The downloading, analyzing and reporting of power quality data

When trying to understand energy consumption or power quality issues in your facility, you need data. Measurements are the ideal form of data, but you must then turn that data into useable information. That process is most commonly referred to as analysis and reporting. The analysis takes the raw data and turns it into a 'story' of what has been happening on the power network or in the facility, and the reporting function develops the story into information that can be acted on.

When performing this analysis it is often important to have information that can be understood by a range of people, not just experts in energy consumption or power quality. Typically, more than one stakeholder is involved in a particular scenario, which requires technicians and engineers to be able explain their analysis in a number of ways. For example, if you work for a power utility and have a complaint from a customer about their intermittent power, they will likely want a simplified, quick answer and resolution of the problem.

By sharing the information, you can reassure the customer that you have found the problem and have come up with a solution. These five steps help simplify and automate the analysis and reporting process:

1. Download the data

This may involve connecting to the instrument using a USB cable, Ethernet cable or a wireless connection. Alternatively, it may be possible to get the data onto an external device such as a USB thumb drive or SD card. The wireless download and USB thumb drive options are particularly convenient and allow for more flexibility in data collection.

2. Collate the basic information

The basic information includes:

- A reference to the site where the data was collected
- A brief description of the reason for the measurement campaign
- Details of the instrument and the instrument settings, including any details of current probes or other accessories that are being used
- The measurement settings, including:
  – Nominal voltage and frequency
  – Circuit type (single or three phase, delta or wye)
  – The date and time of the start and end of the measurement campaign
  – The selected measurement average periods
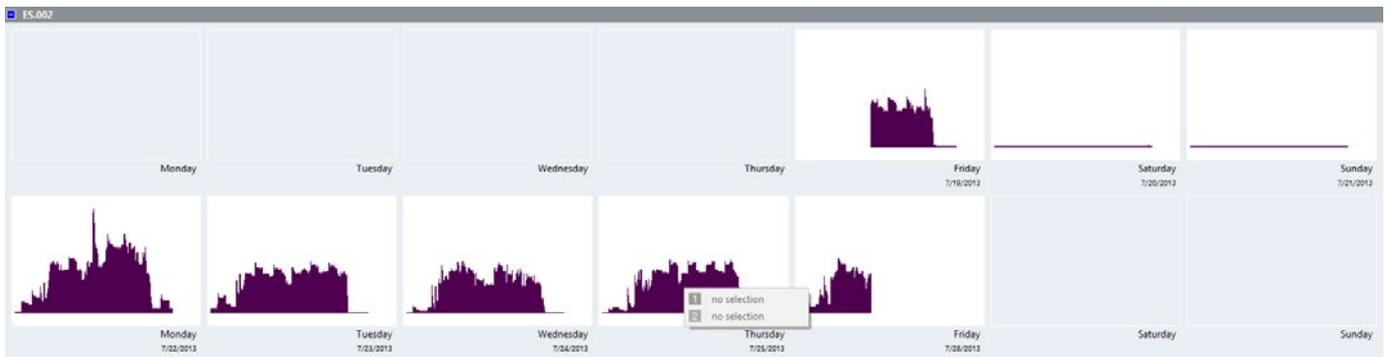
Figure 1. Calendar overview of energy consumption as seen in Fluke Energy Analyze Plus
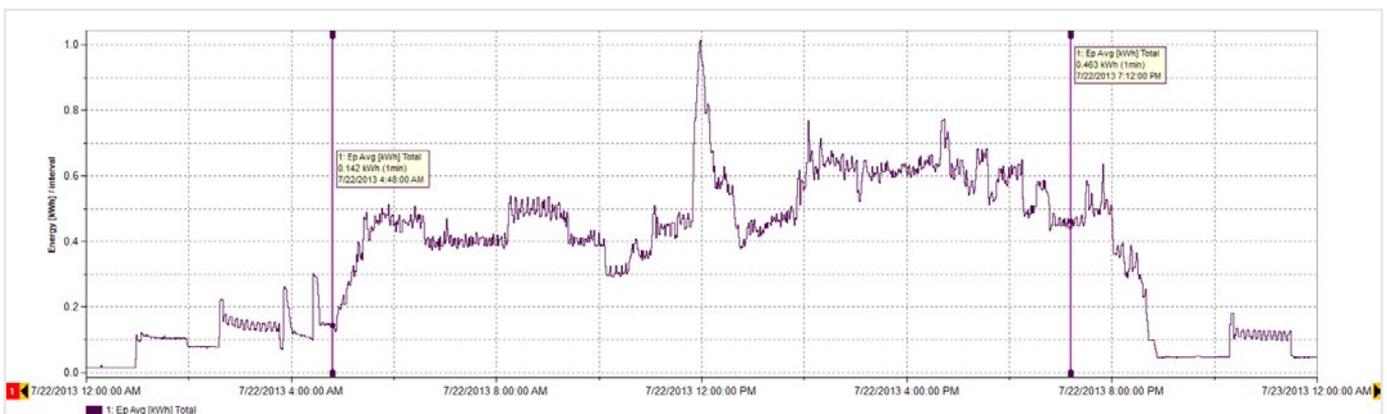
Figure 2. Energy consumption details for Monday (as seen in Figure 1)

3. Develop a data overview

Take a broad look at the data to see if there are obvious patterns. A simple calendar overview like the one depicted in Figure 1 can quickly illustrate the rhythm of the energy usage in a facility. This example data is taken from an industrial facility that produces timber frames, and shows how each working day starts and ends, as well as the decrease in energy consumption during weekends.

Once we have an overview, it's possible to drill down to a more specific level of detailed data. With the data in Figure 1, for example, we see that the highest energy consumption seems to occur on Monday, so we can look at that particular day in more detail (Figure 2).
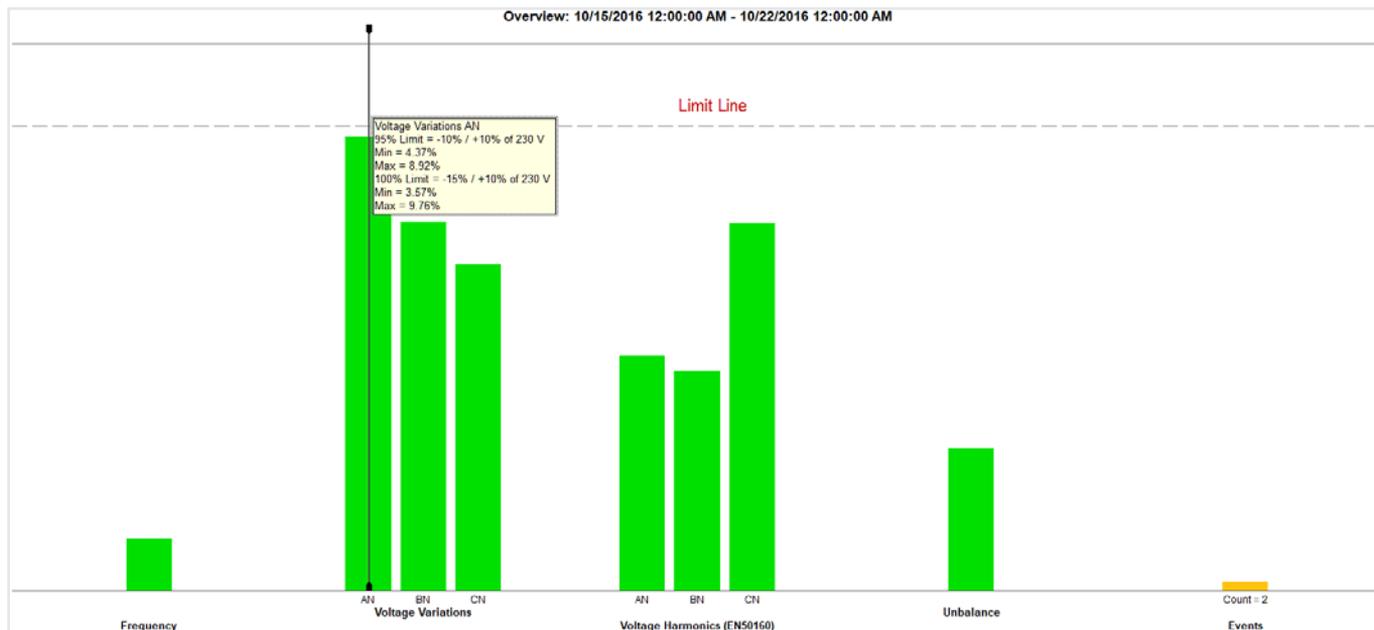
Figure 3. Power quality summary can provide very detailed information in a single simple view

4. Provide a power quality (PQ) summary

Figure 3 shows the key power quality variables against a set of pre-defined limits (in this case EN50160). The standard compares frequency, voltage variations, voltage harmonics, unbalance and events. For harmonics, each individual harmonic up to the 25th has a different allowable level; harmonics above the 25th do not have a limit as they are usually considered to be negligible.

Events take into account dips, swells and interruptions, which are simply counted for evaluation. A vast amount of data and evaluation is behind all of the green bars represented in the graph. This summary is a powerful tool in understanding the state of health of the electrical system.

In Figure 3, we can see that the voltage on phase A (L1) is close to the pre-defined limit line. It's possible to see more detail of the voltage on phase A (L1) by viewing a trend of the voltage (Figure 4).
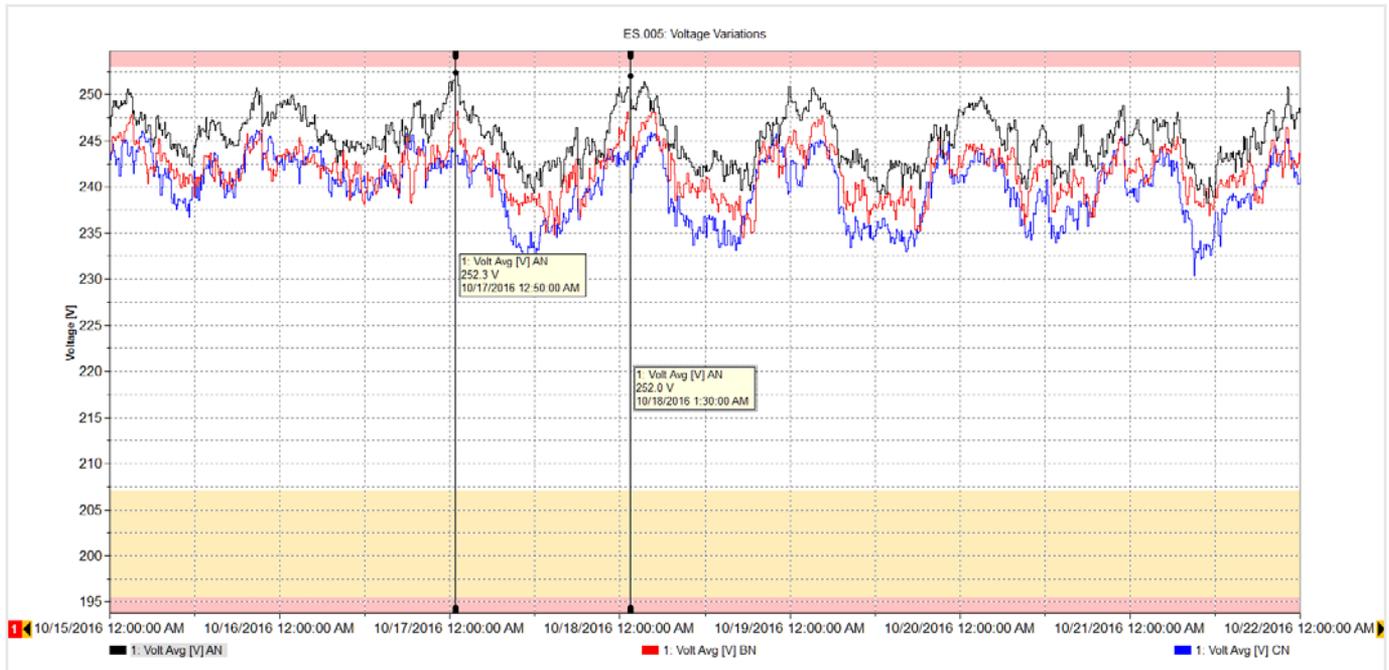
Figure 4. Phase A voltage trend

The graph in Figure 4 displays a week's worth of the voltage trends, overlaying the limit lines (minimum and maximum) to show that the values are within the limits, but come close to the limit early each morning. During that time, there was no production in this facility and loads in neighboring facilities were also switched off. This raised the voltage of the system, but within the allowed level. If this voltage goes beyond the limit, you would most likely need to call the utility to fix the problem. The high voltage could potentially damage equipment over time, so having details of the times the voltage is high could help the utility mitigate the situation.

Returning to Figure 3, we see that other measurements are within limits and we can view the details behind each one of the green bars if required. For example, we can see a list of events and even see the voltage profile behind the events, as in Figure 5.
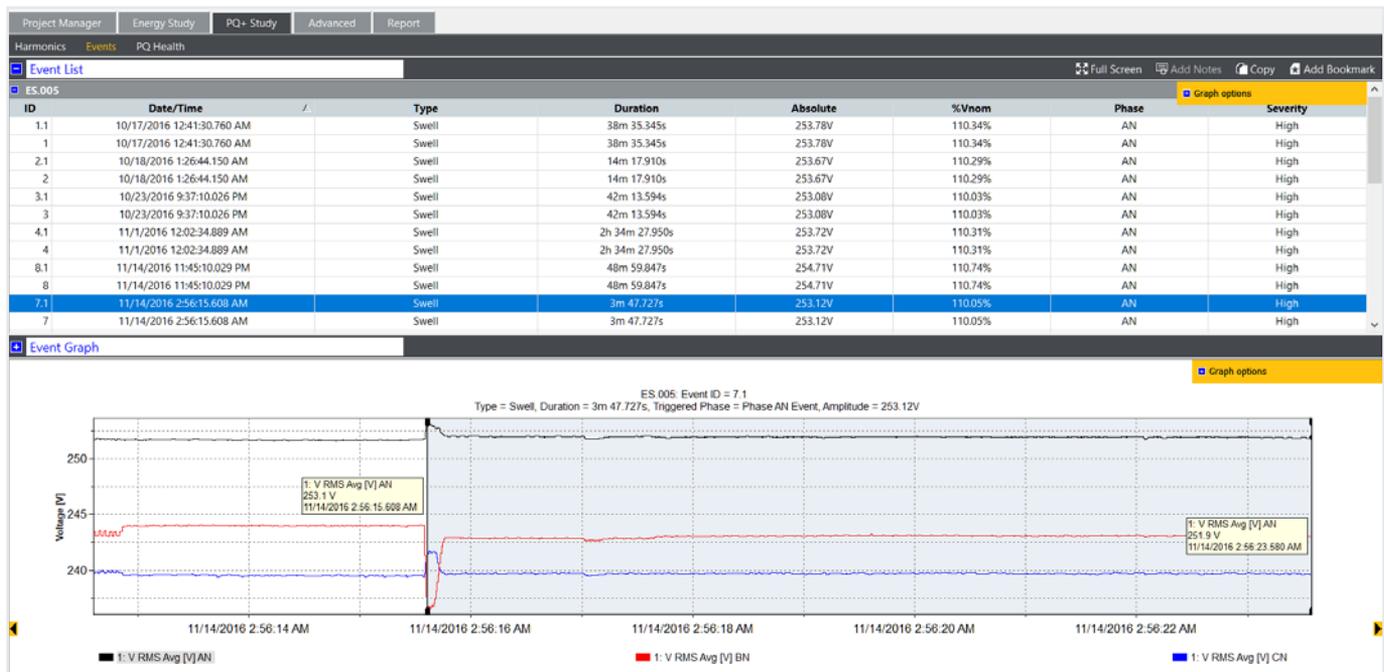
Figure 5. Event table and voltage graph

5. Power quality reporting

By combining each of these important views, it's possible to explain how the facility is operating. With the Fluke Energy Analyze Plus software, it's possible to 'bookmark' each view and then use them to quickly create a report. The bookmarked items appear in the reporting tool, and new reports can be created in a matter of minutes with the simple 'drag and drop' feature. Before bookmarking the views, it's also possible to annotate graphs to highlight points of interest. Figure 6 shows the reporting tool with a list of available bookmarks, some of which were dragged to the reporting area. The report can then be exported in a format to suit the user and emailed to other stakeholders as either a PDF or even as a Microsoft Word document if the report requires additional editing or comments.
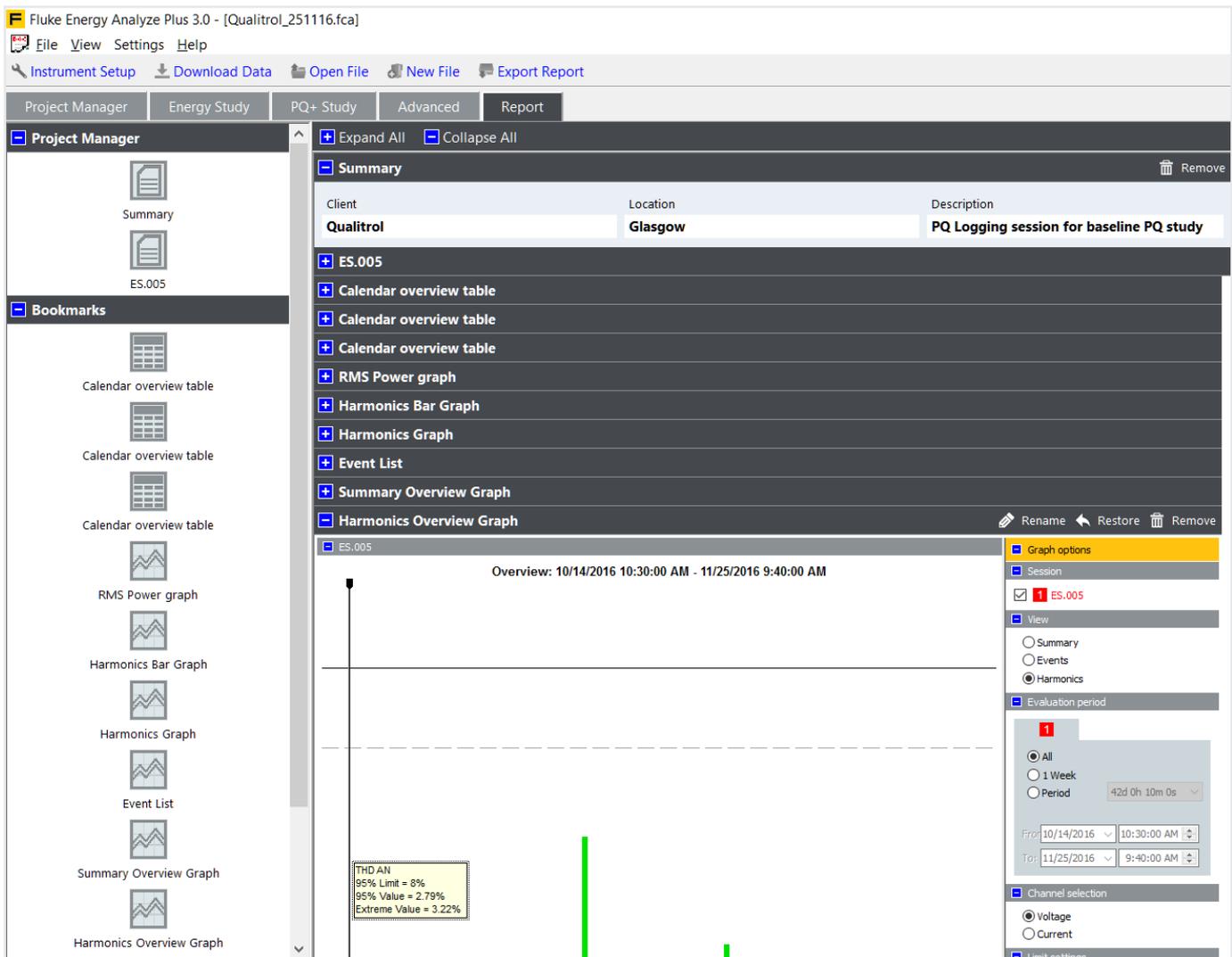
Figure 6 Reporting tool with bookmarks

By following these simple guidelines, you will be able to produce professional reports that convey the most important information in the most efficient way. This will free up time to develop mitigation plans where required or enable you to keep your system running in a way that suits you and all the other users.