

GMO IRP June Stakeholder Meeting

EE-2009-0237

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- integration analysis discussion of inputs and process
- distribution of future values of uncertain factors
- risk analysis

- integrated analysis to be conducted and presented as the revised IRP filing.
 - due date Dec 17, 2010.
- new drivers discussed by stakeholders
 - load forecast from 2010 budget process
 - wind construction costs.
 - new retrofit costs
- other updated drivers
 - national load forecast.

- new market power price forecasts will need to be developed.
 - primary adjustment will be new load forecasts for the GMO system and the rest of the nation

- risk tree from the original filing to be utilized.
- additional uncertain factors will be tested.
 - federal energy efficiency standard
 - “smart grid”
- no changes to the original risk tree will result from these tests.

- discussion concerning alternative plans.
 - sibley 3 replacement options.
- sibley 3 provides
 - 364 MW of dispatchable power
 - 67% 2009 capacity factor
 - estimated 2,300,000 MW-hrs for 2010

- ranges of uncertain factors chosen by subject matter experts.
 - given to integrated analysis with assigned probabilities
 - probabilities of each critical uncertain factor used to develop a risk tree looking at all possible combinations of uncertain factors.
 - taking into account every possible covariant with 486 scenarios
- final risk tree
 - 64 scenarios selected out of the 486
 - chosen because each had a greater than 0.5% conditional probability.

- the preliminary risk tree was developed with each of the 486 branches assigned a probability
 - example: the scenario with high load, high construction, high financing, high CO2 credits, high NG prices and high coal would be:
 $(0.25)(0.25)(0.33)(0.25)(0.25)(0.25)=0.000322$
 - example: the scenario with base load, base construction, base financing, base CO2 credits, base NG prices and base coal would be:
 $(0.5)(0.5)(0.67)(0.5)(0.5)(0.5)=0.020938$

Load Growth
(3 scenarios)

3 Scenarios

Construction Costs
(3 scenarios)

9 Scenarios

Financing Costs
(2 scenarios)

18 Scenarios

CO2 Credits
(3 scenarios)

54 Scenarios

Natural Gas Prices
(3 scenarios)

162 Scenarios

Coal Costs
(3 scenarios)

486 Scenarios

- 486 branch tree pared down to 64 branches.
 - 62 had conditional probabilities greater than 0.5%.
 - 2 additional branches selected to represent extreme scenarios.
- conditional probabilities for the 64 branch tree calculated
 - weighted by the conditional probability of the 486 branch tree

distribution of uncertain factors, cont.

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from Volume 7, Figure 1; the first 20 scenarios

<u>Scenario</u>	<u>Load Growth</u>	<u>Construction Costs</u>	<u>Interest/Finances</u>	<u>CO2</u>	<u>Natural Gas</u>	<u>Coal</u>	<u>Conditional Probability</u>	<u>Cummulative Probability</u>
1	High	High	High	High	High	High	0.081%	0.081%
2	High	High	Mid	Mid	Mid	Mid	1.316%	1.397%
3	High	Mid	Mid	High	Mid	Mid	1.316%	2.712%
4	High	Mid	Mid	Mid	High	Mid	1.316%	4.028%
5	High	Mid	Mid	Mid	Mid	High	1.316%	5.344%
6	High	Mid	High	Mid	Mid	Mid	1.296%	6.640%
7	High	Mid	Mid	Mid	Mid	Mid	2.631%	9.271%
8	High	Mid	Mid	Mid	Mid	Low	1.316%	10.587%
9	High	Mid	Mid	Mid	Low	Mid	1.316%	11.902%
10	High	Mid	Mid	Low	Mid	Mid	1.316%	13.218%
11	High	Low	Mid	Mid	Mid	Mid	1.316%	14.534%
12	Mid	High	Mid	High	Mid	Mid	1.316%	15.849%
13	Mid	High	Mid	Mid	High	Mid	1.316%	17.165%
14	Mid	High	Mid	Mid	Mid	High	1.316%	18.481%
15	Mid	High	High	Mid	Mid	Mid	1.296%	19.777%
16	Mid	High	Mid	Mid	Mid	Mid	2.631%	22.408%
17	Mid	High	Mid	Mid	Mid	Low	1.316%	23.724%
18	Mid	High	Mid	Mid	Low	Mid	1.316%	25.039%
19	Mid	High	Mid	Low	Mid	Mid	1.316%	26.355%
20	Mid	Mid	Mid	High	High	Mid	1.316%	27.671%

- test economic sensitivity of new uncertain factors
 - federal energy efficiency standard/mandate
 - “smart grid”
- develop testing process for each uncertainty
 - difficulty defining nature of each uncertainty
 - confining risks to economic consideration only

- federal legislation mandating various efficiency measures
- assumptions
 - starts in 2011
 - energy consumption reduced annually by a percentage calculated from the targets of Title II in the Waxman-Markey bill.
 - all costs of programs borne by government or consumer via mandate

- Title II summary
 - 30% reduction from baseline in new residential and commercial usage, starting 2011.
 - 50% reduction in new residential in 2014, in new commercial in 2015.
 - 5% growth in target every three years after.

National Annual Energy Reduction from Baseline			
Year	Percent	Year	Percent
2010	0.0%	2020	5.0%
2011	0.4%	2021	5.6%
2012	0.8%	2022	6.2%
2013	1.1%	2023	6.8%
2014	1.6%	2024	7.4%
2015	2.2%	2025	8.0%
2016	2.7%	2026	8.5%
2017	3.3%	2027	9.2%
2018	3.9%	2028	9.7%
2019	4.4%	2029	10.3%

- as a risk, this item would affect national and inter-regional transmission flows.
- assumptions
 - using the July 2009 DOE smart grid report, appendix A, report metrics.
 - 19 of the 20 metrics are either covered in another risk or have no impact on model.
 - metric #16, dynamic line ratings, can be modeled.
 - 15% increase in transmission power flow for 95% of all hours.
- power market price forecast will be modeled with increased inter-regional flow capability.
 - nation-wide “smart grid” costs are assumed to be fixed costs and do not directly impact marginal production costs of electricity.

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