Rice University Environmental and Energy Systems Institute and
The Shell Center for Sustainability Seminar on
Climate Change:

Michael E. Moore
Managing Partner
Falcon ES/CO2 Norway
September 14, 2004
Temperature and CO₂ Correlate: CO₂ Changes...Man or Nature??
White House now says Man!
New York Times Aug 26th, 2004
White House Shifts Its Focus on Climate

By ANDREW C. REVKIN August 26, 2004 New York Times

“In a striking shift in the way the Bush administration has portrayed the science of climate change, a new report to Congress focuses on federal research indicating that emissions of carbon dioxide and other heat-trapping gases are the only likely explanation for global warming over the last three decades.

In delivering the report to Congress yesterday, an administration official, Dr. James R Mahoney, said it reflected "the best possible scientific information" on climate change. Previously, President Bush and other officials had emphasized uncertainties in understanding the causes and consequences of warming as a reason for rejecting binding restrictions on heat-trapping gases.”
IEA US 2002 GHG Statistics


Energy-Related Carbon Dioxide 5,682.0 (82.8%)

(HFCs, PFCs, and SF₆)

120.6 (1.8%)

Nitrous Oxide 333.1 (4.9%)

Other Carbon Dioxide 113.6 (1.7%)

Methane 612.8 (8.9%)
US Potential Crude Oil Resources

31 billion bbls have been identified in Texas that CO2 flooding could produce, 2 billion in East Texas.
U.S. Basins very Mature, Production Peaked in 1970

Annual Domestic Crude Oil Production

Source: API, DE, Bloomberg, Raymond James Research Report
LOUISIANA STATE LONG TERM CRUDE OIL PRODUCTION FORECAST

Calendar Year

Million barrels

Actual
Forecasted
Texas Oil Production Curve

*Cumulative production to date appr. 35 billion bbls*

The green represents estimated production 2005-2015.
Identified Recoverable Texas Crude Oil—Only with CO2

Source: Texas BEG/GCCC

80 Billion Barrels Residual Oil in Significant TX Reservoirs

31 Billion Barrels CO2 EOR Candidate Target

10% of Target to Economic Model
## Potential Sequestration Volume through CO$_2$-EOR in Texas

*Source: Texas BEG/GCCC*

<table>
<thead>
<tr>
<th>Percent Recovery</th>
<th>CO$_2$-EOR Resource (B bbls)</th>
<th>CO$_2$ Sequestered (tons)</th>
<th>CO$_2$ Sequestered (metric tons, tonnes)</th>
<th>CO$_2$ Sequestered (Gigatonne, Gt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>3.7</td>
<td>522,474,000</td>
<td>473,883,918</td>
<td>0.47</td>
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<tr>
<td>20%</td>
<td>7.4</td>
<td>1,044,948,000</td>
<td>947,767,836</td>
<td>0.95</td>
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<tr>
<td>30%</td>
<td>11.2</td>
<td>1,567,422,000</td>
<td>1,421,651,754</td>
<td>1.42</td>
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<tr>
<td>40%</td>
<td>14.9</td>
<td>2,089,896,000</td>
<td>1,895,535,672</td>
<td>1.90</td>
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<tr>
<td>50%</td>
<td>18.6</td>
<td>2,612,370,000</td>
<td>2,369,419,590</td>
<td>2.37</td>
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<tr>
<td>60%</td>
<td>22.3</td>
<td>3,134,844,000</td>
<td>2,843,303,508</td>
<td>2.84</td>
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<tr>
<td>70%</td>
<td>26.0</td>
<td>3,657,318,000</td>
<td>3,317,187,426</td>
<td>3.32</td>
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<tr>
<td>80%</td>
<td>29.8</td>
<td>4,179,792,000</td>
<td>3,791,071,344</td>
<td>3.79</td>
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<tr>
<td>90%</td>
<td>33.5</td>
<td>4,702,266,000</td>
<td>4,264,955,262</td>
<td>4.26</td>
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<tr>
<td>100%</td>
<td>37.2</td>
<td>5,224,740,000</td>
<td>4,738,839,180</td>
<td>4.74</td>
</tr>
</tbody>
</table>
CO2 EOR is Important to Texas
Hence, so is the CO2 Source

GROWTH OF CO2 EOR PRODUCTION IN TEXAS AS A PERCENTAGE OF STATEWIDE PRODUCTION

YEAR

YEAR

CO2 EOR AVE. YRLY PRODUCTION IN BBLs/DAY

0%  4%  8%  12%  16%  20%

“We Have Only Just Begun”
Growing Demand for CO2

RECENT PERMIAN BASIN CO2 PURCHASES BY QUARTER
w/ PROJECTIONS TO 2007

* Normalized to Expected Deliverability Cap in 2005
The Biggest Driver
10-Year Forward WTI Crude Oil Curve
Source: Barclay’s Bank
Gulf Coast Carbon Center
“Tapping the Potential for Large Volume Storage of Carbon in the Gulf Coast”

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The University of Texas at Austin
http://www.beg.utexas.edu/environqlty/co201.htm
Post Capture Main Cost Points

CO\textsubscript{2} Separation, Processing, and Compression
CO\textsubscript{2} Transportation, Aggregation, and Distribution
CO\textsubscript{2} Injection, Collection, Re-injection
CO\textsubscript{2} Reservoir Surveillance: MMV

Note: Source to Sink distance critical
Commodity CO2/ERC’s is a Global Event

Joint OPEC/WPC Workshop
OPEC Headquarters, Vienna, Austria, June 8-9, 2004

Photo: OPEC PR & Information Department
Conclusion

- Large scale EOR driven CO2 sequestration system works: Large scale reductions in anthropogenic CO2 happen
- Gulf Coast makes geographically sense
- Large scale and scalable, second life cycle in Gulf Coast
- GCCC can link other initiatives in source to sink infrastructure
- Creates leadership role
- Motivated participants
- Huge opportunity for regional emitters and sinks as well as technology, equipment, and service providers
- States benefit from positive economic impacts and extended asset life
- Jobs

- Michael E. Moore  Managing Partner was a founding partner in Amerex Power. Emerging commodity market development for past 20 years
- George Lyons III  Managing Partner recently Senior VP of Trading Tractebel USA. Energy market trading past 20 years
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Europe’s Activity Reviving

The graph above illustrates the historical price development in the EU 2005 emissions trading market. As there in periods have been few trades with publicly announced prices, the graph is based on reported bids and offers.