

# SolarEdge Commercial Offering

2013



# SolarEdge at a Glance



Established the DC power optimizer segment and leads it with a market share of over 70%

Over 1,800,000 power optimizers shipped to over 40 countries

More than 68,000 inverters shipped

Quarterly run rate above 100MW

Utility, commercial and residential solutions

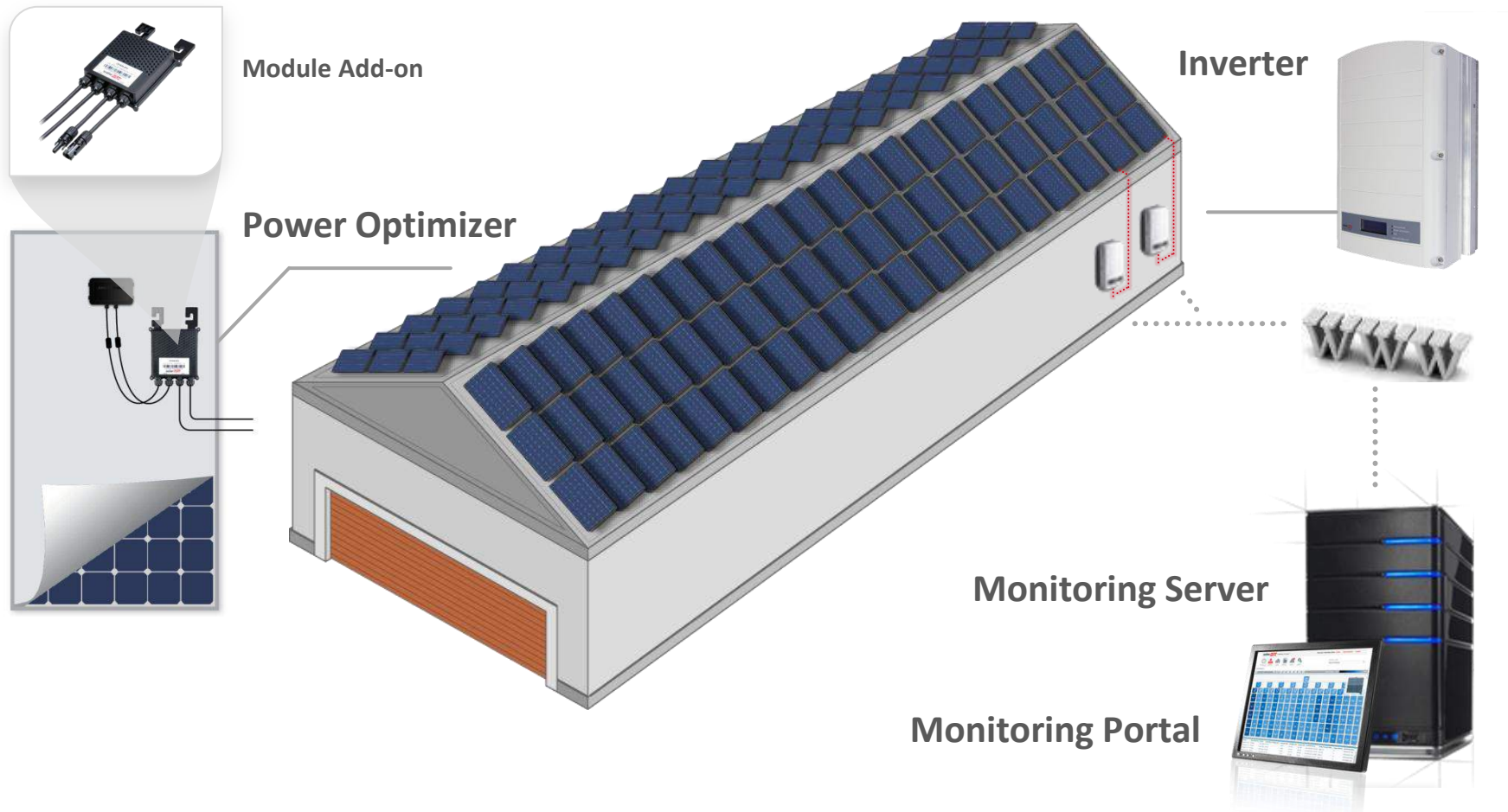
Strategic partnerships across the PV value-chain from module manufacturers to integrators

- SolarEdge Commercial Solution Benefits
- Profit Calculation
  - Lifetime Cost
  - Lifetime Energy Produced
- SolarEdge Commercial Product Offering
- Case studies

# SolarEdge Commercial Solution Benefits

# SolarEdge System Overview

- Module level optimization
- Fixed voltage – flexible design
- Module level monitoring
- Enhanced safety solution



# 2% - 10% More Energy

- More energy due to module-level MPPT
- Mismatch power losses eliminated:
  - No manufacturing or shipment-related mismatch loss
  - No soiling and/or aging mismatch loss
  - No inter-row shading mismatch loss



Traditional    **SolarEdge**

**Best-case system**

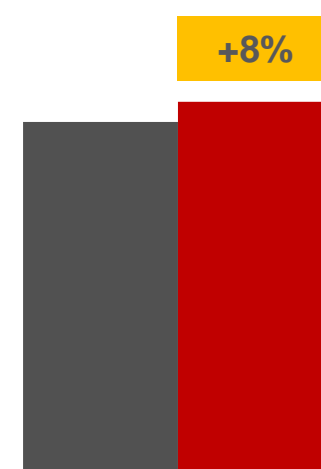
Inherent mismatch only  
(no shading, no soiling)



Traditional    **SolarEdge**

**Good system design**

Inherent mismatch and low  
shading level



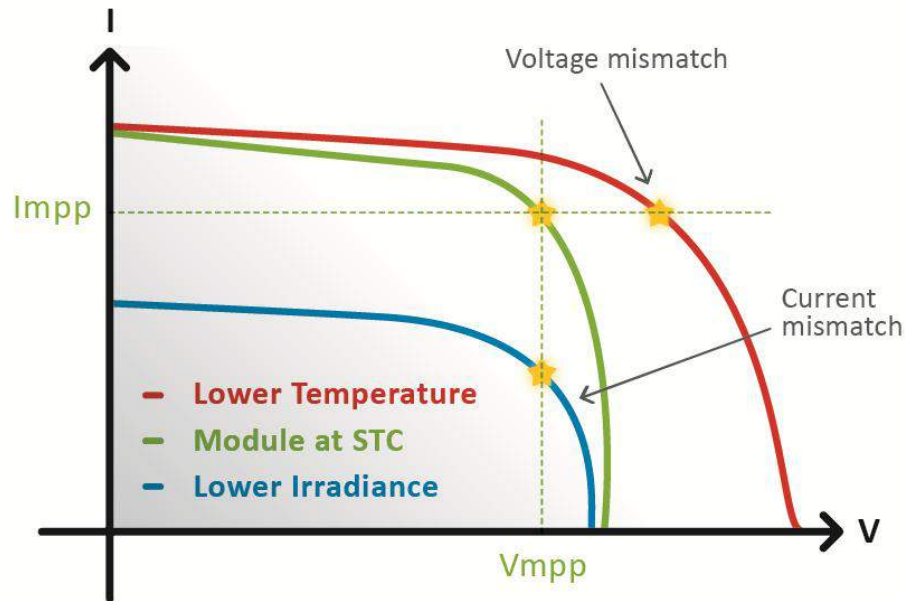
Traditional    **SolarEdge**

**Typical system**

Additional minor  
environmental mismatch

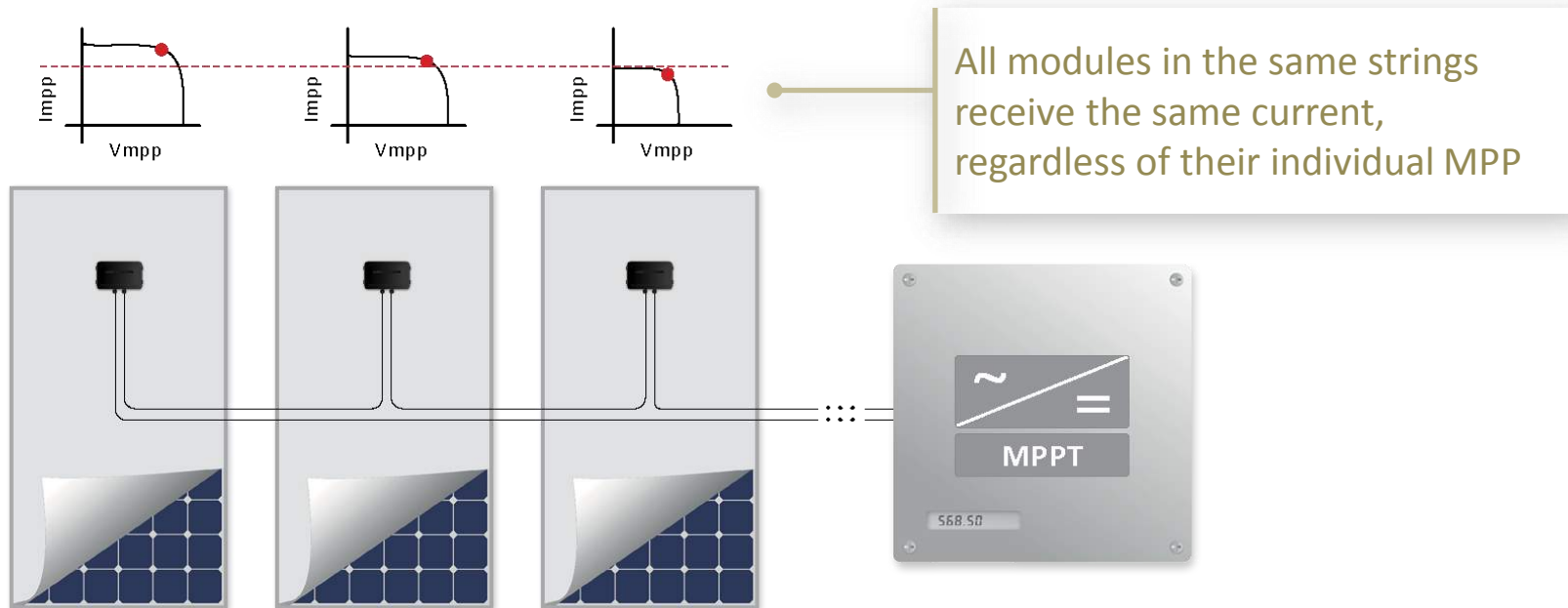
# Module Mismatch Always Exists

- Each module has an individual IV curve and provides maximum power at specific optimal current & voltage ( $P=I*V$ )
  - The maximum power point is abbreviated MPP, ( $P_{mpp}= I_{mpp}*V_{mpp}$ )
  - Module IV curve depends on the individual electrical properties of the module and the ambient conditions (irradiance , temperature)
- Modules with different IV curves = module mismatch



# Module Mismatch -> Power Loss

- Traditional inverters perform MPPT (Maximum Power Point Tracking) for the entire string
  - Due to the module mismatch, weaker modules either impact the output of the entire string or are bypassed





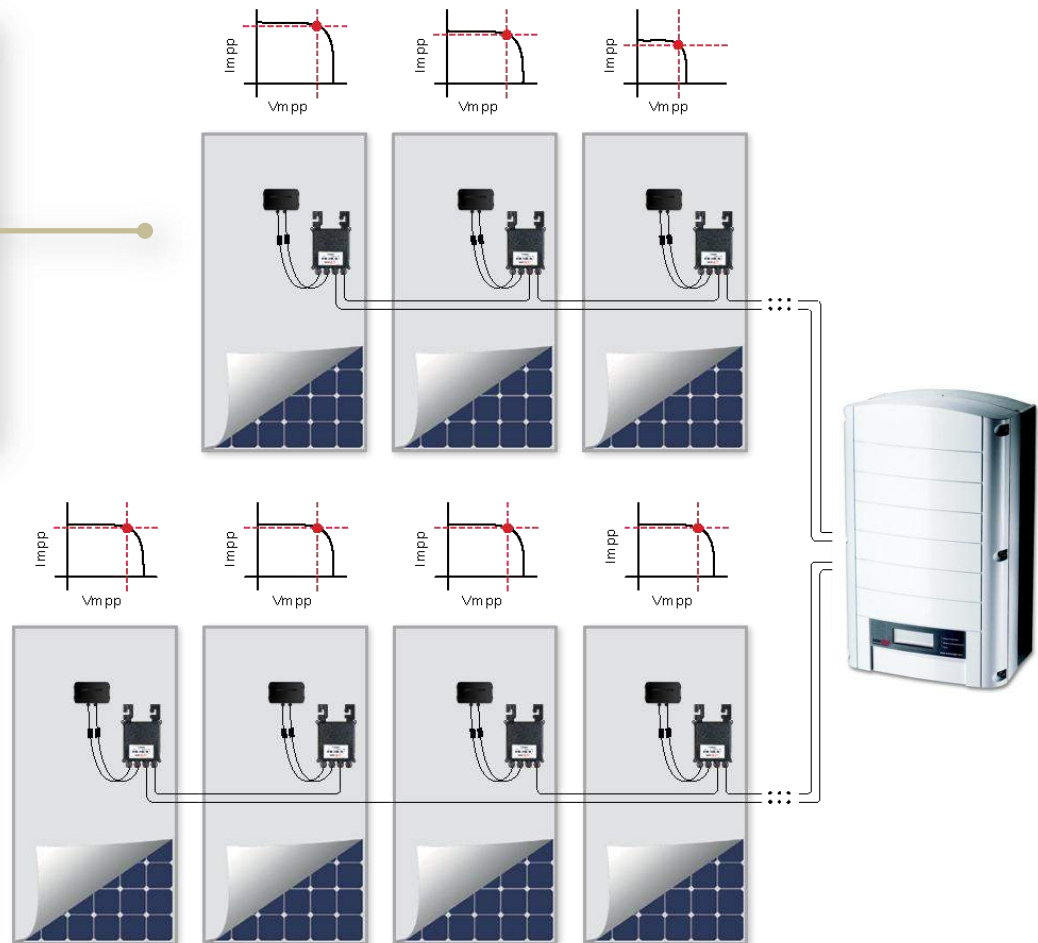
# Module-Level Power Optimizers

## Up to 10% More Energy for commercial systems

### Module-level MPPT

Current & voltage adjusted per module

- eliminating module mismatch
- maximum power from each module individually



# Multiple Mismatch Sources

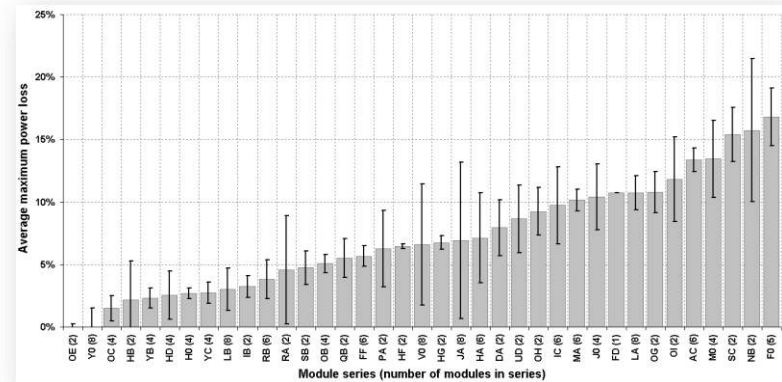
Module mismatch challenges PV plant planners, installers & owners

- Manufacturing tolerance
- Undetected transport damage
- Temperature mismatch
- Soiling mismatch
- Uneven module aging rate
- Partial shading – inter-row, and cloud fronts

**Perfect site design, shading prevention, and even sorting by factory flash test reports cannot resolve mismatch power loss**

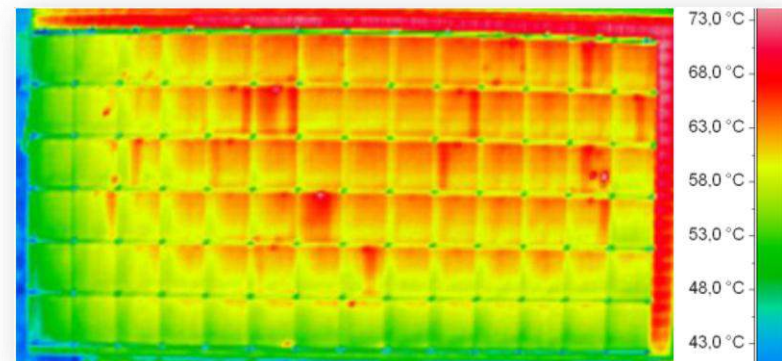
## Uneven module ageing

Black lines: Power variance of identical modules after 20 years



## Temperature mismatch

13°C temperature decrease from the top module row to the bottom row (7.8m distance), due to convective heat transfer

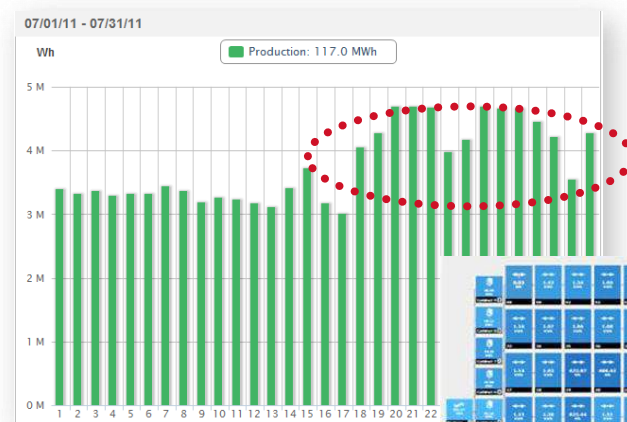


# Mismatch Due to Soiling

- Module soiling by dirt or bird droppings contributes to mismatch between modules and strings (beyond power loss due to sunlight blockage)
- Soiling mismatch exposed by a SolarEdge monitoring system connected to the strings of a 700kW plant, installed flat on a winery roof in California:

**Before:** String mismatch due to uninterrupted soiling (shade of blue = daily string energy)

**After:** cleaning the modules increased power output by over 30% (1MWh per day)

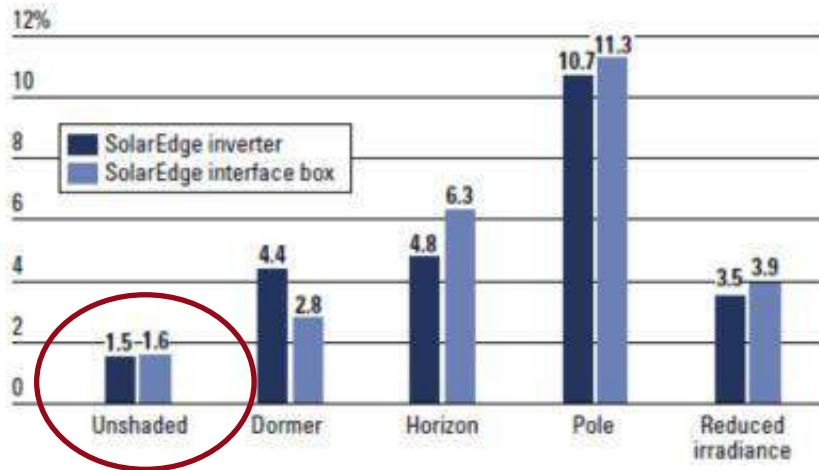


Source: SolarEdge Monitoring Portal. 700kW site monitored by SolarEdge String Monitoring Combiner Box (MCB), 7/2011

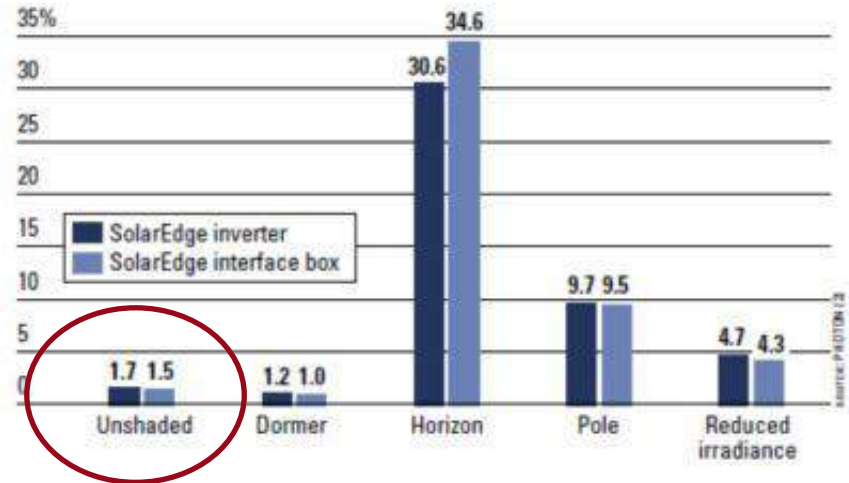
# Added Energy – In All Scenarios

- **PHOTON Magazine** proves: added yield ranges between 2% - 25%
  - PHOTON Labs tested and compared the added energy output of SolarEdge power optimizers to a traditional inverter in the October 2011 issue

**Additional yield produced by SolarEdge power optimizers - two parallel strings of seven modules each**



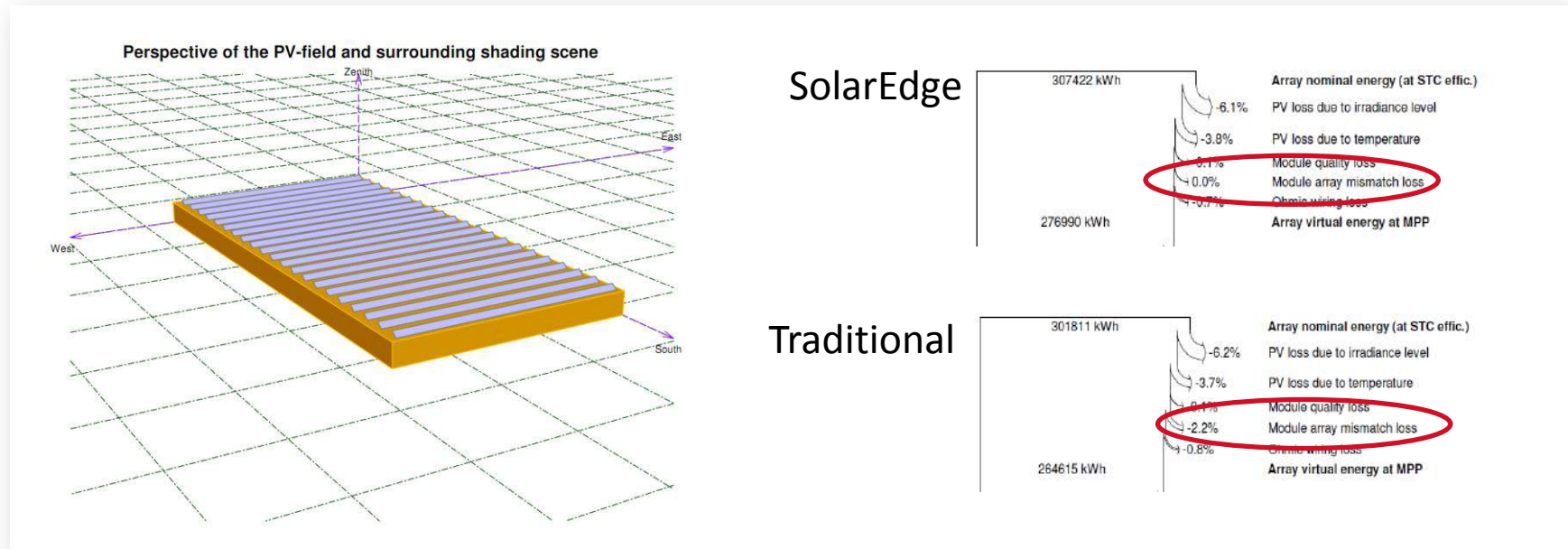
**Additional yield produced by SolarEdge power optimizers - one string of 14 modules**



# Added Energy – No Shade

## Module manufacturing mismatch

- Even if shading is avoided completely, module manufacturing mismatch still gives SolarEdge an advantage
  - **2%** standard energy gain for SolarEdge on module manufacturing tolerance according to leading simulation software (PVsyst, PVSol):





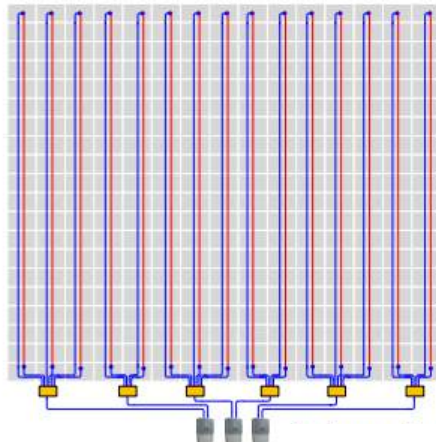
# BoS Saving by Longer Strings

- Up to 50 modules (power optimizers) per string

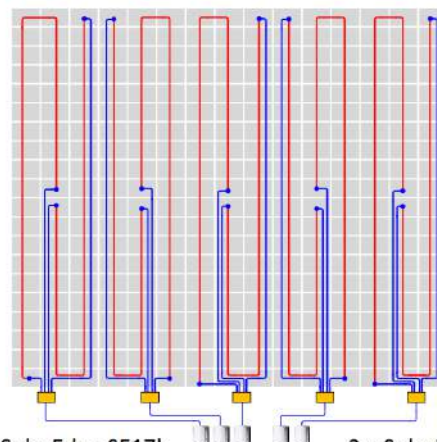
Fewer strings

Less wiring, combiner boxes, fuses, etc.

- Up to 50% reduction in BoS cost



Traditional inverter



3 x SolarEdge SE17k

2 x SolarEdge SE16k

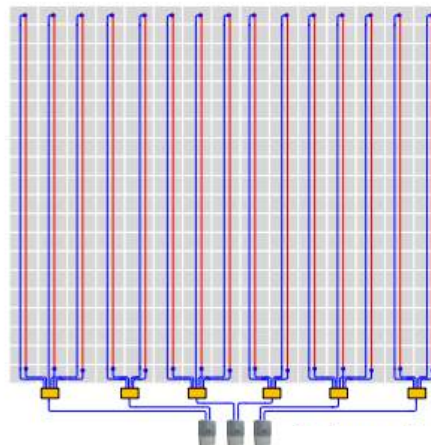
Unique SolarEdge feature - Fixed String Voltage enables:

- Simple system design:
  - No need to calculate string length based on Voc/Vmpp
  - Strings of different lengths
  - Partial/ inter-row shading allowed
- Longer strings:
  - Up to 50 power optimizers per string
  - Fewer combiner boxes and fuses
- Maximum roof utilization:
  - Parallel strings of unequal lengths
  - Modules on multiple roof facets
  - Modules with different power ratings
- Future replacement of modules with any type/model/capacity

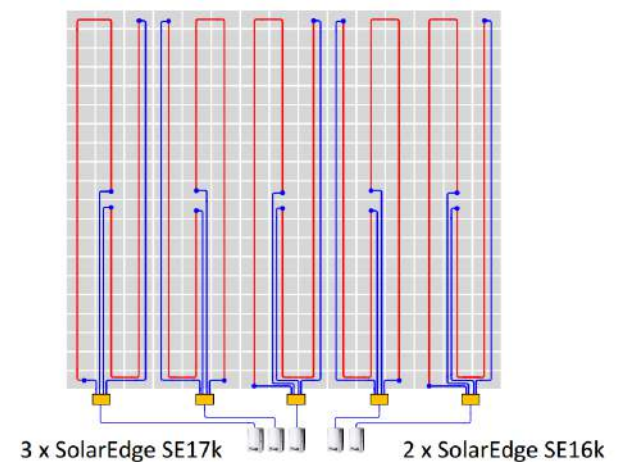
# BoS Saving – 84kW System

## ■ 50% BoS saving

	Leading Traditional Inverter	SolarEdge
Modules	300 x 280W	300 x 280W
Inverters	3 x 27.6kW	3 x SE17k and 2 x SE16k
Strings	15 strings, 20 modules each	10 strings, 30 modules each
6mm <sup>2</sup> PV wire	336 m	225 m
10mm <sup>2</sup> PV wire	120 m	92 m
String boxes	6	5
Inverter DC breakers	3	5
Cost	100%	50%

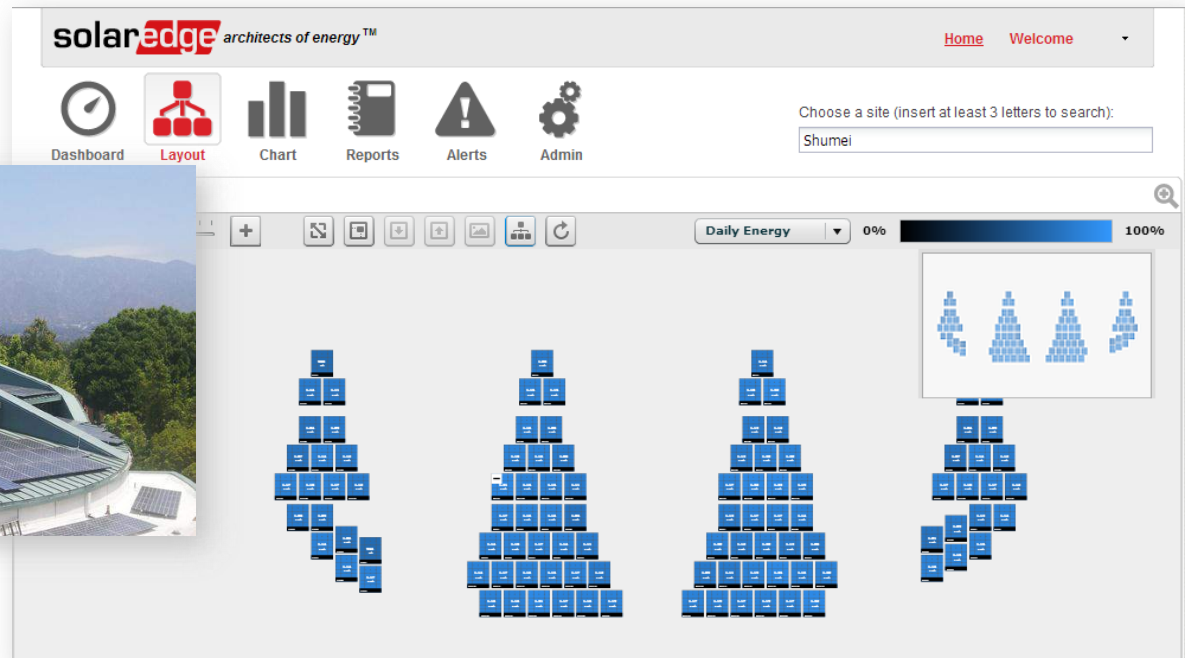


Traditional inverter



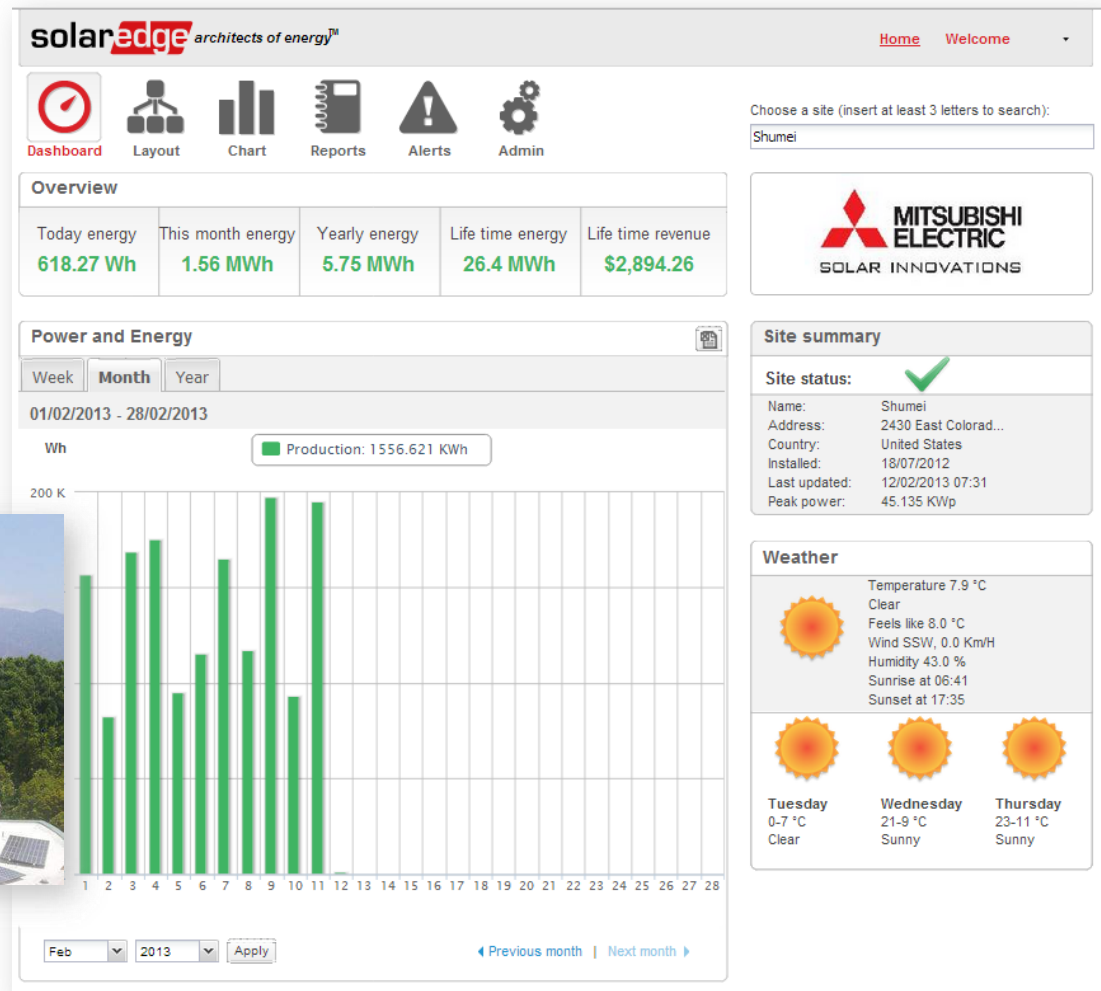


- Module-level performance monitoring & remote troubleshooting
  - Module-level performance data available in real-time
  - Module-level data is presented on a virtual site map
  - Automatic and immediate alerts on system issues pinpointed to module location
  - Easy access via web browser from any device



# Enhanced System Performance

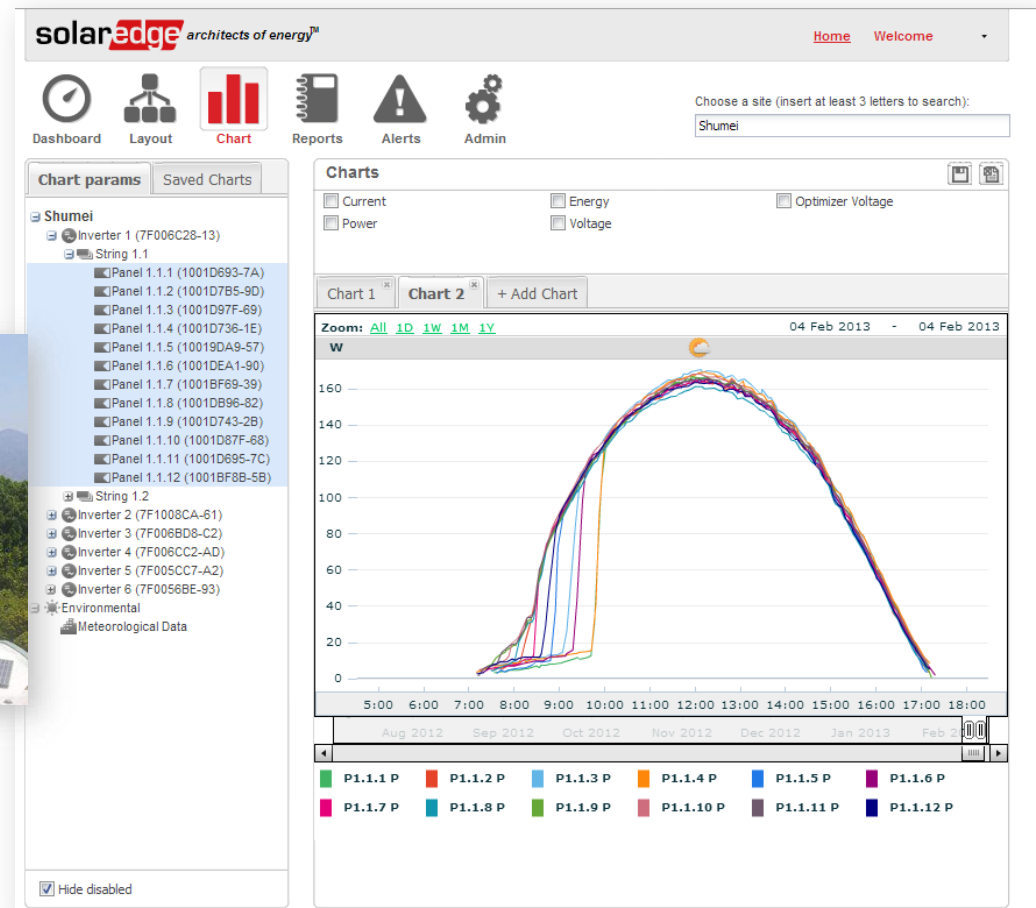
- Increased system availability and yield



# Enhanced System Performance



- Remote diagnostics
- Resolution of issues undetected by string inverters
- Easy location of faults in field based on virtual map



- Safety during installation, maintenance, firefighting & other emergencies
- Automatic module-level shutdown of DC current & voltage
  - Fire prevention: automatic prevention of electric arcs



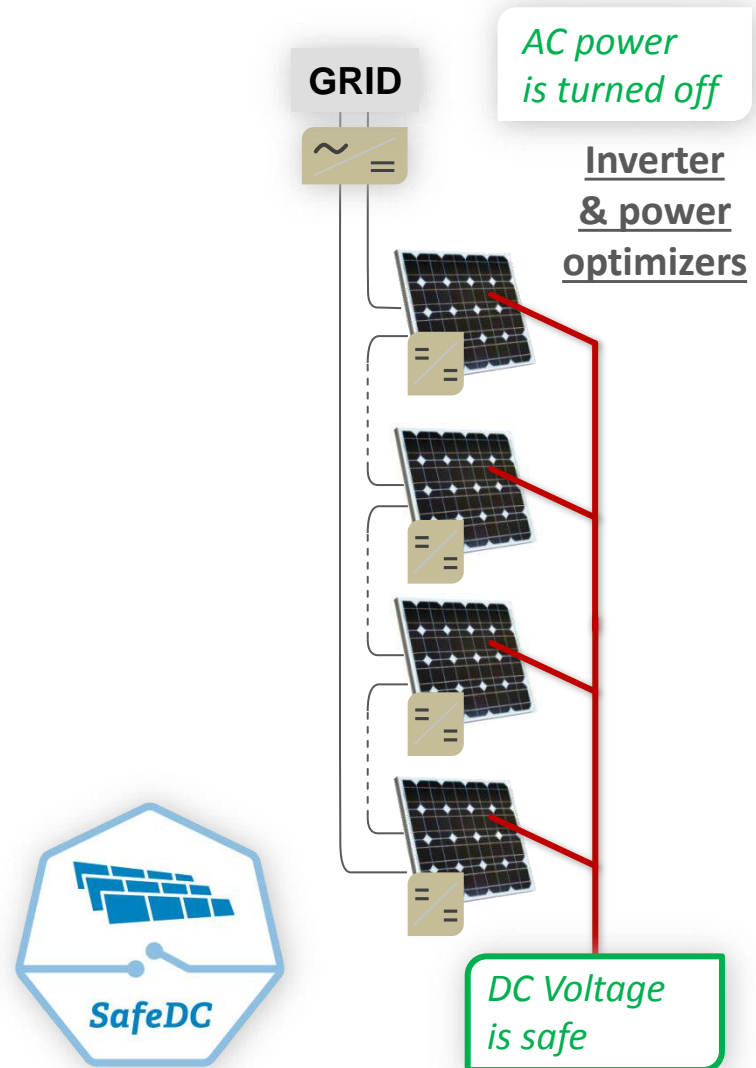
450kW installation on the rooftops of a sustainable neighborhood, New Orleans, Louisiana, USA.  
Installed by Pontchartrain Mechanical Co.



# SolarEdge SafeDC™ Solution



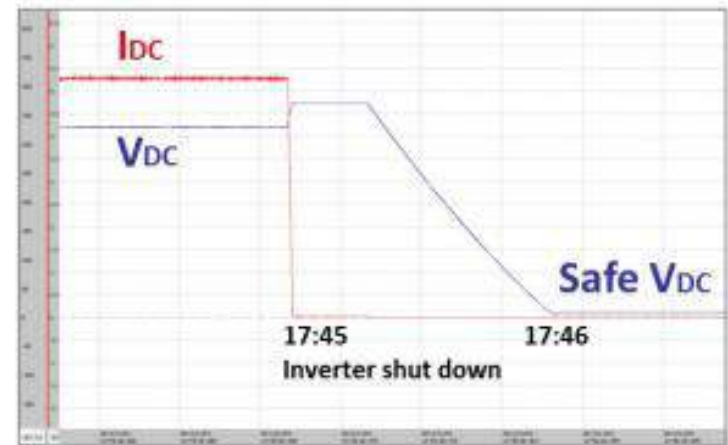
- Each module is equipped with a power optimizer
- When AC power is shut off the inverter stops sending a signal and all power optimizers shut off
- Each module produces 1V safety voltage (string <50v)



- Higher security for installers, maintenance teams & firefighters
  - Installation: safe string voltage - until inverter & AC supply are turned on
  - Maintenance: safe string voltage – automatic once inverter is turned off
  - Emergency: safe string voltage - automatic after grid disconnection
- Improved asset protection

## Automatic DC shutdown

Safe DC voltage within 180 sec.

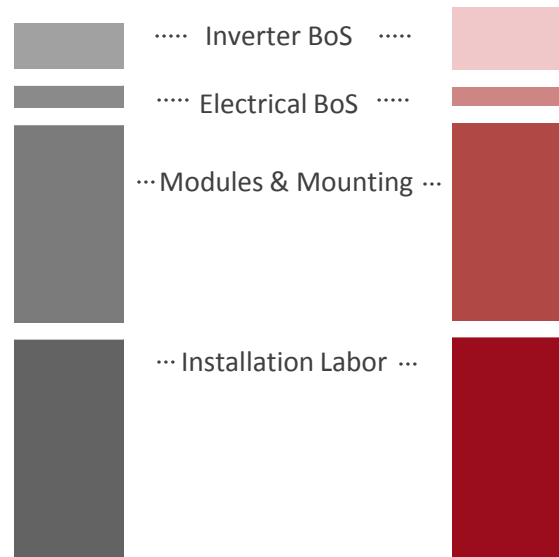


# ROI Calculation

# Lifetime Cost 50kW - System



# Initial System Investment



Traditional

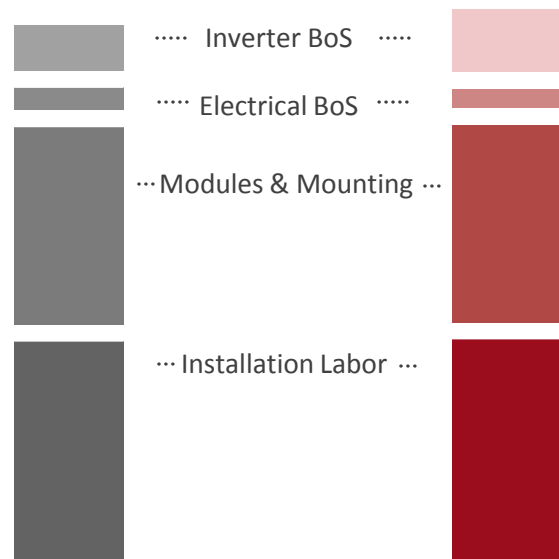
SolarEdge  
OP600

## Labor

Installation labor for all components.

SolarEdge: includes added labor for power optimizers

# Initial System Investment

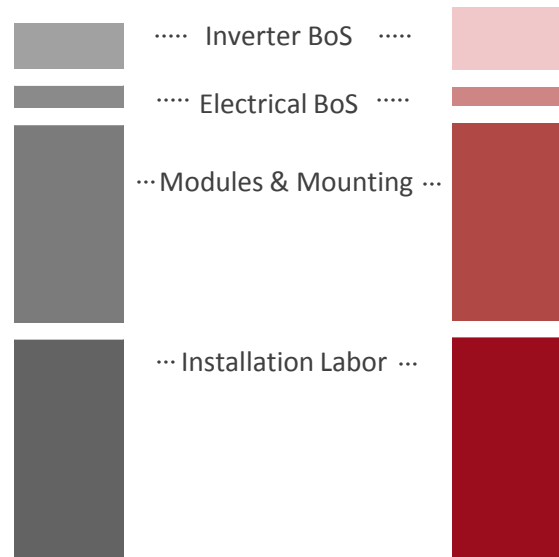


**Modules & Racking**  
Same cost for both systems

Traditional

SolarEdge  
OP600

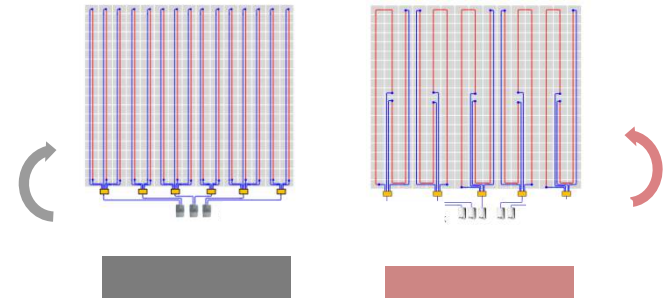
# Initial System Investment



Traditional

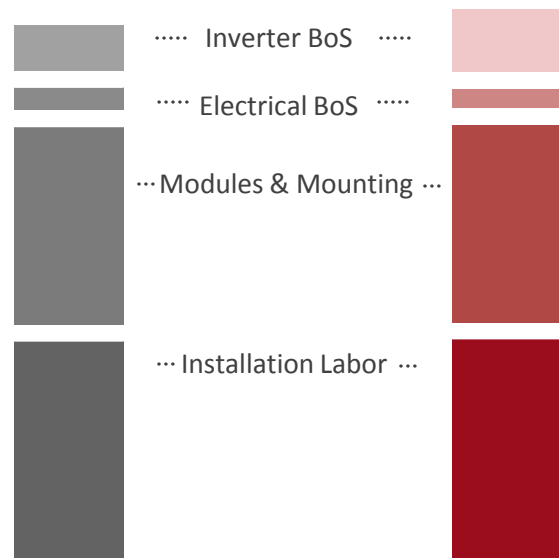
**SolarEdge  
OP600**

## Electrical BoS



SolarEdge: longer strings save **>50%**  
on DC cables, combiner boxes, etc.

# Initial System Investment



Traditional

SolarEdge  
OP600

## Inverter BoS

- Traditional inverter
- Power optimizers
- SolarEdge inverter



Includes:

- Monitoring HW
- 10 year warranty

Includes:

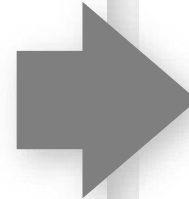
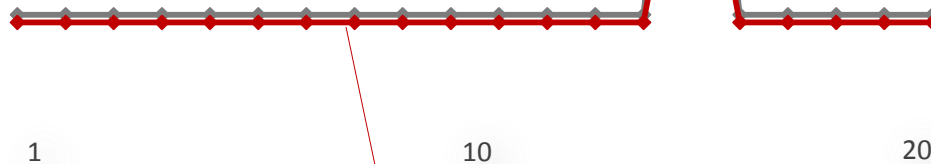
- Monitoring HW
- Inverter warranty: 12 years
- Optimizer warranty: 25 years

# Maintenance and Replacements

## Lifetime O&M Timeline, 25 years

- Power optimizers warranted for 25 years
- Replacement cost only for inverter (SolarEdge inverter cost < traditional inverter cost)

Traditional inverter replacement cost post warranty



## Total O&M (NPV), 25 years

20% O&M cost saving with SolarEdge



Traditional

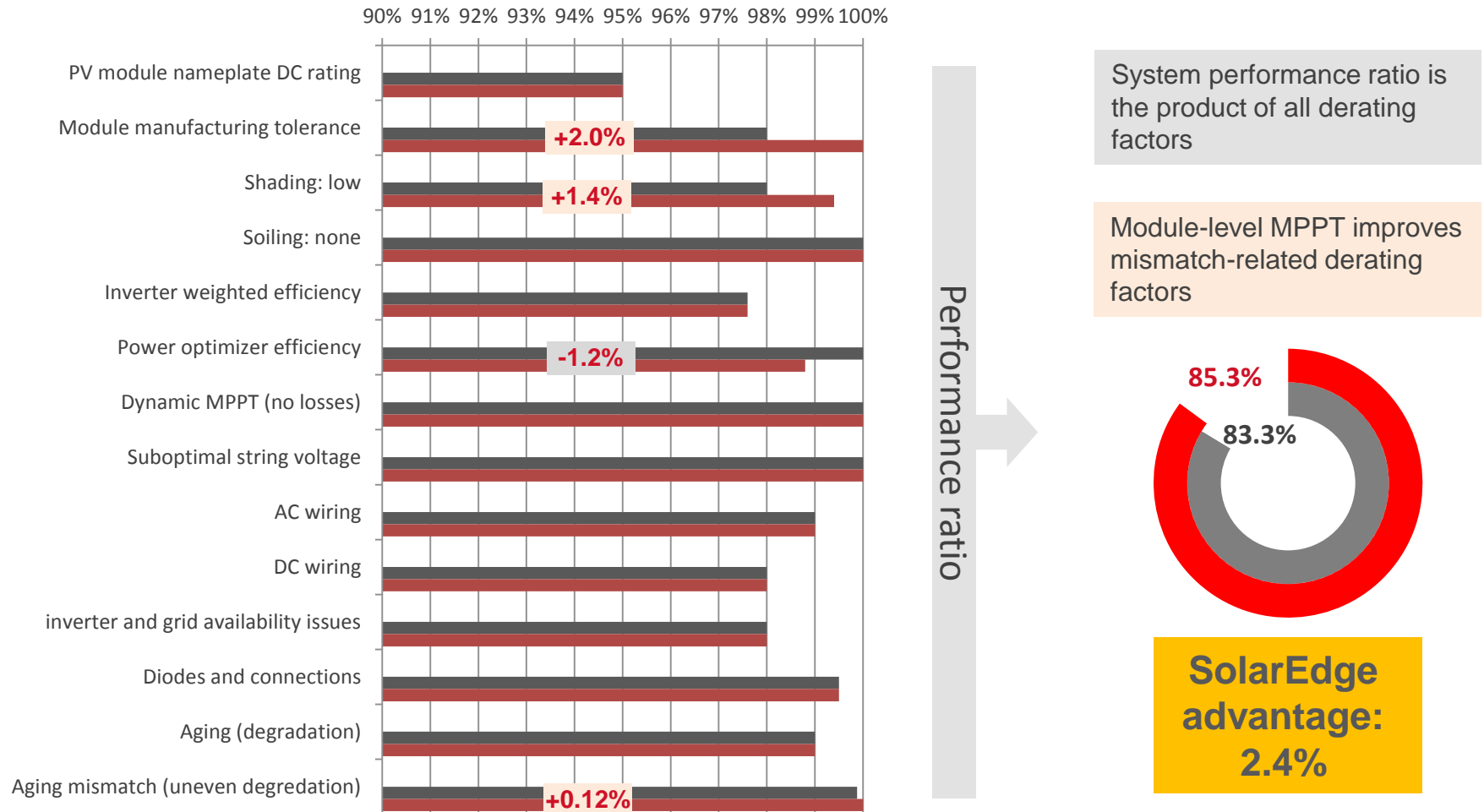
SolarEdge

~10% less O&M annually with SolarEdge due to Module-level monitoring

# Lifetime Energy Produced 50kW System

# System Performance Ratio

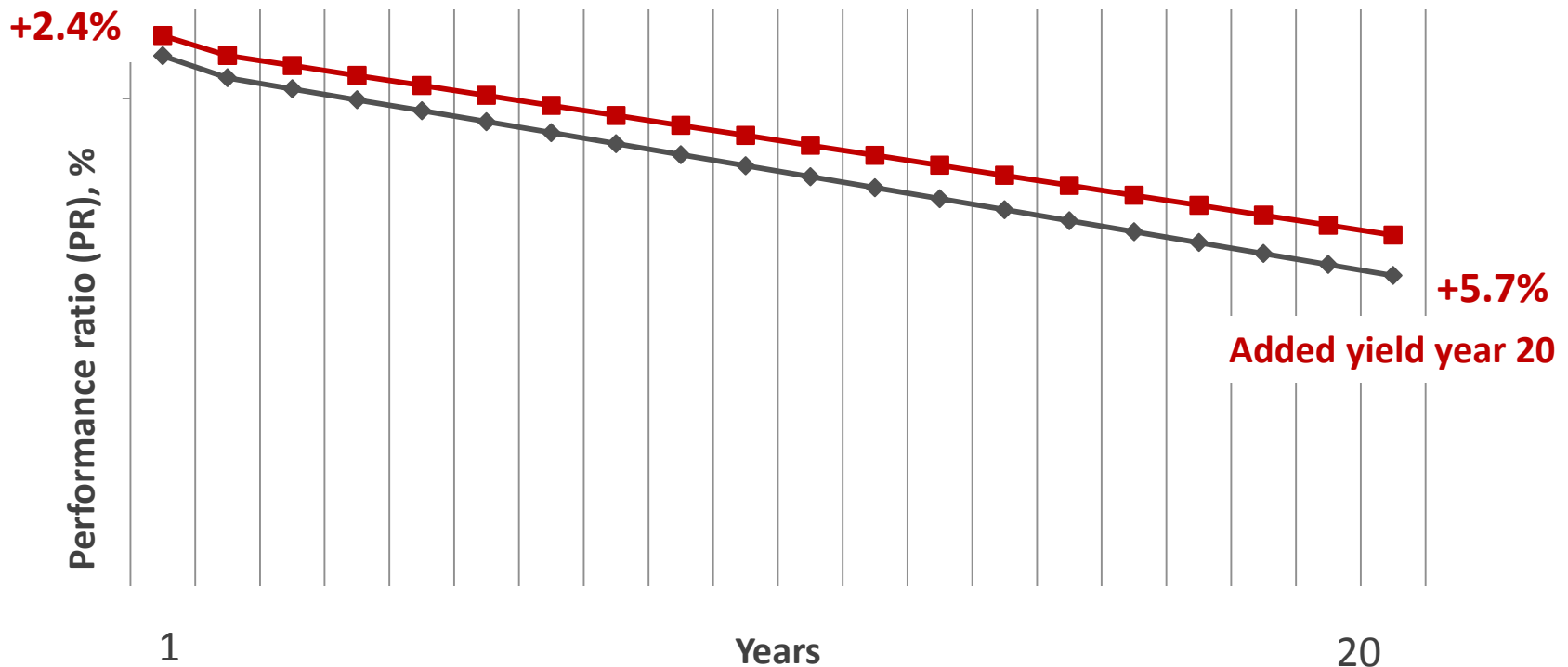
## Comparison of SolarEdge and Traditional inverter performance ratio: Derating Factors (EOY 1)



# System Performance Over Time

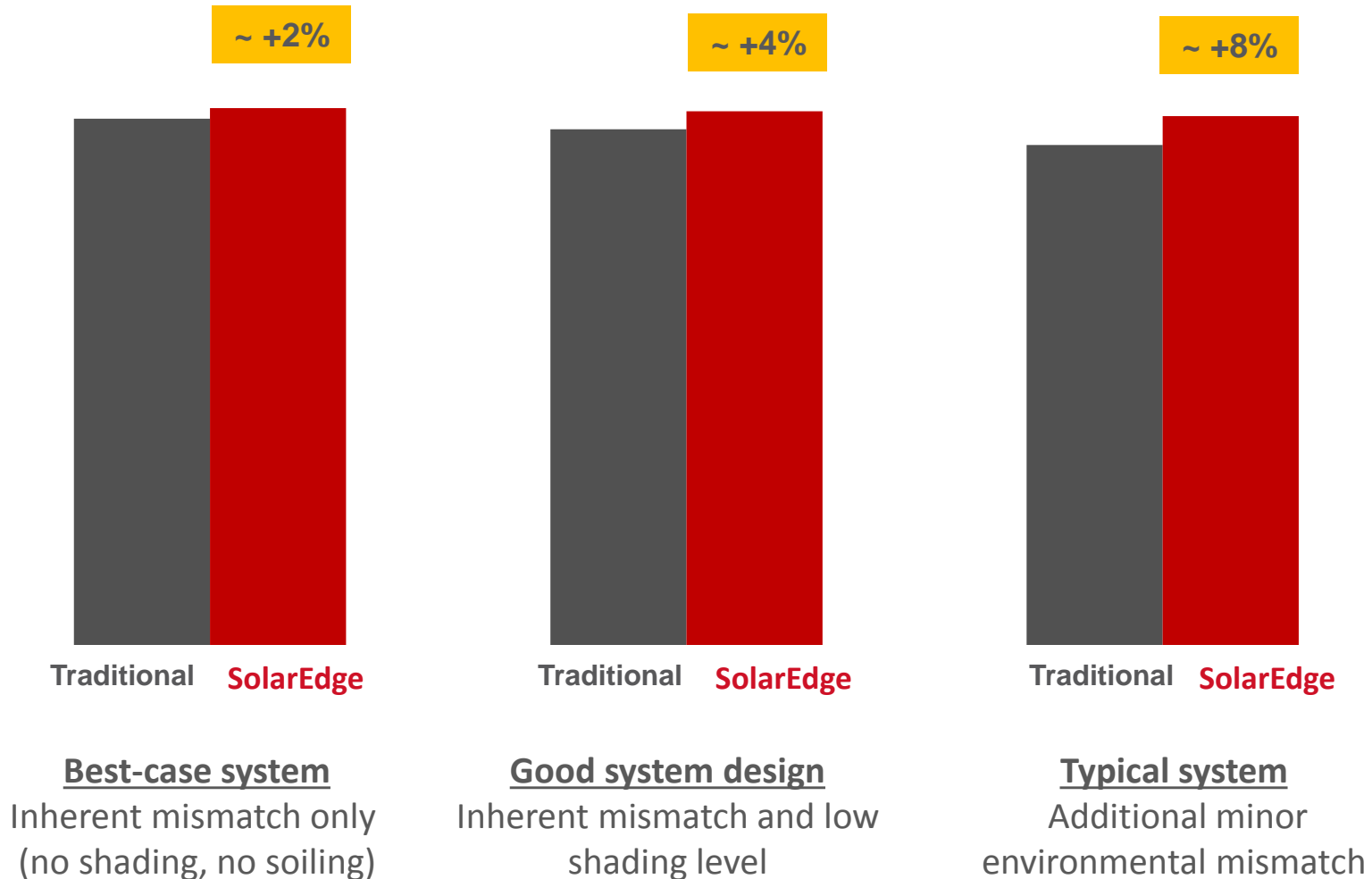
- Annual aging degradation of system: 1%
- Growing degradation mismatch: 0.12% per year for traditional system
- SolarEdge total added energy over lifetime: +4%

## Added yield year 1

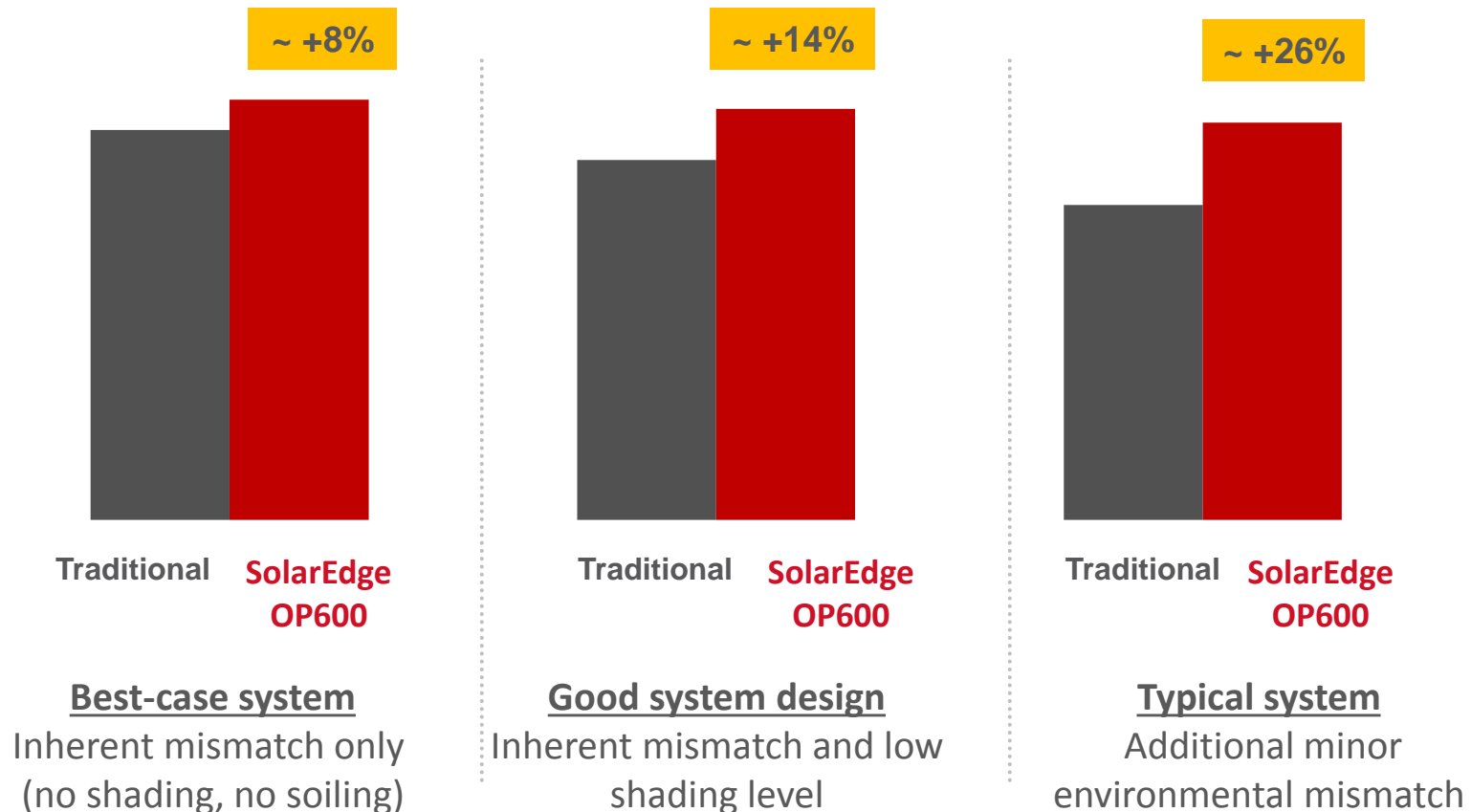




# Lifetime Energy Yield



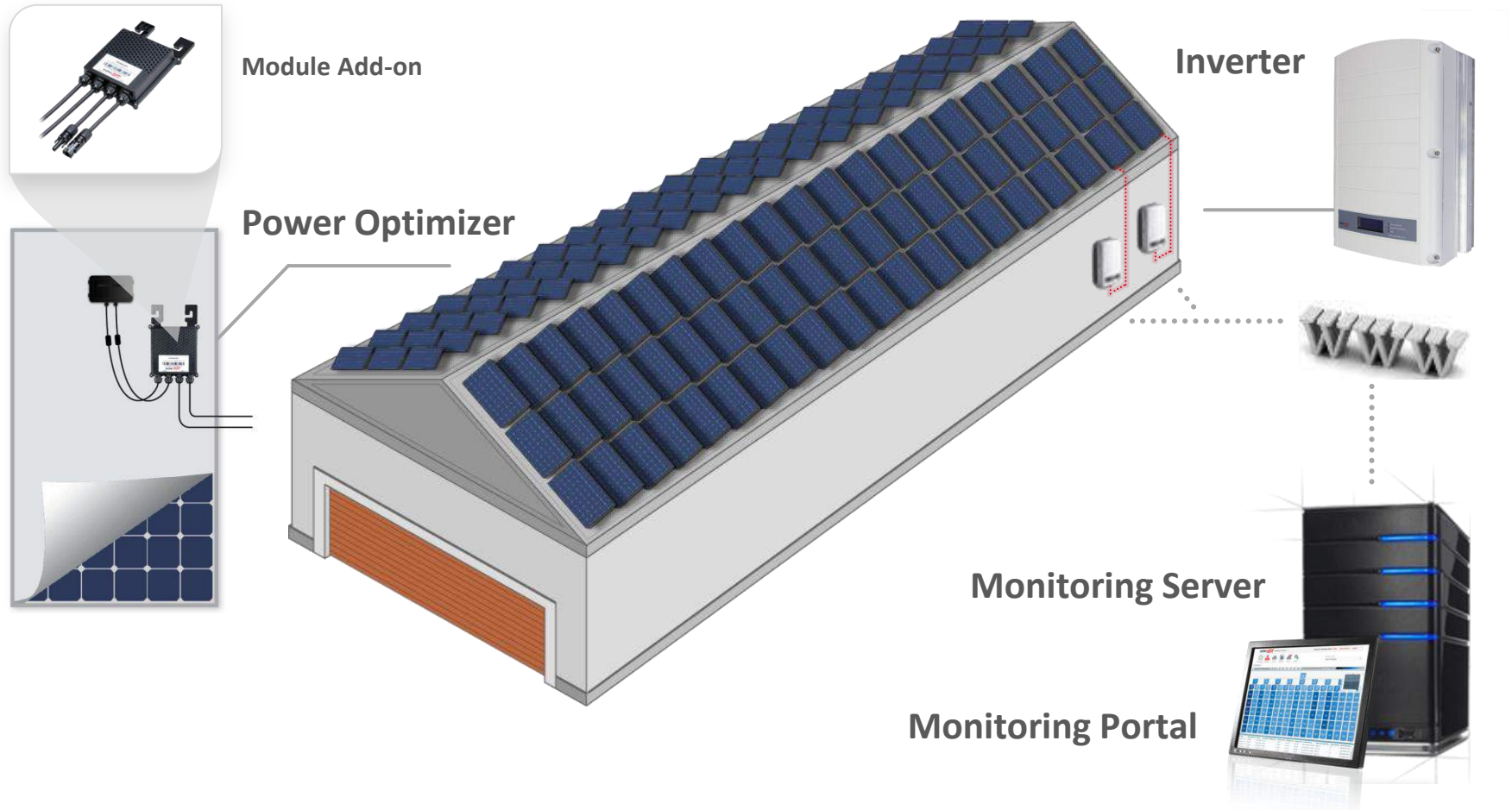
- **Profit = Total lifetime revenue - Total lifetime expenses**
  - Profits are provided in their net present value (discount rate: 2%)



# SolarEdge Commercial Product Offering

# SolarEdge System Overview

- Module level optimization
- Fixed voltage – flexible design
- Module level monitoring
- Enhanced safety solution



- Per-module Maximum Power Point Tracking (MPPT)
- 99.5% maximum efficiency, 98.8% weighted efficiency
- Advanced, real-time performance measurement
- Automatic module shut-down for installer and firefighter safety
- Embedded by module manufacturers, or connected by installers to c-Si and thin-film modules



\* Available H2 2013

250W-400W  
Module add-on



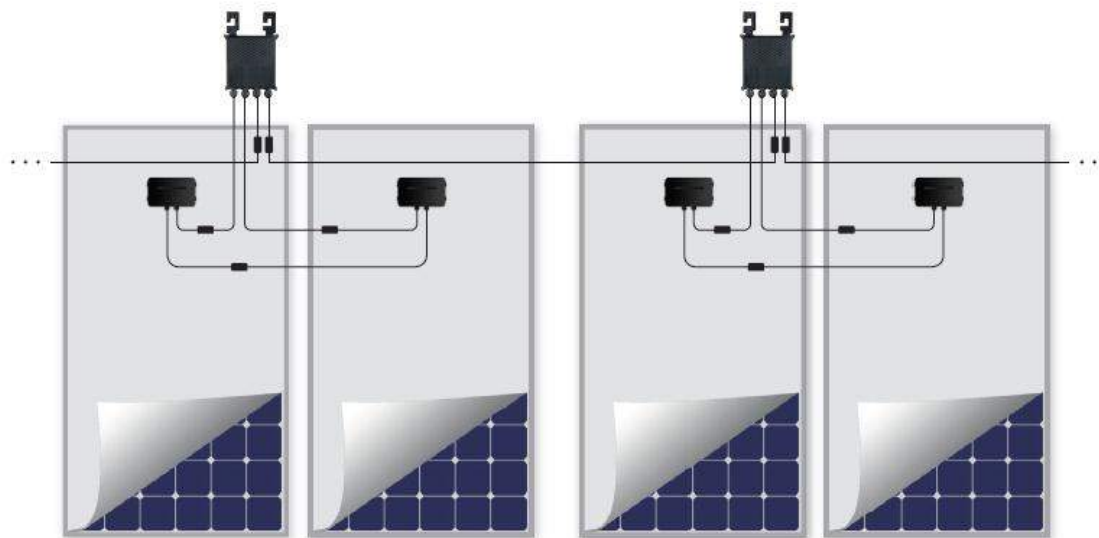
600W Module Add-On  
for Commercial Installations



300W  
Module embedded

# New OP600

- 2 modules per power optimizer connected in series
- Up to 44 modules per string
- Compatible with inverters SE16k and up
- Max DC input power 600W
- Maximum input voltage/current 96V/10A



60 cell modules



- Inverters specifically designed for power optimizers fixed string voltage
- 98% maximum efficiency
- Simpler design → Highest reliability at minimal cost
- Built-in communication hardware



Three phase inverters  
5kW – 17kW

- Inverters specifically designed for commercial installations with power optimizers
- Small, lightest in its class, and easy to install
- No electrolytic bulk capacitor for highest reliability
- Superior efficiency (>98%)
- Separate connection compartment for simple access
- Field-replaceable boards for easy maintenance
- IP65 – outdoor and indoor installation
- Available H2 2013



Commercial inverters 35kW – 50kW



- **Cost effective maintenance and increased system uptime**
  - Module-level and system-wide performance data available in real-time on a web portal
  - Data presented on a virtual site map
  - Automatic, accurate fault detection pinpointed to module location
  - Power-line communication. No added wiring



## Pre Sale



### Valuation

- LCOE calculation



### Design

- System design consulting



### Training

- Technical installation & maintenance training



## On-going Service



### Monitoring

- Module level performance data
- Remote troubleshooting



### Support

- Local expert teams
- Online Service Portal
- Call centers



### Maintenance

- On-site repair
- Preventive remote monitoring



# Case Studies

# 50kWp – Maximum Roof Utilization

- **Location:**  
Exeter, UK
- **Installation date:**  
Sep. 2011
- **Inverters:**  
5 x SolarEdge SE10k
- **Power optimizers:**  
OP250-AOB
- **Installed by:**  
SunGift Solar



*“The SolarEdge system gives us the peace of mind we need in order to ensure that our customer is reaping all the benefits of their PV installation”*

*Scott Oldfield, Trade and Sales Manager of SunGift Solar*

# 250kWp – Rooftop Installation

- **Location:**  
Colmar, France
- **Installation date:**  
Nov. 2010
- **Inverters:**  
42 x SE6000
- **Power optimizers:**  
1,063 x PB250-AOB
- **Installed by:**  
Blue Ice



*“I use SolarEdge for all of my installations because it ensures maximum energy output, reduced O&M cost and superior safety”*

*Eric Gatterer, CEO, Blue Ice*

# 30kWp System – DC safety

- **Location:**  
Paris ,France
- **Installation Date:**  
Jul. 2011
- **Inverters:**  
3 x SE10k
- **Power Optimizers:**  
126 x AOB250
- **Installer:**  
Yomatec



*“When we spoke to the management of Hopital Privé Nord Parisien we realized how concerned they were about safety and related regulations. We were happy to provide a solution that ensures comprehensive safety for the hospital and its patients.”*

*Michel Ayache, Director of Marketing, Yomatec*



# 55 kWp, Israel

- **Location:**  
Carmiel, Israel
- **Installation date:**  
Sep. 2011
- **Inverters**  
4 x SE12.5k
- **Power optimizers:**  
110 x OP500  
(2 in 1)
- **Installed by:**  
Yarok Natural  
Energy



*„ The SolarEdge system is constantly producing more energy compared to a similar 50kW traditional system installed next to it and **will accelerate the return on investment**“*

*Ran Mizrachi, Joint CEO, Yarok Natural Energy*

# 1.63MWp – Largest System in NL

- **Location:**  
The Netherlands
- **Installation date:**  
July 2012
- **Inverters:**  
119 x SE12.5K
- **Power Optimizers:**  
5,712 x OP300-MV
- **Installed by:**
  - AliusEnergy



*“By using the SolarEdge system, The VencoGroup achieved their goal for an innovative solution that minimizes the environmental impact of the VencoCampus and provides safe and sustainable energy.”*

*Ton van de Ven, AliusEnergy*



# 1 MWp, Germany

- **Location:**  
Bavaria, Germany
- **Installation date:**  
Sep. 2012
- **Inverters:**  
6 x SE15k; 19 x SE16k;  
32 x SE17k
- **Power Optimizers:**  
4092 x OP250-LV
- **Installed by:**  
Renew



*„To fulfill its future responsibility, it needs to rely on the most **advanced technology available** today. And that is **module-level power optimization**.“*

*Thomas Rink, Managing Director, Renew  
Handelsgesellschaft mbH*

# Thank you

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