



# CSAPR and EPA Regulations Impacting Louisiana Power Generation

*Air and Waste Management Association (Louisiana Section) Fall Conference. Environmental Focus 2011: A Multi-media Forum*

October 25, 2011  
Baton Rouge, Louisiana



David E. Dismukes, Ph.D.  
Center for Energy Studies  
Louisiana State University

## **Rapidly Changing Regulations**

**Electric Industry Environmental Regulations Create Uncertainty for Coal****National Ambient Air Quality Standards (NAAQS)**

- Sets acceptable levels for six criteria pollutants (carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, sulfur dioxide).
- A network of 4,000 State and Local Air Monitoring Stations is used to determine if geographic areas are meeting or exceeding the NAAQS.

**Transport Rule (now CSAPR) [proposed]**

- Issued to replace the Clean Air Interstate Rule (“CAIR”) and its predecessor the Clean Air Transport Rule (“CATR”). Requires 31 states (and D.C.) to improve air quality by reducing power plant emissions (SO<sub>2</sub> and NO<sub>x</sub>) that contribute to ozone and fine particulate pollution in other states (some annual, some on ozone season only).
- By 2014, the rule and other state and EPA actions would reduce power plant SO<sub>2</sub> emissions by 80% over 2005 levels. Power plant NO<sub>x</sub> emissions would drop by 58%.

**Utility Maximum Achievable Control Technology (MACT) [to be proposed]**

- EPA must set emission limits for hazardous air pollutants. The rule is expected to replace the Clean Air Mercury Rule (“CAMR”) and add standards for lead, arsenic, acid gases, dioxins and furans.

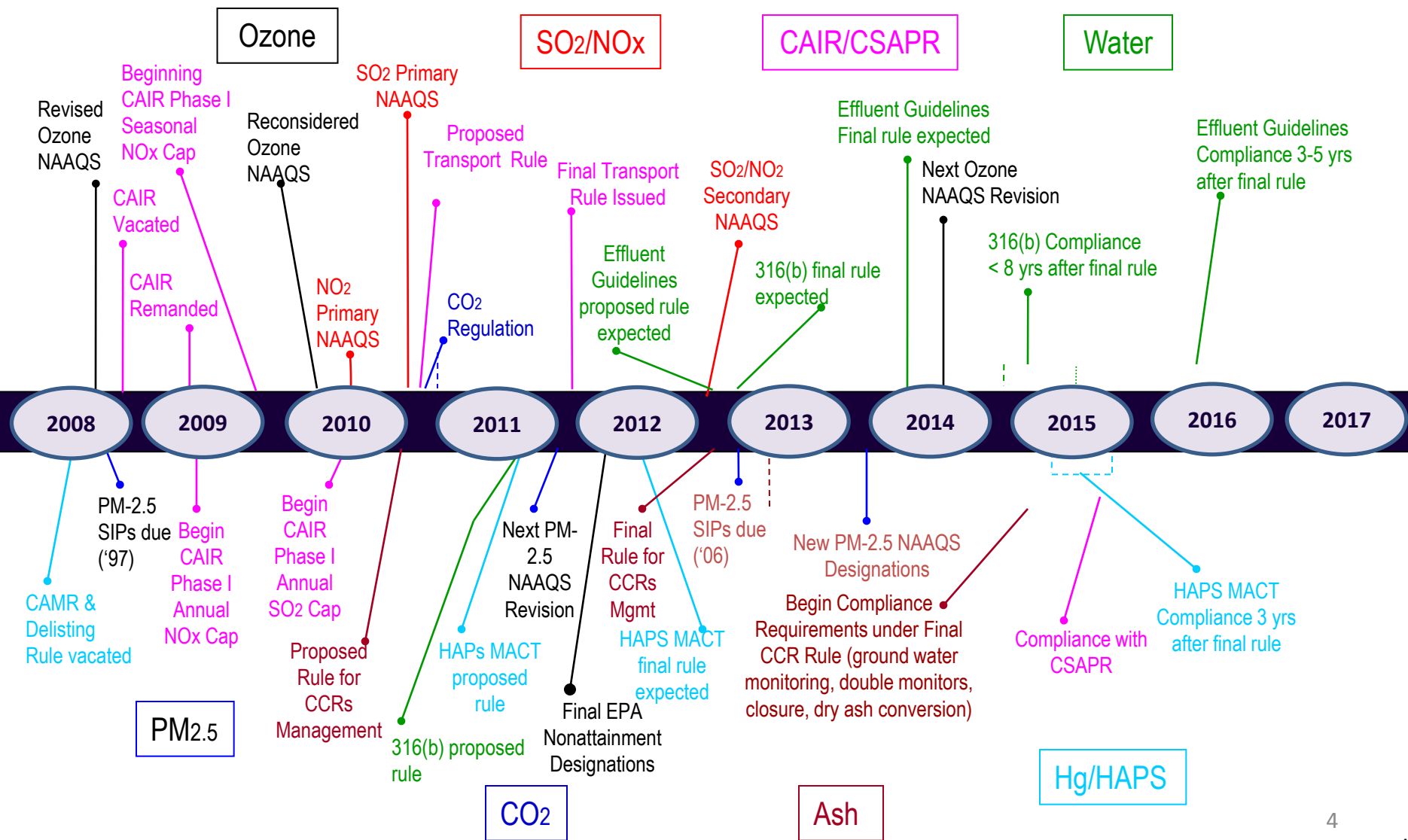
**Coal Combustion Residuals (CCR) [proposed]**

- Would establish, for the first time under the Resource Conservation and Recovery Act (“RCRA”) requirements for the proper disposal of coal ash generated by coal combustion at electric power plants.

**Power Plant Cooling Water Intake Structures Rule**

- Section 316(b) of the Clean Water Act is intended to address environmental impacts from cooling water intake to and discharge from power plant cooling systems. Requires that the location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

Electric Industry Environmental Regulations Create Uncertainty for Coal



# **Cross State Air Pollution Rule (CSAPR)**

**CSAPR at a Glance**

- The Cross-State Air Pollution Rule (“CSAPR”) was finalized July 6, 2011.
- Requires 27 states to significantly improve air quality by reducing power plant emissions that contribute to ozone and/or fine particle pollution in other states.
- This rule replaces EPA's 2005 Clean Air Interstate Rule (CAIR). Purpose is to continue the reduction in acid rain emissions started under CAAA and reduce NOx emissions that can lead to ozone-related air quality problems. Both are/were designed to increase air quality and reduce hazards to human health.
- Emission reductions will take effect starting January 1, 2012 for SO<sub>2</sub> and annual NO<sub>x</sub> reductions, and May 1, 2012 for ozone season NO<sub>x</sub> reductions.
- By 2014, combined with other final state and EPA actions, the CSAPR will reduce power plant SO<sub>2</sub> emissions by 73 percent and NO<sub>x</sub> emissions by 54 percent from 2005 levels in the CSAPR region.
- EPA estimates this rule will cost \$800 million annually, in addition to the \$1.6 billion per year in capital investments already under way as a result of CAIR



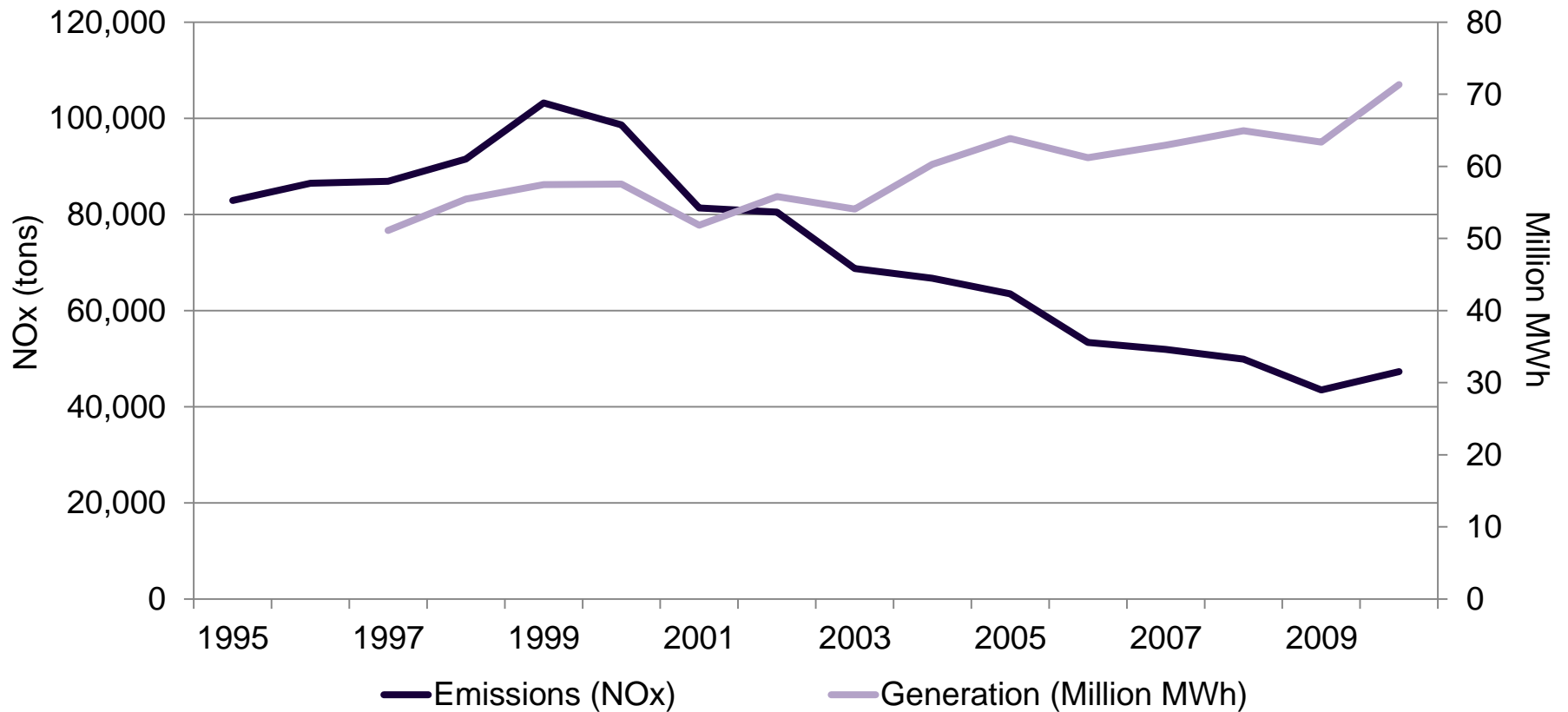
States controlled for both fine particles (annual SO<sub>2</sub> and NO<sub>x</sub>) and ozone (ozone season NO<sub>x</sub>) (21 States)  
 States controlled for fine particles only (annual SO<sub>2</sub> and NO<sub>x</sub>) (2 States)  
 States controlled for ozone only (ozone season NO<sub>x</sub>) (5 States)  
 States not covered by the Cross-State Air Pollution Rule

**CSAPR Proposed Reductions**

	Emissions in 2010 (tons NOx)	Emission Budget 2012-2013 (tons NOx)	Emissions Over or (Under) Budget (tons NOx)	Percent Change (%)
Alabama	27,849	31,746	3,897	14%
Arkansas	17,921	15,037	(2,884)	-16%
Florida	33,334	27,825	(5,509)	-17%
Georgia	26,790	27,944	1,154	4%
Illinois	21,371	21,208	(163)	-1%
Indiana	49,159	46,876	(2,283)	-5%
Kentucky	39,065	36,167	(2,898)	-7%
<b>Louisiana</b>	<b>23,172</b>	<b>13,432</b>	<b>(9,740)</b>	<b>-42%</b>
Maryland	9,428	7,179	(2,249)	-24%
Mississippi	16,089	10,160	(5,929)	-37%
New Jersey	5,192	3,382	(1,810)	-35%
New York	12,887	8,331	(4,556)	-35%
North Carolina	24,661	22,168	(2,493)	-10%
Ohio	47,582	40,063	(7,519)	-16%
Pennsylvania	58,211	52,201	(6,010)	-10%
South Carolina	13,769	13,909	140	1%
Tennessee	14,667	14,908	241	2%
Texas	68,446	63,043	(5,403)	-8%
Virginia	18,311	14,452	(3,859)	-21%
West Virginia	24,206	25,283	1,077	4%
<b>Total</b>	<b>552,110</b>	<b>495,314</b>	<b>(56,796)</b>	<b>-10%</b>

**Historic Generation & Emissions**

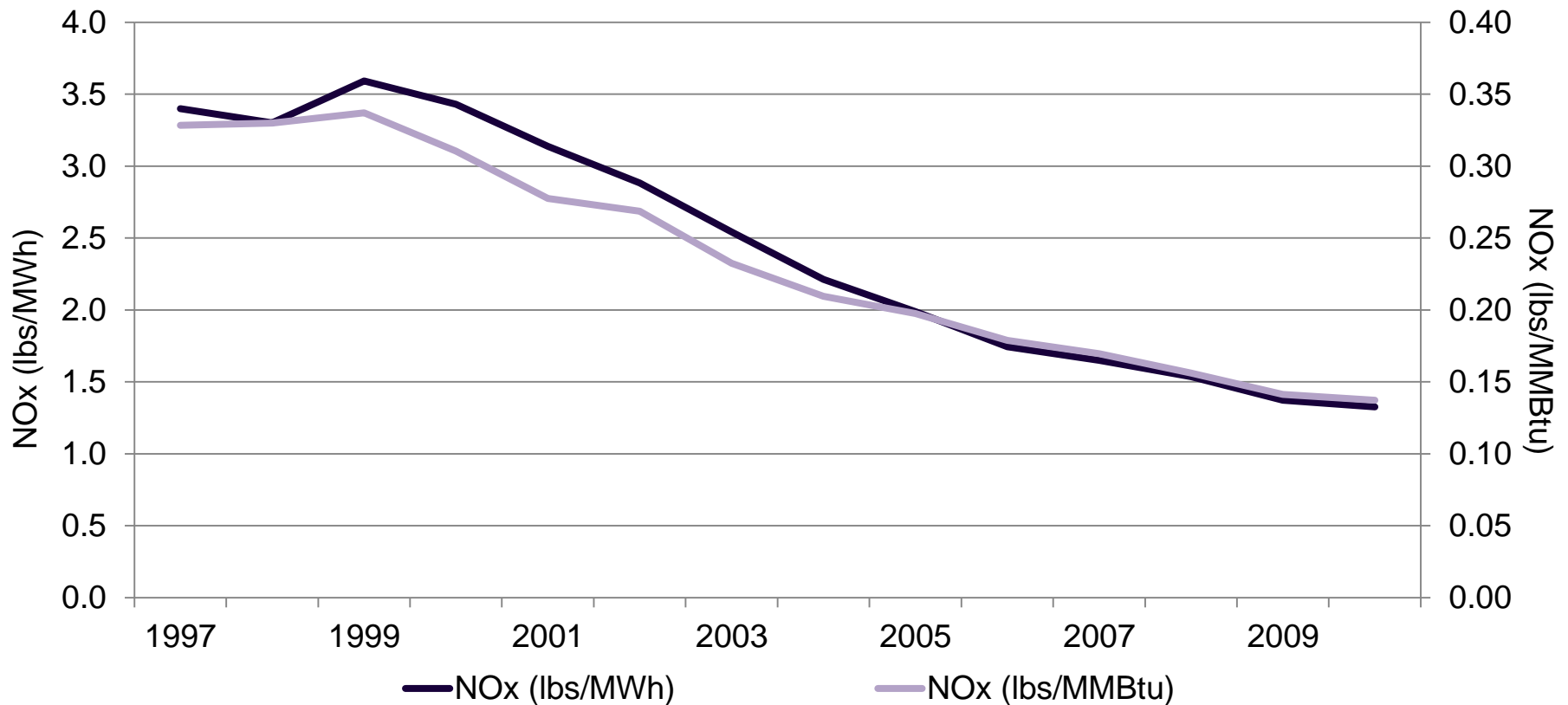
**Louisiana generation trends are up, yet overall NOx emissions from fossil units are down.**





**Emissions per Output (MWh) and Heat Input (MMBtu) Basis**

**Increased generation and decreased emissions translate into higher efficiencies on an output and heat input basis.**



**Louisiana Allocations and Deficits**

	3-Year Average NOx	CSAPR			
		Allocation	Percent Difference	Deficit with CSAPR	
				2012	2014
<b>CLECO</b>	2,760.9	1,534.2	-44.4%	(1,226.7)	(1,226.7)
<b>ELL</b>	6,516.0	2,609.0	-60.0%	(3,907.0)	(3,907.0)
<b>EGSL</b>	2,925.3	1,583.0	-45.9%	(1,342.3)	(1,342.3)
<b>ENO</b>	896.5	592.0	-34.0%	(304.5)	(304.5)
<b>SWEPCO</b>	1,150.0	630.0	-45.2%	(520.0)	(520.0)
<b>Muni</b>	1,637.5	806.8	-50.7%	(830.7)	(830.7)
<b>Big Cajun 2</b>	5,001.7	2,842.0	-43.2%	(2,159.7)	(2,159.7)
<b>IPP</b>	281.6	415.0	47.4%	133.4	133.4
<b>Cogen</b>	1,864.5	2,018.0	8.2%	153.5	153.5
<b>Total</b>	<b>23,034.0</b>	<b>13,030.0</b>	<b>-43.4%</b>	<b>(10,004.0)</b>	<b>(10,004.0)</b>

**Louisiana Specific Problems**

- EPA's emission reductions and allowance modeling is flawed and makes a number of unrealistic assumptions about how specific regional power markets work.
- EPA's model leads to an unattainable standard for Louisiana since physical compliance cannot likely be reached. It takes approximately three years to design, engineer, permit, and install an SCR or scrubber. We have to comply in May, 2012 (8 months)
- Louisiana will be about 10,000 tons short in allowances relative to historic generation levels. Over 9,000 MWs of capacity received zero allowances.
- EPA modeling, and resulting allocations, does not recognize the reliability must-run nature of many units.
- Host of critical modeling errors that include failure to recognize intra-state transmission constraints, operational units, unit operating efficiencies, and likely dispatch.

## **Generation Availability Impacts**

**Coal-Fired Capacity Share by Age Category**

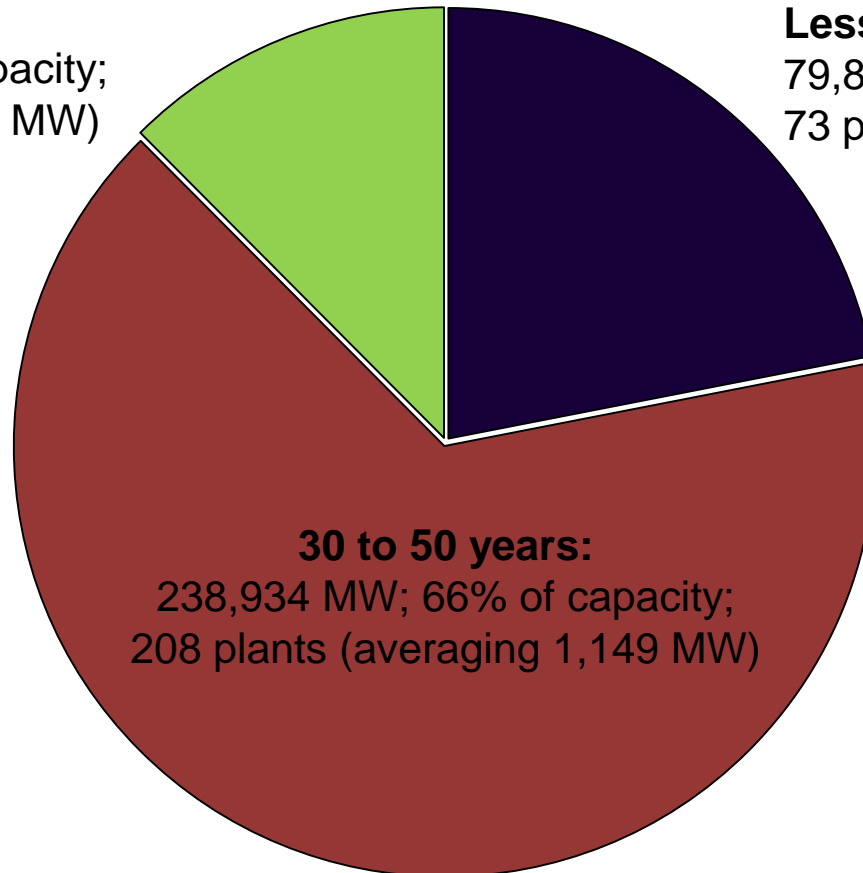
**There is a considerable amount of legacy coal capacity (45 GWs) that is relatively old, and in some instances, has few to little controls to meet anticipated standards.**

**Greater than 50 years:**

45,382 MW; 12% of capacity;  
72 units (averaging 630 MW)

**Less than 30 years:**

79,876 MW; 22% of capacity;  
73 plants (averaging 1,094 MW)



**30 to 50 years:**  
238,934 MW; 66% of capacity;  
208 plants (averaging 1,149 MW)








**Increased Natural Gas Use from CSAPR-Induced Coal Plant Retirements**

**The retirement of 45 gigawatts of capacity would likely still have an impact on overall natural gas usage.**



Note: Assumes 160 Bcf of NGV natural gas use. Also assumes retirement of 45 GW of coal-fired capacity, replaced with new natural gas generation with an 85 percent capacity factor and a 7,600 Btu/kWh heat rate.

**Summary of Retirement Studies Related to EPA Rules**

Study	Retired Capacity	Regulation Requirements	Estimated GW of Retired Coal							
			10	20	30	40	50	60	70	80
NERC (October 2010)	47 to 76 GW by 2018 (total fossil fuel capacity, including oil and gas)	Levelized costs (@2008 CF) after retrofitting each unit for the environmental regulations compared to the cost of a new gas-fired unit.								
		Scenario 1 - Transport Rule								
		Scenario 2 - Transport Rule, MACT Scenario 3 - Transport Rule, MACT, 316(b) Cooling Water, Coal Ash								
ICF/IEE (May 2010)	25 to 60 GW by 2015	Cost of retrofitting coal plant compared to cost of new gas CC								
		Scenario 1 - Transport Rule, MACT Scenario 2 - Transport Rule, MACT, CWA 316(b)								
Brattle Group (December 2010)	50 to 65 GW by 2020	Regulated Units - 15-year present value of costs > replacement power from a CC or CT. Merchant unit - 15-year present value of cost > revenues from energy and capacity markets.								
		Transport Rule, MACT, 316(b) Cooling Water, Coal Ash								
Credit Suisse (September 2010)	60 GW	Size and existing controls								
		Transport Rule, MACT								
Charles River Associates (December 2010)	39 GW by 2015	In-house model (NEEMS) optimizing costs of existing capacity and costs of potential new capacity.								
		Transport Rule, MACT								
MJ Bradley (August 2010)	30 to 40 GW	Switch to lower sulfur coal, install emission controls, or retire								
		Transport Rule, MACT								
Bernstein Research (October 2010)	51 GW	FGS + emissions on all coal fired units by 2015								
		Transport Rule, MACT								

**Louisiana Reliability Impacts**

- EPA clearly did not seek, nor attempt to understand the reliability implications of its proposed regulation.
- Concerns imported generation may not be available (used to meet its own native requirements), that the generation will be expensive, or will be constrained by transmission.
- Most regional NERC reliability councils have expressed serious concerns about the proposed rule and its reliability implications.
- If credits and/or generation are not available, utilities will have to either (a) shut down units or (b) pay a penalty of \$37,500 per ton per day. State emits, on average, about 150 tons per day – could be a \$450 million penalty for 80 days.

***NOTE: Louisiana will likely run out of emission credits around the 4<sup>th</sup> of July weekend if EPA's proposed regulations go into place.  
The ozone season ends the last week of September.***



## **Potential Rate Impacts**

**NERA CATR-MACT Impact Study**

**Significant capital costs will be associated with these regulations. Wide variation in capital and operating cost estimates.**

Equipment/Cost	EPA (Est Cost \$ 2010)	EIA	Equipment/Cost	EPA (Est Cost \$ 2010)	EIA
<b>Wet Scrubber</b>			<b>ACI</b>		
Capital (\$/kW)	\$ 538.00	\$ 485.00	Capital (\$/kW)	\$ 8.00	\$ 6.00
Fixed O&M (\$/kW-yr)	\$ 8.35	\$ 24.99	Fixed O&M (\$/kW-yr)	\$ 0.03	\$ 1.17
Variable O&M (\$/MWh)	\$ 2.11	\$ 0.44	Variable O&M (\$/MWh)	\$ 0.60	\$ -
Capacity Penalty	-0.0184	-0.05	Capacity Penalty	-0.60%	0.00%
Heat Rate Penalty	0.0187	0.0526	Heat Rate Penalty	0.60%	0.00%
<b>Dry Scrubber</b>			<b>Fabric Filter</b>		
Capital (\$/kW)	\$ 460.00		Capital (\$/kW)	\$ 170.00	\$ 78.00
Fixed O&M (\$/kW-yr)	\$ 6.76		Fixed O&M (\$/kW-yr)	\$ 0.73	\$ 5.97
Variable O&M (\$/MWh)			Variable O&M (\$/MWh)	\$ 0.16	\$ -
Capacity Penalty	-1.45%		Capacity Penalty	-0.60%	0.00%
Heat Rate Penalty	1.47%		Heat Rate Penalty	0.60%	0.00%
<b>SCR</b>			<b>DSI</b>		
Capital (\$/kW)	\$ 201.00	\$ 165.00	Capital (\$/kW)	\$ 43.00	
Fixed O&M (\$/kW-yr)	\$ 0.73	\$ 1.66	Fixed O&M (\$/kW-yr)	\$ 0.61	
Variable O&M (\$/MWh)	\$ 1.38	\$ 0.34	Variable O&M (\$/MWh)	\$ 7.70	
Capacity Penalty	-0.58%	0.00%	Capacity Penalty	-0.79%	
Heat Rate Penalty	0.59%	0.00%	Heat Rate Penalty	0.79%	

**NERA CATR-MACT Impact Study**

**While the national average impact is around 12 percent under older CATR these are diverse impacts across the U.S.**

**Some states are likely to see increases close to 24 percent, many well over 15 percent.**

State/Region	Percent Change - Electricity Rates		
	2016	2020	2025
New England	7.5%	7.7%	5.4%
New York City	5.5%	5.0%	7.6%
NY Long Island	6.5%	4.8%	6.6%
NY Update	8.0%	6.4%	8.1%
Mid-Atlantic	17.1%	9.9%	7.8%
VA & Carolinas	12.7%	9.9%	8.2%
Southeast	14.5%	9.4%	9.8%
Florida	8.8%	8.9%	8.5%
Lower MI	20.5%	17.7%	13.4%
OH, IN & WV	12.9%	12.1%	11.9%
KY & TN	23.5%	17.8%	13.3%
WI and Upper MI	21.7%	17.3%	12.6%
Upper Midwest	17.6%	14.1%	10.2%
South IL & East MO	23.1%	18.8%	16.3%
KS & West MO	12.8%	12.0%	14.6%
AR, LA & West MS	9.0%	8.0%	7.5%
Oklahoma	15.8%	12.8%	10.9%
Texas	12.1%	9.4%	9.5%
CO & East WY	6.1%	7.3%	8.8%
Northwest	2.0%	4.0%	7.9%
AZ & NM	6.1%	5.2%	3.6%
California	1.8%	1.9%	0.8%
<b>US Average</b>	<b>11.5%</b>	<b>9.5%</b>	<b>8.5%</b>

**Louisiana Specific Rate Impact Concerns**

- Rate impacts that have been estimated to date for CATR are likely underestimated, potentially by as much as four percent or more.
- Studies to date do not account for the operating inefficiencies that may result from installed controls and “re-optimization/re-prioritization” of dispatch that could result in more inefficient fuel use.
- Studies to date do not take into account the “rush premium” likely to be assessed on mitigation equipment nor engineering and permitting costs.
- Studies likely do not take appropriate “allowance scarcity” into context.
- Studies do not consider the increased state regulatory burden associated with managing the approval and costs of compliance.

## **Regulatory and Ratemaking Impacts**



**Recent NARUC Resolution – Select Findings**

- **NARUC recently passed a resolution expressing concerns about the EPA rulemakings and noted, among other points:**
  - **Such regulations under consideration by EPA could pose significant challenges for the electric power sector and the state regulatory commissions with respect to economic burden, the feasibility of implementation by the contemplated deadlines and maintenance of system reliability.**
  - **NARUC recognizes that flexibility with the implementation of EPA regulations can lessen generation cost increases because of improved planning, selection of correct design for the resolution of multiple requirements, greater use of energy efficiency and demand side resources and orderly decision-making.**
  - **Some generators that will be impacted by the new EPA rulemakings are located in constrained areas or supply-constrained areas and will need time to allow for transmission or new generation studies to resolve reliability issues.**

**Regulatory and Ratemaking Issues**

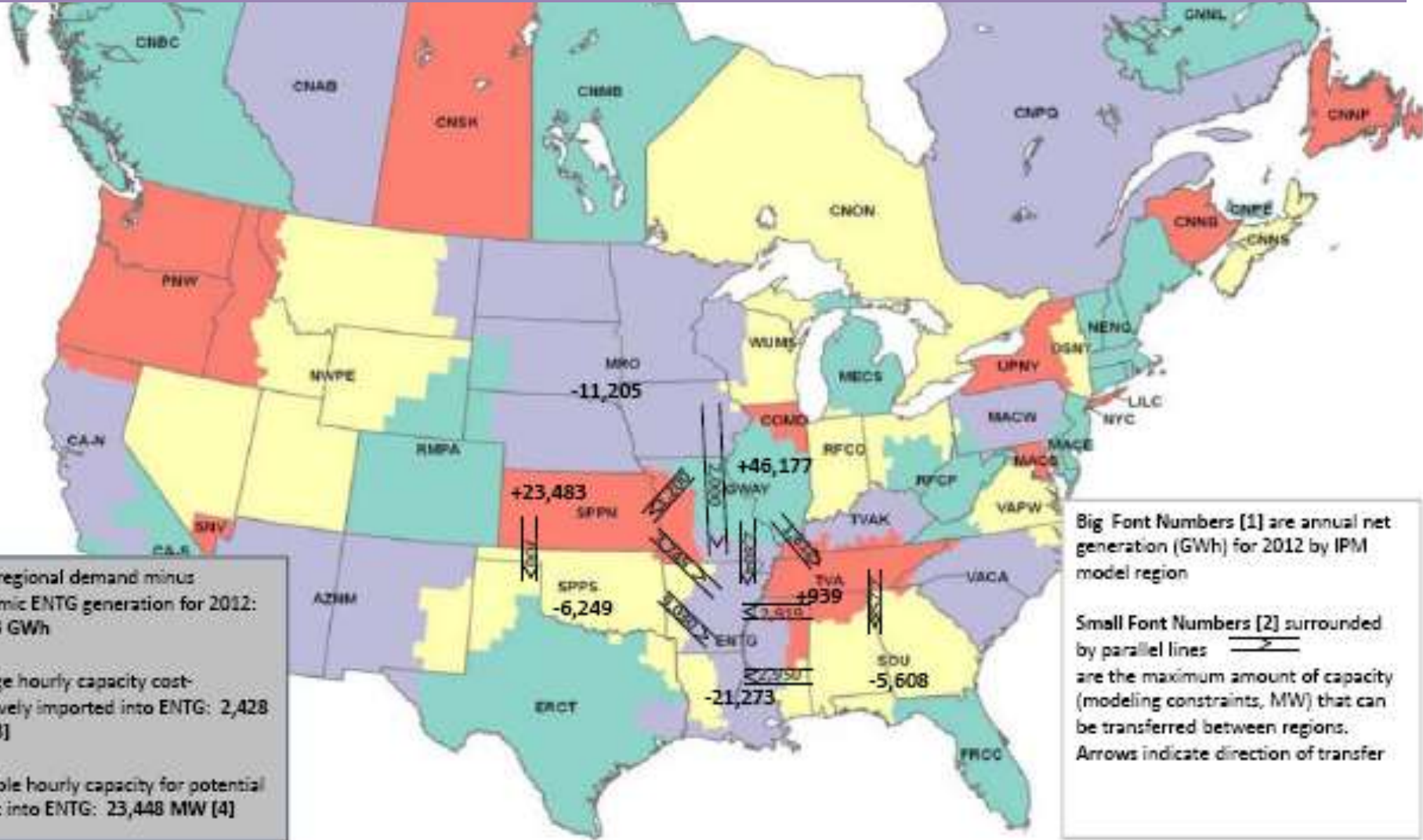
**Regulatory challenges created by the new EPA rules include:**

- **Timing:** the ability to meet these requirements will be difficult if even possible. Equipment procurement, engineering, permitting and installation can be multi-year processes.
- **Flexibility:** there are limited alternatives, such as allowance trading or temporary attainment waivers for reliability, that utilities can utilize.
- **Cost:** limitations on timing and flexibility will increase costs dramatically in an area that has already experienced increased costs.
- **Regulatory Planning Complications:** will have implications for resource additions that are not limited to solid-fuel generation alone.
- **Regulatory Review Complications:** EPA regulations will make environmental cost recovery review more difficult in the near-term and longer run.
- **Risk-shifting:** EPA regulations will place utility regulators, utilities, and ratepayers in opposing positions on many cost recovery, rate of return, and risk allocation issues.

## **Analytic Deficiencies Supporting Rule Changes**



**Failure to Recognize Intra-Regional Transmission Constraints**




ENTG regional demand minus economic ENTG generation for 2012: 21,273 GWh

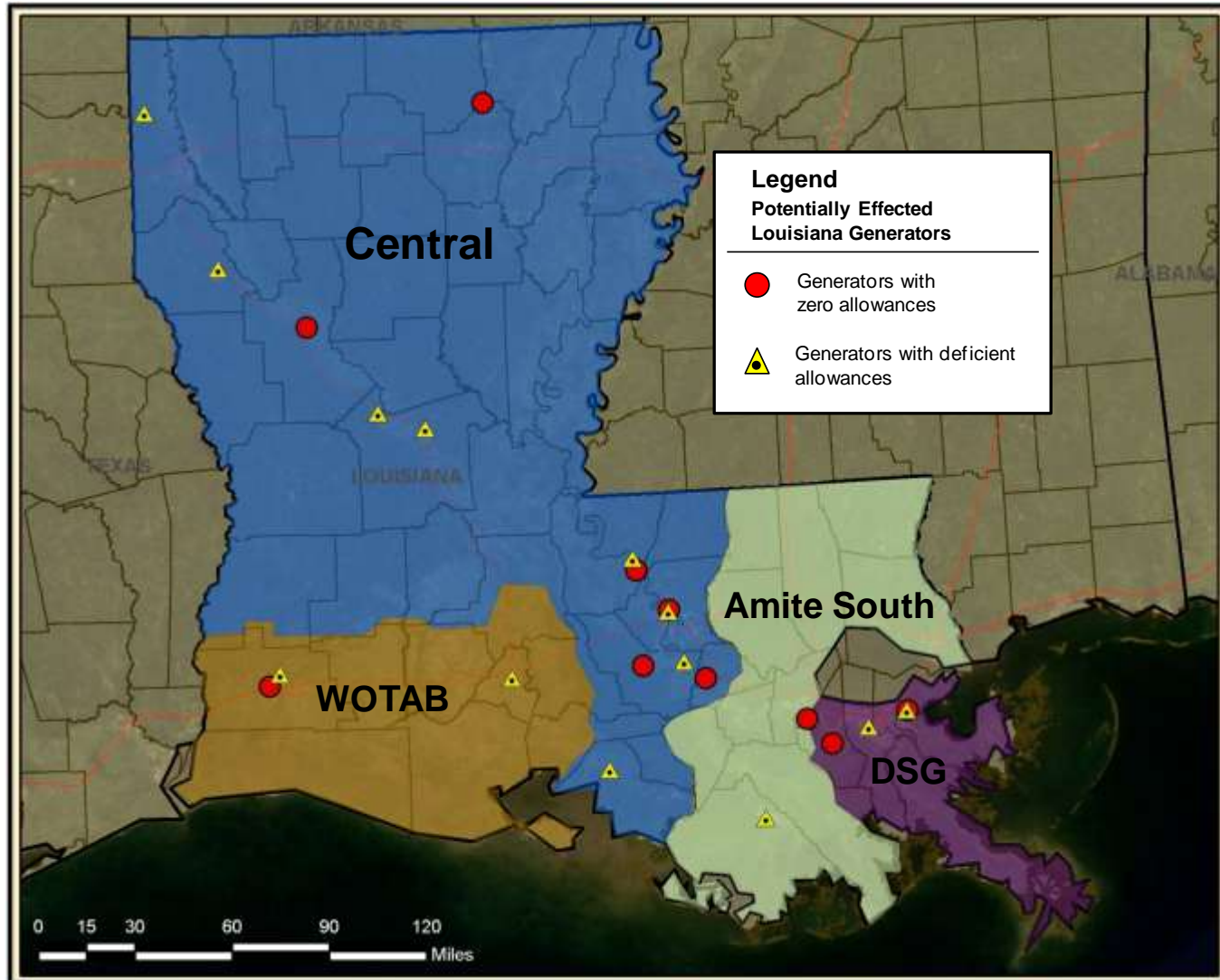
Average hourly capacity cost-effectively imported into ENTG: 2,428 MW [3]

Available hourly capacity for potential import into ENTG: 23,448 MW [4]

Big Font Numbers [1] are annual net generation (GWh) for 2012 by IPM model region

Small Font Numbers [2] surrounded by parallel lines  are the maximum amount of capacity (modeling constraints, MW) that can be transferred between regions. Arrows indicate direction of transfer

**Louisiana Transmission Constraints**

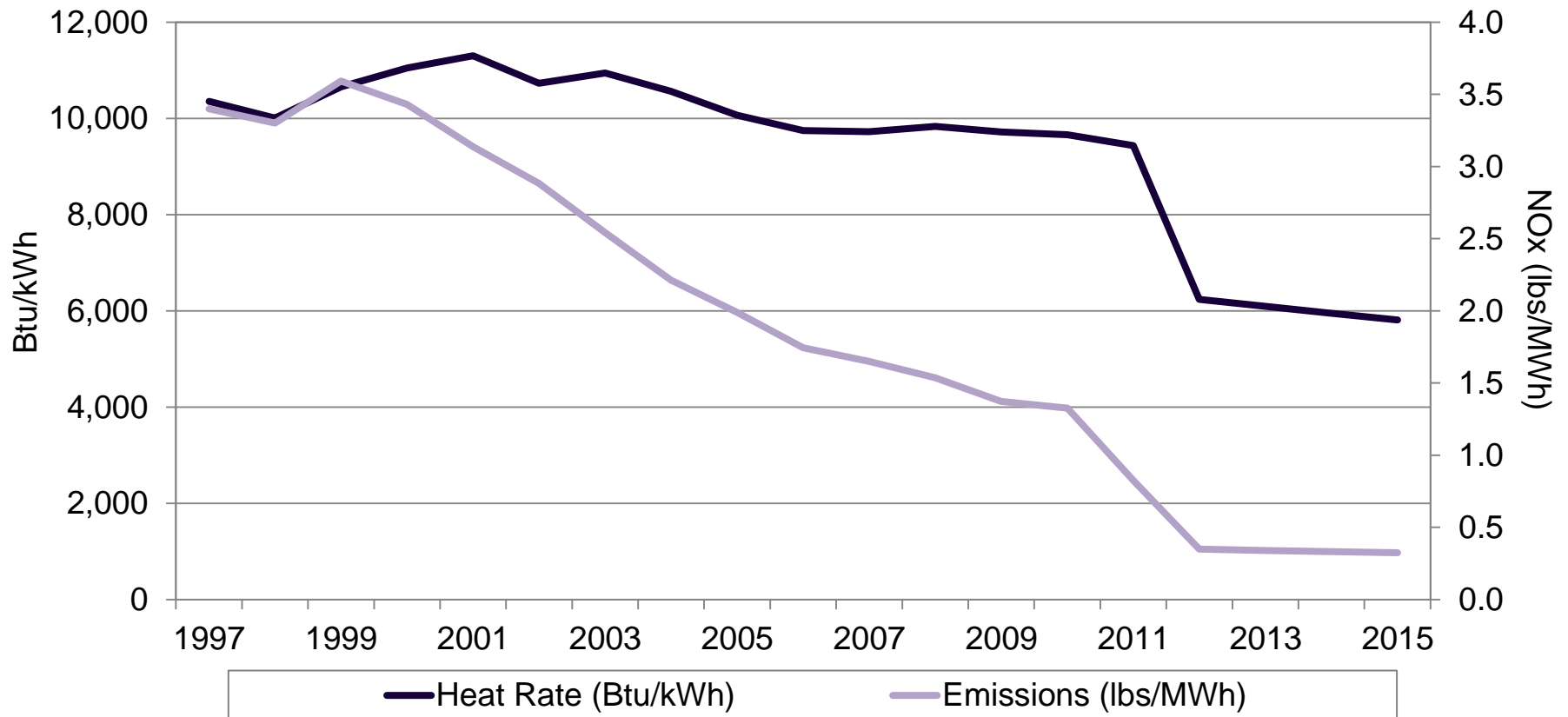


**Incorrect Plant Operating Assumptions**

	<b>Advanced Combined Cycle</b>	<b>Advanced Combustion Turbine</b>
Size (MW)	560	170
Availability (%)	87%	92%
Capacity Factor (%)	71%	32%
Heat Rate (Btu/kWh)	6,810	10,720
NOx Emission Rate (lbs/MMBtu)	0.01	0.01
Overnight Capital Cost (2007\$/kW)	\$ 976	\$ 698
Fixed O&M (2007\$/kW/yr)	\$ 14.4	\$ 12.3
Variable O&M (2007\$/MWh)	\$ 2.57	\$ 3.59

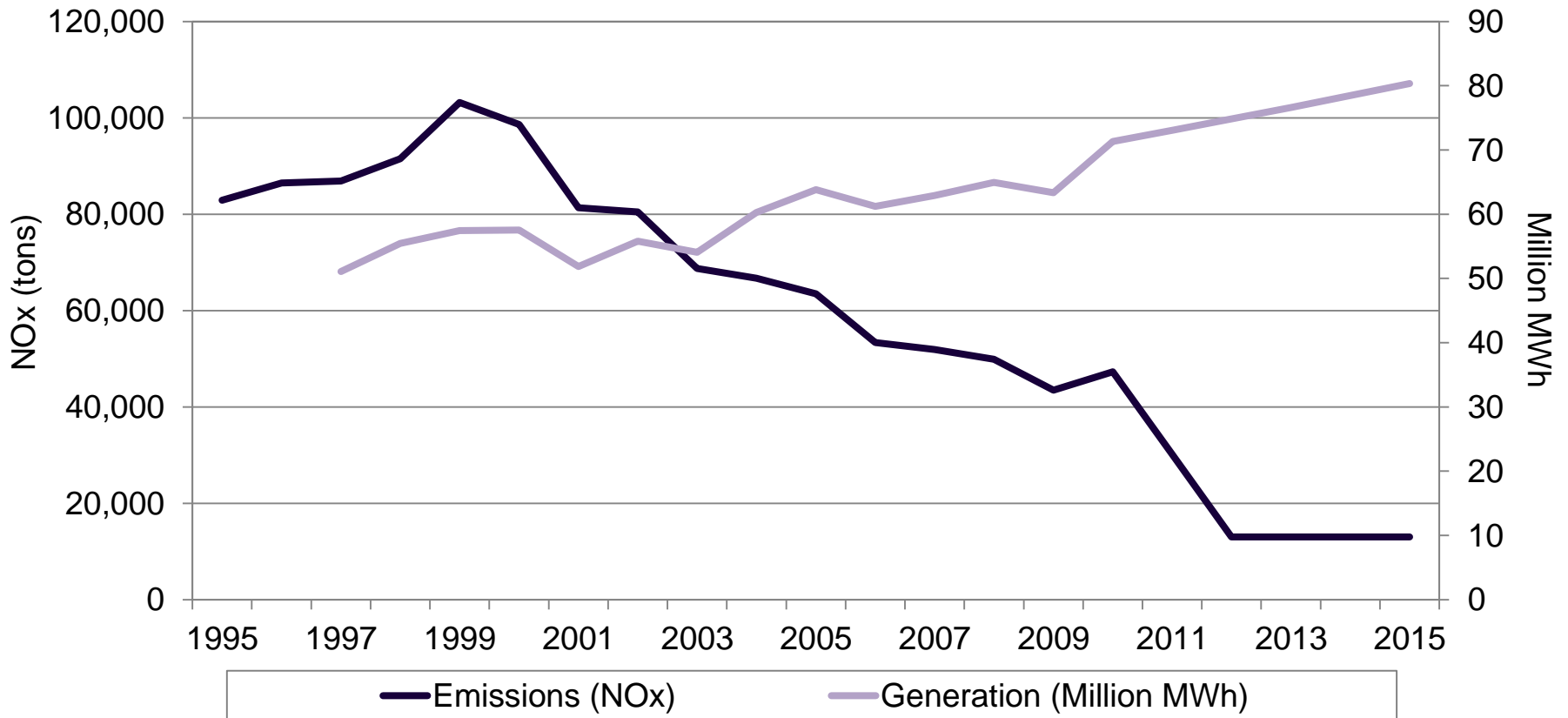
**Implied Heat Input and Emissions Assumptions**

**EPA modeling assumptions result in outcomes suggesting significant reductions of heat input use while lowering emissions**



**Generation and Emissions Assumptions**

**EPA modeling assumptions also suggest that Louisiana can dramatically increase output and lower emissions, at the same time.**



**Conclusions**

- **If left in their current form, EPA's proposed regulations will likely have a considerably negative impact on U.S. utility ratepayers.**
- **These regulations will likely translate into rate increases that will likely occur at a very inopportune time in the country's economic recovery and a time when there are a large number of other policy goals being subsidized and recovered through rates (efficiency programs, renewables, smart meters, etc).**
- **EPA regulations will create an unnecessarily adverse and unproductive environment between utilities, regulators, and ratepayers.**
- **There are opportunities in this process since a degree of consensus is arising:**
  - **Most parties have not opposed the principles of improved air quality standards and regulations.**
  - **Timing of the standards are the biggest issue and one where utilities, regulators ,and ratepayers are all on the same page.**
  - **Flexibility is also an area of consensus – particularly as it relates to reliability.**

## Conclusions

**Conclusions**

- **If left in their current form, EPA's proposed regulations will likely have a considerably negative impact on U.S. utility ratepayers.**
- **These regulations will likely translate into rate increases that will likely occur at a very inopportune time in the country's economic recovery and a time when there are a large number of other policy goals being subsidized and recovered through rates (efficiency programs, renewables, smart meters, etc).**
- **EPA regulations will create an unnecessarily adverse and unproductive environment between utilities, regulators, and ratepayers.**
- **There are opportunities in this process since a degree of consensus is arising:**
  - **Most parties have not opposed the principles of improved air quality standards and regulations.**
  - **Timing of the standards are the biggest issue and one where utilities, regulators ,and ratepayers are all on the same page.**
  - **Flexibility is also an area of consensus – particularly as it relates to reliability.**





[dismukes@lsu.edu](mailto:dismukes@lsu.edu)

[www.enrg.lsu.edu](http://www.enrg.lsu.edu)