NATIONAL ENERGY TECHNOLOGY LABORATORY

# Forum on the Environment: Emerging Energy Technology

Brent Sheets

Arctic Energy Office, Fairbanks, AK

Feb 10, 2010

U.S. DEPARTMENT OF ENERGY

# National Energy Technology Laboratory

*Where Energy Challenges Converge and Energy Solutions Emerge*

- **Only government owned, government operated DOE national lab**
- **One lab, three research sites**
- **> 1,200 Federal and support-contractor employees**
- **Research spans fundamental science to technology demonstrations**

*Oregon*

*Pennsylvania*

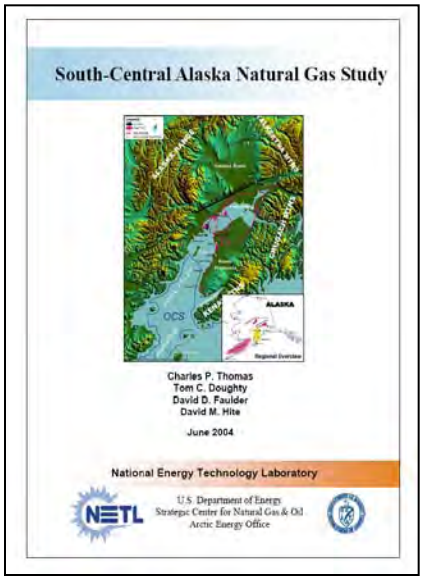
*West Virginia*

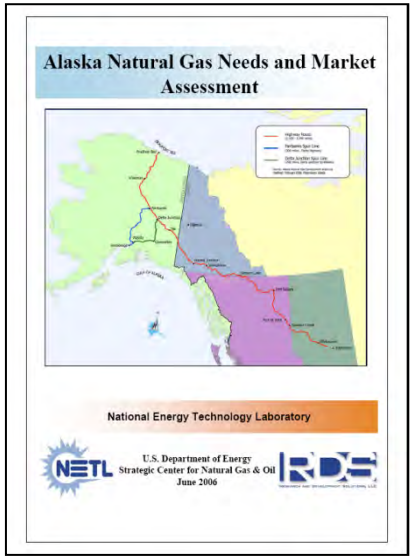
# NETL Locations

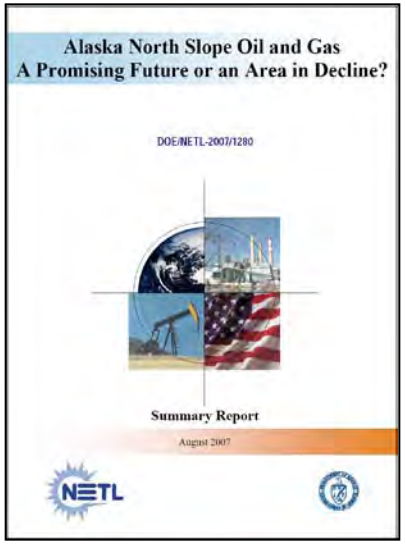
# Arctic Energy Office Mission
## *(Public Law 106-398)*

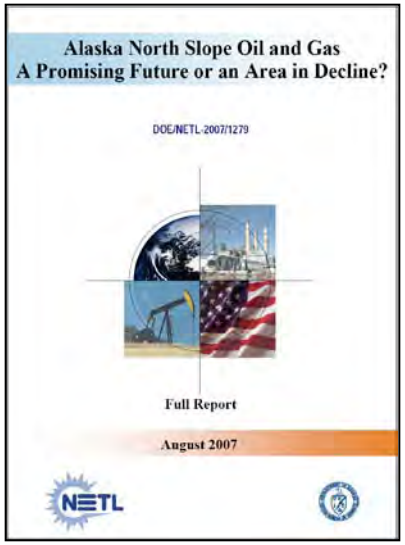
- **Fossil Energy:**
  - Promote research, development and deployment of oil recovery, gas-to-liquids and natural gas production & transportation

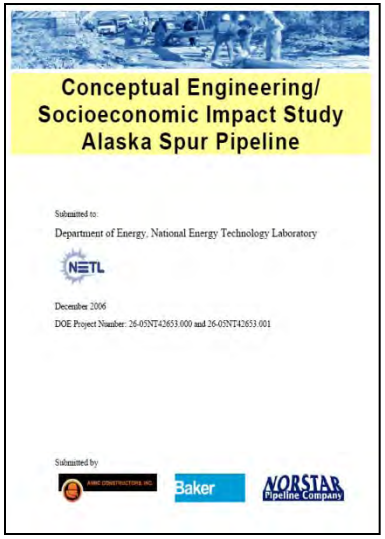
- **Remote Power:**
  - Promote research, development and deployment of electric power in arctic climates, including fossil, wind, geothermal, fuel cells, and small hydroelectric facilities

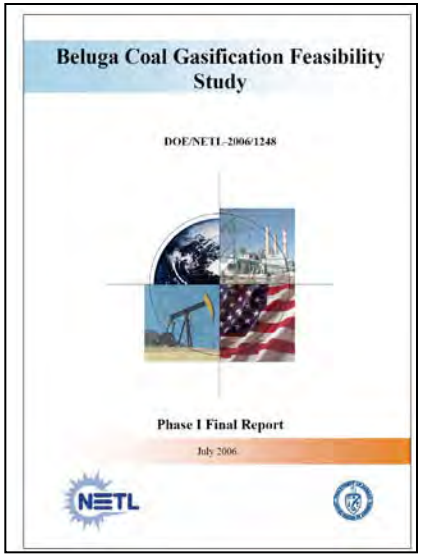


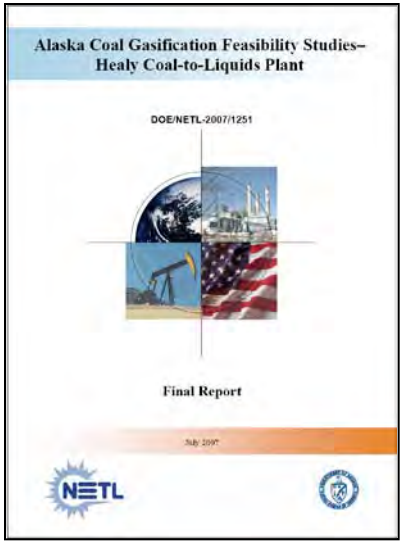





**Work funded by the U.S. Department of Energy, National Energy Technology Laboratory's Arctic Energy Office, Fairbanks, AK**

# Summary of Alaska Projects

- Impacts of arctic lake pumping for ice roads/pads
- Use of $CO_2$ for hydrate production
- Traps in brooks range foothills
- Bristol Bay oil potential
- Naturally Occurring Methane Seeps on the North Slope
- Methane from coal at Fort Yukon
- Ceramic borehole sealants
- Tundra travel model
- North Slope study
- Heat Recovery from Diesel Eng.
- South central natural gas supply study
- Spur line study
- North Slope Science Initiative
- North Slope watershed modeling for freshwater availability
- Beluga coal gasification study
- Healy coal-to-liquids plant
- UAF Power Plant Upgrade
- Barge-mounted coal-fired power plant (Nome power-options analysis)

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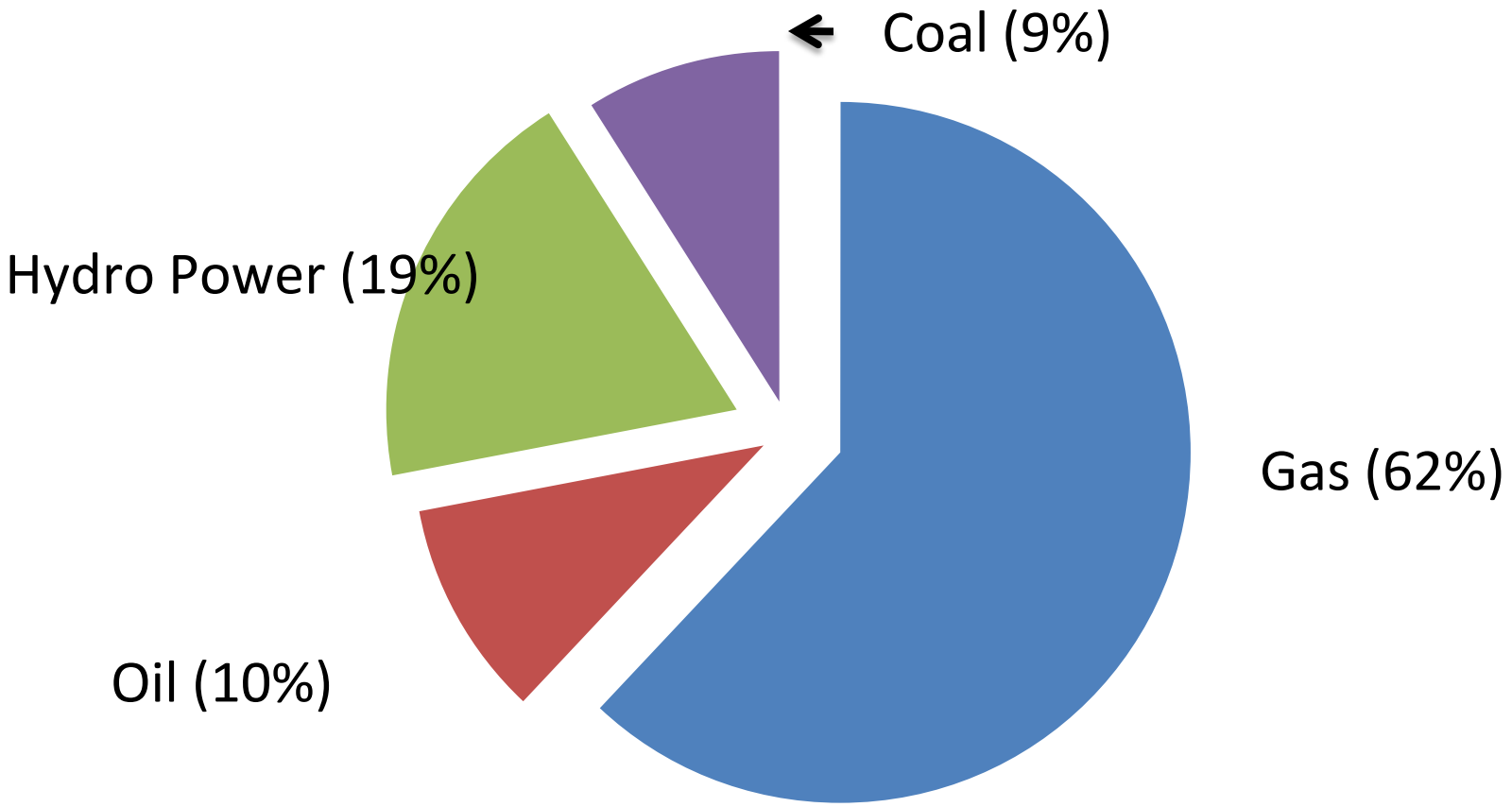
# A Few Drivers for Technology Development

- Demand for more energy
- Economics
  - Lower costs
  - Scalability
- Environmental issues and regulations

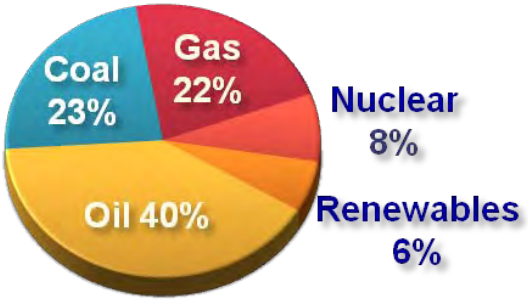
# Alaska's Energy Consumption by Fuel Type



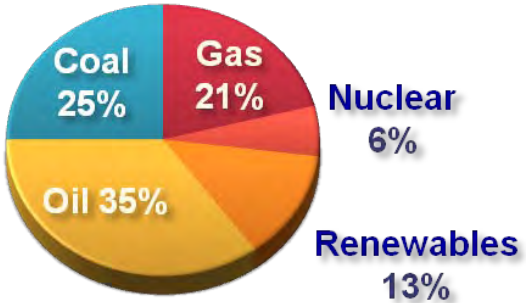

*Source: Energy Information Agency, Electric Power Sector Consumption Estimates 2007*

# Energy Demand Today

**101 QBtu / Year**
**85% Fossil Energy**

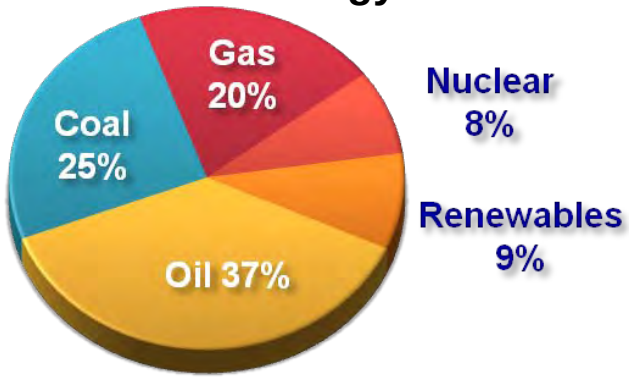



**453 QBtu / Year**
**81% Fossil Energy**

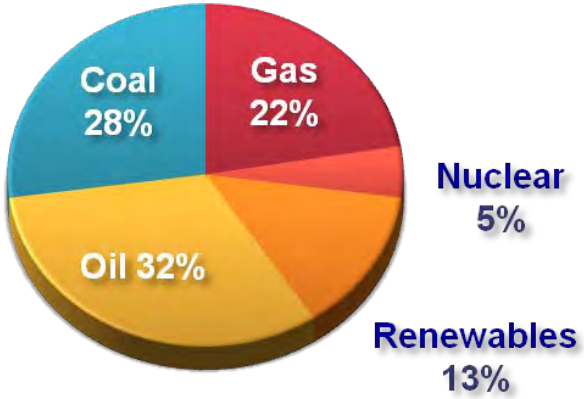



# Energy Demand 2030

**118 QBtu / Year**
**82% Fossil Energy**




**703 QBtu / Year**
**82% Fossil Energy**




**+ 16%**
**United States**

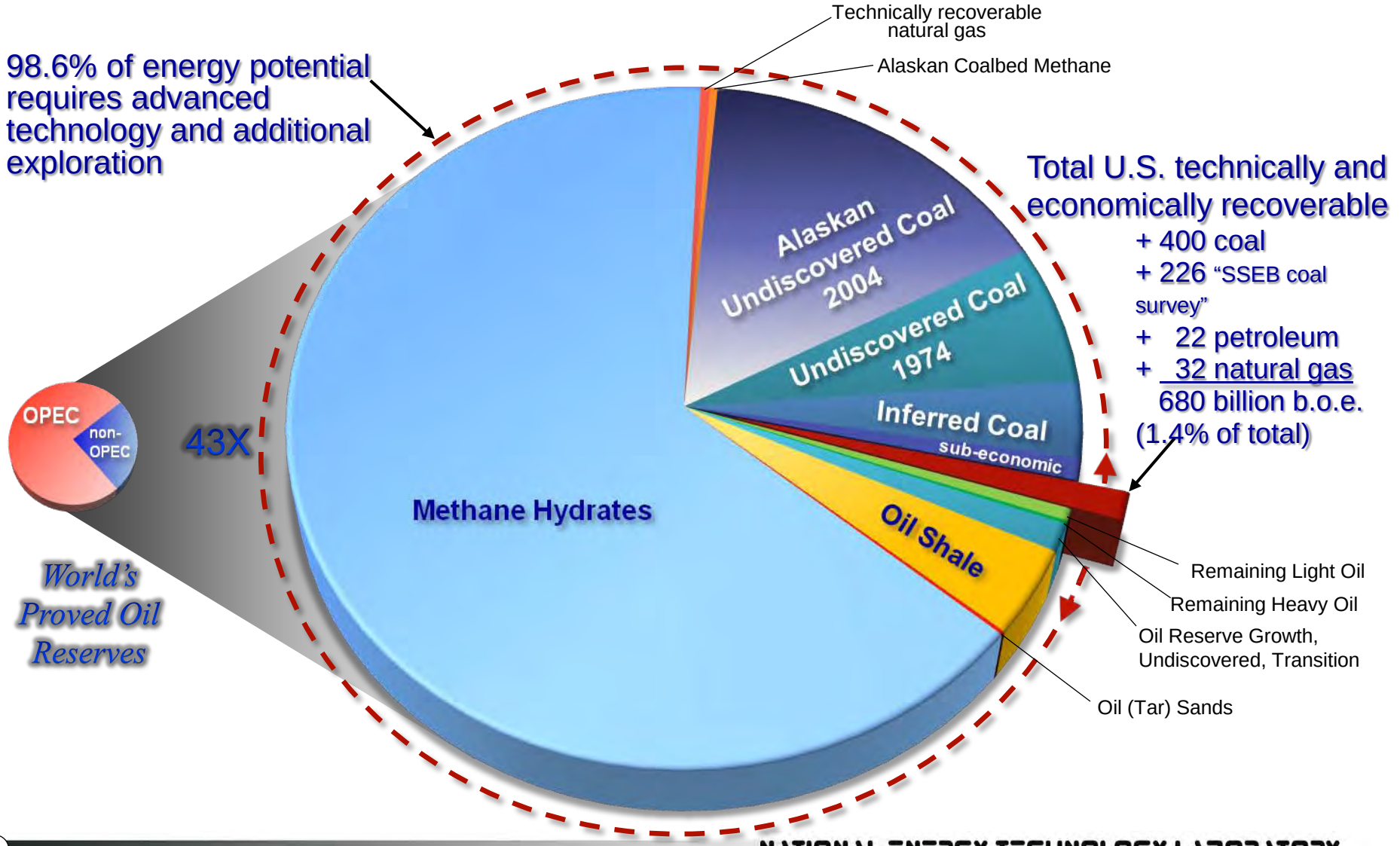
**+ 55%**
**World**

***Fossil Energy Will Continue to Dominate***



*U.S. data from EIA, Annual Energy Outlook 2008 revision; world data from IEA, World Energy Outlook 2007*

# U.S. Endowment of Solid, Liquid, and Gaseous Fuels Resources

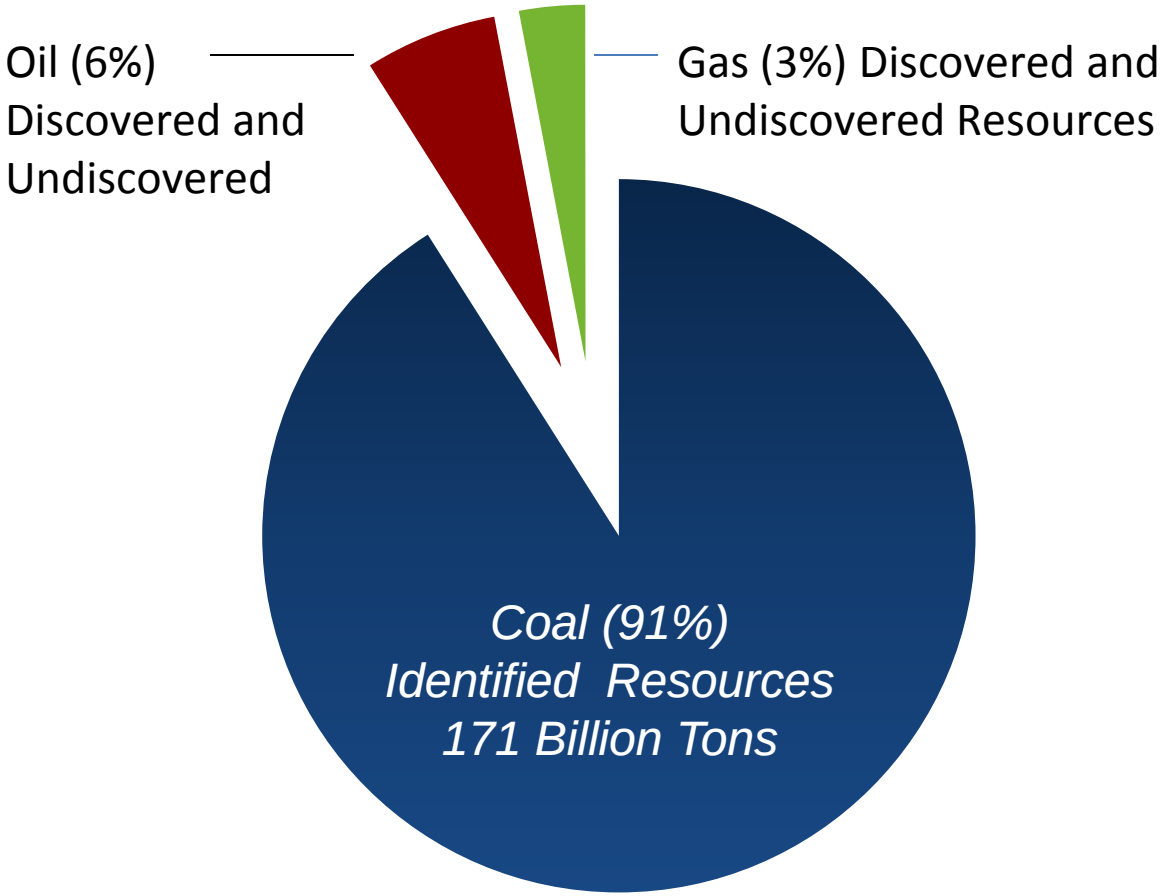







51 trillion barrels of oil equivalent

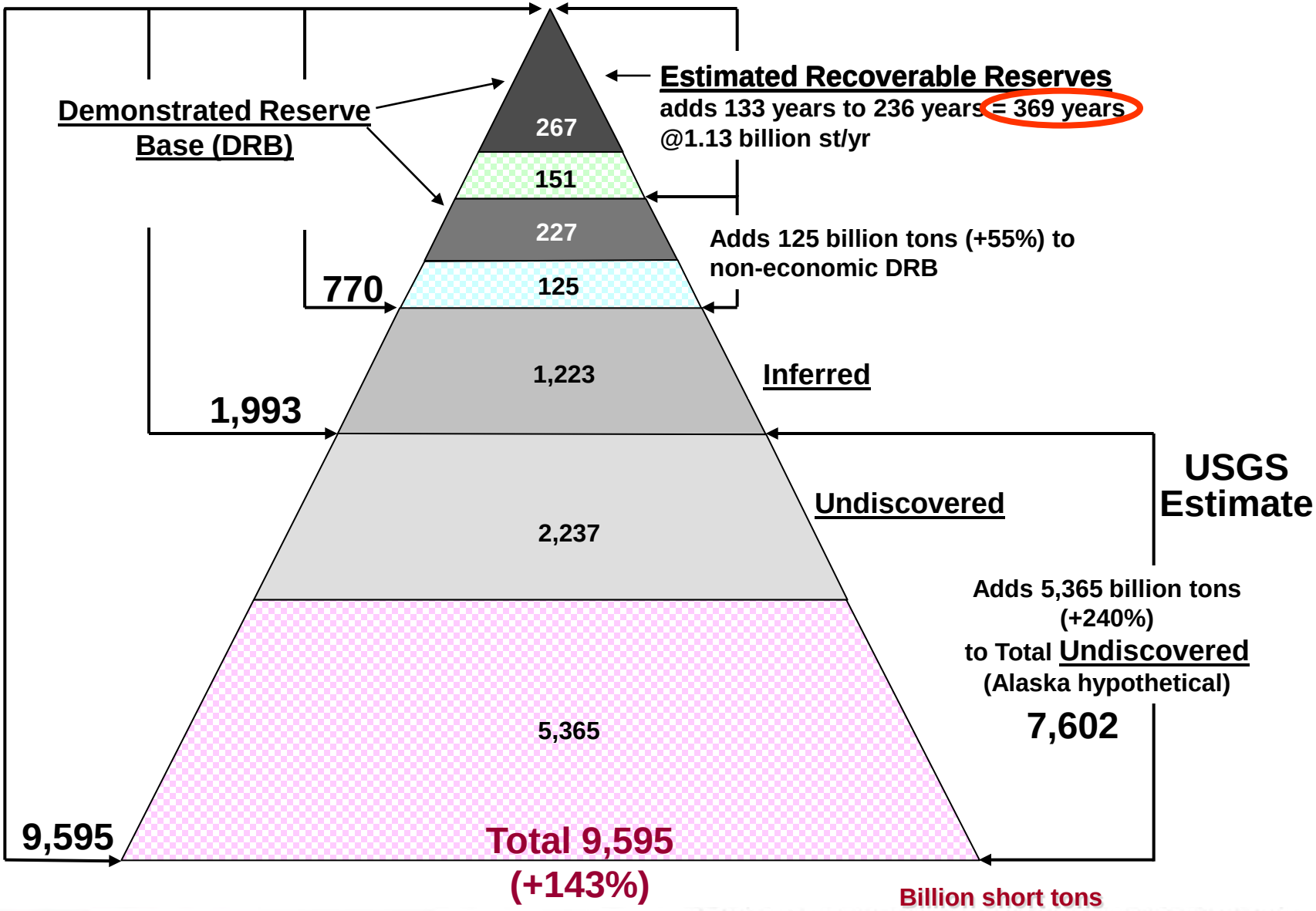
# Alaska's Energy Resources
## Comparing Equivalent Energies






*Oil & Gas Data Source: Alaska DNR/DOG, 3/20/01*
*Coal Data Source: Alaska DNR/DGGS Special Report #37, 1986*

# View of Potential U.S. Coal Resources





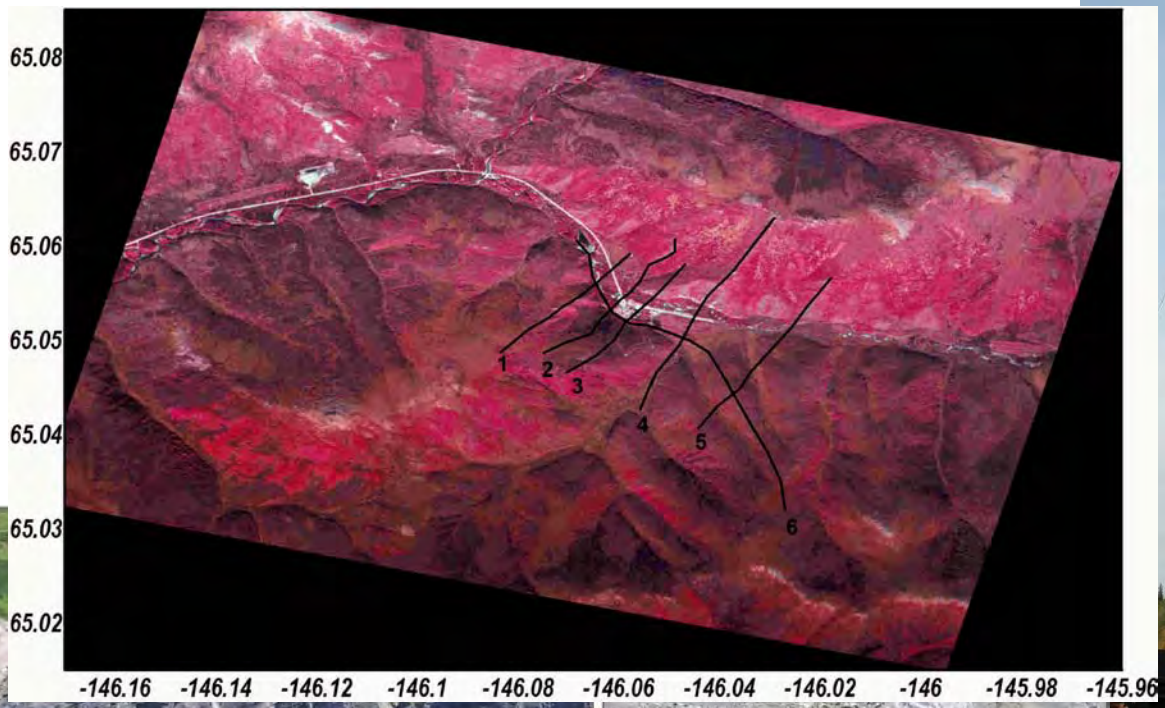

*Alaskan Hypothetical Coal (and Alaskan coalbed methane 1000 Tcf): USGS (Flores, et.al.) 2004 report Digital Data Series 77, http://pubs.usgs.gov/dds/2004/77/*
*SSEB Coal Survey: Southern States Energy Board, American Energy Security - Building a Bridge to Energy Independence and a Sustainable Energy Future, July 2006, survey of State coal estimates, Appendix C ("State coal update")*

Alaska Coal Overview
Alaska Coal Overview

# Alaska Fossil-Based Opportunities

- **Affordable resource assessment technologies**
  - Aerial/Satellite imagery
  - Seismic
  - Small coring/drilling rigs
- **Propane/CNG for villages**
- **Conventional & Unconventional Natural Gas**
- **Transmission Lines**
- **Gas to Liq. & Coal to Liq.**
- **Small-scale technology for coal (& biomass) utilization**

# Technology for Resource Assessment







# Propane or CNG

Alaska Natural Gas Development Authority (ANGDA) is Pursuing a project to provide propane to villages

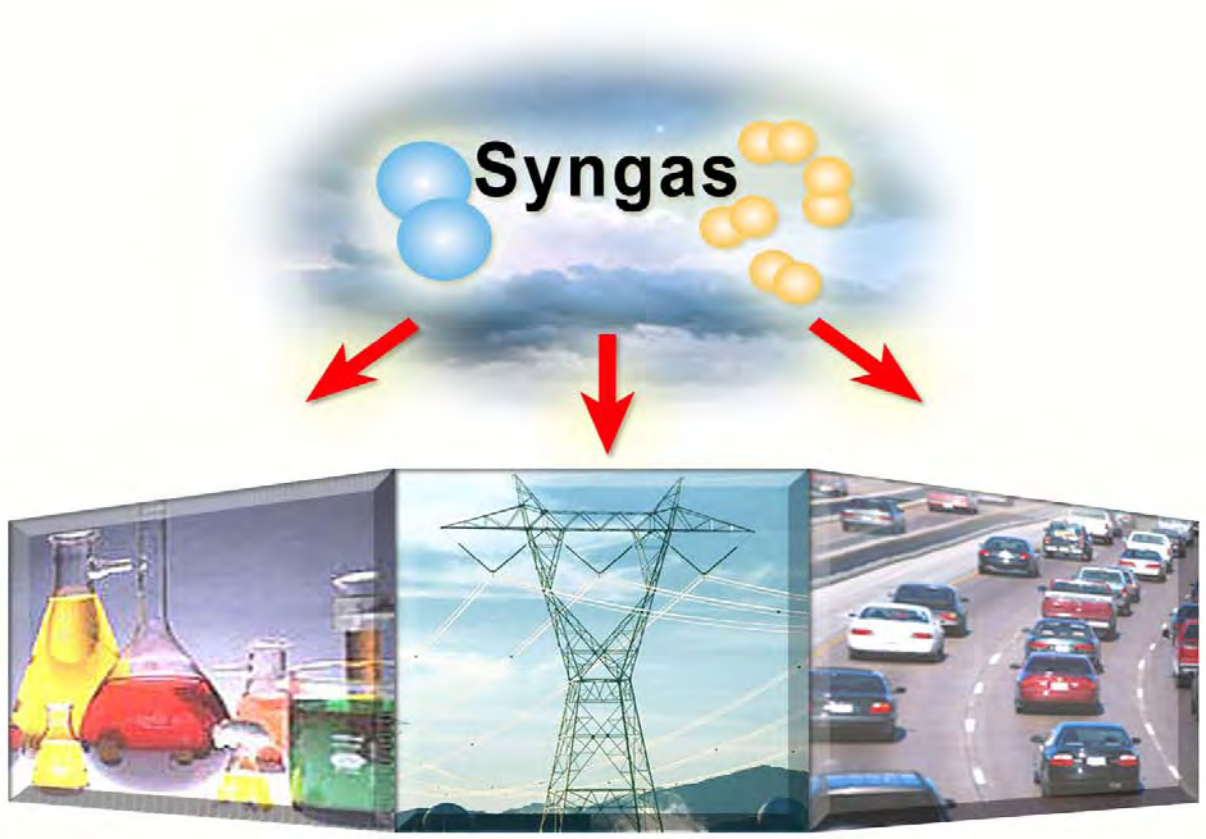
- Home heating &cooking
- Transportation
- Power generation

# Conventional & Unconventional Natural Gas

DGGS seismic shoot at Fort Yukon, 2001.

*Photo's courtesy Jim Clough, DGGS*

# Gas-to-Liquids or Coal-to-Liquids

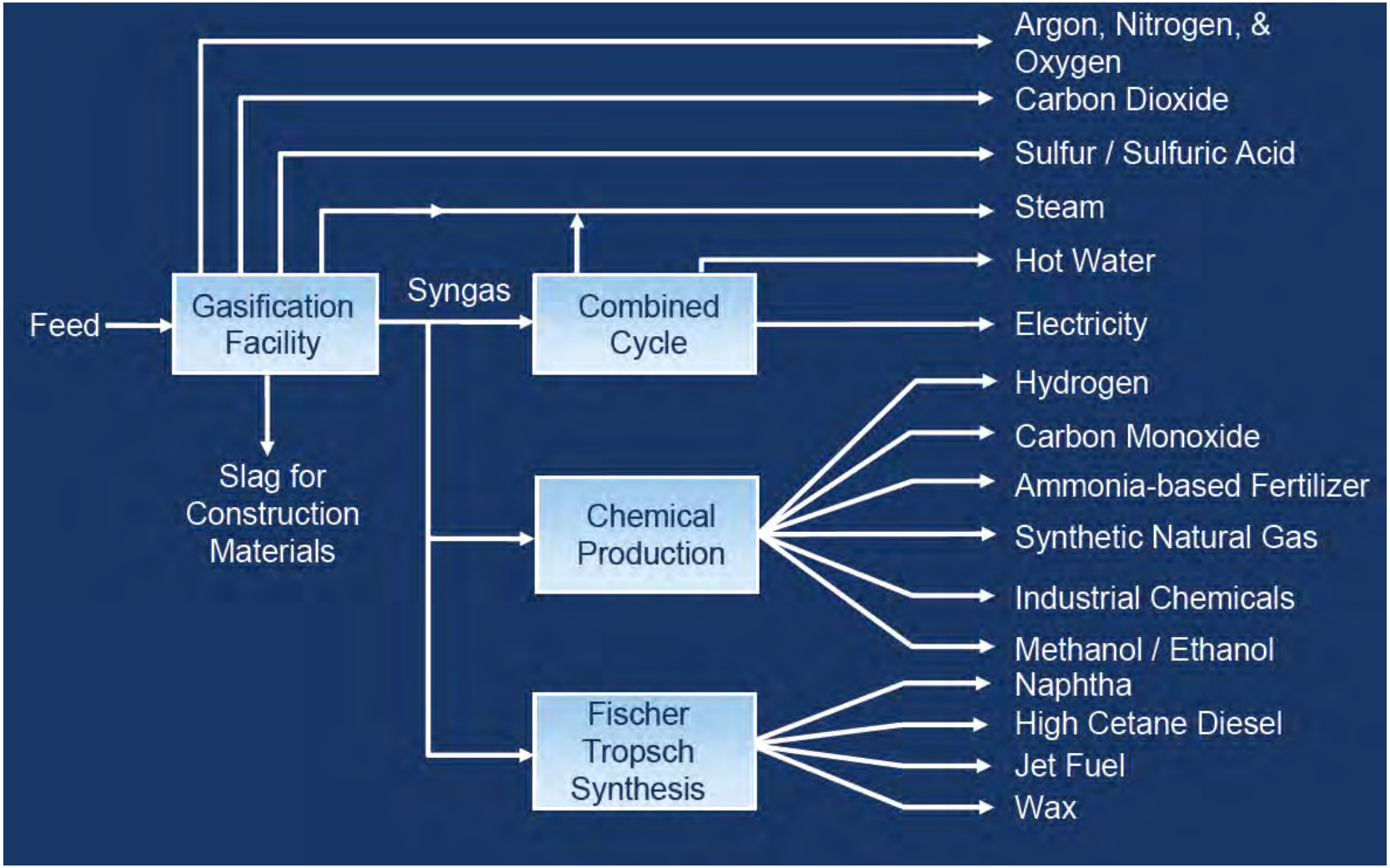



**Building Blocks for Chemical Industry**

**Clean Electricity**

**Transportation Fuels (FT-diesel or Hydrogen)**

# Gasification Products

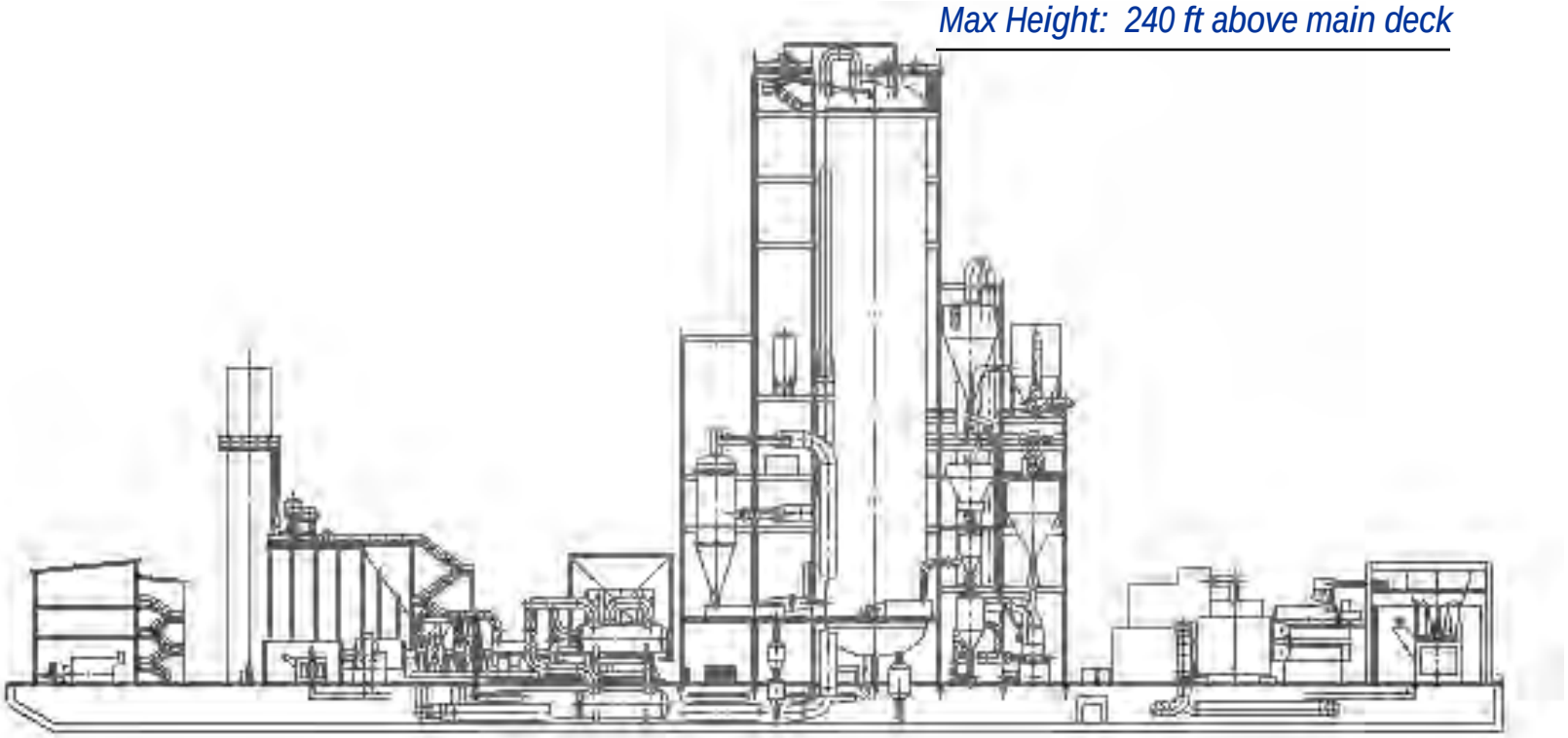



Source: FLUOR®

# Transmission Lines

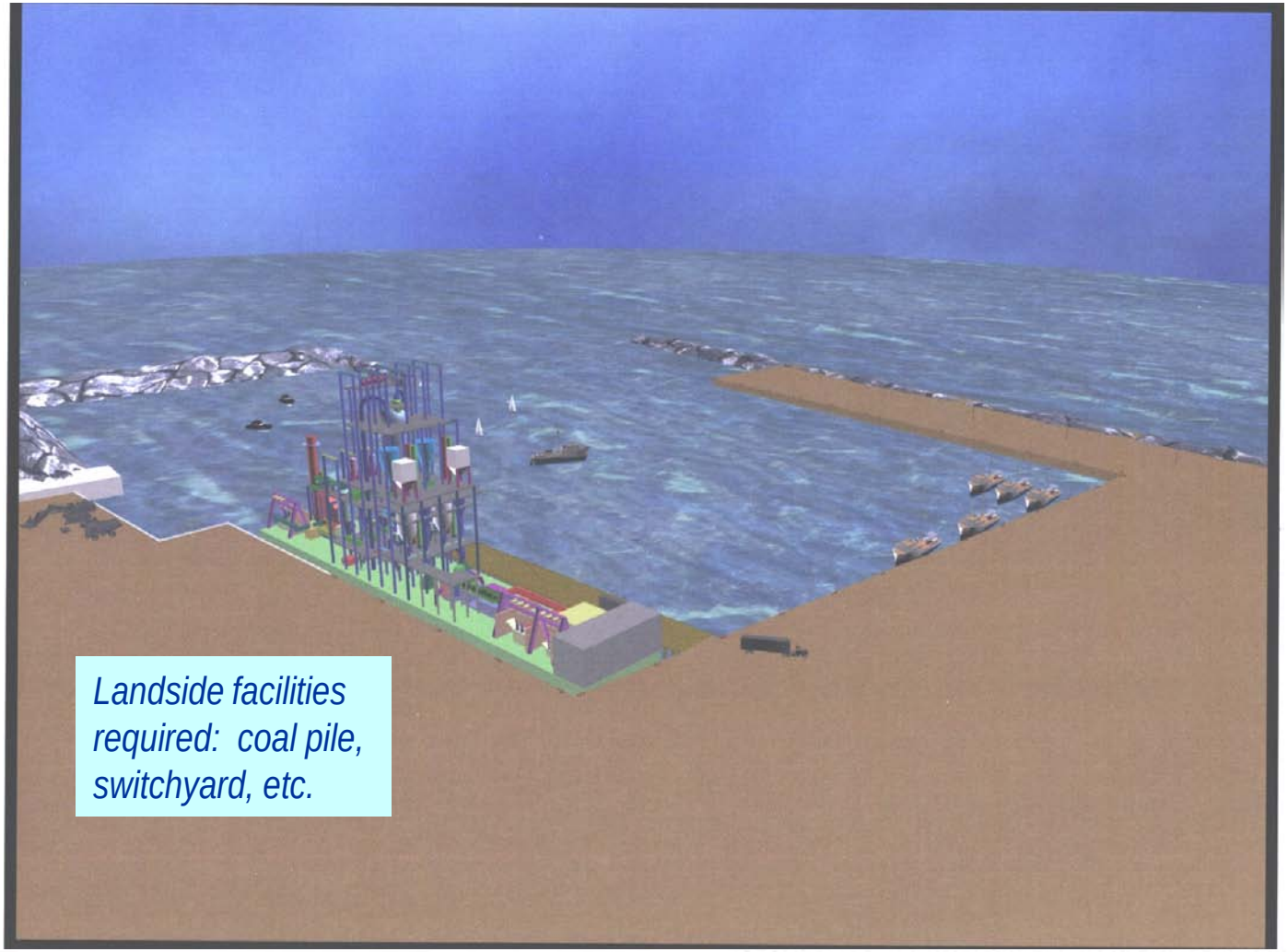
# PFBC Elevation View-Broadside
## (300 MWe/Bituminous Coal/Barge)

*Max Height: 240 ft above main deck*

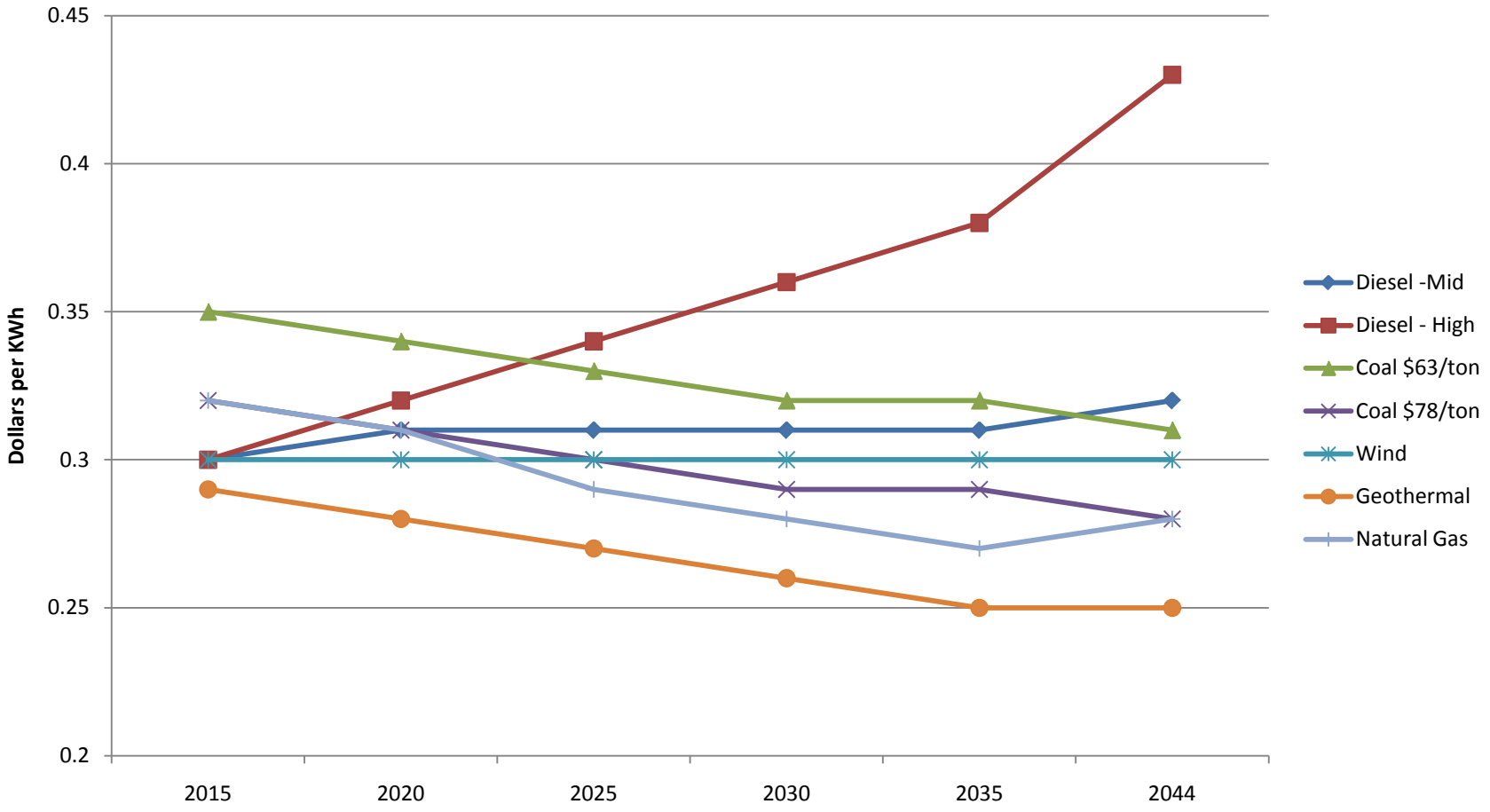


# Nome Region Energy Assessment

# Typical Site for Barge-Based PFBC Power Unit (140 MWe Unit Shown)

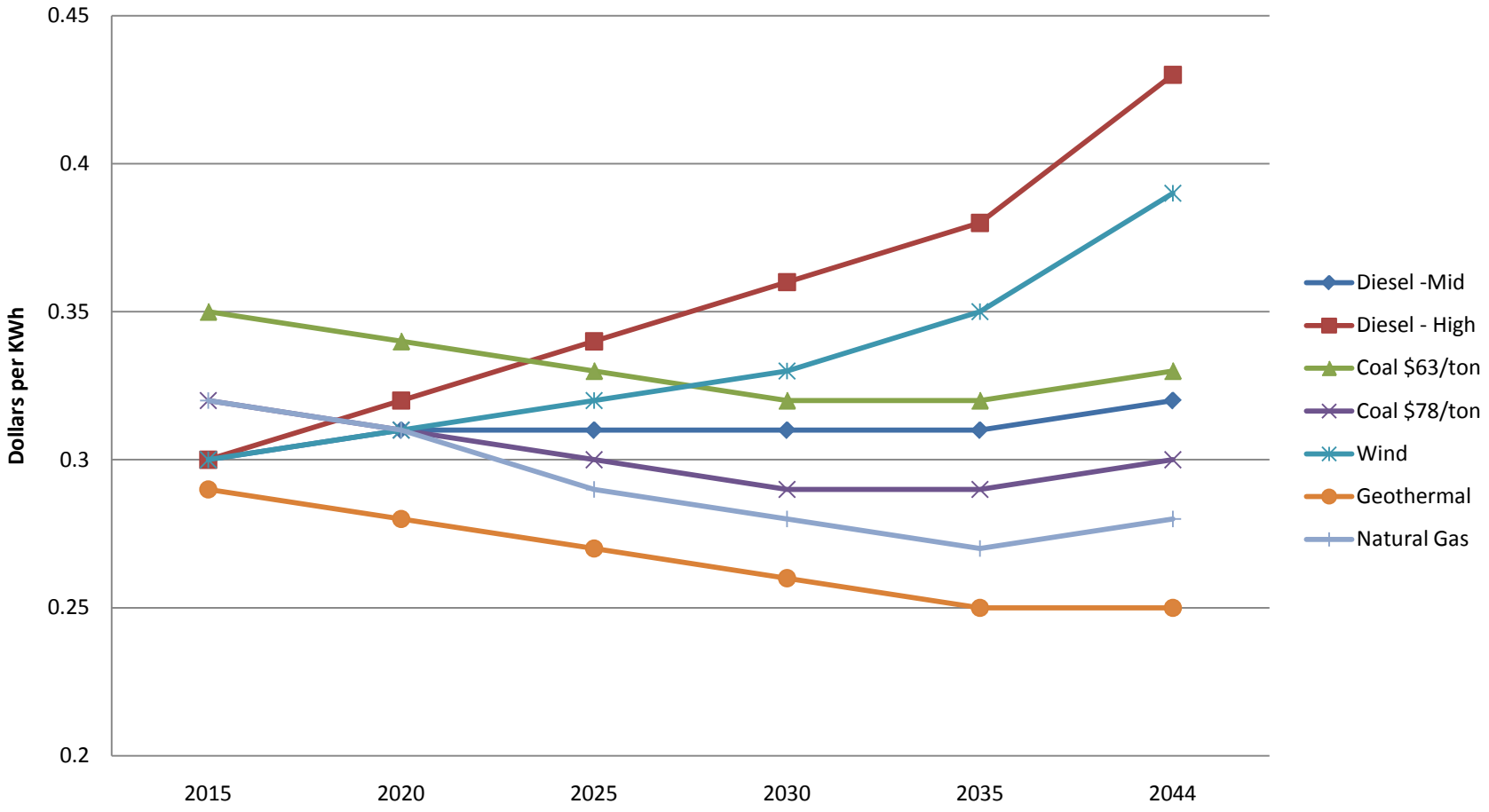


# Nome Electrical Energy Averages
## Mid-Case Escalation (in 2007 $$)




*In Constant 2007 Dollars (no inflation – just price escalation) with mid diesel escalation*

# Nome Electrical Energy Averages
## High-Case Escalation (in 2007 $$)




*In Constant 2007 Dollars (no inflation – just price escalation) with high diesel escalation*

# Technology Alone Will Not Result in Development

- **The following must be a part of any plan to successfully implement new energy technology:**
  - Policy
  - Human Resources
  - Impacts on People
  - Impacts on Environment
  - Infrastructure, including distribution
  - Economics

# Visit Our Websites


## *Office of Fossil Energy*

**www.fe.doe.gov**


## *NETL*

**www.netl.doe.gov**