Improving Energy Efficiency in Alberta's Buildings

Best Practices, Key Actors and the Role of Sustainable Energy Organizations

Prepared for

Alberta Real Estate Foundation

Prepared by

Eugene Mohareb • Jesse Row

The Pembina Institute

January 2014

PEMBINA institute

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The Pembina Institute
219 19 Street NW
Calgary, AB
Canada T2N 2H9
Phone: 403-269-3344

Acknowledgements

Valuable stakeholder feedback was received from: Tarek Baker, Cory Krygier, Dustin Engel, Don Fairgrieve-Park, Roberta Franchuk, James Furlong, Simon Knight, Alvin Law, James Love, Jeremy Miles, David Milia, Shahab Moeini, Justin Pockar, David Silburn, and Benjamin Thibault.

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Abstract

The Government of Alberta has set a goal to become a national leader in energy efficiency, as efficiency is seen as a low-cost energy "resource" that is relatively underdeveloped. The building sector, representing one-third of energy consumption in Canada, presents an opportunity to realise energy efficiency improvements.

A peer-reviewed examination of the state of building energy consumption in Alberta in both the residential and commercial sub-sectors is undertaken, demonstrating a significant potential to conserve energy. A list of best practices is provided for both sub-sectors, as well as recognition of sample jurisdictions that are implementing these; practices described include incentive programs, alternative financing options, and regulatory approaches. These initiatives have limited penetration in Alberta, underscoring a leadership void that needs to be filled in order to improve building energy efficiency. The major actors involved in realising these best practices and lowering building energy demand are illustrated in a power map, with a description of how each of these interconnect. The role of sustainable energy organizations is highlighted due to their primary interest in increasing efficiency in buildings and their engagement across all stakeholder groups; this suggests sustainable energy organizations can play a leading role in advocating and guiding the province towards its goal of a high-performance building sector.

1. Introduction

The Government of Alberta has promised to make energy efficiency a priority, singling it out as low-hanging fruit among the provinces energy resources. Energy efficiency represents a significant opportunity to lower costs for the end user and reduce provincial energy consumption, resulting in lower greenhouse gas emissions. Reduced energy consumption also lowers non-point source air pollutants, which have recently been identified as a significant cancer risk factor by the World Health Organization.[1] With respect to economic impacts, energy efficiency programs have demonstrated value as a job-creating approach to addressing environmental concerns; in B.C., energy efficiency programs are estimated to generate 34.4 direct full-time jobs for every million dollars of economic activity.[2] The "employment intensity" in Ontario is estimated to be similar, at 38.5 direct full-time jobs per million dollars of investment. Additionally, a more energy efficient (and lower carbon) economy in Alberta has the potential to provide social licence for the province and its energy industry stakeholders to develop its abundant fossil energy resources.

Buildings were responsible for nearly one-third of all energy consumption in Canada in 2010, underscoring their importance in energy efficiency efforts.[3] Homeowners who reduce their energy use enjoy lower monthly utility costs, and are perceived as a lower risk of default for mortgages.[4] In the commercial sector, efficient energy consumption can provide a competitive advantage for property owners, either by lowering direct costs to occupants with net leases[5] or reducing the fraction of rents that must be paid for utilities in gross leases. Given these benefits, the impetus exists to encourage energy efficiency in Alberta's buildings. However, as this document will show, existing market forces and government initiatives have had limited success in driving a substantial improvement in building energy efficiency.

The goal of this research is to provide information on the current state of building energy efficiency in the province of Alberta, best practices that encourage adoption of energy conservation practices/technologies, the regulatory/market barriers to improving efficiency, and the actors that can help realize this improvement. This information was collected through research on available literature, the compilation of relevant data sources, and consultation with a variety of industry stakeholders. A discussion of energy consumption in Alberta's buildings is provided first. This describes how Alberta's residential and commercial buildings use energy and

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[1] World Health Organization, *Outdoor air pollution as a leading cause of cancer in humans* (2013). http://www.iarc.fr/en/media-centre/iarcnews/pdf/pr221_E.pdf

[2] G.E. Bridges & Associates Inc. *Power Smart Employment Impacts* (2010). http://www.bchydro.com/content/dam/hydro/medialib/internet/documents/news/press_releases/power_smart_employment_impacts.pdf

[3] Office of Energy Efficiency, *Energy Use Data Handbook, 1990 to 2010* (2013). http://oee.nrcan.gc.ca/publications/statistics/handbook2010/handbook2013.pdf

[4] Institute for Market Transformation, *Home Energy Efficiency and Mortgage Risks* (2013). http://www.imt.org/uploads/resources/files/IMT_UNC_HomeEEMortgageRisksfinal.pdf

[5] *Net leases* pass on utility costs to the tenant, hence the property owner/manager does not have the same incentive to improve efficiency as they would with a *gross lease* where utilities are covered.

how they might become more efficient. This is followed by a review of international best practices for promoting energy efficiency in buildings (both from a technical and regulatory perspective). A power map of the influencers of energy efficiency of Alberta's building stock, as well as detail on the role they play, is also presented to demonstrate how energy efficiency can be advanced in the province. Finally, the next steps toward a more efficient building stock in Alberta are examined, with a focus on the role sustainable energy organizations can assume towards achieving this end.

2. State of energy consumption in Alberta's buildings

2.1 Residential buildings

Electricity and natural gas consumption in Alberta's residential sector are a reality of daily household operation. However, the potential exists to significantly reduce the amount of energy used in Alberta's homes. The average Alberta home consumed ~39,200 ekWh or 141 GJ (287 kWh/m^2 or 1.03 GJ/m^2) in 2009 through energy use related to heating/cooling, appliance use and lighting[6]. This can be contrasted with the Canadian Mortgage and Housing Corporation high-performance demonstration project "Factor 9" in Regina, Saskatchewan, which was able to achieve an annual purchased energy demand of 30 ekWh/m^2 (or 0.1 GJ/m^2). This suggests that technologies and construction methods exist to significantly reduce the energy demand of Alberta's building stock[7], although it is likely cost prohibitive to achieve this level of energy efficiency on a broad scale within the short term.

Examining space heating alone, Figure 1 shows the modeled space heating requirement of homes (an indicator of how efficiently a house can be heated) for various housing types that were constructed in different eras; the heating requirement is represented by the height of the bars. For reference, the heating energy demand required by the passive house standard is presented at 0.054 GJ/m^2 per year, suggesting what is possible for new construction[8]; Alberta's first passive house is currently being constructed in Fort Saskatchewan.[9] The width of the bars in this chart represent how many square meters these types of buildings contribute to the Alberta building stock. As such, the area of each bar represents the total absolute energy this category of home consumes in Alberta.

A few points become clear from Figure 1. First, older buildings (pre-1946), while representing only a relatively small fraction of the total building stock, require roughly twice the heating energy per unit of floor area than newer construction. This is generally attributable to outdated heating equipment and poor-performing building envelopes, which have been addressed to some extent in more recent building codes. These older buildings represent a relatively large opportunity to improve energy conservation, given that the retrofit of a small section of the housing stock can achieve better-than-average energy savings per household. For example, in the recent ecoENERGY retrofit program, single-family detached homes built prior to 1950 achieved

[6] Office of Energy Efficiency, "Comprehensive Energy Use Database" (2012). http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/comprehensive_tables/list.cfm

[7] CHMC, Innovative Buildings – Factor 9 Home: A New Prairie Approach (2007). http://www.cmhc-schl.gc.ca/en/inpr/bude/himu/inbu/upload/65664EnW.pdf

[8] Space heating values are presented in GJ only as the energy used is primarily natural gas.

[9] Cottonwood Passive House (2013). http://cottonwoodpassivehouse.ca/,

a 31% improvement in efficiency compared with 16% for those built after 1950.[10] Secondly, heating demand in single-family attached houses and multi-unit residential buildings are much lower per unit floor area than single-family detached homes, but make up a much smaller share of the total residential space in Alberta. Finally, units constructed in the last half of the 20th century make up the vast majority of actual energy consumption, owing to their prominence in the Alberta building stock. With significant efficiency gains achievable among this very large cohort, residential efficiency measures in Alberta should also consider how to make recently-constructed homes much more efficient.

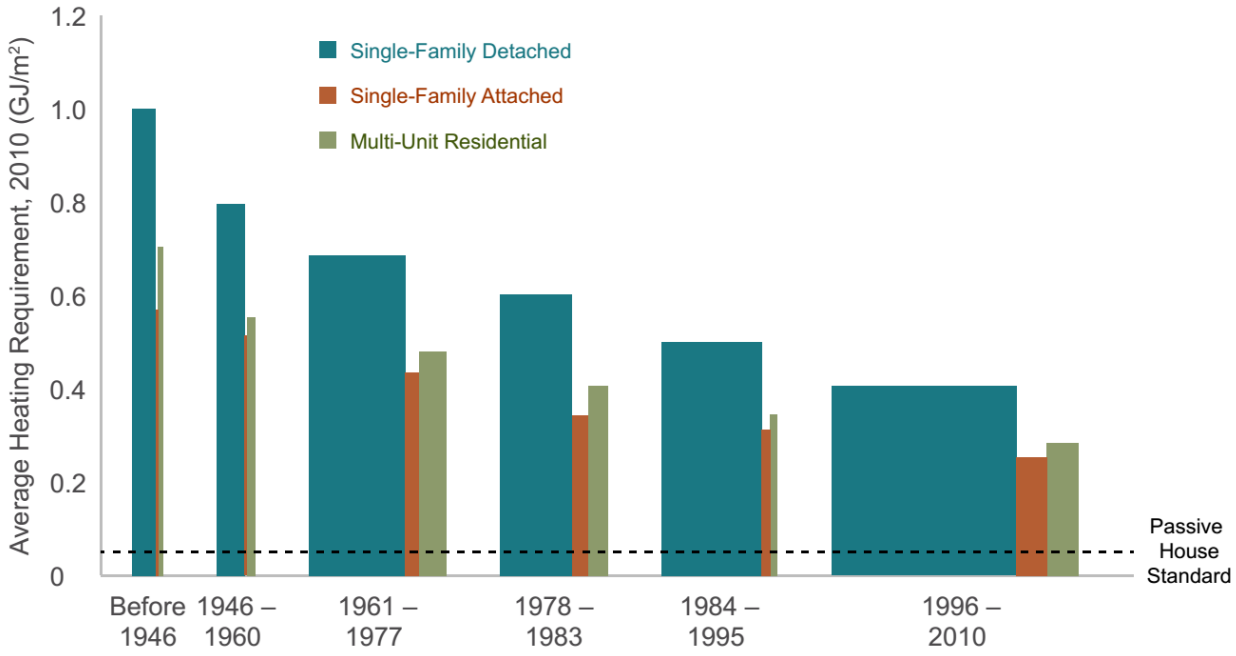

Figure 1: Heating energy intensity for various Alberta's residential building types and eras of construction

Width of columns indicates scale of floor area of given building vintage/type

Data source: OEE[11]

It is also valuable to consider the energy consumption of new buildings being built today. Table 1 below details the insulation requirements in the Alberta building code, compared with a number of other Canadian jurisdictions (as of 2009). No changes to the Alberta building code have been made for energy efficiency for over 30 years[12], so a house built in Fort McMurray today requires less than half of the wall insulation that would be required if it were built in The Pas, Manitoba (a city with similar annual heating requirements). This is expected to change once Alberta adopts the energy efficiency requirements now present in the 2012 National Building

[10] Natural Resources Canada, Pre and Post Retrofit Data for Calgary for Single Family Detached Homes, EcoENERGY Retrofit Data 2006-2013 (2013). Personal Communication, Leslie-Ann Robertson.

[11] "Comprehensive Energy Use Database."

[12] Cryderman, K., "Alberta falling behind in standards for new home energy efficiency: Critics," *Calgary Herald* (2010).

Code (NBC).[13] Alberta is currently in the consultation stage of its implementation of the new NBC, with current expectations being that this will be finalized in the first half of 2014.

It is also important to point out that many jurisdictions outside of Canada are pursuing standards that far exceed the NBC. For example, the European Union directive 2010/31/EU (article 9) requires that all new buildings constructed after December 31, 2020 are to be nearly zero-energy buildings; all new public buildings are required to meet this goal after December 31, 2018.[14]

Table 1: Insulation requirements in the provincial building codes, in R-values*

	Exterior wall assembly (except basements)	Basement perimeter walls	Roof
Alberta			
All regions	12	8	34
British Columbia			
>3500 heating degree days	20	12	30
<4500 heating degree days	22		51
Manitoba			
<=53° Latitude	20	12	40
>53° Latitude	26	24	50
Ontario			
All regions	19	12	40
Nova Scotia			
All regions	25	10	40

*BTU/h ^{o}F ft^{2}

Data source: AEEA[15]

A number of measures can be taken to improve energy conservation in Alberta (Table 2). Many of these are commonplace and have been adopted to some degree in the province. However, there are still many opportunities to conserve energy that are not only cost effective, but simple to do. For example, while over half of Alberta's households have a programmable thermostat, only approximately 45% of all homes actually program their thermostat to save energy and money when they are at work or asleep. Additionally, new energy efficient lighting technologies, such as light emitting diodes (LEDs), present a significant opportunity to conserve energy (lighting represents roughly 7% of energy consumption in residential buildings). LEDs have

[13] "Both the NECB and energy efficiency requirements for houses and small buildings in the NBC are proposed to be adopted as published to support consistent application of these codes across Canada." ttp://www.municipalaffairs.alberta.ca/CP_Energy_Codes_Information.cfm

[14] *Directive 2010/31/EU of the European Parliament and the Council of 19 May 2010 on the energy performance of buildings*. Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010L0031:EN:NOT

[15] AEEA , *Energy Efficiency in the Provincial Building Code – Discussion Paper* (2009). http://www.aeea.ca/pdf/EE%20in%20the%20AB%20Building%20Code%20-%20AEEA%20-%20March%202009.pdf

been shown to be up to three times more efficient than even already efficient compact fluorescent bulbs, and have the additional benefits of being manufactured without mercury.[16,17] Energy audits provide homeowners with detailed energy consumption data and estimates of how much energy could be saved through specific behaviors and home improvements. Only 8% of Alberta households have ever conducted an energy audit of their home, suggesting that many homeowners are not fully aware of the opportunities available to them to reduce their energy consumption and save on their utility bills. Even low-flow showerheads, an easily adopted and inexpensive measure to save energy, have only been installed in half of Alberta's households. In sum, most Alberta residences have a number of low-cost energy efficiency options available to them that could lead to measurable reductions in energy demand.

Table 2: Energy efficiency measures being adopted in Alberta

Efficiency measure	% of households adopting measure
Thermostats	
Lower thermostat temp at night in winter	60%
Have a programmable thermostat	52%
Program the thermostat	*45%*
Program includes lower winter nighttime temperature	*40%*
Lighting	
At least one type of energy-saving light bulb	86%
Compact fluorescent lights	*65%*
Fluorescent tubes	*33%*
Halogen lights	*27%*
LED lights	*19%*
Energy audits	
Have ever conducted energy audits	8%
Modified property in response to energy audit	*5%*
Government grant received as part of energy audit program	*3%*
Audit performed within the last ten years	*7%*
Water usage	
Use low-flow shower heads (2006)	52%

Data source: Statistics Canada[18]

[16] S. Den Baars, "Energy efficient white LEDs for sustainable solid-state lighting," in D. Hafemeister, B. G. Levi, M. D.Levine and P. Schwartz (eds) *Physics of Sustainable Energy: Using Energy Efficiently and Producing it Renewably*, (American Institute of Physics, 2008).

[17] LED lighting is projected to achieve a price that will accelerate its adoption in homes within the next few years. U.S. Department of Energy, *Solid-State Lighting Research and Development – Multi-Year Program Plan* (2013). http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_mypp2013_web.pdf

[18] Statistics Canada, "Households and the Environment" (2011). http://www.statcan.gc.ca/pub/11-526-x/11-526-x2013001-eng.htm; Statistics Canada, "Who Uses Water Saving Fixtures at Home?" http://www.statcan.gc.ca/pub/16-002-x/2008003/article/10686-eng.htm

Residential energy retrofit programs that have run within the past decade have demonstrated substantial efficiency gains, though the results of these programs also suggest that there is much more work to be done. The federal EcoENERGY program participants in the cities of Edmonton and Calgary were able to improve their EnerGuide for Homes scores by 10.1 points, on average, from initial scores of 58.6 and 60.5, respectively (Figure 2). These post-retrofit scores are within the range for an existing home to be considered energy efficient (a score within 66 – 74)[19]. This compares to the average improvement nationally of 9.3, from an initial score of 59.9. It should be noted that participation in these programs was lower than observed in certain other Canadian cities; both cities observed 3% of their single-family housing stocks applying for a retrofit grant, while cities such as Regina, Winnipeg, Kamloops and Ottawa observing participation 14.9, 5.8, 9.3, and 5.3%, respectively[20] (see Figure 3). This low participation rate and the fact that less than 10% of Alberta's residences have conducted energy audits suggests that the significant energy savings that often result from a rigorous whole-building assessment have not been broadly realized.

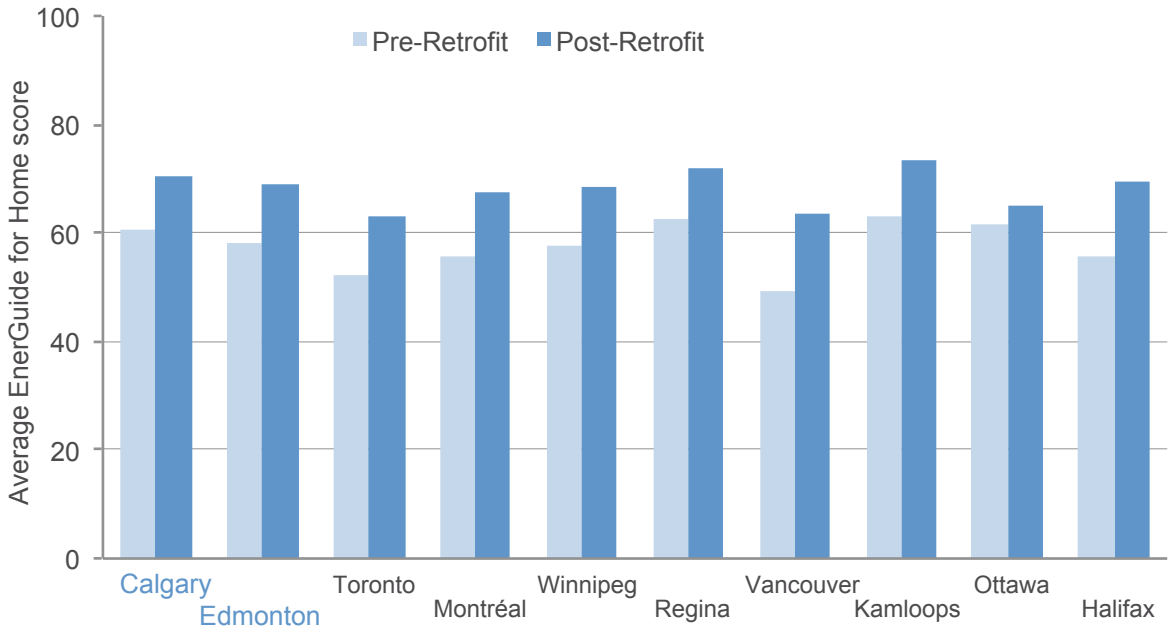

Figure 2: EnerGuide for Homes scores for various Canadian cities, pre- and post-retrofit

[19] EnerVision, an Alberta-based non-profit working in residential energy efficiency, suggests this range http://www.enervision.ca/about_energuide

[20] Natural Resources Canada, *Pre and Post Retrofit Data for Calgary for Single Family Detached Homes,* EcoENERGY Retrofit Data 2006-2013 (2013). Personal Communication, Leslie-Ann Robertson.

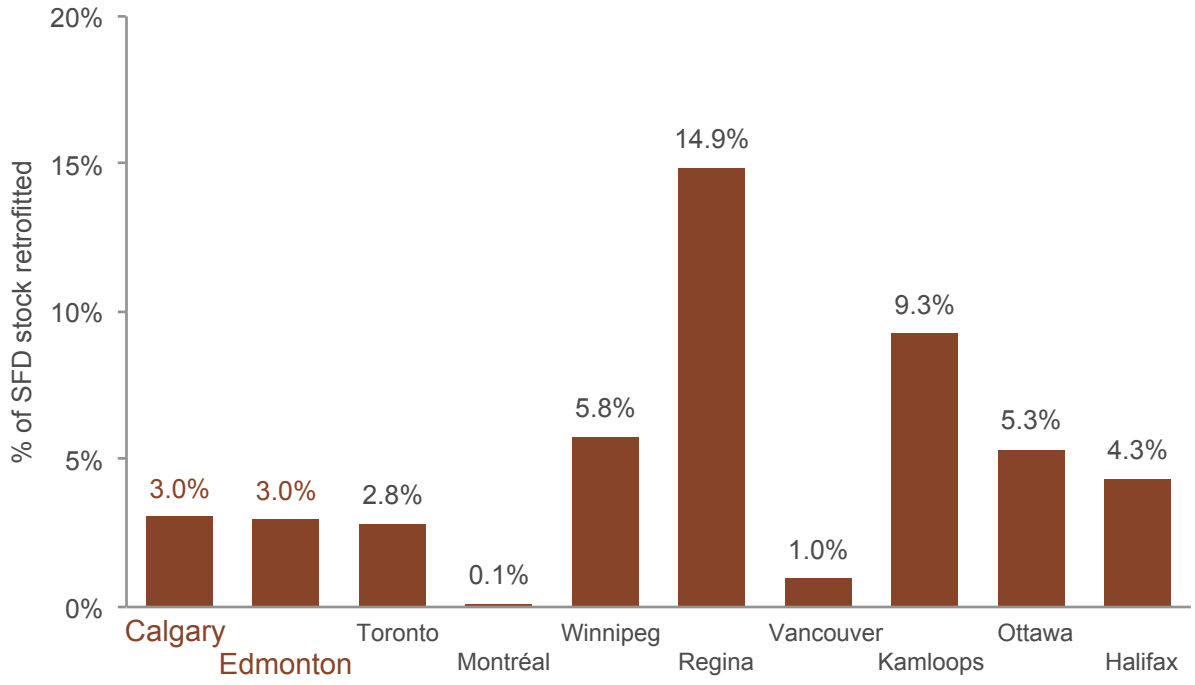

Figure 3: Percentage of housing stock reporting retrofits during federal EcoENERGY program (2006-2013)

Alberta's households have voiced their support for energy efficiency programs; on average, households surveyed would be willing to spend $2 per month to support these.[21] The same survey suggests that 57% of households would support the use of the revenue from the province's Specified Gas Emitters Regulation to fund energy efficiency programs. Given the opportunity for improvements and the public support of action on energy efficiency, the climate exists for adopting better policy and practices in the residential sector.

2.2 Commercial & institutional buildings

Places of work consume a considerable amount of energy in Alberta, with energy demand in commercial and institutional buildings accounting for nearly as much energy as residences. Natural Resources Canada conducts regular surveys of commercial and institutional energy use. This survey details how energy consumption compares between different sectors and how regions compare across Canada. A summary of Prairie data, which includes Alberta, is presented in Figure 4.

Energy intensity (consumption per unit of floor space) is plotted against total floor area. Given that best practices for energy efficiency have not been widely adopted for any of these sectors, opportunities for effective energy conservation can be pursued to reduce each of these energy use intensities.

[21] C3, *Alberta Energy Use Survey* (2011). http://c-3.ca/alberta-energy-use-survey/

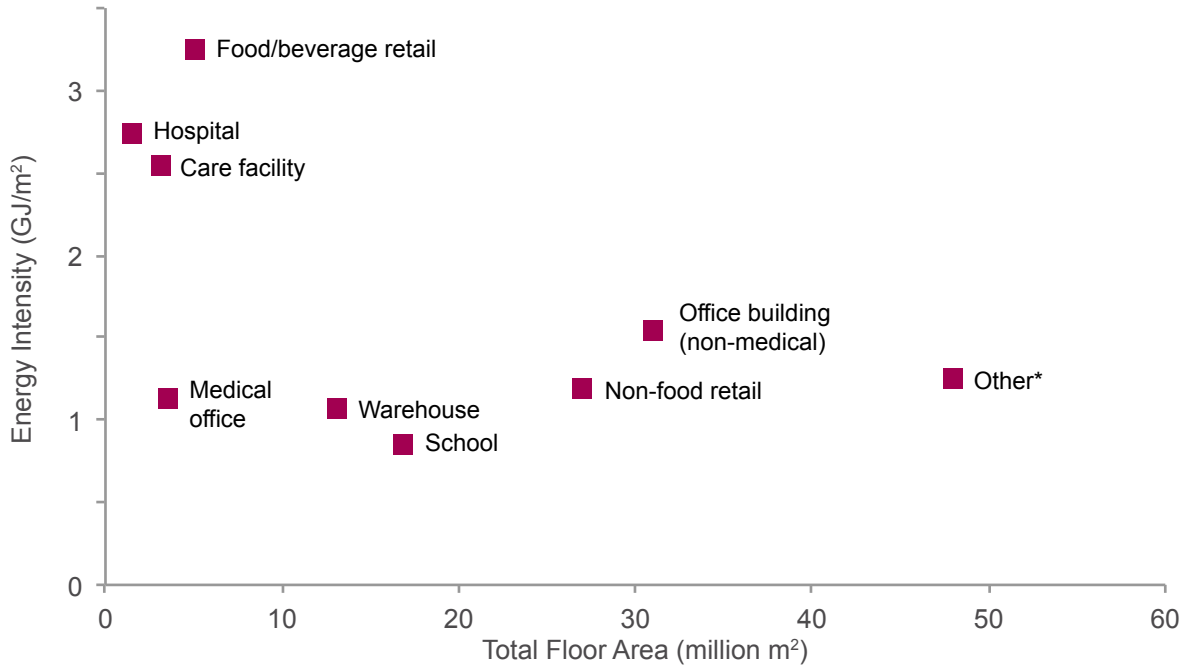

Figure 4: Energy intensity versus total floor space in the Prairie region's commercial/institutional building sector

*Other includes entertainment, leisure and recreation buildings (arenas), shopping centres, colleges and universities

Data source: NRCan[22]

The office building subsector can be used to illustrate this point. The 2010 REALPac Energy Benchmarking report suggests that the average normalized energy use intensity (EUI) from a sample of 40 office buildings in Calgary is roughly 350 ekWh/m^2.[23] Calgary's average is similar to that observed in Vancouver's sample set (355 ekWh/m^2) but higher than offices in Toronto (300 ekWh/m^2). For comparison, the University of Calgary Child Development Centre, which is Leadership in Energy and Environmental Design (LEED) Platinum certified, has an EUI of 140 ekWh/m^2, while the average Canadian office building has an EUI of approximately 380 ekWh/m^2.[24]

[22] Natural Resources Canada, *Survey of Commercial and Institutional Energy Use – Buildings 2009* (2012). http://oee.nrcan.gc.ca/publications/statistics/scieu09/scieu_e.pdf

[23] Real Property Association of Canada, *2010 Energy Benchmarking Report: Performance of the Canadian Office Sector* (2011). http://www.realpac.ca/resource/resmgr/energy_benchmarking/rpbenchmarkingreportsp05c.pdf

[24] Graham Murfitt, Architecture 2030 (2013) http://www.fpinnovations.ca/MediaCentre/Seminars/FpiNrcan/architecture_canada_2030.pdf

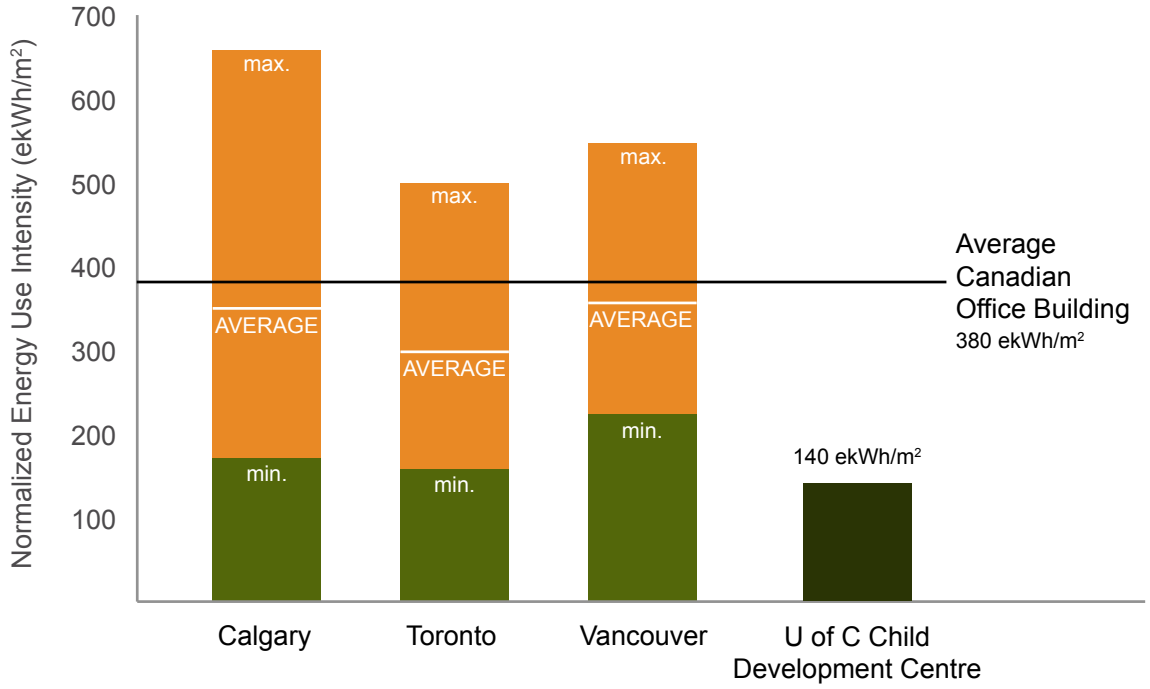

Figure 5. Energy use intensity of a sample of office buildings, 2009

Normalized to account for weather, gross floor area, energy sources, end uses and occupancy

Data source: REALPac[25]; Graham Murfitt[26]

A number of commercial building stakeholders have been providing leadership in improving energy efficiency in their buildings. One stakeholder interviewed for this study suggested that environmental certification of buildings (or at least "shadowing" the criteria of specific certification schemes) was becoming a standard industry practice in the major Alberta centres. Examples of property managers that are taking action to improve energy efficiency in their portfolios include Bentall-Kennedy and Oxford Properties; in 2012, these two companies reduced their total energy demand (per unit of area, relative to 2010) from their buildings by 5% and 12%, respectively.[27]

Green building certification has experienced a strong level of uptake in Alberta compared with other provinces. The Building Owners and Managers Association (BOMA) has been administering a building certification program (BOMA Building Environmental Standards or BOMA BESt) since 2005. In that time, 92 buildings have been certified in Alberta (roughly 20% of the national total). Meanwhile, the CaGBC LEED program has over 600 buildings registered in the province as of December 18, 2013.[28] There is considerable room for increasing the uptake

[25] Real Property Association of Canada, *2010 Energy Benchmarking Report: Performance of the Canadian Office Sector* (2011). http://www.realpac.ca/resource/resmgr/energy_benchmarking/rpbenchmarkingreportsp05c.pdf

[26] Graham Murfitt, Architecture 2030 (2013) http://www.fpinnovations.ca/MediaCentre/Seminars/FpiNrcan/architecture_canada_2030.pdf

[27] Oxford Properties, *2013 Sustainability Report* (2013), http://sustainable.oxfordproperties.com/

Bentall-Kennedy, Simply Better Business (2013), http://cr.bentallkennedy.com/Home

[28] CaGBC, Database (2013). http://www.cagbc.org/leed/projectprofile_EN.aspx

of these certifications as there were an estimated 70,500 commercial and institutional buildings in the province in 2009.[29]

[29] Calculated using 105,519 CI buildings (from Prairie buildings http://oee.nrcan.gc.ca/publications/statistics/scieu09/scieu_e.pdf) and data from the OEE's EUD (103.1 million m^2 of CI floor space, vs 154.3 million m^2 in all the Prairie provinces)

3. Best practices to promote energy efficiency in buildings

Many jurisdictions all over the world have recognized the numerous benefits from greater energy conservation in buildings. Descriptions of a selection of the best practices taken from these innovative locations are provided below. Alberta currently has relatively few of these initiatives underway, so the opportunity exists to adopt additional practices in the province to advance energy efficiency in buildings and make Alberta a national efficiency leader.

3.1 Residential sector

3.1.1 Mandatory building energy labelling

Sample jurisdictions implementing: European Union, Ontario, Calgary (voluntary)

Many homeowners and potential home buyers have a limited appreciation of the energy requirements and related operating costs associated with their purchase. However, energy labelling of all new and resale homes at time of sale would provide both sellers and buyers with valuable information on a particular house's energy demand. Fortunately, Canada already has an established system for rating homes under NRCan's EnerGuide home energy labelling program. While it may be useful to sellers as a means to improve their market price relative to poorer performing homes, the largest contribution likely comes from increased understanding of the option to save energy within their property.[30] Municipalities can start with a subset of all buildings, such as new, single-family residential homes, to phase in the program through the building and occupancy permit requirements before taking on the complexities of applying the requirement to sales of existing homes.

Member states of the European Union are required to have mandatory energy labelling regulations in place for new and resale and rental residential properties (see Figure 6). These requirements have consistently demonstrated that more efficient homes realise higher rental rates and resale values.[31] The City of Calgary currently offers voluntary EnerGuide ratings for homes through its HomeSmarts program.[32]

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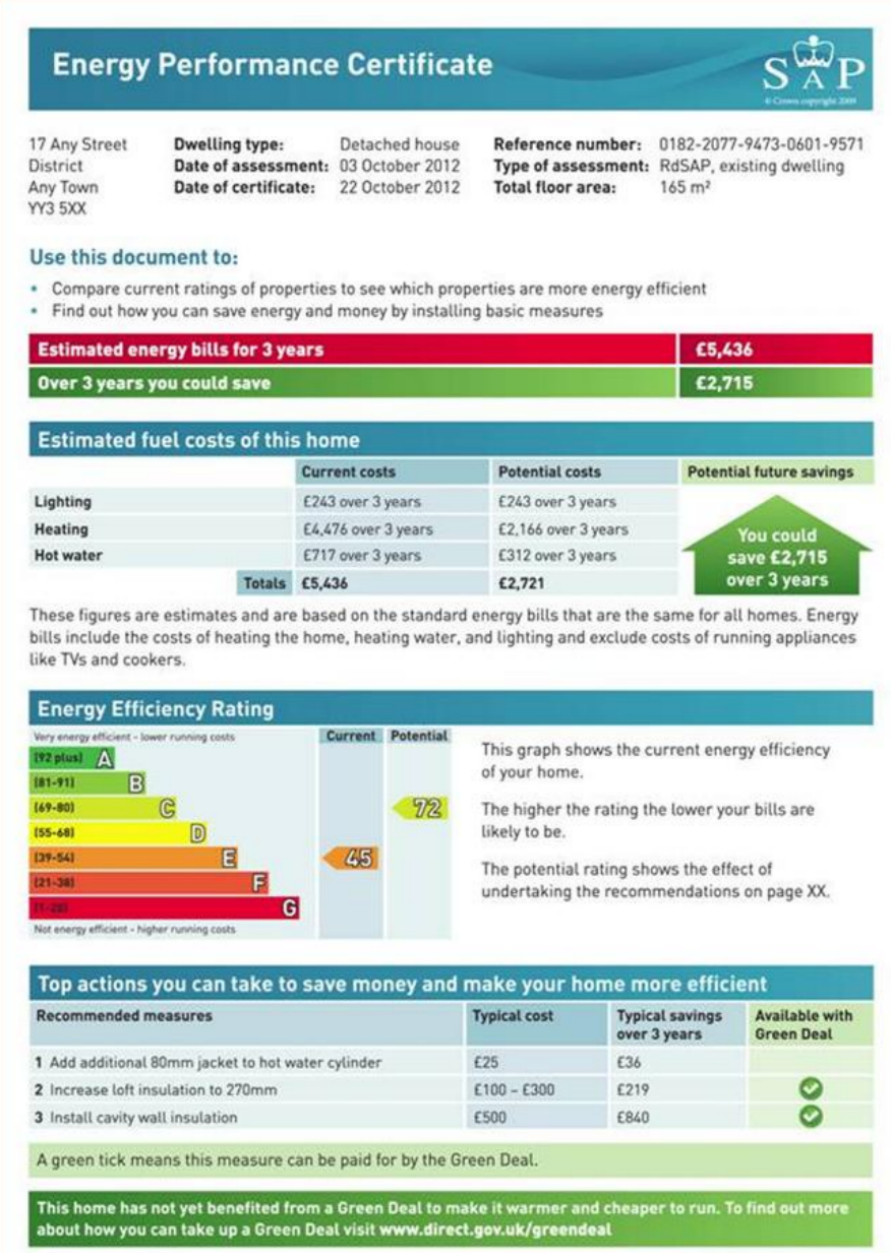
[30] Christensen et al, *Energy renovation practices in Danish homes: The influence of energy labels on home renovation practices* (2011). http://vbn.aau.dk/files/58602742/Christensen_et_al._Energy_renovation_practices_in_Danish_homes_2.pdf

[31] European Commission, *Energy performance certificates in buildings and their impact on transaction prices and rents in selected EU countries* (2013). http://ec.europa.eu/energy/efficiency/buildings/doc/20130619-energy_performance_certificates_in_buildings.pdf

[32] Calgary Real Estate Board, HomeSmarts (2013), http://www.creb.com/homesmarts/



Energy Performance Certificate

SAP

17 Any Street
District
Any Town
YY3 5XX

Dwelling type: Detached house
Date of assessment: 03 October 2012
Date of certificate: 22 October 2012

Reference number: 0182-2077-9473-0601-9571
Type of assessment: RdSAP, existing dwelling
Total floor area: 165 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing basic measures

Estimated energy bills for 3 years	**£5,436**
Over 3 years you could save	**£2,715**

Estimated fuel costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£243 over 3 years	£243 over 3 years	
Heating	£4,476 over 3 years	£2,166 over 3 years	
Hot water	£717 over 3 years	£312 over 3 years	
Totals	£5,436	£2,721	

You could save £2,715 over 3 years

These figures are estimates and are based on the standard energy bills that are the same for all homes. Energy bills include the costs of heating the home, heating water, and lighting and exclude costs of running appliances like TVs and cookers.

Energy Efficiency Rating

Very energy efficient - lower running costs
(92 plus) A
(81-91) B
(69-80) C
(55-68) D
(39-54) E
(21-38) F
(1-20) G
Not energy efficient - higher running costs

Current: 45
Potential: 72

This graph shows the current energy efficiency of your home.

The higher the rating the lower your bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page XX.

Top actions you can take to save money and make your home more efficient

Recommended measures	Typical cost	Typical savings over 3 years	Available with Green Deal
1 Add additional 80mm jacket to hot water cylinder	£25	£36	
2 Increase loft insulation to 270mm	£100 – £300	£219	✓
3 Install cavity wall insulation	£500	£840	✓

A green tick means this measure can be paid for by the Green Deal.

This home has not yet benefited from a Green Deal to make it warmer and cheaper to run. To find out more about how you can take up a Green Deal visit www.direct.gov.uk/greendeal

Figure 6: Sample residential energy performance certificate from England and Wales

Source: European Commission[33]

3.1.2 Energy audit grants

Sample jurisdictions implementing: Medicine Hat; Province of Quebec

Energy audits provide homeowners with customized information on how they can conserve energy. A component of the recent federal ecoENERGY program provided grants for Canadians

[33] *Energy performance certificates in buildings and their impact on transaction prices and rents in selected EU countries*.

to audit their homes so as to identify efficiency measures (from both behavioral changes and retrofits), improvement costs, and payback periods for these improvements. Grants to cover part of the costs of these audits improve the likelihood that homeowners will undertake an audit. Additionally, audits have the potential to educate energy consumers directly, helping them understand which behavioral changes and retrofits will have the greatest impact on energy usage.

Currently, limited-scope energy audits are provided by Medicine Hat municipal utilities through the HatSmart program. Residential audits are being subsidized in Quebec under the RENOclimat program.

A more aggressive approach to energy auditing would be to make audits mandatory (i.e., requiring audit reports be provided as a component of requisite sale documents). This is currently being considered in Ontario.

3.1.3 Property-tied energy efficiency financing

Sample jurisdictions implementing: Ontario (Toronto, Durham Region), British Columbia (Colwood, South Okanagan, Kelowna, Vancouver Island)

The upfront costs of energy efficiency measures can often be a deterrent to their adoption. Additionally, if property owners suspect they may sell their property within the payback period of an energy efficiency investment, they may not wish to implement it (in case they are unable to recoup the costs upon sale). Longer-term financing addresses the former issue, while tying these investments to the property can address the latter. For example, in the case where a furnace is replaced to reduce heating energy consumption, the purchase and installation costs can be financed either through the property tax bill or through monthly utility bills. This approach to energy efficiency financing reduces apprehension from potential losses from selling the property before the savings have fully covered the upfront costs of the investment.

The Ontario government has recently facilitated the municipal adoption of property-tied energy efficiency financing by enabling building-scale local improvement charges. These have been applied in Toronto and Durham Region. Financing through utility bills is being piloted in certain municipalities in British Columbia, with the intent to expand the program throughout the entire province within the next few years.

3.1.4 Informative billing or home energy reports

Sample jurisdictions implementing: Chicago, Illinois; Minneapolis area, Minnesota; Nova Scotia; Ontario

Energy bills typically provide information on consumption with limited context. As well, consumption is often reported in units that many homeowners cannot relate to (such as kilowatt-hours or cubic metres of natural gas). In order to address this communication barrier, informative billing and energy reports provide energy utility customers with more accessible descriptions of their electricity consumption. This more detailed information can be presented with improved context (such as a comparison with similar households in their neighbourhood) or clearer identification of the end uses that consumption can be attributed to. Additionally, informative billing can also provide consumers with behaviour or technology fixes that can help them reduce their energy costs, including low-cost and no cost suggestions to reduce energy demand.

Jurisdictions that are currently pursuing informative billing and home energy reports include Illinois, Minnesota and Nova Scotia. Energy savings averaged around 1.5% for electricity and 1.4% for natural gas across five different jurisdictions studied in the U.S.[34]

3.1.5 Real-time energy feedback

Sample jurisdictions implementing: Woodstock, Ontario; Texas

While informative billing and energy reports provide consumers with detailed data on their energy consumption at predefined intervals (typically monthly or less), real-time feedback provides a continuous opportunity to identify where energy is consumed and how current behaviour will impact energy costs. Through digital displays that can be provided through smart phones or other in-home screen (e.g. computer monitors), consumers can watch changes in their energy consumption in real time. This allows immediate feedback on adjustments in behavior, as well as potentially allowing consumers the opportunity to observe the magnitude of the impact of specific retrofits/upgrades immediately after installation.

Woodstock Hydro (Woodstock, Ontario) currently offers online displays of hourly/daily/monthly usage, as well as information on time-of-use pricing through their "My Hydro Eye" program. This allows consumers to identify both the historic and immediate costs of their energy decisions (see Figure 7). The utility TXU, based in the state of Texas, has distributed in-home displays to its consumers with reported savings of up to 15%.[35] Figure 8 shows the energy monitor display that is provided to TXU customers, including the current hourly cost of electricity consumption, electricity costs for the month to date and the projected monthly cost of electricity consumption.

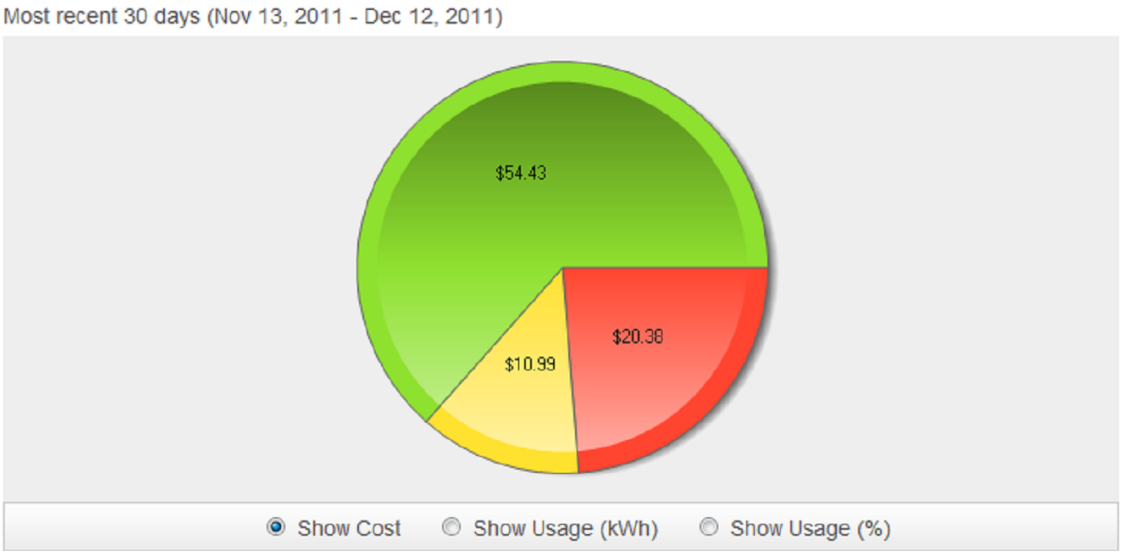


Figure 7: Cost breakdown of time-of-use electricity usage in Woodstock's *My Hydro Eye* program

Source: Woodstock Hydro[36]

[34] Ashby et al, *Green with Envy: Neighbourhood Comparisons and Social Norms in Five Home Energy Report Programs*, ACEEE 2012 Summer Study on Energy Efficiency in Buildings http://www.aceee.org/files/proceedings/2012/data/papers/0193-000218.pdf

[35] TXU Energy, "Brighten[SM] Power Monitor FAQs." http://www.txu.com/residential/promotions/dsm/pm-faqs.aspx

[36] Woodstock Hydro, "My Hydro Eye." http://www.woodstockhydro.com/myhydroeye.html

Figure 8: TXU real-time energy monitoring for electricity monitoring

Source: TXU[37]

3.1.6 Efficiency rebates

Sample jurisdictions implementing: Ontario, Quebec (Hydro Quebec), New Brunswick, Nova Scotia (Efficiency Nova Scotia), Saskatchewan (SaskEnergy), Manitoba (Power Smart), British Columbia (BC Hydro)

Rebates have long been a popular approach for reducing energy consumption in Canadian buildings. From the Canadian Home Insulation Program (which ran from 1977–1986) to the ecoENERGY program (2007–2012), building owners have been receiving grants from all levels of government to improve their energy performance. These rebates incent property owners/operators to improve energy efficiency through targeted measures. Rebates can be applied to specific technologies (such as air-source heat pumps or solar hot water systems), depending on the perceived potential to provide substantial savings. As well, the level of funding for rebates can be tiered according to the anticipated efficiency gains. For example, under the ecoENERGY Retrofit program for homes, the installation of a tankless domestic hot water heater with a minimum .90 energy factor was eligible for a $375 rebate, while one with .82 energy factor would receive $315.

Rebates such as these have been applied across Canada, supported by all levels of government; programs are currently operating in Medicine Hat and at the provincial level through the Municipal Climate Change Action Centre's TAME program in Alberta (though this program currently focuses on municipal operations only). The TAME program, funded through a provincial government grant, aims to improve the efficiency of their buildings, outdoor lighting and water/wastewater facilities.[38] Utilities in British Columbia, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia also currently have significant programs in place. It is estimated that roughly 3% of Alberta and Edmonton's single-family detached

[37] TXU Energy, "Brighten Power Monitor." http://www.txu.com/~/link.aspx?_id=682C623365984AFFAA2FF0546D73D032&_z=z

[38] MCCAC, *Take Action to Manager Energy initiative* (2013). http://mccac.ca/?page=110

building stocks were retrofitted under the EcoENERGY program between 2006-2013 (see Figure 3). On average, EnerGuide for Homes scores of these buildings improved by 10.0 and 10.3 in Calgary and Edmonton, respectively (see Figure 2).

3.1.7 Building code improvements

Sample jurisdictions implementing: British Columbia, Manitoba, Ontario, Quebec, Nova Scotia

Buildings generally have long life expectancies, typically 50 years or more. Additionally, once a building is constructed, renovations addressing orientation, building envelopes and plan shapes can become prohibitively expensive. Even economic retrofit options are only likely to be undertaken with sufficient awareness and availability of funds (aided through incentives or the property owner/operator's initiative). Integrating energy efficiency measures into the building code can at least ensure that future construction meets a higher standard of performance.

The National Building Code was updated in 2012, with many provinces (such as Ontario) choosing to adopt the building code as it was written by National Research Council. Alberta has not yet adopted the revisions, though, as stated earlier, is expected to adopt this in 2014. Anecdotally, a number of reviewers have commented that builders commonly achieve insulation values that exceed the existing code. Looking at future, more aggressive building code changes, the California Public Utilities Commission has set targets for net zero energy use in residential and commercial new construction by 2020 and 2030, respectively[39]. For future iterations of the building code, stakeholders interviewed for this study suggested features such as solar panel readiness (to save future installation costs), southward orientations (to exploit solar gains), requirement for heat recovery ventilators, and maximum south-facing roof size (to obtain the highest possible benefit from solar PV/thermal panels).

3.1.8 Residential energy conservation ordinances

Sample jurisdictions implementing: Berkeley, California; Ann Arbor, Michigan; Wisconsin

Some jurisdictions have imposed residential energy conservation ordinances (RECOs) in order to motivate the adoption of energy conservation measures. These ordinances are generally triggered through either the sale of a home or the initiation of significant building renovations. RECOs involve a site visit by a certified inspector to ensure a list of energy efficiency measures has been properly implemented. In some cases, flexibility in the implementation of these upgrades can be negotiated between the property seller and the prospective buyer.[40]

A number of U.S. municipalities have implemented RECOs (including Berkeley, California and Ann Arbor, Michigan), as well as the state of Wisconsin.

3.1.9 Green leases

Sample jurisdictions implementing: Cambridge, Massachusetts; Australia; Europe

[39] California Public Utilities Commission, *California Long-Term Energy Efficiency Strategic Plan* (2008). http://www.cpuc.ca.gov/NR/rdonlyres/D4321448-208C-48F9-9F62-1BBB14A8D717/0/EEStrategicPlan.pdf

[40] Eco Leader, *Residential Energy Conservation Ordinance Factsheet* (2013). http://ecoleader.org/assets/downloads/RECO/RECO_factsheet.pdf

Improving energy efficiency in the rental housing sector faces a major barrier in the case where the investment costs are borne by the property owner (who pays for the upgrades to the property), but the savings are realised by the occupant (who pays the utility bills). Conversely, tenants are hesitant to commit to improvements to their properties since their anticipated residence in a dwelling is often uncertain. Hence, the incentive for improvements is split in such a way that no party can justify making energy efficiency improvements. One way that this "split incentive" can be addressed is through the incorporation of a "green lease". A green lease provides benefits to both the owner and the occupant by allocating a portion of the savings to the owner (through a higher rental rate) and to the occupant (through lower utility costs).

Green lease clauses have been promoted in Australia[41] and a number of European jurisdictions[42] in the commercial sector, but are currently uncommon in North America.

3.1.10 Minimum energy performance standards

Sample jurisdictions implementing: Canmore (green building standard)

Another way to address the split incentive problem is through the application of minimum energy performance standards (MEPS). These standards dictate a minimum performance for either new buildings or specific household appliances, essentially mandating improved energy efficiency for owners, where benefits are received by either tenants or owners themselves. Since MEPS are mandatory, they ensure a broad approach to reducing energy demand in residential buildings — all purchases must meet a government-stipulated requirement for energy performance. As well, these standards improve the energy performance of all residences, not just rental units.

Federal MEPS are currently in place for a number of household appliances, including refrigerators, freezers and clothes washers. Provincially or municipally imposed MEPS do not currently exist in Alberta; however, the Town of Canmore has implemented a bylaw that requires the adherence to Green Build's checklists (for single family and high density buildings), as well as mandating specific minimum EnerGuide scores depending on a building's projected gross floor area.[43] Similarly, a voluntary approach in Strathcona County provides reduced building permit fees for developments that achieve LEED, R-2000 or Built Green certification.[44]

3.2 Commercial sector

3.2.1 Address split incentive / implement green leases

Sample jurisdictions implementing: New York City, Various Property Management Firms

[41] Australian Department of Industry, "Green Leases for the private sector." (2013) http://ee.ret.gov.au/energy-efficiency/non-residential-buildings/green-leases-private-sector

[42] CMS Legal, *Study on the use of Green Lease Clauses in Europe* (2011). http://eguides.cmslegal.com/greenleases

[43] Town of Canmore, Building Permit Application Requirements for New Construction (2013), http://www.canmore.ca/FAQs/Building-Permit-Information/Building-Permit-Application-Requirements-for-New-Construction.html

[44] Strathcona County, "Green Building Rebate Program" (2013), http://www.strathcona.ca/departments/planning-development-services/permitting/building-rebate-programs/green-building-rebate-program/

Just as in the residential sector, commercial buildings often contend with the "split incentive" issue. Under net leases (where the tenant pays for utilities), owners may take measures to improve building energy performance, but do not fully realise the benefits through increased rents and only the tenant receives the benefit of energy savings. Additionally, in cases where the occupant does not pay the utility costs (gross leases), no financial incentive is provided to the occupant to adopt energy efficient behaviors. Clauses can be provided in lease documents to address these issues. One solution for gross leases requires that the occupant of the commercial space limit their consumption to predetermined targets. For net leases, the landlord can include an energy-aligned clause, which allows for the landlord to recover the costs through increased rental rates, but limits the increase to less than 100% of the expense of the energy efficiency improvement (e.g. New York City suggests 80%).[45] These approaches are similar to the green leases discussed above.

While clauses such as these are increasingly common and have been implemented by a number of property management companies (e.g. Brandywine Realty Trust, Pyramid Companies[46]), they are not currently mainstream within the industry. There are some "soft" green lease components being employed by property management companies in Alberta, but these are currently limited in scope (e.g. requiring motion sensors for lights). RealPAC provides guidance for green lease development, for use in customized leases in the office sector.[47]

3.2.2 Requirements for green certification of new buildings

Sample jurisdictions implementing: Regional Municipality of Wood Buffalo, Toronto, Province of Alberta

A number of green building certification schemes are currently promoted in both the commercial and residential sectors to improve the performance of the future building stock, including Leadership in Energy and Environmental Design (LEED) certification, BOMA Building Environmental Standards (BESt), the Living Building Challenge and the Built Green standard. The LEED program, launched by the U.S. Green Building Council, provides a certification scheme where building developers/operators can have their efforts to provide more sustainable living/working spaces recognized. A component of LEED prerequisites for all certification rating systems is the improvement of energy performance relative to the building code. Exceeding the energy efficiency standard required by these prerequisites can result in additional credits being awards, which can lead to a building qualifying for higher rating levels (e.g. LEED Gold). By mandating that new developments meet a specific LEED standard, a municipality can ensure that relatively efficient buildings are part of the future building stock.

A number of municipalities have included LEED certification in the development of new districts as well as for municipal buildings (e.g. Toronto's waterfront development, Ottawa's municipal building policy). In Alberta, the Regional Municipality of Wood Buffalo requires LEED Gold certification for new developments greater than 1000 m^2 in their central business

[45] New York City, "Energy Aligned Clause" (2013) http://www.nyc.gov/html/gbee/html/initiatives/clause.shtml

[46] Green Lease Library, "Lease Forms and Case Studies" (2013), http://www.greenleaselibrary.com/lease-forms--case-studies.html

[47] RealPAC, "Green Office Leases" (2013) http://www.realpac.ca/?page=GreenOfficeLeases

district.[48] Provincially, all publicly funded buildings require a LEED silver rating[49]. As well, six Alberta cities and towns (Banff, Calgary, Edmonton, Grande Prairie, Regional Municipality of Wood Buffalo, and Spruce Grove) require LEED certification for municipally owned/funded buildings (various rating requirements are applied).[50]

3.2.3 Mandatory energy audits/reporting

Sample jurisdictions implementing: San Francisco, European Union

Providing the commercial sector with complete information on their energy consumption allows building managers to make more informed decisions on how to improve energy savings. Municipalities can mandate that commercial buildings undertake these audits according to a specific schedule to promote awareness of existing and emerging efficiency measures. A less costly option than auditing is mandatory annual reporting of energy consumption; while this does require only a minimal evaluation of facility energy demand/costs, it facilitates benchmarking and can also draw building operator attention to measures that can be taken to reduce consumption.

The City of San Francisco adopted an ordinance in 2009 that obligates existing commercial buildings over 10,000 ft^2 to report energy consumption data annually and conduct an energy audit every five years.[51] Additionally, European Parliament has passed a directive that requires member states to impose mandatory energy audits on large companies, with a target date for implementation of June, 2014.[52]

3.2.4 Mandatory energy managers

Sample jurisdictions implementing: Italy, Portugal, Denmark

A number of European countries require dedicated staff in large buildings to continuously monitor energy consumption and investigate ways to reduce it.[53] While this approach has generally targeted industry, it has also been broadened to include transportation companies and the public sector.

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[48] Regional Municipality of Wood Buffalo, City Centre Land Use Bylaw 12/012 (2012). http://www.woodbuffalo.ab.ca/Assets/Departments/Legislative+and+Legal+Services/Bylaws/City+Centre+Land+Use+Bylaw.pdf

[49] Infrastructure Alberta, "Environmental Initiatives" (2013). http://www.infrastructure.alberta.ca/501.htm

[50] CaGBC, LEED Certification Status of City-Owned and/or Funded Projects in Canada. http://www.cagbc.org/AM/Template.cfm?Section=News_and_Media_Room&Template=/CM/HTMLDisplay.cfm&ContentID=13744

[51] SF Environment, *Overview of Existing Commercial Buildings Energy Ordinance* (2013). http://www.sfenvironment.org/sites/default/files/fliers/files/sfe_gb_ecb_ordinance_overview.pdf

[52] European Commission, "Energy Efficiency Directive" (2013). http://ec.europa.eu/energy/efficiency/eed/eed_en.htm

[53] World Energy Council, *Energy Efficiency – A Worldwide Review* (2004). http://www.worldenergy.org/documents/eepi04.pdf

Countries that have taken this approach include Italy, Portugal and Denmark. BC Hydro and the Ontario Power Authority have developed voluntary programs that support the hiring of energy managers for facilities by subsidizing their annual salary.

3.2.5 Energy performance contracting

Sample jurisdictions implementing: Toronto; Saskatchewan (SaskPower); British Columbia (BC Hydro)

Energy performance contracting is provided by an energy service company (ESCO) who assesses energy efficiency opportunities within a building. The ESCO then finances the improvements, with conditional requirements to pay for the services through energy savings realised through the upgrade. This can allow for the transfer of risk to the ESCO, where payments can be made under an agreement that would guarantee energy savings.

The City of Toronto's Tower Wise program provides Energy Savings Performance Agreements using their Toronto Atmospheric Fund, guaranteeing that energy investment payments do not exceed verified savings.[54] The payments are made up until the project costs are recovered, after which the savings benefit the utility payer. A similar program is not currently available through utilities in Alberta; however, ESCOs have been active in the province for over 20 years.

3.2.6 District energy systems

Sample jurisdictions implementing: Calgary, Strathcona County, Edmonton

Buildings typically have individual heating/cooling systems that are sized to meet the peak demand of their occupants. More often than not, however, these systems are not operating at the peak load. From an energy efficiency perspective, this presents a problem: boilers, furnaces and chillers operate most efficiency at their peak load; outside of peak demand periods, they must cycle off and on more frequently, reducing the overall efficiency of their energy consumption to provide the necessary output[55]. District energy (DE) solves this problem with a large centralized system servicing multiple buildings with different demand profiles (see Figure 9). The diversity of loads provides a more even demand profile and a higher demand minimum demand. Using the example in Figure 9, it is likely that a large centralized unit can be used, running nearly continuously at peak load, with a secondary unit addressing demand variation. As a result, a centralized system serving relatively densely-clustered buildings can operate at a higher efficiency than would be possible otherwise. It should also be noted that higher building density is also beneficial for further energy efficiency outside of the building sector; more compact, mixed-use cities can result in lower energy demand for transportation as commuters can more readily choose active modes of transportation.

[54] Toronto Atmospheric Fund, "Finance," *Tower Wise*. http://www.towerwise.ca/finance/

[55] Harvey, L.D.D., 2007. A Handbook on Low-Energy Buildings and District-Energy Systems. Earthscan, London. P. 577-578.

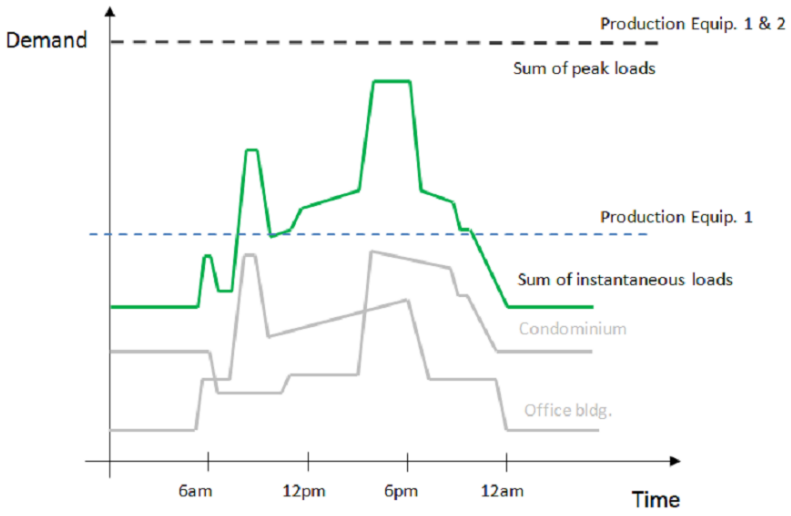

Figure 9: Load profiles of condominium and office buildings, summed into a single instantaneous load (green line)

Summed loads of connected buildings show smoother, more consistent minimum demand

Source: Rulff[56]

District energy projects generally require a coordinated planning process, as has been done in the City of Calgary's downtown DE development, in Strathcona County's Sherwood Park system and in the City of Edmonton at the University of Alberta and provincial legislature. Municipalities and their utilities must collaborate in order to bring long-term energy planning projects such as these into fruition.

[56] D. Rulff, *Modeling Satellite District Heating and Cooling Networks*. M.A.Sc. thesis, University of Toronto (2011), 2. https://tspace.library.utoronto.ca/bitstream/1807/31418/1/Rulff_David_201111_MASc_thesis.pdf

4. Key factors and actors involved in energy efficiency in Alberta

The complexity of the power map illustrated in Figure 10 suggests that there are many factors and actors that influence the adoption of energy efficiency in buildings. To create lasting market transformation, it is important to ensure that owners and operators have suitable motivation and ability to make energy efficiency decisions. This requires the collaboration of developers and builders, realtors, lending institutions, and all levels of government, as well as direct engagement with owners and operators. The role these actors play in boosting the energy efficiency in Alberta's buildings are described below.

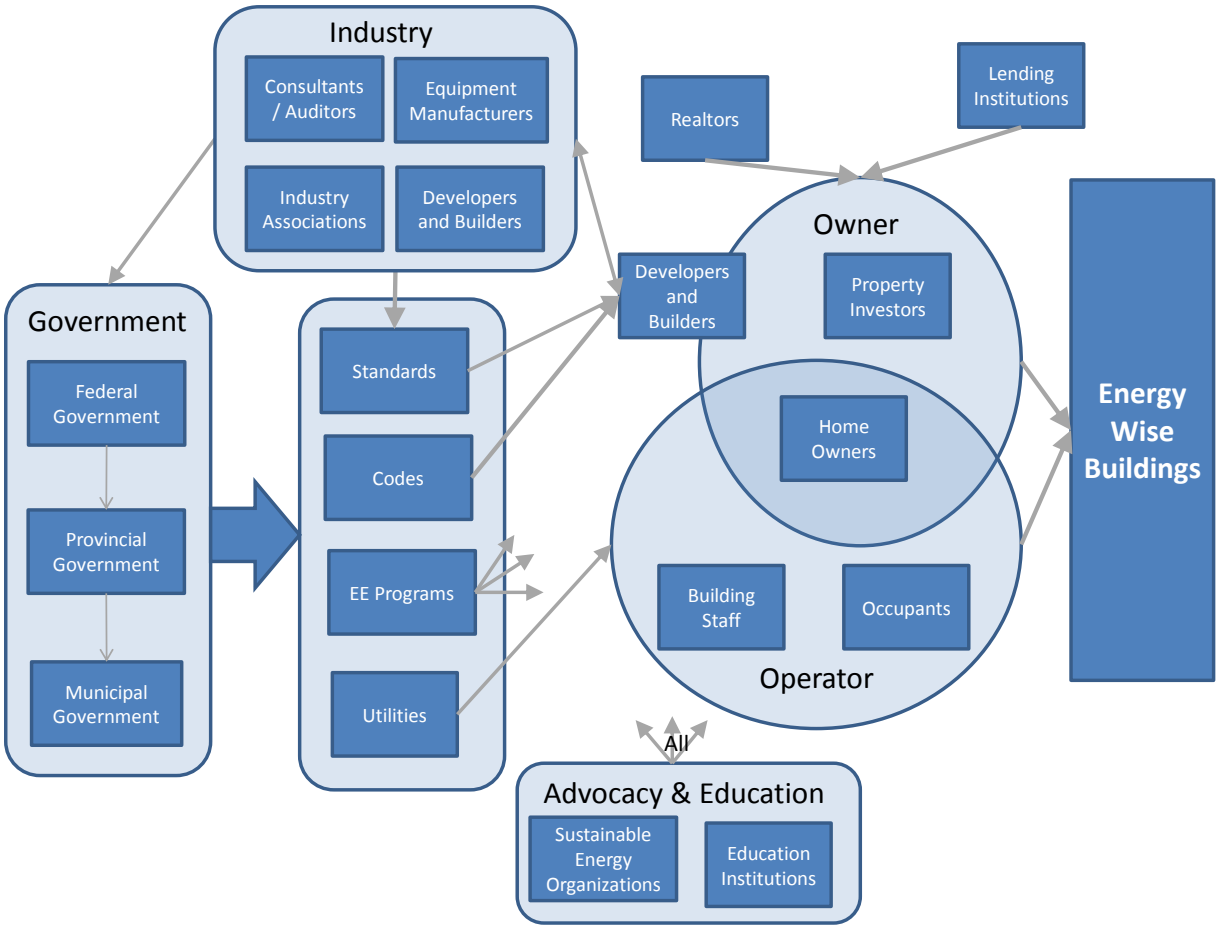

Figure 10: Power map of energy efficiency in Alberta's building sector

Industry

Through the manufacturers, builders, consultants and their associated organizations, industrial actors in the building sector influence energy efficiency in a variety of ways. Manufacturers can supply the latest energy-saving equipment/materials, assuming the demand exists (this demand can be stimulated through a number of actors). Developers and builders, one of the drivers of demand for these equipment and materials, are expected to meet codes set out by provincial government (and can exceed these depending on market demand) or industry standards for commercial and residential buildings (which may improve on the performance mandated by the building codes). Consultants involved in designing buildings may also meet or exceed the code, depending on the criteria put forward by developers, whereas building energy professionals (such as auditors and others who model building performance) are able to estimate demand and how this can be reduced. Industry associations can provide a forum for the discussion of building construction, development and design practices. Additionally, these associations can advocate on behalf of industry on topics related to building energy efficiency.

Some examples of progressive actions towards improving energy efficiency being taken by industry stakeholders include the development of highly efficient building components by Landmark Homes at a centralized production facility,[57] Avalon Home's effort to build 100% net-zero energy homes at no additional cost by 2015,[58] and the widespread adoption of green building certification.

Government

All three levels of government can influence energy demand in buildings, as was discussed in the best practices section. The federal government can develop new building codes that serve as models for provincial codes. Additionally, they can set standards for appliances and other consumer products that are fundamental to energy demand, as well as fund programs that aim to reduce demand in new or existing buildings.

Provincial governments set building codes (in consultation with industry), and direct resources towards various demand-side management programs that can incent building owner/operators. Provincial governments also hold a relatively large portfolio of buildings through which they can provide leadership within the building industry, as well as build capacity for high performance buildings. Finally, Alberta's provincial government can set mandates for energy conservation from its utilities through regulations, which would be enforced through the Alberta Utilities Commission.

At the municipal level, resources can be set aside to fund demand-side management programs. As well, planning and appropriate zoning can encourage greater density households (which have been consistently seen to have lower thermal energy demands, as shown in Figure 1). Finally, bylaws (such as energy performance ordinances) can be passed through council and guidance can be provided from municipal organizations (utilities, government departments) that can ultimately improve energy efficiency.

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[57] Landmark Group, "Landmark Precision Building System" (2013). http://www.landmarkgroup.ca/why-landmark/buying-process

[58] Avalon Central Alberta, "Why We Build Green" (2013). http://www.avaloncentralalberta.com/html/build_green/

Owners / operators

Owners and operators are responsible for many decisions that impact energy efficiency during the construction of a new building. Post-construction, these stakeholders influence both the behavioral choices that shape a building's energy demand, as well as the adoption of retrofit measures. If the incentive to choose efficient building technologies or occupant behaviors is absent, energy efficiency of buildings can suffer. The awareness of high performance features, an understanding of how behavior influences energy use and sufficient financial motivation to act accordingly is essential for this stakeholder group to drive energy efficiency in buildings.

Advocacy and education

Sustainable energy organizations and educational institutions play an important role in providing information to all sectors mentioned above in how they might best improve energy efficiency, as well as providing research/training on existing and emerging practices and technologies. Educational institutions play a vital role in training the engineers, architects and skilled trades in the best technical practices, as well as retraining of current practitioners. Sustainable energy organizations play an advocacy role, conducting research, collaborating with industry/academia and lobbying government to drive these efficiency initiatives forward. Their success in promoting change in the market place has been exemplified by the USGBC and CaGBC's successful promotion of LEED certification, which has gained both government and industry acceptance and improved energy efficiency. Given the multi-sector and multi-stakeholder approach that sustainable energy organizations take, they can play an important role in transforming the market. These actors can act as catalysts to change towards a more energy efficient building sector, stimulating market demand through broader public interest in energy conservation measures in addition to the other approaches listed above. It should be noted that sustainable energy organizations are the only actor within the power map, besides energy efficiency programs, that place energy efficiency as the primary objective of their work.

Other major actors

A number of other actors were identified as being integral to improving the adoption of energy efficiency measures in buildings. These include lending institutions that can provide financial motivation to building owners/operators, as well as realtors who can inform the consumer on the implications of a building's level of energy efficiency. The importance of these actors in providing these services is likely to increase with greater consumer awareness around energy efficiency.

5. What can be done to increase energy efficiency in Alberta buildings?

Interviews with industry stakeholders that were held during the drafting of this report posed two central questions; what can be done to increase energy efficiency in Alberta, and how can existing barriers to this goal be addressed? Generally speaking, the responses to the former focused on increased funding and political will, in order to demonstrate that energy efficiency is a priority in Alberta. Suggestions on what would demonstrate adequate political will included commitments to both the proposed and future building code improvements, regulations that encourage alternative financing models, and funding for long-term programs to improve efficiency. With respect to existing barriers, some of these could be addressed by:

- Improved training of the trades involved in high performance buildings (preventing misinterpretation of the building code)
- Long-term (re)training programs for building operators (to improve recommissioning, as well as update their understanding of evolving technology in modern buildings)
- Making energy efficiency a focus area for both consumers and industry, and a primary factor in the decision-making process of purchasing/building/leasing
- Addressing the relatively low cost of energy, compared with other costs, such as labour (a higher, more broadly imposed price on carbon could potentially increase the perceived importance of reducing energy demand)
- Highlighting the connection between Alberta's resource industries' social licence to operate and energy efficiency
- Long-term commitments from all levels of government to support energy efficiency programs
- A provincial mandate for the Alberta Utilities Commission to encourage demand-side management programs, in order to promote concerted action within the deregulated electricity system
- Given the low price of natural gas, highlighting the numerous co-benefits of energy efficiency measures, such as increased resale/equity value of property and comfort improvements
- Shifting utilities' fixed administrative costs to variable charges, so that energy efficiency measures make a more noticeable difference in reducing monthly costs
- Addressing discrepancies in the billing process (e.g. through "smart" meters), reducing the time before a final adjustment is made to an energy bill and the magnitude of these adjustments

Of the best practices outlined in Section 3, the following were consistently identified as being of particular value in Alberta:

- Mandatory building energy labelling
- Informative billing / home energy reports
- Building code improvements
- Mandatory energy audits / reporting / energy managers

Stakeholders felt that these specific best practices had the best chance for success and that they would provide significant benefits within the Alberta context.

5.1 Making energy efficient buildings a reality

Appropriate actions, such as the best practices highlighted in Section 3, are necessary to improve the energy performance of buildings in Alberta. This document has demonstrated the opportunity that exists for energy demand reduction, and shown that best practices that have been successful elsewhere have limited uptake in the province. Energy efficiency creates jobs, pays dividends on the initial investment (through utility bill savings) and reduces the environmental impact of our economy. New and existing buildings in Alberta, both in the commercial and residential sectors, have relatively high energy demands, yet Alberta lacks sufficient incentives or regulations that would foster an environment of excellence in building energy performance.

While many actors have been identified that can influence the energy efficiency of Alberta's buildings, efforts to this point have not brought the province to the level of a national energy efficiency leader. Additional effort is required to further realize the potential of energy efficiency in Alberta's building sector.

6. The role of sustainable energy organizations

Sustainable energy organizations are well positioned to play a leadership role in increasing building energy efficiency in Alberta. These organizations have a demonstrated ability to create change within the marketplace and have placed energy efficiency as a primary objective of their work. They have a broad enough scope within their mandate to engage with many of the actors identified in Figure 10. A concerted approach has the potential to result in a large-scale transformation of energy efficiency in the province's buildings, including:

- Increased awareness of energy efficiency policies among all actors, as well as the roles of other stakeholders in improving the state of efficiency in Alberta's buildings
- Creation of programs to incent the adoption of energy efficient technologies and energy-conscious behaviour
- Improved codes and standards that will improve the efficiency of new construction, as well as in retrofits, building operation and maintenance
- Institutionalization of energy efficiency principles within industry groups (including developers, builders, product suppliers, consultants, inspectors, realtors, lenders, building operators and educational institutions) so this becomes the norm as opposed to the exception
- Sustained involvement of all levels of government in improving the efficiency of Alberta's building stock, through all the steps detailed above

The sustainable energy organizations most active on the topic of energy efficiency in Alberta buildings are listed below with a summary of their past focus areas.

- Alberta Energy Efficiency Alliance – a multi-sectoral, membership-based organization with a primary focus on advocating for the development of new energy efficiency programs and policies by the provincial government
- Canada Green Building Council (Alberta Chapter), Built Green and BOMA BESt – membership-based organizations with a significant focus on advancing green building certification in Alberta
- C3 (formerly Climate Change Central) – originally a program design and delivery agent for the province, C3 is now a social enterprise offering services to governments and businesses across Canada to help reduce greenhouse gases and improve sustainability
- Net Zero Energy Homes Coalition – While based in Ontario, this member-driven organization is focused on promoting the concept of net-zero homes and communities across Canada and is currently active in Alberta
- Pembina Institute – an independent non-profit clean energy think-tank, advocacy organization and consulting firm with a focus on reducing the environmental impact of energy production and consumption

A key opportunity for advancing energy efficient buildings in Alberta is for one or more of these sustainable energy organizations to take on a more active and visible leadership role in working with the range of actors identified in Figure 10. This will require additional funding to be secured for the organization(s) as each group's activities are limited by the funding available to them.

7. Conclusion

The research presented above is a snapshot of the state of energy efficiency in Alberta's buildings. It identifies room for improvement within the province's residential and commercial building stock. There are many options for advancing energy efficiency in Alberta's buildings, but one of the key opportunities identified is to have one or more sustainable energy organizations take a more active and visible leadership role in order to engage the broad range of actors that play a role in determining the energy efficiency of buildings in Alberta.

If successful, an initiative to increase the energy efficiency of buildings in Alberta can decrease costs, lower energy demands, reduce GHG emissions, decrease maintenance requirements, and lead to a more sustainable building sector.