vermont electric power company

VELCO

Comparison of Vermont and ISO-NE loads

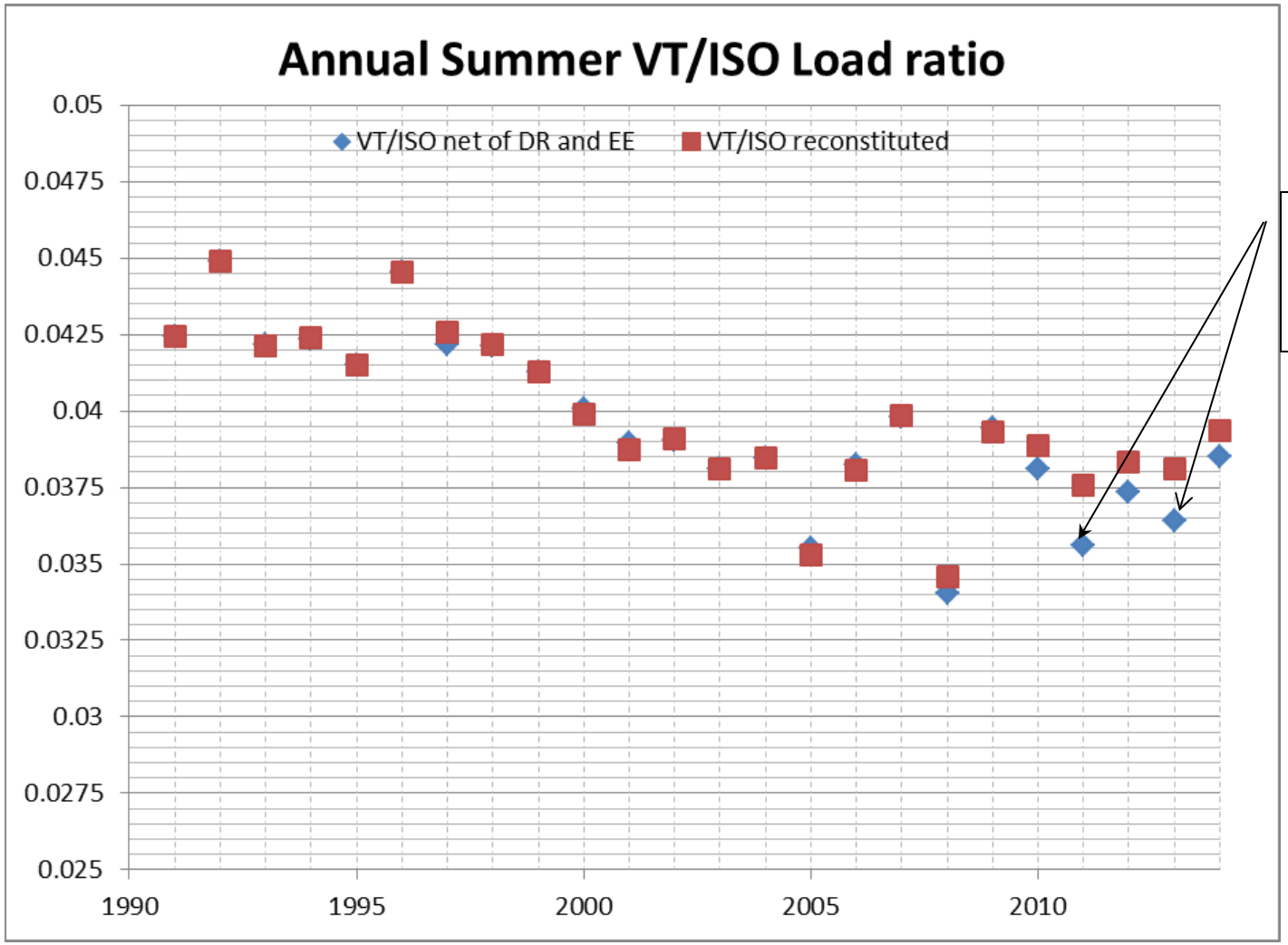
VSPC load forecast committee

May 12th, 2015

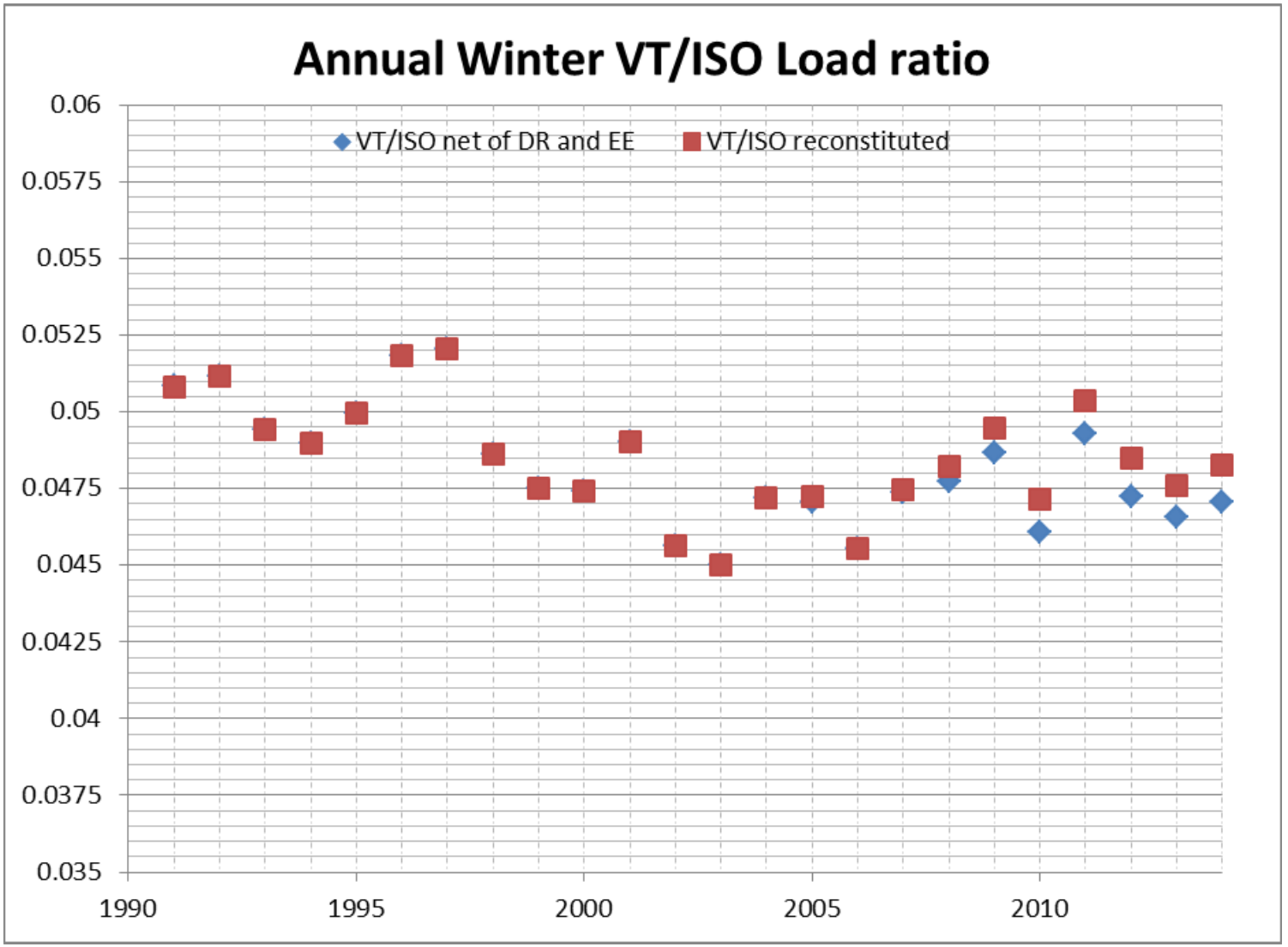
The short story

- Consideration of Energy Efficiency is reducing Vermont's load ratio share
  - The summer peak ratio has been dropping, but the ratio may be stable or rising at other times
- ISO-NE's summer peaks are more peaky than Vermont's peaks
  - Vermont's load factor is higher, and recently Vermont does not seem to respond to severe summer weather
- Vermont's seasonal peaks are not coincident with ISO-NE's peaks
- Vermont's summer monthly peak timing is occurring later while ISO-NE's monthly peak timing has remained stable
- Solar power is having a greater effect on the Vermont load shape as compared to the ISO-NE load shape
  - These effects are more pronounced in the Spring

Summer peak load ratio has been dropping



Winter peak load ratio has been growing a bit



ISO-NE historical loads (net of DR and EE)

Year	Net Energy GWH		Coincident Summer Peak MW	Coincident Load Factor	Following Coincident Winter Peak MW	Coincident Load Factor		Own Summer Peak MW	Own Load Factor	Following Own Winter Peak MW
1991	108682		19742	62.8	18885	65.7		19742	62.8	18885
1992	108826		18707	66.4	18853	65.9		18707	66.4	18853
1993	110532		19570	64.5	19528	64.6		19570	64.5	19528
1994	112277		20519	62.5	19204	66.7		20519	62.5	19204
1995	112845		20499	62.8	19247	66.9		20499	62.8	19247
1996	114653		19507	67.1	18480	70.8		19507	67.1	18480
1997	115579		20569	64.1	18610	70.9		20569	64.1	18610
1998	116887		21406	62.3	20320	65.7		21406	62.3	20320
1999	121938		22607	61.6	21192	65.7		22607	61.6	21192
2000	125394		22005	65.0	20138	71.1		22005	65.0	20138
2001	126554		25072	57.6	19902	72.6		25072	57.6	19902
2002	128059		25422	57.5	21533	67.9		25422	57.5	21533
2003	130778		24685	60.5	22818	65.4		24685	60.5	22818
2004	132517		24116	62.7	22631	66.8		24116	62.7	22631
2005	136355		26885	57.9	21733	71.6		26885	57.9	21733
2006	132087		28130	53.6	21640	69.7		28130	53.6	21640
2007	134466		26145	58.7	21782	70.5		26145	58.7	21782
2008	131753		26111	57.6	21026	71.5		26111	57.6	21026
2009	126838		25100	57.7	20790	69.6		25100	57.7	20790
2010	130773		27102	55.1	21053	70.9		27102	55.1	21053
2011	129163		27707	53.2	19926	74.0		27707	53.2	19926
2012	128081		25880	56.5	20887	70.0		25880	56.5	20887
2013	129377		27379	53.9	21453	68.8		27379	53.9	21453
2014	127138		24443	59.4	20556	70.6		24443	59.4	20556

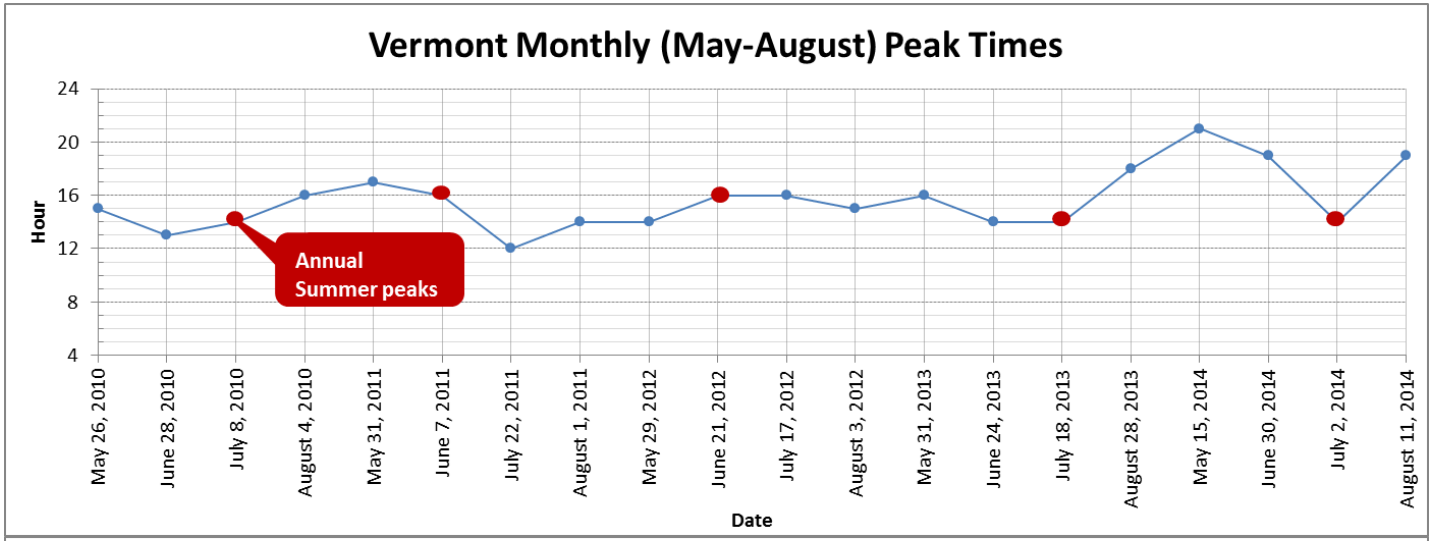
Vermont historical loads (net of DR and EE)

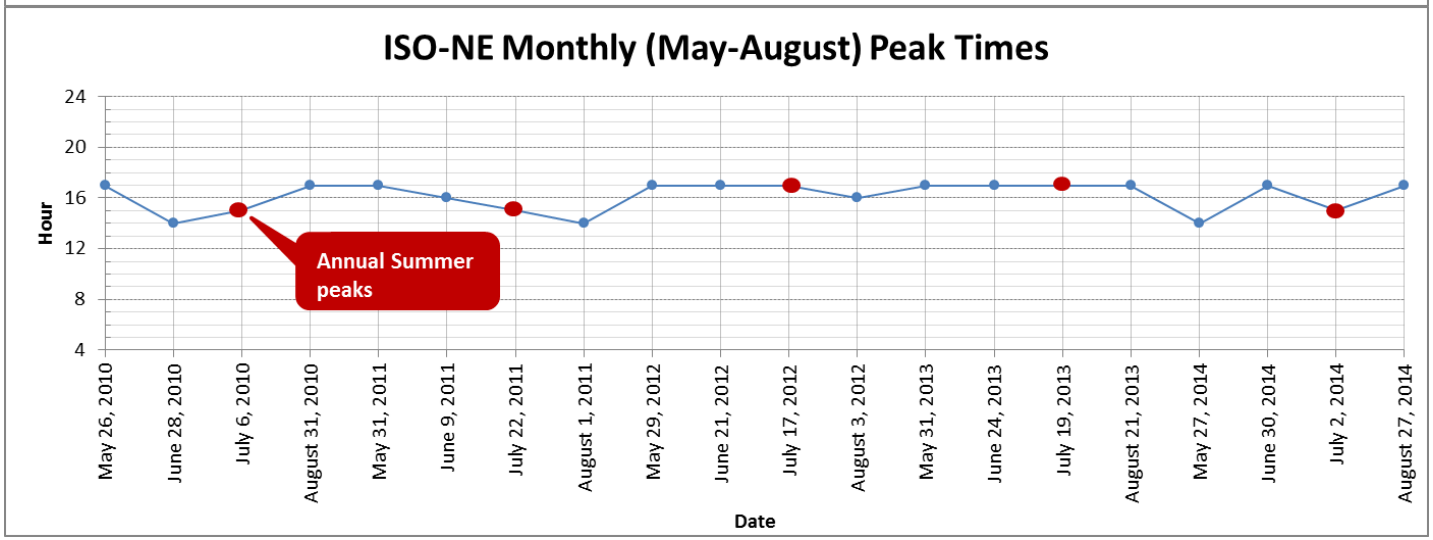
Year	Net Energy GWH		Coincident Summer Peak MW	Coincident Load Factor	Following Coincident Winter Peak MW	Coincident Load Factor		Own Summer Peak MW	Own Load Factor	Following Own Winter Peak MW	Own Load Factor
1991	5672		838	77.3	960	67.5		840	77.1	999	64.8
1992	5849		840	79.5	965	69.2		848	78.7	977	68.3
1993	5841		825	80.9	965	69.1		838	79.6	1050	63.5
1994	5867		869	77.1	941	71.2		886	75.6	979	68.4
1995	5903		851	79.2	962	70.1		888	75.9	973	69.2
1996	6025		869	79.2	958	71.8		898	76.6	999	68.8
1997	6076		867	80.0	969	71.6		886	78.3	974	71.2
1998	6118		902	77.4	988	70.7		939	74.4	999	69.9
1999	6182		933	75.6	1007	70.1		939	75.2	1007	70.1
2000	6186		882	80.1	955	74.0		914	77.3	990	71.4
2001	6094		977	71.2	976	71.3		999	69.7	976	71.3
2002	6181		993	71.0	983	71.8		1007	70.1	984	71.7
2003	6180		941	75.0	1027	68.7		985	71.6	1032	68.4
2004	6344		928	78.1	1068	67.8		951	76.1	1068	67.8
2005	6511		955	77.8	1023	72.7		1060	70.1	1029	72.2
2006	6396		1076	67.8	986	74.1		1101	66.3	1008	72.4
2007	6461		1041	70.8	1032	71.5		1052	70.1	1032	71.5
2008	6357		889	81.6	1004	72.3		1029	70.5	1004	72.3
2009	6117		990	70.5	1012	69.0		998	70.0	1012	69.0
2010	6227		1033	68.8	970	73.3		1054	67.4	999	71.2
2011	6161		987	71.2	982	71.6		1034	68.0	984	71.5
2012	6087		967	71.8	987	70.4		990	70.2	989	70.2
2013	6153		997	70.5	999	70.3		1032	68.0	1012	69.4
2014	6006		941	72.9	967	70.9		957	71.7	968	70.8

VT and ISO-NE summer peaks are not coincident

ISO-NE						Vermont			
				Hour					Hour
Year	Month	Date	Day	Ending		Month	Date	Day	Ending
1991	JUL	19	Fri	14		JUL	19	Fri	12
1992	AUG	26	Wed	15		AUG	27	Thu	14
1993	JUL	8	Thu	15		AUG	27	Fri	12
1994	JUL	21	Thu	15		JUL	21	Thu	14
1995	JUL	27	Thu	14		AUG	16	Wed	14
1996	AUG	6	Tue	16		AUG	7	Wed	14
1997	JUL	14	Mon	15		AUG	11	Mon	14
1998	JUL	22	Wed	17		JUL	22	Wed	12
1999	JUL	6	Tue	14		JUL	6	Tue	14
2000	JUN	27	Tue	13		SEP	1	Fri	12
2001	AUG	9	Thu	15		AUG	9	Thu	14
2002	AUG	14	Wed	15		AUG	15	Thu	14
2003	AUG	22	Fri	15		JUN	26	Thu	14
2004	AUG	30	Mon	15		JUL	22	Thu	15
2005	JUL	27	Wed	15		JUL	19	Tue	12
2006	AUG	2	Wed	15		AUG	2	Wed	13
2007	AUG	3	Fri	15		AUG	3	Fri	13
2008	JUN	10	Tue	17		JUN	10	Tue	14
2009	AUG	18	Tue	15		AUG	18	Tue	14
2010	JUL	6	Tue	15		JUL	8	Thu	14
2011	JUL	22	Fri	15		JUL	22	Fri	12
2012	JUL	17	Tue	17		JUN	21	Thu	15
2013	JUL	19	Fri	17		JUL	18	Thu	14
2014	JUL	2	Wed	15		JUL	2	Wed	14

VT and ISO-NE Summer monthly peak timings are diverging



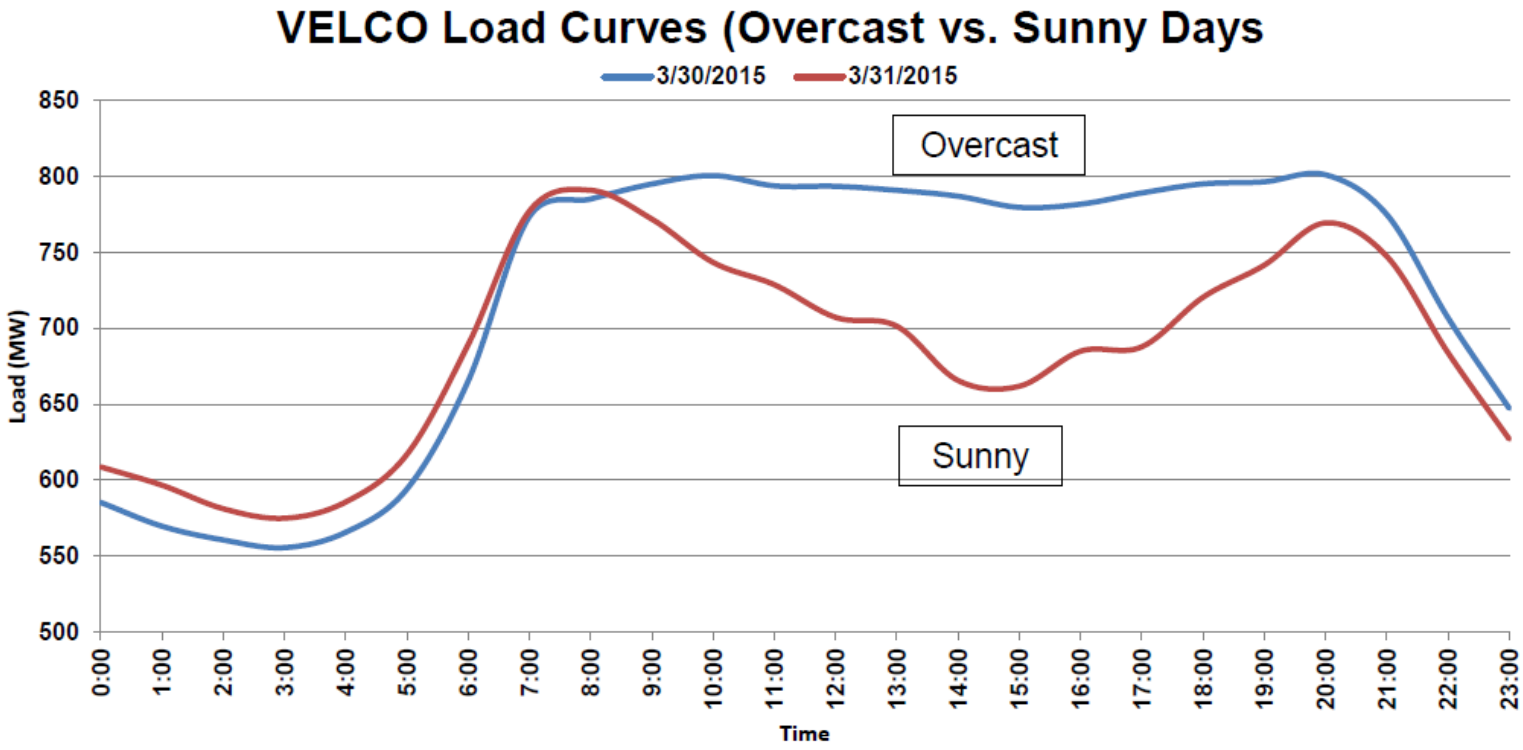


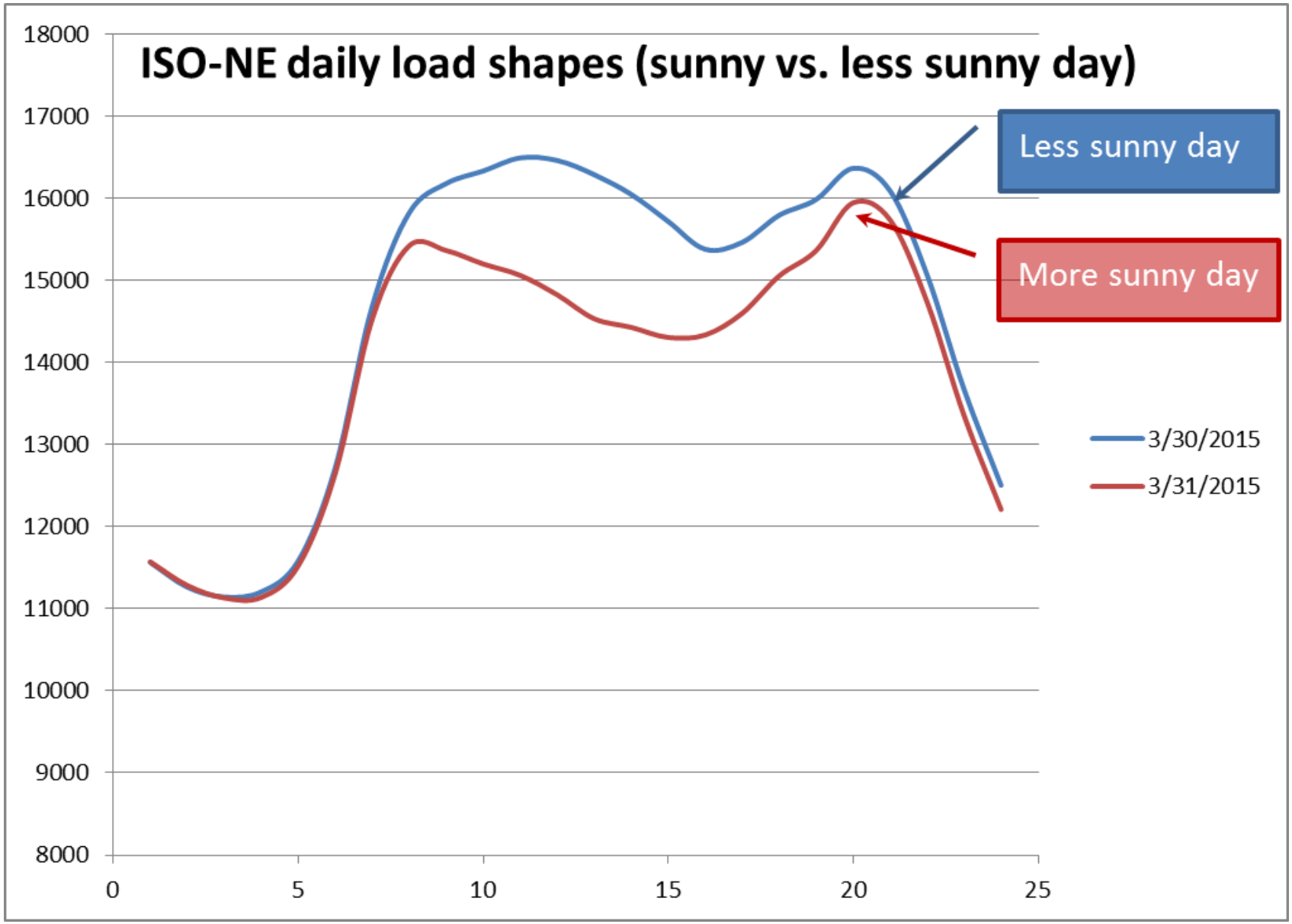
VELCO Load Curve Study

Case #1

Increase of solar generation “behind the meter” is offsetting VELCO demand curve

	3/30/2015	3/31/2015
Cloud Cover	Overcast	Sunny
High/Low (°F)	41/26	42/24
Max Radiation (w/m^2)	241	965




ISO-NE daily load shapes (sunny vs. less sunny day)
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
0
5
10
15
20
25
Less sunny day
More sunny day
3/30/2015
3/31/2015

Weather for the compared dates

	3/30/2015						3/31/2015					
Location	Max_ Temp	Min_T emp	Avg_ Temp	Normal	Departure	Max Solar (w/m^2)	Max_ Temp	Min_T emp	Avg_ Temp	Normal	Departure	Max Solar (w/m^2)
Rutland, VT	41	26	33.5	36.5	-3	241	42	24	33	37.0	-4	965
Boston, MA	45	30	37.5	42.4	-4.9	263	50	37	43.5	42.7	0.8	806
Hartford, CT	50	31	40.5	42.9	-2.4	N/A	48	29	38.5	43.3	-4.8	N/A
Providence, RI	48	30	39	43.4	-4.4	362	49	32	40.5	43.7	-3.2	809
Berlin, NH	38	21	29.5	32.4	-2.9	N/A	38	15	26.5	32.9	-6.4	N/A
Caribou, ME	38	23	30.5	30.5	0	N/A	36	21	28.5	31.0	-2.5	N/A
					-2.933333						-3.35	

Likely greater % PV penetration in VT