

Arizona Buildings

Solutions for Building Owners & Managers

Summer 2010

Energy-Efficient Measures Target Existing Buildings

By Darlene Casella

In the past years, five privately owned multi-tenant office buildings in Arizona – Collier Center, The Phoenix Plaza, 24th at Camelback I, Renaissance I and Renaissance II – have gone green, earning the U.S. Green Building Council's LEED-Existing Buildings Operations & Maintenance certification. These are the first of their breed in Arizona.

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Handheld instruments are ideal for facility energy studies and carbon footprint calculations, and for taking forward/reverse energy measurements for grid-tied alternative energy systems.

Energy Audits Help Arizona Buildings Ride Through Tough Economic Times

Increasingly, facility professionals are turning to energy analyzers to help them identify major energy savings opportunities through an understanding of when, where and how their energy is being used—as the necessary first step in managing it

By Ross Ignall

According to the U.S. Department of Energy, Arizona is a leading researcher and developer of energy-efficient technology, as evidenced by mandates requiring that state-funded buildings derive at least 10% of their energy from renewable resources. Although the sun-drenched state's solar power potential is among the nation's highest, more traditional energy sources still predominate,

including Palo Verde—the nation's largest-capacity nuclear power plant. Even more importantly, large coal deposits primarily in the Black Mesa Basin in northeastern Arizona continue to fuel coal-fired power plants as the leading source of electrons for Arizona homes, institutions and businesses.

Part and parcel to the identification and development of diverse energy

resources, however, is the sobering reality that energy costs will continue to rise and thus increase impact on the facility bottom line—wherever those electrons come from. The net result is that commercial, institutional and industrial facility owners and managers will face mounting pressure to reduce building operating costs in order to maintain profitability.

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It is not unusual for large commercial and industrial power consumers to see in their electric bills demand charges as high as 50% of the facility's actual consumption costs. As an offset, load shedding, peak shaving, installing more efficient lighting and other energy management strategies go far toward helping facility operators lower their demand penalties. However, before any of these strategies can be implemented, it is necessary to first gain an exact picture of how, when and where their energy is being used.

As a cost-effective means for doing just that, an energy audit conducted at the front end of the process helps facility personnel understand their energy usage and identify areas where mitigation strategies can be implemented to save energy and cut operating costs by operating more efficiently and cost-effectively.

Knowing What to Measure

Energy audits come in many forms and can range from simple applications that monitor a single device or machine, to complex monitoring of an entire campus – and anything between. Regardless of a facility's energy load, most energy audits have much in common. The most important parameters to measure when analyzing electrical energy are typically voltage (V), current (I), Watts (W), volt-amperes (VA), volt-amperes reactive (VAR) and power factor (PF). Recorded over time, these basic parameters can provide the necessary information for a complete energy profile.

Voltage and current measurements are used as the basis to compute the other parameters. The parameters can be viewed instantaneously by a variety of instruments, but the key benefit of using an energy analyzer is its ability to record and trend parameters over time. Energy

analyzers also compute the demand and energy that utilities use for billing.



Low-cost energy analyzers like the Dranetz EP1 Energy Platform offer users an unprecedented degree of functionality and flexibility for performing simple to sophisticated energy audits that can be exported into popular software programs.

What to Look For in an Energy Analyzer

Today's energy analyzers are much more powerful and cost effective than

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ever before. Since even low-cost analyzers include all the accessories and software needed to conduct a complete and user-friendly energy audit, energy analyzers are now within reach for facilities of any size needing to manage their ever-rising energy costs.

What an energy-measuring instrument measures and computes is important, but how it measures can be critical. For example, some inexpensive low-resolution instruments may measure the basic parameters mentioned, but they can miss data and thereby produce false and misleading measurements.

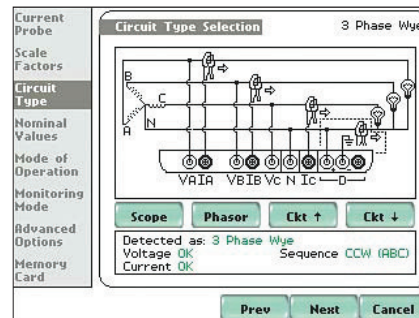
Effective energy-analyzing instruments should provide a sampling rate that is appropriate for the application while also providing the ability to take continuous readings. Power analyzers typically define sampling rate as the number of measurements taken per AC (60/50Hz) cycle. Because the instrument creates a digital representation of the analog voltage and current being measured, it is generally desirable to use an instrument that provides a higher number of samples per cycle, thus resulting in more accurate measurements of the data being collected.

Users are also encouraged to select an energy analyzer that can measure more than just the basic power parameters, since more advanced parameters may be required to also help understand the quality of the electrical supply, including: voltage and current total harmonic distortion (THD), transformer derating factor (TDF) and crest factor (CF). Additionally, with the advent of alternative-energy applications, parameters such as forward and reverse energy that record the flow of power to and from the grid are often required.

Making Instrument Connections

Properly connecting an energy analyzer is essential, especially considering the complex three-phase circuits that are most commonly used

in facility applications. Proper voltage and current connections to the circuit are necessary for proper readings, so it is important to make the proper connections prior to taking the survey. When making instrument connections it cannot be stressed enough to closely follow all appropriate safety procedures and manufacturer's instructions. Such circuit connections can pose a danger and only qualified personnel should make instrument connections.



Determining the connections for an energy analyzer (3-phase WYE circuit shown)

To measure the total power of a circuit, the energy analyzer computes the power in each phase before it totalizes all of the phases. A wattmeter in the instrument measures each phase, although the total number of wattmeters required varies by circuit type. A wattmeter requires both a voltage and current circuit connection and measurement. Voltage is the potential between two points and is always measured between a “hot” wire and a reference, with the most common reference, when available, being Neutral. Voltage is usually connected directly to the circuit in Low Voltage (LV) systems without the use of potential transformers (PTs) or transducers. It is important to make sure the analyzer can safely measure the voltage levels in use.

Current is usually measured using transducers called current transformers (CTs). CTs are available in many types ranging from rigid clamps to very adaptable Flex CTs. Regardless of the

type used, it is necessary that the CT is sized for the application and has a current range appropriate to the current flowing through the circuit. It is important to assure that the current being measured falls in this range, otherwise the measurements may be inaccurate. Each CT will have an arrow or other indicator showing the direction of current flow. All CT connections must have the arrow in the same direction and pointing towards the load. Connecting the analyzer depends on the circuit type, so it is important to first make that determination.

Analyzer Setup and Configuration

Once the analyzer is connected it must be configured properly for the application. As mentioned previously, proper wiring configuration is essential since this information tells the analyzer how it is connected and how to totalize the power. Beyond wiring configuration, other required analyzer settings are usually dependant on the analyzer's capabilities, with each manufacturer having different requirements.

The Survey

Details of the survey can vary greatly according to the application. The goal of an energy audit is usually to determine the energy profile of the system being monitored. Regardless of application, it helps to know some of the information about what is being monitored, such as the type of load, process or facility. These details are essential for determining the duration of the energy survey.

To obtain a complete picture of the energy profile, it is recommended to monitor several business cycles of the load being audited. For example, an industrial process that cycles (start to finish) every 15 minutes may only need monitoring for approximately an hour to capture multiple cycles and to find out what is usual or typical for that

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load. An office building cycling on a 24-hour basis may require a much longer survey, such as a week or more, to determine a typical energy profile. A survey replicating a utility bill may require monitoring for multiple utility billing cycles over several months.

Time of Use Billing			
Site: Breaker 32A-5			
Measured from 07/14/2009 11:12:09.0 to 07/29/2009 02:37:01.0			
BILLING DAY OF MONTH: 25			
TIME OF USE COSTS			
	DEMAND		
	ON-PEAK (USD)	PARTIAL-PEAK (USD)	OFF-PEAK (USD)
Jul (*)	0.0	0.0	82.4
Aug (*)	0.0	0.0	0.0
ENERGY CONSUMPTION			
	ON-PEAK (USD)	PARTIAL-PEAK (USD)	OFF-PEAK (USD)
	Jul (*)	0.0	0.0
Aug (*)	0.0	0.0	0.0
Total values	0.0	0.0	192.6

(*) indicates partial month.

Typical energy analyzer software enables printed or electronic reports

Reporting and Results

All energy analyzers should provide the ability to summarize and report the

result of an energy survey, but the range of capabilities and flexibility vary widely. Reporting requirements will vary greatly by application, with some requiring very little detail while others may require formal reports on a client's company letterhead. Many applications require advanced PC-based reporting for email or printing. To that end, some instruments enable quick and easy reporting that includes a built-in energy audit report along with the ability to export the information to other software.

Conclusion

The good news for Arizona facility operators is that powerful, cost-effective handheld electrical energy and power demand analyzers specifically designed for conducting facility energy audits and power demand studies are now on the market. These tools are the ideal way for gathering, recording and reporting "where, when, and how much" electricity is used by the facility.

Applications in industrial, commercial and institutional facilities include energy/cost reduction programs, alternative energy monitoring and power/harmonic studies. With the growing emphasis on "green" facilities, instruments from Dranetz and others offer facilities engineers and electrical contractors the ability to record both forward and reverse energy, an essential measurement in grid-tied alternative energy system analysis. Another important consideration in the LEED process, these instruments are also ideal for certifying a facility's energy consumption and carbon footprint.

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