Case Study

Addressing Harmonic Distortion & Reactive Power from Solar Panel Installation on Rooftops of Industrial Buildings

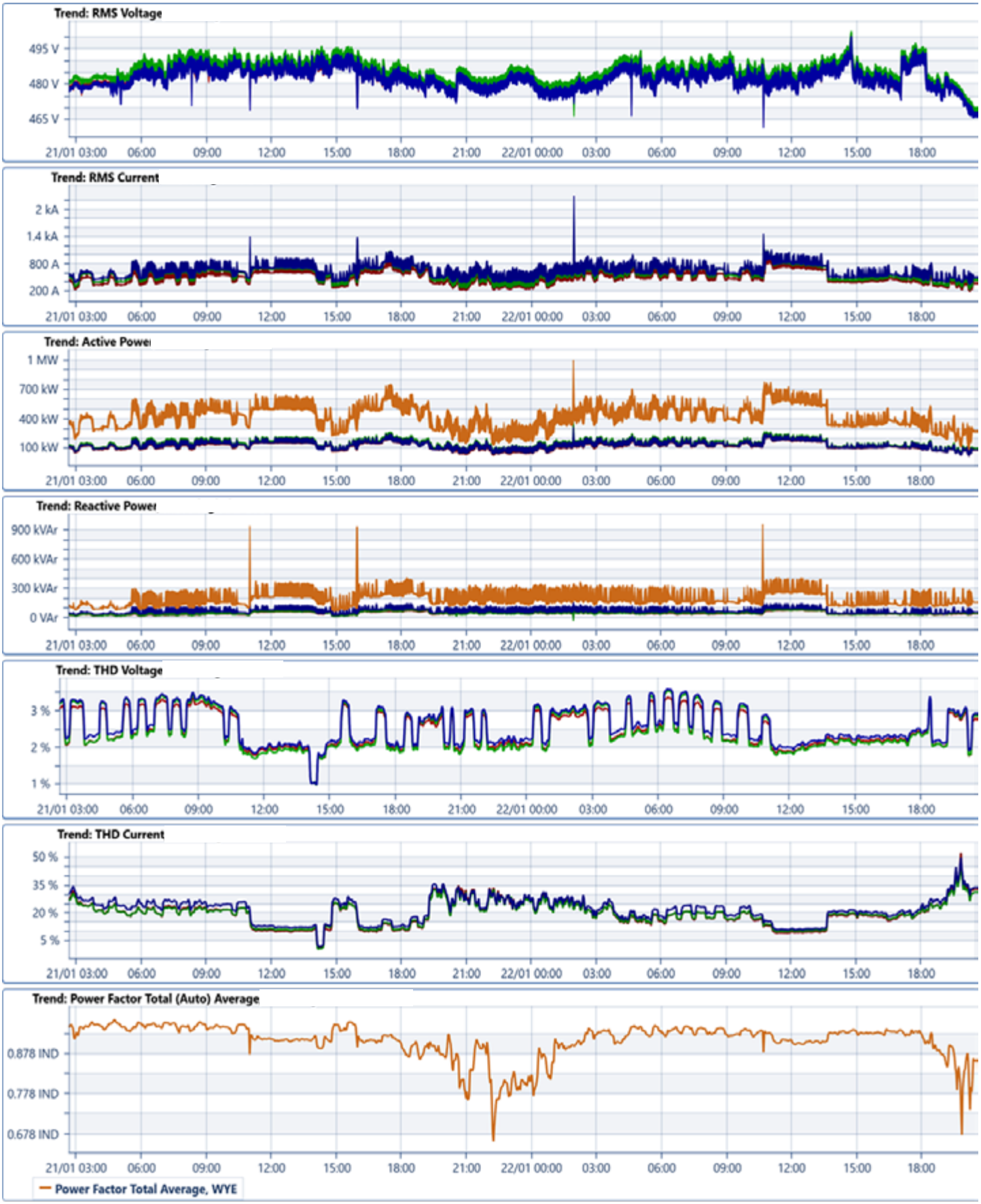
Photovoltaic solar systems installed on rooftops are prevailing as an alternative source for electricity. As the use of Photovoltaic solar rooftops grows among the industry, new challenges for reactive energy compensation and harmonic filtration arise.

Customer Situation

A cold food storage facility in the Philippines recently implemented solar panels on its roof to enhance energy efficiency. However, the adoption of self-generation systems such as PV solar feeders has led to an increase in harmonics within the network. Additionally, it has impacted the balance between active and reactive energies drawn from both the grid and the PV system. This shift has raised concerns about equipment performance and longevity and potential penalties associated with poor power factor and harmonic distortion.

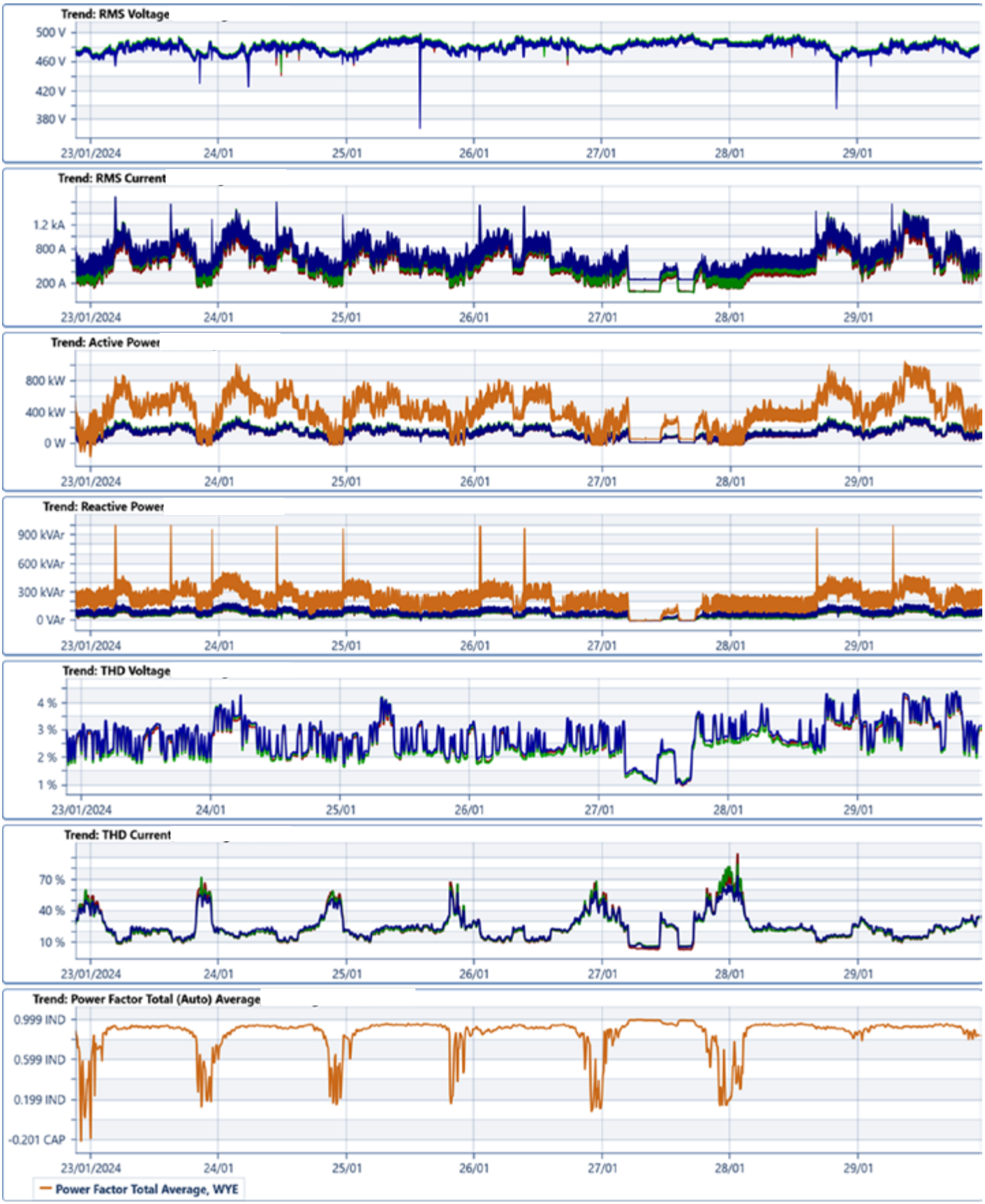
Prior to the installation of the solar panels, the voltage in the facility averaged around 480V, occasionally dropping to 465V every few hours. Reactive power consumption was approximately 170kVAr, spiking to as high as 1000kVAr. Total Harmonic Distortion in voltage (THDV) was measured at around 2.5%, with peak values reaching 14.44%, while THD in current (THDI) was around 20%, with occasional spikes to 50%. The power factor stood at 0.91.

Before the Solar Panels installation



After installing the PV solar panels, the average TDHV was 2.67 and the maximum THD values for voltage rose to 20%. The average THDI increased to 24%, with peaks above 80%. These fluctuations in THD parameters also had an impact on voltage levels, with minimum values dropping to 367V and maximum values rising to 500V. Furthermore, the power factor decreased to 0.89.

After the installation of the Solar Panels



The introduction of the solar panels had a detrimental effect on the power quality of the storage building, necessitating prompt action to rectify the situation and improve key performance indicators.

The Solution

Ozmik Solutions Incorporated, the agent of Elspec in this region of the Philippines, conducted a comprehensive investigation using Elspec's advanced power quality analyzer equipped with continuous waveform recording capabilities. Following an in-depth analysis of the data, they proposed the implementation of Elspec's 330kVAr detuned 7% Equalizer power quality solution. This power quality solution utilizes thyristor switching technology, guaranteeing seamless and transient-free operation. Capacitors are connected at zero-crossing points, facilitating rapid adjustment with a full acquisition time of less than one cycle.

Results

Installing Elspec's Equalizer systems reduced reactive power in 77% from 174kVAr to 39kVAr. Max reactive level dropped from 1000kVAr to 500kVAr. Harmonic Voltage (THDV) was reduced to 2.27% and Harmonic Current (THDI) was reduced to 17% in average, Maximum THDI was reduced to 26%. Voltage was stabilized around 485V and Power Factor was improved to 0.994.

Conclusions

The implementation of Elspec's Equalizer systems yielded significant improvements in power quality parameters at the cold food storage facility. The reduction in reactive power consumption by 77%, from 174kVAr to 39kVAr, demonstrates the effectiveness of the solution in optimizing energy usage and minimizing wastage.

Furthermore, the reduction in Harmonic Voltage (THDV) to 2.27% and Harmonic Current (THDI) to 17% on average, with a maximum THDI reduction to 26%, highlights the system's capability to mitigate harmonic distortions effectively. This reduction in harmonic distortions contributes to enhanced equipment performance and longevity, minimizing the risk of downtime and equipment damage.

Additionally, the stabilization of voltage levels around 485V and the remarkable improvement in Power Factor to 0.994 signify a more stable and efficient electrical distribution system. These improvements not only enhance the reliability of operations but also lead to potential cost savings through reduced energy losses and penalties associated with poor power factor.