Illuminating a more effective way to optimize PV systems

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Disclaimer

SMA

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Agenda

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1   Understanding optimization factors

2   ShadeFix optimization and its role in a PV system

3   How service impacts lifetime system optimization

4   The role of SunSpec rapid shutdown standardization

5   Conclusions

6   Q&A session

Understanding optimization factors

Brad Dore

A spectrum of variables affect system optimization

Quality → Reliability → Safety → Service → Standardization → Quality

=

Energy Production!
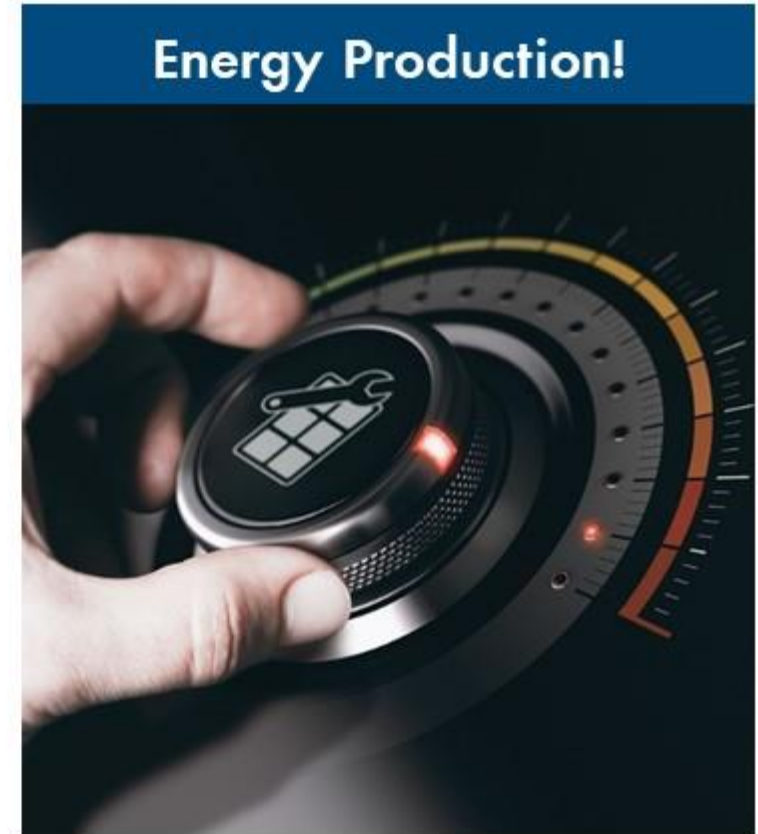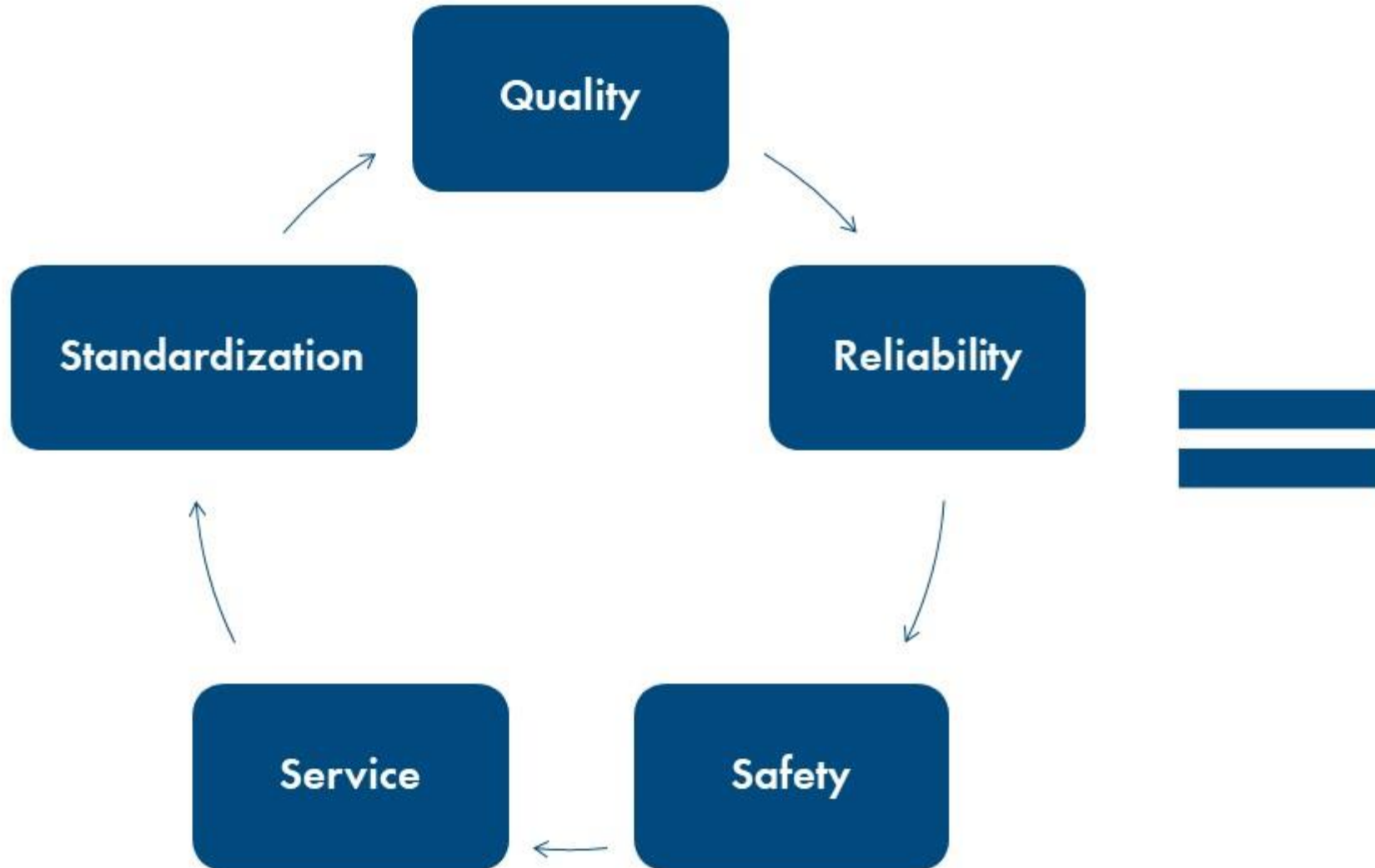
SMA ShadeFix
STRING LEVEL OPTIMIZATION

Poll question #1

Which of these variables is the most important to your business operations?

1 Quality

2 Reliability

3 Safety

4 Service

5 Standardization

Traditional methods of optimization don't minimize business risk

- Traditional optimization methods focus on module-level technology

- Gained traction as a means of code compliance, without consideration of the affect on overall system optimization

- Drawbacks of this approach include:

  - High component count

  - Constantly working – boosting and bucking voltage and current

  - Greater heat production and thermal cycling – applying wear and tear on electronic components

  - All resulting in increased energy loss and greater service risk

Does this look like a welcoming service environment?

How can these variables be optimized?

Energy Production

- Maximize a PV system's production in the most efficient, reliable method even in shaded conditions

- Recognize the importance of annual energy production

Quality & Lifetime Reliability

- Reduce the number of components

- Optimize where sensitive electronics are exposed to the least amount of heat and thermal cycling

Compliance, Safety & Service

- Achieve speed through simplification and standardization

- Reduce costly truck rolls and minimize risk of roof visits

- Speed diagnosis and resolution

ShadeFix optimization and its role in a PV system

Blair Reynolds

What is SMA ShadeFix optimization?

Conventional module optimizers
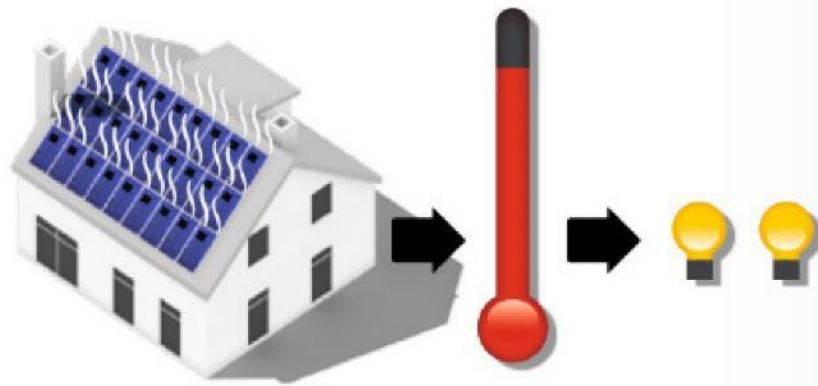
SMA ShadeFix

- Have more components and produce more heat due to constant operation
- This means more points to service in the harsh rooftop environment and higher likelihood of failure
- Excessive power consumption reduces energy production
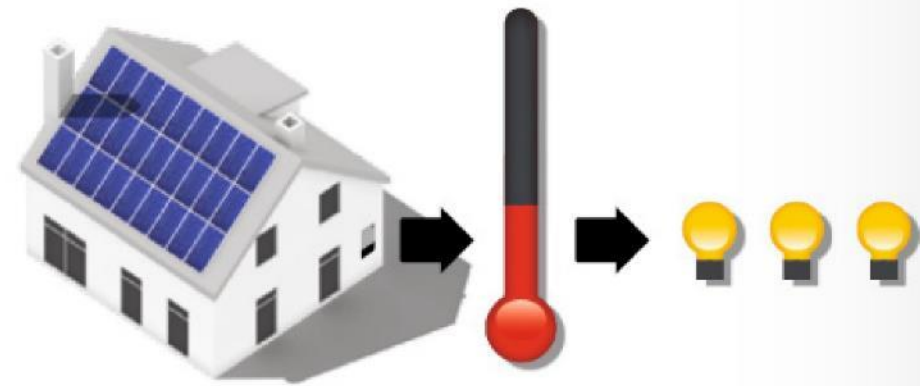
- ShadeFix optimization operates more efficiently and creates greater energy production
- Very few components are needed on the roof to achieve greater system reliability and NEC 2017 compliance

ShadeFix Produces **More Energy Annually** than Traditional Optimizers

TRADITIONAL OPTIMIZATION

FULL-TIME 4WD
MPG
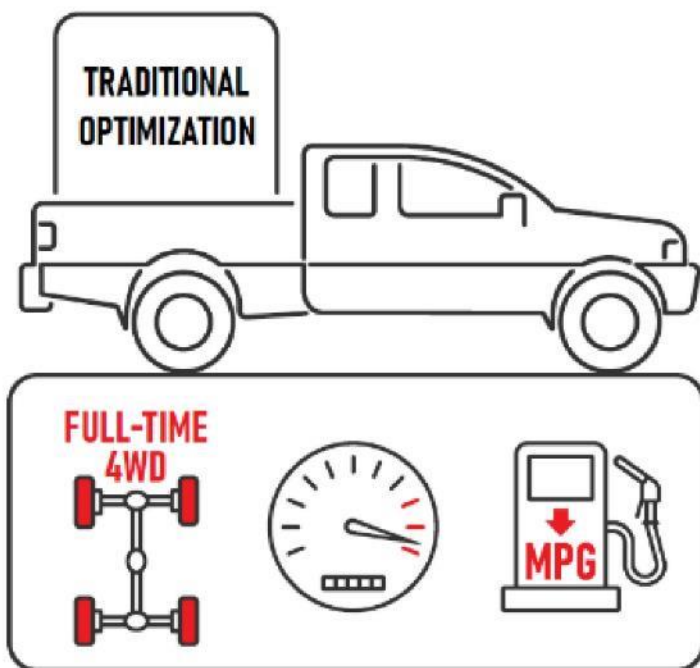
- Working constantly when it's not needed
- Consumes power unnecessarily
- Places additional stress on components
- Increases likelihood of component failure
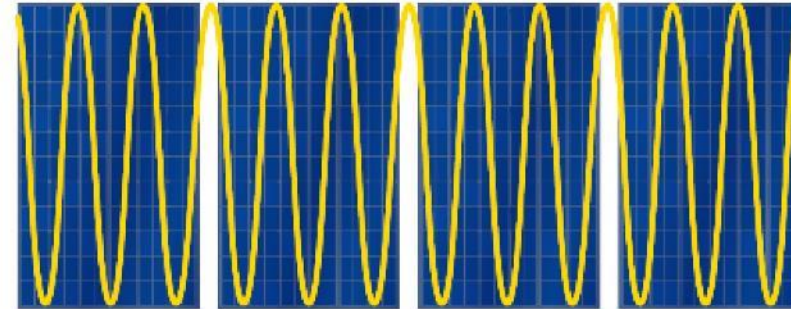- Greater service risk and production loss

ON-DEMAND 4WD
MPG
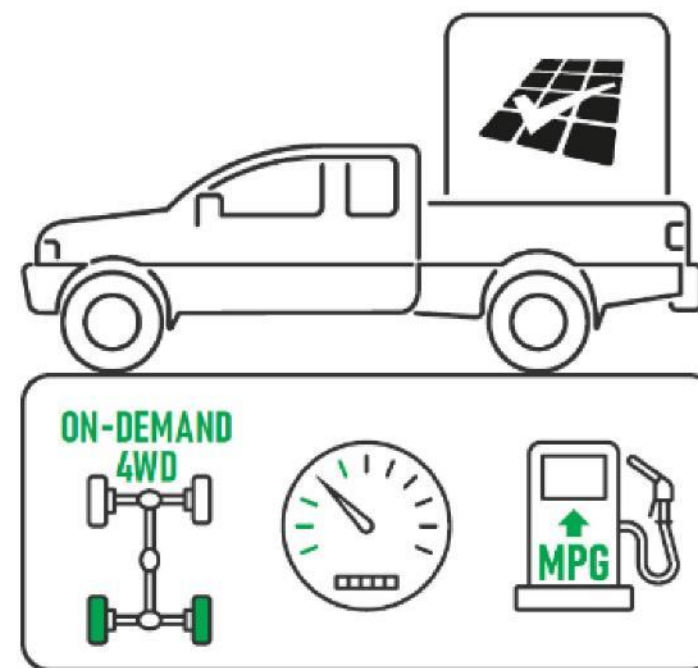
- Working smarter, not harder
- Doesn't consume unnecessary power
- Less stress on components
- Decreases likelihood of component failure
- Reduced service risk with secure energy production

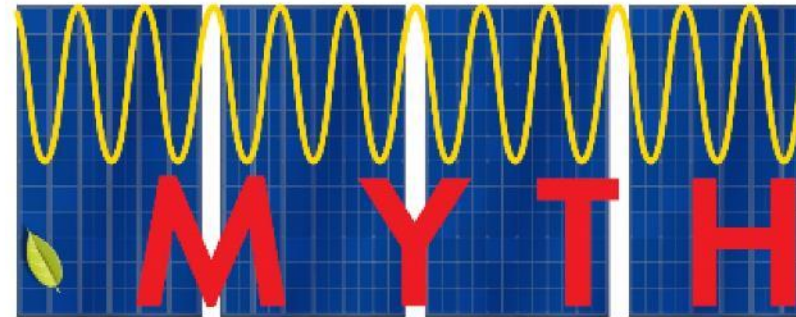# SMA ShadeFix – How does it work?

Normal weather shading
- Electrons pass freely through the array
- Modules at full power

**Partially shaded array**
(The string inverter myth)
- All modules are limited to the current of the shaded module

Partially shaded array
(The facts about SMA ShadeFix optimization)
- ShadeFix acts as a traffic cop, optimizing the flow of electrons around the shaded portions of the module
- More energy is generated from the unshaded modules thanks to SMA ShadeFix optimization

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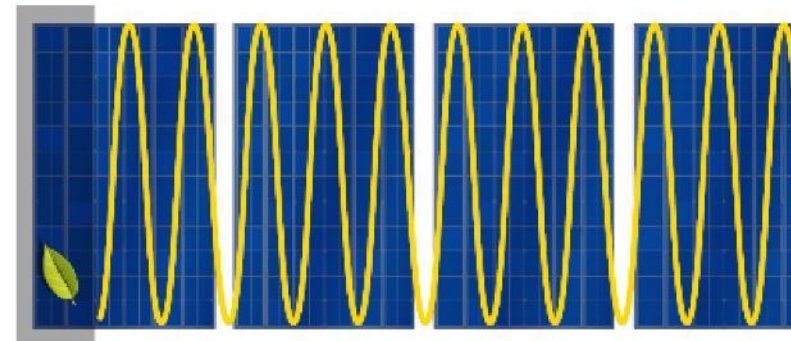
University of Southern Denmark research findings

- Some previous studies inaccurately modeled shading scenarios, resulting in overstated performance gains for traditional optimizers

- The purpose of this university study was to examine the role of shading in a PV system using multiple optimization technologies where equal, real-world shading conditions were measured across each system

- The duration of the test was a full calendar year in order to account for seasonal variability

- The study used commonly accepted methodology, testing methods and sample size – in-line with other PV industry standards

- Comparisons between three systems were made with congruent, continuous periods of time in order to make valid conclusions regarding energy production

**Assoc. Prof. Dr. W.-Toke Franke:**
The Impact of Optimizers for PV Modules, a comparative study

UNIVERSITY OF SOUTHERN DENMARK

https://portal.findresearcher.sdu.dk/da/publications/the-impact-of-optimizers-for-pv-modules

SMA ShadeFix optimization **outperforms traditional optimizers** in approximately 95% of PV systems[1]

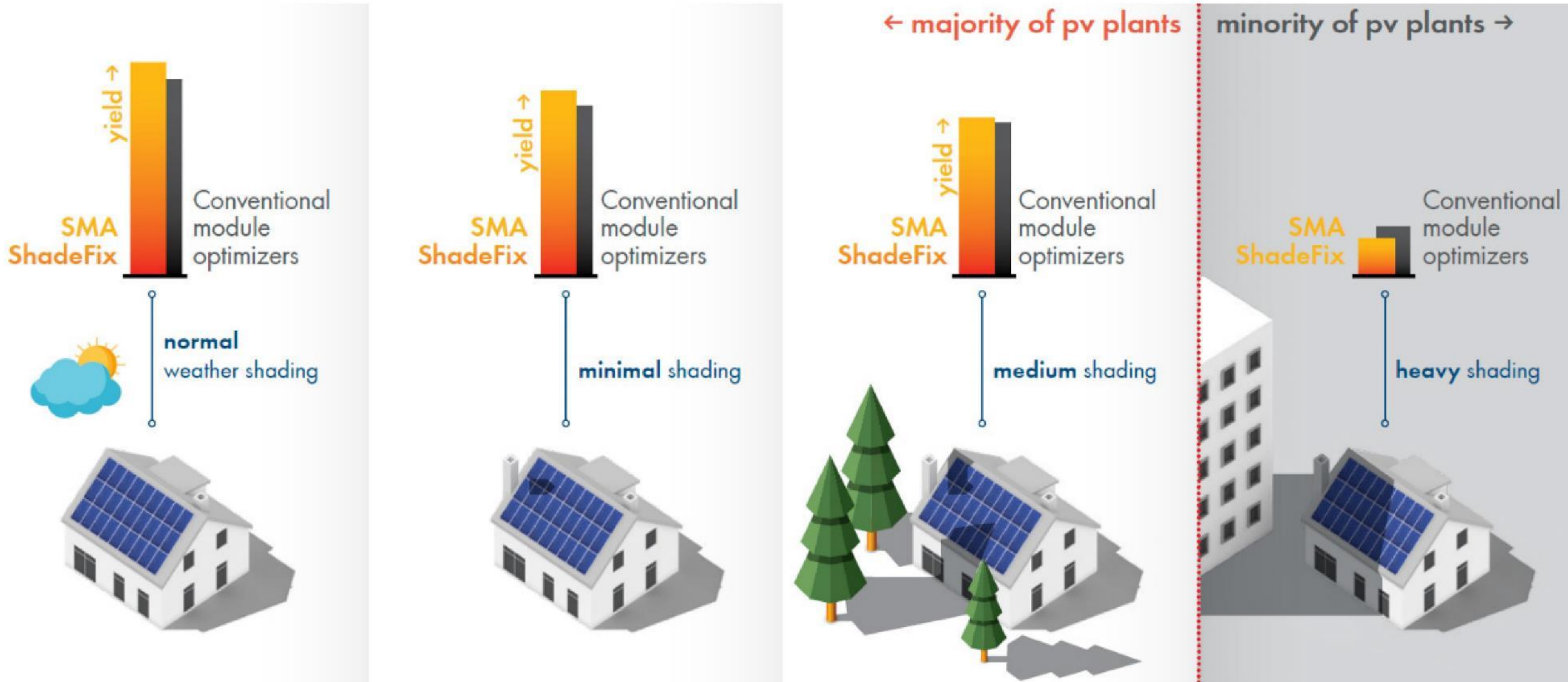Traditional module optimizers

SMA ShadeFix
STRING LEVEL OPTIMIZATION
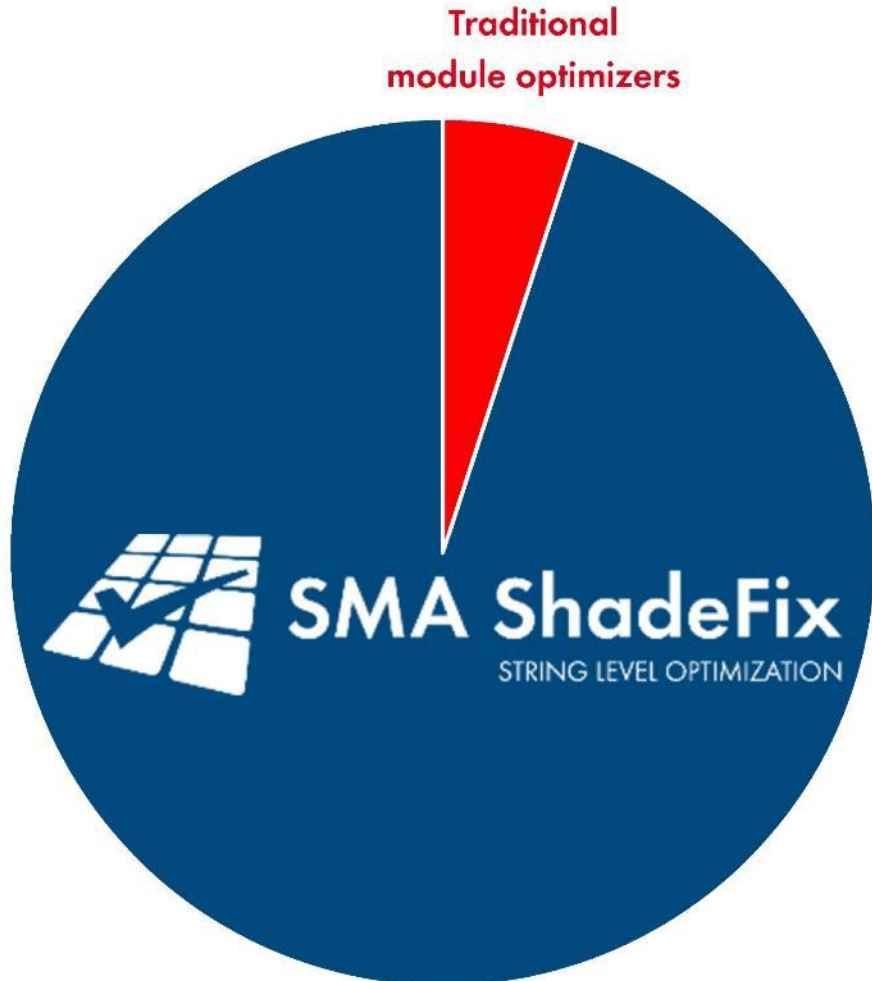
"The common marketing claims of additional energy production by applying optimizers could **not be confirmed** by this experiment. In fact, there are only **very few scenarios where the use of optimizers improves the system performance.**"

UNIVERSITY OF SOUTHERN DENMARK

https://portal.tindresearcher.sdu.dk/da/publications/the-impact-of-optimizers-for-pv-modules

[1]Internal production simulation over entire operating time for 150 different plant scenarios

The majority of PV plants are built in unshaded or minimally shaded areas, where SMA ShadeFix generates greater energy production!

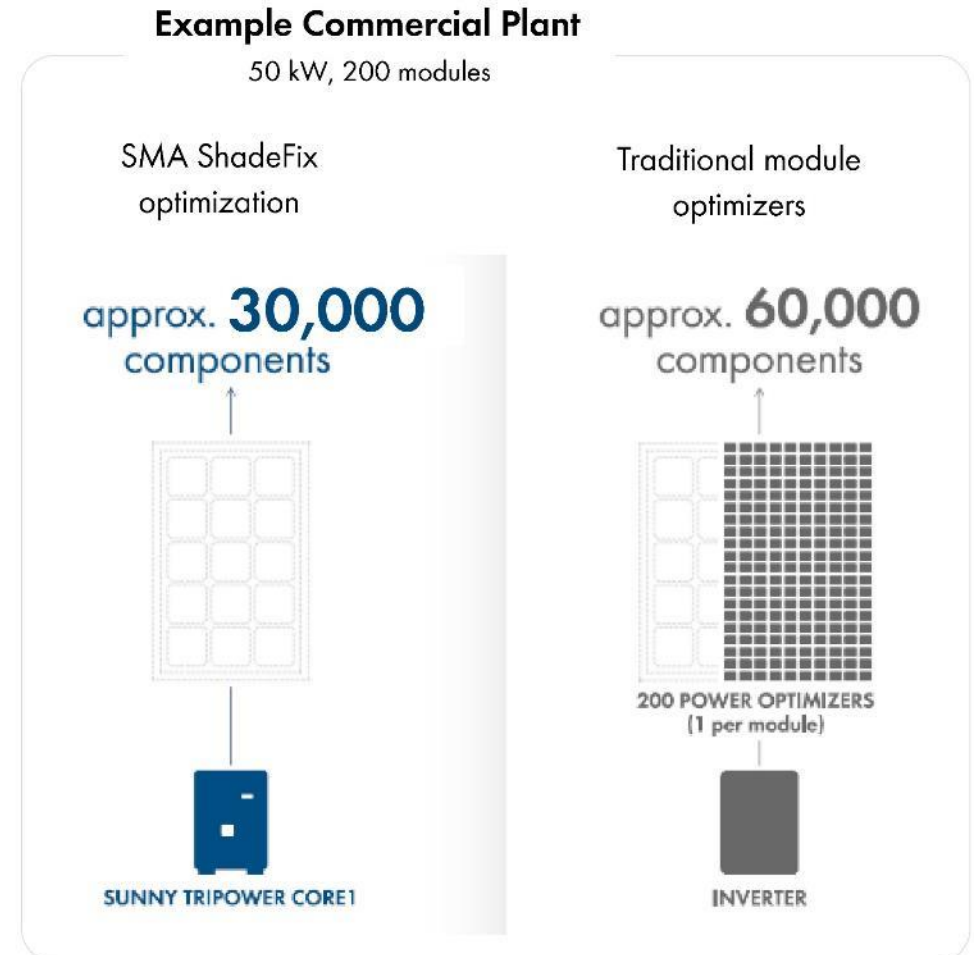# How service impacts lifetime system optimization

Brad Dore

SMA ShadeFix reduces the reliability risk inherent in traditional optimizers

SMA

- SMA avoids the use of unnecessary electronic components that are installed on the roof

- Less heat stressing those components

- All energy generation and optimizing technologies are integrated directly into the inverters

- Reducing the number of components keeps potential sources of error to a minimum, ensuring the maximum lifetime of the PV system

This strategy has been proven by nearly 40 years of experience and 85+ GW installed worldwide

Example Commercial Plant

50 kW, 200 modules

SMA ShadeFix optimization

Traditional module optimizers

approx. **30,000** components

approx. **60,000** components

200 POWER OPTIMIZERS
(1 per module)

SUNNY TRIPOWER CORE1

INVERTER

What's the impact of inferior reliability?

One component failure =

» Roof access

» Removal of connections

» Removal of fixtures

» Removal of PV modules

» Reinstallation of connections, fixtures, and modules

- NEC 2020 updates could further exacerbate the complications of frequent roof visits

Poll question #2

SMA

For a typical residential installation, how much money do you put aside for future service and O&M?

1. $0

2. $500 or less

3. $500 - $1,000

4. More than $1,000

5. I don't know

Exponential risk of lost energy and extended system payback

SMA

One component failure =

» Roof access

» Removal of connections

» Removal of fixtures

» Removal of PV modules

» Reinstallation of connections, fixtures, and modules

Year 1 = $

Year 3 = $$

Year 10 = $ $ $ $ $

Reducing service risk to maximize lifetime system optimization

SMA

SMA Smart Connected

- Proactive service technology automatically informs of any system event
- Provides diagnosis and repair guidance
- Reduce truck rolls up to 50%

SMA Service App

- Offers expedited field service and event resolution
- Access technical documentation
- Spend less time servicing and more time on revenue-generating activities

Online Service Center

- Spend less time servicing and more time on revenue generating activities
- Expedited resolution with self-solve documentation, FAQs and information on software updates

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The role of SunSpec rapid shutdown standardization

Tom Tansy

SunSpec Alliance Today

Global alliance of 115+ of Distributed Energy Resource (DER) industry participants

Developing open information standards to drive down costs and increase innovation

Active programs for system- & device-level communication, financial & operational data exchange, and cybersecurity

Driving Adoption Through Standards & Grid Codes

- SunSpec Modbus

- IEEE 2030.5/CSIP

- Orange Button

- SunSpec Rapid Shutdown
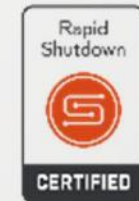
SunSpec Rapid Shutdown Initiative

MEETING A MARKET MANDATE FOR SOLAR SAFETY

PV module-level power control and safety ("rapid shutdown") is required in 34 states as of January 2020

SunSpec Alliance global leaders have developed an open standard rapid shutdown communication solution

SunSpec has launched a Rapid Shutdown Certification Program

nec
2017 Edition for Rapid Shutdown

SunSpec Communication Signal for Rapid Shutdown Functional Specification

Rapid Shutdown

CERTIFIED

NEC 2017 Rapid Shutdown Mandated in 34 States

2020 NEC® - 1
2017 NEC® - 33
2014 NEC® - 10
2008 NEC® - 3
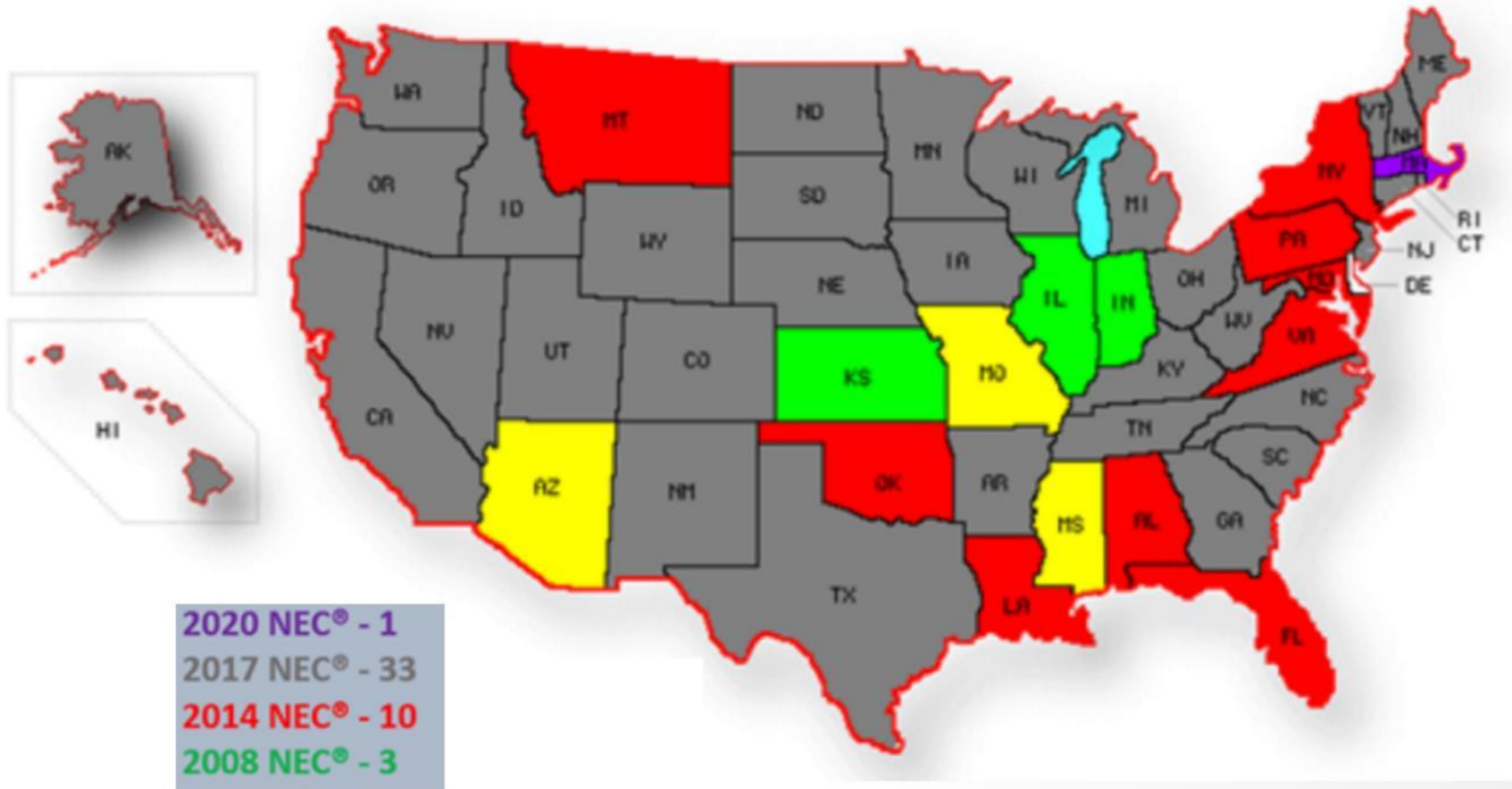
SunSpec Rapid Shutdown: How It Works

Integrated Component View
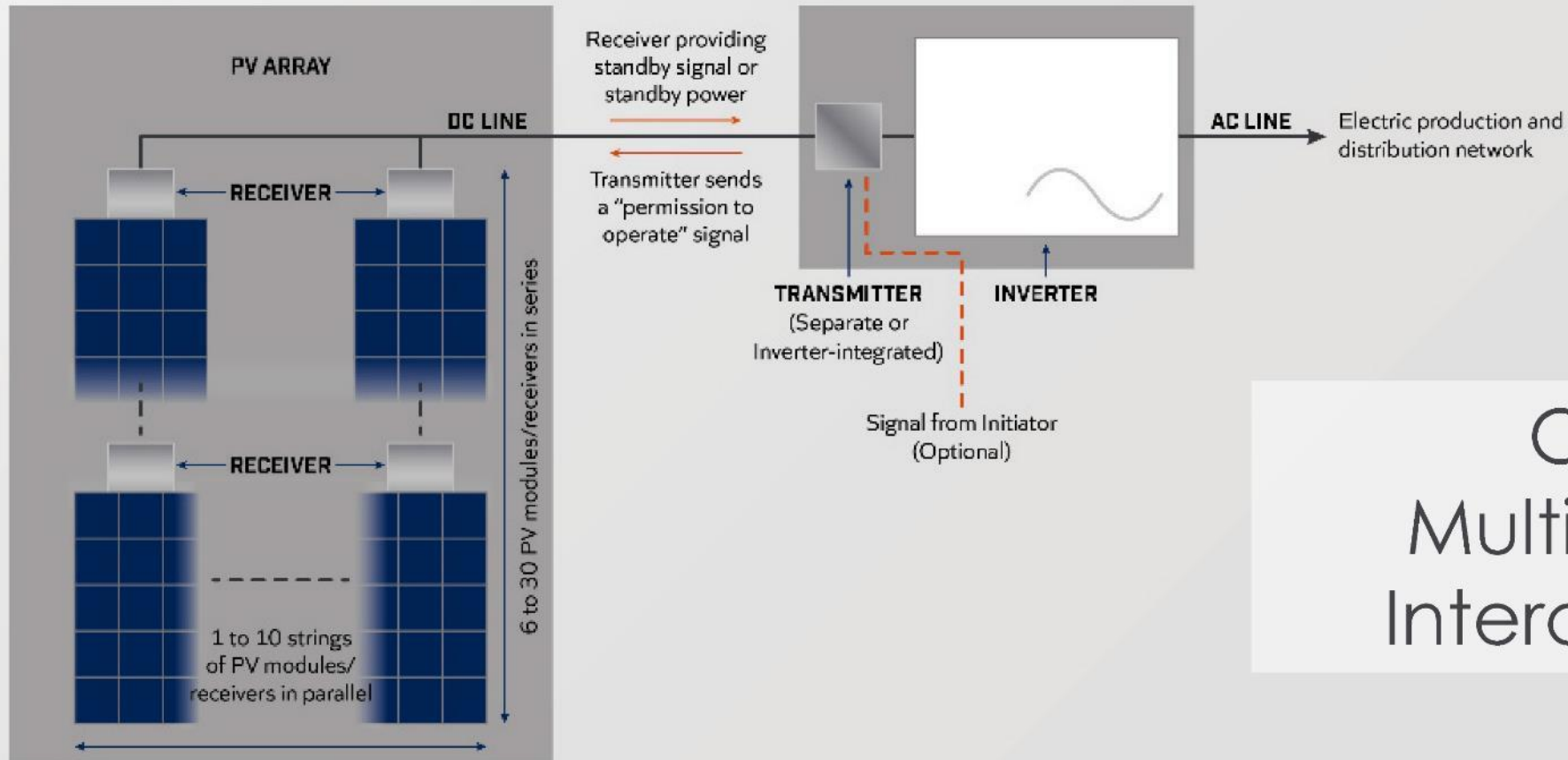
Open Multi-vendor Interoperable

SunSpec Certified Products

- SunSpec Rapid Shutdown
  - 10 product lines from 7 vendors

- IEEE 2030.5/CSIP
  - 22 product lines from 19 vendors

- SunSpec Modbus
  - 53 product lines from 37 vendors

- More consumer choice
- Lower system support expense
- Higher stakeholder satisfaction

SunSpec Rapid Shutdown Ecosystem

What People Are Saying

THE POWERSTORE
Solar and Storage Specialists

"The PowerStore is pleased to support the SunSpec Alliance with industry standardized products for solar and storage professionals. We are a national distributor that offers manufacturer agnostic solutions and competitive pricing for many different NEC 2017 compliant and SunSpec compliant products and solutions. Our knowledgeable staff are NEC and NABCEP trained with the ability to offer design assistance to installers across the U.S."

-Stewart White, Vice President, The PowerStore

What People Are Saying

"Working with leading suppliers of rooftop solar systems for many years, we at Texas Instruments recognize the importance of an easy-to-implement and safe solution for rapid shutdown. We will continue to help SunSpec Alliance establish an open standard so solar companies can deploy safer and more effective designs."

-Jose Sacripanti, Analog Marketing Manager, Texas Instruments

What People Are Saying

"We applaud SunSpec's success in this space. UL proudly works with SunSpec as an authorized test lab to test products to the SunSpec Rapid Shutdown Communication Standard. The combination of the SunSpec communication signal with the safety requirements of UL 1741 for PVRSS and PVRSE results in a powerful combination for implementation of PV systems."

-Scott Picco, Business Development Manager, UL LLC

Product Certification Registry

Powered by SunSpec Alliance

Keyword Search

sma solar

[Search] [Clear filters]

Product Type

- [ ] Inverter
- [ ] Meter
- [ ] Data Logger
- [ ] Controller
- [ ] String Monitor
- [ ] Application
- [ ] AC Meter
- [ ] Weather Station

Certificate Type

- [ ] SunSpec Rapid Shutdown
- [ ] 2030.5 CSIP
- [ ] SunSpec Modbus

[Search] [Clear filters]

Download Results

8 Products

« ‹ **1** 2 › »

Certification Number: 024-004
Manufacturer Name: SMA Solar Technology AG
ProductType: Inverter
CertificateType: SunSpec Modbus
Products: SBx.x-1xP-US-41
Download: PICS1 Certificate1

Certification Number: CS-000019
Manufacturer Name: SMA Solar Technology AG
DeviceProfile: Aggregator
CertificateType: 2030.5 CSIP
Products: SMA SPOT Aggregator Client
Download: PICS1 Certificate1

Certification Number: RS-000002
Manufacturer Name: SMA Solar Technology AG
DeviceProfile: Transmitter
CertificateType: SunSpec Rapid Shutdown
Products: Sunny Boy US
Download: PICS1 Certificate1

Certification Number: RS-000003
Manufacturer Name: SMA Solar Technology AG
DeviceProfile: Transmitter
CertificateType: SunSpec Rapid Shutdown
Products: Sunny Tripower CORE1
Download: PICS1 Certificate1

Certification Number: 23026
Manufacturer Name: SMA Solar Technology AG
ProductType: Inverter
CertificateType: SunSpec Modbus
Products: STP 12000TL-US-10, STP 15000TL-US-10, STP 20000TL-US-10, STP 24000TL-US-10, STP 30000TL-US-10
ModBusModels: 1, 11, 12, 103, 120, 121, 122, 127, 160

Certification Number: 024-002
Manufacturer Name: SMA Solar Technology AG
ProductType: Inverter
CertificateType: SunSpec Modbus
Products: SBx.x-1SP-US-40
ModBusModels: 1, 11, 12, 102, 120, 160
Download: PICS1 Certificate1

SunSpec
Rapid Shutdown

Paving the way for a new distributed energy paradigm that balances sustainability, public safety, and greater customer choice.

LEARN MORE

tom@sunspec.org

Conclusions

Brad Dore

Maximum Value in Residential PV with SMA and the SunSpec Alliance

SMA

The key to increased performance and reliability

- Minimal electronics placed under module (50% less than traditional optimizers), only what is necessary to fulfill NEC 2017 compliance

- Simple stay alive signal transmitted from the inverter via power line communication to SunSpec certified shutdown devices

- Loss of AC power automatically triggers rapid shutdown

Unique benefits of the SMA solution

- Greater reliability and reduced service risk

- No additional communication components necessary

- No other optimized solution generates more power or is as easy as systems featuring SMA ShadeFix and SunSpec certified devices

Rapid Shutdown

CERTIFIED

SMA ShadeFix
STRING LEVEL OPTIMIZATION

SMA ShadeFix
STRING LEVEL OPTIMIZATION

SMA ShadeFix optimizes PV performance while maximizing safety and lifetime reliability of a PV system. It reduces cost and complexity of a PV system as it is automatically integrated into SMA Sunny Boy-US and Sunny Tripower CORE1-US inverters.

✓ **Increased Performance & Energy Production**

✓ **Improved Quality & Lifetime Reliability**

✓ **Simple Compliance, Safety & Service**

= True system optimization!

How can I learn more about system optimization?

Download our white paper

- www.SMA-America.com/ShadeFix

Additional resources

- Solar Academy technical trainings – www.SolarAcademy.SMA.de/en

- PowerUP partner program – www.sma-america.com/powerup/installer

- SMA America Blog – www.SMAInverted.com

- SunSpec Alliance - https://rapidshutdown.sunspec.org/

Thank You!
Questions?

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