PROJECT SUMMARY

UPPER OCCOQUAN SEWER AUTHORITY
COMPREHENSIVE ENERGY AUDIT AND BENCHMARKING STUDY

PROJECT SUMMARY

Bridgestone Associates performed a comprehensive energy audit and benchmarking study of this 54 MGD wastewater treatment facility. The scope of services accomplished in a 12 week period included a complete analysis of all process equipment, systems and facilities for existing energy use and methods of operation, recommendations on changes in technology to lower energy costs, analysis of existing supply tariffs, analysis of medium term and long term energy supply options, analysis of existing on-site peak shaving generator operations, recommendations on real-time metering and monitoring, and recommendations on operational and behavioral changes to improve and lower energy use. The scope included the main wastewater treatment plant as well as pumping stations and the Authority's office and administration buildings.

PROJECT STATISTICS

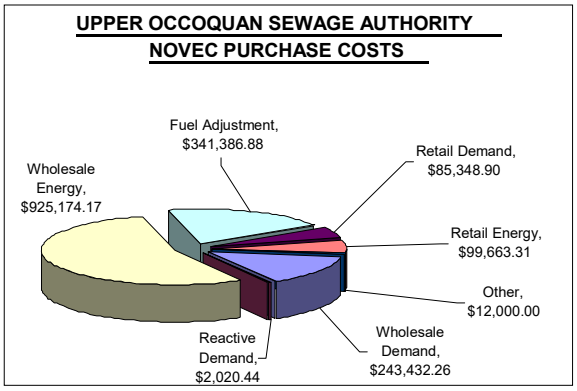
Client:	The Upper Occoquan Sewer Authority (UOSA)
Project Type:	Comprehensive Energy Audit and Benchmarking Study
Size:	54 Million Gallon per Day WWTP and five pumping stations
Plant Type:	Waste Water Treatment Facility with tertiary treatment
Plant Location:	Centreville, Virginia, USA
Plant Elevation:	265 feet above sea level
Outfall Discharge:	Occoquan River
Electricity Utility:	NOVEC (Northern Virginia Electric Cooperative)
Annual Energy Costs:	US$2.4 million/year (pre-expansion from 32 to 54 MGD)
Annual Energy Use:	39,557 MWh/year (pre-expansion from 32 to 54 MGD)
Projected Savings:	US$1.09 million/year (includes O&M and pumping station savings)
Projected Capital Investment:	US$4.3 million

PROJECT DESCRIPTION

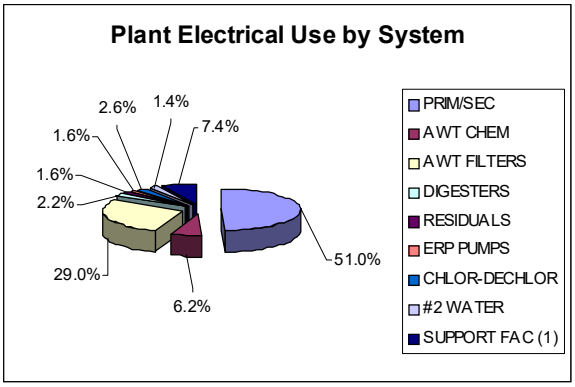
Bridgestone Associates won the project in a competitive bidding process. Bridgestone completed the Comprehensive Facility Energy Audit and Benchmarking Study in a 12 week period with a five-person auditing team including specialists in wastewater treatment plant design and operations, equipment

efficiency, utilities design, and energy supply analysis. The Comprehensive Audit included interviews with Plant management and operations staff, measurements on selected equipment, detailed analysis of historical data and design information, and numerous on-site visits and inspections. The scope of work covered in the Audit included:

- Identification and evaluation of energy cost savings measures for existing facilities
- Analysis of the current utility costs and consumption
- Review of the supply side purchases and impacts on future costs
- Evaluation of the controls, processes, facilities (HVAC, lighting, etc.)
- Identification of obvious deficiencies in current operations including energy, maintenance, and operating difficulties
- Measurement and review of the major electric motor loads, with recommendations on improvements in operation
- Evaluation of energy use breakdown by sub-processes, and comparison via benchmarking to other similar wastewater treatment plants in the region
- Analysis and review of the existing ABB DCS process control system
- Recommendations for changes to the existing EMS control unit of MACC for the HVAC systems
- Reuse of digester gas in other processes to reduce future natural gas or fuel oil purchases



As a result of this work Bridgestone Associates developed a list of potential areas for conservation and cost reduction of both thermal and electrical energy. In addition, other non-energy related areas of cost reduction were also noted during the Audit. Each of these ideas was reviewed with UOSA management and subsequently a series of Energy Conservation and Cost Reduction Measures (ECCRMs) for the existing facilities were developed. Detailed analysis was performed on those measures achieving a criterion of less than five years simple payback, although a few selected measures with longer payback periods were examined in detail if they were needed for continuation of the operation of the Plant, or if they had critical operation and maintenance (O&M) impacts. ECCRMs were evaluated for the main UOSA site and for the Flat Branch Pumping Station, the main outlying pumping station feeding the Plant.



The Plant's existing energy use was "benchmarked" against other wastewater treatment plants in the area. All the other plants had tertiary treatment but without the two additional stages of final filters installed at UOSA. This benchmarking showed that UOSA used more energy per million gallons than any of the other plants reviewed. Some of this may result from the additional processing requirements (additional filtration steps) that UOSA had versus the other plants. However, the results of this benchmarking and the other analysis performed

demonstrated that the UOSA Plant was not as efficient from an energy perspective as the other facilities, even allowing for the additional processing requirements. The results also indicate that UOSA's costs per kilowatthour were generally higher than the other wastewater plants in the area.

Bridgestone identified 20 ECCRMs with a simple payback of less than five years. Four of these were changes in operations and maintenance procedures or behavioral aspects of the Plant. These would require no capital cost to implement and would save an estimated $99,460 in annual energy costs. The remaining 16 required capital investment totaling $4.3 million with an estimated 4 year payback for all measures recommended.

SUMMARY OF MEASURED ENERGY DATA FROM PLANT SUBMETERING

SECTION	NOV	DEC	JAN	FEB	MAR	APR	MAY	% OF TOTAL	Average
PRIM/SEC	1,409	1,825	2,023	1,697	1,573	1,921	1,673	50.0	1,732
AWT CHEM	231	222	229	218	208	218	195	6.3	217
AWT FILTERS	1,005	1,010	1,108	1,005	976	1,034	900	29.0	1,005
DIGESTERS	105	78	93	76	68	79	70	2.3	81
RESIDUALS	59	66	59	61	45	53	55	1.7	57
ERP PUMPS	56	44	60	51	52	73	96	1.8	62
#2 WATER	57	52	51	41	47	52	46	1.4	49
SUPPORT FAC (1)	260	268	315	265	227	232	252	7.5	260
TOTAL KW/MG (2)	3,146	3,553	3,981	3,431	3,171	3,593	3,296		3,453
FLOW (MGD)	30.1	30.6	29.6	32.7	35.3	30.2	34.0		31.8
Actual NOVEC Billing	**3331222**	**3868420**	**4397855**	**3538334**	**3566563**	3417694			
Days Billed by NOVEC	**31**	**31**	**32**	**28**	**29**	30			
Adjusted NOVEC Billing	**3223763**	**3868420**	**4260422**	**3538334**	**3812533**	3417694			
Energy Use kWh/MG	3,570	4,078	4,643	3,864	3,484	3,772			

(1) Support includes Admin, Operations bldg, Maintenance bldg, Lab, Plant waste, and septage receiving.
(2) The numbers above the total have some buildings double-counted, therefore the total is less than calculated.

UOSA electric savings	=	$418,181/year
UOSA thermal savings (oil + natural gas)	=	$484,596/year
UOSA O&M + Other savings	=	$129,478/year
Flat Branch Electric savings	=	$ 59,025/year
Flat Branch O&M savings	=	$ -1,200/year
Total Annual Benefit	**=**	**$1,090,380**
Total Implementation Cost (UOSA + Flat Branch)	=	$4,341,693
Coupled Total Payback	**=**	**4.0 years**

A complete final report was provided to UOSA. This included detailed analysis of each recommendation and the cross-coupling effects of implementation of some or all of the recommendations.

The project was completed and report submitted on time and on budget, a fact that was highlighted by UOSA's Chief Purchasing Manager as apparently unusual in his experience with other consulting firms.