RAND Environment, Energy, and Economic Development Program

An Energy Independent United States? Implications for Pennsylvania

Dr. Keith Crane, Director

RAND Environment, Energy, and Economic Development

November 28, 2012

Except for Oil, the United States is Already Energy Independent

- **Oil**
  - **U.S. imports 46% of consumption**
  - **But down from 60% a decade ago**
- **Natural gas**
  - **U.S. imports some natural gas from Canada, Mexico**
  - **But now exports to Canada**
- **Coal**
  - **U.S. has always been self-sufficient**
  - **Major coal exporter for decades**

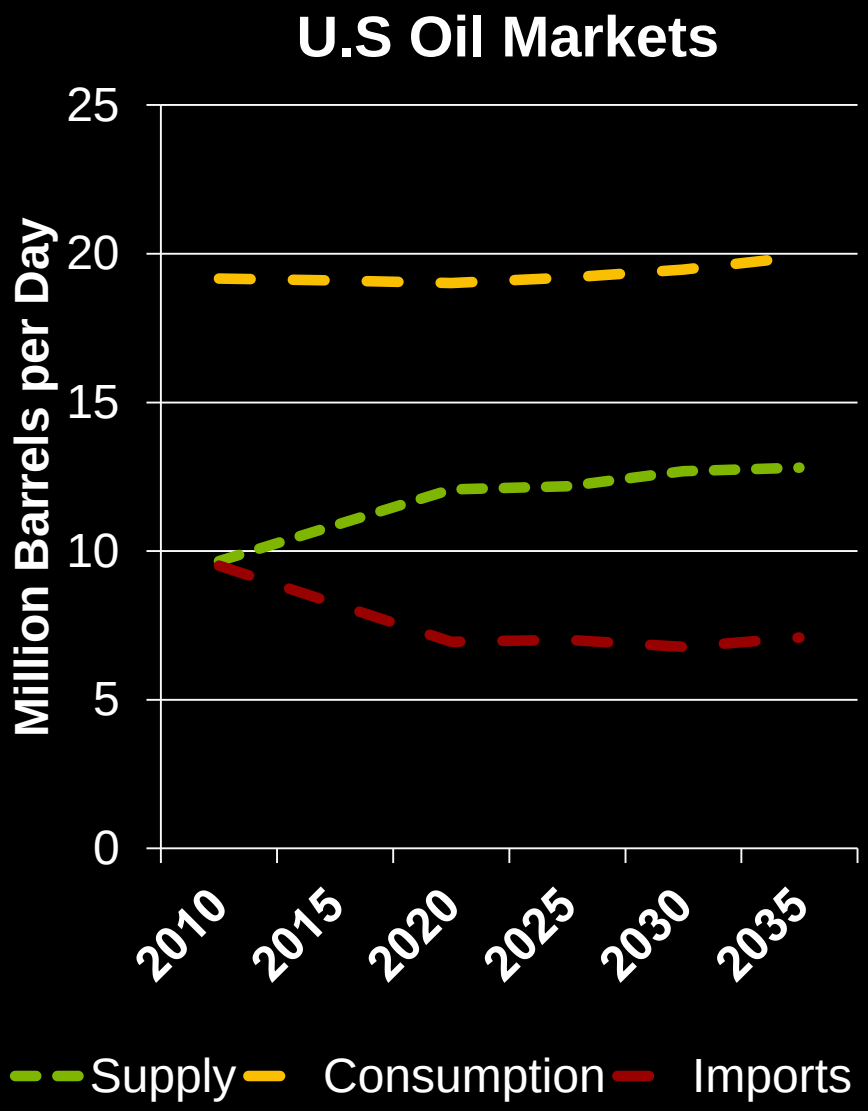
What Difference Does Energy Independence Make?

- **Healthy energy industry contributes to employment, economic growth**
- **Natural gas prices will become more closely linked to global markets**
- **Even if we become independent, global demand, not U.S. supply, will dictate price of gasoline and diesel**

Becoming an oil exporter will make no difference in prices at the pump

What Will the Future Bring? Oil

- U.S. production projected to rise
  - Fracking operations in "tight" oil deposits in North Dakota, Texas
  - More output from offshore fields
  - Liquids from "wet gas"
- More efficient cars, trucks restrain consumption
- Imports fall over next decade

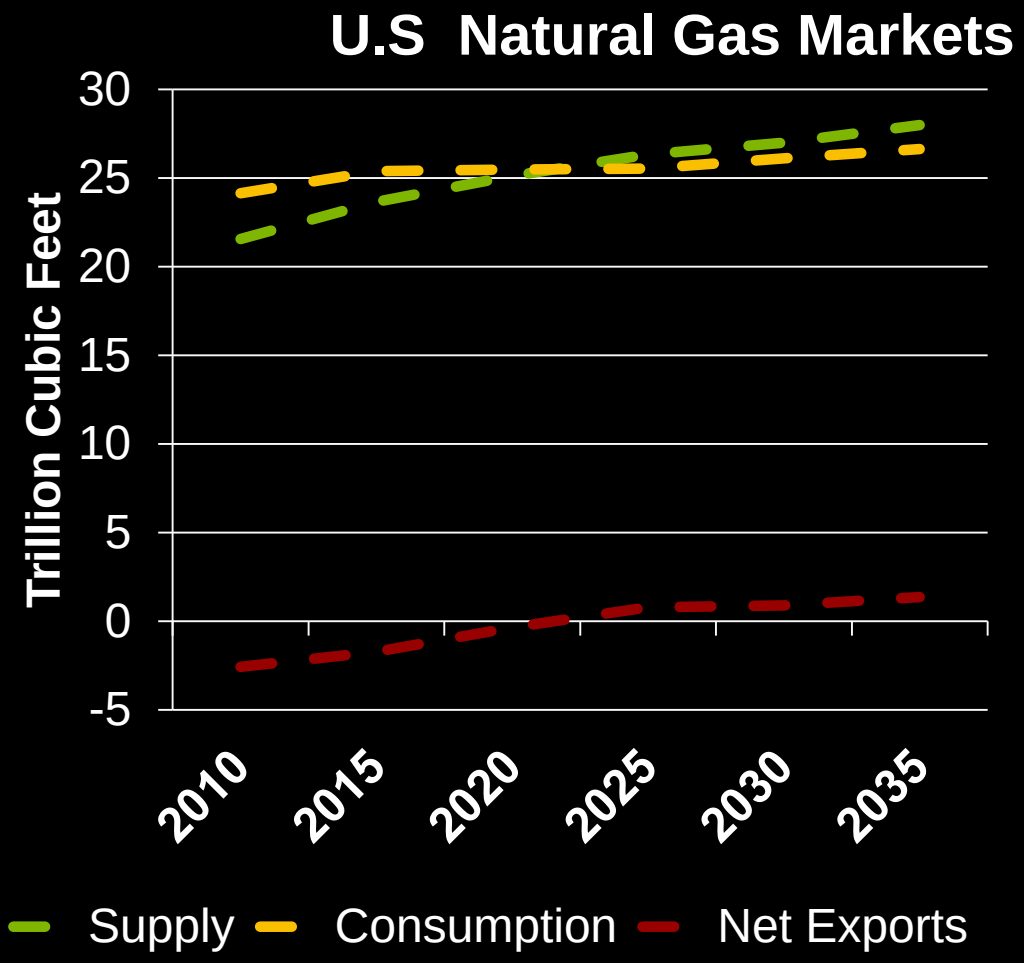


Energy Information Agency, *Annual Energy Outlook*, 2012.

Oil Market Implications for Pennsylvania

- **Mid-Atlantic refining industry will remain under pressure**
  - **Relies on expensive imported oil; limited access to cheaper "tight" oil finds**
  - **Declining East Coast demand**
  - **Continued improvements in productivity in industry likely to result in closures of less efficient refineries**
- **Breakthroughs in drilling, fracking make more exotic technologies less likely to become competitive**
  - **Coal-to-liquids**
  - **Oil shale**

Fracking Operations Driving Increased Output of Natural Gas



Energy Information Agency, *Annual Energy Outlook*, 2012.

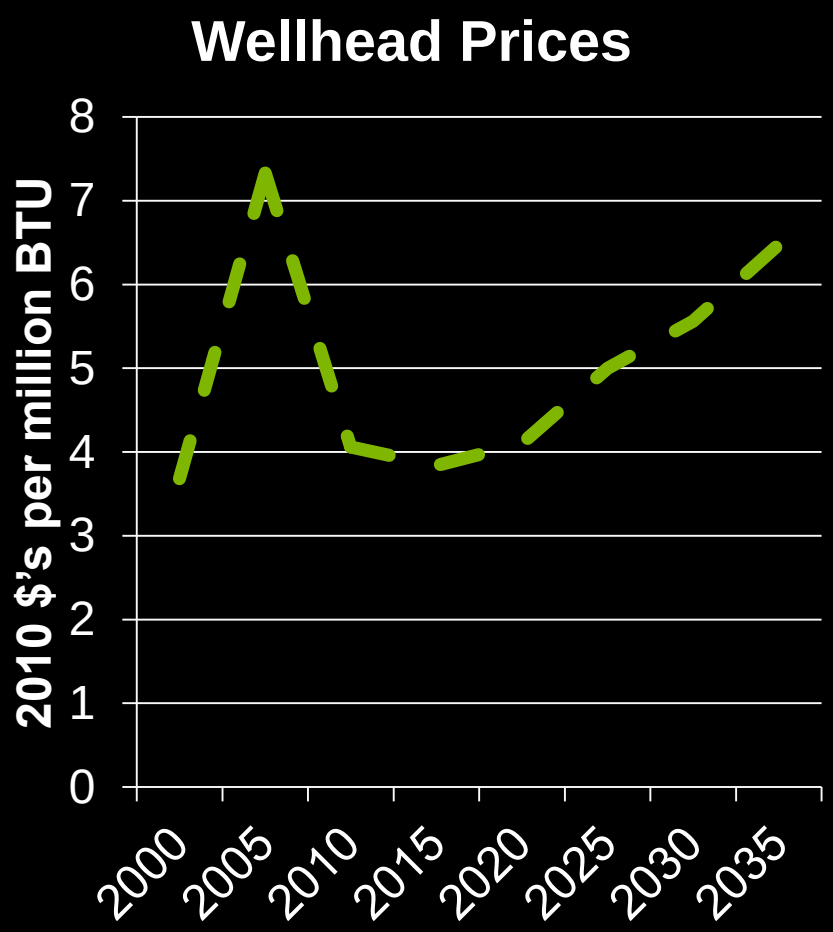
Shale Gas to Account for Half of Output; Major Role for Pennsylvania's Marcellus Shale

SOURCE: Adapted from U.S. Geological Survey.

Conflicting Futures for Natural Gas

- **More certain**
  - **Natural gas will continue to supplant coal to generate electricity**
  - **U.S. will build a few liquefied natural gas terminals; but exports likely to run small share of output**
- **Less certain**
  - **Use of compressed natural gas for motor vehicles may be confined to buses, delivery vehicles**
  - **Gas-to-liquids plants may not become widespread**

Will Natural Gas Prices Stay Low?

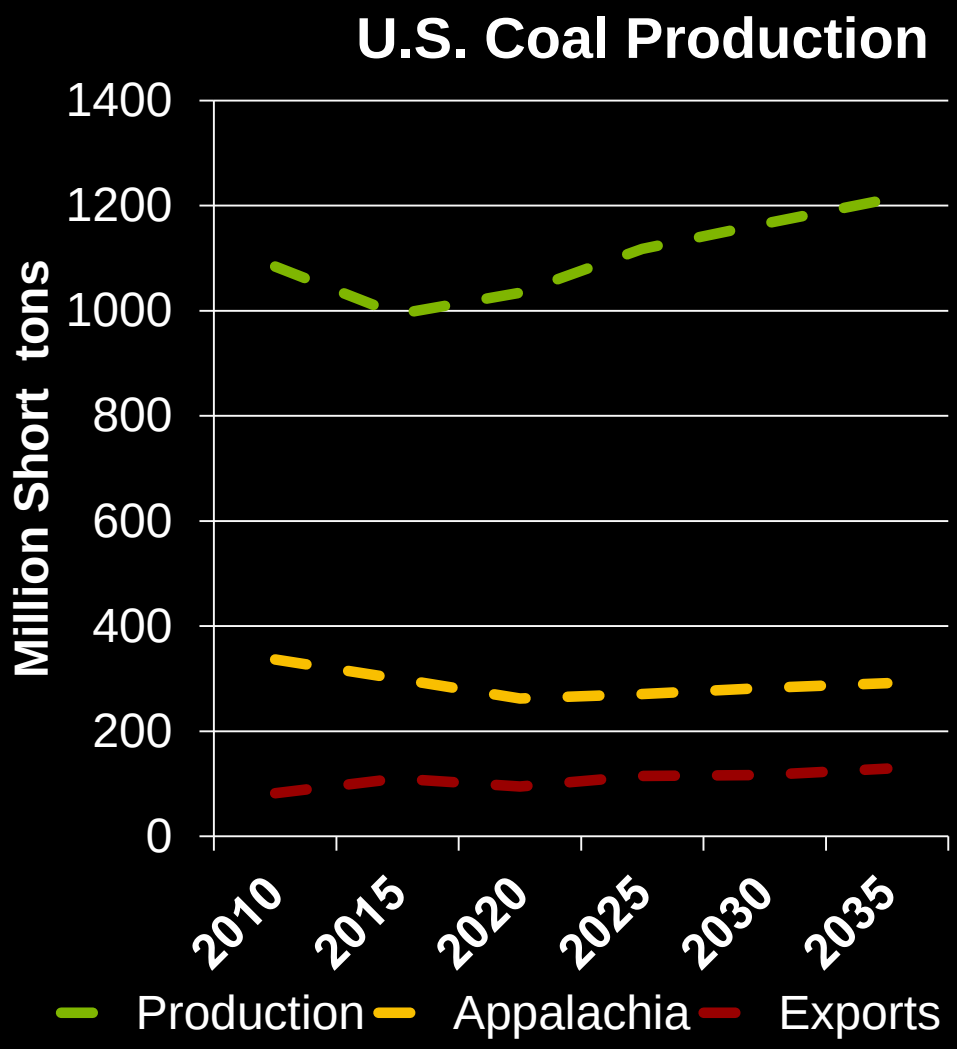


Energy Information Agency, *Annual Energy Outlook*, 2012.

- **Current prices may be too low to sustain fracking operations; rig counts down**
- **Increased demand from new uses would push up prices**
- **DOE thinks natural gas prices destined to rise**

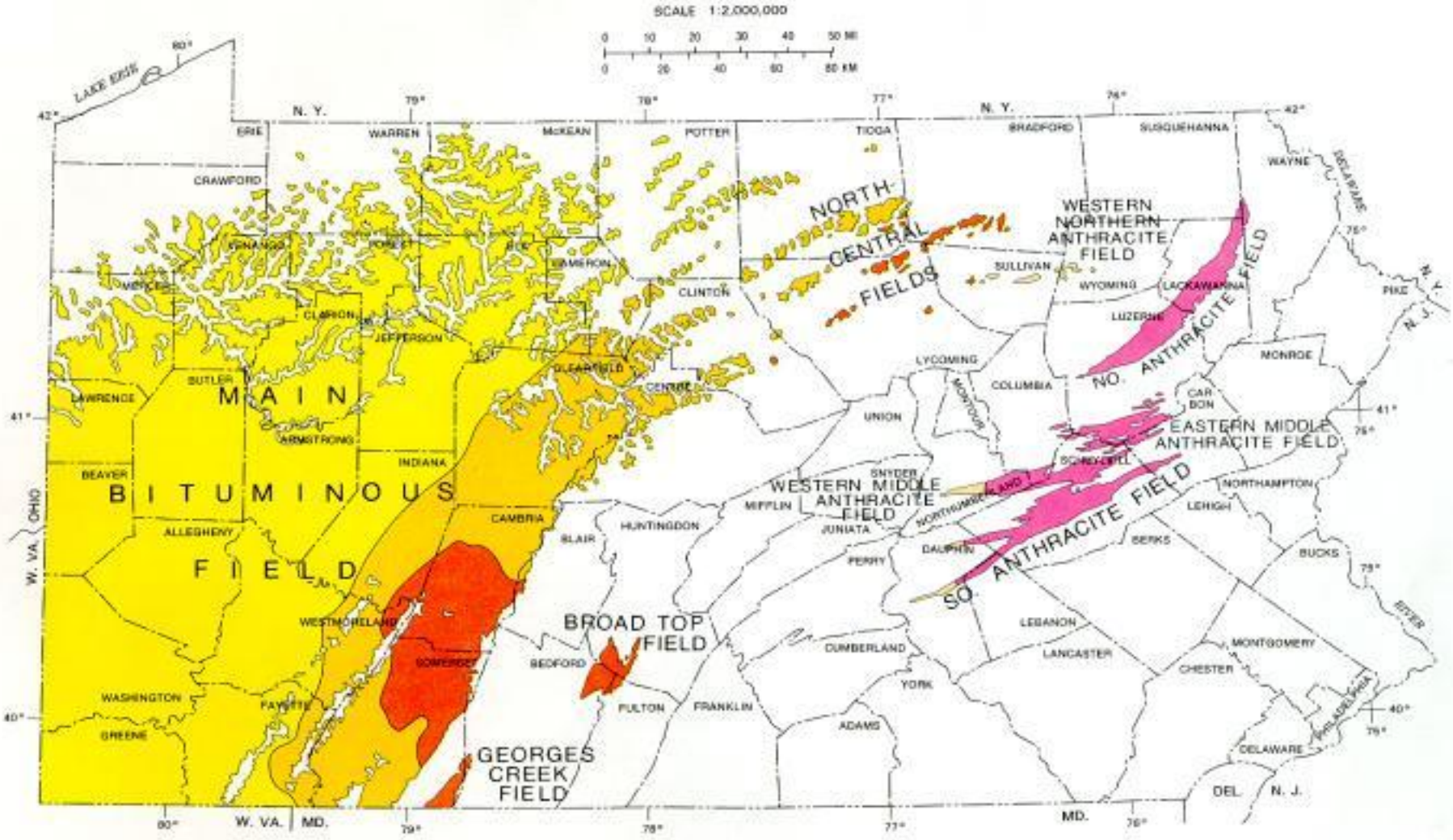
What Will the Future Bring? Coal

- U.S. production projected to rise
- But primarily from Powder River Basin
- Production in Pennsylvania, West Virginia projected to fall
- Exports to rise by one-third



Energy Information Agency, *Annual Energy Outlook*, 2012.

DISTRIBUTION OF PENNSYLVANIA COALS



EXPLANATION

BITUMINOUS FIELDS

- High-volatile bituminous coal
- Medium-volatile bituminous coal
- Low-volatile bituminous coal

ANTHRACITE FIELDS

- Anthracite
- Semi-anthracite

Why Is Appalachian Production Falling?

- **Costs of mining rising because lower-cost seams are depleted**
- **Electric power generation shifting from coal to natural gas, renewables**
  - **Natural gas is currently cheap**
  - **Older coal-fired plants being closed**
    - **Age—fully depreciated**
    - **Cost of meeting new air pollution standards**
- **New coal-fired plants not being built**
  - **Natural gas plants cheaper**
  - **Proposed EPA regulations on emissions of carbon dioxide preclude current technologies**

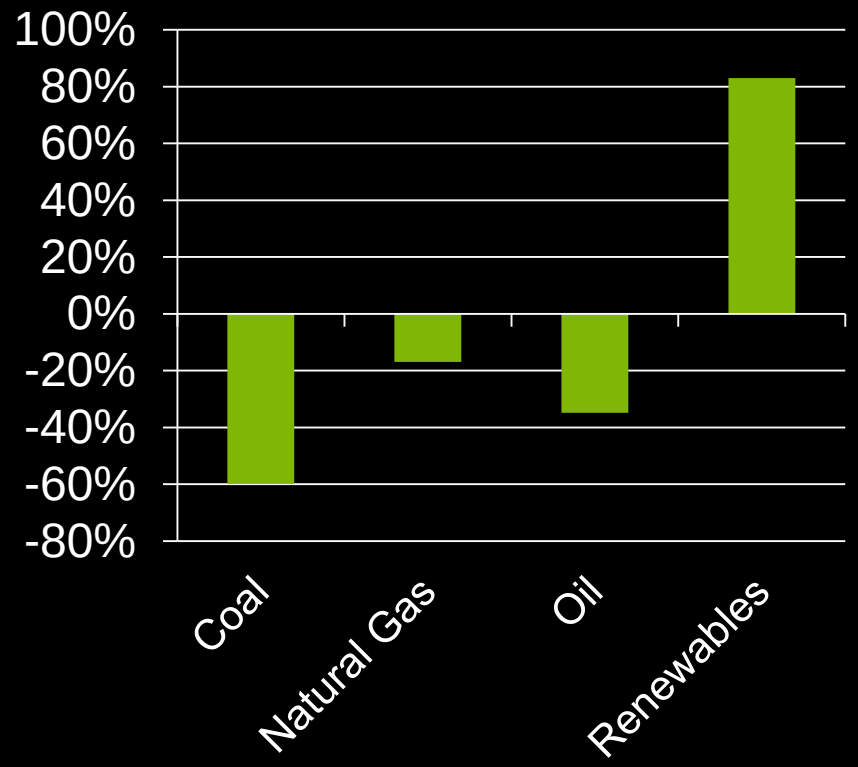
Where Have Energy Policies Made a Difference?

- **Fuel economy standards have led to drop in demand for gasoline, imported oil**
- **Federal programs for weatherproofing, building efficiency standards restraining energy use**
- **State mandates, federal programs have boosted use of renewables for electric power**
- **New air quality standards have contributed to decisions to close older coal-fired power plants**
- **Federal, state environmental regulations have imposed tighter controls on disposal of fracking water**
- **Federal R&D has contributed to development of renewables, fracking technologies**

What Difference Would More Aggressive Policies on Climate Change Make?

- **Oil**
  - Tighter fuel economy standards
  - Tighter mandates for renewable fuels
- **Coal**
  - Carbon price
  - Mandate carbon capture and storage

Fuel Consumption in Low Carbon Compared to Reference Case



International Energy Agency, *World Energy Outlook*, 2012.

Implications for Pennsylvania of More Aggressive Climate Change Polices

- **Most coal-fired power plants in region closed by 2035**
- **More rapid decline in Appalachian coal industry**
- **Increased demand for natural gas, increased fracking activity**
- **Closures of older refineries in Mid-Atlantic region**
- **Large-scale use of biomass for electricity, renewable fuels**

Implications for Future Areas of Energy Research

- **Oil**
  - Drilling and fracking
  - Matching fuels to new engine technologies
- **Natural gas**
  - Drilling and fracking
  - Liquefaction
  - Gas-to-liquids technologies
  - Compressed natural gas as transport fuel
- **Coal**
  - Coal transport and shipping technologies
  - Carbon capture and storage

Environment, Energy, and Economic Development Program