

The New Natural Gas Economy

Components of a Successful Plan



Electricity Generation

- Leverage existing natural gas plant capacity for electricity generation
- Implement new natural gas plants to compliment future renewable infrastructure
- Incent changes to electrical dispatching
- Introduce emission and price standards for all power generators
- Tougher permitting and retrofitting for coal

Natural Gas Transportation

- Promote new natural gas vehicle manufacturing
- Public / Private partnership for infrastructure
- Stimulate investment in midstream facilities
- Introduce new vehicle tailpipe emissions standards
- Measure emissions from “well head to tailpipe” including coal excavation to tailpipe for EVs
- Incent changes to consumer behavior

Natural Gas Economy Plan

...a plan to develop a Natural Gas Strategy to:



Reduce total CO₂ and other emissions



Create 10,000s of green jobs from new natural gas production and usage for power and transportation



Significantly increase annual royalty and tax revenue at the local, state and federal levels



Attract new businesses and industries across the U.S.

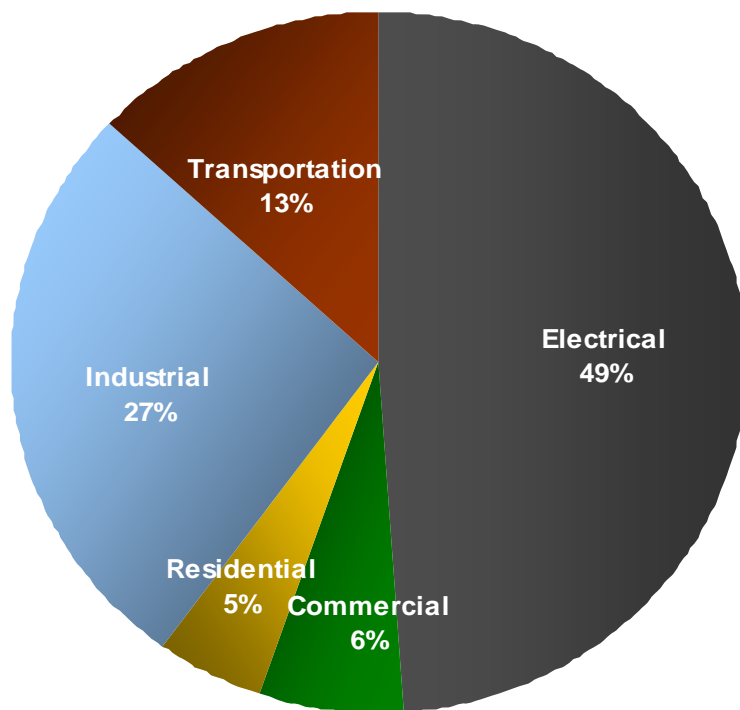


Using existing, proven technologies and facilities in transportation and electrical generation

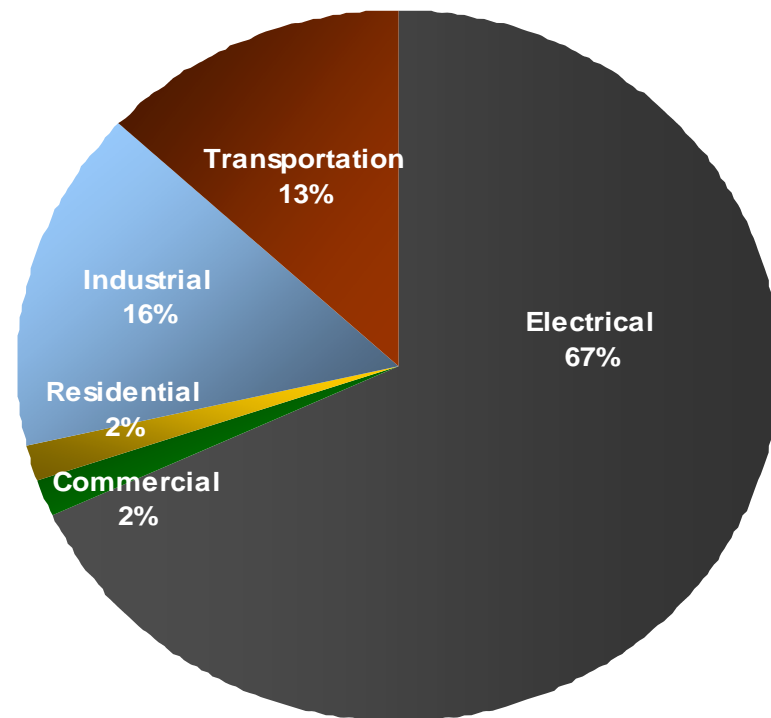
Wyoming Estimated Sector Emissions Sources

Where are the Largest Opportunities?

Energy Consumption
(1.4 Bcfe/d)



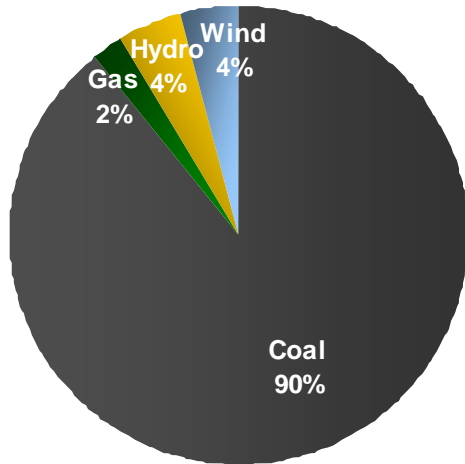
Emissions
(~63 Million Metric Tons CO₂)



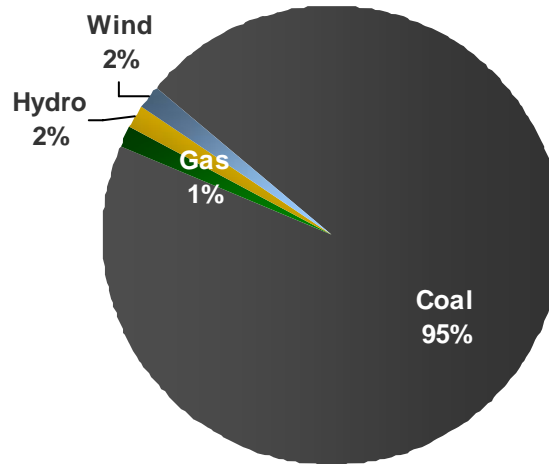
Electricity and Emissions in Wyoming

Status of Electrical Generation Today

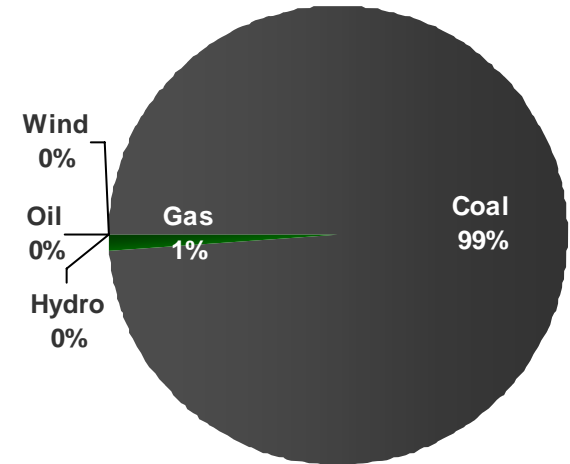
Nameplate Capacity
(60 TWH)



Actual Output
(46 TWH)



Actual CO₂ Emissions
(46 Million Metric Tons)



What are the Implications?

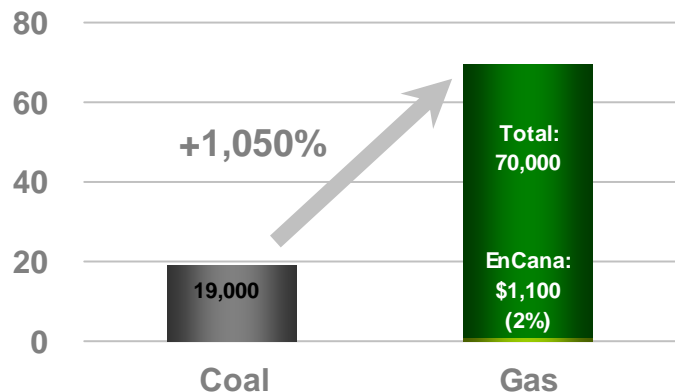
Gas Capacity
Already Exists

Gas is under-utilized

Emissions
Reduction Must
Address Coal

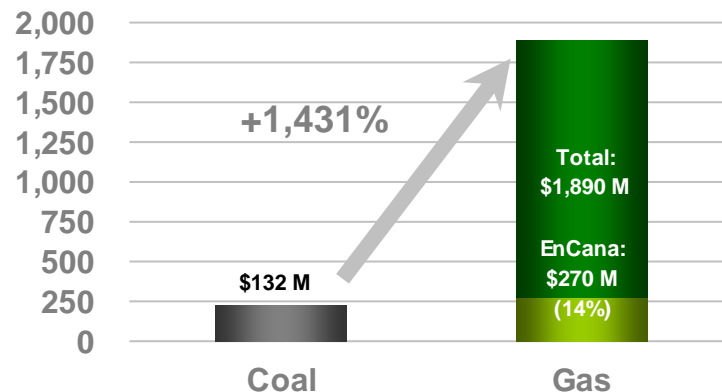
State Royalties, Job Creation and Imports Benefits of Natural Gas in Wyoming

Total Employment (000s)



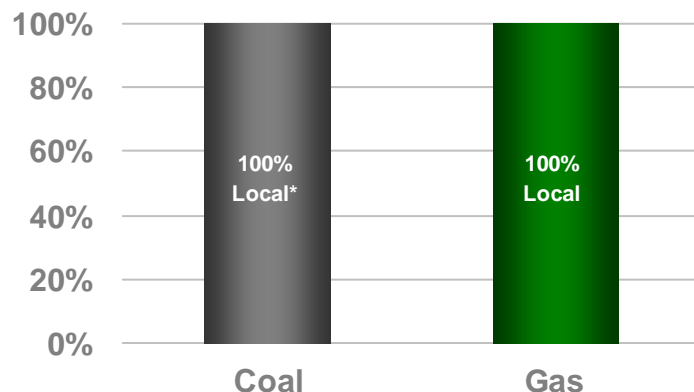
* Indirect Employment

State Royalties & Taxes (\$MM)



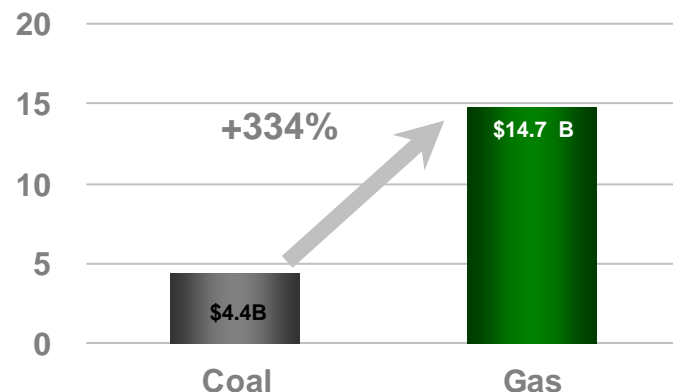
* Direct & Indirect Mineral Taxes, Property Tax

Source of Consumed Fuel



* Split based on energy content, not tonnage

Total Economic Contribution (\$B)



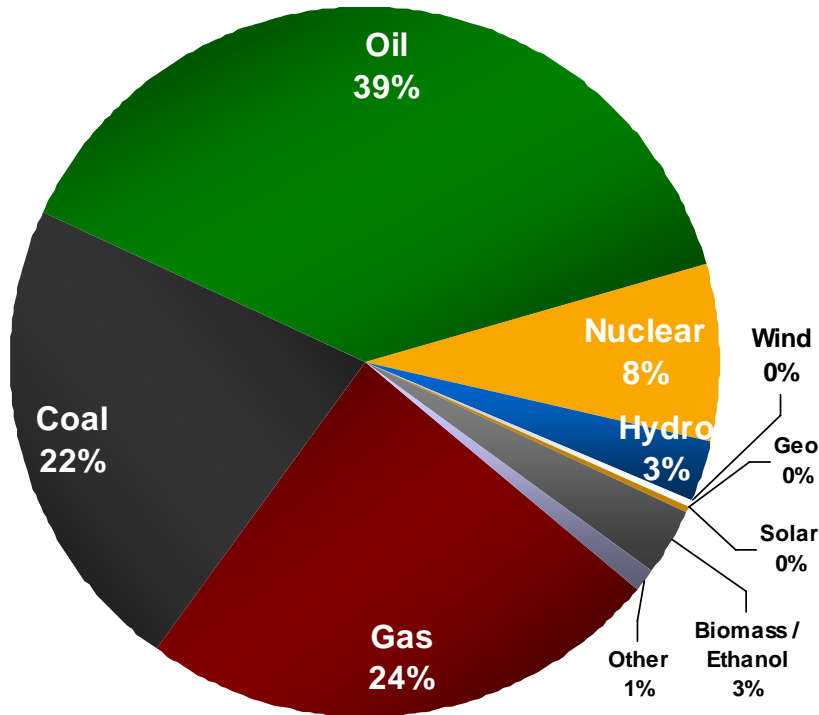
* Direct + Indirect Drilling & Extraction, All Taxes and Royalties

Natural Gas is the *Natural Partner* of Wyoming

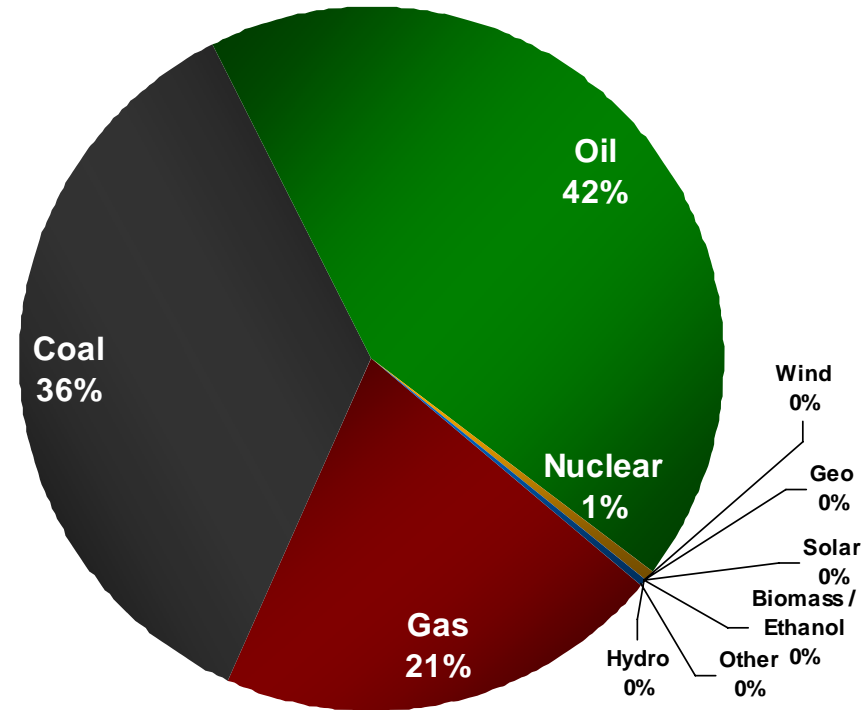
U.S. Energy Consumption and CO₂ Emissions

2005 Data

Energy Consumption
276 Bcfe/d



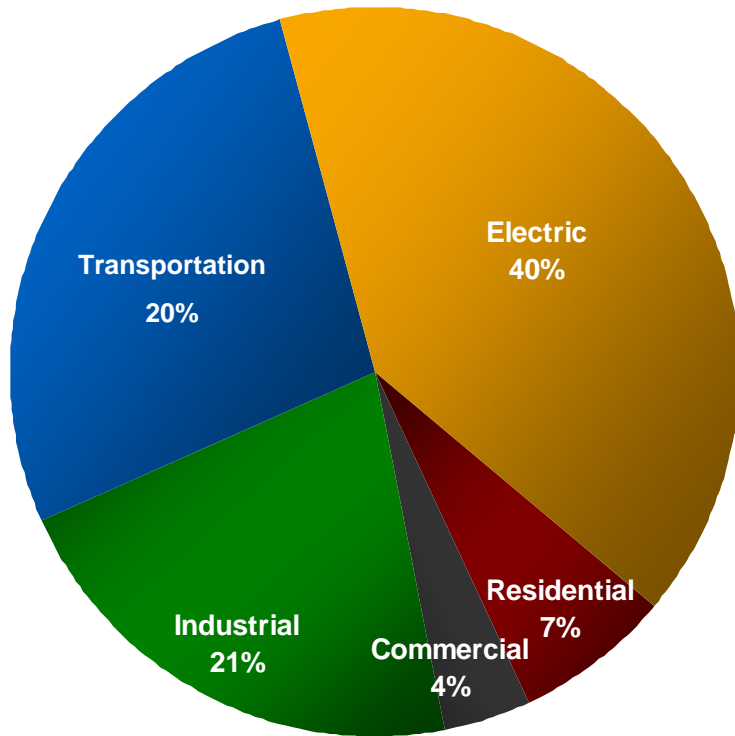
Direct CO₂ Emissions
6.0 Billion Metric Tons



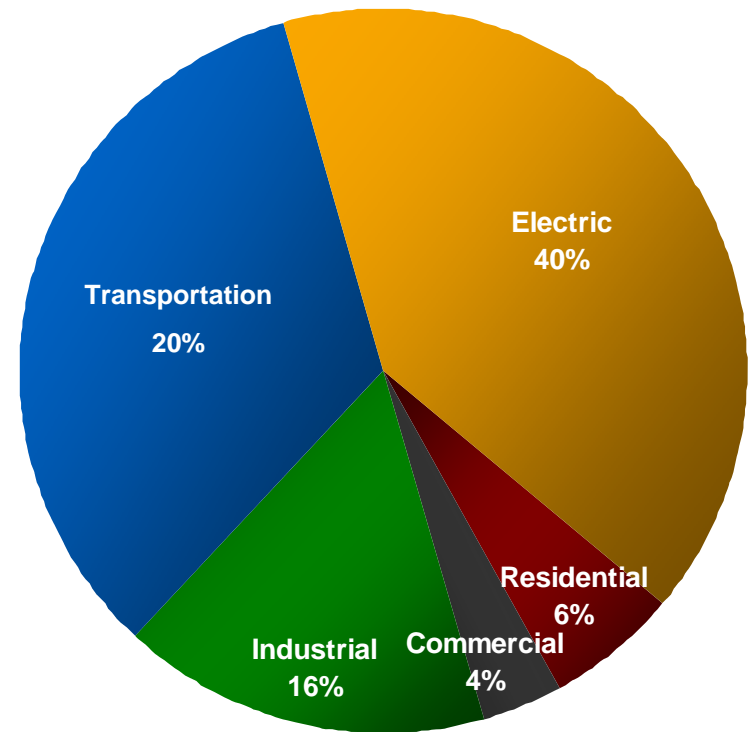
United States

Where are the Largest Opportunities?

Energy Consumption
276 Bcfe/d

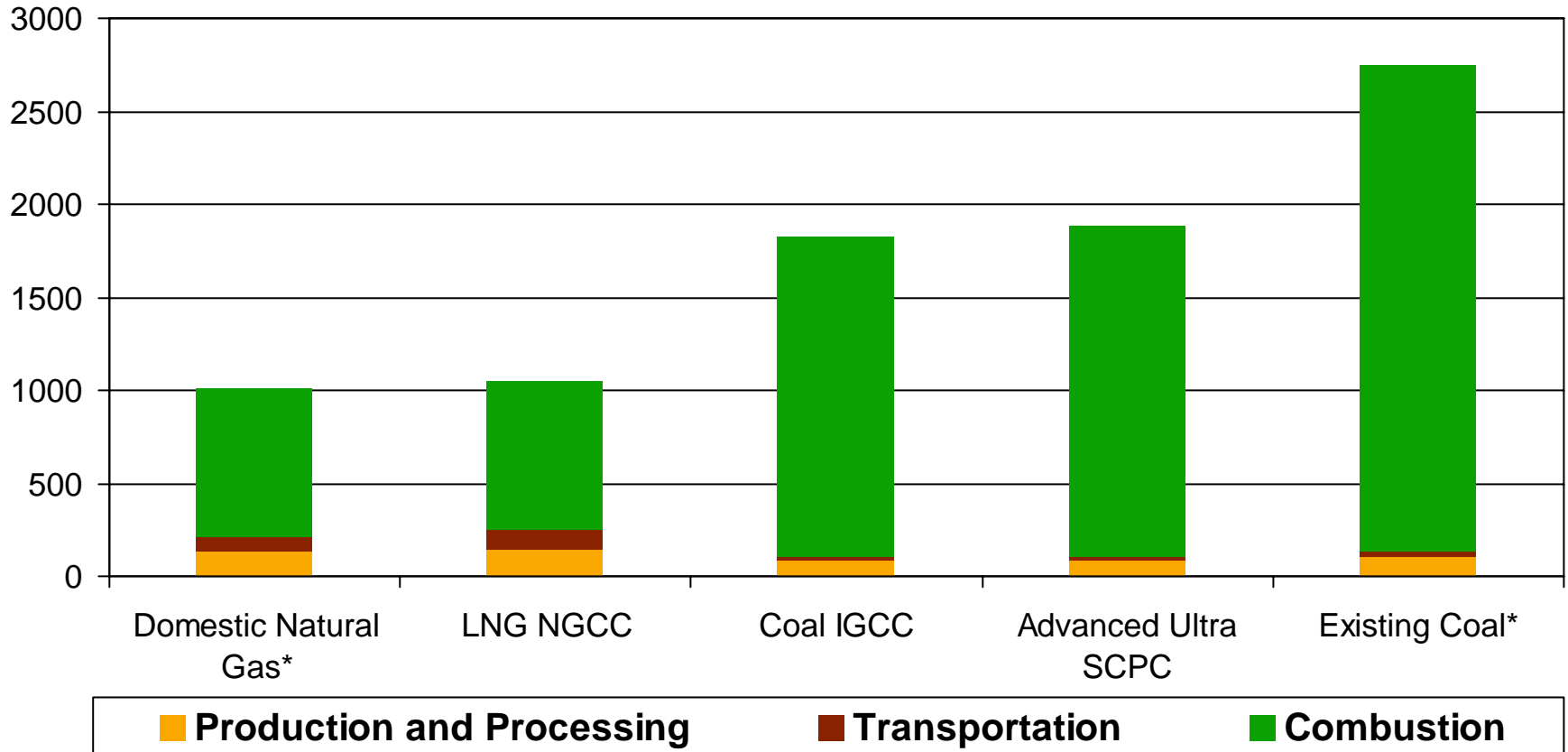


Direct CO₂ Emissions
6.0 Billion Metric Tons



Life Cycle Greenhouse Gas Emissions

lb CO₂e/MWh

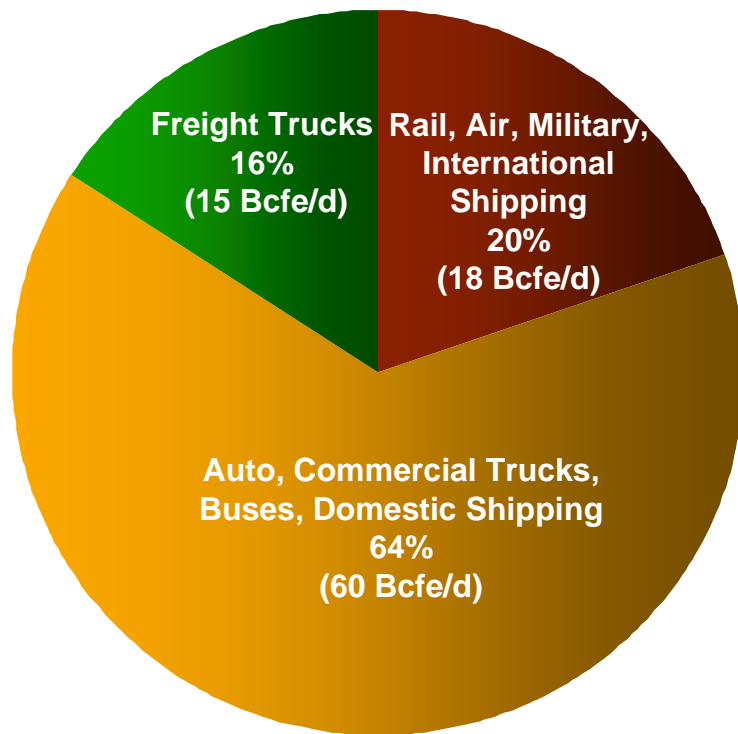


Existing natural gas assessment based on Alberta delivery to existing Ontario generation. Existing coal (U.S. based) not representative of any particular supply chain.

North American Natural Gas Use Opportunity Transportation Sector

2009 Consumption by Vehicle Type

Volume (93 Bcfe/d)



- **“Return to base” urban fleet vehicles (i.e. commercial trucks, buses) provide the greatest immediate opportunities for conversion**
- **Government fleets represent 30% of fleet vehicles in the U.S.**
- **Infrastructure is needed to expand the use of natural gas to other vehicles for long haul purposes**

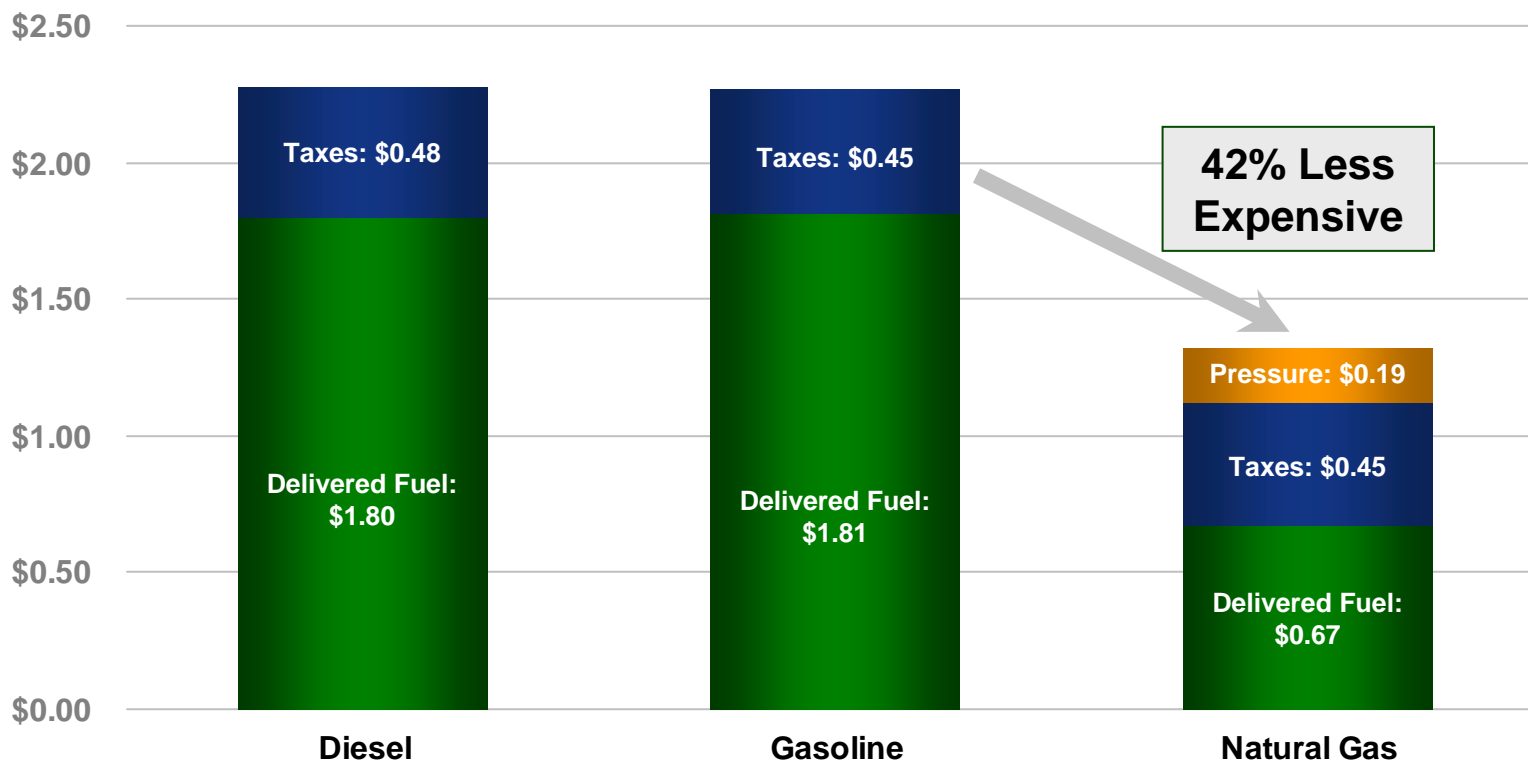
- Current NG engines produce 22% less GHG Emissions than diesel engines
- Current NG engines produce 33% less tailpipe pollution than the newest diesel engines and already meet EPA 2010 emission targets

Cost Profile of Fuels

Assuming Natural Gas at \$0.45 State & Federal Taxes

Comparison of Oil Versus Natural Gas

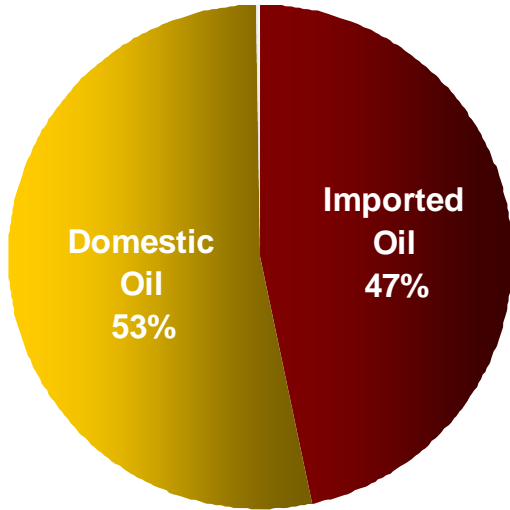
USD Retail Cost per US Gallon Equivalent



May Retail of \$2.28 diesel, \$2.27/gallon gasoline, \$3.85/Mcf natural gas city gate price

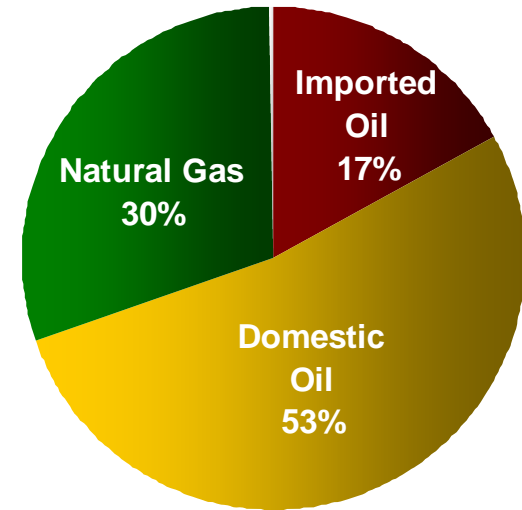
North American Transportation Switch (for 25 bcfd of Natural Gas)

Current Fuel Mix

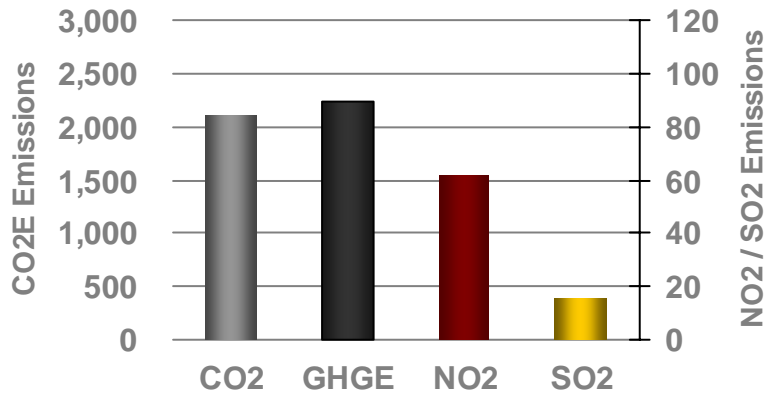


+25 Bcf/d
Domestic Gas

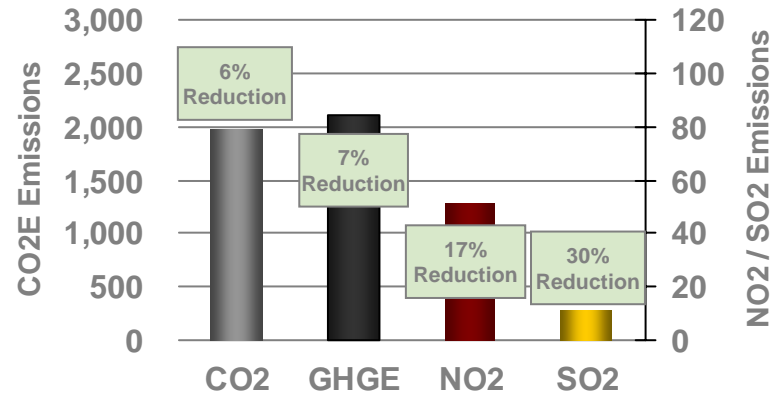
Future Fuel Mix Vision



Emissions (Metric Tons)



Emissions (Metric Tons)



132 MM tons of CO₂ = 2% of Canada/U.S. Total CO₂ Emissions in 2008

Average Daily Long-Haul Truck Traffic 2002



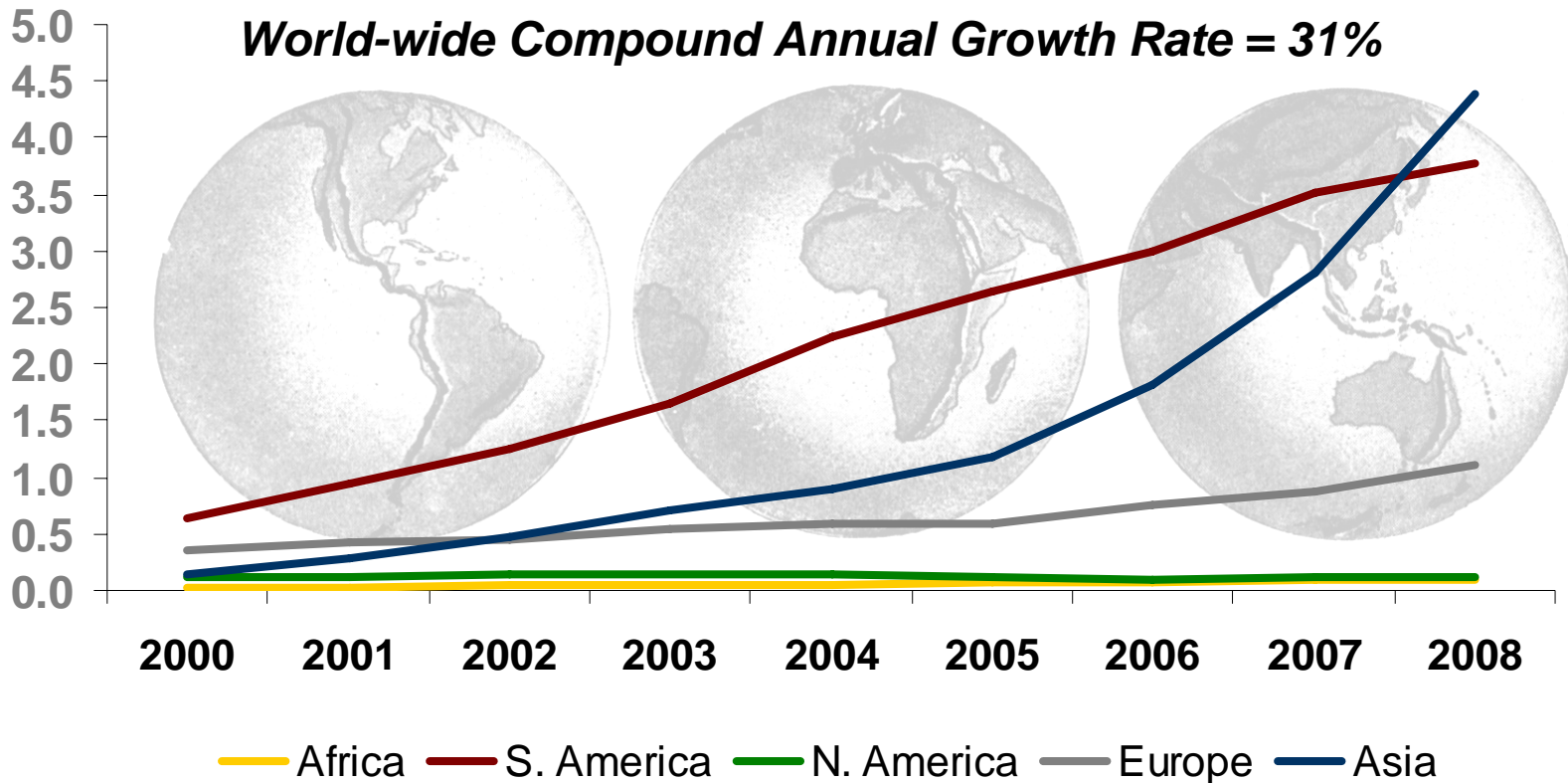
Most long-haul trucking is concentrated on major interstates connecting major cities, ports and border crossings.

Natural Gas Vehicle Growth by Continent

Great North American Opportunity

Natural Gas Vehicles by Continent

Natural Gas Vehicles (Millions)



NGV adoption occurs when the consumer has low cost fuel, multiple vehicle choices, inexpensive conversions, reasonable infrastructure and government incentives.

Italy as an example...

Fiat Qubo Natural Power



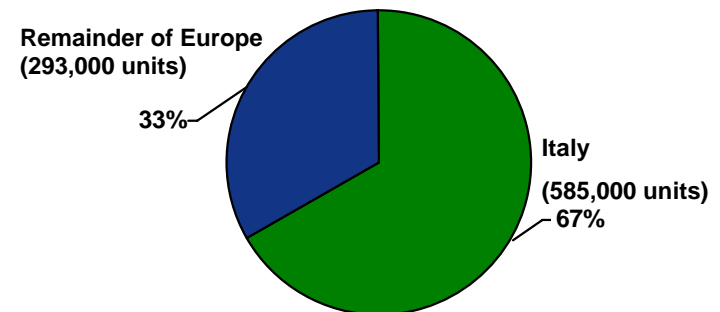
- **Italy – Quick Facts**

- ~600,000 NGVs (37% growth since 2007)
- 7% of market share of all new vehicles
- Refueling station to vehicle ratio currently 1:700
- Cost of CNG is 56% less expensive than gasoline (CNG \$0.90/L, Gasoline \$2.06/L Aug 2009)
- Imports 89% of natural gas

- **Government incentives**

- 3500 Euros for purchase of NGV
- 1500 Euros for scrapping high CO₂ emitting vehicle

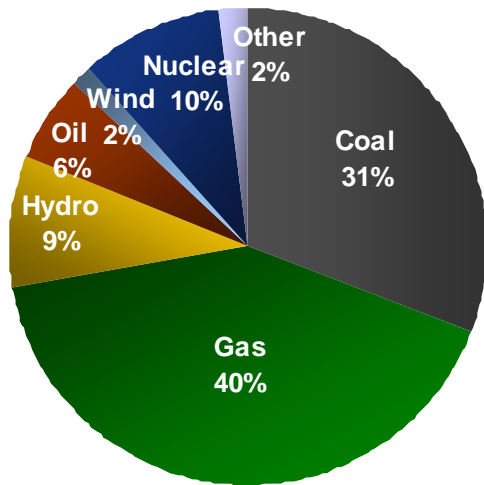
European NGV Distribution



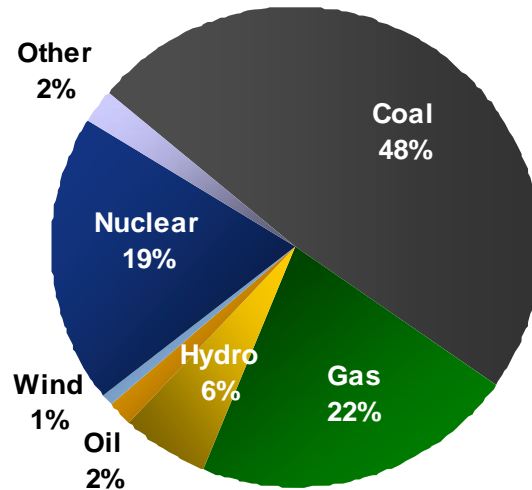
Electricity and Emissions in the U.S.

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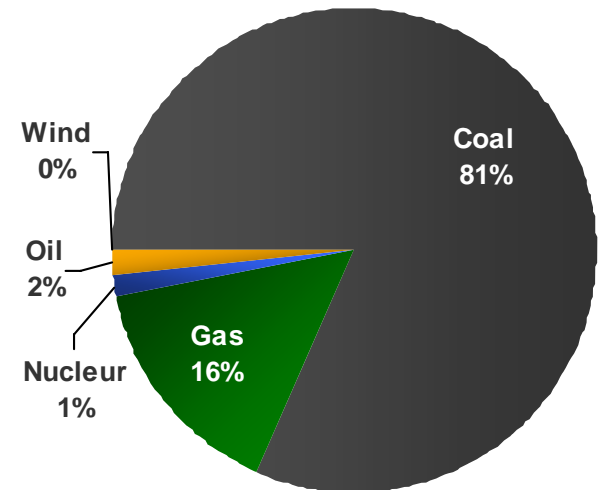
Nameplate Capacity
(9,529 TWH)



Actual Output
(4,156 TWH)



Actual CO₂ Emissions
(2.4 Billion Metric Tons)



What are the Implications?

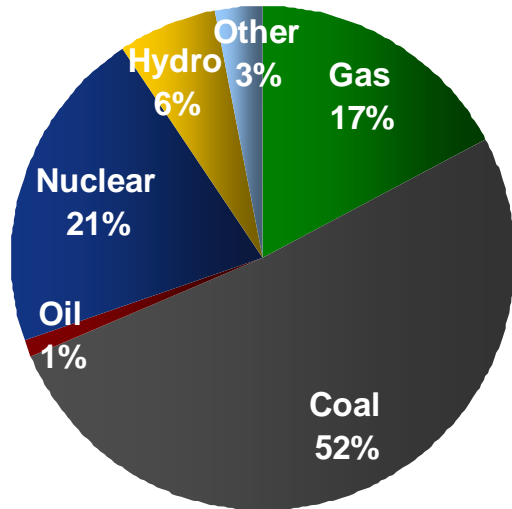
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Already Exists

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Emissions
Reduction Must
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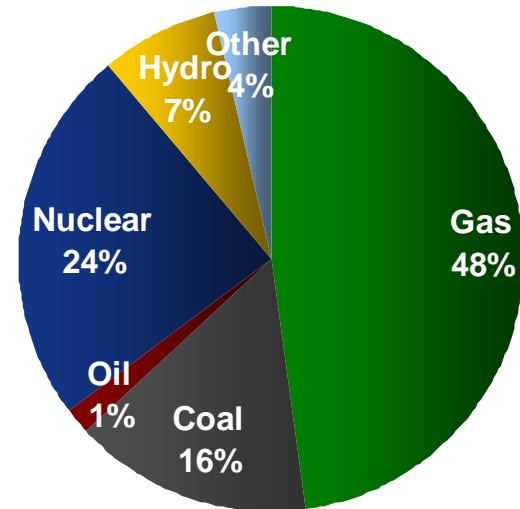
U.S. Electrical Generation Switch (for 25 Bcf/d of Natural Gas)

Current Fuel Mix (107 Bcfe/d)

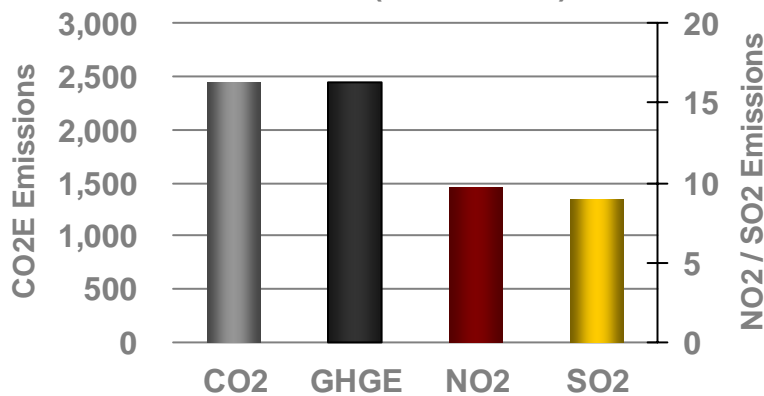


+25 Bcf/d
Domestic Gas

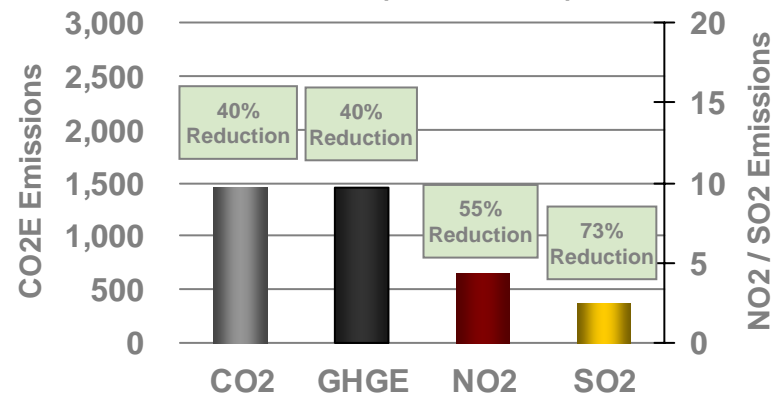
Future Fuel Mix Vision



Emissions (Metric Tons)



Emissions (Metric Tons)



975 MM tons of CO2 = 16% of U.S. Total CO2 Emissions in 2008