This presentation premiered at WaterSmart Innovations

watersmartinnovations.com
Market Study, Nucleation Assisted Crystallization: A tale of 17 households

Waterloo Region, City of Guelph

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Outline

- Why study residential water softeners?
- Study Method
- Study Results
- Next Steps, Municipal Policy
- Questions/Discussion
Pop. 670,000
Hard groundwater

- Up to 56 gpg hardness: "Very Hard," USGS
- Cambridge, Guelph, Kitchener, Waterloo
- 80% or 186,000 households use softeners
- Cation Exchange:
  - 500 million gallons backwash
  - 27,555 U.S. tons salt
Why do people soften?

- Prevent $\text{CaCO}_3$ buildup on HW heater, plumbing fixtures and appliances
- Slippery feel
- Less soap
- Better taste?
Environmental Impacts

- Accounts for 50% sodium chlorides at WWTP discharge and 25% downstream
- Threat to wildlife – NaCl approaching chronic levels
- TDS in wastewater limits reuse
- Backwash = 7% of household water
- 1 lb salt in softener = 4 lbs CO\textsubscript{2}e
Research Partnership: Waterloo Region & Guelph

- Test softeners performance 2009 - 2012
- Educate: www.watersoftenerfacts.ca
- Encourage better performance standards, NSF/ANSI, WaterSense
- Seek viable alternatives

Waterloo test location, 36 gpg
Nucleation Assisted Crystallization (NAC/TAC): No salt or backwash water required.
Pelican Natursoft NS3

Max rated flow 10 gpm,
half a gallon of media

Pelican media

FilterSorb SP3 by WATCH

Watts OneFlow

Media "TAC" by Next
2015 Bench testing in Waterloo

- Potential to reduce scale
- Media could last 4.5 years (3-person HH)
- Next step, field test in real households
Reported NAC Benefits

• no longer having to buy salt, bring it home or having it delivered, and/or remembering to load it into their ion-exchange softener.
• saving money (less water, less electricity, no maintenance on the machine).
• reducing environmental impact.
• ability to drink the water from all taps in the home without concern for salt content.
• reduced or cleaned out calcium build up in the pipes of the home.
Reported NAC Drawbacks

• dishwasher not cleaning properly or leaving a film/residue/staining on the dishes and cutlery.
• no indication that the system is working.
• no indication that the media needs to be replaced.
• it is not mainstream technology, so it could be a complication to those selling their homes.
13 of 18 homes chose to keep the unit

• don’t see many barriers, or find them minor enough that they have adapted to them over the course of the test.
• feel a sense of pride about helping the environment.
• appreciate the convenience associated with no salt, no maintenance.
• in some cases could become, or have become, ambassadors for the technology.
Why remove the unit?

• poor perceived performance from the NAC unit in treating water.
• difference of opinions between individual members of the household (trade-off between benefit and experience).
• not willing to take on any extra steps to remove leftover residue the water conditioner left behind, regardless of how easy or difficult it was to wipe up/off.
• perceive that one household would not impact the environment in any significant way.
"How likely are you to recommend NAC technology to a friend or neighbor?"

- The NPS for the new water conditioner technology for the seventeen residents who participated in the entire test is -18 (29% Promoters vs. 47% Detractors).
Conclusions to inform policy

- A rebate on NAC not recommended
- Enhance watersoftenerfacts.ca
Proposed approach

1. Don't soften water at all
2. Use a salt/water-free alternative
3. SOFTEN HOT WATER ONLY!
## Salt/Water: Cambridge, Kitchener, Waterloo

<table>
<thead>
<tr>
<th>Det/semi/townhouses with softeners</th>
<th>94,067</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population using softeners</td>
<td>292,221</td>
</tr>
<tr>
<td>Annual tons of salt used</td>
<td>18,000</td>
</tr>
<tr>
<td>Acre-feet/year of backwash water used</td>
<td>1,008</td>
</tr>
<tr>
<td>Tons/year CO$_2$e from water/salt consumed</td>
<td>8,227</td>
</tr>
<tr>
<td>Per capita/year/gal backwash water used</td>
<td>1,124</td>
</tr>
<tr>
<td>Per capita Lbs/year salt used for softening</td>
<td>123</td>
</tr>
</tbody>
</table>
Soften Hot Water Only

Assume Hot Water = 35% of total use

<table>
<thead>
<tr>
<th>Annual water bill saving, 3 people</th>
<th>$38.54</th>
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<tbody>
<tr>
<td>Annual Salt Bill Saving, 3 people</td>
<td>$45.36</td>
</tr>
<tr>
<td>Gallons/cap/year water saved</td>
<td>766 (5% reduction)</td>
</tr>
<tr>
<td>Pounds/cap/year</td>
<td>80</td>
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</tbody>
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*98.5 % of homes with softeners do whole house

With $50 rebate to change plumbing, payback is under 2 years
# Pilot Rebate Program: GHG, Water & Salt Savings, Cumulative

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
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<tbody>
<tr>
<td><strong>Cum gal water Saving/yr</strong></td>
<td>1,100</td>
<td>4,200</td>
<td>9,500</td>
<td>16,900</td>
</tr>
<tr>
<td><strong>Salt saved tons/yr</strong></td>
<td>20</td>
<td>60</td>
<td>99</td>
<td>139</td>
</tr>
<tr>
<td><strong>Tons GHG saved/yr</strong></td>
<td>84</td>
<td>305</td>
<td>417</td>
<td>583</td>
</tr>
</tbody>
</table>

1,000 people or 350 households per full year (from 2021); Launch June 2020

* Using 2017 GHG EF
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