

Case Study – PID Regeneration

Description of photovoltaic power plant

| | |
|-----------------------------|-----------------------------------|
| Location: | Central Moravia |
| Installed input: | > 1 MWp |
| Connection method: | SMA 10kW decentral converters |
| PV panels: | Evergreen Solar EA-S 210Wp, 205Wp |
| Number of panels in string: | 27 and/or 25 |

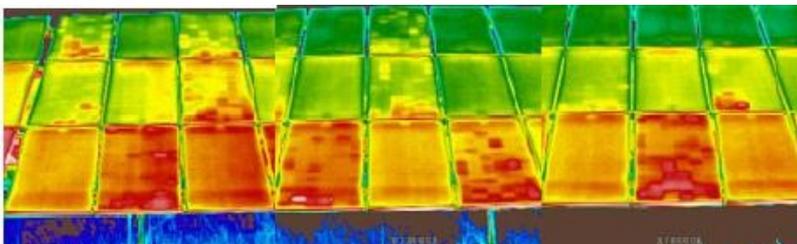
Initial condition of photovoltaic power plant (PPP)

Detailed diagnostics were carried out on the power plant prior to installation of the regeneration system. The aim was to measure panel degradation due to PID and other possible types of photovoltaic-panel defects such as hot spots, delamination, snail trails, junction box overheating, etc.

After detecting PV panel degradation caused by PID, thermovision was used to diagnose output curves (U/I characteristics) to determine the degree of PID effects and calculate the voltage drop on selected PV panels/strings.

Description of the problem

Thermovision images brought clear evidence of PID effects on approximately 1/3 of the total number of panels on the entire photovoltaic power plant (PPP). PID effects were found on up to 4–6 panels from the negative string end.



Measurements of U/I characteristics (the so-called dark method) confirmed the findings of the thermovision inspection and provided a more precise picture of how the PID phenomenon affects production in the power plant. A distinct drop in voltage between 17 and 39 percent was measured on the last panels of the negative string end. Based on these measurements and experience with the PID phenomenon, a qualified estimation was made on the **loss in output due to degradation caused by PID** on the entire PPP and its range defined as **4–6%** of the original output.

Solving the problem

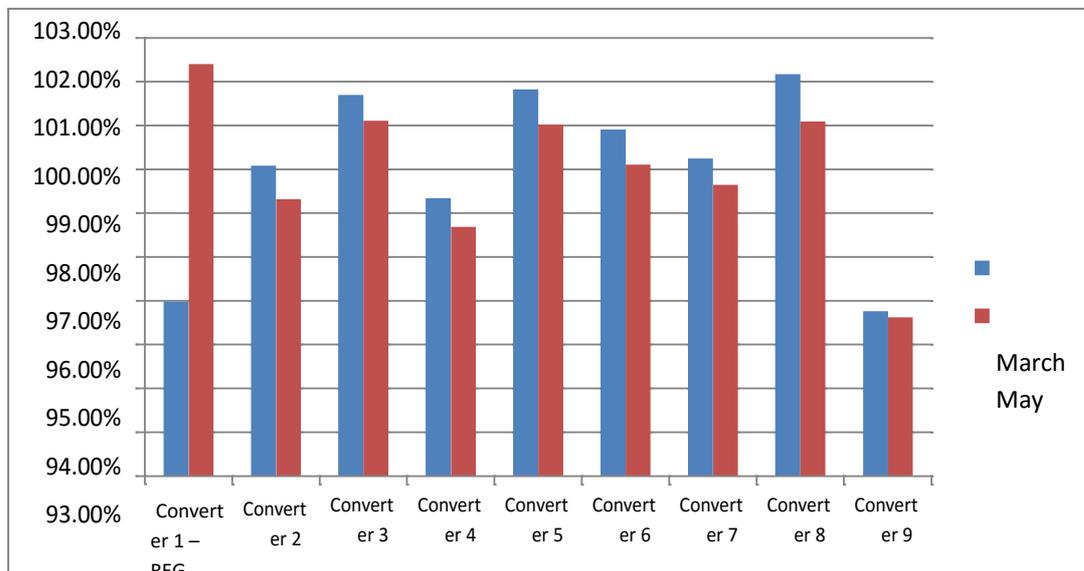
To verify the actual efficiency of the regeneration system, the PPP management decided to order a test installation on a small portion of the PPP first. The aim of this testing was to evaluate the change (production increase) achieved on the regenerated panels. A converter with the worst long-term results was chosen for the test. The EICERO PID Doctor mini system was connected between this converter and two connected strings at the end of March 2015. Other strings connected to other converters were left in their original condition without regeneration.

Evaluation of the measures taken

The efficiency of the PV panel regeneration was first evaluated four weeks after the panels were connected to the regeneration system. This short period of time was sufficient to bring about a **production increase** on regenerated panels by **almost 4.5%**.

In June 2015 the increase in panel output was measured in detail by benchmarks against production over the past months. The measurements showed that the **actual production increase achieved in May 2015 was 5.5%** when compared with March 2015, i.e. the period prior to installation of the regeneration system (see chart).

Benchmarking actual production on converters during March 2015 and May 2015.



Production on the regenerated converter is shown in column 1. The value is in % and shows the production share of the respective converter in the production average on the remaining converters.

A production increase is apparent on the regenerated converter in the period March 2015 to May 2015. The 5.5% is the growth in actual PPP production on the regenerated converter approx. one month since regeneration. The difference in power production on the different converters is shown in the table below

| Converters: | 1 – REG | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------------|---------|---------|---------|--------|---------|---------|---------|---------|--------|
| March | 96.98% | 100.09% | 101.70% | 99.34% | 101.83% | 100.91% | 100.24% | 102.18% | 96.76% |
| May | 102.41% | 99.31% | 101.11% | 98.69% | 101.02% | 100.12% | 99.64% | 101.10% | 96.63% |
| Total change | 5.43% | -0.77% | -0.59% | -0.65% | -0.81% | -0.80% | -0.60% | -1.08% | -0.14% |

Evaluation and conclusion

The Return on Investment (ROI) on this particular PPP is approx. 1.5–2 years.

The ROP calculation takes into account the average annual revenue for produced power and its increase thanks to the restoration of the original output of degraded PV panels, as well as the losses due to progressing PID degradation if no corrective action were taken.

The net investment yield after three years will reach almost 70%.

The investment will generate over CZK 2 million over 10 years.

The well-functioning solution, with the clear and realistic production increase on the regenerated converter and the satisfactory return on investment convinced the owner of this PPP about the benefits and economic sense of permanently installing the Eicero PID Doctor system. As a result, a decision was made to install this regeneration system also on the other converters in the PPP.

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