



# CanmetENERGY

*Leadership in ecoInnovation*

## THE URBAN ARCHETYPES PROJECT

### Community Case Study: City of Ottawa

The Urban Archetypes Project, initiated by Natural Resources Canada's CanmetENERGY in Ottawa, investigated 31 neighbourhoods<sup>1</sup> in 8 communities<sup>2</sup> 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 Ottawa as studied in 2006: Bridlewood, Kirkwood, New Edinburgh and Sandy Hill.

This research project used *The Urban Archetypes Project Methodology*,<sup>3</sup> 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](http://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 Ottawa** is the capital of Canada and is located in eastern Ontario at 45°25'15" north latitude and 75°41'24" west longitude. The city is situated on the Ottawa River, which for centuries was used as a canoe route, first by Aboriginal people and then by voyageurs. By the 1800s, logging had become the main enterprise on the river, and the city came to be known as Bytown after Colonel John By, the engineer of the

Rideau Canal that runs through the city. In 1857, Ottawa was named the capital of Canada by Queen Victoria.<sup>4</sup> Electricity has played an important role in the city's history: in 1891, entrepreneur Thomas Ahearn launched Ottawa's first electric streetcar service and, in the following year, prepared the world's first meal cooked with electricity.

<sup>1</sup> 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.

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

<sup>3</sup> Definitions of measures and indicators can be found in *The Urban Archetypes Project Methodology*. [www.canmetenergy.nrcan.gc.ca](http://www.canmetenergy.nrcan.gc.ca)

<sup>4</sup> Drolet, Daniel. *The History of Ottawa*. [www.ottawa.ca/residents/ottawa\\_150/history/index\\_en.shtml](http://www.ottawa.ca/residents/ottawa_150/history/index_en.shtml)

Today Ottawa is the fourth-largest city in Canada, with a population of 875 000.<sup>5</sup> In addition to the numerous specialized departments of the federal government, the city's universities, colleges and life sciences sector contribute to Ottawa's knowledge economy.

Ottawa has a humid continental climate, with average daily temperatures ranging from 21°C in July to -10°C in January. As is the case in many eastern Canadian communities, residents rely on a mix of energy sources for space heating, with natural gas predominating and oil and electricity found throughout older neighbourhoods.

## NEIGHBOURHOOD DESCRIPTIONS

### BRIDLEWOOD



**Bridlewood**, located outside of the Greenbelt along Highway 417, is approximately 20 kilometres (km) west-southwest of downtown Ottawa and is one of the neighbourhoods in the suburb of Kanata. Originally settled by Europeans in the early 19th century, the area was largely agricultural until the 1960s, when developer Bill Teron built a model suburb in the style of the garden city movement. The study area is bounded by the Trans-Canada Highway to the north, Bridlewood Drive to the east, Stonehaven Drive to the south and Eagleson Road to the west.

Homes in the study area are exclusively single-family dwellings, built in the mid-1980s. In contrast to Ottawa's older neighbourhoods, natural gas is the main energy source for space heating and domestic hot water.

Bridlewood and Shetland parks provide recreational opportunities for area residents. The study area contains one school, St. James Elementary, and shops and services are found at Stonehaven Mall on Eagleson Road.

### KIRKWOOD



The **Kirkwood** neighbourhood, located on the west side of the downtown, was built in the late 1950s and early 1960s. The study area consists of 3.5-storey walk-up apartments on either side of Kirkwood Avenue from Carling Avenue in the north to Laperriere Avenue in the south. These buildings are distinct from the post-war era, single-family dwellings in the surrounding neighbourhood. Although this building type is found throughout the city, its largest concentration is in the Kirkwood neighbourhood. Residents are typically renters.

Although there are no amenities in the study area, a commercial area is found to the west along Laperriere, and there are numerous shops and services to the north at Westgate Mall and along Carling. Kirkwood Avenue has fairly good access to transit and is a major thoroughfare, connecting the Queensway, or Highway 417, and Carling Avenue with Baseline Road to the south. Trucks as well as regular traffic and transit use the route.

<sup>5</sup>The City of Ottawa. *A Snapshot*. [www.ottawa.ca](http://www.ottawa.ca)

## NEW EDINBURGH



**New Edinburgh** is a small neighbourhood east of Ottawa's downtown core, dating back to the mid-1800s. The study area is bounded on the west by Crighton Street, to the north by Dufferin Road and to the south by Beechwood Avenue; the eastern border is less sharply defined but largely marked by Springfield Road and Rideau Terrasse. Dwelling types in the neighbourhood vary in age and type and include many older single-family homes as well as duplexes, row houses and newer low-rise apartments of less than 3.5 storeys. Many homes have been renovated, and there is substantial variation in heating sources and types of mechanical equipment from one dwelling to the next.

New Edinburgh residents enjoy numerous recreational opportunities in the form of parks, sports fields and recreational pathways. The neighbourhood is home to Rideau Hall, the Governor General of Canada's residence, and 24 Sussex Drive, the residence of the Prime Minister of Canada. The study area has good access to transit and is within walking distance of the shops and services along Beechwood Avenue, as well as those in the Byward Market downtown.

## SANDY HILL

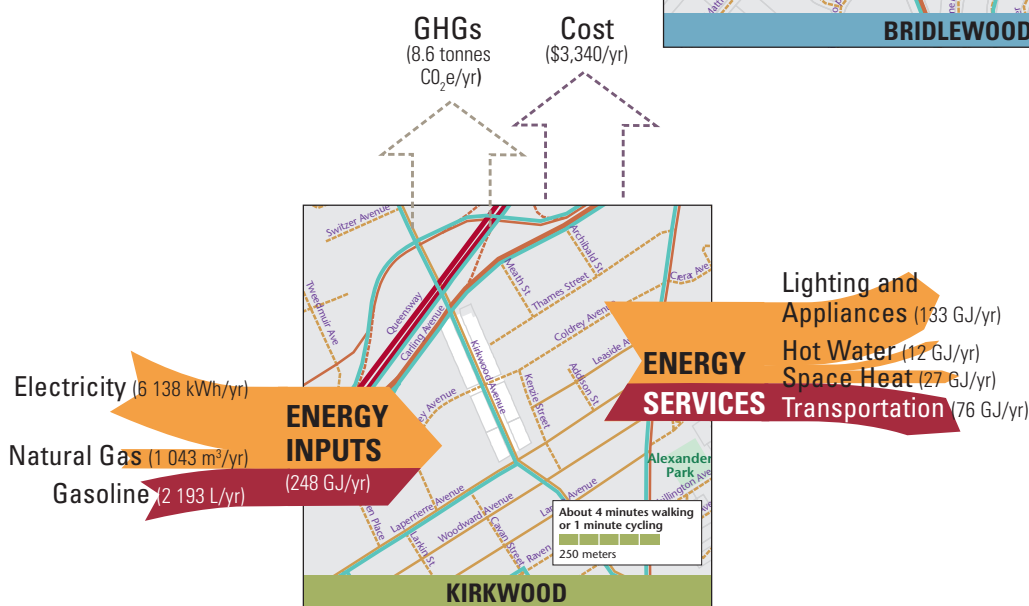
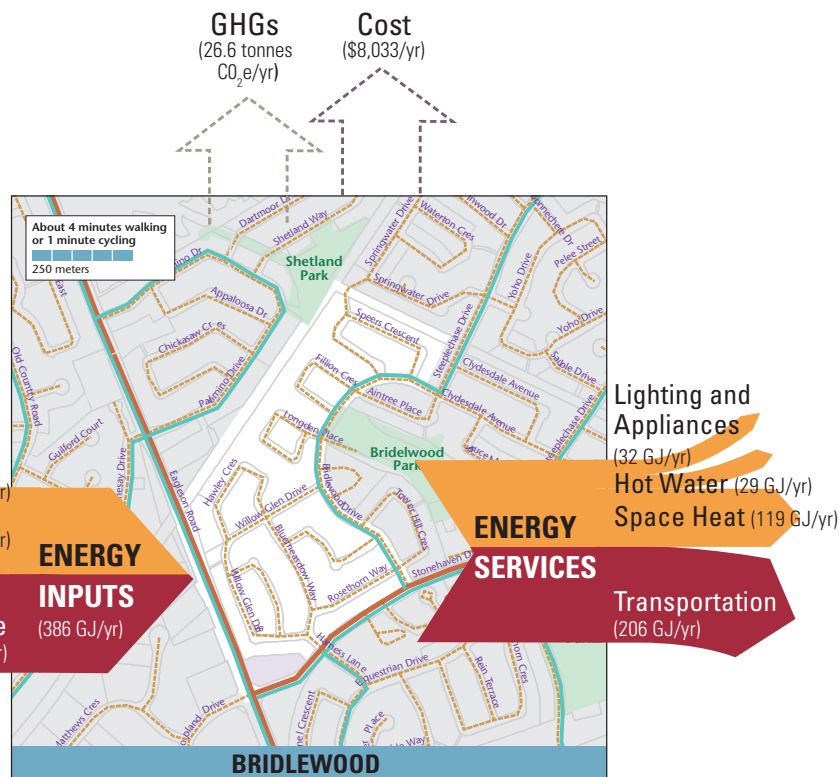
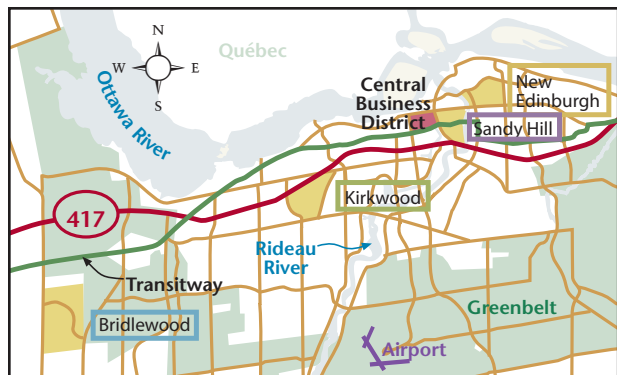


**Sandy Hill**, located just east of downtown, was Ottawa's wealthiest neighbourhood in the 19th and early 20th centuries, containing the homes of lumber barons, prime ministers and dignitaries. Over the years, many large homes were turned into embassies or subdivided into apartments. The study area is bounded by Marlborough Avenue to the east, Mann Avenue to the south, King Edward Avenue to the west and Osgood Street to the north.

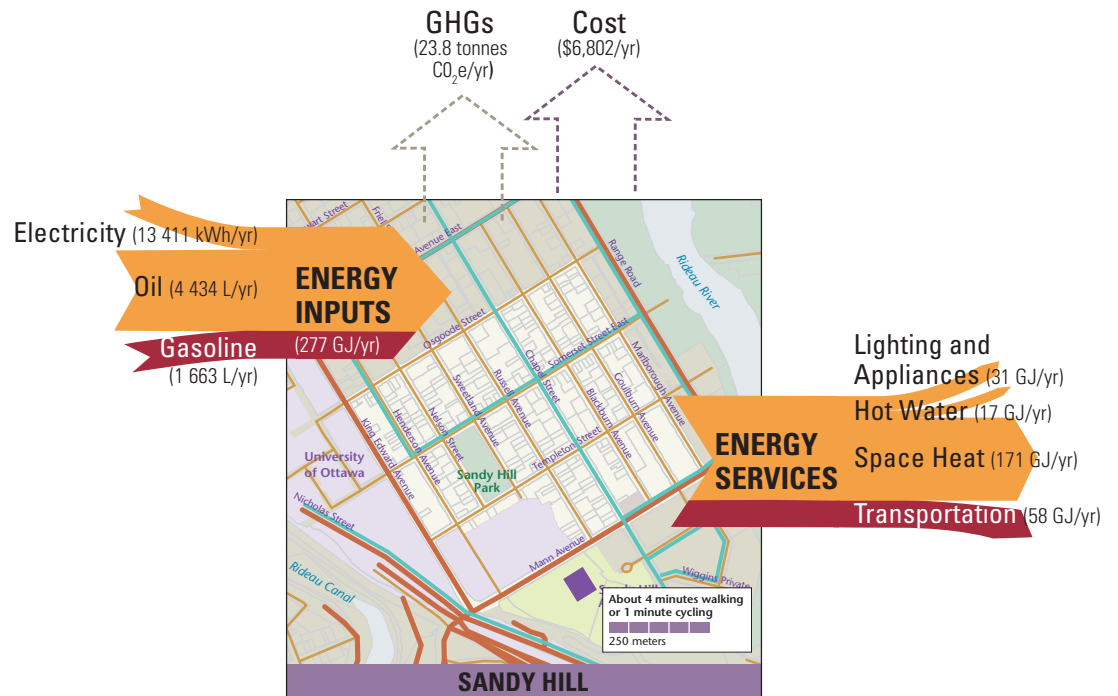
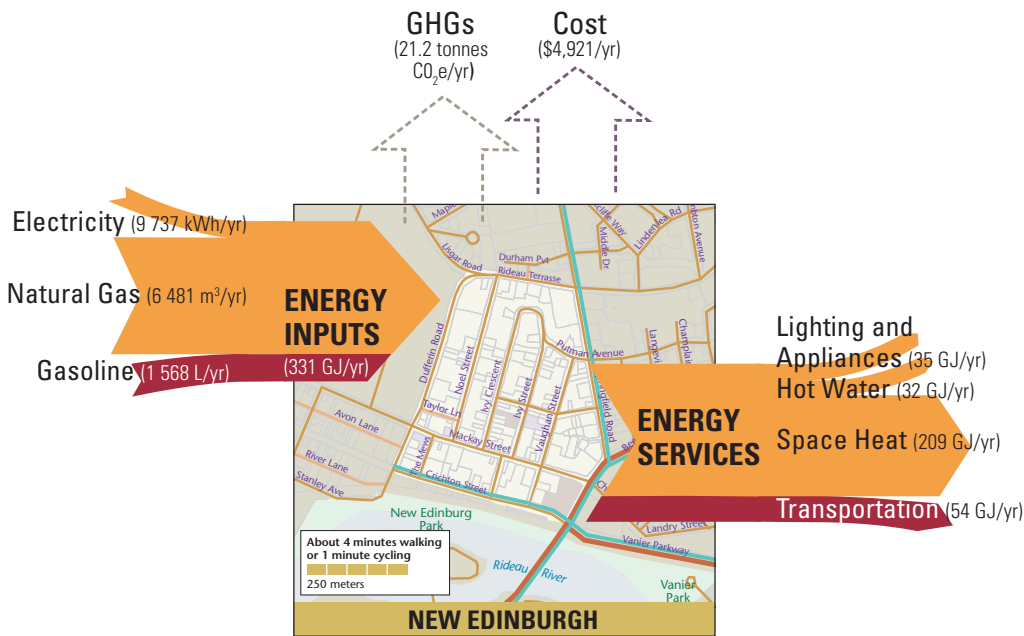
Sandy Hill is similar in some respects to New Edinburgh, including the range of housing types and ages and its proximity to the downtown. The neighbourhood is also demographically diverse, popular with students attending the University of Ottawa, located in the area, and with workers within walking distance of downtown. The Transitway – a system of roadways for the city bus service – is in close proximity, and as a result, the area is well served by public transit. In winter, Sandy Hill residents are also within walking distance of the Rideau Canal Skateway, which for many is a viable seasonal means of transportation. A handful of shops, services and restaurants can be found along Laurier Avenue.

### SUMMARY OF ENERGY INPUTS AND SERVICES

The Sankey-style graphics summarize a representative household’s annual energy inputs and services.<sup>6</sup> 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.



<sup>6</sup> Values in the Sankey diagrams correspond with total household energy consumption modelled for the following representative house and apartment types in Ottawa: Bridlewood A, Kirkwood A, New Edinburgh A, Sandy Hill A.



**Legend for Area Maps**

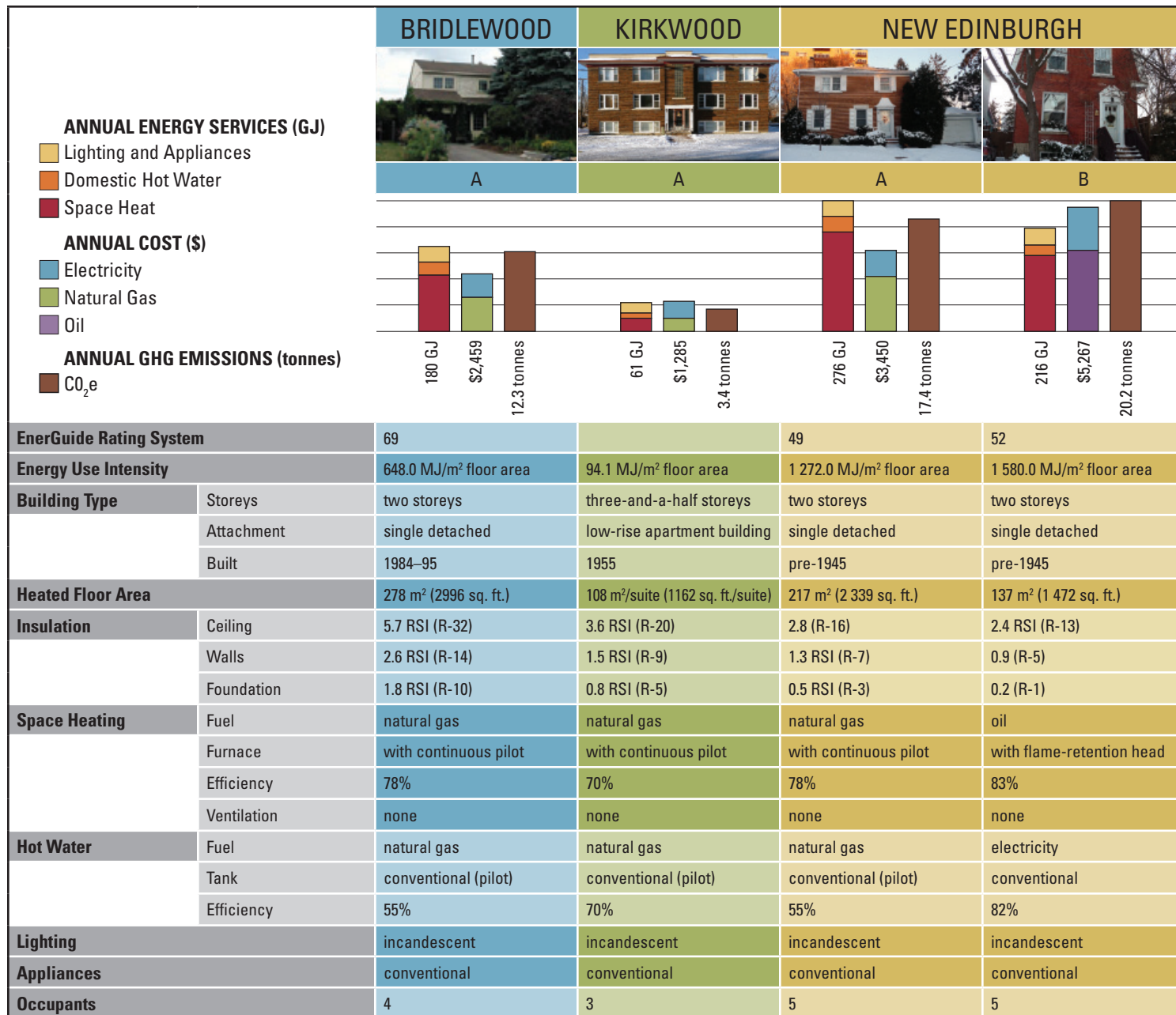
- |                                  |                   |              |                            |                         |
|----------------------------------|-------------------|--------------|----------------------------|-------------------------|
| Residential                      | Retail/Commercial | Municipal    | Arterial (with sidewalks)  | Roads without sidewalks |
| Study area with residential lots | Industrial        | Recreational | Collector (with sidewalks) | Alleys                  |
|                                  | Institutional     | Parkland     | Local (with sidewalks)     | Pathways                |
|                                  |                   | Water        |                            | 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.

The energy consumption of common house<sup>7</sup> and apartment<sup>8</sup> types within the study areas in Ottawa ranged from 61 to 276 gigajoules (GJ) per year. For dwellings heated with



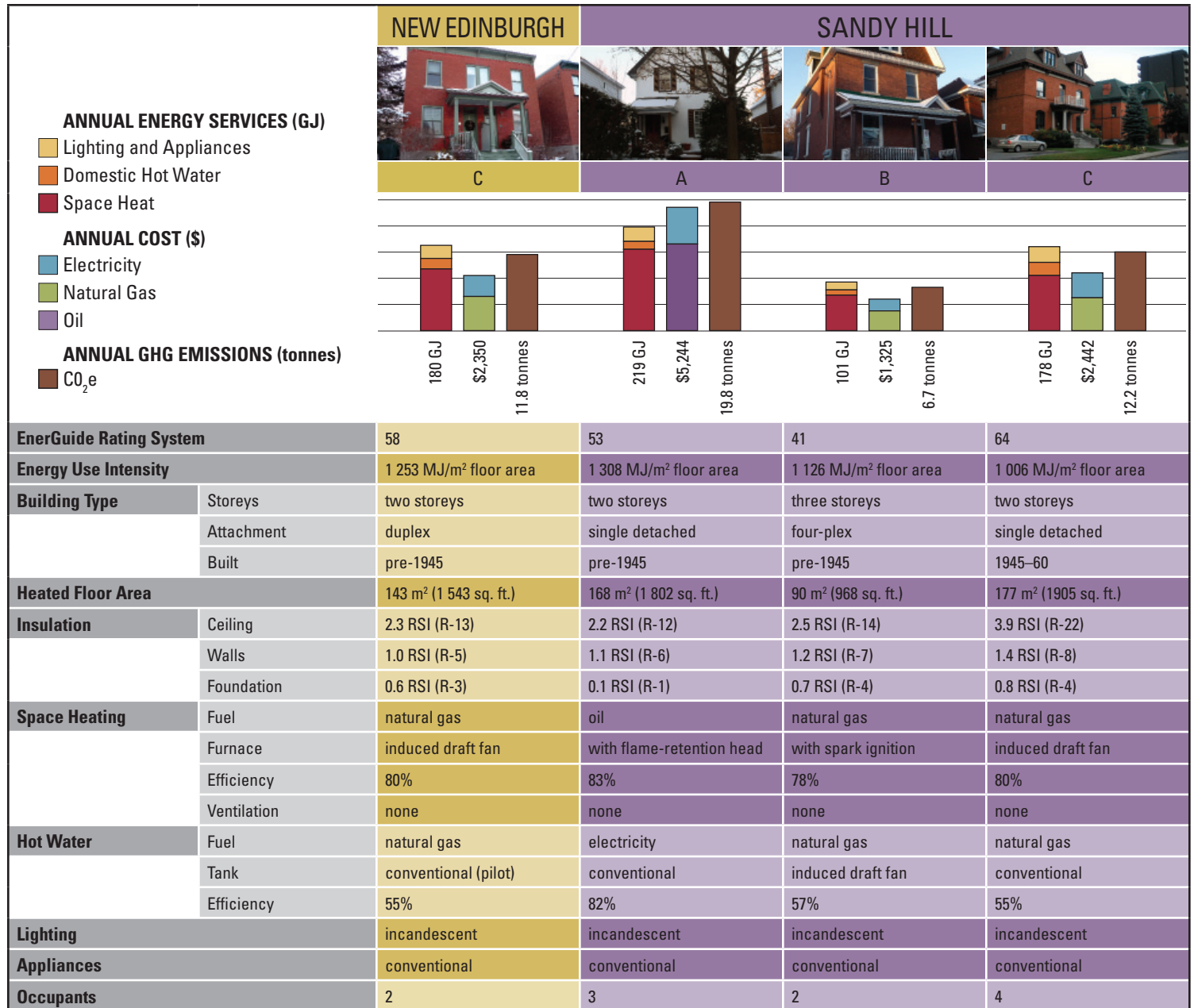
<sup>7</sup> Analysis was derived from ecoENERGY Retrofit – Homes (formerly EnerGuide for Houses) records within the study area. A generalized profile for each representative house type was simulated using HOT2000\* software and compared with the regional building archetype. Default values for house 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.

<sup>8</sup> Results for multi-unit residential buildings are a combination of observed and measured geometry with modelled 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](http://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.

natural gas, use ranged from 1 043 to 6 481 cubic metres (m<sup>3</sup>) per year for space heating and hot water. For homes heated with oil, use ranged from 4 135 to 4 434 litres (L) per year. Electricity use ranged from 4 314 to 15 774 kilowatt hours (kWh) per year for water heating, lighting and appliances.

Given this consumption, energy costs<sup>9</sup> ranged from \$1,325 to \$5,267 per year for the combined use of oil or natural gas and electricity. Associated greenhouse gas (GHG) emissions<sup>10</sup> ranged from 3.4 to 20.2 tonnes of carbon dioxide equivalent (CO<sub>2</sub>e) per year.



<sup>9</sup> Average costs were calculated using available price data for Ontario: oil (\$0.8160/L, 2006 average), natural gas (\$0.5327/m<sup>3</sup>, 2006 average) and electricity (\$0.1155/kWh, 2006 average).

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

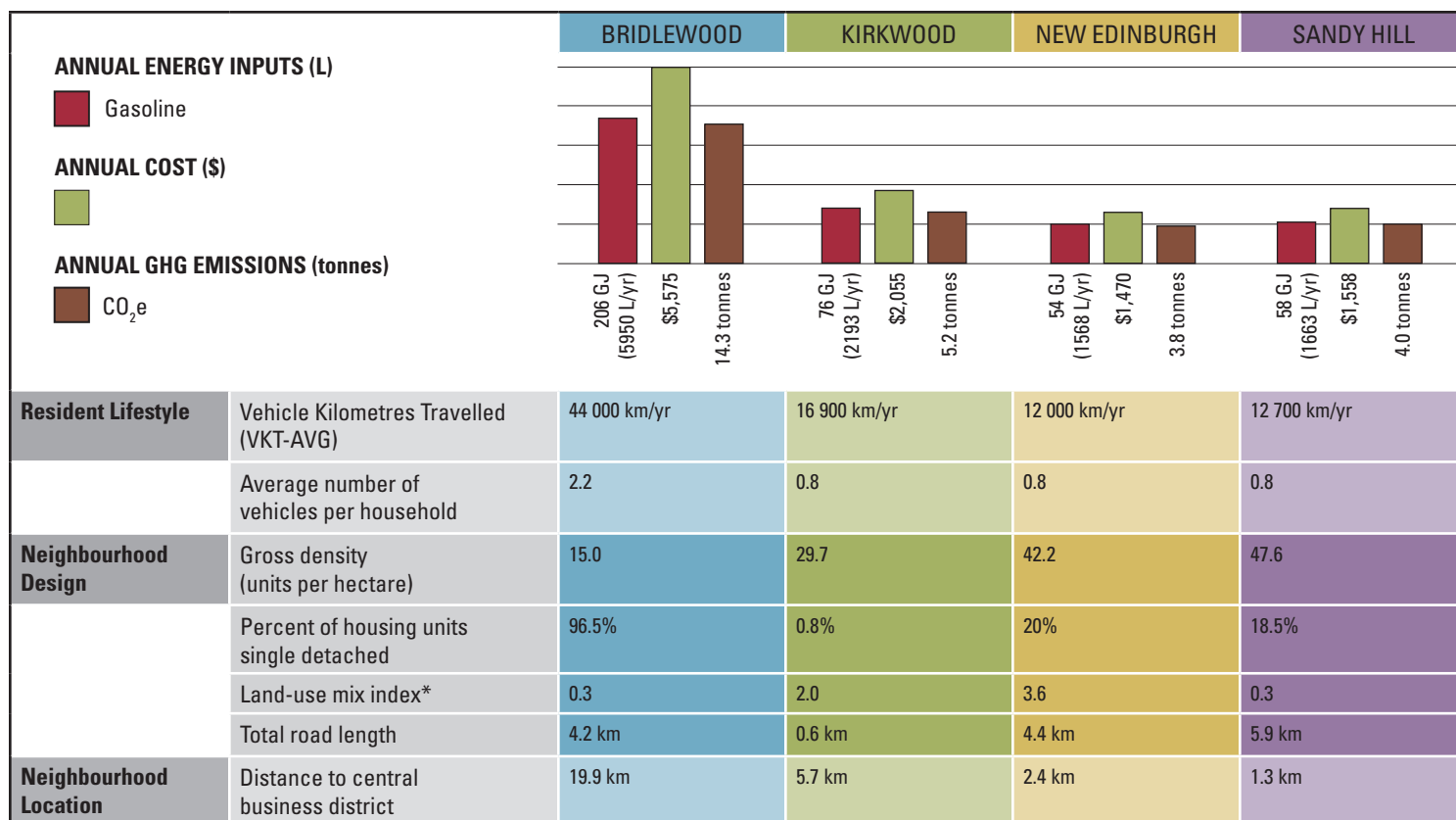
## ENERGY USE FOR PERSONAL VEHICLE TRANSPORTATION

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.<sup>11</sup> The Urban Archetypes Project calculated energy consumption for personal vehicles<sup>12</sup> 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 will be presented in *The Urban Archetypes Project Analysis*.

In the Ottawa study areas, average annual household Vehicle Kilometres Travelled (VKT-AVG)<sup>13</sup> ranged from 12 000 to 44 000 km. In 2006, the average study-area household consumed between 1 568 and 5 950 litres (L) of gasoline that cost<sup>14</sup> between \$1,470 and \$5,575 and produced GHG emissions of between 3.8 and 14.2 tonnes of CO<sub>2</sub>e.



\*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 Ottawa, Ottawa Hydro and Enbridge Gas Distribution.

## 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](http://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](mailto:jessica.webster@nrcan.gc.ca).

<sup>11</sup> 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](http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/tran_00_4_e_2.cfm?attr=0)

<sup>12</sup> Personal vehicles include small and large cars and light trucks.

<sup>13</sup> 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.

<sup>14</sup> Average costs were calculated using available price data for Ottawa: gasoline (\$0.984/L, 2006 average).