

Review of Natural Gas Transmission and Distribution Model – Component Design Report

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Long Term Investment Decisions

- Long term investment decisions require a vision of the future
- No one makes a long term commitment based on today's needs alone
- NEMS and the NGTDM are tasked with a broad range of scenarios – matching investments with demand growth patterns could be difficult

Long Term Investment Decisions

continued

- The Electricity Market Module (EMM) and Liquid Fuels Market Module (LFMM) face similar long term decisions
- Both view the future from the current NEMS forecast year forward and include a multi-period / multi-year planning horizon
- The EMM uses two models one focuses on the investment decision and one that focuses on the current year supply demand balance
- The LFMM use a single model that is run in two different modes.

Long Term Investment Decisions continued

- Strongly recommend the LFMM approach
- Three periods, current forecast year, next year, and multi-year period that covers the remainder of the forecast horizon.
- Current year is solved every iteration, out year periods solved only once per NEMS year
- Investments decisions are reserved for second and third periods only and only decision in the second period kept.

Demand Distribution

- Natural gas demand fluctuates significantly on a daily and seasonal basis
- Natural gas prices are highly dependent on demand levels
- Requiring the model to satisfy an explicit demand distribution would provide a wider range of prices
- Each demand sector could have a unique profile and as the sector demand vary over time the combined demand pattern would change as well
- Further the EMM could provide a more detailed demand estimate depending on the EMM's loading of combined cycle and turbine units

Pipeline Decisions – Size Matters

- Pipeline investment costs per unit of through put is inversely correlated to the size of the pipeline.
- An LP or an NLV given the choice of 2 or more pipe sizes will choose the biggest pipe because the cost per unit is smaller and there is no requirement to invest in the entire project
- A MIP (mixed integer program) can overcome this issue by requiring that the whole project must be selected.
- In a LP or NLV the pipe size must be selected prior to solving the model. In the NEMS environment, it may be possible to use the prior cycle decision to size the pipes but this may not result in a stable process.

International Demands

- Connection to the international natural gas market is likely to become very important part of NGTDM
- Pipeline investments and flows across the Canadian and Mexican borders should be included as quickly as possible
- Development of LNG ports to export or import natural gas – depending on assumptions about natural gas production and/or environmental regulations
- Multiple international markets, Europe, Asia, South America

Data Driven

- EIA has created an automated interface to many of its data collections and to STEO outputs. It is strongly recommend that this interface be used to create a quick and efficient way to update model inputs.
- This interface has been used in the Short Term LFMM to create much of the model inputs including the crude and product pipeline network.
- Beside almost effortless data updates, this allows the granularity of the model to be changed easily.

Assigning Fixed Costs to Citygate Prices

- An alternative to the hierarchical acyclic network is an LP using the solution information from the NGTDM problem
- For each demand sink there is a set of decision variables, one for each pipe segment in the network
- The constraints are that demands must be met, supply source utilization must match the NGTDM solution and the pipe node utilization must also match the NGTDM solution
- The solution to this LP associates pipe utilization to each demand sink
- Basically uses LP logic to solve a set of linear equations that require that demands, supplies and flows match the NGTDM solution
- This method is used in the CTUS model for the same purpose