Marysville School District
Resource Conservation Program

John Bingham – Marysville S.D.
Ray Burton – Snohomish Co. P.U.D.
Resource Conservation Program

✓ Tools
✓ Utility budget
✓ Utility tracking
✓ Benchmarking
✓ Load profiles

✓ Program Support
✓ Board policy
✓ Building operating guidelines

✓ Implementation
✓ Weekly meetings
✓ Setting goals
✓ Identifying projects and getting them installed
✓ Involve staff

✓ New Construction
✓ Presenting Results
Marysville S.D. - Utility Cost Breakdown
4/05 - 3/06

- **Electricity**, $945,774, 55%
- **Natural Gas**, $464,033, 27%
- **Water**, $60,516, 4%
- **Sewer**, $53,288, 3%
- **Garbage**, $156,167, 9%
- **Recycling**, $27,561, 2%

Total Utility Cost = $1,707,339
### Tools

2 Years History for Data Base

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#### Marysville School District, Marysville Pilchuck High School
Utility Usage History -- 09/2003 thru 08/2005

<table>
<thead>
<tr>
<th>Date</th>
<th>Electricity (kWh)</th>
<th>Demand (kW)</th>
<th>Natural Gas (Therms)</th>
<th>Oil (Gallons)</th>
<th>Diesel (Gallons)</th>
<th>Water (kGal)</th>
<th>Irrigation (kGal)</th>
<th>Sewer (kGal)</th>
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**Annual Total**

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<th>Demand (kW)</th>
<th>Natural Gas (Therms)</th>
<th>Oil (Gallons)</th>
<th>Diesel (Gallons)</th>
<th>Water (kGal)</th>
<th>Irrigation (kGal)</th>
<th>Sewer (kGal)</th>
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**Annual Total**

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- You Can’t Manage What You Don’t Measure
Benchmarking

• Where should you be?
  – Your schools compared to each other
  – Your schools compared to other local districts
• Use per square foot (EUI)
  – Track electric and gas separately
  – Can compare across other Puget Sound utilities
• Cost per square foot (ECI)
  – Use for comparison only if rates are similar
  – Can’t compare PSE area school to PUD area school
Tools
Benchmark – (EUI)

Marysville SD - Energy Use Index ('04-'05)

You Can’t Manage What You Don’t Measure
Tools

Benchmark - Electric Loads at Night

Msvl SD - Electric Loads at Night - November '03 - '04 - '05

Watts/sqft

Cascade | Liberty | Summside | Kellogg Marsh | Allen Creek | Msvl Jr. | Tulalip | MAHS | Shoultes | Cedarcrest | Msvl Middle | Quilceda | Pinewood | M-P High | Marshall

'03 | '04 | '05
Tools
Electric Load Profile

Typical week day

290 kW

Typical week end
Tools
Gas Load Profile

Controls put in "hand" mode
ENERGY MANAGEMENT/EDUCATION

The Board recognizes the responsibility to develop and maintain programs to support the conservation of energy and natural resources. In recognition of this leadership responsibility, the district shall strive to (a) institute effective energy management and (b) provide information and develop conservation attitudes and skills for the students it serves. To achieve the objectives of energy management, the Board shall appoint a team representing the Board, administration, staff, students, parents and utility representatives to develop and review plans for efficient energy management in the daily operation of the district’s facilities. The committee shall have the responsibility to:

A. Assess past and present energy consumption practices;
B. Review current operational and maintenance practices;
C. Study operation changes designed to reduce consumption and related costs;
D. Examine the feasibility of retrofitting alternatives for existing facilities as a result of engineering studies and reports;
E. Provide periodic reports and/or recommendations to the Superintendent and Board;
F. Monitor the energy management measures which are implemented;
G. Insure, through a monitoring process, that instruction in energy use and conservation is incorporated into the district's program.

The Board, as part of its educational mission, desires to foster the conservation ethic among the students. To achieve the objectives of the energy education program, instructional activities shall be designed to educate students on supply and costs of natural resources which, in turn, will stimulate skill building to effect responsible conservation behavior in students. As part of the educational process, students will be encouraged to assess the energy consumption policies of the school as a means of applying knowledge and skill.

The Superintendent is authorized to establish annual energy management goals, annual energy education goals, and extrinsic rewards to school buildings in recognition of conservation accomplishments. The Superintendent will make periodic and annual evaluation reports to the Board.

Cross References: Board Policy 2020 6923 Curriculum development and Adoption of Instructional Materials Energy Conservation

Legal Reference: WAC180-030-406 Energy conservation program--Life cycle cost analysis

Adoption Date: 01/03/2000
The following guidelines are set to establish standards to optimize the conditions of our learning and work environment while also conserving energy and natural resources and avoiding unnecessary and costly utility expenses. The implementation of this program is the joint responsibility of all school district staff, students and other users.

**Lighting**
- Individual classroom lighting should be turned on/off by teacher at beginning and end of each day.
- Teachers should ensure that lights are turned off when classrooms, shops, etc., are unoccupied for 15 minutes or longer.
- Lights in gymnasiums, multi-purpose rooms or commons should be turned off if room will be unoccupied for 30 minutes or longer.
- Whenever possible, natural lighting should be taken advantage of in lieu of indoor lights.
- Hallways and commons lighting shall be turned off at the end of the instructional day unless after-school activities require it.
- Outside lighting should remain off from midnight until 4:30 a.m.

**Heating**
- HVAC systems should always be operated in the most economical and efficient way possible.
- The heating system will be set to provide the following temperatures during time of student occupancy:
  - Classrooms/Libraries: 68°-70°
  - Gyms/Multi-Purpose: 68°
  - Offices: 68°-70°
  - School Shops: 68°
  - Hallways: 65°
  - O&M and Trans. Shops: 65°
- Variations from the set schedule can be made by the Maintenance Dept. only for unique or special circumstances. The night setback temperature at all facilities shall be 55° to 60°, including all day during weekends and holidays.

**Electrical**
- All electrical equipment such as computer monitors, printers, copiers, coffee pots, etc. must be turned off at the end of individual’s workday. Do not turn off computer unit itself as system back-ups and software updates occur during night hours.
- High-energy use items such as kilns and self-cleaning ovens should be run between 2:00 p.m. and 5:00 a.m. (non-peak times)
- All staff lounge refrigerators should be cleaned out and turned off during extended breaks.
- Pop machines need to be turned off during extended breaks.

**Water**
- Report any and all leaks.
- Never leave faucets running unattended or between use except when cold weather procedures are warranted.

**Solid Waste and Recycling**
- Each school should develop and implement a recycling plan in order to reduce solid waste.
- Custodial staff will monitor the quantity and usage of the dumpsters. Dumpster size and frequency of pick-up will be adjusted if needed.

For more energy information, please contact Maintenance at Ext. 20847.
Checklists for extended breaks

CONSERVATION CHECKLIST

Summer Shutdown for Custodians

HVAC Systems
- All heat/cooling off
- All portable classroom heat/cooling to “OFF” position (not temporary override).
- If heat/cooling is necessary, only the smallest zone allowable is active.
- Exhaust fans off
- Turbo fan use limited to carpet drying. Open doors and windows for natural ventilation.

Lighting
- All exterior lights off, except when needed for evening community activities.
- Interior lights on only in the immediate areas where work is being done, or use daylight.
- Hallway lights off when not working in halls.
- Display case lighting off.

Water
- Water heaters turned off. Cleaning tasks requiring hot water can be grouped so tanks can be off for extended period of time, and/or, designate one hot water tank to remain on.
- Hot water circulation pumps off.
Implementation
Weekly Meetings

Who
- Maintenance Manager
- Building Operator
  - Lead HVAC Tech
  - Lead Custodian
- RCM

Topics
- Status of Existing Projects
- New ideas to save
- Load Profiles (Monthly)
- Who should be involved in projects

Follow-up “To Do” lists
- Each Member
Implementation
Establish Goals

• Based on existing utility costs
  1\textsuperscript{st} Year = 10\% \ ($170,000 - estimate)
  2\textsuperscript{nd} Year = 15\% \ ($250,000 - estimate)
  3\textsuperscript{rd} Year = 20\% \ ($340,000 - estimate)

Marysville’s results after 5 yrs = $1,100,000
(20\% maintained savings - actual)
Implementation
Ways to Identify Projects

- Night walk-thrus
  - It’s 3:00 a.m. – Do you know where your energy use is?
- Monitoring (sub-metering)
- Controls review
- Bill reviews (checking for errors)
- Employees suggestions
- Typical measures
  - Lighting
  - Mechanical
  - Other
Why non-school hours?

• After school, savings opportunities are abundant
  – No capital budget dollars needed
  – No impact to building systems
  – No impact to staff or students

Consider “after hours” user groups

NO BRAINER!!!
Why should you care?

- 5 times more hours "non-school" than during school
  - From 7:00am – 3:00pm M-F = 1,440 hrs/yr
  - Non-school = 7,320 hrs/yr
- Large % of energy use occurs during non-school hours
Worst Case Scenario

School hours
Energy use = 40%

Non-school hours
Energy use = 60%
Best Case Scenario

School hours energy use = 60%
Non-school hours energy use = 40%
Typical loads left on at night

- **HVAC**
  - Heating to “occupied” temperatures
  - Supply and exhaust fans running
  - Outside air dampers open

- **Lights**
  - All exterior
  - Hallway
  - Common areas

- **Plug Loads**
  - Computers
  - Pop machines
  - Personal refrigerators
Implementation
Ways to Identify Projects

• Night walk-thrus

- Monitoring (sub-metering)

• Controls review

• Bill reviews (checking for errors)

• Employees suggestions

• Typical measures
  – Lighting
  – Mechanical
  – Other
Temporary Meters

- Digital Thermometers
- Lighting logger
- Motor Logger
- Occupancy Logger
- Temperature Logger
- Electrical
- Load profiles
- Air Flow
Implementation
Ways to Identify Projects

- Night walk-thrus
- Monitoring (sub-metering)
  - Controls review
- Bill reviews (checking for errors)
- Employees suggestions
- Typical measures
  - Lighting
  - Mechanical
  - Other
Review controls annually

- Review EMS/time-clock settings
  - Occupied/unoccupied times
  - Start times versus occupied times (warm up period)
  - Temperature set points
  - Dead-bands
  - Economizer enabled

- Program holiday/non-school day schedules at beginning of year
Implementation
Ways to Identify Projects

• Night walk-thrus
• Monitoring (sub-metering)
• Controls review

➤ Bill reviews (checking for errors)
• Employees suggestions
• Typical measures
  – Lighting
  – Mechanical
  – Other
# Understanding Your Utility Bill

## Detail of Utility Charges

<table>
<thead>
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<th>Meter Number</th>
<th>Current Reading</th>
<th>Previous Reading</th>
<th>Difference</th>
<th>Multiplier</th>
<th>Usage</th>
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<td>KW</td>
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<td>987.600 KW</td>
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Connected Load: 884.00 KW  
Load Factor: 39.1%

### Service Dates

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<td>Mar. 17, 2005</td>
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<td>Days in Billing Period</td>
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### Customer Charges

- Energy Charge: 30,000 KWH @ $0.075200 Per KWH  
  - $2,256.00

### Energy Charges

- Energy Charge: 257,400 KWH @ $0.060500 Per KWH  
  - $15,572.70

### Power Factor

- Power Factor: 0.92 (.97 Required)

### Billing Demand Charges

- Billing Demand: 987.600 KW  
  - $3,391.87

- Adjusted Demand Due to Low Power Factor: 1,036.980000 KW  
  - $955.33

### Billing Demand Charge in Excess of 100 KW

- Billing Demand Charge in Excess of 100 KW: 936.980000 KW @ $3.620000 Per KW  
  - $3,391.87

### Taxes

- Taxes: Everett Municipal (21,229.56 @ 4.5 %)  
  - $955.33

### Service Charges

- Service Charges:  
  - $22,184.89

### Total Utility Charges

- Total Utility Charges: $22,184.89

*PUD electric rates include a state public utility tax at 3.873% - approximately $822.22 on this bill.
Understanding Your Utility Bill

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<th>Charge Description</th>
<th>Quantity</th>
<th>Price per Unit</th>
<th>Amount</th>
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<tr>
<td><strong>Total</strong></td>
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- **Current Gas Charges**

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<th>Amount</th>
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<td><strong>Total</strong></td>
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<td><strong>$5,468.15</strong></td>
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- **Current Gas Charges Total**: $9,414.25
Implementation
Ways to Identify Projects

• Night walk-thrus
• Monitoring (sub-metering)
• Controls review
• Bill reviews (checking for errors)
  ➢ Employees suggestions
• Typical measures
  – Lighting
  – Mechanical
  – Other
Encourage staff to submit:

- Needed repairs
- Control problems
- Ideas for conservation!

THEY ARE YOUR BIGGEST ALLIES!!!
Implementation

Ways to Identify Projects

- Night walk-thrus
- Monitoring (sub-metering)
- Controls review
- Bill reviews (checking for errors)
- Employees suggestions

- Typical measures
  - Lighting
  - Mechanical
  - Other
Typical lighting measures
Typical mechanical measure

Programmable thermostats
Typical “other” measures

- Pool Cover
- CO₂ Control of Outside Air
- Motion Sensors for Lights
- Photocell Controls for Lights
- DDC System for HVAC
- Adjustable Speed Drives on Larger Motors
Getting Projects Installed

- No cost/low cost O&M measures
  (Use successes to promote longer pay-back measures)
- “Low fruit” first (most cost-effective)
- Identify funding sources
- DON’T FORGET UTILITY FUNDING!
New Construction

- Have RCM involved from beginning
- Set energy performance goals
- Use utility incentive programs
- Start commissioning agent early
- Secured $250,000 grant from State for Elementary #11 to construct to WSSP
Savings from RCM Program

Electric

Electrical Savings over 5 years = $450,000

Additional Equipment Energy Usage = $140,000*

Total Savings = $590,000

* = 23,500 sq.ft. and 2,600 computers
Savings from RCM Program
Natural Gas

Natural Gas Savings over 5 years = $600,000
Present Results
Individual Schools

Marysville SD - EUI History

30% Reduction at M-P High
Present Results
Entire School District

Marysville School District

- 20% Sustained Total Energy Savings w/o added electric load
10 Steps to a successful Resource Conservation Program

1. Find a conservation champion (RCM)
2. Track your utilities
3. Understand your utility bills
4. Call your local utilities
5. Benchmark your facilities
6. Review operating parameters
7. Implement O&M saving measures
8. Secure financing for capital projects
9. Implement capital projects
10. Present results
Marysville School District
RCM Program

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