

## NGTDM CDR Review: 06/17/15

### Participants:

- Peter Whitman
- Arthur Dai
- Joe Benneche
- Angelina LaRose
- Katie Dyl
- Mike Cole
- Sandy Sanders (OnLocation)
- Lauren Busch (Leidos)
- John Meyer (Leidos)
- David Daniels

These notes represent one person's summary of the discussion which took place at the meeting and were not reviewed by the participants for accuracy.

The meeting was convened to discuss comments and questions about the NGTDM CDR. Discussion centered on comments received from OnLocation, which focused on the proposed treatment of pipeline investment decisions.

Sandy Sanders [SS] accompanied his discussion with a PowerPoint presentation (NGTDM\_Review.pptx). He discussed long-term investment decisions, noting that it is difficult to engage in capital budgeting with an extended time horizon. He discussed approaches used in two other models associated with OnLocation: (1) the Electricity Market Module (EMM), which uses two models that separately address short-term capacity decisions and long-term, multi-year capacity planning, with long-term planning being invoked only in the model's final iteration; and (2) the Liquid Fuels Market Module (LFMM), which addresses investment decisions using a single model that is run in two different modes. [SS] recommended adopting an approach similar to that used in the LFMM for the NGTDM.

Joe Benneche [JB] observed that natural gas demand grows rather consistently in most scenarios, which may simplify the structural needs of the model. He also questioned the comparability of the NGTDM to the EMM and LFMM, noting that NG capacity planning is a simpler problem than decisions to construct new generating/production capacity.

[SS] conceded the difference, but suggested that there are benefits from adopting a more comprehensive approach, including increased flexibility in the model.

Peter Whitman [PW] concurred with [SS], noting that capacity planning may be simpler in the reference case, but outside of that, the model may benefit from a more detailed capacity planning structure, particularly in scenarios where there is a rapid change in price, or significant changes in the NG export market.

[SS] expanded on [PW's] comments, observing that a detailed capacity planning structure would also accommodate the impact of NG storage capacity decisions. He noted that building out pipelines is also a critical issue, since the sizing of pipelines is an important part of the long-term decision process, and pricing for large vs. small pipelines will influence investment decisions.

[JB] commented that while pipeline capacity is added in discrete units, it may be useful to consider the use of incremental builds (i.e., partial units) for modeling purposes.

[SS] responded that this may be useful, but there are limits to its applicability. In the EMM, the addition of “partial plants” is possible, but they are costed-out as whole plants. The pipeline issue is different, as unit costs are vastly different, based on pipe size, and it may be problematic to have the model make an economically-rational decision; if the model can build partial capacities, it would always choose the large pipe (lower unit cost at full capacity), but pay for only that portion that is used.

There was a brief exchange between [SS] and David Daniels [DD] regarding the use of mixed integer programming (MIPS), and how this may mitigate concerns about pipeline selection.

[SS] then spoke about the distribution of NG demand, recommending that, as NG demand fluctuates on a daily and seasonal basis, and prices are highly dependent on demand levels, the NGTDM should follow the example set in the EMM and construct load duration curves for three seasonal segments (summer, winter, spring/fall).

[JB] confirmed the similarity with the EMM approach, noting the relationships between flow levels and tariffs, and agreeing that prices and flows vary considerably within smaller time periods than are currently addressed in the model.

[SS] agreed, noting that the spring season would have a lot of variation in temperatures, and suggested that research be undertaken to develop load duration curves.

[JB] pointed out that it would be necessary to accommodate the fact that climate variations are dependent on region.

[SS] point out that each region would have a different demand shape, which could also be stratified by customer class, reflecting load profile changes. He also indicated that it may be possible to get relevant information from electricity markets in developing these profiles. It would also be necessary to incorporate reservation fees for firm service. An unresolved concern would be how to apply these principles to pipelines of differing capacities.

[SS] then discussed the impact of international demands, noting that the plan to add international gas markets would add a level of complication, since flows through LNG terminals may go both ways.

[DD] commented that the model shouldn't care about the direction of flows, and should be able to handle any scenario for net supply or demand for NG. There followed a brief discussion with [SS] regarding the justification of investment decisions in LNG terminal capacity.

[JB] observed that convergence issues can be a continuing concern in the model, and that it may be beneficial to consider smaller LNG capacity additions to mitigate this effect.

[SS] emphasized the importance of getting more and better information from other modules.

[DD] pointed out that, particularly with large capital projects, a lack of convergence throws off capacity planning as expectations for the future and price fluctuations will cause changes in decisions. He questioned whether there were smarter ways to employ foresight other than using the last cycle's values.

[SS] Acknowledged that the use of perfect foresight is bad, but contended that it is still better than the alternatives, adding that price expectations may be constructed by using a weighted average of the results from different cycles, reducing the reliance on the most recent cycle's results.

[DD] reiterated his concerns about the model's tendency to flip price/construction decisions, oscillating between unstable solutions.

[JB] described an effort to anticipate prices if certain capacity decisions were made, using a "reduced form" of OGSM within the NGTDM.

[SS] recommended the consideration of investment decisions based on the long-term consequences of these decisions employing a simultaneous solution method wherein capacity planning and dispatch decisions are linked.

[PW] observed that LNG is so expensive that there is a broad range of NG prices that would make the decision viable, and that capacity utilization would not be greatly affected with price variations. He questioned how the model would account for peak load.

[JB] explained that the model uses a "weather factor" to increase capacity for peak periods. This may be used for capacity expansion purposes and in estimating reserve margins.

[DD] noted that reserve margins may change seasonally, and [PW] suggested that this may be considered to be a possible proxy for how people will use existing capacity. [SS] added that storage may be used as a buffer to moderate peak demands on capacity.

[JB] and Angelina LaRose [AL] engaged in a brief discussion about storage issues and possible constraints within the model.

[JB] asked whether capacity planning relies only on fixed charges, or does it incorporate variable charges, as fixed charges don't impact 1<sup>st</sup> period solutions.

[SS] indicated that fixed charges would influence 2<sup>nd</sup> period decisions, or they may have a deferred impact on 3<sup>rd</sup> period investments. This is a simultaneous decision in which deferred actions are not retained by the model, but are reconsidered anew in the following year. He concluded by noting that capital budgeting decisions need a comprehensive framework whose time frame depends on the industry being considered.

### **End of OnLocation's Comments**

Scheduling conflicts prevented the participation of other commenters. A follow-up meeting will be arranged.