CARBON

theme overview

planning & design decisions

goals

design urban form to optimize energy efficiency of buildings and infrastructure

incorporate renewable energy sources and a community energy system

ensure the use of green building practices for envelope and mechanical design

detailed design tasks

fostering sustainable living

Burning fossil fuels for energy creates carbon dioxide emissions. This is linked to climate change and global warming, and puts pressure on the security of our energy resources. Sustainable urban neighbourhoods permit a carbon neutral energy supply and demand by optimizing energy use in infrastructure and buildings, and by using renewable and clean sources of energy.

theme overview

why is this theme important?

Increased levels of carbon dioxide in our atmosphere from burning fossil fuels have been linked to climate change and global warming. As a result, global temperatures are predicted to rise to unprecedented and unsustainable ranges over the next century. The impacts of this climate change are wide and varied.
Heating, cooling, lighting and other power demands of our buildings all represent significant sources of carbon dioxide emissions. This is in part related to the amount of energy being consumed, and in part to the source from which energy is derived. Thus, any sustainable urban neighbourhood must consider where energy is coming from, and how much energy from fossil fuels is being used.

why is carbon important to emerald hills urban village?

Alberta has the highest greenhouse gas emissions of all of the provinces, and it is expected that emissions will rise by as much as 83% by 2020. Carbon dioxide emissions from human actions have been linked to rising global temperatures. Global climate change will affect different areas in different ways.

For Alberta, the most likely climate change scenario as estimated by Climate Change Central is increased occurrences of drought. Drier conditions will be detrimental to food production, lead to an increase in forest fires, and an increase in air-borne particulate matter. The health implications of drought episodes will be an increase in respiratory disorders, as well as mental distress in the farming community.

Alberta's energy is predominately derived from natural gas and petroleum, with lesser amounts coming from hydro, biomass, and coal. Of all the energy consumed in Alberta, the commercial and residential sectors accounts for 17%.

how can emerald hills urban village impact on this theme?

There are two basic methods to reduce the carbon footprint associated with the development: reduce energy consumption through demand side management practices, and source new supplies of energy based on non-fossil fuel sources through supply side management practices. The Strathcona County Municipal Development Plan outlines several policies that explicitly deal with these methods.

summary table of goals and strategies for carbon

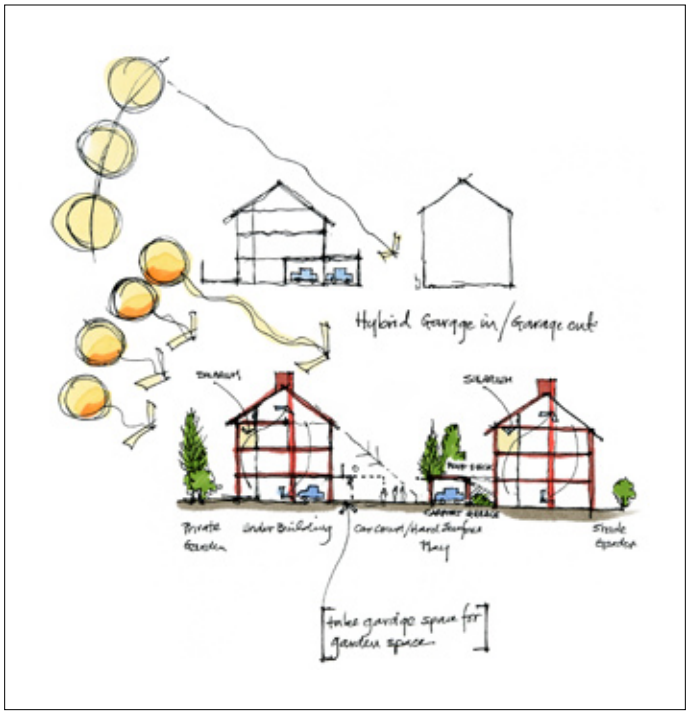
goals	charrette process strategy
Design urban form to optimize energy efficiency of buildings and infrastructure.	Orient buildings and infrastructure to facilitate solar, daylighting, and natural ventilation design.
	Design building massing to minimize energy demand.
	Utilize landscaping techniques that reduce energy demand in buildings and manage heat island effect.
Incorporate renewable energy sources and a community energy system.	Design buildings, site and community energy system (ces) to permit addition of renewable energy technologies in the future.
Ensure the use of green building practices for envelope and mechanical design.	Design in conformance with standardized green building rating protocols.

planning & design decisions

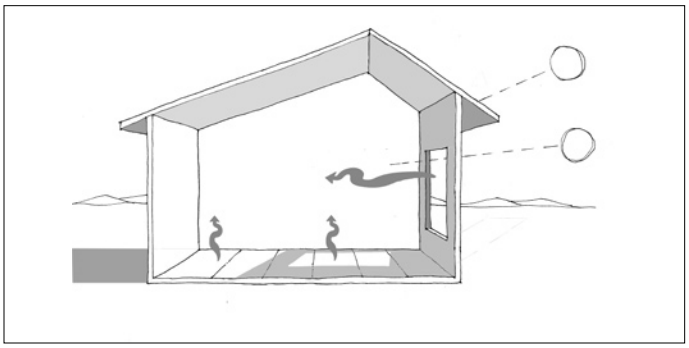
general intent of this strategy / The most important thing that can be done from a site design perspective to reduce the carbon footprint of buildings is to plan street networks and building sites to optimize opportunities to work with the sun, the natural daylight, and prevailing wind currents. The Emerald Hills Urban Village incorporates proper site orientation and passive design strategies to offset heating and cooling costs, and to enable passive and active design approaches and technologies to be incorporated.

Buildings are oriented to capture the sun.

A clerestorey window allows daylight to penetrate deep into the building.



Buildings are oriented to optimize solar and natural daylight opportunities.



Passive solar heating is conceptualized.

goal / design urban form to optimize energy efficiency of buildings and infrastructure.

strategy one / orient buildings and infrastructure to facilitate solar, daylighting, and natural ventilation design.

area i: institutional, residential,commercial
- The extended care facility is designed with substantial southern and western orientation, facilitating solar and natural ventilation access.
- The long axis of the apartment building is oriented north/south to facilitate natural ventilation.
- Floorplates and suncourts are designed to facilitate daylight penetration.
- The highrise apartment/hotel is situated to minimize shadows on adjacent buildings.

area ii: residential, commercial
- The western face of the long axes of the apartment buildings allows for optimal natural ventilation.
- The suncourt and narrow floorplates allow for daylight penetration.
- The western and southern orientation of the long axes facilitate solar access.

area iii: residential, commercial
- The western face of the long axes of the apartment buildings allows for optimal natural ventilation.
- The suncourt and narrow floorplates allow for daylight penetration.
- The western and southern orientation of the long axes facilitate solar access.
- The 6, 8 ,10 ,14-storey apartments are designed to avoid shading the central open space during prime hours.

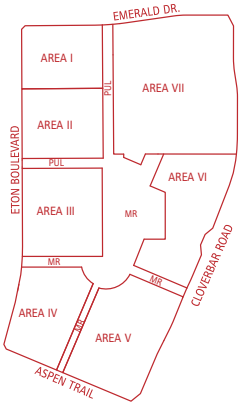
municipal reserve & public utility lot
- The massing of the buildings adjacent to the central open space is designed to avoid shading during prime hours.

area iv: residential
- The mainly East-West and Southeast-Northwest alignment of the internal streets facilitates solar access and daylight penetration into the townhouses.
- The massing of the garages is designed to minimize daylight and solar obstruction.

area v: residential
- The mainly East-West and Southeast-Northwest alignment of the internal streets facilitates solar access and daylight penetration into the townhouses.

area vi: residential, commercial
- The residential and office units are sited to allow for natural ventilation and solar access.
- The narrow floor plates permit daylight penetration.

area vii: commercial, residential
- The mixed use and live/work units along with western edge of this parcel allow for natural ventilation and solar access.
- Sensitive design can ensure that daylight is brought into the commercial retail units.



planning & design decisions

general intent of this strategy / Energy demand in buildings can be mitigated by designing the building mass to achieve a more efficient ratio of exterior skin area to floor area, as this can reduce heat gains and losses through the building envelope. The compact design of attached and stacked units in the Emerald Hills Urban Village helps minimize energy demand.

Buildings designed in a compact way have a massing that reduces energy demand.

The overall massing of the Village is compact with most buildings including units with shared walls.

goal / design urban form to optimize energy efficiency of buildings and infrastructure.

strategy two / design building massing to minimize energy demand.

area i: institutional, residential,commercial
- The extended care facility and apartment / apartment hotel buildings are designed in a compact way to reduce exterior skin area.

area ii: residential, commercial
- The apartment buildings are designed in a compact way to reduce exterior skin area.
- The massing of the 6, 8 ,14-storey apartment buildings is designed to ensure optimal shading patterns.

area iii: residential, commercial
- The apartment buildings are designed in a compact way to reduce exterior skin area.
- The massing of the 6, 8, 10 ,14-storey apartment buildings is designed to ensure optimal shading patterns.

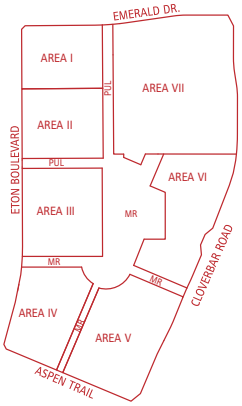
municipal reserve & public utility lot
- The Municipal Reserve and Public Utility Lots support compact development by integrating significant green space into all of the parcels, thereby attenuating the building intensity, and supporting compact development.

area iv: residential
- Shared party walls and compact design reduce the amount of exterior skin exposed in the attached bungalows and low-rise apartments.

area v: residential
- Shared party walls and compact design reduce the amount of exterior skin exposed in the townhouses.

area vi: residential, commercial
- The apartment buildings are designed in a compact way to reduce exterior skin area.
- The massing of the apartment buildings is designed to ensure optimal shading patterns.

area vii: commercial, residential
- The mixed use, residential and work / live units are designed in a compact way to reduce exterior skin area.
- Over time, the commercial retail units are intensified through infill to reduce exterior skin exposed.



planning & design decisions

general intent of this strategy / Trees and other landscaping features can be used to provide shading from the sun, cooling from the heat, and buffering against wind and cold air. Vegetation can also absorb solar incidence rays, reducing the build up of temperatures from hard exterior surfaces. The net result is a reduction in the need to mechanically heat or cool interior areas.

Trees and other landscaping features provide shading, cooling and shelter from winter winds.

Canopy shading reduces the heat island effect.

Sustainable buffer of trees along the side of a property.

goal / design urban form to optimize energy efficiency of buildings and infrastructure.

strategy three /utilize landscaping techniques that reduce energy demand in buildings and manage heat island effect.

area i: institutional, residential,commercial

- Trees are located to act as wind breaks and/or shading devices to reduce seasonal heating and cooling needs.
- Trees are located to provide canopy over hard surfaces, particularly along the green street.
- Where possible, landscaped surfaces are used rather than asphalt (for example, grass pavers or similar in courtyard areas, or green roofs).

area ii: residential, commercial

- Trees are located to act as wind breaks and/or shading devices to reduce seasonal heating and cooling needs.
- Green roofs are incorporated as appropriate to support summer cooling.
- Trees are located to provide canopy over hard surfaces, particularly along the greenway corridor.
- Where possible, landscaped surfaces are used rather than asphalt (for example, grass pavers or similar in courtyard areas, or green roofs).

area iii: residential, commercial

- Trees are located in the courtyard to act as wind breaks to reduce seasonal heating and cooling needs.
- Green roofs are incorporated as appropriate to support summer cooling.
- Trees are located to provide canopy over hard surfaces, particularly along the green street.
- Where possible, landscaped surfaces are used rather than asphalt (for example, grass pavers or similar in sun court areas, or green roofs).

municipal reserve & public utility lot

- The landscaping is designed to provide shelter from winter winds, and to channel summer breezes.
- The trees in the Public Utility Lots help to reduce seasonal heating and cooling needs in adjacent buildings.
- The greenway corridors feature native street trees and plantings integrated into the corridor design.
- Canopy trees are incorporated into the central open space.

area iv: residential

- Trees are located to act as wind breaks and/or shading devices to reduce seasonal heating and cooling needs.
- Trees are located to provide canopy over hard surfaces, particularly along the green street.
- Where possible, landscaped surfaces are used rather than asphalt (for example, grass pavers or similar in courtyard areas, or green roofs).

area v: residential

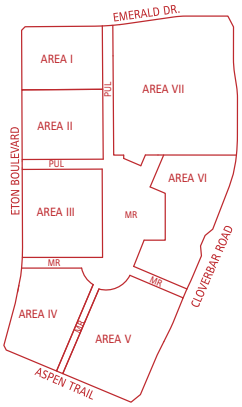
- Trees are located to act as wind breaks and/or shading devices to reduce seasonal heating and cooling needs.
- Trees are located to provide canopy over hard surfaces, particularly along the green street.
- Where possible, landscaped surfaces are used rather than asphalt (for example, grass pavers or similar in courtyard areas, or green roofs).

area vi: residential, commercial

- Trees are located to act as wind breaks and/or shading devices to reduce seasonal heating and cooling needs.
- Green roofs are incorporated as appropriate to support summer cooling.
- Trees are located to provide canopy over hard surfaces, particularly along the green street.
- Where possible, landscaped surfaces are used rather than asphalt (for example, grass pavers or similar in courtyard areas, or green roofs).

area vii: commercial, residential

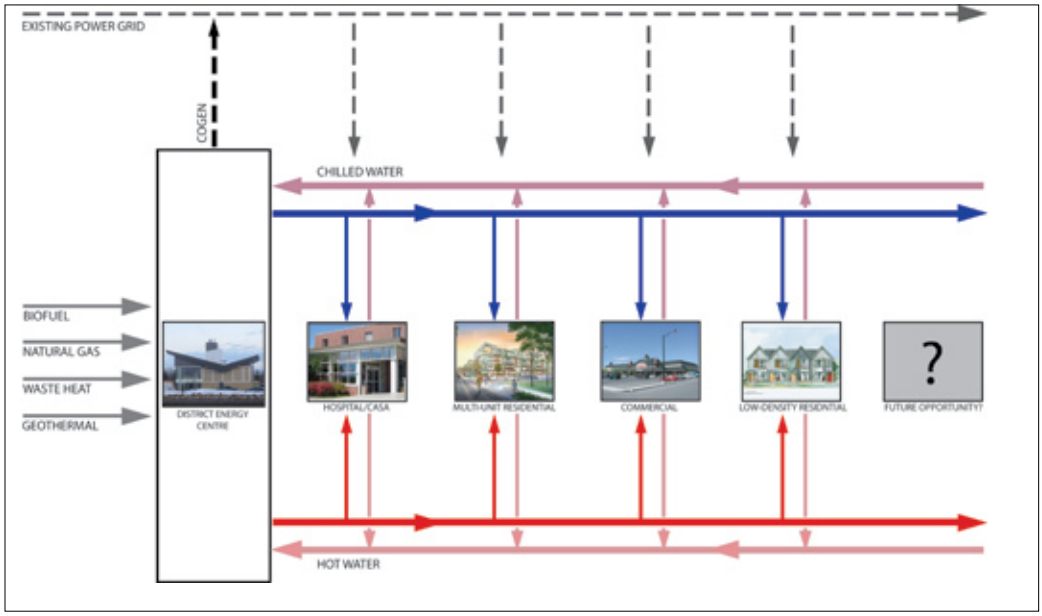
- Green roofs are incorporated as appropriate to support summer cooling.
- Where possible, landscaping is located to act as wind breaks and/or shading devices.
- The commercial parking field is shaded using bioswales and canopy trees, and includes swales as ground cover.
- Where possible, landscaped surfaces are used rather than asphalt (for example, grass pavers or similar in courtyard areas, or green roofs).



planning & design decisions

general intent of this strategy / Renewable energy will be integrated through a phased plan throughout Emerald Hills Urban Village, and is facilitated by the inclusion of a community energy system. The community energy system will provide energy and possibly cooling and will be situated close to the primary load: the hospital. The community energy system plant will initially run on natural gas, but over time can be switched to more renewable fuel sources such as biomass. There is also the potential in the future to harness waste heat from "refinery row."

A possible schematic design for the community energy system.



A community energy system is incorporated into the Village. (Sketch from design charrette.)

Surfaces are ready for future incorporation of renewable energy technologies.

Active solar technologies can be incorporated into awnings and roof surfaces.

goal / incorporate renewable energy sources and a community energy system.

strategy / design buildings, site, and a community energy system (ces) to permit addition of renewable energy technologies in the future.

area i: institutional, residential,commercial

- The diversity and high density residential in this area make it particularly attractive for providing space and domestic hot water heating and cooling via a community energy system.
- The large roof surface on the extended care facility provides space to place active solar hot water or photovoltaic technologies.
- Active solar technologies can be placed on the roof of 12-storey building or integrated into ground-level awnings.

area ii: residential, commercial

- The high density residential and potential commercial component make this area a good candidate for a community energy system.
- Active solar technologies can be placed on the roof of high-rise buildings or integrated into ground-level awnings.

area iii: residential, commercial

- The high density residential and potential commercial component make this area a good candidate for a community energy system.
- Active solar technologies can be placed on the roof of high-rise buildings or integrated into ground-level awnings.

municipal reserve & public utility lot

- Active solar technologies can be integrated into public art pieces and incorporated into the central open space.
- Solar powered lighting can be used in public open spaces.

area iv: residential

- The lower density and reduced cooling load make this area less attractive for a community energy system. A feasibility study will determine this area's potential.
- The attached bungalow designs include the opportunity for south-facing peaked roofs that are ideal for the inclusion of active solar technology.

area v: residential

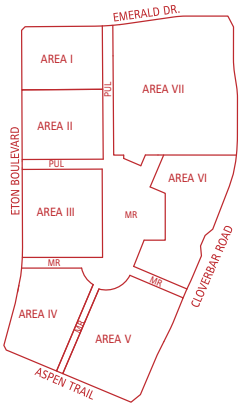
- This area has the lowest density and potentially no requirement for cooling, making it the least attractive for community energy. A feasibility study will determine this area's potential.
- The townhouse designs include the opportunity for south-facing peaked roofs that are ideal for the inclusion of active solar technology.

area vi: residential, commercial

- The high density and mixed use in this area make it a good candidate for community energy.
- Active solar technologies can be placed on the roof of high-rise buildings or integrated into ground-level awnings.

area vii: commercial, residential

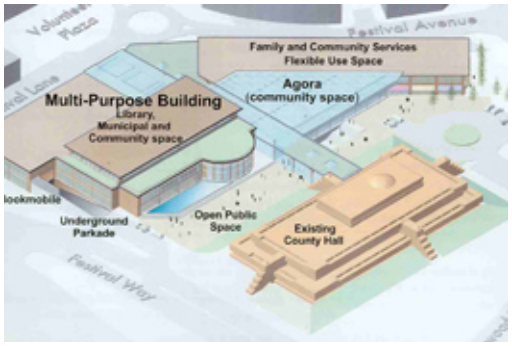
- The commercial and high density residential mix make this area a good candidate for a community energy system.
- Active solar technologies can be incorporated into building components, such as in awnings, and on the roof of the 12-storey building.
- Solar powered parking lot lighting can be incorporated.



planning & design decisions

general intent of this strategy / A range of green building rating protocols are available that incorporate detailed approaches to energy design. These include LEED-NC, LEED-CI, LEED for Homes, Built Green, BOMA GO Green, and numerous others. Once a decision is made which protocol(s) are to be used, careful attention needs to be paid to the requirements and credits laid out.

Strathcona County Community Centre is to be certified leed Gold.



Multi-residential buildings can also be certified to a green building standard.

goal / ensure the use of green building practices for envelope and mechanical design.

strategy / design in conformance with standardized green building rating protocols.

area i: institutional, residential,commercial
- The extended care and apartment buildings are designed to conform with LEED-NC, Built Green, and/or other building rating systems. A range of requirements and credits are included, consisting of such aspects as overall energy performance, hvac design, measurement and verification, and others.

area ii: residential, commercial
- The apartment buildings are designed to conform with LEED-NC, Built Green, and/or other building rating systems. A range of requirements and credits are included, consisting of such aspects as overall energy performance, HVAC design, measurement and verification, and others.

area iii: residential, commercial
- The apartment buildings are designed to conform with LEED-NC, Built Green, and/or other building rating systems. A range of requirements and credits are included, consisting of such aspects as overall energy performance, HVAC design, measurement and verification, and others.

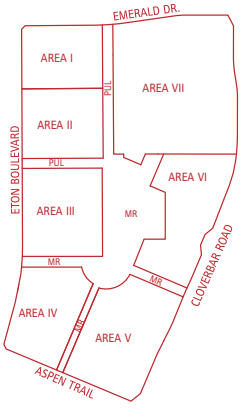
municipal reserve & public utility lot
- Not applicable.

area iv: residential
- The low-rise residential buildings are designed to conform with LEED for Homes, Built Green, EnerGuide 90, R2000, and/or other rating protocols. A range of requirements and credits are included, consisting of such aspects as overall energy performance, HVAC design, measurement and verification, and others.

area v: residential
- The low-rise residential buildings are designed to conform with LEED for Homes, Built Green, EnerGuide 90, R2000, and/or other rating protocols. A range of requirements and credits are included, consisting of such aspects as overall energy performance, HVAC design, measurement and verification, and others.

area vi: residential, commercial
- The apartment and office buildings are designed to conform with LEED, Built Green, and/or other building rating systems. A range of requirements and credits are included, consisting of such aspects as overall energy performance, HVAC design, measurement and verification, and others.

area vii: commercial, residential
- The high-rise residential, office, and commercial buildings are designed to conform with LEED-NC, Built Green, and/or other building rating systems. A range of requirements and credits are included, consisting of such aspects as overall energy performance, HVAC design, measurement and verification, and others.



Biomass can be incorporated into the community energy system.

An active solar hot water system serves as a source of heat for the building.

Strathcona County Centre in the Park community energy system power plant.

detailed design tasks

general intent / This section highlights design tasks flagged during the charrette process as needing to be addressed during the detailed design process. LEED for Neighbourhood Development prerequisites and credits are to be satisfied.

detailed design tasks

- Provide operable windows in all units to allow for natural ventilation.
- Where appropriate, incorporate high ceilings into individual units.
- Determine the appropriate type of tree and/or other landscaping to be used to achieve the desired effect (for example, in some cases evergreen trees will be more appropriate, and in others, deciduous trees will be preferable).
- Develop a palette of surfaces that are matched to the level of use. For example, where possible minimize the use of asphalt and other hard surfaces.
- Even where landscaping cannot be used to reduce the heat island effect, determine if materials with high albedo are possible.
- Use Community Energy System feasibility study to determine buildings to be connected to system.
- Use alternative fuels feasibility study to determine potential for renewable energy and waste heat sources.
- Develop a phasing plan to integrate renewable energy sources into the community energy system.
- Incorporate measurement and verification components and protocols in all new buildings.
- Specify materials that promote high environmental indoor air quality to reduce ventilation demand
- Specify high efficiency HVAC and DHW equipment.

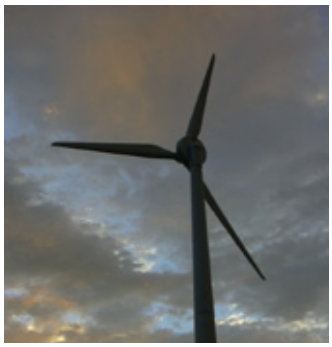
related leed-neighbourhood development credits

- leed-nd gct Credit 10: Heat Island Reduction (Option 1).
- leed-nd gct Credit 12: On-Site Energy Generation
- leed-nd gct Credit 13: On-Site Renewable Energy Sources
- leed-nd gct Credit 14: District Energy & Cooling
- leed-nd gct Credit 1: leed Certified Green Buildings.
- leed-nd gct Credit 2: Energy Efficiency in Buildings (Option 1).

See www.usgbc.org for more information.

fostering sustainable living

general intent / The detailed design decisions that enable sustainable development at Emerald Hills Urban Village must also foster sustainable living. The Strategies and Initiatives/Activities identified below represent an initial framework and point of departure for generating a Fostering Sustainable Living Program at the Urban Village. They are intended to provide the integrated design team with the sustainable living lens that is to be applied to all detailed design decisions. It is recognized that these lists will evolve and be refined as the detailed design for the Urban Village emerges.



Offsite green power offered at time of purchase.

strategies

- Ensure detailed design of built environment supports adoption of carbon neutral lifestyles.
- Develop program to facilitate purchase of green power from centralized renewable source.
- Promote renewable energy upgrade initiatives.
- Incorporate monitoring and feedback into all buildings.
- Engage all Village citizens in creating a carbon neutral lifestyles program.
- Create partnerships with local NGOs working on carbon issues.
- Promote awareness-builidng and community mapping.
- Leverage green purchasing power to buy carbon smart products.
- Introduce community-based social marketing (CBSM) programs to foster low-carbon lifestyles.

Landscaping can be used to provide shading and reduce the heat island effect.

initiatives / activities

- Off-site green power and on-site renewable energy upgrade offered at time of purchase.
- Visual monitoring in Village sustainability centre showing carbon generated on-site.
- Wattson home energy monitoring system.
- Formation of Village Ecoteam with local NGOs.
- Roadmap to a Carbon-Neutral Village created in partnership with NGO.
- Village Green - a community-based energy services company.
- Partner with Carbon Busters - Edmoton-based educational Conservaton Action Program
- Sustainable travel through carbon offsets initiative.
- Low-Carbon Solutions' section in the "Living Smart at the Village" intranet handbook.
- Village / community mapping of carbon-smart products, services and opportunities.
- Carbon-Wise - a CBSM program to foster low-carbon lifestyles.

Integrate renewable energy with landscape elements.