Building Energy Intelligence in Your Utility
OWASA’s Experience in Developing a Comprehensive Energy Management Program

Mary Tiger, MPA
Sustainability Manager
Energy Management Goals and Objectives
Set by OWASA Board of Directors in June 2015

1. Reduce use of purchased electricity by 35% by the end of Calendar Year (CY) 2020 from CY 2010 baseline
2. Reduce use of purchased natural gas by 5% by CY 2020 from CY 2010 baseline
3. Beneficially use all wastewater treatment plant (WWTP) biogas by 2022, provided the preferred strategy is projected to have a positive payback within the expected useful life of the required equipment
4. Formally engage local governments and partners in discussion about potential development of a biogas-to-energy project at the Mason Farm WWTP
5. Seek proposals for third-party development of renewable energy projects on OWASA property
Energy Management Program Goals
Defined by OWASA Staff

• Achieve energy management goals and objectives set by Board of Directors
• Foster a clean energy culture at OWASA through employee engagement and continuous improvement/innovation
• Ensure strategic and prompt pursuit of clean energy opportunities
• Pursue cost-effective clean energy opportunities
Basic Components of an Energy Management Program

1. Establish Organizational Commitment and Set Goals and Objectives
2. Develop a Baseline of Energy Use
3. Evaluate the System and Collect Data
4. Identify Clean Energy Opportunities
5. Prioritize Opportunities for (further) Evaluation or Implementation
6. Evaluate Opportunities
7. Fund and Implement Projects
8. Track Progress and Report
Role of the OWASA Energy Team

- Represent diversity of perspectives and functions of OWASA
- Serve as energy management champions and liaisons
  - Meet Quarterly
    - Track progress
    - Identify clean energy opportunities
    - Evaluate clean energy opportunities
- Serve on team for three years (through December 2019)
Basic Components of an Energy Management Program

1. Establish Organizational Commitment and Set Goals and Objectives
2. Develop a Baseline of Energy Use
Identifying Clean Energy Opportunities

• How
  • Board member nomination
  • Internal review and nomination
  • Review of best practices
  • Audit/assessments

• Resources
  • Staff
  • Consultants
  • Department of Energy Better Buildings Program
  • Industry conferences and reports

• What
  • Capital program or equipment replacement
  • Process change
  • Operational change
  • Automation or controls
  • Maintenance improvements
  • Business measures

Opportunity for new projects, as well as modifications of planned projects
• Commitment to reduce energy intensity by 25% against 2013 baseline
• Network with other utilities and industries
• Assigned a Technical Assistance Manager
  • Help analyze energy information
  • Connect to resources
• In-Plant Training in 2017 >>>>>>>
Evaluation Criteria for Projects

• Financially Responsible (High level)
• Realistic/Implementable
• Operational Impacts
• Energy/Carbon Reduction Potential
• Coordinates with Other Projects
• Community Impacts

Incorporates criteria from:
• Project objectives defined in OWASA’s Energy Management Program’s Project Charter
• City of Raleigh’s Climate and Energy Action Plan
• City of Asheville’s Sustainability Management Plan
• Department of Energy’s Guide to Community Energy Action Planning
Evaluation Criteria for Projects

• Financially Responsible (High level)
  • Likely a good use of public funds
  • Financial viability of similar projects in similar organizations and circumstances
  • Opportunities for outside funding/financing

• Realistic/Implementable
• Operational Impacts
• Energy/Carbon Reduction Potential
• Coordinates with Other Projects
• Community Impacts
Evaluation Criteria for Projects

• Financially Responsible (High level)
• Realistic/Implementable
  • Degree to which strategy has been proven at a scale relevant to our operation
  • Organizational capacity to undertake and manage the project
  • Reasonable amount of staff time to implement
  • Legal
  • Meets regulatory requirements
• Operational Impacts
• Energy/Carbon Reduction Potential
• Coordinates with Other Projects
• Community Impacts
Evaluation Criteria for Projects

• Financially Responsible (High level)
• Realistic/Implementable
• Operational Impacts
  • Consistent with how OWASA wants to operate
  • Degree to which strategy helps to resolve an existing or expected problem
  • Impact on safety, comfort, and productivity
• Energy/Carbon Reduction Potential
• Coordinates with Other Projects
• Community Impacts
Evaluation Criteria for Projects

• Financially Responsible (High level)
• Realistic/Implementable
• Operational Impacts
• Energy/Carbon Reduction Potential
  • Potential to reduce OWASA’s energy use
  • Potential to reduce OWASA’s carbon emissions
• Coordinates with Other Projects
• Community Impacts
Evaluation Criteria for Projects

• Financially Responsible (High level)
• Realistic/Implementable
• Operational Impacts
• Energy/Carbon Reduction Potential
• Coordinates with Other Projects
  • Interdependency with other project(s) increases potential to save energy (e.g. upgrade to HVAC system and building envelope)
  • Potential to take advantage of economies of scale to save money and/or staff time
• Community Impacts
Evaluation Criteria for Projects

• Financially Responsible (High level)
• Realistic/Implementable
• Operational Impacts
• Energy/Carbon Reduction Potential
• Coordinates with Other Projects
• Community Impacts
  • Stakeholder enthusiasm
  • Coordinates with community initiatives
Applying the Evaluation Criteria

- Energy Team discussed each project against criteria
- Recommend to:
  - Implement
  - Study
  - Defer until upgrade
  - Defer indefinitely

<table>
<thead>
<tr>
<th>Energy Strategy</th>
<th>Financially Responsible (High level)</th>
<th>Realistic/Implementable</th>
<th>Operational Impacts</th>
<th>Energy/Carbon Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump and Motor Asset Management Program</td>
<td>Early payback expected based on experience of others</td>
<td>Yes, but is technically involved and includes multifaceted effort</td>
<td>Could help identify pumps and motors that need to be replaced before they fail will help inform performance-based maintenance program</td>
<td>Significant potential motors account for energy use</td>
</tr>
<tr>
<td>Heat, Ventilation, and Air Conditioning Assessment: Operational Changes and Minor Controls</td>
<td>Minor up-front costs Quick payback expected</td>
<td>Yes</td>
<td>Improved occupant comfort and health</td>
<td>Energy and natural potential</td>
</tr>
<tr>
<td>Habitat Water Pump Use Optimization</td>
<td>Modest cost for a study expected to be offset by cost savings from improved optimization</td>
<td>Yes</td>
<td>Use of right pump for right flow condition can reduce pump wear and tear Better control of pump start/stop operations Will be important to avoid large flow changes in the plant</td>
<td>Potential to reduce the energy used by pump</td>
</tr>
<tr>
<td>Heating, Ventilation, and Air Conditioning Assessment: Equipment Replacement</td>
<td>In instances of aging equipment or quick payback</td>
<td>Yes</td>
<td>Improved occupant comfort and health</td>
<td>Energy and natural potential</td>
</tr>
<tr>
<td>Optimize WWTP Filter Backwash</td>
<td>Modest cost for monitoring and control system</td>
<td>Potentially</td>
<td>Increased effort for monitoring Could provide $ energy use for denitrification</td>
<td>Modest energy use for denitrification</td>
</tr>
<tr>
<td>System-Wide Energy Model</td>
<td>Likely a high-cost study</td>
<td>Potentially</td>
<td>Would provide a theoretical baseline for future decision-making</td>
<td>No direct energy use for setting re</td>
</tr>
<tr>
<td>Power Supply Optimization</td>
<td>Modest cost of study could identify cost of upgrade</td>
<td>Involved study strategy may have limited benefits to DWASA</td>
<td>Reduction in power quality could negatively impact YTPA and other equipment</td>
<td>Anticipated in opportunity</td>
</tr>
<tr>
<td>Real-Time Nitrification Control System</td>
<td>Modest up-front investment, we already have about 75% of the monitoring equipments controls will require back-up</td>
<td>Potentially</td>
<td>Would enable changes to operational strategies Potential to improve plant performance Automation requires calibration and oversight</td>
<td>Potential to reduce WWTP by about 20% reductions in energy use</td>
</tr>
</tbody>
</table>
Business Case Evaluation or Implementation?

Projects and strategies where energy management is a secondary objective will be proposed in annual budget or implemented.

Example: Cane Creek Pump Station Improvements

Projects and strategies that have a primary objective of achieving energy management goals will move to the next phase: business case evaluation.

Example: Rooftop solar panel installation
Business Case Evaluation

• Method: Life-cycle Cost Analysis
  • Threshold: Positive net present value

• Financial considerations (Compared against baseline)
  • Design and construction costs
  • Avoided cost of energy
  • Cost of operations and maintenance
  • Utility rebates and other incentives
  • Analyze project with and without applying a social cost of carbon as a benefit (i.e. revenue) in the business case

• Community engagement important for those projects whose business case is “made” by incorporating a social cost for carbon

• Clean energy projects that surpass the business case threshold will be prioritized in OWASA’s Capital Improvement Program or proposed in our annual Operating Budget
Putting a Price on Carbon

Sample of Costs Assigned to Carbon

- Exxon Internal Value (2040)
- Stanford University's Researchers (2015)
- California Air Resources Board (2016)
- Duke University (2015)
- Regional Greenhouse Gas Initiative (2016)

Market-based Price
Social Cost of Carbon
Internal Risk-Based Value
# Clean Energy Project Economic Evaluation

## LED Lighting Retrofit

<table>
<thead>
<tr>
<th>Expenses</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>$63,500</td>
</tr>
<tr>
<td>Installation</td>
<td>$31,750</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>$0</td>
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</tbody>
</table>

### Revenues and Savings

<table>
<thead>
<tr>
<th>Energy</th>
<th>157,057 kWh</th>
<th>117,793 kWh</th>
<th>196,321 kWh</th>
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<tbody>
<tr>
<td>Cost of Energy</td>
<td>$0.064 per kWh</td>
<td>$0.064 per kWh</td>
<td>$0.064 per kWh</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Reduced costs of changing bulbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life of Asset</td>
<td>13 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incentive</td>
<td>$ -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discount Rate</td>
<td>2.11%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Discounted Cash Flow (DCF)

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenses</td>
<td>$(95,250)</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$(95,250)</td>
</tr>
<tr>
<td>Avoided Costs</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
</tr>
<tr>
<td>Total Annual Costs</td>
<td>$(85,277)</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$8,423</td>
</tr>
<tr>
<td>Net Present Value of To</td>
<td>$(85,277)</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$9,973</td>
<td>$8,423</td>
</tr>
<tr>
<td>Cumulative NPV of Annu</td>
<td>$(85,277)</td>
<td>$96,277</td>
<td>$(37,777)</td>
<td>$(48,277)</td>
<td>$(59,277)</td>
<td>$(70,277)</td>
<td>$(81,277)</td>
<td>$(92,277)</td>
<td>$(103,277)</td>
<td>$(114,277)</td>
<td>$(125,277)</td>
<td>$(136,277)</td>
<td>$(147,277)</td>
</tr>
<tr>
<td>Social Value of Carbon Reduction Benefits</td>
<td>$2,150</td>
<td>$2,100</td>
<td>$2,050</td>
<td>$2,000</td>
<td>$1,950</td>
<td>$1,900</td>
<td>$1,850</td>
<td>$1,800</td>
<td>$1,750</td>
<td>$1,700</td>
<td>$1,650</td>
<td>$1,600</td>
<td>$1,550</td>
</tr>
<tr>
<td>Social Cost of Carbon - Annual Values (at 3% discount rate)</td>
<td>$2,150</td>
<td>$2,100</td>
<td>$2,050</td>
<td>$2,000</td>
<td>$1,950</td>
<td>$1,900</td>
<td>$1,850</td>
<td>$1,800</td>
<td>$1,750</td>
<td>$1,700</td>
<td>$1,650</td>
<td>$1,600</td>
<td>$1,550</td>
</tr>
</tbody>
</table>

Total NPV with SCC: $28,423
We have decreased electricity by 27% since 2010!
Next Steps to Achieving our Goal

- Embedding Energy Into Decision Making
- Renewable Energy Generation
Questions?

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