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THE URBAN ARCHETYPES PROJECT

Community Case Study: The City of Regina

The Urban Archetypes Project, initiated by Natural Resources Canada's CanmetENERGY in Ottawa, investigated 31 neighbourhoods[1] in 8 communities[2] 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 four neighbourhoods in the city of Regina as studied in 2006: Cathedral Crescents; Centre Square; Twin Lakes, Northwest; and Twin Lakes, Southeast.

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 Regina is the capital of Saskatchewan and the commercial centre of southern Saskatchewan. It is located at 50°26'50" north latitude and 134°36'58" west longitude.

The arrival of the railroad in 1882 led to rapid growth, and Regina soon became the capital of the Northwest Territories and headquarters of the North West Mounted Police.[4]

Today, Regina is a modern city with a population of 194 971.[5] The city covers just under 119 square kilometres (km^2), with a population density of 1640 inhabitants per square kilometre. It has a diversified economy with strengths in farming, oil and gas, potash and fertilizer, finance, and telecommunications. The city is also home to the Regina Research Park, the University of Regina and provincial and federal government offices.

[1] The term neighbourhood, as used in this project, denotes an area approximately 300 dwelling units in size and of relatively homogenous urban form; it 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 can be found in *The Urban Archetypes Project Methodology.* www.canmetenergy.nrcan.gc.ca

[4] City of Regina: Profile of Our Capital City. www.regina.ca/AssetFactory.aspx?did=293

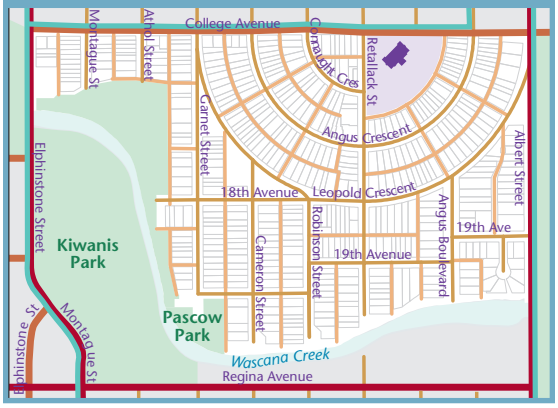
[5] Statistics Canada. Community Profiles from the 2006 Census. www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/details/Page.cfm?Lang=E&Geo1=CSD&Code1=4706027&Geo2=PR&Code2=47&Data=Count&SearchText=Regina&SearchType=Begins&SearchPR=01&B1=All&Custom=h

Regina has a semi-arid continental climate with warm summers and cold, dry winters. Average annual precipitation is 390 millimetres (mm), with June being the wettest month with an average of 75 mm of precipitation. Average daily temperatures range from 18.9°C in July to –15.9°C in January.

Most residents rely on natural gas for space heating and domestic hot water. Most electricity is generated from coal. Provincial Crown corporations SaskPower and SaskEnergy provide electricity and natural gas, respectively. Water, sewer and residential garbage services are municipally owned.

NEIGHBOURHOOD DESCRIPTIONS

CATHEDRAL CRESCENTS

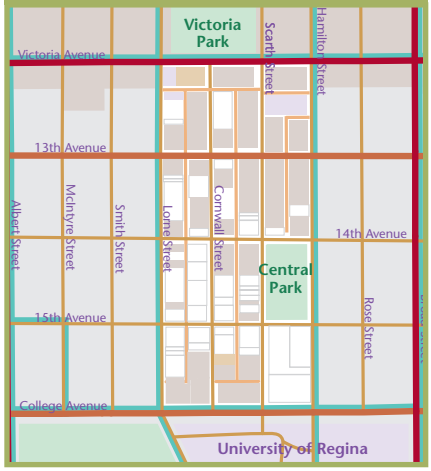


Cathedral Crescents is immediately southwest of the downtown. The study area is bounded by College Avenue to the north, Albert Street to the east, Wascana Creek to the south and Kiwanis Park to the west. More than half of the building stock was constructed between 1910 and 1929, although some new construction, restoration and infill have since occurred. Dwellings in the study area are predominantly single detached. However, the proportion of duplex dwellings in the broader neighbourhood is slightly higher than the city average.

Most neighbourhood streets in the southern portion of the study area have a grid layout, while some form a half-concentric ring pattern south from College Avenue. All streets have streetlights, sidewalks and crosswalks at major intersections, and three bus routes within walking distance link Cathedral Crescents to the downtown. Houses have small setbacks, and mature elm trees form a green canopy overhead in summer. Yard maintenance practices vary – some yards have grass, while xeriscaping has been implemented in others.

A major park area along Wascana Creek includes pathways, green space and recreational areas. Although there are no shops or services within the study area, the larger neighbourhood contains retail, commercial, community services and an elementary school.

CENTRE SQUARE

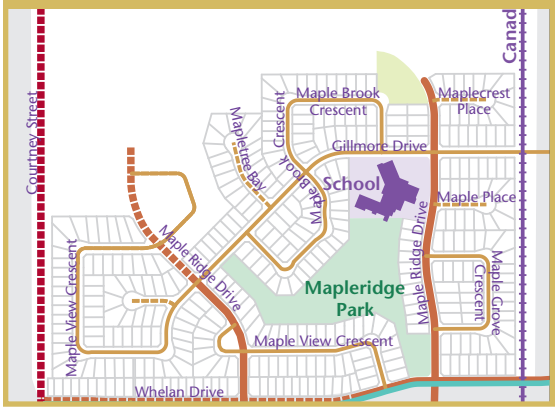


Centre Square is immediately south of the downtown. The neighbourhood's buildings are diverse in age and purpose. The study area is bounded to the north by Victoria Avenue, to the east by Hamilton Street, to the south by College Avenue and to the west by Lorne Street.

Many single-family dwellings and apartments were built between 1900 and 1929. Infill of low-rise apartments and commercial buildings was common between 1961 and 1990. Today, dwellings are almost exclusively low- and high-rise apartments, and many older single-family dwellings have been converted into commercial and office space. A substantial number of lots are undeveloped or are used for off-street parking.

The road network in Centre Square is a grid pattern. Streets are well lit, and many are tree-lined. Central Park, with a gazebo, walking paths, trees, flower beds and a baseball diamond, provides green space and recreational opportunities. Other amenities include restaurants, an organic grocery store, a pharmacy and specialty shops. Although there are no schools in the area, the University of Regina is located just south of College Avenue.

TWIN LAKES, NORTHWEST

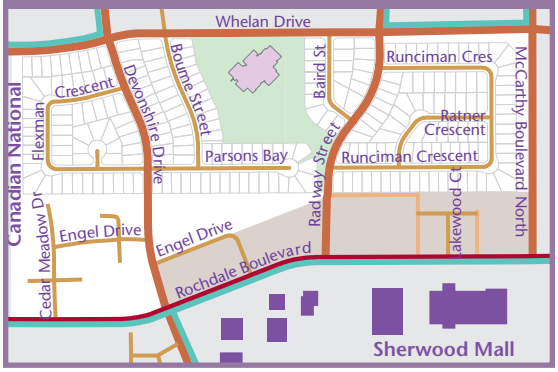


Twin Lakes is in the far northwest of Regina, about 14 km from the downtown core. Designated as a major residential growth area, it contains many single-family dwellings constructed since the late 1990s. The study area is bounded by Gilmore Drive and farmers' fields to the north, the Canadian National railway line to the east, Whelan Drive to the south and North Courtenay Street to the west.

The road network consists of culs-de-sac and crescents linked by three main roads. Streets are lighted and have sidewalks on both sides. Yards are small in proportion to the homes, many of which have garages facing the street. While there are few trees in the newest areas, young trees are found in the yards of more-established sections of the study area.

The study area is exclusively residential, but a grocery store, a pharmacy, a library, gas stations, restaurants and other services are in close proximity. Maple Ridge Park contains a baseball diamond and part of a walking path that winds through the neighbourhood, as well as the area's only school.

TWIN LAKES, SOUTHEAST



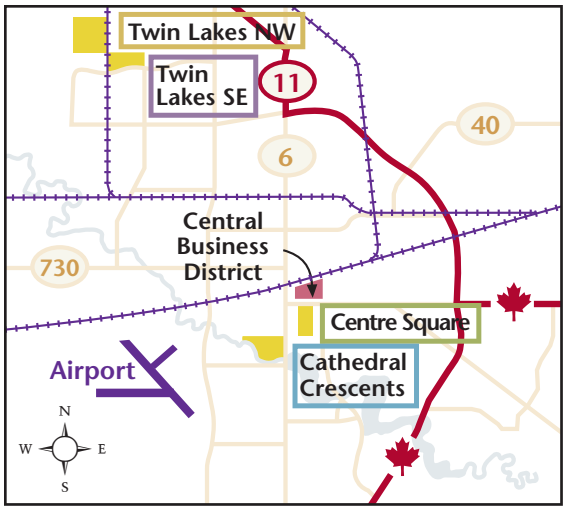
The southeast portion of **Twin Lakes** was built in the mid- to late 1980s. The study area is bounded by Whelan Drive to the north, McCarthy Boulevard North to the east, Rochdale Boulevard to the south and the Canadian National rail line to the west. Single-family dwellings are found in the north portion of the study area, and multi-unit residential buildings are in the southern section of the neighbourhood along Rochdale Boulevard.

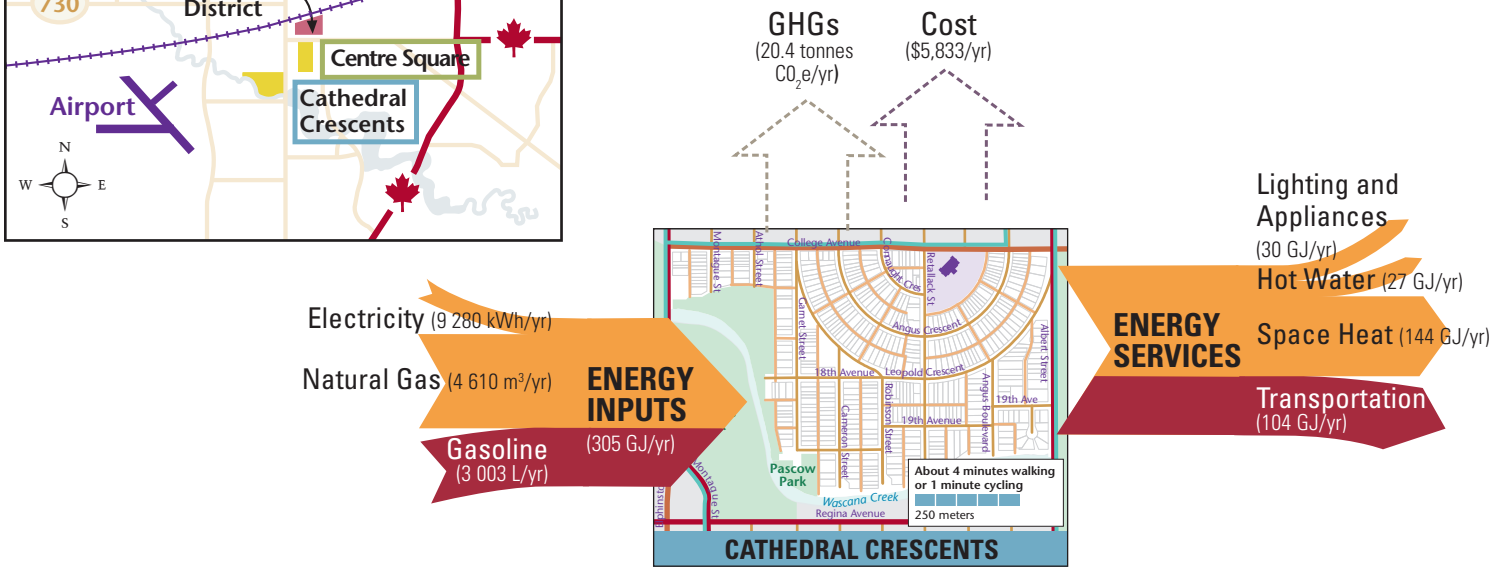
Landscaping is more mature than in the northwest portion of Twin Lakes, but the area is not densely treed. Culs-de-sac and crescents are the chief road types; the main roads have lighting and sidewalks on both sides, while the crescents have them on one side. There is one elementary school, which contains recreational facilities and is integrated in a park.

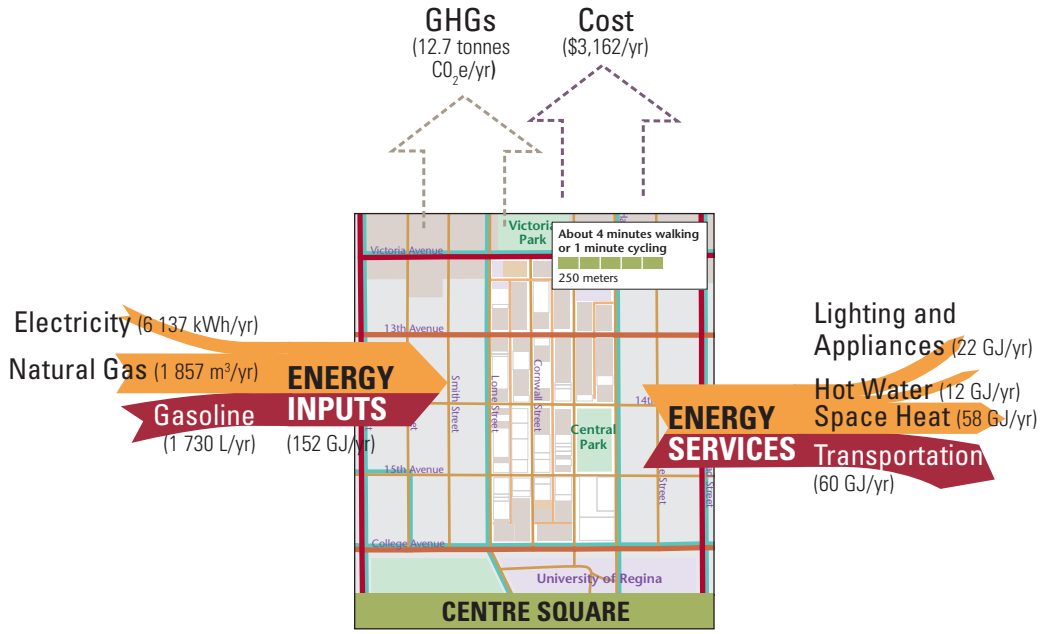
At the southern end of the study area along Rochdale Boulevard, a large commercial district provides access to gas stations, restaurants, hair salons, a grocery store, a pharmacy, a library, the YMCA and other amenities.

SUMMARY OF ENERGY INPUTS AND SERVICES

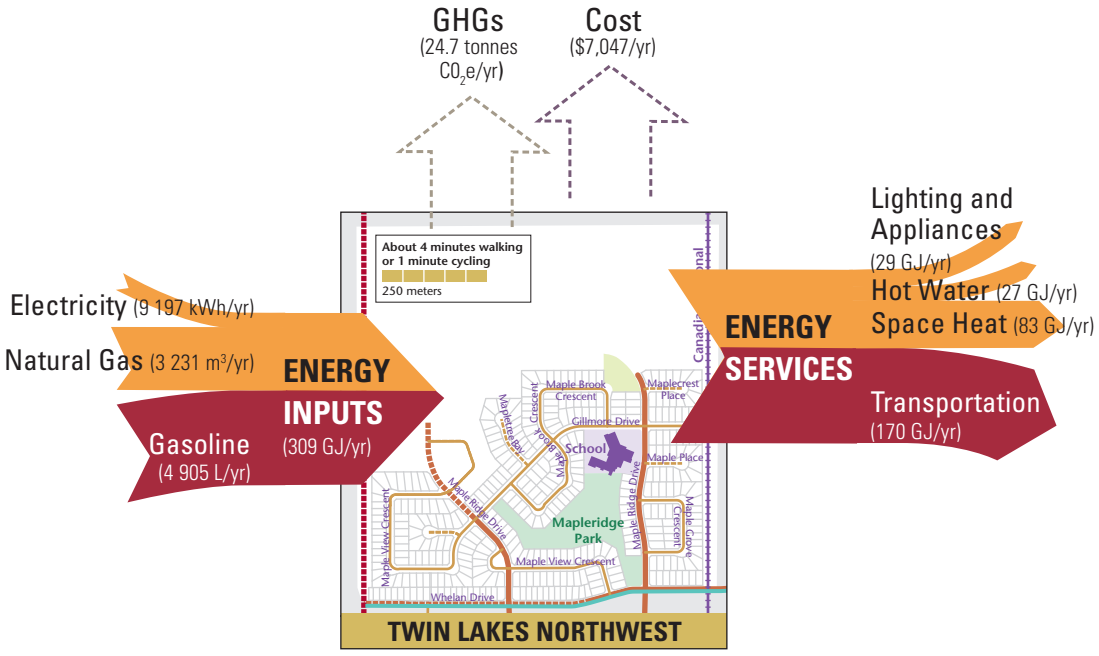
The Sankey-style graphics summarize a representative household's annual energy inputs and services.[6] The proportional scale between neighbourhoods is accurate and is reflected in the different sizes of the maps and arrows. More detailed source data for housing and transportation follow.

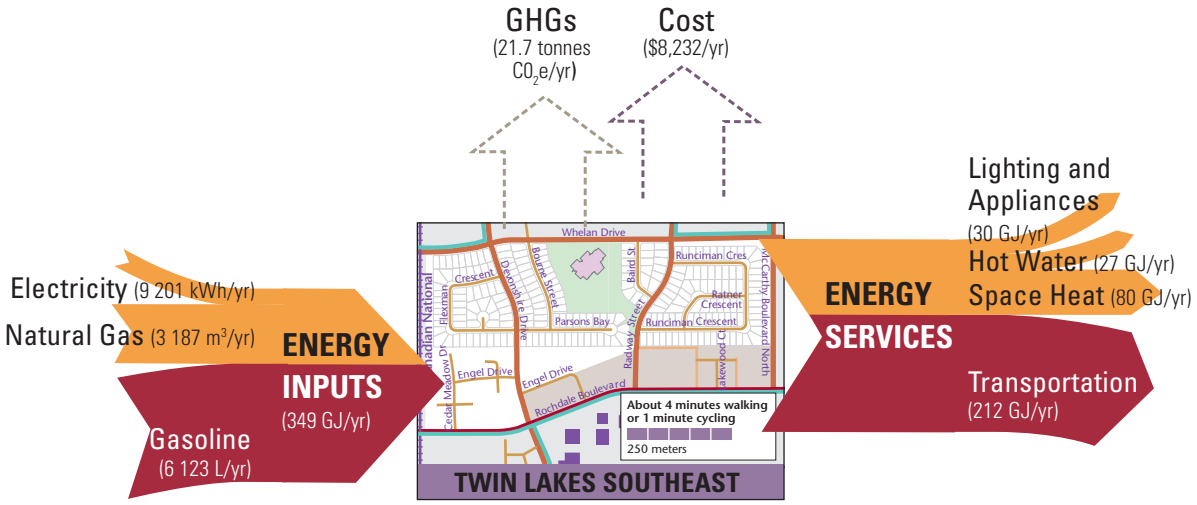






[6] Values in the Sankey diagrams correspond with total household energy consumption modelled for the following representative house and apartment types in Regina: Cathedral Crescents B, Centre Square B, Twin Lakes (Northwest), Twin Lakes (Southeast) A.





Legend for Area Maps

Residential
Study area with residential lots

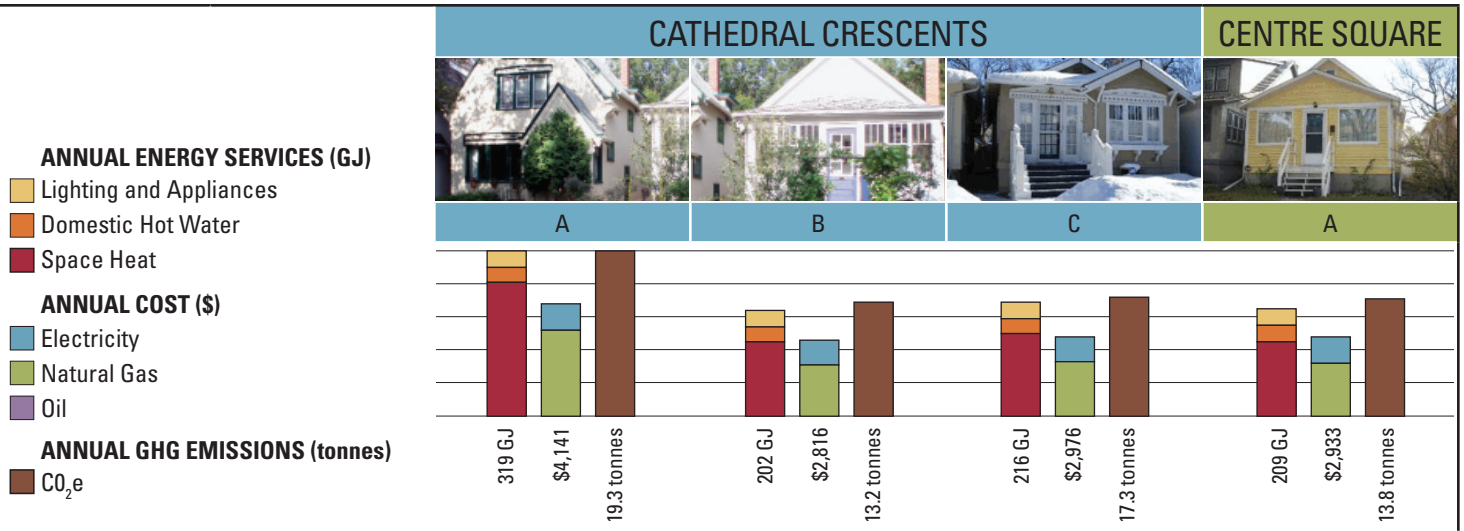
Land Use
Retail/Commercial
Industrial
Institutional
Municipal
Recreational
Parkland
Water

Transportation
Arterial (with sidewalks)
Collector (with sidewalks)
Local (with sidewalks)
Roads without sidewalks
Alleys
Pathways
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 house[7] and apartment[8] types within the Regina study areas ranged from 92 to 319 gigajoules (GJ) per year.



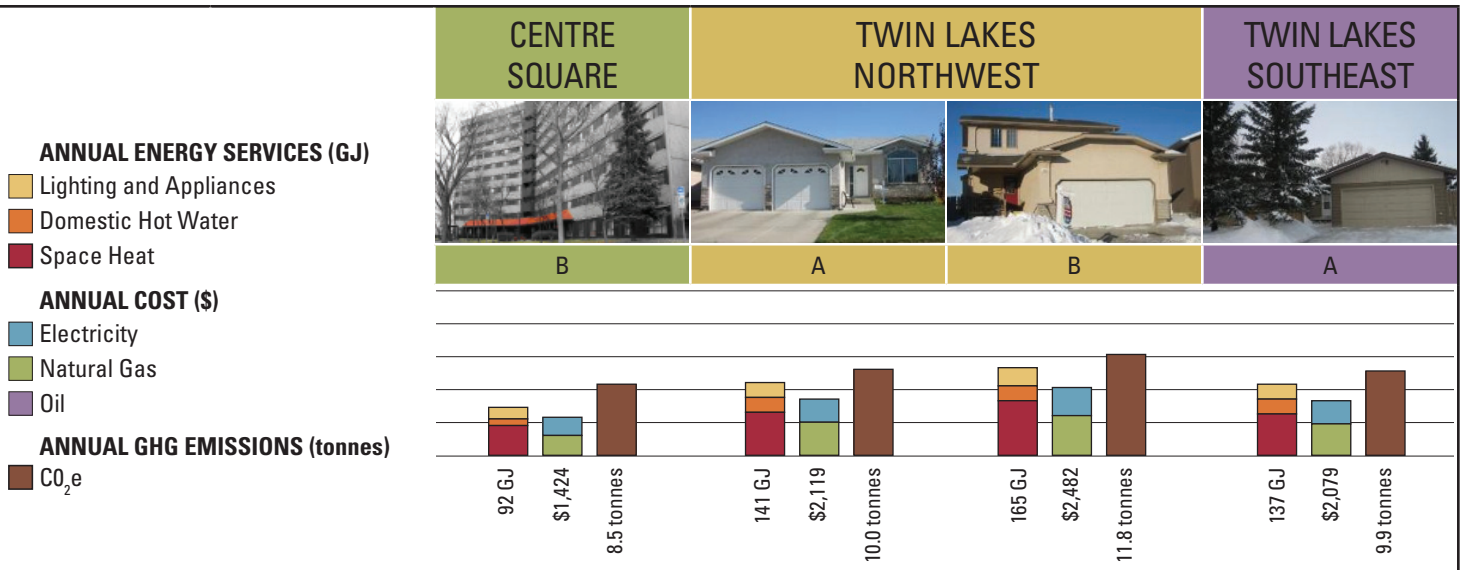
EnerGuide Rating System		47	63	66	66
Energy Use Intensity		1449 MJ/m² floor area	1159 MJ/m² floor area	835 MJ/m² floor area	891 MJ/m² floor area
Building Type	Storeys	two storeys	one storey	one storey	one storey
	Attachment	single detached	single-detached	single-detached	single-detached
	Built	pre-1945	pre-1945	1945–60	1945–60
Heated Floor Area		220 m² (2369 sq.ft.)	174 m² (1877 sq.ft.)	259 m² (2789 sq.ft.)	234 m² (2520 sq.ft.)
Insulation	Ceiling	4.2 RSI (R-24)	4.5 RSI (R-25)	4.6 RSI (R-26)	4.2 RSI (R-24)
	Walls	1.1 RSI (R-6)	1.4 RSI (R-8)	1.8 RSI (R-10)	1.8 RSI (R-10)
	Foundation	0.9 RSI (R-5)	1.0 RSI (R-6)	1.1 RSI (R-6)	1.1 RSI (R-6)
Space Heating	Fuel	natural gas	natural gas	natural gas	natural gas
	Furnace	with continuous pilot	with continuous pilot	with continuous pilot	with continuous pilot
	Efficiency	78%	78%	78%	78%
	Ventilation	none	none	none	none
Hot Water	Fuel	natural gas	natural gas	natural gas	natural gas
	Tank	conventional tank (pilot)	conventional tank (pilot)	conventional pilot	conventional pilot
	Efficiency	55%	55%	55%	55%
Lighting		incandescent	incandescent	incandescent	incandescent
Appliances		conventional	conventional	conventional	conventional
Occupants		3	3	3	4

[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 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.

For dwellings heated with natural gas, use ranged from 1 857 to 7 725 cubic metres (m^3) per year for space heating and hot water. Electricity use for all dwellings ranged from 6 137 to 9 741 kilowatt hours (kWh) per year for lighting and appliances. Given this consumption, energy costs[9] ranged from $1,424 to $4,141 per year for the combined use of natural gas and electricity. Associated greenhouse gas (GHG) emissions[10] ranged from 8.5 to 19.3 tonnes of carbon dioxide equivalent (CO_2e) per year.



EnerGuide Rating System		n/a	74	74	74
Energy Use Intensity		1320 MJ/m² floor area	697 MJ/m² floor area	648 MJ/m² floor area	659 MJ/m² floor area
Building Type	Storeys	ten storeys / 146 suites	one storey	two storeys	one storey
	Attachment	high-rise apartment	single detached	single detached	single detached
	Built	1981	1984–95	post-1995	1978–83
Heated Floor Area		69 m²/suite (743 sq.ft.)	202 m² (2171 sq.ft.)	256 m² (2751 sq.ft.)	208 m² (2240 sq.ft.)
Insulation	Ceiling	1.8 RSI (R-10)	6.4 RSI (R-36)	6.9 RSI (R-39)	6.8 RSI (R-39)
	Walls	1 RSI (R-6)	2.8 RSI (R-16)	2.7 RSI (R-15)	3.1 RSI (R-18)
	Foundation	n/a	2.2 RSI (R-13)	2.0 RSI (R-11)	2.4 RSI (R-14)
Space Heating	Fuel	natural gas	natural gas	natural gas	natural gas
	Furnace	boiler	with continuous pilot	induced draft fan	with continuous pilot
	Efficiency	66%	78%	80%	78%
	Ventilation	corridor pressurization system	none	heat recovery ventilator	none
Hot Water	Fuel	natural gas	natural gas	natural gas	natural gas
	Tank	boiler	conventional (pilot)	conventional	conventional (pilot)
	Efficiency	82%	55%	55%	55%
Lighting		incandescent	incandescent	incandescent	incandescent
Appliances		conventional	conventional	conventional	conventional
Occupants		1	3	3	3

[9] Average costs were calculated using available price data for Saskatchewan: natural gas ($0.4122/$m^3$, 2006 average) and electricity ($0.1083/kWh, 2006 average).

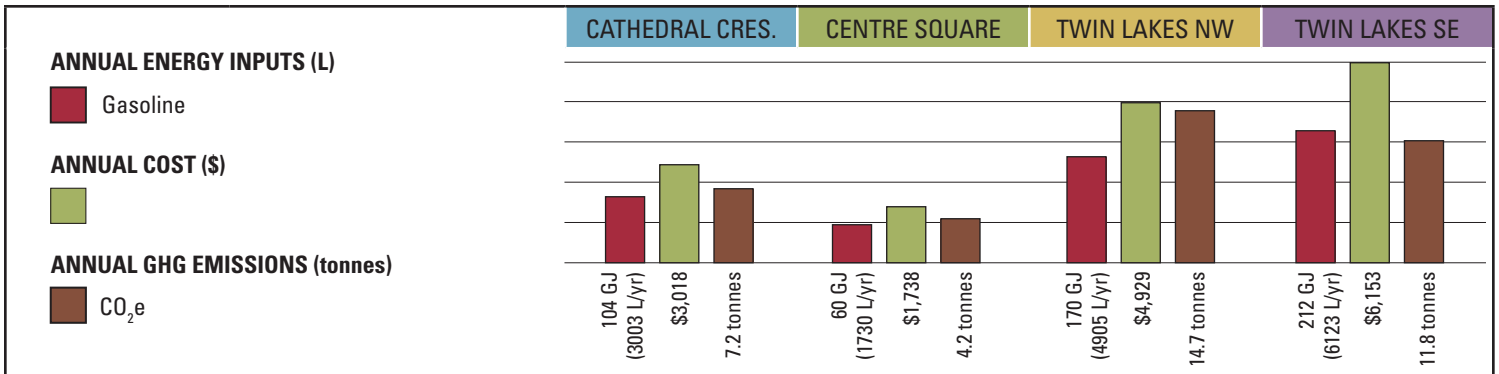
[10] GHG emissions were determined using the marginal fuel factors for the region developed by Environment Canada, as used in HOT2000.

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 vehicles[12] 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 Regina study areas, average annual household Vehicle Kilometres Travelled (VKT-AVG)[13] ranged from 12 400 to 45 200 km. In 2006, the average study-area household consumed between 1 730 and 6 123 litres (L) of gasoline that cost[14] between $1,738 and $6,153 and produced GHG emissions of between 4.2 and 14.7 tonnes of CO_2e.



		CATHEDRAL CRES.	CENTRE SQUARE	TWIN LAKES NW	TWIN LAKES SE
Resident Lifestyle	Vehicle kilometres travelled (VKT-AVG)	23 100 km/yr	12 400 km/yr	37 000 km/yr	45 200 km/yr
	Average number of vehicles per household	1.6	0.9	2.2	2.6
Neighbourhood Design	Gross density (units per hectare)	11.2	50.7	5.3	17.1
	Percent of housing units single detached	99.6%	36.2%	100%	80%
	Land-use mix index*	2.7	1.7	2.9	2.4
	Total road length	2.67 km	3.5 km	3.4 km	5.7 km
Neighbourhood Location	Distance to central business district	0.5 km	0.5 km	7.7 km	6.7 km

*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 Regina, the Saskatchewan Research Council, the Regina Housing Authority, SaskPower and Waterous Power Systems.

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** (Buildings & 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 the study areas' residents in 2006. 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 Regina: gasoline ($1.05/L, 2006 average).

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