

High Performance Development Standard Energy Targets

This document provides additional context and details on the proposed energy targets in the High Performance Development Standard (HPDS). This document will review:

- The role energy planning and modeling plays at early development stages
- How the energy targets were selected
- Comparison of the target thresholds with
 - Toronto Green Standard
 - Past NRCan EnerGuide Models (Low-rise residential buildings)
 - Past Enbridge Savings by Design Energy Models (high rise and commercial buildings)
 - Ontario Association of Architects 2030 challenge EUI targets
- Progression of energy performance in Toronto since adoption of the Toronto Green Standards, from a sample set of buildings

For reference the following are also included

- Energy Metrics from the standard
- Definitions of Energy Terms

Role of Energy Modeling and Community Energy Plans

Energy Models and Community Energy Plans are not intended to predict actual energy use. These are tools to help evaluate design options. This sets the direction and targets for the building to work toward. Early planning is a good foundation for the building but the construction, operation, occupant behavior and weather all have important influence over the realized energy use of the building. These plans and models will include a number of assumptions and projections which may change over time. While they may change the early planning for energy sets a good foundation for the detailed design steps which follow.

Energy at Site Plan

Requiring energy analysis at site planning stage means early consideration of energy in design strategies which supports the following outcomes.

- Enables project to explore the use of the building architecture and passive design to achieve energy reductions. These strategies are often lower cost and lower maintenance than mechanical design solutions.
- Facilitates an integrated design process that includes energy. Integrated design is a collaborative process where design professionals work towards a common goal energy modelling helps to inform this work. An integrated approach to energy goals enables new solutions and avoids costly redesigns later on in the design process.
- Informed decisions and prioritization- completing modeling early enables review of the competing priorities with data to inform decisions. This can include balancing operational carbon impacts with material carbon impacts.

- Enables projects to explore more design options. While it is technically feasible to achieve high energy goals later in design. Early consideration allows for solutions that may require longer schedule, new project partners or novel designs and layouts.

Community Energy Planning

Community Energy Plans (CEP) will seek to identify on-site and off-site measures to be undertaken by a developer, utility or other partners, to align the energy systems with City goals as the development is built. CEPs support the City's goal of reducing GHGs and responding to current and future effects of climate change as expressed in the Official Plan and Climate Change Master Plan by:

- Evaluating the consistency of a proposed development's energy characteristics with City climate change goals and policies;
- Encourage negotiations between stakeholders about the planning and budgeting for utility network and other energy system modifications, upgrades and servicing;
- Facilitating the implementation of preferred energy targets and measures as a condition of development approval
- Helps to ensure communities are equipped with the infrastructure necessary to move toward near zero emissions.
- The CEP helps to identify solutions that are only available if planned at the community scale.

Basis for the Energy Targets

The energy targets have been based on Energy Evolution, the City of Ottawa's community energy model.

The City completed the Energy Evolution model to determine how GHG emission reduction targets could be achieved. This model looks at many community and municipal actions. Emission reductions from new buildings are anticipated to make up approximately 8% of the total emission reductions required to achieve Ottawa's GHG emission reduction targets. This 8% excludes the considerations required for the transportation emissions associated with the occupants of these new buildings, these are captured under the transportation sector. The Energy Evolution model did not include material embodied carbon emissions in its analysis and therefore the impacts of these are not captured in the 8% of either.

The Energy Evolution model's business as planned scenario assumes building code improvements of about 10% every 5 years. In the carbon reduction scenario, the model assumes progressive energy efficiency improvements in line with what has been mapped out in Toronto's Zero Emissions Building Framework and the Toronto Green Standard. Ottawa's HPDS aims to align with these energy targets. Ottawa's proposed Tier 1 threshold aligns with Toronto Green Standard (TGS) Version 4 Tier 1, adjusted for Ottawa's local climate. TGS version 4 Tier 1 will become the mandatory version in spring of 2022, and is equivalent to TGS version 3 Tier 2

The alternative pathways based on certification options are near the same energy performance threshold within the performance pathway of the metric. Allowances for certification options which have slightly lower energy targets have been made, with the consideration that the certification pathway offers a degree of verification and rigor that are not feasible in a planning review alone.

The BC step code has developed guidance to interpolate between climate zones. This method was applied to provide equivalencies across the climate zones for Ottawa’s HPDS relative to TGS. Ottawa’s Tier 1 aligns with TGS v.3 Tier 2/ TGS v4 Tier 1. Figure 1 below provides a visual representation of this interpolation method. The [Zero Emission Building Framework](#) provides further details on modeling and background costing and modeling studies to demonstrate how the targets can be achieved.

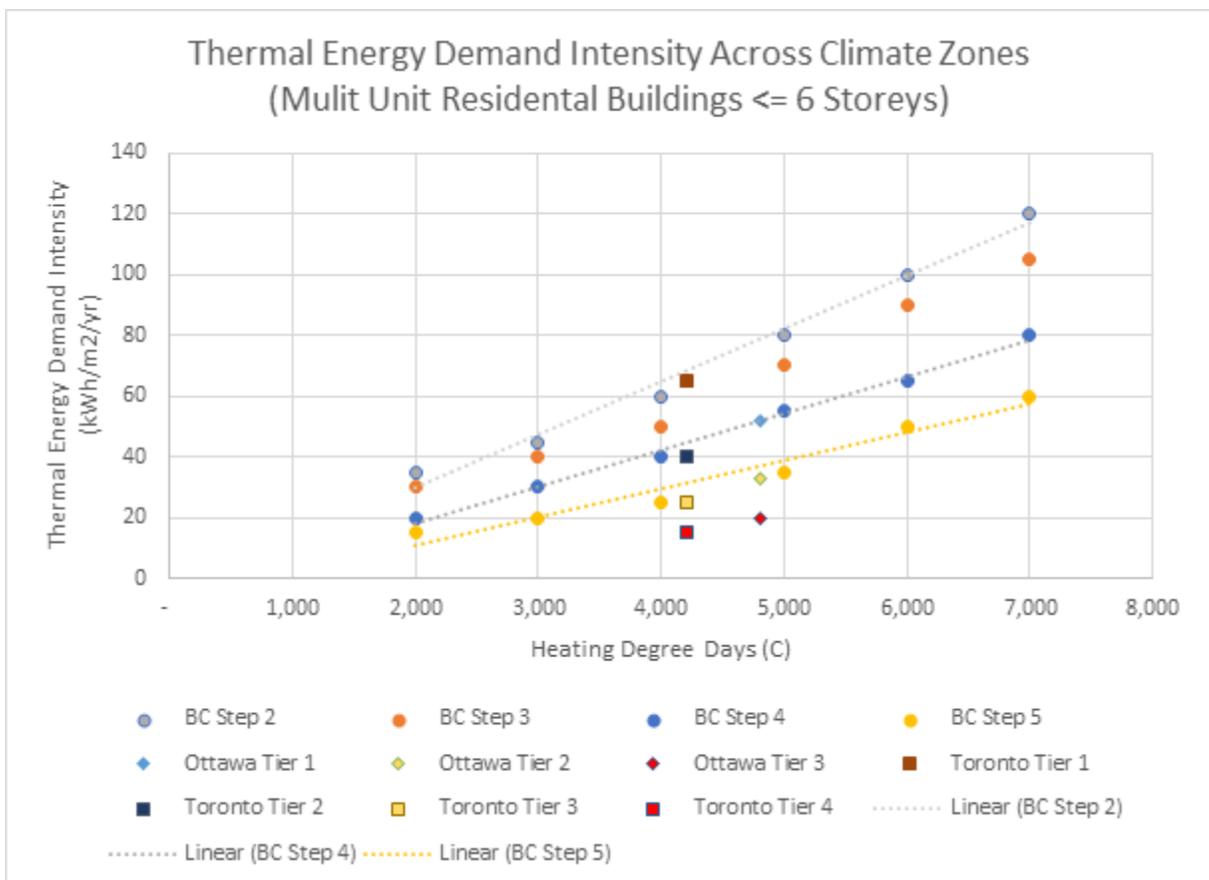
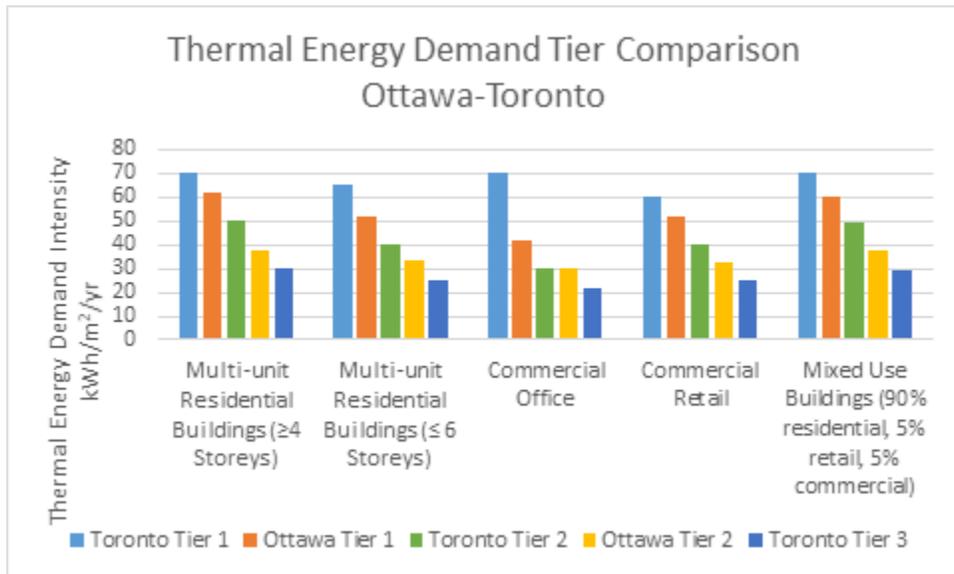
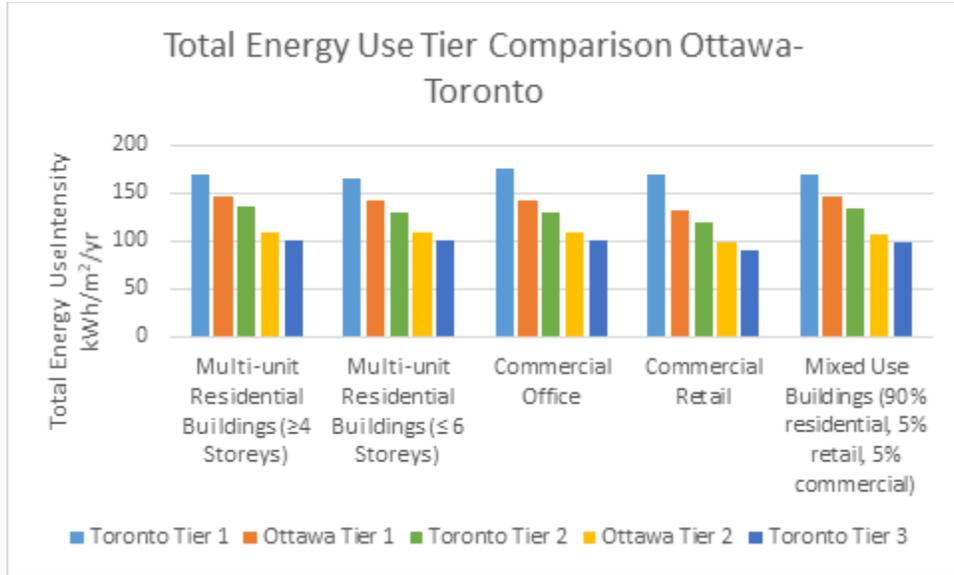
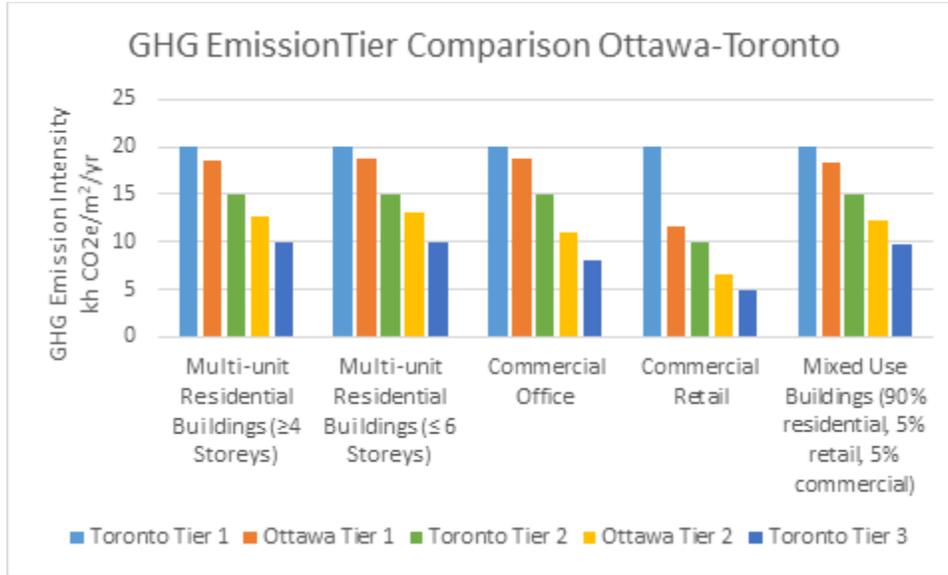


Figure 1 Thermal Energy Demand Intensity across Climate Zones

Figures 2, 3 and 4 on the following page provide comparisons of the intensity targets for Ottawa’s Proposed HPDS and Toronto TGSv3.





Figures 5, 6 and 7 below provide comparisons of the intensity targets for Ottawa's Proposed HPDS and new homes that have been rated in Ottawa under NRCan's EnerGuide rating system. These graphs demonstrate that many home are exceeding these targets in many respects but more focus on GHG intensity is necessary to achieve Ottawa's targets.

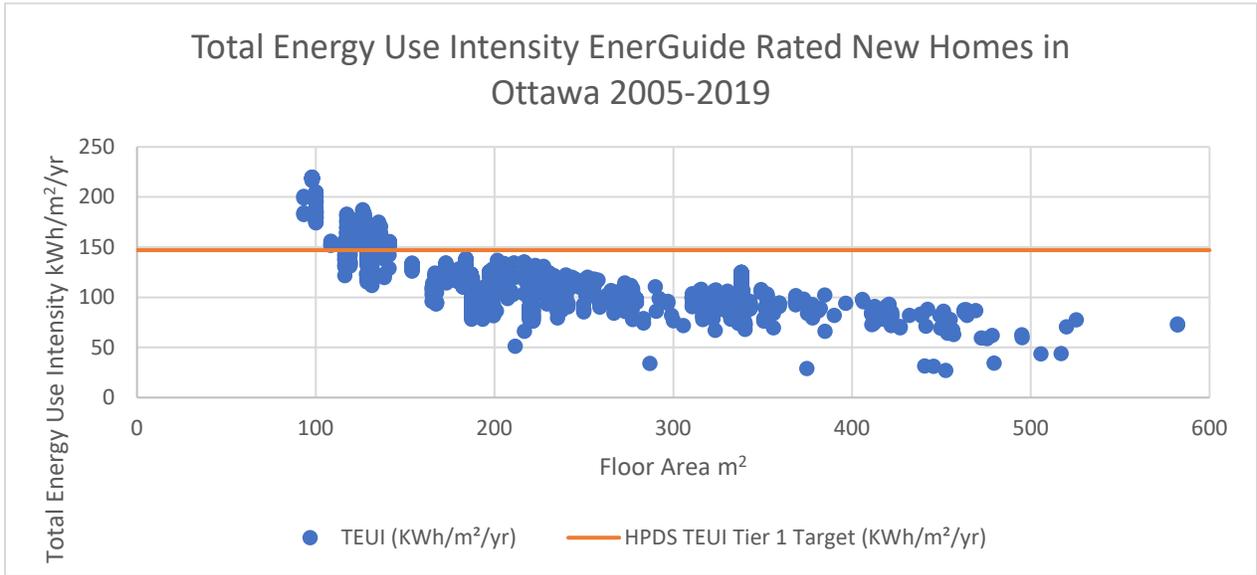


Figure 5 NRCan EnerGuide Models (Low-rise residential buildings) Total Energy Use Intensity EnerGuide Rated New Homes in Ottawa 2005-2019

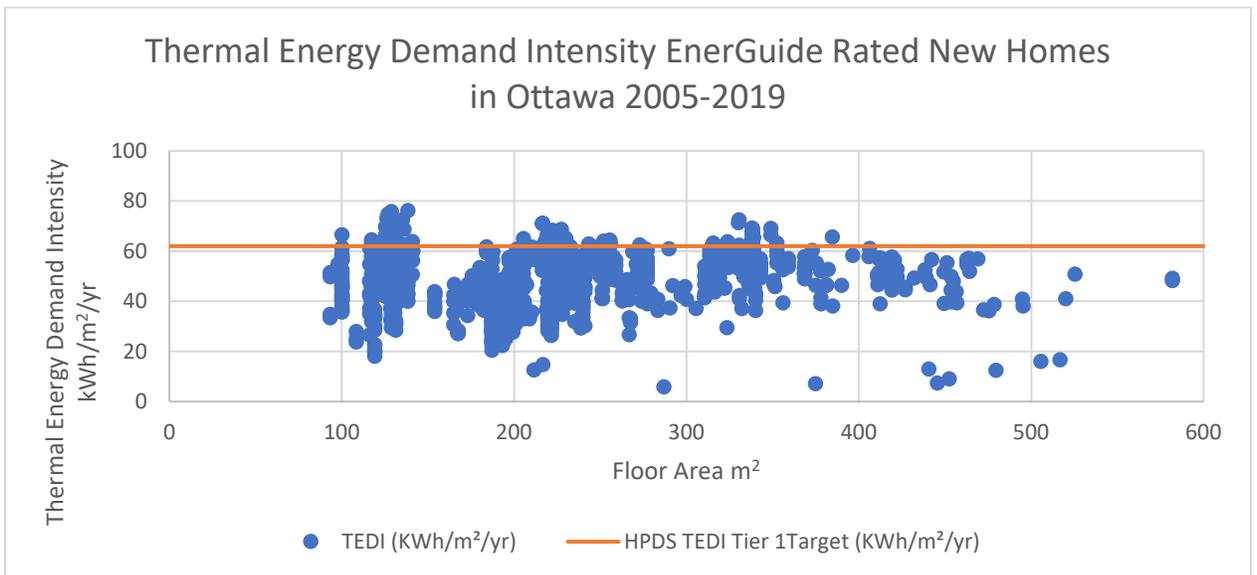


Figure 6 NRCan EnerGuide Models (Low-rise residential buildings) Thermal Energy Demand Intensity EnerGuide Rated New Homes in Ottawa 2005-2019

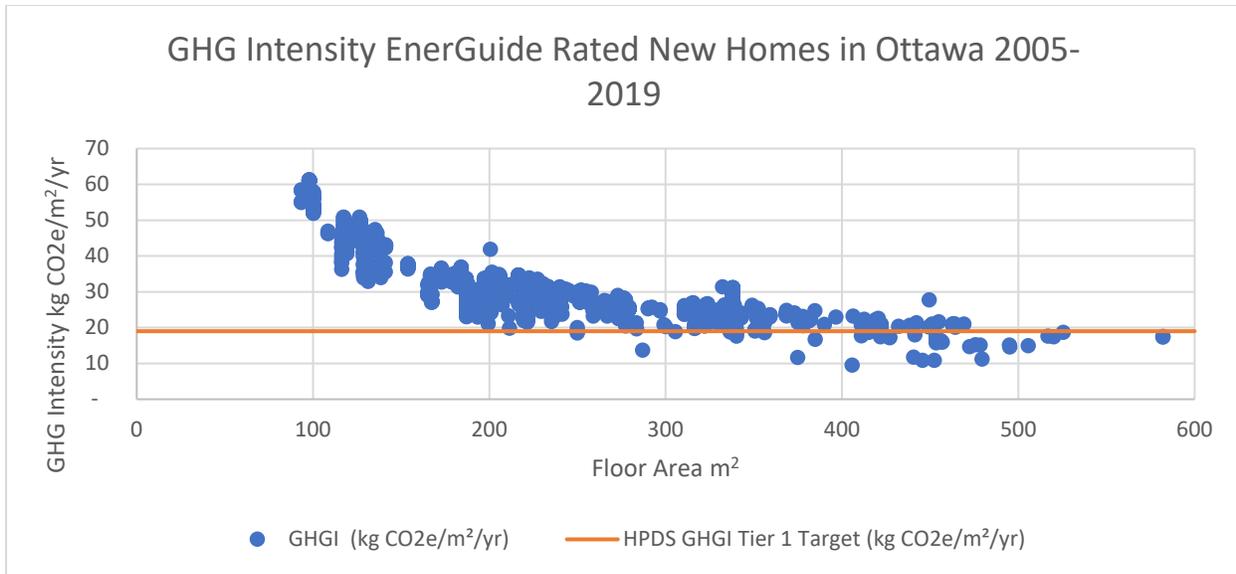


Figure 7NRCan EnerGuide Models (Low-rise residential buildings) GHG Emission Intensity EnerGuide Rated New Homes in Ottawa 2005-2019

Energy Models sample set 2018 -2019 (high rise and commercial buildings)

Energy Model results from a sample of high performing buildings across Ontario have been shared with the City to support with context and evaluation of the HPDS target. Figure 8 displays how these projects performed relative to the High Performance Development Standard 69% of this sample of buildings aligned with the HPDS targets. This sample set looks at some existing and new construction buildings and represents some of the more progressive buildings in the province.

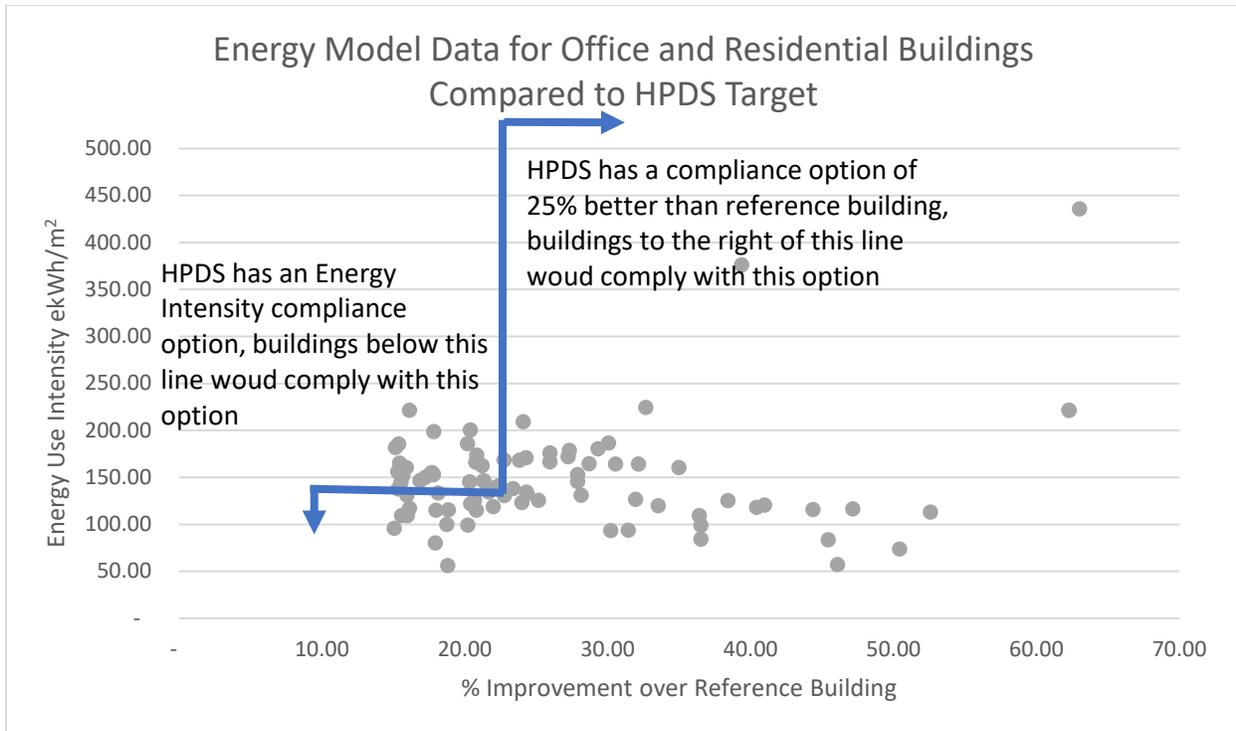


Figure 8 Energy Model Data for Office and Residential Buildings Compared to the HPDS Target

Ontario Association of Architects 2030 challenge EUI targets

In 2014 the Ontario Association of Architects presented a study of energy use of a number of building types. It presented a pathway of performance improvement to achieve zero emissions by 2030. The High Performance Development Standard target is presented in comparison to these targets. In the figure below. This presents a significant improvement over average 2014 buildings but is less aggressive than the association targeted buildings getting to by 2020.

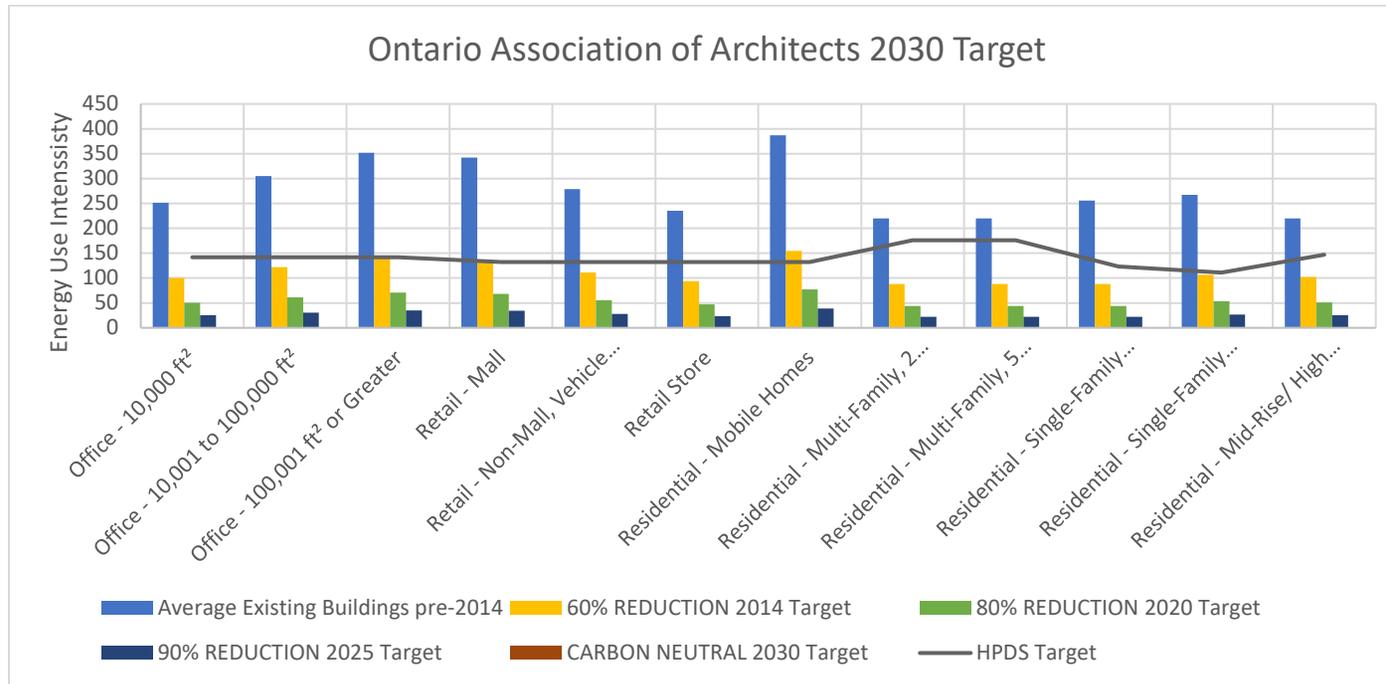


Figure 9 Ontario Association of Architects 2030 Target Relative to the HPDS Target

Energy Targets

Site Plan

Site Plan Application High Performance Development Standard. Projects must demonstrate:

- a) Total Energy Use Intensity (TEUI), Thermal Energy Demand Intensity (TEDI) and GHG Emission Intensity (GHGI) targets by building type per table. Multi Unit Residential Buildings are referred to as MURB in the table. Mixed-use buildings will use an area weighted average by occupancy type.

	Tier 1			Tier 2		
	TEUI (KWh/m ² /yr)	TEDI (KWh/m ² /yr)	GHGI (kg CO ₂ ^e /m ² /yr)	TEUI (KWh/m ² /yr)	TEDI (KWh/m ² /yr)	GHGI (kg CO ₂ ^e /m ² /yr)
MURB (≤6 Storeys)	147	62	19	108	38	13
MURB (≥ 4 Storeys)	142	52	19	108	33	13
Commercial Office	142	42	19	108	30	11
Commercial Retail	132	52	12	98	33	7
All Other Building Types	25% over OBC			50% over OBC		

- b) 25% (50% Tier 2) energy efficiency improvement above the Ontario Building Code, SB-10, Division 3 (2017);

OR

- c) Commitment to pursue certification program such as the ones listed below or an approved equivalent.
 Tier 1: ENERGY STAR® for New Homes, version 17, Energy Star for MURBS, LEED v4 with minimum 4 energy points
 Tier 2: R-2000®, CHBA NZe, NZEr, or Passive House, CaGBC Zero Carbon Standard

Subdivisions

The following tables outline the estimated energy intensity target for different building archetypes based on a combination of resources including Energy Evolution projections and targets, historic modelling data, NRC research data and Toronto Green Standard. These are not prescriptive requirements for new communities, this is to serve as a reference to help inform how closely a new community's community energy Plan aligns with Energy Evolution. On-site solar energy production is included in the GHGI numbers but, not in the EUI.

New Home and Commercial Building Energy Targets under Business as Planned Scenario

Build Year:	2021			2025			2030+		
	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²
Dwelling Unit Type									
Single Detached	111	60	16	89	49	10	39	32	8
Townhouse	123	51	17	102	41	11	53	27	9
Apartment <6storeys	176	76	23	158	68	20	162	73	20

Build Year:	2021			2025			2030+		
	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²
Building Archetype									
MURB (≥ 4 Storeys)	181	81	23	162	33	13	147	66	19
Commercial Office	186	81	23	167	30	11	151	66	19
Commercial Retail	181	71	24	162	64	22	146	57	19

New Home and Commercial Building Energy Targets under Target Scenario

Build Year:	2021			2025			2030+		
	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²
Dwelling Unit Type									
Single Detached	106	56	12	46	15	2.3	39	15	0.3
Townhouse	119	48	13	62	15	3.1	53	15	0.4
Apartment <6storeys	147	62	19	108	38	16	70	15	5

Build Year:	2021			2025			2030+		
	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²	EUI kWh/m ²	TEDI kWh/m ²	GHGI kgCO _{2e} /m ²
Building Archetype									
MURB (≥ 4 Storeys)	142	52	19	108	33	13	75	15	5
Commercial Office	142	42	19	108	30	11	65	15	4
Commercial Retail	132	52	12	98	33	7	70	15	3

As an alternate path to a Community Energy Plan proponents may commit to **one or a combination** of the following building level energy performance pathways for the site low rise home archetypes and commit to following the HPDS as required for any applicable commercial or multi unit residential buildings.

- a) Total Energy Use Intensity (TEUI), Thermal Energy Demand Intensity (TEDI) and GHG Emission Intensity (GHGI) targets

	Tier 1			Tier 2		
	TEUI (kWh/m ² /yr)	TEDI (kWh/m ² /yr)	GHGI (kg CO ₂ ^e /m ² /yr)	TEUI (kWh/m ² /yr)	TEDI (kWh/m ² /yr)	GHGI (kg CO ₂ ^e /m ² /yr)
Residential units (≤6 Storeys)	147	62	19	108	38	13

- b) Commitment to pursue approved certification program
 Tier 1: ENERGY STAR® for New Homes, or equivalent,
 Tier 2: Canadian Home Builders Association Net Zero Energy or Net Zero Energy Ready, Passive House, or equivalent

Certification programs are to be the current version as of date of submission following programs defined transition requirements if the submission falls within a version transition period. Equivalent programs to be approved by City documentation demonstrating equivalency with respect to carbon emission performance, integrity and verification to be provided for review.

- c) Commitment to including 2 of the following Energy Conservation Measure Packages:

	Pick 2
i.min ext. wall effective R-value 20 (R19+5ci nominal)	<input type="checkbox"/>
ii.electric heat pump heating and cooling system	<input type="checkbox"/>
iii.Airtightness target aligned with Energy Star Level 3 with agreement to complete verification testing	<input type="checkbox"/>
iv.Energy Star ZONE3 windows AND R10 underslab insulation	<input type="checkbox"/>

Definitions of Energy Terms

Building articulation: the layout or pattern, expression and material character of building elements, including walls, doors, roofs, windows, and decorative elements such as cornices and belt courses.

Building envelope: the building elements separating interior space from the outdoors such as exterior walls, windows, and roof.

Building orientation: the cardinal (north south east west) direction of a building

Business as Planned (BAP): description of a scenario assuming no change to current path or behavior

Canadian Home Builders Association Net Zero Energy or Net Zero Energy Ready: home labelling program for homes that are designed to produce as much energy as they consume

Carbon sequestration: A method of capturing and storing CO₂ so that it is not released into the atmosphere, thereby reducing GHG emissions. The CO₂ is compressed into a transportable form, moved by pipeline or tanker, and stored in some medium, such as a deep geological formation.

Community Energy Plan (CEP): A plan that identifies pathways and sets objectives and targets on energy and greenhouse gas emissions in support of sustainable and resilient design at the new community scale of development. This may include building energy use and source, wastewater, solid waste and transportation design solutions.

District Energy: District energy is the production and supply of thermal energy.

Electric Vehicles (EV): are powered by motors that draw electricity from on-board storage batteries. Electric vehicles are plugged-in to be recharged.

Embodied carbon: is the carbon dioxide (CO₂) emissions associated with materials and construction processes throughout the whole lifecycle of a building or infrastructure

Energy Use Intensity (EUI): energy use for a building divided by the gross floor area

Energy Star for New Homes: a home certification program targeting 20 percent energy improvement over local building code

Generation (electricity): The process of producing electric energy by transforming other forms of energy. Also, the amount of energy produced.

Geothermal energy: The use of geothermal heat from the earth's molten core to generate electricity. Also used to describe ground-source heating and cooling (also known as geo-exchange or ground-source heat pump).

Greenhouse gas (GHG): A gas such as carbon dioxide, methane, or nitrogen oxide, which actively contributes to the atmospheric greenhouse effect. Greenhouse gases also include gases generated through industrial processes, such as hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

Greenhouse Gas Intensity (GHGI): Greenhouse gas emissions associated with the energy to operate a building divided by the gross floor area

Grid-scale battery storage: A type of energy storage system that collects energy from the electrical grid or a power plant using electrochemical cells, then discharges energy to provide electricity or other grid services when needed.

Gross Floor Area (GFA): The total area of each floor whether located above, at or below grade, measured from the interiors of outside walls and including floor area occupied by interior walls and floor area created by bay windows, with exclusions as outlined in Ottawa's Zoning By-law 2008-250;

High Performance Development Standard (HPDS): Sets performance targets for new construction to improve air and water quality, reduce greenhouse gas emissions and enhance the natural environment. Some of these targets can be directly achieved by incorporating sustainable and resilient design features into the plans and drawings submitted as part of the site plan approval process.

Low-carbon: less carbon dioxide emissions

Local Plan: Secondary plans and area-specific policies that provide more detailed policies to guide growth and change in specific areas or neighbourhoods. Local plans adapt and implement the overall planning approach of this Plan but may deviate from specific policies to fit local contexts.

Municipal Energy Plan (MEP): A Community Energy Plan completed at the municipal scale. For the City of Ottawa this is Energy Evolution

Net zero emissions: Refers to the balance of emitting and removing GHGs from the atmosphere, such that the net effect is zero emissions

One Planet Living Framework: framework comprising ten simple principles and detailed goals and guidance, it's a highly flexible framework that is helping organizations around the world to achieve their vision of a brighter, better future living within the constraints of our planet's resources.

Ontario Building Code (OBC): The provincial law governing building construction practices

Passive: relating to or denoting heating systems that make use of incident sunlight as an energy source

Passive House: a building certification program with a focus on passive elements such as building insulation and orientation.

Proponent: a person or company who advocates a proposal, or project.

Quantitative: relating to a quality that is captured with numerical measurements

Qualitative: relating to a quality that cannot be measured numerically

Renewable energy source: an energy source that is renewed by natural processes and includes wind, water, biomass, biogas, biofuel, solar energy, geothermal energy and tidal forces.

Renewable energy system: means a system that generates electricity, heat and/or cooling from a renewable energy source.

Renewable natural gas (RNG): is natural gas that comes from renewable sources this could be comprised of either biogases refined to a quality that's acceptable for injection into the local pipeline grid or hydrogen or a mixture of the two.

Resiliency: refers to the capacity to adapt to changing climate conditions Secondary Plan

Servicing: the utility infrastructure supporting a development such as electricity, water or energy services.

Thermal Energy Demand Intensity (TEDI): energy required to heat and cool a building divided by the gross floor area

Solar orientation: the cardinal (north south east west) placement of an object particularly as it relates to capturing solar energy or heat

Waste heat: Energy lost during the operation of a piece of equipment or machinery. Various processes, such as cogeneration or combined heat and power (CHP) exist to capture and reuse waste heat.