Synapse
Energy Economics, Inc.

System Planning and Order 1000

Natural Resources Committee
National Governors Association Annual Meeting

July 14, 2012

Presented by Paul Peterson

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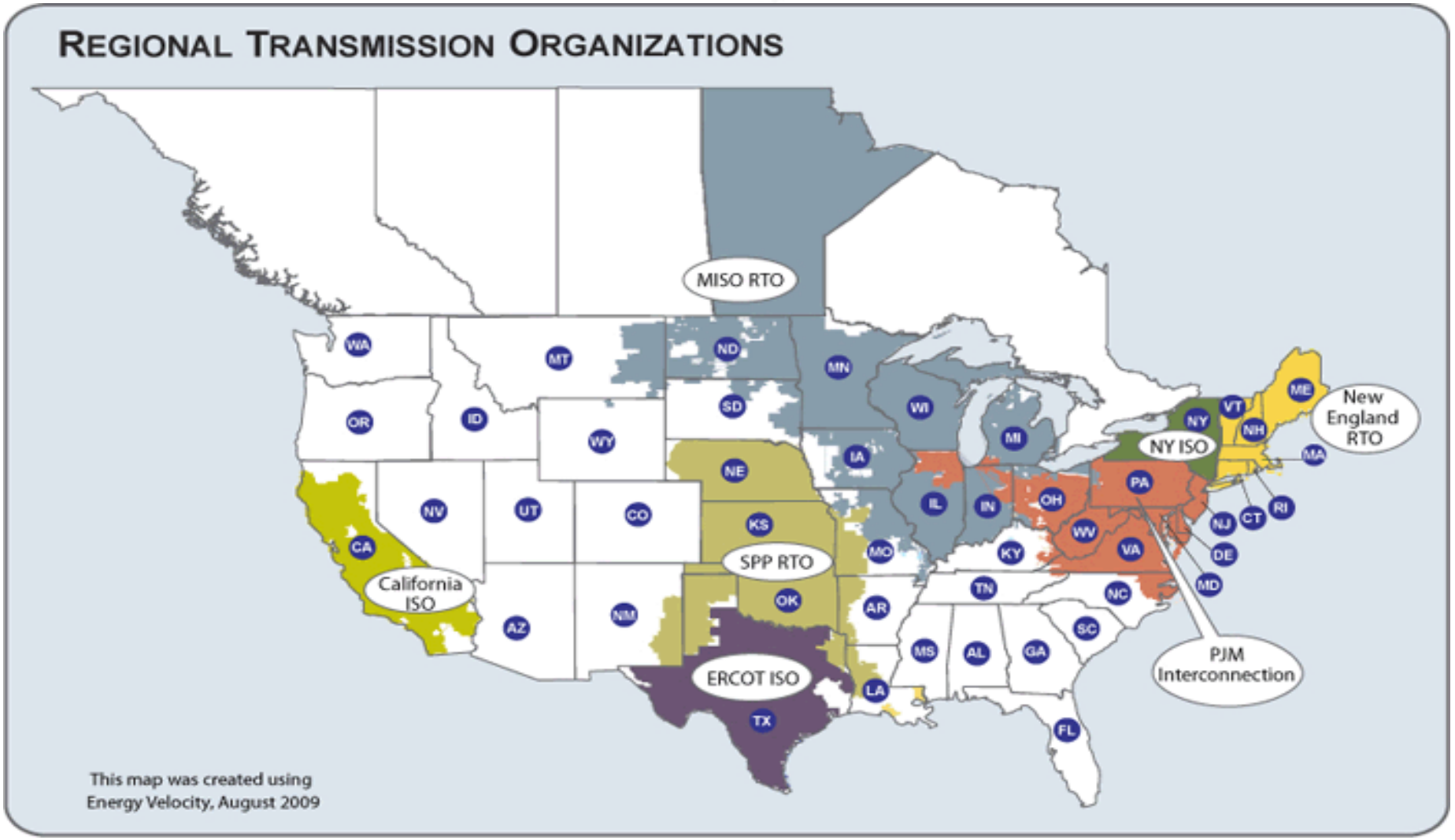
Synapse Energy Economics

- Consulting firm in Cambridge Massachusetts with a staff of 30 people
- Issues
  - Electric industry restructuring & utility rate cases
  - Wholesale markets, ISOs, and RTOs
  - Resource Development and Retirements
  - Environmental impacts of power industry
- Clients
  - State Consumer Advocates and Utility Commissions
  - Public Interest and Environmental groups
  - EPA and DOE
  - RTO stakeholders

North America machines



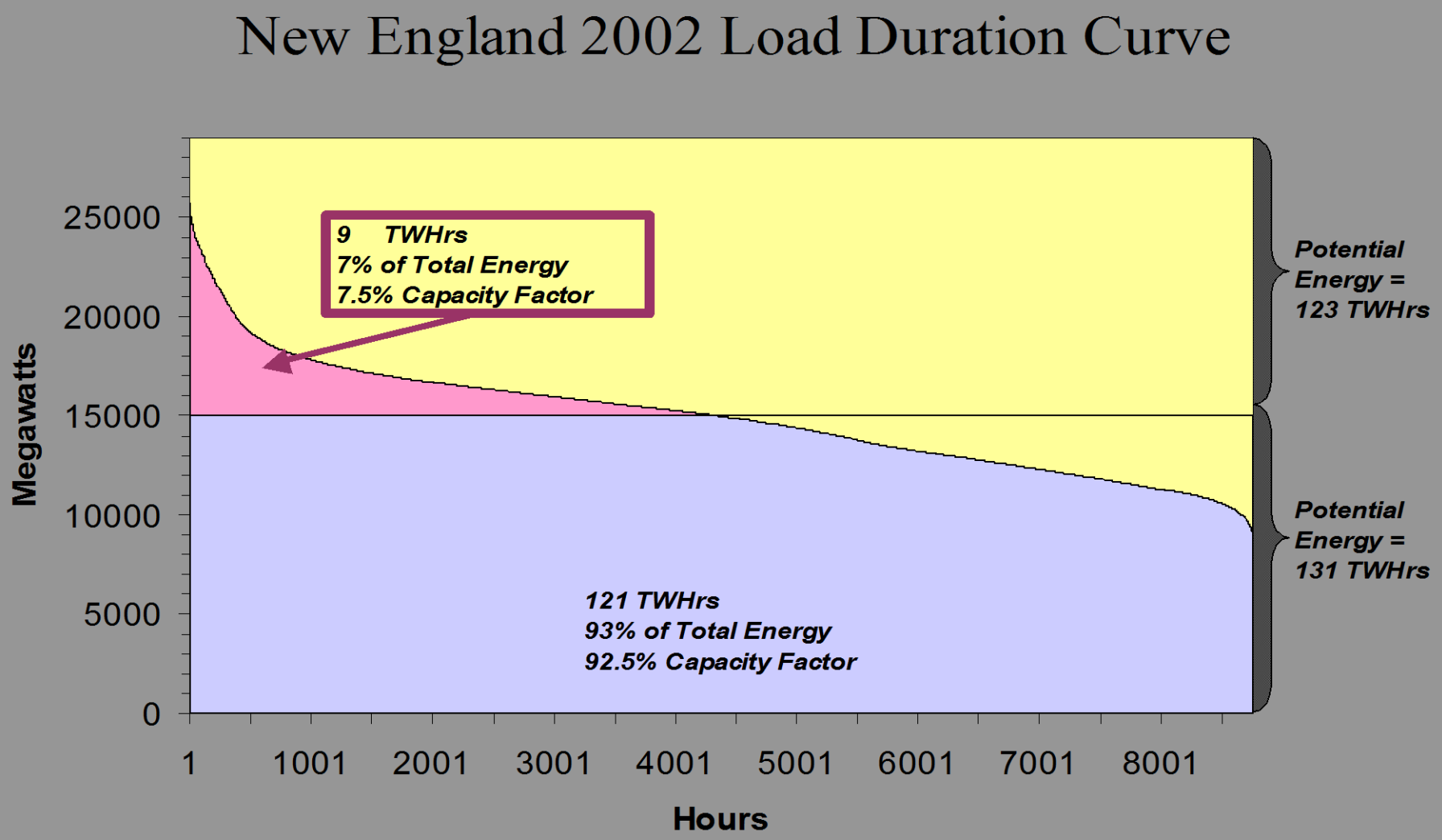
Electric system overview

- Three elements to power system
  - Supply (resources)
  - Demand (loads)
  - Wires (T&D systems)
- Inter-connected electric systems are the largest machines every built
  - 24/7 balancing of supply and demand
  - Cascading effect of disruptions

Electric system overview

- Traditional operation of power grids
  - Day-ahead forecast of hourly loads (weather)
  - Day-ahead commitment of generation
  - Real-time management of generation by operators
- Evolving operation of power grids
  - Day-ahead offers by Supply and Load
  - Day-ahead dispatch schedule includes instructions to both Supply and Load
  - Real-time balancing based on offers
- Supply and load are variable/manageable

Background


New England 2002 Load Duration Curve
Megawatts
25000
20000
15000
10000
5000
0
1
1001
2001
3001
4001
5001
6001
7001
8001
Hours
9 TWHrs
7% of Total Energy
7.5% Capacity Factor
121 TWHrs
93% of Total Energy
92.5% Capacity Factor
Potential Energy = 123 TWHrs
Potential Energy = 131 TWHrs

Federal Energy Regulatory Commission

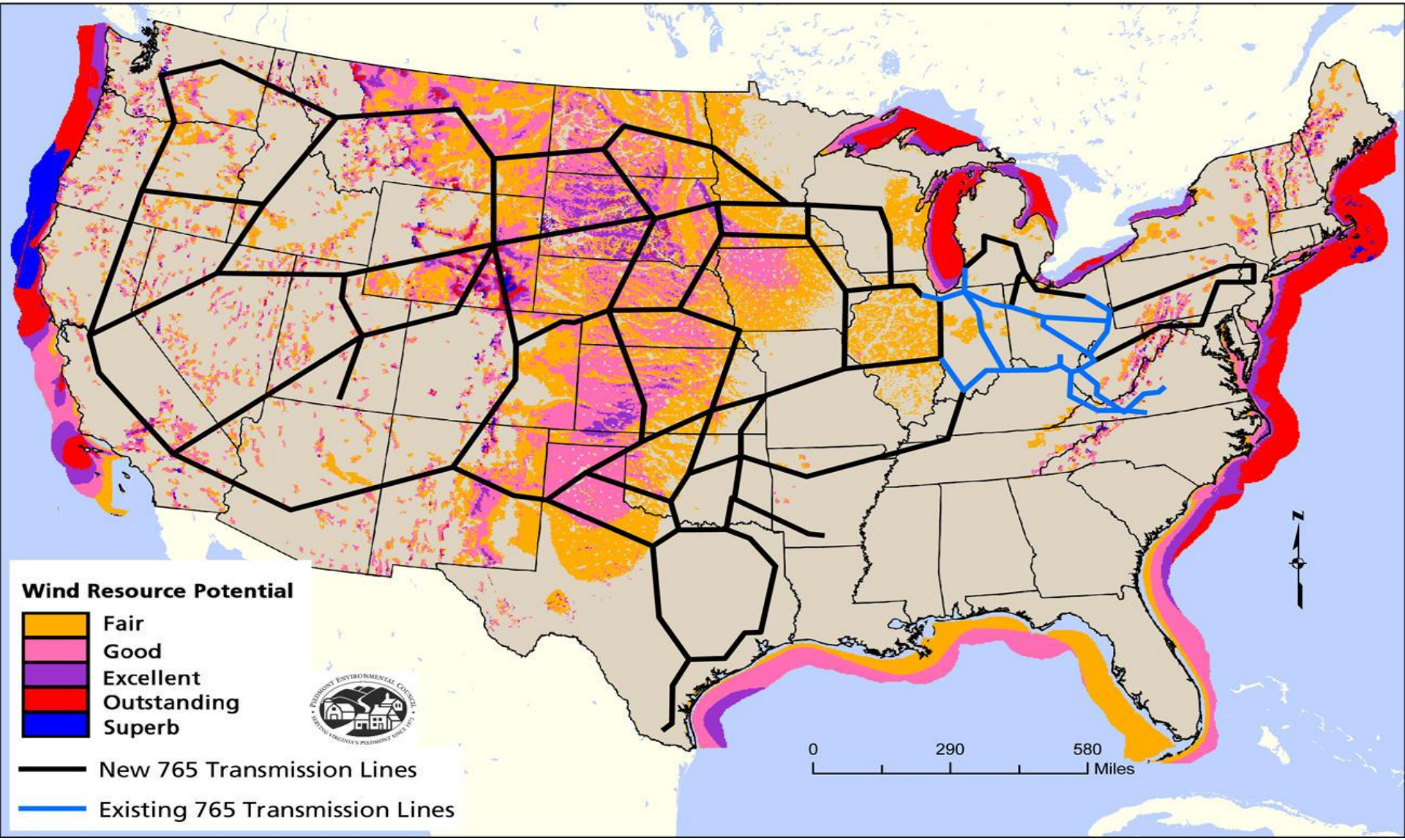
- Jurisdiction over wholesale power markets and bulk power system
- Standards of review
  - Just & Reasonable rates
  - No undue discrimination
- Transmission planning & operations
  - Order 888 & 889
  - Order 890 et seq.
  - Order 1000

FERC Order 1000

- Issued July 2011
  - Regional planning compliance October 2012
  - Interregional planning compliance April 2013
- Key elements
  - Stakeholder participation
  - Consider public policies
  - Evaluate alternatives
  - Assign costs to beneficiaries
  - Eliminate “right of first refusal”
  - Develop inter-regional coordination

Existing Backbone Transmission

AEP Conceptual Transmission Plan for Wind Energy



Key Order 1000 Concepts

- Alternative analysis and ROFR
- Public Policy Requirements
  - State
  - Federal
- Cost allocation
  - Reliability projects
  - Economic Projects
  - Public Policy Projects
- Inter-regional coordination (future)

Reading FERC tea leaves

- PJM as a bell-weather
  - Largest RTO
  - Innovative and competent
  - Proximity to Washington, DC
  - But not all of the best ideas
- Watch other RTOs on special issues
  - California, New England, New York, MISO, SPP, ERCOT, and Ontario Hydro
- Also, individual states have good policies

Summary

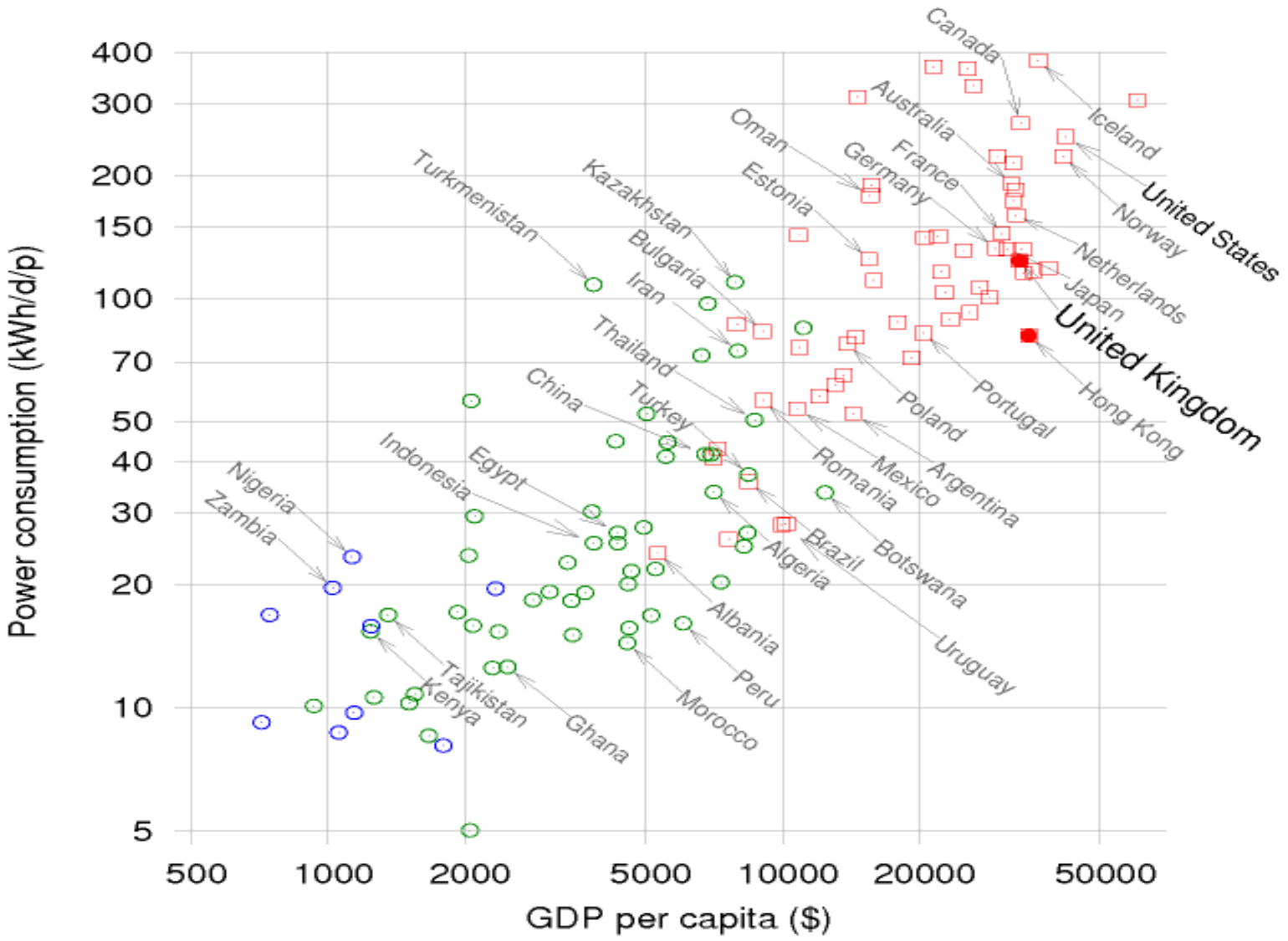
- No silver bullet answer
- Goal is a sustainable energy future
- Greater efficiency is an essential element
- Other elements:
  - Clean resources
  - Grid management of demand and supply
  - Technical applications
  - Integrated solutions

Four Questions

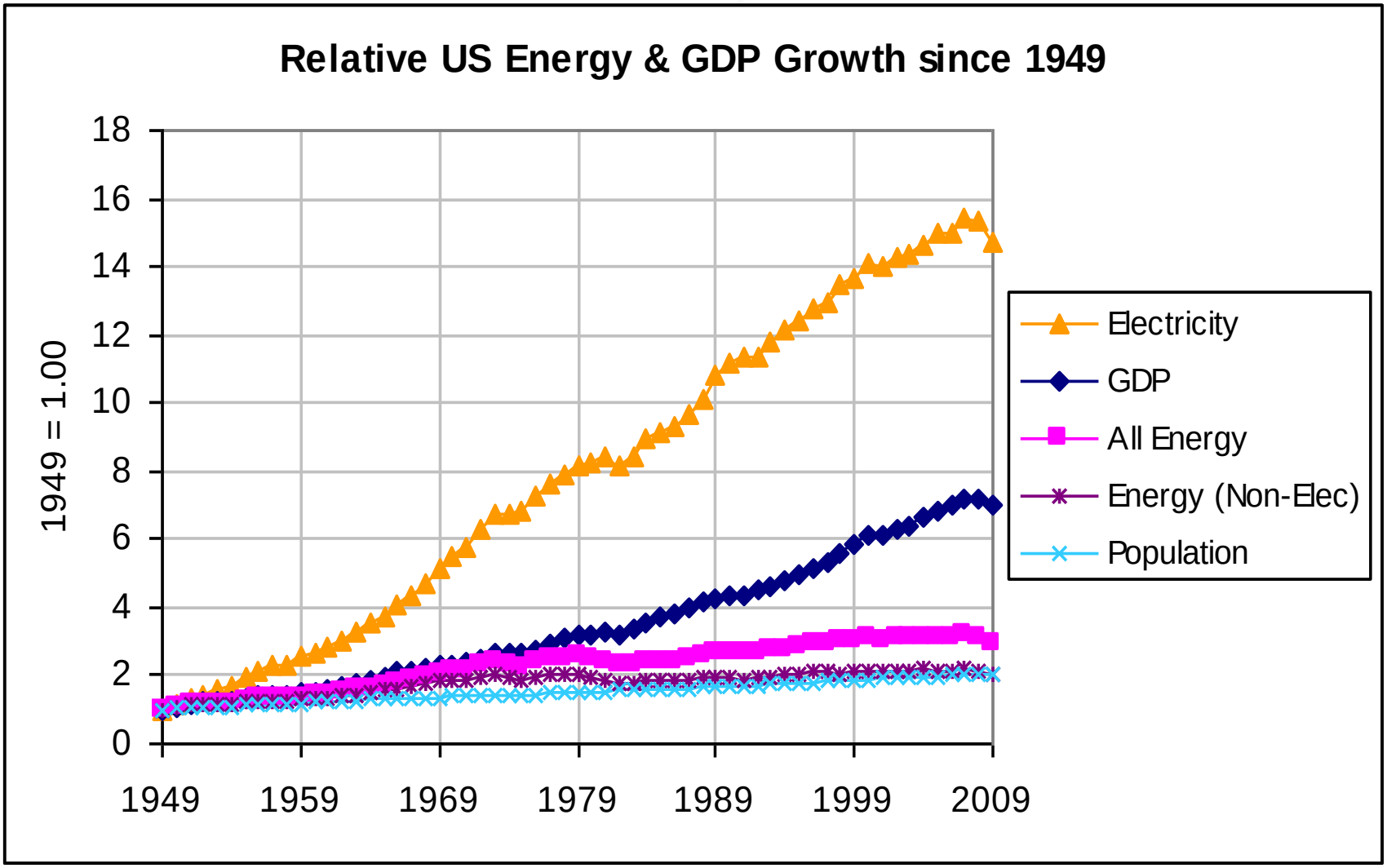
- Ask your state electric utilities for energy and peak load forecasts that show impacts of EE, customer generation, and PV
- Ask your state Energy Office to evaluate strategies for reducing peak loads
- Ask your utility Commission to:
  - evaluate potential for smart meters and smart grids to improve system load factors
  - evaluate rate designs for V2G systems

Background Slides

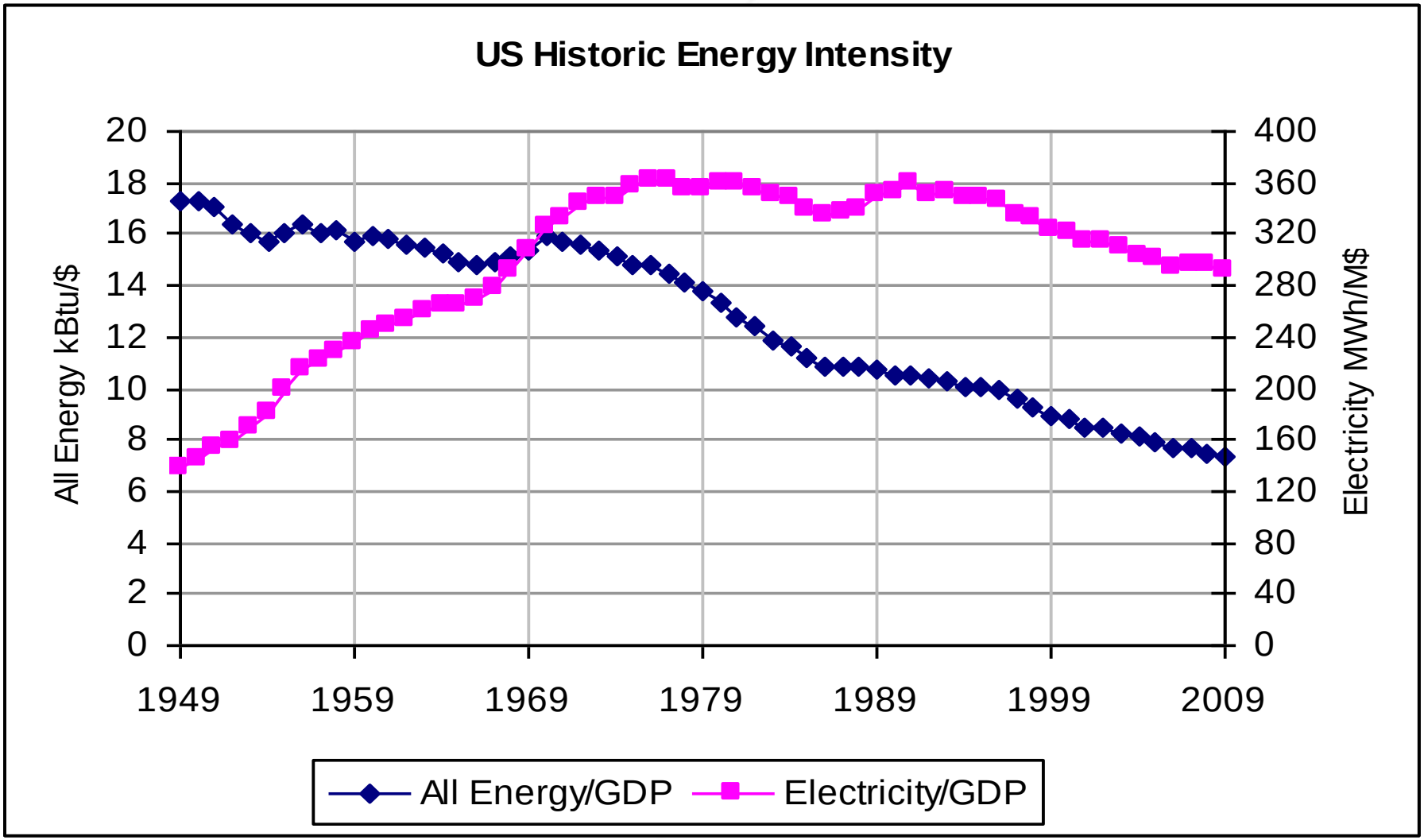
Energy Intensity



Background



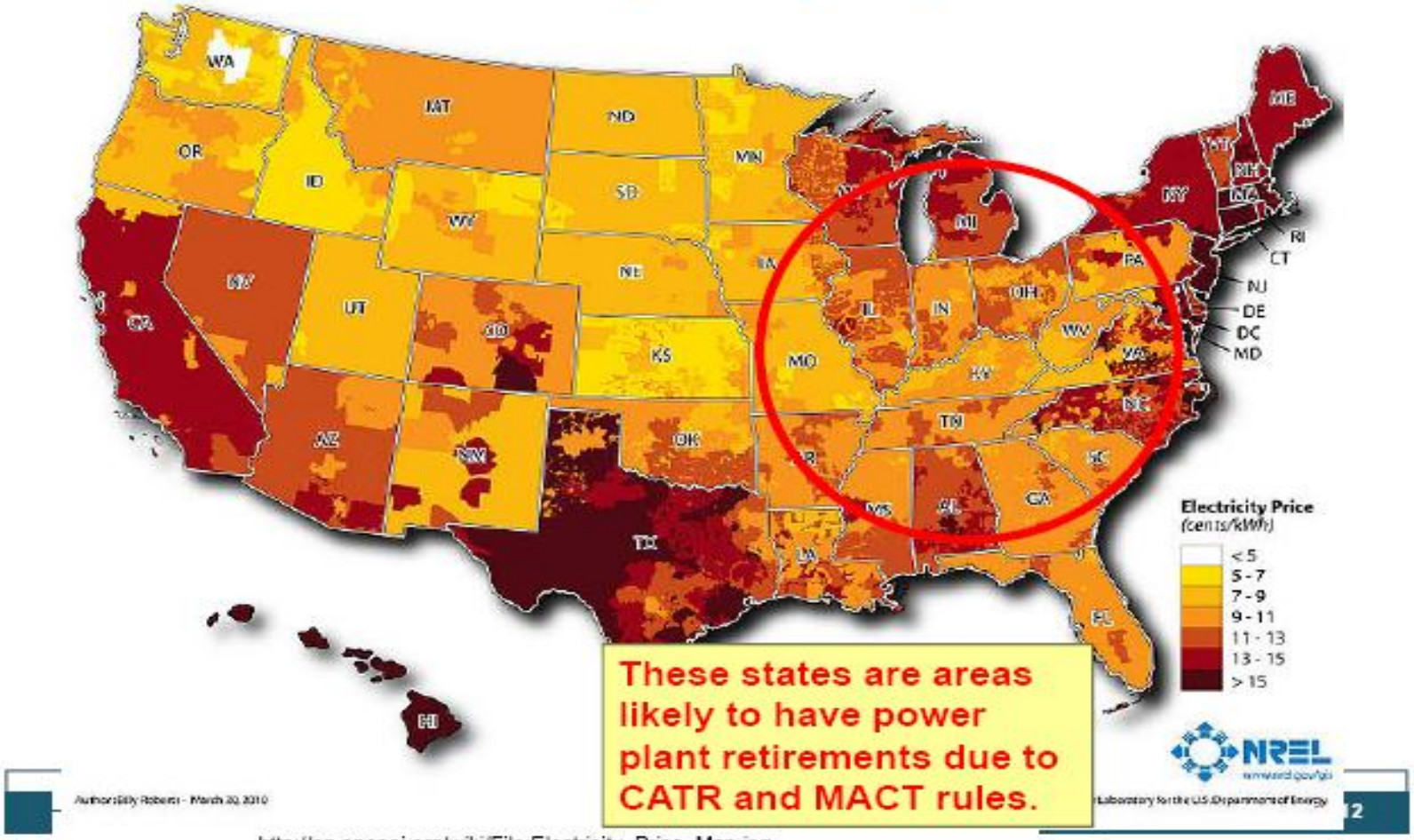
USA Energy Intensity



Understanding Energy Intensity Values

- Each country's energy intensity value, by itself, does not indicate "good" or "bad", it is just a way of understanding and comparing one aspect of energy consumption
- Geography, development, and access to natural resources (low-cost) are key factors
- For the USA, in general, a lower energy intensity value equates to greater efficiency and, therefore, insulation from energy price volatility.

Average Retail Electricity Price (2008)

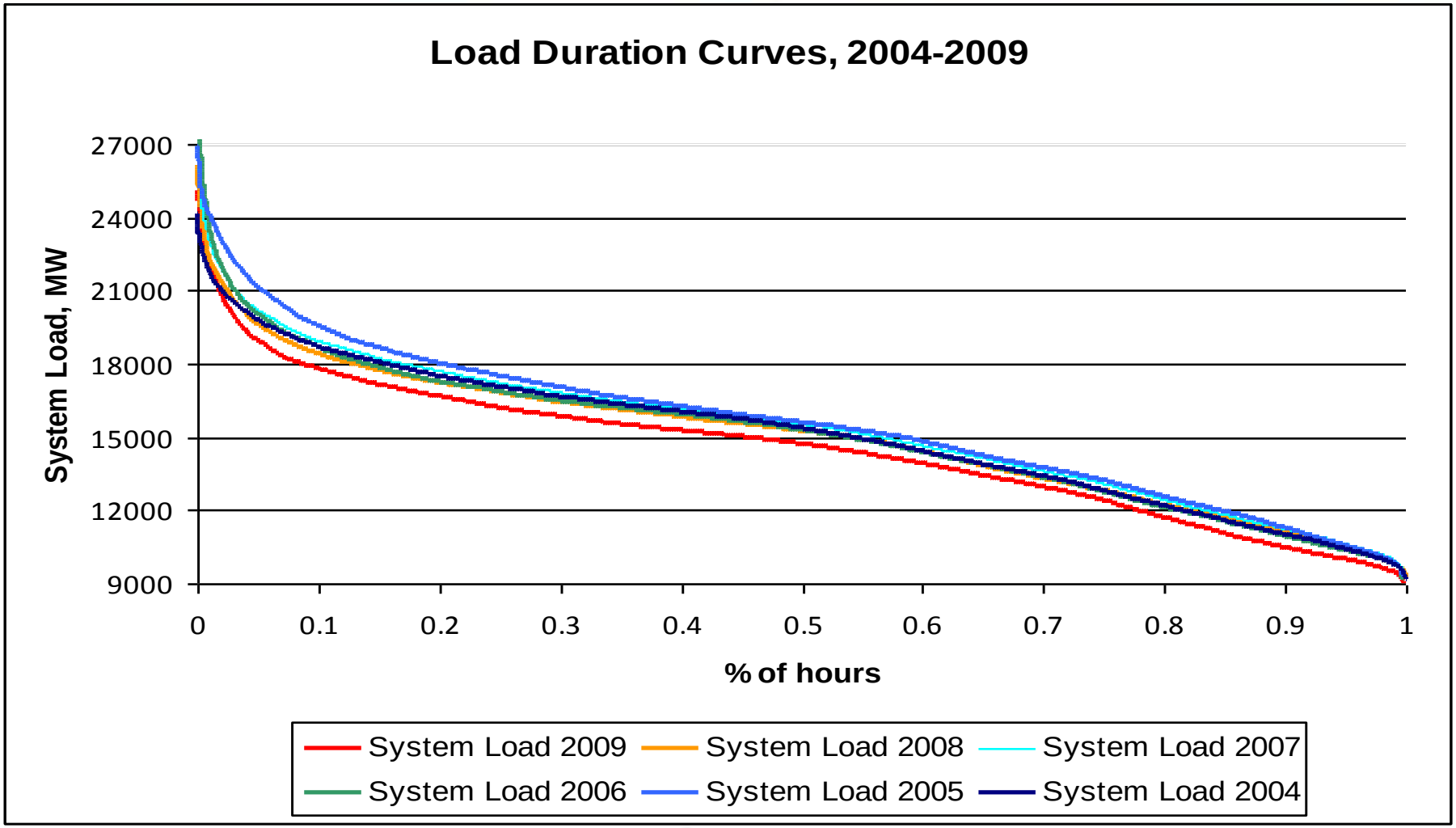


http://en.openei.org/wiki/File:Electricity_Price_Map.jpg

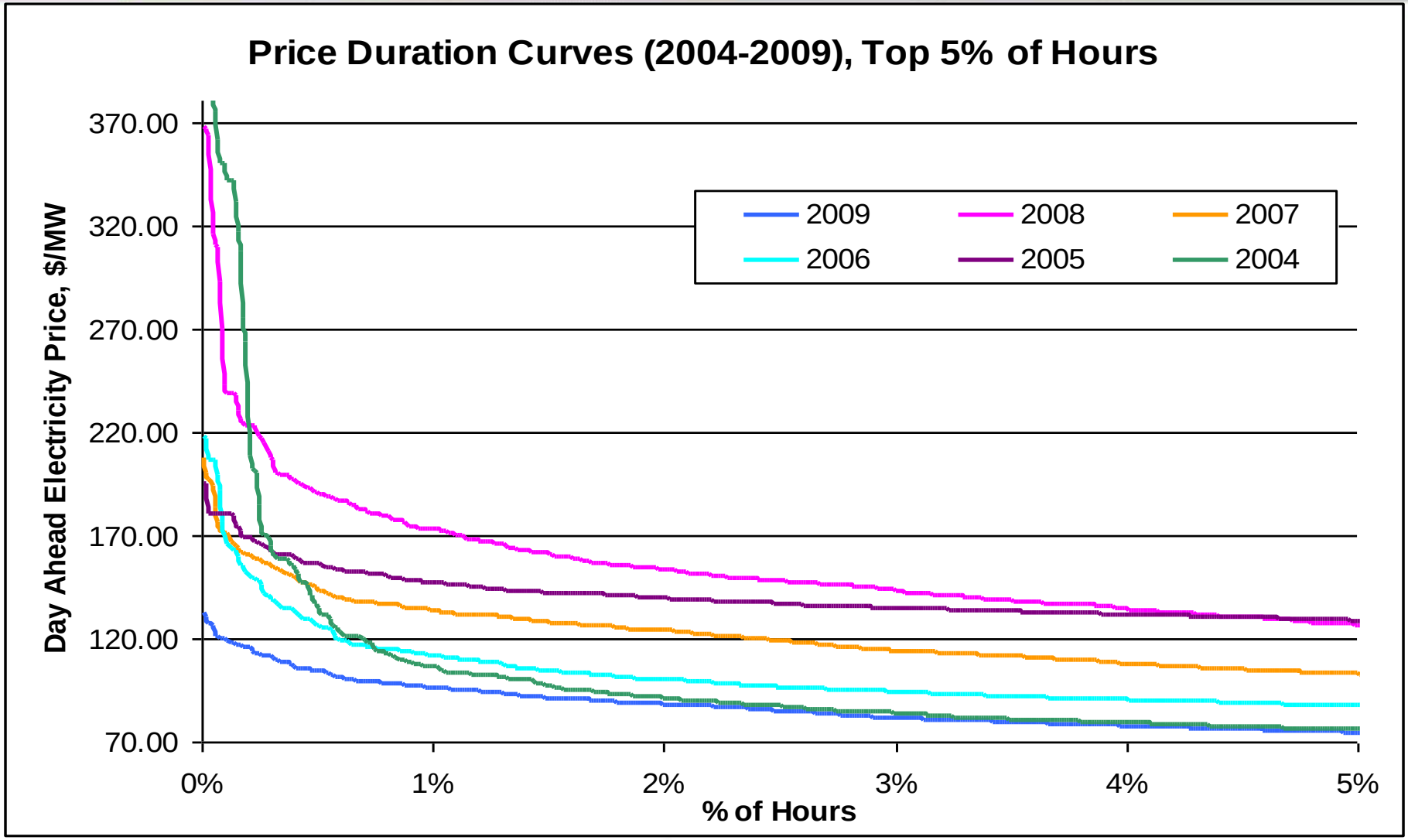
Background concepts

- Peak Load
  - Summer: MW needed for summer peak day
  - Winter: MW needed for winter peak day
  - Daily: MW needed for each daily peak
- Energy
  - MWH needed to meet total annual demand
- Reliability Needs
  - Resource adequacy (thermal loads on wires)
  - Voltage and stability (additional reliability tests)
  - Operational issues (daily reliability issues)

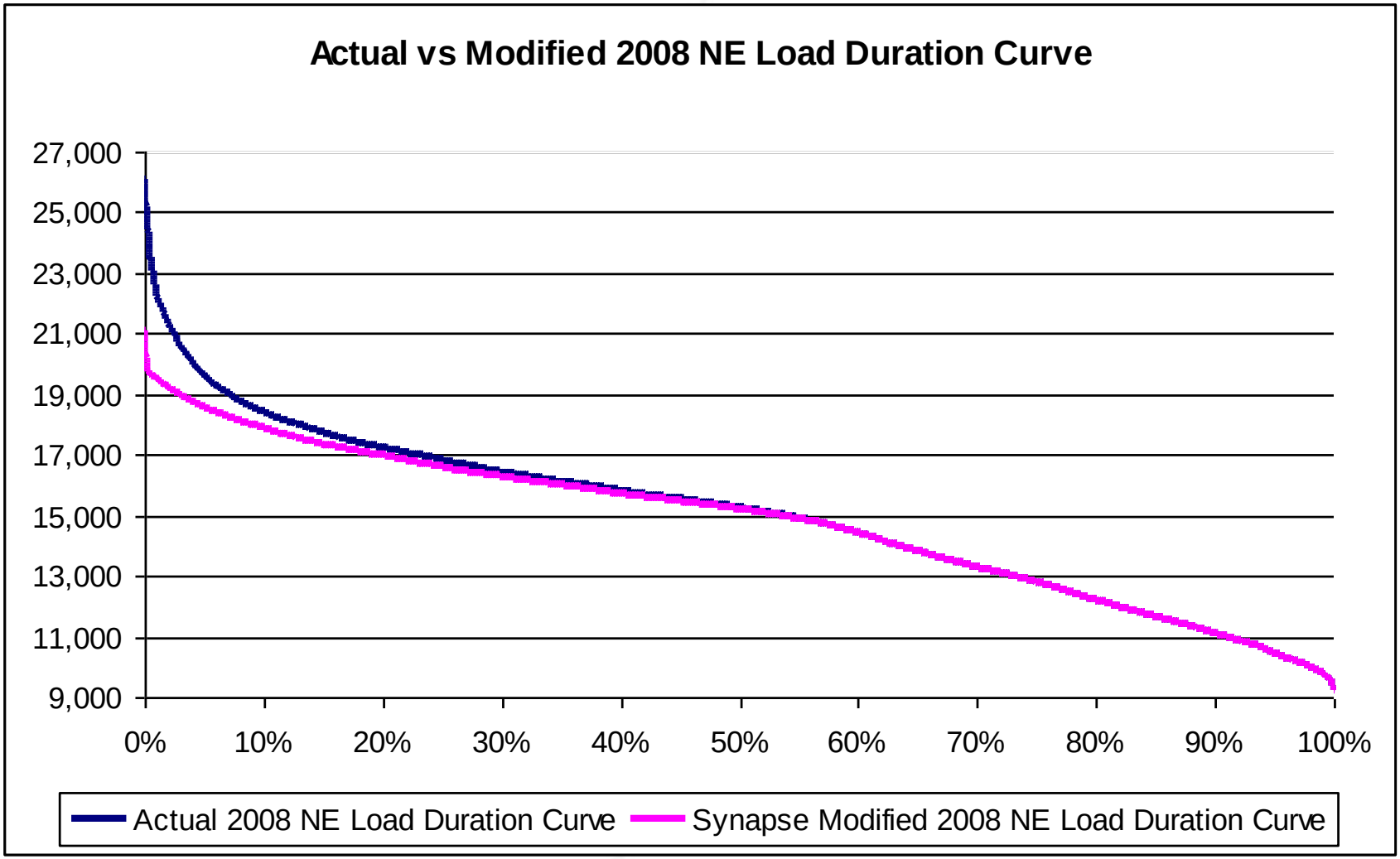
ISO-NE loads 2004-2009



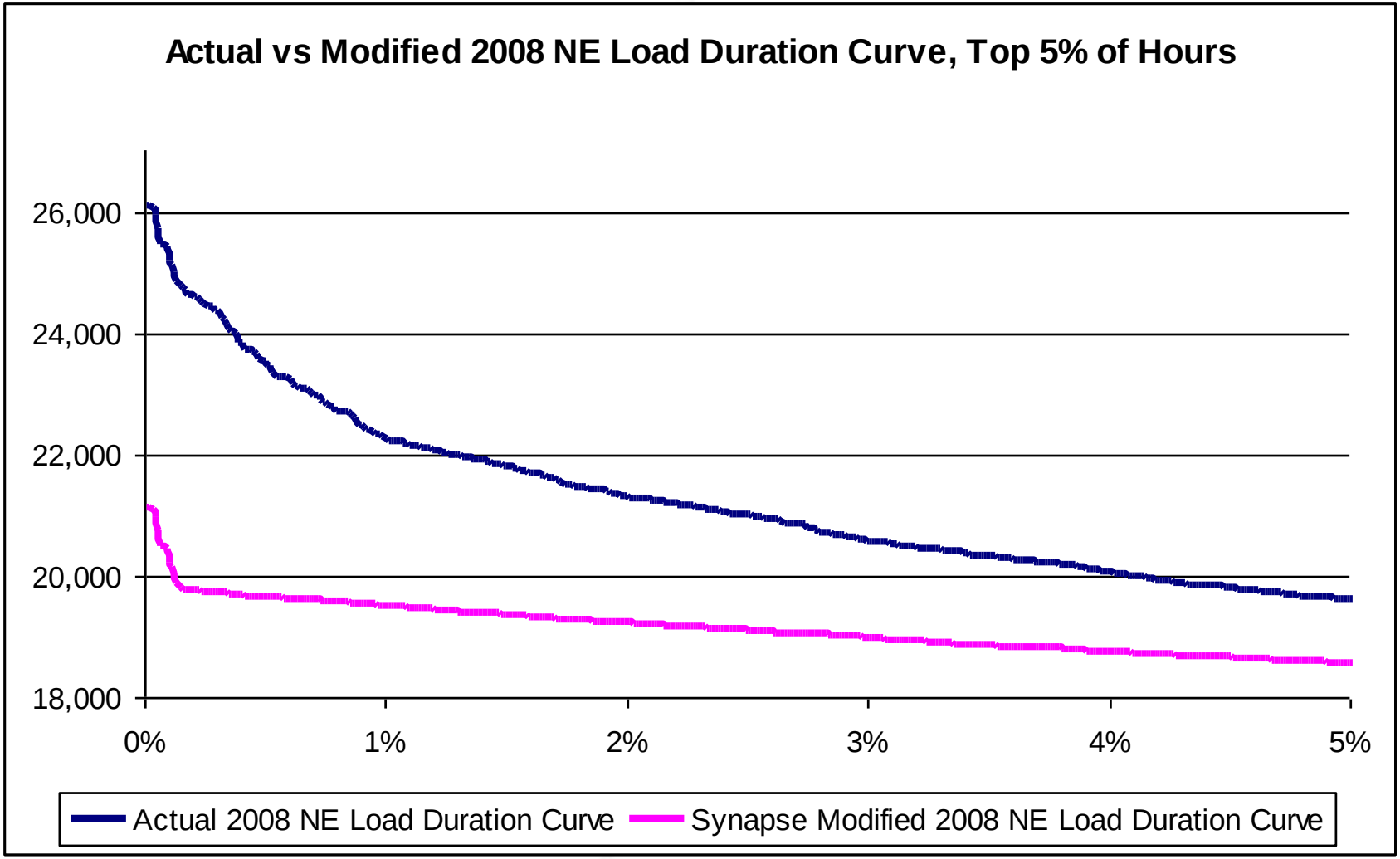
ISO-NE prices 2004-2009



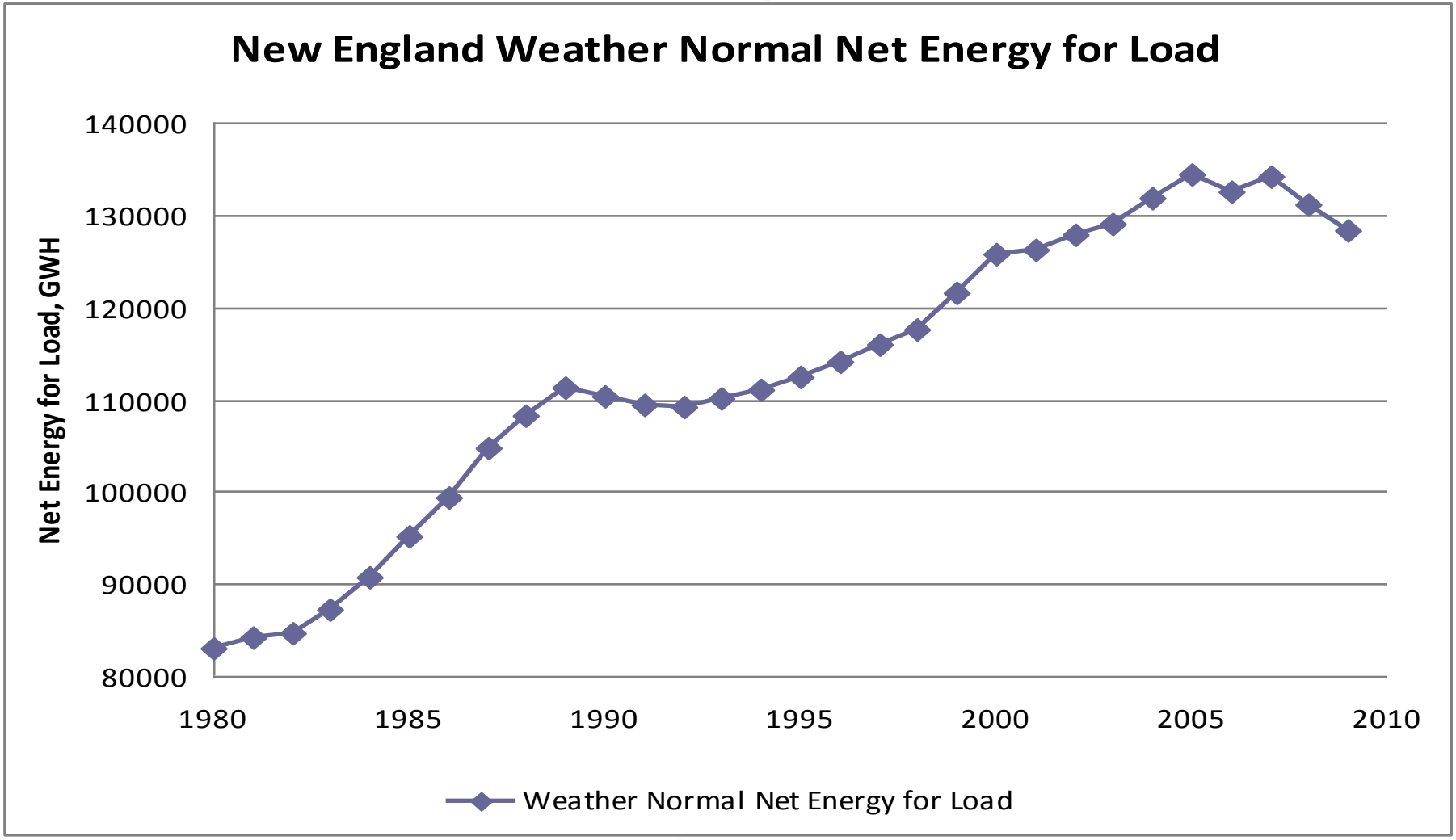
Synapse Modification: all hours



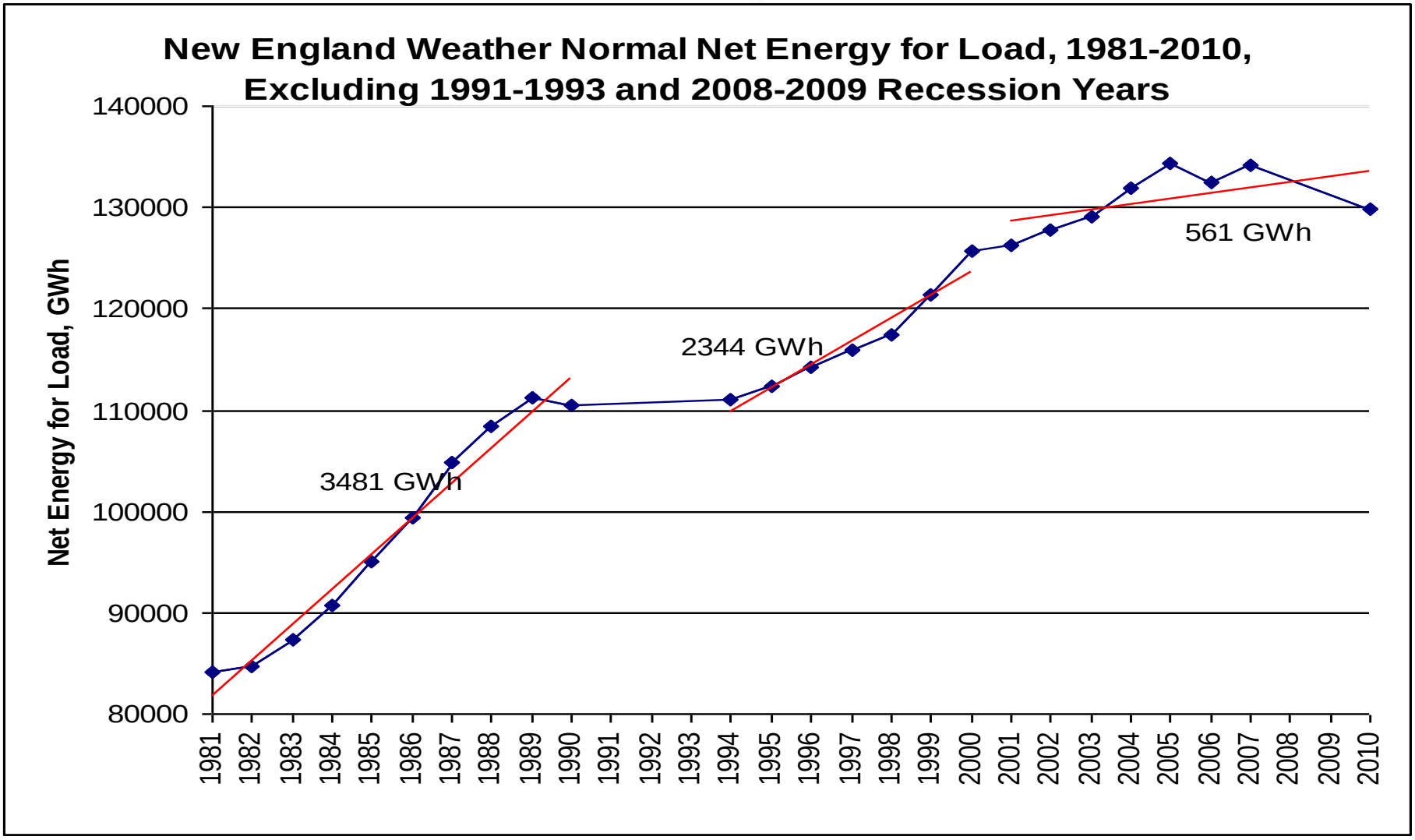
Synapse Modification: 5% of hours



Energy consumption 1980-2009 (weather normalized)



Improving Trend in New England



ISO-NE Forecast of EE resources (2012)

GWh Savings							
	Sum of States	ME	NH	VT	CT	RI	MA
2015	1759	97	71	112	269	167	1042
2016	1690	93	69	107	259	160	1001
2017	1622	88	68	102	250	153	961
2018	1557	84	66	97	241	147	923
2019	1493	79	64	93	232	140	885
2020	1431	74	63	88	223	134	849
2021	1372	70	61	84	215	128	815
Total	10924	585	462	683	1689	1029	6476
Average	1561	84	66	98	241	147	925

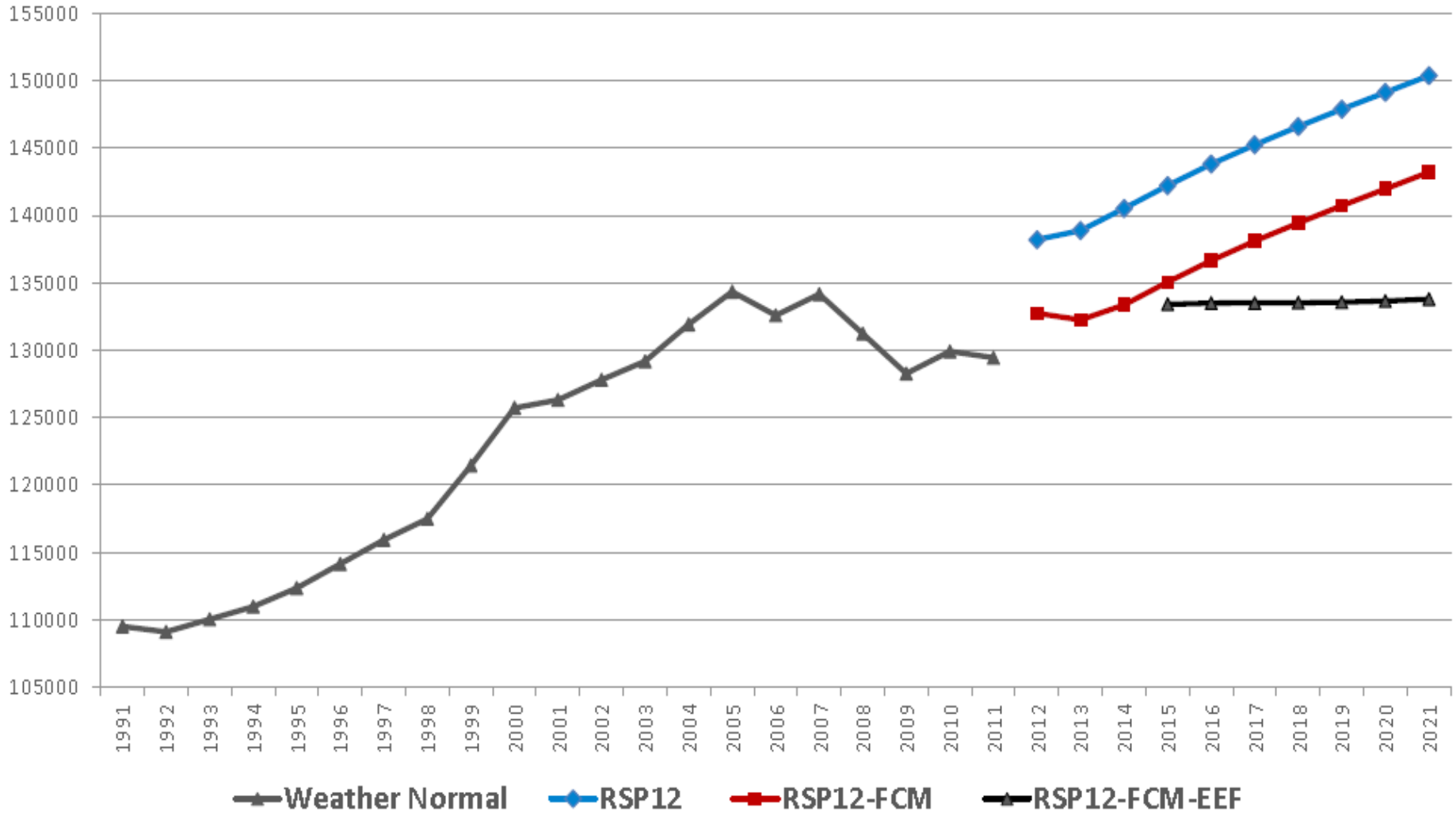
MW Savings							
	Sum of States	ME	NH	VT	CT	RI	MA
2015	270	11	12	21	36	29	162
2016	259	10	11	20	35	28	155
2017	249	10	11	19	33	27	149
2018	239	9	11	18	32	25	143
2019	229	9	11	17	31	24	137
2020	219	8	10	16	30	23	132
2021	210	8	10	16	29	22	126
Total	1675	65	76	127	226	178	1004
Average	239	9	11	18	32	25	143

Key Parameters for ISO-NE EE Forecast Model

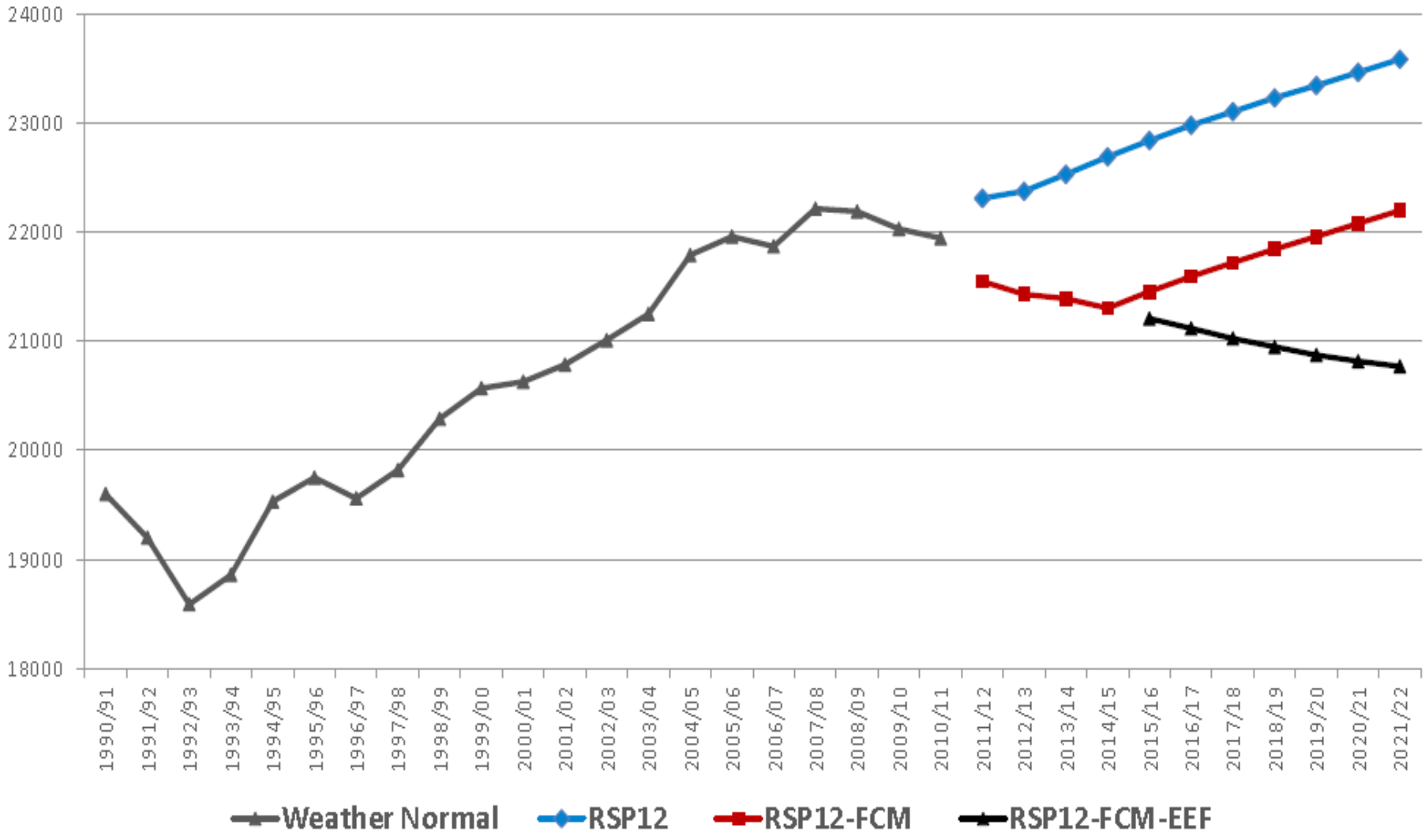
MW = $ * %Spent * MWh/$ * Realization Rate * MW/MWh

- **$:** an estimate of the dollars to be spent on EE (Including Budget Uncertainty)
- **%Spent:** percentage of dollars that can be spent on EE programs in that time period – developed from historical data
- **MWh/$:** MWh savings per dollar spent – developed from historical data
- **Realization Rate:** comparison of observed/measured savings to estimated savings – developed from historical data
- **MW/MWh:** peak to energy ratio (inverse of load factor) developed from historical data and possibly load forecast

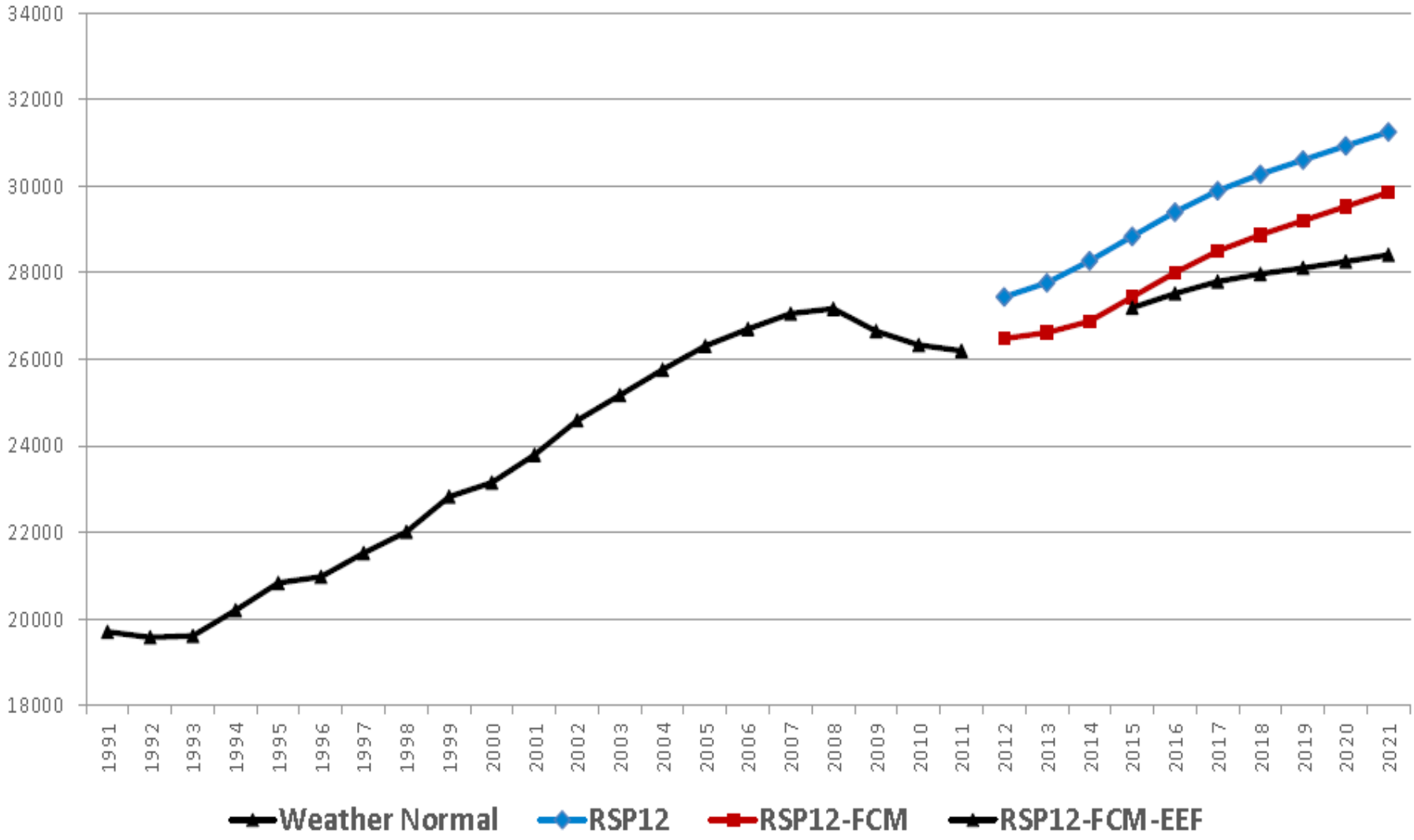
ISO-NE RSP12 Annual Energy (GWh)
Weather Normal History 1991-2011 and Forecast 2012-2021



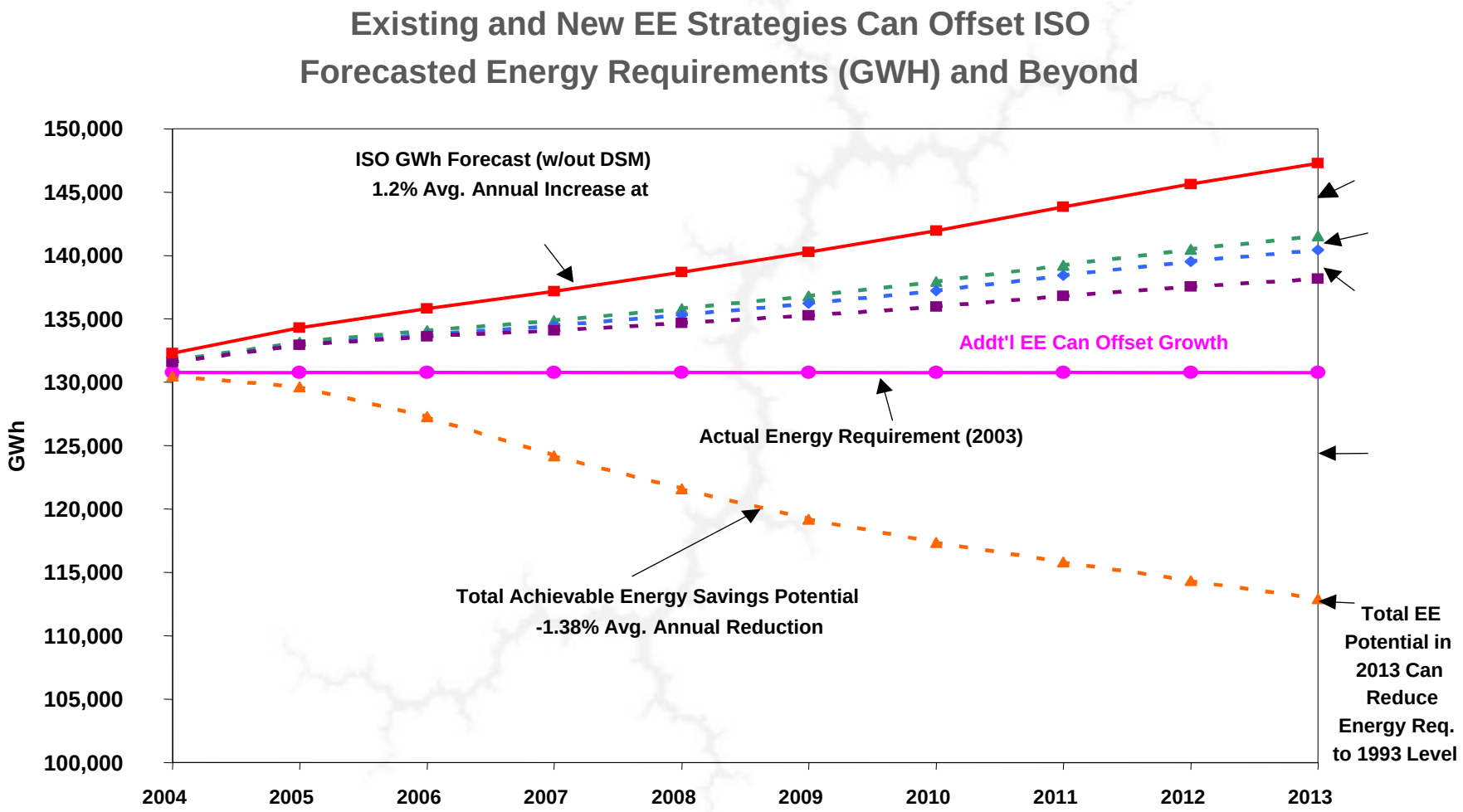
ISO-NE RSP12 50/50 Winter Peaks (MW) Weather Normal History 1991-2011 and Forecast 2012-2021



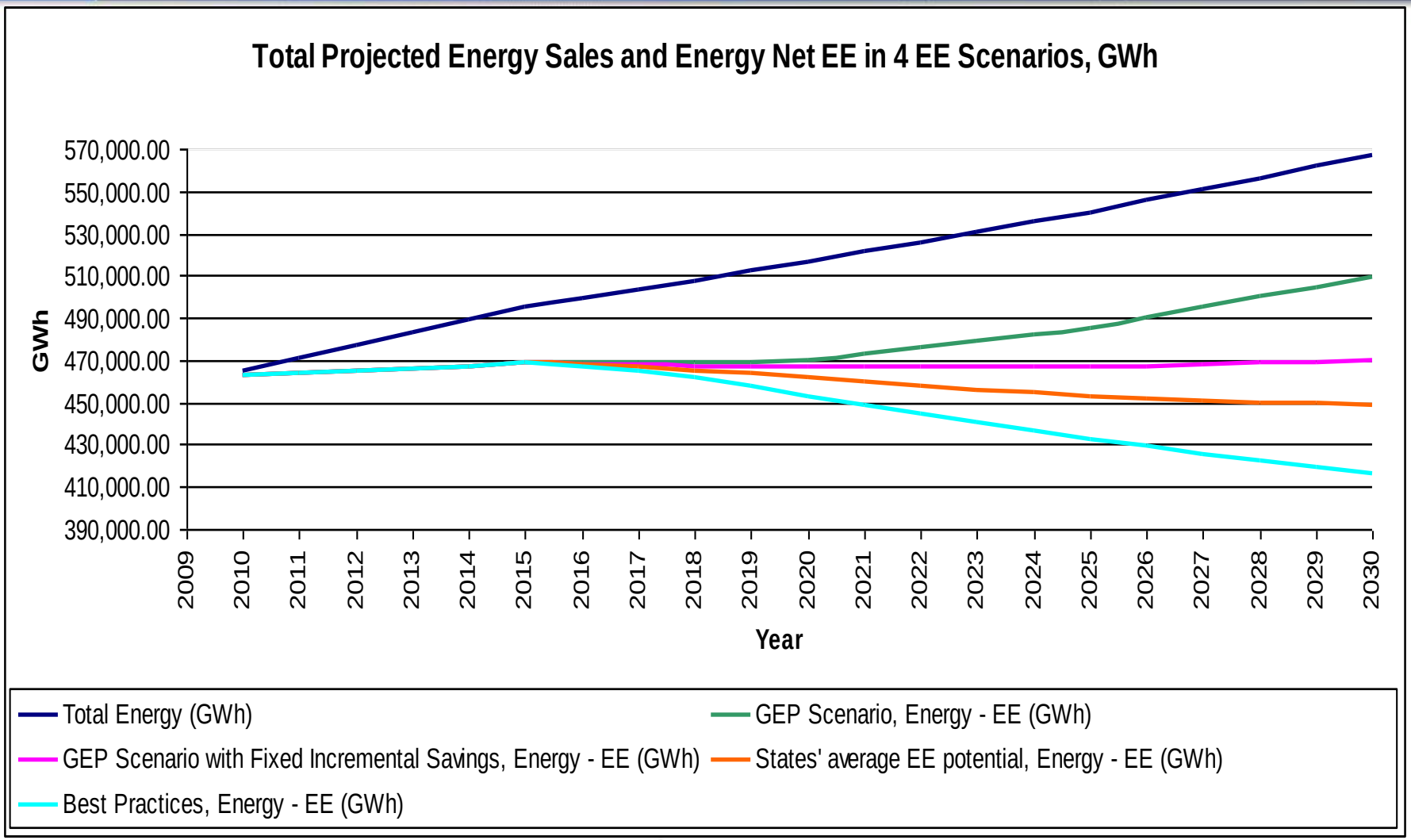
ISO-NE RSP12 50/50 Summer Peaks (MW)
Weather Normal History 1991-2011 and Forecast 2012-2021



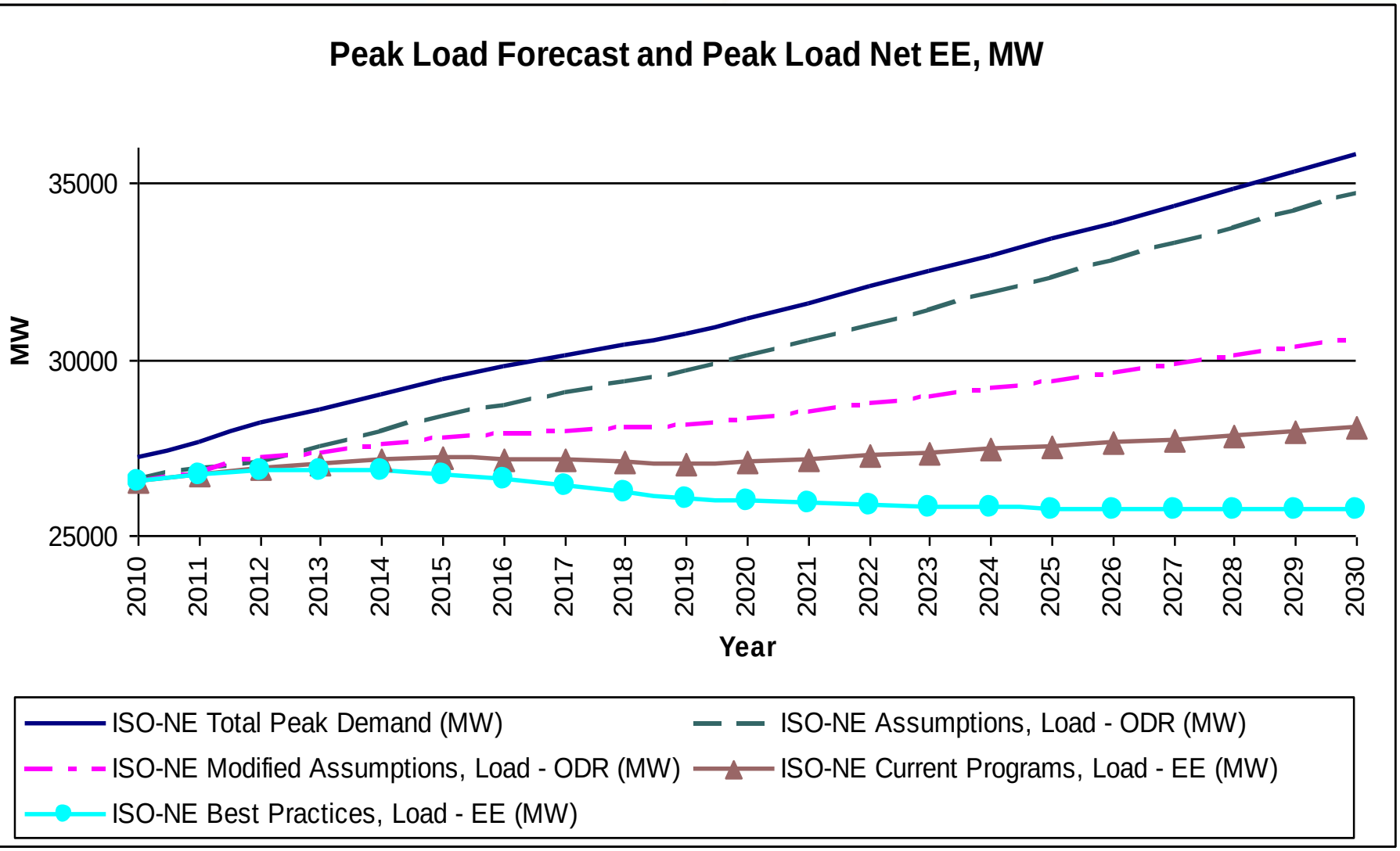
2005 Northeast Energy Efficiency Partnerships Estimate of EE Potential



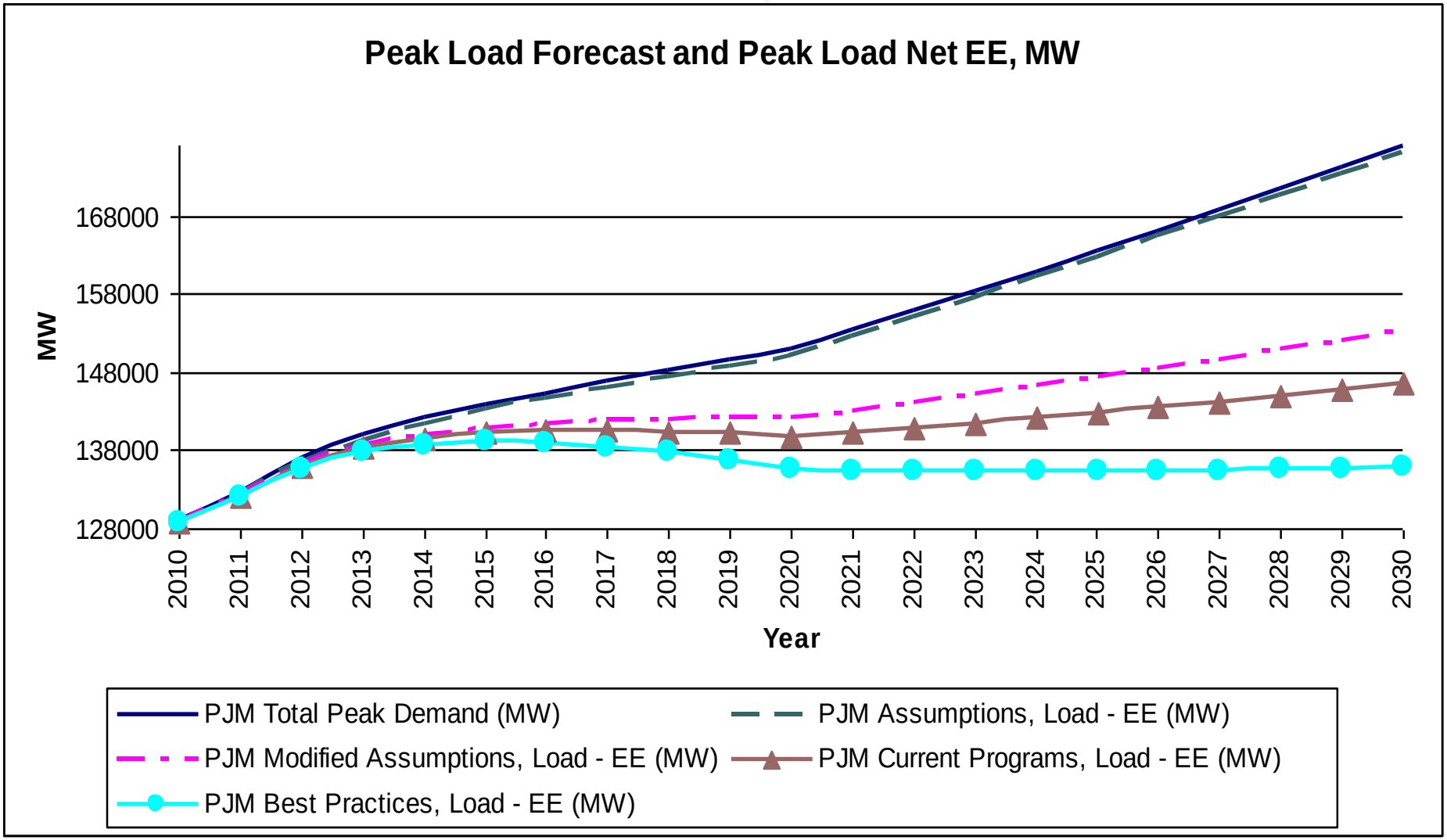
GEP Report analysis



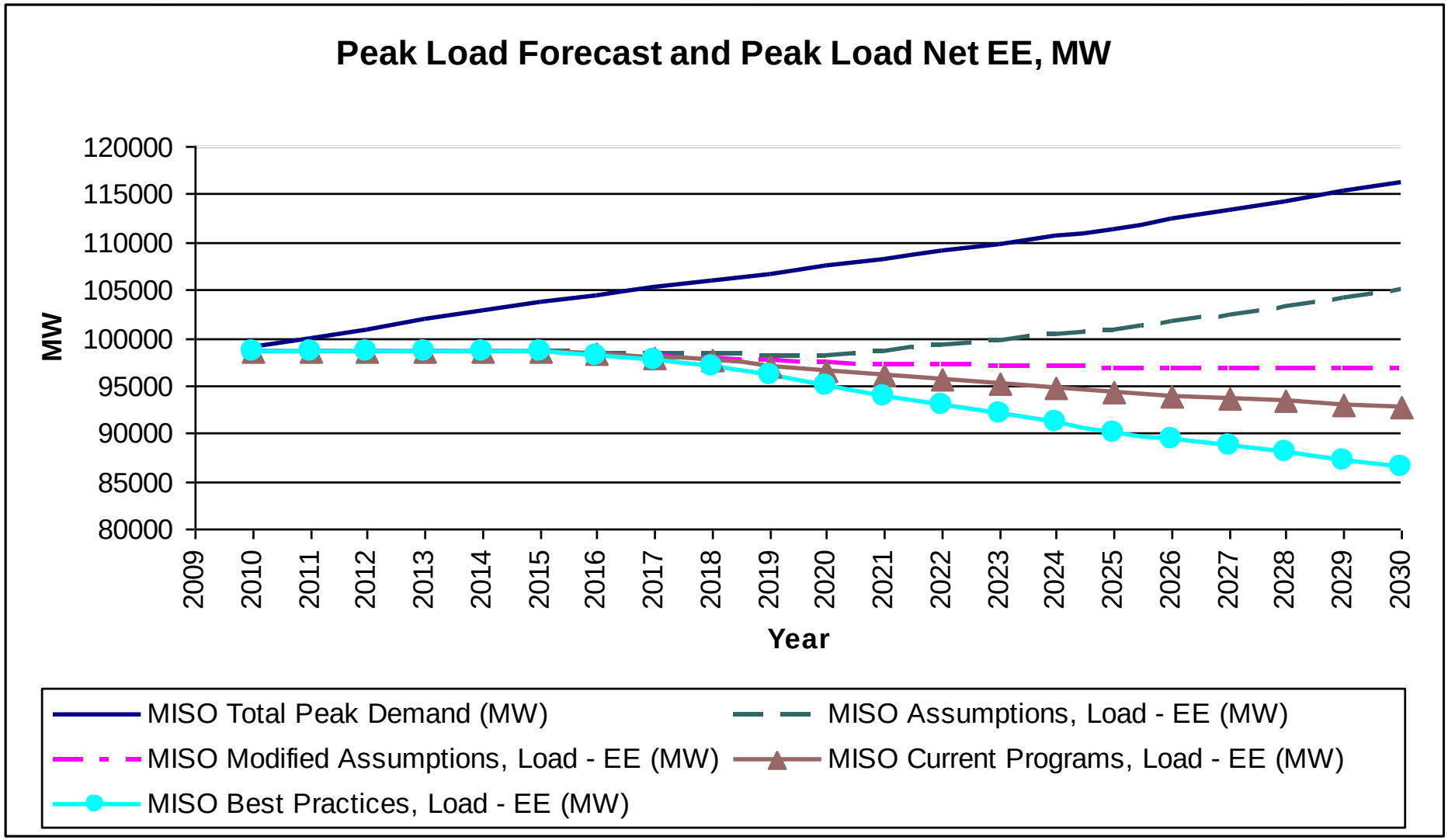
New England Peak Load Forecast



PJM Peak Load Forecast



MISO Peak Load Forecast



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