GENERAC
INDUSTRIAL POWER

factsheet

Installation and Parallel Configuration Brings Overall Cost Effectiveness

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INTRODUCTION

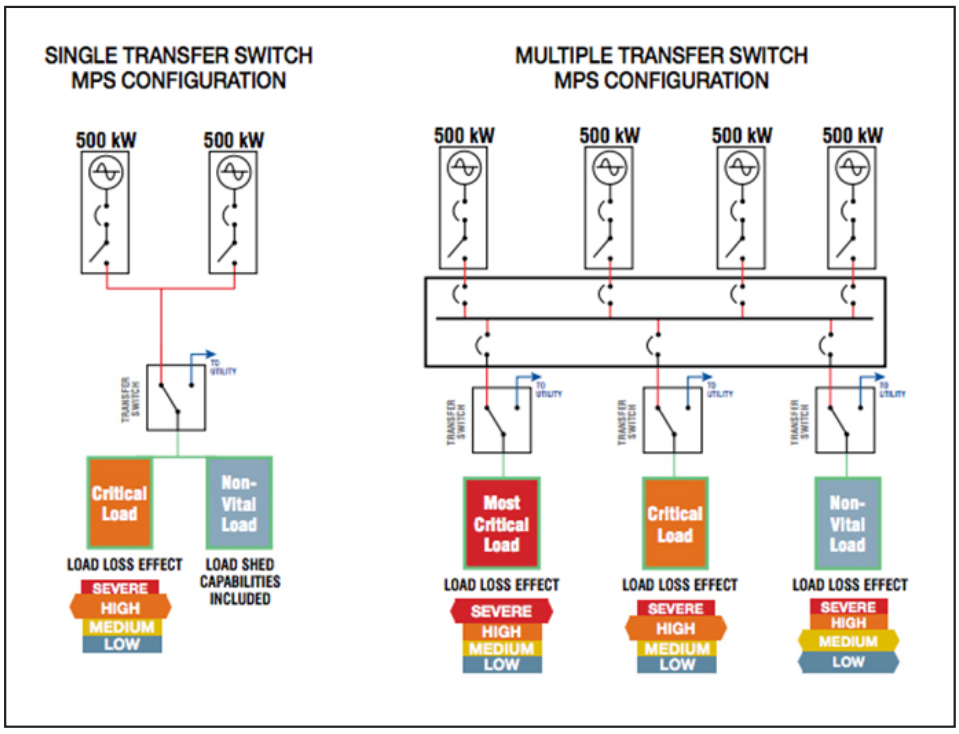
Diesel generators have long been the go-to solution for backup power generation. Diesel technology remains largely unchanged over the past century, but its capacity for high power output keeps it relevant as an attractive solution in many industrial applications. Depending on the configuration, a single, albeit massive, diesel generator often can provide backup power for an entire facility.

Natural gas provides a cleaner, more efficient and more cost-effective alternative to diesel. The obvious disadvantage to this technology is its comparatively limited output – a single natural gas-fueled generator generally can't match the wattage of its diesel counterpart. However, when multiple natural gas generators are installed together in parallel configuration, not only can they produce a comparable or even greater amount of power, they also offer flexibility, scalability and numerous other benefits.

One of the greatest benefits of configuring a network of paralleled natural gas generators instead of a single diesel unit is this:

Over the course of the application's lifetime, a paralleled natural gas solution is significantly more cost efficient than a diesel alternative.

This fact sheet provides an overview to paralleling generator systems, an analysis of overall cost effectiveness, a listing of additional benefits, and a guide to getting started.



PARALLELING GENERATORS OVERVIEW

In terms of electrical generator installation configuration, paralleling is the act of combining or synchronizing two or more electrical inputs by matching the voltage output of one electrical system with that of another system. Synchronization can be created between two or more generator systems or between generator systems and the utility power supply.

When generators are configured to run in parallel, the power generated by each individual generator combines to create the total power output of the system as a whole. For example, a system of four paralleled 250kW generators will create a total power output of 1,000kW

Example:
4 individual generators x 250kW = 1,000kW total output

New, state-of-the-art natural gas generators are designed to work with no functioning communications or load share lines. When active communications go down, these units are still fully capable of automatic starting, paralleling, and load balancing without manual starting.

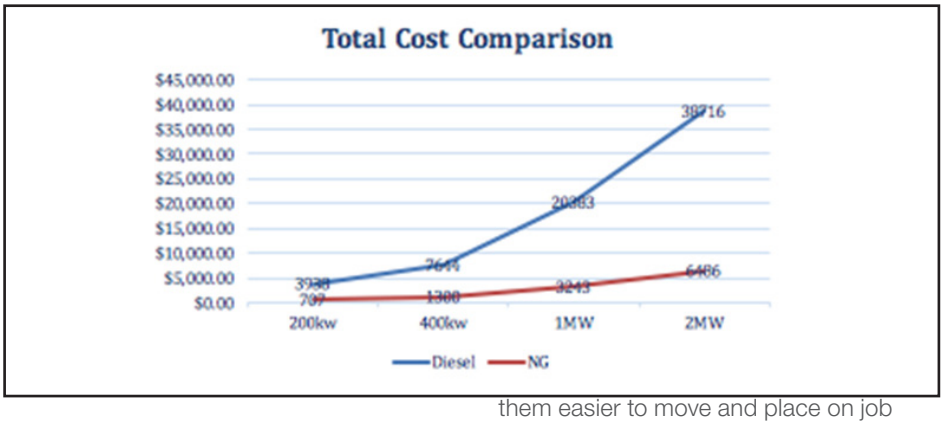
This means if one or more individual generators fail or go offline, the system will still produce power equivalent to the sum of the remaining units. If one of the four generators mentioned in the example above stops functioning, the system will still create an output of 750kW.

Example:
3 (of 4) functioning individual generators x 250kW = 750kW total output

If a single large generator stops functioning, it's power output immediately becomes zero. This topic will be discussed in greater detail in further sections.

PARALLELING GENERATORS FOR COST EFFICACY

With any electrical system, particularly a need above 500 kW, the design engineer should weigh the advantages of a paralleled generator system over that of a single generator system with an eye on TCO (total cost of ownership).



This might mean, for example, installing two 250 kW natural gas-fueled generators could provide a greater cost benefit than installing one 500 kW diesel-fueled generator.

The overall cost comparison between diesel and natural gas generators of different wattages can be seen in the chart to the right (data drawn from GeneratorTCO.com):

By breaking down the various costs associated with natural gas vs. diesel generators, we can see why the TCO differs so dramatically.

Capital Investment: The ability to add additional paralleled generators into your system over time can mean a significant reduction in your initial capital investment. There is no need to install more power than currently needed, since more modules can be added in the future as business grows or power requirements increase.

Installation Cost: The capital investment to specify and install two paralleled lower-kW generators compared to one larger-kW generator can be similar. However, paralleled units often have the advantage of greater installation support from the supplier, which offsets some of the initial cost. Their lighter weight makes them easier to move and place on job sites, requiring smaller, less expensive lifting equipment, and the simple design means installation time is decreased.

Fuel Cost: In the United States, the cost of natural gas trends significantly lower than that of diesel. According to the U.S. Department of Energy's April 2017 Alternative Fuel Price Report, the national average price between April 1 and April 17, 2017 for natural gas was $2.15/GGE. The average price of diesel for over that time period was $2.55/gallon – 18% higher.

Servicing and Maintenance Cost: A single paralleled unit can be taken out of service for maintenance or repair while other units remain available should an outage occur. Smaller paralleled generators can also be stored in easier-to-access locations like on rooftops or in parking garages.

BENEFITS OF A PARALLELED GENERATOR SYSTEM

One large, diesel generator significantly limits options and flexibility – a giant ocean liner, compared to a fleet of smaller, nimbler boats. This section will highlight additional benefits associated with diversifying power generation in multiple units, rather than depending solely on an old diesel.

Diversification: Having multiple units in a system reduces the risk associated with any one of them failing. One diesel unit failing immediately results in zero power. One paralleled unit failing will reduce the amount of power produced by the system, but power will still be produced.

Scalability: As mentioned earlier, installing a system presents the opportunity to add units to that system at a later date. Need more power? Add units. Need less power? Allocate existing units elsewhere.

Redundancy: In most applications, the loads that require the highest degree of reliability are only a percentage of the generator's total capacity. Paralleled natural gas generators can provide N+1, N+2, and more, offering up to 99.999% reliability.

Reduced Space Requirements: Using smaller kW generators offers greater weight distribution making roof-top installations more feasible. These generators are also shorter and more compact so locating them in parking garages becomes a possibility.

Flexibility: Generator sets (Gensets) can be added to a current system depending on growth. This allows owners to make a smaller initial investment and scale accordingly based on increase power demands.

Fuel Accessibility: In cases of crisis or natural disaster, highways often clog making diesel fuel transportation difficult. Natural gas, transported through pipelines, remains unaffected by disruptions to roadways, making it more reliable in situations where it's needed the most.

THE MODULAR POWER SYSTEM SOLUTION

Paralleling natural gas generators provides significant benefits, but given the options and complexity, it's important to have a solid partner in the enterprise as well.

This section will highlight how Generac, a world-class provider of generators and support solutions, has removed the complexity of generator paralleling with an innovative Modular Power Systems (MPS) offering – a transformational technology that eliminates the expense and space requirements required with either a single diesel unit or a less-consolidated paralleling solution.

Partnering with a company like Generac removes many of the initiation obstacles associated with transitioning systems.

With the complexity of options associated with paralleling generators, Generac provides start-to-finish engineer and technical support. They function as a solutions-focused partner to analyze existing needs, design systems tailored for specific footprint and power-output requirements, and install and configure them with automatic backups and other capabilities not available elsewhere.

Generac also offers an integrated control concept with all the necessary components to control paralleling – synchronizer, speed governor biasing, automatic voltage regulator biasing, communications, load sharing, metering, protective relaying, operator interface and even custom logic capabilities. (In the past, it took multiple controllers to provide all these functions.)

This integrated controller platform is extremely flexible and offers the following features:

- Expandable I/O modules – analog and discrete
- Advanced communication capabilities – onsite and via web
- Supports low and medium voltage paralleling
- Custom event and alarm capabilities to site specific needs - motorized louvers, remote fuel tanks, day tanks, remote breakers, etc.
- Custom logic capabilities providing maximum application flexibility
- Parallel switching that can be located internally to the generator or integrated at the switchboard

With more than five decades of experience, Generac provides paralleling solutions that offer significantly more long-term cost efficiency and benefits than a single diesel unit. The company's wide variety of sizes, fuel choices, and configurations allow facility managers, engineers, and contractors to make the selections that provide the best value. They also provide a nationwide network of Industrial Power Distributors to offer support during every part of the process from sizing to fuel selection to specifications to design and installation.

Diesel generators offer an old solution to modern demands. Paralleling natural gas generators – especially with the start-to-finish technical support of a partner like Generac – enables comparable (and scalable) power generation with a significantly lower total cost of ownership over the lifetime of the system. It's also a cleaner, more flexible, and more reliable alternative.

With all these benefits, it might be time to further examine the full spectrum of available paralleling options. For more information on Generac's MPS offerings or to contact a sales representative, please visit: www.generac.com/industrial.