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2014 Economic Planning Study Kickoff

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Introduction

- Process Overview and Timeline
- 2014 Futures Development
  - Historical Process
  - Proposed Process
- MISO MTEP15 Futures Assumptions
- Next Steps

Process Overview and Timeline

- ATC Economic Project Planning
  - **During February,** we hold an initial stakeholder meeting to review the market congestion summary and potential fixes and to discuss economic study scenarios, drivers, ranges, and assumptions.
  - **By March 1**, we work with stakeholders to request and prioritize new/other economic studies and recommend study assumptions.
  - **By April 15** – we identify preliminary areas of economic study, study assumptions and models and solicit further comments from stakeholders.
  - **By May 15** – we finalize areas of economic study, study assumptions and models to be used in analysis.
  - **By November 15** – we provide a summary of the results of the economic analyses to our stakeholders.

2013 Futures Development

- ATC Historical Process - Prior to 2012
  - Develop ATC specific Futures Matrix
  - Modify MISO PROMOD models to match ATC assumptions
  - Process originated prior to expanded stakeholder involvement in MISO MTEP models
- 2013-Present Proposed Process
  - Do not create ATC specific Futures Matrix
  - Utilize the MISO MTEP models and futures
  - Review MISO models and provide updates as necessary
  - Ensures greater alignment with MISO stakeholder process

MISO MTEP15 Futures Definitions

Future	Narrative
Business As Usual	***The baseline, or Business as Usual, future captures all current policies and trends in place at the time of futures development and assumes they continue, unchanged, throughout the duration of the study period. All applicable EPA regulations governing electric power generation, transmission and distribution (NAICS 2211) are modeled. Demand and energy growth rates are modeled at a level equivalent to the 50/50 forecasts submitted into the Module E Capacity Tracking (MECT) tool. All current state-level Renewable Portfolio Standard (RPS) mandates are modeled. To capture the expected effects of environmental regulations on the coal fleet, 12.6 GW of coal unit retirements are modeled.***
Limited Growth	***The Limited Growth future is designed to capture the effects of the economy turning back toward recession-like levels. Greater impacts from demand-side management resources, especially energy efficiency on the residential side, are contributors to reductions in projected demand and energy growth. RPS mandates are modeled as they currently exist and all applicable EPA regulations governing electric power generation, transmission and distribution (NAICS 2211) are modeled. To capture the expected effects of environmental regulations on the coal fleet, 12.6 GW of coal unit retirements are included.***
High Growth	***The High Growth future is designed to capture the effects of pre-recession level economic growth as well as an increase in renewable energy over the entire footprint. All current state-level Renewable Portfolio Standard (RPS) mandates are modeled. All existing EPA regulations governing electric power generation, transmission and distribution (NAICS 2211) are incorporated and 12.6 GW of coal unit retirements are included.***
Generation Shift	***The Generation Shift future focuses on several key items which combine to result in a substantial shift in the main sources of energy in the MISO footprint.*** ***• MISO assumes each non-coal & non-nuclear thermal generator will be retired at 50 years of age.*** ***• Hydro units will retire at 100 years of age.*** ***• Additional coal unit retirements, coupled with a carbon tax and a 20% footprint wide renewable mandate, result in system-wide energy sales derived from coal generation falling to 40% by the end of the 20-year study period."*** ***• Demand and energy growth rates are modeled at a mid level.***
Public Policy	***The Public Policy future captures the effects of increased carbon regulations and an even greater move toward clean energy production and efficient use of resources. Total energy sales derived from coal fall to 25% as a result of the combined effects of a carbon tax, coal unit retirements, and a 30% MISO-wide renewable mandate. Demand and energy growth rates are modeled at a mid level.***

MISO MTEP15 Future Matrix

Future	Demand and Energy	Retirements	Natural Gas Price	Renewable Portfolio Standards	CO2	Demand Side Management
Business as Usual	Mid	12.6 GW Coal	Mid	State Mandates	None	Mid
High Growth	High	12.6 GW Coal	High	State Mandates	None	Mid
Limited Growth	Low	12.6 GW Coal	Low	State Mandates	None	Mid
Generation Shift	Mid	Coal falling to 40% of energy; plus age-related	Mid	20% MISO-wide Mandate	$10 cost	High
Public Policy	Mid	Coal falling to 40% of energy	Mid	30% MISO-wide Mandate	$50-$75 cost	High

Source: MISO 1-29-2014 PAC Meeting (https://www.misoenergy.org/Events/Pages/PAC20140129.aspx)

MISO MTEP15 Future Matrix

Future	Demand and Energy	Retirements	Natural Gas Price	Renewable Portfolio Standards	CO2	Demand Side Management
Business as Usual	0.8%	12.6 GW Coal	$4.30	7 GW wind / 2.3 GW Solar	None	6,800 GWh / 18 MW
High Growth	1.5%	12.6 GW Coal	$5.16	10 GW wind / 2.5 GW Solar	None	7,800 GWh / 20 MW
Limited Growth	0.14%	12.6 GW Coal	$3.44	4 GW wind / 2 GW Solar	None	6,000 GWh / 16 MW
Generation Shift	0.8%	12.6 GW Coal + 11.6 GW age-related + add'l coal to achieve 40%	$4.30	28 GW wind / 7 GW Solar	$10 cost	26,100 GWh / 2,200 MW
Public Policy	0.8%	Min 23 GW Coal; 25% of energy from coal in 2033	$4.30	43 GW wind / 18 GW Solar	$50-$75 cost	26,100 GWh / 2,200 MW

Source: MISO 1-29-2014 PAC Meeting (https://www.misoenergy.org/Events/Pages/PAC20140129.aspx)

MISO MTEP15 Futures Matrix

	Uncertainties																													
	Capital Costs														Demand and Energy					Fuel Cost (Starting			Fuel Escalations			Emission Costs			Other Variables		
Future	Coal	CC	CT	Nuclear	Wind Onshore	IGCC	IGCC w/ CCS	CC w/ CCS	Pumped Storage Hydro	Compressed Air Energy	Photovoltaic	Biomass	Conventional Hydro	Wind Offshore	Demand Response Level	Energy Efficiency Level	Demand Growth Rate	Energy Growth Rate	Natural Gas Forecast	Oil	Coal	Uranium	Oil	Coal	Uranium	SO_2	NO_x	CO_2	Inflation	Retirements	Renewable Portfolio Standards
Business As Usual	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	L	M	L	L
High Growth	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M	M	H	H	H	M	M	M	H	H	H	L	L	L	H	L	L
Limited Growth	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	M	L	L	L	L	L	M	L	L	L	L	L	L	L	L	L
Generation Shift	M	H	H	M	M	M	M	M	M	M	M	M	M	M	H	H	M	M	M	L	L	M	M	M	M	L	L	M	M	M	M
Public Policy	H	H	H	M	M	M	M	M	M	M	M	M	M	M	H	H	M	M	M	L	L	M	M	M	M	L	L	H	M	H	H

Source: MISO 1-29-2014 PAC Meeting (https://www.misoenergy.org/Events/Pages/PAC20140129.aspx)

MISO MTEP 15 Futures
Uncertainty Variables – Capital Costs

MTEP15 FUTURES MATRIX				
Uncertainty	**Unit**	**Low (L)**	**Mid (M)**	**High (H)**
New Generation Capital Costs[1]				
Coal	($/KW)	2,247	2,996	3,745
CC	($/KW)	783	1,045	1,306
CT	($/KW)	518	690	863
Nuclear	($/KW)	4,235	5,647	7,058
Wind-Onshore	($/KW)	1,525	2,034	2,542
IGCC	($/KW)	2,898	3,864	4,830
IGCC w/ CCS	($/KW)	5,054	6,738	8,423
CC w/ CCS	($/KW)	1,604	2,139	2,674
Pumped Storage Hydro	($/KW)	4,050	5,400	6,750
Compressed Air Energy Storage	($/KW)	957	1,276	1,595
Photovoltaic	($/KW)	2,225	2,966	3,708
Biomass	($/KW)	3,151	4,201	5,251
Conventional Hydro	($/KW)	2,248	2,998	3,747
Wind-Offshore	($/KW)	4,771	6,362	7,952

[1] All costs are overnight construction costs in 2014 dollars; sourced from EIA and escalated according to the GDP Implicit Price Deflator; H and L values are 25% +/- from the M value

Source: MISO 1-29-2014 PAC Meeting (https://www.misoenergy.org/Events/Pages/PAC20140129.aspx)

MISO MTEP15 Futures
Uncertainty Variables – Demand and Energy

MTEP15 FUTURES MATRIX				
Uncertainty	**Unit**	**Low (L)**	**Mid (M)**	**High (H)**
Demand and Energy				
Demand Growth Rate[2]	%	0.14%	0.80%	1.50%
Energy Growth Rate[3]	%	0.14%	0.80%	1.50%
Demand Response Level[4]	%		State mandates only	State mandates and goals
Energy Efficiency Level[4]	%		State mandates only	State mandates and goals

[2] Mid value for demand growth rate is the Module-E 50/50 load forecast growth rate
[3] Mid value for energy growth rate is the Module-E energy forecast growth rate
[4] MTEP13 modeled state mandates and goals for DR & EE

Source: MISO 1-29-2014 PAC Meeting (https://www.misoenergy.org/Events/Pages/PAC20140129.aspx)

MISO MTEP15 Futures
Uncertainty Variables – Fuel Forecasts

MTEP15 FUTURES MATRIX				
Uncertainty	**Unit**	**Low (L)**	**Mid (M)**	**High (H)**
Natural Gas				
Natural Gas[5]	($/MMBtu)	Bentek -20%	Bentek forecast from Phase III Gas Study	Bentek +20%
Fuel Prices (Starting Values)				
Oil	($/MMBtu)	Powerbase default -20%	Powerbase default[6]	Powerbase default + 20%
Coal	($/MMBtu)	Powerbase default -20%	Powerbase default[7]	Powerbase default + 20%
Uranium	($/MMBtu)	0.91	1.14	1.37
Fuel Prices (Escalation Rates)				
Oil	%	2.0	2.5	4.0
Coal	%	2.0	2.5	4.0
Uranium	%	2.0	2.5	4.0

[5] Prices reflect the Henry Hub natural gas price

[6] Powerbase default for oil is $19.39/MMBtu

[7] Powerbase range for coal is $1 to $4, with an average value of $1.69/MMBtu; based on MTEP13 database

Source: MISO 1-29-2014 PAC Meeting (https://www.misoenergy.org/Events/Pages/PAC20140129.aspx)

MISO MTEP15 Futures
Uncertainty Variables - Emissions

MTEP15 FUTURES MATRIX				
Uncertainty	**Unit**	**Low (L)**	**Mid (M)**	**High (H)**
Emissions Costs				
SO_2	($/ton)	0	0	500
NO_x	($/ton)	0	0	Seasonal NO_x: 1000
CO_2	($/ton)	0	10	range

Source: MISO 1-29-2014 PAC Meeting (https://www.misoenergy.org/Events/Pages/PAC20140129.aspx)

MISO MTEP15 Futures
Uncertainty Variables - Other

MTEP15 FUTURES MATRIX				
Uncertainty	**Unit**	**Low (L)**	**Mid (M)**	**High (H)**
Other Variables				
Inflation	%	2.0	2.5	4.0
Retirements	MW	12,600 MW	MW age-related	range
Renewable Portfolio Standards	%	State mandates only	20% MISO-wide mandate Solar 5% of overall mandate	30% MISO-Wide Mandate Solar 10% of overall mandate

Source: MISO 1-29-2014 PAC Meeting (https://www.misoenergy.org/Events/Pages/PAC20140129.aspx)

Stakeholder and Customer Feedback

- ATC is soliciting stakeholders and customers for new/other economic studies and recommended study assumptions changes for our 2014 study
- ATC has received a study assumptions request from the Energy Planning and Information Committee – Town of Stark
  - ATC is currently reviewing this request

Next Steps

- Project / Analysis Development
  - Review of Congestion
  - Stakeholder Feedback
- 2014 Futures Development
  - Continued Review of MISO MTEP15 Development
  - Review of MISO PROMOD Models
- Analysis of Projects
  - Study Years - 2024
  - Futures – All MISO MTEP15 Futures
- Timelines
  - April 15: Define Preliminary Assumptions
  - May 15: Finalize Assumptions
  - November 15: Provide Analysis Update

Questions?

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Thank You For Your Time!