



ASW ENGINEERING MANAGEMENT CONSULTANTS

June 14, 2011

To: Pierre Landry, Rich Pulliam, Steven Long, Cassie Cuaresma
SCE

From: Dennis Rowan, PE
ASW Engineering

Re: Investigations of Energy Efficiency Measures and Standard Industry Practice
[Datacenter UPS, ISP-0005]

Dear Pierre, Richard, Steven, and Cassie,

ASW has conducted a review of the Datacenter UPS project and recommends that SCE consider the project is not industry standard practice.

PROJECT BACKGROUND

In 2010, Willdan Energy Solutions (WES) conducted a high-level energy efficiency audit of a data center facility located in California. This audit was designed to explore opportunities for reducing electricity demand and utility costs through the Data Center Energy Efficiency Program (DCEEP) funded by Southern California Edison (SCE) and implemented by WES.

Based on the analysis completed by WES, the data center can save over \$70,000 in annual electric bills by implementing the Installation of Higher Efficiency Uninterruptible Power Supplies.

It is noted that the current UPS units are operated in the industry standard configuration of “double conversion”. This essentially means that the AC power into the unit is passed through a rectifier, the batteries and then back through an inverter as an AC power output. The existing units do not allow any other mode of operation other than manual bypass which takes the UPS offline.

The existing UPS modules were model 3600 manufactured by Exide Electronics. This model is outdated and has been out of production for over ten years. Eight of the existing UPS modules have been in continuous operation for many years since the Data Center was constructed.

The proposed new UPS modules, constructed of Eaton 9395 systems, remain “double conversion”, but their design is transformerless providing a more efficient base design with less utility side harmonics and an improved power factor. Additionally, the 9395 systems are provided with a manufacturer proprietary operating mode, VMMS/ESS, which will improve their efficiency further.

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METHODOLOGY

ASW contacted representatives of the vendor of the proposed UPS, and discussed the technology. Their VMMS/ESS system is proprietary and is not offered by other UPS vendors. The following excerpt from the Feasibility study indicates that the replacement transformer based UPS systems without the VMMS technology would likely operate at 89% efficiency.

The proposed new UPS modules are provided with and optional technology offered by Eaton/Powerware called "Variable Module Management System (VMMS)" that will allow the customer to operate the units in a "line interactive" mode that will improve efficiency. This option will allow them to achieve efficiencies of higher than 94%. If the customer were to simply replace the existing UPS modules, they would most likely operate at the current efficiency levels of 89%. WES will measure and verify the energy savings as well as the operating mode of the new systems. A calculator tool provided by Eaton is included with this PFS along with cost premium information from the manufacturer to upgrade the systems to VMMS.

This refers to replacing the existing transformer based system with a like kind transformer based system. The option chosen for the data center is a transformerless design that offers greater efficiency when compared to these transformer based designs. These transformer based designs are the legacy designs and the industry is very comfortable with them. Their drawbacks include higher input side harmonics, typically less than 7%, when compared to their transformerless counterparts, typically less than 4% as well as increased power factor, typically around 95%, while the transformerless designs provide power factors approaching unity.

The manufacturer estimated installation cost for the upgrade to VMMS/ESS is \$36,250 each unit with an additional \$40,000 for ancillary costs associated with start up and commissioning.

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ASW presents the following matrix of factors for your consideration regarding the Data Center UPS project:

Table 1: Factors indicating Industry Standard Practice

Factors Indicating Industry Standard Practice	Significance (1 – 3) 1=low, 3=high	Significance Explanation
Reliability and serviceability are the primary concerns for the site and not rebate dollars or efficiency.	2	The site personnel are most concerned with system reliability and the rebates and incentives are a lower priority consideration in the decision making process.
The system was nearing the end of its expected useful life and was being replaced eventually.	1	The site personnel only expect these types of systems to operate for about 15 years and this was installed for 18 years indicating that this was overdue for replacement.
Maintenance costs were increased over the past four years due to an accelerated preventive maintenance program.	1	The site initiated an intensive preventive maintenance program to ensure the system would remain operational during these years that extended beyond the expected useful life period.

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Table 2: Factors indicating Non-Industry Standard Practice

Factors Indicating Non-Industry Standard Practice	Significance (1 – 3) 1=low, 3=high	Significance Explanation
The site chose the most efficient transformerless design instead of the less efficient transformer based design.	2	Many options are available and the transformerless design offers the power at a greater efficiency than the transformer based design. Many options indicate the absence of an industry standard practice.
The site also chose the VMMS/ESS option which added significantly to the efficiency of the units operating characteristics.	2	Without these upgrades, the units would perform to the sites specific energy requirements without delivering the energy efficiency these options provide. These options are specific to this manufacturer. Other manufacturers do not offer them so these options are not considered industry standard practice. They are an incremental energy efficiency upgrade.
The customer completed a full analysis of all options and decided to install this high efficiency option.	2	The customer is well informed and well aware of the energy benefits of this improved technology. This speaks to the customer's knowledge of the energy savings and the benefits of this technology and does not mean that this technology is industry standard practice
Energy efficiency was a consideration in the customer's decision making process, and the rebate/incentive was a part of that consideration.	1	Even though the customer had primary concerns that were outside the rebates/incentives offered by the program, their choices to include the most efficient options were informed at some level by the incentives offered.

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The factors in Table 1 indicating the project is Industry Standard Practice (ISP) are outweighed by the factors in Table 2 indicating the project is Not Industry Standard Practice. The primary consideration being that the customer studied a wide variety of options before deciding on this particular technology. The fact that there are a wide variety of options to choose from indicates that the more efficient choice is a unique solution and that there is little in the way of industry standard practice out there. If anything is ISP, it might be the old school, tried and true, transformer based technology that this project did not use. The VMMS/ESS technology proposed is only offered by the chosen manufacturer.

CONCLUSIONS

Legacy designed systems that include transformers are still prevalent in the marketplace and still being installed in services of this magnitude. The VMMS/ESS technology is proprietary to this manufacturer and the other manufacturers do not have these options. Since alternatives to this high efficiency model as well as the additional high efficiency options are optional, ASW recommends that SCE considers that this project is not industry standard practice.

Dennis Rowan, PE
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