The Future of Energy Use in Medicine Hat

Engaging Individuals and Businesses

SUMMARY REPORT

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The Future of Energy Use in Medicine Hat: Engaging Individuals and Businesses

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About the Pembina Institute

The Pembina Institute is a national non-profit think tank that advances sustainable energy solutions through research, education, consulting and advocacy. It promotes environmental, social and economic sustainability in the public interest by developing practical solutions for communities, individuals, governments and businesses. The Pembina Institute provides policy research leadership and education on climate change, energy issues, green economics, energy efficiency and conservation, renewable energy, and environmental governance. For more information about the Pembina Institute, visit www.pembina.org or contact info@pembina.org. Our engaging monthly newsletter offers insights into the Pembina Institute's projects and activities, and highlights recent news and publications. Subscribe to Pembina eNews: http://www.pembina.org/enews/subscribe.

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Erin Welk is a Technical and Policy Advisor with the Sustainable Communities Group at the Pembina Institute. She has a background in land-use planning and is engaged in community energy planning and greenhouse gas inventory analysis with municipalities in British Columbia and Alberta. Currently, her key project is the development of a comprehensive Greenhouse Gas Reduction Plan for the City of Calgary. Before joining the Pembina Institute, Erin was a Planner with Smart Growth BC, a non-profit organization that works with municipalities on sustainable land use and transportation policies. In early 2010, she completed the Official Community Plan for the District of Elkford — an innovative plan that integrates climate change mitigation and adaptation measures. Erin holds a Master of Arts degree in Geography from Simon Fraser University, where she focused on stakeholder engagement and power relations in the contestation of community planning and development in environmentally sensitive locations.

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Introduction

In Jannuary 2008, the City of Medicine Hat released a Community Environmental Roadmap, which sets targets for energy efficiency and conservation, as well as renewable energy generation. As part of this Roadmap, the City has set targets for:

- 25% of residential energy provided from renewable sources by 2025, and
- 20% reduction in residential natural gas and electricity consumption by 2020.

In the fall of 2008, the City of Medicine Hat began providing incentives for energy efficient upgrades and renewable energy installations to its utility customers. The HAT Smart program, as it is known, has since become the most successful municipally offered program of its kind in the province.

As the current HAT Smart rebate programs mature, the City of Medicine Hat is looking to explore what future HAT Smart programming could look like (HAT Smart II). The purpose of this report is to identify and assess potential programming options for the City of Medicine Hat in engaging its residential and non-residential utility customers to reduce energy consumption and adopt renewable energy technologies.

Energy Inventory

The report begins with an inventory of energy use within Medicine Hat.[1] The energy inventory helps to identify key areas of energy use. It also provides a baseline that can be used to identify changes to energy use patterns.

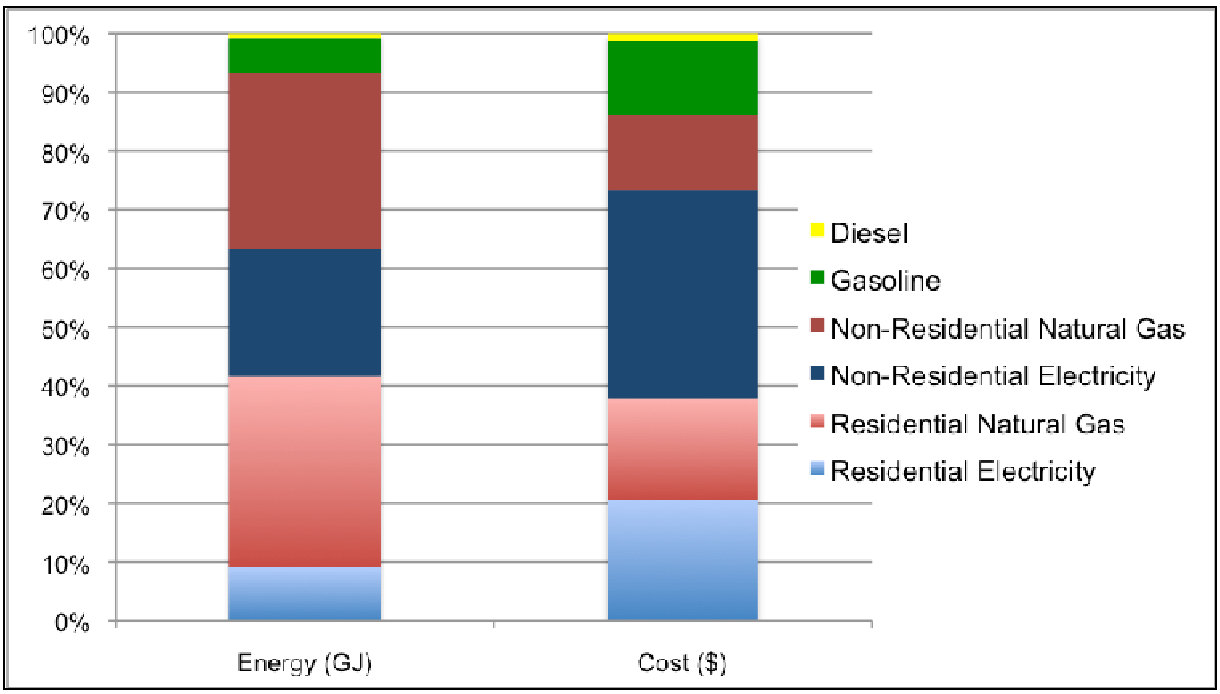

Figure 1: Medicine Hat 2009 Energy Use and Costs[2]

[1] While this summary report covers just energy use in Medicine Hat, the background report also summarizes energy use for all utility customers including customers in Redcliff and the area surrounding Medicine Hat.

[2] Note: The energy inventory does not include the energy consumed by large industrial facilities located in Medicine Hat.

Figure 1 shows a summary of energy use and costs in Medicine Hat for 2009. Energy from natural gas makes up the greatest proportion of energy used in the city with 32% of total energy attributed to natural gas use in the residential sector, and 30% attributed to non-residential uses. Electricity use in the non-residential sector accounts for 22% of energy used in the city, while residential electricity accounts for 9%. Energy used for transportation is a small proportion of the total energy in the city as gasoline is estimated to account for about 6% of total energy and diesel accounts for about 1%. Additional information on the breakdown of energy use by building type, year and month is available in the background report.

Energy Costs

Energy used in Medicine Hat has a significant cost as over $89 million each year are spent on electricity, natural gas, gasoline and diesel. With 56% of the total expenditures, electricity makes up the greatest proportion, as shown in Figure 1, with natural gas considerably lower at 30%. Though gasoline and diesel both contribute to relatively small amounts of total energy consumed, the energy used for transportation is estimated to account for 14% of the energy expenditures in the community.

The differences between energy use and costs result from the higher cost of electricity compared to natural gas. Electricity is over four times more expensive that gas on an energy basis. This is because it is not possible to convert all of the energy in natural gas to electricity when it is burned at a power plant. Once the high pressure energy is used up, the low pressure energy isn't able to spin an electricity generator any longer. This low pressure energy is often released as waste heat from power plants. The average homeowner in Medicine Hat spends approximately $874 per year on natural gas and approximately $883 per year on electricity.

Evaluation of the Current HAT Smart Program

Next, a summary of previous HAT Smart programming is presented. The analysis provides a good review of what has worked previously in Medicine Hat and the value that has been achieved through past programming.

The overall HAT Smart budget for residential and commercial programs is approximately $2 million, with approximately $1 million allocated for each sector.

Residential Program

Since December 2008, the residential program has provided $868,518 in rebates (up to the end of June 2010). Figure 2 shows the total rebates for the residential program categories.[3] Clothes washers, furnaces, insulation and air sealing have seen the highest program participation. Solar installations, air conditioners and new home construction[4] have had the lowest participation. The energy assessments have the highest level of participation as these are mandatory for all program participants.

[3] Data compiled from the start of the program to the end of Q2 2010. Solar Hot Water and Solar Electric system data is up to September 23, 2010.

[4] It is important to note that the new home incentives only begin in February 2010, which is part of the reason for the low level of participation to date.

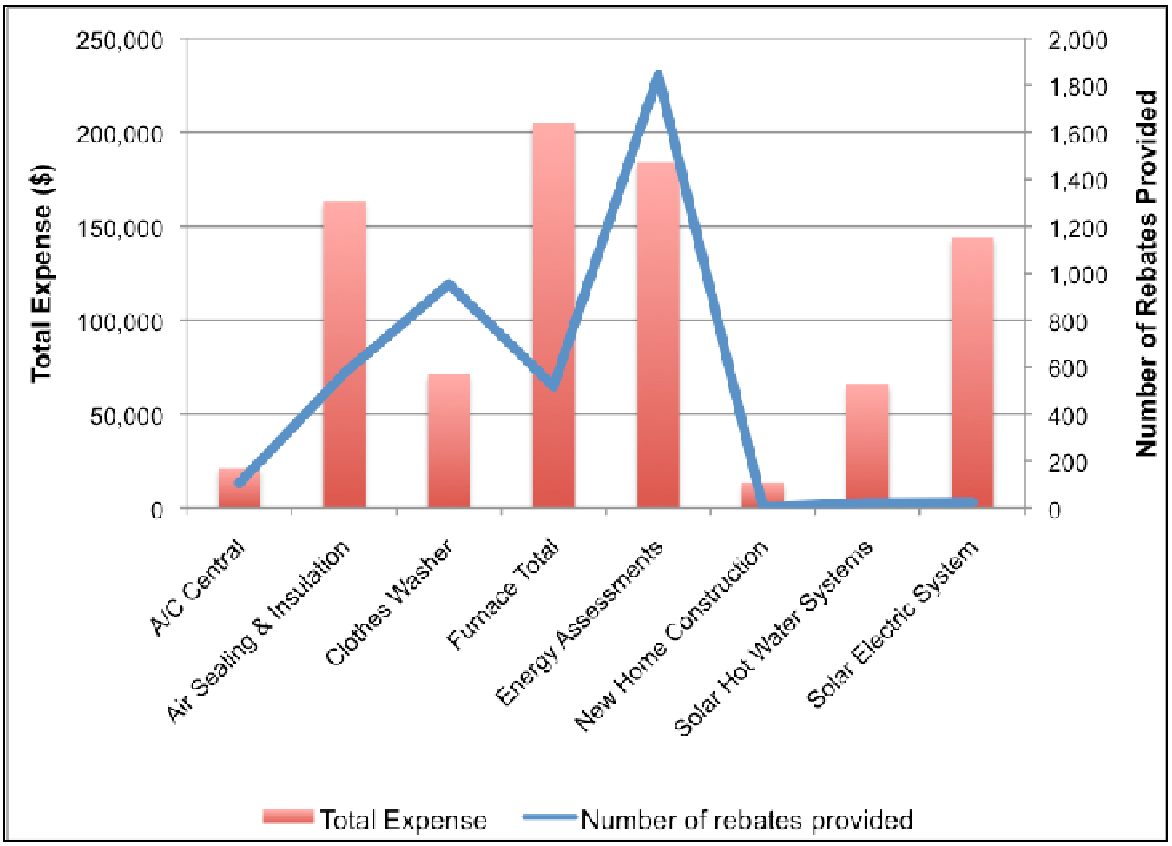

Figure 2: Total Expenses and Program Uptake

As shown in Figure 3 to Figure 5 furnace, insulation and air sealing rebates provide the greatest reduction in energy use per $100 of incentives provided (annual reduction above 4 GJ / $100 in each case).

Rebates for air conditioners save 83 kWh per year for every $100 of incentives provided, but that translates to saving only 0.7 GJ of natural gas at the power plant for every $100 of rebates. Rebates for washing machines save about the same amount of natural gas, but they also save a significant amount of water. Over 11 million litres of water per year are estimated to have been saved through the program.

Incentives for new home construction are shown in Figure 4 estimated to save up to 0.6 GJ of natural gas each year for every $100 of incentives provided when compared to a house built to the minimum building code (approximately EnerGuide 70). However, some houses in Alberta are already being built to a mid-70s level. If this is considered to be the more likely construction practice in Medicine Hat, the cost effectiveness of the new home incentives is reduced to below 0.15 GJ of natural gas saved per year for every $100 of incentives.[5]

Both the solar electric (PV) and hot water systems are estimated to reduce less than 0.4 GJ of natural gas per year for each $100 of rebates.

[5] Energy saving estimates for new homes provided by: Lio and Associates. 2011. *Developing Energy Efficiency Upgrades for Houses in Medicine Hat, Alberta*.

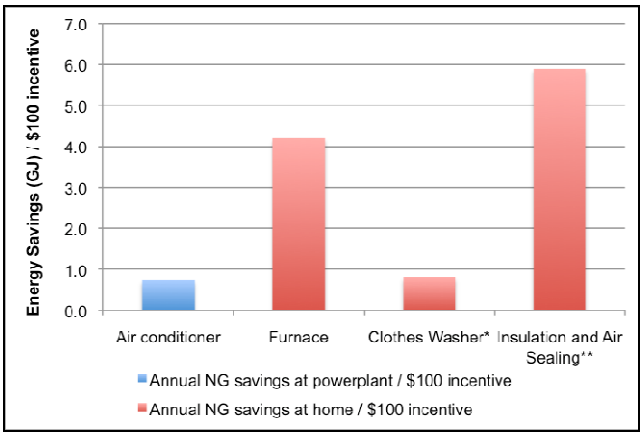

Figure 3: Cost Effectiveness of Conservation-Related Incentives for Existing Houses

*saves significant amounts of water as well
**does not include savings from air sealing; value likely underestimated

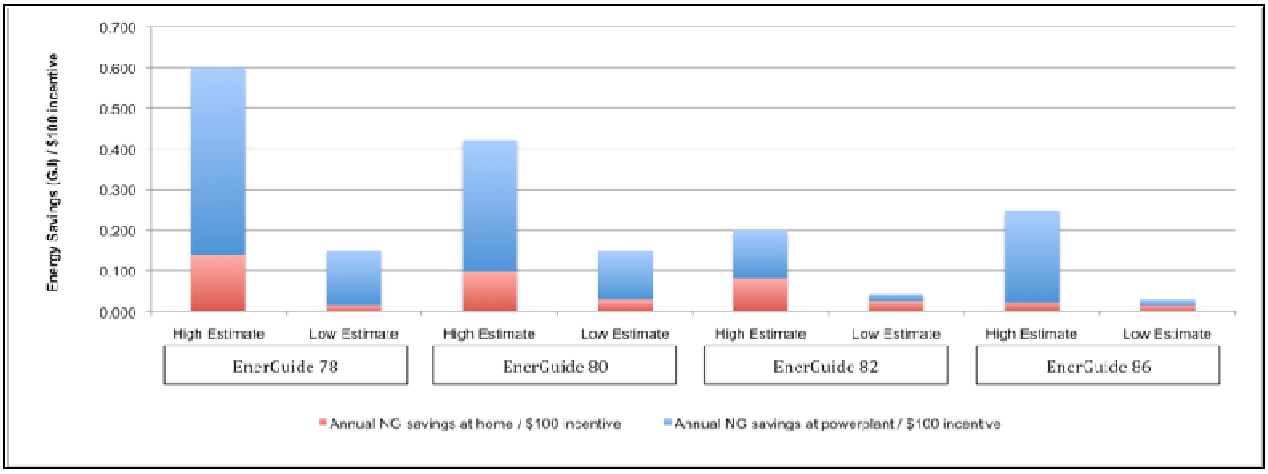

Figure 4: Cost Effectiveness of Incentives for New Homes

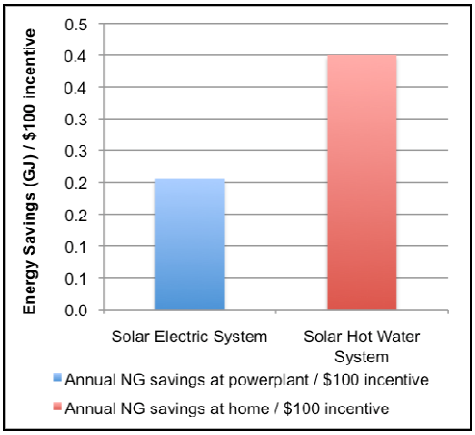

Figure 5: Cost Effectiveness of Renewable Energy-Related Incentives for Homes

Commercial Program

The HAT Smart program for the commercial sector includes incentives for energy audits, conservation and energy efficiency upgrades, and renewable energy. Energy conservation technology was funded at a rate of 10% of the installed cost up to a maximum of $50,000. Renewable energy incentives were offered at a rate of 50% of the installed cost of the technology, up to a maximum of $50,000.

A total of 30 commercial businesses have applied for one of the HAT Smart programs; of those, 12 have applied for a combination of Energy Audits and Conservation activities, while 18 businesses have applied for funding for renewable energy, or a combination of renewable energy and conservation activities.

Out of the 18 commercial businesses that have participated in the renewable energy program, 15 businesses have installed solar electric systems. The majority of these are 10kw systems, though several have a smaller capacity between 2.5 to 5kw.

12 businesses that participated in the program installed a range of different technologies to help conserve energy. Upgrades that have been completed include: insulation; HVAC upgrades; lighting retrofits; furnace replacements; and window upgrades.

The cost effectiveness of incentives provided to a few of the participating businesses is presented in Figure 6 and 7.

The sample in Figure 6 shows energy efficiency upgrades in the commercial sector have been more cost effective than those offered in the residential sector. This could be because of the incentive level set for the upgrades, or it could be a result of the types of upgrades available in the respective sectors. It should also be noted that the incentives directed towards heating energy offer a more cost effective opportunity to reduce energy use than those directed towards electricity use.

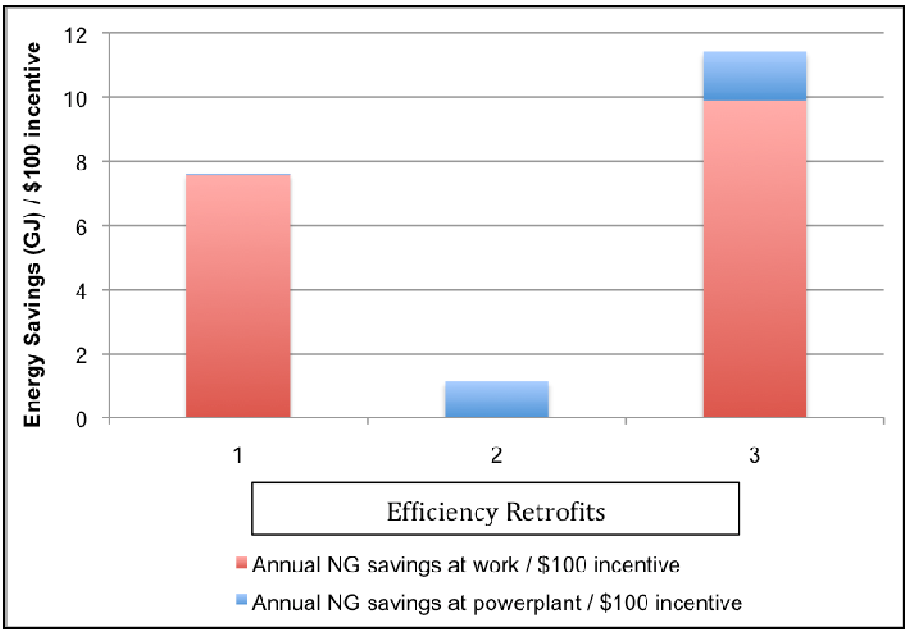

Figure 6: Sample of the Cost Effectiveness of Commercial Sector Incentives for Conservation

The cost effectiveness of the incentives for a sample of commercial PV systems are shown in Figure 7 and are similar to those for the residential sector although some installations are more cost effective as the installed cost per kW is lower.

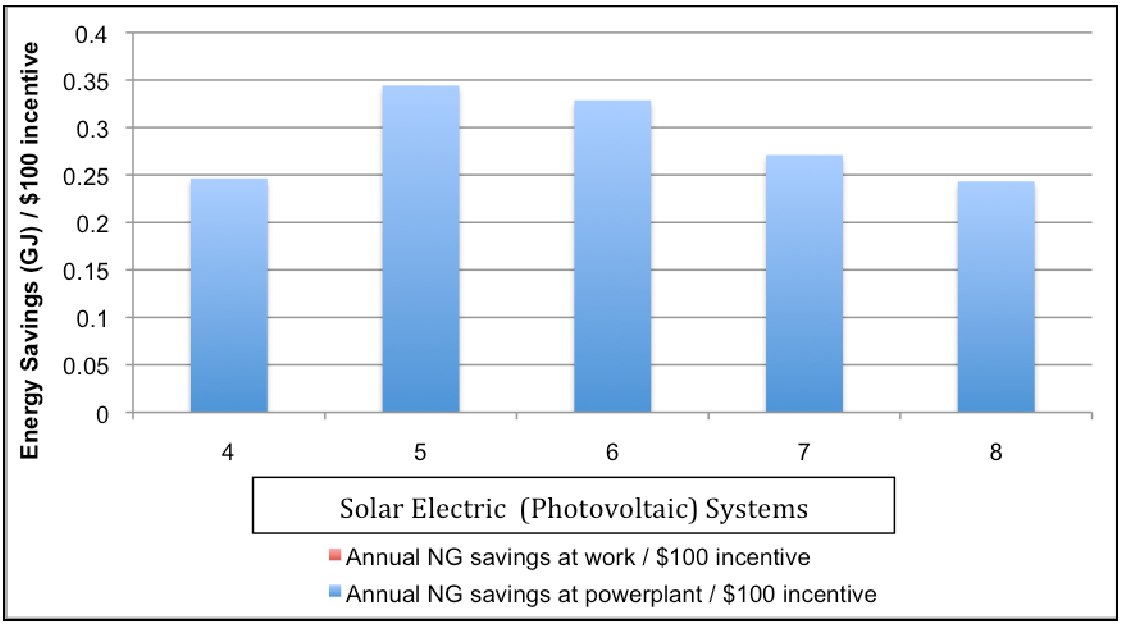

Figure 7: Sample of the Cost Effectiveness of Commercial Sector Incentives for Renewable Energy

Options for HAT Smart II

The bulk of the background report discusses potential options for the City when setting up future HAT Smart programming (HAT Smart II). The approach for identifying potential options was to look at the stages of 'market transformation' as a potential model for achieving the city's energy related goals.

Market transformation occurs when a market, such as the market for energy using and producing devices, transitions from one set of products, services and behaviours to another, as shown in Figure 8. The appeal of the market transformation concept is that the transition is supported and even driven by market forces so the transformation is sustained even without continuous attention from government. This does not mean, however, that government is not involved in the process as many examples include government involvement along most of the market transformation progression.

Section 4.1 includes more information on market transformation.

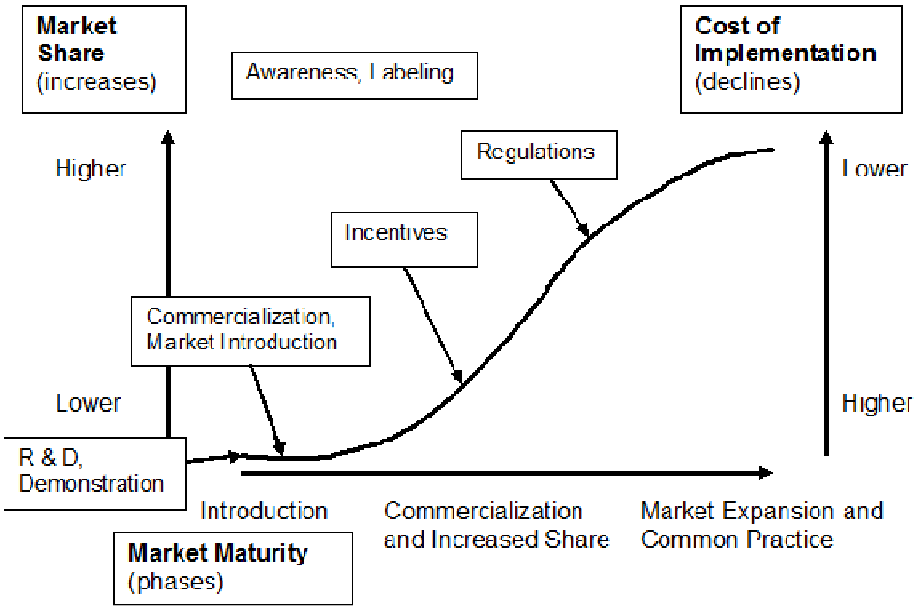

Figure 8 Theoretical: Market Transformation Curve

Four main areas of energy use in the community were investigated:

1. Building heating and cooling
2. Other building equipment
3. Building-scale renewable energy
4. Personal transportation

Based on the analysis completed, there are several different options that the City of Medicine Hat could consider for HAT Smart II. The City may also wish to consider various combinations of the options presented.

It should be noted that advertising, promotion and possibly further energy seminars can be used in combination with any of these options to support their successful implementation.

Rebates for Energy Efficiency

Rebates for energy efficient products (particularly those that are heating related) have provided the highest reduction in energy use for each incentive dollar issued to date. The City could continue to provide these rebates, and possibly increase the number of products eligible, to achieve a similar level of energy savings.

Continued rebates for energy efficient products could be worthwhile for the City if short-term energy savings are a priority (although regulations provide even greater savings).

Rebates for Renewable Energy

Rebates for renewable energy installations have produced much lower energy savings per incentive dollar issued than rebates for energy efficient products. The projects are, however, relatively high profile and they potentially make it easier for future installations of building-scale renewable energy.

Continued rebates for renewable energy projects could be worthwhile for the City if it is a priority to:

1. continue to benefit from the profile of renewable energy projects, (although demonstration projects may provide even greater profile)

2. maintain momentum for future solar energy projects (although the importance of momentum for future solar energy projects has not been evaluated), or

3. support the development of the solar energy industry.

Rebates for Hybrid Electric and Electric Vehicles

Rebates could also be expanded to emerging transportation technologies as a way to reduce energy use.

Local Government Policies

There are a number of opportunities identified where the City could have an impact on energy use through changes to its policies and procedures. These include:

- Efficiency or renewable energy requirements as part of development planning or approvals, or as a part of zoning
- Require increased orientation to the sun and appropriate shading in new developments
- Local government requires disclosure of building energy performance at the time of transfer of property ownership
- Additional fees for standard construction practices
- Raising awareness of energy considerations throughout development and buildings approvals processes
- Offering non-financial incentives such as density bonuses[6]
- Removing barriers to energy efficiency and renewable energy technologies
- Prioritization of infill and redevelopment, as well as bicycle lanes during road construction
- Requirements for alternative transportation amenities in new developments
- Idling bylaw

One or more of these options may be of interest to the City if it is a priority to create city-wide changes that could significantly impact energy use.

Engaging Other Governments

The direct impact of encouraging other governments to increase standards or incentives for energy efficiency and renewable energy is unknown, but may also require a limited amount of resources.

This option may be of interest to the City if it is a priority to create very broad policy changes that significantly impact energy use (although there may be a higher chance of success through pursuing local policies).

Demonstrations

The City could also help to promote new technologies that may not be ready for city-wide incentives. These include:

- Net zero energy homes

[6] A density bonus is provided by a local government and allows a developer to build a greater number of units (higher density) than what is allowed by the local government's zoning regulations. The developer receives this 'density bonus' at no charge in exchange for supplying a desired community amenity, such as reduced energy use. The revenue generated for the developer by the extra units is intended to cover the cost of providing the community amenity."

- LEED Platinum buildings
- Building-scale cogeneration
- LED lighting, light pipes, fibre optics and solar canopy lighting
- Direct or indirect consumer feedback systems
- Passive solar energy houses
- Ground source heat pumps
- Micro-wind installations
- Electric vehicles
- Anti-idling programs

Funding or support for demonstration projects could be worthwhile for the City if it is a priority to:

1. create significant profile for the city, or
2. support the development of new technologies.

Other Initiatives

The City could also support or undertake a variety of other initiatives that do not involve incentives or policy changes. These include:

- an innovative financing program,
- a voluntary building labelling program,
- implementing a feedback system for consumers,
- partnering with local stores to promote energy efficiency or renewable energy products, and
- funding renewable energy feasibility studies (although the need for these may be limited).

Each of these options have their own set of benefits and challenges, but they all share the characteristics that they do not involve rebates or regulation. In most cases, they require partnering with other organizations, or the establishment of a formal program to deliver the service. There are also a range of potential impacts associated with them as highlighted throughout the previous section.

Evaluation of Options

Figure 9 attempts to rank the various options by their estimated level of impact and their likelihood of implementation.

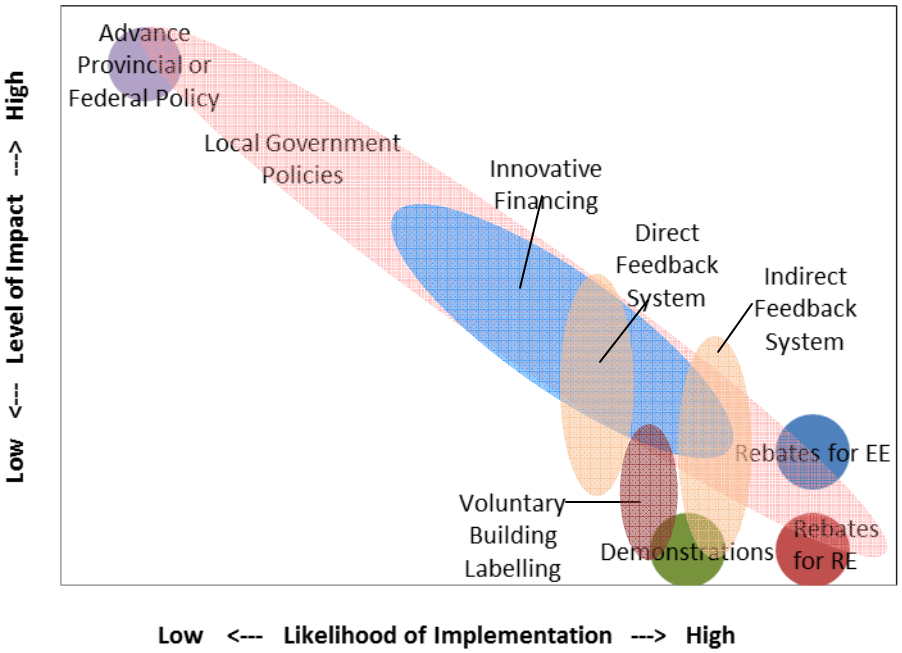

Figure 9: Estimated Level of Impact for HAT Smart II Options

Local, provincial or federal policies are likely to have the greatest level of impact on energy use, but also have a high degree of uncertainty regarding whether they can be implemented. Some local policies, however, may be easier to implement than others, although in some cases, such as providing energy-related information throughout the development approval process, the level of impact is less.

Innovative financing programs and feedback systems have the next highest ranked level of impact as they have the potential to reach city-wide. Again, a highly impactful financing program may be challenging to implement, but a less impactful one is likely easier to establish. This is the reason why it has a wide range across Figure 9.

Pilot and demonstration projects for residential utility feedback systems have produced a wide range of results. The direct feedback systems, such as dedicated digital displays inside homes, showed higher levels of impact, but are more expensive than indirect feedback systems such as providing information on bills. Therefore, the direct feedback systems are indicated to be more challenging to implement, but a higher level of impact than indirect systems. The ranges shown in Figure 9 assume city-wide implementation as opposed to a pilot project.

Rebates for renewable energy projects are listed as the lowest level of impact, but easy to implement because they impact only a limited number of buildings, but they are relatively easy for the City to continue.

Rebates for energy efficient products are similarly easy for the City to continue, but have a higher level of impact on energy use per rebate dollar.

Voluntary building labelling likely requires the City to engage with realtors or directly with consumers to encourage them to undertake the labelling. It is therefore listed as more difficult to implement than the current rebate programs. The level of impact is shown to vary is it depends on the level of participation.

Building-level demonstration projects typically have a limited level of impact on city-wide energy use, and also depends on other parties for implementation.

Path Forward

With all of the information provided in this report, it may be difficult to determine the most appropriate path forward. The following section suggests several different approaches that could be used.

Market Transformation Approach

One strategy to determining an appropriate short-term focus for the City is to use the market transformation approach. In this approach, regulations are often used to have market-wide impacts, and are the ultimate end-goal for a particular market transformation, particularly in energy markets.

The City of Medicine Hat, therefore, may wish to review the policies that could be implemented at the municipal level that can have a significant impact on city-wide energy use to determine which could potentially be implemented in the short- or medium-term.

For those policies that may be possible within the short-term, beginning the work to develop them may be the best next step.

For policies that may be possible in the medium-term, it would be valuable to identify the steps that could be taken now to support the implementation of these policies at a later time.

For example, if the City wished to possibly establish a passive solar heating policy within the next five years, they could begin in the short-term with:

1. research into passive solar design and policy setting,
2. the demonstration of a passive solar house,
3. incentives for appropriate building orientation and design, and
4. providing information to citizens regarding the benefits of passive solar design.

Other Initiatives That Impact All Consumers

Another area that the City could also look at is the implementation of programs that could have a city-wide impact on their own. Those identified in this report include innovative financing programs, consumer feedback systems and voluntary building labelling.

A Focus on Incentives

A third option for the City is to maintain a similar level of impact that is currently achieved through a continued rebate program; however, the impact per rebate dollar could be increased through a focus on energy efficiency instead of renewable energy. Incentives could also be broadened to include emerging transportation technologies.

Supplementary Activities

Further education and demonstration programs can be used to enhance the implementation of any of the options listed.

Next Steps

The City may wish to select one or more of these approaches to pursue. Once a set of focus areas have been selected, work can be undertaken to define a development and implementation plan for HAT Smart II.