



Questioning Black-Box Vendors

By Essie Snell

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Q: What are the most important questions to ask a vendor who is trying to sell you a black-box technology?

A: When approached by a vendor of a product that is bolted on, wired in, or otherwise added to existing technologies in order to yield energy savings—what we refer to as a “black box”—you will want to quickly establish its viability (or lack thereof). We typically start out by asking three straightforward questions.

How is energy currently being wasted without this product? In order for the product to be effective, there has to be a real and significant form of energy waste that would yield benefits if reduced somehow. Simply put, if there’s little to no energy waste, it should be impossible for the product to yield large energy savings. Power factor correction units are a good example of devices that typically run into this problem. Although these units can indeed reduce utility penalties for poor power factor, vendors often cite energy savings as high as 30 percent due to a reduction in resistive losses (which are linked to current draw). However, resistive losses tend to be pretty small, and the maximum energy savings we’d typically expect to see is 1 to 2 percent.

How does it work? In essence, the goal of this question is to check that the product may actually be able to save energy at the levels claimed while obeying the laws of physics. Surprisingly, many vendors make claims that seem to contradict the first law of thermodynamics (conservation of energy), basic physical principles, or real-world experience. For example:

- “[Researchers] state that: ‘the output is greater than the input.’”
- “Using space-age NASA technology, [the product] employs a thin layer of super-insulating ‘Ceramic Microspheres’ which dry to the thickness of a credit card, providing insulation equal to 7 inches of fiberglass batting (R-20).”
- “Up to 25 percent of the billable electricity consumed in homes and businesses is non-productive and unusable.”
- “Once the heater’s thin-film has reached its operating temperature, every photon creates another photon with the same characteristics (energy and wavelength), without requiring additional energy.”

The proposed savings mechanism should be logical, correctly employ physical concepts, and—at least in theory—be able to reduce the previously identified energy waste to the extent the vendors claim.

Are any independent test data available? Once a savings mechanism has been established, you’ll want to look at laboratory or field tests to verify that the real-world operation of the device is consistent with that mechanism. Unfortunately, black-box evaluators often make the mistake of reviewing test reports before a credible savings mechanism is established. But if you assess tests without knowing how a device works, it’s impossible to know whether the test conditions are actually representative of real-world operating conditions, or whether the test results can be generalized to other applications.

In general, the most helpful test data will come from an independent source because there is always a chance that biases (both intentional and unintentional) may shade the results of non-independent testing. However, even when independent test data are available, there may be problems with the study that can cast doubt on the validity of the results.

One problem that frequently arises in tests of heating and cooling technologies is that variations in building loads and weather are not accounted for. In such cases, energy savings are estimated by simply subtracting the power draw after the black box was installed from power draw measured before installation. The problem is that virtually all heating and cooling technologies are affected to some extent by a number of factors, including weather, the number of people in the building (and their energy-use patterns), and the types of energy-consuming devices in the building, all of which can (and often do) change before and after a black box is installed. If these variations are not accounted for, there is no way of knowing what portion of the energy savings is actually due to the black-box product.

Another problem is that it's easier and less expensive to measure current than it is to measure power. As a result, we often see tests in which changes in power draw are estimated based on changes in measured current. However, power isn't necessarily proportional to current—it's also dependent on voltage and power factor. Both of these latter parameters can vary over time—for example, we've seen voltage vary by as much as 10 percent in a 24-hour period—and the only way to account for such changes is to directly measure actual power draw.

Additionally, many tests conducted on black-box technologies may reveal a change in power draw, but they don't measure enough variables to provide insight into *why* such a change might have occurred. For example, we've reviewed tests of black-box lighting technologies in which input power was measured, but light output was not. Were the savings the result of improved lighting system efficiency (as the vendor claimed), or simply due to an overall loss of lighting output? We have no way of knowing.

Ultimately, the most useful tests account for uncontrolled variables (and minimize these when possible), clearly document testing procedures, and provide statistical analysis to show the accuracy of the results—all while revealing the savings levels that were actually achieved by the product and whether or not those savings were a result of the claimed method of operation.

If, after asking these three questions, you still have any doubts about the validity of a product, feel free to [send us a Member Inquiry](#). In the end, obtaining answers to these questions is just one step toward assessing the applicability of a product. Other factors to consider include cost-effectiveness, reliability, quality control, availability of a support network, and how it compares with competing technologies. For more detailed information on how E Source assesses the legitimacy of a vendor's claims, see our article [Evaluating Black-Box Technologies](#).

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