Ensuring that your selected backup-power system can meet both current and future needs depends on a number of factors.

Peace of mind is a priceless and coveted commodity in today's business environment. Adequate backup power contributes to that peace of mind, because downtime means lost revenue. Thus, specifying a backup-power system that's appropriate to a particular application requires attention to several details.

The first thing to consider when specifying a backup-power system should be obvious: power demand—*the amount of electricity needed to back up all necessary circuits.* However, what's often not so obvious are the future power needs for the application.

Over time, the power demands of a building (or the tenants in that building, if applicable) will likely change. The demands won't get smaller, either. According to a commentary by Max Schultz on Forbes.com, the U.S. economy will require 30% more electricity by 2030. Increased power needs place more demand on a backup-power system in emergency situations and can reach a point where the system is no longer capable of supplying the necessary amount of power. Additionally, because backup-power systems have an effective life of several decades, it's important to build in scalability so as not to replace a perfectly good—

not to mention costly
—system before its effective life has been exhausted.

Scalability can be addressed in a single-generator solution by designing extra capacity into the specification to allow for future power needs. This approach, while often acceptable, has its drawbacks. First, it requires an accurate estimate of what the maximum power needs of an application will be over the course of the generator's life. It also ties up capital in the backup-power system at the outset—*monies that might be better invested elsewhere*. Additionally, because large generators use equally large engines that are manufactured in relatively small volumes, turnaround time for such a system can be longer than anticipated, which can cause problems from a project-scheduling standpoint.

An excellent alternative to this approach is a modular power system, in which several smaller generators are connected in parallel to provide the necessary output. Such systems are becoming increasingly cost-effective and space-efficient, thanks to new digital technologies that control all generator functions and switchgear integrated into the generators themselves. As the power needs for the application grow, other generators can be easily added to the system to provide extra capacity. This allows for a less-accurate initial estimate of how power needs will grow, since more capacity can be added in relatively small increments.

A modular system also offers installation flexibility not found in a single-generator (genset) solution, because the units need not be installed side by side. Furthermore, because these smaller generators typically use high-volume, on-highway truck- and automotive-derivative engines, instead of the lower-volume large engines mentioned earlier, most manufacturers can fulfill modular power-system generator orders in a shorter time. That means additional capacity can be added very quickly to a system to accommodate growth.

Build in reliability
Reliability is also a key factor in specifying a backup-power system. Nothing is worse than expecting a backup-power system to protect your investment, only to have it fail when it's needed most. While on the surface, reliability sounds subjective—*related exclusively to one's belief in a brand name or faith in a particular system's components*
—there are some concrete ways to evaluate reliability in a backup-power system.

Consider the single-engine vs. modular-power system example described above. Large single-engine gensets can offer reliability on the order of 98% to 99%, which is acceptable in many applications. However, there are applications, such as those associated with mission-critical data, where a power failure means a business failure—*not just a loss of revenue.* In such cases, maximizing reliability should be the goal. Modular power systems can do that, as well, through increased redundancy.

Unlike a single-generator solution, no one generator-failure results in the failure of the entire backup-power system. As previously mentioned, if the reliability of a standby generator is defined at 98%, a modular power system with an N + 1 configuration has a reliability of 99.96%, and an N + 2 configuration has a reliability of 99.999%. Therefore, when power absolutely, positively must remain on, it might be wise to eschew a single-generator solution in favor of a modular power system.

The fuel supply is another reliability factor. Diesel fuel has been the traditional choice for backup power because its high thermal efficiency typically results in a lower cost/kilowatt in larger applications. On-site emergency-system fuel storage also tends to be preferred by many authority-having-jurisdiction (AHJ) agencies. Issues of fuel storage, contamination and breakdown, however, can have an impact on system reliability. If ongoing fuel maintenance will be a challenge, a diesel-fueled genset might not be the best choice.

Natural gas is being considered more often for standby applications because it avoids the diesel-fuel storage issues. The natural-gas infrastructure is generally not affected by utility failures. The natural-gas supply, though, can be affected in situations such as seismic activity, raising questions of suitability for code-required emergency systems. The AHJ can address the reliability of natural gas in a given area. If on-site fuel storage is required for the application, dual-fuel gensets that can operate on both natural gas and on-site LP fuel are an option.

Bi-fuel generators, which simultaneously burn diesel and natural gas, effectively capitalize on the benefits of diesel and gaseous fuels while minimizing drawbacks that affect reliability. They offer the extended run times of natural gas, but can operate on 100% diesel fuel, if necessary. The amount of diesel fuel stored on site is significantly reduced as well, because natural gas is the dominant fuel. Other benefits include reduced maintenance costs, lower emissions and reduced operational costs.

Explore standards compliance

As clear from the previous discussion, it’s always wise to consult with the appropriate AHJ regarding specific code questions. For example, the key NFPA (National Fire Pro-tection Association) standard for backup-power generation is NFPA 110, which addresses the assembly, installation and performance of backup-power supplies for emergency systems and legally required standby loads. Compliance with NFPA 110 is compulsory in those jurisdictions that also have adopted NFPA 101 (life-safety code) or NFPA 99 (healthcare facilities), as both of those standards require NFPA 110 compliance.

The local AHJ can advise as to whether NFPA 110 compliance is required for a facility backup-power system. But even if it is not, NFPA 110 compliance goes a long way toward ensuring that a backup-power system is adequate for supporting key building systems in particular applications. It can also help you determine the size and type of system you will specify for a given application.

Consider maintenance requirements

Preventive maintenance is the most effective and important tool for ensuring the reliability and adequacy of any backup-power system. However, different backup-power systems will require different amounts of maintenance. The ability of the end-user to comply with the system's maintenance schedule should be considered when specifying a system.

Single-engine gensets offer the benefits that come from having only one unit that needs maintenance. On the other hand, such units incorporate engines built in lower volumes, so consumable preventive-maintenance components tend to be more costly. Moreover, single-engine gensets require large volumes of oil and coolant—*which are also pricey items.* Be fore specifying such a unit, it's important to make sure that the end-user is willing to bear these maintenance costs. Note, too, that since just a single generator will be providing all backup power, the facility won't be protected during any maintenance that calls for taking the unit offline

Modular power systems, by comparison, are multiple in number and offer the advantage of units that can be taken offline—*one at a time*—for extensive maintenance without eliminating the facility's backup-power protection. Moreover, because they are powered by engines that are produced in much higher volumes, preventive-maintenance consumables are more cost-effective.

Keep in mind that the chosen fuel supply also affects preventive maintenance. Diesel fuel, for instance, requires more maintenance than gaseous fuels. Unless properly maintained, diesel fuel will lose its efficacy. Maintenance requires the removal of water and dirt from the diesel tank. Water must also be drained from the tank monthly/weekly in more active systems or in areas with large daily temperature changes. If the end-user operation is unable to perform this type of maintenance, a diesel-fueled genset might not be appropriate.

The value in peace of mind

There's no doubt that backup-power systems mean peace of mind for building owners. Selecting the right system requires planning for those things that truly matter: current and future power needs, reliability, standards compliance and ongoing maintenance. Specifiers and end-users need to stay mindful of these items while maintaining a strong working relationship with the local AHJ to ensure that the right system for the application is installed. **MT**

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