Environmental Update

Planning Advisory Committee

Patricio Silva

SYSTEM PLANNING

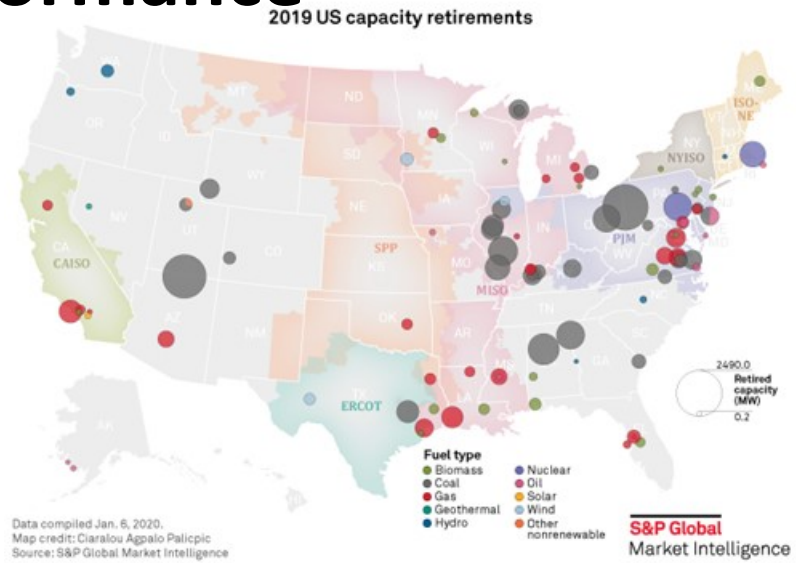
Presentation Overview

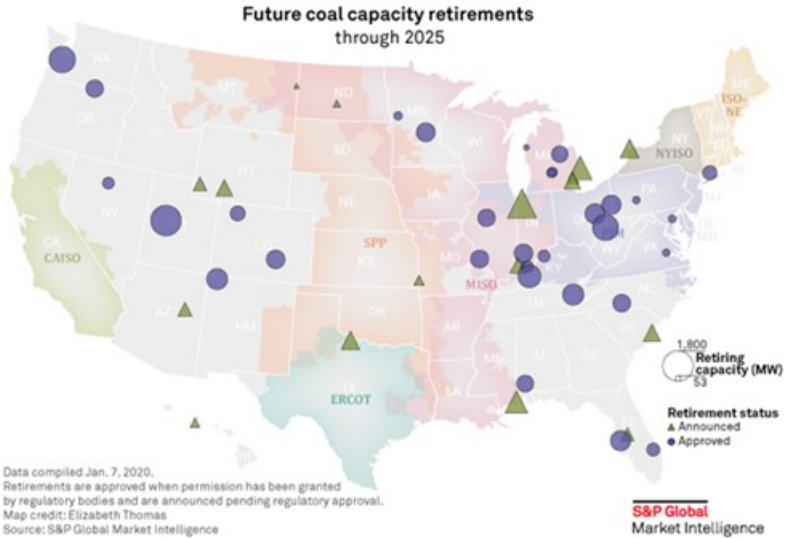
- The Environmental Advisory Group (EAG) assists the Planning Advisory, Reliability and Power Supply Planning Committees, evaluating the impact of environmental rules on the regional power system
- 2019 Regional System Trends
- Regional Generation and Emission Trends
- Impact of Carbon Dioxide (CO_2) Pricing on Regional Energy Costs
- Regional Greenhouse Gas Initiative (RGGI) Update
- Transportation Climate Initiative Update
- GWSA CO2 Cap Update

Retirements Factor in New England Power System Environmental Performance

Shift in Fuel Mixes Across Northeast Impacts New England Either Directly or Thru Regional Initiatives

- Retirement or curtailment of non-emitting capacity (nuclear, hydro, wind and solar) and imports, can impact system air emissions, water use, and wastewater discharges
- Nuclear and fossil retirements in greater Northeast could have environmental impacts in New England:
  - Affecting upwind emissions contributing to ozone and regional haze
  - Shift the composition and availability of net imports and allowance costs
  - Regional environmental compliance costs
- Changes in weather, economic conditions, demand, energy prices, and unit availability can influence emissions, water use and wastewater discharges





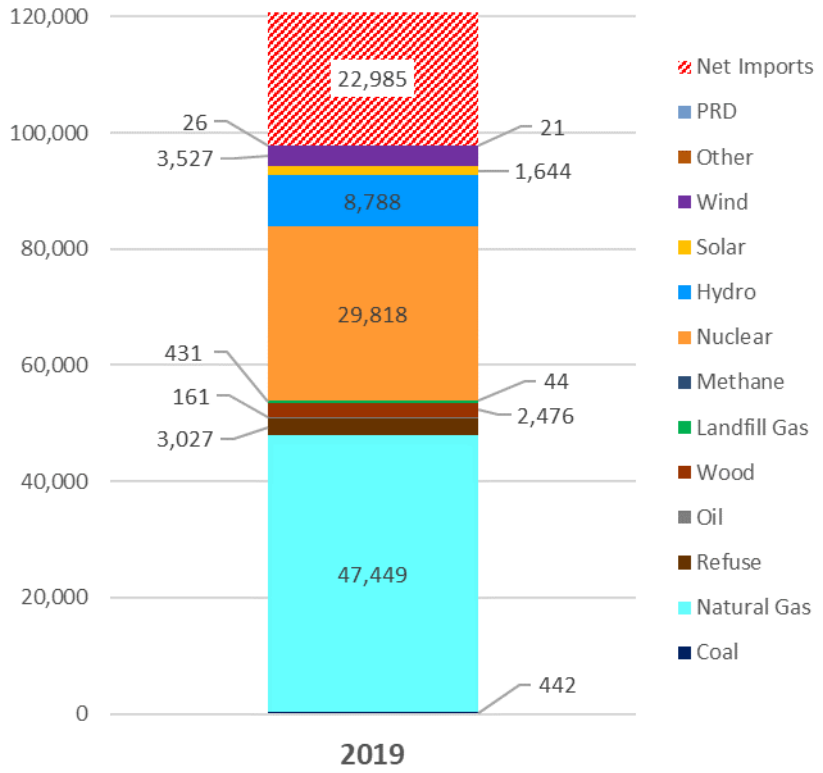
Source: S&P Global

2019 Regional Power System Trends

Net Generation Declined 4% in 2019 Emitting Native Generation Fell 8%

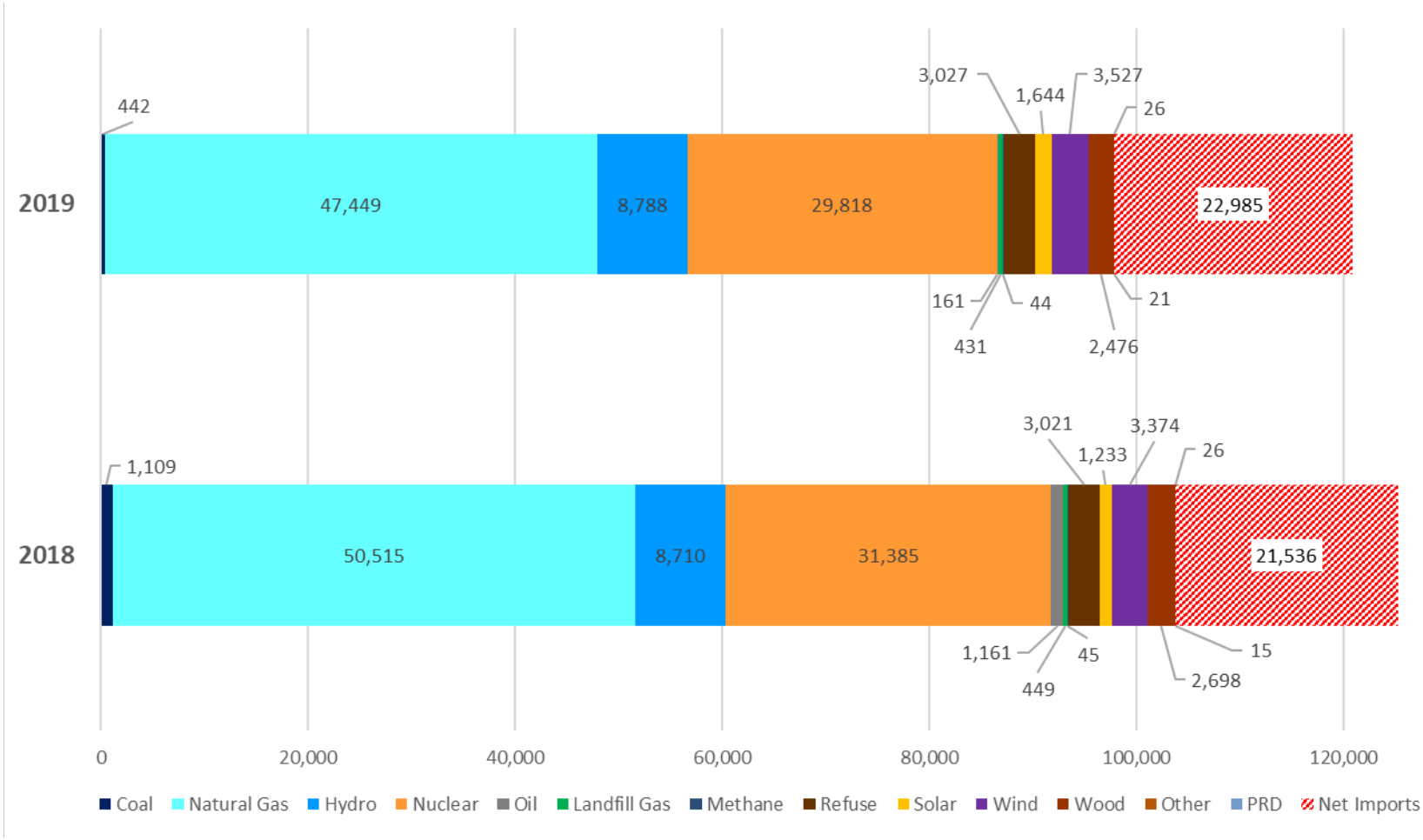
- 2019 net generation for load (120,839 GWh) declined by 4% compared to 2018 (125,277 GWh)
- 2019 native emitting generation (coal, natural gas, refuse, oil, wood, landfill gas and methane) declined by 8%
  - 2019 emitting: 54,030 GWh
  - 2018 emitting: 58,998 GWh
- Nuclear generation declined 5% in 2019 (1,567 GWh) with the retirement of Pilgrim

2019 Net Generation by Fuel Type (GWh)



Source: ISO-NE

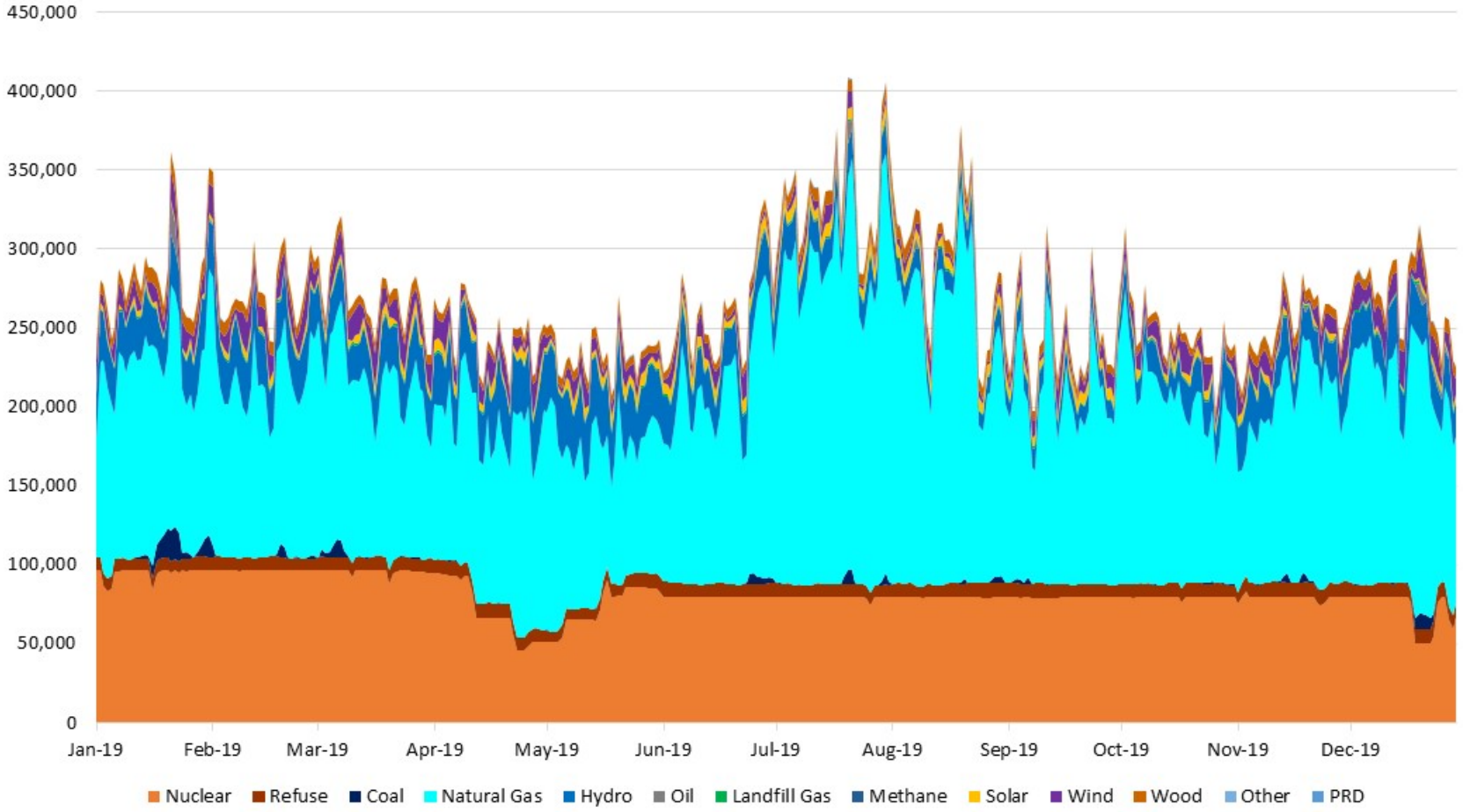
2018 v. 2019 Regional Net Energy for Load Increased Reliance on Imports, Renewables (GWh)



In 2019, net generation for load declined to 120,839 GWh, a 4% decline from 2018 (125,277 GWh). Emitting generation (coal, natural gas, oil, landfill gas, methane, refuse and wood) fell 8% to 54,030 GWh from 2018 (58,998 GWh). Between 2018 and 2019 nuclear generation declined 5% (Δ 1,567 GWh), while solar increased 33% (Δ 411 GWh); hydro 1% (Δ 78 GWh); wind 5% (Δ 153 GWh) and net imports increased 7% (Δ 1,449 GWh).

Source: ISO-NE

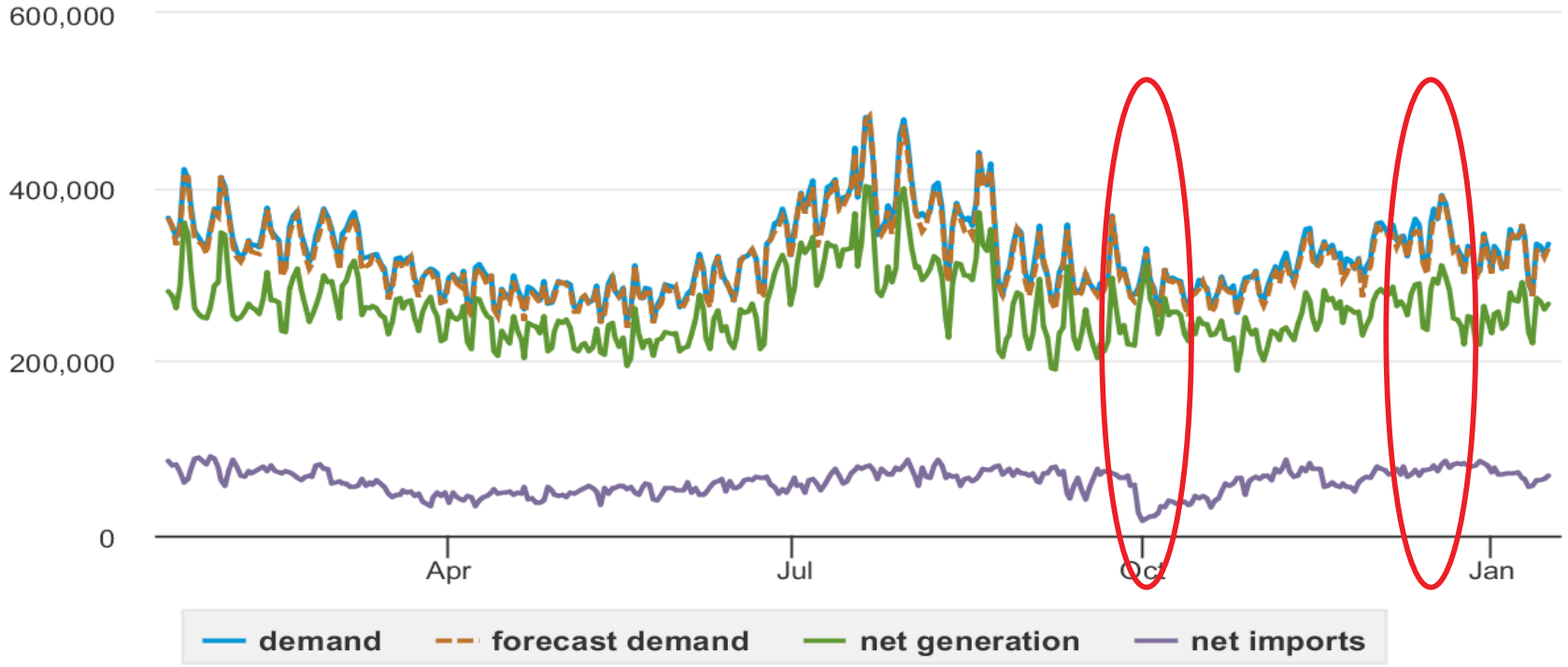
2019 New England Daily Native Generation by Fuel Type (MWh)



Daily generation by fuel type roll-up data (MWh) 2019 (Jan 1 – Dec 29).

Source: ISO-NE

New England Daily Electricity Demand, Net Generation, Net Demand & Net Imports (MWh)



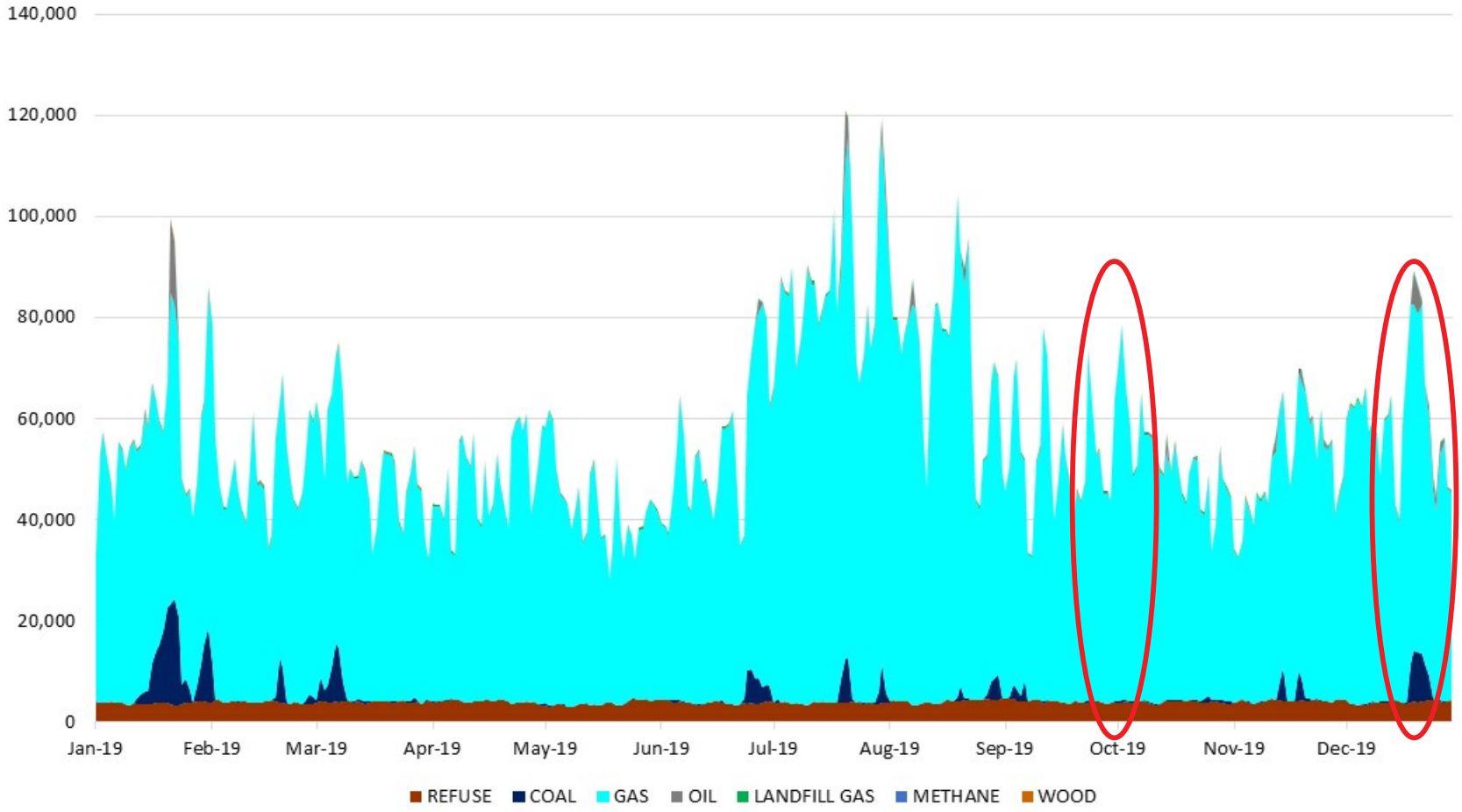
Source: U.S. Energy Information Administration, EIA-930 U.S. electric system operating data

As the native generating mix sheds non-emitting resources, the environmental performance of the New England regional power system is increasingly sensitive to daily and short term changes in availability of non-emitting resources and imports. Preliminary analysis of two episodes in 2019 illustrates different aspects of the sensitivity:

- **October 2019**: hotter than average temperatures (>80 F) and multi-day curtailment of net imports triggered increased dispatch of native natural gas, coal and oil generation, while generation by other fuel types remained static
- **December 2019**: colder than average temperatures and multi-day curtailment of native nuclear generation triggered increased dispatch of native natural gas, and greater dispatch of coal and oil generation, while generation by other fuel types remained static

Source: EIA

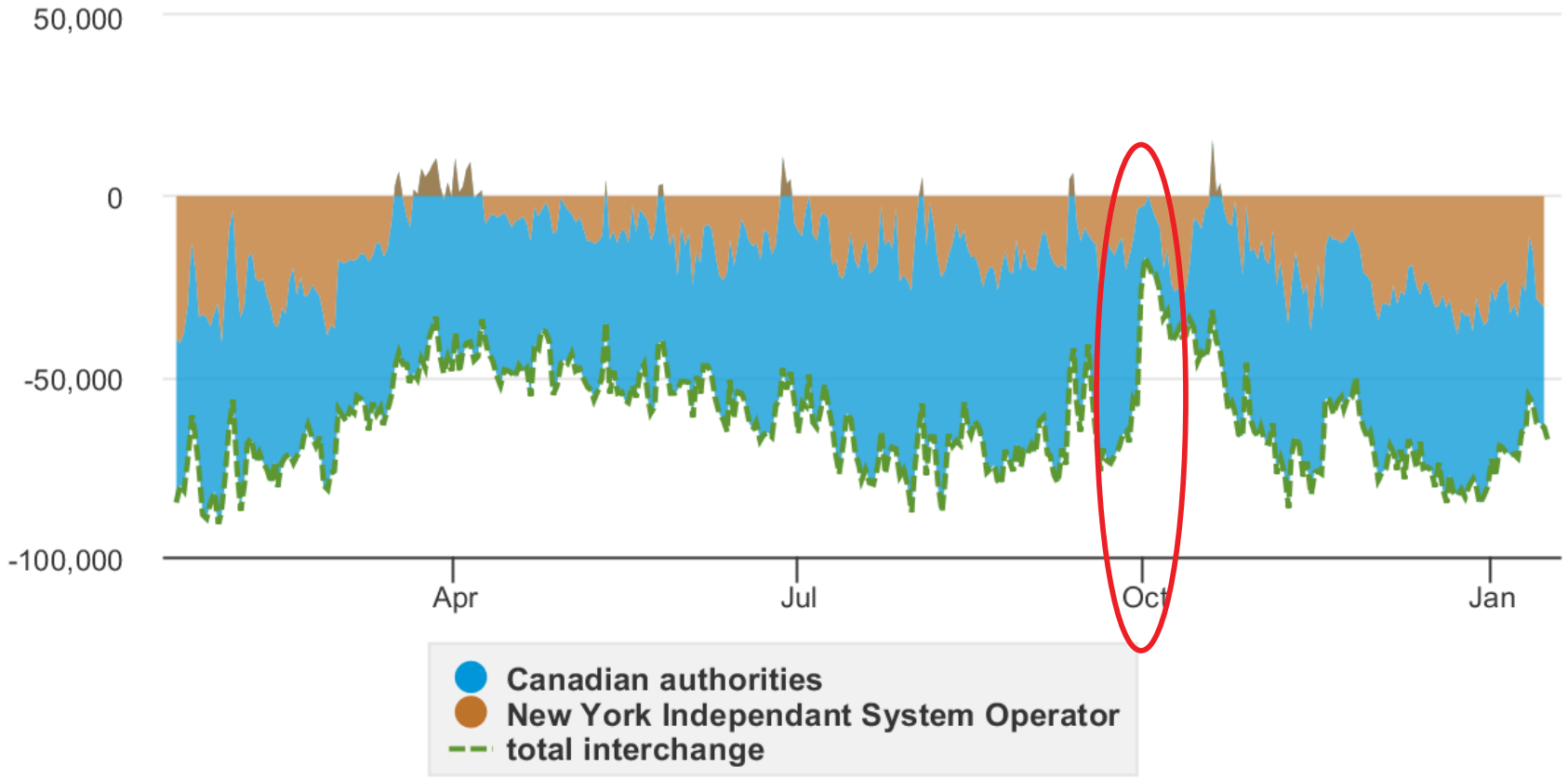
2019 New England Daily Estimated CO_2 Emissions (Metric Tons)



Estimated power system daily CO_2 emissions derived from daily generation roll-up data (MWh) 2019 (Jan 1 – Dec 29). Daily sum of estimated CO_2 emissions in metric tons for emitting source categories (coal, natural gas, oil, landfill gas, methane, refuse and wood) calculated using ISO-NE specific EPA CO_2 emission factors. Sources: ISO New England; EPA

Source: ISO-NE

New England Daily Electricity Interchange (MWh)

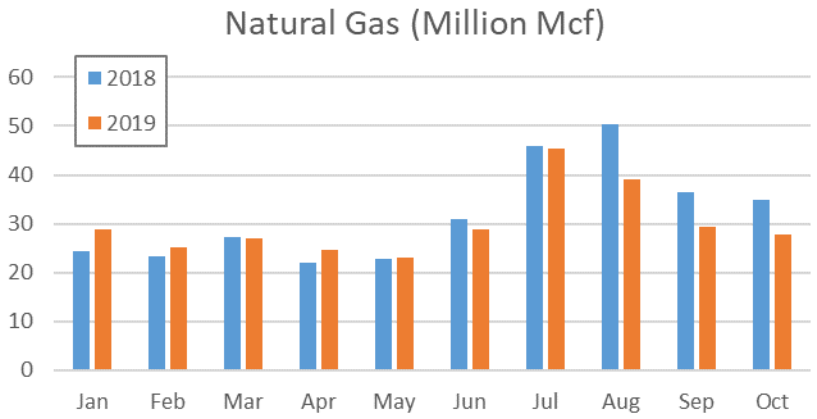


Source: U.S. Energy Information Administration, EIA-930 U.S. electric system operating data

Source: EIA

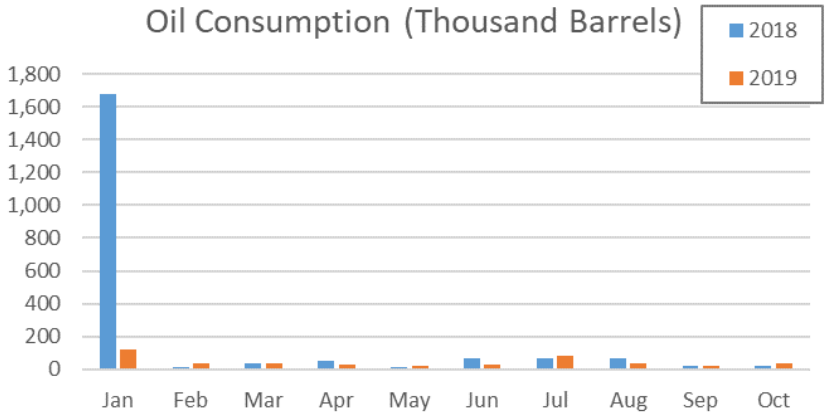
Monthly Fossil Fuel Consumption for Electric Generation in New England

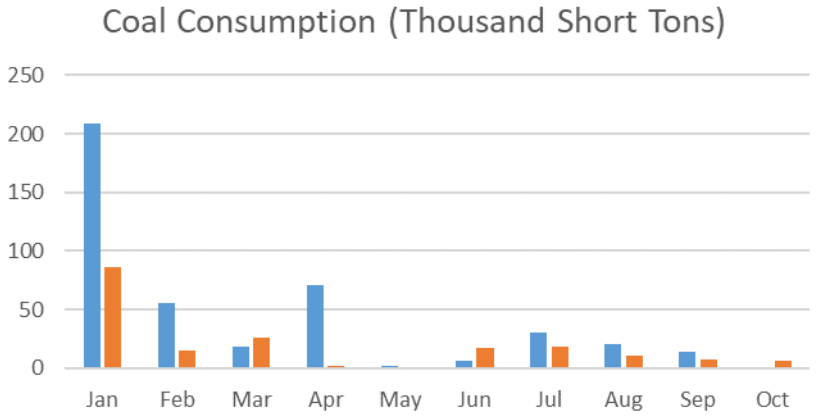
Natural Gas Consumption Lower in 2019



- Year-to-date consumption declined for all fuel types in 2019 compared to 2018 (million MMBtu):
  - Natural gas 2018 (327), 2019 (309)
  - Oil 2018 (10), 2019 (2)
  - Coal 2018 (9), 2019 (3)

Limited Oil & Coal Consumption Lower 2019 SO_2 & NO_X Emissions



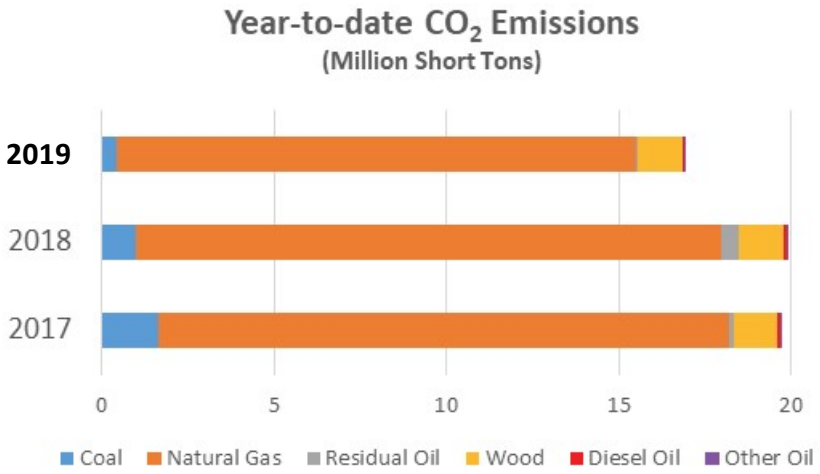


Source: EIA

Monthly System Emissions

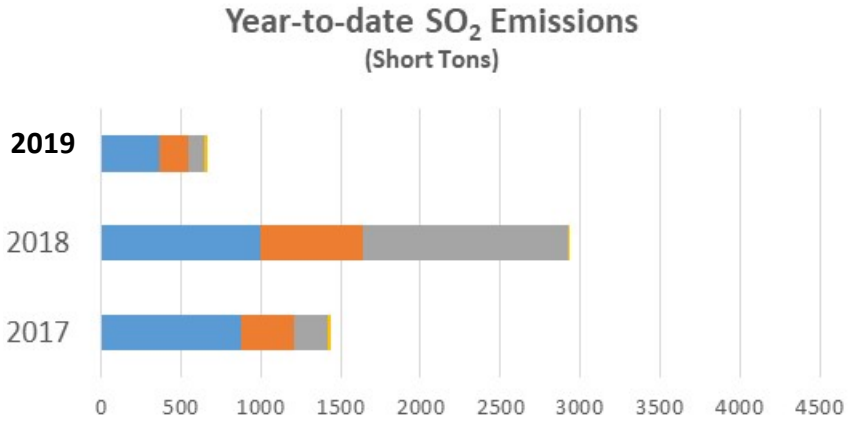
Reported by Fossil Generators directly to EPA on quarterly basis

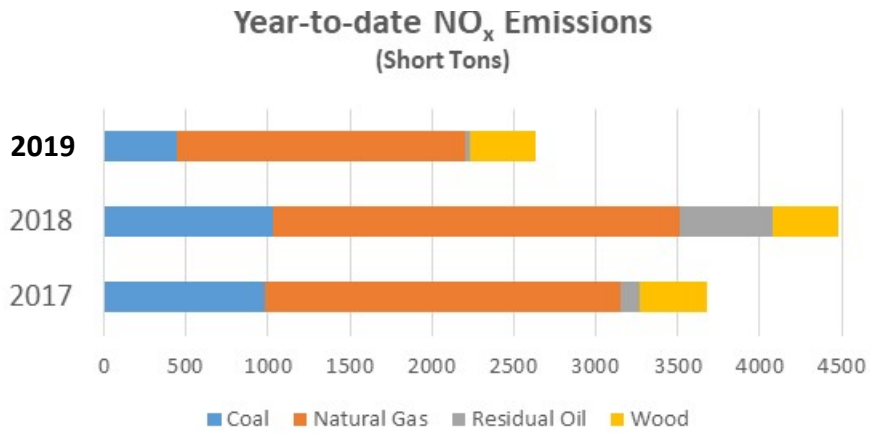
Regional 2019 CO_2 Emissions Trend Lower for Most Fuel Types



- Compared to 2017 & 2018, **2019** year-to-date CO_2 emissions from:
  - Coal & Oil generation fell > 50%
  - Natural gas generation fell 10%
  - Wood, refuse generation & CO_2 emissions were unchanged

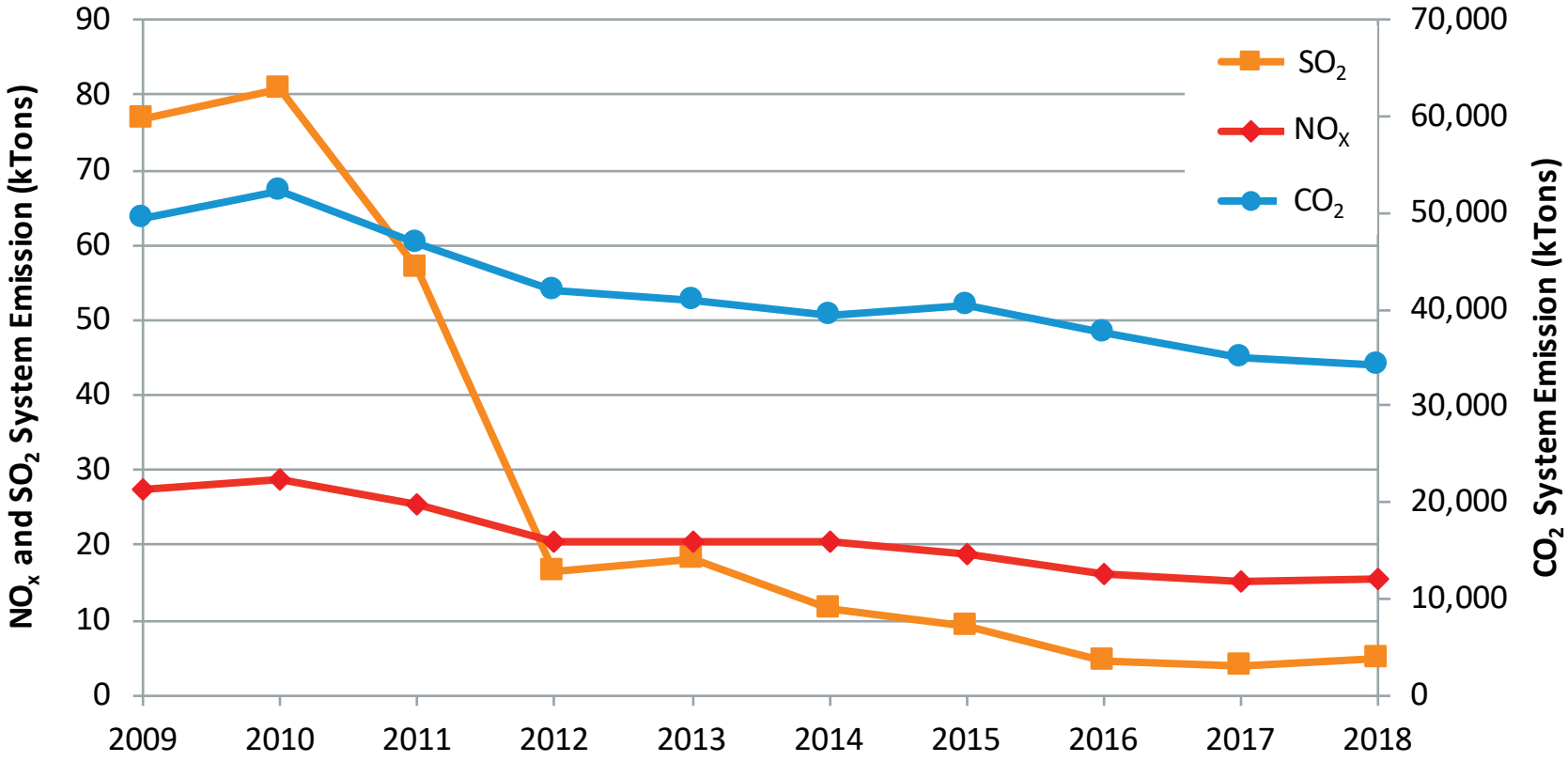
Declines in Coal & Oil Generation Lower Other System Emissions





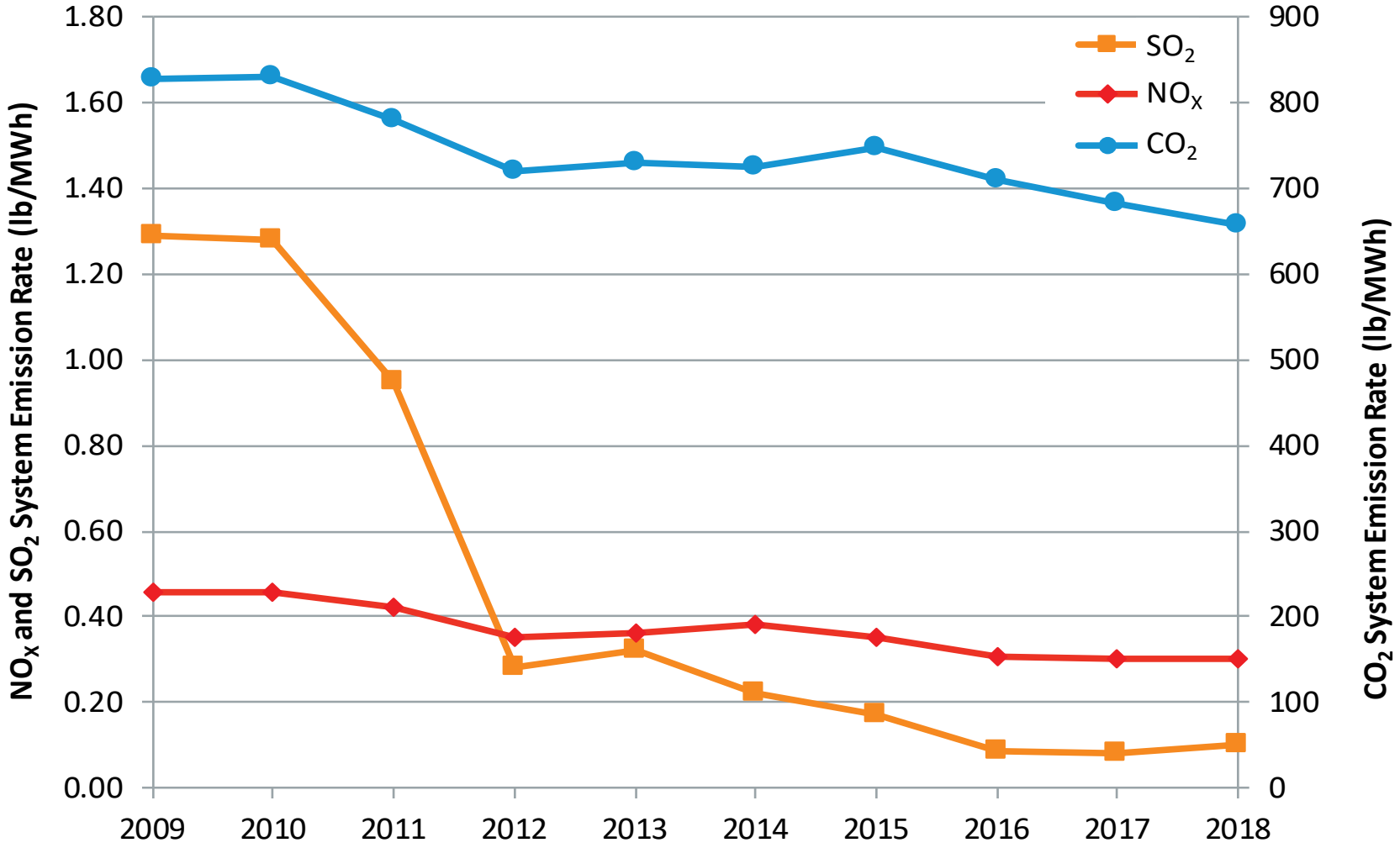
Source: EPA

2009 – 2018 ISO-NE Annual System Emission (kTons)



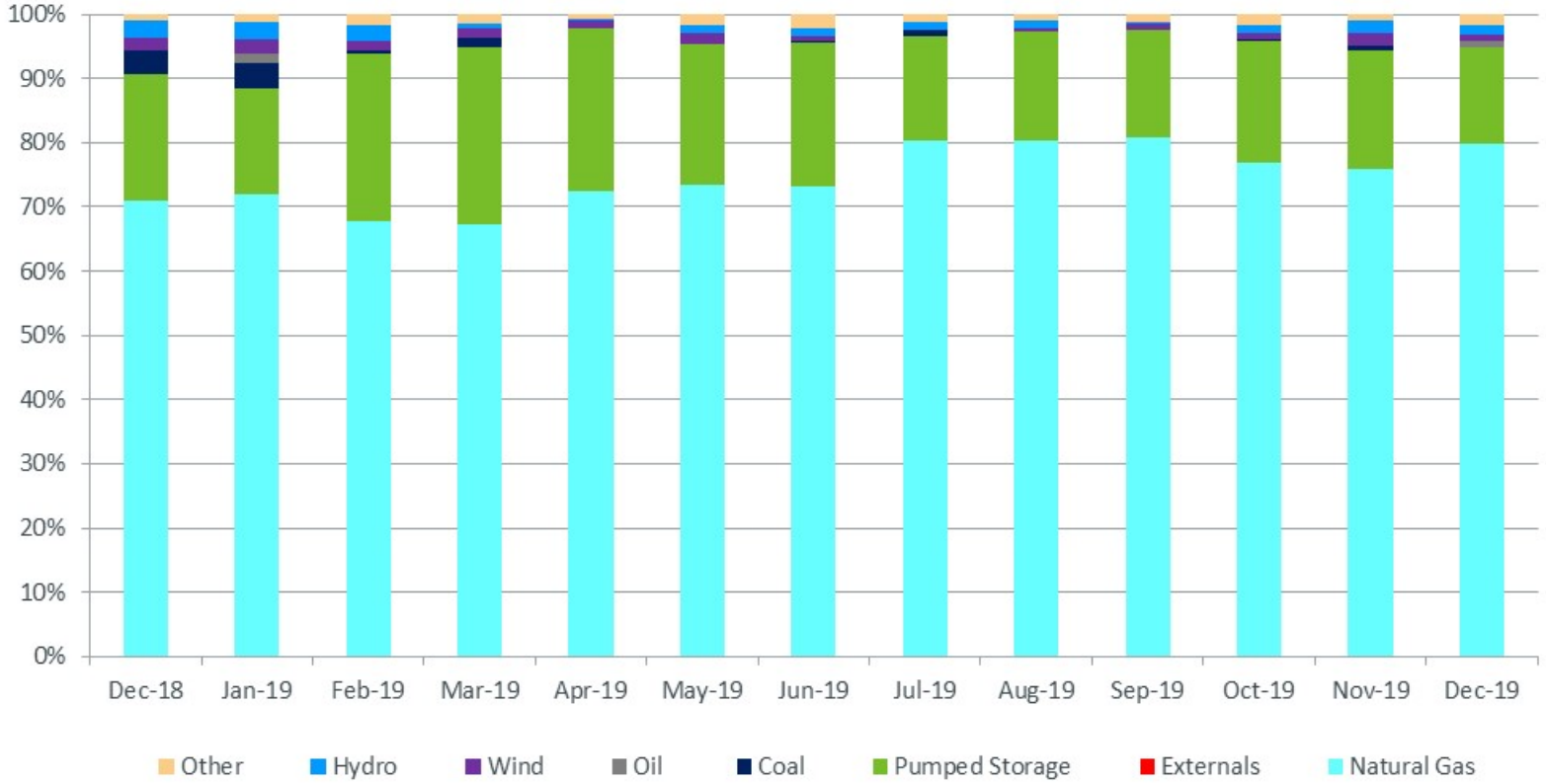
Source: ISO-NE

2009 – 2018 ISO-NE Average Annual System Emission Rates (lb/MWh)



Source: ISO-NE

Load-Weighted Marginal Units by Fuel Type



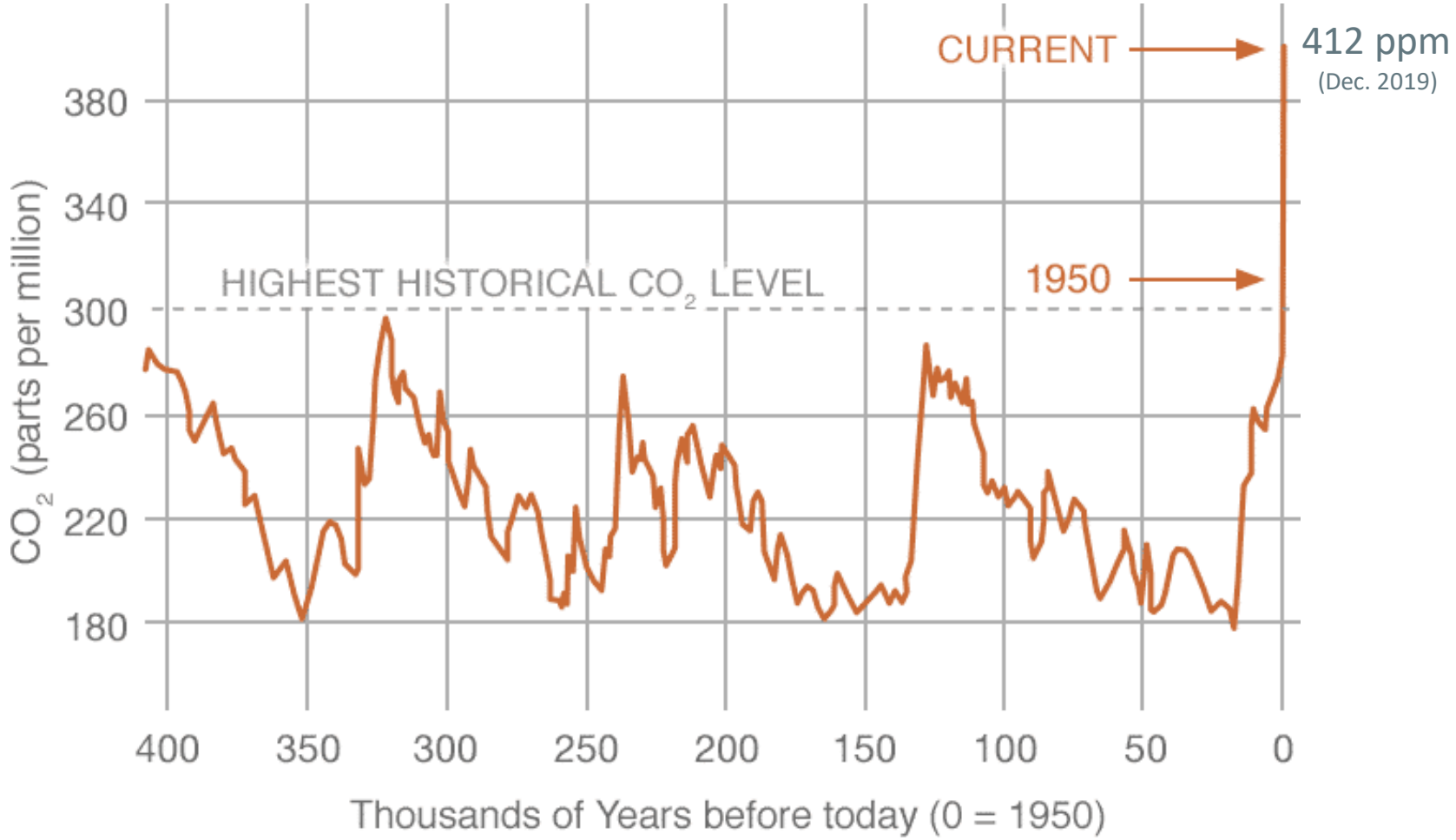
Marginal emission rates are calculated using system data that identifies at least one locational marginal unit for each five-minute period, which is associated with meeting the energy requirements on the system during that pricing interval. Using system data on the magnitude and direction of power flows, load in constrained areas and the marginal generators in the same constrained areas are matched. Since these marginal generators can only serve load in the constrained area, weighting by the load in the constrained area against the overall load on the system provides a more accurate representation of the system impact of load weighted marginal units.

Source: ISO New England

Source: ISO-NE

GREENHOUSE GAS EMISSIONS UPDATE

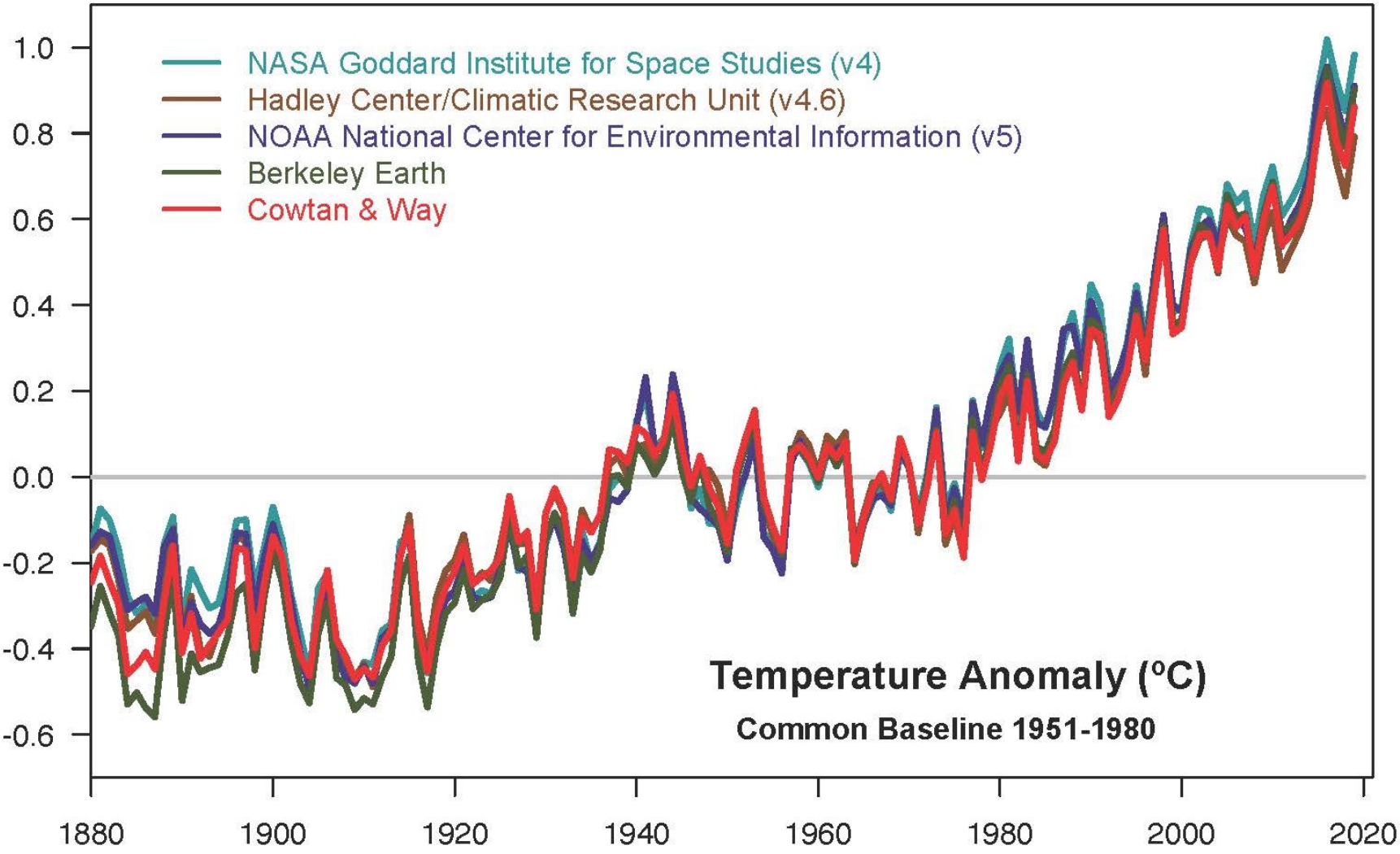
Indirect Atmospheric CO_2 Measurements Reconstructed from Recovered Ice Cores



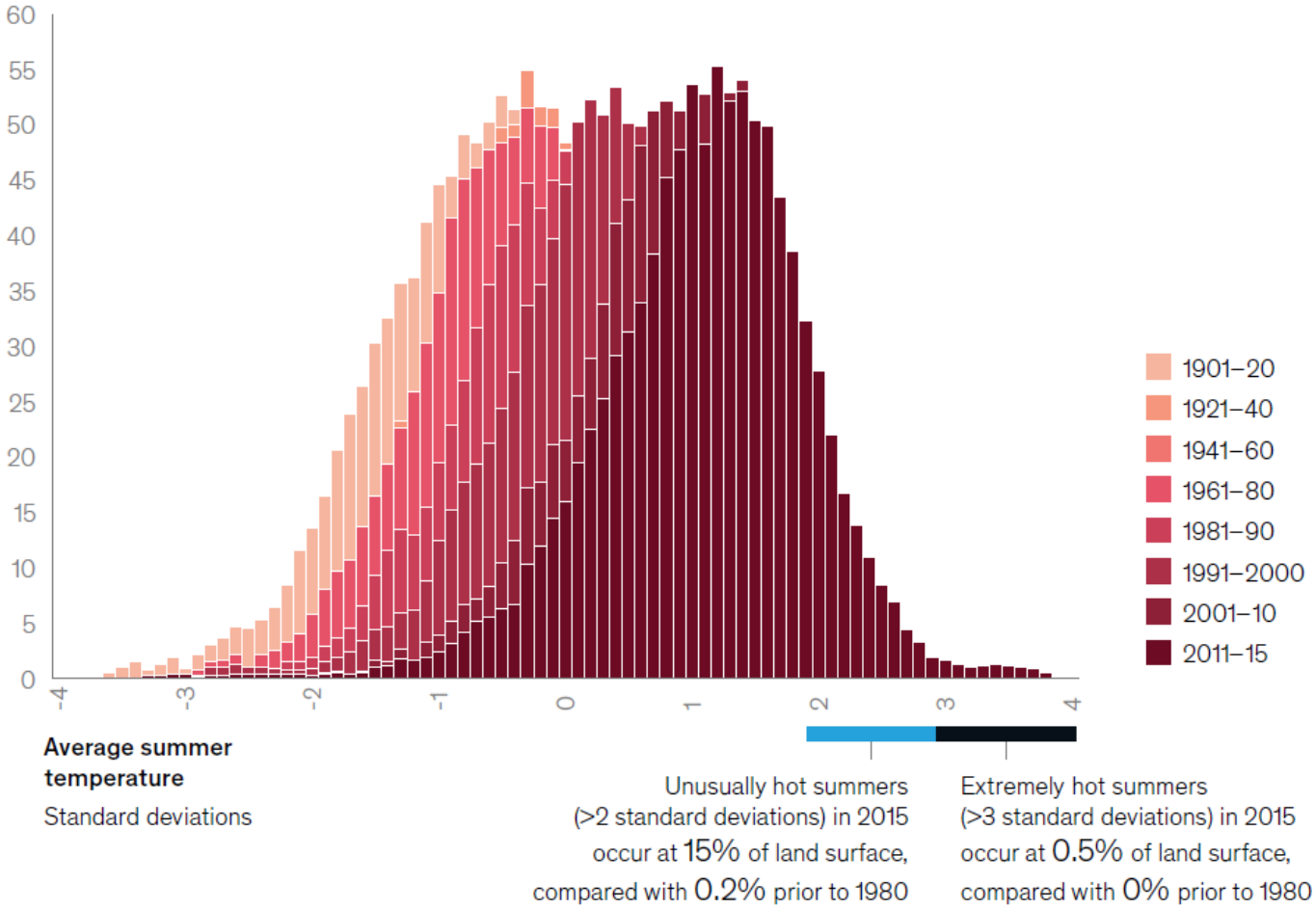
CO_2 levels during the last three glacial cycles, as reconstructed from ice cores

Source: NOAA

Global Average Temperature Anomalies



Frequency of Local Temperature Anomalies in the Northern Hemisphere

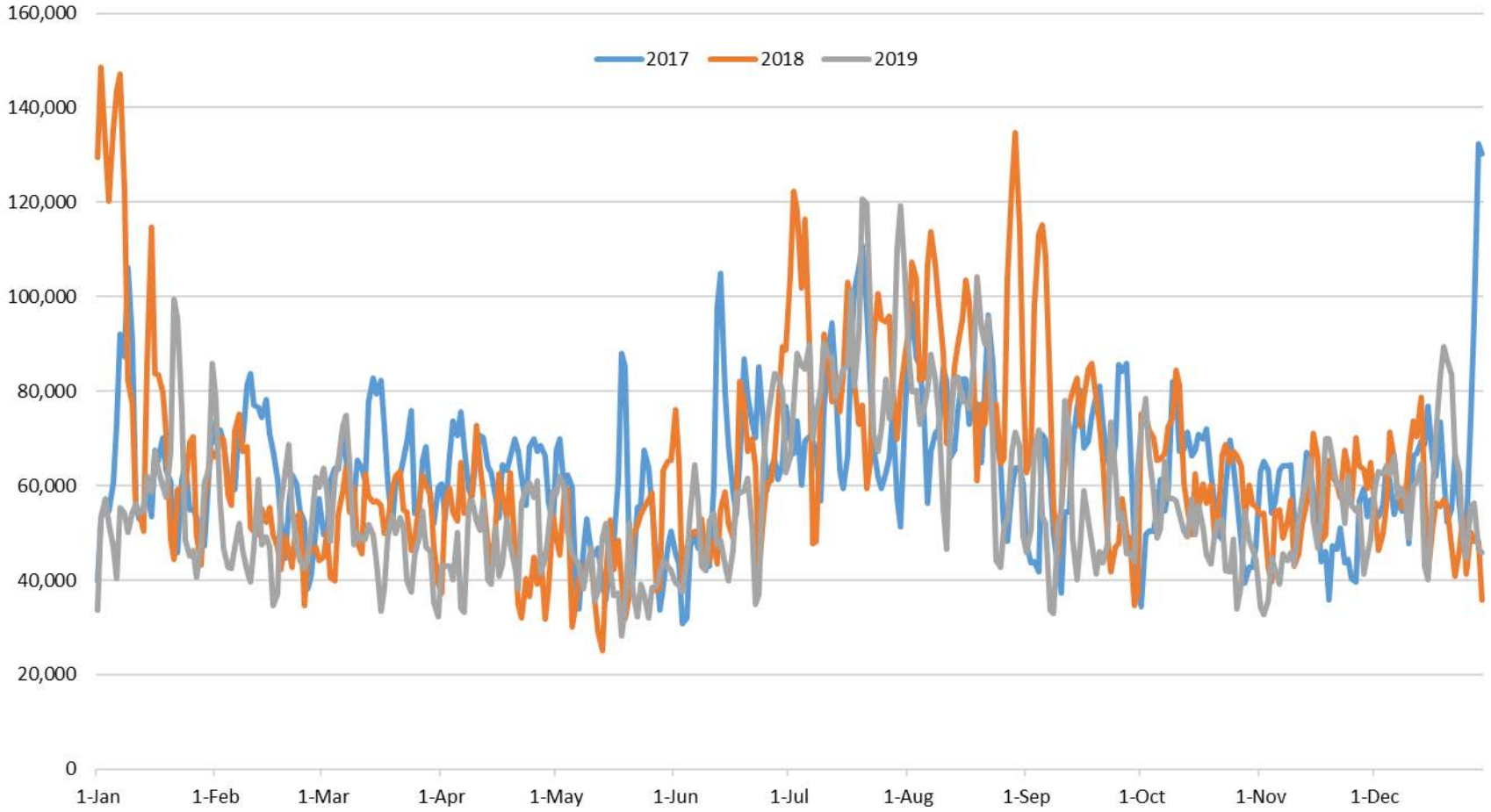


Source: McKinsey Global Institute

2019 GHG Developments in North America

- **EPA Greenhouse Gas Emission Guidelines**
  - Clean Power Plan repealed; Affordable Clean Energy Rule finalized; § 111(d) implementation guidelines updated
  - Litigation over federal carbon rules not expected to impact state and regional power sector carbon reduction efforts
- **PJM Carbon Pricing Senior Task Force**
  - Examining processes and rule changes necessary to integrate regional or sub-regional carbon pricing mechanisms
- **New York Energy Markets Carbon Pricing Market Design**
  - NYISO completes mark design, remains under consideration
- **Regional Greenhouse Gas Initiative**
  - New Jersey rejoined in RGGI in 2020
- **Transportation Climate Initiative**
  - Northeast states working on reducing carbon emissions from transportation by taxing fuels by 2022
- **MA Global Warming Solutions Act CO_2 Cap**
  - **December 2019**: next GWSA auction

New England Daily Estimated CO_2 Emissions (2017-2019)



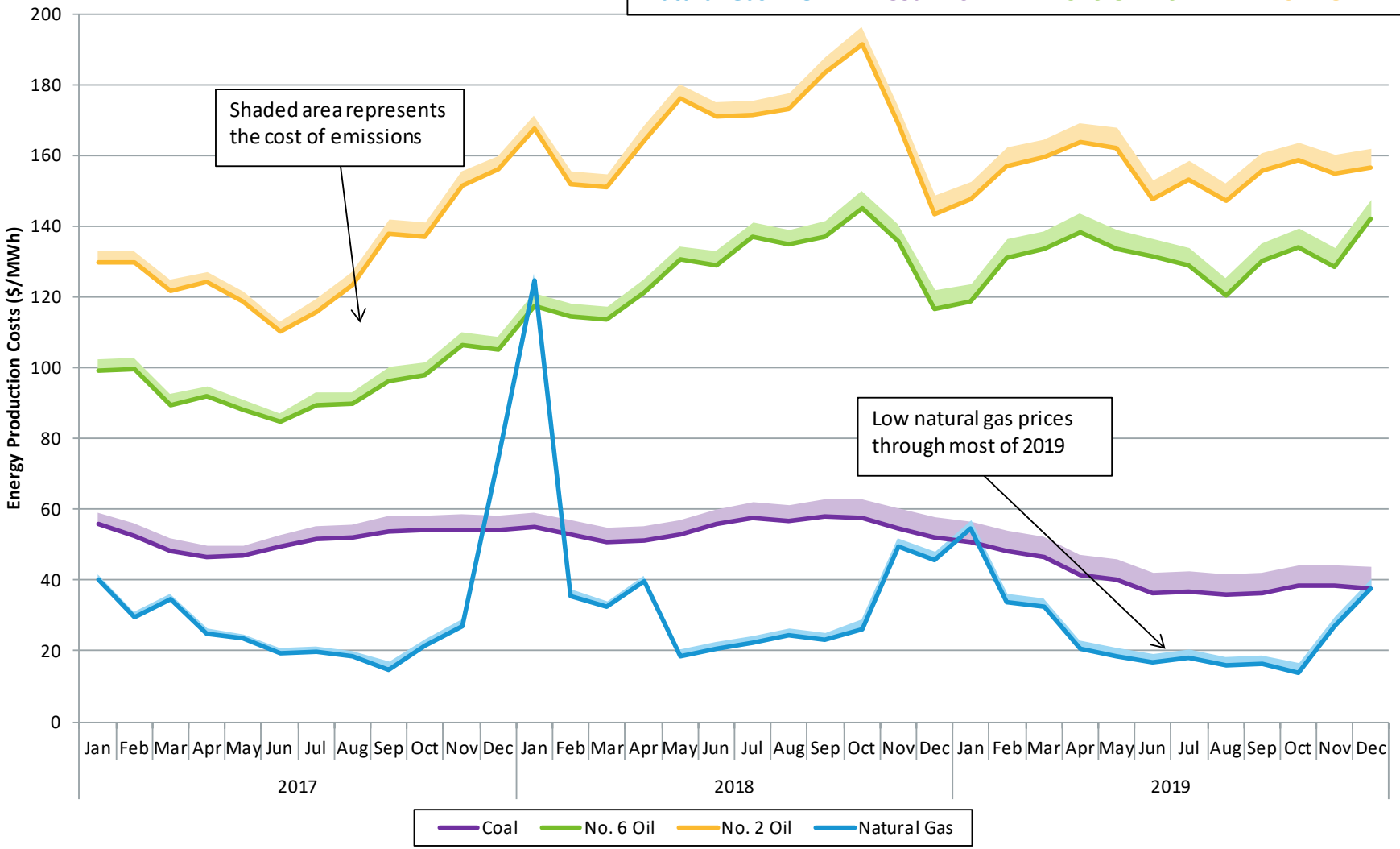
Estimated power system daily CO_2 emissions derived from daily generation roll-up data (MWh) for same year-to-date period in 2017, 2018 and 2019 (Jan 1 – Dec 29). Daily sum of estimated CO_2 emissions in metric tons for emitting source categories (coal, natural gas, oil, landfill gas, methane, refuse and wood) calculated using ISO-NE specific EPA CO_2 emission factors.

Sources: ISO-NE; EPA

IMPACT OF CARBON DIOXIDE (CO_2) ALLOWANCE PRICING ON REGIONAL ENERGY COSTS

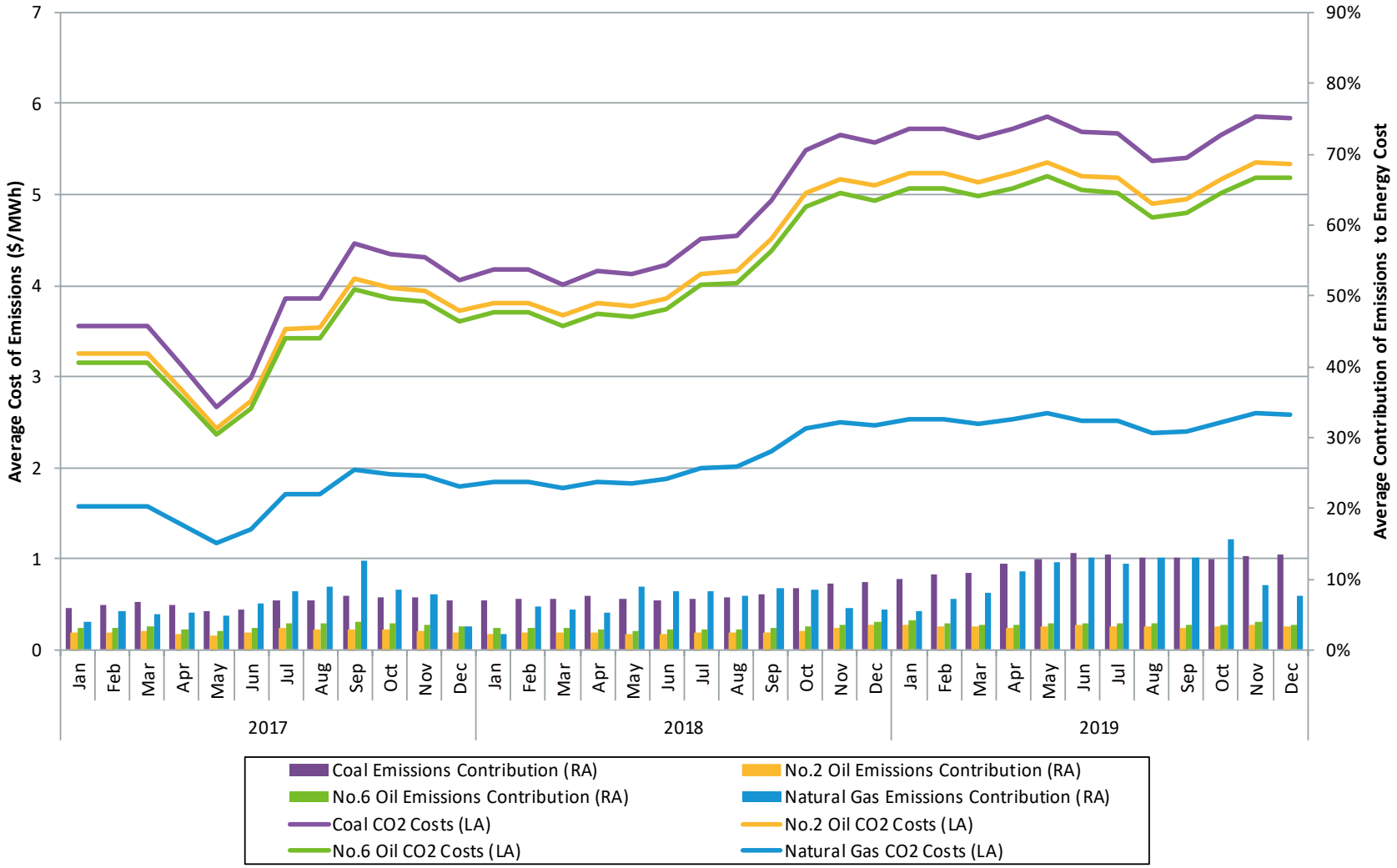
Fuel Prices and Relative Cost of CO_2 Pricing by Fossil Fuel Type

The standard efficiency heat rates (MMBtu/MWh) used in the graph are:
Natural Gas: 7.8 Coal: 10 No. 6 Oil: 10.2 No. 2 Oil: 11.7



Source: ISO-NE

CO_2 Pricing Contribution to Energy Costs by Fossil Fuel Type



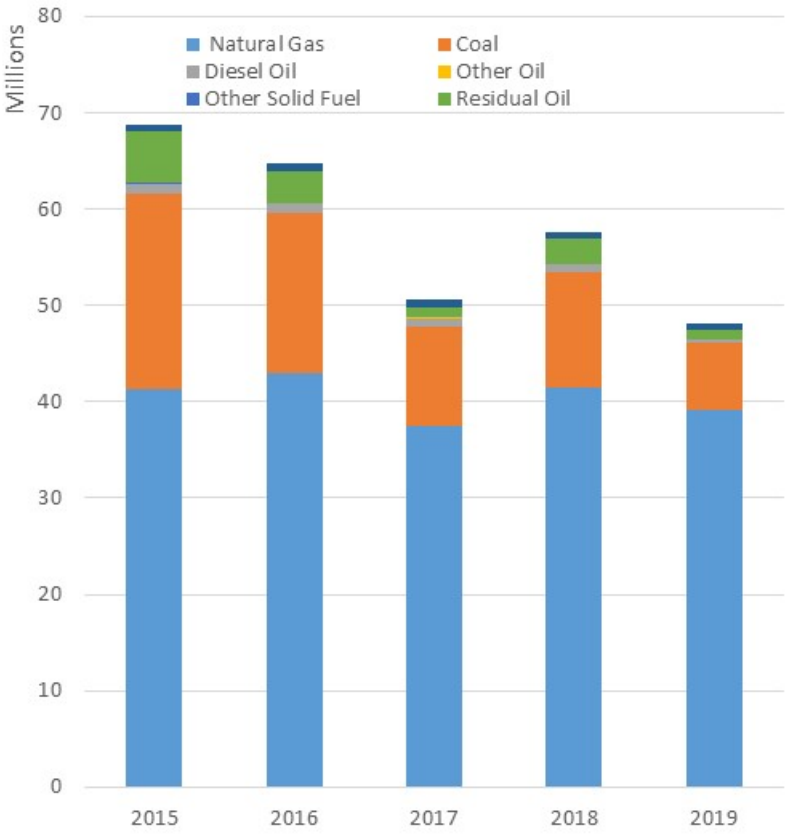
Source: ISO-NE

REGIONAL GREENHOUSE GAS INITIATIVE (RGGI)

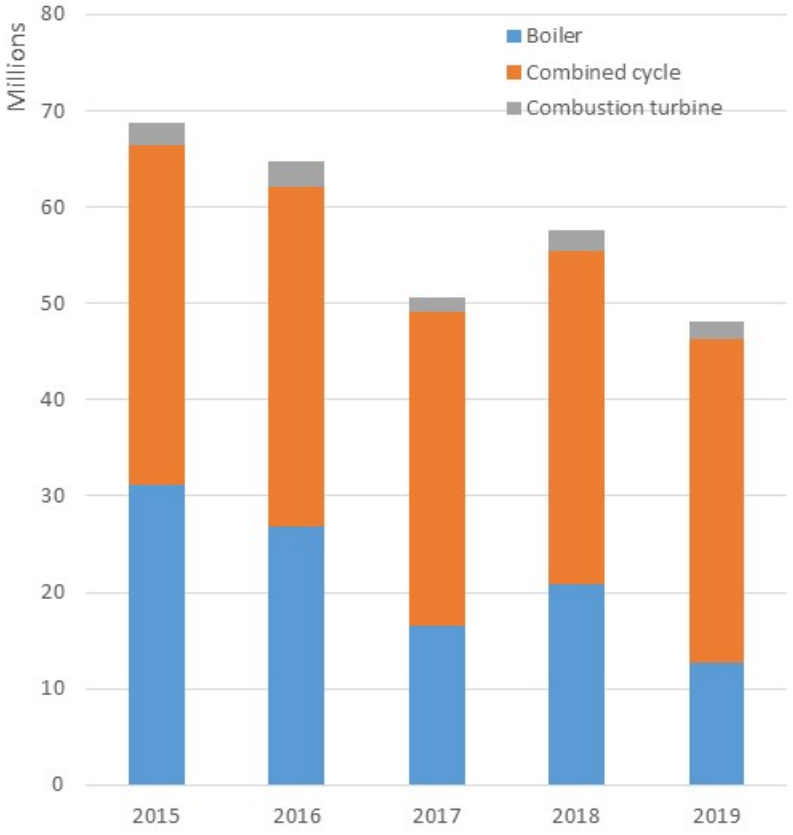
4th Control Period (2018-2020)

RGGI Emissions (Million Short Tons)

RGGI CO_2 Emissions 1st – 3rd Quarters (2015-2019) by Fuel



RGGI CO_2 Emissions 1st – 3rd Quarters (2015-2019) by Type



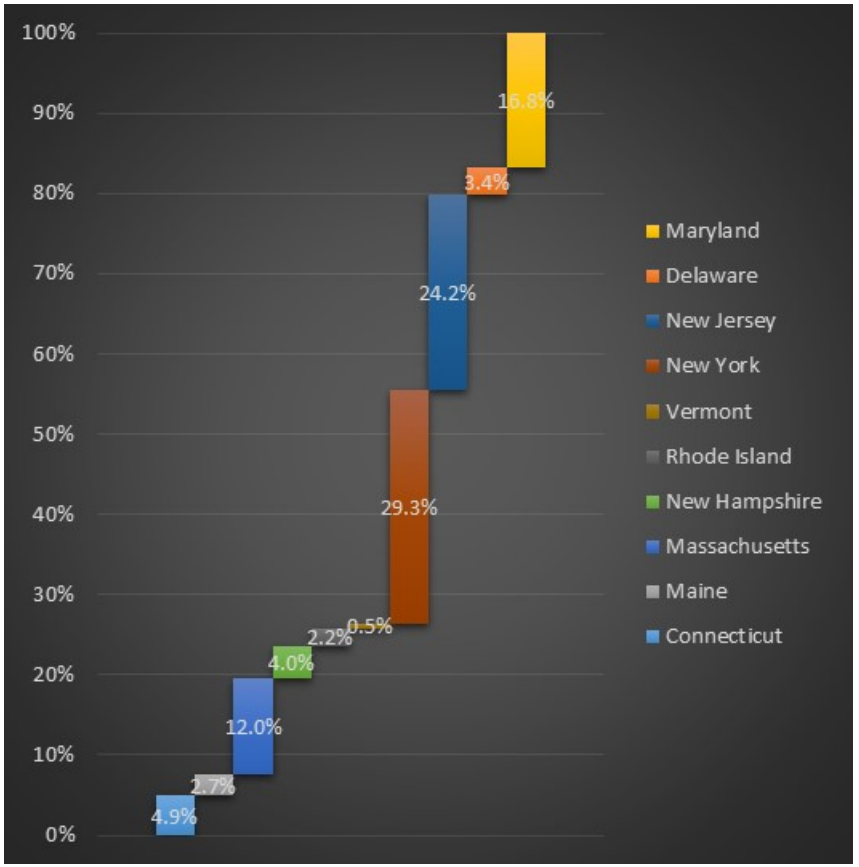
Source: EPA

RGGI Program Overview
4th Control Period (2018-2020)

RGGI 2020 Cap Increases with Addition of New Jersey

- 2020 cap: **74.3** million short tons (MT)
- 2019 cap: **58.2** MT
- 2018 cap: **60.3** MT
- 2020 is final year of 3 year control period (2018-2020)
- RGGI market monitor reports **178** million allowances in circulation at end of 2019 3rd quarter
- 1 RGGI allowance = 1 short ton of CO_2

RGGI 2020 CO_2 Allowance Allocation (State %)



Source: RGGI

RGGI Program Overview
4th Control Period (2018-2020)

Recent Auction Activity

- **Auction 47 (Mar. 11, 2020):** 16.2 million 2020 vintage allowances offered
  - Reserve price $2.32
- **Auction 46 (Dec. 2019) results:** all 13.11 million 2019 vintage year allowances sold at clearing price of $5.62
  - Reserve price $2.26
- **Auction 45 (Sept. 4, 2019) results**: all 13.11 million 2019 vintage year CO_2 allowances sold at clearing price of $5.20
  - Reserve price $2.26

Other RGGI Developments

- **Jan. 13, 2020:** December 2020 RGGI futures climb to $5.94
- **Nov. 2019**: RGGI market monitor secondary market report:
- CO_2 allowance futures prices:
  - averaged $5.32 in 3rd quarter
  - opened quarter at $5.40 rising in late July 2019 before closing near $5.40
- Futures trading volumes:
  - 58.9 million allowances in 3rd
    - Trading up 22% from previous quarter
  - 48.5 million allowances in 2nd
    - Trading up 55% from previous quarter
- Entry of New Jersey (2020) and Virginia (2021) into RGGI expected to increase demand for allowances and allowance prices

Source: RGGI

RGGI Outlook

- No compliance issues expected with current control period (2018-2020), banked RGGI allowances exceeds emissions by roughly 75 million
  - If total RGGI emissions remain static, the bank of RGGI allowances could be depleted between 2025 and 2030
  - If total RGGI emissions decline, with declining/stagnant electric demand within the RGGI domain and increasing renewable generation, the bank of RGGI allowances could persist beyond 2030
- Virginia joining in 2021 expected to drive increased demand for RGGI allowances and could impact New England RGGI compliance costs
- Ultimately supply and price of RGGI allowances is driven by emissions, which vary depending on several variables, including: regional weather, electric demand, fuel supplies and the influx of renewable generation into the RGGI region

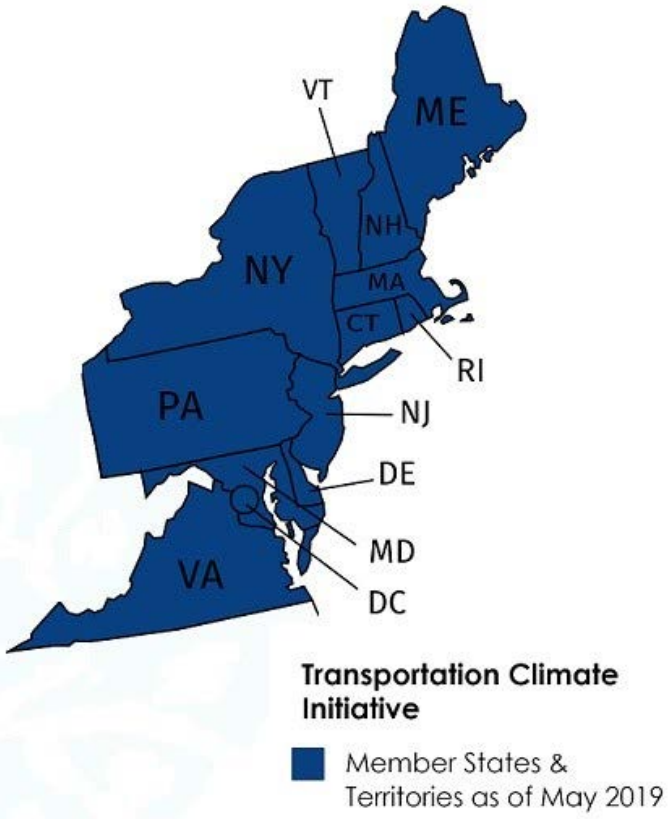
TRANSPORTATION CLIMATE INITIATIVE (TCI)

Transportation Climate Initiative (TCI) Overview

TCI Objectives for Carbon Reduction Design

- Design regional low-carbon transportation initiative capping and reducing carbon emissions from the combustion of transportation fuels
- Either through a cap-and-invest program or other pricing mechanism
- Complete the policy development process within one year, after which each jurisdiction will decide whether to adopt and implement the policy

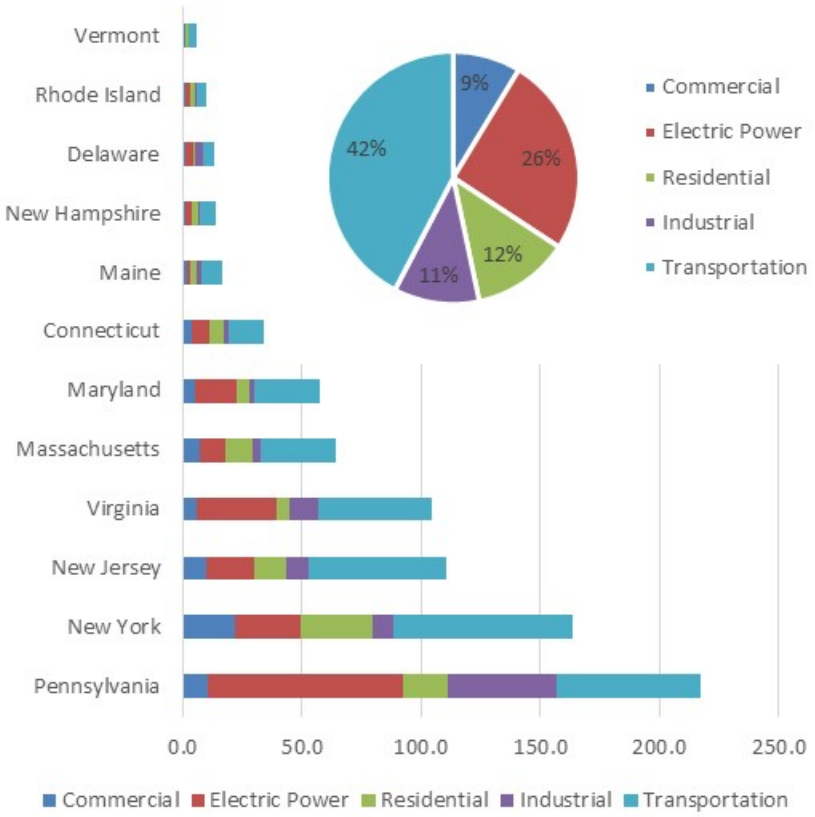
Participating States Span Northeast Region



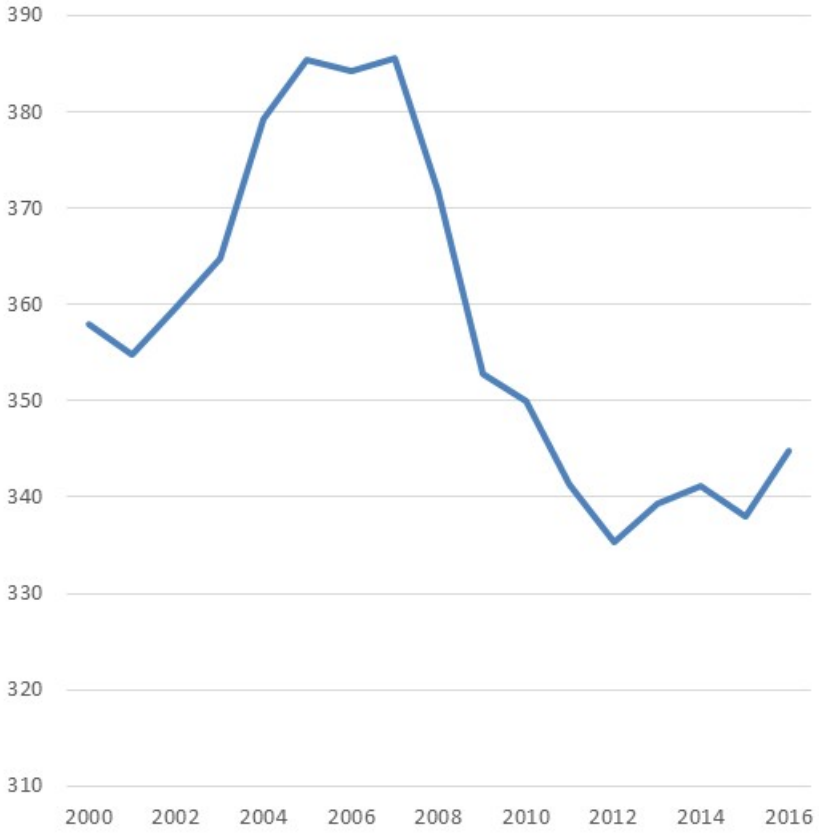
Source: TCI

Transportation CO_2 Emissions Dominate TCI States Emission Profiles

2016 State Energy-Related CO_2 Emissions by Sector (MMT)



TCI Region Transportation Annual CO_2 Emissions (MMT)



Source: EIA

Transportation Climate Initiative Timeline

- **October 2019**: Release of framework for a draft regional policy proposal
- **October/November 2019**: receive public input on framework
- **December 2019**: draft memorandum of understanding (MOU) for regional policy proposal, along with modeling estimating energy and emissions implications of different cap levels and investment scenarios, and potential costs and benefits of different program design options
- **January/February 2020**: receive public input on Draft MOU
- **Spring 2020**: Jurisdictions release a final Memorandum of Understanding. At this point, each jurisdiction will decide whether to sign the MOU and participate in the regional program
- **Spring/Fall 2020**: participating jurisdictions develop a "model rule" and take any legislative or regulatory actions needed to implement the regional program
- **2021**: jurisdictions conduct rulemaking process to adopt regulations
- **Early 2022**: earliest program implementation period

Source: TCI

MASSACHUSETTS GLOBAL WARMING SOLUTIONS ACT

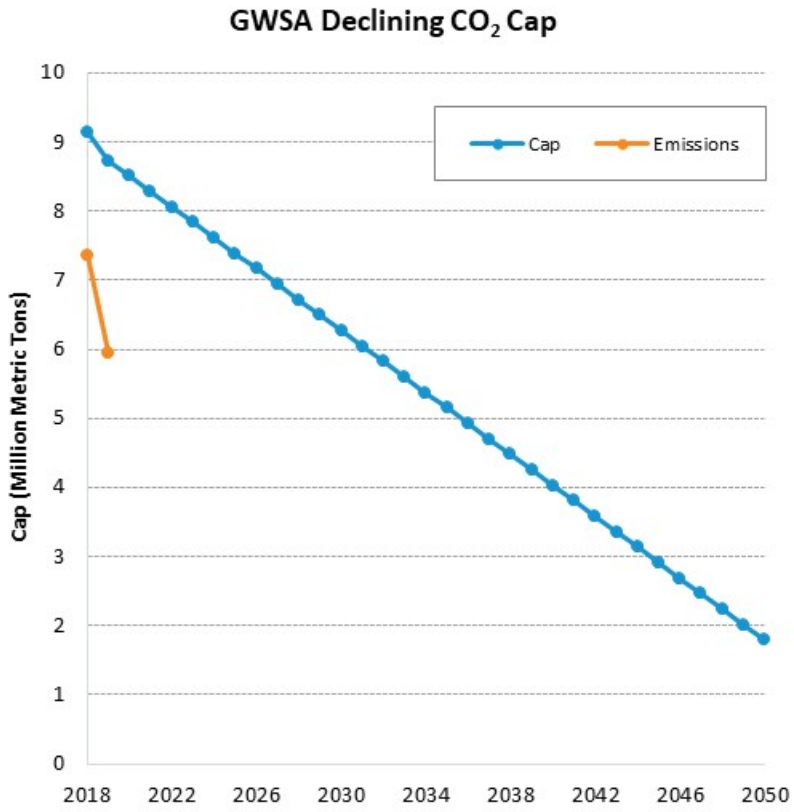
Generator Emissions Cap (310 CMR 7.74) Update

Global Warming Solutions Act (GWSA) CO_2 Cap Update

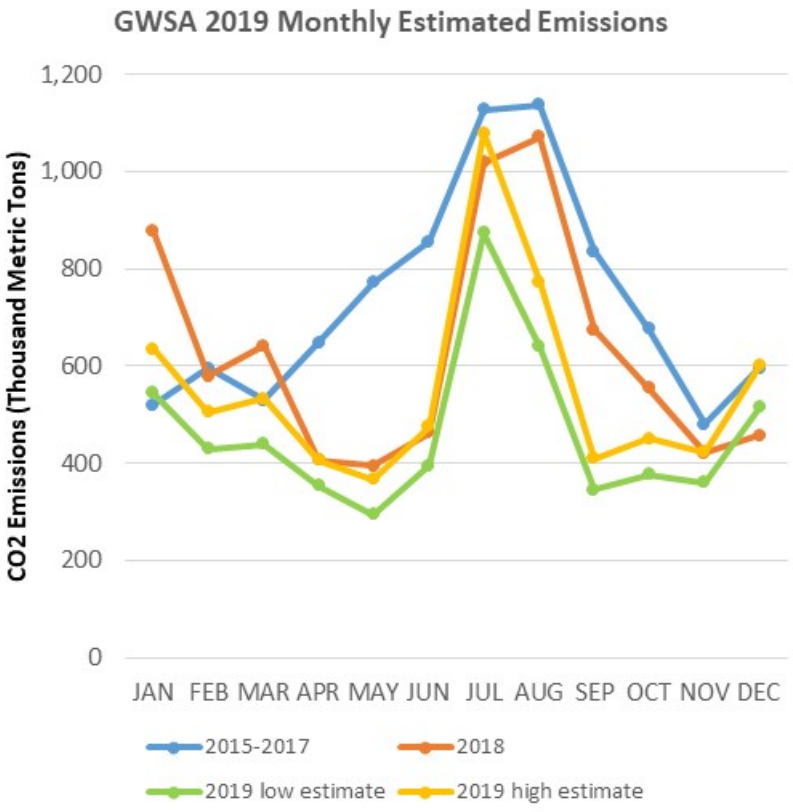
- **2019 cap**: **8.73** million metric ton (MMT) cap (25% auctioned, 75% allocated)
  - 2019 emissions estimated between **5.5 MMT – 6.6 MMT**
  - Limited trading activity
  - 1 GWSA allowance = 1 metric ton of CO_2
- **2020**: **8.50** MMT cap (50% auctioned, 50% allocated)
- **December 2019 GWSA auction**: auction of remaining 2019 and 2020 allowances cleared at $8.26 and $8.00 per allowance

Massachusetts CO_2 Generator Emissions Cap

GWSA CO_2 Annual Cap (Million Metric Tons)



GWSA Monthly 2019 CO_2 Emissions (Million Metric Tons)



Sources: MA DEP; ISO-NE

GWSA CO_2 Cap Update

- **January 2020**: MassDEP is proposing to amend 310 CMR 7.74 to simplify reporting provisions for the power plant CO2 cap regulation and revise auction provisions to minimize impacts of "emergency deferred compliance" on allowance supply
- **December 2019:** GWSA market monitor reports emissions from affected GWSA generators continued to decline and noted other factors:
  - Rolling 12-month emissions fell to 5.66 million metric tons from September 2018 to September 2019
  - Relatively mild weather in first 9 months of 2019 contributed to lower loads levels in Massachusetts (4% decline compared to 2018)
  - Electricity imports increased into Massachusetts in first 8 months of 2019 (16% increase compared to 2018), most significantly after the Pilgrim nuclear retirement

Source: GWSA Market Monitor

Questions