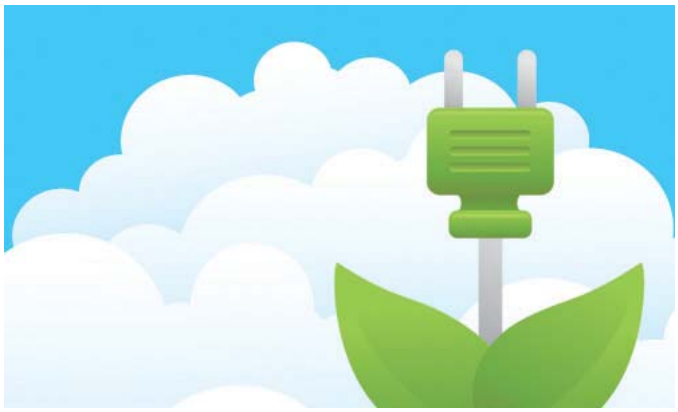
Let’s Clear the Air

by: Paul Reale

OSP Magazine



If your company owns, operates, or maintains Outside Plant Equipment (OSP), then the largest portion of your environmental footprint probably comes from the energy you consume. Surprising to most Americans, 70% of U.S. electricity comes from burning fossil fuels (mostly coal), and that leaves a huge carbon footprint.

While reducing greenhouse gas emissions may not be your top business concern (even with increasing regulatory pressure), many Fortune 500 companies now realize that “going green” can be a strategy that drives profitability.

Take energy. If you add up the energy bills for all the OSP in the U.S., it comes to billions of dollars every year. So finding a way to reduce your energy consumption not only makes you greener, it saves you money. Plus, reducing the load required to keep your OSP running means a smaller, less-expensive backup system for power outages.

Reducing Energy Consumption

Pressuring your equipment suppliers for gear with a smaller energy appetite is one way to reduce your energy consumption. Or perhaps you can co-locate solar and/or wind plant that can help power their sites, which would surely make great headlines. While there are efforts underway to build and deploy such equipment, these options are usually either long-term or just too expensive to consider seriously.

If you’re looking for quick results, look no further than the air conditioners (A/C) you use to keep your OSP cool. They often consume a significant portion of the energy consumed.

Professionals in the OSP space understand that in certain situations A/C is a necessity, and they’re usually right. However, while A/C is often needed for peak thermal issues, augmenting your cooling system with an ambient air solution can offset much of the load on the A/C.

Just mentioning “outside air” can make an OSP professional squirm. A host of issues that can damage your expensive electronics are brought into the picture: dust, salt, humidity, wind driven rain, water, ice, and even insects. But air filters have matured to keep these gremlins at bay; there are filter specs out there to meet the needs of even the most conservative designers and engineers.

Another issue comes to light when you consider your energy backup requirement. It is very expensive to configure sites to enable A/C to operate during a power failure. But without A/C, maximum thermal conditions can be realized in minutes, resulting in critical network downtime and possibly even customer churn for mobile operators.

Of course fans for ambient air cooling consume far less energy than A/C compressors, so an alternative is using ambient air as a good cooling technique during a power outage.

Ambient air cooling isn’t a new idea, but its use for OSP in the U.S. is not yet widespread. Operators must protect their OSP investment, and historically that has created a paradigm of keeping ambient air away from electronics.

One example of an ambient air solution is an “after-market kit” by Schrofftech International Inc. called The Economizer that uses a patent-pending approach to integrate existing DC plant, HVAC, and site controller with intake fans, filters, sensors, a dedicated controller, and exhaust louvers.

“Site requirements are piling up on engineers and designers,” comments David Therrien, Vice President of Schrofftech. “With these new energy constraints, most of them now consider ambient air cooling as a way to solve multiple issues. They’re getting ready to pull the trigger on this.”

Figure 1. Door-mounted Intake Filters (right) and Exhaust Plenum (left).

Figure 2. Exhaust Louvers and Actuator.

Filtering Ambient Air

Of course the devil’s in the details, and here’s where we turn our attention to air filtering.

In 1987, the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) designed the Minimum Efficiency Reporting Value (MERV) rating system for air filter effectiveness. The scale goes from 1 to 20, where you’ll find a washable or throwaway MERV 1 filter in a window A/C unit at home, and a MERV 20 filter in “clean rooms” that will capture radioactive and carcinogenic materials.

Picking the right MERV rating is key. It’s tempting to simply spec a MERV 20 filter, but there is a price, and it’s not just for a more expensive filter. Removing an increasing percentage of increasingly smaller particles requires more air pressure on the filter. More pressure means more energy powering fans for the same airflow rate, so a higher MERV rating means you’re cutting into the very energy savings you’re trying to reap in the first place.

Depending on your environment, MERV 11 will usually suffice for OSP, as it removes 65-80% of particulates between 1.0 and 3.0 microns, and more than 85% of particulates between 1.0 and 10 microns. Typical applications for MERV 11 are for filtering auto emissions and hospital labs.

If you want to play it safe, a MERV 14 filter will capture more and smaller particulates: 75-85% at 0.3 to 1.0 microns, and better than 90% at 1.0-10 microns. MERV 14 filters capture most tobacco smoke.

For your most critical applications, use a MERV 16 filter that captures more than 95% of all particulates from 0.3 to 10 microns. MERV 16 filters are used for general surgery in hospitals.

Fortunately, MERV ratings in the 11-16 range require much less energy for the fans to pull air through the filters than an A/C draws for a compressor.

The MERV specifications don’t address all the concerns, though. To cover the gamut, it’s important to look at Telcordia and UL requirements as well.

Telcordia’s GR-487, “Generic Requirements for Electronic Equipment Cabinets” addresses many cabinet issues, but when it comes to ambient air and the use of filters, it’s critical to adhere to their specs regarding wind-driven rain, salt, fog, and weather tightness. Finally, UL-900 addresses filter flammability.

From an overall engineering and design perspective, it’s prudent to ensure that any ambient air solution you consider has the MERV rating you need for your environment, and that your filters comply with GR-487 and UL 900.

Airing Out the Benefits

A fundamental question is whether you can justify the capital expenditure of an ambient air system.

Installed prices vary, but generally speaking ambient air system prices are on par with that of an installed A/C. The savings from reduced energy consumption depends on a number of variables, including the maximum temperature spec for your equipment (including batteries, if they’re in there, too), the thermal load that must be dumped, the type of filter you choose (e.g., MERV 11, 14, or 16), the solar load on your enclosure and, last but certainly not least, the outdoor ambient air temperature.

Yet the bottom line regarding energy savings is whether you can reduce the need for A/C. Figure 3 shows temperature readings taken every 15 minutes at a site with both ambient air cooling and A/C over a 2-week period. Without ambient air cooling, the A/C would have cycled much of the time. With ambient air cooling, the chart shows that the outdoor air was always cooler than the inside shelter temperature, enabling ambient air to cool the equipment. In this case, the A/C was never used during the entire 2-week period.

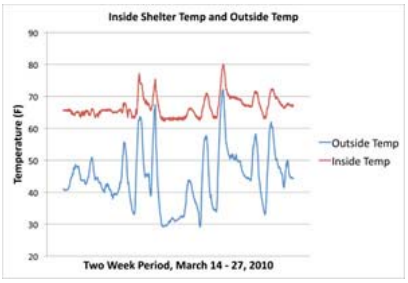


Figure 3. Indoor Shelter Temperature and Outdoor Air Temperature Over a Two-Week Period.

That doesn’t mean that A/C is never required at this site -- only that this reduction in A/C usage creates significant energy savings.

Energy cost is not the sole contributor to your bottom line. The capital expense of your A/C comes into the analysis too. Their longevity is rated on cycles, thus the compressor’s starting and stopping is the key contributor to premature failure. By replacing a substantial portion of your cooling with ambient air, A/C cycles are significantly reduced. Eliminate half the cycles and you’ve doubled the life of the A/C. That’s a huge payoff.

You will definitely have to replace air filters, which of course is an additional expense when using ambient air cooling. The replacement frequency depends on the contaminants present at each site. Your ambient air system should have the ability to send an alarm when it’s time to change the filter.

When you consider your electronics and overall network, there are some significant advantages when you use ambient air cooling.

Advantage #1: The thermal cycling on your electronics is far less dramatic compared to cooling with A/C. The same on/off cycles that damage the A/C compressor also create frequent temperature swings that stress the very electronics that the A/C is meant to protect. Reduced thermal cycling unquestionably reduces failures of your electronics, and of course that means fewer site visits and, depending on your equipment’s architecture, reduced risk of service outages.

Advantage #2: Ambient air cooling can double as a DC-powered emergency heat mitigation system. This has the added advantage of reducing your required backup plant and/or increasing your backup time.

Advantage #3: At the corporate level, since greenhouse gas emissions are reduced, your company gets a “green halo” (i.e., environmentally responsible behavior that can bolster Corporate Social Responsibility efforts and public relations). This is a genuine benefit that cannot be underestimated.

Sometimes it isn’t easy being green. It can mean difficult operational changes and increased expense. Other times, like with ambient air cooling, you can improve your bottom line and reduce your environmental impact at the same time. It’s these environmental initiatives that warrant serious examination and will win the day in the early years of the green wave.

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What’s your take on this subject? Leave a comment and get the conversation going.