

# 2014 Historical Market Data: Locational Marginal Prices Interface MW Flows



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*Planning Advisory Committee Meeting*

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SUPERVISOR, LOAD FORECASTING

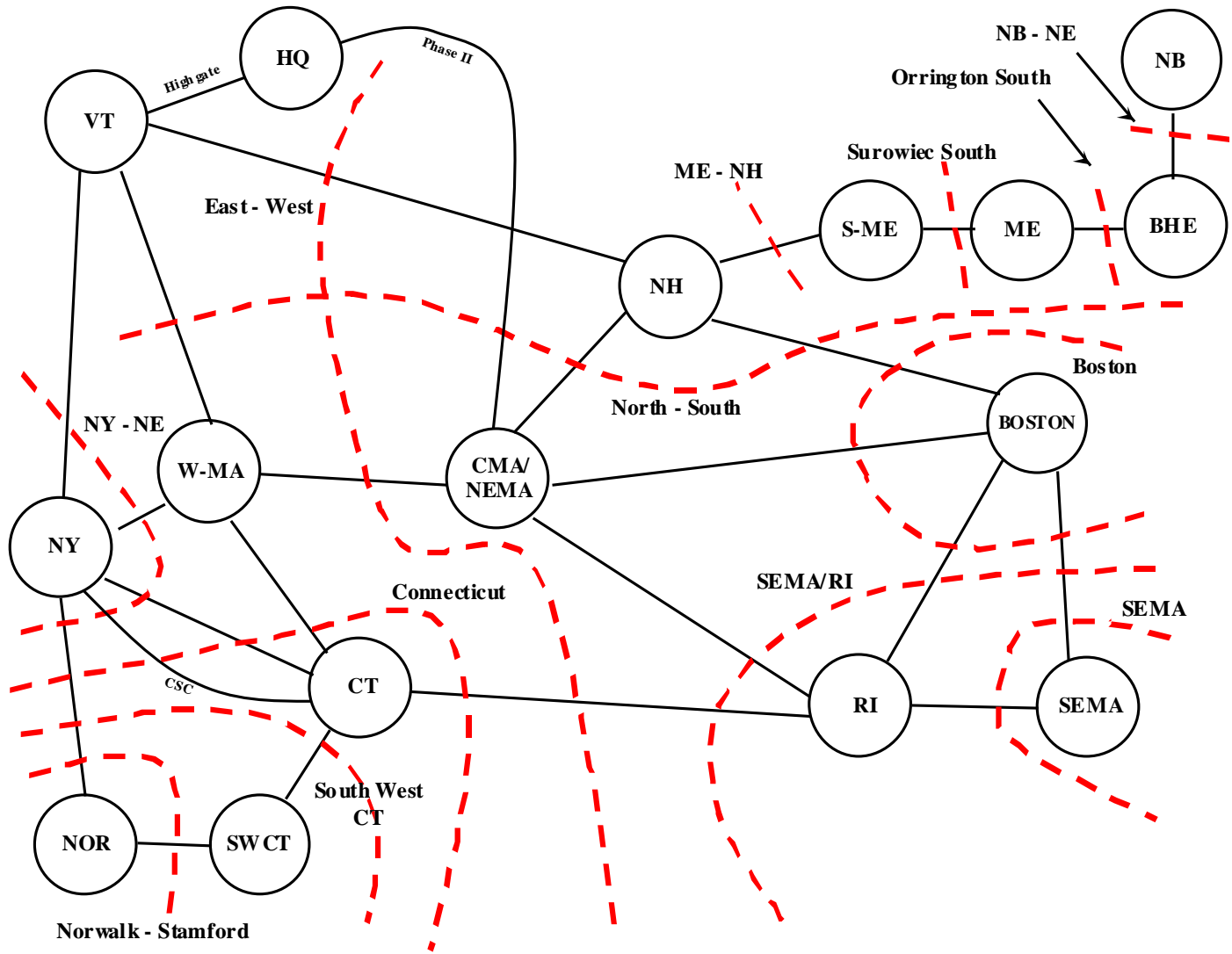


# Overview

- Average Real-time Locational Marginal Prices by subarea
  - Hourly Dollar per MWh
  - May have rounding and precision differences with Market Reports
- Internal Interfaces: Monthly Box Plots & Flow Duration Curves
  - Percentage of Limit
    - Percentages close to the limit may result from interface flows below the maximum due to conditions that reduce the transfer limit
- Market Information is summarized in other ISO-NE publications, such as the Annual Market Report : <http://www.iso-ne.com/markets-operations/market-performance/performance-reports>
- Presentation is meant to show general trends of real time data
  - Anomalies within a trend are usually due to short-term events (for example, a generator or line outage)
- Real time data is subject to errors, missing data



# New England Subarea Model



# Box Plots & Duration Curves for Selected Interfaces

- East – West
- Maine – New Hampshire
- Boston Import
- SEMA/RI Export
- Connecticut Import
- Southwest CT Import
- Norwalk – Stamford
- North – South
- Orrington South
- Surowiec South
- East to West CT
- HQ Phase II
- New Brunswick
- New England-New York Cross Sound Cable
- New England-New York Northport
- New England-New York Rest of AC Ties



# Interface Notes

- HQ Phase II, New Brunswick, and New York Ties Metered Hourly Net Flows can be found on ISO-NE website
  - <http://www.iso-ne.com/isoexpress/web/reports/grid/-/tree/external-interface-metered-data>
- Limits for internal interfaces are calculated in real time by Internal Limit Calculator and are dynamic
- 2010 – 2013 Flows and Limits for internal interfaces now posted on ISO-NE website and 2014 will be posted soon
  - <http://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/historical-hourly-flows-and-limits>



# Real-time Locational Marginal Price Summary

## RSP Sub-areas and HUB Jan-Dec 2014

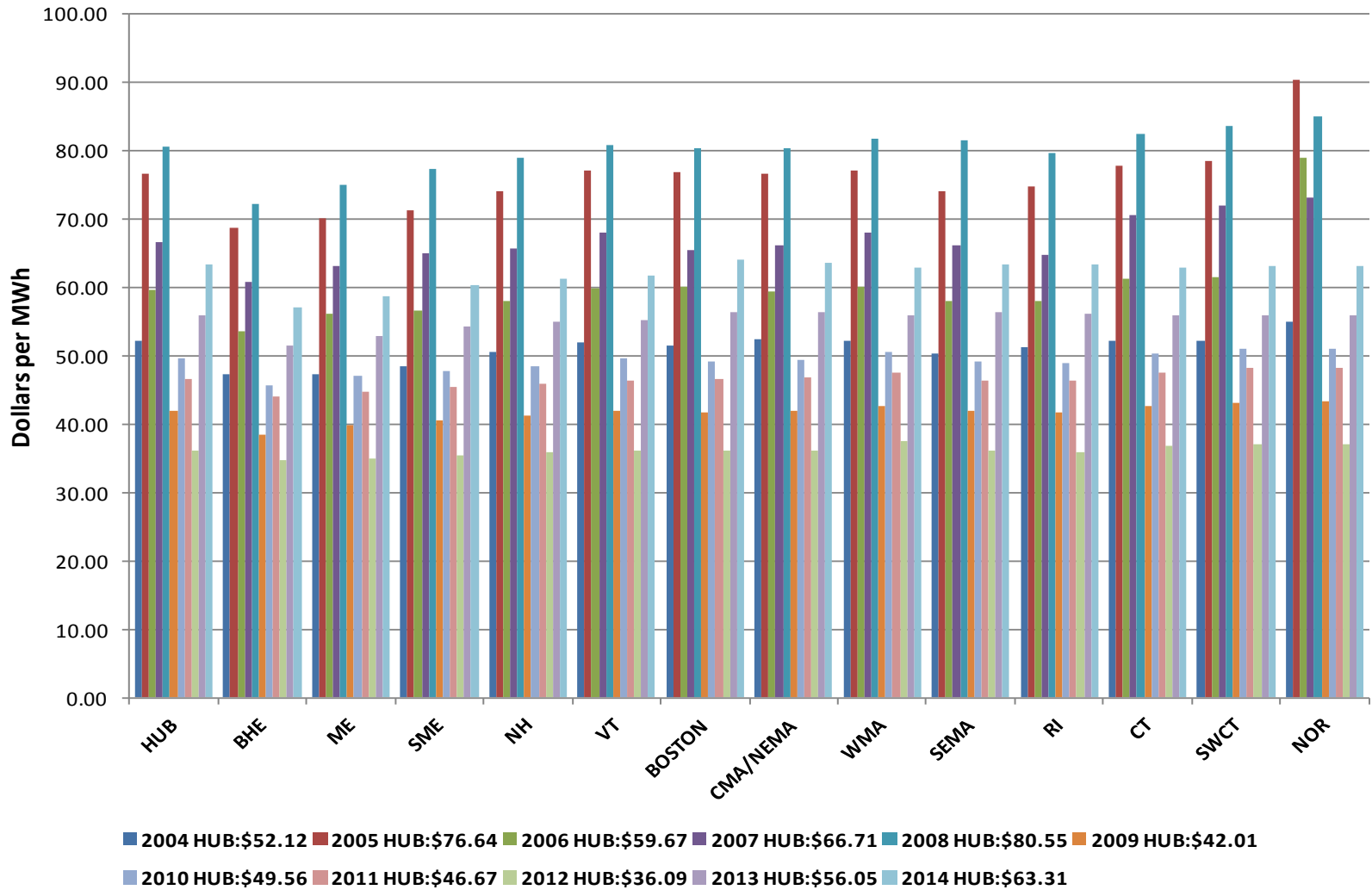
						<b>Mean:</b>
						<b>Difference</b>
	<b>Mean</b>	<b>Std Dev</b>	<b>Maximum</b>	<b>Minimum</b>		<b>from HUB</b>
HUB	63.31	71.99	1116.63	-157.85		0.00
BHE	57.17	61.00	1020.00	-150.92		-6.15
ME	58.72	62.54	1042.49	-152.81		-4.59
SME	60.40	64.76	1118.66	-155.00		-2.91
NH	61.31	66.57	1129.11	-155.10		-2.01
VT	61.77	68.97	1108.22	-152.45		-1.54
BOSTON	64.01	73.02	1231.19	-158.85		0.69
CMA/NEMA	63.65	72.42	1132.57	-158.50		0.34
WMA	62.90	70.96	1082.38	-156.45		-0.42
SEMA	63.44	72.51	1163.75	-158.48		0.12
RI	63.36	72.21	1142.44	-160.06		0.05
CT	63.02	71.04	1076.08	-156.59		-0.29
SWCT	63.17	71.06	1063.77	-156.07		-0.14
NOR	63.18	71.07	1067.68	-156.30		-0.13

<b>Congestion Component of Real-time Locational Marginal Price Summary RSP Sub-areas and HUB Jan-Dec 2014</b>					
					<b>Mean: Difference from HUB</b>
	<b>Mean</b>	<b>Std Dev</b>	<b>Maximum</b>	<b>Minimum</b>	
HUB	0.17	3.10	128.24	-53.25	0.00
BHE	-1.71	12.93	42.65	-620.41	-1.88
ME	-1.49	12.37	43.60	-611.87	-1.66
SME	-1.28	12.13	43.60	-620.41	-1.45
NH	-0.99	9.20	37.03	-461.54	-1.16
VT	-0.45	4.97	8.34	-251.41	-0.63
BOSTON	0.59	6.09	244.17	-53.27	0.41
CMA/NEMA	0.20	3.25	138.87	-53.27	0.02
WMA	0.03	2.52	83.45	-59.29	-0.14
SEMA	0.24	3.71	169.84	-53.27	0.06
RI	0.20	3.38	145.73	-53.26	0.03
CT	0.12	2.66	72.05	-65.84	-0.05
SWCT	0.32	6.56	247.17	-65.55	0.14
NOR	0.30	6.48	247.51	-65.50	0.12

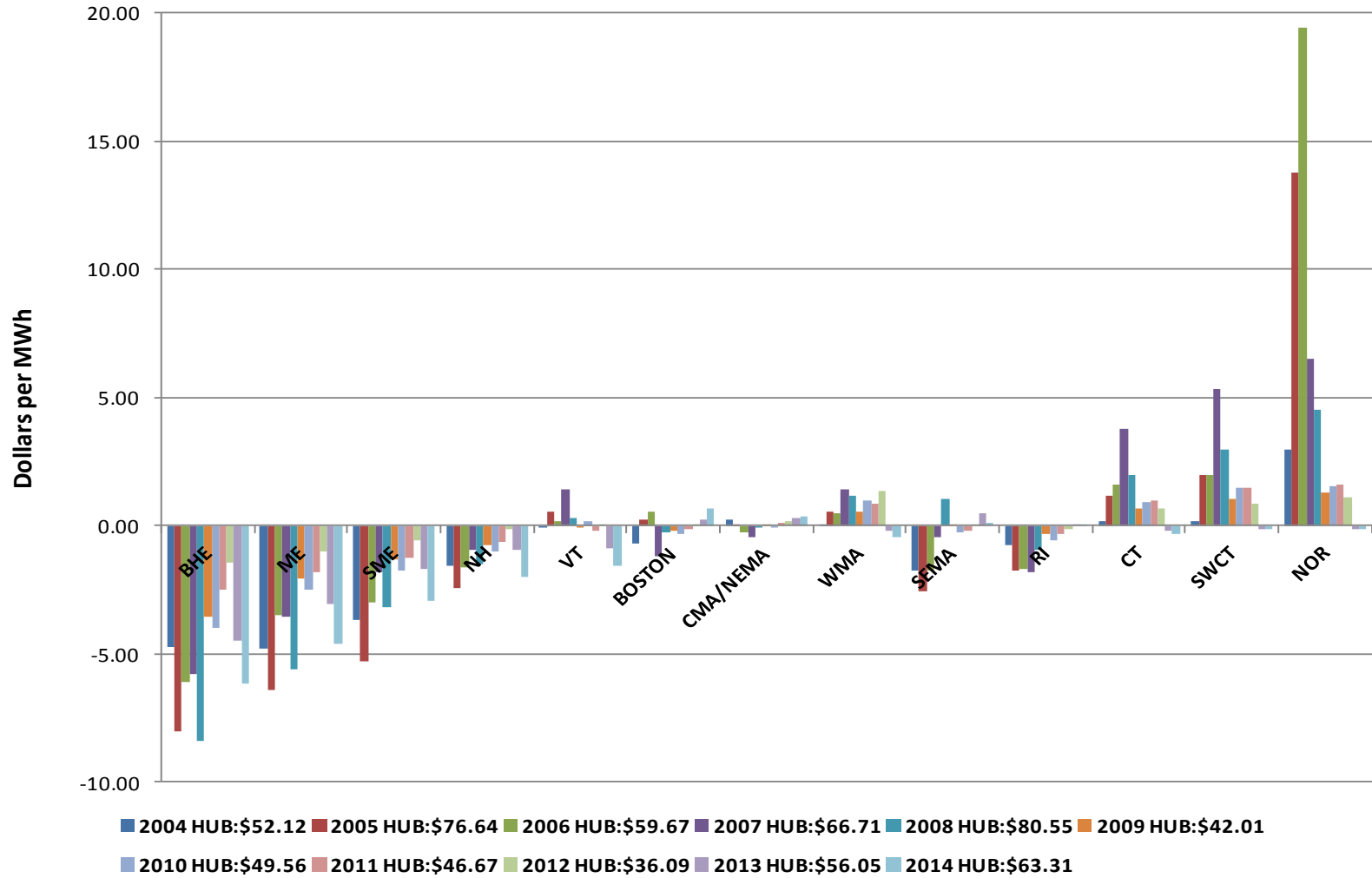
<b>Marginal Loss Component of</b>					
<b>Real-time Locational Marginal Price Summary</b>					
<b>RSP Sub-areas and HUB Jan-Dec 2014</b>					
					<b>Mean:</b>
					<b>Difference</b>
	<b>Mean</b>	<b>Std Dev</b>	<b>Maximum</b>	<b>Minimum</b>	<b>from HUB</b>
HUB	0.37	0.81	11.55	-1.55	0.00
BHE	-3.89	6.50	9.61	-100.02	-4.26
ME	-2.56	4.82	6.05	-72.59	-2.93
SME	-1.10	2.86	12.15	-46.22	-1.46
NH	-0.47	1.48	22.56	-29.38	-0.84
VT	-0.54	1.01	9.89	-15.60	-0.91
BOSTON	0.65	1.08	32.67	-3.01	0.28
CMA/NEMA	0.69	1.17	25.98	-2.00	0.32
WMA	0.09	0.93	9.69	-24.21	-0.28
SEMA	0.43	1.33	19.12	-3.23	0.06
RI	0.39	1.15	19.87	-4.63	0.02
CT	0.13	1.07	14.93	-30.51	-0.24
SWCT	0.09	1.64	22.92	-42.82	-0.28
NOR	0.12	1.81	26.96	-38.92	-0.25



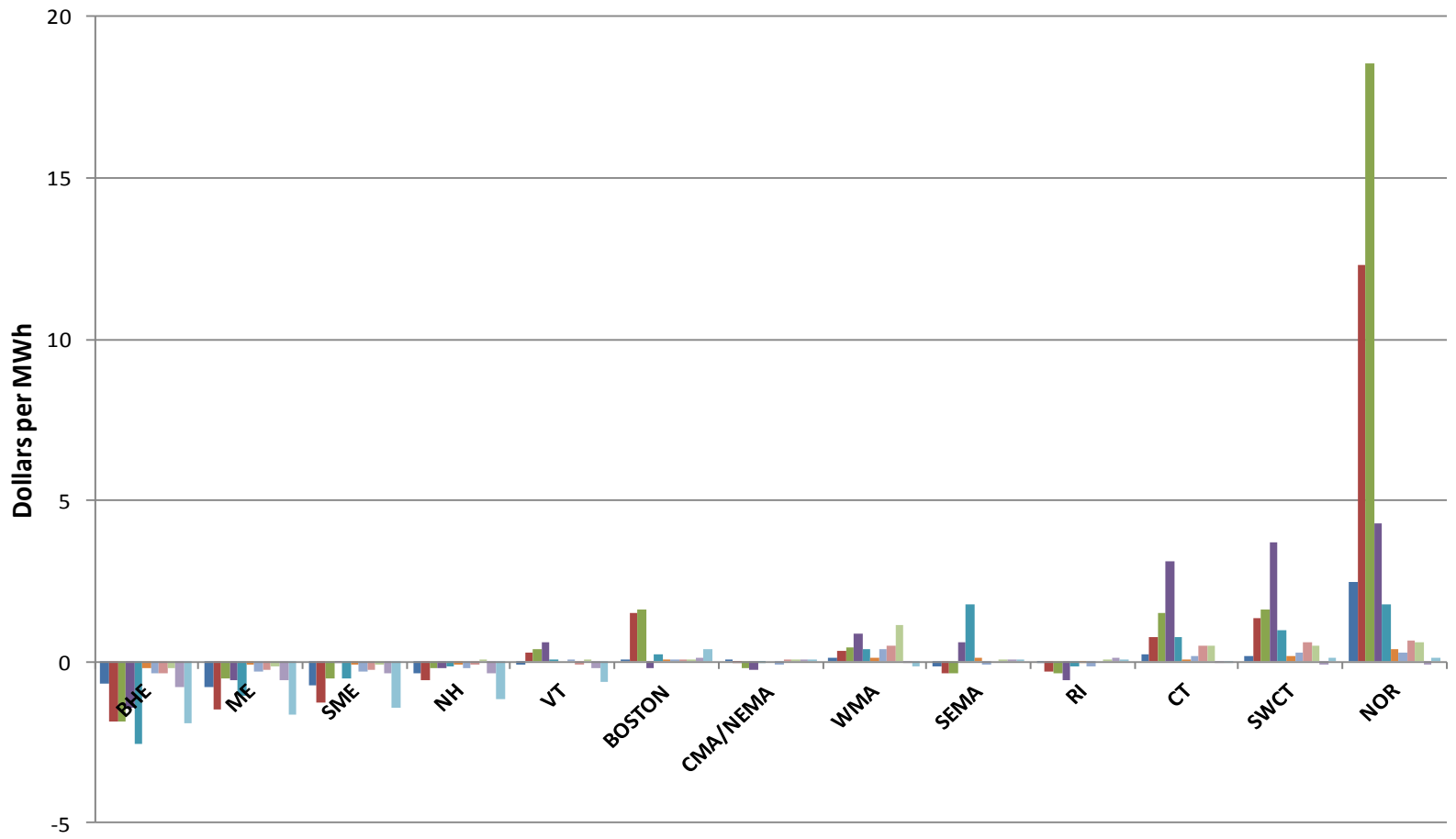
## Average Real-time Locational Marginal Prices RSP Sub-areas and HUB



## Average Real-time Locational Marginal Prices RSP Sub-areas Differences From HUB

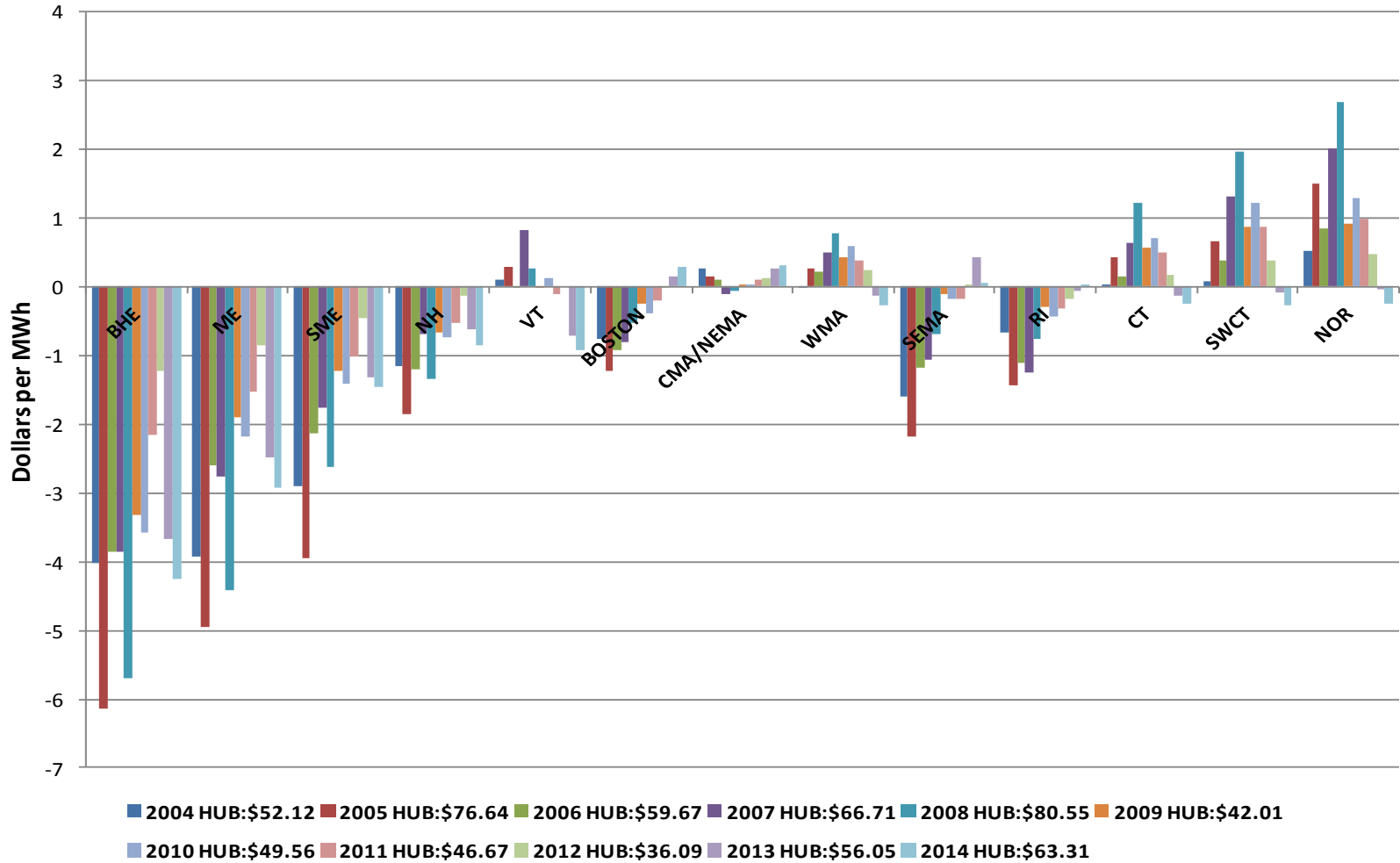


## Average RT Locational Marginal Prices: Congestion Component RSP Sub-areas Differences From HUB

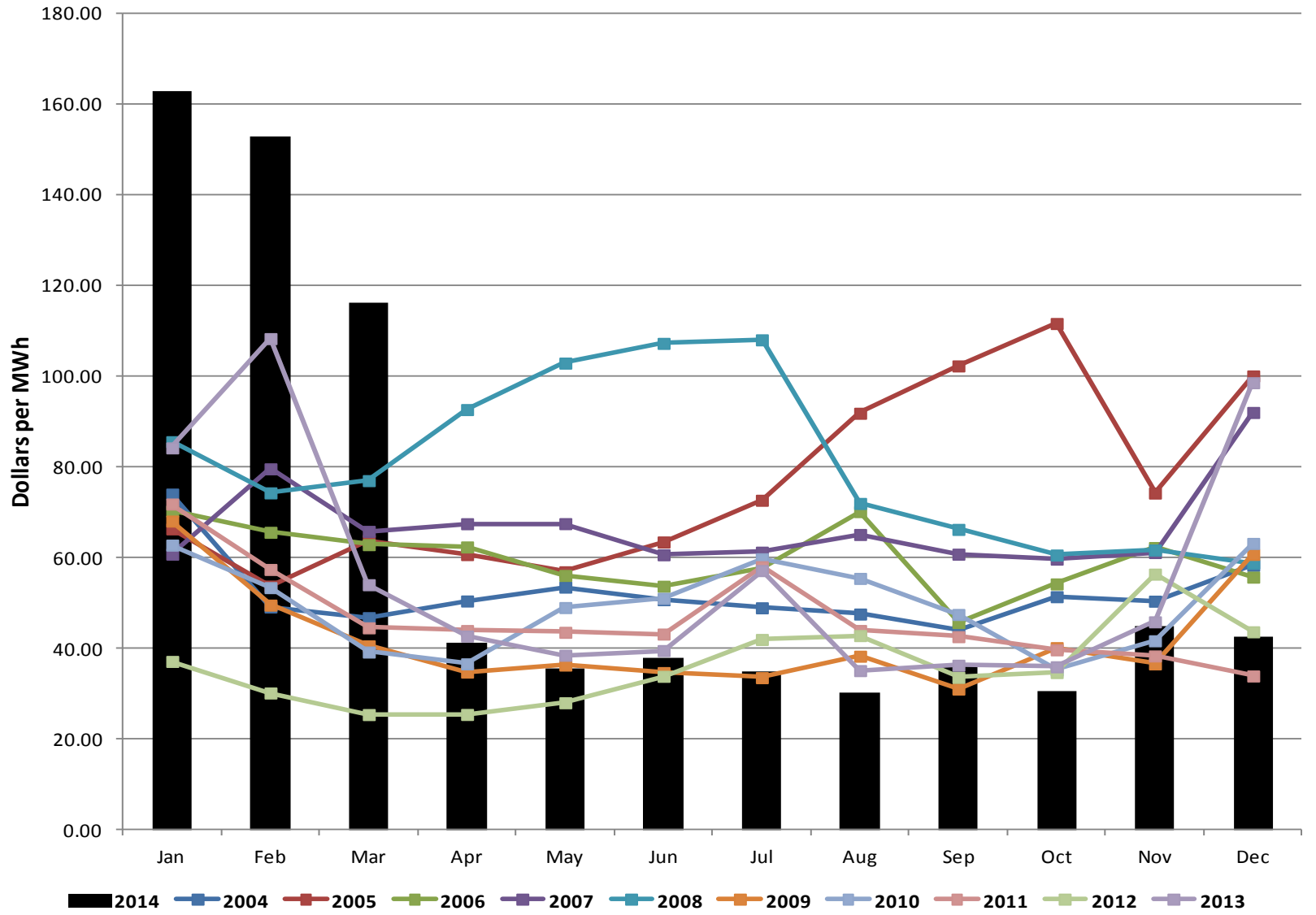


■ 2004 HUB:\$52.12  
 ■ 2005 HUB:\$76.64  
 ■ 2006 HUB:\$59.67  
 ■ 2007 HUB:\$66.71  
 ■ 2008 HUB:\$80.55  
 ■ 2009 HUB:\$42.01  
■ 2010 HUB:\$49.56  
 ■ 2011 HUB:\$46.67  
 ■ 2012 HUB:\$36.09  
 ■ 2013 HUB:\$56.05  
 ■ 2014 HUB:\$63.31

## Average RT Locational Marginal Prices: Marginal Loss Component RSP Sub-areas Differences From HUB



# ISO-NE Monthly Average RT Locational Marginal Prices at HUB



# Interface Details

- The New York-New England interface runs along the border between the New England Control Area and the New York Control Area. This interface is shown as (1) the Cross Sound Cable-central CT to Long Island, (2) Northport-Norwalk CT to Long Island, and (3) the rest of the AC lines. A positive sign on the data indicates power flow from New England to New York.
- The East-West interface runs south from northern Vermont, through central Massachusetts, and through Connecticut just west of the Rhode Island border. A positive sign on the data indicates power flow from East to West.
- The Maine-New Hampshire interface runs across part of southern Maine. A positive sign on the data indicates power flow from Maine to New Hampshire.
- The BOSTON import interface surrounds the northeastern area of Massachusetts, from the NH/MA border to just south of Boston. A positive sign *indicates power flow into NEMA/BOSTON from the rest of New England.*



# Interface Details, *cont.*

- The Southeastern Massachusetts/Rhode Island (SEMA/RI) export interface surrounds Massachusetts south of Boston and all of the state of Rhode Island. The western edge of the interface is the same as parts of the East-West and BOSTON import interfaces. A positive sign on the data indicates power flow into the rest of New England from SEMA/RI.
- The Connecticut Import interface surrounds most of the state of Connecticut. Its eastern edge is the same as parts of the East-West and SEMA/RI export interfaces. A positive sign indicates power flow into Connecticut from the rest of New England.
- The Southwest Connecticut import interface surrounds the southwestern corner of Connecticut. A positive sign indicates power flow into southwest Connecticut.
- The Norwalk-Stamford interface surrounds the extreme southwestern portion of southwest Connecticut, and lies within the Southwest Connecticut import interface. A positive sign indicates power flow into the region.



## Interface Details, *cont.*

- The North - South interface runs across the southern borders of New Hampshire and Vermont, dividing the ISO-NE area into two separate three-state regions. A positive sign on the data indicates power flow from North to South.
- The Orrington South interface separates the areas north and east of Bangor from the rest of Maine. A positive sign indicates a southwest power flow towards Portland.
- The Surowiec South interface is just northeast of Portland, and lies across the lines going southwest from Maine Yankee, roughly separating southern ME from the rest of the state. A positive sign indicates power flow into the S-ME subarea.
- The New Brunswick interface connects New England to the Maritimes. A positive sign indicates power flow from New England to the Maritimes.
- The HQ Phase II interface connects New England to the Hydro Quebec System. A positive sign indicates power flow from New England to HQ.

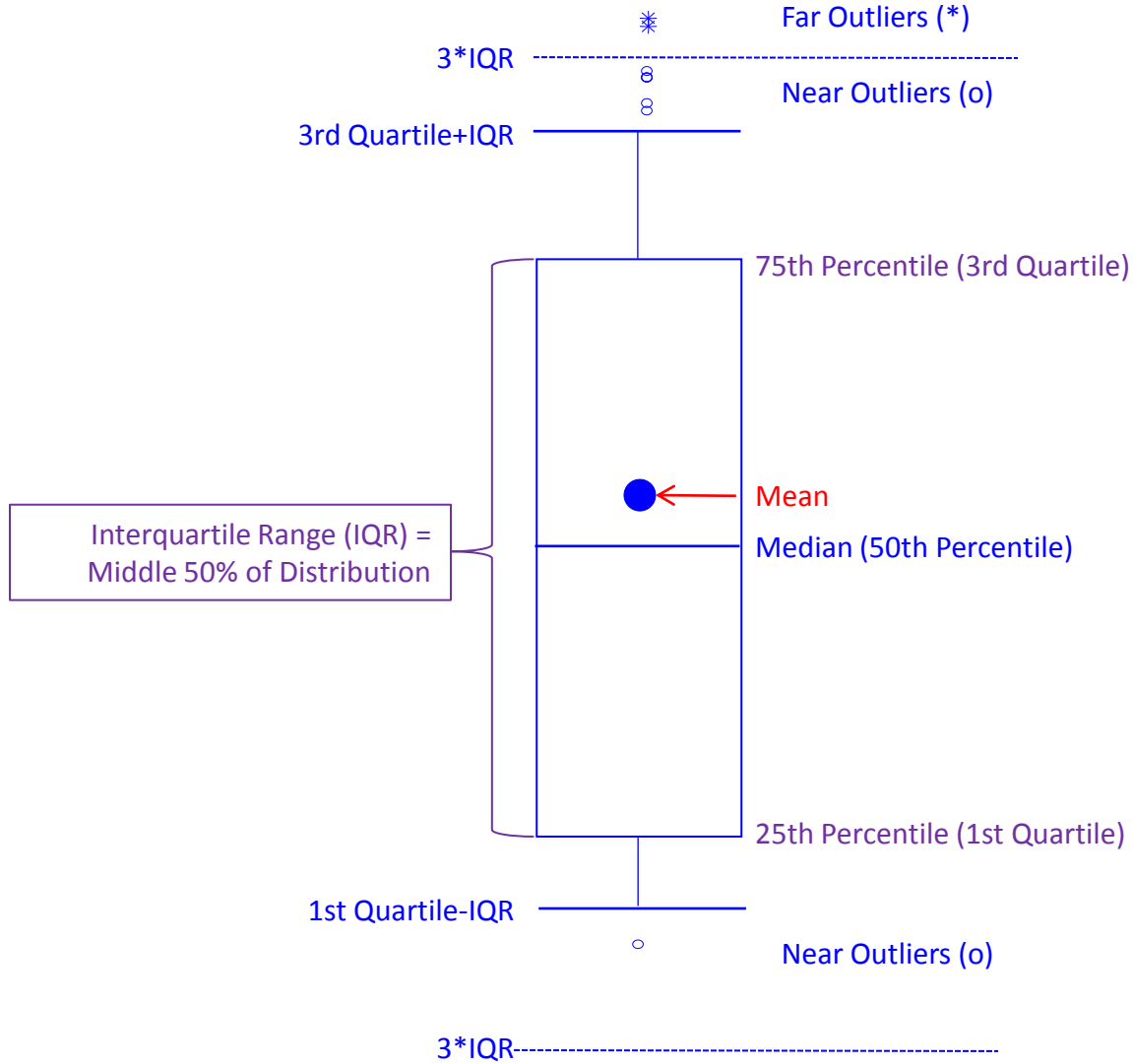




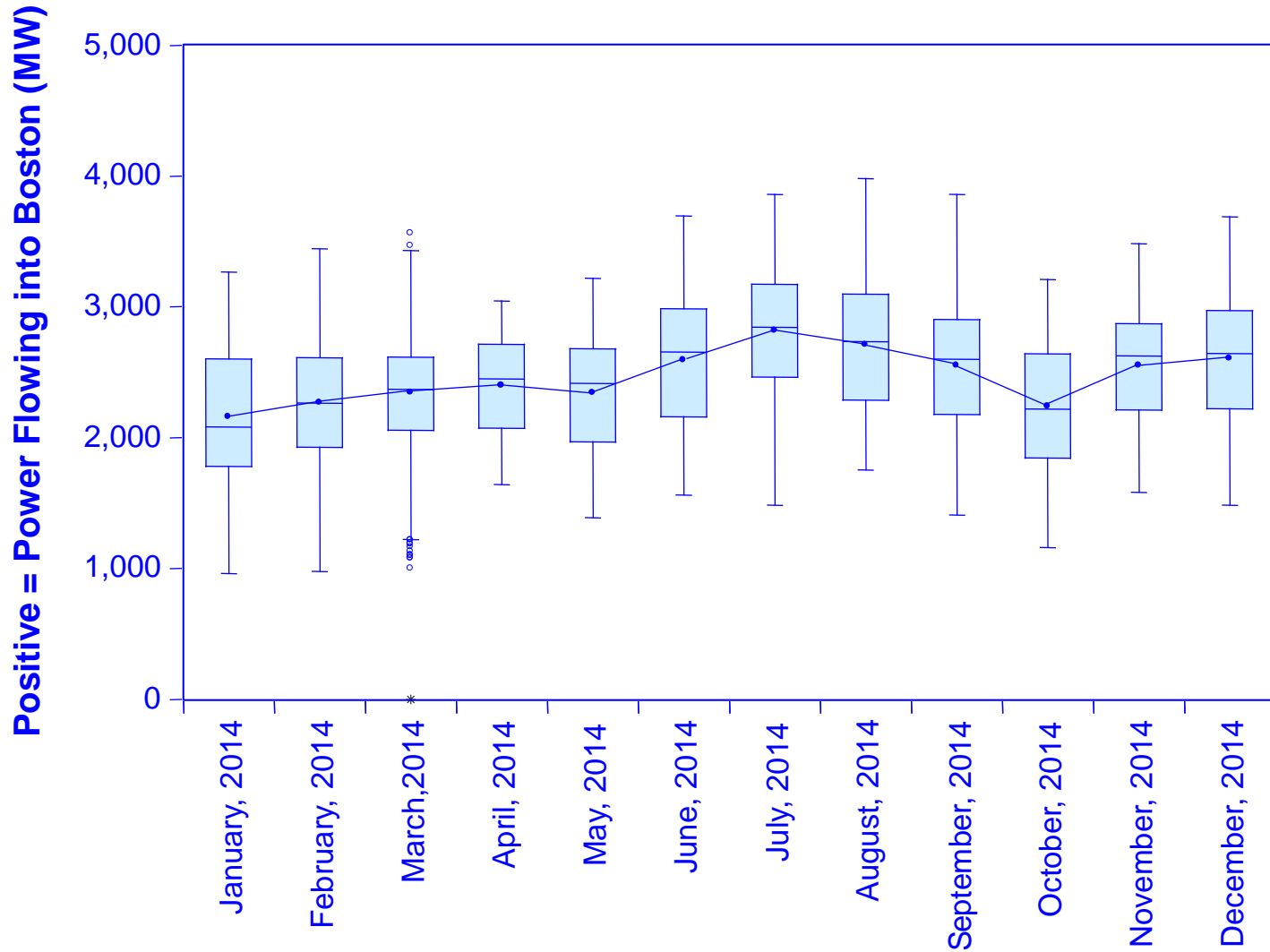
# Interface Details, *cont.*

- The East to West CT interface is generally west of the Connecticut river, excluding the Hartford area. A positive sign on the data indicates power flow from East to West.
- On-peak hours are defined as non-holiday weekdays from 8 AM to 11 PM.
- For a technical description of the interfaces see the “Generic Interface Constraints” spreadsheet at:
  - [p://www.iso-ne.com/markets/hrly\\_data/support\\_docs/generic\\_interface\\_constraints.xls](p://www.iso-ne.com/markets/hrly_data/support_docs/generic_interface_constraints.xls)

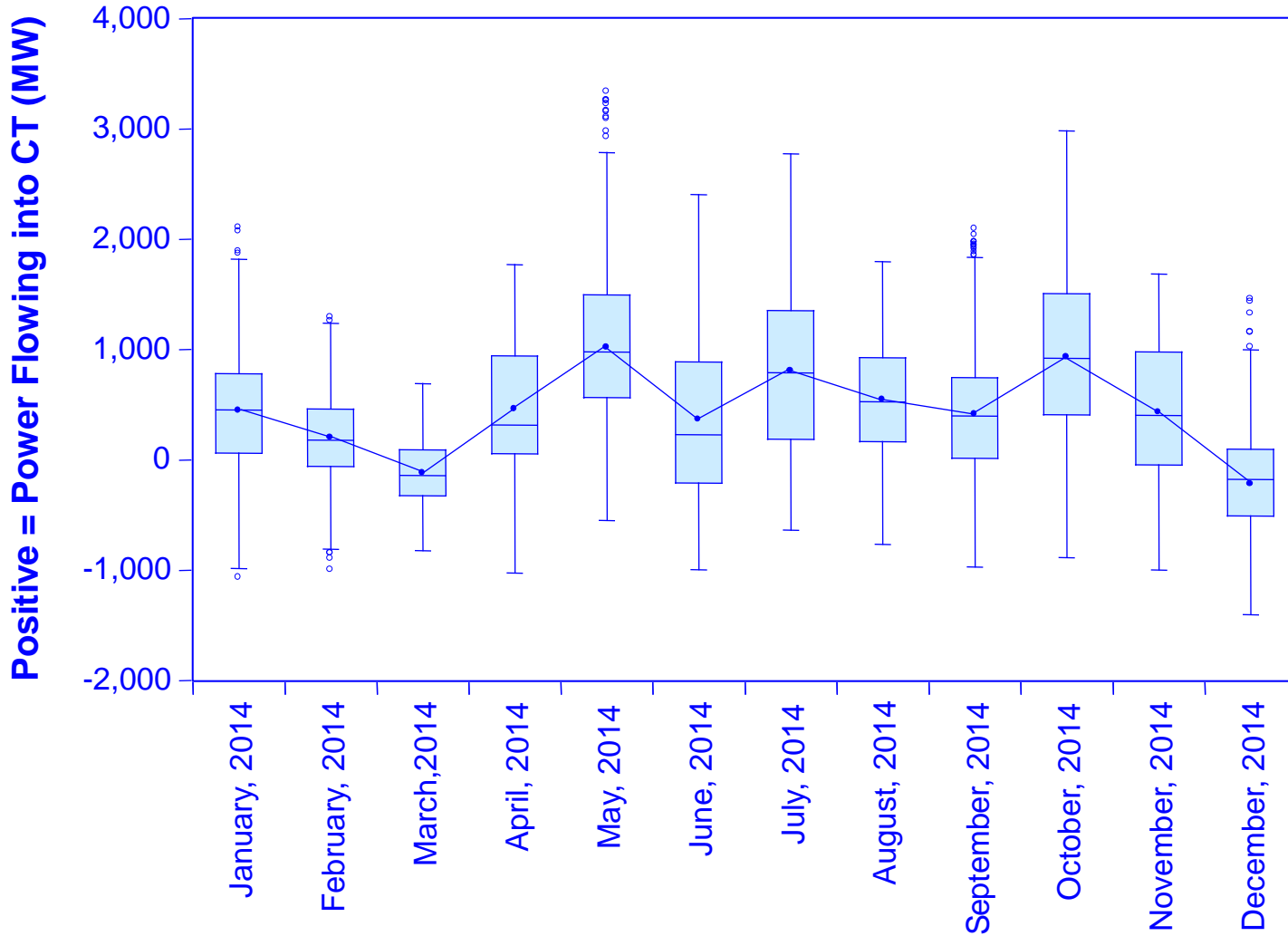
# Boxplot Key



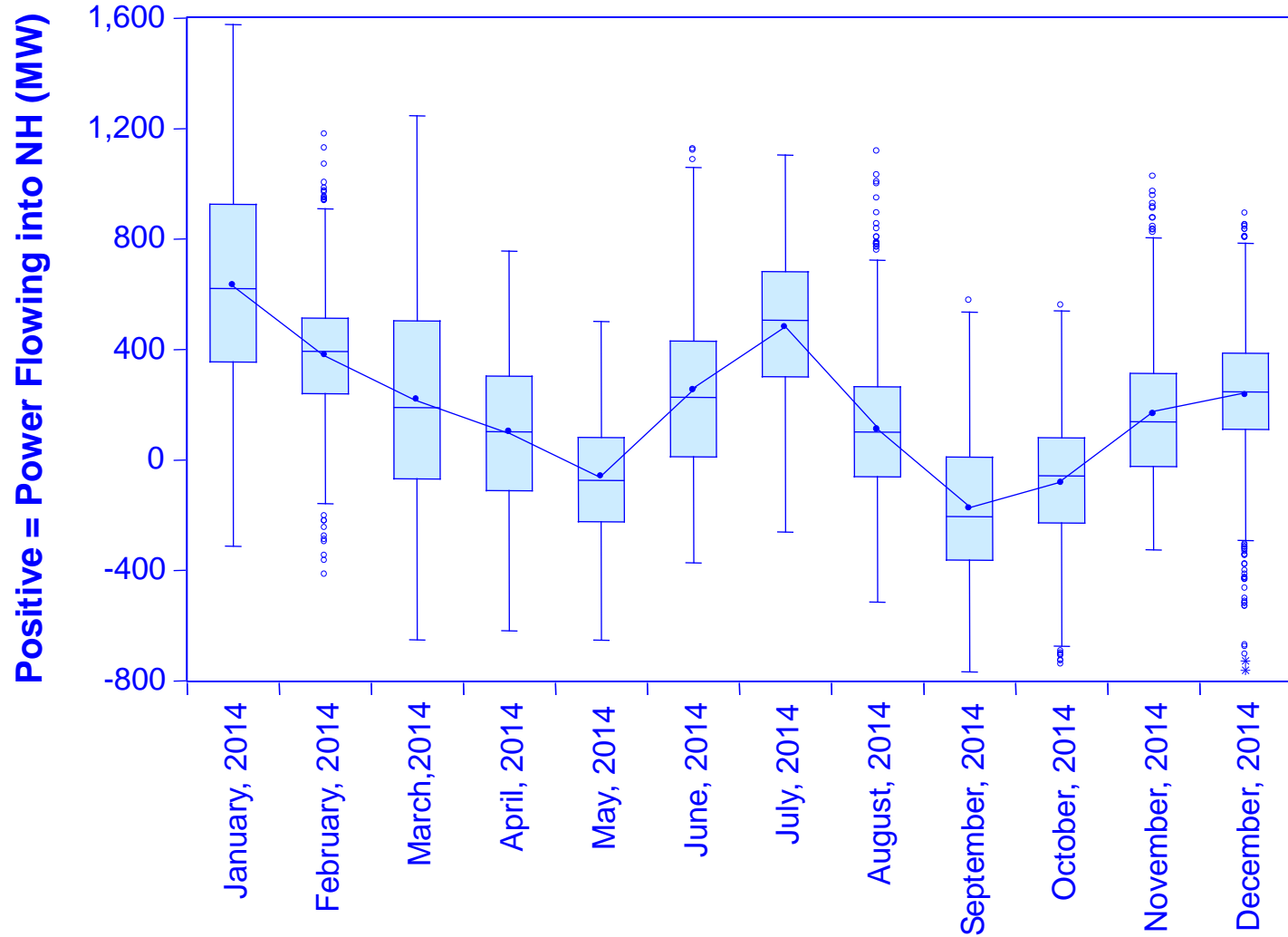
# Boston Import Interface Net Flow by Month



# Connecticut Import Interface Net Flow by Month

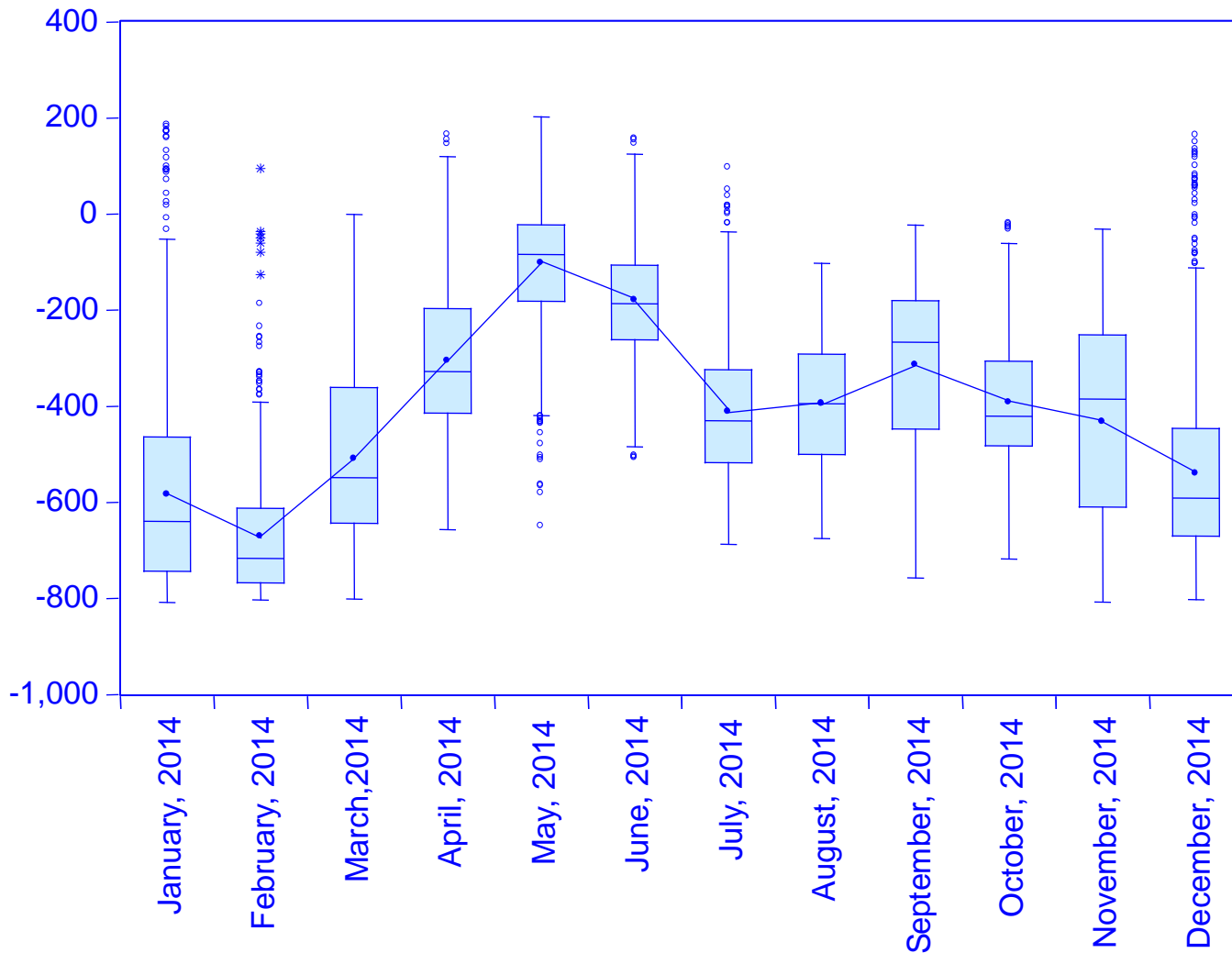


# Maine-New Hampshire Interface Net Flow by Month

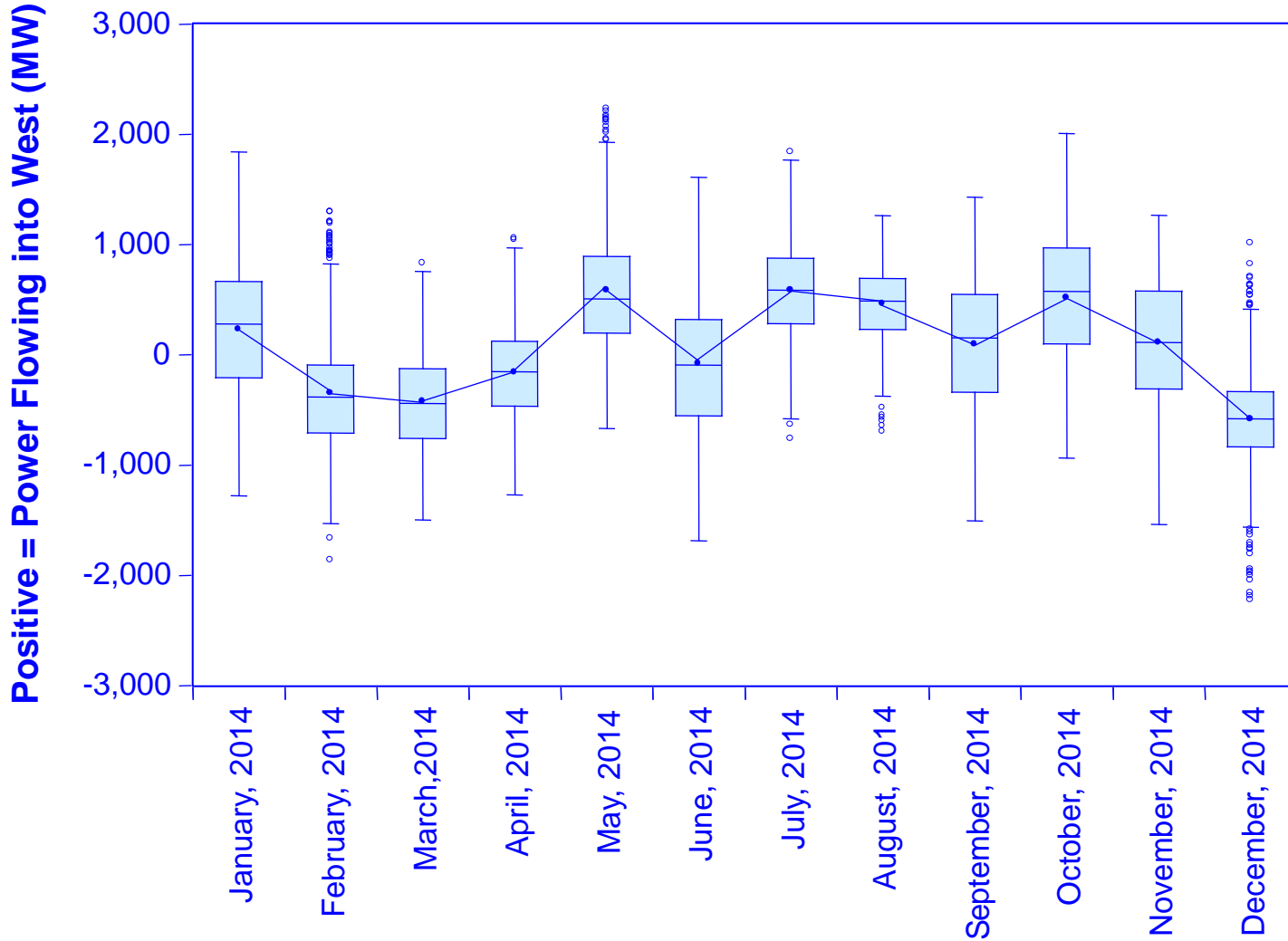


# New Brunswick Interface Net Flow by Month

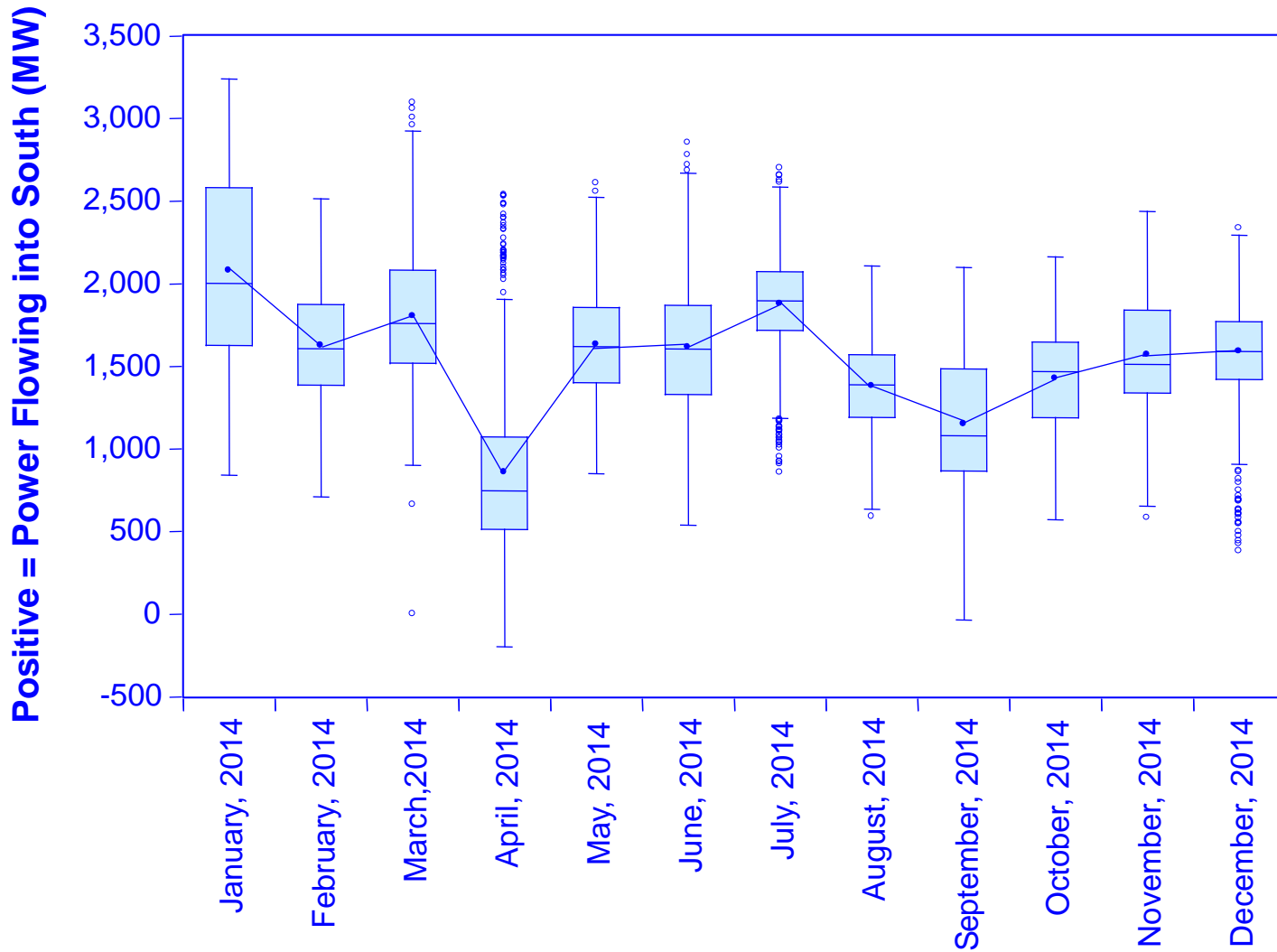
Positive = Power Flowing out of New England (MW)



# East-West Interface Net Flow by Month



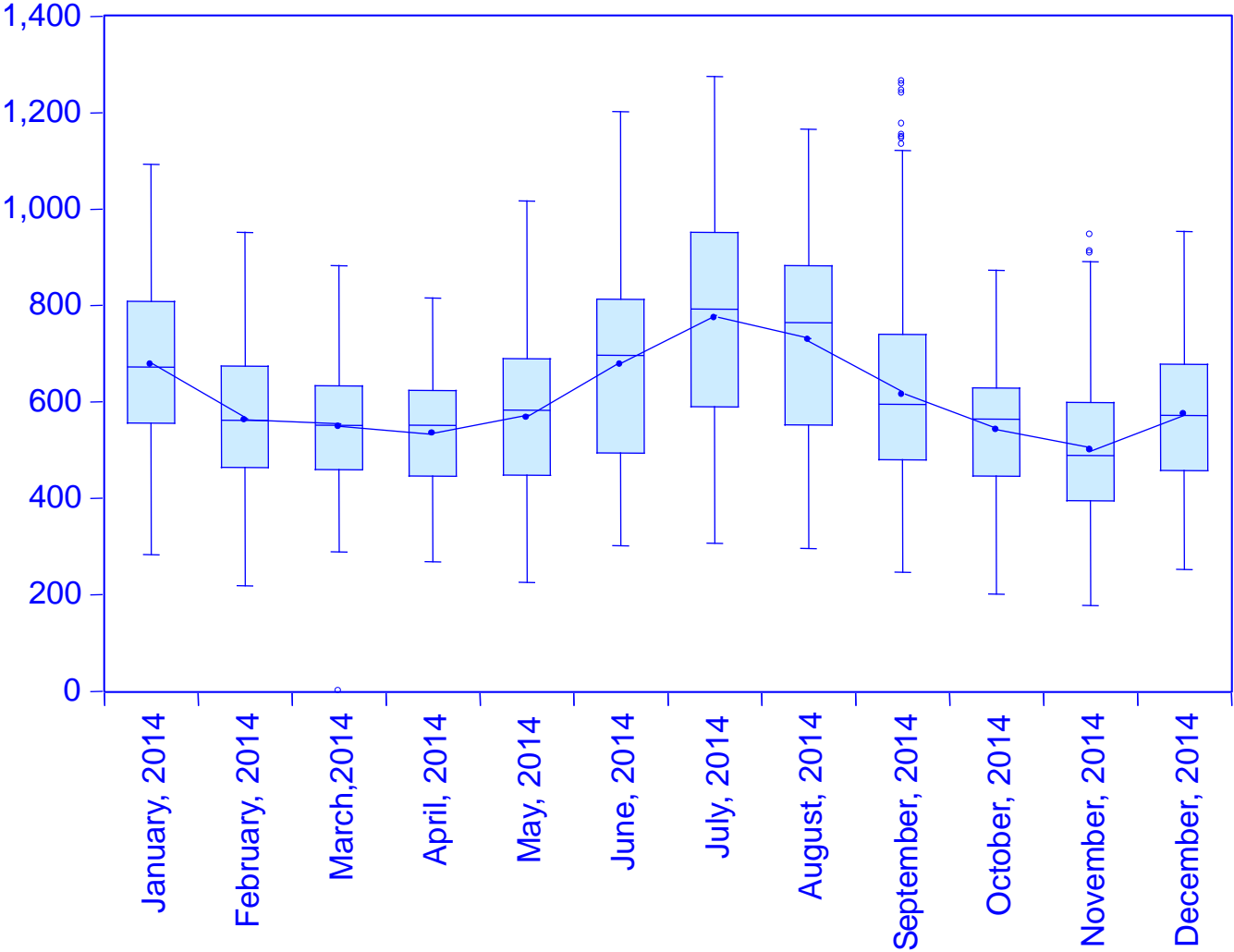
# North-South Interface Net Flow by Month





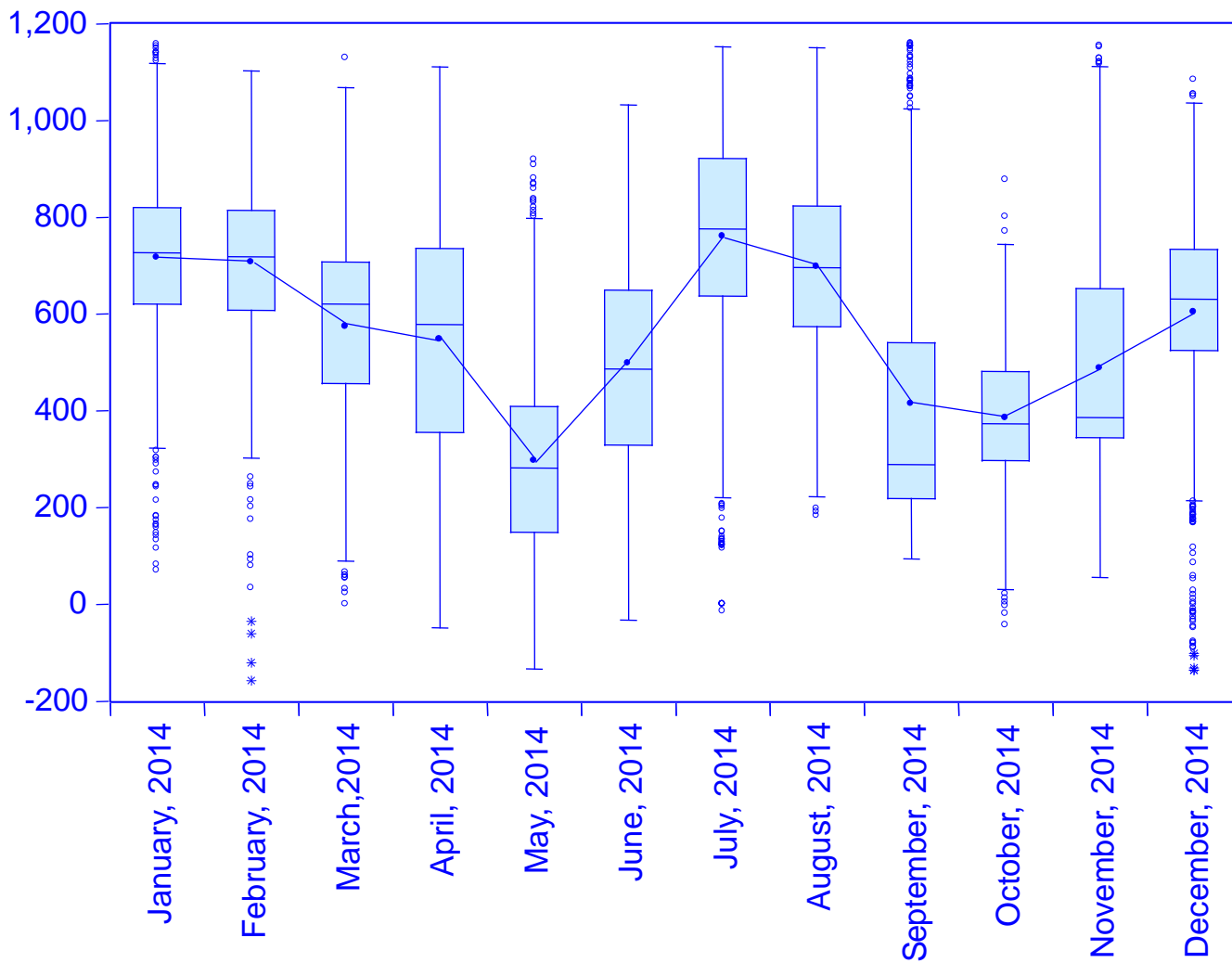
# Norwalk-Stamford Interface Net Flow by Month

Positive = Power Flowing into NOR Sub-area (MW)



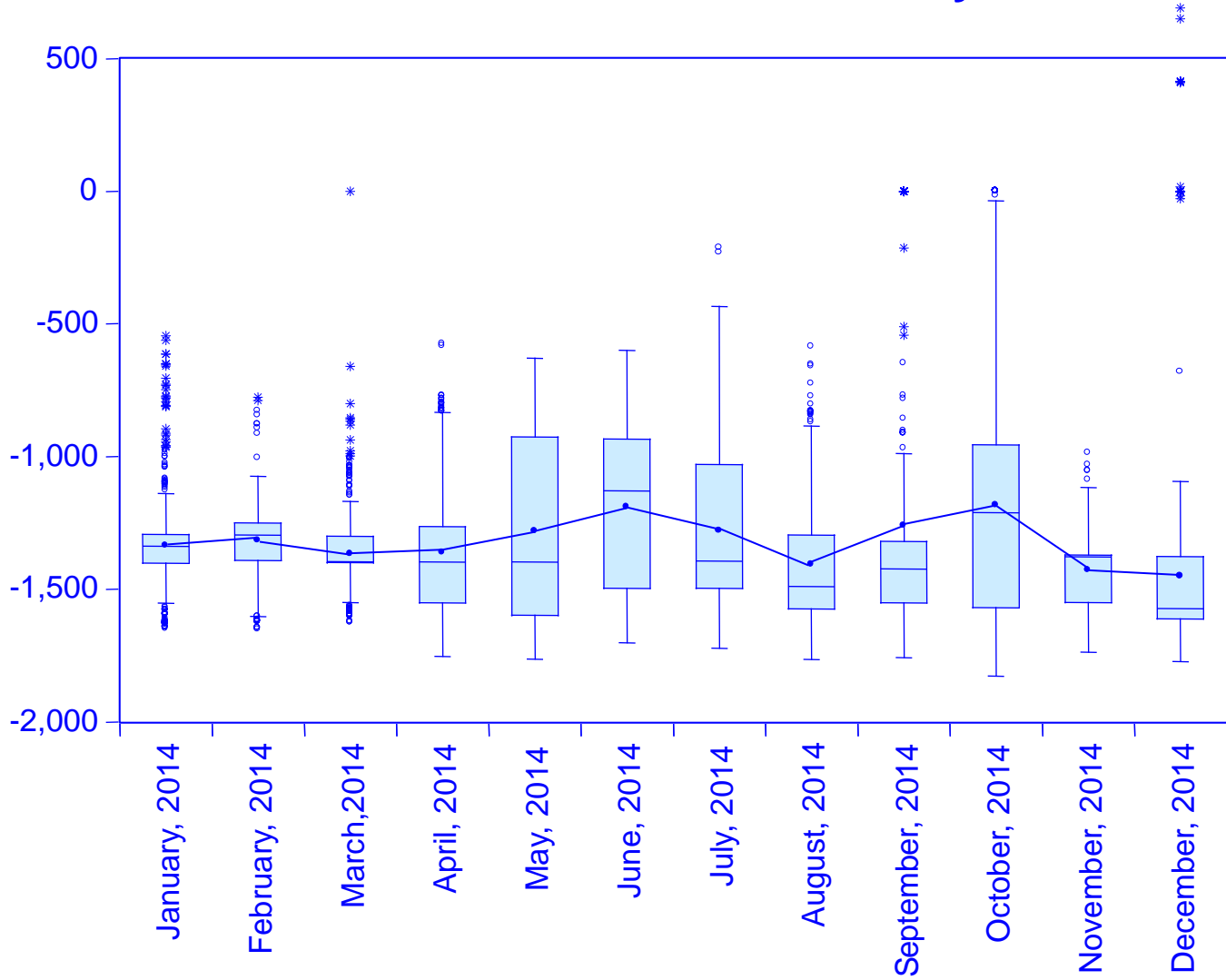
# Orrington-South Interface Net Flow by Month

Positive = Power Flowing into ME Sub-area (MW)



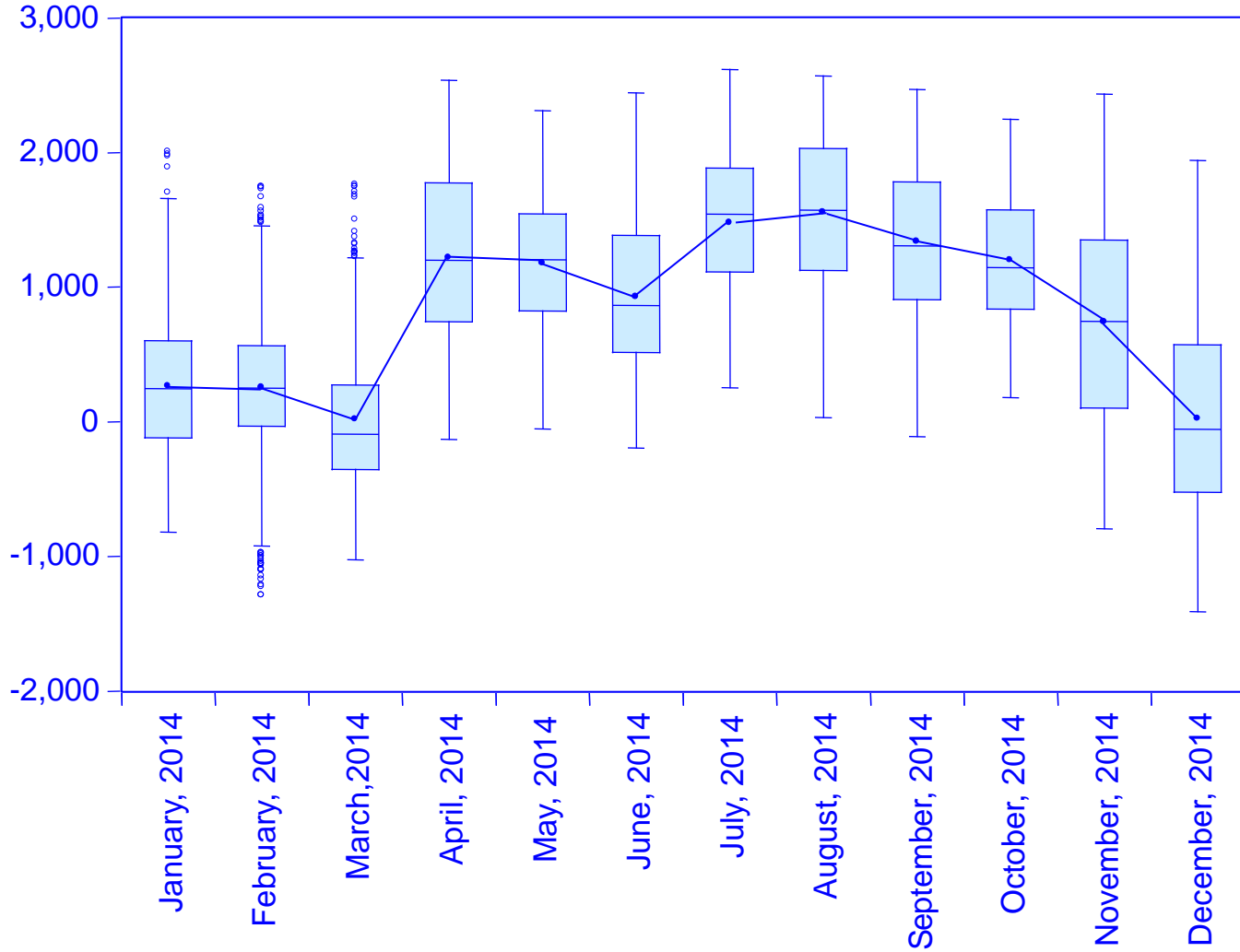
Positive = Power Flowing out of New England (MW)

## HQ Phase II Interface Net Flow by Month



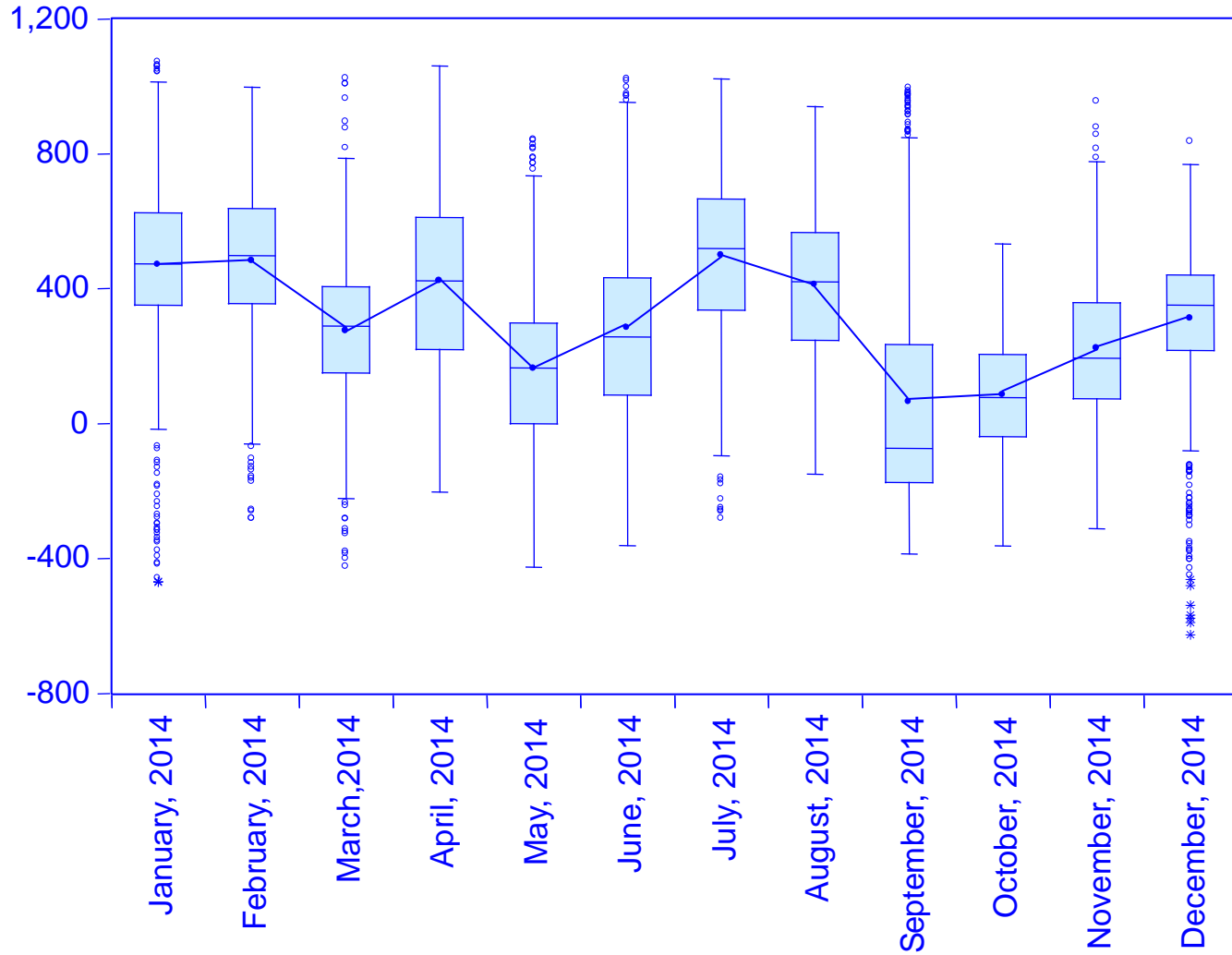
# SEMA-Rhode Island Interface Net Flow by Month

Positive = Power Flowing out of SEMA/RI (MW)

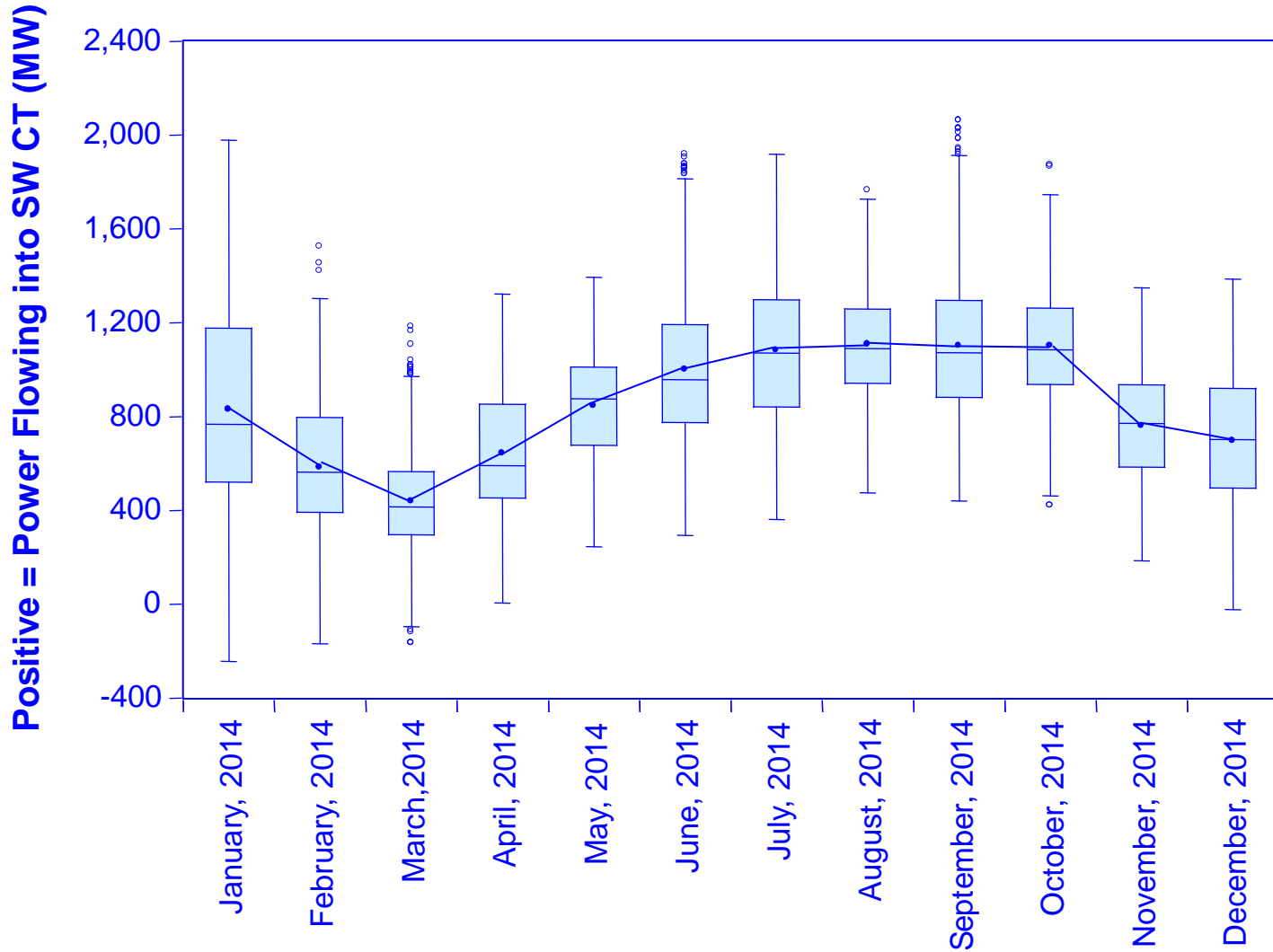


Positive = Power Flowing into S-ME Sub-area (MW)

## Surowiec South Interface Net Flow by Month

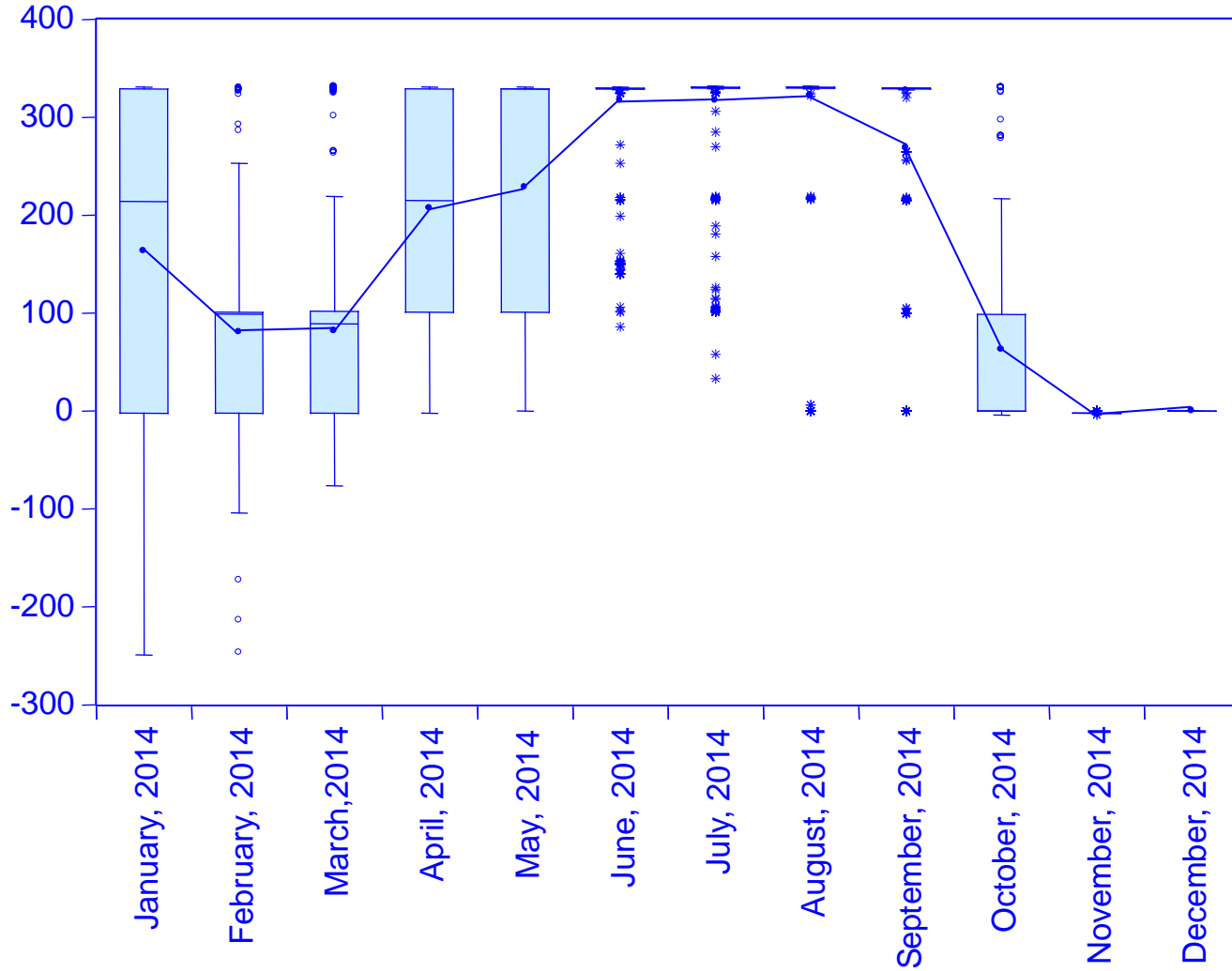


# Southwest Connecticut Import Interface Net Flow by Month



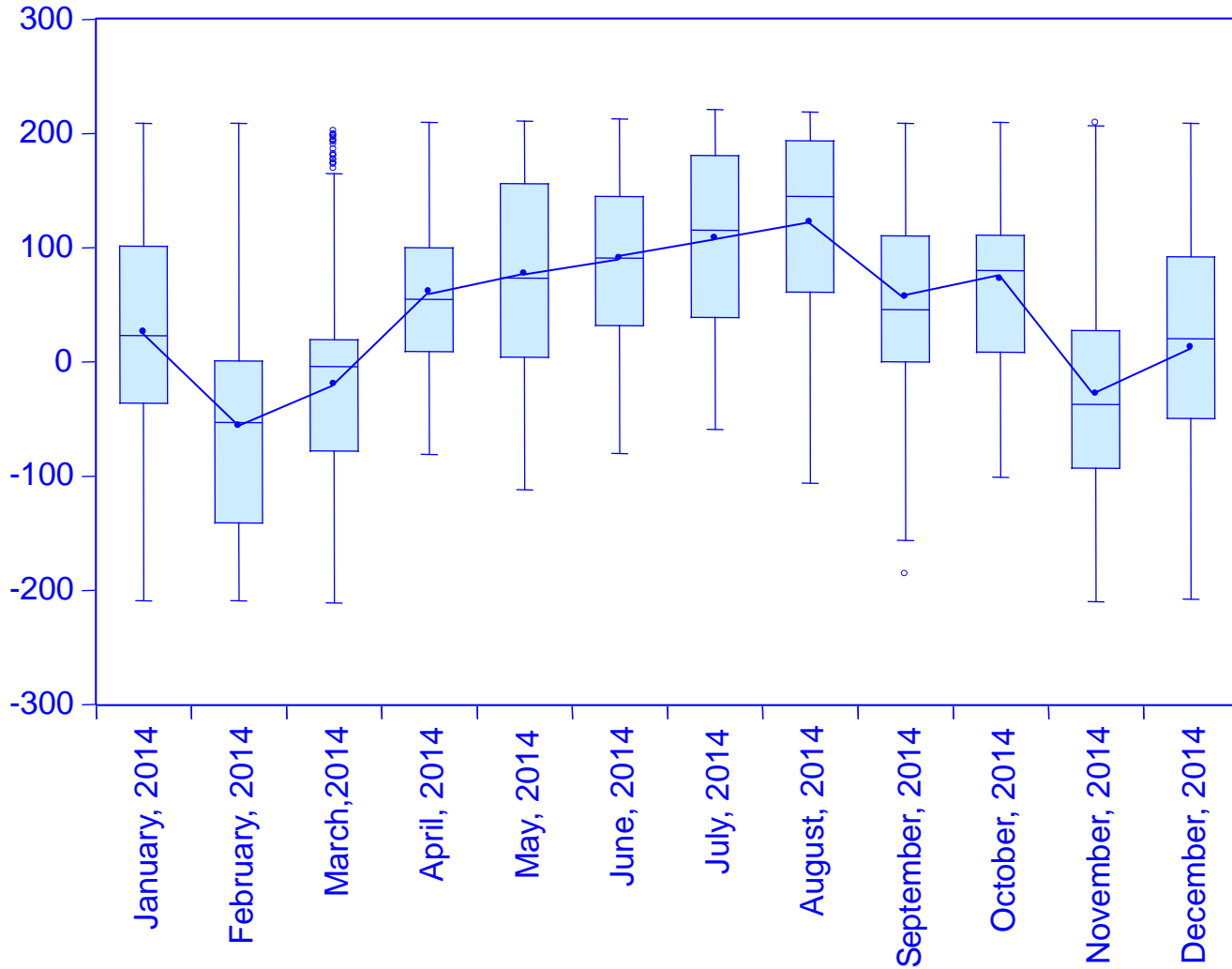
Positive = Power Flowing out of New England (MW)

## NE-NY Cross Sound Cable Interface Net Flow by Month



# NE-NY Northport Interface Net Flow by Month

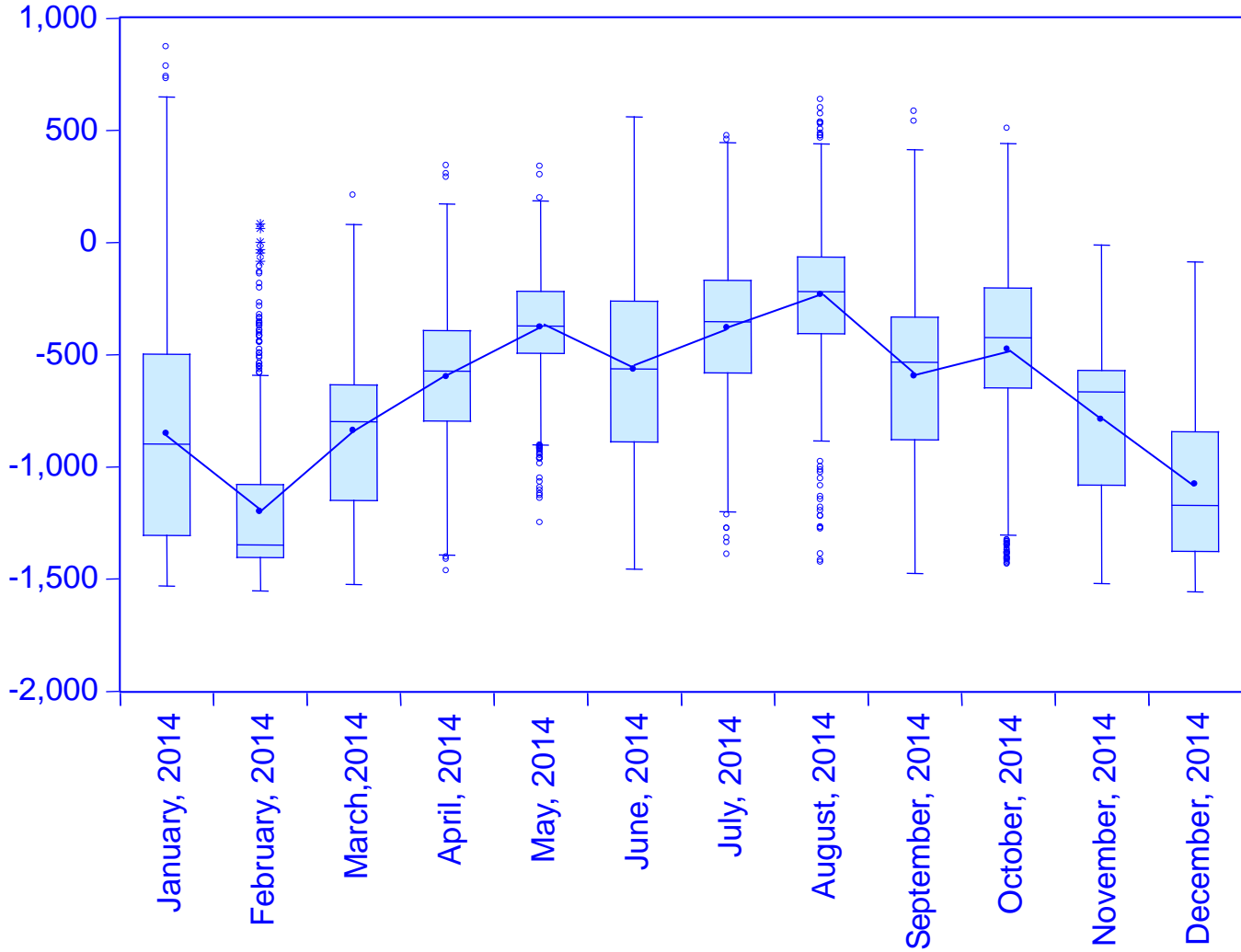
Positive = Power Flowing out of New England (MW)



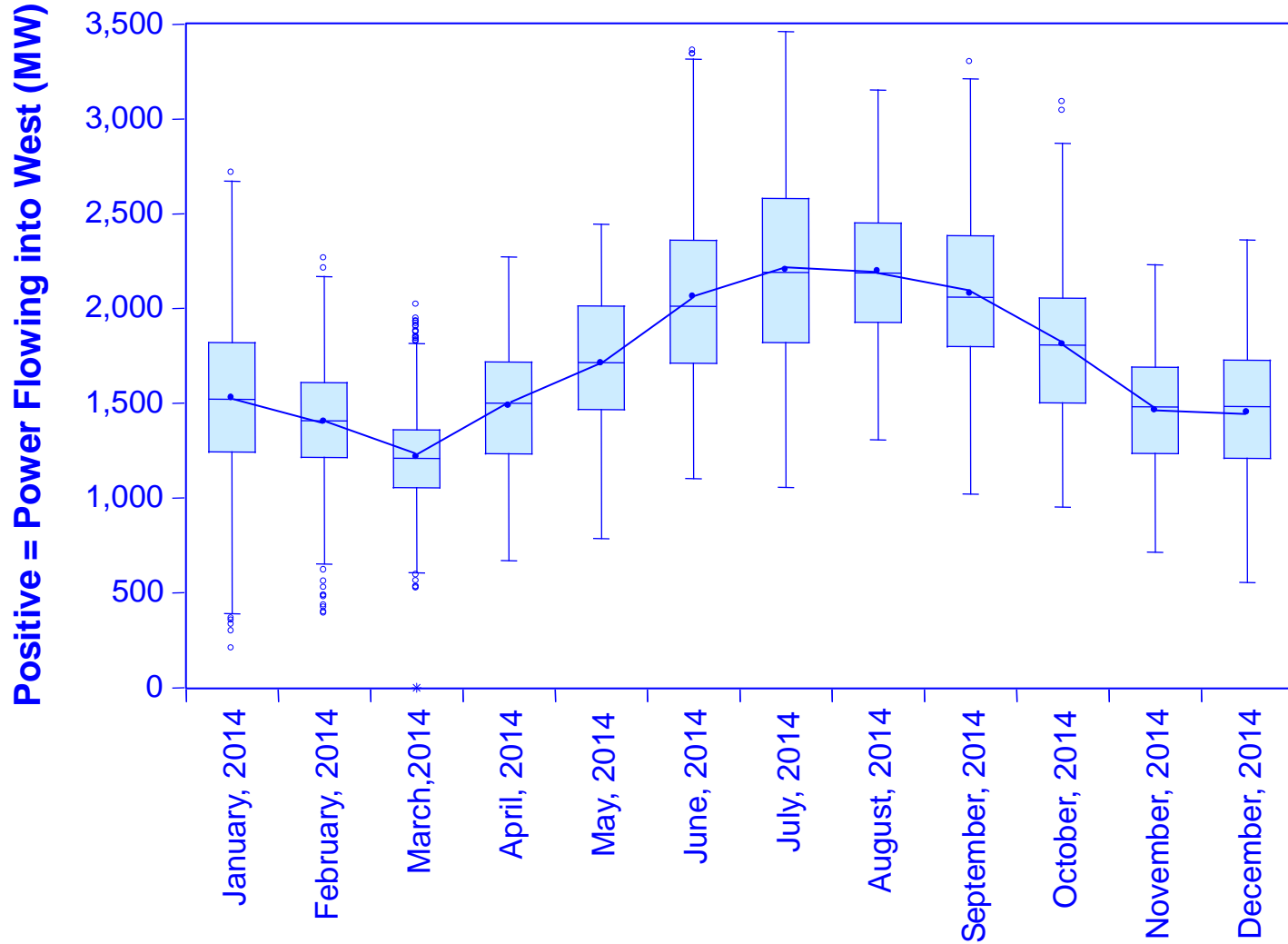


# NE-NY Rest of AC Ties Net Flow by Month

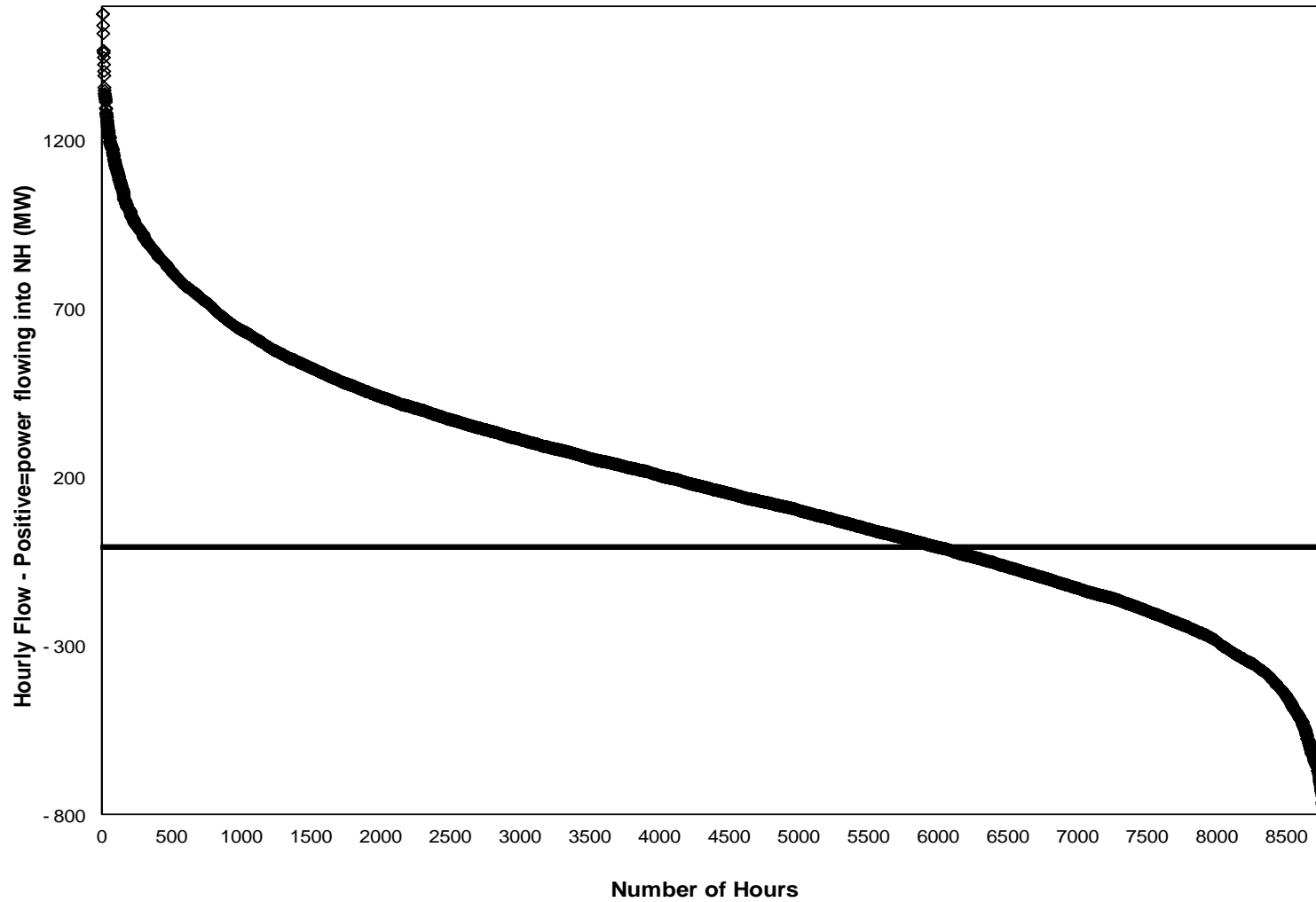
Positive = Power Flowing out of New England (MW)



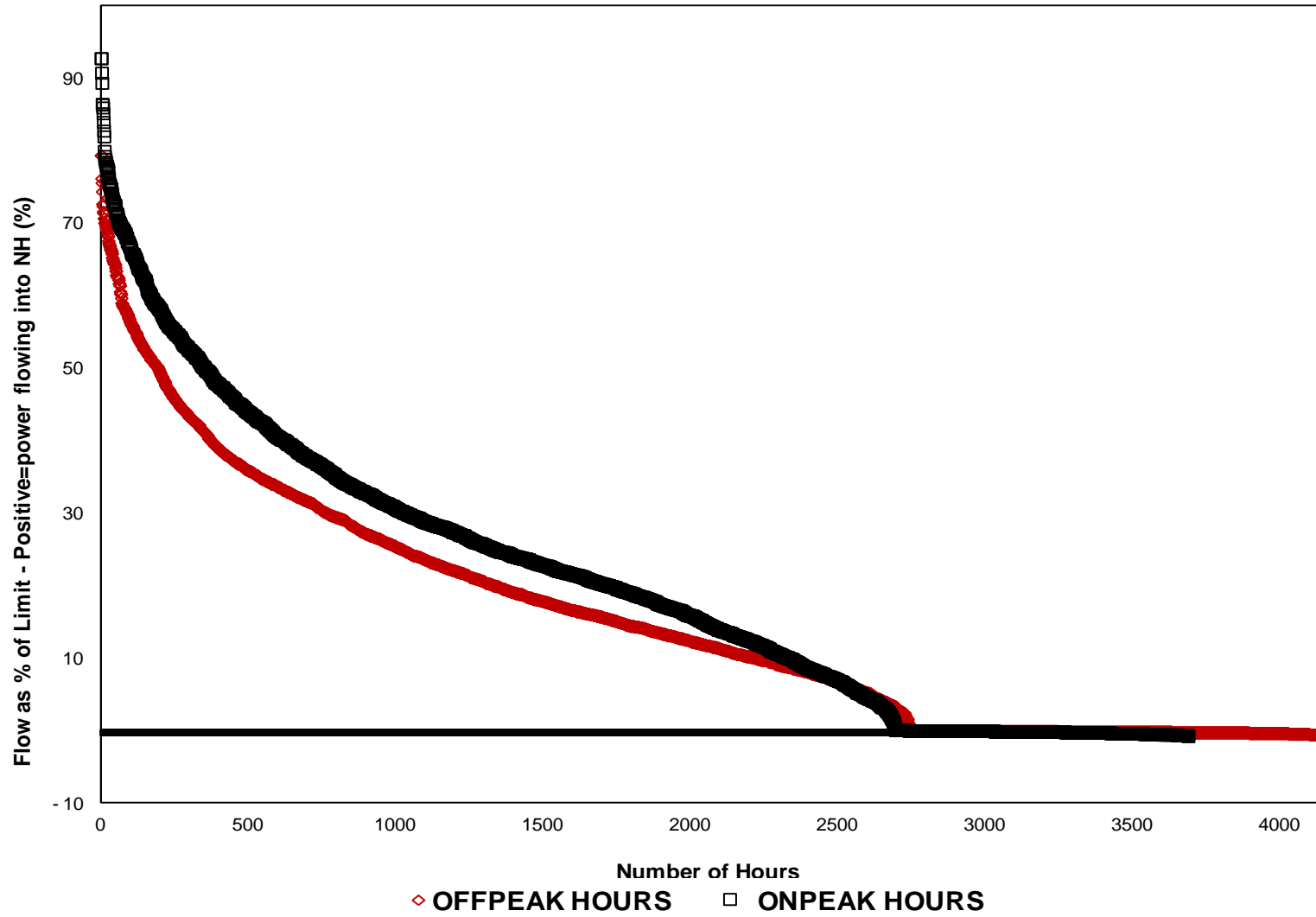
# CT East-West Interface Net Flow by Month



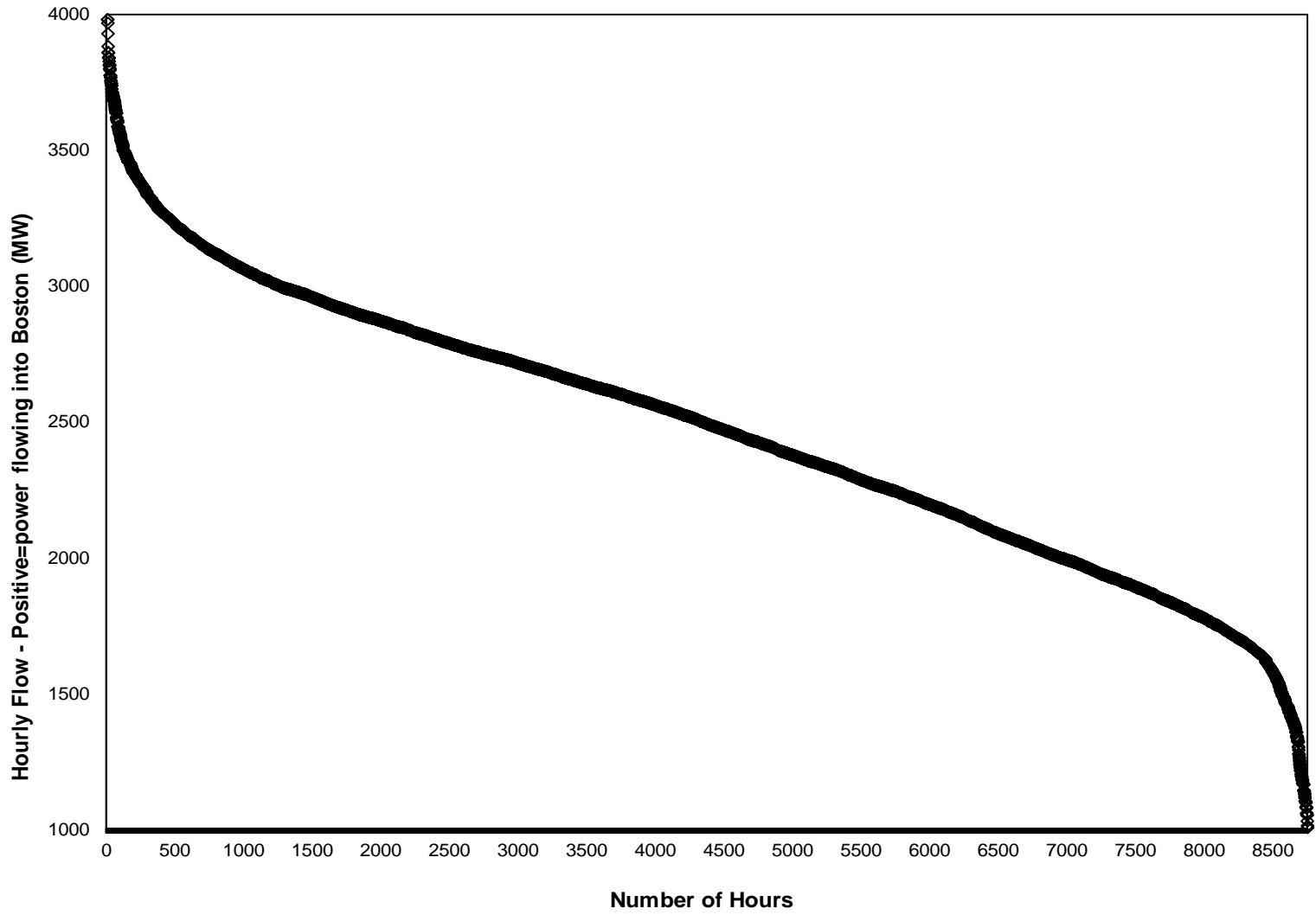
### Maine-New Hampshire Interface Duration Curve: Net Flow MWs January - December 2014



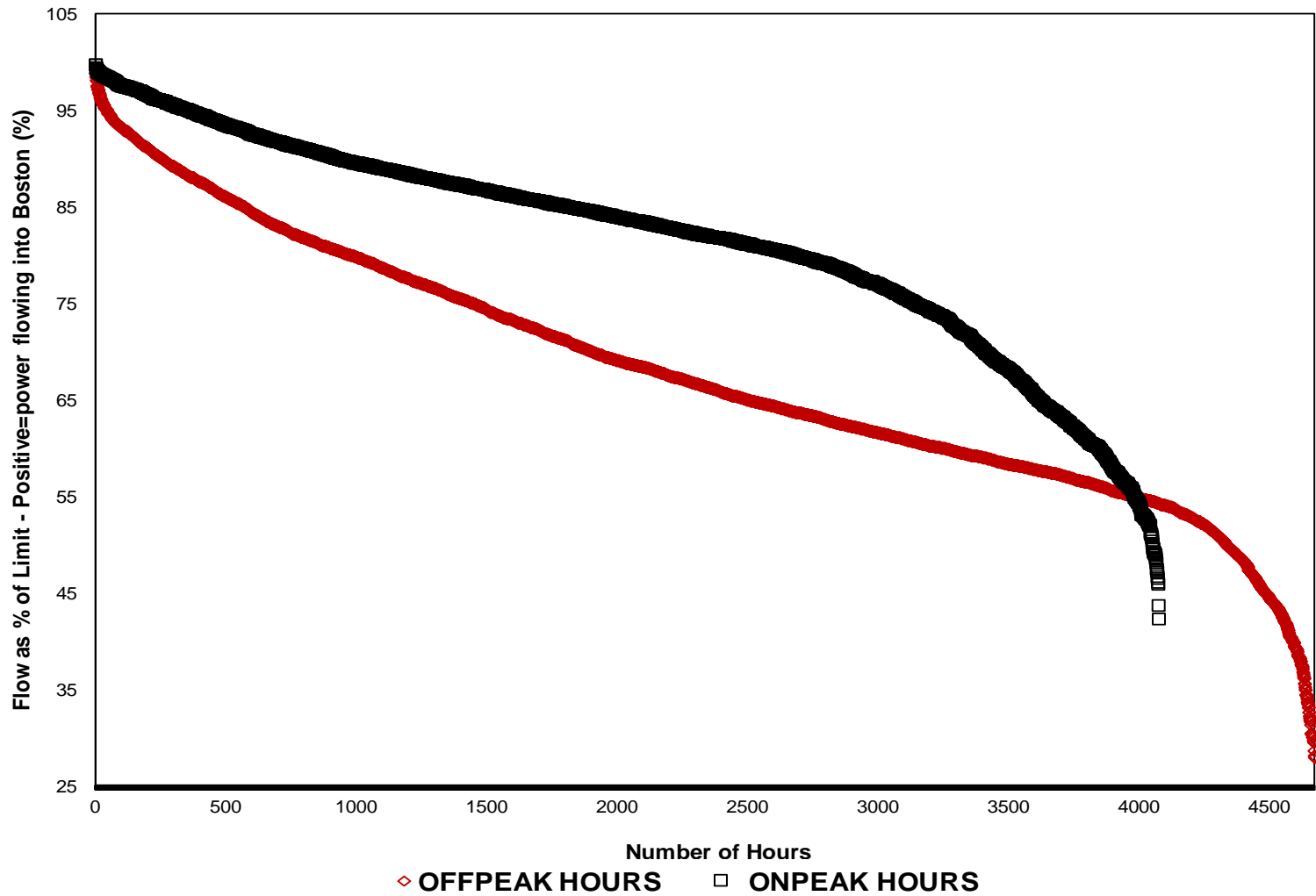
### Maine-New Hampshire Interface Duration Curve: Net Flow as % of Interface Limit January - December 2014



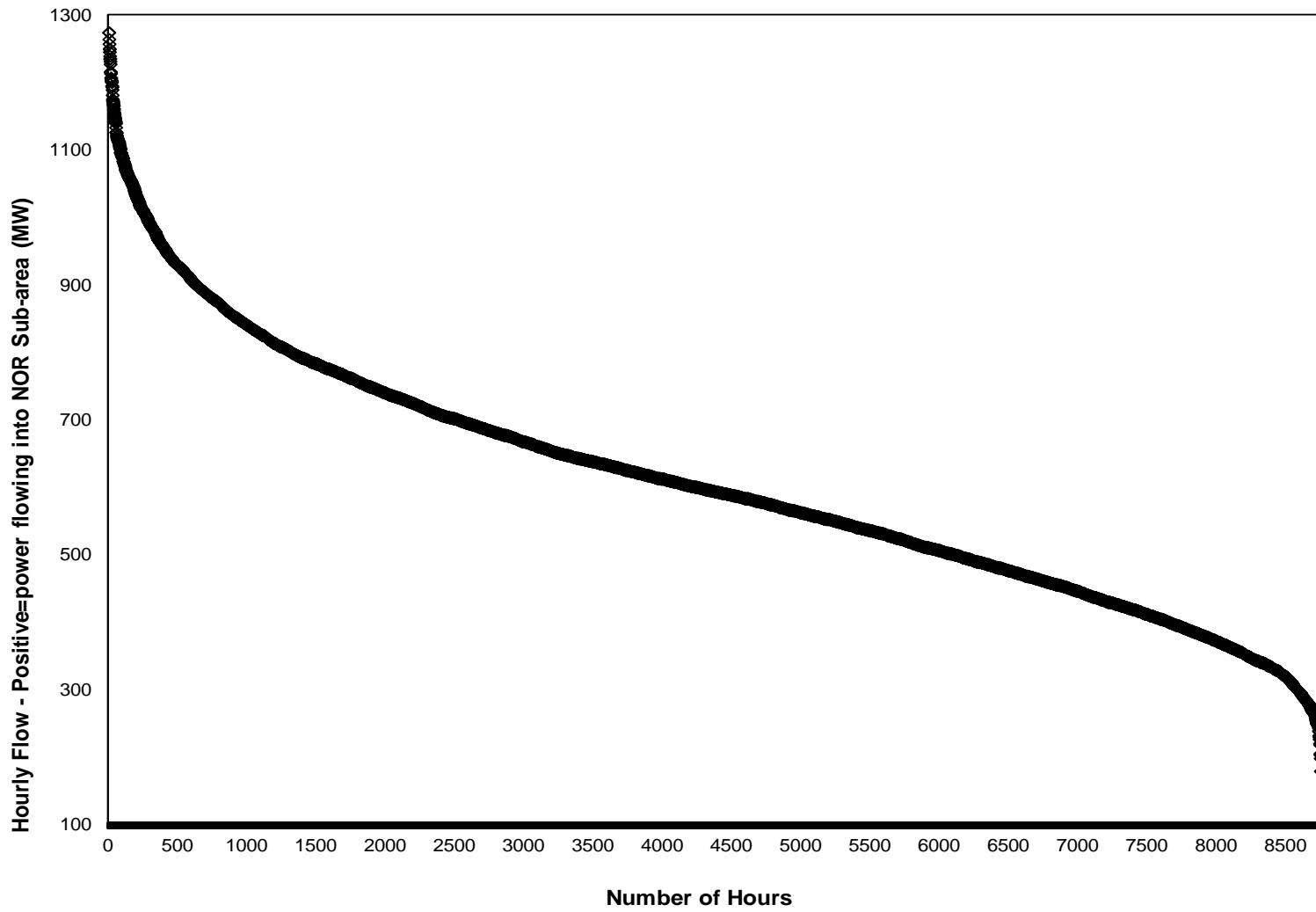
**Boston Import Interface Duration Curve: Net Flow MWs  
January - December 2014**



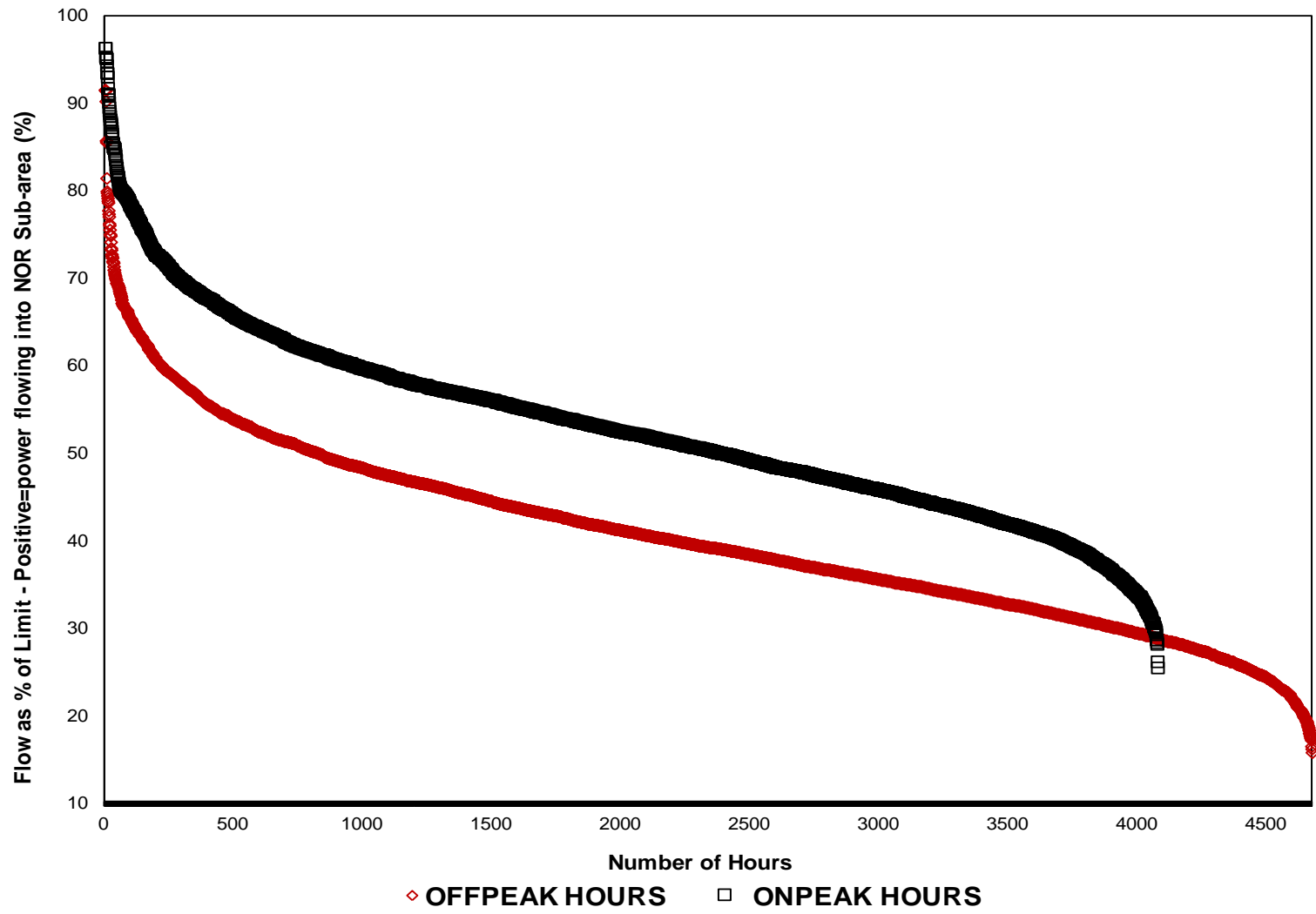
**Boston Import Interface Duration Curve: Net Flow as % of Interface Limit  
January - December 2014**



**Norwalk-Stamford Interface Duration Curve: Net Flow MWs  
January - December 2014**

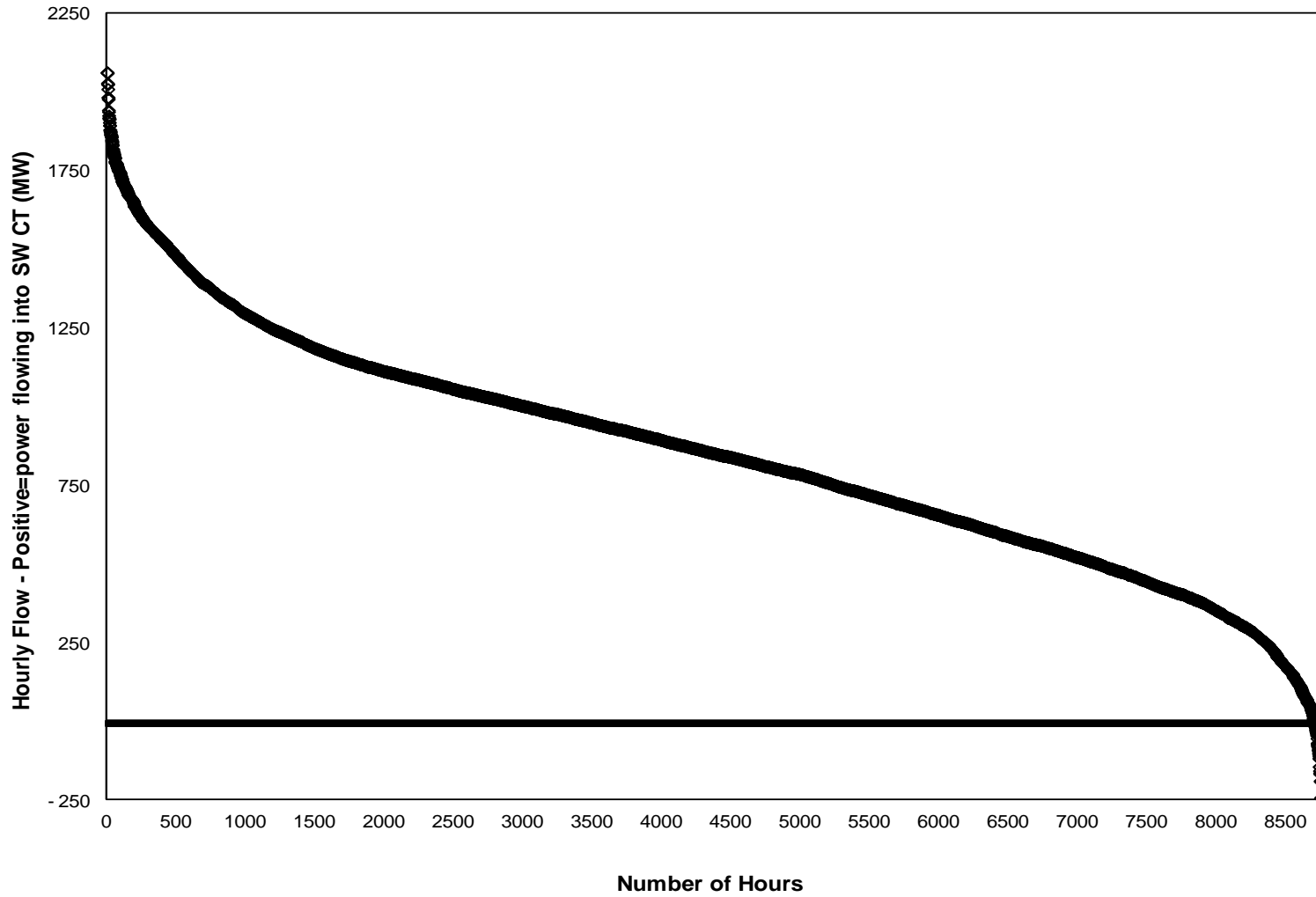


### Norwalk-Stamford Interface Duration Curve: Net Flow as % of Interface Limit January - December 2014

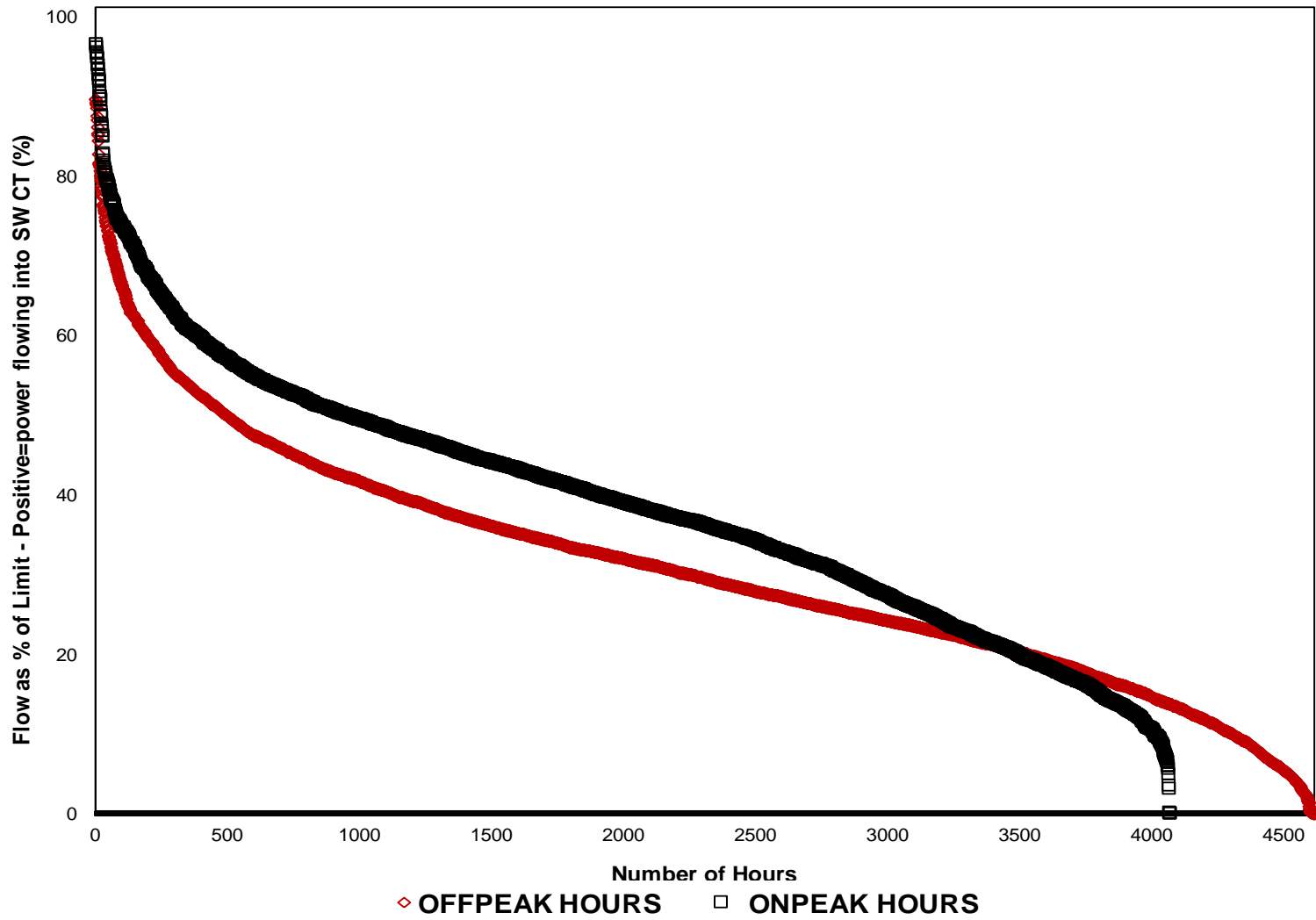




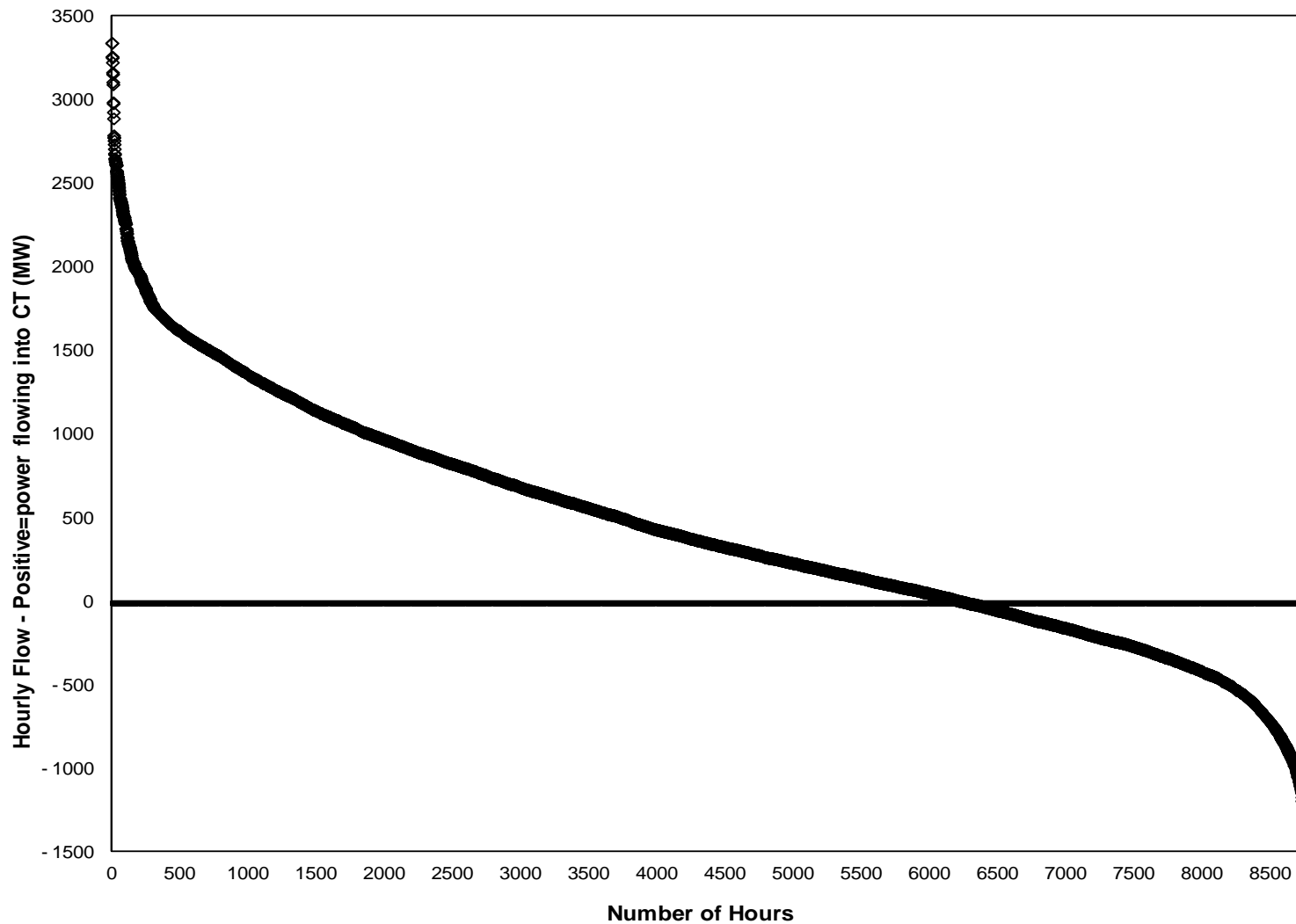
Southwest CT Import Interface Duration Curve: Net Flow MWs  
January - December 2014



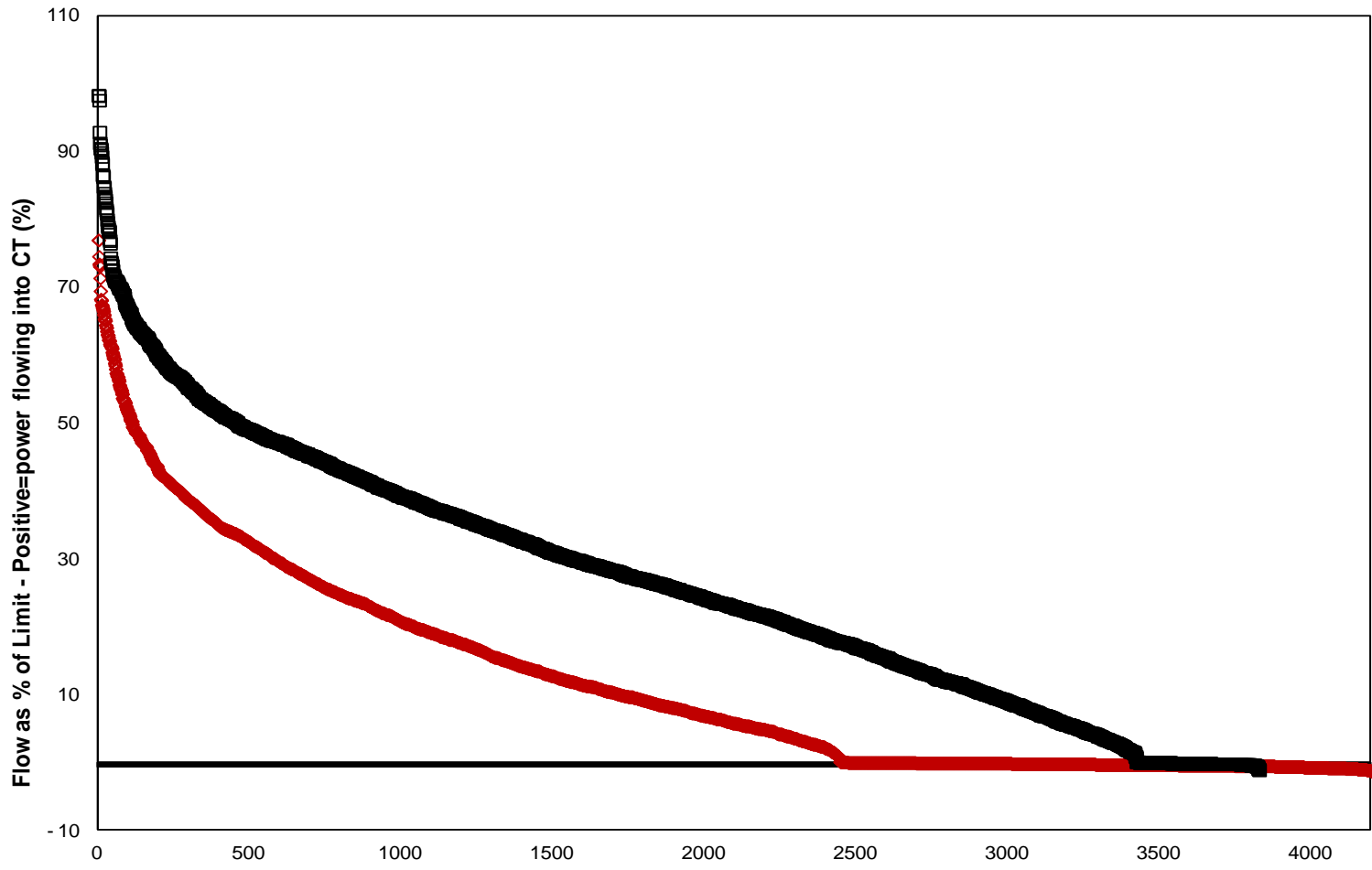
### Southwest CT Import Interface Duration Curve: Net Flow as % of Interface Limit January - December 2014



### Connecticut Import Interface Duration Curve: Net Flow MWs January - December 2014

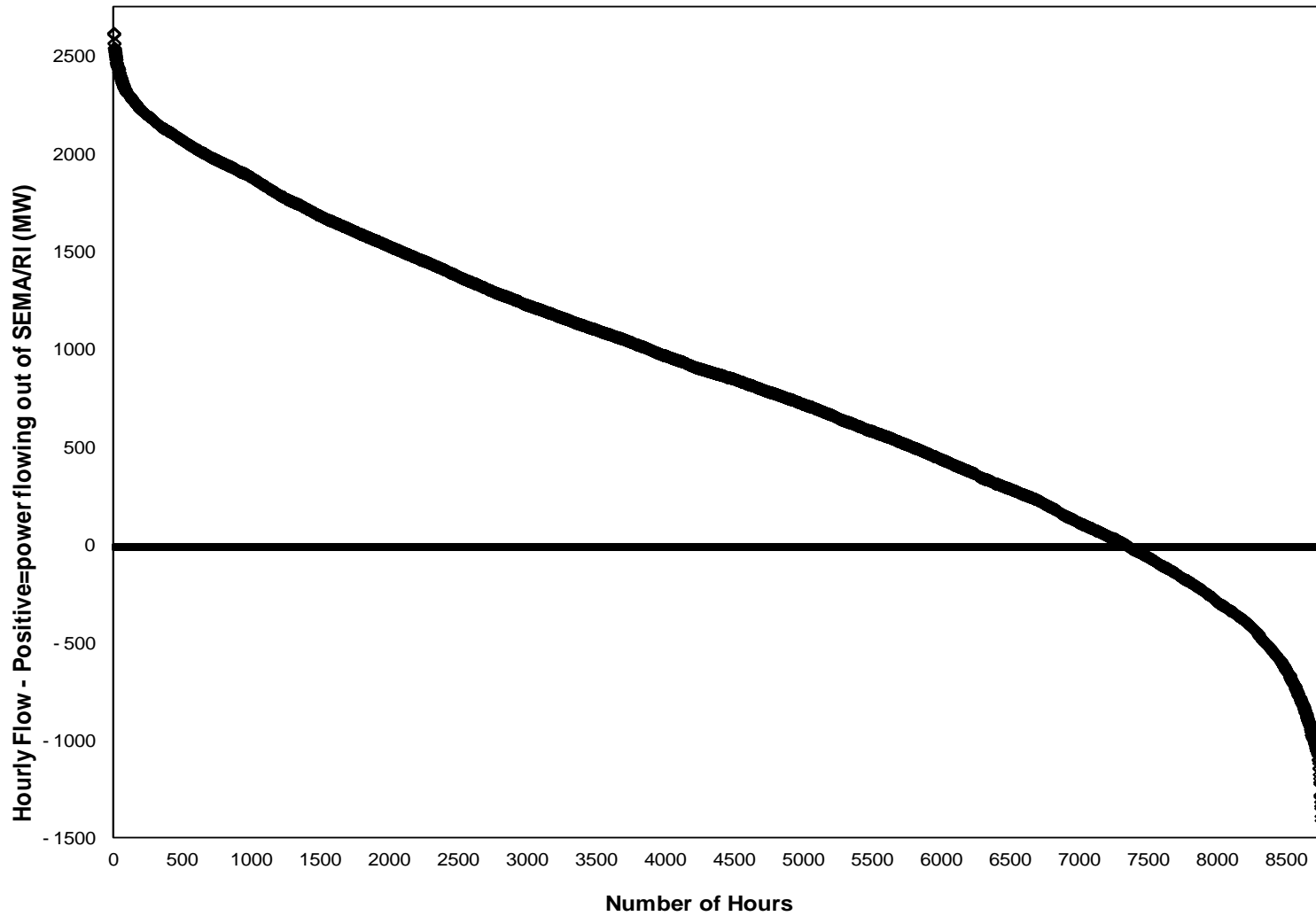


### Connecticut Import Interface Duration Curve: Net Flow as % of Interface Limit January - December 2014

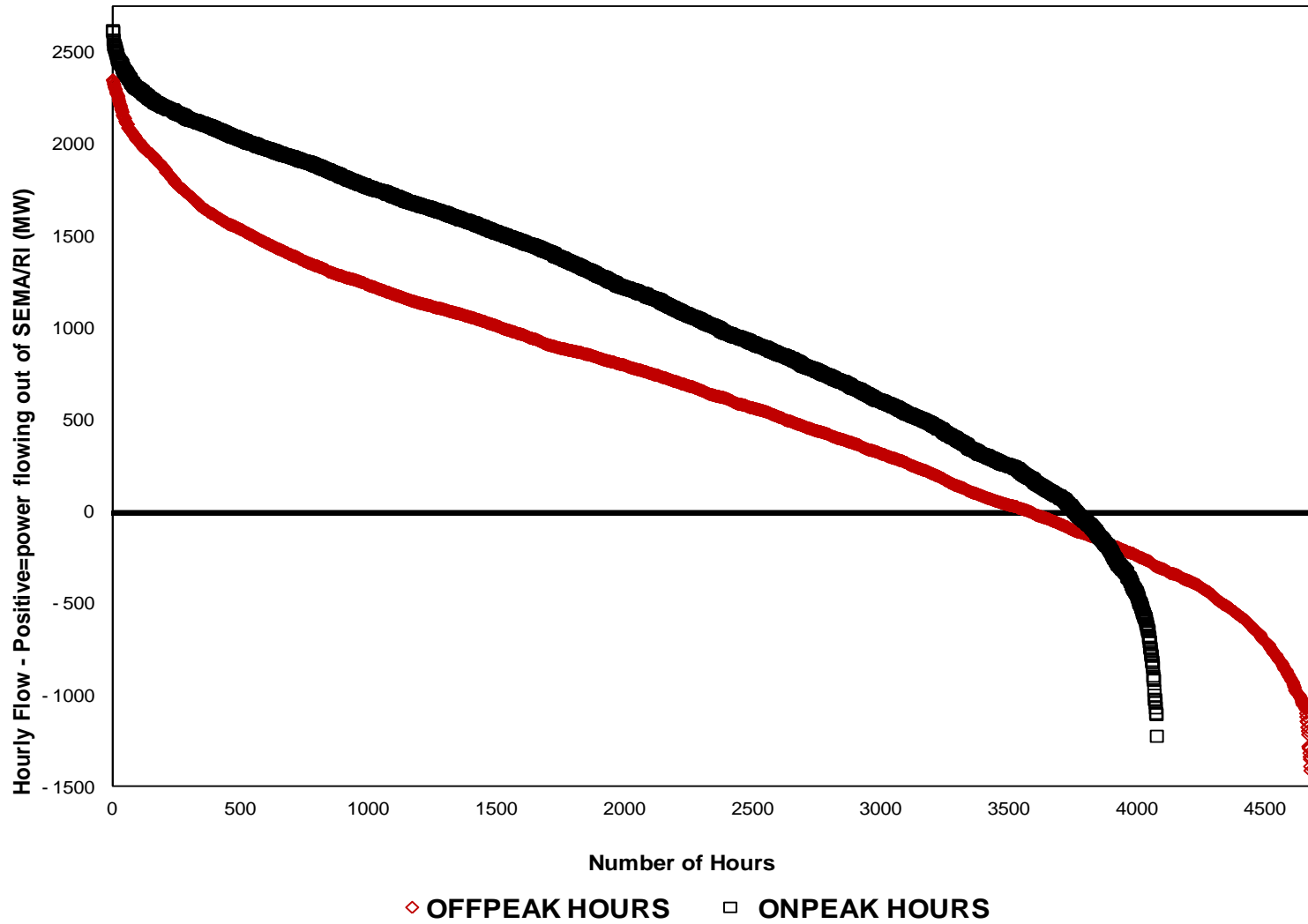


◇ OFFPEAK HOURS    □ ONPEAK HOURS

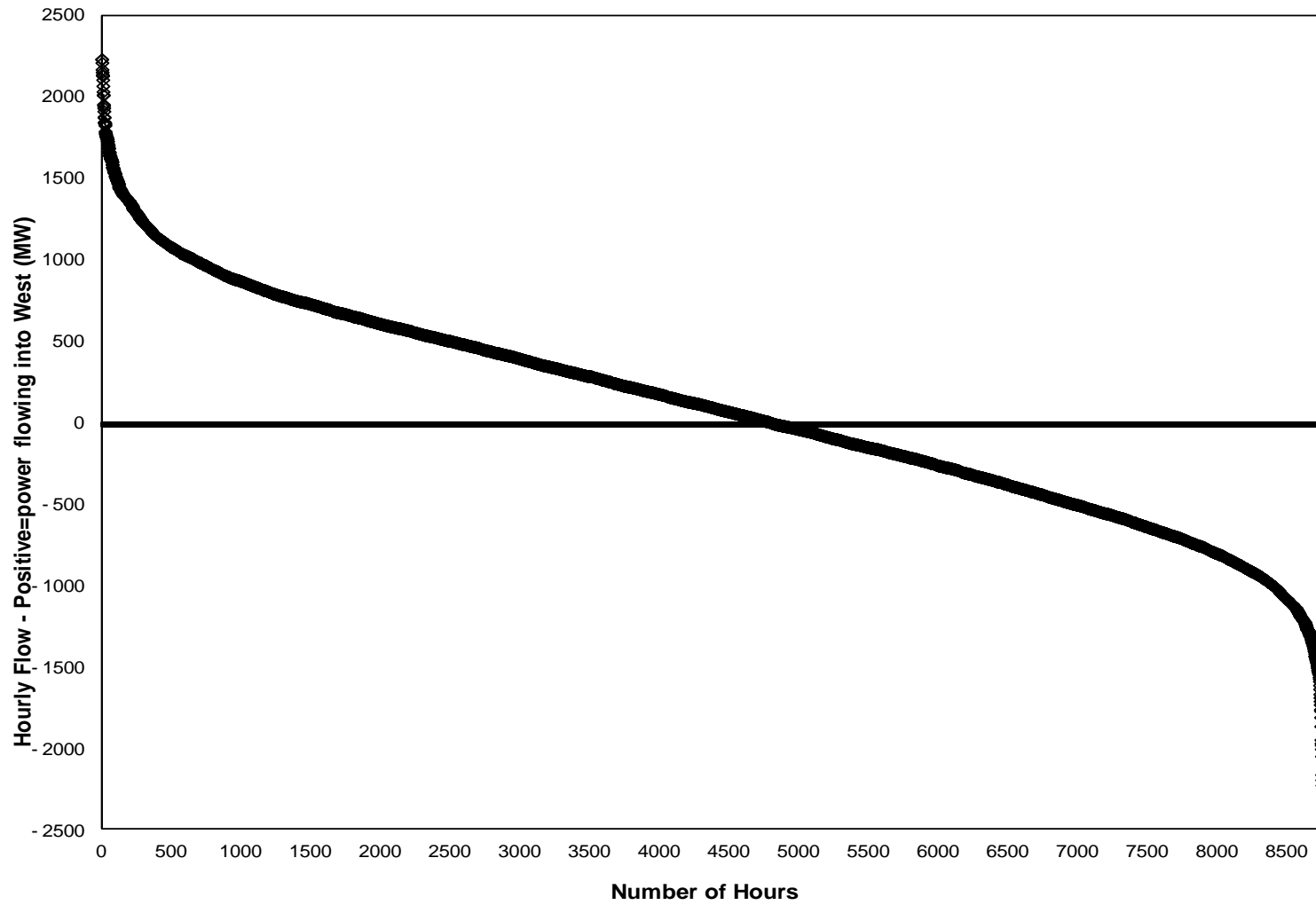
### SEMA/RI Export Interface Duration Curve: Net Flow MWs January - December 2014



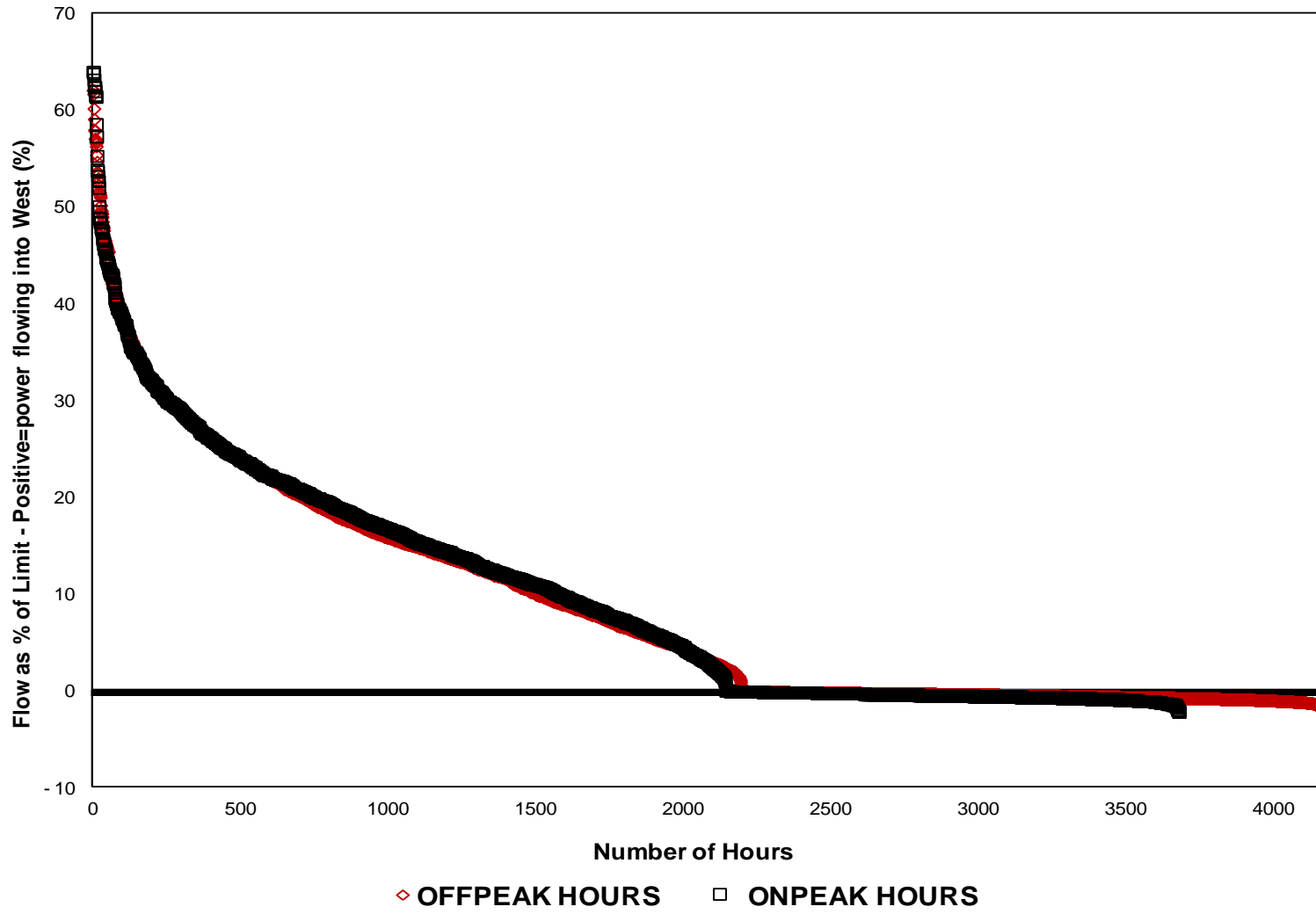
SEMARI Export Interface Duration Curve: Net Flow MWs  
January - December 2014



### East-West Interface Duration Curve: Net Flow MWs January - December 2014

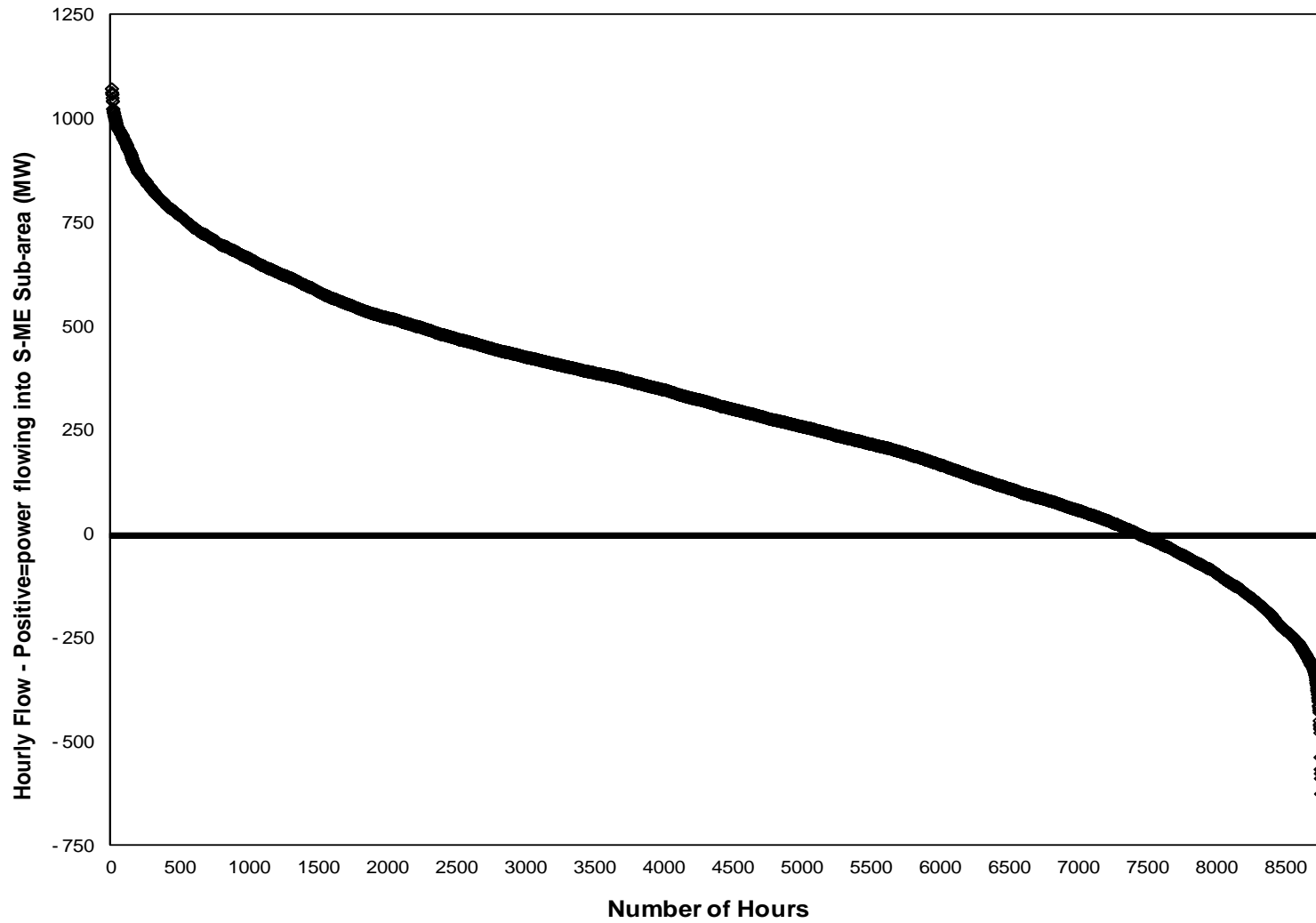


**East-West Interface Duration Curve: Net Flow as % of Interface Limit  
January - December 2014**

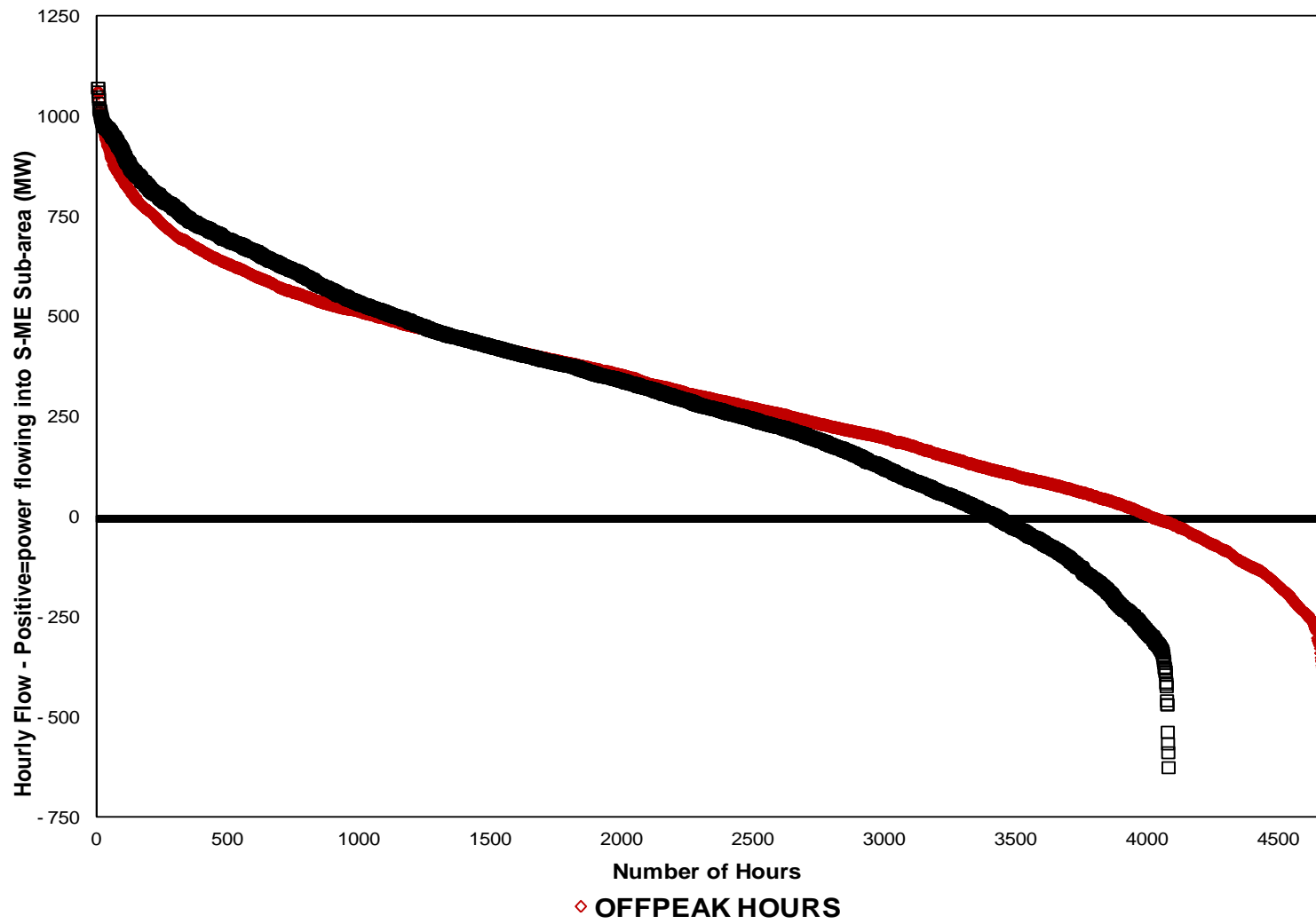




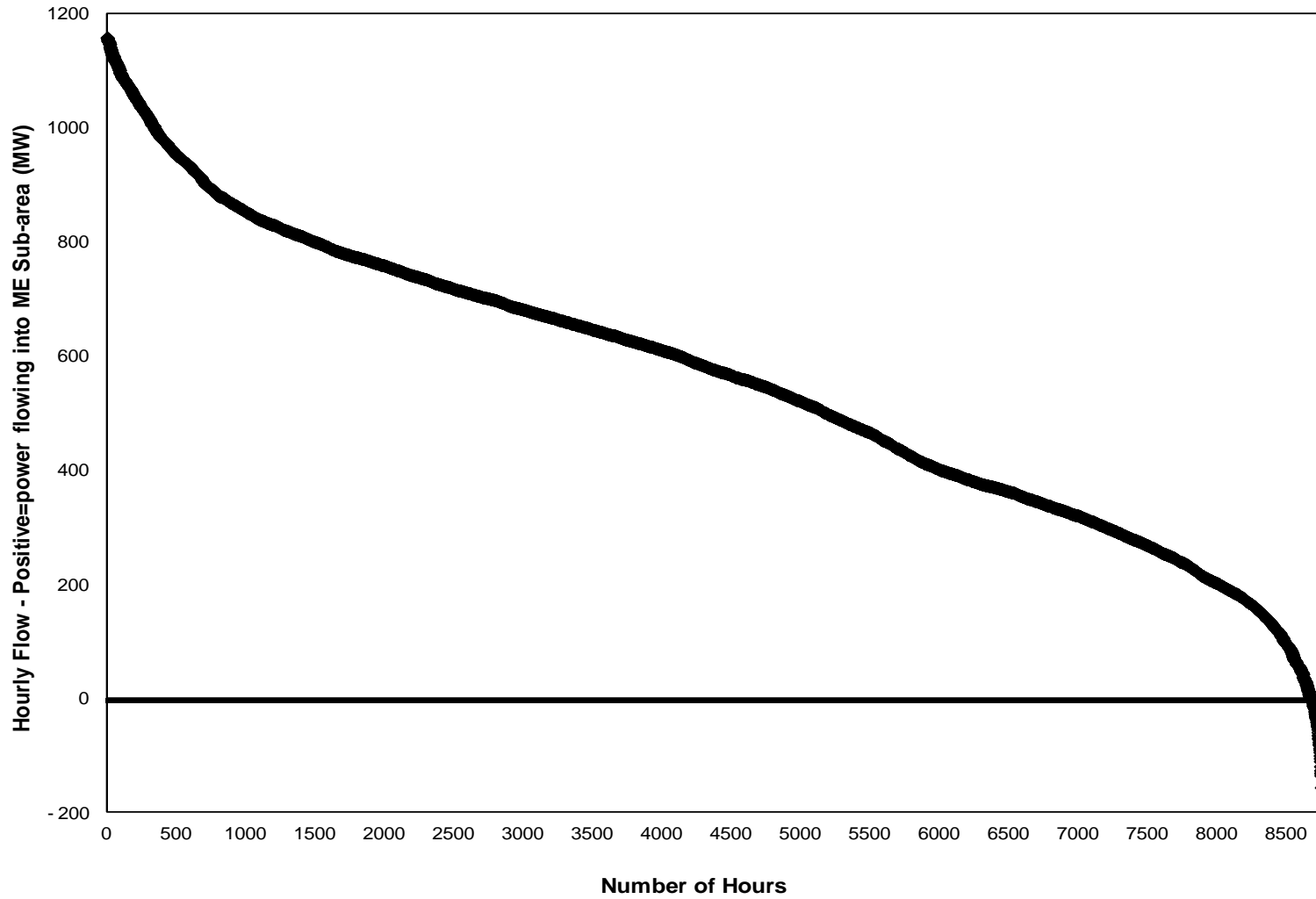
# Surowiec South Interface Duration Curve: Net Flow MWs January - December 2014



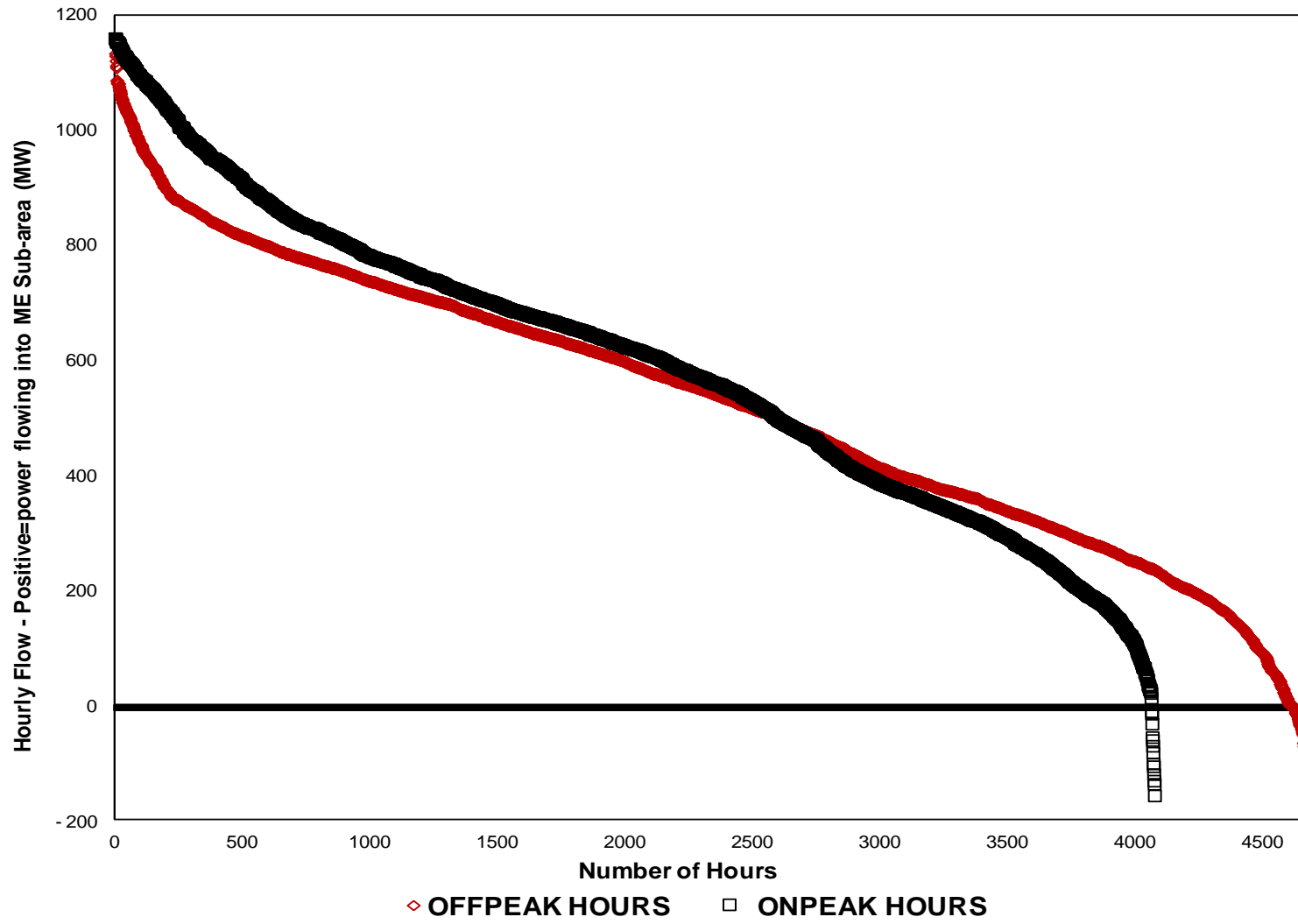
### Surowiec South Interface Duration Curve: Net Flow MWs January - December 2014



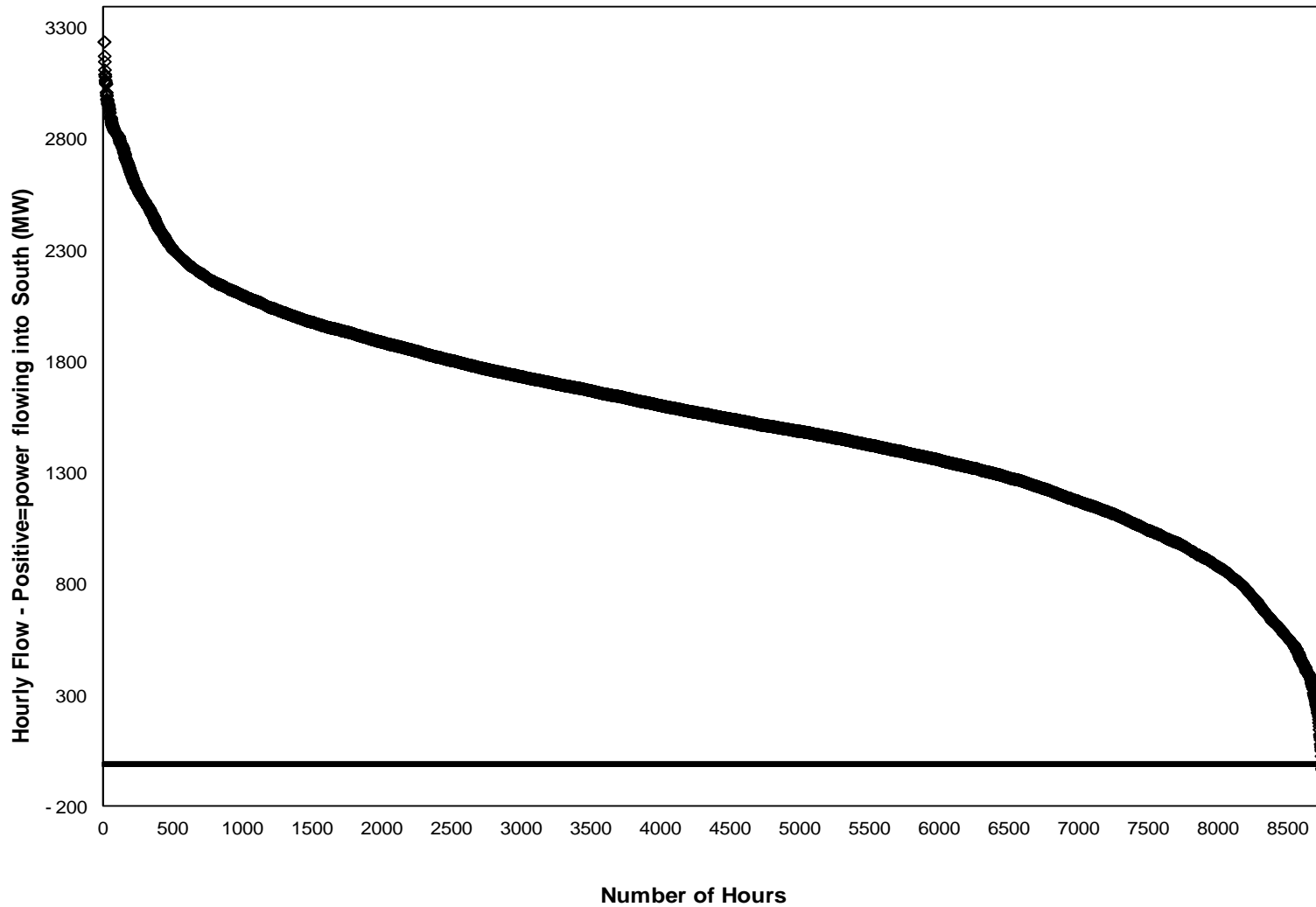
### Orrington South Interface Duration Curve: Net Flow MWs January - December 2014



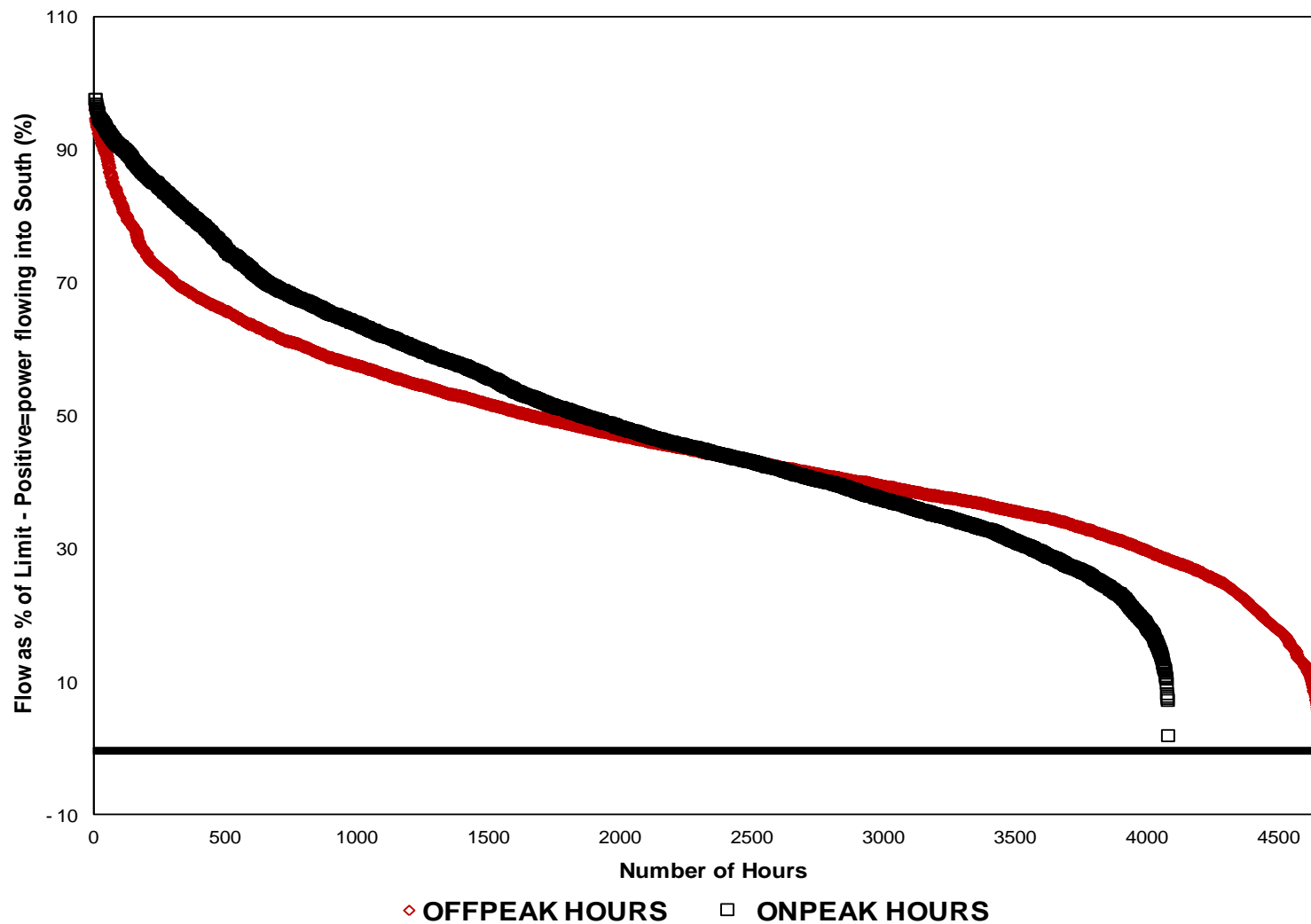
Orrington South Interface Duration Curve: Net Flow MWs  
January - December 2014



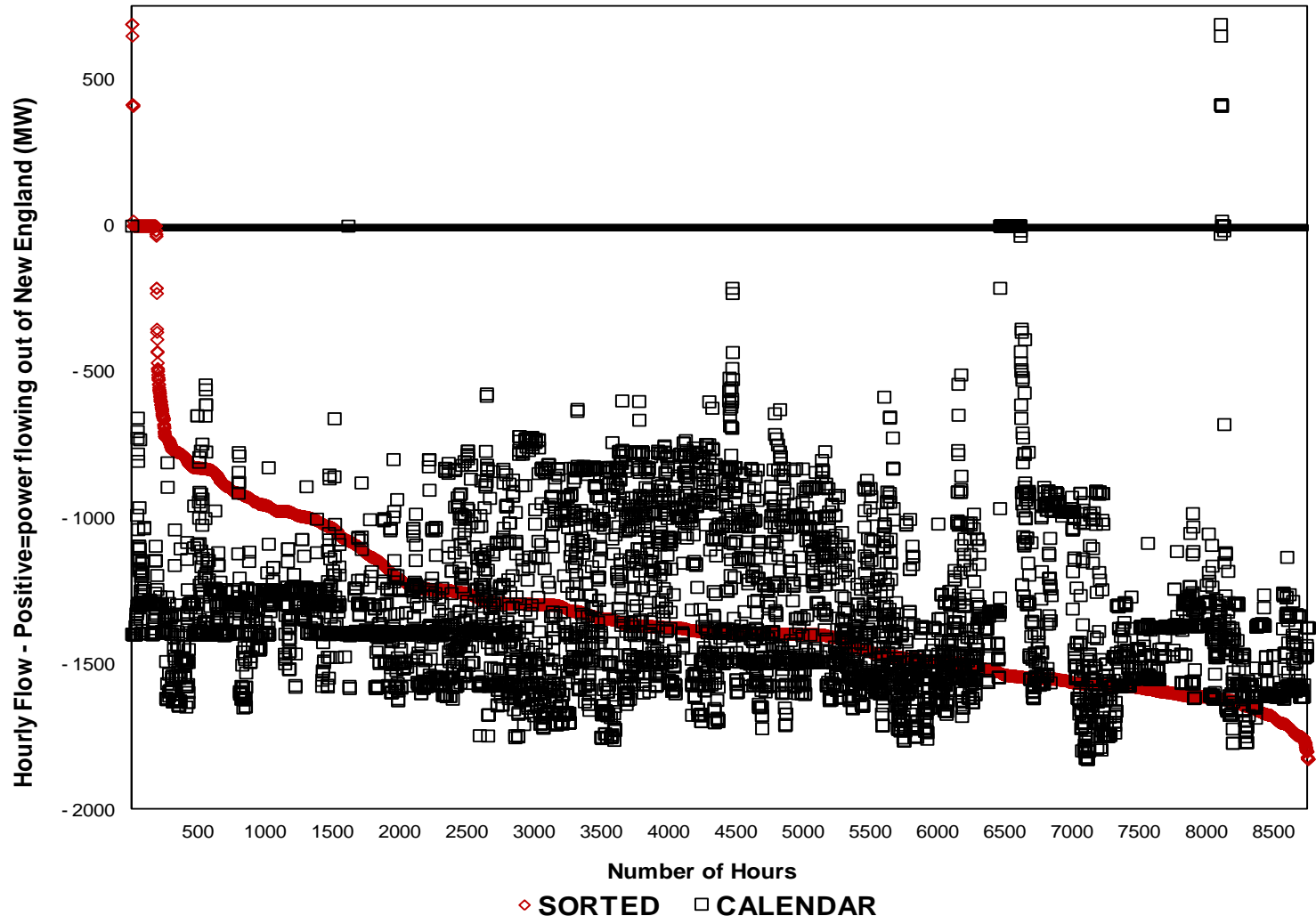
**North-South Interface Duration Curve: Net Flow MWs  
January - December 2014**



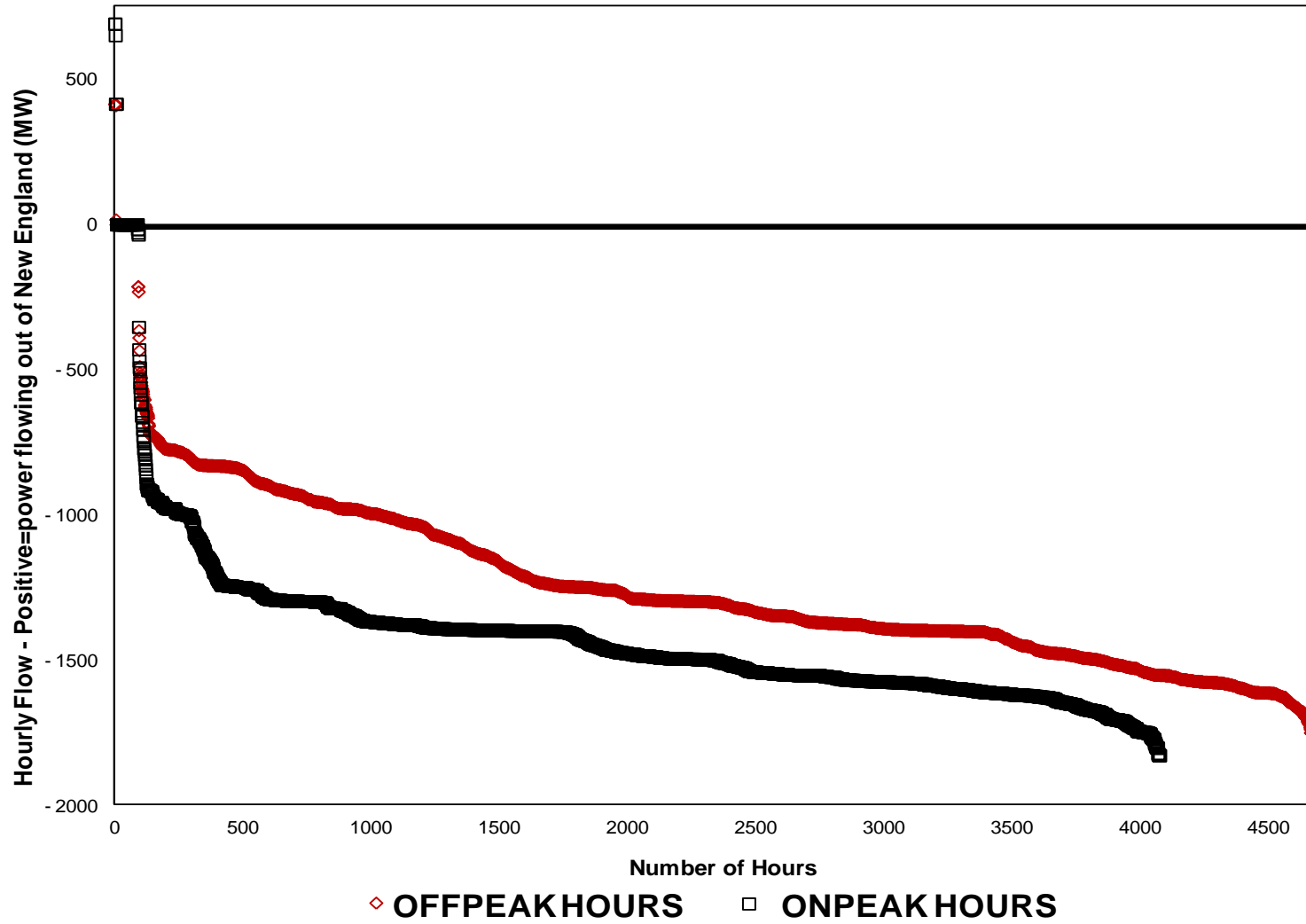
North-South Interface Duration Curve: Net Flow as % of Interface Limit  
January - December 2014



### HQ Phase II Interface Duration Curve: Net Flow MWs January - December 2014

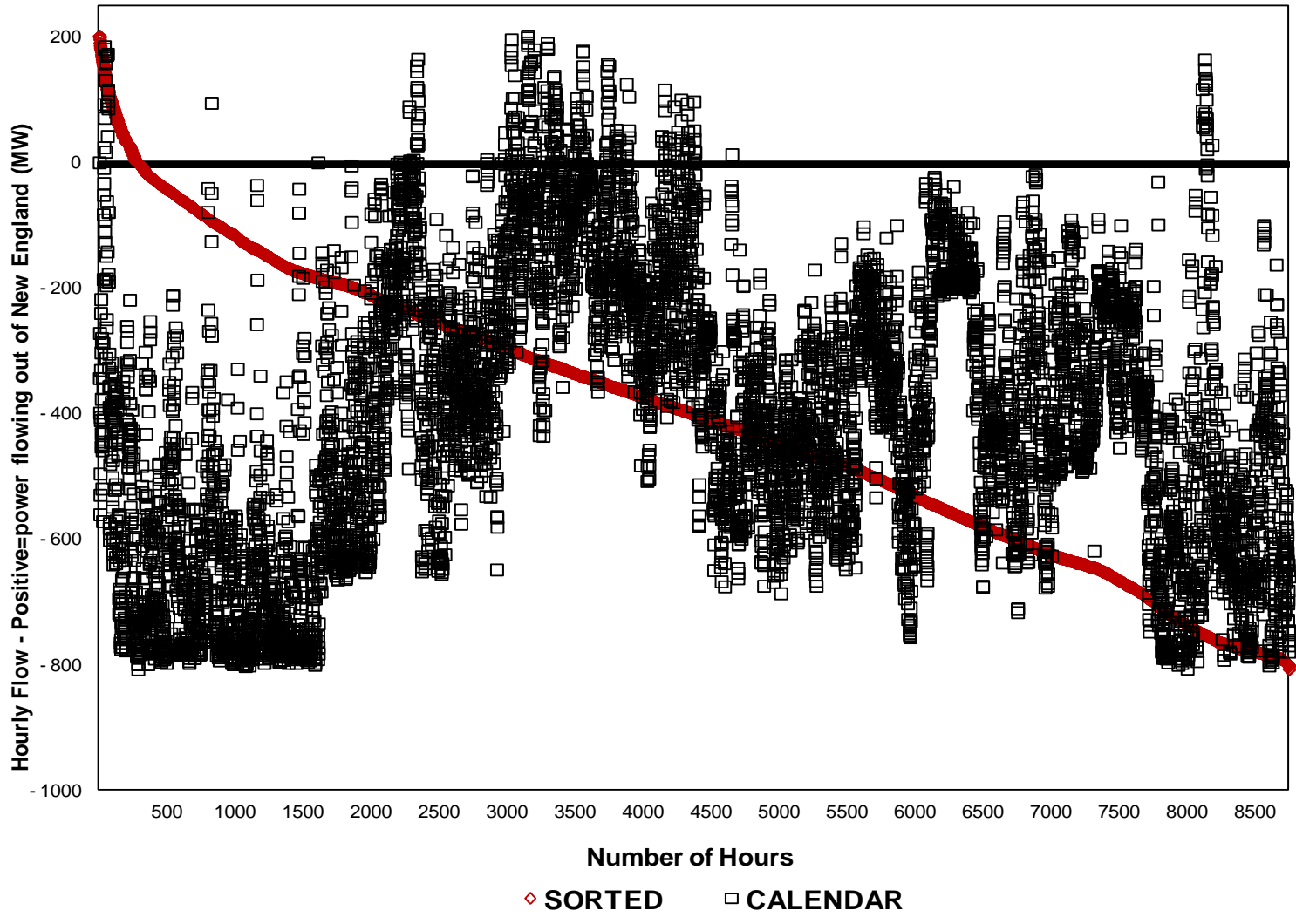


### HQ Phase II Interface Duration Curve: Net Flow MWs January - December 2014

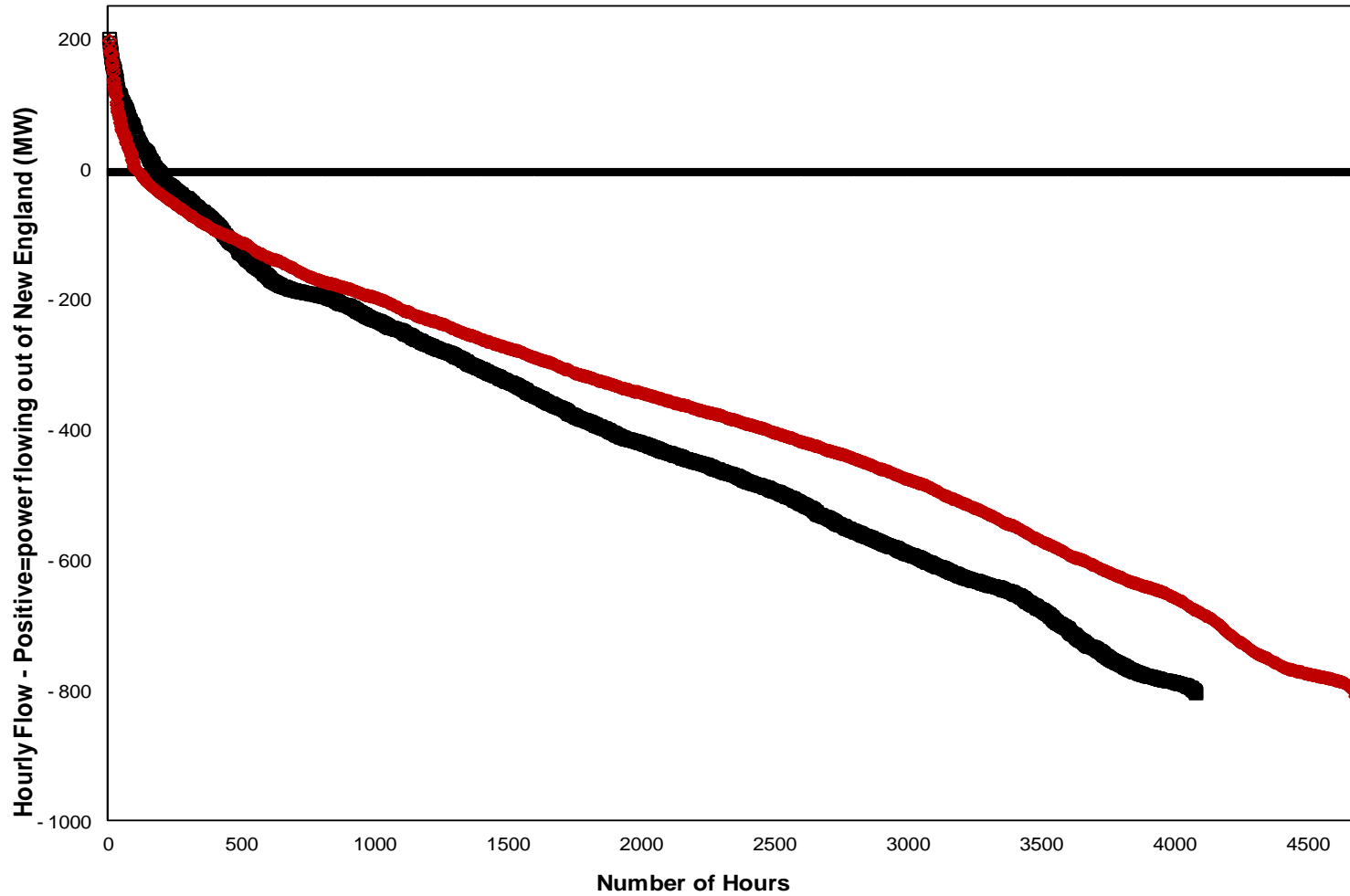




### New Brunswick Interface Duration Curve: Net Flow MWs January - December 2014

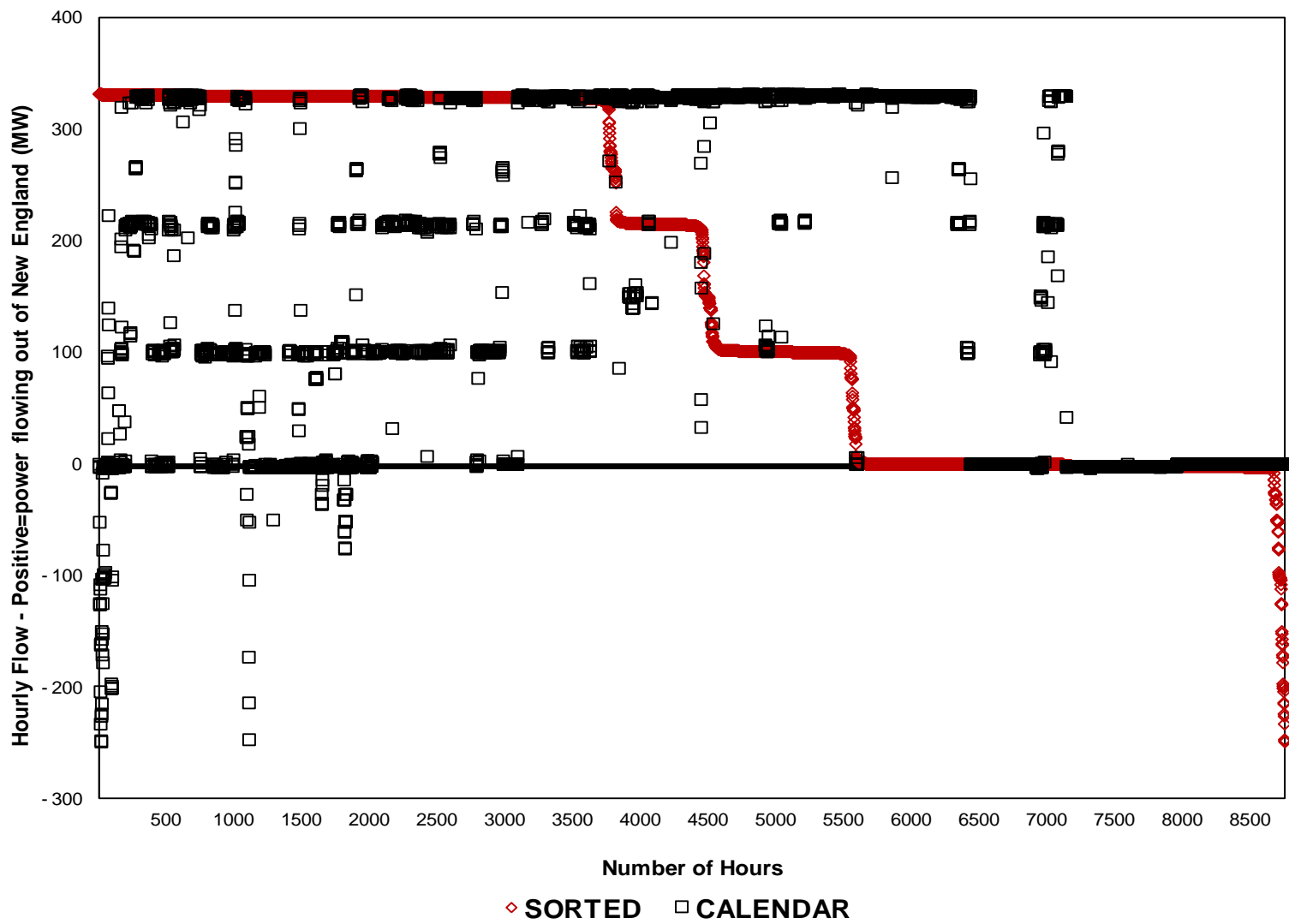


### New Brunswick Interface Duration Curve: Net Flow MWs January - December 2014

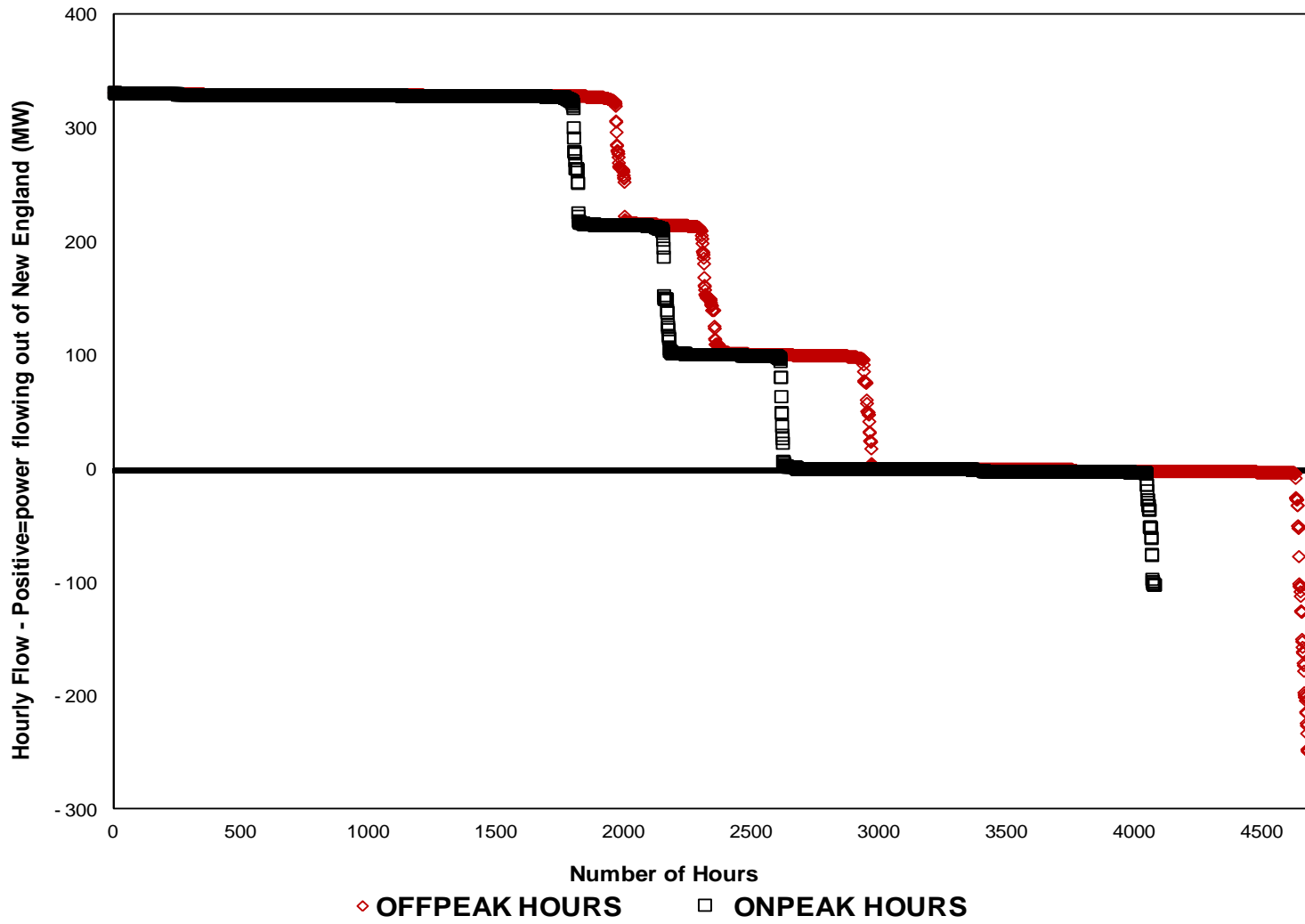


◇ OFFPEAK HOURS      □ ONPEAK HOURS

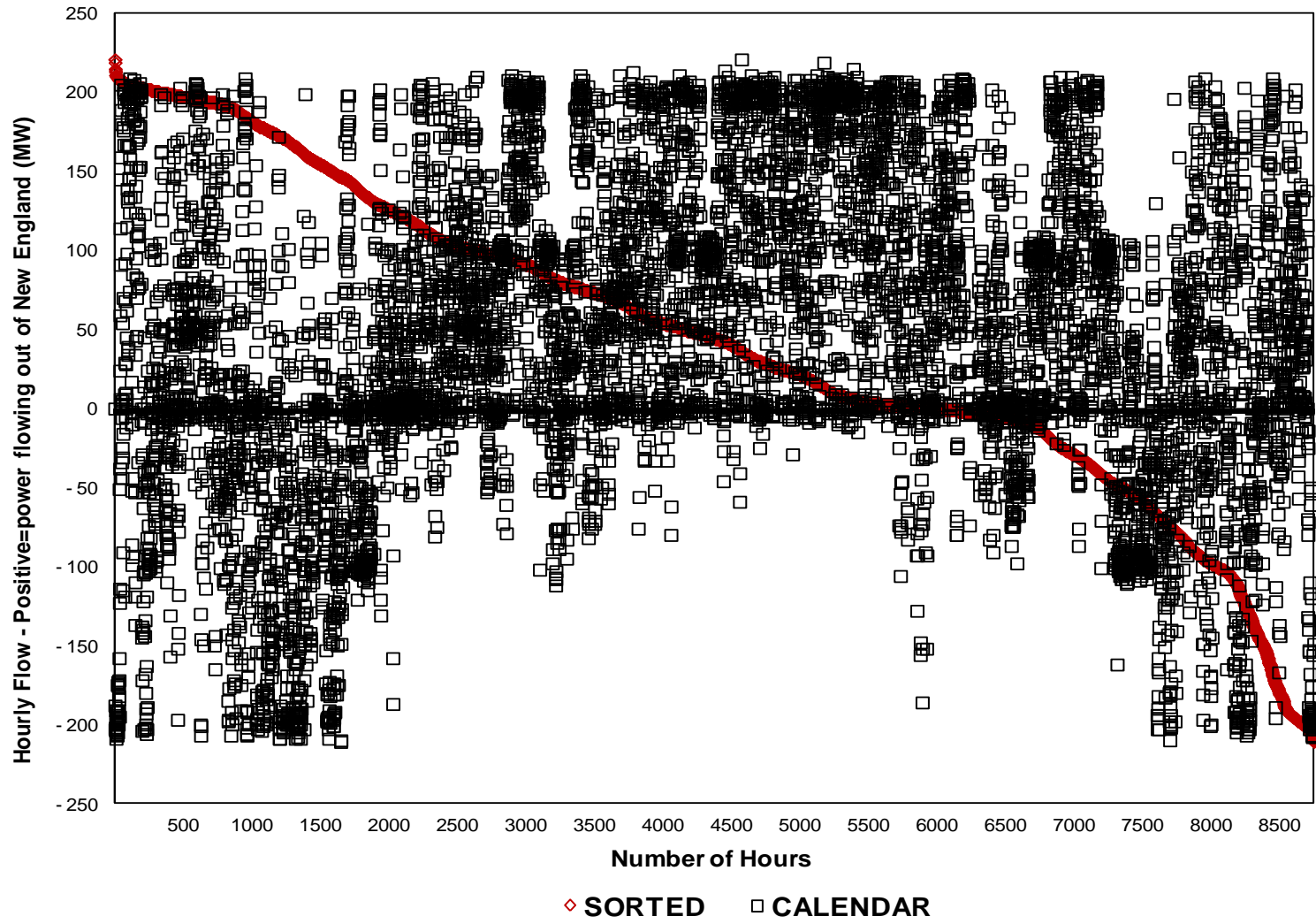
# NE-NY Cross Sound Cable Interface Duration Curve: Net Flow MWs January - December 2014



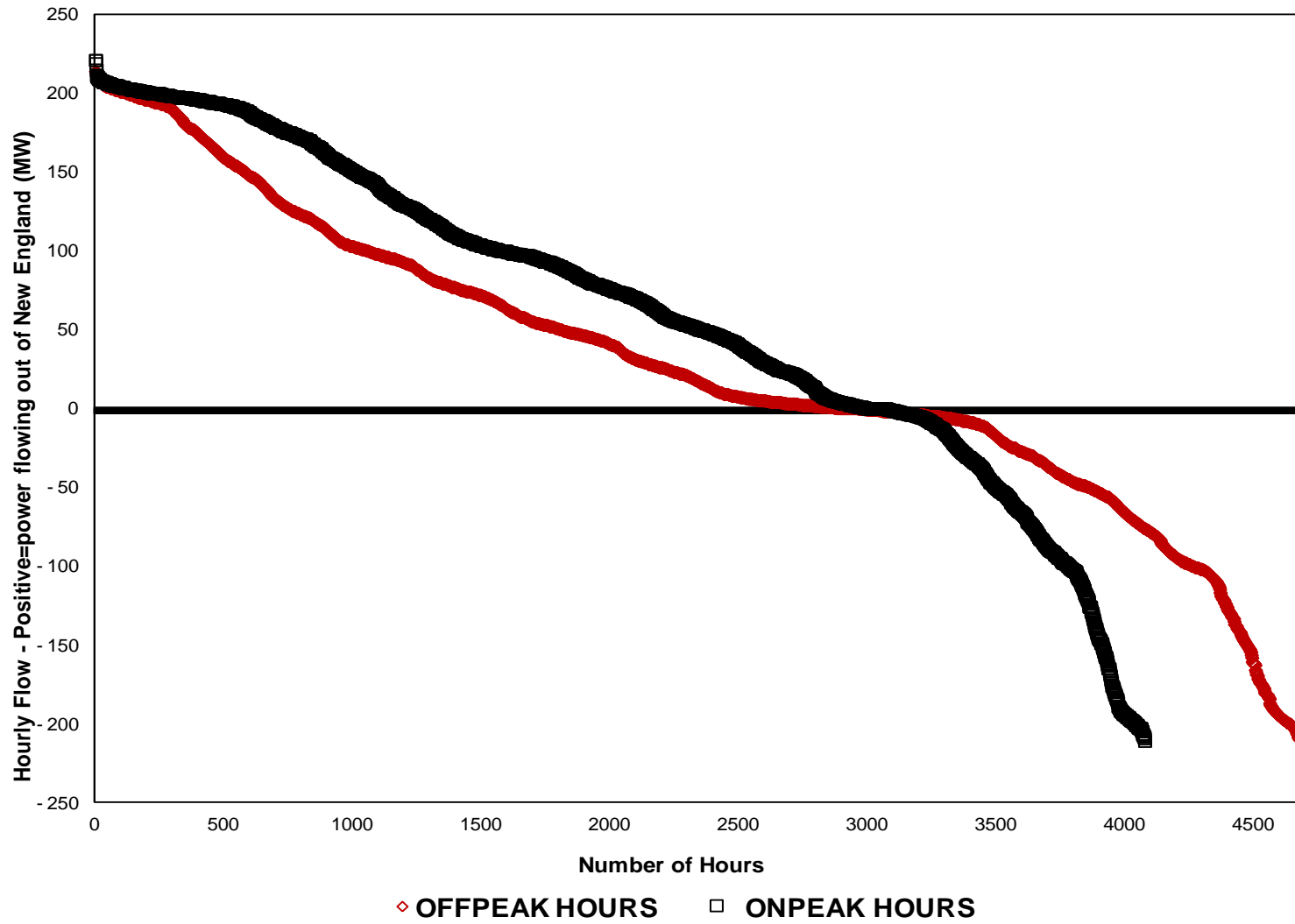
# NE-NY Cross Sound Cable Interface Duration Curve: Net Flow MWs January - December 2014



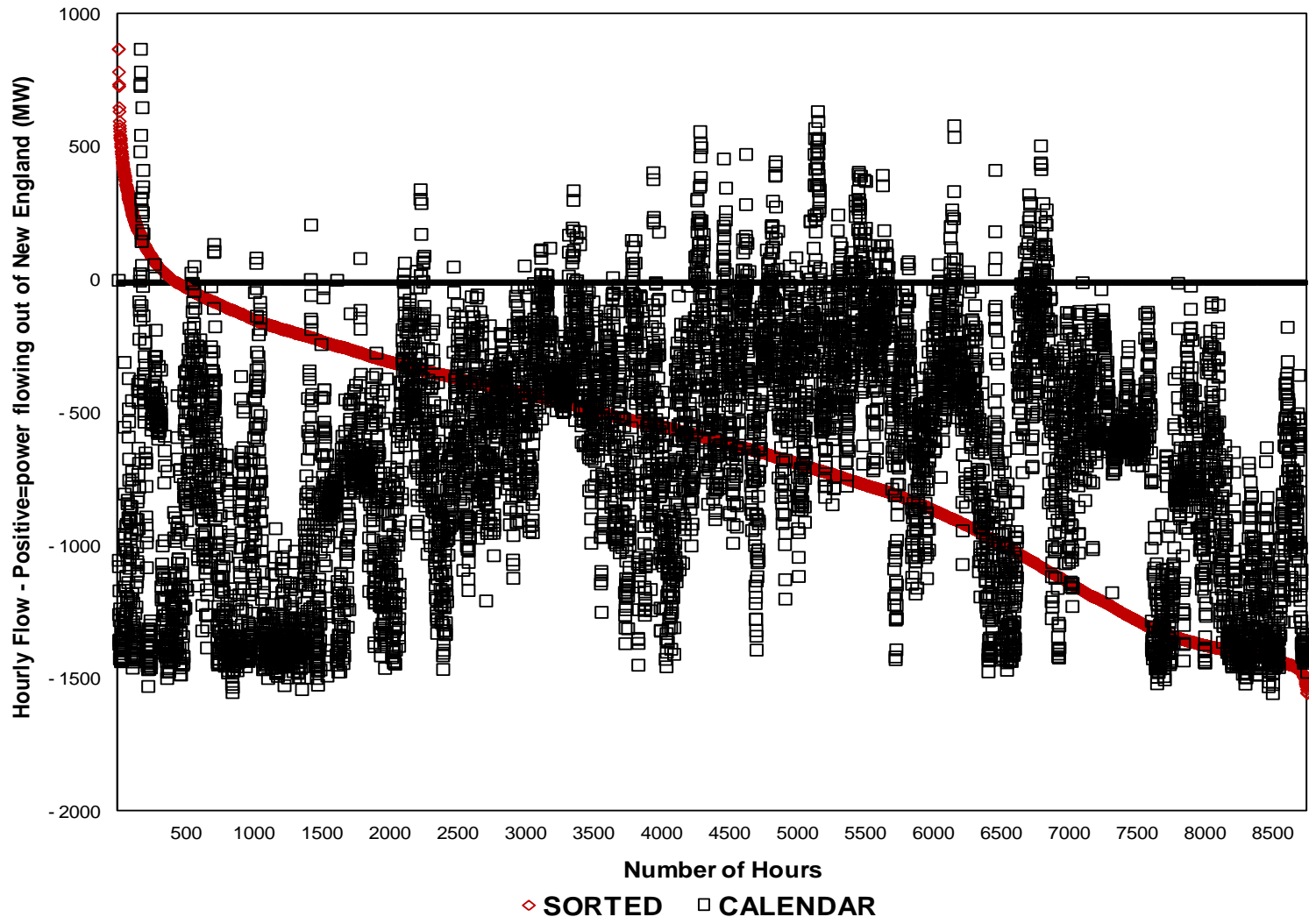
### NE-NY Northport Interface Duration Curve: Net Flow MWs January - December 2014



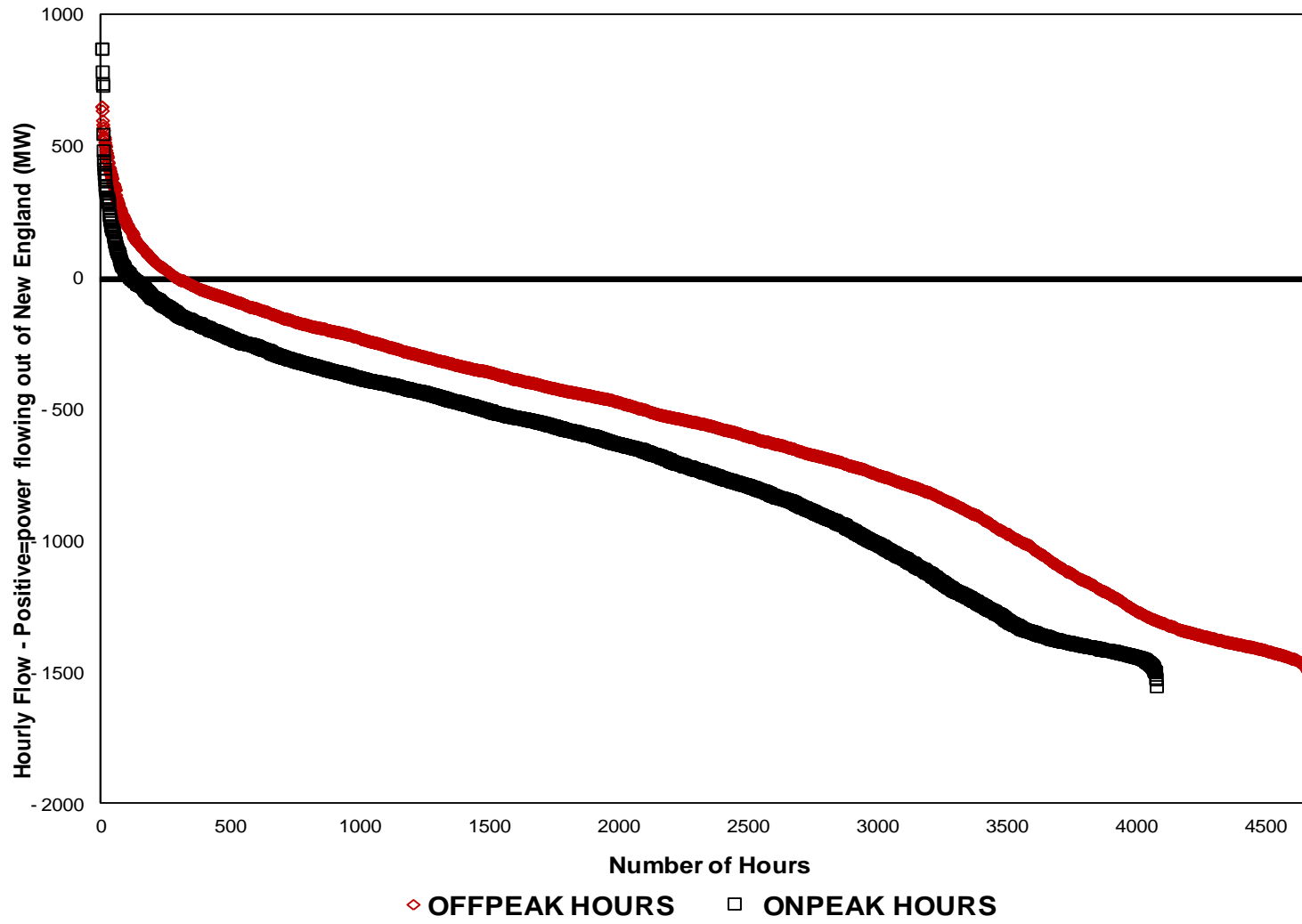
**NE-NY Northport Interface Duration Curve: Net Flow MWs  
January - December 2014**



### NE-NY Rest of AC Interface Duration Curve: Net Flow MWs January - December 2014

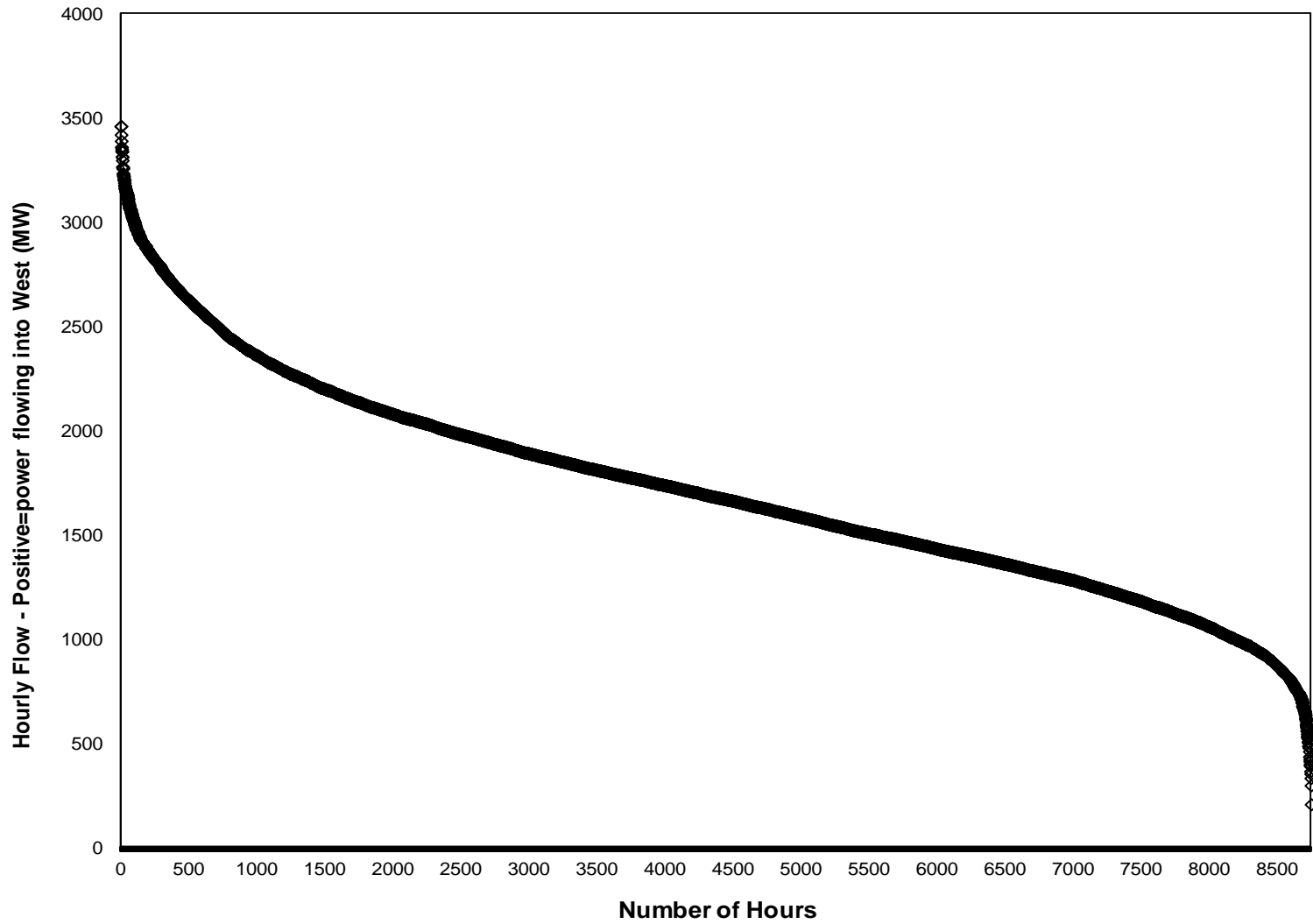


NE-NY Rest of AC Interface Duration Curve: Net Flow MWs  
January - December 2014

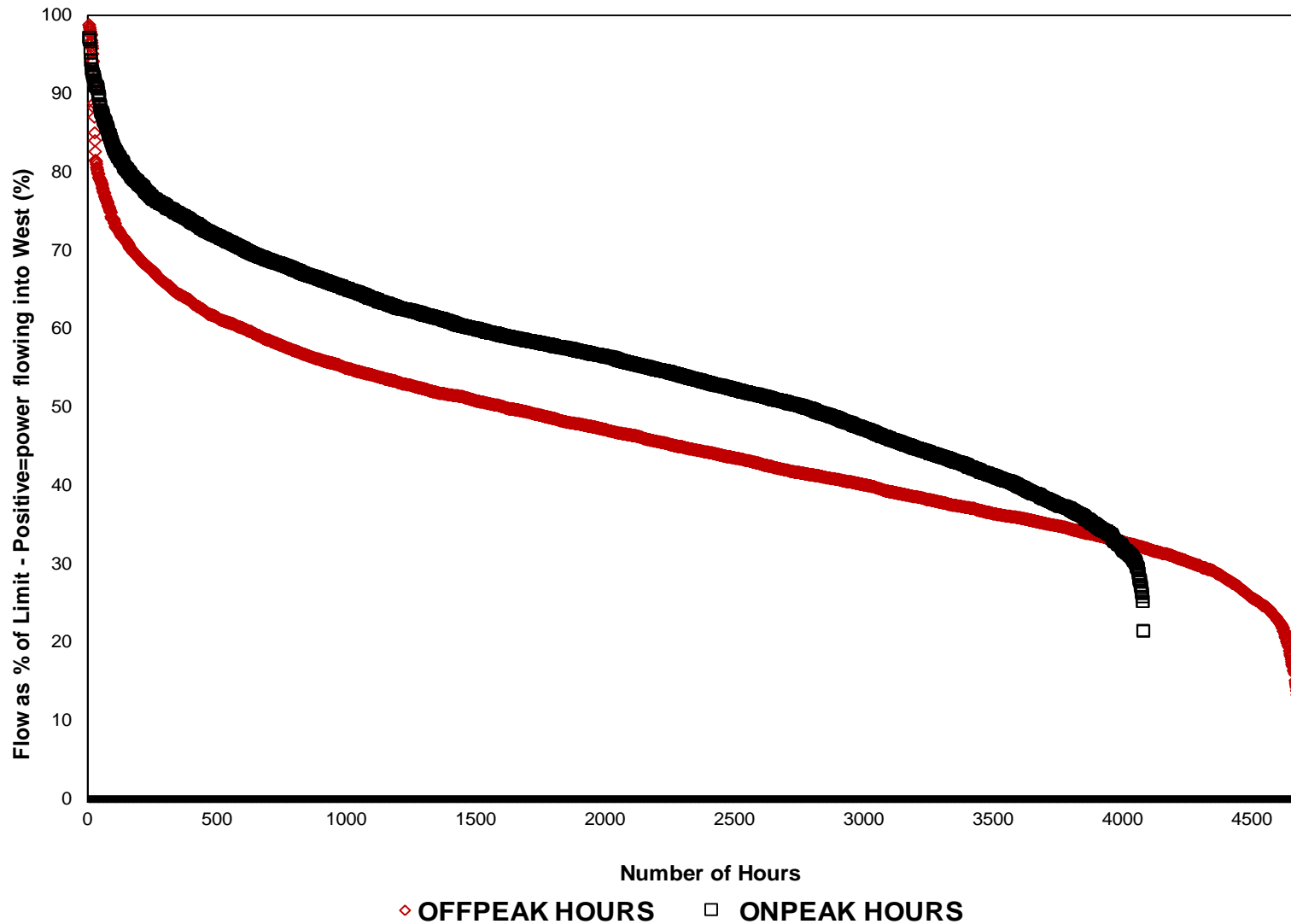




**East to West CT Interface Duration Curve: Net Flow MWs  
January - December 2014**



East to West CT Interface Duration Curve: Net Flow as % of Interface Limit  
January - December 2014



# Observations

- The small Congestion Component of the Locational Marginal Prices suggests there is little congestion on the system.
- In general, interface flows operate closer to the limit on peak as opposed to off peak
- Portions of the system that are remote from load centers, especially northern ME, have high negative loss components

