

**WEC: CARBON CAPTURE & STORAGE & CLEANER FOSSIL
FUELS STRATEGIES
IN THE MIDDLE EAST & NORTH AFRICA:
WHERE WE ARE & WHERE WE ARE GOING**

***“CO₂ Commodity and Carbon
Drivers and Pricing Trends”***

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Abu Dhabi January 21, 2010



Key Drivers for CCS Deployment

- **\$\$\$\$ Carbon \$60-120/ton**
- **Magnitude of issue**
- **Stewardship**
- **CCS Acceptance**

\$\$\$\$ Carbon

- US Cap and Trade legislation could provide as much as \$100/ton (WM) and \$106/ton (BK) for early movers
- Voluntary markets: \$5-13/ton
- Commodity (US) CO₂: \$20-40/ton

Two Markets for Same Molecule

Commodity CO₂ for use in enhanced oil recovery (EOR) in the US where available (~89 bln bbls)

Alternative commodity uses developing

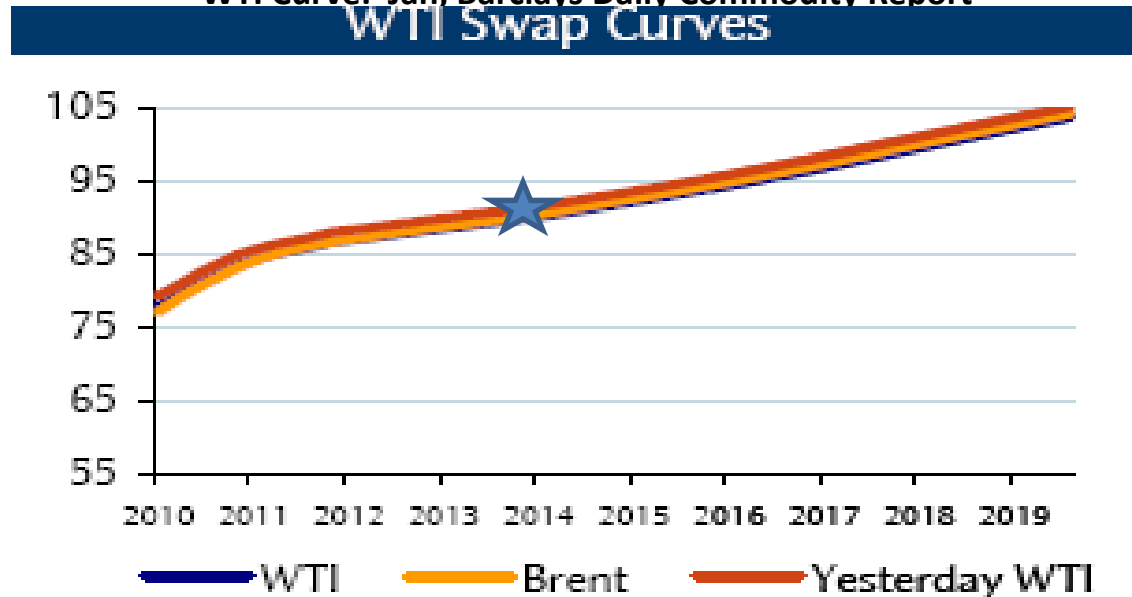
Stored CO₂ and resulting tradable offsets or credits

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

Commodity CO₂

Recent US Commodity CO₂ Assessment

WTI Curve: Jan, Barclays Daily Commodity Report



WTI/Brent Oil price @ 2014 ★ ~\$88./bbl. Value of CO₂ created by oil price.
Permian Basin rule of thumb: 1000 cubic ft of CO₂ is valued as 2.0% of bbl of oil
value delivered to well head ~34.14/tn ~1.76/mcf

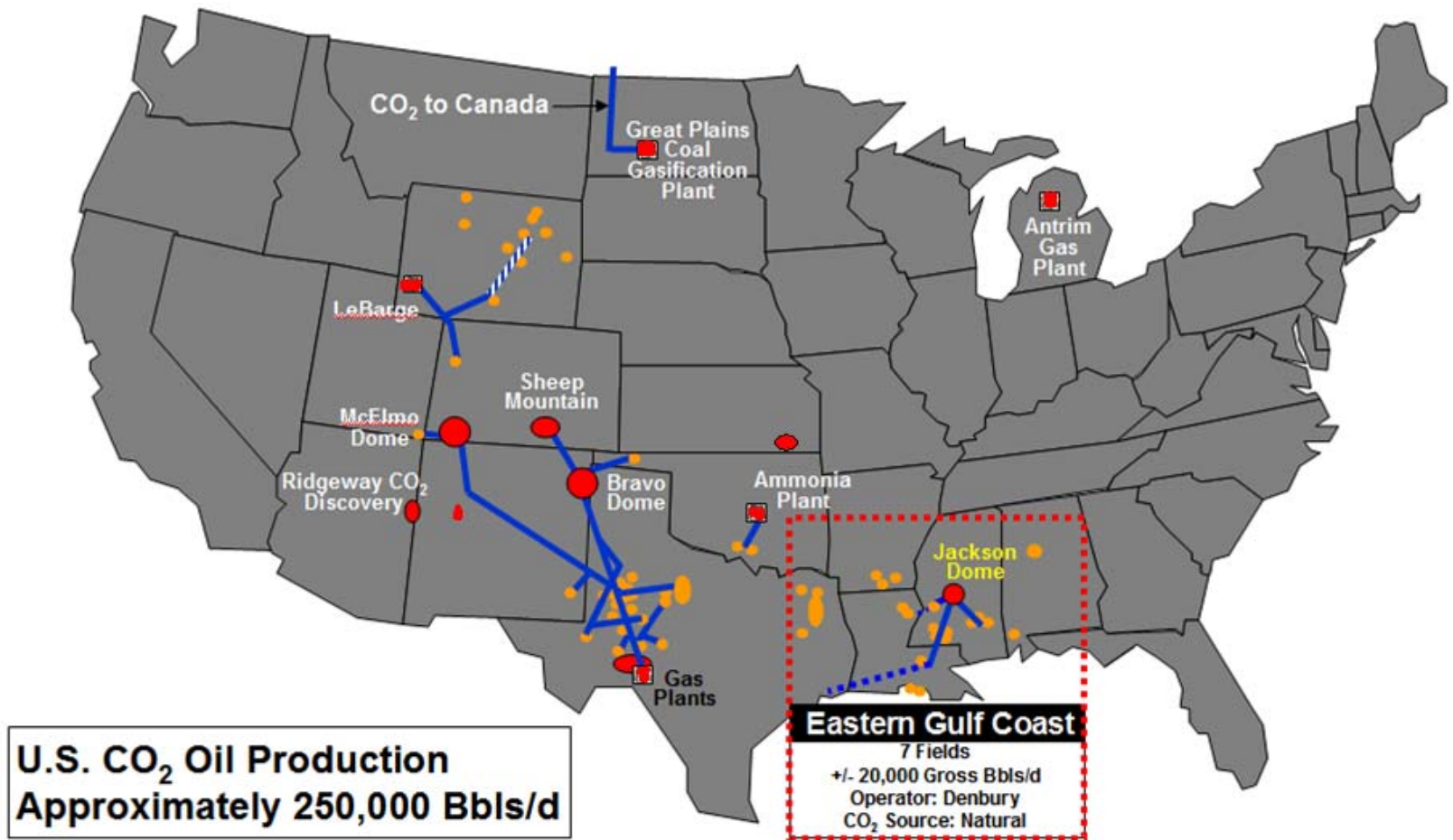
Note: This is an implied value the crude oil quality, field characteristics, CO₂ utilization/bbl and distance to/from markets will influence ultimate commodity CO₂ value/price

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 19th 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 5th.*
- *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.*

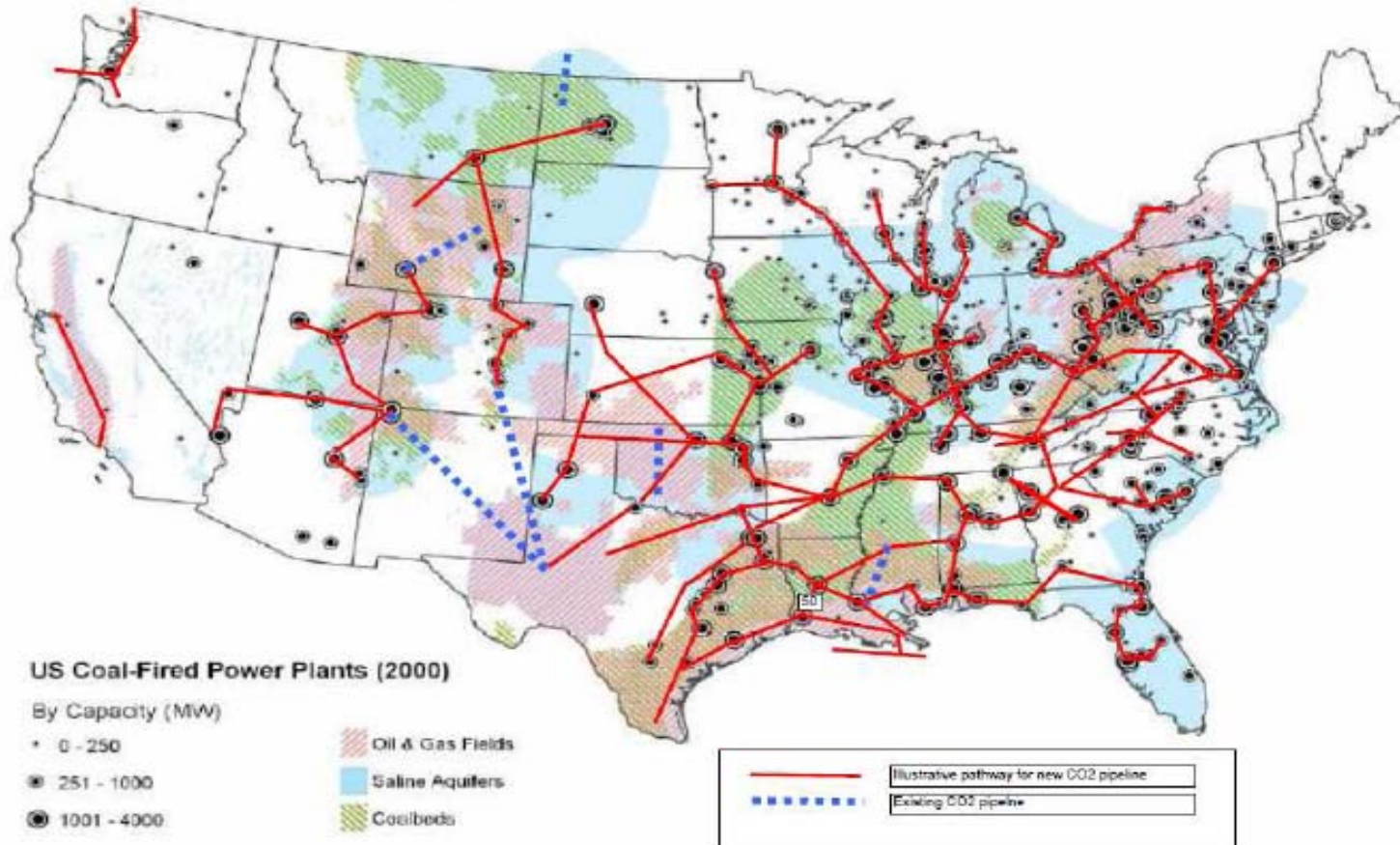
Current CO₂ Pipeline Network



INGAA High EOR CO₂ Pipelines

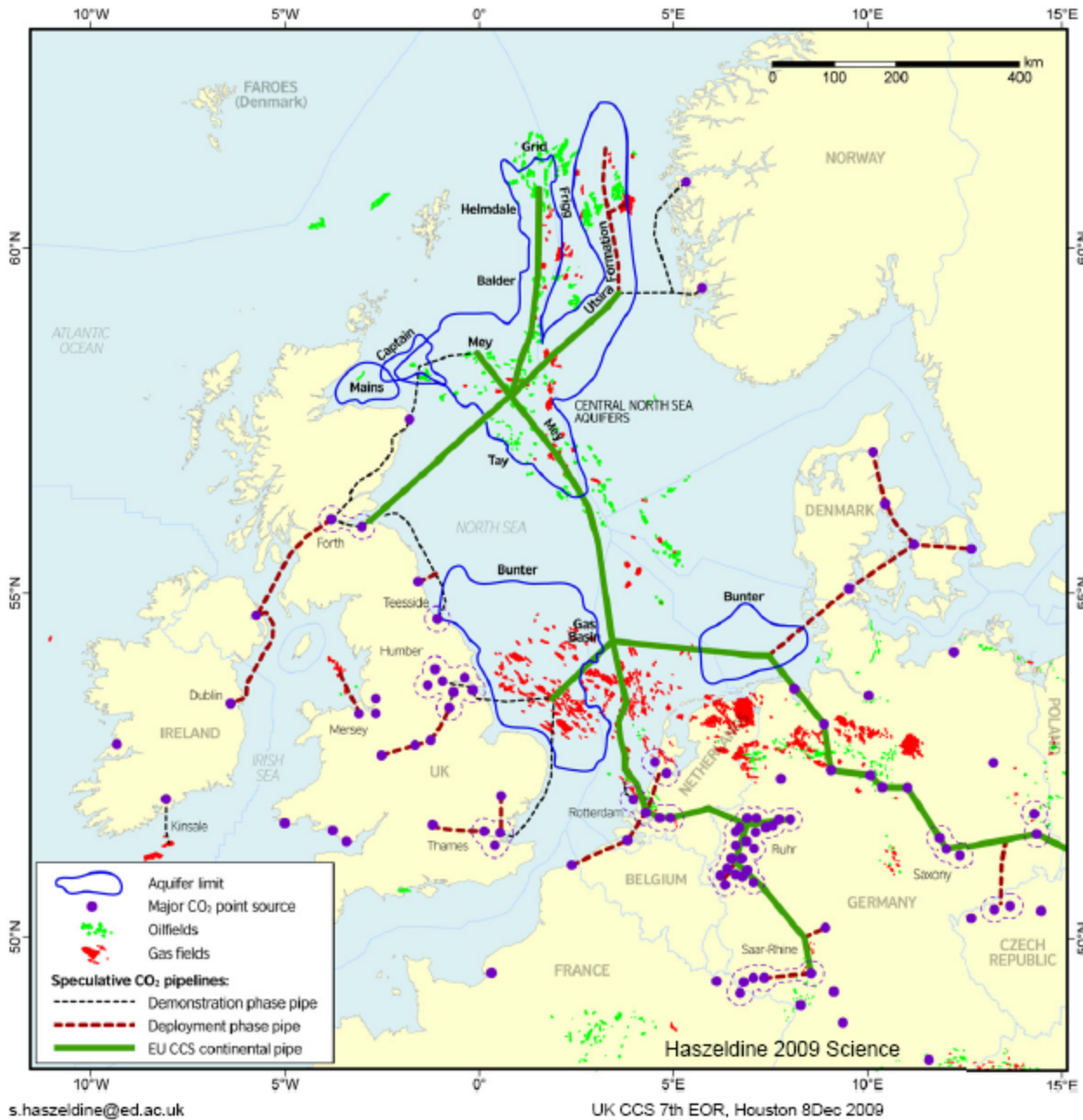
CARBON SEQUESTRATION & STORAGE: DEVELOPING A TRANSPORTATION INFRASTRUCTURE

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



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



**Few
large, or
many
small
stores ?**

**Continental
pipes to
offshore
\$8 Bn/yr
income?**

**MAJOR RISK
Needs REAL
TESTS**

Carbon Markets

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)

[JI and CDM](#)

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 ~\$135 bln
- *Note: ~\$22bln in CDM value*
- 2008 Global carbon market value ~\$119 bln
- 2007 Global carbon market value ~\$ 65 bln

- 2009 global carbon volume ~8.2 bln tonnes
- Note: '09 volumes higher but overall prices lower
- 2010?

Global Carbon Market Expanded 68% 2009

James Murray, [BusinessGreen](http://www.businessgreen.com/business-green/news/2255709/global-carbon-market-expands-68), 07 Jan 2010 <http://www.businessgreen.com/business-green/news/2255709/global-carbon-market-expands-68>

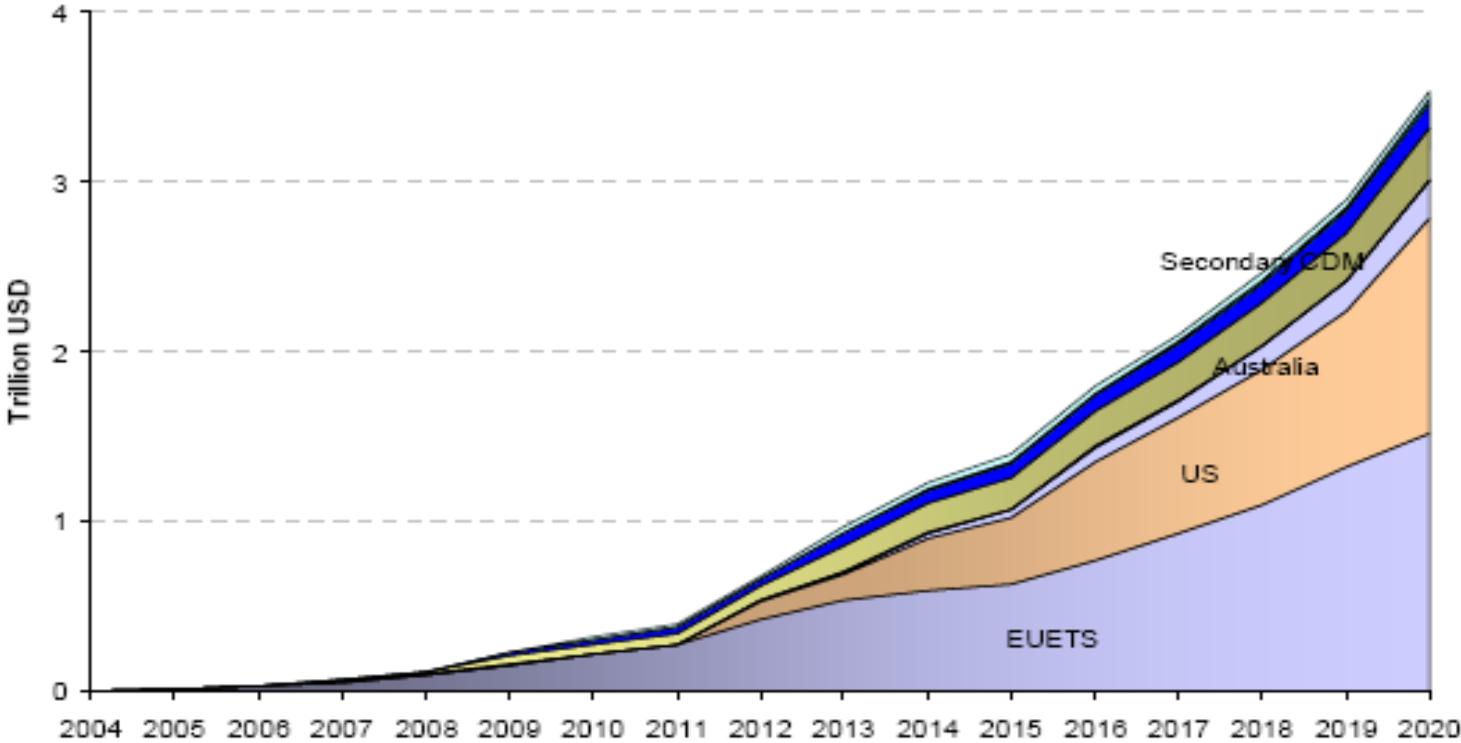
- *Research predicts that the likely integration of carbon capture and storage (CCS) into the global carbon market will see the market expand more than threefold over the next four years to a value of \$395bn a year.*
- *The report also predicted that globally \$14.6 billion will be invested in 73 new CCS projects over the next four years.*
- "One of the major findings of the study is an increasing interconnection between CCS and the Carbon Emissions Trading market, as carbon credits accrued from CCS plants will be traded at carbon exchanges, generating additional revenue for CCS project [developers](#)," said report author Atakan Ozbek.
- But CCS did not make the cut at COP-15....

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

Delayed CCS CDM and Post 2012

- **The end of the Kyoto Protocol's first commitment period**
- Credits start at time of registration; **delays cannot simply be recuperated** by later vintages because of 2012 deadline
- **Longer carbon finance revenue streams needed** but uncertainty regarding post-2012 regime impacts demand

North American CCS Protocols

- Collaborative effort underway with PEW
- Blue Source Canada
- NACCSA
- Industry funds
- Other NGO's
- Current base framework in use in Alberta
- Globally CCS not yet recognized for CDM projects

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CO₂ Pricing Considerations-EOR

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