Greener Energy Opportunities and Priorities for the City of Edmonton

Discussion Paper

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the PEMBINA institute 25 years of Sustainable Energy Solutions

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Bios

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Abstract

This paper discusses some of the multitude of technologies that are capable of making incremental improvements to the way that energy is supplied to the city of Edmonton and Edmontonians. This paper is not meant to be a holistic analysis of integrated community planning or even key energy efficiency options, although both are essential components of eventually achieving a sustainable energy system. The technologies discussed here are limited to energy supply technologies that are practical and immediately accessible at a municipal level. We discuss municipal opportunities for cogeneration, solar photovoltaics, solar hot water, solar hot air and passive solar, along with ground source heat pumps, biofuels, and biomass energy. Jurisdictions that have made the most progress in reducing fossil-fuel dependence have all done so as a result of a supportive policy environment that actively fosters the transition to sustainable, low-impact options. This paper provides a brief overview of some of those policy options to encourage the deployment of the aforementioned technologies at a municipal level and includes an appendix highlighting what a few other municipalities are doing to take steps forward. The options and strategies reviewed include goal setting, education, development permits, zoning requirements, procurement, community ownership, local improvement charges, tax credits, rebates, incentives and financing.

Introduction

In 2008, the United Nations reported that for the first time, more money was invested globally in wind, solar and other forms of renewable electricity generation than into new nuclear, coal and natural gas combined[1], and 2009 was an even better year[2] in spite of the global recession. This rapid evolution of technologies and market has sparked excitement and high expectations – but it can also lead to a lot of hype and sometimes confusion and misunderstanding. This discussion paper looks at existing technology options, how policies can be implemented to adopt these technologies and how the City of Edmonton could make the most of the current opportunities.

Alternative, sustainable, clean – what's what?

The words "alternative", "renewable" and "clean" technologies get used interchangeably, although they can mean different things to different people. While there are no hard and fast definitions, the Pembina Institute tends to differentiate these words as follows:

- *Alternative energy* generally refers to new or emerging technologies that do not currently constitute large proportions of our energy infrastructure. Alternative energy systems can include technologies that do not actually generate energy, but may be important in storing or cleaning up our current energy supply, such as hydrogen fuel cells or carbon capture and storage (CCS).
- *Renewable energy* generally defines technologies that do not use up the resource that they need to generate energy, such as sunlight or the water in a river. Yet some projects (particularly when they are poorly designed or located) can have significant environmental and social impacts, even if they are – strictly speaking – renewable.
- *Clean energy* can be the trickiest term to define as it is relative to the local context. For example, in Alberta (where most of the electricity is generated from coal) natural gas electricity is often seen as a 'clean' alternative, whereas, next door in British Columbia

(where most of the electricity comes from hydro) natural gas electricity is often perceived as dirty[3]. To properly assess the relative cleanliness of any particular technology, its entire life-cycle needs to be considered (from mining the components, to operations, to decommissioning) as well as what other options are realistically available in the local context.

It will take a mix of alternatives to start reducing our use of fossil fuels, recognizing that no alternatives are perfectly benign they can go a long way towards reducing pollution, stabilizing price fluctuations and reducing greenhouse gases. While coal and heavy bunker oil are the dirtiest of the dirty fuels, even wind and solar systems which tend to have the lowest footprints are not without some impacts.

Alberta's energy system clearly needs significant changes as it is currently the most polluting in Canada and per person, amongst the most polluting in the world. The good news is that there is a spectrum of technologies that are capable of making improvements, many of which are accessible at a municipal level. There are no "silver bullets", but incremental improvements can add up to significant changes, and there are many examples of cities, provinces and countries that are making those changes today.

Sources of pollution

Fossil fuel consumption within Edmonton can be reduced using alternative energy approaches in four major areas: electricity, houses and buildings, transportation and industrial processes. For this paper, we will not deal with industry as each process is somewhat unique, and many are regulated by provincial and federal regulations as opposed to municipal ones.

Conservation and efficiency

While this paper focuses on energy supply options, it is important to note that many efficiency technologies are still very much "alternative" even though many have been around for years. In fact there is so much room for improvement that in 2007, staff for the Council of Energy Ministers' working group on the built environment felt that each industrial sector could reduce energy intensity by between two to four per cent every year for the next 20 years. The Council, which includes every provincial and territorial energy minister, had also outlined achievable targets as including such things as ensuring all new buildings and homes would be 50 per cent more efficient than the current average for construction, and even "net zero energy" by 2030. Furthermore the average house in Canada today could be retrofitted to reduce its energy use by at least 30 per cent[4] - all of this without compromising any of the creature comforts we accustomed to. Simple conservation efforts such as hanging your clothes to dry in the summer, and turning off or even unplugging electric devices when they are not being used can lead to even more energy savings. For instance microwaves tend to use more power in a year to run their clocks than they do to heat food.

These are only a glimpse of the scale of the many efficiency opportunities that exist in Canada and in Edmonton - opportunities that tend to cost the least (in fact often make money), are the fastest to deploy and have the largest incremental impact on lowering emissions. While we continue to look for alternative sources of energy, we can significantly reduce our demand at the same time.

Electricity in Alberta

Most Albertans probably do not think about where or how the electricity they use comes from. While much of the electricity generated in Canada comes from large hydro dams, this is not the case in Alberta. No other province consumes more coal to produce electricity than Alberta and, proportionally, only Nova Scotia is more dependent on coal power[5]. This is important to Edmonton and Edmontonians, as some alternative technology options, for example electric cars, involve shifting fuel sources onto the electricity system. The extent of the environmental gains that can be made by such a switch are determined (and in some cases limited) by the relative cleanliness of how the electricity is generated.

Technologies

While no single technology on its own is a silver bullet, but the cumulative gains will add up to major changes. Individual improvements can also be amplified through better overall systems. For example, a community heating system on its own can improve the efficiency of how individual houses and/or buildings are heated. Add to that system a renewable fuel such as waste wood or sewer gas, and the footprint shrinks further. This overall system now provides a heat reservoir that could be used to "dump" excess energy on very windy days for example, allowing additional wind energy to be developed elsewhere in the province. This illustrates how the sum of the system can be more effective than each of its individual parts.

The following discussion focuses on five broad technology alternatives that are ready to use and we know work well in a city like Edmonton. Though it is not an exhaustive list of all the options, these solutions represent some of the "low-hanging fruit" that could substantially reduce in the impacts resulting from the energy consumed in the city.

1 – Combined Heat and Power (CHP)/Cogeneration

Combined heat and power (CHP) - also known as cogeneration or simply "cogen" - refers to the simultaneous production of both electricity and heat by burning a single fuel. The heat from cogeneration plants can also be used by absorption chillers to provide industrial or space cooling. Cogeneration is not necessarily renewable (unless the fuel is biomass) but it offers considerable potential for reducing emissions for three reasons. First, it is a highly efficient process[6] as it uses much of the heat that would otherwise be wasted out a chimney. Second, the power that is generated in the same location that it will be used – either in the building itself, or nearby within the city. Almost one-tenth of all of the power that is generated in Alberta is currently lost in large-scale power transmission. By generating power locally you actually only need to generate 90 per cent as much as you would if you need to transmit it across the province – a savings in Alberta that would be equivalent to shutting down at least one entire coal power plant. Finally, even the simple use of natural gas in place of coal to generate electricity can be as much as a 50 per cent reduction in greenhouse gas emissions, not to mention mercury and other emissions. While a renewable fuel could eventually replace natural gas, cogeneration using natural gas probably represents some of the largest and fastest gains that can be made in Edmonton in the near term. In fact our recent study *Greening the Grid*, found that cogeneration was one of the most significant near-term emission reduction opportunities for the entire province's electricity system[7].

Cogeneration is already used heavily in Alberta in the oil sands, but is not common within Alberta's cities. Nearly every apartment building and industrial complex could be retrofitted with a cogeneration system in place of their existing boilers. In Europe, cogeneration systems are already widely available at a household size, so individuals can generate their own power instead of just

their own heat. District or community heating systems can make these systems even more efficient by providing larger pools for heat, and possibly storing heat generated in the summer in insulated underground reservoirs for use in the winter months. This type of system is already working in Drake's Landing, in Okatoks, Alberta where solar heat collected and stored in the summer.

2 – Solar Energy

Despite being relatively far North with short winter days, Edmonton has a better solar energy resource than a city as far south as Toronto; it also has better solar potential than Berlin or Tokyo[8], two of the leading solar photovoltaic cities in the world. Solar photovoltaics or PV systems capture energy from the sun and convert it to electricity, and they are already at work in Edmonton; in fact they operate more efficiently in cold temperatures. PV systems have the advantage of having no moving parts, and are well suited to generate electricity in the same location where it will be used. A typical home in Edmonton can install enough solar PV panels on its roof to generate, on average, the same amount of electricity that home will consume in a year. Alberta's microgeneration policy enables Albertans to do just that; to send excess electricity to the grid when too much is generated, and to take electricity back from the grid at the same price when it is needed. This policy is often called "net-metering" and while it facilitates systems such as PV (note PV are not the only technologies that can participate), it does little to promote their uptake at a large scale. While solar PV systems are coming down rapidly in price (costs fell almost 30 per cent just last year), they are still relatively expensive compared to buying electricity from the grid, and experience has shown that a cost-recovery policy or a "feed-in tariff" such as Ontario's new Green Energy Act, has been by far the most successful tool to seriously promote solar PV.

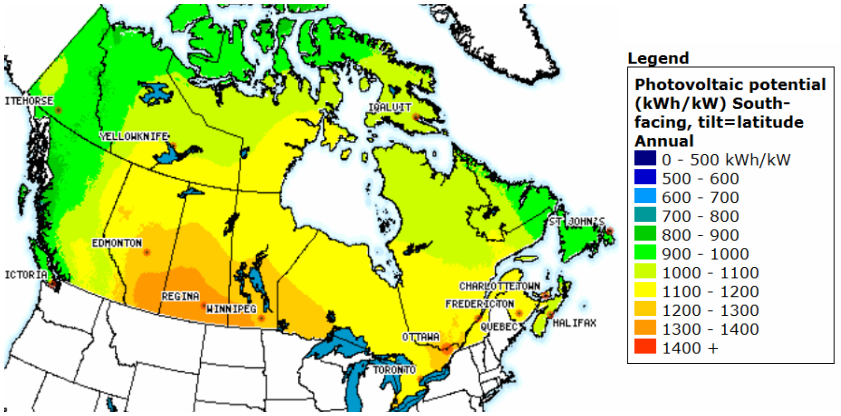

Figure 1: Canadian photovoltaic potential[9]

Solar energy can also effectively be used to heat either water or the air, or both. Solar water heating is a mature technology and is commonly used in many other countries around the world (including those with cold winters). Federally, Canada supported significant research into solar water heating in the 1980s and installed systems in most regions of the country. No major physical or technical barriers were found to prevent solar for water heating panels from being effective in Canada. In Edmonton a solar hot water system would not replace a hot water tank. Instead, it pre-heats the water before it goes into the hot water tank, and in doing so can reduce hot water heating costs by as much as 30 to 40 per cent. They can be even more useful on buildings such as apartments, hotels and pools with higher daily water heating needs.

Pre-heating is the same principle behind using the sun to heat buildings and homes. For new homes, the term "passive solar heating" is often used for homes that are designed (and oriented) in such as to allow winter sun into the home (you can easily design your roof so you block out much of the

direct summer sun when it is at a different angle in the sky, so you do not overheat in the summer). Once the heat is in a well-insulated and air-tight building envelope prevents heat loss – in fact a home designed to optimize passive solar heating can easily supply up to half of its heat with free solar energy.[10] On larger buildings, such as apartments and warehouses that actively bring fresh air in to their heating systems, a Canadian invented technology called a Solarwall®[11] can be added. A Solarwall® is simply dark (preferably black) wall that is added to a south-facing wall of a building. There are many small perforations to allow air that has naturally warmed and has started to rise to pass through from the outside. Pre-heating the air this way can reduce heating needs by up to one quarter. Such systems are already at work on a school in Yellowknife and, just North of Edmonton the Pembina Institute assisted Beaver Lake Cree Nation acquire a Solarwall® for their community centre.

3 – Ground Source Heat Pumps

Ground source heat pumps, or geoexchange systems, use the Earth's energy to warm (or cool) a building. These systems are sometimes referred to as "geothermal" systems, but can be confusing as geothermal energy typically refers to using hot water in the Earth's crust to generate electricity (a technology we will not be discussing in the context of what's relevant in Edmonton). Ground source heat pumps operate on the same principle as a refrigerator, and so they are not novel or unproven technologies. Where a refrigerator takes heat out of the air and the food within it and releases that heat into your kitchen, a ground source heat pump takes heat out of the ground and releases it inside your home (it works in reverse in the summer). Because heat pumps are actually just moving heat from one location to another, they can actually deliver significantly more heat than they energy required to run them. In fact, most heat pumps have an operating efficiency over 300 per cent – that is for every unit of electricity needed to run the system's pumps and compressors, the system is able to deliver three units of heat to the building. Heat pumps can be coupled with solar pre-heating systems, as well as into district heating systems. There are also air source heat pumps, but Edmonton is too cold for them to be effective.

Even though heat pumps will eventually pay for themselves in energy savings, not everyone has the capital available to purchase one as they are expensive, particularly if they are being retrofitted into an existing building. Another Alberta-specific reality is that even though heat pumps use energy very efficiently, they run on electricity, and in Alberta most electricity still comes from coal. Fortunately, a heat pump is so efficient that even when it runs on coal-based electricity it tends not result in any more greenhouse emissions than a mid- to high-efficiency natural gas furnace. So, in the short term a high-efficiency natural gas furnace has a similar environmental benefit as a heat pump; however any particular furnace cannot get any better once it is installed, whereas the electricity system is getting cleaner and cleaner (although there is still a lot of work to do!) as old coal plants are being phased out and new renewable sources such as wind power are coming online.

4 – Transportation and biofuels

Alberta is the province with the highest percentage of its households owning two or more vehicles[12]. According to Edmonton's 2005 household travel survey results, since 1994 there has been a disproportionate growth in total car kilometres driven (+32 per cent) compared to the population growth over the same period (+13 per cent), while the volume of fuel sold between 2000 and 2008 increased by 50 per cent. This increase was largely due to a rise in the number of trips made by city residents and an increase in the average trip length. Increased vehicle usage it highly influenced by expansion of the suburbs, clearly results in a rise in fuel consumption. Exploring urban planning designs and policies to increase desirable and affordable housing options in mature and inner city communities and increased transit service are all key steps in reducing vehicle use.

At the same time, electric and hybrid vehicles can help to reduce overall emissions. As in the case of heat pumps, electric cars are only as clean as the electricity that they are powered on. While highlights the need to clean up Alberta's electricity system, planning for solutions such as plug-in electric and fully electric cars need not wait until this transformation is complete.

Liquid fuels, be they conventional or biofuels, have a key advantage over electric cars as they are very energy dense, as well as rapidly refillable. As such even when electric cars do hit the market, liquid fuels will likely be required to extend the range of electric or plug-in hybrid cars. Biofuels are often touted as a way of reducing conventional gasoline or diesel use. Unfortunately, current liquid biofuel technology including corn-based ethanol and biodiesel, has been criticized for increasing food prices, increasing deforestation and, their overall life-cycle may even result in greenhouse gas emissions compared than fossil fuels. However, given the advantages and the existing infrastructure that liquid fuels have there will be a need for some low impact biofuels as a transitional and then a supplementary fuel. However, they will need to come from different or significantly improved processes than those used today. Two of the more commonly cited "next generation" biofuels that have the potential for significant emissions reductions include ethanol from cellulose (eg. agricultural and forestry residues), and biodiesel from waste fat (tallow) and waste grease (yellow grease), although neither are currently produce in commercial volumes. Unlike electric vehicles, there is not a gradual infrastructure change that needs to take place within the city to accommodate a switch to biofuels when these "next generation" biofuels become commercially available.

5 – Bioenergy

Bioenergy is energy that is derived from biomass resources, such as plant- or animal-based organic matter. Within the city, there are numerous potential sources of bioenergy ranging from sewer gas, to landfill gas, to forestry and agricultural wastes, to wood wastes some of which are already being used in Edmonton. To be truly sustainable, the use of bioenergy cannot lead to overall degradation of the natural environment or undermine people's abilities to meet their needs.

One example that Edmonton could take advantage is wood pellets that are currently being manufactured in Northern Alberta. Pellets are typically made from dried and compressed sawdust that tends to burn significantly cleaner than logs, and because they are small they can be loaded into programmable pellet stoves that automatically feed themselves to control the temperature of a building much like a furnace does. Pellets that are manufactured in Alberta tend to come from forestry residues that used to be burned in "beehive" burners. Many of these pellets are currently shipped to Scandinavia.

As with any city, significant amounts of wood waste are continually generated in the City of Edmonton, either from construction or pallets from industrial or commercial operations. This represents a steady stream of materials that could be used to generate electricity close to the city itself. Enoch reserve, just west of the city, has a massive stockpile of wood waste that could be used as an additional supply for such a system.

Possible Municipal Actions

The City of Edmonton can start taking specific actions to encourage and facilitate the uptake of these and other technologies. In fact, it is becoming increasingly common for cities across North America to take leadership roles in setting goals and enacting incentives and requirements for greener energy sources. Some strategies and programs include:

Regulatory options

Goal setting

Setting a target is an important step toward achieving change, as it sets a benchmark for progress and guides what policies should be implemented and revised as progress is made. Energy use goals can be set for new buildings, as well as for retrofitting existing ones.

Local Improvement Charges (LIC)

Local Improvement Charges (LICs) have long been used by municipalities to help cover the costs of upgrading infrastructure, such as roads and sidewalks, which are deemed to benefit a specific neighbourhood. The city assesses which landowners will benefit from the improvements, and adds an extra charge to their property taxes each year until their share of the improvements have been paid for. LICs can be adapted to finance energy efficiency improvements in residential and/or commercial buildings.

Using LICs to finance green energy projects will help to remove some of the barriers to alternative energy development including a reluctance to accept long paybacks, a lack of access to capital to improve existing buildings and resistance from within the property development industry. Using the LIC approach, municipalities are also able to take direct leadership in the way energy is used within their jurisdiction at little or no net cost to the taxpayer. The UK has recently introduced this mechanism nationally[13], and the Pembina Institute completed a study for how such policies could be of benefit in Canada.[14]

Development Permit

The city's development office could support the deployment of renewable energy by applying renewable energy requirements to certain development sites, and issuing permits only when minimum standards are met. This method could be used to promote development in the core, with less stringent standards in the inner city, and greater requirements in suburban areas. For example, the City of Medicine Hat sold municipally owned lots for housing on the condition that buyers install solar systems: "Successful participants must commit to building a home certified to the Built Green bronze standard or higher, install a solar water heating system, and a microgeneration system (solar or small wind) to supplement household electricity needs." In addition to the requirement for renewable energy development, the city is also offering various incentives totaling up to $10,000 for each home constructed under the program[15].

Zoning

Increasing the density of housing can create greater renewable energy opportunities, since systems such as ground source heat pumps and solar hot water can be exploited more efficiently when applied to a condominium than for a single-family home. Municipalities can also ensure that new developments use energy efficiently through zoning regulations – for instance, by requiring southerly orientation where possible, and setting distance-to-height ratios to prevent shading, zoning rules can encourage passive solar heating and natural lighting, reducing energy use. A combination of zoning and development permits can be applied to ensure new buildings are built "solar-ready" – that is, making sure that solar energy systems can be easily installed by ensuring there is a conduit that runs from the roof to the mechanical room that could eventually contain wires for solar PV and/or piping for solar hot water systems — a very minor cost when a new house is being built, but a significant cost if done as a retrofit. Dawson Creek, BC, currently requires all new homes to be built solar-ready[16], and in September 2008, the City of Vancouver revised their building code to require all one- and two-unit dwellings to be built solar ready. The City of Calgary is investigating this opportunity as well[17].

Zoning could also be used to set up "green business zones" – areas in which all businesses/commercial operations must install renewable energy to offset a proportion of the energy demands of the businesses. This could benefit businesses by reducing the costs for business licenses, permits or taxes. Additionally, the city could promote the green business zones through advertising.

Transportation

Even though electric cars have not yet hit the market there are numerous policy options that can be adopted in order to facilitate their eventual uptake. Adopting plug-in hybrids and electric cars into municipal fleets can be an important first step in proving these technologies in cold climates. Requiring charging stations for new buildings, such as has been already mandated in Vancouver, BC for both single family and multi-family properties[18]. Although biofuels do not need significantly new infrastructure, a requirement that biofuels used in city fleets should be required to meet specific sustainability criteria.

Local budgetary options

Tax Credits

Property taxes and business taxes could be adjusted for residents and businesses that install renewable energy systems. For example, the City of Austin, Texas provides municipal tax credits of 30 per cent up to $1,000.

Rebates

The City of Edmonton could provide rebates to encourage initial uptake of renewable energy technology. Rebates could be structured to fund an amount per kilowatt installed. For example, the Sacramento Municipal Utility District (SMUD) offers rebates of $500 to $1500, depending on the size of the system. Larger rebates could be provided in the early years, and a declining rebate amount in future years. This would promote early adoption of technology and would acknowledge that costs are expected to decline over time.

Feed-in Tariffs

Feed-in tariffs have been shown to be the most effective way of deploying the largest amount of renewable energy and at the lowest cost[19]. Feed-in tariffs (FIT) are very common in Europe and the province of Ontario recently introduced North America's first comprehensive FIT. Under a FIT, a utility offers standard published rates, and standard contract terms for generation under the specific criteria. Such policies are also possible at the municipal level — in fact, they started that way in Germany. Edmonton could explore ways to introduce a municipal feed-in tariff (FIT) through Capital Power. For example, Sacramento Municipal Utility District (SMUD) is required to purchase energy from eligible renewable energy resources and combined heat and power installations. SMUD customers eagerly signed up for the program, filling the queue, which had a limit of 100 MW of total capacity[20].

Revolving fund financing

A major barrier to the advancement of renewable energy is access to financing. Municipalities can directly provide financing to green energy developments. This could be accomplished through a revolving fund that residents must apply for in order to receive funding for renewable energy projects. As initial applicants repay the loan, funds can be made available to additional residents for more renewable energy projects. Berkeley's Financing Initiative for Renewable and Solar Technology (FIRST) is an example of clean energy municipal financing in development by the City of

Berkeley that will provide the up-front funds for residential and commercial property owners to install electric and thermal solar systems and make energy-efficiency improvements to their buildings. Berkeley has committed to providing funding for the program by issuing a special tax bond that is repaid semi-annually over 20 years through special taxes collected on only the property tax bills of participating property owners.[21]

Education

Internal and external education can build awareness of renewable energy opportunities. The City of Edmonton could advance green energy through funding courses for city staff as well as the general public. Raising the awareness of the city staff is an important step toward increasing renewable energy installations in an urban environment. City inspectors and municipal development officers can learn about alternative energy options, installation and operation.

Greening Edmonton's Electricity Supply

The impacts of coal-powered electricity are among the most significant impacts of all of the energy that is consumed in Edmonton. Cleaning up the energy supply for the City of Edmonton will contribute substantially to cleaning up Alberta's overall electricity system.

Procurement Policy

As a large customer and majority shareholder of Capital Power, the City can seek a contract for the provision of up to 100 per cent low-impact renewable power for city operations. For example, the City of Calgary currently buys 80 per cent of their electricity from wind power, and has committed to increasing that amount to 100 per cent. An earlier and smaller step by the City of Calgary was the "Ride the Wind" program, though which the city purchased enough wind energy to power their C-train operations. As a way to support residential renewable energy development, the city could procure a portion of its electricity requirements from residents who sell excess power back to the utility. A premium paid for this electricity would provide incentive for residents to install systems larger than what would be required to meet their own needs.

Community ownership

The City of Edmonton could facilitate the development of a community energy cooperative. Toronto's WindShare offers a model for how this could be accomplished. An initial grant to the cooperative was provided to study potential sites for the wind turbine placement. Following that, the cooperative began a community outreach program and held public information meetings across the Greater Toronto Area, which led to a membership and investment campaign in support of potential wind power projects. WindShare installed the only urban wind turbine in Canada through the support of 427 members who had invested, on average, $2000 each. WindShare is now broadening its sights, and has proposed a 20 MW wind farm called Lakewind near the village of Bervie, east of Kincardine, Ontario.[22]

Appendix A: Select Municipal Policy and Strategy Examples

Medicine Hat, Alberta

The city council of Medicine Hat set aside $1 million in 2005 for renewable energy development[23].

The city organized seminars on solar energy free to public[24] and has invested directly in a 5 kW concentrating photovoltaic panel project[25]. The city's *Municipal Development Plan* requires that solar orientation of buildings and properties be considered in new property development."[26]

Of particular interest is the city's Built Green project. The city sold municipally owned lots for housing on the condition that buyers install solar systems: "Successful participants must commit to building a home certified to the Built Green bronze standard or higher, install a solar water heating system, and a microgeneration system (solar or small wind) to supplement household electricity needs." In addition to the requirement for renewable energy development the city is also offering various incentives totaling up to $10,000 for each home constructed under the program[27]:

- $1,000 to offset costs of Built Green bronze certification
- 50 per cent of the installed cost of a solar water heating system up to a maximum of $3,000
- 50 per cent of the cost associated with a PV installation (or wind system) up to a maximum of $6,000

Okotoks, Alberta

The town Okotoks now purchases 80 per cent of its energy requirement for municipal infrastructure from renewable sources.

The Town established a "Green for Green" Eco-Efficiency Revolving Fund in 1999. The Fund uses initial grant seed investments to fund energy conservation initiatives, and applies energy consumption savings to investment in new energy conservation initiatives. The operating energy budgets remain constant; savings are diverted back to the fund until the investment is paid in full. Operation of a fund in this manner focuses tracking of energy conservation performance measurements and provides the accounting framework and initial investment pool to nurture longer-term return on investment.

The fund was initially tapped (1999) to complete a facility audit of 18 municipal facilities, energy-efficient lighting retrofits for various municipal buildings, mechanical equipment retrofits in several facilities, and expansion of recycling and composting programs. It has been more recently utilized to fund solar initiatives.

In 2001, a multi-year solar energy technologies initiative was implemented in order to lower municipal building operating costs and reduce greenhouse gas emissions.

- Okotoks implemented five main solar projects:
- Swindell's' Pool - Solar Water Heating System
- Murray and Piper Arenas - Solar Ice Resurfacing System
- Recycling Centre - Cardboard Bailing Building Solar Heating System
- Operations Building - Solar Wall Heating System
- Recreation Centre Expansion - South Face Solar Wall

Energy consumption reductions ranging between 15 per cent to 80 per cent, directly attributed to the use of solar energy, have been observed as a result of these installations.

The Town's sustainability leadership in part also led to the siting of the Drake Landing Solar Community (insert web link), Canada's most advanced solar housing, and among North America's most energy efficiency housing.[28]

Dawson Creek, British Columbia

Dawson Creek has emerged as an environmental leader at a municipal level and has supported research into the potential for solar in the community (potential for some 2,100 solar hot water systems and up to 22 MW of solar PV in the residential sector)[29]. In order to realize this potential the municipality has undertaken several other initiatives:

- All new homes must be built 'solar ready'.[30]
- Local improvement charges (LIC) are being employed to help finance solar installations
- Efforts are being undertaken to install solar hot water systems on municipal buildings. "One of our goals is to install solar hot water systems anywhere we (ie municipal buildings of Dawson Creek) heat water with natural gas."[31]

Austin, Texas

Austin has among the most aggressive program of any US community to promote solar energy. Austin had a goal of 5 per cent renewables by end of 2004; and has a goal of 30 per cent by January 1st 2020[32]. Specific to solar "Austin Energy also committed to develop 15 megawatts (MW) of solar generating capacity by 2007, increasing to 100 megawatts by 2020".

Austin has developed municipal Green Building standards for all new buildings which award points for solar[33]. Austin adopted zoning laws that encouraged builders to orient homes and other buildings for maximum sun exposure during the winter, and minimum exposure during the summer[34]. The City of Austin also built an interactive map illustrating solar initiatives[35].

In addition the municipal government offers the following financial incentives[36]:

- PV rebate: $4.50 per Watt installed.
- Solar thermal: Rebates from $1,500 to $2,000
- Municipal tax credits: 30 per cent up to $1,000
- Loans of up to $20,000 are available with terms as long as 10 years.
- No fee
- No closing costs up to $400
- No lien required on loans up to $15,000
- No prepayment penalty

Gainesville, Florida

Gainesville, in December 2008, announced the first municipal level feed-in tariff in North America[37]. The municipal utility of Gainesville Regional Utilities introduced the feed-in tariff aimed at specifically at solar PV which guarantees $0.32/kWh until 2028. The tariff is set to come into force March 2009. Municipalities (eg City of Aachen) pioneered the concept of feed-in tariffs in Europe where they are now common at a federal level.

Selection of Municipal Policy Approaches and Precedents

Policy Approach/Precedent	Example of Municipal Precedent	
	Country	Municipality
Renewable energy development fund	USA	Minneapolis
Leasing opportunities given priority to tenants who invest in solar	Australia	Adelaide
Property tax exemptions/credits	USA	Austin
Low interest loans	USA	Austin
Underwriting loans	USA	Austin
Bylaw that require solar	Spain	Barcelona
Need to consider solar orientation when siting buildings on lots	USA	Austin
Need to consider solar orientation when building streets and communities	USA	Madison
Land sale conditional on solar installation	Canada	Medicine Hat
Municipal R&D funding	Canada	Medicine Hat
Bulk purchasing	USA	Chicago
Grants/donation of solar panels to specific projects	USA	Chicago
Procurement conditional on local manufacturing	USA	Chicago
All new houses must be built "solar ready"	Canada	Dawson Creek

Endnotes

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