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E S Cornwall Scholarship Advisory Committee
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Dear Simon,

E.S. Cornwall Memorial Scholarship – Fifth Quarterly Report – Reena Kwong

Please find enclosed my fifth quarterly report as part of the E.S. Cornwall Memorial Scholarship for the period 8th March to 8th June 2010 during my employment with the Ontario Power Authority (OPA) in Toronto, Canada.

As this is my first report during my placement with the OPA, I have provided some background on the electricity system in Ontario as well as an overview of the OPA; its roles and responsibilities as well as its increased involvement with renewable generation integration due to recent changes introduced by the Ontario government which have impacted the procurement and planning of renewable generation.

I welcome any constructive feedback from all interested parties in relation to this report.

Kind Regards,
Reena

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Executive Summary

My proposed program under the E.S. Cornwall Memorial Scholarship is aimed at gaining international experience in the integration of wind farms into an electricity market. Specifically, exposure to the network planning and operation required to be considered in order to cater for large amounts of wind farm output is sought, as well as investigating the issues, and solutions to such issues, which may arise in the integration of wind farms in a market.

The period of my scholarship is from March 2009 to September 2010. My first placement was with National Grid, the system operator of Great Britain (GB), from March 2009 to March 2010. During my 12 month term with National Grid I was part of the System Strategy department where I was involved in power system studies to assess the impact of certain transmission reinforcements to accommodate wind generation. My current placement until March 2011 is with the Ontario Power Authority (OPA); the transmission planner and generation procurer for the province of Ontario, Canada.

This report is the fifth of six reports which incorporates employment from 8th March 2010 to 8th June 2010 with the OPA in their Transmission Integration team within the Power System Planning department.

The Ontario Electricity System

The Ontario electricity system has endured a number of changes to its pricing structure over the years. Prior to 2002, the electricity industry within Ontario was based on an informal pricing regulation system where electricity was financially integrated within the province. Between May 2002 and December 2004, new provisions with respect to electricity pricing were introduced. The provisions were designed for dispatching the lowest cost generator with side payments to ensure revenue is adequate to support new investment. This adequacy was determined by three different mechanisms:

i) Request for Proposals (RFPs)

ii) The Ontario Energy Board (OEB)

iii) The Government

Although these mechanisms had the intention of ensuring that the cost of the new investments would be compensated for through their revenue return, they created an unstructured market where investments were proposed without justification or need as sufficient planning for these

did not occur. In December 2004, the Ontario Power Authority (OPA) was established in order to provide a more structured approach in conducting planning for electricity generation through the development of an integrated power system plan for Ontario, with an aim to coordinate investment with electricity requirements via a competition-on-entry pricing system.

In May 2009, the Government introduced the Green Energy and Green Economy Act (GEGEA) which changed the competitive pricing system to a pre-determined pricing system. The introduction of the GEGEA means that pricing is based on the types of generators instead of life-cycle cost of electricity and instead of a transparent due-process regulation or competitive market the government sets the price and therefore separates investment decisions from electricity requirements.

Authorities within the Ontario Electricity System

Ontario is one of the ten provinces in Canada where each province's electricity system is independently run. Within Ontario, there are currently five main types of authorities:

Ontario Energy Board (OEB)

The OEB regulates Ontario's electricity and natural gas sectors in the public interest. The OEB mandate is determined by the provincial government, and is embodied in legislation and regulations. Within the electricity sector, the OEB sets transmission and distribution rates, and approves the Independent Electricity System Operator's (IESO) budget and fees. The rate for the Standard Supply Service for distribution utilities that supply electricity directly to consumers are also set by the OEB. The OEB licenses all market participants including the IESO, generators, transmitters, distributors, wholesalers and retailers. Board approval is required for the construction of electricity transmission lines longer than two kilometres. The Board is also responsible for approving specific business arrangements involving the regulated parts of Ontario's electricity industry.

The Board also monitors markets in the electricity sector and reports to the Minister of Energy on the efficiency, fairness and transparency and competitiveness of the markets as well as reporting on any abuse or potential abuse of market power. The Board may also be asked to review the IESO market rules and consider appeals of IESO orders.

The Board does not regulate competitive services. Competitive services for electricity are all business activities other than distribution, transmission and providing Standard Supply Service.

Independent Electricity System Operator (IESO)

The Independent Electricity System Operator (IESO) connects all participants including generators, transmitters, retailers, industries and businesses and local distribution companies so that electricity can be supplied to customers reliably and securely.

Every five minutes, the IESO forecasts consumption throughout the province and collects the best offers from generators to provide the required amount of electricity. This allows customers to see prices fluctuate based on supply and demand. As a result, they can shift consumption away from peaks in demand to times when the price is lower.

The IESO monitors the system and identifies what is required to maintain reliability in the future, reporting on these recommendations through regular publications. In its quarterly 18-month forecasts of the growth in demand for electricity, the IESO assesses whether there will be adequate generation and transmission facilities. In addition, the IESO prepares the semi-annual Ontario Reliability Outlook, which reports on the progress of interrelated generation, transmission and demand-side projects underway to meet Ontario's reliability requirements.

The Ontario Power Authority (OPA)

The OPA plan and procure electricity supply from diverse resources and facilitate the measures needed to achieve ambitious conservation targets. The OPA leads the development of new elements to foster a more sustainable, competitive electricity sector, which is to provide secure supplies of affordable power to Ontario's electricity consumers. More detail of the OPA's role in the electricity sector is discussed in the next section.

Transmitters

Hydro One Network Inc. is the main transmitter in Ontario, owning approximately 98% of transmission assets in the province. The transmission network in Ontario includes 115 kV, 230 kV and 500 kV voltages. Like other transmitters world-wide, the transmitter's role in the industry includes owning and maintaining their assets to sustain system reliability, which also includes proposing new transmission investments when required.

Local Distribution Companies (LDCs)

There are over 80 LDCs in Ontario whose primary role is to ensure that their customers can be supplied efficiently from the distribution network. The distribution network in Ontario consists of 13.8 kV, 27.6 kV and 44 kV voltages. For the purpose of local area planning, since there may be more than one LDC responsible for ensuring supply to a local area pocket, and since any local area reinforcement completed may affect other distribution areas nearby, some

LDCs group together for such planning studies to form a local area 'zone' to ensure that any impacts of distribution works are considered in each municipality within that zone.

The OPA's Responsibilities

The OPA was established by The Electricity Restructuring Act, 2004[1] which set out the following objectives for the organisation:

1) To forecast electricity demand and the adequacy and reliability of electricity resources for Ontario for the medium and long-term.
2) To conduct independent planning for electricity generation, demand management, conservation and transmission and develop integrated power system plans for Ontario.
3) To engage in activities in support of the goal of ensuring adequate, reliable and secure electricity supply and resources in Ontario.
4) To engage in activities to facilitate the diversification of sources of electricity supply by promoting the use of cleaner energy sources and technologies, including alternative energy sources and renewable energy sources.
5) To establish system-wide goals for the amount of electricity to be produced from alternative energy sources and renewable energy sources.
6) To engage in activities that facilitate load management.
7) To engage in activities that promote electricity conservation and the efficient use of electricity.
8) To assist the Ontario Energy Board by facilitating stability in rates for certain types of customers.
9) To collect and provide to the public and the Ontario Energy Board (the energy regulator) information relating to medium and long term electricity needs of Ontario and the adequacy and reliability of the integrated power system to meet those needs.

In order to achieve the above objectives, the OPA has been divided into four key areas which include:

Planning

The Power System Planning group are responsible for developing and maintaining the long-term coordination of supply and transmission of electricity to ensure reliability and adequacy of Ontario's electricity system through an Integrated Power System Plan (IPSP). The IPSP is

[1] http://www.e-laws.gov.on.ca/html/source/statutes/english/2004/elaws_src_s04023_e.htm

a 20-year forward looking plan which identifies the conservation, generation and transmission investments needed to ensure reliable and sustainable energy.

Supply

The Generation Development group are responsible for procuring and managing investment in required new generation and demand management initiatives where that investment would not otherwise occur in the competitive market. Such procurement and demand-side initiatives are based on the needs identified by both the Power System Planning group and the Conservation Bureau and are implemented through a transparent process.

Conservation

The Conservation group facilitate the management of demand through coordination and development of conservation programs for electricity users in order to achieve the provincial wide conservation target mentioned above. The OPA is involved in a host of conservation initiatives for many different sectors including conservation and demand management (CDM) programs, demand response (DR) programs, electricity, housing initiatives, and a new construction program.

Sector Development

The Sector Development group explore market-based approaches to develop the Ontario electricity sector. This includes establishing load-serving entities to manage market risk on behalf of customers and developing electricity market products for forward-trade.

The OPA's Involvement with other Ontario Electricity Authorities

Transmission Investment

The OPA, in a way, is the 'middle-man' in transmission investment applications. Hydro One Networks or any transmitter is required to provide an annual rate filing detailing transmission work including maintenance work and new proposals with their associated costs to the OEB for transmission assets (a separate filing is required for distribution network assets) for the next two years. Hydro One are required to obtain justification from the OPA, in particular, the Transmission Integration group, for the need and priority, on any major transmission works proposed before submitting their filing to the OEB. In the case of new transmission investments, a Leave to Construct (LTC) application is filed. If necessary, the OEB may request OPA's Transmission Integration group to provide evidence of justification for works in Hydro One's rate filing and LTC application. The OPA's justification process begins with determining the 'need' for major transmission reinforcements or new generation for system supply issues, and then providing alternative options which could resolve the 'need' by

showing evidence of screening out all options down to the most viable proposal. System studies to determine the need as well as the impact of required reinforcements on the bulk system are performed by the IESO in collaboration with the OPA. During the OPA's evaluation of all investment options, Hydro One provide the costing requirements and preliminary environmental assessments for the work proposed to help screen out the different options. In some cases it may be that the OPA recommend an alternative option to Hydro One's initial proposal. The OPA's role in this process ends at the recommendation stage with the OEB making the final decision on which investment is to proceed to obtain LTC approval. Once an investment has been justified by the OPA and subsequently approved by the OEB, a formal System Impact Assessment (SIA) is obtained from the IESO on the transmission reinforcements to ensure system security and reliability is not compromised.

Generation Procurement

As done for the transmission investment process, the process of contracting for new generation begins with the identification of the 'need' by the Transmission Integration and Resource Integration teams in consultation with the IESO. Authority to proceed with addressing the need through generation procurement is provided either from the Ministry of Energy and Infrastructure or the Ontario Energy Board. Once approval to proceed with procurement is provided, the OPA, depending on system requirements, can begin with procuring generation contracts by:

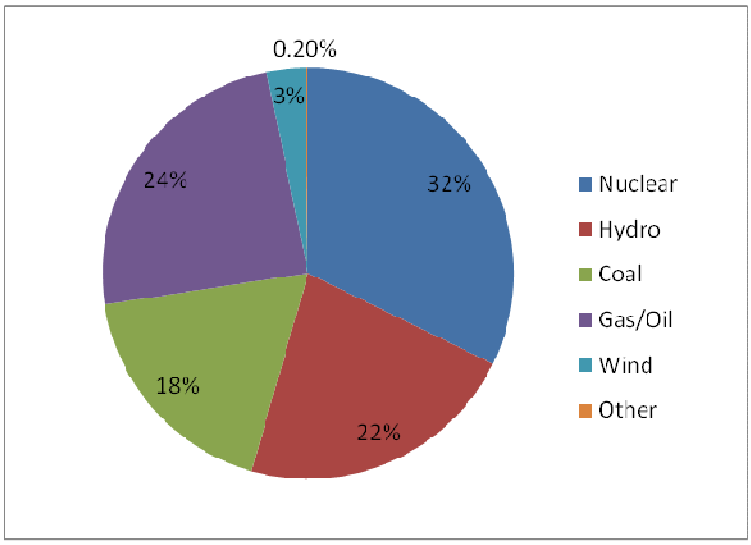
i) seeking expressions of interest from developers for the required capacity,
ii) identifying developers who might be in a position to fulfil the contract through certain qualifications, and/or
iii) securing specific proposals and contract commitments to fulfil the identified need/s.

To ensure the contract is honoured, the Generation Development team supports the supplier providing facilitation as necessary and monitors the development progress prior to commercial operation. Once the project begins commercial operation, the department stewards all financial aspects of the agreement.

Generation resources are procured on a competitive basis wherever competition is likely to produce an efficient outcome. Where the competitive process is unlikely to produce an efficient or cost-effective outcome for electricity ratepayers, or a solid business case is approved by the OPA Board of Directors, individual project negotiations may still be undertaken provided that adequate controls and review mechanisms are applied to ensure a "fair and reasonable" result.

The Ontario Supply Mix

The Ontario electricity system has a summer peak demand of approximately 24 GW with current installed generation capacity of approximately 35 GW. The current fuel mix is shown below in Figure 1.



Source: OPA

Figure 1 – Current Fuel Mix in Ontario

By the year 2025, the following changes to the supply mix is being planned for in order to comply with clean energy initiatives:

- Renewable energy target of approximately 19 GW
- Nuclear energy limited to 14 GW
- Closure of all coal units by 2015
- Improved natural gas capability at peak demand periods
- Total peak demand reduction by 6,300 MW through conservation programs

The above targets have been proposed a result of the Government of Ontario's Green Energy and Green Economy Act, 2009 (GEGEA) which received Royal Assent in May 2009 with a purpose of increasing investment in renewable energy projects and encouraging conservation, creating green jobs and economic growth to Ontario.

The Green Energy and Green Economy Act, 2009 (GEGEA)

The Ministry of Energy and Infrastructure of Ontario is committed to fostering the growth of renewable energy projects by removing barriers to using cleaner sources of energy, as well as promoting opportunities for renewable energy projects to encourage a green economy. In order to achieve such a milestone, the Ministry have established "the right to connect" to the electricity grid for renewable energy projects that meet technical, economic and other regulatory requirements through a Feed-In Tariff (FIT) program. The FIT program is a streamlined approvals process that guarantees specific rates for energy generated from such renewable projects. Through the encouragement of renewable energy sources, such as wind, solar, hydro, biomass and biogas in Ontario, the Ministry estimate that the program will also create approximately 50,000 'green' jobs for Ontarians in its first three years. The Ministry also encourages implementation of a smart power grid to support the development of new renewable energy projects in order to prepare Ontario for new technologies, such as electric cars.

A series of conservation measures is also being encouraged by the Ministry through the GEGEA, with the aim of creating potential for savings and better managed household energy expenditures to ensure that the conservation and use of energy is efficient and a priority throughout Ontario. Measures that the GEGEA is promoting are included in revised Ontario building codes, setting electricity conservation targets for local utilities and helping them to deliver effective programs to households and businesses, as well as requiring targeted conservation measures to protect low income Ontarians from increases in energy prices.

In order for the GEGEA objectives to be delivered successfully, the Ministry requires the assistance of the OEB and OPA to administer the Feed-In Tariff Program as well as facilitate conservation targets required.

The OPA's Role in the GEGEA

In September 2009, the OPA was issued a directive from the Ministry to develop the Feed-In Tariff (FIT) program as well as the program rules, designed to:

- increase capacity of renewable energy supply to ensure adequate generation and reduce emissions,
- introduce a simpler method to procure and develop generating capacity from renewable sources of energy,
- enable new green industries through new investment and job return, and
- provide incentives for investment in renewable energy technologies.

The directive also stated that the program was to cater for renewable source technologies including wind, solar PV, bioenergy and up to 50 MW of hydro generation and contracts were to be 20-years for all renewable projects except waterpower ones, where those contracts were to be 40-years. The developer is required to design, build and operate a renewable generating facility and in exchange should provide for guaranteed, long-term pricing for the output of the renewable generating facility.

To complement the FIT Program, the Ontario government also signed a contract with the Korean Consortium to allow the developer to be able to connect 2,500 MW of renewable energy to the Ontario network in 500 MW phases. This amount of secured renewable generation aligns with Ontario's clean energy initiatives.

In addition to the FIT directive issued, the OPA were again directed by the Ministry in April 2010 with respect to conservation programs. In conjunction with this directive to the OPA, the OEB were also issued a Conservation and Demand Management (CDM) Directive to establish mandatory CDM targets for LDCs to achieve reduction in electricity consumption and reductions in peak provincial electricity demand by 2014. Subsequently, OPA's directive was to provide advice to the OEB, following consultation with LDCs, on the appropriate allocation of CDM targets amongst LDCs, as well as advice on the administration of LDC CDM activities. The OPA have also been directed to design, deliver and fund OPA-Contracted Province-Wide CDM Programs.

The Feed-In Tariff (FIT) Program

The FIT Program is the first comprehensive guaranteed pricing structure in North America for anyone interested in developing a qualifying renewable energy project through standardised program rules, prices and contracts. Prices are designed to cover project costs and allow for a reasonable return on investment over the contract term.

The program is divided into two streams, FIT and microFIT programs, where projects generating more than 10 kW qualify as a FIT project and anything less than 10 kW qualifying as a microFIT project (mainly rooftop solar or bioenergy fuels). In addition to these two streams, there is also another class of renewable energy project, Capacity Allocation Exempt (CAE) projects which are projects as defined by the OEB's Distribution System Code as:

- a generator $\leq$ 250 kW where the facility is connected to a line < 15 kV, or
- a generator $\leq$ 500 kW where the facility is connected to a line > 15 kV.

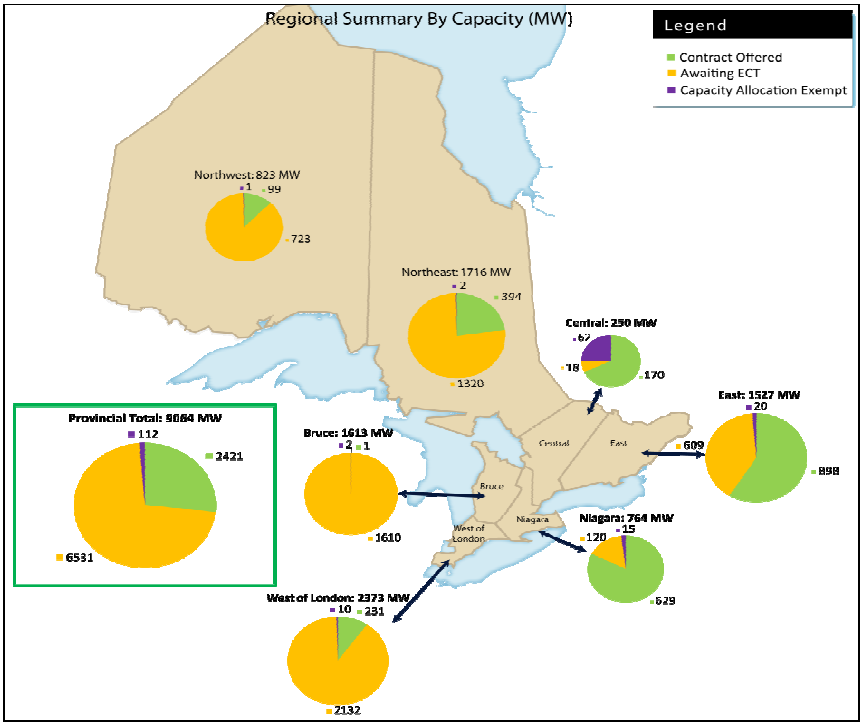
These CAE projects automatically obtain a FIT contract once the application has been reviewed and found to be complete and are not subject to any transmission or distribution availability tests or FIT program launch rules. However they do have normal commercial operation deadlines of three years for solar, on-shore wind and bioenergy, four years for off-shore wind and five years for hydro generation.

The FIT Program was launched by the OPA at the beginning of October 2009. Due to the large amounts of applications expected and in order to streamline the process, the program is divided into two sections, the Transmission Availability Test (TAT) and Distribution Availability Test (DAT), where priority for connection capacity is based on applications received within the FIT Launch Period (1st October 2009 to 30th November 2009) in sequential order based on their application time-stamp i.e. their estimated date of commercial operation, the project's "shovel-readiness", as well as existing transmission or distribution capacity where no system upgrades are required, subject to the TAT or DAT, to accommodate the project. Existing transmission or distribution capability also includes planned or committed capacity expected to be available by the time of the project's commercial operation date (COD). For unsuccessful applications, e.g. projects which require system upgrades, or for applications received after the Launch Period, these will become part of the FIT Reserve and will be assessed in the second part of the FIT Program called the Economic Connection Test (ECT) due to commence in August. This process will be discussed later in the report.

Once a contract has been awarded, the applicant is able to accept or reject the contract. If the contract is accepted, and the security fee received within 10 days of the contract offer, the application can proceed to obtaining a Connection Impact Assessment (CIA) from the Transmitter or Distributor or System Impact Assessment (SIA) from the IESO as long as all capacity of the existing transmission/distribution system will be available by the project's COD. If planned or committed system capacity is not available before COD but a project should 'pass' once this capacity is available, then the application moves to the FIT Production Line where it will wait until network capacity becomes available.

In anticipation of the large majority of renewable applications expected to be received through the FIT Program, the OPA worked with a wind farm consultant in projecting potential wind sites to pre-empt capacity that could be accommodated on the existing transmission system. Although this was a useful exercise for internal purposes, the actual wind applications for connection did not reflect the study and the capacities which applied exceeded expectations. During the Launch Period, over 9,000 MW of renewable energy project applications were received with only approximately 2,500 MW of applications being

awarded contracts based on existing system capability. The remainder 6,500 MW, as well as applications received before the beginning of June 2010 will be assessed in the second part of the FIT Program, the ECT process. The figure below shows provincial-wide applications received during the FIT Program's two-month launch period.



Source: OPA

Figure 2 – Ontario FIT applications received between 1 October and 30 November 2009

The Economic Connection Test (ECT)

The Economic Connection Test (ECT) will occur every six months, and is the second stage of the FIT Program which assesses applications in the FIT Reserve, i.e. those applications which could not be accommodated on the existing transmission system, and also those applications which have been received since the FIT Launch Period end date. It is an ongoing process for assessing economic transmission system developments required to connect such FIT applications with the aim of balancing the right-to-connect and the provincial ratepayer impact of transmission investment and to prioritise economic expansion projects in order to improve coordination between transmission and distribution expansion plans.

The OPA's role in carrying out the ECT process includes network expansion planning by identifying and comparing alternative economic transmission expansion projects required to enable additional renewable generation which will trigger development work to be carried-out by Transmitters under OEB oversight. In order to recommend the most economic solution,

each expansion project undergoes an economic assessment which considers only the cost to ratepayers, where certain thresholds must be met. The OPA has adopted a congestion threshold to maintain a "generally uncongested" system based on research from other North American jurisdictions and studies performed, and plans to limit congestion for FIT connection purposes to be no more than 5% of the time for major transmission paths under normal system conditions. The ECT uses the congestion approach in two ways:

1. Determines the required size of transmission expansion
2. Determines the capability of a particular expansion project to accommodate FIT connections

The OPA has also adopted a $/kW metric to evaluate identified transmission expansions in the ECT with this value being determined based on historical transmission investment in Ontario as well as a range of transmission costs used in North America.

The first step within the ECT process is similar to the TAT and DAT which occurred as part of the first stage of the FIT program. This step is required as additional capability may become available on the existing transmission system due to new transmission facilities scheduled to come into service or the cancellation of another generation project. Once again, projects will be assessed in sequential order of time-stamp priority.

Once additional or rescinded capacity has been reallocated based on the initial step of the ECT, applications in the FIT Reserve will then be reviewed. At the end of the ECT, an application will be moved to the FIT Production Line when there is sufficient existing or planned capability throughout the transmission and distribution system. Transmission system capability will be allocated to the application when it is moved to the Production Line, or applications remain in the Production Line until required approvals for planned transmission and/or distribution projects are received. Applications for which sufficient capability cannot be made available will remain in the FIT Reserve and will be considered again in the next ECT.

Work Experience to Date

My work experience to date has included work leading up to the ECT assessment focussing on certain areas of Ontario which have already been identified as part of the TAT and DAT processes as hindering the connection of large and small scale renewable projects due to current transmission and/or distribution capability limitations. I have noticed that sudden attention has been brought to certain localised systems due to their system characteristics and constraints that delay enabling renewable resources onto the transmission network. For example, the large quantity of distribution-connected renewable projects resulting from the

FIT program was not anticipated and as such, some have not been able to pass transmission and distribution availability tests due to station short circuit limitations. These short circuit limitations, as well as protection scheme changes are similar to those experienced by Red Electrica de Espana. Another aspect of the Ontario electricity network which is delaying the connection of renewable sources through the FIT program includes the large geographic area of the network. Ontario is highly dependent on the system's ability to transmit energy from the north to the south during peak periods due to the large amount of generation located in the north and majority of the load being located south around the Greater Toronto Area. Given that existing generation in northern Ontario already exceeds the regional load at peak demand, any excess generation needs to be transferred to the South using a limited 500 kV transmission corridor. Approximately 25% of FIT applications were received in the north during the initial FIT launch period, however the existing system only has the capability to accommodate 20% of those applications due to congestion issues on the north-south corridor. Factors which have contributed to the congestion issue and therefore limiting the ability to connect renewable generation include the diminishing industrial load in the northern area resulting from the recent economic downturn as well as flows between two northern Ontario-U.S. interconnectors. I have also noticed that cost allocation mechanisms of distribution and transmission upgrades are very important and must be well-defined as these can affect the outcome/s of the economic connection of generation and possibly delay connection. This factor has arisen through the station short circuit limitation issue which the OPA and the OEB have had to address prior to the ECT process.

Also part of the lead-up work for the ECT assessment, I have been involved in a pre-transmission availability test for certain areas of the network to accommodate the Korean Consortium renewable phases, mentioned at the start of my report, as well as the implications of these connections on current FIT program applicants. Due to the confidentiality of this work I am not at liberty to provide further details, however this type of work has not only enhanced my experience with both wind and solar renewable integration, but has also exposed me to the delicate situations involving planning jurisdictions, private developers, the government and the energy board.

Apart from transmission planning to integrate renewable energy, I have also been involved in regional area planning. In addition to the bulk transmission planning, the OPA addresses specific regional supply adequacy issues, either current or foreseen that may affect the reliable delivery of electricity to customers. Given that each regional area has its own unique resource mix, community needs and local considerations, regional planning is viewed in Ontario as an integrated process where solutions are derived by consulting with the

stakeholders involved in delivering solutions within the regional area. Such stakeholders include the local distribution companies (LDCs), municipalities, transmitters, the IESO and other stakeholders in the community. The regional area studies are becoming more complex due to the recent introduction of the FIT program where a large number of distributed renewable generation have successfully applied, and therefore the impact of these as well as the LDC-targeted conservation mandate now need to be considered within the integrated plan. The integrated plans include reviewing options of conservation measures, distributed generation, and transmission and distribution system reinforcements against near-term, mid-term and long-term needs. These options are evaluated based on economic, environmental and technical considerations so that an integrated plan can be recommended to ensure distribution and transmission expansion plans are coordinated. Currently, I am leading the working group for a regional area study in southwest Ontario which consists of representatives from four southwest Ontario LDCs, Hydro One Distribution and Transmission groups as well as the IESO. I am also providing technical support for other regional planning working groups for northern and eastern Ontario areas. Coming from a system operator background in Australia and the UK, this type of work is providing me with experience at the local level by incorporating green energy plans and conservation programs into a reliability study, as well as dealing directly with local council mayors and the community, which can often be a tough group to convince that distribution or transmission reinforcement or even larger-scale generation, such as a gas peaker-plant, may be required to address local and system needs. It is also providing me with experience on how local distribution plans can affect the transmission network and therefore coordination, at specific times is required, particularly with the integration of distributed renewable generation resulting from the FIT Program.

Other work has also included system studies for part of the bulk transmission network in northern Ontario which is mainly supplied by large coal plants and hydro generation. Many of the hydro plants in the northern Ontario area are classed as Non-Utility Generators (NUGs) or contracted generators, whose contracts are coming to an end in the near future. Consequently, with the Government's clean energy initiative of ceasing the operation of all coal plants in the province by 2015, renewal of the NUG contracts under consideration, and with the intermittent nature of renewable generation applied to connect to the area through the FIT Program, the supply to certain areas of northern Ontario in particular is of concern, especially during low-water periods which can occur in the north when there is insufficient melted ice from the lakes due to mild winters. These studies being completed in collaboration with the IESO, are considering potential transmission and distribution reinforcements, load rejection schemes, the extent of reliance on the northern demand response program, as well the

possibility of negotiating extended generation contracts for both some coal generators and hydro NUGs in order to alleviate supply adequacy concerns post-2015. The latter scenario is very sensitive due to the Government's clean energy policy and cost implications of extending contracts of non-utility generators which were not expected to be relied on for supply adequacy. As a result, this type of work has further exposed me to the coordination required between the Ministry and its policies, transmission planning as well as generation company priorities for supply reliability.

During my first three months at the OPA, I have also attended site visits to the Sir Adam Beck hydro generation plant (located at Niagara Falls) as well as the Thorold co-generation plant. I have also been fortunate to attend seminars including the Wind Power Standing Committee which is coordinated by the IESO which discusses wind generation issues in Ontario, as well as the annual Ontario Power Summit which provided me with an insight on the issues of the different sources of energy mix within the province as well a financial perspective on investing in renewable energy projects. I also attended an interesting presentation by Brookfield Power on the Texas CREZ (Competitive Renewable Energy Zone) Project which was created in 2005 where studies were performed to identify zones containing at least 1,000 MW of potential wind resource having financial commitment by generators. A new transmission access regime has been set up to allow the Texas Public Utility Commission (PUCT) to pre-approve transmission alternatives for renewable generation through the designation of CREZs. These transmission projects will not be built under long-term concession contracts with established pricing and terms of service as done in other countries, rather they will be regulated by the PUCT.

Future Direction

Although my placement with the OPA does not finish until March 2011, the next three months of 2010 will be my final term of the scholarship. Over those three months I envisage my work at the OPA to heavily involve assessing the integration of renewable applications in the FIT Reserve as part of the ECT process which is due to commence in August. This will also include identifying transmission expansions required to accommodate such renewable projects and applying the economic assessment criteria in recommending the most viable option. In addition to the ECT work, I will continue to be involved in regional area planning studies around Ontario dealing with distributed renewable generation, as well being involved in bulk system transmission planning projects in more localised areas where supply reliability is a concern due to the planned decrease in baseload generation and expected increase in renewable generation resulting from the Government's clean energy initiatives.