THE REGIONAL GREENHOUSE GAS INITIATIVE

An Initiative of the Northeast and Mid-Atlantic States of the U.S.

RGGI Program Review:

February 8, 2017 Stakeholder Meeting

(New Date)

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RGGI Program Review

February 8, 2017

1:00 PM - 3:00 PM ET

Telephone: (855) 339-8789

Conference ID: 53440198

Webinar: participant-specific link

- Presentation materials posted at the Program Review Meetings webpage

Draft RGGI Reference Case IPM Assumptions

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Presentation Outline

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RGGI High/Low Sensitivity Case Assumptions

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Reference Case Assumptions Outline

- Fuel Prices
- Regional energy and peak demand
- Renewable portfolio standards
- Firmly planned generation and retirements
- Cost and performance of new generation
- Firmly planned transmission additions
- Transmission capability
- Coal plant construction
- Nuclear plant construction
- Nuclear retirements
- Reserve margins and local reserve requirements
- Cost and performance of pollution controls and firmly planned control installations
- State environmental policies
- Federal environmental policies
- Carbon price for CA/Quebec/Ontario
- State-specific generation minimums
- RGGI Requirements: Cap, Reserve price, CCR, Offsets

What are Reference Case Assumptions?

- IPM relies on several user-defined parameters to set the overall requirements and boundaries for its projections. For example, the user must tell IPM what level of energy demand it must meet by year for each model region.
- Most of these parameters are not known with certainty, so users must make assumptions about their values going forward over the time horizon of the analysis.
- We use the term "assumptions" to describe the collection of input parameters that will go into the model.
- The model's projections are developed using market fundamentals informed by the assumptions.
- IPM generates projections for model "run years" that represent individual years or groups of years.
  - For this analysis, the states are leaning towards developing projections for the years 2017, 2020, 2023, 2026, 2029, and 2031 (representing calendar years 2017-2031).

RGGI Reference Case Assumption Development Overview

- The following slides summarize assumptions necessary to prepare the RGGI Reference Case.

- The following discussion elements are included for each assumption:
  - Description of the input variable for which the assumption is needed
  - Source of assumption in 2016 RGGI Program Review Reference Case
  - Proposed approach for 2017 Reference Case

Fuel Prices

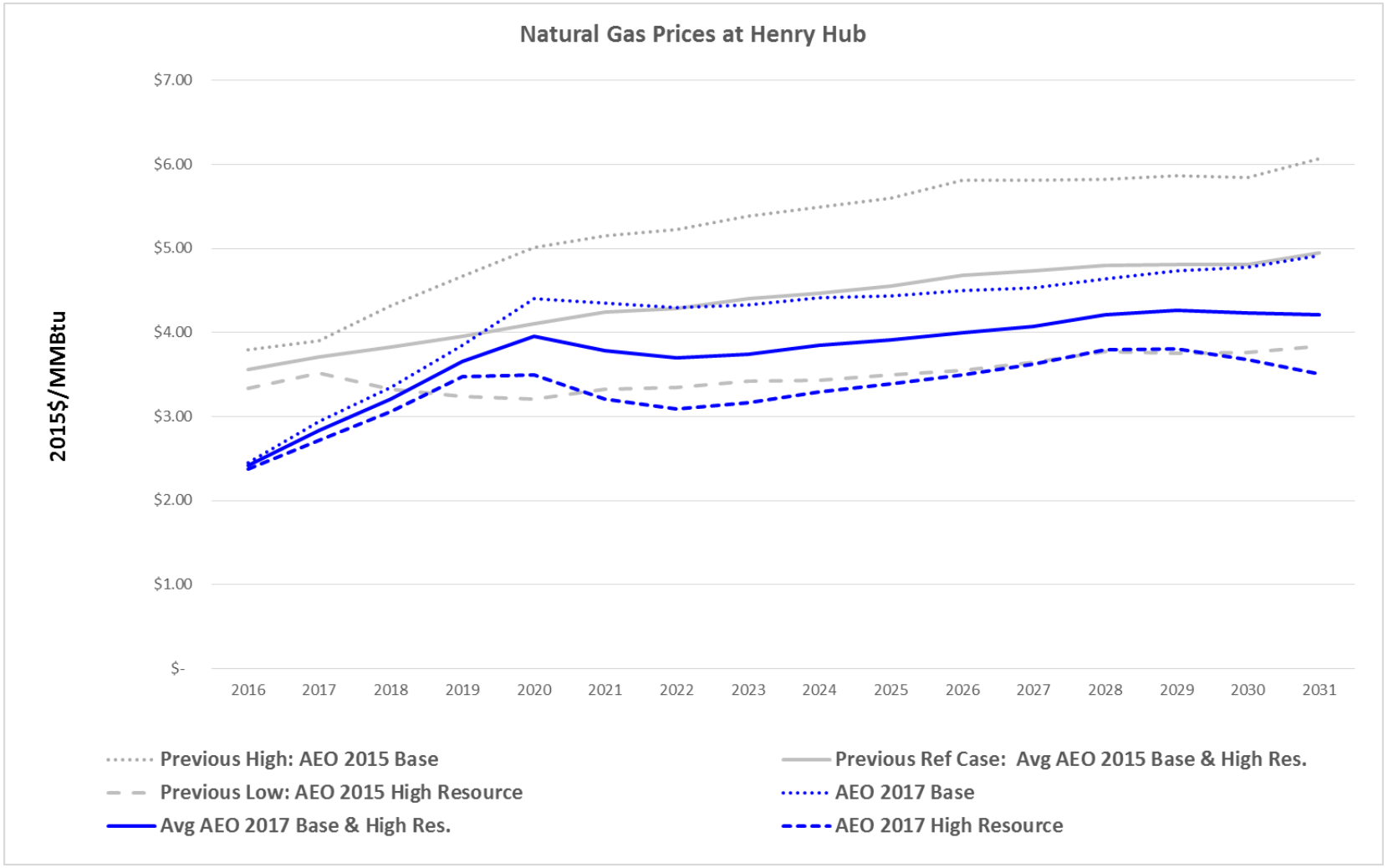
- DESCRIPTION
  - Commodity and delivered prices for natural gas, oil products, and coal
  - Delivered fuel prices are included in unit operation and investment decisions

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Long term natural gas prices use an average of EIA AEO 2015 base case and high resource gas case prices
  - Short term natural gas prices based on futures prices
  - EIA AEO 2015 oil commodity prices
  - Natural gas transportation costs based on historical weather-normalized delivered prices
  - ICF supply curves for coal

- 2017 PROPOSED APPROACH
  - EIA AEO 2017 for natural gas and oil commodity prices
    - AEO 2017 base case prices

      or
    - Average of AEO 2017 base case and high resource gas case prices (see graph on next slide)
  - Natural gas transportation costs based on historical weather-normalized delivered prices/costs
  - ICF supply curves for coal

AEO Natural Gas Prices



Regional Energy and Peak Demand

- DESCRIPTION
  - Energy (MWh) and peak (MW) demand requirements by state for the period 2017 to 2031
  - IPM meets regional energy needs by running existing plants, building new plants, and using transmission resources

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - RGGI States
    - New York: New York Clean Energy Standard White Paper
    - New England: 2015 ISO-NE CELT forecast
    - PJM: PJM 2016 Forecast
  - Outside of RGGI: ISO (as available) or EIA AEO 2015 regional growth rates

- 2017 PROPOSED APPROACH
  - RGGI States
    - New York: New York Clean Energy Standard White Paper
    - New England: 2016 ISO-NE CELT forecast
    - PJM: PJM 2017 Forecast
  - Outside of RGGI: ISO (as available) or EIA AEO 2017 regional growth rates

Renewable Portfolio Standards (RPS)

- DESCRIPTION
  - RPS programs require that a portion of retail sales be met with generation from qualifying sources
  - IPM will comply with RPS targets in making operation and investment decisions, up to assumed alternative compliance payments (ACP)
- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Modeled in regional markets (New England, New York and PJM)
  - RPS targets met in New England (except NH: assume EPA CPP Alternative RE approach, based on NREL feasibility) and PJM with aggregated state-level RPS implementation, as reviewed by the states; ACP levels specified by the states
  - Fulfillment of New York Clean Energy Standard mandate
- 2017 PROPOSED APPROACH
  - Modeled in regional markets (New England, New York and PJM)
  - RPS targets met in New England (assume zero RE growth for NH) and PJM with aggregated state-level RPS implementation, as reviewed by the states; ACP levels specified by the states
  - Fulfillment of New York Clean Energy Standard mandate

Firmly Planned Generation and Retirements

- DESCRIPTION
  - Firmly planned capacity additions and retirements are those that are far enough along in the process to be included in the Reference Case
  - IPM will take firm capacity additions and retirements into account in making projections

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Based on ISO studies with review by the states
  - Assume retirement of other nuclear facilities at 60 years of age (EPA Base Case assumptions)

- 2017 PROPOSED APPROACH
  - Based on ISO studies with review by the states
  - Assume retirement of other nuclear facilities at 60 years of age (EPA Base Case assumptions)
  - Include 3-State RFP (CT, MA, RI)

Cost and Performance of New Generation

- DESCRIPTION
  - Capital and operating costs, heat rates, and emission rates for new generating capacity options, including combined cycle gas, coal, nuclear, and renewable types
  - IPM builds new capacity to meet energy and peak needs based on relative economics

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - NREL 2015 cost and performance for wind and solar; EIA AEO 2015 for other generation options
  - RGGI region-specific cost adjustments
  - State-specific renewable technology costs, if provided by state
  - State-specific changes to economic biomass builds, if provided by state

- 2017 PROPOSED APPROACH
  - NREL 2016 cost and performance for wind and solar; EIA AEO 2017 for other generation options
  - RGGI region-specific cost adjustments
  - State-specific renewable technology costs, if provided by state
  - State-specific changes to economic biomass builds, if provided by state

Firmly Planned Transmission Additions

- DESCRIPTION
  - Additions to existing capacity in planning or construction stages and assumed to be firm
  - IPM relies on transmission capability to help meet regional electricity demand

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Based on ISO studies with review by the states

- 2017 PROPOSED APPROACH
  - Based on ISO studies with review by the states
  - Add transmission line from Canada to New England (1,050 MW) in 2022 (to represent new MA bill, *An Act Relative to Energy Diversity*).

Transmission Capability

- DESCRIPTION
  - Existing interregional transmission capacity for use in moving energy across regional boundaries
  - IPM relies on transmission capability to help meet regional electricity demand

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Capabilities based on ICF review of ISO reports and modeling
    - ISO-NE: 2015 Regional System Plan Assumptions
    - NYISO: 2014 Reliability Needs Assessment
    - PJM: 2015 RTEP

- 2017 PROPOSED APPROACH
  - Capabilities based on ICF review of most recent ISO reports and modeling

Coal and Nuclear Plant Construction in RGGI

- DESCRIPTION
  - Limits on the amount and type of new coal and nuclear capacity that can be built within the RGGI region
  - In IPM, such limits supersede decisions based on market fundamentals

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Coal: New Source Performance Standards (NSPS) rate for new coal of 1,400 lb/MWh, consistent with a supercritical unit with 20% carbon capture
  - Nuclear: No new units unless specified by state as firmly planned capacity

- 2017 PROPOSED APPROACH
  - Coal: New Source Performance Standards (NSPS) rate for new coal of 1,400 lb/MWh, consistent with a supercritical unit with 20% carbon capture
  - Nuclear: No new units unless specified by state as firmly planned capacity

Nuclear Retirements

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Pilgrim retires in 2019
  - Fitzpatrick Continues operating until current license expires
  - Ginna retires 2030
  - Nine Mile Point 1 retires 2030
  - Indian Point retires 2019

- 2017 PROPOSED APPROACH
  - Pilgrim retires in 2019
  - Fitzpatrick Continues operating until current license expires
  - Ginna retires 2030
  - Nine Mile Point 1 retires 2030
  - Indian Point retires 2020-2021

Reserve Margins and Local Requirements

- DESCRIPTION
  - Reserve margins reflect backup capacity required above peak demand to maintain system reliability, expressed as a percentage of peak demand. NYISO also has locational minimum installed capacity requirements for Zones J, K, and G-J, specified as a percentage of peak load that must be met with in-zone resources.
  - IPM must use existing capacity, transmission, and new capacity options to meet reserve requirements in each region.
  - Other requirements include units that must operate at certain times in order to maintain system reliability or that must burn specific fuels to meet state or local rules. These choices might not otherwise be made on an economic basis.

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - ISO projections, including local requirements for NYISO Zones J, K, and G-J
  - Include minimum unit operation levels to meet reliability and minimum fuel burn requirements in New York based on guidance from NYISO; other minimum fossil fuel generation as specified by the states

- 2017 PROPOSED APPROACH
  - ISO projections, including local requirements for NYISO Zones J, K, and G-J
  - Include minimum unit operation levels to meet reliability and minimum fuel burn requirements in New York based on guidance from NYISO; other minimum fossil fuel generation as specified by the states

Cost and Performance of Pollution Controls and Firmly Planned Control Installations

- DESCRIPTION
  - Capital and operating costs of controls to control emissions of SO_2, NO_X and mercury, along with assumed percentage reduction in emissions
  - Firmly planned installations are those that are far enough along in development (planning or installation) that they are included in the model
  - IPM projects other control installations on an economic basis in response to regulatory requirements

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Costs and unit control status from EPA Base Case v.5.15, with review by the states

- 2017 PROPOSED APPROACH
  - Costs and unit control status from EPA Base Case v.5.15, with review by the states

State Environmental Policies

- DESCRIPTION
  - State emission limits for SO_2, NO_X, and mercury, either as statewide cap and trade programs or unit-specific requirements
  - IPM must comply with state requirements in making operation and investment decisions

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Existing requirements for SO_2, NO_X and mercury, as provided by state agencies
  - State-specific CO_2 requirements, as provided by the states for state polices which potentially affect generation or carbon emissions at RGGI sources
    - NY: no coal generation after 2020.

- 2017 PROPOSED APPROACH
  - Existing requirements for SO_2, NO_X and mercury, as provided by state agencies
  - State-specific CO_2 requirements, as provided by the states for state polices which potentially affect generation or carbon emissions at RGGI sources
    - NY: no coal generation after 2020.

Federal Environmental Policies

- DESCRIPTION
  - Federal air pollution requirements for SO_2, NO_X, and air toxics under Clean Air Act
  - Regulation of coal combustion residuals (ash) under Resource Conservation Recovery Act (RCRA)
  - Effluent Limitation Guidelines and Regulation of water intake under Clean Water Act
  - IPM must comply with assumed regulations as it operates units to meet demand

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - MATS (Mercury and Air Toxic Standards)
  - ASH Rule (Disposal of Coal Combustion Residuals from Electric Utilities)
  - CSAPR (Cross-state Air Pollution Rule)
  - 316B: States will provide any information on units impacted by 316 b (i.e. offline) (cooling water intake rule)
  - Federal Production Tax Credit / Investment Tax Credit extension added
  - Included Clean Power Plan

- 2017 PROPOSED APPROACH
  - MATS (Mercury and Air Toxic Standards)
  - ASH Rule (Disposal of Coal Combustion Residuals from Electric Utilities)
  - CSAPR (Cross-state Air Pollution Rule)
  - 316B: States will provide any information on units impacted by 316 b (i.e. offline) (cooling water intake rule)
  - Federal Production Tax Credit / Investment Tax Credit extension added
  - Treatment of Clean Power Plan: seeking comment

RGGI Requirements: Cap, Reserve Price, CCR, Offsets

- DESCRIPTION
  - RGGI program over time horizon, including cap, reserve price, cost containment reserve (CCR), and use of offsets

- 2016 RGGI REFERENCE CASE ASSUMPTIONS
  - Cap: 2016-2020 adjusted cap with known bank of allowance; 2020 base cap held constant after 2020
  - Reserve price: $2.10 in 2016 and increases 1.025 x the previous year's price rounded to the whole cent
  - CCR: 10 million per year, trigger price $8 in 2016, increasing to $10 in 2017, and increasing at 2.5% annually thereafter
  - Offsets: 3.3% compliance limit with offsets available starting at: (in 2015$) $12/ton in 2017 to about $25/ton in 2020, and staying at that level (in real terms) over the remainder of the time horizon.

- 2017 PROPOSED APPROACH
  - Cap: 2017-2020 adjusted cap with known bank of allowance; 2020 base cap held constant after 2020
  - Reserve price: $2.15 in 2017 and increases 1.025 x the previous year's price rounded to the whole cent
  - CCR: 10 million per year, trigger price $10 in 2017 and increasing at 2.5% annually thereafter
  - Offsets: 3.3% compliance limit with offsets available starting at price consistent w/ ICF's CA modeled projected prices: (in 2015$) $12.60 in 2017 rising to $44.30 in 2031

Draft Sensitivity Case Assumptions

Assumption	Base Reference Case	Low Emissions Cases	High Emissions Cases
Fuel prices	AEO 2017 Base Case or Average of AEO 2017 Base Case + High Resource Case	AEO 2017 High Resource Case	AEO 2017 Low Resource Case or AEO 2017 Base Case
Firmly planned generation and retirements	(Impact of MA offshore wind assumed to be captured in RPS assumptions)	Add 1600 MW of wind for MA	No change from Base Reference Case
Cost and performance of new generation	NREL 2016 Reference	NREL 2016 Low Scenario	NREL 2016 High Scenario
Firmly planned transmission additions	New transmission line from Canada to New England (1050 MW) in 2022	Base Reference Case, with additional new transmission line from Canada to New England (1050 MW) in 2025	No new transmission line(s) from Canada to New England
Nuclear retirements	Pilgrim retires in 2019 Indian Point retires in 2020-2021	Pilgrim retires in 2019 Indian Point retires in 2024-2025	Reduction by 50% of all NE nuclear generation by 2024 (incl. Pilgrim retirement in 2019) Reduction by 50% of all NY nuclear generation by 2024 (incl. Indian Point retirement in 2020-2021)

DATA SOURCES

Data Sources

- This presentation included the following possible sources of assumptions:
  - **EIA AEO**: U.S. EIA's 2017 Annual Energy Outlook
  - **ISOs**: Reports of PJM, ISO-NE, and NYISO, including:
    - PJM – 2017 Draft Load Forecast
    - ISO-NE – 2016 Capacity, Energy, Loads and Transmission report (CELT)
    - NYISO – 2016 Load & Capacity Data (Gold Book)
  - **EPA Base Case**: EPA Base Case v. 5.15 (Clean Power Plan Rule, Final)
  - **Other**
    - State agencies
    - Other federal agencies
    - Utility public announcements and filings
    - Publicly available analyses

Stakeholder Comments

RGGI

- States are seeking comment on all draft assumptions provided for the reference case. In particular:
  - For fuel prices, whether to assume AEO 2017 base case prices, or instead assume the average of AEO 2017 base case and high resource gas case prices.
  - For federal environmental policies, whether to assume Clean Power Plan constraints nationally, or instead assume no Clean Power Plan constraints.
- States welcome further comments on program elements, including state considerations presented in previous meetings.
- Written comments are requested by 5:00 PM ET on Friday, February 17, 2017.
- Please send comments by e-mail to info@rggi.org.
- Written comments will be posted on the Program Review webpage.