

COUNTY OF HAWAII
DEPARTMENT OF WATER SUPPLY
FINAL REPORT FOR REBUILD AMERICA PROJECT
February 28, 2005

Executive Summary

The Rebuild America Project for the Hawaii County Department of Water Supply (DWS) was initiated in 2002 to supplement the many ongoing efforts that have been initiated to reduce the nine million dollar annual energy cost for the DWS pumping facilities. Over the last year, the County of Hawaii and Process Energy Services has jointly worked together to develop low-cost procedures, training, and energy tracking software templates to help the DWS optimize system operation on a routine basis.

The project consisted of the following tasks:

Task #1: Develop a Pump Efficiency-Training Program / Standard Operating Procedure

This task included developing a pump system efficiency-testing program using the U.S. DOE Pump Systems Assessment Tool (PSAT) software with new data collection templates and report summary (both in Excel). The data collection templates provide graphical forms customized for each station to help operators perform the calculations needed before the data is entered into the PSAT program. The report summary template provides a summary of the PSAT results along with original flow and head data to help the operator decide if the pump should be repaired or replaced. The program also includes standard operating procedures and training.

Task #2: Develop Energy Tracking Templates / Standard Operating Procedures

This task includes developing energy tracking templates and procedures for the Department of Water Supply to better track existing energy use at 150+ pump station sites, benchmark energy use based on flow each month, and to measure and verify savings at the stations after energy saving initiatives had been completed. The energy tracking tools include a series of linked energy data templates that provide data input and analysis at three different levels. The first level is a simple data entry form that DWS administrative support uses to input the electric bill data. The second level provides a two-year, monthly comparison of energy use for each pump station that includes flow data imported from DWS “pumpage” data collection forms to provide a kWhs/1000 gallons pumped benchmark value. The third level provides a monthly summary of all pump stations in each of the four DWS districts to determine total savings compared to flow pumped.

Task #3: Develop Operational Procedures and Long Term Plan

This task included developing operational procedures and a long term plan for the Department of Water Supply that addresses how to operate deep well and booster pump

systems to take advantage of utility rate schedule riders and the proposed hydro-generation systems.

Task #4: Efficiency Recognition Plan

This task focused on creating an efficiency recognition program for the DWS that promotes energy efficiency throughout the department. This program was aligned with the existing Hawaii County program to recognize employees that identify cost savings opportunities.

Task #5: Presentation at Rebuild America Peer Exchange Meetings

The DWS and Process Energy Services jointly presented the project December 1, 2004 at a Rebuild America Meeting in Honolulu. The presentation included an overview of the DWS facilities and energy use. The scope and implementation of each task was discussed and flowcharts showing how the various tools worked with each other were also presented.

Summary

All tasks included the use of simple software tools and templates that could easily be modified by DWS staff. No proprietary software or licenses were required for the programs. This approach has helped the DWS staff feel more comfortable using the programs and has allowed them to customize the templates when needed.

At this time, the DWS has made progress implementing all of the above procedures to provide a systematic approach for monitoring pump system efficiency, tracking energy costs and flow data, and identifying specific cost savings projects for staff to pursue.

Efforts Required to Accomplish Each Task

The primary goal for the project was to develop tools and procedures to encourage the Department of Water Supply to recognize the importance of being as efficient as possible. Some of the specific tools and procedures created for each task are discussed below.

Task #1: Pump Efficiency Training Program and SOPs

This task initially had two simple objectives that included:

- Develop a pump testing training program/workbook.
- Create pump system testing standard operating procedures.

However, as team members began this effort, it became apparent that additional data collection sheets could simplify the process for operations staff when collecting data in the field. To help with this, additional tools created included:

- Creating pump efficiency data sheets for each of the DWS 140 + pump systems.
- Pre-format PSAT files for each pump system with nameplate data entered to streamline the data entry process required by the operator.
- Enter data for 2000, 2001 and 2002 pump efficiency testing to provide the DWS with historical efficiency data.
- Create a pump efficiency report form that is linked directly to the pump efficiency data sheets to provide a summary of the savings calculated by the PSAT tool and compares it with the original pump specifications.

As the data and forms were developed, input from the DWS operations staff helped configure the program to accommodate a more practical approach to increase the chance of program success. This input included:

- Pump system efficiency testing should be done every 6 months instead of every 3 months due to the level of effort required to perform this for over 230 pumps.
- An intermediate spreadsheet should be included to provide a comparison of pump efficiency with the manufacturer's rated efficiency.
- Use of the PSAT program should be performed by qualified individuals and should not be a "data input" procedure for administration staff.

It was agreed that all of the comments were valid and were incorporated into the design of the program.

At this time, excellent progress has been made that has included performing pump efficiency testing on a regular basis, simplifying the use of the PSAT software and using a hand held personal digital assistant (PDA) to enter data in the field. However, the most important task of initiating action once poor pump performance has been recognized is still in progress. The primary reason for this is the lack of manpower to initiate new projects based only on lower pump efficiency when pump failure repairs and new system improvements are a higher priority.

Although integrating pump efficiency improvements into the existing maintenance program is expected to be an ongoing process, one of the benefits of the pump efficiency program has included flagging poor performing pumps for operators that in turn use "higher efficiency" pump systems as the lead pump systems to help reduce energy costs until pump improvements can be made.

Task #2: Develop Energy Tracking Templates and Procedures

This task included developing energy tracking templates and procedures for the Department of Water Supply to better track existing energy use at the 140+ pump station sites, benchmark energy use based on flow each month, and to measure and verify savings at the stations after energy saving initiatives have been completed.

Before this task could even be started, the following barriers had to be overcome:

- HELCO hand delivered over 140 bills each month to the County Accounting Office. Although the accounting office tracked total energy use and cost, it was not set-up to track specific energy use data. To overcome this HELCO offered to generate two sets of bills. One set would be provided to accounting and the other set was provided to the operations group.
- With electric bills now being provided directly to the operations group, the next important issue was to designate one of the administrative staff to enter the data as bills came in. Graciously, the administrative staff took on this additional role to help with the project.
- Process Energy Services worked with the operations staff to modify their existing pump flow data sheets to include a link to the new energy comparison reports to use flow data to benchmark pump station energy use based on flow pumped each month.

With these issues resolved, the following tools were created:

Energy Input Data Sheets

The energy input data entry sheets were designed to make data entry as simple as possible.

Energy Comparison Reports

The energy comparison reports automatically transfer data from the energy input data sheets and flow data from the existing DWS pumpage reports to provide a comparison of energy use for two years and to evaluate pump station efficiency.

Energy Summary Reports

The energy summary reports were designed to provide an overall summary of system and pump station energy use. The reports also project annual energy use based on average monthly energy use.

The above tools are being used consistently by DWS staff to monitor energy use at each station, document energy savings, and project annual energy costs. One of the indirect benefits of the energy tracking system is the ability to quantify energy savings after water system leaks have been discovered and corrected.

Task #3: Develop Operational Procedures and Long Term Plan

This task includes developing operational procedures and a long term plan for the Department of Water Supply to address how to operate deep well and booster pump systems to take advantage of utility rate schedule riders and the proposed hydro-generation systems.

Without a detailed procedure for system operation, operators had no way of knowing how their actions affect energy use. Many of the energy cost saving strategies in the DWS energy management plan include time-based pump operation, using demand controls to reduce energy demand costs, and operating pumps based on the results of quarterly efficiency testing. The purpose of developing an operational procedure is to outline how each system could be operated to maximize efficiency and minimize energy costs.

The key areas that this procedure covered included:

- Operating deep well pump stations and maintaining tank levels to qualify for the rate reduction provided by the HELCO Rider M Rate Schedule.
- Adjusting controls to prevent simultaneous operation of multiple pumps to reduce utility demand charges.
- Prioritizing pump station operation based on quarterly pump system efficiency reports and scheduling inspections/repairs for low efficiency pumps.
- Selecting deep wells that are most efficient for designated service areas.
- Optimizing the use of hydro turbine systems (to be installed in 2005).

Although the procedure provides general operating guidelines for each system, it was discovered that each system had operating limitations that made it difficult to take full advantage of cost saving opportunities. To help develop future cost saving opportunities, a long-term energy plan was also developed.

The long-term efficiency plan provided an overview of what could be done in the future to improve system efficiency and reduce long-term energy costs. Some of these strategies included the following:

- Over sizing future water storage tanks to allow large horsepower wells to be taken out of service during peak electrical demand periods to qualify for HELCO Rider M Rate reductions.
- Reducing station demand through peak demand control adjustments.
- Equipping new pumps with instrumentation to make future efficiency testing faster and easier.
- Configuring distribution piping and tanks to accommodate the use of hydro-turbines for pressure reduction instead of small diameter piping and multiple pressure reducing valves.
- Installing multiple deep wells in one location as an alternate to single wells in multiple locations.
- Maximize the use of treated high elevation spring water supplies instead of using deep well pump systems. This could include encouraging privatization of abandoned water sources, and distribution improvements to maximize flow from water treatment plants such as the Waimea WTP facility.

This task has paralleled the effort currently being pursued by the DWS to install hydro-generation systems and SCADA control systems at tank and pump sites to provide time-control strategies at selected stations.

Task #4: Efficiency Recognition Plan

This task was focused on creating an efficiency recognition program for the DWS that promotes energy efficiency throughout the department. As this task was researched, it was determined that an existing County Incentive and Service Awards Program was already in place. However the program was not promoted within the department. To help reestablish the program, a procedure was developed to encourage DWS operations staff to identify and help develop efficiency improvements to reduce operational costs.

The procedure developed for the operations group specifically focused on the “suggestion award” category of the county program. Although the guidelines in the procedure follow the county program, the one adjustment recommended by DWS staff was to recognize that the majority of suggestions for efficiency improvements are expected to be “team” efforts that include operations staff, supervisors and support staff. Based on this, cash awards resulting from efficiency improvements could be distributed among all of the staff in the district where the idea originated, as well as any office staff that helped develop the project.

Task #5: Presentation at Rebuild America Peer Exchange Meetings

On December 1, 2004 at the HEI Training Room in Honolulu, HI, Clyde Young with the DWS and Steve Bolles with Process Energy Services presented a 30-minute overview of the DWS Rebuild America Project. Approximately 30 Rebuild Hawaii Consortium members including State, City and County Officials, U.S. Federal Agencies and Rebuild America Business Affiliates attended the meeting.

The presentation included an overview of the DWS facilities and energy use. The scope and implementation of each task was discussed and flowcharts showing how the various tools worked with each other were also presented.

Although the project was successful with over \$250,000 in savings identified in the first 6 months of 2004, during the presentation, both speakers emphasized that they felt that more savings could be realized if the County employed a full-time energy manager to follow-up with the operations staff to make sure the operational procedures were being used consistently.

The presentation was well received and several attendees offered names of potential energy manager candidates. A copy of the presentation is provided.

Due to the unavailability of another Rebuild America Peer Exchange Meeting, Eileen Yoshinaka with the U.S. Department of Energy recommended that a representative of the Department of Water Supply should attend a similar energy related event. Clyde Young completed a visit to facility in California to evaluate their energy savings program.

Evaluation of Efforts and Recommendation for Follow-up Activities

Overall the project went well and stayed on schedule. Although the project tasks were completed on time, an extension was requested to help collect additional data before a presentation was made at the RBA Peer Exchange Meeting.

As indicated previously, the one issue that both the DWS and Process Energy Services felt would improve the savings figures and maintain more consistency, is the addition of a DWS energy manager position. The good news is that the DWS has approved the permanent position. DWS is in the process of interviewing potential candidates for the temporary position during the creation process of the permanent position.