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NATURAL RESOURCES CANADA COMMUNITY ENERGY PLANNING - 2007



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COMMUNITY ENERGY PLANNING GUIDE

Community Energy Planning is an issue that is very much in discussion in municipalities across Canada and elsewhere. The availability of future supplies of inexpensive energy cannot be guaranteed and preparatory steps need to be made by municipalities to ensure their long term growth. The basis of the Factor-2 community is a 50% reduction in its dependency on fossil fuel. This document provides guidance for the community to develop the plan that consolidates their ideas, identifies programs and activities and helps them put them into action.

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- 2 [PROGRAMS AND PROJECTS](#) – An outline to energy efficiency programs and other activities can be undertaken within the community. [Go to Page 142]

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FACTOR-2 COMMUNITIES

PLANNING YOUR COMMUNITY WITH ENERGY IN MIND



COMMUNITY ENERGY PLANNING GUIDE

Executive Summary (Developing the Factor -2 Community)

Factor-2 means a factor of 2. It means 50%

It means developing a community that is 50% less dependent on fossil fuels and it need not be a dream of the future. Technologies exist today that significantly reduce the impact on the community of the fossil-fuel marketplace, but too often these approaches are discounted. Critics cite “too long a payback” or claim that they are “not standard practice” and should therefore be rejected. Proof exists that advanced street design can reduce underground infrastructure by 33%, that the elimination of suburban developments decreases transportation needs by up to 40%, that renewable energy technologies improve air quality, and that Combined Heat and Power or District Energy reduces emissions by 35%. Large-scale integration of these practices can reduce a community’s environmental impact by 30–40%. A community energy plan as described in this guide positions these technologies and changes as a roadmap, heading the community towards its sustainability goal.

Energy in all its forms is a principal component in any activity, food, or textile performed or consumed within a community. It is, without doubt, the community’s greatest expenditure, and the degree to which we manage our energy supply and demand dictates the quality of life within our communities. Every dollar spent on energy, directly or indirectly, is a dollar that cannot be invested in the community, a dollar that cannot raise the capacity of the community and cannot increase the competitiveness of the local economy and its ability to grow the community.

Managing energy does not mean cutting back, nor does it mean reducing your community’s standard of living. Rather, it means gaining an understanding of the role of energy within the community, where the energy originates, and how best to supply and use it. A core element in the community energy plan is the reduction in use of fossil fuels by their replacement with renewable or local energy sources. This action creates significant autonomy within the community and retains earned income. It is fact that only when the local economy thrives can the national economy truly succeed.

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1: Planning the Community

Factor-2 communities represent the application of design practices, policies and technologies that can reduce a community's demand on non-renewable resources by up to 50% over current practices. The result will lie within the community's own sustainability framework and provide a high standard of living and thriving eco-structure.

The community promotes good design, and through good design it manages its energy supplies and demands, making community members more aware of alternative techniques and less dependent upon fossil fuel or the conventional energy-related marketplace. The community becomes more resilient in dealing with the fluctuations of the national or global economy.

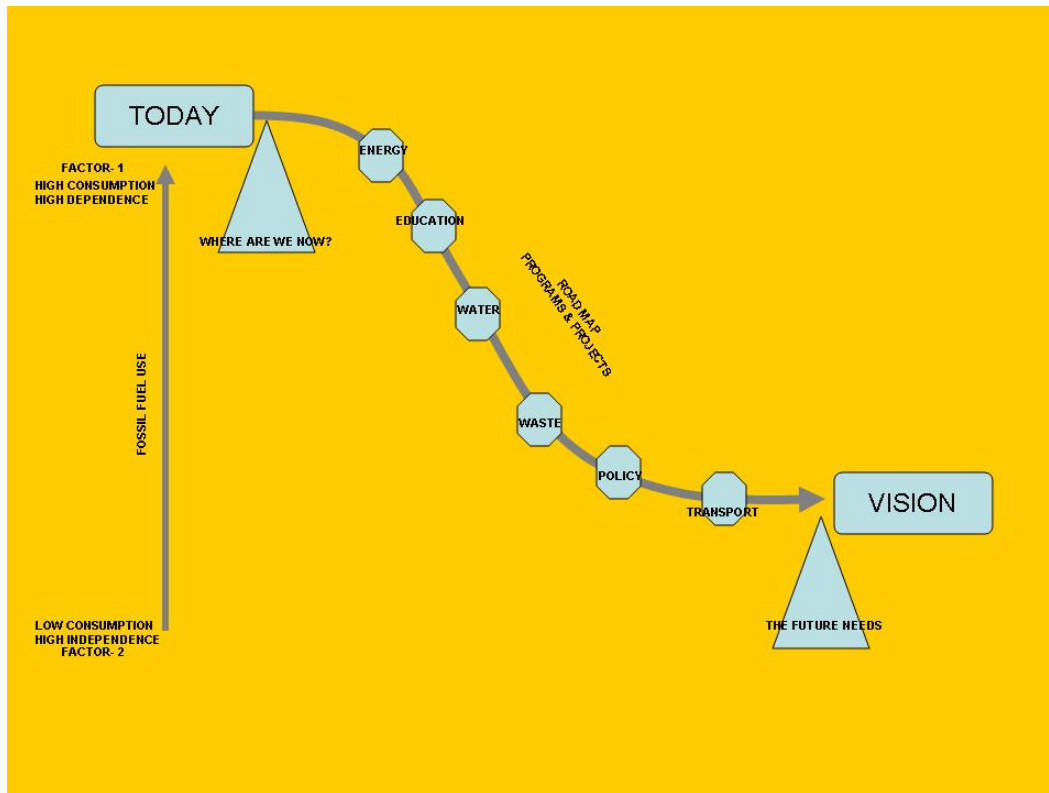
Factor-2 communities cannot just occur – they need a plan – a **community energy plan (CEP)**. The CEP is the first step on the structured pathway to implementation and serves as a framework for the community to understand the role that energy plays within their lives, the role that it plays in planning for future growth and the role it plays in protecting the environment.

This guide has been developed based upon a variety of sources to aid communities in planning and implementing their Factor-2 community practices. The process is outlined graphically, overleaf. By selecting and configuring energy related activities, the community may structure a long-term strategy to reduce its fossil energy dependency and encourage local self-reliance. The exact level of reduction will depend on the sustainability goals set by the community, the practices chosen and the extent of their application.

Pathway to the Factor-2 Community - the 5-step framework

- 1. The Vision***
- 2. Where are we now?***
- 3. The Future Needs***
- 4. The Road Map-
programs & projects***
- 5. Implement & Monitor***

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This guide is complex and to some it may appear intimidating and possibly confusing. However, the process comes in stages; each stage is independent but they should nevertheless be followed in order — first the vision, then the current status and the expectations of the future community, and finally the programs and projects needed to reach that goal. For best results the guide operates in conjunction with its sister document [Programs and Projects](#), which details a range of activities that can be used to reduce the community's overall dependence on fossil fuel.

1.1 Why a Factor-2 community?

Current municipal planning rarely considers the role of energy in terms of supply or use. It is traditionally the responsibility of the electrical or gas utility, not the municipality, to deal with the issue. However, residents of the community pay the cost of energy supply as well as the costs of its distribution. When viewed in total, the financial outlay attributed to the consumption of energy generated by the lifestyle within the community is far greater than simply the supply of energy or gasoline.

A community that is spread out, with few local services or amenities, will spend a greater proportion of its income on energy to the detriment of the local economy.

Energy is an everyday consumable that takes a variety of forms: electricity, gas, propane or wood for building heat, electricity for motive power, and fossil fuel for vehicles and manufactured products. But it is also used in the production of the food we eat and the clothes we wear. The degree to which energy, its form and its availability affect our lifestyles is often underestimated.

Energy versus food?

Research in Britain¹ estimated that the average family of four, in a single year, would emit 4.2 tonnes of greenhouse gas from their home, 4 tonnes from their vehicle, and 8 tonnes from the production, processing, packaging and distribution of the food that they eat.

“(the) distance question highlights a problem of our entire food system, including organic: our love affair with airlifted, railroaded, tractor-trailer delivered grapes in December or tomatoes in February. Often this produce comes from Mexico or Chile or some other far-away place, and



- from Greece?

¹ Elm Farm Research Centre **Eating Oil – Food Supply in a Changing Climate**. 2001.

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its cheap price belies the waste of energy used to transport it to our tables.”

*... "It costs 435 fossil fuel calories to fly a 5-calorie strawberry from California to New York."
(published December 24, 2004, by [Counter Punch](#). Archived on February 23, 2005)*

*“ when iceberg lettuce is imported to the UK from the USA by plane, the energy ratio is only 0.00786. In other words 127 calories of energy (aviation fuel) are needed to transport 1 calorie of lettuce across the Atlantic. If the energy consumed during lettuce cultivation, packaging, refrigeration, distribution in the UK and shopping by car was included, the energy needed would be even higher. Similarly, 97 calories of transport energy are needed to import 1 calorie of asparagus by plane from Chile, and 66 units of energy are consumed when flying 1 unit of carrot energy from South Africa.”
(Published on April 1, 2005, by [Powerswitch \(UK\)](#))*

Energy versus textiles

“The Goodyear Tire and Rubber Co. and Cooper Tire & Rubber Co. have each raised prices twice this year because synthetic rubber is made from chemicals derived from oil. Each \$1-per-barrel increase in the price of oil costs Goodyear an extra \$20 million per year. “

*“Paint manufacturer Sherwin Williams Co. of Cleveland framed the impact of rising energy prices this way: For every 10 percent increase, the raw material costs for a gallon of paint go up more than 1 percent.”
(Brad Foss - the Associated Press, July 1, 2004)*

Energy versus “globalization”

Just how energy inefficient the food system is can be seen in the crazy case of the Swedish tomato ketchup. Researchers at the Swedish Institute for Food and Biotechnology analyzed the production of tomato ketchup. The study considered the production of inputs to agriculture, tomato cultivation and conversion into tomato paste (in Italy), the processing and packaging of the paste and other ingredients into tomato ketchup in Sweden and the retail and storage of the final product. All this involved more than 52 transport and process stages.

The bags used to package the tomato paste were produced in the Netherlands and transported to Italy, filled, placed in steel barrels, and then moved to Sweden.



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The 5-layered, red bottles were either produced in the UK or Sweden with materials from Japan, Italy, Belgium, the USA and Denmark. The polypropylene (PP) screw-cap of the bottle and plug, made from low-density polyethylene (LDPE), was produced in Denmark and transported to Sweden.

Additionally, LDPE shrink-film and corrugated cardboard were used to distribute the final product. Labels, glue and ink were not included in the analysis.
<http://www.sustainweb.org/pubslst.php>



In the production of soya flour and corn syrup, used in the processed food industry, the three highest costs are: raw materials and fertilizer, packaging, shipping. All require fossil fuel. (General Mills Inc, Globe & Mail, March 22, 2004)

These examples demonstrate the extent to which the food system is now dependent on national and international freight transport. Tear up the arable land and we are forced to import food from great (and often unrealistic) distances. There are many steps involved in the production of food, textiles, etc. and they likely involve transportation: the production and supply of nitrogen, phosphorous and potassium fertilizers; pesticides; processing equipment; farm and process machinery. They depend on fossil fuel or its derivatives. To paraphrase Jane Jacobs, the elimination of imports will strengthen a community through the utilization of local resource



At your next group meeting, ask everyone in the room how much they spend annually on oil, gas, electricity and gasoline. Then sum the total and scale it to the number of people in your community. You'll be surprised how much money leaves your community!



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Factor-2 communities look beyond the heating, cooling and power used in the locality – they consider the lifestyle engendered by the design of the community.

The Factor-2 community promotes good design, and through good design it manages its energy supplies and demands. This does not mean a reduced quality of life, nor does it mean the elimination of economic development within the community.

Belling the cat:

We need to dispel certain fallacies concerning Factor-2 communities.

Firstly: energy management does **not** mean increased costs.

Secondly; energy management should **not** imply energy reduction, and

Thirdly: energy management does **not** mean a reduction in the quality of life.

Experience gained from existing best practices suggests that, with an integrated plan, the community could significantly improve performance:

- The application of combined heat and power as a principal energy supply regime reduces fuel consumption by up to 40% and GHG emissions by 30% (several [Canadian District Energy](http://www.environmentalchoice.com/) systems have qualified for Eco-Logo status²).
- The encouragement of live/work developments in the downtown core reduces transportation needs by up to 40%.



Cogeneration engine being installed in the Hamilton Community Energy System

Live-Work development avoids traffic



(Lennox Village, Tennessee)

² <http://www.environmentalchoice.com/> - Markham District Energy Corporation, Hamilton Community Energy System and Revelstoke Community Energy System have all qualified as Eco-Logo systems

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- The preference for increased residential concentrations in downtown cores reduces the demand for water and hence the need for water treatment. (Typically 40% of [water demand](#) for suburban developments is for irrigation, and through management of water consumption patterns communities may reduce their water pumping needs by 15%.)
- Research has shown that with the fused grid style of urban road design, infrastructure costs may be reduced by up to 33%.
- The [economic viability for district energy](#) increases with reduced property setback distance.

Many “design guidelines” in use today were developed in times when building techniques and materials prohibited integrated development, or close proximities, or when the car was king. City Hall has the authority to modify many of these conditions or institute overruling bylaws and encourage increased density and reduced unit costs.

City Hall should be encouraged to examine its bylaws to identify the contradictions.³

1.2 What does it cost?

There are two “costs” involved in developing a Factor-2 community. The first is the financial cost associated with the **physical components** (houses, infrastructure, etc.), which will depend upon the design, options and the ability of the consultants to move with the times. The second “cost” is the one associated with **change!**



Drought-tolerant gardens

Rules steeped in History

The distance between two adjacent buildings was set as a result of timber framing and vinyl siding. The risk of fire required a certain lot width. A change in materials (stucco or brick) would reduce this risk and allow smaller lot sizes.

Road widths are set by the turning radius of fire trucks. Answer: buy smaller fire trucks!

³ <http://www.wcel.org/wcelpub/2002/13724.pdf#search=%22cutting%20green%20tape%20wcel%22>

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Consider this: If the status quo remained, what would it cost to **the community as a whole** to continue to

- construct low/medium quality housing that had high heating and maintenance costs? (low-income families may spend upwards of 30% of disposable income on direct energy costs⁴)
- construct sprawling subdivisions outside town with no amenities, making the use of cars inevitable? (obesity has risen steadily in conjunction with the increase in sprawl and the need for transportation)
- give away prime agricultural land for rampant big-box stores (or worse still, car dealerships)?
- force residents to commute an hour to work? (transportation emissions constitute ~19% of Canada's GHG inventory, with private vehicles making up two thirds⁵)
- bus children across town because safer access was not available?
- depress the downtown business economy by building suburban mega-malls? (town-centre stores are shown to provide 2.5 times the input to the local economy than suburban malls⁶)
- degrade the water table through uncontrolled agricultural/industrial practices?

Or, consider what it would cost the **community as a whole** to

- demand the construction of higher-quality buildings with reduced energy demand that even low-income earners could afford (British social housing cooperatives). utilize locally generated combined heat and power to keep rents low)

Energy - A Marketing Tool?

*The **District Energy System** in the Town of **Markham** has changed the face of Markham. Firstly it has been credited with attracting business to the area and secondly, it has been credited with bringing a sustainability lens to Council.*

Similarly, in Vancouver, the City encourages certain types of commerce to locate in the downtown core, where Central Heat Distribution provides their heating needs. Those tenants include a brewery and numerous restaurants.

Energy as an Environmental Cleanup Tool?

***Energy Revelstoke** is a community energy system in **Revelstoke, BC**, is a joint venture between the City and a local lumber mill. The use of wood waste from the mill enables heating to be supplied to the town while eliminating an air quality problem that has plagued the community for many years.*

⁴ Lorinc, John. **The New City**. Penguin Canada 2006.

⁵ Natural Resources Canada. **Canada's Greenhouse Gas Inventory 1900-2002**.

⁶ Civic Economics, **Lamar Retail Analysis, Local Merchants versus Chain Retailers**, 2002.

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- design downtown cores to encourage year-round community activities.
- improve the economics of transit through the use of mixed and compact developments near transit nodes.⁷
- improve air quality by encouraging walk-ability and accessibility.
- increase economic development by encouraging the use of local resources, farmers' markets, organic produce, etc.
- encourage local economic development through local generation and stable energy pricing.
- reduce the infrastructure needs (and costs) by encouraging natural storm water drainage and protection of wetlands.
- reduce infrastructure needs by utilizing existing buildings for mixed activities (schools/recreation centres, etc.).

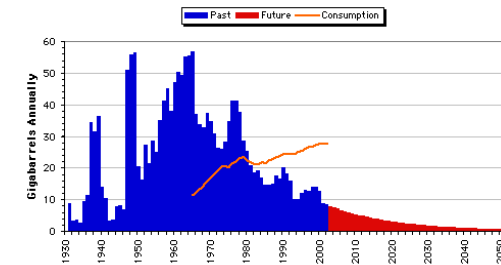
External Issues:

Communities must also consider external geopolitical issues and maybe ask themselves questions such as: how could we maintain or improve our quality of life if our conventional energy supply structure was to fail?

This is not scaremongering. The question reflects an acknowledgement that a community's well-being as inter-woven with the surrounding environment. Decisions made in the residential, commercial and industrial sectors impact each other and cannot be made in isolation.

A Factor-2 community requires council to set the comprehensive vision, including areas that may not normally have been considered within the municipal scope.

⁷ International Economic Development Council - **Economic Development and Smart Growth – 8 Case Studies on the Connection between Smart Growth and Jobs, Wealth, and Quality of Life in Communities**, 2006.
http://www.iedconline.org/?p=Smart_Growth



How does this affect your community?



Katrina - 2005

Kelowna-2004



*The **Hudson Decision** opened the way for municipalities to control activities within their jurisdictions that affect the welfare of the community. More details: <http://www.sierralegal.org/issue/hudson.html>*

2: Developing the community energy plan.

Implementing the plan will move the community to a more sustainable footing. Often, a community already possesses much of the information that would form a CEP, created during other planning activities, but in isolation from other information components. The task therefore becomes one of coordination: getting a variety of departments to share their knowledge and expertise and create an overarching plan. In other communities, the information may not be immediately available and may require the creation of a new plan. This will naturally take time, effort and resources. It will call for research, facts, figures and discussion, wide-ranging and thorough documentation, not to mention reporting and extensive consultation. It will ask:

Who should do the work?

How long will it take?

Who are the right people to involve in such a task?

And who will fund the effort?

Think before starting! Time spent in preparation will save time and money later.

Basic concerns:

1 Who can do the work?

Several possibilities exist. If the plan is a municipal directive, then municipal staff will probably be responsible, maybe with the help of a consultant. Care should be taken here since many consultants are unfamiliar with the exact nature of the work. For example: the Federation of Canadian Municipalities' Partners for Climate Protection (PCP) program asks communities to develop inventories of community GHG emissions. The rules were clear but the report quality varied greatly.

Consultant Selection

Engaging a consultant can be a harrowing experience – with the ever-present risk of not getting what you want, or paying through the nose. But not all consultants are like that, and the majority take great pride in their work. Consultants work best when they have clear direction.

Natural Resources Canada and **Halifax Regional Municipality** have created a Request for Proposal template that spells out the expectations of both community and consultant. (Appendix F – page 132)

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Similarly, if it was the community that initiated the plan, then perhaps the **Planning Advisory Committee**, present in many municipalities, could be the ideal vehicle to be given the mandate to manage the task. If no such committee exists, then the onus will likely be on volunteers, maybe with help from the municipality. *Municipal councillors, municipal planning departments* or other *community associations* can also perform valuable coordination roles.

As the plan progresses, you'll probably find that the scope of the study and the range of required interests expand. You'll be asking questions and seeking advice in areas where you may need additional specialized knowledge. The plan will cover more than one line of interest, so from the outset, start broadening your network of contacts.

Think about including people such as:

- ☒ Local business and industry, including industry associations and unions
- ☒ Utility companies
- ☒ Educational institutions
- ☒ Community and nongovernmental organizations
- ☒ Local media
- ☒ Interested residents and local professionals



(Photo – anonymous)



Your work-crew - the Planning Committee?

One of the first tasks will be to select the number and type of representatives. Depending on available funding and other resources, these members may be: volunteers, paid staff, independent consultants, academics, professionals or students. Start planning your network – you will need it!

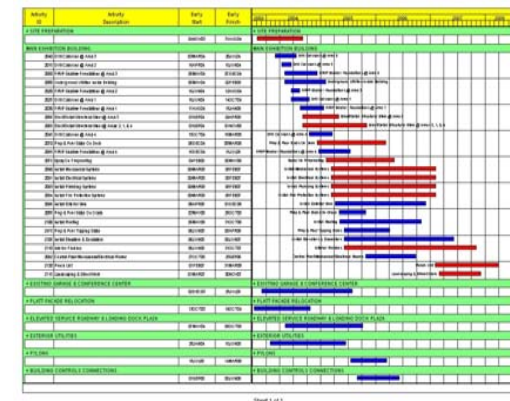
The ideal crew would comprise people who are both knowledgeable technically and respected at the local level. Unfortunately these people are often the busiest and a compromise is often necessary – perhaps calling for someone who is technically knowledgeable but also has the strong support of senior management.

2 How long will this process take?

Development of a plan depends on the size of your community, the depth to which you go (i.e. whether it is a single issue energy plan or a more comprehensive, sustainability plan), and the level of interest shown by its members. Data collection and public consultations are the key culprits for consuming time and resources, largely because of the variety of discussion required (and hassles over privacy issues that may arise). Based on experience to date, an estimate of 6 months to 2 years should be considered.

3 Who will fund the effort?

The development of a plan, if undertaken as part of the municipal agenda, would be funded as part of the annual City Hall budget. However, this may not always be possible. Even when handled entirely by volunteers, the development of a plan will undoubtedly cost money, if only to pay for advertising, public meetings, printing, etc. For large-scale plans, the estimated cost may easily exceed the budgetary capacity of the group.



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Appendix E references a variety of funding sources that might be approached to support planning activities.

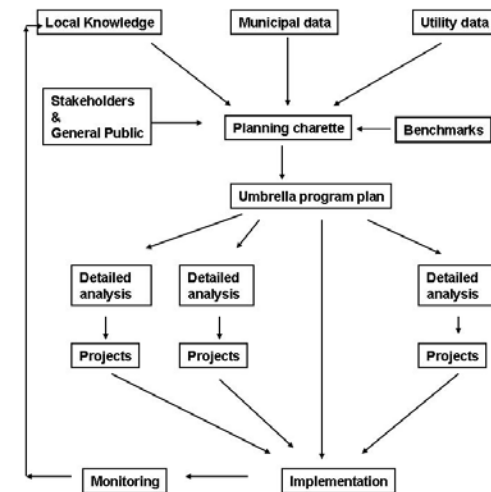
4 CEP or CEP-LITE?

In smaller communities the development of an energy reduction strategy through a full-blown CEP process may be seen as overkill! Much of the information required exists as “local knowledge,” available but not necessarily recorded on paper. It is general knowledge, based on intuition and personal; experience throughout the community. In this case a revised version (**CEP-LITE**) might serve to provide appropriate direction.⁸

It should be remembered, however, that even though the process may be shortened, the questions remain the same and the same degree of consideration should be given to the process. A lengthy planning procedure becomes a few rational steps that rely on local knowledge that can be combined with specific utility and municipal data within a two-day [planning charette](#). The concept of the charette is to provide a session for focused discussion with the intent to provide conclusions and answers for further work. It is not a progress meeting to identify the need for further measurement or data; its purpose is to obtain [consensus](#) on potential solutions.

Although shorter in duration, the process still requires careful thought and preparation. The stakeholders must do a lot of homework prior to the charette. They should think carefully about the community, their vision for the area and the CEP process **as it applies to their field of expertise**.

With the introduction of the federal/municipal gas tax agreements (2005-2010), a certain portion of the proposed funding may be allocated to long-term energy planning. Municipalities should contact their municipal associations for more details.



⁸ This approach might also apply to regional plans or rural communities where activities are varied or when transportation limitations make getting people together for regular meetings difficult.

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To make best use of CEP-LITE, it is helpful to create a questionnaire to pose some probing questions about the community.

A [Community Sustainability Assessment](#) (CSA) document has been developed by the Global Eco-Village Network to address the role of the citizen within the community. The questionnaire often takes participants several hours to complete (longer if done as a group) and is exhaustive in scope.

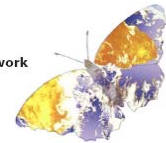
Drawing the group together will allow discussion to advance rapidly since participants will be already “up to speed” with the process and able to contribute constructively at the outset. If you are designing your own questionnaire, the focus should be on the purpose of the community and the integration of the variety of lifestyles existing within the community as a whole. This would become apparent in a regional or a small town/rural situation, where the integration of rural and urban practices would impact the sustainability of the area as a whole.

If data is unavailable for the participating communities, then practical results may be obtained by using benchmarks from similar communities as proxy data. This would make it possible to identify community issues and integrate future activities.

The outcome would be an “umbrella” plan of programs that would guide council and the community in developing the more detailed plans and projects as and when resources became available.

COMMUNITY SUSTAINABILITY ASSESSMENT (CSA)

Developed by
the Global Ecovillage Network
www.gaia.org



Agreements!

Unanimous – an absolute agreement by all parties

Majority – agreement by more than 50% of the party.

Consensus – agreement by all that they can “work with the solution”

2.1 Elements of the successful plan

Developing a functional Community Energy Plan should not be a technically difficult task: the challenge will lie in selecting future targets that are both realistic and within the capacity of the community. It will be necessary for members to assess, truthfully, the effectiveness of the various proposed solutions in relation to the targets. Getting the right match will depend on your understanding of the community and its desire to develop future community resiliency. More importantly, it will depend upon the mechanisms in place to translate the plan into a living document capable of reflecting the community's needs without succumbing to the pressures of short-term budgetary upsets.

Inject flexibility into the plan without creating too much redundancy and cost. The goal is to maintain an affordable plan that combines the collective **desires** of community members with the **technical expertise** of your planning team and the **capacity** of the community to deliver.

1 – The feedback loop

It is sometimes difficult to accept the recommendations of the feedback process. Members struggle with consensus, only to be bombarded with criticism from all sides. There is a natural tendency to resist these recommendations, but feedback is the representation of learned information that can be used to improve the ability to implement the CEP and to confirm and strengthen the direction of the planning process. Without feedback the finished product lacks credibility and authority. For communities without authority for planning (and perhaps without official plans or planning departments), public approval and support may constitute the only local “authority” for implementing the plan.

Okotoks

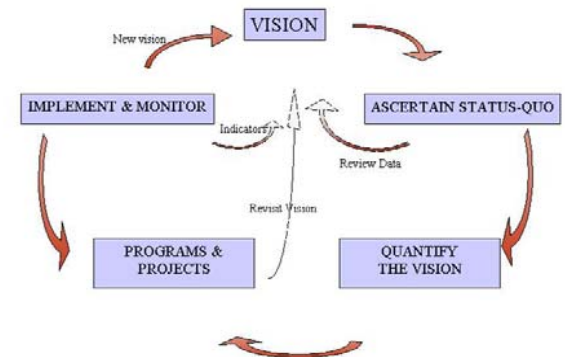
*The town of **Okotoks**, Alberta undertook an extensive public survey to determine the criteria that should govern the growth of their community. The recommendation of the people was that growth should be limited by the carrying capacity of the Sheep River, their water supply. This decision has been challenged and has withstood three successive municipal elections. It was the will of the people!*

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The vision and its direction will likely undergo change during the planning process. This is natural and is not due to some inherent fault in visioning. Rather, it is a refinement in response to new information, such as

- results from gathered data,
- unplanned events,
- funding availability,
- involvement of stakeholder groups,
- other results from monitoring and evaluation

Feedback will help you stay on track and include any information collected along the way. Feedback loops can be incorporated at any time during your process. The adjacent figure demonstrates the feedback loop by using it three times within the five-step framework.



The Feedback Loop

- A feedback loop is first used when quantifying your vision. Data is collected and reviewed against the goals of the vision to provide the objectives and targets. New information gathered during the initial data collection process is incorporated into the CEP and may modify its direction.
- The feedback loop is used again when developing the programs and projects to meet the objectives and targets. The vision is reviewed at this stage in order to design programs and projects that will lead your community towards your vision of sustainability.
- The third stage involving a feedback loop is after the implementation of the projects. Data that is collected (project indicators) and is reviewed against the vision to determine your ability to achieve your goals.

Depending on the results, a new plan with a new direction may have to be developed. This new plan will incorporate information and lessons collected from the feedback loop.

2 – Community engagement

To implement a plan there needs to be consensus – all parties need to accept that there should be a plausible and realistic plan. It must reflect *the collective desires and ambitions of the community* while creating the resiliency and security that sustainability entails. This sounds like motherhood, but ***it is the community that must invest in the product***, either in the built environment or in lifestyle changes.

Studies demonstrate that while most community members indicate an interest in being consulted in a decision-making process, most do not want to get involved unless it is an issue that affects them in some meaningful way.⁹

To ensure that members take an interest, you can use a number of communication mechanisms.

1 Too technical? – Everyone has other obligations in his/her life, and will prioritize their time accordingly. The planning activities can often be perceived as long and technical in nature. While this style may be useful for planners, it is perhaps not so for other community members.

2 Is it “PlainSpeak”? - To encourage community members to become involved in the planning process, make the energy concepts and measurements available in easily understandable terms and in user-friendly formats. The best way of doing this is to match formatting style to the level of interest of each audience group (e.g. industry trustees, city councillors, the public, students).¹⁰

Communications Mechanisms

- o News releases for local newspapers, television stations, and radio stations
- o Reports, brochures, websites, speeches, videos, scripts, and newsletters
- o Surveys and polls to conduct formal and informal research to determine public opinion and attitude as a basis for planning and action
- o Answer public and new residents request for information
- o Plan news conferences, convention exhibits, new facility and anniversary celebrations, contest and award programs, tours, and special meetings
- o A small flier or an invitation to a meeting or ‘open house’, included with the monthly bill from the utility sector to the public
- o Communication is a two-way street: listen to your intended audience
- o Municipal newsletters!

⁹ White, Michael, **Public Involvement in Municipal Priority Setting: the City of Vancouver's Public Involvement Review.**

¹⁰ Alexander, Don et al., **Public Participation Process for Community Energy Planning.**

Examples of communication tools

- o *User-friendly information that matches the level of interest and addresses the specific needs of the intended audience.*
- o *Layout and formatting of information materials using attractive colour schemes, text boxes, and images to help the reader stay interested in the text information.*
- o *Comparative examples to explain technical issues in terms that relate to the audience interests. For example, if you wish to explain to the general public the rate at which urban sprawl decimates agriculture land, a measurement may not have the same impact as a comparative example using everyday concepts: “urban sprawl eats up 3½ football fields in 1 year, which means that 200 kilos of potatoes and 150 kilos of butternut squash have been taken out of local production permanently*

3: STEP 1: Develop the vision

Constructive change is possible only when the community knows where it is going and why it is going in that direction. The initial stage in developing any form of plan involves the development of an end-state.

Where are we going?

The vision defines the future of the community. It allows the community to express itself in terms of its economic, environmental and social ambitions. It sets its sustainability goals. They may imagine themselves as a self-sustaining, back-to-nature village or a modern high-tech community with leading-edge facilities. Whatever the community sees as its future state, the vision defines the boundary conditions and indicates the tools required for the route forward.

The Strategic Planning and Program Planning for Nonprofit Groups program¹¹ defines the *vision* as the “future destination; it provides an image in words of what success would look like. It is built on reasonable assumptions about the future.”

Community visions are not new, but it is surprising just how many communities do not have one. It is often easy to tell, when meeting with community leaders, whether a vision has been established, and, more importantly, whether the community believes in that vision - there is drive, enthusiasm and purpose to their actions.



The idyllic vision?

Examples of Vision Statements and processes
– See Appendix A-page 97

Communities without a long-term vision seem to drift on the political and economic tides!

¹¹ Environment Canada and Health Canada, **Planning for Change**.
http://www.ns.ec.gc.ca/community/cap_planning_for_change_workshop/5.html

An example of the finished product might be..... **Winnipeg – CentrePlan**¹²

A vision of community and belonging

In our vision of the future, the downtown exhibits a strong sense of community and belonging. People are safe, secure and welcome. The downtown prides itself in the strength of its neighbourhoods, providing them with stability and opportunities for personal enrichment. Strong networks are in place to facilitate interaction and support among citizens, the business community and local government. The downtown is a compassionate, caring, humane place characterized by tolerance and social harmony. People are valued, included, accepted and treated with dignity. The downtown welcomes new Canadians. It is proud of its ethnic diversity. It respects and honours its aboriginal ancestry, recognizing their pivotal role in the success of the downtown. The downtown is a place for everyone, where opportunities are shared equally.

A vision of prosperity and innovation

In our vision of the future, the downtown is characterized by prosperity and a spirit of innovation. It offers a range of opportunities for commerce, culture, and living all integrated to form a rich and diverse environment. It is the centre of employment, new technology, life-long learning, and education. New ideas are continuously explored and developed in a manner that is interlocked with the environment, the economy, and the social fabric – sustainability. The downtown offers optimism for future generations.

A vision of effectiveness and efficiency

In our vision of the future, the downtown is a model of effectiveness and efficiency. It provides appropriate services to residents, workers, and visitors, and provides them in a way that demonstrates a commitment to excellence. All downtown uses are well integrated to create a very liveable, comfortable, clean and aesthetically pleasing environment. The downtown is very accessible from all parts of the city and provides good orientation and convenient linkages to activity centres within its boundaries. The downtown works well for everyone.

A vision of soul and personality

In our vision of the future, the downtown has a soul and personality all of its own, one that is vibrant and energetic yet warm and caring. It reflects Winnipeg's status as a capital city



Portage and Main, Winnipeg



Downtown development, Winnipeg

¹² http://www.winnipeg.ca/ppd/pdf_files/1vis_strat.pdf#search=%22winnipeg%20centre%20plan%22

and the heart of government, law and commerce for the province. The downtown embraces its unique landmarks – Portage and Main, the Forks, the Golden Boy, the Red and Assiniboine rivers. It exhibits pride in its special qualities – the clean air, the trees, climate, etc. It cherishes its ethnic and cultural diversity and its reputation for friendliness. It honours its heritage and traditions and builds upon them as a legacy and inspiration for future generations. The downtown encompasses all that is good about Winnipeg.

A vision of direction and commitment

In our vision of the future, clear direction and commitment cultivate ongoing development of the downtown as a vibrant, welcome and secure place where people want to be and stay. Direction is made clear through the pursuit of a defined purpose agreed upon collectively by the community. Leaders work to realize the direction and express commitment through consistent and coordinated action. Building upon past experiences, cooperation through partnerships is an operating principle. Resources are sufficient and expended wisely to obtain maximum benefit. The entire downtown community understands and acts upon its shared responsibilities.

Not all visions lead directly to utopia! The **Village of Whistler**¹³, BC had a vision: to be recognized as a world-class ski resort. In attaining the goal, they must pay the price of success, which involves:

- Housing prices beyond the reach of first-time buyers, reducing the number of younger people returning to the community.
- Solid waste disposal affecting the water supply, and
- Traffic in the village requiring strict control.

However, in spite of the adversity, the community remained behind the vision and supported the council in devising solutions to the problems.



The Forks, Winnipeg



Whistler village

¹³ Personal communication.

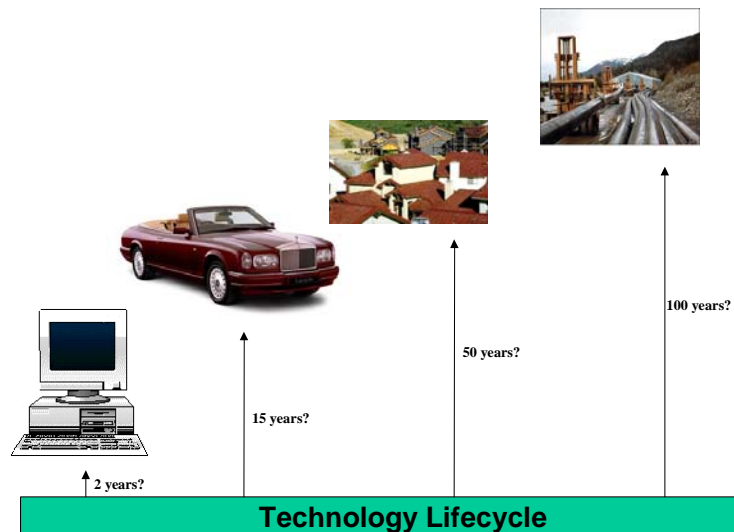
3.1 Community visions and long-term timeframes

Visioning requires a long-term mindset, but that should give justification for a wish-list of sustainable criteria. Remember the need to implement. It will be difficult sometimes to decide whether something is possible – in the long term – or simply not practical or realistic. Remember that Star-Trek is a TV program – it is not reality! Technology will advance (and sometimes at a startling pace, as in the field of electronics), but you still cannot get a quart into a pint pot!

Visioning is not the same as brainstorming or blue-sky-ing. Visioning is an extension of realism, extrapolating what you know today to some time in the future. A sense of realism is essential, even if it means that someone gets upset. All the ideas should be long-term and they should be based on some element of realism.

Think back 50 years from the time of writing (2006-1956) and imagine the comments when someone described a cell-phone with a camera and email.

How much will things change in 50 years?



Quote:

It is possible to define the goal of sustainability in a city as the reduction of a city's use of natural resources and production of wastes, simultaneously improving its livability, so that it can better fit within the capacities of local, regional, and global ecosystems.

Newman and Kenworthy,
Sustainability and Cities, Island Press 1998

COMMUNITY ENERGY PLANNING GUIDE

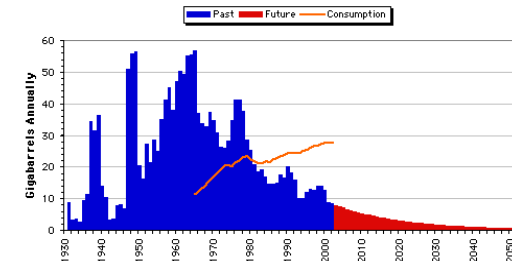
Consider how technology has changed since 1956: the growth in population; new materials, the entire information technology and communications industry. What could be achieved in the next 50 years is unknown.

Present-day infrastructure typically has a lifetime exceeding 60 years. For example, even cheaply built commercial buildings can last (unfortunately) 30 to 50 years, and public transit rolling stock is expected to last well beyond 40 years.

Planning timeframes focused on sustainability must reflect the lifecycles of the infrastructure affected so that changes in thinking and technology can be realistically incorporated.

Short-term timeframes limit changes in both thinking and infrastructure. Changes can come about only as an expensive retrofit project. By adopting an extensive timeline, say 50 or 60 years, substantive changes to the built environment may be envisioned without the fear of encroaching on personal territories.

Political and environmental issues should also be considered when planning for the long term. Peak Oil, the theory of reduced oil and natural gas production, should be included within the vision. There are many people and organizations that claim this imminent shortage to be mere hyperbole, but their argument to the contrary is weak. Communities will naturally err on the side of caution and plan for a major reconfiguration of their conventional energy supply system in the near future, possibly 20-30 years.



[Oil production/prediction](#)

An outside the box approach to energy supply...

Iqaluit is posing itself an interesting question – a break with tradition – Iqaluit has no indigenous energy source and must import oil twice each year to fill its oil storage tanks. So, why not import wood pellets and generate all power and heat with wood-waste? The environmental benefits would improve and the risk of oil spills will decrease.

(personal communication – Quilliq Energy)

COMMUNITY ENERGY PLANNING GUIDE

The [CitiesPlus™](#) exercise examined the future of the Greater Vancouver Regional District and included within the plan the effects of zero natural gas and reduced oil supplies. These changes highlighted the need for an extensive renewable energy component in their plan. It was to their surprise that a realistic solution was possible within a surprisingly short time frame, spurred on by the removal of traditional energy supplies.

Communities often link the length of their planning process with the activities that define their culture. For example, the City of Hamilton¹⁴ was the first city in Canada to install electric street lighting. It became known as the “Electric City.” In 2006 the city undertook a long-term plan to address the issue of Peak Oil – the concern was that the supply of oil will reach a peak in the 2010-2015 timeframe and that reduced availability of both oil and natural gas will impact severely the ability of the community to survive. The plan addresses the availability of energy within the community and the way that energy is distributed and used.

Although plans will extend over a significant length of time, it is not necessary to define all the activities for their entire duration. Rather, link the concepts together to make a path towards the future goal, starting in great detail and gradually reducing that level of detail as the level of uncertainty increases. Technology will inevitably develop, attitudes will change, and it will be impossible to define the specific mechanisms for attaining a long-term goal. However, by defining criteria for acceptance (long-term goals, sustainability parameters, etc.), then adjustments may be made to the plan as time progresses. Energy consumption can form a principal theme throughout the schedule, integrating projects into your community’s existing built environment.



Hamilton, Ontario – The Electric City

¹⁴ www.ibiblio.org/tcrp/lib/hamilton_peak_oil_report.pdf

The Capital Regional District,¹⁵ which includes the City of Victoria and 12 surrounding municipalities, decided to develop a long-term plan to address the interaction between the city and the rural areas. A working relationship was needed between the communities to prevent the assimilation of the rural areas by the city's sprawling growth or the gradual movement of population from the rural communities to the city.

3.2 Defining the development area for your vision

One of the first questions to be asked for the Factor-2-community will be: What is the definition of the physical planning area? What defines the study area?

In any community, actions are inextricably linked: land use affects water, transportation affects housing, and health and welfare are affected by all factors. Undertakings in one area of town affect those in another. For example, it would be simple to eliminate concern over solid waste from a new development by assuming collection and disposal to be "somebody else's problem." However, the design and operation of the proposed community is a driving force in the generation of solid waste. Generation and disposal must be considered as part of the overall planning process.

Integrated Design Planning programs such as Natural Resources Canada (SUN), CMHC's Charette program and [LEED](http://www.cagbc.ca)¹⁶ involve a holistic approach whereby the developer is continually challenged as to their responsibility for all inputs and outputs associated within the development boundary.



Capital regional District – Vancouver Island, BC

¹⁵ <http://www.crd.bc.ca/govlink.htm>

¹⁶ Natural Resources Canada **SUN** – Sustainable Urban Neighbourhood Planning process

<http://www.nrcan.sbc.gc.ca>

Canada Green Building Council **LEED** – Leadership in Energy & Environmental Design <http://www.cagbc.ca>

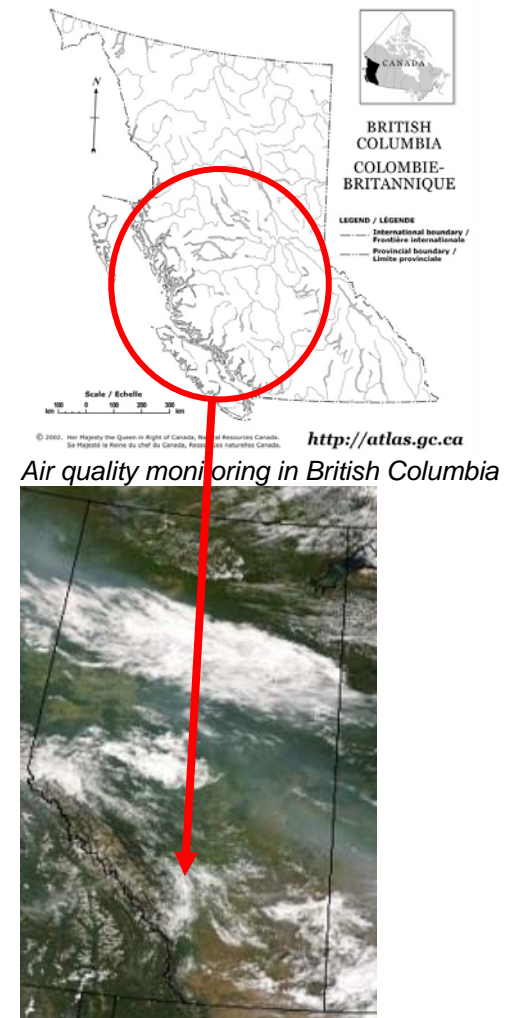
COMMUNITY ENERGY PLANNING GUIDE

Failure to integrate was demonstrated in Renfrew, Ontario, where the development of several big-box stores on the outskirts of town was allowed to proceed essentially unchecked. The development was considered too far away to be cause for concern. The resulting traffic chaos on the roads leading into, and out of, the town created dangers to residents. To avoid possible accidents the town spent significant sums of money to expand the road and to install traffic control measures, at a time when they could sorely afford it.

The nature of the geography encourages the Province of British Columbia to think in terms of air-sheds rather than individual communities. Development of air quality management plans allows communities in a single valley or geographic area to address the issue of air quality as a collective. A certain amount of give-and-take is therefore possible between communities when the result is examined on an aggregate basis. An emitter in one town may be compensated by another elsewhere.

Significant research has been undertaken by Natural Resources Canada and the Government of British Columbia to compare the processes required for community energy plans and air quality management plans.¹⁷ The intent was to combine the two to avoid duplication of effort. The union of the two unfortunately does not seem to be possible, and the community itself still has to decide which of the two approaches to follow.

For urban situations, a clear boundary is required for the area under consideration, along with a definition of the scope that the study entails – for example, the boundary could be physical such as a housing development, or political such as a complete village, or an economic development area.



¹⁷ British Columbia Ministry of Water, Land and Air Protection. **Integration of Air Quality-Related Planning Processes**, May 2004. www.env.gov.bc.ca/air/airquality/pdfs/int_aq_rep_may04.pdf

This will lead to a definition (later) of the data collection requirements and the need for additional or specific committee members.

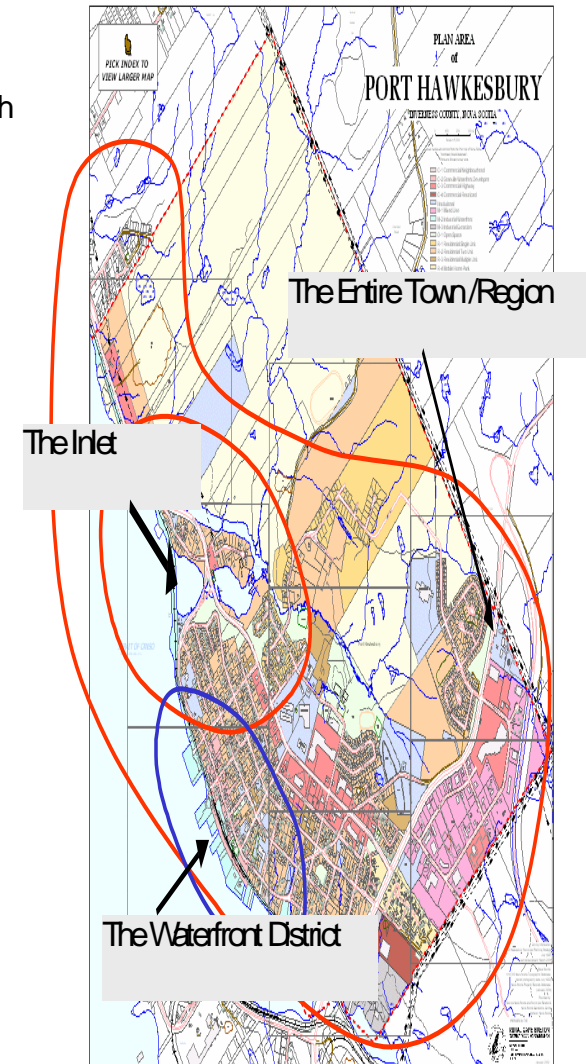
The Sustainable Communities Program, operating in Saskatchewan and Manitoba, found that for a rural area a regional approach is more practical, with the planning areas becoming self-defining. Instead of politically imposed boundaries, planning limits became based on local resources, watersheds, or even areas relating to the Regional Economic Development Agency and the local economy. In one Saskatchewan initiative¹⁸ communities joined together to examine their resource issues and used their watershed as a boundary for the study.

Similarly, in the Maritimes, where studies were aimed at cleaning up the local coastline, the boundary to the study was related to the watershed feeding the coastal area. For other communities, roadways, political or other electoral boundaries, or even the boundary of any regional economic development organization may be suitable.

3.3 *Developing the vision*

Visioning need not be a lengthy process, but it is recommended that the process be as detailed as possible to ensure that the vision created is clear. This ensures that its direction is understood, agreed upon, and followed throughout the implementation process. There are many ways to achieve this clarity. The workshop “Planning for Change,” hosted by the Community Animation Program and the Community Mobilization Program in Atlantic Canada, discusses one possible technique for public-participation visioning.

¹⁸ Saskatchewan Environment, **Sustainable Community Planning Program**, <http://www.its-canada.com/sustain/SCP-info%20net/SCP%20intro2.htm>



While it is designed to assist non-profit organizations, communities can also make use of the principles and framework provided in this document.

There are two basic rules to remember when developing a community vision.

1. It is important for the group charged with the task to reflect the community.
2. The main intent is not to develop the plan but to implement the actions!

Thus the vision must reflect the ideals of the community or the neighbourhood or the physical area under discussion. It must also reflect the **capacity** of the people to undertake and achieve the selected activities.

Blue-sky by all means but KEEP IT REAL- this is not Star-Trek.

**When you are finished, ask yourselves the question:
Does the vision challenge and inspire us?**

3.4 Public engagement

The central theme of the vision might be based upon future anticipated events such as a reduction in fuel availability, future industrial expansion, or a unique social development (e.g. Olympic Games), or it might be a general desire to manage the quality of life within the community (see the vision for downtown Winnipeg above). Whatever the focus, the activity should not be seen as a stage on which to display the singular lifestyle of the loudest voice.

It is imperative that all parties get a fair and equitable hearing and a chance to add their thoughts and ideas to the document.

Guiding Principles & Shared Values
are priorities that guide the organization in making decisions on how an organization conducts itself and what values it wishes to operate under.

- *Making decisions by consensus*
- *Youth involvement*
- *Diversity*
- *Equitable distribution of resources*
- *What do members and staff, believe in?*
- *What are the organizational values of people, process, and programs? For example, how will the groups make decisions?*
- *What are the roles for group members?*
- *Public Consultation*

Whoever is charged with the task of developing the vision and whatever the real reason for its development, it must be recognized that the process involves significant public input, probably more so than many other plans developed within the community, since it covers more aspects of community life. The community members must also invest in the finished product, either in the built environment or in lifestyle changes.

A community vision may already exist, in plans created for economic development or some other aspect of community life. These documents can be used as the basis for discussion and, if consensus is reached and they cover the complete environmental, economic and social intents of the community, then the vision should be accepted. This will undoubtedly save considerable time in the process.

If no vision is available or no consensus can be reached, then a new version of the vision must be developed. There are many ways to achieve this goal. Many communities conduct focus groups, others have open houses, others use surveys, etc. The best technique is the one with which you have experience or the one with which you are most comfortable.

The Atlantic Coastal Action Program in the Maritimes, aimed at rejuvenating shoreline and inlets, suggested that the vision was best developed through group discussion and brainstorming, graphically or pictorially.¹⁹

The Academy for Educational Development suggests the following techniques:

- *Encourage silent members*
- *Use open-ended questions*
- *Divide team into smaller groups:*
 - *Some individuals are more comfortable sharing their opinions in smaller groups*
- *Use team-building activities:*
 - *Help members become better acquainted.*
 - *If a good rapport is developed, the level of tension lessens when a conflict does arise, as members are more likely to listen to a friend.*
- *Set ground rules:*
 - *Basic rules such as: all views will be heard and no one will make personal attacks.*
- *Search for agreement*

¹⁹ Environment Canada, **Sharing the Challenge**, www.ns.ec.gc.ca/community/resources.html

Cornell Rural and Community Development Institute, **Community Visioning Notebook**
www.cdtoolbox.net/community_planning/000159.html

Saskatchewan Environment, **Sustainable Community Planning Program** <http://www.its-canada.com/sustain/SCP-info%20net/SCP%20intro2.htm>

Community Energy Association, **Toolkit for Community Energy Planning**
www.communityenergy.bc.ca/toolkit.htm

Pembina Institute of Appropriate Development, **Community Eco-solutions Program**
www.pembina.org/community_eco.asp

Future Search, **The Method** www.futuresearch.net/method/applications/sponsors.cfm

Many other mechanisms are available for collecting input to the vision from the general public. Some of which are:

- Open houses arranged at times and locations accessible to the general public. These can be an opportunity for two-way communication between the general public and the visioning team.
- Web-based portals can be more accessible to the public and can be used to promote the success of the visioning process.
- Incorporating the local utilities or the municipal offices in your network here can be of great use as these organizations have excellent access to the general public.
- Brochures or advertising incorporated with utility billing provide the opportunity to inform the entire community at relatively little cost.

3.5 Design Charettes

Design charettes offer a holistic and integrated approach to visioning. A charrette presents an open forum where the planning team can meet with the public to explore visioning options. For people who are starting out on this integrated design process a useful reference is the Design Charette program organized by Canada Mortgage and Housing Corporation (CMHC).²⁰

DESIGN CHARETTE

*The term **Design Charrette** has a colourful history. As part of their studies, students of architecture were required to complete a design examination within a fixed time allowance. At the end of the period, the Professor would collect the often incomplete paperwork on an open carriage – the charrette.*

The term “charrette” also refers to a hand-powered carriage used in hospitals for carrying coffins

²⁰ Canada Mortgage and Housing Corporation, <http://www.cmhc-schl.gc.ca>

3.6 Facilitators

To ensure a smooth flow of discussion and equal opportunities for all participants to voice their opinions, many committees avail themselves of the services of a facilitator. He or she acts as an unbiased “referee” who coordinates the discussion and leads it through the desired process. He or she is also responsible for encouraging each player and for drawing ideas from people, keeping the discussion focused and producing some form of finished statement or report. It is a fact that far fewer arguments occur in meetings where a facilitator is present. Facilitators should be persons with no personal involvement in the process – the world of academia has produced many such respected and unbiased individuals.

A number of communities have already begun to use their own visioning process. In its “Community and Economic Development Toolbox,” the Cornell Community and Rural Development Institute suggests two processes to community-designed visioning.

Charting uses a core group of individuals to identify a larger working group (30-40 people) within the community who have been identified as principle stakeholders. These 30-40 citizens then proceed through the “charting” process – a basic SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis – and focus on consensus building and goal identification and then action plans to achieve those goals. It is generally assumed that the process will take between three to six months - depending upon how quickly the “core” group comes together and can get the required commitment from the other participants

“Workshops and meetings designed to engage various sectors of the community in ‘visioning exercises.’ These sessions will allow the community to ‘think outside the box’ and imagine what the community could look like in 20 years based on what people want rather than what they think is possible.”

- Visions for Hornby Island, Hornby Island Community Economic Enhancement Corporation



TEAM GAME: Together, identify a realistic but challenging vision.

A useful exercise is to have flipchart paper posted with a question written at the top. Each person then has 10 minutes to write down their three most important thoughts under each question.

If an idea is already recorded, a check can be used to show that two people had the same idea. The comments will be reviewed as a group.

- How would the world be improved, changed or different if our organization was successful in achieving its purpose?
- What are the most important services that we should continue to provide, change, or begin to offer in the next three years?
- If we could only make three changes that would significantly affect our ability to provide quality services, what would they be?
- What do users consider the most important part of our work?
- What makes us unique?

Then each person can take five minutes to identify three elements they would like to see in their vision. Similar concepts will be grouped together. As a group, review the elements and draw up a common vision. It might require further refinement. A group or an individual can be appointed to finish this work. The vision could be communicated in words, video, or images.

*An **external vision** focuses on how the world will be improved; changed, or altered if the organization achieves its purpose. For example, “All people with AIDS get the appropriate care they need in a comfortable, accessible setting, and we see the day soon when AIDS is no longer a killer in our community.”*

*An **internal vision** describes what the organization will look like when it operates effectively to support the external vision. For example, “The sea otter society will be recognized as a credible national organization that will have a well-informed, active membership in each province and territory of Canada.”*

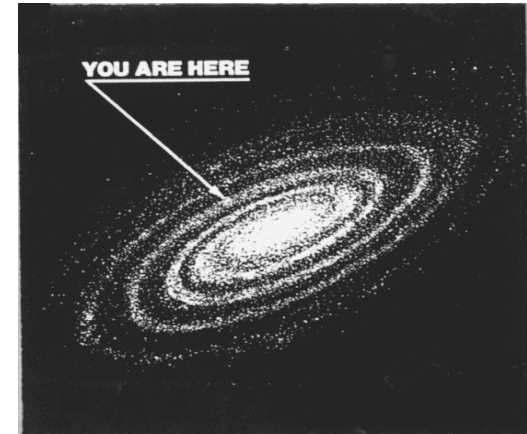
4: STEP 2: Where are we now?

Many planning approaches start with the collection of baseline data and an energy audit and then proceed to build the need for projects. Under the approach adopted here, the community develops a vision first, before spending time and resources collecting the data. The reasoning for this is simple. The vision creates motivation and direction that makes the collection of data simpler, more focused, and achievable within a shorter timeframe.

In the preceding sections we discussed the vision as being something created without the constraints of the present. Community members were free to design their own Factor-2 community. They identified areas that are of concern or importance to them. The plan allowed them to **think outside the box** and then **backcast** to the eventual solution.

Without that vision, it is difficult for the community to recognize the important issues. They do not understand the impact of key decisions, and the projects selected are based often upon present-day concerns. Invariably, the plan becomes a patchwork solution.

It is strongly recommended that the vision be developed at the outset of the project, prior to any data collection.



*Typical data sets are described in
Appendix B, page 103*

4.1 Baseline conditions

Baseline data reflects the initial (starting) condition of your community. This may be considered as today's date or, if the work is undertaken as part of a national program, it could be some other date in the past. For example, the Kyoto protocol and the Federation of Canadian Municipalities PCP program required that participants set their baseline date close to 1990. While it was in accordance with the global initiative, it was nevertheless difficult to determine baseline conditions.

The baseline for your community, or chosen area of study, is found by taking a data inventory at the chosen date. It represents **a snapshot** of your community at that time and can be used **to spot trends** and areas of high energy or resource use.

4.2 The concept of data gathering and analysis

Major warning:

It is easy to get swamped in data.

Many trends can be deduced from a limited supply of data.

Collecting data to determine your baseline condition is best done in a planned manner. The CEP is not an energy audit, nor is it an accountability exercise performed for the benefit of over-zealous accountants. Detailed data may or may not be necessary, nor may it be immediately available. It is often best to undertake a high-level scan, first of key data to highlight the “hot” spots where problems may exist. For this we need only aggregated or general data.

Beware - many consultants will encourage a detailed analysis of the community at the outset.

THIS MAY NOT BE NECESSARY

But it will guarantee confusion and often “paralysis by analysis.”

Numbers by themselves are meaningless.

They only take form when you know what you are looking for!

How much data do you need to make a decision? Less than you think! Check out Blink! by leading author Malcolm Gladwell. His theory is that gut feelings are stronger than you think....

An overall picture can then develop relatively quickly. It prioritizes issues, maintains public interest and generates momentum within the project. Leave the detailed data collection until later – when program concepts need elaboration. The increased level of detail in data from the entire community will highlight the specific areas of concern or interest in your area(s) of study.

As things evolve, data may be collected to reflect principal goals and targets for the community, data that might not have been considered at the outset. For example: if the community expressed an interest in renewable energy, then information would ultimately be required on solar conditions, wind characteristics, geological and hydrological formations, etc. Conversely, if the community felt that the high-tech and transportation sectors were the priority features, then more detailed data might be preferred on demography, traffic movement, communications, etc. The report “Sustainable Community Planning,” published by the Canada Mortgage and Housing Corporation,²¹ outlines a process for decision making in such circumstances.

4.2.1 Steps for data collection

Data is first collected to provide an outline of your area(s) of study. In terms of energy consumption patterns, this initial scan should identify all resources consumed within the study area’s boundary line, whether on the surface, underground, or flowing through the atmosphere.

Quantifying underground and atmospheric flows may not be easy, but a realistic estimate may be possible using proxy resource pathways.

An easy tip: Draw a large map of the area and mark with arrows the flows of energy – in and out.

Why not get a school involved in the data gathering? Kids love to learn about their community and may even have some good suggestions!

Utility data

Utilities can provide aggregated data at low or no cost.

Detailed data gathering often requires permission – this takes time.

²¹ Canada Mortgage and Housing Corporation, **Sustainable Community Planning**, www.cmhc-schl.gc.ca/en/inpr/su/sucopl/index.cfm

The scan provides situational awareness at the community level and can often be an eye-opener to many. People will be able to appreciate the relative magnitude of resource use. Gross data can highlight areas of excessive energy consumption or other resource use problems. It also allows a community to establish its baseline conditions and identify priority issues: energy, emissions, water, employment, waste, etc. When collecting the initial data set, it is important to ensure that the basic data reflects the community boundary and makes sense to the reader.

Major gaps in knowledge at this stage must be identified and addressed - they will only magnify and may/will lead to incorrect conclusions. This is where stakeholder participation starts to pay off and participation of the electrical and gas utilities or the local oil distribution companies can reap rewards.

4.2.2 Utility involvement

A utility's billing process is based upon the customer account number and this may not correspond to the postal or mailing address. Cross-referencing will be required. The process is even more complicated if the mailing and postal addresses differ or if the property is a commercial franchise and bills are sent to a box number in another community.

Large utilities often have their own software department that can undertake data searches in-house free of charge. However, smaller utilities use external billing services and must pay for them.

Collection of a large number of customers' data as an aggregated value is relatively straightforward. Collection of consumption data for a small number of industrial customers may, however, require customer approval. Most utilities now recognize the increasing importance of long-term planning and try to accommodate the request for data.

Energy Aggregation Programs

Programs exist in several provinces to provide energy to various properties under an aggregation program. These programs are operated by provincial and municipal associations, school boards, etc.

The aim is to reduce the cost of the energy supply and/or to gain access to "green" energy. Check out whether your community can become involved.

<http://www.auma.ca/utilities/default.asp#ElectricAgg>

4.3 An approach to data gathering²²

The data required for the initial assessment is varied in nature and, depending on the size of the study area(s), the level of detail can be quite high. The use of a data collection team is often the easiest and least time-consuming approach to data collection. The team leader for this new team would evaluate the capacity and expertise of each team member so that tasks can best be matched with skills. If necessary, the team leader should also provide team members with the authority to collect the data – in the form of a letter, duly signed by the head of the Planning Advisory Committee (e.g. the mayor).

Hints to keep in mind for the data collection team:

- ☑ It is important to make sure that all data collection team members have a clear understanding of the goals of each step before they begin and the level of detail required of the data. This way, they avoid getting swamped, collecting more data than is necessary.
- ☑ Accessibility of the required data will vary depending on the type of data itself. For example, energy consumption data for individual residential units is considered confidential to the building owner and not normally released by the utility. However, *the Block Approach* is a method of releasing consumption patterns while maintaining individual household confidentiality. Using street blocks or postal codes, average energy consumption patterns for an area can be calculated. Appendix C (page 109) provides an outline for how to perform such calculations.



Data comes in all Shapes and Sizes

²² Much of this chapter is based on the approach promoted by the Environment Canada ACAP program

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- ☑ Regular meetings should be held by members of the data collection team to discuss findings. Regular discussion maintains interest in the process, avoids duplication of collection efforts, and allows for prompt corrective measures to be taken should inconsistencies arise. Also, in the event that multiple sets of data are required from a single source but for different purposes (e.g. water consumption and energy demand from the water treatment plant), meeting regularly can facilitate information sharing and ensure that different members do not approach the same client for similar data.
- ☑ Make sure you answer all questions and concerns; ignoring questions or accepting guesses defeats the purpose of the exercise and will invariably lead to incorrect conclusions.
- ☑ Be selective in collecting data. In the process of developing a plan for a small community in northern Ontario (population 535), the band manager collected “all data relating to the village.” The index for the collected data ran to 81 pages of small type. Evaluation of the data was exhausting!

In cases when energy consumption data is simply not available – either it has not been recorded or for some reason it is not being made available — then short cut methods are appropriate and available. While their accuracy may not be as good as measured data, the time and frustration avoided is probably worthwhile.

An example might be to estimate of aggregate energy consumption of a mixed community using the heated building area and knowledge of the geographic conditions prevailing. A technique to perform this calculation is shown in Appendix C of this document.

Data types:

Active data is used in the execution of energy-saving projects over which the community has some level of control, e.g. peak heating loads, electrical usage, building design code, spatial arrangement.

Passive data relates to the use of energy within the community that the community has little or no control over, e.g. design temperatures or oil and gas pricing.

Supportive data has little apparent relevance to the CEP but provides background for an understanding of how the community functions, e.g. climatic data, geographic data, and employment levels.

4.3.1 Units

This may seem trivial, but a data point does not have meaning unless it has units associated with it. It is important to establish a consistent set of units that all team members are comfortable with *before* collecting the data. It becomes very confusing for readers to have to move between metric, imperial and American units.

As a rule: Choose one system of units and stick to it.

4.4 Managing data

Downloads available:

Data management and storage is something worth considering. As the data increases in volume the Gates of Confusion will become terrifyingly close. Create a system, maybe a spreadsheet that can keep a track of the data that has been collected and the results that are being developed. This is even more critical if the plan is intended to span a region where multiple communities are involved. The use of a management system is also a way of avoiding double accounting of energy sources, buildings or other sources of resource consumption.

Torrie Smith (<http://www.torriesmith.com>) has developed a spreadsheet model for recording and managing data flow from GHG analyses. The software is available under license for use by anyone.

The International Council for Local Energy Initiatives (<http://www.iclei.org>) also has software that can be used for managing data. The *Harmonized Emission Analysis Tool (HEAT)* allows communities to tabulate and manage the data that supports the development of a CEP.



4.5 Data analysis

The initial analysis should highlight trends and anomalies. The level of the trend or the size of the anomaly will indicate whether the area under study is in good or bad condition, growing or shrinking, sustainable or not. Eventually, these trends could form the basis of a benchmark or an indicator set that the community would then use to monitor the effectiveness of all implemented plans and projects.

Asking questions about the data is an excellent way to highlight trends:

- ❑ Why is the data the way it is?
- ❑ Are there areas within the community where certain activities dominate?
- ❑ Are there areas of high-energy consumption, waste discharge, water consumption, high transportation needs, cooling, etc.?
- ❑ Are these areas consistent with their dates of construction?
- ❑ Are these areas consistent with a building type, employment regime, or other activity?
- ❑ How does the initial data compare against typical/average data? (e.g. average heat loss for similar building structures).

If the initial data cannot be explained (for example, the energy consumed for a residential community differs from average data as published by energy efficiency organizations such as Natural Resources Canada or ASHRAE), the next step is to look more closely at the data and compare it against how the community in that area functions.

Upholding the Law

The [Canadian Urban Archetype](#) program in their development of a series of archetypes for the City of Coquitlam observed several electrical anomalies in their data sets. On further examination, BC Hydro was able to work with the RCMP to uncover several marijuana grow-ops in the city.

Category	Mean Water Usage (L/c/d)	
	Pre-Retrofit	Post-Retrofit
Toilets	71	30
Leaks*	25	8.3
Clothes Washers	56	35
Faucets	35	30
Showerheads	34	33
Other/unknown	20	15
Total Indoor	241	151

* Mostly attributable to toilets.

Basic Water Consumption Benchmarks, courtesy - Smart Growth on the Ground

Benchmark Comparisons

Energy - Natural Resources Canada has extensive data on the energy consumption of typical buildings. This can be used to evaluate the status of your community.

http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/data_e/databases.cfm?attr=0

Water – Smart Growth on the Ground has some data on water use within the Western provinces and in Canada in general.

http://www.sgog.bc.ca/uplo/OIFRB_Water_Conservation.pdf

4.6 Tools for data analysis

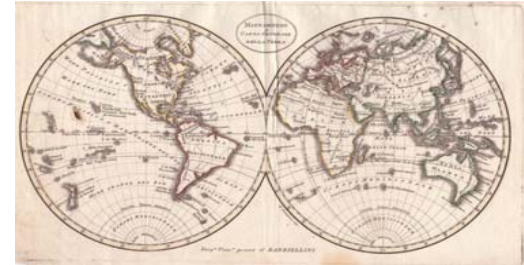
Software packages are analytical tools that can undertake precise calculations to provide an analysis of current energy trends. However, it should be remembered that software packages are merely tools and, as yet, can neither design nor interpret data. That remains the task of the analyst – in other words, you!

Manual mapping

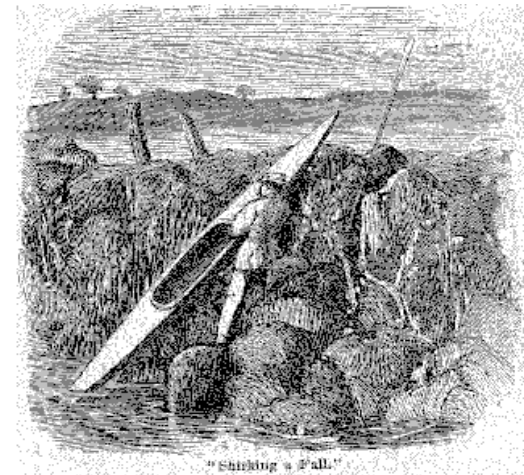
Displaying data on maps is an excellent tool for project visualization. Memory tends to stretch and shrink distances, but a map presents data and allows for trends in usage to emerge.

When selecting maps for your project:

- ☑ Check the age of the map. Look for the publication date and key local landmarks in order to confirm that you have selected the most recently updated map of your study area.
- ☑ Check for errors. Errors on maps can, and do, exist. Topographical maps come from aerial photographs and receive only spot checks after their production. Anyone who has canoed in the North knows that rapids are not always marked!
- ☑ Check for hidden features. Depending on their age, some maps may not include hidden features such as underground tunnels, sewers or discarded oil tanks that may influence future plans.



What age is the map?



Is everything there?

Tips for creating your map:

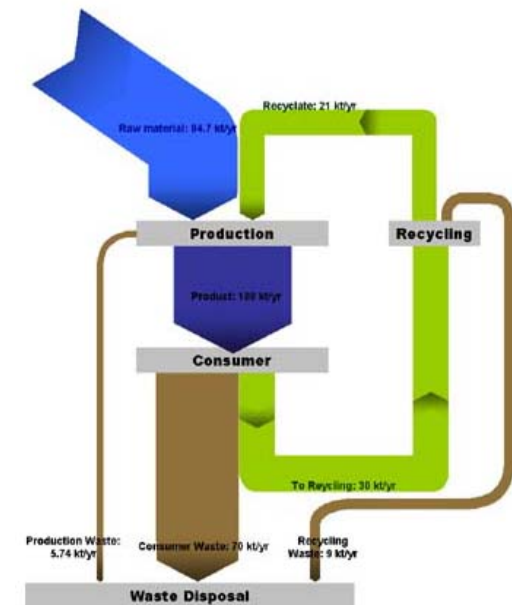
- ☑ Represent only the data collected. For example, include locations of: industries, municipal buildings, institutions, boiler plants, power grids, boundaries and lot lines, etc. – actual data that are not “where you think they are”.
- ☑ Use different but consistent symbols and colours to represent features

4.6.1 Sankey diagrams

The Sankey diagram offers a graphical balance sheet for the community's energy pathways, identifying both energy type and quantity. Many people find this diagram easier to understand than a numerical table, appreciating the relative magnitudes and impacts of the energy streams. They also allow people to visualize the interrelationships between energy, water, transportation and other streams. From the diagram communities are able to see where to focus future efforts.

The figure overleaf is a simple version of a Sankey diagram that describes the energy flowpath for the Village of Whistler, BC. In spite of its simplicity in format, the diagram highlights a number of key features:

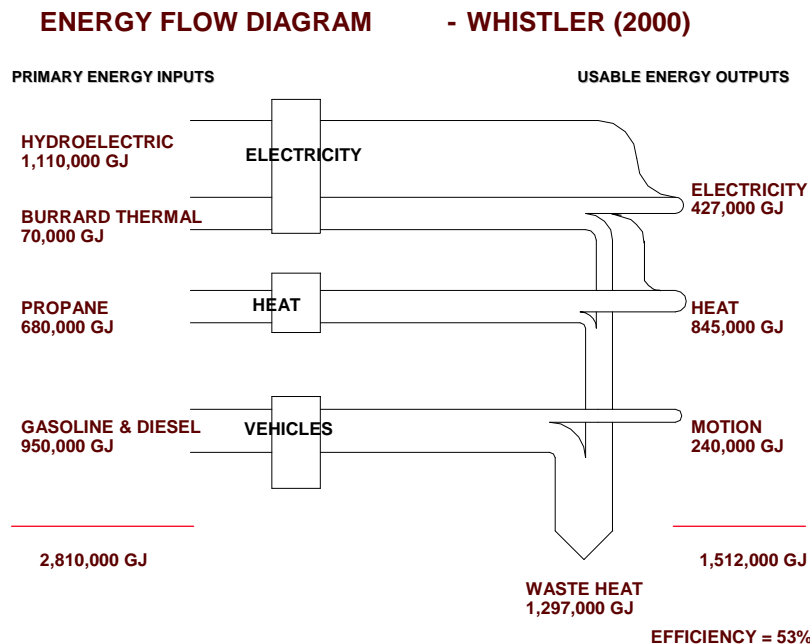
- ☑ Heating within the community uses both propane and electricity in proportions of 54% propane and 46% electricity.
- ☑ The electrical energy used throughout the town originates primarily from hydraulic stations belonging to BC Hydro (70%-efficient water turbines). Only the peaking power is developed from fossil fuel plants (34% efficiency).
- ☑ The average vehicle is effectively 25%-efficient
- ☑ Although the community uses 1,512,000 GJ of energy each year, it is responsible for 2,810,000 GJ of emissions.



A Sankey diagram for a typical process

- ☑ If the economics were suitable, there may be an opportunity for a local high efficiency combined heat and power plant to generate electricity to displace the low efficiency electricity from Burrard Inlet plant and heat to displace propane.

The large amount of energy used in transportation reflects the tourism aspects of the community and supports investigation of mass transit of some form.



Sankey software:

(Inclusion here does not denote the approval of NRCan of any of the products listed)

<http://www.sdraw.com/en/index.html>

<http://www.doka.ch/sankey.htm>

<http://www.uni-weimar.de/projekte/efb/index.html>

http://simba.ifak-md.de/simba/index.php?option=com_content&task=view&id=52&Itemid=202&lang=en

<http://www.umberto.de/en/practice/visualization/sankey/index.htm#flussdarstellung>
http://www.stenum.at/produkte/en_1b-3a.htm

<http://pie.che.ufl.edu/guides/energy/index.html>

<http://www.bridgingtothefuture.org>

Energy Flows, Resort Village of Whistler, BC (courtesy – courtesy - Sheltair Group Inc
<http://www.sheltair.com/>.)

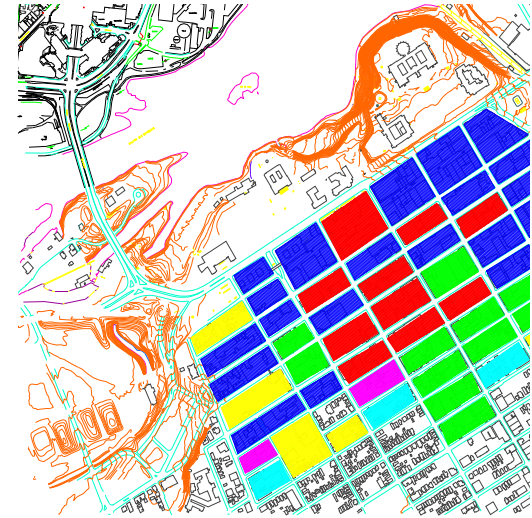
4.7 Interpreting data

The goal of the initial and subsequent scans is to gain a better understanding of the operation of the community and highlight any anomalies. The use of colour can assist in the assessment of resource use. Opposite is a map of unit energy consumption in downtown Ottawa. The red areas indicate high levels of energy consumption (per metre²); the blue areas, moderate consumption; and the yellow and green areas, lower levels of consumption.

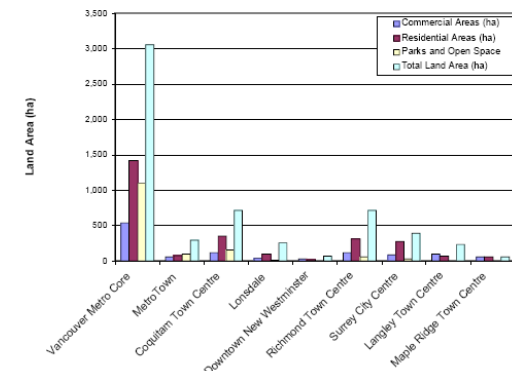
A display of this kind makes it possible to visualize a map of energy density quickly. Components of these areas – energy use, building stock, transportation, etc. – can now be compared to established averages or used as targets for the CEP. For example, the block-by-block energy consumption data for the high occupancy buildings seen in the downtown core should be compared with a target estimate for the year. Higher-than-average consumption might suggest a building retrofit program and provide a rationale for the decision in the form of an estimate of potential savings.

Evaluating energy on a global scale is a relatively straightforward process. With a visual assessment of the buildings, it is possible to develop a feel for the areas of over-consumption or under-utilization as these become highlighted on a map and may warrant a closer inspection.

Likewise, it is possible to evaluate the issues related to energy use that play a part in consumption patterns. Land-use patterns play a major part in the consumption of energy. The premise of the Canadian Urban Archetypes project is that urban form, lifestyle patterns and energy consumption are inextricably linked.



Energy consumption patterns - downtown²³



Land use in GVRD – 1996 (courtesy CitiesPlus – <http://www.citiesplus.ca>)

²³ Building Owners and Managers Association, **Standard Method For Measuring Floor Area in Office Buildings**, www.officefinder.com/boma.html

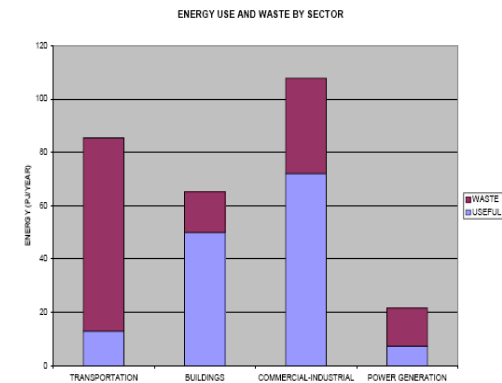
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Urban planning issues such as appropriate density, mixed use, and transit-oriented development combined with the lifestyle of the community play a significant role in overall energy demand. However, energy has traditionally been avoided as a factor in decision making in Canadian communities. The energy implications of urban planning are often not fully realized until well after build-out.

Breaking down the data into consumption sectors can allow the team to identify areas where additional effort is required. In the chart shown opposite, the effective energy use per section may be seen as a comparison of useful and wasted fuel. Any programs aimed at energy efficiency might focus on either the transportation sector (park and ride, mass transit, bus tickets, cycle paths, alternative fuelled vehicles, etc.) or the commercial/industrial sector. In the latter case there would be cause to attract new stakeholders to the group—business development organizations, building owners and managers associations, the local chapter of ASHRAE,²⁴ etc.

The use of archetypes is possible not only as a comparison with the current consumption patterns of your development but also in the setting of targets. This will be discussed in a later section. By examining the communities for which the benchmark data is prepared, it becomes possible to translate that data into a long-term target measure.

[Want Proof? – Watch the Movie –](#)
URBAN SPRAWL TOUR



Energy consumption patterns

Method	Indoor savings	Outdoor savings
Education	10%	10%
Metering	20%	20%
Xeriscaping	-	50%
Efficient fixtures	40%	-
Total	59%	66%

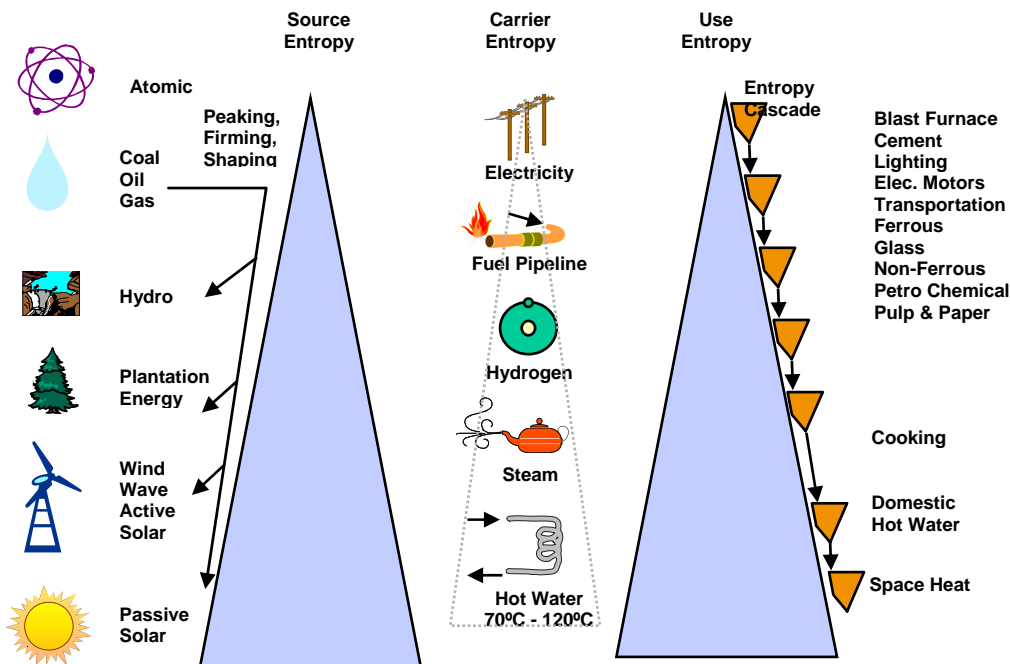
Effectiveness of water conservation programs (Courtesy – Smart Growth on the Ground <http://www.sgog.bc.ca>)

The **Canadian Urban Archetype Program** is developing a library of urban archetypes that will assist communities in comparing the consumption practices of their developments with those of other communities across Canada.
Contact: <http://www.sbc.nrcan.gc.ca>

²⁴ www.ashrae.org

4.7.1 Energy source and exergy

When evaluating the use of energy within the community, it is important to gain an understanding of what the energy is capable of doing. The Factor-2 community should consider the use of energy from an exergetic perspective. Exergy considers both the quantity of the energy used (kWh, GJ, etc.) and its quality (warm water, steam, electricity, etc.).



Exergy

The study of exergy is an emerging issue in the field of sustainability. Research is currently under way through the International Energy Agency to develop a technological link between fuel type and sustainability, thereby demonstrating the true cost of fossil fuels.

For more details see:

<http://www.lowex.net>

<http://www.annex49.com>

The linkage between fuels, their carriers and their use (courtesy BC Hydro – <http://www.bchydro.com>)

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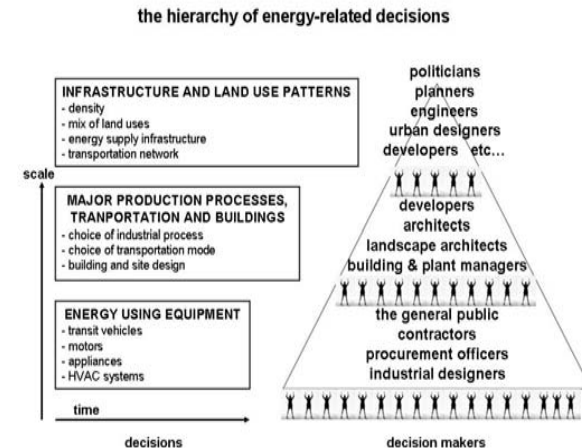
Using high-quality energy (electricity, natural gas) to perform low temperature applications (space heating) is rather like driving a Ferrari to the shopping mall – the ride is very fast and smooth but it makes for a very expensive litre of milk! To maximize the potential for benefit, every community should strive to match energy demands with the most appropriate source of energy supply.

There is an energy hierarchy in terms not only of quality but also of decision-making capacity. When, and by whom, decisions are made affects the ability of communities to change their consumption profiles. Major decisions concerning land use patterns, infrastructure, energy systems and strategic sustainability planning are typically made by a small number of professionals, sometimes in consultation with community members or other stakeholders.

Assuming that the systematic integration of the best possible information from a whole-systems perspective is the ideal for optimal decision-making, tools should be selected to facilitate the incorporation of energy-related information at the professional level.

The numerous individual energy-related decisions made everyday within the community by residents, businesses and institutions each consume a relatively small amount of energy. However, they add up to a significant amount of energy consumed overall. Other decision-making tools are available to support these kinds of decisions and are important in their own right.

EE4 from Natural Resources Canada makes it possible to compare a building design with the Model National Building Code and evaluate retrofit opportunities. The software is available free of charge from the Buildings Group Web site. (http://www.sbc.nrcan.gc.ca/software_and_tools/ee4_e.asp)



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HOT2XP is another software package that is widely used for modeling the heat loss from houses. It is also freely available from the Sustainable Buildings and Communities Web site of Natural Resources Canada.
(http://www.sbc.nrcan.gc.ca/software_and_tools/hot2xp_e.asp)

Metro-Quest™

Envision Tools (<http://www.envisiontools.com/ata glance.aspx>) has developed a model for simulating entire communities in terms of resource supply and demand. The level of detail and cost in this model facilitates interactive growth modeling with community members.

CommunityViz™

CommunityViz (<http://www.communityviz.com>) provides GIS-based analysis and real-world 3D modeling that allows the public to envision land use alternatives and understand their potential impacts, explore options and share possibilities, to examine scenarios from all angles (environmental, economic, and social) and to feel confident in their decisions

Costing Sustainable Community Planning

The Canadian Mortgage and Housing Corporation (CMHC) along with Dillon Consulting, the IBI group, Metropole Consultants and Sustainable Edge are developing an Excel-based spreadsheet tool that allows a full cost comparison to be made of urban design and infrastructure while allowing a limited analysis on certain energy systems.



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The tool is designed for use in the development planning stages by planners and other high-level decision makers to gain a general understanding of cost and revenue estimates including externalities, hard infrastructure, private user costs, municipal services and selected green infrastructure elements over a life cycle of up to 75 years.

The Costing Sustainable Community Planning tool is still in development (as of January 2007).

Performance Measures Scorecard

The cities of New Westminster and Port Coquitlam in British Columbia as well as the Town of Markham in Ontario have developed “Smart Growth Checklists” or “Performance Measures Scorecards” against which new developments may be rated. These checklists are paper-based and available online.

The Town of Markham has developed what it calls a “[Performance Measures Checklist](#)” for new urban development. The checklist comprises a list of criteria developed by the Town in consultation with its community members. They reflect primarily features of urban design in new developments and are intended to evaluate the features of development proposals and determine whether the issues of urban form such as energy supply, transportation arrangements and site design and architectural details comply with local preferences.

Data requirements for input would be the components of a development proposal such as descriptions, maps and plans detailing urban design features. Criteria on the checklist are translated into performance indicators. These receive a rating of bronze, silver or gold. During construction, reporting targets are rated as to whether they are on target or not on target.



New Westminster



Port Coquitlam



Markham



Markham (courtesy – the Remington Group)

There is also room on the sheet for comments, observations and qualitative information used in decision-making.

In its present form, the Town of Markham Performance Measures Scorecard does not support cost analysis, so it is mainly geared towards urban design preference, technology choice and building design at a high level.

InfraCycle

Infracycle has been used successfully within regions to assist municipal staff in testing proposed developments against the level of service they will provide. Examples of applications include urban and rural land use; comprehensive land-use plans, growth management strategies, secondary plans, plans of subdivisions, site specific studies, redevelopment plans and transportation corridors. Because it supports land-use planning, specifically with regard to density, the mix of uses and transportation infrastructure, it supports analysis at the high end of the hierarchy of energy-related decisions.

Infracycle's main strength is that municipal decision makers can use it for financial analysis. It assists with the lifecycle costing of infrastructure including breakeven-point analysis. Especially important in terms of municipal budgeting, it provides an analysis of proposed land use patterns.

(<http://www.infracycle.com/index.htm>)



InfraCycle

5: STEP 3: Quantify the vision

At this point your community has undertaken the visioning process and assessed its baseline condition. You should have information on:

- ☑ A long-term vision for the future – what your Factor-2 community should look like and how it should perform.
- ☑ A timeframe over which this vision is to be achieved – 20, 30, 50 or more years.
- ☑ A breakdown of primary energy users and consumption patterns within the community
- ☑ A list of “areas of concern” that seem to be using a disproportionately high level of resources, creating a disproportionately large level of pollution, etc.
- ☑ A team of people keen on moving the issue forward.

Now it's time to set some goals and targets...

Establishing the goals and targets can seem daunting, especially when the subject matter is unfamiliar to some. Therefore, you will need to develop a clear understanding of what is realistic and achievable for your community.

Regina - Goals

- A city of 250,000 citizens, within a region of 300,000;
- A city where people grow together;
- A city recognized for its economic, social and environmental sustainability;
- A city that is the hub of a region of diversified economic growth;
- A city that is people-centred;
- A city of inclusiveness that celebrates its cultural diversity;
- A city where Aboriginal people participate fully in economic and community affairs;
- A city that people are drawn to because of its quality of life;
- A city that is attractive, generous, affordable, accessible, compact and competitive;
- A city where seniors can retire in security and young people can thrive in opportunity;
- A city that is clearly "a good place to live."
- At the centre of the vision is the word "prosperity."

5.1 Goal setting

Goals are designed to turn the vision into activities that lead to a positive change. In this context, it is important to clarify how the goals will regulate these activities.²⁵

Traditionally, vision statements express goals in the form of qualities and desires including, where possible and practical, quantifiable actions or sets of qualifying criteria in the form of goals.

At this point, it is not necessary to quantify issues in the vision itself, but the statements made must be such that they can be quantified at some stage.

The City of Regina did this by inserting quantifiable goals into their community vision.²⁶

To its credit too, Thunder Bay²⁷ also addresses long-term goals and objectives in their community vision (see sidebar).

Arguments can be made that in a perfect state of affairs not all goals will be possible due to the level of their interaction²⁸. The process of project development and scheduling may show that the community cannot realistically expect to achieve all goals. This reflects the flexibility of the plan and the vision. While it may be inconvenient, it must be accepted that the vision remains fixed; human nature, being what it is, will force change on the community.

Thunder Bay Goals

- *Quality of life / healthy community / implementation of the plan will be measured regularly and changes reported to the community.*
- *Community pride and our marketable quality of life will be packaged and promoted.*
- *Thunder Bay will promote itself as an environmentally friendly, clean and green city.*
- *Thunder Bay will develop the natural attributes of the city such as the waterfront, lakes, rivers and trees for residents and tourists to enjoy. A priority is the implementation of The Next Wave, with the first major initiative being the implementation of Portside.*
- *Alternative transportation corridors will be developed.*
- *Thunder Bay will develop safe neighbourhoods and greenspaces as important attributes of a watchful, caring community.*
- *Thunder Bay will actively work toward respecting diversity and building stronger relationships within the community*

²⁵ Edvardsson, Karin and Ove Hansson, **Environmental goal-setting and efficiency – project plan**, www.infra.kth.se/FIL/agree/eng1full.pdf

²⁶ City of Regina, **A Vision for Regina**, www.regina.ca/vision_statement.shtml

²⁷ City of Thunder Bay, **Fast Forward Thunder Bay**, www.thunderbay.ca/docs/fastforward/773.pdf

²⁸ Berlin, Isaiah, **On the Pursuit of the Ideal**, www.plato.stanford.edu/entries/berlin

Other goals may only be achievable in the future and these too can be accommodated within the plan. For example, if solar energy is more desirable but is currently too expensive, or if it requires the development of a more efficient infrastructure, then the community may choose to continue to use the fossil fuel, but in a combined heat and power mode, as a transitional technology. While the community continues to use fossil fuel, it also establishes building guidelines for conversion of buildings and reconnection to a solar-based system as it becomes available.

As the economic situation becomes more sustainable, medium-term goals can be developed to slowly introduce solar technologies through the replacement of old fossil-fuel infrastructure, and so on.

An alternative approach is to replace the long-term objectives with a set of criteria that qualify the decision-making process. The “Natural Step” approach proposes that moving towards a sustainable future requires key guiding objectives²⁹ that must be considered each time a decision is to be made:

- ☑ Eliminate our community’s contribution to fossil-fuel dependence and to wasteful use of scarce metals and minerals;
- ☑ Eliminate our community’s contribution to dependence upon persistent chemicals and wasteful use of synthetic substances;
- ☑ Eliminate our community’s contribution to encroachment upon nature (e.g. land; water, wildlife, forests, soil, ecosystems).
- ☑ Meet human needs fairly and efficiently.

Short-, medium- and long-term goals are required to facilitate a smooth transition.

²⁹Sarah James and Torbjorn Lahti, **The Natural Step for Communities**, New Society Publishers, 2004, www.newsociety.com/

The Natural Step (<http://www.naturalstep.ca/>) was originally developed for corporate use and has been well proven in that regime. The approach has now been tried in the Resort Village of Whistler, BC, and Canmore, Alberta. The application to a multi-stakeholder, community approach highlights the need to get all parties on side. In this regard, the RV of Whistler and TNS have been leaders³⁰ and their experience has provided a great deal of insight in to the approach.

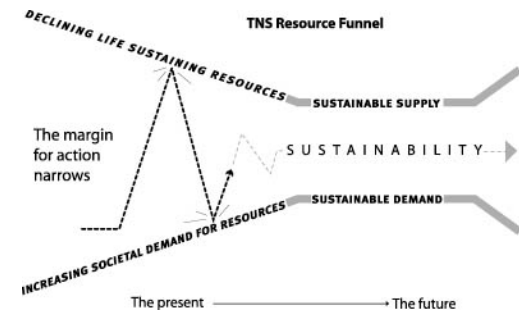
5.2 Approaches to quantifying the community vision

Quantifying the vision uses the baseline condition of the community to set targets and indicators based on a combination of:

- ☒ current and predicted technologies,
- ☒ the community's capacity to achieve future targets, and
- ☒ the community's own environmental carrying capacity.

Because of the diversity of team members, it is likely that the majority of community targets that are set will be limited in technical scope. Most will be generated using the precautionary principle – “100% change is too much, 0% is too little, let's go for 50%.”

The ability to set a target is never an exact science, and to some people, throwing a dart at the wall is as good a mechanism as a detailed engineering analysis. It is the constant feedback that enables targets to become believable. The feedback is obtained through development and learning as time progresses.



The Natural Step framework

³⁰ http://www.whistler.ca/Sustainability/Our_Nature.php

How to pick a target:

Community consultation is generally used when scientific data is limited, as in the case of social issues. A focus group can be used to discuss possible actions and consequences of a project. The advantage of this approach is that results may be obtained inexpensively and in a short period of time. The primary disadvantage is the level of accuracy and reliability of the result. Unless extensive background information is available, discussion may be based on emotional views and possible misconceptions.

The **Calculation** approach analyzes trends observed for the baseline condition to predict the future condition of the community. For example, the use of water within a community may be limited by the capacity of the local watershed. Assuming that a preset rate of growth is envisioned, a target of water use must be set that allows this watershed to provide the associated water supply. Consideration must also be given to eventualities beyond the control of the community (upstream communities, industries, etc.).

Benchmarking uses baseline data sets to describe current conditions within the community. The regular measurement of indicators, when compared to the baseline condition, will highlight improvements (or problems) caused by decisions and actions taken. Indicators are also useful for comparing current practice against similar communities elsewhere. For example, the Sheltair Group compared consumption patterns of various West Coast communities to demonstrate current practices.³¹

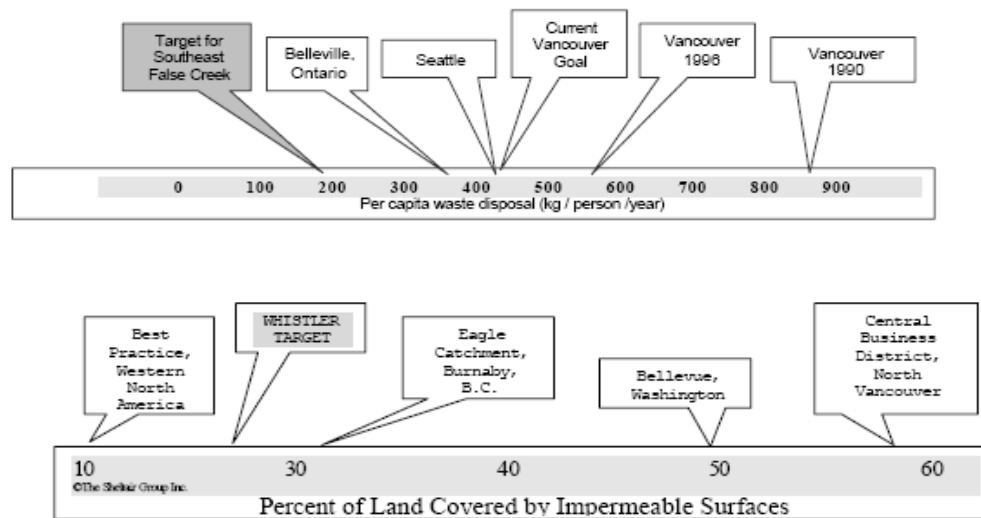
Cities^{PLUS}

A long-term planning exercise for the Greater Vancouver area evaluated its energy needs based on a variety of issues including: availability of fossil fuel, demographics and lifestyle changes, climate change, and technological advances in building design and power generation.

Greenhouse Gas Inventory:

The [Partners for Climate Protection](#) program of the Federation of Canadian Municipalities focuses on a 20% reduction in greenhouse gasses and therefore proposes the development of a greenhouse gas baseline inventory for 1994 as an initial step of their program.

³¹ Ms. Elisa Campbell, **The Use of Benchmarking as a Tool for Implementing Sustainable Urban Development**, The Sheltair Group Inc., www.sheltair.com/



(courtesy: CitiesPlus)

Peck and Tomalty³² describe such a benchmarking process, referring to the process as *Performance Assessment Measures* (PAMs). At the community level, the use of benchmarking (or PAMs) provides several benefits.

- ❑ Opportunity to develop a spirit of competition between the municipalities. It is generally accepted that the spirit of competition is an ideal mechanism to encourage both social and economic development.
- ❑ Encourages continuous and consistent action.
- ❑ Induces an understanding of just what is possible within a range of resources.

³² Peck, Steven and Ray Tomalty, **Theory to Practice: Lessons Learned From The Use of Performance Assessment Measures to Implement Sustainable Communities**, www.corps.ca/team.php

“When quantitative targets are used in combination with indicators for the purpose of evaluating the effectiveness or efficiency of government and non-governmental actions, we refer to them as performance assessment measures (PAMs). PAMs are usually developed in the context of community sustainability initiatives that include policy goals and programs or other initiatives designed to achieve those goals. Thus, a community sustainability initiative involving PAMs usually has seven core elements:

- A set of policy goals or objectives (e.g. improve water conservation).*
- A set of measurable indicators chosen to represent the policy goals or objectives (e.g. litres/person).*
- A baseline set of data to describe current or historical conditions (e.g. 300 litres/person/day).*
- A set of numerical targets representing a desired future state (e.g. 200 litres/person/day).*
- Timeframe(s) for realizing the target (e.g. 250 litres/person/day in five years and 200 litres/person/day in 10 years).*
- An action plan or series of steps that need to be implemented to achieve the target.*
- A reporting framework (e.g. public status report every three years).”*

5.3 Contractual targets

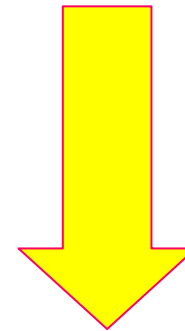
The City of Victoria, BC, is entering into a contractual arrangement with Dockside Green Limited Partnership (<http://www.docksidegreen.ca>) in their bid to construct a new sustainable mixed-use development in downtown Victoria. Dockside Green has set an aggressive target for its development growth. The targets will be audited on an annual basis and will relate to the complete development over its five-year build-out period and include significant penalties should the targets not be met.

The targets for the project cover:

- ☑ Site remediation
- ☑ Land use/housing affordability
- ☑ Environment/LEED considerations
- ☑ Circulation/mobility
- ☑ High-quality public realm

In turn, the city will work with the developer to integrate the development into the city's long-term plan. It is believed that this is the first arrangement of this type undertaken in Canada.

An example of a detailed set of targets that is not contractual but nevertheless highly visible is the Olympic Village in Vancouver. The redevelopment of the South East False Creek area is providing developers with access to some prime real estate in downtown Vancouver. The desire to develop this area in a sustainable manner means that there is a significant level of monitoring of its design and construction. The list of targets and indicators extends for several pages but is summarized³³ as follows:



[Check it out!](#)
Olympic Village

³³ <http://www.vancouver.ca/ctyclerk/ccclerk/20050301/ph2.htm>

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ENVIRONMENT

<i>Total annual building energy consumption (residential and commercial), GJ/sq m gross floor area</i>	<i>0.79 GJ/sq m commercial / institutional; 0.44 GJ/sq m townhouses; 0.31 GJ/sq m multi unit</i>
<i>Water Consumption (residential), litres/capita/day</i>	<i>190 lpcd</i>
<i>Effective impervious area (EIA), as % of total site area</i>	<i>40% EIA</i>
<i>Municipal Solid Waste (residential and commercial), kg/capita/year disposed off-site</i>	<i>200 kg/cap/yr</i>
<i>Area of community demonstration garden</i>	<i>26,000 sq. ft.</i>
<i>% trips non-auto.</i>	<i>60% of daily trips</i>
<i>LEED points</i>	<i>33 points per building</i>

SOCIETY

<i>% units in the city lands in each of low, middle, and market income categories</i>	<i>Mix: 33.3% affordable housing, 33.3% modest market</i>
<i>number of doctors in SEFC providing local health care services/total population.</i>	<i>TBD</i>
<i>real and perceived crime rates and activity; vehicle/pedestrian accidents</i>	<i>TBD</i>
<i>% of childcare demand</i>	<i>100%</i>
<i>% of jobs created in SEFC that are filled by local residents</i>	
<i>arts and cultural vibrancy index</i>	
<i>% of children living in SEFC attending the school</i>	
<i>area (acres) per capita of public open space</i>	<i>2.75 acres/1000 people of public open space and parks</i>
<i>% of local businesses created through a CED process</i>	
<i>% public open and built space that is for social interactions</i>	<i># of people in the space</i>

ECONOMY

<i># of jobs - number of jobs per 1,000 sq. ft. of commercial development</i>	<i>5-8 jobs / 1000 sq. ft. of commercial development, 193 jobs in childcare, community and school</i>
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6: STEP 4: Identifying the actions - programs and projects

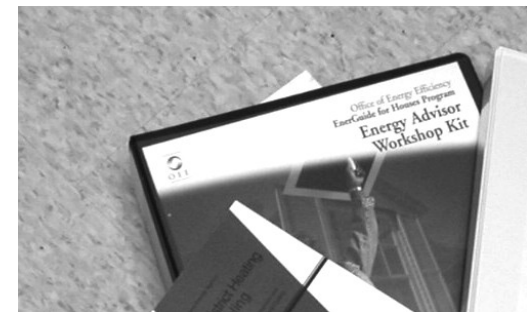
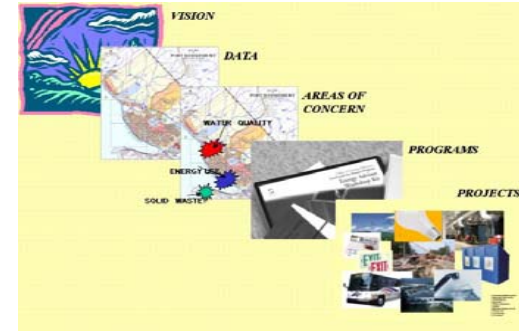
The CEP should be seen as a strategy, a mechanism that leads the community towards its Factor-2 goals and targets with the vision as the end product.

Public meetings or technical analysis of the information and data provided in Step 3 should result in a long list of comments and observations. They might include:

- ☑ Large sections of the community with the same high energy consumption
- ☑ Chronic airborne emissions caused by widespread use of a particular technology (e.g. woodstoves)
- ☑ High water usage due to large suburban/exurban lawns
- ☑ Excessive solid waste generation due to the proliferation of big box stores
- ☑ Reluctance to accept development in downtown core
- ☑ Higher use of river bridges at the west end of town compared with those at the east end

Not all of these issues are independent; many will be related. The key will be to identify the threads that link them together. Each comment needs to be categorized to identify the root cause of the issue.

To categorize the comments, each observation needs to be discussed to itemize the issues relating to the concern, such as “large sections of the community with the same high energy consumption.”



At this point we are only looking for possible causes, so a brainstorming session might suggest: similar poor construction, low income, rental properties, hilltop location, consumer awareness, large houses, or just bad data.

Similarly, other areas could be examined to identify whether these same characteristics are present. Gradually the list is boiled down to primary, secondary and tertiary priorities that will become the basis for the programs and projects forming the activities of the plan.

It is important to remember that many programs will extend beyond conventional energy-related boundaries. For example, the operation of local government, its regulations and its bylaws should also be examined as closely as levels of building insulation to identify areas where process impedes or facilitates sustainable planning or construction, possibly facilitating speedier approvals and reduced confrontation.

Therefore the purpose of developing programs is to achieve a broad-brush reduction in the levels of common complaint. The purpose of a project, however, is to provide a strategic attack on a specific issue. Programs involve issues that cannot be overcome by a one-off activity. They involve a long-term, repeated series of projects scheduled to move the community, or specified area of study, from its current position to a more sustainable future.

6.1 Program content

Often, the content of energy program is divided into categories such as:

- Private sector activities
- Public sector activities
- Individual activities

Which program is for me?

There is no cookie-cutter approach to project selection – it will depend upon individual needs and capacities. For detailed evaluation of economic and environmental savings, you will likely need a consultant.

CUTTING GREEN TAPE

For ideas on how to streamline City Hall, check out the following two reports from West Coast Environmental Law: - <http://www.wcel.org/wcelpub/2002/13724.pdf>

Examples of energy-related programs can be found in Appendix D (page 119).

This categorization enables programs to be tailored to specific issues and to specific sectors. For example, energy-efficiency programs may target institutions, if it is seen that the energy consumption within educational facilities is excessively high. Likewise, a program to increase public transit ridership may involve policies and regulations specific to the public sector. The ability to fund particular programs will depend on the community sector at which it is aimed.

6.2 How do programs work?

A program must address the aims of the community vision and contain realistic approaches for the community to attain the level of change required by the overall plan. It must also take into consideration the capacity of the community to take up the program and to achieve the goals. Manufacturing change is an art in itself and one that requires careful consideration. Many programs delivered by utilities, municipal and senior levels of government have been ineffective because they failed to recognize the needs of the public.

In the event that the goals are too lofty, or the community feels uncomfortable with the program, the goal should be revisited immediately and its timeline reassessed.

Having an idea of the critical areas within the community and the key issues of concern and then holding a meeting of technology experts, financial experts (programs invariably mean incentives) and other interested parties should provide the backdrop for the development of comprehensive programs.³⁴

Program structure does matter!

Lifetime Energy offers a program of low-interest loans for the installation of ground source heat pumps, repayable as part of the hydro bill. Only a few months into its offer, Lifetime Energy was receiving five to seven calls a day. A similar initiative of an Ontario utility offered a buy-down for a heat pump but no financing, generated only three calls in one year.

RenewableAccess – Martin Tampier,
May 22

Basics of Conducting Focus Groups

For more details on developing a focus group to assess your programs –

<http://www.managementhelp.org/evaluation/focusgrp.htm>

A useful site for changing people's attitude: www.toolsofchange.com

³⁴Canadian Mortgage and Housing Corporation, **Sustainable community planning and development: design charrette planning guide**, <https://www03.cmhc-schl.gc.ca/b2c/b2c/init.do?language=en>

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With the concept identified, a series of activities must be identified and their costs and impacts estimated. How much will it cost to achieve how much uptake? Most importantly, since the plan is intended to take many years to complete, it is likely that multiple programs will run sequentially. Which program should be first, which should be second, etc.? Are any of the proposed programs dependent upon their sequencing? For example, if the bus pass program is undertaken, will this increase or decrease the effectiveness of an anti-idling campaign?

Program example: Bus passes for municipal employees:

- Title of project: Employee Transit Pass
- Goal of project: 50% of municipal staff to use transit 50% of the time during employment hours
- Description of project: staff survey, correlation with transit schedule, economic evaluation of discounted cost of passes, awareness campaign, improved bus shelters, flexible work hours, etc.
- Responsible party: human resources
- In-house resources required for implementation: two-person interdepartmental committee to initiate project
- Associated/complementary projects, actions and parties: management committee, transit authority, etc.
- Is technology available: No additional technology required
- Estimated cost to implement: 10% of bus pass for 250 persons
- Estimate of total impact if implemented successfully: 250 persons at 20-kilometre commute each per day. Equivalent to 1,000,000 person-kilometres or 184 tonnes per year, 2,555 GJ, or 71,000 litres of gasoline
- Estimated take-up rate by population: 20 persons / month maximum
- Estimated rate of results: faster in spring and summer
- Time to completion: 3 years
- Sustainability of project/Requirement for follow-up: one person to monitor rider-ship and report



Alberta bus pass



Kenora bus pass



Detroit smart tickets

To ensure the success of the program it is often useful to set up focus groups. Groups of selected/invited people from the area are brought together to answer a series of questions on the issues at hand. An alternative would be to get the group to assess the proposed program and to indicate their interest in or acceptance of the approach. The responses would provide a statistical estimate of the rate of success of the program.

6.3 What is a project?

The vision, status quo, and targeted area of concern will be unique to each community. Therefore, the development of the project(s) to attain these goals will vary and there is no blueprint or “textbook case” to follow as to the correct recipe to implement. Instead, it is the task of your community to select the most appropriate project(s) for your needs, conditions, and vision in order to achieve future sustainability.

Projects come from targets. They also come from knowledge of the local resources and the implementation capacity of the community. A desire for the community to get 70% of its energy from renewable resources may appear as a laudable goal but may turn out to be a major headache if the community includes a sizeable industrial or commercial component.

While programs may be developed based on general macro-data, projects require more detailed assessments. For example, the development of a district energy system requires knowledge of the immediate area, the buildings, the types of energy used within the buildings and the technologies and equipment currently in use.

Keep within your capacity!

An Aboriginal community of 400 people once applied to Natural Resources Canada for assistance to build and run a 5-MWe gas-fired cogeneration plant – the local consultant had convinced them that selling the power to the electrical grid would be profitable. They were not in a position to finance the project, nor were they capable of operating such a system.

Program and Project Ideas contains 150 pages of examples and case studies of energy efficiency activities.

Energy consumption within the community has both quantitative and qualitative components. The quantitative aspect of energy is its consumption ability – its energy content. It is related to the design of the house, the distance driven, or the type of industry located in the community. The qualitative aspect, however, relates to the type of work that the energy can perform. A light bulb, for example, needs electricity; it does not work with gas or oil. Similarly, radiators do not work with natural gas; they need hot water. Unfortunately, the fuel used in many applications today has been selected, not by its suitability, but more by its marketability and convenience. As explained through the concept of exergy, the use of a high-quality energy source for a low-quality job simply wastes the ability to use the available energy. It also costs you money!

A counter to this argument is the fact that, although electricity is the most costly and valuable energy to produce, it is nevertheless the least expensive to transport. The decision as to which is the most appropriate energy supply to be used in an application therefore transforms itself into one of “first cost” versus “through life cost.” To date the compartmentalizing approach taken in urban development, where the builder is responsible for the first costs and the resident is responsible for the through-life expenditures, separates the capital costs from the operating costs.

The extensive application of renewable energy technologies has for a long time been limited by this compartmentalizing approach to project finance. For maximum resiliency against fluctuations in energy cost or availability or in the interest of greater sustainability, it is the **through-life cost** that must become the decision-making criterion.

Energy Return on Energy Invested

*A significant level of discussion is now being generated on the subject of appropriate energy supplies. What is the best source of energy for your community, or the tasks that your community wishes to undertake? People are beginning to consider the **Energy Return On Energy Invested (EROEI)** as the real indicator of sustainable viability. EROEI takes into consideration the impact of the infrastructure required to deliver and dispose of the energy that is used. For example, in the case of natural gas, the calculation would take into account the externalities associated with the drilling, cleanup and distribution of the gas as well as the emissions resulting from the incomplete combustion of the fuel.*

When your community discusses future development, consider the non-community-related infrastructure that must also be installed in order for you to receive your energy supply!

As described in Step 3, The Natural Step promotes a decision-making process based on a series of universal qualifiers. Using these as a filter, it becomes possible to assess the community's energy strategy or proposals to select the most appropriately sustainable project.

Most people will be pragmatic and consider a variety of technologies based upon the physical limitations of the project site, local resources, lifecycle cost and environmental benefits rather than the initial cost of installation. They would also try to create a more inclusive environment where the developer and municipality work together to identify opportunities for more sustainable development.

6.4 Selecting energy sources

For the majority of communities in Canada, traditional supplies of energy come in the form of an electrical connection, a natural gas pipe and an oil delivery tanker. With few exceptions all of these energy sources are imports to the community. Monthly expenditures leave the community and minimal value is retained.

Author Jane Jacobs, in her book *The Economy of Cities*, pointed out that the cities (or communities) that rely totally upon the importing of goods stagnate. It is only when they begin to use their own resources that they begin to grow and to innovate! The example she gave involved Tokyo and its importation of bicycles. The creation of an in-house bicycle industry created rapid growth and wealth within the city. The same philosophy holds true for energy and resource use.

In Canada, energy has long been the preserve of a few provincial or private utilities. As has been seen of late, their adaptability to environmental concerns has been slow, governed as it is by the regulated nature of their business.

TNS System Conditions

- Concentrations of substances extracted from the Earth's crust,
- concentrations of substances produced by society,
- degradation by physical means,
- people not subject to conditions that systematically undermine their capacity to meet their needs.

Retained Earnings?

A typical municipal energy utility that acts as a middle-man between the utility and the end-user retains ~8% of collected revenue. The remainder leaves the community.

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Utility regulators are driven by two issues – firstly, the reliability of generating supply and, secondly, the availability of the technology mix. Currently, solar and wind-generated power offers neither the reliability nor the availability demanded by the regulators as a stand-alone generating supply. This forces the utilities, when investing large sums of capital, to err on the side of caution and opt for tried and tested fossil-fuel-based technologies. For the near future, renewable energy will play only a minor part of the utility mix, but experience in the design and operation of renewable energy is being gained rapidly throughout the world, as is the development of smaller mini-utilities and integrated community energy systems at the municipal level.

The reinvestment of revenue from local generation in the community will increase internal cash flow and offer a value-added component that is not present with the conventional utility approach.

If a decision to undertake local electrical or thermal generation is made, fuel source becomes an issue. Natural Resources Canada proposes a hierarchy of fuel types to maximize the benefit to communities.

1. Fuel that was originally a pollutant
2. Fuel that was originally a waste
3. Renewable energy sources
4. Fossil fuels



Increased community benefit

Local generation achieves:

- *Local investment*
- *Local employment*
- *Control over local energy sources*
- *Stabilization of energy costs*
- *Reinvestment of finances*

Fuel vs Carrier vs Technology

Natural gas, oil - fuel – it occurs naturally

Hydrogen & electricity - carriers – they need to be manufactured

Fuel Cells, cogeneration - technologies – they do nothing without a fuel

What are our local resources?

Natural Resources Canada has identified a large number of alternative energy sources that could, at some time, be used to produce energy. – Contact Ken Church at kchurch@nrcan.gc.ca

- i. Fuel that was originally a pollutant – fuel or energy sources that would normally require treatment of some form, before disposal - [wood waste](#), [landfill gas](#), [municipal solid waste](#), digester gas, straw, flax, etc.
- ii. Fuel that was originally a waste – fuel or energy sources that was originally discharged to the environment - flare gas, process cooling water, sewer outfall water, [engine cooling water](#), chiller-plant cooling
- iii. Renewable energy sources – fuel or energy sources that are renewable within a human lifetime - [solar thermal](#), [solar electric](#), [low head hydro](#), [wind](#), [chipped lumber](#), [earth energy](#), bio-fuel
- iv. Fossil fuels – fuel or energy sources which, once used, are irreplaceable - coal, natural gas, oil, peat, reservoir generated hydro, ethanol

6.5 *Evaluating and selecting technologies*

Your Factor-2 community requires a greater level of energy resiliency than it currently possesses and there will be strong incentive to select technologies that separate you from outside influence. Ask yourselves:

- ☒ What energy is used at present – what is its form and where does it come from?
- ☒ What potential is there for energy efficiency or load management activities in the area and what would be the resulting energy consumption profile for the area under study – daily, seasonally, annually?
- ☒ What local resources are available and what benefit will their development bring to the community?
- ☒ What are the financial, environmental, and social costs and benefits of various energy technologies in relation to the goals of the community?

It may be that several technologies become contenders and more detailed studies are required. These studies should evaluate the technologies and the benefits that they might bring to the community. Based on current economic conditions, it is unlikely that all options would be viable, so each study should identify under what conditions the technology would demonstrate economic/environmental/social viability – and when. This would enable it to be positioned within the plan. For example, photovoltaic panels, while providing environmentally acceptable electricity, may not be economically acceptable today compared with landfill gas and combined heat and power. However, the landfill gas will have a finite lifetime and succession planning might suggest that at that time conditions might support the use of the photovoltaic system.

6.6 Evaluating and selecting sustainable projects

While most options will “get the job done,” not all project options will meet the community’s idea of sustainability. Holistic planning is a complex mixture of interrelationships between parties.

For example, the community may want a new civic arena downtown. To maximize its use, the building will also have a library, retail and a bus station. How, when comparing proposals, do you weight the various contributions and prioritize the proposals to the community?

Using the community’s vision, it is possible to select the issues that are of most importance and align those issues with your project. Weighting and charting each will indicate the overall benefit to your environment, local economics, and social well-being and therefore lead your community to a sustainably high quality of life.

Green Acres Housing Development – Vermont

Green Acres is a 50-unit housing complex owned by the Public Housing Authority in Barre, Vermont. Developed in 1970, the electrically heated buildings had rapidly increasing energy costs in the 1980s, typically in the US\$200–300 range per winter month, beyond the ability of many tenants to afford. Vacancies resulted and caused the Barre Housing Authority to seek a more economical alternative.

In 1991, the Housing Authority converted from electric baseboard heat to a hot-water heating system with a central woodchip-fired heating plant and a district energy loop.

Today, customers of the Green Acres District Heating System are achieving major savings. When the biomass-fired district heating system became operational in 1991, costs dropped to \$28 per apartment per month – a dramatic reduction.

Costs have remained stable since that time. Green Acres tenants have not experienced the spikes in energy costs that users of oil felt during the Gulf War or in the fall of 2000, for example, and the local sawmill supplying woodchips to the Green Acres District Heating System has benefited from the revenue it has received.

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To assist in selecting projects that meet your targets and objectives, as defined by the vision, a sustainability checklist can be developed and used to evaluate each option.

- ☒ Does the development attempt to minimize its energy consumption?
- ☒ Does it recycle or utilize alternative waste reduction techniques?
- ☒ Does the practice encourage the use of local resources and the retention of wealth within the community?

The **Triple Bottom Line** approach allows a weighting factor to be applied to the three legs of the sustainability stool – economic, environmental and social — and be summed (http://en.wikipedia.org/wiki/Triple_bottom_line). It has the capacity to rank the three legs according to the priorities of the community, accepting the notion that sustainability needs to be considered but not necessarily treated equally.

The City of Hamilton recently undertook a growth assessment study. The Growth-Related Integrated Development Strategy (GRIDS) developed a series of 30-year scenarios that were acceptable to the public, using the Triple Bottom Line evaluation technique. Using these prioritized characteristics, the software simulator MetroQuest was used to estimate the impact of such demands. More details – check out <http://www.myhamilton.ca/myhamilton/>

The **Balance Sheet** approach is a method that evaluates the sustainable development impact of various project scenarios to see which ones will have the ability to influence sustainable high quality of life for the community. Below is an example of a district heating project. The sheet lists all positive and negative aspects of the three main pillars of sustainable development: economic growth, environmental health, equality in social well-being.

Provincial projections for Hamilton in 2031

- Hamilton's populations will reach 700,000
- There will be 100,000 more households -- 40,000 within the current urban boundaries
- Hamilton will employ 100,000 more people
- Job growth will require a minimum of 2,500 acres of new employment land

High Priority for Hamilton

Hamilton City Council has identified key priorities for all growth options:

- Revitalization of Downtown
- Importance of Employment
- Accommodating Residential Growth

6.6.1 Balance Sheet: district heating — costs and benefits

Environmental benefits:

- Estimates show that CO₂ emissions are reduced annually by 3,500 tonnes, SO_x by 32 tonnes, NO_x by 4.5 tonnes and particulate matter by 4.2 tonnes.
- It is an extremely flexible technology that can make use of any fuel including the utilization of waste energy, renewable energy and, most significantly, the application of combined heat and power (CHP) and the chilling equipment contains no CFCs.
- Air emissions from the plant are much lower than the combined emissions from plants in individual buildings.
- Cooler water is produced by melting ice, enabling the customers' conditioning system to work more efficiently and effectively.

Social benefits:

- The district heating and cooling system enhances the attractiveness of the city's urban core as a location for development.
- It is a reliable source of energy. Most district energy systems operate at a reliability of "five nines" (99.999 percent) and have backup systems. To our knowledge, there have been no rolling "heat-outs" related to district energy systems.

Economic benefit:

- District energy systems can use a variety of conventional fuels such as coal, oil and natural gas, whichever fuel is most competitive at the time.
- Buildings connected to district energy systems also have lower capital costs for their energy equipment because they don't need conventional boilers and chillers. Building space is saved for more valuable purposes.

Economic costs:

- Heat losses and high electricity costs are due to oversized boilers, district heating pipes and electric pumps, vents, etc.
- Technical deficiencies in the technical interface between district heating grid and individual house heating systems. This interface (heat exchanger, regulation, piping) is not a part of the BMDH plant. Depending on factors relating to the service area, the initial construction cost can be high.

Environmental costs:

- Initial disruption and loss of land for local ecology, ecologically sensitive areas, water systems, and so on during the construction stage.

Social costs:

- Initial disruption of traffic and noise pollution affecting residents near the construction site.

The AtKisson Compass is a tool that can be used effectively to compare sustainable projects. By dividing sustainability into separate segments and comparing each with predefined limits, it becomes possible to compare different projects.

<http://www.atkisson.com/atkissonreport/index.html>

6.7 Finalizing projects to implementation

Not all selected projects can be implemented. This is because the scope of projects is limited by operational parameters such as:

- ❑ Opportunities and barriers
- ❑ The amount of funding and the time when it becomes available
- ❑ Potential scheduling conflict with concurrent projects
- ❑ Community desires for a specific technology

Opportunities and barriers

The Remote-Community Energy Workbook offers an easy-to-follow methodology for determining suitable community projects.³⁵ By answering a series of pertinent questions and completing worksheets, your community can develop a clear picture of opportunities and barriers. The worksheet can be adapted for use by communities of various sizes.

Adjacent is a reproduction of Worksheet 15, Appendix 3, of the Remote-Community Energy Workbook, (<http://www.aea.nt.ca/programs/energyPlanning.html>)

Further ideas on over 200 different areas of energy efficiency can be found in the associated manual – [Programs and Projects](#).

Funding programs and other information is found in Appendix E (page 126)

Project Idea Title:

1. What would the project achieve? What barriers would it overcome?
2. Who would the project benefit or affect??
3. What will it take to carry the project out?
 - Technical assistance?
 - Funding?
 - Time?
 - Political support?
 - Equipment and materials?
 - Skills and expertise?
 - Partnerships/joint efforts?
 - Investment (guess)
 - No / low costs?
 - Large /small investment?
 - No idea?
4. How will this project improve the energy picture?
 - Directly save energy?
 - Make it easier to save energy?
 - Replace oil based energy with renewable energy?
5. How will the project help the economy?
 - Free up money previously spent on energy?
 - Create demand for energy-saving products and services?
 - Keep money in the community?
 - Create new jobs?
6. Will the result of this project be seen over?
 - Short term (less than 1 year)?
 - Medium -term (2-3 years)?
 - Long term (more than 4 years)?

³⁵ Robinson, Andrew, **Remote-community Energy Workbook**

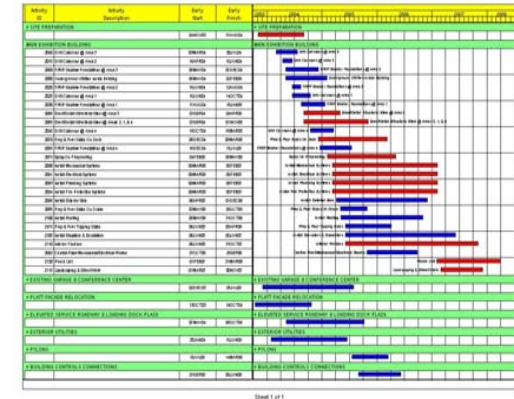
6.8 Scheduling

It is important to avoid creating a schedule that is too rigorous and extensive in design, since much of the data is still unknown. It is also important to avoid creating schedules that are too optimistic in their timelines – and too aggressive for your community. Credibility is easily lost if the schedule is unrealistic! Schedules should be designed to balance projects of different timelines in order to spread out project deadlines.

A schedule provides the reader with a measure of confidence as to whether the designer understands the way the community works. The output from the scheduling process is traditionally a report that lays out the schedule and identifies the proposed plans, their areas of interest, resource requirements, etc.

There are several steps in developing a schedule.

- 1 For each proposed program and set of possible projects:
 - a. Use the community inventory to determine programs that are precursors to others (i.e. pipes and other equipment need to be constructed before a district energy system can be introduced).
 - b. *Refer to Chapter 4: Step 2: Where are we now?*
 - c. Identify the major criteria necessary for the project to operate successfully within the community and to help the community achieve its long-term goal of sustainability. *Refer to Chapter 6: Step 4 Identifying the Actions – Programs and projects.*
 - d. Identify proposed benefits resulting from the implementation of each program.



Details need only be shown for the near future

- 2 Prioritize the short-term goals versus the long-term objectives.
- 3 *Refer to Chapter 5: Step 3 Quantify the Vision.*
- 4 Identify critical points and deadlines that must be met. Is there equipment or construction that is currently near the end of its usable life? For example, the Montreal Protocol required that certain refrigerants be phased out by 2005.
- 5 Identify any forthcoming development plans that City Hall has in its current official plan. Maybe you can work in conjunction with City Hall.
- 6 Align projects in order of available resources (e.g. staff) so as to be compatible with existing levels.
- 7 Estimate the level of resources and funding required for implementation during the first few years

Public-Private Partnerships

The City of Ottawa has a good reputation for developing working Public-Private Partnership contracts. A critical component of the deal is that the development be in accordance with the City's Official Plan. Agreement with the plan gives the City staff the go-ahead to negotiate in detail with the developer.

www.ottawa.ca

6.9 Community priorities

Communities such as Kelowna, BC,³⁶ have identified key issues within their community that must comply with the standards as specified in the official plan.

The geography of the Kelowna area causes air inversions and poor air quality, specifically during the summer months. Similarly, the reliance by a large number of communities on Lake Okanagan for both water supply and disposal places the body of water in a highly critical position. To better manage the disposal issue, Kelowna is attempting to organize a watershed approach, coordinating all communities that function within the same watershed.

Kelowna Priority List

- Air quality
- Water quality/quantity
- Transportation planning

www.kelowna.ca

³⁶ City of Kelowna, **Current Projects Areas**

In the case of the City of Vancouver,³⁷ activities generate an array of environmental impacts that affect a much broader range of people and territory. The results from their city plan process indicate that citizens were most concerned with air pollution.

The report “What’s Stopping Sustainability” by Jennie Moore provides comment on the barriers to sustainability implementation in the Greater Vancouver area. From her surveys, she highlights the following:

- ❑ Surveys have demonstrated that the quality of Vancouver's environment represents the highest value and greatest concern of the resident population.
- ❑ Concerns have recently been expressed about deterioration in some aspects of the natural stock, in terms of air quality (subject to growing pollution, especially from automobiles, which generate about 80% of atmospheric pollutants)....

Policies and regulatory frameworks at the local and regional levels of administration are being adjusted in order to arrest this deterioration, but there are indications that significantly higher levels of effort and expenditure will be needed to ensure that succeeding generations will enjoy similar levels of environmental quality as the present.

In the interest of health and sustainability both in the immediate area and for the planet as a whole, it is important to address these issues of negative environmental impacts caused by the activities of citizens of Vancouver.



Smog in the GVRD and Toronto is largely a product of automobile use.

³⁷ Moore, Jennie Lynn, *What's Stopping Sustainability?* www.newcity.ca/Pages/mooreindex.html

6.10 Community values

The City of Whitehorse set itself a series of “Corporate Values” that would help to drive the development of the schedule. How do they affect the programs and projects?

1. Sense of community

- We value and share the needs, aspirations and diversity of our community – they exemplify our Yukon Spirit and are the foundations of our vision.
- We believe we need a safe and healthy community in order for our citizens and businesses to prosper.
- We aspire to a vibrant quality of life. We believe in community involvement.
- We promote teamwork within our community as the basis of shared success; diversity is our strength. We believe anything can be accomplished by working together.

2. Quality customer service

- Our teamwork and cooperative spirit reaches out to the customers – we include the customer in our team.
- We treat everybody as a customer; including our colleagues.
- We provide fair, honest and consistent customer service.
- We identify, understand and respond to our customers' needs.
- We measure our customer service, looking for opportunities to improve.

3. Fiscal responsibility

- We are the caretakers of our City.
- We believe implementing our community vision requires careful financial planning and accountability to our citizens.
- We are fair and prudent and our expenditures are affordable.
- We save for our community's future

4. Environmental awareness

- We are proud of our land. Its fragility and resources it provides us deserve our respect.
- We believe preservation, protection and rehabilitation of our natural environment are important factors in our decision making process



Main Street, Whitehorse
www.whitehorse.ca

6.11 *Conflicting interests*

At this point in the development of a plan it is possible that community sub-groups develop over concerns that specific issues are not being addressed (the way that they would like them).

Public involvement should always be encouraged, but it is important to make sure that the final schedule is not hijacked by undue pressure from technology-driven opinions. It takes strong leadership to maintain the course.

If a technology is deemed unsuitable for the project and the community in terms of sustainability, then it must be clearly identified as such, even when under pressure. Compromise at this point will destroy much of the credibility that the planning process was intended to create.

7: STEP 5: Implement and monitor

7.1 Implementing a community plan

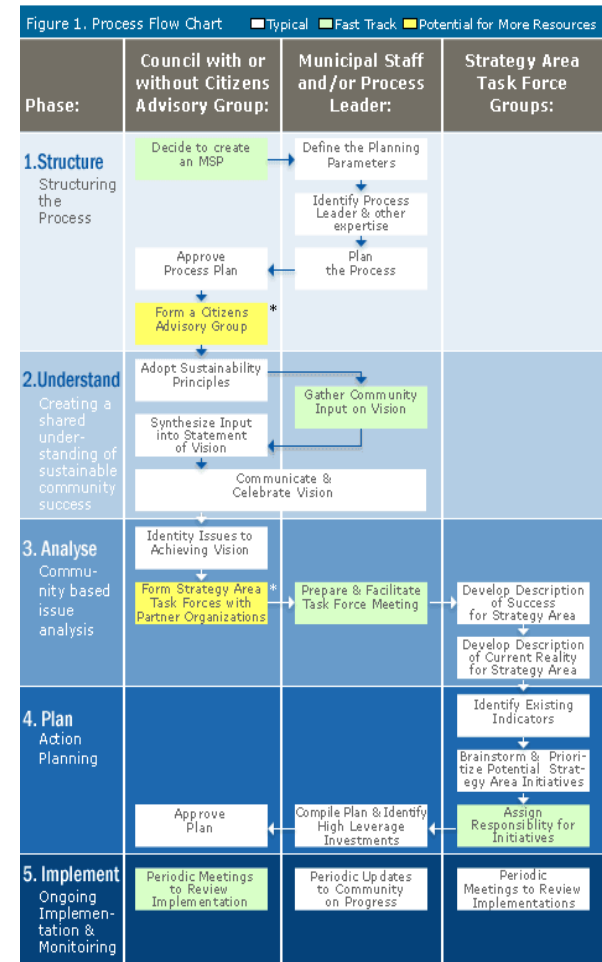
While this guide has focused much of its intention on the process of developing a plan, it is important to remember that the true intention is to implement the plan and develop the improved community.

How does the plan transform its contents into a living and growing process? This is the key issue for every planning process, and it is probably a frustration for many.

The plan must have a home; it must have ownership, a champion. It is not simply a report “for approval by council”. In addition to the main plan there must be a secondary plan – a plan for succession.

One cannot expect a Factor-2 community to emerge simply because a CEP has been completed and approved. No matter what the activity, people are creatures of habit and take time to adapt to a new urban structure — some people more than others. Consideration needs to be given to cross-linking the plan with processes and procedures currently in place throughout the community. The CEP is an umbrella plan and has connections to others, hopefully assisting them to use their authority and legislative powers to enact change.

The Alberta Urban Municipal Association (<http://msp.munilink.net>) adopts this approach and identifies the roles and responsibilities of the various groups for the activities within the planning process.



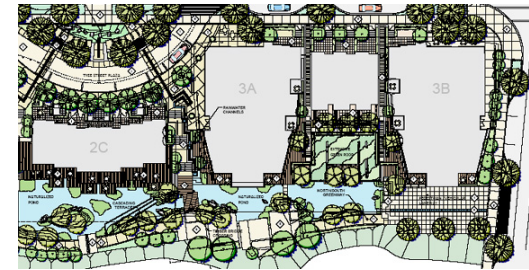
<http://msp.munilink.net>

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Council should undertake periodic reviews of the progress of implementation, and it should be the responsibility of municipal staff or the designated process leader to keep the public aware of what is happening.

The key tools that both staff and council possess to monitor progress are the indicators that define the targets proposed in Chapter 5, Step 3. These indicators will plot the outputs and outcomes of the project as opposed to the associated economic accountability. In Victoria, BC, as noted earlier, specific indicators were selected for use by both the City and the developer to measure the progress of the project. An agreement on the indicators at an early stage enables the design team to ensure that project data is readily measurable.

Many municipalities undertake revisions of the CEP concomitantly with the revision of the Official Plan. A public discussion on the continuing relevance of the vision and the general progress to date could lead to the identification of current key issues that should be included within the Official Plan. The periodic review also allows planning details to be enhanced and an update of the budget to be included within the overall City Hall budgeting process.



Dockside Green, Victoria
www.docksidegreen.ca

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Contacts: further reference

Federal

NRCan/Sustainable Buildings and Communities Group
NRCan/Office of Energy Efficiency
Environment Canada
Infrastructure Canada

<http://www.sbc.nrcan.gc.ca>
<http://www.oeo.nrcan.gc.ca>
<http://www.ec.gc.ca>
<http://www.infrastructure.gc.ca>

Provincial

British Columbia
Alberta
Saskatchewan
Manitoba
Ontario
Quebec
New Brunswick
Nova Scotia
Prince Edward Island
Newfoundland and Labrador
Yukon
Northwest Territories
Nunavut

<http://www.gov.bc.ca>
<http://www.gov.ab.ca>
<http://www.gov.sk.ca>
<http://www.gov.mb.ca>
<http://www.gov.on.ca>
<http://www.gouv.qc.ca>
<http://www.gov.nb.ca>
<http://www.gov.ns.ca>
<http://www.gov.pe.ca>
<http://www.gov.nf.ca>
<http://www.gov.nt.ca>
<http://www.gov.nt.ca>
<http://www.gov.nu.ca>

Municipal associations

Federation of Canadian Municipalities
Union of BC Municipalities
Alberta Urban Municipalities Association
Alberta Association of Municipal Districts and Counties
Saskatchewan Urban Municipal Association
Saskatchewan Association of Rural Municipalities
Association of Manitoba Municipalities

<http://www.fcm.ca>
<http://www.civicnet.bc.ca>
<http://www.auma.ca>
<http://www.aamdc.com>
<http://www.suma.org>
<http://www.sarm.ca>
<http://www.amm.mb.ca>

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Association of Municipalities of Ontario
Union des municipalités du Québec
Fédération québécoise des municipalités
Union of Nova Scotia Municipalities
Federation of Prince Edward Island Municipalities
Association francophone des municipalités du Nouveau-Brunswick
Newfoundland and Labrador Federation of Municipalities
Association of Yukon Communities
NWT Association of Communities
Nunavut Association of Municipalities

<http://www.amo.on.ca>
<http://www.umq.qc.ca>
<http://www.fqm.ca>
<http://www.unsm.ca>
<http://www.fpeim.ca>
<http://www.afmnb.org>
<http://www.nflm.nf.ca>
<http://www.ayc.yk.ca>
<http://www.nwtac.com>
<http://www.nunavutcommunities.ca>

Associations/NGOs

Canadian Institute of Planners
Canadian District Energy Association
Canadian Electrical Association
Canadian Gas Association
Canadian Energy Research Institute
Canadian Social Planning Network
Conservation Council of Ontario – Green Ontario
Federation of Canadian Municipalities – Partners for Climate Protection
Green Communities Association
International Council for Local Environmental Initiatives
Smart Growth Canada Network
Smart Growth BC
Social Planning and Research Council of BC
Green Manitoba
Climate Change Central
Pembina Institute of Appropriate Technology
BC Community Energy Association
Alberta Urban Municipalities Association
Arctic Energy Alliance

http://www.cip_icu.ca
<http://www.cdea.ca>
<http://www.canelect.ca>
<http://www.cga.ca>
<http://www.ceri.ca>
<http://www.ccsd.ca>
<http://www.greenontario.org>
<http://www.sustainablecommunities.fcm.ca>
<http://www.gca.ca>
<http://www.iclei.org>
<http://www.smartgrowth.ca>
<http://www.smartgrowth.bc.ca>
<http://www.sparc.bc.ca>
<http://www.greenmanitoba.ca>
<http://www.climatechangecentral.caom>
<http://www.pembina.org>
<http://www.energyaware.bc.ca>
<http://www.msp.auma.ca>
<http://www.aea.nt.ca>

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Yukon Energy Solution Centre
Waterbucket
Solid Waste Association
Canadian Oil Heat Association
Canadian Association of Recycling Industries

<http://www.nrgsc.yt.ca>
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<http://www.swanaon.org>
<http://www.coha.ca>
<http://www.cari-acir.org/>

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Appendix A: Examples of the visioning process

Example 1: “Planning For Change” – *Environment Canada / Health Canada*

- What is a vision statement?

A *vision* describes the future destination; it provides an image in words of what success would look like. It is built on reasonable assumptions about the future.

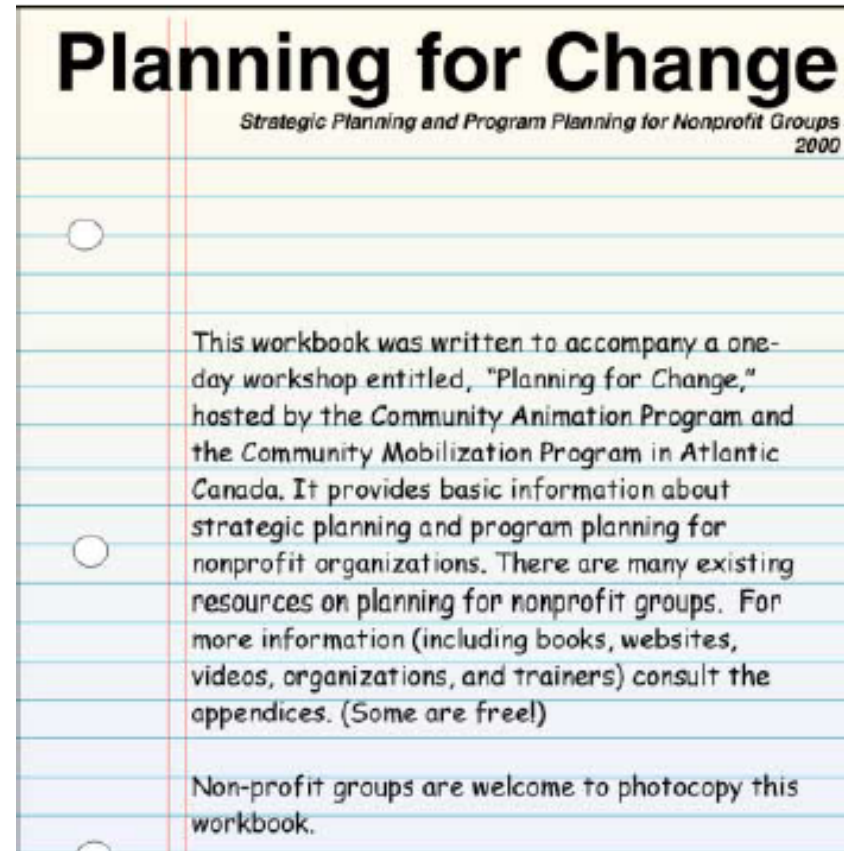
A comprehensive vision statement would convey both an external and an internal vision for the organization!

1. An *external vision* focuses on how the world will be improved, be changed, or be different if the organization achieves its purpose.
2. An *internal vision* describes what the organization will look like when it's operating effectively to support the external vision.

Goal: Dare to dream the possible. Together, identify a realistic but challenging vision.

A useful exercise is to have flipchart paper posted with a question written at the top. Each person will then have 10 minutes to write down their three most important thoughts under each question. (If an idea is already recorded, a check can be used to show that two people had the same idea. The comments will be reviewed as a group.)

How would the world be improved, be changed or be different if our organization was successful in achieving its purpose?



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What are the most important services that we should provide, change, or begin to offer in the next three years?

If we could only make three changes that would significantly affect our ability to provide quality services, what would they be?

What do users consider the most important part of our work?

What makes us unique?

Then each person can take five minutes to identify three elements they would like to see in their vision. Similar concepts will be grouped together. As a group, review the elements and draw up a common vision. It may require further refinement. A group or individual can be appointed to finish this work. The vision could be communicated in words, in video, or in images.

When the vision is completed, ask: Does our vision challenge and inspire us?

Guiding principles/shared values: Guiding principles/shared values are priorities that guide the organization in making decisions on how an organization conducts itself and what values it wishes to operate under.

Examples:

Youth involvement

Diversity

What are the organizational values of people, process, programs, etc.? For example, how will the groups make decisions?

What are the roles for group members?

Mission statement: A mission statement tells why the group exists. A mission statement describes the group's goals, the people it serves, and what makes the group distinctive.

Example:

"Our mission is to protect and restore the natural environment and provide opportunities for public education to preserve regional wilderness corridors and open spaces."

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Process idea: developing a new mission: If you already have a mission statement, include this statement as part of the information that you will review in your situational analysis to see if the mission needs to be refined.

Before the meeting, we will send a survey asking the following key questions of group members:

Our group's main purpose is to...?
Our group is intended to help the following people...?
Our group is important because we...?
Others should support our group because?
The people who serve this group are...?

A list will be created from the survey responses before the meeting. At the meeting, each person will be given coloured dots to stick beside the statements on the list they agree with the most. Based on the highlighted priority areas, the group will be broken down into smaller groups who will use this information to create a mission statement. They will report back with comments. The mission statement may be refined later by an individual or small group.

Organizational structure and culture: Organizations are in a constant state of change. It is useful to identify what your organization does and what roles you play within it. There is a range of structures that an organization can use.

Whole group model: The whole group operates as a team and so it is often used in small agencies. A team leader is not necessary; however, someone is usually needed to schedule things and lead the group so that everyone has a chance to contribute.

Hierarchical model: The traditional hierarchical model consists of managers/supervisors with people reporting to them. Some decisions are delegated or the supervisor makes decisions based on input and feedback.

Team model: In larger agencies, staff can be broken into subgroups. Each team functions similarly in the whole group model. The executive director coordinates the various teams.

Combination: An agency may choose any combination of the above models.

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Culture: “In identifying and understanding the origins of an organization’s culture, we need to investigate three elements, in addition to the desired organizational values, which are the heart of the culture, the organization’s heroes/heroines, its rites and rituals, and its cultural network.”

Example 2: “Hornby Island Community Project”

The Hornby Community Visioning Project will take place in 4 steps:

- 1. Sustainable Community Education Series** - Community members to broaden their understanding of how to create a sustainable and diverse community. This will set the groundwork for the survey and visioning processes to follow.
- 2. Quality of Life Survey** - A research process, including a survey, to measure the current baseline for community health that can also help five years from now when we want to measure our progress.
- 3. Community Visioning** - Workshops and meetings designed to engage various sectors of the community in "visioning exercises." These sessions will allow the community to "think outside the box" and imagine what the community could look like in 20 years based on what people want rather than what they think is possible.
- 4. Strategic Planning** - Based on the values, goals and projections articulated in the community visioning process, form "issue-specific" action groups to create manageable and clearly defined plans for the future. These groups will be responsible for developing a roadmap of activities to achieve specific, strategic goals as well as the timelines for achieving those goals, and for determining appropriate groups and organizations to oversee the successful completion the plans.

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Example 3: Community and Economic Development Toolbox – Cornell

Community Visioning: Most communities will face special challenges over the next decade. The world is experiencing major transitions. One of the most important changes is that the community is emerging as the "place where the action is." As a result, communities have to determine "what needs to be done" and "how to do it" to secure a successful future. Whether the issue is community revitalization, health care, education, telecommunications, economic development or the delivery of social services, communities will be required to make far more complex decisions than in the past.

The purpose of community development is to empower communities to be in charge of their future. They can give direction to this effort by pursuing the following activities:

- Building the social capacity for vital and healthy communities - developing informed citizen participation.
- Developing, expanding and retaining a community's agricultural industry - developing the workforce.
- Fostering healthy families; promoting life-long learning, improving community services, protecting the natural environment while increasing economic vitality. Promoting and encouraging the "sustainability" of communities.

One of the largest problems facing many local governments is people power. It takes extensive effort to build partnerships and coalitions for community action. In the past, many (if not most) strategic or comprehensive plans were the result of a "top-down" approach, that is, professional planners or elected officials made plans and then presented them to their community. This led citizens to feel that they had no ownership or involvement in the goals.

Without this involvement, there is little or no support for implementation or completion of plans and projects.

The Alternative — Citizen Participation: Successful community planning comes from citizen participation. Involved citizens must:

- Determine when their community is ready to engage in an action planning or visioning process;
- Create and organize a community planning process that is inclusive in nature, for all citizens, officials and stakeholders, and focuses on community purpose, vision, action planning and implementation;
- Develop follow-up strategies and provide assistance to sustain the community's energy and momentum as it implements short-term and longer-term strategies for creating its future.

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Communities have many options as to how to design their own visioning process. It is important to make a preliminary assessment of the issues to be addressed. Most processes are similar in nature and in the derived outcomes, and all have plenty of room for adaptation to local needs and circumstances.

The best-known process is "charting." It uses a core group of individuals to identify a larger working group (30 - 40 people) within the community who have been identified as principal stakeholders. These 30-40 citizens then proceed through the "charting" process – a basic SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis — along with consensus building and goal identification, and then action plans to achieve those goals. It is generally assumed that the process will take between three to six months, depending upon how quickly the "core" group comes together and can get the required commitment from the other participants.

Another popular process has been developed by the Rocky Mountain Institute — Community Economic Renewal. While it is very similar to other processes, the difference lies in that it encourages a broader community participation, not limiting the number of participants but basing much of its success on average citizen participation and, hence, community capacity building. The process actively encourages community surveys, numerous meetings, small group dynamics and, ultimately, group actions to achieve success. A significant element of this process is that it builds in educational opportunities for the participants concerning their community, issues of community development, and economic components of the "community renewal" process. There is no set timeframe - it is determined by the level of participation and the commitment of the citizens.

Outcomes: From a visioning effort, communities or organizations will be positioned to move forward and achieve the goals and objectives they have identified. By having a clearer understanding of what they are and what they hope to be, they will have a better "roadmap" on how to arrive to that point.

The most critical element is to arrive at an "action plan" - a more developed idea, written down for future use, that clearly articulates "who" will do "what" and "how." Ultimately, it is the sustainability of the community that is most important to the organization, to the participants and, most importantly, to the citizens of the community.

Appendix B: Data characteristics

NB: Communities may evaluate the following suggested list of data and select from it the data sets that relate to their own needs. Not all data sets are necessary for all communities.

To simplify the collection of data, we suggest dividing the requirements into three groups. These groups define distinct areas of the community energy plan – Built, Social, and Geographic.

Remember: it may not be necessary to assess data from each and every section of this list, and other data may be added depending upon your circumstance. The team should consider the community in terms of the questions posed by the list.

Built environment - buildings, industries, heating systems, local generation, energy demand/cost, energy distributors, sewerage.

Social environment - transportation, demography, recreational activities, local services, energy payment, solid waste, financial.

Geographic features - geography, climatic conditions, water, waste disposal site.

1 Built environment:

The built environment includes all buildings, their associated infrastructure, and the infrastructure currently in place within the study area. An assessment of the community in terms of current consumption and resources will create a baseline for the plan.

Buildings – The intent is to understand the form and status of the building stock. In a small community it may be possible to inspect each and every construction in the community. However, in the majority of communities, individual inspection is impractical.

In urban areas the study can map the energy consumption according to block building density. In this way energy consumption may be provided by the utilities (gas and electric) in an aggregated manner, avoiding confidentiality issues.

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Assuming some degree of similarity between building stock in a single block, any trend in energy consumption should be visible.

A second approach, more suited to rural communities, is to group building stock into building types (i.e. single-family homes, duplexes, low-rise, etc.). Data would then be collected as being representative of each group. “Typical” data sets would thus be developed and trends identified. Oil consumption data for such buildings could be more readily obtained since specific owners could be approached and permission obtained for the use of their consumption data.

Much of the collected data can be estimated by visual inspection. The type and use of the buildings will dictate or suggest the way that the energy is consumed within the building. Typical boiler or furnace efficiency is lower than that promoted by the manufacturers. In many residential systems, seasonal efficiency of heating and cooling systems (i.e. covering an entire year’s operation) could safely be assumed to be 65% unless better data can be confirmed; it is rarely as high as the manufacturers claim. Likewise, the fuel used can be confirmed by visual inspection. The presence of gas meters; external oil tanks or fill pipes are immediate signs. However, cordwood is also an indication that a second fuel source is used within the building. The size of the woodpile and a knowledge of the local climate will indicate whether the wood is the primary heat source or supplementary.

Industries – Many attempts to design for sustainability have ignored the industrial or commercial sector. Industry is a heavy user of energy, possibly the major employer, and must therefore be viewed as part of the community. Industry also has a vested interest in conserving energy, since for many the expenditure on energy is a significant part of the annual operating cost. It is not within the mandate of the CEP to dictate process change to the industrial sector, but the community may still partner with the industry when it is to the advantage of both. For example, low-grade energy being rejected by industry may be used as a heating medium by local premises. Similarly, wood waste generated by the community as construction waste or tree trimmings can be used as a fuel for biomass fired boilers, etc. Organic waste from the community, too, may be the source of compost for garden industries.

Data required by industrial sector may be considered as proprietary by many of the industries concerned. However, their participation in the project should still be encouraged even if the resource data available is only qualitative.

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Typical data that should be sought includes:

- Number and type of industries within the boundary area distinguished by size and whether they use local resources (lumber, minerals, etc.) or whether they are service industries such as restaurants, hotels or couriers.
- An estimate of industry ownership – whether it is locally owned and operated or a subsidiary of an external operation.
- Size and capacity of the major industries.
- What practice is used for industrial waste – particularly agricultural waste?

Municipal infrastructure – The municipal government is a major investor in the community, not just in terms of buildings but also in terms of roads, equipment, schools, hospitals, police, fire, ambulance and other services.

Energy demand/cost – The energy audit of the community will identify the passage of energy streams into and out of the community. Once the individual stream flows are recognized and measured, an attempt to define overall system efficiency may be made. An imaginary line around the community will allow the importation of energy to be measured – for example, the number of oil trucks.

- A breakdown of fuel supplies entering the community — Oil, natural gas, coal, lumber (for consumption as fuel), propane, electricity, other.

Energy distributors – The end result of any action taken is to create an improvement in the standard of living. Displacing fossil fuel may appear to be a virtuous undertaking, but when it is done at the cost of creating unemployment, the benefit is harder to accept. The contribution of the fossil fuel distribution network must be replaced by alternative revenue generation mechanisms:

- A description of the manner by which the various fuel supplies are delivered within the community.
- How much of the energy distribution system is owned and operated internal to the community?
- Oil, electricity, natural gas, gasoline, coal, lumber, propane.

Sewerage – Liquid waste and its treatment constitutes a significant portion of a municipal energy budget. Immediate costs might include pumping and aeration, but indirect costs involve infrastructure and land costs. Even with a local “honey wagon” approach, the impact is the need for pumping trucks, transportation and the cost of disposal.

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- What is the method of collection and disposal for sewerage within the community?
- Where is the sewage disposed?
- What level of treatment is employed?
- What is the capacity of the system and what is the average/typical level of use?

2 Social environment:

Investigating the social environment will encompass not only the current situation but also the situation that is desired by the community. The community's goal must be clearly understood if its long-term needs are to be identified.

Vision – A long-term vision is an essential part of the community energy plan. The plan is not merely an efficiency plan that minimizes the energy needs of today's society but it is also a plan that encourages growth, where growth is desired. Solutions must be designed to expand and grow with the community.

- What is the long-term vision for the community?

Transportation – Traditional transportation strategies have involved measuring the traffic flow and building new roads to accommodate the increase. This was in spite of evidence that new construction simply increases the level of traffic. In London, UK, the building of the M25 motorway was intended to remove traffic from the centre of the city, allowing it to bypass the core. When completed, the road was at capacity within a year with no perceptible decrease in city centre flows. The overall result has been deepening car dependency, spiralling infrastructure costs and worsening environmental impacts. This approach is unsustainable and many analysts recommend a move towards Transportation Demand Management (TDM).

Expenditure on vehicular traffic often comprises up to 40% of a household's expenditure. Fuel and maintenance is an issue that is often ignored in the running of a household – assumed to be negligible. To the community, however, the money spent on owning and operating vehicles is money that cannot be spent on other community services. An understanding of the level of expenditure that is attributed to transportation will yield ideas on changes in development design that can reduce the need for motorized transport and thereby retain more money within the community.

- A description of the transportation in use within the community – car, SUV, commercial truck.
- An estimate of the modal split between ridership of the various transportation mechanisms.

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- An estimate of the vehicle count and the traffic profile.

The data that would enable TDM to be considered within the community would essentially have to be compiled in a log of traffic movement within the study area. Typical data collected for an analysis includes:

- Before-and-after travel behaviour data, such as commute mode choice and average vehicle ridership.
- Information on take-back effects, such as additional vehicle trips that participants make when they telecommute or when they have extra non-work days due to compressed workweeks.
- Participants' reactions, including both positive and negative feelings about the program and individual strategies.
- Problems and barriers, including unanticipated costs, spillover impacts (such as parking problems in nearby neighbourhoods), and opposition by some participants.
- Costs to participants, such as additional home heating and electricity consumption while telecommuting, and perceived benefits, such as more convenient childcare scheduling.
- Costs and benefits to employers, including program administrative costs, and effects on productivity and recruitment.
- Market information (i.e. surveys of potential participants) to help determine demand for potential new transportation services and the effects of possible transportation improvements and to identify barriers and potential problems.
- Parking and traffic counts.

Demography - How is the community growing or declining? Decisions made now as to which route to take and which technology to install will impact the community for a long period of time. Will the community be in a position in 5, 10 or 20 years to support such a decision? An understanding is required of the demographic distribution of population within the community.

- Population in age groups
- Trend in population shift over last five years, into and out of the area
- Estimate of the movement shift over the next five years

Recreational activities – Expectations regarding the quality of life within the community will dictate how the residents invest their time and resources. The needs of an outdoors-oriented community in terms of social amenities are very

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different from a community of stay-at-home individuals. This section links with the vision of the community in that it describes future needs and demands.

- What are the recreational activities of the community - physical sports, hunting, shooting, fishing, etc.?
- What is the social centre for the community?

Retail – The food that is purchased within the community is a major source of fossil-fuel consumption, often forgotten or ignored in studies. Research in the UK indicated the level of fossil fuel consumption resulting from the production, processing, transportation and distribution of food equals that of housing and transportation combined. Issues to be considered include:

- What are the prominent forms of retail in the community – big box, strip mall, downtown, suburban?
- Is retail locally owned or chain developed?
- Are there any local market developments for food or other retail?
- Are there any local initiatives to use local resources – farmers markets, etc.?

Local services - Developing a sustainable community will depend upon the level of involvement of the members of that community. Responsibility, ownership and answerability are important. In areas where all services are provided by outside bodies or are subsidized, it is difficult to reform the operating structure of the community.

What local services are provided within the community?

- Who runs and who funds the schools, hospital, seniors' residences, community centres, etc.?
- How is the cost of energy structured within the community – per unit energy, demand charge/energy charge, subsidized, etc.?
- Who pays for the energy used?
- What is the frequency of billing and what is the cost profile for each fuel type over the last three years?

Employment – Experience in other communities has shown that the use of renewable energy is a greater multiplier factor than the use of fossil fuel. There must therefore be opportunities for economic development associated with the plan so that the actions are seen as investing in local resources within the community.

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- How many inhabitants work within the community?
- How many people, working within the community, live outside of the community?
- How many people are in seasonal jobs?
- Salary – in ranges

Solid waste – Solid waste is as much an energy demand within a community as is water distribution. The disposal of garbage, whether residential or industrial, requires transport, resources and real estate. Simple landfill is capital-intensive and may present health concerns (polluted water table) if incorrectly designed. A basic recycling program or the use of digester technologies to recover energy for use elsewhere might offer opportunities for revenue generation from certain markets.

- How is solid waste collected within the community?
- What is a typical volume of waste that needs to be collected?
- What is the composition of the solid waste in terms of paper, cardboard, plastic, wood, metal, organic, other?
- How is the solid waste disposed?

Financial – What is the financial state of the community and to what extent can the community accommodate development and expansion? Does fiscal responsibility lie with the community or with some outside body, such as INAC or the province?

- What is the annual budget breakdown?
- What is the debt loading for the community?
- Who is responsible for the financial operation of the community?

3 Geographic Environment:

The geographic environment encompasses the working parameters that will constrain the scope of the plan. For sustainability to exist, the community must operate within its environmental footprint. Simply put, the community must aim to support itself on a land area equivalent to that already designated.

Geography – Facilitate an understanding of the terrain, the existing layout and the relationship between the building structures and the demands of the community.

- A detailed map of the community is required.
- A description of the soil type for the community, indicating the drainage potential, bedrock and construction properties.
- A description of local resources such as forestry, peat, mines (abandoned), rivers and agriculture, identifying the ownership (where possible) of each.

Climatic conditions – the prevailing weather conditions, etc.

- Statistical data on the local weather conditions including seasonal rainfall, sunshine, snowfall, wind (strength, direction), and other meteorological phenomena.

Water – Society, as we know it, depends upon water. The primary factor defining quality of life is the supply of fresh water. Some communities have defined their growth capacity and the industries within their community by the capacity of their watershed.

- Where is the primary source of potable water for the community?
- Is industrial and residential water taken from the same location?
- What is the quality of the water supply (hard/soft/turbidity)?
- Has there been any water table fluctuation over the past period of time?
- What form of water distribution system is in place and how old is the system?
- What is the capacity of system and its state of repair?

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- What is the typical cost of pumping for the community?
- What is the cost of water to the community?
- Who are the primary users?
- What happens to grey water?

Waste site – The waste disposal site constitutes a dormant source of energy and energy consumption. As regards greenhouse gas emissions, methane is 21 times as powerful as carbon dioxide, and its production/emission should be addressed. It also offers the potential for energy generation and/or revenue generation.

- What is the status of the waste disposal site?
- Who owns the site?
- Is the site operated according to a preset plan?
- What is the capacity and age of the site?
- Estimated useful life remaining?
- Is a fill profile available?
- Is a gas collection system in place?

Appendix C: Building heat load estimation

The heating demand of a building or group of buildings can be estimated in several ways:

- building heat loss calculations
- actual building fuel consumption
- installed boiler capacity
- building area, usage, age and weather conditions

If exact fuel consumption data is available from the various buildings, it becomes a relatively straightforward task to determine the heat demand for the community. Combustion efficiency becomes the only variable that could affect the final answer.

It should be noted at the outset that no single method gives an exact answer, due to the influence of uncertainty in parameters such as boiler efficiency, energy conservation and ventilation rate. However, comparing several of these methods can bring more confidence into the estimate.

1 Building heat loss calculations

A quick way to estimate the demand of a building without the need to obtain heating data is to use its heated floor area. The method uses default relating to the type of building and its construction. This data reflects the power per square metre needed to maintain an inside temperature at a comfortable level and compares the known unit energy demand (watts/m^2) to other buildings of the same type.

Different categories of buildings such as hospitals, offices and residential units will have different unit heating demands. An estimate of the heating demand of a community that comprises a mix of these buildings types may be done on an individual basis or aggregated using an average value and the total building floor

Boiler Efficiency

Caution should be exercised when selecting a boiler's efficiency. Suppliers are notoriously optimistic about their systems and quote values that really only represent operation at full load. Cyclical operation will dramatically lower the efficiency. Seasonal efficiency of most boilers often lies between 55 and 65%.

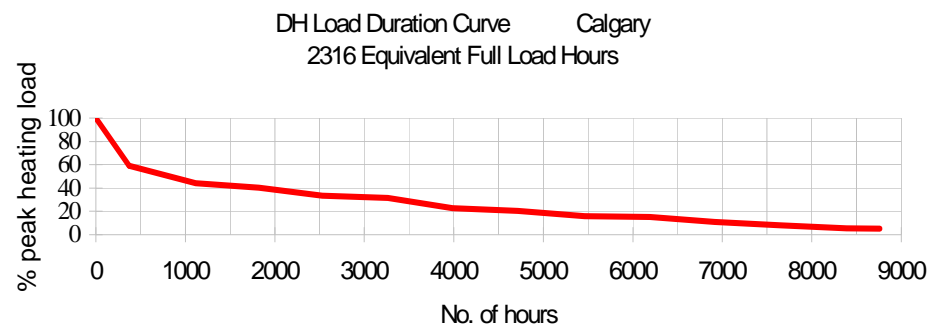
space of the community. This overall unit heating demand is a blended average of the heating demands of individual buildings.

Variation of unit heating demands will be geography-dependent. It will depend on the design temperature and level of domestic hot water used within that particular community. The energy demand for domestic hot water (DHW), however, is relatively independent of the community design temperature; thus the design temperature exerts the greatest influence on unit heating demand value.

Design temperature

The design temperature for a community is the coldest temperature that a community would expect to experience during the year. Design temperatures for communities throughout Canada can be obtained from Environment Canada and range from -7°C to -53°C . Typical values for some Canadian Communities are included in Table D1.

The total energy consumed by a community can then be estimated using unit energy demand and an “Equivalent Full Load Hours” EFLH. EFLH can be developed using degree-day data and an estimate of DHW energy demand to create a “Load Duration Curve.” This curve is the graphical representation of cumulative load of a building or group of buildings in a specified period – any point on the curve represents the number of hours that the demand exceeds that particular load.



EFLH

The EFLH is the number of hours that a plant would have to operate at peak conditions to produce the total energy for a building or community of buildings in a year.

Figure C1: Load Duration Curve for Calgary

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City	Degree Days	Design Temperature C	EFLH hours	City	Degree Days	Design Temperature C	EFLH hours
Antigonish	4399	-23	2329	Nelson	3734	-22	2077
Armstrong	7052	-42	2560	Okotoks	5303	-33	2290
Brampton	4321	-21	2406	Ottawa	4597	-27	2261
Brantford	3937	-19	2322	Ouje-Bougoumou	6869	-38	2621
Burwash	8018	-46	2701	Owen Sound	4236	-21	2353
Calgary	5365	-33	2316	Port Tupper	4336	-22	2345
Charlottetown	4527	-22	2437	Prince Albert	6559	-41	2443
Chicoutimi	5435	-32	2389	Prince George	5376	-36	2209
Cornwall	4418	-25	2269	Quebec	5026	-28	2392
Edmonton	5484	-34	2328	Regina	5877	-36	2395
Edmundston	5271	-29	2446	Revelstoke	4256	-29	2035
Flin Flon	6719	-40	2531	Saint John, NB	4768	-24	2458
Fort McMurray	6661	-41	2479	Saint John's, NFLD	4824	-16	2992
Fort Smith	7692	-45	2655	Saskatoon	5974	-37	2393
Gaspé	5437	-25	2696	Sault Ste Marie	4943	-28	2355
Geraldton	6753	-38	2614	Sudbury	5043	-30	2319
Halifax	3880	-18	2325	Sydney	4541	-18	2658
Hamilton	3772	-19	2239	Thunder Bay	5673	-33	2433
Hinton	5679	-38	2242	Toronto	3646	-20	2175
Inuvik	10040	-48	3180	Truro, NS	4661	-23	2447
Iroquois Falls	6244	-36	2521	Val D'or	6199	-36	2504
Kamloops	3751	-28	1865	Vancouver	2846	-9	2252
Kapuskasing	6454	-36	2592	Victoria	3115	-7	2580
Kenora	5938	-36	2418	Waterloo	4301	-21	2398
Kingston	4202	-24	2215	Watson Lake	7766	-48	2572
Lac Lacroix	5546	-35	2323	White River	6479	-42	2353
Masset	3791	-9	2859	Whitehorse	6988	-43	2501
Medicine Hat	4752	-34	2065	Windsor	3622	-18	2213
Mississauga (Downsview)	3992	-22	2300	Winnipeg	5819	-35	2417
Montreal	4198	-26	2132	Wunnumin Lake	7387	-39	2782
				Yellowknife	8530	-45	2895

Table C1: Design temperatures for Canadian cities

Summary:

EFLH is the energy consumed over a year divided by the peak load. A reasonable approximation can also be made using the following:

$$\text{EFLH} = (\text{degree-days per year} * 24) / (18 - \text{design temperature})$$

$$\text{Peak Load (Connected Load)} = (\text{Heat Loss Factor}) * (\text{square metre of floor space})$$

Once the peak load is obtained or known and the square metres of floor spaced known, then a unit energy demand can be estimated by the following:

$$\text{Energy Demand} = \text{EFLH} * \text{Peak Load}$$

Diversification:

In the case of an individual building, the building's Peak Load would also be its Connected Load. However, when multiple buildings are connected, as would be the case in a community application, this is not always the case. Not all buildings would need heat at the same time and this would result in diversification of load. A value called the Diversification Factor must be included in the calculation.

Diversification factors range between 70% and 99% and depend upon the homogeneity of building uses. Unfortunately, there is no accurate method available to calculate this value. Utilities estimate using established real systems and a pinch of experience.

When incorporating a diversification factor, the EFLH for a community must be adjusted to be greater than the average for the individual buildings. In general, for a community of buildings:

Diversification Factor
- is the percentage of the connected loads of a group of buildings that would yield a real peak load.

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Heat Loss Factors:

(Sum of Individual) Building Loads	* (Individual Building) EFLH	= (Connected) Load	* (Diversification) Factor	* (Community) EFLH
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	Regina			Ottawa			Halifax			Vancouver		
	Heat Loss Factor			Heat Loss Factor			Heat Loss Factor			Heat Loss factor		
Building Type	Low	Ave	High	Low	Ave	High	Low	Ave	High	Low	Ave	High
	watts/m ²			watts/m ²			watts/m ²			watts/m ²		
Office	60	65	70	50	55	60	35	40	45	25	30	35
Retail	65	80	95	50	65	80	30	45	60	20	35	50
Restaurant	90	105	120	75	90	105	50	65	80	35	50	65
Warehouse	45	60	75	35	50	65	20	35	50	15	30	45
School	50	65	80	40	55	70	25	40	55	20	35	50
Health/Medical	55	70	85	45	60	75	30	45	60	20	35	50
Hospital	100	115	130	90	105	120	75	90	105	65	80	95
Hotel	90	105	120	80	95	110	65	80	95	55	70	85
Residential	65	80	95	55	70	85	40	55	70	30	45	60
Food/grocery	65	80	95	50	65	80	30	45	60	20	35	50
Misc.	55	75	95	45	65	85	30	50	70	20	40	60
Community average	69	83	97	58	72	86	41	55	69	32	46	59
Design temperature	-36			-27			-18			-9		
EFLH	2360			2261			2325			2358		
Degree-days	5946			4606			4103			3001		

Low = Well-designed, new construction: Typical = Good construction, no apparent degradation: High = Poor construction.

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In the table above, the building terminology may be described as follows:

Office: Government, data processing, financial centre, post office, office with retail (except food), real estate, computer centre, etc.

Retail: Strip mall, hardware store, department store, furniture store, drugstore, car dealership, multi-retail buildings

Restaurant: Full service, cafeteria, carry out, food related sales and service

Warehouse: Storage, agricultural storage, stand-alone barns, etc.

School: Educational buildings, colleges, universities, etc

Health/Medical: Medical clinic, dental clinic, veterinary clinic, outpatient care, rehabilitation centre

Hospital: Medical care hospital, mental-care facility.

Hotel: Motel, hotel, short-term residential, tourist home

Residential: Apartments, condominiums (may be used for single family homes)

Food / Grocery: Retail food, supermarket, farmers' market, specialty food stores

Misc. Fire/police station, library, religious assembly, amusement arcade, museum, art gallery, concert hall, theatre, gas station, jail, shelter home, civic assembly, passenger terminal, etc.

A more detailed breakdown of commercial building types is used by the USDOE and is listed in http://www.eia.doe.gov/emeu/cbecs/building_types.html

Worked example

The following is a methodology that a community can use to determine its energy requirements in the context of a community district energy study.

Step 1 - Determine the design temperature of the community. This may be obtained from Table C1 or through published data from Environment Canada.

Step 2 - Survey the buildings to be included in the district energy study and determine unit energy heat loss factors from Table C2. If uncertainty about the type of buildings exists, then choosing a point somewhere in the middle of the range would be a good starting point. The square metres of floor space should be available from the owners or tax office.

Step 3 - Estimate the total connected load in the community using the heat loss factor and the area of each building.

Step 4 – Determine a diversification factor. A value between 80% and 90% would be a good first estimate for groups of buildings numbering over 25. The community now has an estimated connected load and a peak load. This is the rated size of the heat supply for the community.

Step 5 – Calculate the EFLH. Using Table D1 or degree-day data from Environment Canada and an estimate of DHW demand, generate a load duration curve. Resources are available from the Community Energy System at Natural Resources Canada to develop one for any interested community.

Step 6 – Calculate the total consumed energy. This is the energy that needs to be supplied throughout the year and will determine the economic viability of any project. If fuel consumption data is available, it is a good idea to cross-reference energy consumption generated by the two methods.

Appendix D: List of examples of community programs

See also *Programs & Projects.doc*

Transportation

A sustainable transportation system is one that:

- Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
- Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.
- Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, reuses and recycles its components, and minimizes the use of land and the production of noise.

Motor vehicles are major energy consumers and sources of air, noise and water pollution. Transportation represents about 27% of total US energy consumption and 70% of total petroleum consumption.³⁸ Transportation energy consumed by mode is summarized below. Personal transportation represents about 60%, and commercial transport about 40%, of total transportation energy consumption.

Demand management strategies can be used within most communities to reduce or manage the level of traffic congestion seen in a community – and hence the energy and cost involved.³⁹

[Distance-Based Emission Fees](#) [Fuel Tax Increases](#)

[Freight Transport Management](#) [Aviation Transport Management](#)

[Transport Demand Management](#) [\(TDM\) Programs](#)

[Pay-As-You-Drive Vehicle](#) [Insurance and Other Distance-Based](#)
[Fees](#) [Market Reforms](#)

[Land Use Management Strategies.](#) [Ridesharing.](#)

[Speed Reductions](#) [Transit Improvements and Incentives](#)



*A little excessive – but nevertheless persuasive!
This picture is a US wartime advertisement to conserve gasoline.*

³⁸ Oak Ridge National Laboratory research, 2001.

³⁹ Victoria Transport Policy Institute, **Energy Conservation and Emission Reduction Strategies.**

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High Occupant Vehicle (HOV) Priority

TDM Marketing

Car-Free Planning and Vehicle Restrictions

Non-motorized Transportation Improvements and Encouragement

Sustainable Transportation Planning

Parking Management and Parking Pricing

Traffic Calming and Roundabouts

Telework

Transit-oriented development

Transportation planning is often considered after the community has been developed - the tail that wags the dog. Transit-oriented development (TOD) is a solution to this problem, proposing land-use scenarios during the planning stage of new development.

The concept of TOD can be defined as “the revival of the lost art of place-making, i.e. the creation and restoration of compact, pedestrian-friendly mixed use neighbourhoods containing housing, workplaces, shops, entertainment, schools, parks, and civic facilities essential to the daily lives of their residents – all within easy walking distance. TOD promotes increased use of commuter and light rail transit, instead of building more highways and roads for auto travel. Transit-oriented development is essentially a city on a small scale.”⁴⁰



Transit will not be a panacea to cure all ills of a poorly thought-out design, but it can assist in the bulk movement of personnel and freight at key periods of the day. In combination with other transportation systems, transit can reduce bottlenecks, smooth flow patterns and facilitate the movement of goods and services with reduced energy and effort.

Reference: Guidebook on Smart Growth <http://www.metrocouncil.org/planning/assistance/TODguidebook.pdf>

⁴⁰ Day, Deborah, **Transit-Oriented Development**: City of Coquitlam.

Variable work hours (flexible working)

In the 1860s, the average workweek was 68 hours. It wasn't until the 1930s that labour unions fought for legislation that created the 40-hour workweek. Today, this arrangement no longer works for the majority of the North American work force. The huge number of working women (including mothers of school-age children); the increase in two-career families and the rise in single-parent families have forced companies to reconsider their work schedules.

Employers have been pleasantly surprised to find that what we now call “variable work-hours” has many benefits. Companies are recognizing that employees have lives outside the workplace and that, by providing the flexibility to accommodate family needs, leisure activities and other obligations, everyone wins.⁴¹ In this program, energy is conserved by decreasing the number of individual commuting trips, traffic congestion is reduced as people are arriving at and leaving their place of work at different hours, and a number of other benefits are achieved.

Housing

Energy-efficient housing

Energy-efficient housing can be achieved at costs well within the accepted limits for affordability, while resulting in annual savings in operating costs that contribute to affordability over the life of the building. Energy-saving measures being considered for use in affordable housing can be evaluated using the Model National Energy Codes introduced by the National Research Council in 1997.

There are five areas in which energy savings can be achieved in new construction and major renovations:

- The building envelope
- Heating, ventilation and air conditioning systems
- Lighting and power
- Passive solar design
- Water conservation



⁴¹ Anderson, Stuart and David Ungemah, **Variable Work Hours: Implementation Guide for Employers.**

Affordable housing

The cost of adequate shelter should not exceed 30% of household income. Housing which costs less than this is considered affordable. However, consumers, housing providers, and advocacy organizations tend to use a broader definition of affordability. See <http://www.cmhc-schl.gc.ca> for more details.

- Better Buildings Program - Toronto Better Building Partnership

In January 1990, the City of Toronto made an official commitment to reduce the city's net carbon dioxide (CO₂) emissions by 20%, relative to 1988 levels, by the year 2005. In 1999, the newly amalgamated City of Toronto reaffirmed this CO₂ reduction goal and remained in full support of this important issue.

The Better Buildings Partnership (BBP) program was developed to focus on curbing CO₂ emission, and it would take a lead role in the City of Toronto's overall CO₂ reduction commitment. The BBP program began in June 1996, and after the Metro-wide amalgamation in 1999, the full-scale program was launched to include the entire city.

In partnership with [Enbridge Gas Distribution Inc.](#), [the Toronto Atmospheric Fund](#), [Toronto Hydro](#) and [Ontario Hydro Energy Inc.](#), the City established the objectives and goals behind the BBP. It also consulted with a broad range of stakeholders, including: International Council for Local Environmental Initiatives (ICLEI), financial institutions, building owners and managers, the environmental community, trade unions, community groups, equipment manufacturers, and the construction energy/water efficiency service delivery industries.

Since the program's inception in June 1996, it has become evident that the BBP, in co-operation with the building marketplace, has the capacity and momentum to increase the amount of retrofits implemented by 400-800% in both dollar value and CO₂ emissions per year. The CO₂ emission reduction achieved to date represents 4.1% of the former City of



Toronto's 20% target. The full-scale program could potentially achieve over 3 million tonnes of CO₂ reduction, a significantly larger portion of the amalgamated City's 20% goal.⁴²

Recycling

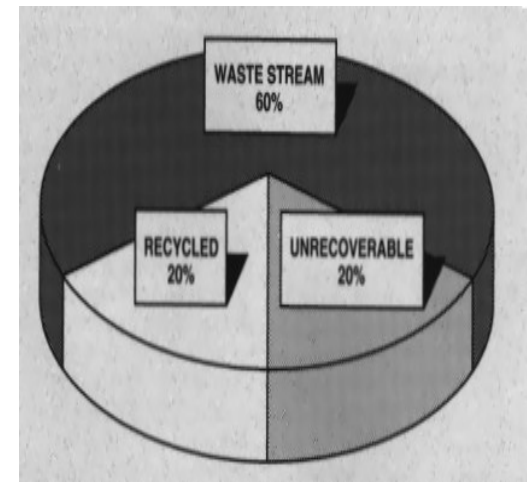
Paper⁴³

Paper and paper products account for more than one third of the materials discarded into Canada's municipal waste stream. Today, it is widely recognized that the volume of paper products we discard must be dramatically reduced and soon. Not only are many communities facing a critical shortage of landfill space, but the sustainability of the forest resource is also a concern.

One obvious way to reduce the amount of paper waste being discarded and to conserve our forest resources is to recycle more paper. It is estimated that less than one quarter of the 6 million tonnes of paper and paperboard used annually in Canada is recycled.

Of course, not all the paper we use can be recycled: approximately 20% is unavailable for recycling for a number of reasons. Some is destroyed through fire or permanently conserved (as books, roofing materials, etc.), and some is so severely contaminated that recycling is impossible or impractical.

However, a substantial proportion of the millions of tonnes of paper products entering Canada's waste stream every year could be recycled. Waste management is everyone's responsibility: we all have a role to play in encouraging the recycling of waste paper and the reduction of waste in general. By changing our habits and attitudes, at home and at work, Canadians can substantially reduce the amount of waste paper that is simply thrown away.



⁴² City of Toronto, **Better Building Program**.

⁴³ Government of Canada, **Waste Paper Recycling in Canada**.

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Used oil

The programs reflect provincial waste management advisory group principles that consumers, industry and government share responsibility for ensuring environmentally sound management of used oil materials and the viability of their used oil materials recycling programs.

PITCH-IN programs - The National Civic Pride Recognition Program⁴⁴

PITCH-IN CANADA's National Civic Pride Recognition Program is the highest form of national recognition extended to those communities who have taken steps to partner with businesses and residents in year-round initiatives to encourage civic pride and improve their community's environment. These communities will be designated as a *"Partners in Civic Pride."*

Energy-saving programs

Power Smart⁴⁵

In 2001, BC Hydro launched a conservation potential review in order to estimate the potential for electricity conservation in British Columbia. The purpose of the study was to develop a reliable estimate of the potential for electricity conservation that was realistically achievable in their service area by the year 2016 and also to estimate the potential contribution of Power Smart energy efficiency initiatives to reducing their peak capacity requirements.

The study was completed in 2002. It concluded that, by 2016, BC Hydro customers could reduce their electricity consumption by 5,800 gigawatt-hours (GWh) per year by implementing cost-effective energy efficiency measures. These savings would be equivalent to the electricity generated by a power plant with a capacity of 840 megawatts (MW) and



Advertisement used by
NASA for their in-house
energy efficiency program.

⁴⁴ Pitch-in Canada, **The National Civic Pride Recognition Program.**

⁴⁵ BC Hydro, **Electricity Conservation Potential Review.**

would be sufficient to serve the electrical needs of 580,000 residential customers. Put another way, the potential electricity savings are equivalent to annual cost savings of \$255 million. The study estimated that residences could achieve savings of \$80 million per year, while commercial buildings and industrial plants could save \$175 million per year.⁴⁶

Water conservation and water management⁴⁷

In order to determine ways of reducing water use, you must first divide it into separate categories. This will make your task easier. Water use in any industrial, commercial, or institutional operation may be divided as follows:

- domestic water use
- industrial water use
- external / outdoor water use

Water management options may be divided into various groups that will make it possible to pinpoint reduction possibilities.

Network monitoring - Regularly measure and record data on water consumption, analyze trends to quickly detect major leaks, and repair damage as soon as possible.

System optimization – Make sure that equipment, devices or systems that use water are running smoothly and that they do not use too much water (regular, preventative maintenance).

System replacement - Replace or make changes to existing equipment through more effective devices or technologies for water use.

Reuse and recycling - Replace drinking water from municipal or local system used by current equipment with water that has already been used once (grey water) in your facility.



⁴⁶ BC Hydro, **Conservation Potential Review**.

⁴⁷ Government of Canada, **Water Measurement and Conservation**.

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Changes in procedures and operations - Make changes to procedures that use water in your facility so that the same work can be performed with less or no water.

Water conservation awareness - Reduce water consumption by making people more aware of water conservation. This may mean persuading them to drop water-wasting habits.

Renewable energy/Community energy systems

Green power is low-environmental-impact electricity generated using renewable energy resources and technologies. These are clean energy sources such as wind, solar, biomass and small hydroelectric facilities. Green power substantially reduces the amount of air pollution, greenhouse gas emissions and other impacts while adding to the overall sustainability of the generation systems mix.⁴⁸



Solar thermal collectors



Wind turbines



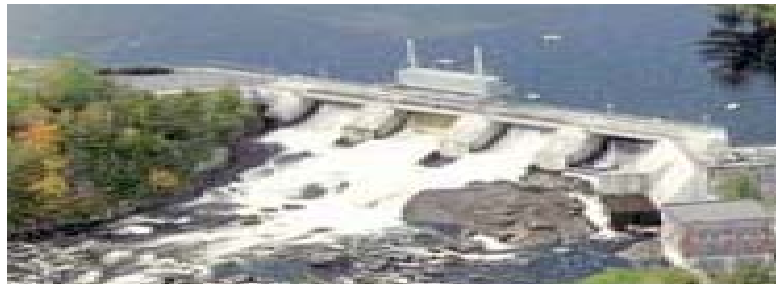
Bio-fuels

⁴⁸ Ontario Power Generation, **Waterloo Landfill Gas**.

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[Sudbury District Energy System, Sudbury, Ontario](#)



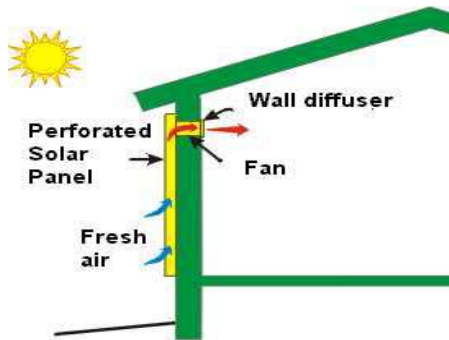
[Small hydro plant](#)



[Ground source heat pumps](#)








[Solar paneling](#)



Solar air heating

Emerging Technologies:

-  Solar thermal power
-  Ocean thermal power
-  Tidal power
-  Ocean current power
-  Wave power

In 2005, “green” technologies contributed over 6% to Canada's energy needs, displacing 36 million tonnes of CO₂ annually. Canada's renewable equipment and service industry has grown to over 250 companies, 3700 jobs and \$1.4 billion of goods and services (including \$400 million in exports).⁴⁹ In time, new renewable energies and other emerging technologies will be developed and integrated into the generation mix, phasing out the more polluting energy technologies.

An example of an emerging technology is the recovery of landfill gas. Landfill gas is a resource that many communities have access to. With correct capping and treatment the resource stream may be used for power generation using reciprocating engines or micro-turbines. Since micro-turbines are relatively small in size and are self-contained, installing and operating them on landfills too small for larger plants is an attractive option for many communities.⁵⁰

⁴⁹ Government of Canada, **Renewable Energy Technology**.

⁵⁰ Kinectrics, **Microturbines Using Landfill Gas**.

Appendix E: Funding programs

Green Municipal Funds – Federation of Canadian Municipalities <http://www.fcm.ca>

Industry Energy Research and Development – Natural Resources Canada
http://www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/funding_programs_ierd_e.html

Eco-Energy Renewable Energy Initiative – Natural Resources Canada
<http://www2.nrcan.gc.ca/es/erb/erb/english/View.asp?x=698>

Transportation Program – Natural Resources Canada
<http://oee.nrcan.gc.ca/transportation/business/index.cfm?attr=0>

Sustainable Development Technology Canada – Government of Canada
<http://www.sdte.ca/en/about/index.htm>

Canadian Foundation for Innovation – Government of Canada
<http://www.innovation.ca/programs/index.cfm?websiteid=53>

Programs Directory – Office of Energy Efficiency, Natural Resources Canada
<http://www.oee.nrcan.gc.ca/corporate/statistics/neud/dpa/home.cfm>

Agriculture Canada
http://www.agr.gc.ca/index_e.php?s1=prog

Supporting Communities Partnership Initiative – Human Resources and Development Canada
<http://www.hrsdc.gc.ca/en/home.shtml>

Infrastructure Canada Program (2000 – 2007) – Infrastructure Canada,
http://www.infrastructurecanada.gc.ca/index_e.shtml

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Rural Economic Development Program - an Ontario Small Town and Rural (OSTAR) Development Initiative –

Ministry of Municipal Affairs and Housing, Government of Ontario

http://www.mah.gov.on.ca/userfiles/HTML/nts_1_16999_1.html

Climate Change Connection – Government of Manitoba

<http://www.gov.mb.ca/est/climatechange/schools/index.html>

R2000 – Manitoba – Government of Manitoba

<http://www.gov.mb.ca/conservation/r2000/>

Regional Economic Development Authorities – Government of Saskatchewan

<http://www.ir.gov.sk.ca/Default.aspx?DN=3148,2936,Documents>

Business Development Bank of Canada

http://www.bdc.ca/en/business_solutions/venture_capital/about_us/default.htm

Community Activity – SaskPower, Saskatchewan

<http://www.saskpower.com/aboutus/community/community.shtml>

Volunteer and Community Development – Alberta Community Development,

http://www.cd.gov.ab.ca/building_communities/volunteer_community/index.asp

Funding and Partnerships – Alberta Community Development,

http://www.cd.gov.ab.ca/funding_partnerships/index.asp

Revitalizing the Forest Economy – Government of British Columbia

<http://www.for.gov.bc.ca/mof/plan/#information>

Power Smart / Green IPPs – BC Hydro

<http://www.bchydro.com/info/ipp/ipp956.html>

BC Transit

http://www.transitbc.com/corporate/transitplus/other_programs.cfm

Community Sponsorship Program - Columbia Power Community Sponsorship

<http://www.columbiapower.org/content/fundform.html>

Canada – New Brunswick Infrastructure Program – Government of New Brunswick

<http://www.gnb.ca/0096/Infrastructure-e.asp>

Green Buildings BC – New Buildings Program

http://www.greenbuildingsbc.com/new_buildings/index.html

Green Buildings BC – Retrofit Program

<http://www.greenbuildingsbc.com/retrofit/index.html>

Appendix F: Consultant Selection

An extract from REPORT Community Energy Plan – Development of a Request for Proposal Template
HALIFAX REGIONAL MUNICIPALITY
PROJECT NO. 1009416

Community Energy Plan RFP Template

Background

Long-term planning is an accepted part of the planning process for most municipalities across Canada. However, the level of detail within these documents varies depending upon the regulations as laid out by the specific provincial governments. The advent of intra-provincial down loading, volatility and projected supply constraints in the energy market, as well as environmental concerns are encouraging municipalities to raise the level of importance of the long-term plan and to include energy security and environmental impacts of energy production and use in the scope of such undertakings. The inclusion of social issues, energy supply and demand, along with future availability of resources is highlighting the need for a structured approach to the development of strategic plans. In the event that Community Energy Planning is undertaken as an integral part of a municipality's planning process and regulated at the provincial level, then it will likely become an issue too complex for many communities to undertake as an in-house activity.

Consultants would be required to produce the plans, but to attain a level of consistency across the country, there needs to be some standardization of consulting capability for the work. To that end, using the Community Energy Planning needs of the Halifax Regional Municipality as a baseline, this work proposes to develop a template for a Request for Proposals that establishes the terms and conditions for the selection of a consultant or consultants to undertake the development of a Community Energy Plan. The use of HRM as a baseline enables the RFP to consider urban, suburban, and rural issues relating to the plan. The development of the RFP will provide to prospective consultants a clear picture of the planning process, the requirements for the consultants, expected deliverables of the Community Energy Plan, and the expectations of the municipalities.

Objective

Develop an RFP template that will allow municipalities to plan for efficient and sustainable delivery of services and infrastructure to residents, in light of energy supply/demand issues, and the environmental impact of energy production and use.

Workscope

1. Research and review the approaches taken by municipalities, both in Canada and elsewhere that have retained consultants to undertake community energy plans. These might include unsolicited proposals from consultants or NGO's to municipalities,

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proposals from municipalities to funding agencies such as FCM (Federation of Canadian Municipalities), or RFPs from municipalities to consultants for Community Energy Plans, whether implemented or not. Evaluate collected RFPs and proposals for scope, level of detail, and methodology.

2. Identify existing or proposed requirements for sustainability planning within Canada, and in particular within the Province of Nova Scotia.

3. In conjunction with HRM management and existing planning processes and long term plans, identify and prioritise the issues to be included within the region-wide Community Energy Plan. Compare these issues with those of existing proposals. Thought should be given to organization and structure of the RFP. For example, some basic categories may include:

- transportation
- settlement
- service delivery (Utilities)
- infrastructure investment
- social impact
- economic impact
- environmental impact
- urban / suburban
- rural

4. Identify the distribution of authority levels within the process of plan development and hence, the minimum required stakeholders. While the municipality's vision may encompass all aspects of life within the HRM, the municipality itself may have its authority limited to only a few areas. This will define the base level of stakeholders that must be consulted during RFP development.

5. Define the planning process that will be followed to develop the plan, and thereby the basic tenets for decision making. For example, some basic tenets may include:

- projected population growth
- resource availability
- projected temperature increase due to climate change impacts
- projected rise in sea water level due to climate change impacts
- projected changes in precipitation due to climate change
- projected changes in consumer energy demand patterns

6. Identify a suggested public consultation and review process.
7. Define the form of the deliverables expected from each step of the process. This deliverables might include:
 - the community vision
 - renewable resource inventory
 - recommended changes to existing planning and development processes
 - recommended actions to promote energy security, conservation, and renewable energy within the municipality
 - a framework or methodology to incorporate energy security and environmental sustainability in municipal decision making.
 - evaluation and rating of possible programs
 - benchmarks/indicators and a monitoring process
8. The RFP should contemplate a time frame for the Community Energy Plan and recommend how to implement the plan and provide for periodic updates to the plan.
9. The RFP should contemplate inclusion of a discussion of barriers to small scale renewable energy projects and distributed generation; and the respective roles of the local utility, and other levels of government.
10. Propose a scoring methodology to review RFP submissions, including a definition of the areas of expertise required of the consultant and a suggested prioritization/weighting to be used in the RFP selection process.
11. Prepare a template that summarizes the RFP document, organized in an appropriate manner such that other urban, suburban, rural or "mixed" municipalities in Canada could utilize the RFP.

- or from the RFP itself:

3. SCOPE OF THE WORK:

3.1 Introduction

The Halifax Regional Municipality will receive proposals from qualified consultants/companies with strong technical backgrounds and proved effective experience in preparing community energy plans and programs in both the municipal government and private sectors. A creative problem solving approach that meets the criteria for Partners for Climate Protection Milestones and also tailored to the physical, socioeconomic, and environmental needs specific to HRM as a municipality, including its ongoing related environmental planning is desired.

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The goal of a Community Energy Plan is to design for energy efficiency in community systems as a tool of reaching long term sustainability. A CEP selects land use and full community design and infrastructure options based upon their ability to make the most efficient use of energy. The CEP is a collaborative effort where contributions to the direction and goals of the plan are sought and incorporated.

The required Community Energy Plan for HRM must be thorough, practical, achievable, cost effective and measurable. HRM is also interested in innovative, strategic approaches that meet this criterion. The following broad objectives are to be met.

- a) The CEP should promote energy efficiency and establish a commitment to increased renewal energy capacity.
- b) The CEP should set out goals to ensure energy security within the municipality.
- c) The CEP shall ensure continued delivery of municipal services requiring energy inputs.
- d) The CEP should lead to greater GHG emissions reduction
- e) The CEP shall be consistent with existing HRM strategic, environmental, and planning objectives.

A Community Energy Plan is a voluntary planning tool which takes a long range (100 year) view of community development towards a sustainable future. It influences a municipality's land use, transportation, site planning, building design, infrastructure design and efficiency and planning for new supply energy options. The goal of a community energy plan is to minimize energy use, establish energy security and maximize renewable energy development in all aspects of municipal growth and operations.

3.2 Community Description

- a) Population and type (urban, rural, combination)
- b) List of primary industries
- c) Sustainability development history and environmental goals of HRM
- d) Detailed descriptions of any milestones already developed or implemented (which would hopefully stem from the list in the Scope of Work)
- e) List of any existing action or sustainable development groups.
- f) Electrical Regulatory Regime

3.3 Proposal Process

- a) Proponent's meeting
- b) Enquiries
- c) Submission Deadline

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- d) Proposal Format
- e) Evaluation and Selection

The evaluation and selection will follow a two envelope system. The points for the technical portion of the proposal will total 90% and the fee portion will be worth 10%. Points for the fee portion of the work will be made on a pro-rated basis. The following point allocation is provided for the technical portion of the proposal.

	Points
1. Firm	
1.1 Experience with Community Energy Plan	5
1.2 Experience with Public Consultation Process	5
1.3 Firm Background, knowledge of HRM requirements	5
2. Project Team	
2.1 Project Manager	5
2.2 Project Team members, roles, experience and qualifications	20
3. Methodology and Approach	
3.1 Overall Approach to completing scope of work tasks	25
3.2 Public consultation process	10
3.3 Identification and Incorporation of Stakeholders	5
3.4 Creativity and innovation	5
4. Schedule	5
Total Score of 90	90

The consultant's minimum qualifications are described in Section 4.0 below.

3.4 Scope of Work

The Partners for Climate Protection from the Federation of Canadian Municipalities, uses the following milestones as a baseline for development of municipal action on Greenhouse Gas emission reductions:

- a) Take Stock
- b) Set a Reduction Target
- c) Develop a Local Action Plan
- d) Implement the Plan
- e) Measure Progress

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While a CEP is clearly different from a GHG emission reduction plan, this same set of milestones is applicable in creating a CEP. The RFP contemplates at a minimum all five milestones.

The following tasks are defined as the minimum requirement.

a) Conduct an Energy Resource Assessment of the municipality.

A detailed analysis based on urban, suburban and rural energy usage should be developed as energy reduction plans will depend on where and for what the energy is being used. The focus should be on the source of production, how it is produced, energy intensity factors and energy security. Include a cost analysis/breakdown of the energy inventory.

b) Link the energy consumption and production to environmental output, related to air emissions through the GHG conversion factors.

- This should allow a justified comparison of energy costs to environmental costs and aid significantly in determining energy reduction goals

c) Perform an anticipated energy demand project and supply risk assessment for a future date.

- This should be based on anticipated population, economic, land use growth, and municipal development.

d) Determine goals (based on monetary goals and environmental goals) for future energy supply. This should include at a minimum:

- a) Growth of domestic energy sources.
- b) Increase in renewable energy sources.
- c) Percentage reliance on energy from external sources.
- d) Long term and short term goals should be addressed.

e) Describe the energy supply, use and demand issues and determine specific action involved in order to reach the energy reduction goals for each of the following sectors. Suggest and described any other sectors that might apply. Innovation is a crucial component in this stage. Focus sectors include the following:

i. Land Use Planning and Transportation

Transportation is one of the major ways in which energy is spent within communities. Settlement patterns and land-use planning decisions have enormous impacts on the way we commute, the length of our commutes, the reasons we commute, and the modes of transportation we choose. In a compact neighbourhood, or one that is part of a network of regional nodes, citizens often have more transportation options including walking, biking, or taking the bus. If the neighbourhood is a complete neighbourhood with a mix of residential, commercial, institutional and recreational uses, the need for commuting itself might be reduced since citizens may not need to leave the neighbourhood to meet daily needs. Additionally, availability of public transit incentives and barriers to the use of the single occupancy vehicle influence citizens' transportation decisions. The energy implications of land use planning and transportation must be explored and recommendation must be made to bring future land use and transportation planning in line with energy reduction, efficiency, and diversification goals.

The following issues must be addressed at a minimum:

- a. contiguous development patterns;
- b. parking plans and siting;
- c. street design and traffic rules;
- d. trip reduction measures;
- e. stakeholder participation
- f. alternative (public) transit fuels

ii Neighbourhood/Site Planning and Building Design

The design of buildings and their relationship to one another as well as to other landscape features can have a tremendous impact on the demand and efficiency of energy use. Attached buildings, for example, lose less heat, while energy efficient windows and ventilation systems can reduce the need for space heating significantly. Lot and building orientation with respect to natural elements such as the sun and wind are key factors. The attractiveness of the street and neighbourhood to pedestrians and cyclist can also be important as it influence transportation choices. The following issues need to be considered and interventions recommended to make site planning and building design practices consistent with the goals of the CEP:

- a. building and appliance and appliance efficiency
- b. solar orientation
- c. landscaping
- d. neighbourhood design
- e. wind shielding and shading

- f. pedestrian facilities and orientation
- g. transit facilities and orientation

iii Infrastructure Efficiency

Large amounts of energy are spent in municipal infrastructure delivery including water supply, sewers, and solid waste management. Energy is spent to treat and pump water and sewage, as well as to pick up and dispose of waste. Recycling processes are also often energy intensive. Recommendations into infrastructure design, implementation and maintenance that is conscious of energy use and efficiency is required as part of the CEP. Best practices and practical solutions should be presented in each of the following areas:

- a. water supply and use
- b. wastewater collection and storm drainage
- c. recycling facilities
- d. heat and power recovery
- e. joint infrastructure planning and delivery

iv Alternative Energy Supply

While municipalities do not usually have a mandate for the supply and distribution of energy, the growth of alternative energy sources are dependant on a variety of municipal decisions. Various municipal building requirements can determine whether or not it is feasible for landowners to orient their homes for the best solar energy, to utilize ground source heat pumps on their land, or to install wind turbines on their property. Zoning can influence the decision of major renewable energy producers to location in a neighbourhood or not. Municipal operations also have opportunities to adapt their own operations to include energy recovery from waste including landfill gas. Projects such as district heating systems can only be implemented with full participation from the municipality along with other partners. Incentives programs from the municipality can also encourage the development of alternative energy sources. The CEP must address the full range of potential alternative energy options including the following, and must make recommendations as to the role of the municipality in helping to develop these:

- | | |
|-----------------------------|------------------------------------|
| a. "district" energy | b. waste heat utilization |
| c. ground source heat pumps | d. co-generation of heat and power |
| e. wood-waste systems | f. solar technologies |
| g. alternative fuels | h. landfill gas utilization |
| i. wind | |

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f) Design and implement a consultation process to gain the necessary collaboration on the CEP including necessary departments of government (parks, engineering, etc), citizens, neighbourhood communities, developers and consultants, provincial government, transportation agencies, energy utilities, military bases. Develop a means to communicate with stakeholders on the plan and provide information on how the plan is developing.

g) Explore additional benefits to be realized from implementation of the steps in Point 6.

- Address social impacts, economic impacts, health benefits, and contribution to the national effort of GHG reduction and other environmental issues. A complete picture of the benefits of the plan would provide strong support and incentive to ensure the time and financial effort to implement the program are present.

h) Develop a companion program to address internal education and awareness, as well as a strategy for public outreach and education.

- As with the development stakeholders, the general population should be educated in the environmental goals of its municipal government, as awareness and understanding leads to support.

i) Design a monitoring program such that goals can be measured following CEP implementation, and evaluated in order to reassess and carry on with CEP goals.

j) Assist in identifying current available funding applications to improve energy efficiency. Identify potential projects, funding opportunities, bylaw changes, policy changes etc. that may have the potential to be funded by supporting government programs.

- While the implementation of a CEP is inevitably a cost saving measure, and therefore, an investment as opposed to an expenditure, the available funding/financial assistance should be exploited. Examples include Green Municipal Enabling Funds, Green Municipal Investment Funds, Atlantic Innovation Fund, Atlantic Canada Opportunities Agency, NS Resource Recovery Fund, etc, etc.

k) Design an Implementation Plan

- Discuss barriers forecast in implementing the CEP and recommend appropriate mechanisms by which to overcome them (such as government programs, financial tools, etc.).

4.0 Consultant Minimum Qualifications

The development of the Community Energy Plan will require diverse and specialized expertise. The consultant team shall include the following professionals:

- A qualified and highly capable Project Manager who can lead the project and coordinate team members on the tasks required. The Project Manager must understand Community Energy Plans, be able to communicate with the municipality understanding its objectives, and be capable of executing the project through the course of schedule commitments and budget allocations. The Project Manager shall fully understand the level of work required for each project task and will lead the public consultation process for the project. The proposal shall demonstrate this knowledge as well as which and how collaboration with interrelated organizations to the CEP will be led by the Project Manager.
- The project team will require an energy engineer/scientist who is fully knowledgeable of existing and potential energy sources and the limitations of these sources within the municipality. These energy sources include electricity, natural gas, fuel oil and other heating oils, transportation fuels, renewable energy sources, and potential existing waste energy (heat) sources.
- The project team will require an energy engineer/scientist who can compile the existing aspects of energy utilization with the municipality as well as projected potential future uses given projected growth scenarios. The energy utilization analysis will include residential, commercial, institutional, industrial, transportation and other sectors.
- The project team will require an urban planner who understands existing and likely future growth in the municipality and environmental engineers or scientists who are versed in the latest sustainable development frameworks and their applications.
- The project team will require specific analysis in several subject areas and would benefit from the expertise of an economist (for price forecasts), regulatory specialist (to evaluate barriers and recommend solutions), and support for public consultation and education.
- The project team will need to demonstrate experience in the development of community energy plans.
- The proposal shall clearly demonstrate how the consultant will approach the various issues of the CEP based upon the qualifications of the proposed team. An organizational chart and manpower loading matrix shall be provided to demonstrate the specific technical resources proposed for the project; the manpower allocation matrix shall be broken down by each major project task.

**FACTOR-2 COMMUNITIES
PROGRAMMES & PROJECTS**



Executive Summary (Programs and Projects)

Developing a community that is Factor-2 or 50% less dependent on fossil fuels is not a dream for the future. Technologies exist today that can reduce the impact of today's fossil-fuel-driven marketplace. However, people too often discount them, citing "too long a payback" or claiming that they are "not standard practice." Urban planners have demonstrated that street layouts can reduce infrastructure costs by 33%, that the avoidance of suburbia reduces transportation by 40%, that renewable energy technologies improve air quality, and that fossil-fired Combined Heat and Power and District Energy reduces emissions by 35%. Wide-scale integration of these practices can reduce a community's environmental impact by 30–40% or, more likely, by FACTOR-2. A community energy plan is the road-map to such a goal.

To implement the plan there needs be a structured approach to integrated technologies. Programs allow projects to interact and attain the maximum benefit for the community. But to implement them, the community needs to feel confident that the approaches will achieve the goals set. This report provides examples of where such technologies have been applied and monitored. They give readers sufficient information for discussing the potential for applying the technologies to their own communities.

Development of the plan, even for a large city, should not be burdensome in terms of time and resources. This guide and its supporting literature, tools and advice was developed to support communities in developing their plans and implementing their overall energy reduction strategies. The process is consistent with other federal and provincial plans.

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LAND USE PLANNING OPPORTUNITIES

L.1 Contiguous development patterns

L.1.1 Mixing residences and workshops

(See co-housing, main street redevelopment, telework and telecentres)

- Case study: Markham, ON

The City of Markham adopted a blanket bylaw for home-based businesses. It permits businesses in all residential neighbourhoods provided they meet certain criteria. The bylaw also identifies activities not permitted.

- Energy costs are reduced because of reduced transportation, road requirements and parking – i.e. land is used efficiently.
- Air pollution is reduced because of the elimination of commuting to work.
- Employment and economic development is increased.
- Neighbourhood security is increased and housing affordability is increased.

Source: Home Occupation Scenarios and their Regulatory Requirements:
Ferrera Contreras Architects Inc. www.actprogram.com



A proposal for transit-oriented redevelopment in Markham, Ontario
(www.bettertransit.ab.ca/wnew.htm)

- Case study: Sainte-Genevieve, QC

The City of Sainte-Genevieve introduced regulations to permit artisans to live, work and sell their products from their workshop or residence and created artisan districts and zones.

- Transportation costs are reduced.
- It encourages revitalization in the downtown core while commercial activity on the main street is stimulated.
- Tourism increases.
- The elimination of two rents increases affordability.

Source: City of Sainte-Genevieve. May 1998. Planning an Artisan Community www.actprogram.com/

L.1.2 Shops and services within walking distance of homes

Mixed-use development provides shops, housing and services in close proximity to each other.

- Proximity to shops reduces vehicle use.
- Eyes on the street reduce policing requirements.
- Building reuse curbs urban decline and urban sprawl.

Urban forms that emphasize pedestrian- and transit-friendly neighbourhoods are known as “New Urbanist” developments. The self-contained neighbourhoods incorporate a mix of land uses and housing types, ranging from apartments to non-profit housing to single-family detached homes. Streets are designed to accommodate pedestrians, and services are located within easy walking distance of all residents.

- Case study: Victoria, BC

Shoal Point is an award-winning high-density, mixed-use commercial and residential, energy efficient complex in Victoria's city centre. It is considered to be one of the most environmentally advanced buildings in North America and is promoted as a showcase initiative by Natural Resources Canada's C-2000 program.

- It consumes 45% less energy than an equivalent built to Model National Energy Code for Buildings.
- Much of the heat for the residential suites is provided by a ground source (or geothermal heat pumps).
- It incorporates a portfolio of relatively low-tech features that are responsible for much of its energy gains.
- It revitalized a depressed economic area by using local building materials, bringing in wealthy residents (units sold from \$280 to \$300k in 2003), and employing local labour.
- Shops and services near housing reduce vehicle use.



(www.baysidemc.com/projects.php)

Source: BC Community Energy Association Committee. Shoal Point: Towards Sustainability in Victoria.

http://www.energyaware.bc.ca/tk_c_shoalpoint1.htm

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-Additional resource:

Office of Energy Efficiency of Natural Resources Canada www.see.nrcan.gc.ca

CANMET Energy Technology Centre www.sbc.nrcan.gc.ca,

- Case study: *Walkable Communities* <http://www.walkable.org/>

Walkable Communities was established in the state of Florida in 1996. It was organized for the express purpose of helping whole communities, whether they are large cities or small towns, or parts of communities, such as neighbourhoods, business districts, parks, school districts, subdivisions and specific roadway corridors, become more walkable and pedestrian-friendly.

-Case study: Los Angeles, CA, USA

South Village is a public-private partnership development in downtown Los Angeles. The 7.2-acre multi-block is based on the conversion of the three gas company buildings into 251 rental lofts and 22,500 sq. ft. of retail space: five levels of loft apartments above a 50,000 sq. ft. supermarket, an additional 10,000 sq. ft. of retail space, and 152 loft apartments and 25,000 sq. ft. of retail space. The final phase will add 520 condos and 30,000 sq., ft. of retail space.

- Case study: Pomona, CA, USA

The City of Pomona, in inner Los Angeles, has developed a three-storey, mixed-used building with retail on the ground floor and office and lofts on upper floors. This is a major redevelopment project in a very old, declining inner suburb on two acres, near Metrolink (a commuter rail).

-Case study: Sidney, BC

The Town of Sidney, BC, offers examples of residential units above spaces with different commercial uses. A shopping mall on McKenzie Avenue has residential units above it, at the suggestion of local council. There are also many smaller, older apartments above commercial space.

- Additional resources: www.town.sidney.bc.ca/

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-Case study: Vancouver, BC

Vancouver has several examples of apartments above grocery stores. Urban Fare in False Creek North, developed by Concord Pacific, is a very large grocery store in the ground floor, with several types of residential space above, including a tower. The IGA at Burrard and Smythe is a two-storey grocery store with offices, residential units and a hotel above it. Soon there will be a Costco with four to five residential towers on top, also developed by Concord Pacific.

Another successful infill project is the Caper's mixed-use development on a block of Fourth Avenue in the Kitsilano area of Vancouver. Originally a car dealership, the block was redeveloped in the early 1990s into an attractive, well-insulated building heated by an underground heat pump and heat exchangers that transfer hot and cold air (as needed) between the building's commercial and residential spaces.

The building features 78 condominium units and 75,000 square feet (gross) of commercial space, divided between office space on the upper floors and retail on the ground floor. The anchor store, Caper's Natural Foods, features an attractive courtyard café that is well used in the warm weather.



(<http://www.bizmapbc.com/media/commercial/yaletown/photo4.jpg>)

The development has helped to strengthen the neighbourhood and contributes to the pleasant pedestrian-friendly ambience of this part of the city. The building is also on a well-used transit route and is close to a bikeway.

- Additional resources: www.concordpacific.com/aboutus/about_us.html

- Case study: Chicago, IL, USA

DePaul University in Chicago has dormitories above a two-storey Dominick's grocery store. The US\$10-million mixed-use building of 88,635 gross square feet contains a residence hall and 28,000 square feet of retail that includes a two-storey Dominick's food store

- Additional resources: <http://www.depaul.edu/>

L.1.3 Transit-oriented development

(See also mixed-use development)

A transit-oriented development is a functioning neighbourhood centred on a rail or bus station. The intent is to eliminate the use of private transportation and give the residents immediate access to public transit. In this high-density mixed development with retail, progressively lower-density occupancy is spreading outwards.

Resource: <http://www.vtpi.org/tdm/tdm45.htm>

- Case study: Arlington, VA, USA

Arlington County, just outside of Washington, DC, built its Metrorail transit system underground and channeled nearly all development along the Metrorail lines. It promoted high-density development adjacent to and above rail stations, with relatively high-density housing within convenient walking distance. Benefits included the following:

- Transit ridership has grown steadily, offsetting car use.
- Mixed land use has resulted in relatively balanced ridership over the day, resulting in efficient use of the transit system, rather than two sharp peaks experienced on some transit systems.
- Many riders walk or bicycle to stations rather than driving or riding a bus.
- The County has grown rapidly without major expansion of the highway network or parking facilities, while maintaining low tax rates.
- The Metrorail corridors use land effectively. The corridors use only 7% of the land yet provide 50% of the County's tax base.

- **Additional Resources:** www.co.arlington.va.us

- Case study: Vancouver, BC

The SkyTrain stations in Vancouver have led to the creation of regional town centres. Government encourages commercial, employment and residential development within the centres by leasing office space and by addressing developers' needs, such as building parks.



Vancouver's light rail Sky-Train has led to the creation of regional town centres. www.railworks.com/sky_train_profile.html

The result has been hundreds of millions of dollars in development and hundreds of thousands of square feet of new office and residential buildings, high population densities, and high levels of transit use. The Vancouver SkyTrain is an automated, light rapid transit train that delivers over 140,000 passenger-trips a day.

L.1.4 Location-efficient development and mortgages

(See transit-oriented development)

Location-efficient development consists of residential and commercial development located and designed to reduce automobile dependency. The residential and commercial development is in close proximity to good transit service and public services and provides good walking and cycling conditions. It works well with location-efficient mortgages.

- Case study: Seattle, OR, USA

The City of Seattle, working with the federal housing agency Fannie Mae, rewards homeowners with larger loans than they would normally qualify for and lower down payments if participants agree to own one car or no car at all and agree to live within a quarter of a mile of a bus line or half a mile from a train or light rail system. The initiative also offers discounted annual bus passes for one member of the household. Residents and employees in such areas tend to drive less, rely more on alternative forms of transportation, and enjoy better transportation options than those living or working in less accessible areas.

Source: Victoria Transport Policy Institute. <http://www.vtpi.org/tdm/tdm22.htm>

-Additional resource: <http://www.locationefficiency.com/>

- Case study: Chicago, USA

Chicago's suburban transit system discounts annual transit passes for households that use the location-efficient mortgage (LEM) to purchase a home outside the city of Chicago. A monthly pass usually costs \$75; the special offer to LEM homebuyers will cost \$62.50, or \$750 per year. Two discounted passes are offered per household.

- Additional resources: www.cnt.org

L.1.5 Transportation user fees

- Case study: Austin, Texas, USA

The City rewards households that reduce their vehicle ownership. City utility bills include a transportation user fee. The annual fee is from US\$30 to US\$40 for an average home. This charge is based on the average number of daily motor vehicle trips made per property, reflecting its size and use. For example, single-family development is estimated to generate 40 motor vehicle trips per acre per day; condominium residential use and townhouse residential use generate approximately 60 motor vehicle trips per acre per day; and offices generate approximately 180 motor vehicle trips per acre per day. Residential property owners with no cars or aged 65 years or older are exempt from the tax.

- **Additional resources:** www.ci.austin.tx.us/development/ldc1.htm

L.1.6 Diverse and compact housing

L.1.6.1 Co-housing

- Case Study: Calgary, AB

Prairie Sky is an 18-unit multi-family complex located at 402 - 30 Ave NE, Calgary, Alberta in the inner-city community of Winston Heights. The project consists of 2- and 3-bedroom townhouses and apartments and a 3200-square-foot common house surrounding a central courtyard with community gardens and a children's play area. Each unit is self-contained with a full kitchen, laundry rough-in, and private outdoor seating space. The heart of the complex is the common house, which includes a full kitchen and dining room, lounge, children's playroom, teen room, laundry, guest room, multi-purpose rooms and workshop. Parking is underground.



- Case study: Toronto, ON

Creative Communities and the Collaborative Housing Society developed Windsong as a form of communal housing where services are shared and could include meals, daycare, lawns, and gardens or shared office amenities (fax, printers, workstations, etc) to facilitate home-based businesses and reduce isolation, which is a common complaint of those working from their homes. Vehicle use is reduced because many services are provided locally. Locally grown produce reduces energy associated with transportation of agricultural food products. Eyes on the street improve neighbourhood security.

Windsong Community, Langley BC shown right.....>

Source: Creative Communities and the Collaborative Society. 1997. Planning for Cohousing. (PB0177-40). ACT case study. www.actprogram.com

-Additional resource: *The Intentional Communities Web site of cohousing communities.* See <http://www.ic.org/iclist.html>

(<http://www.windsong.bc.ca/photos.htm>)



L.1.6.2 Eco-villages

- Case study: Ithaca, NY (USA)

Eco Village in Ithaca combines the co-housing model of communal housing with the eco-village aspects of minimizing energy and natural resource use. Eco-villages use emerging technologies for waste and water management and treatment. There are also strong socioeconomic benefits such as self-sufficiency in employment and different types of housing for different income and age groups. The eco-village in Ithaca will eventually house 500 people in five neighborhoods, all with common houses centred on a village common. The first neighbourhood (known as “FROG”) was completed in 1997. Thirty tightly clustered homes line a meandering pedestrian street. FROG's homes feature a number of innovative energy-efficient features.

- Typically, eco-villages use 50% less energy and produce 90% less solid waste than conventional developments.

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- They provide a comprehensive approach to health, livability, economic feasibility, social equity and safety.
- 80% of the site (176 acres) of the Ithaca Eco Village is preserved for green space.

- Additional resources: <http://www.ecovillage.ithaca.ny.us/>

- Case study: Steyerberg, Germany

The Lebensgarten eco-village was founded in 1984, when a Berlin businessman bought a dilapidated housing estate and he and six others decided to initiate an ecological and spiritual centre there. The complex has 65 row houses and various community buildings. The original site was built in 1939 as housing quarters for an ammunition factory. After the Second World War, it was used as a barracks by the English army. Reuse of existing buildings saves energy in construction and materials and makes efficient use of existing infrastructure. In 1996, the Lebensgarten eco-village was identified by the UN as a Global Best Practice for Improving the Living Environment.

Source: Declan Kennedy. 1996. Communities: Eco-Village "Lebensgarten", Steyerberg.

- Additional resources: Communities, PO Box 169, Masonville, CO, USA 80541-0169, (970) 593-5615.

L.1.6.3 Urban villages

- Case Study: Gatineau QC

The City of Gatineau is incorporating the concept of “urban villages” within its official plan. The Urban Village Charter establishes a set of fundamental features and attributes that each urban village should have. Urban villages should:

- Gather residents around a place with which they can identify and with which they have a historical connection;
- Possess a set of distinctive traits that contribute to the emergence of a distinctive calling, a reason to live there;
- Bring together around a common axis several distinct neighbourhoods with alternative housing types to enable residents to remain there through different stages of their lives;
- Have a housing density that justifies the introduction of one or more service cores that are readily accessible from every home and conducive to public transportation;
- Offer residents various neighbourhood services that meet the ongoing needs of households;
- Provide residents with a meeting place right at the heart of their neighbourhoods; and
- Connect to a traffic corridor to ensure that residents can travel throughout their village and out to employment poles, activity centres and the downtown area.

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- Case study: Chilliwack, BC

Chilliwack, in the Lower Mainland of BC, about 100 km east of Vancouver, is planning a network of compact pedestrian-oriented rural villages also known as “urban villages”. Planning is based on the principles of sustainable land use planning and design.

- Resources are used efficiently to preserve agricultural lands.
- Agriculture is an integral part of urban areas. Producing and buying locally grown food minimizes energy costs associated with transportation.
- Only 5% of the land base in BC is suitable for agriculture, much of it being in the Lower Mainland. Protecting this scarce agricultural land from urban sprawl is therefore a key smart growth strategy.
- Innovative sanitary sewage and storm water management allows for development on hillsides.
- Transportation management strategies allow reduced vehicle reliance.

Source: ACT. 1998. Ryder Lake "Urban Village": Development Plan for a Sustainable Community: District of Chilliwack (PB0177-50). ACT case study. <http://www.actprogram.com>

- Case study: Cap-Pelé, NB

Beaubassin Planning Commission received approvals from the province to intensify development in rural community centres by building on 2000-square-metre lots or two units on 4000-square-metre lots instead of one unit on 4000-square-metre lots. The requirements were modified as a result of provincial approvals of new septic system technologies.

- Agricultural lands are preserved.
- Sprawl is reduced.
- Rural life is enhanced.
- The province also designated the Beaubassin Planning District as pilot rural village.

Source: ACT. 1999. Increasing Housing in Rural Community Centres: Beaubassin Planning Commission. (61995). ACT case study <http://www.actprogram.com>

- Additional resources: Global Eco-Village Network at <http://gen.ecovillage.org/>

L.1.6.4 Expandable Envirohome

- Case study: Montreal, QC

Sevag Pogharian Design built an innovative detached home that can be altered and expanded as the needs of the family change; it includes an accessory apartment. It is also an Envirohome, meeting stringent energy efficiency, indoor air quality, and resource conservation requirements.

- Environmental benefits are demonstrated through the use of recycled materials, environmentally responsible approaches to landscaping and construction, and products designed to reduce indoor pollutants and allergens. Infill development makes efficient use of land and existing infrastructure, reducing sprawl.
- Infill encourages downtown revitalization and economic development.
- Housing affordability is increased because the second unit can contain a home-based business or an accessory apartment; the apartment could be used to house senior family members or generate income to assist in mortgage payments.



Source: ACT.1997. Sprout: Infill Housing for Young, Middle-Income Households: Sevag Pogharian Design (PB0177-44). ACT case study. <http://www.actprogram.com> (envirohome.chba.ca/seethehomes/montreal.html)

- Additional resources: Canadian Home Builders' Association (613) 230-3060 or www.envirohome.chba.ca
<http://oee.nrcan.gc.ca/corporate/awards/ambassadors/index.cfm>

- Case study: Halifax, NS

The Nova Scotia Home Builders' Association's Millennium House is an R-2000 Envirohome with Flex Housing and Healthy Housing Features - <http://www.envirohome.chba.ca/seethehomes/millennium.html>.

- The house uses 40% less energy than a conventional home.
- Indoor air quality is improved, leading to a better living environment.

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- The interior space can be easily refigured to accommodate someone living with reduced mobility, such as a senior living with disabilities.

Source: 2002. N.S. Home Builders Spearhead Regulatory Reform and Envirohome Project: Nova Scotia Home Builders' Association. ACT case study.

[-Additional resources](#)

Canadian Home Builders' Association. (613) 230-3060 www.chba.ca
Office of Energy Efficiency of Natural Resources Canada
www.oeenrncan.gc.ca

<http://envirohome.chba.ca/seethehomes/montreal.html>

L.1.6.5 Accessory suites

- Case study: Quebec City, QC

Quebec City rezoned single-family neighbourhoods to permit the addition of secondary suites and updated site development standards.

- Urban sprawl is countered by intensifying existing development and optimizing municipal infrastructure.
- Maintenance of existing housing stock is encouraged, and seniors can stay in their houses longer.
- Affordable housing is provided in safe, quiet neighbourhoods.

Source: ACT 2002. Modifying Municipal Regulations to Accommodate Two-generational Houses in Quebec City. ACT case study. <http://www.actprogram.com>

- Case study: North Vancouver, BC

The District of North Vancouver modified its guidelines and developed information packages regarding accessory apartments to facilitate the implementation of the District's accessory apartment policy.

- Secondary suites discourage urban sprawl.

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- Most plans for single-family homes submitted for municipal approvals have suites designed into them.
- It has brought illegal suites out of hiding. The new bylaw serves to protect the existing affordable housing stock.
- Tenants can make complaints against landlords without fear that the illegal unit will be discovered and closed down.
- Landlords now have accurate information about costs and can charge accordingly; rents have gone up 1-2%.

Source: ACT. 1999. *How the District of North Vancouver Built Community Acceptance for the Legalization of Secondary Suites in Single Family Neighbourhoods* District of North Vancouver. Community Planning, Building, Land and Bylaw Division of the District of North Vancouver. ACT case study. <http://www.actprogram.com>

L.1.6.6 Solar housing

Case study: Wallisellen, Switzerland

The International Energy Agency is undertaking an international study to increase the use of solar energy in housing to more than 5% of the housing stock by the year 2010. Canada is participating in the study, which runs until 2005. The study will look at many housing types, different solar technologies, and retrofit possibilities. It will provide a model approach to builders and municipalities and include demonstration initiatives.

- Additional resources:

<http://www.ecbcs.org/annexes/annex38.htm>



L.1.6.7 Healthy House

- Case study: Toronto, ON

Rolf Paloheimo of Creative Communities built the Toronto Healthy House (right), <http://www.cmhc-schl.gc.ca/popup/hhtoronto/works.htm> designed by Martin Leifhegger Architect, in 1996. It is also known as the Codicile house. It is two semi-detached infill houses that are completely self-sufficient from the municipal water and wastewater servicing and electrical grids. The Codicile harvests its own energy, collects and purifies rainwater for drinking and reuses and biologically treats its own wastewater.

- It uses 10 times less water than a conventional house.
- Energy savings result from use of photovoltaic and solar panels.
- Intensification reduces sprawl.
- The first floor is ideal for a home-based business.



(www.fims.uwo.ca/newmedia/newmedia2004/energy/...)

Source: CMHC. 2000. Practices for Sustainable Communities. 2000.

- Additional resources: Canadian Housing and Information Centre.
<http://www.cmhc-schl.gc.ca/popup/hhtoronto/works.htm>

-Additional resource CMHC. Case Studies of Potential Applications of Innovative Residential Water and Wastewater Technologies. Technical Series 99-116 <http://www.cmhc-schl.gc.ca/publications/en/rh-pr/index.html>

- Case study: Yellowknife, NWT

The City of Yellowknife examined wastewater reclamation technology, such as the one used in the CMHC Healthy House, to determine the impact on land development costs, housing costs, and overall capital and operational cost of the infrastructure system.

- A large portion of housing energy costs in the North is associated with the trucking of water to housing and of wastewater from housing. On-site reclamation technologies have significant potential application in the North.

Source. ACT. Universal Application of Wastewater Reclamation Technology. City of Yellowknife. ACT Grant Award fact sheet <http://www.actprogram.com>

L.1.6.8 Car-free housing developments

- Case study: Vienna, Austria

The social housing project in Floridsdorf (250 units) has extensive community facilities and demonstrates the latest resources in innovation and energy use.

- The six-storey buildings have been oriented to enable direct sunlight to access the ground floors; they feature active (hot water) and passive heating.
- A heat-recycling unit makes use of wastewater heat and can also switch to a cooling system in the summer. Grey water is then treated on site to be reused in toilets.
- District heating supports the renewable systems when needed. A photovoltaic system supplies energy for electric car charging. All building materials have been selected on the basis of environmental auditing.
- The open space has a maximum share of soft surfaces, is landscaped in native vegetation, and features a small wetland.
- Rooftops are accessible for community use, and an adjacent site with tall trees has been preserved for parkland.
- Car parks are used exclusively for car-sharing vehicles.
- Tenants are discouraged from vehicle ownership by a clause in their lease. If they buy a car, they lose their rent-control status. There is parking for 400 bicycles.



- Floridsdorf: Clockwise from top left: Community life in a small park between the tram stop and the buildings; view of facade and open spaces; mini-wetland in the northern courtyard; car-free housing meets car-oriented retail in this most heterogeneous part of Vienna. Photos courtesy of Murdoch

The program is largely financed by a reduction in parking requirements from 250 spots (one spot per unit) to 25 places
Source: Scheurer, Jan. 2001. Car-free Housing in European Cities: A Survey of Sustainable Residential Development Projects.

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See car-free housing in Europe at
<http://www.wistp.murdoch.edu.au/>.

- Additional resources: Murdoch University,
South Street, Murdoch, WA 6150.

(



<http://www.hw.ac.uk/sistech/rae/images/Slateford.jpg>

One of the outer London boroughs in the south, Sutton is well known for its “Zero Energy and Car Free” development at Beddington (BedZed). With its futuristic styling, this ground-breaking initiative has led the way with car-free developments.

<http://www.peabody.org.uk/pages/GetPage.aspx?id=179>



L.1.6.9 Small-lot housing

- Case study: Charlottetown, PEI

The City of Charlottetown undertook a study on small lot housing as a means of intensification. It developed design guidelines for infill housing and modified its zoning by-law to permit it.

- Building on smaller lots encourages the construction of smaller houses; these houses require less energy to build and maintain than larger houses.
- Small lot regulations and guidelines allow houses to be built on lots that otherwise would have remained vacant.

Source: ACT. 1998. Small Lot Housing--City of Charlottetown (PB0177-52). ACT case study.

<http://www.actprogram.com>

L.1.6.10 Straw bale housing

- Case study: Montreal, QC

Julia Bourke Architect designed and built a single-family infill home of straw bales (right, under construction). Regulatory innovations include modifying the City charter, the subdivision bylaw, the City's urban design guidelines and heritage area restrictions.

- Less energy is required to heat and cool the house. Straw bale provides R40 insulation properties, exceeding the requirements of the Model National Building Code.
- Much of the heat is provided by a ground source (or geothermal heat pumps) and is greenhouse gas-emission free.

Source: ACT. 2001. Straw Bale Infill Housing on Small Urban Lots:

Julia Bourke Architect. (PB63199). ACT case study. www.actprogram.com

-Additional resources: Globe and Mail. Feb 21 2003. Cosy in a Blanket of Straw.

<http://www.theglobeandmail.com/servlet/ArticleNews/TPPrint/LAC/20030221/RESTR/TPEntertainment>



- Case Study: Kahnawke, QC

Julia Bourke Architect and the Kahnawke First Nations Community are constructing an affordable, ecological demonstration house as part of a proposed sustainable neighbourhood master plan in a First Nations community in Kahnawke, Quebec. Inclusion of a biological water treatment system as well as other sustainable design strategies will require changes to zoning regulations.

Source: ACT. 2001. Montreal-area Project To Demonstrate Sustainable, Affordable Aboriginal Housing. ACT Grant fact sheet

<http://www.actprogram.com>

L.1.6.11 Garden suites

Garden suites, also known as granny flats, are temporary self-contained housing units capable of being moved onto a lot already containing a house. It is usually intended for elderly family members of the host family; they make efficient use of existing services (family support and municipal infrastructure).

- Additional resource:

<http://www.cmhc.ca/en/imquaf/afho/afadv/pore/prgasu/index.cfm>

(<http://www.good-sam.com/GoodSamKiss/images/Suite.jpg>)



- Case study: Oshawa, ON

A housing consultant working with the local municipality developed model regulations to administer the approval and use of garden suites in the Region of Durham. Garden suites are temporary housing units placed on lots to house senior family members.

- Garden suites are temporary infill developments that make efficient use of existing services.
- The cost of housing seniors in garden suites can be much lower than housing seniors in institutional care.
- Seniors occupying larger homes can be provided with an attractive alternative, freeing up the larger home for families with children and enabling seniors to access family support while remaining independent.

Source: ACT. 1996. Criteria for Garden Suite Regulations: Harbour Management Services Ltd. ACT case study.

<http://www.actprogram.com>

- *Case study: Oshawa, ON*

Municipally based, practical and enforceable guidelines were developed to control the use and maintenance for onsite sewage systems that service garden suites.

- It eliminates the need to install a separate sewage system, thereby increasing affordability and feasibility
- It also addresses the problem that sometimes arises when the host property is unable to accommodate an additional on-site septic system.
- Municipalities in rural areas can use the guidelines to develop regulations and procedures to determine system capacity, water conservation features and devices and remedial measures to be taken in the event of system malfunction.

Source: ACT. 1996. *Laying the Groundwork: Garden Suites and Onsite Septic Systems: Harbour Management Services Ltd. ACT case study.* <http://www.actprogram.com>

L.1.7 Urban growth boundary

Implementing an urban growth boundary that restricts suburban development and encourages mixed-use development around transit centres is an effective control against urban sprawl. If it is necessary for major commercial development to be located in the suburbs, it is important to ensure they are clustered with other commercial and residential areas and are located very near a transit centre. The policy should be linked with strong public education and good pedestrian and cycling routes.

Limiting suburban development reduces sprawl and preserves agricultural lands. In 2003, the City of Ottawa adopted its official plan, limiting the growth of the urban boundary. It was quite contentious.

- Additional resources: City of Ottawa (613) 580 2424

- Stopping sprawl with urban containment boundaries.

http://www.smartgrowth.bc.ca/index.cfm?group_ID=3434

<http://pppm.uoregon.edu>

<http://www.metro-region.org/article.cfm?articleID=277>

L.1.8 Design for transit access

(See also transit-oriented development and transportation.)

- Case study: Singapore

The city-state of Singapore implemented a land transport system to reduce traffic congestion and its associated problems. The initiative includes an area-licensing scheme; control of car population through various fiscal measures; promotion and establishment of a more efficient public transportation system; and highly integrated land use and transportation planning.

- The Singapore initiative has resulted in relatively congestion-free roads.
- Road pricing by using electronic tolls that vary according to time of day limits the growth of urban traffic.
- Efficient use of existing transport facilities, especially within the usually congested city area, results from planning and developing an alternative urban structure where economic activities become dispersed and there is better physical integration between employment, amenities and housing.

Source: Land Transport Authority. <http://www.lta.gov.sg/>

- Additional resource: UN. 1998 *Evolving a World Class Land Transport System in Singapore. Best Practices Brief.*
http://www.bestpractices.org/bpbriefts/urban_infrastructure.html



(www.urbanrail.net/as/sing/singapore.htm)

- Case study: Markham, ON

The City of Markham developed a "Performance Measures Document," a planning tool consisting of environmental, design, transit and pedestrian-supported best practices used to assess development proposals and to support the development of a more sustainable community.

- Energy use and CO₂ emissions can be significantly reduced because staff will be able to evaluate development proposals based on their degree of sustainability.

- Case study: Copenhagen, Denmark

The City of Copenhagen has adopted an overall travel management policy to improve the quality of transport, the urban environment and city life in general. The policy involves computerized traffic management, the development of public transportation, a cycle network and a parking policy.

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- Car traffic measured in terms of kilometres driven per year is reduced by some 10% below the 1970 level, saving energy.
- In 1996, 30% of home-to-work trips in the summer season were by bicycle, 37% by public transport, and 30% by private car.

Source: "Good Practice Guide" - The European Commission. 1996. Transport management. <http://www3.iclei.org/egpis/egpc-042.html>

- Case study: Groningen, The Netherlands

The City of Groningen has an integrated travel management policy to reduce car traffic while maintaining a good level of accessibility to the city. Green transport modes, especially in the inner city, are strongly promoted. The travel management policies consist of a number of elements, including urban planning measures, management of car traffic, improvements to public transport, encouragement and facilitation of cycling, and introduction of new parking policies. Groningen is the world's third-ranking city for bicycle use.



Photo: Ken Church

Source: European Commission Expert Group on the Urban Environment. 1996. Integrated approach to the improvement of the inner city. <http://www3.iclei.org/egpis/egpc-043.html>.

- Case study: Brampton, ON

The City of Brampton planned public transit use at the subdivision development stage to maximize public transit use. Subdivision agreements include a component to phase in public transit use. Roads are wide enough for buses and allow enough turnaround space.

- Public transit use increased by 40% between 1996 and 2000; this is double the population growth for that same period.

Source: City of Brampton. 2002. Improving Transit Ridership and Transit Means to Accommodate Growth. <http://sustainablecommunities.fcm.ca>.

- Case study: Quesnel, BC

The City of Quesnel adopted an official community plan that improves the transportation systems. Land use policies were created to encourage more energy efficient urban transportation infrastructure, such as a mix of land uses downtown and

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infill development. They also allow developers to build at higher density in exchange for meeting certain requirements, such as building housing that is considered affordable to low income households, and they make residential developments conditional upon the provision of commercial space. Transportation-related initiatives were developed involving the building of roads that use less energy in their construction, bicycle trails and pathways, and a study into public transportation possibilities. This is also an example of a community energy plan.

Source: Community Energy Association BC. Quesnel: Small Steps Towards Better Transportation: Transport Specific Policies. http://www.energyaware.bc.ca/tk_c_quesnel1.htm.

- Additional resource: Smart Growth BC write-up http://www.smartgrowth.bc.ca/index.cfm?group_ID=3435

L.1.9 Intensification, infill and conversion

- Additional resources: David Suzuki Foundation. 2003. *Understanding Sprawl: A Citizen's Guide*
http://www.davidsuzuki.org/Climate_Change/Sprawl.asp

Local Government Commission in Cooperation with the US Environmental Protection Agency. 2003. Smart Growth. Creating Great Neighborhoods: Density in Your Community <http://www.epa.gov>

L 1.9.1 Downtown revitalization

- Additional resource:
CMHC. 2002. Disinvestment and the Decline of Urban Neighbourhoods
<http://www.cmhc-schl.gc.ca/publications/en/rh-pr/index.html>

- Case study: Montreal, QC

A community-based organization, Collectif Hochelaga Maisonneuve <http://www.frp.ca/PDFDocuments/hochelaga.PDF> undertook a land use study on revitalizing a run-down area of Montreal through mixed housing and commercial development, including recommendations on necessary zoning amendments.



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- The project reversed the trend toward decline in an inner-city community, encouraging the efficient use of land and resources and saving energy that would have been used in developing new areas.
- Economic development was encouraged, increasing the municipal tax base.

Source: ACT. 2000. An Action Plan for Revitalizing a Commercial Artery: Collectif en aménagement urbain Hochelaga Maisonneuve. ACT case study. <http://www.actprogram.com>

- Case study: Drummondville, QC

The City developed the architectural concept, financial strategy and communication plan and modified regulations for a housing redevelopment project to revitalize downtown Drummondville.

- Energy is saved by making efficient use of existing land and services rather than developing new areas.
- The City found that it is possible to build innovative housing units at a reasonable cost and create a quality downtown living environment.

Source: ACT. 1996. Downtown Revitalization: City of Drummondville, Bolduc et le groupe Urbi. ACT case study. <http://www.actprogram.com>

- Case study: Malmo, Sweden

The Malmo Western Harbour site, a former shipyard and landfill with polluted soil, was transformed into an ecologically leading-edge example of a sustainable urban development.

- This residential development is supplied with 100% locally produced renewable energy.
- An electric car pool was set up as a means of affordable shared transport.
- A wide range of innovative green products and services has resulted from the projects, including green roofs, low energy villas and renewable energy solutions.
- A pilot recycling project was established.
- Green space is better maintained and local treatment of surface water run-offs has decreased the risk of flooded basements during heavy rain.
- 1800 dwelling units were rehabilitated, with 95 of them being reconstructed for people with special needs.
- 600 new dwellings were constructed to accommodate the different needs of the elderly, students and families.



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This project was identified by the UN as a Global Best Practice for Improving the Living Environment.

Source: UN. 2002. Sustainable Urban Development in the City of Malmö, Sweden. Best Practices Briefs.
http://www.bestpractices.org/bpbriefts/urban_infrastructure.html

- Case study: Freiburg, Germany

The City of Freiburg is redeveloping an old army base as an innovative residential community for 5000 people, to be completed by the year 2006. The area occupies a 42-hectare site. The current neighbourhood houses 1200 citizens; 10% of them are children below 10 years of age.

- All houses are built to utilize improved low energy standards.
- Carbon dioxide emissions are reduced by 60% by means of insulation and efficient heat supply systems that utilize solar power and cogeneration.
- Traffic congestion is reduced; 35% of the households agreed to live without motorized vehicles; a car-sharing system is available.
- Playgrounds and public spaces are reserved for green development.
- Building owners formed an organization that develops schemes for low-income earners to become homeowners.
- An extremely high level of citizen participation characterizes the housing project in both the planning and the construction phases.

Source: UN. Undated. Sustainable Urban District Freiburg-Vauban, Germany. UN Best Practice Briefs.
http://www.bestpractices.org/bpbriefts/urban_economics.htm



- Freiburg, Vauban: Individual houses and owner cooperative buildings. Bottom row, from left: Perimeter solar garage; streetscape in a parking-free access street; greening of a façade. <http://www.wistp.murdoch.edu.au/>

-Additional resource

Car-free Housing in European Cities: A Survey of Sustainable Residential projects. <http://www.wistp.murdoch.edu.au>

L.1.9.2 Main street redevelopment

- Additional resources:

<http://www.downtowndevelopment.com/>; <http://www.mainstreet.org/>;

<http://www.planetizen.com/announce/item.php?id=610>

- Case study: Ottawa, ON

The architectural firm Leaning and Associates completed a study showing that a low-rise, commercial street can be intensified by incorporating affordable housing. Modifications to existing regulations in order to allow such intensification were identified.

Source: ACT. 1995. *Redeveloping the Bank Street Corridor: Leaning and Associates, Architects and Planner. ACT case study*
<http://www.actprogram.com>



(www.answers.com/topic/bank-street)

- Case study: Charlottetown, PEI

The City of Charlottetown is determining the feasibility of using existing heritage structures in the downtown core for apartment dwellings. They will conduct a building inventory, assess the feasibility of having second- and third-floor units, and identify regulatory barriers to using the unused commercial space.

Source: Charlottetown Area Development Corporation. 2002. *Converting Commercial Space to Revitalize Historic Heart of Charlottetown. ACT Grant Award fact sheet.* <http://www.actprogram.com> .

L.1.9.3 Brownfield remediation

There are estimated to be 30,000 brownfield sites in Canada; 20,000 have potential for redevelopment.

- Additional resources:

CMHC. http://www.aboutremediation.com/sustainableCommunities/sc_publications_reports.asp

NRTEE. Cleaning up the Past Building the Future. A National Redevelopment Strategy for Canada.

http://www.nrtee-trnee.ca/eng/index_e.htm

L 1.9.3.1 Regulatory approaches to brownfields remediation

- Case study: Hamilton, ON

The City of Hamilton has designed and is implementing an outstanding brownfields redevelopment strategy to promote the cleanup and development of contaminated sites in the city's industrial areas. The program is known as the "Environmental Remediation and Site Enhancement (ERASE) Community Development Plan". It provides grants for feasibility studies and financial incentives in the form of tax and other fee rebates.

The project won a 2001 Canadian Urban Institute Brownie Award.

www.aboutremediation.com/.../mm_hamilton.asp



Source: ERASE - Business Development Consultant/Brownfields Coordinator, City of Hamilton, One James Street South, 8th Floor, Hamilton, ON L8P 4R5.

- Case study: Windsor, ON

A system of development review was developed that local governments could use to evaluate and encourage the reuse of former industrial sites for residential purposes. The project was pilot-tested in the City of Windsor.

- The project streamlines the redevelopment of former industrial sites for residential purposes.
- The range of affordable housing stock will be increased and an alternative provided to living in the suburbs.
- The quality of the community will be improved because the new uses will encourage redevelopment of neighbouring properties, reverse urban decline and create greater security.
- It also results in more efficient use of existing infrastructure and increases the municipal tax base.

Source: ACT program. *Development of a Review and Approval Strategy for Reuse of Former Industrial Lands*, University of Windsor, Planning Program. ACT grant announcement sheet. <http://www.actprogram.com>

- Case study: Guelph, ON

The City of Guelph developed a comprehensive brownfields redevelopment strategy that includes the creation of a database of sites, the establishment of standards, the examination of financial issues, and the development of marketing/promotion strategies.

Source: City of Guelph. <http://www.city.guelph.on.ca/main.cfm>

L 1.9.3.2 Demonstrations of brownfields remediation

- Case study: Thorold, ON

The City of Thorold, working with the Region and the private sector, rehabilitated a heavily contaminated 16-acre parcel of land in the downtown area. It combines the new development of mixed commercial, retail and residential development with the imaginative reuse of heritage buildings—notably a defunct paper mill and vacant hospital structure. The City has created a community improvement plan that provides heritage grants and tax incentives.

Source: contact <http://www.thorold.com/>

- Case study: Halifax, NS

The Creighton-Gerrish Development Association developed a mixed-use project to revitalize a somewhat depressed area of Halifax. To date, an 18-unit rent-geared-to-income building has been built with space for a community group to deliver its homeless outreach initiative. Six affordable market rate townhouses will be built. A 12-unit building will be rehabilitated for affordable rental units. Thirty-five two- and three- bedroom row houses will be built.

- The revitalization project reduced urban decline, improved the tax base and led to economic development.
- The project served as an important initial step in renewal; it has led to revitalization of surrounding areas in that developers have brought forward plans to develop a neighbouring parcel of land.
- Owner-led renovation has increased in the neighbourhood.
- The development was a finalist for the 2002 Canada Mortgage and Housing Corporation's Housing Awards Program.

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- Case study: Trenton, NJ, USA

Trenton had considerable amount of organic contamination from fuels, concentrations of PCBs and heavy metals as a result of rapid industrialization. Isles' Urban Brownfields Program builds self-sufficiency in the community by helping low-income, minority residents understand and combat environmental degradation. It was launched in 1995.

- Recycling brownfields sites makes efficient use of existing land and services, eases development pressures on farmland and neighbouring communities, generates jobs and tax revenue, and saves energy.
- Enduring partnerships have been developed among stakeholders to address environmental issues.

Source: UN. 1998. Urban Brownfields Program: Rehabilitating Toxic Industrial Land, New Jersey, USA.

<http://www.bestpractices.org/bpbriefts/environment.html>

- Case study: Montreal, QC

The National Pacific Railways had originally used the Angus site as an industrial complex to maintain its trains and locomotives. The site was redeveloped to create over 2500 housing units; 40% are for low- and moderate-income households. The Canadian Pacific Railway aided in the cleanup.

- The housing and occupants were integrated into the surrounding neighbourhood, thereby using the existing infrastructure, schools and other community facilities.
- The project provides affordable housing for workers employed in the core area of Montreal.

Source: NRTEE. Angus Shops, Montreal, Quebec: Before site cleanup, 1998

- Case study: Moncton, NB

The land was used as an industrial site for 85 years to house the Canadian Railway repair shop for eastern Canada. The site will be completed in 2012 and will include the following: business and technology parks; a 45-acre common recreational area; between 450 and 550 residential units; and a sports complex with an NHL-size hockey rink. The soil had been polluted with numerous industrial contaminants. Cleanup will cost from \$12 to 15 million.



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- It will create 300 person-years of employment during the cleanup.
- It will generate potential municipal tax revenue of \$9 million.
- It can potentially create over 5000 permanent jobs for employees in the industrial park.
- Urban sprawl will be reduced.

- Additional resource: *City of Moncton* <http://www.moncton.org/>

- Case study: Argentia, NL

The land was used as a military site. Decommissioning began in 1995. The site will be used for a commercial and industrial park.

- It will create \$26.5 million in investment.
- It will create 630 construction jobs.
- Increase in property taxes collected to date amounts to \$195,000.

- Additional resource: <http://www.argentia.nf.ca>

- Case study: Shawinigan, QC

The site was used by ICI to manufacture chlor-alkali and another manufacturing solvent. The soil was heavily contaminated with mercury and chloride solvents. The groundwater is also severely contaminated. The three-acre site cost \$10 million to clean up. Its proposed use is a shopping mall.

- Effective use of land and services will reduce sprawl and save energy in infrastructure cost construction.
- The project generated \$12.8 million in economic investment.

- Additional resource: <http://www.ville.shawinigan.qc.ca/>

- Case study: Hamilton, ON

The Canadian National Railway previously used the three-acre site; a portion was used as a gas station and a dumping ground for fill. The site was heavily contaminated with oil, lead and other substances. It cost \$250,000 to clean up the site, and the site will be used for 17 single residential units, 17 townhouses, and 930 square metres of commercial space.

- It will create \$3.6 million in private sector investment and 10 new permanent jobs.
- It will create a tax base and curb urban sprawl.

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- **Additional resource:** <http://www.city.hamilton.on.ca/>

- *Case study: Toronto, ON*

A metal company previously used the site for its fastener operation. Two large ponds and wetlands were created and used as a dump for waste materials. The soil was contaminated with petroleum products and metals. The site will be used for 850 residential units (townhouses and three towers), small parks and green spaces.

- It will generate \$2.5 million in additional annual property taxes.

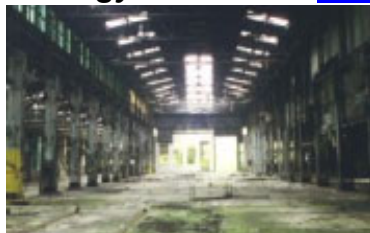
- **Additional resource:** <http://www.toronto.ca>

- *Case study: Dundas, ON*

The site was used for the Betran Steel factory, and it was established in the late 1800s. The five-acre site was contaminated with creosote, foundry sand and PCBs. The Spencer Creek Village in downtown Dundas will comprise 489 residential units used as an adult-style community, and 3700 square metres of commercial space, and it will include a club house and a medical centre.

- It will create \$94 million in private sector investment and 40 new permanent full- and part-time jobs.

Source: National Round Table of the Environment and the Economy. *Cleaning up the Past Building the Future. A National Redevelopment Strategy for Canada* <http://www.nrtee-trnee.ca>



Above: The vacant Bretran Steel factory (left and middle photos). A proposed adult style community (right) is an excellent model of redevelopment.



www.nrtee-trnee.ca/.../Recommendation2-6_e.htm

L.1.9.4.1 Regulatory approaches to infill and intensification

- Case study: Ottawa, ON

The Haven Group, working with the City and a local developer, devised a tool that municipalities can use to estimate the potential for infill development.

- Efficient use is made of existing infrastructure.
- Intensification curbs urban sprawl.
- Reliance on vehicles is reduced.

The project won a **2002 Brownie Award from the Canadian Urban Institute**; the award recognizes leadership, innovation and environmental sustainability in brownfields redevelopment across Canada.

Source: The Haven Group. 2002. *Estimating Residential Infill Development Potential*. See *Estimating Residential Development Potential for Sustainable Communities*.

- Case study: Saint John, NB

The City of Saint John streamlined the development approval process for infill housing and redevelopment projects in older areas of the city by developing zoning bylaws and design guidelines that are sensitive to the characteristics of older neighbourhoods.

- Facilitating the approvals process for infill and redevelopment saves builders money and provides incentives to avoid energy-intensive development of green fields.

Source: Rowena E. Moyse. 1977. *Zoning Standards and Design Guidelines for Infill Housing and Redevelopment: City of Saint John (PB0177-33)*. <http://www.actprogram.com>

- Case study: Airdrie, AB

The City of Airdrie developed a strategy for densification of the city's downtown, including the adaptive reuse of existing surface parking and changes to land use bylaws and parking standards.

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- Downtown densification reduces infrastructure costs, facilitates accessibility to downtown services, and helps to meet environmental goals, while providing unique apartment and condominium housing options.

Source: ACT. 2003. *New Parking Standards to Promote Downtown Densification*. (63196) <http://www.actprogram.com>

- Case study: Montreal, QC

To study habitable laneway space and recommend regulatory amendments, including rear yard setbacks and principal entrances from laneways.

- Building houses on laneways makes effective use of existing services and helps curb urban sprawl.

Source: *Habitat sur mesure enr. Building Houses that Front on Alleys*. <http://www.actprogram.com>.

L.1.9.4.2 Small-scale infill demonstrations

See also compact and diverse housing.

- Case study: Victoria, BC

The City of Victoria's award-winning project developed design guidelines and an infill zoning bylaw and, in cooperation with Zebra Designs, built three infill houses.

- Energy savings result from lower costs of maintenance and construction materials for smaller houses, elimination of need to build new roads and services, and reduced transportation requirements since the houses are centrally located.
- Public resistance to innovation is reduced and approvals streamlined because community concerns were addressed during the preparation of the design guidelines for infill housing. These guidelines address parking, architectural design and landscaping.
- Units sold for 22% less than conventional homes.

Source: *Small-Lot Single-Family Infill Housing: City of Victoria (62325)*. ACT Case study. <http://www.actprogram.com>.

- Case study: Toronto, ON

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An affordable laneway dwelling is being built in Toronto. The regulatory framework will be examined and a new approval process proposed.

- Laneway housing makes efficient use of services and curbs urban sprawl.

Source: *Jeff Stinson, Terence Van Elslander. 2002. Seeking Ways to Develop Laneway Lots as Affordable Housing.* <http://www.actprogram.com>.

- Case study: *Vancouver, BC*

The City of Vancouver also permits laneway housing. <http://www.city.vancouver.bc.ca/>

L.1.9.5 Conversion

- Case study: *Sillery, QC*

The City of Sillery amended its zoning bylaws to allow the division of single-family homes into two units.

- Energy use is reduced because it takes less energy to maintain or reuse existing building stock than it does to build new stock.
- Allowing two households on what was previously one lot eliminates the need to build new housing, thereby reducing urban sprawl, makes more efficient use of existing services, and increases the municipal tax base.
- Younger families with children were attracted to the neighbourhood.
- Sillery seniors are able to stay in their houses longer because the residents of the second unit help with property maintenance and income and provide added security and assistance.

Source: *ACT. 1995. Dividing Large Houses: A Solution for Affordability and Maintenance (PB0177-6). ACT case study.* <http://www.actprogram.com>

- Case study: *Vancouver, BC*

Wings Housing Society secured funding and renovated a heritage building, creating 30 apartments for men, women and children living with advanced HIV infection. A special emphasis was placed on gaining community support.

- Energy costs and development time were reduced through reusing an existing building rather than constructing a new building.
- Affordable units are provided to special needs individuals.

Source: ACT. 2001. Affordable Housing for People in Vancouver Living with HIV Aids Wings Housing Society. ACT case study. <http://www.actprogram.com>

- Case study: Newmarket, ON

The Region of York conducted studies, prepared plans and converted unused areas of an institutional building into affordable and accessible rental housing for seniors and adults with disabilities. The housing complex is linked to a facility that provides services such as dental care, lunch out programs, and 24-hour nursing and staff on call.

- The facility allows seniors to live close to each other, eliminating commuting requirements.
- It increases the diversity of housing options and allows people to remain in the community as they age or as their life circumstances change.
- Providing a diversity of housing creates more complete and stable communities, making residents more loyal and concerned about their community.

Source: ACT grant fact sheet. <http://www.actprogram.com>

- Case study: Charlesbourg, QC

The City of Charlesbourg developed regulations and invited applications to add a second unit onto an existing bungalow. A demonstration unit was built.

- Efficient use is made of existing infrastructure.
- Urban sprawl is curbed.
- Vehicle use between suburbs and city centre is reduced.
- Affordable housing is provided.
- Over 80 units have been added to date.

L.1.9.6 Development cost charges

- Case study: Maple Ridge, BC

Development cost charges (DCCs) are applied by municipalities to new developments to offset the costs of additional expenses associated with the development (such as roads and schools). There are various ways of calculating the DCCs charged to developers (or builders). The most common practice is to charge a flat fee or per-unit rate, regardless of the

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size of the house. The Urban Development Institute, Pacific Region, developed a square foot model for charging DCCs and consulted with municipalities in Greater Vancouver Regional District.

- Charging DCCs on a square footage basis encourages builders to build smaller houses. Smaller houses use less energy to maintain and build.
- Studies indicate there is also less car ownership among residents of smaller houses.
- In most cases, smaller houses are on smaller lots, generate less storm water runoff, and demand less transportation infrastructure.
- Additional DCCs for secondary suites should be avoided because this discourages the building of houses with suites.
- DCCs should reflect the true costs of different types of development. DCCs should be lower for moderate density mixed-use areas located in central locations and higher for distant low-density single use areas.

Source: ACT. Urban Development Institute: Pacific Region. 1997. *Levying Development Cost Charges on a Square-Foot Basis (PB0177-39)*. ACT case study. <http://www.actprogram.com>

-Additional resources

James Taylor Chair in Livable Landscapes, UBC. May 2001. Technical Bulletin No. 10: Thee Effects of Development Cost Charges on Sustainable Growth in the Greater Vancouver Regional District.

www.sustainable-communities.agsci.ubc.ca/bulletins/TB_issue_10_DCCs_edit.pdf

Greg Lambert. 2003. Levies, Fees, Charges and Taxes on New Houses: 2002. CMHC publication.

<https://www.cmhc-schl.gc.ca/50104/b2c/b2c/init.do?language=en&shop=Z01EN>

- Case study: Surrey, BC

Significant progress towards stimulating private sector development in Surrey's city centre was made by amending the City's DCC bylaw. It allows for a reduction of DCCs in the city centre for high-density residential units as part of a two-year pilot project running until 2005.

- Additional resources

The City of Ottawa has also made changes to its DCC bylaw to encourage intensification. For additional information see <http://city.ottawa.on.ca/>

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West Coast Environmental Law. 2003. Do Development Cost Charges Encourage Smart Growth and High Performance Building Design: An Evaluation of Development Cost Charge Practices in BC.

<http://www.wcel.org/wcelpub/2003/14083.pdf>

L.2.1 Alternative planning and development standards

- Additional resources:

CMHC. 2002. Residential Street Pattern Design. Socio-economic Series 75.

<http://www.cmhc-schl.gc.ca/publications/en/rh-pr/index.html>

L.2.1.1 Regulatory approaches

- Case study: Sackville, NB

The Town of Sackville and the Tantramar Planning District Commission developed a subdivision bylaw suitable as a model for small towns. The approvals process was also modified. Environmental concerns with regard to subdivision development are outlined in an accompanying guidebook. The bylaw provides measures to increase land efficiency and expand servicing options by allowing for private roads and alternative lot configurations.

- It allows creative and sustainable approaches to subdivision development that save energy in construction and maintenance.
- Infrastructure and servicing costs are reduced, making subdivision development more economical.
- The guidebook provides for a greater focus on environmental issues, thereby reducing CO₂ emissions.
- City staff work more closely with individual developers and obtain all development related permits (health, transportation, etc.) on behalf of the developers since this saves time and reduces the number of meetings and interactions required with the developer.
- When approvals are streamlined, the developer has more incentive to undertake innovations.

Source: ACT. 1998. *Subdivision Regulation: Meeting Small-Town Needs: The Town of Sackville and the Tantramar Planning District Commission (PB0177-51)*. ACT case study <http://www.actprogram.com>

L.2.1.2 Demonstration initiatives

- Case study: Truro, NS

The Town of Truro, working with Farmington Development, built a community using alternative planning and development standards and convertible house designs as a way of reducing housing costs. The demonstration project, known as Farmington Village, used several new regulations and standards, including reduced lot size and setbacks, narrower street

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width, narrower right-of-way, combined servicing laterals to houses, and an increase from 5 to 10% in parkland dedications (to retain more natural vegetation).

- Less energy is used in the construction of roads and rights of ways because they are narrower than conventional streets.
- The new, narrower road width has been adopted municipality-wide as part of the new plan review and update, creating further energy savings.
- Conversion potential built into the houses to allow a secondary unit facilitates intensification, reducing urban sprawl.
- Smaller lots reduce purchasing and maintenance costs.
- Combining servicing laterals to houses reduces the construction costs and energy associated with it.

Source: ACT. *Grant Award fact sheet.* <http://www.actprogram.com>

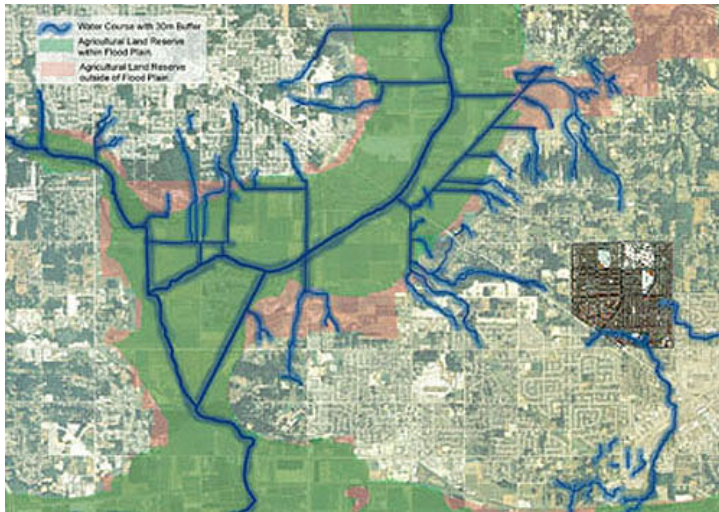
- Additional resources: City of Truro www.town.truro.ns.ca

- Case study: Surrey, BC

The University of British Columbia, working with the City of Surrey, developed planning principles, standards and bylaws to demonstrate a sustainable community development that may reduce housing costs by 30%. The Headwaters Project or East Clayton project (see below), as it is commonly referred to, is being built in Surrey, BC.

- Compact and walkable neighbourhoods encourage pedestrian activities because the basic services (schools, parks, transit, shops, etc.) are within a five-to-six-minute walk of people's homes, saving energy in car use.
- Mixed-use commercial core (commercial-residential live/work and work/live, ground-oriented town homes), and street-oriented buildings encourage pedestrian-friendly and economically vibrant community nodes.
- Trip generation per capita is reduced by 40% because of the grid street pattern layout and other features. Narrow, curbside streets save money, allow natural water runoff and are more easily shaded by street trees, saving energy for cooling and construction and maintenance of infrastructure.
- Useable backyard space is increased because front yard setbacks are reduced and parking is accessed through back lanes.

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- Mixed-uses allow people to live, work, and play in the same community throughout their lives.

Source: http://www.energyaware.bc.ca/tk_c_award4.htm, Patrick M. Condon and Jacqueline Teed. *Alternative Development Standards for Sustainable Communities: Design Workbook*. 1998. UBC

James Taylor Chair in Landscape and Liveable Environments. www.sustainable-communities.agsci.ubc.ca/orderbody.html.

- Additional resources: *Sustainable Urban Landscapes: Site Design Manual for BC Communities*. <http://www.sustainable-communities.agsci.ubc.ca/projects/DesignManual.html> or <http://www.tndtownpaper.com/neighborhoods.htm>

(www.sustainable-communities.agsci.ubc.ca/proj...)

- Case study: Ottawa, ON

In response to concerns related to the costs and amount of land devoted to residential development, the Regional Municipality of Ottawa-Carleton adopted guidelines for alternative development standards in Gloucester to reduce the cost of housing, create more compact development, and make better use of land. The guidelines include minimum standards for local road allowances, lot sizes and utility placement. The developer (Minto) and the City of Gloucester built a pilot project to test and monitor the performance of the alternative standards against the project's objectives of reducing development costs, offering affordable and marketable housing, and providing safe, effective and cost-efficient servicing.

- Alternative development standards, such as smaller roads and cost-efficient servicing, saved energy required for infrastructure construction, resulting in savings of \$8,500 per unit.
- Alternative planning standards, such as reduced frontages and setbacks, saved energy required for developing and houses, resulting in cost savings of \$8,500 per unit.
- The compact development made more efficient use of land and services by reducing land required for semi-detached homes by 48% and land required for row housing units by 46%.
- The project was chosen by the United Nations as a Global Best Practice for Improving the Living Environment.

Source: ACT. 1994. *Alternative Development Standards for Affordable Housing in Ottawa-Carleton: Regional Municipality of Ottawa-Carleton (PB0130)*. <http://www.actprogram.com>

-Additional resources

City of Ottawa Alternative Development Standards Monitoring Report (Gloucester Pilot Project Final Report). City of Ottawa planning department.

The James Taylor Chair in Landscape and Livable Environments of the University of BC has produced many documents on its research on sustainable community planning:

- Sustainable Urban Landscapes: The Surrey Design Charrette ISBN 0-88865-535-5 (\$20.00)
- Sustainable Urban Landscapes: The Brentwood Design Charrette ISBN 0-88865-646-7 (\$20.00)
- Sustainable Urban Landscapes: Site Design Manual for B.C. Communities ISBN 0-88865-654-8
- Sustainable Urban Landscapes: Neighbourhood Pattern Typology (no ISBN number).

L.2.2 Heat generated from asphalt

Using reflective materials in pavement can reduce the urban heat island effect and reduce air-conditioning costs.

- Case study: Victoria, BC

A car park, built in the Victoria Technology Park, eliminated the need for tree shading. The car park surface was constructed using a plastic grid with gravel on top of it. This allowed storm waters to be absorbed and retained on the roof (eliminating the storm water impact) and reduced the ambient temperature.

The Vancouver Island Technology Park is the first project in Canada to achieve Gold certification under the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED™) Rating System. It has also received a BOMA Earth Award (sponsored by BC Hydro PowerSmart), a National Research Council award and many others.

For additional information contact Canada Green Building Council Tel.: (250) 483-3242. <http://www.usgbc.org>

L.2.3 Street trees

(See shade trees)

Planting trees and bushes can help reduce urban temperatures as well as make municipalities greener. By providing shade and reducing urban temperatures, vegetation can save energy.

- Branches and leaves provide shade and reduce wind speed.
- Evapo-transpiration from leaves cools surrounding air.
- Leaves, twigs and branches block sound and water causing erosion.
- Roots, leaves and trunks provide habitat for bird, insects and wildlife.
- Roots stabilize soil and prevent erosion.



-Additional resources

<http://eetd.lbl.gov/ea/heat island/Vegetation/> and Energy > Ways to Save Energy <http://www.evergreen.ca>

L.2.4 Integrated circulation systems

- Case study: Coquitlam, BC

The Northeast Coquitlam Official Community Plan guides the development of a sustainable and energy-efficient community for 24,000 people. The Plan provides for a transit-oriented community, protection of the area's significant environmental assets and a diverse mix of housing types, commercial, retail, and community leisure services.

Some key sustainability benefits over the more conventional suburban approach include:

- 5% reduction in energy consumed for all purposes
- 93% improvement in solar orientation of streets
- 70% less travel distance to shopping
- 30% lower infrastructure capital and operating costs
- 24% lower CO₂ emissions
- 20% less land covered in streets
- 400% increase in local job opportunities.

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In March 2002, Council adopted the Citywide Official Community Plan. It includes a vision for a more sustainable new community in Northeast Coquitlam. This plan is now known as the Citywide Official Community Plan – Northeast Coquitlam Area Plan.

Source: Community Energy Association BC. The Best of BC - BC Community Energy Association Award Winners, 2000 Winner - The City of Coquitlam: Northeast Coquitlam OCP.

http://www.energyaware.bc.ca/tk_c_award5.htm. Community Energy Association BC case study.

-Additional resources

Northeast Coquitlam Area Plan – City of Coquitlam Planning and Development Department

<http://www.coquitlam.ca/default.htm>

L.3.1 Bikeways

- Case study: Rails to Trails (US)

The purpose of Rails-to-Trails Conservancy (RTC) is to enrich America's communities and countryside by creating a nationwide network of public trails from former rail lines and connecting corridors. RTC is a nonprofit organization with more than 100,000 members and supporters. Founded in 1986, Rails-to-Trails Conservancy is located in Washington, DC, and has offices in California, Florida, Massachusetts, Michigan, Ohio and Pennsylvania.

- Energy for car use is saved when people chose bikes over cars.
- Regular exercise improves health, reducing the impact on the health care system.

Additional resources: <http://www.railtrails.org>

- Case study: Spain

The aim of the Greenways Program in Spain is to convert disused and abandoned railway lines into pathways for non-motorized traffic, including pedestrians, cyclists and persons with reduced mobility. Eight hundred and fifty kilometres of greenways have been refitted for new users and uses.

- Energy is saved when people choose to cycle or walk rather than use motorized vehicles.

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- Remote and lesser-known areas have benefited from enhanced services and new employment opportunities, particularly those related to eco-tourism.
- Once the new eco-tourism activity started, it became one of the most productive sectors in generating employment.

This project is a 2000 winner of the UN Global Best Practice for Improving the Living Environment.

Source: UN. 2000. Spanish Greenways Programme: Ecological Reuse of Disused Railway Lines.
www.bestpractices.org

- Case study: Erlangen, Germany

The City of Erlangen's bike path system was voted the national winner in a "Safety for Cyclists" competition and most bicycle-friendly city in Germany. Priority is given to bicycle paths and to the protection of bicycle traffic through a variety of infrastructure and policy initiatives. These include clearly marked, level bicycle paths and first turn priority for bikes at traffic lights.

- Bike trips by residents rose 70%.
- Use of private vehicles has declined, reducing demand for gas, saving energy and creating less pollution.

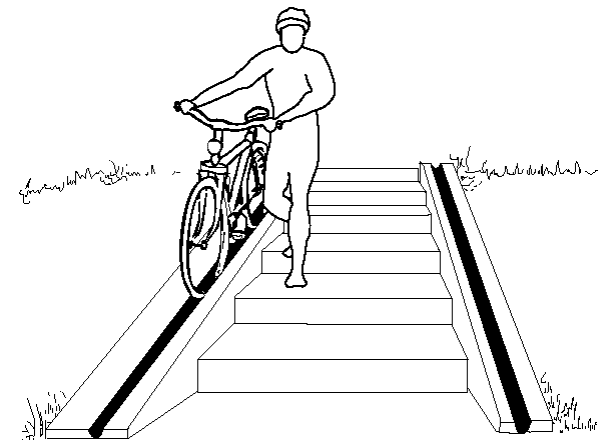
Source: Erlangen.1996. ICLEI case study.
<http://www3.iclei.org/egpis/egpc-024.html>

- Case study: Portland Oregon, USA

The City of Portland Oregon developed design guidelines for bicycles. They include useful visuals.

- Road safety for cyclists is improved.
- Bicycle use is facilitated.

Source: City of Portland. Design References: Bikeway design and engineering guidelines.



<http://www.trans.ci.portland.or.us/DesignReferences/Bicycle/AppendA.htm>.

-Additional resources

<http://www.bikeplan.com/10quest.htm>.

http://www.bteam.com/bikeway_sign_study.pdf.

Bicycle parking at school, Amersfoort, Netherlands>>>>>>

L.3.2 Bike parking and facilities

- Case study: Portland, Oregon, USA

Photo: Ken Church

The City of Portland developed guidelines to aid bike parking and facilities. The guidelines address planning for bicycle parking, finding a good location, rack selection and installation, locating short-term parking, locating long-term parking, spacing and site standards, covered bicycle parking, bicycle parking signs, minimum required parking spaces, and examples of poor parking racks.

- Increasing facilities for bike parking encourages bike use and discourages vehicle use, saving energy.

Source: City of Portland Office of Transportation. Design Guidelines. <http://www.trans.ci.portland.or.us/bicycles/>

L.3.3 Pedestrian facilities

Pedestrian facilities, such as walkways, crosswalks, and amenities such as benches and fountains that link common utilitarian facilities make walking more comfortable and increase the likelihood that people will walk rather than drive.

- Case study: Toronto, ON

The City of Toronto adopted a Pedestrian Charter in 2002. It sets out six principles necessary to ensure that walking is a safe and convenient mode of urban travel. It reflects the concept that walk-ability is one of the most important measures of the quality of a city's public realm, its health and its vitality, and it is used to show decision makers, both in the City and in the community at large, that walking should be valued as the most sustainable of all forms of travel and that it has enormous social, environmental and economic benefits.

This is the first pedestrian charter in North America, and the first approved by a municipality anywhere.

Source: Toronto Pedestrian Charter - <http://www.city.toronto.on.ca/pedestrian/>.

-Additional resources

<http://www.vtpi.org/tdm/tdm92.htm>

<http://www.bikewalk.org/>

L.4.1 Creating complete pedestrian and transit-orientated communities

Transit-oriented development refers to residential and commercial areas designed to maximize access by transit and non-motorized transportation and, along with other features, to encourage public transit use. A transit-oriented neighborhood has a centre with a rail or bus station, surrounded by relatively high-density development, with progressively lower-density development spreading outwards.

- Case study: Calgary, AB

McKenzie Towne is a pedestrian and transit-oriented development (also referred to as a neo-tradition community or new urbanism development) on the southeastern fringe of Calgary. A corner store is within walking distance of every home in McKenzie Towne. There is a network of paths, streets and lanes suitable to allow residents the option of walking or biking within their neighborhood. There are two daily express bus round trips to downtown, as well as a light rail feeder bus route. It operates in the morning and evening.

- People are encouraged to walk and use public transit; this saves energy.
- Driving distances are reduced because stores are closer than Calgary.
- Shopping at stores within the area improves residents' sense of community and quality of life.



(www.mckenzie-towne-connect.com)

TRANSPORTATION OPPORTUNITIES

The transportation sector is responsible for about 30% of the country's CO₂ emissions. Pollution from transportation is a major contributor to acid rain, smog and poor urban air quality in many urban areas. Approximately 70% of greenhouse gas emissions from transportation are a result of people driving cars and of goods being moved by truck; two thirds of these emissions are generated within urban areas.

- Additional resources: The Victoria Transport Policy Institute. <http://www.vtpi.org>

T.1.1 Transportation management associations

Transportation management associations are private, non-profit, member-controlled organizations that provide transportation services in a particular area, such as a commercial district, mall, medical centre or industrial park. Transportation management associations provide a variety of services, such as “guaranteed ride home” programs and “commute trip reduction” initiatives, to encourage more efficient use of transportation and parking resources.

- Case study: Toronto, ON

The Black Creek Regional Transportation Management Association is a private, nonprofit membership organization located in the Black Creek area north of Toronto. This area has more than 150,000 employees generating over 62,000 automobile commute trips each workday. The Association receives financial support from the local chamber of commerce, individual employers and the various orders of government (local, regional, provincial and federal).

- These associations coordinate activities that save energy in transportation, such as reducing vehicle use through carpooling.

Source: TDM Encyclopedia. Black Creek Regional Transportation Management Association
www.blackcreekcarpool.org

-Additional resource: TDM Encyclopedia, Transport Management Associations and Coordinators.
<http://www.vtpi.org/tm44.htm>

T.1.2 Commute trip reductions

Commute trip reduction (also called “employee trip reduction” or “vehicle trip reduction”) programs give commuters resources and incentives to reduce their automobile trips. Commute trip reduction programs typically include strategies such as parking management and pricing, telework, and guaranteed ride home programs.

- Reduced automobile travel saves energy, reduces congestion, saves money in road construction and parking, increases road safety, protects the environment, makes efficient use of land, increases community livability and reduces employee costs associated with travel.

-Additional resource: TDM Encyclopedia, Commute Trip Reduction (CTR): Programs that Encourage Employees to Use Efficient Commute Options <http://www.vtpi.org/tdm/tdm9.htm>

T.1.3 Parking management

- Case study: Lyon, France

Parking policies were developed for the city’s downtown. Sprawl was curbed through the elimination of 800 parking places on the surface and construction of underground facilities for 6000 parking places. The downtown area was protected by locating car parks on the outskirts, in the immediate proximity of major highway facilities. Parking supply was prioritized: short duration on the surface, medium duration underground, and long duration underground for long-term subscribers. The percentage of long-term parking for home/work trips is being reduced gradually. Certain car parks are reserved for residents.

- Traffic in the in the downtown was reduced, saving energy and reducing CO₂ emissions.
- Efficient use was made of land and services, curbing sprawl.

Source: "Good Practice Guide" - The European Commission. 1996. Parking Management. <http://www.iclei.org/>

- Case study: Portland, OR, USA

The Tri-County Metropolitan Transportation District has implemented various parking management strategies around transit stations to minimize costs and support transit-oriented development. It has arranged shared parking with park-and-ride and other types of land uses, including apartments, churches, movie theatres and government buildings near transit stations. Lower minimum parking requirements are permitted around transit stations. Park-and-ride capacity near transit stations can be reduced if the land is used for transit-oriented development, thus allowing car trips to be replaced by walk/bike trips.

- Parking management strategies around transit minimize costs and support transit-oriented development, saving energy costs and CO₂ emissions.

Source: TDM Encyclopedia. www.tri-met.org, *Parking Management: Strategies for More Efficient Use of Parking Resources* http://www.vtpi.org/tdm/tdm28.htm#_Toc42574727

T.1.4 Reduced employee parking

- Case study: Victoria, BC

The developer of the Vancouver Island Technology Park negotiated a 50% reduction in municipal parking requirements. Through discussions with the public transit agency, the developer arranged for city buses to pass in front of the buildings. In exchange, the developer paid for and built adequate road access for the buses. Overall, the developer saved money because the additional road expansion expense was offset by the reduced parking space expense. The development also provided bicycle parking; showers, and parking for car sharing.

- Energy is saved because more people will use public transit, cycle or car-pool rather than drive by themselves.
- Workers may also choose to work in the park because of the increased transportation options.

The Vancouver Island Technology Park is the first project in Canada to achieve Gold certification under the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED™) Rating System. It has also won awards such as the BOMA Earth Award (sponsored by BC Hydro PowerSmart).

- Additional resources: Canada Green Building Council <http://www.cagbc.ca>

T.1.5 Guaranteed ride home programs

- *Case study: San Luis Obispo County, CA, USA*

Ride-On, the transportation management association for San Luis Obispo County in Central California, offers door-to-door guaranteed ride home service anywhere in the area on weekdays between 8:00 a.m. and 7:00 p.m. Employers can set up a guaranteed ride home program to fit their needs. In the event of an emergency, authorized staff telephone Ride-On to request a guaranteed ride home. The travel management association will send a vehicle within 15 minutes. This program is insurance against ever being at work without a car and helps increase rideshare commuting. The cost of the ride home ranges from US\$5 to \$20, depending on the distance traveled. Some businesses pay the fare for the actual ride or let the employee pay the fare. The guaranteed ride home program has proven to be a significant benefit for employees.

- Reducing car use saves energy.

Source: TDM Encyclopedia: San Luis Obispo Rideshare www.rideshare.org

-Additional resource: TDM Encyclopedia, Guaranteed Ride Home: A Backup for Commuters who use Alternative Modes <http://www.vtpi.org/tm/tm18.htm>

T.1.6 Telework

(See also mixing residences and work sites.)

Telework includes various programs and activities that substitute telecommunications (telephone, fax, e-mail, Web sites, video connections, etc.) for physical travel.

- *Case study: King County, Washington, USA*

The Commuter Challenge Web site has detailed descriptions of more than two dozen Puget Sound area employers that offer telework. Each case study describes the type of employer, the policies and the resources they offer, the program's effectiveness, and feedback from program administrators.

- Telework reduces commute trips and significantly reduces energy for transportation, congestion and parking costs.
- Telework, however, may result in increased non-commute trips and more dispersed land use as people move farther away from their jobs, and it may increase sprawl. It is most effective when matched with disincentives to drive.

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- Telework increases employee satisfaction and productivity and reduces their transit costs.

-Additional resource: TDM Encyclopedia, *Telework: Using Telecommunications to Substitute for Physical Travel*
<http://www.vtpi.org/tdm/tdm43.htm> or <http://www.commuterchallenge.org/>

T.1.7 Telecentres

- Case study: Chula Vista, CA, USA

Chula Vista, the second largest city in San Diego County, developed a neighbourhood telecentre where residents, instead of commuting to work, can drop in to use computers, modems, telephones and other office support services to complete normal work activities.

- Telecentres reduce automobile trips, traffic congestion, energy consumption, and air pollution.
- They also promote a better quality of life by providing a workplace closer to home and can improve worker productivity.

Source: *UN. Telecenters: Changing the Way People Work, Chula Vista, USA. Best Practices Brief*
<http://www.bestpractices.org/bpbriefs/environment.html> .

- Case study: Toronto, ON

Women Plan Toronto, working with City staff, undertook a study to explore the feasibility of a residentially based, shared telework centre that can maximize the advantages of home-based work and to propose regulations to facilitate implementation of this concept.

Source: *The Residentially based Telework Centre: A Feasibility Study Women Plan Toronto.*
www.actprogram.com

- Additional resources: *Women Plan Toronto, mhare@urbanstrategies.com*

T.2.1 Traffic signal timing

Traffic lights can be timed to reduce car stopping and starting. The process of moving the car from a start position uses significantly more energy than maintaining the car at a constant speed.

T.2.2 Fleet efficiency

- Case study: *Edmonton, AB*

Edmonton's Fuel \$ense reduces fuel consumption in its corporate fleet by encouraging energy-efficient driving habits. Drivers use fuel-saving and safe-driving techniques such as reducing idling time and planning more efficient routes. A computerized –fuel-dispensing system tracks the fuel usage of individual drives.

- Fuel consumption is reduced by at least 5 to 10% annually, saving energy and reducing green house gas emissions and fuel spending by approximately \$600,000 per year.

Source: City of Edmonton. Fuel \$ense Program. FCM 2001 Best Practices Guide <http://sustainablecommunities.fcm.ca>. FCM Sustainable Communities case study.

- Case study: *Cornwall, ON*

Cornwall Transit has proven that natural gas can be a cost-effective transportation fuel for mid-sized urban bus fleets, as well as large fleets. The company is operating about one third of its fleet on natural gas. It has excellent driver and passenger acceptance and no significant maintenance or operational problems.

Source: Office of Energy Efficiency. Cornwall Transit: Mid-Sized Transit Service Helps Change Thinking About Natural Gas. http://www.oeenrcan.gc.ca/fleetsmart/successStories/stories_cityBus_cornwall.cfm

- Case study: *Hamilton, ON*

The Hamilton Street Railway Company has paved the way for using natural gas to fuel transit buses in many Canadian municipalities. In the Company's experience, reliable vehicle operation, ease of refuelling, reduced operating costs and fewer exhaust emissions have all contributed to a smooth transition to this abundant transportation fuel.

Source: Hamilton Street Railway Company: Pioneers in Using Compressed Natural Gas in Transit Buses. http://www.oeenrcan.gc.ca/fleetsmart/successStories/stories_cityBus_hamilton.cfm

T.2.3 Switching to Light Emitting Diodes (LED's)

- Case study: *Hillsborough, Florida, USA*

Hillsborough replaced incandescent lights in traffic signals with LEDs (light-emitting diodes).

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- LEDs consume 85% less energy and last much longer than conventional traffic lights. In addition, they are very reliable as they can last up to ten years, compared to only two years for conventional signals.
- LEDs saved Hillsborough 1,800,000 kilowatt-hours and \$150,000 annually.
- ENERGY STAR® qualified traffic and pedestrian signals consume only 8 to 17 watts, depending on the colour and size of the signal.

-Additional resources:

ENERGY STAR® - NRCan Office of Energy Efficiency

<http://oee.nrcan.gc.ca/energystar/>

<http://www.portlandonline.com/index.cfm?c=edaeg>

T.2.4 Solar-powered lights at bus stops

- Case study: Washington, DC, USA

Lights at a bus stop in Washington, DC, are powered by solar energy. Patrons press a button within the shelter and the lights are turned on for 15 minutes. The lights provide greater safety for those waiting for buses and increases visibility for bus drivers; the bus drivers sometimes failed to see commuters waiting at stops and left them stranded.

- Energy is saved because an attachment to an energy grid is not required.

For additional information, contact the Washington Metropolitan Area Transit Authority, www.wmata.com.



(<http://www.solarelectricpower.org>)

T.2.5 Light rail transit

(See also land use.)

- Case study: Ottawa, ON

The City of Ottawa's diesel-powered light rail transit system opened in 2001 (below - www.subways.net.) The 8-km, 5-station O-Train may be extended, including a line to the airport.

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(www.ca.geocities.com)

- Use of light rail transit saves energy by providing alternatives to private vehicle use.

Additional resources: City of Ottawa. <http://city.ottawa.on.ca/>

BUILDING PLANNING OPPORTUNITIES

Buildings use 25% of all the world's raw materials and 25% of the water, and they account for 35 to 40% of municipal solid waste (28% of it from construction) and demolition debris. In addition, buildings are a major source of pollution: they cause urban air quality problems and the pollutants that many scientists believe cause climate change.

B.1 Sustainable development guidelines for building and site development

(See also water, transportation, and land use.)

- [Additional resources](#): Sheltair Corporation. *Methods and Tools for Creating Effective Sustainable Development Guidelines for Buildings at the Community Level*. <http://www.sheltair.com>
<http://www.smartcommunities.ncat.org>
<http://www.ciwmb.ca.gov/GreenBuilding/CaseStudies/>

- Case study: Santa Monica, CA, USA

The City of Santa Monica developed sustainable development guidelines for building and site development that directly address environmental issues related to energy, water, materials, occupant health and land use. Two performance-based ordinances improve the environmental and resource performance of buildings by requiring reduced energy consumption and reduced runoff.

- [Additional resources](http://greenbuildings.santa-monica.org/): <http://greenbuildings.santa-monica.org/>

- Case study, Vancouver, BC

The City of Vancouver created a context for building green buildings and designed criteria for building energy performance at a broader community level. The performance criteria were established to guide the redevelopment of Southeast False Creek, a sustainable, high-density residential neighbourhood on the Vancouver waterfront. The criteria identify results that the development must meet, and they cover solid waste, transport, energy, air emissions, soil, water, green spaces and buildings.



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False Creek: Map showing the location of Southeast False Creek in Vancouver. Community-wide green performance measures were used to guide development. Photo courtesy of the City of Vancouver

<http://vancouver.ca/commsvcs/southeast>

-Additional resources: Sheltair Scientific Ltd. and the City of Vancouver. *Green Buildings in Green Context: Specifying Environmental Performance at the Community Scale.* <http://www.sheltair.com/library/gbcpaper.pdf>

CMHC. 2001. *Southeast False Creek Design Charrette: Exploring High Density, Sustainable Urban Development.* Research Highlights Issue 81. <http://www.cmhc.ca/publications/en/rh-pr/socio/socio081.pdf>

(www.tc.gc.ca/.../etudesdecasplanification.htm)

- Case study: San José, CA, USA

In 2001, the City of San José adopted a green buildings program. In addition to requiring city buildings to be designed and built using green building principles, the City of San José encourages building owners, architects, developers, and contractors to incorporate meaningful sustainable building goals early in the building design process.

The City's program received an honourable mention at the Acterra 2002 Business Environmental Awards event.

- Additional resources: <http://www.ci.san-jose.ca.us/esd/GB-HOME.HTM>

B.2 Going beyond building code requirements

(See also diverse and compact housing).

B.2.1 Energy efficiency for new housing

B.2.1.1 R-2000 energy efficiency for new housing

- *Case study: Banff, AB*

In Banff, the Banff Housing Corporation built what is currently the largest R-2000 project that also demonstrates innovations in alternative development standards.

- R-2000 homes are 40% more efficient than building code requirements. By using less energy, an R-2000 house also produces fewer greenhouse gases that harm our environment and contribute to climate change.
- Development and zoning standards were changed for future developments, allowing for more efficient land use within subdivisions to reduce house prices; the bylaw provides for narrower streets, at-grade open parking, and the elimination of some sidewalks (where trails existed already).
- The higher-density development was built at a lower cost and the savings were passed on to the consumers and to the community.

Source: ACT. *Alternative Development Standards, Banff Housing Corporation*. <http://www.actprogram.com>.

- **Additional resources:** Town of Banff. www.banff.ca

- Canadian Home Builders' Association www.chba.ca

- Office of Energy Efficiency of Natural Resources Canada: www.see.nrcan.gc.ca

The Yukon Housing Corporation offers reduced-rate mortgage financing for homes built or upgraded to the Corporation's energy efficiency standard. Nova Scotia has a program in place to demonstrate and promote new sustainable building practices, and Manitoba has an R-2000 Home Program.

B.2.1.2 Envirohome energy efficiency for new housing

Envirohomes surpass R-2000 homes in energy efficiency and indoor air quality.

- Case study: Montreal, QC

Sevag Pogharian Design built an innovative detached infill home that could be altered and expanded as the needs of the family changed and included plans for an accessory apartment. It is also an Envirohome, meeting stringent energy efficiency, indoor air quality, and resource conservation standards.



- Environmental benefits are demonstrated through the use of recycled materials, environmentally responsible approaches to landscaping and construction, and products designed to reduce indoor pollutants and allergens;
- Infill development makes more efficient use of land and existing infrastructure, reducing sprawl.
- Infill encourages downtown revitalization and economic development.
- Housing affordability is increased because the expanded home can contain a home-based business or an accessory apartment; it can be used to house senior family members or generate income to assist with mortgage payments.

Source: ACT. 1997. *Sprout: Infill Housing for Young, Middle-Income Households: Sevag Pogharian Design (PB0177-44)*. ACT case study.

<http://www.actprogram.com>

(<http://www.envirohome.chba.ca/seethehomes/montreal.html>)

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- Case study: Halifax, NS

The Nova Scotia Home Builders' Association built the Millennium House, an R-2000 Envirohome with flex housing and healthy housing features.

- The house uses 40% less energy than a conventional home.
- Indoor air quality is improved, leading to a better living environment.
- The interior space can be easily refigured to accommodate someone living with reduced mobility such as a senior living with disabilities.



Left: The Millennium House in Halifax. Photo courtesy of CHBA.

Source: 2002. N.S. Home Builders Spearhead Regulatory Reform and Envirohome Project: Nova Scotia Home Builders' Association. ACT case study. <http://www.actprogram.com>

-Additional resources

For information on the Envirohome program, contact the Canadian Home Builders' Association at (613) 230-3060 or see <http://www.envirohome.chba.ca>

(envirohome.chba.ca/seethehomes/montreal.html)

B.2.1.3 Advanced houses

The Canada Centre for Mineral and Energy Technology (CANMET) Advanced Houses Program shows how to reduce waste by using recycled-content building materials and by practicing resource-efficient construction and demolition methods. Ten demonstration units were built across Canada.

- Additional resources: NRCan, CANMET Advanced Houses Group. <http://www.sbc.nrcan.gc.ca>

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- Case study: Saskatoon, SK

The Saskatchewan Advanced House in Saskatoon (below) features a number of prototypes and innovations that focus on water as an ideal conductor of heat. Total annual energy consumption is 20,514 kWh.



- Building energy efficiency is through a variety of features: heating and cooling by radiant cooling ceiling panels connected to polypropylene tubing buried under ground; hydronic radiant-floor heating for high temperature solar storage; an integrated high-efficiency gas-fired heater for domestic hot water and back-up space heating; and a 1.92-kW photovoltaic array with battery storage for the HRV, emergency lighting and refrigerator.
- Recycled plastic soft drink bottles were used for oven carpets, reducing landfill.
- The home automation system reduces energy by controlling heating, lights and other appliances.
- Drought-resistant landscaping reduces energy required to filter and treat water.

-Additional resources - John Carroll, Carroll Homes, tel.: (306) 955-6677.

(envirohome.chba.ca/seethehomes/montreal.html)

- Case study: Winnipeg, MB

The Manitoba Advanced House (below) emphasizes a healthy indoor environment, reduced energy requirements through heat recovery, and "barrier-free" accessibility on the ground floor. The two-storey, 2000-square-foot home is located in south Winnipeg. Total annual energy consumption is 17,685 kWh.

- Building energy efficiency is provided through a variety of features: a gas range with high-capture hood and interlocked make-up air supply; domestic hot water preheat system using grey water heat recovery; clothes dryer heat recovery; solar-shade window screens made of high density mesh fabric to reduce cooling requirements; digital electric-power-consumption meter allowing residents to measure and thereby curbs energy consumption; and summertime attic heat dumped and stored outside the basement foundation.
- Mixed recycled-glass and gravel for foundation drainage reduces impact on landfills.
- Indoor air quality is improved through a high-efficiency air-filtration system and a separately ventilated hobby room.

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- Energy for water filtering and treatment is reduced by a sump pump/cistern collection system for exterior water requirements.

The Manitoba Advanced House.



- Additional resources:
Manitoba Home Builders'
Association (204) 925-2560.



(envirohome.chba.ca/seethehomes/montreal.html)

(www.cmhc-schl.gc.ca/.../fr/rh-pr/tech/98113.htm)

- Case study: Laval, QC

The “Maison performante” (right), built by APCHQ, the home-builders' association in Quebec, uses solar energy as the focal point for many of its innovative approaches. This 1700-square-foot home is located in Laval, near Montreal. Total annual energy consumption is 12,055 kWh.

- Building energy efficiency is provided through a variety of features: enhanced solar contribution using an insulated solarium with thermal storage system; vacuum-tube solar collectors for domestic hot water heating integrated with thermal storage; free ground cooling using ground-source heat pump without the compressor; and, a closed-loop, ground-source heat pump integrated with a solar storage system.
- The home automation system reduces energy by controlling heating, lights and other appliances.
- Indoor air quality is improved by an innovative exterior air-barrier system (EASE).
- A rainwater cistern reduces energy for water filtering and treatment. The water is used for exterior use.

- Additional resources: **Hugh Ward, APCHQ (514) 353-1120.**

- Case study: Charlottetown, PEI

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The PEI Advanced House (see below) is located on a four-acre hilltop outside Charlottetown and is the only advanced house in a rural setting. The owner of this two-storey, 2250 square-foot structure is an integral part of the project team. Total annual energy consumption is 13,997 kWh.

- Building energy efficiency is provided through a variety of features: prototype ground-source heat pump with spiral ground loop; 10-kW wind turbine connected to the electric utility grid; prototype quadruple-glazed windows with heat-reflecting films; solar domestic hot water system with photovoltaic pump; and a high-efficiency propane fireplace with radiant thermal storage.
- Indoor air quality is improved by an air-distribution system with an electrically commutated motor and a basement subfloor ventilation system.
- Residents are encouraged to reduce energy consumption by a continuous display energy-consumption meter.

- Additional resources: *Norman Finlayson, PEI R-2000 Office (902) 368-3303.*

B.2.1.4 Energy efficiency retrofit

(See also retrofitting commercial buildings, City of Toronto's Building Better Partnership program)

- Case study: Peterborough, ON

The City of Peterborough piloted a building retrofit project. A certified energy advisor conducts an Energuide Evaluation for Houses audit of the house (by checking windows, air exchange, insulation, water heating, etc.). A rating of 1 to 10 and a list of suggested energy retrofit upgrades are provided. After the upgrades were complete, an evaluator returned to the house and assigned a new rating. The difference in rating determined the amount of financial rewards. This initiative became the model for a federal funding initiative. The Canadian government provides financial rebates of about \$750 per home on average.

- Additional resource: *Home Energy Efficiency Retrofit Grants, contact the Office of Energy Efficiency of Natural Resources Canada at www.oeenrcan.gc.ca*

- Case study: Portland, Oregon, USA

The City of Portland developed guidelines for greening of affordable housing. The green building criteria for affordable housing cover the following: enhanced design and site; energy conservation; water conservation; conserving materials

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and resources; enhanced indoor air quality; and operations and maintenance. It also provides estimates of construction cost increases where applicable.



- Enhanced site design, such as minimizing solar exposure in the winter and maximizing solar exposure in the summer, reduces energy requirement.
- Energy conservation measures, such as improvements in the insulation properties of the building envelope, reduce cooling requirements in the summer and heating requirements in the winter.
- Renewable energy use, such as installing solar water heating systems and purchasing green power from a local utility, reduces burning of fossil fuels, thereby reducing the emission of CO₂ and causing less ozone depletion and fewer health problems.
- Water conservation measures, such as water-conserving plumbing fixtures and the use of only native and low maintenance plant material, reduce demand for water and the energy required to produce it.
- Conserving waste management and resources, such as building waste management and recycling, reuses materials, reduces waste going to landfill sites, and thereby reduces the emission of methane gas and its impact on global warming.
- Enhanced indoor air quality measures, such as using solvent-free finishing and fresh air ventilation, improve health and well being of occupants.

Source: *Portland Development Commission and City of Portland Green Building Initiative. Greening Portland's Affordable Housing: Design and Construction Guidelines to Improving Environmental Performance, Tenant Health, and Long-Term Durability in Affordable Housing.* http://www.pdc.us/housing_serv/default.asp.

- Additional resources: *Portland Development Commission, Rental Housing Development Program, or City of Portland Greening Building Initiative,*

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- Case study: Portland, OR, USA

The City of Portland provides comprehensive assistance to multi-family property owners and managers to improve the resource efficiency of their properties. The Multifamily Energy Savings Program connects property owners and managers with programs that offer free energy audits, cash rebates, tax credits, and low-interest loans for efficiency measures.

- Apartment residents have more comfortable homes and lower utility bills.
- Housing costs have been reduced.
- Property values have risen.
- Neighborhoods are more livable.
- The Program results in savings of 9.2 MMBTU and US\$162,500 annually.
- More than 14,000 apartment units have been weatherized and more than 46,000 units have participated in recycling through the Program.
- Thousands of apartment units have installed efficient lighting, showerheads, faucet aerators, toilet tank devices and high efficiency water heaters.
- In 1992, an evaluation of energy savings found average annual space heating savings of 26%.
- In 1991, an evaluation of the recycling program found that more than 80% of the residents participated in recycling and that one third of garbage (measured by weight) was diverted from landfills as recyclable material.
- The Program has created approximately 55 jobs.
- It is estimated that the recyclables collected from an average Portland multifamily unit in one year save enough energy to provide lighting to an apartment for six months.
- The Multifamily Housing Council of Oregon selected the Program as Vendor of the Year.

Source: Smart Communities Network. Undated. Multifamily Energy Savings Program: Portland Oregon. Smart Communities Network case study. <http://www.smartcommunities.ncat.org>.

- Additional resources: City of Portland Energy Office, <http://www.portlandonline.com>

B.2.1.5 New commercial/institutional buildings

- Case Study: Saskatoon, SK

In October 1998, the City of Saskatoon constructed the Alice Turner Branch Library (below), which showcases the latest technology in energy efficiency. Among the building's enhanced energy performance features are radiant floor heating, passive solar design and compact fluorescent lighting. The Library is owned and operated by the City of Saskatoon.

- It uses 65% less energy than prescribed in the Model National Energy Code for Buildings.
- The City will realize annual energy cost savings of about 50% or \$15,813.
- It will prevent more than 194 tonnes of CO₂ annually from being emitted into the atmosphere.



(<http://oee.nrcan.gc.ca>)

Source: Pembina - Energy Efficient Municipal Library Design – Saskatoon. Pembina case study
www.pembina.org/climate-change/

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-Case study: Richmond, BC

The City of Richmond built a new, sustainable, energy-efficient city hall (rendition below) that has a healthy indoor environment and meets C-2000 requirements.

- It uses 26% less energy than prescribed in the Model National Energy Code for Buildings, generating savings of more than 2,850 GJ of energy annually.
- The City will realize annual savings of \$32,700 in avoided utility costs.
- The project also realizes energy savings through energy-efficient landscaping and reduced construction waste.

Source: NRCan. CBIB projects: Richmond City Hall.

<http://oee.nrcan.gc.ca/Publications/infosource/Pub/commercial/new/rch.cfm>



- Additional resources: www.richmond.ca

(<http://www.greenbuildingsbc.com>)

- Case study: Toronto, ON

In 1991, the City of Toronto initiated an energy building efficiency initiative under which all new buildings had to meet uniform energy efficiency standards throughout the individual building's life cycle. Applicants are required to submit an energy efficiency and conservation plan at the time of request for all city permit approvals. Anticipated annual savings for new construction are 60 million eKWh of energy and 12,000 tonnes of CO₂ emissions per year. (This data predates municipal amalgamation, when the population was approximately one million.)

Source: City of Toronto. *Energy Efficiency and Conservation Plan (EECP)*. www.iclei.org

-Additional resources: NRCan – CBIP [http:// www.oee.nrcan.gc.ca](http://www.oee.nrcan.gc.ca) The Commercial Building Incentive Program provides financial assistance to owners that incorporate energy efficient measures into the design of new buildings, provided the design exceeds the requirements of the Model National Energy Code for Buildings by at least 25%. The Energy Innovators Initiative helps building owners invest in energy-saving retrofits by providing financial incentives, information, advice, audits and planning assistance.

B.2.1.6 Energy efficiency retrofit of commercial and institutional buildings

- Case study: Toronto, ON

The City of Toronto is undertaking a major building retrofit initiative to curb CO₂ emissions. Launched in 1996, the Building Better Partnership (BBP) program retrofits institutional, commercial and residential buildings for energy efficiency. Retrofits generally repay their capital investment in reduced energy bills over a period of three to 10 years. Significant results have occurred in the first four years of the program.

- Retrofit efforts have reduced annual greenhouse gas emissions by 110 kilotonnes.
- Annual building operating costs have been reduced by \$11.8 million
- 3000 person-years of employment have been created.

The BBP is being expanded into a full-scale initiative with the goal of a three-megatonne (Mt) annual reduction in greenhouse gas emissions and the creation of 90,000 person-years of employment.. There are six separate BBP components:

- The Residential Energy Awareness Program, which increases public awareness of energy efficiency and conservation in the residential sector;
- The Large Office Building Program;
- The Small/Medium Commercial Buildings Program, which provides tools and awareness to realize energy and cost savings;
- The Multi-Residential Non-Profit Buildings Program;
- The In-House Energy Efficiency Program, which retrofits municipally owned buildings; and
- The BBP Loan Recourse Fund, which provides loans for energy efficiency retrofits.



(www.infiltration.org/various-cityhall.html)

Other impacts:

- The programs reduce energy consumption, peak utility loads and related costs, CO₂ and other emissions that lead to climate change, and poor air quality including smog.
- Water consumption and water costs are reduced through the installation of water-efficient technologies and measures.

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- Knowledge and awareness of the benefits of energy and water-efficiency technologies and measures are increased through seminars, workshops and training programs for building owners, operators and tenants.
- Indoor air quality and building occupant comfort is improved.
- The city building stock is renewed, making Toronto a more healthy and vibrant city for building owners, tenants, investors and citizens.

Source: Pembina. 2000. Renewing Commercial Buildings—Toronto Building Better Partnerships. Pembina case study.

<http://www.pembina.org/climate-change/index.php> or

City of Toronto. Undated. Better Buildings Partnership <http://www.toronto.ca>

- *Case study: Sudbury, ON*

In 1995, the Regional Municipality of Sudbury (now the City of Greater Sudbury) initiated a strategic energy plan to identify all potential energy retrofit projects and options for funding. In 1998 they implemented municipal building retrofits. Implementation costs are recovered through energy savings.

Source: FCM. Strategic Energy Planning. <http://sustainablecommunities.fcm.ca>

- Additional resources: City of Greater Sudbury. Tel.: (705) 674-4455 ext. 4161, fax: (705) 673-5173.

- CMHC Retrofitting a City: A Guide for Municipalities to Implement a Building Retrofit Program. www.cmhc-schl.gc.ca

-*Case study: Victoria, BC*

The Vancouver Island Technology Park (below, left and right) is an environmental showcase for green building and site design. It is a technology park for advances in technology and research initiatives by the private industry, government and educational sectors.

- It uses 28% less energy than prescribed by ASHRAE/IESNA 90-1-1999.
- Strategies include occupancy sensors to control lighting, CO₂ demand ventilation control, and optimal start systems to control fan start times.
- The project also realizes energy savings through water use and construction materials and resources: water use is reduced by 33%, water-efficient landscaping requires no irrigation, and it uses 100% of the existing structure.
- Indoor air quality is high because all adhesives, sealants, paints, carpets and composite wood emit low or no volatile organic compounds.

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The Vancouver Island Technology Park is the first project in Canada to achieve Gold certification under the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED™) Rating System. It has also received the BOMA Earth Award (sponsored by BC Hydro PowerSmart), a National Research Council award and many others.

Source: LEED. 2002. Vancouver Island Technology Park. LEED case study
<http://www.usgbc.org>



(<http://www.cagbc.org>)

-Additional resources: The LEED (Leadership in Energy and Environmental Design) Green Building Rating System™ is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. LEED is operated by the Canadian Green Building Council. The initiative deals with sustainable site development, water efficiency, energy and atmosphere, materials and resources, indoor air quality, and innovation and design process. Its Web site contains many case studies such as the above. See <http://www.cagbc.ca>.

- Case study: Cambridge, MB, USA

High-performance school buildings integrate healthy productive learning places with energy efficiency, lowering operating costs and reducing environmental impacts. Retrofitting institutional buildings can create significant energy savings.



- Use of fossil fuels is reduced for heating, cooling, and lighting as they are replaced with renewable energies such as day lighting, solar and wind power.
- Utility costs are reduced by 30 to 40% per year for new schools and 20 to 30% per year for renovated schools.
- The indoor environment is improved by providing cleaner air, better acoustics, and natural light.
- Greenhouse gas emissions are reduced.

The Choptank Elementary School, left, expects to save US\$400,000 in energy and maintenance costs over the next 20 years by using a geothermal heat pump

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to heat and cool 45,000 square feet. Sustainable Buildings Industry Council. (<http://www.sbicouncil.org/>)

- Case study: Green Bay, WI, USA

Green Bay East High School (Green Bay, WI) has 48 solar panels 4' x 6 1/2'.

- At peak capacity, the unit offers 12kW of electricity to the school, saving the school about US\$2100 in energy costs per year.
- The solar panels will provide additional curricular and learning opportunities for the students.



(<http://www.sbicouncil.org/>)

- Case study: Lincoln, NE, USA

Cavett Elementary School (Lincoln, NE) (right) is one of several Lincoln schools that save money and energy on heating and cooling with geothermal heat pump technology.

- Case study: South Gate, CA, USA

Building integrated solar roofing at Montara Elementary School (South Gate, CA) offers the same levels of protection and aesthetics as premium roofing and generates clean solar electricity to power homes and commercial buildings.



(<http://www.sbicouncil.org/>)



(<http://www.sbicouncil.org/>)

- Additional resources

Collaborative for High Performance Schools (CHPS) <http://www.chps.net/>.
http://www.sbicouncil.org/workshops_web_page.htm .

B.2.1.7 Solar design guidelines

Orienting housing to take advantage of the heat from sunlight can reduce heating costs in the winter and reduce air conditioning costs in the summer.

- Case study: New Pattonsburg, MO, USA

In 1996, the municipality adopted solar codes and ordinances dealing with such things as access provisions, wind energy conversion systems, energy standards for buildings, and site planning requirements for all buildings.

- Solar codes and ordinances ensure solar energy efficiency in buildings.

Source: Smart Communities Network. <http://www.smartcommunities.ncat.org>

B.2.1.8 Construction waste management

(See also Advanced Houses, Envirohome)

- Case study: Contra Costa County, CA, USA

Contra Costa County adopted a plan to promote environmentally sound construction. The plan, developed in cooperation with the City of Raman, promotes the use of recycled materials and the reduction and recycling of job-site waste.

- The reduction and reuse of construction materials reduces construction waste in landfills.

- Additional resources: <http://www.co.contra-costa.ca.us/>

- Case study: Regina, SK

UMA Engineering Ltd and the Regina Home Builders' Association completed a study to determine the feasibility of developing a Residential Construction Waste Management Plan for the City of Regina, including any controls that may be necessary for such a plan. It found that the distance required to transport the recycling goods to a recycling plant (for example, to another province) determines project feasibility.

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- Recycling and reusing residential construction waste reduces builders dumping costs, and alleviates pressure on the landfills.

Source: UMA Engineering Ltd and the Regina Home Builders' Association. 1996. New Residential Construction Waste Management Plan: A Feasibility Study (PB0177-36). www.actprogram.com

-Additional resource: <http://www.usgbc.org>

B.2.2 Building reuse

(See also section on Intensification, infill and conversion.)

- Case study: Edmonton, AB

The City of Edmonton adopted flexible and safe housing standards to provide incentives to landowners of (often illegal) rooming houses to bring their units into the regulated market and make the necessary upgrades. The regulations were pilot-tested on a 21-unit rooming house.

- Significant renovation cost savings resulted from using the new guidelines, thereby making building reuse financially feasible.
- It allows for the reuse of buildings that would have been demolished and saves energy.

Source: ACT. 1996. Safe Housing Standards for Affordable Renovation City of Edmonton: (61380). ACT case study. www.actprogram.com

- Case study: Cobourg, ON

Habitat for Humanity of Northumberland renovated buildings that were formerly used for military housing. To date, 10 of the 29 units are complete and occupied.

- Reusing existing buildings saves energy for construction, makes efficient use of land and reduces sprawl.
- The project served as an important initial phase of renewal: it has led to revitalization of surrounding areas, and developers have brought forward plans to redevelop a neighbouring parcel of land.

Source: CMHC. 2003. Assessment of the Direct and Indirect Impacts of the ACT Program. For additional information, contact www.actprogram.com

B.2.3 Efficient lighting

Homeowners that replace regular incandescent lights with energy-efficient compact fluorescent lights save energy. The bulbs bearing the international high efficiency ENERGY STAR[®] symbol on the packaging ensure maximum energy efficiency. According to NRCAN's Office of Energy Efficiency, a typical Canadian home can have as many as 30 light fixtures, costing an average of \$200 annually in electricity. Replacing regular incandescent bulbs with compact fluorescent lights in just five fixtures that are used three hours a day or more could reduce the yearly expense by \$30. These savings are enough to pay off the added cost of the compact fluorescent lights bulb in less than two years.



For more information on ENERGY STAR[®] or tips on energy-efficient products, call Natural Resources Canada's Office of Energy Efficiency (OEE) toll-free at 1-800-387-2000 or visit OEE's Web sites at

<http://oee.nrcan.gc.ca> or <http://energystar.gc.ca>.

- Case study: Santa Monica, CA, USA

The City of Santa Monica retrofitted all its six downtown garages, the city hall, and the police department with energy efficient lighting. Lighting retrofits may be the most cost-effective method of saving energy and have the fastest rate of return on investment.

- The downtown parking garages were retrofitted at a cost of US\$198,750; it will save the City over US\$60,000 per year, and reduce electricity consumption by over 558,775 kilowatt-hours per year.
- Lighting retrofits at the city hall and the police department were completed at a cost of US\$39,975; it will save over \$14,000 per year and reduce electricity consumption by over 130,500 kilowatt-hours per year.

The City has retrofitted 55% of its building surface area with energy efficient lighting and has committed to retrofitting 90%, if it is cost-effective. The project operates with assistance from the federal environmental protection agency as well from the local energy provider.

Source: <http://www.ci.santa-monica.ca.us>

B.2.4 Shade trees

Trees reduce cooling energy use in buildings by shading them and cooling the air.

B.2.5 Rooftop gardens

Traditionally two styles or types of green roofs are distinguished: intensive or traditional roof gardens, and extensive or ecological rooftops. The former, typically referred to as roof gardens, includes structures that can accommodate deep soils, trees, shrubs, and deeper-rooted vegetation.

- *Additional resources:*

<http://www.cardinalgroupp.ca>; <http://www.greenroofs.com/>

http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/01-101_e.pdf

- *Case study: Ottawa, ON*

The National Research Council built a demonstration project on its Ottawa campus to study green roofs and vertical gardens. The Field Roofing Facility was designed to compare different roofing systems. It measured temperature profile, heat flow, solar reflectance, rooftop microclimate, soil moisture content, and storm water runoff.

- Green roofs reduce energy used for air conditioning by 23 to 30% (the savings are at the high end in Vancouver.) Evaporative cooling saves additional energy.
- Green roofs reduce energy used for heating in the winter due to the increased insulation. Heating accounts for the largest share of energy consumption in residential and commercial buildings.
- During the spring and summer, the average daily demand for space conditioning (heating, cooling) was reduced by over 75% for the green roof.
- The green roof reduced water runoff rate and volume. During rainfalls of 10mm in 12 hours, when the roof top garden became saturated with water, it retained 45% of the rainwater, and reduced the runoff rate by 75%.
- Roof top gardens can preserve the roof and prolong its use by reducing heat aging and thermal stress. Typically the life of a roof is 15 to 20 years, while a green roof is expected to last 25-40 years.

Source: *The National Research Council. 2003. Evaluating Rooftop and Vertical Gardens as an Adaptation Strategy for Urban Areas (NRCC-46737).* <http://irc.nrc-cnrc.gc.ca/fulltext/nrcc46737/>

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- Case study: Toronto, ON

The Toronto Green Roof Infrastructure Demonstration Project (below left - <http://www.cardinalgroupp.ca/grhcc/main.htm>) has two demonstration sites: the publicly accessible City Hall Podium Roof and the roof of the Eastview Community Centre. There are eight garden plots on the City Hall roof; each test a different style of construction and maintenance of roof top gardens. The Eastview Neighbourhood Community Centre Green Roof Research site was launched in September 2002. The Institute for Research in Construction, a branch of the Ottawa-based National Research Council, is measuring the impact of the projects, particularly on the heat island effect.



Toronto (www.ec.gc.ca/pp/en/storyoutput.cfm?storyid=93)
Church)



Amsterdam, Holland

(photo: Ken

**Source: Green Roofs for Healthy Cities. Green Roof Demonstration Project. www.cardinalgroupp.ca.
For information, contact Karen Liu, Tel: (613) 993-4585, fax: (613) 954-5984. E-mail: karen.liu@nrc-cnrc.gc.ca**



Photo: Ken Church

Amersfoort, Netherlands

- Case study: Netherlands

The use of extensive green roofs has become increasingly common in the Netherlands. Several creative applications include the terminal building at Schiphol Airport, the Technical University in Delft, and the GWL-terrain housing project in Amsterdam.

- Case study: Germany

In Germany, 80 municipalities provide incentives for green roof conversions, with the result that 13 million square metres of green roof were built from 1998 to 2003.

- Case study: Tokyo, Japan

The City of Tokyo requires all large buildings to green at least 20% of their roofs. This was done to counter the urban heat island effect.

- Case study: Portland, Oregon, USA

In Portland, where green roofs are appreciated for their role in storing rain water and keeping the local river salmon safe, downtown builders are allowed to increase their density if they provide green roofs.

- Additional resources: www.portlandonline.com

- *Case study: Chicago, IL, USA*

Chicago, which had a traumatic encounter with a death-dealing heat wave during the 1990s, is also making green roofs the law. In addition, Chicago's city hall roof top garden won the American Society of Landscape Architects award in 2002.

- **Additional resources:** www.ci.chi.il.us

B.2.6 Vertical gardens

Vertical gardens include green walls and green window shades. They provide many of the same benefits as green roofs.

- *Case study: Ottawa, ON*

The National Research Council measured the impact of vertical gardens, or green walls, and found many benefits.

- Green walls shield against UV rays.
- They provide shading and cooling during summer months, and insulation during winter months (as much as 30%) provides protection against chemical weathering.
- Vertical gardens reduce energy used for air conditioning by 23 to 30%.
- They provide health benefits such as filtering of air pollutants, minimizing of noise, and positive humidifying effects.

Source: *The National Research Council. 2003. Evaluating Rooftop and Vertical Gardens as an Adaptation Strategy for Urban Areas (NRCC-46737).* <http://irc.nrc-cnrc.gc.ca/fulltext/nrcc46737/>

B.3.1 Designing efficiency programs

B.3.1.1 Municipal facilities

(See also section on retrofitting institutional buildings.)

- Case study: Regina, SK

The City of Regina has undertaken a number of initiatives to protect the climate and reduce energy consumption, making it a Canadian leader in this area.

- Improving building energy efficiency (including sports facilities) and electrical system enhancements have reduced greenhouse gas emissions by 1656 tonnes per year.
- Street lighting conversion to efficient, cost-effective, high-pressure sodium lights has yielded a greenhouse gas emissions reduction of 5182 tonnes per year.
- Changes to water supply systems in the form of pipeline twinning, variable-speed pumps, operational efficiencies and a water efficiency improvement program have cut 3898 tonnes of greenhouse gas emissions per year.
- Sewer and wastewater system improvements have provided annual emission reductions of 2917 tonnes of greenhouse gas emissions.
- The deployment of 79 natural gas vehicles in Regina's civic fleet, including fleet vehicles for transit and public works, is reducing greenhouse gas emissions across the city. Natural gas vehicles emit 26% fewer greenhouse gas emissions at the tailpipe than the same vehicles that run on regular gasoline. Previously, the conversion of 60 civic vehicles to natural gas and the installation of related fueling facilities had been projected to reduce greenhouse gas emissions by 250 tonnes per year and save about \$80,000 annually.
- It also participated in the annual Commuter Challenge events and activities encouraging municipal employees to car-pool as a way to make fewer vehicle trips.

Source: Pembina. Comprehensive GHG Emissions Reductions: Regina, Saskatchewan
www.pembina.org/climate-change/.

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- Case study: Portland Oregon, USA

In 1991, the City of Portland developed an initiative called the City Energy Challenge to reduce its annual energy bill in municipal buildings by 10% over five years. The City succeeded in reducing its US\$8.8-million annual energy bill by over \$1 million through efficiency and conservation measures, and in 2001 it set a target of \$1.5 million annual savings.

- 68,260 million BTUs (British thermal units) are saved every year.
- Through the Green Power purchase program negotiated with Portland General Electric, a minimum of 5% of power supplied by Portland General Electric will be from wind power.
- Wind power delivers about 2.25 million kilowatt-hours a year and will result in net savings of US\$175,000 annually.
- By reducing demand for coal and hydroelectric power, the Green Power purchase will reduce CO₂ emissions by more than 4,500 tonnes over five years through reduced demand for coal.
- Energy savings from the program have reduced pressure on the US Northwest hydro system and on endangered salmon runs.



Source: US Department of Energy. City Energy Challenge.

<http://www.smartcommunities.ncat.org> . Smart Communities Network case study.

(www.orstudents.org/action_center/info/Hundred...)

- Additional resources: David Tooze, Portland Energy Office, City of Portland, Oregon
www.portlandonline.com

B.3.1.2 Business facilities

- Case study: Portland, OR, USA

The Businesses for an Environmentally Sustainable Tomorrow (BEST) Program of the City of Portland Office of Sustainable Development provides assistance to area businesses and recognition for their accomplishments in introducing sustainable practices.

The quantified annual benefits from the actions by the 80 award-winning businesses from 1993 to 2003 are significant.

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- Energy is saved in the following ways: 48.2 million kilowatt-hours of electricity; 6.8 million therms of natural gas; and, 993,000 gallons (4.5 million litres) of gasoline.
- Energy required to treat water is reduced because 868 million gallons (3.9 billion litres) are saved.
- Solid waste is reduced by 72,136 tonnes, reducing impact on landfills.
- Carbon dioxide (CO₂) emissions are reduced by 113,792 tonnes.
- Cost savings are US\$13.2 million.

Winnipeg, Manitoba, also worked with the Portland Energy Office to develop a BEST program.

Source: Portland Office of Sustainable Development. www.portlandonline.com

-Additional resources

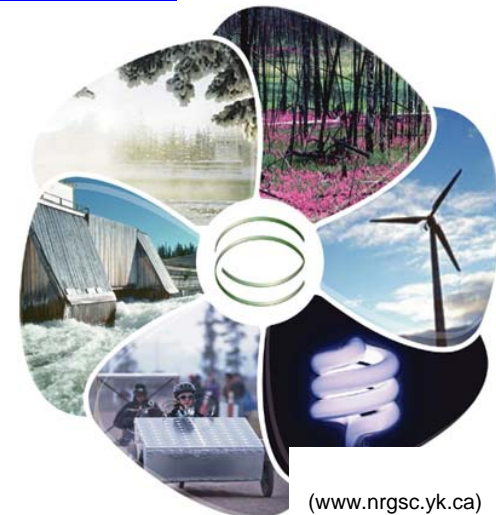
The winning projects are documented in case studies and are available at www.portlandonline.com

B.3.1.3 Community at large

- Case study: Whitehorse, Yukon

The Energy Solutions Centre offers technical services and helps deliver a range of government programs to help find homegrown solutions to local energy problems. The intent of this one-stop shop is to help people save money on their energy bills and reduce greenhouse gas emissions by using alternative energy sources. Run by the Yukon government, the office operates out of a downtown Whitehorse office and assists in the development of a wide range of renewable energy projects, and some of them are described below.

- An air-to-heat pump takes heat from the outside at a temperature of –20 degrees Celsius to heat a single-family home in Whitehorse, saving \$8,000 per year in heating costs.
- Technicians in the Home Call Program visit houses and install energy-efficient devices such as insulating blankets wrapped around hot water heaters and compact fluorescent light bulbs, saving \$215 per household per year in energy costs and eliminating 1854 tonnes of CO₂ that would otherwise be released into the atmosphere.



(www.nrgsc.yk.ca)

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- The Yukon Brewing Company uses cold winter air to provide the cooling power for brewing beer and recycles the heat produced during the brewing process to heat the building by the use of free-cooling and ground water heat pumps.

The Energy Solutions Centre was recognized in 2001 by the Canadian Energy Efficiency Alliance for its leadership in energy efficiency. Municipalities could use this as a model to set up their own energy solutions centre.

Source: Energy Solutions Centre. <http://www.nrgsc.yk.ca>

- Additional resources: Yukon Development Corporation. Tel.: (867) 393-7062. <http://www.nrgsc.yk.ca/>
Canadian Energy Efficiency Alliance see <http://www.energyefficiency.org>
Climate change initiatives in the Yukon see <http://www.taiga.net/nce/index.html>

-Case study: San Diego, CA, USA

The City delivers a state program called Climate Wise-Energy Star® Action Plans, which publicly recognizes sustainable businesses. Annual Savings from Strategic Energy Plans during 2000 were significant.

- Approximately US\$3.5 million have been saved.
- 22 million kilowatt-hours of electricity have been saved.
- Consumption of 1.6 million gallons of gasoline has been avoided.
- Emissions of 23,000 tons of carbon dioxide, a greenhouse house that contributes to global warming, have been avoided.

Source: City of San Diego <http://www.sandiego.gov>

WATER USE OPPORTUNITIES

W.1.1 Water efficient landscaping

Water-efficient landscaping involves seven steps: design, including the grading, positioning of plants and drainage; adding organic materials to clays and sandy soils to improve the nutrient holding capacity; reducing the turf areas; mulching to reduce weed growth and hold moisture; irrigating plants following a zone system and watering according to plant needs and using water-saving methods; placing plants so that those with similar water needs are placed together; and proper maintenance, such as mowing and fertilizing.

- Water-efficient landscaping reduces maintenance time and costs as well as water use by as much as 60%.

Source: CMHC. 2000. *Practices for Sustainable Communities*, p. 141-142.

- Additional resources: Department of Horticultural Science, University of Saskatchewan, Saskatoon, SASK S7N 0W0.

W.1.2 Roof top gardens

Roof top gardens, such as the one right, can reduce the water runoff rate and volume by up to 75%, filter pollutants from water, and reduce the temperature of the water runoff, thereby reducing environmental impact.



([www.eh\(ponline.org/docs/2002/110-11/forum.html](http://www.eh(ponline.org/docs/2002/110-11/forum.html))

W.1.3 Storm water management-drainage techniques

Downspouts or eavestroughs transfer water from roofs to the ground level. In some cases these downspouts are directly attached to the municipal sewage system. In existing neighbourhoods downspouts are disconnected; in new developments, they are prohibited.

- Storm water runs off naturally into the ground, and oils and other materials can be naturally filtered, reducing the impact on rivers and streams.
- Water can be stored and used to irrigate plants and lawns.

- Case study: Ottawa, ON

The City of Ottawa undertook the “Waterlinks” program and subsidized the cost of rain barrels to offset the potential impact of storm water runoff from a new road it was building, thereby eliminating the requirement to expand municipal capacity for storm water runoff.

- Allowing rainwater to be absorbed into the groundwater system saves energy.

- Additional resources: City of Ottawa (613) 580 2424.

- Case study: Surrey, BC

The East Clayton subdivision development in Surrey uses alternative storm water engineering standards, such as the elimination of sidewalks and downspout connections, to allow the natural infiltration of water flow onsite. The project also includes innovations in affordable housing and transportation.

- Runoff is minimized, and 80 to 90% of the detrimental downstream consequences are eliminated; this saves energy.

-Additional resources: Surrey BC case study under alternative planning and development standards.
<http://www.surrey.ca/Inside+City+Hall/City+Departments/Planning+and+Development/default.htm>.

- *Case study: Quebec City, QC*

The Quebec Urban Community developed the world's first dynamic real-time water management project, including a sophisticated rainfall prediction system.

- The system prevents pollution by eliminating the overflow of wastewater into the watercourse when it rains, saving energy required to clean the water and curbing environmental impacts.

Source: Quebec Urban Community. 2001. *Using dynamic management and sophisticated forecasting to control wastewater flows. FCM 2001 Best Practices Guide, p37.*

<http://sustainablecommunities.fcm.ca>

W.1.4 Collecting rainwater

(See also storm water management-drainage techniques)

Collecting rainwater from downspouts and other devices can be used to water gardens, thereby conserving treated water and reducing energy costs associated with it.

W.2.1 Hazardous waste source reduction

- *Case study: Ottawa, ON*

Volunteer City of Ottawa staff and elected officials periodically set up convenient downtown collection points for household hazardous waste.

- Energy is saved because citizens travel to the downtown instead of the more distant m Trail Road municipal disposal site.
- Pollution is reduced through proper disposal of materials instead of their being placed out on the street with household garbage or being poured down the sink or toilet.

- Additional resources: City of Ottawa (613) 580 2424.

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- Case study: Stockholm, Sweden

Stockholm Water Limited (Vatten), a municipally owned company, carries out an extensive public and industry education program to reduce disposal of hazardous substances into the sewage system. They focus on metals that modern sewage systems are unable to eliminate from wastewater such as lead, cadmium and mercury.

- Vatten's program has reduced wastewater pollution levels and their discharge back into the ecosystem.

Source: ICLEI. Project Summary #68. Sewage Stockholm, Sweden Environmental Program Evaluation. ICLEI case study. www.iclei.org.

- Case study: Toronto, ON

In 2000, the City of Toronto implemented a new sewer-use bylaw to prevent industries from discharging toxic materials into the municipal sewer system.

- Toxic waste discharge into Lake Ontario will be reduced by 25 to 50% by 2007.
- Industries use less energy, water and raw materials to produce their goods.
- Smaller quantities of toxic fumes are released into the atmosphere because industries are using smaller quantities of toxic substances.
- Reduction of toxic content in biosolids increases public acceptance for using biosolids as a fertilizer.

Source: City of Toronto. 2001. Creating a New Sewer Use By-law to Cut Toxic Waste. FCM 2001 Best Practices Guide, p28. <http://sustainablecommunities.fcm.ca>

- Case study: Waterloo, ON

The Regional Municipality of Waterloo implemented policies with the agricultural community and business to protect the quality of its water source.

- Preventative measures reduce the likelihood of water contamination and the need to build new wells, saving energy.
- The region is the first municipality in Ontario to fund a source water quality incentive program specifically for the agricultural community.

Source: FCM. 2002. *Municipal Governments and Sustainable Communities: A Best Practice Guide*, 2002. p. 34. *Protecting Water Supplies at the Source*. <http://sustainablecommunities.fcm.ca>.

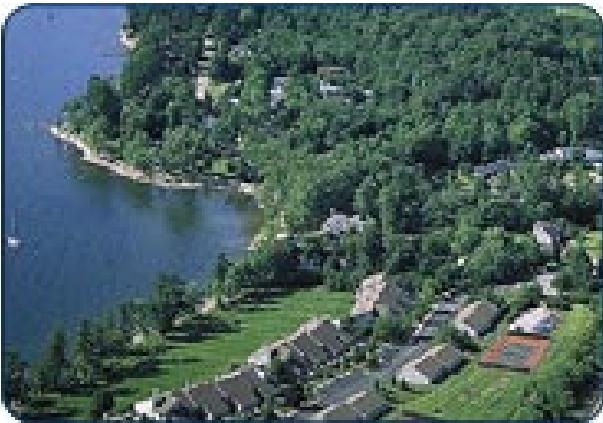
W.2.2 Efficient wastewater treatment

- Case study: Lethbridge, AB

The City of Lethbridge introduced a new wastewater treatment process that digests sludge for use as a fertilizer on farmlands and creates digester gas to produce electricity through cogeneration.

- Annual energy cost saving is about \$150,000.

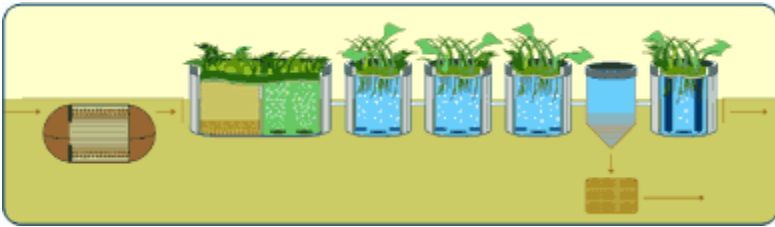
- Case study: South Burlington, VT, USA



The South Burlington Living Machine™ system treats 80,000 gallons per day of municipal sewage, an amount typically generated by approximately 1600 residential users. The waste stream is diverted from the municipal government's conventional treatment plant, where it is treated in a greenhouse.



(<http://www.livingmachines.com>)



Source: *Living Machines case study* <http://www.livingmachines.com>



(www.Citiesplus.ca)

- Case study: *Errington, BC*

A Solar Aquatics System (right) is used to treat sewage in Errington, BC.

W.2.3 Water conservation

- Case study: *Okotoks, AB*

The Sustainable Okotoks plan, adopted in 1998, is based on the watershed limits of the Sheep River. The project is governed by the many strategies including: capping growth and urban boundaries at the carrying capacity (25,000 people); living within the natural carrying capacity of potable (drinkable) water drawn from the Sheep River watershed; creating an infrastructure that supports the carrying capacity, including building an underground infrastructure (for water, sewers and storm sewers) that meets demand; modifying urban design by implementing mixed land-use neighbourhoods, increasing employment opportunities within neighbourhoods, creating home-based businesses and expanding the network of off-street pedestrian pathways; incorporating eco-efficiency measures such as recycling, water conservation, architectural regulations and urban forest policies for urban renewal and expansion; and implementing a Sheep River watershed management plan, regional plan and transportation plan.

- Water consumption was reduced by 1% within the first year (1999 to 2000) of the Water and Waste Education Program; a further reduction of 30% is expected over 15 years.
- Landfill tonnage was reduced by 2% by 2000; a further reduction of 35% is expected over 15-20 years.
- Recycling tonnage increased by 400% between 1992 and 2000, reducing the impact on landfills.
- Pesticide and herbicide use on public lands was reduced by 85%.

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The project won an FCM-CMH2 Hill Sustainable Communities Award.

Source: FCM. <http://sustainablecommunities.fcm.ca>.

- Additional resources: *Chris Fields, Community Development Officer, P.O. Box 220, Okotoks Alberta, T0L 1T0.*
Tel.: (403) 938-4404, E-mail: <http://www.okotoks.ca>

- Case study: *Sunshine Coast Regional District, BC*

The Sunshine Coast Regional District implemented a 10-year master plan including a water conservation program and grey water reuse to strengthen and extend the District's water supply.

SOLID WASTE REDUCTION OPPORTUNITIES

R.1.1 Recycling

- Case study: *Albert Counties and City of Moncton, NB*

A residential wet/dry recycling and organic materials waste diversion program was developed that has achieved an 83% participation rate.

- Almost 50% of the waste entering landfill has been diverted, eliminating the need to build new landfill cells.

R.1.2 Backyard composting

Municipalities can make available backyard composting boxes and allow residents to compost organic materials.

- Less energy is used trucking away solid waste.
- Pressure on landfills is reduced.

Source: Cities^{PLUS}: Vancouver Compost Demonstration Garden is experimenting with compost methods, renewable energy, rainwater capture and community gardening.



R.1.3 Variable rates for garbage collection

Municipalities can require residents to purchase ties to close garbage bags. Only garbage bags closed with this tie will be collected. Alternatively, municipalities can limit the number of garbage bags they collect per household. Only the permitted number of garbage bags is collected. Additional garbage must be put out for the next garbage collection.

R.1.4 Economic development and recycling

- Case study: Newcastle, England

The Newcastle Schools Recycling Project locates recycling facilities in the city's schools so that pupils, teachers, parents and the local community can be encouraged to dispose of both school and domestic waste in a responsible way.

- The project contributes to education and awareness raising, which may curb garbage going to landfills.
- The sale of recycled materials generates income for spinoff projects such as tree planting, school ground development or other environmental/education projects.

Source: Local Management Government Board. 1997 Newcastle Schools Recycling Project. ICLEI case study.
<http://www3.iclei.org/egpis/egpc-103.html>.

R.2.1 Efficient waste and recycling collection

- Case study: Helsinki Metropolitan Area, Finland

Residents in the Helsinki Metropolitan Area separate organic waste from mixed refuse, and the municipality collects the organic waste during its regular garbage collection. The organic waste is transported to a composting field near the landfill, where it is composted in open pits. It takes about one year for the waste to decompose into soil. Depending on the quality of the final product, it is used for either soil improvement or landscaping projects.

- This has substantially reduced landfill loads and produced usable soil.
- Efficient use is made of limited landfill space.
- The emission of hazardous gases has been reduced.

Source: The Association of Finnish Local Authorities. 1996. Learning New Skills.
<http://www3.iclei.org/egpis/egpc-062.html>. ICLEI case study.
- Case study: Vienna, Austria



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Since the beginning of the 1990s Vienna has taken important steps towards the installation of separate waste collection systems. In 1994, Vienna's volume of waste was the same as the previous year.

- Waste minimization policy has become an essential part of waste management.
- Waste management is focusing on the best ecological standards.
- Special attention is given to the limitation of waste dumping.
- Rapid progress has been made with biogenetic and waste-to-energy systems.

Source: European Academy of the Urban Environment. 1996. Waste minimization and recycling strategies. EAUE case study <http://www.eaue.de/winuwd/47.htm>

- Case study: Vienna, Austria

Biodegradable waste is collected separately to produce environment-friendly compost for use in farming. The City of Vienna operates its own open-ground composting plant. Compost is distributed free of charge. A very successful do-it-yourself urban agriculture project (with compost as fertilizer) has been established.

This project was identified in 1998 by the UN as a Global Best Practice for Improving the Living Environment.

Source: UN. 1998. Bio-waste Management - Organic Farming, Vienna, Austria. UN Best Practices Briefs. <http://www.bestpractices.org/>

- Case study: Red Deer, AB

The City of Red Deer developed an innovative waste management and recycling facility. Its design exceeds provincial standards. It includes an interpretative centre where school children can learn about recycling and reducing waste, and it houses a composting and recycling centre.

- Transportation costs are saved; without the facility, Red Deer was faced with transporting the garbage 100 km.
- Materials are reused.
- Waste is monitored and businesses are contacted to encourage them to reduce or recycle.

Source: FCM. 2002. Municipal Governments and Sustainable Communities: A Best Practice Guide, 2002. p.14. Not in My Backyard! The City of Red Deer's Waste Management Facility. FCM 2002 Best practices case study. <http://sustainablecommunities.fcm.ca>

ALTERNATIVE ENERGY SUPPLY OPPORTUNITIES

Renewable energy systems use resources that are constantly replaced and are usually less polluting than fossil fuels. These resources never run out and therefore enhance sustainability. Examples of renewable energy systems include solar, wind, and geothermal energy (energy from the heat in the earth). We also get renewable energy from trees and plants, rivers, and even garbage.

- *Additional resources:*

<http://www.newenergy.org/links.html>

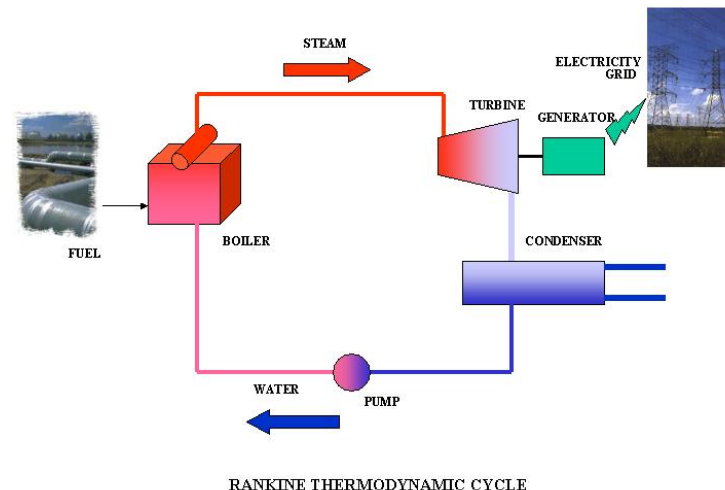
<http://www.smartcommunities.ncat.org>

A.1 Cogeneration

Traditionally, electricity has been generated using the Rankine thermodynamic cycle (see below), often with steam as the generating medium. Overall electrical generating system efficiency lies between 30 and 36%, depending on the fuel and other factors. Even with the use of gas turbines and supplementary steam generation, barely 50% of the input fuel creates electricity. The remaining energy is rejected to the atmosphere or to a nearby water source.

Modern thinking makes use of the reject heat, possibly for space heating, and thereby reduces the amount of fossil fuel that would otherwise have been required for that heating purpose. The process of efficient generation of electricity followed by the use of reject heat is known as cogeneration or Combined Heat and Power and is fast becoming the starting point for community energy or district heating systems. Through the use of both electricity and heat, efficiencies of up to 85% are possible.

- *Case study: Cornwall, ON*



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In 1995, the first municipally owned hot water district heating/cogeneration system was opened in Canada. The Cornwall district heating/cogeneration system heats approximately 14 buildings, including hospitals, schools, recreational buildings, a municipal library, a senior citizens' residence, an apartment building and a government office building.

- The system generates about 4% of the city's electrical energy.
- The Cornwall system replaced numerous fossil fuel-fired boilers.
- The combined production of heat and power has reduced fuel consumption by close to 30%.
- Cornwall Electric has lowered its dependency on outside energy suppliers and maintained its low electricity rates.
- Local jobs were created for the construction and maintenance of the plant.

Cornwall's energy facility reduces fossil fuel consumption by 30%.



(Left) Cornwall's heat exchanger captures the reject heat that is used in the district energy system.



(Right) The facility is sound-proof and was built in a residential area.

Source: NRCan. [Cornwall, Ontario District Heating System](#). NRCan Community Energy Systems case study. E-mail: kchurch@nrcan.gc.ca

A.2 Community energy systems

A community energy system represents the most effective approach that a community can take to managing its energy needs. The concept involves a network of energy users and providers, trading energy needs through a physical network of hot water piping. Energy users may be residential, commercial or industrial, and energy suppliers may include anyone with excess or reject thermal energy. Examples include industry, combined heat and power plants, solar collectors and municipal landfill sites.

- Case study: Vancouver

Central Heat Distribution Limited, a private sector operation in Vancouver, started up in 1968 and is now in a prime position to take advantage of the high-density building boom in downtown Vancouver. After 35 years of operation, the system now supplies 170 buildings, of which 60 are condominiums, 75 are offices and 15 or so are institutional. Included in that list are the famous Steam Clock in Gastown, an excellent brewpub and General Motors Place.

Even though this is a private undertaking, there are very close ties with City Hall. Central Heat is treated much like any other utility and a franchise fee is charged annually. In addition, the City retains the right to undertake the street-based piping installation at a rate of cost plus 20%. This is to ensure that the roads standards are adhered to. In return, City Hall regularly consults with Central Heat regarding their city-centre planning activities to ensure compatibility of new developments with the district energy system. New businesses are also encouraged to establish in the area and take advantage of the stabilized energy prices.

The locally owned and operated company provides the city planners with many benefits, including the elimination of multiple stacks and the maintenance of view corridors. Architects benefit from increased flexibility of design (rooftops, etc.), and building owners are quick to realize the fiscal benefit of eliminating mechanical spaces as land prices increase. The additional floor space is a major attraction.

- Additional resources: Central Heat Distribution – John Barnes, President Tel: (604) 688 9584

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- Case study: Copenhagen, Denmark

Copenhagen operates the largest district-heating grid in Europe. In 1993, an area including 1.2 million inhabitants was supplied with district heating; 65% of the buildings were connected to the district-heating grid. The target was set at 95% connected to the grid by 2002. The district heating is almost exclusively produced through cogeneration of heat and power.

- The city had the ability to achieve a 30% reduction in CO₂ emissions by the year 2005.

Source: *BUND for Environment and Nature Protection Germany. 1993. Vorbildliche kommunale Energieprojekte in Europa. ICLEI case study.* <http://www3.iclei.org/egpis/egpc-012.html>

- Additional resources: Agency of Environmental Protection, City of Copenhagen, Flaesketorvet 68, DK 1711 Copenhagen V, Tel.: 0045/33665800; fax. 0045/31316621
Energy and Environment in Copenhagen, Community Information, Vester Farimagsgade 19, DK 606 Copenhagen V, Tel.: 0045/22114220

- Case study: Kungsbacka-Sarö, Sweden

A solar energy-supplemented district heating system has been in operation in Sarö since 1989. Solar energy is used to supplement energy in district heating systems that supply an entire residential area with heat.

- Sarö hopes to be able to heat in winter with the summer sun, and collect more than two thirds of total energy needs for space and water heating from solar facilities.

Source: *BUND for Environment and Nature Protection Germany. 1993. Vorbildliche kommunale Energieprojekte in Europa. 1996. ICLEI case study, Kungsbacka-Sarö, Sweden, Solar Energy Supplemented District Heating System.* <http://www3.iclei.org/egpis/egpc-011.html>.

- Additional resources: EKSTA Hamutorget 1, S 43430 Kungsbacka, Tel.: 0046/30011708, fax: 0046/30014060.

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- Case study: Växjö kommun (the Municipality of Växjö), Sweden

In 1996, the municipal council of Växjö (73,000 inhabitants) in southern Sweden unanimously adopted the long-term goal of completely phasing out the use of fossil fuels in municipal buildings, vehicles and services. Växjö was committed to reducing CO₂ emissions in the community by 50%. The new community heating plant, fuelled by wood chips, was opened in 1997. This and an older district heating plant, also fuelled by bioenergy, supply the city of Växjö with most of its thermal energy needs and much of its electricity requirements. Smaller district heating plants have been installed in three of the surrounding villages. The municipal housing company, Värendshus, has begun fitting new buildings with solar collectors.

- Buses run on 50% rape methyl ester (RME).
- The municipal government has acquired both electric and ethanol-fuelled cars.
- Seven major industrial companies and utilities have formed the Växjö Bioenergy Group and have undertaken to pursue the same targets as the municipality.

In 2000, this project was identified by the UN as a Global Best Practice for Improving the Living Environment. Växjö is a partner in the European Commission's CTO-campaign for 100% renewable energy systems.

- Additional resources: - UN best practices database. <http://www.bestpractices.org/>

- Case study: North Vancouver, BC

In the fall 2003 the City of North Vancouver launched the municipally owned Lonsdale Energy Corporation and began the first district energy system based on distributed generation. Partnering with Terasen Gas (formerly BC Gas), the Lonsdale Energy Corporation is connecting a series of cogeneration plants and new, primarily residential developments to form a single district energy system.

- Reliance on gas and oil is reduced, thereby lowering CO₂ emissions.

Source: City of North Vancouver. Undated. The Best of BC - BC Energy Aware Award Winners: 1998 Winner: City of North Vancouver: Lower Lonsdale District Heating System Study. Community Energy Association Committee case study. http://www.energyaware.bc.ca/tk_c_award2.htm

- Additional resources: Deputy City Engineer Tel.: (604) 985-7761.

- Case Study: Markham, ON

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The Town of Markham uses district heating and cooling to control energy costs and as a tool to encourage economic development. When software giant IBM consolidated its software research and development sector, it chose to locate in Markham because the municipality offered a cost-effective energy supply. Markham District Energy Incorporated was established to provide IBM with district heating and cooling. The municipal government quickly realized that Markham District Energy offered more than stable pricing; it was an economic development magnet. Even before the IBM construction project was completed, another hi-tech giant, Motorola, moved to the area; it has also been connected to district system. Recently, condominium developer Tridel agreed to link a condominium complex (slated for construction in 2004) to the district energy system. Markham's city hall and surrounding municipal buildings are also to be linked to the system.

- Additional resources: Bruce Ander, President, Markham District Energy Inc., Tel.: (905) 513-4164.

- Case Study: Hamilton, ON

The district energy system in Hamilton, Ontario (below) produces both heat and electricity from a clean-burning natural gas-fired reciprocating engine connected to a generator and three gas-fired boilers. When compared to the typical 40-to-60% efficiency range for conventional installations, this combined heat and power technology produces energy at an overall efficiency rating that approaches 80%.

The installation produces hot water that is distributed by an underground pipeline to 10 or 11 large buildings clustered on the west side of downtown, including City Hall, Copps Coliseum and the District School Board, the Market Library, Hamilton Place, the Convention Centre, the Board of Education, the Art Gallery, the Ellen Fairclough Building, and Sir John A. MacDonald High School. Besides thermal heat, the installation produces 3.3 megawatts of electricity to be routed through the city's Central Utilities Plant. That is enough to supply City Hall, the Convention Centre and other nearby buildings in the event of a long-term power disruption — the kind that ice storms can cause. The system is designed with backup capacity to ensure reliable service in the event that any major component fails. The district heating company will be operated as a for-profit commercial enterprise.



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- Case Study: Watson Lake

Watson Lake, the second-largest community in the Yukon, derives its electrical energy from a diesel electric power station located near the local school, the swimming pool and the newly constructed recreation centre. Together the buildings could consume approximately 1.5 megawatts of heating. Through inspection, it was determined that the six engines comprising the Watson Lake Power Plant could meet the town's electrical energy and thermal needs during all four seasons. An agreement between the Town of Watson Lake, Yukon Electric and the Territorial Government of the Yukon allowed a district energy system to be developed to provide heating to six buildings and thereby displace both fuel oil and greenhouse emissions.

- Additional resources: Bob McCullough, Watson Lake District Energy, tel.: (867) 536-7702.

- Case study: Fort McPherson, NWT

The Village of Fort McPherson is located approximately 100 kilometres north of the Arctic Circle and has a population of about 700 people. Residual heat is distributed from the water jacket coolant of the Northwest Territories Power Corporation diesel generators (below) as a source for supply of supplemental heat to customer buildings. The system services five commercial customers including a new school, a water treatment plant, a swimming pool, a manufacturing shop and the hamlet council office.



- The district heating system has decreased the consumption of imported fossil fuel.
- It has increased the efficiency of the diesel power plant.
- Estimates show that CO₂ emissions are reduced annually by 645 tonnes and SO_x emissions are reduced annually by 1 tonne.

Source: NRCan. Fort McPherson, Northwest Territories District Heating System. NRCan case study.
kchurch@nrcan.gc.ca

-Additional resource: Ken Church, Manager, Community Planning, CANMET Energy Technology Centre, Natural Resources Canada, 1 Haanel Drive, Nepean, Ontario K1A 1M1. Tel.: (613) 947-8952, fax: (613) 947-0291. E-mail: kchurch@nrcan.gc.ca

A.3 District cooling

An extension to the district heating system involves the supply of chilled water, again through a system of dedicated piping. Chilled water may be produced either by high efficiency electrical chillers (absorption chillers using reject steam) or by cold water from a nearby lake.

- Case study: Toronto, ON

Near-freezing water will be drawn from the bottom of Lake Ontario and used to chill buildings in Toronto. After being pumped to shore, the 4°C water will pass through a heat exchanger, a device that absorbs the chill from the water. The lake water then goes on to a treatment plant at a more comfortable 13°C to become the source of the city's tap water. The District Cooling System will be operational in spring 2004 and is being developed by Enwave District Energy, jointly owned by the city and the Ontario Municipal Employees Retirement System.



- It could save as much as 35 megawatts of electricity each day, or about 75% of the energy used to air-condition office towers in the downtown core.

Source: *Wallace Imman. August 20, 2003. Globe and Mail.*

- Additional resources: *Dennis Fotinos, Chief Executive Officer, Enwave District Energy Ltd Tel: (416) 338 8912.*

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- Case study: Halifax, NS

The two towers of Purdy's Wharf (aside) in Halifax utilize cold water directly from the harbour to provide cooling for their tenants. The water is pumped from the harbour floor, filtered, and then passed through two plate-and-frame heat exchangers (see photograph below), where the water absorbs heat from the building's internal cooling system. The system works so well that traditional electrical chillers are required only for a short period of time in the shoulder seasons.



Purdy's Wharf: Water from the harbour floor is filtered and passed through two plate-and-frame heat exchangers (black units in photo), where the water is heated by the building's cooling water system. (Below) The two towers at Purdy's Wharf in Halifax are the first buildings in North America to be cooled by seawater as a primary source of cooling.

- Additional resources: Bill MacNeil tel.: (902) 421-1122.

- Case Study: Ottawa, ON

The Cliff Street Heating and Cooling Plant is part of the network of district heating and cooling systems owned and operated by Public Works and Government Services Canada to provide heating and cooling to federally and privately-owned buildings. The Cliff Street system, located in Ottawa near the Parliament buildings, provides up to 96MWt of thermal heating and up to 29,000 tonnes of chilling. The chilling is provided by a combination of electrical chilling units, absorption chillers using low pressure steam from the boilers and, during the shoulder season, free cooling provided directly by water from the Ottawa River. The mix of chilling equipment enables the plant to optimize its performance and has become one of the most cost effective sources of cooling in Ottawa.

- Additional resources: Director, Operational Support Services, PWGSC. Tel.: (819) 775 4040.

A.4 Waste heat recovery

The use of heat recovered from an industrial process to displace the use of fossil fuel within the community or industrial park.

- Case Study: Burnaby, BC

The solid waste incinerator, operated by Montenay Inc. for the Greater Vancouver Regional District (GVRD) in Burnaby, has for many years provided medium-pressure steam for local industries. The plant has since been modified to allow the boilers to produce high-pressure steam that is then passed through a turbine to generate electricity. Medium-pressure steam, suitable for the needs of the local industries, is extracted from the steam turbine. The green electricity is used locally within the GVRD.

-Additional resource: Ron Richter, Monteany Inc. Tel.: (604) 521 1025

- Case study: City of Vancouver and the Corporation of Delta, BC

A landfill gas collection and flare system and cogeneration plant at the Burns Bogg landfill was developed in partnership with Maxim Power Corporation to produce electricity for local greenhouses and reduce greenhouse gas emissions.

A.5 Bioenergy

The use of biological matter (wood, landfill gas, biosolids, combustible refuse) can provide a regular supply of inexpensive fuel for thermal or electrical power generation. Bioenergy, like fossil fuels, can produce CO₂. However, the net emission of CO₂ from bioenergy will be zero as long as plants are replenished.

- *Additional resource:* <http://www.eere.energy.gov/consumerinfo/refbriefs/nb2.html>.



A.5.1 Wood waste systems

- *Case study: Burlington, VT, USA*

In 1984, a 50-MWe biomass-fuelled power plant was constructed in Burlington, Vermont. At the time it was the largest biomass-fuelled plant in North America. It was estimated that, between 1984 and 2001, the accumulated costs expended on the plant were \$123 million. Of this total cost, fuel comprised only 50%.

	Cumulative Cost (US\$, estimated)	
Payroll	\$ 28,953,517	23%
Property Taxes	\$ 12,809,536	10%
Sales Taxes	\$ 856,507	0.7%
Rail Transportation	\$ 10,592,676	9%
Local Contractors	\$ 8,977,103	7.3%
Wood Fuel Purchases	\$ 61,665,118	50%
TOTAL	\$123,854,457	100%

- Benefits to the city include the provision of local services, support for contractors, fuel suppliers, etc.
- The plant created 40 jobs directly involved with power plant operation, and another 90 jobs are indirectly associated with the plant.
- To supplement the use of woodchips the plant accepts 2000-3000 tons of yard trimmings and 3000-4000 tons of clean shipping pallets annually. With a tipping fee of \$85/ton, this means that US\$600,000 annually will remain in the community.
- A plantation at the site allows for the rapid growth (within three years) of fuel crops such as hybrid trees.

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-Additional resource: *John Irving, Burlington Electric Department, Plant Manager, McNeil Power Plant. Tel.: (802) 865 7482.*

- Case Study: Burwash Landing, YK

The community of Burwash Landing uses local biomass to fuel its district energy system. The community recently examined the possibility of extending the system to include new homes that are proposed for construction. Deforestation due to Pine Beetle infestation has resulted in significant dead fuel on the band's lands. The expansion of the district energy system to take advantage of this fuel would generate several benefits: stability of energy costs, reduction in greenhouse gas emissions, creation of employment, and retention of the local workforce.

- Additional resource: *Dave Beaudoin, Regional Manager, PWGSC. Tel.: (867) 667-3373.*

- Case study: St. Paul, Minnesota USA

The City of St. Paul District heating system heats 141 large buildings and 298 single-family residences, amounting to over 75% of the City's downtown. Biomass waste (originally destined for landfill) now supplies 70 to 80% of the district heating system's annual energy needs. The fuel is mostly chipped tree trimmings and other clean wood wastes.

- Additional resource: *Anders Rydaker, President, District Heating St Paul Inc. Tel.: (651) 297-8955.*

- Case study: Oujé-Bougoumou, QC

Oujé-Bougoumou Cree Nation, about 1000 km north of Montreal, uses wood waste to fuel a district heating system that supplies both heat and hot water to all the buildings of the village. Over 135 housing units and 16 public buildings are connected to the district heating system.

- It heats 72% of the development but accounts for only about 10% of the fuel costs (1997 statistics).
- Residential operating costs are reduced.
- Carbon dioxide (CO₂) emissions are reduced by 2300 tonnes annually.
- Jobs were created and money stayed within the community.
- The community received the United Nations We the People: 50 Communities Award and a Habitat II Best Practices citation.

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Source: NRCan. Undated. Ouje-Bougoumou, Quebec, District Heating System. (09201) NRCan Community Energy Systems case study kchurch@nrcan.gc.ca.

- Case study: Langeac, France

The City of Langeac developed a district heating system that uses wood waste. It is one of the largest wood-fired heating plants in France; the plant supplies heat for 13,000 of the 20,000 inhabitants.

- Langeac pays 20% less than before for heating the municipal buildings that are connected to the district heating network.
- Wood combustion is CO₂-neutral: wood absorbs CO₂ when it grows and releases it when it burns.

Source: BUND for Environment and Nature Protection Germany. 1993. *Vorbildliche kommunale Energieprojekte in Europa*. ICLEI case study. Langeac, France, Vitry-le-François-sur-Marne, France, District Heating from Wood Waste. <http://www.iclei.org/egpis/egpc-015.html>.

- Additional resources: Commune de Langeac Tel.: 0033/71770718 or ADEME Délégation Régionale Auvergne, 15 Mail d'Allagnat, F 63012 Clermont-Ferrand, Tel.: 0033/73342890 or Vitry Habitat, MMe Isabelle Costa, 11 bis, rue de la Pépinière BP 32, F 51301 Vitry-le-Francois Cedex, Tel.: 003326/741698, fax: 003326/743457.

- Case study: Grande Prairie, AB

A combined heat and power plant, fuelled by biomass, will provide green power to the Canfor facility and to the Alberta grid. It will also provide heat to Canfor and, eventually, to the municipal downtown core. The prefeasibility study indicates financial feasibility. Currently marketing is underway to create consumer demand.

A.5.2 Energy from municipal solid waste

Municipal solid waste can be used to produce energy by burning it or by capturing the gases it gives off and using them as fuel.

A.5.2.1 Municipal solid waste

Municipal solid waste can be burned in large power plants to generate electric power. However, as with burning any type of fuel, municipal solid wastes can produce air pollution and require adequate emission control equipment.

- Case study: Charlottetown, PEI

The City of Charlottetown's district heating and cogeneration plant burns municipal solid waste and sawmill waste to heat over 80 buildings. The main customers are the Province of Prince Edward Island, the Queen Elizabeth Hospital, the University of Prince Edward Island, the Atlantic Veterinary College, two malls, larger commercial buildings, retail stores, apartment buildings and a few private residences.

- Charlottetown has reduced its dependency on imported oil with 45% of fuel being generated by municipal waste and 45% generated by sawmill waste.
- Estimates indicate that for every dollar spent on biomass fuel, 70 cents stay in the local economy, compared with 10 cents for every dollar spent on oil.
- Estimates show that CO₂ emissions are reduced annually by 48,900 tonnes and SO_x emissions are reduced annually by 135 tonnes.
- The system has created new opportunities for sawmill operators.
- The use of municipal waste has enabled their current landfill site to retain 30% of its capacity and reduced the landfill requirements for that waste by 90%.
- The Charlottetown District Heating System burns municipal solid waste (and sawmill waste) to heat over 80 buildings.



Source: NRCan. 2003. [Charlottetown, Prince Edward Island District Heating System](http://kchurch@nrcan.gc.ca). kchurch@nrcan.gc.ca

A.5.2.2 Using landfill gas as a renewable energy

When organic material such as food scraps decay methane is produced. Methane is the main ingredient in natural gas. Wells are drilled into landfills to release this gas, and pipes from each well carry the methane gas to a central point where it is cleaned. The gas can then be burned to produce steam in a boiler, or it can be used to power generators to produce electricity. Canadian landfills generate about 24 Megatonnes of greenhouse gas emissions annually, primarily from methane. Currently, an estimated 25% of landfill methane is recovered through active collection systems.

- Case Study: Trail Road, Ottawa, ON

A test program was undertaken by Natural Resources Canada to determine the practicality of using landfill gas to fuel microturbine generators to produce electricity. Traditionally, the use of landfill gas as a fuel has always been dependent upon the quality of the gas; a stream diluted with too much CO₂ requires oversized piping and valves, yet it produces very little power. A microturbine's greater swallowing capacity overcomes this problem, but it must still produce sufficient energy to run smoothly. The test, conducted at Ottawa's Trail Road Landfill Site (right), demonstrated that a microturbine could function safely using landfill gas with less than 50% methane.



- Additional resources: Rob Brandon, Senior Project Manager, Distributed Energy, Natural Resources Canada, tel.: (613) 992 2958.

- Case Study: Waterloo, ON

Potent greenhouse gas from a municipal landfill is transformed into electricity while reducing odours and eliminating the release of methane gas into the atmosphere.

- Virtually 100% of the methane gas is recaptured and turned into electricity

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- The City will receive royalties of up to \$500,000 per year.
- Approximately 2000 houses are powered with this electricity.
- Waterloo recovers approximately 8.5 million cubic metres of methane and CO₂ per year, reducing the impact on climate change.
- It also recovers small amounts of smog-producing nitrogen oxide and sulphur dioxide.

Source: Regional Municipality of Waterloo. 2001. Transforming greenhouse gas into renewable energy. FCM 2001 Best Practice Guide, p16. FCM-CMH2 Hill Sustainable Community Awards case study.

<http://sustainablecommunities.fcm.ca>

- Case study: Portland, OR, USA

A municipal sewage system supplies its own power from methane generated during the sewage treatment process. The plant installed four microturbines to burn biogas from a previously installed fuel cell that converts biogas into energy. The microturbines burn the gas to provide electricity and heat used in plant operations.

- The project is part of the City Energy Challenge run by the Portland Office of Sustainable Development.
- It has reduced Portland's energy costs by more than US\$2 million per year.

- Additional resources: contact www.portlandonline.com

A.6 Heat pumps

Heat pumps can be used to upgrade existing heat supplies. They operate by extracting heat from an energy source, raising its temperature through mechanical compression and delivering the heat to the end user. Increases in temperature of between 20 and 40°C are currently possible.

- Case Study: Haines Junction, YK

The community of Haines Junction sits atop a warm 15°C water aquifer that offers the potential for use as a heat source in conjunction with a heat pump. Currently, studies are underway to determine the capacity and to develop a community energy distribution system. If the project is successful, a significant portion of the Yukon community could eliminate the need for oil as an energy source.

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- Case Study: Springhill, NS

Disused and flooded coalmines, in the vicinity of Springhill, provide a seemingly endless heat supply for the industrial park. Water is pumped up from one section of the mine, and heat is extracted using a heat pump. The cooler water is returned to another section of the mine. During the summer months the cycle is reversed, providing the buildings with air conditioning. The initial customer was Ropak, a company that was contemplating a move to an area where energy was less costly. After installation of the heat pumps, Ropak realized a 60% reduction in energy bills.

For additional information, contact Springhill and Area Economic Development Commission, Springhill Geothermal Industrial Park. Town Clerk Tel.: (902) 597-3751.

- Case study: Sylvain Lake, AB

Town of Sylvan Lake installed a geothermal heating system to meet the needs of a new swimming pool facility. Underground piping collects and stores heat from the earth. The project creates a zero-emissions heating system and saves \$60,000 to \$70,000 per year in operating costs.

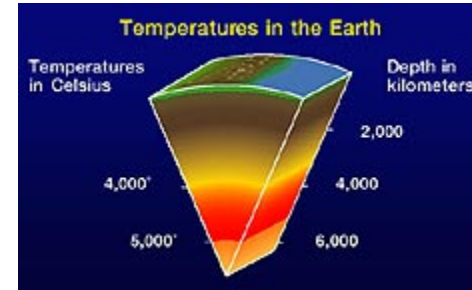


Source: FCM. 2002. *Municipal Governments and Sustainable Communities: A Best Practice Guide*, 2002. P11. Sylvan Lake Aquatic Facility. <http://sustainablecommunities.fcm.ca> FCM-CMH@ Hill Award 2002 case studies.

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A.7 Geothermal

Geothermal energy, extracted directly from pent-up energy within the Earth's core, may be used directly for the generation of electricity.



Left: Geothermal steam can be used to make pollution-free electricity.

Centre: Geothermal heat utility in California. Right: Geothermal temperatures of the Earth's core.

- Additional resources: <http://www.nrel.gov/learning/> <http://geothermal.marin.org/>

- case study: Meagre Creek, BC

Explorations have been undertaken for the extraction of steam from the hot springs in Meagre Creek, British Columbia.

- Additional resources: <http://www.investgreen.ca>

A.8 Wind energy



Wind is considered an indirect form of solar energy because the wind is driven mainly by temperature differences on the surface of the earth caused by sunshine. Wind can be used to generate electricity through wind turbines placed on towers. The blades drive a generator that produces the electricity. Large groups of wind turbines, called wind farms or wind plants, are connected to electric utility power lines and provide electricity to many people.

Wind power generators. <http://www.greenhosting.org/>

- *Additional resource:* <http://www.nrel.gov/learning/>.

- *Case study: Calgary, AB*

The City of Calgary uses wind power to fuel its light rail public transit system.

- Carbon dioxide (CO₂) emissions are reduced by 26,000 tonnes per year, the amount that would have been produced in generating electricity from coal and natural gas to power the light rail train.
- The C-Train is 100% emissions-free. It is the first public light rail transit system in North America to power its train fleet with wind-generated electricity.
- The project has received two awards. In 2001 Calgary Transit won a Federation of Canadian Municipalities CH2M HILL Sustainable Community Award for its leadership in renewable energy. Most recently, Calgary Transit was the recipient of the Canadian Council of Ministers of the Environment 2001 Pollution Prevention Award in the innovations category.



Calgary Ride the Wind train. Photo courtesy of Calgary Transit.

Source: City of Calgary. Calgary Transit: A Success Story.
<http://www.tac-atc.ca/english/abouttac/abouttac.cfm>

- *Case study.*

Wind power can be a potent means of economic development and income diversification for those in rural communities. Existing wind energy projects in the American Midwest create enough power for 250,000 homes in the region, pay more than US\$2 million annually in royalties to farmers, and eliminate almost 3 million tons of CO₂ from coal-fired power plants, equivalent to taking 469,000 cars off the road.



A.9 Solar energy

(See also solar design guidelines in the “Buildings” section.)

We can use the energy in sunshine to warm and light our homes, heat our water, and provide electricity to power our lights, stoves, refrigerators and other appliances. This energy comes from processes called solar heating, solar water heating, photovoltaic energy (converting sunlight directly into electricity) and solar thermal electric power (when the sun's energy is concentrated to heat water and produce steam that is used to produce electricity).

- *Additional resource:* <http://www.nrel.gov/learning/>

A.9.1 Solar heating

(See healthy housing and passive solar design guidelines)

Solar heating is using the sun's energy to heat our homes and water. There are many solar heated houses in Canada. These homes often use passive solar designs that operate without pumps, fans or other mechanical equipment to store and distribute the sun's energy. In contrast, active solar designs need additional mechanical components.

- *Case study: Okotoks, AB*

A subdivision development is being planned in the town of Okotoks, where each of the 74 houses will have solar collectors on the garages and bore-hole storage (ground storage) of heat capabilities, allowing heat stored during summer to be used in the heating months via a district energy system. The houses will be built to R-2000 standards. Garages are accessed through back lanes. The project will save 1,300 megawatt-hours per year and will reduce greenhouse gas emissions from 370 tonnes per year.

- *Additional resources: Town of Okotoks:* <http://www.okotoks.ca>

A.9.2 Solar water heating

The sun also can heat water for bathing and laundry. Most solar water-heating systems have two main parts: the solar collector and the storage tank. The collector heats the water, which then flows to the storage tank. The storage



tank can be just a modified water heater, but ideally it is a larger, well-insulated tank. The water stays in the storage tank until it is needed for some purpose, such as taking a shower or running the dishwasher.

- *Case study: Lillooet, BC*

Solar energy is used to heat Lillooet's municipal swimming pool.

- Solar energy is greenhouse-gas-emission-free.
- Payback times will vary but will generally be 5-10 years.

Source: City of Lillooet. Lillooet Solar Municipal Pool. Community Energy Association Committee case study
http://www.energyaware.bc.ca/tk_c_lillooet1.htm

- *Case study: Okotoks, AB*

Okotoks is a rural town with a population of 12,000 in the metropolitan area of Calgary. The municipality, working with the University of Calgary and a local real estate developer, wrote an award-winning municipal development plan (MDP) for growth management and sustainable development. The plan sets out a long-range commitment to live within the carrying capacity of the surrounding environment and preserve the small town atmosphere using innovative planning and land use strategies. This includes limiting water use and expansion of the urban boundary and pursuing eco-efficiency through urban design and recycling. The MDP plan focuses on: land use and urban design; mixed residential housing; transportation systems; open space/urban forest; regional partnerships and planning; planning for a socially responsible community; and long-term affordability.

CMHC. 2002. Sustainable Community Design Demonstration in Okotoks, Alberta: Testing Consumer Receptivity
<http://www.cmhc-schl.gc.ca/publications/en/rh-pr/index.html>.

A.9.3 Photovoltaic energy

Photovoltaic energy is a type of solar energy that converts sunshine into electricity. Photovoltaic systems are mostly used for water pumping, highway lighting, weather stations, and other electrical systems located away from power lines (because it tends to be expensive). Photovoltaic cells can be wired together to form a module. A module of about 40 cells is often enough to power a small light bulb. For more power, photovoltaic modules are wired together into an array. Photovoltaic arrays can produce enough power to meet the electrical needs of a house — or even those of more large-scale operations.

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- Case study: Washington, DC, USA

Lights at a bus stop in Washington, DC, are powered by solar energy (below). Patrons press a button within the shelter that turns lights on for 15 minutes. The lights provide greater safety for those waiting for buses and increases visibility for bus drivers; sometimes the bus drivers failed to see commuters waiting at stops and left them stranded.

- Additional resources: contact the Washington Metropolitan Area Transit Authority, www.wmata.com.

- Case study: San Diego, CA, USA

San Diego has a green photovoltaic rooftop and carport that can generate as much as 53 kilowatt-hours daily.

- It saves the City US\$11,600 per year and US\$300,000 over the life of the solar array.
- It is non-polluting and produces zero greenhouse gas emissions.

- Additional resources: contact <http://www.sandiego.gov/>

- Case study: Southern Virginia, USA

In March 2000, PowerLight installed a 42-kilowatt photovoltaic system on a building in the Cape Charles Sustainable Technology Industrial Park in southern Virginia, USA. At the time, it was considered the largest roof-integrated, thin-film solar electric system in North America. .

- The solar panels generate solar electricity, insulate the building and thereby reduce the cost of heating and air conditioning, and protect and extend the life of the roof.
- It is non-polluting and produces zero greenhouse gas emissions.

Source: Solar Electric Power Association. 2000. Sustainable Industrial Park is Solar-Powered.
<http://www.solarelectricpower.org/index.php?page=library>



A.10 Fuel cells



Hydrogen is a flammable gas; when burned with oxygen, it produces harmless water vapour. Combining oxygen with hydrogen is a clean, efficient way to make huge amounts of both heat and electricity. Drawbacks with fuel cells concern the making and safe storage and handling of the hydrogen gas. Currently, hydrogen is made by "stripping" methane or natural gas, which is -a fossil fuel. This process is costly and produces CO₂.

- Case study: Madrid, Spain

Madrid received the first of three zero-emission buses powered by Ballard(TM) as part of the European Fuel Cell Bus Project. This is the first of 30 Citaro buses equipped with 205-kWe Ballard(R) fuel cell engines that will be delivered over the next year to ten different cities, including Amsterdam, Barcelona, Hamburg, London, Luxembourg, Madrid, Porto, Reykjavik, Stockholm and Stuttgart. This is the largest fleet test of fuel cell commercial vehicles in the world. At a price of US\$1.2 million each, the buses run on compressed gaseous hydrogen, with a top speed of 80.4 kmh and a range of 299 km.

- The fuel cell buses have zero-emission rates.

Fuel cells combine hydrogen (obtained from methanol, natural gas, petroleum or renewable sources) and oxygen into electricity in a zero-emission process. Fuel cells have also been used for public buses in Canada (Vancouver), USA (Chicago and California), Australia (Perth) and elsewhere.

Source: Ballard Power Systems. The European fuel cell bus.

- Additional resources: Ballard Power Systems Inc., Investor Information, Michael Rosenberg, (604) 412-3195, (604) 412-3100 (fax) E-mail: <http://www.ballard.com>.
http://www.fuelcelltoday.com/FuelCellToday/FCTFiles/FCTArticleFiles/Article_512_MarketSurveyFuelCellBuses0902.pdf.
<http://www.navc.org/planning.html>

A.11 Hydroelectric power

Hydroelectric power is energy produced by using the energy in flowing water to make electricity. Hydroelectric power is also inexpensive, and like many other renewable energy sources, it creates no air pollution. However, the drawback to hydropower is that damming rivers can change the ecology of the region.

- Case study: Ottawa, ON

“Run-of-the-river” means that the stations do not dam or interrupt the flow of the river — an important criterion for recent certification under Environment Canada's EcoLogo program.

- The two stations generate 110 GWH per year of electricity — enough to supply all of the annual electricity needs of the nearby Parliament Buildings four times over.

Energy Ottawa, a subsidiary of the city-owned electric company Ottawa Hydro, generates Eco Logo-certified green power and markets it to commercial customers. Energy Ottawa's run-of the-river generating station generates hydroelectricity without damming rivers or changing the flow of the river.



Source: http://www.energyottawa.com/forms/index.cfm?dsp=template&act=view3&template_id=152&lang=e. For additional information, contact Energy Ottawa Inc. 1970 Merivale Road, Ottawa, Ontario K2G 6Y9. Tel.: (613) 225 0418 Fax: (613) 225 0644.

A.12 Alternative supplies

A.12.1 Peat

-Case study: Newfoundland

Canada has the largest supply of peat in the world. Peat can be used to produce heat and electricity from cogeneration for space heating, process heat and grid electricity. Newfoundland has been the most active in assessing its peat resources. Historically, a few of its residents have used peat to heat their houses, but to date there has been no commercial development of peat for energy purposes on the island. Challenges are the number of warm summer months required to dry the peat and the initial capital investment.

Source: *NRCan. 2003. [Alternative Energy Sources for Potential Community Use.](#)*

- Case study: Finland

Finland is a work leader in the use of peat combustion, generating 6% of its primary energy from this resource. Peat-fired combined heat and power plants are used for district heating in over 200 municipalities.

Source: *NRCan. 2003. [Alternative Energy Sources for Potential Community Use.](#) .*

A.12.2 Bio-oil

Bio-oil is a free-flowing dark brown liquid produced by heating biomass feedstock to 450-500°C for less than two seconds. It can be used as an energy source to replace natural gas and diesel in boilers, gas turbines and diesel engines. Industry Canada sees bio-refining as a promising vehicle to promote sustainable rural industries.

Source: *NRCan. 2003. [Alternative Energy Sources for Potential Community Use.](#)*

EDUCATION AND INFORMATION OPPORTUNITIES

-Additional resource <http://sustainablecommunities.fcm.ca>

- Case study: Tuscan, Arizona, USA

Civano is a model community in the City of Tuscan. Specific performance targets were developed in 1990 using participatory processes to: reduce energy consumption by 75%; reduce potable water consumption by 65%; reduce landfill-destined solid waste by 90%; reduce internal vehicle trip miles by 40%; and create one community job for every 2 residences.

Source: UN. 2002. *Planning and Designing of the Civano Community Model. UN Best Practice Briefs.*
<http://www.bestpractices.org/bpbriefts/>

- Additional resources: Wayne Moody, E-mail: wayne@civano.com fax: (520) 889-6207.

- Case study: Hamilton, ON

This initiative falls within the framework of Vision 2020, a plan for regional decision-making adopted by the region in June 1990 and revised in 1999. Through its Vision 2020, the Hamilton-Wentworth region, with a metropolitan population of 468,000, has instituted a process that links the municipality, citizens' organizations and other local stakeholders in the development and implementation of strategies to achieve a sustainable community.

- Air quality improvements are being achieved through interventions ranging from tree planting to traffic and transportation to an international conference on air quality.
- In less than five years, Vision 2020t has achieved a remarkable improvement in environmental conditions.
- Its approach to sustainable development in general and to air quality control in particular has become a model studied by local authorities and institutions worldwide.
- Vision 2020 is the recipient of numerous awards. In 2000, it received both the UN Dubai Award for Improving the Living Environment and the International Council for Local Environmental Initiatives (ICLEI) Local Initiatives Award in the air quality category.

Source: UN. 2000. *The Hamilton-Wentworth Air Quality Initiative and Vision 2020, (Creating a Sustainable Community, Hamilton-Wentworth Vision 2020/Air Quality).*

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- Additional resources: *City of Hamilton & Regional Municipality of Hamilton-Wentworth, 71 Main Street West, 5th Floor, Hamilton, Ontario L8P 4Y5. Tel: (905) 5464221, fax: (905) 546 4346, E-mail: hagic@city.hamilton.on Web site: <http://www.vision2020.hamilton-went.on.ca/>*

- Case study: Sidney, BC

Humanité Services Planning Ltd, working with residents in an older established neighbourhood, generated criteria for affordable housing and proposed a revised zoning bylaw for their implementation.

- Consultation with community members leads to better planning, more efficient use of resources, and elimination of potential delays in approvals because different views have already been considered and built into the project. This can create overall energy efficiency in the community.
- The character of the older neighbourhoods is also preserved while supporting diversity, innovative design and affordability.

Source: 1977. Orchard Neighbourhood: A Model for Community Architecture: Humanité Services Planning Ltd. (PB0177-28). ACT case study. www.actprogram.com

- Case study: Portland, Oregon

The Businesses for an Environmentally Sustainable Tomorrow (BEST) Program of the City of Portland Office of Sustainable Development provides assistance to area businesses and recognition for their accomplishments in sustainable practices. Resource experts from the City of Portland's Energy, Water, and Environmental Services Bureaus help businesses learn the latest on pollution prevention, energy efficiency, waste reduction, and water efficiency. The annual BEST Business Awards are presented to Portland businesses demonstrating innovative ways of conserving energy, minimizing waste, and improving transportation efficiency.

The quantified annual benefits from the actions of the 80 award-winning businesses from 1993 to 2003 are significant.

- Energy is saved in the following ways: 48.2 million kilowatt-hours of electricity; 6.8 million therms of natural gas; and, 993,000 gallons (4.5 million litres) of gasoline.
- Energy required to treat water is reduced because 868 million gallons, (3.9 billion litres) are saved.
- Solid waste is reduced by 72,136 tonnes, reducing impact on landfills.
- Carbon dioxide (CO₂) emissions are reduced by 1113,792 tonnes.
- Cost savings are US\$13.2 million.

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Portland's BEST program model is being explored and implemented in several other locations throughout the US, including Chula Vista, CA; Austin, TX; Las Cruces, NM; Boulder, CO; and Olympia, WA. Winnipeg, Manitoba, Canada has also worked with the Portland Energy Office in developing a BEST program.

Source: www.portlandonline.com

- Case study: Plymouth, UK

Plymouth Young Person's Agenda 21 encourages the young people of Plymouth to ensure their voices are heard in the local decision-making process as it relates to the environment. The group currently comprises students ranging in age from three to fifteen years. The project builds leadership and communications skills and enables members to be more proactive in their local environment.

- The focus of the project has led to what the originators feel is a very creative and unusual approach to dealing with climate change.
- The project has generated enthusiasm amongst young people to do something to address climate change and energy use.

Source: *Local Management Government Board. 1997. Plymouth Young Person's Agenda 21. Local Government Management Board Local Agenda 21 case study. See electronic version at <http://www3.iclei.org/eqpis/egpc-112.html>.*

- Additional resources: Jackie Young, c/o Environmental Development, Plymouth City Council, Floor 6, Civic Centre, Royal Parade, Plymouth PL1 2EW, Tel: 01752 668000 x 4220.

- Case study: Ottawa, ON

In 2001, the City of Ottawa launched the Smart Growth Summit. The intent was to introduce the public to a wide variety of leading-edge speakers on the subject of urban sustainability and to obtain public input for future development plans.

- The Summit led to a new official plan for Ottawa that limits the urban boundary and integrates planning and transportation. This all contributes to saving energy.

- Additional resources: <http://www.ottawa.ca>

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- Case study: Surrey, BC

The University of British Columbia undertook a design charrette process where experts were invited to brainstorm innovative solutions. In this case, the result was an innovative plan for a sustainable community in Surrey, BC, known as the East Clayton Neighbourhood Concept Plan.

- Because more people were involved in the design process, it is seen to be more representational of community views.
- Less energy was eventually used to construct the development (e.g. roads and infrastructure) and to maintain it (e.g. storm water runoff).

Source: Community Energy Association. Undated. The Best of BC - BC Energy Aware Award Winners: 1999 Winner: The City of Surrey: East Clayton Neighbourhood Concept Plan (Green Infrastructure). Community Energy Association case study. http://www.energyaware.bc.ca/tk_c_award3.htm

SUSTAINABLE AGRICULTURE OPPORTUNITIES

- **Additional resources:** http://www.smartgrowth.bc.ca/index.cfm?group_ID=3404. See this subsection of the Smart Growth BC Web site for issues and actions related to agriculture.

S.1 Sustainable farming

- *Case study: Delta, BC*

In an effort to keep farmland as farmland and stop the trend toward country estate homes, Delta Municipal Council wants to create a bylaw to limit the size of homes on agricultural land. The bylaw has been drafted and is to be passed.

- Country estate homes let the land go fallow.
- Limiting development on agricultural lands encourages local production of food, saving energy required to transport food.

Source. Vancouver Sun. September 12, 2003. Delta tries to rein in on country estate homes.

<http://www.canada.com/vancouver/vancouversun/>.

- *Case study: Devon, UK*

A wide range of projects and partnerships are currently underway in Devon aimed at developing sustainable agriculture. They include a concept design for sustainable agriculture at a farm in the Blackdown Hills; a two-year project involving cooperation with farmers to develop sustainable agriculture farm strategies linked to community sustainable development; the Devon Sustainable Agriculture Partnership; and the Local Food Links project.

Source: Devon. 1997. Local Government Management Board Local Agenda 21 case study.

<http://www3.iclei.org/egpis/egpc-117.html>.

- **Additional resources:** Ian Hutchcroft, Environment Department, Devon County Council, County Hall, Exeter EX2 4QW. Tel: 01392 382245, fax: 01392 382135. E-mail: ihutchr@environ.devon-cc.gov.uk

- *Case study: Cwmbran, UK*

In the early 1980s, a group of local people formed an action committee in a bid to protect one of the last green spaces in Cwmbran from development. The group came up with the idea of a community farm. With support from local

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organizations and funding from local authorities and other agencies, the original seventeenth-century farmhouse was restored as a focus for a community farm of 150 acres with rare breeds, wildlife and educational activities.

- The community farm protects the local environment and provides educational opportunities.
- The farm led to economic development, as it is considered one of Wales's top 20 tourist destinations.

Source: Cwmbran. 1997. Greenmeadow Community Farm. Local Government Management Board Local Agenda 21 case study. <http://www3.iclei.org/egpis/egpc-123.html>. For additional information, contact Peter Pusey, Director, Greenmeadow Community Farm, Green Forge Way, Cwmbran NP44 5AJ, Tel: 01633 862202.

- Additional resources: The West Coast Environmental Law Society <http://www.wcel.org>

PROCUREMENT POLICIES AND PRACTICES OPPORTUNITIES

P.1 Guidelines for environmental procurement

- *Case study: Sarasota, Florida, USA*

Municipalities buy green products such as EnergyStar office equipment and recycled paper. Furthermore, municipalities can develop policies, guidelines and strategies for environmental preferred procurement municipality-wide. Sarasota staff have been directed to prepare guidelines for environmental preferred procurement countywide.

- Green products save energy and money.

- **Additional resources:** *Nina Powers, Public Works Department, Sarasota (941) 316-1747.*

P.2 Purchasing green power

- *Case study: Chicago, IL, USA*

The City of Chicago was honoured in 2002 by the US Environmental Protection Agency (EPA) energy for its decision to acquire 20% of energy from green power within one year. Green power is electrical energy generated from renewable sources such as solar, wind, water, geothermal biomass, and biogas. Partners in the Green Power program pledge a switch to green power for a portion of their electricity needs over the coming year. In return, EPA provides technical assistance and public recognition.

- Partners in the Green Power program have made a combined total commitment to procuring over 500 million-kilowatt hours of green power a year.
- If generated by conventional means, the emissions associated with that much electricity would include over 800 million pounds of CO₂.
- That is about the same amount of CO₂ absorbed each year by 100,000 acres of forest, or the annual emissions of about 80,000 cars.

- **Additional resources:** <http://www.epa.gov/greenpower>

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- Case study: Vancouver, BC

BC Hydro is now selling Green Power Certificates from 100%-generated-in-BC green electricity to domestic business customers on a pilot basis. Businesses buy certificates (sold in kilowatt-hours) worth up to 100% of the energy they use. BC Hydro then buys green power. Most of the energy in 2003 comes from small hydro plants that meet minimum environment impact requirements, and a small amount comes from landfills and biomass projects. Using green energy instead of fossil fuels avoids greenhouse gas and particulate matter emissions.

- Additional resources: in Greater Vancouver, contact (604) 224-9376, in other areas, call toll-free: 1 (800)-224-9376. BC Hydro 6911 Southpoint Drive, Burnaby, BC.

<http://www.bchydro.com/business/gpcerts/gpcerts3621.html>

GOVERNANCE OPPORTUNITIES

- Case study: *Vancouver, BC*

The Livable Region Strategic Plan (LRSP) for the Greater Vancouver Regional District is the region's official growth strategy forged and is shared by 21 previously competing municipal jurisdictions.

- More complete communities are developed.
- Urban sprawl is limited by achieving a compact metropolitan area.
- Transportation choices are increased.
- The protected green zone has increased by approximately 60,000 hectares since 1991.
- Air quality improvements have been significant as a result of reductions in emissions from industry and vehicles.
- This project was a 2002 winner of the UN Global Best Practice for Improving the Living Environment.

Source: UN. 2002. *Livable Region Strategic Plan (LRSP) for the Greater Vancouver Regional District, Canada*. UN Best Practices Briefs. www.bestpractices.org/bpbriefs/

- Additional resources: Hugh Kellas, Division Manager, Regional Development, GVRD Policy and Planning, 4330 Kingsway, Burnaby, British Columbia, Canada V5H 4G8. Tel: (604) 432-6380, Fax: (604) 436-6970. E-mail: hugh.kellas@gvrd.bc.ca Web: www.gvrd.bc.ca

EXAMPLES OF COMMUNITY ENERGY PLANS

- Case study: Vancouver, BC

B.C. Hydro's Lower Mainland Electricity Choices program has developed a community energy planning orientation. It works with municipalities and considers local demand-side management (reducing or shifting energy use), site-based energy (such as building orientation and district energy systems) and low-energy community design as alternatives to substation and transmission line development.

- Additional resources: <http://www.bchydro.com/info/>

- Case study: Quesnel, BC

The City of Quesnel is developing a community energy plan. It focuses on land use and planning options, energy efficiency options, renewable energy options, and sustainable transportation options. Quesnel is considering implementing the plan with industry. If implemented, it would have significant results in reducing CO₂ emissions and saving energy.

- Additional resources: *Community Energy Association at www.energyaware.bc.ca or the Pembina Institute at www.pembina.org*

- Case study: Kamloops, BC

The City of Kamloop's community energy plan was an ambitious attempt to maximize energy savings by developing a comprehensive portfolio of policies and actions covering everything from alternative fuel use to energy management protocols, from energy modeling to subdivision planning. Some consider that the initiative failed because only a fraction of the initiatives were implemented. The plan, if implemented, would have significant results.

- Total costs could be reduced by 5 to 10%.
- Air emissions could be reduced by over 10%.
- Total per capita energy use could be reduced by 5 to 10%.

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Source: Community Energy Association. Undated. Community Energy Planning in Kamloops. Community Energy Association case study. http://www.energyaware.bc.ca/tk_c_kamloops1.htm

- Case study: Revelstoke, BC

Revelstoke developed a community energy plan. It examined three scenarios: establishing a wood-fired district energy system; developing a utility-managed energy retrofit industry to retrofit older residential homes; and implementing energy retrofit programs for existing municipal buildings and municipal infrastructure. The plan, if implemented, would have significant results.

- Household energy expenditures will be reduced by 7%.
- Twenty-six full-time positions will be created.
- Two new local industries will be created.
- Carbon dioxide (CO₂) emissions per capita will be reduced by 16% below 1996 levels.
- Cumulative savings on energy dollars spent in the community will be approximately \$10 million between 1996 and 2016.

Source: Sheltair Scientific Inc. Community Energy Planning for Revelstoke BC. Tel.: (604) 732-9106.

- Case study: Town of Banff, AB

The Town of Banff developed a community energy plan. It includes the development of building design guidelines, a transportation management plan and a local action plan. The plan, if implemented, would have significant results.

- Household energy expenditures would be reduced by 7%.
- Carbon dioxide (CO₂) emissions per capita would be reduced by 20% below 1998 levels.
- Cumulative savings on energy dollars spent in the community would be approximately \$20 million between 1996 and 2016.

Source: Sheltair Scientific Inc. Town of Banff Community Energy Plan. Tel.: (604) 732-9106.

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- Case study: Whistler, BC

Whistler has developed a sustainability plan based on 16 separate strategies that work together towards a long-term vision.

Source: http://www.whistler.ca/Sustainability/Whistler_2020/

- Case study: Sudbury, ON

The City of Sudbury is developing a community energy action plan. It focuses on site design, land-use patterns and transportation policy. It is to be issued.

- Additional resources: *Barb McDougall-Murdoch (705) 674-4455 ext. 4690.*

- Case study: Portland, OR, USA

The City of Portland's Community Efficiency Energy Plan comprises a suite of energy-conservation programs. It includes a number of residential, commercial, industrial and institutional programs. The Smart Communities Success Story indicates significant results.

- Energy cost savings identified are US\$1.2 million; cost savings realized are \$710,000.
- Energy savings are 14.2 million kWh.
- Jobs Created are over 100.
- Environmental benefits: 9096 lbs. of NO_x emissions and 12,780,000 lbs. of CO₂ emissions are avoided.

Source: *Smart Communities Network. Portland, Oregon. Undated. Smart Communities Success Story*
<http://www.smartcommunities.ncat.org> . or www.portlandonline.ocom

- Case study: San Jose, CA, USA

The City of San Jose designed and implemented an energy management program. These reductions are to be achieved through the incorporation of energy-efficient technologies (including solar design features) in new construction and through the installation of high-efficiency lighting in existing fixtures. In addition, San Jose expanded its programs in waste management and recycling, water conservation and pollution prevention. The Smart Communities Success Story indicates significant results.

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- Due to energy conservation investments, San Jose saves US\$7 million annually on its energy bill.
- Carbon dioxide emissions have been reduced by 50,000 tons per year.
- Recycling has tripled in area households from 6.7 to 16.7 pounds per week.
- Garbage sent to landfills has been reduced by 45%.

Source: Smart Communities Network. The Sustainable City Project. Smart Communities success story
<http://www.smartcommunities.ncat.org>.

- Additional resources: Mary Tucker tel.: (408) 277-5533 or see <http://www.sanjoseca.gov/> <http://www.ci.sanjose.ca.us/esd/energyresources.htm>

- Case study: San Diego, CA, USA

The 2030 San Diego Regional Energy Plan provides a framework of specific actions needed to achieve a reliable, affordable, and environmentally sound energy future for the San Diego region. The goals of the strategy deal with public policy; electrical supply and infrastructure capacity; electricity demand; natural gas supply, infrastructure capacity and costs; and transportation energy supply and demand. The plan won the Competition for Metropolitan Energy Design for being the most integrated and comprehensive approach to sustainable energy planning among the competing US municipalities.

- Additional resources: <http://www.sdenergy.org/>

- Case study: Vancouver, BC

B.C. Hydro's Lower Mainland Electricity Choices program has developed a community energy planning orientation. It works with municipalities and considers local demand-side management, site-based energy and low-energy community design as alternatives to substation and transmission line development.

Some countries, such as Sweden and Denmark, have mandated community energy planning by statute, but community energy planning is a relatively new concept in North America.

- Case study: Vancouver, BC

In January 2002, Greater Vancouver embarked on an innovative initiative called Cities Planning for Long-Term Urban Sustainability, or Cities^{PLUS}. As part of an international competition, Greater Vancouver represented Canada in showing how a large metropolitan area can reach the destination of sustainability over the next 100 years. Canada received the grand prize for this submission in the International Sustainable Urban Systems Design competition.

- Additional Resources: <http://www.citiesplus.ca/>

- Case study: San Francisco, CA, USA

The City of San Francisco developed a community energy plan, called the Sustainability Plan for San Francisco. It deals with 15 areas including: air quality; biodiversity; energy, climate change, and ozone depletion; food and agriculture, hazardous materials; economy and economic development; environmental justice; risk management; human health; parks, open spaces and streetscapes; solid waste; transportation; water and wastewater; municipal expenditures; and public information and education.

Source: For additional information, <http://www.sustainable-city.org/>

- Case study: Perth, ON

The Town of Perth is implementing educational, economical and environmentally friendly projects throughout the community as part of its goal to reach its targeted 20% reduction in greenhouse gases by 2010. It breaks projects into categories dependent on the following teams: green team, building team, transportation team, and communications team.

- Greenhouse gas emissions and other air pollution are reduced. For example, a Christmas tree light timer program reduced emissions by about 4.5 tonnes in the first year and achieved payback within the first month of installation.
- Community-wide retrofit program should decrease CO₂ emissions by an estimated 21,000 tonnes per year from 1997 levels.
- Residents purchased more than 8200 trees in the spring of 2000; this will reduce CO₂ emissions by about 70 tonnes a year.

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Sources: CMHC. 2001. *Ecoperth: A Small Rural Municipality Takes Action of Climate Change*. Issue 82 <http://www.cmhc-schl.gc.ca/publications/en/rh-pr/index.html> FCM. 2000. *Ecoperth: A Community-based demonstration of greenhouse gas reductions: Perth, Ontario* <http://sustainablecommunities.fcm.ca>

- **Additional resources**: contact ecoPerth, Bob Argue, Manager, ecoPerth, 83 Gore Street East, Perth, Ontario K7H 1J1. Tel.: 613-267-1128, fax: 613-267-6696. E-mail: reic@perth.igs.net Web site: www.ecoperth.on.ca

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- Additional resources:

Affordability and Choice Today program. www.actprogram.com. See over 180 fact sheets and case studies on projects that deal with regulatory reform in the residential sector focusing on land use, buildings and streamlining approvals.

CMHC http://www.cmhc-schl.gc.ca/en/imquaf/afho/afho_015.cfm. See affordable housing demonstration best practices identified by CMHC.

European Academy of the Urban Environment. <http://www.eaue.de/winuwd>. See 135 best practices on sustainable urban development in Europe.

FCM. <http://sustainablecommunities.fcm.ca> See Best Practices Guides for case studies on air, water, wastewater, solid waste and transportation and find out about financial assistance.

ICLEI case studies <http://www3.iclei.org/iclei/casestud.htm>. See over 80 case studies on local environmental initiatives.

Integrated Waste Management Board. <http://www.ciwmb.ca.gov/GreenBuilding/CaseStudies> See green building case studies.

National Research Council www.infraguide.gc.ca/best.htm. See National Guide to Sustainable Municipal Infrastructure best practice case studies.

Natural Resources Canada Office of Energy Efficiency www.oe.nrcan.gc.ca. See case studies and find out about financial and other assistance.

United Nations Centre for Human Settlements <http://www.bestpractices.org/>. See the UN's database of best practices for improving the living environment.

SmartGrowth.net www.smartgrowth.net/Case/sq_Casefst.html. See more than 19 case studies on infill development, brownfields redevelopment, inner-ring development and suburban development.

Smart Growth Network www.smartgrowth.org/casestudies/casestudy_index.html See more than a dozen case studies on smart growth development projects.

Smart Communities Network of Best Practices, a project by the US Department of Energy <http://www.smartcommunities.ncat.org> See their community energy success stories.

Community Association of BC (formerly Energy Aware BC)
www.energyaware.bc.ca/toolkit.htm

Canadian Geo-Exchange Coalition <http://www.geo-exchange.ca>

Canadian District Energy Association <http://www.cdea.ca>

Canadian Urban Institute www.canurb.com

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Communities of Tomorrow www.communitiestomorrow.ca

Federation of Canadian Municipalities www.fcm.ca

ICLEI www.iclei.org

Institute for Sustainable Energy www.sustainenergy.org/programs/programsCommunity.asp See their information on how to design a community energy plan.

International Institute for Sustainable Development www.iisd.org/default.asp

Northwest Energy Efficiency Alliance www.nwalliance.org/projects/index.asp

Pembina Institute for Appropriate Development

www.pembina.org See their eco-efficient communities initiative.

www.climatechangesolutions.com

Rocky Mountain Institute <http://www.rmi.org>

Sheltair www.sheltair.com

Smart Growth BC www.smartgrowth.bc

SmartGrowth.net www.smartgrowth.net

Smart Growth Canada www.smartgrowthcanada.com

Smart Growth Online www.smartgrowth.org

Sustainable Communities Network www.sustainable.org

Western Economic Diversification www.wed.gc.ca/ced/default_e.asp

Useful documents

American Journal of Public Health. September 2003. www.ajph.org. See more than three dozen papers about the impacts of the built environment on health.

California Energy Commission. Energy Aware Planning Guides 1 and II.

www.energy.ca.gov/reports/energy_aware_guide.html. Guide I contains over 260 policy areas for community energy planning. It contains case studies from the US. Guide II highlights planning for energy facilities. See also PLACES, a planning tool that allows communities to measure the impact of their decisions on energy. www.energy.ca.gov/places/

Cities^{PLUS} www.citiesplus.ca. This document provides information on how to develop a long-term, 100-year sustainable urban plan and includes a copy of the plan.

CMHC www.cmhc-schl.gc.ca/publications/en/rh-pr/index.html This is the index of research highlights. See especially the Community Energy Foundation Paper, technical series 02-112.

www.cmhc.ca/en/imquaf/hehosu/sucopl/sucopl_001.cfm. This has several CMHC documents related to sustainability.

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- Community Associations Institute Research Foundation. 2002. Best Practices. www.cairf.org/research/BPefficiency.pdf
This US report outlines best practices for community associations to reduce energy by retrofitting homes and through green building.
- Community Energy Association (formerly Energy Aware BC)
www.energyaware.bc.ca/tk_e_ocp.htm. This provides a good general theory of community energy planning.
www.energyaware.bc.ca/toolkit.htm. This is their toolkit on how to prepare community energy plans.
- David Amborski and Steven M. Webber, Ecological Fiscal Reform and Urban Sustainability: Case Study of the Ontario Provincial Government and Greater Toronto Area Municipalities, report prepared for the National Round Table on the Environment and the Economy. August 2002. Available at www.nrtee-trnee.ca
- NRCan. 2003. Community Planning Methodology (Part I and Part II). <http://kn.fcm.ca>
- Policy.link. 2003. Expanding Housing Opportunity in Washington, DC: The Case for Inclusionary Zoning
www.policylink.org/DCIZ.html
- Rocky Mountain Institute. 1995. Community Energy Workbook www.rmi.org/
- Smart Growth BC. Undated. Smart Growth Toolkit. www.smartgrowth.bc.ca/index.cfm?Group_ID=3383. This tool kit provides an overview of key sustainability issues including an introduction to smart growth, smart growth tools, citizen involvement strategies and references on additional information sources for those who want to know more.
- Smart Growth Network
Getting to Smart Growth: 100 Policies for Implementation. www.smartgrowth.org/pdf/gettosg.pdf
Getting to Smart Growth II: 100 More Policies for Implementation. www.smartgrowth.org/pdf/gettosg2.pdf
- Victoria Transport Institute. 2003. Online TDM Encyclopedia. www.vtpi.org/tdm/
http://www.transact.org/library/decoder/american_dream.pdf
- West Coast Environmental Law. Cutting Green Tape: An Action Plan for Removing Regulatory Barriers to Green Innovations. www.wcel.org/wcelpub/2002/13724.pdf