Incorporating Solar Energy in New Habitat Homes

A Manual for Collaborations between Habitat Affiliates and Rotary and Rotaract Clubs in Canada

This manual was created by the Renewable Energy Task Force of the Environmental Sustainability Rotary Action Group (ESRAG) with review by the staff of Habitat for Humanity International, local Habitat Chapters, and Rotary International.

ESRAG is an independent, Rotary-affiliated entity and is not an agency of, or controlled by, Rotary International.

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Overview of Solar for Habitat Affiliates

Purpose

The purpose of this guidebook is to help Habitat for Humanity affiliates and their local Rotary and Rotaract clubs make rooftop solar available to new Habitat homeowners. The addition of rooftop solar to new Habitat homes will reduce the homeowner's monthly power bills, thereby making the homes more affordable, decrease their carbon footprint, and strengthen the local collaborations between clubs and Habitat affiliates.

Acknowledgements

This document has been prepared by the Environmental Sustainability Rotary Action Group (ESRAG), an independent, Rotary-affiliated entity with expertise in and commitment to environmentally sustainable actions. ESRAG operates independently of Rotary International and The Rotary Foundation as a consultancy resource to Rotary and Rotaract clubs and districts seeking to reduce their environmental footprint through local and international projects. Rotary International extends its appreciation for ESRAG's support of the Rotary-Habitat partnership and for creating this guide to reduce the environmental impact of projects that advance access to safe, long-term housing, improved water and sanitation facilities and hygiene practices, and skills development to strengthen the long-term safety, health, and economic viability of communities partnering with Habitat and Rotary on projects.

Basic Overview of Solar for Habitat

Rooftop solar uses photovoltaic panels that convert the sun's light into electricity which is used by the homeowner. Excess electricity is fed back to the grid, which further offsets the homeowner's monthly electric bill in most states provinces (also known as net metering).

Depending on where you live in Canada, a Habitat 5 KW solar installation can save the homeowner $50 to $150 per month in electricity cost depending on the electric rates in the affiliate's province. The Canadian average price of electricity is 17.9 cents per kWh. Installing 5 KW of solar panels would save the homeowner approximately $75 per month, which translates into initial savings of more than $9,830 over 10 years, $21,770 over 20 years, and $36,280 over 30 years, assuming the cost of electricity continues to climb by 1.96% per year (?). The average solar payback period in Canada is between

eight years and fifteen years, depending on local cost of electricity, incentives, availability of sunlight, and cost of installation.

The Benefits of Adding Solar

The addition of solar panels will result in greater equity, make the home more affordable, and benefit the community, and the planet.

1. Homeowners

The installation of solar significantly decreases monthly power bills for homeowners. In addition to the direct financial impact, homeowners gain benefits in health, information monitoring, and equity.

The installation of solar can help interrupt the cycle of poverty by significantly decreasing monthly power bills. This is because utility bills account for a much higher percentage of monthly income for low-income vs high-income families. Solar electricity production also buffers the homeowner from electricity rate increases. As the cost of electricity rises the savings from the solar system rises at the same rate.

Generating clean electricity protects the homeowner from the health hazards associated with the burning fossil fuels in the home and encourages installation of all electrical appliances. Of note, low-income people of colour are statistically more vulnerable to the adverse health consequences of poor indoor air quality (IAQ).

Solar installations have online monitoring systems that allow families to see their energy production and electrical consumption, thereby helping them reduce their consumption and further decrease their energy bills. The addition of solar typically increases the resale value of the home.

In some provinces, homeowners can benefit from the sale of their solar renewable energy credits (RECs), or offset credits, every year.

2. Local Economy

The solar industry can provide good quality jobs. Installing solar on low-income homes sends the message that solar is for everyone. Solar adoption by Habitat can help lead the larger building industry to embrace solar, thereby increasing the number of individuals employed in this growing industry.

3. Climate Change

Solar panels generate electricity without burning fossil fuels and hence help protect all of us by decreasing CO2 production and improving air quality. Although 67% of Canada's electricity grid is powered by renewables (mainly hydropower), the addition of a 5 KW system to one Habitat home saves approximately 81,650 kilograms of carbon over 30 years. That's the equivalent to planting more than 2,000 trees or not driving nearly 322,000 kms, which is the distance of driving from Vancouver to Halifax 52 times.

4.Society Benefits from Greater Equity

Although low-income families gain the most benefit from rooftop solar, they are the least likely demographic to have access to this renewable source of energy. High upfront costs and limited financing opportunities create obstacles for low-income families to afford solar. Low-income families also typically cannot qualify for loans. This guide can help low-income homeowners access clean, equitable energy.

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Going Solar

⇨ *Note that this process can be adapted to retrofit existing homes.*

Step 1: Assemble the Team

1. Bring stakeholders together.

   You should include leadership and staff of the Habitat affiliate (CEO, CFO and VP construction, board, and other decision makers), an architect if one is already involved, a solar installer if already identified, and members of the local Rotary/Rotaract club(s). Consider inviting a member of the Renewable Energy Task Force of the ESRAG for a discussion of the benefits of solar and a brief overview of the process.

2. Identify a solar champion.

   The solar champion will be responsible for seeing the adoption of solar through to completion. This committed person could be a member of Habitat, a Rotarian or Rotaractor, a local solar advocate, or a community leader. You can contact Canadian solar advocacy organizations such as CanREA (Canadian Renewable Energy Association) or The Solar Business Hub to help identify solar champions in specific geographic areas.

3. Keep a log of your process.

   Keep a log of your process and your contacts and consider a primary and secondary point of contact as these will be invaluable if there are staffing changes.

4. Discuss and decide.

   Discuss the division of responsibilities and make the decision to move forward.

Step 2: Determine the Cost

1. Identify the number of homes to solarize.

2. Estimate the cost.

Obtain one year of monthly electric bills from a similar Habitat home to help the solar installer determine the optimal size in kilowatt hours (kWh) of the system.

3. Negotiate with licensed solar installers to get the best price.

   In 2022, the Canadian national average retail cost for installing solar panels on a roof is about $3 per watt. For a 5 kW system at the $3/W pricing, you would need about $15,000 to get solar panels on the home. Some contractors may be willing to consider installations at cost or may even donate a system. Solar installers who partner with Habitat to install solar at reduced cost are appropriately seen as supporting their communities and can celebrate the partnership on their and Habitat's platforms.

Step 3: Design the Budget

Overview

Funding will be country, province - and region-specific. In Canada, some provinces have higher install rates and other provinces have better incentives. The higher the cost of electricity, the more cost effective the solar system. Regulation of the electricity sector is primarily at the provincial level including most policies related to pricing. See more at https://www.energyhub.org/electricity-prices. In 2021, the average cost of electricity in Canada was $0.179 per kWh (range $0. 073 - $0.382 kWh). Your solar installer will be able to calculate a more precise lifetime savings for the individual homeowner. You can use this solar calculator for your region to determine how much the homeowner will save with a residential solar installation in Canada.

Review available funding sources

Federal

As of 31 August, 2022, Canadian homeowners can apply and become eligible for a $40,000 federal interest-free loan to help make their homes more energy-efficient and comfortable.

The Canada Greener Homes Loan program provides rebates up to $600 rebates for home energy audits and up to $5,000 in rebates for energy-efficient upgrades.

Provincial

Most provinces have tax credits and/or rebates. Some additional incentives are region- specific. **Remember that your installer should be aware of all local and provincial incentives and rebates and can advise and help you obtain these cost savings.**

Province/Territory	Net-Metering	Size Limit	Rebate or Rate
Alberta	Yes	5 MW	Rebate: Depends
British Columbia	Yes	100 kW	Rate: $0.0999/kWh
Manitoba	No	200 kW	Rate: $0.02403/kWh
New Brunswick	Yes	100 kW	Rebate: $0.20 – $0.30/Watt
Newfoundland & Labrador	Yes	100 kW	Wholesale rate
Northwest Territories	Yes	15 kW	Rebate: 50% up to $50,000
Nova Scotia	Yes	100 kW	Rebate: $0.60/Watt
Nunavut	Yes	10 kW	Loan available, partially forgivable
Ontario	Yes	500 kW	
Prince Edward Island	Yes	100 kW	Rebate: $1.00/Watt
Quebec	Yes	50 kW	
Saskatchewan	Yes	100 kW	Rate: $0.075/kWh
Yukon	Yes	50 kW	Rebate: $0.80/Watt

Alberta Incentives

Net-Metering in Alberta

The Alberta Micro-Generation Regulation allows for annual net-metering of systems up to 5 MW.

Alberta Solar for Schools Program

Rebate of $1.50/Watt for systems 10kW and under, going down to $1.00/Watt for the very large systems between 2 and 5 MW in size. Kindergarten through grade 12 schools are eligible to apply for the Solar for Schools Program.

Alberta Municipal Program

Municipalities can apply for rebates for installed solar PV through the Alberta Municipal Program. Up to 30% of installed cost is available as rebates, with $0.90/Watt for 10kW, going down to $0.55/Watt for systems 2 to 5 MW in size. First-time applicants are also eligible for an additional $0.25/Watt.

City of Edmonton Change Homes for Climate PV Incentive

Those living in Edmonton are eligible for $0.40/Watt in City of Edmonton solar rebates for installed solar PV on residential buildings.

Town of Banff Solar Photovoltaic Production Incentive

Residents of the Town of Banff can apply for a Town of Banff solar power rebate of $0.75/Watt for systems between 2 kW and 20 kW in solar PV. Both residential and commercial properties are eligible.

City of Medicine Hat Solar Electric Rebate

Medicine Hat is offering a Clean Energy Improvement Program.

Canmore Clean Energy Improvement Program

The town of Canmore offers a Clean Energy Improvement Program to fund initial investment in energy improvements, including solar PV. A new bylaw allows the Town to offer financing for eligible upgrades and recover costs by levying a Clean Energy Improvement Charge on the property where upgrades are installed. This ties repayment to the property, and not the home-owner, so even when the property is sold the repayments continue.

EQUS Micro-Generators Solar Incentive

EQUS Members can access their Alberta Solar Offset Credits program to get $0.10/Watt in rebates, for up to 5 kW of solar PV. This program is capped at $10,000 total. EQUS members also have the option to request financing for solar installation costs. Subject to approved credit, members may receive $1,500 per kW installed, up to $15,000 total financing per EQUS service. This is capped at $300,000 total for EQUS.

British Columbia Incentives

Net-Metering & BC Hydro

BC Hydro offers anet-metering program for residential and commercial customers. Eligible customers must have a clean or renewable electricity generator connected to the BC hydro distribution system with an aggregate nameplate capacity no more than 100kW. For systems of 27 kW or less the “simple net-metering” process can be used. If more energy is generated versus used in a month the excess is shown as a credit on the electricity bill. If after 12 months there is a net credit (over a one-year period, more electricity is produced than used) the excess is sold to BC Hydro at 9.99 ct/kWh and the credits are set to zero again.

BC Regional District of Nanaimo Renewable Energy System Incentive $250

This rebate enables homeowners in RDN Electoral Areas and the District of Lantzville to save money while upgrading to energy efficient technology in their home. Homeowners that install a solar PV system are eligible to receive a $250 incentive. In addition, a $400 rebate is available for renewable energy systems that require and obtain a development variance permit.

BC PST Tax Exemption

The province of British Columbia province offers a sales tax exemption for the following renewable energy system equipment: Solar photovoltaic collector panels, wiring, controllers, and devices that convert direct current into alternating current (inverters), when they are sold as part of a solar photovoltaic system. Solar thermal collector panels, wiring, pumps, tubing, and heat exchangers, when they are sold as part of, a system that includes solar thermal collector panels.

Manitoba Incentives

Manitoba Customer Owned Generation

Manitoba unfortunately does not offer regular net-metering. Customers who own their own electric renewable generation systems may connect to the distribution system. For small systems up to 10 kW, the process is simple. The produced energy can be used to offset one's own use, and the excess is paid by Manitoba Hydro at a rate of $0.02403/kWh for systems up to 200 kW in size. For generators producing more than 200 kW, Manitoba Hydro will negotiate a Power Purchase Agreement (PPA) with the generator based on hours of operation, type, reliability, etc. Generation systems up to 10 MW are possible.

Manitoba Residential Earth Power Loan

The Residential Earth Power Loan is an option if you are looking to make energy efficiency upgrades to your home, including solar photovoltaic systems. The loan is applicable to residential, non-seasonal customers only. Your monthly payment will be added to your energy bill. The minimum allowable loan amount is $500, and the loan can go up to $30,000 for solar photovoltaic panels. Solar PV financing is calculated based on $3 per watt installed; the maximum term is 15 years; no down payment is required; the loan becomes due and payable when the house is sold; the loan is not transferable; and the annual interest rate is fixed at 4.8 per cent for the first 5 years.

New Brunswick Incentives

NB Power Net-Metering Program

The NB Power Net Metering program provides customers with the option to connect their own environmentally sustainable generation unit to NB Power's distribution system. In order to qualify, generators must produce electricity using a renewable energy resource that does not exceed 100 kW. There are also a number of NB Power technical requirements including using approved equipment, obtaining an electrical wiring permit, as well as an inspection and approval by the New Brunswick Department of Public Safety. Any power exported to the grid is converted to credits, and credits reset to zero every March, essentially making this a form of annual net-metering.

The New Brunswick Total Home Energy Savings Program

For home owners there are incentives to improve energy efficiency, through the Total Home Energy Savings Program. This program pays between $0.20 and $0.30 per Watt of solar PV that is installed. It is important to note that this program pays for many other home energy efficiency improvements as well, not just for solar PV! In fact, having multiple improvements increases the rate that solar is paid out at.

New Brunswick Energy Smart Commercial Buildings Retrofit Program

The Energy Smart Commercial Buildings Retrofit Program provides financial incentives for energy efficiency upgrades in a commercial building. The program provides up to $3,300 for the energy audit evaluation. Additionally, the program offers a maximum of $100,000 towards the energy retrofitting project costs that result in measurable electricity savings, including solar photovoltaic systems. The Energy Smart Program outlines a number of requirements that your Energy Management Service Provider must meet in order to be eligible for the program. The implementation funding is on a 'per gigajoule saved' basis and is intended for projects that have not yet been started.

Newfoundland & Labrador Incentives

Newfoundland & Labrador Net-Metering

NL Hydro offers annual net-metering that allows customers who own small renewable energy generators to back feed the grid with the electricity that they produce. This allows customers to reduce both their electricity bill as well as their carbon footprint. Generators must be approved by Hydro, and must not exceed 100 kW. The Net Metering Program is available to residential and commercial customers who apply and meet the eligibility criteria. Excess monthly production is applied as a credit on the customer's account, to be applied to future bills, and once a year left-over credits (if any) are paid out at the wholesale rate.

Northwest Territories Incentives

Northwest Territories Net-Metering

Northwest Territories Power Corporation and Northland Utilities both offer annual net-metering to their customers. The program is open to NWT residents with renewable energy generators up to 15 kW in size. Excess production is accounted for with credits on the customer's account at full retail rate, and those can be used up at a later date. The credits reset to zero on March 31 every year, effectively making this annual net-metering.

Northwest Territories The Alternatives Energy Technology Program (AETP)

The Arctic Energy Alliance program is available to assist Northwest Territories residents and businesses to integrate clean energy technologies on their property, building, or other assets for the purpose of reducing fuel usage. AEA provides funding of up to half of the cost of qualified renewable energy systems with a maximum amount of $20,000 for homeowners, and $50,000 for business, indigenous, and governments. Communities that receive their electricity from hydro-generation are NOT eligible. The program is also available to assist NWT commercial businesses including off-grid lodges and camps to integrate commercially available, clean energy technologies into their operations. The fund is intended to reduce fuel use and lower the cost of operations in remote locations where fuel prices and carbon footprints are high. Eligible technologies include: Photovoltaics, Wind turbines, solar hot water heating systems, solar air heating systems, ground source heat pumps, in stream and Micro Hydro, and more.

Nova Scotia Incentives

Nova Scotia Enhanced Net-Metering

Nova Scotia has a great annual net-metering program, allowing for systems up to 100 kW in size, and any excess production appears as a credit on the customer's bill. Credits can be used within one year, and if after that time there are still credits remaining they are paid out as a cash payment at full retail rate,although systems should be sized to cover annual use according to their rules.

Nova Scotia SolarHomes Rebate

Nova Scotia has one of the best rebates in solar in Canada. The SolarHomes rebate is $0.60/Watt for eligible solar photovoltaic systems. For most systems, the rebate will equate to approximately 25% of the cost of the system. The maximum rebate is $6,000, or 25% of the eligible cost, whichever is less. The minimum system size needs to be 1 kW.

Nunavut Incentives

Nunavut Net-Metering

Nunavut has very high electricity prices. Despite the dark winters, the long days of summer actually make annual solar energy production clock in at a very reasonable 1,092 kWh per kW of solar PV per year (that's only 200 kWh less than southern Ontario!). Nunavut offers annual net-metering, for solar systems up to 10 kW in size. Credits are carried forward and can be used up within a year. They reset to zero every March 31st.

Nunavut Home Renovation Program

To help pay for a solar system Nunavut offers the Home Renovation Program. This is a comprehensive assistance program offered by the Nunavut Housing Corporation. The program includes financial, program, and technical assistance for Nunavut residents wishing to carry out major repairs, renovations, and energy efficiency upgrades to their home.

The financial assistance comes in the form of a forgivable loan of up to $65,000 and an extra $15,000 for energy efficiency upgrades. The loan is offered on a 10 year time frame and is forgiven at 1.67% monthly beginning the first month of the fifth year, such that 20% of the loan is forgiven yearly from years 6 through 10.

Ontario Incentives

Ontario Net-Metering

Electricity consumers in Ontario may take advantage of the net-metering initiative with renewable energy generators up to 500kW or less. Net metering allows Ontarians to send excess electricity to the distribution system for a credit toward energy costs. Once you're connected to the distribution system, your local distribution company will continue to read your meter just as they do now and then subtract the value of electricity you supply to the grid from the value of what you take from the grid. What you'll see on your bill is the "net" difference between these two amounts. Credits can be used up within one year, any remaining credits after that are reset to zero (i.e. you give them away to the electrical company).

Important Notes:
Be advised that the rules make it much more difficult and expensive to connect systems over 10 kW to the grid. In particular for residential use 10 kW of solar PV should be considered the practical limit, based on the inverter size. In addition, many areas in Ontario are currently "grid constrained". This means the limit of 7% of renewable sources set by Hydro-One and other electrical providers has been reached for large areas of the electrical network, and no additional renewable energy systems will be allowed to connect to the grid in those areas.

Prince Edward Island Incentives

PEI Net-Metering

Prince Edward Island offers annual net-metering for residents through the Renewable Energy Act for systems up to 100 kW in size. Maritime Electric customers can find information on how to apply at this link. Overproduction is credited at the retail rate, and those credits can be used up in subsequent billing periods. Credits expire after 12 months, making this annual net-metering.

PEI Solar Rebate Program

One of the best rebate programs in Canada can be found in PEI. The Solar Electric Rebate Program pays $1.00/Watt for PV installations for homes, and $0.35/Watt for business, up to 40% of installed costs, to a maximum of $10,000. Systems have to be eligible for net-metering, which rules out off-grid use.

Quebec Incentives

Hydro-Quebec Net-Metering

The Quebec net-metering option allows for renewable power generation, including solar, up to 20 kW for single-phase (most residential customers) and 50 kW for 3-phase. Overproduction is credited as kWh's on the customer's account, and the credits can be used up when production falls short. The credits reset after only two years.

Quebec Heating with Green Power

In Quebec, financial assistance is available to homeowners under the Heating with Green Power program for the replacement of fossil-fueled home heating systems and fossil-fueled water heater systems with systems that use electricity or other renewable sources of energy, including solar energy. This allows you to improve the energy efficiency of your home and also reduces your greenhouse gas emissions.

Saskatchewan Incentives

Saskatchewan Net-Metering Program

Saskatchewan's Net Metering Program offers residents the opportunity to generate their own power through the use of renewable energy technology. Residents, farms and businesses can apply for systems of up to 100 kW of generating capacity. They count the DC side, so that is the total solar panel peak-power. Electricity sent to the grid is banked and applied to your current month's electricity consumption. Any excess electricity exported to the grid is converted to credits at 7.5 ct/kWh, that are carried forward to future months/bills. There is no time limit on those credits, they stay valid until the account is closed.

Saskatchewan Solar or Wind-powered Water Pump Grant for Farms

Bringing power lines out to remote wells or streams can be costly. Solar or wind-powered water pumps can offer an economical, safe, reliable and environmentally friendly alternative. SaskPower offers a grant of 50% of costs above $500, to a maximum of $500, toward the purchase and installation of a complete solar or wind-powered water pumping system for farm livestock watering facilities.

Yukon Incentives

Yukon Micro-Generation Program

Micro-generation in the Yukon Territory refers to the small-scale generation of electricity (depending on location the size limit is between 5 kW and 50 kW). It is not quite net-metering, but comes close since it allows offsetting one's energy use and pays for overproduction at decent rates. It can be used to supplement power from the grid or as an alternative source of energy. Where system size allows, surplus generation is exported to the grid for annual reimbursement, and up to 65% of modeled consumption is allowed. Rates are not published, talk to your electrical provider for those.

Yukon Rural Electrification and Telecommunications Program

If you live outside of municipal boundaries you may be eligible for the Rural Electrification and Telecommunications Program. This program offers rural Yukoners an affordable and convenient way to have electrical or telephone service extended to their home where it might not otherwise be practical or possible. Eligible projects include single-site connections, group-installations, and alternate energy systems for private use. Not applicable to properties within Carmacks, Dawson City, Faro, Haines Junction, Mayo, Teslin, Watson Lake and Whitehorse.

Yukon Good Energy Residential Incentives Program

The Good Energy Residential Incentives Program offers an incentive to reduce the costs of installing residential renewable energy systems to generate electricity. This includes solar photovoltaic, wind, hydro, biomass or geothermal energy systems. The program offers an $0.80 per Watt rebate up to a maximum of $5,000 per system per year. For solar systems the size limit is up to 50 kW or the smaller of what the local electrical utility will allow.

Canadian Municipalities

Utility companies
Speak with your local utility. Many power companies offer rebates and incentives.

Grants
Talk to your county and municipal government about potential grants like this one for sustainable affordable housing

Interest-free Loans
Some municipalities are offering interest-free loans between $5,000 and $50,000.

Donations of equipment, labor, and expertise
Reach out to local businesses and suppliers. For example, some energy companies may have surplus solar panels to support Habitat projects in their community.

Cash donations
Many donors are eager to see their dollars house the underserved and benefit the planet. For example, in the US, Cape Cod Habitat for Humanity received more than $400,000 donations for their solar program from community donors. Crowdfunding for Habitat solar may also be possible in some communities.

Partnering between Habitat Affiliates and local Rotary clubs
Habitat affiliates and local Rotary clubs can work together on all aspects of solar installs:

a. Fundraising. Partnering clubs can help organize fundraisers to raise needed funds, secure sponsorships, and in-kind donations, and bring additional partners to the collaboration.
b. PublicityCommunications and promotion. Jointly publicize this initiative to build knowledge about solar installs, energy consumption, and financial literacy as well as to celebrate renewable energy systems, more broadly, as a necessity to manage future energy availability and cost. Maximize the use of social media.

Gifts in kind
Habitat could consider negotiating with companies to supply panels and other equipment at markedly reduced cost, as they do for other building supplies.

Homeowner
Partial financing by the homeowner can help cover funding shortfalls and make the program sustainable, as well as align with Habitat's emphasis on homeowner buy-in. The monthly loan payment should be meaningfully less than the monthly homeowner savings on the electric bill from solar.

c. *Option 1:* A small increase in the Habitat mortgage. For example, increasing the mortgage by $5,000 at 0% interest. The $20/month that the homeowner would pay would be more than offset by the >$50/month that

the homeowner would save on their electric bill.

d. *Option 2*: Low interest financing through a green bank. For example from HSBC

Leasing
In many provinces, companies are allowed to lease panels to individuals.

Solar Renewable Energy Credits
RECs (or unbundled RECs) can be procured from trading desks either for the short or long term. In Canada, these independent RECs can only be retired for business' use and cannot be traded once purchased. Independent RECs can also be purchased in regulated markets as they are an indirect way to go green and cut carbon emissions.

Power Purchase Agreements (PPAs)
A solar power purchase agreement is a financial arrangement in which a third-party developer owns, operates, and maintains the photovoltaic (PV) system, and a host customer agrees to site the system on its property and purchases the system's electric output from the solar services provider - such as Bullfrog Power

Crowdfunding and solar seed fund
.Read about how crowdfunding is helping to push the renewable energy transition

Step 4: Consider the Homeowner

1. *Educate the homeowner.*
   Educate the homeowner about the benefits of solar and show them how to read their monthly electricity use and production data. Homeowners who enjoy the benefits of solar will become advocates for renewable energy. See homeowner handout in appendix.

2. *Address equity issues.*
   Not all Habitat for Humanity homeowners will be eligible for solar because of roof orientation, shading from trees, etc. This needs to be discussed and explained to the homeowners, and alternative energy efficiency improvement options may still

be explored with Habitat.

3. *Discuss liability.*
   Solar on duplexes requires deciding whether and how to share ownership/liability of the solar installation. In most cases, each household will need its own inverter.

Step 5: Design the Site

- *Your solar installer should be able to assist with all of the following issues*

1. *Siting, orientation, and angle of roof*
   Does the orientation of the home on the site need to be changed to maximize solar gain? Ideally, roof-mounted solar energy systems should be at an angle equal to the latitude of the location where it is installed. However, roof angles between 18 and 45 degrees are usually acceptable.

   Solar panels are most effective when installed on south-facing roofs. Involve the solar installer early in the building process so that they can advise you as to the optimal orientation of the roof. This tool from Google can help get you started.

2. *Ground vs roof mount*
   Garden solar (ground mount) may be an option for larger building projects, but space must be set aside in the planning stages and consider the environmental effects of a ground mount's footprint.

3. *Tree and shade analysis*
   Your installer can use a shade assessment tool and advise you. Partial shade of even one panel can markedly affect the efficiency of the whole installation. There are ways around this such as choosing another site on your roof that isn't shaded or using micro inverters and power optimizers which enable each solar panel to operate independently. In addition, solar panels with parallel circuitry design limit shading loss to just the shaded area. In the event of partial shade, discuss options with your solar panel provider.

   Should trees be cut down or topped or can trimming be avoided?

   Tree removal is strictly regulated in many communities. Nevertheless, the lifetime output of one 5.4 kWh solar system (after accounting for the CO_2 production from manufacturing and installation) is equivalent to the lifetime carbon absorption of 90 trees. Therefore, from an environmental standpoint, topping,

pruning, replanting, or removing a few trees branches for solar while respecting local biodiversity may still make sense. Cost, homeowner's desires as well as environmental and aesthetic concerns also must be considered.

Step 6: Make the Home Solar Ready

⇨ *See this planning guide for solar ready buildings in Canada*

1. It is ideal, but not necessary, that homes be all-electric.
2. Run conduit to the utility-required point of connection (usually at the meter or the house's mains panel).
3. Identify and install a charging point for future EVs (electric vehicles).
4. There is no need to reinforce the roof.
5. Life expectancy of roofing material needs to be at least 25 years.
6. Consider adding a programmable thermostat (required in some US states).
7. Identify space for future battery storage.

Step 7: Install Solar Panels

1. Permitting and installation will be done by the installer.
2. You will need to coordinate with the solar installer and with the power company. This is critical if the power company issues rebates.
3. If the power company offers a rebate for nonprofits, then Habitat should sign the net metering agreement; otherwise, the homeowner signs.

Step 8: After installation

1. Arrange for local inspection and grid interconnection.

2. Finalize any rebate with the power company if they offer one. In some provinces the homeowner may need to sign a net metering agreement.

3. Notify homeowners if they are eligible for federal/provincial tax rebates.

4. No significant maintenance costs are anticipated. Any unforeseen maintenance cost could be the responsibility of the homeowners association (HOA) if there is one. You should try to negotiate a labour guarantee for 10 years with the installer. Inverters are typically warranted for 10-15 yrs. The cost of inverters in 15 years should be a fraction of the current cost. Solar panels usually have a 25-year warranty.

5. The solar system should be added to homeowner's insurance.

6. Monitor output from panels. Monitoring can be made public and posted on an affiliate's website, social media, or email newsletter. Electricity use data is very informative for the family and can change behavior and thus help the family save more money.

7. Solar panels are unlikely to adversely affect the roof. Indeed, because they block the sun's UV from hitting the roof, they may increase shingle longevity.

8. Follow up with the homeowner to answer questions and address concerns.

9. The impact of solar on property taxes varies by municipality. .

10. If available, the homeowner can register to sell Solar Renewable Energy Credits.

Summary

⇨ *This suggested order of priority for the first installation(s) may help you plan.*

1. **Identify a solar champion** who will see the process through.

2. **Negotiate the lowest possible cost** with the installer.

3. **Discuss the locally available rebates** from utilities, local government, federal, provincial, and with the installer.

4. **Check for any other grants** (like this).

5. **Advertise your intent** to add solar via website, Facebook, etc., and solicit donations.

6. **Engage with your local Rotary club(s)**.

7. **Consider soliciting donations** from solar equipment manufacturers.

8. **Slightly increase the mortgage**. Whether or not there is a funding shortfall, consider increasing the homeowner's mortgage by a small amount such as $5,000 ($20/month). The homeowner will still save at least $30/month on their electric bill, and the mortgage increase will help the program become sustainable.

9. **Select and educate the homeowner.**

10. **Let your solar installer guide you** through the installation process.

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Appendix

Resources

Planning

Sunroof Solar Planning Tool | Google

Provincial Electricity Profiles | Energy Hub

Costs and Incentives

Solar Incentives in Canada | Solacity

Solar Installed System Cost Analysis | NREL

Tax Incentives for Clean Energy | Government of Canada

Costs of Leasing vs Buying Solar Panels | Consumer Reports

Greenhouse Gas Equivalencies Calculators | Natural Resources Canada

Clean Energy Financing Programs Canada | Energy Hub

Canada Greener Homes Loan

Reviews and Support

Solar Panel Savings Calculator Canada | WOWA

Solar Supply Chain Traceability Protocol USA| SEIA

Amicus Solar Cooperative | Amicus

Solar Adoption in Terms of Access and Equity | Renewable Energy World

Canadian Solar Industry Association Guides and Directories I CANsia

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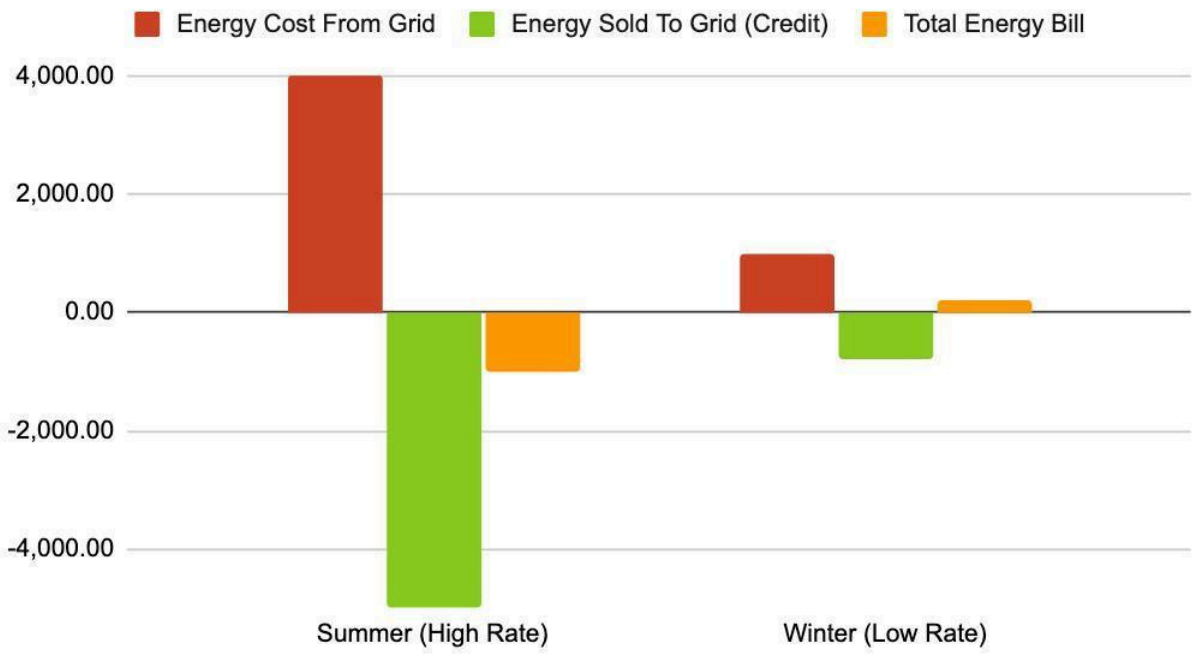
Examples

Try this Handy Solar Energy Savings Calculator for Canada

Read the article: Habitat for Humanity builds first net-zero homes in Winnipeg

Example from Spot Power in Alberta of Residential Home Owner Savings over 1 year with Solar



Information for Homeowners

How Solar Energy Works

Solar panels change sunlight into electricity which powers your home. Any extra electricity your solar panel produces that you do not use immediately is sent to the electric grid and further reduces your monthly electric bill. You should expect to save money each month. You will save more in the summer than the winter because there is more sunshine in the summer.

Your solar panels produce clean energy, which protects the health of your family and our planet. Over the next 30 years, your solar panels will reduce the amount of carbon

polluting the air by 300,000 lbs., which is the same as planting more than 3,500 trees or not driving nearly 350,000 miles. In Canada, your monthly electric bill will show you how much money your solar panels are saving you. Indeed, you will be able to monitor your solar electricity production and your power consumption. Your solar installer will show you how.

Maintenance and Tips

Solar panels do not damage your roof and are designed to last for 30 years. During that time, they will make electricity every day, saving you money. The solar system will save you even more money in the future if, as is likely, the price of electricity increases. Indeed, the solar installation should save you money for more than 30 years.

Solar panels do not usually need to be cleaned. Typically, they require no maintenance and have a 25-year warranty.

Your home and your solar panels are connected to the electric grid so that you always have as much power as you need in your home even when the sun is not shining. Although you have solar panels, if there is a local grid power outage, you will lose power to your home just like your neighbours unless you have a storage battery.

When landscaping, remember to plant shrubs and dwarf trees because large trees over time can shade the solar panels and decrease your savings.

In Canada, the addition of solar often does not increase property taxes, but it depends on local regulations. Let your homeowner's insurance company know that you have a solar system. The panels should be covered by your insurance.

Here are some simple choices that could lower your electric bill further and save you more money.

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Example of installations in the USA (2021-2022)

The optimal size of the system was changed from 5.0 kWh to 5.4 kWh after reviewing the average monthly electricity usage of similar Habitat homes in the area.

- *Funding*
    - Rotary District provided a District Grant of $6,000.
    - Orange County provided a grant of $95,000.00.
    - Duke Energy offered rebates in $40,000.00 (anticipated).
    - Strata Clean Energy donated 100 solar panels.
    - A local business donated 100 five-year-old used panels.
    - SEM donated solar install for an average cost of $7,500 per install (cost savings of $9,500 over retail price).
    - $66,000 will remain in a solar fund to help make the program more sustainable.

- *Installation*
    - The local Habitat affiliate ran conduit and coordinated with Duke Energy and SEM.

- *After install*
    - For duplex installations, any unlikely maintenance cost will be covered by their HOA.

The Habitat affiliate has been able to monitor the monthly electrical savings of the system, which has given them concrete evidence that they are helping their homeowners save money by installing solar.

The process for subsequent installations was easier after the first installation, including interfacing with the installer and homeowners and obtaining the rebates.

- *Future Plans*
    - The Duke Energy rebate ends in 2023.
    - The Habitat affiliate is considering partial homeowner funding through a small increase in the mortgage, e.g. $5,000 at 0% interest which will cost the homeowner $20/month while saving $55/month on the electric bill.
    - The stakeholders plan to apply for a County Grant in 2022.
    - Local Rotary clubs will apply for Rotary District Grants.
    - Strata Clean Energy will donate another 160 new solar panels in 2022.
    - Starting in 2023, the affiliate plans to add solar on at least 15 homes per year.
    - The affiliate went back to their architects to be sure as many of their homes as possible could receive solar and roof orientation was changed to maximize solar energy gain.

Photos of homes built by Habitat for Humanity of Orange County, North Carolina.

Photos of homes built by Habitat for Humanity of Orange County, NC *(Courtesy Southern Energy Management)*

2. Habitat For Humanity of Cape Cod

Habitat For Humanity Cape Cod (Habitat Cape Cod) has demonstrated what can be achieved and what obstacles can be overcome when there is commitment to adding solar. Since 2009, they solarized 48 homes, and all but out of their last 30 homes has have solar. All installations have been done at no additional cost to the homeowner.

Habitat Cape Cod also leads the way in energy efficient homes. Since 2018, their homes have consistently received the best HERS ratings of any Habitat affiliate in the US.

- *Funding*
    - Cape Cod Light Compact
    - Private donations and foundations ($400,000 in private donations)
    - SREC/Now SMART credits (retained by the affiliate or funder)
    - Rebates and incentives (MA SAVE energy efficiency incentives and equipment rebates)
    - Net metering credits (directed to Office/Restore accounts in the interim period between solar installation and closing)

Photo of Habitat Cape Cod home builds (*Courtesy of E2 Solar, Dennis, Massachusetts*).

3. Central Valley Habitat for Humanity (Bridgewater, Virginia)

In October 2020, Central Valley Habitat partnered with GiveSolar to explore solar programs for the affiliate. A proof-of-concept project was identified and implemented on a duplex in Broadway, Virginia.

In February of 2021, the Central Valley Habitat Board approved a proposal made by GiveSolar to develop a $100,000 revolving Solar Seed Fund to finance future solar installs. Donations in the amount of $149,820 were raised between December 2020 and November of 2021.

- *Funding*
  - Crowdfunding donations: $39,505
  - Businesses: $13,700
  - Faith Communities: $ 6,940
  - Family endowments: $60,000
  - Solar United Neighbors: $29,675

- *Installation/Permitting*
  - Installations and permitting are managed by a licensed solar installation company. Habitat homeowners and volunteers participate in a “solar barn-raising” to assist in the installation of the solar modules.

- *After Install*
  - Homeowner education regarding solar and energy efficiency is conducted. Homeowners can choose to participate in a solar tracking program that collects data on energy produced by solar, net electricity usage, savings from solar, and electricity bills.

- *Future Plans*
  - Central Valley Habitat will administer the Solar Seed Fund for the next five years. They plan to use the fund to install solar on 20 homes at the rate of approximately four each year. At the end of five years, the Central Valley HFH board will evaluate the merits of continuing the project.

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Frequently Asked Questions

⇨ *See more frequently asked questions here.*

Do solar panels reduce roof temperature?

Yes, solar panels reduce the amount of heat reaching the roof by 38%, keeping a building's roof 5 degrees cooler than portions of a roof exposed to sunlight directly.

Is solar covered by the homeowner's insurance policy?

Most solar energy systems, including the paneling on the roof, are considered a permanent attachment. Like a security system or a deck, solar panels are considered part of the home and therefore can be protected by a homeowner's policy.
However, because of outdated concerns within the insurance market in Florida, one should shop around for insurance. See more here.

Can you install solar in areas of the country that have hurricanes?

Concerns about wind and solar damage are also misplaced. "A lot of data shows that solar panels help hold a roof down. They're beneficial, not detrimental," said Philip Fairey, Director of the Florida Solar Energy Center, a research organization based at the University of Central Florida. The center was created by the Florida Legislature in 1975 to research all aspects of solar energy. In fact, one solar company gave examples of roof shingles that were damaged in a hurricane, except for where the solar panels were.

Do solar panels adversely affect roof integrity?

No, solar panels do not adversely affect roof integrity when installed correctly.

What are the expected maintenance costs?

Most solar systems require little to no repairs or replacements. If any part of the solar equipment is likely to fail, it is the inverter. The guarantee for inverters is typically 10-15 years. It is expected that the cost of a new inverter in 15 years will be at most a few hundred dollars. Fortunately, solar panels also come with manufacturer warranties that are typically 25 years, helping protect the homeowner in case of faulty equipment. Most solar panels are installed at an angle and are cleaned naturally by the rain.

Solar will typically decrease the monthly power bill by >50%, but not 100%, so it is important to set appropriate expectations.

Are there any landscaping limitations?

It is recommended to plan future landscaping with dwarf trees and shrubs so that tree shade does not become a problem over time.

Is snow on solar panels a problem?

Panels are designed to withstand snow. Because of their solar orientation, snow usually melts fast and in doing so cleans the panels, just like snow on your car. A Norwegian company has developed a method for melting snow on panels for industrial and large installation use. See more here.

What is a PPA?

A solar *power purchase agreement* (PPA) is a financial agreement where a developer installs solar on a customer's property at little to no cost. The developer sells the power generated to the customer at a fixed rate that is typically lower than the local utility's rate, thus offsetting the customer's purchase of electricity from the grid. The developer receives the income from the sale of electricity as well as any tax credits and other incentives generated from the system and is responsible for the operation and maintenance of the system for the duration of the agreement.

How bad is air pollution?

Globally, air pollution is the fourth leading risk factor for mortality and contributed to an estimated 6.7 million deaths in 2019. The National Renewable Energy Laboratory (NREL) estimated that emissions reductions resulting from the Solar America Initiative, known as the widespread adoption of renewable energy, will have a positive impact on a range of respiratory and cardiovascular health issues as well as decreasing workdays lost because of illness. See more here.

What is net metering?

Net metering is an electric billing mechanism that allows the excess energy produced by the solar panels to be stored by the electric grid and is credited back to the homeowner.

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