
“CASE STUDY ON TEXAS DATA CENTERS AND ENERGY EFFICIENCY”

PROJECT SCOPE

On this project, Austin Energy’s (AE) focused on the identification of methods to reduce energy consumption and demand for data centers in Texas with the intent of enabling “Energy Efficiency” to move up on the priority list for Data Center operators, CIO’s, and other decision makers.

PROJECT DESCRIPTION

To facilitate the identification of methods to reduce energy consumption and demand for data centers, AE first needed to identify test case data centers within the AE service area for analysis. Then AE worked with these data center facility managers to determine baseline operating conditions. Programs used to establish baseline operating conditions also enabled an evaluation of data center energy efficiency opportunities. At each data center location, both Department of Energy (D.O.E.) Data Center Profiler (DC Pro) assessments and E.P.A. EnergyStar Portfolio Manager data center baseline assessment were utilized to evaluate data center energy efficiency opportunities.

This project findings are presented in the form of a case study. Particular attention should be directed to the conclusions of this case study. These conclusions will help future participants identify different analysis tool requirements that may turn into barriers for assessing a project. The case study conclusions also provide excellent examples of how to overcome these barriers.

AE developed this case study utilizing the Texas State Energy Conservation Office (SECO) funding. Specific milestones were developed to provide the framework of the study. These milestones included the following activities.

- Identification of Test Case Data Centers
 - Public Workshop on Current Best Practices in Data Center Energy Efficiency
 - Identify qualified Participants (Data Centers) for Case Studies
- Baseline Conditions Assessment and Identification of Energy Efficiency Opportunities
 - Collection of baseline data for use in the Environmental Protection Agency (E.P.A.) – Department of Energy (D.O.E.) EnergyStar Portfolio Manager Center data gathering efforts for Data Centers.
 - Data Center Energy Assessment using D.O.E. Data Center Profiler (DC Pro) Tool
- Analysis and Findings from E.P.A. – D.O.E. EnergyStar Portfolio Manager and D.O.E. DC Pro Tool
 - Case study describing findings and options for pursuing energy efficiency in data centers.

PROJECT BACKGROUND

The Data Center market, nationally, represents 1.6% of the national energy consumption and according to a D.O.E. study, this segment has doubled over the last 5 years and business as usual trends report another doubling in 5 years.

(http://www.energystar.gov/ia/partners/prod_development/downloads/EPA_Datacenter_Report_Congress_Final1.pdf). Data Centers also have high energy densities using lots of power for not only running the large amount of computing equipment but also the cooling used to remove that heat and run the infrastructure that supports the mission critical systems

Prior to 2006 D.O.E. and E.P.A. studies on energy efficiency in data centers had been limited. Data Centers represent a market segment that is traditionally very protective of its data and business practices due to the critical nature of the customers they represent. Since 2006, several data center managers around the country have shown more of a willingness to participate in energy efficiency efforts. In 2008, D.O.E. officially began to gather utility and facility information for data centers in an effort to incorporate energy efficiency as a top business practice priority. However, Lawrence Berkley National Laboratories (L.B.N.L.) noted that only five Texas data centers had committed themselves to submitting data as of the beginning of this project. It became evident to AE that being able to provide data for two or more data centers would be benefit the overall data center energy efficiency efforts for Texas.

Due to this competitive and private nature of data center business practices, AE found it difficult to identify data centers willing to utilize available E.P.A. and D.O.E. tools. When the project started, only five data centers in Texas had offered to contribute to the E.P.A. EnergyStar baseline data and only one data center in Texas had gone through the DC Pro process (City of Austin Communications and Technology Management (CTM) Data Center). It was hoped that participation by data centers in this program would not only provide valuable information to E.P.A. and D.O.E. but that participation would also encourage other data centers to use the publicly available tools.

A primary reason AE elected to participate in this project was because a key component of AE's energy resource strategy is to provide 800 MW of demand reduction by the year 2020. Participation in the E.P.A. and D.O.E. efforts will also help develop energy efficiency programs for AE as well as stand as an example for other utilities who are interested in developing a conservation program for data centers.

IDENTIFICATION OF TEST CASE DATA CENTERS

In order to identify the largest pool of data centers in the AE service territory, AE elected to present the project in a public workshop. Using this forum also enabled AE identify test case data center participants. A public work also enabled AE to validate existing data center interest in energy efficiency. In order to participate as a test case data center, each data center owner was required to participate in the population the E.P.A. EnergyStar data center baseline assessment and utilize the D.O.E. Data Center Profiler (DC Pro) assessment.

A public one-day workshop, hosted by AE, was held on November 2008 at the West Pickle Research(WPR) building in Austin, Texas. Data center managers from all over the State of Texas were invited to attend the one day workshop, free of charge. (see attachments B and C: flyer and agenda). Workshop presenters included Mr. Bill Tschudi and Mr. Dale Sartor from Lawrence Berkley National Laboratories (L.B.N.L.) and the presentation topic

was current Best Practices in Data Center Energy Efficiency (see attachment A). L.B.N.L. was selected to present at this workshop because of their strong research background in data center energy efficiency. L.B.N.L. developed the DC Profiler Tool as part of the D.O.E. Save Energy Now Program. Attendees at the workshop included Information Technology (IT) and Data Center managers from over 50 data centers in the Austin region, San Antonio region, and from South Texas to provide information on current best practices.

During the workshop, a description of the AE provided an overview of the project. In addition, a questionnaire, with pertinent criteria needed to ensure the success of the project (see attachment D), was given to interested parties. Because the Portfolio Manager questionnaire requested information on energy and power consumption at individually sub-metered critical points along the electrical distribution system, having this information for the time periods specified by the E.P.A. was crucial.

After the workshop completion, AE spoke communicated with potential test case data center managers and reviewed the submitted questionnaire information. Two data centers were selected as qualified participants. These data centers, owned by Dell and Oracle, are located in the AE service area. For security reasons, their specific location for both data centers could not be presented in this document.

FIELD INVESTIGATION

DATA GATHERING FOR E.P.A. ENERGY STAR PORTFOLIO MANAGER

Data gathering for facility information and energy consumption began with the collection of information in accordance with the published ENERGY STAR Benchmarking Starter Kit (Appendix ??). This document identifies the data required to benchmark the data center and included the following information: Facility gross floor areas, IT energy configuration, and IT energy consumption data for the past 12 months,

New accounts were created for each data center at the following location, http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager. Upon creation of the new account, a new data center was added to the account. Then facility information and energy consumption data was input into the online database.

This process involved.....

Information used for input into the E.P.A. ENERGY STAR Portfolio Manager for each data center can be seen in Appendices D and E.

DATA GATHERING FOR D.O.E. DC PRO

The required information to be collected for the DC Pro was far more extensive than the information required for the E.P.A. ENERGY STAR Portfolio manager. Categories of information collected for input into the DC Pro program included: Geographic, facility, data center type, classification and current build out, energy management, IT equipment details, facility environment conditions, internal air management, cooling plant, IT equipment power chain, and lighting. This information is published in the form of a checklist (Appendix ??).

After the information was collected, a new case was created at the following location, <http://dcpro.ppc.com/DCProCaseInformation.aspx?case=new>. Upon creation of the new account, the checklist information was input into the online database. This process involved...

Information used for input into the D.O.E. EC Pro for each data center can be seen in Appendices F and G.

RESULTS

E.P.A. ENERGY STAR PORTFOLIO MANAGER

No scores were provided for each test case data center. This was because the E.P.A. ENERGY STAR Portfolio Manager interface had not yet been created for the data centers. At the time the information was input for E.P.A., AE was not aware this interface did not exist.

D.O.E. DC PRO

After the completion of the DC Pro case, each data center manager was provided with a customized, printable report that shows the detailed the following information: energy purchases for the data center, how energy was consumed by the data center, potential cost and energy savings, a comparison of the data center energy utilization versus other data centers, and a list of next steps that each data center manager could follow to start saving energy.

The report for each test case data center is provided in Appendices F and G.

Analysis:

- 1) E.P.A. Baseline Data – Oracle
 - a. Information submitted by Oracle contributed to the E.P.A. Portfolio Manager data base so that a rating tool could be provided for the Data Center segment.
- 2) Oracle - D.O.E. – Energy Assessment
 - a. The Oracle project team had every intention of participating in the full grant project from the beginning and contributed to the E.P.A. data gathering efforts. They have been active participants in years past with the Austin Energy's Efficiency Programs. The knowledge base that exists within the Oracle Project Team is extremely well-versed on the deliverables. In the end, the Oracle Project Team was unable to complete the full energy assessment due to their work efforts being directed to other projects by upper-level management to fulfill other duties that had been prioritized for them. It is because of this situation that we acknowledge that the assessment efforts do require a significant amount of time and a solid commitment internally and from the decision makers. It appears that some data centers may require a consultant to

be hired, or someone internal to be assigned the role of data gathering and that role to be labeled as a priority.

3) E.P.A. Baseline Data – Dell

- a. Information submitted by Oracle contributed to the E.P.A. Portfolio Manager data base so that a rating tool could be provided for the Data Center segment.

4) D.O.E. Energy Assessment – Dell – See Attachment G

- a. The Dell Project Team already had an existing business relationship with a consultant who performs energy analysis for them on a regular basis. They expanded the consultant responsibilities to include the DC Pro Assessment.

Conclusions:

Although the conclusions are based on the experiences of two data centers the project team has assess that these conclusions can be drawn into use throughout other facets of energy efficiency analysis and data center management.

- b. **Proper infrastructure needs to exist.** The E.P.A. baseline data required effort and organization to obtain internally. For any data center, a major contributor to energy efficiency is information. Having sub-metering capabilities is essential to dealing with the challenges of knowing where the energy is being used especially in mid to large sized facilities. For the E.P.A. data, a data center candidate had to possess sub-metering at certain points in the infrastructure to keep a level of consistency in order to formulate the baseline. For information on the documentation form visit: http://www.energystar.gov/index.cfm?c=prod_development.data_center_process . This link will also detail the Energy Star Rating Development Process. Having the sub-metering in place only solidifies the need to have an internal commitment to improving energy efficiency (see Conclusion ‘C’). As is the case of gathering this information, in both situations, the data gathering took effort and time, but was obtainable through the Data Center Facility Manager and able to be formatted in the manner that E.P.A. required. The information on the infrastructure and the IT information are typically managed by different persons, so there was a slight delay in obtaining both sides of the information for full completion.
- c. **Self assessment needs designated assessor.** Although the DC Pro tool was designed to be a self-assessment tool, in both situations, neither data center conducted the assessment internally. For Dell, their team recognized the need to designate an assessor who could be devoted to the task. They hired a consultant through Clearesult who was familiar with their

facility. For Oracle, they attempted to conduct the assessment internally, but found out they didn't have the time due to other internal obligations (see **Agreement from Upper Management** for further details).

Initially, even the consultant thought the profiler tool was less comprehensive than in actuality. This meant two things; one, that there was more work than expected and two, that this produced a more desirable product.

The tool required more time than originally expected. Initially this was due to a misunderstanding about the full capabilities of the DC Pro Tool. This was a moot point in that they were able to still fulfill their obligations, but it shows that the tool takes some time to use to its fullest extent. The first part of the tool, the DC Pro Overview is the least time consuming because the information needed to fulfill it is more generalized. Once the assessor delves into the individual assessment tools (Air Management and Electrical Distribution), the questions are much more specific and detailed and may require more effort to obtain the answers (see **Usability of the Tool** for further discussion). A good portion of the effort exerted for this report meant that the consultant needed to find and coordinate with the right person to obtain the right information (see also **Agreement from Upper Management** for more details).

- d. **Agreement from Upper Management.** Agreement from Upper Management that energy efficiency is a business priority is essential. This holds true not only for capital expenditures for facilities improvements but also for conducting assessments. For Dell, when their consultant, Robert Baird, was tasked with gathering the information necessary to complete the DC Pro Overview and Assessments, he knew the information was available, but just through many different sources. Having the upper level support made it possible to communicate with multiple groups. Each responsible party was forthright about supplying information.

Data Center managers know their facilities like the back of their hand. Just like we all have "wish list" items for home improvements, facilities managers will have their "wish list" of improvements for their data center facility as well. Sometimes they may even know which improvements would bring them the best ROI but reasons such as not enough budgeted capital or lack of support from upper management decision makers, these improvements get

overlooked. From the list of improvements developed from the DC Pro tool, Dell's Global Energy and Sustainability Manager noted that not much on the list of recommendations was a surprise. These were all improvements he had recommended in the past or known could help his facility perform better. What it did mean was that this was now another solid source to help support his previous recommendations and meant more surety in funding those projects.

- e. **Incentive needed to 'kick off' project.** but may translate to use of the tool for other projects if company owns more sites
- f. **Provides Validation for Improvement Ideas.** Data Center manager aware of ways to improve efficiency. Tool provided a method of justifying internal ideas and a measurement by which to compare improvements. Same with AE collaboration – tool provided justification for projects previously considered but not approved.
- g. **Usability of Tool** – most data was easy to retrieve but there was not a one-point source for it all. Consultant had to seek out data from persons who would most likely have it. Once again, upper management support is crucial to make sure that this is executed properly Assessor D.O.E.s not need previous training, but knowledge of data center facility. and have any parties that have access to data contribute to the process. Some questions were not particularly clear, so the project team had a few discussions about the interpretation of the questions. Fortunately, the project team knew one of the tool developers (Bill Tschudi) to contact and asked for clarification.

References

Acknowledgments

Eddy Trevino, Bill Tschudi, Dale Sartor, Paul Scheihing, Mitch Martin, Mukesh Khattar, Eric Graham, Robert Baird, Jay Taylor

Appendix:

Attachment A –

Attachment B –

Attachment C –

Attachment D –

Attachment E –

Attachment F –

Attachment G –