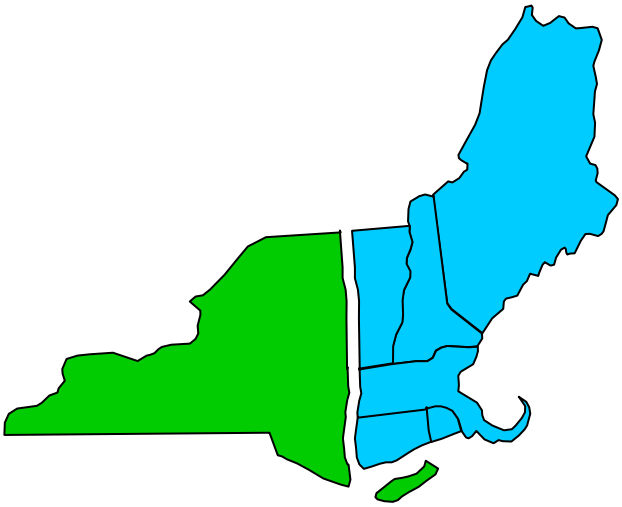
Intra-Hour Transaction Scheduling Between NYISO and ISO-NE



Report of the Pilot Tests Conducted on April 20–21, 2005

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Document:	Pilot#1 report_2005_10-21clean.rtf

Date:	Revision Comments:
8/04/2005	Draft #1 ISO-NE draft
8/15/2005	Draft #2 NYISO additions
9/15/2005	Draft #3 ISO-NE & NYISO synchronization
9/26/2005	Final -- NYISO/ISO-NE additions & clean-up
10/21/05	Final – ISO-NE clean-up

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1. Summary

The Intra-hour Transaction Scheduling (ITS) project is a joint proposal by the New York Independent System Operator (NYISO) and ISO New England (ISO-NE) to improve the exchange of energy between the New York and New England control areas when price differences exist. The development of the effort includes both improvement in the timeliness of participant transactions and exchanges between the ISOs based on price differentials remaining after participant trades have been implemented. This document reports on the pilot tests based on direct exchanges between the ISOs.

The direct exchange of energy between ISOs is analogous to "economy energy" transactions that took place between the New England and New York pools for many years prior to the advent of the wholesale energy markets. "Economy energy" transactions were pool to pool transactions designed to reduce production cost. The two systems have a history of adjusting the flow of energy between them, but the systems have not tested this type of coordination in today's competitive market environment.

The ITS pilot tests were successfully conducted on April 20 and 21, 2005. The results provide the opportunity to study the operational impacts of the ISO on ISO energy exchanges and to collect data to improve the development of the remaining aspects of the ITS program. The pilot program was designed to intrude as little as possible on the normal operation of the markets and the resources committed to other major projects. Since the pilot tests focused on specific objectives, its scope was limited to primarily evaluate operational issues and observe any price changes. It was not designed to allow a full evaluation of price effects, and was of too short a duration to do so.[1]

The pilot tests results were largely as expected. Existing control room software will have to be enhanced to account for and foresee the impact of ITS transactions. Prices at the border between NYISO and ISO-NE appeared, at times, to respond to the change in ITS transactions. Prices at the borders of other control areas were not affected.

No road blocks to the implementation of ITS were discovered, although new tools must be developed.

NYISO and ISO-NE recommend going forward prudently. The next step should be to develop further a proposal made by market participants. This proposal would allow market participant transactions to be scheduled on the basis of the price difference and in a time frame similar to the initial ITS proposal. These transactions would be exhausted prior to any transactions initiated by the ISOs.

[1] The design and objectives of the pilot are more fully described in ISO-NE's November 12, 2004 FERC filing seeking approval of the pilot. See dockets RT-04-2-006, ER04-116-006, and EL01-39-006.

2. Description of Pilot Operation

2.1 Pilot Test Schedule

The initial pilot testing sequence took place on April 20 and 21, 2005. On April 20, the tests were conducted from 10:00 through 14:00, and on April 21, from 10:00 through 13:00.

A four-hour test period was scheduled for both days. However, in keeping with a prior agreement between the ISOs and market participants, the test on April 21 was completed in three hours. The shortened test period was due to the price differential at the border reaching the agreed upon $50 maximum, thereby limiting the number of flow increments (see the test description below). The ISOs provided their respective market participants 14 days advanced notification of the tests. The tests were originally scheduled for April 19 and 20, but were shifted due to an unexpected transmission outage in New England on April 19.

To fulfill its objectives, the pilot program was structured to minimize its impact on system operations. Each day's test sequence was conducted during flat load and supply periods on normal operating days in both ISOs. The pilot test process added and then removed specific short-term exchanges of energy to the normal flow of energy that market participants scheduled on an hourly basis between the NYISO and ISO-NE, as shown in Figure 2-1.

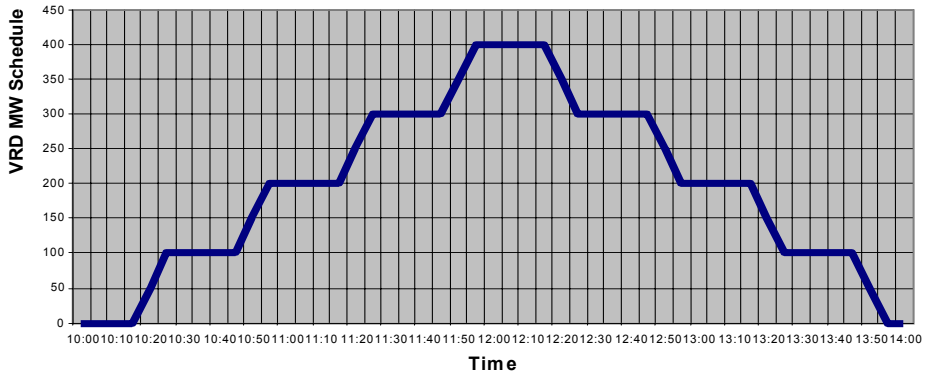

Figure 2-1. ITS pilot test schedule

Settlement of the pilot test transactions between the New York and New England markets was

similar to emergency energy exchange settlements.[2]

2.2 Capacity

Pilot test transactions did not affect capacity requirements or the amount of capacity available systemwide, as specified below:

- The capacity commitment was not changed to support pilot test transactions.
- Fast-start units were included in the capacity assessment up to their 30-minute response time.
- Pilot test transactions were considered in the day-ahead market (DAM) solution.

2.3 Operating Reserve

Pilot test transactions also did not affect operating reserves in either system:

- Pilot test transactions did not affect the ISO-NE requirements for 10-minute spin, 10-minute total, or 30-minute operating reserves.
- The NYISO experienced a brief shortage of 10-minute total reserve during the ITS pilot tests of April 20, when ITS transactions were flowing from NY to NE.
- Pilot test transactions did not reduce actual ISO-NE system operating reserves below required levels.
- Test transaction energy was recallable by both New York and New England prior to a reserve shortage. No recall was necessary, however.

[2] These settlements are prescribed by the "Emergency Energy Transactions Schedule" in the *Coordination Agreement between ISO New England Inc. and New York Independent System Operator.*

3. System Dispatch to Meet VRD Objectives

The dispatch process for both ISOs did not changed to support pilot test transactions. Each ISO adapted its current process for emergency energy transactions to accommodate the transactions of the pilot tests.

3.1 Emergency Operation Contingency Guidelines

No abnormal or emergency conditions occurred during the tests. However, the following guidelines would have applied in such situations:

- Pilot test transactions would have been curtailed if they had caused or contributed to either a system-wide or area-specific capacity deficiency.
- Shared activation of reserves would not have been an adequate reason for curtailing pilot test transactions.
- First-contingency coverage would have been provided without the curtailment of pilot test transactions.
- Either of the ISOs could have curtailed pilot test transactions for reliability reasons at any time during the pilot test period.

3.2 Curtailment of Pilot Transactions due to Proxy-Bus Price Separation

During testing on April 21, the price separation between the proxy prices exceeded the limit noted below. As a result, further increments of ITS energy were curtailed, and ITS transactions were decremented. This process shortened the test period by one hour.

The following guidelines were followed to curtail the pilot transactions:

- Test transactions during the pilot were curtailed when the New England/New York proxy-bus price separation exceeded fifty dollars and further pilot test transactions would have exacerbated the separation.
- New England Markets Development personnel determined when proxy-bus price separation was sufficient to require further pilot test transaction curtailments.
- New England Markets Development personnel recommended to the New England control room shift supervisor the quantity of energy to curtail to correct the price separation.
- Subject to reliability constraints, New England and New York control rooms agreed to the pilot test transaction curtailments, which they ramped out at the next scheduled ramp interval.

3.3 NERC Tagging of Pilot Test Transactions

ISO-NE created open purchase and sale pilot test transactions. Each pilot transaction was treated as follows for North American Electric Reliability Council (NERC) tagging purposes:

- ISO-NE assigned a unique NERC tag and number to each transaction.
- For each ramp interval, hourly energy amounts for each transaction were based on the test schedule and were determined prior to control room checkout.

The ISO-NE and NYISO control rooms used the NERC tag number for checkout between the control areas, akin to the pool-to-pool emergency energy transaction checkout.

4. Operational Observations

Many operational issues associated with ITS and requisite tools to manage them were foreseen and are discussed in the VRD process description. The following section discusses ISO operator observations and concerns following the initial pilot test. This process is ongoing, and operations requirements will continue to be revealed. Solutions will be incorporated as an acceptable and effective ITS process develops.

4.1 Automation and New Operating Procedures

The ITS design presumed additional software will be needed for implementation, and the first pilot confirmed this presumption. The current process for conducting hourly transactions requires considerable staff analysis and communication with outside parties. For example, significant changes in New England's hourly transactions are subject to several levels of security analysis. The operator then follows the analysis with phone calls to both local control centers within New England and system operators outside New England.

The new software will need to provide two functions. First, it will need to better integrate security analysis to eliminate many of the current manual steps. Second, the software will need to evaluate the economics of inter-area transactions.

This second requirement is for an advanced "look-ahead" function. It would permit operators forecast prices and quantities accurately in both their own and the neighboring control area. NYISO's new real-time commitment software is an example of the type of functionality needed in both control areas. In addition, the software's forecast must incorporate basic supply-stack information from the neighboring party.

The new software will call for new operating procedures. For example, normal practice today requires fresh manual security analysis when the interchange schedule changes. Since ITS requires more frequent schedule changes, it would be useful for operators to have a procedure that identifies schedule changes that can rely on automated security analysis.

4.2 Assigning of NERC Tags.

For the purposes of the pilot, ISO-NE created NERC tags for each change in the transaction amount, as described above. This procedure worked well for the pilot, although the final version will require a similar simplified tag system for ITS transactions. For example, a single standing-transaction tag whose MWh value is changed to the ITS scheduled flow after-the-fact may be required. The process to enter the correct MWh value would also need to be automated.

4.3 Circumstances Requiring Suspension of ITS

A variety of possible circumstances may require the suspension or modification of an ITS schedule. For example, to maintain voltage, a desired increase in exports may require such actions as closing capacitor banks, for which transmission owners would need adequate notification. ITS schedules violating the notification requirements would have to be temporarily suspended.

The ITS software might enhance the notification procedures in that it would improve the forecasting of security issues. In general, ITS software would provide operators with improved analysis and monitoring tools and allow them to suspend or alter the schedules as necessary.

5. Evaluation of Proxy Bus Prices

Even though the purpose of the pilot test was limited to exercising the mechanics of frequent schedule changes and specifically excluded any attempt to control or adjust prices, examining the price impacts observed during the tests is instructive. Transaction flows and energy prices from the ITS pilot tests are discussed below using the following definitions:

- The proxy bus price labeled "NY" is the NY price for NE (Sandy Pond bus).
- The proxy bus price labeled "NE" is the NE price for NY (Roseton bus).
- "ITS MW" refers to the MW of scheduled transaction above the normal transaction schedule.

The following analysis overlays prices at the border buses and the ITS scheduled flow. Although one case shows a clear pattern of a price following the scheduled flow, data gathered from only a few hours of operation is not significant enough to draw any conclusions about price effects.

The quantities of ITS pilot transactions and the real-time prices calculated during the pilot testing period are shown in *Figure 5-1*and *Figure 5-2*for the April 20 and 21 tests, respectively.

Figure 5-1 below shows no apparent relationship between price and flow during the tests of April 20.

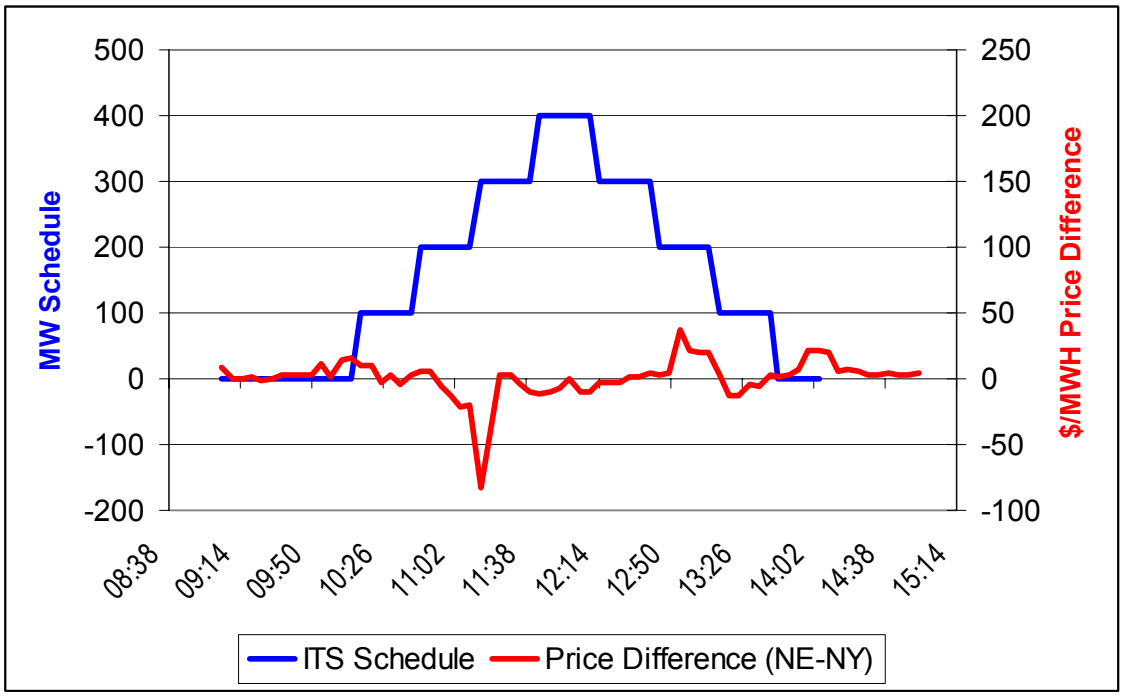

Figure 5-1: April 20, 2005, scheduled transactions and prices

Sensitivity of price to flow was more apparent during the tests of April 21, shown in *Figure 5-2*. The ISO-NE energy price increased during the test as the flow of energy to NYISO increased,

and the ISO-NE energy price decreased as the flow of energy from NYISO decreased. Energy prices in NYISO appeared to be relatively stable.

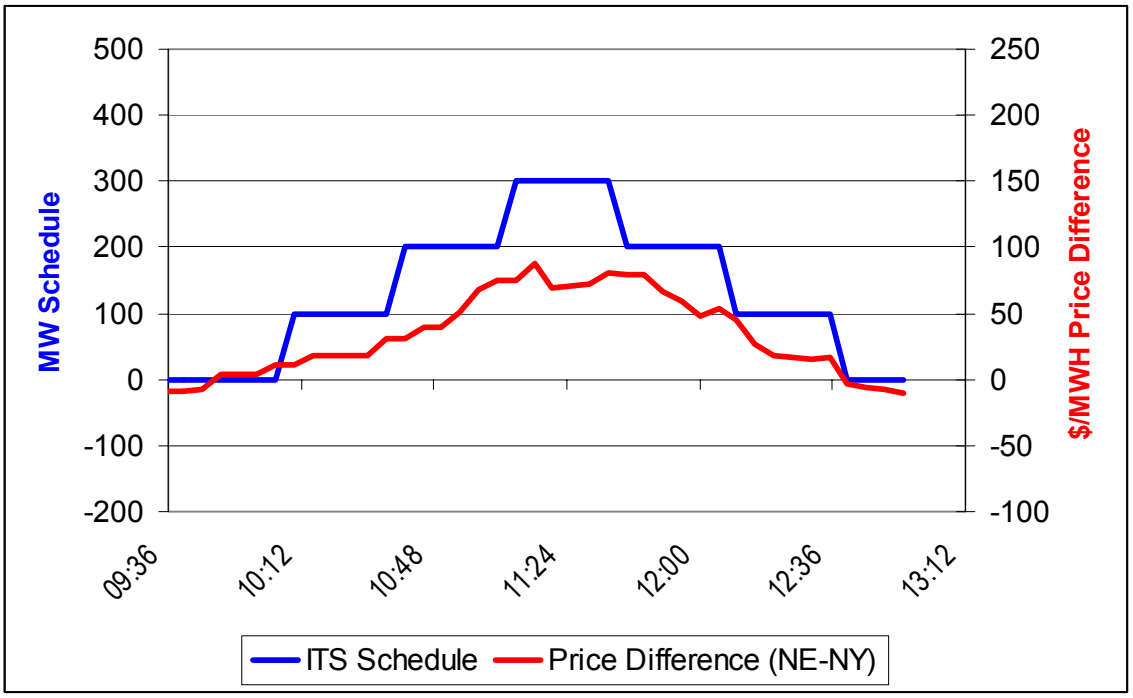

Figure 5-2:April 21, 2005 Scheduled Transactions and Prices

While *Figure 5-2*suggests prices show a basic level of sensitivity to transaction flow, however too little data are available from which to draw conclusions. Extensive additional testing and substantial analysis of the results are needed before any conclusions can be made regarding the relationship between ITS and energy prices.

6. Conclusions and Recommendations

Observations and conclusions of the tests from April 20, and 21, 2005 are as follows:

- **Control room tools and automation are needed.** The tests confirmed that system operators need readily accessible and easy-to-understand information on the state of the ITS process. This information includes both the observed and forecast flow of energy between the two control areas. The testing process also confirmed the need for tools to manage and control the ITS process, as previously recommended in the Virtual Regional Dispatch (VRD) proposal. Such tools would enable operators to: 1) stop and start the automated ITS process; 2) quickly communicate essential information and intentions between control rooms, allowing rapid agreement on necessary actions; and 3) override the ITS process and set the flow manually.
- **Prices moved as expected.** While no attempt was made to control price differences between the two control areas, the changes in flow between the control areas suggest that, under certain circumstances, prices react as expected.
- **Look-ahead tools are needed**: ITS transactions must be incorporated in NYISO's real-time commitment (RTC) process as well as its real-time dispatch (RTD) process. A real-time look-ahead process will be required in ISO-NE.
- **The impact on other control areas could not be detected.** The effects of flow and price changes on PJM, IESO, and HQ proxy buses were too small to assess conclusively.
- **No road blocks were discovered.** No insurmountable operational or other problems were discovered during this limited pilot. Additional management tools would be required, as noted above, but are not likely to interfere with the feasibility of ITS.
- **The ISOs should proceed with prudence.** New York ISO and ISO-NE will jointly recommend to their participants the continued development of plans for implementing ITS. As part of this process, the ISOs intend to develop mechanisms proposed by participants to allow timely private transactions to arbitrage price differences. The draft plan is targeted for completion at the end of 2005. Additional testing of the ITS design should be deferred until the plan is developed and evaluated.

Appendix A: Plots of Test Results

The plots of desired net interchange (DNI), actual interface flow (FLOW), and proxy bus prices (PRICE) collected during the ITS pilot tests conducted on April 20 and April 21, 2005, are shown below. These variables are:

- **DNI:** DNI plots were based on data recorded in NY. The plots show the actual DNI used by the real-time dispatch software and illustrate how schedule changes were accomplished (ramped in) over two five-minute dispatch intervals. Positive numbers indicate flow from NE to NY; negative numbers indicate flow from NY to NE. DNI includes both the ITS scheduled MW and other scheduled flows.
- **FLOW:** The plots of interface flow show the actual interface flow as recorded by NY every six seconds.
- **PRICE:** The proxy bus price labeled "NY" is the NY price for NE (Sandy Pond bus). The proxy bus price labeled "NE" is the NE price for NY (Roseton bus).

Note that the April 21 pilot was terminated prematurely. By prior agreement, the test was to terminate if associated changes in the interface flow caused counter-intuitive price movement and continued testing had increased rather than decreased the price difference between NY and NE. Such a circumstance occurred on April 21, for which the test was terminated at 1:00 PM.

A-1 Desired Net Interchange (DNI)

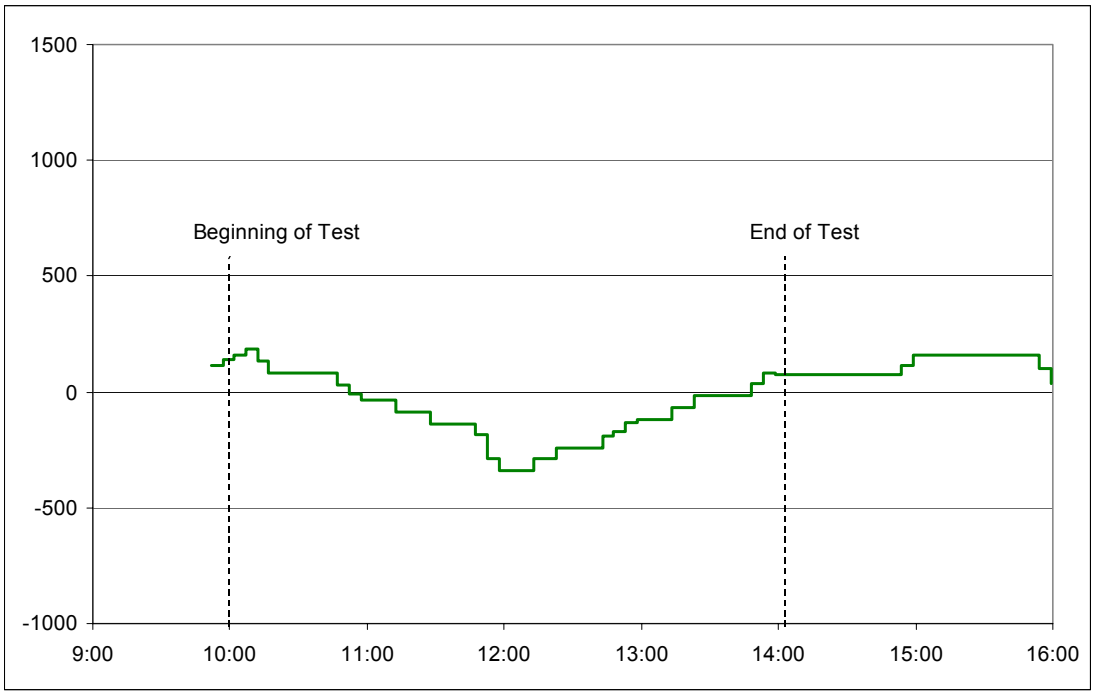

Figure A-1: Desired Net Interchange During Pilot Test of April 20, 2005

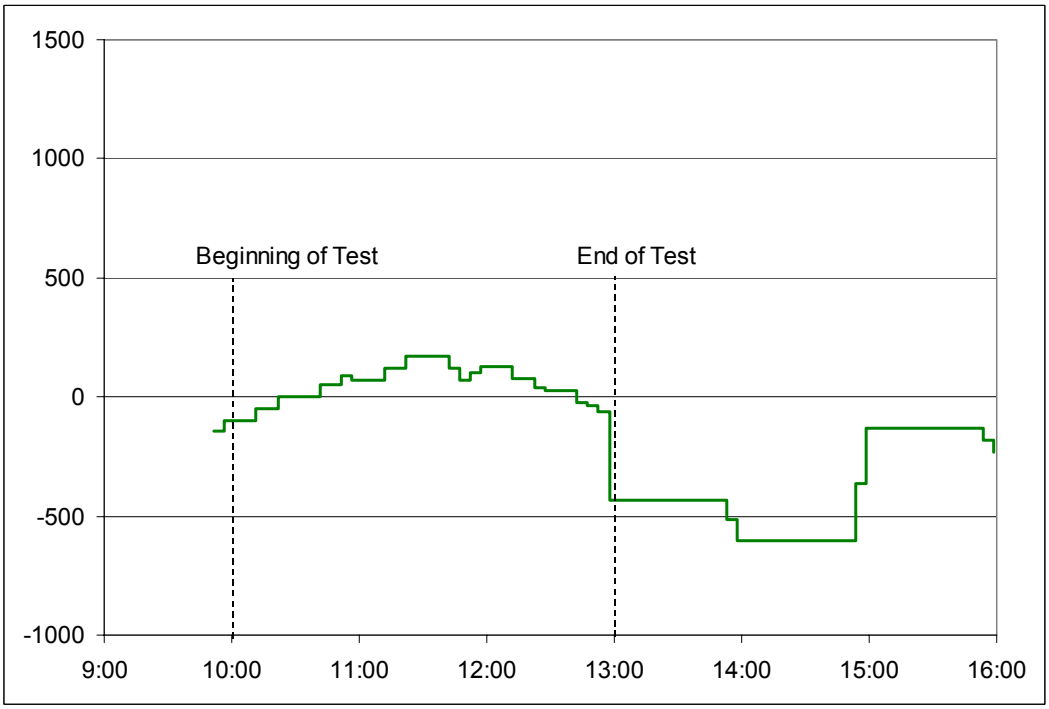

Figure A-2: Desired Net Interchange During Pilot Test of April 21, 2005

A-2 Actual Flow (FLOW)

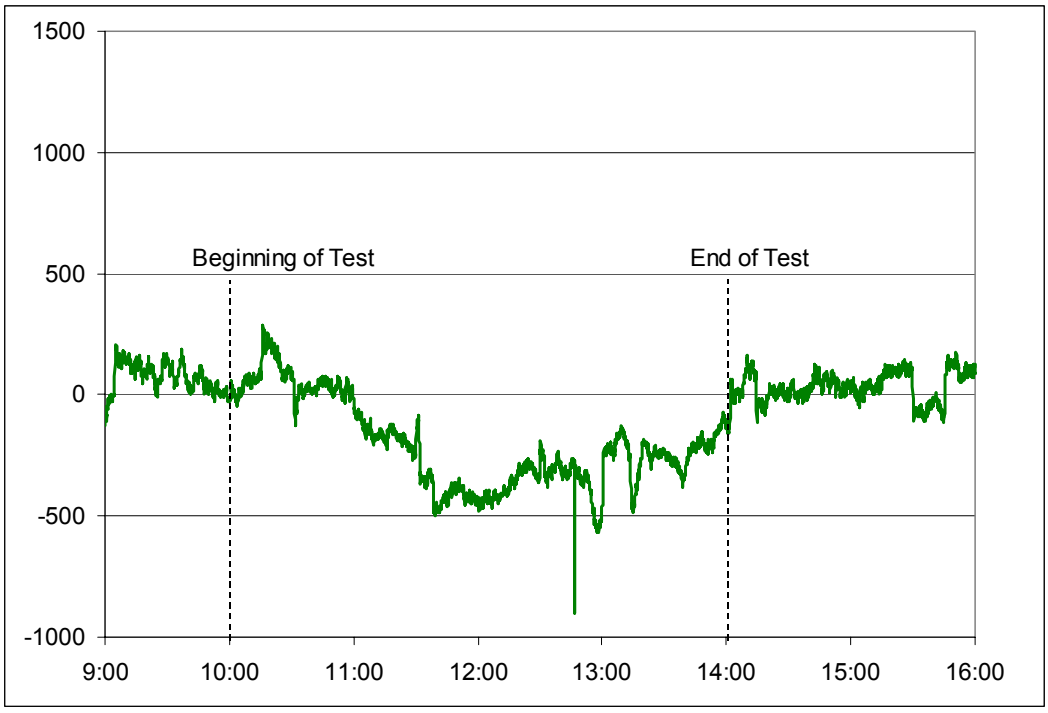

Figure A- 3: Actual Flow Over Interface, April 20, 2005

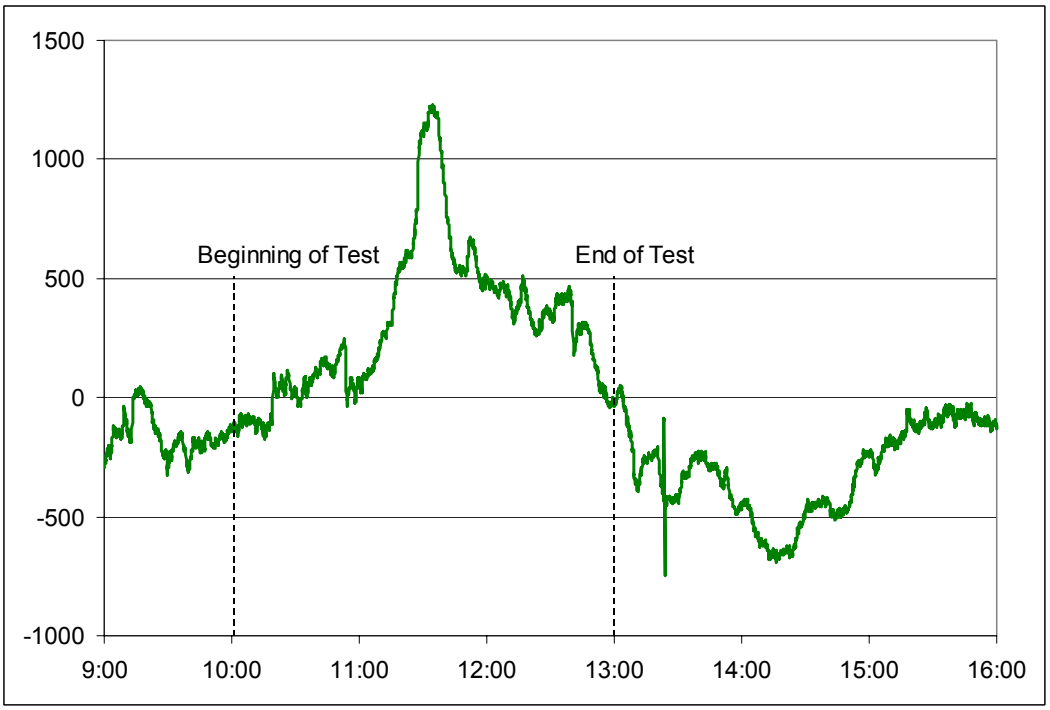

Figure A- 4: Actual Flow Over Interface, April 21, 2005

A-3 Proxy Bus Prices (PRICE)

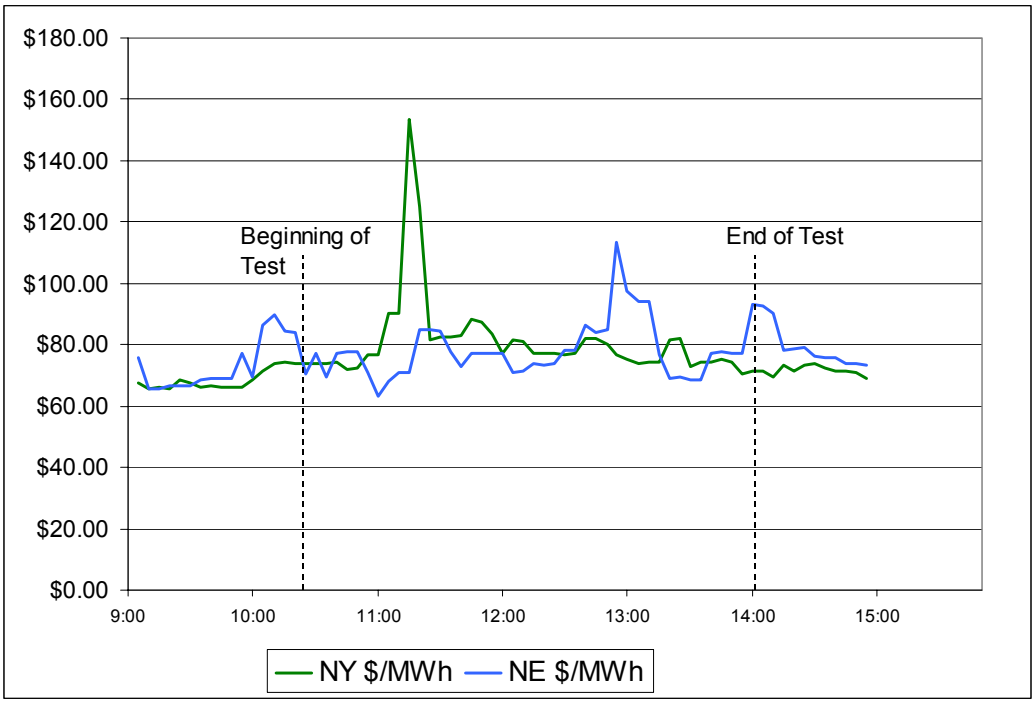

Figure A- 5: Proxy Bus Prices in NY and New England, April 20, 2005