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May 30, 2012

Mr. Gil C. Quiniones
Co-Chair, Energy Highway Task Force
President and Chief Executive Officer
New York Power Authority
123 Main Street, 16th Floor
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Dear Mr. Quiniones:

Siemens Industry Inc., Siemens Power Technologies International (Siemens PTI) is pleased to submit the enclosed response to the New York Energy Highway Task Force's Request for Information.

Siemens Power Technologies International (Siemens PTI) is a world leader in power systems analysis. Siemens PTI provides advanced technical consulting services, world-standard analytical software programs, and professional education in power systems engineering. Founded in 1969, Siemens PTI evolved into a world-class resource in the electric power industry. Our services and expertise are internationally acknowledged. We offer solutions to power-related problems with our unique combination of global experience, analytical skill, industry leading software tools, and network of industry relationships established over decades of high-quality consulting services. We offer engineering services that can supplement your existing staff and help with unique projects requiring specialized expertise. Siemens PTI has a legacy of world renowned engineering experience and innovative software and technology to assist you with today's complex issues.

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or the undersigned.

Sincerely,

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A Modernized Planning Approach for the Future of New York State's Energy Highway

30 May 2012

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Executive Summary

With the advent of deregulation of the electric utility industry and the introduction of advanced technologies and renewable energy resources, the paradigm for planning the electric power system must also mature to an approach that establishes more localized, near-independent regional energy highways (or mini-grids). The State should consider adopting this modernized approach to planning the future of New York's power grid.

Through an updated approach to system planning, the development of new localized near-independent regional mini-grids would be established within New York which would meet all of the objectives of the New York State Energy Highway Initiative (NYEHI). This modernized approach would also minimize the funding requirements of the overall NYEHI and the implementation of infrastructure projects could be prioritized and phased in based upon the State's near- and long-term objectives.

If this vision were adopted, the next steps required for implementation would include the following in sequence:

1. Perform power system studies to determine the optimum delineation of localized near-independent mini-grids within the State.
2. Perform detailed technical and/or economical analyses on each defined localized mini-grid to determine the infrastructure recommendations across the spectrum of generation, transmission, substation, imports/exports, DSM/EE programs, etc.
3. Initiate a solicitation for projects, programs, and advanced technologies that is in line with the recommendations from the above studies to maximize the benefits of localized mini-grid planning.

A Modernized Planning Approach for the Future of New York State's Energy Highway

A Submission by Siemens Industry, Inc., Siemens PTI to New York Energy Highway Task Force's Request for Information

Background

Governor Andrew M. Cuomo, in his 2012 State of the State address, put forward a comprehensive public-private initiative to upgrade and modernize New York State's electric power system. The objectives of the New York State Energy Highway Initiative (NYEHI), in summary, are to:

- Reduce the transmission constraints between generating resources and load centers
- Ensure the long-term reliability of NY State's electric power system
- Encourage the development of renewable generating resources, consistent with the State's goal of 30% of energy consumption from renewable supplies by Year 2015 (30x15 Renewable Portfolio Standard or RPS)
- Encourage investments in advanced technologies
- Improve efficiency of existing power generation, particularly in densely populated areas
- Maintain or improve overall system reliability
- Adherence to market rules and procedures

The NYEHI Task Force has issued a Request for Information (RFI) to invite ideas from interested parties to enhance the energy system in the State.

Our Submission

This document represents the response of Siemens Industry, Inc., Siemens Power Technologies International (Siemens PTI) to the RFI. It contains ideas put forth by a team of consultants who have extensive experience in conducting electric power system planning studies in the U.S. and many other countries and who are extremely familiar with the development of the power grid in New York State.

The vision presented in our submission is consistent with NYEHI's objectives and takes into consideration the aging electric power infrastructure and the uncertain future of aging power plants. It will take advantage of advanced technologies and smart grid applications to un-bottle generation, particularly potential new renewable generation resources, to meet the State's RPS goals. Over conventional planning for the grid, this proposed vision provides for improvement of the physical security of critical infrastructure, protection of the environment, and consideration of the impact on ratepayers, in terms of energy prices and cross-state allocation. This new approach to planning New York's Energy Highway will reduce the State's exposure to $1B/year congestion costs and an estimated $25B in replacement costs to address the aging transmission assets over the next 30 years[4]. The outcome will be a prioritized phased-in set of programs and projects that will foster in-state jobs, infrastructure investment, and State-wide economic growth while re-structuring New York's Energy Highway for the next 50 years.

Historical Transmission Planning Model

Most of today's electric power system in New York State was built more than 50 years ago, based upon the technologies, energy resources, transmission corridors, and socio-economic conditions of the time. Generating facilities, which were highly dependent on the availability of transportation networks (including rail and maritime) for delivering fuel supplies and the proximity of water resources to facilitate power plant cooling, were typically located at large distances from load centers. This favored the implementation of large fossil-fueled and nuclear generation technologies and necessitated considerable transmission infrastructure over long distances to deliver energy from the remote generation sources to the load centers. Hence, the reliability, operation, and planning of the power system was based around large bulk power technologies and infrastructure with inter-dependency on neighboring power systems. Over the years, the load growth, in terms of its rate of change and location, largely dictated the expansion plans of the transmission system.

An overview of the current New York State bulk power transmission infrastructure is shown in Figure 1 below. The system consists mainly of a backbone of 230, 345 and 765 kV transmission lines linking the hydro resources in western and northern New York, a concentration of fossil and nuclear power plants in the Oswego area, and other hydro and thermal power plants in various locations and delivering the power to population centers in Upstate New York and the major metropolitan area around New York City and Long Island. Much of the electrical load downstate is served by sources from Upstate or the neighboring power grids of PJM and New England, which creates transmission congestion within the State and upward pressure on pricing for its ratepayers[2].

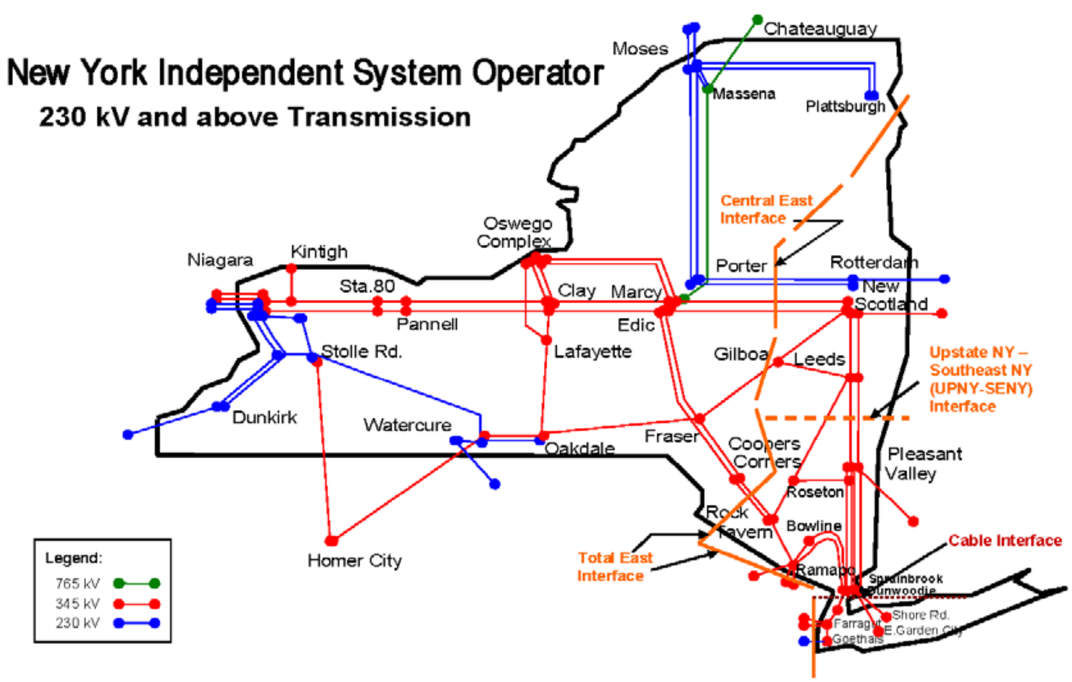

Figure 1: Current New York State Bulk Power Transmission

This transmission grid has served the consumers reliably and adequately for a number of decades. According to several studies conducted by the New York Independent System Operator (NYISO), this system is adequate for the near future[1,2,3]. Some system improvements have been considered, such as upgrading sections of existing 345 kV transmission lines, reconfiguring some substations to improve reliability and installing reactive power supplies at strategic locations to maintain adequate voltage profile. If load growth in the State continues to be moderate in the next 10 to 20 years, the conventional approach of applying incremental upgrades to the power grid will likely continue.

However, the current system planning model and infrastructure do not provide the State with the ability to optimally address current issues such as economic pressures on New York's ratepayers and businesses, expanding environmental regulation, congestion impacts and aging infrastructure, nor does it provide the ability to capture the full benefits available from advanced technologies, renewable resources, and additional inexpensive hydro resources from Quebec.

The existing infrastructure within New York is based around large assets (physically and electrically) which introduce complexities during system disturbances and operational contingencies and lead to increased costs as the system must have significant built-in redundancy to accommodate large scale asset outages. Such large assets also result in large cross-state power transfers that increase system losses and increase physical security concerns from single point critical exposures.

Current estimates suggest in-state congestions cost New Yorkers over $1B/year and replacing the aging transmission facilities will cost in excess of $25B over the next 30 years[4].

Planning Model for the Future

Today's conditions are much different than they were 50 years ago when the conventional planning process was formed. For the next 50 years, with large uncertainties in economic conditions, energy needs and resource availability, it is appropriate to consider different planning approaches to realign the State's energy infrastructure to capture the benefits of more localized grid planning by incorporating advanced technologies, expected available resources, and progressive socio-economic trends.

Technology improvements are enabling the development of smaller, cleaner, more localized, and more efficient generating resources. Hence, the siting of generating facilities will be less dependent on the availability of transportation networks and proximity to water resources. According to industry estimates, the U.S. is expected to have a long-term abundance of natural gas supply, which favors the application of gas-fired generating facilities that require a smaller footprint and have less cooling needs than conventional large-scale coal-fired or nuclear power plants. Also, advanced transmission technologies, such as the use of high voltage direct current (HVDC) and flexible AC transmission systems (FACTS), enhance the ability of the power system to deliver remote, inexpensive, renewable energy to large load centers. Such generation and transmission options will lessen the historical dependency on neighboring power systems and the necessary incremental upgrades and replacements of aging infrastructure.

Today's technologies and socio-economic conditions suggest that the planning of the power system needs modernizing to shift toward a system comprised of more localized, near-independent regional energy highways (or mini-grids) within the State to capture the benefits of advanced technologies and smart grid applications while reducing the exposure to bottled generation. The shift away from large assets and significant cross-state infrastructure will reduce the complexities and redundancy costs necessary to withstand asset disturbances and contingencies while also reducing physical security concerns and impacts on the environment.

Strategic Vision for a Modern Energy Highway

This vision represents a paradigm shift in electric power system planning philosophy toward a more localized, near-independent mini-grid approach within the State that will be based around current technologies and today's socio-economic conditions.

There will be less dependence on remote non-renewable generation resources and conventional power imports. There will be a reduction in the power system's exposure to outages of large generating units and bulk power facilities. Meanwhile, aging infrastructure will be retired or in some cases rebuilt to enable local supply sources while significantly reducing the level of investment in new bulk power facilities and in-kind traditional replacements. The result is the elimination of bottled generation and congestion impacts on energy market prices, reduction in capital investment levels required to replace aging bulk power assets, a reduced dependency on energy imports, and decreased physical and environmental exposure from large generation and transmission infrastructure.

The power grids of the future should take full advantage of the benefits from employing advanced and reliable technologies, smart grid applications and renewable generation sources. Improved technologies in transmission and generation will lead to better system reliability through reduced exposure to equipment failures. A power grid that is flexible and adaptable out into the foreseeable future can align with and accommodate further technological advancements, and shifts in socio-economic and development trends. Special attention should be on the application of inexpensive renewable energy, such as land-based and off-shore wind, and potentially higher levels of Canadian hydro electric power import to the downstate load centers, to encourage the diversification of generation supply and increase environmental stewardship.

This Strategic Vision is consistent with existing energy market rules and procedures and complements statewide plans to maximize the implementation of renewables and demand side management (DSM) and energy efficiency (EE) programs designed to control the growth in peak demand. Furthermore, this modernized planning approach addresses all of the objectives of the NYEHI such as providing maximum ratepayer value while fostering in-state job creation, infrastructure investments, and overall economic growth. This approach will also lead to optimizing the level of investment necessary to address New York State's aging energy infrastructure, potentially saving New Yorkers billions of dollars in avoided congestion and capital replacement costs.

Summary of benefits to New Yorkers:

- Reduces costs to New York ratepayers – lower congestion and level of capital investments to replace the aging transmission infrastructure
- Reduces cost of electricity thus attracting business into the State
- Enables implementation of advanced technologies
- Encourages expansion of in-state renewable energy resources and supports NY's RPS goals
- Complements current DSM and EE programs
- Adheres to market rules and procedures
- Maintains or improves reliability
- Fosters more in-state energy supply reducing reliance on energy imports
- Reduces exposure to regional blackouts and restoration complexities
- Decreases security exposure of critical physical assets
- Supports environmental stewardship
- Creates in-state jobs for infrastructure investments
- Reduces cross-state cost allocation issues
- Establishes an Energy Highway in New York that is flexible and adaptable for future technological and socio-economical advancements

Localized Grid Planning Methodology and Next Steps

If the State were to adopt this new modernized planning approach, a number of steps for implementation would need to be taken:

1. Perform power system studies to determine the optimum delineation (quantity and boundaries) of localized near-independent mini-grids within the State. An example of a localized mini-grid planning map with several possible localized mini-grids is shown in Figure 2 below. Each localized mini-grid would be developed over time with its own generation resources and optimized to become as self-

sufficient as possible, while utilizing inter-regional transmission ties for economic and emergency power exchanges, and the transmission of renewable energy.

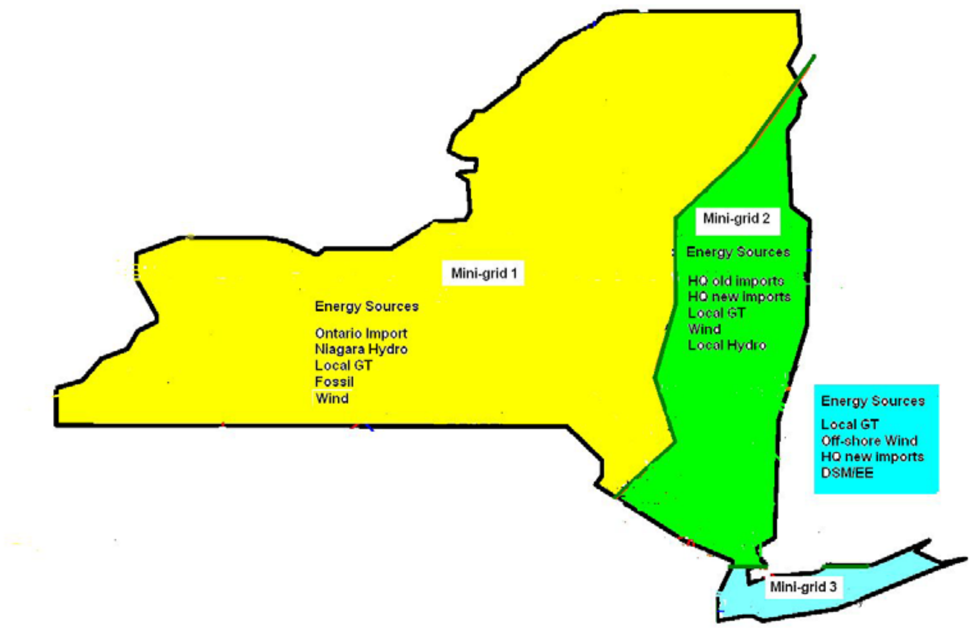

Figure 2: An Example Outcome of New York State's Energy Highway Mini-grid Planning

2. Perform a detailed analysis on each optimized localized mini-grid to determine the infrastructure recommendations across the spectrum of generation, transmission, substation, imports/exports, DSM/EE programs, etc. The analysis would also identify the necessary prioritization and timing of infrastructure needs (such as new assets, replacements, upgrades, retirements of obsolete/unnecessary assets, DSM/EE program concentrations, etc.) over a typical planning horizon.
3. Initiate a solicitation for projects, programs, and advanced technologies that are in line with the recommendations from the above studies to maximize the benefits of localized mini-grid planning.

Summary

The paradigm for planning the electric power system in New York State must mature to a planning approach that establishes more localized, near-independent regional energy highways (or mini-grids). The establishment of mini-grids within the State will meet all of the objectives of the NYEHI, and minimize the funding requirements of the overall NYEHI. This new planning approach will facilitate the creation and expansion of New York's Energy Highway of the future and delivers the objectives outlined in the NYEHI. This approach could potentially reduce the current congestion and estimated infrastructure replacement costs to New Yorkers by billions of dollars. The State should consider adopting this modernized approach to planning the future of New York's Energy Highway.

References

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3. 2010 Comprehensive Reliability Plan, January 2011, and 2010 Reliability Needs Assessment, September 2010, both by New York Independent System Operator.
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