Cost-Benefit Analysis of Water Efficiency Programs

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Alliance for Water Efficiency
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%
- Other: 26%
- Non-revenue Water: 2%
- CII: 10%
- Irrigation: 0%

Southwest Oakland Township, MI
- Residential: 81%
- Commercial: 5%
- Other: 11%
- Irrigation: 0%

Reconnecting the Great Lakes Water Cycle
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>
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</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>
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<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>
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<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>
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<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

Cumulative Savings (MWh)

Annual Savings (MWh/Yr)

- 2011
- 2013
- 2015
- 2017
- 2019
- 2021
- 2023
- 2025
- 2027
- 2029
- 2031
- 2033
- 2035

Reconnecting the Great Lakes Water Cycle
Greenhouse Gas Reduction Benefit Example

Cumulative CO₂ Emission Reductions
## 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)
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.