

# Choosing Data Loggers For Green Building Projects

## *10 Important Considerations*

**T**he green building industry is growing quickly, and successful projects benefit from assessment and evaluation at all stages. From hospitals and industrial complexes to single-family homes, measurements of conditions such as temperature, solar radiation, and energy consumption are essential to carrying out and testing designs.

Battery-powered data loggers are powerful tools that monitor a wide range of indoor and outdoor parameters. The data they collect can help users select sites, verify design, allow for adjustments, and generate required documentation for projects in line for LEED® Certification, the industry standard.

Today's data loggers are small, low-cost, rugged devices that can take unattended indoor and outdoor measurements at user-specified intervals 24 hours a day, 7 days a week. Indoor units are already in common use by performance contractors and engineers responsible for monitoring energy efficiency and usage, air quality, and heating ventilation/air conditioning/refrigeration (HVAC/R). Weather stations are used outdoors worldwide by research scientists and farmers for collecting environmental data such as rainfall, wind speed, and solar radiation.

Whether you are an experienced data logger user or are just getting started, this guide will help you to understand how data loggers fit into the green building industry, and will give advice about several areas to consider when selecting a logger best suited for your particular needs.

### **How Data Loggers Fit In**

The goals of green building are to increase building efficiency with regard to energy, materials, and water use; to take advantage of natural resources such as solar radiation and wind; and to lessen the environmental impact of building siting, construction, and operation. In practice, some designs address all these factors, while other buildings incorporate just a few.

Data loggers can provide valuable information for nearly every aspect and scale of green design. For example, a facilities manager can monitor temperature in a fifteen-story office building over the summer to check whether the fans in the building's cooling tower need adjustment.

1. Measurement parameters
2. Measurement accuracy
3. Software and ease of configurability
4. Data offload options
5. Support for ethernet connectivity
6. Durability
7. Battery Life
8. Cost of ownership
9. Product support
10. Flexibility and range of solutions

A homeowner considering adding passive solar hot water panels to his roof can deploy a weather station first to determine where solar radiation is most intense, and how many sunny days there are per year. Engineers can monitor energy use in a retrofitted elementary school to make sure that new lighting and appliances are indeed cutting electricity costs.

In an effort to create a national industry standard, the US Green Building Council ([www.usgbc.org](http://www.usgbc.org)) created the Leadership in Energy and Environmental Design (LEED) Green Building Rating System®. This system serves as a guide for measuring and documenting successful green building practices at all phases of a building's lifecycle. Guidelines cover site selection, new construction, renovation, and occupancy/facilities management, and can apply from homes to entire neighborhoods. Data logging devices are valuable during the LEED Certification process because documentation is required by the USGBC every step of the way.

Whether you are involved in the construction of a LEED Certified campus center or are retrofitting your home with PV panels, data loggers can provide you with valuable data, from design concept to operation.

## Choosing A Data Logger For Green Design Applications

Data loggers are not all the same and with so many choices available today, it can be challenging to know which one is right for your application. Generally, indoor units fit in the palm of a hand, and can measure one or two parameters. Outdoor units are usually part of tripod weather stations, and the desired sensors are plugged via cables into a central data logger.

Indoors or out, here are ten considerations to keep in mind when shopping for loggers for your green building application.

### 1. Measurement Parameters

The first step is determining what you need to measure, and where.

Battery-powered data loggers can monitor a wide range of indoor and outdoor parameters, depending on the manufacturer. Indoor options can include the following, singly or in combination: temperature, relative humidity, light intensity, CO<sub>2</sub>, DC voltage, AC voltage, kW, kWh, water flow, differential pressure, events, light on/off, motor on/off, and carbon monoxide. Available outdoor sensors monitor rainfall, wind speed and direction, solar radiation, and soil moisture, among others.

How many loggers do you need? Will you monitor temperature in twelve rooms at the same time, or can three loggers work in four shifts? Do you need to measure power usage in four circuits at once or in eight?

Weather station sensors work a bit differently. The number of data channels your weather station logger must accommodate will be determined by the sensors you need. If you will be measuring temperature and wind speed and direction at a site, you'll want to purchase a logger with only a few input channels. If, however, you are investigating a suite of conditions that require multiples of the same kind of sensor, such as monitoring solar radiation at six locations on a site, you might want to choose a logger with a dozen channels or more.

Remember, you don't need to buy more logging capability than necessary, though you should consider future monitoring requirements.

### 2. Measurement Accuracy

Once you know what you'll be measuring, think about your accuracy requirements and take a look at logger specifications.

Accuracy specifications vary widely among different

loggers, and understanding your requirements will prevent you from buying more accuracy than you need. For example, monitoring temperature in a classroom may only require an accuracy of  $\pm 2$  degrees; a logger with an accuracy of  $\pm 0.1$  degree would be excessive and probably more expensive. When shopping around, be sure to look for charts that indicate accuracy over an entire measurement range, not just at a single value.

Another important factor is data logger resolution, which refers to the number of increments of a value a data logger is capable of reporting. This is important if you plan to deploy a logger for months at a time, or want the logger to record data in 10-second intervals. You should also ask about a logger's response time.

If you're unsure about your application's accuracy and resolution requirements, an experienced supplier should be able to help you determine which product will meet your needs.

### 3. Software and Ease of Configurability

All data loggers use software for setup and configuration, but some manufacturers demand more from their users than others.

User-friendly loggers can be set up and launched by someone with no training in electrical wiring or programming. The user just connects the logger to a PC and the accompanying logger software automatically recognizes the device and asks a series of configuration questions. The user simply chooses a sampling interval and selects an immediate or designated future launch time. There is no wiring or programming involved, even for multi-component weather stations.

Ask about the software that comes with a logger or weather station. Applications are generally Windows-based, but some manufacturers also make Macintosh versions. The software should enable you to quickly and easily perform tasks such as setting configuration parameters, designating launch times, and offloading data with point-and-click simplicity.

Check the software's graphing and analysis capabilities, including whether you can combine graphs to compare data between sites, or if you can view all of a site's data clearly in a single graph. Depending on the scope and type of data, the manufacturer may also have special application-specific software available.

Since data often needs to be passed into other software programs such as spreadsheets or modeling programs, make sure that the logger software allows you to quickly

and easily export data with the click of a mouse. Also be sure that you can print graphs and tables, which is especially important for documentation purposes.

#### 4. Data Offload Options

For most building applications, data download is usually done on-site.

In the most straightforward systems, data download is achieved by connecting a laptop computer equipped with the appropriate software to the logger with a cable. The software automatically recognizes the logger and downloads the data in less than a minute. Alternatively, data can be downloaded to a shuttle-type device. These small hand-held units can hold data from multiple loggers and relaunch them without users having to take a laptop out of the office.

#### 5. Support for Ethernet Connectivity

Recent advances in data logging and networking technologies has improved download efficiencies. In facilities where an Ethernet network exists, a user can now implement a facility-wide data logger network, without any special wiring, and reduce the time and expense associated with manual data retrieval and logger management tasks. All logger management and offload tasks can occur from one centralized workstation. Additionally, data can be readily shared throughout a facility via any Internet browser.

Some data logger manufacturers offer Ethernet adapters or “hubs” that enable this type of connectivity. If your indoor monitoring application could benefit from a networked data logging solution, be sure to ask suppliers if they offer solutions for linking data loggers over Ethernet networks.

#### 6. Durability

While some data loggers sit comfortably in office hallways, others are subject to grueling environments. From winter rooftops to furnace combustion chambers, data loggers are often required to work under tough conditions.

Make sure a logger’s enclosure is designed to withstand the conditions it will be subject to. For example, in an office hallway a hard plastic enclosure should suffice. On the other hand, if a logger will be deployed in a greenhouse, choose one with a moisture-protective enclosure. For outdoor weather stations, be certain that the sensors, logger housing and tripod can withstand rain, wind, and ice.

#### 7. Battery Life

Data loggers are generally extremely low-power devices. However, because they are used in a variety of

environmental conditions and sample at different rates, battery life can vary widely. As a general rule of thumb, make sure the data logger you select has a battery life of at least one year. Most logger manufacturers’ software will indicate when the logger’s battery power is getting low.

You may also want to ask your supplier about whether or not the data logger battery is user-replaceable, as this can eliminate the time and expense of having to ship the logger back to the manufacturer for battery replacement.

#### 8. Cost of Ownership

Today’s battery-powered data logging devices are very reasonably priced, and can be a real value if you plan to use them over and over again in multiple applications. It is, however, important to look closely at the total cost of ownership when shopping around. Will the logger need to be periodically calibrated by the manufacturer, and if so, how much will it cost over time? How much does the software cost? How much will you have to spend on cables and structural components for a weather station?

Asking these questions will help you understand the true cost of owning the data logger over the long-term.

#### 9. Product Support

Data loggers should be easy to use and not require a great deal of technical assistance. However, as with any high-tech product, there will always be questions.

Seek out a supplier offering a range of product support services. These often start with the initial assessment of your application requirements, and should include telephone and internet-based support resources.

Does a potential supplier have the track record and financial stability to maintain their role as a long-term solutions provider? Be assured that the company will be there to meet your future data logging requirements. Finally, ask the supplier for application notes and other references to gain a sense for how their loggers perform in applications similar to yours.

#### 10. Flexibility and Range of Solutions

In most cases, indoor data loggers or simple outdoor weather stations are suitable for most green building applications. However, there may be situations where you need a more centralized data gathering system for monitoring multiple parameters.

Weather stations are usually equipped to handle such situations, but indoors, you might need to ask about other options. For example, you may want a simple setup for measuring temperature, relative humidity, and CO<sub>2</sub> each

at several points in a room for every room in a renovated building. In that case, you might ask a supplier if they offer systems-based data logging solutions, where multiple sensors plug into a central, multi-channel logger. As is the case with weather stations, with the simplest models you can simply plug in individual sensors to measure various parameters and the system recognizes each one without complicated wiring, programming or calibration. Most are also battery powered, and allow you to configure the system with any combination of available sensors.

Consider also whether you require immediate notification when environmental conditions fall outside of set tolerances. If so, be sure to ask your supplier about data loggers with alarm capabilities.

### **Conclusion**

As the green building industry grows, so will the demand for instruments that make assessing design and monitoring performance easy and inexpensive. Battery-powered data loggers are affordable, reliable tools that collect data when and where you need it. The best loggers pair with intuitive, easy-to-use software so you don't waste valuable time and effort configuring devices or formatting data. Shop around. A supplier with in-depth data logging application experience can offer valuable guidance in helping you not only understand features and benefits of a particular logger, but also how certain factors in your own application may affect logging performance.

### **About Onset**

Onset Computer Corporation has been producing small, inexpensive, battery-powered data loggers and embedded controllers since 1981, and has sold over one million loggers that are used around the world by over 50,000 customers. The company manufactures a broad range of data logger and weather station products that are used to measure temperature, humidity, light intensity, voltage, and a broad range of other parameters. Onset products are used widely in research, commercial, industrial, and educational applications.

Onset Computer Corporation  
<http://www.onsetcomp.com>  
(800) 564-4377 / (508) 759-9500  
Fax: (508) 759-9100  
[info@onsetcomp.com](mailto:info@onsetcomp.com)