Interregional Production Cost Analysis
Draft Scope of Work

Northeast Coordinated System Plan
IPSAC09
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ISO new england

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Introduction

- PJM, NYISO, and ISO-NE are working towards developing data bases for use in production cost studies
  - Each ISO/RTO uses different production cost models
  - Production Cost Models vary in level of complexity and data requirements, from “policy” or screening level analysis to detailed network analysis that can align with actual nodal market operation tools
  - Data bases are being coordinated and developed in a two step effort
    - Build “bubble” or high level model database
    - Coordinate and build common database from existing planning level databases at three ISOs that can be used for equivalent interregional efforts, better external representations in own studies
- IPSAC is being asked to review the scope of work of proposed interregional production cost analysis

Background

Required Assumptions

- Resource Expansions, Retirements, and Replacements
  - Amounts
  - Locations
  - Types and profiles
  - Capital Costs
  - Performance
- Dispatch and Emissions
  - Fuel prices and dispatch costs
  - Emission rates and cost adders
- Transmission Interface Limits
- Load
  - Levels and Profiles

Solution

- Creation of a new production cost database for interregional planning
  - ISO/RTOs have ability to share information
  - Low cost compared with other options
- Meets a need for studies across the three regions
  - Helps ensure that internal databases are accurate
  - Will give many studies inherent coordination by working from common source material

Data Sources

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

Load Forecast

- Assumed loads verified on a per-region basis
  - ISO New England region based on 2009 ten-year forecast
  - NYISO region based on Load & Capacity Data Report
  - PJM region based on 2009 forecast report

Production Cost Models

Production Cost Tools

- High level simplified representation
  - Resources dispatch and commitment may 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"
- Detailed representation
  - More explicit resource dispatch and commitment
  - Transmission constraints are explicitly modeled and not limited to major interfaces
  - Provides detailed understanding of system performance
- Need to balance detailed analysis with "broad perspective" analysis

IREMM
High Level Production Cost Program

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 (continued)

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

Detailed Production Cost Programs used For Long Term Planning

What are these programs?

- Detailed production-cost simulation tools
  - Examples: MAPS, GridView, PROMOD
  - Designed for modeling complicated transmission systems
  - Interactions of resources, load and transmission
  - Simulate nodal markets into the future

What are these programs? (continued)

- Minimum cost security-constrained unit commitment and dispatch (SCUC/ED) algorithms;
  - Commits and dispatches units emulating market and security operations
  - Ensures that transmission line limits are not violated
    - Under normal conditions
    - Contingency conditions
- Appropriate for detailed investigations
  - When looking for the forest, use the “wide-screen” approach
  - When looking for trees, use the “zoom-in” approach

What they can do?

- Production cost calculation to mimic system operations in the current market environment
- Commit units to provide transmission system security
- Market Simulator to provide market price signals
  - Projection of congestion, load payments, gen payments
  - Other market metrics such as TCCs, FTRs, ancillary services

What they can do? (continued)

- Allows unit commitment issues to be investigated
  - Quantify tradeoff between
    - Unit commitment to protect against contingencies or
    - Quick start resources
  - Effect of transmission upgrades can be considered

Capabilities for Transmission

- Transmission studies can focus on:
  - Explicit contingency lists
  - Asset utilization
  - Bottleneck identification
  - Congestion mitigation optimization
  - Market based probabilistic reliability assessment
  - Transmission expansion planning and alternative evaluation
  - Identification and economic assessment of transmission projects
- Transmission considerations may impact
  - Emissions
  - LMPs
  - Production cost
  - Others

Capabilities for Generation

- Generation studies
  - Plant siting and cycle optimization
  - Bidding strategy assessment
  - Asset evaluation and management
  - Portfolio optimization and risk management
  - Plant market performance analysis
  - Generation interconnection evaluation
- Generation type, location and business strategies can affect emissions

Model Power Network Detail

- Supply:
  - Generators locations (existing and future)
  - Incremental heat rates
  - Fuel cost
  - Operation constraints
  - Emission rates (including SO2, NOx, CO2)
  - Forced outage rates
  - Bidding information (if applicable)
- Demand:
  - Spatial load distribution over time
- Transmission system:
  - Bus-level load flow model,
  - Contingencies
  - Interfaces

Ability to Model Emissions

- Three options to model emissions
  - Simple Cost Adder
    - Emission cost adders are user's inputs
  - Calculated Emission Cost Model
    - Based on the emission rates of the units and input allowance price, calculates the cost adders
  - Iteration for Allowance
    - Determine an allowance price which limits emissions to a pre-specified cap (defined by areas, regions, or system)
- Seasonal/monthly allowance price can be modeled
- Single emission rate for each resource

Scope of Work

Study Efforts

- NYISO/PJM targeted analysis
  - Previously discussed
  - Will include detailed models using the PROMOD program
- Overall “three” system analysis
  - Our current focus
  - Will initiate IREMM analysis
  - Detailed simulation work to follow
  - Coordination with each ISO’s own studies

Scope of Work - IREMM

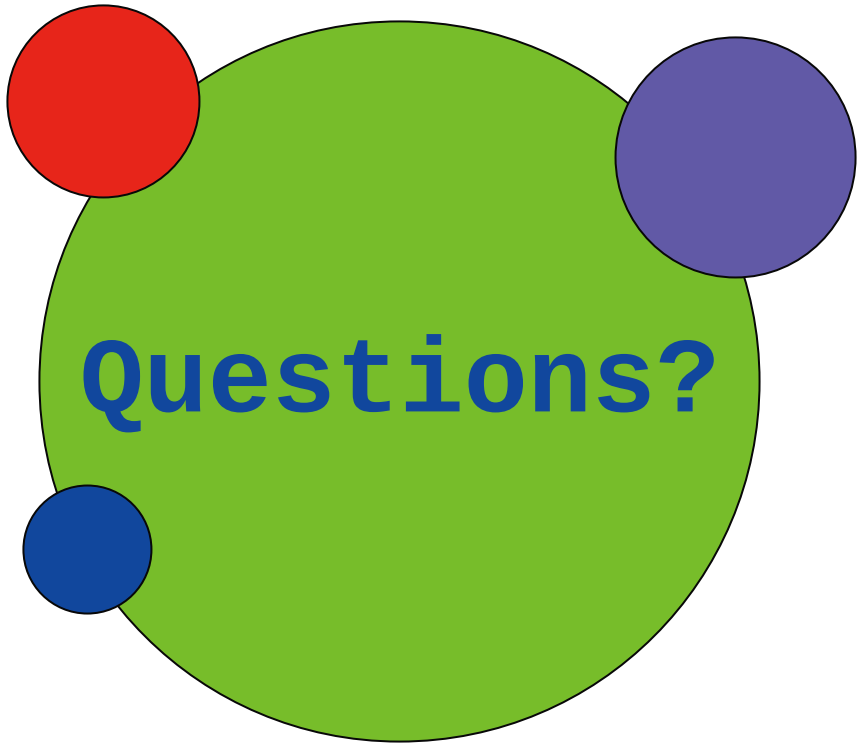
- Represent the three ISO/RTO's and neighboring systems with a less detailed model
- Conduct production cost analysis to identify where major interfaces are constraining interregional transfers
- Relax the limits of the constrained interfaces in postulated increments of 500 MW to 1000 MW

Scope of Work – IREMM (continued)

- 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
  - Conduct IREMM simulation results
  - Present to IPSAC 4th Quarter 2009
- Detailed Production Cost Analysis
  - Develop coordinated database for testing
  - Provide IPSAC progress report 4th Quarter 2009
  - Conduct production cost analysis and discuss with IPSAC by 2nd Quarter 2010
- Conduct detailed transmission analysis as may be warranted
  - Scope of work to be discussed with IPSAC 4th Quarter 2009


Questions?