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THE URBAN ARCHETYPES PROJECT

Community Case Study: The Municipality of Clarington

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 two neighbourhoods in the Municipality of Clarington as studied in 2007: Hobbs Drive and Newcastle Village.

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 **Municipality of Clarington** in Durham Region is found in southern Ontario at 43°54'48" north latitude and 78°41'20" west longitude. Settlers first arrived in the area in 1794 and farmed and built sawmills. Today Clarington is the fastest growing municipality east of Toronto, with a population of 77 820[4] living in the communities of Bowmanville, Courtice and Newcastle Village and in rural areas.

Major employers in the area include General Motors in Oshawa and several other manufacturers. Located along Highway 401, approximately 80 kilometres (km) from Toronto, Clarington is also a bedroom community of the Greater Toronto Area. People can commute to the city from the nearby Oshawa GO Station, using either GO Transit or Via Rail.

[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 can be found in *The Urban Archetypes Project Methodology.* www.canmetenergy.nrcan.gc.ca

[4] Clarington Community Profile. 2007. www.clarington.net/htdocs/bus-stats.html

Clarington has average daily temperatures ranging from 19.8°C in July to –6.3°C in January, due to the tempering effect of Lake Ontario.

Residents rely on oil and electricity in older areas and on natural gas in newer subdivisions for space heating and domestic hot water. The Darlington Nuclear Generating Station, in the Municipality of Clarington, provides 20 percent of Ontario's electricity needs and generates 3524 megawatts (MW) – enough electricity to serve a city of 2 million people.[5]

The Clarington Green Advisory Committee, through its Green Community Strategy, focuses on the community's response to the interrelations among energy, health, climate change and development.[6]

NEIGHBOURHOOD DESCRIPTIONS

HOBBS DRIVE

Hobbs Drive is found just south of downtown Bowmanville. The neighbourhood was built in the late 1970s and early 1980s. The study area is bounded to the east and south by Soper Creek Park, to the west by Simpson Avenue and to the north by Bowmanville Mall. Houses are small to medium-sized single-dwelling link homes. The road network consists of crescents and culs-de-sac.

The neighbourhood's numerous paths and its proximity to services in downtown Bowmanville and at the Bowmanville Shopping Centre promote walking among the residents. Local regional transit stops are on Simpson Avenue, providing easy access to transit. However, Bowmanville is fairly far from major transit hubs, such as the Oshawa GO Station.

NEWCASTLE VILLAGE

Newcastle Village is an older community in the eastern portion of the municipality, with some houses dating back to the 1800s. The study area stretches north from Highway 401 in the south to the Canadian Pacific Railroad line to the north and from Beaver Street in the east to Baldwin Street in the west.

Dwelling types in Newcastle Village are varied, ranging from small cottages to large brick 3½-storey dwellings. Lot sizes are large and often irregular, with yards containing mature trees. Most of Newcastle's downtown services and shops are along King Street in the centre of the study area. Parks and recreational services are just outside the study area, providing easy access for residents.

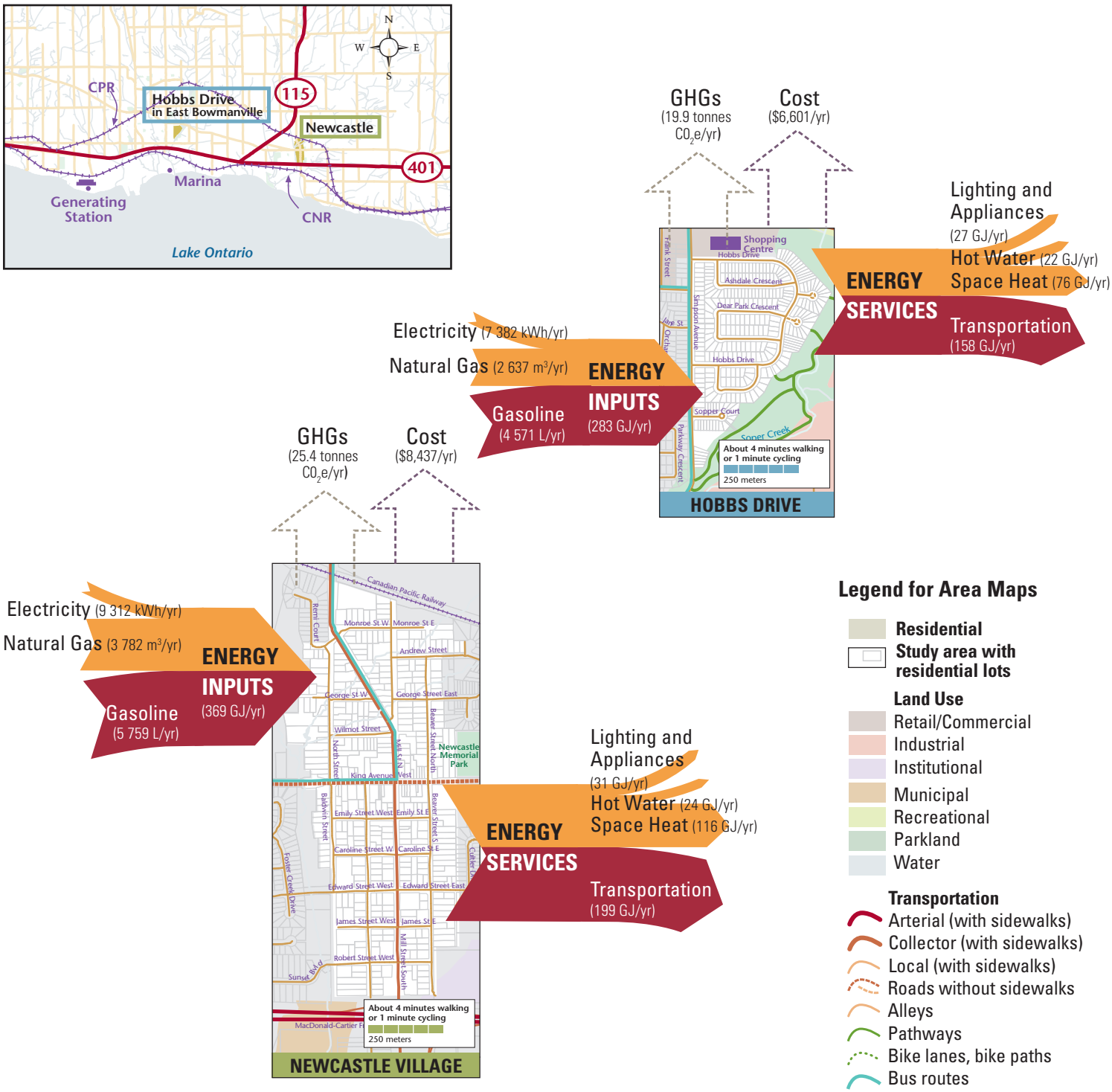
Proximity encourages walking, although all sections of the village have sidewalks or walking paths. Cycling is also viable, but many village residents are older, and most shops do not offer bike racks. The village is not large enough to have local transit lines and is far from transit hubs. GO bus service runs along Highway 2, providing access to regional transit. Nevertheless, close proximity and easy access to Highway 401 encourage driving.

[5] Ontario Power Generation. *Welcome to Darlington Nuclear Generating Station*. www.opg.com/pdf/brochure_darlington.pdf

[6] Green Community Advisory Committee. www.bluetogreen.clarington.net/committee_background.html

SUMMARY OF ENERGY INPUTS AND SERVICES

The Sankey-style graphics summarize a representative household's annual energy inputs and services.[7] 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.



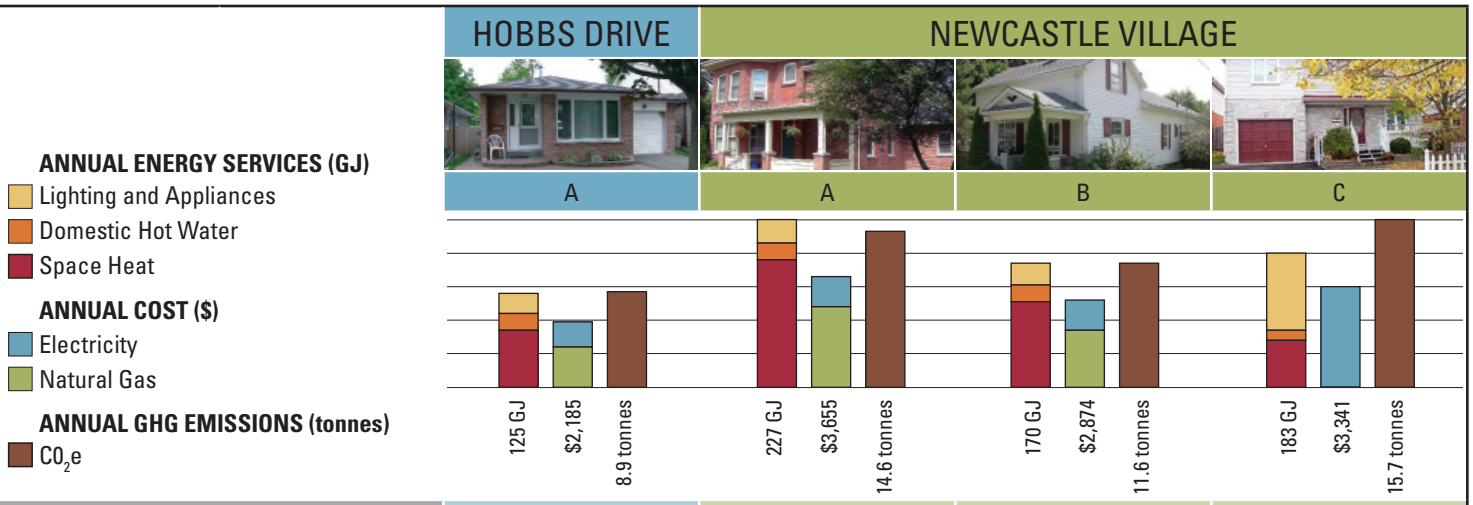
[7] Values in the Sankey diagrams correspond with total household energy consumption modelled for the following representative house types in Clarington: Hobbs Road A, Newcastle B

ENERGY USE IN HOUSES

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 types[8] within the study areas in Clarington ranged from 125 to 227 gigajoules (GJ) per year.

For homes heated with natural gas, use ranged from 2 637 to 5 234 cubic metres (m^3) per year for space heating and hot water. Electricity use ranged from 8 965 to 9 600 kilowatt hours (kWh) per year for lighting and appliances, exclusive of dwellings heated with electricity. Given this consumption, energy costs[9] ranged from $2,185 to $3,655 per year for the combined use of natural gas and electricity. Associated greenhouse gas (GHG) emissions[10] ranged from 8.9 to 15.7 tonnes of carbon dioxide equivalent (CO_2e) per year.



		A	A	B	C
EnerGuide Rating System		72	55	67	71
Energy Use Intensity		684 MJ/m² floor area	936 MJ/m² floor area	681 MJ/m² floor area	957 MJ/m² floor area
Building Type	Storeys	one storey	two storeys	two storeys	two storeys
	Attachment	single detached	single detached	single detached	single detached
	Built	1961–77	pre-1945	1945–60	1961–77
Heated Floor Area		182 m² (1963 sq.ft.)	242 m² (2604 sq.ft.)	250 m² (2688 sq.ft.)	191 m² (2054 sq.ft.)
Insulation	Ceiling	4.4 RSI (R-25)	2.9 RSI (R-17)	4.2 RSI (R-24)	4.0 RSI (R-23)
	Walls	2.0 RSI (R-11)	1.1 RSI (R-6)	1.8 RSI (R-10)	1.9 RSI (R-11)
	Foundation	1.7 RSI (R-10)	0.1 RSI (R-1)	0.4 RSI (R-2)	1.7 RSI (R-10)
Space Heating	Fuel	natural gas	natural gas	natural gas	electricity
	Furnace	with continuous pilot	condensing furnace	condensing furnace	baseboard heaters
	Efficiency	78%	90%	90%	100%
	Ventilation	none	none	none	none
Hot Water	Fuel	natural gas	natural gas	natural gas	electricity
	Tank	conventional	induced draft fan	induced draft fan	conventional
	Efficiency	55%	57%	57%	82%
Lighting		incandescent	incandescent	incandescent	incandescent
Appliances		conventional	conventional	conventional	conventional
Occupants		2	3	3	2

[8] 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.

[9] Average costs were calculated using available price data for Ontario: natural gas (55.55¢/m^3, 2007 average) and electricity (11.55¢/kWh, 2006 average).

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

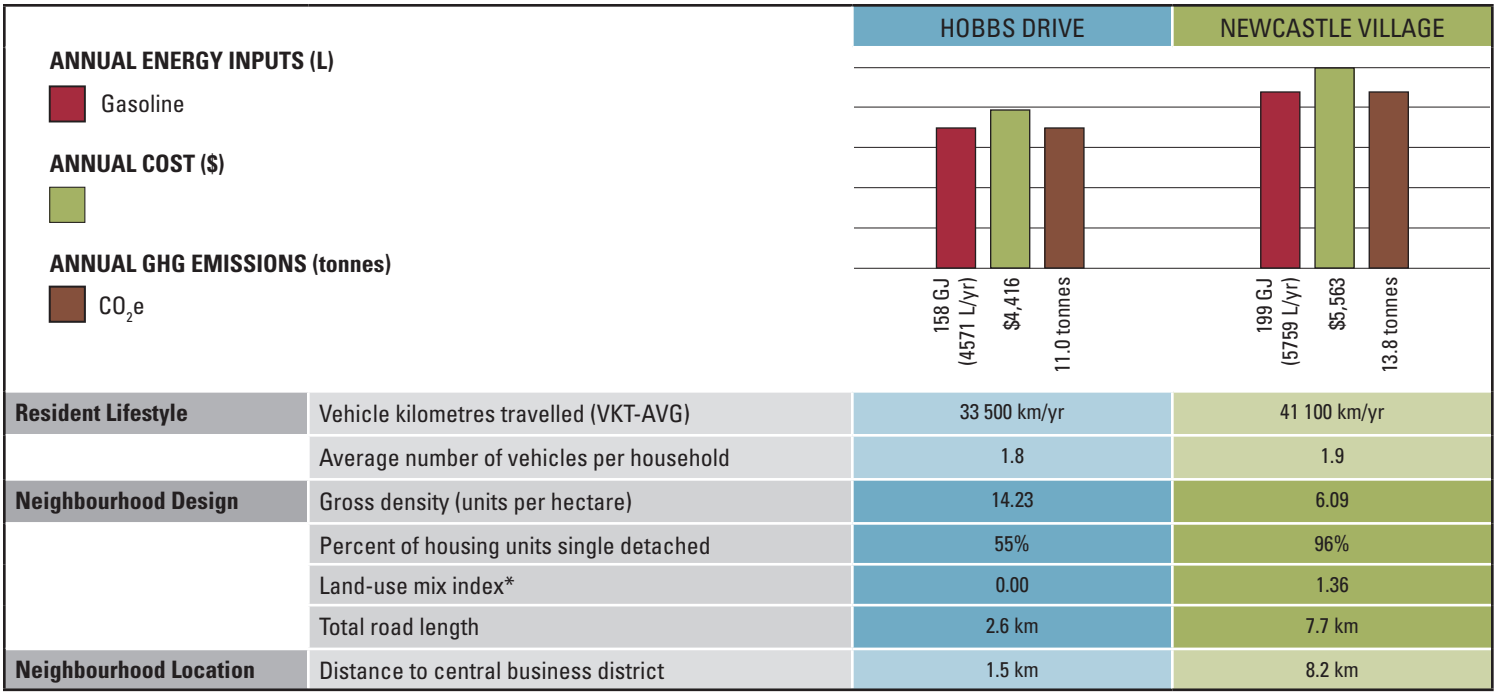
*HOT2000 is an official mark of Natural Resources Canada.

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 Clarington study areas, average annual household Vehicle Kilometres Travelled (VKT-AVG)[13] ranged from 33 500 to 41 100 km. In 2007, the average study-area household consumed between 4 571 and 5 759 litres (L) of gasoline that cost[14] between $4,416 and $5,563 and produced GHG emissions of between 11.0 and 13.8 tonnes of CO_2e.



		HOBBS DRIVE	NEWCASTLE VILLAGE
Resident Lifestyle	Vehicle kilometres travelled (VKT-AVG)	33 500 km/yr	41 100 km/yr
	Average number of vehicles per household	1.8	1.9
Neighbourhood Design	Gross density (units per hectare)	14.23	6.09
	Percent of housing units single detached	55%	96%
	Land-use mix index*	0.00	1.36
	Total road length	2.6 km	7.7 km
Neighbourhood Location	Distance to central business district	1.5 km	8.2 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 Municipality of Clarington, the University of Ontario Institute of Technology, Veridian 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** (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 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 Peterborough (the closest municipality for which data were available): gasoline ($0.928/L, 2007 average).

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