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# Carbon Capture Utilization and Storage

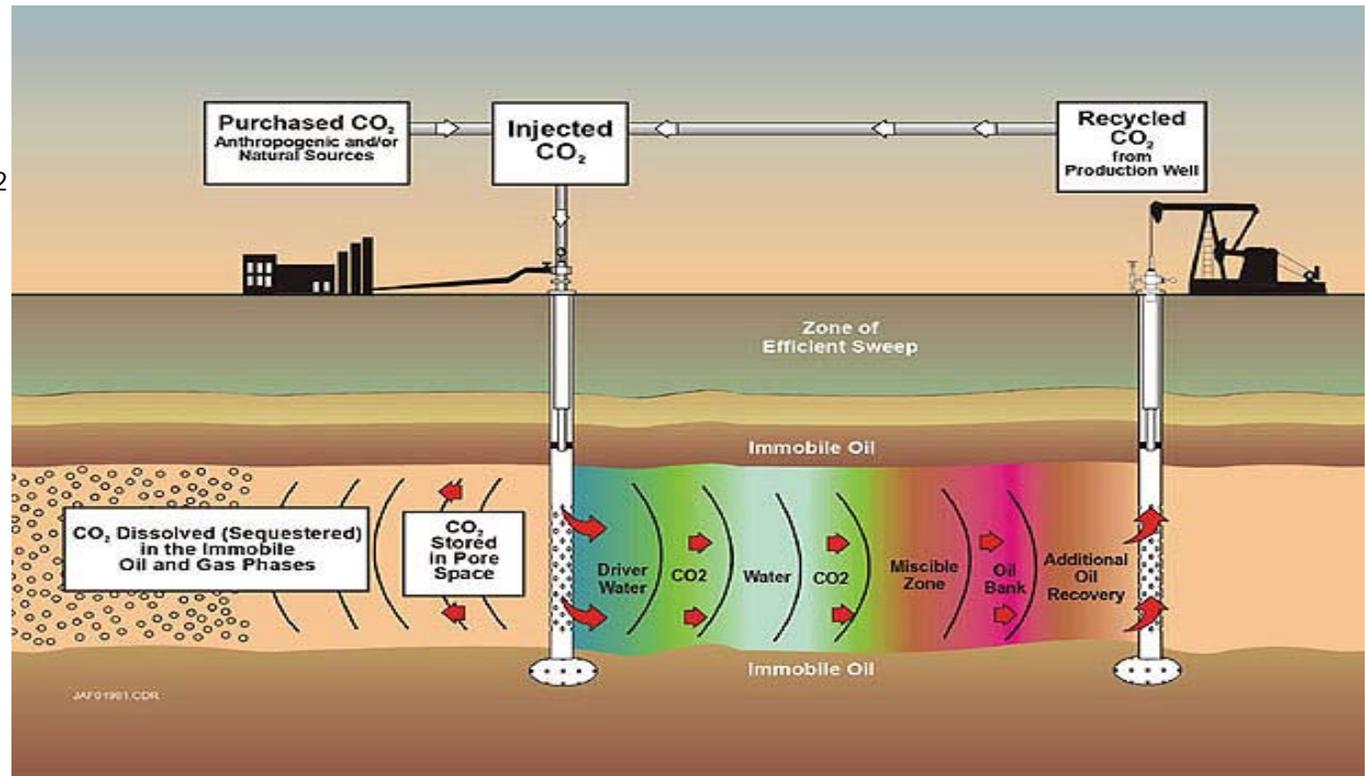
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Phelps Dunbar, LLP

June 1, 2013



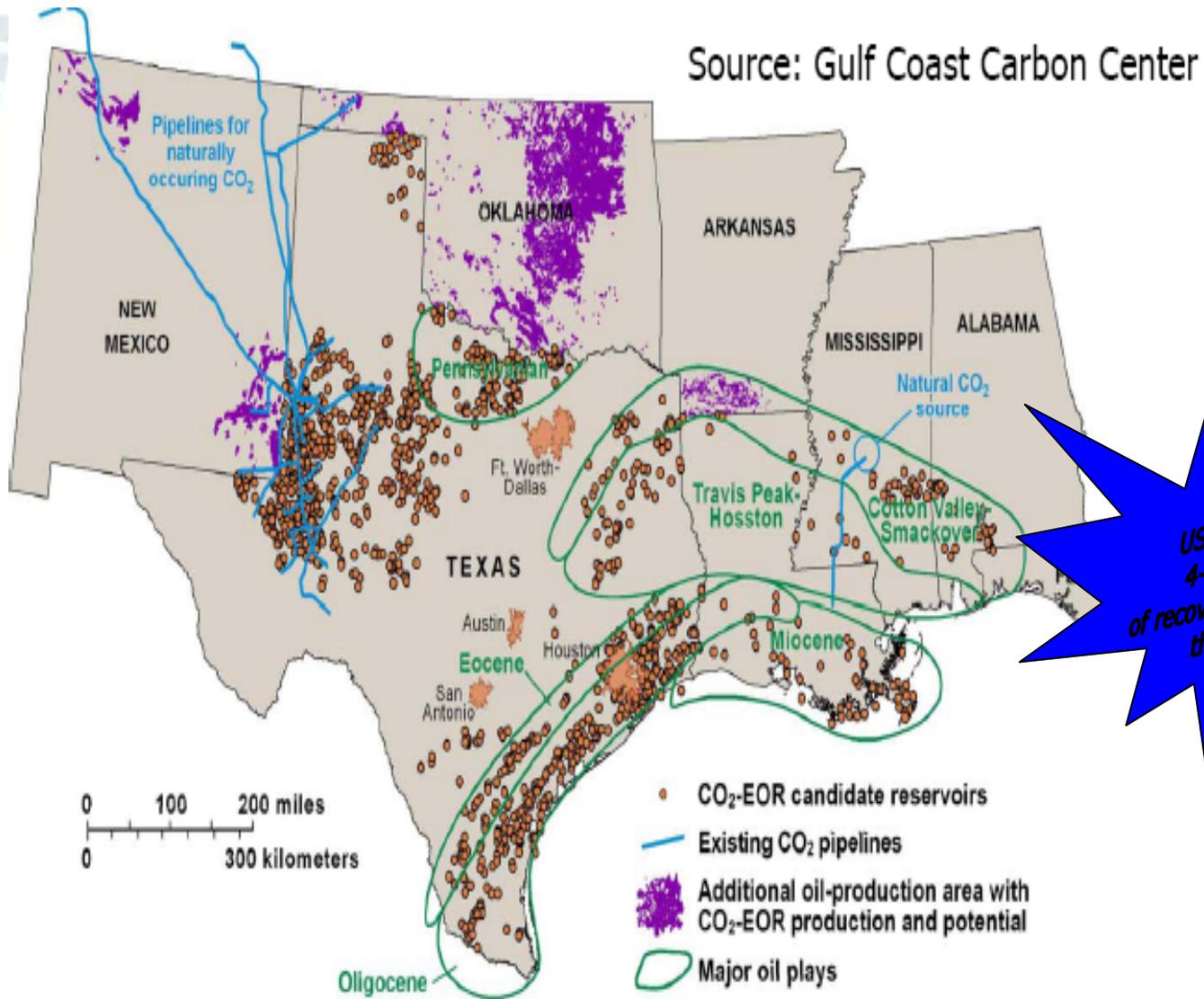
# CO<sub>2</sub>-Enhanced Oil Recovery

- Using captured CO<sub>2</sub> to produce incremental oil is currently the only economically viable path to carbon capture in the US
- EOR is a proven technology – approximately 250,000 barrels of oil per day produced in US from CO<sub>2</sub> EOR



- Lack of CO<sub>2</sub> supply is the major constraint to greater EOR adoption
- U.S. potential is as high as 3 million incremental barrels per day of oil from CO<sub>2</sub> EOR – enough to off-set half of US imports from OPEC countries

# US Gulf Coast CO<sub>2</sub>-EOR Potential



*US Gulf Coast has  
4-7 Billion BBLs  
of recoverable on-shore oil  
through EOR*

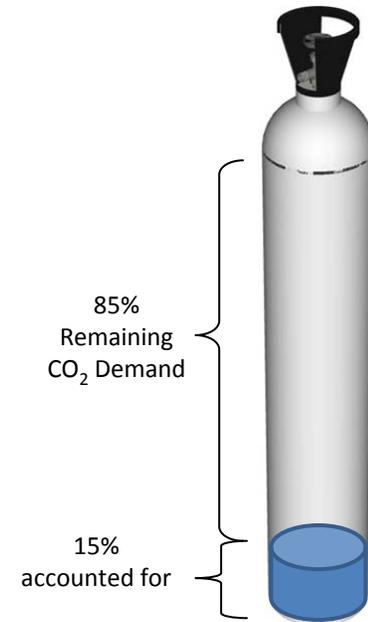
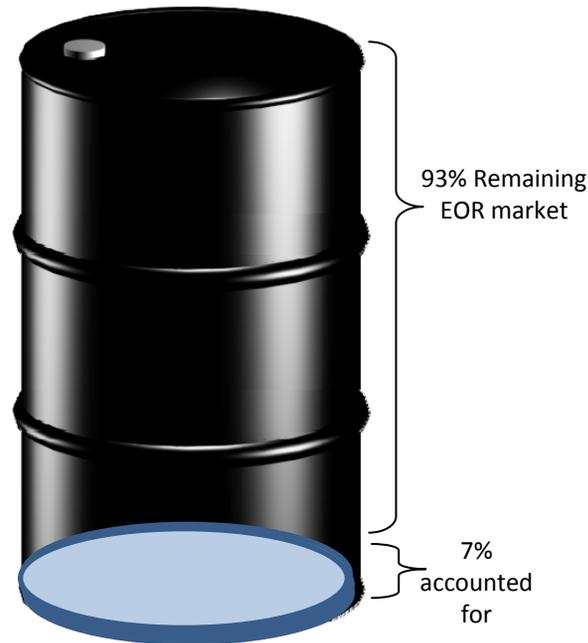
# The Opportunity

- CO<sub>2</sub>-EOR has been proven for more than 30 years in the Permian Basin of West Texas. Many of those fields are still receiving CO<sub>2</sub> today.
- It has been estimated that the remaining recoverable on-shore Gulf of Mexico (GOM) oil fields have over 6 billion bbls in EOR recoverable reserves; requiring 46 TCF of CO<sub>2</sub> to produce.

	Economically Recoverable Barrels* (billion)	CO <sub>2</sub> needed (TCF)
Louisiana	0.9	5.8
Texas Gulf Coast & East Texas	5.9	40.4
Other Market Players	0.5	7.1
<b>Remaining Market</b>	<b>6.3</b>	<b>39.1</b>

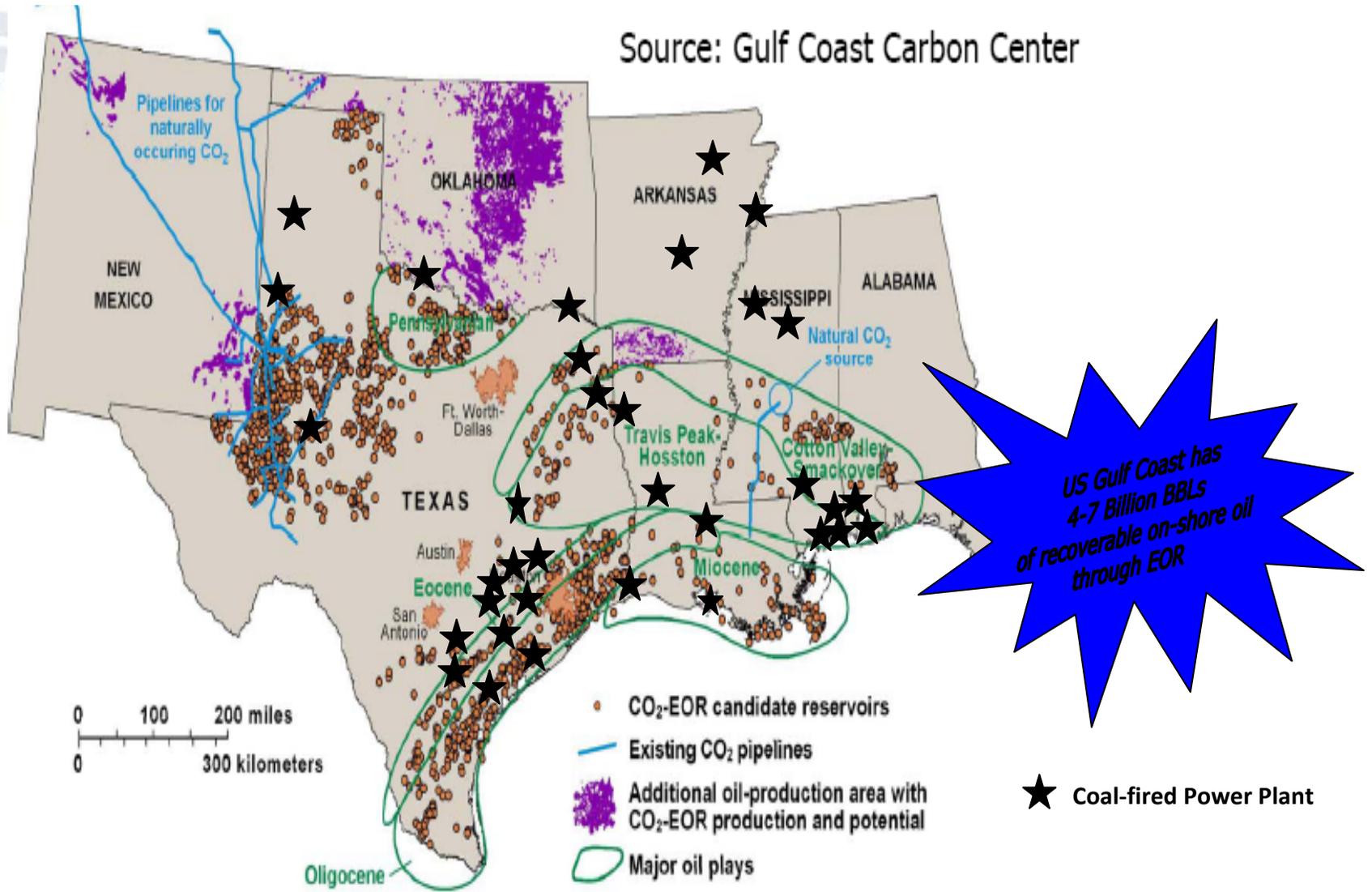
\* Assuming \$85/bbl oil price with a minimum return of 20%. Market numbers from June 20, 2011 DOE Report: *Improving Domestic Energy Security and Lowering CO<sub>2</sub> Emissions with "Next Generation" CO<sub>2</sub>-Enhanced Oil Recovery (CO<sub>2</sub>-EOR)*

Gulf Coast & East Texas EOR potential is 6.8 billion barrels

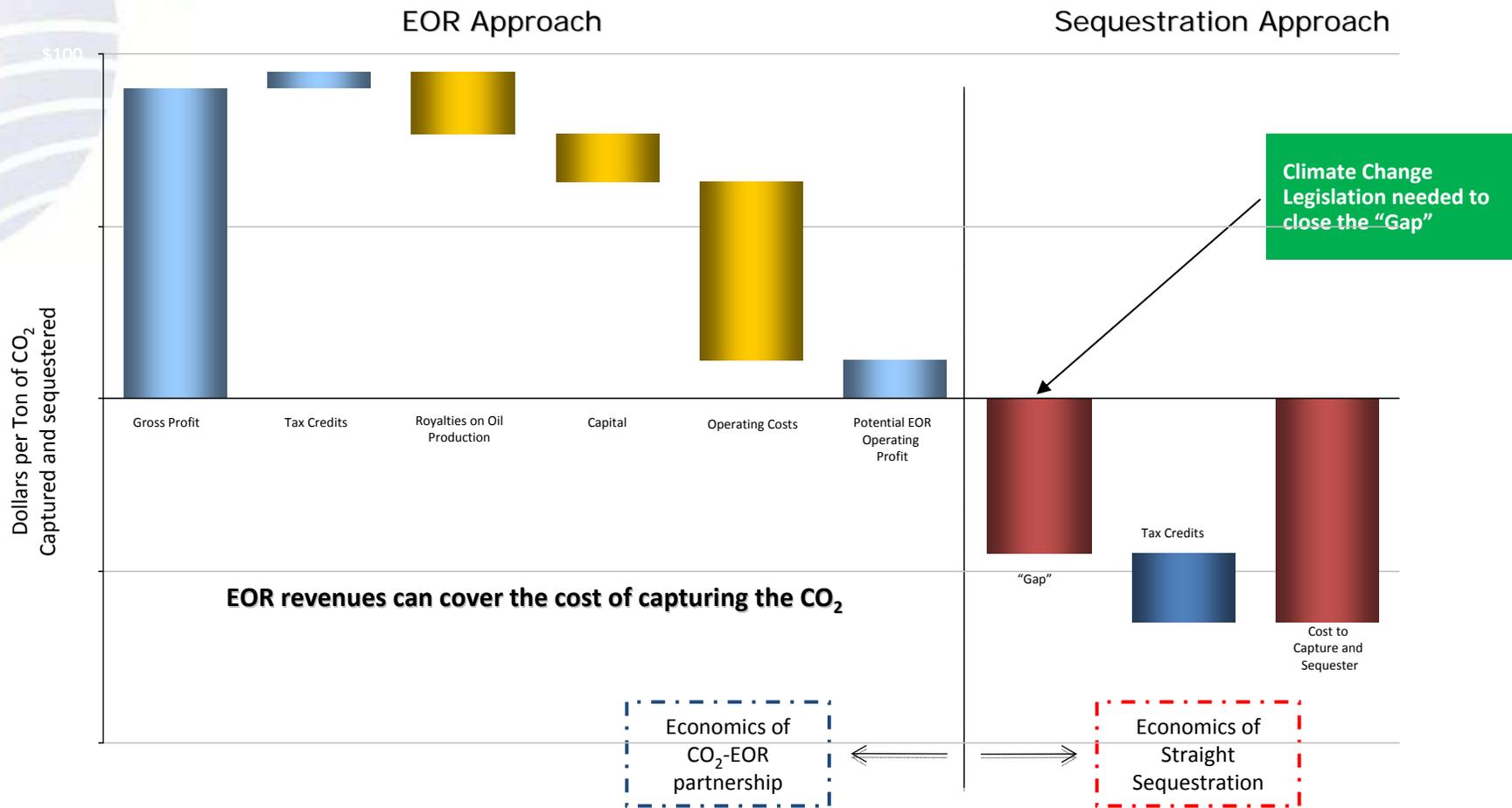


**The Onshore Gulf of Mexico is short 40 TCF CO<sub>2</sub>**

# The Gulf Coast Convergence of Oil and CO<sub>2</sub>



# Why the CO<sub>2</sub>-EOR Partnership Works



**Without a price on carbon emissions, CCS can only work with EOR**



# Typical Project Participants

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- CO<sub>2</sub> Source (Coal Plant or other Industrial)
- CO<sub>2</sub> Capture Technology Provider
- Design, Engineering, Procurement and Construction
- CO<sub>2</sub> Pipeline
- EOR Field Owner/Operator
- MMV- Sequestration Specialist
- DOE- Government Sponsor



# Challenges to Commercial Ventures

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- Taking the CO<sub>2</sub> transfer price out of the discussion
- Typical oilfield commercial structures (form JOA's, fixed price, take-or-pay) don't exactly work
- Each party trusts its own technology but not the other's
- Parties have different risk and payout profiles
- Patchwork financings
- Science Project vs. Commercial project
- Uncertainty of Regulations



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# Energy Practice Group

Cecilia Vidigal

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Major Issues in EPCs



# Maximum Liability

EQUIPMENT SUPPLIER	OWNER
<ul style="list-style-type: none"><li>•<b>SPLIT EPC!</b></li><li>•The maximum liability of the Supplier shall not exceed an amount equal to twenty percent (<b>20%</b>) of the Price.</li></ul>	<ul style="list-style-type: none"><li>•<b>SINGLE POINT LIABILITY!</b></li><li>•The maximum aggregate liability of contractor shall be one hundred percent (<b>100%</b>) of the contract price</li></ul>

# Delay Liquidated Damages

EQUIPMENT SUPPLIER	OWNER
<p>The cap for damages for delay payable by the Supplier shall be five percent (<b>5%</b>) of the Price.</p> <p>DLDs payable for <b>each Wind Turbine</b> until such Wind Turbine has reached Wind Turbine Take Over.</p>	<p>In the case of liquidated damages, the maximum liability shall not exceed forty percent (<b>40%</b>) of the contract Price.</p> <p>The foregoing limitations of liability shall not apply to delay in achieving <b>mechanical completion.</b></p> <p>DLDs for each <b>unit and the Facility!</b></p>

## EQUIPMENT SUPPLIER

Delay damages shall only be payable by the Supplier in the case that **a direct loss** is **actually suffered** by the Buyer **as a consequence** of the delay.

Supplier shall **not be liable for any other costs or damages due to its delay.**

## OWNER

**Daily penalty, not indemnification for damages effectively incurred!!**

If Contractor's, in the **Owner's sole judgment, is behind in schedule** by a period of **one month**, Owner may invoice Contractor for the applicable **Delay Liquidated Damages** with payment due from Contractor **immediately.**

# Performance Liquidated Damages

EQUIPMENT SUPPLIER	OWNER
	<p>Liquidated damages = US\$ per kW less than Output Guarantee</p> <p>Contractor not entitled to pay Performance Liquidated damages in lieu of meeting specific performance obligations</p>

# Insurance Deductible? Other?

EQUIPMENT SUPPLIER	OWNER
<p>If the Buyer has taken out <b>insurance covering loss</b> due to the relevant delay any amounts available under such coverage shall be <b>deducted from the aggregate damage payable</b> by the Supplier to the Buyer <b>for the delay in completion.</b></p>	<p>Liability of contractor provided for by the proceeds of the insurance maintained and the proceeds of the insurance maintained by owner <b>shall not be counted toward any of the foregoing limitations of liability.</b></p>

# Early Completion

EQUIPMENT SUPPLIER	OWNER
<p>The amounts received by the Buyer for any <b>electricity produced</b> by a Wind Turbine before <b>Wind Turbine Take Over</b> shall be <b>deducted in the liquidated damages</b> payable by the Supplier.</p> <p>•Supplier shall receive <b>50% of the gross revenue</b> generated prior to COD</p>	<p>•Daily bonus, not profit sharing!</p>

# Indemnification X Liquidated Damages

EQUIPMENT SUPPLIER	OWNER
<p>Neither Party shall be liable to the other Party for <b>any loss</b> of profit, loss of use, loss of production, loss of contracts, loss of Permits, loss of tax credits or subsidies or for <b>any other indirect or consequential loss</b> that may be suffered by the other Party.</p>	<p><b>CIVIL CODE:</b> Except as otherwise expressly provided in law, the losses and damages owed to the creditor comprise, <b>besides what he/she/it effectively incurred, reasonable loss of profits which derive directly from the non-compliance.</b></p> <p>- no <i>ordre public</i> provisions – may be modified by law or the parties</p>

# Liability Limitation Standards

EQUIPMENT SUPPLIER	OWNER
<p>Supplier does not warrant, any <b>fitness for a particular purpose</b>, either expressly or implied.</p>	<p><b>Not a standard for civil law jurisdictions!</b></p> <p>No liability limit if gross negligence or willful misconduct</p> <p>= predominant Court decisions</p>

# Excusable Events

EQUIPMENT SUPPLIER	OWNER
<p>Excusable events include “force majeure”.</p>	<p><b>CIVIL CODE:</b></p> <p>The debtor is not liable for damages resulting from force majeure, if he/she/it is <u>not responsible for it in writing.</u></p> <p>Force majeure event is the event <b>out of control</b> of the party affected by it and the <b>effects of which were not possible to prevent.</b></p>

EQUIPMENT SUPPLIER	OWNER
<p>Excusable events do not excuse Owners obligations such as &gt;&gt;&gt;&gt;&gt;</p> <p>Force Majeure events shall <b>not</b> include</p> <p>(i)a Party's financial inability to make payments or</p> <p>(ii)the inability of a Party to obtain Governmental Authorizations</p>	<p>Excusable Events shall include, without limitation [besides acts of God / unforeseeable and irresistible events]:</p> <ul style="list-style-type: none"> <li>✓ <b>Changes in Law that substantially prevent a party from complying with its obligations</b></li> <li>✓ <b>unavailability of electric power/other inputs</b> from third parties for the construction start up and commissioning of the Facility</li> <li>✓ impossibility of one of the parties, despite its best efforts, to obtain in a timely and appropriate manner any <b>Governmental Authorization</b></li> </ul>

# Excusable Events

EQUIPMENT SUPPLIER	OWNER
<p><b>CIVIL CODE</b></p> <p><b>Economic hardship</b></p> <p><b>IMPRÉVISION (unpredictability theory) only if :</b></p> <ul style="list-style-type: none"><li>➤ <b>unforeseeable and inevitable event</b></li><li>+ <b>Extreme advantage to one party</b></li><li>+ <b>Excessive burden to the other</b></li> <li>➤ <b>TERMINATION AVOIDED if defendant offers contract review</b></li></ul>	<p><b>An “Excusable Event” shall not include</b></p> <ul style="list-style-type: none"><li><b>(1) economic hardship,</b></li><li><b>(2) changes in market conditions,</b></li><li><b>(3) late delivery of machinery, equipment, materials, spare parts, or consumable goods except when such late delivery is due to an Excusable Event.</b></li></ul>



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# Development of Gas to Liquids (“*GTL*”) Projects

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Porter Hedges LLP

June 1, 2013





# Drivers for GTL Projects

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## 1. Large increase in supply of natural gas

- Horizontal drilling and fracking have created a surge in natural gas supply that has resulted in depressed natural gas prices.
- Half of the world's natural gas deposits are considered remote or stranded and not economically accessible to markets by LNG or pipelines.
- 50 billion cubic meters is flared or vented annually.
- Unconventional gas is being developed geographically in the largest energy consuming regions: North America, China, Eurasia and Australia.

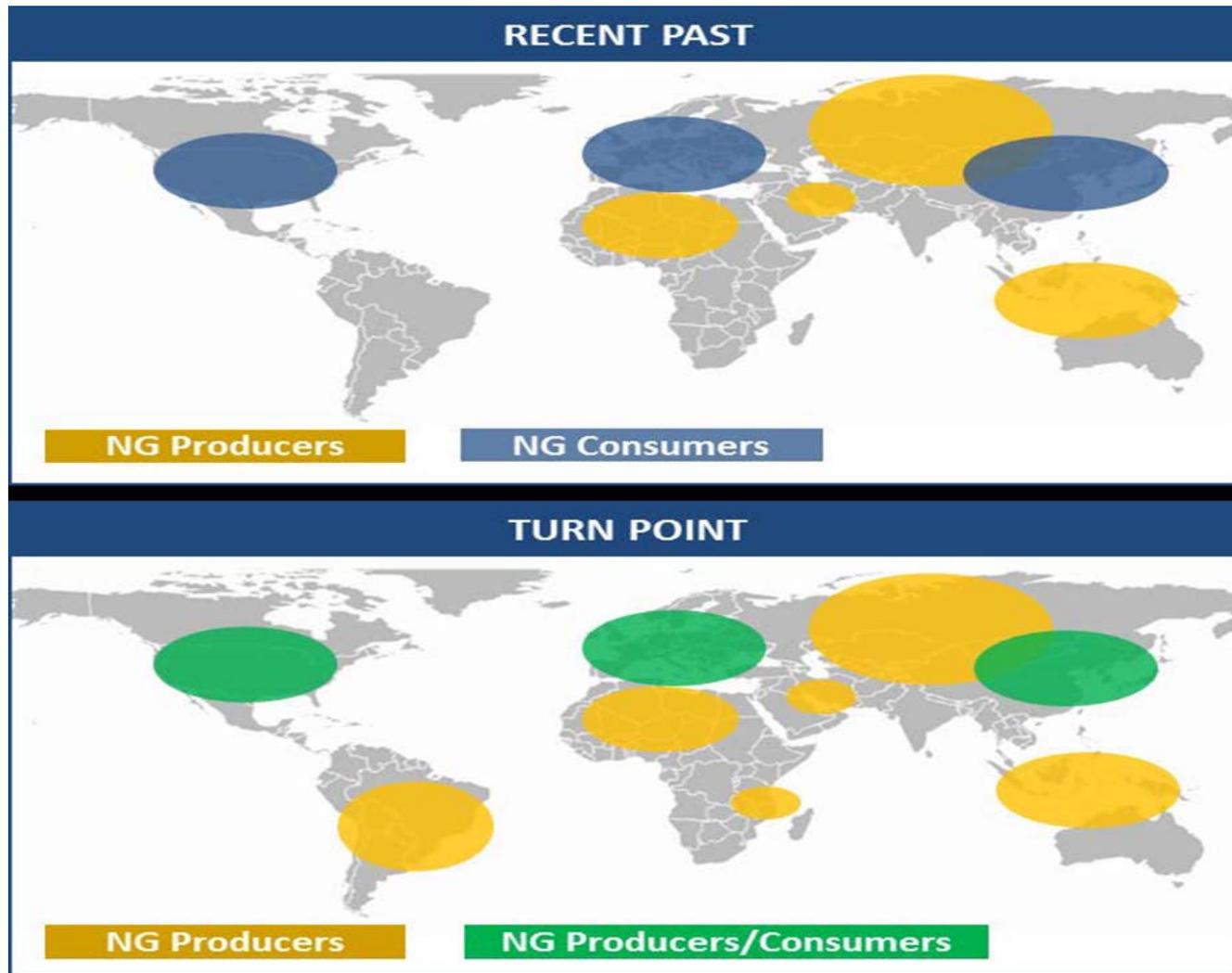
## 2. Demand for Transportation Fuels is Growing

- The global market for transportation fuels is expected to grow by approximately 50% between 2010 and 2035 from 47 million BPD to 66 million BPD. This includes a projected doubling of the world's car fleet to 1.7 billion vehicles in 2035.



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# Drivers for GTL Projects

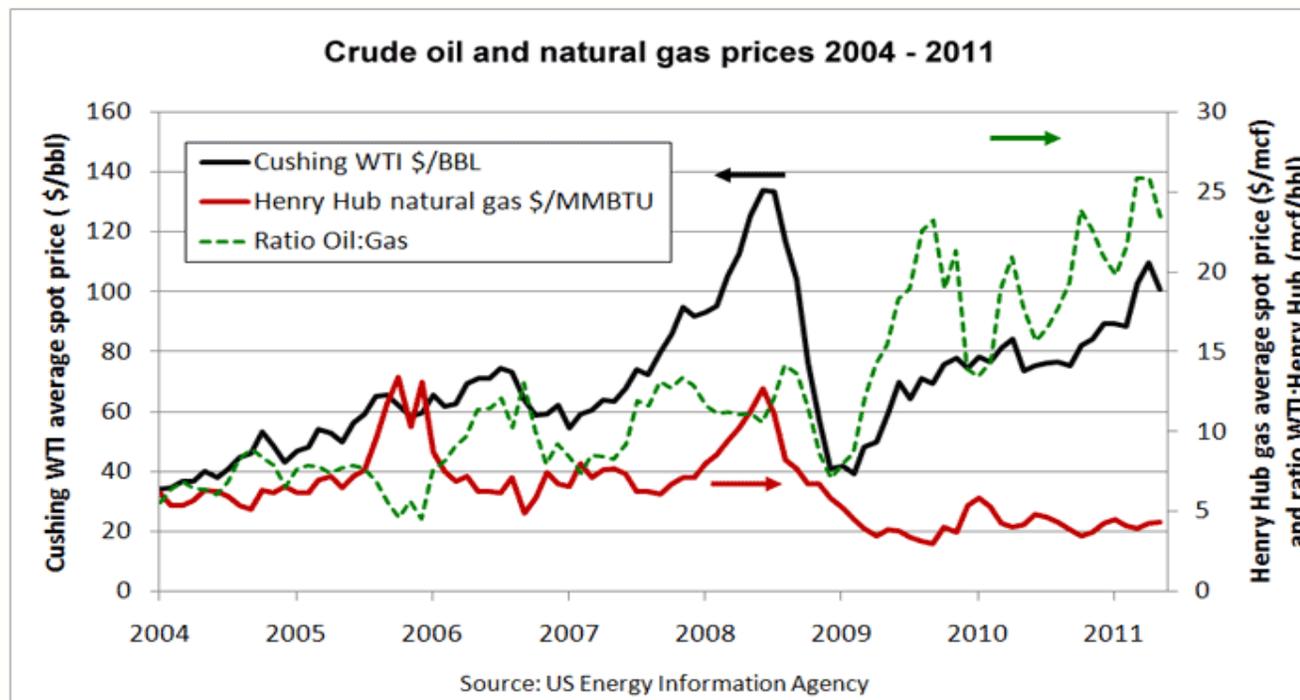


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# Drivers for GTL Projects

## 3. Natural gas price has decoupled from crude oil price.

•GTL projects are a new way to utilize stranded natural gas reserves, shale gas, and coal bed methane by chemically converting natural gas to clean synthetic fuels. GTL projects monetize the structural margin between crude oil and natural gas prices.

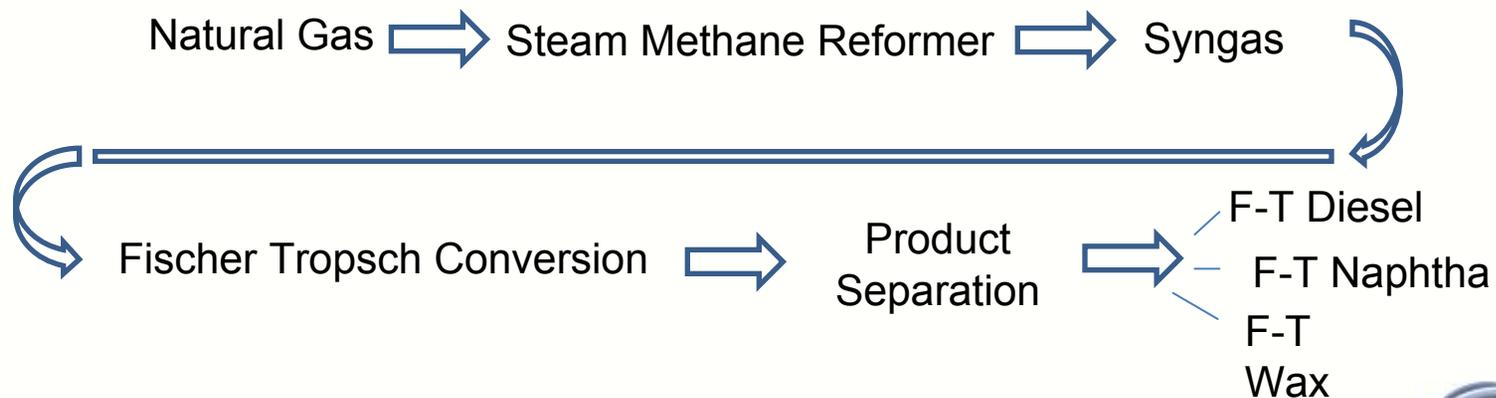


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## The GTL Process:

GTL projects convert natural gas to transportation fuels in a two-step process:

- Step one converts the natural gas into Syngas (a mixture of carbon monoxide and hydrogen).
- Step two reacts syngas with an iron or cobalt catalyst in a Fischer-Tropsch reactor into liquid products which are then refined into products including, diesel, naphtha, and waxes



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## GTL Projects-to-date:

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The rationale for developing GTL Projects in the past was either large cheap reserves of natural gas (Qatar and Nigeria) or geopolitical (South Africa under apartheid).

These GTL projects were big projects developed by big players only.  
(minimum capex of over \$1.0 billion)

- Sasol
- Shell
- Statoil
- Exxon
- Petrobras (offshore)

GTL projects in South Africa, Qatar, Nigeria, Malaysia and Brazil.

- 40,000 BPD to over 100,000 BPD





## New GTL Projects

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New GTL Projects between 1,000 BPD -10,000 BPD are being developed because the current spread between crude oil and natural gas prices makes them economically attractive.

The new GTL players own the IP and technology to both parts of the GTL process. Examples are:

- Rentech
- SGCE
- Syntroleum
- Velocys

These technology providers are looking to partner with companies with gas reserves and to use these reserves as fuel in small to medium size GTL projects.

- GTL projects can be strategically located near existing natural gas production (don't need new pipelines) and fuel markets.
- Much easier to permit, construct and finance these smaller GTL projects.





## Benefits of GTL

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- Uses gas as a feedstock which otherwise would be vented or flared to produce transportation fuels that are cheaper to transport, market, and distribute to large markets than LNG or CNG.
- Projects are scalable allowing design optimization and application to smaller gas deposits thereby allowing maximization of gas utilized.
- GTL projects use well-established technologies.
- Products produced are clean burning and provide for superior engine performance.
- GTL products produce significantly less pollutants than conventional products because of low sulfur content resulting in Sox and Nox emissions reductions.
- GTL products can be sold at a premium or blended to upgrade lower quality products.
- Unlike CNG, GTL products do not require any vehicle retrofit or engine changes. No filling stations need to be built to deliver products.





## Challenges of GTL Project Development

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- Reliance on low natural gas prices relative to fuel prices.
- Risk in a prolonged spike in natural gas or slump in price of oil.
- Breakeven points:

Natural gas price at \$6/MMbtu = \$77 per barrel of crude oil

Natural gas price at \$8.50/MMbtu = \$97 per barrel of crude oil

- Capital intensive projects and only approximately 60% energy efficiency.
- Proven technology, but commercialization, scalability, and reliability issues – i.e. extrapolation from pilot plants into 1,000- 10,000 BPD plants.



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## Legal Issues in GTL Project Development

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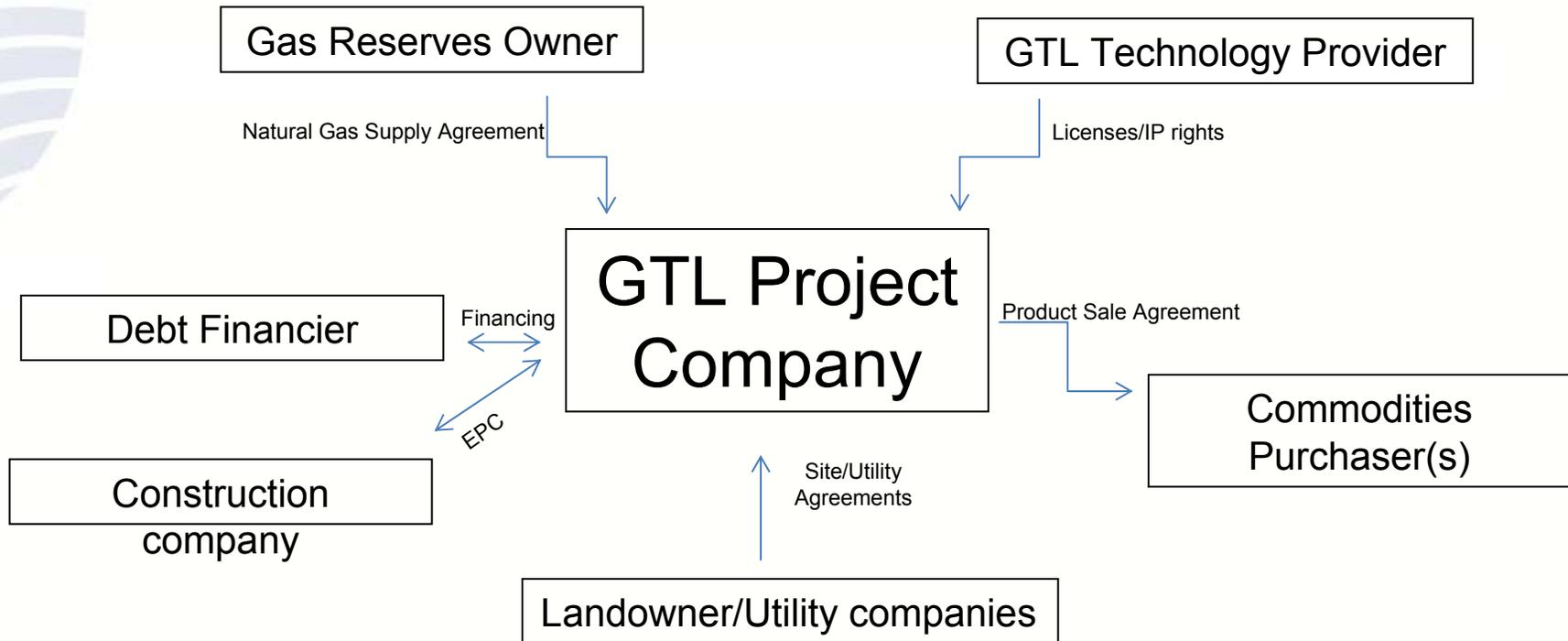
GTL projects are complex requiring legal expertise in many areas:

- JV and/or other structuring between GTL technology provider and owner of natural gas reserves (or other industry participant)
- Fuel supply, products sale and hedging instruments.
- EPC and construction and equipment contracts
- Licensing, IP rights
- Legislative and regulatory issues
- Environmental and permitting



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# Typical GTL Project Structure



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