Advancing Energy Efficiency in Calgary

Prioritizing Energy Efficiency Program Options

February 2014

ALBERTA
Energy Efficiency Alliance

THE CITY OF CALGARY

Who we are

The **Alberta Energy Efficiency Alliance** is a multi-sector organization that collects and provides input on energy efficiency issues to the provincial government. Our members include energy utilities, municipalities, oil and gas companies, consulting firms, product and service providers and non-profits. All of these organizations recognize the important role energy efficiency has in responsible energy production and consumption.

You can find out more about us at **www.aeea.ca**.

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Background

Calgary is in the early stages of a market transformation to an energy efficient economy. A previous report has provided an examination of the state of energy consumption and efficiency in the city of Calgary, as well as the implications of efficiency gains for greenhouse gas (GHG) emission reductions. Residential, commercial and industrial sectors exhibit a strong potential for improving energy conservation, with a need for a market-based approach to transform the nature of the energy consumption. In these early stages of this market transformation (where Calgary and much of the rest of Canada is presently situated), government encouragement through incentives and regulations will be key in setting the pace of energy efficient technology/behaviour adoption. It follows that Calgary's municipal decision makers need to assist in the creation of conditions to allow homeowners and businesses to identify energy (and cost) savings by introducing programs and policy measures that can bring about a broad improvement in energy literacy. Please see Figure 1 for the steps of a typical market transformation.

Based on the opportunities identified for notable city-wide improvements in energy efficiency and conservation, The City of Calgary has undertaken an assessment to prioritize six options identified in the previous report (*Advancing Energy Efficiency in Calgary*). The options assessed here are opportunities that have been identified in past research undertaken by the Alberta Energy Efficiency Alliance, are within the authority of The City, and have been demonstrated in other jurisdictions to effectively provide notable jurisdiction-wide energy savings. The six options identified all have good potential to reduce GHG emissions in Calgary; however the prioritization undertaken in this document is designed to identify the opportunities best suited for near-term implementation.

Further details on the technical rationale for these options are summarized in Table 1.

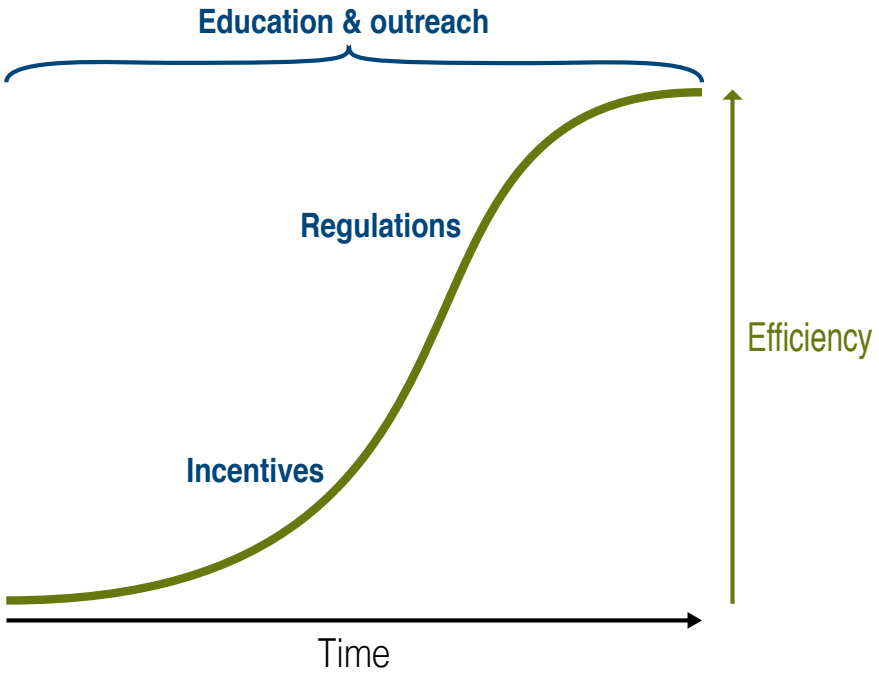

Figure 1: Market transformation steps

Table 1: Energy efficiency program options for The City of Calgary

ENERGY EFFICIENCY OPTION	TECHNICAL RATIONALE FOR SELECTION
Regulations for higher energy efficiency in buildings and industrial facilities	Higher energy efficiency standards for commercial and residential buildings have been shown to reduce energy demand significantly in a number of different countries (10-30% depending on the measures mandated). Regulations targeting industry have the potential to reduce emissions up to approximately 20%.
Incentives for energy efficiency upgrades	Energy efficiency incentives coupled with an education program have been modelled to reduce energy demand in Alberta by 4% and 2% in the residential and commercial sectors, respectively, by 2025. Industrial energy demand could potentially be reduced by 1.4% under a similar approach.
Consumer feedback systems	Energy savings from consumer feedback systems have been documented to cost as little as US$0.03 per kWh saved in other jurisdictions, well below the typical cost of energy use.
Requirement for energy audits of large industrial facilities	Mandatory energy audits have been found to save companies 5–10% of their energy costs. In some jurisdictions they are required for large facilities, typically above 11,000 GJ of energy use. As the energy saving projects themselves are voluntary and audits are typically a small part of the cost of energy saving projects, such mandatory energy audit programs are therefore considered to have had a positive net economic benefit for companies.
Requirement for energy labelling of houses at time of sale	In Denmark, mandatory energy labelling for houses at time of sale has been partially attributed to an increase in energy efficiency actions.
Requirement for southward orientation of new residences	Energy consumption can be reduced by up to 20% through orientation optimization of low-energy solar homes. The opportunity to impact house orientation is available for homes built in new neighbourhoods (i.e., without pre-existing road infrastructure that dictates building orientation).

Methodology

The six options were assessed against seven criteria. The criteria were developed to assess the magnitude of GHG emissions reductions (the top priority), the probability of acceptance from stakeholders, and the likelihood of expedient adoption. When summing all of these criteria together, a high score suggests that the measure will result in significant GHG emission reductions from the wider community, will be relatively acceptable to community stakeholders, and can be implemented and approved relatively quickly. These criteria were assessed through discussion with City staff, industry leaders, and consultants with expertise in energy efficiency and GHG emission reductions. The criteria are:

Magnitude of GHG emissions reductions

- **Potential for GHG reductions** – Will the measure will result in significant GHG emission reductions at the community scale?

Probability of acceptance from stakeholders

- **Costs of implementation for The City** – Can the GHG reduction opportunity be implemented at a relatively low cost to The City?
- **Potential for cost savings** – Will the measure result in a net cost savings in the short-to-medium term for energy consumers in the community?

Likelihood of expedient adoption

- **Timeline of implementation** – Can project implementation occur within the next 1–2 years?
- **Ease of approval** – Will stakeholders mostly approve of the GHG reduction opportunity?
- **City authority** – Is it within The City's authority to enact or promote the GHG reduction measure?
- **Alignment with council priorities** – Does the measure match priorities already approved by City Council?

The metrics for the assessment are described in the scoring rubric below.

All of the projects identified for prioritization have the potential to reduce GHGs in Calgary. Since this criterion is the most important element for strategically addressing energy efficiency in Calgary and in meeting the targets outlined in the Community GHG reduction plan, it is rated on a scale where up to three points are awarded depending on projected GHG emissions reductions, as noted in the rubric.

The other criteria are evaluated against whether they will be likely to meet the objectives, fail to meet objectives, or have a mixture of positive and negative elements.

SCORING RUBRIC	
For GHG reductions	
+++	Potential for very significant city-wide reductions (>10%)
++	Potential for significant city-wide reductions (1-10%)
+	Potential city-wide emissions reductions are modest (<1%)
For all other criteria	
+	Relatively positive
0	Both pros and cons
-	Relatively challenging

The following tables evaluate the six possible programs for implementation using the described criteria and scoring system.

Evaluation of the alternatives

REGULATIONS FOR HIGHER ENERGY EFFICIENCY IN BUILDINGS AND INDUSTRIAL FACILITIES		
Criterion	Rating	Comments
Potential for GHG reductions	+++	Potential for significant impact. Economic energy efficiency improvements in industrial facilities estimated to be 10–40%;[1] residential buildings 10–80% and commercial buildings 10–60%.[2] Regulations have the potential to reduce emissions from all industrial facilities and buildings within Calgary.
Costs of implementation to The City	+	Limited cost to the municipality compared with incentive programs. Costs include the cost of engagement, monitoring and enforcement.
Potential for cost savings	+	Net cost savings for consumers as energy efficiency regulations are typically designed to provide a positive net present value. Consumer group(s) impacted depends on the regulation. Regulations can be used to target residential or commercial buildings, or industrial facilities.
Timeline of implementation	0	Would take several years to build buy-in for the need for regulations.
Ease of approval)	-	There are few instances of municipalities in Alberta regulating the energy efficiency of buildings or equipment. Some examples include a mandatory checklist for new developments in Canmore, a requirement for LEED certification for new buildings in downtown Fort McMurray, and design for passive solar heating in a new industrial park built by the Town of Hinton. There is generally resistance from the development and building industry to new regulations.
City authority	0	The City has the ability to set bylaws that are in the interests of its citizens, and regularly places restrictions on land uses and new developments. The City is not able to regulate in areas already regulated provincially or federally. This means The City could likely regulate in a number of areas pertaining to energy efficiency that are not already regulated, but is unlikely to be able to regulate the efficiency of new buildings once the Province adopts the new energy code for buildings (expected by the end of 2013).
Alignment with council priorities	+	Aligned with the council-approved Community Greenhouse Gas Reduction Plan.
TOTAL SCORE	+5	Significant opportunity for impact, but will require time to build buy-in for The City's ability to act in this area.

INCENTIVES FOR ENERGY EFFICIENCY UPGRADES		
Criterion	Rating	Comments
Potential for GHG reductions	++	Estimated to reduce energy use in the residential and commercial sectors by up to 5%.[3] Similar reduction opportunity expected for the industrial sector. Can be used as a way to build capacity/support for new regulations.
Costs of implementation to The City	-	Effective incentive programs cost millions of dollars each year to run.
Potential for cost savings	+	Energy efficiency incentive programs are typically designed to provide a positive payback within a reasonable period of time.
Timeline of implementation	+	Engagement of decision makers can begin immediately and needs to continue until the 2015-19 budget is set.
Ease of approval	0	Generally popular for energy consumers, as demonstrated with EcoENERGY retrofit program.
City authority	+	Common area of activity for municipalities.
Alignment with council priorities	+	Aligned with the council-approved Community Greenhouse Gas Reduction Plan.
TOTAL SCORE	+5	An important and achievable step in the market transformation process.

CONSUMER FEEDBACK SYSTEMS		
Criterion	Rating	Comments
Potential for GHG reductions	++	Documented to reduce energy use by approximately 2% in large scale residential programs.[4, 5]
Costs of implementation to The City	+	Program costs do not need to be borne 100% by the City. Program costs can be shared among partners, or, in some jurisdictions, full program costs are flowed through to energy consumers. Feedback programs are one of the lowest cost options to reduce energy use and GHGs.
Potential for cost savings	+	Cost of paper feedback system estimated to be between $0.03 and $0.06 per kWh saved.[6] This is significantly less than the current and projected cost of electricity.
Timeline of implementation	+	Reasonably simple and self-contained program for the residential sector that could be implemented relatively quickly.
Ease of approval	0	Has been well-accepted and successfully implemented in many jurisdictions for the residential sector. Alberta does not currently have any recent history of adopting similar initiatives, making stakeholder acceptance uncertain.
City authority	+	The City has the authority to pursue the full range of implementation options, including partnerships, incentives or bylaws.
Alignment with council priorities	+	Aligned with the council-approved Community Greenhouse Gas Reduction Plan.
TOTAL SCORE	+7	Potential for noticeable city-wide impact through a process that could be taken for approval within the next eight months.

REQUIREMENT FOR ENERGY AUDITS OF LARGE INDUSTRIAL FACILITIES		
Criterion	Rating	Comments
Potential for GHG reductions	++	Mandatory energy audits have been found to stimulate the adoption of energy efficiency measures that saved companies 5–10% of their energy costs.[7] Typically only required for larger facilities (e.g., above 11,000 GJ of energy use).
Costs of implementation to The City	+	Limited cost to the municipality compared with incentive programs. Costs include the cost of engagement, monitoring and enforcement.
Potential for cost savings	+	As the energy saving projects undertaken following audits are voluntary measures and audits are typically a small part of the cost of energy saving projects, the mandatory energy audit programs are therefore considered to have had a positive net economic benefit for companies in jurisdictions where they are now required.
Timeline of implementation	0	Would take several years to build buy-in for the need for regulations.
Ease of approval	0	Likely stakeholder push back until awareness is raised regarding the benefits of energy audits. However, this may be one of the easier requirements to institute given its relatively low cost for large energy users.
City authority	+	The City has the ability to set bylaws that are in the interests of its citizens and regularly places restrictions on land uses and new developments except those already regulated provincially or federally. Energy audits for industrial facilities are not currently regulated by any level of government.
Alignment with council priorities	+	Aligned with the council-approved Community Greenhouse Gas Reduction Plan.
TOTAL SCORE	+6	Significant opportunity for impact, but will require time to build buy-in for The City's ability to act in this area.

REQUIREMENT FOR ENERGY LABELLING OF HOUSES AT TIME OF SALE		
Criterion	Rating	Comments
Potential for GHG reductions	+	Mandatory energy labelling for houses at time of sale in Denmark has been partially attributed to an increase in energy efficiency actions.[8]
Costs of implementation to The City	+	Cost burden predominantly borne by home seller, which is relatively small, when compared to other transaction costs and cost savings achieved through energy retrofits. Costs to The City include the cost of engaging citizens and monitoring and enforcing the requirement.
Potential for cost savings	+	Net cost savings from energy retrofits usually greatly exceeds the cost of the energy audit.
Timeline of implementation	0	Requires time to build awareness and buy-in.
Ease of approval	-	Likely pushback from real estate sector, due to concern over marketability of low-rated homes. Potential to overcome this concern if it were easy to upgrade homes prior to sale and pass the cost of upgrades onto the buyer.
City authority	+	The City has the ability to set bylaws that are in the interests of its citizens and regularly places restrictions on land uses and new developments except those already regulated provincially or federally. Energy labelling of houses at time of sale is not currently regulated by any level of government.
Alignment with council priorities	+	Aligned with the council-approved Community Greenhouse Gas Reduction Plan.
TOTAL SCORE	+4	Similar to other opportunities that require buy-in prior to regulating, although there is not as much experience with the potential impact of this measure as some of the other regulations.

REQUIREMENTS FOR SOUTHWARD ORIENTATION OF NEW BUILDINGS		
Criterion	Rating	Comments
Potential for GHG reductions	+	Passive design can reduce household heating/cooling energy demand by up to 20%,[9] and annual housing starts have ranged between 4,000-10,000 units over the past decade.[10] Accordingly, this could result in a slight reduction in BAU GHG emissions growth.
Costs of implementation to The City	+	Additional administration required to include passive solar design requirements within existing review and approval processes. Total cost relatively low compared with incentive programs.
Potential for cost savings	+	All purchasers of newly constructed homes would benefit from the utilization of solar gains during winter months, reducing heating bills.
Timeline of implementation	0	Requires time to develop industry support and implementation mechanisms.
Ease of approval	-	While the Municipal Development Plan includes promoting the use of passive solar heating, requirements for new developments are generally not supported by the development and building industry.
City authority	+	The City currently approves the design of new roads and buildings within the city.
Alignment with council priorities	+	Aligned with the council-approved Community Greenhouse Gas Reduction Plan; included within The City's MDP.
TOTAL SCORE	+4	Potential for impact on new construction, but not existing. Requires additional research to determine how easy or challenging this would be.

Table 2: Summary of energy efficiency program options

	STRATEGY					
Criterion	Regs for Higher EE	Incentives for EE Upgrades	Consumer Feedback	Audit Req't for Large Facilities	Energy Labelling	Southward Orientation
GHG reduction potential	+++	++	++	++	+	+
Cost to City	+	-	+	+	+	+
Cost savings potential	+	+	+	+	+	+
Timeline of implementation	0	+	+	0	0	0
Ease of approval	-	0	0	0	-	-
City authority	0	+	+	+	+	+
Alignment with council priorities	+	+	+	+	+	+
TOTAL SCORE	**5**	**5**	**7**	**6**	**4**	**4**

Summary

Based on the prioritization evaluation above, the consumer feedback system presents the greatest opportunity for significant reductions in greenhouse gas emissions within the shortest amount of time (see Table 2). Consumer feedback systems provide the end user with clear information on how they use energy and how they can reduce their energy consumption (and associated GHG emissions). This improves the energy literacy of the general public; absence of information is prominent barrier to market transformation towards energy efficiency (see Figure 2).

The second highest ranked opportunity is to provide incentives for energy efficiency upgrades. This is an opportunity that should be considered as part of The City's effort to reduce GHG emissions related to energy consumption. Incentives follow the removal of barriers in the market transformation curve, which make them a logical next step once an energy feedback system is in place. It is recommended this initiative remain a top priority for The City given its favorable ranking within this analysis and its ability to support the advancement of other opportunities assessed.

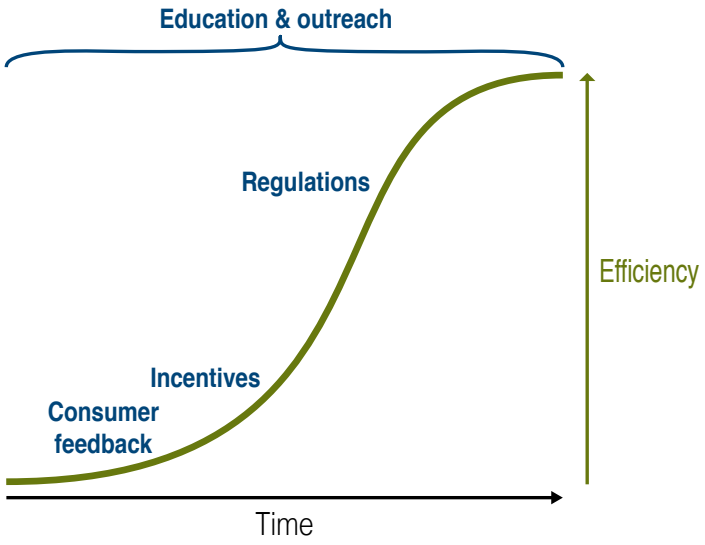

Figure 2: Position of consumer feedback and incentives within the market transformation steps for energy efficiency

Next steps

In order to pursue community energy feedback systems in the City of Calgary, further research needs to be conducted on how feedback systems are structured, how they typically operate and best practices that might be applied for Calgary. After the completion of this research, stakeholders (energy retailers, distributors) will then be consulted to understand how a system could be incorporated at the community level. The goal will then be to formulate a plan with the relevant stakeholders on how to implement such a program.

Notes

1. Hannah Choy Granade et al., *Unlocking Energy Efficiency in the U.S. Economy* (McKinsey&Company, 2009), 58. http://www.mckinsey.com/clientservice/electricpowernaturalgas/downloads/US_energy_efficiency_full_report.pdf
2. World Energy Council, *Energy Efficiency: A Worldwide Review* (2004) www.worldenergy.org/documents/eepi04.pdf
3. Canadian Gas Association, *Demand Side Management Potential in Canada: Energy Efficiency Study*, Appendix C: Achievable Potential Scenarios (2006).
4. Hunt Allcott, "Social Norms and Energy Conservation," *Journal of Public Economics* 95 (2011).
5. Matt Davis, Behavior and Energy Savings: Evidence from a Series of Experimental Interventions (Environmental Defence Fund, 2011). http://www.edf.org/sites/default/files/behavior-and-energy-savings.pdf
6. Opower, "Behavioural Energy Efficiency." http://opower.com/solutions/behavioral-energy-efficiency
7. World Energy Council, *Energy Efficiency Policies around the World: Review and Evaluation* http://www.worldenergy.org/publications/energy_efficiency_policies_around_the_world_review_and_evaluation/3_evaluation_of_energy_efficiency_policies_and_measures/1191.asp
8. Pembina Institute, *Home Energy Labelling Requirement at Point of Sale: Pilot Program Design* (2012). http://www.pembina.org/pub/2400
9. This 20% figure is taken from a model of a rectangular, energy efficient "solar house", which has lower overall energy demands and a greater reliance on passive solar design. The average house would likely observe a lower percentage reduction, but this emphasizes the emerging importance of orientation as homes become more efficient. C. Hachem, A. Athienitis and P. Fazio, "Evaluation of energy supply and demand in solar neighborhood," *Energy and Buildings*, 49 (2012).
10. CMHC, *Housing Market Outlook: Calgary CMA*, Fall 2012. http://publications.gc.ca/collections/collection_2012/schl-cmhc/nh12-59/NH12-59-2012-2-eng.pdf