Remote Site Troubleshooting

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Agenda

- Inverter-level troubleshooting
- Power optimizer-level troubleshooting
- Examples

Inverter Level

Is the Inverter:

Communicating?

Producing?

Underperforming?

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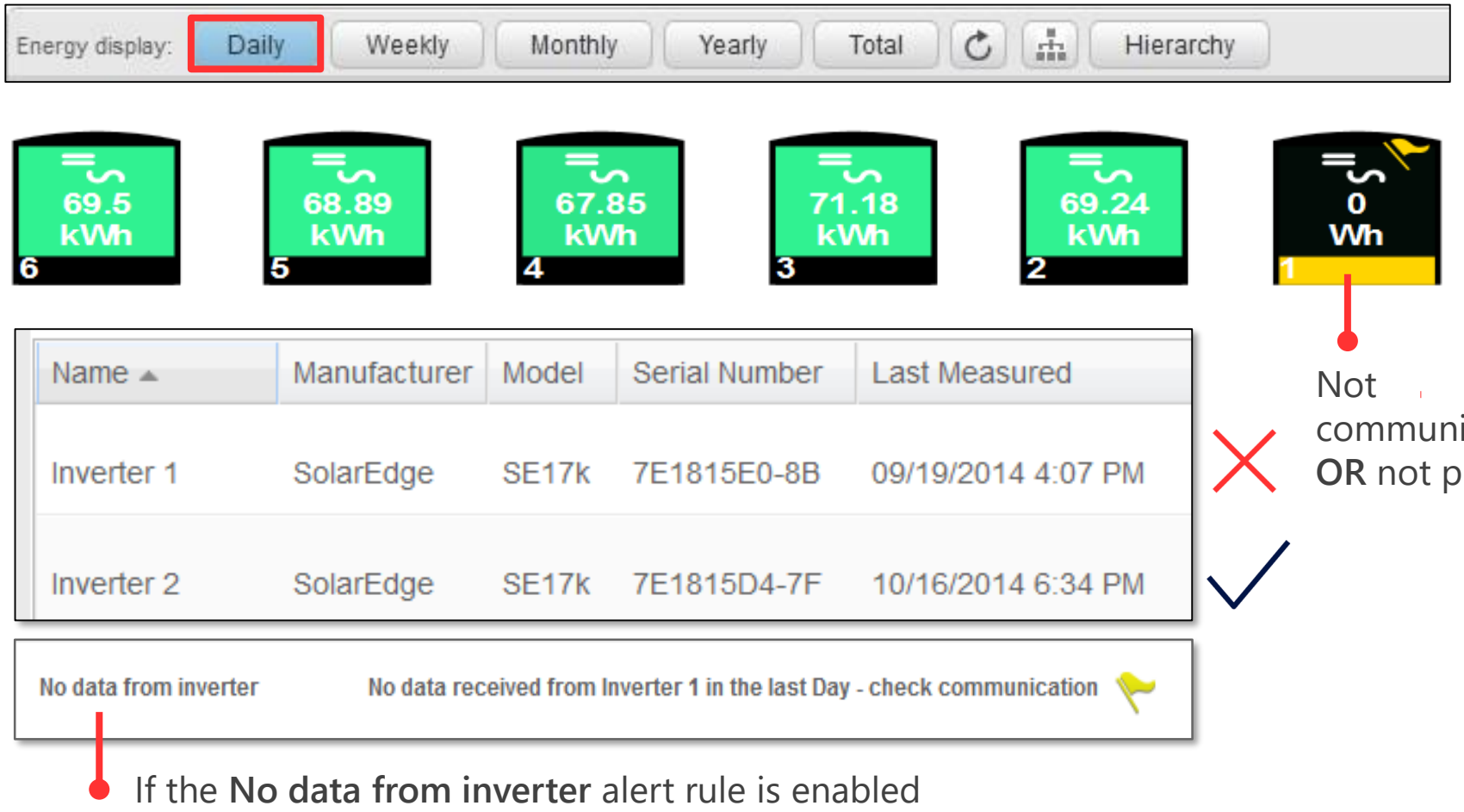
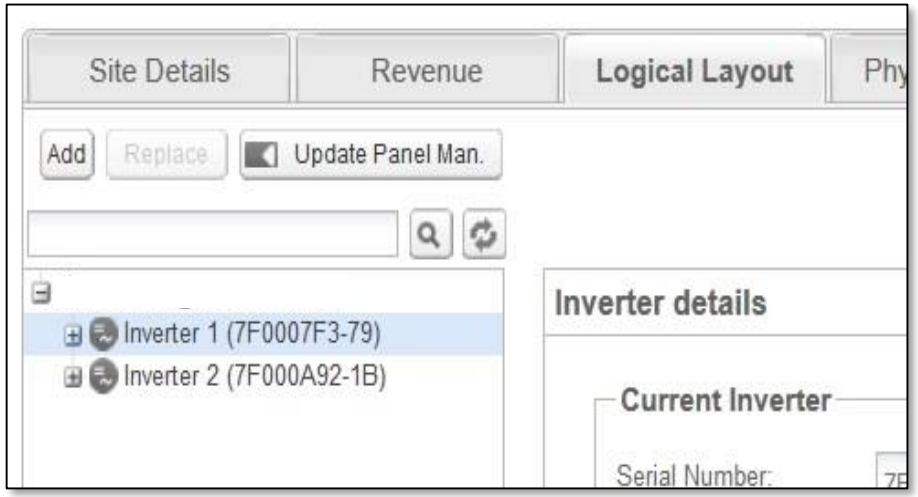
1. Is the Inverter Communicating?

- How to identify?



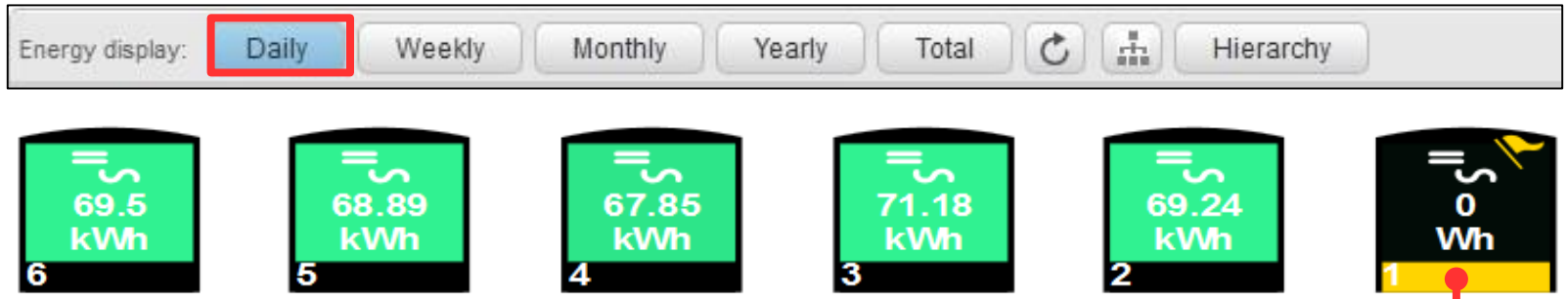
1a. Is the Inverter Communicating?

- Has the inverter been replaced without updating the serial number in the monitoring platform?
  - Go to **Admin – Logical Layout** to enter the correct serial number
- Contact the system owner to check the inverter connection and communication status



2. Is the Inverter Producing?

- How to identify?



Not communicating **OR** not producing

Name	Manufacturer	Model	Serial Number	Last Measured	I AC [A]	P AC [W]	V AC [V]	V DC [V]	Energy [Wh]	
Inverter 1	SolarEdge	SE17k	7E1815E0-8B	10/16/2014 6:34 PM	0	0	228.61	885.06	0	✗
Inverter 2	SolarEdge	SE17k	7E1815D4-7F	10/16/2014 6:34 PM	0	0	227.14	63.13	69,242.05	✓

Communicating

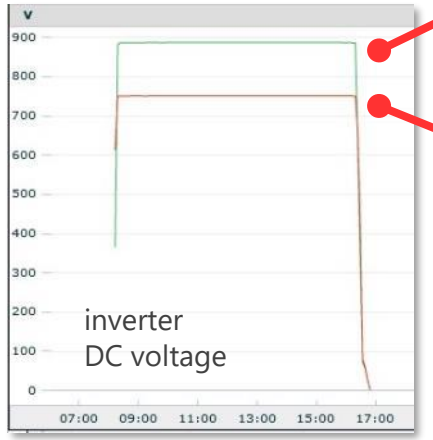
Not producing

2a. Inverter is Not Producing - Troubleshooting

- Check the inverter DC voltage in the table below the layout

Name	Manufacturer	Model	Serial Number	Last Measured	I AC [A]	P AC [W]	V AC [V]	V DC [V]	Energy [Wh]
Inverter 1	SolarEdge	SE17k	7E1815E0-8B	09/19/2014 4:07 PM	0	0	228.61	885.06	0

- If Vdc = safety voltage, check:
  - ON/OFF switch is in the ON position
  - System is paired? -> re-pair
- If Vdc is higher than **Vdc nominal** for long periods of time, check:
  - Inverter errors in the **Layout**
  - If the inverter displays an error

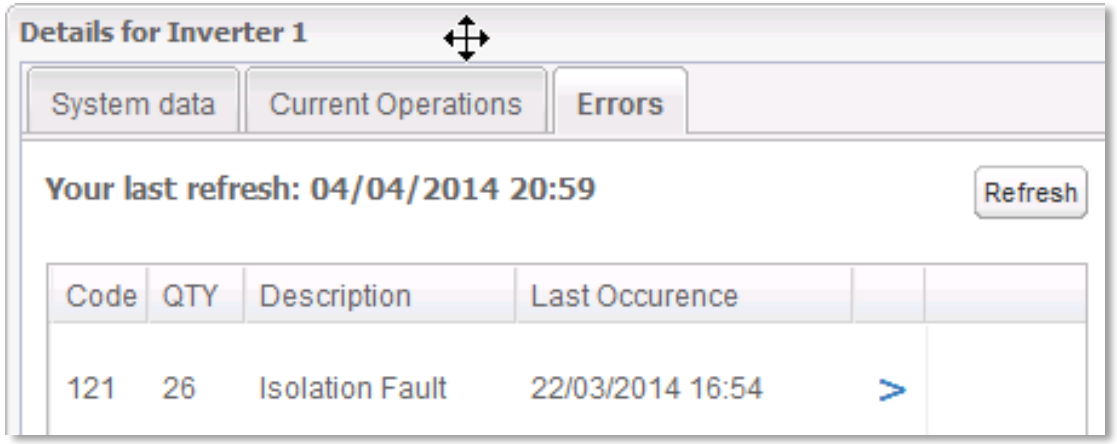


≈ 880V
= stuck at startup voltage due to error

≈ 750V
= nominal voltage three phase inverter

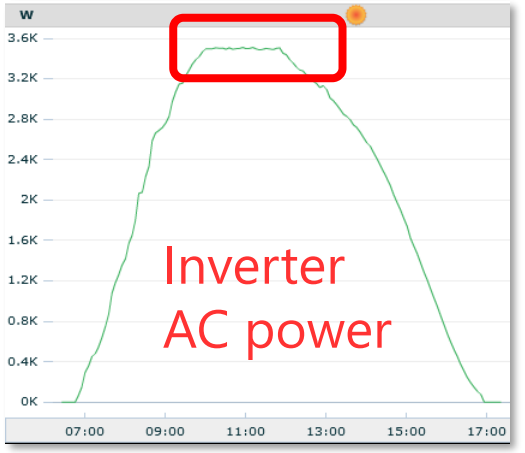
2a. Inverter is Not Producing – Troubleshooting (cont.)

- Confirm design follows SolarEdge design rules (min # power optimizers, etc.)
- Check inverter for errors
  - Right-click on inverter in the layout
  - Select **Info** and check **System data** and **Errors** for possible error messages
  - AC voltage & AC frequency errors can be due to a wrong country setting of the inverter

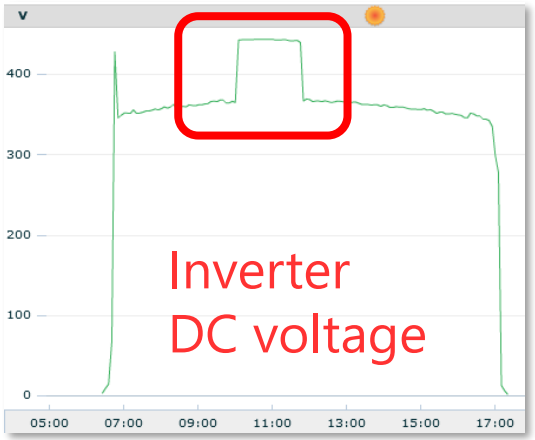


3. Is the Inverter Underperforming?

- AC clipping can be due to:
  - Undersized inverter (unless intended, install larger inverter)
  - Smart energy management limiting output (correct system behaviour)
  - Overheating (clean fan/heatsink, check clearances)
  - Technical/configuration issue (contact SolarEdge)



➔ Check for power clipping in the inverter AC power curve



➔ Check inverter DC voltage for verification (DC well above nominal voltage)

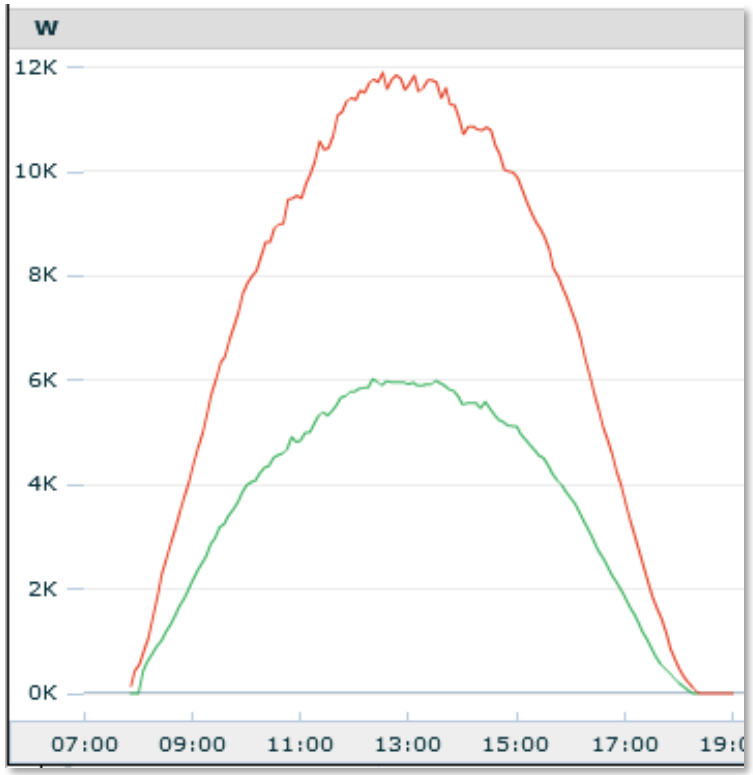
3a. Is the Inverter Underperforming? Troubleshooting

- Select a sunny day, when checking a system – this makes finding issues much easier
  - In the layout, right-click on the inverter and select **Info**
  - Check the **Errors** tab and check inverters display for error code

Code	QTY	Description	Last Occurence
99	1	AC Voltage Too High ...	09/19/2014 15:44

➔ Power curve looks scattered despite perfectly sunny conditions

The inverter might be shutting down due to an error



➔ Inverter produces a lot less than other inverters on site.

Possible problem with one of the inverter's strings

Power Optimizer Level

Is the Power Optimizer:

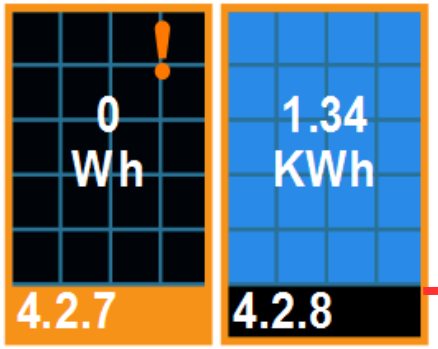
Communicating?

Producing?

Underperforming?

1. Is the Power Optimizer Communicating?

- How to identify?



Not communicating **OR** not producing

Name	Manufacturer	Model	Serial Number	Last Measured
Panel 4.2.7			0004FA9A-98	17/10/2013 5:16 PM
Panel 4.2.8			0004FACA-C8	04/04/2014 6:38 PM

If the **Power shutdown** alert rule is enabled, the following alert will appear:

Power optimizer shutdown	No measurements received from Panel 33.2.1 in the last 2 Days	!

If it is disabled, a black power optimizer will be displayed, but without an alert

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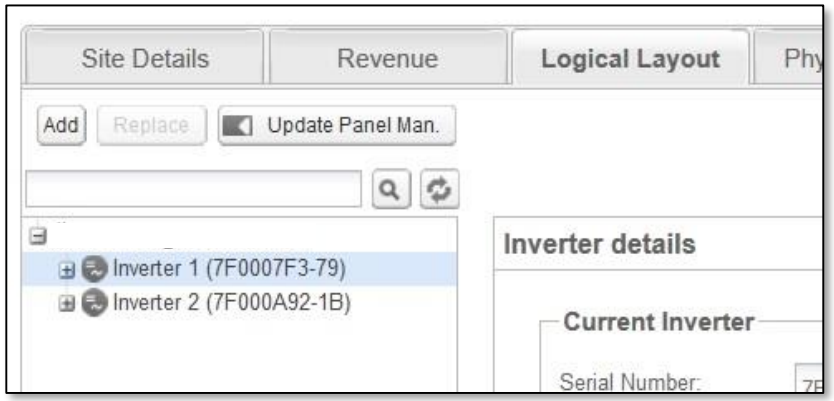
1a. Power Optimizer Communication Troubleshooting

- Has a power optimizer been replaced without updating the serial number in the monitoring platform?
  - Check the logical layout to see all operating power optimizers
  - Go to **Admin – Logical Layout** to correct the serial number



- Contact the system owner to check:
  - Modules (for snow coverage, damage or extreme shading)
  - P-OK # on inverter display during daytime
  - If P-OK # is too low, send technician
  - If the P-OK # is correct, there is an issue in the monitoring platform. Call SolarEdge

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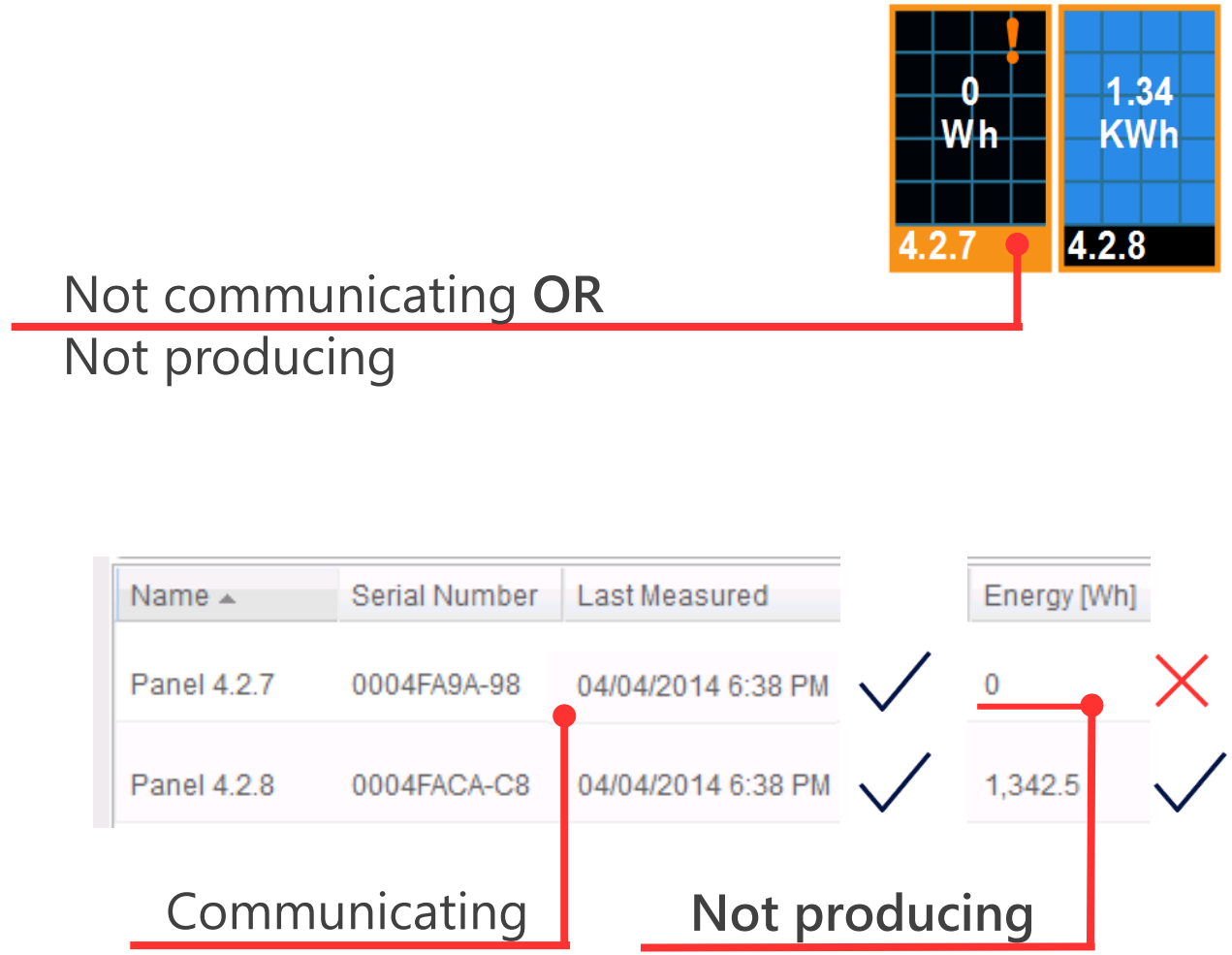
2. Power Optimizer is Not Producing

- How to identify?
  - Locate the power optimizer that is not producing and review the last measurements



2a. Power Optimizer is Not Producing - Troubleshooting

- Only a single/few power optimizers not working?
  - Perform pairing to reassure that the power optimizer are listening on the correct frequency for the wake-up signal from the inverter
- Whole string not working?
  - Check if the string was designed according to the SolarEdge design rules
    - Re-design ➔ Re-pair
- Check on-site all series connections of the string:
  Cable, connectors, combiner boxes, DC-disconnects, etc.
- Contact SolarEdge for support

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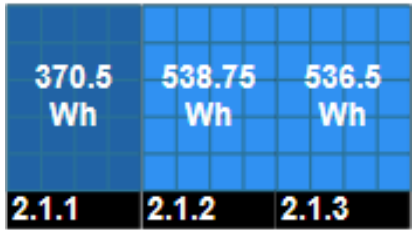
3. Are the Power Optimizers Underperforming?

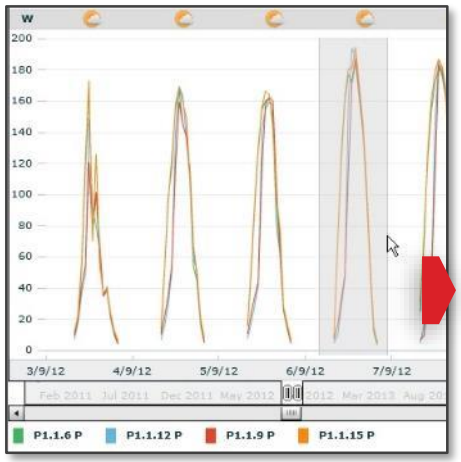
- How to identify?
  - Compare between modules



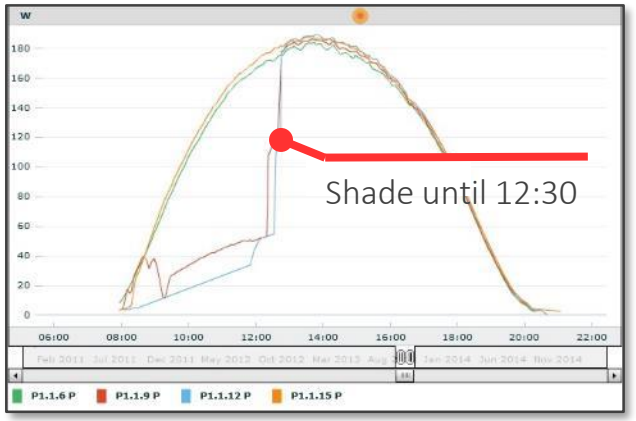
? ✓ ✓

- Select one or more system components in the Layout menu
- Right-click on one of the selected components

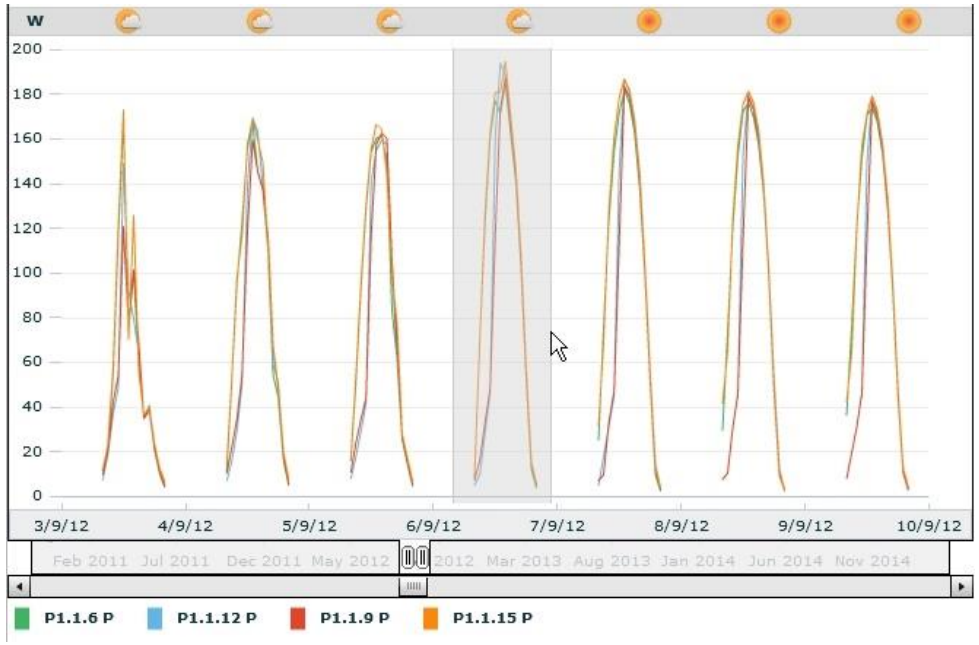
- Select a specific day in the graph



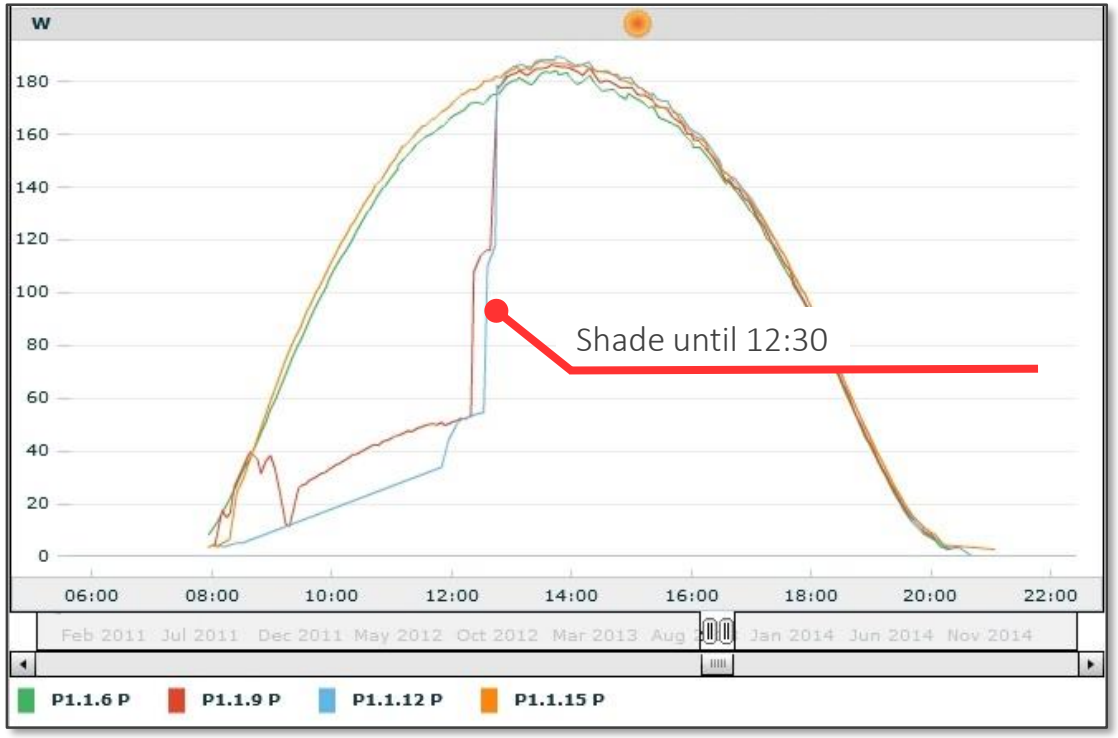
- Graph shows the output power of each module and allows comparison



3a. Analyzing Underperforming Modules



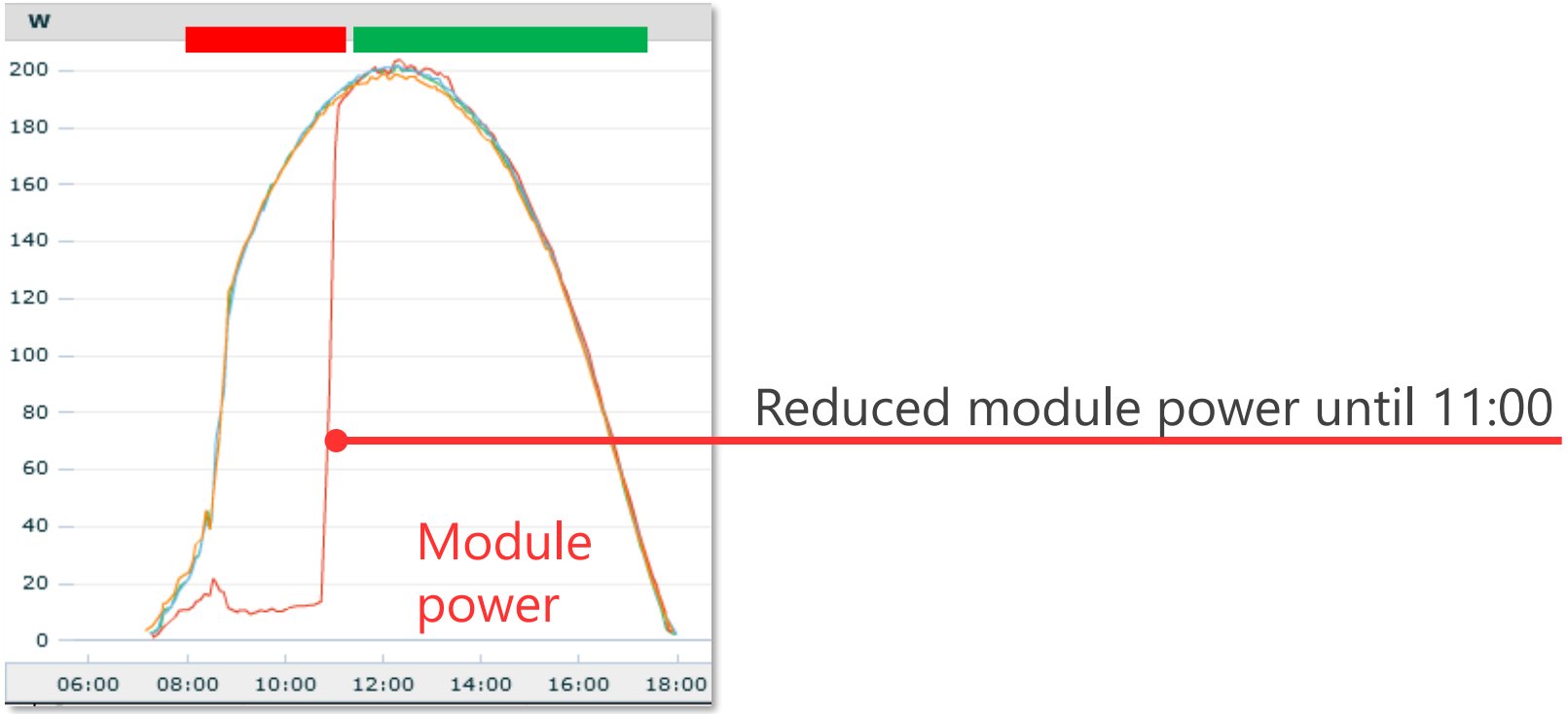
Select a specific day in the graph to zoom in



Graph shows the output power of each module and allows comparison

3b. Four Ways to Identify Shading

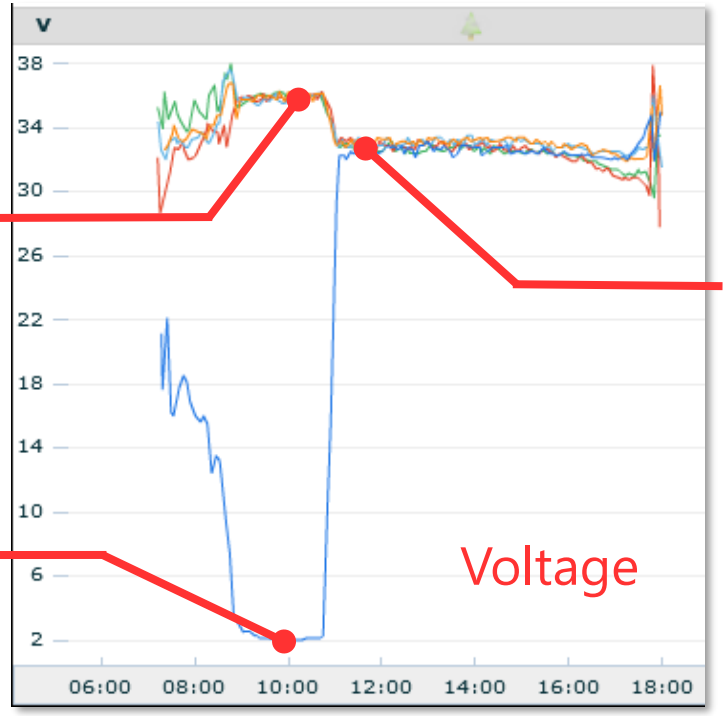
1. Check module's **Power** chart. Shading is often only occuring a certain times of the day



3b. Four Ways to Identify Shading (cont.)

2. Check the **Power Optimizer Voltage** chart (showing power optimizer output voltage)

One shaded power optimizer:

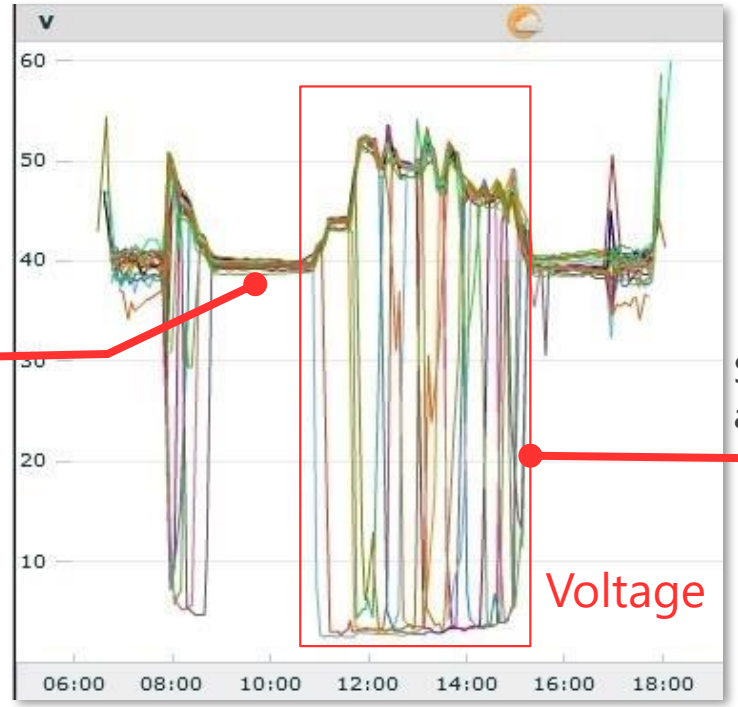


Unshaded modules will increase output voltage

Shaded modules will reduce output voltage

Shading gone after 11:00

Multiple shaded power optimizers:



Modules unshaded between 9:00 and 11:00

Shade moves across modules

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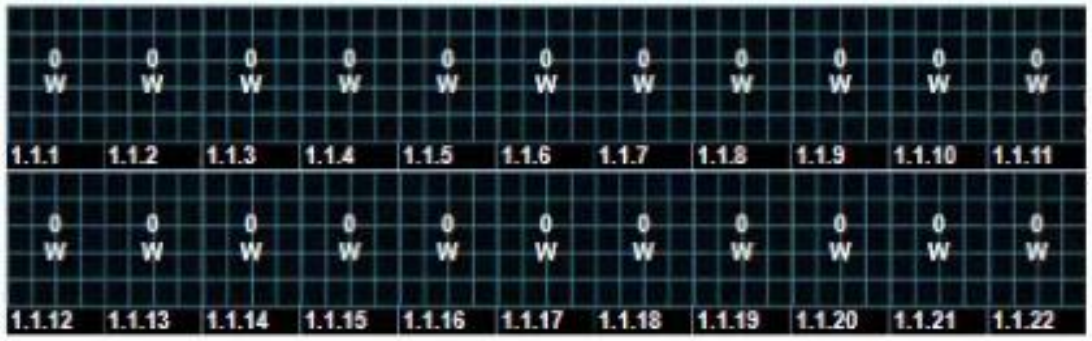
3b. Four Ways to Identify Shading (cont.)

3. Check module's **Voltage** chart (output voltage of module). Shading causes the power optimizer to pick a different MPP

Shaded module with different MPP

4. Use the Layout's **Playback** feature



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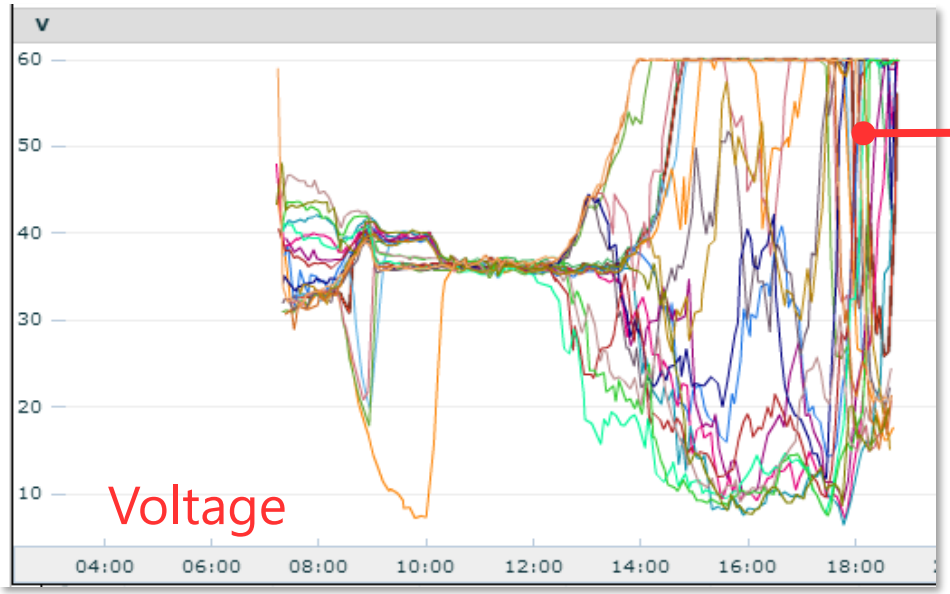
3c. Underperformance Troubleshooting



Power optimizers at max Vout
for long periods of time

They operate at their
voltage limit and cannot deliver
the modules full power ➔ They are **blocked**

Troubleshooting:
Check the design (minimum number of power optimizers per string).
Increase the number of power optimizers according to the design rules
(e.g. by combining two strings in series)

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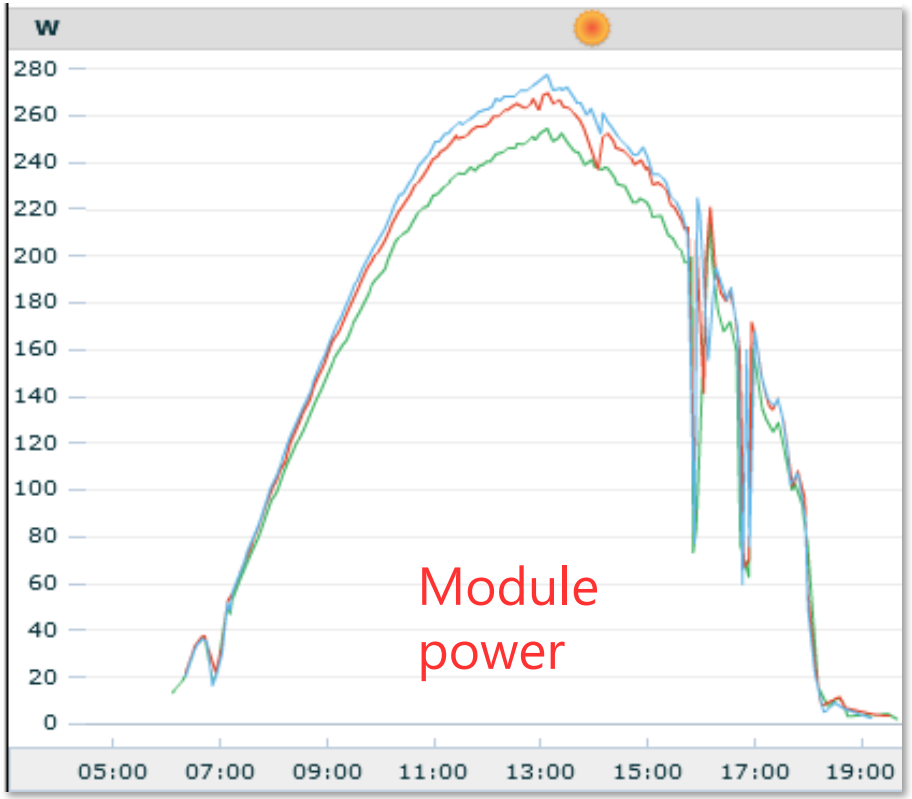
3c. Underperformance Troubleshooting (cont.)

- Module mismatch
  - Optimizers measurement tolerances will cause a slight mismatch in the charts
  - Soiling can have a strong impact on the mismatch
  - If the mismatch grows over time (measured with clean modules), it might be necessary to check the modules' IV curves



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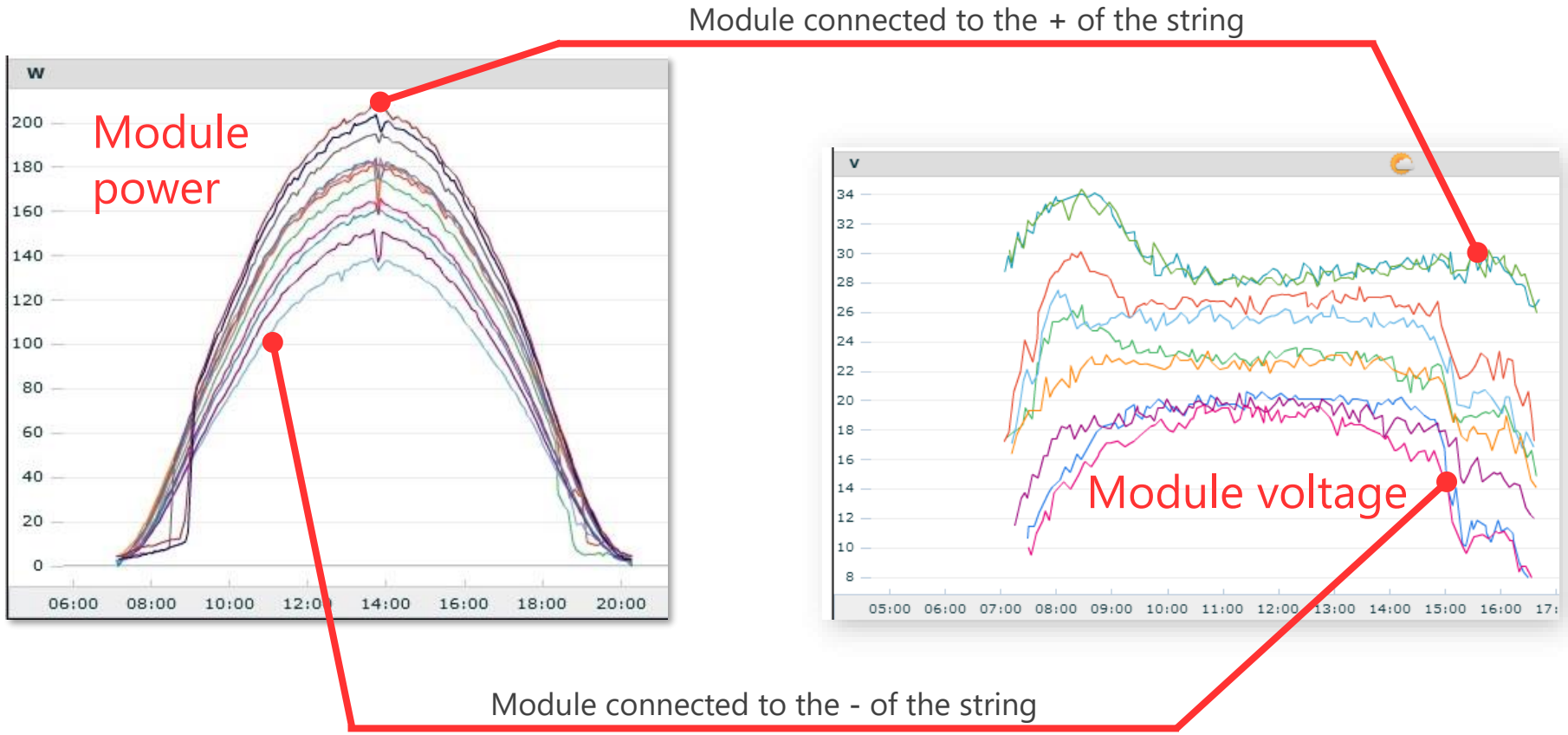
3c. Underperformance Troubleshooting (cont.)

- PID effect (potential induced degradation)
  - The module power decreases from + to - of the string ➔ Check modules



Let’s Practice!

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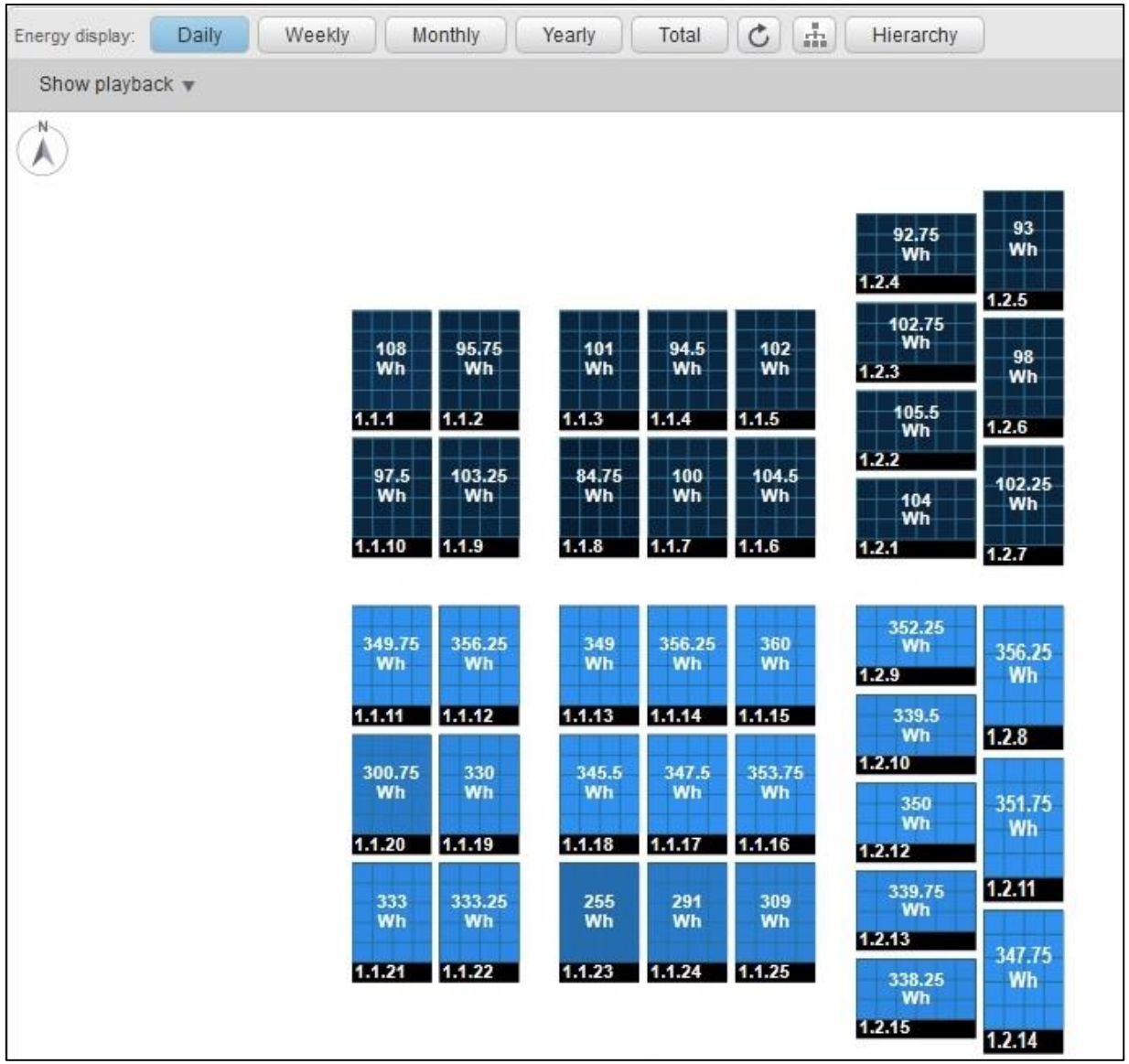
Inverter Examples

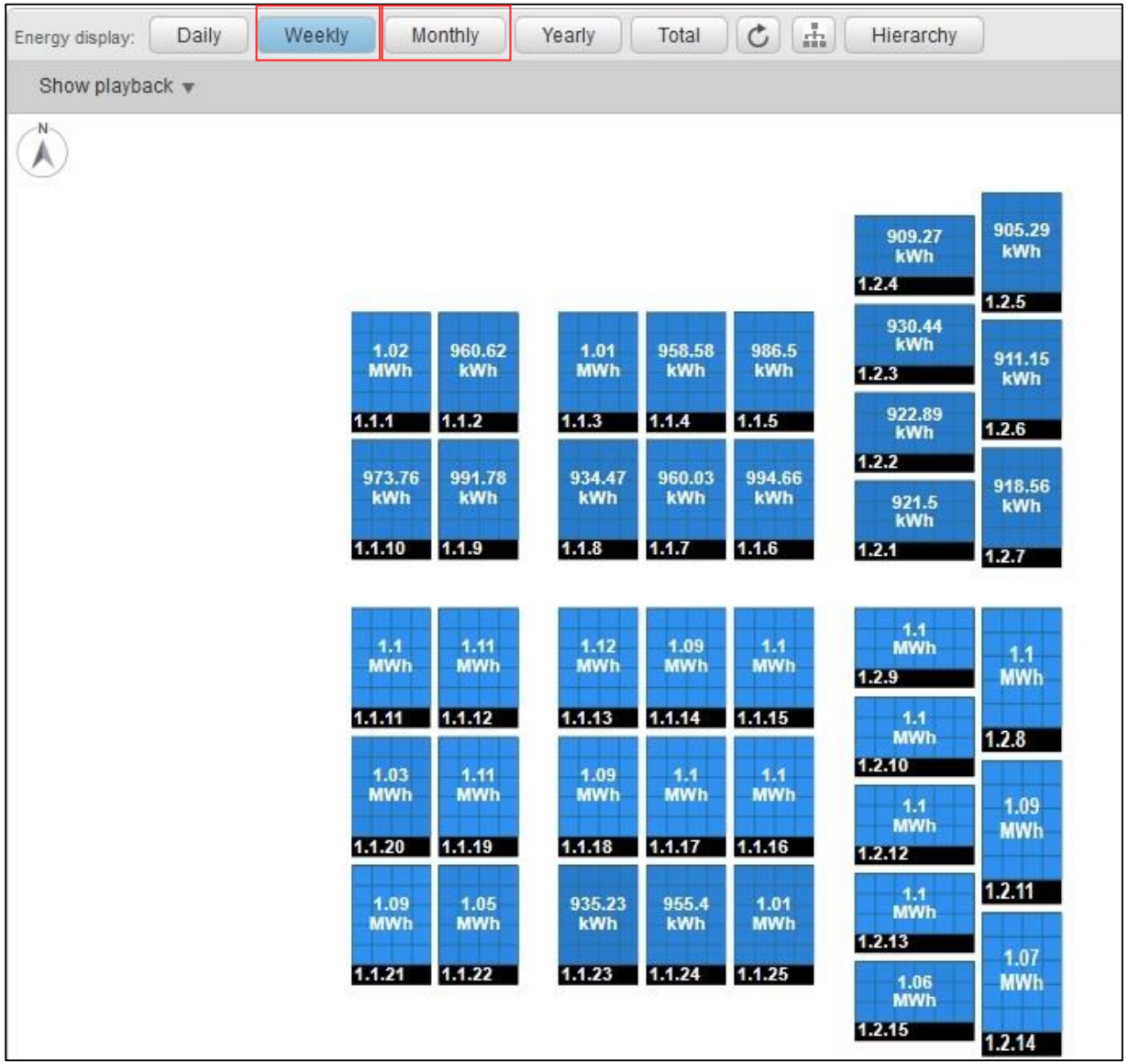
Inverter Example 1

- Underperforming string?



Inverter Example 1

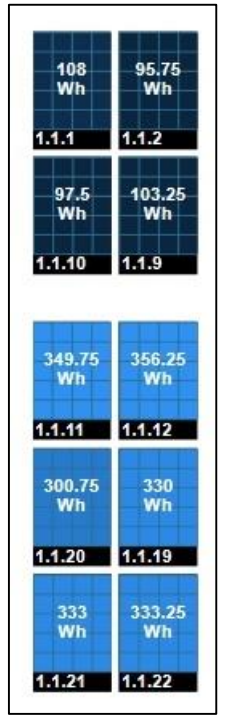
- Switching the timeframe shows that all modules produce roughly the same power



Inverter Example 1

- By looking at the module power charts, we can see that the arrays are set up in an east/west configuration

Layout view at 10:30am



Inverter Example 2

- First indication of power derating

Inverter Example 2

- Confirmation of power derating (static)
  - Inverters AC limit, configured power/current limit

Inverter Example 3

- Two inverters start one hour later than the other inverter

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Inverter Example 3

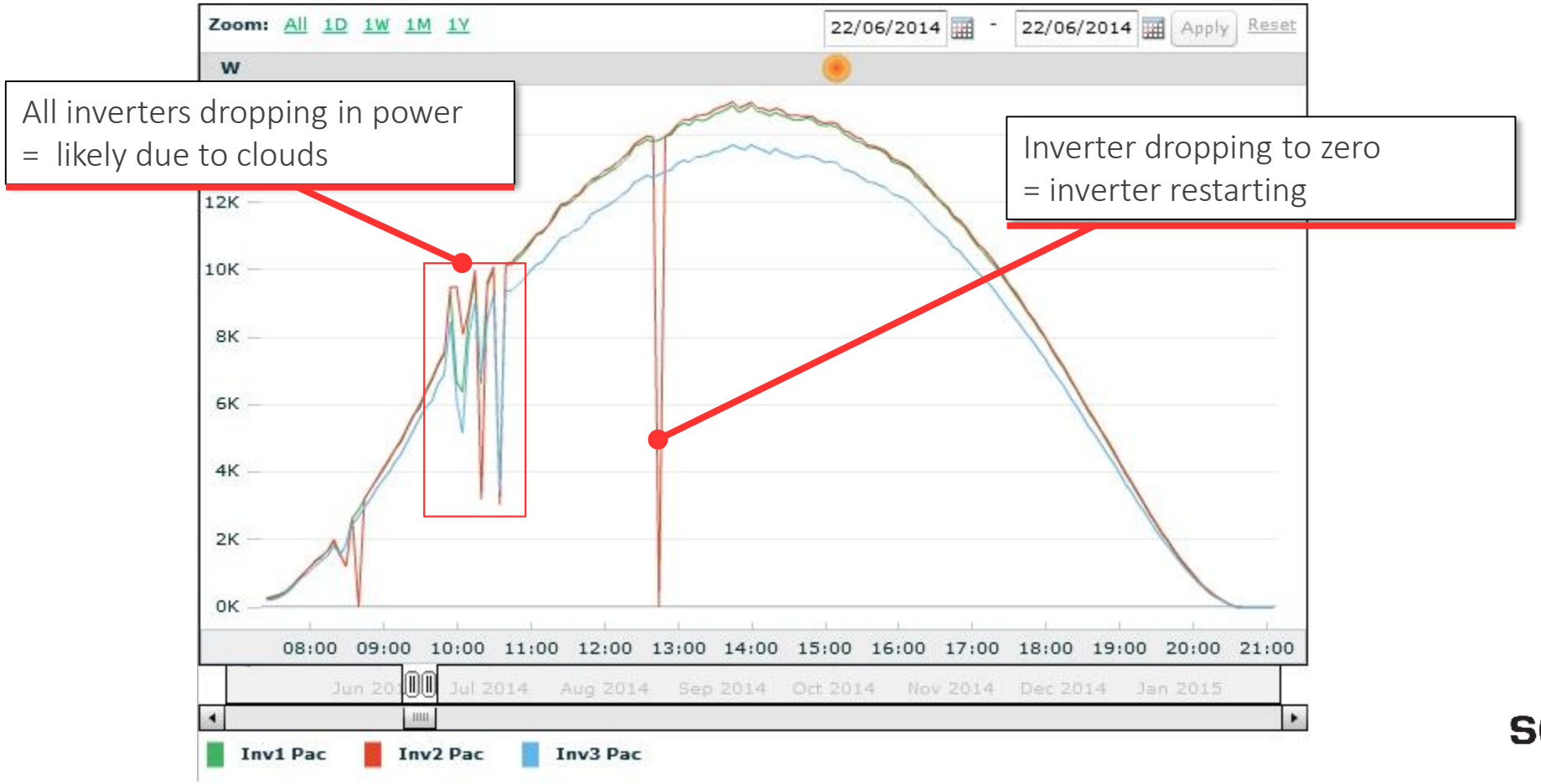
- If an inverter is not producing power, but the DC voltage remains higher than the nominal DC voltage, an inverter error is likely

Isolation Fault

Inverter Example 4

- In this example: inverter tripping due to wrong country setting

Frequency or Voltage Level



Power Optimizer Examples

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Power Optimizer Example 1

All modules are dirty

Clean modules = +12%

Dirty modules

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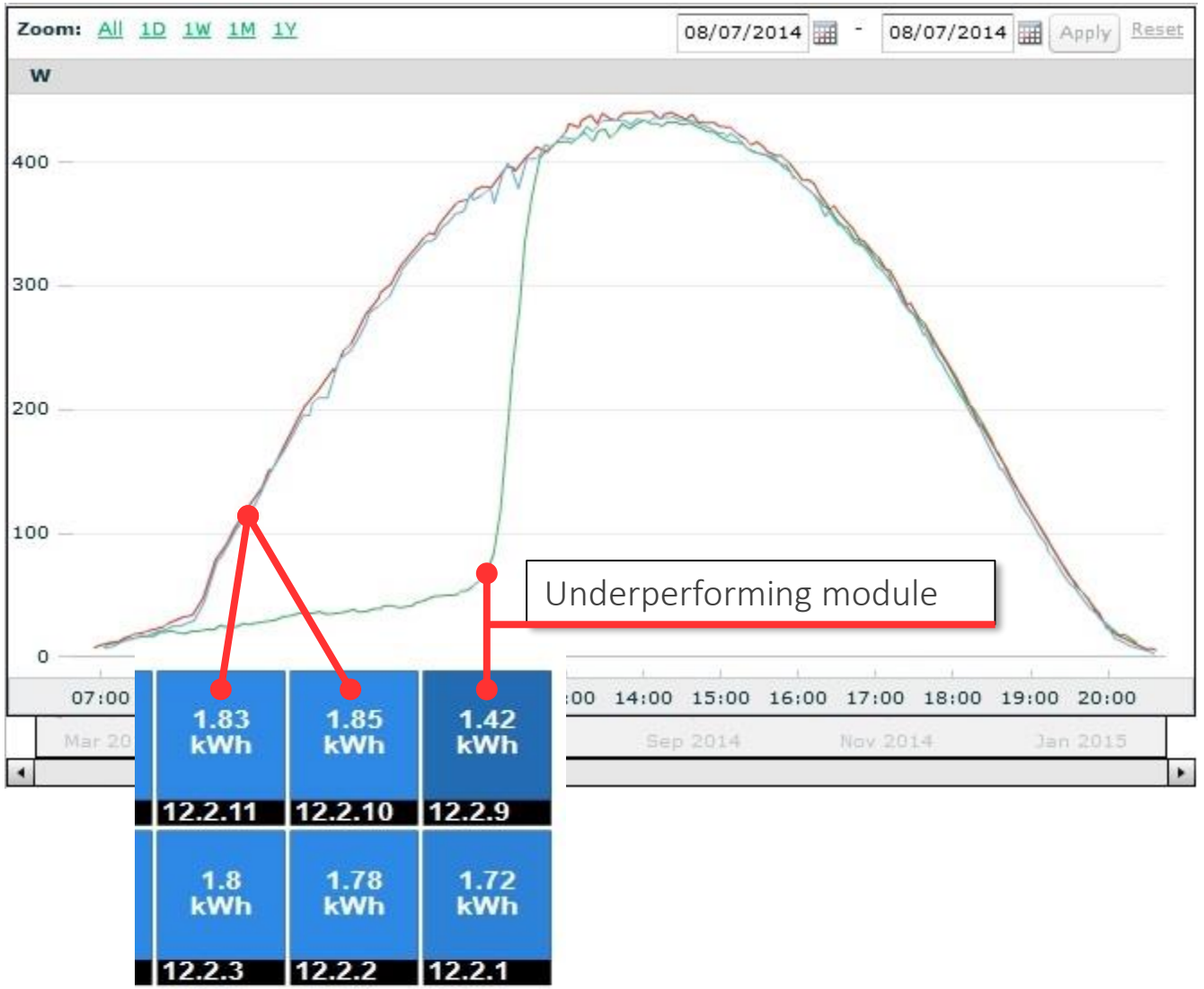
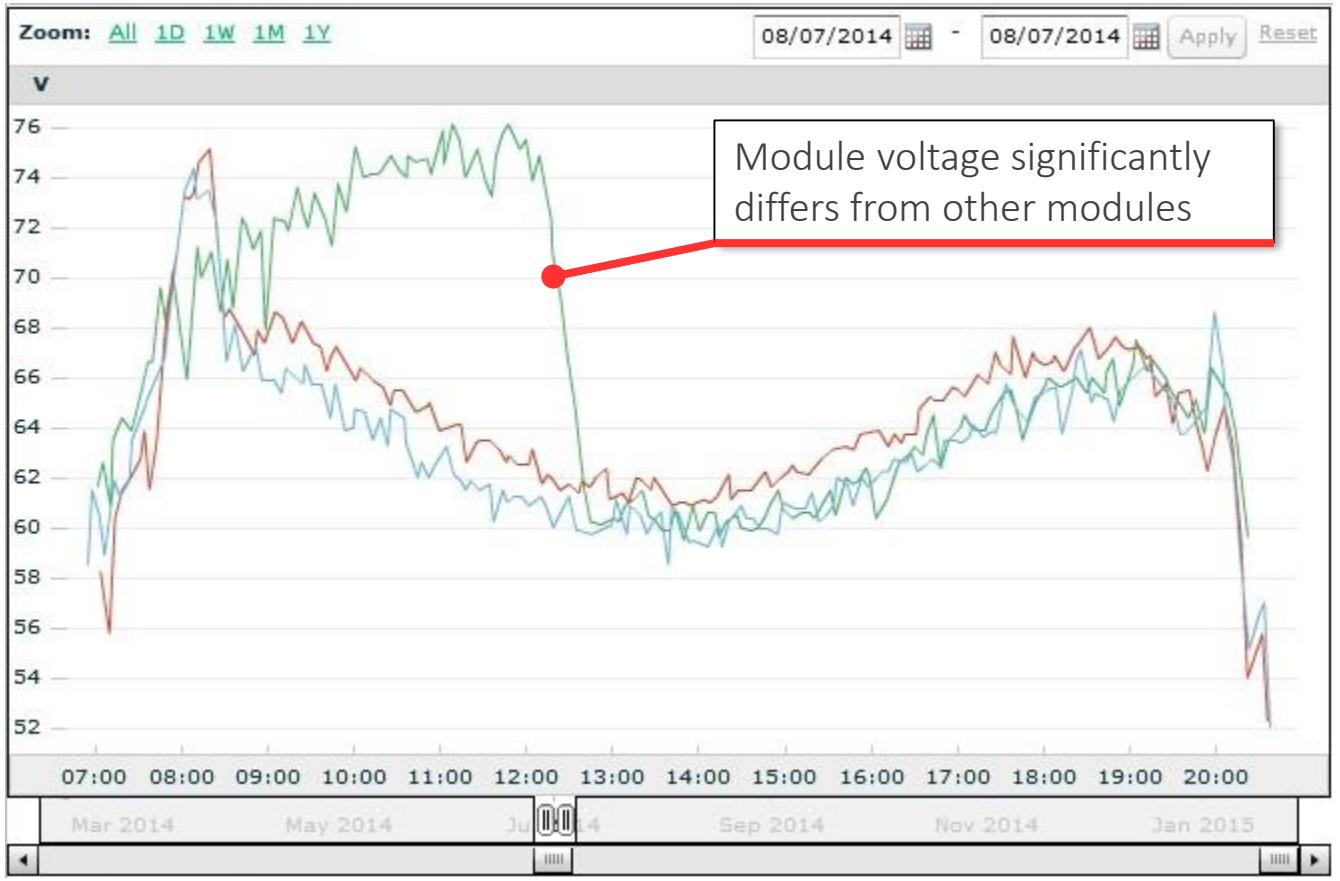
Power Optimizer Example 2



Power Optimizer Example 2

Clear Indication of Shading



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Thank You!

Cautionary Note Regarding Market Data & Industry Forecasts

This power point presentation contains market data and industry forecasts from certain third-party sources. This information is based on industry surveys and the preparer's expertise in the industry and there can be no assurance that any such market data is accurate or that any such industry forecasts will be achieved. Although we have not independently verified the accuracy of such market data and industry forecasts, we believe that the market data is reliable and that the industry forecasts are reasonable.

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