EB-2022-0024

ELEXICON ENERGY INC.

2023 Electricity Distribution Rates

VECC Compendium

In light of the significant growth in this area, Elexicon, in close consultation with the Brooklin Developers, is proposing the Sustainable Brooklin project. The core feature of the Sustainable Brooklin project is an approach through which new construction homes will be built DER-and-EV-ready, with standard rough-ins for rooftop solar, battery storage, and EV charging ("Standard Rough-In"). The estimated cost to the Brooklin Developers to install the Standard Rough-In is approximately $23M. As a result of the Brooklin Developers incurring incremental costs to build Standard Rough-In's, Elexicon is requesting an exemption from Section 3.2 of the Distribution System Code ("DSC"). As discussed throughout the ICM application, Elexicon believes the fairness principle justifies this quid-pro-quo treatment to exempt the Brooklin Developers from paying a capital contribution to construct the Sustainable Brooklin project.

To accommodate near term and long term forecasted demand within North Brooklin, the first phase of development requires Elexicon to construct two new 27.6 kV feeders connecting the North Brooklin development to Whitby TS DESN 1.

Elexicon has already outlined its plan for the 'Grid of the Future" with the Whitby Smart Grid being one of the key projects that will enable this through the installation of Smart Grid hardware and software. The Sustainable Brooklin project is also another key project that further enables this 'Grid of the Future" by supporting the development of a DER and EV-ready community. Along with the assets being installed as part of the Whitby Smart Grid, the connection of these homes will allow Elexicon and its customers to reap the benefits of a more sustainable and smarter grid and community.

traditional functionality, and therefore customers would have to undertake costly retrofits if they wanted DER and EV capabilities.

The Brooklin Developers will invest their own capital in the creation of a new, innovative community wherein DER and EV uptake can significantly exceed business-as-usual; with resulting benefits for both the residents of North Brooklin and the broader Whitby rate zone customer base. Based on initial quotes the Brooklin Developers has received, it is estimating a cost of around $23M install the standard rough-in. The Brooklin Developers will undertake the following:

With respect to solar generation, all residences will be built to be solar-ready. This would involve the following key elements: (i) conduit from the circuit panel to the attic to allow for wiring a solar panel; (ii) two spare breaker slots; and (iii) sufficient space on the wall next to the circuit panel to install solar controls and an inverter. Where the roof size and orientation are suitable, the Brooklin Developers will offer customers the option to purchase and install solar panels and related inverter and controls. The Brooklin Developers will offer this alone or in a package with battery storage.

With respect to in-home battery storage, all residences will be built to be have the ability to store a battery in the homes premises. The Brooklin Developers will offer customers the option to purchase and install a battery storage system (e.g., Tesla, Panasonic, or LG) either in conjunction with solar or for peak-shaving, reliability needs. This will also allow for the eventual participation in a local capacity market when this is formed. Battery storage would allow customers the added benefit of outage protection.

With respect to EV charging, all residences will be built to be EV charging ready. The Brooklin Developers will install electrical conduit from the circuit panel to the location of

an EV charger, with a plate at the point of a future installation, room on the wall for the charger, and appropriate room in the circuit panel for a breaker. The Brooklin Developers will offer customers the option to purchase and install either a unidirectional or a bidirectional 240V EV charger. Both can be used for fast charging of electric vehicles, but the bidirectional charger can also be used as additional battery storage for the home or to feed power into the grid. An electric vehicle can be programmed to charge using ultra low overnight rates, and then discharge back to the home during the day when the vehicle is not in use to offset peak electricity.

Investments made by the Brooklin Developers to create a DER and EV-ready community will incur capital costs on their part, for which recovery at the time of home sale is highly uncertain. Given the high and increasing cost of residential development and construction, the Brooklin Developers would be otherwise unlikely to assume the business risk of constructing DER and EV-ready homes in North Brooklin. This outcome is highly sub-optimal, as the costs and challenges of DER and EV retrofits are significantly greater than inclusion of these technologies at the design and construction phases. All else equal, failing to incorporate these technologies into front-end development will result in a community of North Brooklin that has low or average levels of DER and EV uptake.

Smart Grid Functionality

Consistent with broader plans for the Whitby Smart Grid, Elexicon intends to build the new distribution assets servicing Sustainable Brooklin to incorporate innovative functions and features such as VVO, FLISR/DA, and a supporting ADMS. On the back of these technologies, Elexicon's assets in North Brooklin will be capable of automatically monitoring and managing the distribution system. The end-state will be the promotion and wide adoption of DERs while maintaining the service and reliability of the distribution

Electric Vehicle Charging Infrastructure Costing Study

Electrical Engineering Services

Prepared for:
Clean Air Partnership

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Date: 10/13/2021

DESIGNING A BETTER TOMORROW

Summary

Electric vehicle (EV) adoption is growing rapidly, and near total replacement of passenger vehicles with EVs will be required to achieve local and Federal government climate targets. Providing access to "at home" EV charging is a critical factor to ensure that households will choose EVs. Accordingly, local governments are increasingly requiring 100% "EV Ready" residential parking in new developments. EV Ready parking is defined as a parking stall that has an adjacent energized outlet (i.e. an electrical junction box or a receptacle) at which an EV supply equipment (EVSE – i.e. an EV charger) can be installed in the future.

This *Electric Vehicle Charging Infrastructure Costing Study* summarizes design options and costing analysis for four residential development archetypes to comply with 100% EV Ready residential parking requirements. Table ES-1 summarizes the archetypes.

Table ES-1: Overview of parking for each archetype.

				Parking Stalls	
#	Archetype	Storeys	Number of Units	Resident	Visitor
1	High-Rise	16	405	369	61
2	Mid-Rise	7	151	119	38
3	Townhouse	3	19	38	5
4	Single Family	3	22	44	7

For each archetype, a range of different electrical design scenarios were developed. These scenarios included those:

- Complying with the Toronto Green Standard version 3 (TGSv3) requirement for 20% EV Ready parking.
- With 100% EV Ready parking. The 100% EV Ready parking scenarios feature various electrical designs. Some scenarios' electrical designs comply with the TGSv3's limits on how much load sharing between EVs could be implemented; other scenarios featured higher levels of load sharing, which AES's analysis indicates can be appropriate for communities where vehicles travel on average of 45km or less per weekday.

The high-rise archetype was evaluated in both Toronto Hydro and Alectra utility territories, reflecting differences in supply voltages and service policies in these territories.

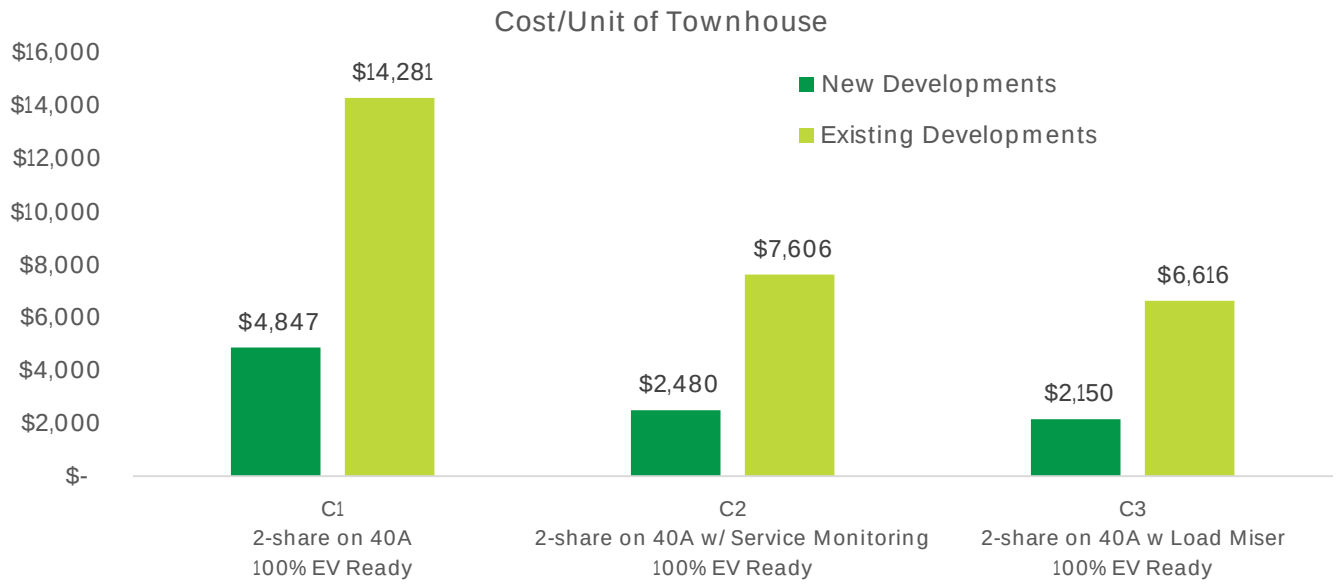


Figure 14 Comparison of cost per unit of EV charging infrastructure for new and existing developments for the townhouse archetype

5. Operating EV Charging Infrastructure

This study focuses on the cost of EV Ready infrastructure for new developments. It does not forecast operating costs for use of this infrastructure. This section provides commentary on the costs to end users of EVSE; EV charging services, including EVEMS; and electricity.

5.1.1 EVSE Costs

The cost of residential level 2 EVSE varies depending on the power level, built-in load sharing, and whether the EVSE can communicate over some network for the purposes of EV energy management and other services (i.e. "smart charging station"). In AES's experience, installed costs for 7.2kW smart EVSE with appropriate for residential applications range from approximately $1000 to $2000+, depending on the vendor.

Developments with dedicated circuits could use "dumb" EVSE without network connectivity. These dumb EVSE are typically lower cost (e.g. $300 to $1000+). However, use of dumb EVSE may entail higher ongoing utility costs, due to higher demand charges, and broader inability to respond to utility price signals.

6. Conclusion

Local governments are increasingly requiring 100% of residential parking in new developments to be EV Ready. This report provides relevant context and background information, and summarizes design and costing analysis for four residential building archetypes common to the GTHA.

This costing analysis suggests that in the high-rise and mid-rise archetypes, it is possible to implement 100% EV Ready parking for approximately $1500 to $1800 per parking space. For the townhouse and single family subdivision archetypes, parking can be made EV Ready at a cost of approximately $2000 or less per dwelling unit with onsite parking. These costs represent a small fraction of the cost for a new development to provide onsite parking. Moreover, future-proofing buildings with this EV charging infrastructure will realize significant value for drivers, enabling them to adopt EVs and benefit from their associated savings in total cost of vehicle ownership. The costing analysis documents that retrofits to provide EV charging infrastructure in buildings that are not future-proofed with 100% EV Ready parking will be much more costly and complicated than implementing 100% EV Ready parking in new construction.

It is recommended that local governments implement 100% EV Ready requirements for residential parking in new developments.

EV READY REQUIREMENTS FOR MUNICIPALITIES

Clean Air Partnership

APPENDIX A: EV READY SCAN FOR ONTARIO MUNICIPALITIES

MUNICIPALITY	METRICS/ REQUIREMENTS	NOTES
AJAX	Going to Council in early 2022 with Ajax Green Standard: Tier 1 calls for 50% of dwelling units to have EV chargers or are EV ready. T2 is 75%.	
AURORA	No EV Ready Metrics/Requirements	
BRAMPTON	Will be going to Council in mid 2022 with update to Sustainability Metrics. Aiming to include EV ready requirements in update.	
BURLINGTON	Electric Vehicles: A voluntary metric of a minimum of 3% of parking spaces provide charging stations to accommodate electric vehicles and design additional areas to be EV conversion ready.	https://www.burlington.ca/uploads/92/
CALEDON	No EV Ready requirements at present. In the process of developing Green Standards	
CLARINGTON	An EV Plan has been developed for the Municipality of Clarington and was approved by Council in early 2022. Development of Green Standards is planned. Timeframe for green standards not finalized.	Clarington EV Plan
HALTON HILLS	Added in EV to Green Standards: Provide 5% of parking spaces or a minimum of 1 space with plug-ins for electric vehicles.	https://www.haltonhills.ca/en/your-government/resources/Documents/Green-Development-Standards-Checklist.pdf Green Standard as the mechanism to advance EV Readiness
KING	Menu Approach Green Standard in place: Minimum target: if parking in provided on-site, a minimum of 25% of parking spaces have the infrastructure for electric vehicle charging conduits.	King Green Standards Green Standard as the mechanism to advance EV Readiness

MUNICIPALITY	METRICS/ REQUIREMENTS	NOTES
KITCHENER	Using Zoning By-law 2019-051 to secure 20% (non-residential is 17.5%) of parking spaces required for multiple dwellings shall be designed to permit the future installation of electric vehicle supply equipment	Page 26 of https://cleanairpartnership.org/cac/wp-content/uploads/2022/02/Kitchener-ZBL-Section-5-Parking-Regulations.pdf Using Zoning Authorities to secure EV Ready requirements
MARKHAM	No EV Ready requirements at present. No EV ready metric in Sustainability Metrics.	
MISSISSAUGA	No EV Ready requirements at present. In the process of developing green standards but looking to bring EV ready requirements into parking by-law.	
NEWMARKET	No EV Ready requirements at present	
OAKVILLE	No EV Ready requirements at present	
PICKERING	Pickering in the process of developing their green standard. Aiming to have EV ready metric in green standard.	
RICHMOND HILL	No EV ready requirements at present.	

APPENDIX A: EV READY SCAN FOR ONTARIO MUNICIPALITIES

MUNICIPALITY	METRICS/ REQUIREMENTS	NOTES
TORONTO	Ev Ready Requirements Were Previously In The Tgsv3: Aq 1.3 Electric Vehicle Infrastructure Design The Building To Provide 20 Per Cent Of The Parking Spaces With Electric Vehicle Supply Equipment (Evse). The Remaining Parking Spaces Must Be Designed To Permit Future Evse Installation (Conduit). T2 Of V3 Was 25%. In Mid 2021 The Tgsv4 Approved An Increase To 25% Ev Ready For Tier 1. Toronto In Late 2021 Moved To Using Zoning By-Law Authorities. City Council Directed The Chief Planner And Executive Director, City Planning To Revise The Performance Measures For Electric Vehicle Requirements In The Toronto Green Standard Version 4 In Accordance With The Revised Zoning By-Law. Toronto Is Planning On Moving Towards 100% Ev Ready As The New Ev Ready Requirement As Was Identified In The Ev Strategy. The Ev Ready Requirements Were Advanced While Toronto Was Also Reviewing Minimum Parking Requirements.	Toronto Council Report: Recommended Parking Requirements for New Development EV Ready Requirements in Toronto Green Standard Toronto Electric Vehicle Strategy Toronto was previously using the Toronto Green Standard to secure EV Ready requirements but are in the process of transferring their EV Ready requirements into their parking by-law authorities
VAUGHAN	No EV Ready Metrics/Requirements	
WATERLOO	Will be going to Council in mid 2022 with update to Sustainability Metrics. Aiming to include EV ready requirements in update.	Page 151 of https://www.waterloo.ca/en/government/resources/Documents/Zoning-bylaw/Zoning-Bylaw-2018-050.pdf Using Zoning Authorities to secure EV Ready requirements Amendment: https://www.waterloo.ca/en/government/resources/Documents/Zoning-bylaw/General-amendments/2020-061-to-modify-regulations-pertaining-to-electric-vehicle-parking.pdf

MUNICIPALITY	METRICS/ REQUIREMENTS	NOTES
WHITBY	Using Whitby Green Standard to advance EV readiness of new builds. No mandatory requirements in Tier 1 of WGS. Tier 2 is: At least 20% of parking spaces are equipped with electric vehicle charging stations. Tier 3: At least 20% of parking spaces are equipped with electric vehicle charging stations. All remaining spaces are designed to enable future charging station installation. Tier 4: At least 30% of parking spaces are equipped with electric vehicle charging stations. All remaining spaces are designed to enable future charging station installation.	https://www.whitby.ca/en/work/whitby-green-standard.aspx Whitby has used their Green Standard as the mechanism to advance EV Readiness

APPENDIX B: EV READY REQUIREMENTS IN OTHER CANADIAN JURISDICTIONS

JURISDICTION	RESIDENTIAL	COMMERCIAL
City of Toronto, ON	100% EV Ready	25% EV Ready
Province of Quebec	100% EV Ready (single family)	
Ville de Laval, QC	50% EV Ready	
City of Vancouver, BC	100% EV Ready	45% EV Ready
City of North Van, BC	100% EV Ready	45% EV Ready
City of Port Moody, BC	100% EV Ready	20% EV Ready
City of Surrey, BC	100% EV Ready	20% EV Ready
District of North Van, BC	100% EV Ready	20% EV Ready
District of Saanich, BC	100% EV Ready	Varies, ~5% EV Ready
City of Victoria, BC	100% EV Ready	5% EV Ready
Town of View Royal, BC	100% EV Ready	~5% EV Ready
City of Richmond, BC	100% EV Ready	
City of Burnaby, BC	100% EV Ready	
City of New West, BC	100% EV Ready	
District of Squamish, BC	100% EV Ready	
City of Coquitlam, BC	1 EV Ready / dwelling	
District of West Van., BC	100% EV Ready	
Township of Langley, BC	1 EV Ready / dwelling	
City of Nelson, BC	1 EV Ready / dwelling	10% EV Ready

2.0 | THE ROLE EV READY REQUIREMENTS PLAYS IN DRIVING EV UPTAKE

EV adoption is growing rapidly, and near total replacement of ICEV with EVs will be required to achieve municipal, provincial and federal government GHG reduction targets. Providing access to at home EV charging is a critical factor to driving uptake of EVs. Local governments are increasingly considering what they can do to ensure the EV readiness of their communities. EV Ready parking requirements for new developments are emerging as a leading practice. EV Ready parking is defined as a parking stall that has an adjacent energized outlet (i.e. an electrical junction box or a receptacle) where an EV supply equipment (EVSE – i.e. an EV charger) can be installed in the future.

The Electric Vehicle Charging Infrastructure Costing Study summarizes design options and costing analysis for four residential development archetypes to comply with 100% EV Ready residential parking requirements.

The EV Charging Performance Requirements Report is a technical resource document that provides guidance to municipalities and developers for EV Ready design options that meet the daily driving needs while still allowing for the efficient use of electrical infrastructure, and reducing up front capital costs.

This EV Ready Requirements Primer for Municipalities highlights:

- The results of the EV Costing Study;
- The feedback received from municipalities, developers and utilities;
- The status of municipal EV Ready requirements in Ontario thus far; and
- What Ontario can learn from the experiences of other jurisdictions that are further ahead of Ontario in their EV uptake journey.

RATIONALE FOR RESISTANCE TO THE EV READY REQUIREMENTS IN THE ONTARIO BUILDING CODE

The EV market is not without its challenges. The infrastructure needed for accessible charging is one of the factors greatly limiting the wide scale adoption of the market towards EVs. Municipalities have been developing EV strategies that identify and act on opportunities to advance EV readiness and uptake within their communities. Advancing EV readiness of new developments has emerged as a leading action within municipal EV Strategies. EV Ready requirements that are advanced at the time of construction reduce the need for future logistically challenging and costly retrofits. This is particularly important in the case of MURBs and townhomes where common space rules and processes result in logistically challenging and costly retrofits.

In 2018, the Ontario Building Code (OBC) brought in EV charging requirements via Regulation O.Reg. 139/17 that required every new single detached, semi-detached and row townhouse to be provided with a rough in for the installation of future EVSE (charging stations). The rough-in was required to include:

- A minimum 200 amp panel board
- Conduit that is not less than 1-1/16" (27mm) trade size; and
- A square 4-11/16" (119 mm) trade size electrical box.

In addition to the above Part 9 (three stories and less) building requirements, the OBC also required electric vehicle charging in commercial workplace buildings with parking spaces in the buildings (this did not apply to MURB developments such as condominiums and apartment buildings). It was required that not less than 20% of parking spaces be provided with EVSE and the remaining 80% of parking spaces be provided with rough ins for future installation of EVSE. In addition to the EV charging requirements in new buildings, the Government of Ontario also provided incentives for the purchase of EV and PHEVs and financial support for EV charger installations in Ontario workplaces. The EV

Whitby Green Standard Reference Guide

2020

Whitby

1.4 Overview of the Whitby Green Standard

The goal of the WGS is to improve the environmental performance of new development within the Town of Whitby.

The WGS defines sustainability expectations for all new development in Whitby, including Checklists for new development and re-development.

The WGS is divided into two Development Review Checklists: Draft Plan of Subdivision and Site Plan applications. The Checklists are organized under ten sustainable principles with corresponding performance measures that promote sustainable site and building design. Each Checklist includes four tiers. Tier 1 is mandatory and required through the planning approval process. Tiers 2 to 4 are higher level voluntary standards that could eventually be tied to financial and non-financial incentives.

The Checklists will be used as a component of the development review process to assess the sustainability of new development. The WGS applies to new applications submitted after September 2020 for Draft Plans of Subdivision and Site Plans.

By the Numbers

The WGS is a tiered program designed to tackle upfront emissions caused by construction as well as operating emissions.

21% 21% of global emissions are caused by **constructing** new buildings.

28% 28% of global emissions are caused by **operating** buildings.

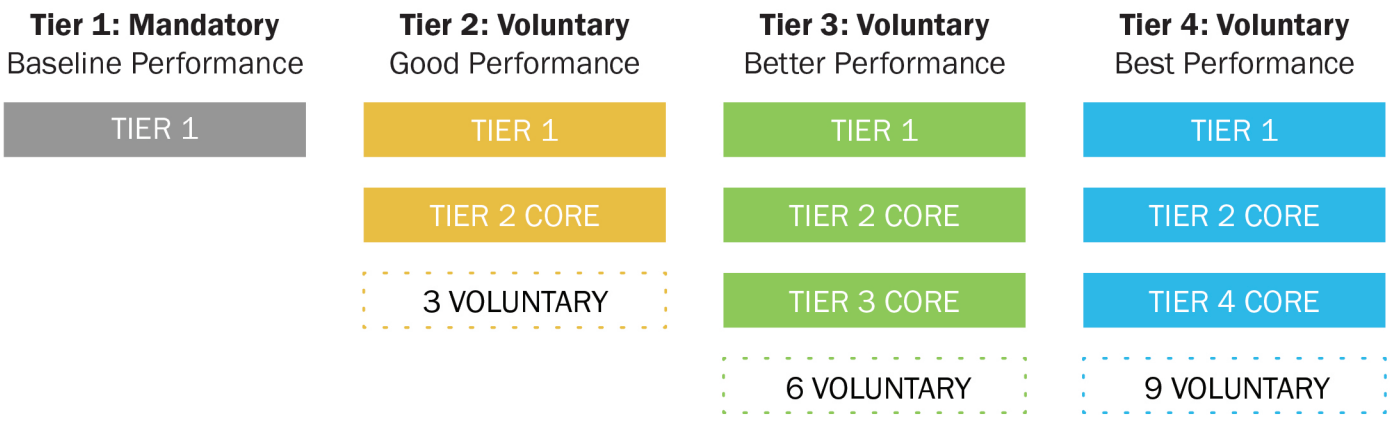
13.5 Reducing emissions of one house is equivalent to taking up to 13.5 cars off the road each year.

2.2 Performance Tiers

At a minimum, all new Draft Plan of Subdivision and Site Plan applications submitted to Whitby under the Planning Act must demonstrate compliance with Tier 1.

Note that for some performance measures, there is a stepped increase in performance between Tiers. For these performance measures, the applicant must only demonstrate compliance with the Tier being pursued. For example, the Irrigation for Lots/ Units performance measure for Draft Plans of Subdivision (number SW1.4) steps from 60% (Tier 2) to 80% (Tier 3) to 100% (Tier 4). If the applicant is pursuing Tier 4, there is no need to demonstrate achieving the Tier 2 target, given that it is implicitly achieved through compliance with the higher Tier.

Each Tier beyond Tier 1 also requires the achievement of voluntary performance criteria (as outlined in the diagram below). Importantly, up to two (2) innovation performance measures may be used in lieu of two (2) voluntary measures. The voluntary performance measures are found at the bottom of the Tier 2, 3, and 4 checklists.



Whitby Green Standard (WGS), Version 1
Site Plan Application: Checklist

Health and Happiness: Encouraging active, sociable, meaningful lives to promote good

Performance Measure(s)		
Number	**Development Feature**	**Tier 1 Criteria**
ECC.V.1	Renewable Energy	Design on-site renewable energy systems to supply a minimum of 5% of the building's total energy load from solar PV, solar thermal or wind, or 20% from geo-exchange.
ECC.V.2	Solar Readiness For residential buildings four storeys or more and non-residential buildings.	Design and orient 75% or more of the project's total building floor area (excluding existing buildings) such that one axis of each qualifying building is at least 1.5 times longer than the other, and the longer axis is within 15 degrees of geographical east-west.
EEC.V.3	Solar Readiness For low-rise residential development	Buildings are designed to accommodate connections to solar PV or solar thermal.

Secondary Plans
A plan for a specific geographic area containing specific policies to guide future development and redevelopment which is adopted by Council as an amendment to this Official Plan.

Simpson Diversity Index
The Simpson Diversity Index calculates the probability that any two randomly selected dwelling units in a project will be of a different type.

For more information, review Option 1 Diversity of housing types using this link.

Solar Ready
Solar ready refers to the design and installation of elements in preparation for the installation of a future solar system. Design considerations and modifications include the following elements: roof space, solar domestic hot water systems and solar PV conduits, plumbing connections to an existing hot water heater, an electrical outlet, mechanical room floor space and mechanical / electrical room wall space.

For more information, click here.

Town of Whitby Design Criteria and Engineering Standards
The Town of Whitby's Engineering Design Criteria and Engineering Standards provide guidance for consulting engineers on design issues under the jurisdiction of the Public Works Department. This includes storm drainage, Town of Whitby roads, lot grading, fencing, and street lighting, among others.

For more information, click here.

Town of Whitby Lighting Guidelines
The purpose of these Guidelines is to regulate outdoor/external lighting, and specifically mitigate the detrimental impacts of inappropriate or improperly installed lighting fixtures as part of new development. Proponents intending to install new lighting systems or retrofitting existing systems as part of the site plan application process should refer to these Guidelines and ensure they are in compliance with all requirements therein.

For more information, click here.

Town of Whitby Official Plan
An Official Plan is a statutory document that sets out policy directions for land use planning matters regarding long-term growth and development in a municipality.

For more information on Whitby's Official Plan, click here.

Natural Resources Canada
Ressources naturelles Canada

SOLAR ready GUIDELINES

for solar domestic hot water and photovoltaic systems

TABLE OF CONTENTS

CanmetENERGY/Housing, Buildings and Communities

Version 1.1

Canada

I. INTRODUCTION & KEY BENEFITS

The Solar Ready Guidelines specify a number of design considerations and modifications builders can make to new attached and detached homes in preparation for the installation of a future solar system. The design considerations and modifications include the following elements: roof space, SDHW and solar PV conduits, plumbing connections to an existing hot water heater, an electrical outlet, mechanical room floor space and mechanical / electrical room wall space. Structural loading considerations are not addressed explicitly in the Guidelines.

These Guidelines are intended to be simple and inexpensive to implement, while enabling significant savings in installation costs should a homeowner choose to install a complete solar system in the future. The Solar Ready Guidelines are specifically targeted towards the installation of solar domestic hot water systems (SDHW) and/or solar photovoltaic systems (solar PV) as tested and/or certified according to Canadian Standards Association (CSA) relevant test standards; and as installed by certified installers. For more information on relevant CSA test standards and certified installers, see Section III, Part 8.

See Section IV for an explanation of the anticipated performance of SDHW and/or solar PV systems for homes built Solar Ready.

This Guideline is intended to help increase builder and consumer awareness of the opportunity solar energy affords.

A SOLAR READY HOME BENEFITS:

- Homeowners, by enabling them to save money on the installation of a future SDHW and/or solar PV system while increasing the value of their home;
- Builders, by offering them the tools to provide an environmentally-conscious, low-cost upgrade to new homes; and
- Manufacturers and installers, by encouraging market uptake of solar energy systems.

The Solar Ready Guidelines can be found on NRCan's website *nrcan-rncan.gc.ca*. Builders should ensure they are working with the most recent version.

SOLAR READY BACKGROUND: *Natural Resources Canada partnered with the Canadian Solar Industries Association to develop the technical specifications of these Solar Ready Guidelines, while builder-led pilot projects provided an opportunity to demonstrate the Solar Ready concept. The pilot projects found that a few simple and inexpensive design modifications made "up front" in the design and construction phase of a new home would enable homeowners to save significantly on the future installation costs of a complete SDHW system.*

II. TECHNICAL SPECIFICATIONS

Each of the following requirements should be completed by the builder. See Section III for additional information.

1. On The Roof

Builders should:

1.1 identify on the house plans at least 3.7 m (12') x 3.0 m (10') of unobstructed area (clear of chimneys, roof vents, skylights, gables and other protrusions and it should not be foreseen to be significantly shaded by building elements, surrounding buildings or mature trees at any time of the year);

1.2 ensure the roof area identified in 1.1 has an orientation ranging from east to west facing corresponding to azimuth angles of 90º to 270º from true north;

1.3 ensure the roof area identified in 1.1 is located below the roof ridge (of a sloped roof), does not extend beyond the roof edges and is located above the wall line (away from overhang areas);

1.4 consider designing the roof to a recommended (not required, see Section III, Part 1) roof pitch of 5/12 to 18/12, corresponding to angles of between 23º and 56º above horizontal (0º).

NOTE: *Structural loading considerations are outside the scope of the Solar Ready Guidelines. Builders may wish to ensure the roof structure as designed not only meets all applicable building code requirements, but will also support additional loads associated with common solar energy systems. Refer to Section III, Part 1, "Loading" for related commentary. Builders may wish to consult with building code authorities for guidance on issues associated with installing solar systems on roof structures.*

2. PV Conduit

2.1 To prepare for Solar PV, one solar PV conduit of at least 2.5 cm (1") nominal diameter constructed of rigid or flexible metal conduit, rigid PVC conduit, liquid tight flexible conduit or electrical metallic tubing (as per Section 12 of the Canadian Electrical Code Part 1 concerning "raceways") should be installed. The conduit should be continuous from an accessible attic or roof location to the designated wall space for the PV electrical hardware (continuous, straight as possible; bends / elbows will be fine). **Reference: PV and the Electrical Code, CanSIA, 2004, Section 8.8**

3. SDHW Conduit(s)

3.1 Ideally, two 7.6 cm (3") nominal diameter, or a minimum of two 5.1 cm (2") nominal diameter, or one 10.2 cm (4") nominal diameter conduit(s) that run straight and continuous (very slight bends are acceptable; elbows are not) should be installed from an accessible attic or roof location to a designated location (as close as possible to the floor space allocated in 5.5) in the mechanical room and securely fastened. The conduit(s) should be installed entirely within the home envelope (except for the roof termination if applicable).

3.2 Pipe conduit materials should be chosen with consideration of the maximum temperatures and pressures encountered in SDHW systems (PVC pipe certified to ASTM D1785, Schedules 40, 80 or 120 will be suitable). **Reference: CSA Standard F383-08, Section 7.**

III. SUPPORTING INFORMATION

1. ON THE ROOF

Roof Space, Orientation and Mounting Angle

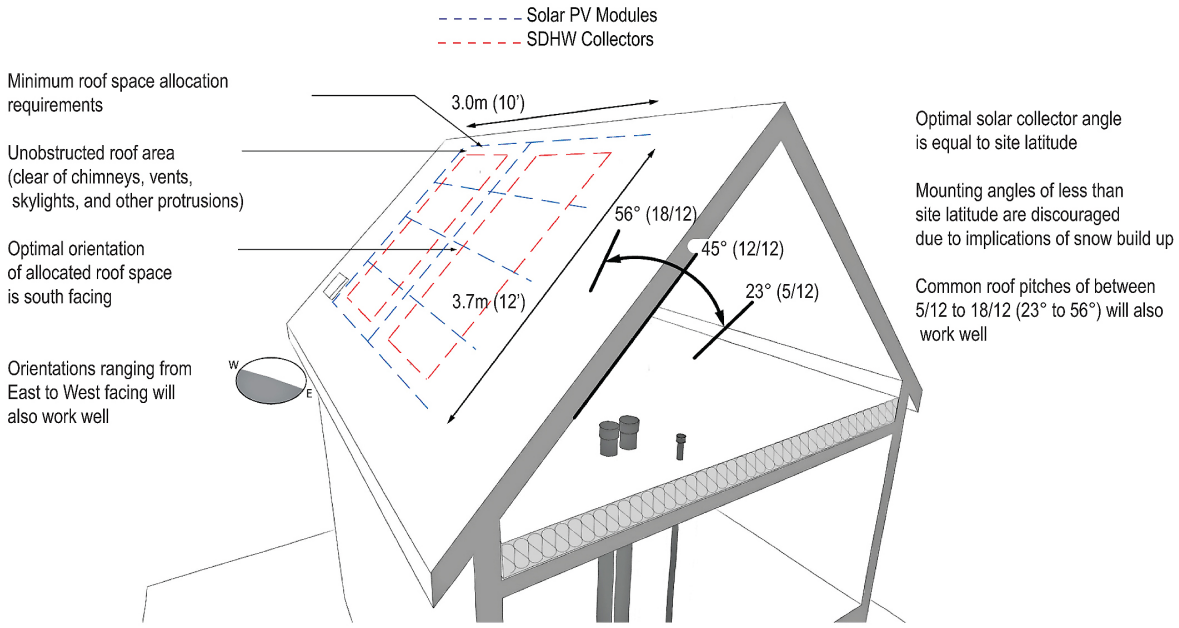


Figure 1: Roof space, orientation and mounting angle of SDHW collectors and solar PV modules

ROOF SPACE

In most residential applications, roof-mounted equipment is the most cost effective way to install solar energy systems. The roof space specifications for Solar Ready enable the rooftop installation of a minimum of: two 1.2 m (4') x 2.4 m (8') flat-plate solar thermal collectors (allowing 30.5 cm (12") of work space around each collector); or one evacuated tube collector consisting of about 30 tubes; or approximately eight 0.9 m (3') x 1.5 m (5') solar PV modules. Figure 1 describes the recommended roof space, orientation and mounting angle of the SDHW collectors and/or solar PV modules. A site inspection of surrounding building structures and consultation with landscaping plans will ensure the allocated area will not be significantly shaded by surrounding buildings / mature trees at any time of the year. Solar Ready shading considerations are described in Figure 2.

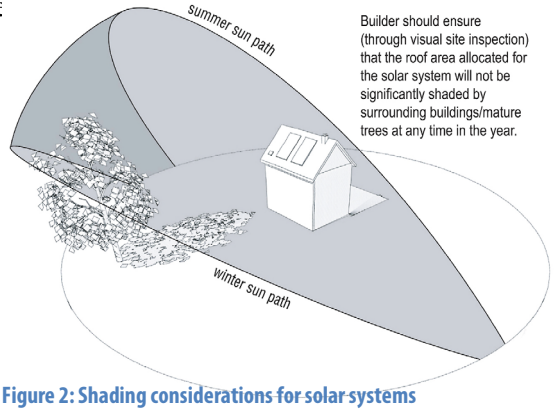


Figure 2: Shading considerations for solar systems