ISSUES WITH PEAK DEMAND

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June 2019

CATERPILLAR®

Generator sets in the range of 10 kW to 20 MW are designed to operate mainly under variable loads and will be purchased as either Standby, Mission Critical, Prime or Continuous rated depending on the application. The definitions of these are as follows:

Standby
Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Mission Critical
Output available with varying load for the duration of the interruption of the normal source power. Average power output is 85% of the mission critical power rating. Typical peak demand up to 100% of rated power for up to 5% of the operating time. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Prime
Output available with varying load for an unlimited time. Average power output is 70% of the prime power rating. Typical peak demand is 100% of prime rated ekW with 10% overload capability for emergency use for a maximum of 1 hour in 12. Overload operation cannot exceed 25 hours per year.

Continuous
Output available with non-varying load for an unlimited time. Average power output is 70-100% of the continuous power rating. Typical peak demand is 100% of continuous rated kW for 100% of the operating hours.

Before a generator set is sized for a job, the application load profile must be determined. Recording amp-meters or watt-meters may be attached to the load to accurately assess the load profile and determine the rating of the generator set.

However, there are some things in the load profile that need to be examined:

1. How high is the Peak Demand and how long does it last?
2. What is the average load?
3. What is the lowest load and how long does it last?

Customers with high peak demand are apartment blocks, schools, hotels and offices, where the demand is high at certain periods from the use of cookers, air conditioning, hot water, lighting, etc. These high demands cause utilities problems since they must have the capacity to meet the peak which is only required for a fraction of a 24-hour period. This extra needed capacity is costly to build and maintain and therefore the utility’s rates reflect this by a peak service charge.

On the other hand, data centers (which have become huge users of electricity), hospitals and manufacturing plants that run 24 hours a day are consistent, steady users of electricity that the utilities can count on for steady loads.

The first question tells you how much total electrical power is required. The last question tells you whether you can supply that peak load with one generator set or if you need multiple generator sets. If you have a very high Peak Load but have a very low average load, then you will need multiple generator sets arranged to operate in parallel with each other. This will avoid the need to run a single large generator set at low loads. Problems can arise if a generator set is operated at low loads (below 30% rated load) for long periods as it will “wet stack”. Wet stacking means the exhaust temperature in the exhaust manifold is not high enough to burn off any oil that comes down the valve guide and so the oil accumulates in the exhaust manifold (known as “slobber”) and can cause deposits to form on the exhaust valve faces. Eventually this can cause burning of the exhaust valve faces and the valves will have to be reground and the valve seats replaced, an unnecessary added cost.

The other item to consider when sizing a generator set is the type of load. The two main types of load are resistive loads and inductive loads. Resistive loads are loads such as radiant heaters and older lighting. These are straightforward and easy to consider when sizing a generator set. Inductive loads have other problems depending on their size and how large they are in relation to the complete load profile. Inductive loads are mainly electric motors but there are many other kinds also such as capacitors and LED lighting. When an electric motor is started without any load attached it draws up to 50% more current than when it is running. If it has a load attached when it is started it may draw even more current which can overload an undersized generator set and cause its engine to stall.

Where permitted, customers may elect to use generator sets to lower their electric bill. This is due to the electric utility charging a long-term fee for the customer’s highest peak (typically in 15-minute increments) electric usage. The Utility does this because they require enough capacity to cover **all** the electric demand from their customers - including all the peak demands. This is especially true in high ambient temperatures when air conditioning can consume vast amounts of electricity. During these periods the utility will call on large customers to lower their usage to a pre-agreed level. They will be given time to start their “peaking generator sets” and bring them on line. While the utility’s generators are large enough to accept large motor starting loads, the customer’s smaller peaking generator sets may not be. The customer must take this into account when determining what size generator set best meets peak demand. If the customer has large motor loads that start and stop often or have sudden large loads dropped onto the motor, larger generator sets may be required to meet these demands.

The Heating and Air Conditioning (HVAC) industry now tends to utilize radiators with multiple small fans and motors, replacing the previous large fan and motor that required more current when the HVAC unit started. This means the generator set does not need to be as large for motor starting purposes.

Assuming they are properly sized, the generator sets will do what they intended to do very reliably providing they are properly maintained. Lack of proper maintenance is the main cause of generator sets not running properly when required.

Unfortunately, maintenance can be neglected or eliminated since the “savings” go right to the company or organization’s bottom line profits. However, when the unit is needed and does not operate, because of lack of maintenance, the losses involved greatly exceed the short-term savings. Generator sets that are used for peaking need to be run at least monthly, if possible under load, and if batteries are used for starting they must be kept fully charged. The fuel supply needs to be of adequate size for the conditions – usually, at least, a 24-hour supply.

In recent years, there has been an increasing focus concerning testing of the fuel. Diesel Fuel can be counted on to run the generator set successfully if tested and, if necessary, treated every year. Contaminated fuel will quickly clog the fuel filters and cause the engine to shut down.

Finally, maintenance of switchgear should not be neglected. Generator sets are reliant on functioning switchgear in a utility backup. There have been numerous documented cases of well-maintained, redundant generator sets not able to supply power due to switchgear issues – all traced back to a lack of switchgear maintenance.

So how do you have a peaking system that will save you money on your utility bill?

- Size the system properly for the loads you intend it to power.
- Test the system, including all switchgear and controls at least monthly.
- Monthly tests should be under load, if possible; otherwise, at least annually.
- Maintain the system as required by the manufacturer and the dealer.
- Have a good supplier of fuel and check it adequately every six months.

LEXE1561-01 (06/19)