The Effect of Electricity-Use Feedback on Residential Consumption Behaviour and Attitudes

Jennifer Robinson (j23robin@uwaterloo.ca)
Dr. Ian H. Rowlands (irowland@uwaterloo.ca)
University of Waterloo, Waterloo, ON Canada

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Context

- The province is calling for Ontarians to adopt a "conservation culture"
- To aid in this, all households will be equipped with "smart meters" by 2010
- Milton, Ontario has already deployed a significant number of smart meters in the residential sector, and is one of the first jurisdictions to have implemented time-of-use (TOU) pricing

Research Objective

- Determine whether smart meter-derived feedback can affect the electricity consumption behaviour of households and promote the development of pro-conservation attitudes

Methodology

1. Surveyed Milton residents with smart meters
2. Chose 106 respondents to provide household-specific feedback sheets via mail and email on a weekly basis from July to October 2006
3. Follow-up survey assessed changes in attitudes and self-reported behaviour for both feedback recipients and control groups
- Analysis consisted of weather-adjusted consumption deltas between 2005 and 2006, and deltas between pre- and post-feedback survey responses for each household

Results

I – Changes in Consumption Behaviour

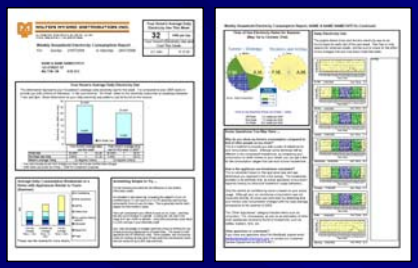
Overall feedback effectiveness

- Only 9 (out of 72) instances in which the treatment groups' conservation or shifting was found to be significantly different than the control groups
- For these few instances:
  - Feedback appeared to be effective in encouraging shifting in the month of October; in some cases, this October shifting effect appeared for low consumer groups
  - Feedback appeared to encourage overall consumption for September; in some cases and for other months this effect appeared for high consumer groups

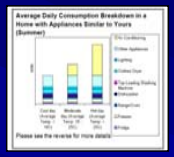
Relative effectiveness of different feedback types

- Only 2 instances (out of 16) indicating some types of feedback more effective than others

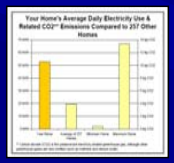
Feedback Examples



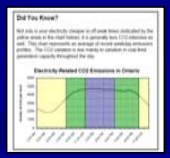
Historic versus Comparative Standards



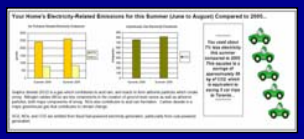
Household-specific appliance consumption charts



Household-specific electricity-related CO2 emissions information



Daily Ontario electricity-related CO2 emissions



Summer Emissions Information

Results, continued

II – Changes in Attitudes

- Differences in pre- and post-feedback survey responses were calculated for 5 different attitudinal questions
- Comparing these differences for the feedback and control groups, no significant changes in attitude were found

III – Customer Opinions

- 89% of respondents found the feedback useful
- 64% said they took action because of the feedback
- 43% said they were surprised that their homes' consumption levels were as high as they were
- Most useful:
  - Quick reference box
  - Main consumption bar chart
- Least useful:
  - Household-specific appliance consumption chart
  - Weekly conservation tips
- Usefulness of environmental metrics was low, but overall, 67% indicated that they made them more aware of climate change and/or air quality issues relating to electricity consumption
- 80% indicated they would be interested in having an in-home display that would indicate real-time consumption

Conclusion and Recommendations

- The feedback was not overwhelmingly found to be beneficial in encouraging conservation attitudes or behaviour:
  - TOU pricing in effect, overshadowed feedback?
  - Households were already efficient/conservative?
  - Could take more time for habits to form?
- Results do support some cautious recommendations:
  - Low consumers good to target specifically for TOU pricing/shifting
  - To target high consumers, do not focus on price as a metric
  - Email may be effective for feedback, some are ready; need choice for those not connected
  - Comparative can be interesting if done in a way that customers trust

References

Darby, S. (2000) *Making it obvious: designing feedback into energy consumption.* Proceedings, 2nd International Conference on Energy Efficiency in Household Appliances and Lighting. Italian Association of Energy Economists/ EC-SAVE programme.

Seligman, C., Becker, L. S., & Darley, J. M. (1981). Encouraging residential energy conservation through feedback. *Advances in Environmental Psychology in Energy Psychological Perspectives Issue, 3*, 93-113.