Smart Solar Monitoring by the Best in Class

Questions?
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From Expert to Expert: Our Key Note Speakers

Guillermo Esquivel
Industrial Engineer, Direct Sales Manager, Lufft USA Inc

Environmental measurements in renewable energies is one of the key topics for Guillermo, who started working in environmental monitoring in 2008. He is an expert in solar monitoring and will be explaining systems, from the choice of sensor to the final data output.

Victor Cassella
Meteorologist, Sales Office Director - North America, Kipp & Zonen

With more than 18 years of experience as a meteorologist of the Brookhaven National Laboratory, and 10 years as Sales Office Director of Kipp & Zonen, Victor will bring his expertise to the table in helping explain the technologies of choice and best practices in the renewables sector.

Smart Solar Monitoring by the Best in Class

1. Why accurate measurement of environmental parameters is important
2. Best in class sensors for solar monitoring
3. A smart solar monitor system, what does it look like?
4. Some best practices from the field

1. Why accurate measurement of environmental parameters is important for calculating the performance ratio

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Solar Plant Performance

Contract items	Measurement uncertainty
Yield	0.5 to 1 %
Availability	< 1 %
Performance ratio	> 2 %

$$\text{Performance Ratio} = \frac{\text{Actual yield}}{\text{Theoretical yield}}$$

Performance Ratio > 90% is getting more common

External plant parameters

Irradiance

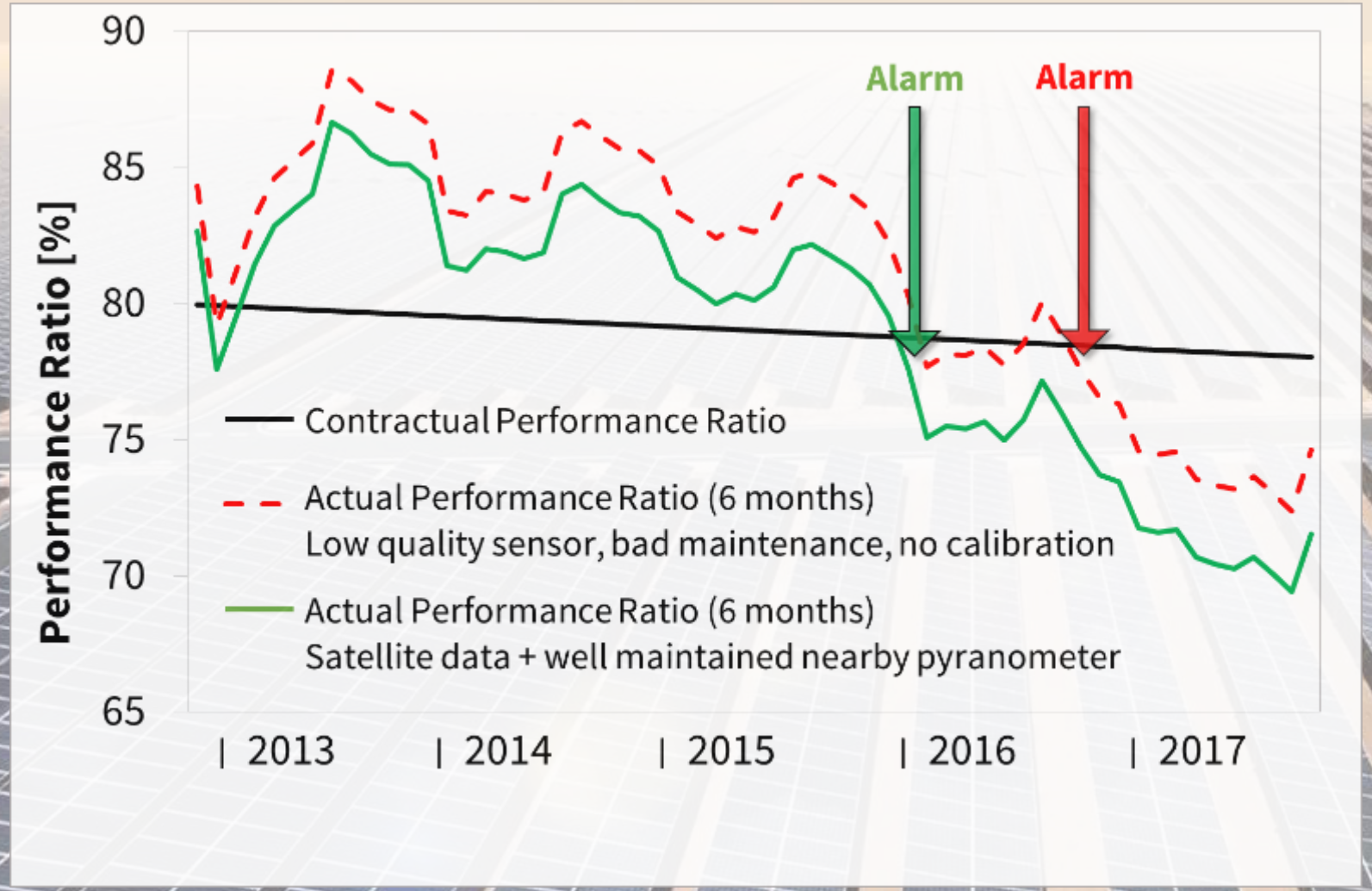
Temperature (panel + ambient)

Soiling

Precipitation

Wind direction and wind speed

A business case for correct irradiance measurements



5 MWp solar plant

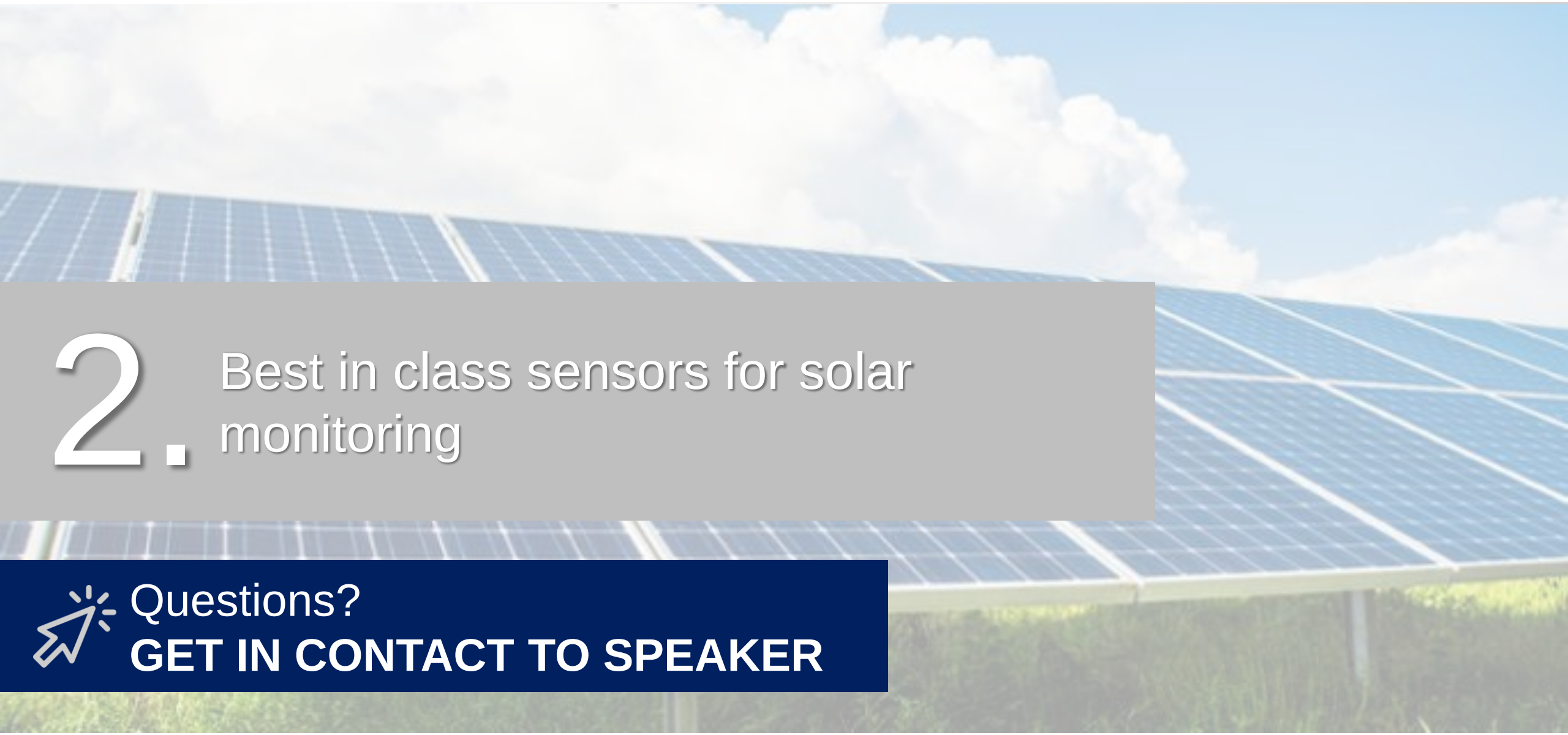
Expected annual revenues
$ 850K

9 months delay in taking action, due to low quality measurements

7% drop in expected revenue during 9 months:
~$ 45K revenue loss

Satellite data + 3 pyranometers system costs (25 year) < $ 25K

Root cause:
Rapid panel degradation
(found by comparison to well maintained nearby pyranometer data)



2. Best in class sensors for solar monitoring

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The OTT Hydromet Group

Hydro

HYDROLAB

Loveland USA

Water Quality Instrumentation

39 years of multi-parameter water quality instruments

OTT

Kempten Germany

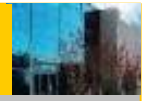
Water Quantity Instrumentation, Global Headquarters

144 years of hydrological instruments and systems

SUTRON

Integrated in July, 2015

Sterling USA



Water Quantity Telemetry Meteorology Air Quality Instrumentation

42 years of real-time data collection and control products, systems, software and services

ADCON TELEMETRY

Vienna Austria

Agro-Met Telemetry Instrumentation

24 years of smart wireless communication

Meteo and Renewables

Lufft

Integrated in January, 2016

Fellbach Germany

Meteorology Instrumentation

136 years of meteorological instruments and sensors

KIPP & ZONEN SINCE 1830

Integrated in December, 2017

Delft NL

Meteorology Instrumentation

187 years of meteorological instruments and sensors

The common link of all companies is a rich history of providing the highest quality of innovative, accurate instruments

Kipp & Zonen at a Glance

Leading innovator of solar irradiation systems and atmospheric instruments with its primary applications in Solar Energy and Meteorology

	Meteorology & Renewables	Meteorology & Science	Service in Calibration
Product portfolio			
	▪ Product range for solar-related measurements and supporting equipment	▪ Products for atmospheric measurements	▪ Variety of support and assistance services
Main industries served	▪ Solar ▪ Meteorology	▪ Meteorology	▪ Solar ▪ Meteorology

Lufft at a Glance

Highly innovative manufacturer of meteorological sensors with its primary applications in renewable energies, meteorology and transportation weather

	Meteorology & Renewables	Meteorology & Science	Transportation Weather
Product portfolio	 ▪ Product range of multi-parameter weather sensors (All-in-one)	 ▪ Products for atmospheric and climatological measurements	 ▪ Variety of sensors to measure visibility, road/runway conditions and others…
Main industries served	▪ Solar ▪ Building Automation and others...	▪ Meteorology	▪ Road weather ▪ Airport weather

Kipp & Zonen and Lufft in the PV market

Why Kipp & Zonen and Lufft match together

Kipp & Zonen and Lufft in the PV market

Market position	▪ **Kipp & Zonen is a world-leading manufacturer of solar irradiation - and soiling measurement instruments, providing the best solution to assure Solar plant performance**	▪ **Lufft is well known as the first manufacturer of „compact multi-parameter weather sensors" that fit perfect to the needs of solar energy monitoring systems.**

Go To Market Strategy

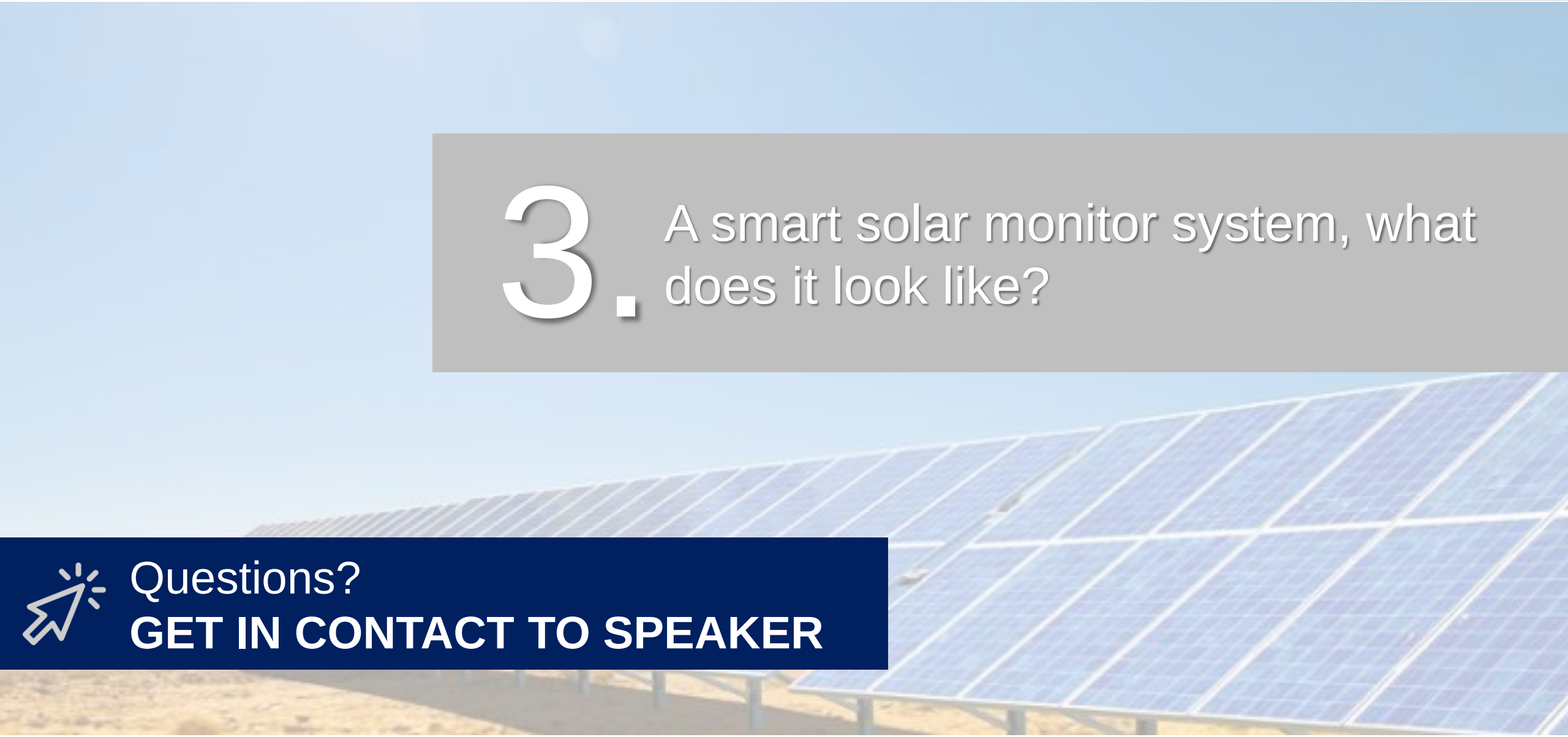
Manufacturer of instruments working together with business partners/system integrators

Component manufacturers → **Instrument Manufacturer** → Business partners / System integrators → Contractor → End Users

Shared Customer need

Insights about the performance ratio and soiling of the PV farm needed to monitor and manage optimal output of PV plants

3. A smart solar monitor system, what does it look like?



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Kipp & Zonen and Lufft in the PV market

- **Product range for solar and soiling measurement and support equipment**

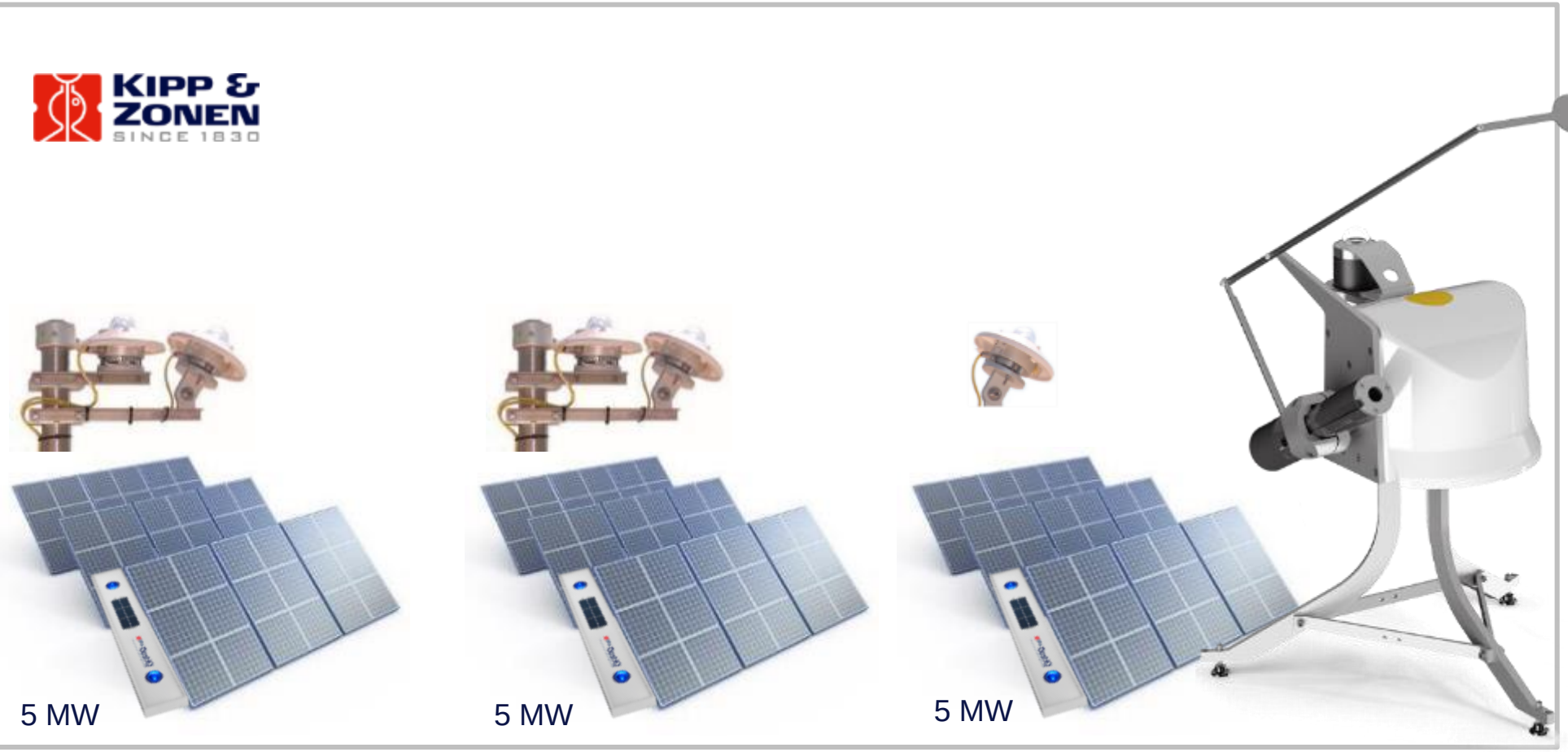
- **Product range of multi-parameter weather sensors (All-in-One)**

Kipp & Zonen and Lufft together provide reliable instruments for <u>all environmental parameters</u> required for the calculation of the performance ratio of solar energy plants

Kipp & Zonen and Lufft in the PV market

Solar Irradiation System with Kipp & Zonen + Lufft instrument set-up

Example: 15 MW PV Plant



How many pyranometers do I need?

IEC 71624-1 + redundancy: absolute minimum

PV plant size	Min. number of SMP10 pyranometers	
	Horizontal	Plane of array
< 5 MW	1	2
5 to 40 MW	2	4
40 to 100 MW	3	6
100 to 200 MW	4	8

Extra pyranometers at substantial deviations in environment or plant design:

- Tilt & orientation of panels
- Near and far shading
- Micro climates
- Dust accumulation

How many weather stations do I need?

“Rule of thumb”:

→ *One met station per every 20MW*

- Met station includes 1xWS sensor, 1x POA, 1x GHI, 3x BOM
- 1x POA per every per each inverter power block (vary depending on the customer)

Note: Many customers also add weather sensors, depending on the project environment

4. Some best practices from the field

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Best Practice: 8 Minute Energy

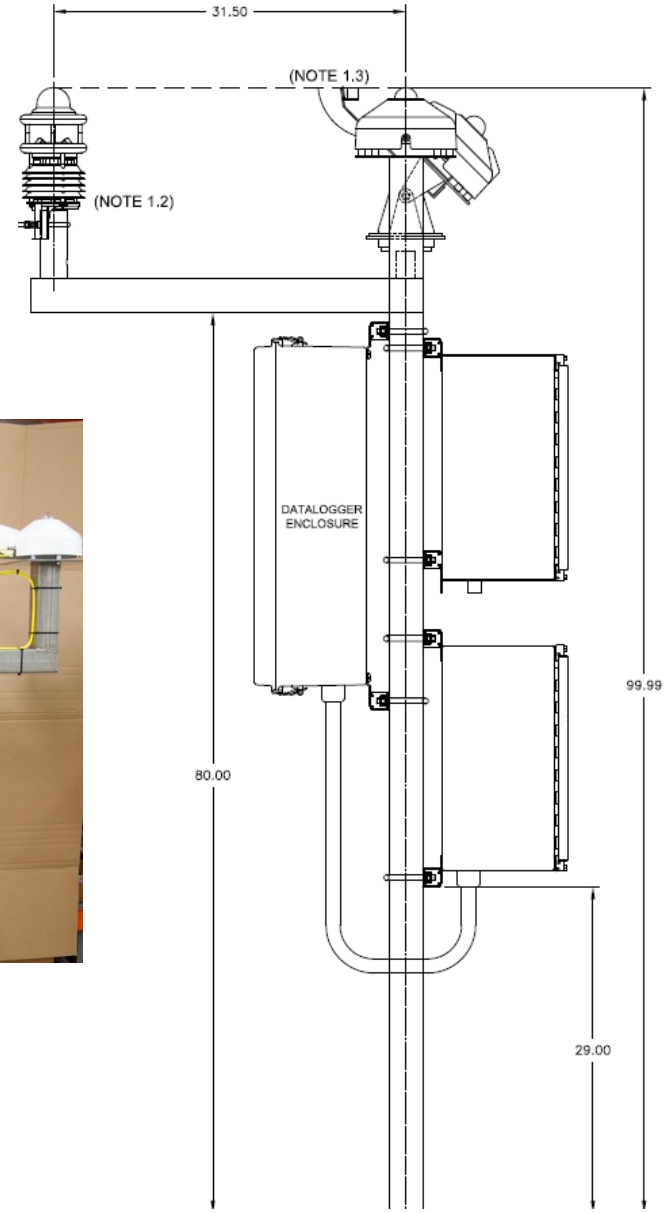
Owner:	8 Minute Energy
Solar Power Plant:	Mount Signal 3 Solar
Capacity:	205MW
Sensors:	Lufft WS601 Weather Station: Qty 5 Kipp & Zonen SMP11 Pyranometer: (1) POA per each inverter power block, for a total quantity of 101 SMP11
System Provider:	Nor-Cal Controls ES, Inc.

Best Practice: Cypress Creek Renewables

Owner: Cypress Creek Renewables
Solar Power Plant: DAS Portfolio (30 Sites)
Capacity: *Multiple Sites*
Sensors: Lufft WS500 Weather Station Qty 30
Kipp & Zonen SMP11 Pyranometer Qty 60
System Provider: Nor-Cal Controls ES, Inc.

Best Practice: First Solar

Capacity: *Multiple Sites*
Sensors: Lufft WS600-UMB Weather Station
Kipp & Zonen CMP11 Pyr and CVF4 Ventilation unit
System Provider: Olson Motor & Control Co, Inc.



Meteorological Station Instruments & Highlights

- Lufft WS600 Sensors, proven to be the most reliable units used in the PV Market
- Kipp and Zonen CMP11 Pyranometers
- Long Term warranty requirements – they need high quality equipment
- 4” Stainless Steel Structure
- Stainless Steel or Nema4x Enclosure Options
- Shadow band Instrument Option
- Supplied with Temperature Sensors
- Instrumentation Battery Backup
- Modbus Capabilities

OM &C

Solar Monitoring Success Stories

Added value of the Kipp & Lufft product combination

Shared purpose of Kipp & Zonen and Lufft:

Provide **accurate environmental insights** from reliable instruments that produce **high quality inputs** for solar investment operational efficiency!

QUESTIONS & ANSWERS

Contact:

Two offices (New York & Los Angeles)

Tel.: +1 888 519 8443

Web Contact

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