Greenhouse Gas Regulatory Update

Environmental Advisory Group

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LEAD ANALYST

Presentation Overview

- GHG Developments in North America
- 2018 U.S. CO_2 Emissions
- 2018 Regional Power Sector CO_2 Emissions
- Impact of CO_2 Pricing on Regional Energy Costs
- Regional Greenhouse Gas Initiative (RGGI) Update
- Transportation & Climate Initiative
- New York Energy Markets Carbon Pricing Proposal
- Global Warming Solutions Act (GWSA)

GHG Developments in North America

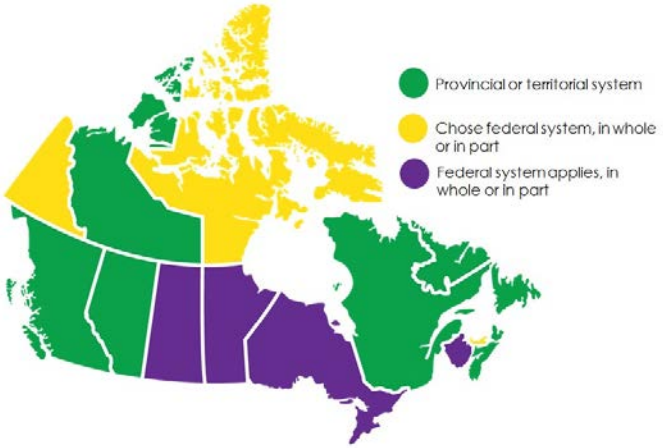
- **United States**: preliminary data suggest nationwide CO2 emissions, which are sensitive to changes in weather, economic growth, energy prices, and fuel mix, increased by roughly 3%.
  - In 2018 the winter was colder and the summer hotter than in 2017, and the economy grew by almost 3%—contributing to higher CO_2 emissions according to EIA, the Rhodium Group and others
  - EPA finalizing Clean Power Plan replacement, the Affordable Clean Energy Rule, early in 2019, incentivizing efficiency upgrades at coal-fired generators. Limited regional impact expected.
- **Canada**: Pan-Canadian output based carbon pricing takes effect in provinces lacking individual carbon reduction initiatives, federal carbon pollution price set at $20 Canadian per ton in 2019, increasing at $10 Canadian per ton per year until reaching $50 per ton in 2022
- **Regional Greenhouse Gas Initiative**: preliminary 2018 emissions increased outside of New England based on reported and estimated emissions data (increases in New York and Maryland).
  - **RGGI expansion by 2020**: New Jersey proposed rejoining with a 2020 budget cap of 18 million short tons; Virginia revised downward its budget cap to 28 million tons. Limited regional impact expected initially.
- **NYISO** announces meeting schedule (January 2019 – March 2019) for developing tariff revisions to include carbon pricing in various energy markets. Uncertain regional impact.
- **MA 310 CMR 7.74 CO_2 Cap**: reported and estimated 2018 emissions roughly 7.6 million metric tons, below 2018 cap of 9.15 million metric tons. Energy output from affected generators declined by 2.3 GWh compared to 2017.
  - Over 1 million metric tons in 2018 vintage allowances estimated to remain
  - Initial auction of 2019 vintage allowances (December 2018) reached clearing price of $6.71 per allowance

Pan-Canadian Pricing Carbon Pollution Initiative

- **January 2019**: federal backstop output-based pricing begins on carbon emissions from many industrial sectors including power, cement and steel in five provinces lacking provincial measures
  - Federal pricing system for large industry will apply in Ontario, Manitoba, New Brunswick, Prince Edward Island, and partially in Saskatchewan
  - Provincial systems will apply in British Columbia, Alberta, Quebec, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador
- **April 2019**: carbon fuels tax takes effect, set initially at 20 Canadian dollars (US$15) per metric ton — roughly 4.4 Canadian cents per liter of fuel, or 12 U.S. cents per gallon — increasing to CA$50 per ton by 2022
  - federal fuel charge will apply starting in April 2019, in Saskatchewan, Ontario, Manitoba, and New Brunswick
- Canadian emissions projected to decline to 616 megatons (2030) from current level of 704 megatons (2016)

Pan-Canadian Pricing Carbon Pollution Initiative by Jurisdiction

- Provincial or territorial system:
  - British Columbia
  - Alberta
  - Quebec
  - Nova Scotia
  - Prince Edward Island
  - Newfoundland and Labrador
  - Northwest Territories
- Chose federal system, in whole or in part:
  - Yukon
  - Nunavut

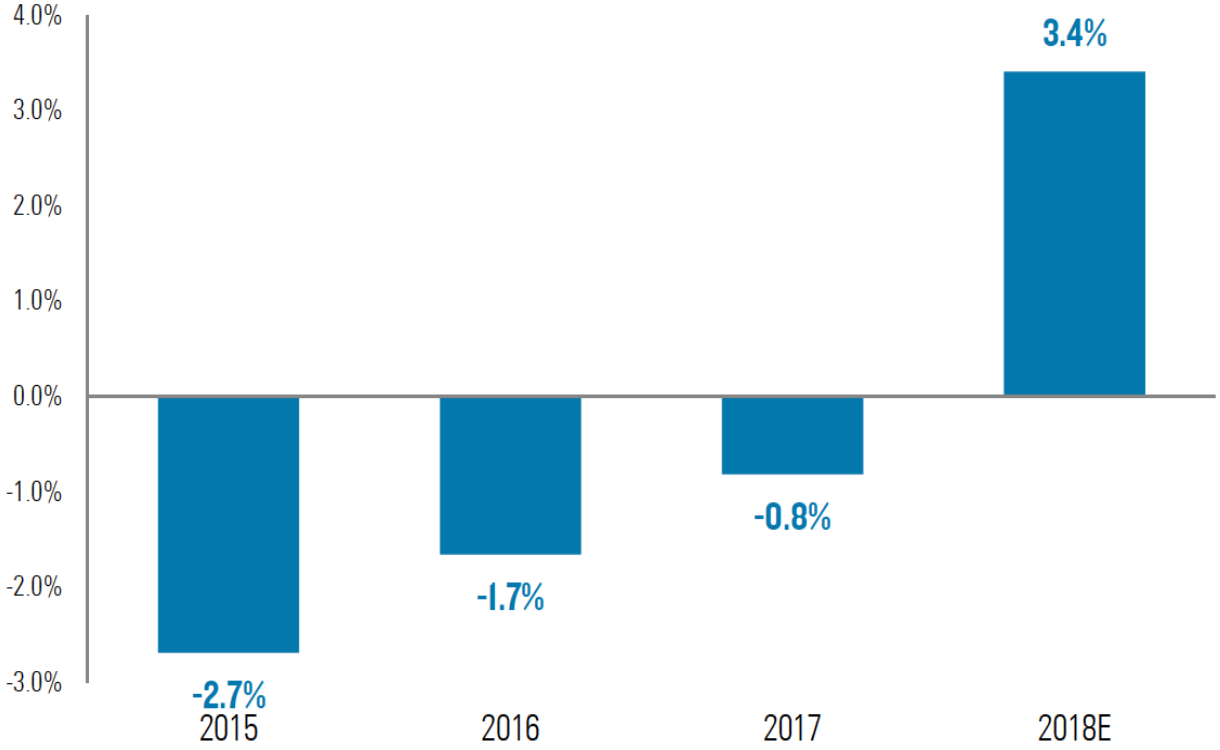


- Federal system applies, in whole or in part:
  - Saskatchewan
  - Manitoba
  - Ontario
  - New Brunswick

2018 U.S. CO_2 EMISSIONS

2018 Estimated CO_2 Emissions Increased

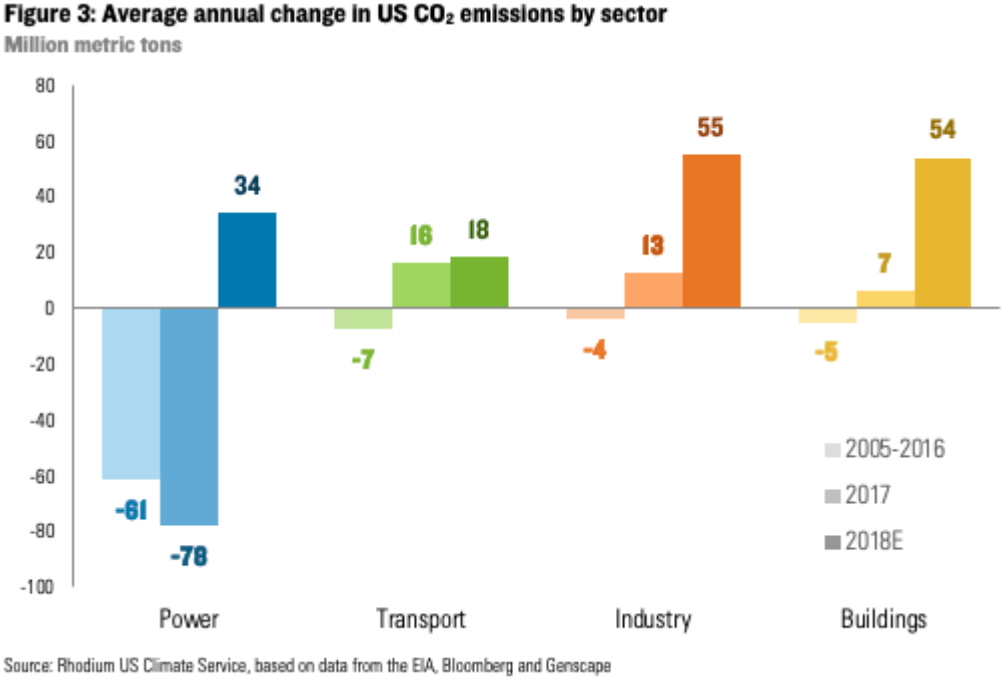
Annual change in energy combustion all sectors



Source: Rhodium US Climate Service, based on data from the EIA, Bloomberg and Genscape

Source: Rhodium Group

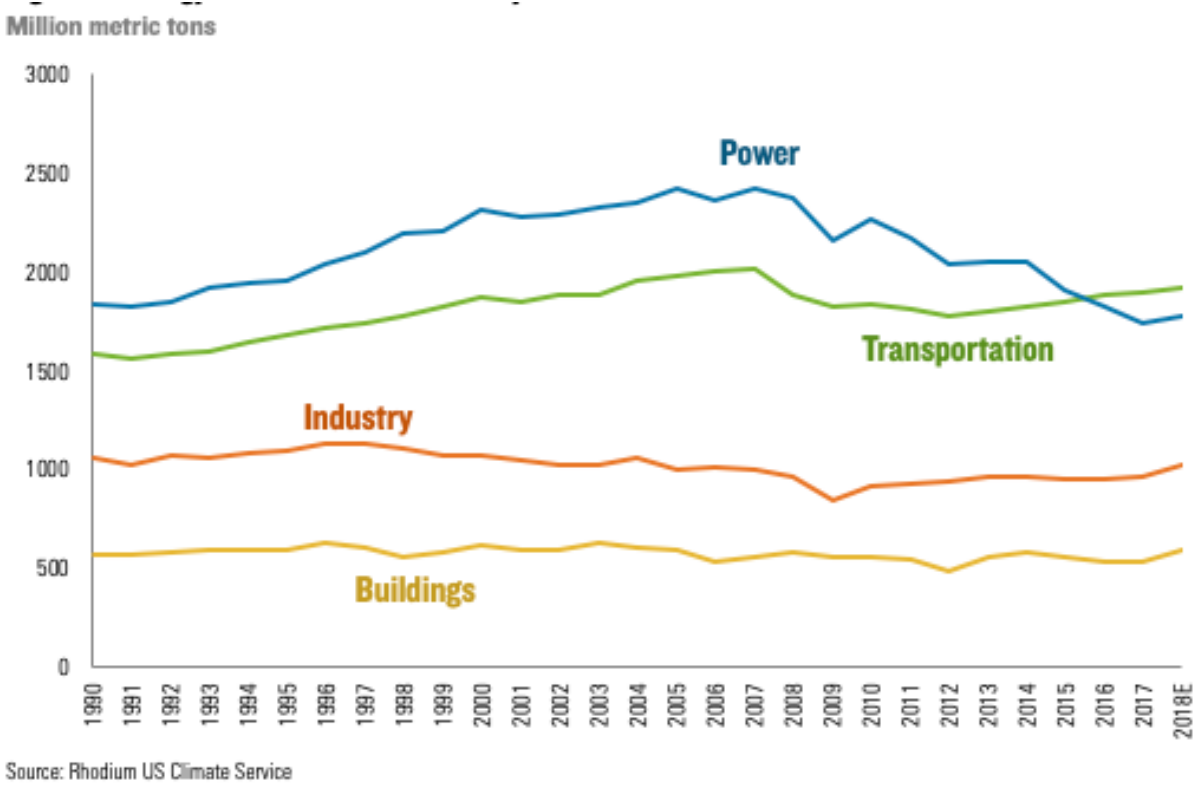
2018 Estimated CO_2 Emissions Increased
Industry, Buildings, Power sectors Increased



Source: Rhodium Group

2018 Estimated U.S. CO_2 Emissions Increased

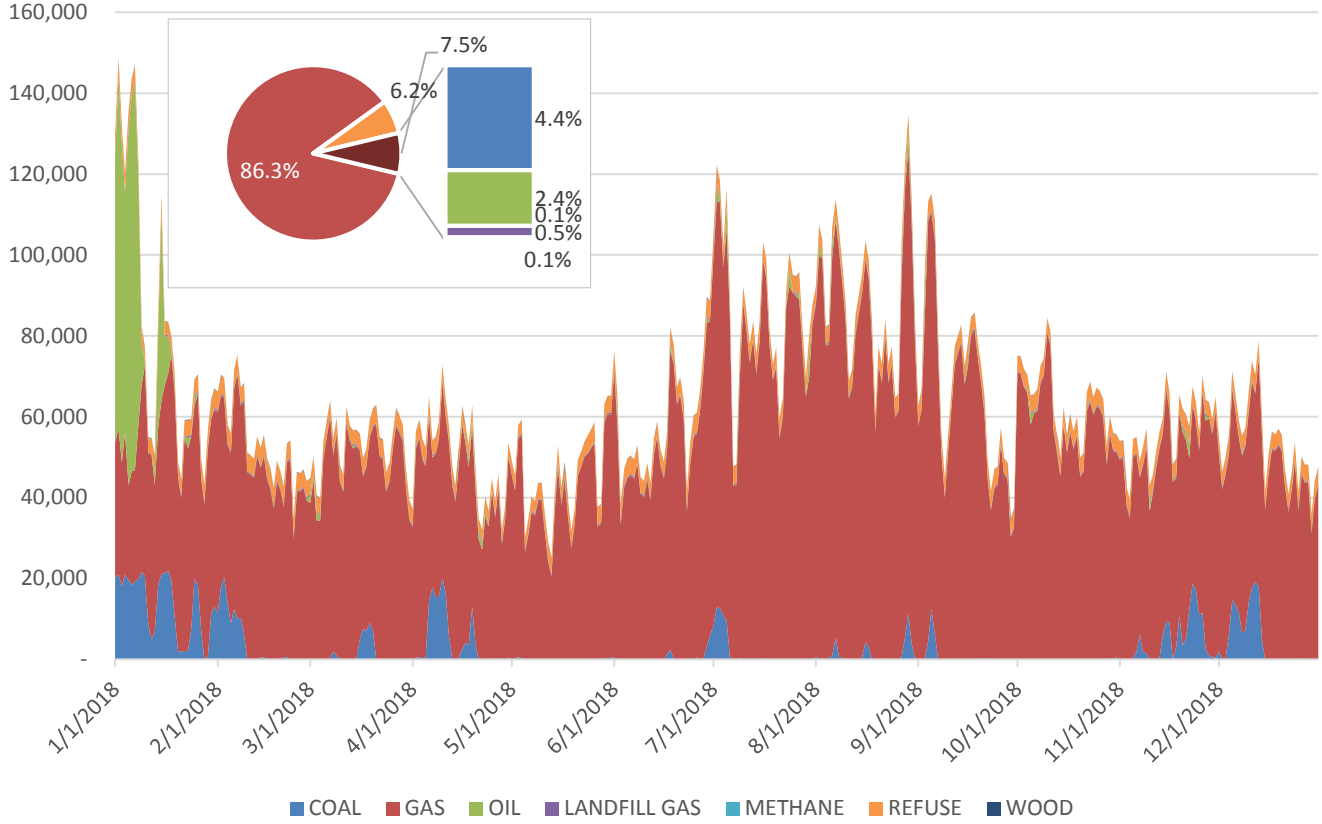
Based on preliminary U.S. power generation (EIA), natural gas and oil consumption (Genscape) data



Source: Rhodium Group

2018 REGIONAL POWER SECTOR CO_2 EMISSIONS

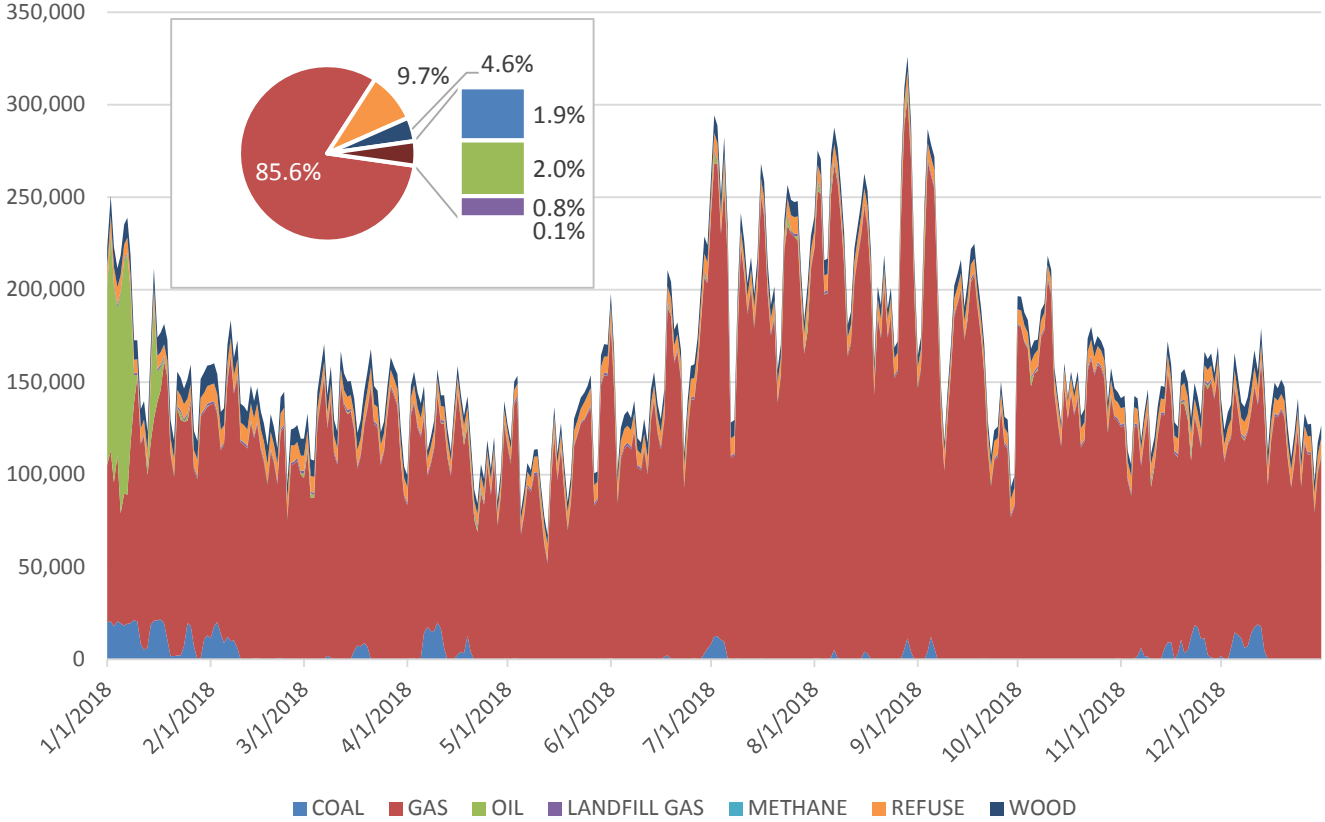
2018 Regional Estimated CO_2 Emissions (Metric Tons) *% share of estimated annual emissions (inset box)*



Source: ISO-NE

2018 Regional Emitting Net Generation (MWh)

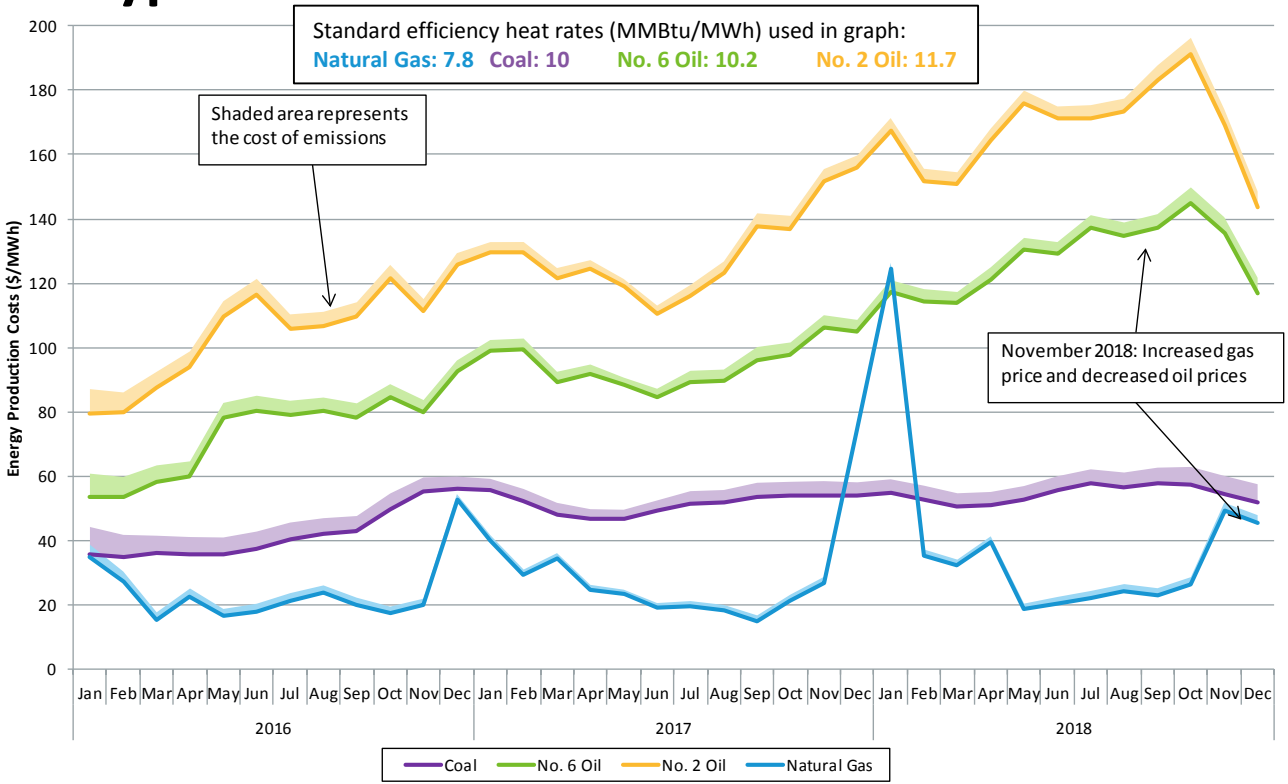
% share of all emitting annual generation (inset box)



Source: ISO-NE

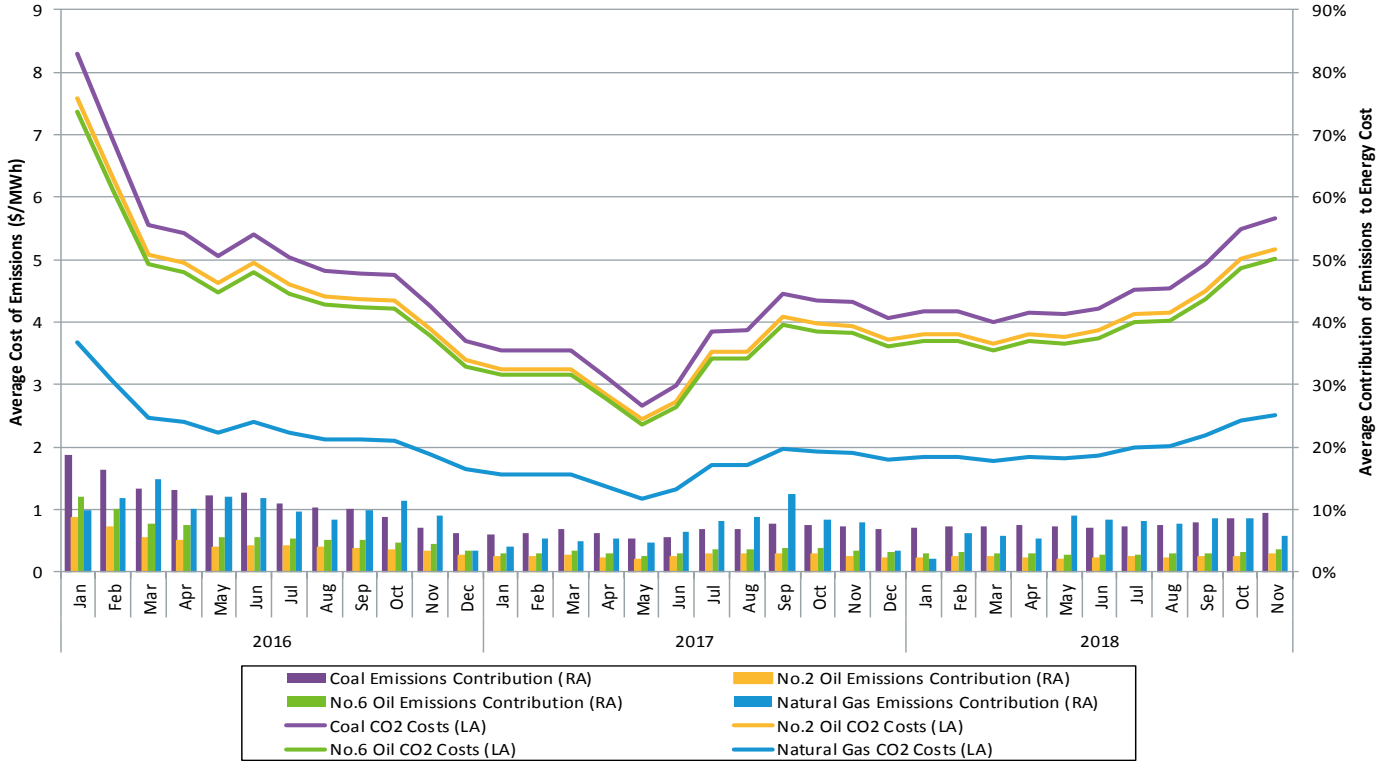
IMPACT OF CO_2 ALLOWANCE PRICING ON REGIONAL ENERGY COSTS

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



Source: ISO-NE

CO_2 Pricing Contribution to Energy Costs by Fossil Fuel Type



Source: ISO-NE

EPA CLEAN POWER PLAN/AFFORDABLE CLEAN ENERGY RULE UPDATE

EPA Clean Power Plan/Affordable Clean Energy Rule Update

- **March 2019**: EPA plans to finalize the lean Power Plan replacement, the Affordable Clean Energy Rule, early in 2019. The proposed rule would:
  - replace the Clean Power Plan (CPP) with revised emissions guidelines (the Affordable Clean Energy (ACE) rule) for the development, submittal, and implementation of state plans to reduce greenhouse gas (GHG) emission from certain EGUs
  - Propose limits on any future emission guideline issued under section 111(d) of the Clean Air Act (CAA)
  - Limit New Source Review (NSR) program applicability to efficiency upgrade projects at EGUs
  - 83 FR 44746 (August 21, 2018)
- Limited regional impact expected due to <1,000 MW of coal-fired capacity remaining within control area

Source: EPA

EPA Proposes Changes to greenhouse gas (GHG) NSPS for Fossil fuel-fired EGUs (111(b))

- **December 20, 2018**: EPA proposed revisions to 2015 performance standards governing CO_2 emissions from new, reconstructed and modified coal-fired electric generating units (80 FR 64510)
  - Eliminates carbon capture and storage (CCS) as the best system of emission reduction (BSER) for new units in favor of efficient supercritical steam design for large units and subcritical design for smaller units, both in combination with best operating practices
- EPA proposes to increase the corresponding performance standards consistent with the change in the BSER
- Given the change in new source standards, EPA is also proposing conforming revisions to the standards for modified and reconstructed units and will add a proposed new standard for new and reconstructed units that burn coal refuse

Sources: EPA: Troutman Sanders LLP

Overview EPA Proposes Changes to GHG NSPS for Fossil fuel-fired EGUs (111(b))

Affected EGUs	Current Performance Standard	Proposed New Performance Standard
New Coal-Fired Units	1,400 lb CO2/MWh gross	1,900 lb CO2/MWh gross for large units1 2,000 lb CO2/MWh gross for smaller units2
Reconstructed Coal-Fired Units	1,800 lb CO2/MWh gross for large units 2,000 lb CO2/MWh gross for smaller units	1,900 lb CO2/MWh gross for large units No change for smaller units
New & Reconstructed Coal-Refuse-Fired Units	No separate standard	2,200 lb CO2/MWh-gross, regardless of the size of the unit
Modified Coal-Fired Units	Unit-specific standards based on the unit's best historical annual CO2 emission rate but no lower than 1,800 lb CO2/MWh gross for large units and 2,000 for smaller units	Same unit-specific approach but conforming the lower limit to the new source standards: 1,900 for large units, 2,000 for smaller units, and 2,200 for coal-refuse-fired units

Source: Troutman Sanders LLP

REGIONAL GREENHOUSE GAS INITIATIVE

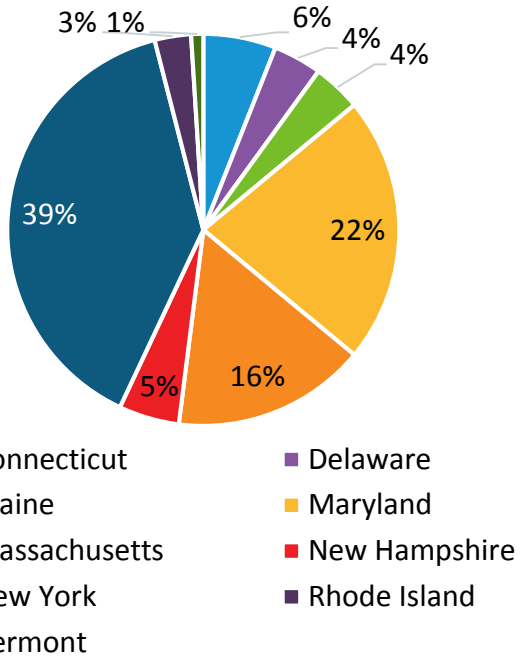
2017 Program Review and Recent Auction Activity

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

Overview, Allocations & Auction 41 (September 2018) Results

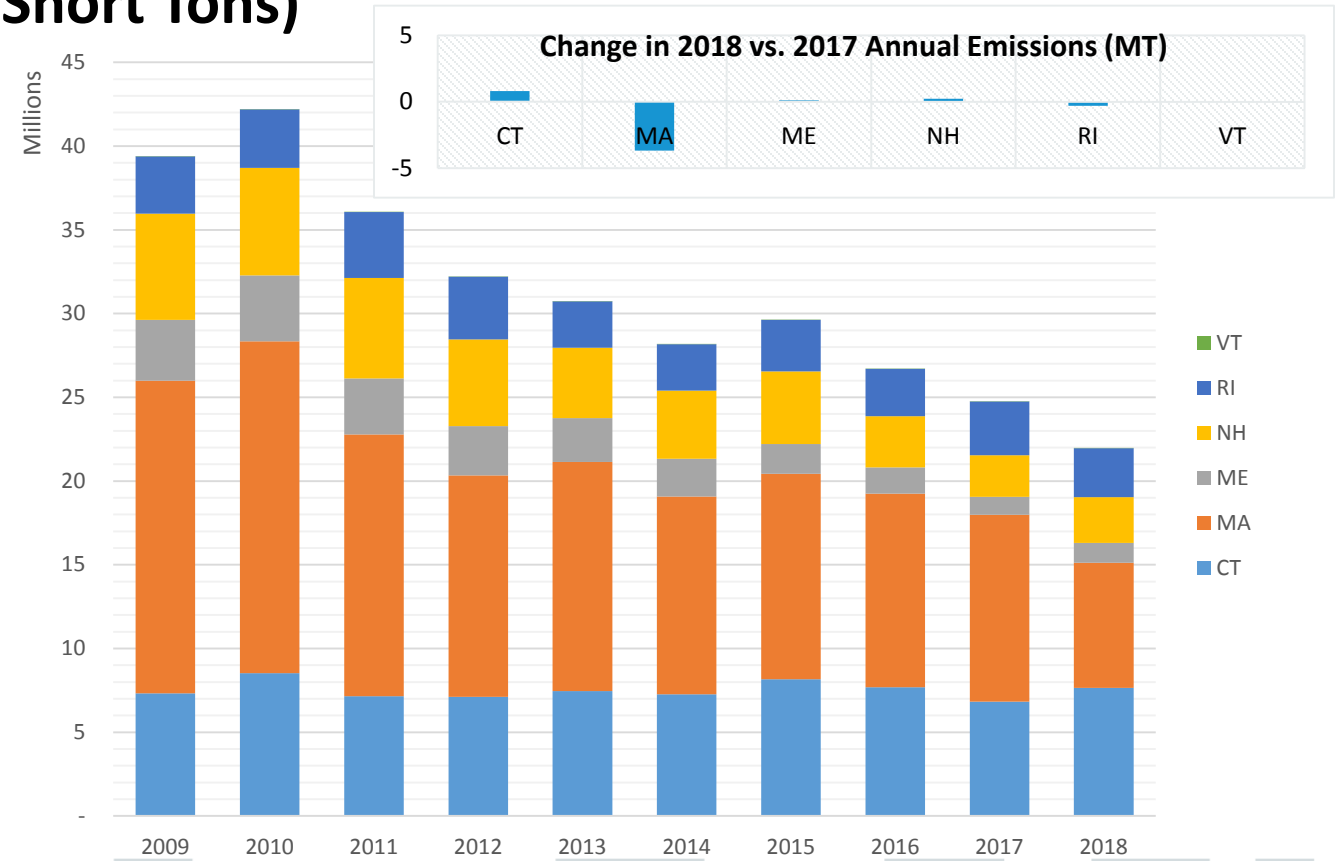
- **RGGI 2018 cap**: **82.2** million short tons, covers 20% of 9 RGGI States total GHG emissions inventory (all sectors):
  - 165 affected entities (RGGI wide)
  - New England share **28.5** M
- **2018 Adjusted RGGI cap**: **60.3** million short tons, to account for banked allowances. Allowance offered at auction.
  - New England share **21.1** M (35% of total)
- **155** million CO_2 allowances in circulation at the end of the 3rd Qtr. 2018
- **Auction 42 (December 5, 2018) results:** All 13.36 million CO_2 allowances offered purchased at clearing price of $5.35/ton
- **Auction 43 (March 13, 2019)**: 2019 vintage year allowances, quantity to be determined, reserve price of $2.26

RGGI 2018 CO_2 Allowance Allocation (State %)

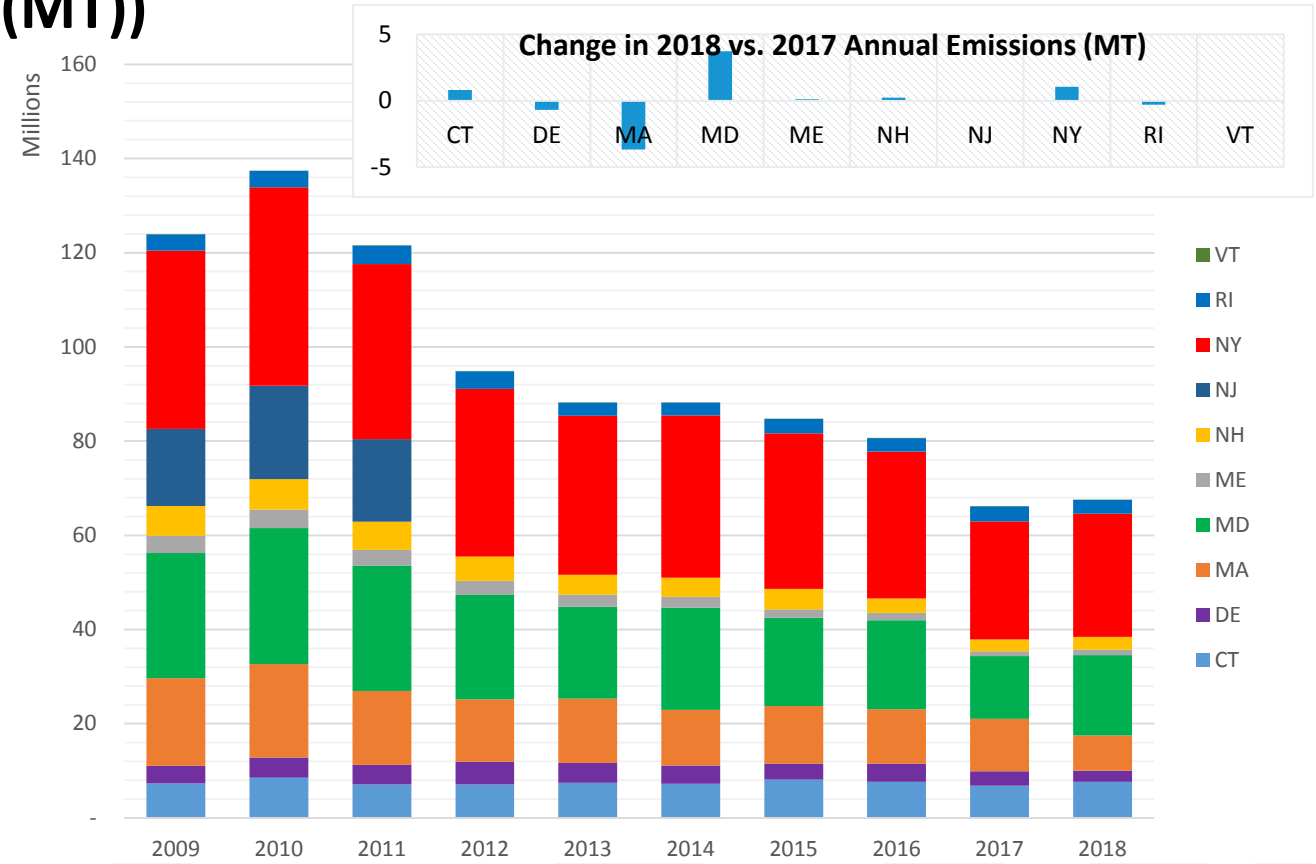


Sources: RGGI; MJ Bradley & Associates LLC

New England Annual RGGI Emissions (Million Short Tons)

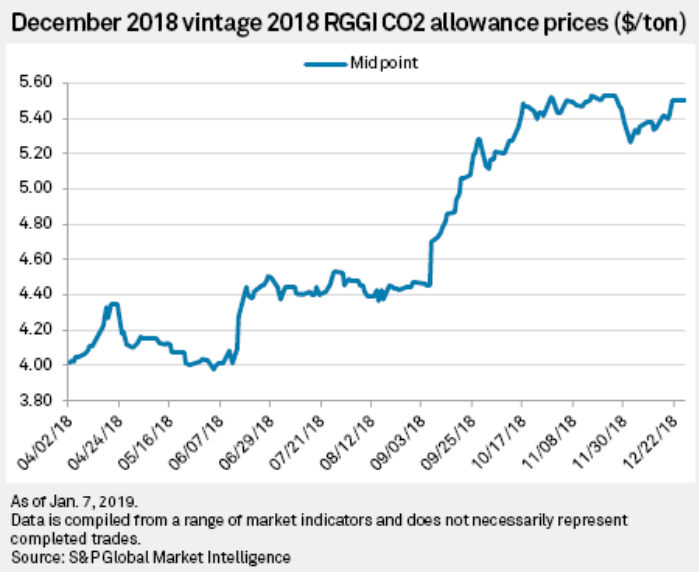


Annual RGGI Emissions (Million Short Tons (MT))



Trading in RGGI Allowance Secondary Market

- **January 7, 2019**: December 2019 vintage 2019 contract in a bid-and-offer range of $5.65/ton to $5.85/ton
- **Dec. 21, 2018**: the December 2018 vintage allowance contract ended in range of $5.45/ton to $5.56/ton, up 20 cents from the beginning of December 2018
- Increased trading activity in RGGI secondary market throughout 2018



New Jersey & Virginia Making Progress on Participating in RGGI by 2020

New Jersey RGGI proposal (18 million ton budget in 2020)

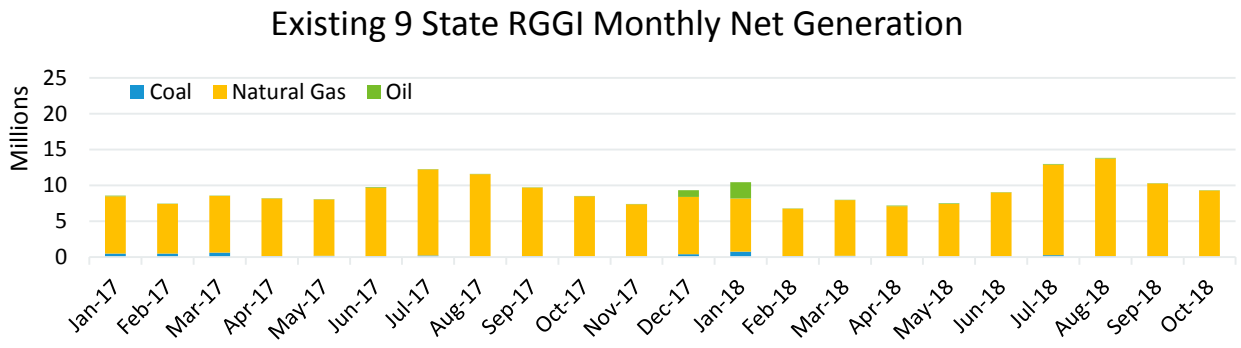
- **December 17, 2018**: New Jersey RGGI proposes an Sets 18 million ton CO2 in 2020, compared to business as usual projected emissions of 20.6 million tons in 2020
- Cap declines 3% annually through 2030 with other adjustments that are standard to all member states
- Covers emissions from currently operating electric generating facilities
  - RGGI proposal (CO_2 Budget Trading Program Rules N.J.A.C. 7:27C and Global Warming Solutions Fund N.J.A.C. 7:27D)

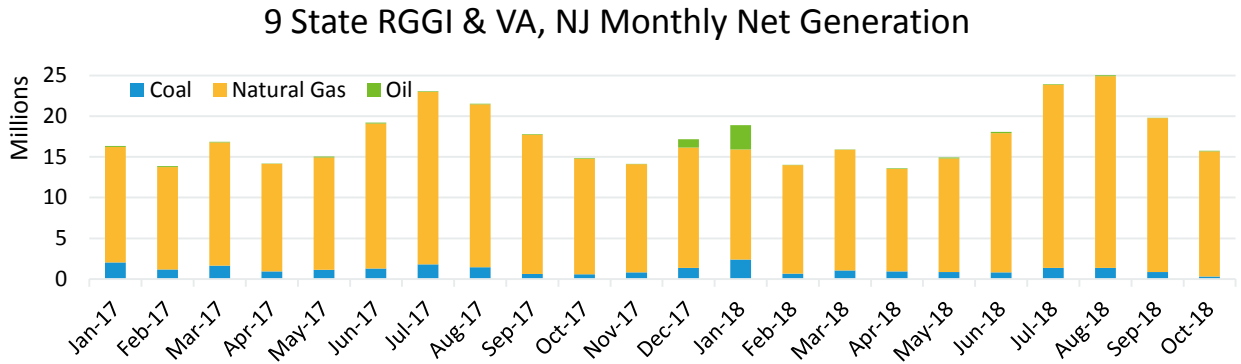
Virginia RGGI proposal (28 million ton budget in 2020)

- **November 2018**: Virginia releases additional modeling showing modest impacts from RGGI
- **September 29, 2018**: Virginia State Air Pollution Control Board (VA SAPCD) approved the re-proposed carbon trading regulation (Revision C17)
- After executive review and public comment period, the VA SAPCD is expected to consider the final regulation next spring
  - RGGI proposal (Regulation for Emissions Trading (9VAC5 Chapter 140, Rev. C17))

Sources: States of New Jersey, Virginia; RGGI

Existing & Potential RGGI States Monthly Net Generation by Fuel Type





Sources: ISO-NE; EIA (data)

TRANSPORTATION & CLIMATE INITIATIVE OF THE NORTHEAST & MID-ATLANTIC STATES

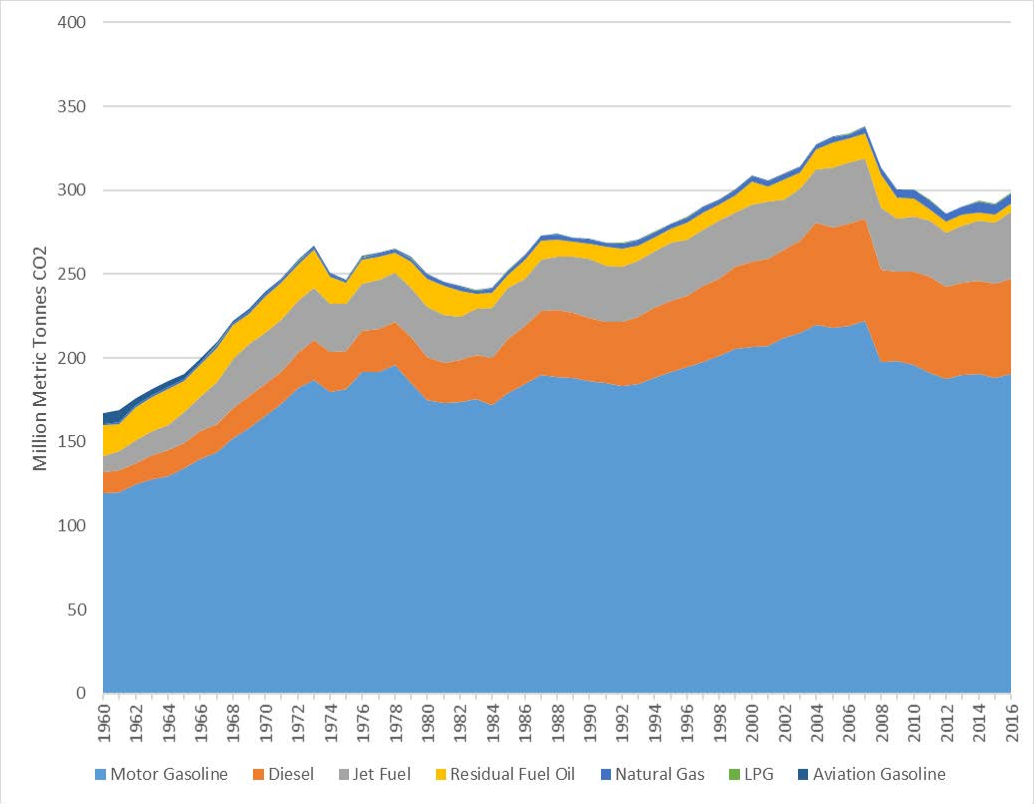
"RGGI for Transportation"

Regional Approach to Cap Transportation Greenhouse Gas Pollution

- **December 2018**: Participating Transportation & Climate Initiative (TCI) jurisdictions announce plans to "design a regional low-carbon transportation policy proposal that would cap and reduce carbon emissions from the combustion of transportation fuels through a cap-and-invest program or other pricing mechanism"
- TCI jurisdictions aim to complete design process late in 2019
- Participating TCI jurisdictions:
  - Connecticut, Delaware, Maryland, Massachusetts, New Jersey, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, DC

Source: Transportation & Climate Initiative

Northeast and Mid-Atlantic Transportation Emissions by Fossil Fuel Type (MMT CO_2)



Source: Georgetown Climate Center

NYISO CARBON PRICING PROPOSAL

NYISO Carbon Pricing Proposed Market Issues Working Group (MIWG) Schedule

- January 15: Import/Export Transactions
- January 22: Overview of Impacted Tariff Sections
- January 24: Carbon Residual Allocation
- January 31: Tariff Revisions Discussion
- February 4: Carbon Residual Allocation
- February 15: LBMPc Calculation – Identifying Marginal unit(s)
- March 4: Carbon Bid Adjustment for Opportunity Cost Resources
- March 18: Tariff Revisions Discussions
- https://www.nyiso.com/miwg

Source: NYISO

NYISO Carbon Pricing Proposal External Transactions Overview

- Apply carbon charges or credits to external transactions such that they compete with internal resources (and each other) as if the NYISO was not applying a carbon charge to internal suppliers (i.e., on a status quo basis)*
  - Import [transfers into New York] would be paid the [Locational Based Marginal Price] LBMP and get a carbon charge equal to the carbon impact (LBMPc), at the relevant border
    - Conceptually, this is similar to an internal generator
  - Exports would pay the LBMP and receive a carbon credit equal to the LBMPc at the relevant border
  - Wheel-through transactions have a two part carbon charge; they pay the LBMPc at the import interface and are paid the LBMPc at the export interface
  - Carbon charges only apply to transactions that flow in real-time
- The real-time LBMPc, based on the real-time system dispatch, will be used to determine charges and credits.
  - Full NYSIO presentation

*For further information, please see the IPPTF Carbon Pricing Proposal (December 7, 2018)

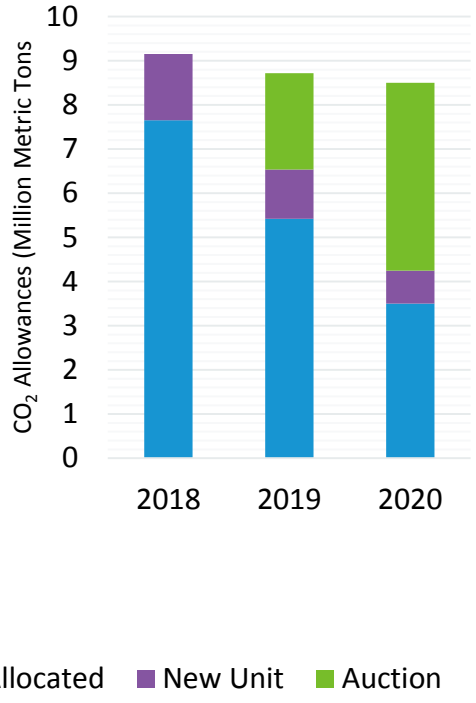
Source: NYISO

MASSACHUSETTS GLOBAL WARMING SOLUTIONS ACT

Generator Emissions Cap (310 CMR 7.74) Update

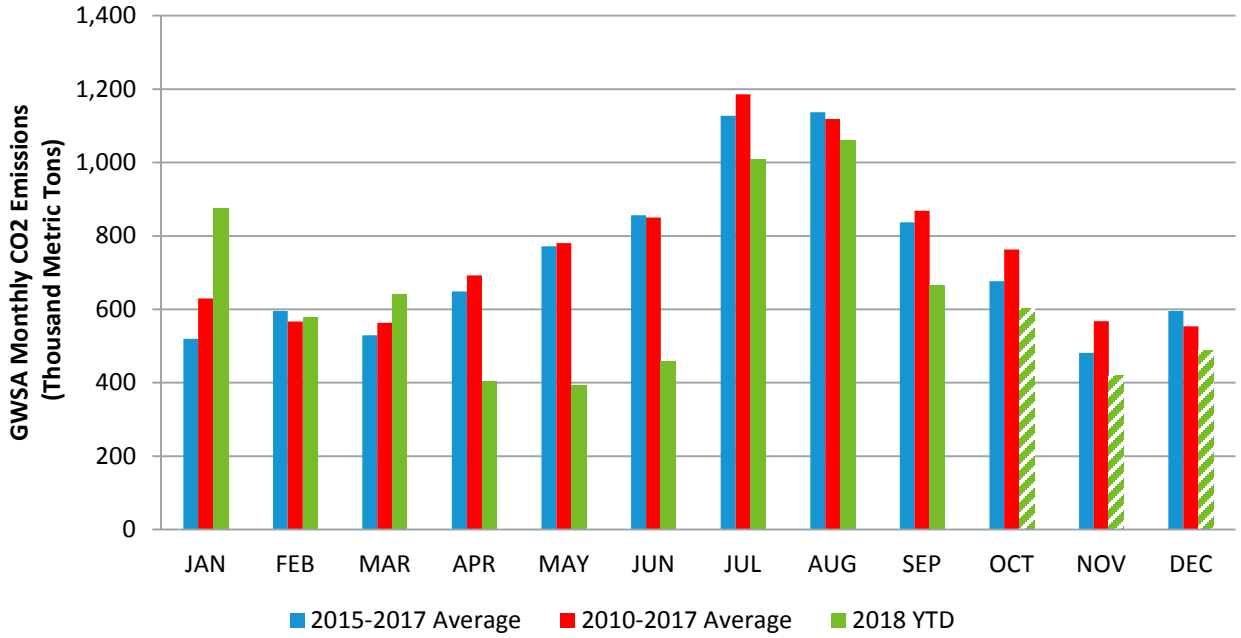
GWSA Implementation Update

- 2018 CO_2 emissions cap of 9.15 million metric tons
  - Cap declines 223,876 metric tons each year until it reaches 1.8 million metric tons in 2050
  - In 2018, affects 48 generating units at 1 new and 21 existing generating facilities
- Reported and estimated 2018 emissions roughly 7.6 million metric tons
  - Over 1 million metric tons in allowances remaining
  - Energy output declined by an estimated ~2.3 GWh in 2018 compared to 2017
- Allowances initially allocated, auctions phased in from 2019-2021
- Initial auction of 2019 vintage allowances held December 18, 2018 with clearing price of $6.71 per allowance



Sources: GWSA Market Monitor; ISO-NE (data)

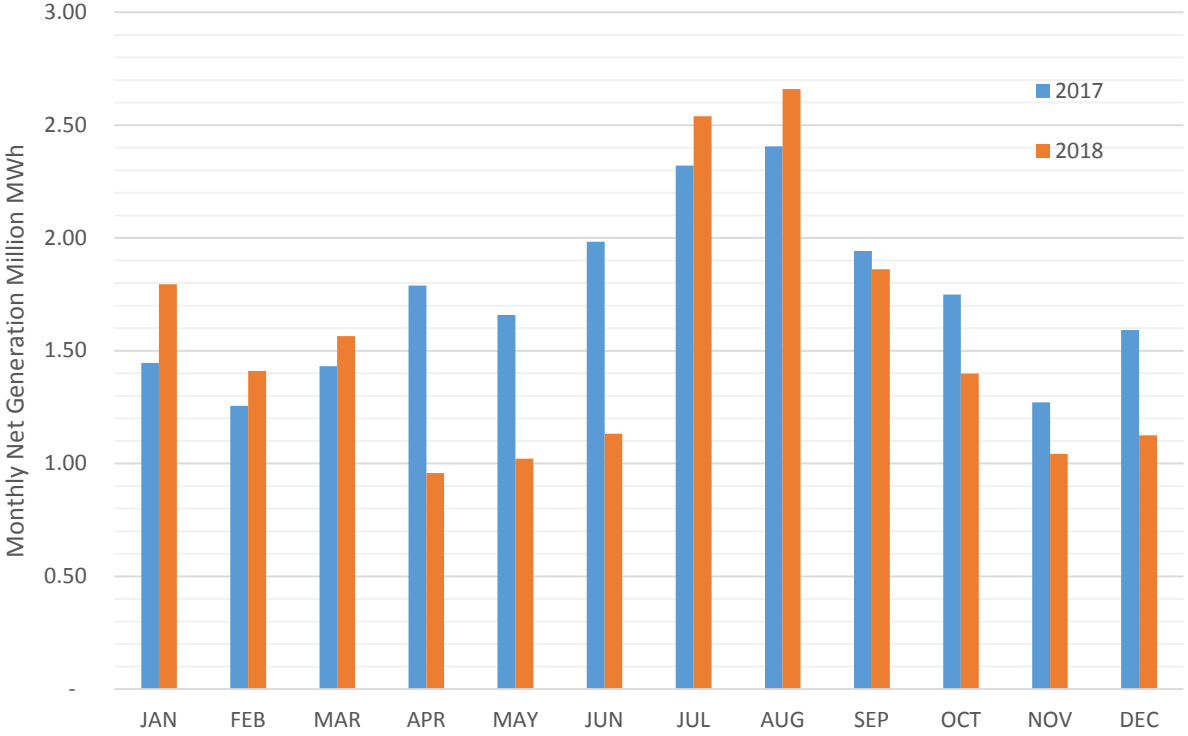
2018 Reported & Estimated Monthly CO_2 Emissions vs. Monthly Averages (Metric Tons)



Reported (Jan-Sept) & estimated (Oct-Dec) CO_2 emissions total 7.16 million metric tons, below 2018 cap of 9.15 million metric tons

Source: ISO-NE

Net Generation from GWSA Affected Generators in Massachusetts Declined (2017 vs. 2018)



2018 net generation reached 18.5 million MWh, in 2017 existing GWSA generators produced 20.84 million MWh

Source: ISO-NE

GWSA Market Monitor Reports

- As the market monitor for the GWSA cap program, Potomac Economics reported on the following initial auction (December 2018) and 3rd Qtr trading outcomes:
  - Twelve bidders sought 2019 vintage CO2 allowances, submitting bid to purchase 3.6 times the available allowances, resulting in a clearing price of $6.71 per metric ton
  - The clearing price of $6.71 per metric ton is substantially lower than most secondary market transaction prices reported from the beginning of the program until the auction
  - Prices have fallen since the first half of 2018 when reported transaction prices ranged between $10 and $20 per metric ton
  - The total rolling emissions over the first 3 quarters of 2018 and the 4th quarter of 2017 totaled 8.1 million metric tons. This amount is 12 percent lower than the 2018 cap, suggesting that regulated entities should be able to acquire allowances as required prior to compliance

Source: Potomac Economics

Questions