

# EVALUATION OF THE MIDWEST RPO INTERIM MEASURES AND EGU1 AND EGU2

*Submitted On Behalf of*  
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# OBJECTIVE OF STUDY

- Evaluate compliance and marginal costs for CAIR and the two Interim Measures (Caps) for the year 2012
- Evaluate the compliance and marginal costs for CAIR and EGU1 and EGU2 (Caps) for the year 2013
- Modeling significantly different from March due to change in numerous assumptions
- Modeling for EGU1 & 2 was in two steps:
  - Initial compliance to meet the EGU caps without regard to costs
  - Evaluated the expected costs to meet the EGU caps

# APPLICABLE EMISSION RATES FOR THE 5-STATE REGION

Scenario	NOx (lbs/MBtu)	SO2 (lbs/MBtu)
Base/CAIR	0.15	0.58
IM1	0.15	0.36
IM2	0.12	0.24
EGU1	0.10	0.15
EGU2	0.07	0.10

# INTERIM MEASURES AND EGU1 & 2

- Affected Units – Fossil Units >25 MW That Sell Electricity To The Grid
- Applicable Emission Rates Are Used To Establish State Budgets Within the Five States
- IM and EGU State & Unit Budgets Followed The CAIR Allocation Process For NO<sub>x</sub>
- Alternative to CAIR SO<sub>2</sub> Allocation for IM and EGU Based Upon Average Heat Input For Years 2000 – 2004 from EPA's CEMs data for Acid Rain units
- Regional Trading and Banking of Allowances Allowed Within the 5-States for the Interim Measures

# REGIONAL BUDGETS

(in tons)

Scenario	NOx	SO2
CAIR	399,895	1,046,659
IM1	376,037	860,956
IM2	300,830	573,971
EGU1	250,069	358,732
EGU2	175,484	239,154

# EMISSIONS-ECONOMIC MODELING SYSTEM

- Determines a least cost solution for a specific utility system under a specific regulatory regime
- Evaluates a combination of compliance options (technology cost vs allowance prices) at the unit level
- Allocates allowances to affected units (e.g., CAIR allowances)
- Assumes perfect market behavior
- Provides a feed-back mechanism to re-adjust emissions based upon compliance decisions
- Incorporate an extensive data base of unit design and operational data
- EIA AEO 2005 regional generation forecasts and regional fuel prices

# SO<sub>2</sub> CONTROL TECHNOLOGY CHOICES

- SO<sub>2</sub> Controls
  - Base Wet FGD System with SO<sub>2</sub> removal efficiencies of 90 and 95 percent for PRB/sub-bituminous coals, respectively
  - High Performance Wet FGD System with SO<sub>2</sub> removal of 94 and 98 percent for PRB/sub-bituminous coals, respectively
  - FGD Upgrade for existing FGD systems with removal efficiencies at or below 90 percent to 93 percent
  - Fuel Switching from a high sulfur coal to a low sulfur PRB coal
  - Fuel Switching Existing or Retrofitted FGDs an aggressive fuel switch from high sulfur bituminous coal to a PRB coal for the EGU scenarios.

# NOX CONTROL TECHNOLOGY CHOICES

- NOx Controls
  - Combustion Modifications installed on units that exceed specified NOx emission rates
  - Selective Non-Catalytic Reduction (SNCR) with NOx removal efficiencies upwards to 45 percent depending on size
  - Selective Catalytic Reduction (SCR) limited to 90 percent removal or specified floors depending on coal type

# 5-STATE CONTROL TECHNOLOGIES

- FGD Capacity
  - Through 2009: 26.9 GW
  - Announced 2010 – 2012: 10.3 GW
  - Projected CAIR 2010 – 2012: 3.4 GW
- SCR Capacity
  - Through 2009: 34.6 GW
  - Announced 2010 – 2012: 4.0 GW
  - Projected CAIR 2010 – 2012: 10.0 GW
- SNCR Capacity
  - Through 2009: 4.9 GW
  - Announced 2010 – 2012: 0
  - Projected CAIR 2010 – 2012: 11.6 GW

# SUMMARY OF REGIONAL CONTROLLED CAPACITY: 2012

Element	Capacity (GW)	% of Regional Capacity
Coal-fired Capacity (>25 MW)	82.7	
FGD	40.7	49.2
SCR	48.6	59.8
SNCR	16.5	19.9

# SUMMARY OF REGIONAL CONTROLLED CAPACITY: 2012

- By the end of 2009 43% of the region's coal-fired capacity will be burning PRB or a PRB blend
- Combustion modifications will be installed on 2.4 GW of coal-fired capacity between 2010 - 2012

# 5-STATE SO<sub>2</sub> & NO<sub>x</sub> EMISSIONS:2003 & 2009 & 2012

Parameter	2003	2009	2012
Heat Input: TBtu	4,817	5,871	5,991
NO <sub>x</sub> : tons	921,884	403,918	380,050
NO <sub>x</sub> : lbs/mmbtu	0.38	0.14	0.13
SO <sub>2</sub> : tons	2,896,631	2,322,306	1,631,714
SO <sub>2</sub> : lbs/mmbtu	1.20	0.79	0.54

# INITIAL SO2 COMPLIANCE COSTS

(in 2003 \$)

Simulation	Eff. ER	MC (\$/ton)	Ann. \$	Emissions
CAIR (2012)	0.54	1,052		1,631,000
IM1(2012)	0.29	2,598	1.6B	860,000
IM2(2012)	0.19	5,029	2.6B	573,000
EGU1(2013)	0.12	23,472	4.3B	372,000
EGU2(2013)	0.12	23,472	4.3B	372,000

# SO2 CONTROL TECHNOLOGY – FIVE STATE REGION: (in GW)

Tech	5-State (OTB)	IM1	IM2	EGU1	EGU2
FGD	40.7	59.1	75.4	80.8	80.8
FGD FS	0	0	0	18.6	18.6
FGDI	1.5	2.2	4.6	3.6	3.6

# INITIAL NOX COMPLIANCE COSTS: 2012

(in 2003 \$)

Simulation	Eff. ER	MC (\$/ton)	Ann. \$	Emissions
CAIR(2012)	0.13	2,584		380,000
IM1(2012)	0.12	4,122	457M	376,000
IM2 (2012)	0.10	4,669	604M	300,000
EGU1(2013)	0.08	10,169	865M	250,000
EGU2 (2013)	0.08	12,377	873M	249,000

# NO<sub>x</sub> CONTROL TECHNOLOGY – FIVE STATE REGION: (in GW)

Tech	5 – State (CAIR)	IM1	IM2	EGU1	EGU2
SCR	48.6	55.3	61.5	73.6	74.0
SNCR	16.5	9.0	5.8	6.1	6.2

# SUMMARY OF INITIAL COSTS (2003 \$)

Simulation	Capital	Annual	SO2 MC (\$/ton)	NOx MC (\$/ton)
CAIR (2012)			1,052	2,584
IM1(2012)	9.5B	2.0B	2,598	4,122
IM2(2012)	15.5B	3.2B	5,029	4,669
EGU1(2013)	20.4B	5.2B	23,472	10,169
EGU2(2013)	20.5B	5.2B	23,472	12,377

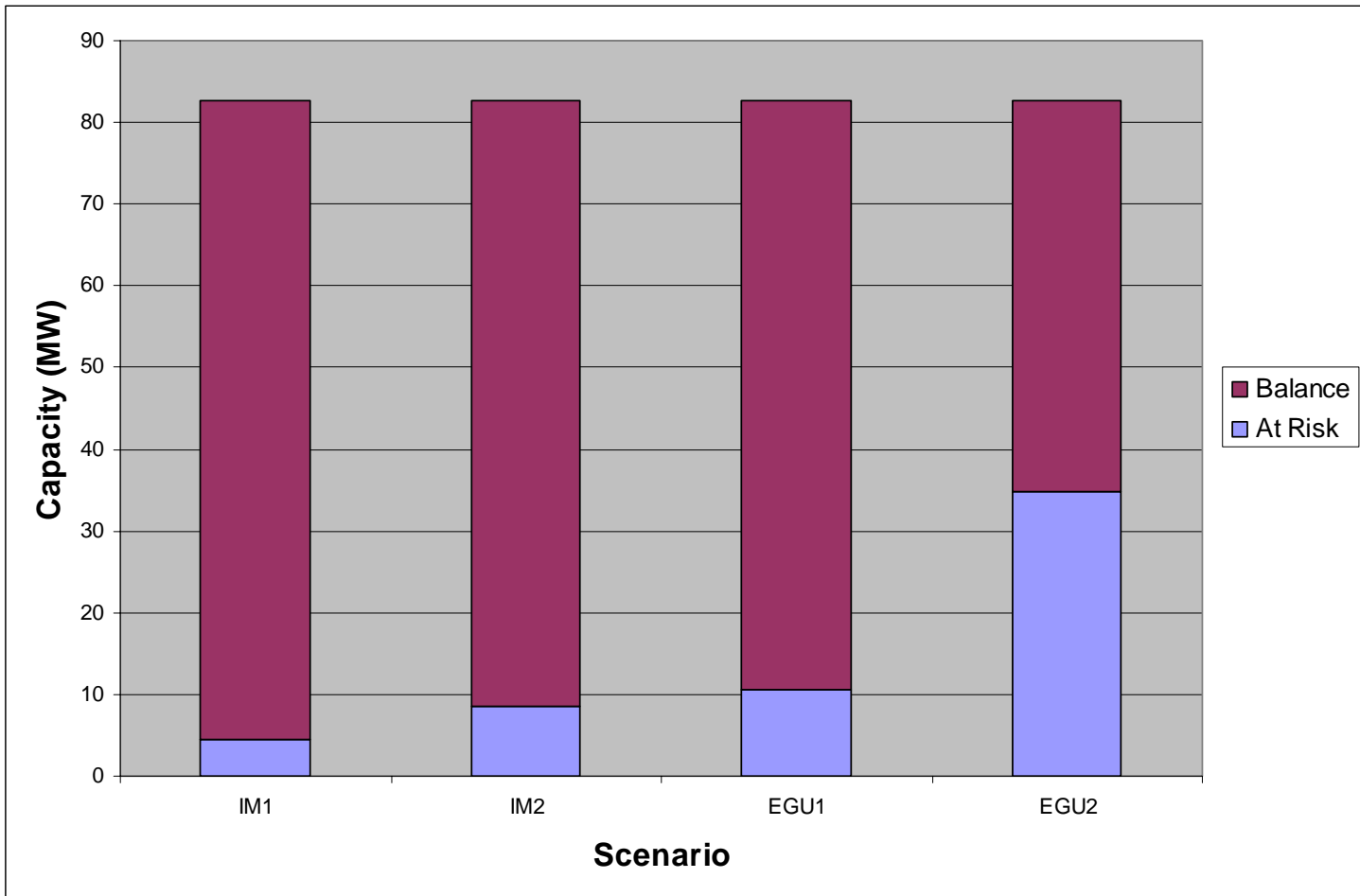
# WHAT DOES THIS MEAN IN TERMS OF IM1 & 2 COMPLIANCE

- To Meet IM1 SO<sub>2</sub> Cap – Technology has to be Installed on Units 56 to 60 Years Old Resulting in a Marginal Cost of \$2,598/ton and Potentially having 4.4 GW at Risk
- To Meet IM2 SO<sub>2</sub> Cap – Technology has to be Installed on Units 56 to 60 Years Old Resulting in a Marginal Cost of Almost \$5,029/ton and Potentially having 8.5 GW at Risk
- To Meet IM2 NO<sub>x</sub> Cap – Forces Systems to Switch from SNCR (IM1) to SCR Resulting in a Marginal Cost of Almost \$4,669/ton to Meet an Effective Emission Rate of 0.10

# WHAT DOES THIS MEAN IN TERMS OF EGU1 & 2 COMPLIANCE

- With Extremely Aggressive Controls SO<sub>2</sub> Emissions in 2013 would be 13,000 tons Above the EGU1 Cap and 132,000 Above the EGU2 Cap
- All Units that can get Technology have it, which Includes Scrubbed Units Switching to PRB – 98.2 Percent of the Region's Coal-Fired Capacity will have Scrubbers
- Moving From A National to Regional Trading Regime coupled with very Stringent Reduction targets significantly Raises the Cost of Compliance
- EGU1 could Result in the Retirement of upwards to 10.6 GW of Existing Coal-Fired Capacity due to Compliance and Age
- EGU2 could Result in the Retirement of upwards to 34.9 GW Existing Coal-Fired Capacity due to Compliance and Age
- To Replace the 10.6 and 34.9 GW of Coal-Fired Capacity through a Combination of Imports, Existing and New Gas-Fired Capacity would result in an Incremental Cost \$1.4 and \$4.9 Billion, respectively, in 2013

# COMPARISON OF CAPACITY AT RISK TO TOTAL COAL-FIRED CAPACITY



# REGIONAL BUDGETS & 2013 ANNUALIZED COMPLIANCE COSTS

Scenario	NOx	SO2	Costs
CAIR	399,895	1,046,659	0.7B
IM1	376,037	860,956	2.0B
IM2	300,830	573,971	3.2B
EGU1	250,069	358,732	5.0B
EGU2	175,484	239,154	7.1B