Basic Plan to Enable Bill 150,

the

Green Energy and Green Economy Act

March 25, 2011

Revised: November 23, 2011

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1.0 SUMMARY

The following Basic GEA Plan has been revised as of November 23, 2011, to update the plan elements timing and corresponding expenditures into a 2012-2015 timeframe. The original plan anticipated a 2011-2015 plan timeframe with OEB approval obtained early in 2011 in order to commence proposed projects in 2011. The revised plan anticipates OEB approval in late 2011 or early 2012, with an early 2012 plan start.

In accordance with the Ontario Energy Board's (OEB) filing requirements under the *Green Energy and Green Economy Act, 2009* (the Act), Guelph Hydro Electric Systems Inc. (Guelph Hydro) has prepared the following Basic GEA Plan. Guelph Hydro supports the Act and sees it as a proactive and effective means of meeting the objectives of the Province. In the case of connecting renewable generation, proactive work on the part of Local Distribution Companies (LDCs) should reduce or eliminate connection delays and reduce the amount of reactive work that may otherwise occur. Guelph Hydro believes that the OEB's Green Energy Act policies will permit the connection of renewable generation projects to be completed in an accelerated and more cost effective manner than without the support of proactive work on the part of the LDCs.

In preparing this plan, Guelph Hydro has attempted to identify investments that will be necessary to facilitate the connection of renewable generation to its distribution system, and prioritize them based on our understanding of where the highest likelihood of connection requests exist or may exist. As part of this analysis, Guelph Hydro has identified work that will be required to ensure that the interconnection of renewable generation and other distributed resources do not increase either risks or constraints on the distribution system.

Given the geography and primarily urban nature of Guelph Hydro's service territory, we believe that there will limitations on the types of renewable connections that will be sought in our service area. Specifically, we expect to see higher numbers of solar project connection requests, with a small number of bio-gas and very few wind projects.

Overall Guelph Hydro's distribution system is well designed, built and maintained to accept an influx of renewable generation. However, we anticipate that some system expansion and renewable enabling investments will be required to accommodate the forecast renewable generation project connection requests.

The most significant anticipated investment is a 15 kV system expansion in 2013, estimated at $500k net cost to Guelph Hydro, required for the connection of a 10.0 MW ground mounted solar photovoltaic project.

In this plan we have also identified a number of projects we believe are innovative and support the development of a Smart Grid. These initiatives will reinforce the creation of a "culture of conservation" in Ontario, by providing both education and technology to support customers to better understand and manage energy use. These projects also support the City of Guelph's innovative Community Energy Initiative, which has deep per capita energy and water consumption reduction targets.

The following tables provide a summary of the five year spending levels of expenditures resulting from Guelph Hydro's GEA plans, broken down by category and year. Each of these investments is discussed in more detail in the body of the plan.

Table 1: Project / Investment - Capital Summary

	2011 ($000)	2012 ($000)	2013 ($000)	2014 ($000)	2015 ($000)	Total ($000)
Renewable Generator Connection Upgrades	$0	$0	$500	$50	$50	$600
In-Home Display Messaging Project	$0	$479	$0	$0	$0	$479
Electric Vehicle Pilot	$0	$50	$0	$0	$0	$50
Smart Grid High School Education	$0	$0	$0	$0	$0	$0
Demonstration "Smart Grid-Smart Home"	$0	$0	$0	$0	$0	$0
Additional Technical Staffing Resources	$0	$0	$0	$0	$0	$0
Total	$0	$529	$500	$50	$50	$1,129

Table 2: Project / Investment - OM&A Summary

	2011 ($000)	2012 ($000)	2013 ($000)	2014 ($000)	2015 ($000)	Total ($000)
Renewable Generator Connection Upgrades	$0	$0	$0	$0	$0	$0
In-Home Display Messaging Project	$0	$92	$92	$92	$92	$368
Electric Vehicle Pilot	$0	$200	$290	$30	$20	$540
Smart Grid High School Education	$0	$75	$35	$35	$20	$165
Demonstration "Smart Grid-Smart Home"	$0	$45	$130	$55	$10	$240
Additional Technical Staffing Resources	$0	$174	$174	$174	$174	$696
Total	$0	$586	$721	$386	$316	$2,009

Table 3: Total Capital and OM&A Expenditures Summary

	2011 ($000)	2012 ($000)	2013 ($000)	2014 ($000)	2015 ($000)	Total ($000)
Capital	$0	$529	$500	$50	$50	$1,129
OM&A	$0	$586	$721	$386	$316	$2,009
Total	$0	$1,115	$1,221	$436	$366	$3,138

2.0 INTRODUCTION AND OBJECTIVES OF THE ACT

The Green Energy and Green Economy Act (the Act) was introduced to further expand the development of a "conservation culture" in Ontario, to promote and expand energy conservation and encourage all Ontarians to use energy efficiently and wisely. It includes a number of key policy changes, intended to foster the growth of renewable energy projects, and to promote the development of a green economy.

Objectives of the Act include:

1. ***To stimulate energy conservation, through the establishment of programs and policies within the Ministry or such agencies as may be prescribed, load management and the use of renewable energy sources throughout Ontario;***
2. ***To encourage prudence in the use of energy in Ontario;***
3. ***To stimulate the planning and increase the development of infrastructure in Ontario, and***
4. ***To support planning and growth and building strong communities in Ontario.***

Two other key elements of the Act include:

5. ***To facilitate the implementation of a smart grid in Ontario; and***
6. ***To promote the use and generation of electricity from renewable energy sources in a manner consistent with the policies of the Government of Ontario, including the timely expansion or reinforcement of transmission systems and distribution systems to accommodate the connection of renewable energy generation facilities.***

2.1 *GEA Plan Guiding Principles*

The Act requires that each LDC file a GEA Plan with the OEB, in a manner consistent with the requirements in the GEA. The plan filing will serve three main purposes:

1. *To provide information to the Board and interested stakeholders regarding the readiness of a distributor's system to accommodate the connection of renewable generation, as well as the expansion or reinforcement necessary to accommodate renewable generation, and the development and implementation of "smart grid";*
2. *To provide evidence in rate applications for capital budget approvals related to infrastructure investments for renewable generation and smart grid, and the recovery of the resulting costs from ratepayers; and*
3. *To provide a basis, through the approval of a GEA Plan, by which the costs of certain investments will be the responsibility of the distributor under the DSC, and therefore possibly recovered through the provincial cost recovery mechanism set out in section 79.1 of the OEB Act.*

The OEB has identified two types of Plans; the Basic GEA Plan and the Detailed GEA Plan. As a minimum, a Basic GEA Plan is required of all LDCs. A Detailed GEA Plan is required only for those distributors where:

1. The total capital costs of all a distributor's planned projects related to the connection of renewable generation and/or the development of a smart grid in any one year:
   - *Are more than $100,000 and exceed 3% of the distributor's distribution rate base; and*
   - *Exceed $5,000,000.*

2. The total capital costs of all a distributor's planned projects related to the connection of renewable generation and/or the development of a smart grid over five years:
   - *Are more than $100,000 and exceed 6% of the distributor's distribution rate base; and*
   - *Exceed $10,000,000.*

Guelph Hydro does not meet the threshold for filing a Detailed GEA Plan and, as such, has prepared this Basic GEA Plan. The Basic GEA Plan includes requirements for:

1. A current assessment of the LDC's distribution system;
2. A planned approach to upgrading the distribution system to accommodate renewable generation; and
3. Proposed initiatives to enable the development of a "smart grid".

3.0 SMART GRID VISION

The key elements and objectives of the Act are aligned with Guelph Hydro's vision:

> *"To lead Ontario in powering community well-being and environmental stewardship with sustainable energy solutions".*

This plan includes Guelph Hydro's response to the requirement for the development of a smart grid plan, in accordance with the Act. We believe it is the thoughtful and prudent integration of smart metering, advanced monitoring and communications and information technologies on the electric distribution system, will improve service to our customers and improve communications within the communities we serve, as well as enhance service reliability while supporting the goals of the City of Guelph's innovative Community Energy Initiative. The City's Community Energy Initiative has aggressive long term per capita energy and water conservation targets, which again reinforce the overall goals of the Act in building a culture of conservation in Ontario.

Guelph Hydro believes that by providing our customers with enabling tools, information and technologies, we will help them make smart decisions on how they consume energy. One of the primary elements of the GEA Plan is the development of a community wide energy consumption and in-home messaging system, leveraging off the investment of the Smart Metering

infrastructure, in concert with an anticipated Ontario Power Authority (OPA) In-Home Display Tier 1 conservation program.

By supporting an initiative to accelerate the deployment of devices which can show energy usage in both dollars and kWh, as well as view customized energy conservation messages, customers will better understand how to make wise energy use choices. The proposed back-office system to support the customer display devices can also be leveraged for other community and conservations purposes, such as water conservation measures, emergency notifications, "amber alerts", school closures, etc, and can become a focal point in the home for reinforcing the message of a sustainable community.

4.0 SMART GRID GOALS AND OBJECTIVES

LDCs have always sought improvements in the design, construction and operation of their distribution systems, to improve both reliability and customer service. However, Guelph Hydro does not believe in investing in technology simply for technology's sake.

Guelph Hydro prefers to make investments in pilots and demonstration projects when it is appropriate to do so, when the investment can create value for the customer and the shareholder, and when it makes good business sense. Guelph Hydro expects to invest in ways to create opportunities for Guelph Hydro, its customers, employees and community, and in ways that strengthen relationships with our customers and the shareholder.

Guelph Hydro believes that the Smart Grid Strategy can be an excellent opportunity to further improve on an already good system, and should be leveraged by LDCs to bring maximum benefit to their customers.

5.0 CURRENT ASSESSMENT – GUELPH HYDRO'S DISTRIBUTION SYSTEM

Guelph Hydro owns, operates and maintains a relatively modern distribution system, currently serving over 50,000 customers in the City of Guelph and the Township of Guelph-Eramosa. Guelph Hydro distributes power from transformer stations owned by Hydro One Networks Inc. (HONI) to its customers either directly or through its substations. The service territory is primarily urban, and historically has exhibited a high degree of reliability. While there are no municipal substations in Guelph, the distribution system has been built with a high degree of distribution monitoring, intelligent power factor correction, and remote switching capability.

Like many LDC's, our SCADA system provides our System Control Operators with real-time information to monitor and operate the distribution system, through the installation of strategically located remotely operable switches and electronic faulted circuit indicators. To further enhance operational effectiveness, Guelph Hydro has developed a robust Geographic Information System (GIS), leveraged to support other LDC corporate systems such as Customer

Information System and Work Order System, to provide the Control Room with operational support tools.

We have a history of distribution system optimization through sophisticated system modeling and planning tools to optimize the efficiency of the system; we have introduced mobile computing with real-time GPS vehicle tracking, and developed an automated outage messaging system for improved internal response to system conditions. In addition, we have completed the installation of over 48,000 Smart Meters, and intend to use their "last gasp" communication capability to further improve customer service through more advanced outage detection and response. The following table summarizes general statistics of Guelph Hydro's distribution system:

Table 4: GUELPH HYDRO DISTRIBUTION SYSTEM STATISTICS

	2006	2007	2008	2009	2010
Service Area (sq km)	93	93	93	93	93
Total Metered Customers	45,665	46,828	47,912	48,790	49,727
Number of Transmission Stations (owned by HONI)	3	3	3	3	3
Number of Municipal Stations (owned by Guelph Hydro)	1	1	1	1	2
Number of Municipal Stations (owned by HONI)	1	1	1	1	1
Total Circuit Length (km)	958	986	1,045	1,060	1,066
O/H Circuit (km)	414	417	429	428	427
U/G Circuit (km)	545	569	616	632	638
Number of Poles	10,365	10,449	10,694	10,748	10,921
Number of Power Transformers	1	1	1	1	2
System Peak - Summer (MW)	278	277	270	264	281
System Peak - Winter (MW)	246	252	245	242	250
Total Energy Purchased (annual MWh)	1,634	1,632	1,594	1,504	1,641

6.0 ENABLING RENEWABLE EMBEDDED GENERATION CONNECTIONS

Ensuring that renewable generation projects can be readily connected to the LDCs distribution system without undue delay is a major focus of the Act. To this end, LDCs are subject to the following requirements:

1. ***The licensee is required to provide, in accordance with such rules as may be prescribed by regulation and in the manner mandated by the market rules or by the Board, priority connection access to its transmission system or distribution system for renewable energy generation facilities that meet the requirements prescribed by regulation made under subsection 26 (1.1) of the Electricity Act, 1998.***
2. ***The licensee is required to prepare plans, in the manner and at the times mandated by the Board or as prescribed by regulation and to file them with the Board for approval for;***
    i. ***the expansion or reinforcement of the licensee's transmission system or distribution system to accommodate the connection of renewable energy generation facilities, and***
    ii. ***the development and implementation of the smart grid in relation to the licensee's transmission system or distribution system.***
3. ***The licensee is required, in accordance with a plan referred to in Paragraph 2, that has been approved by the Board or in such other manner and at such other times as mandated by the Board or prescribed by regulation;***
    i. ***to expand or reinforce its transmission system or distribution system to accommodate the connection of renewable energy generation facilities, and***
    ii. ***to make investments for the development and implementation of the smart grid in relation to the licensee's transmission system or distribution system.***

While the Act specifically focuses on embedded renewable generator connections, it is understood that LDCs are to facilitate connection of all generators, including those non-renewable generation projects (landfill gas; energy from waste; gas; etc) to their distribution grids. A fully developed and integrated smart grid will assist in facilitating non-renewable generator connections.

6.1 Constraints

Since their inception, distribution systems, including monitoring and protection elements were planned, designed and constructed to serve loads. They were never intended to facilitate the connection and management of a large number of discrete embedded generators. As such, the amount of generation capacity to be connected to the grid will be constrained by a variety of engineering factors, such as supply feeder ampacity, short circuit capacity, power quality as well as limits on reverse power flow and short circuit capability at transformer stations and substations.

It is anticipated that early on the connection of small-scale inverter-based renewable generation will not impose many limitations, but that over time a larger concentration of micro-generators,

or several medium-sized generators on the same distribution feeder will have a noticeable impact on the distribution system and upstream elements. Large scale projects will have an immediate impact and will require detailed study and analysis to understand the impact of the proposed connection.

Guelph Hydro's service territory is served by feeders that generally exceed current capacity demands. This is a result of Guelph Hydro's application of feeder loading design parameters consistent with good utility practice, to provide Guelph Hydro operational flexibility for load switching operations.

The generation capacity of a feeder is to some degree a function of the load capacity of the feeder. Constraints on renewable generation connections are therefore expected to result from limitations of reverse power flow and short circuit capability at Hydro One transformer stations and Guelph Hydro substations. Limitations on reverse power flow and short circuit capability constrain the total generating capacity that can be added to the feeders of a station. The typical three to five year planning process for mid-sized projects generally provides Guelph Hydro an adequate timeframe to plan any required expansions to accommodate mid-sized load or generation additions.

The following tables show transformer station and substation generation connection limitations as well as the "available generation capacity" by feeder for those feeders directly connected to Hydro One transformer stations. The available generation capacity for any specific feeder is two-thirds of the feeder egress current carrying capacity less generation already connected to the feeder. These feeder "available generation capacities" are subject to change as Guelph Hydro continues to study generation capacity on its distribution system. These feeder "available generation capacities" are also subject to transformer station generation capacity limits established by Hydro One and publicly available on Hydro One's website.

Table 5: TRANSFORMER STATION GENERATION CONNECTION LIMITATIONS

Station	Bus	Forecasted FIT& microFIT Connections (MW)	Total Forecasted Generator Connections (MW)	Existing Installed Generation Capacity (MW)	HONI Thermal Limit (MW)	HONI Short Circuit Limit (MVA)
Campbell TS	*BY*	*1.79*	*1.79*	*0.03*	*13.4*	*6.5*
	JQ	*1.69*	*2.13*	*0.01*	*15.3*	*60.8*
	ZE	*4.05*	*4.05*	*2.81*	*15.0*	*62.4*
	Total	**7.53**	**7.97**	**2.85**	**43.7**	
Cedar TS	*BY*	*0.48*	*0.48*	*0.02*	*17.3*	*106.7*
	ZE	*0.30*	*0.30*	*0.03*	*6.4*	*131.8*
	JQ	*0.42*	*1.42*	*1.41*	*35.3*	*153.1*
	Total	**1.19**	**2.19**	**1.46**	**59.0**	
Hanlon TS	**BY**	**11.90**	**11.90**	**0.02**	**29.6**	**131.2**
Rockwood DS	**Station**	**0.00**	**0.00**	**0.00**	**3.8**	
Rockwood MS1	**Station**	**0.02**	**0.02**	**0.00**	**2.5**	
Rockwood MS2	**Station**	**0.00**	**0.00**	**0.00**	**2.5**	
Total		**20.64**	**22.08**	**4.32**	**141.1**	

Table 6: GUELPH HYDRO "AVAILABLE GENERATION CAPACITY" BY FEEDER

Station	*Feeder*	*Forecasted FIT/microFIT Generation [MW]*	*Total Forecasted Generation [MW]*	*Installed Generation [MW]*	*Feeder Design Rating [amps]*	*Generation Design Capacity [amps]*	*Installed Generation [amps]*	*Total Generation Capacity [amps]*
Campbell TS	*M11*	*1.25*	*1.25*	*0.00*	*550*	*367*	*0*	*367*
	M12	*0.00*	*0.00*	*0.02*	*520*	*347*	*1*	*346*
	M13	*0.10*	*0.10*	*0.00*	*550*	*367*	*0*	*367*
	M14	*0.50*	*0.50*	*0.00*	*520*	*347*	*0*	*347*
	M21	*0.00*	*0.00*	*0.01*	*550*	*367*	*0*	*366*
	M22	*0.50*	*0.50*	*0.01*	*550*	*367*	*0*	*366*
	M23	*1.76*	*1.76*	*0.00*	*550*	*367*	*0*	*367*
	M24	*0.00*	*0.00*	*0.00*	*520*	*347*	*0*	*347*
	M31	*0.75*	*0.75*	*0.00*	*550*	*367*	*0*	*367*
	M32	*1.00*	*1.00*	*0.00*	*520*	*347*	*0*	*347*
	M33	*0.23*	*0.23*	*0.01*	*520*	*347*	*0*	*346*
	M34	*0.50*	*0.50*	*0.00*	*550*	*367*	*0*	*367*
	M41	*0.00*	*0.00*	*0.00*	*520*	*347*	*0*	*347*
	M42	*0.50*	*0.50*	*0.00*	*550*	*367*	*0*	*367*
	M43	*0.03*	*0.03*	*0.00*	*520*	*347*	*0*	*346*
	M44	*0.04*	*0.48*	*0.00*	*550*	*367*	*0*	*367*
	M51	*0.00*	*0.00*	*0.00*	*550*	*367*	*0*	*367*
	M52	*0.09*	*0.09*	*0.00*	*520*	*347*	*0*	*347*
	M53	*2.09*	*2.09*	*0.00*	*550*	*367*	*0*	*367*

Station	Feeder	Forecasted FIT/microFIT Generation [MW]	Total Forecasted Generation [MW]	Installed Generation [MW]	Feeder Design Rating [amps]	Generation Design Capacity [amps]	Installed Generation [amps]	Total Generation Capacity [amps]	
	M54	0.00	0.00	0.00	520	347	0	347	
	M61	0.00	0.00	0.00	520	347	0	347	
	M62	0.22	0.22	2.81	520	347	117	230	1
	M63	3.51	3.51	0.00	520	347	0	347	
	M64	0.26	0.26	0.00	550	367	0	367	
Cedar TS	M11	0.05	0.05	0.00	550	367	0	367	
	M12	0.35	0.35	0.01	520	347	0	346	
	M13	0.11	0.11	0.01	550	367	0	366	
	M14	0.00	0.00	0.00	520	347	0	347	
	M21	0.42	0.42	0.01	550	367	0	366	
	M22	0.00	0.00	0.01	550	367	0	366	
	M23	0.00	0.00	0.00	520	347	0	347	
	M24	0.01	0.01	0.00	520	347	0	347	2
	M51	0.20	0.20	0.00	520	347	0	347	
	M52	0.00	0.00	0.01	550	367	1	366	
	M53	0.00	0.00	0.00	0	0	0	0	
	M54	0.01	0.01	0.00	550	367	0	367	
	M61	0.01	0.01	0.00	550	367	0	367	
	M62	0.01	0.01	0.00	550	367	0	367	
	M63	0.01	0.01	0.01	520	347	1	346	
	M64	0.00	0.00	0.00	0	0	0	0	
	M71	0.02	0.02	0.00	550	367	0	367	
	M72	0.34	0.34	0.01	520	347	0	346	
	M73	0.00	0.00	0.00	520	347	0	347	
	M74	0.24	1.24	0.00	520	347	0	347	
	M81	0.11	0.11	1.40	550	367	58	308	2
	M82	0.00	0.00	0.00	0	0	0	0	
	M83	0.01	0.01	0.00	520	347	0	347	
	M84	0.25	0.25	0.00	520	347	0	347	
Hanlon TS	M11	1.24	1.24	0.00	550	367	0	367	
	M12	0.00	0.00	0.00	550	367	0	367	
	M13	0.11	0.11	0.00	550	367	0	367	
	M21	0.11	0.11	0.02	550	367	1	366	
	M22	1.60	1.60	0.00	550	367	0	367	
	M23	10.00	10.00	0.00	550	367	0	367	
Rockwood DS	F2	0.00	0.00	0.00	250	167	0	167	
RockwoodMS1	F1	0.00	0.00	0.00	250	167	0	167	
	F2	0.02	0.02	0.00	250	167	0	167	
	F3	0.00	0.00	0.00	250	167	0	167	
RockwoodMS2	F1	0.00	0.00	0.00	250	167	0	167	
	F2	0.00	0.00	0.00	250	167	0	167	
	F3	0.00	0.00	0.00	250	167	0	167	

Notes: ***1: Eastview Generator can connect to both M52 & M62***

2: OMAFRA Generator can connect to both M81 & M24

6.2 Anticipated Renewable Embedded Generation Connection Requests

Small scale solar photovoltaic (PV) project applications under the microFIT program and small capacity allocation exempt solar PV applications under the FIT program typically have capacities less than the building load. In addition, for these solar projects, peak generation will tend to coincide with peak building energy use. Nevertheless, a small number of projects may trigger the need to complete upgrades to either the distribution system or customer connections.

Anticipated renewable generation connections are forecasted over the next five years based on the level of interest in the FIT/microFIT programs, Pre-FIT Consultations completed to date, project applications received to date, as well as the knowledge that the City of Guelph's Community Energy Initiative (CEI) encourages the implementation of renewal energy projects within the City of Guelph in support of the goals of the CEI to dramatically reduce energy consumption on a per capita basis.

At the time of writing of this plan, Guelph Hydro has received requests for and completed over 80 Pre-FIT Consultations with the following breakdown:

- Generation <= 250 kW (CAE): 90%
- Generation > 250 kW, <= 500 kW: 2%
- Generation > 500 kW, <= 10 MW: 8%

Guelph Hydro expects these connections to be accommodated with standard metering and connection techniques, with real-time monitoring for the larger FIT generators. In addition, Guelph Hydro is forecasting sufficient capacity to accommodate the anticipated connections without needing to prioritize the projects.

The anticipated number of renewable generation projects is summarized in the following table:

Table 7: NUMBER OF ANTICIPATED RENEWABLE GENERATION CONNECTIONS

Number of Renewables by Year	***2011****	***2012***	***2013***	***2014***	***2015***	***Total***
Micro Generation (<= 10 kW)	40	40	40	40	40	***200***
Small Generation (<= 250 kW)	3	7	7	7	7	***31***
Small Generation (> 250 kW,<= 500 kW)	0	1	0	0	0	***1***
Mid-Size Generation (> 500 kW, <= 10 MW)	0	0	1	1	1	***3***
Total	***43***	***48***	***48***	***48***	***48***	***235***

2011 FIT Connections: 2 connecting in Q2-2011; 1 completed CIA; 2 more CIAs expected with possible connections in 2011

The anticipated generating capacity for these renewable generation projects is summarized in the following table:

Table 8: ANTICIPATED RENEWABLE GENERATION CONNECTION GENERATION IN MW

Renewables by Year [MW]	***2011****	***2012***	***2013***	***2014***	***2015***	***Total***
Micro Generation (<= 10 kW)	0.21	0.21	0.21	0.21	0.21	***1.04***
Small Generation (<= 250 kW)	0.48	1.12	1.12	1.12	1.12	***4.96***
Small Generation (> 250 kW,<= 500 kW)	0.00	0.50	0.00	0.00	0.00	***0.50***
Mid-Size Generation (> 500 kW, <= 10 MW)	0.00	0.00	10.00	3.00	1.14	***14.14***
Total	***0.69***	***1.83***	***11.33***	***4.33***	***2.47***	***20.64***

2011 FIT Connections: 2 connecting in Q2-2011; 1 completed CIA; 2 more CIAs expected with possible connections in 2011

6.3 Consultation with Affected Distributors or Transmitter

Guelph Hydro has had discussions with Hydro One, the affected transmitter, with respect to the Hydro One "List of Station Capacity" and Threshold Connection Impact Assessments, and is planning to have additional discussions with Hydro One.

There are no other affected distributors.

6.4 Planned Development to Enable Renewable Embedded Generation Connections

Planned and anticipated projects can either be accommodated with existing available capacity or the anticipated lead time will allow capacity to be made available in time for connections. For capacity allocation exempt applications, no connection impediments currently exist. In the short term, Guelph Hydro does not anticipate that any of the projects would be subject to an Economic Connection Test involving Guelph Hydro, and as a result, prioritization is assumed not to be required at this time. Hydro One may be involved in Economic Connection Tests for FIT projects in Guelph Hydro's territory due to capacity limitations at transformer stations and on the transmission system.

Projects in this GEA plan that are not capacity allocation exempt are subject to the availability of generation capacity on the transmission system. Based on information gained through the Pre-Fit Consultations, expansions included in this plan do not affect generation capacity on the transmission system.

Again based on our Pre-Fit Consultations, we are anticipating the connection of a 10.0 MW ground mounted solar project with a proposed in-service date of 2013. The net cost to Guelph Hydro for a distribution system expansion to accommodate this project is estimated at $500k in 2013. As an embedded distributor, we further anticipate net upstream costs to the distributor,

estimated at $50k in 2014 and $50k in 2015. We believe these costs will be renewable enabling improvements to facilitate the connection of smaller mid-sized generation projects.

These anticipated costs are summarized in the Budget table below.

6.5 Prioritization Method

Projects will be prioritized to align with the intent of the OPA FIT and microFIT programs. Prioritization of FIT projects is based on project application dates and the ongoing status of the new development. Guelph Hydro intents to prioritize expansion and renewable enabling projects that will expedite the connection of projects that are "shovel ready". To date project timeline information has not been made available and as such Guelph Hydro has not prioritized any of the proposed work.

6.6 Direct Benefits for Customers

Guelph Hydro is not proposing that any 2011 costs incurred to make eligible investments for the purpose of enabling the connection of renewable electricity generation is recovered from provincial ratepayers rather than solely from Guelph Hydro's ratepayers. It is therefore not necessary to calculate the direct benefits accruing to Guelph Hydro customers.

BUDGET

Anticipated costs to support the objectives of the Act with respect to ensuring that renewable generator connection requests can be accommodated in a reasonable timeframe are broken down by category and year in the following table:

Renewable Generator Connection Request System Upgrades

	2011 ($000)	*2012 ($000)*	*2013 ($000)*	*2014 ($000)*	*2015 ($000)*	*Total ($000)*
Capital	***$0***	***$0***	***$500***	***$50***	***$50***	***$600***
OM&A	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
Total	***$0***	***$0***	***$500***	***$50***	***$50***	***$600***

Timing of these projects is sometimes difficult to determine. Guelph Hydro will undertake an annual review of the anticipated renewable generation connection project schedule as well as related costs.

7.0 SMART GRID

Under the Act, LDCs are required to file plans to facilitate the development of a "smart grid". Under the Act, ***"smart grid" means the advanced information exchange systems and equipment that when utilized together improve the flexibility, security, reliability, efficiency and safety of the integrated power system and distribution systems, particularly for the purposes of;***

i. ***Enabling the increased use of renewable energy sources and technology, including generation facilities connected to the distribution system;***
ii. ***Expanding opportunities to provide demand response, price information and load control to electricity customers; and***
iii. ***Accommodating the use of emerging, innovative and energy-saving technologies and system control applications.***

As the smart grid evolves, it will include an increasing number of intelligent information exchange devices and systems, such as smart meters, smart appliances, sensors, and in-home energy management systems, to provide modern households the ability to share and access detailed household activity information to gain greater control of personal energy use.

The smart grid will include the ability to provide consumers with more opportunities to manage demand response, price information and control loads, as well as support emerging and innovative technologies.

In support of the development of a smart grid, Guelph Hydro has included in its GEA Plan a number of innovative projects, described in further detail in the following sections.

8.0 IN-HOME DISPLAY MESSAGING PROJECT

The smart meters deployed by Guelph Hydro meet the Ministry's minimum functional specifications as set out by regulation. These meters record consumption data on an interval basis, provide full two-way communication to the home capability, provide basic power quality event recording (power outages, voltage sags/swells, etc.) and meter tamper alarms as well as the ability to remotely upgrade the meter or Network Interface Card (NIC) firmware.

Guelph Hydro has exceeded the smart meter minimum functional specification in one key area by the inclusion of a secondary communications chip. This chip will permit communications to devices inside the home through a non-proprietary communications protocol known as "Zigbee". Guelph Hydro is unique in that it is the only utility in Ontario that has deployed Zigbee communications chip-enabled smart meters throughout its service territory. Guelph Hydro wishes to leverage this investment in Zigbee chip technology by developing an In-Home Display Messaging Project as a component of our Green Energy Act Plan.

We believe that smart meters are the foundation of the customer–facing element of smart grid, as they provide the technology to serve as a catalyst for a whole new range of products and services for the customer, and provide the potential to build a more informed, energy conscious and sustainable community.

8.1 Background / Situational Analysis – Zigbee Communications Chip

Guelph Hydro views the Zigbee communications chip as a key enabling technology, a vital component of building an educated and informed energy consumer community in Guelph. By providing real-time energy consumption information from the smart meter directly to the customer through an in-home display or similar Zigbee-enabled device, customers will have the ability to make more informed choices about energy use in their homes, supporting both the conservation goals of the province as well as Guelph's Community Energy Initiative.

ZIGBEE

Zigbee is a communications protocol/interface standard that is maintained by the Zigbee Alliance and used in a myriad of products, including In-Home Displays, home energy management systems, smart appliances and electric vehicle charging stations.

Silver Spring Networks, the California based supplier of Guelph Hydro's Advanced Metering Infrastructure (AMI) smart meter and back office systems, tests and certifies various devices to ensure they communicate properly and are truly compliant with the Zigbee enabled smart meters. Guelph Hydro is working with Silver Spring Networks to bench test various In-Home Displays (IHD) to understand their compatibility with Guelph Hydro deployed smart meters, as well as understand how the display capability can be used for customer education, energy conservation, as well as other community based messaging in support of the goals of the Act and Guelph's Community Energy Initiative (CEI).

8.2 In-Home Display Messaging Project Objectives

The inclusion of the Zigbee communications chip in the smart meter is an enabling technology that will permit the development of a variety of opportunities for customer education, device monitoring and control, as well as communications and messaging through an In-Home Display (IHD). A critical element of this project is the anticipated inclusion of IHDs in the future Tier 1 OPA Conservation program expected to replace the *peaksaver*^{TM} residential demand response program.

Objectives of this project include the investigation of a variety of customer and community wide education and messaging opportunities, followed by the roll-out of those applications deemed practical and cost-effective, and which support the goals of the Act and the CEI. This may include elements such as:

- Local real-time display of customer energy consumption directly from the Zigbee enabled smart meter;
- Transmission of related electricity pricing information to the IHD (ie. cost to date, current price and forecast of bill);
- Transmission of Critical Peak Pricing notification and messaging;
- Improved Customer Service through better communications, such as:
  - Safety (Call Before You Dig, Overhead Power Lines, Ladder Awareness, etc);
  - Notification of Work in Your Area (capital build or maintenance, tree trimming, street light relamping, etc);
  - Ability to transmit potential power outage and restoration notification information, (i.e. work in your area);
- Electricity conservation program promotion, including upcoming event notification for "saveONenergy" and other conservation programs;
- Electricity conservation messaging, guidance and tips on how to manage and reduce their bill, provide comparisons to other comparable homes, etc;
- Municipal water conservation messaging and program notification;
- Municipal Emergency Services messaging and notification (ie. "Amber Alert", Smog Day warnings, etc); and
- Other Community messaging (Earth Hour, Snow Days – school closures, road work, etc).

8.3 In-Home Display Messaging Project Description

We view the smart meter and related infrastructure as a vital link between the customer and their energy consumption and pricing information, through an In-Home Display (IHD), and wish to leverage the investment in both smart meters as well as the Zigbee chip.

This project includes costs for the design, acquisition, installation, system integration, commissioning and training for a back-office hardware and software solution that will manage the community's IHD inventory, smart meter - IHD pairing and device security, as well as provide a tool for creating and managing messaging as described above. Also included in the project are OM&A costs for annual software licensing fees and system operational support.

We note that IHDs would not be funded through this project budget, as the assumption is that IHDs will be funded through a new 2011 OPA Tier 1 CDM program which is expected to replace the *peaksaver*^{TM} residential demand response program.

BUDGET

Costs to support the in-home display messaging project as described above are broken down by category and year in the following table:

In-Home Display Messaging Project	***2011 ($000)***	***2012 ($000)***	***2013 ($000)***	***2014 ($000)***	***2015 ($000)***	***Total ($000)***
Capital	***$0***	***$479***	***$0***	***$0***	***$0***	***$479***
OM&A	***$0***	***$92***	***$92***	***$92***	***$92***	***$368***
Total	***$0***	***$571***	***$92***	***$92***	***$92***	***$847***

9.0 ELECTRIC VEHICLE PILOT

The introduction and rapid adoption of electric or plug-in hybrid electric vehicles (EV/PHEV) will have a dramatic impact on LDCs in the way their distribution systems are designed, built and managed. The electricity grid must be prepared to meet this anticipated industry shift, and accommodate for a high penetration of such vehicles. EV/PHEV penetration will be driven around a number of benefits, including:

- Environmental: air pollution, noise;
- Health: air pollution, noise; and
- Improved utilization of energy, as electric vehicles are more efficient and cost effective, especially when off-peak energy is used to charge the vehicle batteries.

More specifically, the Ontario government has set the goal that one in twenty passenger vehicles on the province's roads will be electric by 2020, in the hopes that their "1 in 20 by 2020" goal will help the province reach its goal of reducing greenhouse gas emissions by 15 per cent below 1990 levels by 2020.

9.1 Background / Situational Analysis

In order to prepare for the introduction of EV/PHEV, Guelph Hydro has approached the City of Guelph and a number of other potential partners to gauge their interest in undertaking an Electric Vehicle Charging Station Pilot Project. Guelph Hydro, the City of Guelph and community partners are extremely interested in participating in a pilot for the following reasons:

- The City of Guelph has published an internationally recognized, innovative Community Energy Initiative (CEI) that sets out targets for energy and greenhouse gas reductions for the next 15 years for the community. Transportation is considered a large contributor to these reductions so the City is seeking projects that will further the goals of the CEI;
- The City of Guelph has money in their 2011 fleet budget to purchase an electric vehicle;
- The Guelph community has a strong interest in renewable technologies and environmental issues;
- A number of large employers in the community have robust Sustainability or Corporate Social Responsibility programs;
- Metrolinx recently announced that a new GO station would be built in Guelph and will be operational in the fall of 2011;
- Guelph Hydro has been named by the City of Guelph as the key implementer of energy projects under the CEI;
- Guelph Hydro is the only utility in Ontario to have fully deployed Zigbee chip-enabled smart meters;
- Guelph Hydro is working with Silver Spring Networks in California as the supplier of the back office systems for the Zigbee chip-enabled smart meter network;
- Silver Spring Networks has been working with Coulomb Technologies to test their electric vehicle charging stations with their Zigbee chip-enabled smart meter networks; and

- Guelph Hydro has strong connections in the community with Chamber of Commerce and large industrial / institutional customers that would likely be interested in participating in an electric vehicle project including a local mall, the University of Guelph as well as large manufacturing organizations.
- In February 2011 Guelph Hydro completed a telephone market research study of 200 residents and 25 fleet managers regarding electric vehicles in the Guelph community, in order to measure the community's interest in electric vehicles and obtain information that will be useful in planning for the demands electric cars may put on the local electricity grid once they become available in Canada. Results of the survey indicate that Guelph is an ideal community in which to conduct a pilot program on electric vehicles due to the fact that the average resident works locally, so the average driver's commute is only 22 km one way. More than one-third of the fleets in the community also typically travel no farther than the city or the region.

  The survey also provided valuable information related to anticipated consumer uptake of plug-in vehicles, driving profiles, vehicle charging patterns and preferences for electric vehicle charging infrastructure, as well as barriers to electric vehicle adoption, and will provide a good knowledge base to further build a pilot project on.

9.2 Electric Vehicle Pilot Objectives

Objectives of the electric vehicle pilot include the following:

- Increase awareness in the Guelph Community re: electric vehicles and charging stations;
- Make the connection between electric vehicles and the Guelph Community Energy Initiative, the smart grid and smart meters;
- Enhance the reputations of Guelph Hydro and the City of Guelph in the community;
- Establish a relationship with Metrolinx (GO Station) and car rental companies, as appropriate;
- Serve as a demonstration site for various electric car charging station business models for municipalities and utilities as well as users of Zigbee chip technologies;
- Test Zigbee chip functionality for electric vehicle charging;
- Install charging stations with smart meters to record and analyze electricity consumption patterns to better understand the potential impact on the distribution system, for both Level 1 and Level 2 charging stations; and
- Install trial home charging units with smart meters to encourage off-peak charging.

9.3 Electric Vehicle Pilot Description

This plan includes the provision to purchase an electric vehicle. The pilot project will include partnering with the City of Guelph and other local agencies and businesses as described above, to install well signed and well branded electric vehicle charging stations in a number of high-visibility locations in the community. In addition to the high visibility locations, we also wish to install a small number of charging stations at strategic residential locations in order to record and analyze consumption patterns, and better understand and encourage off-peak charging.

Over time and as the project unfolds, we also wish to explore the possibility of partnering with a car share organization in Guelph to promote the use of electric cars, as well as to conduct workshops and conferences about electric cars and charging systems in the community featuring field trips to view the charging system installations.

BUDGET

Costs to support the electric vehicle pilot are broken down by category and year in the following table:

Electric Vehicle Pilot	***2011 ($000)***	***2012 ($000)***	***2013 ($000)***	***2014 ($000)***	***2015 ($000)***	***Total ($000)***
Capital	***$0***	***$50***	***$0***	***$0***	***$0***	***$50***
OM&A	***$0***	***$200***	***$290***	***$30***	***$20***	***$540***
Total	***$0***	***$250***	***$290***	***$30***	***$20***	***$590***

10.0 SMART GRID HIGH SCHOOL EDUCATION

In the area of conservation Guelph Hydro has participated in the delivery of the Grade 5 energy conservation program "Generation Conservation", through a regional OPA pilot project to both school boards in our service territory. Our local school boards and educators spoke very highly of the program, and indicated they were very interested in longer term delivery of the conservation material. As a result, Guelph Hydro is planning to continue to offer to this program as a Tier 2 CDM offering over the 2011-2014 timeframe.

Similarly, as the concept of smart grid takes hold and evolves, Guelph Hydro foresees a need to engage the minds of the future to enter into and embrace the opportunities that smart grid will present.

As such, we are proposing the development and implementation of a high school smart grid education component, delivered through the local school boards.

The education material content would be based on material already developed through Silver Spring Networks, our California based smart metering technology provider, but modified for the Ontario context. Elements of the smart grid education material would include the following:

Unit 1: Benefits of a Smart Grid

Until recently, the operation of the electricity distribution grid that was launched over 100 years ago has not substantially changed. In most areas, it is still essentially a one-way "street" of large power generators moving energy along a network of lines and cables to homes and businesses. The introduction of small scale renewable and embedded generation is forcing a transformation of the electricity system into a smarter grid.

In this unit students will familiarize themselves with energy usage in their own homes, connect that usage to the current energy grid and energy sources, and are introduced to the concept of a smart grid, its technologies and benefits. Part of the unit includes the completion of a project for which they research information and create a public service announcement to present one benefit of the smart grid to people in their community.

Concepts taught through this unit include:

- Where does energy come from and how is it distributed?
- What is the smart grid and how does it work?
- What are the benefits of a smart energy grid?

Unit 2: Careers in the Smart Grid Industry

Across North America, the energy industry currently employs millions of people with a vast variety of skills, from coal miners to electricians to administrative workers to the people who install and repair the power lines. Many of these jobs have not changed substantially in years.

The advent of smart grid technologies, however, offers the opportunity for an employment explosion in jobs that will assist our society in taking advantage of the benefits that smart grid can provide. This will enable us to:

- Become more energy independent;
- Use more renewable energy sources to reduce carbon dioxide emissions and create more sustainable supplies;
- Utilize two-way communication to maximize the efficient use of existing power sources;
- Exercise consumer choices about energy use; and
- Reduce energy costs.

In this unit, students will research existing jobs in the energy industry and explore ways they will be affected and enhanced by smart grid technologies. For their unit project, students will create career profiles for a print or online energy career guide. The career profiles will include information about career preparation, responsibilities, and actual work scenarios. Sharing their career profiles will allow students to educate their peers about these promising opportunities.

Concepts taught through this unit include:

- What skills are needed to create and maintain the smart grid?
- What careers related to the smart grid currently exist or may be available in the future?
- How might you prepare for these careers?

BUDGET

Costs to support the development and implementation of smart grid education for high schools, including teacher workshops, education materials, and delivery through the local school boards which support Guelph high schools are broken down by category and year in the following table:

Smart Grid High School Education	***2011 ($000)***	***2012 ($000)***	***2013 ($000)***	***2014 ($000)***	***2015 ($000)***	***Total ($000)***
Capital	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
OM&A	***$0***	***$75***	***$35***	***$35***	***$20***	***$165***
Total	***$0***	***$75***	***$35***	***$35***	***$20***	***$165***

11.0 SMART GRID - SMART HOME DEMONSTRATION PROJECT

Smart meters, the foundation of a smart grid, provide a tool and the technology to serve as a catalyst for a whole new range of consumer interactive products and services. Guelph Hydro is unique in that it is the only utility in Ontario that has deployed Zigbee communications chip-enabled smart meters throughout its service territory. Guelph Hydro wishes to leverage this

investment in Zigbee chip technology by developing a Smart Grid-Smart Home Demonstration Project as a component of our Green Energy Act Plan.

The City of Guelph has been identified as the only community in Canada to be asked to host a workshop as part of the **Transatlantic Urban Climate Dialogue** in the spring of 2013 being organized by the Freie Universitat Berlin. The goal of this undertaking is to "*to strengthen the transfer and application of sustainable energy and climate practices between metropolitan regions in Germany and North America."* This event is expected to attract a number of high-level international experts and officials to the Guelph community. A Smart Grid - Smart Home Demonstration Project would be seen as a very positive addition to this workshop.

11.1 Background / Situational Analysis

Although the concept of a smart grid is commonly discussed within the energy industry, the average consumer does not have an understanding of what a smart grid might be and how a smart grid may transform society in years to come.

The benefits of a smart grid are generally cited in the energy industry as:

- Reliability - Improve utility outage detection and speed of response;
- Reliability - Improve the ability of the LDC to remotely address outages, potentially eliminating the need to roll trucks and thereby reduce greenhouse gas emissions;
- Capacity - Enable utilities to better manage distributed renewable generation; and
- Security - Improve the security of the electricity grid

Considering that experts state that the smart grid has the potential to transform our society to the same extent that the Internet did, there is a concerning lack of focus on the consumer and on industries outside the utility industry that will need to develop new and innovative products based on the needs and interests of customers.

In order for the smart grid to live up to its potential it will be necessary to expand the focus to customers and bring on board innovative, entrepreneurial companies that know how to create products and services that customers will value.

ZIGBEE

As previously described, Guelph Hydro is the only utility in Ontario that has deployed Zigbee chip-enabled smart meters throughout its territory. Zigbee is an interface/protocol standard that can enable communication and control between a myriad of products and devices that are Zigbee enabled and Zigbee compliant.

The scope of potential use of the standard is very broad, covering areas such as:

- Commercial building management;
- Consumer electronics;
- Energy management;
- Health care and fitness;
- Residential management;
- Retail management; and
- Telecommunications

Guelph Hydro intends to work with Silver Spring Networks in California as the supplier of the back office systems for the Zigbee chip-enabled smart meter network, to ensure compatibility and proper communications between the Zigbee enabled smart meters and devices and appliances to be showcased in the demonstration home, including proposed home energy management systems, in-home display systems, smart appliances and electric vehicle charging stations.

11.2 Smart Grid-Smart Home Demonstration Project Objectives

This project will use a newly constructed "green" home, provided by a local builder, to showcase innovative technologies and bring to life the vision of a smart grid that has the potential to spur the kind of transformation that the Internet brought to the way we live, work, play and learn. Its main purpose would be education – of a wide variety of audiences. It is envisioned that this project will incorporate and showcase the following technologies:

- Smart meters;
- Renewable energy;
- In-home display units;
- Home energy management systems;
- Smart appliances – large and small;
- Electric car charging stations;
- Demand management systems; and
- Automated lighting controls.

One of the goals will be to provide a window into the future by showcasing innovative technologies and bringing to life the vision of a smart grid and smart home. This will be an ideal opportunity to teach consumers:

- What they can do with real-time energy usage information
- How they can best conserve energy and reduce peak demand
- What they need to know about renewable generation
- About innovation in appliances
- How home energy management systems will work
- How electric car charging systems will work
- What a smart grid will make possible

Other objectives of the project will include:

- To serve as a tour destination for government officials and industry conferences, both local and international;
- To complement educational offerings for students (field trips) and teachers (as a workshop location and a tool for teaching teachers about energy usage data);
- To serve as a demonstration house for various Ontario Power Authority saveONenergy programs;
- To provide the opportunity to conduct research into various rate plans for electric car charging systems; and
- To provide opportunities for selected companies to:
    - Advance the testing and validation of home energy management systems in particular related to Zigbee chip compatibility;
    - Advance the testing of electric vehicle charging systems; and
    - Demonstrate their systems

11.3 Smart Grid-Smart Home Demonstration Project Description

Guelph Hydro plans to engage a local developer / builder of green homes to provide the location for the demonstration smart home for the duration of the project. We will source a smart appliance manufacturer, home energy management system developer, renewable energy supplier, in-home display unit manufacturer as well as other related partners to bring the project to life.

Guelph Hydro has strong connections in the community with the University of Guelph, Guelph Chamber of Commerce, the local builder / developer community, as well as large industrial and institutional customers, and will work with industry, universities, schools, etc. to design exhibits to support the educational and demonstration aspects of the smart home.

Guelph Hydro has had preliminary discussions with smart appliance manufacturers, as well as completed some preliminary research work on electric cars in the City of Guelph. Findings from the study indicate that due to the distance driven by drivers, the Guelph community is an ideal location for an electric car pilot project. Such a project could be linked to the Smart Grid - Smart Home Demonstration Project to further enhance the vision of what a smart grid can become, and how its evolution will impact our lives.

Finally, Guelph Hydro will be supporting the City of Guelph in hosting the **Transatlantic Urban Climate Dialogue** workshop/conference in 2012 and 2013, and views this project as a positive element and addition to both the workshop/conference and the community.

BUDGET

Costs to support the demonstration smart grid-smart home are broken down by category and year in the following table:

Demonstration "Smart Grid - Smart Home"	***2011 ($000)***	***2012 ($000)***	***2013 ($000)***	***2014 ($000)***	***2015 ($000)***	***Total ($000)***
Capital	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
OM&A	***$0***	***$45***	***$130***	***$55***	***$10***	***$240***
Total	***$0***	***$45***	***$130***	***$55***	***$10***	***$240***

12.0 ADDITIONAL TECHNICAL STAFFING RESOURCES

To support the undertaking and delivery of the various Green Energy Act initiatives as described in this plan, Guelph Hydro is proposing to add two additional technical resources. Costs are broken down by category and year in the following table:

BUDGET

Additional Technical Staffing Resources	***2011 ($000)***	***2012 ($000)***	***2013 ($000)***	***2014 ($000)***	***2015 ($000)***	***Total ($000)***
Capital	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
OM&A	***$0***	***$174***	***$174***	***$174***	***$174***	***$696***
Total	***$0***	***$174***	***$174***	***$174***	***$174***	***$696***

13.0 OPA Letter of Comment

Consultation with the Ontario Power Authority (OPA) is in progress; all relevant documentation will be provided upon receipt.