



CanmetENERGY

Leadership in ecoInnovation

THE URBAN ARCHETYPES PROJECT

Community Case Study: The City of Calgary

The Urban Archetypes Project, initiated by Natural Resources Canada's CanmetENERGY in Ottawa, investigated 31 neighbourhoods¹ in 8 communities² to explore the linkages among urban form, lifestyle patterns of residents and energy consumption.

The project developed energy profiles for average households within each neighbourhood for personal vehicles, household heat, hot water, and electricity for lighting and appliances. It also investigated the influence of urban design, neighbourhood location and lifestyle variables on average household vehicle travel and associated energy consumption. Communities in the project reflected a range of sizes, geographical regions, climates, energy sources and energy efficiency issues.



This fact sheet, one in a series of eight **community case studies**, presents the results for six neighbourhoods in the city of Calgary as studied in 2007: Britannia, Citadel, Lake Bonavista, Mission, Rundle and Tuscany.

This research project used *The Urban Archetypes Project Methodology*,³ which allows for a comparative analysis of energy consumption of typical households in different neighbourhoods in the same community. A further analysis of all of the project's neighbourhoods (31) will be presented in *The Urban Archetypes Project Analysis*. These documents will be posted to www.canmetenergy.nrcan.gc.ca as they become available.

The Urban Archetypes Project is among the first to explore, in an integrated fashion, the energy implications of land use, infrastructure and building decisions through case studies that present quantitative energy information in a neighbourhood context. In so doing, this project begins to address a significant gap in Canadian community energy-planning practice. Building on the findings of this project, CanmetENERGY, with project collaborators, will continue to work to provide energy information to assist Canadian communities in making strategic energy-planning decisions.

The city of Calgary is in south-central Alberta at 51°02'43" north latitude and 114°02'23" west longitude. When the Canadian Pacific Railway reached the area in 1883, Calgary began to grow into an important commercial and agricultural centre. Today, Calgary is the third-largest civic municipality by

population in Canada. As of the 2008 civic census, Calgary had a population of 1 042 892.⁴ The oil and gas industry, agriculture and tourism are mainstays of the economy. Calgary holds many annual festivals, including the Calgary Stampede. In 1988, The City also played host to the XV Olympic Winter Games.

¹ The term neighbourhood, as used in this project, denotes an area approximately 300 dwelling units in size and of relatively homogenous urban form; a neighbourhood could vary in size geographically.

² The term community, as used in this project, refers to the same scale as the municipality.

³ Definitions of measures and indicators will be found in *The Urban Archetypes Project Methodology*. www.canmetenergy.nrcan.gc.ca

⁴ City of Calgary. 2008 Civic Census Overview. www.calgary.ca/DocGallery/BU/cityclerks/city.pdf

Calgary is situated at the junction of the Bow and Elbow rivers in an area of foothills and high plains, approximately 80 kilometres (km) east of the Canadian Rocky Mountains. Average daily temperatures range from 16°C in July to -9°C in January. The city is among the sunniest in Canada, with 2 400 hours of annual sunshine on average.

Most residents rely on natural gas for space heating and domestic hot water. Most electricity is generated by natural gas and coal. Calgary's CTrains, however, are powered entirely with electricity generated by 12 wind turbines in southern Alberta, offsetting 26 000 tonnes (t) of carbon dioxide (CO₂) emissions annually.⁵

NEIGHBOURHOOD DESCRIPTIONS

BRITANNIA



Britannia is a residential neighbourhood just southwest of Calgary's downtown that was developed in the late 1950s. The study area is bounded by Elbow Drive to the east, 50th Avenue SW to the south, the Elbow River and Riverdale Park to the west and Britannia Drive to the north.

The neighbourhood comprises single-family dwellings, some of which contain suites, and a few buildings that contain walk-up apartments. Some homes have been extensively renovated, while others remain in their original condition. A plaza with numerous shops and services and the Temple B'nai Tikvah are within the study area.

CITADEL



Citadel, developed in the early to mid-1990s, is a residential neighbourhood in the northwest quadrant of Calgary. The study area is bounded by Citadel Boulevard NW to the north, Citadel Park NW to the west, Citadel Hills Boulevard NW to the south and Sarcee Trail NW to the east.

The neighbourhood contains single-family dwellings and one elementary school, Citadel Park School. Shops, services and a movie theatre are in the Country Hills Village Shopping Centre, to the east of Sarcee Trail NW.

⁵Calgary Transit. www.calgarytransit.com/environment/ride_d_wind.html

LAKE BONAVISTA



Lake Bonavista, developed beginning in the late 1960s, is in southeast Calgary. The study area is bounded to the north by Lake Bonavista Drive SE, to the east by Lake Placid Drive SE, to the south by Lake Simcoe Close SE and to the west by Bonaventure Drive SE. Single-family dwellings and Nickle School are within the study area. Nearby shopping areas include Lake Bonavista Promenade and Southcentre Mall. Two lakes, Bonaventure and Bonavista; a recreation centre; and many parks and playgrounds offer recreational opportunities. Calgary Transit operates bus routes through the neighbourhood, and Canyon Meadows CTrain Station is nearby.

RUNDLE



Rundle is a residential neighbourhood built in the early 1970s in the northeast quadrant of Calgary. The study area is bounded by Rundlehorn Drive NE to the north, 52nd Street NE to the east, 16th Avenue NE to the south and Rundlefield Road NE to the west. Dwelling types include single-family homes and townhouses. A park is on Rundlecairn Rise NE. Although no retail stores are within the study area, residents have access to the Village Square Shopping Centre to the north on 52nd Street NE and Sunridge Mall to the north on 36th Street NE, where the Rundle CTrain station is. Rundle Elementary School is within walking distance on Rundlehorn Drive NE.

MISSION



The **Mission** district is an inner-city neighbourhood slightly to the southwest of the Central Business District. It originated as a Catholic mission, Notre Dame de la Paix, and for a time was the incorporated Village of Rouleauville. The study area is bounded to the north by 21st Avenue SW, to the east by 2nd Street SW, to the south by 23rd Avenue SW and to the west by 4th Street SW. Most of the dwellings in the neighbourhood are low-rise apartment buildings, with a few older single-family dwellings. The popular 4th Street has many trendy restaurants and shops.

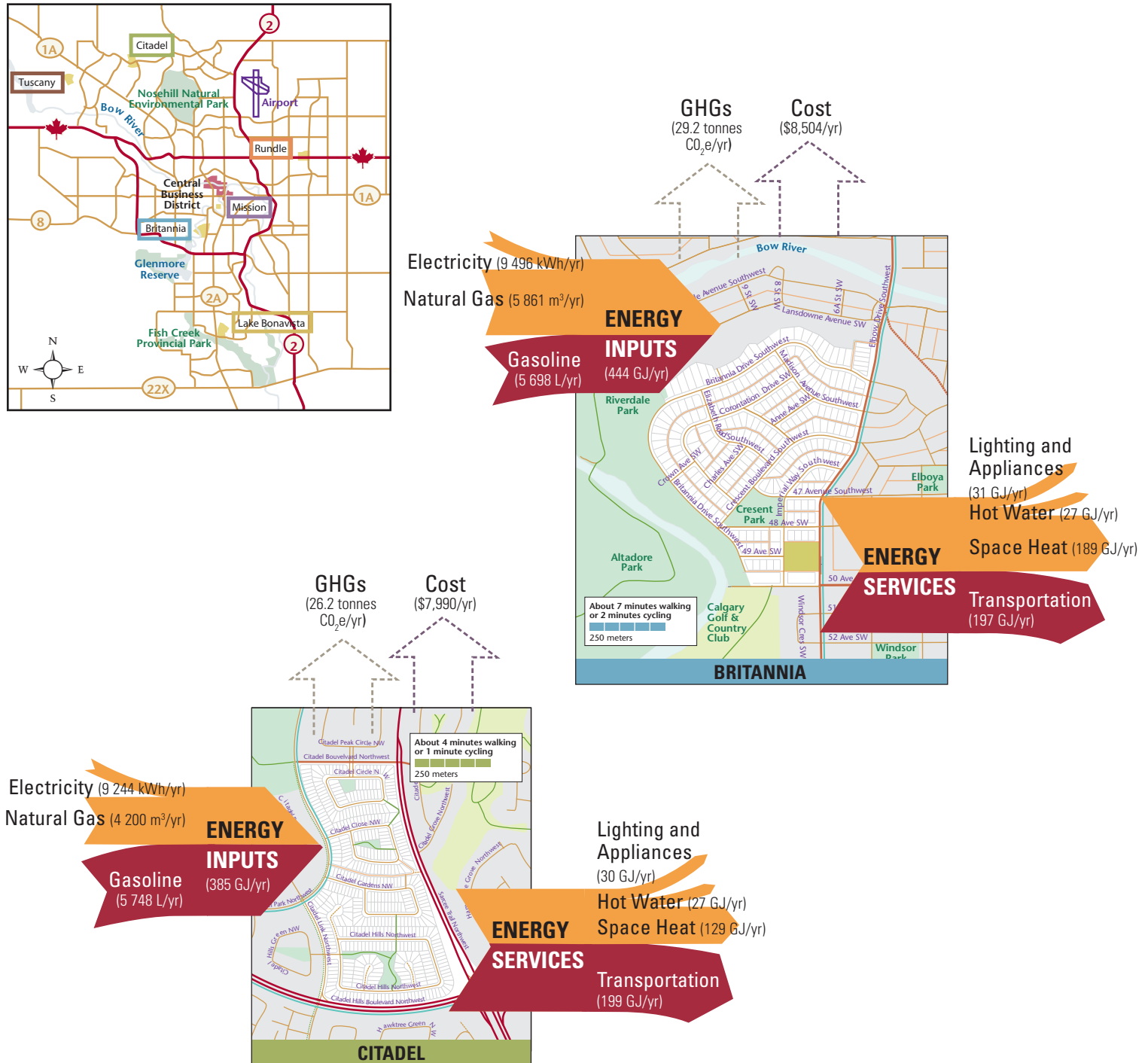
TUSCANY



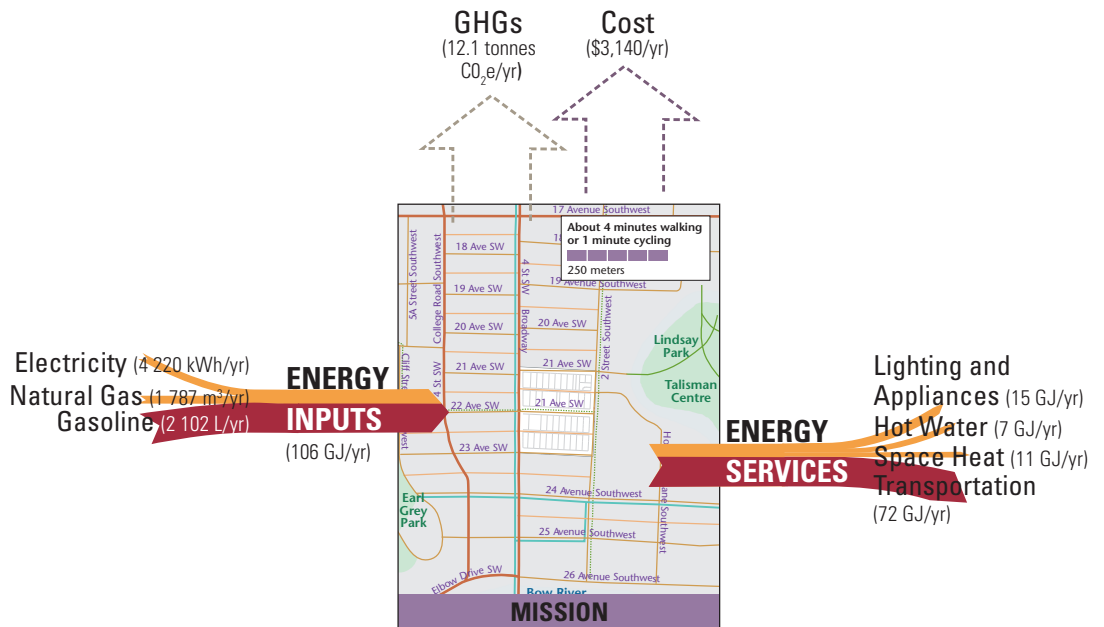
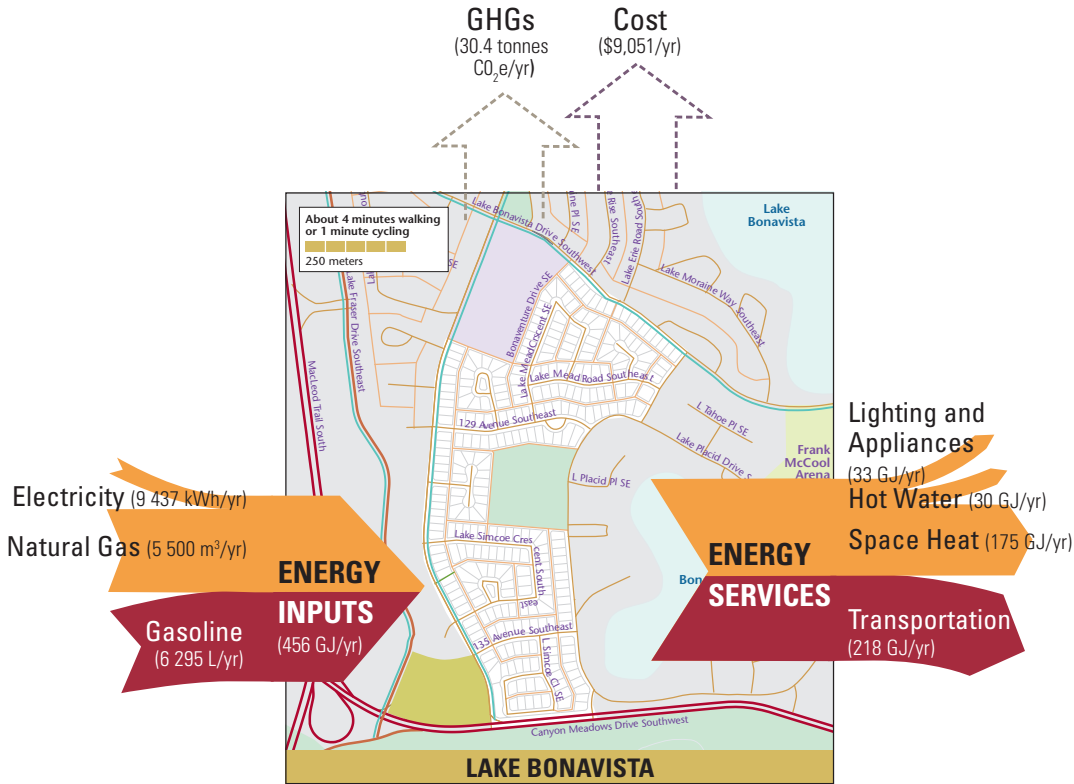
Tuscany is a residential neighbourhood built in the mid-1990s in the northwest quadrant of Calgary. Named after the Italian province, the study area is bounded to the north by Tuscany Drive NW, to the east by Tuscany Valley View NW, to the south by Tuscany Boulevard NW and to the west by Tuscany Way NW. Tuscany has one elementary school, Tuscany School. Recreational opportunities are found at the Northwest Recreation Centre; also nearby is the Tuscany Shopping Centre.

SUMMARY OF ENERGY INPUTS AND SERVICES

The Sankey-style graphics summarize a representative household’s annual energy inputs and services.⁶ The proportional scale between neighbourhoods is accurate and is reflected in the different sizes of the maps and arrows. More detailed source data for housing and transportation follow.

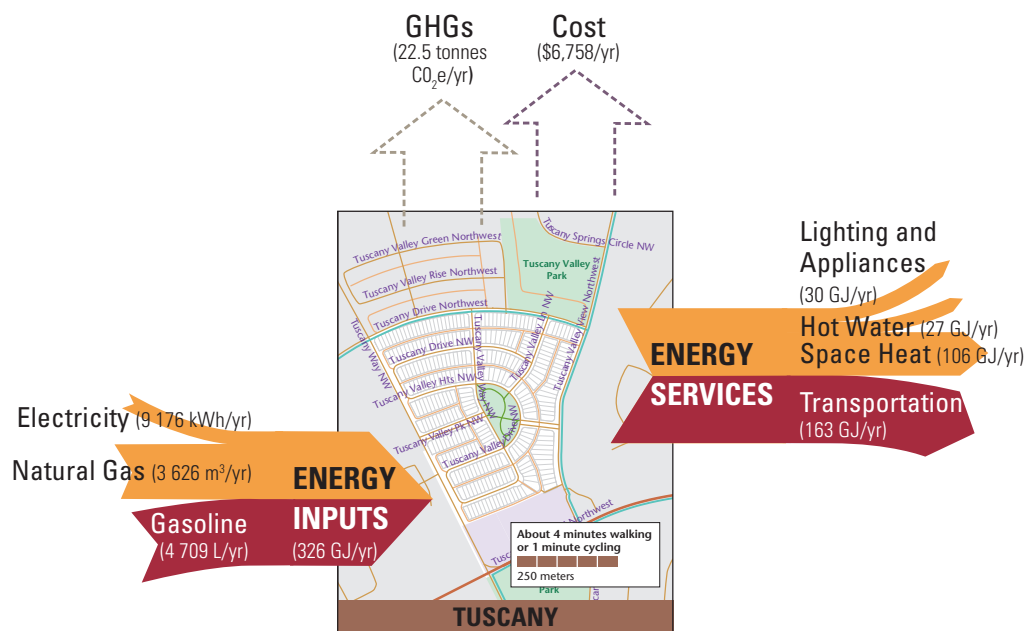
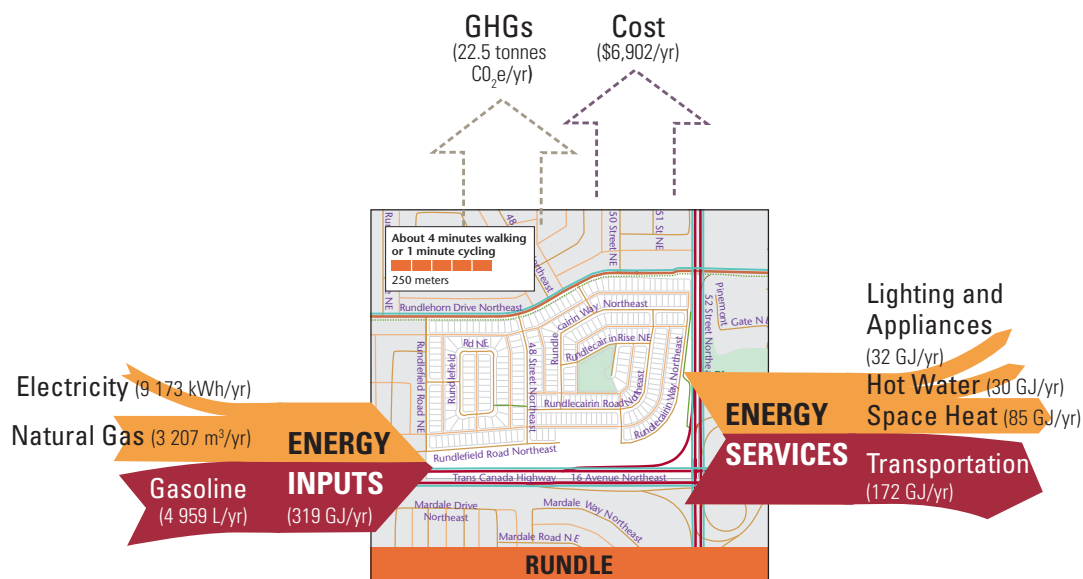


⁶ Values in the Sankey diagrams correspond with total household energy consumption modelled for the following representative house and apartment types in Calgary: Britannia A, Citadel A, Lake Bonavista B, Mission A, Rundel A and Tuscany A.



Legend for Area Maps

- | | | | | |
|----------------------------------|-------------------|--------------|----------------------------|-------------------------|
| Residential | Retail/Commercial | Municipal | Transportation | Roads without sidewalks |
| Study area with residential lots | Industrial | Recreational | Arterial (with sidewalks) | Alleys |
| | Institutional | Parkland | Collector (with sidewalks) | Pathways |
| | | Water | Local (with sidewalks) | Bike lanes, bike paths |
| | | | | Bus routes |



ENERGY USE IN DWELLINGS (HOUSES AND APARTMENTS)

The amount of energy used to provide the energy services of space heating, domestic water heating, lighting and appliances can vary substantially from house to house. Factors influencing household energy consumption include levels of insulation and

air tightness, efficiency of mechanical systems for space heating and hot water, choice of lighting and appliances, size of house, and occupant lifestyles.



Energy use in common house⁷ and apartment⁸ types within the study areas in Calgary ranged from 33 to 321 gigajoules (GJ) per year. For dwellings heated with natural gas, use ranged

from 1 787 and 7 866 cubic metres (m³) per year for space heating and hot water. Electricity use ranged from 4 220 to 9 745 kilowatt hours (kWh) per year for



⁷ Analysis was derived from ecoENERGY Retrofit – Homes (formerly EnerGuide for Houses) records within the study areas. A generalized profile for each representative house type was simulated using HOT2000* software and compared with the regional building archetype. Default values for house temperature and internal gains were used, and occupancy was determined by interview; Parekh, Anil. 2005. “Development of Archetypes of Building Characteristics Libraries for Simplified Energy Use Evaluation of Houses.” Ninth International Building Performance Simulation Association Conference, Montréal.

⁸ Results for multi-unit residential buildings (MURBs) are a combination of observed and measured geometry with measured performance values using generic assumptions for building age. Simulations were completed using Natural Resources Canada’s Screening Tool for New Building Design (www.screen.nrcan.gc.ca). Assumptions for lighting, appliances and miscellaneous electrical use per suite are derived from *Model National Energy Code for Buildings* schedules. Suite energy use was pro-rated from simulated whole-building energy use.

*HOT2000 is an official mark of Natural Resources Canada.

lighting and appliances. Given this consumption, energy costs⁹ ranged from \$1,798 to \$3,544 per year for the combined use of natural gas and electricity. Associated greenhouse gas

(GHG) emissions¹⁰ ranged from 7.1 to 19.1 t of carbon dioxide equivalent (CO₂e) per year.



⁹ Average costs were calculated using available price data for Alberta: natural gas (33.258¢/m³, 2007 average) and electricity (11.52¢/kWh, 2006 average).

¹⁰ GHG emissions were determined using the marginal fuel factors for the region developed by Environment Canada, as used in HOT2000.

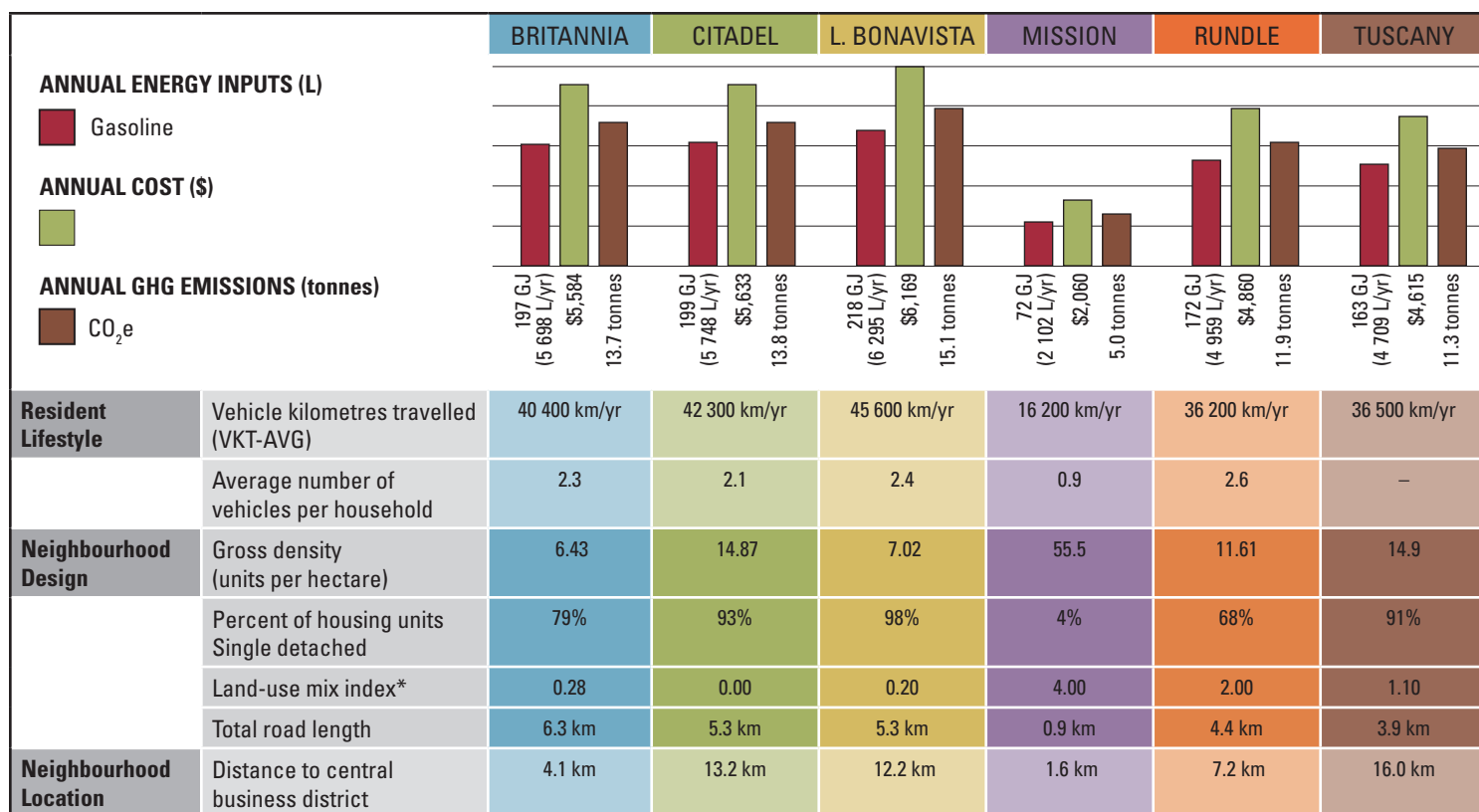
ENERGY USE FOR PERSONAL VEHICLE TRANSPORTATION

Personal transportation helps Canadians accomplish a wide variety of activities and is essential for the functioning of our communities. Personal vehicles are the predominant form of personal transportation, accounting for 78 percent of total passenger transportation energy end-use in Canada in 2005.¹¹ The Urban Archetypes Project calculated energy consumption for personal vehicles¹² and examined public transit and the active modes of walking and cycling.

The factors that influence transportation energy consumption for personal vehicles include distance travelled, vehicle

type and fuel efficiency. Furthermore, the influence of neighbourhood design characteristics, location and lifestyle for all 31 study neighbourhoods was analysed and will be presented in the *Urban Archetypes Project Analysis*.

In the Calgary study areas, average annual household Vehicle Kilometres Travelled (VKT-AVG)¹³ ranged from 16 165 km to 45 625 km. In 2007, the average study-area household consumed between 2 102 and 6 295 litres (L) of gasoline that cost¹⁴ between \$2,060 and \$6,169 and produced GHG emissions of between 5.0 and 15.1 t of CO₂e.



*Land-use mix variables include the number of retail/commercial units, retail/commercial buildings, industries, institutions and municipal buildings. The higher the score, the more mixed the land use in the neighbourhood.

PROJECT COLLABORATION

Natural Resources Canada recognizes the contribution of The City of Calgary – in particular, the Ecological Footprint Project, imagine CALGARY and Plan It Calgary teams – Sustainable Calgary, the University of Calgary, ENMAX Corporation and ATCO Gas.

FOR MORE INFORMATION

To learn more about the Urban Archetypes Project or to access companion documents (methodology, analysis and case studies), visit www.canmetenergy.nrcan.gc.ca (Building & Communities, Communities section) or contact Jessica Webster by telephone at 613-992-9532 or by e-mail at jessica.webster@nrcan.gc.ca.

¹¹ Passenger Transportation Secondary Energy Use by Energy Source and Transportation Mode. oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/tran_00_4_e_2.cfm?attr=0

¹² Personal vehicles include small and large cars and light trucks.

¹³ Based on total estimated household Vehicle Kilometres Travelled (VKT) data collected from study area residents in 2007. To account for possible under-reporting, neighbourhood household average VKT was substituted in cases of non-response, producing the Vehicle Kilometres Travelled-Average (VKT-AVG) figure. See *The Urban Archetypes Project Methodology* for more details.

¹⁴ Average costs were calculated using available price data for Calgary: gasoline (\$0.98/L, 2007 average).