

Potential Induced Degradation

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Abstract—This thesis has been made to owners of solar panels aware of the PID problem and to demonstrate the operation of a PID-box mini from Ilumen.

I. INTRODUCTION

Potential induced degradation (PID) is a complex problem. To verify where PID evolved and its reasons, is made a test case with at least 30 randomly selected test sites. The owners of these test sites noticed any problems or losses. As a solution, the PID-box mini from Ilumen is used. So the operation of the PID box will be proved/disproved.

II. TESTCASE

This test was carried out at 31 places, in order to obtain a relevant average. First, there is executed an IV-curve measurement, in order to examine how the plants, work after a couple of years. After this measurement, is placed a PID-box mini of Ilumen for 3 to 4 weeks to do its job. After this period, a second measurement is done in order to evaluate the improvement by the installation of the PID-box. These results can then be compared with that of the first measurement and the reference value of the panel.

III. RESULTS TESTCASE

The results of the test case are surprising. The owners noticed any problems or losses, but each plant that was measured, had a loss in power output. So the PID-box has a positive effect on each installation to the performance.

A. Degradation model

With this information from the measurements has been made a degradation model for 20 years, in Figure 1. The blue dots are measured points from the test cases, the red ones are theoretical values. This is an average, but real degradation curve, based on previous research [1].

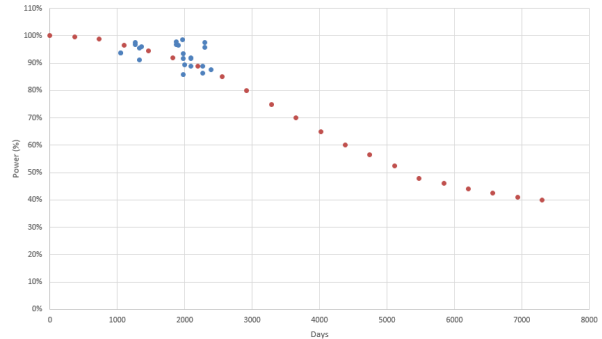


Fig. 1. Degradation model for 20 years.

B. Financial

The measurements shows that the average system was installed in 2010, equivalent to certificates of €350/1000kWh. If this is combined with the prediction of the degradation, current energy price (€0,23/kWh), average yield of a PV plant (5500kWh/year) and the price of a PID-box (€699). The average payback period will be less than 3 years. When the same situation is used, but at a new PV plant (means without support from certificates). The result is that the payback time of a PV plant is shortened with the installation of a PID-box and after 20 years, an average profit of just under €7200 will be obtained.

C. Power profit range

The average, minimum and maximum improvement in power is displayed in Figure 2. At each installation will be a profit of electricity production. Which ensures that there are more certificates/year that can be obtained. This results in a quick return of investment for a PID-box.

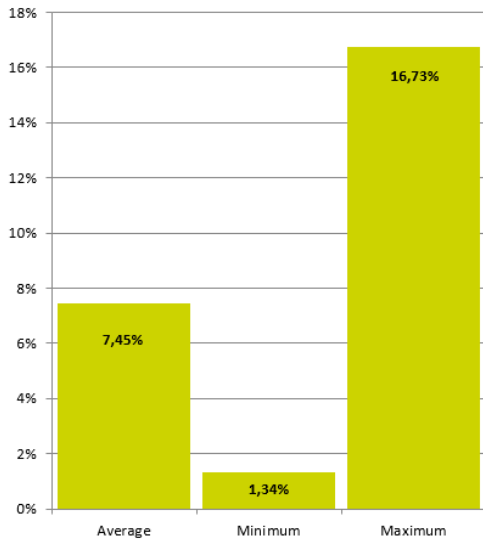


Fig. 2. Power Profit (aver. min. max.)

D. Average yield with and without a PID-box

The average power is increased by placing a PID-box. The red bar is without PID-box, green is after installing a PID box. The power with PID-box rises just above 100%, this is possible because panels have a certain margin of eg. +/-5%.

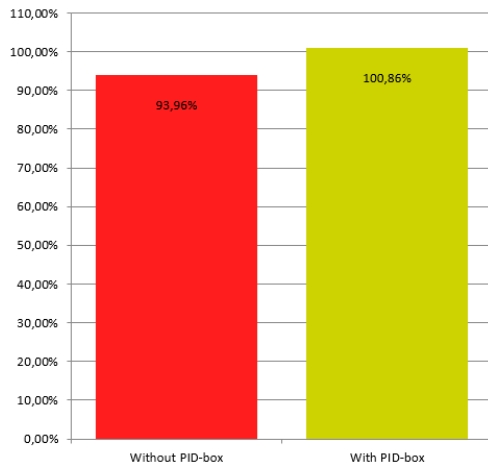


Fig. 3. Average yield with and without a PID-box.

E. Power Profit test cases

The profit rate of the test sites is between 1.34% and 16.73%. These are shown in Figure 4. The age of the plants is between 1 and 7 years. If the age is compared with the rate of efficiency, it is not true that the oldest plant has the most PID. There are a lot of parameters that play such as cell quality, panel building, system configuration. These are discussed in the literature [2].

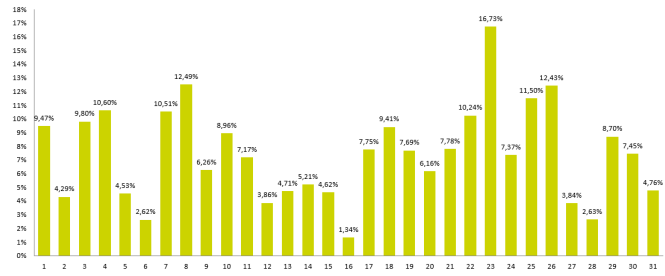


Fig. 4. Profit of each installation by installing a PID-box.

IV. CONCLUSION

This research was started from regular PV installations whose owners noticed any problems or losses. The results prove the opposite, as the average profit with the PID-box is approximately 7.5%, and there was an improvement in every installation that was measured.

There will be a lot of green power lost before you notice any problem. Measured plants were working at an average yield of 94 % compared to the reference, with the PID-box this is increased to 101% (This is possible because solar panels have a margin of eg. +/-5% yield).

Therefore it's advisable for every PV installation, new or existing, to place a PID box. Because the loss is very difficult to notice (when the efficiency drops 1-10%) without extensive measurements. Also the lifetime of the PV system extends by the placement of a PID-box.

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