

The GLOBE Guide to Planning Renewable Energy Projects for Social Housing





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Renewable Energy Technologies Checklist

With a wide range of funding options and government incentives available for renewable energy technologies, solar photovoltaic (PV), solar thermal, geothermal, and solar air systems will undoubtedly become more common in the social housing sector.

This document lists some of the most important high-level questions to ask for each type of system. It should be noted that all renewable energy systems are best installed in buildings where energy and water efficiency have already been addressed and where staff and residents have been trained in energy conservation.





Solar PV Systems

How old is the roof?

The best time to install a system is when a new roof is installed, or when a roof has just recently been replaced. Solar panels last longer than most roof-covering materials and can be difficult to remove if the roof must be replaced.

Can the roof support solar panels?

Solar panels add about 4lbs per square foot which can be accommodated by most roofs, but older properties may require structural work before a system can be installed.

Will the system conflict with rooftop equipment?

Considerations must be made to ensure solar panels and wiring do not conflict with vents, HVAC equipment, and other rooftop structures.

Are there trees or other structures that might cause shading of the panels?

Shade drastically reduces power output and can damage solar panels, so shading should be studied before installing a system. Tree pruning and landscaping may have to be addressed.

Is there enough sunlight?

The number of hours that sunlight reaches the solar panels is an important variable in system performance. For example, northern Ontario has fewer hours of sunlight so the power generated by a solar PV system will be lower than the same system in southern Ontario.

Is the system appropriately sloped and facing in the right direction?

Systems on sloped roofs facing south will receive the most sunlight and therefore will perform better. On flat roofs, systems should be mounted on brackets to ensure they point to the south and are tilted appropriately.

Solar Thermal Systems

How old is the roof?

The best time to install a system is when a new roof is installed, or when a roof has just recently been replaced. Solar panels last longer than most roof-covering materials and can be difficult to remove if the roof must be replaced.

What is the water heating load?

The amount of hot water consumed in the building should be understood in order to correctly size the system.

Is there enough indoor space?

Solar thermal systems usually involve installing a second hot water tank for which there must be adequate space.

Can the roof support solar collectors?

Solar collectors weigh about 100 lbs each which can be accommodated by most roofs, however older properties may require structural work before a system can be installed.

Will the system conflict with rooftop equipment?

Considerations must be made to ensure solar collectors and piping do not conflict with vents, HVAC equipment, and other rooftop structures.

Are there trees or other structures that might cause shading of the panels?

Shade reduces the hot water output of solar collectors, so shading should be studied before installing a system. Tree pruning and landscaping may have to be addressed.

Is there enough sunlight?

The number of hours that sunlight reaches the solar panels is an important variable in system performance. For example, northern Ontario has fewer hours of sunlight so the hot water output will be lower than the same system in southern Ontario.

Is there a backup source of hot water?

Solar hot water systems still require a backup system to heat water when there is not enough solar energy.



Geothermal Systems

What are the space heating and space cooling loads?

The heating and cooling load of the property must be understood in order to correctly size the system.

Is the timing right?

Because there is drilling and trenching required, geothermal systems are most easily installed on new properties where there is minimal disruption. Fortunately systems are also routinely installed on existing properties, but contractors should be prepared to avoid disrupting residents as much as possible.

Is it the right season?

Soil is much harder when cold, so drilling and trenching will likely be more costly and labour intensive during the winter.

How much land is available?

The amount of space available on the property and the placement of underground utility lines will affect the placement of the system. Horizontal systems require more intrusive trenching than vertical systems.

Have permitting requirements been investigated and addressed?

Geothermal systems may have special permitting requirements in some municipalities. If an open-loop system is used that uses groundwater or injects water underground, provincial permitting may be required.

Will the system be compatible with the existing heating and cooling systems?

Geothermal systems are most effective and affordable when they integrate well with existing HVAC equipment and ductwork.

Has the property's geology been investigated?

The type of bed rock and soil influences how much underground heat is available and how much piping is needed.

Has the property's hydrology been investigated?

An investigation of the amount of water available underground is an important factor in choosing the best type of system: closed-loop vs. open loop.

Solar Air Heating – Solar Walls

What are the space heating and space cooling loads?

The heating and cooling load of the property must be understood in order to correctly size the system. Solar walls are generally used as make-up air assists.

Are exterior walls and insulation in good condition?

The best time to install a system is when cladding is repaired because the solar wall is a cladding material. Also, repairing components of the building envelope, such as insulation, after installing a solar wall could prove challenging, so these should be in good condition beforehand.

How much unobstructed, south-facing wall space is available?

The amount of space available on the building will dictate the capacity of the system. South-facing walls receive more sunlight and therefore will host more effective heating systems. Generally speaking a significant wall space with very few or no windows is required.

Is there enough sunlight?

The number of hours that sunlight reaches the solar wall is an important variable in system performance. For example, northern Ontario has fewer hours of sunlight so the heat output will be lower than the same system in southern Ontario.

Will the system be compatible with the existing heating and cooling systems?

Solar air systems are most effective and affordable when they integrate well with existing HVAC equipment and ductwork.

Is there a backup source?

Solar air systems still require a backup system to heat the building when there is not enough solar energy to keep the building warm.



Renewable energy project planning for social housing

An unprecedented opportunity to invest in renewable energy projects

The Ontario Government has allocated \$120 million of its stimulus dollars to encourage the development of alternative, renewable energy sources in Ontario. \$70 million of these funds is being allotted to renewable energy projects in the non-profit housing sector. This funding presents service managers and housing providers with an excellent opportunity to significantly increase the energy efficiency of their buildings and reduce Co2 emissions that cause Global Warming while also developing new sources of income.

The Ministry of Municipal Affairs and Housing (MMAH), has released a Vendor of Record (VOR) list that includes qualified, pre-approved professionals to ensure that all projects meet a high standard of quality and help to create jobs in Ontario through content regulations. Service Managers can access the vendors list using login and password information that was sent to them by MMAH.

Additionally, the Ontario Power Authority (OPA) has developed a Feed in Tariff (FIT) that will allow you to sell your renewable energy at a set price which will make the construction of your renewable energy projects more economically viable.

There has never been a better opportunity for providers to invest in renewable energy systems to modernize, reduce operating costs and CO2 emissions and establish a new revenue stream.

Strategically plan your SHRRP projects with your renewable energy projects

As many of you are in the process of your Social Housing Renovation and Retrofit (SHRRP) planning, it is important to strategically mix and match the available funding opportunities to achieve maximum gains. For example, if you are planning to install a new roof as part of your SHRRP planning, it's also the best time to think about adding a renewable solar energy system on the new roof. If you receive SHRRP funding to replace your old roof and successfully apply for the renewable energy program to install a solar energy system on it, you will be benefitting from a new roof, electricity savings and a new revenue stream from the sale of your excess energy without having made any capital investment on your part. The opportunity to complete high quality, necessary and energy-efficient renovations on your building with careful planning is in front of you.

Introduction

This guide will provide you with an overview of what renewable energy system applications are most appropriate for social housing, what the relevant technologies are and what you need to know when considering installing and purchasing a renewable energy system. As more information becomes available this document will be updated, so please visit www.globeservices.ca or www.shscorp.ca to ensure you have the most recent version of this guide. In addition, at the end of this guide, there is a quick reference Q & A and a glossary of renewable energy terms.



Understanding renewable energy technologies and their benefits

The 5 renewable energy technologies applicable to the Provincial renewable energy program

- 1 Solar PV
- 2 Solar thermal
- 3 Geothermal
- 4 Solar air heating
- 5 Micro-wind

What is Solar PV?

Solar photovoltaic (PV) technology converts the sun's energy into electricity using solar panels. A Solar PV system is the most beneficial renewable technology you can install because it will not only reduce your operating costs but through participation in the OPA's Micro Feed-In-Tariff (MicroFIT) program you are also potentially gaining an additional revenue stream. By installing a Solar PV system you are using the power you generate, reducing the cost of your utility bills, and selling your surplus energy your system produces through the MicroFIT program.

The OPA MicroFIT program

If you choose to participate in the OPA's MicroFIT program, electricity produced by your Solar PV system is fed into the grid. As part of the MicroFIT Program, providers will be paid the subsidized rate of 80.2¢ for each kilowatt-hour (kWh) they generate, regardless of whether it is consumed in-house or sold on the grid. The MicroFIT program has a simple application process, making accessing the program manageable for even small providers.

On a yearly average, Ontario receives about 4.2 hours per day of sunlight strong enough for solar panels to function at full capacity. For example, a provider who has installed a modest 5 kilowatt system on an unobstructed, south-facing roof will generate 21 kWh of electricity per day for which they will be paid the subsidized rate. With this system, a provider can potentially earn \$16.84 per day (or \$505.26 per month) for the solar electricity they generate.

Installing a solar PV system has four key benefits:

- Modernizes your building
- Reduces your operating costs
- Establishes a new revenue stream through participation in the MicroFIT program
- Reduces CO2 emissions

What is the cost?

If you are receiving stimulus funding, it will cover the capital investment (by far the largest expense) and the electricity savings and revenue from the MicroFIT program begin immediately. In addition, Solar PV systems have an expected lifetime of more than 30 years and are very durable. As there are no moving parts, mechanical failures are extremely rare. There are some maintenance costs to maintain the system, but they are relatively minor when compared to the additional revenue generated by the system. These include:

- Inverters, an essential component of the system, will not last as long as the solar panels. Inverters cost between \$2,000 and \$4,000 and may have to be replaced more than once.
- Panels and wiring are rated to withstand extreme weather, but occasionally they can crack or wear out and need to be replaced.
- Trees need to be maintained in order to prevent shading of the panels which interferes with electricity generation.

The benefits of installing a solar PV system far outweigh these low maintenance costs. More important, however, is to ensure that your property management staff are properly trained to understand the system and conduct basic maintenance or to have an operations and maintenance agreement with a service company.

NOTE: In addition to ongoing maintenance, providers should take out adequate insurance coverage to protect the equipment in case of fire or other disasters.



What is Solar Thermal?

Solar thermal technology uses the sun's energy to heat water. When the subject of solar thermal systems comes up, almost everyone talks about heating for domestic hot water supply, and with good reason. Approximately 15% of the energy bill in an average household is related to hot water heating costs. Under optimal conditions, Ontarians can achieve an average of 50% of their water heating demand from solar. Working in conjunction with your existing hot water heating system, solar thermal systems provide "pre-heating" of the water supply which reduces the cost of your utility bills.

What is Geothermal?

Geothermal heat pumps are similar to solar thermal technology, but in this case energy from below ground is collected and used for domestic heating, cooling and hot water uses. During the heating season, the limitless warmth stored below ground is concentrated and used to heat the indoor environment. In the thick of the cooling season, the system is reversed and heat from the home is collected and dispersed below ground.

Under the best circumstances, a geothermal system can provide 4 kW of heating for every 1 kW of electricity used to run the system; an energy saving of up to 75% on heating costs. Maintenance costs are also reduced because there are no combustion systems nor any parts exposed to the elements. Utility bill savings of 60% are not uncommon, which could mean thousands of dollars per year in operational cost savings for providers.

NOTE: The considerations to make before installing a geothermal system are best left to a professional installer. Some of the factors to consider include:

- Geology: the type of bed rock and soil influences how much underground piping is needed

- Hydrology: An investigation of the amount of water available underground is an important factor in choosing the best type of system
- Land availability: The amount of space available and the placement underground utilities will affect the placement of your system"

What is Solar Air Heating?

Solar air heating technology is a simple way to heat indoor air by using energy from the sun. Cladding material is mounted on the south, east, or west walls, and can also be installed on the roof. Tiny perforations allow outdoor air to travel through the exterior surface. During the day, as outside air passes through the panel and along its inside surface, it absorbs the sun's energy, warming the air which in turn rises. The preheated air is then drawn into the building's ventilation system, reducing the load on the heating system. Temperature controlled fans ensure only warm air enters the ventilation system. At night, as heat energy leaves the building to the cooler exterior, the warm air enters the cavity between the cladding and the wall, rises, and is recycled back into the building. Solar air heating systems allow you to realize savings on your utility bills.

Not all renewable energy technologies are quite ready for home-use.

What is Micro-Wind?

Micro wind systems convert wind energy to power using a small roof-mounted wind turbine. Although wind power is the fastest-growing source of energy in the world, current wind turbine technologies are not yet well-suited to urban residential applications.

For more information about these technologies, consult GLOBE's Primer: Renewable Energy for Residential Buildings available online at: http://www.globeservices.ca/uploads/32_EnergyPrimer.pdf



Installing a roof-mounted renewable energy system

What should I consider before installing a roof-mounted renewable energy system?

1. **Timing:** Roof replacement time is the best time to consider a renewable energy system, which is why solar projects work especially well with SHRRP funding. Because solar energy systems have a life span of at least 20 years and a considerable portion of the cost is installation on the roof, a new roof gives a much greater degree of certainty that these systems will not need to be removed for re-roofing
2. **Roof load:** Solar panels and thermal collectors add about 4lbs per square foot which can be accommodated by most roofs, but older properties may require structural work before a system can be installed
3. **Roof angle:** To maximize system output solar panels and collectors should be installed on a south-facing, pitched roof. Systems can be installed on flat roofs too, but in these cases they must be mounted on brackets in order to collect as much sunlight as possible
4. **Rooftop equipment:** Considerations must be made to ensure solar panels and collectors do not conflict with vents and other HVAC equipment
5. **Shading:** Shade drastically reduces power output of solar panels, so landscaping may have to be addressed
6. **Climate:** Because northern Ontario receives less directly sunlight, the power output of a system will be lower than the same system in southern Ontario

Purchasing a renewable energy system

MMAH has developed a Vendor of Record (VOR) list that includes qualified, pre-approved professionals to ensure that all projects meet a high standard of quality. Service Managers can access the vendors list using login and password information sent to them by MMAH.

MMAH is now reviewing Service Managers' submissions from across the province. It will continue to accept applications up to June 30, 2010. In July 2010 the Ministry will announce the conditional allocations of the REI funding. REI projects that receive a conditional allocation should move quickly to the procurement/vendor selection stage, firm up contract price and submit the final project information form (PIF) for funding commitment by September 30, 2010.

Note: The vendor list created does not pre-qualify a company to meet the domestic requirements of the FIT program. Proponents who apply to the OPA for a FIT contract will be required to meet all the FIT Program requirements including domestic content requirements.



Quick Reference Q & A

What is renewable energy?

Renewable energy comes from energy sources that will never run out, unlike the coal and oil that are currently used to generate power now. Renewable energy sources include sunlight, wind, and heat from deep within the Earth.

Why should we use renewable energy?

Renewable energy is clean, non-polluting and non-emitting which means that there are no harmful emissions such as Co₂, Methane and NOX that lead to Global Warming. Depending on the type of renewable energy system you install, your electric or gas bills will decrease, and you will be less vulnerable to energy price increases and security of supply problems.

Why is now the time to invest in renewable energy?

The Ontario Government has allocated \$120 million of its stimulus dollars to encourage the development of alternative, renewable energy sources in Ontario. \$70 million of these funds is being allotted to renewable energy projects in the non-profit housing sector.

I have applied for SHRRP funding. Can the renewable program be combined with SHRRP?

Yes, in fact it is wise to plan your SHRRP projects along with your renewable projects to maximize your gains. For example, roof replacement time is the ideal time to consider adding a renewable solar energy system. If you select a roofing system with a life span similar to your solar panel system you avoid having to remove and reinstall the system for re-roofing.

What is the OPA MicroFIT program?

The Ontario Power Authority (OPA) has developed a Micro Feed-in-Tariff (MicroFIT) program, which will buy the surplus renewable energy your solar PV system produces, which translates into profits and an additional revenue stream for your building.

What is the payback period for installation of a solar PV system?

If you receive funding from the Provincial renewable energy program, your capital investment is covered, therefore your payback period is instantaneous – revenue from the MicroFIT program begin immediately.

When is the best time to install a solar PV or solar thermal system?

Roof replacement time is the best time to consider a renewable energy system. Because Solar systems have a life span of at least 20 years and, in the case of Solar PV and Solar Thermal roofing, a considerable portion of the cost is installation on the roof, a new roof gives a much greater degree of certainty that these systems will not need to be removed for re-roofing.

What are some of the key dates of the Renewable Energy Initiative (REI)?

MMAH is now reviewing Service Managers' submissions from across the province. It will continue to accept applications up to June 30, 2010. In July 2010 the Ministry will announce the conditional allocations of the REI funding. Projects that receive a conditional allocation should move quickly to the procurement/vendor selection stage, firm up contract price and submit the final project information form (PIF) for funding commitment by September 30, 2010. A funding agreement will be issued once the program requirements have been met.



Ownership models for renewable energy systems

There are several ownership options. They include: Complete ownership, power purchase agreements, rooftop leasing and system leasing. A detailed description of each of these options is included in this guide.

Complete Ownership

How it works:

Buying a solar PV system directly from an installer has a high upfront cost and puts the onus on the provider to pay any operational and maintenance costs. Upfront costs may be paid through the SHRRP program; however ongoing operational and maintenance costs will not be eligible under the program.

Capital Cost and Payback:

The installation cost for a solar PV system ranges from \$10,000 to \$15,000 per kilowatt of system capacity, so a 10 kW system will cost in the range of \$100,000 to \$150,000. Systems that rated at 10kW or less attract the highest revenues from the FIT program while encountering the fewest regulatory and permitting issues. In absence of stimulus funding, payback periods are typically between 10 to 12 years.

Maintenance:

Solar PV systems have an expected lifetime of more than 30 years and are very durable, requiring low-cost maintenance.

Advantages:

- Ownership adds to property value
- High revenue stream
- Reduced electricity costs
- No third-party ownership or rooftop lease which could affect decisions to upgrade roofing or other building systems

Disadvantages:

- High capital costs (if not funded via SHRRP)
- Must cover maintenance costs
- Must ensure that solar equipment warranties are not voided due to improper maintenance or care

Power Purchase Agreements

How it works:

Power Purchase Agreements (PPAs) are the most common alternative to complete ownership, and is a model for installing a solar PV system without having to pay any upfront capital costs or maintenance costs. Solar companies become third-party owners of the system, and handle all aspects of installation, operations, and maintenance. There is no opportunity for the provider to collect any money through the FIT program as they do not own the system.

As part of the PPA, the provider must purchase their electricity from their own rooftop system for the duration of the contract, typically 15 to 20 years. A fixed electricity rate is negotiated with the solar company, and is usually lower than the LDC rates, however any electricity demand that exceeds rooftop production is supplied by the LDC at regular rates.

Capital Cost and Payback:

Because the housing provider does not own the system, there are no initial capital costs nor an associated payback period. At the end of the PPA, the provider has the option to renew the agreement, purchase the system from the solar company at a depreciated price, or ask that the system be removed.

Maintenance:

Under this ownership model, all maintenance costs are covered by the solar company. Solar companies increase their profits by generating more electricity, therefore they have an incentive to keep the system in good condition.

Advantages:

- No capital costs
- No maintenance costs
- Fixed electricity rates for the duration of the contract
- System monitoring by experts

Disadvantages:

- Low revenue stream
- Incrementally higher electricity rates are incorporated to the agreement meaning that provider's electricity costs rise independent of provincial rates or feed in tariffs.



- Potentially complicated negotiations; may need to renegotiate terms on less favourable conditions at the end of the agreement.
- Potential restrictions on renovating the rooftop or other property features that could affect energy generation
- Administrative burden of paying two electricity bills – one to the solar company and one to the LDC
- A roof access agreement giving the solar company 24-hour access to the roof may inconvenience staff and tenants.
- Increased risk of damage to roof structure and rooftop equipment as third-party system owners are primarily concerned with optimizing solar PV output and may lack respect for a provider's property.

Rooftop Leasing

How it works:

Rooftop leasing for solar PV systems is a business model similar to that used for installing antennae and telecommunication towers atop properties, and is currently rare for small solar projects. With this type of agreement, solar companies lease rooftop space and pay providers monthly for the duration of the lease. When rooftops are leased, the solar company takes full responsibility for installation, operation and maintenance of the system, and sells electricity directly to the LDCs at FIT rates rather than routing it through the provider's meter. Unlike power purchase agreements, the provider would not be required to purchase the electricity generated by the system.

Capital Cost and Payback:

Because the housing provider does not own the system, there are no initial capital costs nor an associated payback period.

Maintenance Costs:

Under this ownership model all maintenance costs are covered by the solar companies. Solar companies increase their profits by generating more electricity, therefore they have an incentive to keep the system in good condition.

Advantages:

- No capital costs
- No maintenance costs
- New revenue stream

Disadvantages:

- Low revenue stream
- Potentially complicated negotiations
- Potential restrictions on renovating the rooftop or other property features that could affect energy generation
- A roof access agreement giving the solar company 24-hour access to the roof may inconvenience staff and tenants.
- Increased risk of damage to roof structure and rooftop equipment as third-party system owners are primarily concerned with optimizing solar PV output and may lack respect for a provider's property.

Glossary

FIT program: The Feed-In-Tariff program: A program run by the Ontario Power Authority that allows property owners to connect a renewable energy system to the electricity grid and receive attractive payments for the electricity they generate.

Fuel: In the context of this document, fuel is means energy resources like oil and coal that are in limited supply.

Geothermal energy: Energy derived from the heat found underground. In a residential setting it is used for heating and cooling and not to generate electricity.

The grid: The Ontario electrical grid, which is the network that delivers electricity from suppliers to consumers.

HVAC equipment: Equipment used for heating, ventilation and air conditioning.

Micro wind system: Micro wind systems convert wind energy to power using a small roof-mounted wind turbine

MicroFIT program: The Micro Feed-In-Tariff program. A simplified version of the FIT program that allows residential property owners to receive attractive rates for electricity generated by small-scale renewable energy systems.



The GLOBE Guide to Planning Renewable Energy Projects for Social Housing

Renewable energy: Energy obtained from sources that can essentially never run out, like the sun, wind and geothermal energy.

Renewable energy system: A renewable energy system is a residential-scale system that can collect renewable energy. Examples include roof-mounted solar panels and solar hot water heating.

Rooftop leasing: With this type of agreement, solar companies lease rooftop space and pay providers monthly for the duration of the lease. Unlike power purchase agreements, the provider would not be required to purchase the electricity generated by the system.

Solar collector: The equipment used to transfer the Sun's energy to water in a solar thermal system.

Solar panels: The equipment used to convert the Sun's energy into electricity in a solar photovoltaic system.

Solar PV system: Solar photovoltaic (PV) technology converts the Sun's energy into electricity using roof-mounted solar panels.

Solar thermal system: Solar thermal systems use the Sun's heat directly, usually to heat domestic hot water.

System capacity: The maximum electricity output of a renewable energy system.

System leasing: Providers make fixed monthly payments to the solar companies for the equipment and maintenance rather than pay for the electricity they consume which provides additional price stability.

System output: The amount of electricity produced by a renewable energy system.

Wind energy: Energy derived from the wind that is converted to electricity using a wind turbine

Primers to Help You Go Green

GLOBE has created a series of primers for housing providers who want to green their communities but don't know where to start.

Sustainable Landscaping for Social Housing



Learn how, through careful planning and design for sustainability, you can economize, improve the environment, encourage your residents to participate in their housing community, and contribute to neighbourhood quality of life.

You will also get practical information about green roofs, fertilizers, pest control, soil health, irrigation, and design

Renewable Energy for Residential Buildings



GLOBE created this primer in collaboration with William Kemp, a respected author of several publications on renewable energy sources and their potential role in modern society. This primer is based on his book, \$mart Power.

These primers are available for download at www.globeservices.ca in the Publications section.

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