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Distributed-Scale LNG Energy Supply and Use for Industrial and Transportation Sectors

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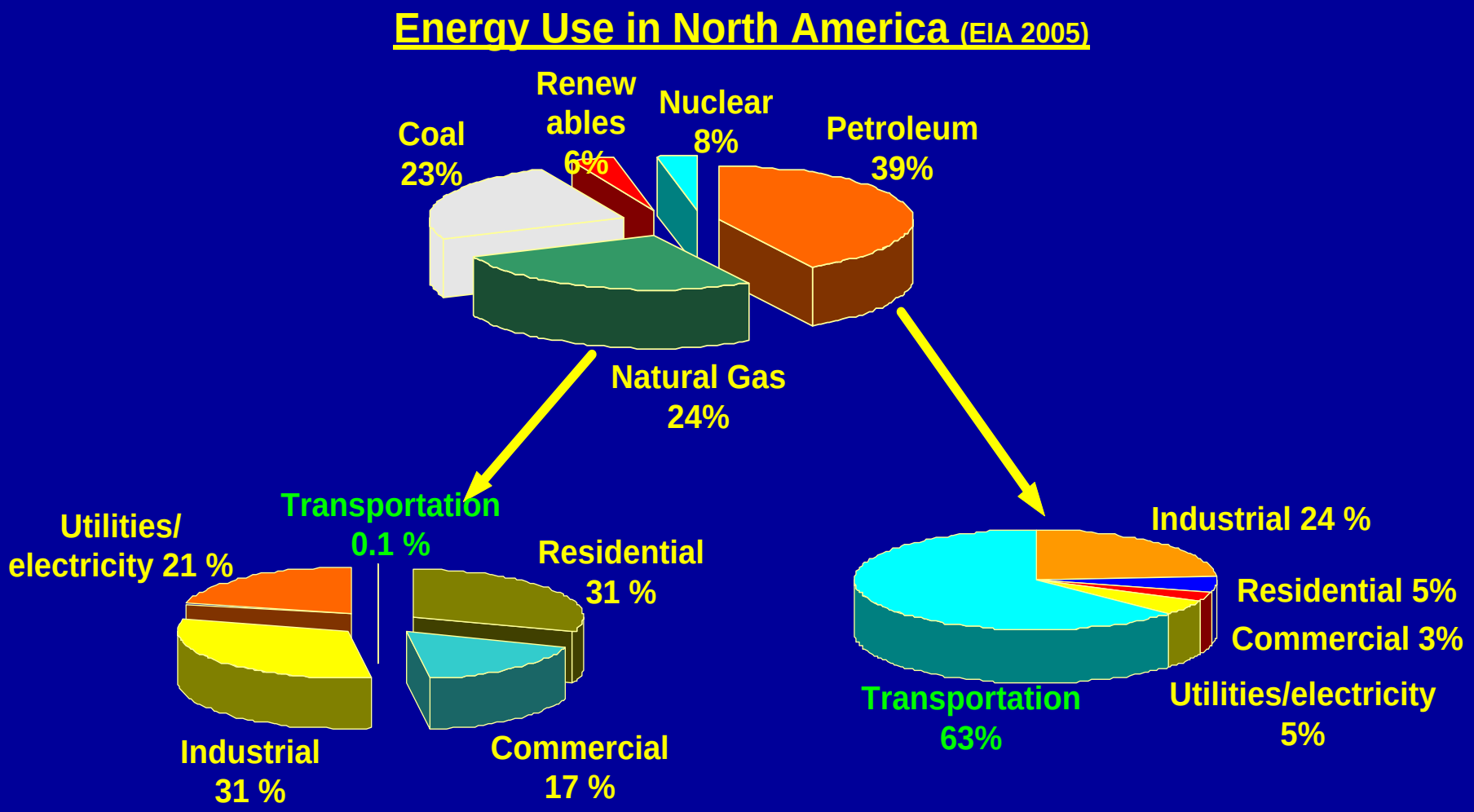
The US obtains and uses ~100 quads of energy per year



Changes in fuel choices are being driven by important issues

- Global supply & demand for crude oil as countries such as China and India make rapid advances
- Domestic energy security
- Climate change and GHG emissions
- Quality of environment and unhealthy air;
- Lowering terrorists profile is pushing distributed-scale supply
- Economics of fuel choices impact balance of payments, significant deficit reduction, US jobs, and quality of life
- Technology innovations along entire energy supply chain with numerous energy sources; renewable and sustainable are key

Natural gas is a great fuel

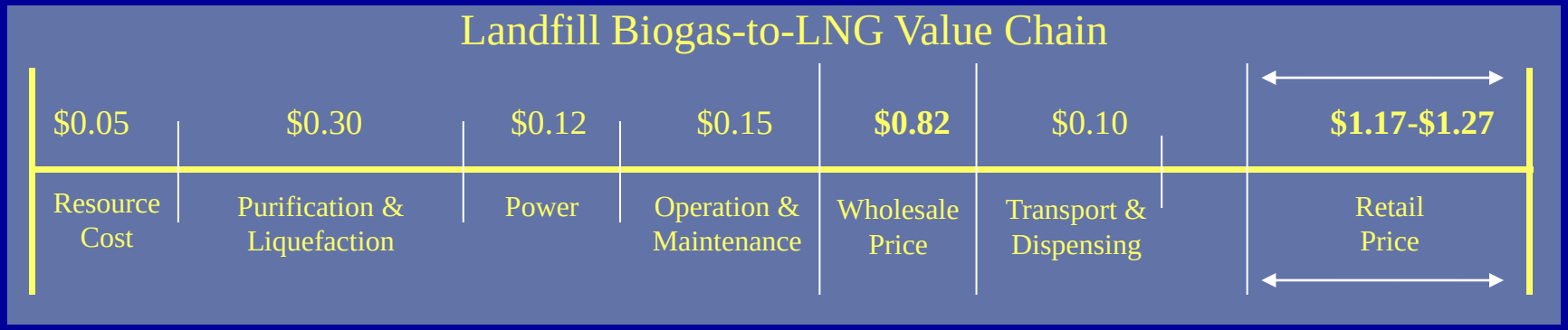
- Methane is clean
  - Much less pollutants such as NOx, particulates, and CO_2 for same energy than higher carbon fuels; 1 carbon in methane vs. 8 in gasoline or ~14 in diesel
- Methane is safe
  - Small flammability range, e.g., NG limits are 5-15 vol.% in air at STP
  - High ignition temperature; 1000-1100 º F
  - NG is lighter than air and disperses rapidly upward in most cases
- Methane is primarily used as low pressure natural gas
  - stored as compressed natural gas (CNG) or as liquid natural gas (LNG)
- LNG is a cryogenic fluid
  - NG is composed primarily of methane (typically, at least 90 %). When natural gas is cooled to a temperature of approximately -260 º F at atmospheric pressure it condenses to a liquid called liquefied natural gas.
  - The liquefaction process removes impurities such as carbon dioxide, sulfur compounds, and water. LNG is odorless, colorless, non-corrosive, and non-toxic.
  - LNG has higher energy density that makes it easily storable & transportable

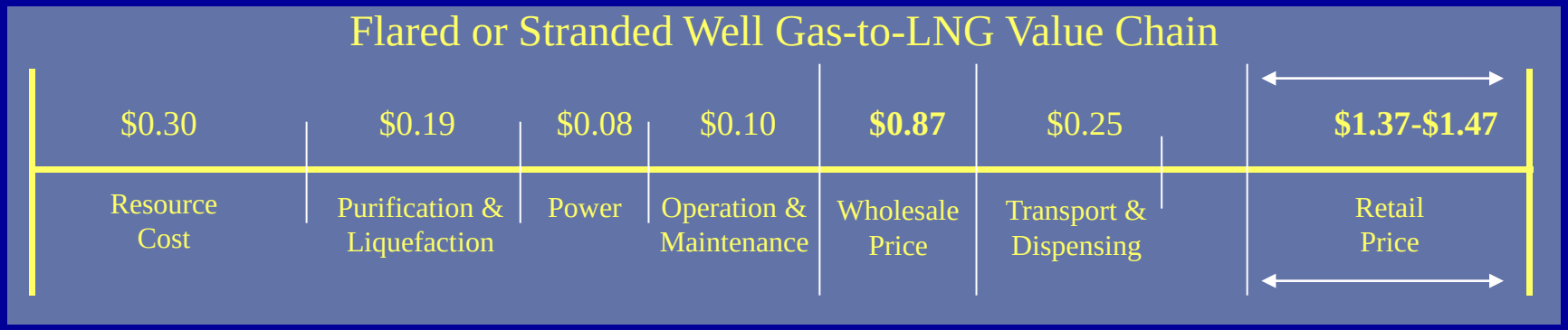
Shale gas has created unique US opportunity

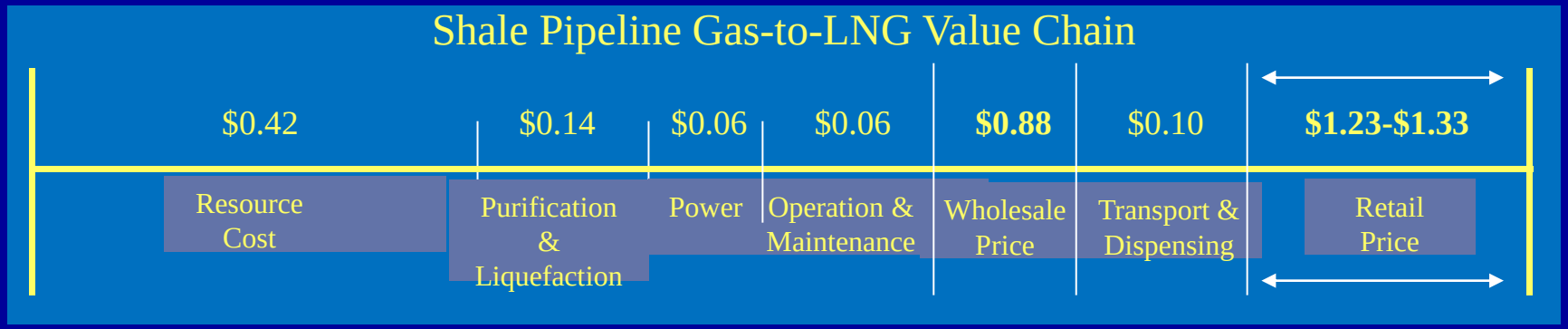
- Methane from shale deposits in US injected into existing pipeline network offers a long-term, stable, low-priced LNG/LCNG fuel
  - ~$4/MMBtu for shale-gas supplied PNG feedstock for next 20+ years
  - ~$18-$20/MMBtu for diesel/gasoline @ $100/bbl
  - ~$10-$12/MMBtu for end use as LNG/LCNG/CNG in vehicles or as NG in industrial uses such as process heat or genset fuel

- Distributed LNG supply and end-use infrastructure are key elements to complete LNG/LCNG supply chain
  - Emerald Energy NW provides purifier/liquefier plants to produce ~10,000 gpd to ~50,000 gpd of LNG from shale gas PNG
  - Emerald Energy NW provides integrated LNG/LCNG refueling stations for HDVs, MDVs, and LDVs for fleet customers
  - Emerald Energy NW provides integrated storage/vaporization systems for industrial customers.

LNG/LCNG energy supply prices have several essential elements







Examples of LNG/CNG End-Users

- Honda Civic GX is a OEM-backed LDV using CNG
- GM has recently introduced OEM-backed vans using CNG
- Numerous HDV and MDV OEMs offering CNG and LNG vehicles for buses, garbage trucks, vans, and others
- After market conversions by several companies for high mileage fleet vehicles using CNG or LCNG

CR&R Waste Services - Stanton, CA

Orange County Transit Authority - Orange County, CA

Prometheus Energy's Bowerman plant is a distributed-scale design with several modular unit operations into an integrated plant. It produced ~1,000,000 gallons of high quality LNG from LFG

Example of a LNG/LCNG Dispensing Facility

Sacramento County refueling station utilized by County's LNG refuse fleet

Prometheus' Cryogenic Tankers at Bowerman for LNG delivery into local fuel market demand