Interruptions of electrical power, even of short duration, create situations that can imperil public health and safety. Whether the loss in power is from weather-related natural disasters or electrical grid failures, resulting blackouts or brownouts wreak havoc and have enormous economic impacts. Emergency backup electrical generators powered by diesel engines provide reliable, immediate and full strength electric power when there is a failure of the primary power supply system, minimizing losses from these events.

Loss of electrical grid power due to storms, natural disasters or high power demands are increasingly common. With a growing dependence on technology and interconnected systems that rely on electricity, power reliability becomes increasingly critical. Hospitals, data centers, water and sewage facilities, fueling stations, and communication and transportation systems require continuous power to protect public health and safety. As opposed to some other fuels and technologies, diesel-powered generators provide a steady supply of high-quality power and superior performance for transient or fluctuating power demands due to the high-torque characteristics of diesel engines. Beyond these most critical applications, the power needs for food and medical refrigeration, building operations such as elevators and sprinklers as well as banking and business networks further highlight the significant economic and other losses from power outages.

Diesel-powered generators provide the most reliable form of emergency backup power. Many international building codes and standards effectively require diesel generators for code compliance because of the need for rapid response time, load carrying capacity, fuel supply and availability, and reliability. One of the most important and unique features of diesel-powered generators compared to other technologies is quick response time, able to start and absorb a full electrical load within ten seconds of grid power failure.
Diesel Generators: A Reliable and Clean Source of Power

For example, the National Electrical Code 517-13, as well as the California Electrical Code, requires all hospitals and critical care facilities to have backup power systems that start automatically and are up and running at full capacity within ten seconds after power failure. Finally, the California Building Code requires emergency facilities to operate during disasters. This eliminates natural gas as a source of power for generators in these settings because during a disaster, such as an earthquake, gas lines are immediately turned off to avoid risk of fire and explosion during a rupture.

Emergency diesel generators are available in a range of sizes all based on electricity demands. Units can be permanently installed at fixed locations such as hospitals or can be brought in on a mobile trailer to disaster sites or outage areas. The actual system consists of the diesel engine unit and generating system, fuel storage/supply, and electrical switchgear.

Emissions Regulations and Standards

Diesel generators are covered by a wide range of federal, state and local requirements regarding emissions performance and operating conditions. Facility owners must determine the type of use and application for the generator—emergency, non-emergency stand by or prime power. Federal regulations governing the hours of operation are different for emergency and non-emergency uses. Regulations do not limit the use of backup generators during emergency situations. However, federal regulations in place since 2006 limit the number of hours generators may be used for non-emergency purposes. Also, state and local regulations may also stipulate the size, location and use of generators. Additionally, federal regulations require the adoption of emission control devices to improve emissions for older non-emergency backup generators.

In 2006, EPA finalized the first national emission standards for new stationary diesel engines under the New Source Performance Standards (NSPS). The NSPS requires all new diesel engines to be certified to emission standards that generally follow EPA’s non-road or marine mobile emissions standards which generally require over 90 percent reduction in emissions of particulate matter and nitrogen oxide.

Over the 2011-2015 period, EPA requirements will mean that emissions for all non-emergency diesel generators regardless of horsepower rating will be approaching a near-zero level.

Since October 2010, most diesel fuel used in diesel-powered generators has been ultra-low-sulfur diesel fuel (no more than 15 ppm sulfur). Using ULSD in existing units reduces particulate matter emissions by 10-20 percent, and when cleaner fuel is used in today’s new technology lower-emissions engines particulate matter will be reduced by 90 percent compared to engines made before 2011.

Older, existing non-emergency diesel-powered generators are also subject to new regulations under EPA’s National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engines (RICE). These regulations will in many cases require retrofitting with emissions control technology.
such as a diesel oxidation catalyst in order to meet the requirements. EPA estimates that 900,000 existing stationary diesel engines will be affected by this regulation.

For more information, view EPA emission regulations: What they mean for diesel powered generating systems.2

CONTRIBUTING TO GRID RELIABILITY

While used most frequently as a source of emergency backup rather than prime power, advances in clean diesel technology have enabled the introduction of prime power generators with extremely low emissions, opening new market opportunities for diesel-powered generation in the area of distributed generation and peak shaving. As the economy searches for clean, reliable power to supplement the fragile electrical grid, investments in alternative energy sources such as hydro-electric, nuclear, wind and solar power also boost demand for diesel-powered generators. Wind and solar energy, while clean, is intermittent, thereby necessitating the incorporation of stationary generators to provide ongoing power reliability.

During certain periods of high electricity demand, shortages of electricity in various regions of the country have resulted in rolling blackouts. One option for responding to high electricity demand days and preventing grid failures is to bring on supplemental electrical supply through the strategic use of existing stand-by diesel generators in a “demand response” mode. In this instance, during periods of peak electrical demand, the generator owner activates the building generator to take the electrical demand off the grid or in some instances operates the generator to put power back into the grid.

Through the use of diesel generators in this way, load on the grid is reduced during periods of high demand, thereby avoiding more prolonged use of emergency generators in the case of an actual power outage. Other related solutions include reducing demand on the conventional power plant through distributed generation, that is producing electricity on-site with a diesel or natural gas generator where it is used, bypassing the need for full reliance on the grid.

Rural or remote locations where grid power and other fuel sources are unavailable are common applications and the portability of diesel-powered generators and their fuel storage also make them a power source of choice for temporary power needs like those used on construction sites. Use of high-quality renewable and biodiesel fuel blends in prime power applications is also possible, thereby further reducing emissions levels.

The significance of continuous electrical supply is increasingly evident. Recent studies have found that the loss of continuous electrical grid power results in economic impacts on the order of $80 billion annually in the United States. The 2003 Northeast blackout is reported to have cost the nation between $7 and $10 billion.

CONCLUSION

Diesel engines provide durable, reliable energy to meet both mobile and stationary power needs. A continuous power supply can mean the difference between life and death. Thanks to diesel-powered generators, supplies of food, water, medicines and fuel can be protected during natural disasters, days of peak grid demand and in remote or isolated locations.
Diesel Generators: a Reliable and Clean Source of Power

Today’s new prime power diesel generators emit 26 times less particulate matter than those manufactured 10 years ago. These developments are reducing the air quality implications for diesel-powered generators use and creating new market opportunities as communities look for clean energy alternatives. Thanks to this technology transformation, clean diesel power will continue to play a dominant role in key sectors of the U.S. economy for many years to come.

Only backup generators powered by diesel fuel can provide these features:

Quick start-up time: 10 seconds or less. Other fuel sources may take up to two minutes, which may be too long in many emergency situations and out of compliance with state and federal laws.

Power density/fuel efficiency: Due to the chemical structure of diesel fuel, more energy is released per unit than any other source of commonly used power. For the same size engine, a diesel can produce twice the kilowatts of a gas engine generator. Greater power density means less fuel consumption than other sources of fuel.

Continuous strength: Diesels provide a steady supply of power and can handle wide swings in power use. Turbine (jet) engines cannot easily handle these fluctuations. A diesel generator does not “flicker” or dip in power output when appliances such as a large air conditioner turn on, surge and drain power. Gas and turbine engines can slow down when strained, causing failure of the electrical equipment. To compensate for such “straining”, users may install unnecessarily oversized generators, causing significant inefficiencies and fuel consumption.

Disaster utility: When a disaster such as an earthquake strikes, the first source of power turned off by utilities is natural gas due to its explosive nature and vulnerability of pipes to rupture - leaving an uncertain supply of fuel. Diesel generators have their own storage for clean diesel fuel, which is readily available and replenishable.

Reliability: There is no lack of confidence about the ability of a diesel generator to provide power quickly and continuously during a power blackout.

Availability: It is easy for any person, business or facility to select, finance, install and service a generator in the United States because of a comprehensive system of local dealers, and readily available supplies of clean diesel fuel.

Portability: In addition to stationary units, diesel generators of various sizes and capabilities are highly mobile and available to be transported and positioned in virtually any setting to meet emergency power needs. Clean diesel fuel supplies are readily available in most locations and portable tankage accompanies the mobile units.

Durability: Some high quality engines last 20,000 - 30,000 hours before their first overhaul. That’s equivalent to one and one-half million miles in an automobile!