RGGI DRAFT 2016 Reference Case-February 2nd Draft Results: Assumptions

2/9/16

Presentation Outline

Modeling Overview

RGGI 2016 Reference Case Assumptions

Data Sources

Reference Case Assumptions Outline

- Regional energy and peak demand
- Cost and performance of new generation
- Coal plant construction in RGGI
- Nuclear plant construction in RGGI
- Firmly planned generation and retirements
- Transmission Capability
- Firmly planned transmission additions
- Reserve margins and local reserve requirements
- Fuel Prices
- Federal environmental policies
- Renewable portfolio standards
- State environmental policies
- RGGI
- Cost and performance of pollution controls and firmly planned control installations

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 2016-2031) for greater consistency with the EPA Clean Power Plan.

RGGI 2016 Reference Case Assumption Development Overview

- The following slides summarize assumptions that were used for the draft 2016 Program Review reference case results discussed at the February 2nd stakeholder.

- The following discussion elements are included for each assumption:
  - Description of the input variable for which the assumption is needed
  - Source of assumption in 2012 RGGI Program Review Reference Case
  - 2016 approach for each assumption

Regional Energy and Peak Demand

- DESCRIPTION
  - Energy (MWh) and peak (MW) demand requirements by state for the period 2016 to 2031
  - IPM meets regional energy needs by running existing plants, building new plants and using transmission resources

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - RGGI States – ISO projections, with potential adjustments by the states
  - ISOs and EIA AEO 2012 regional growth rates outside of RGGI

- 2016 APPROACH
  - RGGI States – ISO projections
  - NY Gold Book 2015 forecast
  - ISO-NE CELT forecast
  - PJM 2016 Forecast
  - ISOs and EIA AEO 2015 regional growth rates outside of RGGI

ASSUMPTION: For RGGI region, ISO projections; ISO and AEO 2015 regional growth rates outside of RGGI

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

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - EIA AEO 2012, with RGGI region-specific cost adjustments
  - State-specific renewable technology costs, if provided by state

- 2016 APPROACH
  - EIA AEO 2015, with RGGI region-specific cost adjustments except NREL 2014 for wind and solar
  - State-specific renewable technology costs, if provided by state

ASSUMPTION: AEO 2015, with RGGI region-specific cost adjustments; NREL wind and solar (corrected on 2/16/16)

Coal Plant Construction in RGGI

- DESCRIPTION
  - Limits on the amount and type of new coal capacity that can be built within the RGGI region
  - In IPM, such limits supersede decisions based on market fundamentals
- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - Only coal with carbon capture will be built in the U.S.
- 2016 APPROACH
  - New Source Performance Standards (NSPS) rate for new coal of 1,400 lb/MWh, consistent with a supercritical unit with 20% carbon capture

ASSUMPTION: Only coal complying with NSPS will be built in the U.S.

Nuclear Plant Construction in RGGI

- DESCRIPTION
  - Limits on the amount and type of new nuclear capacity that can be built within the RGGI region
  - In IPM, such limits supersede decisions based on market fundamentals
- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - Existing nuclear units were offered options to relicense and uprate
  - Nuclear additions limited to existing plants with sites for additional units, based on information provided by Nuclear Energy Institute
- 2016 APPROACH
  - No new units unless specified by state as firmly planned capacity

ASSUMPTION: No new units unless specified by states as firmly planned capacity

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

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - ISO studies and queues, with modifications by the states as necessary

- 2016 APPROACH
  - ISO studies and queues, with modifications by the states as necessary
  - Assume retirement of nuclear facilities at 60 years of age, consistent with EPA Base Case assumptions, with modifications by the states as necessary
  - Firm Build and Retirement list provided

ASSUMPTION: ISO studies and queues, supplemented with additions by the states

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

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - Capabilities based on ISO reports and modeling

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

ASSUMPTION: ISO studies and modeling

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

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - Capabilities, including any planned additions, based on ISO studies
  - Use ISO timing for capability expansion – MAPP in 2019; Susquehanna-Roseland by 2015; Hudson Line by 2013

- 2016 APPROACH
  - Based on ISO studies with review by the states
  - Transmission additions included in Firm Build and Retirement list

ASSUMPTION: Use ISO timing for capability expansion, with review by the states

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. IPM relies on ISO demand curves for NYISO.
  - 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.

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - ISO projections, including local requirements for NYISO Zones J and K
  - Include minimum unit operation levels to meet reliability and minimum fuel burn requirements in New York based on guidance from NYISO
  - NYISO requirements increase to 17% and 18% with retirements of Indian Point units 2 and 3

- 2016 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 states

ASSUMPTION: Latest ISO projections for PJM and ISO-NE; projected 2015 reserve margin for NYISO, held constant; NYISO local requirements; reliability unit requirements based on guidance from NYISO

Fuel Prices

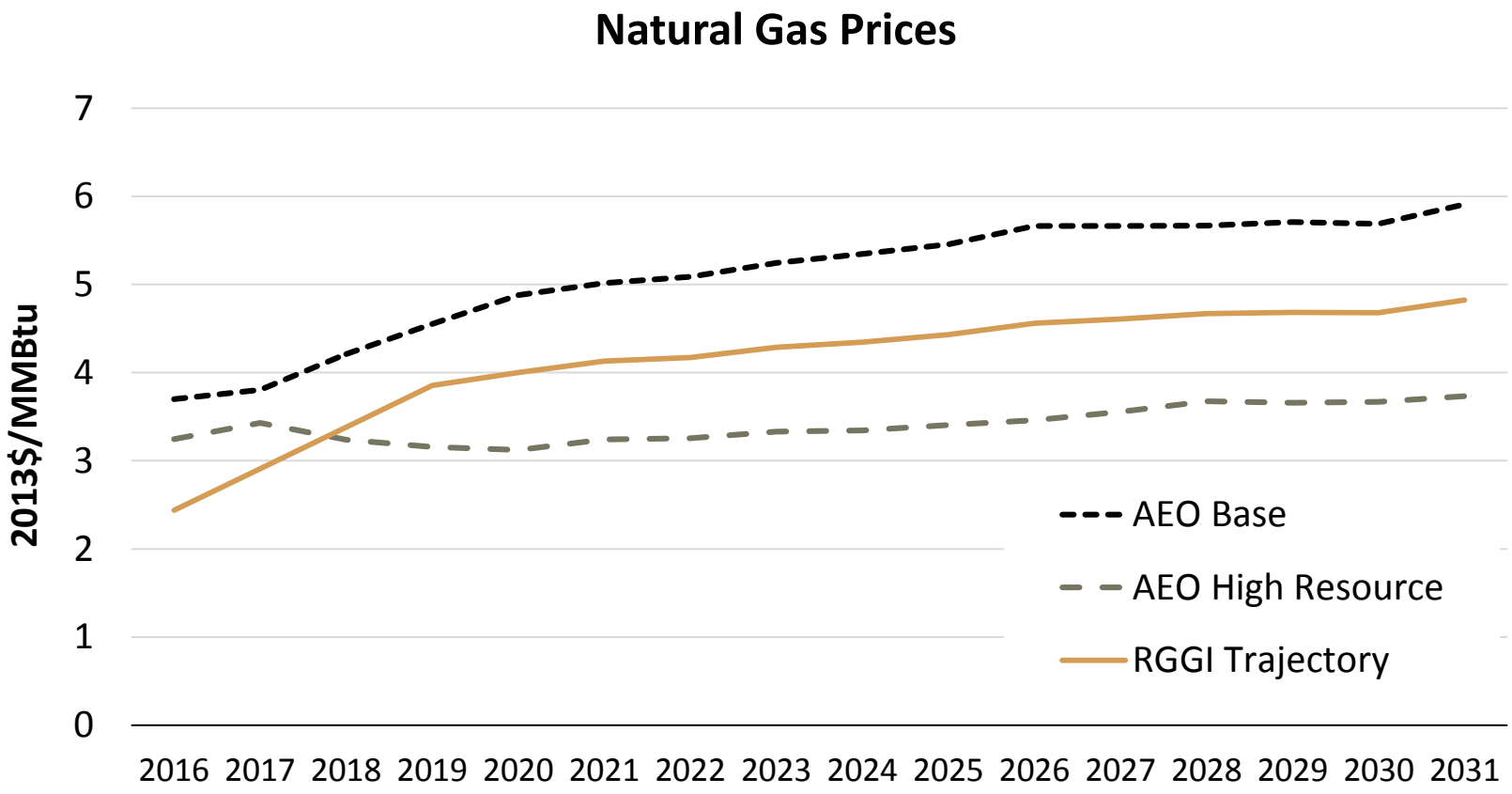
- DESCRIPTION
  - Commodity and delivered prices for natural gas, oil products and coal
  - Delivered fuel prices are included in unit operation and investment decisions

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - EIA AEO 2012 for commodity prices
  - EIA Short-term Energy Outlook
  - ICF supply curves calibrated to EIA AEO 2012 for coal
  - AEO historically derived transportation costs

- 2016 APPROACH
  - Long term natural gas prices uses 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 projected using AEO delivered price trends
  - ICF supply curves for coal

ASSUMPTION: (Oil) EIA AEO 2015 ; Gas (Average of base and high resource EIA AEO 2015 and Futures prices in short term) Transportation costs based on AEO; (Coal) ICF supply curves

Natural Gas Prices



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

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - Final EPA rules, CSAPR in 2013, Mercury and Air Toxics Standards Rule (MATS) in 2016

- 2016 APPROACH
  - Final EPA rules
    - MATS in 2016
    - Water intake structure, coal ash, and effluent limitation based on EPA Base Case v.5.15, with input from states as necessary
  - EPA Clean Power Plan not included, but will be evaluated in the upcoming policy scenario analysis

ASSUMPTION: Final EPA Rules

Renewable Portfolio Standards (RPSs)

- 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)

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - Modeled in three regional markets (New England, New York and PJM)
  - RPS targets met in New England and PJM
  - Partial fulfillment of RPS target in New York based upon NYISO certainty criteria, capacity under RPS contract, and RPS funds currently approved for future solicitations.
  - ACP levels specified by states

- 2016 APPROACH
  - Modeled in three regional markets (New England, New York and PJM)
  - Aggregated state-level RPS implementation, as reviewed by the states
  - Partial fulfillment of RPS target in New York based upon NYISO certainty criteria, capacity under RPS contract, and RPS funds currently approved for future solicitations
  - ACP levels specified by the states

ASSUMPTION: Three regional markets, by ISO, with regional ACPs specified 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

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - Requirements as provided by state agencies

- 2016 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
  - Included a carbon price for California, Ontario, Quebec

ASSUMPTION: Existing requirements, provided by the states

RGGI

- DESCRIPTION
  - Representation of RGGI program over time horizon, including cap, cost containment reserve (CCR), and use of offsets
- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - Requirements as provided by States
- 2016 APPROACH
  - Cap
    - 2016-2020, adjusted cap with known bank of allowances
    - 2020 base cap held constant after 2020
  - CCR: 10 MMTons per year, trigger price increasing at 2.5% post-2017
  - Offsets: 3.3% compliance limit with offsets available starting at $25/ton

ASSUMPTION: 2020 cap held constant post-2020; CCR of 10 MMTons per year, price rising at 2.5% per year post-2017: offsets available at $25/ton

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

- 2012 RGGI REFERENCE CASE ASSUMPTIONS
  - EPA Base Case assumptions
  - States for firm controls

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

ASSUMPTION: Control costs and status from EPA Base Case, with review by the states

DATA SOURCES

Assumptions Sources

- This presentation included the following possible sources of assumptions:
  - **EIA AEO**: U.S. EIA's 2015 (Final) Annual Energy Outlook
  - **ISOs**: Reports of PJM, ISO-NE, and NYISO, including:
    - PJM –2016 Load Forecast
    - ISO-NE – 2015 Capacity, Energy, Loads and Transmission report (CELT)
    - NYISO – 2015 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