

**Appendix 4:
Missouri GMO IRP
May Stakeholder Meeting
Supply-Side Information**

May 20, 2010

EE-2009-0237

** Public **



From Appendix A - Retirements, Wind Integration and Contingency Planning

- 10. As the starting point of the discussion, GMO will provide
- (a) its load and capacity table; and
- (b) a tabulation of all supply-side and demand-side resources that were considered in developing alternative resource plans for the August 2009 filing.

GMO Load and Capacity Table

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
LOADS										
Projected Internal Demand										
Demand Response - Existing										
Energy Efficiency - Existing										
Peak Responsibility										
Annual Percent Increase										
Capacity Responsibility										
CAPACITY										
Total Existing Generating Capacity										
Total Capacity Purchases										
Total Capacity Sales										
TOTAL ACCREDITED CAPACITY (Existing Resources)										
PLANNED CAPACITY UNDER DEVELOPMENT										
Wind Generation										
Water 2										
TOTAL ACCREDITED CAPACITY (With Planned Additions)										
REQUIRED CAPACITY ADDITIONS (Negative Values)										
CAPACITY MARGIN										
CAPACITY MARGIN ABOVE 12% MARGIN										

Capacity Margin = (Total Accredited – Peak Responsibility)/Total Accredited

GMO Load and Capacity Table

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
LOADS										
Projected Internal Demand										
Demand Response - Existing										
Energy Efficiency - Existing										
Peak Responsibility										
Annual Percent Increase										
Capacity Responsibility										
CAPACITY										
Total Existing Generating Capacity										
Total Capacity Purchases										
Total Capacity Sales										
TOTAL ACCREDITED CAPACITY (Existing Resources)										
PLANNED CAPACITY UNDER DEVELOPMENT										
Wind Generation										
Water 2										
TOTAL ACCREDITED CAPACITY (With Planned Additions)										
REQUIRED CAPACITY ADDITIONS (Negative Values)										
CAPACITY MARGIN										
CAPACITY MARGIN ABOVE 12% MARGIN										

Capacity Margin = (Total Accredited – Peak Responsibility)/Total Accredited



GMO Load and Capacity Table - Expanded

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
LOADS										
Projected Internal Demand										
Demand Response - Existing										
Energy Efficiency - Existing										
Peak Responsibility										
Annual Percent Increase										
Capacity Responsibility										
CAPACITY										
Iatan										
Jeffrey Energy Center 1										
Jeffrey Energy Center 2										
Jeffrey Energy Center 3										
Lake Road 4										
Sibley 1										
Sibley 2										
Sibley 3										
Greenwood 1										
Greenwood 2										
Greenwood 3										
Greenwood 4										
Jeffrey Wind Turbine 1										
Jeffrey Wind Turbine 2										
KCI 1										
KCI 2										
Lake Road 1										
Lake Road 2										
Lake Road 3										
Lake Road 5										
Lake Road 6										
Lake Road 7										
Nevada										
Ralph Green 3										
South Harper 1										
South Harper 2										
South Harper 3										
Cross Roads Unit 1										
Cross Roads Unit 2										
Cross Roads Unit 3										
Cross Roads Unit 4										
Total Existing Generating Capacity										
Total Capacity Purchases										
Total Capacity Sales										
TOTAL ACCREDITED CAPACITY (Existing Resources)										
PLANNED CAPACITY UNDER DEVELOPMENT										
Wind Generation										
Iatan 2										
TOTAL ACCREDITED CAPACITY (With Planned Additions)										
REQUIRED CAPACITY ADDITIONS (Negative Values)										
CAPACITY MARGIN										
CAPACITY MARGIN ABOVE 12% MARGIN										
- RESERVE MARGIN										

GMO Load and Capacity Table - Expanded

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
LOADS										
Projected Internal Demand										
Demand Response - Existing										
Energy Efficiency - Existing										
Peak Responsibility										
Annual Percent Increase										
Capacity Responsibility										
CAPACITY										
Iolan										
Jeffrey Energy Center 1										
Jeffrey Energy Center 2										
Jeffrey Energy Center 3										
Lake Road 4										
Sibley 1										
Sibley 2										
Sibley 3										
Greenwood 1										
Greenwood 2										
Greenwood 3										
Greenwood 4										
Jeffrey Wind Turbine 1										
Jeffrey Wind Turbine 2										
KCI 1										
KCI 2										
Lake Road 1										
Lake Road 2										
Lake Road 3										
Lake Road 5										
Lake Road 6										
Lake Road 7										
Nevada										
Ralph Green 3										
South Harper 1										
South Harper 2										
South Harper 3										
Cross Roads Unit 1										
Cross Roads Unit 2										
Cross Roads Unit 3										
Cross Roads Unit 4										
Total Existing Generating Capacity										
Total Capacity Purchases										
Total Capacity Sales										
TOTAL ACCREDITED CAPACITY (Existing Resources)										
PLANNED CAPACITY UNDER DEVELOPMENT										
Wind Generation										
Iolan 2										
TOTAL ACCREDITED CAPACITY (With Planned Addition)										
REQUIRED CAPACITY ADDITIONS (Negative Values)										
CAPACITY MARGIN										
CAPACITY MARGIN ABOVE 12% MARGIN										
- RESERVE MARGIN										

Supply-Side Resources

	SCPC	SCPC w/CCS*	Circulating Fluid Bed	IGCC	IGCC w/CCS*	Nuclear	Combined Cycle
Capital w/o AFUDC (\$/kW)							
Low							
Mid							
High							
Fixed O&M (\$/kW-yr)							
Low							
Mid							
High							
Variable O&M (\$/MWh)							
Low							
Mid							
High							
FFOR (%)							
Low							
Mid							
High							
* CCS = Amine Absorption Capture and Compression - No Pipeline, Transportation or Sequestration Costs Included							

Supply-Side Resources

	Combined Cycle - Total Ownership Offer	CT - G.E. 7EA	CT - LM6000	Wind	CAES	Solid Oxide Fuel Cells	Reciprocating Engines
Capital w/o AFUDC (\$/kW)							
Low							
Mid							
High							
Fixed O&M (\$/kW-yr)							
Low							
Mid							
High							
Variable O&M (\$/MWh)							
Low							
Mid							
High							
EFOR (%)							
Low							
Mid							
High							

Supply-Side Resources

	Distributed Generation	Photovoltaic Flat Plate	Animal Waste-Poultry	Landfill Gas	10% Biomass for Existing Unit	100% Biomass Fluidized Bed
Capital w/o AFUDC (\$/kW)						
Low						
Mid						
High						
Fixed O&M (\$/kW-yr)						
Low						
Mid						
High						
Variable O&M (\$/MWh)						
Low						
Mid						
High						
EFOR (%)						
Low						
Mid						
High						

Note: 10% Biomass is assumed as a retrofit option for an existing unit.

Demand-Side Resources

PEAK (MW)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Energy Optimizer	10.7	18.2	21.1	23.4	24.3	25.2	26.0	27.0	27.9	28.8
MPower	11.6	25.5	36.0	42.7	45.1	45.8	46.5	47.3	48.0	48.7
TOTAL	22.3	43.6	57.1	66.1	69.4	70.9	72.6	74.3	75.9	77.6
Change a Light	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Energy Star	0.2	0.5	0.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Low Income Weatherization	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Low Income Affordable New Homes	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Energy Star New Homes	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Building Operator Certification	0.5	1.4	2.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
TOTAL	1.3	3.0	4.7	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Appliance Turn In	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Blue Line	0.5	1.0	1.6	2.1	2.5	2.8	3.1	3.3	3.5	3.7
Cool Homes	0.1	0.2	0.3	0.3	0.4	0.5	0.5	0.5	0.6	0.6
Energy Star	4.7	9.7	15.2	19.1	23.1	26.1	29.1	30.6	32.7	34.4
On Line Audit	0.1	0.2	0.4	0.4	0.5	0.6	0.7	0.7	0.8	0.8
TOTAL	5.4	11.3	17.7	22.3	27.0	30.5	34.0	35.7	38.2	40.2
Custom Rebate	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Prescriptive Rebate	0.4	0.9	1.5	2.2	3.1	3.0	2.8	2.8	2.8	2.7
TOTAL	2.4	5.2	8.5	12.5	17.3	16.7	16.1	15.9	15.6	15.3
GRAND TOTAL	31.8	64.1	89.4	109.4	122.9	127.3	131.7	134.9	138.6	142.0

Demand-Side Resources

PEAK (MW)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Energy Optimizer	29.8	30.8	31.8	32.8	33.9	35.0	36.1	37.2	38.3	39.5
MPower	49.5	50.4	51.1	51.9	52.9	54.0	55.1	56.2	57.3	58.5
TOTAL	79.4	81.2	83.0	84.8	86.8	88.9	91.1	93.4	95.7	98.0
Change a Light	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Energy Star	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Low Income Weatherization	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Low Income Affordable New Homes	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Energy Star New Homes	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Building Operator Certification	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
TOTAL	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Appliance Turn In	3.8	3.8	3.8	3.8	3.7	3.3	3.0	2.6	2.3	1.9
Blue Line	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.4	0.3
Cool Homes	35.1	35.3	35.2	34.8	34.2	30.8	27.5	24.4	21.1	17.9
Energy Star	0.8	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.4
On Line Audit	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.4	0.3
TOTAL	41.0	41.3	41.1	40.6	39.9	35.9	32.1	28.5	24.6	20.9
Custom Rebate	2.5	2.4	2.1	1.9	1.6	1.5	1.3	1.1	0.7	0.2
Prescriptive Rebate	14.4	13.3	12.0	10.7	9.3	8.6	7.5	6.1	4.0	1.4
TOTAL	16.9	15.7	14.1	12.6	10.9	10.1	8.9	7.2	4.7	1.6
GRAND TOTAL	143.4	144.3	144.4	144.2	143.8	141.1	138.3	135.3	131.2	126.7

Sibley 3 Discussion - Background Information

- Capacity = 364 MW
- Capacity Factor = 67%
- Projected Energy for 2010 = ~2,300,000 MWh
- 11. GMO and the other Parties agree to discuss combinations of demand and supply side resources that would be sufficient to replace the energy and capacity currently provided by the Sibley 3 unit and that would be sufficient to replace the energy and capacity that Sibley 3 is projected to provide in future years if the unit undergoes the program of environmental retrofits that is proposed by the company.
- The expected impact of proposed retrofits on the unit's heat rate and capacity factor will also be discussed.

Sibley 3 Discussion - Background Information

Input Data	2009 GMO IRP	Sega
BACT Capital Cost		
VOM (\$/MWh)		
FOM (\$/kW)		
Aux Load (MW)		
Heat Rate Increase (Btu/KWh)		
SO ₂ emission rate (lbs/mmBtu)		
NO _x emission rate (lbs/mmBtu)		
Hg (lbs/Tbtu)		

- IRP: BACT technology assumed for Sibley 3 consisted of a Wet Flue Gas Desulfurization (WFGD) system for SO₂, PJFF baghouse and Activated Carbon Injection (ACI) for Mercury with estimates obtained in 2007 plus a 20% contingency factor
- Sega: BACT technology assumed for Sibley 3 consisted of a Circulating Fluidized Bed Scrubber system for SO₂, PJFF baghouse and Activated Carbon Injection (ACI) for Mercury

Sibley 3 Discussion - Background Information

Technology Data	2009 GMO IRP	Sega
Net Capacity (MW)	351	360
Capacity Factor	67.0%	67.0%
Fixed O&M (\$/kW-Yr)		
Var O&M (\$/MWh)		
Technology Cost w/AFUDC (\$/kW)		
Technology Capital		
Levelized FCR for construction projects		
Annual Technology Carrying Cost		
Total Fixed O&M		
Total Variable O&M		
Total Fixed Cost Per Year		
Total Fixed Cost Per Year (\$/MWh)		
Ht Rt (Btu/KWh)		
Fuel Cost \$/mmbtu		
Fuel Cost \$/MWh		
All-In (\$/MWh)		
All-In with Emissions Costs (\$/MWh)		
Emissions		
SO2 emission rate (lbs/mmBtu)		
SO2 emission rate (lbs/MWh)		
SO2 emission (\$/MWh) at \$954/ton		
NOx emission rate (lbs/mmBtu)		
NOx emission rate (lbs/MWh)		
NOx emission (\$/MWh) at \$292/ton		
NOx Seasonal emission (\$/MWh) at \$231/ton		

Wind Integration Discussion

- 17. GMO commits to include discussions regarding reliable wind integration and contingency supply planning.
- Topics?