Alliance to Save Energy
WATERGY CASE STUDY
Veracruz, Mexico

CHALLENGES

The Metropolitan System of Water and Sanitation at Veracruz (SAS), the water utility in Veracruz, Mexico, was motivated to undertake significant steps to become more energy efficient for two reasons: one is that energy costs ranked second in total operating costs, and the other is that their service was sporadic with severe interruptions a common occurrence. The system serves 628,000 users, and provides water and sanitation in the municipalities of Veracruz, Boca del Rió and Medellín in the state of Veracruz.

Before the project, parts of the system experienced severe interruption of service lasting up to five hours at a time. The project goal was to increase the energy efficiency of the operating system, improve the conditions of operation, and provide better service to the customer. The Alliance to Save Energy assisted in developing a plan to save energy based on its energy and water saving concept, Watergy. The plan helps to improve energy and water supply efficiency, at the same time improving water service. This case study describes a pilot project conducted in the Volcanes sector of the Veracruz system, with a population of 25,000.

APPROACH

The following analysis was conducted to determine the specific actins needed:

- An energy diagnostic using production statistics and electricity bills.
- A feasibility analysis of energy saving measures such as demand management, and power factor optimization.
- A feasibility analysis of cost saving measures including load shifting to off-peak hours.
- Collection of data and field measurements using specialized equipment for analyzing electrical networks and the electromechanical efficiency of pumping systems.
- Data analysis and selection and installation of high efficiency pumping equipment.

Key Results

- Energy Savings: 24 million kWh/year, a 24% reduction
- Cost Saving: US$ 394,000/year
- Improved reliability in water & sanitation service
- Elimination of service complaints
- Substantial reduction in losses of water due to

- Analysis of physical conditions of deep wells to evaluate their condition and determine rehabilitation and maintenance options.
- Use of hydraulic modeling to optimize pressure and flow sectors in the system.
- Sectorization (the process of isolating a section of a distribution system using valves), as a key first step in developing hydraulic models of the system, GIS mapping, and conducting maintenance programs such as unidirectional flushing, ultrasonic leak detection, and valve exercising.

The analysis found that water supply was being inefficiently delivered with three principal effects:

- Excessive operational energy use for pumping system and interrupted service when the pumps were operating at maximum capacity.
- Loss of water to the supply zones bordering the Volcanes sector and excessive operating pressure in the sector itself, which caused increased leaks.
- Low level of service to the local population, reflected in consistent complaints, averaging 100 complaints per month.

RESULTS

The project achieved savings primarily from basic supply side strategies, using a variety of methods:

- Optimization of electromechanical efficiency resulting in savings of 153,254 kWh/month, with a payback period of 1.7 years;

- Leak Detection and Water Conservation resulting in savings of 35,500 kWh/month.

The baseline energy intensity of the SAS system, taken at the beginning of the Watergy program was 0.48 kWh/m^3. Over the development of the program, the energy intensity had been reduced to 0.39 kWh/m^3 resulting in US$394,000 in savings for the utility.

LESSONS LEARNED

To improve operational conditions, several corrective actions are highlighted as follows:

Sectorization

The optimal pressure and flow range of the sector was determined using hydraulic modeling tools. Once determined, isolation valves were installed so that the sector could be cut off from the rest of the system and supplied solely from the pumping system at the Volcanes well.

Well rehabilitation and improvements in electromechanical efficiency

The Volcanes well was rehabilitated and a high efficiency submersible pump was installed.

Automation of the system and installation of a variable frequency drive

To avoid excessive energy consumption and to eliminate the necessity of constructing a storage tank, an automatic control mechanism was installed that includes a variable frequency drive. Controlled at constant pressure, the drive reduces the pump's energy consumption by 30% compared to when the pump operates without the drive.

The variable speed drive allows the Volcanes pump system to save energy during hours of low demand. The reduction of pressure in low demand hours also reduces leakage substantially.
This monitoring forms a part of the Supervisory Control and Data Acquisition (SCADA) system that SAS has implemented as part of its improvement strategy and will be applied in a similar way to other sectors of the city. The continuous monitoring of the sector, together with an aggressive program of maintenance and leak repair, has permitted SAS to reduce water losses to a minimum.

The course of action described above has shown quantifiable results, including the following highlights:

- **Elimination of public complaints.** The number of monthly complaints in this sector has decreased to almost zero. This improvement has allowed SAS to leverage user confidence to raise their income from previously unpaid monthly service bills.
- **Energy Savings.** The use of the variable speed drive in the Volcanes pump system has an electromechanical efficiency of 72% compared to 45% previously, and the combination of measures has allowed for 24% energy savings compared with previous consumption.
- Due to pressure control, water losses have been substantially reduced. Combined with a leak and loss recovery program, energy consumption will be reduced further.

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