



Eastern Interconnection Planning Collaborative

Gas-Electric System Interface Study

Target 2, 3, 4 Update

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LEVITAN & ASSOCIATES, INC.

MARKET DESIGN, ECONOMICS AND POWER SYSTEMS

Acknowledgement and Disclaimer

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Target 2: Status

- ◆ Updated AURORAxmp / GPCM runs underway
 - 3 Gas Demand Scenarios (Reference, High, Low)
 - 18 first set sensitivities
 - (#0 R/H/L, 1 R/H/L, 3 R, 5a R, 5b R, 5c R, 9 H, 13 R, 14 R, 16 R, 18 R, 19 R, 30 R/H)
 - 8 second set sensitivities
 - (#2 H/L, 23 R, 31 R, 33 R, 34 R, 36 R, 37 R)
- ◆ Sensitivity descriptions and results posted to EIPC website as they become available
 - http://www.eipconline.com/Gas-Electric_Documents.html

Target 2 Status: GPCM Update

- ◆ Continued refinement of segment capacities and interconnect flows
- ◆ Validation / refinement of local area storage deliverability
- ◆ Formulation of first and second set case sensitivities

Target 2: Presentation Formats

- ◆ Emphasis on demand / deliveries
- ◆ Quantification of transportation deficits by location
 - Pipeline utilization levels used to support quantitative results
- ◆ Maps showing GPCM locations / specific plants at-risk for partially or fully unserved demand
- ◆ Quantitative analysis of unserved Peak Day demand at various levels of locational granularity
- ◆ Frequency / duration analysis will identify gas-fired units potentially impacted by each specific constraint
- ◆ Units with & without firm transportation entitlements identified based on Target 1 research / public data
 - Non-public third-party arrangements not considered

Target 3: Status

- ◆ Hydraulic modeling of pipeline systems underway
 - Increased granularity of RCI forecast (by gate station)
- ◆ Contingency lists in development
 - Gas-side event types: Loss of supply, Loss of storage, Line breaks, Loss of compression
 - Electric-side event types: Loss of electrical supply, Electric-drive compressor outages
 - High impact, low probability contingencies centered on gas capable units, not LDCs
- ◆ Select LDCs in New York, PJM and Ontario conducting gas side contingency analysis and/or providing LAI with information
 - Range of approaches to local system analysis

Target 4: Task Summary / Research Goals

- ◆ Task 1: Liquid Fuel Storage and Resupply Methods
- ◆ Task 2: CT Operating Characteristics and Costs
- ◆ Task 3: Market Assessment of Petroleum Fuels for Electric Generation
- ◆ Task 4: Generator Pressure-Sensing and Fuel-Switching Capabilities
- ◆ Task 5: Dual-Fuel Capability v. Gas System Expansion

Target 4 / task 1: Current Dual-Fuel Capabilities

- ◆ Liquid Fuel Storage and Resupply Methods
 - Focus on backup fuel storage capacity and fuel use at full load
 - Data on resupply/delivery logistics
- ◆ Data assemblage from a mix of public and confidential data sources: PPAs, generators, air permit applications for existing, new and proposed units, and U.S. EPA
- ◆ Task 1 database contains consistent storage and fuel use data for 52 units – Combustion Turbines (CT) and Combined Cycles with dual-fuel capability
 - Database used to support other Target 4 tasks – unit specific details will not be published

Target 4 / task 2: Status Report – Past Activities

- ◆ Cost and performance data from GE and Siemens
 - Heavy frame units: 7FA and SGT-6
 - Aeroderivative units: LM6000 and LMS100
- ◆ No usable communications / information from CT user groups
- ◆ Defined incremental costs for dual-fuel capability
 - PJM and NYISO Cost of New Entry studies for framework
 - Capital costs: CT vendor scope, balance of plant
 - Fixed O&M costs: fuel inventory, staffing, property taxes
 - Variable O&M costs: water, maintenance accrual

Target 4 / task 2: Status Report – Current Activities

- ◆ Interviewed generators on fuel switching practices
 - Periodic oil testing too expensive without assurance of cost recovery
 - Fuel and water systems are complex and subject to cold weather problems

- ◆ Cost models developed for incremental dual-fuel capability
 - PPA locations to be determined based on Target 2 results
 - Three plant types
 - Standard CC plant (2x1 7FA)
 - Heavy-frame SC plant (2 7FA)
 - Aeroderivative SC plant (2 LMS100)

Target 4 / task 3: Fuel Oil Market Assessment

- ◆ Continued discussions with generators re backup fuel issues
 - Going forward most backup fuel use will be ULSD
 - Reduction in seasonal supply constraints
 - Some constraints on supply reported for last winter
 - Weather conditions affecting deliveries by truck
 - Confusion between low sulfur diesel and ULSD
- ◆ Data from refiners, suppliers and distributors re availability, costs, and storage issues
 - Some storage and use issues: lubricity and microbiological contamination can be treated with additives and biocide applications to storage tanks

Target 4 / task 4: Fuel Switching (Manufacturers' Perspective)

- ◆ On-the-fly switching “no problem”
- ◆ Fuel switching capability is common design option
 - Frame units drop load (e.g. 80%) to switch
- ◆ Entire process takes a few minutes *if* systems ready
 - Liquid fuel systems are on stand-by (recirculating between tank and CT)
 - Water injection systems (not required for gas firing)
- ◆ Switching can be automatic (based on delivery pressure signal) or operator-initiated

Target 4 / task 4: Fuel Switching (Manufacturers' Perspective)

- ◆ Regular Testing of liquid fuel systems
 - Testing does not require a 100% switchover
 - Liquid fuel only needs to be fired for a few minutes

- ◆ Water injection for heavy frame CTs on liquid fuel
 - Needed to meet NO_x limits
 - Additional equipment to maintain in ready status
 - Additional extreme cold-weather concerns

Target 4 / task 4: Fuel Switching (Genco Perspective)

- ◆ Reasons for periodic oil operation
 - Reliable switching requires training and practice
 - Long Term Service Agreements may require testing to maintain oil firing and emission guarantees
 - Fuel and water systems tested and ready
 - Operator training critical due to frame CT complexities
- ◆ Benefits of periodic oil operation
 - Systems and operators ready if called upon
 - Less chance of trip or emission excursion
- ◆ Costs of periodic oil operation
 - High ULSD price relative to LMPs
 - Higher maintenance accrual rate is not an issue

Target 4 / task 4: Fuel Switching (Genco Perspective)

- ◆ Periodic testing doable if costs recoverable
- ◆ Fuel switching practices
 - GTs can run at reduced load if gas pressure drops
 - If need to switch, GT load reduced to minimize chance of trip and avoid emission excursions
 - Problems with oil and water systems in cold weather
 - GTs injecting water for gas are less vulnerable
 - Switching virtually always by operators; seldom automatic
- ◆ Gencos do not test / practice on oil
 - Costs > benefits
 - Inadequate financial incentive to test on oil

Target 4 / task 5: Dual-Fuel Costs v. Firm Transportation

- ◆ Dual-fuel plant cost models developed
 - Locations and oil inventory requirements TBD based on Target 2 results
 - 1-Combined Cycle and 2-CT plant configurations
- ◆ Models designed for site-specific variables
 - Construction labor cost factor for target site
 - Hours of full load liquid fuel burn for tank capacity and oil inventory carrying cost (fixed operating cost)
 - Liquid fuel price
- ◆ Incremental demineralized water treatment and storage
 - Investigating purchase and rent options