

South Central Connecticut Regional Water Authority

Energy Management and Cost Savings Program

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Paul B. Doran, P.E.
Consulting Engineer

Why Develop an Energy Management Program

- Beyond Saving the Authority and Customers Money
 - ❖ Set an Example for Communities and Customers
 - ❖ Reduce Dependence on Foreign Oil
 - ❖ Slow Down Expenditure of New Energy Infrastructure
 - ❖ Extend Capacity of Existing Energy Supplies
 - ❖ Partners with Local Utility
 - ❖ Energy Efficient Water Utilities - The New Standard
 - ❖ Proactive Approach to Future Requirements
 - ❖ Environmental Benefits - The Being Green Label



Energy Management Program Steps

- Secure Management Commitment
- Appoint an Energy Program Manager
- Select an Energy Team
- Determine Energy Fence-Line
- Determine Data Collection Approach
- Conduct Energy Audits
- Prepare Electric Billing Computer Model
- Analyze Energy Audit Results



Energy Management Program Steps (cont)

Establish Authority Energy Saving Goals

- Prioritize Energy Saving Improvements
- Develop Authority-wide Management Plan
- Modify Operation SOP and Staff Activities
- Develop Capital Investments Needs
- Integrate Improvements in Authority Annual CIP
- Monitor and Evaluate Results
- Operate & Maintain Improvements



Senior Management Role

- Establish Energy Policy/Savings Goals
- Establish Energy Saving Goals
- Demonstrate Commitment to Energy Savings
- Delegate Responsibility & Authority
- Provide Program Visibility
- Active Participation Through Quarterly Meetings
- Support Authority Employees
- Recognize Individuals for Achieved Results



Energy Team Participants

- Paul B. Doran, P.E. in Facilitator Role
- RWA Energy Program Manager
- RWA Energy Team
 - ❖ Authority Departments Represented
 - ❖ Key Authority Employees
 - ❖ First-hand Knowledge of Operation/Functional Areas
 - ❖ Responsible to Perform the Detailed Work
 - ❖ Desire & Commitment
 - ❖ Personal Attribute of Making a Difference



Facilitator Role



The Facilitator plans, guides and manages a group to ensure that the group's objectives are effectively met, with clear thinking, valued participation for all in the group and full buy-in from everyone involved.



Facilitator Interactions

- Design & Interactively Plan
 - ❖ Focus on Outcome
 - ❖ Design the Group Process
 - ❖ Lead the Program
- Guide and Control
 - ❖ Set Meeting Objectives
 - ❖ Explain Program Activities
 - ❖ Listen, Engage and Include
 - ❖ Monitor Milestones & Goals
 - ❖ Educate as Necessary
- Record Decisions & Actions
 - ❖ Debrief the Group



Why Paul B. Doran, P.E.

- Familiar With Authority Infrastructure
- Skilled in Water System Treatment and Operations
- Accomplished in Pumping and Hydraulic Analysis
- Possess Blend of Business & Technical Talent
- Provided Water/Wastewater Facility Planning, Design/Operation for More Than 3 Decades
- Knowledge of Mix of Factors Which Affect Rates
- Track Record of Finding Energy Saving Measures



Authority's Energy Program Manager

- Demonstrates Effective Leadership Traits
- Delegates Authority From Senior Management
- Leads the Authority Energy Team
- Drives the Day to Day Energy Program Activities
- Conducts Quarterly Meetings w/Senior Management
- Skilled in Management Techniques
- Interfaces with Facilitator
- Educates the Energy Team as Needed
- Follows Up with Energy Team



Sample Authority Energy Team Composition

- Energy Program Manager
- Operations Personnel
 - ❖ Facilities - 2
 - ❖ Maintenance - 1
 - ❖ Instrumentation and Control - 1
 - ❖ Distribution - 1
 - ❖ Fleet Service - 1
 - ❖ Construction - 1
- Water Quality and Treatment Personnel - 2
- Engineering Personnel - 2
- Information Technology Personnel - 1



Initial Data Gathering

- Analyze Utility Bill for Type of Charges
 - ❖ Time of Use (On and Off Peak Rates)
 - ❖ Interruptible Rates, Customer Generator Rates
 - ❖ Consumption, Demand, Power Factor, Rate Code
 - ❖ Charges: Service, Energy, Demand and Ratchet
 - ❖ Equipment Served by Each Bill
- Identify Existing Energy Savings Programs
- Identify Any Past, Present and Future RWA Energy Savings Projects
- Organize Data Gathering per Utility Bill Loads



Initial Data Gathering (cont)

- Collect Energy Consumption Data & Inventory
 - ❖ Process, Pump Systems, Fans, HVAC, Lighting
- Obtain Motor Data: Speed, Voltage, Amps, Type
- Obtain Power Factor, Load, Use
- Obtain Drive Data
- Determine Patterns of Equipment Use
 - ❖ Daily, Weekly, Monthly and Seasonally
- Establish Sub-meter Placement Locations
- Monitor Electrical Use Over Small Fence-lines



Data Collection Form Example

- Create Data Collection Forms
- Recording Field Data
- Consistency of Data Collection
- Documentation of Field Work
- Minimize Errors
- Traceable



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Appendix A
Motor Nameplate and Field Test Data Form

Employee Name _____ Facility/Location _____
 Company _____ Department _____
 Date _____ Process _____

General Data

Serving Electrical Utility _____
 Energy Rate (\$/kWh) _____
 Monthly Demand Charge (\$/kW/mo.) _____
 Application _____
Type of equipment that motor drives
 Coupling Type _____
 Motor Type (Design A,B,C,D _____
 AC,DC, etc.)
 Motor Purchase Date / Age _____
 Rewound Yes No

Motor Nameplate Data

1. Manufacturer _____
2. Motor ID Number _____
3. Model _____
4. Serial Number _____
5. NEMA Design Type _____
6. Size (hp) _____
7. Enclosure Type _____
8. Synchronous Speed (RPM) _____
9. Full Load Speed (RPM) _____
10. Voltage Rating _____
11. Frame Designation _____
12. Full Load Amperage _____
13. Full Load Power Factor (%) _____
14. Full Load Efficiency (%) _____
15. Service Factor Rating _____
16. Temperature Rise _____
17. Insulation Class _____
18. kVA Code _____

Motor Operating Profile

Hours	Weekdays	Wknd/Holiday
	Days/Year	Days/Year
Per 1st Shift	_____	_____
Per 2nd Shift	_____	_____
Per 3rd Shift	_____	_____

Annual Operating Time _____ hours/year

Type of load (Place an "X" by the most appropriate type)

1. Load is quite steady, motor "On" during shift
2. Load starts, stops, but is constant when "On"
3. Load starts, stops, and fluctuates when "On"

Answer the following only if #2 or #3 above was selected:
 % of time load is "on" _____%

Answer the following only if #3 was selected:
 Estimate average load as a % of motor size _____%

Measured Data

Supply Voltage
By Voltmeter

Line- to- Line	V _{ab} _____	V _{avg} _____
	V _{bc} _____	
	V _{ca} _____	

Input Amps
By Ampmeter

A _a _____	A _{avg} _____
A _b _____	
A _c _____	

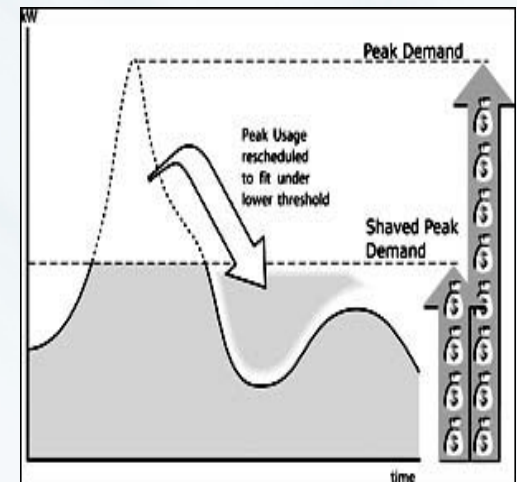
Power Factor (PF) _____
Input Power (kW) _____
 If available. Otherwise equal to:

$$V_{avg} \times A_{avg} \times PF \times \sqrt{3} / 1000$$

Motor Operating Speed _____
By Tachometer
Driven Equipment Operating Speed _____

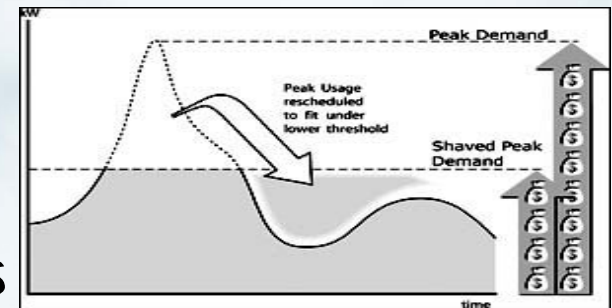
Selected Energy Savings Opportunities

- The Well-Known “Old Standbys”
 - ❖ Premium Efficiency Motors
 - ❖ Variable Frequency Drives
 - ❖ Lighting Modifications
- Additional Options
 - ❖ Load Shifting
 - ❖ Power Factor Optimization
 - ❖ Peak Load Reduction/Peak Shaving
 - ❖ Process & Equipment Modifications
 - ❖ Operation & Maintenance Practices



Selected Energy Savings Opportunities (cont)

- Fill Storage Tanks - Off Peak Hours
- Implement Load Shifting - Off Peak Hours
 - ❖ Fill Storage Tanks
 - ❖ Backwash Filters
 - ❖ Diesel Driven Pumps
 - ❖ Fill Wash Water Tanks
- Modify Process Operation Procedures
- Increase Power Factors
- Remove Simultaneous Equipment Operation
- Install Lower Motor Horsepower



Post Energy Audit Activities

- Create List of Target Energy Improvements
- Compute Estimated Energy Savings
- Prioritize Improvements by Criteria:
 - ❖ Projected Costs vs Projected Savings
 - ❖ Return on Investment
 - ❖ Operational Improvements
 - ❖ Existing Need for Equipment Upgrades
 - ❖ Asset Management Goals
 - ❖ Feasibility of Energy Efficiency Savings
- Recommended List of Energy Improvement Goals



Establish Energy Management Program

- Develop Action Plans to Implement Improvements
 - ❖ List Individual Tasks
 - ❖ Assign Responsibility for Achieving Energy Goal
 - ❖ Establish Deadline for Achieving Goal
 - ❖ Estimate Level of Effort and Costs
- Obtain Senior Management Approval
 - ❖ Ensure Integration with Overall Utility Mission
 - ❖ Define Temporary and Permanent Impacts on the Utility
 - ❖ Approval of Department Budgets
- Frequent Two-Way Communication



Monitor & Measure Energy Program

- Determine Energy Measurement Needs
- Develop Procedures for Documenting Program
- Review Progress Toward Goals
- Determine Impediments to Achieving Goals
- Implement Corrective Actions
- Monitor & Reassess Compliance
- Operate & Maintain Energy Improvements
- Continual Improvement
- Apply Lessons Learned

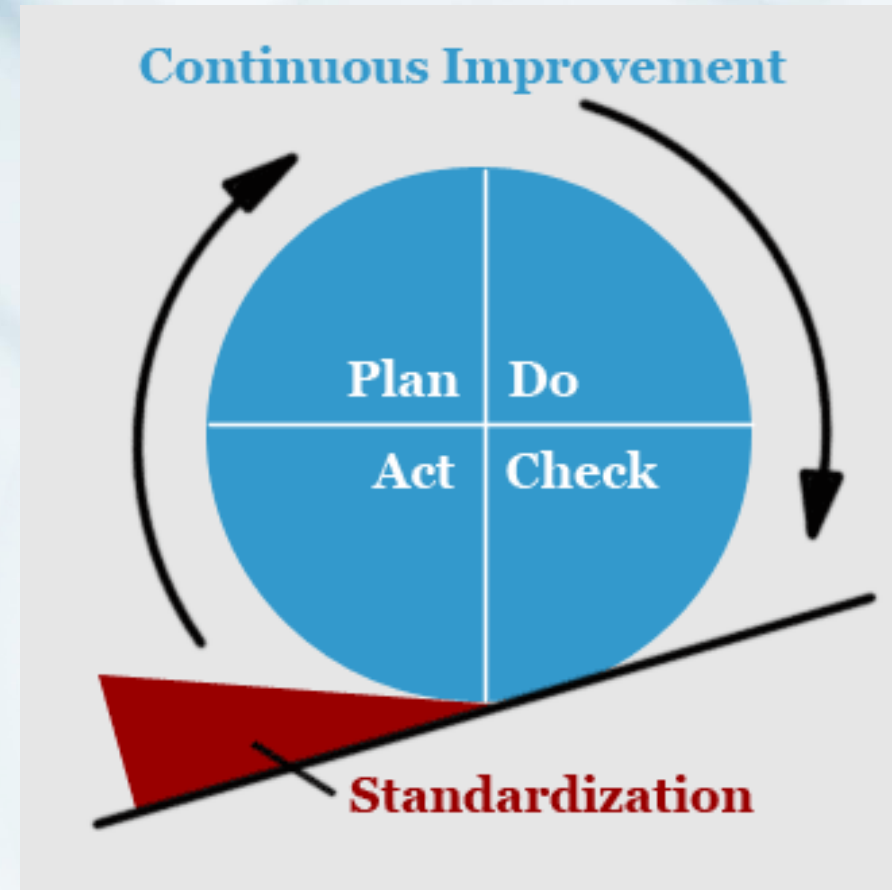


Sustainability

Continuous energy improvements requires a structure that combines the technical aspects of energy efficiency with effective operation control to ensure the initial efficiency gains are sustained and imbedded within the Authority operating practices.



Paul B. Doran, P.E.; Consulting Engineer



Why Paul B. Doran, P.E.

Paul B. Doran, P.E. partners with the Authority staff to create a practical, targeted Energy Savings Program that will be broadly supported, clearly communicated and effectively implemented Authority-wide. He joins the Authority's Energy Team to create positive energy savings results keeping the Authority competitive.

