

# ISO-NE Energy Markets and the SHEI

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Vermont System Planning Committee (VSPC)

July 12, 2017

# Purpose and Outline

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## □ Purpose

- Explain financial impact of constraints of the SHEI constraints on Vermont Electric Cooperative (VEC)

## □ Outline

- Energy Market Basics
- Utility Settlements with ISO-NE
- % of Hours
- Financial Impact

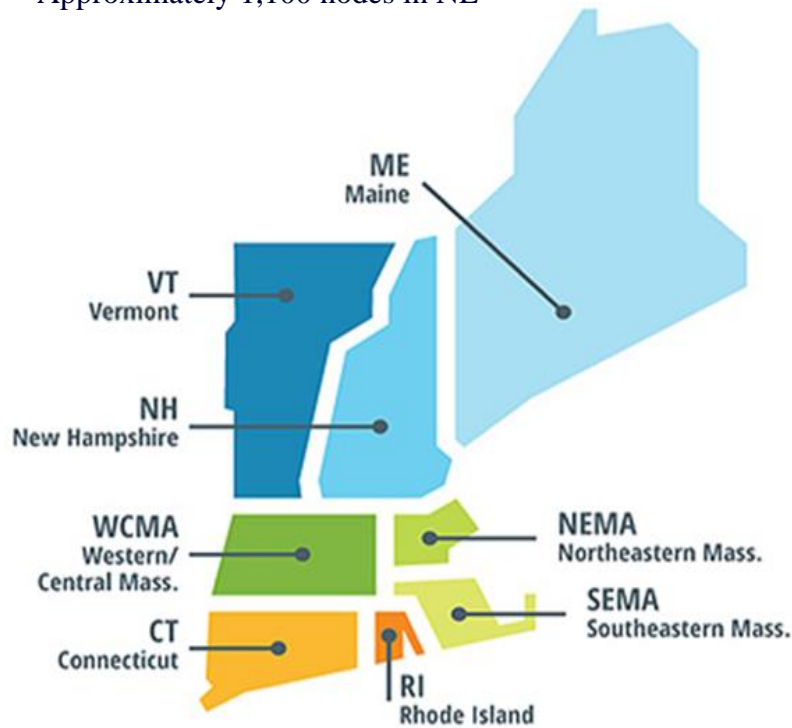
# ISO-NE Energy Market Basics

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- ❑ Monitors load on NE system
- ❑ Dispatches generating assets in most cost-effective way possible, given reliability constraints
- ❑ Pays for resource entitlements on cost of **next** MWh of generation to be delivered to specific location (“Locational Marginal Price” or “LMP”)
- ❑ Charge Load Serving Entities the weighted average LMP in Load Zone
- ❑ Approximately 1,100 pricing points to take into account reliability constraints and line losses

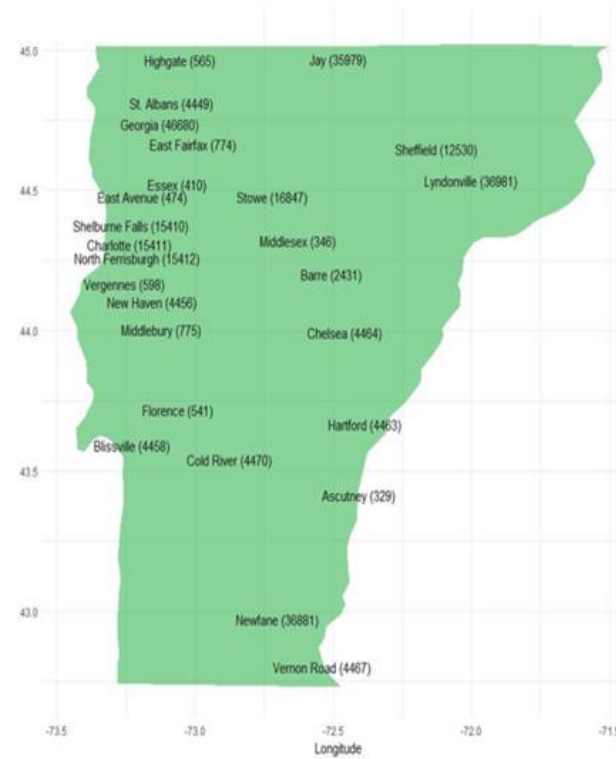
# ISO-NE Energy Market Basics - Locations

Approximately 1,100 nodes in NE



Wholesale Load Zones in New England

Approximately 70 nodes in VT

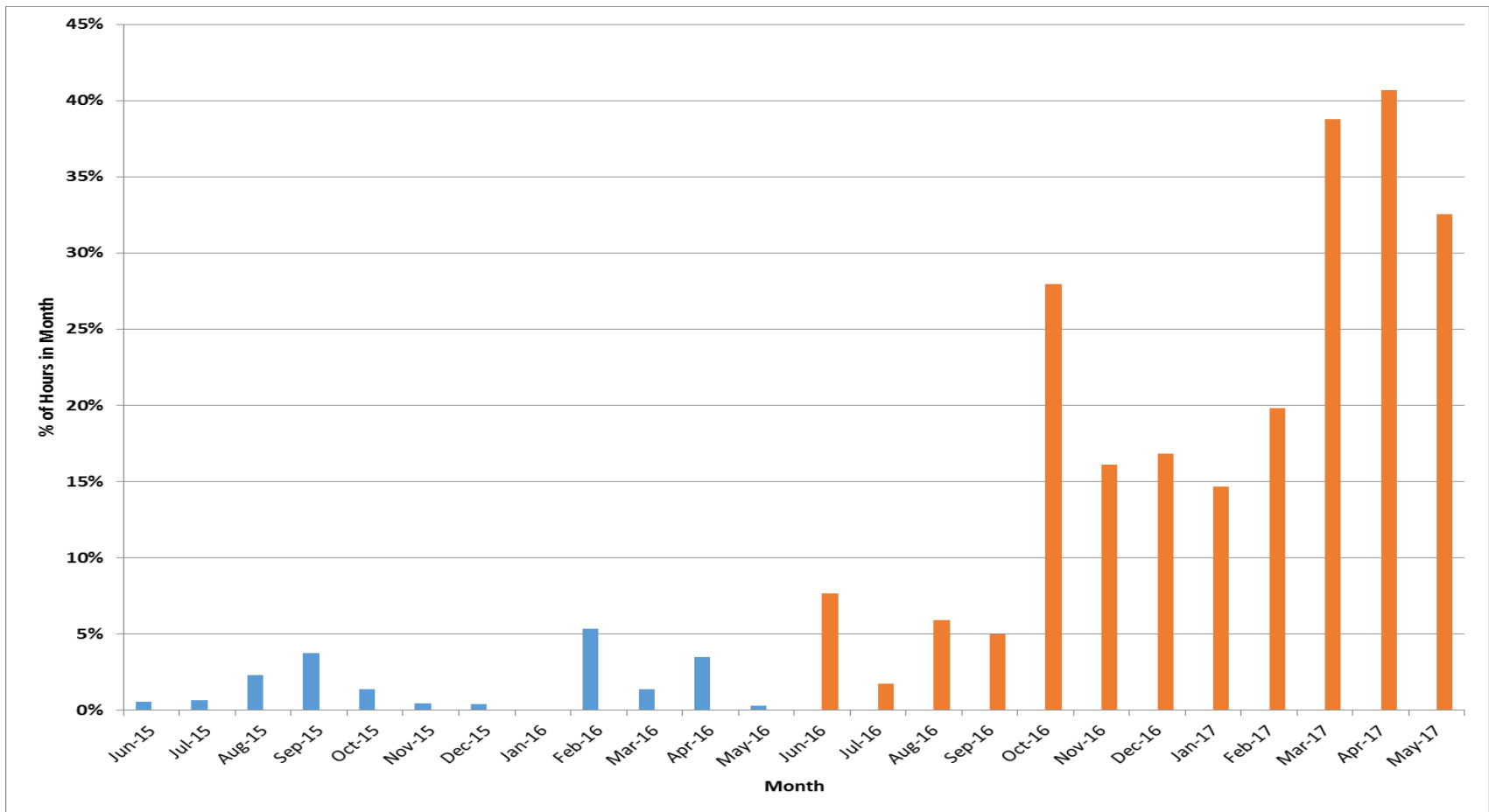


# Utility Settlements with ISO-NE

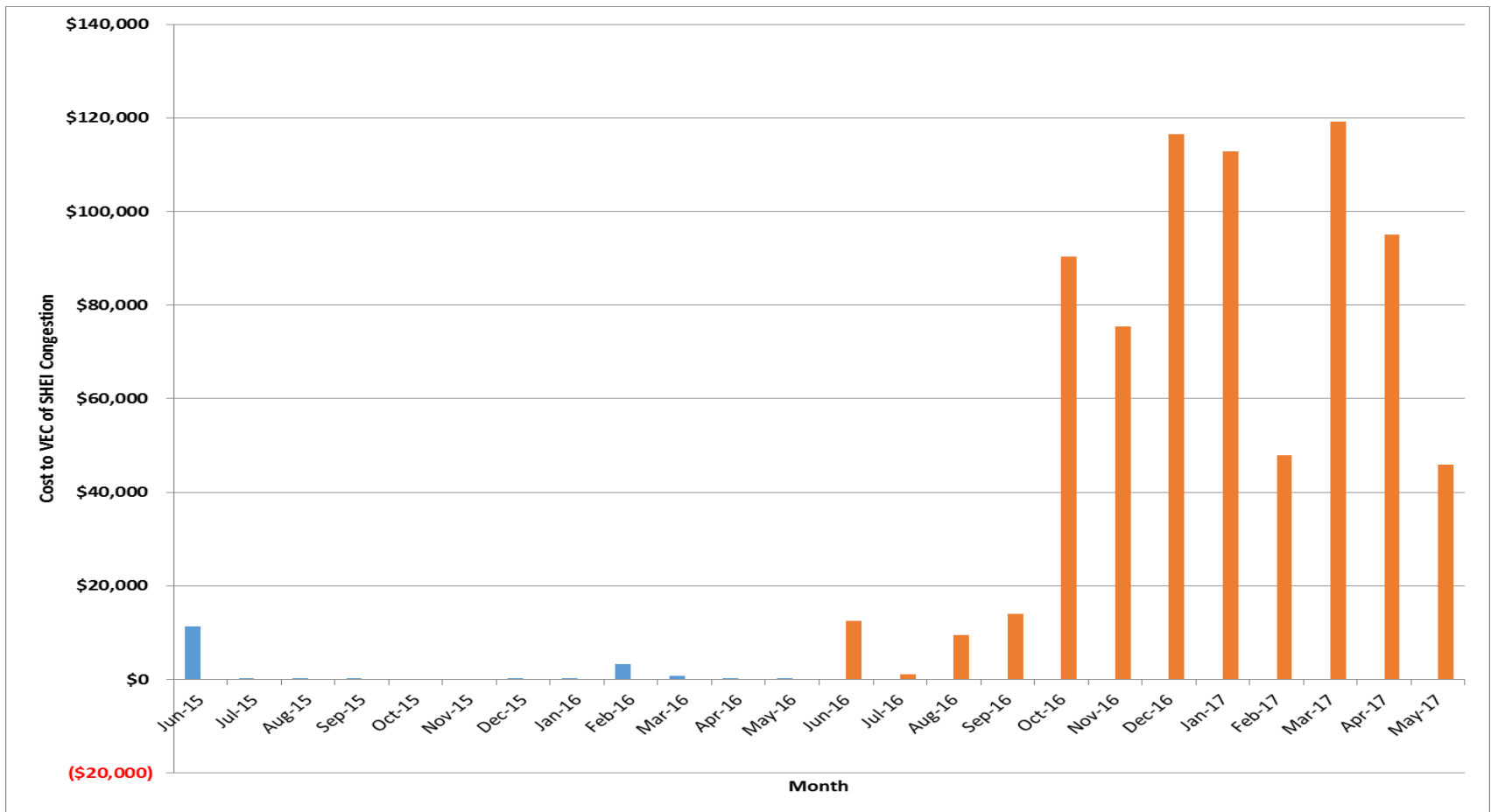
VEC Settlement for May 1, 2017 Hour Ending 1200

Resource Name	ISO-NE Settlement Location	Resources (Load) - MW	Energy Component of LMP - \$/MWh	Losses Component of LMP - \$/MWh	Congestion Component of LMP - \$/MWh	Total LMP	Total Credit (Charge) - \$	Total LMP No Constraint - \$/MWh	Total Credit (Charge) - No Constraint - \$
Purpa Unit	LD.ASCUTNEY46	0.038	\$61.14	\$1.42	\$0.07	\$62.63	\$2.37	\$62.56	\$2.36
NYPA	.I.ROSETON 345 1	5.547	\$61.14	(\$0.54)	\$1.87	\$62.47	\$346.52	\$60.60	\$336.15
Purpa Unit	LD.HARTFDVT46	0.069	\$61.14	\$0.51	\$0.07	\$61.72	\$4.23	\$61.65	\$4.23
Seabrook	UN.SEABROOK24.5SBRK	1.940	\$61.14	\$0.36	\$0.07	\$61.57	\$119.45	\$61.50	\$119.31
Purpa Unit	LD.N_RUTLND46	0.000	\$61.14	\$0.04	\$0.07	\$61.25	\$0.00	\$61.18	\$0.00
Purpa Unit	LD.MIDDLEBRY46	0.034	\$61.14	\$0.01	\$0.07	\$61.22	\$2.07	\$61.15	\$2.07
Exelon	.H.INTERNAL_HUB	10.000	\$61.14	(\$0.43)	\$0.07	\$60.78	\$607.80	\$60.71	\$607.10
Purpa Unit	LD.MIDDLESX34.5	0.074	\$61.14	(\$1.63)	\$0.07	\$59.58	\$4.40	\$59.51	\$4.39
Purpa Unit	LD.BERLINV34.5	0.000	\$61.14	(\$1.79)	\$0.07	\$59.42	\$0.00	\$59.35	\$0.00
Dodge Falls	UN.BARRE_VT34.5DODF	0.321	\$61.14	(\$2.04)	\$0.07	\$59.17	\$18.98	\$59.10	\$18.96
Ryegate	UN.BARRE_VT34.5RYGT	1.513	\$61.14	(\$2.04)	\$0.07	\$59.17	\$89.54	\$59.10	\$89.44
Purpa Unit	LD.BARRE_VT34.5	0.024	\$61.14	(\$2.04)	\$0.07	\$59.17	\$1.41	\$59.10	\$1.41
Load	.Z.VERMONT	(52.360)	\$61.14	(\$1.45)	(\$1.66)	\$58.03	(\$3,038.45)	\$59.69	(\$3,125.37)
Purpa Unit	LD.STJHNSBY34.5	0.331	\$61.14	(\$3.85)	\$0.07	\$57.36	\$18.96	\$57.29	\$18.94
Purpa Unit	LD.STALBANS34.5	0.018	\$61.14	(\$3.99)	\$0.07	\$57.22	\$1.01	\$57.15	\$1.01
HQ	.I.HQHIGATE120 2	26.671	\$61.14	(\$0.04)	(\$20.77)	\$40.33	\$1,075.64	\$61.10	\$1,629.60
Newport Hydro	LD.IRASBURG46	0.332	\$61.14	(\$4.51)	(\$20.65)	\$35.98	\$11.94	\$56.63	\$18.79
Sheldon Springs	UN.HIGHGATE46 SHEL	1.106	\$61.14	(\$5.50)	(\$20.70)	\$34.94	\$38.65	\$55.64	\$61.56
Purpa Unit	LD.HIGHGATE46	0.048	\$61.14	(\$5.50)	(\$20.70)	\$34.94	\$1.67	\$55.64	\$2.66
Swanton Peaker	UN.HIGHGATE13.8SWC1	0.000	\$61.14	(\$5.50)	(\$20.70)	\$34.94	\$0.00	\$55.64	\$0.00
Swanton Peaker	UN.HIGHGATE13.8SWC2	0.000	\$61.14	(\$5.50)	(\$20.70)	\$34.94	\$0.00	\$55.64	\$0.00
KCW	UN.JAY_T 46 KCW	2.785	\$61.14	(\$4.96)	(\$41.18)	\$15.00	\$41.77	\$56.18	\$156.45
Sheffield Wind	UN.SHEFIELD34.5SHEF	8.055	\$61.14	(\$4.45)	(\$41.77)	\$14.92	\$120.18	\$56.69	\$456.64
Net Credit (Charge)							(\$531.86)		\$405.68

# % of Hours Reduced LMP in SHEI



# \$ Impact to VEC of Reduced LMP in SHEI



# Determining LMPs - General

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- Asset owners submit confidential bids to ISO-NE signifying the minimum price they are willing to be paid to generate
  
- Dispatches Generating Assets in most cost-effective way possible, given reliability constraints
  
- ISO dispatches assets to meet load starting with least expensive offers and working through the offers to the most expensive. Taking into account:
  - Start up time and costs
  - Load forecasts
  - Reliability/transmission constraints



# Determining LMPs – No Transmission Constraints (Simplified)

Resource	Size (MW)	Offer Price (\$/MWH)	Load (MW)
1	40	(\$150.00)	40
2	50	(\$50.00)	90
3	1,200	\$0.00	1,290
4	400	\$10.00	1,690
5	135	\$15.00	1,825
6	300	\$27.00	2,125
7	680	\$40.00	2,805
8	400	\$50.00	3,205
9	25	\$350.00	3,230
10	175	\$650.00	3,405
11	25	\$1000.00	3,430

# What is an Export Constraint?

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- Localized issue where the amount of resources in the region minus load (energy consumed in the region) is greater than the transmission capability to send energy out of the region.

$$[\text{Resources} - \text{Load}] - \text{Transmission Capability Out} > 0$$

- If this equation  $> 0$ , Resources in the region need to decrease (or Load needs to increase) until this equation is  $\leq 0$ .
- Resources are decreased within the region by ISO-NE conducting a similar stacking order of bids within the region as they do in NE when no constraints exist.

# Determining LMPs – In Export Constrained Region (Simplified)

## Constraint Assumptions

Resources =	325 MW
<u>Load =</u>	<u>50 MW</u>
Net Resources =	275 MW
<u>Export Limit =</u>	<u>250 MW</u>
Limit Violation =	25 MW

## Resource Offers in Region

Resource in Region	Size (MW)	Offer Price (\$/MWH)
1	40	\$0.00
2	200	\$15.00
3	25	\$20.00
4	15	\$25.00
5	15	\$30.00
6	15	\$35.00
7	15	\$40.00

**LMP in Region with Constraint = \$35.00**  
**LMP in Region w/no Constraint = \$50.00**