PEAKING GENERATION WITH STANDBY EQUIPMENT

Many large commercial and institutional buildings have existing small standby generators. This equipment is installed to serve certain critical electrical loads during a utility failure. Like an insurance policy, the equipment is very important, but it is rarely used. Typically, diesel-fired combustion engines with synchronous generators are installed. The equipment capacity is usually significantly larger than the dedicated loads.

It is important to recognize, however, that while standby equipment can be used in several ways to reduce a facility's power demand, some of the available methods may jeopardize the operation of the electrical load dedicated to the standby generator. In addition, the switchgear and controls are usually not programmed for peaking purposes; and, unless the peaking period is short with time-sensitive rates, the process is not always economical. These problems, along with past discouragement from the utilities, are why so little available standby generation is used for peaking purposes.

There are three basic possible peaking methods with respective advantages and disadvantages:

Open-transition transfer

Open-transition transfer is the most widely used method of employing standby equipment for demand reduction. The existing emergency loads are transferred to the energized standby equipment and completely off the utility system using breaker pairs or transfer switches. These dedicated loads are frequently less than 50% of the generator's potential output. If the loads can withstand the momentary loss of power during the transfer, this may be the least expensive approach to peaking generation. Yet many loads cannot withstand the interruption or the frequency and voltage transients that occur during transfer. More often the occupants in the building find even a blink in power to be a major disruption in their activities. If there is a failure of the standalone generator, then the load will be interrupted again as the transfer is made back to the utility. This method also fails to utilize the standby generators to full capacity.

Closed-transition transfer

This technique momentarily synchronizes the generator with the utility before transferring the loads. This avoids the interruption during transfer by closing the generator breaker to the load before opening the utility breaker. The reverse is done to transfer the load back to the utility. The elimination of a blink during transfer is a major improvement over the open-transfer method. However, frequency and voltage transients can still occur during transfer, and the generator capacity is still not fully utilized. Synchronization can drift between transfers; and in the event of generator failure, the load - as in open-transfer - is dropped. In addition, the transfer-operating scheme is more complex, which increases the probability of a control malfunction. This method, too, poses risks that may not be acceptable for important loads that justify standby equipment in the first place. Some utilities require full paralleling protective measures even for systems that involve only momentary synchronization with the grid.

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Paralleling

This system uses a paralleling breaker to directly tie the generator to the utility system. During peaking operation, the generator is electrically synchronized with the utility. The generator can be gradually loaded to either a preset output or one that is controlled by the building's energy management system. When terminating peaking, the generator is gradually unloaded to prevent system disturbance. After the generator's breaker is opened the generator goes through the shutdown procedure. This peaking method is far superior to the other methods. The introduction of the generator into the building's electrical system is transparent to the building loads. Shock loading is avoided by the gradual loading and unloading of the generator. The standby equipment can be used to its full capacity. If desired, the building reactive loads can be offset by adjusting the generator power factor. This synchronous power source improves voltage regulation. Transient loads are fully supported by the utility and reduce the impact on the generator or other building loads. Full emergency standby generation operation is retained. While new paralleling system installation costs are higher than dedicated load-transfer systems, a retrofit of an existing system can be quite expensive. Other transfer methods cannot fully test the generator's ability before an emergency occurs. Performing an occasional paralleling operation will verify during a non-emergency whether the standby system is reliable, and corrective action can be taken while utility service is still available. Paralleling has critical design requirements. A full fault-current analysis and circuit breaker coordination study of the building system and utility service must be performed to determine whether or not the contribution of the generator's fault-current contribution will exceed the ratings of existing protective equipment. A paralleling operation imposes additional safety concerns on the utility system to ensure the generator does not feed a distribution fault. Even when the facility load is larger than the generator's capacity there is still a possibility of exporting power to the utility. The settings of the customer's switchgear and the utility's protective gear must be coordinated. The local utility must approve the system design prior to the switchgear's manufacture and installation. The customer is usually required to reimburse the utility for the cost of its protective measures.

Existing equipment checkups

Some components of an existing standby generator system may not be capable of the extended run time for peaking duty. An increase in fuel supply may be needed to provide a minimum of 24 hours for peaking plus sufficient fuel for standby duty. The cooling system must be adequate for full-capacity running on the hottest hours of the year. The generator must be in sound mechanical and electrical condition to handle additional run time. While there will be additional run time on the generator, standby equipment receives so little run time that the incremental maintenance is not as significant as the additional fuel cost. Exhaust systems on existing equipment are not always insulated or terminated with extended operation in mind. In many cases governor modifications and a voltage regulator will be required. The biggest hurdle is usually meeting environmental emission regulations. Mitigating NOX emissions can be expensive and may require a catalytic converter.

Strategic ramifications

With current policies encouraging the use of intermittent sources of generation like solar and wind power there is an increased need for quick-acting small scattered generators to shore up the reliability of the utility systems. Conventional generation requires "reserves' of about 10% to

20% of the peak demand so make-up power is available when an unexpected outage occurs in the utility fleet of power plants. Intermittent sources, wind and solar, require upwards of 40% reserve capacity. This capacity can be provided by the developers of renewable generation, the utility or generator-owning customers. Since the customer already has generation justified for reliability reasons, the added cost to be able to operate in parallel with the utility is the cheapest source of back up for renewables.

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