

Independent Solar Power for Single Family Homes



Exergetic Design of Energy Systems



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Table of Contents

Business Overview	3
Business History	
Experience Statement	
Objectives	
Solar Photovoltaic System and Services	4
Description of Solar PV Systems	
Key Features of the Solar PV Services	
Site Assessment and Procurement Services	
Design and Regulatory Procedures	
Installation and Connection Procedures	6
Communication Protocol with Utility	
Use of Certified Installers	
Comparta Solar Village: A Typical Illustration	7
Project Sizes and Costs	
Financing Options	
Leasing Option	
Revenue Estimation	
Exergetic Design of Solar PV Systems	



Business Overview

Business History

Energhx Green Energy Corporation (“Energhx”) is an engineering consortium, specialised in green energy solution development, including the design and demonstration of alternative energy solution for residential and commercial clients. Driven by the increasing need for clean energy system, Energhx provides affordable independent power and heat from solar-wind energy resources. The desire to design, develop and deliver distributed power and heat, which started in January 2008 when Energhx was registered in the Province of Ontario, has resulted in the processing and possession of regulatory and professional licences, including Certificate of Authorization to provide engineering services; Gas Marketer licence to supply natural gas, and Electricity Retailer licence to supply electricity. Being a licensed Market Participant in the energy industry, Energhx is able to effectively work with Utilities and regulatory bodies in providing clients with independent power and heat generation credits on their energy accounts.

Experience Statement

Energhx is one of the first solution providers to obtain microFIT conditional contracts in the City of Ottawa. This has enabled Energhx to obtain all the experiences required to successfully navigate the complex process of designing roof-top mounted Solar PV system that can retain the structural integrity of local buildings in the City of Ottawa against dead and live loads, pull out Building Permit from the City of Ottawa, and obtain interconnectivity from Hydro Ottawa.

Objectives

Energhx understands that the development of green energy and economy in Ontario starts with good energy assessment services for existing home and commerce. Thereafter, customized power and heat generation facilities can be design, develop, and delivered for independent application. These objectives will be implemented as follows: 1. Application for generator contract to develop independent power generation facility on individual clients' land asset, either for clients ownership or lease agreement; 2. Processing of financing for each project, using the newly developed equity-based financing tool, through Energhx GreenPartners; 3. Installation of customised solar-wind and solar domestic hot water/air generators; 4. Connection of the embedded generator to the distribution system; and 5. Delivery and management of energy commodity supplies.

Especially for homeowners within urban cities like Ottawa, integration of solar solution is more suitable. Hence, the rest of this material is focussed on independent solar power for single family homes.

Solar Photovoltaic System and Services

Description of Solar PV Systems

Solar Photovoltaic (Solar PV) cells/modules convert solar irradiation from the sun into direct current of electricity. The grouping of series of Solar PV modules is designed to meet the expected system requirement and the available space for installation. Efficient harvest of the energy from sunlight is possible when the modules are oriented between south-east and south-west. Energhx, as a member of the Canadian Solar Industries Association (CANSIA), can guarantee satisfactory design and installation of all configurations of Solar PV systems.

Key Features of the Solar PV Services

Comprehensive Energhx Solar PV services include electricity supply, project management, permitting, financing, and demand side monitoring. Starting from energy assessment to demonstration of green energy and conservation solutions, the marketplace would prefer services of Energhx to others whose focus is partial to the complete solution required:

- 1. Demand Side Monitoring.** This service provides a unique energy conservative initiative by exploring the responsibility of Energhx as clients' energy supplier, and the relationship of Energhx with their local distribution companies as a market participant. The key features of this service include access to metering data, historical consumption of electricity, and remote monitoring services. Clients will continue to obtain their electricity bill from their local distribution company (either Hydro Ottawa or Hydro One) at the pre-provincial benefit rated Regulated Price Plan (as posted by the Ontario Energy Board), while activating an optional Generation Credit, being the proceeds of their investment into the Solar PV asset.
- 2. Project Management.** Energhx provides the design, permits and contract processing, optional equity-based financing, installation, and connection of the Solar PV system to the grid. The entire handling of the project from conception to commissioning of the project will be managed by Energhx.
- 3. Independent Power Generation.** This service involves the commissioning and operation of Solar PV system. Depending on the option of deciding who owns the installed generators, OPA-guaranteed higher rates for every kWh of electricity are paid through the Utilities. Although the Solar PV modules are procure with, at least, 20-years manufacturers' warrantee, workmanship warranty, the cost of maintenance within this period is not covered under manufacturers' warrantee. Energhx Solar PV services are backed with additional system integration, 5-year workmanship and maintenance warrantees. The owner of the Solar PV system is responsible for the cost of maintenance thereafter.

The production of each of these green energy projects follows a similar process Ontario, including:

- Application for contract from the Ontario Power Authority;
- Processing of Building Permit from the Municipality;
- Processing of Connection Permit from the Local Distribution Company;
- Sourcing and Installation of all appliances;
- Application for Inspection from the Electrical Safety Authority;
- Connection and Commissioning of Project

Site Assessment and Procurement Services

After Energhx obtains the authorization to commence the green energy project, the following site assessment and procurement services will enable proper delivery of Energhx services:

- 1. Solar Readiness.** Except with ground-mounted installation, right orientation of the available roof space that will be used for mounting the Solar panels must be the first point of assessment. The space area must be sufficient for the designed system size and facing either south-west or south-east.
- 2. Irradiation Data.** Solar Irradiation data is available in most government publications including Environment Canada. However, most green energy project developers use RETScreen™, a set of free tools developed by NRCan's International Renewable Energy Decision Support Centre; and this

tool is used by Energhx, in addition to others, to develop the energy model, and analyse the economic viability of the project.

3. **Historical Data.** Given the authorization of clients, Energhx is able to request for up to 24 months of historical usage information directly from local distribution company, like Hydro Ottawa. Rather than relying on the scanty or unavailable information from client's previous electricity bills, historical data from the Utility enables the projection of the required size of Solar PV system that can displace load demands.

4. **Procurement of Appliances.** Energhx has dealership arrangement with manufacturers of Solar PV appliances and can guarantee reliable and cost-effective supply for all clients. Direct procurement to installation is made after regulatory and connection permits have been processed.

Design and Regulatory Procedures

The production of Solar PV services requires regulatory permits from Utility, Electrical Safety Authority (ESA), and the Municipality (City of Ottawa). Among other documents that needed review before Connection, Safety, and Building Permits are given, the sets of drawings showing proper design of anchorage, and the electrical lines represent the significant part of all the regulatory procedures. Energhx design team comprises of experts with experience in the use of SolidWorks and other drafting tools. The installation of a Solar PV energy system on an existing building requires, according to the Ontario Building Code Act, the preparation and submission of relevant drawings, including the site plan and elevation of the proposed building. Copies of these drawings will be prepared and submitted to the City of Ottawa by Energhx.

Before the generator can be connected to the electrical system it must be inspected and approved by the Electrical Safety Authority. The Ontario Electrical Safety Code ("OESC") requires an Application for Inspection to be submitted by the contractor doing the electrical installation. The inspection provides assurance that the installation meets the safety requirements of the OESC and does not pose a hazard to you, your family, or friends during and after the completion of the project. It also provides an assurance that the installation will not pose a hazard to the local utility workers who may be required to service or repair the electrical supply to your home. Energhx will coordinate the processing of this permit.

Exergetic Design of Energy Systems

Installation and Connection Procedures

Communication Protocol with Utility

Being a Market Participant, licensed by the Ontario Energy Board, Energhx is able to effectively establish an Electronic Business Transaction (EBT) with client's local distribution company. Therefore, access to relevant information required for design, installation, and connection of the Solar PV system to the grid is possible. The Ontario Energy Board has outlined the standard connection procedure, and all Market Participants are required to comply, if proper communication protocol is followed.

The local distribution companies are licensed by the Ontario Energy Board (OEB) to supply electricity to consumers through the distribution grid. Hydro Ottawa has the mandate to operate distribution facilities within its licensed area. The defined area, as defined in its distribution license, is the former municipalities of Ottawa, Vanier, Nepean, Gloucester, and Kanata, plus Manotick, the Township of Goulbourn, the Village of Casselman (County of Russell), the Village of Rockcliffe Park, and the portion of the former township of Rideau on Long Island, north of Bridge Street. This service area is subject to change with the OEB's approval. Since the proposed embedded generator will be grid-tied, OEB has detailed the procedure for connection of the proposed generator to the distribution grid. Being an OEB-licensed electricity retailer, Energhx has additional privilege of administering the processing of the connection permit through Hydro Ottawa. The flowchart of the connection process is shown below:

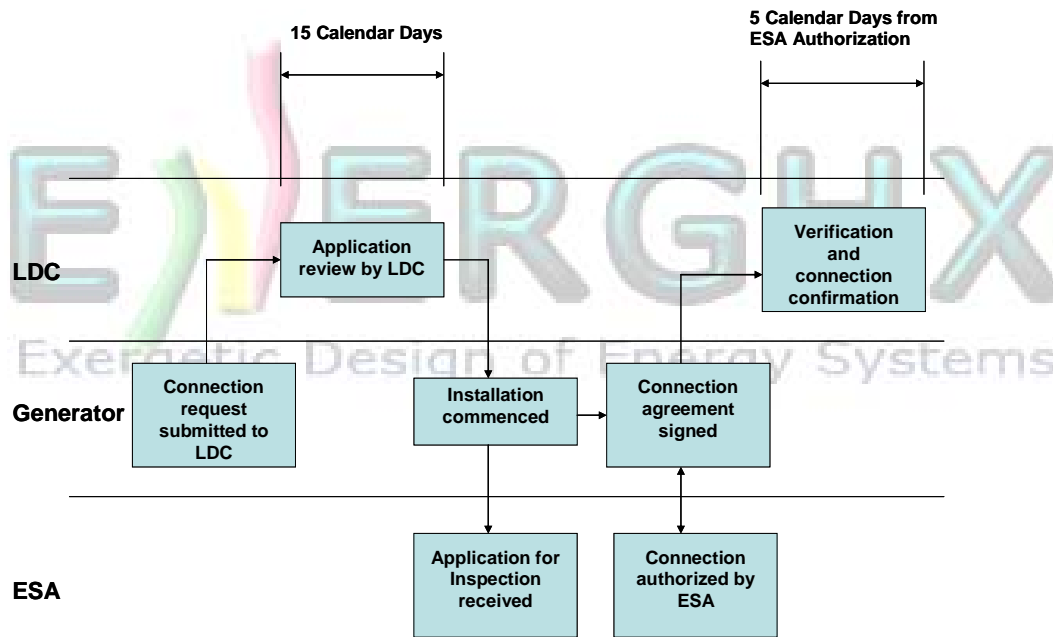


Figure 1: Grid Connection Process

Use of Certified Installers

Energhx is a corporate member of the Canadian Solar Industries Association (CanSIA), a body which promote the professional and practical use of solar technologies in Canada, and has unrestrained access to pool of certified installers. In addition, Energhx ensures that Electricians with Master Licence are retained for all installation procedure.

Compata Solar Village: A Typical Illustration

Project Sizes and Costs

Every Solar PV module comes in standard sizes, in term of length, width, and height; or simply square area. The system power of any project is obtained by adding up the power rating of each module. Given the available space for installation, it is straightforward to obtain the number of module required and the cost of modules. Table 1 provides the cost analysis for a 3.44 kW Solar PV system, designed using an Ontario-made PhotoWatt solar module for a flat roof in the City of Ottawa.

Table 1 – Cost Analysis of a 3.44 kW Solar PV Project

Cost Estimate of Parts and Labour:							
Mechanical PartList							
Description	Size	Unit Price	Material	Remark	Specification	Qty	Cost (\$)
Lag Screw	5/16" x 6	1.09	steel			72	78.48
Hex Bolt	3/8" x 1.5/1.75	0.49	stainless steel			192	94.08
Hex Nut	3/8"	0.26	stainless steel			192	49.92
L-foot		4				72	288.00
Rail		15				24	360.00
Solar PV Module		800		System Capacity 3.44kW	215 W	16	12800.00
End Clamp		4				48	192.00
Mounting Clamp		4				24	96.00
Outer Sliding Leg Assembly		25				24	600.00
Inner Sliding Leg Assembly		20				24	480.00
							15038.48
Electrical PartList							
Description	Size	Unit Price	Material	Remark	Configuration	Qty	Cost
Service Layout- Hydro Ottawa		1336.37				1	1336.37
Cabling		100				1	100.00
Solar Inverters		190				16	3040.00
							4476.37
Labour & Project Management							
Description	Size	Unit Price	Material	Remark	Qualiifcation	Qty	Cost
Installation		100				16	1600.00
Design and System Integration				25% of total PartList			4878.71
Building Permit		12/1000				15038.48	180.46
Electrical Safety		12/1000				4476.37	53.72
							6712.89
Insurance							
Description	Size	Unit Price	Material	Remark	Qualiifcation	Qty	Cost
Facility Coverage				Additional Premium on existing building/prop		0	50.00
							26277.74

Financing Options

While clients have the option of arranging the financing of their projects, many clients will be excited at the indirect financing arrangement through Energhx. Many clients will also be excited to know that they can participate in the ongoing microFIT program without incurring huge borrowing cost from the bank. The equity-based Green Partnership program, developed by Energhx, would allow clients to only invest a portion of any Solar PV asset of their choice. At Energhx, the convenience of clients with project management and financing is an uncompromised priority.

Leasing Option

For cluster of projects on community basis, clients can even be eligible for generation credit without contributing any amount into the development of the Solar PV asset on their roof or property. Considering the cost of maintaining Solar PV system, especially after the expiration of manufacturer's warranty, some clients would prefer the leasing of a portion of their property, to a green energy developer, for the project. Energhx offers the leasing option on a royalty payment term, where landowners are paid an agreed monthly rate per kWh of electricity generated. Because of the micro-size of Solar PV project for single-family homes, this option is mostly adopted by farmers with bigger project size or community-based projects.

Revenue Estimation

Contrary to the misconception of many, revenue from OPA is not based on the net power supplied to the grid. The local Utility, on behalf of OPA, pays for every kWh of electricity generated through the microFIT project. Apart from the load account, the Solar PV project will be dedicated a separate account (cost of new meter is included in the connection fee, received from Hydro Ottawa). Therefore, the estimation of the expected revenue is solely dependent on the size of the system, the efficiency of system integration, and the local solar resources.

Using Energhx Solar PV Calculator (based on 60% capacity on an average of 6 hours harvest per day), the estimated revenue for a 3.44 kW system as shown in Table 2.

Table 2 – Solar Harvest for a 3.44-kW Solar PV System

System Rating		3.44 kW
Estimation of Solar Harvest		6 hours/day
Days in month		30
Efficiency of solar harvest		60 %
Estimated month solar yield	4458.24	371.52 kWh
Contract Price for Solar PV		0.802 cents/kWh
Projected Annual OPA Payment for electricity (Solar)		\$3,575.51

Exergetic Design of Solar PV System

Apart from the manufacturer efficiency of solar PV modules and the intensity of solar irradiation at the project location, conventional integration of solar PV systems are often designed without effective consideration of the import of energy conversion on system efficiency. The exergetic design of energy system is possible by considering the optimization of available resources. Energhx has conducted series of sensitivity techniques towards selection of optimized system configuration for maximum solar energy harvest. Using in-house software (e.g., *Energhxflow*) and solution techniques, the best solar tracking system will be designed for maximum return of investment.

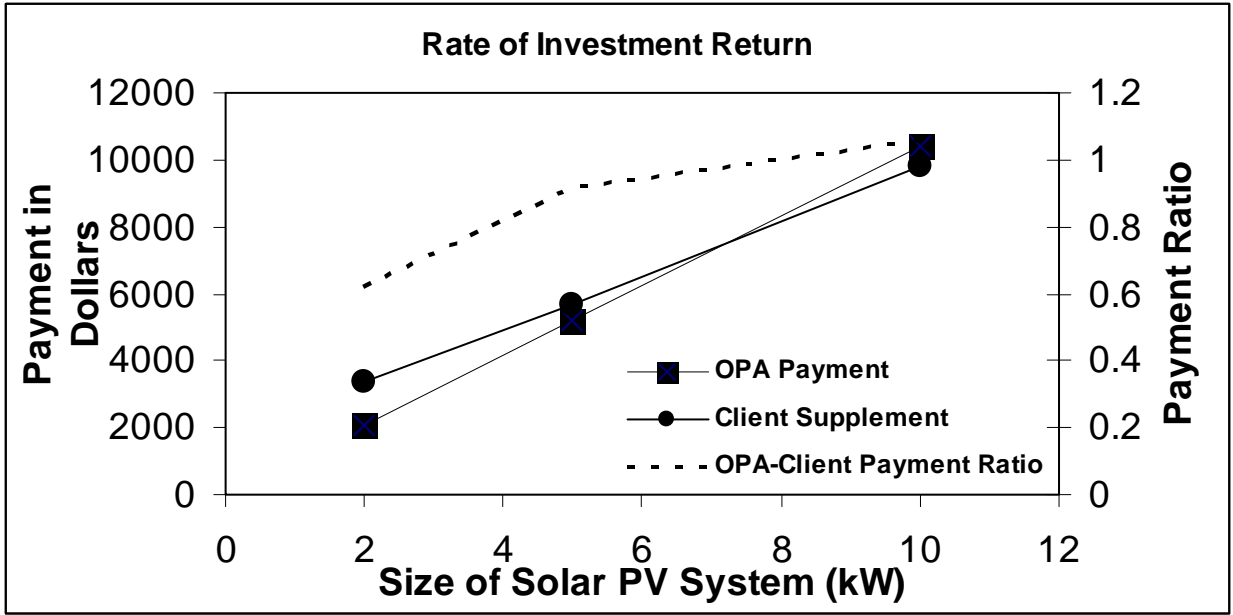


Figure 2 – Ratio of OPA Payment to Client Supplement with Project Size

