NEW TECHNOLOGIES' PERFORMANCE AT TRACTEBEL ENERGIA'S PHOTOVOLTAIC PLANT NOW MONITORED BY ELIPSE E3

Technologies tested at Cidade Azul Photovoltaic Plant are now monitored by Elipse Software's solution, which contributes to meet Aneel's Strategic R & D premises to detect the best technologies for photovoltaic energy in Brazil

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Needs

In 2011, Brazil's Aneel (Brazilian Electricity Regulatory Agency) released the Public Call for Strategic Research and Development (R&D) Projects 013/2011 – *Technical and Trade Arrangements for Inserting Photovoltaic Solar Generation into the Brazilian Energy Matrix,* which requested electric energy companies to present their R&D projects focused on this area.

Tractebel Energia proposed a very innovative project, alongside 12 other companies in this field, which aims at evaluating seven different types of photovoltaic generation technologies in eight different climate zones in Brazil, among other goals. Additionally, it will also evaluate three of the more popular technologies in the world by using them in a 3,0 MWp plant.

For this, the first step of this project was taken in May 2014: the Cidade Azul Photovoltaic Plant (CAPP) was built by Tractebel Energia in Tubarão, a town in southern Brazil that is 65 miles away from Florianópolis. Placed on a 10-hectare area, six of which comprise only solar panels, the CAPP is the largest photovoltaic plant in the country and uses three different technologies: Amorphous Microcrystalline Silicon (a-Si/μc-Si), Copper Indium Gallium Diselenide (CIGS), and Polycrystalline Silicon (p-Si).

Figure 1. Plant's overview

Each technology was used when creating the three different PV panel modules at the plant. Around R$ 30 million (U$ 11 million) were invested by Tractebel Energia, the largest private sector generator in Brazil, when building the CAPP, which is capable of generating up to 3 MWp (mega Watts peak) on heavily sunlit days.

However, it was also important to be able to count on a tool that could remotely control the different electrical magnitudes and devices involved in photovoltaic generation. For those purposes, Tractebel Energia decided to adopt Elipse E3, a solution developed by Elipse Software, and indicated and implemented by Vieira-Ishikawa Software.

"We've decided on Elipse E3 because it was indicated by Vieira-Ishikawa, and because we had a positive experience when using this technology in our other plants," replied Jefferson Silva de Oliveira, Tractebel's plant manager, when asked why the company had chosen this software solution.

Figure 2. The plant's automation network's architecture

Solution

E3's screens and commands are accessed via two computers installed in the same operations room where Tractebel's Jorge Lacerda B Thermoelectric Plant (JLBTP) is controlled. This room is located in Capivari de Baixo, a town next to Tubarão, and these plants' shared access represent great cost savings for Tractebel, because this means the company is able to use the same maintenance team for both places, and because controlling CAPP from afar means supervising the plant with no need for crossing the road to another town for its maintenance.

Figure 3. Enginner Júlio Albien and the two computers accessing CAPP's E3 application; JLBTP's control screens on the background

Via software, the operators of JLBTB plant (40 altogether, divided into five shifts of eight people each) have a broad view of the photovoltaic plant. The application comprises two main screens. The first one reveals the complete electric system with the main buses and connection points in an alternate current. On it, both medium and high voltage can be viewed all the way to the connection to CELESC (Centrais Elétricas de Santa Catarina, the local electricity utility) network.

The second one displays everything pertaining power inverters and boards, each comprising one of the three different technologies used in the plant. The photovoltaic boards generate energy in a continuous current, which is converted into an alternate current by the inverters. Once converted, the energy can then be distributed to Tubarão and nearby towns by CELESC. The temperature of the transformers' windings is also monitored on this screen, as well as the UFCA breakers and sectionalizers.
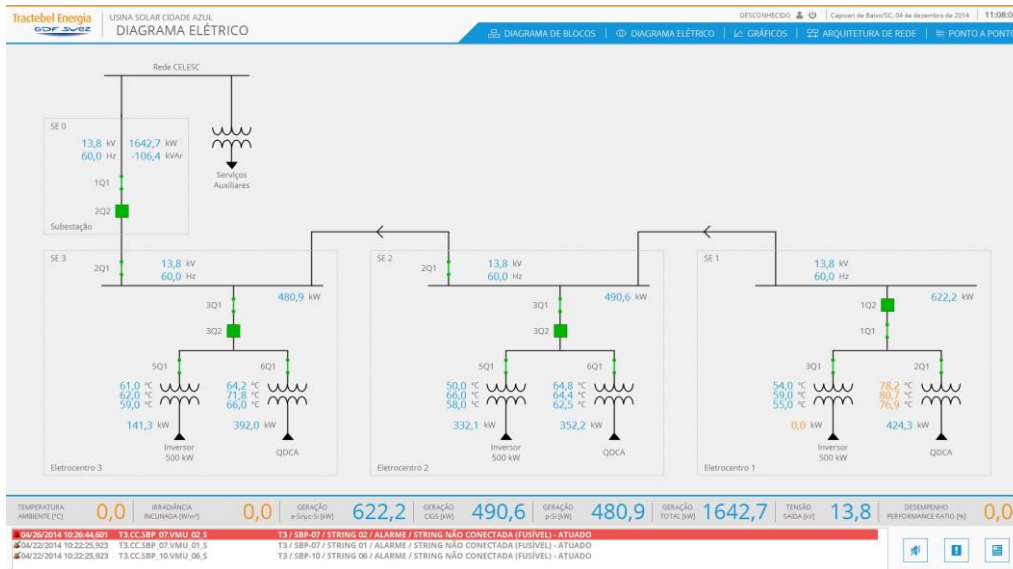
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Figure 4. The plant's electric diagram screen

On this screen, there is also a representation of the distribution cubicles, each associated to one of the three available technologies. On its footer and other screens, the operator has access to the energy values generated by each module, as well as the total amount of energy generated by the CAPP. Thus, it's possible to check and compare the performances of the three technologies, as well as of the plant as a whole.
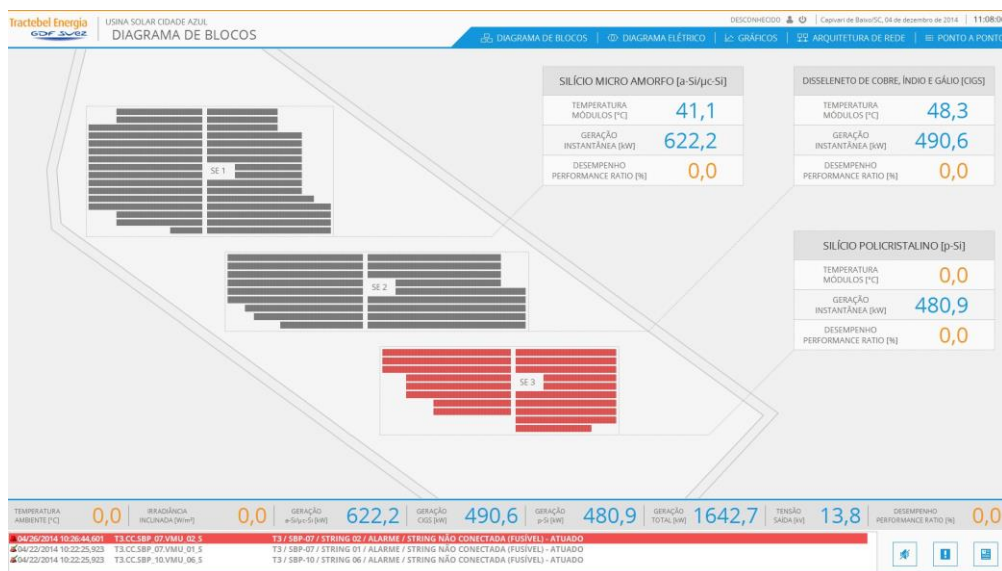

Figure 5. Screen displaying the three PV boards modules, as well as their energy levels and temperatures

In addition to these, the software also provides other screens with more detailed information on each technology's behavior. On the screen above, displaying the three modules of the plant,

when the operator clicks on any of them, a new screen will pop up with exclusive information on the module. On it, the operator can monitor the energy generated by the relation of the technology used in that module with different inverters, with 500 kW, 165 kW, 55kW, and 10 kW. Thus, they can evaluate not only the module's technology performance, but also how it behaves with the different types of inverters being used.

Figure 6. Screen displaying the energy generated by polycrystalline silicon boards with three different inverters, with 10, 165, and 500 kW

Additionally, Elipse E3 has another screen displaying all levels of frequency, voltage, current, and potency measured with each of the inverters present in each of the three modules. It is also possible for the user to monitor a single inverter in details.

Figure 7. Set of inverters associated to the polycrystalline silicon boards

For further information on one of the 22 inverters illustrated above, for example, the user only has to click on the one they wishes to specifically monitor. Having done so, a new screen will pop up with not only the inverter, but also the corresponding stringbox and its strings, a set of PV boards serially connected that feed the inverter so it can convert the energy generated by the boards from continuous to alternate.

Figure 8. IP-23 inverter's monitoring screen related to 10 strings

The software also features an alarms history. With it, the user can check all alarms selected within a time interval, with details related to any type of failure in the plant. In case there is any issue, the occurrence will be highlighted in red by E3, as seen in figures 5 and 6.
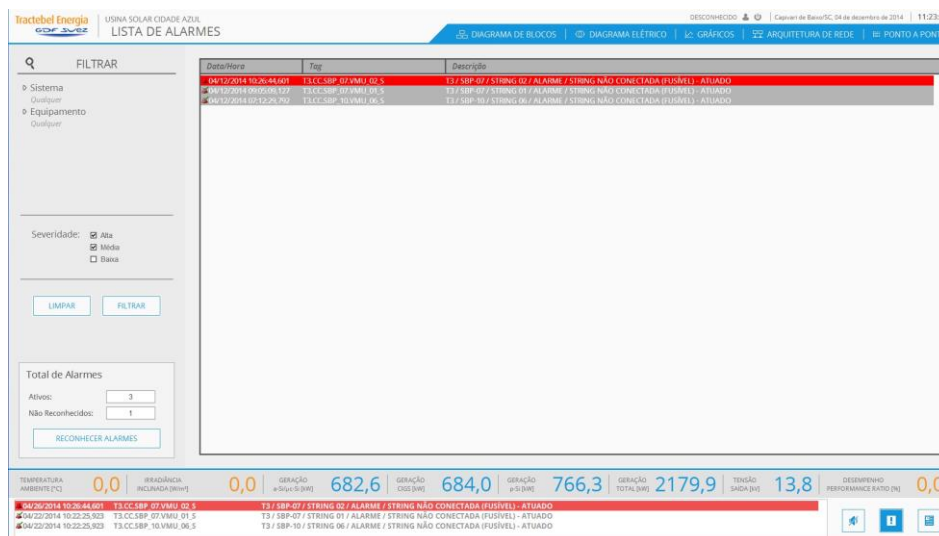

Figure 9. Alarms history

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Once the problematic area is singled out, the user will just have to click it and browse the screens until the occurrence's original source, in order to diagnose it and fix it as soon as possible. Additionally, the system will issue graph reports through which it is possible to view and evaluate the generating capacity of the three technologies and of the whole plant as well, in any time interval.
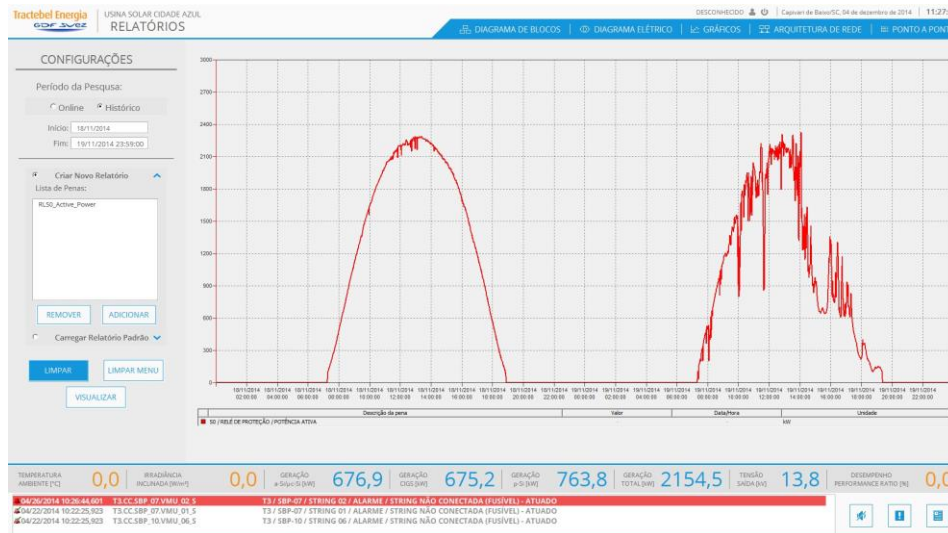

Figure 10. Energy generated by the plant from 2 AM 11/18/2014 to 10PM 11/19/2014

Benefits

For Júlio Albien, JLBTB's and CAPP's operational engineer, Elipse E3's greatest benefit was providing Tractebel with a solution that performs both macro and micro supervision, which allows browsing between screens just like it was zooming each of the plant's devices. According to him, this application was perfectly tailored for CAPP, with a friendly interface and juxtaposed screens.

"This plant is very large and complex; however, thanks to Elipse E3, you can visualize all parameters simultaneously, comparing different technologies remotely, with no need to leave the operations room," said Albien.

The remote control was also praised by Jefferson Silva de Oliveira, the plant manager.

"Providing Tractebel with a remote, broad supervision process of the plant, thus facilitating its operation and maintenance, was the main benefit provided by Elipse E3," said Oliveira.

See below the complete list of benefits:

- Less man-power needed, since both JLBTB and CAPP are controlled in the same room and by the same team, which consequently leads to more cost savings.

- Remote control of all modules and devices at the plant.

- Juxtaposed screens, which makes browsing easier.

- Friendly, intuitive interface.

- Energy sample generated by all modules, allowing comparisons between each of the three technologies being tested at the plant.

- Frequency, voltage, current, and power output of each inverter at the plant are easily accessed, which permits evaluating the best technology for each scenario.

- Reduced time for diagnosing issues at the plant via E3's alarm system.

TECHNICAL INFORMATION

Client: Tractebel Energia

Systems integrator: Vieira-Ishikawa Software

Elipse package used: Elipse E3

Platform: Windows Server 2012

Number of copies: 7

Number of I/O points: 7500

I/O drivers: DNP3.0 Master and Modicon Modbus TCP Master