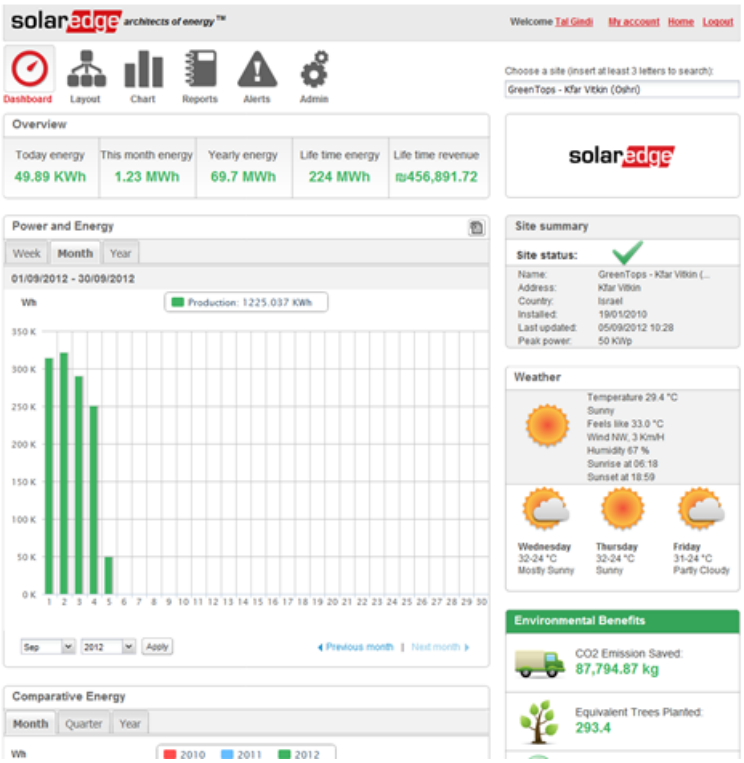

Figure 9-4 SolarEdge Monitoring System for Green Tops site

The PV system and monitoring system at the Green Tops site were functioning properly during the DNV visit. While the optimizers and inverters were from an earlier generation than the products being reviewed in this report, the site did provide a positive reference for an installation using SolarEdge products that has been installed for multiple years.

9.3 Dugma Site

The second site visited was a 50 kW system that is called Dugma and is in Azriel, Israel on top of a barn at a flower greenhouse. This system was installed in November 2011. It is shown in Figure 9- from the back and the array is illustrated in the photo in Figure 9-. The array is made up of Suntech poly-crystalline PV modules. Two modules are connected in pairs to a dual 480W optimizer as seen in Figure 9-. The system utilizes four SolarEdge 12.5 kW three-phase inverters which are illustrated in Figure 9-.

Figure 9-5 SolarEdge 50 kW System at Dugma Site

Figure 9-6 PV Array at Dugma Site

Figure 9-7 SolarEdge Power Optimizer at Dugma Site

Figure 9-8 Solar Edge Inverters at Dugma Site

DNV viewed the power and energy production remotely (from the SolarEdge HQ) using the SolarEdge remote monitoring system. Two screen shots are given in Figure 9- from the monitoring system on the day of the DNV visit. The layout diagram on the left shows that the optimizers are functioning properly as indicated by the blue color and one can also see the four inverters shown in grey.

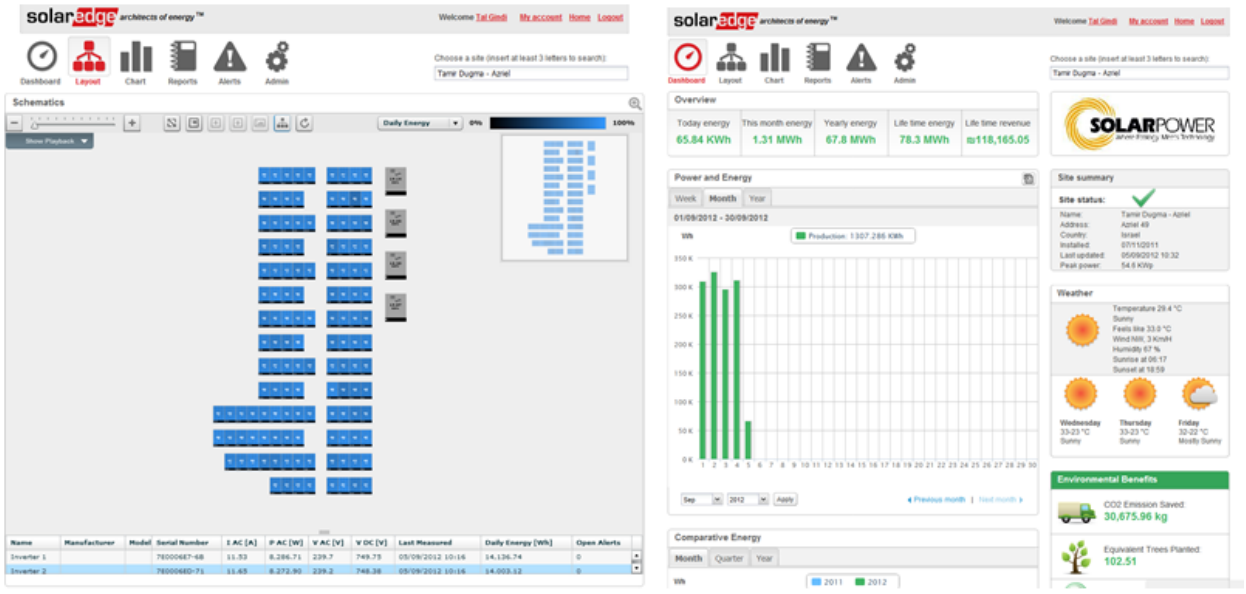

Figure 9-9 SolarEdge Monitoring at Dugma Site

The PV system and monitoring system at the Dugma site were functioning properly during the DNV visit. While the optimizers are the dual units and the inverters are three phase, they are from the present generation of products being reviewed in this report. This site does provide a positive reference for an installation using the present generation of SolarEdge products.

9.4 PVUSA test site in Davis, California

DNV visited a SolarEdge test site at the PVUSA Outdoor Research Center. Located just outside of Davis, California, the 86-acre PVUSA site is one of the oldest active utility scale PV systems in North America and was originally operated in 1989.

PV Evolution Labs (PVEL) operates a test facility at the PVUSA Outdoor Research Center. This test site can accommodate non-UL certified products, any system size or configuration, and is heavily instrumented with calibrated meteorological monitoring, dc current, voltage, and revenue grade ac meters.

Figure 9-10 PVUSA / PVEL Test Site in Davis, CA

DNV, Dru Sutton and Manny Lugos of Solar Edge, and Jason Forrest of Renewable Ventures (PVUSA owner) visited the site on November 26, 2013, to review the SolarEdge test bed.

The current Solar Edge test bed includes 72 Sharp ND240 PV modules coupled to the same number of SolarEdge's OP250-LV optimizers, all powering a single SolarEdge SE20KUS (480 VAC, 3-phase) inverter. The modules are south-facing at a 20-degree tilt.

Figure 9-11 SolarEdge Test Bed at PVUSA

This configuration has been running without failures since mid-2013 (date uncertain) and was scheduled to be removed at the end of November 2013. The present testing is only being done to generally track performance and reliability of both the SolarEdge optimizers and their corresponding inverter. There are no special tests currently to characterize unique operating attributes such as shading, soiling, string length, or comparative output against their competitors.

Figure 9-12 Test array with SolarEdge Optimizers Rack Mounted

75

Figure 9-13 OP 250-LV Optimizers Under Test

This test setup is characterized as ungrounded and 850 VDC. It was not apparent that the strings are mono-polar, and there is no marking on the inverter to indicate + and – pole inputs are used to keep voltages below 600 VDC, but the inverter label did show a maximum dc operating voltage of 490 VDC**.**

Figure 9-14 SE20KUS (480 VAC, 3-phase) Inverter Under Test

It was observed that the inverter was running at a dc voltage of 793VDC which is lower than the nominal 850VDC indicated on the label and data sheet. SolarEdge reported that the fixed DC string voltage is electronically adjusted as necessary, based on the AC line voltage.

The inverter was observed to be operating normally and there were no observations or discussion around any documented field failures at this site.

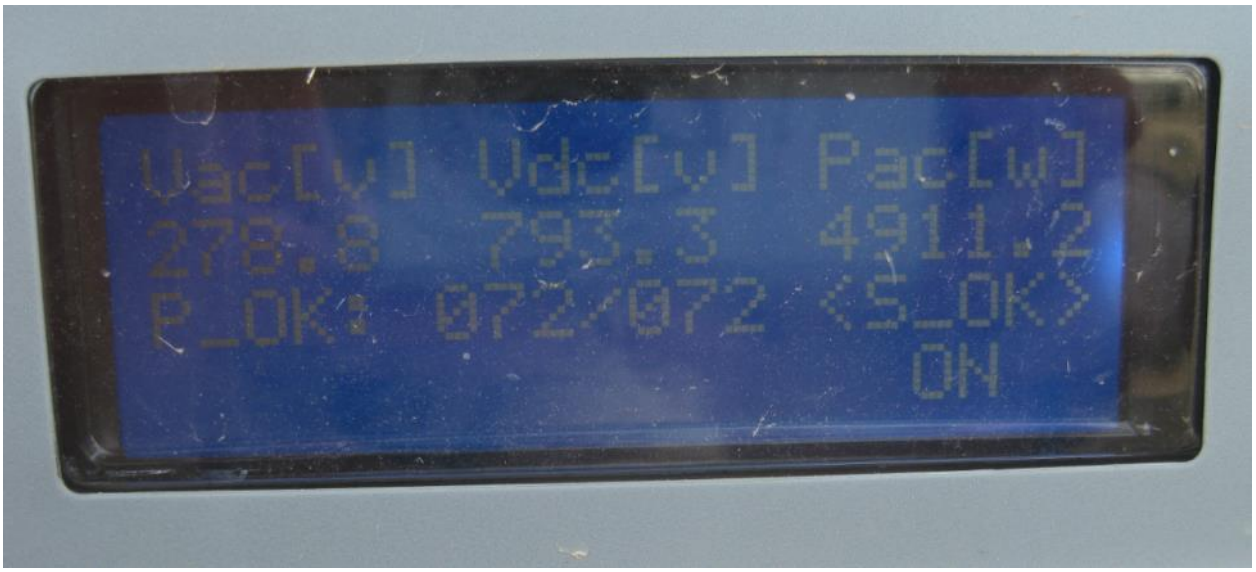

Figure 9-15 Photo of Inverter LCD Showing Operating Parameters

APPENDIX A – DATASHEETS

A.1 OPTIMIZERS – S-SERIES S440, S500, S500B MODELS

Power Optimizer
For Residential Installations

S440, S500, S500B

25 YEAR WARRANTY

POWER OPTIMIZER

Enabling PV power optimization at the module level

- Specifically designed to work with SolarEdge residential inverters
- Detects abnormal PV connector behavior, preventing potential safety issues*
- Module-level voltage shutdown for installer and firefighter safety
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch loss, from manufacturing tolerance to partial shading
- Faster installations with simplified cable management and easy assembly using a single bolt
- Flexible system design for maximum space utilization
- Compatible with bifacial PV modules

* Functionality subject to inverter model and firmware version

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/ Power Optimizer

For Residential Installations

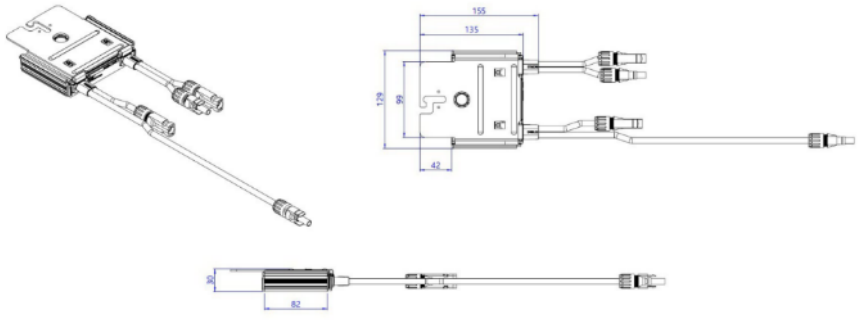
S440, S500, S500B

	S440	S500	S500B	UNIT
Rated Input DC Power[1]	440	500		W
Absolute Maximum Input Voltage (Voc)	60		125	Vdc
MPPT Operating Range	8 - 60		12.5- 105	Vdc
Maximum Short Circuit Current (Isc) of Connected PV Module	14.5	15		Adc
Maximum Efficiency	99.5			%
Weighted Efficiency	98.6			%
Overvoltage Category	II			
OUTPUT DURING OPERATION				
Maximum Output Current	15			Adc
Maximum Output Voltage	60		80	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM INVERTER OR INVERTER OFF)				
Safety Output Voltage per Power Optimizer	1			Vdc
STANDARD COMPLIANCE				
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3, CISPR11, EN-55011			
Safety	IEC62109-1 (class II safety), UL1741			
Material	UL94 V-0, UV Resistant			
RoHS	Yes			
Fire Safety	VDE-AR-E 2100-712:2013-05			
INSTALLATION SPECIFICATIONS				
Maximum Allowed System Voltage	1000			Vdc
Dimensions (W x L x H)	129 x 155 x 30		128.4 x 155 x 45	mm
Weight (including cables)	655			gr
Input Connector	MC4[2]			
Input Wire Length	0.1			m
Output Connector	MC4			
Output Wire Length	(+) 2.3, (-) 0.10			m
Operating Temperature Range[3]	-40 to +85			°C
Protection Rating	IP68 / NEMA6P			
Relative Humidity	0 - 100			%

(1) Rated power of the module at STC will not exceed the Power Optimizer Rated Input DC Power. Modules with up to +5% power tolerance are allowed
(2) For other connector types please contact SolarEdge
(3) For ambient temperature above +70°C / +158°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details

PV System Design Using a SolarEdge Inverter		Single Phase HD-Wave	Three Phase	Three Phase for 277/480V Grid	
Minimum String Length (Power Optimizers)	S440, S500	8	16	18	
	S500B	6	14		
Maximum String Length (Power Optimizers)		25	50		
Maximum Nominal Power per String[4]		5700	11250[5]	12750[6]	W
Parallel Strings of Different Lengths or Orientations		Yes			

(4) If the inverters rated AC power ≤ maximum nominal power per string, then the maximum power per string will be able to reach up to the inverters maximum input DC power Refer to: https://www.solaredge.com/sites/default/files/se-power-optimizer-single-string-design-application-note.pdf
(5) For the 230/400V grid: it is allowed to install up to 13,500W per string when the maximum power difference between each string is 2,000W
(6) For the 277/480V grid: it is allowed to install up to 15,000W per string when the maximum power difference between each string is 2,000W
(7) It is not allowed to mix S-series and P-series Power Optimizers in new installations



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A.2 OPTIMIZERS – S-SERIES S1200 MODEL

Power Optimizer

S1200

POWER OPTIMIZER

SolarEdge's most advanced, cost-effective Power Optimizer for commercial and large field installations

- **Greater Energy Yields**
  - High efficiency (99.5%) with module-level MPPT, for maximized system energy production and revenue, and fast project ROI
  - Supports high power and bifacial PV modules, and high string current for more power per string
- **Maximum Protection with Built-In Safety**
  - Designed to automatically reduce high DC voltage to touch-safe levels, upon grid/inverter shutdown, with SafeDC™
  - Includes SolarEdge Sense Connect, allowing continuous monitoring to detect overheating due to installation issues or connector-level wear and tear
- **Lower BOS Costs**
  - Flexible system design enables maximum space utilization and up to 2x longer string lengths, 50% less cables, fuses and combiner boxes
  - Supports connection of two PV modules in series with easy cable management and fast installation times
- **Simpler O&M**
  - Module-level system monitoring enabling pinpointed fault detection and remote, time-saving troubleshooting

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/ Power Optimizer

S1200

	S1200		Unit
INPUT			
Rated Input DC Power[1]	1200		W
Absolute Maximum Input Voltage (Voc)	125		Vdc
MPPT Operating Range	12.5 – 105		Vdc
Maximum Short Circuit Current (Isc) of connected PV Module	15		Adc
Maximum Efficiency	99.5		%
Weighted Efficiency	98.8		%
Overvoltage Category	II		
OUTPUT DURING OPERATION			
Maximum Output Current	20		Adc
Maximum Output Voltage	80		Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM INVERTER OR OFF)			
Safety Output Voltage per Power Optimizer	1		Vdc
STANDARD COMPLIANCE			
EMC	FCC Part 15, IEC 61000-6-2, and IEC 61000-6-3 - Class B, EN 55011		
Safety	IEC62109-1 (class II safety)		
Material	UL94 V-0, UV Resistant		
RoHS	Yes		
Fire Safety	VDE-AR-E 2100-712:2013-05		
INSTALLATION SPECIFICATIONS			
Maximum Allowed System Voltage	1000		Vdc
Dimensions (W x L x H)	129 x 155 x 59 / 5.08 x 6.10 x 2.32		mm / in
Weight (including cables)	1064 / 2.3		gr / lb
Input Connector	MC4[2]		
Input Wire Length	Short Input: 0.1 / 0.32	Long Input: 1.6 / 5.24[3]	m / ft
Output Connector	MC4		
Output Wire Length (Landscape and Portrait Leap Frog)	(+) 5.3 (-) 0.10 / (+) 17.38 (-) 0.32		m / ft
Output Wire Length (Portrait)	(+) 2.8 (-) 0.10 / (+) 9.19 (-) 0.32		m / ft
Operating Temperature Range[4]	-40 to +85		°C
Protection Rating	IP68 / NEMA6P		
Relative Humidity	0 - 100		%

(1) Rated power of the module at STC will not exceed the Power Optimizer Rated Input DC Power. Modules with up to +5% power tolerance are allowed.
(2) For other connector types please contact SolarEdge.
(3) For S-Series models with long input cables (1.6m / 5.24ft), the Sense Connect feature is only enabled on the output.
(4) For ambient temperature above +65°C / +149°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details.

PV System Design Using a SolarEdge Inverter[5][6][7][8]		230/400V Grid SE16K, SE17K, SE25K*	230/400V Grid SE27.6K*	230/400V Grid SE30K*	230/400V Grid SE33.3K*	277/480V Grid SE40K*
Compatible Power Optimizers		S1200				
Minimum String Length	Power Optimizers	14	14	15	14	15
	PV Modules	27	27	29	27	29
Maximum String Length	Power Optimizers	30	30	30	30	30
	PV Modules	60	60	60	60	60
Maximum Continuous Power per String		15000	15500	17000	15000	17000
Maximum Allowed Connected Power per String[8] (Permitted only when the difference in connected power between strings is 2,000W or less)		1 string – 17250	1 string – 17750	1 string – 19250	1-2 strings – 17250	1-2 strings – 19250
		2 strings or more – 20000	2 strings or more – 20500	2 strings or more – 23000	3 strings or more – 20000	3 strings or more – 23000
Parallel Strings of Different Lengths or Orientations		Yes				
Maximum Allowed Difference Between the Shortest and Longest String Connected to the Same Inverter Unit		5 Power Optimizers				

* The same rules apply for Synergy units of equivalent power ratings, that are part of the modular Synergy Technology inverter.
(5) S1200 can be mixed in one string only with S1200.
(6) For each string, a Power Optimizer may be connected to a single PV module if 1) each Power Optimizer is connected to a single PV module or 2) it is the only Power Optimizer connected to a single PV module in the string.
(7) For SE16K and above, the minimum STC DC connected power should be 11KW.
(8) To connect more STC power per string, design your project using SolarEdge Designer.

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A.3 OPTIMIZERS – P300, P400, P405 NORTH AMERICA MODELS

SolarEdge Power Optimizer

Module Add-On for North America

P300 / P400 / P405

		P300 (for 60-cell modules)	P400 (for 72 & 96-cell modules)	P405 (for thin film modules)	
INPUT					
Rated Input DC Power[1]		300	400	405	W
Absolute Maximum Input Voltage (Voc at lowest temperature)		48	80	125	Vdc
MPPT Operating Range		8 - 48	8 - 80	12.5 - 105	Vdc
Maximum Short Circuit Current (Isc)		10			Adc
Maximum DC Input Current		12.5			Adc
Maximum Efficiency		99.5			%
Weighted Efficiency		98.8			%
Overvoltage Category		II			
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)					
Maximum Output Current		15			Adc
Maximum Output Voltage		60		85	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)					
Safety Output Voltage per Power Optimizer		1			Vdc
STANDARD COMPLIANCE					
EMC		FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3			
Safety		IEC62109-1 (class II safety), UL1741			
RoHS		Yes			
INSTALLATION SPECIFICATIONS					
Maximum Allowed System Voltage		1000			Vdc
Dimensions (W x L x H)	Pxxx-2 series	141 x 212 x 40.5 / 5.55 x 8.34 x 1.59			mm / in
	Pxxx-5 series	128 x 152 x 27.5 / 5 x 5.97 x 1.08	128 x 152 x 35 / 5 x 5.97 x 1.37	128 x 152 x 48 / 5 x 5.97 x 1.89	mm / in
Weight (including cables)	Pxxx-2 series	950 / 2.1			gr / lb
	Pxxx-5 series	770 / 1.7	930 / 2.05	930 / 2.05	gr / lb
Input Connector		MC4 Compatible			
Output Wire Type / Connector		Double Insulated; MC4 Compatible			
Output Wire Length		0.95 / 3.0	1.2 / 3.9		m / ft
Operating Temperature Range		-40 - +85 / -40 - +185			°C / °F
Protection Rating	Pxxx-2 series	IP65 / NEMA4			
	Pxxx-5 series	IP68 / NEMA6P			
Relative Humidity		0 - 100			%

[1] Rated STC power of the module. Module of up to +5% power tolerance allowed.

PV SYSTEM DESIGN USING A SOLAREDGE INVERTER[2]	SINGLE PHASE	THREE PHASE 208V	THREE PHASE 480V	
Minimum String Length (Power Optimizers)	8	10	18	
Maximum String Length (Power Optimizers)	25	25	50	
Maximum Power per String	5250	6000	12750	W
Parallel Strings of Different Lengths or Orientations	Yes			

[2] It is not allowed to mix P405 with P300/P400/P600/P700 in one string.

A.4 OPTIMIZERS – P370, P401, P485, P505 NORTH AMERICA MODELS

Power Optimizer

For North America

P370 / P400 / P401 / P485 / P505

25 YEAR WARRANTY

POWER OPTIMIZER

PV power optimization at the module-level

- Specifically designed to work with SolarEdge inverters
- Up to 25% more energy
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch losses, from manufacturing tolerance to partial shading
- Flexible system design for maximum space utilization
- Fast installation with a single bolt
- Next generation maintenance with module-level monitoring
- Meets NEC requirements for arc fault protection (AFCI) and Photovoltaic Rapid Shutdown System (PVRSS)
- Module-level voltage shutdown for installer and firefighter safety

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DNV

Power Optimizer

For North America

P370 / P400 / P401 / P485 / P505

Optimizer model (typical module compatibility)	P370 (for higher-power 60 and 72-cell modules)	P400 (for 72 & 96-cell modules)	P401 (for high power 60 and 72 cell modules)	P485 (for high-voltage modules)	P505 (for higher current modules)	
INPUT						
Rated Input DC Power[1]	370	400	430	485	505	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	60	80	60	125[2]	83[2]	Vdc
MPPT Operating Range	8 - 60	8 - 80	8-60	12.5 - 105	12.5 - 83	Vdc
Maximum Short Circuit Current (Isc)	11	10.1	12.5	11	14	Adc
Maximum DC Input Current	13.75	12.5	14.65	12.5	17.5	
Maximum Efficiency	99.5					%
Weighted Efficiency	98.8					%
Overvoltage Category	II					
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)						
Maximum Output Current	15					Adc
Maximum Output Voltage	60			80		Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)						
Safety Output Voltage per Power Optimizer	1 ± 0.1					Vdc
STANDARD COMPLIANCE						
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3					
Safety	IEC62109-1 (class II safety), UL1741, NEC/PVRSS					
Material	UL94 V-0 , UV Resistant					
RoHS	Yes					
INSTALLATION SPECIFICATIONS						
Maximum Allowed System Voltage	1000					Vdc
Compatible inverters	All SolarEdge Single Phase and Three Phase inverters					
Dimensions (W x L x H)	129 x 153 x 27.5 / 5.1 x 6 x 1.1	129 x 153 x 33.5 / 5.1 x 6 x 1.3	129 x 153 x 29.5 / 5.1 x 6 x 1.16	129 x 159 x 49.5 / 5.1 x 6.3 x 1.9	129 x 162 x 59 / 5.1 x 6.4 x 2.3	mm / in
Weight (including cables)	630 / 1.4	750 / 1.7	655 / 1.5	845 / 1.9	1064 / 2.3	gr / lb
Input Connector	MC4[3]			MC4[3]	MC4[3]	
Input Wire Length	0.16 / 0.5					m / ft
Output Wire Type / Connector	Double Insulated / MC4					
Output Wire Length	1.2 / 3.9					m / ft
Operating Temperature Range[4]	-40 to +85 / -40 to +185					°C / °F
Protection Rating	IP68 / Type6B					
Relative Humidity	0 - 100					%

(1) Rated power of the module at STC will not exceed the optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed
(2) NEC 2017 requires max input voltage be not more than 80V
(3) For other connector types please contact SolarEdge
(4) Longer inputs wire lengths are available for use. For 0.9m input wire length order P401-xxxLxxx
(5) For ambient temperature above +85°C / +185°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

PV System Design Using a SolarEdge Inverter[6][7]		Single Phase HD-Wave	Single phase	Three Phase for 208V grid	Three Phase for 277/480V grid	
Minimum String Length (Power Optimizers)	P370, P400, P401	8		10	18	
	P485, P505	6		8	14	
Maximum String Length (Power Optimizers)		25		25	50	
Maximum Power per String		5700[8] (6000 with SE7600-US - SE11400-US)	5250[8]	6000[9]	12750[10]	W
Parallel Strings of Different Lengths or Orientations		Yes				

(6) For detailed string sizing information refer to: http://www.solaredge.com/sites/default/files/string_sizing_na.pdf
(7) It is not allowed to mix P485/P505 with P370/P400/P401 in one string
(8) A string with more than 30 optimizers does not meet NEC rapid shutdown requirements; safety voltage will be above the 30V requirement
(9) For 208V grid: it is allowed to install up to 6,500W per string when the maximum power difference between each string is 1,000W
(10) For 277/480V grid: it is allowed to install up to 15,000W per string when the maximum power difference between each string is 2,000W

Intertek RoHS

A.5 OPTIMIZERS – P320-ZEP, P400-ZEP NORTH AMERICA MODELS

Power Optimizer
Zep Compatible™
Module Add-On For North America

P320-ZEP, P400-ZEP

POWEROPTIMIZER

Compatible with Zep Groove framed modules

- Specifically designed to work with SolarEdge inverters
- Certified Zep CompatibleTM bracket
- Attaches to module frame without screws - reduces on-roof labor and mounting costs
- Power optimizer equipment grounded through the bracket
- Up to 25% more energy
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch losses, from manufacturing tolerance to partial shading
- Flexible system design for maximum space utilization
- Next generation maintenance with module-level monitoring
- Compliant with arc fault protection and rapid shutdown NEC requirements (when installed as part of the SolarEdge system)
- Module-level voltage shutdown for installer and firefighter safety

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/ Power Optimizer - Zep Compatible™

Module Add-On For North America

P320-ZEP, P400-ZEP

Optimizer model (typical module compatibility)	P320-ZEP (for 60-cell modules)	P400-ZEP (for 72 & 96-cell modules)	
INPUT			
Rated Input DC power[1]	320	400	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	48	80	Vdc
MPPT Operating Range	8 - 48	8 - 80	Vdc
Maximum Short Circuit Current (Isc)	11	10.1	Adc
Maximum DC Input Current	13.75	12.63	Adc
Maximum Efficiency	99.5		%
Weighted Efficiency	98.8		%
Overvoltage Category	II		
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING INVERTER)			
Maximum Output Current	15		Adc
Maximum Output Voltage	60		Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM INVERTER OR INVERTER OFF)			
Safety Output Voltage per Power Optimizer	1 ± 0.1		Vdc
STANDARD COMPLIANCE			
EMC	FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3		
Safety	IEC62109-1 (class II safety), UL1741		
RoHS	Yes		
INSTALLATION SPECIFICATIONS			
Maximum Allowed System Voltage	1000		Vdc
Input Connector	MC4[2]		
Output Connector	Double Insulated; MC4		
Output Wire Length	0.95 / 3.0	1.2 / 3.9	m / ft
Operating Temperature Range	-40 - +85 / -40 - +185		°C / °F
Protection Rating	IP68 / NEMA 6P		
Relative Humidity	0 - 100		%

* These specifications apply to power optimizers with part number Pxxx-5NM4MTx
[1] Rated STC power of the module. Module of up to +5% power tolerance allowed.
[2] Other input connector types available upon request; contact SolarEdge for details.

PV System Design Using a Solaredge Inverter[3]	Single Phase HD-Wave	Single phase	Three phase 208v	Three phase 480v	
Minimum String Length (Power Optimizers)	8		10	18	
Maximum String Length (Power Optimizers)	25		25	50[4]	
Maximum Power per String	5700 (6000 with SE7600H-US)	5250	6000	12750	W
Parallel Strings of Different Lengths or Orientations	Yes				

[3] For detailed string sizing information refer to: http://www.solaredge.com/sites/default/files/string_sizing_na.pdf
[4] A string with more than 30 optimizers does not meet NEC rapid shutdown requirements; safety voltage will be above the 30V requirement

CE RoHS

A.6 OPTIMIZERS – P700, P730 NORTH AMERICA MODELS

solaredge

SolarEdge Power Optimizer

Frame-Mounted Module Add-On for Commercial Installations for North America

P700 / P730

POWER OPTIMIZER

Fast mount power optimizers with module-level optimization

- Quicker installation - Power optimizers can be mounted in advance saving installation time
- Up to 25% more energy
- Superior efficiency (99.5%)
- Mitigates all types of modules mismatch-loss, from manufacturing tolerance to partial shading
- Flexible system design for maximum space utilization
- Next generation maintenance with module level monitoring
- Compliant with arc fault protection and rapid shutdown NEC requirements (when installed as part of the SolarEdge system)
- Module-level voltage shutdown for installer and firefighter safety

USA-CANADA-GERMANY-ITALY-FRANCE-JAPAN-CHINA-AUSTRALIA-THE NETHERLANDS-UK-ISRAEL-TURKEY-SOUTH AFRICA-BULGARIA www.solaredge.us

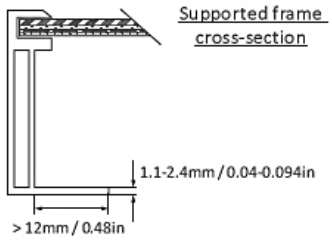
SolarEdge Power Optimizer Module Add-On
For Commercial Installations for North America P700 / P730

Optimizer model (typical module compatibility)	P700 (for 2 x 72-cell PV modules)	P730 (for 2 x high power 72-cell modules)	
INPUT			
Rated Input DC Power[1]	700	730	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	125		Vdc
MPPT Operating Range	12.5 - 105		Vdc
Maximum Short Circuit Current (Isc)	10.1	11	Adc
Maximum DC Input Current	12.63	13.75	Adc
Maximum Efficiency	99.5		%
Weighted Efficiency	98.6		%
Overvoltage Category	II		
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)			
Maximum Output Current	15		Adc
Maximum Output Voltage	85		Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)			
Safety Output Voltage per Power Optimizer	1 ± 0.1		Vdc
STANDARD COMPLIANCE			
EMC	FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3		
Safety	IEC62109-1 (class II safety), UL1741		
RoHS	Yes		
INSTALLATION SPECIFICATIONS			
Compatible SolarEdge Inverters	Three phase inverters		
Maximum Allowed System Voltage	1000		Vdc
Dimensions (W x L x H)	139 x 165 x 63 \ 5.5 x 6.5 x 2.5		mm / in
Weight (including cables)	1185 / 2.6		gr / lb
Input Connector	MC4 Compatible		
Output Wire Type / Connector	Double Insulated; MC4 Compatible		
Output Wire Length	2.1 / 6.9		m / ft
Operating Temperature Range[2]	-40 - +85 / -40 - +185		°C / °F
Protection Rating	IP68 / NEMA6P		
Relative Humidity	0 - 100		%

[1] Rated combined STC power of 2 modules connected in series. Module of up to +5% power tolerance allowed.
[2] For ambient temperature above +70°C / +158°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Application Note for more details.

PV SYSTEM DESIGN USING A SOLAREDGE INVERTER[3][4]	THREE PHASE 208V	THREE PHASE 480V	
Minimum String Length (Power Optimizers)	8	13	
Maximum String Length (Power Optimizers)	30	30	
Maximum Power per String	6000[6]	12750[7]	W
Parallel Strings of Different Lengths or Orientations	Yes		

[3] P600, P700 and P730 can be mixed in one string. It is not allowed to mix P600/P700/P730 with P300/P320/P400/P405 in one string.
[4] In a case of odd number of PV Modules in one string it is allowed to install one P700/P730 power optimizer connected to one PV Module.
[5] P700 and P730 design with three phase 208V inverters is limited. Use the SolarEdge Site Designer for verification.
[6] For SE14.4KUS-208: It is allowed to install up to 6,500W per string when 3 strings are connected to the inverter and when the maximum power difference between the strings is up to 1,000W.
[7] For SE33.3KUS: It is allowed to install up to 15,000W per string when 3 strings are connected to the inverter and when the maximum power difference between the strings is up to 2,000W.



A.7 OPTIMIZERS – P860, P960, P1101 NORTH AMERICA MODELS

/ Power Optimizer For North America

P860 / P960 / P1101

Power OptimizerModel (Typical Module Compatibility)	P860 (for 2 x 72 cell modules)		P960 (for 2 x 72 cell modules)		P1101 (for up to 2 x high power or bi-facial modules)	
INPUT						
Rated Input DC Power[1]	860		960		1100	W
Connection Method	Dual input for independently connected modules[2]				Single input for series connected modules	
Absolute Maximum Input Voltage (Voc at lowest temperature)	60				125	Vdc
MPPT Operating Range	12.5 - 60				12.5 - 105	Vdc
Maximum Short Circuit Current (Isc)	22		23.2		14.1	Adc
Maximum Short Circuit Current per Input (Isc)	11		11.6		-	Adc
Maximum Efficiency	99.5					%
Weighted Efficiency	98.6					%
Overvoltage Category	II					
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)						
Maximum Output Current	18					Adc
Maximum Output Voltage	80					Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)						
Safety Output Voltage per Power Optimizer	1 ± 0.1					Vdc
STANDARD COMPLIANCE						
Photovoltaic Rapid Shutdown System	Compliant with NEC 2014, 2017, 2020					
EMC	FCC Part 15 Class A, IEC61000-6-2, IEC61000-6-3					
Safety	IEC62109-1 (class II safety), UL1741				IEC62109-1 (class II safety), UL1741, UL3741	
Material	UL94 V-0, UV resistant					
RoHS	Yes					
INSTALLATION SPECIFICATIONS						
Compatible SolarEdge Inverters	Three phase inverters				SE30K & larger	
Maximum Allowed System Voltage	1000					Vdc
Dimensions (W x L x H)	129 x 169 x 59 / 5.1 x 6.65 x 2.32		129 x 169 x 72 / 5.1 x 6.65 x 2.83		129 x 162 x 59 / 5.1 x 6.4 x 2.32	mm / in
Weight	1340 / 2.95		1410 / 3.1		1064 / 2.34	gr / lb
Input Connector	MC4[3]					
Input Wire Length Options	Input #1	Input #2	Input #1	Input #2	-	
1	(-) 0.16 / 0.52, (+) 0.16 / 0.52	(-) 0.16 / 0.52, (+) 0.16 / 0.52	(-) 1.6 / 5.2, (+) 1.6 / 5.2	(-) 1.6 / 5.2, (+) 1.6 / 5.2	1.6 / 5.2	m / ft
2	(-) 1.6 / 5.2, (+) 0.16 / 0.52	(-) 0.16 / 0.52, (+) 1.6 / 5.2				
3	(-) 1.6 / 5.2, (+) 1.6 / 5.2	(-) 1.6 / 5.2, (+) 1.6 / 5.2				
Output Wire Type / Connector	Double insulated; MC4					
Output Wire Length	2.3 / 7.5		2.3 / 7.5		2.4 / 7.8	m / ft
Operating Temperature Range[4]	-40 to +85 / -40 to +185					°C / °F
Protection Rating	IP68 / NEMA6P					
Relative Humidity	0 - 100					%

(1) Rated power of the module at STC will not exceed the Power Optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed
(2) In the event of an odd number of PV modules in one string, installation of one P860 /P960 Power Optimizer connected to one PV module is allowed. When connecting a single module to the P860/ P960, seal the unused input connectors with the supplied pair of seals
(3) For other connector types please refer to: https://www.solaredge.com/sites/default/files/optimizer-input-connector-compatibility.pdf
(4) For ambient temperature above +70°C / +158°F, power de-rating is applied. Refer to the Power Optimizers Temperature De-Rating Application Note for more details

PV System Design Using a SolarEdge Inverter[5][6]		208V Grid SE14.4K*	208V Grid SE17.3K*	277/480V Grid SE20K, 30K	277/480V Grid SE33.3K*, SE40K*	
Compatible Power Optimizers		P860, P960, P1101	P860, P960, P1101	P860, P960, P1101	P860, P960, P1101	
Minimum String Length	Power Optimizers	8	10	14	14	
	PV Modules	15	19	27	27	
Maximum String Length	Power Optimizers	30	30	30	30	
	PV Modules	60	60	60	60	
Maximum Continuous Power per String		7200	8820	15300	15300	W
Maximum Allowed Connected Power per String[7] (Permitted only when the difference in connected power between strings is up to 2,000W for the 277/480V grid, or 1,000W for the 208V grid)		1 string - 8400	1 string - 10020	1 string - 17550	2 strings or less - 17550	W
		2 strings or more - 9000	2 strings or more - 10620	2 strings or more - 20300	3 strings or more - 20300	
Parallel Strings of Different Lengths or Orientations		Yes				

* The same rules apply for Synergy units of equivalent power ratings, that are part of the modular Synergy Technology inverter
(5) P860/P960 can be mixed in one string only with P860/P960
(6) P860/P960 design with three phase 208V inverters is limited. Use the SolarEdge Designer for verification
(7) To connect more STC power per string, design your project using SolarEdge Designer

RoHS

A.8 OPTIMIZERS – M2640 NORTH AMERICA MODELS

/ Single Phase Inverter, Power Optimizer
with Compact Technology
Inverters: SE1000M, SE1500M, SE2000M
Power Optimizer: M2640

INVERTER SPECIFICATIONS:

	SE1000M	SE1500M	SE2000M	UNIT
OUTPUT				
Maximum AC Power Output	1000	1500	2000	VA
AC Output Voltage (nominal)	220 / 230			Vac
AC Output Voltage Range	184 - 264.5			Vac
AC Frequency (nominal)	50 / 60 ± 5			Hz
Maximum Continuous Output Current	5	7	9.5	A
INPUT				
Maximum DC Power	1350	2025	2640	W
Transformer-less, Ungrounded	Yes			
Maximum Input Voltage	500			Vdc
Operating Voltage	75 - 480			Vdc
Maximum Input Current	11			Adc
Maximum Inverter Efficiency	97			%
European Weighted Efficiency	95.7	96.5	97	%
ADDITIONAL FEATURES				
Supported Communication Interfaces	Basic: No Communication Interfaces Extended: RS485 Interface, communication to SolarEdge monitoring platform via built-in Ethernet or Wi-Fi(1) connectivity, or additional options purchased separately such as ZigBee or GSM plug-ins			
Smart Energy Management	Basic: No Smart Energy Management Extended: Export Limitation, Home Energy Management			
STANDARD COMPLIANCE				
Safety	IEC-62103 (EN50178), IEC-62109			
Grid Connection Standards	VDE-AR-N-4105, VDE 0126-1-1, AS-4777, RD-1663, DK5940			
Emissions	IEC61000-6-2, IEC61000-6-3, IEC61000-3-11, IEC61000-3-12, FCC part 15 class B			
RoHS	Yes			
INSTALLATION SPECIFICATIONS				
Dimensions (H x W x D)	340 x 239 x 127			mm
Noise	< 25			dBA
Weight	6			kg
Cooling	Natural Convection			
Operating Temperature Range	-40 to +60(2)			°C
Protection Rating	IP65 - Outdoor and Indoor			

(1) Wi-Fi connectivity requires an external antenna. For more information refer to: https://www.solaredge.com/sites/default/files/se-wifi-zigbee-antenna-datasheet.pdf
(2) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

/ Single Phase Inverter, Power Optimizer
with Compact Technology
Inverters: SE1000M, SE1500M, SE2000M
Power Optimizer: M2640

POWER OPTIMIZER SPECIFICATIONS:

	M2640 (For 4-8 60-cell modules or 4 72-cell / 96-cell modules)	UNIT
INPUT		
Number of Inputs	4	
Number of MPP Trackers	4 (one per input)	
Rated DC Power per Input[1]	660	W
Absolute Maximum Input Voltage per Input (Voc at lowest temperature)	96	Vdc
MPPT per Input Operating Range	12.5 - 80	Vdc
Maximum Short Circuit Current per Input (Isc)	10.5	Adc
Maximum Efficiency	99.5	%
Weighted Efficiency	98.8	%
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)		
Maximum Output Current	10.5	Adc
Maximum Output Voltage	340	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)		
Safety Output Voltage per Power Optimizer	10 ± 1	Vdc
INSTALLATION SPECIFICATIONS		
Maximum Allowed System Voltage	600	Vdc
Dimensions (H x W x D)	152 x 211 x 60	mm
Weight (including cables)	1.5	kg
Input Connector	4 x MC4 Pairs	
Output Connector	1 x MC4 Pair	
Operating Temperature Range	-40 to +85	˚C
Protection Rating	IP68	

(1) Rated STC power of the module. Module of up to +5% power tolerance allowed.

	SE1000M	SE1500M	SE2000M	UNIT
PV SYSTEM DESIGN				
Number of M2640 per Inverter	1			
Maximum DC System Power	1350	2025	2640	W_{DC}

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A.9 OPTIMIZERS – P370, P401, P404, P485, P500, P505, P601 INTERNATIONAL MODELS

Power Optimizer

P370 / P401 / P404 / P485 / P500 / P505 / P601

25 YEAR WARRANTY

POWER OPTIMIZER

PV power optimization at the module level

- Specifically designed to work with SolarEdge inverters
- Up to 25% more energy
- Next generation maintenance with module-level monitoring
- Mitigates all types of modules mismatch-loss, from manufacturing tolerance to partial shading
- Superior efficiency (99.5%)
- Flexible system design for maximum space utilization
- Module-level voltage shutdown for installer and firefighter safety
- Fast installation with a single bolt

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/ Power Optimizer

P370 / P401 / P404 / P485 / P500 / P505 / P601

OPTIMIZER MODEL (typical module compatibilty)	P370 (60&70 Cell modules)	P401 (60&70 Cell modules)	P404 (for 60-cell and 72 cell, short strings)	P485 (for high voltage modules)	P500 (for 96-cell modules)	P505 (for higher current modules)	P601 (for 1 x high power PV module)	UNIT
INPUT								
Rated Input DC Power(1)	370	420	405	485	500	505	600	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	60		80	125	80	83	65	Vdc
MPPT Operating Range	8 - 60		12.5 - 80	12.5 - 105	8 - 80	12.5-83	12.5 - 65	Vdc
Maximum Short Circuit Current (Isc)	11	12.5	11.75	11	10.1	14		Adc
Maximum Efficiency	99.5							%
Weighted Efficiency	98.8						98.6	%
Overvoltage Category	II							
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)								
Maximum Output Current	15							Adc
Maximum Output Voltage	60		80		60	80		Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)								
Safety Output Voltage per Power Optimizer	1 ± 0.1							Vdc
STANDARD COMPLIANCE								
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3							
Safety	IEC62109-1 (class II safety), UL1741							
RoHS	Yes							
Fire Safety	VDE-AR-E 2100-712:2013-05							
INSTALLATION SPECIFICATIONS								
Maximum Allowed System Voltage	1000							Vdc
Dimensions (W x L x H)	129x153x27.5 / 5.1x6x1.1	129x153x29.5 / 5.1x6x1.16	129 x 153 x 42.5 / 5.1 x 6 x 1.7	129x159x49.5 / 5.1x6.2x1.9	129x153x 33.5 / 5.1x6x1.3	129 x 162 x 59 / 5.1 x 6.4 x 2.3	129 x 153 x 52 / 5.1 x 6 x 2	mm / in
Weight (including cables)	655 / 1.5		775 / 1.7	845 / 1.9	750 / 1.7	1064 / 2.3		gr / lb
Input Connector	MC4(2)			Single or Dual MC4(2)(3)	MC4(2)			
Input Wire Length	0.16 / 0.52, 0.9 / 2.95		0.16 / 0.52					m / ft
Output Connector	MC4							
Output Wire Length	1.2 / 3.9						1.4 / 4.5	m / ft
Operating Temperature Range(4)	-40 to +85 / -40 to +185							°C / °F
Protection Rating	IP68							
Relative Humidity	0 - 100							%

(1) Rated power of the module at STC will not exceed the optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed
(2) For other connector types please contact SolarEdge
(3) For dual version for parallel connection of two modules use the P485. In the case of an odd number of PV modules in one string, installing one P485 dual version power optimizer connected to one PV module is supported. When connecting a single module, seal the unused input connectors using the supplied pair of seals
(4) For ambient temperature above +70°C / +158°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details

PV System Design Using a Solaredge Inverter(5)		Single Phase HD-WAVE	Three Phase SExxK-RWB	Three Phase 230/400V	Three Phase for 277/480V Grid	
Minimum String Length (Power Optimizers)	P370, P401, P500	8	9	16	18	
	P404, P485, P505, P601	6	8	14 (15 with SE30K)	14	
Maximum String Length (Power Optimizers)		25		50	50	
Maximum Nominal Power per String		5700(6)	5625(6)	11250(7)	12750(8)	W
Parallel Strings of Different Lengths or Orientations		Yes				

(5) It is not allowed to mix P404/P485/P505/P601 with P370/P401/P500 in one string
(6) If the inverters rated AC power ≤ maximum nominal power per string, then the maximum power per string will be able to reach up to the inverters maximum input DC power
Refer to: https://www.solaredge.com/sites/default/files/se-power-optimizer-single-string-design-application-note.pdf
(7) For the 230/400V grid: it is allowed to install up to 13,500W per string when the maximum power difference between each string is 2,000W
(8) For the 277/480V grid: it is allowed to install up to 15,000W per string when the maximum power difference between each string is 2,000W

CE

A.10 OPTIMIZERS – P605, P650, P701, P730, P800P, P801, P850, P950, P1100 EUROPE MODELS

PV power optimization at the module level

The most cost-effective solution for commercial and large field installations

- Specifically designed to work with SolarEdge inverters
- Up to 25% more energy
- Superior efficiency (99.5%)
- Balance of System cost reduction; 50% less cables, fuses and combiner boxes, over 2x longer string lengths possible
- Fast installation with a single bolt
- Advanced maintenance with module-level monitoring
- Module-level voltage shutdown for installer and firefighter safety
- Use with up to two PV modules connected in series or in parallel

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Power Optimizer

For Europe

P605 / P650 / P701 / P730 / P801

Power Optimizer Model (Typical Module Compatibility)	P605 (for 1 x high power PV module)	P650 (for up to 2 x 60-cell PV modules)	P701 (for up to 2 x 60/120-cell PV modules)	P730 (for up to 2 x 72-cell PV modules)	P801 (for up to 2 x 72/144 cell PV modules)	
INPUT						
Rated Input DC Power(1)	605	650	700*	730**	800	W
Connection Method	Single input for series connected modules					
Absolute Maximum Input Voltage (Voc at lowest temperature)	65	96		125		Vdc
MPPT Operating Range	12.5 - 65	12.5 - 80		12.5 - 105		Vdc
Maximum Short Circuit Current per Input (Isc)	14.1	11	11.75	11**	12.5***	Adc
Maximum Efficiency	99.5					%
Weighted Efficiency	98.6					%
Overvoltage Category	II					
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)						
Maximum Output Current	15					Adc
Maximum Output Voltage	80					Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)						
Safety Output Voltage per Power Optimizer	1 ± 0.1					Vdc
STANDARD COMPLIANCE						
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3	FCC Part 15, IEC 61000-6-2, and IEC 61000-6-3 - Class B, EN 55011				
Safety	IEC62109-1 (class II safety)					
RoHS	Yes					
Fire Safety	VDE-AR-E2100-712:2013-05					
INSTALLATION SPECIFICATIONS						
Compatible SolarEdge Inverters	Three Phase Inverters SE16K & larger(2)					
Maximum Allowed System Voltage	1000					Vdc
Dimensions (W x L x H)	129 x 153 x 52	129x153x42.5		129x153x49.5		mm
Weight	1064	834		933		gr
Input Connector	MC4(3)					
Input Wire Length	0.16			0.16 / 0.9(4)		m
Output Connector	MC4					
Output Wire Length	Portrait orientation: 1.4	Portrait orientation: 1.2				m
	-	Landscape orientation: 1.8		Landscape orientation: 2.2		
Operating Temperature Range(5)	-40 to +85					°C
Protection Rating	IP68 / NEMA6P					
Relative Humidity	0 - 100					%

* For P701 models manufactured after work week 06/2020, the rated DC input is 740W

** For P730 with manufactured date greater than working week 06 of 2020 the rated DC input is 760W and maximum Isc per Input is 11.75A

*** For P801 models manufactured in work week 40/2020 or earlier, the maximum Isc per input is 11.75A

The manufacture code is indicated in the Power Optimizer's serial number. Example: S/N SJ0620A-xxxxxxxx (working week 06 in 2020)

(1) Rated power of the module at STC will not exceed the Power Optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed

(2) For compliance with EN 55011 class A (where required), installation shall be done with inverter 20kVA or larger, and comply with the requirements in the EMC section of the installation manual

(3) For other connector types please contact SolarEdge

(4) Longer inputs wire lengths are available for use with split junction box modules. (For 0.9m/2.95ft order P730-xxxLxxx)

(5) For ambient temperature above +70°C/ +158°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details

PV System Design Using a SolarEdge Inverter(6)(7)(8)		230/400V Grid SE20K, SE25K*, SE33.3K*		230/400V Grid SE27.6K*		230/400V Grid SE30K*		277/480V Grid SE33.3K*, SE40K*	
Compatible Power Optimizers		P605	P650, P701, P730, P801	P605	P650, P701, P730, P801	P605	P650, P701, P730, P801	P605, P650, P701, P730, P801	
Minimum String Length	Power Optimizers	14		14		15		14	
	PV Modules	14	27	14	27	15	29	27	
Maximum String Length	Power Optimizers	30		30		30		30	
	PV Modules	30	60	30	60	30	60	60	
Maximum Continuous Power per String		11250		11625		12750		12750	W
Maximum Allowed Connected Power per String(9) (Permitted only when the difference in connected power between strings is 2,000W or less)		13500		13875		15000		15000	W
Parallel Strings of Different Lengths or Orientations		Yes							

* The same rules apply for Synergy units of equivalent power ratings, that are part of the modular Synergy Technology inverter

(6) P650/P701/P730/P801 can be mixed in one string only with P650/P701/P730/P801. P605 cannot be mixed with any other Power Optimizer in the same string

(7) For each string, a Power Optimizer may be connected to a single PV module if 1) each Power Optimizer is connected to a single PV module or 2) it is the only Power Optimizer connected to a single PV module in the string

(8) For SE25K and above, the minimum STC DC connected power should be 11KW

(9) To connect more STC power per string, design your project using SolarEdge Designer

/ Power Optimizer

For Europe

P800p / P850 / P950 / P1100

Power Optimizer Model (Typical Module Compatibility)	P800p (for up to 2 x 96-cell5" PV modules)	P850 (for up to 2 x high power or bi-facial modules)	P950 (for up to 2 x high power or bi-facial modules)	P1100 (for up to 2 x high power or bi-facial modules)	
INPUT					
Rated Input DC Power(1)	800	850	950	1100	W
Connection Method	Dual input for independently Connected modules	Single input for series connected modules			
Absolute Maximum Input Voltage (Voc at lowest temperature)	83	125			Vdc
MPPT Operating Range	12.5-83	12.5-105			Vdc
Maximum Short Circuit Current per Input (Isc)	7	14.1*		14.1	Adc
Maximum Efficiency	99.5				%
Weighted Efficiency	98.6				%
Overvoltage Category	II				
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)					
Maximum Output Current	18				Adc
Maximum Output Voltage	80				Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)					
Safety Output Voltage per Power Optimizer	1 ± 0.1				Vdc
STANDARD COMPLIANCE					
EMC	FCC Part 15, IEC 61000-6-2, and IEC 61000-6-3 - Class B, EN 55011				
Safety	IEC62109-1 (class II safety)				
RoHS	Yes				
Fire Safety	VDE-AR-E2100-712:2013-05				
INSTALLATION SPECIFICATIONS					
Compatible SolarEdge Inverters	Three Phase Inverters SE16K& larger(2)			Three Phase Inverters SE25K &larger	
Maximum Allowed System Voltage	1000				Vdc
Dimensions (W x L x H)	129x 168 x 59	129x162x59			mm
Weight	1064				gr
Input Connector	MC4(3)				
Input Wire Length	0.16	0.16, 0.9,1.3, 1.6(4)	0.16, 1.3, 1.6(4)	0.16, 1.3(4)	m
Output Connector	MC4				
Output Wire Length	Portrait orientation: 1.2			2.4	m
	Landscape orientation: 1.8	Landscape orientation: 2.2			
Operating Temperature Range(5)	-40 to +85				°C
Protection Rating	IP68/ NEMA6P				
Relative Humidity	0 - 100				%

* For P850/P950 models manufactured in work week 06/2020 or earlier, the maximum Isc per input is 12.5A. The manufacture code is indicated in the Power Optimizer's serial number Example: S/N SJ0620A-xxxxxxxx (work week 06 in 2020)

(1) Rated power of the module at STC will not exceed the Power Optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed

(2) For compliance with EN 55011 class A (where required), installation shall be done with inverter 20kVA or larger, and comply with the requirements in the EMC section of the installation manual

(3) For other connector types please contact SolarEdge

(4) Longer inputs wire length are available for use with split junction box modules (For 0.9m/2.95ft order P801/P850-xxxLxxx. For 1.3m/2.95ft order P850/P950/P1100 -xxxXxxx. For 1.6m/5.24ft order P850/P950-xxxYxxx)

(5) For ambient temperature above +70°C/+158°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details

PV System Design Using a SolarEdge Inverter(6)(7)(8)		230/400V Grid SE20K, SE25K*	230/400V Grid SE27.6K*	230/400V Grid SE30K*	230/400V Grid SE33.3K*	277/480V Grid SE33.3K*, SE40K*	
Compatible Power Optimizers		P800p, P850, P950, P1100	P800p, P850, P950, P1100	P800p, P850, P950, P1100	P800p, P850, P950, P1100	P800p, P850, P950, P1100	
Minimum String Length	Power Optimizers	14	14	15	14	14	
	PV Modules	27	27	29	27	27	
Maximum String Length	Power Optimizers	30	30	30	30	30	
	PV Modules	60	60	60	60	60	
Maximum Continuous Power per String		13500	13950	15300	13500	15300	W
Maximum Allowed Connected Power per String(9) (Permitted only when the difference in connected power between strings is 2,000W or less)		1 string - 15750	1 string - 16200	1 string - 17550	2 strings or less - 15750	2 strings or less - 17550	W
		2 strings or more - 18500	2 strings or more - 18950	2 strings or more - 20300	3 strings or more - 18500	3 strings or more - 20300	
Parallel Strings of Different Lengths or Orientations		Yes					

* The same rules apply for Synergy units of equivalent power ratings, that are part of the modular Synergy Technology inverter

(6) P800p/P850/P950/P1100 can be mixed in one string only with P800p/P850/P950/P1100

(7) For each string, a Power Optimizer may be connected to a single PV module if 1) each Power Optimizer is connected to a single PV module or 2) it is the only Power Optimizer connected to a single PV module in the string

(8) For SE25K and above, the minimum STC DC connected power should be 11KW

(9) To connect more STC power per string, design your project using SolarEdge Designer

A.11 SINGLE PHASE HOME HUB INVERTERS – SE3000H-US, SE3800H-US, SE6000H-US, SE7600H-US, SE10000H-US, SE11400H-US NORTH AMERICA MODELS

Single Phase Energy Hub Inverter with Prism Technology

For North America

SE3000H-US / SE3800H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US(1)

HOME BACKUP

Optimized battery storage with HD-Wave technology

- Record-breaking 99% weighted efficiency with 200% DC oversizing
- Small, lightweight, and easy to install
- Modular design, future ready with optional upgrades to:
  - DC-coupled storage for full or partial home backup
  - Built-in consumption monitoring
  - Direct connection to the SolarEdge smart EV charger
- Multi-inverter, scalable storage solution
  - With enhanced battery power up to 10kW
- Integrated arc fault protection and rapid shutdown for NEC 2014, NEC 2017 and NEC 2020, per article 690.11 and 690.12
- Embedded revenue grade production data, ANSI C12.20 Class 0.5

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Single Phase Energy Hub Inverter with Prism Technology

For North America

SE3000H-US / SE3800H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US(1)

	SE3000H-US	SE3800H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	UNITS
OUTPUT - AC ON GRID							
Rated AC Power	3000	3800 @ 240V 3300 @ 208V	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	W
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	W
AC Frequency Range (min - nom - max)	59.3 - 60 - 60.5(2)						Hz
Maximum Continuous Output Current @ 240V	12.5	16	25	32	42	47.5	A
Maximum Continuous Output Current @ 208V	-	16	24	-	-	48.5	A
GFDI Threshold	1						A
Total Harmonic Distortion (THD)	<3						%
Power Factor	1, adjustable -0.85 to 0.85						
Utility Monitoring,IslandingProtection,Country ConfigurableThresholds	Yes						
Charge Battery from AC (if allowed)	Yes						
Typical Nighttime Power Consumption	<2.5						W
OUTPUT - AC BACKUP(3)							
Rated AC Power in Backup Operation(4)	3000	3800 7600*	6000	7600 10300*	10000	10300	W
AC L-L Output Voltage Range in Backup	211 - 264						Vac
AC L-N Output Voltage Range in Backup	105 - 132						Vac
AC Frequency Range in Backup (min - nom - max)	55 - 60 - 65						Hz
Maximum Continuous Output Current in Backup Operation	12.5	16 32*	25	32 43*	42	43	A
GFDI	1						A
THD	<5						%
OUTPUT - SMART EV CHARGER AC							
Rated AC Power	9600						W
AC Output Voltage Range	211 - 264						Vac
On-Grid AC Frequency Range (min - nom - max)	59.3 - 60 - 60.5						Hz
Maximum Continuous Output Current @240V (grid, PV and battery)	40						Aac
INPUT - DC (PV AND BATTERY)							
Transformer-less, Ungrounded	Yes						
Max Input Voltage	480						Vdc
Nom DC Input Voltage	380						Vdc
Reverse-Polarity Protection	Yes						
Ground-Fault Isolation Detection	600kΩ Sensitivity						
INPUT - DC (PV)							
Maximum DC Power @ 240V	6000	7600 15200*	12000	15200 22800*	22000	22800	W
Maximum DC Power @ 208V	-	6600	10000	-	-	20000	W
Maximum Input Current(5) @ 240V	8.5	10.5 20*	16.5	20 31*	27	31	Adc
Maximum Input Current(5) @ 208V	-	9	13.5	-	-	27	Adc
Max. Input Short Circuit Current	45						Adc
Maximum Inverter Efficiency	99	99.2					%
CEC Weighted Efficiency	99					99 @ 240V 98.5 @ 208V	%
2-pole Disconnection	Yes						

* Supported with PN SExxxxH-USMMxxxxxx or SExxxxH-USMNxxxxxx

(1) These specifications apply to inverters with part numbers SExxxxH-USSMxxxxx or SExxxxH-USSNxxxxxx and connection unit model number DCD-1PH-US-PxH-F-x

(2) For other regional settings please contact SolarEdge support

(3) Not designed for standalone applications and requires AC for commissioning. Backup functionality is only supported for 240V grid

(4) Rated AC power in Backup Operation are valid for installations with multiple inverters. For a single backup inverter operation, rated AC power in Backup is 90% of the value stated

(5) A higher current source may be used; the inverter will limit its input current to the values stated

Single Phase Energy Hub Inverter with Prism Technology

For North America

SE3000H-US / SE3800H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US(1)

	SE3000H-US	SE3800H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	UNITS
INPUT - DC (BATTERY)							
Supported Battery Types	SolarEdge Energy Bank, LG RESU Prime(6)						
Number of Batteries per Inverter	Up to 3 SolarEdge Energy Bank, up to 2 LG RESU Prime						
Continuous Power(7)	6000	7600	10000				W
Peak Power(7)	6000	7600	10000				W
Max Input Current	16	20	26.5				Adc
2-pole Disconnection	Yes						
SMART ENERGY CAPABILITIES							
Consumption Metering	Built - in(8)						
Backup & Battery Storage	With Backup Interface (purchased separately) for service up to 200A; Up to 3 inverters						
EV Charging	Direct connection to Smart EV charger						
ADDITIONAL FEATURES							
Supported Communication Interfaces	RS485, Ethernet, Cellular(9), Wi-Fi (optional), SolarEdge Energy Net (optional)						
Revenue Grade Metering, ANSI C12.20	Built - in(8)						
Integrated AC, DC and Communication Connection Unit	Yes						
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi Access Point for local connection						
DC Voltage Rapid Shutdown (PV and Battery)	Yes, according to NEC 2014, NEC 2017 and NEC 2020 690.12						
STANDARD COMPLIANCE							
Safety	UL1741, UL1741 SA, UL1741 PCS, UL1699B, UL1998, UL9540, CSA 22.2						
Grid Connection Standards	IEEE1547, Rule 21, Rule 14H						
Emissions	FCC part 15 class B						
INSTALLATION SPECIFICATIONS							
AC Output and EV AC Output Conduit Size / AWG Range	1" maximum / 14-4 AWG						
DC Input (PV and Battery) Conduit Size / AWG Range	1" maximum / 14-6 AWG						
Dimensions with Connection Unit (H x W x D)	17.7 x 14.6 x 6.8 / 450 x 370 x 174			17.7 x 14.6 x 6.8 / 450 x 370 x 174 17.7 x 14.6 x 6.8 / 450 x 370 x 174*	17.7 x 14.6 x 6.8 / 450 x 370 x 174		in / mm
Weight with Connection Unit	26 / 11.8			26 / 11.8 41.7/ 18.9*	41.7 / 18.9		lb / kg
Noise	< 25	< 25 < 50*	< 25	< 50			dBA
Cooling	Natural Convection						
Operating Temperature Range	-40 to +140 / -40 to +60(10)						°F / °C
Protection Rating	NEMA 4						

(6) The part numbers SExxxxI-USxMxxxx only support the SolarEdge Energy Bank. The part numbers SExxxxI-USxNxxxx support both SolarEdge Energy Bank and LG RESU Prime batteries
Requires supporting inverter firmware
(7) Discharge power is limited up to the inverter rated AC power for on-grid and backup applications
(8) For consumption metering current transformers should be ordered separately: SECT-SPL-225A-T-20 or SEACT0750-400NA-20 units per box. Revenue grade metering is only for production metering
(9) Information concerning the Data Plan's terms & conditions is available in the following link:
https://www.solaredge.com/sites/default/files/se-communication-plan-terms-and-conditions-eng.pdf
(10) Full power up to at least 50°C / 122°F; for power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

RoHS

A.12 SINGLE PHASE HOME HUB INVERTERS – SE3000H-XXX, SE4000H-XXX, SE5000H-XXX, SE6000H-XXX, SE8250H-XXX, SE10000H-XXX AUSTRALIA AND NEW ZEALAND MODELS

Single Phase Energy Hub Inverter with Prism Technology

HOME BACKUP

For Australia and New Zealand

SE3000H-XXX / SE4000H-XXX / SE5000H-XXX /
SE6000H-XXX /SE8250H-XXX / SE10000H-XXX

Optimised battery storage with HD-Wave technology

- Single string design for inverters up to 5kW AC
- Record-breaking 99% weighted efficiency with 200% DC oversizing, for higher energy yield
- Modular design, future ready with optional upgrades enabling:
  - Full home backup power
  - High efficiency DC-coupled storage
  - Backup generator connection
  - EV charging, with SolarEdge Smart EV Charger
- Built-in consumption monitoring
- Multi-inverter, scalable storage solution
- Advanced safety features including SafeDC™, rapid shutdown, and integrated arc fault protection
- Built-in panel-level monitoring
- Rapid inverter commissioning via smartphone using SetApp
- Small, lightweight, and easy to install
- IP65-rated, for indoor and outdoor installations

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Single Phase Energy Hub Inverter with Prism Technology

For Australia and New Zealand

SE3000H-XXX / SE4000H-XXX / SE5000H-XXX /
SE6000H-XXX / SE8250H-XXX / SE10000H-XXX(1)

	SE3000H-XXX	SE4000H-XXX	SE5000H-XXX	SE6000H-XXX	SE8250H-XXX	SE10000H-XXX	UNITS
OUTPUT - AC ON GRID							
Rated AC Power	3000	4000	5000	6000	8250	10000	VA
Maximum AC Power Output	3000	4000	5000	6000	8250	10000	VA
AC Output Voltage (Nominal)	220 / 230						Vac
AC Output Voltage Range	184 - 264.5						Vac
AC Frequency Range (nominal)	50/60 ± 5						Hz
Maximum Continuous Output Current	14	18.5	23	27.5	37.5	45.5	A
Total Harmonic Distortion (THD)	<3						%
Power Factor	1, adjustable -0.8 to 0.8						
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes						
Charge Battery from AC (if allowed)	Yes						
Typical Nighttime Power Consumption	<2.5						W
OUTPUT - AC BACKUP(2)							
Rated AC Power in Backup Operation(3)	3000	4000	5000	6000	7400	9000	W
AC Output Voltage (Nominal)	220 / 230						Vac
AC Output Voltage Range	184-264.5						Vac
AC Frequency	50/60 ± 5						Hz
Maximum Continuous Output Current in Backup Operation(4)	14	18.5	23	27.5	34	41.5	A
INPUT - DC (PV AND BATTERY)							
Transformer-less, Ungrounded	Yes						
Max Input Voltage	480						Vdc
Nom DC Input Voltage	380				400		Vdc
Reverse-Polarity Protection	Yes						
Ground-Fault Isolation Detection	600kΩ Sensitivity						
Maximum DC PV Power	6000	8000	10000	12000	16500	20000	W
Maximum Input Current(5)	8.5	11	14	16.5	22.5	25.5	Adc
Maximum Inverter Efficiency	99.2						%
European Weighted Efficiency	98.8		99				%
2-pole Disconnection	Yes						
BATTERY STORAGE							
Supported Battery Types	SolarEdge Energy Bank Battery, LG RESU10H Prime, LG RESU16H Prime						
Number of Batteries per Inverter	Up to 3 SolarEdge Energy Bank Batteries or up to 2 LG Prime batteries(6)						
Continuous Power	Up to inverter rated power						
SMART ENERGY CAPABILITIES							
Consumption Metering	Built-in(7)						
Battery Storage	In backup: Up to 3 inverters, 88.2kWh with SolarEdge Energy Bank Battery						
EV Charging	Smart EV ready - separate EV charger and cabling required						

(1) These specifications apply to inverters with part numbers SExxxxH-AUS3xxxxx and connection unit model number DCD-1PH-AU-PxH-F-x
(2) Not designed for standalone applications and requires AC for commissioning
(3) Rated AC power in Backup Operation are valid for installations with multiple inverters. For a single backup inverter operation, rated AC power in backup is 90% of the stated value
(4) Rated current in backup operation are valid for installations with multiple inverters. For a single backup inverter operation, rated current in backup is 90% of the stated value
(5) A higher current source may be used; the inverter will limit its input current to the values stated
(6) Support for 2 LG Prime batteries with compatible inverter firmware
(7) For consumption metering current transformers should be ordered separately: SE-CTML-0350-070 or SE-ACT-0750-100 or SE-ACT-0750-250

Single Phase Energy Hub Inverter with Prism Technology

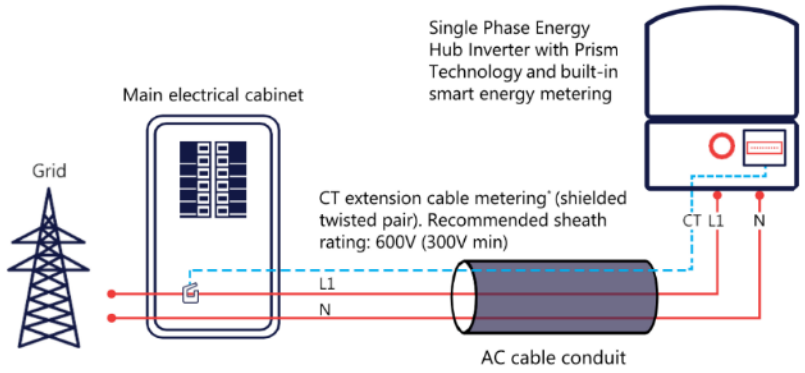
For Australia and New Zealand

SE3000H-XXX / SE4000H-XXX / SE5000H-XXX /
SE6000H-XXX / SE8250H-XXX / SE10000H-XXX(1)

		SE3000H-XXX	SE4000H-XXX	SE5000H-XXX	SE6000H-XXX	SE8250H-XXX	SE10000H-XXX	UNITS
ADDITIONAL FEATURES								
Supported Communication Interfaces		RS485 - Modbus devices, RS485 - SE protocol, Ethernet, Wi-Fi, EnergyNet						
Integrated AC, DC and Communication Connection Unit		Yes						
Inverter Commissioning		With the SetApp mobile application using built-in Wi-Fi Access Point for local connection						
STANDARD COMPLIANCE								
Safety		IEC-62103 (EN50178), IEC-62109, AS/NZS3100						
Grid Connection Standards		AS/NSZ 4777.2:2020, EN 50549-1						
Emissions		IEC61000-6-2, IEC61000-6-3, IEC61000-3-11, IEC61000-3-12						
Listing	Photovoltaic Inverter	SExxxxxH						
	Battery Inverter	SExxxxxK-B						
	Photovoltaic and Battery Inverter	SExxxxxK-BPV						
	Multiple Mode Inverter (Battery only)	SExxxxxK-MMB						
	Multiple Mode Inverter	SExxxxxK-MM						
INSTALLATION SPECIFICATIONS								
AC Output and DC Input Conduit Size / Wire Cross Section		32 mm Maximum / 1-10 mm^2						
Dimensions with Connection Unit (H x W x D)		450 x 370 x 174				540 x 370 x 185		
Weight with Connection Unit		<15				<20		
Communication Glands		2						kg
Noise		<25				<50		dBA
Cooling		Natural convection						
Operating Temperature Range		-40 to +60(8)						°C
Protection Rating		IP65 - Outdoor and Indoor						
Manufacturing Countries		China / Vietnam / Hungary						

(8) Full power up to at least 50°C; for power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

Connecting CTs to the Revenue Grade and Consumption Meter



* One CT for import/export or consumption metering

RoHS

A.13 SINGLE PHASE INVERTERS WITH HD-WAVE – SE3000H-US, SE3800H-US, SE5000H-US, SE6000H-US, SE7600H-US, SE10000H-US, SE11400H-US NORTH AMERICA MODELS

Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US

INVERTERS

12-25 YEAR WARRANTY

Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking 99% weighted efficiency
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014, NEC 2017 and NEC 2020 per article 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Small, lightweight, and easy to install both outdoors or indoors
- Built-in module-level monitoring
- Optional: Faster installations with built-in consumption metering (1% accuracy) and production revenue grade metering (0.5% accuracy, ANSI C12.20)

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/ Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/ SE7600H-US / SE10000H-US / SE11400H-US

MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXXXH-XXXXXBXX4							
OUTPUT								
Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	✓	-	✓	-	-	✓	Vac
AC Frequency (Nominal)	59.3 - 60 - 60.5[1]							Hz
Maximum Continuous Output Current @240V	12.5	16	21	25	32	42	47.5	A
Maximum Continuous Output Current @208V	-	16	-	24	-	-	48.5	A
Power Factor	1, Adjustable - 0.85 to 0.85							
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							
INPUT								
Maximum DC Power @240V	4650	5900	7750	9300	11800	15500	17650	W
Maximum DC Power @208V	-	5100	-	7750	-	-	15500	W
Transformer-less, Ungrounded	Yes							
Maximum Input Voltage	480							Vdc
Nominal DC Input Voltage	380				400			Vdc
Maximum Input Current @240V[2]	8.5	10.5	13.5	16.5	20	27	30.5	Adc
Maximum Input Current @208V[2]	-	9	-	13.5	-	-	27	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kΩ Sensitivity							
Maximum Inverter Efficiency	99	99.2						%
CEC Weighted Efficiency	99						99 @ 240V 98.5 @ 208V	%
Nighttime Power Consumption	< 2.5							W

(1) For other regional settings please contact SolarEdge support
(2) A higher current source may be used; the inverter will limit its input current to the values stated

Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/
SE7600H-US / SE10000H-US / SE11400H-US

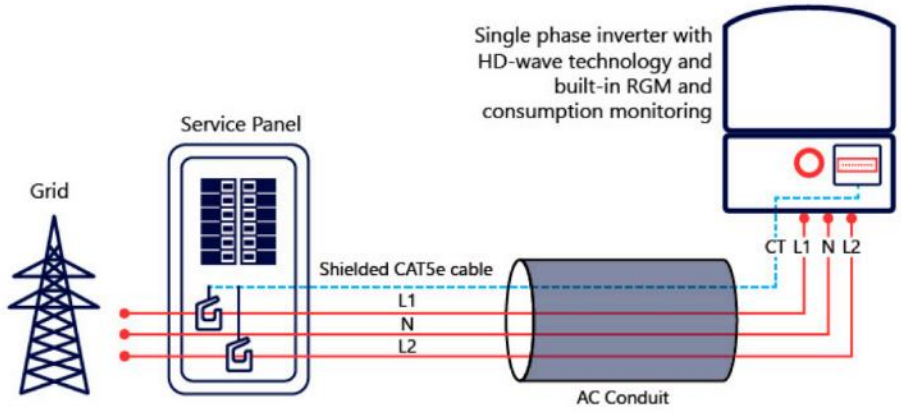
MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
ADDITIONAL FEATURES								
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional), Cellular (optional)							
Revenue Grade Metering, ANSI C12.20	Optional[3]							
Consumption metering								
Inverter Commissioning	With the SetApp mobile application using Built-in Wi-Fi Access Point for Local Connection							
Rapid Shutdown - NEC 2014, NEC 2017 and NEC 2020, 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect							
STANDARD COMPLIANCE								
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07							
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)							
Emissions	FCC Part 15 Class B							
INSTALLATION SPECIFICATIONS								
AC Output Conduit Size / AWG Range	1" Maximum / 14-6 AWG					1" Maximum /14-4 AWG		
DC Input Conduit Size / # of Strings / AWG Range	1" Maximum / 1-2 strings / 14-6 AWG					1" Maximum / 1-3 strings / 14-6 AWG		
Dimensions with Safety Switch (HxWxD)	17.7 x 14.6 x 6.8 / 450 x 370 x 174					21.3 x 14.6 x 7.3 / 540 x 370 x 185		in / mm
Weight with Safety Switch	22 / 10		25.1 / 11.4	26.2 / 11.9		38.8 / 17.6		lb / kg
Noise	< 25				<50			dBA
Cooling	Natural Convection							
Operating Temperature Range	-40 to +140 / -40 to +60[4]							°F / °C
Protection Rating	NEMA 4X (Inverter with Safety Switch)							

(3) Inverter with Revenue Grade Meter P/N: SExxxxH-US000BNC4; Inverter with Revenue Grade Production and Consumption Meter P/N: SExxxxH-US000BNI4 . For consumption metering, current transformers should be ordered separately: SEACT0750-200NA-20 or SEACT0750-400NA-20. 20 units per box

(4) Full power up to at least 50°C / 122°F; for power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

How to Enable Consumption Monitoring

By simply wiring current transformers through the inverter's existing AC conduits and connecting them to the service panel, homeowners will gain full insight into their household energy usage helping them to avoid high electricity bills



RoHS

A.14 SINGLE PHASE INVERTERS WITH HD-WAVE – SE2200H, SE3000H, SE3500H, SE3680H, SE4000H, SE4600 (NOT SHOWN), SE5000H, SE6000H INTERNATIONAL MODELS

Single Phase Inverter with HD-Wave Technology

SE2200H, SE3000H, SE3500H, SE3680H, SE4000H, SE5000H, SE6000H

	SE2200H	SE3000H	SE3500H	SE3680H	SE4000H	SE5000H	SE6000H	
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXXXH-XXXXXBXX4							
OUTPUT								
Rated AC Power Output	2200	3000	3500	3680	4000	5000[1]	6000	VA
Maximum AC Power Output	2200	3000	3500	3680	4000	5000[1]	6000	VA
AC Output Voltage (Nominal)	220/230							Vac
AC Output Voltage Range	184 - 264.5							Vac
AC Frequency (Nominal)	50/60 ± 5							Hz
Maximum Continuous Output Current	10	14	16	16	18.5	23	27.5	A
Total Harmonic Distortion (THD)	<3							%
Power Factor	1, adjustable -0.9 to 0.9							
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes							
INPUT								
Maximum DC Power	4400	6000	7000	7360	8000	10000[2]	12000	W
Transformer-less, Ungrounded	Yes							
Maximum Input Voltage	480							Vdc
Nominal DC Input Voltage	380							Vdc
Maximum Input Current	6.5	9	10	10.5	11.5	13.5	16.5	Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kΩ Sensitivity per Unit							
Maximum Inverter Efficiency	99.2							%
European Weighted Efficiency	98.3	98.8				99		%
Nighttime Power Consumption	< 2.5							W
ADDITIONAL FEATURES								
Supported Communication Interfaces	RS485, Ethernet, Wi-Fi (optional), wireless SolarEdge Energy Net (optional)[3], Cellular (optional), ZigBee (optional)							
Smart Energy Management	Export Limitation							
Inverter Commissioning	With the SetApp mobile application using built in Wi-Fi station for local connection							
Arc Fault Protection	Integrated, User Configurable (According to UL16998)							
STANDARD COMPLIANCE								
Safety	IEC-62109-1/2							
Grid Connection Standards	IEC61727, IEC62116, EN 50438, VDE-AR-N-4105, VDE 0126-1-1, UTE_C_15-712, G98, G99, CEI-021, ÖNORM, TF3.2.1, C10-11, NRS 097-2-1							
Emissions	IEC61000-6-2, IEC61000-6-3, IEC61000-3-11, IEC61000-3-12, FCC Part 15 Class B							
INSTALLATION SPECIFICATIONS								
AC Output - Supported Cable Diameter	9-16							mm
AC - Supported Wire Cross Section	1-13							mm^2
DC Input	1 x MC4				2 x MC4 pair			
Dimensions (H x W x D)	280 x 370 x 142							mm
Noise	< 25							dBA
Weight	7.8				9		10.6	kg
Cooling	Natural Convection							
Operating Temperature Range	-40 to +60[4]							°C
Protection Rating	IP65 — Outdoor and Indoor							

(1) 4600VA in Germany
(2) 7130VA in Germany
(3) For more information, refer to: https://www.solaredge.com/sites/default/files/se-energy-net-plug-in-datasheet.pdf
(4) Full power up to at least 50°C / 122°F. For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.15 SINGLE PHASE INVERTERS WITH HD-WAVE – SE2500H (NOT SHOWN), SE3000H, SE4000H, SE5000H, SE6000H, SE8000H, SE10000H AUSTRALIA MODELS

/ Single Phase Inverter with HD-Wave Technology

For Australia

SE3000H, SE4000H, SE5000H, SE6000H, SE8000H, SE10000H

APPLICABLE TO INVERTERS WITH PART NUMBER	SE3000H	SE4000H	SE5000H	SE6000H	SE8000H	SE10000H	
	SEXXXXH-AUXXXBXX4						
OUTPUT							
Rated AC Power Output	3000	4000	5000	6000	8000	10000	VA
Maximum AC Power Output	3000	4000	5000	6000	8000	10000	VA
AC Output Voltage (Nominal)	220/230						Vac
AC Output Voltage Range	184 - 264.5						Vac
AC Frequency (Nominal)	50/60 ± 5						Hz
Maximum Continuous Output Current	14	18.5	23	27.5	36.5	45.5	A
Total Harmonic Distortion (THD)	< 3						%
Power Factor	1, adjustable -0.8 to 0.8						
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes						
INPUT							
Maximum DC Power	4650	6200	7750	9300	12400	15500	W
Transformer-less, Ungrounded	Yes						
Maximum Input Voltage	480						Vdc
Nominal DC Input Voltage	380				400		Vdc
Maximum Input Current	9	11.5	13.5	16.5	20.5	25.5	Adc
Reverse-Polarity Protection	Yes						
Ground-Fault Isolation Detection	600kΩ sensitivity per unit						
Maximum Inverter Efficiency	99.2						%
European Weighted Efficiency	98.8		99				%
Nighttime Power Consumption	< 2.5						W
ADDITIONAL FEATURES							
Supported Communication Interfaces	RS485, Ethernet, ZigBee for Smart Energy (optional)(1), Wi-Fi (optional)						
Smart Energy Management(2)	Export limitation						
Arc Fault Protection	Integrated, user configurable (according to UL1699B)						
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi Access-Point for local connection						
STANDARD COMPLIANCE							
Safety	IEC62109, AS/NZS3100						
Grid Connection Standards	AS/NZS4777.2015						
Emissions	IEC61000-6-2, IEC61000-6-3, IEC61000-3-11, IEC61000-3-12, FCC Part 15 Class B						
INSTALLATION SPECIFICATIONS							
AC Output Conduit Size / Wire Cross Section	25mm maximum / 1-13 mm^2						
DC Input Conduit Size / # of Strings / Wire Cross Section	25mm maximum / 1-2 strings / 1-13 mm^2				25mm maximum / 1-3 strings / 1-13 mm^2		
Dimensions with Safety Switch (H x W x D)	450 x 370 x 174				540 x 370 x 185		mm
Weight with Safety Switch	10	11.4		11.9	17.6		kg
Noise	< 25				< 50		dBA
Cooling	Natural convection						
Operating Temperature Range	-40 to +60(3)						°C
Protection Rating	IP65 - outdoor and indoor						

(1) For more information refer to: https://www.solaredge.com/sites/default/files/se-zigbee-plug-in-wireless-communication-for-setapp-datasheet-au.pdf
(2) For export limitation, the optional export meter is required. This built-in meter can also be used for additional home energy management capabilities, if needed.
(3) Full power up to at least 50°C. For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.16 THREE PHASE INVERTER – SE9KUS NORTH AMERICA MODEL

Three Phase Inverters for the 120/208V Grid

for North America

SE9KUS

INVERTERS

12-20 YEAR WARRANTY

The best choice for SolarEdge enabled systems

- Specifically designed to work with power optimizers
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Internet connection through Ethernet or Wireless
- Fixed voltage inverter for longer strings
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Built-in module-level monitoring
- Integrated arc fault protection and rapid shutdown for NEC 2014, 2017 and 2020, per article 690.11 and 690.12
- Integrated Safety Switch
- Supplied with RS485 Surge Protection, to better withstand lightning events
- Small, lightweight, and easy to install outdoors or indoors on provided bracket

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Three Phase Inverters for the 120/208V Grid[1] for North America

SE9KUS

APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXK-XXXXXBXX4	
MODEL NUMBER	SE9KUS	
OUTPUT		
Rated AC Power Output	9000	VA
Maximum AC Power Output	9000	VA
Output Line Connections	3 phase, 3-wire / PE (L1-L2-L3), TN, TT 3 phase, 4-wire / PE (L1-L2-L3-N), TN, TT	
AC Output Voltage Minimum-Nominal-Maximum[2] (L-N)	105-120-132.5	Vac
AC Output Voltage Minimum-Nominal-Maximum[2] (L-L)	183-208-229	Vac
AC Frequency Min-Nom-Max[2]	59.3 - 60 - 60.5	Hz
Maximum Continuous Output Current (per Phase)	25	A
GFDI Threshold	1	A
Utility Monitoring, Islanding Protection, Country Configurable Set Points	Yes	
THD	≤ 3	%
INPUT		
Maximum DC Power (Module STC)	12150	W
Transformer-less, Ungrounded	Yes	
Maximum Input Voltage DC to Gnd	250	Vdc
Maximum Input Voltage DC+ to DC-	500	Vdc
Nominal Input Voltage DC to Gnd	200	Vdc
Nominal Input Voltage DC+ to DC-	400	Vdc
Maximum Input Current	26.5	Adc
Maximum Input Short Circuit Current	45	Adc
Reverse-Polarity Protection	Yes	
Ground-Fault Isolation Detection	1MΩ Sensitivity[3]	
CEC Weighted Efficiency	96.5	%
Night-time Power Consumption	< 3	W
ADDITIONAL FEATURES		
Supported Communication Interfaces	RS485, Ethernet, Built-in Cellular (optional)	
Inverter Commissioning	With the SetApp mobile application using built-in access point for local connection	
Rapid Shutdown – NEC 2014, 2017 and 2020 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect	
RS485 Surge Protection Plug-in	Supplied with the inverter	
Smart Energy Management	Export Limitation	
STANDARD COMPLIANCE		
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07	
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)	
Emissions	FCC part15 class B	
INSTALLATION SPECIFICATIONS		
AC output conduit size / AWG range	3/4" minimum / 8-4 AWG	
DC input conduit size / AWG range	3/4" minimum / 12-6 AWG	
Number of DC inputs[4]	2 pairs	
Dimensions (H x W x D)	21 x 12.5 x 10.5 / 540 x 315 x 260	in / mm
Dimensions with Safety Switch (H x W x D)	30.5 x 12.5 x 10.5 / 775 x 315 x 260	in / mm
Weight	93.6 / 42.5	lb / kg
Weight with Safety Switch	100.3 / 45.5	lb / kg
Cooling	Fans (user replaceable)	
Noise	< 55	dBA
Operating Temperature Range	-40 to +140 / -40 to +60[5]	°F / °C
Protection Rating	NEMA 3R	

(1) For 277/480V inverters refer to: https://www.solaredge.com/sites/default/files/se-three-phase-us-inverter-277-480V-setapp-datasheet.pdf
(2) For other regional settings please contact SolarEdge support
(3) Where permitted by local regulations
(4) Field replacement kit for 1 pair of inputs P/N: DCD-3PH-1TBK; Field replacement kit for 3 pairs of fuses and holders P/N: DCD-3PH-6FHK-S1
(5) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

CE

A.17 THREE PHASE INVERTERS – SE14.4KUS, SE17.3KUS NORTH AMERICA MODELS

Three Phase Inverters for the 120/208V Grid

For North America

SE14.4KUS / SE17.3KUS

INVERTERS

The best choice for SolarEdge enabled systems

- Specifically designed to work with power optimizers
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Fixed voltage inverter for superior efficiency (97.5%) and longer strings
- Built-in type 2 DC and AC Surge Protection, to better withstand lightning events
- Small, lightest in its class, and easy to install outdoors or indoors on provided bracket
- Integrated arc fault protection and rapid shutdown for NEC 2014 and 2017, per article 690.11 and 690.12
- Built-in module-level monitoring with Ethernet, wireless or cellular communication for full system visibility
- Integrated Safety Switch
- UL1741 SA certified, for CPUC Rule 21 grid compliance

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Three Phase Inverters for the 120/208V Grid(1)

For North America

SE14.4KUS / SE17.3KUS

MODEL NUMBER	SE14.4KUS	SE17.3KUS	UNITS
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXK-USX2IXXXX		
OUTPUT			
Rated AC Power Output	14400	17300	W
Maximum apparent AC output power	14400	17300	VA
AC Output Line Connections	3W + PE, 4W + PE		
AC Output Voltage Minimum-Nominal-Maximum(2) (L-N)	105-120-132.5		Vac
AC Output Voltage Minimum-Nominal-Maximum(2) (L-L)	183-208-229		Vac
AC Frequency Min-Nom-Max(2)	59.3 - 60 - 60.5		Hz
Continuous Output Current (per Phase)	40	48.25	Aac
GFDI Threshold	1		A
Utility Monitoring, Islanding Protection, Country Configurable Set Points	Yes		
THD	≤ 3		%
Power Factor Range	+/- 0.85 to 1		
INPUT			
Maximum DC Power (Module STC)	21600	26000	W
Transformer-less, Ungrounded	Yes		
Maximum Input Voltage DC+ to DC-	600		Vdc
Operating Voltage Range	370 - 600		Vdc
Maximum Input Current	40	48.25	Adc
Maximum Input Short Circuit Current	55		Adc
Reverse-Polarity Protection	Yes		
Ground-Fault Isolation Detection	167kΩ Sensitivity(3)		
CEC Weighted Efficiency	97.5		%
Night-time Power Consumption	< 4		W
ADDITIONAL FEATURES			
Supported Communication Interfaces	2 x RS485, Ethernet, Cellular (optional)		
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection		
Rapid Shutdown	NEC2014, NEC2017 and NEC2020 compliant/certified		
RS485 Surge Protection Plug-in	Supplied with the inverter, Built-in		
AC, DC Surge Protection	Type II, field replaceable, Built-in		
DC Fuses (Single Pole)	25A, Built-in		
Smart Energy Management	Export Limitation		
DC SAFETY SWITCH			
DC Disconnect	Integrated		
STANDARD COMPLIANCE			
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07		
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)		
Emissions	FCC part15 class A		
INSTALLATION SPECIFICATIONS			
AC output conduit size /AWG range	¾" or 1" / 6 - 10 AWG		
DC input conduit size / AWG range	¾" or 1" / 6 - 12 AWG		
Number of DC inputs pairs	4		
Dimensions with Safety Switch (H x W x D)	31.8 x 12.5 x 11.8 / 808 x 317 x 300		in / mm
Weight with Safety Switch	78.2 / 35.5		lb / kg
Cooling	Fans (user replaceable)		
Noise	< 62		dBA
Operating Temperature Range	-40 to +140 / -40 to +60(4)		°F / °C
Protection Rating	NEMA 3R		
Mounting	Bracket provided		

(1) For 277/480V inverters refer to: https://www.solaredge.com/sites/default/files/se-three-phase-us-inverter-277-480V-setapp-datasheet.pdf
(2) For other regional settings please contact SolarEdge support
(3) Where permitted by local regulations
(4) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

CE

A.18 THREE PHASE INVERTERS – SE20KUS, SE30KUS, SE33.3KUS, SE40KUS NORTH AMERICA MODELS

Three Phase Inverters for the 277/480V Grid

For North America

SE20KUS / SE30KUS / SE33.3KUS / SE40KUS

INVERTERS

The best choice for SolarEdge enabled systems

- Specifically designed to work with power optimizers
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Fixed voltage inverter for superior efficiency (98.5%) and longer strings
- Built-in type 2 DC and AC Surge Protection, to better withstand lightning events
- Small, lightest in its class, and easy to install outdoors or indoors on provided bracket
- Integrated arc fault protection and rapid shutdown for NEC 2014 and 2017, per article 690.11 and 690.12
- Built-in module-level monitoring with Ethernet, wireless or cellular communication for full system visibility
- Integrated Safety Switch
- UL1741 SA certified, for CPUC Rule 21 grid compliance

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Three Phase Inverters for the 277/480V Grid[1]

For North America

SE20KUS / SE30KUS / SE33.3KUS / SE40KUS

MODEL NUMBER	SE20KUS	SE30KUS	SE33.3KUS	SE40KUS	UNITS
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXK - USXXXBXXX	SEXXK-USX8IXXXX			
OUTPUT					
Rated AC Power Output	20000	30000	33300	40000	W
Maximum apparent AC output power	20000	30000	33300	40000	VA
AC Output Line Connections	4W + PE	3W + PE, 4W + PE			
AC Output Voltage Minimum-Nominal-Maximum[2] (L-N)	244 - 277 - 305				Vac
AC Output Voltage Minimum-Nominal-Maximum[2] (L-L)	422.5 - 480 - 529				Vac
AC Frequency Min-Nom-Max[2]	59.3 - 60 - 60.5				Hz
Maximum Continuous Output Current (per Phase)	24	36.25	40	48.25	Aac
GFDI Threshold	1				A
Utility Monitoring, Islanding Protection, Country Configurable Set Points	Yes				
Total Harmonic Distortion	≤ 3				%
Power Factor Range	+/- 0.85 to 1				
INPUT					
Maximum DC Power (Module STC)	27000	45000	50000	60000	W
Transformer-less, Ungrounded	Yes				
Maximum Input Voltage DC+ to DC-	1000				Vdc
Operating Voltage Range	840 - 1000				Vdc
Maximum Input Current	26.5	36.25	40	48.25	Adc
Maximum Input Short Circuit Current	33	55			Adc
Reverse-Polarity Protection	Yes				
Ground-Fault Isolation Detection	1MΩ Sensitivity	167kΩ Sensitivity[3]			
CEC Weighted Efficiency	98	98.5			%
Night-time Power Consumption	<3	<4			W
ADDITIONAL FEATURES					
Supported Communication Interfaces	2 x RS485, Ethernet, Cellular (optional)				
Inverter Commissioning	With the SetApp mobile application using built-in access point for local connection				
Arc Fault Protection	Integrated, User Configurable (According to UL1699B)				
Rapid Shutdown	NEC2014, NEC2017 and NEC2020 compliant/certified				
RS485 Surge Protection Plug-in	Supplied with the inverter, Built-in				
DC Surge Protection	Type II, field replaceable, optional	Type II, field replaceable, Built-in			
AC Surge Protection	-	Type II, field replaceable, Built-in			
DC Fuses (Single Pole)	-	25A, Built-in			
Smart Energy Management	Export Limitation				
DC SAFETY SWITCH					
DC Disconnect	Integrated				
STANDARD COMPLIANCE					
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07				
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)				
Emissions	FCC part15 class A				
INSTALLATION SPECIFICATIONS					
AC output conduit size / AWG range	3/4" minimum / 12-6 AWG	¾" or 1" / 6 - 10 AWG			
DC input conduit size / AWG range	¾" or 1" / 6 - 12 AWG				
Number of DC inputs pairs	2	4			
Dimensions with Safety Switch (H x W x D)	30.5 x 12.5 x 10.5 / 775 x 315 x 260	31.8 x 12.5 x 11.8 / 808 x 317 x 300			in / mm
Weight with Safety Switch	74.2 / 33.7	78.2 / 35.5			lb / kg
Cooling	Fans (user replaceable)				
Noise	< 50	< 62			dBA
Operating Temperature Range	-40 to +140 / -40 to +60[4]				°F / °C
Protection Rating	NEMA 3R				
Mounting	Bracket provided				

(1) For 120/208V inverters refer to: https://www.solaredge.com/sites/default/files/se-three-phase-us-inverter-208V-setapp-datasheet.pdf
(2) For other regional settings please contact SolarEdge support
(3) Where permitted by local regulations
(4) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

CE

A.19 THREE PHASE INVERTER WITH SYNERGY TECHNOLOGY – SE50KUS NORTH AMERICA MODEL

Three Phase Inverter with Synergy Technology

INVERTERS

For the 208V Grid for North America

SE50KUS

Powered by unique pre-commissioning process for rapid system installation

- Pre-commissioning feature for automated validation of system components and wiring during the site installation process and prior to grid connection
- Easy 2-person installation with lightweight, modular design (each inverter consists of 3 Synergy units and one Synergy Manager)
- Independent operation of each Synergy unit enables higher uptime and easy serviceability
- Built-in thermal sensors detect faulty wiring ensuring enhanced protection and safety
- Built-in arc fault protection and rapid shutdown
- Built-in PID mitigation for maximized system performance
- Monitored* and field-replaceable surge protection devices, to better withstand surges caused by lightning or other events
- Built-in module-level monitoring with Ethernet or cellular communication for full system visibility

*Applicable only for DC and AC SPDs

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/ Three Phase Inverter with Synergy Technology

For the 208V Grid for North America

SE50KUS

Applicable to inverter with Part Numbers	SExxK-US02Ixxxx SE50KUS	
OUTPUT		
Rated AC Active Output Power	50000	W
Maximum AC Apparent Output Power	50000	VA
AC Output Line Connections	3W + PE, 4W + PE	
Supported Grids	WYE: TN-C, TN-S, TN-C-S, TT, IT; Delta: IT	
AC Output Voltage Minimum-Nominal-Maximum[1] (L-N)	105-120-132.5	Vac
AC Output Voltage Minimum-Nominal-Maximum[1] (L-L)	183-208-229	Vac
AC Frequency Min-Nom-Max[1]	59.5 - 60 - 60.5	Hz
Maximum Continuous Output Current (per Phase, PF=1)	139.5	Aac
GFDI Threshold	1	A
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes	
Total Harmonic Distortion	≤ 3	%
Power Factor Range	+/-0.2 to 1	
INPUT		
Maximum DC Power (Module STC) Inverter / Synergy Unit	75000 / 25000	W
Transformer-less, Ungrounded	Yes	
Maximum Input Voltage DC+ to DC-	600	Vdc
Operating Voltage Range	370 - 600	Vdc
Maximum Input Current	3 x 46.5	Adc
Reverse-Polarity Protection	Yes	
Ground-Fault Isolation Detection	167kΩ sensitivity per Synergy Unit[2]	
CEC Weighted Efficiency	97	%
Nighttime Power Consumption	< 12	W
ADDITIONAL FEATURES		
Supported Communication Interfaces[3]	2 x RS485, Ethernet, Wi-Fi (optional), Cellular (optional)	
Smart Energy Management	Export Limitation	
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection	
Arc Fault Protection	Built-in, User Configurable (According to UL1699B)	
Photovoltaic Rapid Shutdown System	NEC 2014, 2017 and 2020, Built-in	
PID Rectifier	Nighttime, built-in	
RS485 Surge Protection (ports 1+2)	Type II, field replaceable, integrated	
AC, DC Surge Protection	Type II, field replaceable, integrated	
DC Fuses (Single Pole)	25A, integrated	
DC SAFETY SWITCH		
DC Disconnect	Built-in	
STANDARD COMPLIANCE		
Safety	UL1699B, UL1741, UL1741 SA, UL1998, CSA C22.2#107.1, Canadian AFCI according to T.I.L. M-07	
Grid Connection Standards	IEEE 1547, Rule 21, Rule 14 (HI)	
Emissions	FCC part 15 class A	

(1) For other regional settings please contact SolarEdge support
(2) Where permitted by local regulations
(3) For specifications of the optional communication options, visit https://www.solaredge.com/products/communication or the Resource Library webpage: https://www.solaredge.com/downloads#, to download the relevant product datasheet

/ Three Phase Inverter with Synergy Technology

For the 208V Grid for North America

SE50KUS

Applicable to inverter with Part Numbers	SExxK-US02Ixxxx SE50KUS	
INSTALLATION SPECIFICATIONS		
Number of Synergy Units per Inverter	3	
AC Max Conduit Size	2 ½"	in
Max AWG Line / PE	4/0 / 1/0	
DC Max Conduit Size	1 x 3" ; 2 x 2"	in
DC Input Inverter / Synergy Unit	12 / 4 pairs; 6-12 AWG	
Dimensions (H x W x D)	Synergy Unit: 22 x 12.9 x 10.75 / 558 x 328 x 273 Synergy Manager: 14.17 x 22.4 x 11.6 / 360 x 560 x 295	in / mm
Weight	Synergy Unit: 70.4 / 32 Synergy Manager: 39.6 / 18	lb / kg
Operating Temperature Range	-40 to +140 / -40 to +60(4)	℉ / °C
Cooling	Fan (user replaceable)	
Noise	< 67	dBA
Protection Rating	NEMA 3R	
Mounting	Brackets provided	

(4) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.20 THREE PHASE INVERTERS WITH SYNERGY TECHNOLOGY – SE80KUS, SE100KUS, SE110KUS, SE120KUS NORTH AMERICA MODELS

Three Phase Inverter with Synergy Technology

INVERTERS

For the 277/480V Grid for North America

SE80KUS / SE100KUS / SE110KUS / SE120KUS

Powered by unique pre-commissioning process for rapid system installation

- Pre-commissioning feature for automated validation of system components and wiring during the site installation process and prior to grid connection
- Easy 2-person installation with lightweight, modular design (each inverter consists of 2 or 3 Synergy units and one Synergy Manager)
- Independent operation of each Synergy unit enables higher uptime and easy serviceability
- Built-in thermal sensors detect faulty wiring ensuring enhanced protection and safety
- Built-in arc fault protection and rapid shutdown
- Built-in PID mitigation for maximized system performance
- Monitored* and field-replaceable surge protection devices, to better withstand surges caused by lightning or other events
- Built-in module-level monitoring with Ethernet or cellular communication for full system visibility

*Applicable only for DC and AC SPDs

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/ Three Phase Inverter with Synergy Technology

For the 277/480V Grid for North America

SE80KUS / SE100KUS / SE110KUS/ SE120KUS

Applicable to inverter with Part Numbers	SExxK-US08Ixxxx				
	SE80KUS	SE100KUS	SE110KUS	SE120KUS	
OUTPUT					
Rated AC Active Output Power	80000	100000	110000	120000	W
Maximum AC Apparent Output Power	80000	100000	120000	120000	VA
AC Output Line Connections	3W + PE, 4W + PE				
Supported Grids	WYE: TN-C, TN-S, TN-C-S, TT, IT; Delta: IT				
AC Output Voltage Minimum-Nominal-Maximum[1] (L-N)	244 - 277 - 305				Vac
AC Output Voltage Minimum-Nominal-Maximum[1] (L-L)	422.5 - 480 - 529				Vac
AC Frequency Min-Nom-Max[1]	59.5 - 60 - 60.5				Hz
Maximum Continuous Output Current (per Phase, PF=1)	96.5	120	145		Aac
GFDI Threshold	1				A
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes				
Total Harmonic Distortion	≤ 3				%
Power Factor Range	+/-0.2 to 1				
INPUT					
Maximum DC Power (Module STC) Inverter / Synergy Unit	120000 / 60000	150000 / 50000	180000 / 60000		W
Transformer-less, Ungrounded	Yes				
Maximum Input Voltage DC+ to DC-	1000				Vdc
Operating Voltage Range	850 - 1000				Vdc
Maximum Input Current	2 x 48.25	3 x 40	3 x 48.25		Adc
Reverse-Polarity Protection	Yes				
Ground-Fault Isolation Detection	167kΩ sensitivity per Synergy Unit[2]				
CEC Weighted Efficiency	98.5				%
Nighttime Power Consumption	< 8	< 12			W
ADDITIONAL FEATURES					
Supported Communication Interfaces[3]	2 x RS485, Ethernet, Wi-Fi (optional), Cellular (optional)				
Smart Energy Management	Export Limitation				
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection				
Arc Fault Protection	Built-in, User Configurable (According to UL1699B)				
Photovoltaic Rapid Shutdown System	NEC 2014, 2017 and 2020, Built-in				
PID Rectifier	Nighttime, built-in				
RS485 Surge Protection (ports 1+2)	Type II, field replaceable, integrated				
AC, DC Surge Protection	Type II, field replaceable, integrated				
DC Fuses (Single Pole)	25A, integrated				
DC SAFETY SWITCH					
DC Disconnect	Built-in				
STANDARD COMPLIANCE					
Safety	UL1699B, UL1741, UL1741 SA, UL1998, CSA C22.2#107.1, Canadian AFCI according to T.I.L. M-07				
Grid Connection Standards	IEEE 1547, Rule 21, Rule 14 (HI)				
Emissions	FCC part 15 class A				

(1) For other regional settings please contact SolarEdge support
(2) Where permitted by local regulations
(3) For specifications of the optional communication options, visit https://www.solaredge.com/products/communication or the Resource Library webpage: https://www.solaredge.com/downloads#, to download the relevant product datasheet

/ Three Phase Inverter with Synergy Technology

For the 277/480V Grid for North America

SE80KUS / SE100KUS / SE110KUS/ SE120KUS

Applicable to inverter with Part Numbers	SExxK-US08Ixxxx				
	SE80KUS	SE100KUS	SE110KUS	SE120KUS	
INSTALLATION SPECIFICATIONS					
Number of Synergy Units per Inverter	2	3			
AC Max Conduit Size	2 ½"				in
Max AWG Line / PE	4/0 / 1/0				
DC Max Conduit Size	1 x 3" ; 2 x 2"				in
DC Input Inverter / Synergy Unit	4 pairs; 6-12 AWG	12 / 4 pairs; 6-12 AWG			
Dimensions (H x W x D)	Synergy Unit: 22 x 12.9 x 10.75 / 558 x 328 x 273 Synergy Manager: 14.17 x 22.4 x 11.6 / 360 x 560 x 295				in/m
Weight	Synergy Unit: 70.4 / 32 Synergy Manager: 39.6 / 18				lb /kg
Operating Temperature Range	-40 to +140 / -40 to +60(4)				F / °C
Cooling	Fan (user replaceable)				dBA
Noise	< 67				
Protection Rating	NEMA 3R				
Mounting	Brackets provided				

(4) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.21 THREE PHASE INVERTERS – SE3K, SE4K, SE5K, SE6K, SE7K, SE8K, SE9K, SE10K INTERNATIONAL MODELS

/ Three Phase Inverter

SE3K-SE10K[1]

	SE3K[2][3]	SE4K[2]	SE5K	SE6K[2]	SE7K	SE8K	SE9K	SE10K	UNITS
Applicable to inverters with part number	SEXXK-XXXTXBXX4								
OUTPUT									
Rated AC Power Output	3000	4000	5000	6000	7000	8000	9000	10000	VA
Maximum AC Power Output	3000	4000	5000	6000	7000	8000	9000	10000	VA
AC Output Voltage - Line to Line / Line to Neutral (Nominal)	380 / 220 ; 400 / 230								Vac
AC Output Voltage - Line to Neutral Range	184 - 264.5								Vac
AC Frequency	50/60 ± 5								Hz
Maximum Continuous Output Current (per Phase)	5	6.5	8	10	11.5	13	14.5	16	A
Grids Supported - Three Phase	3 / N / PE (WYE with Neutral)								
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes								
INPUT									
Maximum DC Power (Module STC)	4050[4]	5400	6750	8100	9450	10800	12150	13500	W
Transformer-less, Ungrounded	Yes								
Maximum Input Voltage	900								Vdc
Nominal DC Input Voltage	750								Vdc
Maximum Input Current	5	7	8.5	10	12	13.5	15	16.5	Adc
Reverse-Polarity Protection	Yes								
Ground-Fault Isolation Detection	700kΩ Sensitivity								
Maximum Inverter Efficiency	98								%
European Weighted Efficiency	96.7	97.3	97.3	97.3	97.4	97.6	97.5	97.6	%
Nighttime Power Consumption	< 2.5								W
ADDITIONAL FEATURES									
Supported Communication Interfaces[5]	RS485, Ethernet, ZigBee (optional), Wi-Fi (requires antenna)[6], Cellular (optional)								
Smart Energy Management	Export Limitation, Home Energy Management (Device Control)								
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection								
STANDARD COMPLIANCE									
Safety	IEC-62103 (EN50178), IEC-62109								
Grid Connection Standards[7]	VDE 0126-1-1, VDE-AR-N-4105, AS-4777, G83 / G59								
Electromagnetic Compatibility (EMC)	EN/IEC 61000-6-1, EN/IEC 61000-6-2, EN/IEC 61000-6-3, EN/IEC 61000-6-4, EN 55011, FCC Part 15, EN/IEC 61000-3-2, EN/IEC 61000-3-3, EN/IEC 61000-3-11, EN/IEC 61000-3-12								
RoHS	Yes								
INSTALLATION SPECIFICATIONS									
AC Output	Cable Gland - diameter 15-21								mm
DC Input	2 MC4 pairs								
Dimensions (HxWxD)	540 x 315 x 191								mm
Weight	16.4								kg
Operating Temperature Range	-40 to +60[8]								°C
Cooling	Internal Fan								
Noise	< 40								dBA
Protection Rating	IP65 - Outdoor and Indoor								
Mounting	Bracket Provided								

[1] For higher power models refer to: https://www.solaredge.com/sites/default/files/se-three-phase-inverter-extended-power-datasheet.pdf
[2] Available in some countries; refer to Certifications category in Downloads page: http://www.solaredge.com/groups/support/downloads
[3] SE3K-RW010BNN4 is dedicated for connection of exactly 10 P404/P405/P485/P505 optimizers.
[4] Maximum allowed DC power is 3700W with SE3K-RW010BNN4
[5] Refer to Datasheets -> Communications category in Downloads page for specifications of optional communication options: http://www.solaredge.com/groups/support/downloads
[6] Wi-Fi connectivity requires an external antenna. For more information refer to: https://www.solaredge.com/sites/default/files/se-wifi-zigbee-antenna-datasheet.pdf
[7] For all standards refer to Certifications category in Downloads page: http://www.solaredge.com/groups/support/downloads
[8] For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE

A.22 THREE PHASE INVERTERS – SE12.5K, SE15K, SE16K, SE17K, SE25K, SE27.6K INTERNATIONAL MODELS

Three Phase Inverter

SE12.5K - SE27.6K

INVERTERS

Specifically designed to work with power optimizers

- Superior efficiency (98%)
- Small, lightest in its class, and easy to install
- Built-in module-level monitoring
- Internet connection through Ethernet or wireless
- IP65 – outdoor and indoor installation
- Fixed voltage inverter for longer strings
- Smart Energy Management control
- Optional integrated DC Safety Unit - eliminates the need for external DC isolators (SE25K and SE27.6K only)
- Optional DC surge protection and DC fuses (SE25K and SE27.6K only)

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/ Three Phase Inverter

SE12.5K - SE27.6K

	SE12.5K	SE15K	SE16K	SE17K	SE25K	SE27.6K	
OUTPUT							
Rated AC Power Output	12500	15000	16000	17000	25000 [1]	27600	VA
Maximum AC Power Output	12500	15000	16000	17000	25000 [1]	27600	VA
AC Output Voltage - Line to Line / Line to Neutral (Nominal)	380 / 220 ; 400 / 230						Vac
AC Output Voltage - Line to Neutral Range	184 - 264.5						Vac
AC Frequency	50/60 ± 5						Hz
Maximum Continuous Output Current (per Phase)	20	23	25.5	26	38	40	A
Grids Supported - Three Phase	3 / N / PE (WYE with Neutral)						V
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes						
INPUT							
Maximum DC Power (Module STC)	16850	20250	21600	22950	33750	37250	W
Transformer-less, Ungrounded	Yes						
Maximum Input Voltage	900						Vdc
Nominal DC Input Voltage	750						Vdc
Maximum Input Current	21	22	23	23	37	40	Adc
Reverse-Polarity Protection	Yes						
Ground-Fault Isolation Detection	700kΩ Sensitivity				350kΩ Sensitivity[2]		
Maximum Inverter Efficiency	98				98.3		%
European Weighted Efficiency	97.7	97.6	97.7	97.7	98	98	%
Nighttime Power Consumption	< 2.5				< 4		W
ADDITIONAL FEATURES							
Supported Communication Interfaces[3]	RS485, Ethernet, Zigbee (optional), Wi-Fi (optional), Built-in GSM (optional)						
Smart Energy Management	Export Limitation, Home Energy Management						
DC SAFETY UNIT (OPTIONAL)							
2-pole Disconnection	N/A				1000V / 40A		
DC Surge Protection	N/A				Type II, field replaceable		
DC Fuses on Plus & Minus	N/A				Optional, 20A		
Compliance	N/A				UTE-C15-712-1		
STANDARD COMPLIANCE							
Safety	IEC-62103 (EN50178), IEC-62109, AS3100						
Grid Connection Standards[4]	VDE-AR-N-4105, G59/3, AS-4777,EN 50438 , CEI-021,VDE 0126-1-1, CEI-016[5], BDEW						
Emissions	IEC61000-6-2, IEC61000-6-3 , IEC61000-3-11, IEC61000-3-12						
RoHS	Yes						
INSTALLATION SPECIFICATIONS							
AC Output Gland Diameter / Wire Cross Section	15-21mm / Solid wire 2.5-16 mm², Stranded wire 2.5-10 mm²				18-25mm / Solid wire 2.5-16 mm², Stranded wire 2.5-10 mm²		
DC Input	2 MC4 pairs				3 MC4 pairs		
DC Input with Safety Unit	N/A				Gland diameter 5 - 10		mm
					Wire cross section 0.5 - 13.5		mm²
Dimensions (HxWxD)	540 x 315 x 260						mm
Dimensions with Safety Unit (HxWxD)	N/A				775 x 315 x 260		mm
Weight	33.2				45		kg
Weight with Safety Unit	N/A				48		kg
Operating Temperature Range	-20 - +60[6] (M40 version -40 - +60)						°C
Cooling	Fan (user replaceable)						
Noise	< 50				< 55		dBA
Protection Rating	IP65 - Outdoor and Indoor						
Mounting	Bracket Provided						

[1] 24.99kVA in the UK
[2] Where permitted by local regulations
[3] Refer to Datasheets -> Communications category in Downloads page for specifications of optional communication options: http://www.solaredge.com/groups/support/downloads
[4] For all standards refer to Certifications category in Downloads page: http://www.solaredge.com/groups/support/downloads
[5] Models SE25K and SE27.6K only
[6] For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.23 THREE PHASE INVERTERS – SE25K, SE30K, SE33.3K INTERNATIONAL MODELS

Three Phase Inverter

For 220V/230V Line to Line Grids

SE25K / SE30K / SE33.3K

INVERTERS

Specifically designed to work with power optimizers

- Fixed voltage inverter for superior efficiency (98.3%) and longer strings
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Small, lightest in its class, and easy to install
- Integrated type 2 DC Surge Protection, to better withstand lightning events
- Optional RS485 and type 2 AC Surge Protection
- Built-in module-level monitoring with Ethernet, wireless or cellular communication for full system visibility
- Advanced safety features - integrated arc fault protection and optional rapid shutdown
- IP65 Outdoor and indoor installation
- Optional integrated DC Safety Unit - eliminates the need for external DC isolators
- Future-proof for SolarEdge energy storage solution

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/ Three Phase Inverter
For 220V/230V Line to Line Grids
SE25K / SE30K / SE33.3K

Applicable to inverters with part number	SEXXK-BEX0IXXXX			
	SE25K	SE30K	SE33.3K	
OUTPUT				
Rated AC Active Power Output	14500	17300	19200	W
Maximum AC Apparent Output Power	14500	17300	19200	VA
AC Output Voltage - Line to Line / Line to Neutral (Nominal)	220 / 127 ; 230 / 130			Vac
AC Output Voltage - Line to Line / Line to Neutral	184 - 264.5			Vac
AC Frequency	50/60 ± 5%			Hz
Maximum Continuous Output Current (per Phase)	36.25	43.5	48.25	Aac
AC Output Line Connections	3W + PE (Corner grounding not supported)			
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes			
Total Harmonic Distortion	≤ 3			%
Power Factor Range	+/-0.2 to 1			
Maximum Residual Current Injection(1)	100			mA
INPUT				
Maximum DC Power (Module STC)	21750	26000	28800	W
Transformer-less, Ungrounded	Yes			
Maximum Input Voltage DC+ to DC-	600			Vdc
Operating Voltage Range	370 - 600			Vdc
Maximum Input Current	36.25	43.5	48.25	Adc
Reverse-Polarity Protection	Yes			
Ground-Fault Isolation Detection	167kΩ Sensitivity(2)			
Maximum Inverter Efficiency	98.3			%
European Weighted Efficiency	98			%
Nighttime Power Consumption	< 4			W
ADDITIONAL FEATURES				
Supported Communication Interfaces	2 x RS485, Ethernet, Wi-Fi (optional)(3), Cellular (optional)			
Smart Energy Management	Export Limitation			
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection			
Arc Fault Protection	Integrated, User Configurable (According to UL1699B)			
Rapid Shutdown	Optional(4) (Automatic upon AC Grid Disconnect)			
RS485 Surge Protection	Optional			
DC Surge Protection	Type II, field replaceable, integrated			
AC Surge Protection	Type II, field replaceable, optional			
DC SAFETY UNIT (OPTIONAL)				
2-pole Disconnection	1000V / 48.25A			
DC Fuses (Single Pole)	Optional, 25A			
Compliance	UTE-C15-712-1			
STANDARD COMPLIANCE				
Safety	IEC-62109, AS3100			
Grid Connection Standards(5)	EN50549-1			
Emissions	IEC61000-6-2, IEC61000-6-3 Class A, IEC61000-3-11, IEC61000-3-12			
RoHS	Yes			
INSTALLATION SPECIFICATIONS				
AC Output Gland Diameter / Line cross section / PE cross section	Cable diameter 19 - 28 mm / 4 - 16 mm² / 4 - 16 mm²			
DC Input(6)	4 MC4 pairs			
DC Input with Safety Unit (6)(7)	4 MC4 pairs			
	4 Strings: Gland: Cable outer diameter 5 - 10 mm / Wire cross section 2.5 - 16 mm²			
Dimensions (H x W x D)	550 x 317 x 273			mm
Dimensions with Safety Unit (Hx W x D)	836 x 317 x 300 (DC MC4); 819 x 317 x 300 (DC Gland)			mm
Weight	32			kg
Weight with Safety Unit	36.5			kg
Operating Temperature Range	-40 to +60(8)			°C
Cooling	Fan (user replaceable)			
Noise	< 62			dBA
Protection Rating	IP65 - outdoor and indoor			
Mounting	Brackets provided			

(1) If an external RCD is required, its trip value must be ≥ 100mA
(2) Where permitted by local regulations
(3) Wi-Fi connectivity requires connection of an additional Wi-Fi component, ordered separately. For more details ask your SolarEdge sales person or refer to: https://www.solaredge.com/products/communication
(4) Inverter with rapid shutdown part number: SExxK-xxRxxxxxx
(5) For all standards refer to Certifications category in Downloads page: http://www.solaredge.com/groups/support/downloads
(6) DC input is available with MC4 or Gland connectors under the inverter part number. For more information, contact SolarEdge
(7) Only MC4 connectors manufactured by Stäubli are approved for use
(8) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.24 THREE PHASE INVERTERS WITH SYNERGY TECHNOLOGY – SE66.6K, SE90K, SE100K, SE120K INTERNATIONAL MODELS

Three Phase Inverter with Synergy Technology

INVERTERS

SE66.6K / SE90K / SE100K / SE120K

Powered by unique pre-commissioning process for rapid system installation

- Pre-commissioning feature for automated validation of system components and wiring during the site installation process and prior to grid connection
- Easy 2-person installation with lightweight, modular design (each inverter consists of 2 or 3 Synergy Units and one Synergy Manager)
- Independent operation of each Synergy Unit enables higher uptime and easy serviceability
- Built-in thermal sensors detect faulty wiring ensuring enhanced protection and safety
- Built-in arc fault protection and optional rapid shutdown
- Built-in PID mitigation for maximized system performance
- Monitored* and field-replaceable surge protection devices, to better withstand surges caused by lightning or other events: integrated RS485 and Type 2 DC SPDs, optional Type 2 AC SPD
- Optional integrated DC safety switch eliminates the need for external DC isolators
- Built-in module-level monitoring with Ethernet or cellular communication for full system visibility

*Applicable only for DC and AC SPDs

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/ Three Phase Inverter with Synergy Technology

SE66.6K / SE90K / SE100K / SE120K

Applicable to Inverter with Part Number	SExxK-xxxxIxxxx			SExxK-xxx8Ixxxx	
	SE66.6K for 380/400V Grid	SE90K for 380/400V Grid	SE100K for 380/400V Grid	SE120K for 480V Grid	
OUTPUT					
Rated AC Active Output Power[1]	66600	90000	100000	120000	W
Maximum AC Apparent Output Power[1]	66600	90000	100000	120000	VA
AC Output Voltage — Line to Line / Line to Neutral (Nominal)	380 / 220 ; 400 / 230			480 / 277	Vac
AC Output Voltage — Line to Line Range / Line to Neutral Range	304 - 437 / 176 - 253 ; 320 - 478 / 184 - 264.5			432 - 529 / 249 - 305	Vac
AC Frequency	50/60 ± 5%				Hz
Maximum Continuous Output Current (per Phase)	96.5	145	145	145	Aac
AC Output Line Connections	3W + PE, 4W + PE				
Supported Grids	WYE: TN-C, TN-S, TN-C-S, TT, IT; Delta: IT				
Maximum Residual Current Injection[2]	200	300			mA
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes				
Total Harmonic Distortion	≤ 3				%
Power Factor Range	+/-0.2 to 1				
INPUT					
Maximum DC Power (Module STC) Inverter / Synergy Unit	100000 / 50000	135000 / 45000	150000 / 50000	180000 / 60000	W
Transformer-less, Ungrounded	Yes				
Maximum Input Voltage DC+ to DC-	1000				Vdc
Operating Voltage Range	680 - 1000				Vdc
Maximum Input Current	2 x 48.25	3 x 48.25	3 x 48.25		Adc
Reverse-Polarity Protection	Yes				
Ground-Fault Isolation Detection	167kΩ Sensitivity per Synergy Unit[3]				
Maximum Inverter Efficiency	98.3			98.1	%
European Weighted Efficiency	98				%
Nighttime Power Consumption	< 8	< 12			W
ADDITIONAL FEATURES					
Supported Communication Interfaces[4]	2 x RS485, Ethernet, Wi-Fi (optional), Cellular (optional)				
Smart Energy Management	Export Limitation				
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection				
Arc Fault Protection	Built-in, user configurable (according to UL1699B)				
Rapid Shutdown	Optional (automatic upon AC Grid Disconnect)				
PID Rectifier	Nighttime, built-in				
RS485 Surge Protection (ports 1+2)	Type II, field replaceable, integrated				
DC Surge Protection	Type II, field replaceable, integrated				
AC Surge Protection	Type II, field replaceable, optional				
DC Fuses (Single Pole)	25A, optional				
DC Disconnect Switch	Optional				
STANDARD COMPLIANCE					
Safety	IEC-62109-1, IEC-62109-2				
Grid Connection Standards[5]	VDE-AR-N-4105, AS-4777, EN 50549-1, EN 50549-2, CEI-021, VDE 0126-1-1, CEI-016				
Emissions	IEC61000-6-2, IEC61000-6-3 Class A, IEC61000-3-11, IEC61000-3-12				
RoHS	Yes				

(1) Maximum values at 400V / 230V
(2) If an external RCD is required, its trip value must be ≥ 200mA for SE66.6K; ≥ 300mA for SE90K/SE100K/SE120K
(3) Where permitted by local regulations
(4) For specifications of the optional communication options, visit https://www.solaredge.com/products/communication or the Resource Library webpage: https://www.solaredge.com/resource-library, to download the relevant product datasheet
(5) For all standards and certificates download, refer to the Certifications category on the Resource Library webpage: https://www.solaredge.com/resource-library

/ Three Phase Inverter with Synergy Technology

SE66.6K / SE90K / SE100K / SE120K

Applicable to Inverter with Part Number	SExxK-xxxxIxxxx			SExxK-xxx8Ixxxx	
	SE66.6K for 380/400V Grid	SE90K for 380/400V Grid	SE100K for 380/400V Grid	SE120K for 480V Grid	
INSTALLATION SPECIFICATIONS					
Number of Synergy Units per Inverter	2	3			
AC Wire Cross Section and Outer Diameter:Line/PE (Aluminum or Copper)	Cross section up to 120 / 70 mm^2; outer diameter 30-50 / 12-20 mm				
DC Input: Inverter / Synergy Unit[6][7]	8 / 4 MC4 pairs	12 / 4 MC4 pairs			
	Gland, 2 pairs / 1 pair, Cross section up to 50 mm^2, aluminum or copper Cable outer diameter 12-20 mm	Gland, 3 pairs / 1 pair, Cross section up to 50 mm^2, aluminum or copper Cable outer diameter 12-20 mm			
Dimensions (H x W x D)	Synergy Unit: 558 x 328 x 273 Synergy Manager: 360 x 560 x 295				mm
Weight	Synergy Unit: 32 Synergy Manager: 18				kg
Operating Temperature Range	-40 to +60[8]				°C
Cooling	Fan (user replaceable)				
Noise	< 67				dBA
Protection Rating	IP65 — outdoor and indoor				
Mounting	Brackets provided				

(6) DC input is available with MC4 or Gland connection under the inverter part number. For more information, contact SolarEdge
(7) Only MC4 connectors manufactured by Staubli are approved for use
(8) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

Accessories (purchased separately)	
Accessory	**PN**
AC SPD kit for Synergy Manager (5 units per box)	SE-AC-SPD-SM
Antenna for Wi-Fi and ZigBee Wireless Communications	SE-ANT-ZB-WIFI-03

CE RoHS

A.25 THREE PHASE INVERTERS – SE25K, SE30K, SE33.3K EUROPE MODELS

/ Three Phase Inverter
For 220V/230V Line to Line Grids
SE25K / SE30K / SE33.3K

Applicable to inverters with part number	SEXXK-BEX0IXXXX			
	SE25K	SE30K	SE33.3K	
OUTPUT				
Rated AC Active Power Output	14500	17300	19200	W
Maximum AC Apparent Output Power	14500	17300	19200	VA
AC Output Voltage - Line to Line / Line to Neutral (Nominal)	220 / 127 ; 230 / 130			Vac
AC Output Voltage - Line to Line / Line to Neutral	184 - 264.5			Vac
AC Frequency	50/60 ± 5%			Hz
Maximum Continuous Output Current (per Phase)	36.25	43.5	48.25	Aac
AC Output Line Connections	3W + PE (Corner grounding not supported)			
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes			
Total Harmonic Distortion	≤ 3			%
Power Factor Range	+/-0.2 to 1			
Maximum Residual Current Injection[1]	100			mA
INPUT				
Maximum DC Power (Module STC)	21750	26000	28800	W
Transformer-less, Ungrounded	Yes			
Maximum Input Voltage DC+ to DC-	600			Vdc
Operating Voltage Range	370 - 600			Vdc
Maximum Input Current	36.25	43.5	48.25	Adc
Reverse-Polarity Protection	Yes			
Ground-Fault Isolation Detection	167kΩ Sensitivity[2]			
Maximum Inverter Efficiency	98.3			%
European Weighted Efficiency	98			%
Nighttime Power Consumption	< 4			W
ADDITIONAL FEATURES				
Supported Communication Interfaces	2 x RS485, Ethernet, Wi-Fi (optional)[3], Cellular (optional)			
Smart Energy Management	Export Limitation			
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection			
Arc Fault Protection	Integrated, User Configurable (According to UL1699B)			
Rapid Shutdown	Optional[4] (Automatic upon AC Grid Disconnect)			
RS485 Surge Protection	Optional			
DC Surge Protection	Type II, field replaceable, integrated			
AC Surge Protection	Type II, field replaceable, optional			
DC SAFETY UNIT (OPTIONAL)				
2-pole Disconnection	1000V / 48.25A			
DC Fuses (Single Pole)	Optional, 25A			
Compliance	UTE-C15-712-1			
STANDARD COMPLIANCE				
Safety	IEC-62109, AS3100			
Grid Connection Standards[5]	EN50549-1			
Emissions	IEC61000-6-2, IEC61000-6-3 Class A, IEC61000-3-11, IEC61000-3-12			
RoHS	Yes			
INSTALLATION SPECIFICATIONS				
AC Output Gland Diameter / Line cross section / PE cross section	Cable diameter 19 - 28 mm / 4 - 16 mm² / 4 - 16 mm²			
DC Input[6]	4 MC4 pairs			
DC Input with Safety Unit [6][7]	4 MC4 pairs			
	4 Strings: Gland: Cable outer diameter 5 - 10 mm / Wire cross section 2.5 - 16 mm²			
Dimensions (H x W x D)	550 x 317 x 273			mm
Dimensions with Safety Unit (Hx W x D)	836 x 317 x 300 (DC MC4); 819 x 317 x 300 (DC Gland)			mm
Weight	32			kg
Weight with Safety Unit	36.5			kg
Operating Temperature Range	-40 to +60[8]			°C
Cooling	Fan (user replaceable)			
Noise	< 62			dBA
Protection Rating	IP65 - outdoor and indoor			
Mounting	Brackets provided			

(1) If an external RCD is required, its trip value must be ≥ 100mA
(2) Where permitted by local regulations
(3) Wi-Fi connectivity requires connection of an additional Wi-Fi component, ordered separately. For more details ask your SolarEdge sales person or refer to: https://www.solaredge.com/products/communication
(4) Inverter with rapid shutdown part number: SExxK-xxRxxxxxx
(5) For all standards refer to Certifications category in Downloads page: http://www.solaredge.com/groups/support/downloads
(6) DC input is available with MC4 or Gland connectors under the inverter part number. For more information, contact SolarEdge
(7) Only MC4 connectors manufactured by Stäubli are approved for use
(8) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.26 THREE PHASE INVERTERS WITH SYNERGY TECHNOLOGY – SE50K, SE66.6K, SE90K, SE100K, SE120K EUROPE MODELS

Three Phase Inverter with Synergy Technology

For Europe

SE50K / SE66.6K / SE90K / SE100K / SE120K

INVERTERS

Powered by unique pre-commissioning process for rapid system installation

- Pre-commissioning feature for automated validation of system components and wiring during the site installation process and prior to grid connection
- Easy 2-person installation with lightweight, modular design (each inverter consists of 2 or 3 Synergy Units and one Synergy Manager)
- Independent operation of each Synergy Unit enables higher uptime and easy serviceability
- Built-in thermal sensors detect faulty wiring ensuring enhanced protection and safety
- Built-in arc fault protection and optional rapid shutdown
- Built-in PID mitigation for maximized system performance
- Monitored* and field-replaceable surge protection devices, to better withstand surges caused by lightning or other events: integrated RS485 and Type 2 DC SPDs, optional Type 2 AC SPD
- Optional integrated DC safety switch eliminates the need for external DC isolators
- Built-in module-level monitoring with Ethernet or cellular communication for full system visibility

*Applicable only for DC and AC SPDs

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/ Three Phase Inverter with Synergy Technology

For Europe

SE50K / SE66.6K / SE90K / SE100K / SE120K

Applicable to Inverter with Part Number	SExxK-xxx0Ixxxx				SExxK-xxx8Ixxxx	
	SE50K[1] For 400V Grid	SE66.6K For 400V Grid	SE90K For 400V Grid	SE100K For 400V Grid	SE120K For 480V Grid	
OUTPUT						
Rated AC Active Output Power	50000[2]	66600	90000	100000	120000	W
Maximum AC Apparent Output Power	50000[2]	66600	90000	100000	120000	VA
AC Output Voltage — Line to Line / Line to Neutral (Nominal)	380 / 220 ; 400 / 230				480 / 277	Vac
AC Output Voltage — Line to Line Range / Line to Neutral Range	304 - 437 / 176 - 253 ; 320 - 460 / 184 - 264.5				432 - 529 / 249 - 305	Vac
AC Frequency	50/60 ± 5%					Hz
Maximum Continuous Output Current (per Phase)	72.5	96.5	130.5	145		Aac
AC Output Line Connections	3W + PE, 4W + PE					
Supported Grids	WYE: TN-C, TN-S, TN-C-S, TT, IT; Delta: IT					
Maximum Residual Current Injection[3]	200		300			mA
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes					
Total Harmonic Distortion	≤ 3					%
Power Factor Range	+/-0.2 to 1					
INPUT						
Maximum DC Power (Module STC) Inverter / Synergy Unit	75000 / 37500	100000 / 50000	135000 / 45000	150000 / 50000	180000 / 60000	W
Transformer-less, Ungrounded	Yes					
Maximum Input Voltage DC+ to DC-	1000					Vdc
Operating Voltage Range	680 - 1000					Vdc
Maximum Input Current	2 x 36.25	2 x 48.25	3 x 43.5	3 x 48.25	3 x 48.25	Adc
Reverse-Polarity Protection	Yes					
Ground-Fault Isolation Detection	167kΩ sensitivity per Synergy Unit[4]					
Maximum Inverter Efficiency	98.3				98.1	%
European Weighted Efficiency	98					%
Nighttime Power Consumption	< 8		<12			W
ADDITIONAL FEATURES						
Supported Communication Interfaces[5]	2xRS485, Ethernet, Wi-Fi (optional), Cellular (optional)					
Smart Energy Management	Export limitation					
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection					
Arc Fault Protection	Built-in, user configurable (according to UL1699B)					
Rapid Shutdown	Optional (automatic upon AC Grid Disconnect)					
PID Rectifier	Nighttime, built-in					
RS485 Surge Protection (ports 1 + 2)	Type II, field replaceable, integrated					
DC Surge Protection	Type II, field replaceable, integrated					
AC Surge Protection	Type II, field replaceable, optional					
DC Fuses (Single Pole)	25A, optional					
DC Disconnect Switch	Optional					
STANDARD COMPLIANCE						
Safety	IEC-62109-1, IEC-62109-2, AS3100					
Grid Connection Standards[6]	EN50549-1, EN50549-2, VDE-AR-N 4105, VDE-AR-N 4110, VDE V 0126-1-1, CEI 0-21, CEI 0-16, TOR Erzeuger Typ A+B, G99 Type A+B, G99 (NI) Type A+B, VFR 2019					
Emissions	IEC61000-6-2, IEC61000-6-3 Class A, IEC61000-3-11, IEC61000-3-12					
RoHS	Yes					

(1) Only available in Poland and the UK. Refer to: https://www.solaredge.com/sites/default/files/se_inverters_supported_countries.pdf
(2) 49990 in the UK
(3) If an external RCD is required, its trip value must be ≥ 200mA for SE50K/SE66.6K; ≥ 300mA for SE90K, SE100K, SE120K
(4) Where permitted by local regulations
(5) For specifications of the optional communication options, visit https://www.solaredge.com/products/communication or the Resource Library webpage https://www.solaredge.com/resource-library, to download the relevant product datasheet
(6) For all standards and certificates download, refer to Certifications category on the Resource Library page: https://www.solaredge.com/resource-library

/ Three Phase Inverter with Synergy Technology

For Europe

SE50K / SE66.6K / SE90K / SE100K / SE120K

Applicable to Inverter with Part Number	SExxK-xxx0Ixxxx				SExxK-xxx8Ixxxx	
	SE50K[1] For 400V Grid	SE66.6K For 400V Grid	SE90K For 400V Grid	SE100K For 400V Grid	SE120K For 480V Grid	
INSTALLATION SPECIFICATIONS						
Number of Synergy Units per Inverter	2		3			
AC Wire Cross Section and Outer Diameter: Line/PE (Aluminum or Copper)	Cross section up to 120 / 70 mm^2; outer diameter 30-50 / 12-20 mm					
DC Input: Inverter / Synergy Unit[7][8]	8 / 4 MC4 pairs		12 / 4 MC4 pairs			
	Gland, 2 pairs / 1 pair, cross section up to 50 mm^2, aluminum or copper cable, outer diameter 12-20 mm		Gland, 3 pairs / 1 pair, cross section up to 50 mm^2, aluminum or copper cable, outer diameter 12-20 mm			
Dimensions (H x W x D)	Synergy Unit: 558 x 328 x 273 Synergy Manager: 360 x 560 x 295					mm
Weight	Synergy Unit: 32 Synergy Manager: 18					kg
Operating Temperature Range	-40 to +60[9]					°C
Cooling	Fan (user replaceable)					
Noise	< 67					dBA
Protection Rating	IP65 — outdoor and indoor					
Mounting	Brackets provided					

(7) DC input is available with MC4 or Gland connection under the inverter part number. For more information, contact SolarEdge
(8) Only MC4 connectors manufactured by Staubli are approved for use
(9) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

Accessories - SPDs (purchased separately)	
Accessory	**PN**
AC SPD kit for Synergy Manager (5 units per box)	SE-AC-SPD-SM

CE RoHS

A.27 THREE PHASE INVERTERS – SE5K-AUB, SE7K-AUB, SE8.25K-AUB, SE10K-AUB AUSTRALIA AND NEW ZEALAND MODELS

Three Phase Residential Inverter

For Australia and New Zealand

SE5K-AUB / SE7K-AUB / SE8.25K-AUB / SE10K-AUB

INVERTERS

The ideal solution for residential PV installations

- Supports optional smart energy devices and expansion of system capabilities
- Single vendor solution for seamless operation of all system components, and one address for warranty and service issues
- Built-in module-level monitoring for greater visibility into system performance
- Excellent reliability with standard 12-year warranty (extendable to 20 or 25 years)
- Advanced safety features, including SafeDC™ and integrated arc fault protection
- Quick inverter commissioning directly from a smartphone using SolarEdge's SetApp
- Suitable for outdoor or indoor installations

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/ Three Phase Residential Inverter

For Australia and New Zealand

SE5K-AUB / SE7K-AUB / SE8.25K-AUB / SE10K-AUB

APPLICABLE TO INVERTERS WITH PART NUMBER	SE5K-AUB	SE7K-AUB	SE8.25K-AUB	SE10K-AUB	
	SEXXK- AUBTEBEU4				
OUTPUT					
Rated AC Power Output	5000	7000	8250	10000	VA
Maximum AC Power Output	5000	7000	8250	10000	VA
Rated Current (per phase)	8	12	14	16	a.cA
AC Output Voltage - Line to Line / Line to Neutral (Nominal)	400 / 230				Vac
AC Output Voltage - Line to Neutral Range	184 - 264.7				Vac
AC Frequency	50 ± 5%				Hz
Maximum Continuous Output Current (per Phase)	8	12	14	16	A
Maximum Inrush Current AC (peak / duration)	3 / 20				
Maximum Output Fault Current	26	51			A
Maximum Output Continuous Overcurrent Protection	8	11.5	14	16	A
Overvoltage Category (Mains)	OVC III				
Overvoltage Category (PV)	OVC II				
Protective Class	I				
Grids Supported - Three Phase	3 / N / PE (WYE with Neutral)				
Power Factor Range	1 (adjustable from -0.8 to +0.8)				
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes				
Active Anti-Islanding Method	Slip mode frequency shift				
INPUT					
Maximum DC Power (Module STC)	6750	9450	11135	13500	W
Transformer-less, Ungrounded	Yes				
Maximum Array Input Voltage	450				Vdc
PV Input Operating Voltage Range	375 - 450				d.c V
Maximum Voltage to Earth (DC to GND)	450				Vdc
Maximum Input Current	14	20	23	28	Adc
Maximum Inverter Backfeed Current to Array	0				
Reverse-Polarity Protection	Yes				
Ground-Fault Isolation Detection	350kΩ Sensitivity				
Maximum Inverter Efficiency	97.8				%
Isc PV (absolute maximum)	14	20	23	28	d.c A
European Weighted Efficiency	96.3	97	97.1	97.4	%
Nighttime Power Consumption	< 4				W
Inverter Topology	Non-isolated				
Short Circuit Current from the PV Array	14	20	23	28	Adc
ADDITIONAL FEATURES					
Supported Communication Interfaces(1)	2 x RS485, Ethernet, Wi-Fi(2), ZigBee for Smart Energy (optional)(3)				
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection				
Smart Energy Management(4)	Export Limitation, Home Energy Management (Device Control)				
STANDARD COMPLIANCE					
Safety	IEC62109, AS/NZS3100				
Grid Connection Standards	AS/NSZ 4777.2:2020, EN 50549-1				
Emissions	IEC61000-6-2, IEC61000-6-3, IEC61000-3-11, IEC61000-3-12				
RoHS	Yes				

(1) Refer to Datasheets -> Communications category in Downloads page for specifications of optional communication options: http://www.solaredge.com/groups/support/downloads
(2) Wi-Fi connectivity requires connection of an additional Wi-Fi component, ordered separately. For more details ask your SolarEdge sales person or refer to: https://www.solaredge.com/aus/products/communication
(3) For more information refer to: https://www.solaredge.com/sites/default/files/se-zigbee-plug-in-wireless-communication-for-setapp-datasheet-au.pdf
(4) An export meter is required for export limitation and most of home energy management functions

/ Three Phase Residential Inverter

For Australia and New Zealand

SE5K-AUB / SE7K-AUB / SE8.25K-AUB / SE10K-AUB

APPLICABLE TO INVERTERS WITH PART NUMBER	SE5K-AUB	SE7K-AUB	SE8.25K-AUB	SE10K-AUB	
	SEXXK- AUBTEBEU4				
INSTALLATION SPECIFICATIONS					
AC Output Conduit Size / Wire Cross Section	20mm minimum / 3-13mm²				
DC Input Conduit Size / Wire Cross Section	20mm conduit size minimum				
DC Input	Single DC terminal block				
Dimensions with Safety Switch (H x W x D)	775 x 315 x 260				mm
Weight	30				kg
Operating Temperature Range	-40 to +60(5)				°C
Cooling	Fan (user replaceable)				
Noise	< 50				dBA
Protection Rating	IP65 - outdoor and indoor				
Mounting	Bracket provided				
Manufacturing Countries	China / Vietnam / Hungary				

(5) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE

A.28 THREE PHASE INVERTERS – SE25K, SE30K, SE33.3K AUSTRALIA AND NEW ZEALAND MODELS

Three Phase Inverter

For Australia and New Zealand

SE25K / SE30K / SE33.3K

INVERTERS

Specifically designed to work with power optimizers

- Fixed voltage inverter for superior efficiency (98.3%) and longer strings
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Small, lightest in its class, and easy to install
- Optional Type 2 DC and AC surge protection, to better withstand lightning events
- Built-in module-level monitoring with Ethernet or wireless communication for full system visibility
- IP65 outdoor and indoor installation
- Smart Energy Management control
- Future-ready for the SolarEdge energy storage solution
- Integrated DC Safety Unit - eliminates the need for external DC isolators

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/ Three Phase Inverter

For Australia and New Zealand

SE25K / SE30K / SE33.3K

Applicable to inverters with part number	SEXXK-AUX0IXXX			
	SE25K	SE30K	SE33.3K	
OUTPUT				
Rated AC Power Output	25000	30000	33300	W
Rated Maximum Apparent AC Output Power	25000	30000	33300	VA
AC Output Voltage - Line to Line / Line to Neutral (Nominal)	380 / 220 ; 400 / 230			Vac
AC Output Voltage - Line to Neutral Range	176 - 253 ; 184 - 264			Vac
AC Output Line Connections	3W + PE, 4W + PE			
Grids Supported - Three Phase	WYE: TN-C, TN-S, TN-C-S, IT; Delta: IT			
AC Frequency	50 ± 5%			Hz
Rated Continuous Output Current (per Phase)	38	43.5	48.25	Aac
Maximum Continuous Overcurrent Protection	38	43.5	48.25	Aac
Residual Current Detector / Residual Current Step Detector	100 / 30			mA
Inrush current AC (Peak / Duration)	3.6 / 20			Aac rms / ms
Maximum Residual Current Injection[1]	100			mA
Maximum Output Fault Current	54	66	71	Aac
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes			
Total Harmonic Distortion	≤ 3			%
Protective Class	Class I			
Overvoltage Category	III			
Active Anti-Islanding Method	Slip Mode Frequency Shift			
Power Factor Range	+/-0.8 to 1			
INPUT				
Maximum DC Power (Module STC)	37500	45000	50000	W
Transformer-less, Ungrounded	Yes			
Operating Voltage Range DC+ to DC-	680 - 830			Vdc
Minimum Input Voltage DC to Gnd	340			Vdc
Maximum Input Voltage DC to Gnd	415			Vdc
Maximum Input Voltage DC+ to DC-	830			Vdc
Maximum Operating Input Current	37	43.5	48.25	Adc
Short Circuit Current From The PV Array	48.25			Adc
Maximum Back-Feed Current	0			Adc
Overvoltage Category	II			
Reverse-Polarity Protection	Yes			
Ground-Fault Isolation Detection	167kΩ Sensitivity[2]			
Protective Class	Class I			
Overvoltage Category	II			
Maximum Inverter Efficiency	98.3			%
European Weighted Efficiency	98			%
Nighttime Power Consumption	< 4			W
ADDITIONAL FEATURES				
Supported Communication Interfaces	2 x RS485, Ethernet, Wi-Fi[3]			
Smart Energy Management	Export Limitation			
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection			
Arc Fault Protection	Integrated, User Configurable (According to UL1699B)			
RS485 Surge Protection	Supplied with the inverter			
DC / AC Surge Protection	Type II, field replaceable, Optional			
Maximum Altitude	2000			m
Inverter Topology	Non-Isolated Photovoltaic Inverter			
DC SAFETY UNIT				
DC Disconnect	Provided			
STANDARD COMPLIANCE				
Safety	IEC62109, AS/NZS3100			
Grid Connection Standards[4]	AS/NZS4777:2020			
Emissions	IEC61000-6-2, IEC61000-6-3 Class A , IEC61000-3-11, IEC61000-3-12			
RoHS	Yes			

(1) If an external RCD is required, its trip value must be ≥ 100mA
(2) Where permitted by local regulations
(3) Wi-Fi connectivity requires connection of an additional Wi-Fi component, ordered separately. For more details ask your SolarEdge sales person or refer to: https://www.solaredge.com/aus/products/communication
(4) For all standards refer to the Certifications category in the Resource Library: http://www.solaredge.com/groups/support/downloads

/ Three Phase Inverter

For Australia and New Zealand

SE25K / SE30K / SE33.3K

Applicable to inverters with part number	SEXXK-AUX0IXXX			
	SE25K	SE30K	SE33.3K	
INSTALLATION SPECIFICATIONS				
AC Output Conduit Size / Wire Cross Section	20 mm minimum / 4-16 mm^2			
DC Input Conduit Size / Wire Cross Section	20 mm minimum / 6-35 mm^2			
Dimensions with Safety Unit (H x W x D)	808 x 317 x 300			mm
Weight with Safety Unit	35			kg
Operating Temperature Range	-40 to+60[5]			°C
Cooling	Fan (user replaceable)			
Noise	< 62			dBA
Protection Rating	IP65 - Outdoor and Indoor			
Mounting	Bracket Provided			
ADDITIONAL INFORMATION				
Manufacturing Countries	China, Vietnam, Hungary			

(5) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.29 THREE PHASE INVERTERS WITH SYNERGY TECHNOLOGY – SE50K, SE66.6K, SE82.8K, SE100K AUSTRALIA AND NEW ZEALAND MODELS

Three Phase Inverter with Synergy Technology

INVERTER

For Australia and New Zealand

SE50K / SE66.6K / SE82.8K / SE100K

Powered by unique pre-commissioning process for rapid system installation

- Pre-commissioning feature for automated validation of system components and wiring during the site installation process and prior to grid connection
- Easy 2-person installation with lightweight, modular design (each inverter consists of 2 or 3 Synergy Units and one Synergy Manager)
- Independent operation of each inverter unit enables higher uptime and easy serviceability
- Built-in thermal sensors detect faulty wiring ensuring enhanced protection and safety
- Built-in arc fault protection
- Built-in PID mitigation for maximised system performance
- Monitored* and field-replaceable surge protection devices, to better withstand surges caused by lightning or other events: integrated RS485 and optional Type 2 DC and AC SPDs
- Built-in DC safety switch eliminates the need for external DC isolators
- Built-in module-level monitoring with Ethernet or cellular communication for full system visibility

* Applicable only for DC and AC SPDs

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/ Three Phase Inverter with Synergy Technology

For Australia and New Zealand

SE50K / SE66.6K / SE82.8K / SE100K

Applicable to Inverter with Part Number	SExxK-AUxxIxxxx				
	SE50K	SE66.6K	SE82.8K	SE100K	
OUTPUT					
Rated AC Active Output Power	50000	66600	82800	100000	W
Maximum AC Apparent Output Power	50000	66600	82800	100000	VA
AC Output Voltage — Line to Line / Line to Neutral (Nominal)	380 / 220 ; 400 / 230				Vac
AC Output Voltage - Line to Neutral Range	176 - 253 ; 184 - 264				Vac
AC Output Line Connections	3W + PE, 4W + PE				
Supported Grids	WYE: TN-C, TN-S, TN-C-S, TT, IT; Delta: IT				
AC Frequency	50 ± 5%				Hz
Maximum Continuous Output Current (per Phase)	72.5	96.5	120	145	Aac
Maximum Continuous Overcurrent Protection	72.5	96.5	120	145	Aac
Residual Current Detector / Residual Current Step Detector	100 / 30				mA
Inrush current AC (Peak / Duration)	7.2 / 20		10.8 / 20		Aac rms / ms
Maximum Residual Current Injection[1]	200		300		mA
Maximum Output Fault Current	109	142	176	213	Aac
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes				
Total Harmonic Distortion	≤ 3				%
Protective Class	Class I				
Overvoltage Category	III				
Active Anti-Islanding Method	Slip Mode Frequency Shift				
Power Factor Range	+/-0.8 to 1				
INPUT					
Maximum DC Power (Module STC) Inverter / Synergy Unit	75000 / 37500	100000 / 50000	124200 / 41400	150000 / 50000	W
Transformer-less, Ungrounded	Yes				
Operating Voltage Range DC+ to DC-	680 - 830				Vdc
Minimum Input Voltage DC to Gnd	340				Vdc
Maximum Input Voltage DC to Gnd	415				Vdc
Maximum Input Voltage DC+ to DC-	830				Vdc
Maximum Input Current	2 x 36.25	2 x 48.25	3 x 40	3 x 48.25	Adc
Short Circuit Current From The PV Array per Synergy Unit	48.25				
Maximum Back-Feed Current	0				Adc
Overvoltage Category	II				
Reverse-Polarity Protection	Yes				
Ground-Fault Isolation Detection	167kΩ sensitivity per Synergy Unit[2]				
Protective Class	Class I				
Overvoltage Category	II				
Maximum Inverter Efficiency	98.3				%
European Weighted Efficiency	98				%
Nighttime Power Consumption	< 8		< 12		W
ADDITIONAL FEATURES					
Supported Communication Interfaces[3]	2 x RS485, Ethernet, Wi-Fi (optional), Cellular (optional)				
Smart Energy Management	Export Limitation				
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection				
Arc Fault Protection	Built-in, user configurable (according to UL1699B)				
PID Rectifier	Nighttime, built-in				
RS485 Surge Protection (ports 1 + 2)	Type II, field replaceable, integrated				
DC Surge Protection	Type II, field replaceable, optional				
AC Surge Protection	Type II, field replaceable, optional				
DC Disconnect Switch	Provided				
Maximum Altitude	2000				m
Inverter Topology	Non-Isolated Photovoltaic Inverter				
STANDARD COMPLIANCE					
Safety	IEC-62109-1, IEC-62109-2, AS3100				
Grid Connection Standards[4]	AS/NZS4777.2020				
Emissions	IEC61000-6-2, IEC61000-6-3 Class A, IEC61000-3-11, IEC61000-3-12				
RoHS	Yes				

(1) If an external RCD is required, its trip value must be ≥ 200mA for SE50K/SE66.6K; ≥ 300mA for SE82.8K/SE100K
(2) Where permitted by local regulations
(3) For specifications of the optional communication options, visit https://www.solaredge.com/products/communication or the Resource Library webpage: https://www.solaredge.com/resource-library, to download the relevant product datasheet
(4) For all standards and certificates download, refer to the Certifications category on the Resource library webpage: https://www.solaredge.com/resource-library

/ Three Phase Inverter with Synergy Technology

For Australia and New Zealand

SE50K / SE66.6K / SE82.8K / SE100K

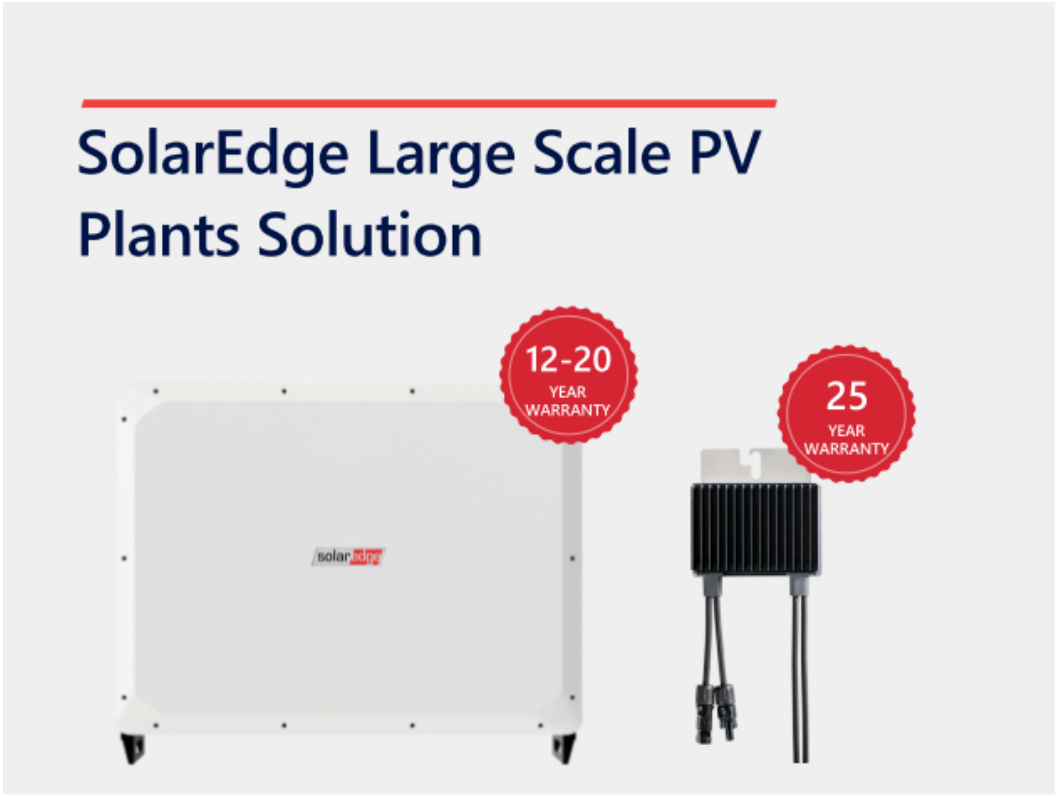
Applicable to Inverter with Part Number	SExxK-AUxxIxxxx				
	SE50K	SE66.6K	SE82.8K	SE100K	
INSTALLATION SPECIFICATIONS					
Number of Synergy Units per Inverter	2		3		
AC Max Conduit Size	63				mm
AC Wire Cross Section Line/PE (Aluminum or Copper)	95 / 50		120 / 70		mm^2
DC Max Conduit Size	2 x 40 mm		3 x 40 mm		
DC Max Wire Cross Section (Copper) / Number of PV Arrays	50 mm^2 / 2 x PV arrays		50 mm^2 / 3 x PV arrays		mm^2
Dimensions (H x W x D)	Synergy Unit: 558 x 328 x 273 Synergy Manager: 360 x 560 x 295				mm
Weight	Synergy Unit: 32 Synergy Manager: 18				kg
Operating Temperature Range	-40 to +60(5)				°C
Cooling	Fan (user replaceable)				
Noise	< 67				dBA
Protection Rating	IP65 — outdoor and indoor				
Mounting	Brackets provided				
ADDITIONAL INFORMATION					
Manufacturing Countries	China, Vietnam, Hungary				

(5) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note.pdf

CE RoHS

A.30 UTILITY SCALE THREE PHASE INVERTER SE330K AND UTILITY SCALE OPTIMIZER H1300 FOR NORTH AMERICA

SolarEdge Large Scale PV Plants Solution



Higher Energy Yield

- Module-level MPPT with 99% weighted inverter efficiency
- Up to 200% DC/AC oversizing
- Module mismatch mitigation, also for bi-facial modules
- Wide operating temperature range, suitable for hot environments

Lower BoS Costs

- Higher power per inverter - fewer units needed per system
- Less cabling with long 80-module string lengths
- Better utilization of solar trackers – fewer trackers for the same DC capacity

Simpler O&M

- Module-level remote troubleshooting with pinpointed visibility and actionable insights
- Built-in Type 1 / Type 2 AC & DC surge protection devices to better withstand electrical surges; monitored and field-replaceable
- Built-in AC & DC terminal block temp. sensors to prevent overheating

Flexible Installations

- Fits both distributed and virtual central deployments
- Pre-commissioning for automated, early validation of system components and wiring, even prior to AC connection

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/ Inverter Technical Specifications

SE330K

		UNIT
OUTPUT		
Rated AC Active Output Power	330,000 @ 122F	W
Maximum Apparent AC Power Output	330,000 @ 122F	VA
AC Output Voltage - Line to Line (Nominal)	690	Vac
AC Output Voltage - Line to Line (Range)	587-759	Vac
AC Frequency	60 ± 5%	Hz
Maximum Continuous Output Current (per Phase) @Nominal Voltage	276.1	Aac
AC Output Line Connections	3W + PE	
Total Harmonic Distortion	≤3	%
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes	
Power Factor Range	0 - 1 / leading, lagging	
INPUT		
Max DC Power (Module STC)	660,000	W
Maximum Input Voltage DC+ to DC-	1500	Vdc
Nominal DC Input Voltage DC+ to DC-	1250	Vdc
Maximum Input Current	266.7	Adc
Module-Level Optimization	Yes	
EFFICIENCY		
Max Inverter Efficiency[1]	99.0	%
CEC Efficiency[1]	99.0	%
PROTECTION FEATURES		
DC Reverse Polarity Protection	Yes	
Ground Fault Isolation Detection	Yes	
AC Surge Protection	Type 2, monitored and field replaceable	
DC Surge Protection	Type 2, monitored and field replaceable	
RS485 Surge Protection	Optional	
DC Disconnect	Yes, integrated	
ADDITIONAL FEATURES		
Supported Communication Interfaces	CAN bus, RS485, Ethernet, WiFi, Cellular (optional)	
PID Protection	PID Rectifier	
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection	
Pre-Commissioning	Inverter activation and validation powered by PV modules	
VAR at Night	Yes	
STANDARD COMPLIANCE[6]		
Safety	UL 1741, UL1998	
Grid Connection Standards	UL 1741SA, IEEE1547, Rule 21, Rule 14, CAN/CSA-C22.2	
Emissions	FCC Part 15, Class A	
Advanced Grid Support Capabilities	L/HFRT, L/HVRT, Volt-VAr, Volt/Watt, Frequency / Watt, Ramp Rate Control, Fixed Power Factor	
RoHS	Yes	
GENERAL DATA		
Dimensions (W x H x D)	42.9 x 35.6 x 16.1 / 1090 x 903 x 409	in / mm
Weight	342 / 155	lb / kg
Operating Temperature Range	-40 to +140 / -40 to +60(1)	°F / °C
Cooling	Fans (field replaceable)	
Noise Emission	< 69	dBA
Protection Rating	NEMA 4X	
Mounting	Bracket provided	
Topology	Transformerless, ungrounded	
AC Connection[2]	Up to 2x2.5" conduit, terminal lugs, max. 600 kcmil per wire, Al or Cu	
DC Connection[3][4]	Up to 2x3" conduit, terminal lugs, max. 600 kcmil per wire, Al or Cu	

(1) Power de-rating from 50C
(2) Two AC terminals per line are available
(3) Up to two DC terminals (+,-) are available
(4) A DC input with MC4 connectors supporting up to 20 strings is also available
(5) Preliminary
(6) Certification pending

/ Power Optimizer Technical Specifications

H1300

	H1300 (FOR CONNECTION TO TWO PV MODULES)	
INPUT		
Rated Input DC Power[1]	1300	W
Connection Method	Single input for series connected modules	
Absolute Maximum Input Voltage (Voc at lowest temperature)	125	Vdc
MPPT Operating Range	12.5-105	Vdc
Maximum Short Circuit Current per Input (Isc)	15	Adc
Maximum Efficiency	99.5	%
Weighted Efficiency	98.8	%
Overvoltage Category	II	
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)		
Maximum Output Current	20	Adc
Maximum Output Voltage	75	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED TO OPERATING SOLAREDGE)		
Safety Output Voltage per Power Optimizer	1 ± 0.1	Vdc
STANDARD COMPLIANCE[4]		
EMC	FCC Part 15 Class A, IEC61000-6-2, IEC61000-6-3	
Safety	IEC62109-1 (Class II safety)	
Material	UL94 V-0, UV resistant	
RoHS	Yes	
Fire Safety	VDE-AR-E 2100-712:2013-05	
INSTALLATION SPECIFICATIONS		
Compatible SolarEdge Inverters	SE330K	
Maximum Allowed System Voltage	1500	Vdc
Dimensions (W x L x H)	129 x 155 x 59 / 5.08 x 6.10 x 2.32	mm / in
Weight (including cables)	1170 / 2.6	g / lb
Input Connector	MC4-Evo2[2]	
Input Wire Length	0.1, 1.7 / 0.32, 5.57	m / ft
Output Connector	MC4-Evo2	
Output Wire Length	Option 1: 0.1, 2.5 / 0.32, 8.2 Option 2: 0.1, 5.1 / 0.32, 16.73	m / ft
Operating Temperature Range[3]	-40 to 65 / -40 to 149	°C / °F
Protection Rating	IP68 / NEMA6P	
Relative Humidity	0-100	%

(1) Rated power of the module at STC will not exceed the Power Optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed
(2) For other connector types please contact SolarEdge
(3) For ambient temperature above +65°C / 149°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details
(4) Certification pending

	SE330K	
	Module Power	
Minimum String Length[5] (Power Optimizers/Modules)	400 - 450W	27 / 54
	455 - 550W	24 / 48
	555 - 650W	22 / 44
Maximum String Length (Power Optimizers / Modules)		45 / 90
Maximum Continuous Power per String		25000 W
Maximum Allowed Connected Power per String[6]		33000
Maximum allowed difference between the shortest and longest string connected to the same inverter	5 Power Optimizers	W

(5) Design your project using SolarEdge Designer, in order to use a lower minimum string length and/or connect more STC power per string
(6) A minimum of 14 strings must be connected. For 13 strings or less, 29000W is allowed

CE RoHS

A.31 UTILITY SCALE THREE PHASE INVERTER SE330K AND UTILITY SCALE OPTIMIZER H1300 FOR EUROPE

Preliminary

SolarEdge Large Scale PV Plants Solution

Higher Energy Yield

- Module-level MPPT with 99% weighted inverter efficiency
- Up to 200% DC/AC oversizing
- Module mismatch mitigation, also for bi-facial modules
- Wide operating temperature range, suitable for hot environments

Lower BoS Costs

- Higher power per inverter - fewer units needed per system
- Less cabling with long string lengths, up to 80 modules
- Better utilization of solar trackers – fewer trackers for the same DC capacity

Simpler O&M

- Module-level remote troubleshooting with pinpointed visibility and actionable insights
- Built-in Type 2 AC & DC surge protection devices to better withstandelectrical surges; monitored and field-replaceable
- Built-in AC & DC terminal block temp. sensors to prevent overheating

Flexible Installations

- Fits both distributed and virtual central deployments
- Pre-commissioning for automated, early validation of system components and wiring, even prior to AC connection

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Preliminary

/ Inverter Technical Specifications

SE330K

		UNIT
OUTPUT		
Rated AC Active Output Power	330,000 @ 50°C	W
Maximum Apparent AC Power Output	330,000 @ 50°C	VA
AC Output Voltage - Line to Line (Nominal)	690	Vac
AC Output Voltage - Line to Line (Range)	587-759	Vac
AC Frequency	50 ± 5%	Hz
Maximum Continuous Output Current (per Phase) @Nominal Voltage	276.1	Aac
AC Output Line Connections	3W + PE	
Total Harmonic Distortion	≤3	%
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes	
Power Factor Range	0 - 1 / leading, lagging	
INPUT		
Max DC Power (Module STC)	660,000	W
Maximum Input Voltage DC+ to DC-	1500	Vdc
Nominal DC Input Voltage DC+ to DC-	1250	Vdc
Maximum Input Current	266.7	Adc
Module-Level Optimization	Yes	
EFFICIENCY		
Max Inverter Efficiency[1]	99.0	%
PROTECTION FEATURES		
DC Reverse Polarity Protection	Yes	
Ground Fault Isolation Detection	Yes	
AC Surge Protection	Type 2, monitored and field replaceable	
DC Surge Protection	Type 2, monitored and field replaceable	
RS485 Surge Protection	Optional	
DC Disconnect	Yes, integrated	
ADDITIONAL FEATURES		
Supported Communication Interfaces	CAN bus, RS485, Ethernet, WiFi (optional), Cellular (optional)	
PID Protection	PID Rectifier	
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection	
Pre-Commissioning	Inverter activation and validation powered by PV modules	
VAR at Night	Yes	
STANDARD COMPLIANCE[2]		
Safety	IEC62109, AS3100	
Grid Connection Standards	VDE-AR-N 4110, VDE-AR-N 4120, EN50549-2, BDEW, C10/11, EN50438, PO 12.3, AS 4777, G99 Type A and B, CEI 0-16, UTE C15-712, VDE V 0126-1-1, RD1699, RD413, NTS, TOR Erzeuger Typ B, C, D	
EMC	IEC61000-6-2, IEC61000-6-3, EN55011	
Advanced Grid Support Capabilities	L/HFRT, L/HVRT, Volt-VAr, Volt/Watt, Frequency/Watt, Ramp Rate Control, Fixed Power Factor	
RoHS	Yes	
GENERAL DATA		
Dimensions (W x H x D)	42.9 x 35.6 x 16.1 / 1090 x 903 x 409	in / mm
Weight	342 / 155	lb / kg
Operating Temperature Range	-40 to +140 / -40 to +60[3]	°F / °C
Cooling	Fans (field replaceable)	
Noise Emission	< 69	dBA
Protection Rating	IP66	
Mounting	Bracket provided	
Topology	Transformerless, ungrounded	
AC Connection[4][5]	2 Glands, Cable Diameter 38-66mm, Terminal Lugs, Max. 300mm² per wire, Al or Cu	
DC Connection[5][6]	4 Glands, Cable Diameter 19-28mm, Terminal Lugs, Max. 300mm² per wire, Al or Cu	

(1) Preliminary
(2) Certification pending
(3) Power de-rating from 50°C
(4) Two AC terminals per line are available
(5) Two sets of DC terminals (+, -) are available
(6) A DC input with MC4 connectors supporting up to 20 strings is also available

Preliminary

Power Optimizer Technical Specifications

H1300

	H1300 (FOR CONNECTION TO TWO PV MODULES)	
INPUT		
Rated Input DC Power[1]	1300	W
Connection Method	Single input for series connected modules	
Absolute Maximum Input Voltage (Voc at lowest temperature)	125	Vdc
MPPT Operating Range	12.5-105	Vdc
Maximum Short Circuit Current per Input (Isc)	15	Adc
Maximum Efficiency	99.5	%
Weighted Efficiency	98.8	%
Overvoltage Category	II	
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)		
Maximum Output Current	20	Adc
Maximum Output Voltage	75	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED TO OPERATING SOLAREDGE)		
Safety Output Voltage per Power Optimizer	1 ± 0.1	Vdc
STANDARD COMPLIANCE		
EMC	FCC Part 15 Class A, IEC61000-6-2, IEC61000-6-3	
Safety	IEC62109-1 (Class II safety)	
Material	UL94 V-0, UV resistant	
RoHS	Yes	
Fire Safety	VDE-AR-E 2100-712:2013-05	
INSTALLATION SPECIFICATIONS		
Compatible SolarEdge Inverters	SE330K	
Maximum Allowed System Voltage	1500	Vdc
Dimensions (W x L x H)	129x155x59/5.08x6.10x2.32	mm / in
Weight (including cables)	1170/2.6	g / lb
Input Connector	MC4-Evo2[2]	
Input Wire Length	0.1, 1.7 / 0.32, 5.57	m / ft
Output Connector	MC4-Evo2	
Output Wire Length	Option 1: 0.1, 2.5 / 0.32, 8.2 Option 2: 0.1, 5.1 / 0.32, 16.73	m / ft
Operating Temperature Range[3]	-40 to 65 / -40 to 149	°C / °F
Protection Rating	IP68 / NEMA6P	
Relative Humidity	0-100	%

(1) Rated power of the module at STC will not exceed the Power Optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed.
(2) For other connector types please contact SolarEdge.
(3) For ambient temperature above +65°C / 149°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details.

	SE330K	
	Module Power	
Minimum String Length[4] (Power Optimizers/Modules)	400 - 450W	27 / 54
	455 - 550W	24 / 48
	555 - 650W	22 / 44
Maximum String Length (Power Optimizers / Modules)		45 / 90
Maximum Continuous Power per String		25000 W
Maximum Allowed Connected Power per String[5]		33000 W
Maximum allowed difference between the shortest and longest string connected to the same inverter		5 Power Optimizers

(4) Design your project using SolarEdge Designer, in order to use a lower minimum string length and/or connect more STC power per string.
(5) A minimum of 14 strings must be connected. For 13 strings or less, 29000W is allowed.

CE RoHS

A.32 SOLAREDGE ENERGY NET PLUG-IN

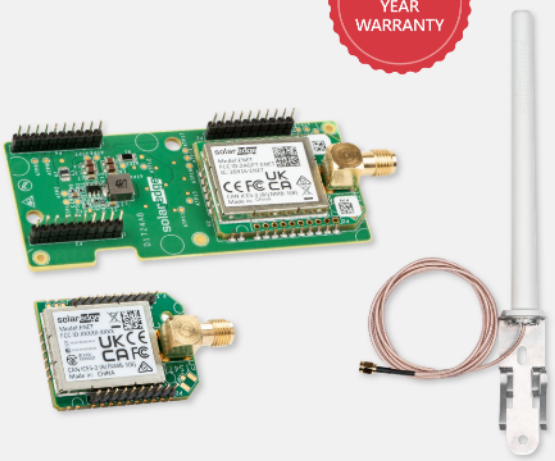
SolarEdge Energy Net Plug-In

Wireless Mesh Network

Model: ENET

5 YEAR WARRANTY

COMMUNICATIONS



One communication platform for seamless device connection within the SolarEdge Smart Energy Management ecosystem

- Faster, easier and cleaner installations*
  - Avoids the hassle of wired infrastructure with wireless connectivity between inverter and system devices
  - Simple plug and play connection
  - Automatic device detection and configuration using SetApp
- Field-proven wireless technology Mesh network
  - topology enabling long-range transmissions
  - Robust performance in challenging environments
- Connectivity you can count on
  - Reliable communications with no single point of failure (for multiple device systems)
  - Secured telemetry with advanced device authentication and data encryption
- External antenna to ensure maximum coverage

* When compared to SolarEdge installations using wired communications

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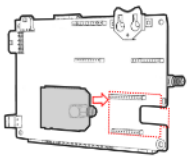
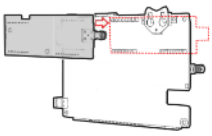
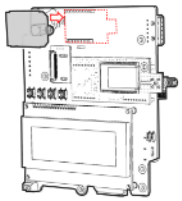
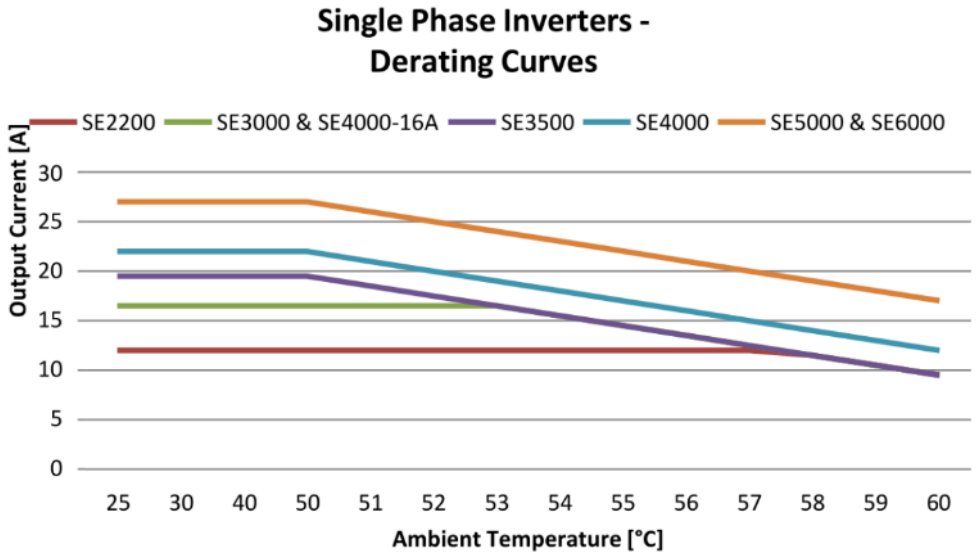
/ SolarEdge Energy Net Plug-In

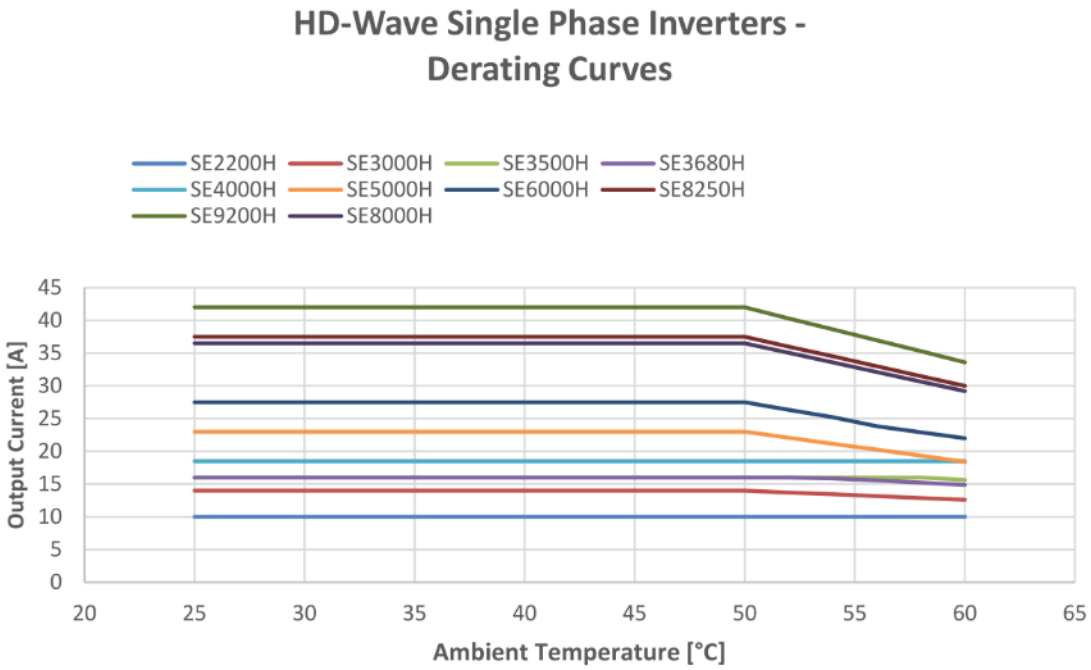
PART NUMBER		ENET-xBNP-01	ENET-xBCL-01	ENET-xBRP-01	UNIT
PERFORMANCE					
Transmit Power (Max)		17[1]			dBm
Receiver Sensitivity		-100			dBm
EIRP with Antenna		17[1]			dBm
Indoor Range (none line of sight)		50 / 160			m / ft
Frequency Band		HB 863-876, 902-930 LB 310-358, 426-445			MHz
ENVIRONMENTAL					
Operating Temperature		-40 to 185 / -40 to +85			°C / °F
Storage Temperature		-40 to 185 / -40 to +85			°C / °F
MECHANICAL					
Size		0.98 x 1.37 / 25 x 35	1.29 x 2.99 / 33 x 76	0.98 x 1.37 / 25 x 35	in / mm
POWER SUPPLY					
DC Voltage (nominal)		3.3			Vdc
Max Input Current		200			mA
ANTENNA					
Antenna Bands[2]		HB 863 - 930 LB 310 - 445			MHz
Antenna Type		Outdoor			
Antenna Connector		RP-SMA			
VSWR		≤4.0			dBi
Gain		2			dB
Polarization		Vertical			
Material		PC Lexan 503R-WH515L or WH8G952 Sabic			
Dimensions (Length x Diameter)		7.87 x 0.78 / 200 x 20			mm / in
COMPLIANCE					
US	EMC / EMI and Radio	FCC Part 15B, FCC Part 15C			
Canada	EMC / EMI	ICES-003			
	Radio	RSS-247 for SRD, RSS-102 MPE report			m / ft
Europe	EMC / EMI	CISPR 32, EN 55032, EN 55035, EN 301 489-1, EN 301 489-3			
	Radio	EN 62311 (EMF test), EN 300-220-1, EN 300-220-2			
Australia	EMC / EMI	CISPR 32 AS/NZS CISPR 32, AS/NZS 4268			m / ft
	Radio	AS/NZS 4268			
Japan	EMC / EMI	VCCI-CISPR 32			°C / °F
	Radio	ARIB STD-T93, JAPAN EXTREMELY LOW POWER			
Korea	EMC / EMI and Radio	Korea RF (KN 32/35)			
Taiwan	EMC / EMI and Radio	NCC LP0002			%
Compatibility		Energy Net-ready inverter with the following part number format: SE...-...BExx SE...-...BZxx SE...-...BXxx SE...-...BLxx For example: SE7K-AUBTEBEU4 	SetApp-enabled inverter Note: Plugs into the cellular socket. Cellular plug-in or ZigBee plug-in cannot be installed in parallel 	SetApp-enabled LCD inverter Requires replacement communication board with LCD 	

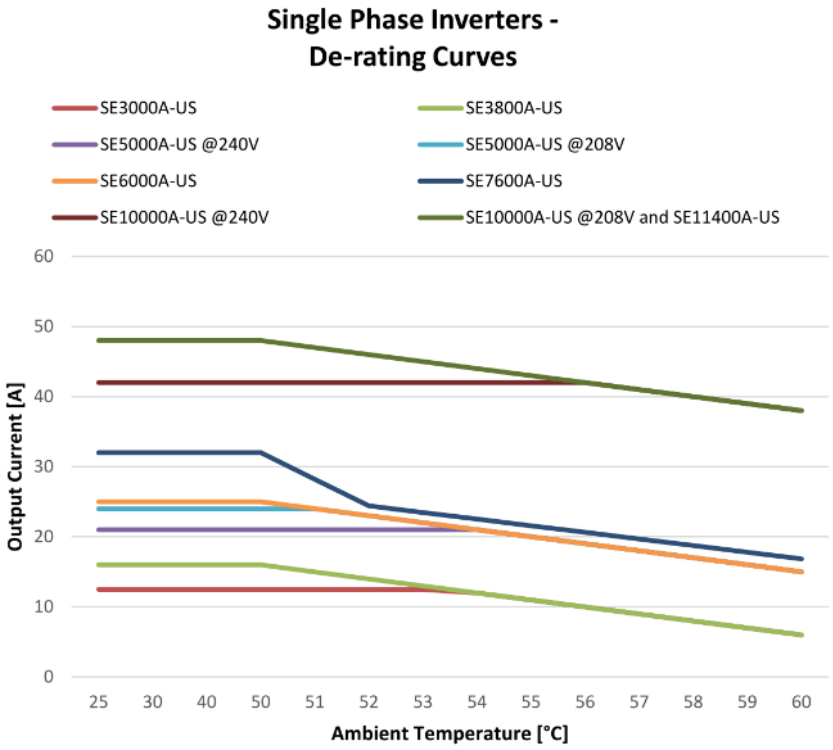
(1) Transmission power / EIRP may be higher according to each country's standard requirements
(2) External antenna is provided with the Energy Net Plug-In kit

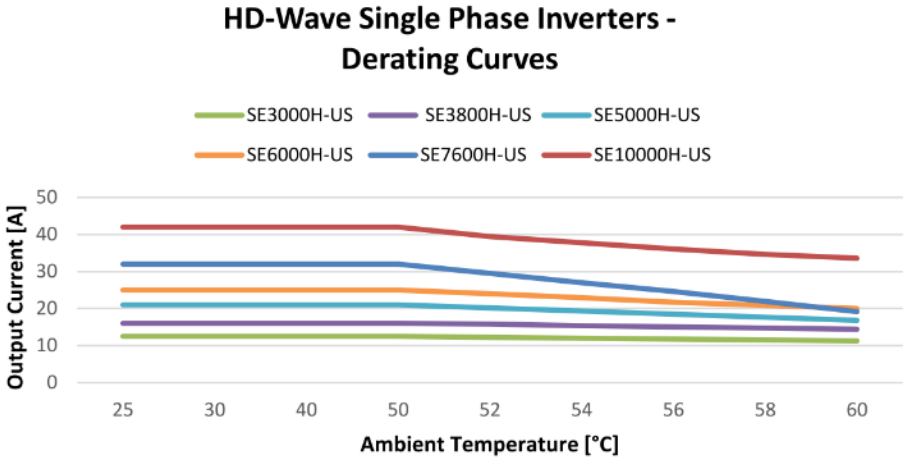
APPENDIX B – DERATING CURVES

B.1 SINGLE PHASE INVERTER DERATING CURVES

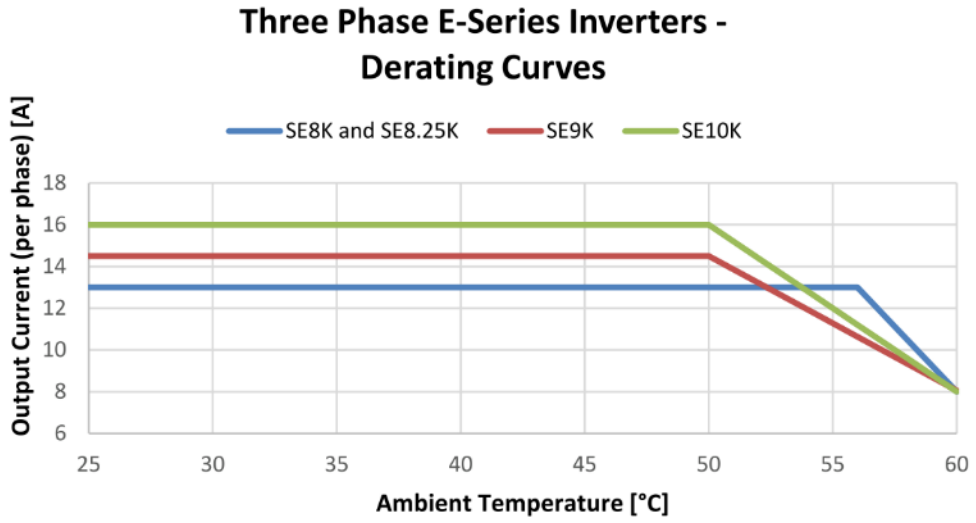


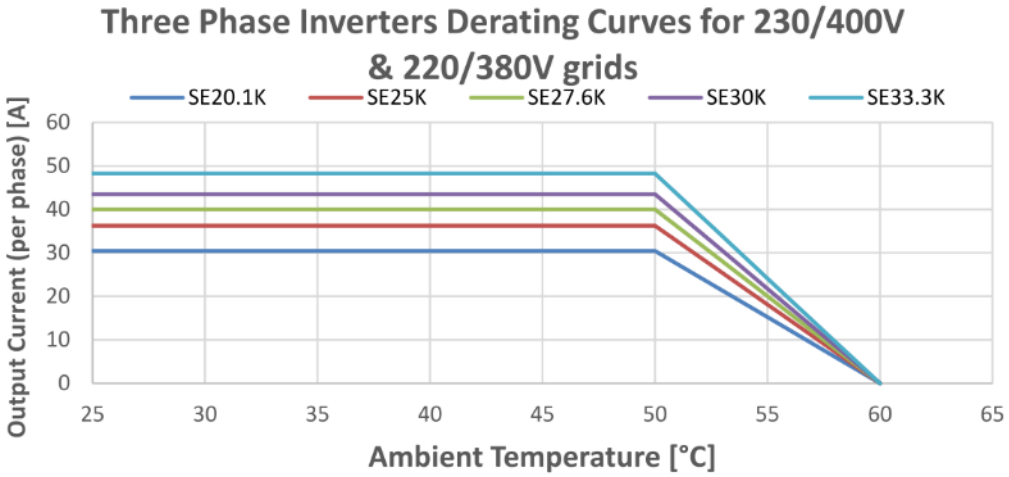


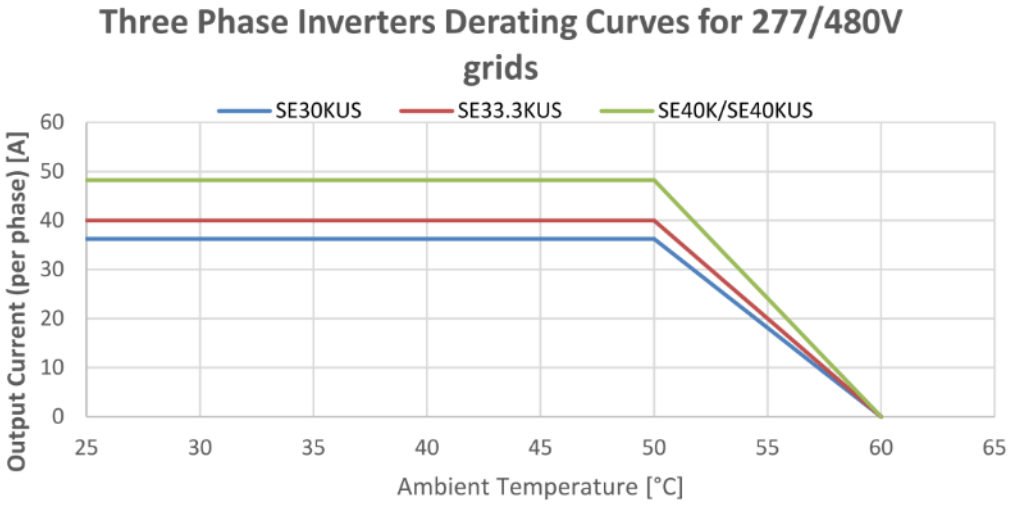

Single Phase Inverters -
De-rating Curves
SE3000A-US
SE3800A-US
SE5000A-US @240V
SE5000A-US @208V
SE6000A-US
SE7600A-US
SE10000A-US @240V
SE10000A-US @208V and SE11400A-US
Output Current [A]
60
50
40
30
20
10
0
25 30 40 50 51 52 53 54 55 56 57 58 59 60
Ambient Temperature [°C]


HD-Wave Single Phase Inverters -
Derating Curves
SE3000H-US
SE3800H-US
SE5000H-US
SE6000H-US
SE7600H-US
SE10000H-US
Output Current [A]
50
40
30
20
10
0
25 30 40 50 52 54 56 58 60
Ambient Temperature [°C]

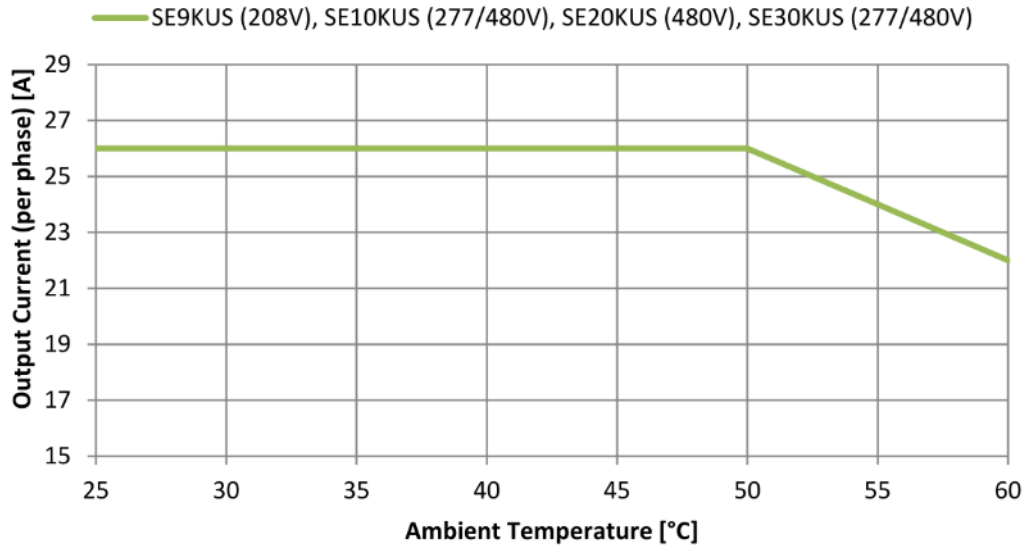
B.2 THREE PHASE INVERTER DERATING CURVES

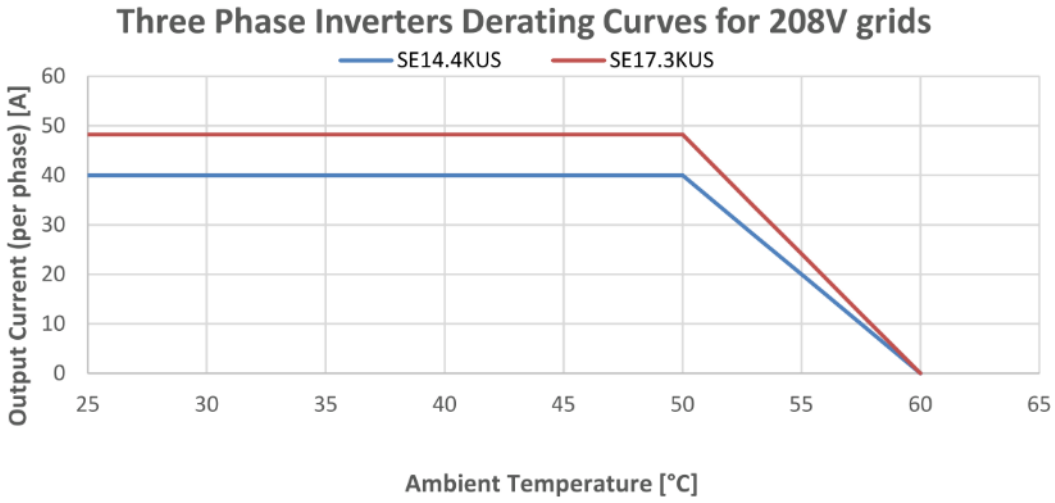


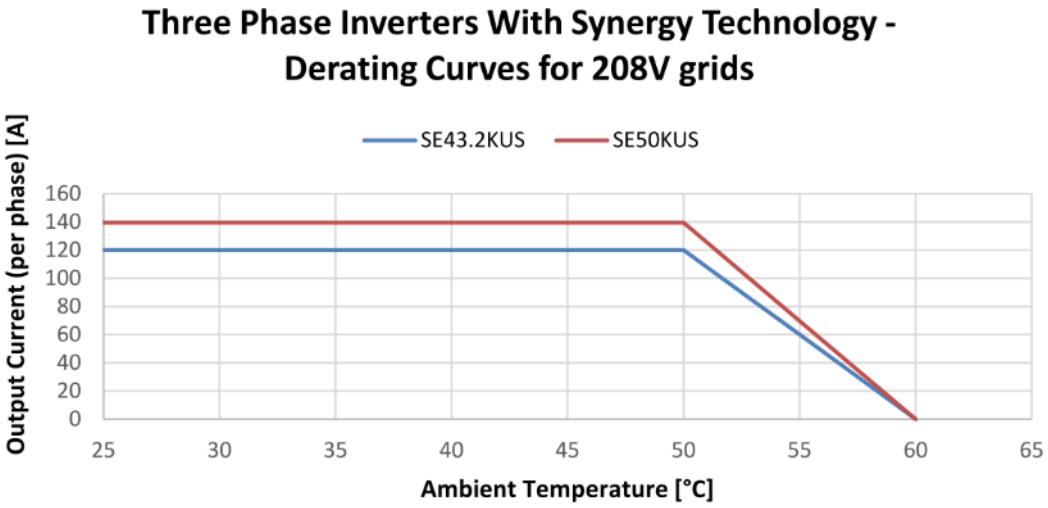


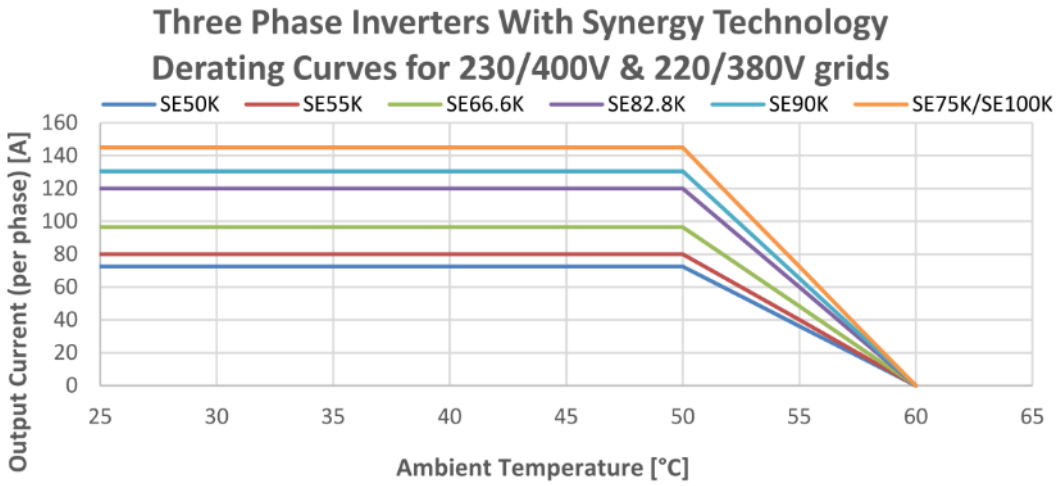


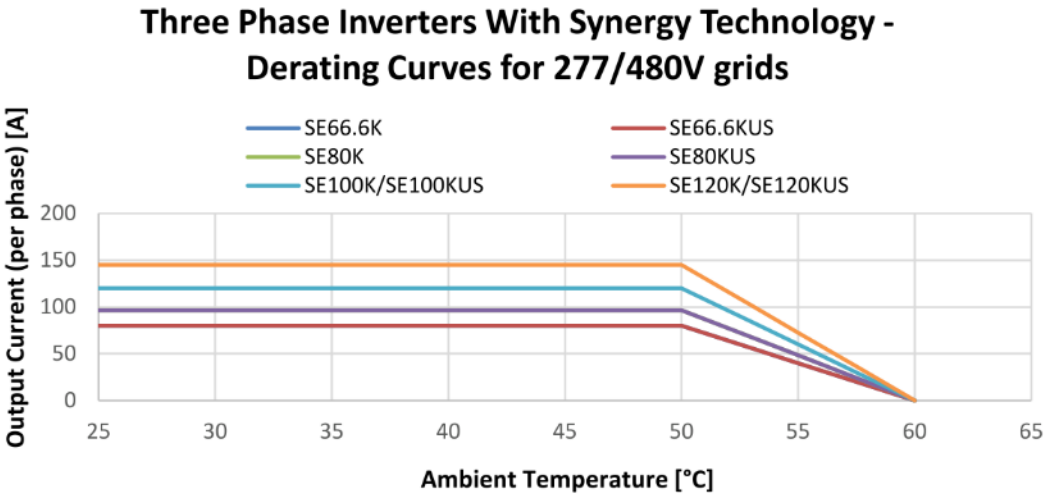
Three Phase Inverters - Derating Curves

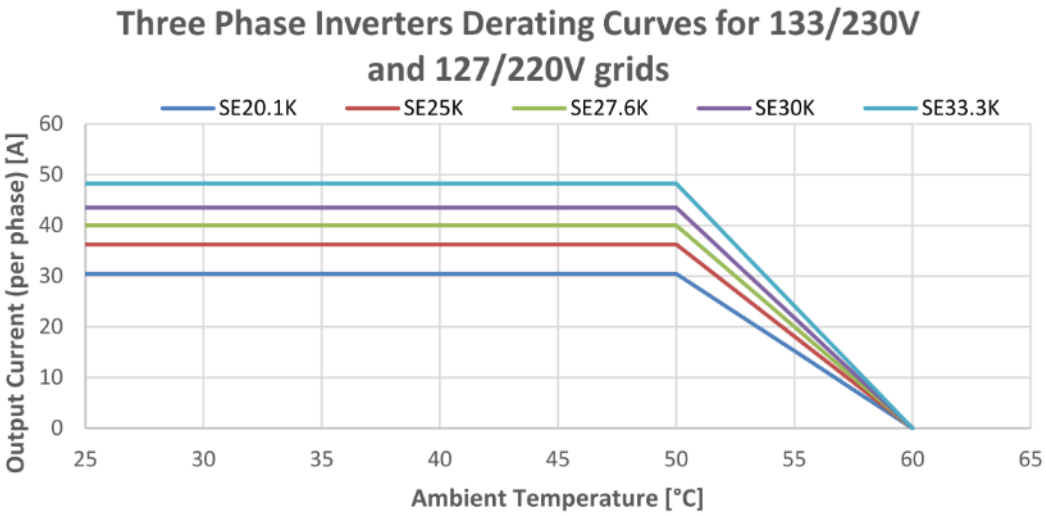


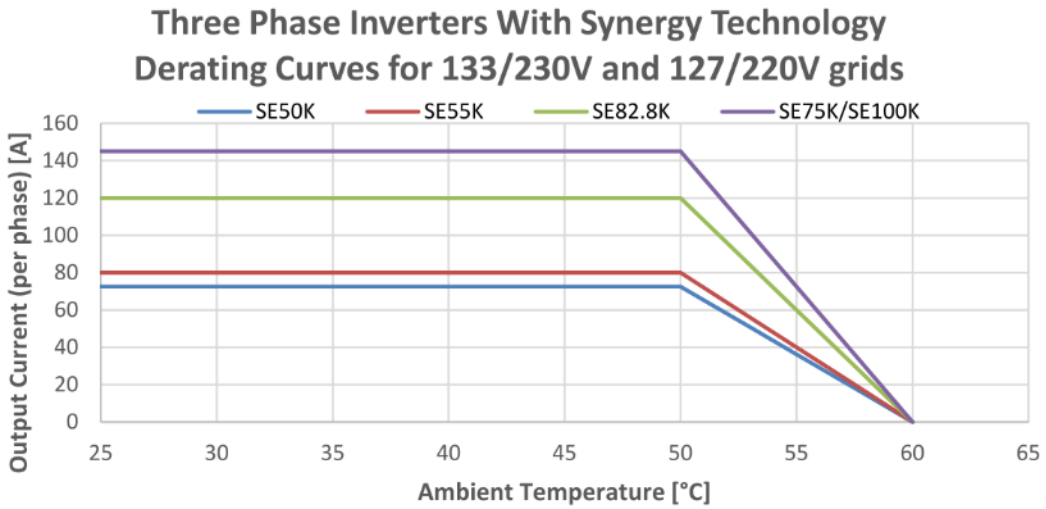



Three Phase Inverters With Synergy Technology -
Derating Curves for 208V grids
SE43.2KUS
SE50KUS
Output Current (per phase) [A]
160
140
120
100
80
60
40
20
0
25
30
35
40
45
50
55
60
65
Ambient Temperature [°C]


Three Phase Inverters With Synergy Technology
Derating Curves for 230/400V & 220/380V grids
SE50K
SE55K
SE66.6K
SE82.8K
SE90K
SE75K/SE100K
Output Current (per phase) [A]
160
140
120
100
80
60
40
20
0
25
30
35
40
45
50
55
60
65
Ambient Temperature [°C]


Three Phase Inverters With Synergy Technology -
Derating Curves for 277/480V grids
SE66.6K
SE66.6KUS
SE80K
SE80KUS
SE100K/SE100KUS
SE120K/SE120KUS
Output Current (per phase) [A]
200
150
100
50
0
25
30
35
40
45
50
55
60
65
Ambient Temperature [°C]

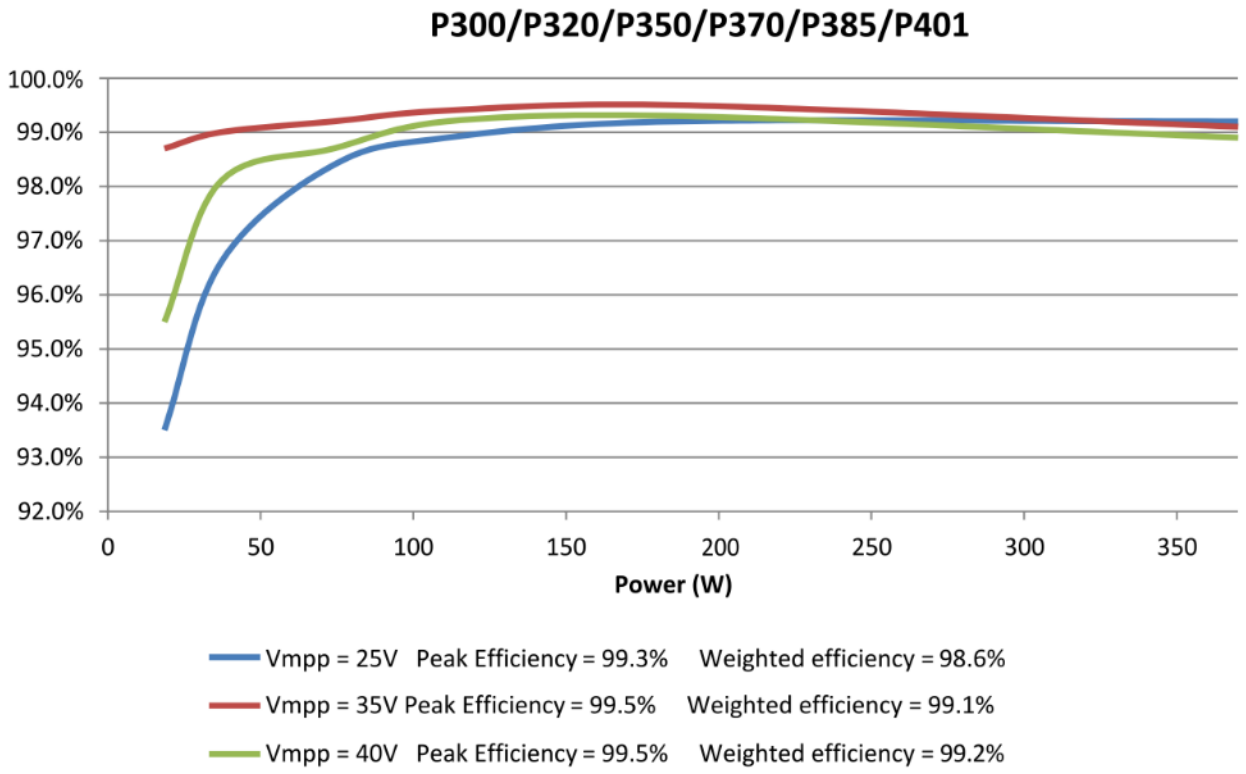

Three Phase Inverters Derating Curves for 133/230V and 127/220V grids
SE20.1K
SE25K
SE27.6K
SE30K
SE33.3K
Output Current (per phase) [A]
60
50
40
30
20
10
0
25
30
35
40
45
50
55
60
65
Ambient Temperature [°C]


Three Phase Inverters With Synergy Technology Derating Curves for 133/230V and 127/220V grids
SE50K
SE55K
SE82.8K
SE75K/SE100K
Output Current (per phase) [A]
160
140
120
100
80
60
40
20
0
25
30
35
40
45
50
55
60
65
Ambient Temperature [°C]

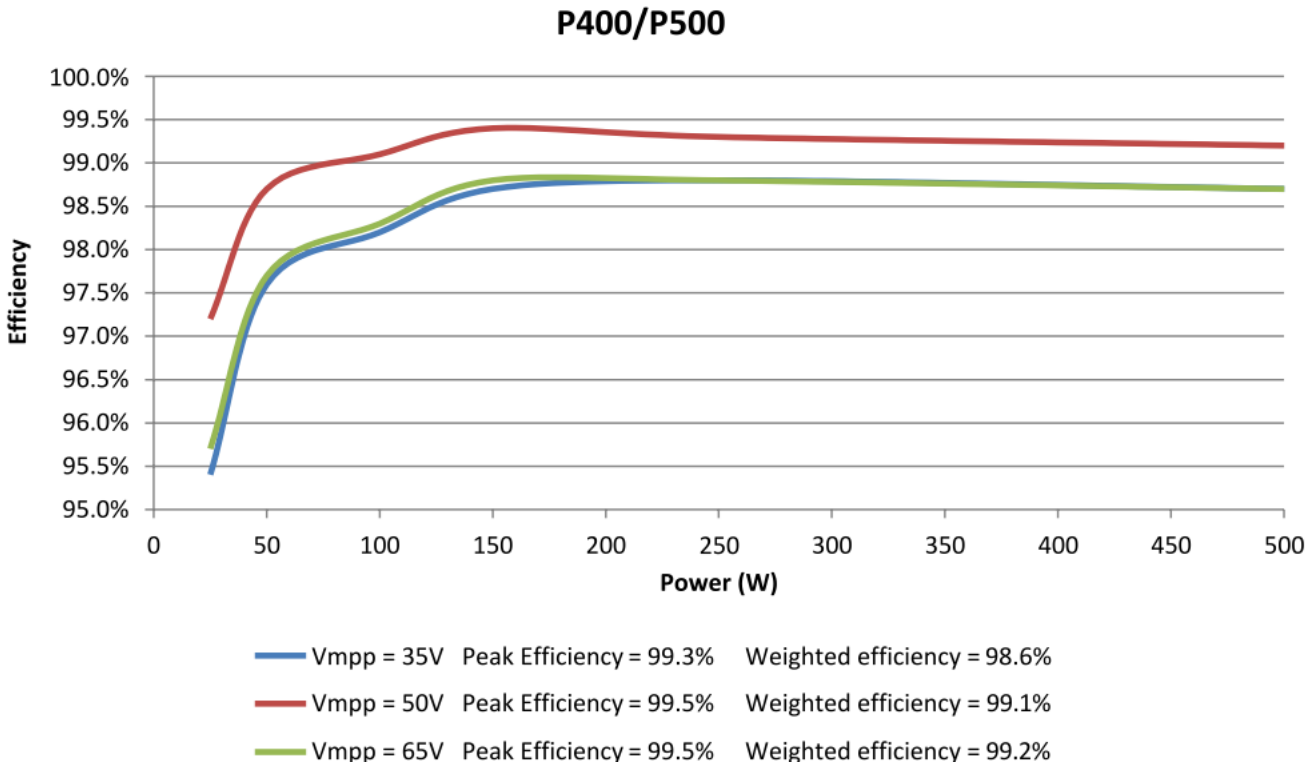
APPENDIX C – OPTIMIZER EFFICIENCY CURVES

C.1 OPTIMIZERS – S440/S500

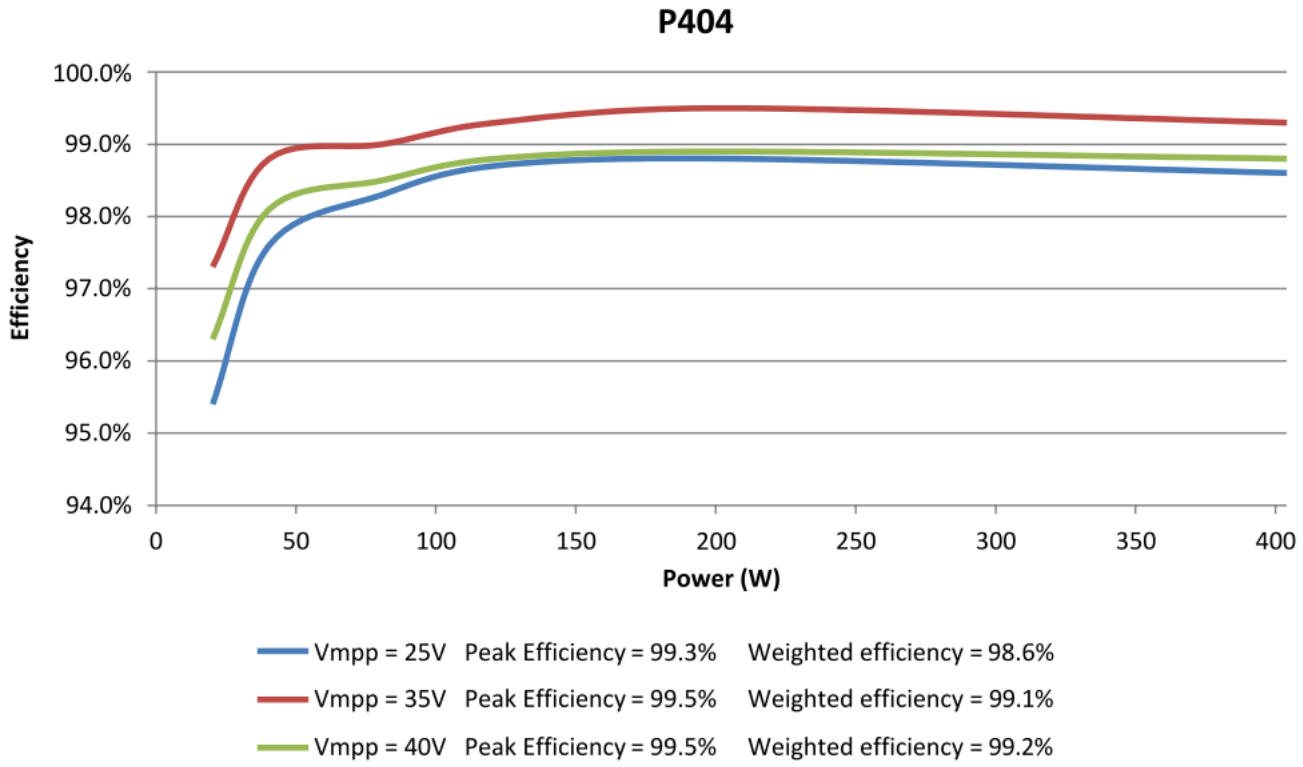
C.2 OPTIMIZERS – P300/P320/P350/P370/P385/P401



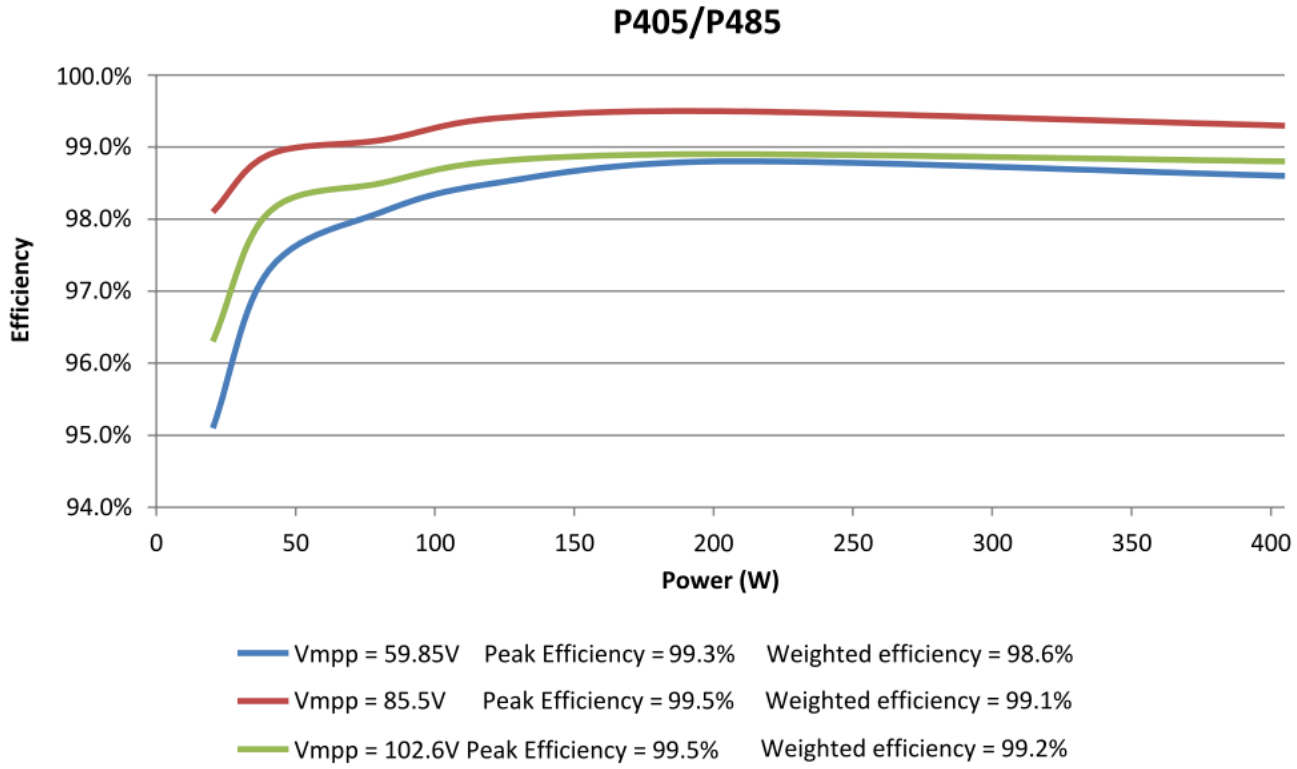
C.3 OPTIMIZERS – P400/P500



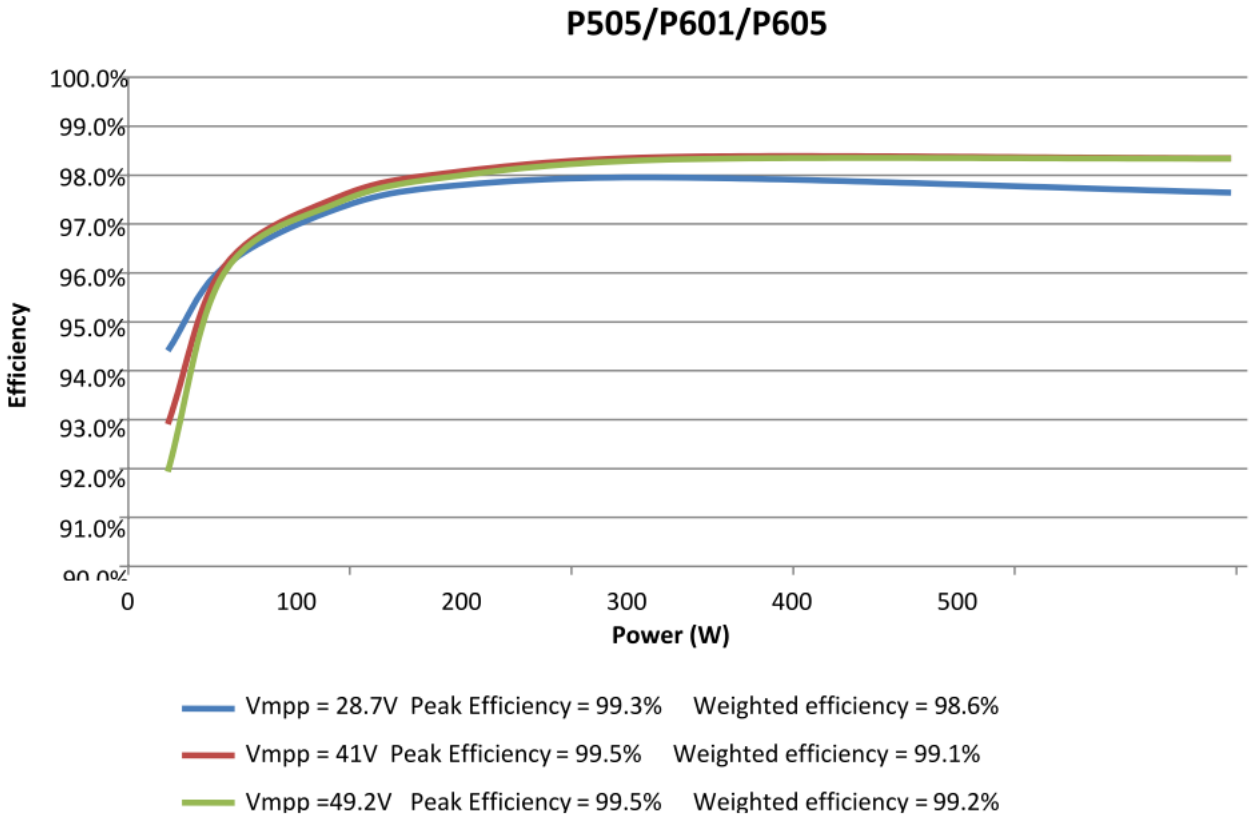
C.4 OPTIMIZERS – P404



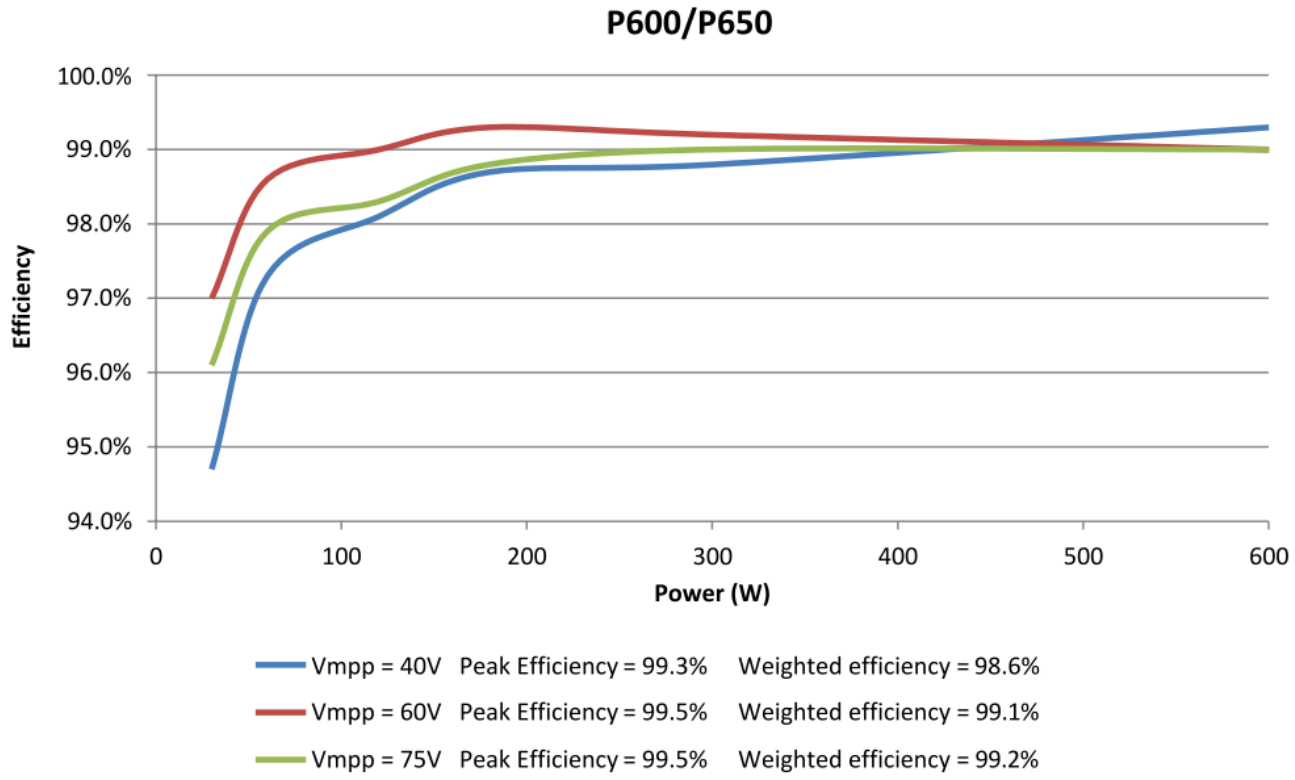
C.5 OPTIMIZERS – P405/P485



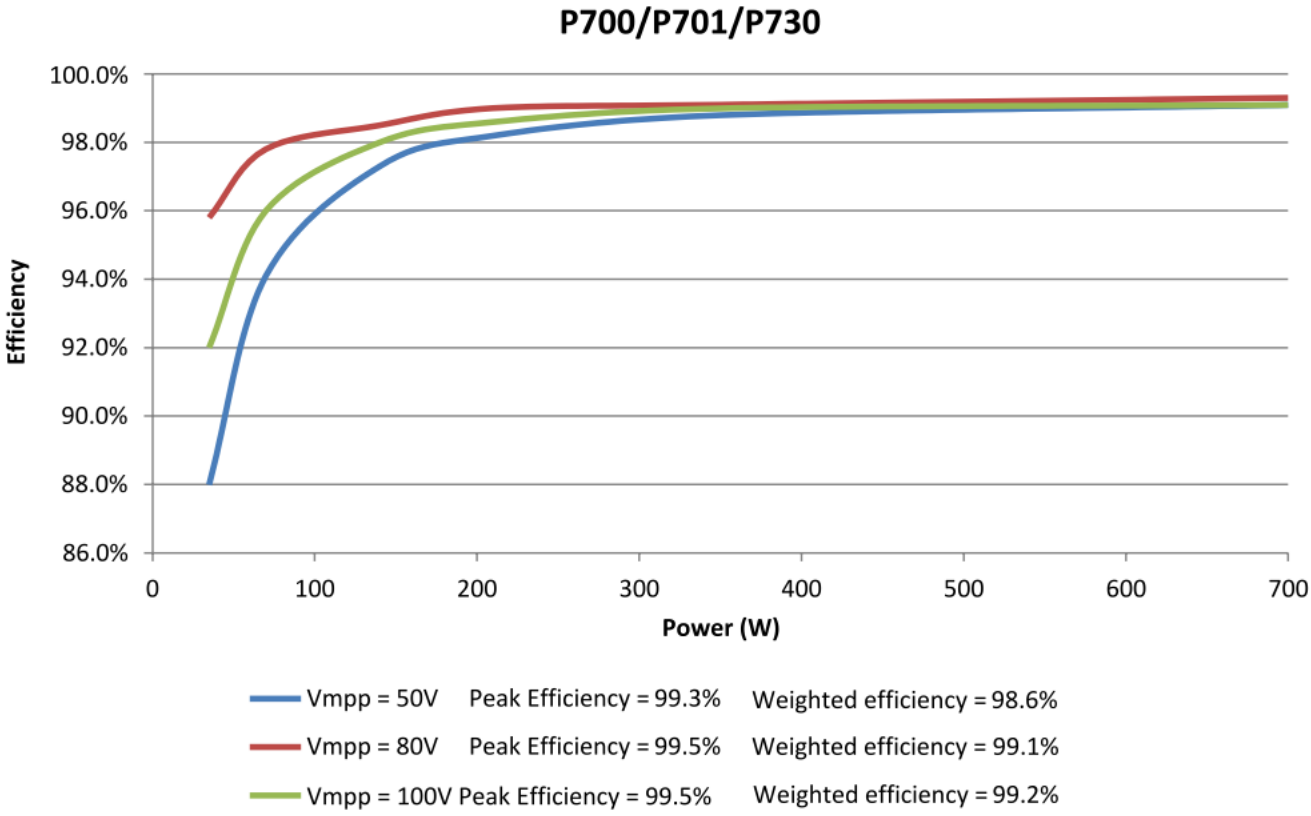
C.6 OPTIMIZERS – P505/P601/P605



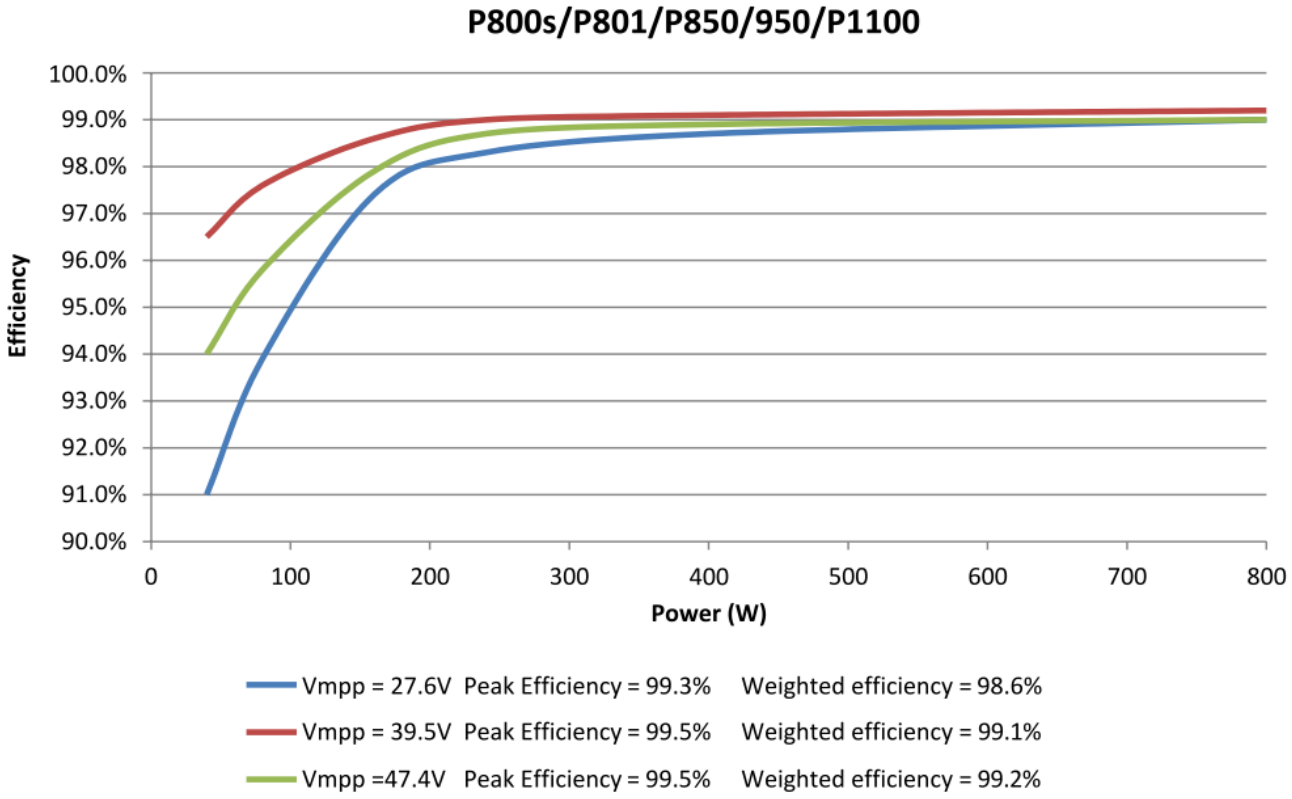
C.7 OPTIMIZERS – P600/P650



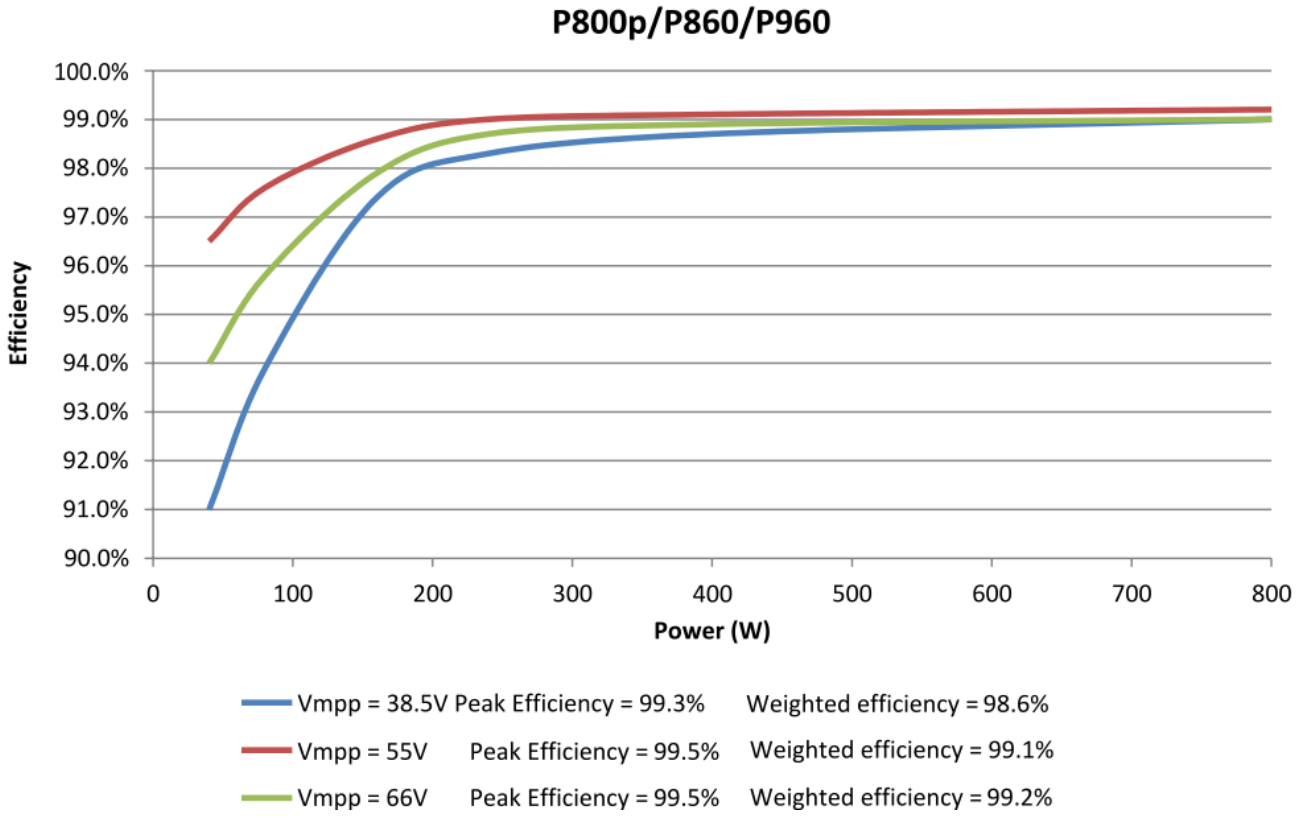
C.8 OPTIMIZERS – P700/P701/P730



C.9 OPTIMIZERS – P800S/P801/P850/950/P1100



C.10 OPTIMIZERS – P800P/P860/P960



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We are the independent expert in assurance and risk management. Driven by our purpose, to safeguard life, property and the environment, we empower our customers and their stakeholders with facts and reliable insights so that critical decisions can be made with confidence. As a trusted voice for many of the world's most successful organizations, we use our knowledge to advance safety and performance, set industry benchmarks, and inspire and invent solutions to tackle global transformations.