Planning for Solar Energy

Halifax Regional Municipality

By: Quality Urban Energy Systems of Tomorrow (QUEST) Nova Scotia

2013

QUEST Nova Scotia

Quality Urban Energy Systems of Tomorrow

Acknowledgements

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Table of Contents

Executive Summary

Nova Scotia and the rest of the world are at an interesting crossroad with the use of energy. Global and local recognition of the increasing and unstable costs of energy combined with the impacts of fossil fuel energy use has caused the world to look at alternatives. The use of solar energy technology in particular holds tremendous potential. It represents an economic, social and environmental opportunity. Significant cost reductions (greater than 20%) are being achieved with respect to Solar power (PV) year over year, while performance is also improving. "The US Department of Energy expects the cost of solar power to fall by 75 percent between 2010 and 2020. By then, average costs will have dropped to a dollar per watt for big solar farms, $1.25 for offices, and $1.50 for homes, achieving the Holy Grail of grid parity with new coal and gas plants."[1] Germany is already half way there, with the 2012 average cost at $2.60 per watt versus the current North American average of $5.30 per watt.[2]

Arguments about whether solar energy is cost effective are largely over – the debate now is when a particular jurisdiction will hit "grid parity". Nova Scotia, with some of the highest energy costs in Canada, has a world class solar resource that is underutilized. The result is that "grid parity" could be reached within the next 5-10 years in Nova Scotia. The increased use of solar energy will most benefit those communities and economies able to foresee its potential and are able to plan and quickly adapt to a new energy reality.

Quality Urban Energy Systems of Tomorrow (QUEST) NS formed a Solar Subcommittee in April 2013 to provide comments, at the request of the Halifax Regional Municipality (HRM), on 2 solar reports commissioned by HRM in early January 2013[3]. The QUEST Solar Subcommittee members, comprised of industry, government and academic interests, met with the goal of making a set of actionable recommendations to the HRM Environment and Sustainability Standing Committee to both promote the use of solar energy and develop supporting policies to encourage passive solar and solar ready homes.

Planning departments and policies are some of the strongest tools in the box for municipalities in responding to and creating economic opportunities. With this in mind and the fortuitous timing of the review of HRM's Regional Plan currently underway, several of the recommendations are specifically flagged for consideration under the HRM RP +5 process.

In responding to the request for comment on the HRM reports that looked at the planning implications of solar orientation it became apparent that focusing on the HRM reports without considering the overall context for solar would be difficult. Encompassing appropriate solar recommendations in urban, suburban and rural settings is a challenging task. The QUEST Solar Subcommittee took a pragmatic approach to its initial review of the HRM reports and its recommendation and feels that it would be worthwhile to continue to explore the policy developments required to make HRM a true "Solar City" while implementing these initial ten recommendations.

[1] The Saskatoon StarPhoenix – August 17, 2013

[2] *Tracking the Sun VI, An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2012, Lawrence Berkeley National Laboratory, July 2013*

[3] HRM Environment and Sustainability Standing Committee Report http://www.halifax.ca/boardscom/SCenv/documents/13110esscinfo2R.pdf

Summary of Recommendations (see Section 3.0 for full explanation)

Short Term (1-2 years)

Lead by Example 15% Solar

Start Rural

Start Solar Planning Policy Development Now

Define Solar Ready

Encourage Solar Readiness Through Incentives

Recommendation #1

It is recommended that…**HRM lead by example** and work with other levels of government to maximize, promote and educate the public on passive solar opportunities, as well as solar air, solar water and solar power applications; and adopt a policy requiring a minimum of 15% of all new HRM owned buildings' energy use is met from solar technologies or integrated design (ie. day-lighting, passive solar, etc).

Recommendation #2

It is recommended that…**HRM develop a policy and guidelines that require houses constructed in rural areas follow passive solar criteria** as established by HRM. The Genivar report notes that there are few, if any, costs associated with implementing a number of passive solar criteria in such instances. The experience in rural areas would provide insight on how to implement similar policies in more densely populated parts of the municipality.

Recommendation #3

It is recommended that…**HRM Planning should start in depth solar policy development NOW and adopt best practices** that encourage passive solar and solar ready homes in urban, suburban and rural settings. Supporting policies could include zoning flexibility and planning incentives, renewable energy targets, reviewing setback policies, establishing "right to light" policies, extending financing initiatives based on the solar city model, and encourage training programs and incentives for builders and education initiatives for designers and homeowners.

Recommendation #4

It is recommended that…**HRM adopt a "Solar Ready" technical guideline** (See Appendix C example) that is uniformly enforced by municipal building inspectors.

Recommendation #5

It is recommended that…**HRM work with the Province to expand existing Efficiency Nova Scotia programming** to include rebates and incentives for passive and active solar systems and for encouraging solar ready new housing and commercial buildings.

RP +5

Resource Appropriately

Recommendation #6

It is recommended that…**HRM dedicate sufficient planning resources to enable these solar recommendations - hire a planner** dedicated for 2 years to solar policy development and implementation.

Mid Term (2-5 years)

Energy Labels

Recommendation #7

It is recommended that…**HRM and the Province of Nova Scotia launch a program for homes to obtain an energy rating and label** at the point of sale to encourage energy literacy as well as promoting the value of solar.

RP +5

Solar Ready Bylaw

Recommendation #8

It is recommended that…**HRM create a solar ready bylaw** and policies that mandate new construction solar readiness in both residential and commercial buildings in HRM.

Nova Scotia Solar Act

Recommendation #9

It is recommended that…**HRM work with the Province of Nova Scotia to explore legislation, policies** and other approaches to promote solar such as solar access rights, promoting solar orientation of residential and commercial buildings in the province, property tax assessment exemptions for solar, collaborating on a new Provincial Solar Act.

Long Term (5+ years)

A Solar Vision for HRM

Recommendation #10

It is recommended that…**HRM adopt a VISION for solar**. The QUEST NS Solar Committee's vision was that solar technology make a meaningful economic impact for residents and businesses by reducing the $2 Billion in energy expenditures in HRM while creating local employment opportunities.

1.0 Policy Analysis

Long Term Strategic Importance

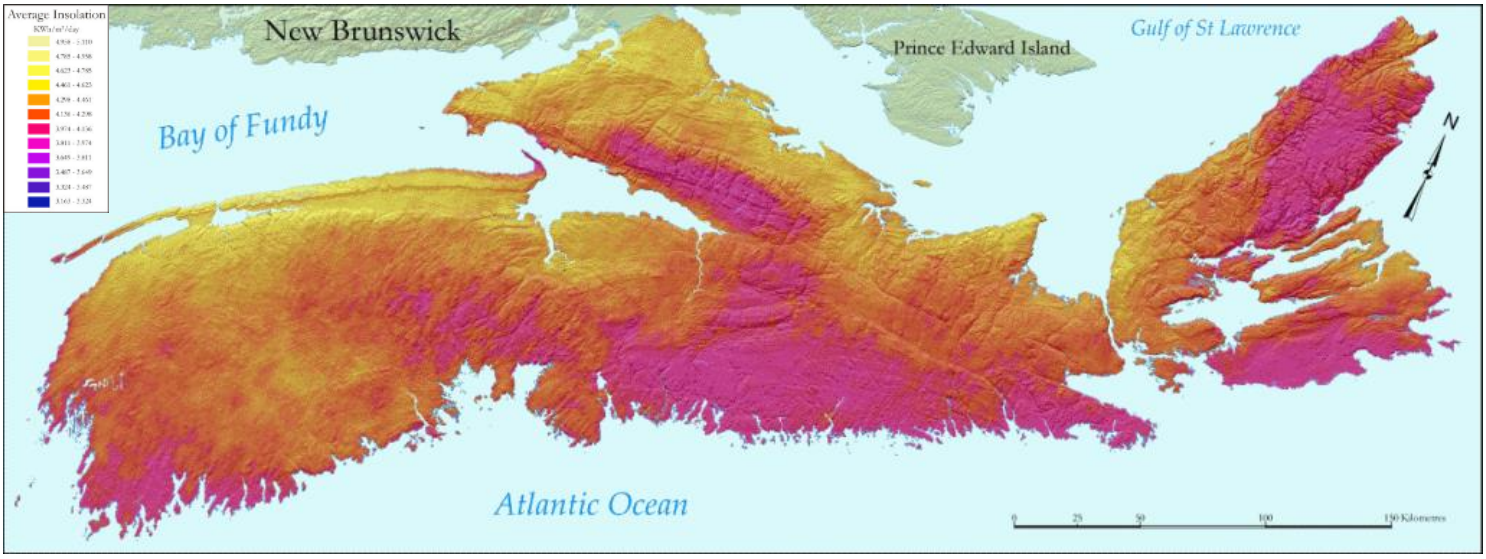
Low cost energy coupled with energy independence in the 20th century was a significant economic driver in North America. This strategic economic advantage has been challenged starting in the latter part of the 20th Century by the significant rise in energy costs and loss of energy independence. In recognition of this, energy independence in particular has become a focus of the US presidency, recognizing that economic fundamentals have to be addressed if the economic strength of North America is to be maintained on the world stage. This is a shared reality in Canada.

Saving big with solar in Truro, Nova Scotia…

In Truro, a 47 unit apartment building at 9 Braemar Court, with almost full occupancy, has enjoyed considerable savings with solar. During 2013, the building used only 882 litres of oil or approximately 20 litres/unit for domestic hot water. These cost savings allow the building owner to keep rents low while increasing profitability even in the face of rising energy costs showing that, once again, solar does work in Nova Scotia.

Nova Scotia's Excellent Solar Resource

Nova Scotia has a very good solar resource. Natural Resources Canada has developed a database of photovoltaic (PV **Solar Power**) potential for over 3500 municipalities[4] that demonstrates Nova Scotia and Halifax have good solar resources as compared to the rest of Canada and are well above global solar leaders such as Germany.



A world class resource. Nova Scotia Solar Resource Map (July 2009).[5]

[4] Natural Resources Canada Solar PV Potential. http://pv.nrcan.gc.ca/

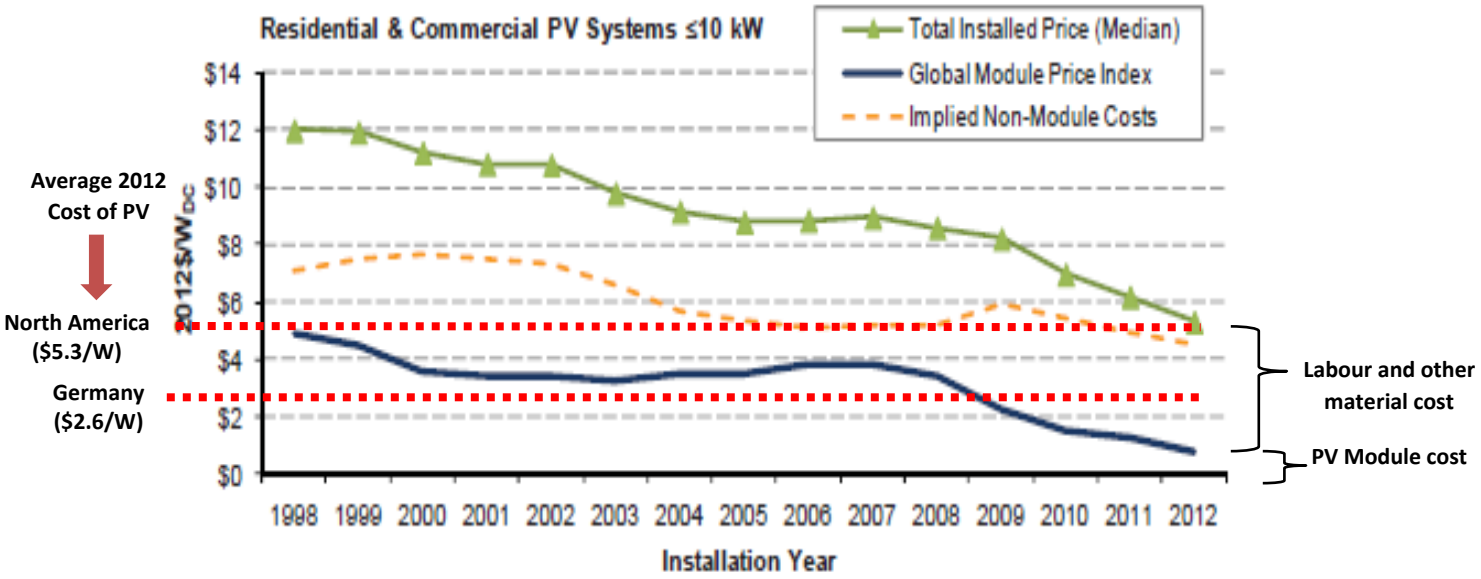
[5] Nova Scotia Community College, Applied Geomatics Research Group. http://agrg.cogs.nscc.ca/Solar-Resource-Maps

Economic Opportunities - Beyond Manufacturing

There are significant economic development opportunities in education, research, installation, assessment and design, project management, and financing - all related to the solar industry's exponential global growth. A local company, Green Power Labs, has done extensive work mapping solar resources[6] both at home and abroad. This demonstrates one of the underlining economic development attributes of the solar industry – that there is significant potential beyond just manufacturing.

Implications of Significant Solar Cost Reductions

Solar energy is becoming an increasing part of the energy cost and energy independence equation. Solar energy has the unique advantage of providing an energy generation source accessible by the average home and business owner. The barrier in North America to more ubiquitous use has been its cost relative to other generation sources. But that reality is changing rapidly, almost as rapidly as computing technology. The attached graph demonstrates the reality of the dramatically improving cost competitiveness of solar technology.



Solar PV Pricing's Steady Decline. (Source LBNL July 2013 Update)

A recently released report[7] in the US tracking the prices of installed systems showed 20-30% per year price reductions continuing as solar scales up. Another interesting conclusion from the report **was the US (and Canadian) market has total installed costs approximately twice that of Germany. This is due to a higher percentage of labour cost in North America with each installation. This demonstrates that there is significant room for further price declines in North America as unnecessary labour costs are eliminated with more efficient installation practices. It should be noted that many of the QUEST Solar Committee's recommendations are aimed at reducing these same unnecessary labour costs.**

[6] Solar Energy Mapping. Green Power Labs http://www.greenpowerlabs.com/serm.html

[7] *Tracking the Sun VI, An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2012, Lawrence Berkeley National Laboratory, July 2013*

Solar photovoltaic (Solar PV) use has moved in the last 5 years from something noteworthy to becoming commonplace and a part of everyday life. Its commonplace use is everything from miniature Solar PV panels powering household birdbaths to highway signage and garden lighting. In recognition of the pivotal point that has now been reached with solar PV, the US California cities, Lancaster and Sebastopol, in 2013 adopted bylaws mandating solar PV installation in all new housing construction.

Energy Independence and keeping some of the $2 Billion in energy expenditures local

This new solar/energy reality is sitting in front of HRM. There are numerous ways that HRM can pave the way to a transformational change in building energy use within HRM. The 2007 HRM Community Energy Plan[8] noted in 2006 that $1.2B is lost to the homeowner and business community annually by spending on energy costs, spending that did not happen in the early 20th century when Nova Scotia was energy independent. That $1.2B in local energy costs is estimated to have grown to $2B today. With a high reliance on oil for heating and coal for electricity, more than 50% of these energy expenditures leave the local economy.

How do we get that money back in the pockets of HRM home and business owners? Decisions about solar energy in HRM need to be considered in a broader and longer term policy context. It is clear that global energy demand is going to increase significantly, particularly in light of the development path of key developing countries such as China, India, and Brazil. This means that the cost of conventional sources of energy, particularly fossil fuel based energy, is predicted to continue to rise.

Climate change and its cost on fossil fuel energy

Furthermore, while global climate negotiations have been slow to date, there is little doubt that developed countries will have to reach some form of carbon neutrality between 2040 and 2060 for the global community to avoid the worst impacts of climate change. From an energy security perspective, an environmental perspective and a price stability perspective, it will therefore be important to make decisions now that will prepare HRM for maximum energy efficiency and a diverse range of local, low carbon and renewable sources of energy.

The energy independence provided by solar arrays is increasingly being recognized, and with that recognition solar energy is being implemented for its strategic energy security advantages.

Solar and Energy Security

"The flexibility of Solar PV has proved itself militarily as demonstrated by recent announcements by the US military that it is investing $7 billion in renewable energy technologies. The US Naval air Weapons Station has relied on a 14 megawatt array of solar panels in California's Mojave Desert for a third of its power since last year. Pearl Harbour will soon follow as the Pentagon goes off grid. The military is also incorporating solar in its forward operating bases. The new kit is a military imperative. The pentagon says the cost of refueling forward bases is $100 a litre."

(The Saskatoon StarPhoenix, August 17, 2013)

[8] Halifax Regional Municipality. 2007 Community Energy Plan. http://www.halifax.ca/environment/energyplan

Planning for the future and avoiding "stranded assets"

Any infrastructure (such as subdivisions, roads and buildings) built now in a manner that fails to maximize opportunities for energy conservation as well as renewable, low carbon energy, is likely to become a "stranded capital asset" before the end of its life. In other words, it is at risk of becoming obsolete before the end of its life. At a minimum, infrastructure not designed or constructed to easily take advantage of these opportunities will be worth much less in the future than infrastructure designed and constructed with this in mind. Governments should therefore ensure the design and construction of infrastructure does not result in such stranded assets.

The goal should be to design and build smart for a future where energy is more expensive, where GHG emissions are not acceptable, and where locally produced, renewable energy is much more valuable than it is today.

2.0 Legal Issues

Before influencing planning and other policies it is important to understand the legal issues surrounding any progressive solar recommendations that can act as a barrier to change.

Right-To-Light

As noted in both the Green Power Labs report, p.15 and the Genivar report, p.9, solar orientation is a critical element in optimizing solar energy collection. However, once a solar investment is made, its benefits can be severely impacted by new or altered structures that block the sun.

Figure 1: Solar Planning Gone Awry in HRM? A new building built to the south and next door to a sunroom and solar company in an industrial park (2011).

Adoption of "right to light" regulations using differing approaches have been employed in both the USA and Europe to address this issue. The situation in both Canada and the US has been described in a 2007 report by the Law Reform Commission of Saskatchewan, and specifically, the USA experience by Colleen Kettles in a 2008 report funded by the Florida Department of Energy entitled "A Comprehensive Review of Solar Access Laws in the United States".

This issue of solar access rights has been studied locally[9] and elsewhere in Canada[10] since the 1980's.

[9] Legal aspects of solar access in Nova Scotia. Blair Mitchell and Susan Holtz, Law Foundation of Nova Scotia, 1980.
[10] A LEGAL REVIEW OF ACCESS TO SUNLIGHT IN SUNNY ALBERTA, Alberta Environmental Research Trust, 1981.

In 1860 An Act Respecting Ancient Lights in the City of Halifax was proclaimed, which ultimately was incorporated largely intact into the Halifax City Charter, eliminating any post 1860 common law acquired "right to ancient light" in respect of windows and other apertures. That removal was itself repealed effective on amalgamation April 1, 1996. As a common law right, once repealed, it cannot be revived. Thus the right to ancient light with respect to windows and other apertures remains unavailable within the boundaries of the former City of Halifax as they existed as of March 31, 1996. This legislative history is limited in its application to the former City of Halifax windows and apertures. This raises two questions: whether the common law right to ancient light continues to exist in the rest of HRM. And whether solar panels, not addressed in the 1860 legislation, continue to have a right to light in all of HRM.

This is an area of legal uncertainty that will inhibit solar installations or homeowners who design passive solar homes. Providing certainty through the enactment of regulatory provisions, various options in respect of which are identified in the referenced reports, would be an effective way to encourage solar installations within Nova Scotia.

Property Tax

Members of the public have raised concerns from time to time about the prospect of increased property assessments as a result of solar panel installations. To date the Property Valuation Services Corporation (PVSC) has not increased a residential property value as a result of a solar panel installation. Similar uncertainty previously existed in Ontario over the potential property tax treatment of solar panels. To address this, Ontario enacted[11] Regulation 282/82 which exempted rooftop ancillary use solar panels from property assessment increases. To ensure that this concern does not act as a disincentive to solar panel installations, it is recommended that the NS Assessment Act be amended to mirror the Ontario legislation.

[11] www.canadianenergylaw.com/2012/01/articles/electricity/ontario-amends-property-tax-treatment-of-renewable-energy-installation

Developer Anti-solar covenants

Restrictive covenants imposed by a subdivision developer exist in some major HRM subdivisions. Now that communities have moved into a new energy era, the policy thinking restricting the use of energy saving devices for aesthetic reasons by the developer, has become outmoded and can impede the adoption of cost effective and environmentally friendly new approaches to energy use and generation. Similarly, in recognition of this, the NS Clothesline Act, was adopted in 2010 to prevent restrictions on the use of exterior clotheslines. It is recommended that the act be amended to include the elimination of property covenants restricting the installation of solar panels.

Heritage Properties

A review of municipal heritage legislation should be undertaken to facilitate heritage properties taking advantage of solar opportunities.

3.0 Recommendations

The QUEST Nova Scotia Solar Subcommittee has reviewed the reports submitted by Genivar and Green Power Labs to the Halifax Regional Municipality (HRM) Environment and Sustainability Standing Committee. After careful consideration and discussion, the Solar Subcommittee has prepared several recommendations, that should be implemented in the short term (1-2 years), mid-term (2-5 years) and long term.

Short Term Recommendations(1-2 years)

Lead by Example 15% Solar

Recommendation #1

It is recommended that…a target of a minimum of 15% of overall building energy use in all new HRM owned buildings be provided by solar technologies or design. This is cost effectively achievable with today's variety of solar technology. Passive solar technologies for heating and lighting as well as active technologies for air, water and power (photovoltaic) technologies should be considered. HRM is already building LEED buildings, and as part of that integrated design process an energy model is a requirement, so determining the overall building energy use and measuring it against solar energy usage designs would be relatively easy. The new Canada Games Centre is an excellent example where multiple solar technologies have been cost effectively deployed. The building has a large solar hot water array, but also solar air duct heaters to heat the ventilation air to the 50,000 ft^2 gym and integrated passive solar features like day-lighting that can be used to offset electric lighting. HRM won the **Canadian Solar Industry Association's Solar Installation of the Year Award in 2011** for this facility.

Halifax Canada Games Centre. CANSIA Solar Award 2011

HRM has demonstrated leadership in promoting solar with its Solar City initiative[12]. The Solar City program's goal of installing up to 1,000 solar hot water systems within 18 months is extremely ambitious and the funding/financing model unique.

HRM should continue to lead by example and work with other levels of government to promote and educate the public on passive solar opportunities, as well as solar air, solar water and solar power applications. Solar air – preheating air used for ventilation should also be a consideration. HRM should

[12] Halifax Regional Municipalities' Solar City Program. www.halifax.ca/solarcity

adopt a policy requiring that a minimum of 15% of each new HRM buildings' energy use come from solar technologies.

It is recommended that HRM continue its efforts to retrofit appropriate existing municipal buildings to take advantage of solar. This develops the capacity of the municipality to understand the benefits and challenges associated with solar technology – in both new and retrofit applications.

Halifax Police Station utilizing solar hot water

Recommendation # 2

It is recommended that…HRM develop a policy and guidelines that require houses constructed in rural areas follow passive solar criteria. The Genivar report notes that there are few, if any, costs associated with implementing a number of passive solar criteria in such instances. The rural experience would provide insight on how to implement similar policies in more densely populated parts of the municipality.

There is a natural real estate market attraction to consider solar orientation during design. Homes that are brighter with more southern exposure and living spaces tend to command higher value in the market.

Start Solar Planning Policy Development Now

Recommendation #3

It is recommended that…HRM start in depth solar policy development now. There is a wealth of existing planning policies that provide a strong foothold for HRM to quickly adopt and leapfrog into a Solar City. HRM should review the myriad of solar policies in other jurisdictions, adopt best practices and start developing supporting policies that encourage passive solar and solar ready homes in urban, suburban and rural settings. S upporting policies could include zoning flexibility and planning incentives, renewable energy targets, reviewing setback policies, establishing "right to light" policies, extending financing initiatives based on the solar city model, encourage training programs and incentives for builders and education initiatives for designers and homeowners.

HRM Solar Policy Success

Prior to the launch of HRM's Solar City program in December 2012, the municipality consulted extensively with the Nova Scotia solar industry about streamlining the permitting process. Industry representatives and the HRM Permitting office met over a 2 year period and developed a fast-track, flat fee approach to permitting that has increased solar contractor permits. A solar permit guide was also developed and over 40 building inspectors took a 1 day custom course at NSCC on solar installations.

Define Solar Ready

Encourage Solar Readiness Through Incentives

Recommendations #4 & #5

It is recommended that…HRM adopt a definition of Solar Ready and work with the Province to expand existing Efficiency Nova Scotia programming to include rebates and incentives for Solar Ready construction. It is important to create a transition to a solar future by encouraging new housing and commercial buildings owners to voluntarily adopt Solar Ready construction. Although it is not currently the mandate of the municipality to offer direct incentives for solar, the municipality should play an active role in creating a consistent Solar Ready building practice and can influence new construction to adopt these best practices.

Considering the 50+ year lifespan of buildings, an important first step in the evolution and wide scale adoption of solar technologies is ensuring homeowners and building owners look into the near future and avoid unnecessary costs to adopting solar at that time.

The municipality should encourage Efficiency Nova Scotia to re-establish a $400 incentive for homeowners to build "Solar Ready" and support technical enforcement costs including the training of building inspectors. The municipality should also work with Efficiency Nova Scotia and the solar industry to adopt a uniform "Solar Ready" guideline. Currently what it means to build "Solar Ready" is all over the map. Some homeowners are very disappointed when they learn after the fact, that the "solar ready" features of their homes are inadequate to facilitate a cost effective installation. This issue of inconsistent solar ready building and marketing practices could easily be solved with the input and uniform enforcement by municipal building inspectors.

Resource Appropriately

Recommendation #6

It is recommended that…**HRM Planning dedicate resources** to enable these solar recommendations - hire a planner for 2 years dedicated to solar policy development and implementation.

It was recognized by the QUEST Solar Committee that planning resources in HRM currently cannot meet the demands of the development industry and therefore in order to implement these recommendations, new and dedicated resources are required.

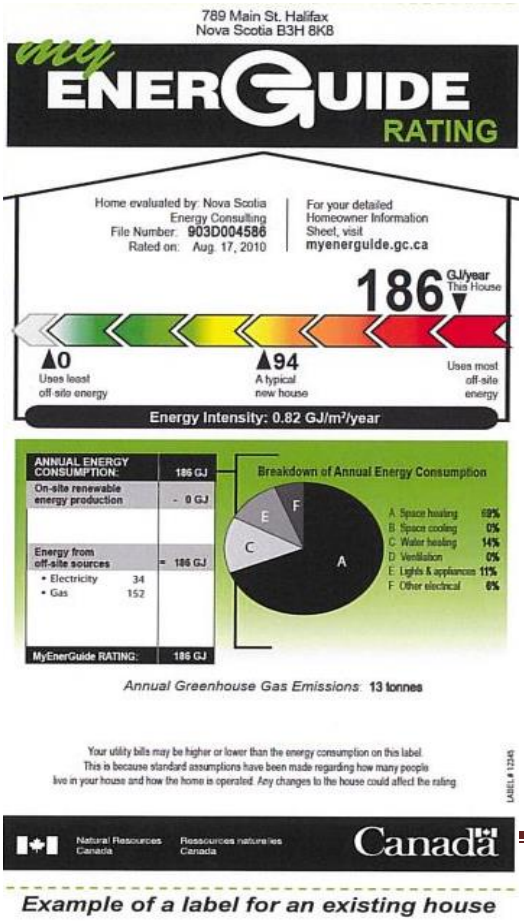
Mid Term Recommendations (2-5 years)

The committee has identified a series of recommendations that should be adopted in the mid-term (2-5 years). These were moved to a longer time frame than the first six recommendations as it was recognized that these recommendations were either not entirely within the municipality's mandate or legislative powers or they require deeper analysis and engagement with industry for effective implementation. There are some alternatives that could be quickly enacted by the municipality should it choose only to adopt the spirit of these mid-term recommendations.

Energy Labels

Recommendation #7

It is recommended that…**HRM and the Province of Nova Scotia launch a program for homes to obtain an energy rating and label** at the point of sale to encourage energy literacy as well as promoting the value of solar.



Example of a label for an existing house

Solar Ready Bylaws

Recommendation #8

It is recommended that…HRM create a solar ready by-law and policies to mandate for all residential and commercial buildings in HRM.

In the long term there can be no doubt about the wide scale adoption of solar technologies. However considering residential building stock can last 100+ years and the majority of opportunities will involve retro-fitting homes to solar, it is critical to lower the adoption costs by incorporating solar readiness into new construction - sooner rather than later.

Building "solar ready" homes adds very little to the overall new construction costs (less than $500). By coupling the shorter term recommendations #4 & #5, it is hoped that voluntary early adoption will "prime the pump" and create enough long term market support to ease the transition into full "solar ready" construction 100% of the time.

This recommendation is less onerous than what is currently required in other jurisdictions, some of which are mandating the complete solar installation. Two cities in California recently adopted solar mandates for PV installation. In 2005 Madrid adopted a bylaw requiring the use of solar hot water technology which has resulted in exponential growth of solar in the city.

There are currently 36 communities[13] across BC who have already committed to a Solar Ready bylaw that requires all new single family homes (where applicable) to be built to accommodate future installation of a solar hot water system for water heating. In the city of Vancouver, this bylaw has been in place since 2008 and in the last two years, approximately 1220 permits have been issued for new homes the majority of which have been built solar ready.

Going one step further than just Solar Ready…Solar Now…

"Requiring that all new houses install solar panels, or are designed to be solar ready at the time of construction, does have many cost advantages. Up until now, most solar mandates have only required new-build homes to be solar ready (California, Arizona), or at the very least, offer the option of solar ready to customers (Colorado, New Jersey) but they have stopped short of actually requiring the installation of solar panels on the roof. This is where Lancaster and Sebastopol are different.

In Lancaster, the mandate says that all new residential homes on lots of 7,000 sq. ft. (≈ 1/6 acre) or larger must install a solar system of 1.0–1.5 kW. In Sebastopol, all new residential and commercial buildings are required to install 2 watts of power per square foot of insulated building area or offset at least 75 percent of the building's annual electric load."

Source: Rocky Mountain Institute

[13] QUEST INTEGRATED COMMUNITY ENERGY SOLUTIONS PROGRESS REPORT , PROVINCE OF BC, August 2013

Nova Scotia Solar Act

Recommendation #9

It is recommended that… **HRM work collaboratively with the Province to explore areas of mutual interest around legislation, policies** and other approaches to promote solar such as solar access rights, promoting solar orientation of residential and commercial buildings, property tax assessment exemptions for solar, and adopt best practices from other jurisdictions for solar ready housing building codes. It is further recommended that this standard and other legal changes form the basis of discussion for a Provincial Solar Act.

Long Term Recommendation (5+ years)

A Solar Vision for HRM

Recommendation #10

It is recommended that…**HRM adopt a VISION for solar**. There is an opportunity for HRM to engage its residents on creating a collective vision for the use of solar. The QUEST NS Solar Committee's vision was that solar technology make a meaningful economic impact for residents and businesses by reducing the $2 Billion in energy expenditures in HRM.

4.0 Highlight of Future Considerations

During the course of discussions within the QUEST Solar Committee a variety of "parking lot" issues came up. This section is intended to highlight issues to consider in the future.

The need to study Economic Impact to support policy

It is of primary importance that HRM commit to studying the economic implications of adopting a full range of solar policies, from solar ready buildings and subdivision policies to regulatory schemes that require solar installations for new buildings.

While it is important to identify the implications of solar orientation for rural, urban and suburban areas, it is also important to address the economic implications of policies around passive solar, PV and solar thermal readiness.

Furthermore, it is imperative that research be undertaken to examine the full economic impact of these policies for the HRM and surrounding region, not just a cost-benefit analysis. There are broader implications for the region that go beyond the building's owner and its occupants.

While the "economics" should not necessarily drive solar policies, an economic study would provide valuable information to help determine what factors are at play. These factors then point to possible policy options that are both acceptable and viable for the short and medium term with the aim being to encourage passive solar and solar readiness where conditions are appropriate.

Other Policy Considerations – Energy Security and Reliability

As the technology matures, solar energy provides an opportunity to increase the reliability of the electricity grid through distributed energy generation and storage. With increasing electricity consumption and load in HRM, there is also the possibility to avoid new transmission costs. Providing homeowners a more robust and secure energy future should be one of the desired outcomes of any solar enabling policies.

Other Policy Considerations – Social and Environmental

Although the impacts can vary greatly depending on the type of solar technology or scale of system, the environmental and socio-economic impacts specific to HRM should consider socio-economic benefits including: improved health, greater energy self-reliance, reduced dependency on fuel imports, increased work opportunities, and technological advances. The environmental impacts should consider reduced air pollution, greenhouse gas emissions, impacts on watersheds, reduced transportation of energy resources, opportunities for use of degraded land, brownfields or less desirable land space, and sustained natural resources for the long term.

Appendix A: Policy Scan

Solar regulations in other jurisdictions

Solar regulations in Canada

- **Brampton, Ontario, 2009**
  Under the Renewable Energy Approval (REA) Act, solar energy facilities are exempt from all municipal planning approvals including land use planning permits, zoning by-laws and plans of subdivision.

- **Edmonton, Alberta, 2008**
  Micro Generation Regulation: allows Albertans to generate their own environmentally friendly electricity and receive credit for any power they send into the electrical grid.

- **Vancouver, British Columbia, 2008**
  Bylaw requiring all new home construction is built Solar Ready. By 2013, 35 other BC communities have adopted similar provisions.

Solar regulations in Europe

- **European Union, 2007**
  A minimum proportion of the heating requirement has to be met from renewable sources. Solar obligations are probably the single most powerful tool for promoting the use of renewables in new buildings due to their benefits.
- **Spain, 2006**
  Solar obligations are in force in more than 50 Spanish municipalities by local governments. By using a new Technical Building Code to cover part of the domestic hot water (DHW) demand with solar thermal energy. This obligation applies to all new buildings and to those undergoing major refurbishments.
- **Germany, 2009**
  All new homes built in Germany from January 1st 2009 are required to install renewable energy heating systems under a new law called the Renewable Energies Heating Law. (20% of the household's heating and domestic hot water needs).
- **Italy, 2006**
  Local solar obligations are in force in a number of small municipalities around Milan. A municipal obligation is in advanced state of discussion in the City of Rome.
- **Portugal, 2006**
  The new Portuguese buildings code includes an obligation to install solar thermal systems or some other form of renewable energy providing a similar energy saving.

Solar regulations in US

- **National level, 2010**
  Solar Access rights are in place in 39 states protecting access to sunlight on a property or allowing for the installation of solar equipment through solar access laws.
- **New Mexico, 1978**
  The legislature declares that the right to use solar energy is a property right, the exercise of which is to be encouraged and regulated by the laws of this state
- **California, 1978**
  Solar access rights establishes the legal right to a solar easement, defines which solar energy systems are covered by its provisions, and limits local governments from adopting ordinances that would unreasonably restrict the use of solar energy systems.
- **Ashland, Oregon, 1982**
  Protecting Solar Access through Setbacks and Permits to ensure that shadows at a northern property line don't exceed a certain height.
- **Madison, Wisconsin, 2007**
  Special permitting process has been created in historic districts to allow installation of solar energy systems.
- **New Jersey, 2007**
  Legislation to prevent homeowners associations from prohibiting the installation of solar collectors on certain types of residential properties.
- **Lancaster, California, 2013**
  City has adopted a bylaw that mandates installation of solar PV on all new housing on lots greater than 7,000 sq. ft. up to 1.5 kw per home.
- **Sebastopal, California, 2013**
  City has adopted a bylaw that mandates installation of solar PV on all new residential and commercial buildings. The requirement is to install 2 watts of power per square foot of building area or offset at least 75% of building's annual electrical load.

Appendix B: Definitions

Definitions of Solar Terms and Solar Technology

- **Solar Ready Homes**
  There are four essential elements to ensure that a new home can be classified as solar ready.
  I. **Structural.** Residential solar equipment is typically not very heavy (less than 300 lbs) , but structural consideration for wind and snow loads do need to be taken into account. Typically an additional truss would suffice in make a roof solar ready;
  II. **Orientation**. An unobstructed, south facing roof, pitched a minimum of 15% is ideally suited for solar panels. Depending upon the size and type of solar system (PV or heat) a large enough area to mount equipment is required. Solar PV systems will require a larger roof area than solar heat for the same energy input;
  III. **Rough-in chase**. A straight pipe/wiring chase of 3"-4" conduit from the roof to the mechanical/electrical room will avoid the cost and complexity of routing piping after the fact;
  IV. **Space** left in the utility room for the control system and storage tank for solar heated water.

  A best practice is also to label the system "Solar Ready" after proper allowances and inspection has been made.

  The Canadian Solar Industry and Natural Resources Canada have produced a "Solar Ready' Guideline and "Solar Ready" Builders Specification (see Appendix C).

- **Solar Photo-Voltaic (PV)**
  The photo-voltaic effect is the direct conversion of sunlight into electricity. Electrons in the cells in a PV panel are energized by sunlight. Once electrons are energized or "freed", they move in a single direction creating a direct current (DC). The power generation is measured in watts. Most homes will usually require a 3000 – 5000 watt system. A PV installation could mean only supplemental power for the home, and during times of excess production the surplus power could be sent to the grid for credit, or during times of insufficient PV power electricity is drawn from the utility. An off-grid home would produce enough power to charge batteries to allow for year round living.

- **Solar Heat**
  This broad category refers to any solar application which generates heat that is applied to the domestic hot water or heating systems within or around a home. Those systems are based on the movement of either fluids or air. The term is usually used as a separate stream to a solar PV application (although both are often used on the same home). Halifax's Solar City program is a good example of the application of solar water heating technology.

- **Passive Solar**
  Passive solar is a concept of using the sun's energy to better light and heat a home naturally through placement of windows. Passive solar design has a wide spectrum of performance from better lighting, to full heating of homes using only the sun. A passive solar home refers to the complete package, not just a few, south-facing windows or porch that may provide heat during a winter day, yet subsequently lose that same heat through glass later. Passive solar as applied to homes, ideally requires a design element that can capture, store and distribute heat gained from direct sunlight. A passive solar house acts as a large heat collector (through the heating season) but also must be able to manage the heat gains of our warmest days. To be effective, the home must be situated on a building lot that ensures maximum solar gain when most needed.

  Solar Nova Scotia has produced an excellent Solar Home Design Guidebook (see References).

- **Passive House**
  This term is included to avoid confusion with the more general passive solar or passive home terminology. Passive House (Passivhaus) is a total design concept that originated in Germany. These homes may or may not include some type of active solar system. Before being certified as such, they must meet rigorous standards applied to the overall building envelope and contents from the perspectives of sustainability and energy conservation. Passive House design and standards are also applied to non-residential buildings.

- **Net Zero**
  A net zero home uses as much energy as it produces on a year round basis. The home can use both passive and active solar systems to reach that goal but will also use the most up-to-date building science to maximize heating and cooling savings. All energy applications (plus occupant behaviour) in the home such as the use of efficient appliances will all be important to reaching a net zero goal.

- **EnerGuide rating system**
  Buildings are responsible for a significant percentage of greenhouse gas emissions at the community level. In Nova Scotia, heavy reliance on coal and oil for electricity and home heating translates into higher levels of greenhouse gas emissions and energy costs than the national average. With over 80 per cent of home energy use in Nova Scotia going to space heating and hot water, energy efficiency plays a significant role in both greenhouse gas emissions and utility bills.

  The majority of Nova Scotia's housing stock is older and is associated with poor energy performance compared to today's homes that are constructed according to meaningful energy efficiency code requirements. While many homes in Nova Scotia have already undergone energy upgrades such as sealing, better insulation, more efficient heating equipment and the introduction of renewable energy, ample opportunity exists to further increase the energy efficiency of the bulk of our homes. In Canada, energy ratings and labelling is commonplace for

most major appliances and vehicles. Although home energy labelling is voluntary in Canada, over one million homes already have an EnerGuide label.

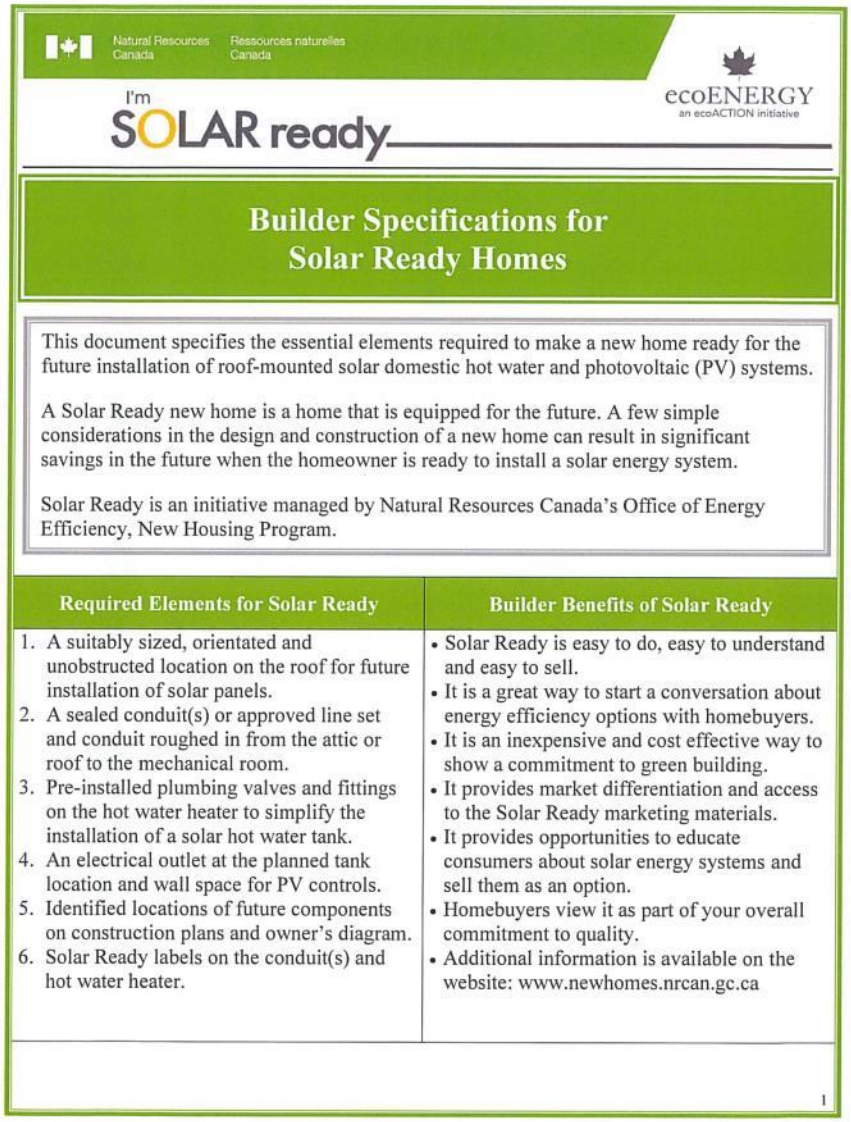
There are many jurisdictions throughout Europe, Australia and the USA that require energy labelling on homes and who reap the many social, environmental and economic benefits associated with energy labels on homes and the related spin offs. For Nova Scotia, this would mean: increased "energy literacy"; reduced greenhouse gas emissions; stimulated local employment; less money spent on foreign energy; reduced risk of energy price increases; helping to foster a 'conservation culture'; reduced need for energy supply infrastructure; and the establishment of energy efficiency in the mainstream real estate market.

An Australian study showed that homes that had retrofits or were built to a superior standard sold at a price premium, while the values of other homes were not affected. Dave Foster of the Canadian Home Builders' Association has stated that "While there are legitimate concerns on how to effectively implement a resale home energy label, it is important for buyers to receive energy related information from an objective third party. Our members are seeing an increase in public interest and we are in favour of mandatory labelling."

It is strongly recommended that as a first step in Nova Scotia, we launch a program to have homes obtain an energy rating and label for homes at the point of sale. Providing disclosure by assigning a meaningful value on a home's energy performance will offer increased transparency, help drive the local economy and protect both consumers and the environment.

Appendix C: Solar Ready Builders Spec (by NRCan)

For full Solar Ready Guidebook see References.



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ecoENERGY
an ecoACTION initiative

I'm SOLAR ready

Builder Specifications for Solar Ready Homes

This document specifies the essential elements required to make a new home ready for the future installation of roof-mounted solar domestic hot water and photovoltaic (PV) systems.

A Solar Ready new home is a home that is equipped for the future. A few simple considerations in the design and construction of a new home can result in significant savings in the future when the homeowner is ready to install a solar energy system.

Solar Ready is an initiative managed by Natural Resources Canada's Office of Energy Efficiency, New Housing Program.

Required Elements for Solar Ready	Builder Benefits of Solar Ready
1. A suitably sized, orientated and unobstructed location on the roof for future installation of solar panels. 2. A sealed conduit(s) or approved line set and conduit roughed in from the attic or roof to the mechanical room. 3. Pre-installed plumbing valves and fittings on the hot water heater to simplify the installation of a solar hot water tank. 4. An electrical outlet at the planned tank location and wall space for PV controls. 5. Identified locations of future components on construction plans and owner's diagram. 6. Solar Ready labels on the conduit(s) and hot water heater.	• Solar Ready is easy to do, easy to understand and easy to sell. • It is a great way to start a conversation about energy efficiency options with homebuyers. • It is an inexpensive and cost effective way to show a commitment to green building. • It provides market differentiation and access to the Solar Ready marketing materials. • It provides opportunities to educate consumers about solar energy systems and sell them as an option. • Homebuyers view it as part of your overall commitment to quality. • Additional information is available on the website: www.newhomes.nrcan.gc.ca

1

Consumer Benefits of Solar Ready

- Solar Ready is a cost effective way to be prepared for a future rise in energy costs.
- Future installations will be easier and energy savings will be optimized.
- Planning up front may eliminate the need for future building permits.

Solar Ready is a simple yet effective way for builders and homebuyers to build for the future.

2

1. Roof Location for Solar Panels

In most residential applications, roof-mounted equipment is the most cost effective way to install solar energy systems. The "ideal" location for much of Canada would be on a south facing roof with a 9/12 pitch. However, less than a 25% drop in performance from this ideal can be achieved with orientations between due west through to south-east and roof pitches between 5/12 and 12/12. Some panels may be installed on a rack to adjust the pitch. Shading of the designated area by dormers, adjacent houses or trees must be avoided.

Roof Plan: location options A&B

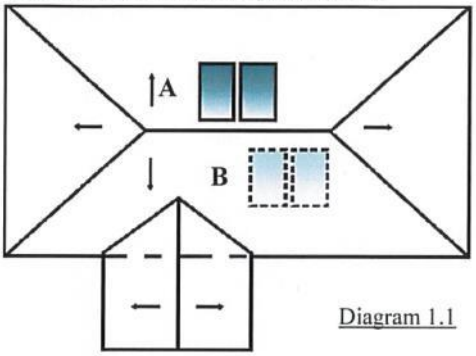
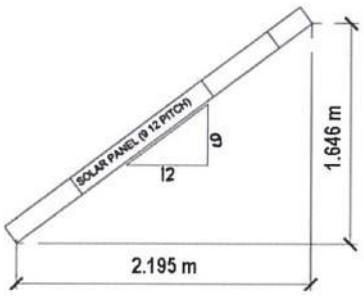


Diagram 1.1



1. Solar Ready Program Requirements – Roof Location:

1.1 For each house model, provide a minimum of 9.3 m^2 (100 sq. ft.), with no dimension less than 2.7 m (9'), of unobstructed roof;

1.2 Provide an orientation of the roof location anywhere from south-east to west;

Note: If the orientation of the model is not known then show 2 locations on opposite sides of the roof (180 degrees apart). This way, however the model is placed, one of the locations will be pointing between south-east and west. See diagram 1.1 as an example.

1.3 Provide a roof pitch in the designated location of no less than 5/12 and no more than 12/12.

Helpful Hints for the Roof Location

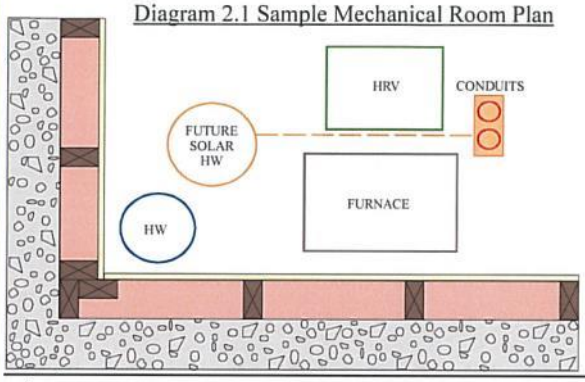
- Vaulted or cathedral ceilings may mean the attic isn't accessible so you may need to exit the roof and flash, cap and seal the conduit(s).
- Any skylights that are located within the designated area will need to be relocated.
- The location of roof vents may need to be altered to accommodate the panels.
- Typical solar panels will not weigh enough to require truss changes, however, check with your truss manufacturer or local building official for point load requirements.

3

2. A Conduit or Approved Line Set from the Roof to a Mechanical Room:

The goal is to run a conduit or pair of conduits from an accessible attic space to an accessible location in the mechanical room to allow future installation of wires for photovoltaic systems and/or fluid and sensor lines for solar thermal systems. While wires are flexible, the current technology for solar thermal lines will require a nearly straight conduit, i.e. no elbows. Central vacuum tubing is suggested. Builders should consult their local building officials and electrical safety authority to ensure code compliance.

Diagram 2.1 Sample Mechanical Room Plan



2. Solar Ready Program Requirements – Conduit Provisions:

Provide two 5 cm (2") diameter or one 10 cm (4") diameter plastic pipe(s) that run from an accessible attic to a planned mechanical room or other accessible room. Additionally:

a. the pipes must be relatively straight;

b. the ends of the pipe(s) must be capped (not glued), with appropriate manufactured caps, the caps must be sealed in the attic and the space around the pipe(s) must be sealed to the vapour barrier to prevent air leakage;

c. in the attic, the pipe(s) must terminate above the top of the insulation with at least 0.9 m (3') of vertical workspace above the pipes to allow for access;

d. if the attic is not accessible, the conduit(s) must exit the roof and be capped, sealed and flashed appropriately; and

e. in the basement, the pipe(s) must not terminate in an area where they will be obstructed by duct work, major plumbing pipes or room finishes, the pipes should extend below the floor joists and the pipes should be labeled. Consult your local building official for fire separation requirements.

Note: If you know the specific requirements of the solar system that will be installed it is acceptable to run the actual line sets needed rather than a simple conduit. An empty 5 cm (2") conduit will be required to allow the option of installing a future PV system.

4

Helpful Hints for Conduit Provisions:

- In a two storey home, the provision of a wall that goes from the mechanical room to the attic will facilitate conduit runs. Many plans will need some redesign to get a common stacked wall location.
- Design the stacked wall location such that it does not fall directly below a truss.
- Two 5 cm (2") pipes provide greater installation flexibility than a single 10 cm (4") conduit. 5 cm is flexible enough to allow slight bends. Elbows are not acceptable.
- The plastic conduit is essentially a placeholder. Where required by code, a secondary approved conduit could be run inside it at the time of system installation.
- Running the actual line sets needed for specific solar systems is acceptable and would eliminate the need to ensure straight runs from the roof to the attic since the line sets can be installed with bends and turns. This may reduce costs now or in the future. With this option, at least one conduit must be run for a future photovoltaic (PV) system.
- The most common solar panels need either two 9.5 mm (3/8") dia. or two 19 mm (3/4") dia. insulated copper lines. However, choosing to install a specific line set may restrict homeowners' options for future solar thermal system installations.

3. Pre-installed Plumbing Connections for Future Solar Tank:

Typical solar thermal systems require the installation of a separate storage tank. Install valves and fittings to make future connections simple and affordable.

3. Solar Ready Program Requirements - Plumbing Connections:

(Refer to Diagram 3.1)

3.1 Provide two tees connections in the cold water inlet pipe that delivers cold water to the main (existing) water heater.

3.2 Provide shut-off valves on each of the tees and one on the main pipe between the two tees to allow for the quick connection of a future tank.

Sample installation with a solar hot water tank on the left connected to the regular hot water heater on the right.

5

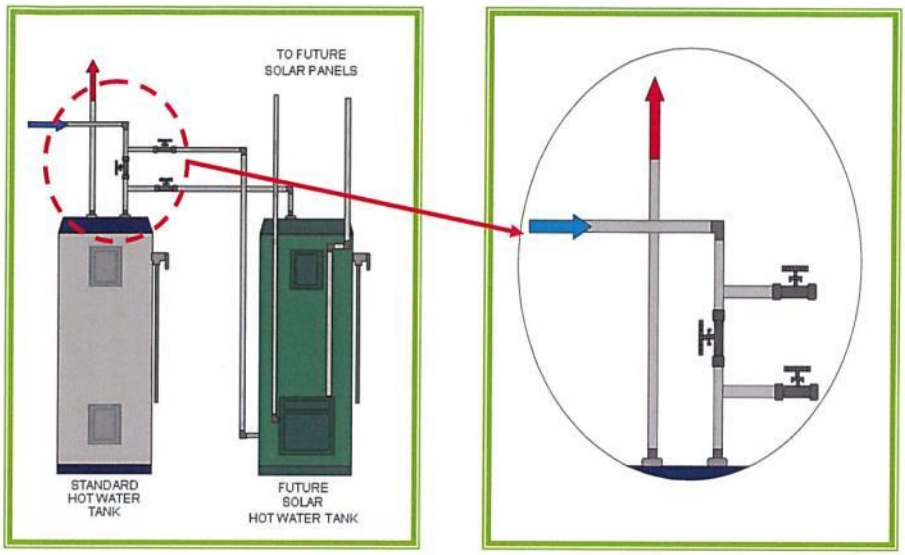


Diagram 3.1 Plumbing Connections

4. Provide an Electrical Outlet Near the Planned Water Tank Location:

Most solar thermal systems will require an electrical outlet for pump or control operation. Ensure a 110 volt plug is easily accessible. Space should also be left for the electrical panel or inverter needed for a future PV system. This could be in the mechanical room or near the main electrical service panel. Wall space of 1 m^2 (3' x 3') will be sufficient.

4. Solar Ready Program Requirements – Electrical Connections:

4.1 Provide one 110 volt outlet within 1.5 m (5') of the planned solar water tank location - the outlet can be on the same circuit as a power vented water heater;
4.2 Provide 1 m^2 (3' x 3') of wall space for a PV system connection or inverter.

5. Location of Components on the Construction Plans:

It is important that all of the elements needed for future installation of a solar system be identified on the construction plans for future reference. This will make it easier for homeowners and contractors to install the future system cost effectively. A simple diagram for the homeowner showing key component locations is desirable.

5. Solar Ready Program Requirements – Construction Plans Identification:

On the construction plans and homeowner's diagram clearly identify:
5.1 the roof location(s) for solar panel installation (Diagram 1.1 on page 2);
5.2 the location of the conduit(s) or line set and conduit (Diagram 2.1 on page 3);
5.3 a 1 m^2 (3' x 3') floor location that will accommodate a future solar storage tank in the mechanical room (Diagram 2.1 on page 3);
5.4 1 m^2 (3' x 3') of wall space for a photovoltaic system connection or inverter.

6

6. Label the Solar Ready Components:

Solar Ready components should be clearly identified for the future homeowners. This will assist both in marketing and in the future installation of solar energy systems. Labels are available for ordering through NRCan. Visit www.newhomes.nrcan.gc.ca for more information.

6.1 Solar Ready Program Requirements - Solar Ready Labels:

6.1 Provide small (5 cm x 7.5 cm) Solar Ready labels on the basement end(s) of the conduit(s) or the installed line set and conduit.

6.2 Provide a large (10 cm x 15 cm) Solar Ready label on the main hot water tank.

Sample Label

7. Typical Costs for Solar Ready:

• Plumbing	$ 60 - $100	Plumber to install shut off valves
• Electrical Outlet	$ 30 - $ 50	Electrician to add outlet
• 2-5cm Central Vac Conduits	$150 - $180	Contractor to place conduits
• Design Time (per plan-set)	$ 35 - $ 50	Designer to verify plans for roof layout & conduit placement
• Labels	$ 5	Contractor to order labels
•Total Estimated Cost	**$280 - $380**	

8. Solar Ready Marketing:

NRCan has developed a Solar Ready graphic which may be used in promotional materials. A brochure, *Are You Solar Ready?* explaining the benefits and features of a Solar Ready new home is available for distribution to interested home buyers. Builders may order large and small labels for hot water tank and conduit labeling. Additional information on Solar Ready new homes is available at **www.newhomes.nrcan.gc.ca**

7

9. What can you expect from your Solar Ready home?

The Solar Ready provisions in this specification will make it easier and more cost efficient for homeowners to install, within the 9.3 m^2 (100 sq. ft.) of roof area and based on current technologies, either:

- up to two panels for a roof-mounted solar domestic hot water system (which can provide up to 50%-60% of a typical families hot water needs) OR
- up to a 1.25 kilowatt (kW) photovoltaic system to generate electricity OR
- a combination of one solar domestic hot water panel and up to 0.65kW of photovoltaic panels to generate electricity.

This makes the homes you build today even better in the future. Solar ready is a cost effective way to empower homeowners to benefit from solar technologies.

Solar Ready Checklist	
Program Requirements	**Verified**
1. Roof Location: 1.1 at least 9.3 m^2 of unobstructed area (min. 2.9 m dimension), 1.2 orientation SE to W or 2 locations noted on plans, 1.3 roof pitch between 5/12 and 12/12.	☐
2. Conduit Provisions: 2.1 two 5cm diameter or one 10 cm diameter plastic pipe(s) that run from an accessible attic or roof to a planned mechanical room.	☐
3. Plumbing Connections: 3.1 two tee connections on the water heater's cold water inlet line; 3.2 shut off valves on both tees and on the main pipe between the tees.	☐
4. Electrical Connections: 4.1 a 110 volt outlet located near the hot water heater; 4.2 1m^2 available wall space for PV system connection or inverter.	☐
5. Construction Plan Identification/Homeowner's Diagram: 5.1 the roof location(s) for solar panel installation; 5.2 the location of the conduit(s) or line set; 5.3 the 1 m2 area for the future solar storage tank in the mechanical room; and 5.4 1 m^2 of wall space for a PV system connection or inverter.	☐
6. Solar Ready Labels: 6.1 small Solar Ready labels on the basement end(s) of the conduit(s) or the installed line set and conduit; 6.2 a large Solar Ready label on the main hot water heater.	☐

8

Appendix D: References

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