Community Energy Association

A Tool Kit for Community Energy Planning In British Columbia

Energy Ideas

Volume 2

Revised 2006

Overview

The Community Energy Association (CEA) is a charitable non-profit organization taking action on energy sustainability and climate change by assisting communities to develop energy efficiency and green energy initiatives.

The BC Energy Aware Committee, CEA's predecessor, first produced a *Toolkit For Community Energy Planning in BC* in 1997. It has subsequently been updated and expanded to reflect the issues and experiences of community energy planning throughout BC. The Toolkit is available as an internet resource, downloadable pdf, or in a printed version, available from the Community Energy Association.

The Toolkit is written for local elected officials, municipal and regional planners and engineers, real estate developers, First Nations, provincial and federal governments, and anyone interested in community sustainability and energy opportunities. It will also be a valuable resource for residents and community associations, gas and electric utilities, independent power producers, planning and development consultants, architects and homebuilders. In addition, the Toolkit offers ideas for policy changes to move conservation to a higher priority, reduce consumption, save or protect greenspace and reduce greenhouse gases.

How to Use these Energy Ideas

The Energy Ideas tool provides a list of strategies for community energy planning. The strategies are grouped by planning scale, including regional, community, neighbourhood and site-level strategies. A special set of strategies is also included for municipal infrastructure and facilities.

If, for example, you are working on a subdivision plan or approval, Energy Ideas for Neighbourhood Concept Plans and Subdivision Plans will be most relevant. There are however, a number of strategies that are relevant at more than one scale, so we advise you to be familiar with all the sections. Reading all the sections will also help you understand how neighbourhood strategies are related to broader community and regional strategies, and how specific site designs might complement your neighbourhood plan.

Energy supply strategies are included under each planning scale. However, since many of them are repeated at several scales, a separate section – A Guide to Energy Supply Technologies – is included for reference. It includes a brief description of all the major energy supply technologies listed in individual sections.

This set of strategies is a synthesis of a wide range of literature, guidelines and case studies in community planning, transit planning, site design and landscaping, energy supply and efficiency, and other fields. It is intended to stimulate thinking about things that make sense from an energy perspective, not to provide comprehensive guidelines on individual measures.

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Energy Ideas for Regional Growth Strategies

Regional growth strategies address critical issues that can't be adequately addressed by individual municipalities. Some energy-related issues are best addressed at this scale, either because they require inter-jurisdictional coordination or because they involve the allocation or use of regional resources.

Energy strategies for regional growth strategies include:

Land Use and Transportation Strategies

- **Regional Town Centres**. Strategic locations – on transit corridors consistent with local official community plans – can be targeted as centres of residential, commercial, and civic activity. Moderate-to-high density, mixed use activity centres offer energy and cost savings through reduced travel needs, reduced auto-dependency, better utilization of infrastructure and increased opportunities for utilizing waste heat and other alternative energy supply resources.

- **Regional Transit Routes.** These link regional activity centres, which may also serve as transfer points for transit and carpool travelers. Connection points with airports, ferries and other travel modes should be considered at the regional level.

- **Urban Containment Bylaws and Growth Concentration Areas**. Strict urban boundaries protect productive land – agricultural land, wetlands, forest and wildlife areas – and prevent costly urban sprawl. New growth can be concentrated in appropriate areas adjacent to developed areas, or through redevelopment of existing neighbourhoods.

- **Greenspace Networks.** Greenspace networks should protect and link key environmental resources, but should also support a compact urban form. Avoiding unnecessary fragmentation of the urban core allows new development to be located next to existing urban areas and infrastructure. Effective greenspace planning can preserve environmental resources, reduce the cost of servicing new development, and discourage auto-dependency.

- **Joint Corridor Planning**. Coordinate the planning of gas and power distribution lines with bicycle and other green corridor networks. This requires early contact with local energy distribution utilities. Cost savings can also be realized by coordinating the timing and routes of municipal water mains, sewers, telecommunication lines and any other linear underground infrastructure with energy utility distribution systems.

- **Regional Environmental Review Processes.** Establish environmental review processes that reward the use of preferred design features – including energy options -- with streamlined approvals. Although these approvals are usually made at the community level, the burden of compliance for developers will be minimized if standards are regional. Further, consistency across regions will ensure that standards aren't dropped locally as a means of attracting development from other jurisdictions.

Site Planning and Building Design

- **Building Rating and Labelling.** Regional commitment to a mandatory building labelling system will improve consumer awareness of the performance of buildings and may improve marketing opportunities for developers who feature energy-efficient design. Natural Resources Canada has developed Model National Energy Codes for Buildings and Houses that specify minimum levels of energy performance. The Green Building Information Council is a Canadian non-profit organization that disseminates information about energy and environmental issues in the building sector.

- **Energy Efficient Mortgages.** The existence of building rating systems facilitates the use of energy efficient mortgages. Municipalities and regions can work with local lending agencies to offer PITE mortgages (principal, interest, taxes and energy). These mortgages recognize savings from energy efficiency as income when qualifying applicants for mortgages. Better still; encourage homeowners to apply for mortgage interest rate reductions for efficient houses. These are now offered by at least one lending institution in BC. Similarly, Location Efficient Mortgages take into account the benefits of living in a high density area when calculating the qualifying income of an applicant.

Energy Supply Strategies

Energy utilities, regions and municipalities can work together to identify and evaluate these and other potential energy sources:

- Heat and Power from Wood Waste
- Heat and Power from Industrial Facilities
- Heat and Power from Landfill and Sewage Gas

Growth Strategies Act

Provincial goals stated in the Growth Strategies Act include:

"planning for energy supply and promoting efficient use, conservation and alternative forms of energy"

Energy Ideas for Official Community Plans and Zoning Bylaws

Most communities prepare official community plans, or OCPs, which are official statements of the development objectives and priorities of the community. Energy strategies can be integrated with other community planning strategies during the development of the OCP. Many of the following examples can also be found in guidebooks for transit, bicycle and pedestrian travel, for creating "livable" spaces, and for preserving valued greenspace, emphasizing again that good energy planning is compatible with recent trends in community planning.

Land Use Strategies

- **Contiguous Development**. When new subdivisions are built on the outskirts of the city boundaries, large tracts of empty land are left between these new neighbourhoods and existing ones. This increases travel requirements, and consequently emissions and travel costs, as well as infrastructure costs for servicing such neighbourhoods. Staged development plans, established in OCP's, can avoid this kind of costly urban pattern.

- **Activity Centres**. Strategic locations (usually with access to transit and complementing existing neighbourhood character), can be targeted as centres of residential, commercial, and civic activity. The community as a whole may have a "hierarchy" of activity centres that range in scale from small, neighbourhood-oriented centres, up to large, regionally-focused areas. Densities, total population and other design characteristics will vary depending on the scale and the community.

- **Mixed Use Zoning.** Zoning bylaws have traditionally been "exclusive", reflecting traditional values about community living. Mixed-use zoning is "inclusive". It allows and encourages complementary land uses to coexist in a single neighbourhood. Mixed use zoning can be applied even in areas that are not designated "activity centres" but development applications must be sensitive to existing neighbourhood character.

- **District Energy Zones.** Special standards for density, diversity, rate of growth and infrastructure connections can be established for development within neighbourhoods that have been identified as candidates for district energy. In this way, the community can preserve options for adopting cost-effective and more environmentally friendly energy choices (For more details on district heating, see Energy Ideas for Neighbourhood Concept Plans and Subdivision Plans).

- **Solar Energy Zones.** Special standards will include roof pitches, solar access provisions, street orientations, and landscaping guidelines in order to preserve the viability of solar energy options. These standards can be applied either in specific neighbourhoods (perhaps in response to constraints on local electricity distribution systems) or city-wide. Solar homes today look like ordinary homes. They're just far better insulated, properly oriented and use shade and exposure effectively. The days of funny-looking solar houses with huge windows in the south side and a buried north side are long gone.

Transportation Strategies

- **Multi-modal Street Design.** Multi-modal streets have design features for transit, bicycles, pedestrians and high-occupancy vehicles, in addition to the single-occupant vehicle. Some of these features include:

    - **Narrower Streets and Traffic Calming:** Narrower streets, speed bumps, pedestrian corner-bulges and other features all slow or deter traffic, making streets more attractive for walking and cycling. Street designs that require less asphalt reduce the energy needed to produce the asphalt.
    - **Interconnected Streets.** A "gridiron" street design provides more direct access throughout the area, which promotes alternatives to automobile travel.
    - **Bicycle Lanes and Signals:** There are many different designs for bicycles lanes, from signage for designated routes to the provision of dedicated lanes.
    - **HOV / Transit Lanes**: Special lanes for high-occupancy vehicles and transit. They can be permanent, or designated for peak hours only.
    - **Preferential Traffic Rules.** Traffic rules that allow transit or high-occupancy vehicles to bypass long line-ups at on-ramps or left turns.

Rationalizing Roads
The Development Services Department of the City of North Vancouver has taken the initiative to identify inefficient street patterns that use unnecessary amounts of asphalt due to excessive width or poor geometry. Solutions are designed to rationalize the road geometry and convert surplus rights-of-way into developable land. This generates significant financial return for the community, puts the land to productive use, and improves traffic patterns.

- **Parking Plans.** Although parking requirements will vary by neighbourhood, a comprehensive community-wide parking plan complements the overall plan for community development patterns. A community perspective is needed to ensure that one neighbourhood's "parking problem" is not just transferred to streets in an adjacent neighbourhood. Parking plans should address:

    - **Parking Supply Ratios.** Establish *maximum* parking ratios for selected land uses based on average peak uses and the availability of other travel options. For example, base space requirements on transit proximity. Additional revenue from leasable space freed up by removing parking stalls can pay for local shuttle services.
    - **Shared Parking.** Look for opportunities to share parking spaces at facilities with different operating hours.
    - **Parking Pricing.** Raise parking rates in areas and during hours that transit is most available. Establish reduced parking rates for high-occupancy vehicles.

- **Parking Location and Design.** Establish guidelines to locate parking spaces behind or adjacent to buildings, or underground. This preserves transit and pedestrian access. Also, establish special spaces for high-occupancy vehicles in the most convenient locations.

Parking Notes
Parking costs about $1-$2000 per space for surface lots, $7-9000 for above ground and $9-12,000 for underground – all excluding the cost of land.

- **Bicycle and Pedestrian Facilities**
  - **Bicycle Networks.** Design systems of interconnecting bicycle paths and routes that link key destinations. Make sure they link across municipal boundaries and don't terminate in heavy traffic zones.
  - **Bicycle-Vehicle-Transit Split Mode Trip Facilities.** Provide facilities to store and lock bicycles securely at connection points with transit
  - **Pedestrian Corridors and connectivity with Transit.** Design systems of pedestrian walkways that link key destinations, including transit centres.
- **Trip Reduction Measures.** Municipalities and regions can take the lead in providing information, services and facilities for reducing the number of trips made in the community each day.
  - **Vanpools and Rideshare programs.** Providing information services, meeting points and / or multi-passenger vehicles can encourage carpooling. Coordinate joint ventures between municipalities and local transit providers.
  - **Employer Trip Reduction Programs.** Municipalities can offer guidelines or seminars on trip reduction programs, usually for firms employing 100 or more employees. If they have their own program to serve as an example, all the better.
  - **Car-share Cooperatives.** Car share coops offer members the use of a fleet of jointly owned vehicles for occasional use. Members of car share coops who were previously car owners have been shown to travel fewer kilometres after joining the coop. Municipalities can support car-share cooperatives by providing preferential parking spaces and rates.

Energy Supply Strategies

- **District Energy.** Identify neighbourhoods that approach the necessary levels of energy use (density), distribution (number of users) and diversity (time of use). Target these as potential "district energy zones" and work with energy utilities to evaluate district energy options.

Other energy supply options that require consideration during the official community planning stage include:

- Heat and Power from Landfill Gas

- Power from Sewage Treatment Facilities
- Heat from Sewage Return Lines

Sensitive integration of moderate density and mixed use strategies over time, in areas where these virtually "free" energy options are viable, will preserve options for wise use of energy resources in the future.

District Energy Tips

The economics of district energy are very site-specific. As a rough rule of thumb, a neighbourhood will be a good candidate if it has some of the following characteristics:

- several large buildings or building complexes (such as hospitals, hotels or colleges);
- a mix of uses (such as a town or village centre);
- moderate residential densities (such as multi-family units or apartments);
- relatively small spacing between buildings and a grid-street layout;
- a source of relatively cheap energy (such as waste heat from an existing boiler or sewage treatment facility);
- existing buildings are not served by electric resistance heating (these cannot be easily retrofit).

District energy is best installed at the time new buildings are constructed - either in a greenfield development or a major redevelopment project. In a greenfield development, even low-density suburbs can sometimes be served cost-effectively.

A "pre-feasibility" study of district heating - assessing the availability of waste heat, densities, use mixes and local energy costs - should cost about $15,000 for a typical 15 to 20 block system. This will tell you whether it's worthwhile to investigate further. A "feasibility" study - with enough detail to finalize a decision and go out for financing - will likely cost about $50,000 to $60,000.

Energy Ideas for Neighbourhood Concept Plans and Subdivision Plans

At the neighbourhood level, developers put forward subdivision plans for approval by the municipality. Sometimes, municipalities prepare a neighbourhood concept plan. Usually, this means involving the public in evaluating alternative models of development for the neighbourhood. Energy considerations can be a part of these processes. By considering energy strategies proactively, they can support and enhance other neighbourhood objectives.

At the neighbourhood scale, energy ideas include:

Land Use and Transportation Strategies

- **Site or Neighbourhood Development Standards.** These standards are set by planners to establish physical design characteristics of a neighbourhood, such as:
    - **Density Thresholds.** By establishing minimum density levels, planners can leave the actual design up to developers. Developers may use any combination of reduced lot sizes, reduced setbacks, multi-family units, accessory units, "granny" suites, housing type mix or any other strategy for achieving desired density levels.
    - **Jobs to Residents Ratio**. The mix of uses in a neighbourhood defines its efficiency in reducing trip length, promoting alternative modes of travel, utilizing waste heat and establishing the necessary diversity of demands for local energy supply options.
    - **Total Population Targets.** Total population is important because it establishes a market for commercial activities in the neighbourhood. If the total population is too small, few businesses will be viable and the advantages of a mixed-use community are lost.
    - **Transit Access Features**. Design features such as the number of residences within walking distance of transit, grid-like street design, the orientation of a sub-division to transit routes, the provision of bus shelters and amenities can all be prescribed in site development standards.
    - **Bicycle and Pedestrian Amenities**. Design features such as bicycle lanes and routes, street calming features, sidewalks and street furniture all improve the viability of cycling and walking in the neighbourhood.
    - **Parking Location and Design.** By locating parking spaces behind or adjacent to buildings, or underground, transit and pedestrian access can be preserved.
- **Performance Points Systems.** Some design characteristics are essential. Others are simply preferred. Planners can develop "performance points" systems for preferred characteristics. Performance point systems assign

points for each proposed design feature or amenity. Developers can meet some preferred criteria but not others, as long as they have enough points. Include energy efficiency or on-site energy supply options in such a system.

- **Neighbourhood Modeling and Performance Targets.** Many developers view prescriptive rules as restrictive – even with a "points" system. Alternatively, establish performance targets for key objectives of the neighbourhood plan. This will normally require that a developer use a detailed design model to establish compliance. Sophisticated transportation and energy models are available to do this, and support the use of performance targets such as:
    - total vehicle kilometers traveled
    - average household energy use
    - percent of all trips made by automobile
- **Comprehensive Development Agreements.** Some types of neighbourhood concepts only become viable above a minimum threshold population or mix of services. By negotiating "comprehensive development agreements" with developers, municipalities can ensure that all of the design features necessary for creating a vibrant and efficient neighbourhood are included in the design concept.
- **Covenants on the Sale of Municipally-owned Land.** Where lands are owned by the municipality, the use of energy supply and efficiency options can be guaranteed by placing conditions of sales or covenants on the properties. This will ensure that future developments meet a predeterimined set of minimum criteria.
- **Incentives.** Develop incentives for development proposals to include preferred features in targeted areas. For example –
    - **Density and Height Bonuses.** Provide incentives to developers to include energy efficient design, or renewable or on-site energy supply options by allowing increased density in exchange for meeting energy supply or efficiency targets. Bonuses can also be offered in exchange for the provision of amenities such as bus shelters, cycling paths or street furniture.
    - **Transfer of Development Rights.** This is an increasingly popular mechanism for preserving low density areas (especially greenspace or heritage sites) and increasing the density of targeted areas.
    - **Streamlined Approval Processes.** Development proposals that include preferred development standards or features should receive priority treatment in the approval process. This translates into money for developers, whose costs can escalate rapidly as a result of delays in approval.
- **Neighbourhood Transit Plans.** Design transit into the subdivision or neighbourhood plan. Telephones, transit maps and schedules, bicycle racks

and postal services located at transit stops help to make transit a more attractive travel alternative.

- **Street Grid.** Establish a "finer" street grid with shorter blocks in neighbourhoods where pedestrian travel is encouraged. Also, consider street designs that require less asphalt (to reduce the energy needed to produce the asphalt) and reduce excessive rights-of-way.
- **Street Orientation.** Orient streets within 30 degrees of an east-west axis is order to maximize the benefits of passive solar gain and optimize conditions for the use of photovoltaics.

The Sub-Hub - A Neighbourhood Design Strategy

Recognizing that the suburb is and will continue to be an essential part of the many communities, the "Sub-hub" is a compromise strategy intended to gain some of the energy-efficiency and liveability advantages of an "urban village," while preserving the integrity of the surrounding residential neighbourhoods (including auto access). It concentrates activity in a moderate density, mixed-use nodal area. Sub-hub design standards are built on GIS-based modeling results and predict energy, cost and emissions savings of 5-10% over conventional development.

Some of the sub-hub design measures include:

- average residential density increased 57%
- average commercial density increased 125%
- average employment density increased 407%
- street "connectivity" increased 58%
- solar orientation of street centrelines improved 12%
- off-street parking reduced 16%
- sub-hub buildings served by district heating
- geothermal heat pumps in 10% of non-district heat buildings
- solar thermal heating for 15% of single family space and water heating and 15% of multi-family water heating

Energy Supply Strategies

At the neighbourhood level, there are a number of energy supply strategies that should be considered by planners, engineers and developers. Some of them could provide unique revenue generating opportunities. Municipalities, regions, or land and building developers can produce and sell heat and power to a discrete group of tenants or owners – and make a profit in the process!

- District Energy Systems
- Micro-cogeneration of Heat and Power
- Waste Heat Utilization
- Heat Pumps
- Heat and Power from Sewage Facilities or Local Industry

Energy Ideas for Site Planning and Building Design

Planners, developers, engineers, architects, and builders are all involved in decisions about site and building design. These decisions can affect energy used in buildings, transportation *and* infrastructure. They can also support broader goals for the surrounding neighbourhood.

Land Use and Transportation Strategies

- **Vertical Development**. Design structures to accommodate present or future second floor condominiums. Even auto-dependent developments like big box retailers or strip malls can be made more pedestrian- and transit-friendly this way. Buildings in activity centres, particularly those facing primary pedestrian routes, should have a minimum of two stories of active use.
- **Parking Location and Design**. Locate parking spaces behind or adjacent to buildings, or underground. This preserves transit and pedestrian access. Also, establish at workplaces special spaces for high-occupancy vehicles in the most convenient locations.
- **On-site Bicycle / Pedestrian Facilities.** Provide secure storage for bicycles, showers and changerooms in medium-to-large commercial buildings to encourage bicycle commuting. Orient buildings and entrances toward the primary pedestrian system, including links to neighbouring properties.

Parking lots and driveways with concrete, earth-filled blocks on perforated rubber sheets reduces cooling load on the neighbouring buildings in the summer, lets grass grow through, lets water sink into the ground to reduce runoff, and keeps underlying soils healthy.

- **On-site Carpool Facilities.** Large employers are increasingly offering trip reduction programs. On-site facilities for ride-matching, meeting areas and transit shuttles can enhance participation in these programs.
- **On-Site Transit Features**. Develop transit plans and building plans together to maximize convenient access and amenities at transit stops. Orient buildings toward transit facilities, and if possible, include transit facilities such as shelters, benches and telephones in the original building design.
- **Building Setbacks and Facades.** Buildings located close to and oriented toward sidewalks add interest to pedestrian travel. Vary the building line with offsetting walls, awnings, textures, and especially, entrances and windows. In residential areas, avoid the "garage door" effect and plan for individual front yards in multi-family units.
- **Landscaping.** Attractive landscaping creates interest and can be used to buffer pedestrian pathways from moving traffic. It can also create shading or windbreaks in areas where summer heat or winter winds are a deterrent to pedestrian travel.

Effective use of micro-climate (landscaping, wind shielding and shading) can save 5 to 10% of building heating and cooling costs

- **Option Preservation: Solar access.** Builders build for today's market, assuming yesterday's technologies will be with us forever. Anticipate the value of solar energy by appropriately orienting streets and setting building design standards that will stand the test of time.

Building, Equipment and Appliances Strategies

There are dozens of building design features and equipment and appliance choices that improve energy efficiency. BC Hydro PowerSmart, FortisBC, and Terasen are good sources of information on cost-effective efficiency ideas, including –

- building envelope design standards for air tightness, insulation and windows
- heating ventilating and air conditioning equipment and operation
- lighting appliances and controls
- water heating options
- energy efficient appliances
- mechanical heat recovery systems

Zoning Tip

Zoning bylaws generally tend to discourage energy efficiency in smaller buildings. This is because floor area calculations are taken to the exterior face of walls. More energy efficient detailing may mean thicker walls, at the penalty of usable square footage. This is a major issue in compact buildings and housing. Relatively minor changes to zoning regulations could remove this barrier.

It is relatively simple to design buildings that meet or exceed "ASHRAE 90.1" efficiency standards, as required in the City of Vancouver. These include elements such as orientation, glazing, insulation, daylighting, vegetation shading, efficient lamps, and so on.

Some additional site and building energy options include:

- **Landscaping.** Strategic landscaping buffers buildings from wind and sun, and can significantly reduce heating and cooling needs at low cost.
- **Solar Orientation.** Locate buildings on a site so that solar access is preserved. Present the longest facade to the south.
- **Daylighting.** Most of the light that comes through office windows is converted to heat that then, together with the electric lights, loads down the cooling system. Intelligent design and advanced windows can simultaneously reduce electric lighting requirements, provide non-glare, full spectrum task lighting and save energy in building cooling.
- **Reflectivity.** The colour of a building and its surroundings influences its energy use significantly. Dark surfaces create excess heat in summer, loading down air conditioners, which then add to the uncomfortable heat outside. In a cold, sunny climate, dark buildings absorb heat in the winter.
- **Building Rating and Labelling.** Have buildings certified for energy and other performance characteristics through certification programs such as

LEED, or build according to ASHRAE 90.1 or Natural Resources Canada's Commercial Building Incentive Program. Promote environmentally-sound buildings by labelling them and marketing them on the basis of their long-term cost and performance.

> "Passive solar heating can provide 30 to 60% or more of space heating needs depending on building design. There need not be extra costs associated with this - it is just a matter of good design that should be encouraged."
>
> -- Richard Kadulski Architect

- **Local and resource-efficient construction materials.** The use of local or recycled construction materials reduces energy used in transporting and manufacturing materials. It may also stimulate local business in materials collection, distribution and retail.
- **Water-efficient Appliances and Appliance Controls.** Water savings, especially hot water savings, save energy in water pumping (in infrastructure) and water heating (on-site). Information on the most efficient and convenient appliances is available through municipal water departments and equipment distributors and retailers.

Energy Supply Strategies

- **Multi-use Buildings and Waste Heat Utilization.** Many commercial activities are net generators of heat, while residences are net heat users. Mixed uses within a building, especially with commercial uses on the ground floor and residential units above, are favourable for saving energy. Use heat pumps to move energy around, with no need to generate new heat or cooling.
- **Multi-use Buildings and Power Production.** Multiple uses also even out heat and power needs over time, increasing the viability of on-site energy supply. Mature technologies are now available for simultaneously producing heat and power in stand-alone units suitable for on-site installation. Systems can be owned and operated by developers, building owners, or energy service companies as a revenue generating venture, or by owner/tenant cooperatives as a community based cost-saving initiative.

Proven, mature technologies for on-site energy production include:

- Ground and Water Source Heat Pumps
- Solar-thermal Hot Water Systems
- Passive Solar Design

Photovoltaics and wind power today, in BC, are best for remote sites. But technology and costs are changing rapidly as global markets expand. There are now experimental building designs that simply use the evaporative power of the wind to cool office towers, saving most of the fans, blowers and chillers, as well as their power use. Rooftop photovoltaic arrays are now a status symbol in some regions. Stay on top of these and other technologies as they develop**.**

Energy Ideas for Municipal/Regional Facilities & Infrastructure Planning

Municipalities and regions plan and operate facilities and infrastructure that not only use large amounts of energy, but have the potential to supply energy too.

Water, Wastewater, and Solid Waste Management Strategies

- **Energy Efficiency Measures.** The use of more efficient equipment and technologies will save energy and money. Twenty years of utility experience has brought forward valuable lessons. For example, far more energy can be saved by optimizing the size and design of a pump than by improving the efficiency of the motor that drives it. Energy efficiency experts at energy utilities can help identify energy and cost-saving opportunities

- **Water Conservation.** Energy is used to pump and heat water and to convey and treat wastewater. Reducing the demand for water will reduce energy costs and associated emissions for both water and wastewater infrastructure. Further, these reductions may defer the need to expand existing facilities, resulting in further energy and cost savings. Examine the costs to deliver water – both the costs of operation and the costs of expansion. A comprehensive water conservation program may be warranted.

- **Recycling and Re-use.** Blue box programs, composting, white goods collection, and industrial recycling all reduce the volume of goods going to landfill, and thus the energy costs of transporting them there. Re-use programs reduce the consumption of goods in the first place. Since energy is used to produce those goods, re-use programs also save energy. Energy savings should be included in cost-benefit analyses for recycling and re-use strategies.

  Recycled aluminium takes 5% of the energy of new aluminium. Newsprint runs at about 40%.

- **Development Cost Charges.** Development cost charges are often seen as merely a means of recovering the costs of providing new services. However, they can also be used as a tool to influence the nature of new development. Design development cost charges to reflect the true costs of different types of development. Changes to existing cost structures are more acceptable to developers and the public if they are designed to be revenue-neutral – lower for moderate density mixed use areas located in central locations, and higher for distant low density single use areas.

- **User Fees.** User fees can also be designed to influence choices. The introduction of direct user fees for services such as solid waste collection, water supply and wastewater treatment will not only provide a means of recovering costs without raising taxes, but will encourage consumers to balance their needs with the real costs of the service. Reductions in demand can be expected, which will lead to energy and cost savings, both for operational expenses and future capital expenditures.

Strategies for Facilities and Fleets

- **Trip Reduction Programs.** Municipal and regional employment centres can be used to demonstrate employer trip reduction programs. Depending on local needs and facilities, such a program could include:
    - employee communications and education
    - providing cash or transit passes instead of free parking as an employee benefit
    - showers and lockers for employees who walk, jog or cycle to work
    - municipal fleet vehicles for employees to use for work-related trips
    - an optional public transit subsidy for employees
    - pay parking for employees
    - a shuttle service to public transit stops
    - support for formation of car pools or other ride-sharing opportunities
    - preferential parking for car pools
    - a guaranteed ride home policy for employees who work late
    - telecommuting options and variable working hours.

  Guidelines for employer trip reduction programs can be developed from municipal / regional experience and used to provide assistance to private employers.

- **Energy Audits and Efficiency Investments**. Most municipalities can expect to save 30% or more of energy operating costs by conducting energy audits and investing in efficiency opportunities. Work with energy utilities or private energy service companies. The latter often offer no-risk programs, in which they finance efficiency investments, and receive payment as a percentage of actual savings realized over time.

- **Fleet Alternative Fuel Vehicles.** Use alternative fuel vehicles in public fleets. Work with private fleet managers to develop common purchasing and monitoring programs. This encourages wider participation, reduces administrative costs, and provides a larger market for local distributors and refuelling stations. This will in turn reduce fuel costs and emissions.

- **Public Facility Siting**. Locate municipal and regional employment centres in transit-accessible mixed-use zones to ensure long term accessibility to public facilities.

> In North America, we purify and disinfect the water we flush our toilets with, for no health-related reason, and at great cost. If we have to do this, why not simply use low-flush toilets and save not just water, but also purifying, disinfection, pumping and treatment costs

Energy Supply Strategies

Energy strategies for municipal and regional facilities include:

- **Power from Landfill Gas**
- **Power from Sewage Gas**
- **Heat from Sewage Return Lines**

In addition to cost savings and environmental benefits, such investments are often net revenue generators. Municipal engineers should investigate potential opportunities and work with planners to develop long term growth plans that will develop energy markets (moderate density, mixed use neighbourhoods, or large institutional customers) nearby.

Guide to Energy Supply Options

Many energy supply technologies can be applied at several scales of planning, from regional planning to site design. The least expensive size of electric generators has been dropping rapidly over the last decade. The era of the megaproject is, by and large, over in North America. Both new and established energy technologies, frequently located inside buildings themselves, generate electricity and useful heat. A variety of renewable energy supply forms are increasingly useful for remote communities or communities not connected to electricity or natural gas grids.

Cogeneration and District Energy

Cogeneration

is the simultaneous production of power and usable heat. In conventional power plants, a large amount of heat is produced but not used. By designing systems that can use the heat, the efficiency of energy production can be increased from current levels that range from 35-55%, to over 80%. New technologies are making cogeneration cost-effective at smaller and smaller scales, meaning that electricity and heat can be produced for neighbourhoods or even individual sites.

Micro-cogeneration

refers to systems that produce heat and power at site scale – for individual buildings or building complexes. The costs of small gas turbines has been dropping recently. They are now available in package units at increasingly small scale. These generators can be housed in self-contained units located in building basements or utility sheds. Noise levels are approximately the same as average street noise.

District Energy Systems

are multi-building heating and cooling systems. Some district energy systems are cogeneration systems. That is, they produce both usable heat and electricity. Heat is distributed by circulating hot water (or steam) through underground piping. Some systems also circulate chilled water for cooling. There are many sources of energy for district heating systems, including wood waste, heat from cogeneration, geo-exchange, heat from wastewater treatment, solar, or natural gas boilers. Hybrid systems, using a combination of sources, are possible and may be more economical. District energy system technologies are standard and in common use. Because they can use waste heat and benefit from economies of scale, they are often more efficient, cleaner and more cost-effective than conventional supply systems.

Renewable Options

The following are some of the most promising renewable energy supply options in B.C. today. However, the feasibility of renewable energy options depends on the specific site and application. Use the following as a guide to opportunities that may be available in your community. You will need to follow-up with expert analysis and advice.

Heat pumps

move heat around without creating new heat, just like a refrigerator. They can heat or cool a building, reversibly. Although they do require electricity, they typically move about three times as much energy as they use. Heat pumps can use the ground, air or river or ground water as a source of heat. They are a highly adaptable, proven and energy-efficient technology. They can be built to the scale of an individual house, to suit a large building or to provide heat on a district (neighbourhood) basis.

Photovoltaics

directly convert sunlight into electricity. They have long been used in specialty applications, such as parking meters, warning lights and anywhere else it is hard to string wire to. Sales are rapidly increasing world-wide, which will continue to bring costs down.

Solar thermal devices

come in various forms, but among simplest is a swimming pool cover, which can provide 100% of pool heating needs. Existing commercial rooftop solar hot water heaters can provide about half of an average load over the year for a coastal BC site.

Fuel cells

A fuel cell is an electricity generator that produces an electric current by combining fuel and oxygen in an electrochemical reaction. Fuel cells are efficient, clean and can run on a variety of fuels, including natural gas and hydrogen. Because they produce electricity directly (while conventional generators must burn the fuel and use the heat to turn a shaft), even those that run on natural gas (a fossil fuel) are a "clean" energy alternative.

Local pollutant emissions from fuel cells are cleaner than the air in many North American cities. They have very high efficiency over a wide range of operating conditions. They are quiet, very easy to site, have low maintenance costs, and can be built to almost any size by linking cells in a *stack*. Most types also produce useful heat that can be used for space or water heating, or in some cases, for further power generation

Commercial fuel cells have been running for many years. Expect prices to continue to come down very fast.

Wind turbines

underwent large price reductions in the 1980's and demand is growing world-wide, with Germany and India leading. For BC, they would be very useful for displacing diesel fuel in off-grid generators, except that utility rate subsidies may make them uneconomic from the customer's perspective. Today, ranching/agricultural pumping station applications are the most common uses.

Small-scale hydro

sites abound in BC, including many abandoned plants that can be modernized, such as the now-operating Goat River plant near Creston. The economics are site-specific,

but can be very competitive, especially in areas where the real cost to serve (before rate subsidies) is high.

Wood "waste"

is a renewable resource. British Columbia wastes about four million tonnes per year of energy-rich wood residue, mostly from sawmill operations. Wood smoke has been identified as the number one environmental health hazard in many Interior communities. Locally-used heat and power from wood waste may be a potential means of phasing out beehive burners.

"Waste" Heat and Power Options

Residual heat produced from existing facilities can provide a useful (and often nearly-free) source of energy, provided a sufficient heat "market" is located nearby – either in the form of several large users, or a compact mixed-use neighbourhood.

Methane from anaerobic decay can be tapped, gathered and used for ***power generation at landfill sites***. Landfill gas projects use standard technology to generate useful heat and power. Not only can energy be produced, but greenhouse gas emissions will be reduced, as methane releases from landfills are a significant contributor to the climate change problem.

Sewage gas can be used for combined ***heat and power at sewage treatment facilities***. This is in place at Annacis Island near Vancouver. Costs for small, natural gas-fired turbines and reciprocating engines / generators have been dropping in recent years. Most communities over 40,000 in population have sewage treatment facilities suitable for power production.

Heat pumps can take the ***waste heat from wastewater treatment plants or sewage trunk lines*** to create useful heat sources for district heating systems.

Industrial facilities (such as pulp mills and other large industrial plants) close to communities generate large quantities of residual heat that may be recovered and used productively. Recent plastic piping technology enables relatively long-range transport of low-pressure steam and hot water, with minimal heat loss.

Getting Started – A Model Statement for Official Community Plans

You don't have to become an energy planning expert to get things rolling. Right now, most of the decisions made by local governments impact energy performance – entirely unintentionally. These impacts in turn affect other community objectives like affordability, livability and environmental quality. Community energy planning is, first of all, a process of understanding why this is so, and then, over time, changing the urban form to accommodate energy as well as other objectives.

The single most important first step in community energy planning is to *get energy objectives into policies and the official community plan.* This will help create a culture-change in the community over time, as well as providing a legal basis for future action.

For example, Richmond's Official Community Plan objectives include "Encourage the construction of energy-efficient subdivisions and buildings" and "Encourage the development of a compact community and discourage urban sprawl".

A model statement for Official Community Plans or Regional Growth Strategies will cover the essential features of a sustainable energy system and might read as follows:

> *Anytown will encourage the planning, design and construction of energy-aware neighbourhoods and buildings [to minimize greenhouse gas emissions], including minimizing the use of non-renewable energy, increasing the use of clean and efficient on-site energy supply systems, investing in energy-efficient design features for sites and buildings, and developing a compact and complete urban form.*

The City of Coquitlam's OCP for NE Coquitlam offers a more comprehensive statement than this example.

The reference to greenhouse gases is optional, but would help to raise awareness of the role of local government in addressing global climate change.

Follow this statement with a set of guidelines to govern new development and redevelopment. Initially, the list may be quite short, but you can add to it over time.

If you're just getting started, remember:

Roll energy into existing planning processes

Creating general public process around energy doesn't "sell" in most communities in B.C. Integrate energy with other community priorities. And do it up-front. Energy has traditionally been treated as an add-on to pre-existing designs for buildings, neighbourhoods and regions. But the big benefits come from dealing with it before the architect or planner places pen to paper.

Start with a single issue or a single neighbourhood

For example:

- the community of Pincher Creek is developing a local renewable resource as a means of stimulating the local economy
- the City of Kamloops developed the "sub-hub" concept and site development standards to deal with new residential subdivisions
- the Cities of North Vancouver and Coquitlam are considering district energy for inner city redevelopment projects
- the District Municipality of Lillooet is making use of solar thermal energy
- the City of Richmond uses heat pumps and energy efficient design to reduce operating costs in new municipal facilities

All of these initiatives raise awareness about energy and its implications for communities. All of them are success stories that will lead to further initiatives. Match up the ideas in this Tool Kit with local issues and resources to get started in your community.

Appendix 1 – Community Energy Planning Resources

Community Energy Association documents – available on the CEA website (www.communityenergy.bc.ca)

A Toolkit for Community Energy Planning in BC

Volume 1 – An Introduction
Volume 2 – Energy Ideas
Volume 3 – Case Studies

- Sustainable Developer, Realistic Realtor
- Quesnel: Small Steps Towards Better Transportation
- Shoal Point: Towards Sustainability in Victoria
- The Best of BC: BC Energy Aware Award Winners

Other Community Energy Planning guides

The ***Energy Aware Planning Guide***, a 350-page community-development planning tool for local governments. Produced by the California Energy Commission, the guide explores the connection between land-use patterns, automobile dependence, energy consumption and air pollution. Written by energy, planning and economic experts at the Energy Commission as well as by guest authors from the private sector, the document contains a wealth of ideas, opportunities and important information for understanding many of the complex linkages between energy, land-use planning, air quality, transportation and economics. It can be downloaded from their website at http://www.energy.ca.gov/reports/energy_aware_guide.html

Community Energy Planning – A Guide For Communities is a three volume guide produced by Natural Resources Canada. It can be downloaded from the NRCan website:

http://www.sbc-bcd.nrcan-ncan.gc.ca/documentation/communities/volume_1.pdf
http://www.sbc-bcd.nrcan-ncan.gc.ca/documentation/communities/volume_2.pdf
http://www.sbc-bcd.nrcan-ncan.gc.ca/documentation/communities/volume_3.pdf

The ***Smart Communities Network*** is a website developed by the US Department of Energy and offers great resources, tools, links to articles and publications, and community success stories on a variety of topics from community energy, to green development, to sustainable business.

http://www.smartcommunities.ncat.org/