Interregional Production Cost Analysis
Common Economic Database and Analysis

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Northeast Coordinated System Plan
IPSAC10
November 6, 2009

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Background

- IREMM is a high level simplified representation
  - Resources dispatch and commitment are not be detailed
  - Loads are aggregated into subareas (a.k.a. bubbles)
  - Transmission constraints are represented as transportation limits on major interfaces
  - Offers advantages of understanding of system performance and "seeing the forest for the trees"
  - The "bubble" or high level model database coordinates and builds upon common databases and can be used to improve external representations when using more detailed production cost programs
- IPSAC has reviewed the scopes of work and the high level assumptions that will be used in these studies

Scope of Work

- Represent the three ISO/RTO's and neighboring systems with IREMM
- Conduct production cost analysis to identify where major interfaces are constraining interregional transfers for the 2013 system
- Relax the limits of the constrained interfaces in postulated increments of 500 MW to 1,000 MW
  - Initial analysis will focus on the NYISO/ISO-NE area

Scope of Work, *cont.*

- Run additional cases that assume higher interface limits for various combinations of interfaces
  - Will restrict the total number of simulations
- Show impact on production costs and other metrics for all cases
  - LSE expenses
  - Fuel usage
  - Emissions

Schedule

- IREMM
  - Finalize coordinated database (Complete)
  - Conduct IREMM simulation results
    - NYISO/ISO-NE focused analysis to be presented to IPSAC on December 18, 2009
    - Analysis focusing on the three ISO/RTOs to be completed by second quarter 2010
- Detailed Production Cost Analysis
  - Coordinated database under development
  - Provide IPSAC progress report on December 18, 2009
  - Conduct production cost analysis and discuss with IPSAC by 2nd Quarter 2010
- Conduct detailed transmission analysis as may be warranted
  - Next steps to be discussed with IPSAC on December 18, 2009

Data Sources

- EIA 860 data
  - 2008 data, heat rates from 1995
- FERC Fips Codes
- NERC GADS summary
- ISO/RTO information/databases

Required Assumptions for the 2013 System

- Resource Expansions, Retirements, and Replacements reflect ISO/RTO expansion plans based on capacity markets and other "firm" plans for generation expansion
  - Amounts
  - Locations
  - Types and profiles
  - Capital Costs
  - Performance
- Dispatch and Emissions are consistent with EIA database assumptions
  - Fuel prices and dispatch costs
  - Emission rates and cost adders
    - Analysis includes $10/ton for carbon emissions

Required Assumptions for the 2013 System, *cont.*

- Transmission Interface Limits based on limits used in resource adequacy studies (MARS program)
- Load Levels and Profiles are based on 50/50 forecasts
  - ISO New England region based on 2009 ten-year forecast
  - NYISO region based on 2009 Load & Capacity Data Report
  - PJM region based on 2009 forecast report

Appendix
IREMM
High Level Production Cost Program

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IREMM Simulation Tool

- Simplified production simulation model
  - Focus on production and marginal cost of energy to customers
  - Developed by simulating salient factors of the power system
    - Customer loads
    - Resources
      - Generating units
      - Other resources
    - Transmission limitations and or constraints between areas
    - Choice of fuels based on relative price and conversion efficiencies
  - Estimated emissions can be derived from these simulations
- Designed for broad production cost studies with reasonable level of detail

Modeling Approach – Framework

- Designed to simulate the key aspects of the electric sector over its entire geographic scope
  - Electric generation infrastructure across North America
  - Major transmission limitations across North America
- Allows analysis of market place fundamentals
  - Supply and demand balance
  - Effects of exogenous influences on fundamentals can be seen
- Currently configured to allow
  - 180 areas
  - 15,000 resources
  - 100 transmission limits

Modeling Approach – Resources

- Typically single block dispatch representation of generating resources is used
  - Forced Outage Rate (EFOR) and Scheduled Outage Factor (SOF)
  - Single heat rate for entire unit
  - Multi-block representations are available
    - Multi-block bidding strategies
    - Multi-block heat rates
    - Multi-block NOx emission rates
- Primary and alternate fuels
  - Each fuel can have a distinct variable O&M cost
  - Each fuel can have a different NOx emission rate
  - Switch based on monthly fuel prices

Modeling Approach – Load

- Hourly load model for all areas
  - Input monthly peaks and energy
  - Scale hourly load to meet target peaks and energy
- Loads increased over time to match input summer peak, winter peak and annual energy
- All loads can be perturbed
  - To reflect higher or lower loads
  - After maintenance schedule to see effect of unexpected weather

Modeling Approach – Dispatch Simulation

- Chronological simulation
  - Limited ability to represent unit commitment in response to prices
  - Pumped storage pumping / generating based on heuristics
  - Conventional hydro load adjustment based on its monthly energy
  - Wind can be modeled by inputting hourly wind profile
- Operating reserve can be specified
  - In terms of MWs and / or
  - Percent of load
- Dispatch simulation
  - Derated dispatch reflecting average EFOR
  - Monte-Carlo representation of EFOR can be specified as an alternative

Modeling Approach – Emissions

- Emissions based on energy production and fuel used
  - CO2 emissions based on fuel's carbon characteristics
  - SO2 based on fuel used with ability for each unit to have unique emission rate
  - NOx emission rate based on
    - Unit specific emission rates for primary and alternate fuels
    - Rates may be changed over time
- Environmental control technology models included
  - SCR for NOX control and
  - Scrubbers for SO2
- Can provide insights into emissions from areas

Transmission Congestion

- Congestion is caused by
  - Imbalance in the location of supply vis-a-vis demand
    - Demand for electricity is a function of many factors
      - Customer type
      - Day of the week
      - Hour of the day
      - Season of the year
      - Weather
      - etc.
- Supply of electricity may be available, but
  - Transmission may not be sufficient to transport to demand
  - Fewer suppliers that can deliver increases market concentration
  - Increased concentration leads to ability to influence prices

Modeling Results

- Typical results include
  - Marginal prices
  - Congestion
  - Fuel consumption by type
  - Technology utilization
  - Emissions
    - CO2
    - SO2
    - NOx

Modeling Results, *cont.*

- Various ways to summarize results
  - Systemwide
  - Subareas
  - Hourly
  - Monthly
  - Annual
- Output easily extracted to MS Excel format

Questions