Appendices

MACD Intertie Transactions Failures Working Group

18 November 2005

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APPENDIX A

Terms of Reference
MACD Intertie Transactions Failures Working Group

The purpose of the working group is to provide advice to the Market Assessment and Compliance Division (MACD) on the usefulness of the existing guidelines[1] in reducing intertie transaction failures and to assist in revising the guidelines and relevant market manual.[2] The focus of the working group is the appropriate standards and thresholds for investigation of possible breaches of the market rules and the working group will consider the relative importance of the various causes of transaction failures and parallel work underway to address these problems. The working group will also consider whether there are alternative mechanisms to the existing penalties under the market rules that might better promote fewer inter-jurisdictional transaction failures. The review comes at a time when the Midwest ISO is about to open its market and the New York ISO has recently introduced Standard Market Design (SMD2).

The working group is a forum to raise issues, signal concerns, and consider relevant data, with the goal of providing advice to MACD on its enforcement of participant intertie trading obligations. The output of the group is the knowledge MACD gains to round out its understanding of the issues to be considered in revised guidelines. It is expected that the working group will be wound up by mid-summer.

This approach is proposed as a complementary means to obtain input from market participants to address a specific issue. Its work will be integrated with that of the Intertie Trading Sub-Committee and it is not meant to restrict the ability of other market participants from providing advice on this subject to MACD and the IESO generally.

Process

- The IESO's Director, Market Assessment and Compliance will chair the Working Group
- Membership is by invitation. Each member will name a principal representative and is encouraged to enlist other members of their organization with relevant knowledge to participate as necessary.
- Every effort will be made to circulate an agenda and meeting material in advance of meetings.
- A schedule of meetings and forward work plan will be developed and revised as work progresses.
- MACD will record the highlights of meetings and maintain an Action Item list.
- Conference calls and the use of email will supplement face-to-face meetings whenever possible.

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[1] "Guidelines for determining when failure for 'economic' reasons in the NYISO jurisdiction may breach IMO market rules", effective June 24, 2003 and "Guidelines for determining when failure for 'improper NERC tagging' in the Michigan Control Area (MISO) jurisdiction may breach IMO Market Rules", effective October 30, 2003.

[2] Market Manual 2.15: Intertie Transaction Non-Compliance Financial Penalty.

- No confidential information will be disclosed.

- Material used by the Working Group will be posted on the Intertie Trading Sub-Committee web page. MACD and working group members will provide status reports at Sub-Committee meetings.

- Both members of the working group and members of the Intertie Trading Sub-Committee will be given an opportunity to provide written comments, should they wish.

- The working group membership, terms of reference and any written comments of market participants will be posted on the Sub-Committee web page.

Members

BRASCAN ENERGY MARKETING INC.

CORAL ENERGY CANADA INC.

DTE ENERGY TRADING INC.

HQ ENERGY MARKETING INC.

ONTARIO POWER GENERATION INC.

POWEREX CORP

APPENDIX B

Intertie Failure Effect on Market Clearing Price Study

(Methodology of Market Price Calculation)

Purpose/Overview

The following report is an overview of the methodology used in the calculation of simulated Market Clearing Prices (MCP) of electricity in the Ontario market. The simulations were done in order to provide intuitive information on the effect of intertie transaction failures on the MCP. Five separate simulations were run using the Market Simulation Program (MSP) tool. This resulted in five groups of MCP for every 5-minute interval, over a randomly generated sample set of 70 days between August 1, 2003 and April 30, 2005.

Methodology: Market Clearing Price (MCP) Calculations using the Market Simulation Program (MSP)

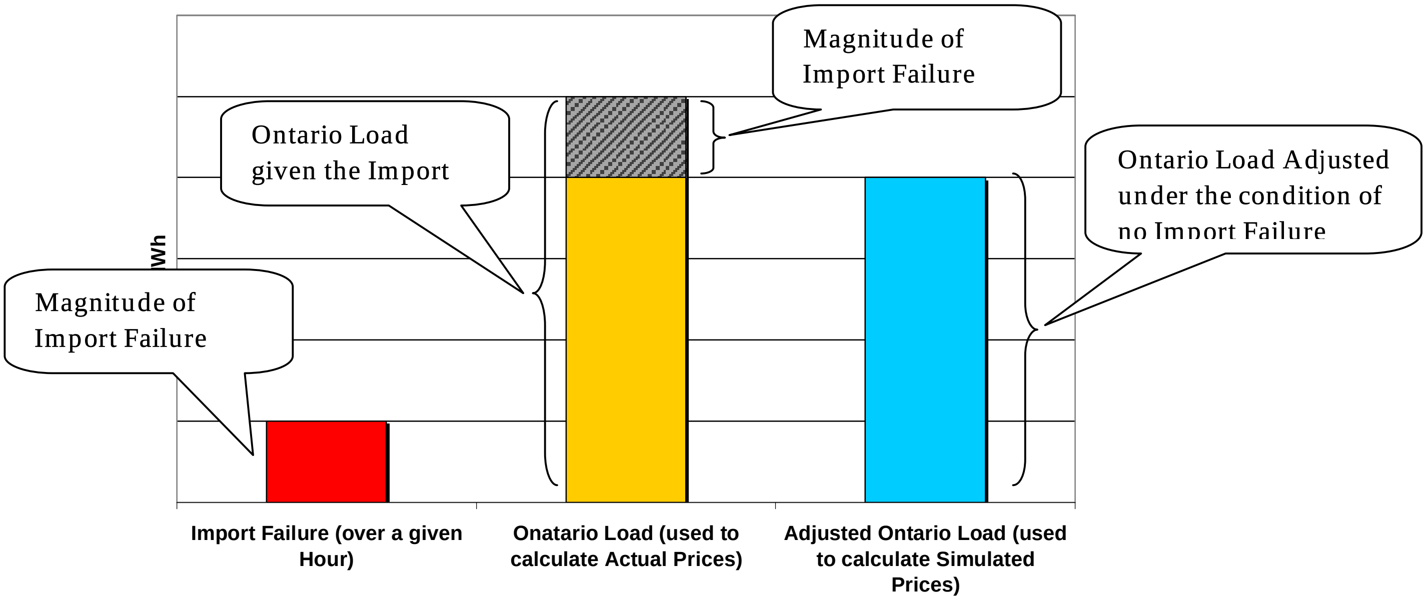
The MSP is a joint optimization tool that uses recorded, real-time market and system data as inputs to calculate the MCP of energy and operating reserve markets in Ontario. For the purpose of this study, the input data set containing ***Ontario Load*** was modified for the simulation process. ***Ontario Load*** is defined as the required amount of domestic generation, after taking into account all real-time intertie transactions (including import and export failures). An import failure increases the real-time demand for domestic generation, while an export failure lowers the real-time demand.

In order to model the effects that failed intertie transactions have on the MCP, it is necessary to simulate prices under the hypothetical condition that failed intertie transactions had not actually failed. This hypothetical condition is achieved by following one of two paths, depending on whether the failed intertie transaction(s) for any given hour resulted in a net-import failure (failed imports > failed exports) or a net-export failure (failed exports > failed imports).

Net-Import Failures:

Net Import Failures effectively remove a given amount of supply from the system, shifting the demand burden onto domestic generation. For hours in which such a failure occurs, ***Ontario Load*** reflects the domestic generation required, having taken into account the failure. In order to model the hypothetical situation in which the net-import failure had actually flowed through in the hour, the magnitude (in MWh) of the failure must be subtracted from the load in each interval of that hour. This reduces the amount of domestic generation required by the system, effectively mimicking a successful import.

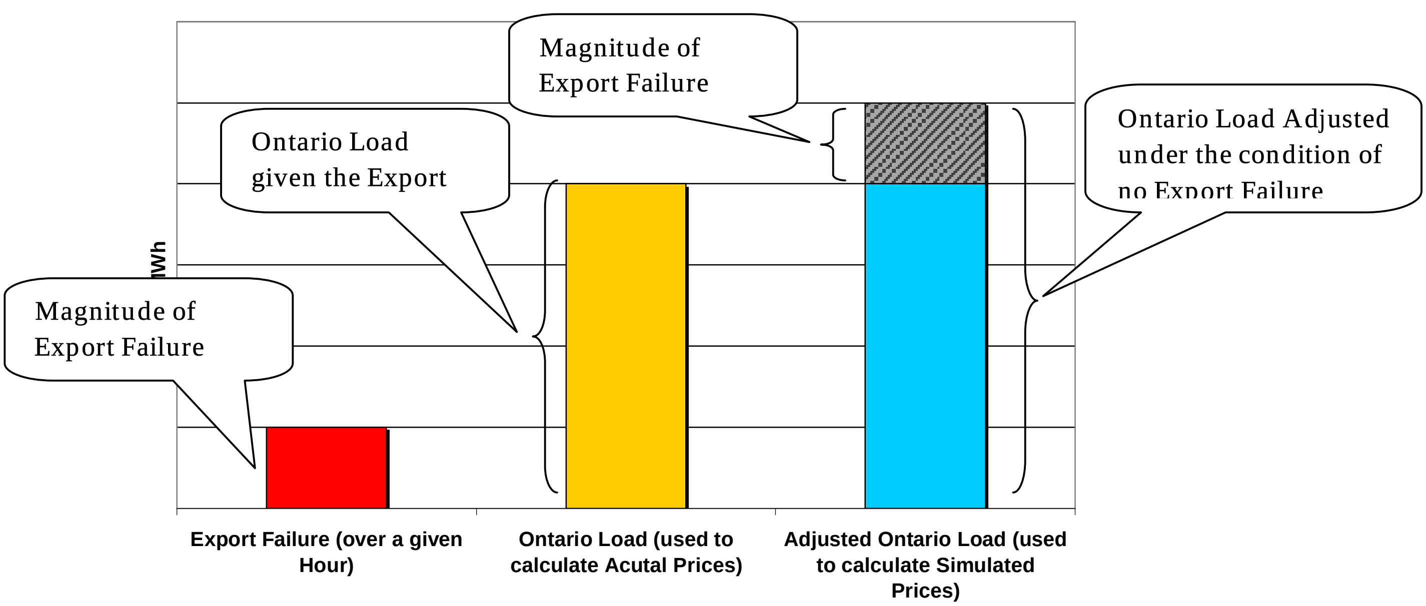
Net Import Failure: Example



Net-Export Failures:

Net-Export Failures result in less domestic generation required over the dispatch hour, because the generation needed to support the given export is no longer required once the failure has occurred. Modelling the scenario in which a net-export failure had actually flowed is done by adding to the domestic load the MWh quantity of the failure. This results in increased domestic generation required in the delivery hour.

Net-Export Failure: Example



Simulation Studies: Five Sets of Simulated MCP

In an attempt to gauge the effects of intertie failures on the MCP, several scenarios were employed to capture the specific characteristics of the different types of intertie transaction failures. A list of the scenarios is as follows:

- Unchanged simulated MCP using MSP
- Simulated MCP with net intertie failures for all reasons
- Simulated MCP with net intertie failures due to economic and tag errors
- Simulated MCP with only import failures due to economic and tag errors
- Simulated MCP with only export failures due to economic and tag errors

Unchanged simulated MCP using MSP

This scenario is a baseline reference calculation of the MCP without any changes made to the system/market parameters. This result set is used in two ways: first, the prices generated from this simulation are compared to the actual market prices recorded in the Ontario market, as a reference to determine the accuracy of the MSP calculation. Second, the prices are used as a reference point for the rest of the simulations to determine the price effect of intertie failures.

Simulated MCP with net intertie failures for all reasons

This scenario models the net effect of intertie transaction failures resulting from all reasons (security, economics, tags, etc.). In any given hour, there exists one of three possibilities:

1. import failure(s) occurred
2. export failure(s) occurred
3. a combination of import/export failures occurred

The simulation employs the methodology described above for ***Net-Import Failures*** and ***Net-Export Failures***. For hours in which only import failures occurred, the magnitude of all failures in the given hour is subtracted from the ***Ontario Load***. Conversely, the magnitude of export failures is added to the ***Ontario Load***. For hours in which there was a combination of import and export failures, the 'net-effect' of the failures in the hour was determined and the ***Ontario Load*** was adjusted accordingly.

Simulated MCP with net intertie failures due to economic and tag errors

In this scenario, the net effect of intertie transaction failures resulting only from economic and tag errors is modelled. Apart from that difference, the process and principles of the simulation are identical to that of the previous scenario.

Simulated MCP with only import failures due to economic and tag errors

This scenario simulates MCP under the hypothetical situation that only import failures due to economic and tag errors had not occurred. Export failures that occurred in those hours were ignored. Therefore, under the hypothetical condition of no import failures having occurred, the total MWh value of all import failures due to economic and tag errors in the hour was subtracted from the load for that hour.

Simulated MCP with only export failures due to economic and tag errors

This scenario simulates MCP under the hypothetical situation that only export failures due to economic and tag errors had not occurred. Import failures that occurred in those hours were ignored. Therefore, under the hypothetical condition of no export failures having occurred, the total MWh value of all export failures due to economic and tag errors in the hour was added to the load in that hour.

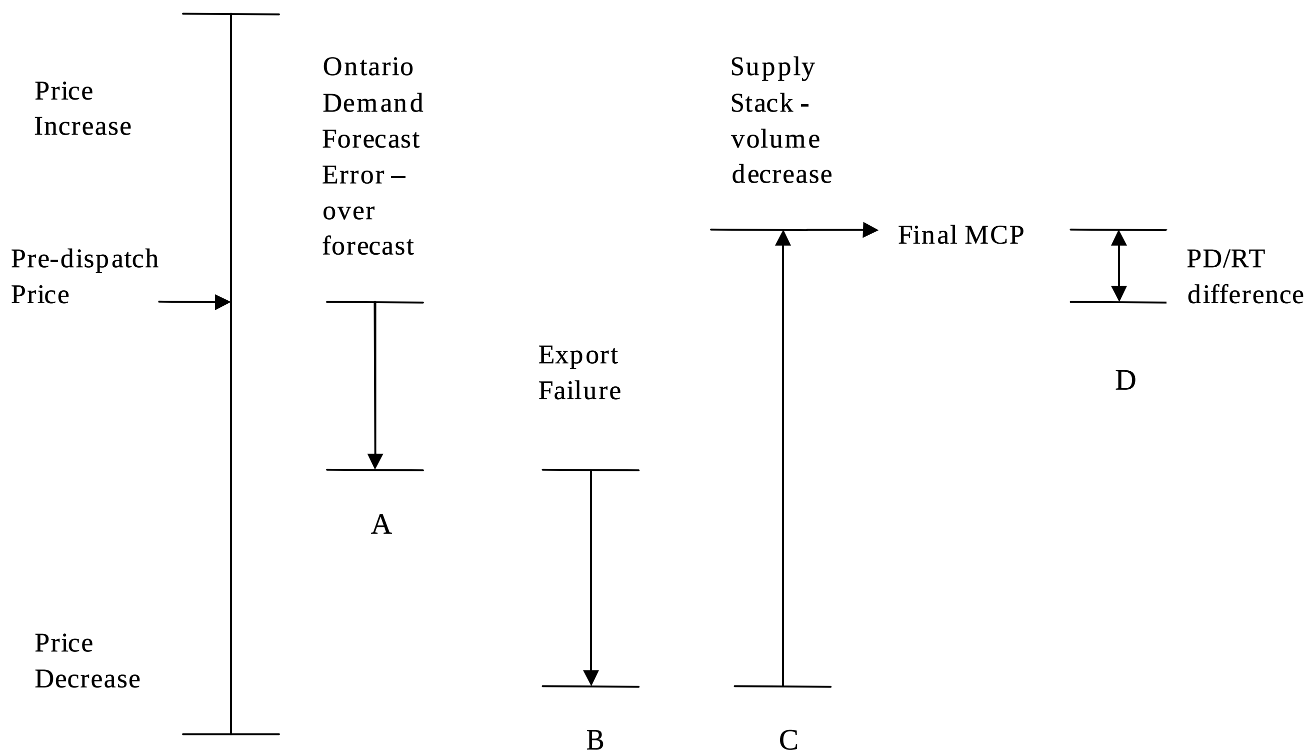
Data Manipulation

When comparing the simulated MCP using the MSP tool with the actual real-time MCP during the 1,210 hours when an intertie transaction failed, the average difference of 9 cents was discovered. This average difference was considered an acceptable error.

A sample of 70 days were randomly selected representing 660 days in the study period. These 70 days had 1210 hours where transaction failures occurred. Hours when the net schedule change was zero (i.e. the sum of import failures in the hour was equal to the sum of export failures), the MCP change was zero because Ontario load need not be adjusted to conduct the simulation. These hours were included in the calculation of the average absolute differences. For hours where the changes in the net schedule were not zero and the simulated MCP was zero, these results were also included in the calculation of the average absolute differences.

All hours of the randomly selected days were examined and of those days there were 1210 hours where transaction failures occurred and 470 hours where no transaction failures occurred. Appendix C (Bar 1 and 2), shows the price differences were approximately $10.0 for all hours in the random sample and for hour where only transaction failures occurred. Both these bars include all contributions to these differences such as supply stack changes and Ontario demand forecast error; they do not isolate the absolute magnitude of any single contribution. The below diagram contrasts what is captured by Bar 1 and 2 as opposed to Bars 3 and 4 in Appendix C.

Contribution to Real-time Price changes Captured by the Simulation



Bar 1 & 2 are the mean of the absolute pre-dispatch to real time price differences of “D”

Bar 3 & 4 are the mean of the absolute changes in real time MCP for influence “B”

Conclusions

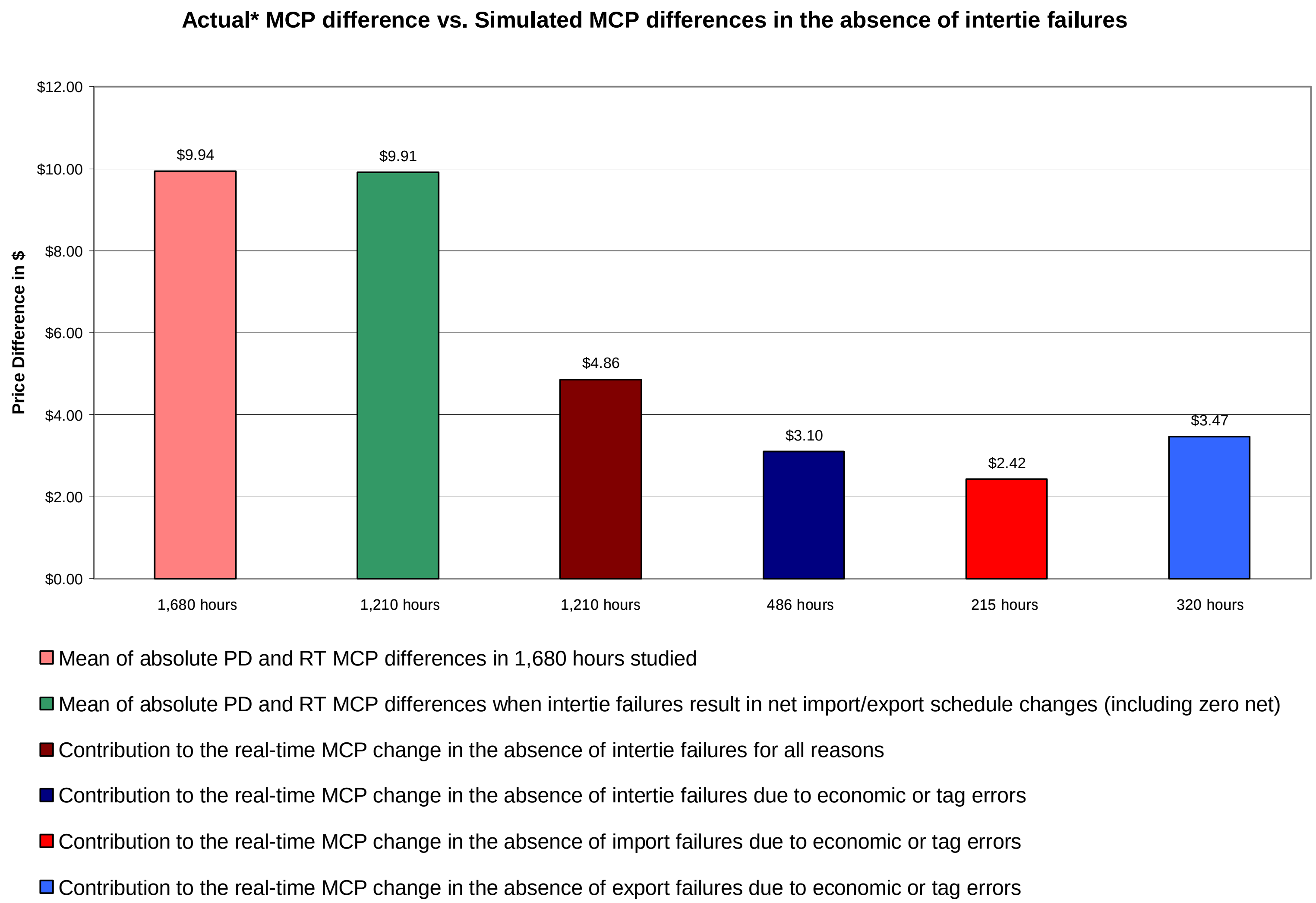
Appendix C- Bar 3 and 4 summarizes the results of the simulations. The study simulates the impact on the real-time market clearing price had transactions failures not occurred. This study does not attempt to comment on the contribution of transaction failures to the pre-dispatch to real time price differences by comparing Bars 1 or 2 with Bars 3 to 6. Of the 1210 hours where transaction failures occurred, scheduling errors (NERC tag and economics) by market participants occurred in 486 hours which resulted on average to a $3.10 (Appendix C- Bar 4) real time price change[3]. $2.42 (Appendix C- Bar 5) was the average contribution of imports only caused by scheduling errors and $3.47 (Appendix C- Bar 6) was the contribution by only export failures. On average price changes in the absence of export failure were $1 more than import

[3] Appendix D illustrates the variability in the data presented in Appendix C that is masked when attempting to describe data sets using averages. The simulated price differences are quite variable. In general, the magnitude of price differences changes with volume of failure and time of the trade (on-peak/off-peak). As the volume of failed transactions increase, so does the magnitude of price difference. Transactions that fail during the on-peak hours tend to cause greater price differences then those that fail during the off-peak.

failures. The magnitude of the pre-dispatch to real time price differences by failed transactions as compared to other contributions has not been quantified in this study. However, movements in the real time price as a result of failed transactions for all reasons have been captured and amounts to $4.86 on average. Of that magnitude 62% ($3.01) is attributable to economic or tagging errors by market participants.

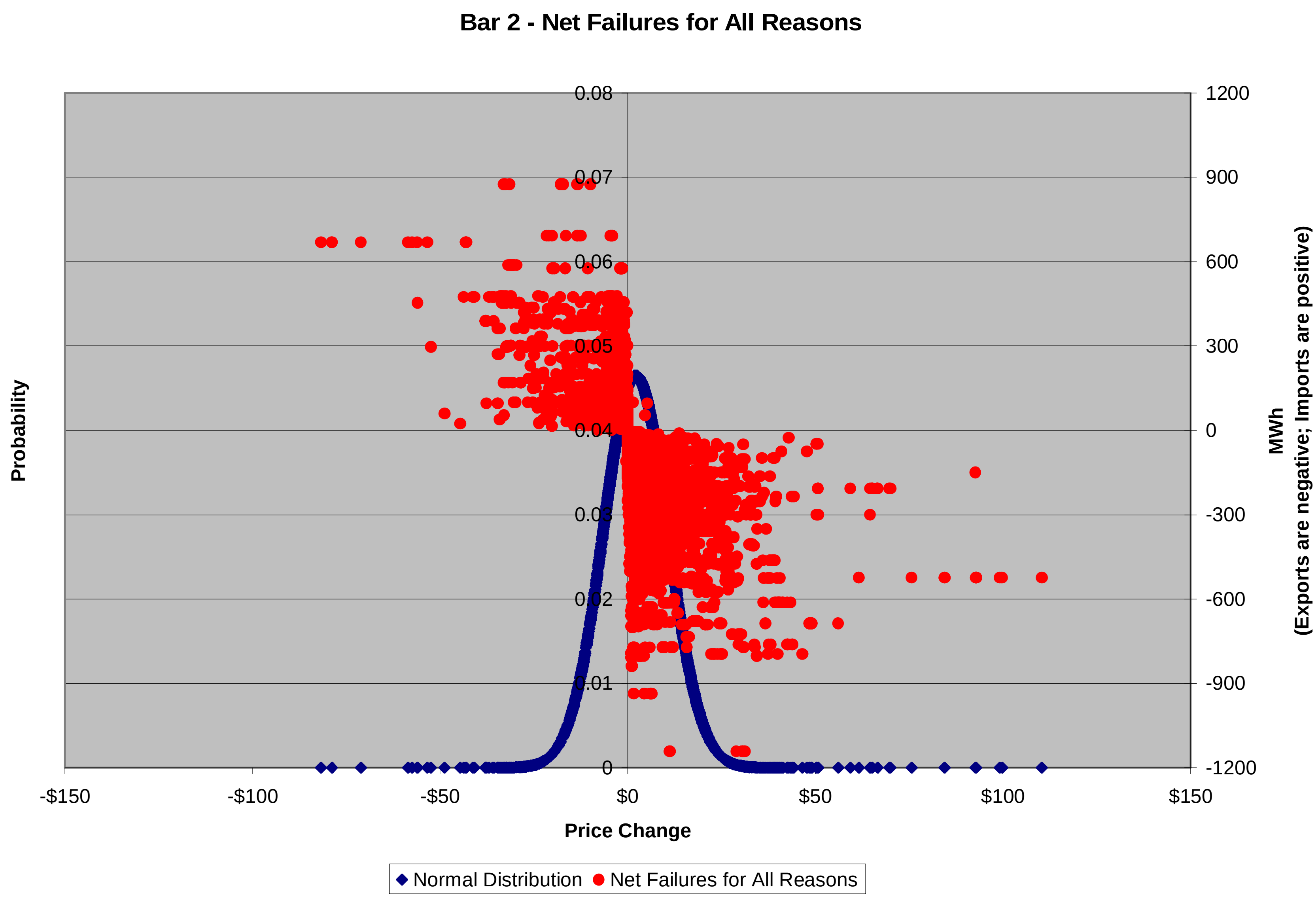
In summary, transaction failures have an impact on the disassociation of the pricing signals in pre-dispatch and real time by an absolute magnitude of $4.86 a substantial portion of which is attributable to market participant actions.

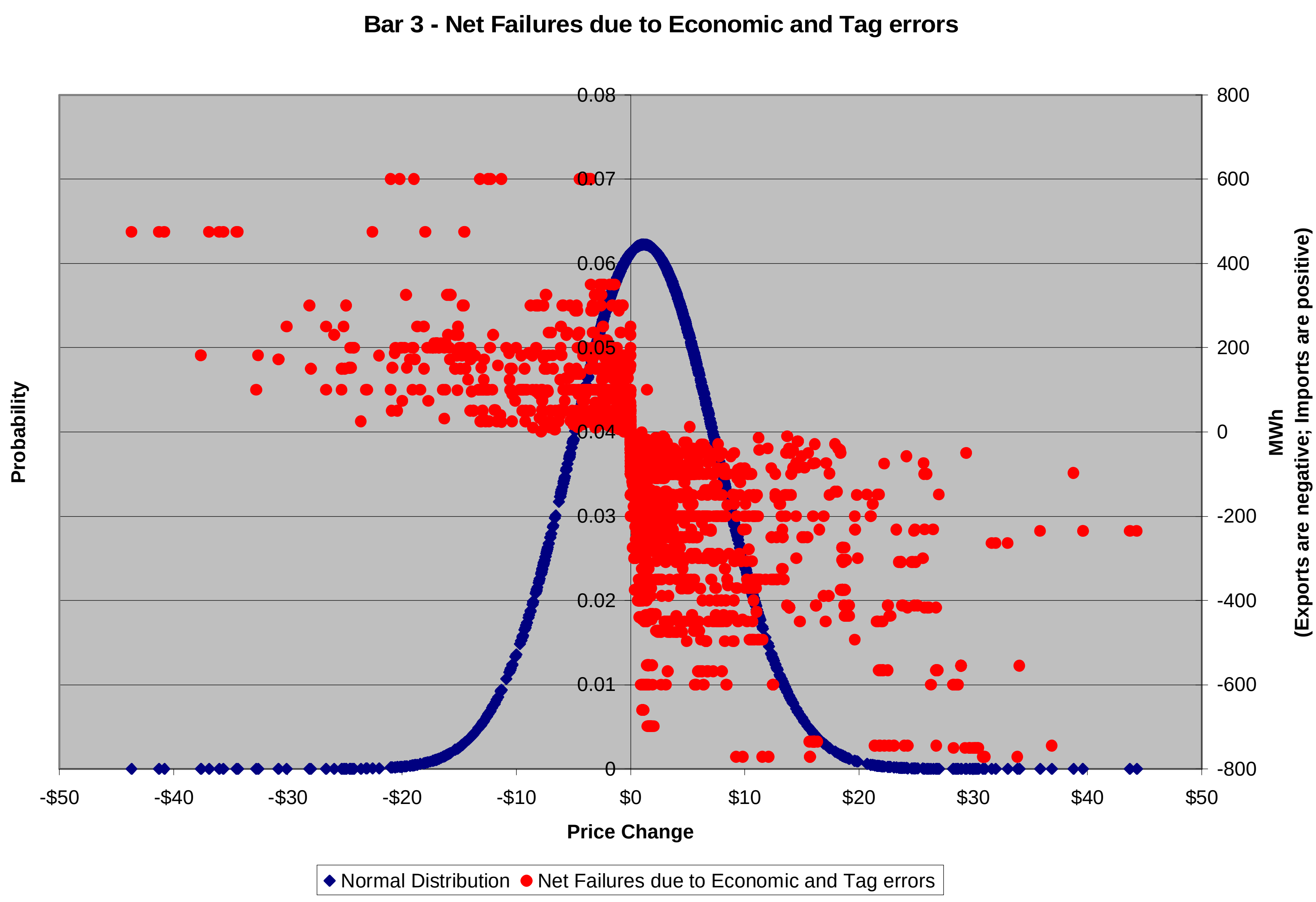
APPENDIX C

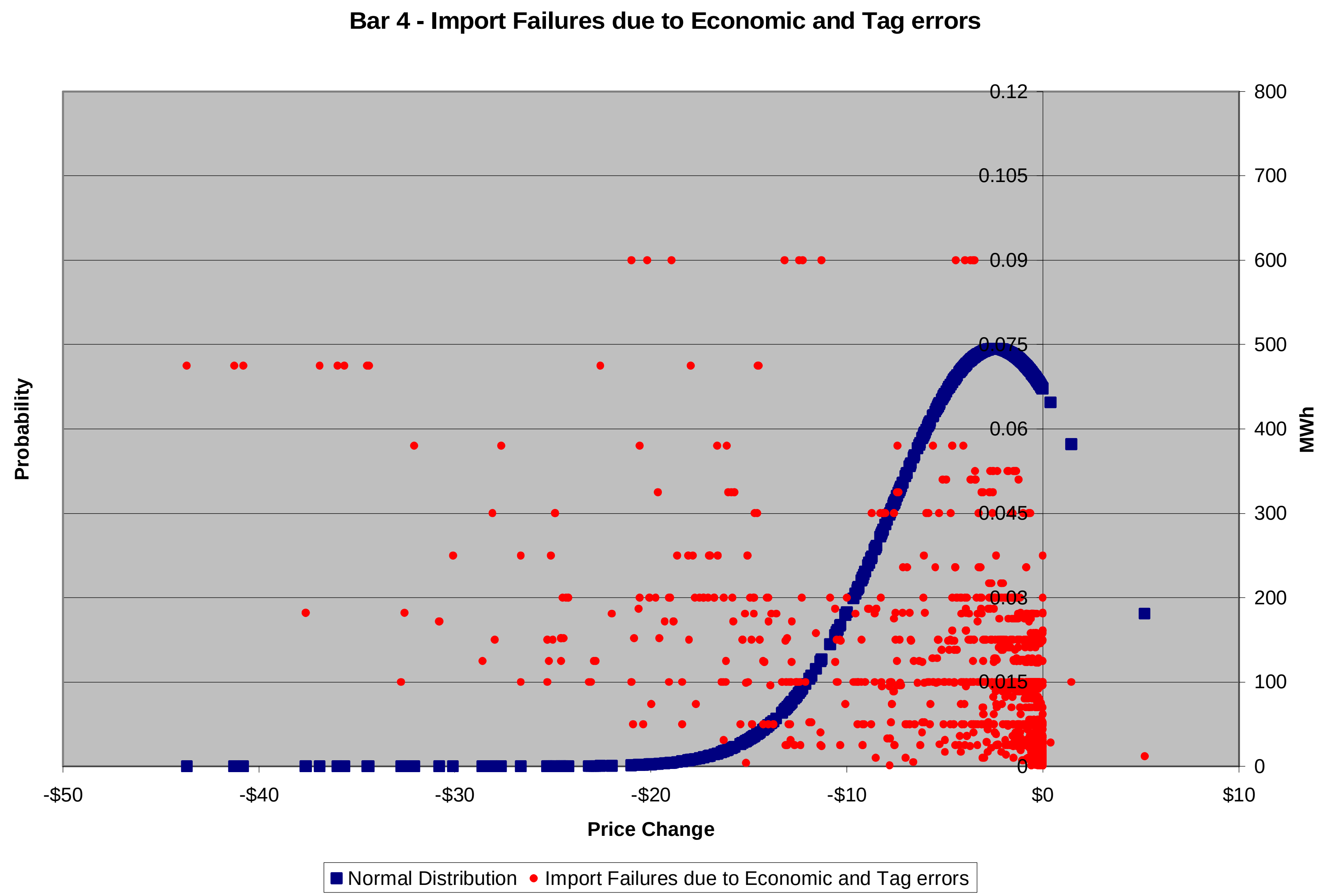


* Difference between actual Pre-dispatch MCP and Real-time MCP from the MSP tool
The study period is from August 1, 2003 to April 30, 2005 (639 days). 70 days were selected at random for simulations.

APPENDIX D: Data for Appendix C – Simulated MCP data

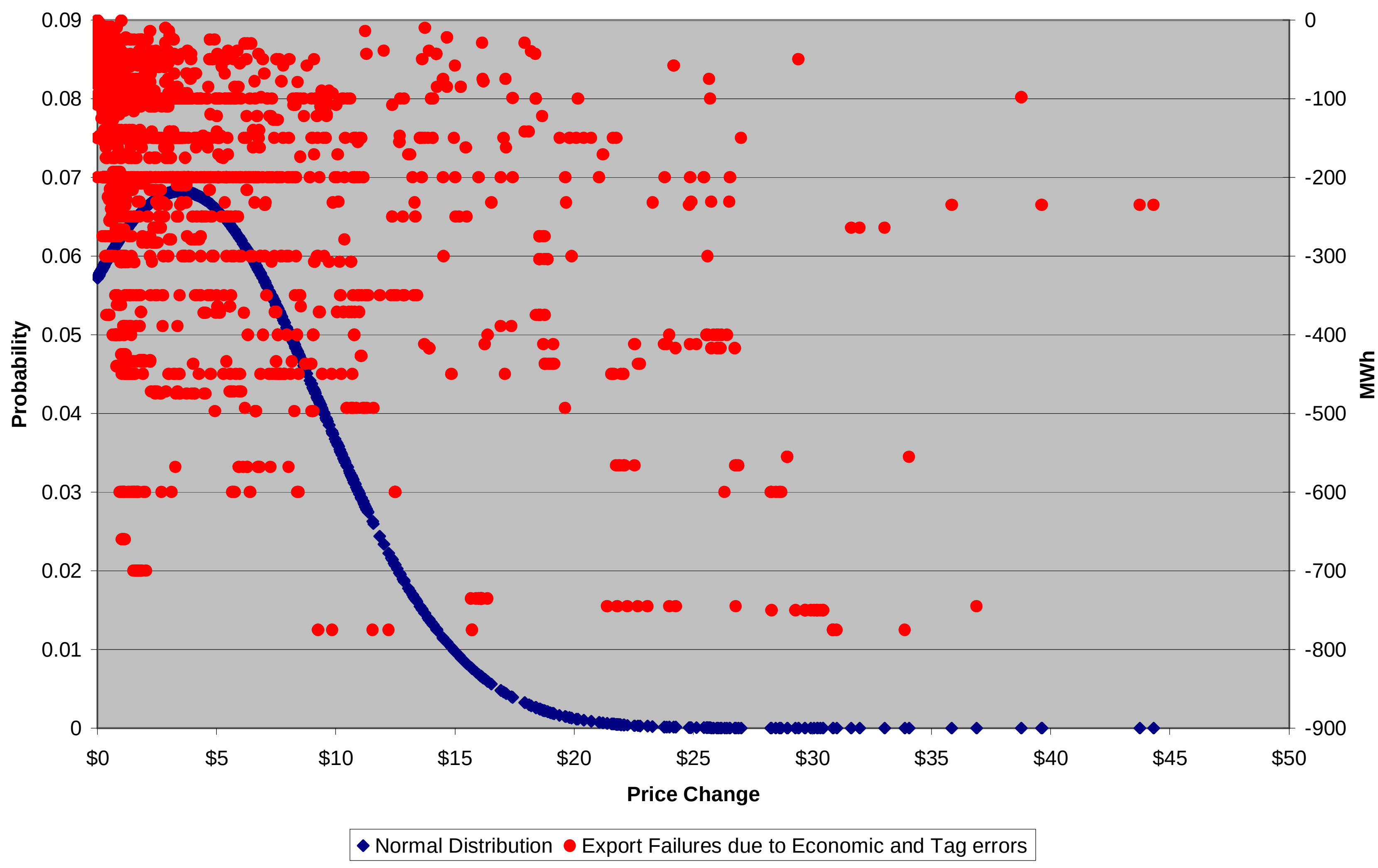



Bar 3 - Net Failures due to Economic and Tag errors
Probability
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
800
600
400
200
0
-200
-400
-600
-800
MWh
(Exports are negative; Imports are positive)
-$50
-$40
-$30
-$20
-$10
$0
$10
$20
$30
$40
$50
Price Change
Normal Distribution
Net Failures due to Economic and Tag errors

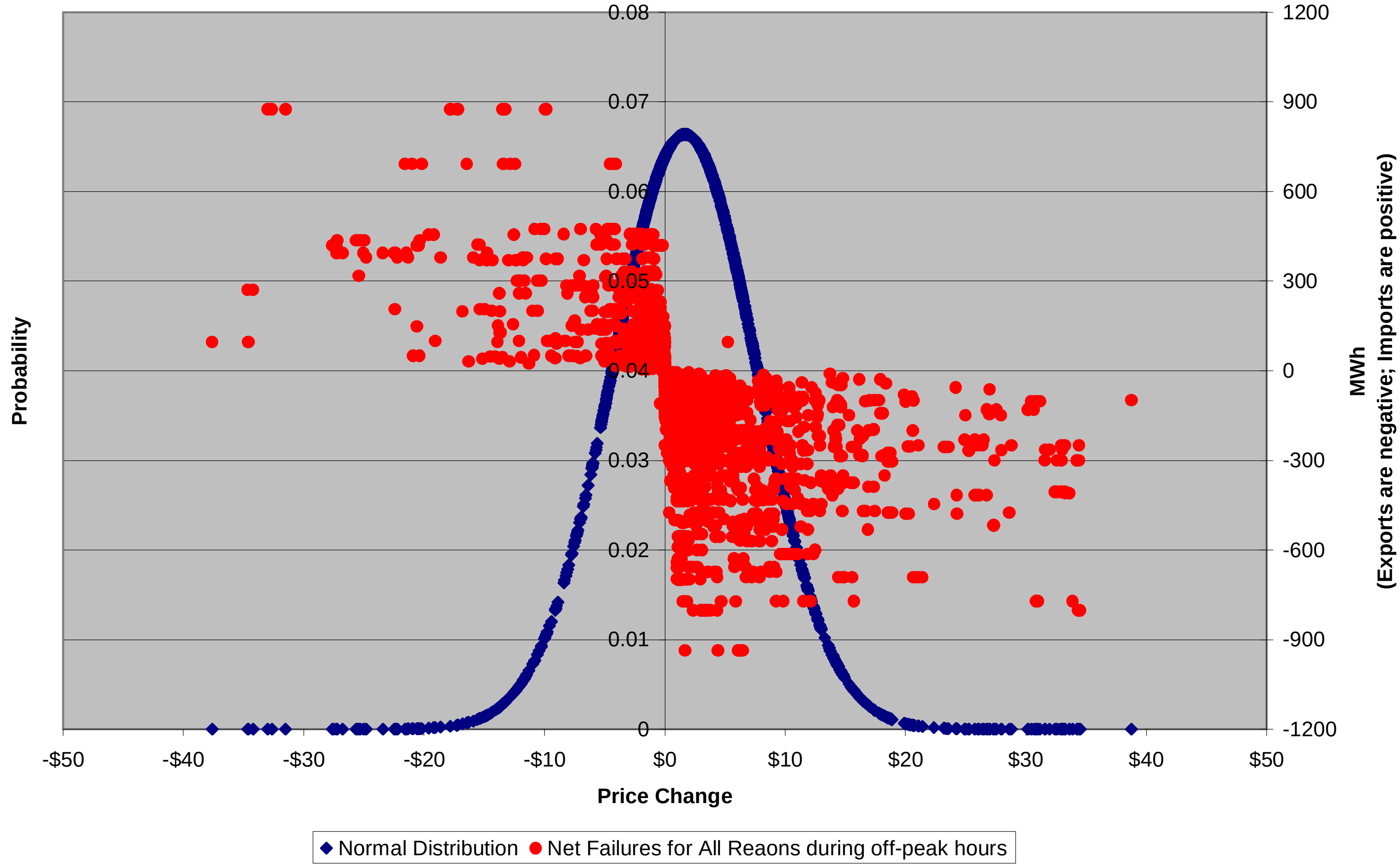


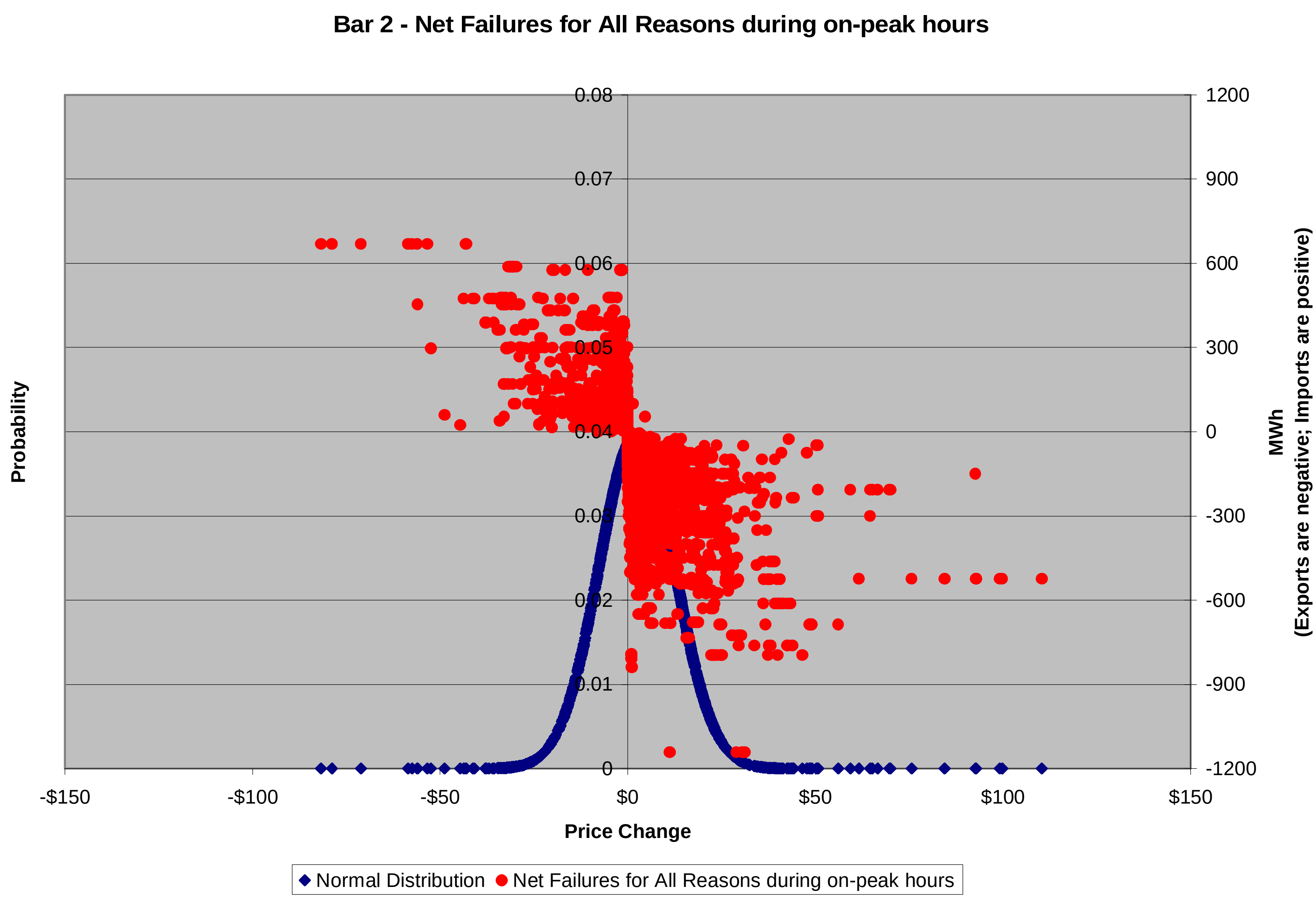
Bar 4 - Import Failures due to Economic and Tag errors
Probability
MWh
0.12
0.105
0.09
0.075
0.06
0.045
0.03
0.015
0
800
700
600
500
400
300
200
100
0
-$50
-$40
-$30
-$20
-$10
$0
$10
Price Change
Normal Distribution
Import Failures due to Economic and Tag errors

Bar 5 - Export Failures due to Economic and Tag errors



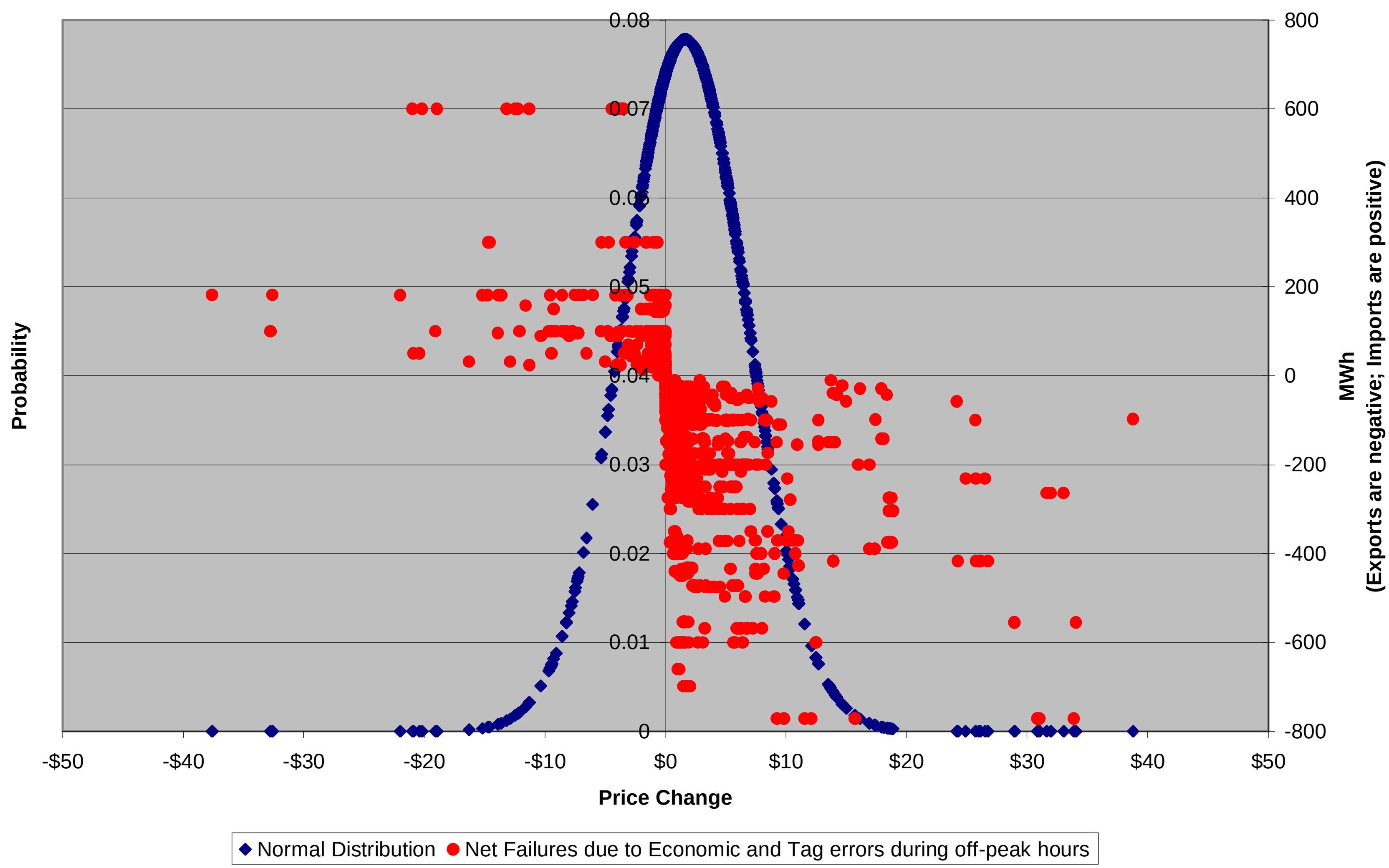
Bar 2 - Net Failures for All Reasons during off-peak hours



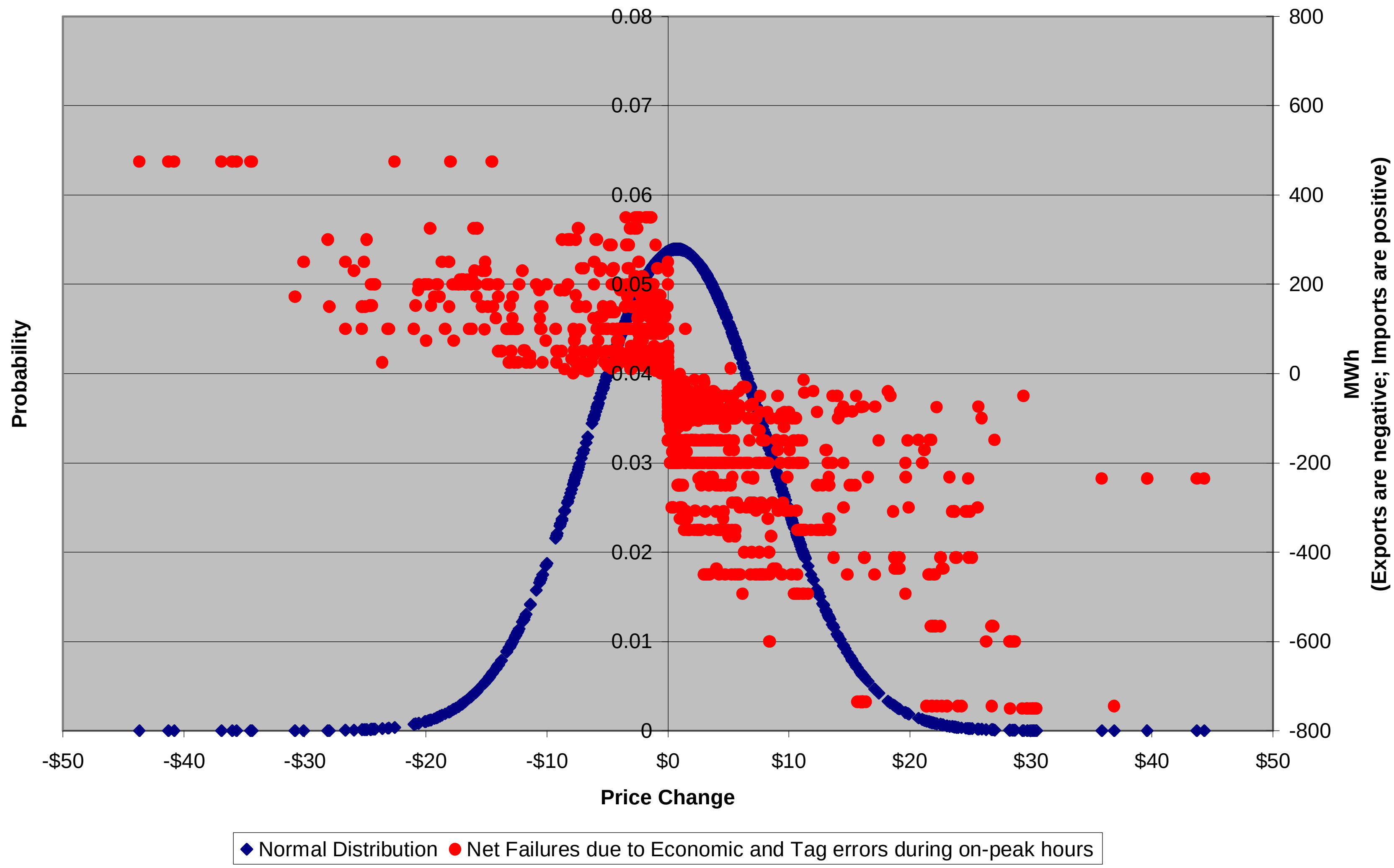


Bar 2 - Net Failures for All Reasons during on-peak hours
Probability
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1200
900
600
300
0
-300
-600
-900
-1200
MWh
(Exports are negative; Imports are positive)
-$150
-$100
-$50
$0
$50
$100
$150
Price Change
Normal Distribution
Net Failures for All Reasons during on-peak hours

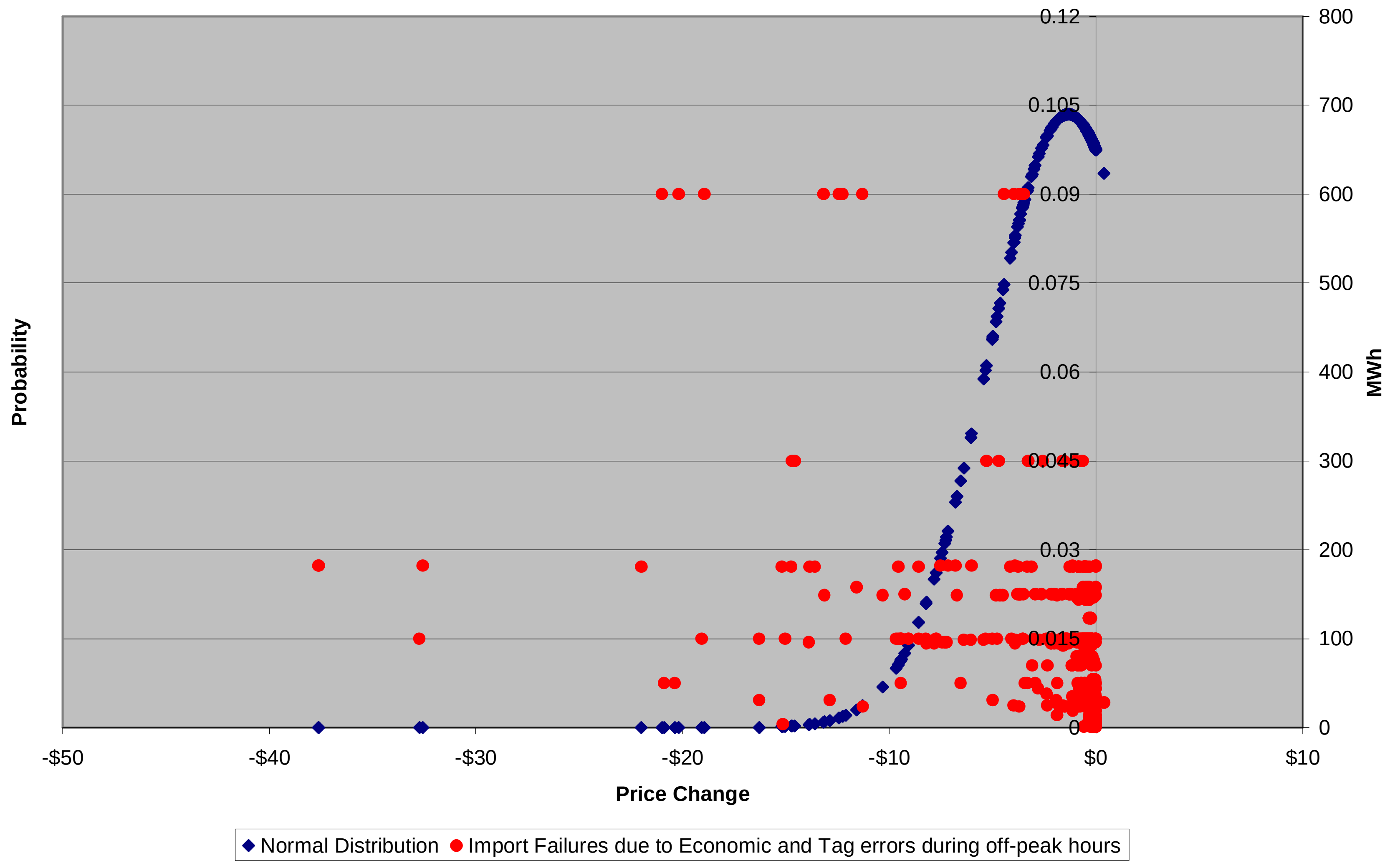
Bar 3 - Net Failures due to Economic and Tag errors during off-peak hours

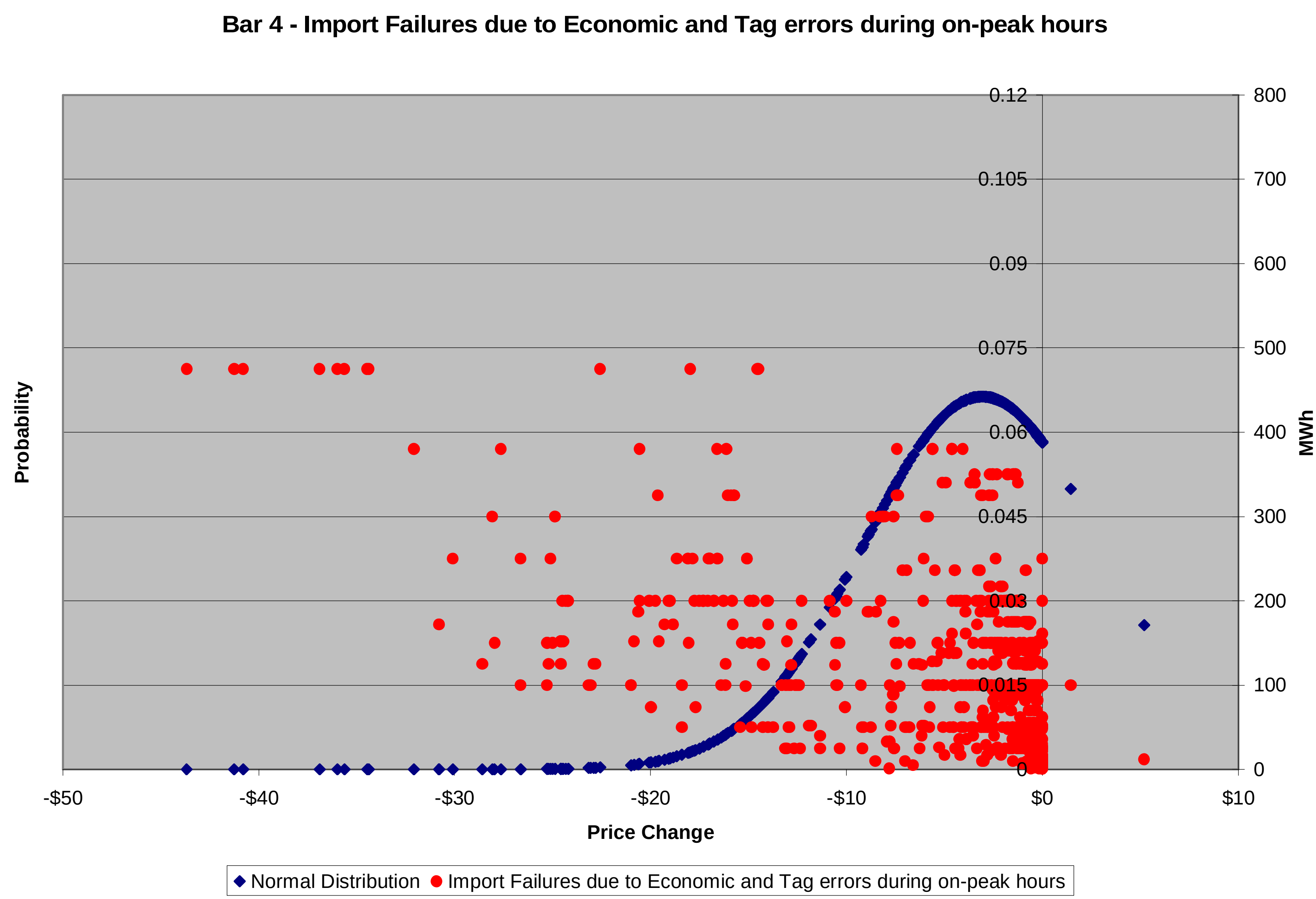


Bar 3 - Net Failures due to Economic and Tag errors during on-peak hours

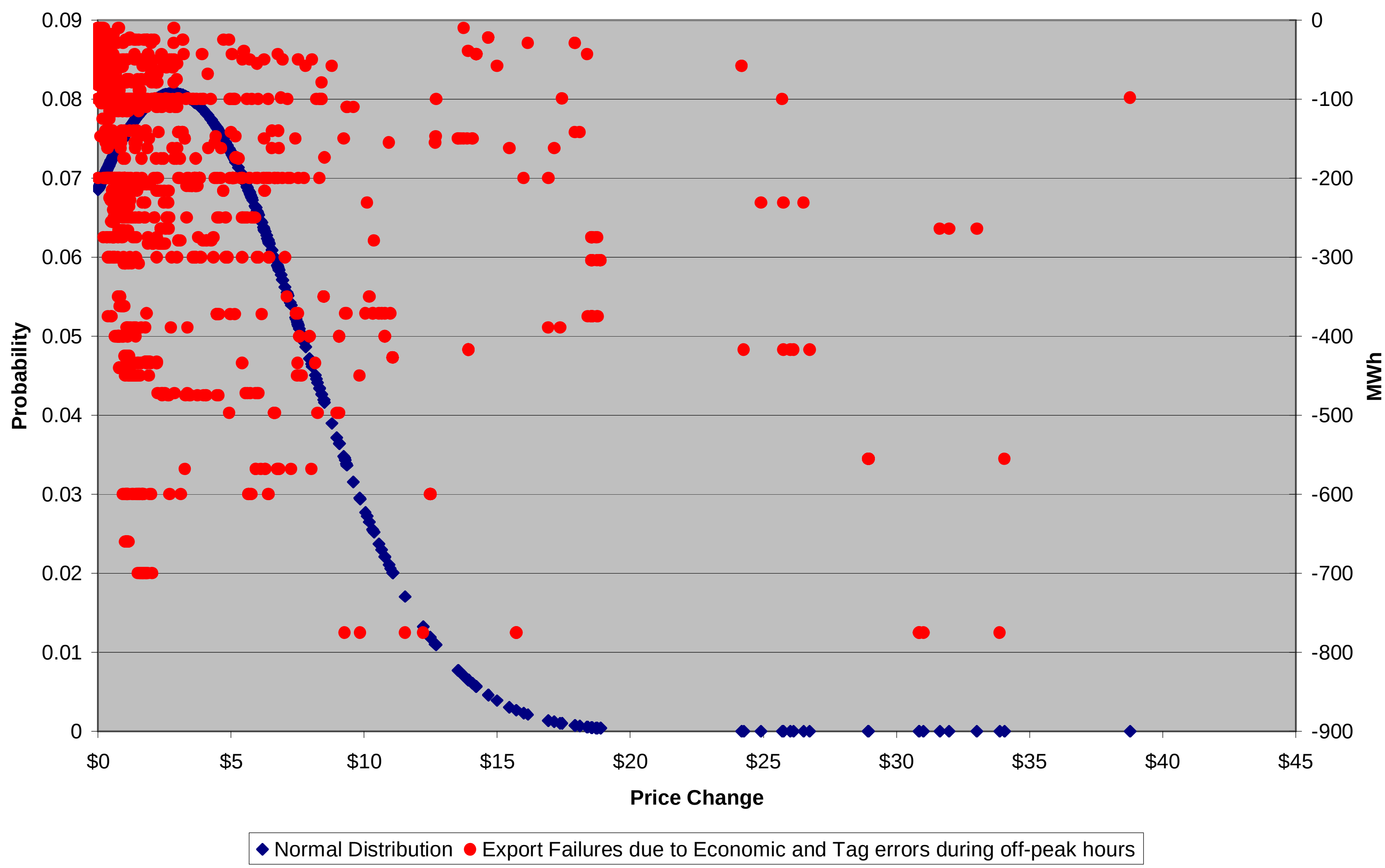


Bar 4 - Import Failures due to Economic and Tag errors during off-peak hours

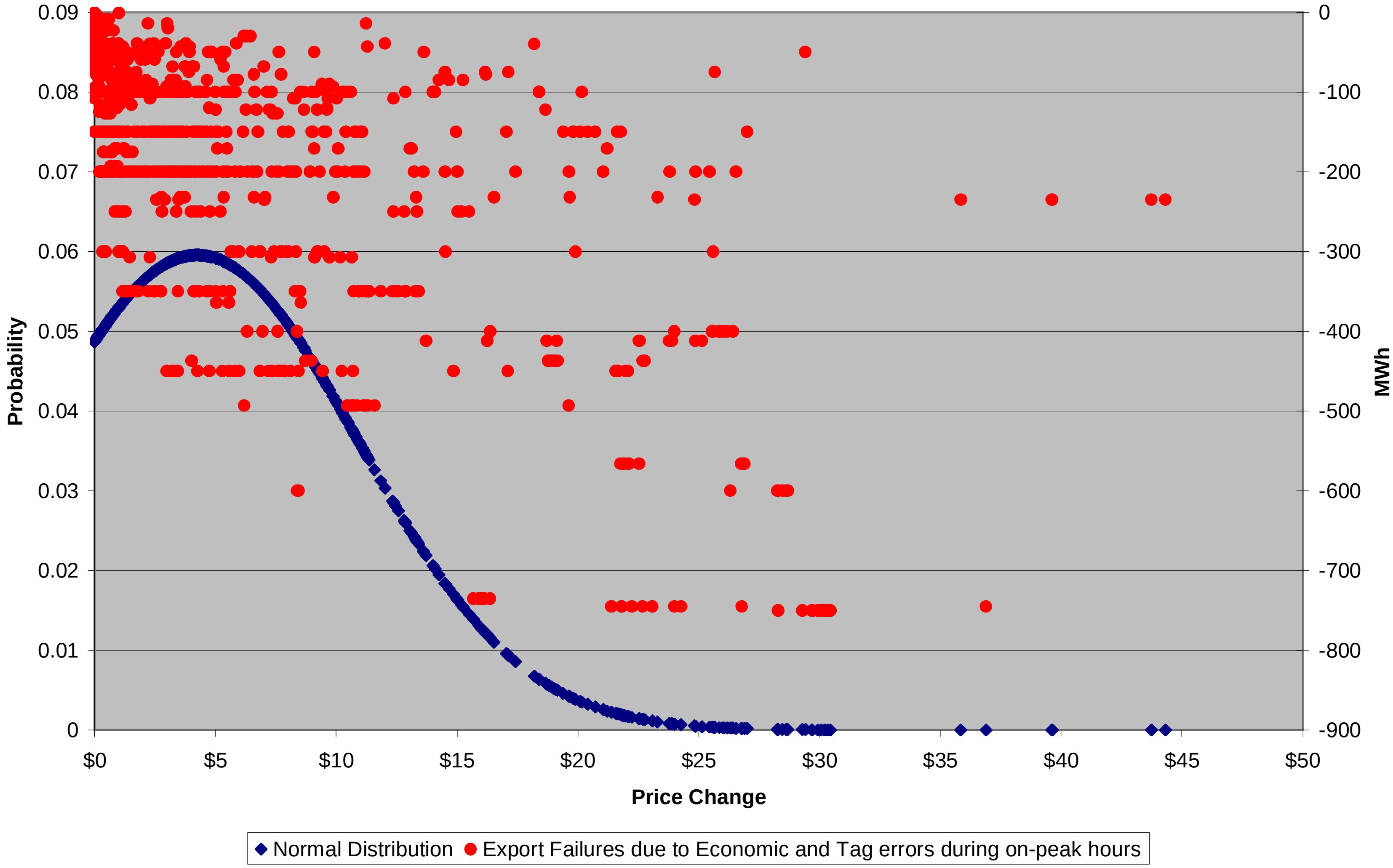



Bar 4 - Import Failures due to Economic and Tag errors during on-peak hours
Probability
0.12
0.105
0.09
0.075
0.06
0.045
0.03
0.015
0
MWh
800
700
600
500
400
300
200
100
0
-$50
-$40
-$30
-$20
-$10
$0
$10
Price Change
Normal Distribution
Import Failures due to Economic and Tag errors during on-peak hours

Bar 5 - Export Failures due to Economic and Tag errors during off-peak hours



Bar 5 - Export Failures due to Economic and Tag errors during on-peak hours



APPENDIX E

Summary of Data on Schedule Deviations

August 1, 2003 – February 28, 2005

- Monthly scheduling deviations across all interfaces by MWh, count of transactions and expressed as a percentage of the pre-dispatch constrained schedule
  - As above but separately for imports and exports
  - As above but imports and exports further separated into on-peak and off-peak periods
- As for each of the data series above but separately for Manitoba, Michigan, Minnesota, NYISO and Quebec
  - As above (but not including a breakdown by peak periods) with the reason for the deviation – economic, tag, external security, external TLR, internal TLR, or other – expressed in MWh and as a percentage of the total monthly deviation on the particular interface
- Monthly scheduling deviations due to NERC tag errors or uneconomic bids by individual market participant (identity concealed) across all interfaces expressed as a percentage of total scheduling deviations and as a percentage of total trade
- Monthly scheduling deviations attributable to each interface (Manitoba, Michigan, Minnesota, NYISO and Quebec) in MWh, count of transactions and as a percentage of total scheduling deviations, separated into exports and imports for each interface
- Monthly NYISO scheduling deviations triggering the MACD guidelines (for each of Tests 1, 2 and 3) in MWh and as a percentage of total 'economic' failures over the NYISO interface
- Monthly MISO scheduling deviations triggering the MACD guidelines in MWh and as a percentage of total 'tag' failures over the MISO interface
- Individual market participant (identity concealed) scheduling deviations due to 'economic' or 'tag' failures in MW by hour for selected 'supply tight' days[4]

[4] Defined as when a Energy Emergency Alert had been declared by the IESO [list dates]

APPENDIX F: Summary of Failure Data

Table A: Intertie Failure Rates by Interface during August 1, 2003 to July 31, 2005

		Scheduled (MWh)	Failed for all reasons (MWh)	Failed due to Economic and Tag errors (MWh)	Average percentage failure for all reasons weighted by Total trade (%)	Average percentage failure due to Economic and Tag errors weighted by Total trade (%) *
Total System	**Imports**	21,343,443	1,007,680	297,341	4.72	1.39
	Exports	19,007,792	1,869,733	610,066	9.84	3.21
	Total	40,351,235	2,877,413	907,407	7.13	2.25
New York	**Imports**	2,383,185	296,437	177,729	12.44	7.46
	Exports	15,926,334	1,734,370	586,102	10.89	3.68
	Total	18,309,519	2,030,807	763,831	11.09	4.17
Michigan	**Imports**	14,589,199	605,219	112,405	4.15	0.77
	Exports	920,913	83,093	14,422	9.02	1.57
	Total	15,510,112	688,312	126,827	4.44	0.82
Manitoba	**Imports**	2,115,616	52,766	1,404	2.49	0.07
	Exports	396,417	6,731	159	1.70	0.04
	Total	2,512,033	59,497	1,563	2.37	0.06
Minnesota	**Imports**	553,213	18,156	4,776	3.28	0.86
	Exports	341,308	4,434	248	1.30	0.07
	Total	894,521	22,590	5,024	2.53	0.56
Hydro Quebec	**Imports**	1,702,230	35,102	1,027	2.06	0.06
	Exports	1,422,820	41,105	9,135	2.89	0.64
	Total	3,125,050	76,207	10,162	2.44	0.33

* Economic and tag failures are subject to guidelines screens on New York and Michigan interfaces

Table B: Reasons for Failure Rates by Interface from August 1, 2003 to July 31, 2005

		Scheduled (MWh)	Failed due to	Failed (MWh)	Percentage (%)
New York **	**Imports**	2,383,185	Economic	172,082	58.05
			Tag	5,647	1.90
			External Security	68,646	23.16
			External TLRs	12,230	4.13
			Internal TLRs	14,515	4.90
			Other	23,317	7.87
			Total	296,437	
	Exports	15,926,334	Economic	569,577	32.84
			Tag	16,525	0.95
			External Security	917,432	52.90
			External TLRs	117,561	6.78
			Internal TLRs	28,789	1.66
			Other	84,486	4.87
			Total	1,734,370	
	Total	18,309,519	Total	2,030,807	
Michigan **	**Imports**	14,589,199	Economic	1,624	0.27
			Tag	110,781	18.30
			External Security	24,972	4.13
			External TLRs	408,717	67.53
			Internal TLRs	38,863	6.42
			Other	20,262	3.35
			Total	605,219	
	Exports	920,913	Economic	109	0.13
			Tag	14,313	17.23
			External Security	8,160	9.82
			External TLRs	52,338	62.99
			Internal TLRs	5,463	6.57
			Other	2,710	3.26
			Total	83,093	
	Total	15,510,112	Total	688,312	

** Economic and tag failures are subject to guidelines screens

Table C: Results of New York transaction failure screens

New York	Failed (MWh)	Percentage of economic failures which failed test (%)
Economic failures	741,659	
Test 1 failures (over 1,000 MWh and failure ratio over 3% in the last 30-days)	553,156	74.58
Test 2 failures (failure occurred in stable price hour)	356,231	48.03
Test 3 failures (bid/offer outside safe-harbour)	15,250	2.06

Table D: Results of Michigan transaction failure screens

Michigan	Failed (MWh)	Percentage of tag failures which failed test (%)
Tag failures	125,094	
Test 1 failures (over 1,000 MWh and failure ratio over 3% in the last 30-days)	31,892	25.49

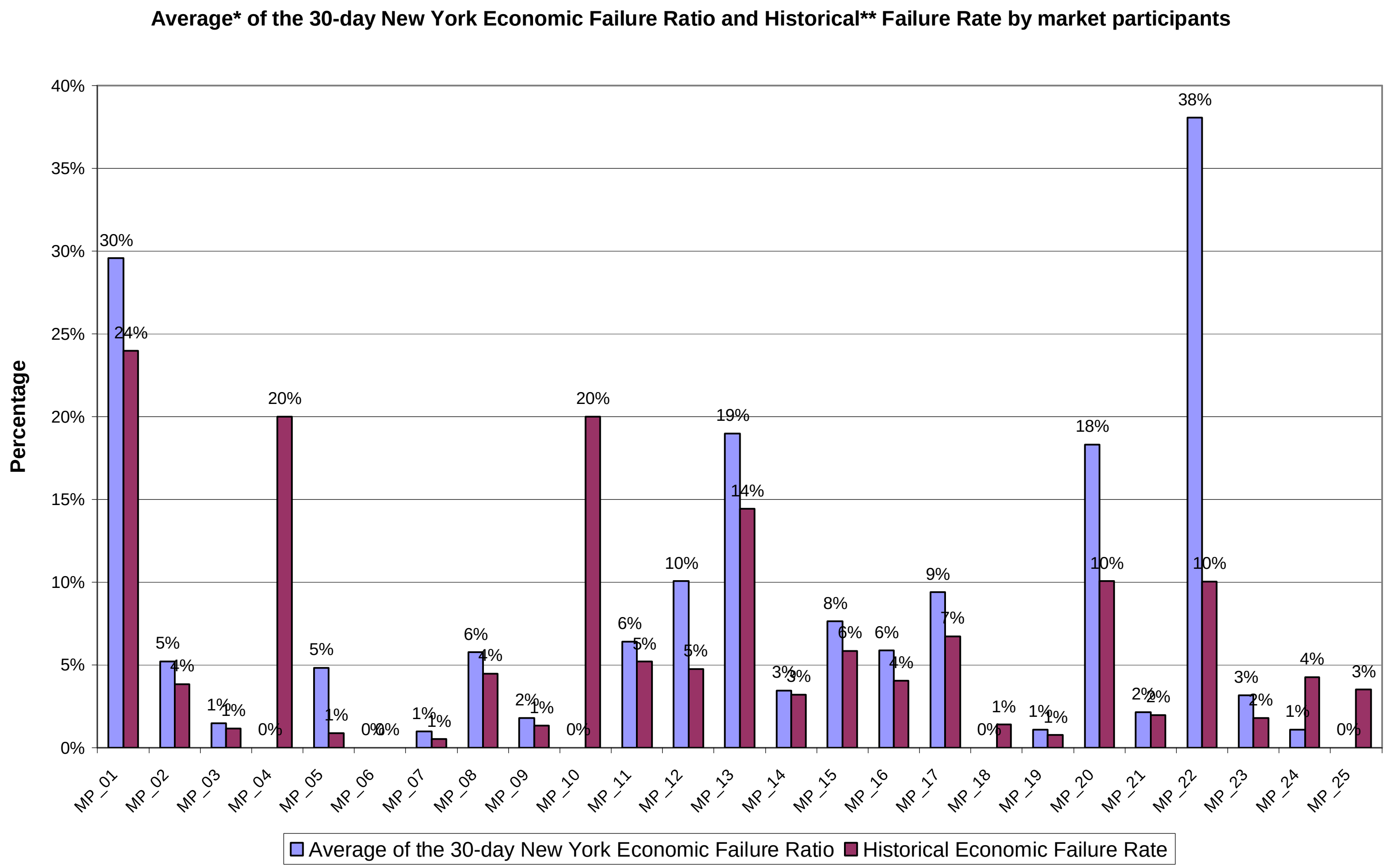
Table E: Failure Rates during volatile price hours in New York

New York	Failed (MWh)	Percentage of economic failures (%)
Economic failures	741,659	
Failures during volatile price hours	276,108	37.23

Table F: Interface Failure Rates

Interface	Failed (MWh)	Percentage of interface failures to Total system failures (%)
New York	2,030,807	70.58
Michigan	688,312	23.92
Manitoba	59,497	2.07
Minnesota	22,590	0.79
Hydro Quebec	76,207	2.65
Total System	2,877,413	

APPENDIX G



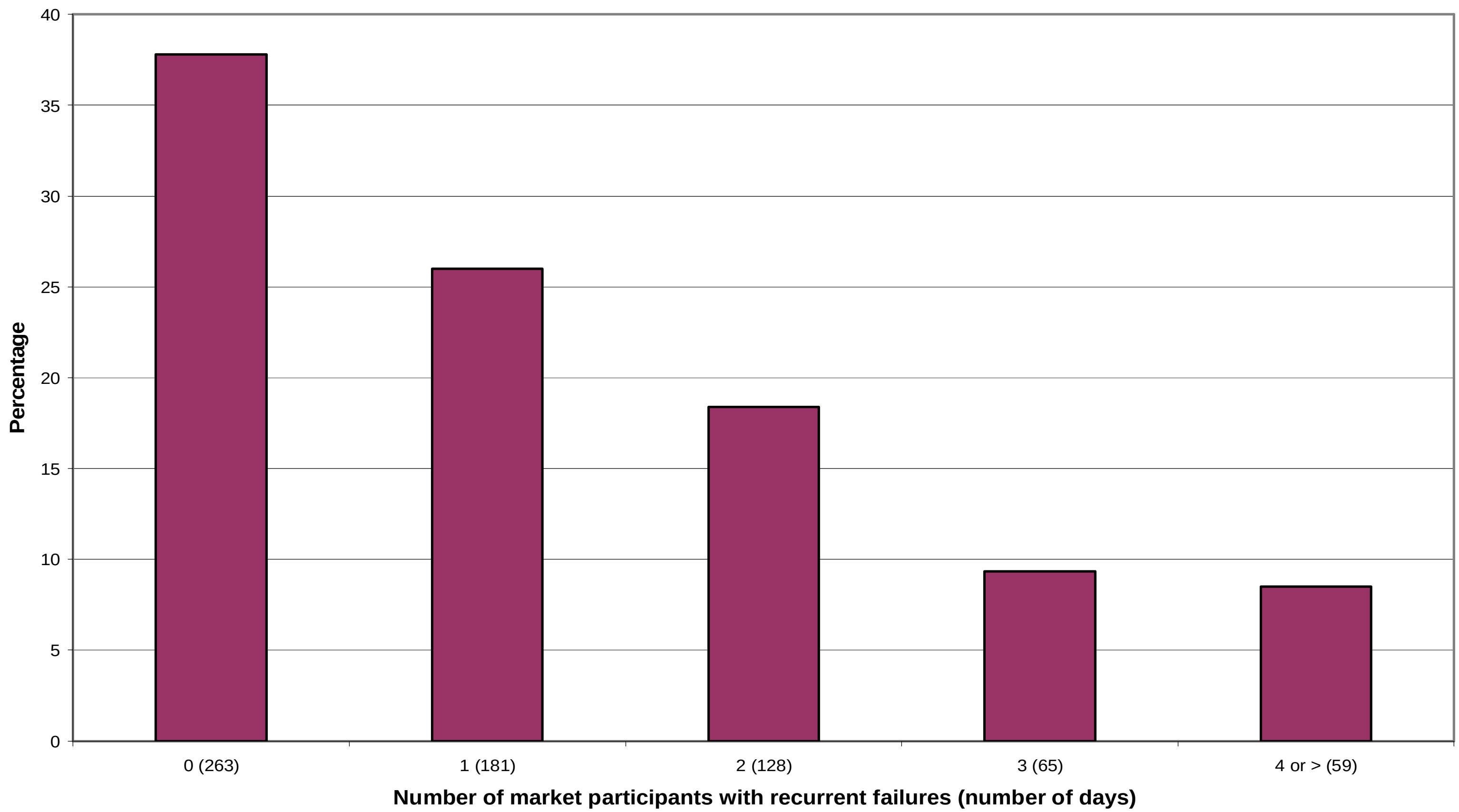
The study period for this analysis is from August 1, 2003 to July 31, 2005

* Average is the mean of the failure ratios when calculated as per the New York economic guidelines

** Historical Economic Failure Rate over the period = New York Economic Failures (MWh) / New York Scheduled Volume (MWh)

APPENDIX H

Recurrent* economic failures during Non-supply-tight** days



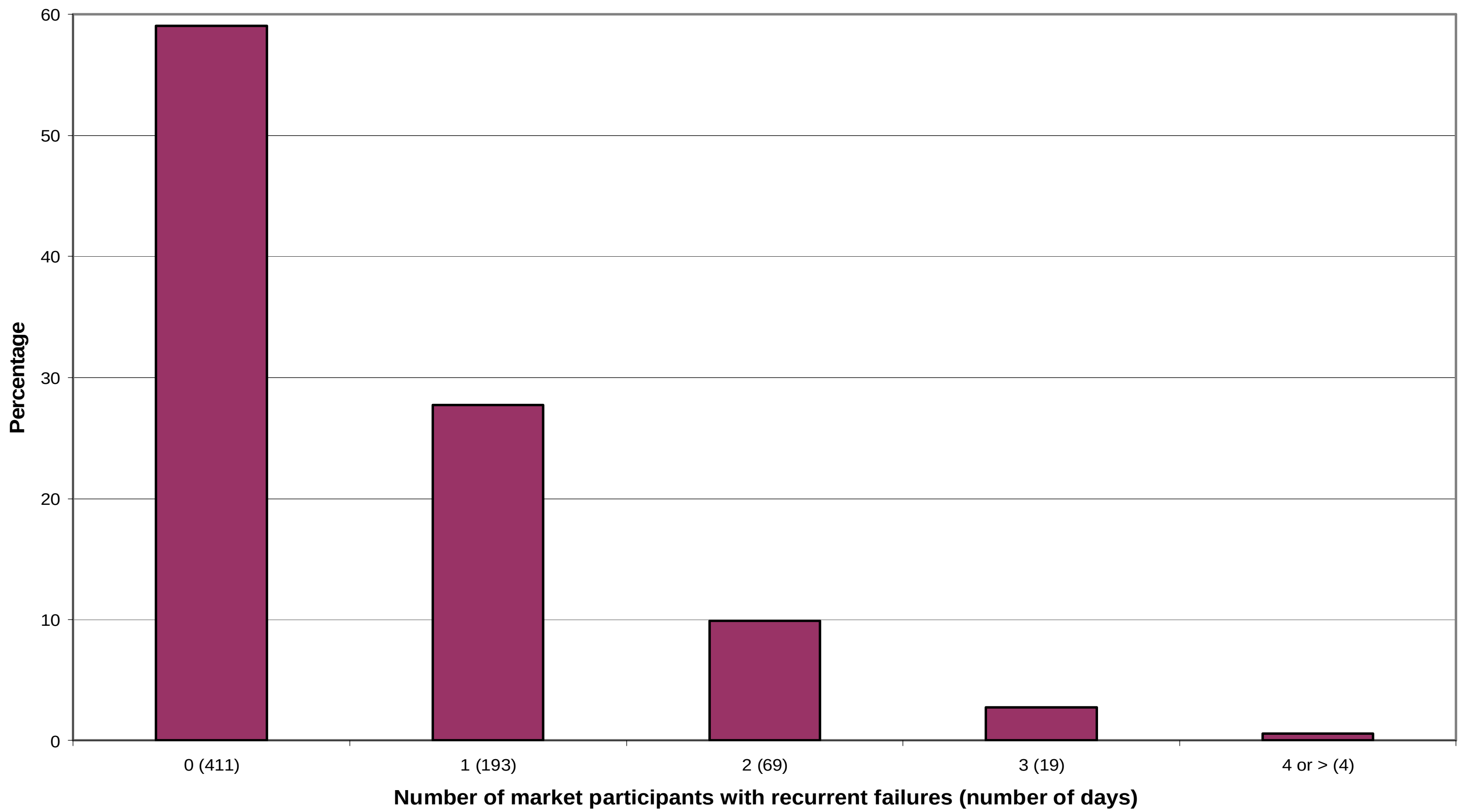
* Recurrent failures are defined as a Market Participant having failed 3 or more intertie failures within a day, not necessarily in consecutive hours

** Non-supply-tight days are defined as days when IESO did not issue an Emergency Energy Adequacy (EEA) warning

The period of this study is from August 1, 2003 to June 26, 2005 (696 days)

APPENDIX I

Recurrent* tag failures during Non-supply-tight days**



* Recurrent failures are defined as a Market Participant having failed 2 or more intertie failures within a day, not necessarily in consecutive hours

** Non-supply-tight days are defined as days when IESO did not issue an Emergency Energy Adequacy (EEA) warning

The period of this study is from August 1, 2003 to June 26, 2005 (696 days)

APPENDIX J

Changes to New York Economic Guidelines – Option 1