Gas Electric Coordination – What Now?

2017 Annual Meeting & *Conference*

April 3-4, 2017

Natural Gas Issues 2018 - 2050

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clf
conservation law foundation

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- What's the Problem We're Facing?
- How Can We Solve It
  - Reliability
  - Price
  - Emissions
- What About the Future?

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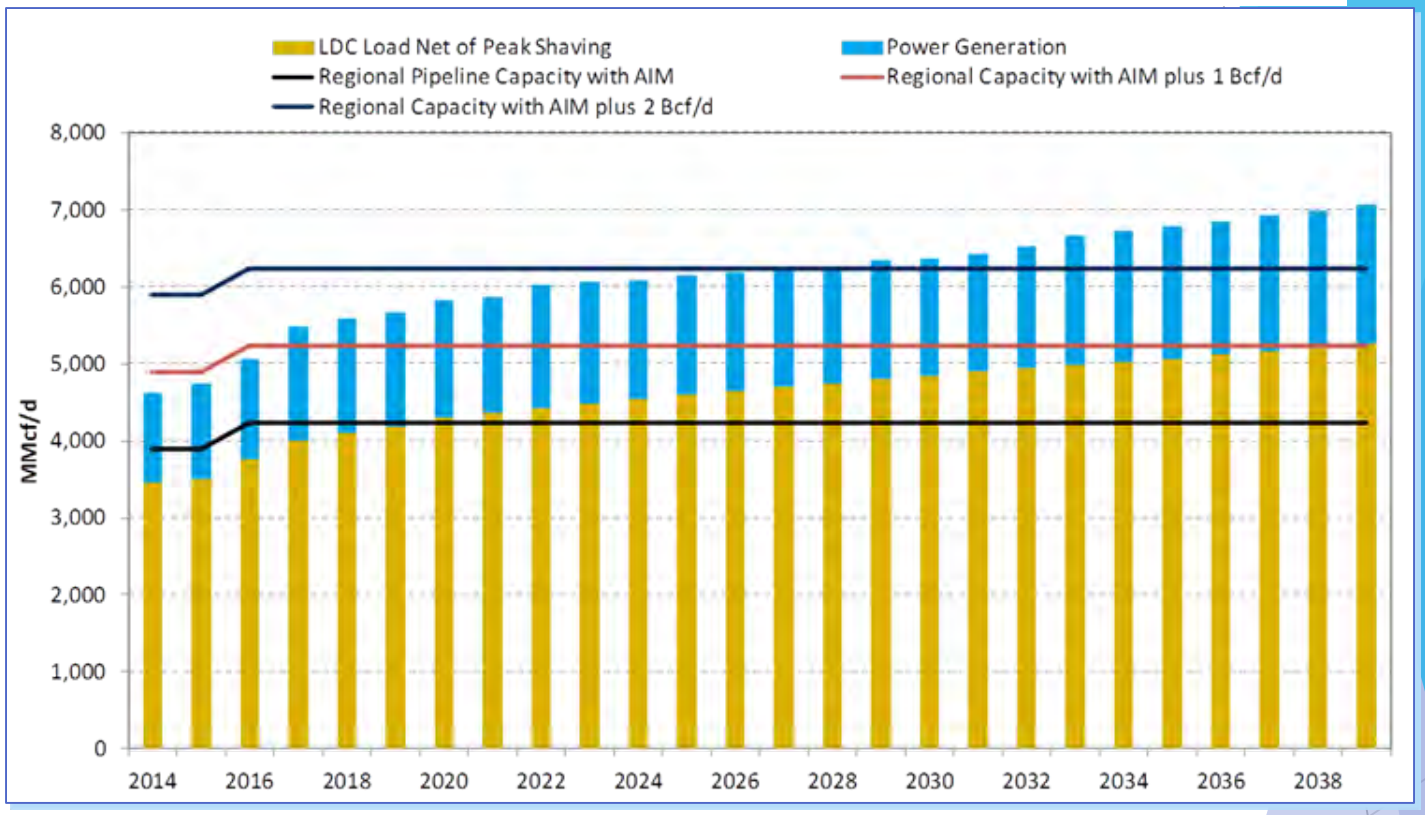
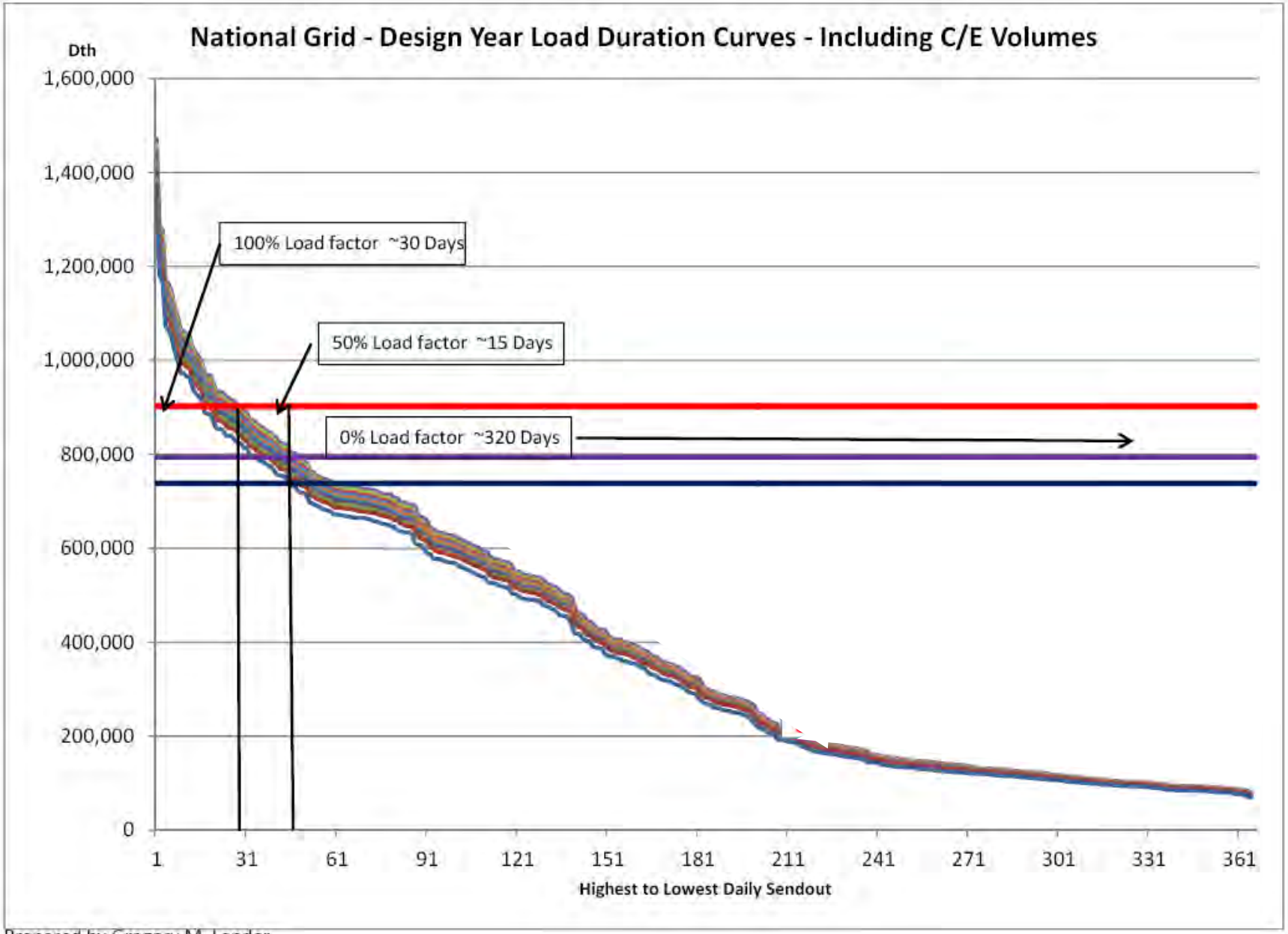
The Situation:

- Past 10 years, more gas-fired electricity (40% MW / 50% MWh)
- Buy on secondary spot market; interruptible service
- Winter 2013/14 – price spikes (NG → electricity) during cold snap

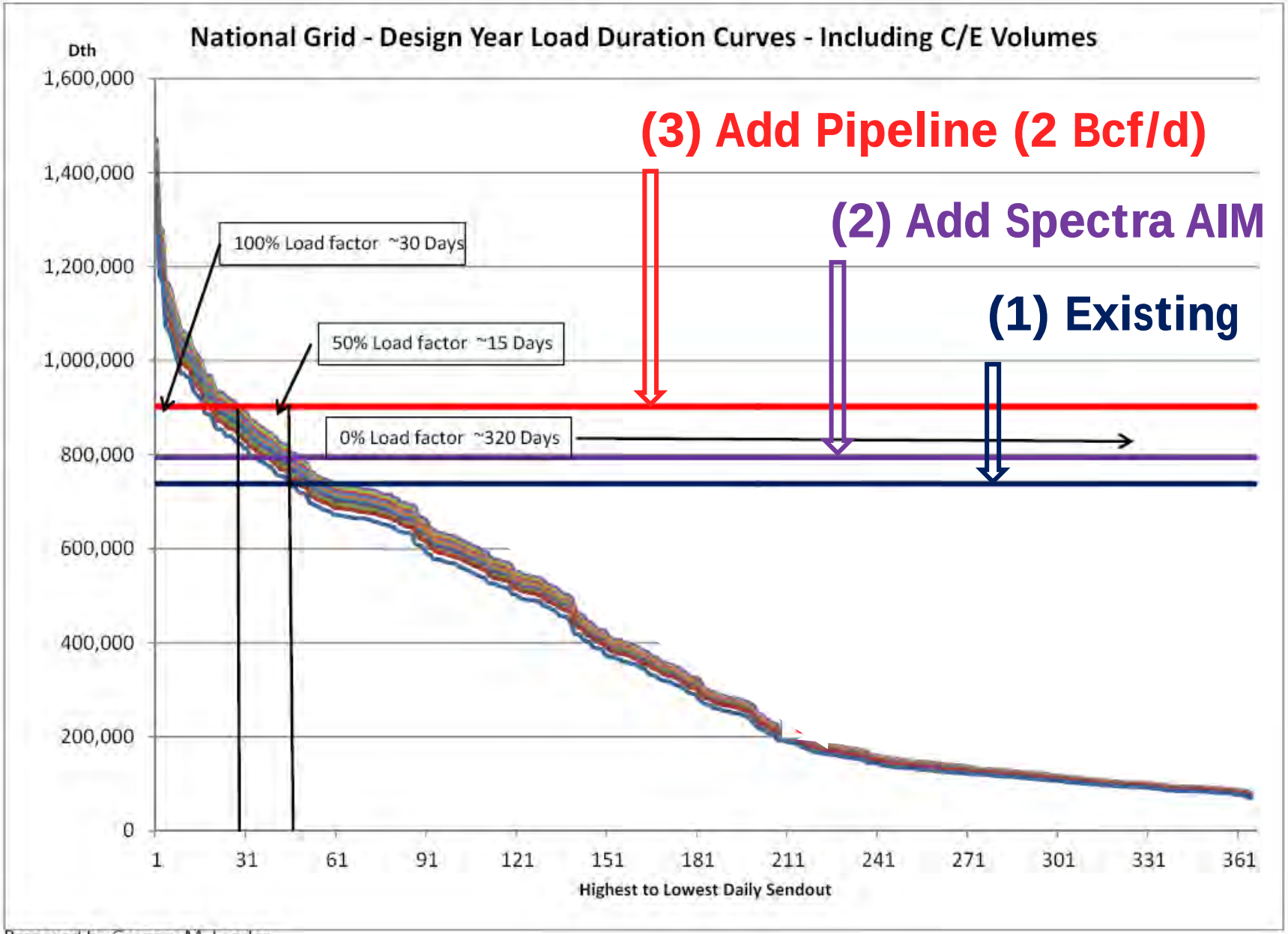
Projected Design Day Natural Gas Demand in New England & Regional Pipeline Capacity



Design Day → Coldest of the Cold / Max Volume



Prepared by Gregory M. Lander



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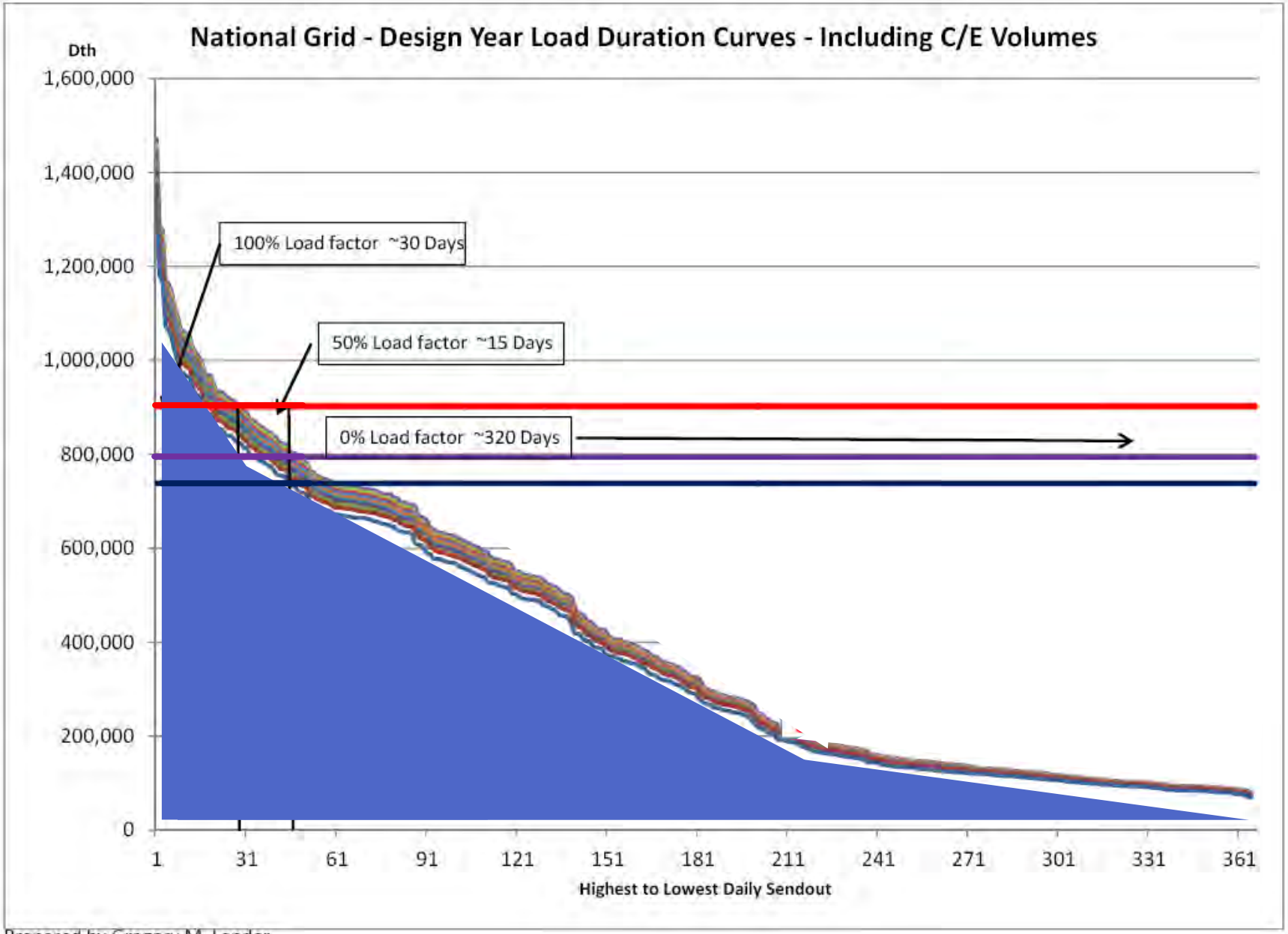

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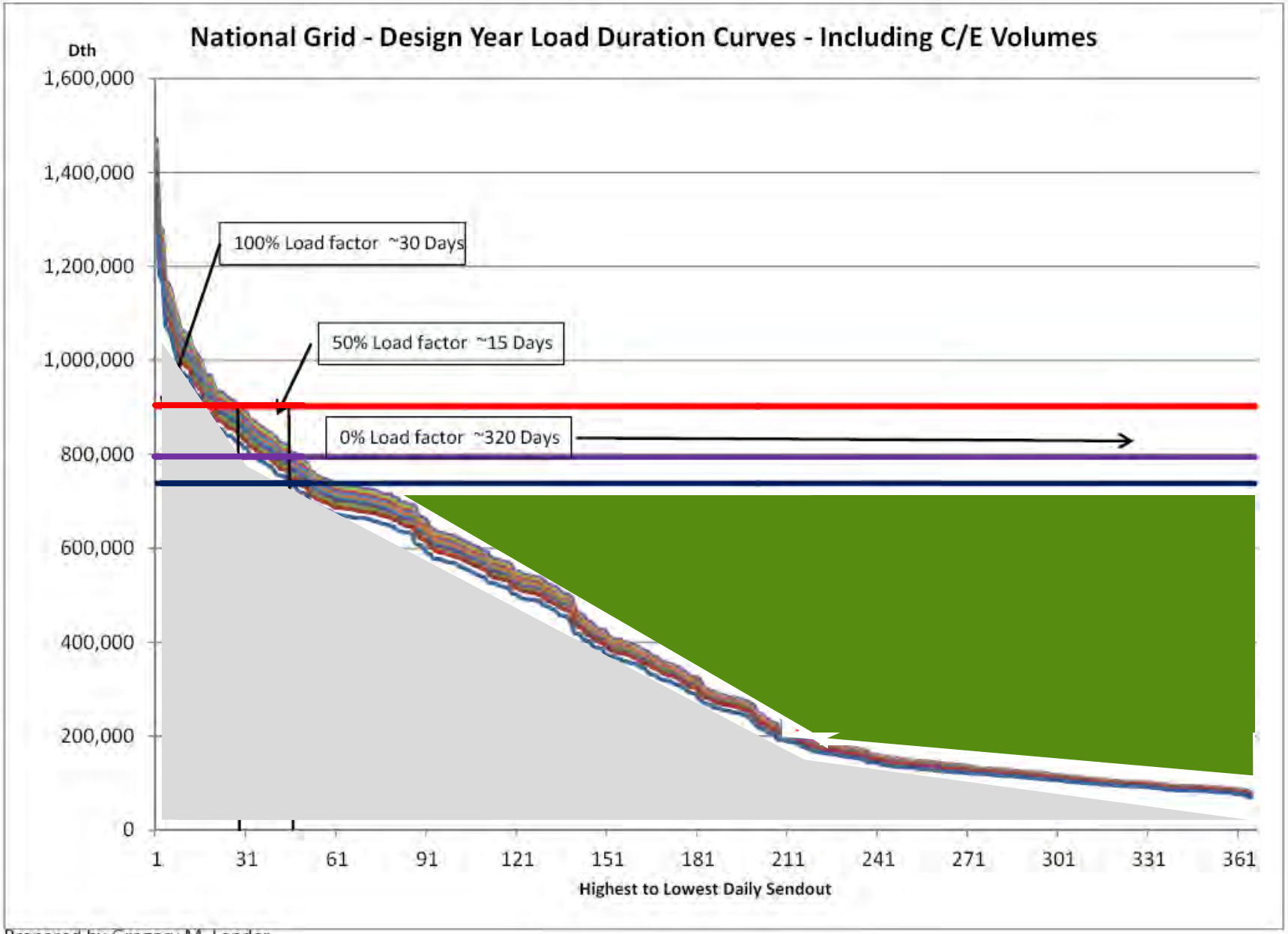

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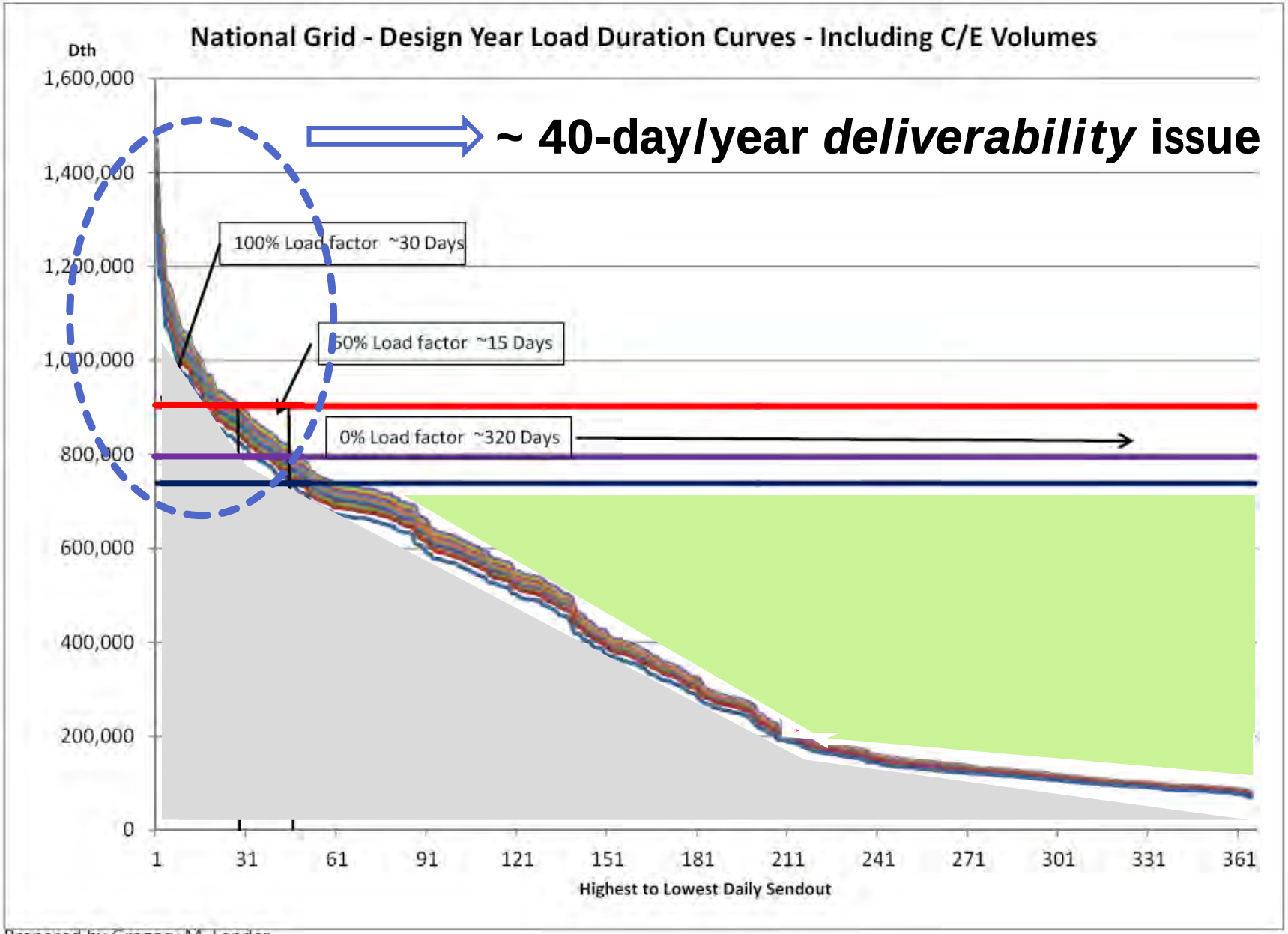

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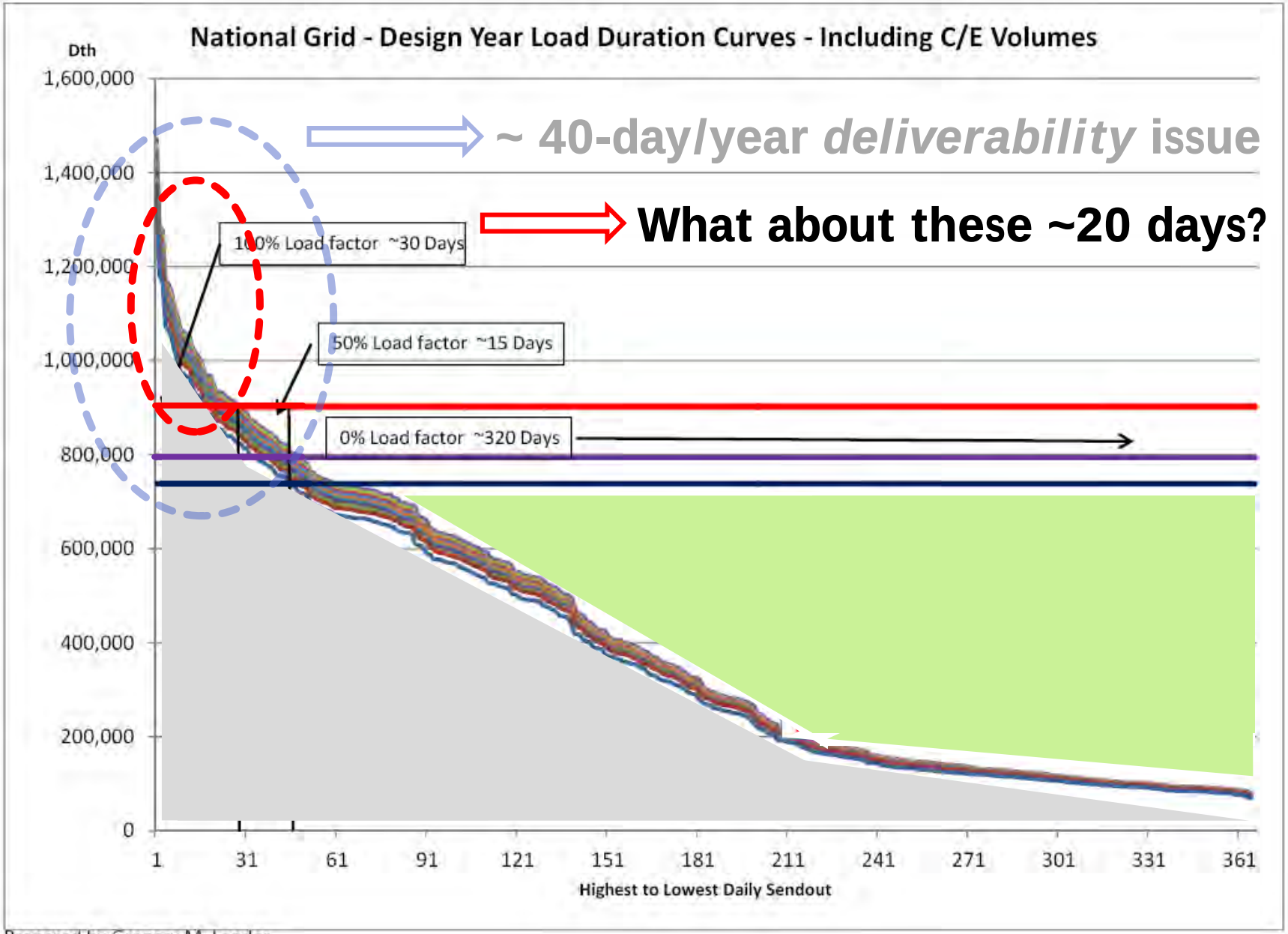

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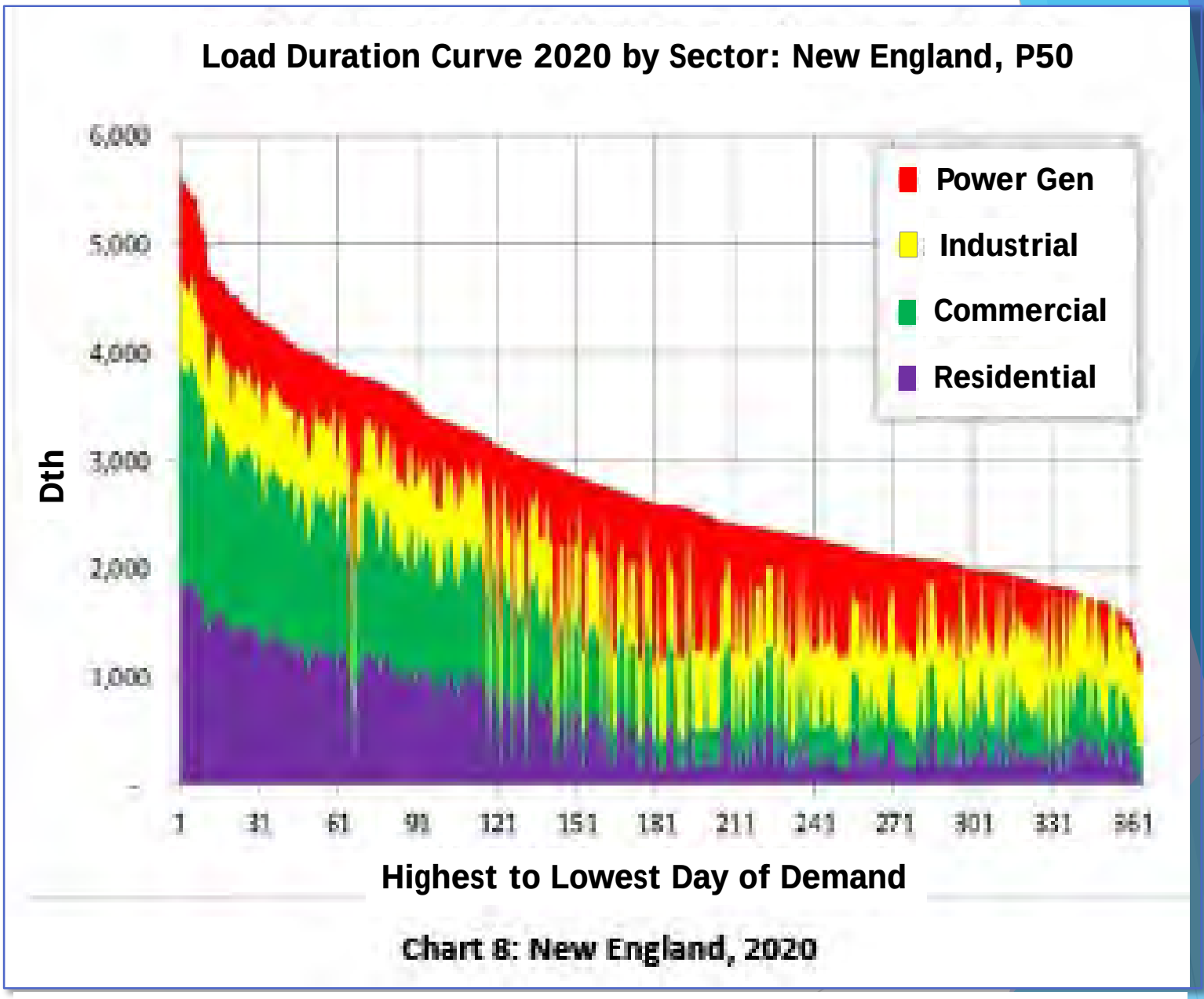
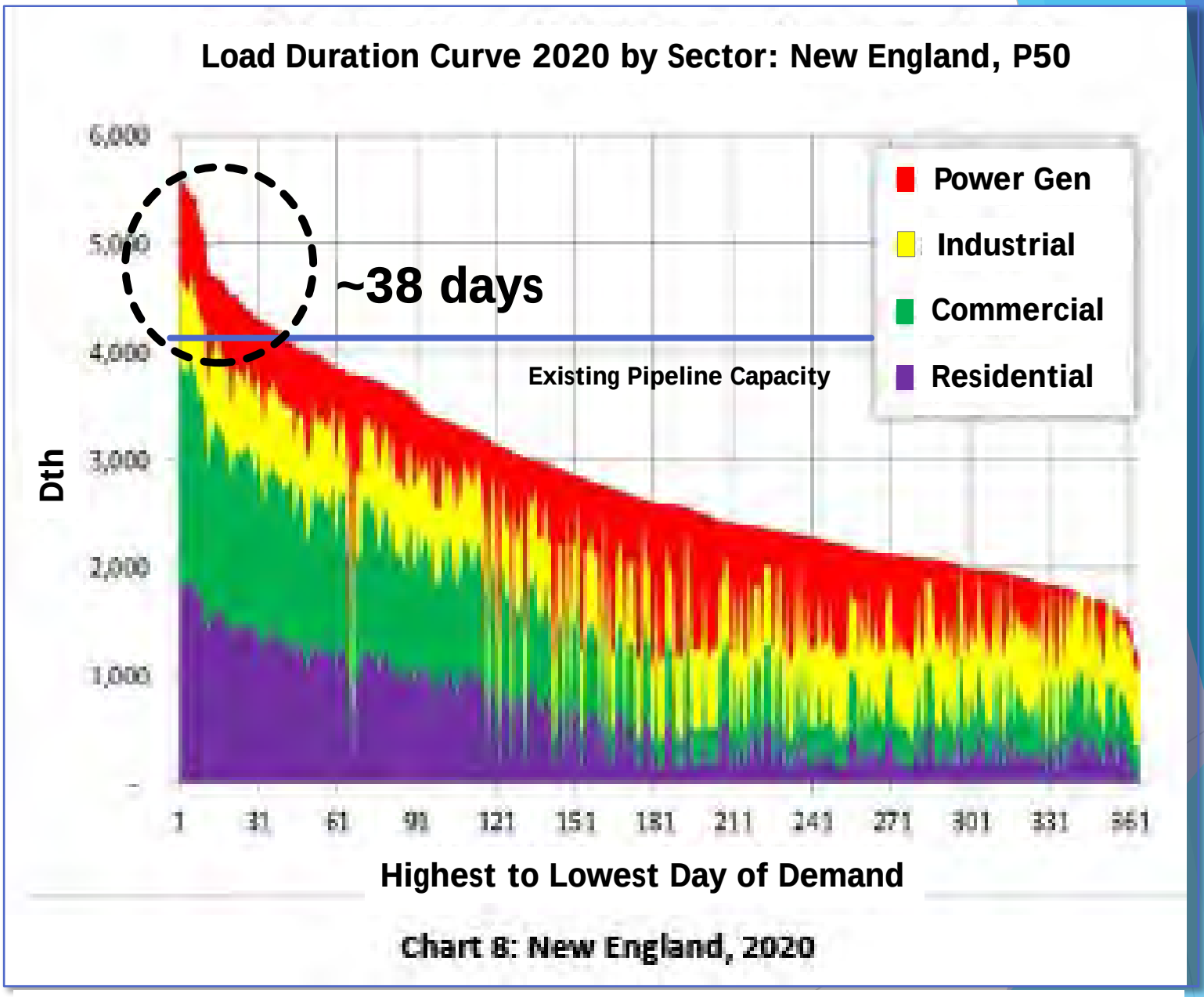


Skipping Stone, *Solving New England's Gas Deliverability Problem Using LNG Storage and Market Incentives* (2015)



Skipping Stone, *Solving New England's Gas Deliverability Problem Using LNG Storage and Market Incentives* (2015)

- What's the Problem We're Facing?
- How Can We Solve It
  - Price
  - Reliability
  - Emissions
- What About the Future?

Average annual natural gas and wholesale electricity prices in New England (2003 to 2015[a])

	Avg. natural gas price (per MMBtu[b])	Avg. wholesale electricity price (per MWh[c])	Wholesale electric energy market value[d] (in billions)
2003[e]	$5.96	$48.59	$5.6
2004	$6.86	$52.13	$7.5
2005	$9.75	$76.64	$11.5
2006	$7.40	$59.68	$8.9
2007	$8.17	$66.72	$10.1
2008	$10.07	$80.56	$12.1
2009	$4.79	$42.02	$5.88
2010	$5.29	$49.56	$7.3
2011	$4.99	$46.56	$6.7
2012	$3.95	$36.09	$5.19
2013	$6.97	$56.06	$8.0
2014	$7.99	$63.32	$9.1
2015	$4.73	$41.00	$5.91
% Change 2014-2015	-40.8%	-35.2%	-34.9%
% Change 2004-2015[f]	*-31.0%*	*-21.4%*	*-20.8%*

ISO-NE, 2015

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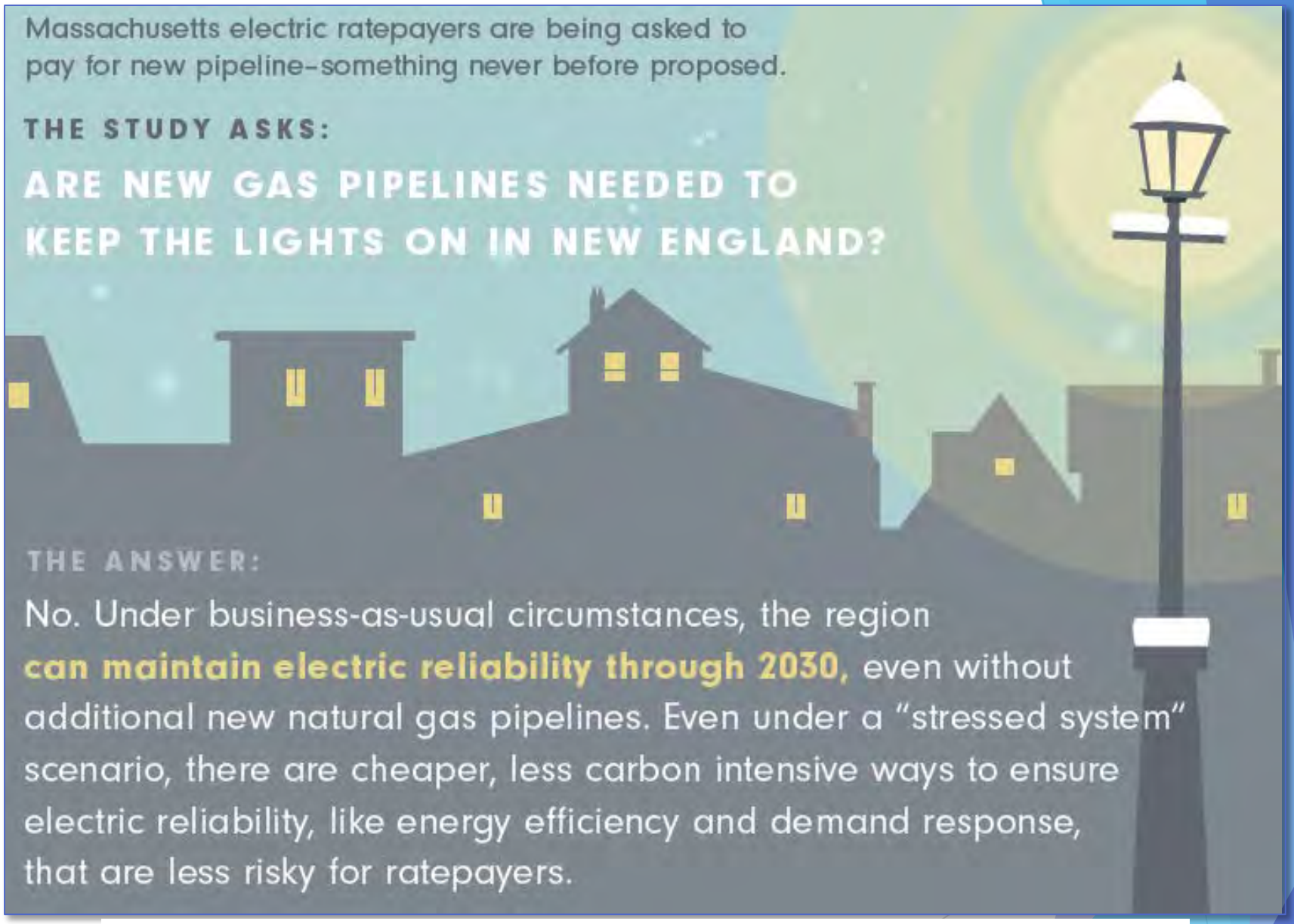
Massachusetts (EIA, 2011 – 2015):

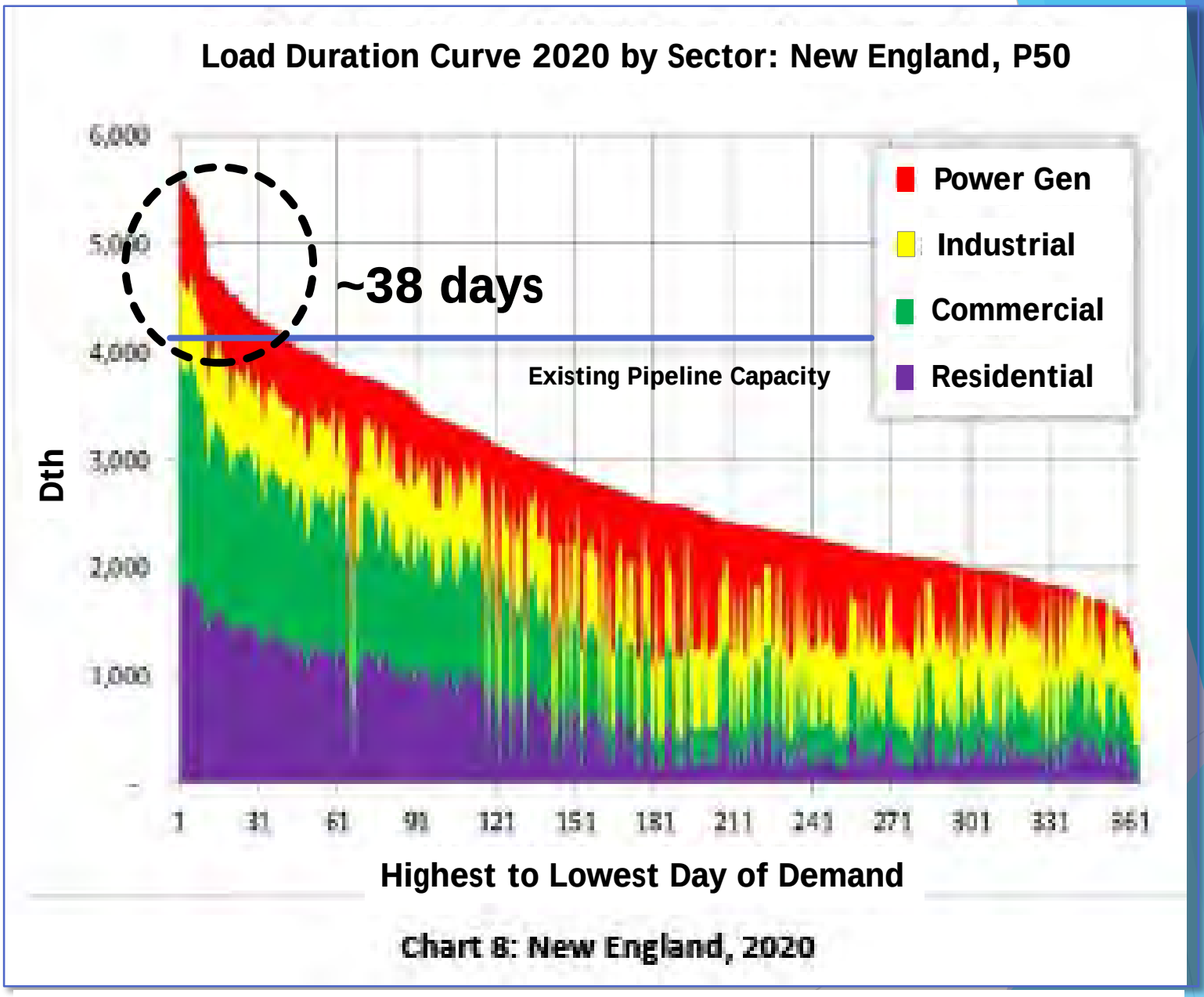
- 5th highest residential electricity rate
- Ranked 31st electricity bill (6.5% below national avg.)



Hibbard & Aubuchon, *Power System Reliability in New England* (Analysis Group) (Nov. 2015) for the Attorney General of Massachusetts

Increase Near-Term Winter Deliverability?

- Modify state LDC rules to incentivize release of excess existing LNG storage in winter
  - Winter Only “LNG Pipeline”



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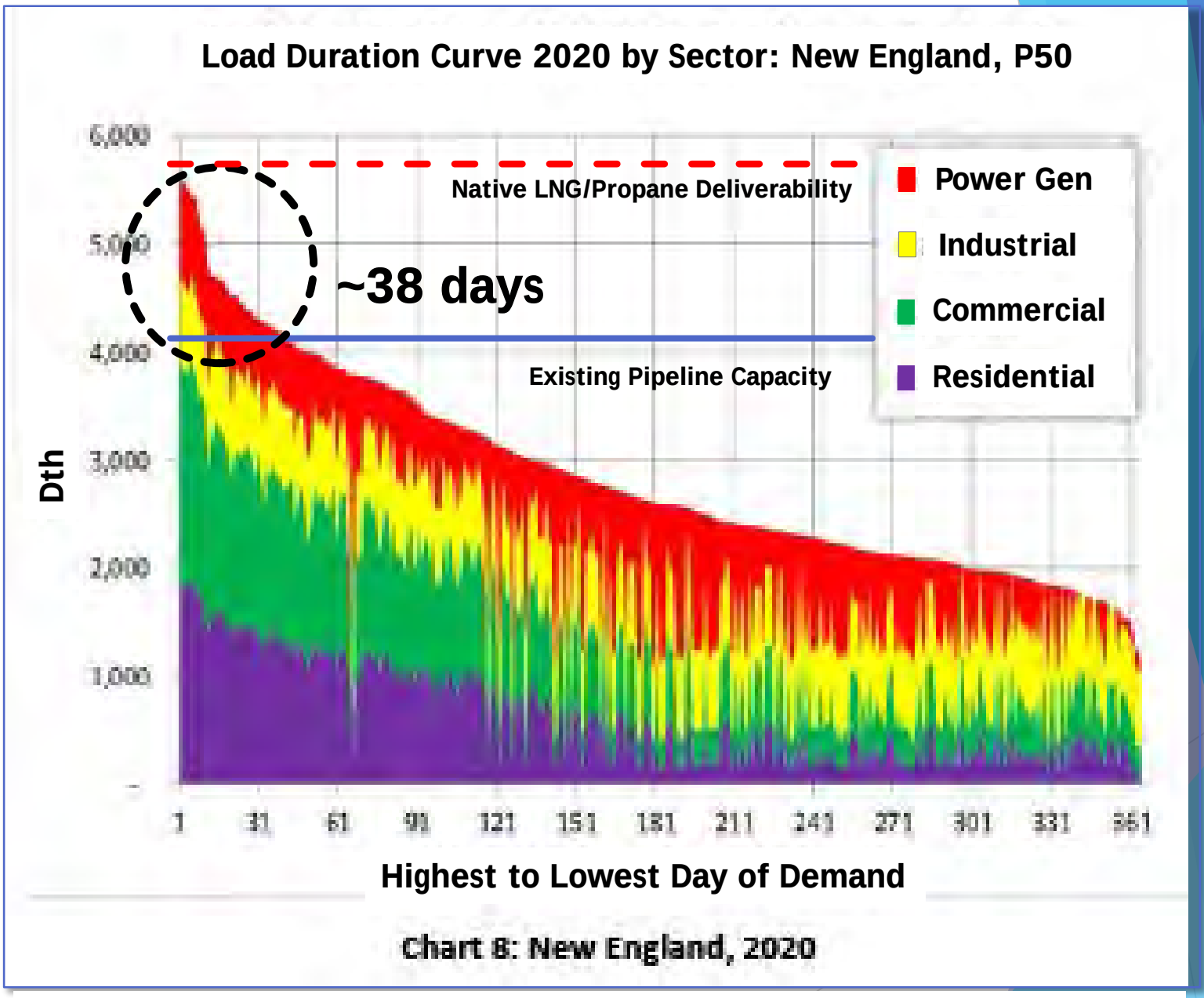

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Increase Near-Term Winter Deliverability?

- Modify state LDC rules to incentivize release of excess existing LNG storage in winter
  - Winter Only "LNG Pipeline"

- Create wholesale electricity market for desired service: reliable locational winter capacity
  - Incentivize range of market solutions
    - "Shaped capacity" (time/place)
    - Compression & looping
    - Elect. Storage & EE
  - De-rate capacity that doesn't clear

- What's the Problem We're Facing?
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MassAGO Study – Stressed System Scenario → 2030

- + 1,200 MW of non-gas fired capacity retirements (beyond base-case assumptions) replaced with gas-only resources

- No oil at winter peak for ~ 20 percent of existing oil-fired resources (~ 1,800 MW of generation)

→ Electric reliability deficiency of approximately 1,675 MW in 2024, growing to approximately 2,400 MW in 2029/30.

  - Equivalent of approximately 0.42 Bcf/d

  - ***26 hours of deficiency spread out over 9 total days***

  - Only 2 days and 4 hours with a total deficiency greater than 2,000 MW in the 2029/30 winter in any scenario

Energy Efficiency / Demand Response

Additional investment in EE & DR programs that allows customers to use less energy, and that incentivizes energy users to reduce consumption when demand for power is highest.

Greatest savings

$146 million net savings

1.86 million tons of CO_2

Oversized Natural Gas Pipeline

New 0.5 Bcf/day natural gas pipeline in service in 2020 and sized larger than the stressed system reliability need.

$133 million net savings

200K tons of CO_2

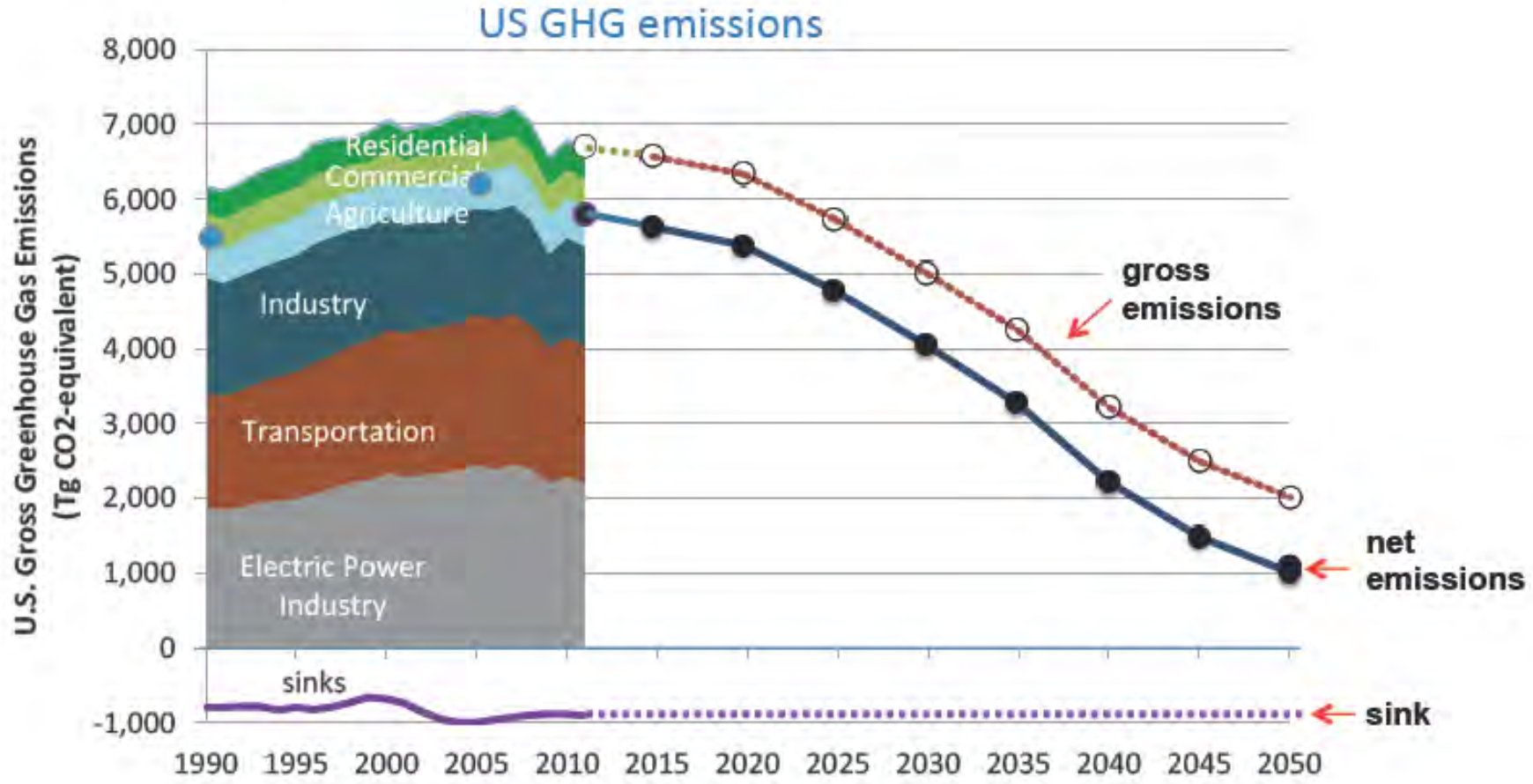
Liquefied Natural Gas

Guaranteed supplies of liquefied natural gas for power plants.

Lowest up-front cost

$27 million net savings

30K tons of CO_2



Pathways to Deep Decarbonization in the United States (2014)

2030 → 2050?

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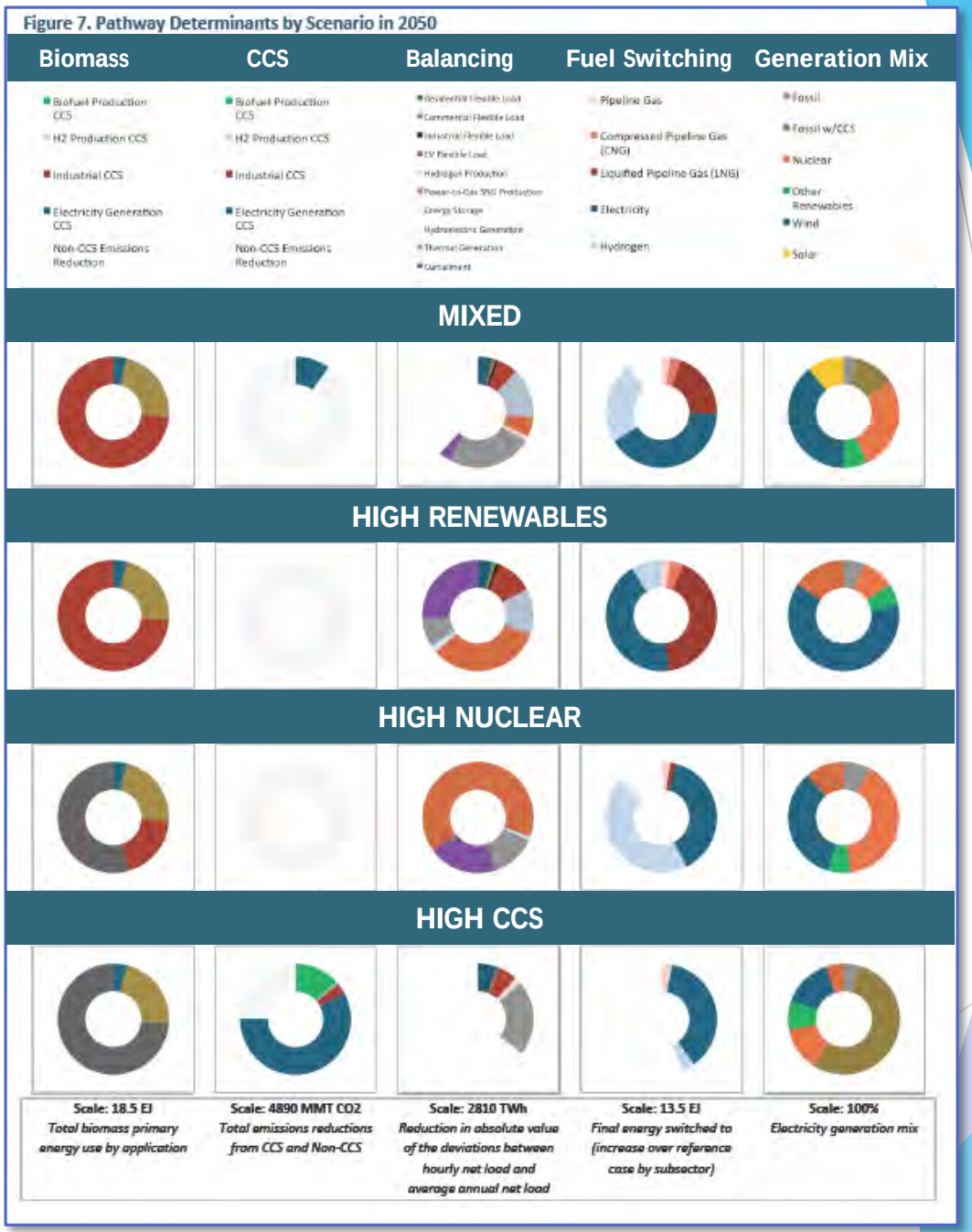
Role for NG 2050?



Pathways to Deep Decarbonization in the United States (2014)

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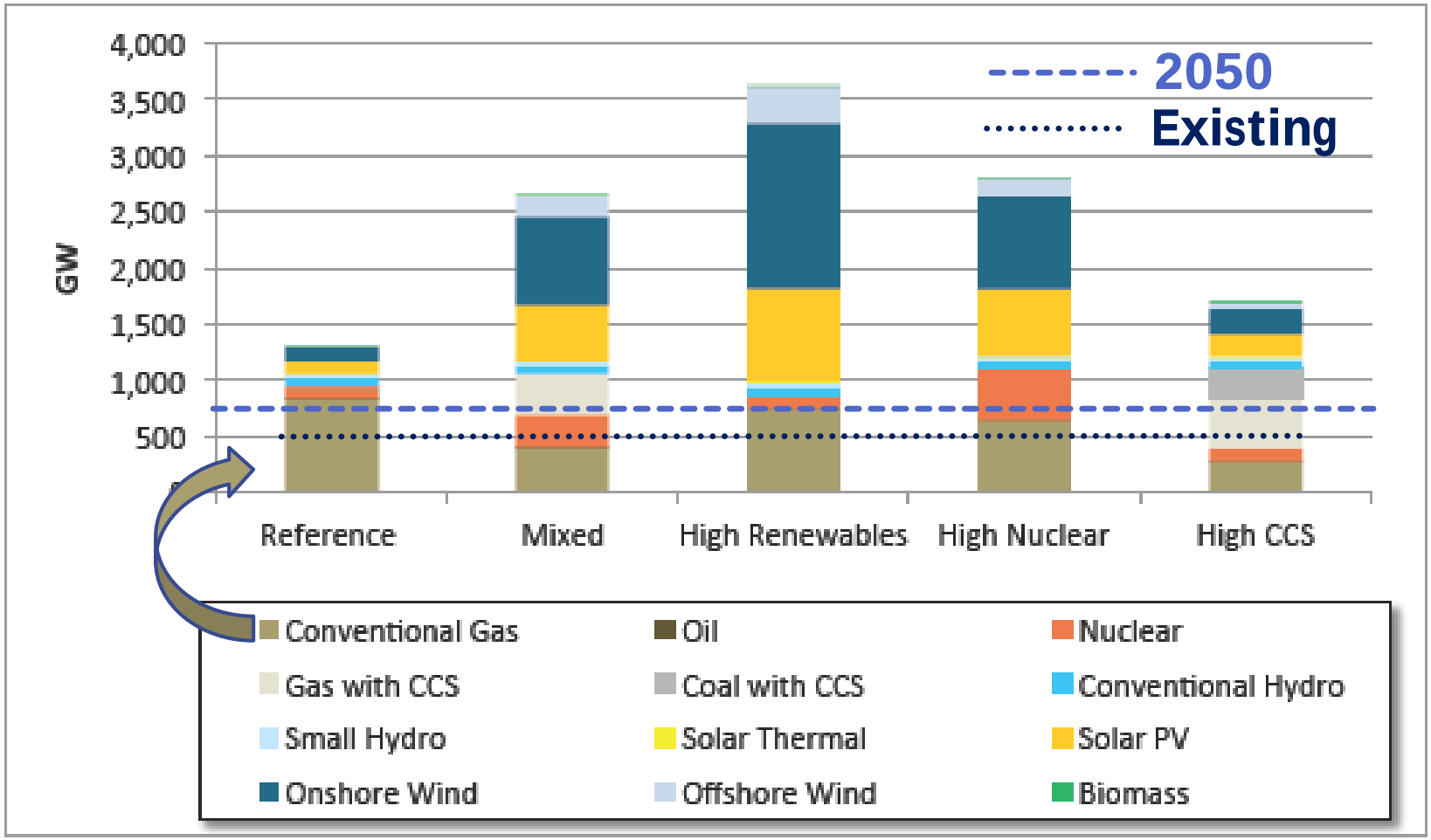
Figure 30. 2050 Installed Electric Generating Capacity



Pathways to Deep Decarbonization in the United States (2014)

All US – 50%; New England - 15%
(20% of Installed; 5% of Installed)

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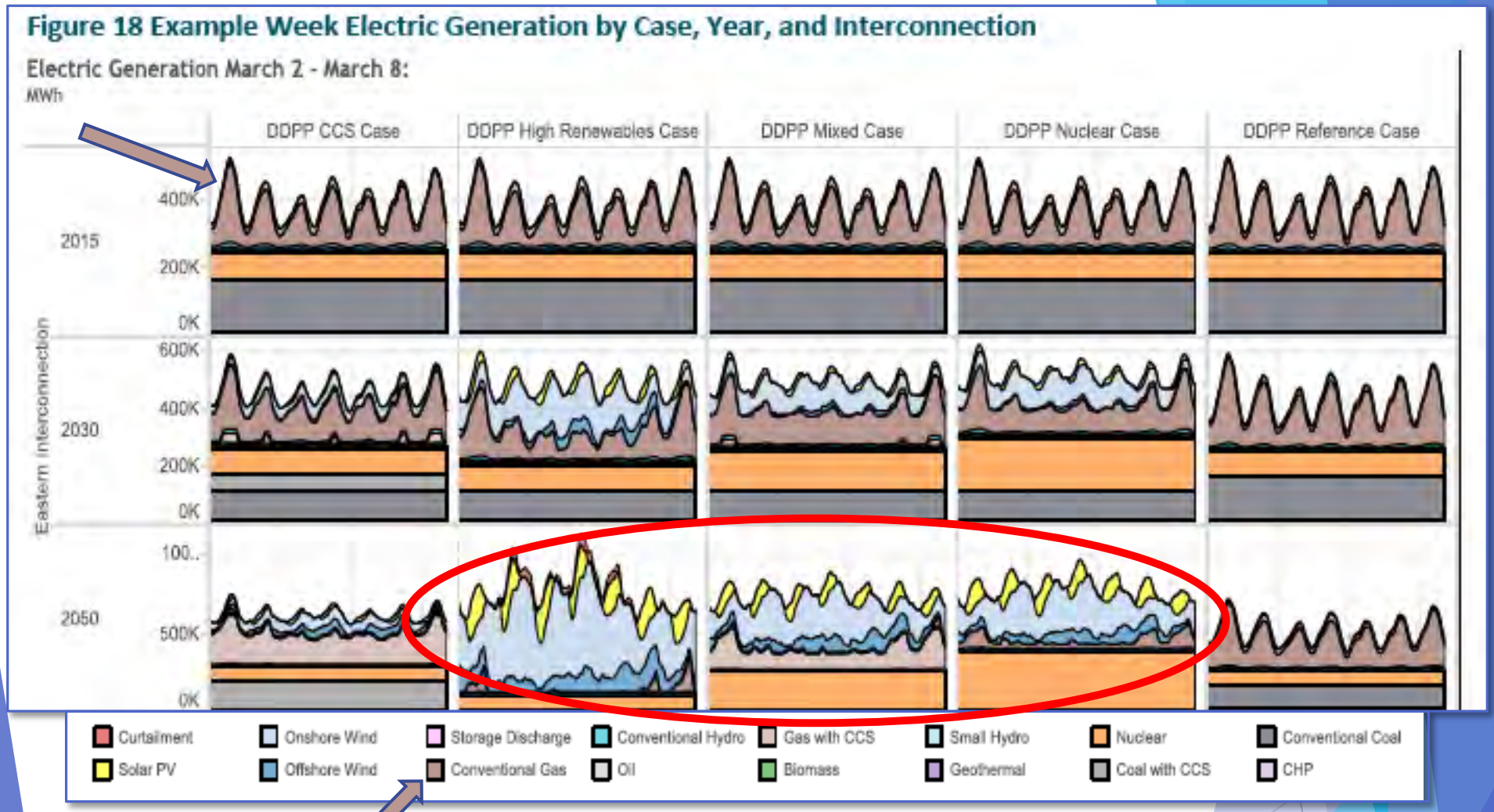

Pathways to Deep Decarbonization in the United States (2014)

2050 NG-Fired MWh Drops to < 5%

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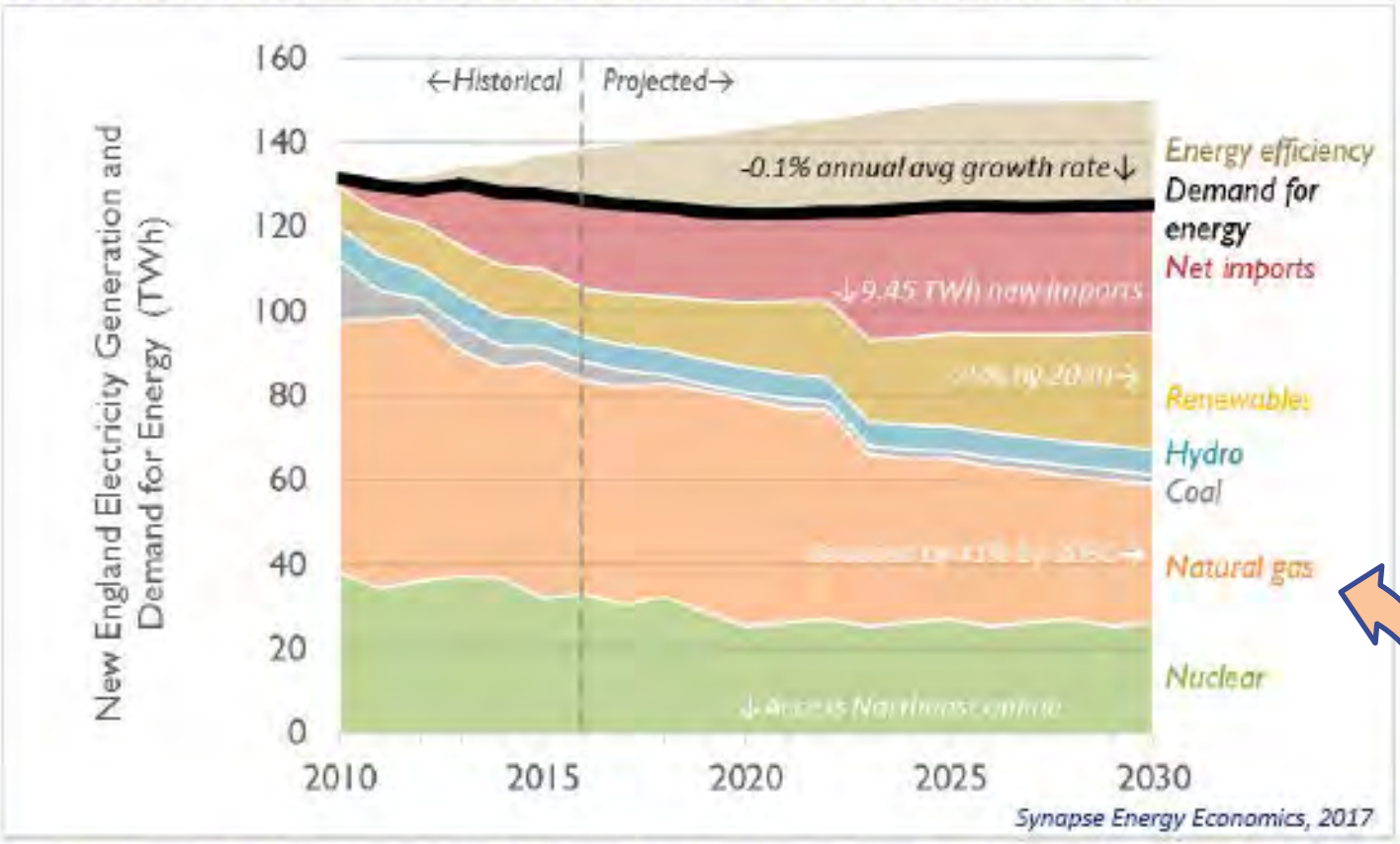
Figure 5. Electricity generation and demand in New England, 2010 to 2030 in the Pipeline Case



Note: 2010 through 2015 are historical data; 2016 through 2030 are modeled years. In this figure, "Renewables" includes wind, solar, biomass, and landfill gas. "Hydro" includes in-region hydroelectric plants. "Natural gas" includes both natural gas and petroleum use by generating units typically using natural gas. "Net imports" refers to the electricity imported over existing transmission lines from Canada and New York as well as new long-term contracts for imported renewable electricity.

Synapse Energy Economics, *New England's Shrinking Need for Natural Gas* (Feb. 7, 2017)

2030 with New Pipeline:

NG Generation Down 41% (from 2015)

(Down 51% if GWSA-Compliant)

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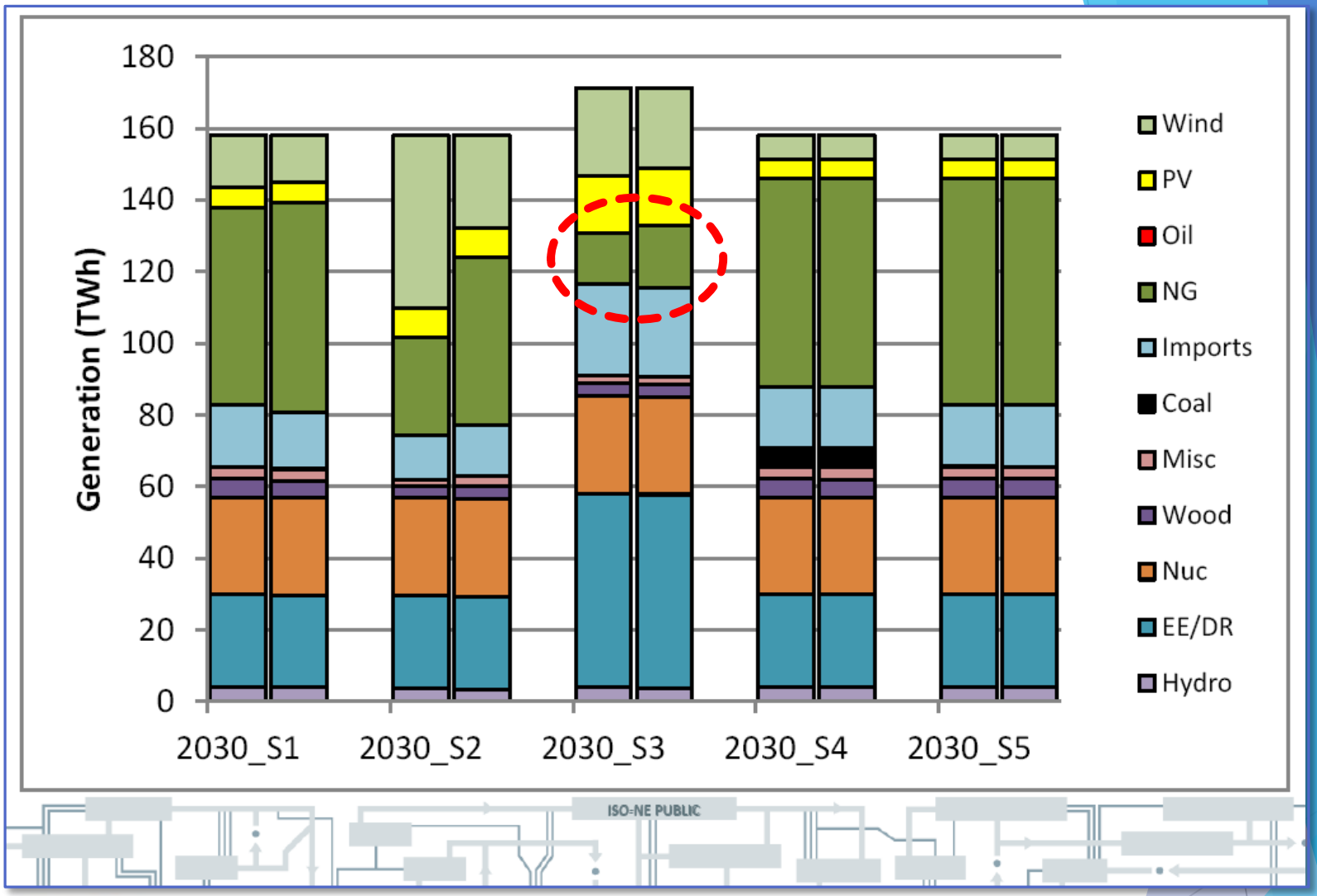

ISO-NE *2016 Economic Studies Executive Summary Supplement* (Nov. 29, 2016)

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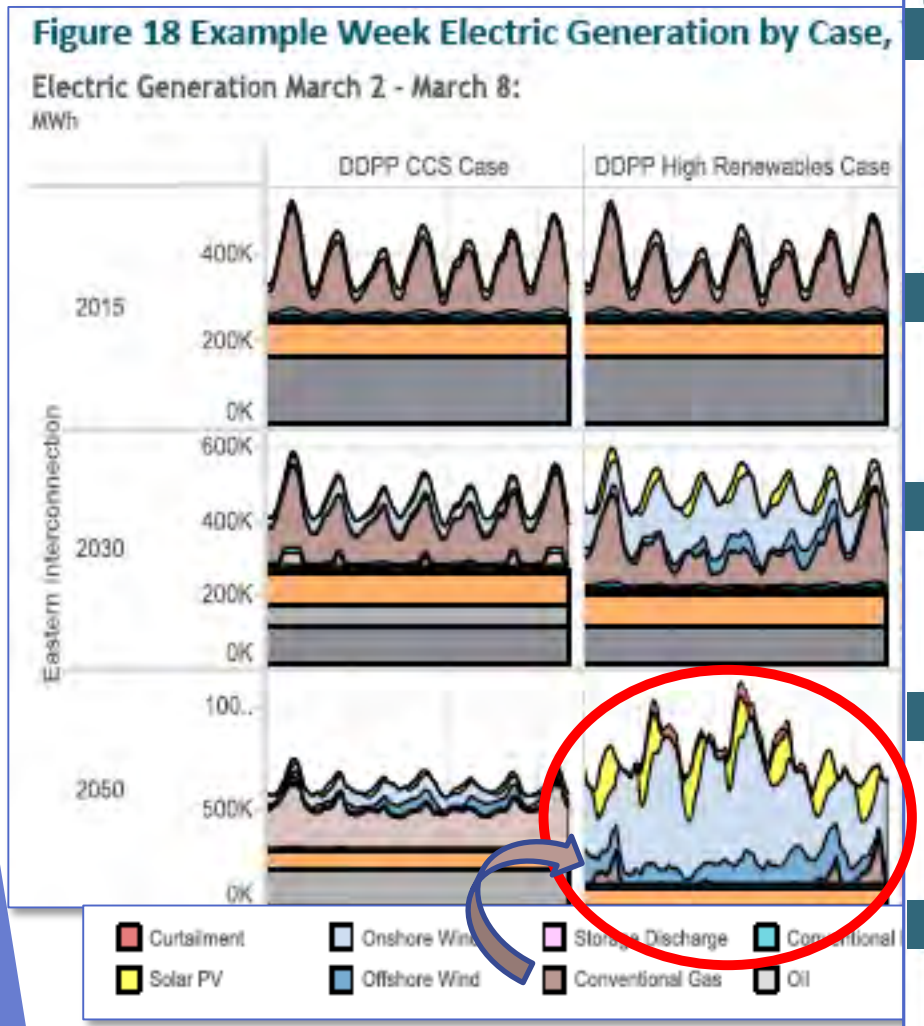
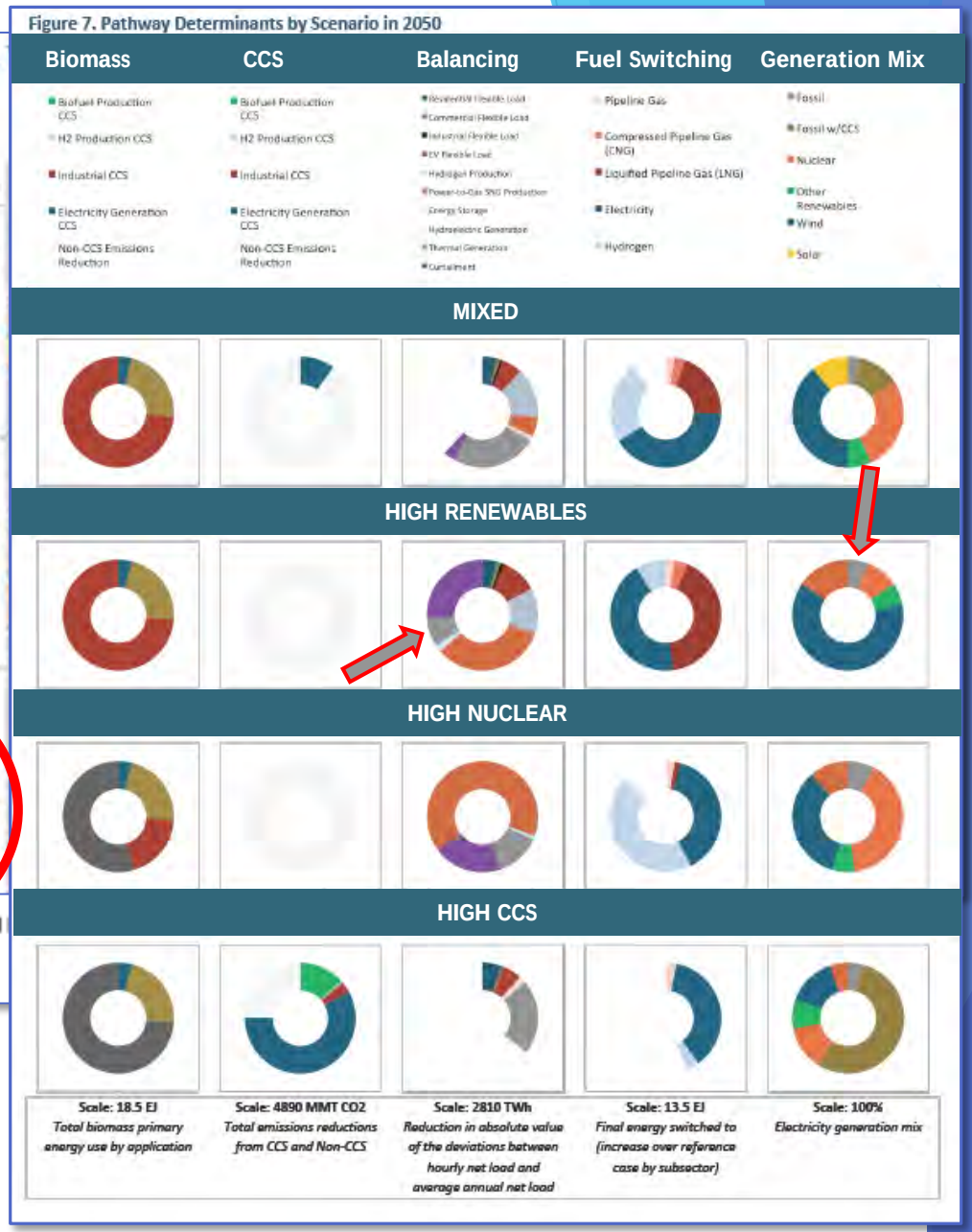
GWSA-Compliant 2030 (S3):

NG Generation Down 38% (from 2015)

(48% →10% of MWh)

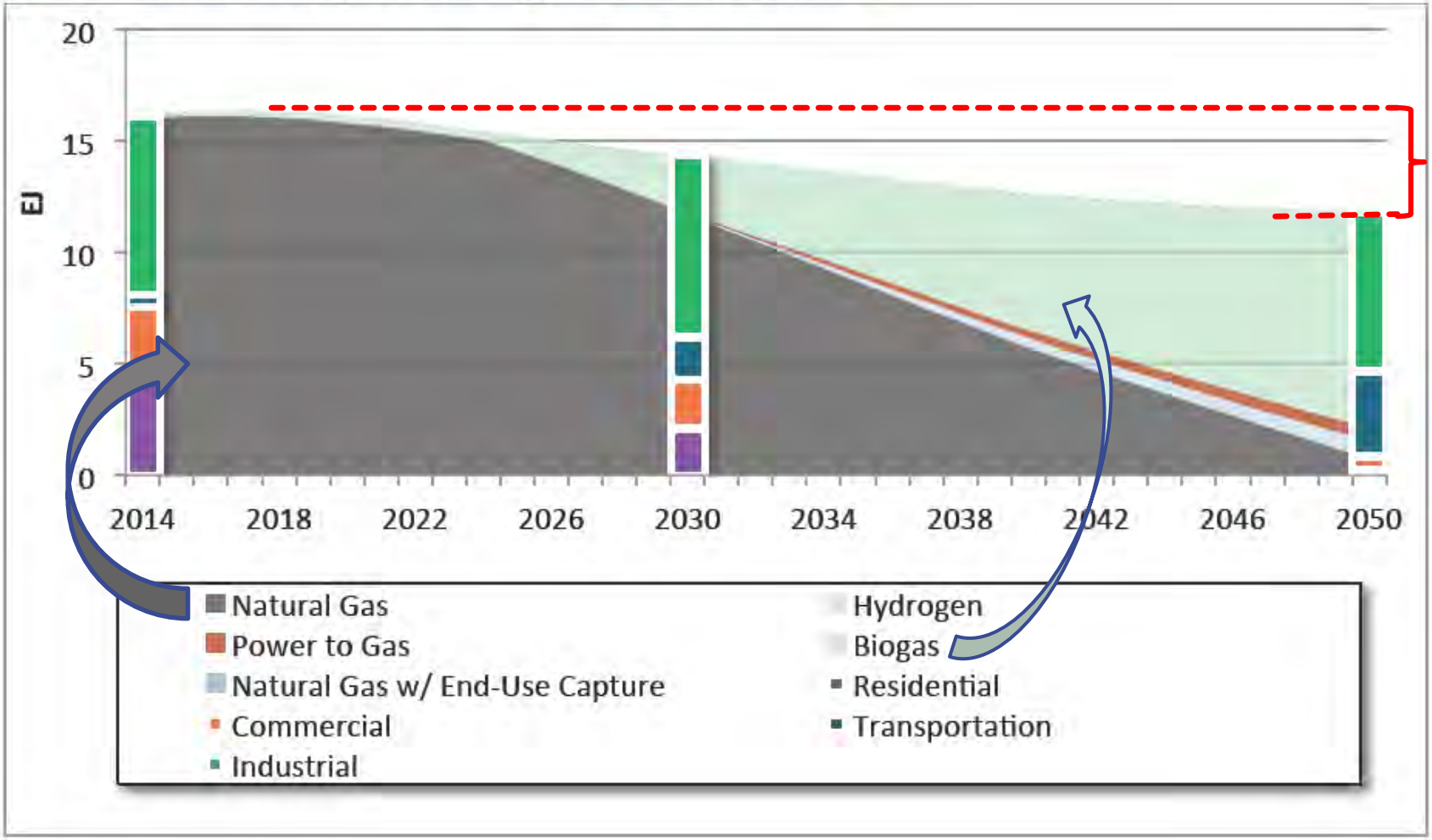




Needed to "Balance" Renewables?

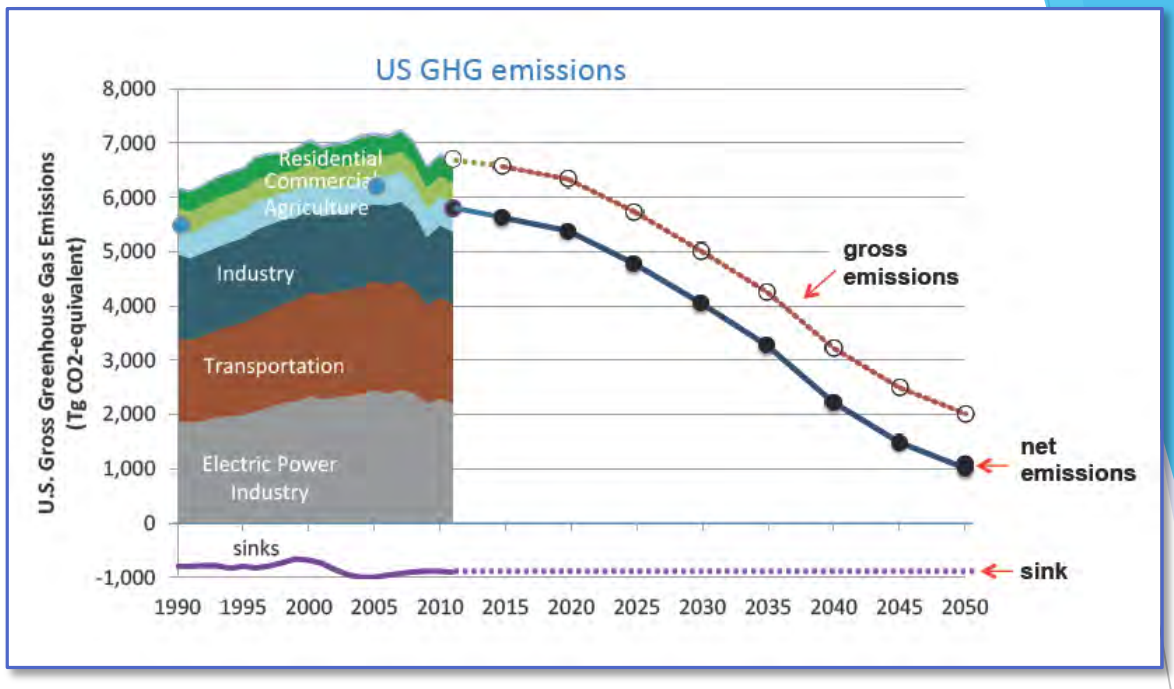
Pathways to Deep Decarbonization in the United States (2014)

Figure 33. Mixed Case Pipeline Gas Supplies and Sector Demand



Pathways to Deep Decarbonization in the United States (2014)

More Pipeline Capacity or Less in 2050?



- **Not Business as Usual**
- **Near-Term Decisions Must Be 2050-Compliant**
- **Flexible Market Solutions**

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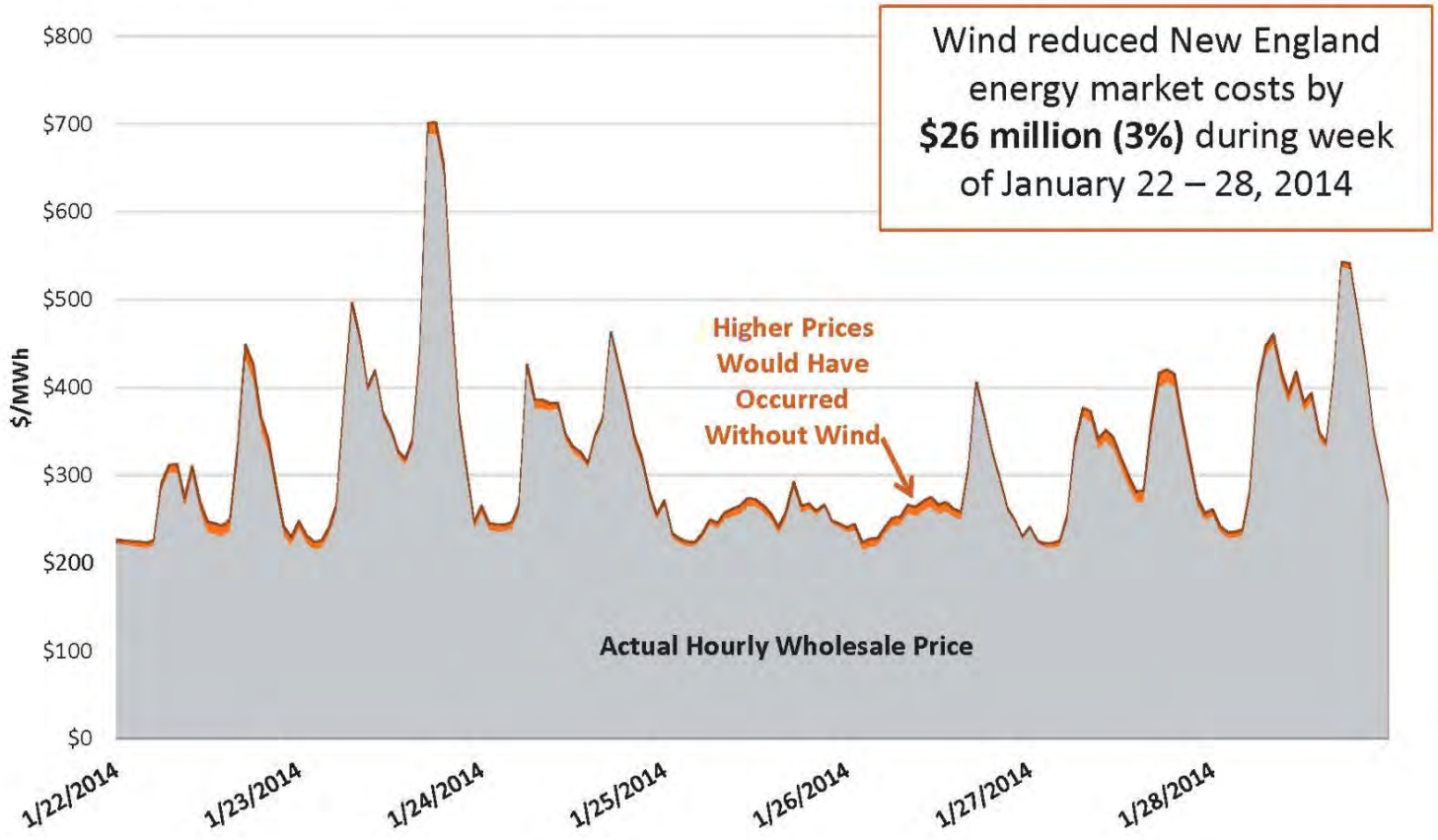
RENEW Northeast

Value of Wind During Polar Vortex

Wind helped to lower market prices during the polar vortex. Although it only constituted approximately 1% of energy, wind reduced total energy market costs by approximately 3% during the Polar Vortex.



Block Island Wind Farm Breezes Through "Stella"

Strong performance during this season's worst winter conditions

Providence, R.I. – March 16, 2017 – The Block Island Wind Farm posted an impressive performance as winter storm Stella barreled through Rhode Island earlier this week.

All five turbines at the wind farm three miles off Block Island were operating at full capacity (30 megawatts) during much of the powerful storm Tuesday, according to Deepwater Wind's performance data.

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Thank you for attending this EBA Program

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2017 EBA
Annual Meeting & Conference

Resolving Interstate Pipeline Capacity Constraints in the Northeast

Macdara Nash
Vice President – Business Development
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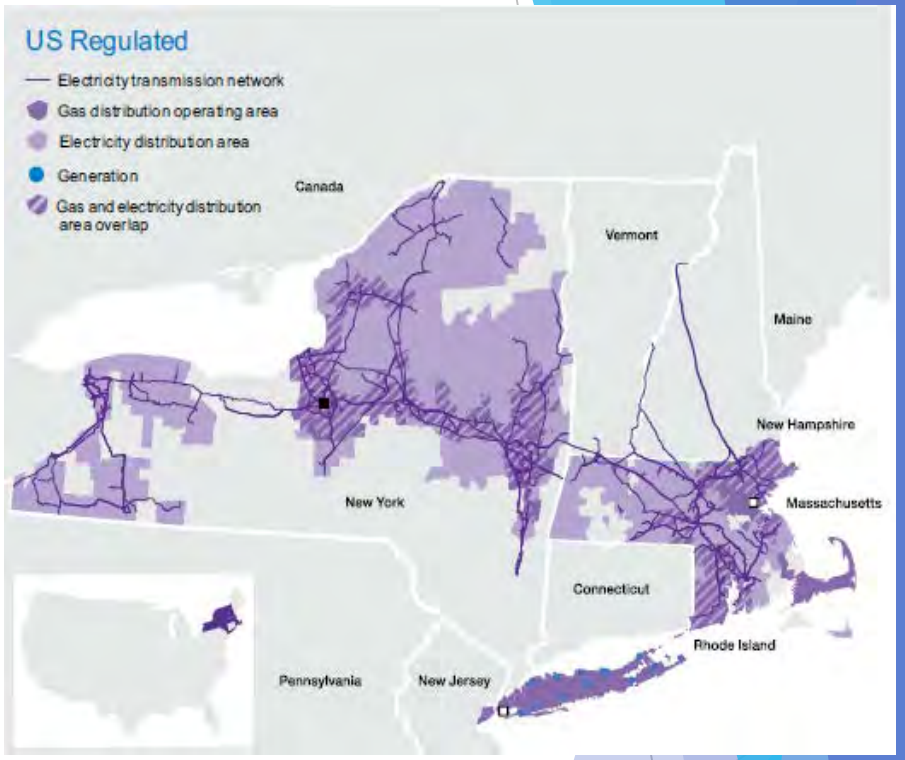
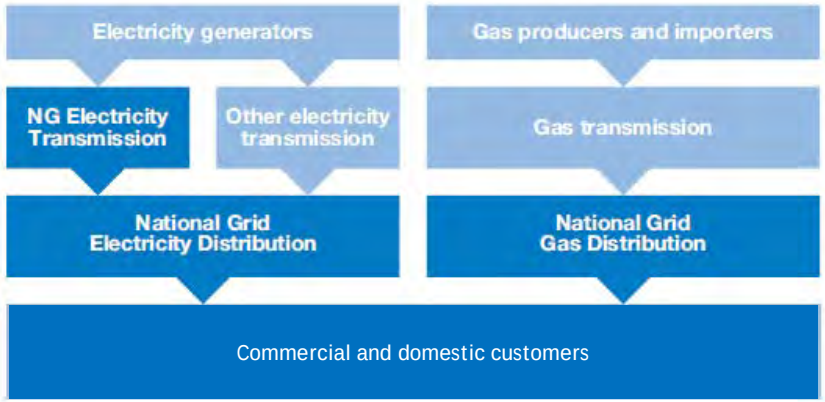
nationalgrid

National Grid in the US

- **Regulated utility focused on wires and pipes**
- **~3.5 m electric and ~ 3.4 m gas customers**
- **Massachusetts, New York, and Rhode Island**
- **Largest transmission network in the northeast US**
- **Interconnector providing Canadian hydro power to New England**
- **Minority interests in gas transmission:**
  - **Millennium Pipeline Company,**
  - **Access Northeast pipeline project**

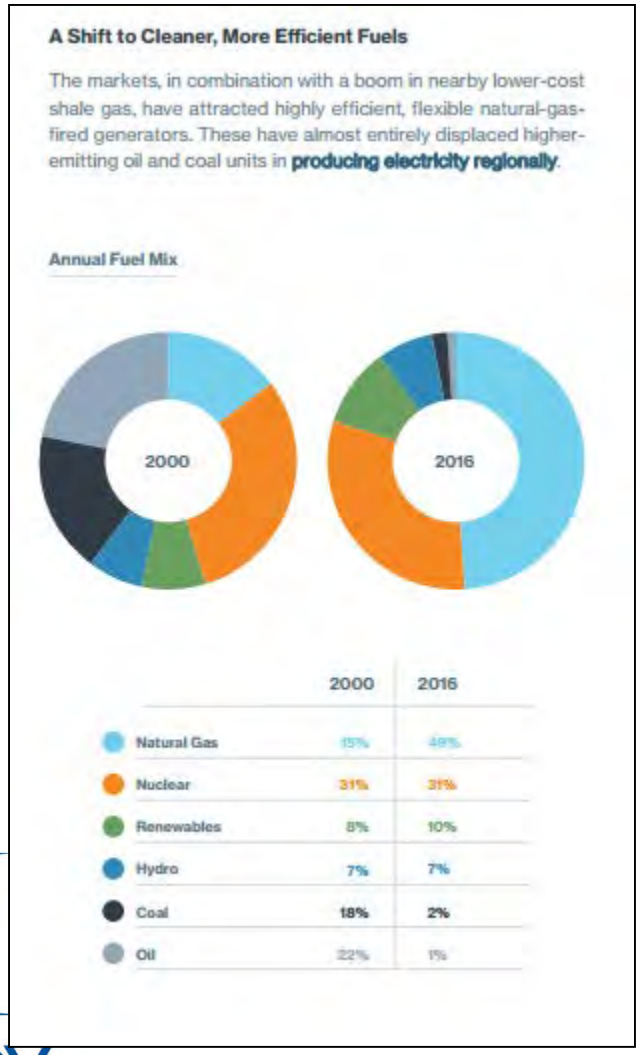


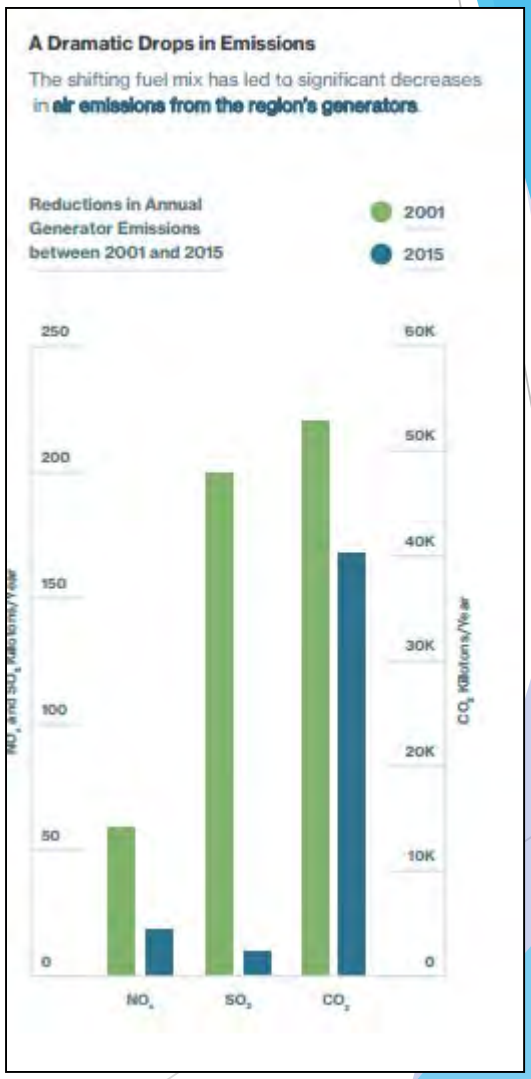


Gas Electric Coordination – What Now?

- **Increased use of natural gas as fuel for generation**
  - **Gas generation provided 49% of 2016 electricity in ISO-NE**
- **Natural Gas pipeline constraints increase spot price of gas for generators during cold snaps**
  - **Increases cost to consumers**
  - **Increases use of fuel oil (and emissions) to meet peak needs**
- **Market and regulatory mechanisms under stress to address the reliability and affordability challenge**
  - **Forward capacity markets do not provide IPPs enough revenue certainty to contract for firm gas capacity**
  - **Other alternatives have their own challenges**

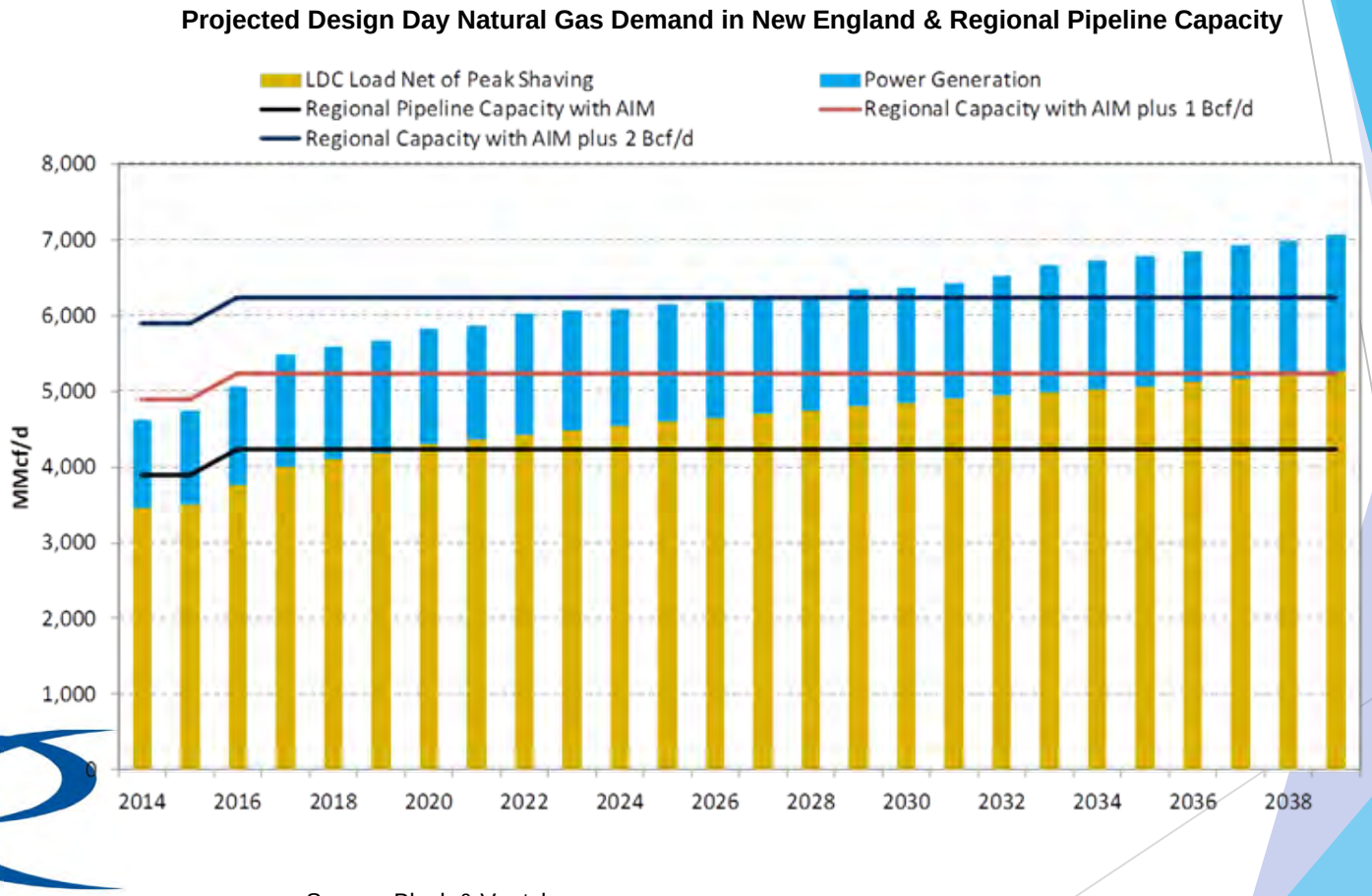
NE Electricity Production Has Shifted Dramatically to Cleaner, More Efficient Fuels





Source: ISO-NE 2017 Regional Energy Outlook

New England's Peak Demand for Natural Gas is Far Exceeding Existing Pipeline Capacity



Source: Black & Veatch

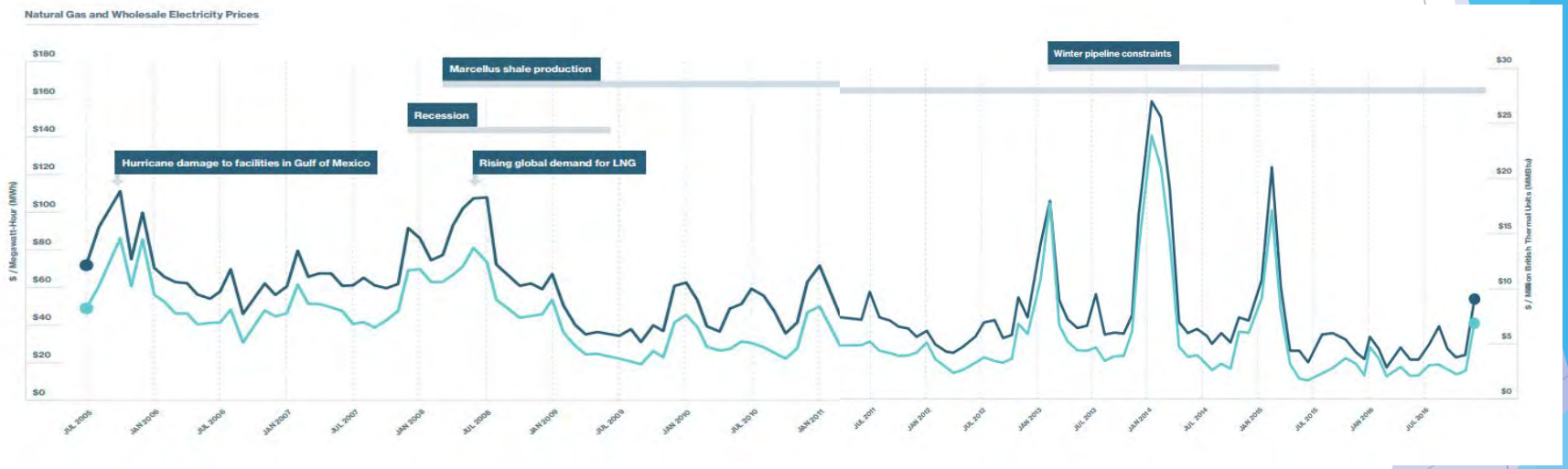
Natural Gas Pipeline Constraints Limit Fuel for Generators During Cold Snaps

Natural Gas Pipeline Constraints Can Lead to Price Volatility

Natural-gas-fired generators set the **price for wholesale electricity** most of the time. When natural gas prices spike due to pipeline constraints, wholesale electricity prices spike, too. In contrast, when the region's gas-fired generators have unconstrained access to natural gas, wholesale electricity prices tend to be low and competitive nationally.

Underlying natural gas data furnished by ice

- **Natural Gas Prices** at Algonquin City Gate
- **Wholesale Electricity Prices** in Real-Time Energy Market



Source ISO-NE 2017 Regional Energy Outlook; pp. 24-25

New England has Paid Significant, Constraint-Driven Price Premiums for Three Winters

In the winters subsequent to 2011/2012, the region has seen a dramatic increase in the frequency and level of basis differentials (constraint-driven price premiums) applicable to its Algonquin City Gate spot gas.

Algonquin City Gate vs. Henry Hub Basis Differential	Number of Days - Winter (Dec -Feb)				
	2011/12	2012/13	2013/14	2014/15	2015/16
Greater than $2/MMBtu	21	**65**	**77**	**72**	32
Greater than $5/MMBtu	4	**41**	**64**	**53**	1
Greater than $10/MMBtu	0	**28**	**51**	**21**	0
Greater than $20/MMBtu	0	**10**	**20**	**9**	0
Greater than $30/MMBtu	0	**1**	**7**	0	0
Greater than $40/MMBtu	0	0	**3**	0	0

The significantly higher prices paid for the natural gas used to fuel much of the region's power generation fleet were the primary drivers of New England wholesale electricity costs increases of $1.7 billion in the winter of 2012/2013, $3.8 billion in the winter of 2013/2014, and $1.6 billion in the winter of 2014/2015, all compared to the winter of 2011/2012.

	Winter (Dec -Feb)				
	2011/12	2012/13	2013/14	2014/15	2015/16
Avg. Gas Price @ Algonquin City Gate ($/mmBtu)	$ 4.40	**$ 11.26**	**$ 19.56**	**$ 10.73**	$3.40
Total Cost of ISO-NE Electric Energy Market ($Billions)	$ 1.2	**$ 2.9**	**$ 5.0**	**$ 2.8**	$ 1.0

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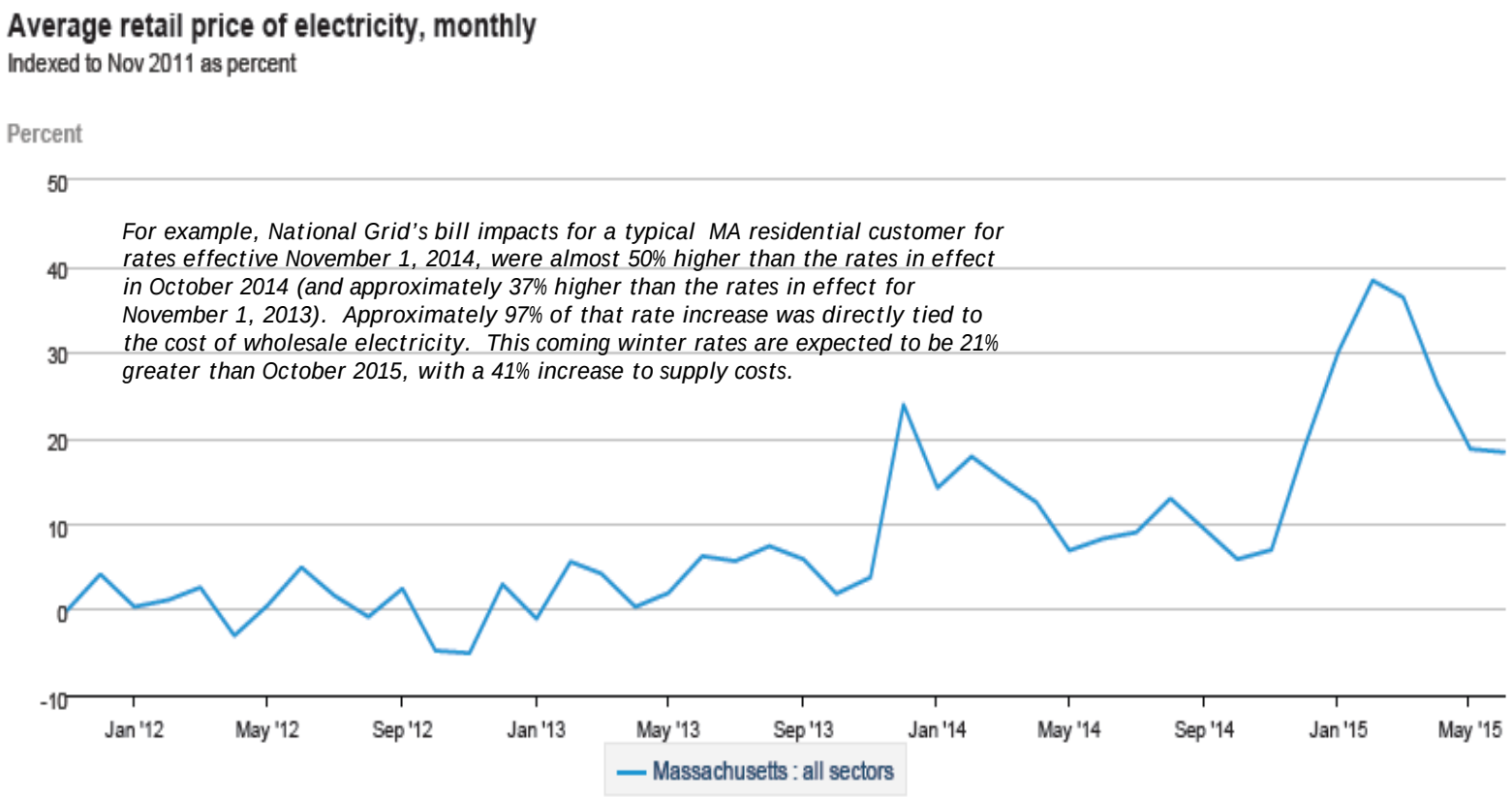
Electric Customers Now Realizing the High Cost of Inadequate Gas Infrastructure in Retail Rates



For example, National Grid's bill impacts for a typical MA residential customer for rates effective November 1, 2014, were almost 50% higher than the rates in effect in October 2014 (and approximately 37% higher than the rates in effect for November 1, 2013). Approximately 97% of that rate increase was directly tied to the cost of wholesale electricity. This coming winter rates are expected to be 21% greater than October 2015, with a 41% increase to supply costs.

eia Source: U.S. Energy Information Administration

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Gas Electric Coordination – What Now?

- Added Market mechanisms
  - ISO-NE has modified the electricity markets with Winter Reliability Programs and "pay-for-performance" mechanisms to increase winter reliability
  - Dual fuel capabilities are typically least cost alternative but have higher emissions and may be limited by State air emission levels
  - LNG and oil may have price volatility and have reliability risks during peak periods

Changing supply mix

- Wind and solar will help – but are not installed at sufficient quantities and may not be available during extreme cold snaps if wind isn't blowing or sun isn't shining
- Transmission to access distant wind and hydro resources faces commercial and siting challenges
- Retirements of 2,200 MW of oil and nuclear generation (Brayton Point and Pilgrim) plus increasing retail gas heating load and proposed new gas-fired generation may exacerbate the impacts of gas constraints

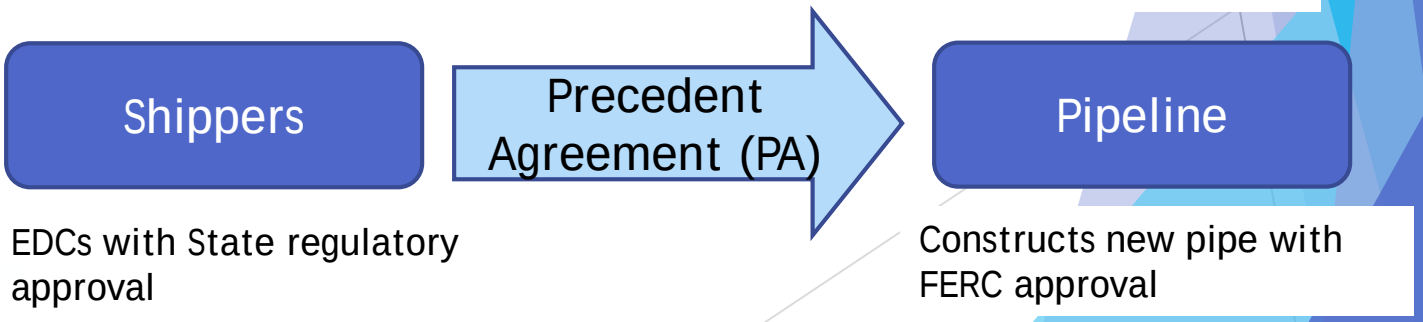
- **Natural gas will play a pivotal role in balancing energy innovation with continued affordability and reliability – for consumers.**
- **Even as renewables become more reliable and cost-efficient, gas-fired generation will still be required as a safe, reliable, and dependable backstop for the electricity grid of the future.**

Challenge – How to Secure Adequate Fuel for Natural-Gas-Fired Generation

- According to the ISO-NE 2017 Regional Electricity Outlook, "Timely solutions are imperative for this major challenge to the regional power system. Reliability, rising winter air emissions, and electricity price volatility are all at stake.
- Generators have no guarantee of when or how long they'll be called to run – thus they typically forego premium firm gas supply contracts instead only arranging for fuel only as needed and relying on unused (if any) pipeline capacity for delivery to be cost competitive.
- Simultaneously, there is increased demand by retail gas customers as conversions from oil to gas increase heating and industrial loads

Electric Distribution Companies (EDCs) Offered a Potential Solution

- EDCs in New England, on behalf of electric customers, could enter into long-term firm capacity contracts with one or more interstate pipeline companies to ensure a more reliable and economical deliverability of natural gas supplies required by the region's growing fleet of gas-fired electricity generators
- The EDCs, or a Capacity Manager, would release the new pipeline capacity to the market following existing requirements for capacity releases, along with any additional FERC approved waivers/exemptions required to best enable the capacity to be used as needed/intended
  - Any capacity payments received from the gas-fired generators or others would be credited toward the pipeline support charges, thus reducing the net remaining costs to be collected from the EDC customers.
- The EDCs would recover the total costs associated with the pipeline capacity contracts (including administrative costs and remuneration) through a fully reconciling, non-bypassable retail electric cost recovery mechanism



New England States Recognize the Need for a Solution

- **Rhode Island**: Affordable Clean Energy Security Act, R.I.G.L§39-31 includes provisions authorizing the EDC, "subject to the review and approval of the Public Utilities Commission, to enter into long-term contracts for natural-gas pipeline infrastructure and capacity that are commercially reasonable and advance the purposes of this chapter at levels beyond those commitments necessary to serve local gas distribution customers"
- **Massachusetts:** DPU 15-37 "Investigation by the Department of Public Utilities on its own Motion into the means by which new natural gas delivery capacity may be added to the New England market, including actions to be taken by the electric distribution companies" opened on April 27, 2015 in response to a petition filed by the Massachusetts Department of Energy Resources (DOER)
  - In August 2017, the Supreme Judicial Court (SJC-12051) determined that state law, dating back to 1926, precluded the DPU from allowing EDCs to enter into contracts for gas capacity. The court said that the law neither expressly prohibits nor permits the department's order. Instead, it relied on legislative intent for its ruling.
- **Connecticut**: Public Act No. 15-107 An Act Concerning Affordable and Reliable Energy: authorizes CT DEEP to seek proposals for up to 375 million cf/d of "incremental capacity, gas, or storage that has a firm delivery capability to transport natural gas to natural gas-fired generating facilities located in the control area" and to direct EDCs to enter into long-term contracts for any proposal(s) selected

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- **Maine:** Title 35-A, Chapter 19, The Maine Energy Cost Reduction Act authorizes the PUC, subject to conditions, "to execute or direct one or more utilities to execute an energy cost reduction contract if … the agreement is commercially reasonable and in the public interest and…reasonably likely to… A. Materially enhance natural gas transmission capacity into the State or into the ISO-NE region and that additional capacity will be economically beneficial to electric consumers, natural gas consumers or both in the State and that the overall costs of the contract are outweighed by its benefits to electric consumers, natural gas consumers or both in the State; and B. Enhance electrical and natural gas reliability in the State."
- **New Hampshire:** PUC IR 15-124 Staff "Investigation into Potential Approaches to Ameliorate Adverse Wholesale Electricity Market Conditions in New Hampshire", opened April 17, 2015
- On October 6, 2016, the NH PUC dismissed Eversource's petition to purchase long-term gas pipeline capacity to be used by gas-fired electric generators, and include the net costs of its purchases and sales in its electric distribution rates. The NH PUC found that it could not approve such an arrangement under existing laws arguing the proposal goes against the overriding principle of restructuring, which is to harness the power of competitive markets to reduce costs to consumers by separating unregulated generation from fully regulated distribution. (Order No. 25,950)

New England Energy Strategy

- New England's economic and environmental well being depends on affordable, cleaner sources of energy delivered safely and reliably.
- National Grid believes a portfolio of energy resources including large-scale renewables, increased natural gas capacity and enhanced demand reduction and conservation programs is the key to securing New England's long-term energy future.
- **Action is needed now in order to allow adequate time to plan, site and develop the infrastructure that is critically needed in order to stabilize regional electricity prices, ensure continued reliable energy supply and delivery and meet regional clean energy policy requirements.**

Future questions:
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Thank you for attending this EBA Program

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