MEMORANDUM

To: David Allen; NYISO
Paul Hibbard; Analysis Group

From: Mark Younger; Hudson Energy Economics, LLC

Subject: Analysis Group Net Energy and Ancillary Service Model Depiction of Winter Operation

Date: August 1, 2016

cc: Randy Wyatt; NYISO
Pallas LeeVanSchaick; Potomac Economics

During the last several Installed Capacity Working Group meetings I have raised concerns about ways that the Analysis Group's ("AG") Net Energy and Ancillary Service ("Net E&AS") revenue model fails to match how the NYISO market works and especially how the model addressees high priced winter conditions. This memo focuses on ways in which the model does not adequately represent peak winter operating conditions and therefore grossly overstates likely Net E&AS revenues during such conditions.

The AG Net E&AS model needs to be revised in two ways. First, it needs to incorporate rules representing the logistics of refilling fuel oil tanks. This should include analysis of how fast one can reasonably hope to refill the tank both in terms of just the physical act of refueling from trucks and that the time when substantial refilling would be required are the same times when numerous other customers also want fuel oil deliveries. The Analysis presented as well as the NYISO's experience in the polar vortex makes it clear that just assuming perfect optimization of fuel burn and replacement delivery is not reasonable. In the absence of incorporating the logic then the assumed size of the fuel tank should be doubled.

Second, the AG Net E&AS model must be revised to incorporate OFO logic and to limit operation on OFO days either to burning oil or to enforcing that a commitment to burn on gas will require the unit to run for a full 24 hours on gas to comply with the OFO.

Background

As described at the meetings, the AG Net E&AS model determines whether the proxy unit will run in the day-ahead market by assuming that the unit will run on the less expensive fuel and then determining when operating revenues are sufficient to cover startup costs and variable operating costs. The critical oversimplification for winter operating conditions is that the model does not have any logic to address operation under

Operational Flow Order ("OFO") conditions and, furthermore, that it assumes an essentially infinite supply of oil. This will be addressed in more detail below.

In the real-time market the model includes real-time fuel cost adders but then assumes that the unit can then buy out of its DAM schedule or start operating in the RT any time such operation would appear economic based on the adjusted fuel cost. Again, the model does not consider any costs that are related to operating under OFO conditions or the logistics of running on oil for a prolonged period of time.

The NYISO MMU runs a more sophisticated model that attempts to incorporate issues associated with running during OFO conditions.[1] In spite of the MMU model's greater sophistication, when the MMU compared its Net E&AS model's projected operation to actual unit operation for the Polar Vortex it found that combined cycle and steam unit actual operation on oil was less than ½ the optimal level estimated by the model.[2] The result was that their model estimated a significant amount of Net E&AS revenue that the units were unable to achieve. The MMU attributed its models failure to accurately represent operation during these periods to unit forced outages, unit's difficulty in predicting and maintaining optimal fuel inventories, and unit air permit restrictions.[3]

The AG Net E&AS model does not include all the sophistication of the MMU's model and therefore is expected to overstate Net E&AS revenues by as much or more than the MMU's model. The monthly results that AG released for the July 20th ICAP working group show that more than 2/3 of the projected Net E&AS revenues for the NYC proxy unit in the 2013/2014 period are assumed to come from operation during the first quarter when the Northeast was experiencing the polar vortex. While high operation is expected during this unusual period, overstating the Net E&AS revenues during this period will understate the appropriate demand curve. Consequently, the previously approved collar mechanism will result in a suppressed demand curve for the first year and continue affecting future years, as well. It is critical that the misrepresentation of likely revenues during critical winter months be addressed so that the proposed demand curves are not understated, produce adequate price signals and model future conditions accurately.

The remainder of this memo provides more detail on the issues with fuel oil operation and operating under OFO conditions.

Oil Inventory Replenishment

At the July 20th ICAP meeting Paul Hibbard reiterated that the AG Net E&AS model assumes that the proxy unit always has sufficient fuel available to operate on oil if necessary and that he believes it is reasonable to assume that the unit could manage its fuel usage to always have sufficient oil. This position is in direct contrast with the

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[1] The MMU model also incorporates the NYISO process of committing units in the real-time market based upon RTC prices and then paid based on RTD prices.

[2] Quarterly Report on the New York ISO Electricity Markets First Quarter 2014, Potomac Economics Market Monitoring Unit, p. 28. See, http://www.nyiso.com/public/webdocs/markets_operations/documents/Studies_and_Reports/Reports/MMU_Quarterly_Reports/2014/NYISO Quarterly Report - 2014 Quarter 1.pdf

[3] Ibid, p. 26.

MMU's recognition that difficulty in predicting and maintaining optimal fuel inventories was one of the reasons that the MMU's Net E&AS, which also assumes a unit can always get fuel, overstated oil operation during the polar vortex.

The proxy unit is assumed to get its oil delivered by truck. It is not clear that the analysis has adequately considered the amount of oil that the unit would be consuming or the difficulty in refilling its oil storage. By my calculation the proxy unit would burn approximately 13,700 gallons of oil per hour. (See Attachment A.) A standard oil truck holds approximately 3000 gallons and a tanker trailer pulled by a semi holds approximately 9000 gallons. Consequently, the proxy unit burns more than 4.5 standard truckloads of oil per hour or 1.5 trucks per hour if it is possible to accommodate the larger tankers pulled by a semi. To put things even more in perspective, the default assumption is that full day operation would be for 16 hours. This is the equivalent of more than 73 standard trucks or 24 semi-trucks per day of operation. It is not clear that semi-trucks could deliver at all assumed proxy plant locations or that it is reasonable to assume that it would be possible to accommodate the queue of trucks that would be necessary to accomplish replenishing the oil inventory. There also may be restrictions on the hours when fuel deliveries would be allowed. The final consideration is that the peak times where the proxy unit would need these massive amounts of oil to replenish its tanks are the same times that the oil trucks are in heavy demand by every other customer that burns oil. In effect, the model assumes that the proxy unit is supplied by a pipeline connected to an infinite supply of oil.

There is no indication that either the Analysis Group or the NYISO has considered the logistics of requiring the level of oil delivery for a day's operation on oil. While this is not a consideration during periods of sporadic operation on oil where the deliveries can be spread out over many days or weeks between oil burns, that is not the case when we are looking at the operation during the polar vortex. The MMU identified that there were nine contiguous days at the end of January 2014 that had particularly high oil usage on the NYISO system. And as the MMU has already determined, operation during the polar vortex was affected by difficulty in predicting and maintaining fuel inventories.

Given the complication of replenishing fuel inventories it is unreasonable for the AG Net E&AS model to assume that the proxy unit could run on oil any time it is more economical. Some limitations on the ability for the proxy unit to obtain fuel and replenish its supplies must be built into the Net E&AS model.

Operational Flow Order Impacts on Unit Generation and Net E&AS
The AG Net E&AS model also does not account for the impacts of Operational Flow Orders on the proxy plant operation and Net E&AS for the proxy unit. This is most critical for operation in NYC where OFOs are frequent. For example, during the 2014 polar vortex there were OFOs on 19 days in January, 15 days in February, and 8 days in March.[4]

[4] The gas day is from 10 AM to 10 AM. An OFO day called on the last day of the month would continue into the first day of the next month.

During the more restrictive types of OFOs, such as those experienced during the aforementioned periods, the generating unit is required to consume the same level of gas during each hour of the gas day. Deviations from a level gas withdrawal results in substantial costs, either in the form of punitive cash-outs or penalties. However, these costs and penalties are not intended to provide an economic, albeit very expensive, choice of not taking gas that was nominated or taking gas that was not nominated. Significant deviations in withdrawal rate such as if a generator elected to purchase gas for the entire day but elected to not consume it (e.g. by buying out of its DA schedule and thus not consuming the gas or leaving the gas on the LDC system altogether and accepting the cash-out price) the unit would bear the risk that the LDC would impose a unit-specific curtailment (i.e. close the unit's gas valves for noncompliance with the OFO).

During an OFO the generator has essentially two choices. First, it can burn oil if that is available. This may result in the generator burning oil when it is more expensive than gas and also increases the level of oil burn. The AG Net E&AS model does not capture that there are conditions where the generator may be required to burn the more expensive fuel and instead assumes that the generator can always burn gas if it is cheaper. Choosing to burn oil means that the generator would also have to deal with the logistics of replenishing its oil tank as described above. It would also need to make sure that its operation on oil did not result in violating any air permit restrictions.

Alternatively, a generator that receives a commitment to operate for one or more hours could nominate gas for the entire gas day. This significantly increases the cost of operation and means that the generator would likely run many hours when it was not economic. The additional hours of operation would clearly reduce and might likely eliminate the Net E&AS revenues for the day. The AG Net E&AS model does not capture the additional cost of running in the uneconomic hours on gas.

The monthly results from the AG Net E&AS model shows the significance of assumed winter revenues. The failure to capture real-world implications of OFO days results in these net revenue estimates being substantially overstated. This must be corrected before it is used to set the Demand Curves for the next four years.

Attachment A

Oil Consumption of Siemans Frame 7

8,749	BTU/kWh	Heat Rate
8,749,000	Btu/MWh	Heat Rate
217	MW	Average Degraded Net Plant Capacity ICAP
1,898,533,000	Btu	Hourly Fuel Consumption
138,500	Btu/gal	No. 2 Oil Heat Content
13,707.82	Gal/hour	Hourly Fuel Consumption
3,000	Gal/Std. truck	Oil Tanker Truck Capacity
4.57	Trucks/Hour of Operation	Hourly Fuel Consumption
16	Hours	Assumed Daily Operation on Oil
73.11	Std Trucks/day	Daily Fuel Consumption