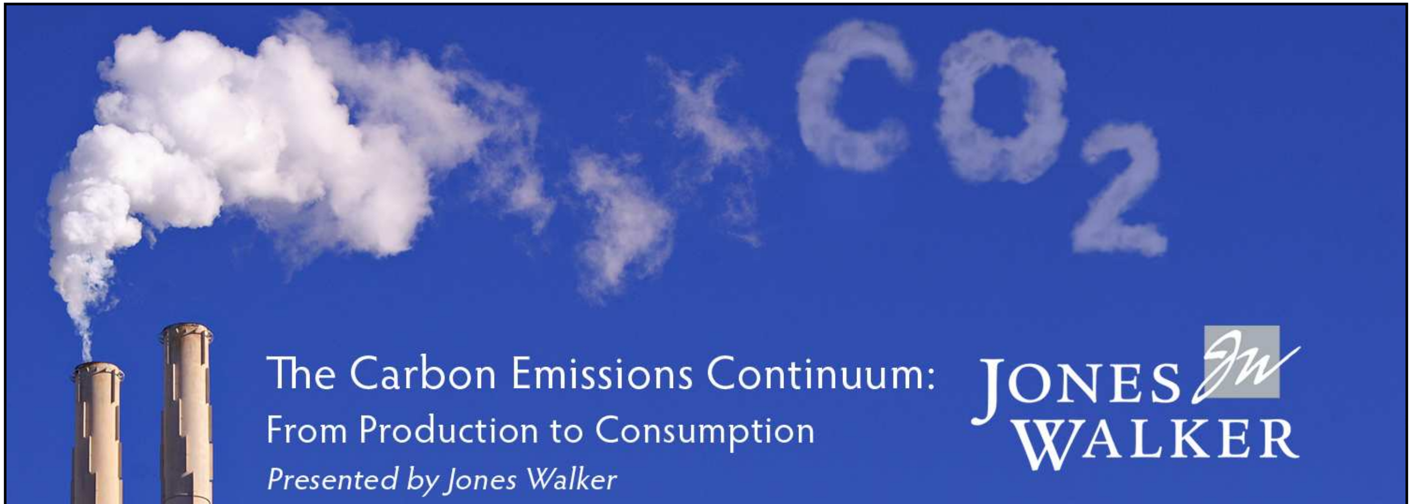

July 23, 2009
Energy, Coast & Environment Building
Louisiana State University
Baton Rouge, Louisiana

Possibilities for CO_2 Sequestration and CO_2-Enhanced Oil Recovery in Louisiana

Presentation to

JonesWalker Briefing
The Carbon Emissions Continuum

LSU Center for Energy Studies
Baton Rouge, LA

By
Mike D. McDaniel, Ph.D.
LSU Center for Energy Studies

July 23, 2009

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Possibilities for CO_2 Sequestration and CO_2-Enhanced Oil Recovery in Louisiana

PRESENTATION OUTLINE

- Background for CO_2-EOR
  - U.S.
  - Louisiana
- GHG Regulation (Carbon Capture & Storage) as a Source of CO_2
- Combining CO_2 Sequestration with CO_2-EOR
- Summary Remarks
- Questions/Discussion

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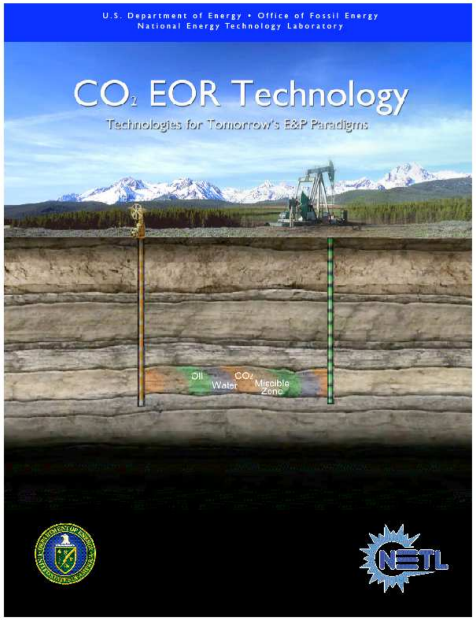
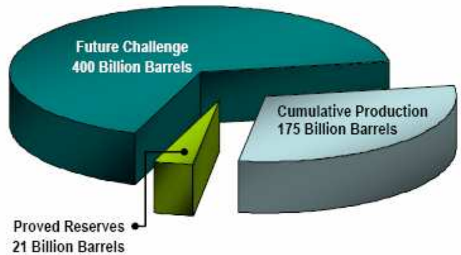
CO_2-Enhanced Oil Recovery (CO_2-EOR)



Large Volumes Of Domestic Oil Remain "Stranded" After Traditional Primary/Secondary Oil Recovery

Original Oil In-Place: 596 B Barrels*

"Stranded" Oil In-Place: 400 B Barrels*

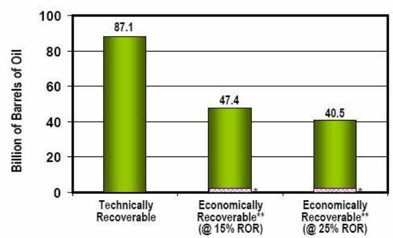


*Based on field-by-field assessment of over 2,011 large U.S. oil fields accounting for 74% of domestic oil production; excludes deep-water GOM.
Source: Advanced Resources International (2008)

May 6, 2008

Advanced Resources International

Economically Recoverable w/CO_2-EOR



*Already produced or place into proved reserves with CO2-EOR.
**Assuming oil price of $70/B (real); CO2 costs (delivered to field at pressure) of $45/metric ton ($2.38/Mcf); investment hurdle rate (15% and 25% ROR, real).

May 6, 2008

Advanced Resources International

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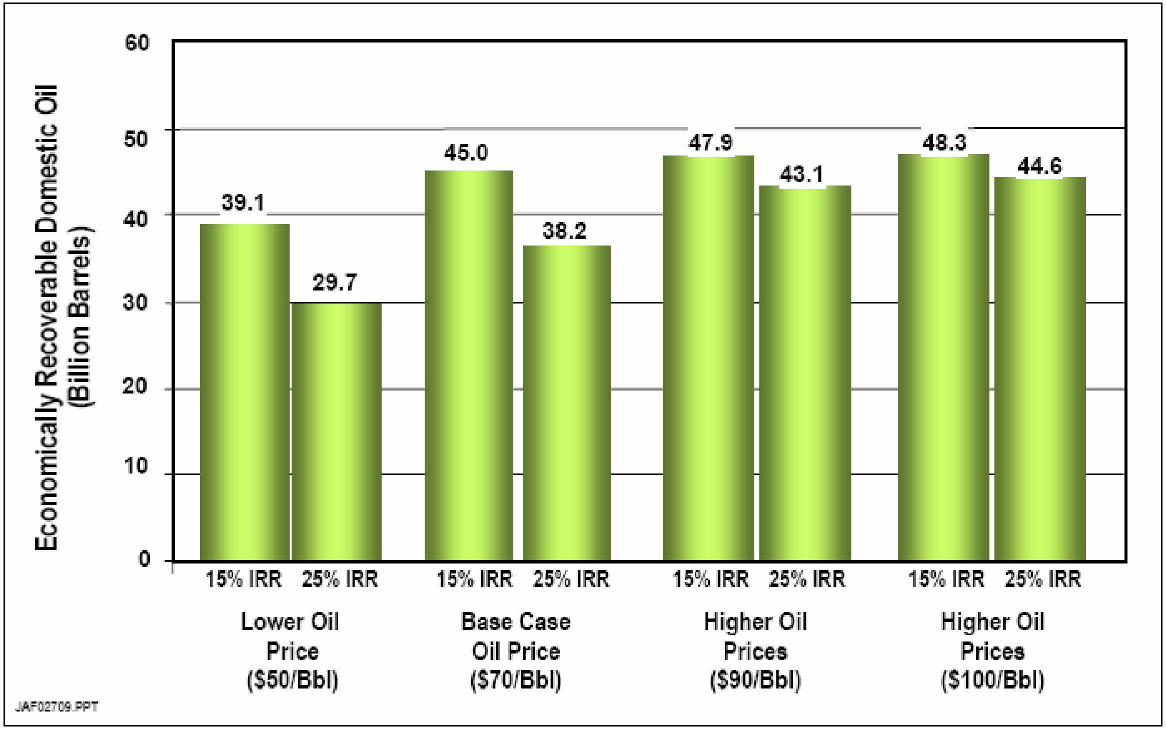

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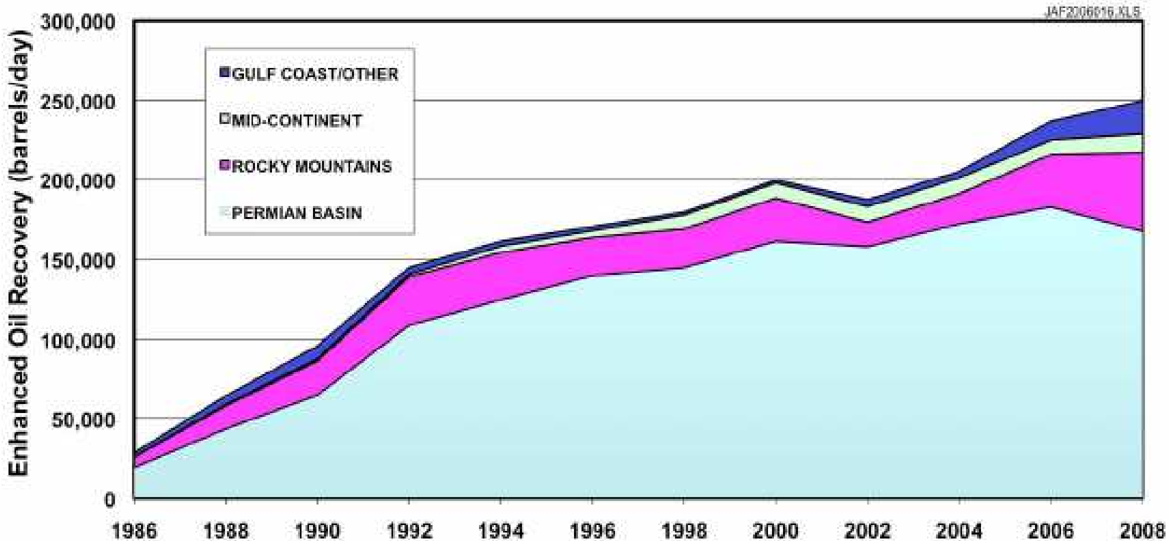
Growth of CO_2-EOR Production in the U.S.



Oil and Gas Journal, 2008.

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ALTERNATIVE ENERGY DEVELOPMENTS

Unconventional Energy : CO_2-Enhanced Oil Recovery (CO_2-EOR)

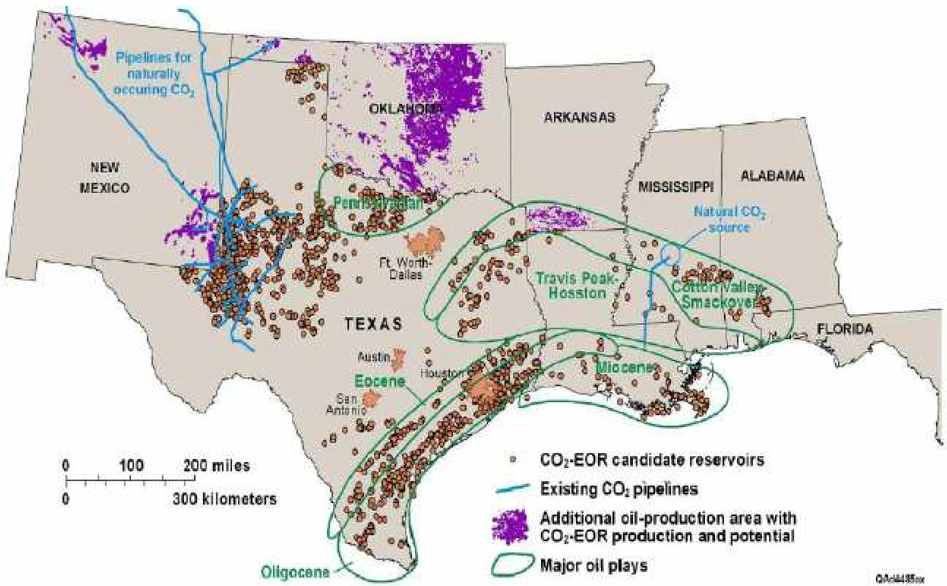
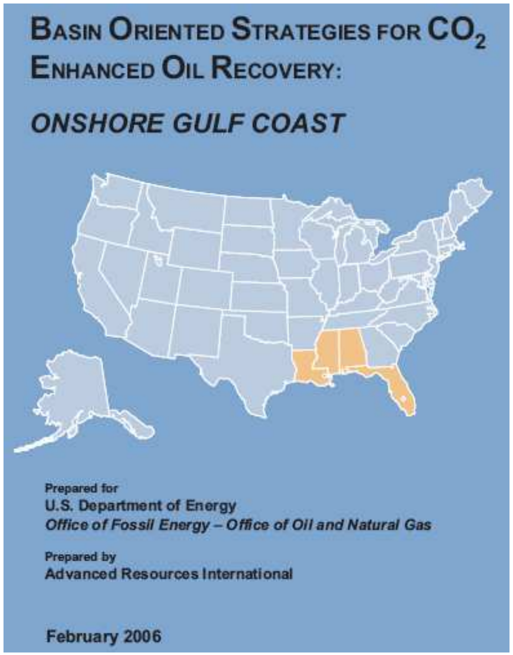


Figure 21 Areas with miscible CO_2 –EOR Potential [8]

Source: Pone & Kim (2006)

ALTERNATIVE ENERGY DEVELOPMENTS

Unconventional Energy : CO_2-Enhanced Oil Recovery (CO_2-EOR)



BASIN ORIENTED STRATEGIES FOR CO_2 ENHANCED OIL RECOVERY:

ONSHORE GULF COAST

Prepared for
U.S. Department of Energy
Office of Fossil Energy – Office of Oil and Natural Gas

Prepared by
Advanced Resources International

February 2006

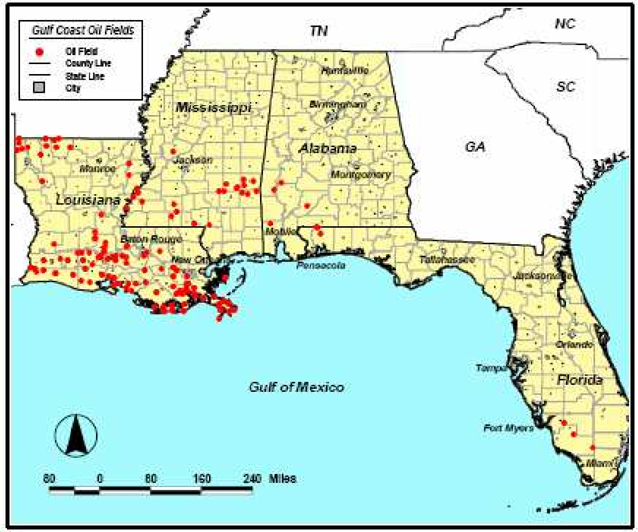


Table 2. The Gulf Coast Region's "Stranded Oil" Amenable to CO_2-EOR

Region	No. of Reservoirs	OOIP (Billion Bbls)	Cumulative Recovery/ Reserves (Billion Bbls)	ROIP (Billion Bbls)
Louisiana	128	16.1	6.7	9.4
Mississippi	20	1.9	0.7	1.2
Alabama	5	0.8	0.3	0.5
Florida	5	1.3	0.5	0.8
TOTAL	158	20.1	8.2	11.9

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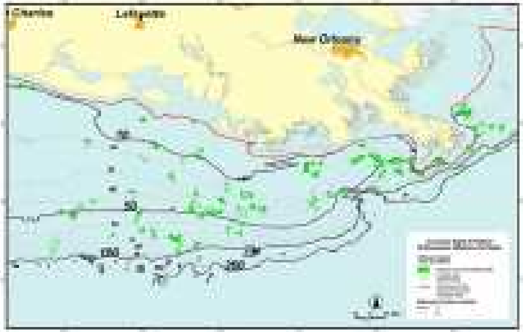
ALTERNATIVE ENERGY DEVELOPMENTS

Unconventional Energy : CO_2-Enhanced Oil Recovery (CO_2-EOR)



Offshore Louisiana Fields with Future Incremental Oil Recovery Potential

Estimates of Technical Recoverable Oil Resources in the Louisiana Offshore			
	No. of Fields	OOIP (MM Bbls)	Technically Recoverable (MM Bbls)
State Offshore	12	1,100	237
Federal Offshore	87	20,960	4,213
Total	99	22,060	4,450

Economic Benefits of Producing Incremental Oil from CO_2-EOR

Assuming that 3.6 billion barrels are developed over a 40-year time frame, by 2025 this would amount to:

- Incremental crude oil production of 200,000 to 250,000 barrels per day
- Over 6,000 jobs retained by the Louisiana oil and gas industry
- Increased economic activity in Louisiana amounting to over $500 million per year
- Increased state and federal revenues of over $250 million per year.


BASIN ORIENTED STRATEGIES FOR CO_2 ENHANCED OIL RECOVERY:

OFFSHORE LOUISIANA

Prepared for:
U.S. Department of Energy
Office of Fossil Energy – Office of Oil and Natural Gas

Prepared by:
Advanced Resources International, Inc.

March 2005

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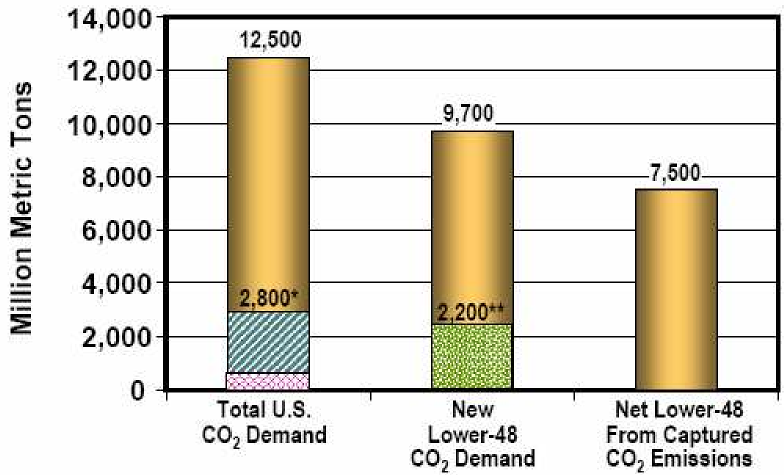
Market Demand for CO_2 by the Enhanced Oil Recovery Industry(1)



*CO_2 demand being met by on-going CO_2-EOR projects and CO_2 demand in Alaska.

**CO_2 demand that can be met by natural CO_2 and already being captured CO_2 emissions.

(1) Economic CO_2 market demand for EOR at oil price of $70/B (real), CO_2 cost of $45/mt, and ROR of 15% (real).

Advanced Resources International

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CLIMATE LEGISLATION UPDATE

Administration

Obama and congressional leaders have goal to pass a new climate law before the Climate Conference in Copenhagen in December.

U.S. House

- Last year the primary climate legislation bill (Lieberman-Warner, S. 2191) failed in the Senate
- This year climate legislation originated in the House (H.R. 2454, Waxman-Markey, ACESA)
- After considerable horse-trading, ~1500 page Waxman-Markey passed out of the House on a 219-212 vote.

U.S. Senate

- Boxer, Chair of Senate Environment and Public Works Committee initially announced her desire to start with Waxman-Markey and produce a bill in August.
- Reid, Senate Majority Leader has said that the Senate climate plan envisions all committee action being completed by the end of September, with an eye toward October for the floor debate.
- Latest count: 35 yes; 9 probably yes; 21 fence sitters; 13 probably no; 22 no.

Note: If climate legislation fails, EPA could regulate GHG under the "endangerment finding". EPA has already proposed rules for GHG emissions reporting and carbon sequstration.

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WAXMAN-MARKEY
THE AMERICAN CLEAN ENERGY AND SECURITY ACT OF 2009
(ACESA)
SUMMARY

Title I – Clean Energy

Renewable Energy
Carbon Capture and Sequestration
Clean Fuels and Vehicles
Smart Grid and Electricity Transmission
Partnering with the States
Federal Purchases of Renewable Electricity

Title II – Energy Efficiency

Building Energy Efficiency
Manufactured Homes
Appliance Energy Efficiency
Transportation Efficiency
Utilities Energy Efficiency
Industrial Energy Efficiency
Public and Federal Energy Efficiency

Title III – Reducing Global Warming Pollution

Global Warming Pollution Reduction Program
Supplemental Pollution Reductions
Offsets
Banking and Borrowing
Strategic Reserve
Carbon Market Assurances and Oversight
Additional Greenhouse Gas Standards
Clean Air Exemptions

Title IV – Transitioning to a Clean Energy Economy

Ensuring Domestic Competitiveness
Green Jobs and Worker Transition
Consumer Assistance
Exporting Clean Technology
Adapting to Global Warming

Title V – Agriculture and Forestry Related Offsets

WAXMAN-MARKEY
THE AMERICAN CLEAN ENERGY AND SECURITY ACT OF 2009

Overview of the proposed greenhouse gas (GHG) cap-and-trade program contained in Titles III and V

Coverage

large stationary sources emitting more than 25,000 tons/yr of GHGs, producers and importers of all petroleum fuels, distributers of natural gas to residential, commercial and small industrial users, producers of "F-gases", and other specified sources.

Emissions Reduction Targets

Emission caps that would reduce aggregate GHG emissions for all covered entities from 2005 levels by 3% in 2012; 17% in 2020; 42% in 2030; and 83% in 2050. Bill also establishes economy-wide goals for all sources, including but not limited to those covered by the cap-and-trade program.

Distribution of Allowances

[See following chart] Approximately 20% of allowances are auctioned in the initial years of the cap-and-trade program. This percentage increases over time to about 70% by 2030 and beyond.

Offsets and Other Cost Containment Measures

Bill allows up to 2 billion tons of offsets (1 billion from domestic sources, 1 billion from international sources) to be used for compliance system wide.

Carbon Market Oversight

Bill requires FERC to regulate the cash market in allowances and offsets, and assigns the Commodity Futures Trading Commission the responsibility for regulation and oversight of any derivatives markets (unless the President decides otherwise).

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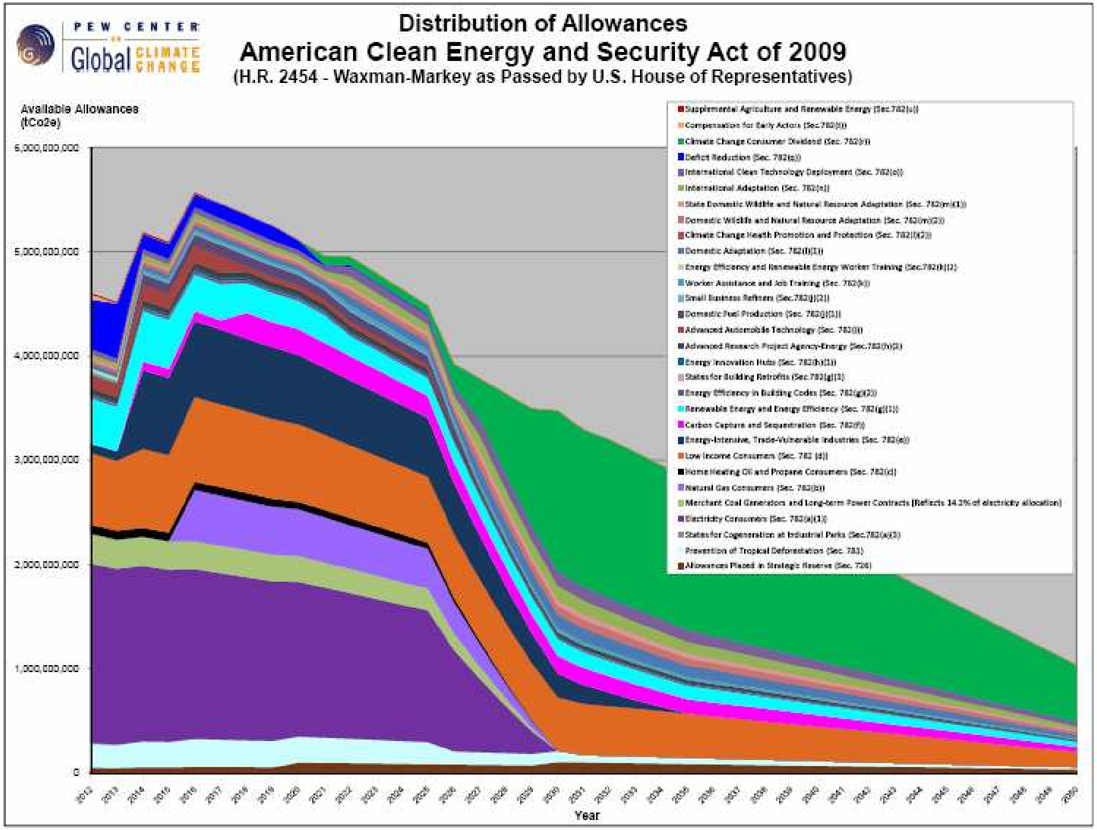

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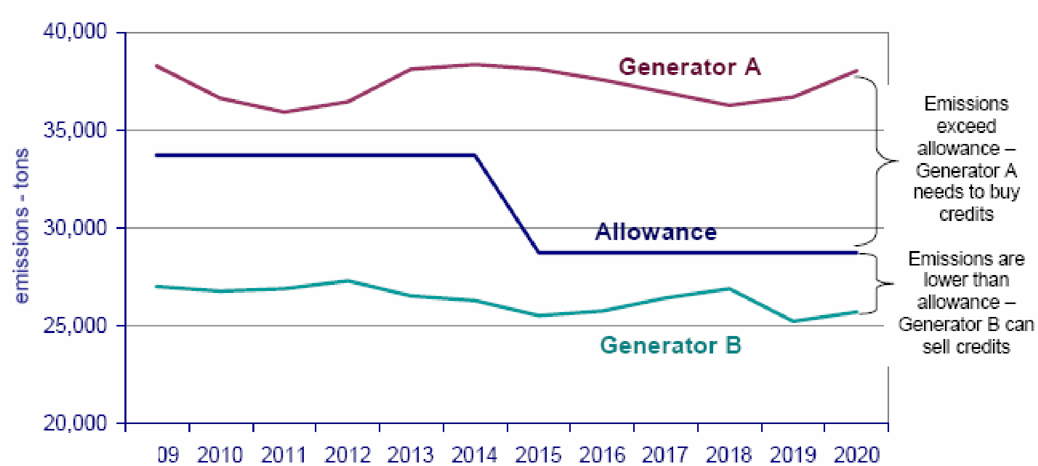
ENVIRONMENTAL IMPLICATIONS OF CARBON CAP-AND-TRADE

Background

Cap–and–Trade Basics



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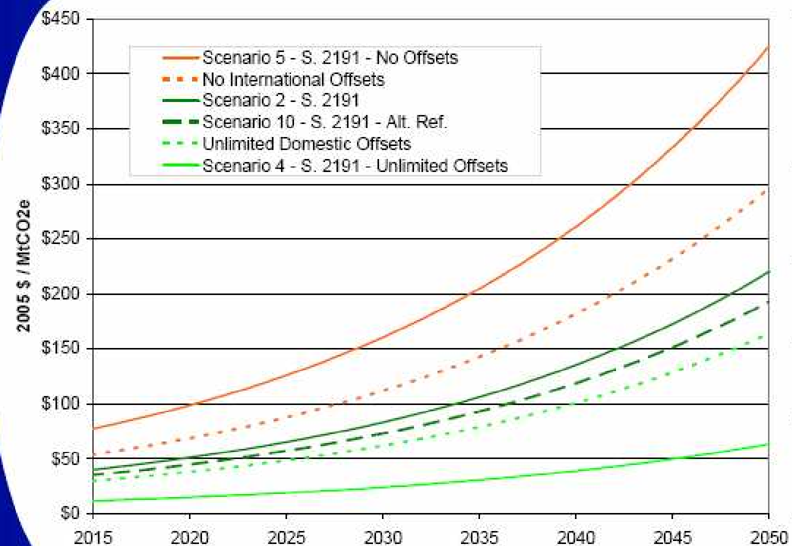
Scenario Comparison

GHG Allowance Prices (IGEM)



- Compared to the variation in allowance prices between the various alternative technology scenarios, there is a greater variation in allowance prices amongst the alternative offset and international credit scenarios.
- Allowing the unlimited use of domestic offsets and international credits can reduce allowance prices by 71% compared to scenario 2.
- Allowing the unlimited use of just domestic offsets can reduce allowance prices by 26% compared to scenario 2.
- If international credits are not allowed, allowance prices increase by 34% compared to scenario 2.
- If both international credits and domestic offsets are not allowed, allowance prices increase by 93% compared to scenario 2.
- Allowance prices are 12% lower under the alternative reference case compared to scenario 2.

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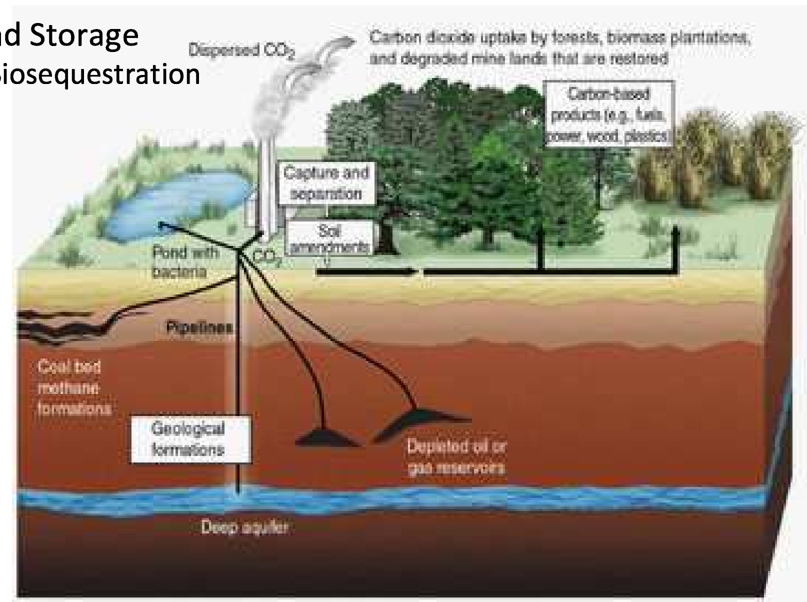
To Comply with GHG Emissions Reduction Requirements, Affected Sources Can:

1. Reduce emissions
2. Purchase allowances
3. Produce or purchase offset credits

Carbon Capture and Storage

Geosequestration - Biosequestration



Source: www.123eng.com/projects/carbon.doc

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Storing CO2 with Enhanced Oil Recovery

DOE/NETL-402/1312/02-07-08

February 7, 2008

NETL

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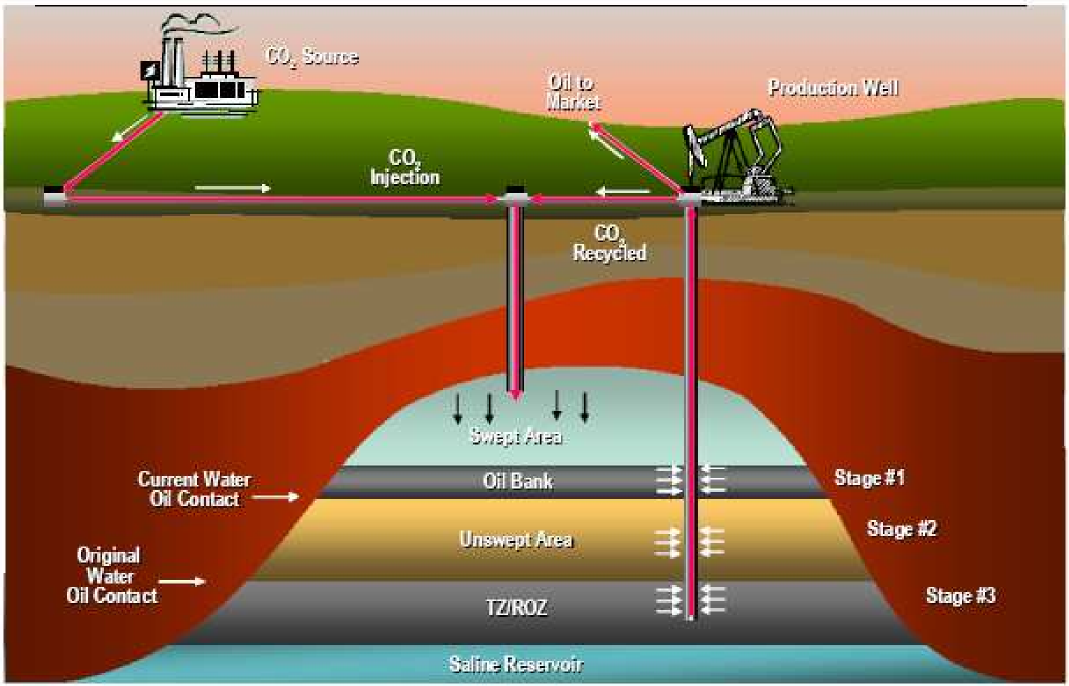
Illustration of Next Generation Integration of CO_2 Storage and EOR



Source: DOE, 2008

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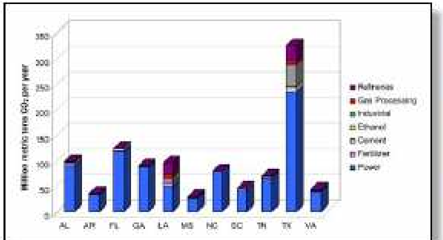
Southeast Regional Carbon Sequestration Partnership (SECARB)

SECARB CO_2 Sources

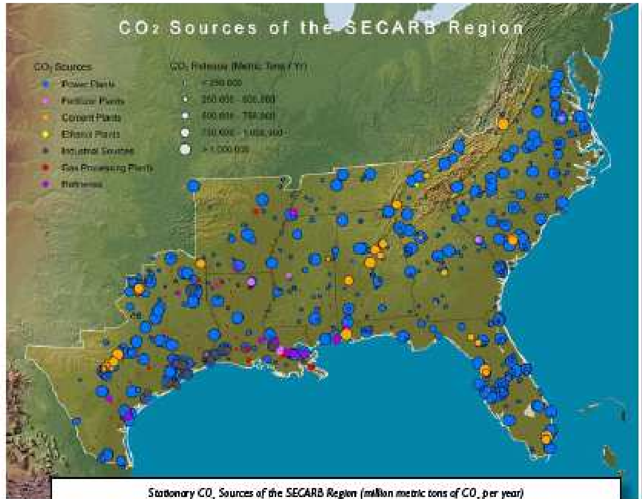
There are more than 900 large, stationary sources of CO_2 in the SECARB Region which are potential targets for carbon sequestration. Their total annual emissions are estimated at just over 1 billion metric tons (1.2 billion tons) of CO_2. Fossil-fuel (coal, oil, and gas) power plants are the largest contributors, accounting for approximately 83 percent of the total CO_2 emissions (see graph).

The SECARB Region is also host to a number of non-power related stationary sources of CO_2. These include, in descending order of contribution of CO_2: refineries, ethylene plants, cement plants, gas processing plants, iron and steel plants, and ethylene oxide plants.



CO_2 emissions for the SECARB Region are displayed in the chart (right) and map (above) by location, source type, and quantity.

Scherer Coal fired power plant in Juliet, Georgia produces over 25.6 million tons of CO_2 per year. (Source: Georgia Power)

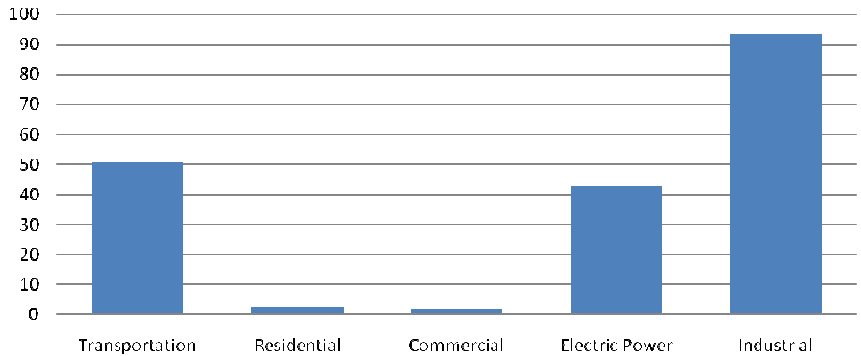


Stationary CO_2 Sources of the SECARB Region (million metric tons of CO_2 per year)

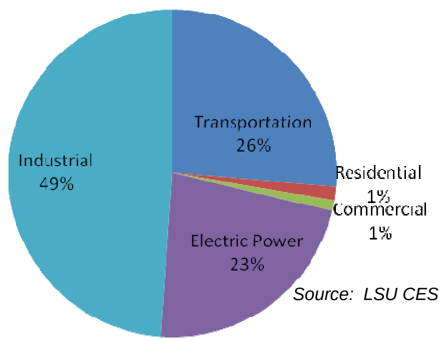
State	Electric Generation*	Fertilizer*	Cement Plants*	Ethanol*	Industrial*	Petroleum/ Natural Gas*	Refineries/ Chemical*	Total*
AL	71.1	0.2	5.4	—	0.5	0.3	1.3	78.8
AR	32.9	—	0.9	—	0.3	0.5	0.8	35.4
FL	137.0	—	5.5	—	0.1	0.1	—	142.7
GA	88.0	0.9	1.0	—	0.1	—	—	90.0
LA	52.6	4.6	0.8	—	9.6	5.9	28.3	101.8
MS	28.3	0.6	0.5	—	0.1	0.8	3.6	33.9
NC	76.7	—	—	—	0.1	—	—	76.8
SC	36.1	—	3.8	—	0.4	—	—	40.3
TN	61.8	—	1.5	0.4	0.2	—	1.8	65.7
TX**	237.6	—	11.1	—	42.5	4.8	37.2	333.2
VA	44.6	0.7	1.1	—	0.2	—	—	46.6
TOTAL	866.7	7.0	31.6	0.4	54.1	12.4	73.0	1045.2

* Units are all in million metric tons
** Eastern Texas: TRRC Districts 1-6

Louisiana 2005 Fossil Fuel Combustion Emissions by Sector ($MMTCO_2E$)



Louisiana 2005 Fossil Fuel Combustion Emissions by Sector



Source: LSU CES Greenhouse Gas Inventory, preliminary data, 2009.

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Southeast Regional Carbon Sequestration Partnership (SECARB)

SECARB: Composite Map of CO_2 Sources and Geologic Storage Formations

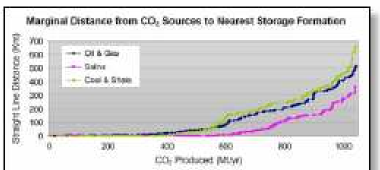
The distance between a CO_2 stationary source and a geologic storage formation is calculated as the shortest straight-line distance from each source to the nearest geologic storage site. While these results do not give a complete picture of the transportation and infrastructure requirements, they do give a first-order interpretation of the magnitude of the requirements.

The sources in SECARB match up well with the potential storage reservoirs. For example, more than 70 percent of all sources (by volume) in the SECARB Region are located within 50 km (31 mi) of a storage formation. Approximately 40 percent of the sources are actually co-located with an appropriate storage formation. This especially occurs in the Gulf Coast region where many of the sources overlie saline formations, coal beds, or both.

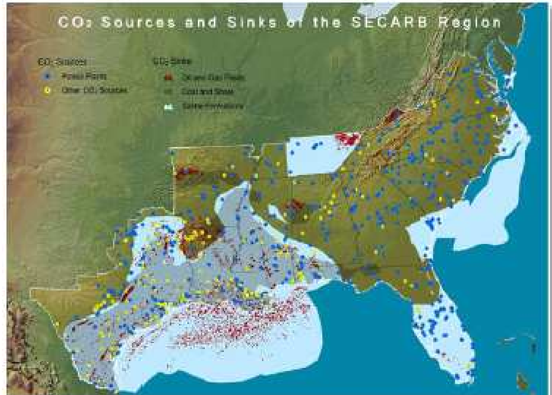
The table below identifies how many years storage is possible given the current annual emissions and the known CO_2 storage resource.

Formation Type	Straight-Line Distance to Nearest Formation		
	< 50 km	50 -100 km	> 100 km
Oil and Gas Fields	50%	9%	42%
Saline Formations	71%	5%	25%
Coal and Shale	52%	4%	44%
All Reservoirs	76%	5%	19%

Note: The total annual CO_2 storage rate used was 938 million metric tons, which was estimated based on current emissions and assuming 90% capture efficiency.



Above: Marginal distance from all CO_2 sources to their nearest storage formation.



State	CO_2 Sources (million metric tons per year)	CO_2 Storage Resource (million metric tons)				Number of Years Storage **
	Total	Oil and Gas	Coal and Shale*	Saline*	Total	
AL	79	390	2,592	32,250	35,232	446
AR	35	372	16,200	23,623	40,195	1,148
FL	143	183	1,700	28,950	30,833	216
GA	90	—	—	3,068	3,068	34
LA	102	7,960	11,100	348,744	367,804	3,606
MS	34	579	7,200	116,068	123,847	3,643
NC	77	—	—	3,380	3,380	44
SC	40	—	—	1,247	1,247	31
TN	66	—	—	1,250	1,250	19
TX****	333	6,332	18,700	513,870	538,902	1,618
VA	47	10	308	398	716	15
Federal Offshore	—	18,860	—	1,201,741	1,220,741	N/A
TOTAL	1,045	34,686	57,800	2,274,589	2,367,215	2,263***

* Low estimates used
** Years of CO_2 Storage at the current emission rates (State CO_2 storage resource/ state annual emissions)
*** Average years storage for whole of SECARB area (Total CO_2 storage resource/ total annual emissions)
**** Eastern Texas: TRRC Districts 1-6

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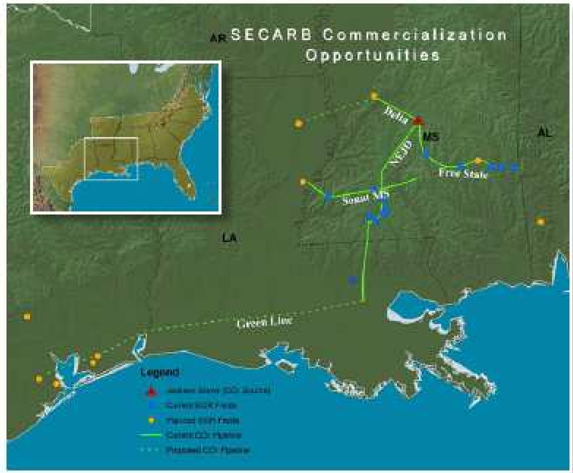
Southeast Regional Carbon Sequestration Partnership (SECARB)

SECARB Commercialization Opportunities

Early opportunities for commercialization in the Southeast Region most likely will be associated with an ability to offset the cost of capturing and storing CO_2. Utilizing CO_2 for EOR is the primary candidate for offsetting costs in several SECARB states. Work conducted by SECARB in Gulf Coast formations will assist in expanding CO_2 EOR opportunities. Another candidate is ECBM recovery utilizing CO_2. Field tests conducted by SECARB in Central Appalachia and in the Black Warrior Basin of Alabama will assist in determining the technical and economic feasibility of ECBM.

Within the SECARB Region, EOR is in place in Mississippi. Currently, the CO_2 that is used for EOR is coming from the Jackson Dome, a natural source of CO_2 located near Jackson, Mississippi. Denbury Resources operates a pipeline network that transports Jackson Dome CO_2 to oil fields in the Southeast. The Cranfield unit, near Natchez, Mississippi, is one EOR field operated by Denbury Resources, and it is host to a SECARB Validation Phase small-scale injection as well as a Development Phase large-scale injection in the brine formation down-dip of the EOR field.

Denbury Resources is developing and expanding a CO_2 pipeline network from the Jackson Dome to potential EOR sites in Mississippi, Louisiana, Texas Gulf Coast, and Alabama. Denbury Resources also is establishing agreements with sources of CO_2 that can supplement the volumes of CO_2 produced at Jackson Dome. As a result, the Denbury Resources pipeline system has the potential for becoming the regional backbone of an integrated network for CO_2.



Regional Incentives

Two initiatives in the SECARB region will help advance carbon capture and sequestration deployment:

- As part of SECARB Validation Phase field investigation, Virginia Tech, Marshall Miller & Associates (MM&A), and the Geological Survey of Alabama are evaluating the feasibility of capturing CO_2 from an industrial source and storing it in unmineable coal seams and associated brine formations in Central Appalachia and the Black Warrior Basin.
- As part of SECARB Development Phase field investigation, the Electric Power Research Institute (EPRI) and Southern Company (with operating units in Mississippi, Alabama, Georgia, and Florida) currently are evaluating CO_2 capture and separation technologies. SECARB plans to inject 100,000–250,000 metric tons (110,000–280,000 tons) per year of anthropogenic (power plant) CO_2 from 2011 to 2014.

Pipeline (Source: Denbury Resources).

Current EOR Fields	Location	Proposed EOR Fields	Location
Lockhart Crossing	LA	Tinsley Field	MS
Little Creek	MS	Lake St. John Field	LA
Mallalieu	MS	Heidelberg Field	MS
McComb	MS	Delhi Field	LA
Brookhaven	MS	Citronelle Field	AL
Eucutta	MS	Oyster Bayou	TX
Soso	MS	Fig Ridge	TX
Martinville	MS	Gillock Fields	TX
Yellow Creek	MS	Hastings Field	TX
Cyprus Creek	MS	Conroe Oil Field	TX
Smithdale	MS		
Lazy Creek	MS		
Cranfield Field	MS		

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Summary Remarks

- There are significant petroleum resources (stranded oil) in the U.S. amenable to recovery with CO_2-EOR
  - Total of 400 billion barrels in the U.S., of which about 87 billion barrels are technically recoverable
  - Total of around 14 billion barrels onshore and offshore Louisiana, of which about 7.7 billion barrels are technically recoverable
- CO_2-EOR offers a large "value added" market for captured CO_2 emissions
- Storing CO_2 with EOR helps with three of today's concerns about geological storage of CO_2
  - Regulatory/public acceptance
  - Mineral (pore space) rights, and
  - Long-term liability
- Oil produced today with CO_2-EOR is 70% "carbon free" and can become 100+% "carbon free" with the "next generation" technology (i.e. "green oil")

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Questions/Discussion

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Evolving Carbon and Clean Energy Markets

The Carbon Emissions Continuum: From Production to Consumption

Jones Walker Law Firm
June 23, 2009

LSU
Center for Energy Studies

David E. Dismukes
Center for Energy Studies
Louisiana State University

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.

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 of policy capability to meet goals is questionable.

Market Mechanisms

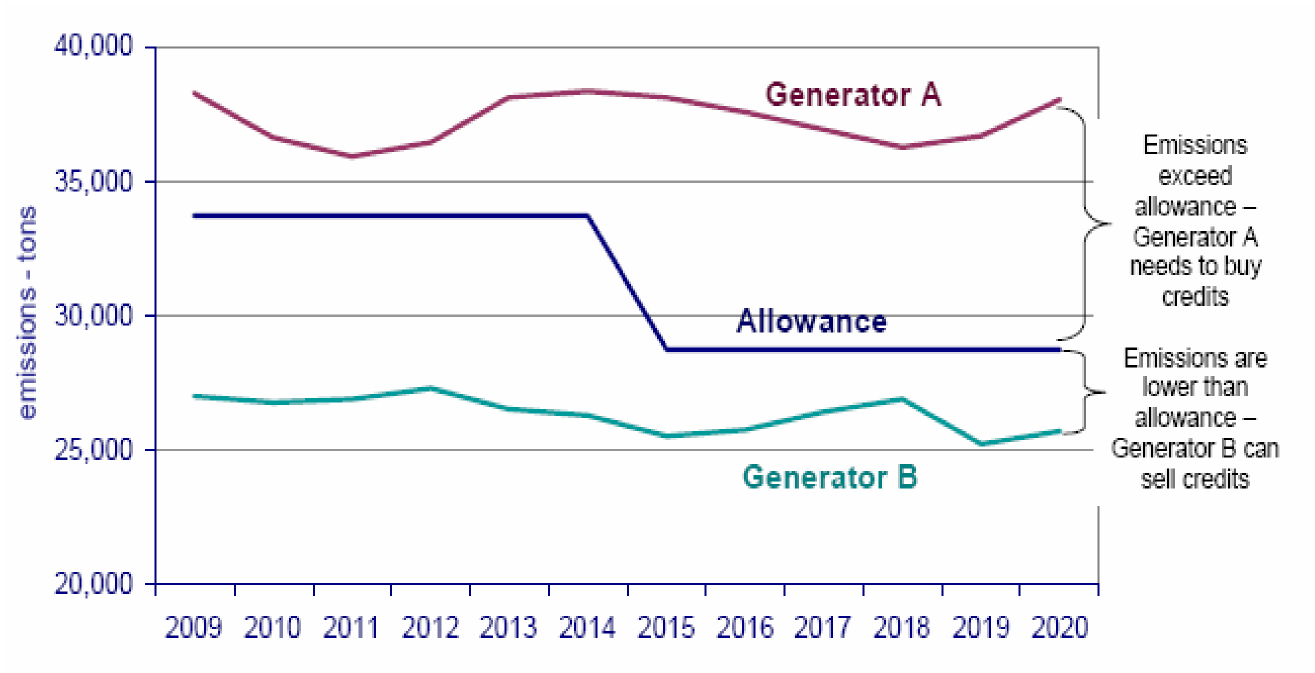
For Affecting Climate Change

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.

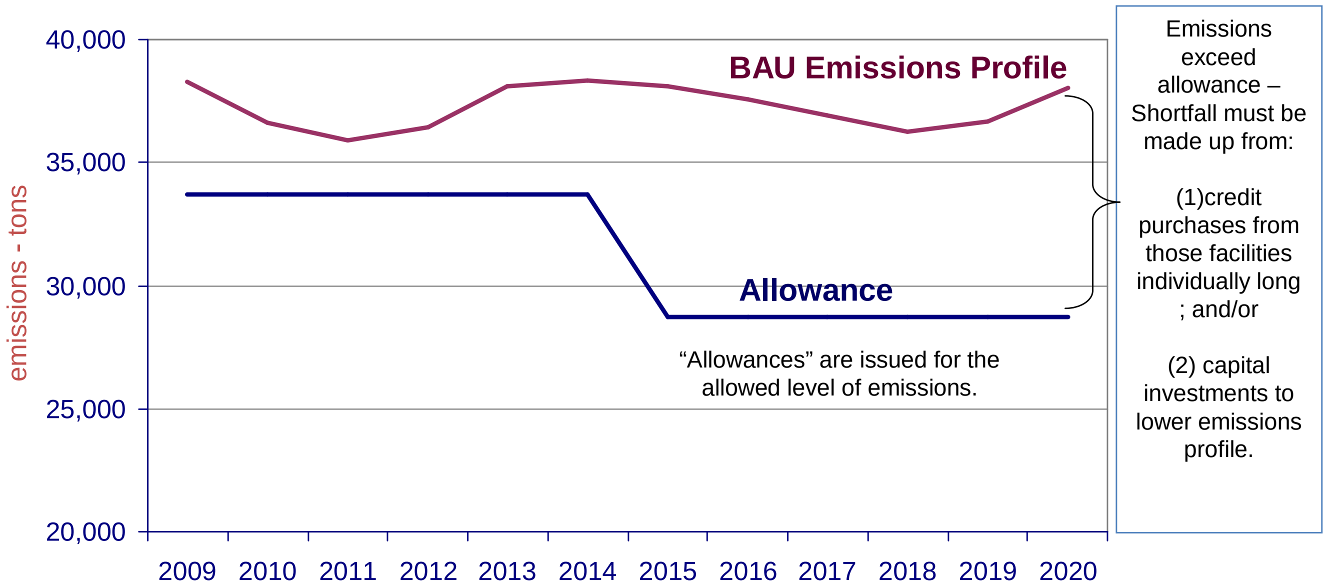
Cap & Trade Mechanics

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



How Does Cap & Trade Improve Overall Emissions?

Framework creates “scarcity” because the initial regulatory “design” is intentionally “short” in the aggregate.



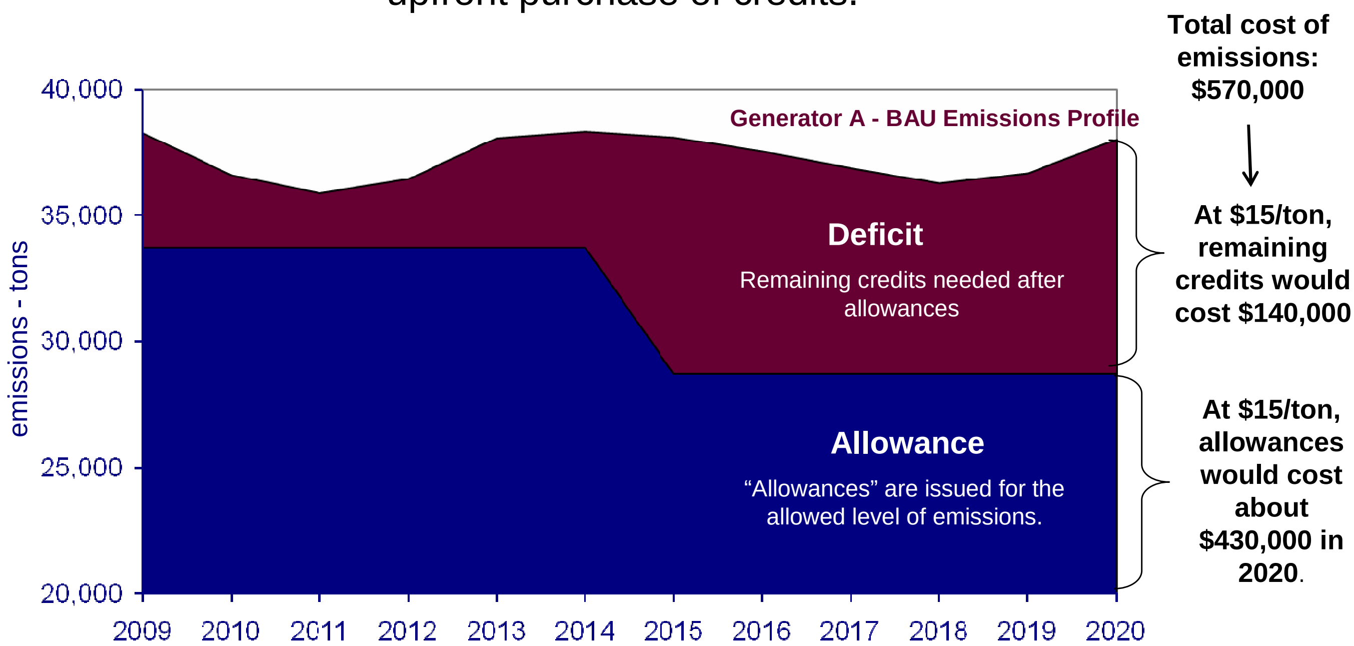
How Are Allowances Determined?

Allowances are offered to participants based upon two different methods:

Allocated	**Auction**
Regulator makes an administrative determination of who gets allowances.	Market makes the decision about who gets the allowances.
Allocations made on a wide range of considerations and metrics including: Metric (Heat Input, Output) Baselines (Year, Updates) Growth Pool Set-Asides	Periodic auction (think “eBay”) for the credits. Can be done in a variety of methods, but general approach is to allocate credits to those with the highest willingness to pay. There is an important issue associated with what to do with “auction proceeds.” Who gets those?

Auction Versus Allowance

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



Compliance Alternatives

Anticipated Forms of Mitigation

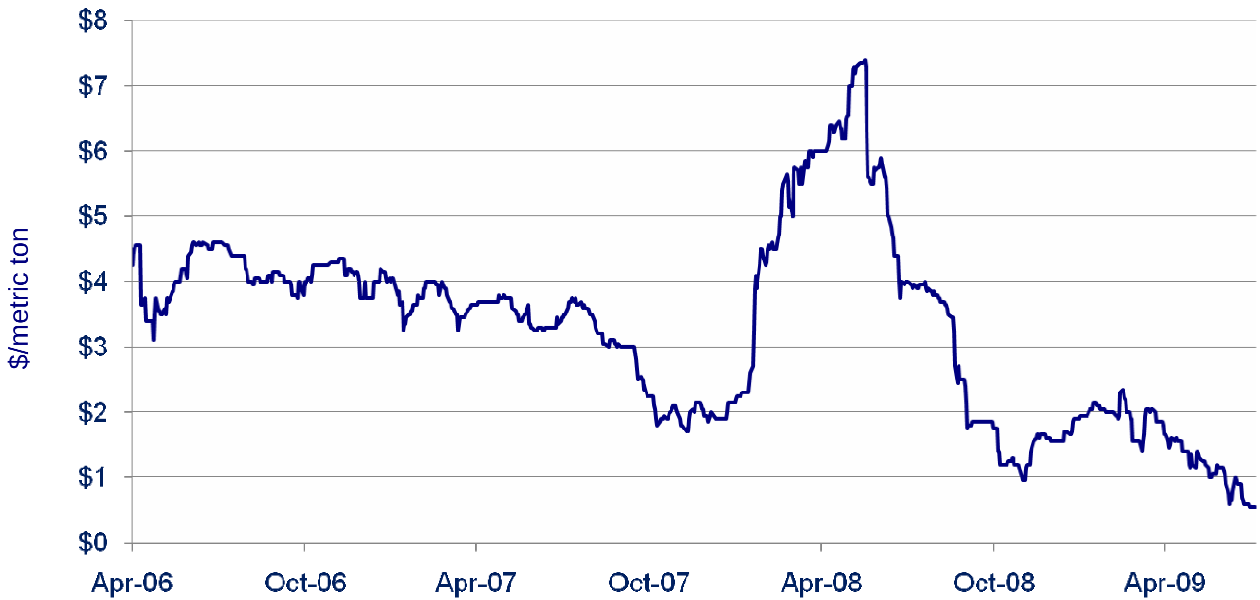
Method	Description	Challenges
Credits & Offsets	Initially allocated/auctioned credits and new offsets developed from mitigation projects	Efficiency of system (credits). Monitoring and verification of offsets.
Capital Investment	Carbon capture and storage	Expensive, uncertain, large supporting infrastructure 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

- Regional Greenhouse Gas Initiative (RGGI)
  - 2009 is the first full year of operations
  - Prices around \$4 / tCO_{2e}
- Chicago Carbon Exchange
  - 67 $mmtCO_{2e}$ transacted at a value of \$309 million (USD) in 2008
  - Prices trading around \$1-2 / tCO_{2e}
    - Concerns about fungibility if Waxman-Markey becomes law
- California Climate Action Reserve
  - Largely an exchange for California companies looking for pre-compliance with anticipated federal law.

Source: State and Trends of the Carbon Market 2009 by World Bank Organization

Chicago Climate Exchange
Daily Closing Prices



Source: Chicago Climate Exchange.

American Clean Energy and Security Act
Caps and Allocation

Caps

- Establishes emission allowances (annual tonnage limits) for 2012-2049, and 2050 and thereafter.
- Prohibits States from implementing any cap and trade programs that covers any capped emissions emitted between 2012 and 2017.
- Reduction targets (based on 2005 levels):
    - 3 percent by 2012;
    - 17 percent by 2020;
    - 42 percent by 2030; and
    - 83 percent by 2050.

Allocation

- Specifies a percentage allocation of various vintage years of the total number of allowances to electricity consumers, natural gas consumers and energy intensive-trade exposed entities.
- About 80 percent of allowances will be issued for free initially, with that number declining over time.
- Auction of specified percentage from each vintage year. Proceeds benefit low income consumers and investment in green jobs. Auction of some unused allowances, initially to be used to fund rebates to consumers.
- Provides for trading, banking and borrowing, auctioning, selling, exchanging, transferring, holding and retiring of emission allowances.

Source: Clayton Utz

Offsets

- Domestic and international offsets allowed. Projects will be approved by the Administrator on the basis of recommendations from the Offsets Integrity Advisory Board.
- Offsets equivalent to two billion tonnes of emissions can be used for compliance (generally half domestic and half international).
- One domestic offset or 1.25 international offset credits must be submitted for every one tonne of emissions, although up until 2018, one international offset credit can be used.
- Avoided tropical deforestation projects will be recognised as capable of generating offsets for compliance use. This is likely to provide significant support to REDD projects internationally.

Prices and penalties:

- Strategic reserve of 2.5 billion allowances to be created by setting aside a small number of allowances to be issued each year (1-3 percent), to be made available through auction if allowance prices rise to unexpectedly high levels.
- An excess emissions penalty is payable for non-compliance equivalent to the amount of excess emissions (ie. the emissions in respect of which no offset or allowance was held) multiplied by twice the clearing price for the earliest vintage at the last auction.
- There is also a "make good" obligation which means that the covered entity is still obliged to surrender allowances or offsets for the excess emissions in the following calendar year.

Source: World Resources Institute

Capital Investments

- 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

Big Picture Cost Estimates

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

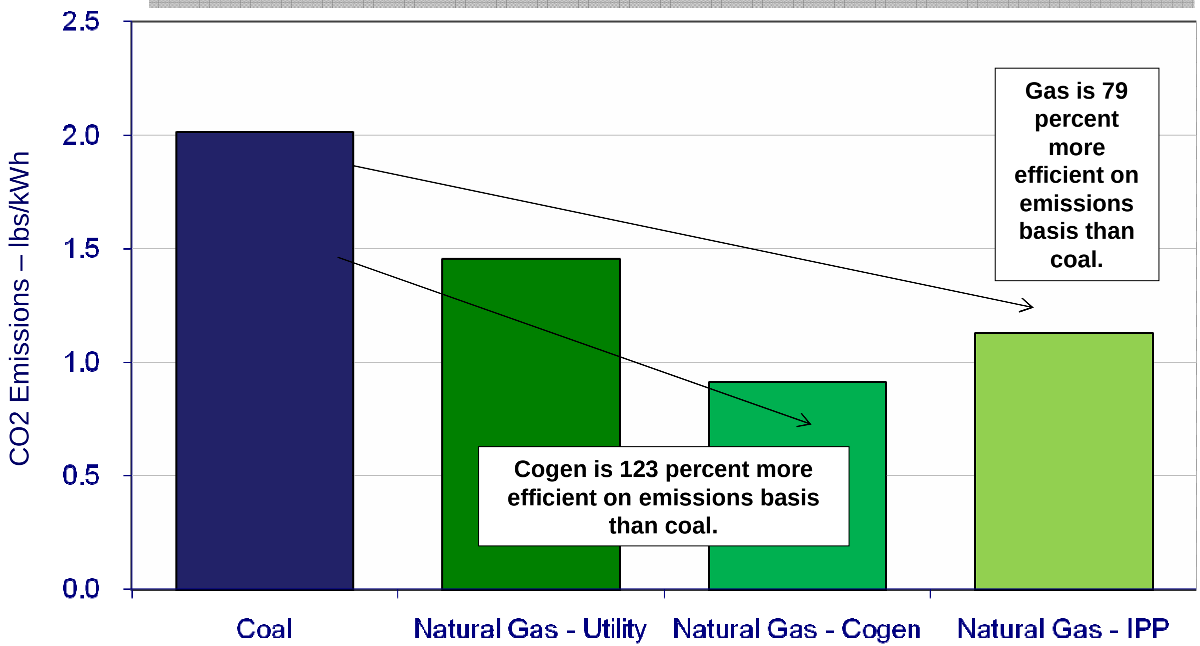
- Three main methods industrial capture:
  - Integrated gasification combined cycle (IGCC)
    - Plants can capture 75%-80% CO_2 emissions without major loss of efficiency.
  - Oxygen-fuel combustion
    - Oxygen separators can be retrofitted, but consume up to 15% of generated electricity.
  - Flue gas separation
    - Main focus of research.

Source: National Petroleum Council

Fuel Switching

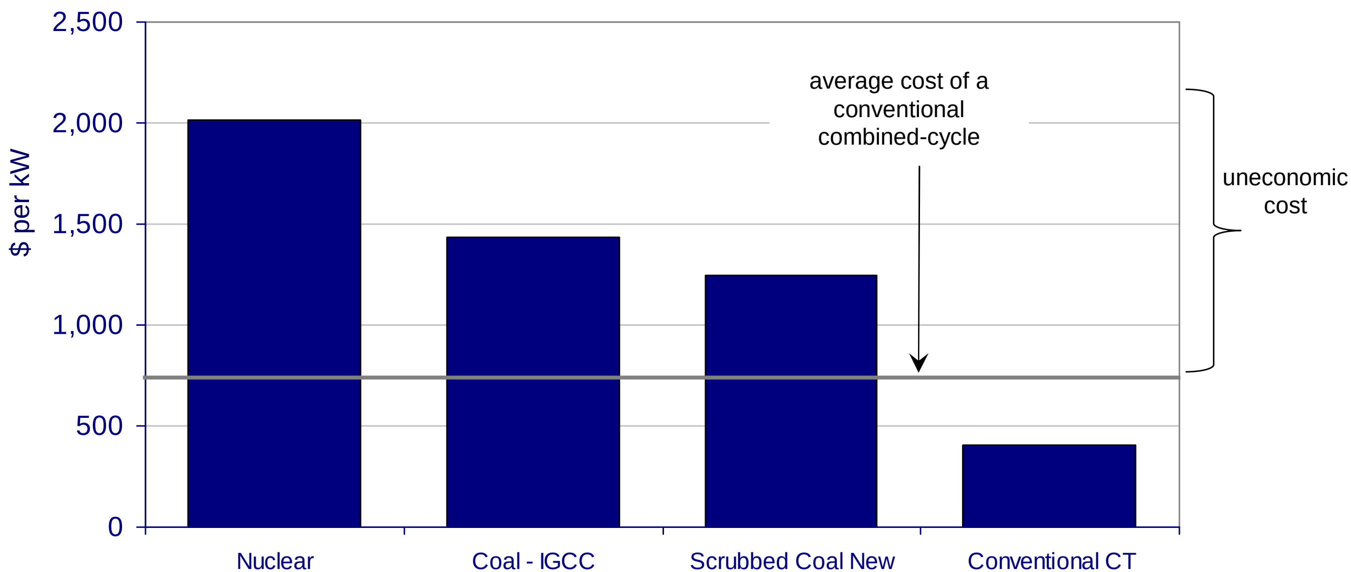
CO2 Emissions Rate by Fuel Type

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

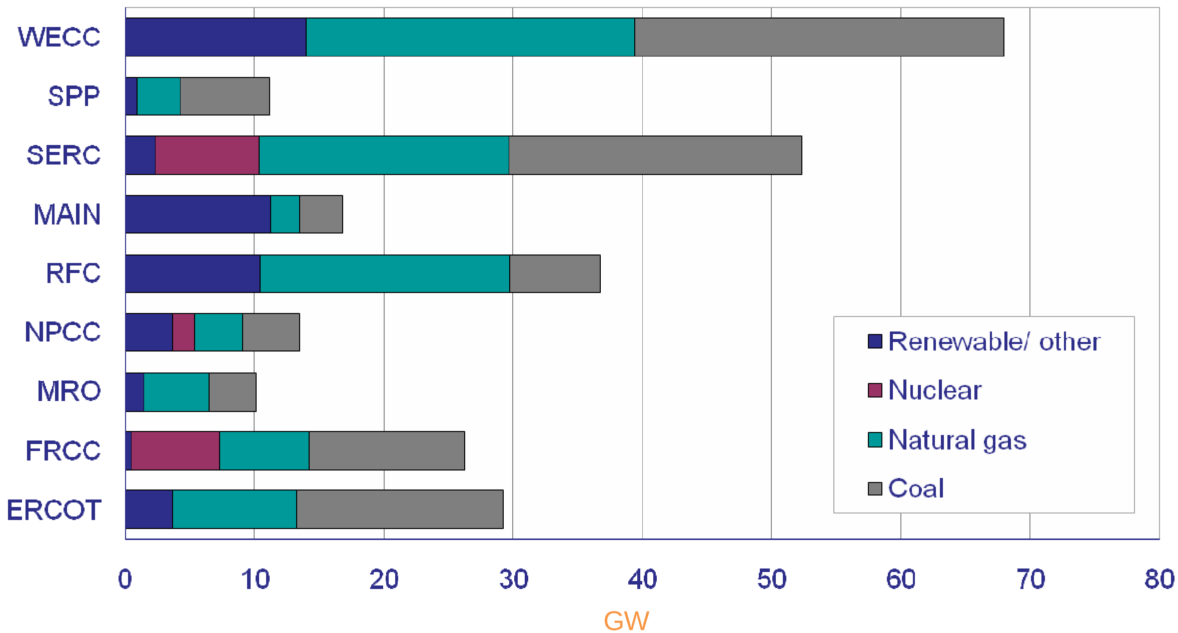


These differentials will have to be recovered from various funding sources

Source: Assumptions to the Annual Energy Outlook 2006

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

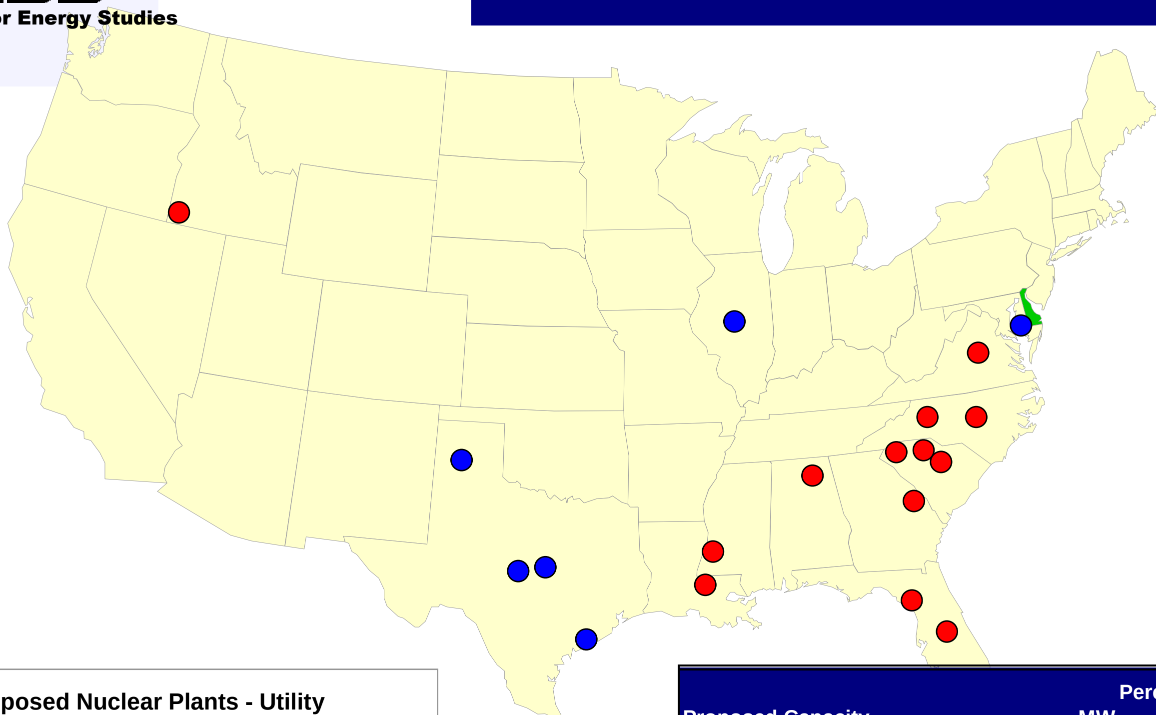
All electricity demand regions are expected to need additional, currently unplanned, capacity by 2030. The largest amount of new capacity is expected in the Southeast (FL and SERC), which represents a relatively large and growing share of total U.S. electricity sales and thus requires more capacity than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



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

LSU
Center for Energy Studies

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%

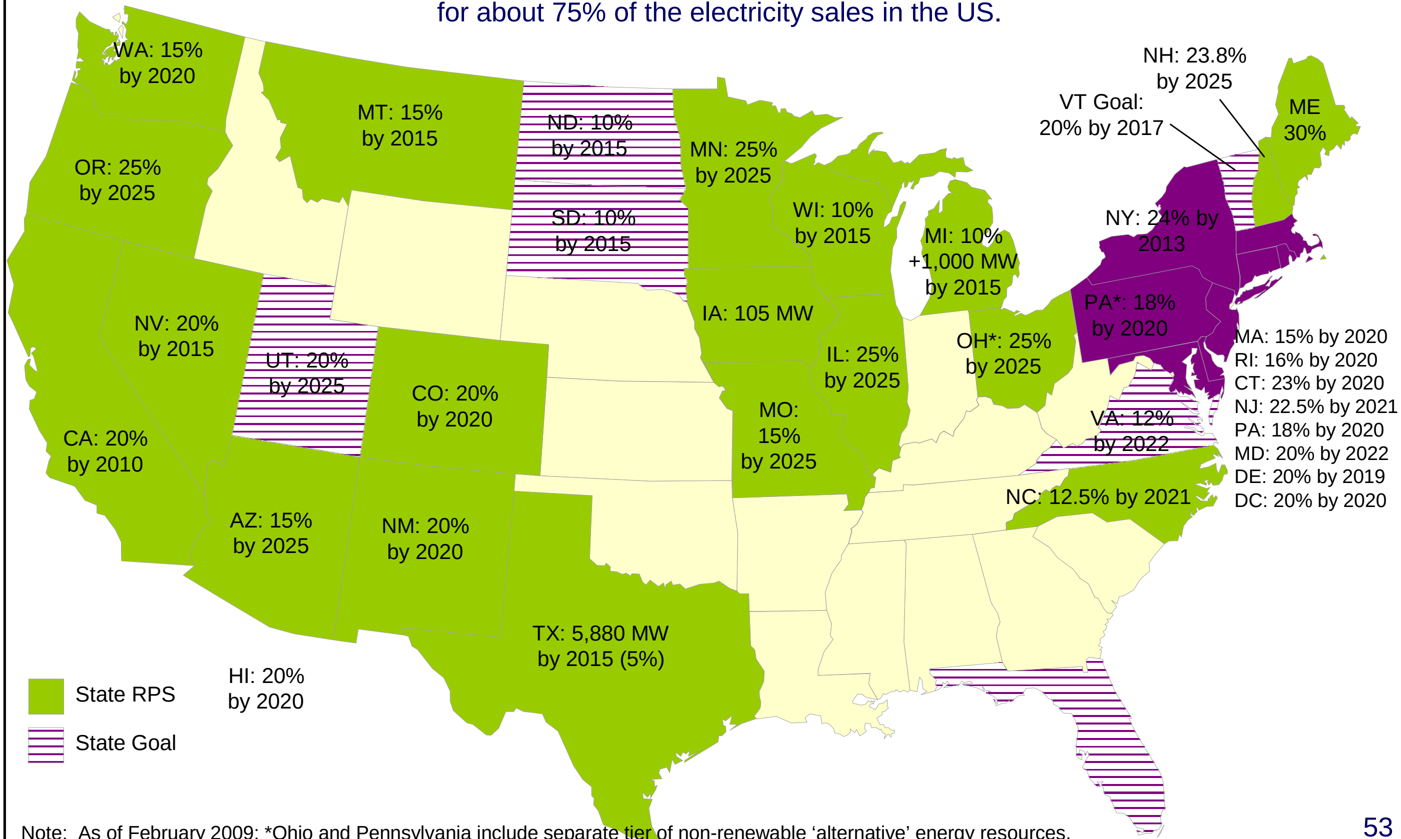
Note: One proposed plant in Florida and two proposed plants in Texas have locations that are yet to be determined.

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

Renewables

States with Renewable Portfolio Standards

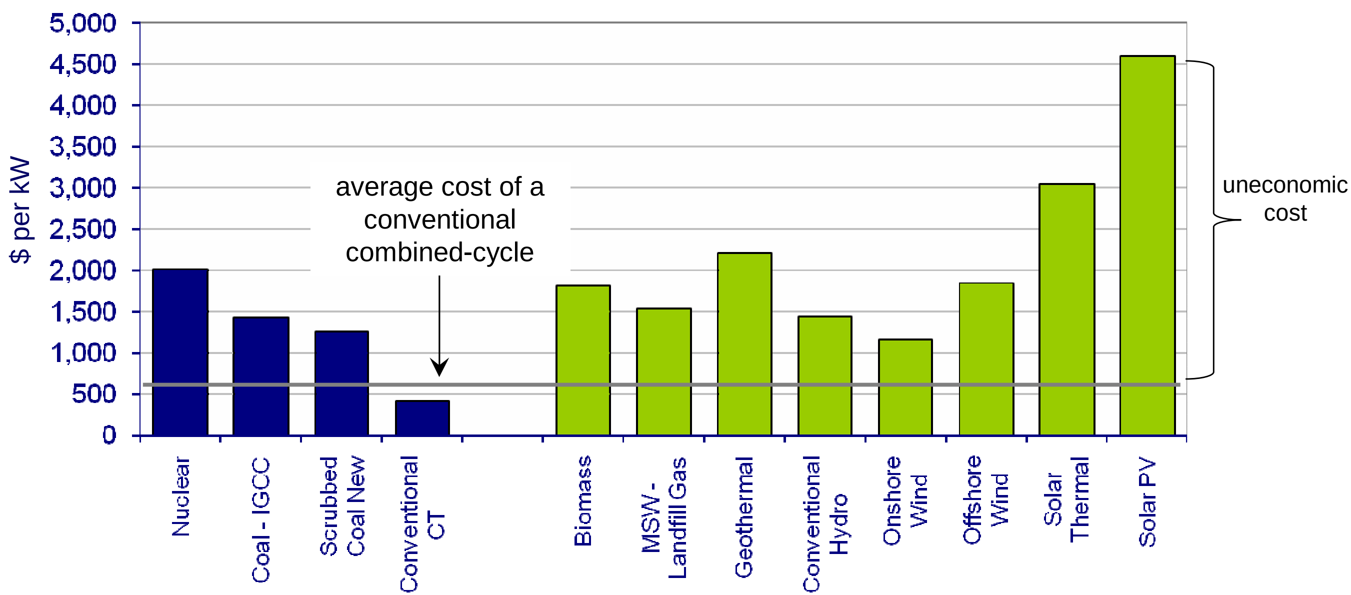
Currently there are 33 states that have RPS policies in place. Together these states account for about 75% of the electricity sales in the US.



Note: As of February 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 2006

Renewable Energy Credits and Carbon Offsets

Method	Renewable Energy Credits ("REC")	Carbon Offsets
Type of Projects	RECs only come from renewable energy projects such as solar, wind, geothermal, biofuels, etc.	Offsets can come from renewable projects but also include the collection and storage of carbon through reforestation; ocean and soil collection; and capture and storage efforts.
Units of Measurement	MWh	Metric tons
Design	Forward looking, focused on building a clean energy economy and providing incentives for the creation of renewable energy.	Oriented in the present, dealing with preventing greenhouse gases from entering the atmosphere right now; or removing carbon after it has been released.
Markets	Too many to list	Chicago Climate Exchange, Voluntary Carbon Standard Program
Distribution	Allocated by state or regulatory authority; any amount needed over allocation must be purchased.	Purchased to offset "carbon footprint"

Demand Reduction & Efficiency

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.

Energy Efficiency Resource Standards

ID: Energy Plan puts conservation – DR and EE – as priority resource

MT: state agency reduction initiative: save 20% by 2010

WA: must pursue all cost effective conservation

OR: IOUs required to have EE in IRP & assess cost-effectiveness

CA: IOUs reduce MW 10%, peak demand (MWh) 12% by 2013; munis 10% by 2017

NV: use EE for up to 25% of RPS by 2015

UT: EE incentives in RPS goal

CO: save 40 MW and 100 GWh annually to 2013

NM: use EE and DR to save 10% of 2005 retail electric sales by 2020

KS: Order advocates voluntary utility programs, not mandate

OK: PSC approved quick-start DSM programs, including EE

TX: 10% of load growth, beyond 2004, based on prior 5 years

MI: annual savings: 1% of prior year's sales by 2012

MN: reduce fossil fuel use 15% by 2015 through EE, RE

IA: utilities must establish EE goals by end of 2008

WI: RPS requires utility EE

IL: reduce energy 2% by 2015 (EE) and 0.1% from prior year (DR)

OH: reduce peak-demand 8% by '18; 22% energy savings by '25

KY: proposed REPS - EE and conservation to offset 18% of projected 2025 demand

ME: 10% new EE by 2017; in RPS goal as 2nd priority

VT: EE & RE to meet 2007-12 growth

MA: meet 25% of capacity and energy with DSR by 2020

NY: 15% electric use reduction by 2015; doubles EE funding

CT: 4% savings by 2010; a Tier III RPS resource

NJ: reduce consumption 20%, and peak demand 5,700 MW by 2020

DE: EE, RE, DG, and DR are priority resources before new gen

PA: reduce energy consumption 3% and peak demand 4.5% by 2013

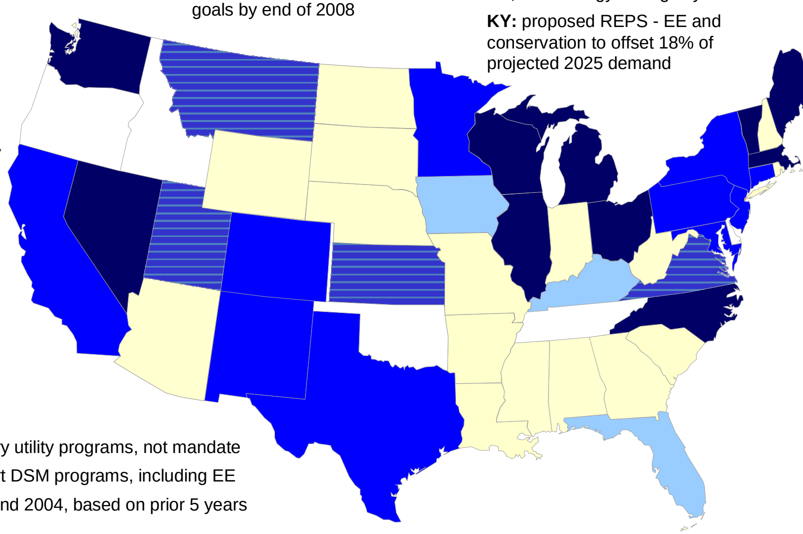
DC: reduce peak demand and energy consumption

MD: reduce peak demand and per cap electricity use 15% by 2015

VA: reduce 10% of 2006 sales by 2022 with EE, DR

NC: EE to meet up to 25% of RPS to 2011; later to 40%

FL: PSC to adopt goals to reduce electric consumption, peak demand



- 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

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.

Questions & Comments

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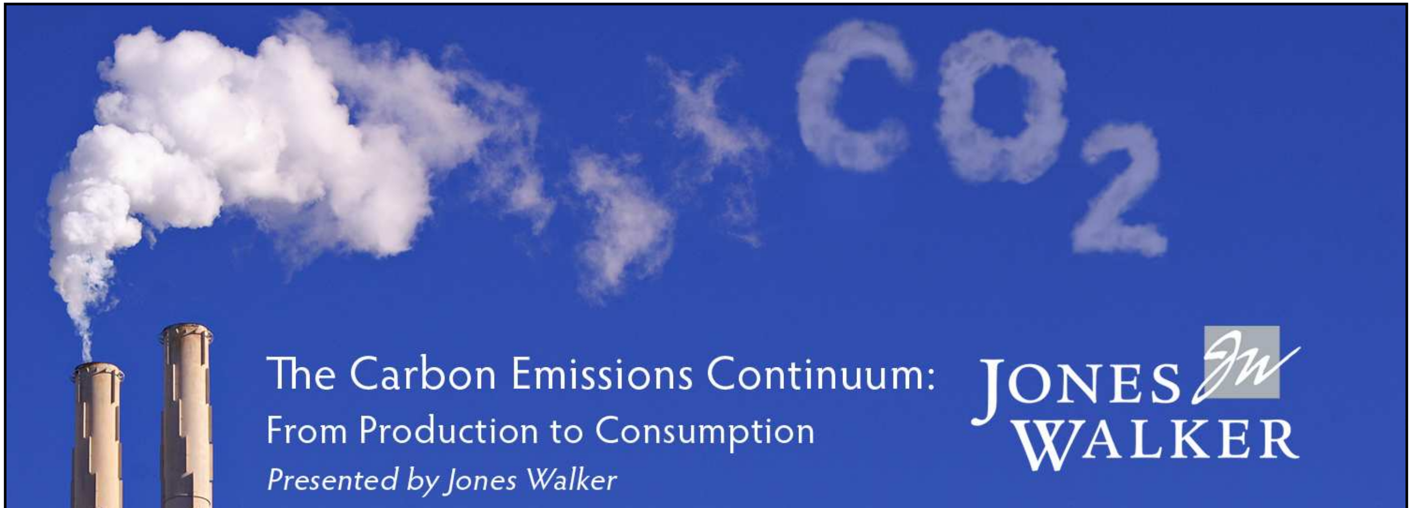


Presentation by:

James H. Welsh, Commissioner of Conservation
State of Louisiana

The Carbon Emissions Continuum:

JONES WALKER

Major CO2 Pipe Lines

Green Pipeline

Carbon Dioxide (CO_2) Enhanced Oil Recovery (EOR)

Carbon Dioxide is a gas that both occurs naturally and is produced in plants as a byproduct of industry

Enhanced Oil Recovery or tertiary recovery is a process to improve oil production by altering the physical properties the oil. The three main types are Chemical flooding (alkaline), Miscible (CO_2 injection) and thermal (steam flooding).

Severance Tax is paid after payout (determined by DNR) at a rate of 12.5%

Active C02 Project

Estimated Oil Reserves	54 million barrels
Estimated Recoverable	10 million barrels
Capital Investment first 2 years	$60 million
Daily Production	1,000 barrels
Operating expenses	**$650,000 / month**
Ad Valorem taxes	$170,000 / year
Severance taxes estimated after payout	125 X barrel cost / day
under current prices $50/bbl	*~$2.8 million/year*
Project Duration	**25 – 30 years**

In EOR operations it takes between 6 to 12 months from the time the first CO2 injection starts to first EOR production. So there is significant upfront investments and greater operating expenses the first several years waiting on enhanced oil response

CO_2 Enhanced Oil Recovery
(CO_2 - EOR)

Current Severance Tax Rates for Texas, Louisiana and Mississippi

Texas EOR Severance Tax Rate –	**1.15%**
Mississippi EOR Severance Tax Rate –	**3.0%**
Louisiana EOR Severance Tax Rate –	**12.5%**
Louisiana Proposed 50% Reduction -	**6.25%**

Undeveloped national domestic oil resources still in the ground (in-place) total 1,124 billion barrels.
Of this large in-place resource, 430 billon barrels is estimated to be technically recoverable. -- DOE

Why did the state need to lower CO2 EOR Severance Tax Rate – SB 10?

The future of the Oil Industry is with EOR Recovery

- Reserves are known so they are low risk
- Credit environment for risky plays is almost non-existent
- Low hanging fruit has been picked

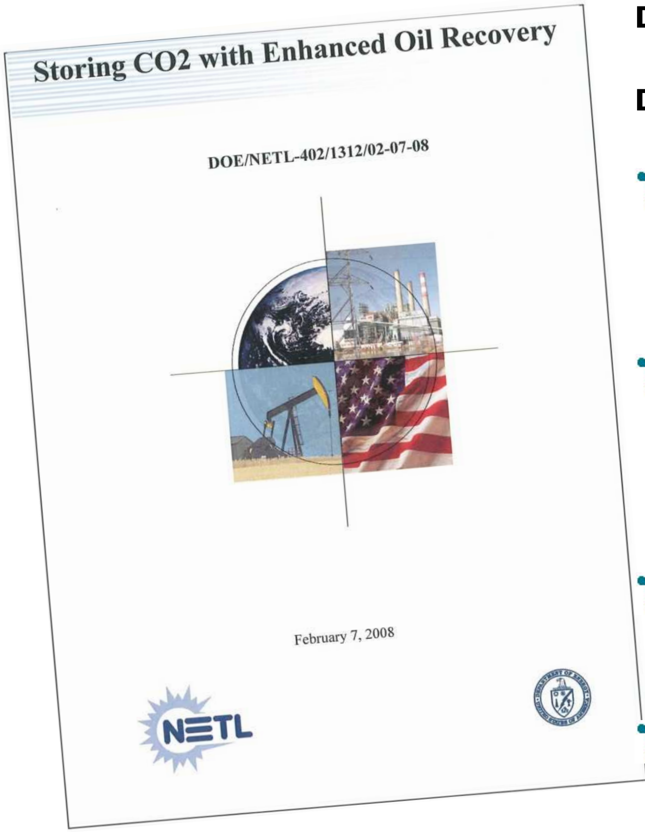
Remain Competitive with neighboring states

- Texas and Mississippi have taken steps to reduce severance taxes
- Reduced severance tax means more investment in state
- Keeps jobs in Louisiana

Financials

- Projects require SUBSTANTIAL up front investment
- Projects require on-going costs far and above traditional extraction methods
- Improves the number of fields available for EOR projects

The Potential



Department of Energy / National Energy Tech. Lab

DOE/NETL Report:

- ***"CO_2 enhanced oil recovery (CO_2 - EOR) offers the potential for storing significant volumes of carbon dioxide emissions while increasing domestic oil production."***
- **Approximately 84.8 billion barrels of oil in existing US oilfields could be recovered using state-of-the-art CO_2 - EOR**
  (In a range of $50-$100/barrel, it is economically feasible to recover 39 to 48 billion barrels)
- **Next generation technology offers potential for recovering more stranded oil and storing significantly more CO_2**
- **Infrastructure for CO_2 - EOR can be used for large-scale carbon capture and sequestration (CCS) projects in underlying saline formations**

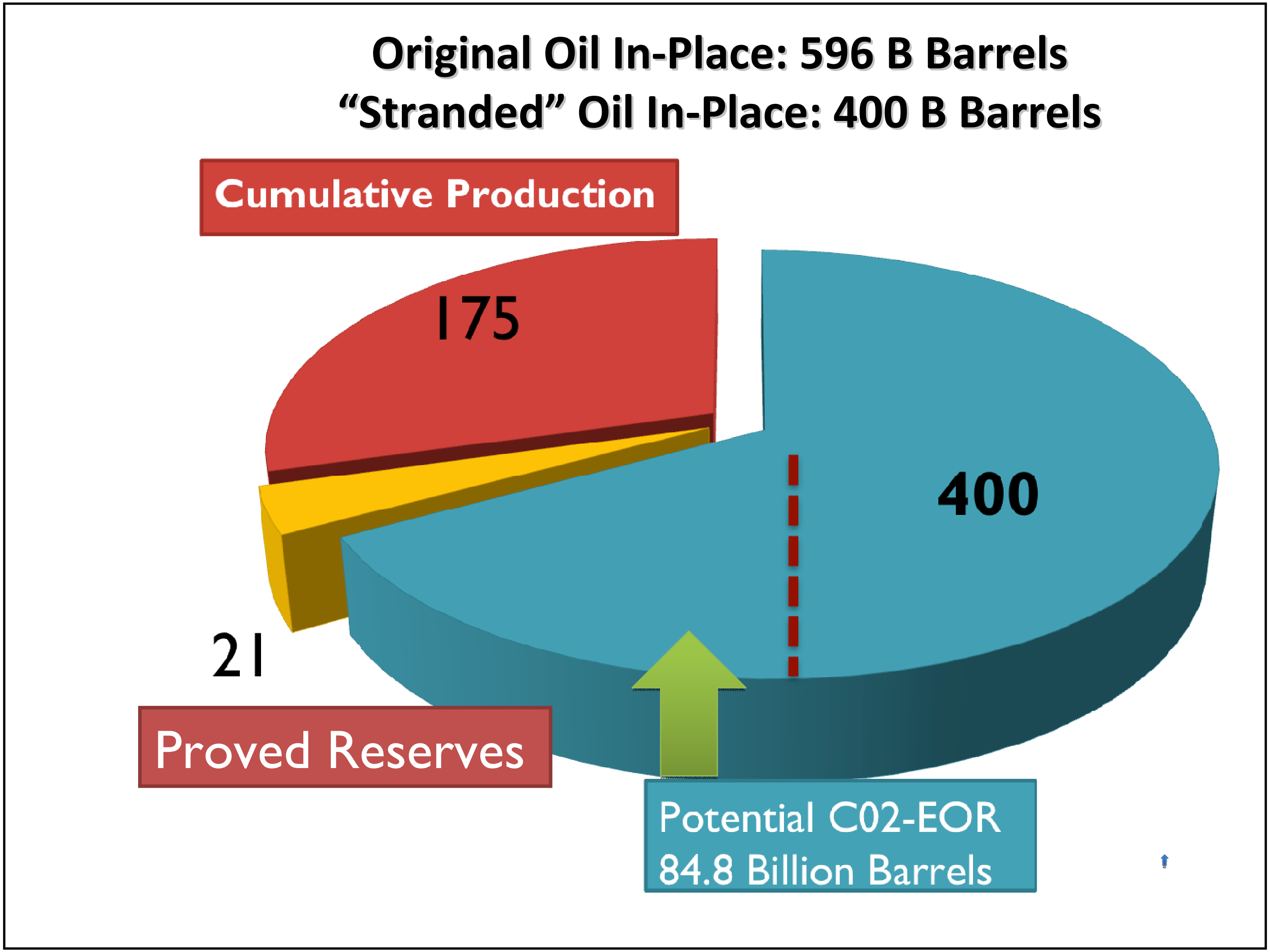
American Oil Resources

- In most US oilfields, about 33% of the original oil in-place is recoverable through primary and secondary methods, increasing to 50-60% with tertiary (CO_2) recovery

- The Gulf Coast (AL, FL, MS, LA)* has an estimated 44.4 billion barrels of identified oil in-place; 27.5 billion barrels are "stranded" and 7 billion barrels are recoverable with current CO_2 - EOR techniques

  *Does not include offshore basins

- DOE estimates that Louisiana has approximately 4.6-5.8 billion barrels of oil offshore that may be recovered using tertiary recovery technologies


Original Oil In-Place: 596 B Barrels
"Stranded" Oil In-Place: 400 B Barrels
Cumulative Production
175
400
21
Proved Reserves
Potential C02-EOR
84.8 Billion Barrels

Environmental Benefits

Reduce CO_2 or Green House Gas (GHG) Emissions

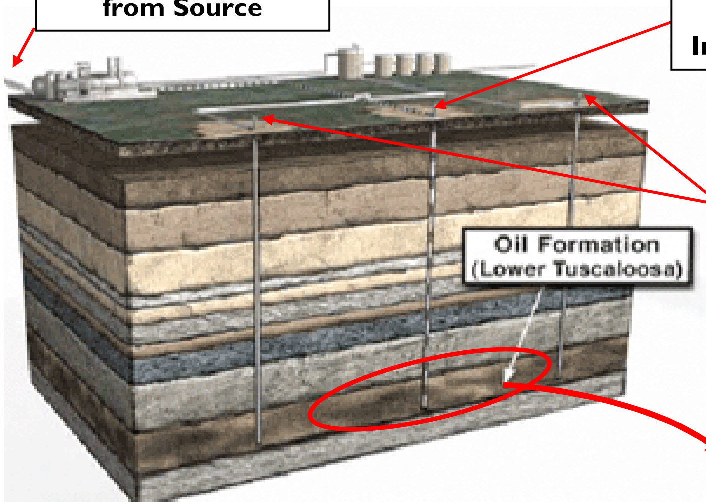
- **Instead of releasing GHG into the atmosphere, industrial plants will capture and sell their emissions to oil companies for EOR**
- **Companies will then use the CO_2 for injection purposes, increasing the domestic production of oil**
- **Because these are older fields, companies will be using pre-existing well-bores for injection and production, minimizing the footprint**
- **Finally, the CO_2 will be sequestered underground in a safe and secure manner**

CO_2 Enhanced Oil Recovery
(CO_2 - EOR)

CO_2 PIPELINE
from Source

INJECTION WELL
Injects CO_2 in dense phase

PRODUCTION WELLS
Produce oil, water and CO_2
(CO_2 is later recycled)



CO_2 moves through formation mixing with oil droplets, expanding them and moving them to producing wells.

Model for Oil Recovery Using CO_2 is +/- 17% of Original Oil in-Place (Based on Little Creek)

Primary recovery = +/- 20%

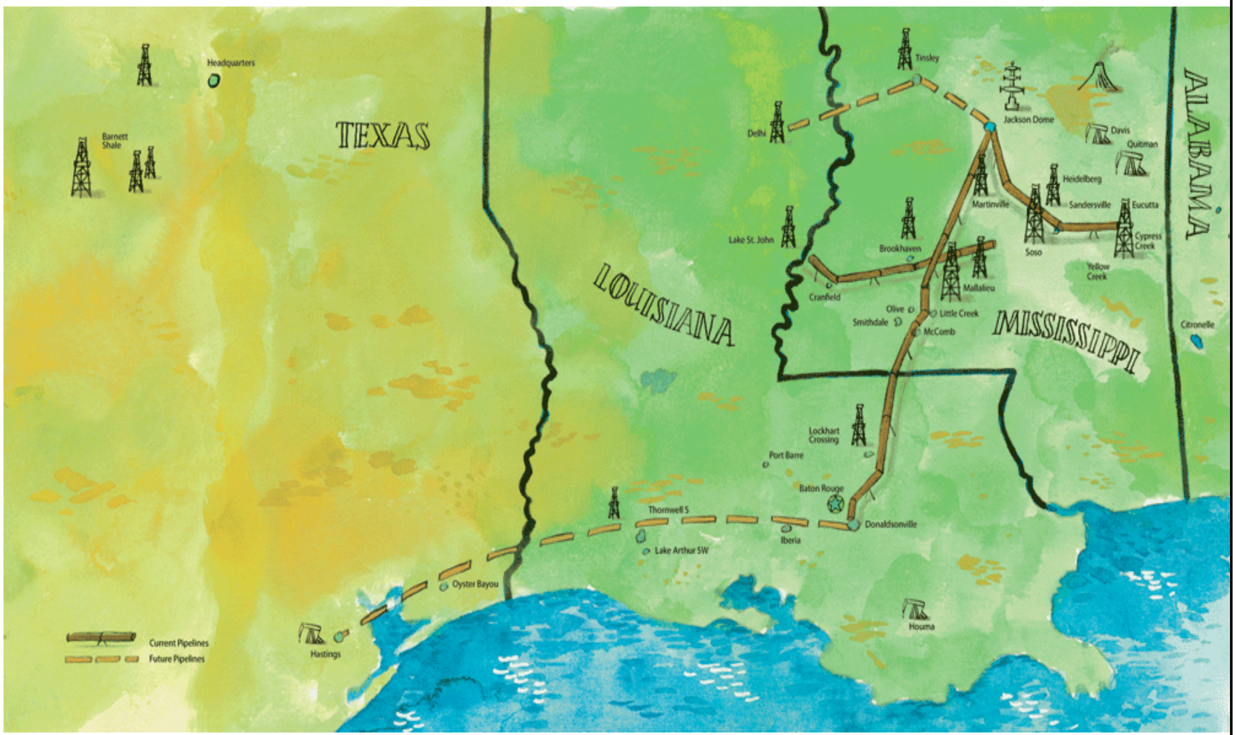
Secondary recovery (waterfloods) **= +/- 18%**

Tertiary (CO_2) **= +/- 17%**

Key to Success: CO_2 Pipeline Network

- **A CO_2 pipeline network is required to link oil reservoirs and/or sequestrating sites with CO_2 emitters across the US**
- **CO_2 emitters, power plants, chemical plants, manufacturing facilities require continuous run-time (24/7 operations)**
- **Pipeline network will connect to both natural and man-made sources, providing flexibility to manage emitters volume fluctuation and demand imbalances**
- **CO_2 - EOR projects require constant supplies of relatively pure (+/- 95%) CO_2 at 2,000 psi**

The Green Pipeline



Green Pipeline: Growing Louisiana's Economy

- **Jobs With Benefits: 775**

- **Louisiana Companies:**

Stupp Corporation	**Baton Rouge**
Project Consulting	**Metairie**
Wilco Pipeline	**Raymond**
Bayou Companies	**New Iberia**
C.H. Fenstemaker	**Lafayette**

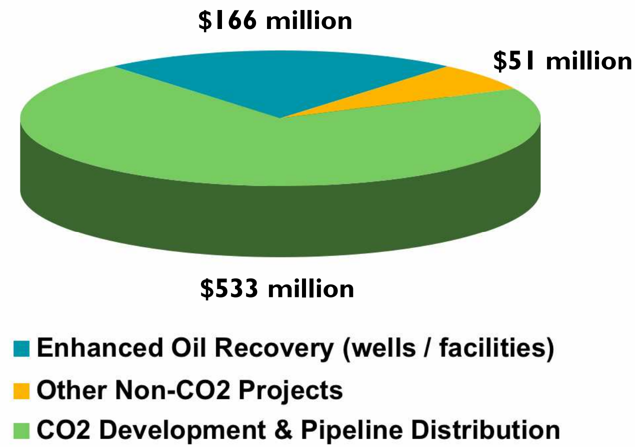
Total LA Investment to-date (12/31/08) **$122.2 MM**

- **Est. Project Total in LA is $355 MM**

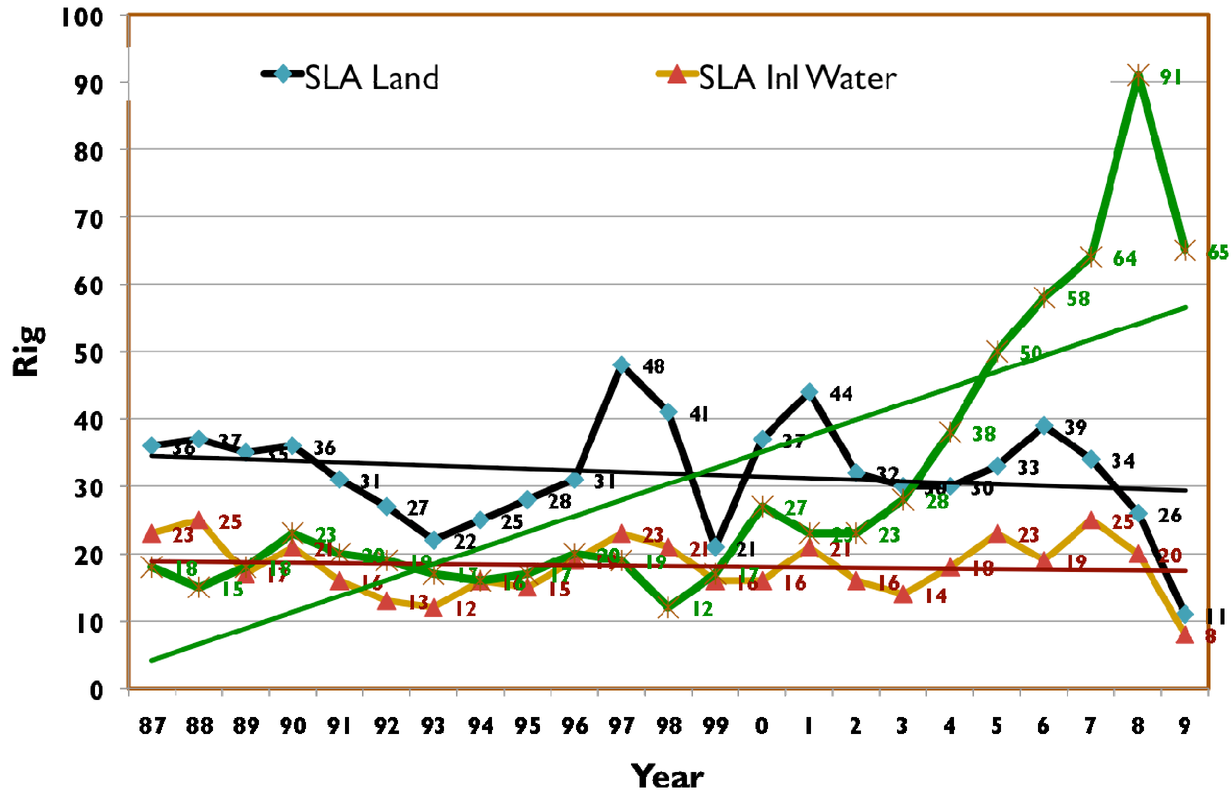
- **Total Capital Investment: $740 million**
  2007 - $13 million
  2008 - $202 million
  2009 - $453 million
  2010 - $78 million

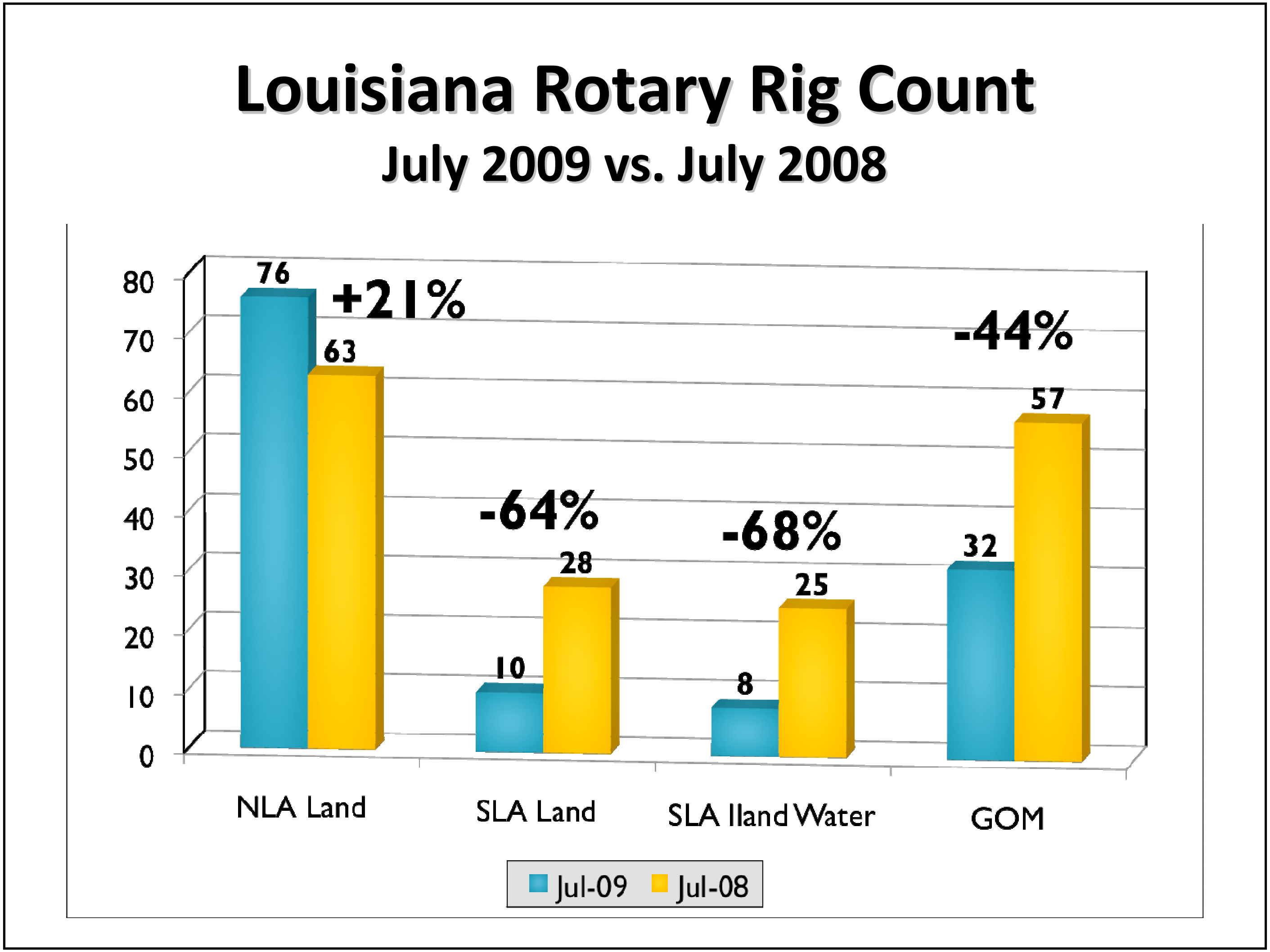
- **No Federal or State Funding**

Denbury 2009 Capital Budget



Louisiana Rig Count vs. Oil Prices

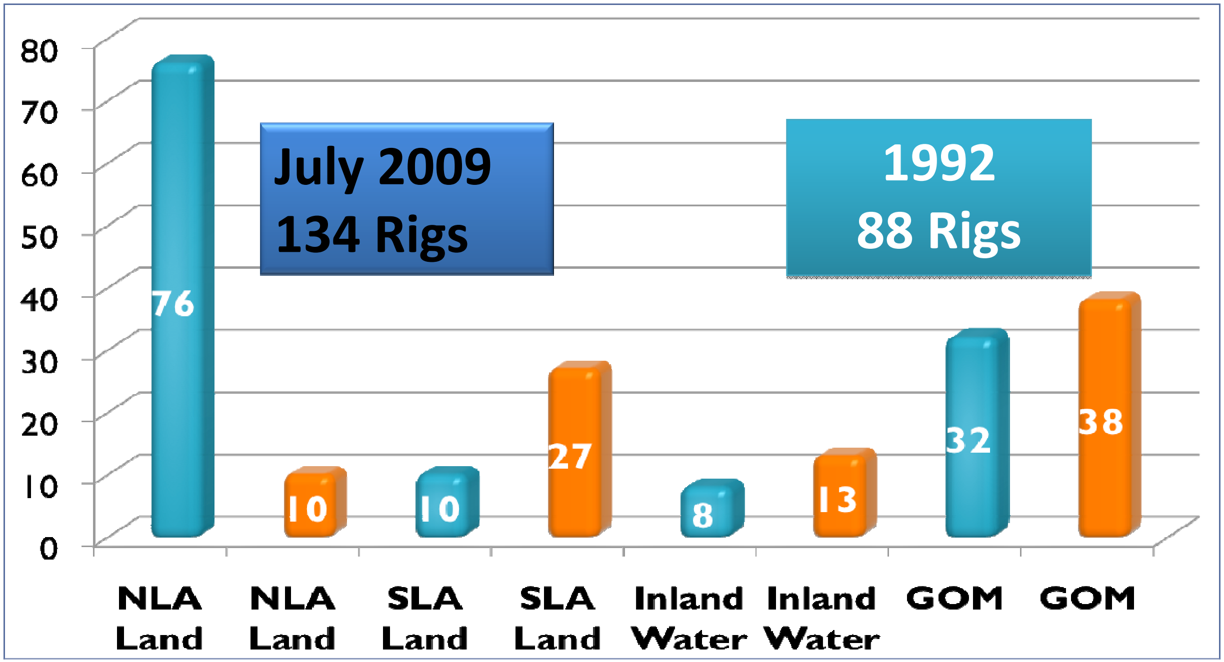


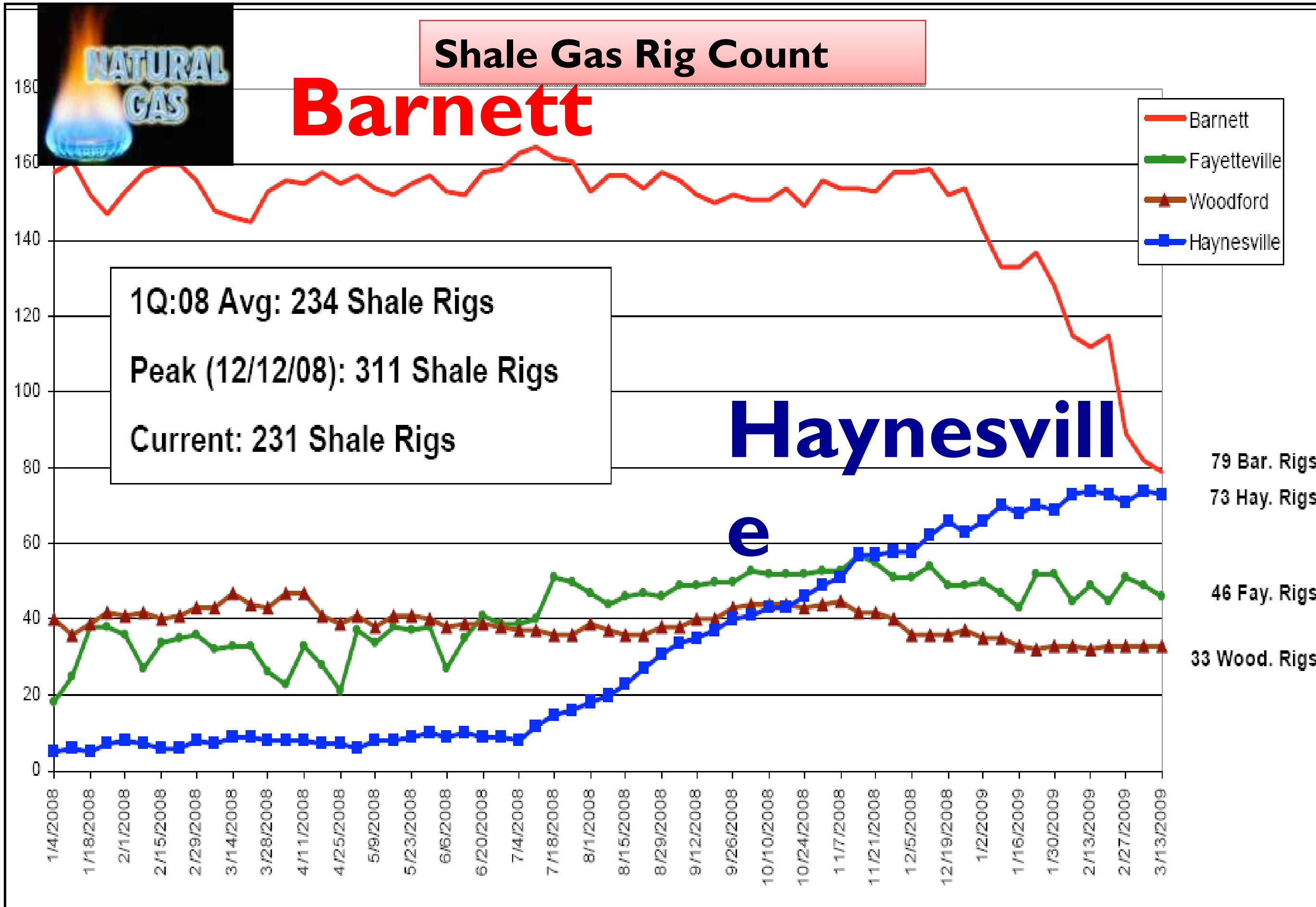


Louisiana Rotary Rig Count
July 2009 vs. July 2008
80
70
60
50
40
30
20
10
0
76
63
+21%
10
28
-64%
8
25
-68%
32
57
-44%
NLA Land
SLA Land
SLA Iland Water
GOM
Jul-09
Jul-08

Louisiana Rig Count

July 2009 vs. 1992 Annual Average

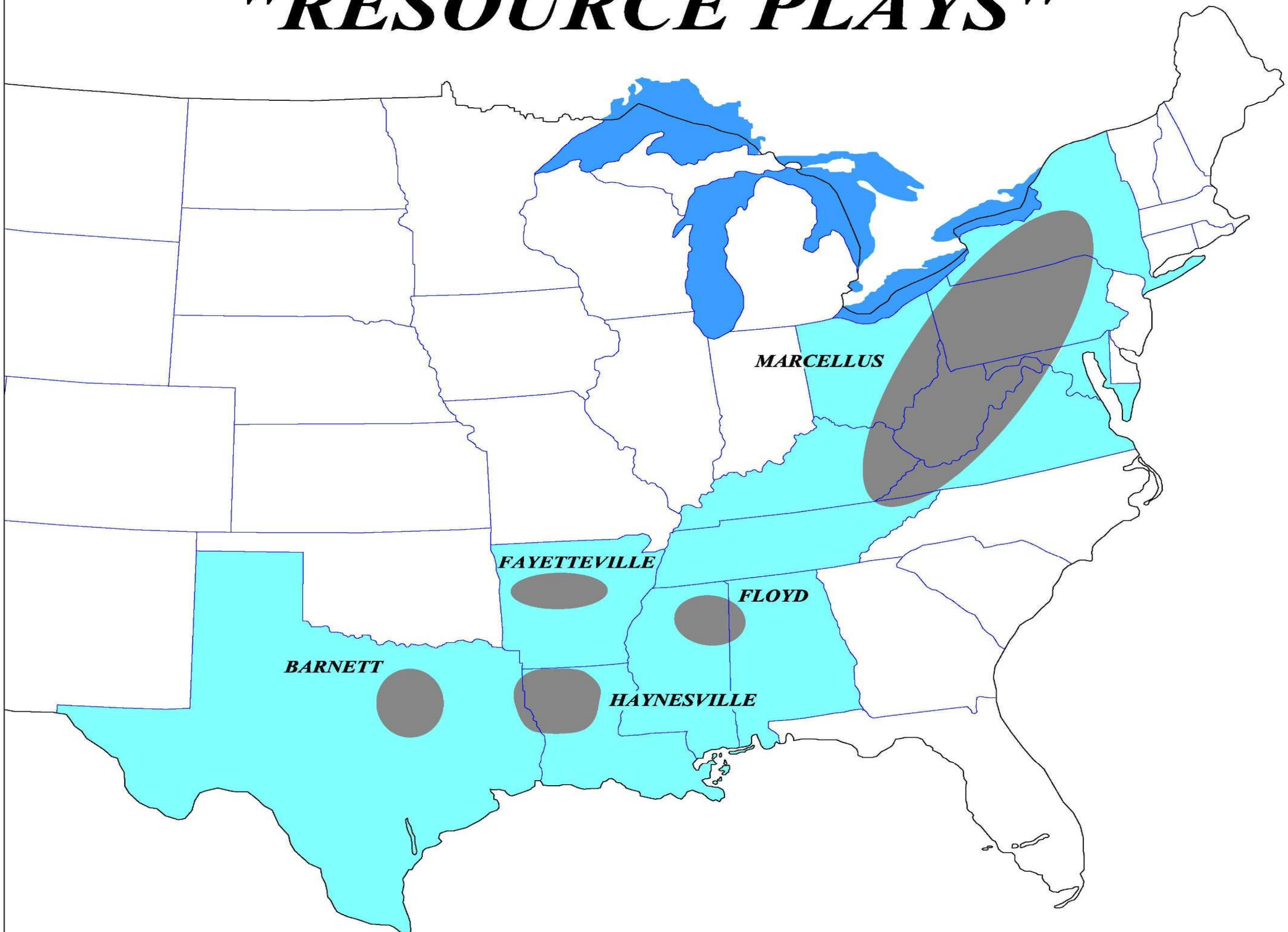




Note, our rig counts are usually below other's estimates, as we adjust for geography, orientation and drilling depth

Sources: Company reports, SMITH Stats, JRCO estimates

"RESOURCE PLAYS"



Q&A

We would like to thank our speakers

JONES WALKER

www.joneswalker.com