Energy in the U.S.
Who We Are

For more information:
http://www.beg.utexas.edu/energyecon
Our Geography and Reach

CEE Project Locations (since 1991)

New Era in Oil, Gas & Power Value

Creation Delegate Countries (since 2001)
Regional Economy

- Oil & gas value chain is very important for Texas and Houston
- Texas is major exporter of oil, products and natural gas to rest of the U.S.
- Home to international companies
- Competition in electricity encourages new businesses (renewables, smart grid, etc) but still small share of the economy
Unconventional story

http://www.searchanddiscovery.net/documents/abstracts/2005hedberg_vail/abstracts/extended/holditch01/holditch01.htm
The US Shale Gas Resource

Excludes all moratoria areas
"100 ft of pay, 50% porosity, 90% gas saturation"

U.S. Crude Oil Resources (Undiscovered Technically Recoverable Federal Resources)*

- **Pacific Offshore**: 10.5 Bbl
- **Lower 48, Onshore**: 11.7 Bbl
- **Atlantic Offshore**: 3.8 Bbl
- **Alaska Onshore**: 18.8 Bbl
- **Alaska Offshore**: 26.6 Bbl
- **Gulf Offshore/Deepwater**: 44.9 Bbl

**116.4 billion barrels is enough oil to power over 65 million cars for 60 years.**

Source: MMS, ELM, and API calculations

*Figures may not add exactly to total due to rounding.*
NARUC Moratoria Study
(SAIC/GTI)

MMS Proven and Undiscovered Oil Resources
(GOM Year 2006 Proven Oil Numbers Include 13 Bbo of Oil Production)

MMS Proven and Undiscovered Gas Resources (GOM Year 2006 Proven Gas Numbers Include 152 Tcf of Gas Production)

“Strengthening Our Economy: The Untapped US Oil and Gas Resources;” American Petroleum Institute, December 2008
CEE-UT US/North America LNG Import Capacity Assessment

Based on agency pre-filings, filings, approvals and industry information. As of: March 2010

NOTE: Includes both onshore projects (in US, Federal Energy Regulatory Commission, FERC) and offshore (in US, Coast Guard and Maritime Administration, USCG/MARAD). US Gulf Coast capacity is an estimate of most likely additions based on projects under construction and approved projects and expansions (onshore and offshore).
Wellhead Price Eras ($2005)

- Wellhead
- Structural Cost Adjustment: Shale Gas
- Structural Cost Adjustment: Post NGPA, Section 29

“Long” Gas

“Short” Gas

Jan-76 to Jan-08
• Market fundamentals differ 1976-99 vs 2000-09
• Avg real prices are $2.50 and $5.30
• Range is $2.39 to $10.19
• No apparent mean reversion yet for later period
## Price Volatility ($2005)

<table>
<thead>
<tr>
<th></th>
<th>Wellhead</th>
<th>City Gate</th>
<th>Res</th>
<th>Com</th>
<th>Ind</th>
<th>El Pwr</th>
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<tbody>
<tr>
<td>Before 99:12</td>
<td>7.2% a</td>
<td>6.0% b</td>
<td>6.3% c</td>
<td>2.5% b</td>
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<td></td>
</tr>
<tr>
<td>00:01-09:11</td>
<td>12.2%</td>
<td>10.5%</td>
<td>7.7%</td>
<td>5.3%</td>
<td>11.4% d</td>
<td>10.6% e</td>
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<tr>
<td>Change</td>
<td>71%</td>
<td>74%</td>
<td>22%</td>
<td>110%</td>
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</tbody>
</table>

* a 76:01-99:12; b 83:10-99:12; c 81:01-99:12; d 01:01-09:12; e 02:01-09:12

* Std dev of change in price
Modern Energy Markets

Policy/Regulatory Frameworks
• Market structure (entry, exit)
• Transparency
• Public interest

Physical Fundamentals
Supply-demand for Commodities

Financial Markets
Supply-demand for commodity derivatives

What are the interactions?

Behavioral Responses
• To real signals from physical, financial markets
• To perceptions of signals from physical, financial markets
Price Observations

• Volatility is a sensitive issue for large users and regulated utilities; lack of data prevents analysis on changes over time
• Residential (and some commercial) customers are sheltered by regulators
• Wellhead conditions drive overall price structure and may contribute to volatility
• Electric power demand swings on marginal gas generators + renewables may contribute to volatility
Does Renewable Energy Create Volatility?

**ERCOT balancing market prices, March 7, 2009, US$/MWh.**

- **North zone price**
- **South zone price**
- **West zone price**
- **Houston zone price**

Occurred for >1,000 hrs in 2008
Technology – Our Industry’s Investments (2000-2007)

$188 Billion

BY INVESTOR

$121.4 Billion (65%)
Oil and Gas Companies

$58.3 Billion (31%)
Other Private

$8.3 Billion (4%)
Federal Government

BY TECHNOLOGY

$109.8 Billion (60%)
Frontier Hydrocarbons

$46.5 Billion (25%)
End Use

$32.7 Billion (15%)
Non Hydrocarbons

Source: I² and Associates and CEE

Source: API
U.S. Environmental Expenditures since 1990 (by sector$)
Carbon Mitigation Investment by Investor Group (2000-2008)

$133 Billion

$58.4 Billion (44%)
Oil and Natural Gas Industry

$55.3 Billion (42%)
Other Private Industries

$19.2 Billion (14%)
Federal Government

Carbon Mitigation Investments by Technology and Investor Group (2000-2008)

$72.8 Billion

- Federal Government: $8.1 billion (11%)
- Other Private Industries: $34.1 billion (47%)
- Oil and Natural Gas Industry: $30.6 billion (42%)

$30.0 Billion

- Non-Hydrocarbon: $6.1 billion (20%)
- $17.1 billion (58%)
- $6.7 billion (22%)

$28.9 Billion

- Fuel Substitution: $3.9 billion (13%)
- $4.1 billion (14%)
- $21.1 billion (73%)

$1.1 Billion

- Basic and Applied Research

### Gross Domestic Product (GDP), Real Disposable Personal Income

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP (Billions of Fixed 2000 Dollars)</th>
<th>Real Disposable Personal Income (Billions of Fixed 2000 Dollars)</th>
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<tbody>
<tr>
<td>2012</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>2013</td>
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<td>10</td>
</tr>
<tr>
<td>2020</td>
<td>20</td>
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</table>

### Total Employment

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment (Thousands of Jobs)</th>
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<tbody>
<tr>
<td>2012</td>
<td>100</td>
</tr>
<tr>
<td>2013</td>
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<td>2019</td>
<td>30</td>
</tr>
<tr>
<td>2020</td>
<td>20</td>
</tr>
</tbody>
</table>

### Reference Case vs. High Case

- **Reference Case**
  - GDP: Decreasing trend from 2012 to 2020
  - Employment: Decreasing trend from 2012 to 2020

- **High Case**
  - GDP: Steeper decreasing trend from 2012 to 2020
  - Employment: Steeper decreasing trend from 2012 to 2020

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**Texas Comptroller/CEE-UT**

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Energy per Capita (Btu, Left) and Industrial Energy Consumption Share (Right)

Peak (1979) to present US mfr employment decline: 39%