Cost-Benefit Analysis of Water Efficiency Programs

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Program Manager
Alliance for Water Efficiency
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Components of AWE Tracking Tool
Analysis

**Inputs**
- Demographic data
- Weather data
- Customer utility rates
- Water demand forecast
- Avoided costs
- Efficiency program information
- Greenhouse gas module

**Outputs**
- Water savings
- Costs and benefits
- Impact to revenue and rates
- Greenhouse gas and energy reductions
AWE Tracking Tool Analysis for Six Communities

**Province of Ontario, Canada**
- City of Guelph
- Regional Municipality of Waterloo
- City of Waterloo

**Oakland County, Michigan, United States**
- Commerce Township
- Lyon Township
- Southwest Oakland Township

*All have water systems operated by the Oakland County Water Resources Commissioner's Office*
Service Area Characteristics

City of Waterloo, ON

Southwest Oakland Township, MI

Source: Google Earth. 2014.
Customer Class Demands

Region of Waterloo, ON

- Single-family: 35%
- Multifamily: 27%
- CII: 26%
- Non-revenue Water: 10%
- Other: 2%

Southwest Oakland Township, MI

- Residential: 81%
- Irrigation: 11%
- Non-revenue Water: 5%
- Commercial: 3%
Indoor Water Efficiency Programs Analyzed

- Toilet Replacements
- Toilet Flapper Replacements
- Clothes Washers
- Hot Water Recirculation Systems
- Voluntary New Home Specifications
- Residential Package Graywater Systems
- Pre-rinse Spray Valves
- Restaurant Certification
- Capacity Buyback Program
- Cooling Towers
- Site Visits
- Education
Outdoor Water Efficiency Programs Analyzed

- Landscape Surveys
- Weather Based Irrigation Controllers
- Soil Moisture Sensors
- Efficient Sprinkler Nozzles
- Rainwater Harvesting
### Region of Waterloo, ON Costs and Benefits

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>PV Cost ($)</th>
<th>PV ($) Benefit</th>
<th>NPV ($)</th>
<th>B/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>CII Tank-Type HE Toilet</td>
<td>$ 8,791</td>
<td>$ 124,655</td>
<td>$ 115,864</td>
<td>14.18</td>
</tr>
<tr>
<td>CII Valve-Type HE Toilet</td>
<td>$ 50,168</td>
<td>$ 94,846</td>
<td>$ 44,678</td>
<td>1.89</td>
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<tr>
<td>CII Laundromat</td>
<td>$ 12,900</td>
<td>$ 27,250</td>
<td>$ 14,350</td>
<td>2.11</td>
</tr>
<tr>
<td>CII Pre-Rinse Spray Valve</td>
<td>$ 22,170</td>
<td>$ 334,930</td>
<td>$ 312,761</td>
<td>15.11</td>
</tr>
<tr>
<td>Community Education</td>
<td>$ 1,290,042</td>
<td>$ 370,051</td>
<td>$ (919,991)</td>
<td>0.29</td>
</tr>
<tr>
<td>School Curriculum</td>
<td>$ 143,338</td>
<td>$ 32,530</td>
<td>$ (110,808)</td>
<td>0.23</td>
</tr>
<tr>
<td>Developer Incent: Hot W. Recirc System</td>
<td>$ 57,335</td>
<td>$ 61,771</td>
<td>$ 4,436</td>
<td>1.08</td>
</tr>
<tr>
<td>Developer Incent: RainW Harv. System Plumbed</td>
<td>$ 334,455</td>
<td>$ 38,147</td>
<td>$ (296,309)</td>
<td>0.11</td>
</tr>
<tr>
<td>Targeted User Prog: Education</td>
<td>$ 1,146,704</td>
<td>$ 1,390,991</td>
<td>$ 244,287</td>
<td>1.21</td>
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<tr>
<td>Targeted User Prog: Audit</td>
<td>$ 365,512</td>
<td>$ 495,456</td>
<td>$ 129,944</td>
<td>1.36</td>
</tr>
<tr>
<td>Targeted User Prog: Rebate</td>
<td>$ 401,346</td>
<td>$ 2,644,591</td>
<td>$ 2,243,245</td>
<td>6.59</td>
</tr>
<tr>
<td>CII Cooling Tower</td>
<td>$ 267,564</td>
<td>$ 168,968</td>
<td>$ (98,596)</td>
<td>0.63</td>
</tr>
<tr>
<td>Restaurant Certification Program</td>
<td>$ 121,837</td>
<td>$ 636,457</td>
<td>$ 514,619</td>
<td>5.22</td>
</tr>
<tr>
<td>CII Audit/Recommendations</td>
<td>$ 1,469,215</td>
<td>$ 3,498,394</td>
<td>$ 2,029,179</td>
<td>2.38</td>
</tr>
<tr>
<td>Developer Incent: GreyW. Recyc. System</td>
<td>$ 86,003</td>
<td>$ 4,496</td>
<td>$ (81,507)</td>
<td>0.05</td>
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<tr>
<td>Residential Rainwater Harvesting Rebate Outdoor Only</td>
<td>$ 157,672</td>
<td>$ 19,958</td>
<td>$ (137,714)</td>
<td>0.13</td>
</tr>
<tr>
<td>Toilet Flapper Replacement</td>
<td>$ 86,003</td>
<td>$ 158,866</td>
<td>$ 72,864</td>
<td>1.85</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$ 6,021,057</strong></td>
<td><strong>$ 10,102,358</strong></td>
<td><strong>$ 4,081,302</strong></td>
<td><strong>1.68</strong></td>
</tr>
</tbody>
</table>
## Guelph, ON Costs and Benefits

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>PV Cost ($)</th>
<th>PV ($) Benefit</th>
<th>NPV ($)</th>
<th>B/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal Flush Toilet Rebate, SF</td>
<td>$ 1,676,300</td>
<td>$ 12,068,155</td>
<td>$ 10,391,855</td>
<td>7.20</td>
</tr>
<tr>
<td>Royal Flush Toilet Rebate, MF</td>
<td>$ 525,400</td>
<td>$ 2,534,944</td>
<td>$ 2,009,544</td>
<td>4.82</td>
</tr>
<tr>
<td>Royal Flush Toilet Rebate, ICI</td>
<td>$ 55,800</td>
<td>$ 441,405</td>
<td>$ 385,605</td>
<td>7.91</td>
</tr>
<tr>
<td>Smart Wash Washing Machine Rebate</td>
<td>$ 1,333,250</td>
<td>$ 4,806,374</td>
<td>$ 3,473,124</td>
<td>3.61</td>
</tr>
<tr>
<td>Blue Built Home - Bronze</td>
<td>$ 329,280</td>
<td>$ 545,126</td>
<td>$ 215,846</td>
<td>1.66</td>
</tr>
<tr>
<td>Blue Built Home - Silver</td>
<td>$ 15,900</td>
<td>$ 21,487</td>
<td>$ 5,587</td>
<td>1.35</td>
</tr>
<tr>
<td>Greywater Reuse Systems</td>
<td>$ 21,000</td>
<td>$ 3,157</td>
<td>(17,843)</td>
<td>0.15</td>
</tr>
<tr>
<td>ICI Audit and Capacity Buyback Program</td>
<td>$ 967,395</td>
<td>$ 12,323,719</td>
<td>$ 11,356,324</td>
<td>12.74</td>
</tr>
<tr>
<td>Rainwater Harvesting System</td>
<td>$ 50,000</td>
<td>$ 7,264</td>
<td>(42,736)</td>
<td>0.15</td>
</tr>
<tr>
<td>Healthy Landscape Visit</td>
<td>$ 368,970</td>
<td>$ 36,022</td>
<td>(332,948)</td>
<td>0.10</td>
</tr>
<tr>
<td>Efficient Home Visit Surveys (GEL/NetZero City)</td>
<td>$ 229,505</td>
<td>$ 24,127</td>
<td>(205,378)</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$ 5,572,800</strong></td>
<td><strong>$ 32,811,780</strong></td>
<td><strong>$ 27,238,980</strong></td>
<td><strong>5.89</strong></td>
</tr>
</tbody>
</table>
Energy Reduction Benefit Example

Annual and Cumulative Electricity Savings

Cumulative Savings  Customer-Programs  Customer-Codes  Utility-Programs  Utility-Codes

Annual Savings (MWh/Yr)

Cumulative Savings (MWh)

Reconnecting the Great Lakes Water Cycle
Greenhouse Gas Reduction Benefit Example

Cumulative CO₂ Emission Reductions

Cumulative Reduction (Metric Tons)

Reconnecting the Great Lakes Water Cycle
## Oakland County, Michigan Costs and Benefits

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Commerce</th>
<th>Lyon</th>
<th>SW Oakland</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B/C Ratio</td>
<td>B/C Ratio</td>
<td>B/C Ratio</td>
</tr>
<tr>
<td>Residential High-Efficiency Toilet Rebates</td>
<td>13.57</td>
<td>1.42</td>
<td>2.29</td>
</tr>
<tr>
<td>Residential High-Efficiency Clothes Washer Rebates</td>
<td>2.84</td>
<td>0.45</td>
<td>0.71</td>
</tr>
<tr>
<td>Residential Efficient Irrigation Nozzle Replacements</td>
<td>0.51</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>Residential Irrigation ET Controller Rebates</td>
<td>1.22</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>Residential Soil Moisture Sensor – Targets High Water Users</td>
<td>3.08</td>
<td>0.69</td>
<td>0.83</td>
</tr>
<tr>
<td>Large Landscape Surveys</td>
<td>4.27</td>
<td>0.74</td>
<td>0.77</td>
</tr>
<tr>
<td>Large Landscape Irrigation Controller Rebates</td>
<td>3.94</td>
<td>0.64</td>
<td>0.66</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7.22</strong></td>
<td><strong>0.75</strong></td>
<td><strong>0.97</strong></td>
</tr>
</tbody>
</table>
High Peak Water Use Example

Oakland County, MI 2010 Total Water Consumption by Quarter (MG)

- Lyon Township (PF = 2.42)
- SW Oakland Township (PF = 3.32)
- Commerce Township (PF = 1.91)

1st Quarter
2nd Quarter
3rd Quarter
4th Quarter
Components of Successful Landscape Water Efficiency Programs

- Target high irrigation users
- Educate contractors and customers
- Follow-up to assess water savings
- Follow-up to ensure equipment is programmed and functioning properly
- For turf that is not replaced with native plants or other options, maintain turf quality
- Piloting small scale programs may be a good option to deal with uncertainty associated with planning outdoor efficiency programs
Beyond Water Efficiency Incentive Programs

• Rates
  o Inclining Block
  o Seasonal

• Requirements for New Construction
  o Efficient fixtures
  o Irrigation controllers
  o Other landscape requirements

• Watering Restrictions

• Education and Outreach

• Water Loss Control

• Professional Training and Development
  o Qualified Water Efficient Landscaper Training (QWEL)
  o Irrigation Association Certification
Lessons Learned

• Each service area is unique. What works in one community may not work elsewhere, and vice versa.

• Water providers with a long history of water conservation programs are still able to find cost-effective opportunities for savings.

• High peak water use can be an issue (and an opportunity for savings), even in the Great Lakes Region.

• Graywater and rainwater harvesting programs were not predicted to be cost-effective in Ontario.

• Communities with a predominance of new housing (i.e., built after 1994 in the U.S.) have less opportunity for residential indoor water efficiency programs.
Lessons Learned (continued)

• Low avoided costs make planning cost-effective water efficiency programs challenging. Those costs may change over time.
• Strategies such as ordinances, educational programs, professional training, or water rate design can also be employed to reduce demand.
• Water conservation programs will become increasingly cost-effective if a community can reduce demands to avoid expensive infrastructure expansion.
• Water conservation programs will become increasingly cost-effective in Lyon Township and Southwest Oakland Township if those communities are faced with purchasing water from Detroit Water and Sewerage Department (DWSD).
• Water conservation programs provide meaningful energy savings and greenhouse gas emission reductions.