
Preserving Public Safety: The Facts About Diesel Power Generation



The Facts About Diesel-Powered Electric Generation

Diesel-powered generators can save lives during a power crisis. Interruptions of electrical power — even of short duration — create situations that could imperil public health and safety. Blackouts also wreak havoc for businesses and create significant inconveniences for individuals. Emergency generators must be able to provide reliable, immediate and full strength electric power when there is a failure of the primary power supply system.

As peak demands affect electrical power supply — particularly during hot weather months — diesel-powered electric generators are being deployed to provide for standby and emergency power.

Standby emergency power must be provided for:

Public Health

- Hospitals (particularly emergency rooms and life support systems), blood banks, nursing homes and other health care facilities;
- Food refrigeration, both commercial and personal;
- Drinking water systems and sewage treatment and pumping facilities;
- Air conditioning, particularly for the elderly and infirm;

Public Safety

- Emergency 911 communications systems for police, fire and medical response, correctional and security systems; emergency power on fire trucks;
- Transportation systems, including air traffic controller networks, airport and seaport navigation, radar, and radio communications, military bases, weather forecasting, and railroad track switches and lights, emergency vehicle fuel pumps and repair facilities.
- Building operations, including elevators, security and sprinkler systems

Businesses and Personal Use

- Computers, Internet connections, data systems, communications systems, business machines, such as cash registers and credit checking systems, ATMs;
- Food processing plants, biomedical facilities, manufacturing facilities;
- Home health devices such as ventilators, respirators and dialysis machines, as well as lighting for all.

Only back-up 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 a tornado, hurricane or 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.

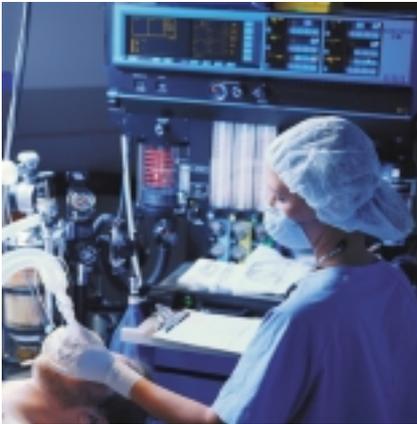
Durability: Some high quality engines last 20,000 - 30,000 hours before their first overhaul. That's equivalent to one and one-half million miles in an automobile!

Cost: The combination of greater fuel efficiency and lower fuel costs means diesel is the most cost efficient source of reliable back-up power. While diesel prices rose an average 60% in 2000, natural gas prices have risen from 200% to 600% in various parts of the country with many states indicating that natural gas supplies are low.

Frequently Asked Questions

Q: What is the most common type of generator?

Diesel is the fuel of choice for the majority of generators. These generators range from car-engine sized portables to large air conditioner-sized (small building) models, to those that are about 8'X10' in size and reside in a 20- to 40-foot protective covering or trailer. There are also mobile models fully contained in a tractor-trailer and designed to be driven to sites where emergency power is needed. Diesel generators can be used alone, or in some situations as an integral part of a power system that includes solar, wind and other sources of electricity.



Q: How do the generators work?

Generators are powered by diesel engines that operate by the injection of fine diesel fuel droplets into a combustion chamber heated by compression (compression-ignited). The air heats the fuel and causes it to evaporate and mix with the available oxygen. The fuel ignites and spreads through the chamber. Power output is managed by controlling the amount of fuel injected into the combustion chamber. This process is different than “spark-ignited” engines such as gasoline engines (internal combustion process), which initiate combustion by mixing air and fuel with a timed spark of electricity. Output from the engines turn turbines which generates electrical power.

Q: What are the laws and national standards for emergency power generators?

State laws and national standards require that hospitals and emergency services maintain a backup power and lighting system that is immediately available at all times. Only diesel systems have the ability to meet these immediate start-up and load-carrying requirements. Gasoline, natural gas, turbine (jet) engines, wind and solar power take 40 seconds to 2 minutes to reach the power level to carry necessary emergency electrical loads. Prior to start up, turbines (jet engines) must first purge or blow out existing gas otherwise risking an explosion.

Specific laws and standards demand the power attributes that only diesel emergency generators provide include:

Most State and local codes require the system to *“provide automatic restoration of power for emergency circuits within ten seconds after normal power failure”* to ensure public health and safety.

The National Electrical Code 517-13 as well as state codes recommend and/ or require all hospitals and critical care facilities to have back-up power systems that start automatically and are up and running at full capacity within ten seconds after power failure.

Most State Building Codes require emergency facilities to operate during disasters. This *eliminates* natural gas as a source of power for generators because during a disaster, such as a tornado, hurricane or earthquake, gas lines are usually turned off to avoid risk of explosion during a rupture.

The National Building Code of the National Fire Protection Association, as well as the majority of state codes, require high-rise buildings to have *immediately available emergency power generation* for elevators. This ensures that passengers will not be stranded on elevators on upper floors in the event of a fire or other emergency.



Q: Why are back-up generators important to non-emergency electricity users?

Nine out of 10 small businesses were hit by a power outage in 1998, according to a 1999 study (“Pure Power Electrical Systems for the 21st Century”). On average, these companies were hit with three power outages, the average cost of which was estimated at \$7,500 per day. These figures are expected to rise significantly in 2001.

Some electricity customers made agreements with utility companies to an average of 20% reduction in electric costs in exchange for the being at the top of the list for a power “interruption.” Many of these companies are experiencing far more frequent blackouts than anticipated and need a temporary fall-back source of power.



Q: What are the impacts of a temporary loss of electric power?

Risks to Worker Safety and Health...

Workers operate machines, power tools and are engaged in chemical processes. These workers could be at risk of injury, exposure to dangerous chemicals or death from a sudden loss of power without immediate restoration of power for vital systems.

Environmental Damage...

Continuous chemical process and manufacturing centers rely on air pollution control systems to remove harmful pollutants, which require a steady source of power to operate, monitor and maintain machinery, equipment and systems. Power failures interrupt these systems and could result in dangerous worker exposure to chemicals or the release of untreated air pollutants into the environment.

Increased solid and hazardous waste generation...

Interrupted manufacturing processes resulting in product quality failures or spoilage requires disposal of wasted process chemicals or spoiled products, increasing other waste streams.

Food Processing Spoilage... Loss of continuous refrigeration, production line and processing capabilities caused by power interruptions results in destruction of perishable fresh produce and other agricultural products undergoing food processing. This also necessitates disposal of thousands of pounds of wasted food and food by-products. Reliable electrical power is a necessity to protect the nation's food supply.

Shortages of critical parts and supplies...

From aircraft replacement parts to heart valves, an uncertain power supply that reduces production could cause shortages of critical parts for critical applications.

Economic Impacts... Manufacturing processes and businesses require stable power supplies — without which they cannot operate — resulting in lost production, lower economic output for the state and increased layoffs and unemployment. And, new e-commerce and internet businesses require reliable, uninterrupted sources of power to operate; without this power, they must shut down computer and internet systems that support banking, trade and other vital business services. Growing reliance on Internet and telecommunications in business, stock and commodities markets and banking magnifies the severity of impacts of even momentary flickers in power supply. These interruptions in turn have trickle down effects on virtually all other aspects of the economy...raw materials, transportation and consumers.

Q. Are diesel-powered generators subject to state and federal controls for hours of operation, and air quality?

All but the smallest emergency generators are subject to federal and usually to state laws which govern their hours of operation, and permissible emissions. Like on-road diesel engines, portable and stationary generators also incorporate new clean diesel technology to reduce air quality impacts. The environmental performance of some older generators can also be improved through use of ultra low sulfur diesel fuel (ULSD) and filters or particulate traps.

Q. Is there a functional distinction between stand-by (emergency) generators and other diesel-powered generators?

Yes. As noted, stand-by generators are generally smaller and intended only for intermittent use. Larger diesel-powered generators can be relied upon as a prime source of electricity, and are increasingly used to achieve “distributive generation”, i.e., independence for individual users from reliance on a central power plant. A prime-source generator may or may not be connected to the central power “grid”; when connected, a prime-source generator can feed surplus electricity into the grid of which it is a part.

Q. Are there advantages to use of stand-by (emergency) generators prior to a blackout?

As an official in New York State has recently observed, the use of stand-by generators in anticipation of a blackout would prevent any disruption of supply, and avoid the necessity of having to suddenly activate older, less dependable generating equipment.



Q. Is it possible to achieve the operational advantages of stand-by (emergency) diesel generators without adversely affecting air quality?

Yes. Like all sources of electricity, even the most technologically advanced diesel “gen sets” produce exhaust emissions. State officials who are committed to the maintenance of air quality, particularly in “non-attainment” areas, have authorized increased use of diesel generators, on condition that there be “no net loss” (or deterioration) of air quality.

This can be achieved by reduction of other sources (“offsets”) and the establishment of emissions credit banks.



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