Louisiana's Stakes in the Greenhouse Gas Debate

The Billion Dollar Budget Crisis: Catastrophe or Change?

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David E. Dismukes
Center for Energy Studies
Louisiana State University

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Overview and Preliminary Thoughts

- Considerable national and international attention has been given to this issue.
- The current increase in energy prices and challenges in supply capabilities confound climate change issues and approaches.
- GHG regulation also raises considerable questions about market organization and structure in restructured energy markets.
- Uncertainty and “policy volatility” creates challenges for the high levels of expensive investment considered needed to address this issue.
- Policies are likely to result in the most dramatic restructuring of energy markets to date.

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Take Away Points and Conclusions

- Significant increases in the cost (price) of all forms of energy.
- Significant redistribution of wealth between sectors, income classes, and even various regions and countries around the world.
- High near and intermediate term reliance on natural gas particularly for power generation.
- Very large increases in the price of electricity.
- Policies are outpacing technological and institutional capabilities.
- Ability to meet goals (at projected timetable) is questionable.

Market Mechanisms

For Affecting Climate Change

Different Policy Frameworks

Policy Type	Definition
Carbon Tax	Places a fixed tax on end-user energy usage.
Cap and Trade (Downstream, Emissions Type)	Would require certain emitting sectors to acquire emission credits for fuel burned in production processes.
Standards	Would change the efficiency (emissions) standards of appliances, motors, equipment, automobiles, etc.

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Federal Proposals

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H.R. 2454 (Waxman-Markey) "American Clean Energy and Security Act"

Renewable Electricity Standards

- Requires 6% of electricity to come from renewables by 2012; and 20% by 2020.
- Up to 5% can come from efficiency improvements.

Emission cuts

- Caps emissions of greenhouse gases starting in 2012.
- Covers 85% of economy (including electricity producers, oil refineries, natural gas suppliers and energy-intensive industries like iron, steel and cement manufacturing).
- Goals for U.S. emissions reductions, below 2005 levels:
  - o 3% by 2012;
  - o 17% by 2020;
  - o 42% by 2030; and
  - o > 80% by 2050.
- Cap and trade program completely phased in by 2016.

Emission permits

- Regulated industries must acquire permits for their emissions.
- About 85% of permits are given away at start of program, with percentage decreasing over time.
- About 15% of permits are auctioned off at start of program, with percentage increasing over time.
- A permit to emit one ton of CO2 would be worth $11 to $15 in 2012 and $22 to $28 in 2025 (EPA estimate).
- The value of all permits would be about $60 billion in 2012 and roughly $113 billion in 20205.

Source: grist.org

Senate Bill (Kerry-Boxer)
"Clean Energy Jobs and American Power Act"

Greenhouse Gas Reduction
- Requires EPA to establish standards for new heavy-duty vehicles and engines.
- Promotes studies into and approaches to permitting geological sequestration sites.
- Establishes policy of promoting safe and clean nuclear industry.

Energy Efficiency and Renewable Energy
- Directs EPA to establish program to provide grants and other assistance to renewable projects in states with mandatory renewable portfolio standards.
- Directs EPA to establish a program to provide grants for research and development of advanced biofuels.
- Requires national goal for improvement in building energy efficiency.

Global Warming Pollution
- Goals for U.S. emissions reductions, below 2005 levels:
  - 3% by 2012;
  - 20% by 2020;
  - 42% by 2030; and
  - 83% by 2050.

Allowances
- Establishes annual tonnage limit on emissions. Allowances are equal to the tonnage limit for each year (one allowance represents permission to emit one ton of CO2E.
- Does not restrict purchase, sale or transactions involving allowances.
- Includes a "Market Stability Reserve" that will be auctioned at minimum set price ($28/ton in 2012) that increases annually. This is to help contain costs and minimize price fluctuations.

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Significant Differences Between House and Senate Bills

Renewable Electricity Standards

- ACES creates a RES or 20% by 2020.
- CEJAPA has no federal RES. Instead, it includes a provision to empower the EPA to give grants and other assistance to help states meet their own RES.

Emission cuts

- Both bills seek to cut emissions; CEJAPA starts by requiring a similar 3% cut by 2012 but requires a sharper cut of 20% by 2020.

Emission permits

- ACES requires regulated industries to acquire permits for their emissions.
- CEJAPA creates a similar system of tradeable credits.
- Difference: CEJAPA would set a ceiling price ("soft collar") of $28, adjusted for inflation.

Permit revenues

- ACES has a detailed description of how give-aways will be distributed.
- It is still unknown how CEJAPA will handle this.

Offsets

- With ACES, carbon emitters can buy into offsets. The bill has outlined explanations for tradeoffs.
- CEJAPA also has opportunity for offsets, but has less precise instructions as to what qualifies.

Investing in Renewables

- ACES includes money for investment in renewable energy – as much as $190 billion by 20205.
- CEJAPA is just the "climate" side. It's partner bill ("ACELA") is the energy half and its provisions are still being penciled in.

Source: grist.org

Compliance Alternatives

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Anticipated Forms of Mitigation

Method	Description	Challenges
Credits & Offsets	Initially allocated/auctioned credits and new offsets developed from mitigation projects	Efficiency of system (credits). Monitoring and verification of offsets.
Capital Investment	Carbon capture and storage	Expensive, uncertain, large supporting infrastructure and institutional support.
Fuel Switching	Nuclear, IGCC, natural gas	Expensive, longer-term investments, questionable development realization (cost, scope, reliability).
Renewables	Biomass, wind, solar, geothermal, hydro	Expensive, varying reliability, uncertainty (cost recovery)
Efficiency Improvements	Automotive Appliances Building measures Demand-Side Mgt. Demand Response	Good short run opportunities, significant, but limited in scope. Also require investment to reach pay-back.

Credits and Offsets

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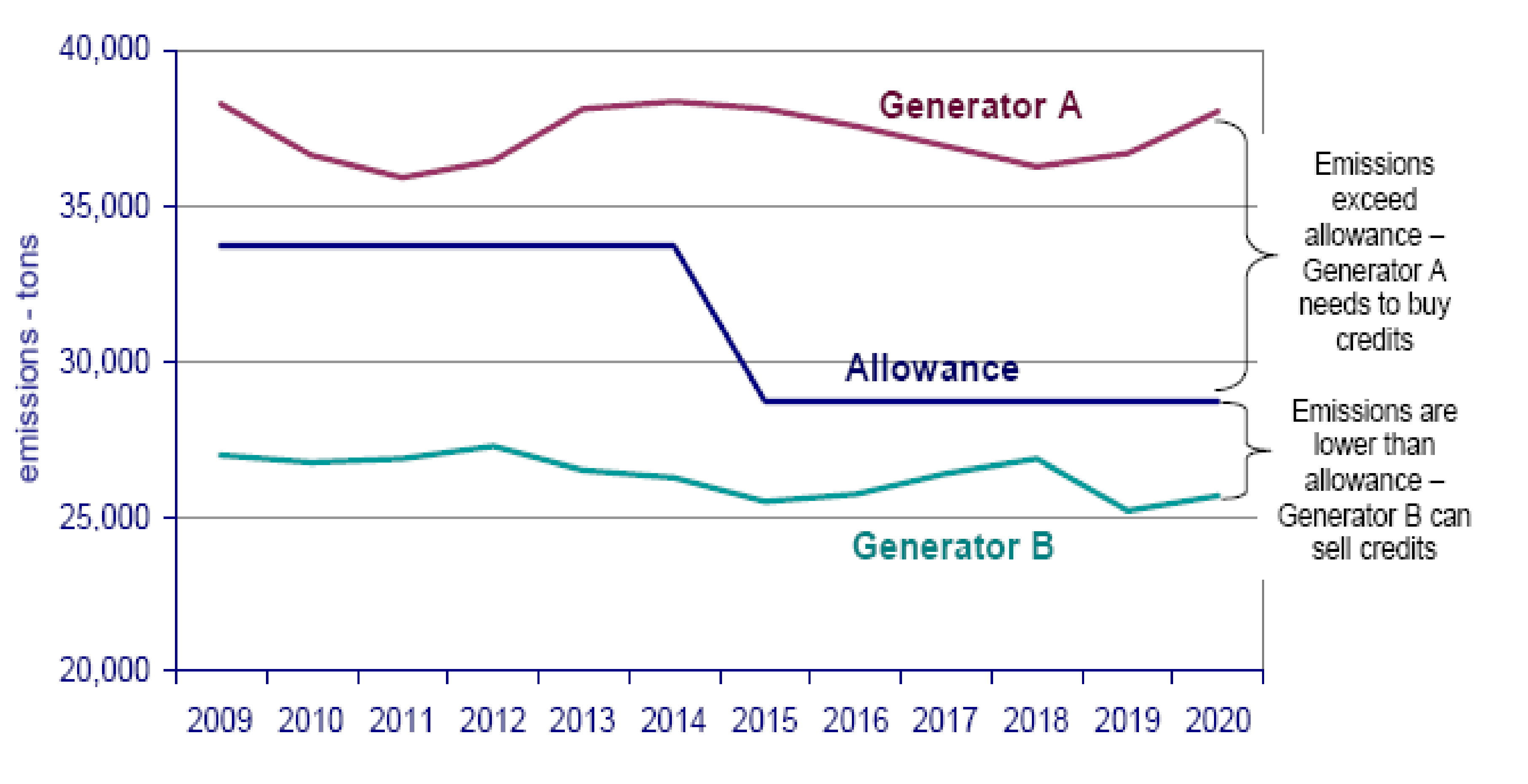
How Does Cap & Trade Work?

Simply speaking, sources "long" on credits will trade with those that are "short."



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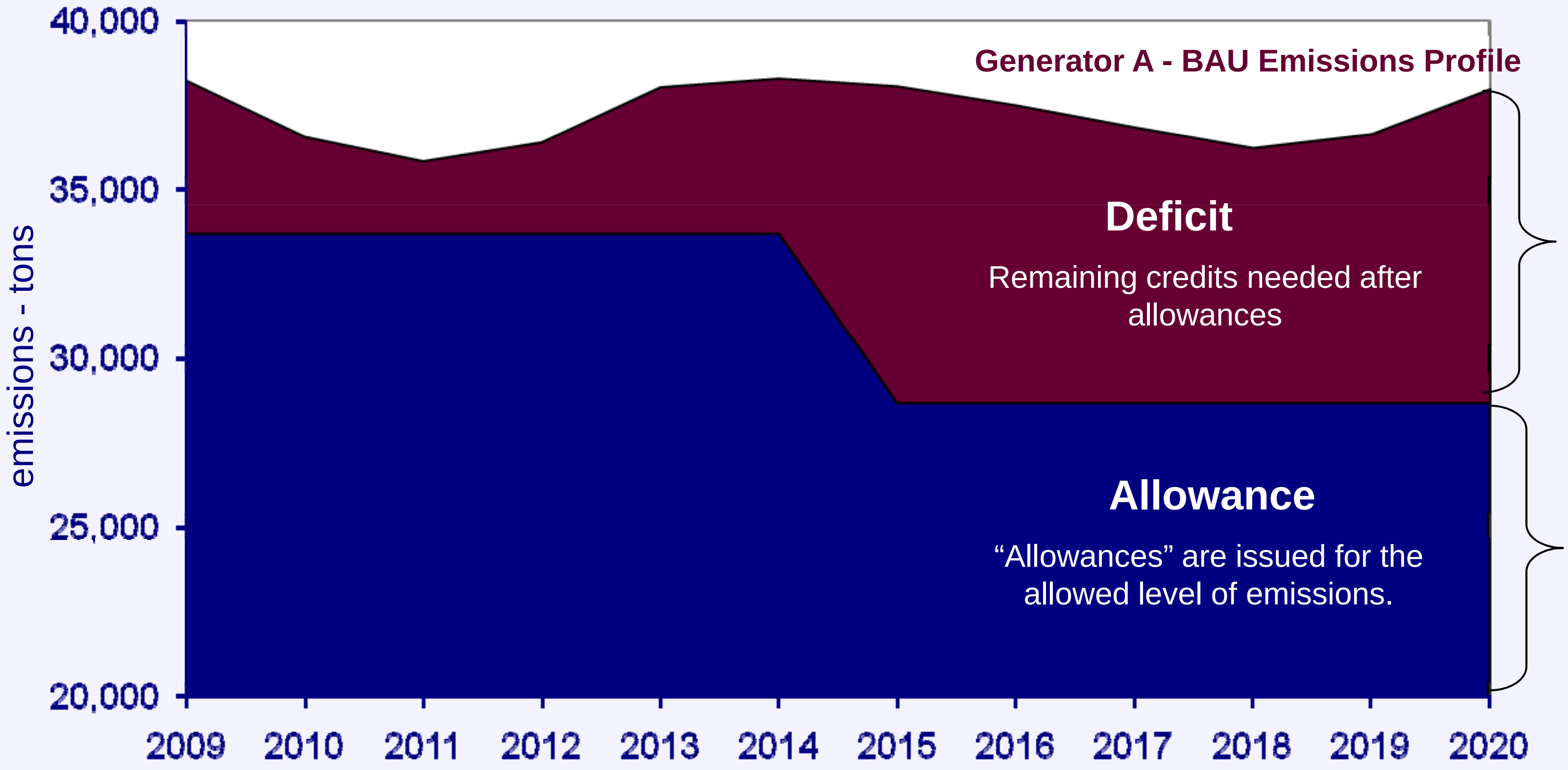
Auction Versus Allowance

An auction system is more expensive because it requires a larger upfront purchase of credits.



Total cost of emissions: $570,000

At $15/ton, remaining credits would cost $140,000

At $15/ton, allowances would cost about $430,000 in 2020.

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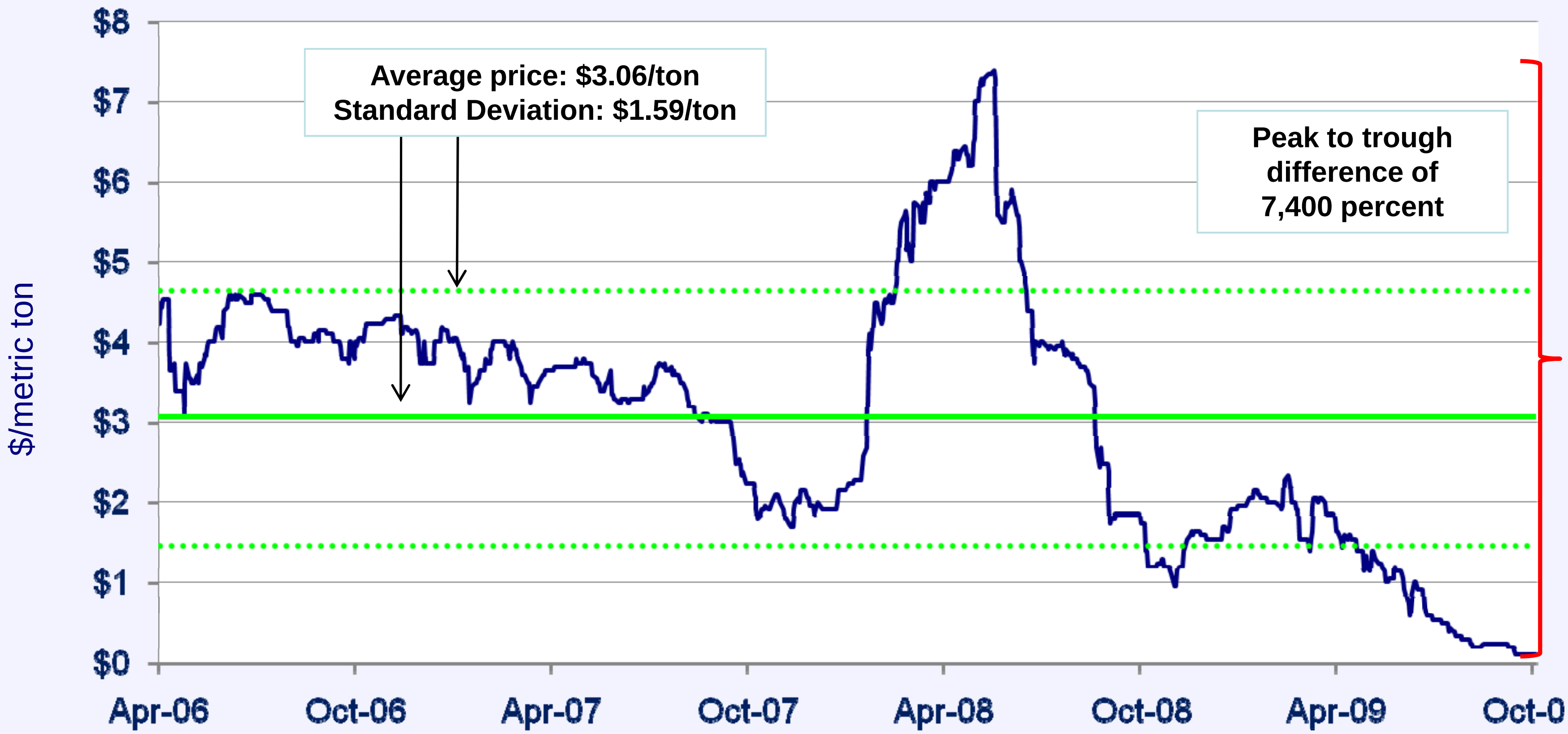
Chicago Climate Exchange Daily Closing Prices



Source: Chicago Climate Exchange.

Capital Investments

What is Carbon Capture and Storage?

- Carbon Capture and Storage ("CCS") is a method of managing and reducing CO_2 in the atmosphere
- Carbon dioxide is captured from a power plant or other industrial source, compressed and put in a pipeline where it travels to a nearby oil or gas field or "sequestration site".
- CO_2 can be safely sequestered (or stored) in depleted oil or natural gas fields for an indefinite period of time.
- CO_2 can be held underground by the same solid rock layers that have held the trapped oil and gas for millions of years.

Source: CCS-Education.net

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Process	Cost range per metric ton of CO_2 captured	Comments
Capture from power plant	\$15.00 - \$75.00	Net cost
Transportation	\$1.00 - \$8.00	Per ~155 miles via pipeline
Geological storage	\$0.50 - \$8.00	Not including EOR revenue
Monitoring of storage	\$0.10 - \$0.30	Depending upon regulation
Total estimated costs	\$16.60 - \$ 91.30	

Source: Intergovernmental Panel on Climate Change, JPMorgan Chase

Fuel Switching

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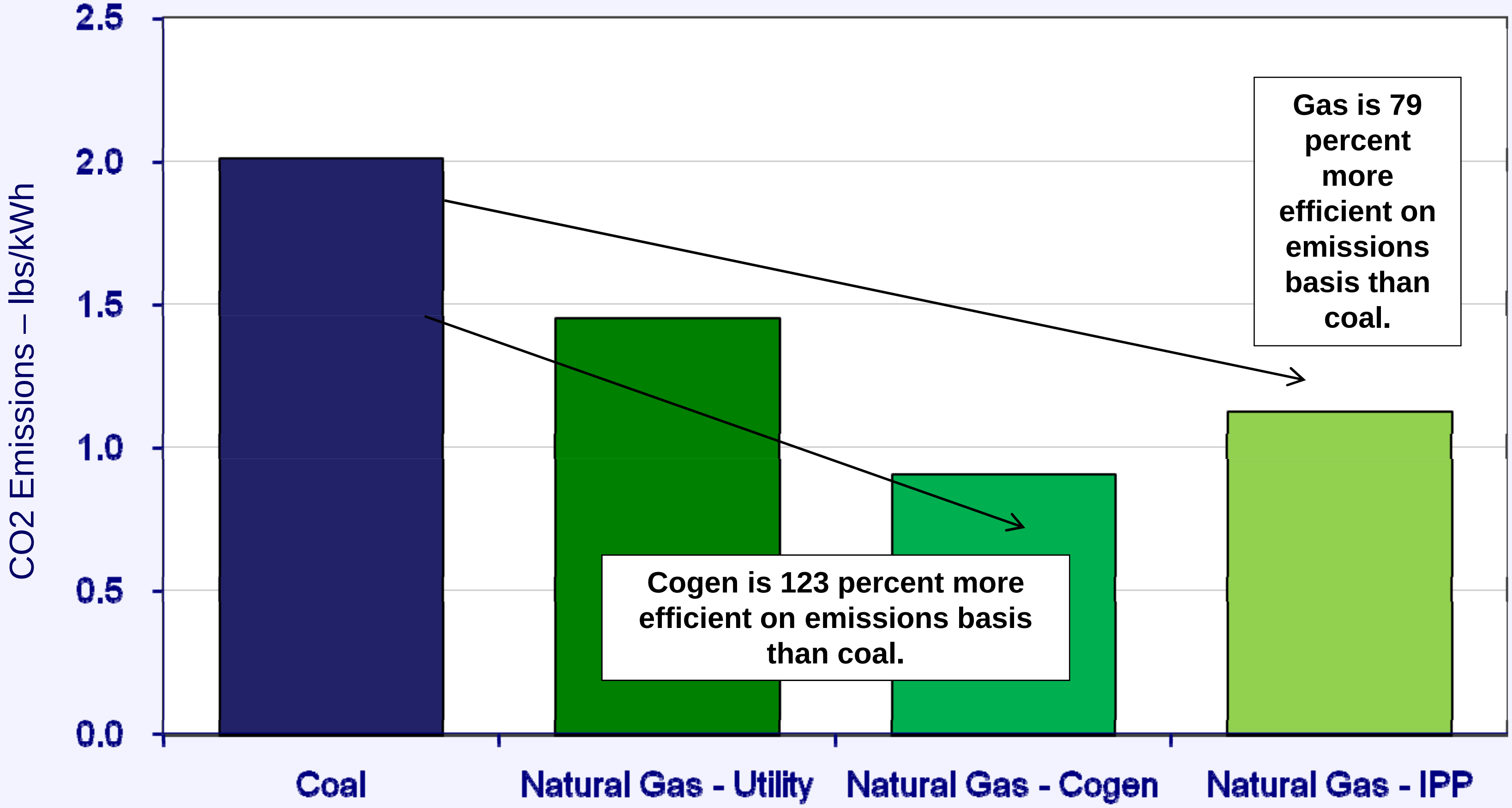
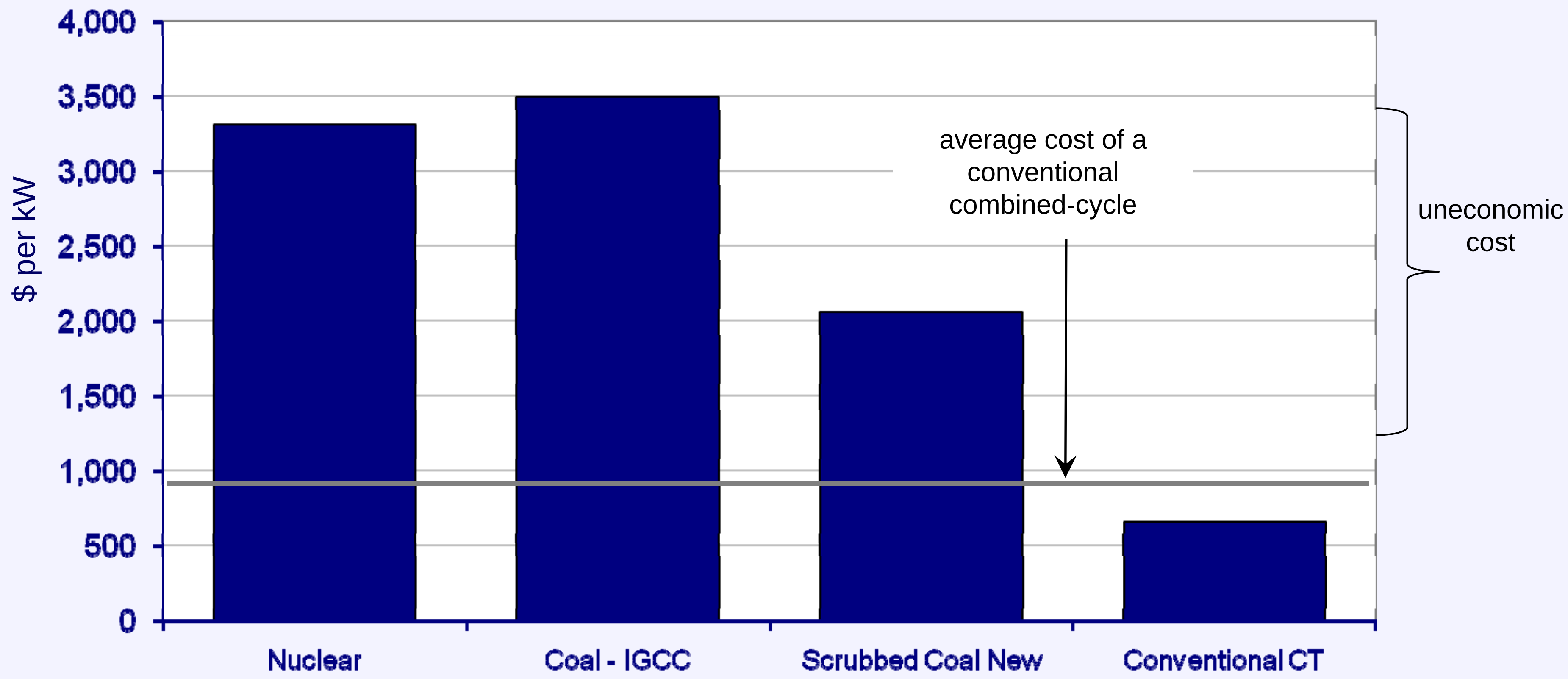
CO2 Emissions Rate by Fuel Type

Coal plants have higher emissions rates than all types of gas plants. Cogeneration and newer gas plants have the lowest overall carbon emission rates.



Total Overnight Cost for New Plants

Resources are typically uneconomic without additional support

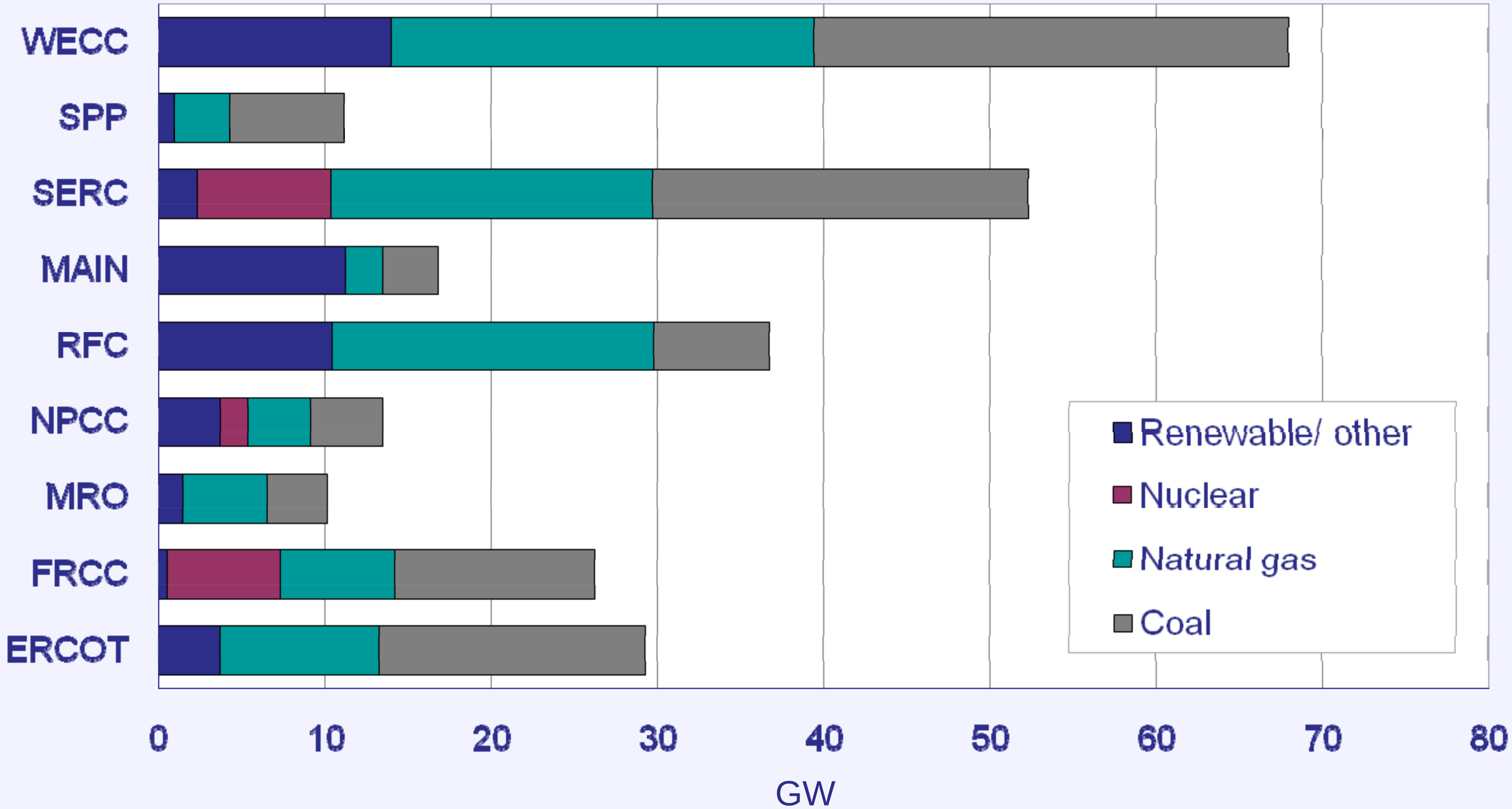


These differentials will have to be recovered from various funding sources

Source: Assumptions to the Annual Energy Outlook 2009, Energy Information Administration, U.S. Department of Energy.

Electric Generation Capacity Additions By Region and Fuel (2007-2030)

All electricity demand regions are expected to need additional, currently unplanned, capacity by 2030. The largest amount of new capacity is expected in the Southeast (FL and SERC), which represents a relatively large and growing share of total U.S. electricity sales and thus requires more capacity than other regions.



Source: Energy Information Administration, U.S. Department of Energy

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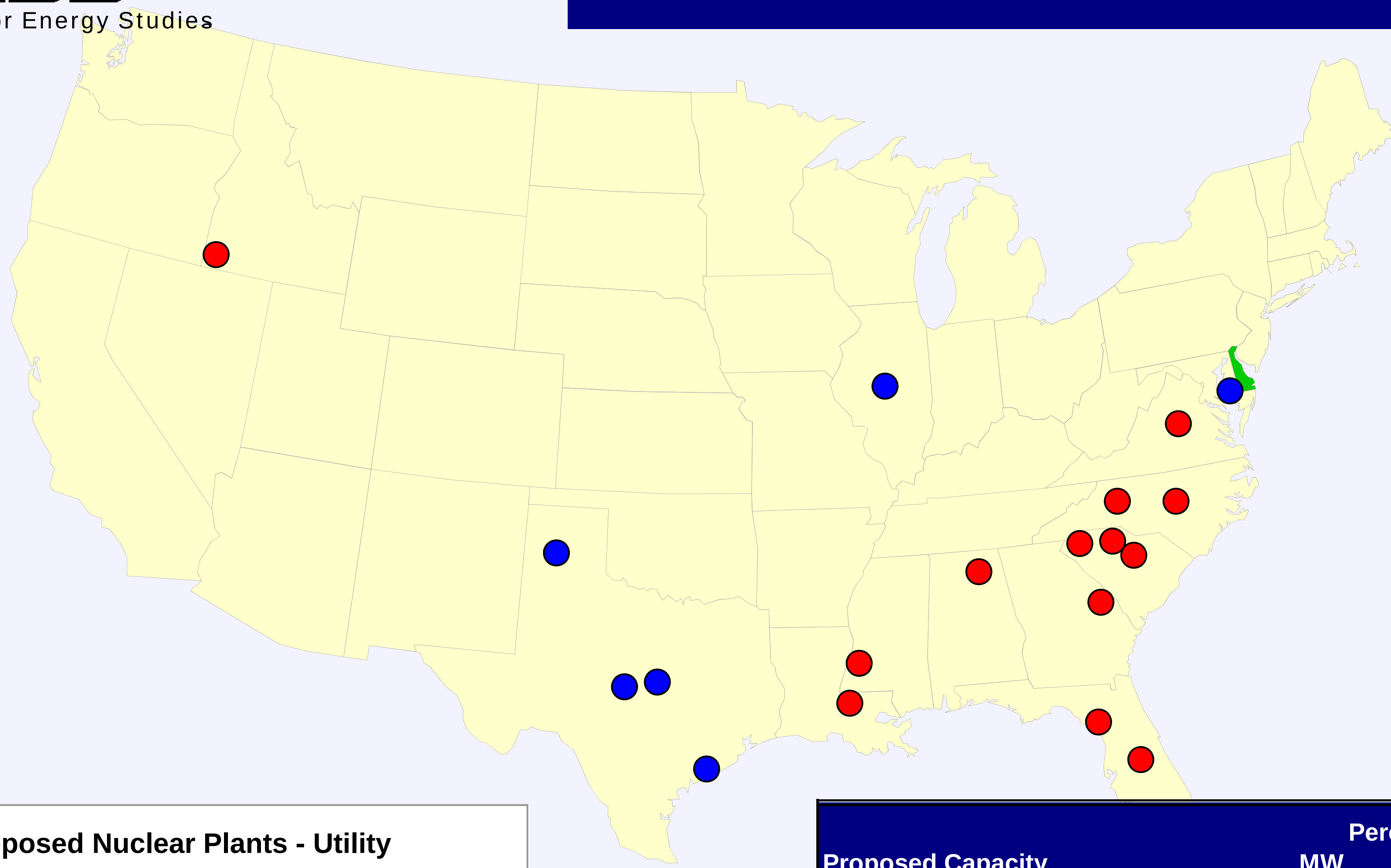
Announced Nuclear Plants



- Proposed Nuclear Plants - Utility
- Proposed Nuclear Plants - Merchant
- Proposed Nuclear Plants - Undetermined

Proposed Capacity	MW	Percent of Total
Utility	22,900	59.2%
Merchant	15,750	40.8%
States w/ Cost Recovery Rules	5,750	14.9%
States w/o Cost Recovery Rules	32,900	85.1%

Note: One proposed plant in Florida and two proposed plants in Texas have locations that are yet to be determined.

Source: Energy Information Administration, US Department of Energy; and Nuclear Energy Institute.

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Renewables

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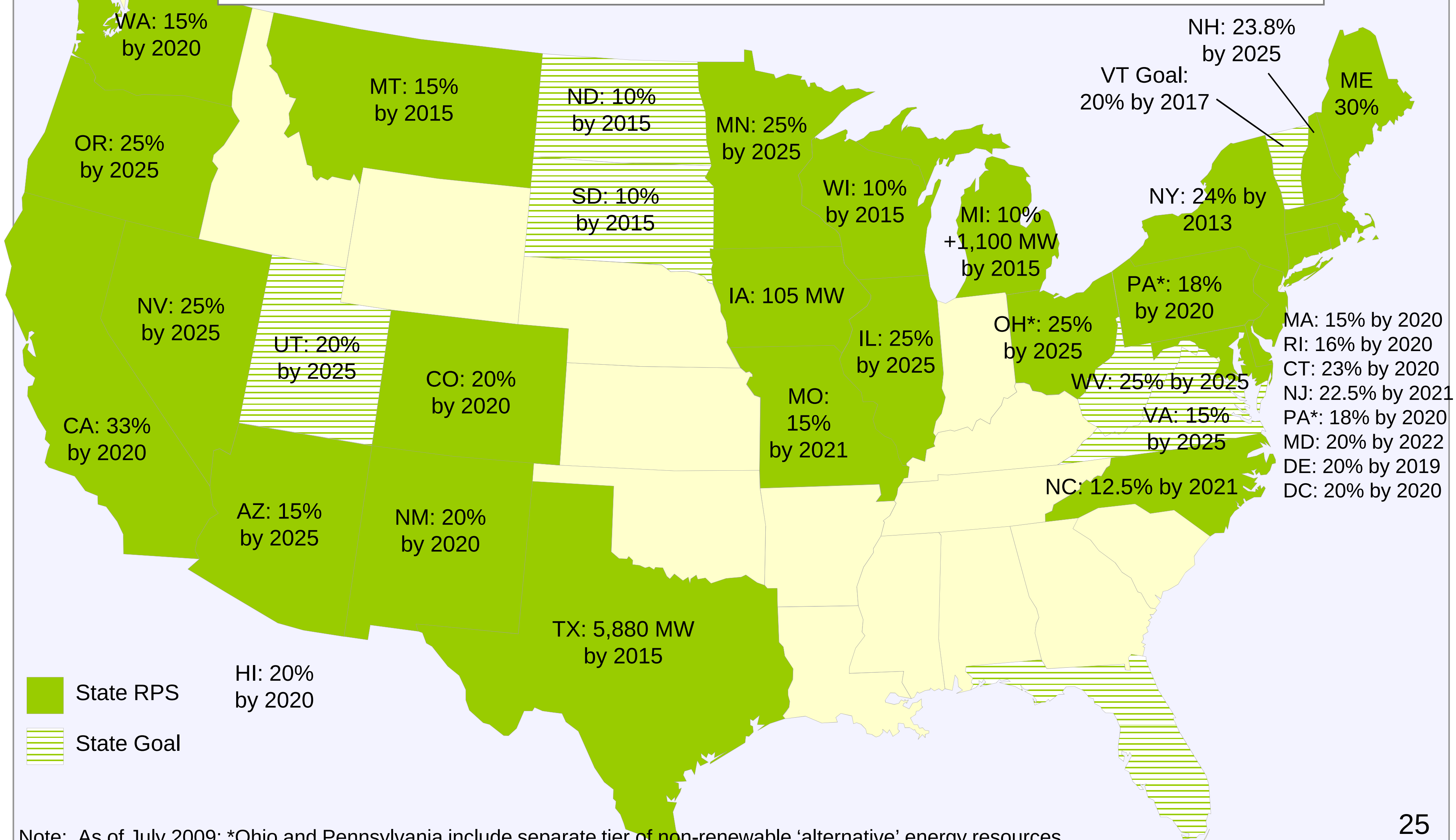
States with Renewable Portfolio Standards

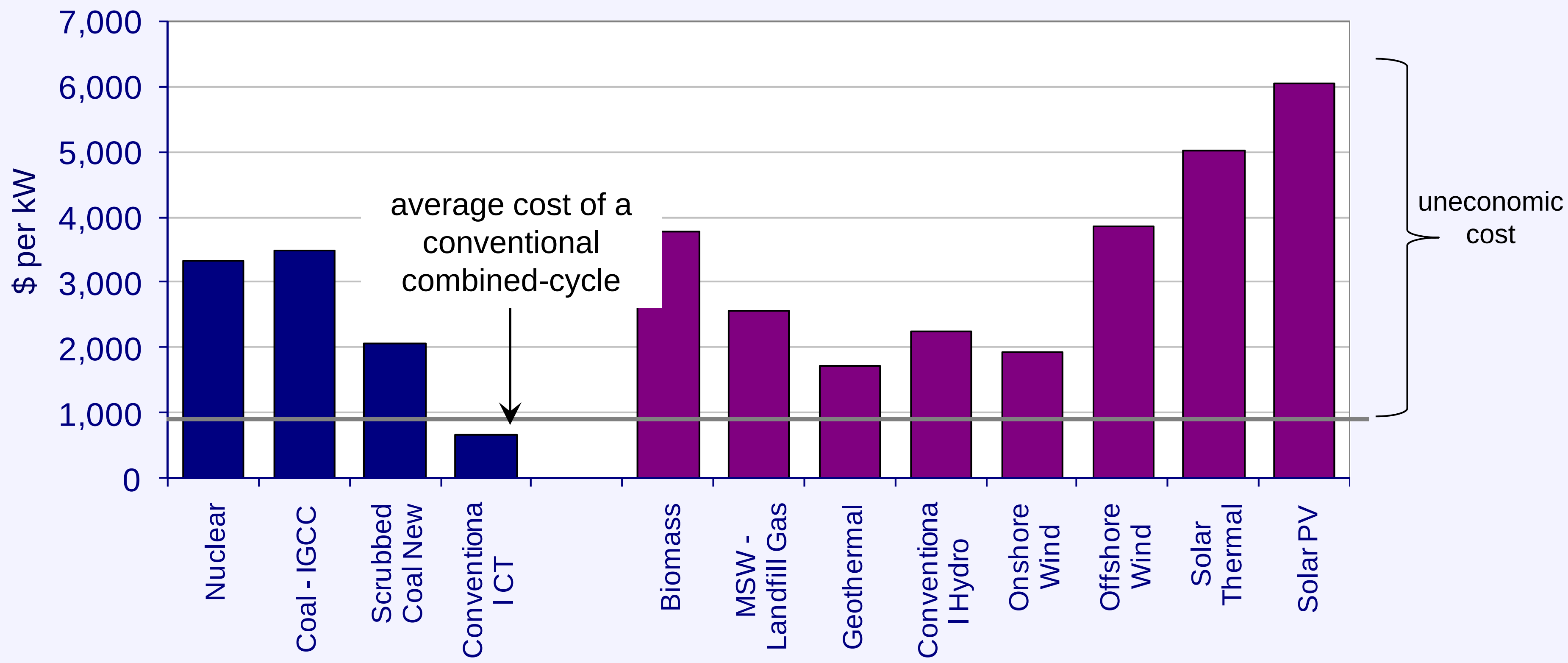
Currently there are 33 states that have RPS policies in place. Together these states account for about 75% of the electricity sales in the US.



Note: As of July 2009; *Ohio and Pennsylvania include separate tier of non-renewable 'alternative' energy resources.
Source: Database of State Incentives for Renewables and Efficiency.

Total Overnight Cost for New Plants

Resources are typically uneconomic without additional support

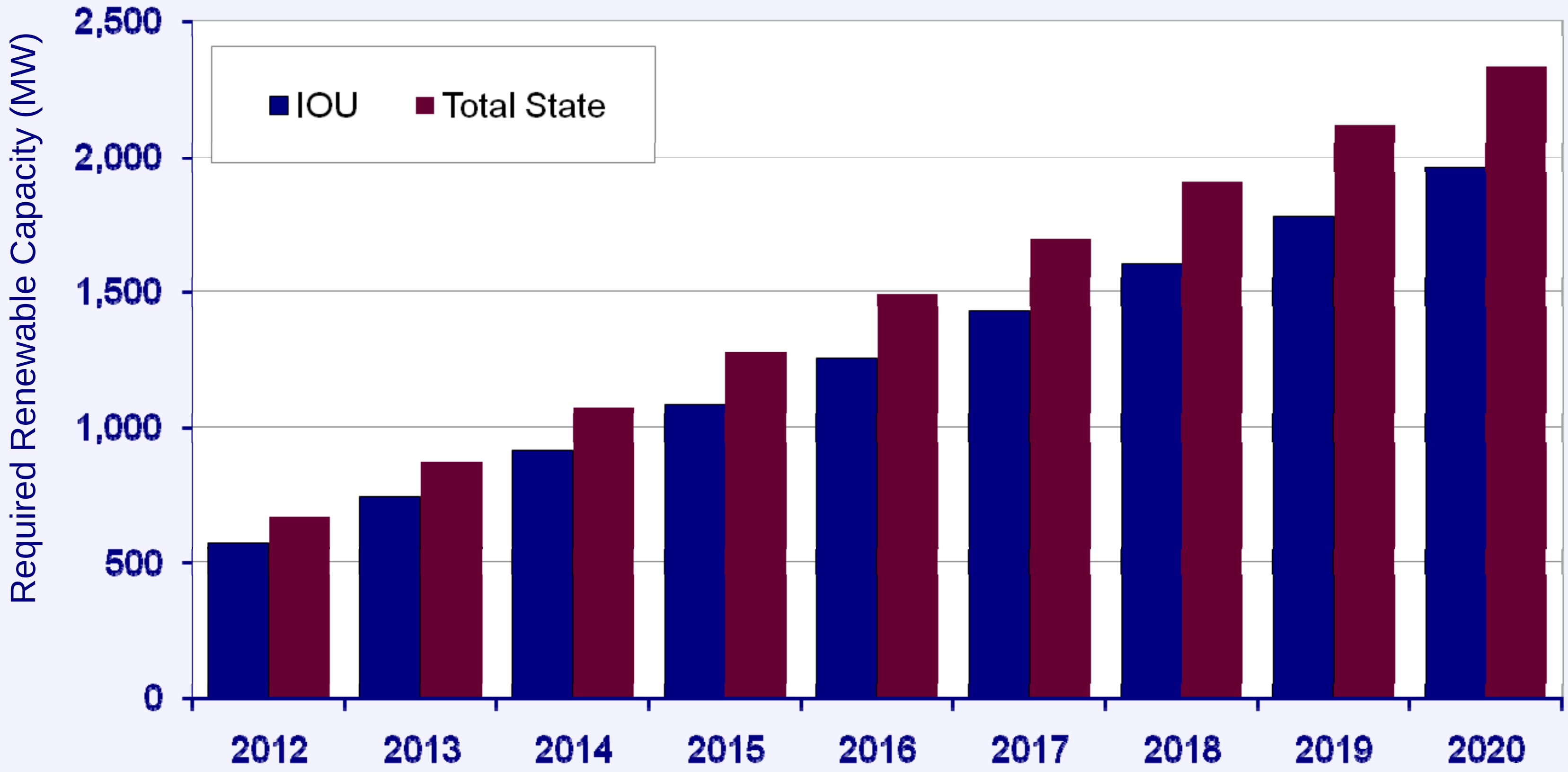


These differentials will have to be recovered from various funding sources

Source: Assumptions to the Annual Energy Outlook 2009, Energy Information Administration, U.S. Department of Energy.

Potential Louisiana RPS Requirements

If generation were to follow current trends and increase each year, the federal RPS would require 1,960 MW of renewable capacity for Louisiana's investor owned utilities and 2,338 MW for the total State, by 2020.



Demand Reduction & Efficiency

What are Utility Conservation Programs?

Programs commonly referred to as "demand side management" – attempt to encourage more efficient use of electricity.

Energy efficiency programs: programs that encourage more efficient energy (kWh) consumption.

Load management programs: programs designed to encourage more efficient peak demand (kW) usage.

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Energy Efficiency Resource Standards

ID: Energy Plan sets conservation – DR and EE as priority resources

WA: pursue all cost effective conservation: ~10% by 2025

OR: IOU 2008 goals 34 MW; administered by Energy Trust OR

CA: 8% energy savings; 4,885 MW peak reduction by 2013 (from '04)

NV: EE up to 25% of RPS: ~5% electric reduction by 2015

UT: EE earns incentive credits in RE goal

CO:11.5% energy savings by 2020 ~ 3,669 GWh (from '08)

NM: 10% retail electric sales savings by 2020 (from '05)

NE: Interim Energy Plan stresses multi-sector EE improvements

KS: Voluntary utility programs

OK: PSC approved quick-start DR utility EE and DR programs

TX: 20% of load growth by 2010, using average growth rate of prior 5 years

HI: 30% electricity reduction: ~4,300 GWh by 2030 (from '09)

MI: 1% annual energy savings from prior year's sales

MN: 1.5% annual savings based on prior 3-years average, to 2015

IA: 5.4% energy savings by 2020 ~ 1.5% annual

WI: RPS requires utility EE

IL: reduce energy use 2% by 2015 and peak 0.1% from prior year

OH: 22% energy savings by 2025 (from '09); reduce peak 8% by 2018

KY: proposed RPS-EE to offset 18% of projected 2025 demand

ME: 30% energy savings; 100 MW peak electric reduction by 2020

VT: 11% energy reductions by 2011 (2% annual) administered by Efficiency VT

MA: 25% of electric load from DSR, EE by 2020: capacity and energy

NY: reduce electric use 15% by 2015 from levels projected in 2008

CT:4% energy savings (1.5% annual) and 10% peak reduction by 2010 (from '07)

RI: reduce 10% of 2006 sales by 2022

NJ: BPU proceeding to reduce consumption, peak

DE: Sustainable Energy Utility charged with 30% energy reduction by 2015

PA: reduce use 3%; peak 4.5% by 2013 as % of 2009-10 sales

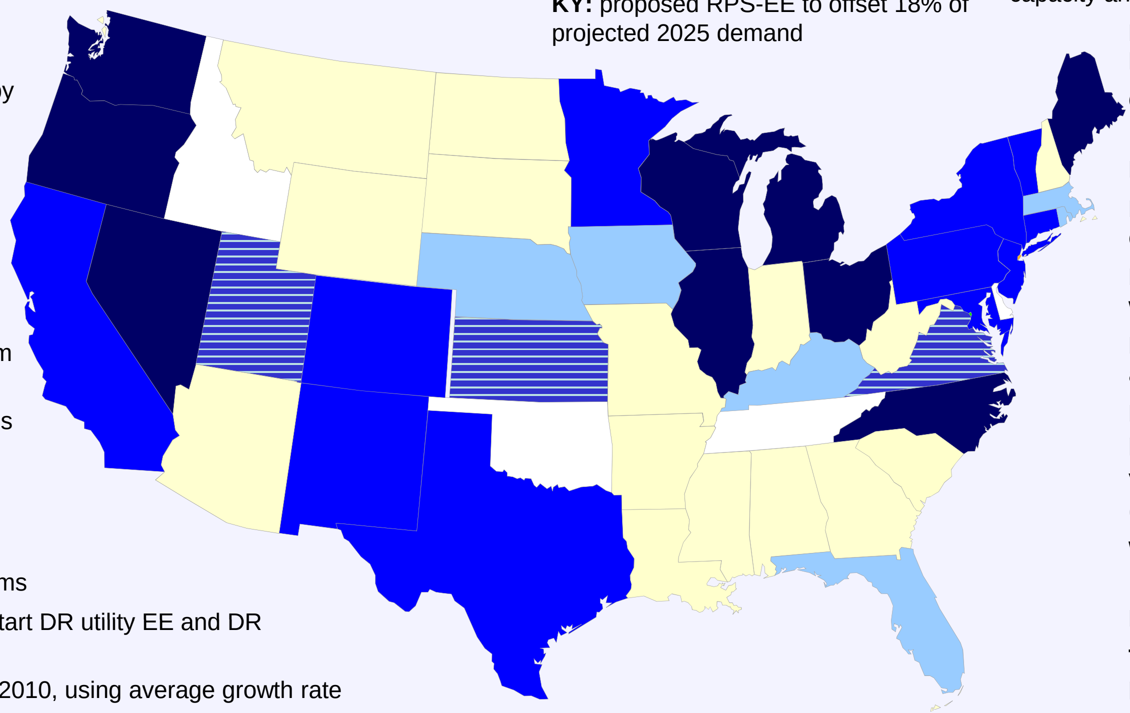
MD: reduce per capita electricity use and peak by 2015 (from '07)

VA: reduce electric use 10% by 2022 (from '06)

WV: EE & DR earn one credit for each MWh conserved in the 25% by 2025

NC: EE to meet up to 25% of RPS by 2011

TVA: reduce energy use 25% and cut peak 1,400 MW by 2012 (from '08)



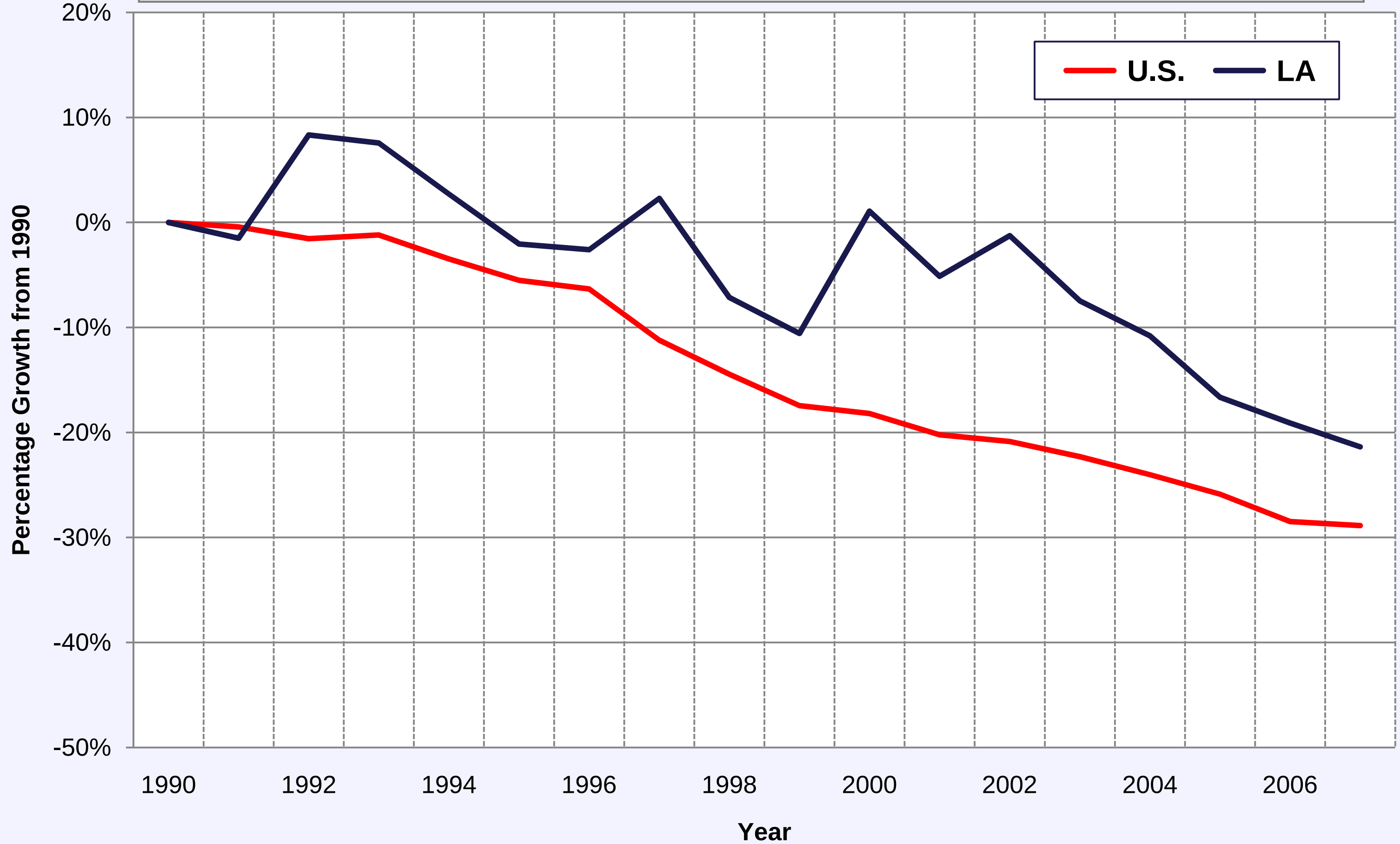
- EE only as part of an RPS law, rule or goal
- EERS by regulation or law (stand-alone)
- Voluntary standards (in or out of RPS)
- EE goal proposed/being studied
- Other EE or DSM rule or goal

Source: Federal Energy Regulatory Commission

Louisiana CO2 Emission Trends

Gross CO2E per GDP and GSP
U.S. and Louisiana

Louisiana has been following emissions reduction trends similar to overall U.S. since 1990.



Source: U.S. Environmental Protection Agency; and Bureau of Economic Analysis, U.S. Department of Commerce.

CO2 E per Btu of Fossil Fuel Consumption Louisiana and U.S.

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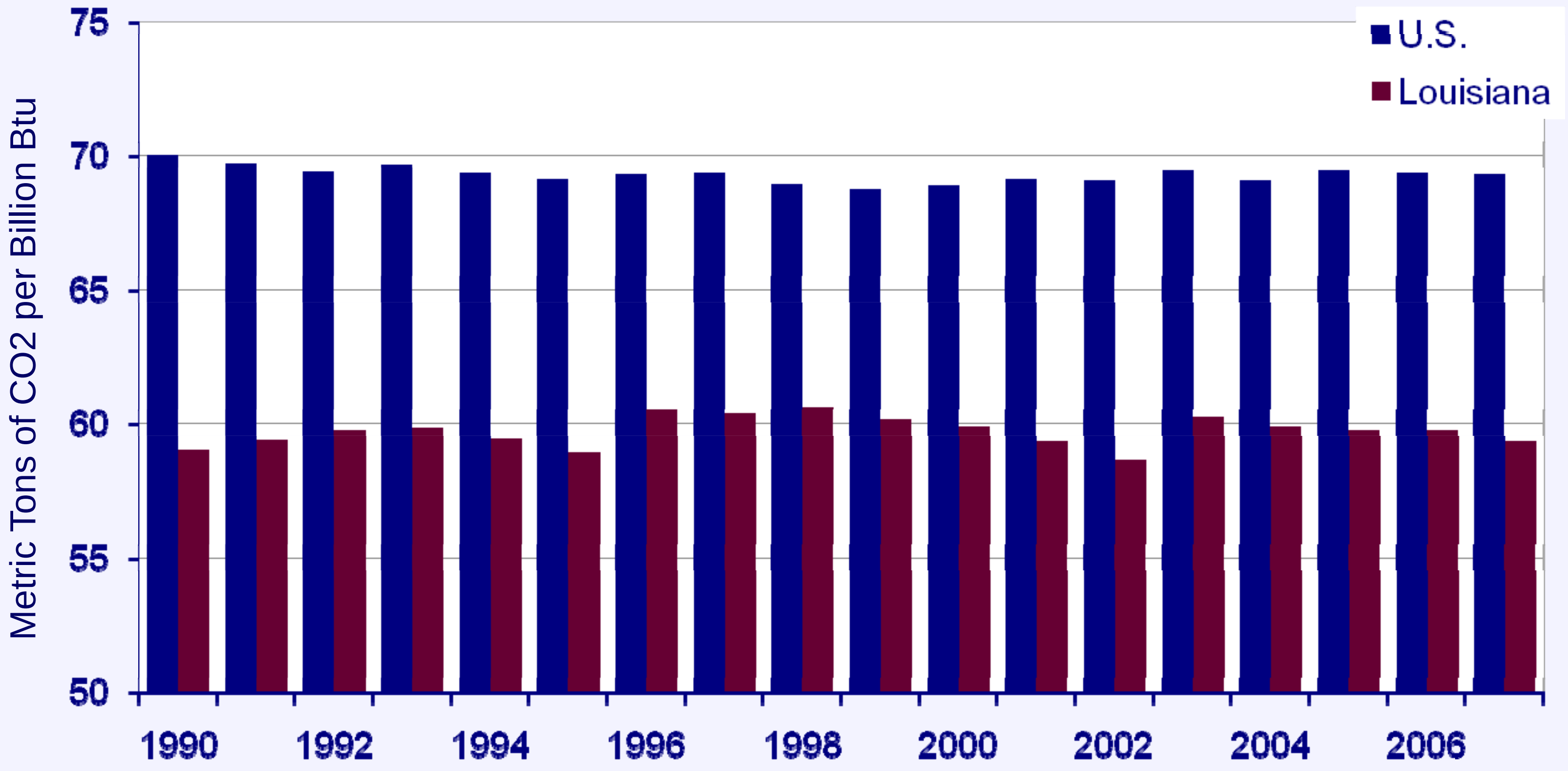
Louisiana tends to be more efficient, however, in emissions per unit of energy consumed.



Source: U.S. Environmental Protection Agency; and Energy Information Administration, U.S. Department of Energy.

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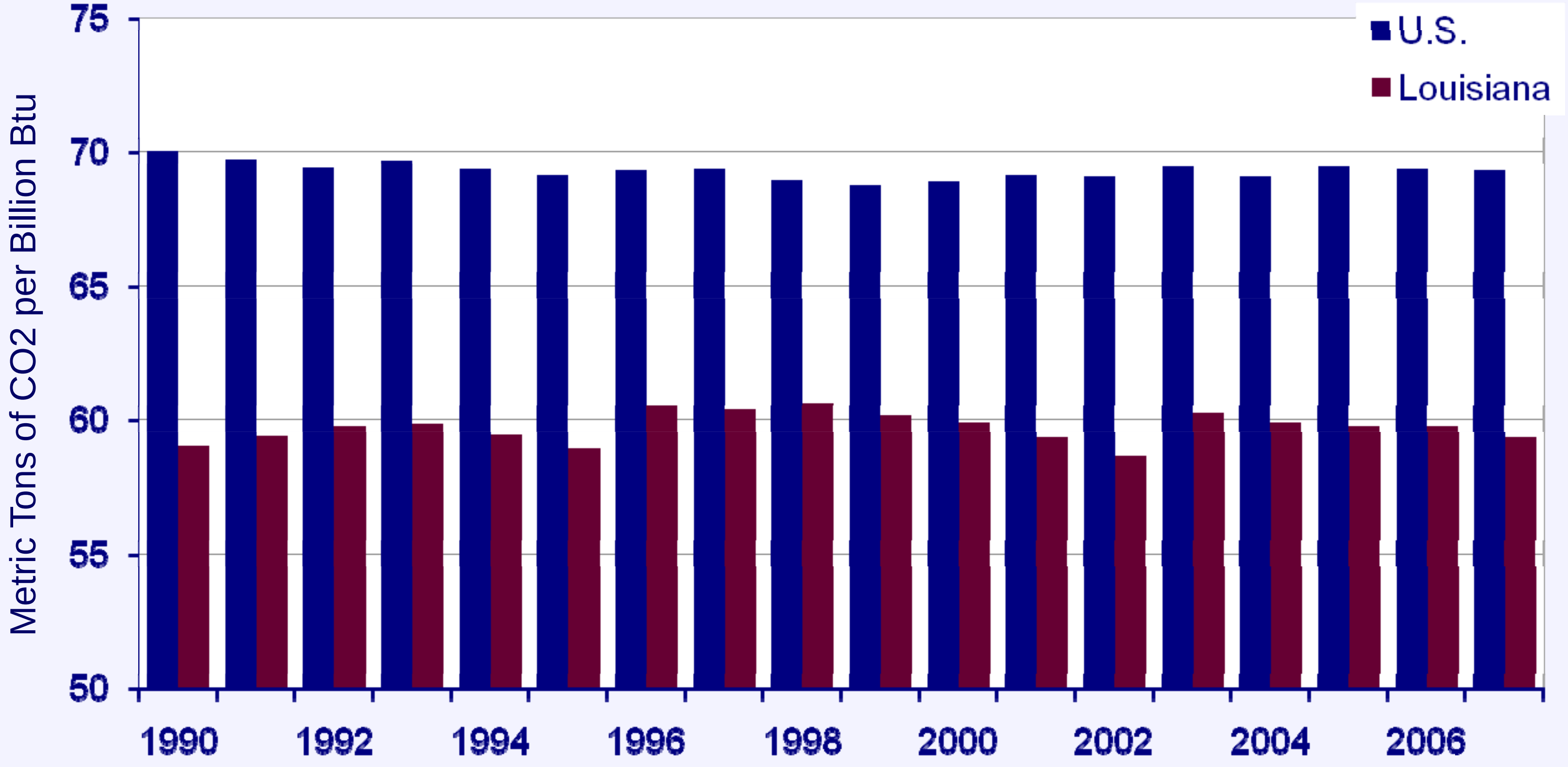
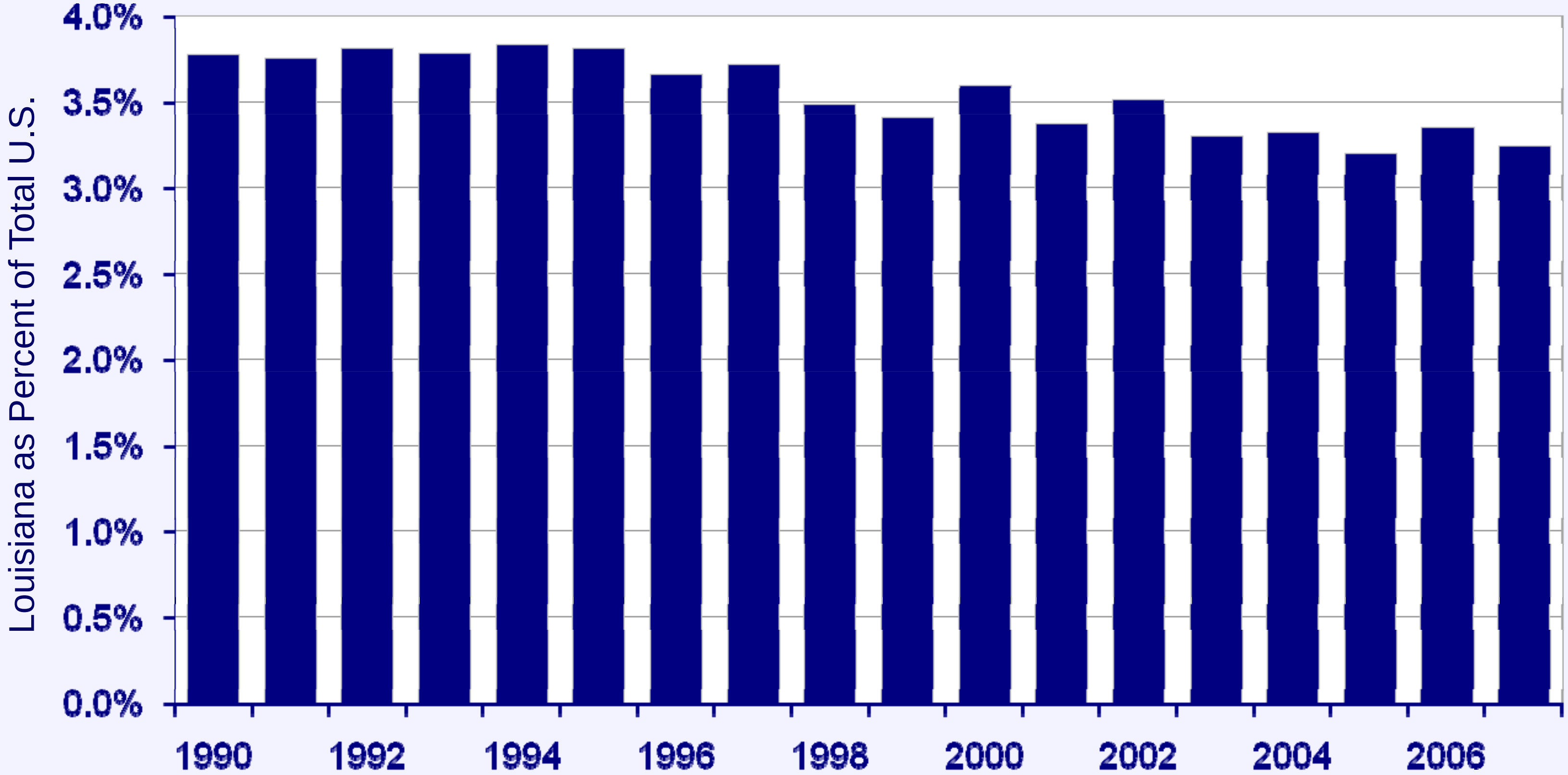


Source: U.S. Environmental Protection Agency; and Energy Information Administration, U.S. Department of Energy.

Louisiana Share of Total U.S. CO2 Emissions

Louisiana's share of U.S. CO2 emissions has been between 3 and 4 percent, but has been falling in recent years.



Source: U.S. Environmental Protection Agency.

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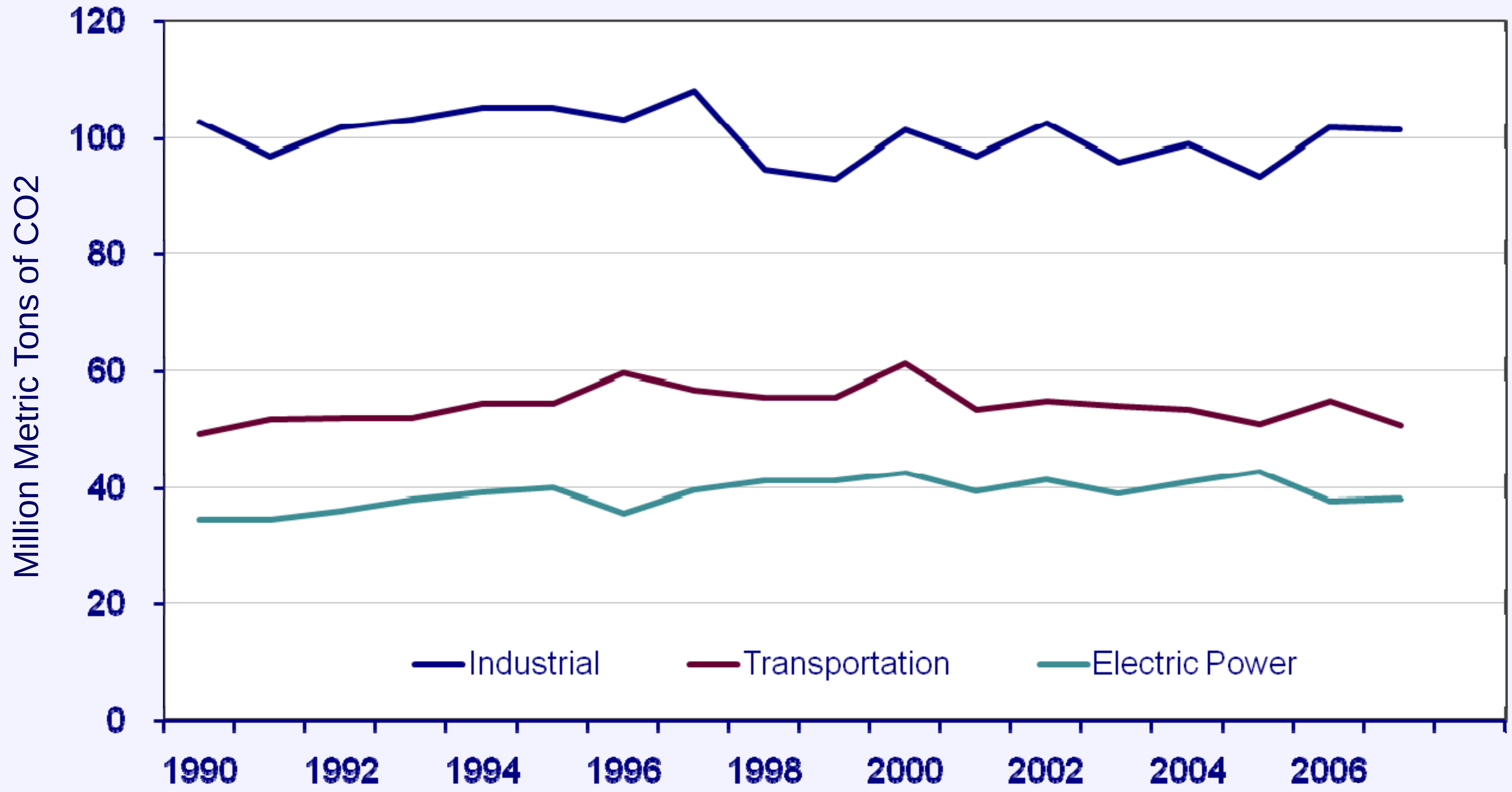
Louisiana CO2 Emissions per Sector 1980 - 2005

Louisiana carbon emissions have been driven primarily by moderate amounts of growth in transportation and electric power generation sectors.



Source: U.S. Environmental Protection Agency.

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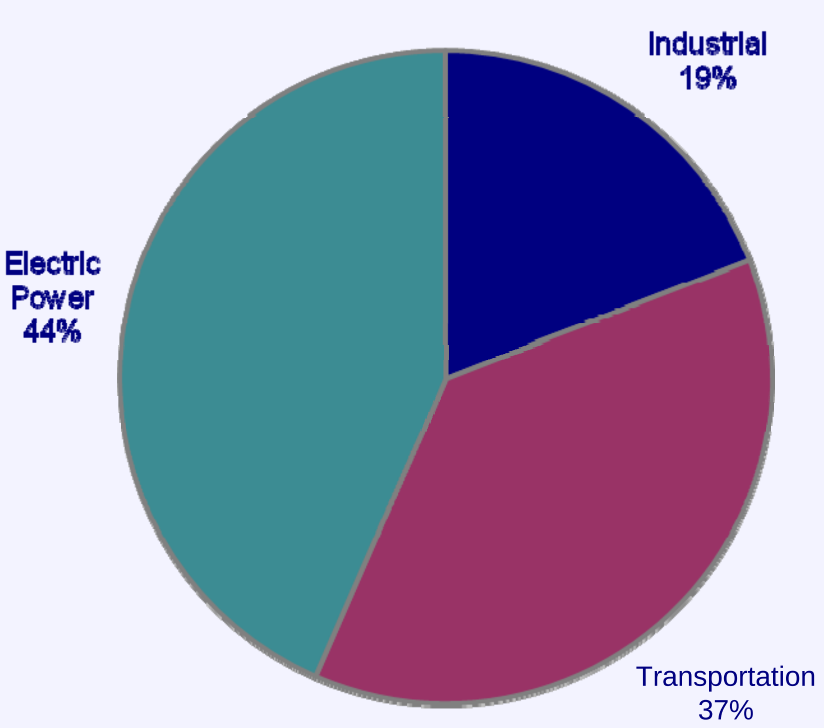
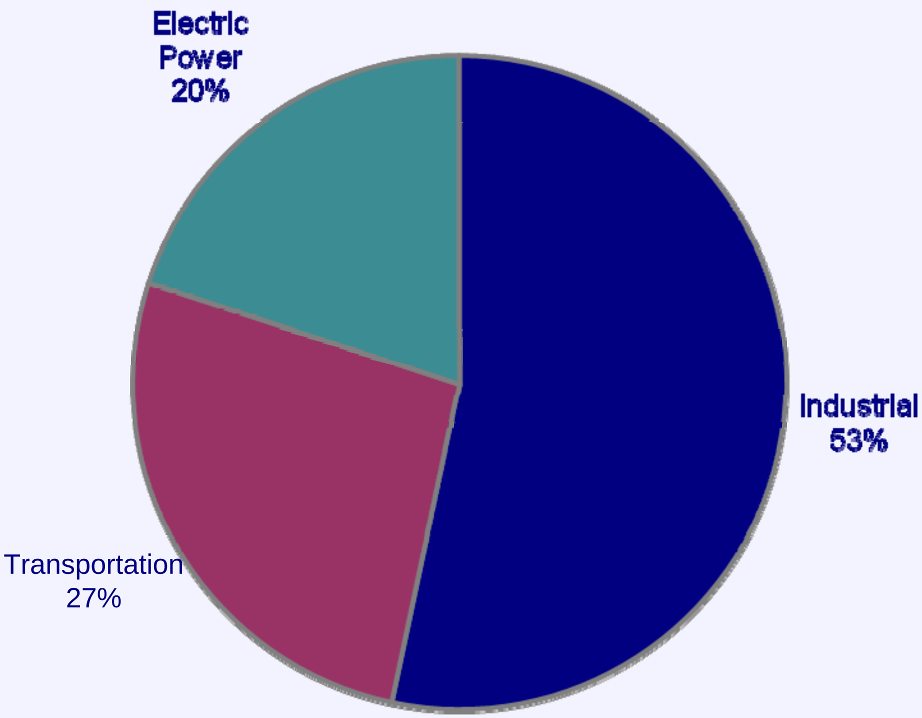
U.S. and Louisiana CO2 Emissions per Sector 2007

In the U.S., power generation comprises about 44 percent of overall national emissions.



In Louisiana, power generation comprises about 20 percent of overall state emissions.



Source: U.S. Environmental Protection Agency.

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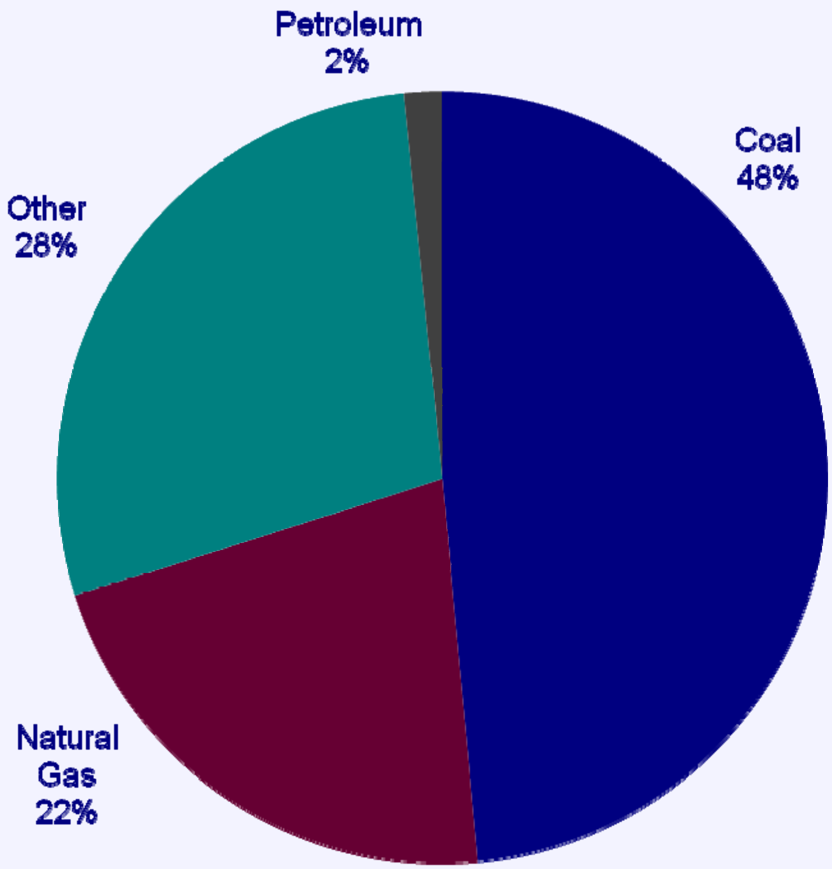
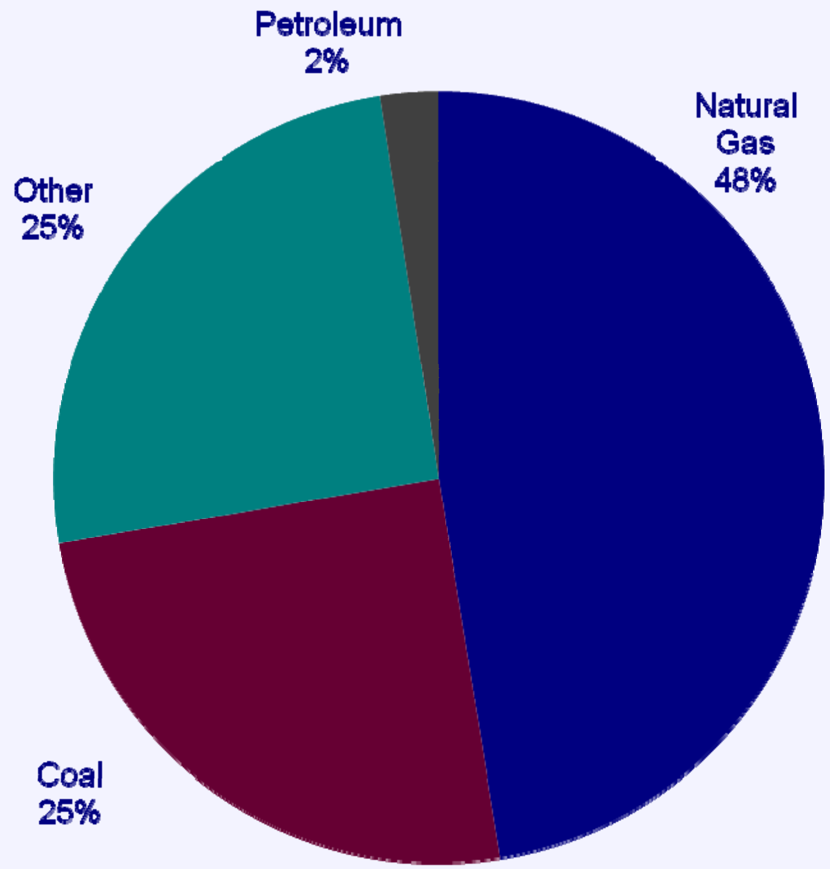
Louisiana and U.S. Electric Power Fuel Mix

In the U.S., coal represents 48 percent of the electric power fuel mix (capacity basis).



In Louisiana, almost half of the electric power generation is fueled by natural gas. Coal only represents 25 percent of the electric power fuel mix (capacity basis).



Source: Energy Information Administration, U.S. Department of Energy

Potential Costs To Louisiana

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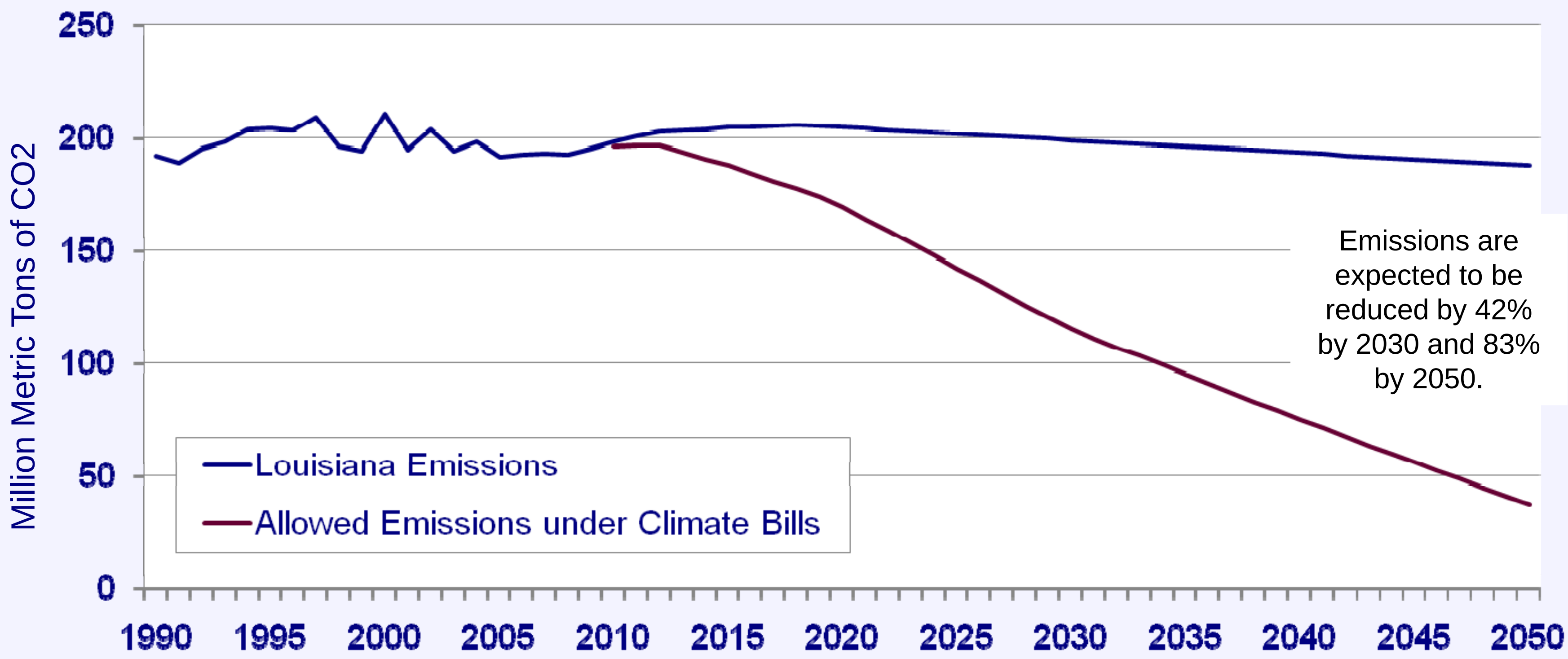
Historic and Projected Louisiana Emissions



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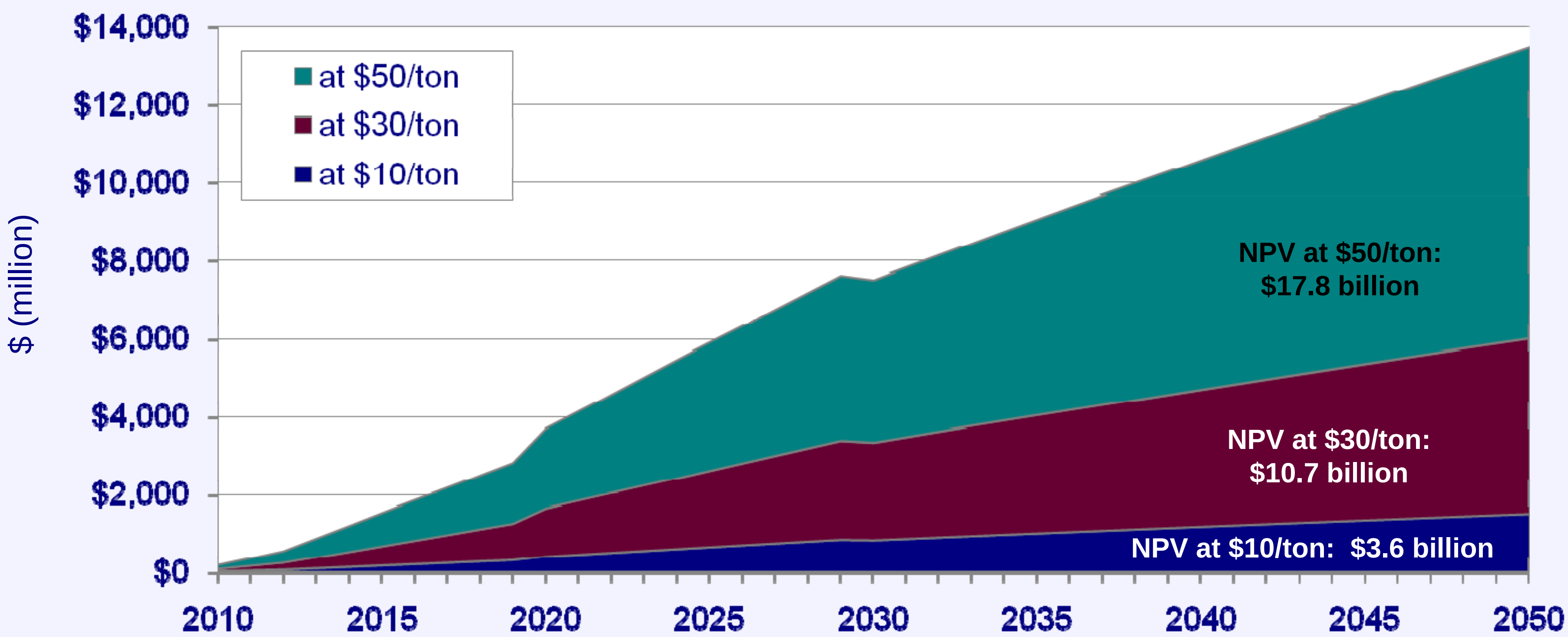
Estimated Cost of Emission Credit Deficits Louisiana Total



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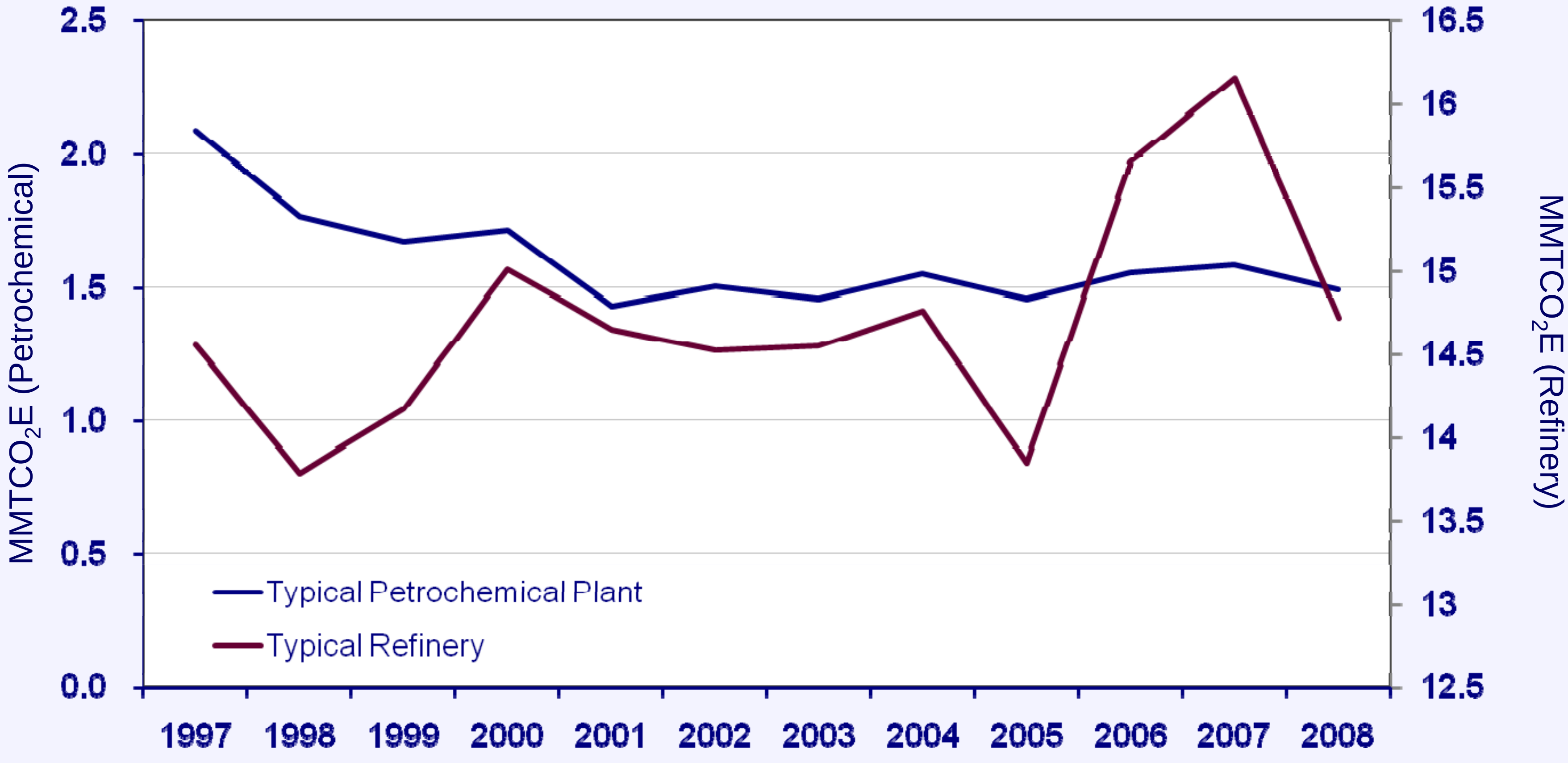
Historic CO2 Emissions "Typical" Facilities

Typical petrochemical facilities and refineries have seen relatively stable trends in recent emissions. Exceptions would be the post-2005 increases for a "typical" refinery.



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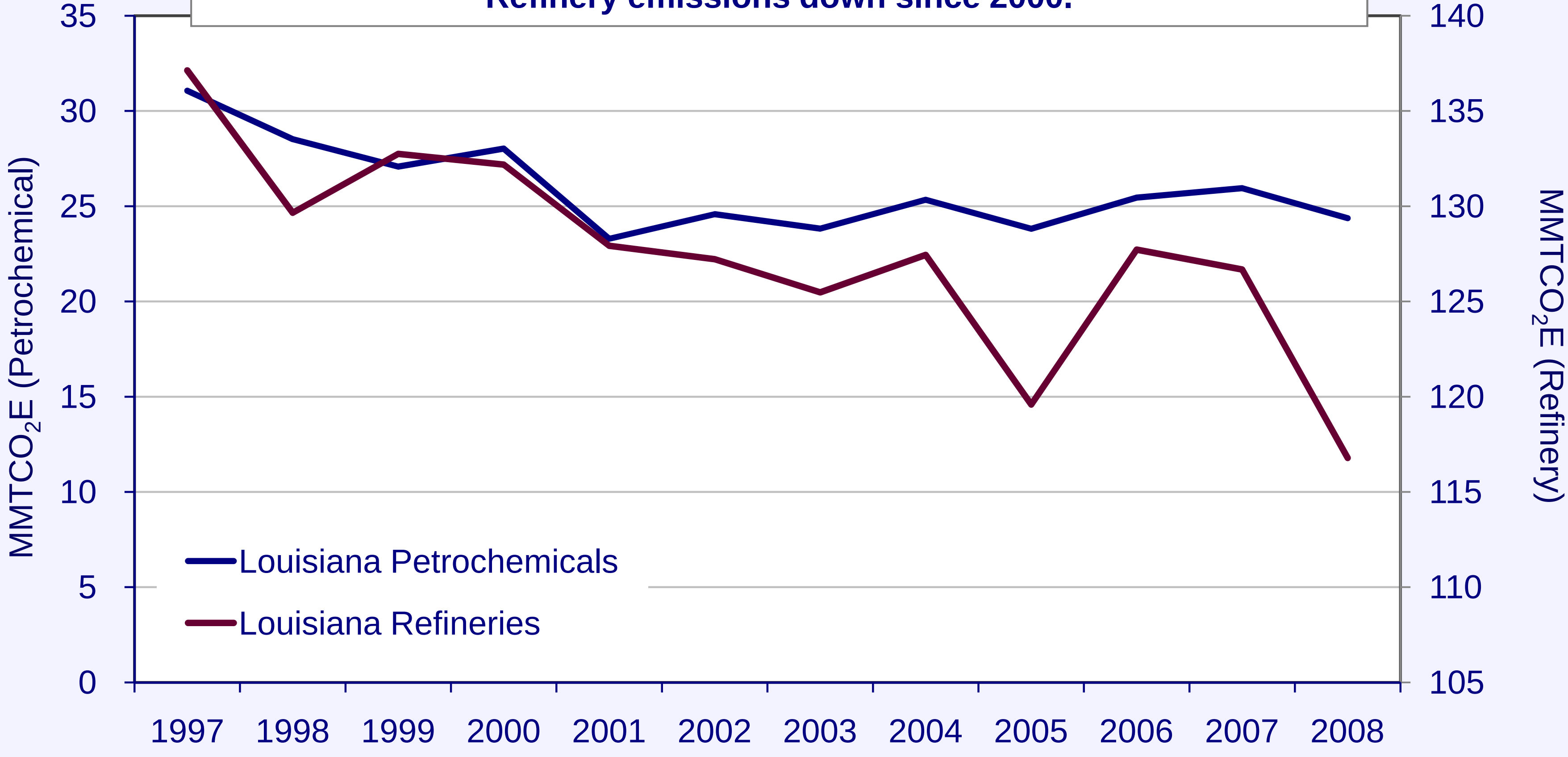
Historic CO2 Emissions
Total Louisiana

Total emissions from both petrochemical facilities and refineries are down considerably from the mid-1990s.

Petrochem emissions relative constant since 2000.
Refinery emissions down since 2000.



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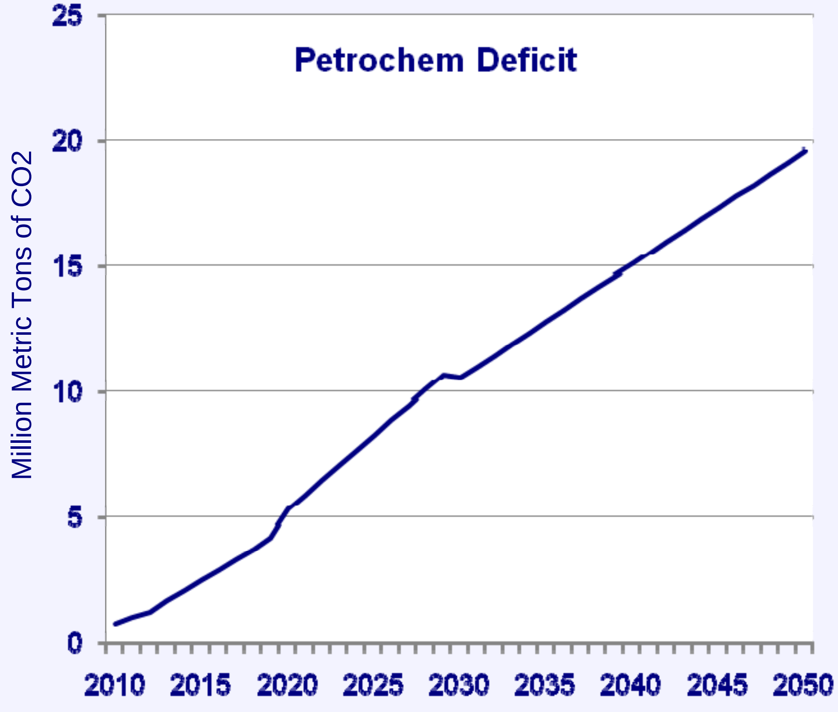
Projected Cost to Louisiana Petrochemical Plants

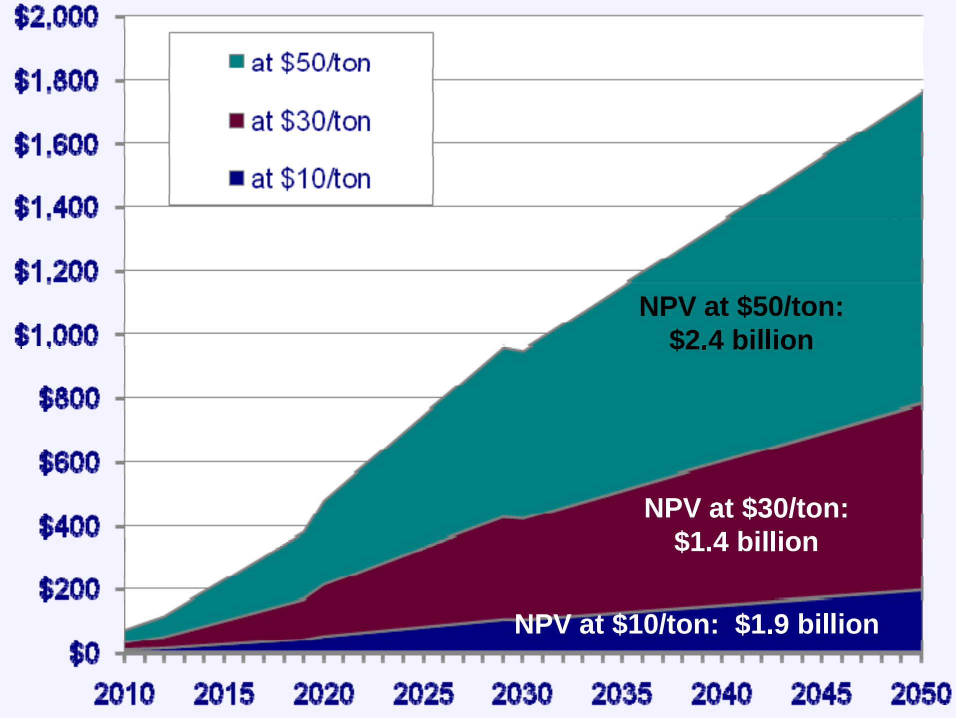
Business as usual projections suggest dramatically increasing emission deficits for Louisiana petrochemical companies. The NPV cost of compliance for this sector is estimated to be $1.4 billion at $30/ton emissions price.

Preliminary estimate, typical facility (@ $25/ton):

2010-2020: $0 to $20 million per year

2020-2050: $20 to $50 million per year.





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Note: assumes petrochemical emissions stay constant at 2008 levels.

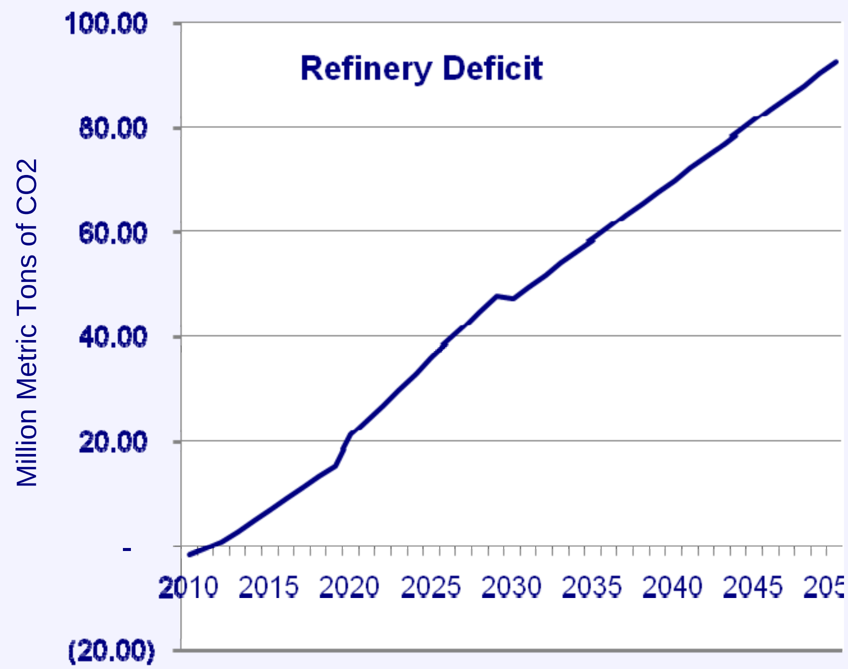
Projected Cost to Louisiana Refinery Plants

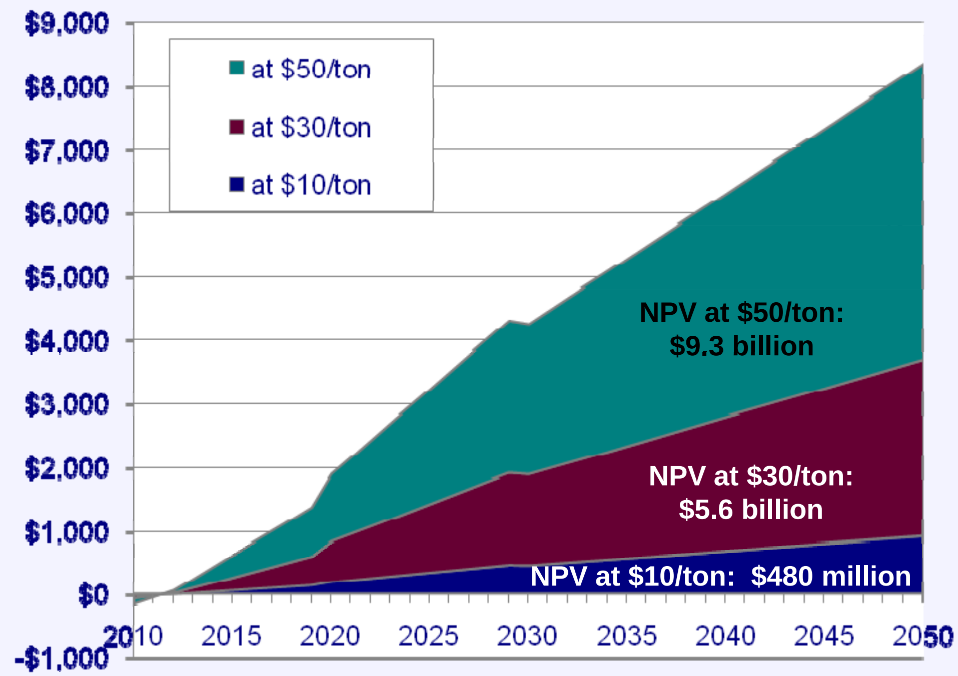
Business as usual projections suggest dramatically increasing emission deficits for Louisiana refineries. The NPV cost of compliance for this sector is estimated to be $5.6 billion at $30/ton emissions price.

Preliminary estimate, typical facility (@ $25/ton):

2010-2020: $0 to $100 million per year

2020-2050: $100 million to $1 billion per year.





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Note: assumes refinery emissions stay constant at 2008 levels.

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Total CO2 Surplus/Deficit by Year and Utility Growth Case

	Annual CO2 Surplus or Deficit by Utility									
	ELI	ENO	EGSI	CLECO	SWEPCO	MUNI	COGEN	IPP-COAL	IPP-GAS	STATE TOTAL
	(tons)									
2012	(500,441)	(102,878)	(535,624)	(580,615)	(195,601)	(184,388)	(734,628)	(1,393,920)	(160,005)	(4,388,099)
2015	(892,090)	(185,188)	(964,167)	(1,045,157)	(354,882)	(331,913)	(1,422,166)	(2,397,477)	(281,320)	(7,874,361)
2020	(2,234,168)	(364,525)	(1,873,688)	(2,028,156)	(1,117,499)	(651,937)	(2,615,415)	(4,358,474)	(537,728)	(15,781,589)
2025	(2,827,940)	(871,174)	(2,606,150)	(2,831,478)	(1,462,209)	(867,874)	(3,342,109)	(5,387,710)	(707,380)	(20,904,024)
2030	(3,895,585)	(1,162,784)	(3,131,540)	(3,777,193)	(1,778,270)	(1,036,213)	(4,035,466)	(6,279,190)	(876,104)	(25,972,345)
2035	(4,675,083)	(1,406,812)	(3,504,733)	(4,277,071)	(2,019,842)	(1,146,626)	(4,880,040)	(6,880,813)	(997,824)	(29,788,844)
2040	(5,427,784)	(1,685,363)	(3,872,278)	(4,806,203)	(2,856,581)	(1,253,471)	(5,364,271)	(7,466,141)	(1,127,964)	(33,860,056)
2045	(5,857,677)	(1,860,762)	(3,991,927)	(5,026,263)	(3,017,210)	(1,299,380)	(5,608,672)	(7,696,836)	(1,214,330)	(35,573,057)
2050	(6,046,280)	(1,907,695)	(4,052,490)	(5,102,519)	(3,144,094)	(1,326,228)	(5,781,919)	(7,813,607)	(1,290,491)	(36,465,323)

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Total CO2 Cost by Year and Utility
Growth Case

					Annual Abatement Costs					
	ELI	ENO	EGSI	CLECO	SWEPCO	MUNI	COGEN	IPP-COAL	IPP-GAS	STATE TOTAL
					(million $)					
2012	$ 103.0	$ 21.2	$ 110.2	$ 119.5	$ 40.3	$ 37.9	$ 151.2	$ 286.9	$ 32.9	$903.10
2015	$ 114.9	$ 23.8	$ 124.1	$ 134.6	$ 45.7	$ 42.7	$ 183.1	$ 308.7	$ 36.2	$1,013.87
2020	$ 178.1	$ 29.1	$ 149.4	$ 161.7	$ 89.1	$ 52.0	$ 208.5	$ 347.5	$ 42.9	$1,258.36
2025	$ 201.4	$ 62.0	$ 185.6	$ 201.7	$ 104.1	$ 61.8	$ 238.0	$ 383.7	$ 50.4	$1,488.73
2030	$ 262.8	$ 78.4	$ 211.3	$ 254.8	$ 120.0	$ 69.9	$ 272.3	$ 423.6	$ 59.1	$1,752.26
2035	$ 317.8	$ 95.6	$ 238.2	$ 290.7	$ 137.3	$ 77.9	$ 331.7	$ 467.7	$ 67.8	$2,024.91
2040	$ 375.4	$ 116.6	$ 267.8	$ 332.4	$ 197.6	$ 86.7	$ 371.0	$ 516.4	$ 78.0	$2,341.98
2045	$ 433.9	$ 137.8	$ 295.7	$ 372.3	$ 223.5	$ 96.3	$ 415.5	$ 570.2	$ 90.0	$2,635.13
2050	$ 487.1	$ 153.7	$ 326.5	$ 411.1	$ 253.3	$ 106.8	$ 465.8	$ 629.5	$ 104.0	$2,937.80
NPV:	$1,404.19	$395.16	$1,121.34	$1,320.04	$677.51	$373.20	$1,546.10	$2,364.10	$327.57	$9,529.21

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Note: Assumes credit cost of $15/ton (escalated by 2% per year).

LSU Center for Energy Studies

Residential Annual Bill Impact Growth Case

	ELI	ENO	EGSI	CLECO	SWEPCO	MUNI	COGEN	IPP-COAL	IPP-GAS	STATE AVG
	Annual Average Ratepayer Impacts (Bill Impact)									
	($/bill)									
2012	$56.99	$46.12	$90.82	$207.73	$111.34	$124.90	n.a.	$577.16	n.a.	$177.61
2015	$63.58	$51.78	$102.28	$233.98	$126.26	$140.72	n.a.	$621.02	n.a.	$199.38
2020	$98.55	$63.31	$123.13	$281.08	$246.16	$171.37	n.a.	$699.07	n.a.	$247.47
2025	$111.44	$134.88	$152.96	$350.62	$287.61	$203.67	n.a.	$771.90	n.a.	$292.78
2030	$145.41	$170.55	$174.14	$442.92	$331.53	$230.36	n.a.	$852.16	n.a.	$344.60
2035	$175.84	$207.97	$196.31	$505.33	$379.33	$256.73	n.a.	$940.88	n.a.	$398.19
2040	$207.71	$253.66	$220.71	$577.81	$545.93	$285.73	n.a.	$1,038.85	n.a.	$460.57
2045	$240.08	$299.77	$243.70	$647.17	$617.48	$317.36	n.a.	$1,147.08	n.a.	$518.26
2050	$269.52	$334.36	$269.08	$714.62	$699.81	$351.97	n.a.	$1,266.38	n.a.	$577.77
Percent Increase on a Typical Bill										
2015	3.8%	3.1%	6.1%	13.8%	7.4%	8.3%	n.a.	38.5%	n.a.	11.8%
2020	4.2%	3.4%	6.7%	15.3%	8.3%	9.2%	n.a.	40.6%	n.a.	13.0%
2025	6.3%	4.1%	7.9%	18.0%	15.8%	11.0%	n.a.	44.8%	n.a.	15.9%
2030	7.0%	8.5%	9.6%	22.0%	18.1%	12.8%	n.a.	48.5%	n.a.	18.4%
2035	9.0%	10.5%	10.7%	27.3%	20.4%	14.2%	n.a.	52.5%	n.a.	21.2%
2040	10.6%	12.6%	11.9%	30.5%	22.9%	15.5%	n.a.	56.8%	n.a.	24.0%
2045	12.3%	15.0%	13.1%	34.2%	32.3%	16.9%	n.a.	61.5%	n.a.	27.3%
2050	13.9%	17.4%	14.1%	37.6%	35.8%	18.4%	n.a.	66.6%	n.a.	30.1%

Note: Assumes credit cost of $15/ton (escalated by 2% per year). Assumes a typical bill is $1,500 per year (escalated by 2% per year)

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Center for Energy Studies

Industrial Annual Bill Impact
Growth Case

Annual Average Ratepayer Impacts (Bill Impact)

	ELI	ENO	EGSI	CLECO	SWEPCO	MUNI	COGEN	IPP-COAL	IPP-GAS	STATE AVG
	($/bill)									
2012	$5,042	$1,273	$10,338	$52,090	$2,957	$111	n.a.	$10,519	n.a.	$11,761
2015	$5,299	$1,351	$10,970	$55,278	$3,163	$118	n.a.	$10,666	n.a.	$12,407
2020	$7,443	$1,492	$11,958	$60,168	$5,586	$130	n.a.	$10,876	n.a.	$13,950
2025	$7,622	$2,885	$13,455	$67,952	$5,913	$140	n.a.	$10,876	n.a.	$15,549
2030	$9,008	$3,304	$13,872	$77,779	$6,170	$144	n.a.	$10,876	n.a.	$17,308
2035	$9,866	$3,647	$14,168	$80,372	$6,396	$145	n.a.	$10,876	n.a.	$17,924
2040	$10,556	$4,027	$14,427	$83,234	$8,336	$146	n.a.	$10,876	n.a.	$18,800
2045	$11,051	$4,313	$14,427	$84,436	$8,541	$147	n.a.	$10,876	n.a.	$19,113
2050	$11,236	$4,356	$14,427	$84,436	$8,767	$148	n.a.	$10,876	n.a.	$19,178

Note: Assumes credit cost of $15/ton (escalated by 2% per year).

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Center for Energy Studies

Industrial Annual Bill Impact
Growth Case

	Annual Average Ratepayer Impacts (Bill Impact)									
	ELI	ENO	EGSI	CLECO	SWEPCO	MUNI	COGEN	IPP-COAL	IPP-GAS	STATE AVG
	($/bill)									
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2020	$7,443	$1,492	$11,958	$60,168	$5,586	$130	n.a.	$10,876	n.a.	$13,950
2025	$7,622	$2,885	$13,455	$67,952	$5,913	$140	n.a.	$10,876	n.a.	$15,549
2030	$9,008	$3,304	$13,872	$77,779	$6,170	$144	n.a.	$10,876	n.a.	$17,308
2035	$9,866	$3,647	$14,168	$80,372	$6,396	$145	n.a.	$10,876	n.a.	$17,924
2040	$10,556	$4,027	$14,427	$83,234	$8,336	$146	n.a.	$10,876	n.a.	$18,800
2045	$11,051	$4,313	$14,427	$84,436	$8,541	$147	n.a.	$10,876	n.a.	$19,113
2050	$11,236	$4,356	$14,427	$84,436	$8,767	$148	n.a.	$10,876	n.a.	$19,178
Percent Increase on a Typical Bill										
2012	5.0%	1.3%	10.3%	52.1%	3.0%	0.1%	n.a.	10.5%	n.a.	11.8%
2015	5.2%	1.3%	10.8%	54.2%	3.1%	0.1%	n.a.	10.5%	n.a.	12.2%
2020	7.2%	1.4%	11.5%	57.8%	5.4%	0.1%	n.a.	10.5%	n.a.	13.4%
2025	7.2%	2.7%	12.7%	64.0%	5.6%	0.1%	n.a.	10.2%	n.a.	14.7%
2030	8.3%	3.1%	12.8%	71.9%	5.7%	0.1%	n.a.	10.0%	n.a.	16.0%
2035	8.9%	3.3%	12.8%	72.8%	5.8%	0.1%	n.a.	9.9%	n.a.	16.2%
2040	9.4%	3.6%	12.8%	73.9%	7.4%	0.1%	n.a.	9.7%	n.a.	16.7%
2045	9.6%	3.8%	12.6%	73.5%	7.4%	0.1%	n.a.	9.5%	n.a.	16.6%
2050	9.6%	3.7%	12.3%	72.1%	7.5%	0.1%	n.a.	9.3%	n.a.	16.4%

Note: Assumes credit cost of $15/ton (escalated by 2% per year). Assumes a typical bill is $100,000 per year (escalated by 2% per year)

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Conclusions

Conclusions

- Policy proposals associated with climate change are likely to be the biggest form of energy market restructuring ever experienced.
- Credibility, M&V, volatility, and confusion are likely to be experienced early in this process. Policy is outpacing the technology and institutional capabilities.
- The combination of climate, energy efficiency, and renewables are likely to have unanticipated consequences.
- Significant redistribution of wealth between sectors, income classes, and even various regions and countries around the world.
- High near and intermediate term reliance on natural gas particularly for power generation.

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Questions & Comments

dismukes@lsu.edu

www.enrg.lsu.edu