Small Embedded Data Center pilot shows potential for big energy savings

The National Resources Defense Council reports that smaller localized data centers, server rooms or data closets house over half of all computer servers in the United States, representing the equivalent output of seven medium-size coal-fired power plants (500 MW).[1] These small embedded data centers (SEDCs) are one of the fastest growing end uses of electrical energy in commercial buildings today.[2]

While larger, stand-alone data centers are the target of a variety of utility programs, smaller data centers are problematic for utilities to reach effectively through CIP programs for a number of reasons identified in a 2014 Minnesota Technical Assistance Program (MnTAP) CARD report, "Energy Conservation Potential at Minnesota Data Centers." Barriers include unawareness of how much energy embedded data centers use, difficulty in identifying where data centers are located, and priority differences between overall management and data center management. Identifying opportunities to improve the energy efficiency of SEDCs is important for utilities because results will assist them in developing low-cost programs to reduce energy consumption for a wide variety of their small- and medium-sized business customers across the state.

Under CARD grant funding, the Center for Energy and Environment (CEE) and its partners are in the process of monitoring 23 small embedded data centers at 11 participant sites using one of two non-obtrusive approaches. The sites include two design firms, a healthcare clinic, three small industrial companies, two public school districts, a law firm, a municipal city hall, and a nonprofit. Through their data analysis the team is identifying operating measures and energy usage trends that reveal unique opportunities for energy savings.

The preliminary results have been very promising. For example, the results from monitoring at the nonprofit site found that the energy consumption from the SEDC stays fairly constant during the entire week even though normal business hours are only Monday–Friday 8 a.m. to 5 p.m. Even considering a small amount of use required during the night and on weekends, the data indicate there is an opportunity to reduce power demand for over 70% of the work week through a variety of options including:

- Virtual machine migration to further reduce the number of physical servers that are in use during off peak hours;
- Energy management scheduling of the network switches into standby mode; and
- Possible sleep modes for storage arrays.

Figure 1: Small Embedded Data Centers: High energy use suggests high potential for savings. (Photo courtesy of Center for Energy and Environment)

Additional opportunities for this (and other) SEDCs are related to optimizing the delivery of cool air and the removal of hot air in the room where the SEDC resides. This is an important aspect of the energy savings potential for SEDCs because the rooms where the SEDCs are often placed are not usually designed to house a SEDC. This causes inefficiencies such as the room being heated in the winter when it actually needs to be cooled. Going forward the team will continue to monitor and analyze the data from the 23 SEDCs across Minnesota and will study ways in which such inefficiencies can be addressed through CIP.

For more information on this project contact project manager Adam Zoet or CARD program administrator Mary Sue Lobenstein.

References

[1] Bennet, Drew and Pierre Delforge, 2012. "Small Server Rooms, Big Energy Savings: Opportunities and Barriers to Energy Efficiency on the Small Server Room Market." Natural Resource Defense Council: New York, NY. Report is available online (pdf) (or at http://www.nrdc.org/energy/files/saving-energy-server-rooms-issuepaper.pdf).

[2] Jonathan Koomey, 2011. "Growth in Data Center Electricity Use 2005 to 2010," Analytics Press: Oakland, CA. Report is available online (pdf) (or at http://www.analyticspress.com/datacenters.html).