



PROMETHEUS*energy*

Carbon Capture/Recycle Forum

September 18, 2008

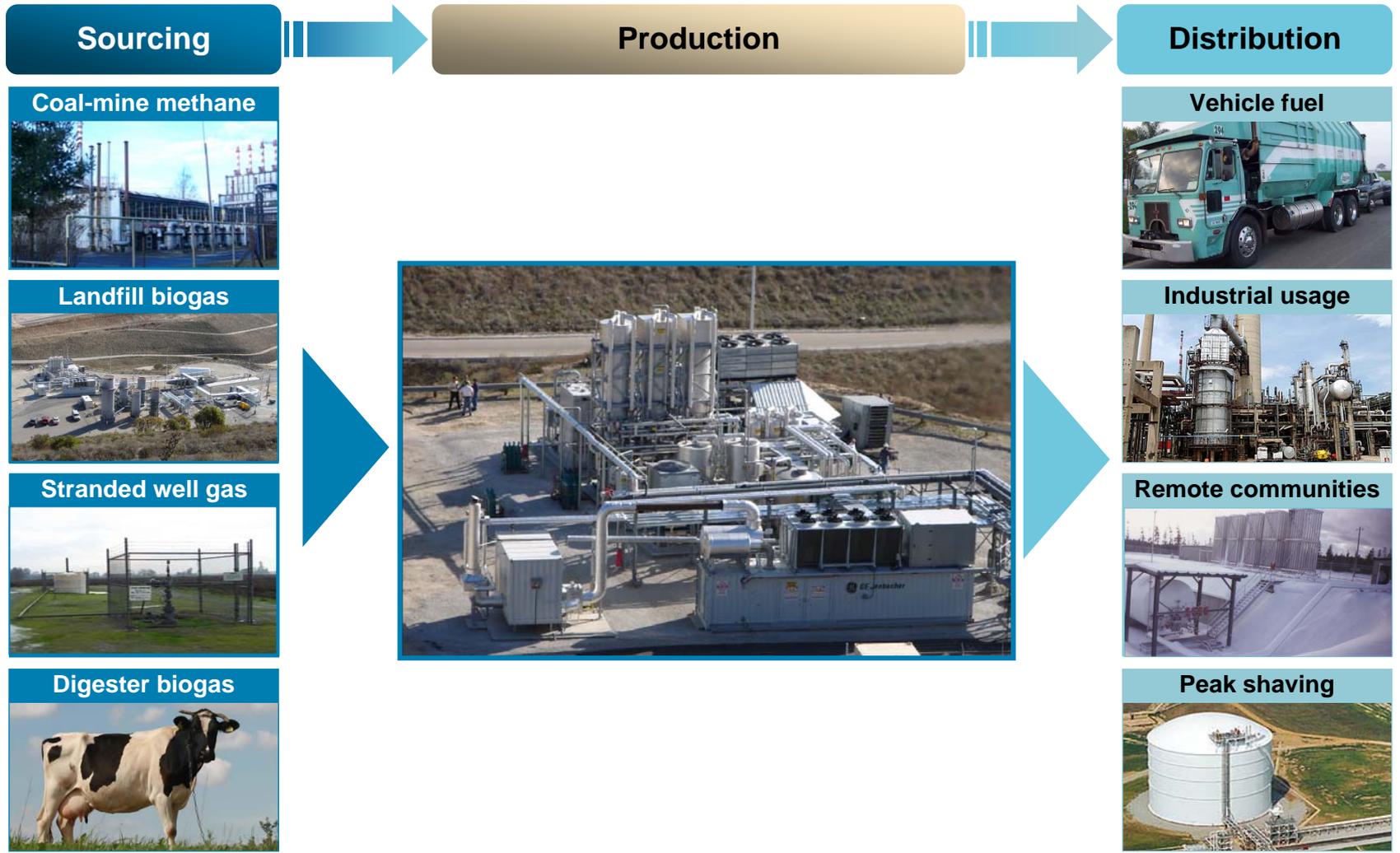




The transportation sector - simultaneously a great challenge and a great opportunity

- Total dominance by gasoline and diesel fuel only in this sector; only NG appeared competitive in early 1990's.
- Average refueling station sizes from fleet market studies indicated a few thousand gallons per day LNG capacity would cover more than 80 % of the demand
 - ~0.5 MMscfd of methane as LNG or LCNG or CCNG
- In the early 1990's no distributed-scale liquefiers making ~5,000 gpd of LNG from ~0.5 MMscfd of pipeline methane were available other than custom orders
- Our strategic technology development focused on making cost-effective technology at distributed-scale sizes to produce LNG that was 'all-in' priced to compete at a small discount against diesel and gasoline
 - Most large and medium-scale technologies for purification and liquefaction did not cost effectively scale down to this capacity
- Technologies were selected from the best available technologies in the public domain as a good starting place while developing better techniques
- We have made numerous improvements and new inventions related to purification and liquefaction during last decade as operating plants have been designed, built, installed and slowly but successfully commissioned and operated

The Prometheus business model evolved from demand side to waste or stranded source supply side





Our technology development vision has evolved too

- The global transition to sustainable, renewable energy supplies and end uses is driven by technology substitution more than by depletion; e.g. this is challenging because of the huge amount of depletable sources such as coal, and methane hydrates.
- Superior energy technologies must technically perform very well; satisfy demands to be economical, secure, and renewable; be friendly to the environment; utilize waste streams; reduce or eliminate climate change impacts; and embody carbon capture/recycle methods; e.g. H₂ use for gasification of coal to make CH₄ without production of CO₂!
- Economics should and will strongly influence choices among practical energy scenarios, e.g. produce a fuel so superior to gasoline or diesel fuel that its adoption is compelling!
- The transportation sector is the most challenging because of the dominating dependence on gasoline and diesel and because it is a huge, profitable business; e.g., in the US it is more than \$150 billion/year so success here drives a transitions globally.
- We are focused on advanced technology for methane and hydrogen that enables an economically competitive and environmentally friendly transition to renewable & sustainable energy for the transportation sector; e.g., a sustainable CO₂ to CH₄ fuel cycle!
- Electricity, hydrogen, and **renewable-recycled methane** will be the preferable sustainable energy carriers in the coming decades.

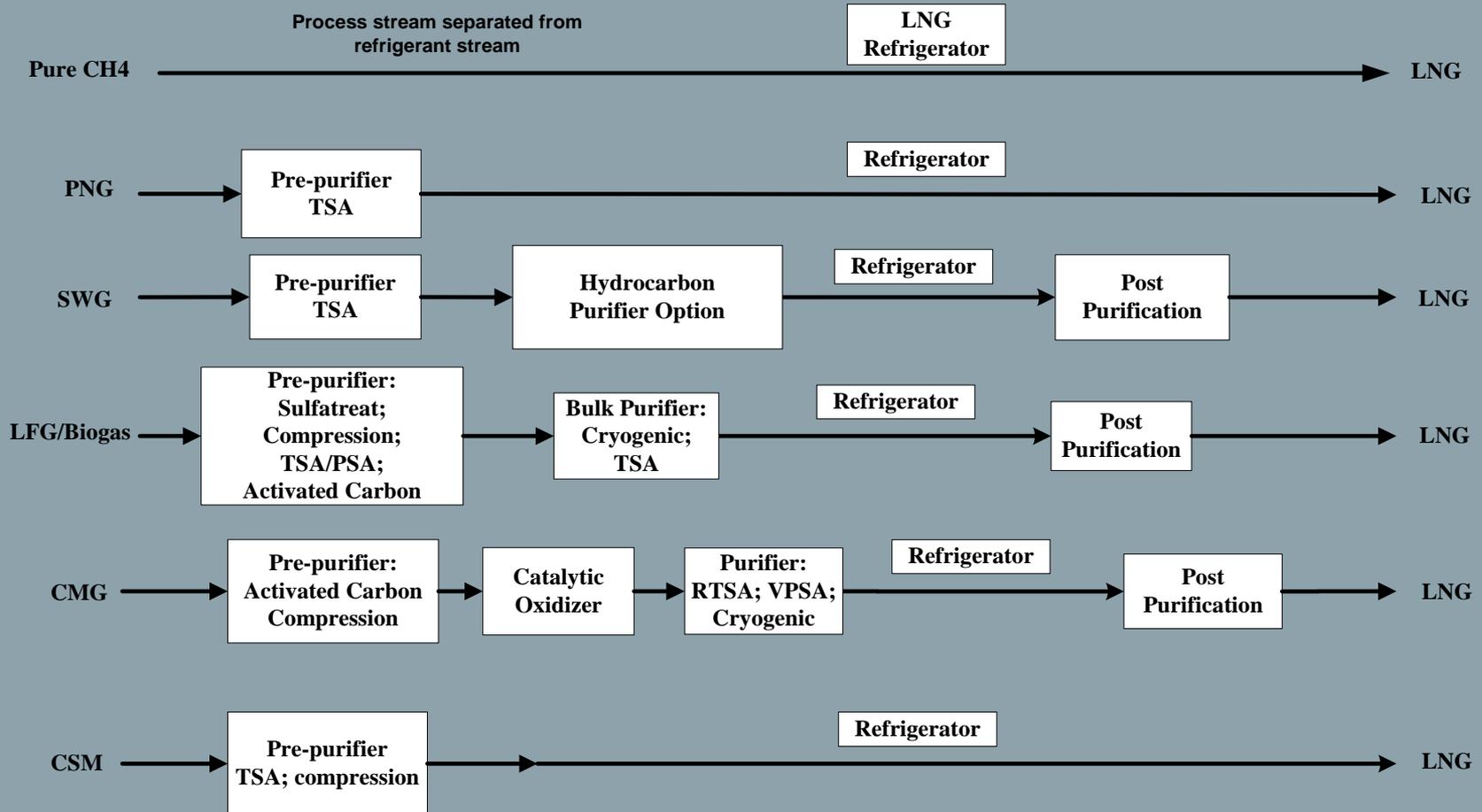


The distributed nature of methane sources & end uses requires innovative economic technology

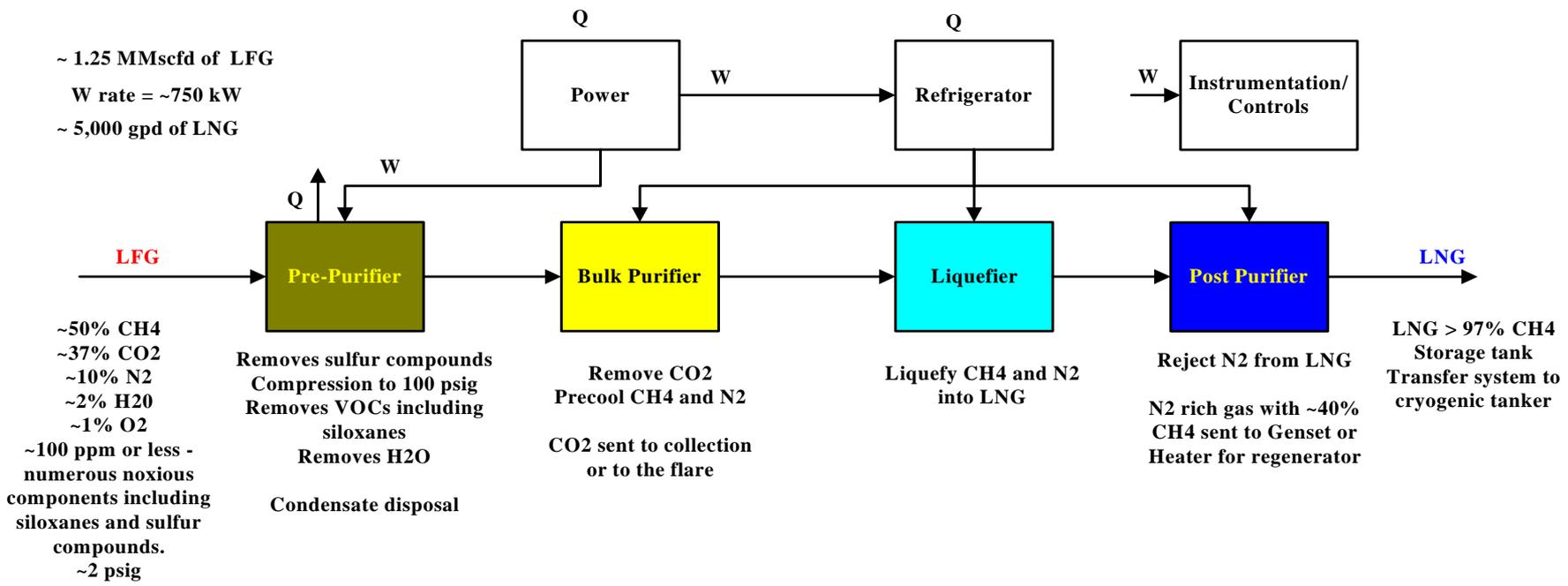
- Our focus is on purification and liquefaction technology for new applications in waste-to-biogas-to-LNG & LH₂ for transportation.
- Use modular, distributed-scale anaerobic digesters to make biogas at waste-to-biomethane-to-LNG facilities.
 - Use a combination of waste streams from animals, food processing, municipal solid waste, and from algae and other non-food biomass.
 - Unique advantages from capture of CO₂ from biogas purification & from vehicles with recycle into biomass via algae farms fed with CO₂ + solar.
- Conversion of biogas to LNG adds significant value.
 - Vehicle fuel that is significantly less expensive than diesel/gasoline
 - Local production matches sources to end users
 - Readily stored for secure, reliable supply coupled by cryogenic transport network.
- Our ‘gated’ approach for advanced development is to analyze, design, & validate a sequence of lab and engineering prototypes to understand and validate the technology.
 - Prove it is less expensive, significantly more efficient, rapid to deploy, and robust to operate.
 - Provide a sound basis for writing a strong patent applications.

Prometheus has developed innovative purification & liquefaction technology for distributed-scale sources

Evolution of Prometheus Energy Company's Technology

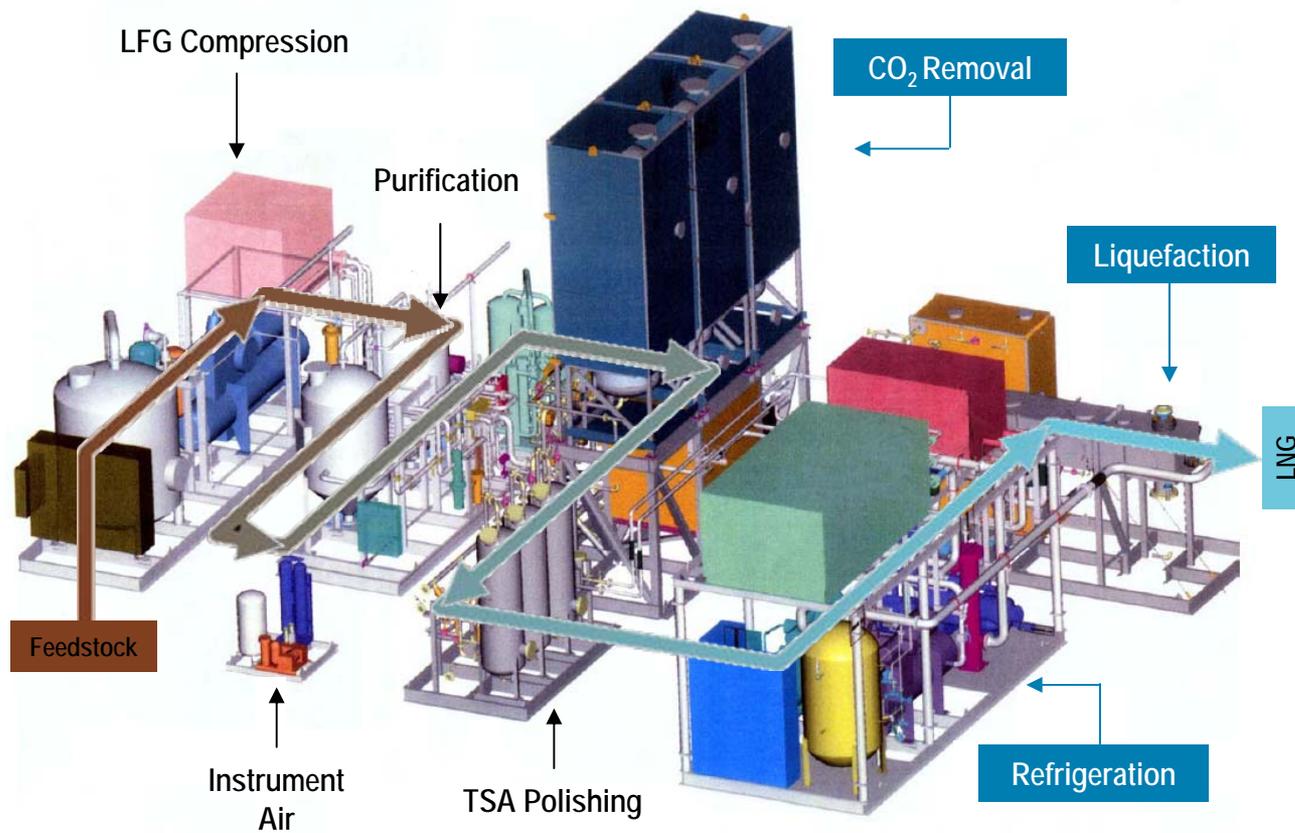


The facility at Bowerman Landfill is a great commercial beta site that also provides a basis for commercial biogas to LNG projects



Prometheus' bulk purification technology has been tested/improved by converting LFG to LNG

Illustrative facility



Prometheus' Competitive Advantages

- Proprietary small-scale purification and liquefaction technology
- Scalable modular design enables rapid and portable deployment
- Integrated purification and liquefaction system leads to higher efficiency and lower power requirements

Proprietary / Unique Technology



Frank R. Bowerman Landfill

- Located in Orange County, CA
- Landfill is owned/operated by Orange County Integrated Waste Management Department
- Landfill site is 725 acres
- Max permitted daily acceptance rate is 8,500 tonnes/day
- 10 million standard cubic feet of LFG is flared each day





The Bowerman-I beta-site distributed-scale design incorporated many efficiency features with integrated modules, sensible heat and cold recovery, and use of process waste streams





Cryogenic tankers for LNG delivery into increasing fuel market demand



- Q2 2007 - Kenworth T800 equipped with Cummins ISX and Westport HPDI Fuel System
- Q1 2008 - Ports of Los Angeles and Long Beach announces [\\$US 1.6 billion Clean Truck Superfund to replace 16,800 Class 8 trucks](#) with LNG-powered vehicles.



Example of a LNG/LCNG Dispensing Facility



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

Benefits of Natural Gas Vehicles

- Particulate matter reduction of 65-95%
- Smog-forming compounds (NOx) reduced by 32-73%
- Airborne toxins (non-methane organic compounds) reduced by 69-83%
- 15-20% Greenhouse gas emissions reduction

CR&R Waste Services - Stanton, CA

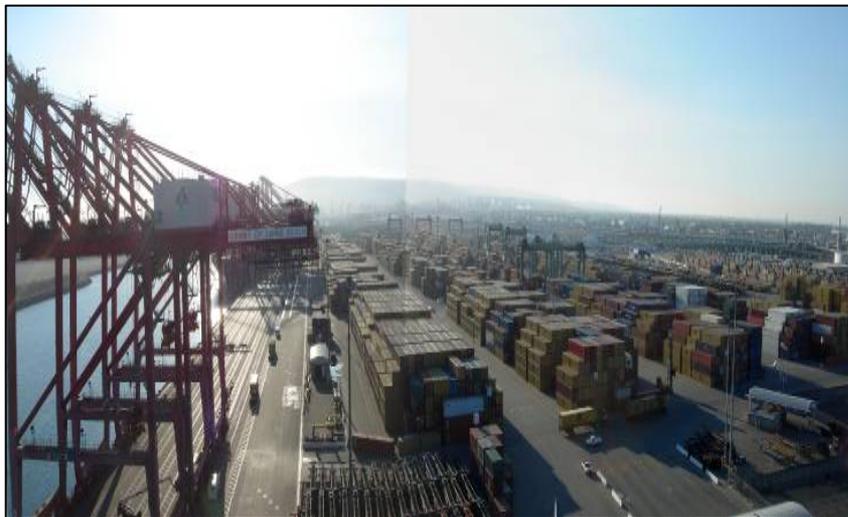


Orange County Transit Authority - Orange County, CA





SSA Marine UTR Demonstration



- Prometheus Energy Company is working with SSA Marine converting diesel-fueled tractors (UTRs) to LNG.
- LNG-fueled tractors generate a 77% reduction in Nitrogen Oxide (NOx) and a 93% reduction in Particulate Matter (PM).
- The U.S. Environmental Protection Agency requires such emission levels by 2010.
- SSA Marine's facilities in Southern California use more than two million gallons of diesel annually.

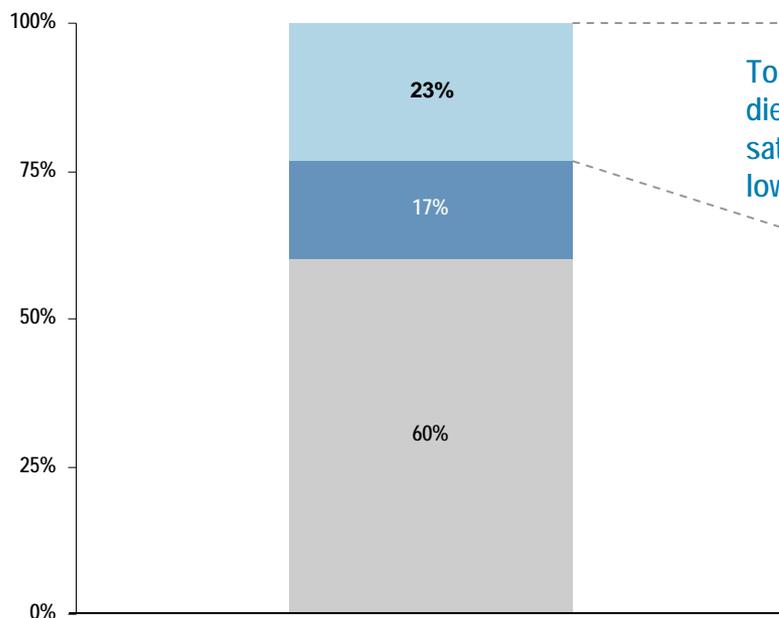


Potential LNG Supply from Waste Methane Resources - Example of the USA⁽¹⁾

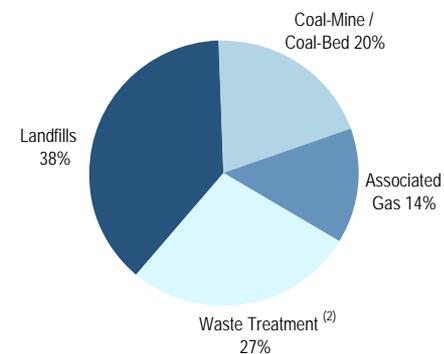
Gas demand breakdown in the US ⁽¹⁾

DGE

Total: 101.7 million DGE



Today almost ¼ of the US diesel gas demand could be satisfied by non-traditional, low-cost gas sources of LNG



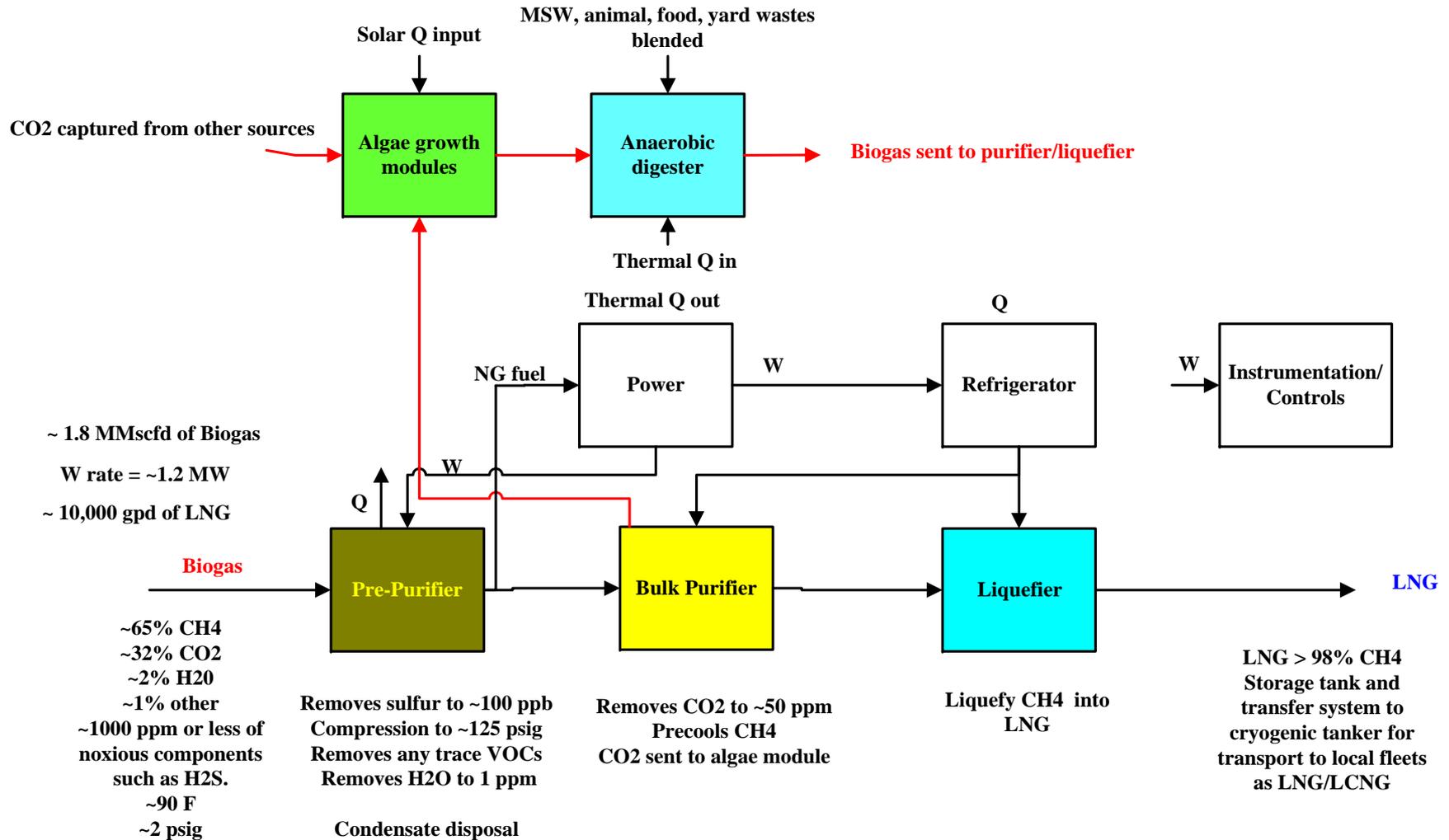
- Landfills alone stand for almost 40% of the whole potential LNG resources
- Coal-mine / Coal-bed represent 20%

These trends could be extrapolated to most developed geographical areas

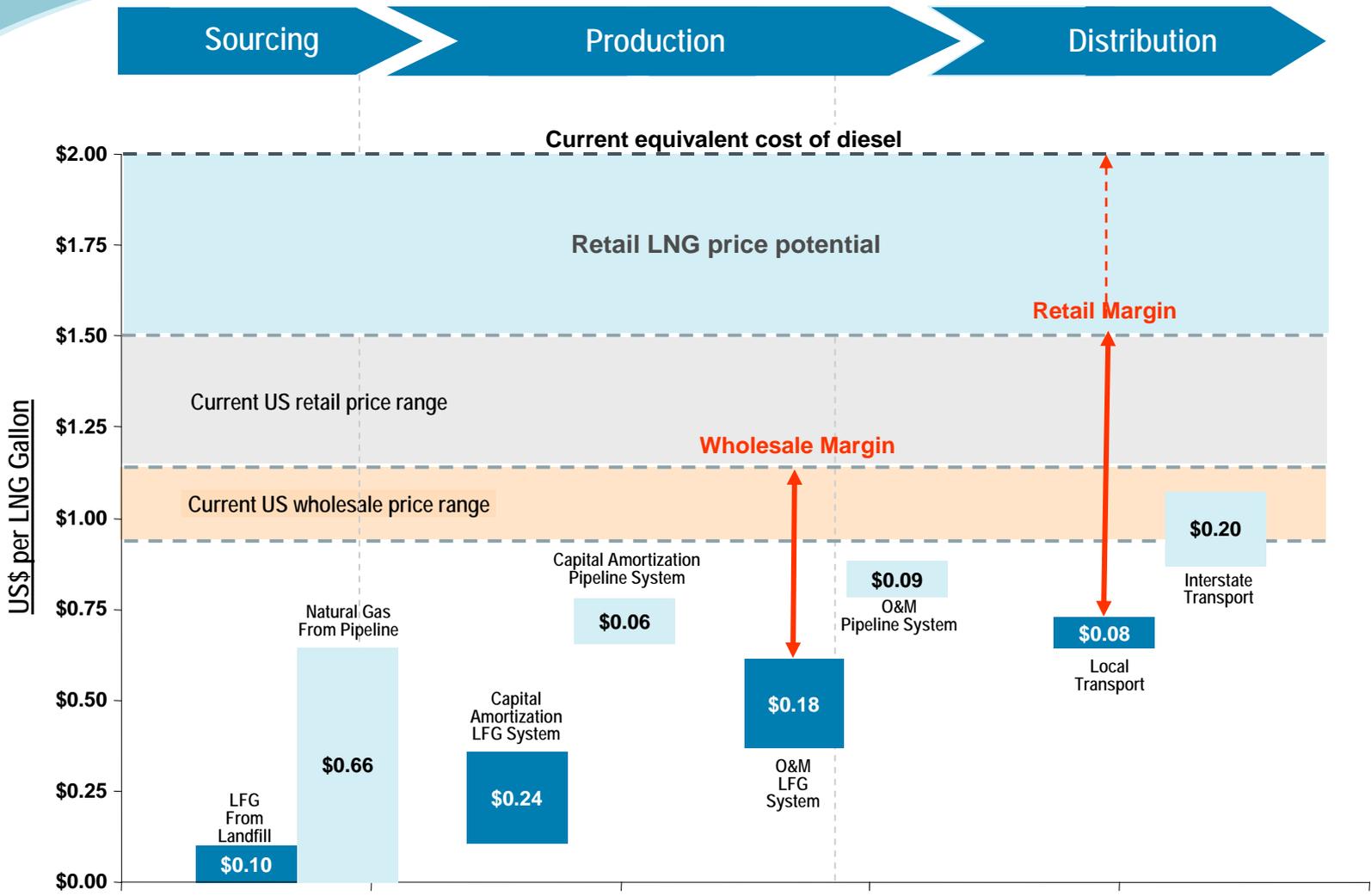
- LNG from "non-traditional" sources of methane, part of which is landfill gas
- LNG from pipeline and stranded well resources
- Remaining diesel demand

(1) Source: EIA - Adjusted Sales For Transportation Use: distillate fuel oil and residual fuel oil, 2004
 (2) Includes Waste Water and Manure Management

The ability to capture high grade CO₂ cryogenically and distributed scale liquefaction provides an excellent source of LNG for fleets



The economics of biogas to LNG for vehicles can be compelling



Prometheus' competitive advantage secures low-cost source and customer proximity

(1) For illustration purposes - actual figures will vary from one project to another – assume Natural Gas price at \$8.00/mmBtu
 (2) Historically, LNG has been priced at a bargain to diesel, but there are now specific instances of price and margin increases as LNG becomes a more mainstream fuel for fleet users. Given the superior qualities of LNG over diesel, we expect this trend to continue.