Contextual Narrative
Hydropower

General Socioeconomic Context

A. P*roduction value of the interest:*

The New York Power Authority, Ontario Power Generation, and Hydro Quebec are public utilities owned by New York state and the provinces of Ontario and Québec respectively. The hydroelectric facilities they operate on the St. Lawrence River have a total average annual hydro-power production of approximately 25,000,000 Mwh (13, 000,000 Mwh at Moses-Saunders and 12,000,000 Mwh at Beauharnois-Les Cèdres). Although the mission of these entities is to produce low cost power, the market value of the energy produced at these facilities is approximately $1.5 billion (US) at current market rates

B. *Number of stakeholders:*

The energy produced by the St. Lawrence facilities is enough energy for the consumption of approximately 2,000,000 homes.

C. *Organizational characteristics:*

These facilities are a major contributor to the interconnected power grid that services customers throughout the eastern part of North America. Electricity demand varies both seasonally and daily. Energy production at the Hydro Quebec facility is consistent throughout the day, while energy production at the Moses Saunders powerplant varies to some degree during the day to match demand.

D. *Values and perceptions of the interest:*

Hydroelectricity plays a significant role in providing clean, inexpensive, renewable energy to the region. The scale of these "heritage electricity generation investments" on the St Lawrence also contribute to keeping electricity prices low. In NY, several significant industrial users such as ALCOA and GM rely on low cost electricity from Moses.

Both NY and Ontario have made significant commitments to reduce the use of coal fired generation and support the use of renewable energy sources. The St. Lawrence plants contribute to the base supply of clean, renewable energy. The ability to vary production to contribute to peak demands further reinforces the important contribution these facilities make to the health and welfare of the regions population Air quality is one of the most important environmental concerns in Southern Ontario and Northeastern United States. The St. Lawrence hydro facilities provide substantial air quality benefits; if the

equivalent amount of energy from these facilities generated using fossil fuel, like 50% of the electricity in North America, 18,000,000 tons of CO2 annually would have been discharged into the atmosphere. State and federal legislation is still evolving to further reduce air quality problems associated with power production, especially acid rain, and carbon emissions which drive climate change. Because overall electricity demand is rising, and environmental concerns may force the closure of some coal fired plants, Lake Ontario regulation favorable to hydropower production will be more important, not less in the future. Reductions in hydropower production would have to be addressed by greater production from other types of plants, with consequent emissions and cost impacts. Much of the substitution will come from gas turbines, some from coal fired plants, both of which produce more carbon and airborne acids than hydropower. Nuclear production is more or less fixed, although there are industry efforts to promote new nuclear capacity.

Regionally, hydropower is seen mainly as a friend. The economy of northern New York State is strongly impacted by the regional allocation of hydropower from Moses to local industry. Hydropower provides low cost electricity to the ALCOA Aluminum Recycling Plant and GM Powertrain Production facility in Massena, New York. The importance of hydropower to the sustainability of Northern New York State has been formally recognized by New York State's "Build Now – NY" program, and this will remain true for the foreseeable future. This low cost power provides approximately 2000 high paying manufacturing jobs to the local economy. According to the ALCOA website, ALCOA contributes approximately $250 million dollars annually in payroll, taxes and purchases to the local economy. These jobs are tied directly to the favorable electricity rates they have with NYPA. NYPA also provides low cost power to municipalities

E. *Significant statutory, regulatory and policy restrictions:*

In the next ten years the most significant statutory, regulatory or policy restrictions directly or indirectly affecting hydropower production at the NYPA facility will be U.S. and New York State air quality laws, which are expected to reduce coal fired energy production, and further limit control emission s from fossil fueled generation, which comprises about 70 % of the energy in the New York system. These actions will affect the electricity supply market, increasing the importance of hydropower. NYPA has just completed its FERC relicensing of St. Lawrence-FDR, securing a license under terms that will apply until 2054. The terms of that license are essentially reflected in the shared vision model so far as they affect performance indicators for this study.

In Canada, the Provincial Government of Ontario has announced its intent reduce its reliance on coal fired generation and increase capacity from new renewable energy by 1350 MW by 2007 and 2700 MW by 2010. Canada is a signatory of the Kyoto Treaty. Canada's emission reduction target is a 6% reduction from 1990 levels by 2012. The net impact of these actions will be to increase the importance of hydropower in the Canadian markets.

F. *History of the interest:*

Commercial hydropower production began just upstream of Lake Ontario in Niagara Falls at the beginning of the twentieth century. Initial investments made more than 50 years ago, along with ongoing investments for facility improvement and life extension continue to provide clean renewable energy at a fraction of the cost of other, more polluting sources, Investment in these hydropower assets have provided the economic engine in the region and continue to keep energy prices in the region low.

Because there is no fuel cost in hydropower, once the investment in a hydropower plant is made, the additional costs of using the plant to produce energy are much smaller than for other forms of power production. As a result, once built, energy production at these three plants is rarely reduced because of a decline in energy demand. The value of the energy produced in the long term is affected by the costs of electricity produced by other means and by the price of other energy sources such as natural gas and oil.

All generating sources of electricity have environmental costs but surveys show that the public served by these three plants generally prefers hydropower production over other means, especially coal and nuclear, which are seen to have greater environmental impacts. Hydro producers, regulators, and water users are challenged to balance electricity production with environmental and social objectives. Concerns about the impacts of hydroelectric development on fish and other users must be balanced with the positive economic and societal benefits hydroelectric generation provides. To minimize the impacts of hydro development and operation on the natural environment, NYPA. Hydro Quebec and Ontario Power Generation continue to invest million of dollars annually in science research. An example of this is recent work to reduce the mortality of the American Eel as it moves through the St Lawrence River.

The St. Lawrence power project (NYPA and OPG) is regulated by the International Joint Commission. The New York Power Authority is regulated and licensed by the Federal Energy Regulatory Commission (FERC). The IJC and FERC as well as provincial regulations in Ontario and Quebec mandate that the hydropower dams and all related structures are operated safely within design limitations to ensure the stability of the structures and prevent loss of life and property.

Long Sault Spills: During the process leading up to the issuance of a new FERC license for the St. Lawrence project, spills at Long Sault became an issue for several parties. Two specific concerns were raised by NYSDEC and BIA: cooler river water spilling into the warmer, shallow-water habitats of the upper end of the South Channel, causing concern for the propagation and survival of warm-water species immediately downstream of the dam, and the potential effects of gas bubble disease (GBD) caused by nitrogen supersaturation.

FERC incorporated these concerns into Article 402 of the new license, which requires a monitoring plan for water temperature and dissolved gases in the South Channel; advance notification of DEC for all planned spills over Long Sault Dam, and to notify DEC regarding any non-planned spills, and annual reporting of monitoring data.

Ice Control: The IJC has charged the hydropower companies with forming a stable ice cover. Numerous flow changes are often necessary to help form and protect the ice cover. Since nature dictates when ice forms it is necessary for any regulation plan to be flexible to allow the ice to form and strengthen.

High flow conditions can cause potential flood conditions downstream of the Moses-Saunders project. Minimizing the number of occurrences and duration of excessively high outflows would be desirous under all plans of regulation.

G. *Trade flows and current market conditions:*

The demand for energy is strong and growing. Oil and gas prices are fairly high relative to long term values and most analysts believe these prices to be essentially permanent adjustments. This is caused by the increased demand for oil worldwide and adjustments in the natural gas market (driven by both regulatory costs and the fact that lower historic gas prices have expanded the use of gas to the point where the lowest costs supplies have been fully subscribed). Given the combination of higher energy prices, the environmental and economic advantages of hydropower, and the well recognized importance of hydropower to the regional economy, the overall value of hydropower production on the St. Lawrence will almost certainly increase in the next few decades.

The New York Power Authority (NYPA), Ontario Power Generation (OPG) and Hydro Quebec (HQ) are all public utilities, owned by New York state and the provinces of Ontario and Québec respectively. While they closely coordinate their operations through Operations Advisory Group (OAG), each operates in very different and independent market environments. The market rules, availability of generation, transmission constraints, demand for energy and peak and off-peak demand times all contribute to making each of these systems unique.

New York: The New York electricity market is competitive, and operated by the New York Independent System Operator (NYISO). The NYISO is a not-for-profit organization formed in 1998. The NYISO facilitates fair and open competition in the wholesale power market and creates an electricity commodity market in which power is purchased and sold on the basis of competitive bidding.

NYISO administers the Day Ahead Market (DAM) and Hour Ahead Market (HAM). The DAM requires that bids and schedules be submitted by 5 a.m. When the DAM closes at 5 a.m. generation bids are evaluated and units are committed beginning with the least expensive generation and progressing to more expensive generation until enough generation is committed to meet the forecasted load. The final unit of generation committed becomes the price for every megawatt during an hour for a given zone. In effect, the system energy price is determined by the most expensive block of power committed to serve the load. In the Hour Ahead Market (HAM) bids and schedules must be submitted 90 minutes prior to the hour in which service will start.

Ontario: The Ontario government is restructuring Ontario's electricity sector to ensure adequate supplies of electricity as well as stable prices. Under the Electricity Restructuring Act, 2004, a new wholesale pricing structure has been established that incorporates both regulated and market prices.[1]

Pursuant to the Electricity Act, the Independent Electricity Market Operator (IMO) was re-named as the Independent Electricity System Operator, or IESO, effective January 1, 2005. The IESO manages the Province's power system, balances demand for electricity against available supply through the wholesale market and directs the flow of electricity across the transmission system. A not-for-profit entity established by the Government of Ontario, IESO fees and licenses to operate are set by the Ontario Energy Board. The Ontario Power Authority has been created to oversee long-term supply adequacy and the development of a Conservation Culture in Ontario.

On a continual basis, the IESO forecasts how much power is needed throughout the province and takes in offers from generators and other suppliers to meet that demand. Each day, the IESO issues forecasts of how much energy will be needed throughout the following day and up to the month ahead. These forecasts are continually updated as new information comes in -- such as changes in weather. Typically, the IESO's day-ahead forecasts are highly accurate, with less than a two per cent variance from the actual demand figures.

Generators and importers of electricity review the forecast information and determine how much electricity they can supply and at what price. The IESO then matches the offers to supply electricity against the forecasted demand, first accepting the lowest priced offers and then "stacking" up the higher priced offers until enough have been accepted to meet customer demands. All suppliers are paid the same price - the market-clearing price. This is based on the last offer accepted.

The IESO collects bids and offers until two hours before the energy is needed. The IESO will issue its instructions to power suppliers based on the winning bids, who then provide electricity into the power system for transmission and distribution to customers. The IESO runs a real-time market, meaning purchases of electricity are made as they are needed. There are occasions, when the best priced energy may not be available due to limitations on the transmission lines. In this case, that generator's offer is still used to help set the price, but another generator may be asked to provide the electricity.

Quebec: Hydro Québec does not operate in a competitive market environment within the Province of Quebec. Hydro Quebec has implemented a functional separation of its three major business units: Generation (Hydro Québec Production), Transmission (TransÉnergie) and Distribution (Hydro-Québec Distribution).

The Trans-Energie mission in the market is essentially to transmit electricity at the lowest possible cost and with the expected level of reliability, in compliance with the regulations governing the North American Electric Reliability Council. Hydro-Québec

[1] Homeowners, small businesses and certain public-sector institutions pay a set rate of 4.7¢/kWh for the first 750 kWh of electricity consumed in a month and 5.5¢ for each additional kWh. Large-volume users pay the fluctuating market rate.

Distribution is responsible for providing reliable electricity service to the people of Quebec, and offering services designed to meet customer expectations.

Hydro-Québec Production must supply up to 165 TWh of electricity per year to Hydro-Québec Distribution. Any production exceeding this volume may be sold at market prices. In Québec, demand for electricity is increasing at an average rate of 1.2% per year. At this rate, Quebec's needs will exceed the heritage electricity pool in 2005. To meet demand beyond this volume, Hydro-Québec Distribution will have to issue calls for tenders from suppliers

In Québec, there is no short term bid system as there exists in New York or Ontario. Nevertheless, Hydro-Québec Production, as well as other producers, can bid in the New York, Ontario or any other market to buy or sell energy.

H. *Effect of last high or low water conditions:*

High water conditions in the past have generally increased the quantity of energy produced at these facilities, while lower water levels have the opposite effect. The lowest flows have not historically forced brownouts due to lowered capacity.

2.0 Performance Indicators:

(a.) The objectives of regulation for hydropower are:

Maximize power production: The generating units at H-Q, OPG and NYPA are designed to operate within a design range. Within this range is a point of best efficiency. It is desirable to operate at the point of best efficiency because this enables the most megawatts to be produced with the water. High flows that exceed the best efficiency result in diminishing megawatt production through the plant. If flows are higher than the capacity of the plant then the water must be spilled.

Maximize the value of the power production: The price of power is determined by the demand for power and the resources available to meet that demand. During the day there are periods of high and low demand. Also the demand for power is usually higher during the heating and cooling months than during the spring and fall months. Regulation plans that provide for higher outflows during the summer and winter (with the flexibility for ice formation) and lower flows during the spring and fall will enable more power to be produced during the higher value periods. In addition the flexibility provided by peaking allows for generation to be varied within the day to match the variation in demand.

Flow Predictability: Normally, power entities remove units from service for maintenance during the low flow period or try to match an outage with the expected flows. If units are down and flows increase unexpectedly, the power from that additional flow may be lost. Units that are out of service for maintenance are usually disassembled which prevents them from being returned to service quickly. Plan 1958DD is predictable because the outflows are primarily determined by the level of Lake Ontario which rises and falls in a predictable seasonal pattern.

Flow Stability: The metric used in the shared vision model is a measure of the quarter month variation in flow. A plan that minimizes the quarter month fluctuations is preferable to a plan with large weekly fluctuations. This PI complements the flow predictability performance indicator as it allows for critical maintenance planning.

Ice cover formation: A properly formed ice cover allows flows to be maximized during the winter because flow friction and obstruction are minimized. Because stable ice cover is so valuable to so many interests, PFEG believes that all new plans include rules to limit discharges to be between about 5,700 cms to 6,300 cms during ice formation. At a minimum, plans should be evaluated to determine how often releases outside this range occur during ice formation

(b.) The hydropower performance indicators concerned with flow predictability and stability will best be measured as frequency and duration of occurrences that exceed plan 1958DD. As stated in the discussion above Plan 1958DD is beneficial to hydropower for these measures because the outflows are dependent on Lake Ontario levels which are inherently predictable and stable.

The performance indicator that measures the maximization of power (best efficiency) is quantifiable according to the ratings of the generating units. These ratings have been incorporated into the model and can be measured objectively.

The performance indicator that seeks to maximize the value of the megawatts will be determined by several variables. The cost of power, along with the determination of the periods of highest value will be addressed in the model. The Synapse report and historical demand data are available for model inputs. Regulation plans that prescribe flows that seasonally match the demand periods will be preferable. In addition, plans with fewer instances of flows above 7,930 cms will be preferable to allow for peaking. This performance indicator while the most subjective, also has the potential for understating impacts if the assumptions are incorrect or if they change in the future.

3. Potentially Significant Benefit Categories Not Addressed by the Current Performance Indicators.

The St. Lawrence hydro facilities provide substantial air quality benefits and energy cost savings that are not directly addressed by the performance indicators.

The Federal Energy Regulatory Commission issued a license for the NYPA's St. Lawrence-FDR Project (Moses) in October, 2003. The Final Environmental Impact Statement prepared for that licensing effort estimated the amounts of pollutants that would be generated by a steam-electric facility of equivalent size (SOx, NOx, CO, CO2, and particulates. (FEIS at 4-118)

Table 4-9. Approximate Annual Air Emissions from a Hypothetical 800 MW Fossil Fuel Power Plant[1]

	Coal (ton)	Oil (barrel)	Gas (million cubic feet)
Fuel Quantity	2.8 million	11.2 million	69,000
Pollutants:	*(tons)*	*(tons)*	*(tons)*
Oxides of Sulfur	55,000	3,500	170
Oxides of Nitrogen	25,000	54,000	500
Carbon Monoxide	1,300	2,900	40
Carbon Dioxide	6,400,000	5,900,000	4,100,000
Particulates	170,000	700	NA

[1] Air emissions were calculated utilizing EPA AP-42 emission factors and annual production of 6,650 GWh.

The total air emissions offset by the three hydro facilities is approximately three times that presented in Table 4-9 above.

Combined cycle gas fired generation would likely be a major source of replacement power, along with renewables.

Hydropower is a price stabilizing factor in the competitive energy markets in Ontario and New York. While hydropower is bid as a low cost supply, any replacement power would come from the most expensive source necessary to fill the system demand.

4.0 Key Baseline Conditions:

The value of energy estimated in the shared vision model assumes a market similar to todays, with the same mix of energy producers, and the same influence of the navigational needs of the St. Lawrence Seaway. Near term expectations are that the market will be at least as strong, with the available production capacity unlikely to outgrow the expansion of the market.

Future Energy Supply: The hydro power developed by the three facilities affected by the Plan of Regulation is integrated into the power supply of the North-eastern States and Provinces. Hydropower constitutes approximately 15 % of New York's, 25 % of Ontario's, and 95 % of Quebec's energy supply, respectively. Changes to hydropower production would have to be offset by changes from other types of plants, which have significantly different cost and environmental characteristics. Substitution may come from gas turbines, some from coal fired plants, both of which produce more carbon and airborne acids than hydropower, which essentially emits no conventional pollutants. Nuclear production is more or less fixed and is expected to decline over the next few decades as older plants close and no new plants are built.

5.0 Key Trends:

Air Quality: Air quality is one of the most important environmental concerns in Southern Ontario and Northeastern United States. State and federal legislation is still evolving to further reduce air quality problems associated with power production, especially acid rain, and carbon emissions which drive climate change. In the United States, there are several bills under discussion that would amend the Federal Clean Air Act to varying degrees. Regardless of what measures might be enacted, all will require stricter emission controls on fossil fired generation during the 2010-2020 time frame. Although carbon controls remain controversial at the Federal level, the Northeastern States are moving forward with regulatory programs that would establish a regional cap and trade program for Carbon Dioxide by 2008.

In Canada, the Provincial Government of Ontario has announced its intent to reduce reliance on fossil fuel generation and increase renewable energy by 1350 MW by 2007 and 2700 MW by 2010. Canada is a signatory of the Kyoto Treaty, and will be required to reduce carbon emissions beginning in 2005.

The net affect of these actions will be environmental and economic pressure on many of the existing facilities that contribute to the current energy markets in Canada and the United States. "Cheap" sources of existing sources of power will be required to retrofit emission control technologies, or close. Short term replacement facilities will likely come from gas-fired combustion technologies, which will continue to put upward pressure on gas prices. All jurisdictions in the region are pursuing additional sources of renewable generation (hydroelectric, wind and biomass). Wind technologies will likely be the most wide spread renewable for the near term. These facilities, however, produce intermittent generation that does not contribute significantly to the base load or capacity needs of the region in the same manner that the hydro facilities do.

Because overall demand is rising and environmental concerns are expected to force the closure of some coal fired plants, Lake Ontario regulation favorable to hydropower production will insure the long term supply of competitively priced, renewable, clean energy for the foreseeable future be more important, not less in the future.

Demand and Price

High water conditions in the past have generally increased the value of energy produced at these facilities, while lower water levels have the opposite effect.

Synapse (**Electricity Price Forecasts for St. Lawrence Hydroelectric Generation**) developed estimated prices for the electricity generated by the Moses/Saunders and Beauharnois/Cedars hydroelectric stations on the St. Lawrence to help inform decisions about the regulation and operation of that shared water body.

> "The primary factors affecting future long-term electricity prices are:
> - Fuel Prices;
> - Technology;

- Environmental Factors; and
- Electricity Demand.

There is considerable uncertainty about future fuel prices. The marginal cost of electricity in the US Northeast and Eastern Canada is strongly influenced by the cost of natural gas. In the last several years, there has been a large rise in the price of natural gas as demand has increased for new, clean electrical generation. The consensus view is that natural gas prices will decline from their current highs, but there is no consensus about how much they will decline or for how long. The futures market for natural gas goes out for six years and suggests a 30% decline in prices by 2010, but trading in the futures market very thin in the later periods and based on past history it is not always a reliable predictor of actual prices. Since natural gas demand in North America outpacing production, imported LNG is likely to establish the market price in the future. How rapidly these new supplies can be brought to market is uncertain."

"In terms of impacts associated with shifts in hydro generation, the most likely fuel to be displaced when electricity prices are high is natural gas which has a low carbon emission factor. When coal is the marginal fuel with higher carbon rates, the electricity prices are generally lower. To the extent that externalities are fully reflected in emission taxes, then the best policy for hydro plants is to generate more when prices are high and less when they are low."

Much effort has been put forth to determine the long term pricing of megawatts and the future look of the electric industry. This is valuable to demonstrate the value of hydropower and to give an indication of the cost of replacing hydropower with more expensive substitutes. It does not however, give a true picture of the benefits or losses to hydropower. This is because our mission as a publicly owned entity differs from that of a stockholder owned corporation whose mission is to maximize profits. Our mission is to provide low cost, reliable power, and the St. Lawrence hydroelectric plants contribute to this mission by generating low cost power.

As stated earlier, the cost of the last megawatt of power that is dispatched to serve a load in Ontario and New York becomes the cost of every megawatt in a particular zone for that hour. Inexpensive hydropower reduces the cost the entire load. Any hydropower generation that is removed from the baseload would be offset by higher cost generation that would drive up the cost of the entire load.

Peaking:

Megawatts produced from hydroelectric facilities cannot be stored. The value of that generation is directly tied to the demand for them. In the de-regulated electricity environment, the least cost energy is supplied first (hydro) and more costly megawatts are subsequently added to meet the demand; namely nuclear and fossil fuel. The value of energy in peak can be significantly higher than that of energy off-peak. Energy demand varies on a daily and seasonal basis. The night time hours are considered low demand

hours; high demand hours are generally from seven a.m. to ten p.m. High demand seasons are typically summer and winter, while lower demand occurs in the spring and fall.

The power entities at Moses-Saunders conduct peaking and ponding operations to better match the demand for electricity with the production of electricity. In this way clean, inexpensive hydropower can be used to offset other energy sources. Peaking is the variation of the hourly flow about the daily mean flow so that the total daily flow is equal to that which would have occurred had the peaking not taken place.

Peaking is conducted when the maximum hourly outflows are 7,930 m^3/s (280,000 cfs) or less. The maximum allowed peaking range is plus or minus 850 m^3/s (30,000 cfs) around the daily average flow.

Synapse looked at the incremental value of peak period generation. The period evaluated was short term, and consistent with the emergence of the competitive markets in New York and Ontario. They found an average ratio of peak to non-peak energy value of 1.17 for New York, and 1.26 for Ontario; compared to Moses, the Saunders values are higher and there is a much greater seasonal variation in the ratio.

Hydro-Québec makes very few peaking adjustments at Beauharnois-Les Cedres.

6.0 Expected Consequences of Changes:

Because the demand and price for energy is expected to be strong over the next few decades, the importance and value of St. Lawrence hydropower is almost certain to increase. In that light, the value of energy estimated in the shared vision model may well underestimate the future value and almost certainly will not overstate its future worth.

7.0 Adaptive Behaviors

Energy demand is increasing, and hydropower will remain an important component of the energy supply in New York, Ontario, and Quebec.

The Hydropower infrastructure on the St. Lawrence is a critical component of the International seaway and power project, and represents a significant investment. Hydro generation will continue to utilize available flows to generate in the most efficient manner possible. Any reduction of generation from these hydro facilities will likely be replaced by a number of sources (Combined cycle gas, coal, renewables, etc), and be provided either from the competitive market, or sources chosen by the respective province or state.

If lower outflows are predicted for an extended period of time, the power entities would take the opportunity to perform maintenance and long term refurbishment to the generating equipment.

8.0 Risk Assessment:

There is some risk that the value of energy estimated in the shared vision model will underestimate the value of future production from these plants. Substantial changes to the pattern of water supply experienced in the twentieth century could reduce the dependable capacity of these plants, and capacity benefits are not directly addressed in the shared vision model.

9.0 Sources

The Hydroelectric Power TWG has relied on, and previously provided the following documents:

- The Hydroelectric Power TWG response to PFEG economic questionnaire
- Executive Summary, "**Effects of Peaking and Ponding within the St. Lawrence Power Project Study Area"** (Study prepared for the International St. Lawrence River Board of Control ISLRBC)
- Executive Summary, "**Effects of Project Operations on Aquatic and Terrestrial Habitats and Biota in Lake St. Lawrence"** (NYPA relicensing study)
- Executive Summary, **"Shoreline Erosion and Sedimentation Assessment Study"** (NYPA Relicensing Study)
- Executive Summary, "**Water Level Variations in the St. Lawrence River from Moses-Saunders Power Dam to Summerstown, Ontario**." (NYPA relicensing study)
- Executive Summary, "**Effects of Project Operations on Aquatic and Terrestrial Habitats and Biota Downstream of the St. Lawrence-FDR Power Project**." (NYPA relicensing study)
- Executive Summary, "**Shoreline Erosion and Sedimentation Assessment Study Downstream of the Moses-Saunders Power Dam**." (NYPA relicensing study)
- Executive Summary, "**Effect of Operation of the International St. Lawrence Power Project on Shoreline Erosion below Moses-Saunders Power Dam**." (NYPA relicensing)
- "**Estimating Hydropower's Contribution to the Control of Greenhouse Gas Emissions**" M. J. Sale and S. W. Hadley, Oak Ridge National Laboratory.
- "**St. Lawrence Peaking and Ponding**." March 1, 2002 presentation to the International St. Lawrence River Board of Control.
- Executive Summary, "**Assessment of Potential Effects of Peaking/Ponding Operations at the St. Lawrence Power Project on Downstream Muskrat Populations."** March 1983 joint NYPA and Ontario Hydro report.
- Executive Summary, "**Assessment of Shoreline Erosion and Marshland Recession Downstream of the St. Lawrence Power Project**." March 1983 joint NYPA and Ontario Hydro report.

Electricity Price Forecasts for St. Lawrence Hydroelectric Generation (Final Full Report) David White, Bruce Biewald , Synapse Energy Economics, 22 Pearl Street, Cambridge, MA 02139

Please refer to the following websites for further information:
New York Power Authority: www.nypa.gov
Ontario Power Generation: www.opg.com
Hydro-Quebec www.hydroquebec.com
New York Independent System Operator: www.nyiso.com
Ont. Ind. Electricity System Operator (IESO) : www. ieso.ca/imoweb/infoCentre/ic_index.asp
Regional Greenhouse Gas Initiative : www.rggi.org/
NYPA FERC License : http://ferris.ferc.gov/idmws/search/results.asp (doc 20031023-3050)
NYPA FERC FEIS : http://ferris.ferc.gov/idmws/search/results.asp (doc 20030923-0054)

10. Review Process

The Hydropower Contextural Narrative was jointly authored and reviewed by the following Hydropower Technical Working Group participants:

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The Hydropower TWG supports the submission of this document.

External review was afforded to Ian Crawford (Study Board) and Paul King-Fisher (PFEG)

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