Today, you can’t go anywhere without being inundated with messages to “go green”. More than ever before, consumers are aware of environmental messages, and businesses are responding in a big way.

And companies aren’t just trying to sell green products to their customers. Most of the smart ones are greening up their own operations. Why? Usually, it’s very simple: they’re focused on the bottom line.

Companies that waste energy on a monthly basis are leaving profit dollars on the table. How many dollars? The answer varies with the size of the operation, local utility rates, and variations in local climate conditions. But in most cases, there are energy savings options available to the facility owner/operator that have attractive paybacks -- many within 10 months to 3 years.

Communications shelters are a great example. Because they are often positioned in remote locations and face severe climate conditions, many companies look at the power consumption of these shelters as primarily a fixed cost.

As it turns out, it’s a lot easier and cheaper to make equipment shelters energy-smart than it is to retrofit your main operational sites.

So what are the options for making your equipment shelters more energy efficient? These options fall into 2 broad groups: renewable energy devices and equipment, and design features that lower the total energy requirements of the shelter site. They can be applied singly or in combination to achieve energy consumption reductions on the order of magnitude of 50 percent of normal energy consumption.

Think about it: how big a number is 50 percent of your annual energy bill?

Option #1: Renewable Energy

SOLAR PANELS

On a shelter with the dimensions of 12 feet by 20 feet, you could install 10 to 14 240-watt panels, generating about 2.4kW of power at peak daylight conditions. While solar panels cannot be used to power most shelters on a 24/7, 365 days-per-year basis, they can significantly reduce the consumption of power from the utility grid or the need to run an auxiliary generator.

WIND TURBINES

Like their larger utility-scale versions, small wind turbines work by using blades to turn gears and a shaft, which drives a small electrical generator, providing power to equipment in the shelter.

WHAT ARE THE BENEFITS?

• While most shelter sites have access to utility power, this power is becoming increasingly more expensive. Augmenting utility power with solar and/or wind-generated energy can significantly reduce the amount of grid power consumed, particularly if other energy savings equipment (such as air-to-air heat exchangers) are incorporated into the shelter’s design.

• Many shelters don’t have access to reliable, affordable commercial power. The cost of installing and fueling generators to power equipment in the shelter can be significant, and in many cases, snowpack can be an obstacle to refueling the generator, resulting in the need for fuel storage (diesel or propane) capability (which also drives up the cost to set up the site). Augmenting a remote site with wind turbines and/or solar panels can result in the use of a significantly smaller generator, reduced fuel consumption, and smaller fuel storage requirements.

• When your shelter has the greatest need for cooling -- on sunny, hot days -- solar panels are most effective and provide the most energy to offset this energy consumption.

• COST: Very simply, you don’t need to pay for power received from the sun or wind. Generating 2.4kW of solar power would cover about 25 percent of the HVAC load during peak solar generation hours, cutting the need for mechanical cooling by one-third. (See Figure 1.)

THINGS TO CONSIDER BEFORE YOU BUY:

• Obviously, solar and wind power are not viable sources of energy for all climates. Significant energy reductions can be achieved in surprising places, but payback periods should be examined.
Option #2: Energy-Reducing Design Features/Equipment

There are 5 devices you can specify for your shelter that can help you lower your energy consumption. They include the following with the details for each outlined below:

1. Air-to-Air Heat Exchangers
2. HVAC Economizers
3. High Efficiency Air Conditioners
4. High Efficiency Insulation (Walls and Doors)
5. Embedded Ceramic Exterior Coatings

1. AIR-TO-AIR HEAT EXCHANGERS

These devices help to remove heat generated by the equipment in the shelter, thereby reducing the run times of expensive mechanical cooling and without introducing outside air (contaminated with dust, pollen, and humidity) into the equipment space.

These exchangers work by passing cooler outside air through one side of a series of sealed conductive plates while air from inside the shelter (which has been warmed by the equipment) is passed through the opposite side of the plates. The heat from the warm air is passed through the sealed plates into the cooler outside air, which in turn results in a cooling of the clean, conditioned air inside the shelter. This cooling of the air inside the shelter allows it to continue its job of keeping the equipment cool.

How effective can heat exchangers be? That depends on the difference between the indoor and outdoor temperatures. Generally, heat exchangers begin to be effective when there is at least a 12 degree F temperature difference between the outside air temperature and the desired temperature inside the shelter. So, if the internal temperature target is 72 degrees, heat exchangers begin to be cost-effective when the outside air temperature is 60 degrees or lower. Heat exchangers won’t provide any benefit on a hot summer day in Phoenix, Arizona, but they can provide significant savings in the winter, spring, and fall, and during cool summer nights in northern and mountain climates.

WHAT ARE THE BENEFITS?

• An exchanger can often be run in place of mechanical cooling for hundreds of hours per year and at a fraction of the cost. Using your air conditioning system less frequently should increase its life span, meaning that you’re not only saving on operational cost, but also on capital and repair expenditures. The short cycling that most mechanical HVAC units experience during periods of cooler outside temperatures can be extremely detrimental to the compressor and result in a premature (and expensive) failure of the unit.

• REDUCED OPERATING COSTS: In a field trial in Denver, Colorado (1,840 heating degree days per year below 45 degrees F), heat exchangers reduced energy consumption by half for 6 months of the year, 66 percent for 3 months of the year, and not at all for 3 months of the year. That leaves a weighted annual energy reduction of 41.5 percent.

2. HVAC ECONOMIZERS

An economizer is a system of dampers and controls that allows filtered outside air to provide cooling to the shelter when outside temperature and humidity levels make this a viable option. When specifying an HVAC unit for your shelter, an economizer option should always be specified.

Economizers are most effective at reducing energy consumption in cool or temperate climates – generally at or below 60 degrees F.

WHAT ARE THE BENEFITS?

• In a typical shelter, mechanical cooling may be required for as many as 75 percent of operating hours. An economizer can be used for 30 percent of total operating hours, reducing the need for mechanical cooling to 45 percent. (See Figure 2.)

• As with air-to-air heat exchangers, reducing the usage of mechanical systems increases their life span, reducing capital expenses.

THINGS TO CONSIDER BEFORE YOU BUY:

• While economizers filter the outside air, they cannot stop all dust and other pollutants. This is one reason why air-to-air heat exchangers are a preferred solution, since they do not introduce outside air into the shelter environment during periods of operation. However, since all HVAC units require the introduction of filtered outside air into the shelter, an HVAC unit with an economizer is still a better choice than one without it.

3. HIGH-EFFICIENCY AIR CONDITIONERS

Unlike standard air conditioner systems that are either “fully on” or “fully off,” variable speed or 2-stage air conditioning units continuously adjust the output of the unit to more closely match the cooling requirements of the shelter.

Variable speed units vary the speed of the compressor to between 10 percent and 100 percent cooling demand while simultaneously adjusting the speed of...
5. EMBEDDED CERAMIC EXTERIOR COATINGS

Urban designers are starting to catch on that changing the color and composition of your roof can affect sunlight absorption. On hot days, this can achieve a significant percent reduction in absorbed heat (heat which ordinarily needs to be counteracted by other means, often mechanical cooling).

The same concept can pay great dividends with equipment shelters. Embedded ceramic exterior coatings are reflective paints that have embedded hollow, ceramic “micro balls”. These structures are about the diameter of a human hair, so tiny that they would get lost in the grooves of your skin if you held them in your hands.

When applied in several layers to a thickness of 12-15 millimeters to the roof and walls of a shelter, this coating creates a virtually “hollow” layer that hinders the transfer of energy into the building, and reflects infrared and ultraviolet light back in the atmosphere.

WHAT ARE THE BENEFITS?

• Polyurethane foam insulation helps to eliminate transmission of moisture, which can be highly damaging to electronics equipment.

THINGS TO CONSIDER BEFORE YOU BUY:

• Once again, this is a feature that benefits pretty much everyone. The only hurdle is a higher upfront cost, which can cause challenges with capital expenditures.

4. HIGH-EFFICIENCY INSULATION (WALLS AND DOORS)

Obviously, insulation has 2 primary purposes: to keep out the cold and retain heat in the shelter in the winter, and to keep out the heat in the summer. To do this, it must have a high “R” value and prevent air leakage. High-efficiency expanding foam type insulation not only has a very high R-value compared to traditional fiberglass insulation, but it also has the added advantage of expanding inside the shelter walls to seal off leaks, gaps and penetrations which might allow air leakage. It also serves as an additional vapor barrier. Usually, we associate insulation with keeping us warm in cold temperatures. As it turns out, in a communications shelter, insulation is actually used more to keep hot air out of an environment in warm climates. Insulating doors and windows should also be considered; factory-installed thermal breaks on doors that are at least as efficient as wall insulation will prevent costly transmission of heat into the conditioned space.

WHAT ARE THE BENEFITS?

• By limiting the transmission of heat from outside the shelter into the conditioned space, high-efficiency insulation lowers the operating costs of HVAC units. Polyurethane insulation can be as much as 60 percent more effective than fiberglass insulation. (See Figure 4.)

• By putting less demand on mechanical cooling units, you can get by with a smaller HVAC unit, reducing purchase and operational costs.

• Once again, this benefits everyone, and it comes down to a debate between capital costs and operational savings.

The Best Option?

Several of these options -- high-efficiency air conditioners, high-efficiency insulation, and embedded ceramic coatings -- are smart business decisions for most owners and operators of equipment shelters. For other options, such as renewable energy sources, these decisions are dependent on several factors. In Thermo Bond’s decades of experience on this topic, these factors usually include climate and regional considerations, the cost of energy, the reliability of commercial power, and the internal heat load of the shelter.

A recurring theme of employing these solutions is the weighing of short-term costs and long-term benefits. In most cases, companies that choose to pay marginally more for ongoing benefits -- in energy costs, reliability, and ease-of-use -- are very satisfied they made this choice.

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