Fueling up
The Economic Implications of the American Oil & Gas Boom

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The Dark before the Dawn
Oil and natural gas prices
Real 2012 USD

Source: EIA, BLS, HSUS
President Bush calls for an end to oil
2006 State of the Union Address

Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world. By applying the talent and technology of America, this country can dramatically improve our environment, move beyond a petroleum-based economy, and make our dependence on Middle Eastern oil a thing of the past.

—President George W. Bush
An Oil & Gas Renaissance
High gas prices catalyze upstream investment

Natural gas prices and rig count

Source: EIA
EIA natural gas production forecasts
Billion cubic feet per day

Source: EIA
Recent natural gas production forecasts
Billion cubic feet per day

- Citigroup (2012)
- WoodMac (2011)
- IHS (2012)
- ExxonMobil (2012)
- BP (2013)
- IEA (2013)
- EIA (2013)
- Historical
Oil and gas prices part ways

Real 2012 USD per MMBTU

Source: EIA, BLS
Turning the focus to oil
Number of active rigs

Source: Baker Hughes
A turnaround in US oil supply
Million bbl/d of production

Source: EIA
EIA oil production forecasts

Million bbl/d

Source: EIA
Recent oil production forecasts

Million bbl/d

- Citigroup (2012)
- WoodMac (2011)
- IHS (2012)
- ExxonMobil (2012)
- BP (2013)
- IEA (2013)
- EIA (2014)
- Historical
Changing outlook for US dependence on imported energy
Share of total consumption

Source: EIA
Modeling Framework
The National Energy Modeling System (NEMS)

Basic structure

- Oil and Gas Supply Module
- Macroeconomic Activity Module
- International Energy Module
- Residential Demand Module
- Natural Gas Transmission and Distribution Module
- Commercial Demand Module
- Coal Market Module
- Transportation Demand Module
- Renewable Fuels Module
- Industrial Demand Module
- Supply
- Conversion
- Demand
Oil and gas supply module regions
Macroeconomic Activity Module
Interaction with NEMS

Macroeconomic Activity Module

Integrating Module

Macroeconomic variables

Energy demand and prices

Investment
Economic Impact
Change in global oil production, H1 2013 vs. H1 2008

Thousand barrels per day

Source: EIA
Change in consumer expenditures
Billion USD, 2013-2035 average

- **Pre-Shale**
  - Lower oil prices: $1,580
  - Higher oil demand: $97
  - Lower natural gas prices: $22
  - Higher natural gas demand: $70

- Optimistic
  - Lower coal expenditures: $17
  - Lower renewable expenditures: $0.5
  - Lower power expenditures: $8
  - Lower power prices: $50
  - Higher power demand: $10

Overall change:
- **Pre-Shale**: $1,580
- **Optimistic**: $1,403

**HIGHER OIL DEMAND**

**LOWER OIL PRICES**

**HIGHER NATURAL GAS DEMAND**

**LOWER NATURAL GAS PRICES**

**LOWER COAL EXPENDITURES**

**LOWER RENEWABLE EXPENDITURES**

**LOWER POWER PRICES**

**HIGHER POWER DEMAND**
Change in producer revenue
Billion USD, 2013-2035 average

- Higher oil production: $255 billion USD
- Lower oil prices: $101 billion USD
- Higher natural gas production: $64 billion USD
- Lower natural gas prices: $118 billion USD
- Lower coal production and prices: $14 billion USD
- Lower renewable revenue: $8 billion USD
- Lower nuclear revenue: $15 billion USD

Pre-Shale: $738 billion USD
Optimistic: $802 billion USD
Fixed asset investment by industry
Billion 2005 chained dollars

- Manufacturing: $188
- Finance and insurance: $158
- Upstream oil and gas: $123
- Information: $119
- Healthcare and social assistance: $96
- Retail trade: $94
- Professional, scientific and technical services: $78
- Wholesale trade: $77
- Utilities: $76
- Transportation and warehousing: $71
- Agriculture: $43
- Accommodation and food services: $35
- Administrative and waste management services: $33
- Management of companies and enterprises: $30
- Other private services: $29
- Educational services: $26
- Arts, entertainment and recreation: $17

Source: BEA
Textbook stimulus
Impact of the oil and gas boom vs. the American Recovery and Reinvestment Act

<table>
<thead>
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<tbody>
<tr>
<td>GDP - Low</td>
<td>0.34%</td>
<td>0.62%</td>
</tr>
<tr>
<td>GDP - High</td>
<td>2.13%</td>
<td>1.88%</td>
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<tr>
<td>EMPLOYMENT - Low</td>
<td>0.32%</td>
<td>0.51%</td>
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<tr>
<td>EMPLOYMENT - High</td>
<td>1.68%</td>
<td>1.77%</td>
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Source: Houser and Mohan
Energy trade deficit
As a percent of GDP

Source: Houser and Mohan
Dutch disease or Dutch sniffle? Recent precedents

Source: IMF, UN Comtrade
Natural gas prices for industrial consumers
USD per MMBTU

Source: EIA, IEA
A boon to US chemicals production

Feedstock cost, USD per MMBTU

- Naphtha (Gulf Coast)
- Crude Oil (WTI)
- Ethane (Mont Belvieu)
- Natural Gas (Henry Hub)

Source: EIA, Bloomberg
Energy-intensive industry in perspective

Potential reduction in energy costs as a share of shipment value

Source: Houser and Mohan

Share of manufacturing employment, 2010

Reduction in energy costs as a share of shipment value

<table>
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<th>Percentage Range</th>
<th>Share of Employment</th>
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<tbody>
<tr>
<td>0% - 0.5%</td>
<td>70.9%</td>
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<tr>
<td>0.5% - 1%</td>
<td>21.1%</td>
</tr>
<tr>
<td>1% - 2%</td>
<td>3.2%</td>
</tr>
<tr>
<td>2% - 5%</td>
<td>3.4%</td>
</tr>
<tr>
<td>5% - 10%</td>
<td>0.1%</td>
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<tr>
<td>&gt; 10%</td>
<td>1.3%</td>
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</table>
Balancing energy savings against exchange rate effects
Potential cost reductions vs. net export exposure

Source: Houser and Mohan
Environmental Effects
US CO2 emissions have dropped sharply

Actual vs. projected energy-related CO2 emission, million tons

Source: EIA
CO2 emissions, US vs. EU

Billion tons
What explains the drop?

Actual vs. projected energy-related CO2 emissions in 2012

Projected Emissions: 6,536
Actual Emissions: 5,271

-817: Economic Growth
-85: Energy-Intensity of the Economy
-362: Carbon-Intensity of Energy

Source: EIA, BEA, authors' estimates
Power generation – pre-shale vs. optimistic
Billion kwh

![Graph showing power generation trends from 2011 to 2035 for pre-shale and optimistic scenarios. The graph compares the share of various energy sources including Coal, Nat Gas, Petroleum, Nuclear, Hydro, and Other Renewables.](image)
US CO2 emissions
Billion tons

- Pre-Shale
- Conservative
- Optimistic
- Historical
Change in US CO2 emissions by source
Million tons, 2013-2035 annual average
Power generation – pre-shale vs. optimistic w/ carbon price
Billion kwh
Trade Policy Implications
US refined petroleum product trade balance

Thousand barrels per day

Source: EIA
Refinery acquisition cost of crude

$ per barrel

Source: EIA
Wholesale gasoline prices

$ per gallon

Source: EIA
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