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Case Study: Notre Dame Peak Shaving

Application Note

Description **Page**

UNIVERSITY OF NOTRE DAME

General Description

The University of Notre Dame purchases electrical power from two 138 kV lines. This voltage is stepped down to 4160 and distributed to various campus locations on a system that is best described as a primary loop. Several tie and isolating switches permit redirecting or isolating any segment of the 4160 V bus.

During the peak cost warmer months, Notre Dame starts on campus generation. However, the amount of on campus generation could be increased to take advantage of additional savings.

Problem

Notre Dame knew that during the most expensive months, they could reduce their electrical costs further, but the cost to construct additional facilities to house the generation would result in higher project costs and longer project payback. This reduced the ROI to the point to where the other campus projects were more attractive.

Solution

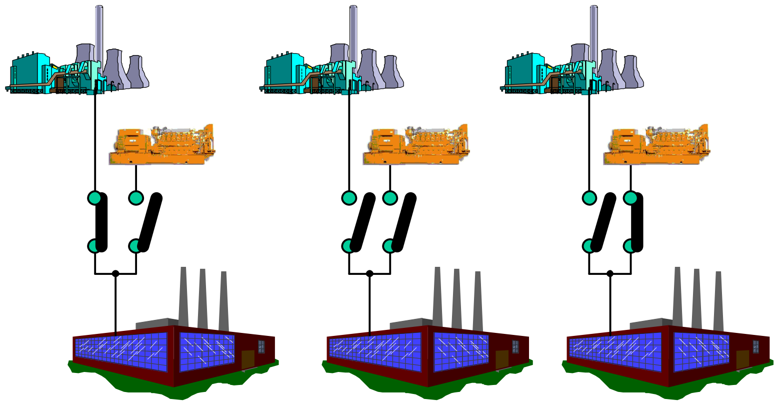
While Notre Dame was evaluating the economics of purchasing addional dedicated on campus generation, a new technology was introduced. This new technology, known as a "Peaking Switch", permitted existing standby generation with conventional transfer switches to be used as peak shaving generation.

Traditionally, a conventional transfer switch and generator could always have been used to peak shave by simply starting and transferring the load to the generator. The utility connection would see less load and the demand charge would be suitably reduced.

However, most low cost transfer switches perform what is known as a "open-transition" switching operation. In this system, the load is disconnected from the first source before being connected to the second source. During this disconnection time, the load is without power.

Note Dame preferred to not interrupt loads, but conventional technology meant that the transfer switch needed to be replaced with a more sophisticated paralleling controller.

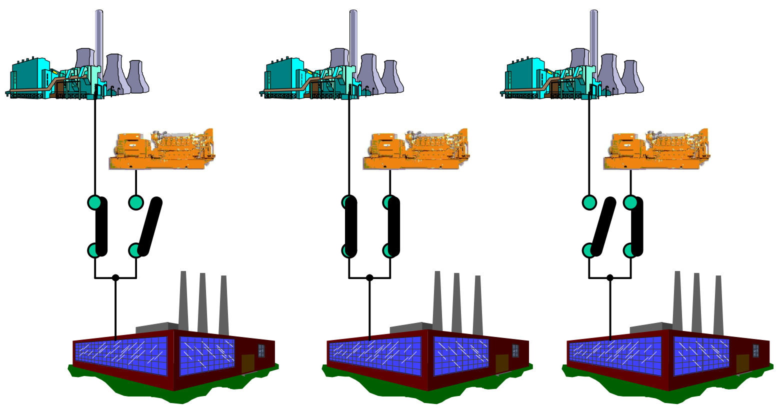
Open Transition Switching



The open transition transfer removes power to the load when it switches from one source to another.

This results in a "second" outage when returning to the utility source.

Closed Transition Switching

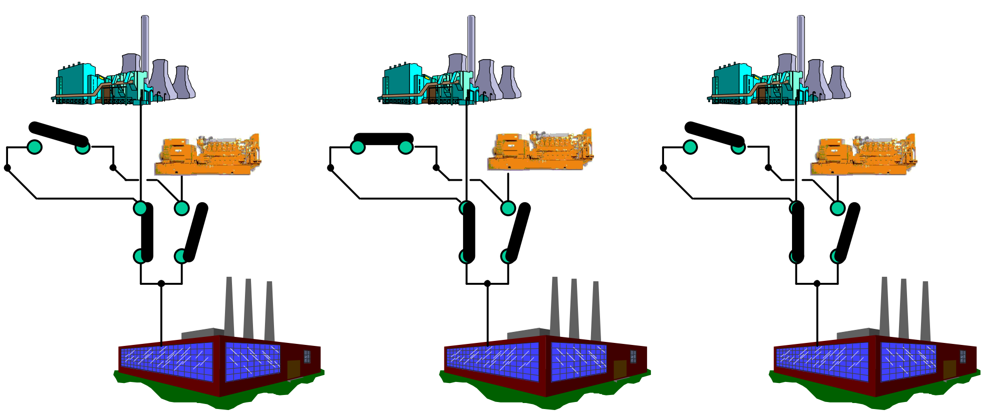


The closed transition transfer switch waits until the two sources are "synced".

This permits the two sources to be paralleled without causing excessive current or voltage swings.

The load can be switched from one source to another without an outage. Closed transition switching requires special synchronization and protection not included in conventional open transition transfer switches.

Peak Shaving Retrofit



A Peaking Switch Retrofit permits adding closed transition to an existing open transition switch. What's more, the peaking switch includes engine governor and voltage regulator control to permit a "soft" or "zero-power" transfer from one source to another.

When the shorting switch is closed, the load receives power from both the normal utility and from the generator.

Cost Savings

Since the existing transfer switch does not need to be removed, labor and downtime is reduced.

Also, the cost of the peaking switch is less than the cost of a new closed transition/paralleling transfer switch, so capital costs are lower.

The result is the cost to retrofit an existing generator was less than the cost to install new peak shaving generation.

While the generator was 500 kW, it was oversized for the load. Since the excess power from that generator had to backfeed through a 225 kVA transformer (see Figure 1 at right), the peaking capacity of this retrofit solution was limited to 225 kVA.

Based on Notre Dame's $14/kW charge, 225 kVA x $14 = $3150. Since the utility ratchets a peak demand event for 12 months, the generator reduced the annual demand charge by $3150 x 12 = $37800.

The generator is called upon during various hot days, but can average 4 hours a day, 5 days a week for 8 weeks or 160 hours per year, producing 160 x 225 = 36000 kWh. At 5.1 cents per kWh, that generates $1800 in energy savings or $39600 ($37800 + $1800) total savings per year.

Offsetting these savings are the cost to implement, which includes fuel, maintenance and installation cost. Based on current prices of fuel and engine efficiency, the generator costs approximately 9 cents per kWh for fuel and maintenance or $3240 per year. The projected net savings (per year) is $36360.

With an estimated installed cost of $80 per kW, the installation price was 225 x 80 = $18000. Assuming cost of money at 5% and inflation at 3%, the payback would be 0.98 years (0.495 years at 0% cost of money and 0% interest).

Additional Benefits

The new peaking switch included a Modbus and Lonworks communication port. These ports allowed the peaking switch to be connected to the existing PowerNet™ campus power monitoring system.

This permitted an automatic dispatch when the campus energy consumption came dangerously close to setting a costly new demand limit.

For More Information

For additional application details and a Notre Dame reference, contact:

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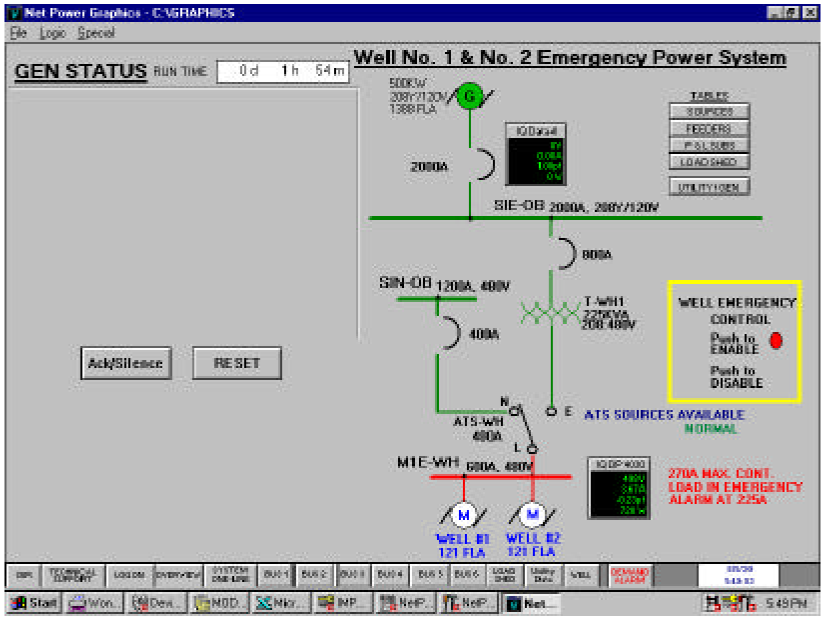

Figure 1: Screen shot from the University of Notre Dame PowerNet™ screen showing the one-line diagram with the 500kW standby generator. Normally, this generator was used to provide power to a water well. The peaking switch was installed on the ATS-WH 400A shown on this schematic, with the switch shorting the normal to the emergency source. This permits power from the generator to back feed through the normal side of the ATS back toward bus SIN-OB and supply up to 225 kVA of the campus requirements. This reduces in the power consumed at the service entrance by 225 kVA, saving the demand charge for that energy.

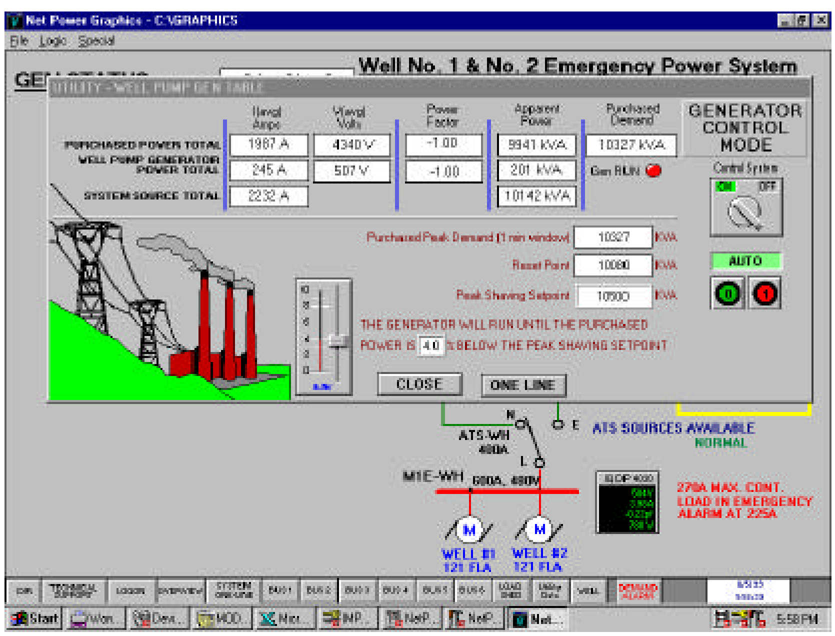

Figure 2: Screen shot showing incoming campus demand, settings for when generator is to automatically start and when it is to automatically disengage.

Summary

Based on the costs listed in this report, this project paid for itself in 0.98 years.