

# **KSU Winter Intersession 2010**

## **Carbon Sequestration Policy, Business Development, and Regulatory Issues**

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**NACCSA**  
North American Carbon Capture & Storage Association

# Session 4b – Carbon Sequestration Policy, Business Development, and Regulatory Issues

Start 1:50-2:40 Thursday

40 minutes 10 QA

# **Policy and Regulatory**

# H.R. 2454, The American Clean Energy and Security Act of 2009

- Provide substantial support for early movers in carbon capture and storage
- Bonus allowance for early movers could be as high as \$100/ton
- Recognizes the use of geologic sequestration (Section 813)
- Primary sequestration mediums are saline formations , depleted oil and gas fields and deep coal seams (June 5<sup>th</sup> Committee Report)
- EPA sets up Task force to study legal framework within six months of enactment and due within 18 months to Congress of enactment could be interpreted as also including BAU Class II EOR wells.
- EPA tasked with establishing itself (1 yr report to Congress), the geologic sequestration regulations (2 yrs), Safe Drinking Water regulations (3 yrs) and requirements for geologic sequestration both subsurface and atmospheric reporting (4 yrs)
- Using Enhanced hydrocarbon recovery results in reduced bonus allowance values at the EPA Administrator's discretion
- 17% reduction of 2005 CO<sub>2</sub> levels by 2020

# Interesting Finding on Oil

In WM but not in Boxer-Kerry

- **SEC. 127. OPEN FUEL STANDARD.**
- **17 (a) FINDINGS.— “The Congress finds that—(1) the status of oil as a strategic commodity, which derives from its domination of the transportation sector, presents a clear and present danger to the United States”;**
- *Final version language on page 120. Language found on page 117 of June 19<sup>th</sup> HR 2454 this language also found on page 115 of the “Amendment in the Nature of a Substitute” 946 page version of HR 2454 not in the May 21, 932 page version but also on page 33 in the Committee report June 5<sup>th</sup>.*
- *Note: “Clear and present danger” was used by Ronald Reagan in Policy Memorandum No.3 “Foreign Policy and National Security” to convey his feelings about the threat from Russia and its nuclear weapons. Fall of 1979 while running for President. Effectively set the stage for the “Star Wars” initiative*

# Senate's "American Clean Energy Leadership Act of 2009" S. 1462

- Accelerate the introduction of new clean energy technologies in the United States, creating new jobs and helping businesses grow through clean energy project financing, a renewable electricity standard, and a robust and secure national electricity transmission highway
- Increase energy efficiency in buildings, major equipment, and appliances, saving consumers and businesses billions of dollars on their energy bills
- Enhance America's energy independence by increasing clean energy supplies and energy security, including new access to over 20 trillion cubic feet of clean natural gas resources
- Strengthen America as the world leader in energy innovation, by doubling our national investment in energy research and technology
- Build a new energy workforce for the future
- Protect consumers by making energy markets more transparent and fair, and by providing new tools to fight market manipulation;
- Tackle future energy and climate challenges with smarter, more integrated planning.
- 20% reduction of 2005 CO<sub>2</sub> levels by 2020
- ***Promoting the development of domestic sources of oil and natural gas***
- ***Demonstrating the large-scale geologic storage of industrial sources of carbon dioxide;***

# Senator Cantwell's "CLEAR Cap and Refund Act"

- Unlike the Waxman Markey bill, this legislation envisions: 100% auction of "carbon shares"; reduced trading with trading limited to energy producers; a price collar \$7-12 with escalator; no offsets; emission cap limited to only CO<sub>2</sub> (not other GHGs); and program run by DOE. A "carbon share" is the right to sell or otherwise place into commerce in the United States 1 ton of fossil carbon. Thus, unlike the "allowance" approach of Waxman Markey, which focuses on industrial emissions, the Cantwell bill addresses carbon when it is introduced upstream in fossil fuels (and fossil fuel products) in commerce at the wellhead, mine mouth, or point of entry.
- For CCS purposes, the bill grants operators of CCS facilities surplus "carbon shares" in a quantity that corresponds to the quantity of fossil carbon permanently sequestered. (A similar incentive is provided for the beneficial reuse of CO<sub>2</sub>.) The "carbon shares" could be used by the facility or sold in the market. Background materials accompanying the draft legislation describe these bonus "carbon shares" as a "strong, positive incentive for fossil fuel power plants to reduce their net carbon dioxide emissions through permanent sequestration ...."
- 75% of auction revenues go back to public
- The bill does not define "sequestration" and is silent on issues such as permitting and long-term stewardship.

# Senator's Kerry, Lieberman & Graham Compromise Bill

- Cap and Trade
- Expanded offshore leasing for oil and gas production
- More carbon capture & storage and “clean coal” support
- More loans and incentives for nuclear power
- 17% CO<sub>2</sub> emissions cut by 2020



# Federal CCS Funding Opportunities

U.S. Department of Energy-National Energy Technology Laboratory Recovery Act: Carbon Capture and Sequestration from Industrial Sources and Innovative Concepts for Beneficial CO<sub>2</sub> Use Funding Opportunity Number: DE-FOA-0000015 Announcement Type: Initial CFDA Number: 81.089 Fossil Energy Research and Development.  
Announcement June 8, 2009 application due August 7, 2009

- **\$1,321,765,000.00 Available**
- Carbon Capture Storage from Industrial Sources-can be with/from steel, aluminum, cement, manufacturing, muni-waste, petcoke fuel source. Exclusions on power plants with energy output over 50% and fuel is over 55% coal. Efficiency in capture technology min 10% CO<sub>2</sub> content with 75% capture of emitted CO<sub>2</sub> stream storage, 1 million tons/year in CO<sub>2</sub>-EOR-EGR, basalt, stacked and ECBM, required site characterizations and MVA as program components
- Phase I: concept and planning. Seven months. 10-12 awards, \$500K to \$3 million. DOE 80% cost share
- Phase II: Design, Construction and Operations. 60 months. 4-6 awards must be in Phase I to qualify. \$50 to \$400 million award size. DOE targets 50% but cannot exceed 80% cost share.
- No min-max on awards and qualifications open-financial ability in Phase II. Applications in by August 7, 2009

# EPA

- **UIC Codes/Geologic Sequestration Well Protocols-** Docket ID No. EPA-HQ-OW-2008- 0390- Proposed rule: 40 CFR Parts 144 and 146 Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells
  - EPA proposes adding Class VI, MSG proposes Class IIb and Class VII
  - Public comment period ended December 24, 2008
  - Expect out sometime end 2010 or early 2011
  - <http://www.epa.gov/fedrgstr/EPA-WATER/2008/July/Day-25/w16626.htm>
- **Mandatory GHG Reporting-** Docket ID No. EPA-HQ-OAR-2008-0508 FY2008 Consolidated Appropriations Act (H.R. 2764; Public Law 110–161), EPA has proposed a rule that requires mandatory reporting of greenhouse gas (GHG) emissions from large sources(>25,000tns) in the United States.
  - Public comment period ended June 9, 2009
  - In effect Jan 1, 2010, first reporting due 2011
  - Industry data collection under the draft rule would begin in January 2010, with the first reports due to EPA in March 2011.
  - <http://www.epa.gov/climatechange/emissions/ghgrulemaking.html>
- **Endangerment Finding**-issued under Section 202(a)(1) of the Clean Air Act, **OMB approved Dec. 7**
  - Given that similar endangerment findings serve as the bases for other programs under the Clean Air Act, it is anticipated that, unless Congress acts, EPA will also begin to regulate GHGs from stationary sources and set ambient air quality. The endangerment determination may include an assessment of current and future risks rather than being limited to proof of actual harm.
  - EPA cannot control how a federal court would rule in the event of a citizen's suit to force regulation of all sources that emit GHGs in excess of the statutory thresholds.
  - ***On May 12, EPA Administrator Lisa Jackson told the U.S. Senate Environment and Public Works committee: "It is true that if the endangerment finding is finalized, EPA would have the authority to regulate green-house-gas emissions and...we would be judicious, we would be deliberative, we would follow the science, we would follow the law."***

# EPA

- Endangerment finding gives the EPA authority to regulate greenhouse gasses/ $\text{CO}_2$  under the Clean Air Act
- Fuel switching may be triggered pushing coal gasification (IGCC) over to natural gas for gas turbine generation
- EPA pushes Kentucky regulators in determining permit applications from the Cash Creek IGCC plant in Kentucky to consider if natural gas would not be “BACT” or best available control technology for generating electricity at this project

# **Two Markets for Same Molecule**

**Commodity CO<sub>2</sub> for use in enhanced oil recovery (EOR) in the US where available (~89 bln bbls)**

**Alternative commodity uses developing**

**Stored CO<sub>2</sub> for compliance and resulting tradable offsets or credits**

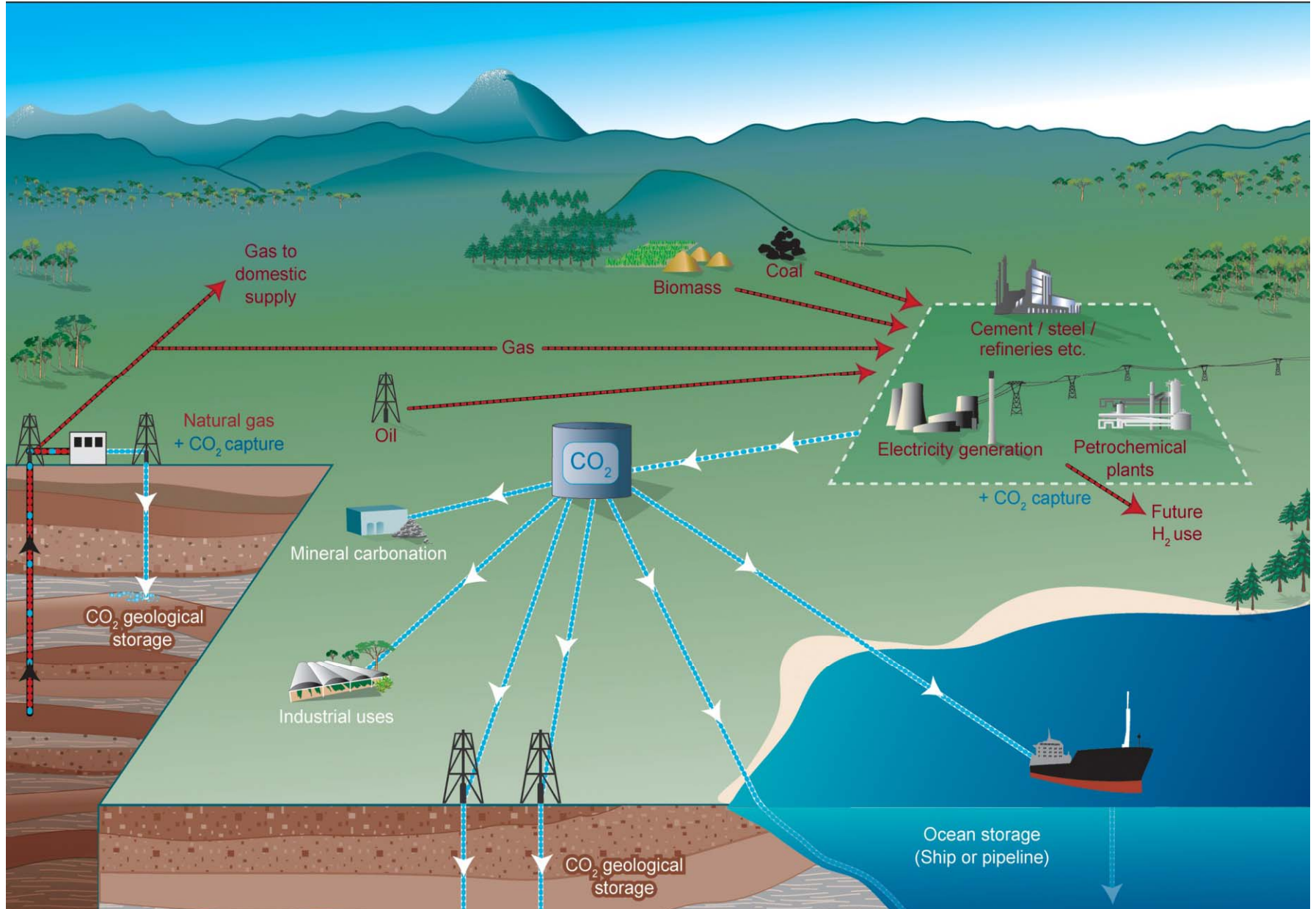
**Carbon Capture Storage (CCS) could readily utilize values from both markets**

**Commodity CO<sub>2</sub>**  
**Markets and Infrastructure for CO<sub>2</sub>-EOR-**  
**Sequestration**

# Geologic Sequestration

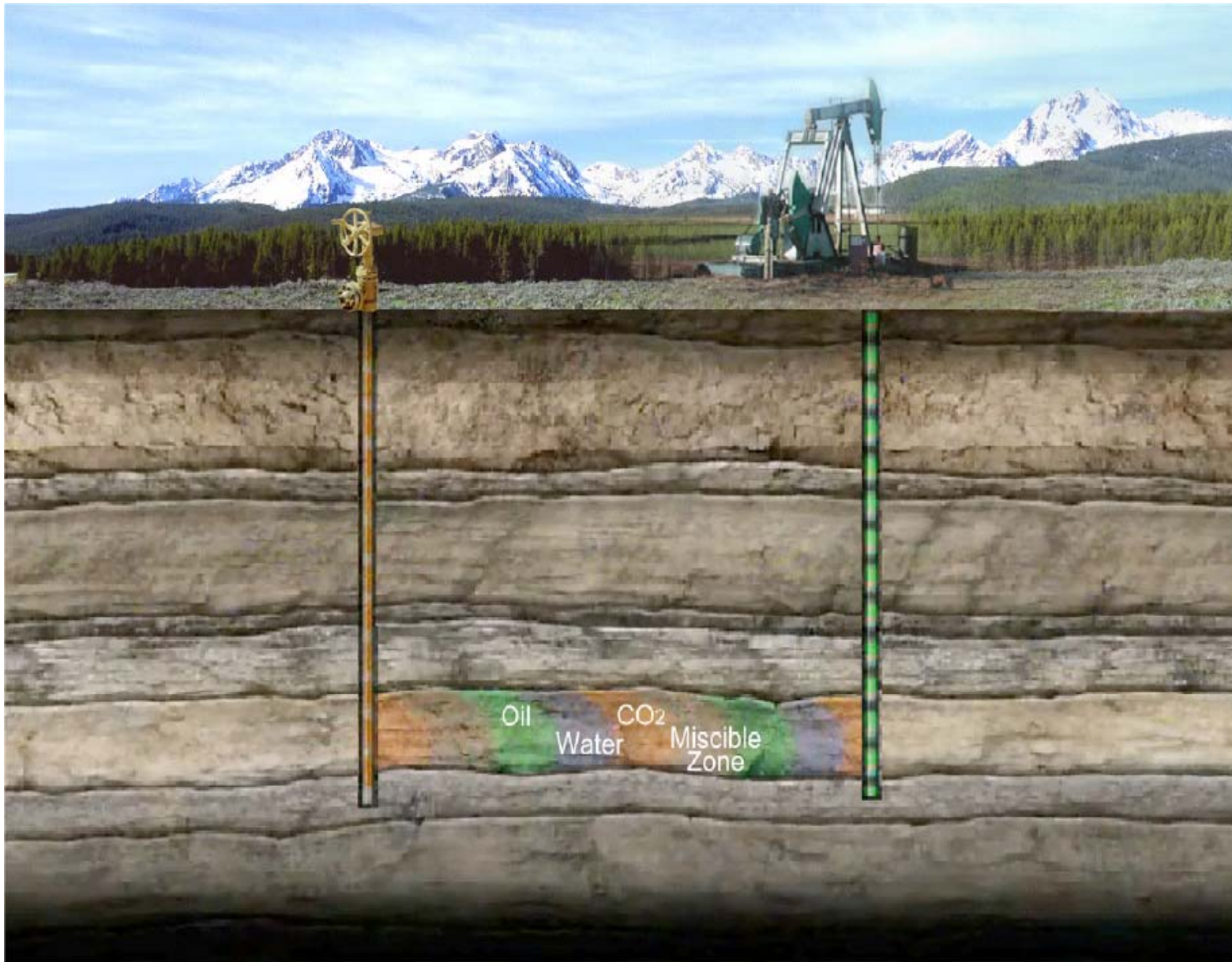
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[http://www.netl.doe.gov/technologies/carbon\\_seq/core\\_rd/storage.html](http://www.netl.doe.gov/technologies/carbon_seq/core_rd/storage.html)





# CO<sub>2</sub>-Enhanced Oil Recovery (EOR)



Graphic courtesy of USDOE  
National Energy Technology  
Laboratory

# DOE-ARI US Oil Basin Assessments

## OUTLOOK FOR CO<sub>2</sub>-EOR



Recently completed “basin studies” of applying “state-of-the-art” CO<sub>2</sub>-EOR in the U.S. indicate:

- Nearly 89 billion barrels of technically recoverable resource,
- From 4 to 47 billion barrels of economically recoverable resource.

**Results are based on applying streamline reservoir simulation to 1,581 large oil reservoirs (two thirds of U.S. oil production).**

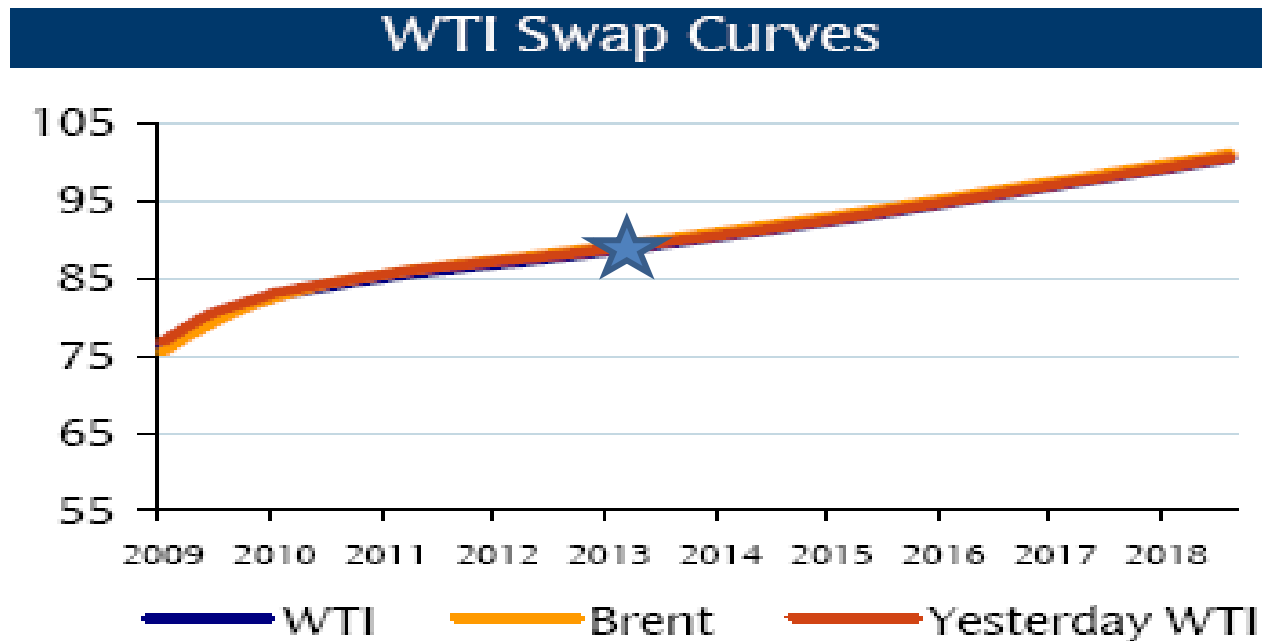
Available on the U.S. DOE web site.

[http://www.fe.doe.gov/programs/oilgas/eor/Ten\\_Basin-Oriented\\_CO2-EOR\\_Assessments.html](http://www.fe.doe.gov/programs/oilgas/eor/Ten_Basin-Oriented_CO2-EOR_Assessments.html)



# Recent US Commodity CO<sub>2</sub> Assessment

WTI Curve: November 13, Barclays Daily Commodity Report



10 year mid★WTI/Brent Oil price ~\$88./bbl. Value of CO<sub>2</sub> created by oil price.  
Permian Basin rule of thumb: 1000 cubic ft of CO<sub>2</sub> is valued as 2.0% of bbl of oil  
value delivered to well head ~34.14/tn ~1.76/mcf

*Note: This is an implied value the crude oil quality, field characteristics, CO<sub>2</sub> utilization/bbl and distance to/from markets will influence ultimate commodity CO<sub>2</sub> value/price*

Example: Kansas crude oil basket runs ~ \$5 to 10.00/bbl discount to WTI

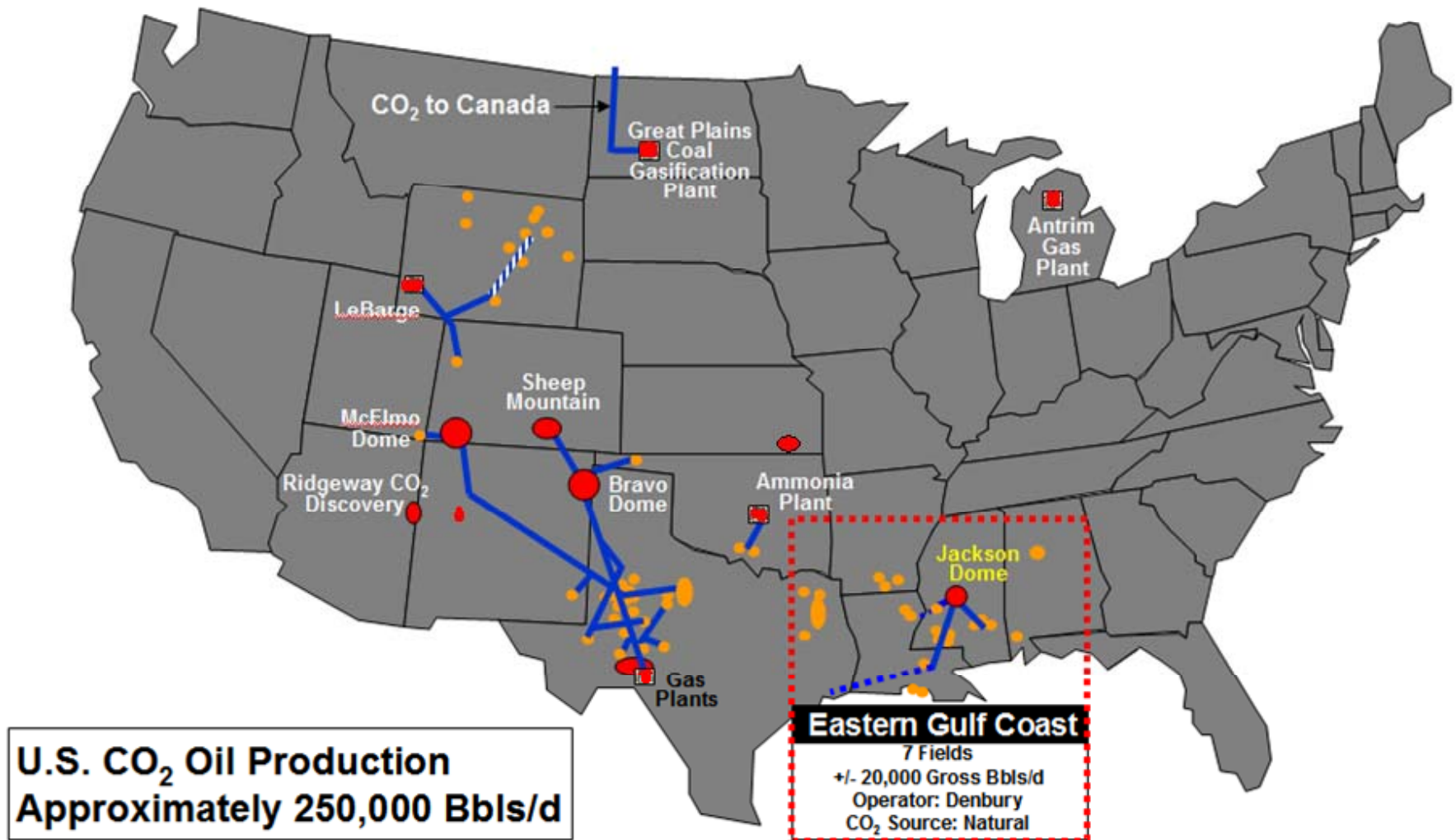
# CO<sub>2</sub> Pricing Considerations-EOR

- Quality of produced crude oil
- Local transportation/storage costs/access
- Regional oil market demand/pricing
- Local/distant refinery requirements
- Competitive alternatives-Canadian syncrude avails in midwest markets
- Utilization factor
- Operators margins
- Up front cost considerations-discount on first years-premium on back years

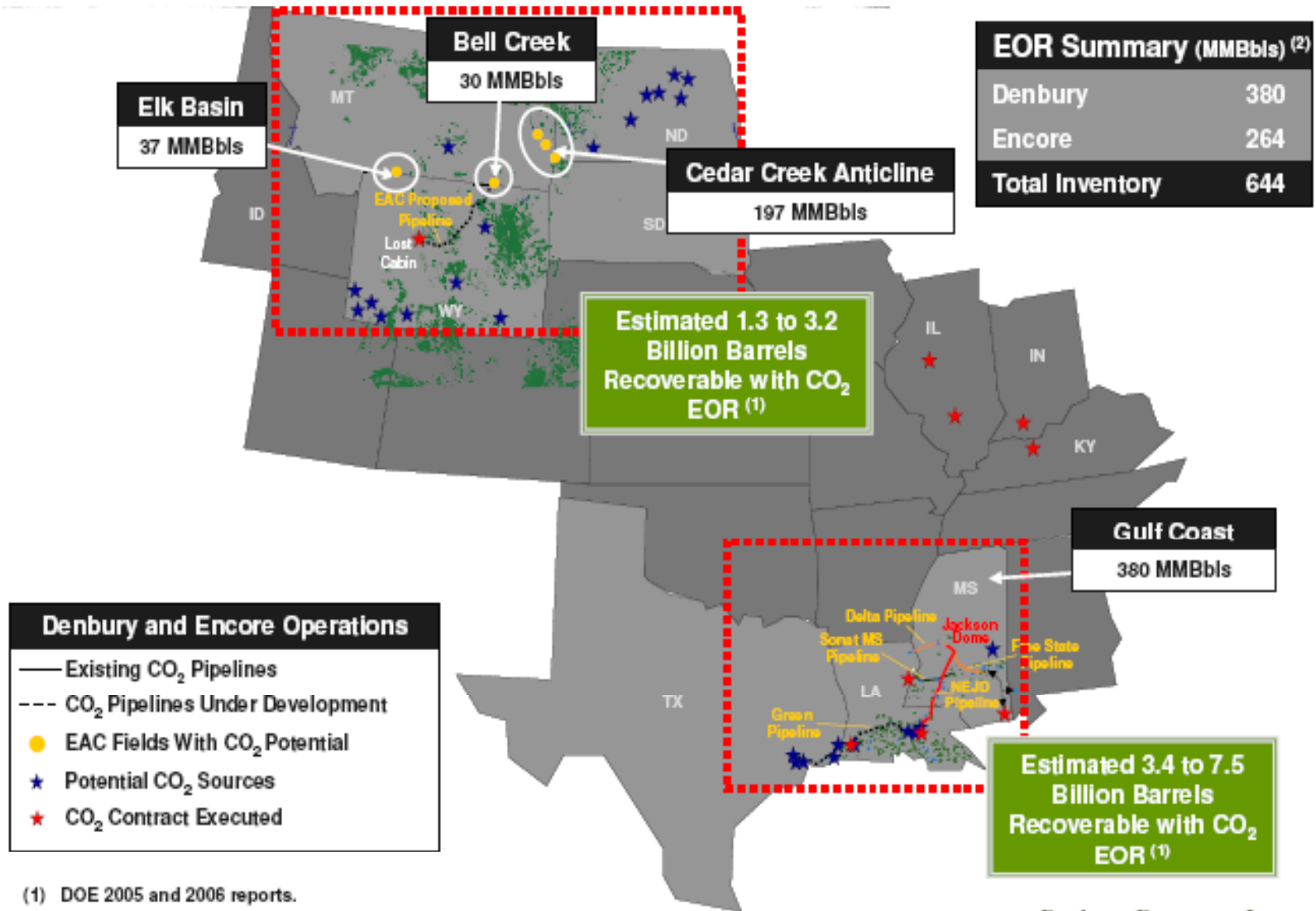
# Commodity CO<sub>2</sub> Valuation Issues

- Quality i.e. too much H<sub>2</sub>S could change permitting, oversight and public acceptance
- Regional volumes-too much/not enough
- Funding-cost per barrel produced too high
- Recognition of concurrent oil production and storage
- Who holds ultimate carbon compliance responsibility

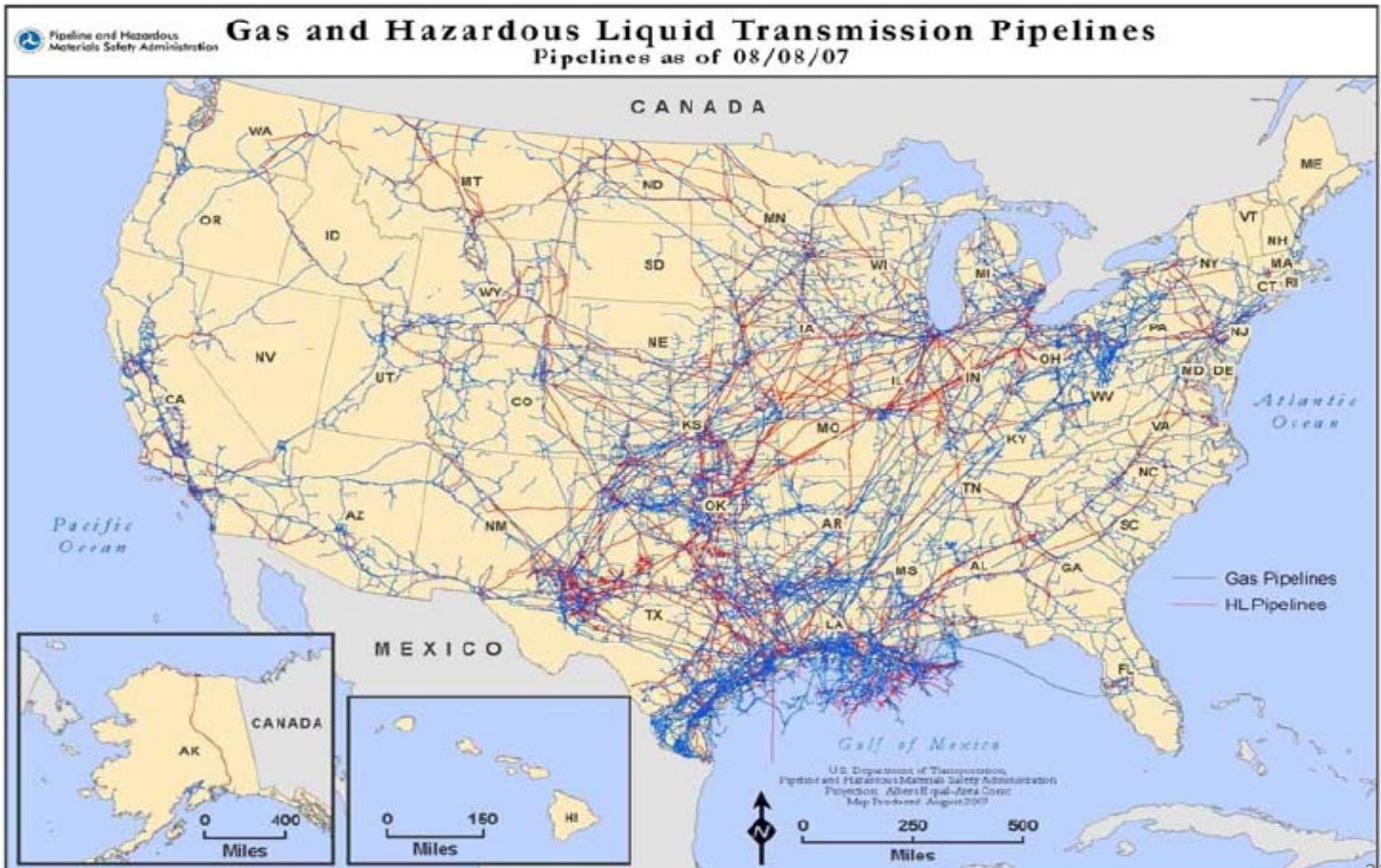
# Current CO<sub>2</sub> Pipeline Network



# Expected CO<sub>2</sub> Supplies and Opportunity



# 480,000 Miles of Natural Gas and HL Pipelines

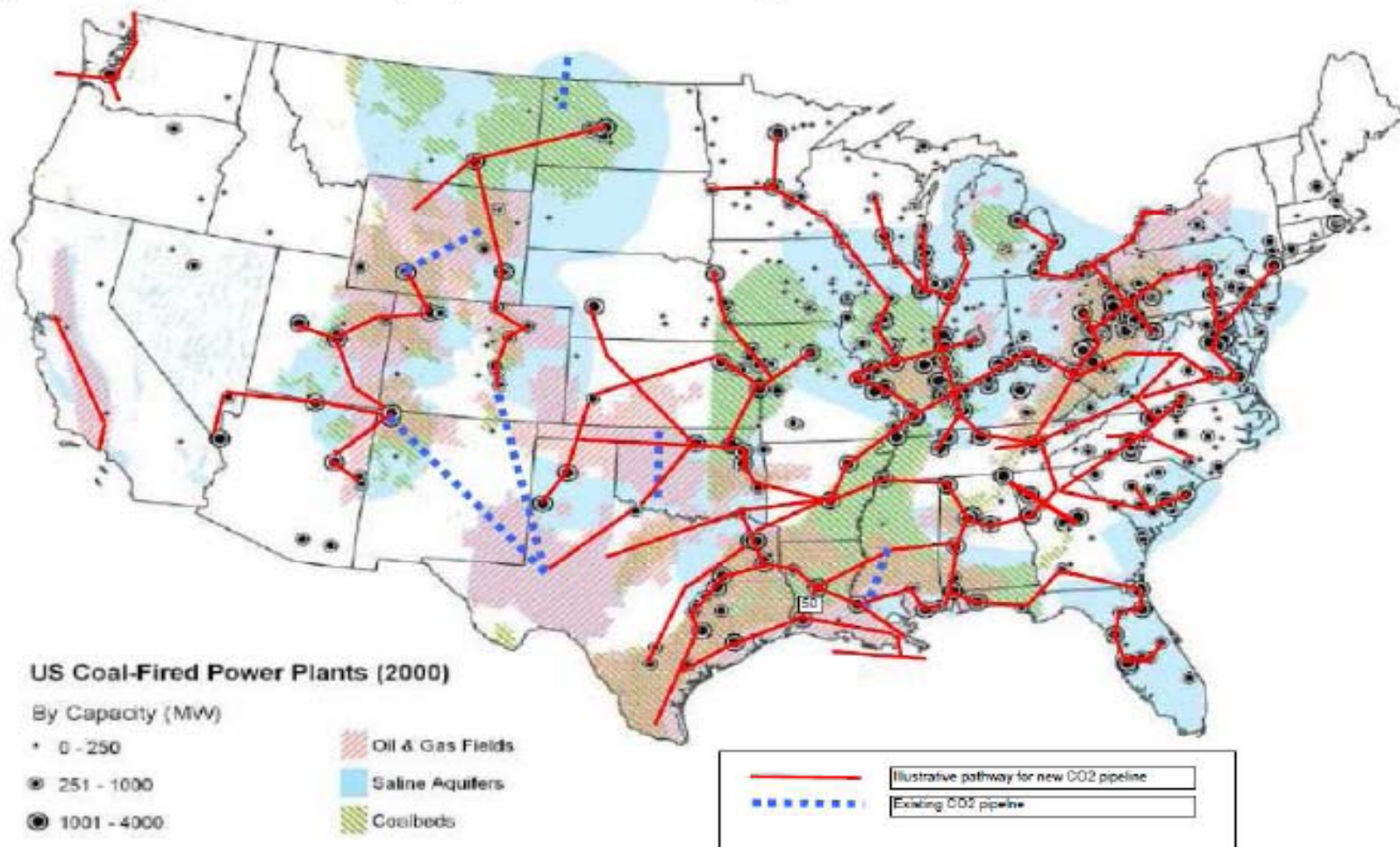




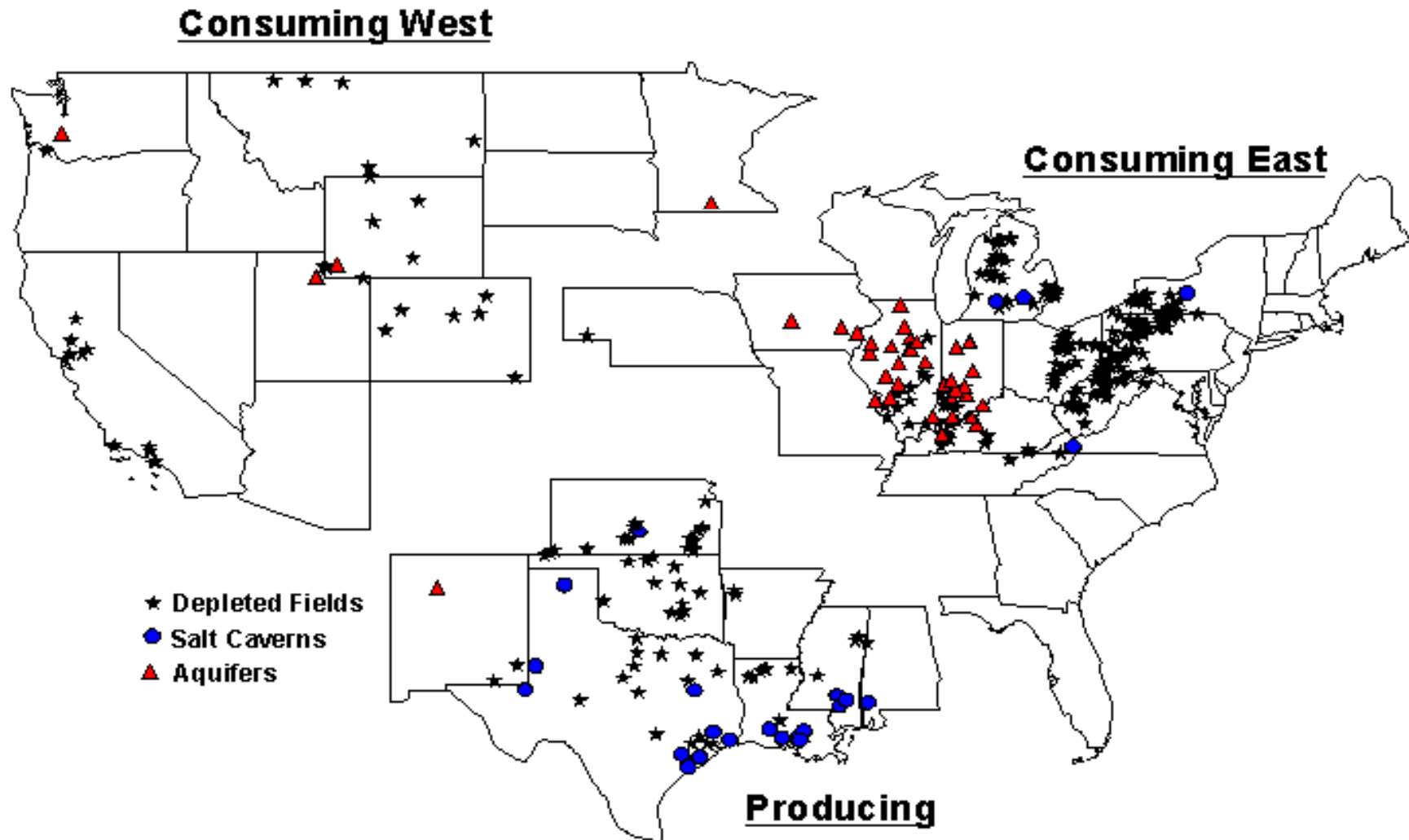
# INGAA High EOR CO<sub>2</sub> Pipelines

CARBON SEQUESTRATION & STORAGE: DEVELOPING A TRANSPORTATION INFRASTRUCTURE

Prepared for The INGAA Foundation, Inc. by: ICF International Feb 2009



# ~400 Lower 48 Gas Storage Facilities



Source: Energy Information Administration (EIA), EIA GasTran Geographic Information System Underground Storage Data Base.



# States with Geologic Storage Legislation and Regulation

- Texas
- Wyoming
- Kansas
- New Mexico
- Oklahoma
- Montana
- Pennsylvania
- Indiana
- Kentucky
- New York
- Washington
- Louisiana
- Michigan
- Mississippi
- North Dakota
- South Dakota
- West Virginia
- Illinois

# Public Acceptance is Crucial

<http://sites.google.com/site/noco2wasteindarke/>



# **Carbon Markets**

## **Global Credits and Offsets**

# CFTC's Commissioner Chilton

<http://www.cftc.gov/newsroom/MediaAdvisory/2009/mediaadvisory061109.html>

- Commissioner Bart Chilton of the Commodity Futures Trading Commission (CFTC) told an audience here that Green CAT Markets (cap and trade) that are currently trading on a voluntary basis in Chicago and New York could become the largest of all commodity markets.
- “Globally, these environmental markets have already grown on average 329 percent per year since 2002”, Chilton said.
- With the passage of legislation, such as H.R. 2454 introduced by Representatives Henry Waxman (D-CA) and Edward Markey (D-MA), Chilton estimates "Green CAT Markets could become \$2 trillion endeavors in five years.”

# Carbon Markets

<http://carbon.newenergyfinance.com/?gclid=CJ2dyNOqjJ4CFQ4hDQodUDx6pw>

**EU Emissions Trading Scheme** (EUAs)

**Kyoto Protocol and its successor** (CERs, ERUs, AAUs)

**North America** (RGGI allowances, prospective federal allowances, Canadian allowances)

**Australia** (CPRS allowances)

**Voluntary Market** (VCS, GS CER, CAR, ACR, CCX, WCI, MGGA, EPA Climate Leaders)

# Carbon Market Assessment

## RGGI Auction Results

<http://www.rggi.org/co2-auctions/results>

Auction Number	Auction Format	Allocation Year	Quantity Offered	Quantity Sold	Clearing Price
Auction 1 9/25/2008	Sealed Bid, Uniform Price	2009	12,565,387	12,565,387	\$3.07
Auction 2 12/17/2008	Sealed Bid, Uniform Price	2009	31,505,898	31,505,898	\$3.38
Auction 3 3/18/2008	Sealed Bid, Uniform Price	2009 2012	31,513,765 2,175,513	31,505,898 2,175,513	\$3.51 \$3.05
Auction 4 6/17/2009	Sealed Bid, Uniform Price	2009 2012	30,887,620 2,172,540	30,887,620 2,172,540	\$3.23 \$2.06

## Chicago Climate Exchange

<http://www.chicagoclimatex.com/>

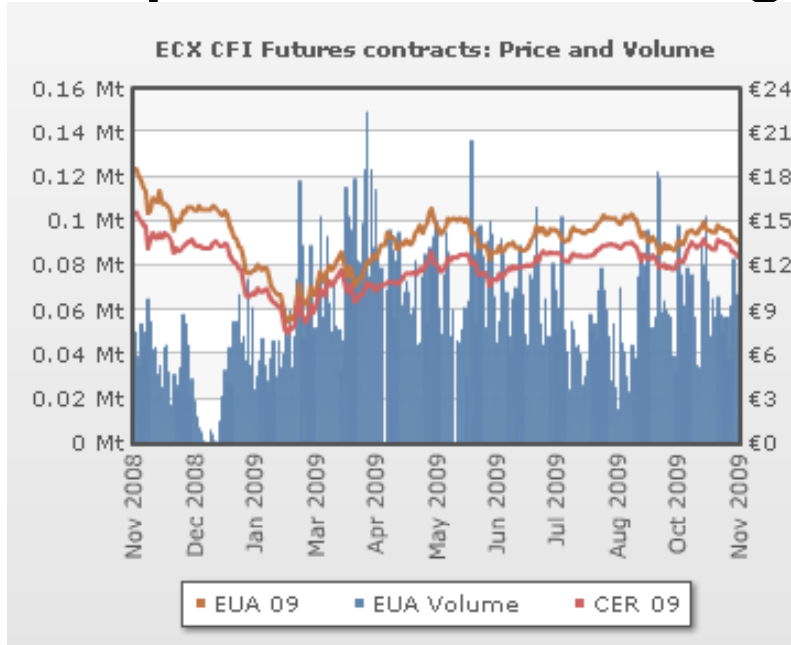
August 14, 2009 Updated end of day.  
Total Daily Electronic Volume: 0 mt CO2

CCX CFI	CLOSE	CHANGE
CFI 2003	\$0.40	\$0.00
CFI 2008	\$0.25	\$0.00
CFI 2010	\$0.30	\$0.00

To view all listed contracts click [here](#).



## European Climate Exchange



## US Voluntary Market:

Standard	2001 - 2008	2009 - 2011	2012+
Climate Action Reserve (CAR)	3.00 - 5.00	5.50 - 8.50	7.50 - 11.25
Voluntary Carbon Standard (VCS)	2.00 - 4.00	4.00 - 7.25	6.00 - 11.00
American Carbon Registry (ACR)	1.25 - 4.00	3.50 - 5.00	5.00 - 7.50

### Notes

- 1) Additional premiums paid for certain project types (Forestry, Landfill Gas): \$0.50 - \$2.00
- 2) Discounts apply to certain project types or sources that are likely to be capped (Industrial Gas, CCS): \$0.50 - \$3.00
- 3) Start date also impacts pricing. Prices noted above pertain to projects began after 2001.
- 4) Premiums paid for projects that begin after 2009.
- 5) Heavy discounts apply to project begun prior to 2001.

# Carbon Market Values & Volumes

Source: <http://www.commodities-now.com/news/environmental-markets/938-global-carbon-market-shrinks-in-q3.html>

- 2009 Global carbon market value ~\$122 bln
- 2008 Global carbon market value ~\$119 bln
- 2007 Global carbon market value ~\$ 65 bln
  
- 2009 global carbon volume ~7.588 bln tonnes
- 2009 volumes increased 103% over 2008

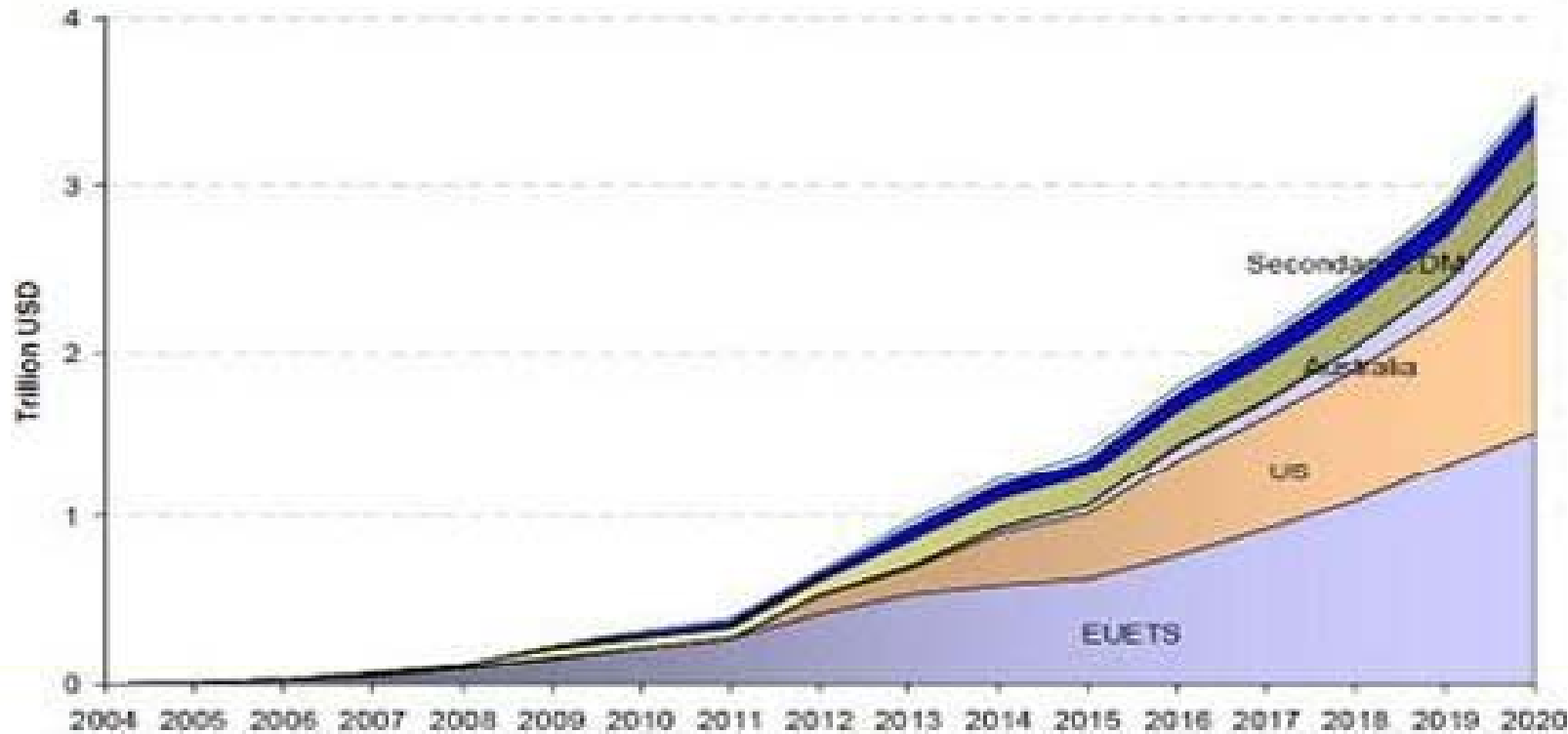
# Estimated Size of Global Carbon Markets

Projections on Carbon Market Value, Breakthrough Institute 2009		
Source	U.S. Carbon Market Projection	Global Carbon Market Projection
CFTC, 2009	\$2 trillion futures market (in 2017)	N/A
New Energy Finance, 2009	\$860 billion (in 2020)	\$2.1 trillion (in 2020)
New Energy Finance, 2008	\$1.2 trillion (in 2020)	\$3.5 trillion (in 2020)
Point Carbon, 2008	\$2.07 trillion (in 2020)	\$3.1 trillion (in 2020)



# Expected Size of Global Carbon Market

Potential growth in the carbon market 2004-2020



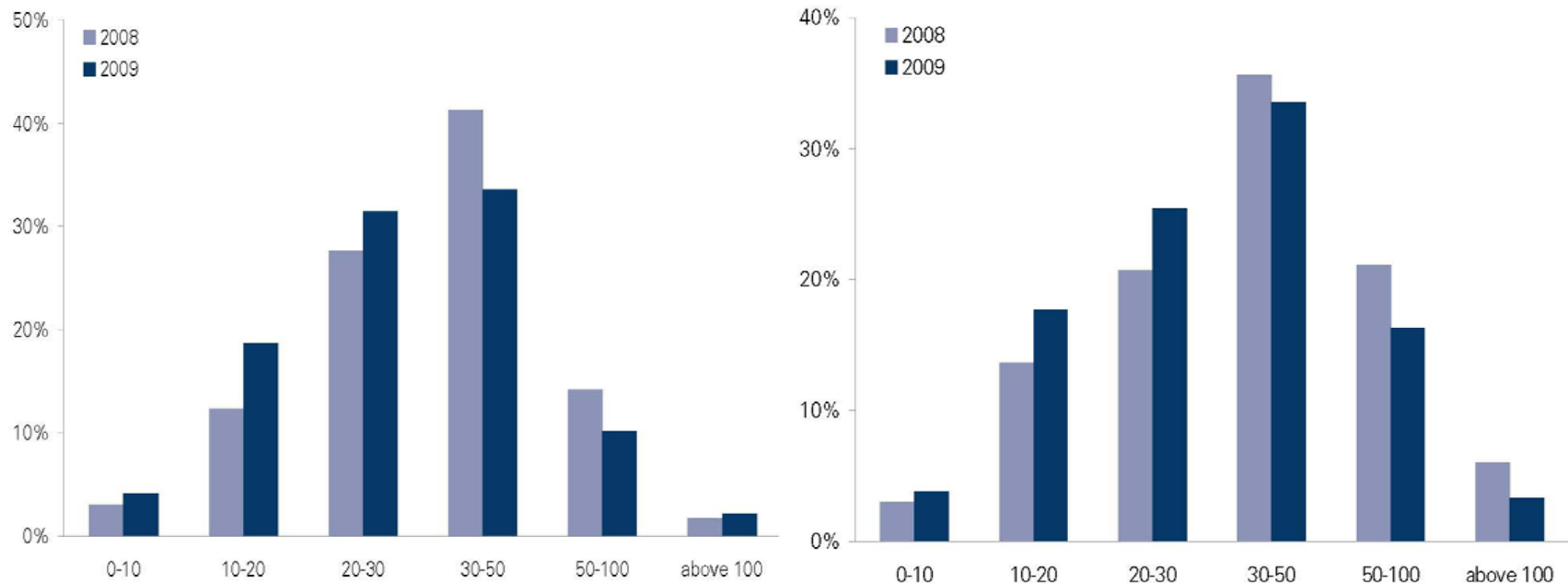
Source: *New Carbon Finance*

# Expected Global Carbon Price by 2020

## Price expectations, 2020

Expectations for global CO2 price level in 2020, in EUR (left) and USD (right). N=1966

Source: Point Carbon



**PointCarbon**

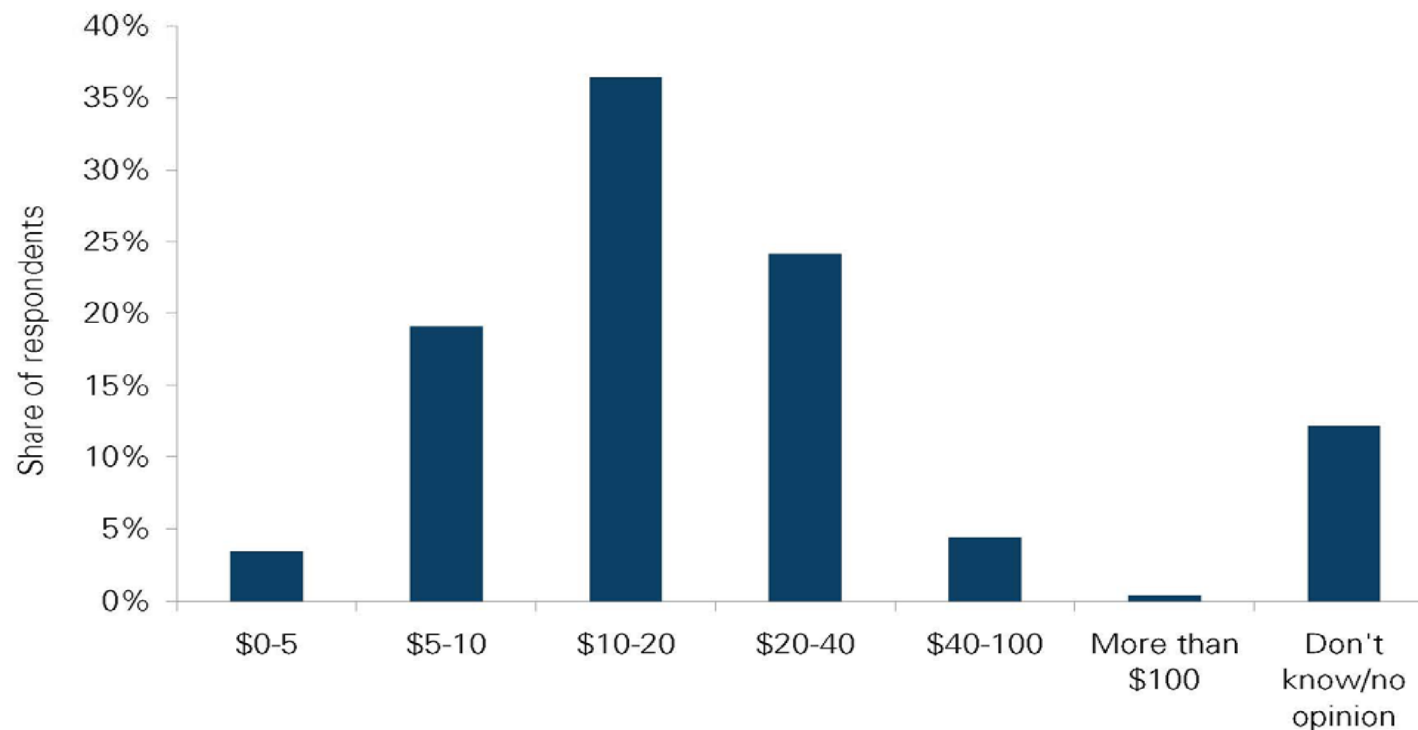
Source: Carbon 2009, page 39, 17 March 2009

# Expected CO<sub>2</sub> Price End of First Yr US Cap & Trade Compliance

## Price expectations under a US ETS

Expected carbon price at the end of the first compliance year of a US federal cap-and-trade scheme. N=2328

Source: Point Carbon



# Potential Size of Offsets per HR 2454

Source: [http://www.thebreakthrough.org/blog/Projection\\_Offset\\_Market\\_Breakthrough\\_2009.JPG](http://www.thebreakthrough.org/blog/Projection_Offset_Market_Breakthrough_2009.JPG)

Projections on carbon offset market, Breakthrough Institute 2009						
(all numbers in millions)	Total potential		Using CBO projection		Using EPA projection	
	2012	2020	2012	2020	2012	2020
Domestic offset permits	1,000	1,000	230	300	110	110
Domestic offset permit value	\$15,000	\$20,000	\$3,450	\$6,000	\$1,650	\$2,200
International offset permits	1,000-1,500	1,000-1,500	190	340	1,000	1,000
International offsets value	\$15,000 - 22,500	\$20,000 - 30,000	\$2,800	\$6,800	\$15,000	\$20,000

# Issues of Confidence in Carbon Markets

- The recent announcements of “carousel” fraud in the European Union’s \$90 billion emissions trading scheme has prompted the European Commission to propose a temporary solution later this month to stop tax fraud in the European carbon emissions market, reports Reuters.
- However, experts are warning that a patchwork of unilateral actions by member states like the UK and France to prevent carousel fraud in spot trading of EU carbon permits could push the suspected activity into neighboring states, according to Reuters.

# Contact Information

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