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Operationalizing Feed-in Tariffs in Ontario

A Solar Photovoltaic Development

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Abstract

This project report details the development of a 200kW AC / 270kW DC rooftop solar photovoltaic (PV) system on Kinghaven farm in King City, ON. The project involves active engagement with the Ontario Feed-in Tariff Program. The Feed-in Tariff Program seeks to encourage the development of renewable energy in Ontario by offering 20 year contracts for generation electricity from renewable resources. This report details the project steps involved in developing such a project. It covers both the regulatory requirements associated with interconnecting with the Ontario electrical grid, and the steps involved in procuring and developing the solar PV system itself. The report finishes with conclusions and reflections about the development process and lessons learned throughout its execution.

Foreword

I entered the Master of Environmental Studies program at York University's Faculty of Environmental Studies with the intention of studying ways that business, law, and environmental values could interact to foster a positive attitude toward the protection and restoration of the natural environment. This project report represents the culmination of my studies in that regard. During my first year of study in the MES program it became clear to me that renewable energy was the area of study in which my greatest interests would fall. Energy, being one of the largest industries in the world, represents one of the greatest opportunities for the advancement of principles of sustainability within society today. In following with the other two principle focuses of my Plan of Study – business and law – the development of energy infrastructure is primarily the interplay of legislation, regulation, and big business.

Feed-in Tariffs represent an interesting sub-set of energy resource development that breaks away from the older model of centralized generation using conventional resources – such as coal, gas, and nuclear – and moves in the direction of a distributed generation model focusing on the inclusion of renewable resources – such as wind, solar PV, biomass, biogas, and hydro. Feed-in Tariffs also facilitate the participation of smaller groups of community and aboriginal developers of energy resources that the traditional model of capital intensive centralized generation had excluded in the past. By incentivizing participation of the private sector in energy resource development, Feed-in Tariffs help to avoid large capital expenditures of tax payer dollars by government.

This project report summarizes my experience in developing a solar PV installation on my family's farm. In completing this project I have been able to tie in all aspects of my Plan of Study. The practical demonstration of sustainability principles in the development of energy resources is represented in the use of the solar PV generation technology to help satisfy Ontario's electricity demand. Principles of law have defined every aspect of this project ranging from the initial legislation passed by the Ontario government, to the interplay of regulatory requirements and dealings with the administrative arm of government, to the private sector law governing contracts and liability. Of course, principles of business have been the underlying foundation of viability analysis and are the building blocks of action. This project has truly been a fulfilling and enlightening experience.

Acknowledgements

I would like to acknowledge my loving family for their wonderful support in helping to develop this project and believing in me along the way. This project would have been impossible were it not for the support of my parents in lending the use of their property and generous funding. I would like to especially thank my brother Greg for his hard work in helping me edit this report. Your hard work and dedication was an inspiration right to the very end.

Many thanks to Stephen Trappe, and Christy Prada for working with me during the summer and helping me to develop my understanding of the requirements involved in developing a solar PV electrical generation facility. Your vibrant energy and enthusiasm has been a constant source of fun and has provided a fantastic venue for me to test ideas and put plans into action.

Here's also to the friends I've made in the solar PV industry; especially Tom, Christian, and Sebastian at Ontario Solar Provider – I look forward to building more projects with you. Your expertise in helping me develop this project has been intrinsic to its successful completion. Best of luck to you as you continue to help others develop solar PV across Ontario.

Finally, I would like to thank my advisors Dayna Scott and Mark Winfield for helping me to define and execute this project. This project would not have happened were it not for your guidance and inspiration along the way. This has been a truly thrilling experience and I am forever grateful for everyone's help in making it happen.

Sincerely Yours,

Jay Willmot

Contents

1.0 Introduction

This project report details the underlying theory, methodology, and practical execution of the development of a 200kW AC / 270kW DC solar PV system under the Ontario Feed-in Tariff program at Kinghaven Farm in King City, Ontario. Application to the Feed-in Tariff program was made in July, 2010. It is expected that the project will be fully commercially operational and interconnected to the Ontario grid by July 4th, 2012.

The following sections of this project report will include a brief discussion of feed-in tariffs and their history in Ontario. It will then discuss the methodology employed in undertaking this project and the outcome of each step in that methodology. The last section of this report will discuss the insights and reflections drawn from these project activities and will suggest ways that a new entrant into the arena of renewable energy development in Ontario could accomplish their development goals without running into the same issues that were experienced in this project.

1.1 Feed-in Tariffs: Basic Principles and Purposes

A feed-in tariff (FIT) is an energy supply policy focused on supporting and providing incentives for the development of new energy projects by offering long-term purchase agreements for the sale of electricity.[1] Most commonly, FITs are associated with the development of renewable energy resources such as solar PV, wind, hydro, biomass, and biogas. FITs work by providing three things: guaranteed access to the grid, long-term purchase agreements, and payment levels based on costs of renewable energy (RE) generation.[2] Rather than relying solely on government funds sourced from the tax base, FITs are used to encourage private sector spending in the area of renewable energy development. FITs

[1] U.S., National Renewable Energy Labratory, *A Policymaker's Guide to Feed-in Tariff Policy* Design (Technical Report / TP-6A2-44849) by Toby D. Couture, Karlynn Cory, Clair Kreycik, & Emily Williams (Washington D.C.: United States Government Printing Office, 2010) at 6

[2] Miguel Mendonca, *Feed-in Tariffs: Accelerating the Deployment of Renewable Energy* (London: Earthscan, 2007) at 8

can also be used to accomplish non-energy related goals such as environmental sustainability and job creation[3].

1.2 Characteristics and Design

FITs aim to develop each potential resource where it is appropriate and to pay a reasonable amount that guarantees a fair return. Due to this, different rates are offered to projects comprised of different technologies and different scales. For example, in Ontario producers of electricity generated from wind turbines receive CAD$.115/kWh where producers of electricity from solar photovoltaic (PV) receive CAD$.347/kWh or greater.[4] Concordantly, small solar projects receive a higher tariff rate than larger projects due to the cost advantages associated with development on a larger scale.[5] Some jurisdictions also differentiate by available resource, offering a higher tariff for electrical generation in areas with a lesser resource than in areas with a greater resource.[6]

FITs are usually designed with the non-energy goals in mind of cost-effectiveness, inclusivity, and economic development.[7] Inclusiveness refers to the degree to which the program facilitates participation from diverse market segments. This primarily refers to the inclusion of small and non-commercial producers who would normally be excluded from tender bids based on economic advantages of scale and the availability of financial resources.[8] It also relates to diversification of electricity supply with respect to geography, technology, project size, and other factors.[9] Cost effectiveness relates to the net economic impact of the program on ratepayers relative to its feasible alternatives over an appropriate investment horizon. Most FIT programs procure renewables through charges to users of electricity. Therefore, cost-

[3] Miguel Mendonca, David Jacobs, and Benjamin Sovacool, *Powering the Green Economy: The Feed-in Tariff Handbook* (London: Earthscan 2010) at 2 [*Mendonca et al.*]
[4] Ontario, Ministry of Energy, *Ontario's Feed-in Tariff Program Two-Year Review Report*,(Toronto: 2012) at 27 [*FIT Review*]
[5] *Ibid*, at 27
[6] *Mendonca et al.*, *supra* note 3 at 47
[7] California, Los Angeles Business Council, *Implementing Feed-in Tariff Programs: Comparative Analyses and Lessons Learned* (Los Angeles: 2011) at 5
[8] *Ibid*. at 4
[9] *Ibid*. at 4

effectiveness is most directly expressed as the impact on users of electricity.[10] Economic development is the ability of the program to create localized direct, indirect, and induced economic effects including employment, increased regional output, growth of the industrial base, and public fiscal effects.[11]

It has been suggested that FIT programs can only be designed taking into account two out of the three factors explained in the previous paragraph.[12] In the case of the Ontario FIT program it seems likely that it was designed with the twin goals of inclusiveness and economic development in mind. Differentiated tariffs offering different rates to projects of different size and technology, and available grant funding to community and aboriginal developers of renewable energy show a commitment to inclusiveness.

Economic development is also an evident goal as the program aims to create 50,000 private sector jobs by the end of 2012 and to build a manufacturing base in the province for renewable technologies that will eventually make Ontario-made RE technologies competitive on a global scale.[13] The Ontario FIT program originally seemed to have been designed with cost-effectiveness as less important than either inclusiveness or economic development due to the high tariff rates offered in some cases, and the lack of a capacity cap. However, the conclusion of the anticipated two-year review of the program has demonstrated that government is now attempting to include cost-effectiveness as a priority.[14]

1.3 Common Pitfalls of FITs

Mendonca sets out several FIT design features that have contributed to the poor performance of various FIT programs around the world. Those design features include:[15]

- Overly low tariff levels that fail to provide enough incentive for investors;

[10] *Ibid.* at 4
[11] *Ibid*. at 5
[12] *Ibid*. at 5
[13] *FIT Review*, *supra* note 4 at 5
[14] *Ibid*. at 17
[15] *Mendonca et al.*, *supra* note 3 at 57

- Unnecessarily high tariff levels that are eventually transferred onto the end user as electricity costs;
- Flat rate tariffs that fail to take into account problems of scale and differentiated costs of development;
- Maximum and minimum tariffs that require unnecessary negotiation for each project;
- Bad financing mechanisms;
- Bad tariff calculation methodologies including those based on the avoided costs of not operating conventional generation facilities;
- Exemptions for local distribution companies (LDCs) from the purchase obligation;
- The linking of tariff rates to electricity prices;
- Capacity caps; AND
- Denial of legal status to the FIT program

The Ontario FIT program, while not perfect, does a reasonably good job of avoiding most of these problems. In the development of the Kinghaven solar PV facility it was noted that, if anywhere, the Ontario FIT program could only be accused of not providing a satisfactory methodology for the calculation of FIT rates. As will be discussed later, the Ontario program eventually suffered from unnecessarily high tariff rates in the case of solar PV. However, this and other issues were addressed in the Two-Year Review of Ontario's FIT program.

1.4 History of Feed-in Tariffs in Ontario

The first FIT program was introduced in 2006 by the Liberal government under Dalton McGuinty. It was termed the Renewable Energy Standard Offer Program (RESOP).[16] The program offered low tariff rates on a flat rate basis that were not effective at achieving any memorable result. It was eventually frozen in 2008. Bill 150 – *The Green Energy and Green Economy Act* (*GEA*)[17] – was passed in May 2009. This piece of legislation announced the implementation of a new FIT program that was modelled after many of the FIT programs being used in Europe. This new model turned out to be much more conducive to inspiring the development of renewable energy projects – especially small and medium sized solar PV projects.[18] FIT 1.0, as it has come to be known, was commended for its consideration of many points considered crucial in the development of any FIT regime. First, tariff rates were differentiated by technology and size of project aiming to provide a reasonable return to investors. Second, the *GEA* gave priority to developers of renewable power projects in several ways. This included both guaranteeing producers of electricity under the new scheme that LDCs would purchase the power they produced (a feature that was vaguely addressed at best under the RESOP), and allowing developers of RE projects under the FIT program to circumvent the *Planning Act.*[19] Third, the FIT program was designed to derive significant advantages from an economic development standpoint.[20] Through such measures as the "domestic content" requirement, developers are required to use products manufactured in Ontario in building their projects.[21]

There were, however, several problems with FIT 1.0 that began to surface over the first two years of its use. These issues were recently under review in accordance with the "Program Review," originally scheduled to take place two years after FIT 1.0's launch, which was announced on October 31, 2011. The

[16] Renewable Energy Standard Offer Program, online: Ontario Power Authority Archives <http://archive.powerauthority.on.ca/sop/>
[17] *Green Energy Act*, S.O. 2011 c. C-12 [*GEA*]
[18] *FIT Review*, *supra* note 4 at 4
[19] *GEA*, *supra* note 17 at Schedule K
[20] *FIT Review*, *supra* note 4 at 4
[21] Ontario, Ontario Power Authority, *Feed-in Tariff Program FIT Rules*, v. 1.5.1 (OPA: 2011) at 16 [*FIT Rules*]

primary issue examined in the program review was whether some of the original FITs were initially set too high, especially in the case of small and mid-sized solar PV projects. The original tariffs were set at rates that made sense when the program was launched in 2009, but input costs fell significantly up to the point that the Two-Year Review took place. As a result of the FIT program review tariffs offered to applicants to FIT 2.0 will be lower and the various size tranches of project tariffs have been altered.[22] It was announced upon completion of the initial two-year review that yearly reviews of tariff pricing will now be conducted by the OPA to determine the appropriateness of tariff rates being offered to developers. Also of concern during FIT 1.0 was the relatively slow speed with which the OPA issued new rounds of contracts. As was confirmed by an OPA spokesperson at the 2011 APPro / OSEA Community Power Conference in Toronto, while micro-FIT applications were assessed and issued on an incoming basis, applications to the FIT program were looked at in batches "to ensure fairness."[23]

(Peter Thom of Kinghaven Farms Ltd. transporting a skid of newly acquired Silfab solar PV modules to a temporary storage location on the farm. [Photo credit: Jay Willmot, taken on March 16, 2012])

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[22] *FIT Review*, *supra* note 4 at 27
[23] Shawn Cronkwright, *FIT 2.0*: *Proceedings of the Associated Power Producers of Ontario Conference, Toronto, 2011*(Toronto: APPro / OSEA)

2.0 Project Report

2.1 Methodology

This project report details the process that was followed in order to the get Kinghaven Farms Ltd.'s (KFL) solar PV project past the "Kick-off" meeting with Hydro One and into the early stages of system construction. The following steps were followed in interacting with various government agencies - mainly the Ontario Power Authority (OPA), Hydro One Networks Inc. (HONI), and the Electrical Safety Authority (ESA) – and assorted private sector actors:[24]

- Phase 1: Pre-Project Preparation and Analysis
    - Site Selection
    - Project Location
    - Pre-FIT Consultation and Application to FIT Program
    - Research & Solar PV Industry Introduction
    - Preliminary Engineering
    - Project Financing
    - Grant Funding
- Phase 2: Project Design
    - Identification of Ancillary Project Requirements
    - Selecting Contractors
    - Equipment Selection
- Phase 3: Regulatory Approvals & Construction
    - Conditional Offer of FIT from the OPA
    - Connection Impact Assessment with HONI
    - Electrical Safety Plan & Approval with the ESA
    - Notice to Proceed from the OPA
    - Connection Cost Assessment with HONI
    - Kick-off Meeting with HONI
    - Construction

[24] Refer to Appendices J & K respectively for an overview of the regulatory overview of the FIT program.

2.2 Phase One: Pre-project Analysis

2.2.1 Site Selection

When selecting a suitable site for the installation of a rooftop solar PV project it is important to consider several factors including roof type (flat vs. angled), azimuth (orientation on a compass), inclination (the vertical angle at which the panels will sit), and potential sources of shading. The first consideration to be made is whether the proposed project is to be installed on a flat or angled rooftop. Flat roofs have the advantage of allowing modules to be installed at an azimuth and inclination of the installers choosing. This allows installers to position every module at the same orientation, allowing for the use of a centralized inverter which is cheaper than using many smaller string inverters or other corrective technologies. One disadvantage to using a flat roof installation is that it requires more intricate racking. This either means using ballasted racking that weighs a lot and can have detrimental effects from a structural engineering standpoint, or affixed racking that requires that the roof be punctured and open up the possibility of leaks following a sub-par install.[25] Angled rooftops allow for simpler racking systems to be used as the roof itself provides the orientation at which the panels will sit. However, angled rooftops are less likely to be optimally oriented and the inclination offered can be a negative factor to system performance.[26] Also, as is the case with the Kinghaven project, angled rooftops can have different sections, each with an individual orientation, further complicating design. This makes centralized inverters a poor selection for the project as the inverter will follow the lowest common denominator in terms of string performance, and can have the effect of reducing system performance.[27] In this case, smaller inverters must be used to generate the maximum amount of electricity from the proposed system.[28]

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[25] William H. Kemp, *The Renewable Energy Handbook: A guide to Rural Energy Independence, Off-Grid and Sustainable Living* (Tamworth: Aztext Press 2005) at 248 [*Handbook*]
[26] *Ibid.* at 249
[27] Dr. Patrick Chapman, "Understanding Inverter Strategies" *Solar Novus Today* (03 May 2010) online: Novus Media Today LLC <http://www.solarnovus.com/index.php?option=com_content&view=article&id=634:understanding-inverter-strategies&catid=38:application-tech-features&Itemid=246> [*Inverters*]
[28] *Ibid.* at *Inverters* (online)

An optimal site for the installation of a solar PV system in Ontario allows for orientation of the system azimuth to be set between due south and south-west (solar south).[29] At this azimuth system performance will be maximized as the sun will shine on the panels for the longest portion of the day. An important note here is that sun tracker technology can be employed to increase the amount of time that a solar system receives direct sunlight.[30] Trackers continually adjust the solar panels throughout the day so that they are always producing electricity at their maximum capacity. However, these types of systems add a great deal of cost to a system so a proponent should be sure to perform a diligent analysis of exactly how much extra production the use of tracker technology could provide. Tracker technology will also add maintenance costs to a solar PV installation. It is for these reasons that I generally advise against the use of tracker technology.

The optimal average inclination for a solar project can be calculated simply as the latitude at which the project is located.[31] During the winter and summer months this optimal inclination is adjusted by approximately plus or minus 15 degrees – flatter in summer and steeper in winter. For projects located in Toronto, CA this places the optimal average inclination at approximately 43 degrees (28 degrees in summer and 58 degrees in winter).[32] Since most solar systems get the majority of their electrical production out of the summer months, system designers tend to design fixed racking systems (ie. no tracker) at a lower inclination – usually around 22 degrees. Indeed, some systems are designed to be inclined even lower than this or even flat. This is because panels sitting lower to a flat roof will produce less wind load on the structure and will require less structural reinforcement to sustain the project. Systems built on angled rooftops will in almost all scenarios use racking that creates a gap between the roof and the solar module, but doesn't increases nor decreases the inclination naturally created by the rooftop.

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[29] *Handbook, supra* note 24 at 542
[30] *Handbook, supra* note 24 at 250
[31] *Handbook, supra* note 24 at 249
[32] *Handbook, supra* note 24 at 249

Proponents of solar PV electrical systems should also consider sources of potential shading such as trees or buildings in selecting a site for system installation.[33] The best solar systems are not shaded by any obstacles. PV modules are so sensitive that even a small amount of shade can have an extremely detrimental effect on the productivity of the entire panel.[34] This effect is most detrimental to systems using centralized inverters as the inverter will compensate for the loss of production on one panel by balancing the lower voltage across the entire system. New module technologies such as those using three bus-bars (instead of two), or selective emitter technology, are not as badly affected as older module technologies.

The Kinghaven site is made up of several buildings including houses or house-like structures, storage sheds, and barns. Since we did not want to pursue a larger ground-mount solar PV installation to the tune of several megawatts of installed capacity we instead opted to analyse our potential rooftop resources. Some buildings were not selected for the installation because they did not possess the characteristics necessary to facilitate adequate performance for the solar PV system. In the end, the Kinghaven project was planned to incorporate several buildings all tied together and joined at one large step-up transformer and fed into the street. The rooftops selected for the project include a combination of flat and angled rooftops, each having varying inclinations and azimuth. All in all, the Kinghaven project is probably one of the more complicated systems being installed in Ontario today.[35] Kinghaven's site map and basic system layout are included as Appendix A.

As noted earlier, Kinghaven's system is listed as a 200kW AC installation. The Kinghaven property was originally two farms that were purchased together and merged. As such, the buildings on the farm are

[33] *Handbook, supra* note 24 at 252
[34] *Handbook, supra* note 24 at 252
[35] It is my expectation that many farmers with similar sites will run into the same design issues. It is for this reason that complicated sites of this nature should be handled by experienced solar PV design and installation professionals. Most solar PV installation companies operating in Ontario today do not have this experience, so proponents developing sites such as Kingahven need to be wary of those less experienced firms simply looking to make a quick profit.

found in two clusters - the east farm and the west farm. For this reason, we have been referring to the total project as if it is in fact two smaller projects, the east property project and the west property project, each sized at 100kW AC. The east property project is comprised of angled rooftops of varying inclinations and azimuths. The west property project is comprised of a combination of angled and flat roof installation. The race barn complex, as it is listed on the site map, is a combination of three connected structures. The race barn and "hot-walk" building use their own angled rooftops, while the indoor race track itself will use an affixed flat-roof racking system oriented south-south west.

The average azimuth of all of the buildings on the farm is slightly south-east. This is not optimal but the deviation from south is not significant enough to render the entire project financial unviable, as is demonstrated by our project analysis using RETScreen software (Appendix L). Kinghaven is also using a limited amount of east/west and north facing panels but these portions of the site make up a very minimal component of the overall system. System orientation can be up to 45 degrees off of due south without damaging system performance by more than about 25%.[36] North facing systems have traditionally been considered the method of last resort in the northern hemisphere. The north facing module string has only been added since the price of modules has fallen by enough to make sense of the extra capacity given the high original tariff rate offered by the OPA.

The average rooftop inclination is approximately 40 degrees with some lower inclinations and some as steep as 55 degrees.[37] Most of the buildings are not shaded at all, there is a limited amount of shading on the farm office and east property equipment shed. On the west property project shading will only affect a limited number of panels located on the east side of the indoor race track. These panels in particular will be oriented closer to west-south-west in order to counteract the presence of trees to the east.

[36] *Handbook, supra* note 24 at 250

[37] It will be interesting to compare system performance across these components during different parts of the year. The lower inclined system sections will benefit from the longer sun hours produced during the summer, but the steeper system components will benefit from the higher efficiency afforded by lower temperatures during winter.

2.2.2 Project Location

Where a proposed FIT project is to be located geographically will also affect the feasibility of the installation. Renewable energy (and all energy for that matter) is most efficient when generated close to a demand source; locations near or within cities are generally the most feasible. Projects built long distances from where the produced electricity will eventually be consumed do not benefit from one of renewable energy's greatest strengths – close proximity to the end use point. The availability of transmission capacity in certain areas is also determinative of whether or not a proposed project will be able to proceed within a feasible time-frame in many parts of Ontario. For this reason it is important to perform due diligence regarding grid capacity in a certain area before proceeding with project development. Kinghaven's project is in a good location from an efficiency perspective due to its proximity to nearby demand centers, especially the city of Vaughan.

2.2.3 Pre-FIT Consultation and Application to FIT Program

The Pre-FIT Consultation Report, as it is delivered by Hydro One, provides important project information relevant to the applicant's FIT application to the OPA. It is completed using HONI's "Form A," which can be found on the HONI website.[38] This stage of the project can also tip off a potential renewable energy developer to any grid capacity constraint issues that may affect a project prior to the occurrence of any development costs. It also determines what type of electrical infrastructure is present at the property in question. If there is no electrical infrastructure (as is the case with some large ground-mount installations) then the proponent can go straight to the electrical code to determine connection requirements. If there is infrastructure in place, as was the case with Kinghaven, then it must be determined if that infrastructure is suitable to connect the system to the grid. This determination depends largely on the voltage level of the power-line being proposed for inter-connection. The most important

[38] "Pre-FIT Consultation" *Hydro One Networks Inc.* (2009) online: Hydro One Networks Inc. <http://www.hydroone.com/Generators/Pages/Pre-FITConsultation.aspx>

pieces of information for a developer under the FIT program that are assessed by the Pre-FIT Consultation Report are as follows:

1) The voltage level of the electrical service line currently servicing the property where the proposed project is intended to be installed and operated;
2) The transmission station / distribution station (if applicable) / feeder number and voltage to which the intended project will be connected;
3) A distribution map showing the relevant power line, and the distance to the relevant transmission / distribution station; AND
4) Potential confirmation of the intended project as being “Capacity Allocation Exempt” as defined in the OPA FIT Rules.

This information can be used in conjunction with the capacity availability tables found on the OPA FIT Program website to identify any possible grid constraints that could affect the viability of a project. The information described above is also a pre-requisite to an actual application to the FIT program. The time required for this stage of the development process is approximately 10 days. No cost beyond the time involved in putting together a Pre-FIT application is generally attributed to this stage.[39]

Following the satisfactory return and review of the Pre-FIT Consultation by the relevant LDC, a proponent must apply to the FIT program via the OPA FIT Program website.[40] The application requires that a personal profile be made on the MyFIT website, accessible through the main OPA FIT portal. The FIT application itself is a fairly straight-forward document that asks questions relevant to project development such as who will own the project, what type of a project it will be, where the project will be

[39] Also of note: not all LDC’s will present the information requested in as organized a package as Hydro One, so proponents working with smaller LDCs should expect the information usually in Excel spreadsheet format, or in some cases, simply via an email response. Kinghaven’s own Pre-FIT Consultation Response package from Hydro One has been included in this document as Appendix B.

[40] This is done via the web-address fit.powerauthority.on.ca for applicants to the FIT program, or via the web-address microfit.powerauthority.on.ca for applicants to the microFIT program.

developed, and how the project will interconnect with the electrical grid. Kinghaven's own FIT application is included in this document as Appendix C. Several pieces of information are required to successfully complete a FIT application:

1) In the case that the project will be owned by a corporate entity: the entity's HST# (if applicable), and the names of all directors of the organization;
2) The land deed to the property proposed for the intended project to be installed – this document provides the property's legal description;[41]
3) The information contained in the Pre-FIT Consultation Response document

Following the electronic completion and submission of the proponent's FIT application the proponent must follow up with a hard copy submission of materials to the OPA.[42] The items that must be included in this package differ depending on the form and size of the project proposed. This report will deal with the requirements involved for a rooftop solar PV installation. Included in Kinghaven's hard copy submissions to the OPA (and which must be included with any rooftop solar PV application) were the following items:[43]

1) Two hard copies of the FIT application previously submitted online – one labelled "original" and one labelled "copy" – with the FIT reference # provided online written on every page;
2) A signed copy of the OPA "LDC Authorization Form" – this is available on the OPA FIT website and gives the relevant LDC permission to access information about the property in determining the feasibility of the project from a connection standpoint (FIT reference # must be listed on this page as well);

[41] The legal description is different from the mailing address and refers to the respective concession and lot #'s associated with the property in question.
[42] *FIT Rules, supra* note 21 at s. 4.1(a)
[43] *FIT Rules, supra* note 21 at s. 3.1

3) A certified cheque, bank draft, or money order for the applicable FIT application fee – this is calculated as the greater of either $.50/W of proposed capacity or $500 (FIT reference # listed on banking instrument).[44]

4) A certified cheque, bank draft, or money order for the FIT application security[45] in the amount of $20/kW of installed capacity for solar PV, $10/kW of installed capacity for other technologies, and $5/kW of installed capacity for community or aboriginal applicants.

5) Evidence of access rights to the property – either in the form of the land deed by itself or accompanied by a memorandum of understanding (MOU) from the actual owner if the proponent is leasing the land.

The hard-copy submission to the OPA must be delivered within five business days of the electronic submission of the application in order for the priority time-stamp associated with the project at the time of electronic submission to be crystallized. The OPA estimates a turn-around time on these applications of 60-90 days, but this is a misleading figure that should be disregarded (at least under the FIT programs current administration).

I originally submitted my pre-FIT consultation request to HONI after receiving a piece of advice at the Ontario Solar Network Conference in London, ON in June 2010 from an individual who spoke at the conference and seemed competent in matters of solar PV development. The advice was simply that I would require a 44kV power line to connect a project sized at over 150kW. In fact, the entire pre-FIT and FIT application process was completed before I understood the significance of my line voltage selection.

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[44] Note: It is EXTREMELY important that the instrument used to provide this application fee is not sent in using a personal cheque that is not certified by the proponents banking institution as the OPA will refuse to acknowledge receipt of the application. This can have the detrimental effect of delaying the crystallization of the proponents FIT "Priority Time-stamp." This is bad for proponents as the OPA has the tendency to not announce critical date junctures until several months after the actual date has passed. For example, it was announced on October 31, 2011 (the announcement date of the first bi-annual FIT Review, that all applications for CAE projects with a priority time-stamp after December 8, 2010 would no longer be eligible for the old FIT rates as originally announced and officiated up to the point of the review. All developers who had applications following this date, and who had been planning their affairs from the assumption that they would receive the published rates once their project was commercially operational, were forced to throw away the majority of the development work they had already done and go back to square one while the OPA finished its program review.

[45] Not applicable to Capacity Allocation Exempt projects.

The voltage level for a proposed project is also determinative of whether the project will be connected via single phase, or three phase connection (three phase being appropriate for connection to higher voltage lines and larger projects). As I learned from the consultation process with HONI, there was both a 27.6kV line and a 44kV line running in close proximity to Kinghaven. There was no short-circuit capacity available on the 27.6kV line, however there was plenty of available capacity on the 44kV line. On this basis I applied to the FIT program for a solar PV project that was to be connected to the grid via three-phase 44kV connection. As was discovered several months after this, Kinghaven's electrical service is connected to the 27.6kV line on single phase. As will be discussed later, this had far reaching consequences regarding electrical improvements necessary to connect the project.

Following Kinghaven's pre-FIT consultation I quickly submitted an application to the FIT program on July 12, 2011. As with the pre-FIT stage, I did this somewhat impetuously, without first understanding how system layout was actually done. As a result, my original system sizing projections were considered a bit too aggressive by many engineering, procurement, and construction (EPC) providers to whom I spoke during the early stages of project development. However, I once again got lucky in finding that it would be possible to reach my sizing targets for the project. The process of working with knowledgeable third parties regarding project size and proposed building locations led me to discover that, according to the OPA FIT rules, a project must be built to 90% of the size listed for the project at the time of receiving the OPA Notice to Proceed.[46] After an application is submitted for a FIT project, and up to the point of NTP, the proponent has an option to re-size the project down to 75% of the originally applied for capacity without OPA consent.[47] The effect of these two rules when paired together is that a project only needs to be built to 67.5% (90% of 75%) of the originally applied for capacity in order to meet the requirements of the FIT rules. This is of course dependant on the appropriate procedural steps being taken with the OPA.

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[46] Ontario, Ontario Power Authority, *Feed-in Tariff Contract*, v. 1.5.1 (OPA: 2011) at s. 2.6(a)(iv)(C) [*FIT Contract*]
[47] *FIT Contract*, *Ibid.* at s. 2.1(c)

Any other changes to the project, such as a request to increase the size of the project beyond that amount listed on the original application or a drastic re-sizing smaller, must be applied for in writing to the OPA.

One other important point for potential FIT project developers is to keep in mind the status of a project as either Capacity Allocation Exempt or not, and as either a community, aboriginal, or standard commercial project. This is important because it determines the amount of application security that must be included at the application stage and at further stages. If a project is considered CAE (confirmed by the LDC to which the pre-FIT application was submitted) then there is no need under the FIT program rules to submit an application security deposit. In fact, as long as projects are CAE the only fee that must be submitted at the application stage is the minimum amount of $500 (non-refundable). At more advanced stages of development where application security deposits are also required, the price paid by developers of community and aboriginal projects is much lower, especially regarding solar PV.

2.2.4 Research & Solar PV Industry Introduction

Over the course of developing the solar PV installation at Kinghaven I had the opportunity to introduce myself to the real industry players of solar PV in Ontario. While it is exceptionally important to have a good theoretical knowledge of renewable energy prior to embarking on the development of a renewable energy FIT project, the realities of any business environment mean that a certain level of networking and understanding of the "human" side of industry affairs must be achieved in order to effectively participate. To achieve this experiential knowledge of the solar PV industry in Ontario I attended several conferences and tradeshows and met many industry professionals. Getting involved with provincial and national solar PV associations such as the Ontario Solar Network (OSN), the Canadian Solar Industry Association (CanSIA), and the Ontario Sustainable Energy Association (OSEA) is a good way to stay informed about industry events. It was through these associations that I gained knowledge of large conferences and expos such as the APPro / OSEA Community Power Conference 2010/11, and the Solar Canada 2010/11 expos put on by CanSIA. OSN also hosts useful events from time to time, though they are generally of a smaller nature than either of the aforementioned two events. OSN does, however, boast a strong technical training program for solar PV system design and installation that neither of the previous two conferences make easily available.

Attending these events helped me to gain a better understanding of how various parties were involved in the industry and to determine the legitimate sources of solar know-how versus some of the more spurious "fly-by-nighters" currently operating in the newly opened Ontario marketplace. Conferences and tradeshows also offered me a good opportunity to get acquainted with the current Ontario domestic content products that are available. This was an important step for me as up until very recently the level of Ontario content used in various products was subject to a significant amount of misdirection within the industry. For instance, some module manufacturers were claiming that their panels qualified for 17% Ontario domestic content, when under the OPA DC guidelines this level is impossible on a piecemeal basis.[48] Further, some manufacturers of inverters, such as Power One, had previously announced that various products would be available up to a year prior to actually becoming available to the market.

Finally, attending these types of conferences and tradeshows helped me to uncover any previously unidentified issues associated with the development of a proposed project. An example as it pertained to Kinghaven was the identification of previously unknown complications with the electrical transmission system "step-up" requirements with connecting to a 44kV high-voltage power line and feeder. This issue was initially pointed out to me several months after having gone through the pre-FIT consultation by an analyst at HONI who noted that connection to a 44kV line was impossible without the incorporation of a "substation." I had no idea what a substation was, or what exactly it was that my HONI contact was talking about, so the APPro 2010 event provided an excellent venue for me to learn more about this component of system design and installation. At the APPro conference I was able to ask a few high-

[48] Refer to Appendix D – NTP and DC Plan Checklist – note that module framing in Ontario only carries a maximum score of 15% domestic content.

voltage contractors (easily identifiable at the conference) and gain some more insight into the situation. It was suggested that first I find out exactly what type of electrical infrastructure we already had present on the property, what the transformer requirements for the proposed system were, and what the electrical distribution code said about connecting to the grid in the way proposed by Kinghaven's FIT application. Aside from this, I also had the chance to discuss issues such as project design, project location, how the various system components would be connected on the PV system (DC) side of the inverters, types of inverters, how the low-voltage and high-voltage electrical systems would be situated to facilitate the project, and final project size with many different parties during the same day.

2.2.5 Preliminary Engineering

When considering whether or not to proceed with a potential roof-mounted solar PV project, it is of the upmost importance to determine whether the proposed structure is able to support the project. Older buildings (usually made of wood) are more susceptible to rot and degradation. As such, they must be examined to determine what amount of work, if any, must be done in order to ensure that the building can support the extra weight of the solar panels and related equipment for at least the period of the FIT contract. If a building being considered is already in a state of disrepair then a potentially significant amount of work will need to be done to it in order for it to be capable of handling the project. In the case of the Kinghaven project, one of the barns was originally being considered for holding some panels but this idea was abandoned when it was found that the state of the roof and roof structure were such that the building would more or less have had to have been re-built.

2.2.6 Project Financing

The Kinghaven solar PV installation was financed through a combination of debt and equity financing. The equity contribution represents 20% of the total investment and is being provided by KFL. Debt financing was provided by the Bank of Montreal (BMO) to satisfy the remaining 80% of project costs.

BMO had not financed any FIT projects in Ontario prior to the Kinghaven project. Some proponents of renewable energy projects being developed as part of the FIT program run into the problem of not being able to secure suitable sources of financing to pay for project development. This is more frequently the case with proponents who are not traditionally involved in the commercial generation of electricity, and is especially prevalent in the case of farmers and other community developers who do not have access to large amounts of capital. The commercial banks in Canada, who are not very familiar with the development of renewable energy projects, are generally only willing to lend in the case that the proponent has other security with the bank. In other words, the proponent will have the best luck with a commercial lending institution with whom they have a previously established relationship, such as a mortgaged property or a line of credit with established collateral. If a proponent is unable to secure financing through a commercial lending institution there are several private lending options available, though these sources of financing generally charge higher levels of interest for facilitating the loan.[49]

While there are a variety of financing sources currently available to project developers in Ontario, BMO was a desirable financing source based on Kinghaven's previously established relationship with the bank as the corporations commercial banker. In order to secure this funding, I was required to prepare a business plan for the solar PV project. In the end, BMO provided Kinghaven with a Financing Commitment Letter, the terms of which are included as Appendix E.

2.2.7 Grant Funding – The Community Energy Partnerships Program (CEPP)

The CEPP offers grants of varying sizes to renewable energy developers under the FIT program differentiated by project size and technology. In the case of solar PV, grants of up to $75,000 are available to projects sized between 50kW – 1MW, and up to $200,000 for projects sized between 1MW –

[49] The advantage of using private lending sources in Ontario is that some will offer "project" financing, also known as "non-recourse" financing. This type of financing takes no security on the proponents property other than on the equipment that comprises the renewable energy project and the future cash flows associated with the FIT contract itself.

10MW.[50] It is my belief that a "G1" application to the CEPP or AEPP (Aboriginal), as it applies, should be submitted in very close order with the project's FIT application. The G1 application relates to project activities that are undertaken prior to the issuance of a Conditional Offer of FIT by the OPA. In contrast, a "G2" application is submitted after the proponent has received a Conditional Offer and relates to regulatory requirements and processes set into motion as a result of receiving an OPA offer.

It is a common misconception by many developers of FIT projects that they do not qualify for funding by the CEPP. Some of this confusion stems from the fact that the CEPP definition of "community" specifically makes reference to corporations, where the definition of "community" in the OPA FIT Rules makes no mention of projects owned by corporate entities and partnerships.[51] It has however, been confirmed by the Renewable Energy Facilitation Office (REFO) that applicants to the FIT program using corporate entities or partnerships, wherein the shareholders or partners are all "community" applicants as defined in the rules, will also be considered "community" applicants. As such, they also qualify for lower community application securities and price adders where applicable. With this in mind, it is important for proponents of "community" projects to consider applying to the CEPP as the funding received can pay for up to 90% of the costs associated with development up to the NTP stage of project development.

While the Kinghaven FIT application was submitted in July 2010, an application to the CEPP was not submitted until December of that year. This stemmed partially from my own misunderstanding at first of which types of projects qualified to receive CEPP funds. For the purposes of the Kinghaven project however, no expenses were incurred during those early stages as I was personally performing most project activities on a volunteer basis. For a proponent who wishes for a consultant to handle most project activities right from the beginning, an early application to the CEPP would allow them to undertake more project development activities without incurring heavy costs. The Kinghaven project

[50] "CEPP Project Grant Overview" *Community Energy Partnerships Program* (2010), online: The Community Power Fund <http://www.communityenergyprogram.ca/Project_Grants/Project_Grants_OverviewPage.aspx>
[51] *FIT Rules, supra* note 21 at s.9.1(e)

received just over $51,000 in funding from the CEPP from the maximum $75,000 for the project class. These funds were used to pay for engineering activities, business planning, project management, and amongst other activities, the costs associated with the preparation of Kinghaven's CIA and ESA plan / approval documents.

2.3 Phase 2 – Project Design

2.3.1 Identification of Ancillary Project Requirements

Over the course of the Kinghaven project's development it was noted that many solar PV system designers / installers do not inform proponents of the ancillary requirements that are almost always required for a project to be completed successfully. For instance, most "turn-key" system installers do not address the structural or electrical system improvements that will be required for a project to move forward. Beyond the aforementioned structural concerns for existing structures, it may also be necessary to construct new structures, such as when dealing with inverter equipment. Further, as was the case with the Kinghaven project, many properties, especially rural, do not have the appropriate electrical infrastructure present to connect the proposed project to the grid. This is especially the case where a project is required to be connected to the grid on a three-phase service.

If the proponent intends to connect the project on single phase service then the connection requirements are usually in the $20-30,000 range. This is because a single phase service is capable of running at lower voltages. Alternately, if a project is to be connected on a three phase line then the step-up transformer must be adequately sized to handle the voltage increase. In the case of connecting to a 44kV line at the street, the smallest transformer that can be used to connect is 500kVA under the Ontario Electrical Distribution Code. If this service is not already available at the property then the installation of the appropriate infrastructure can be very costly – potentially reaching into the hundreds of thousands of dollars. Also, the low voltage service requirement of the secondary service connecting the project inverters to the step-up transformer must be either 480V or 600V depending on the inverters used.

2.3.2 Selection of Contractors

In order to ascertain who would be used to perform the various services involved with the project, interviews were conducted with any potential consultants or contractors and a quote for services was prepared by the relevant third party. Kinghaven selected contractors and consultants to assist with the project in the areas of structural / roofing improvements and upgrades, electrical system design / tendering / installation, and solar PV system design / installation / training. It became apparent that our system installer would both design and install the system. We also ended up amalgamating the roles of roofer and structural contractor, though that was more of an issue of finding a company capable of performing both roles and achieving better economies of scale on the work due to greater volume. The selection of successful bidders was done by balancing quality of offering against cost of service. The amount of knowledge that a third party possessed on their respective topic relative to solar PV was an important third consideration, but was only ascertainable pertaining to areas of project development in which I already possessed knowledge. For example, while I possess a relatively high level of knowledge pertaining to solar PV theory, regulatory / policy matters, and business in general, I do not possess any sort of knowledge in the fields of structural / roofing analysis or electrical system design and engineering. Fortunately, due to the timeline upon which I selected contractors for various activities, I was able to draw upon the knowledge of several different professionals to satisfy my needs in these various categories and to cross-check information for accuracy in assessing relative value.

The largest cost in the installation of Kinghaven's solar PV system fell to the EPC provider role due to the expensive nature of solar PV equipment. Therefore, this was the role given the greatest scrutiny in making a selection of who would do the work. Over the course of the summer and fall of 2010, nine companies were interviewed who were advertising EPC services for solar PV projects. The framework for analysis used in evaluating individual bids was made up of a combination of price, service offering, and expected performance (both system performance and financial performance). The chief price metric used was cost/watt installed. This is the most commonly cited metric among EPC providers offering "turn-key" packages to proponents. Cost/watt usually refers to the DC side of the project installation, meaning the total watt capacity of the installation. It is a somewhat confusing metric in this sense as EPC providers quote a certain price which includes all equipment and labour required for the installation. However, some pieces of equipment, such as inverters, are only understandable in terms of the AC side of the installation. Wiring and other electrical equipment is not always perfectly aligned with system size either and so this can cause confusion in understanding the price indicated by a system quote. With this in mind, it is prudent for the proponent to itemize the quote provided by the EPC provider in order to determine the relative value of each product or service being offered.

One factor to consider when deciding on an EPC provider is what work is included in the price of installation. Most EPC providers will indicate at the outset that they will take care of everything related to the project, but a closer inspection of the fine print included in the quote will usually show that there are serious limitations to what "everything" includes. Commonly, EPC providers will indicate that they will take care of roofing / structural work, as well as any electrical upgrades associated with the project, but limit the extent to which they will perform this work in the wording of the contract they offer. EPC contracts are also commonly very one-sided as presented by EPC providers so it is important that a proponent makes sure to read carefully and address any concerns arising from the contract before entering into any agreement.

Another important EPC consideration is the equipment being suggested by the installer in accordance with the particular needs of a project. This was a recurring point of contention as very often sales personnel will go to great lengths to convince a proponent that they are wrong in their analysis and that the particular product being offered is optimal to the proponent's situation. My best advice here is to not trust sales personnel and do one's own research into what is being suggested. It also helps to try and get in touch with the most senior executives of the company you are in contact with as every solar PV installation company in Ontario is, at this point, very small, and all employ relatively horizontal work structures. For example, during development of the Kinghaven project we had one company initially offer thin-film PV modules to us in order to avoid having to do any structural work on our barn roofs, however they offered it to us at a price that was immediately identified as being highly inflated after a short market analysis regarding thin-film.[52]

Finally, it is important to keep in mind that "turn-key" solar PV system providers will offer the best price on equipment and services when the project is at the stage closest to actual construction. It is therefore worthwhile for the proponent to consider the use of third party consultants during the development stages of a project to ensure that they are receiving optimal value for their money. To give an example, the first quote Kinghaven received for its 200kW system was at $5.96/watt including balance of system and labour. Today that same system is available in some circumstances for under $4.00/watt. This price difference represents a savings on total capital expenditure of $460,000+HST. I acted too quickly in this regard when developing the Kinghaven project as I entered into a contract for balance of system (inverters, racking, wiring & electrical) and installation / development consultation in January of 2011 – about a year before the project received its Notice to Proceed from the OPA. Luckily, this agreement excluded the purchase of solar panels which turned out to be a good idea as the price of solar PV modules fell quite substantially over the period of time that passed between entering into our initial agreement with OSP and actually constructing the project.

[52] Thin film solar PV equipment can be produced at much cheaper prices than either poly or monocrystalline modules, usually at a price of less than $1/w. Mono and polycrystalline modules on the other hand were at that time priced at approximately $2.40/w. From an efficiency standpoint, thin-film modules are around half in comparison to either mono or poly products. Kinghaven received a quote for a thin-film system at $5.50/w turn-key at the same time that we received quotes for systems using mono-crystalline modules for the same price. This bid was quickly dismissed.

Our selection of electrical and structural engineers came from a combination of referrals from solar companies and Kinghaven's business affiliates. Our analysis in selecting the firms that we would do business with followed similar logic to that employed in our analysis of EPC firms. A combination of quality service and competitive pricing was our chief determining factor, though an engineering firm's relative experience with the solar industry was also taken into consideration. Our initial electrical engineering consultants were introduced to us to by a contact in the horse racing industry. This firm was known for having dealt with several forms of renewable energy in the past, including solar PV and biogas. For Kinghaven, they were responsible for completing preliminary drawings of what electrical equipment a 200kW AC solar system would require in order to connect to the grid at 44kV transmission voltage. Through them we also received a quote from one high-voltage contractor on which we based all other quotes as the project progressed. They also referred us to a structural engineering company in Welland, ON that was experienced at analysing barn roofs for the application of solar PV. We did not continue with our initial electrical engineering consultants because they provided relatively poor service, and charged a lot for comparatively sub-par workmanship. Our relationship with the structural engineering firm was also marked by tardy service. However, our engineer provided helpful advice and helped us to obtain the necessary building permits with quality structural drawings detailing the necessary work to be done. He also reduced the price of the final bill for the amount of time that it took him to complete his drawings.

Following the completion of this these engineering steps we proceeded to interview several electrical and structural / roofing contractors. Our structural contractor was referred to us through a contact in the horse racing industry and our second electrical engineer was referred to us through a contact in the solar PV industry. The structural contractors selected for the project had extensive experience working on horse barns and around horses from working at Woodbine racetrack, so they were ready to handle the requirements of working around the on-farm race horse training facility currently being used by several trainers boarding their horses on the property.

2.3.3 Equipment Selection

The selection of equipment for application within the Kinghaven project was a process closely linked with our selection of EPC provider. Generally speaking, it is important that the EPC provider selected to perform the install of any RE project is comfortable working with the selected equipment for the project. Due to the complicated nature of Kinghaven's site, it was doubly important that our system installer was open to working with us to solve problems arising from the nature of the site.

2.3.3.1 Inverter

The most complicated issues arising from the Kinghaven project had to do with the electrical system used to convert and transmit the DC electricity produced by the modules into AC electricity of a sufficient voltage to be useable by the Ontario electrical grid. Primarily, this issue related to the inverter selection for the project. This question was important for the reason that a very definite trade-off arose, in the case of the Kinghaven project, between cost of equipment used in the electrical system and system performance. This is not the case with all projects. As discussed earlier, systems built on flat rooftops can align all of the panels and racking in exactly the same orientation. This allows for the use of a centralized inverter to serve the entire system that reduces system costs without hurting system performance. Since they represent the cheapest unit cost of inverter equipment most solar PV projects should first consider the use of a centralized inverter for any installation with a proposed system capacity of greater than 50kW.

The Kinghaven site, on the other hand, featured many rooftops, each having a different inclination and azimuth. A centralized inverter in this case would not serve the system well for two reasons. First, centralized inverters regulate the voltage of the entire system on the basis of the lowest-common-denominator. This means that the system can only function as well as its weakest part. Since the Kinghaven site features some rooftops that receive sunlight mutually exclusive to other rooftops (ie.

east/west, etc.) this would have had a seriously detrimental effect on system performance. Secondly, the use of a centralized inverter at the Kinghaven site would have facilitated the need for long DC-wire runs to connect the various barns to the location housing the centralized inverter. DC wiring is, by necessity, much larger than AC wiring and is therefore more expensive.

In order to solve this problem Kinghaven was forced to consider all other feasible options: the use of a centralized inverter utilizing intelligent multiple power point tracking (MPPT) technology; the use of small string inverters; the use of slightly larger string inverters using intelligent MPPT technology; the use of micro-inverters; and the use of DC-to-DC optimizer technology.

The first consideration, the use of a centralized inverter using intelligent MPPT, initially seemed like a good solution for the project as it solved the problem of irradiance levels varying on roofs at different points of the day. The issue of long DC wire runs was not solved, but this factor by itself was not determinative to whether or not the technology was used. Intelligent MPPT allows an inverter to isolate the voltage of particular strings flowing into it, thereby regulating voltage over the system without having to resort to operating at the lowest common denominator. However, our equipment choice in this category was not free of problems. First, the company who produced the inverter was in a very weak financial position, leading to doubts as to its continued existence over the 20 year course of Kinghaven's FIT contract. The equipment is also not easily cross-compatible with other inverter technologies as it operated at 480V (the American standard) rather than 600V (the Canadian standard) and required specialized technicians for service, repair, and replacement. In the case that the company went out of business and Kinghaven was forced to replace the equipment, it seemed likely that we would be faced with performing an entire system overhaul in order to accommodate a different inverter technology. As such, we decided it would be prudent to consider smaller inverter options.

At one end of the spectrum we had the option of using micro-inverter technology, and at the other end, the use of larger string inverters with intelligent MPPT. Micro-inverter technology refers to module level inverters, meaning that one inverter is attached to each module and electricity is converted to AC at the source. String inverters allow for individual strings, representing a small number of panels, to be connected to the inverter. Larger string inverters, especially those using intelligent MPPT can accommodate multiple strings. Micro-inverters were ruled out fairly quickly due to a combination of high cost, low nameplate capacity, an unproven track record, the inability to be used with a three-phase electrical system, and an expectation of increased maintenance and labour costs. Small string inverters ran into similar problems as those of micro-inverters. While being slightly cheaper than micro-inverters, small string inverters can still only facilitate the connection of one string, and in many cases cannot connect to a three-phase system.

The use of DC-to-DC optimizer technology allows for either string inverters or centralized inverters to act as though they are using micro-inverters by facilitating module level monitoring. DC-to-DC optimizers are, however, somewhat redundant for use with many string inverters due to the isolation of modules already achieved by isolating the string from the rest of the system. For this reason they are often considered a more appropriate choice for systems using centralized inverters. In the case of the Kinghaven project however we would have needed to install optimizers across the entire system and the associated costs made the extra investment not worthwhile.

The Kinghaven project's inverter problem was eventually solved by selecting a larger, three-phase capable string inverter that used intelligent MPPT and could accommodate multiple strings. This gave us the flexibility to accommodate the different inclinations and azimuths while still achieving the cost advantages associated with using larger pieces of equipment and minimizing the required DC cable runs that would have been associated with the use of a larger, centralized inverter. Refer to Appendix F for details regarding the inverter selection used for the Kinghaven project.

2.3.3.2 Photovoltaic Modules

The selection of modules for the Kinghaven project was based on three streams of consideration: what form of solar PV technology we would choose for use in the project (mono-crystalline, poly-crystalline, or thin-film technology); what the expected installed capacity (rated capacity in watts) of the panels would be and how many PV cells would be included in each module; and how much the panels would cost and who manufactured them.

Our first line of consideration was the easiest to deal with. Thin-film modules were quickly ruled out because, even though we would have been able to save some money by not having to reinforce the barn roofs, the cost savings were much less than the value represented by the increase in performance offered by either poly or mono-crystalline modules. The decision between poly and mono-crystalline modules was more difficult as the cost-benefit analysis was much tighter. In the end we decided that mono-crystalline modules would be the best choice for the project due to their higher efficiency over the life of the FIT contract despite higher upfront costs.

The other two considerations were handled in a much more organic manner. Because the solar modules were excluded from our original EPC agreement with OSP, our original estimations of number of modules installed, rated capacity of each module, cost, and manufacturer changed constantly as the industry evolved over the development period. For example, we originally thought that we would be working with 230W PV modules at best. However, the rated capacity of available modules increased over the development period to 250W+. The technology also saw a marked drop in price and an increase in number of available manufacturers. These factors forced me to adopt a flexible evaluation model in determining what manufacturer to eventually procure modules from. In the end it was decided to purchase modules from Silfab Ontario Inc., an originally Italian based manufacturer that has set up operations in Mississauga, ON (Appendix H).

Of extreme importance during the evaluation period was physical interaction with manufacturers and their products. I accomplished this through a combination of manufacturing plant tours, conferences, trade shows, and other networking events. The CanSIA 2011 conference was especially useful in getting to see the products of multiple manufacturers side by side.

2.4 Phase 3: Regulatory Approvals & Construction

2.4.1 Conditional Offer

To provide an example, Kinghaven's application to the FIT program was submitted to the OPA on July 12th, 2010, and a conditional offer of FIT (Appendix I) was finally received back from the OPA regarding the project on May 26, 2011 – over 10 months later. The particular internal problems at the OPA as pertaining to the administration of the FIT program are beyond the scope of this report, but would be an interesting focus for a following study.

After receiving a Conditional Offer of FIT from the OPA a proponent has 15 business days to return two signed copies of the form to the OPA along with the applicable application security.[53] Originally, the OPA Conditional Offer of FIT contained a provision at s. 2.4(a) which gave the OPA a right of revocability of the offer up until the point of a project reaching Notice to Proceed.[54] However, in the events leading up the 2011 Ontario provincial election, the Liberal government ordered the OPA to offer

[53] At this stage there is no exemption for Capacity Allocation Exempt Projects. For commercial solar PV installations the proponent must include an application security of $50/kW of installed capacity. For proponents of any other commercial FIT installation the applicable security is $20/kW of installed capacity. Finally, for community or aboriginal developers of FIT projects the application security is $5/kW of installed capacity. It is important for community and aboriginal developers to identify the fact that they qualify for this category early on in project development as the difference between application securities owed is quite substantial. In the case of Kinghaven, it was not identified until the Notice to Proceed stage that we could submit the "community" fee as an application security and as a result we had to leave a much larger amount with the OPA over the pre-Commercial Operation stage of project development. All application securities are returned to the applicant upon reaching Commercial Operation.

[54] *FIT Contract, supra* note 45 at s. 2.4(a)

holders of Conditional Offers of FIT a waiver that nullified the revocability clause.[55] In return, the applicant had to agree to submit a Domestic Content Plan (DCP) (Appendix E) by a certain date depending on the size and type fo the FIT project. In the case of Kinghaven this date was December 08, 2011. Since the DCP is also a requirement of application for Notice to Proceed, this was an easily attainable goal.

2.4.2 Connection Impact Assessment

The Connection Impact Assessment (CIA) is an analysis undertaken by the proponent's LDC (HONI in Kinghaven's case) to determine whether sufficient grid capacity exists at the location of the potential project to facilitate its interconnection to the grid.

The CIA is submitted to the LDC on what is known as a "Form B".[56] Through it, grid capacity is officially assigned to the project. In the case that the grid infrastructure to which the project is intending to connect is owned by an LDC other than HONI, the process is slightly more complicated and expensive as both the private LDC and HONI must conduct separate analyses in order to determine the feasibility of connection. For example, HONI suggests that the CIA stage should take 40-60 days following submission of the "Form B" and supporting documentation. This is accompanied by a fee of $3,000 for small and medium scale projects, and a fee of $7,000 for large scale projects. If a second LDC is involved then both the LDC and HONI will require payment of the respective fee and the total analytical process undertaken will require that a similar amount of time be invested at each company. At the end of this process the relevant LDC(s) will guarantee grid capacity for the interconnection of the project contingent on a Connection Cost Agreement (CCA) being executed between the proponent and HONI within a period of 6 months.[57]

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[55] "Waiver of OPA Termination Rights Available" *Ontario Power Authority* (02 Aug 2011), online: Ontario Power Authority <http://fit.powerauthority.on.ca/waiver-opa-termination-rights-available>

[56] "Connection Impact Assessment" *Hydro One Networks Inc.* (2009), online: Hydro One Networks Inc. <http://www.hydroone.com/Generators/Pages/ConnectionImpactAssessment.aspx>

[57] Kinghaven CIA Complete.email (Appendix G)

It should be noted that the CIA submission package must be complete, accurate, and containing all required ancillary information requested by the LDC. If a CIA package is not perfect, significant delays will be experienced by the proponent in getting the LDC to assign grid capacity to the project. In my experience developing the Kinghaven project LDC internal processes are ideally, from the LDC standpoint, simply a rubber-stamping process. If the application reviewed is not at least nearly perfect, it will be set aside and not looked at again with little or no communication to the proponent. For the Kinghaven project, the project consultant and EPC service provider, Ontario Solar Provider Ltd. (OSP), ensured the application package was prepared correctly. Even with a knowledgeable consultant administering the CIA file Kinghaven still experienced delays in getting CIA approval from Hydro One as there were outstanding questions regarding the high-voltage transformer that would be used to connect the project to the Ontario electrical grid. For certainty, a completed CIA application package should include the following items:

1) Completed “Form B”;
2) Site plan for project installation;
3) Distribution Map (acquired at pre-FIT consultation stage);
4) Single Line Diagram for the proposed system installation on the project side; AND
5) Complete proposed equipment characteristics and accompanying electrical philosophy.

A final tip for the proponent at this stage is to be absolutely sure of their choice of interconnected line voltage (i.e. selecting which power line running near their property to which they intend to connect). In my experience, LDCs are very accommodating when it comes to changes to the selection of equipment being used in the construction and interconnection of a project, but are very rigid when it comes to changing the line voltage and, as a result, the feeder to which the project is connecting. If a proponent wishes to change the feeder to which they are proposing to connect their project, they will be forced to submit a completely new CIA package and, therefore, experience the waiting period involved. At this stage the LDC also provides an estimation of what the costs to the proponent will be to purchase the required metering equipment and to interconnect the project to the Ontario grid. However, these costs are not firm and are subject to an adjustment, or "true-up / true-down," at the time that the project is actually interconnected. The proponent has the option of applying for a Connection Cost Estimate (CCE – Class "A" estimate) which more accurately establishes interconnection costs prior to reaching the true-up / true-down stage, but this is expensive and requires further administrative processing. Kinghaven decided not to pursue the CCE for its solar PV installation. Kinghaven's interconnection costs were estimated at this stage to be just over $29,000. Kinghaven's own CIA application package, as well as accompanying approvals from HONI, is included in this report as Appendix J.

2.4.3 Electrical Safety Authority Plan & Approval

In order to conform to the Ontario Electrical Systems Code a proponent must receive ESA approval for all electrical systems being installed in accordance with project design. Electrical system plans should ideally be submitted to and approved by the ESA prior to the construction of any new electrical system improvement, upgrades, or new installations because without approval there is a chance that the ESA will require the system to be changed – at added expense to the proponent – in order to adhere to code. Kinghaven's submissions to the ESA included two separate packages. The first was done by OSP and detailed the electrical system being employed for the system side of the inverters used to convert the DC flow of electricity produced by the solar panels into AC power usable by the Ontario electrical grid. The second plan was produced by the Wamback Corporation and pertained to the 600V secondary (low-voltage) service running from the project inverters out to the secondary kiosk – which houses the generation meters and other important electrical equipment – and the high voltage service beginning at a 500kVa substation transformer installed as a step-up transformer for preparing the electricity produced to be fed into the 44kV electrical line to which the project is connecting. As well, the second plan also included the three-phase high-voltage service used to connect the 500kVa transformer to the street. Kinghaven's ESA plan submission packages have been included in this report as Appendix M.

2.4.4 Notice to Proceed

The OPA "Notice to Proceed" (NTP) was, prior to the introduction of the OPA pre-NTP waiver issued in the days leading up to the 2011 provincial election, the stage at which a proponent's Conditional Offer of FIT goes firm between the proponent and the OPA. As it was originally constructed, the OPA Conditional Offer contained a revocability clause through which the OPA could cancel the offer prior to reaching this stage. The NTP stage of FIT project development includes three components:[58] the NTP form, the Domestic Content Plan, and proof of financing for the project. At the NTP stage the OPA assigns a Contract Analyst to the FIT project file that coordinates with the proponent for all further stages of FIT project development up to interconnection with the grid and finalization of the FIT Contract.

The Request for Notice to Proceed form is a one-page document that is quite simple to complete. The DCP and supporting documentation is a more flexible document that so far follows no standard template as presented by the OPA. The DCP includes a series of checklists, differentiated by technology, that lay out the DC "score" attributed to a particular piece of equipment or labour. A project must reach a certain level of DC based on points received from each category in order to be said to have met the FIT contract's DC requirements. In support of this form the proponent must write a document detailing how the assertions made on the OPA DC checklist are going to be met, as well as several assertions from the proponent that the proposed DC levels for the project will be met. Proof of financing generally takes the form of a letter of comfort from the proponents financing source, as well as assertions from the proponent that the financing secured for the project will only be used for the development of that specific project and no others. These forms and all other documentation are included as Appendix E.

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[58] "Notice to Proceed Instructions" *Ontario Power Authority* (27 Sept. 2010), online: Ontario Power Authority <http://fit.powerauthority.on.ca/Storage/11144_NTP_Instructions_100927.pdf>

Following submission of the NTP documentation to the OPA, contact was made by the assigned Contract Analyst. Any problems with the documents were highlighted at this stage. Once the assigned contract analyst approves the NTP Request package it takes about 10 days for the OPA to produce the final NTP documentation and send it to the proponent. The proponent then executes two copies of the NTP form, already signed by a representative at the OPA, and mails them in along with the Final Application Security.[59] For Kinghaven, this security totalled $5,000 as we did not elect at the application stage to be considered a community project by the OPA.

2.4.5 Connection Cost Assessment

This step can be undertaken after the conclusion of the CIA stage, and must be initiated at least 45 days prior to the end of the six month limitation period established by the CIA. It does not depend on the satisfactory attainment of NTP by the OPA. During this stage the LDC finalizes their estimate of interconnection costs established at the CIA stage. It is wise to get some form of preliminary approval from the OPA contract analyst regarding NTP as the entire initial estimate of interconnection costs must be paid by the proponent to the respective LDC once the CCA stage is completed. Once again, this cost is subject to adjustment at the true-up/true-down point.

During development of the Kinghaven project, a certain amount of circular logic was encountered at this stage because HONI will not assign a project manager to the file until after the CCA is completed. This was difficult from a timing perspective as the LDC project manager is the only person that can provide information with any certainty regarding placement of the generation meters – a crucial piece of information for producing an ESA plan. Due to time constraints and the interest of installing the

[59] This security is once again $25/kW of installed capacity for solar PV projects, $10/kW of installed capacity for other technologies, and once again $5/kW of installed capacity for community or aboriginal projects.

Kinghaven project and reaching commercial operation before the summer months, our ESA plans were submitted for approval prior to receiving word on where the generation meters should in fact be located.

2.4.6 Kick-0ff Meeting

Kinghaven's "kick-off" meeting with HONI took place on March 2, 2012. Present at the meeting were five members of HONI, Kinghaven's head project manager, site manager, and master electrician from OSP, as well as myself and a key representative of Kinghaven's property management team. The purpose of the kick-off meeting is to set the approximate date for interconnection of the project based on expected construction timelines and interconnection requirements. This stage is useful as it gives the proponent a chance to get a more realistic idea of what the cost of interconnection will be in comparison to what was paid at the initial Connection Cost Deposit stage as determined after the CCA. In the case of Kinghaven, the HONI project manager assigned to our file decided to coordinate communications through our EPC provider based upon a pre-existing relationship.

2.4.7 Construction

While structural reinforcements and roof surface preparation took place in October, 2011, construction of the solar PV system began on March 5th, 2012. Thomas Kreutzer, the executive vice-president of Ontario Solar Provider and head OSP project manager of the Kinghaven solar project, notes that the first stage of a solar project is usually the installation of the inverters. However, based on the fact that the inverters intended for the project were not available at the time, it was decided to pursue other project activities instead. Our first task was instead to begin the trenching of the main low-voltage wiring that would connect the east and west halves of the project. We originally planned for trenching to take 35 hours but encountered numerous delays including weather, incorrect component deliveries, and running into underground obstacles. While the Kinghaven project incorporated trenching runs that would be considered unusual for most solar projects, if the project activity is necessary it would be wise to plan on it taking a long time. Fortunately we were able to move onto other project activities while the trenching was delayed. At the writing of this report, construction was still a long way from complete. Installation of racking and modules on the east farm buildings (see Site Map – Appendix A) was approximately 60% complete at the time of writing this report. Trenching was completed on Monday, March 26, 2012. At this time it is anticipated that installation of the remainder of the system will be complete by mid-May, 2012. The 500kV transformer and other high-voltage equipment are scheduled to arrive around that time, and be installed by early June. As noted, it is anticipated that the project will be inter-connected to the Ontario grid roughly one month following, on July 4th, 2012. Ideally we can interconnect before this date, however, as noted above, July 4th was the earliest date that HONI was prepared to offer as of the Kick-off Meeting.

Left: Storing solar panels at Kinghaven.
Right: Unloading solar panels.

Photo Credit: Jay Willmot

Above: panels begin to go up on Barn 1. Left: standing beside panels in storage. Bottom Left: trenching to the Race Track project site. Bottom middle: trenching on the East Farm project site. Bottom right: racking and other equipment – East Farm project site.

Photo Credit: Jay Willmot

3.0 Conclusions and Reflections

Like most projects, the Kinghaven project has, insofar as it is complete, had its share of successes and areas for improvement. The greatest success for me personally has been that I was able to take the steps to get it started in the first place. As an old mentor of mine used to say, "There will always be 100 different people with 100 different reasons why something will never work but, at the end of the day, you just have to do it." Those words have never rung truer for me.

Another great success that I attribute to this project was the completion of the project business plan and subsequent submission to the Bank of Montreal. Obtaining financing is a crucial component of almost any venture and without success at this stage the project would have been severely hindered from moving forward. That financing was obtained from one of Canada's largest commercial banks is also a victory because, when we approached BMO, the Canadian commercial banks were generally not participating in project financing for FIT projects. As was noted by our commercial banker at BMO, the bank was simply unfamiliar with the risks involved in the development of renewable electricity infrastructure and was therefore hesitant to move ahead with any one project. The Kinghaven business plan that was prepared for the bank, did, however, answer close to all of BMO's questions and concerns. It should be noted that Kinghaven already had a prior lending relationship with BMO that assisted substantially in getting the bank to seriously consider the offer to finance in the early stages. BMO is now lending to solar PV FIT projects much more frequently, and I have been told that the Kinghaven project has helped them set a benchmark for the due diligence expected of a new developer to the field of renewable energy.

The first thing that I would improve about this project would be to set realistic expectations of the development timeline and the realities of the development process right from the start. We were disappointed several times to find out that project activities would take much longer or be much more complicated than originally anticipated. A thorough understanding of the regulatory requirements involved in the development of a FIT project would also have been extremely useful from the outset. I would also have approached negotiations with EPC providers much differently if I were to start again. As noted above, proponents have the most bargaining power regarding construction, etc. as they approach the actual construction of the project. For instance, at the point of reaching NTP the vast majority of regulatory and project planning steps have already been accomplished, helping to greatly reduce development risk moving forward from that point.

With these points in mind, I've distilled a few lessons for the potential proponent of a solar PV installation. The first is that it is very helpful to have a good consultant on hand to facilitate development as it is very difficult to carry out every aspect of project development individually. To have a complete understanding of all of the technical, financial, and legal issues involved in developing a project under the Ontario FIT program is nearly impossible. If an individual can possess sufficient understanding to manage two of the aforementioned categories they will find themselves at an advantage over most. It is certain, however, that they will still need help in completing the project, as well as in making sure that their own analysis is correct. For me, the technical side of project development was where I struggled most. If it had not been for the expertise of Ontario Solar Provider I feel it would have been much more difficult to navigate several technical steps in the development process. The Connection Impact Assessment and ESA approval process are examples of project steps I would not have been able to complete on my own, especially because my experience has shown me that if the paperwork is not nearly perfect the first time the application will be more or less ignored by the authority to which it is sent. This can only reconciled by constant check-ins by the applicant.

I first recognized this weakness in my understanding during the original pre-FIT consultation when I mistakenly assumed that it would be easy to connect the project to a high-voltage 44kV transmission line. I had no idea what the cost of connecting to a 44kV line would be and also failed to consider whether our current low-voltage infrastructure would either suit the technology we were planning to use for the project or connect to the grid at the desired voltage.

A second lesson worth taking away from the Kinghaven project is that if the proponent is capable then it is in their best interest to carry out as much of the pre-construction development work as possible by themselves. One should at least contract for only those initial development services instead of entering into a full turn-key package deal. As mentioned above, the best value for money in developing a solar project can be found at a stage as close as possible to the actual construction of the project, such as NTP. EPC providers charge a substantial premium to individuals involved in pursuing a truly "turn-key" solution. Though "turn-key" solutions save a lot of trouble for clients who want the benefit of developing a project without having to worry about it, those who wish to maximize the value of their dollar and are willing to do some of the work themselves will benefit greatly from employing this strategy. The activities that I refer to in this sense include all administrative, regulatory, and project management activities – this includes handling negotiations with equipment suppliers and procuring equipment directly.

A third point of consideration is to have realistic expectations of the project development timeline. Even with the best of intentions, the government authorities involved in passing all the necessary regulatory approvals for development have, in my experience and the experience of many others in the industry, taken substantially longer than they originally promised to complete various stages. The most apparent breakdown in adherence to timelines in the case of the Kinghaven project took place during the approval of our original FIT application to the OPA. While I applied for our FIT contract on July 12th, 2010, I was not issued a Conditional Offer of FIT until May 26, 2011 – over 7 months after the OPA's projected window of 60 – 90 days for approval had expired. Similarly, our CIA took longer than anticipated for HONI to approve. The CCA stage was quite a bit smoother with HONI, however this may have something to do with the fact that the end of the CCA stage includes a large cheque sent from the proponent to the LDC.

A proponent should also consider the fact that the development process involves navigating a highly uncertain environment. The proponent is left with the task of distinguishing between quality companies with real experience in the design and installation of solar PV systems and "fly-by-night" organizations looking to sell a project and build it quickly simply to make some money and move on, never to be seen again. The challenge for a proponent is to take the long view regarding project development. They must consider which companies will be around for 20 years or, failing that, how to request that their project be designed to facilitate an easy transition through which another organization can take over for maintenance or repairs. For example, during the development of the Kinghaven project a well known developer in the GTA area won contracts to develop solar installations on a number of rooftops owned by a large box store. The installation was done poorly using questionable materials and in the end the system created a fire on the roof and had to be torn off messily by the fire department.[60] Needless to say, that developer and box store corporation are no longer working together. Proponents in the Strathroy area have also run into issues by not completing the proper due diligence regarding the presence of requisite grid capacity needed to connect their project.[61] As a result many were left with equipment installed on their properties but no way to connect to the grid. This problem has been addressed by the OPA by requiring all microFIT applicants to consult with their LDC's prior to receiving a FIT contract.[62]

It is also very much worth considering some of the barriers generally encountered by proponents trying to develop projects for the first time. As noted, finding sufficient funds to construct a project larger than a microFIT installation is difficult for most people as many lending institutions require collateral in order to lend on the project. This is usually in the form of a mortgage on the property, which many people have already used in order to buy the house in the first place. "Non-recourse" lending is becoming increasingly available in Ontario as a reasonable solution to this problem. However, it is not a perfect solution as the companies offering financing of this type often demand high interest rates and inflexible lending terms. Canadian commercial banks are becoming more approachable to finance larger projects. However, there

[60] Details withheld to protect the parties involved
[61] John Spears, "Ontario Solar Projects Put on Hold" *The Toronto Star* (11 Feb 2011), online: Toronto Start <http://www.thestar.com/article/937782>
[62] "Rule Change for New MicroFIT Applications" *Ontario Power Authority* (9 Feb. 2011), online: Ontario Power Authority <http://microfit.powerauthority.on.ca/rule-change-new-microfit-applications>

is still a long way to go before there is a truly workable financing solution that is accessible to the average Ontarian looking to develop a project for him or herself.

Worth noting as well is that the apprehensive approach that the commercial lending industry currently holds regarding the development of renewable energy in Ontario is shared by insurance underwriters. Insurance premiums in Ontario for solar PV installations have in my experience been quoted around the 1% of total asset value level or higher. Christian Wentzel, Sebastian Seyfarth, and Thomas Kreutzer of Ontario Solar Provider, all of whom have experience working within the German FIT scheme, note that insurance premiums in Germany are generally closer to 0.2% of asset value.[63] This is largely a result of a lack of knowledge on the part of most Ontario-based insurance underwriters.

Though my reflections and conclusions have so far been largely centered on the proponent's perspective, considerations of the broader industries involved can also be very useful in understanding how to approach project development. While this paper doesn't purport to engage in a thorough analysis of the political and legal issues that have arisen as a result of the Liberal government's treatment of renewable energy, it is still worth considering how the politicization of the Ontario FIT program has affected every player involved in the program from the top down. One criticism of the program that I feel is fairly fitting is that the government rolled the program out quickly and as a result has had to seriously adjust how it has approached the program's actual administration. There have been several problems that have developed since the inception of the FIT program, arguably due to poor planning, and certainly due to a lack of communication between the administrative actors involved and other stakeholders outside of government. The interconnection problems experienced by microFIT developers in the Strathroy area are an example of the results of this type of miscommunication.

Project developers and equipment manufacturers, many of whom have re-located to Ontario or have set up new offices, are a prominent example of a group heavily invested in the existence and efficient

[63] Interview of Christian Wentzel, Sebastian Seyfarth, and Thomas Kreutzer (28 Sept 2011)

administration of the FIT program. From my own experiences in dealing with these parties, participating in discussion groups online, and attending conferences, it is clear that the administrative deficiencies that have so far been experienced by the private sector are causing serious concern among those stakeholders. Private sector actors depend on certainty in the business environment in order to effectively administer their respective organizations. Unfortunately, the Liberal government has shown a tendency to make what some describe as "knee-jerk" changes to the program in response to political pressure experienced from the press and other politicians. For example, in June of 2010 the OPA put out an announcement that the tariff rate for microFIT ground-mounted solar PV installations was being reduced from $.802/kWh to $.588/kWh because an inordinately high level of interest in projects of that type resulted in an overload of applications.[64] This rate was eventually raised again to $.642/kWh after significant backlash from private sector actors and industry associations such as OSEA and CanSIA.[65]

In my experience, it seems as though the Liberal party has been more interested in using the FIT program to advertise its success in implementing policy meant to position Ontario to recover from the financial crisis of 2008 than in designing and administering a public program which carries out the goal of incentivizing the development of privately held green energy resources in an efficient and effective manner. The Liberal government constantly holds the FIT program out as an economic policy rather than an as energy policy. By this I mean that the focus has been on creating jobs instead of trying to educate people on the less tangible benefits of building a green energy economy. The benefits include inspiring the innovation and development of materials and technologies that over time can to help eliminate our dependence on oil and nuclear technologies and re-building our electrical grid to be more transparent and efficient through the use of smart-grid technologies. However, it seems that the political pressure being felt by the current provincial government with regards to rising electricity prices and the restriction of municipal control over the development process has significantly skewed the focus of discourse on the

[64] Tyler Hamilton, "Clouds Over Ontario Solar Plan" *The Toronto Star* (19 Jul 2010), online: Toronto Star <http://www.thestar.com/article/836499--hamilton-clouds-over-ontario-solar-plan>

[65] "Feed-in Tariff Price Schedule" *Ontario Power Authority* (03 Jun 2011), online: Ontario Power Authority <http://fit.powerauthority.on.ca/sites/default/files/FIT%20Price%20Schedule_June%203%202011.pdf>

political front. Winning votes has become more important than implementing the best possible energy policy.

The politicization of the FIT program became increasingly clear during the provincial election campaign of 2010/2011 when Tim Hudak and the provincial Progressive Conservative Party took a strong stance against the Liberal's position regarding FITs. The discourse surrounding the FIT program began to describe "government subsidies" rather than more appropriately describing the actual financing mechanisms used to pay project owner/operators. FITs also began to shoulder the vast majority of the blame for rising electricity rates despite the fact that this increase had resulted almost exclusively from infrastructure improvements. By the time of the provincial election interconnected FIT projects amounted to less than 100MW – approximately 0.05% of the average operational grid capacity and not even close to a level where FIT prices could have had any meaningful impact on the actual determination of electrical rates paid by consumers.[66]

The message was effective, however, in determining the direction of the Liberal campaign platform and subsequently the actions taken by the various parts of its administrative departments. For instance, following the first incendiary comments by Tim Hudak in his campaign to become Premier of Ontario, the Liberals released the third round of contract offers to mid-sized projects. In fact, the Kinghaven contract was part of this batch. As mentioned above, the issuance of the contract offer by the OPA had been delayed to such an extreme degree that the timing of the contract release could be seen as the government trying to demonstrate that the program was in fact successfully producing results. The contract release also contained a very peculiar alteration to the original contract language. Where Kinghaven had originally applied to receive a contract containing provisions for 50% domestic content, the OPA released a contract amendment requiring all project proponents who had not already paid for equipment in full to adhere to a domestic content level of 60%. The effect of this was to require all

[66] "Bi-weekly FIT & microFIT Report" *Ontario Power Authority* (20 Sept 2011), online: Ontario Power Authority <http://fit.powerauthority.on.ca/sites/default/files/Bi-Weekly%20FIT%20and%20microFIT%20Report%20September%2030th%202011.pdf>

projects to use Ontario produced solar panels in their installations. While this did not turn out to be a hindrance in the end, and in fact allowed me to familiarize myself greatly with the Ontario manufacturing community, it was not difficult to view the move by the government as a means of bolstering economic demand and trying to create more jobs on the manufacturing side in anticipation of the PC campaign against the FIT program. The Liberals also released a waiver agreement to project developers with Conditional Offers of FIT in hand, but who had not yet reached NTP by the time of the provincial election, which waived the revocability clause contained in the original Conditional Offer terms. Prior to the waiver it would have been possible, had the PCs had been elected to power, for the newly formed government to revoke all unfulfilled Conditional Offers of FIT that were outstanding with developers regardless of what stage of development the projects were at or how much money had been spent by local developers. Following the provincial election, upon the announcement of the FIT Program Review, the OPA noted that the program was being frozen and that new pricing would be instituted for all projects that were applied for after specific dates depending on project size.[67] This decision has, in my experience, not been accepted gracefully by many stakeholders in the industry as it explicitly contradicts s. 7.1(b) of the most recent version of the FIT rules (version 1.5.1).[68] S. 7.1(b) states that the pricing to be applied to a contract is the tariff pricing available as of the price schedule published at the time of the application's priority time-stamp as issued by the OPA.

The recent conclusion of the anticipated two-year review of the FIT program has provided more insight into how the Liberal government views the future of the FIT program. Upon beginning the review, the OPA announced the objectives of the review as topics including but not limited to FIT price reductions, ensuring the long-term sustainability of clean energy procurement, continuing to build on the success of Ontario-based manufacturing and clean energy job creation, consideration of new technologies and fuel sources, and a review of the current processes in place to deal with local consultation and the renewable

[67] "FIT Program Under Review" *Ontario Power Authority* (31 Oct. 2011), online: Ontario Power Authority <http://fit.powerauthority.on.ca/fit-program-review-under-way>
[68] *FIT Rules, supra* note 21 at s. 7.1(b)

energy approval (REA) process.[69] The FIT Review recommendations – that have been accepted by the Liberal government – address all of these points. Some key points of policy that came out of the FIT Review are as follows:[70]

- Tariff rates are being reduced for wind and solar PV projects. Wind is experiencing reductions of approximately 15% while solar PV tariffs are being reduced in some cases by as much as 31%.
- Tariff rates for hydro, biomass, and biogas will remain the same.
- Where s. 7.1(b) of the old FIT rules states that the tariff rate applied to the contract would be the tariff rate applicable at the time of the priority time-stamp, the tariff rate will now be offered at the time of contract offer.
- FIT rate reviews and adjustments will now take place annually.
- Some regulatory processes are being streamlined, specifically the REA process.
- Community and Aboriginal projects as defined by the FIT rules will now be given priority over projects being procured and developed by private developers and others in the energy industry.
- Funding will continue to be offered to Community and Aboriginal projects for "soft-costs" that take place during the pre-construction development phases of development.
- The program will be capped at 10,700MW until the end of 2015.
- 10% of the remaining capacity to be allocated will be given to Community and Aboriginal projects.
- A new "points" system is being introduced to determine the level of Community or Aboriginal participation in a given project and projects with over 15% Community or Aboriginal participation will be given priority for review and the award of contracts.
- Municipalities are being given rights of review for large solar and wind projects, and projects that are able to get the support of their municipal council will be given points that will result in the prioritization of that contract.

[69] *FIT Review, supra* note 4
[70] *FIT Review, supra* note 4

All in all, the review addresses and proposes solutions to a number of key issues that were hanging over the head of the first formulation of the FIT program. The central issue of the review was the downward adjustment of tariff rates paid to generators in the arenas of wind and solar development, especially solar. This is not particularly surprising due to falling equipment prices. An interesting point of note is that the size tranches for solar PV were re-organized into the groups <10kW, 10-100kW, and 100-500kW. However, the tariff rate assigned to the <10kW size category is only one cent higher than the tariff rate assigned to projects in the 100-500kW category ($.549/kWh vs. $.539/kWh).[71] It could be argued based on the new tariff that either the government believes that equipment and development costs are appropriately close regardless of project scale, or that projects sized closer to 500kW are being deemed as more desirable. It also seems apparent that the government is trying to make it clear that a priority of the FIT program is to encourage the involvement of local Community and Aboriginal groups in project development. That we are seeing a call for streamlined processes in the REA process and other regulatory processes shows that the government is also trying to curb the tendency of the FIT program to be criticized as heavily obstructed in deployment due to bureaucratic inefficiencies. There is, however, no guidance provided on what the long-term goal of the government is regarding the development of renewable energy beyond 2015. The presumption is that new goals will be set at that point, though what the new goals will be depends on several externalities – particularly the amount of grid capacity that is dedicated to new nuclear builds or the refurbishment of old plants. Overall, the findings of the FIT Review could be seen as encouraging on the basis that there is still a commitment by the government to develop more renewable energy in Ontario. However, how these recommendations will be implemented is still yet to be determined, as is the question of how much capacity will be allocated between the current year and 2015. The fact that the program will face rate reviews on a yearly basis also seems to signal that FIT contracts will only be issued for 8 to 10 months of the year. This is largely dependent on whether contracts continue to be issued in batches or if the OPA will in fact set out to issue contracts once the file has been reviewed in accordance with the original aims of the FIT program.

[71] *FIT Review*, *supra* note 4 at 27

All in all, the completion of this project has been one of the most rewarding experiences of my life. As I began researching renewables during the twilight phase of the old RESOP, and had a reasonable working knowledge of FITs prior to the passing of the *Green Energy Act*, the prospect of Ontario implementing a FIT system modelled after Germany's was extremely exciting for me. I originally set out in the MES program to find ways that knowledge of the natural environment and sustainability could be incorporated into business practices and how the law interacted with this relationship. A solar PV development under the FIT program provided exactly that opportunity as policy and law moved to establish a viable market in the renewable energy industry. Because I would be able to apply the skills I had learned in my undergrad studies and the skills that I had learned in my JD degree through Osgoode Hall, the chance to get involved in the FIT program myself and develop a project was something I could not pass up. Though the project itself took almost two years develop, and was extremely frustrating at times, I can honestly say at this point that there is no other way I could have spent my time in Environmental Studies that would have brought me as much satisfaction and fulfillment.

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3) "Connection Impact Assessment" Hydro One Networks Inc. (2009), online: Hydro One Networks Inc. <http://www.hydroone.com/Generators/Pages/ConnectionImpactAssessment.aspx>

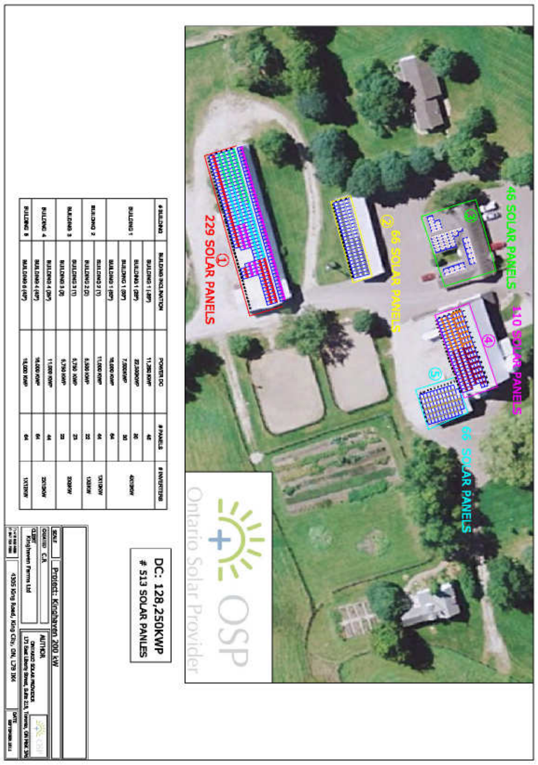
4) "Feed-in Tariff Price Schedule" Ontario Power Authority (03 Jun 2011), online: Ontario Power Authority <http://fit.powerauthority.on.ca/sites/default/files/FIT%20Price%20Schedule_June%203%202011.pdf>

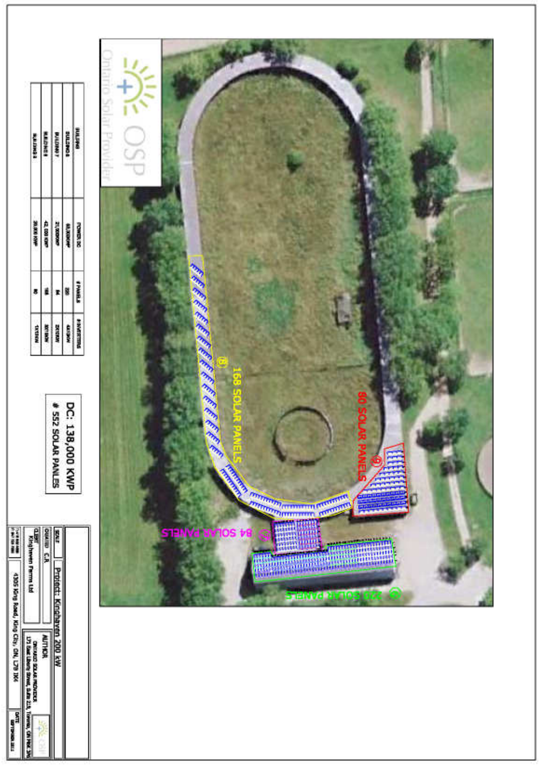
5) "FIT Program Under Review" Ontario Power Authority (31 Oct. 2011), online: Ontario Power Authority <http://fit.powerauthority.on.ca/fit-program-review-under-way>

6) “Notice to Proceed Instructions” Ontario Power Authority (27 Sept. 2010), online: Ontario Power Authority <http://fit.powerauthority.on.ca/Storage/11144_NTP_Instructions_100927.pdf>
7) “Pre-FIT Consultation” Hydro One Networks Inc. (2009) online: Hydro One Networks Inc. <http://www.hydroone.com/Generators/Pages/Pre-FITConsultation.aspx>
8) “Rule Change for New MicroFIT Applications” Ontario Power Authority (9 Feb. 2011), online: Ontario Power Authority <http://microfit.powerauthority.on.ca/rule-change-new-microfit-applications>
9) “Waiver of OPA Termination Rights Available” Ontario Power Authority (02 Aug 2011), online: Ontario Power Authority <http://fit.powerauthority.on.ca/waiver-opa-termination-rights-available>
10) Chapman, Dr. Patrick. “Understanding Inverter Strategies” Solar Novus Today (03 May 2010) online: Novus Media Today LLC <http://www.solarnovus.com/index.php?option=com_content&view=article&id=634:understanding-inverter-strategies&catid=38:application-tech-features&Itemid=246>
11) Hamilton, Tyler.“Clouds Over Ontario Solar Plan” The Toronto Star (19 Jul 2010), online: Toronto Star <http://www.thestar.com/article/836499--hamilton-clouds-over-ontario-solar-plan>
12) Renewable Energy Standard Offer Program, online: Ontario Power Authority Archives <http://archive.powerauthority.on.ca/sop/>
13) 1Spears, John.“Ontario Solar Projects Put on Hold” The Toronto Star (11 Feb 2011), online: Toronto Start <http://www.thestar.com/article/937782>

5.0 Appendices

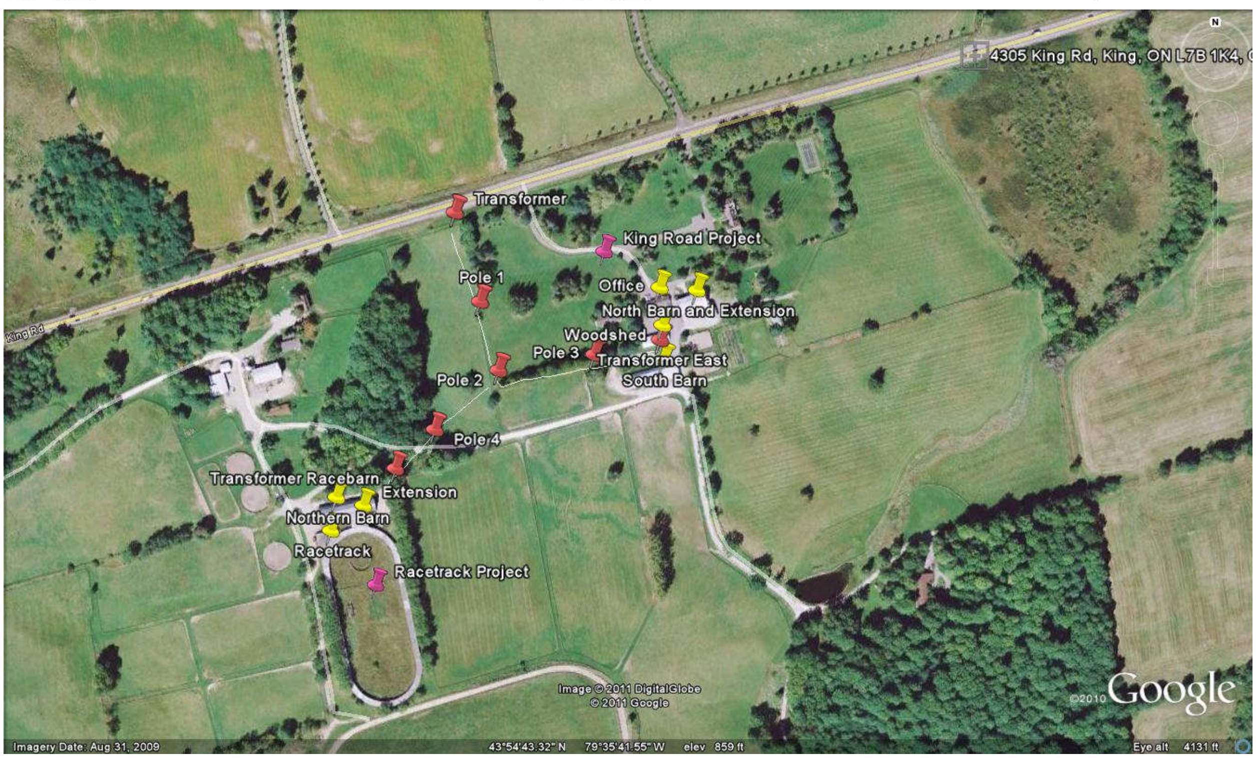
Appendix A – Layout & Site Map

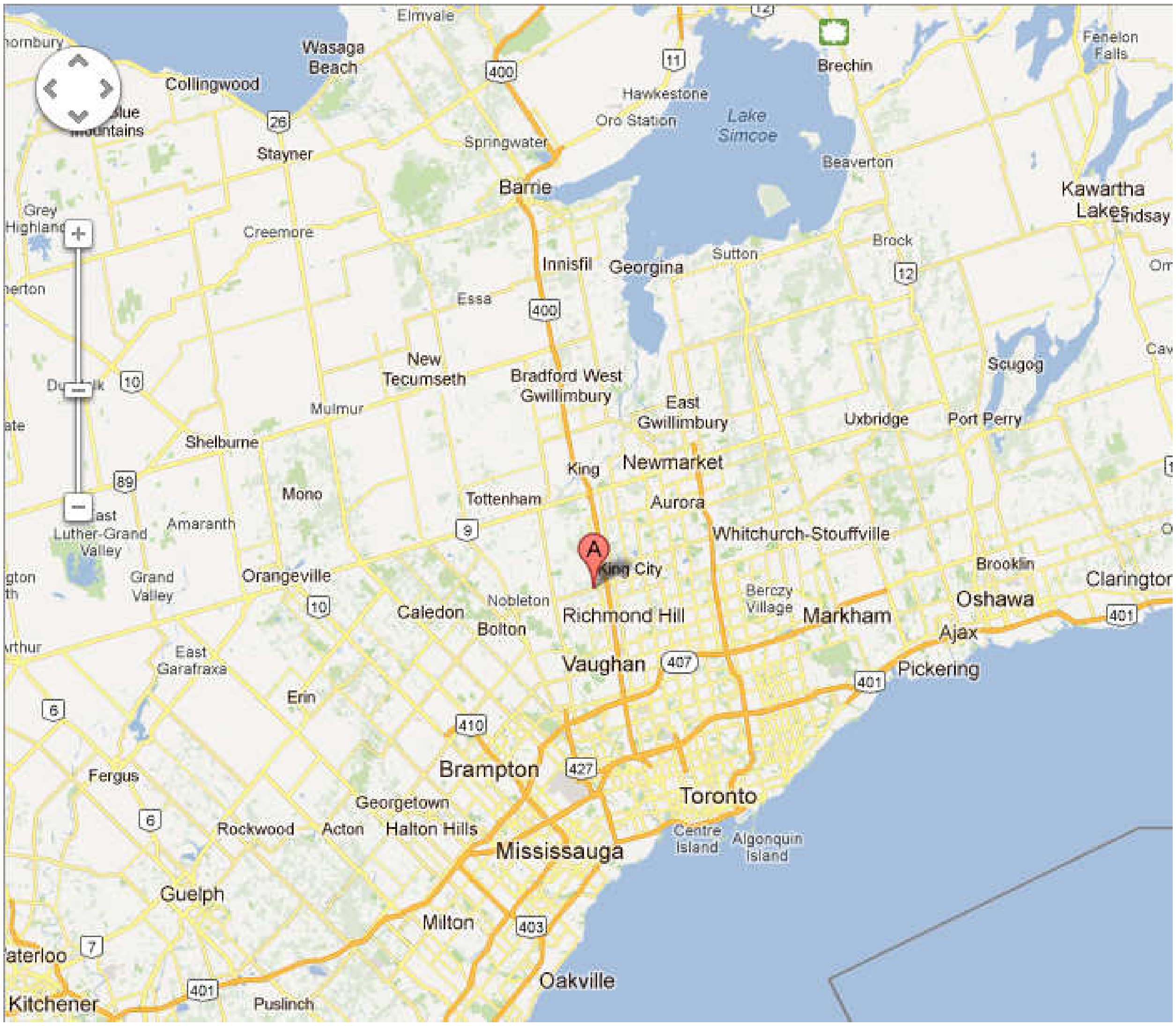




Layouts (Left) Produced by Ontario Solar Provider Inc.

Site Maps (Below): Google Earth & Google Maps




Elmvale
Wasaga Beach
Collingwood
Stayner
Springwater
Barrie
Hawkestone
Oro Station
Lake Simcoe
Brechin
Beaverton
Fenelon Falls
Kawartha Lakes
Lindsay
Creemore
Innisfil
Georgina
Sutton
Brock
Essa
New Tecumseth
Bradford West Gwillimbury
East Gwillimbury
Mulmur
Shelburne
Uxbridge
Port Perry
Scugog
King
Newmarket
Aurora
Mono
Tottenham
Amaranth
Whitchurch-Stouffville
King City
Grand Valley
Orangeville
Nobleton
Caledon
Bolton
Richmond Hill
Berczy Village
Markham
Brooklin
Oshawa
Ajax
Pickering
Vaughan
East Garafraxa
Erin
Brampton
Toronto
Fergus
Georgetown
Rockwood
Acton
Halton Hills
Mississauga
Centre Island
Algonquin Island
Guelph
Milton
Oakville
Kitchener
Puslinch

Appendix B – Pre-FIT Consultation Report

Hydro One Networks Inc.
Distribution Generation – Markham Office
185 Clegg Road, Markham, Ontario L6G 1B7
Fax: 905-944-3342, Telephone: 1-800-419-5208

July 8, 2010

Jay Willmot
Kinghaven Farms Ltd.
4305 King Road, King City, ON L7B 1K4

Re: CONSULTATION # 1200 - Kinghaven Solarworks (250 kW)

Dear Mr. Jay Willmot,

Thank you for participating in Hydro One's Pre-FIT Consultation Process. Hydro One supports the Government of Ontario's initiatives to encourage the connection of new embedded generation facilities using renewable and clean technologies.

As a summary of our conference call, please note the following information for your Feed-In-Tariff (FIT) Application:

- Contract Facility is a Renewable Generating Facility For: Solar PV
- Gross Nameplate Capacity: 250 kW
- Site Location: 4305 King Road, Lot 3 & 5 Concession 6, King city, ON L7B 1K4
- Name of Local Distribution Company (LDC): Hydro One
- Generator connecting on: Three Phase
- Feeder Name: 45M23
- Connection Voltage Level in kilovolts (in kV): 44 kV
- Name of Transformer Station to which the Feeder is connected to: Kleinburg T.S. 44 kV
- Approximate GPS coordinates of the connection point location[1]: 43°54'53.22"N, 79°35'27.34"W

As discussed, a feeder's capacity, for all sections of a feeder, is based on the conductor size, voltage of the feeder, system strength and distance from the Hydro One supply station to the Generator's Point of Common Coupling (PCC). Available capacity for each section of the feeder is allocated and the remaining available capacity is adjusted accordingly. This is commonly known as the distance limitation rule and your project will be subject to this rule upon submission. For additional information regarding connection requirements, please refer to Hydro One's Technical Interconnection Requirements (TIR) document located http://www.hydroone.com/Generators/FITmicroFIT/Pages/TechnicalRequirements.aspx.

For the most recent list of available capacity, please visit the Hydro One Distribution Connected Generators website (http://www.hydroone.com/Generators/Pages/Distribution-connected.aspx). Please note that the List of Applications is based on the current list of allocated capacity to this feeder as of today, and may change prior to your submission of your application to the Ontario Power Authority (OPA). Please keep in mind, capacity has not been reserved for your project and is allocated upon passing the Distribution Availability Test as part of the FIT process with the Ontario Power Authority.

Additionally, since your project is below 250kW connecting to a feeder line of 15kV and below OR below 500kW and connecting to a feeder line above 15kV, according to the Distribution System Code it is classified as a Capacity Allocation Exempt (CAE) project.

[1] The connection point (or Point of Common Coupling – PCC) is typically located at the perimeter of the project site.

Appendix C – FIT Application

FIT-FMXX5J1 - Kinghaven Solarworks

The Ontario Power Authority (OPA) requires that all parties wishing to apply to the FIT Program complete this Application Form and submit it to the OPA indicated in Section 4.1 of the FIT Rules.

FIT Help Center: 1-888-387-3403 Fax: 1-866-833-7978 Email Address: FIT@powerauthority.on.ca

By submitting this Application Form, the Applicant hereby declares that the information contained in this document and submitted by the Applicant is tru complete and accurate.

By submitting this Application, the Applicant agrees and acknowledges that the Applicant has read and understood the FIT Rules, obtained independen legal advice, and agrees to comply with all requirements contained therein.

For Office Use Only

Reference Number FIT-FMXX
(Applicant must include this Application number on each page of all supporting documentation submitted to the O

Print Application

Section 1 - General Applicant Information

Required fields are marked *

1. Applicant's Legal Name:*	Kinghaven Farms Ltd.
2. Applicant's Primary Contact Details:	
First Name:*	Jay
Last Name:*	Willmot
Email Address:*	jay.willmot@gmail.com
Mailing Address:*	4305 King Road
City/Town:*	King City
Country:*	Canada
Province/State/Region:*	Ontario
Postal Code/Zip Code: (mandatory for Canada and USA)	L7B 1K4
Phone Number:*	905-833-3770
Extension:	
Mobile Number:	416-453-3650
Fax Number:	905-833-1156
3. Applicant Secondary Contact Details:	
First Name:	Gregory
Last Name:	Willmot
Email Address:	gregory.willmot@gmail.com
Confirm email address:	gregory.willmot@gmail.com

Mailing Address:	4305 King Road
City/Town:	King City
Country:*	Canada
Province/State/Region:*	Ontario
Postal Code/Zip Code:	L7B 1K4
Phone Number:	905-833-3770
Extension:	
Mobile Number:	905-713-7211
Fax Number:	905-833-1156

4. The Applicant is:*
   a corporation

4a. Where the Applicant is a corporation, provide the names of the Directors and Officers; where the Applicant is a partnership, joint venture or other, provide the names of the directors, officers and partners as applicable.

David Willmot - President & CEO
Susan Willmot - VP Operations
Jay Willmot - VP Business Development
Greg Willmot - VP Business Development

5. Is the Applicant a non-resident of Canada as defined in the Income Tax Act?*
   No

6. Is the Applicant a GST Registrant?*
   Yes

6a. Provide the Applicant's GST Registration Number:
   134622686 2RT0001

7. Is the Applicant a generator currently licensed with the Ontario Energy Board?*
   No

8. Is the Project eligible for the Aboriginal or Community Price Adder?*
   No

9. Has the Applicant applied for the OPA's Aboriginal or Community funding for this Project?*
   No

9i. If no, does Applicant intend to apply for the funding?:*
   No

10. Is the Project located on Crown lands?*
   No

11. Is the Applicant applying for an ecoENERGY incentive?*
   No

12. Is the Applicant currently a Market Participant?*
   No

ection 2 - Project Eligibility Requirements

equired fields are marked *.

1. Project Name:*	Kinghaven Solarworks

2. Municipal address of Project (must be located in Ontario)

Street Address:*	4305 King Road

City/Town:* King City

Province:* ON

Postal Code:* L7B 1K4

3. Legal description of Location of Project:*

Lots 3-5, Concession 6, King City, ON, L7B 1K4

4. Project is a Renewable Generating Facility for:*
   Solar photovoltaic (PV) (rooftop)

5. Gross Nameplate Capacity in kilowatts (kW):* (Note: 1MW = 1,000kW) 200

6. Does the Project have, or has it had, a Prior Contract?*
   No

7. Has the Applicant applied for an Impact Assessment?*
   No

7a. Has the Applicant's Impact Assessment been rescinded?*

8. Is this Project an Incremental Project?*
   No

ection 3 - Project Connection Requirements

equired fields are marked *.

1. Expected Commercial Operation Date of Project:*
   30/11/2011 (dd/mm/yyyy)

2. Is the Project a Capacity Allocation Exempt Project?*
   Yes

3. Is Project connected to a Host Facility?*
   No

4. Project is connected to:
   Distribution System

2.1. Name of Local Distribution Company:* Hydro One Networks Inc.

2.2. Does the Project require expansion of the distribution system in order to connect economically?*
No

2.3. Generator connecting on:
Three Phase

2.4. Is your proposed connection point at a feeder or at Transformer Station or Distribution Station:*
Feeder

2.4a. Feeder Name:* 45M23 e.g. 22M24

2.4b. Connection Voltage Level in kilovolts (in kV)* 44 kV e.g. 27.6 kV

2.4c. GPS coordinates of the connection point location (longitude, latitude - Degree Decimal Format):*
43.914783, -79.59092777777778 e.g. 49.392, -75.570

2.4d. GPS coordinates of Location of Project (longitude, latitude - Degree Decimal Format):*
43.91224444444445, -79.59451666666666 e.g. 49.392, -75.570

Appendix D – Notice to Proceed & Domestic Content Plan

ONTARIO POWER AUTHORITY

120 Adelaide Street West
Suite 1600
Toronto, Ontario M5H 1T1
T 416-967-7474
F 416-967-1947
www.powerauthority.on.ca

NOTICE TO PROCEED

Pursuant to Section 2.4 of the FIT Contract, the OPA is hereby issuing this Notice to Proceed. Capitalized terms not defined herein have the meanings ascribed thereto in the FIT Contract.

We request that you acknowledge receipt of this Notice to Proceed by signing both copies of this document and returning one (1) hardcopy of this Notice to Proceed to the OPA and emailing an electronic copy to FIT.Contract@powerauthority.on.ca

Date	December 14, 2011
Legal Name of Supplier	Kinghaven Farms Ltd.
Contract Identification #	F-001789-SPV-130-502
Milestone Date for Commercial Operation	June 14, 2014
Contract Date	June 14, 2011

OPA AUTHORIZED SIGNATORY	
By: [signature] Michael Killeavy Director, Contract Management Ontario Power Authority	Date: 13 December 2011

SUPPLIER AUTHORIZED SIGNATORY	
The Supplier acknowledges receipt of this Notice to Proceed.	
By: [signature] Name: JAY WILLMOT Title: VP, BUSINESS DEVELOPMENT	Date: JAN. 5, 2011

Table 2: Domestic Content Grid – Solar (PV) Power Projects Greater than 10 kW Utilizing Crystalline Silicon PV Technology

Designated Activity		Qualifying Percentage	Yes/No
1.	Silicon that has been used as input to solar photovoltaic cells manufactured in an Ontario refinery.	11%	N
2.	Silicon ingots and wafer, where silicon ingots have been cast in Ontario, and wafers have been cut from the casting by a saw in Ontario.	13%	N
3.	The crystalline silicon solar photovoltaic cells, where their active photovoltaic layer(s) have been formed in Ontario.	11%	N
4.	Solar photovoltaic modules (i.e. panels), where the electrical connections between the solar cells have been made in Ontario, and the solar photovoltaic module materials have been encapsulated in Ontario	15%	Y
5.	Inverter, where the assembly, final wiring and testing has been done in Ontario.	8%	Y
6.	Mounting systems, where the structural components of the fixed or moving mounting systems have been entirely machined or formed or cast in Ontario. The metal for the structural components may not have been pre-machined outside Ontario other than peeling/roughing of the part for quality control purposes when it left the smelter or forge. The machining and assembly of the mounting system must have entirely taken place in Ontario (i.e. bending, welding, piercing and bolting).	11%	Y
7.	Wiring and electrical hardware that is not part of other Designated Activities, that has been sourced from an Ontario Supplier.	9%	Y
8.	Construction costs, and on-site labour performed by individuals Resident in Ontario, provided that no more than 5% of the total person-hours of all such labour is performed by individuals that are not Resident in Ontario.	18%	Y
9.	Consulting services, including legal, technical and accounting performed by individuals Resident in Ontario, provided that no more than 5% of the total person-hours of all such services are performed by individuals that are not Resident in Ontario.	4%	Y
Total		**100%**	%

Domestic Content Plan Substantiation Letter

Supplier: Kinghaven Farms Ltd.
FIT Contract Identification Number: F-001789-SPV-130-502
Date: Nov. 12, 2011

Kinghaven Farms Ltd. intends to satisfy the 60% Domestic Content requirement pursuant to the Feed-in Tariff Contract F-001789-SPV-130-502 as issued by the Ontario Power Authority as per the following: (Total Domestic Content achieved: 65%)

1) Designated Activity: Solar photovoltaic modules, where the electrical connections between the solar cells have been made in Ontario, and the solar photovoltaic module materials have been encapsulated in Ontario (15%)
   a. Manufacturer: Eclipsall Energy Corp.
   b. Location: Scarborough, ON
   c. Model: NRG 60 Series (230-250W), Made in Ontario

2) Designated Activity: Inverter (8%)
   a. Manufacturer: Power One Inc.
   b. Location: Toronto, ON
   c. Model: Aurora PVI – 10.0 – OUTD – CAD Inverter, Transformerless, Ultra-high efficiencies, UL1741/IEEE1547 compliant, 5 to 10 year warranty, Made in Ontario

3) Designated Activity: Mounting System (11%)
   a. Manufacturer: Ontario Solar Provider Inc.
   b. Location: Toronto, ON
   c. Model: OSP rooftop PV racking system, customized assembly for reliable mounting of solar panels to roof, Made in Ontario; KB Racking flat roof racking system, Made in Ontario

4) Designated Activity: Wiring and Electrical Hardware not part of other Designated Activities (9%)
   a. Manufacturer: NedCo.
   b. Location: Mississuaga, ON
   c. Equipment Description: wiring, combiner box and panel, meter base, miscellaneous components

5) Designated Activity: Construction Costs and On-Site Labour (18%)
    a. Contractors: Lane Construction Inc., Ontario Solar Provider Inc., Wilson High Voltage Inc.
    b. Contractor Location(s): Toronto, ON
    c. Services: Structural / roofing improvements to buildings, Solar PV System Installation, High Voltage System Installation

6) Designated Activity: Consulting Services (4%)
    a. Legal Consultant: Peter James (Mississauga, ON)
    b. Technical Consultants: Ontario Solar Provider (Toronto, ON), H. H. Angus Engineering Consultants (Toronto, ON), KLS Engineers (Welland, ON), Wamback Corporation Ltd. (Newmarket, ON), Kinghaven Energy Consultants Ltd. (King City, ON)
    c. Accounting Consultant: Nick Kehar (Brampton, ON)

I hereby certify this 12th Day of November, 2011 that all information presented in this letter is to the best of my knowledge accurate and complete and represents Kinghaven Farms Ltd.'s plan to satisfy the 60% Domestic Content requirement of the Ontario Feed-in Tariff Program.

Kinghaven Farms Ltd.

____

Jay Willmot

VP, Business Development

Appendix E – Bank of Montreal Financing Commitment Letter

Kinghaven Farms Limited
Commitment Letter

CREDIT FACILITY # 5 (NEW)

AMOUNT: $1,360,000 CDN

LOAN TYPE: Demand Loan Non-Revolving and/or Fixed Rate Term Loan

ACCOUNT: To be determined

LOAN PURPOSE: Available to finance up to 80% of the total project costs for large scale renewable energy project on farm property under the Feed-in Tariff (FIT) program offered through the OPA (Ontario Power Authority). Total Project costs to be capped at $1,700,000 and includes $150,000 contingency.

Actual Project costs estimated at $1,553,000 x 80% = $1,242,000
Minimum anticipated equity injection of $311,000

REPAYMENT: Interest only payments during construction phase up to a maximum of one year, followed by equal monthly principal and interest payments over the remaining amortization period.

AMORTIZATION: Maximum 15 Years.

TERM: Available terms of 1-5 years for Fixed Rate Term Loan

INTEREST RATE:

Demand Loan Non-Revolving:
Prime rate + 1.00%, payable monthly in arrears. Prime Rate means the floating annual rate of interest established from time to time by the Bank of Montreal as the reference rate it will use to determine rates of interest on Canadian dollar loans to customers in Canada.

Fixed Rate Term Loan:
Matrix rate spread over cost of funds depending on term selected. Fixed rate to be determined based on applicable rates at time the funds are booked.

APPLICATION FEE: $500.00. Fee is discounted down form the matrix fee of $3,400

CONDITIONS PRECEDENT: The borrower is to provide the following documentation prior to advance of funds:

1. Copy of conditional offer of FIT contract from OPA.
2. Firm Quotes from installers and paid invoices (as received)
3. Confirmation that appropriate business insurance relevant to the solar project has been arranged
4. Prior to first draw, confirmation of minimum up front equity injection by the borrower equivalent to 20% of the final contract costs.

DRAW CONDITIONS:

1. Funds available via Demand Loan Non Revolving as a Construction Loan during construction.
2. Draws permitted against presentation of invoices once 20% equity injection is confirmed.
3. Signed promissory note required for each draw request
4. Minimum draw $100,000
5. Provision of a detailed project budget and cash flow outlining all hard and soft costs, holdbacks and cost to complete with each draw request.
6. Nothing shall have occurred which would have a material adverse effect on the business, operations, assets or undertaking of the Borrower, on the rights and remedies of the Bank or, on the ability of the Borrower to perform its obligations to the Bank, all as determined in the sole discretion of the Bank and its Counsel.

- - 4 - -

Appendix F – Inverter Selection: Power One Trio

power-one Renewable Energy Solutions

AURORA®

PVI-10.0-TL-OUTD
PVI-12.5-TL-OUTD

AURORA TRIO

GENERAL SPECIFICATIONS
OUTDOOR MODELS

The three-phase 10.0 and 12.5 kW non-isolated inverter is an industry leader.

Designed for commercial usage, this three-phase inverter is highly unique in its ability to control the performance of the PV panels, especially during periods of variable weather conditions. This transformerless device has two independent MPPTs and efficiency ratings of up to 97.7%.

The wide input voltage range makes the inverter suitable to low power installations with reduced string size. It is available with an optional fully-integrated DC switch, fuse and remote controlled DC disconnect function. The unit is free of electrolytic capacitors, leading to a longer product lifetime.

Features

- 'Electrolyte-free' power converter to further increase the life expectancy and long term reliability
- True three-phase bridge topology for DC/AC output converter
- Each inverter is set on specific grid codes which can be selected in the field
- Dual input sections with independent MPP tracking, allows optimal energy harvesting from two sub-arrays oriented in different directions
- Wide input range
- High speed and precise MPPT algorithm for real time power tracking and improved energy harvesting
- Flat efficiency curves ensure high efficiency at all output levels ensuring consistent and stable performance across the entire input voltage and output power range
- Outdoor enclosure for unrestricted use under any environmental conditions
- Integrated DC disconnect switch in compliance with international Standards (-S Version)
- RS-485 communication interface (for connection to laptop or datalogger)
- Compatible with PVI-RADIOMODULE for wireless communication with Aurora PVI-DESKTOP

Appendix G – Connection Impact Assessment Confirmation

Jay Willmot <jwillmot@kinghavenenergy.ca>

FW: Hydro One Project #17,640 - Kinghaven SolarWorks CIA Complete

Ian Rice - OSP <irice@ontariosp.ca> Tue, Oct 11, 2011 at 4:10 PM
To: jwillmot@kinghavenenergy.ca
Cc: Jay Willmot <jay.willmot@gmail.com>, ss@ontariosp.ca

Hi Jay,

Finally gotten the CIA for your project back from Hydro One – it's taken them a month from finalizing the CIA to actually prepare the connection estimate, which is how they account for the delay. Pretty outrageous.

In any event: it's here! I have reviewed the document and you've been approved for 200kW, so this thing is ready to be pushed through to NTP and the CCA stage. That being said, there are 3 minor mistakes:

1) P.4: Jay Willmot appears as the Generator, instead of Kinghaven Farms Ltd. My suggestion would be to change this immediately, as the OPA held up one of our NTP requests for this reason. If you give me the go-ahead I should be able to get this changed within 24 hours or so.

2) P.5: the distance between the PCC and the generator is actually much less than 850m. The actual figure is more like 220m. This is a good mistake for us, as the smaller figure will actually make connection of your project easier. Consequently, we need to decide whether to bring this to HONI's attention immediately, the two issues being:

    a. Having them change this figure on the CIA may save you a few thousand dollars on your Class C estimate (at the item marked *Customer connection at the demaracation point* – it may be possible to bring that number down from $10k). However, note that this 10K figure may primarily be based on the 44kV connection voltage, so it may be tough to bring the number down.

    b. Making this change will likely take longer than the change in point 1), so may delay your application for NTP.

3) P.15: they've gotten OSP's postal code wrong. We'll correct this when we submit the CCA application.

Let me know what you think. If you have any questions or comments shoot me an email or I can give you a call to discuss.

From: Emilie.Nagato@HydroOne.com [mailto:Emilie.Nagato@HydroOne.com] **On Behalf Of** DXGenerationConnecti@HydroOne.com
Sent: October-11-11 2:16 PM
To: tk@ontariosp.com
Cc: darryl.tackaberry@HydroOne.com
Subject: Hydro One Project #17,640 – Kinghaven SolarWorks CIA Complete

IMPORTANT INFORMATION

Please read the following document thoroughly and proceed accordingly

Dear Mr. Kretuzer,

As per your application, Hydro One has completed a Connection Impact Assessment (CIA) package for your generation Project #17,640.

This CIA package includes the following documents:

- Completed CIA for the subject project;
- Detailed Connection Cost Estimate (+/- 50%) outlining the cost to connect for the subject project; and
- Connection Cost Agreement (CCA) Application Form.

Important Information Regarding Your Project:

- Your project has been allocated capacity as of today's date (Hydro One's CIA Sent Date). You must sign a CCA within 6-months of this date in order to maintain capacity for the project. As per the Distribution System Code (DSC) Section 6.2.4.1 (e) (i), failure to sign a CCA within the prescribed time period will result in the removal of capacity allocated for your project

Appendix H – Module Selection: Silfab SLA 250W Monocrystalline 60 Cell Module

Silfab

Monocrystalline PV Module

SLA240/245/250/255M 60 cells

The SLA PV module series is a result of the experience of the Silfab technical team, specialized in the entire photovoltaic value chain, with modules produced and operating for over 30 years. Many field experiences attest a typical expected lifetime of Silfab modules of over 40 years;

Quality and characteristics

Module produced with 60 high efficiency and high quality monocrystalline solar cells, with a nominal power of up to 255Wp, with 3 busbars to reduce ohmic losses of the module and of the PV system;

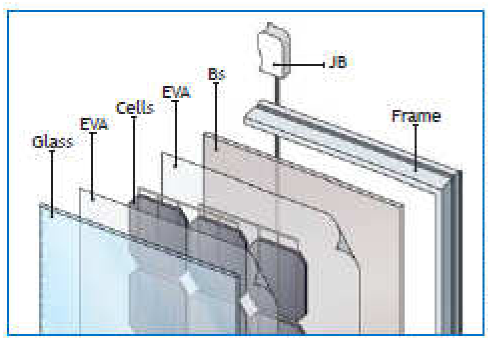
Enhanced Energy production at low wavelength guaranteed by the use of selective emitter solar cells;

Narrow tolerance of nominal power +/-1%, to minimize mis-match losses in the strings and achieve the maximum electrical performance of the PV system;

Use of reference modules calibrated by Fraunhofer ISE;

Quality, reliability and stability of the electrical performance over the years guaranteed by strict controls during each production step and by using only high quality raw materials;

Reduced weight and overall dimensions maintaining high mechanical characteristics (certified for hail impact and for wind and snow load up to 5.4kN/m²);



Guaranteed power
90% remaining power after 10 years
80% remaining power after 25 years

Warranties and product certifications

Frame with practical and compact structure, provided with:
- grounding holes
- mounting holes for a rapid and safe installation
- drainage holes to avoid water stagnation in the aluminum channels and subsequent ice formation

Appendix I – Conditional Offer of FIT

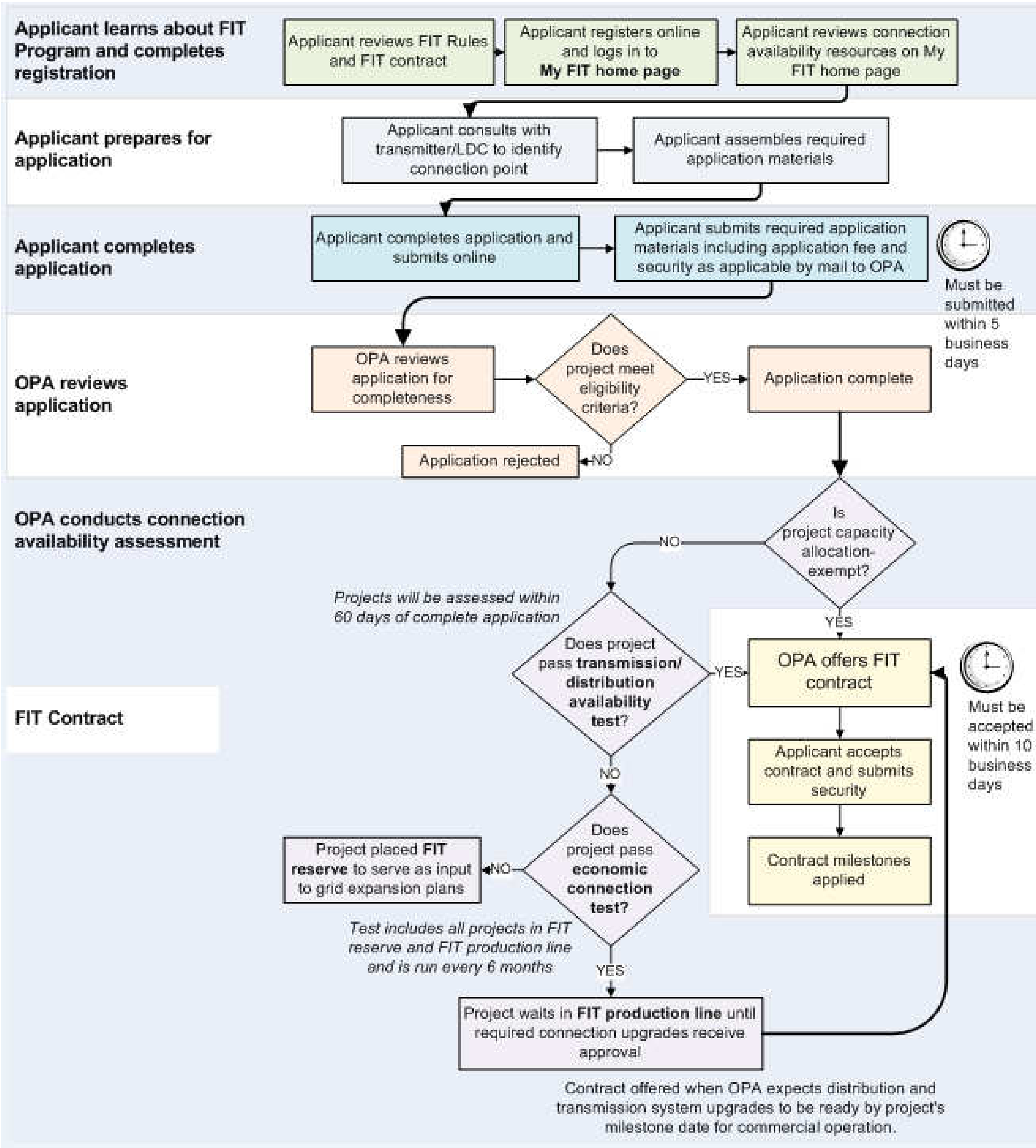
FEED-IN TARIFF CONTRACT (FIT CONTRACT)

Version 1.5

1.	**CONTRACT IDENTIFICATION #**	F-001789-SPV-130-502	
2.	**FIT REFERENCE #**	FIT-FMXX5J1	
3.	**CONTRACT DATE**	June 14, 2011	
4.	**SUPPLIER**	**Kinghaven Farms Ltd.**	
5.	**SUPPLIER'S ADDRESS**	**4305 King Road** **King City ON L7B1K4** **Canada**	Fax: (905) 833-1156 Phone: (905) 833-3770
		Contact Person: Jay Willmot	Email: jay.willmot@gmail.com
6.	**SUPPLIER INFORMATION**	Not a Non-Resident of Canada	
7.	**RENEWABLE FUEL**	**Solar (PV) (Rooftop)**	
8.	**CONTRACT CAPACITY**	200 kW	
9.	**INCREMENTAL PROJECT**	No	
10.	**GROSS NAMEPLATE CAPACITY**	200 kW	
11.	**CONTRACT PRICE**	71.3 ¢/kWh	Peak Performance Factor does not apply
12.	**(a) ABORIGINAL PRICE ADDER (as of the Contract Date)**	0.00 ¢/kWh	Aboriginal Participation Level (if applicable) 0 %
	(b) COMMUNITY PRICE ADDER (as of the Contract Date)	0.00 ¢/kWh	Community Participation Level (if applicable)

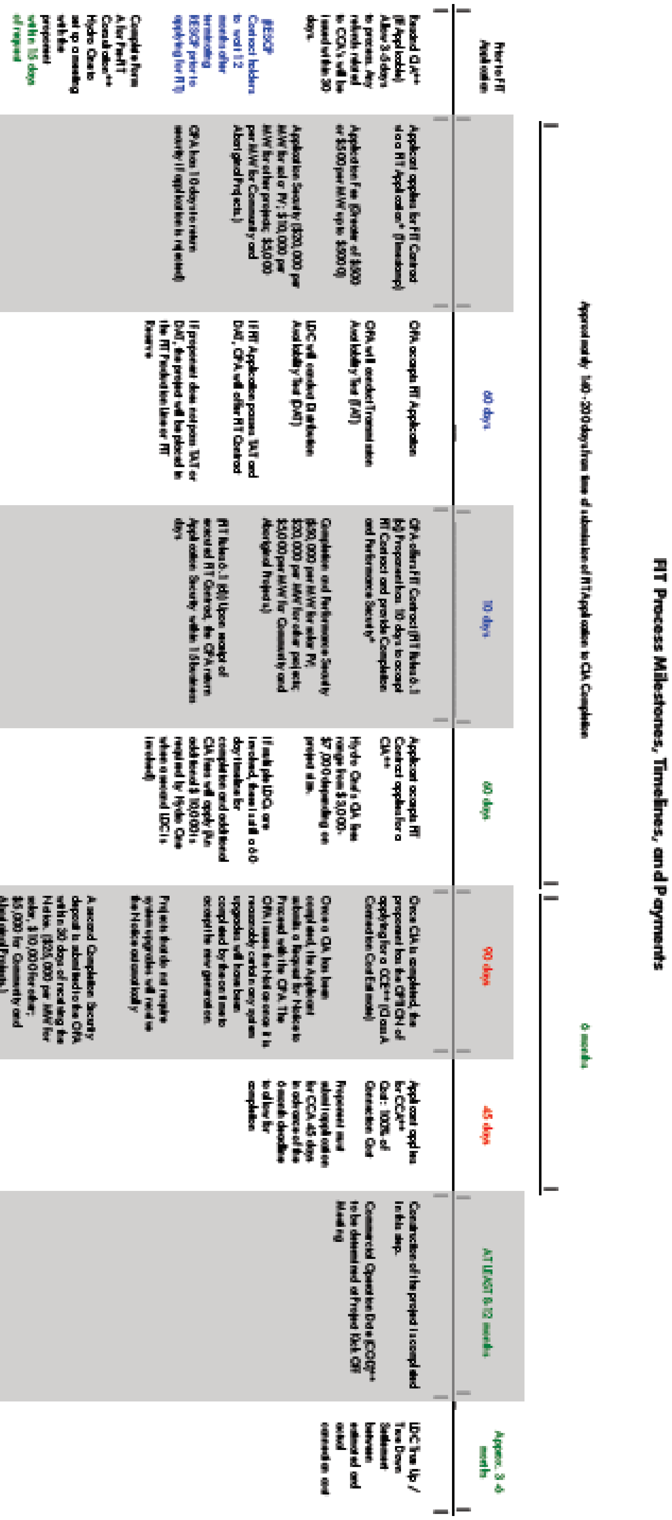
13.	**PERCENTAGE ESCALATED**	_0 %
14.	**MINIMUM REQUIRED DOMESTIC CONTENT LEVEL**	_60 %
15.	**BASE DATE**	September 30, 2009
16.	**AUTOMATIC NTP FACILITY**	No
17.	**LOCATION:**	Municipal Address: Kinghaven Solarworks 4305 King Road King City ON L7B1K4 Legal Description: Lots 3-5, Concession 6, King City, ON, L7B 1K4
18.	**IMPACT ASSESSMENT PRIORITY START TIME**	N/A **IMPACT ASSESSMENT PRIORITY STOP TIME** N/A
19.	**CONNECTION POINT**	Distribution System - LDC: Hydro One Networks Inc.
20.	**HOST FACILITY (IF APPLICABLE)**	Name: Municipal Address: Legal Description:
21.	**FIT RULES**	Applicable version: Version 1.5
22.	**INCORPORATED SCHEDULES, APPENDICES AND EXHIBITS**	FIT Contract Execution Instructions FIT Contract Offer Notice Schedule 1 – General Terms and Conditions, Version 1.5 Exhibit A – Technology-Specific Provisions, Type 5: Solar (PV) Rooftop Exhibit B – Metering and Settlement, Type 3 B Exhibit C – Form of Irrevocable Standby Letter of Credit Exhibit D – Domestic Content, Version 1.5 Exhibit E – Arbitration Provisions Applicable to Sections 1.7, 1.8, 2.10 & 12.2 Exhibit F – Form of Supplier Certificate re: Commercial Operation Exhibit G – Form of Independent Engineer Certificate re: Commercial Operation Exhibit H – Form of Secured Lender Consent and Acknowledgement Appendix 1 – Standard Definitions, Version 1.5 Anticipated Notice To Proceed (NTP) Request Date Form

Appendix J – OPA FIT Application Process Flow-chart



Source: Available online @ http://fit.powerauthority.on.ca/program-flowchart-0 (visited on May 4, 2012).

Appendix K – OPA FIT Program Milestones



Source: Available online @ http://fit.powerauthority.on.ca/what-feed-tariff-program (Visited on May 4, 2012).

Appendix L – RETScreen

Resource assessment

Solar tracking mode		Fixed
Slope	°	32.0
Azimuth	°	20.0

☑ Show data

Month	Daily solar radiation - horizontal kWh/m²/d	Daily solar radiation - tilted kWh/m²/d	Electricity export rate $/MWh	Electricity exported to grid MWh
January	1.68	2.84	713.0	23.29
February	2.28	3.21	713.0	23.69
March	3.60	4.35	713.0	34.51
April	4.90	5.24	713.0	39.08
May	5.36	5.25	713.0	39.46
June	5.82	5.50	713.0	39.21
July	6.18	5.94	713.0	42.96
August	5.28	5.43	713.0	39.50
September	3.90	4.44	713.0	32.03
October	2.50	3.24	713.0	25.03
November	1.28	1.74	713.0	13.45
December	1.18	1.83	713.0	14.98
Annual	**3.67**	**4.09**	**713.00**	**367.19**

Annual solar radiation - horizontal	MWh/m²	1.34
Annual solar radiation - tilted	MWh/m²	1.49

Photovoltaic

Type		mono-Si	
Power capacity	kW	270.25	
Manufacturer		Heliene	
Model		mono-Si - HEE215M - 250W	1081 unit(s)
Efficiency	%	15.0%	
Nominal operating cell temperature	°C	45	
Temperature coefficient	% / °C	0.40%	
Solar collector area	m²	1,798	
Miscellaneous losses	%	5.0%	

Initial costs (credits)	Unit	Quantity	Unit cost	Amount	Relative costs	Notes/Range
Feasibility study						
Feasibility study	cost	1	$ -	$ -		
Sub-total:				$ -	0.0%	
Development						
Development	cost	1	$ 64,874	$ 64,874		See Excel Soft Costs
Sub-total:				$ 64,874	4.0%	
Engineering						
Engineering	cost	1	$ 10,000	$ 10,000		
Sub-total:				$ 10,000	0.6%	
Power system						
Photovoltaic	kW	270.25	$ 1,250	$ 337,813		
Road construction	km	1	$ 10,000	$ 10,000		Road assumed cost
Transmission line	km	1	$ 10,000	$ 10,000		Incremental charges: Higher DC rating
Substation	project	1	$ 190,900	$ 190,900		HV Work
Energy efficiency measures	project	1	$ 30,375	$ 30,375		Additional Panel Installation
Roof Preparation and Reinforcement	cost	1	$ 221,173	$ 221,173		See Excel Spreadsheet
Trenching & backfilling		1	$ 15,180	$ 15,180		See Excel Spreadsheet
Sub-total:				$ 815,441	50.7%	
Balance of system & miscellaneous						
Spare parts	%			$ -		
Transportation	project			$ -		
Training & commissioning	p-d	40	$ 1,500	$ 60,375		
Balance of System	cost	230	$ 2,841	$ 653,430		Assumes BoS cost: $2.841/w
Contingencies	%		$ 1,604,120	$ -		
Interest during construction	4.00%	2 month(s)	$ 1,604,120	$ 5,347		
Sub-total:				$ 719,152	44.7%	
Total initial costs				$ 1,609,467	100.0%	

Annual costs (credits)	Unit	Quantity	Unit cost	Amount	Notes/Range
O&M					
Parts & labour	project	0	$ 10,000	$ -	Assumes maintenance contract
Insurance premium	cost	1	$ 8,047	$ 8,047	Assumes insurance rate: 1%
Contingencies	%		$ 8,047	$ -	
Sub-total:				$ 8,047	

Periodic costs (credits)	Unit	Year	Unit cost	Amount	Notes/Range

Financial viability		
Pre-tax IRR - equity	%	50.5%
Pre-tax IRR - assets	%	7.0%
After-tax IRR - equity	%	50.5%
After-tax IRR - assets	%	7.0%
Simple payback	yr	6.1
Equity payback	yr	2.0
Net Present Value (NPV)	$	1,775,796
Annual life cycle savings	$/yr	130,666
Benefit-Cost (B-C) ratio		6.52
Debt service coverage		2.19
Energy production cost	$/MWh	357.15
GHG reduction cost	$/tCO2	(508)