# 2008 OHIO POWERMANAGER UPDATE

## Program Summary and Impact Evaluation Results

**Prepared by Duke Energy**

**March, 2009**

**Program Summary**

The purpose of the PowerManager program is to reduce demand by cycling residential air conditioning usage during peak demand conditions in the summer months. The program is offered to residential customers with central air conditioning. DE-Ohio installs a load cycling device to the customer's compressor to enable DE-Ohio to cycle the customer's air conditioner off and on when the load on DE-Ohio's system reaches peak levels. Customers receive financial incentives for participating in this program based upon the cycling option selected. If a customer selects Option A, their air conditioner is cycled to achieve a 1 kW reduction in load for an incentive of $25 at the time of installation. If a customer selects Option B, the air conditioner is cycled to achieve a 1.5 kW load reduction for an incentive of $35 at the time of installation. In addition, when a cycling event occurs, a Variable Daily Event Incentive based upon marginal costs is also provided. (If customers are considering opting out of the program, a 0.5 kW option is also made available to them as an alternative to opt-out.)

The cycling of the customer's air-conditioning system has shown that there is no adverse impact on the operation of the air-conditioning system or on the customer's comfort level. However, customers can opt out of the program if desired. The load control device has built-in safe guards to prevent the "short cycling" of the air-conditioning system. The air-conditioning system will always run the minimum amount of time required by the manufacturer. The cycling simply causes the air-conditioning system to run less which is no different than what it does on milder days. Research from other programs, including previous Duke Energy Indiana and Duke Energy Kentucky programs, has shown that the indoor temperature typically rises approximately one to two

degrees for control Option A and approximately two to three degrees for control Option B. Additionally, the indoor fan will continue to run and circulate air during the cycling event. DE-Ohio continues to explore opportunities to cross-market the PowerManager program with DE-Ohio's other energy efficiency programs thus tying both conservation and peak load management together as one package.

In the second half of 2008, DE-Ohio mailed 83,920 PowerManager marketing pieces and had 3,841 customers enrolled in the program with 3,395 switch installations completed from the enrollments. The cumulative installations for 2008 total 10,427 switches. A total of 13,401 installations have been completed since the beginning of the project. On average the marketing response rates have been approximately 5% to 6%. Customers can sign up for the program one of the following ways; phone, internet or reply card. Seventy-four percent of customers have signed up via reply card, ten percent by internet and sixteen percent by phone.

DE-Ohio performed five control events this season, on 6/6/2008, 6/9/2008, 7/17/2008, 7/21/2008 and 9/2/2008. DE-Ohio closely monitored the performance of the new load control technology during summer 2008 within a randomly selected load research study group consisting of 40 customer sites with 44 cooling units and load control devices. Beginning May 2008, data loggers were installed on these cooling units to measure unit duty cycles, and load research meters were installed to measure 15-minute interval energy usage. In addition, these load control devices were scanned at regular intervals throughout the summer with a Palm PC to record detailed information about the operation and reliability of the device. DE-Ohio reviewed this data to validate correct operation of the load control devices.

**Impact Evaluation Results**

The load research sample group for 2008 for PowerManager consisted of 40 customer sites, randomly selected from Ohio PowerManager participants in January 2008. Beginning May 2008, data loggers were installed on these cooling units to measure unit duty cycles, and load research meters were installed at these customer premises to measure 15-minute interval kWh. Also, LCR 4700 load control devices, installed on research group cooling units, were scanned frequently throughout the summer with a palm computer (Aceeqa) that records detailed information about device status and operation. The LCR 4700 load control device is a new adaptive cycling technology designed for the Ohio PowerManager program, which adapts to customers' natural AC duty cycles, such that a fixed KW reduction can be consistently achieved from each home. The cycling time (time held off) of a particular cooling unit is determined by the size of the unit (measured by rated amps, which is entered into the LCR 4700 at installation) and the typical run-time of the unit (recorded by the LCR 4700). In addition, hourly adjustment factors, modifying the shed time for all devices, can be transmitted as part of a shed command. To verify that LCR 4700 shed times are correct, i.e., calculated according to the design algorithm, a series of four shed tests was conducted with the research group on Aug. 27, Sept. 11, Sept. 22, and Sept. 26. LCR 4700 scan data was collected after each test for a small group of five devices, and for the entire research group after the first and last tests in the series. Each separate component of the shed time calculation algorithm was exercised and validated in these tests. Cumulative shed time over the series of tests was within the expected tolerance for all but

four devices. Two devices were somewhat outside the expected tolerance - one was 6% low, but the other was 9% high. In another case, some scan data was invalid and expected shed time could not be determined, although cumulative shed time for the device was reasonable. Finally, there was one device that may have missed all shed commands, likely due to its location. But overall, the tests have shown that LCR 4700 shed times in the field are consistent within the expected algorithm specifications To assess the operability and realization of the load reductions for the units, and to determine a reasonable operational de-rate of the expected load reductions, the cumulative shed register (History0) was cleared for all Ohio switches on August 29. Switches with program setting 1.0-kW reductions in the general population were test controlled for two hours (3-5 PM, on September 2, 2008). Scan data was collected for 116 switches randomly selected from this population. This data has been analyzed to assess how closely the register matches the expected shed computed from the Amp, Power Factor, and Voltage parameter values in the switch. As of September 2, with historical data cleared within the history table, and the register table values (i.e., the expected run time) still set to 100% for all hours, the results from the tests were quite good. The tests indicate system reliability of 95% or greater, relative to expected load reduction shed amounts. For all but 5 of the 116 switches, the deviation of the History0 register from the expected shed was less than 30 seconds per shed period (shed period is 30 minutes). Within this group, the cumulative shed is typically a few seconds less per-period than the expected shed, and the mean deviation per period for the group is -10.5 seconds. The operability, or derating factor, based on this group of 111 switches, is also quite good, at 98%.

The table below (Table 1) shows results for just the 5 switches in the study which had the large deviations from the expected shed. So, the current operability assessments suggest a reasonable de-rate factor range would fall within 95% to 98%. For 2008 impact estimation purposes, Duke Energy uses a conservative value of 96%, which when applied to 2008 participants and program target levels, and weighted according to enrollment in the 1.5, 1.0, and 0.5 program options, yields a net program reduction average of 1.015 kW per program participant.

| SerialNumber | Amps | History0 | Expected Shed (min) | Shed Deviation (sec/per) |
|---|---|---|---|---|
| 409503574 | 22.7 | 1:00:00 | 27.04 | 494 |
| 409501338 | 15 | 1:00:00 | 40.92 | 286 |
| 409500959 | 14.8 | 0:58:00 | 41.47 | 248 |
| 409508322 | 20 | 0:45:00 | 30.69 | 215 |
| 409506020 | 20 | 0:22:00 | 30.69 | -130 |

**Table 1. Selected Switches Results.**

**This foregoing document was electronically filed with the Public Utilities**

**Commission of Ohio Docketing Information System on**

**3/15/2010 5:18:57 PM**

**in**

**Case No(s). 10-0317-EL-EEC**

Summary: Text Appendix T of Status Report electronically filed by Anita M Schafer on behalf of Watts, Elizabeth H. Ms.