EVALUATION OF THE MIDWEST RPO INTERIM MEASURES AND EGU1 AND EGU2

Submitted On Behalf of
Midwest Ozone Group

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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 NOx
- Alternative to CAIR SO2 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

SO2 CONTROL TECHNOLOGY CHOICES

- SO2 Controls
  - Base Wet FGD System with SO2 removal efficiencies of 90 and 95 percent for PRB/sub- bituminous coals, respectively
  - High Performance Wet FGD System with SO2 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 SO2 & NOx EMISSIONS:2003 & 2009 & 2012

Parameter	2003	2009	2012
Heat Input: TBtu	4,817	5,871	5,991
NOx: tons	921,884	403,918	380,050
NOx: lbs/mmbtu	0.38	0.14	0.13
SO2: tons	2,896,631	2,322,306	1,631,714
SO2: 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

NOx 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

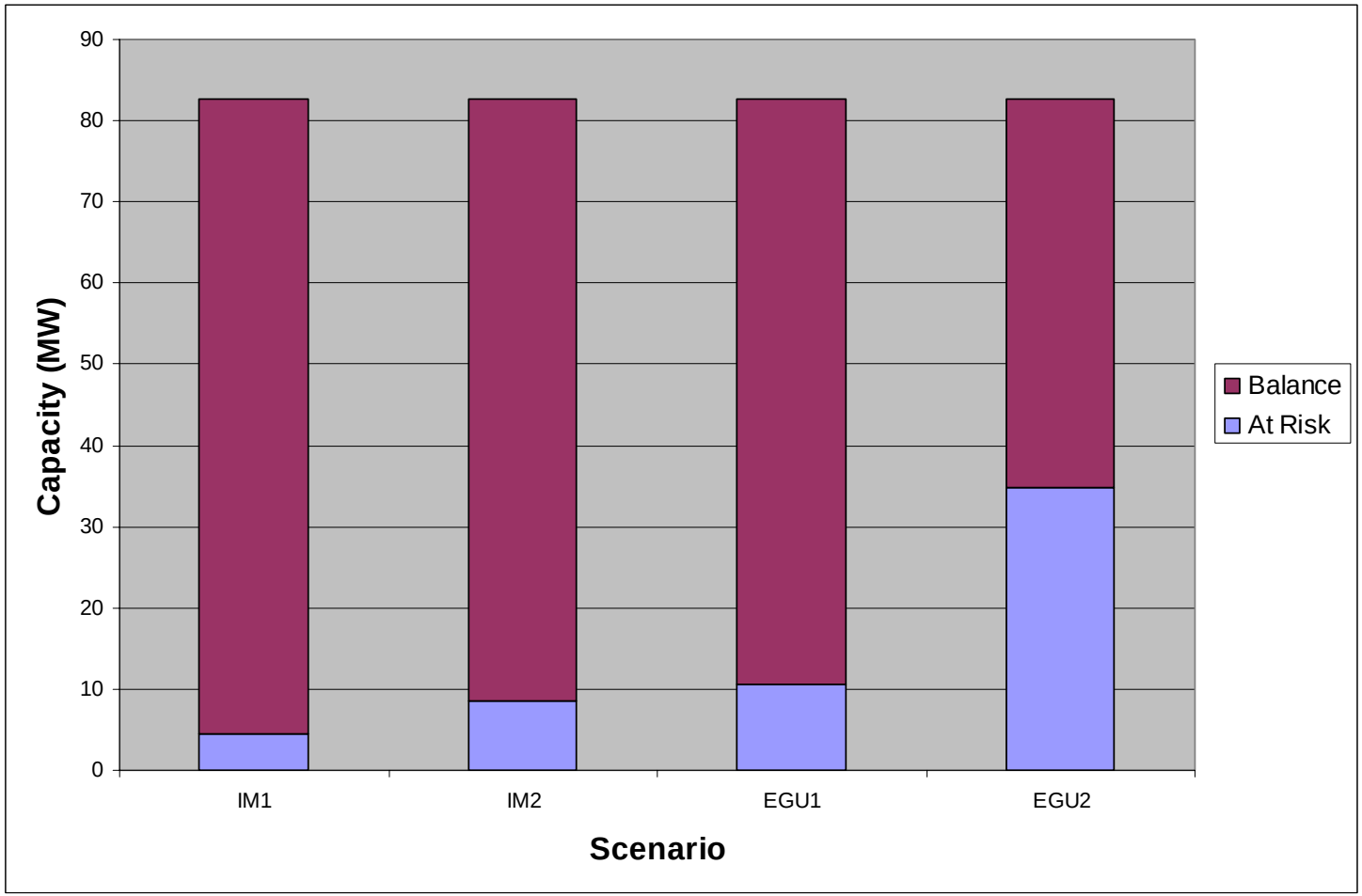
WHAT DOES THIS MEAN IN TERMS OF IM1 & 2 COMPLIANCE

- To Meet IM1 SO2 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 SO2 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 NOx 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 SO2 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
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IM2	300,830	573,971	3.2B
EGU1	250,069	358,732	5.0B
EGU2	175,484	239,154	7.1B