True Energy Resilience With On-Site Power

Backup Power Generation, Protecting Against Utility Rate Spikes, and Assuring Future Energy Supply

True energy resilience is more than backup emergency power. Energy resilience means your organization is *protected* from utility rate spikes, and *prepared* in case of energy supply constraints. Here's how you can achieve practical and affordable energy resilience for your facility.

There are three important aspects to energy resilience:

1 PROTECTION AGAINST FUTURE UTILITY RATE HIKES

Uncertainty about future energy costs and significant utility rate increases is a serious concern. For example, energy policies in some states will likely force upward pressure on utility rates. These pending policies mandate increased energy generation from renewable sources, and significant reduction in greenhouse gases. Given these conditions, utility rate hikes can impact profitability for many operations.

2 PROTECTION AGAINST UTILITY SUPPLY RISK

The local utility company may not be able to expand its supply or infrastructure to meet your operation's energy needs for future expansion. This may occur as the result of expansion plans requiring greater supply capacity, a constrained market area or region, or excessively high costs or long lead times for these utilities to provide increased supply service upgrades for your site.

3 PROTECTION AGAINST POWER DISRUPTIONS

Energy resilience also means your facility is protected from the costs and disruptions of utility power losses. Whether the disruption is caused by external events, such as major storms, summer blackouts or brownouts, or caused by grid breakdowns or terrorist attacks, being prepared is an absolute and critical necessity. This is especially true for hospitals and other healthcare facilities, whose operations require round-the-clock energy.

Without a true energy resilience plan that addresses these aspects, companies and organizations in all fields—business, industry, healthcare, services, and education—could experience the negative impacts of power outages, energy cost uncertainty, and utility supply risk in the future. Unexpected and significant increases in utility energy costs, production downtime and business interruption costs, and hard limits to future expansion plans are some of the tangible limitations to profits and growth for companies without energy resilience.

In addition to providing reliable backup power in emergencies, a true energy resilience plan stabilizes energy costs and ensures adequate energy supply to your facility in the future.

Beyond Diesel Generators: Developing True Energy Resilience

Backup power generation in the event of storms and other power outages is certainly an important part of any energy resilience program, and diesel backup generators are commonly used to provide this backup power. However, diesel generators do carry a number of limitations that may prompt building owners and facility managers to re-assess their use as part of a broader energy resilience plan, especially in view of newer on-site power generation technologies now available:

- **Emergency backup use only:** Compared to combined heat and power (CHP) systems, which are highly reliable and run continuously to provide a share of a facility's power requirements, diesel generator systems are designed for short-term use to provide backup electrical power in the case of sporadic utility outages. Because they were not designed for continuous long-term operation, either in place of or alongside utility-supplied power, diesel generators cannot be used to offset the costs of utility-supplied power, which is an important part of a broader energy resilience plan.
- **Reliability issues:** Diesel backup systems require ongoing service, which includes regularly-scheduled start-up and load testing, preventive maintenance, and periodic monitoring and replenishment of stale diesel fuel. Even if the preventive maintenance is performed, diesel backup systems may not operate reliably in a power outage. For example, during Hurricane Sandy in 2012, diesel generators failed in almost 50% of New York City-area hospitals for various reasons including flooded diesel storage tanks.
- **Limited fuel supply and high emissions:** A diesel backup generator carries a limited fuel supply, with operating time of just days or perhaps 1-2 weeks at most, which means that backup power will not be available beyond this time if refueling by truck is not possible in a disaster scenario. Additionally, some areas may restrict diesel generator operations due to local emission regulations.
- **Cannot be used to offset ongoing utility costs:** Aside from their use during emergencies, a diesel generator cannot be used to provide ongoing power generation to offset the facility's utility-generated power costs, which eliminates its potential for energy cost-savings.

Energy-efficient backup power technologies, such as CHP systems, address these drawbacks and provide companies with on-site power generation capabilities that are of a larger energy resilience program. These technologies also offer continuous electrical and thermal power generation to offset utility costs and provide rate stability.

The On-Site Power Solution for True Energy Resilience:

Combined Heat and Power

A Combined Heat and Power (CHP) system, properly designed and configured for your facility and its energy needs, is the foundation for achieving true energy resilience on multiple fronts:

- As a backup power supply
- As a clean, continuous on-site source of electricity and thermal energy
- An energy source that can provide as much as 50% of your facility's energy needs at a lower cost than utility-generated power

CHP systems are usually 50% more fuel efficient in generating both electricity and thermal energy, compared to electricity produced by your local utility and traditional building heating systems.

A reliable on-site CHP system can consist of multiple clean and highly energy efficient compact gas turbine (microturbine) units, fueled by low-cost natural gas and engineered to run either alongside power generated by your local utility ("grid-parallel") or also as an independent power source ("black-start").

Depending on your facility's electricity profile and energy objectives, a micro turbine CHP system can pair with a solar electric system to offset a share of your facility's ongoing energy needs. The high efficiency, daytime operation and zero emissions can make solar-generated power a valuable complement to CHP systems.

CHP systems consisting of compact, reliable microturbines, sometimes combined with solar panel systems, provide on-site power to offset utility-generated energy costs, provide emergency backup power, and assure long-term energy supply.

TYPES OF CHP SYSTEMS

On-site CHP generation systems are available in either or both of the following configurations:

- **Grid-parallel-only systems operate in parallel with local utility-generated power.** Their primary purpose is to offset a portion of the facility's utility costs by generating a share of the facility's energy requirements on-site. Additionally, these systems can offset a portion of the utility peak demand rates charged to the facility when they operate during peak electricity periods. Multiple micro turbines offer a higher reliability and total uptime than a single combustion engine or turbine.
- **Black-start capable** CHP systems are capable of providing power to the facility during utility outages in addition to in parallel with an operating utility grid. These systems are equipped with a battery subsystem and controls to allow for safe and reliable switchover from the local utility when this stand-alone power is required. Uninterruptable Power Supply (UPS) units are sometimes added to these systems when conditioned power must be continuously supplied to support servers, networking gear and other IT equipment.

A CHP system fueled by natural gas has a plentiful and low-cost fuel source which is expected to stay low for many years to come. Natural gas delivered via standard distribution lines is highly reliable and unaffected by storms and transportation delivery issues.

While each of these configurations has advantages, CHP systems that combine both of these capabilities provide the best approach to a comprehensive energy resilience program, delivering both reliable back-up power in the event of emergencies, and providing continuous, lower-cost energy to offset the higher cost of utility generated energy. As a result, many CHP systems are now black-start capable and this functionality is often required for participation in state energy incentive programs, which can cover a significant portion of the capital costs of these systems.

Solar Power Generation Added to Microturbine CHP Systems

Depending on your facility, its energy needs, and site layout, solar power generation can be incorporated into an on-site power system to provide the following added benefits:

- **Increased resiliency**, supplementing CHP output using free solar energy.
- **Additional energy generation** during summer daytime hours, to offset utility peak demand charges.
- **Predictable and reliable energy** output to stabilize facility energy costs for the 20 to 25-year lifetime of these systems.

State incentives available to reduce solar power system implementation costs: Many innovative incentive programs are available at the federal, state and private level to help businesses and organizations finance the cost of a solar power system incorporated as part of a CHP system.

Key Benefits of On-Site CHP Power Generation

An efficient CHP system usually replaces 25 to 50% of a facility's utility-generated power with electricity generated on-site. CHP systems provide the following benefits:

ASSURING MORE STABLE AND PREDICTABLE FUTURE ENERGY COSTS

Shifting power generation from your local utility to on-site power generation removes this share of your facility's energy requirements from the added costs of future electric rate increases. In making this shift, you protect your organization from future utility power price spikes, adding increased stability and predictability to your facility's ongoing energy costs.

MEET FUTURE ENERGY NEEDS

In the event your local utility is unable to provide additional capacity infrastructure to meet your facility's increased energy supply needs in a timely and cost-effective manor, a CHP system can fill this gap, providing additional energy on-site to meet your future energy requirements.

SIGNIFICANTLY REDUCE PEAK ENERGY DEMAND COSTS

CHP can also significantly reduce or even eliminate time-of-day peak demand costs charged by the local utility during times of high energy usage (for example, daytime hours in summer months). Using on-site power to offset these costs provides your operation with significant cost savings from much higher peak demand utility charges.

REDUCE YOUR FACILITY'S HEATING AND COOLING COSTS

In addition to generating electricity, the heat generated by CHP can be efficiently recovered to supplement your building's heating and cooling needs, reducing total facility heating and cooling costs.

PROVIDE RELIABLE BACKUP POWER

Replacing a diesel backup generator with CHP provides reliable, low-cost backup power in the event of utility power outages due to storms, blackouts, fires or other events.

PROTECT AGAINST FUTURE ENERGY REGULATIONS

By incorporating an energy-efficient and low emission CHP system, your organization has a hedge against possible future regulation that may restrict emission levels or establish a carbon tax on energy use.

Organizations that make energy resilience a priority, by using on-site combined heat and power systems, will gain control of their energy costs and operating profits for many years into the future, helping leadership improve profitability and create a roadmap for future growth.

Is your facility protected and prepared? To discuss energy resilience for your organization, contact GEM Energy. We'll provide more details on how on-site CHP power generation helps you realize the benefits of true energy resilience for your operation.

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