Biogas Development: Challenges & Drivers

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A Leading International Oil and Gas Company

Source: BP Annual Report 2015

Our marketing and trading team optimizes & trades around our extensive global asset base.

70+
Countries of operation

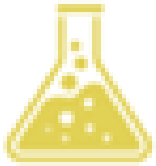
~80,000
Employees

$19.1 billion
Operating Cash Flow*

3.3
Million barrels of oil equivalent a day

17,180
Million barrels of oil equivalent net proved reserves (estimated)

7,146
Million cubic feet of total gas production per day



14.8
Million tons of annual petrochemicals production

13
Refineries

Expansive Commodity Coverage

Refined Products
Heating Oil, Gasoline, Diesel, Crack Spreads, 3:2:1, Various Grades of Refined Products

Chemicals
LLDPE, LDPE, HDPE, PGP, PP, Eth, RGP

Ethanol & Agricultural Products
Corn, Soybeans

Crude
WTI, Brent, major global grades, Canadian Heavy, WTI%, WTI differential, Physical, Financial, Options

Power
Transact in all North American ISOs/RTOs; commodity swaps, standards and exotic options for electricity, heat rates and spark spreads

Natural Gas Liquids
C2, C3, C4, IC4, C5, Conway, MtB, Edmonton, WTI%, ARA, FEI

Natural Gas
NYMEX, trades at most Platts pricing points

Biogas
RIN & LCFS generation from landfill biogas

Gas Solutions for the Transportation Sector

We are active in RINS & LCFS generation from landfill biogas.

We deliver transport fuels in addition to associated environmental credits, and we optimize value for both buyers and sellers.

We provide credits to customers to meet sustainability initiatives.

- Active at state/federal levels
- Understand regulatory and reporting requirements
- Offer innovative structures
- Strong balance sheet
- A- credit rating (S&P)
- Appetite for risk
- Web of assets to fulfill requirements

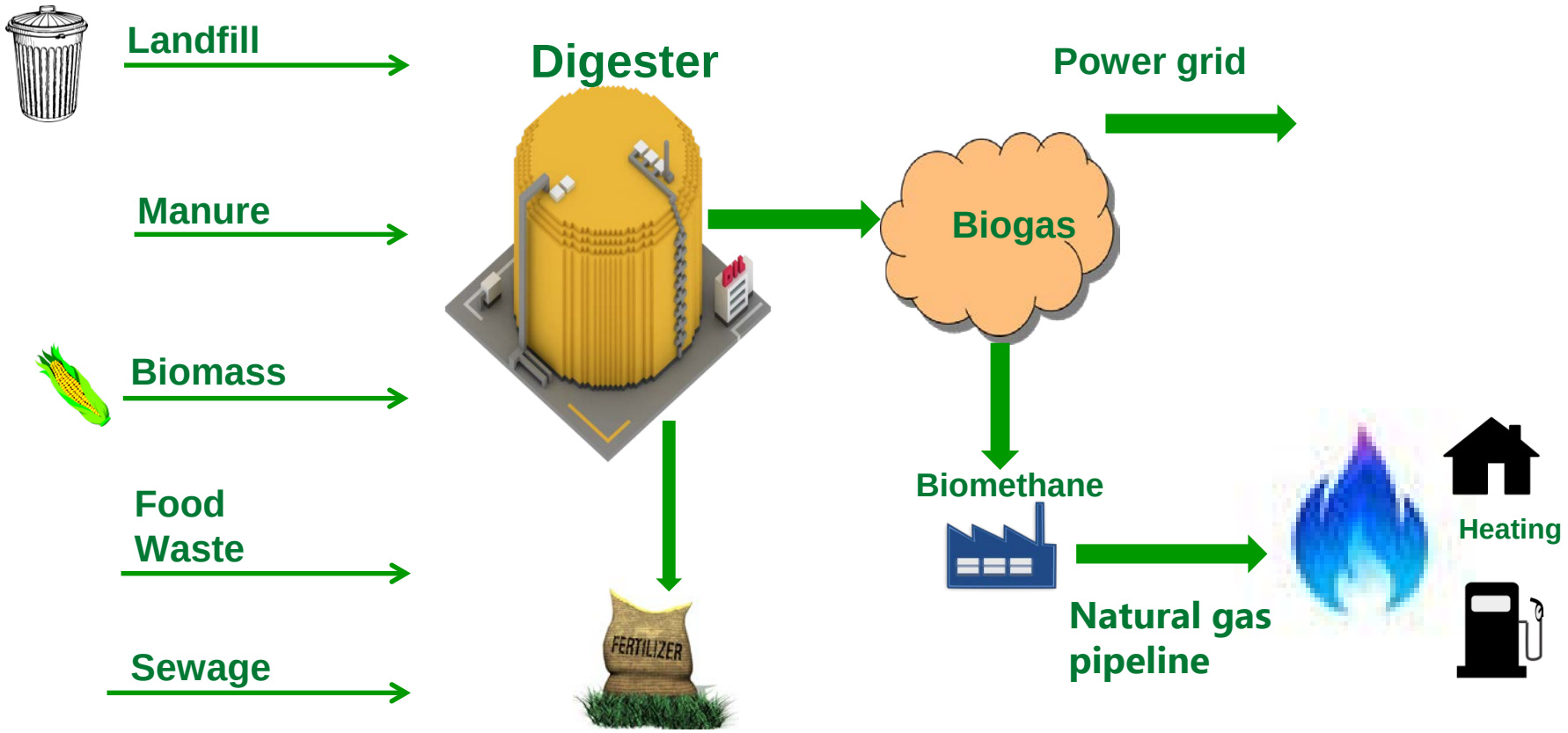
300,000+ Compliant LCFS Credits

130+ Million Renewable Identification Numbers (RINS)

15+ Registered Biogas Pathways

70+ CNG & LNG Fueling Stations

What is Biogas?



- **Biogas** is a mixture of methane & other gases produced from the decomposition of organic materials. It is produced naturally in landfills and from the processing of animal waste, sewage, crop waste and cellulosic and non-cellulosic crops.
- **Biomethane** is a pipeline-quality natural gas-substitute produced by purifying biogas.

Demand for Biogas:
Federal / State / Voluntary Green Initiatives Create Demand

Federal Program

Renewable Fuel Standard

- Importers and Refiners are obligated to produce an allocated amount of transportation fuel from renewable sources

Renewable Identification Numbers (RINs)

State Programs

California AB 32

- Reduce statewide emissions to 1990 levels by 2020
- 9/8/16 – Climate programs extended to 2030

Carbon Allowances (CCAs) / Carbon Offsets (CCOs)

Low Carbon Fuel Standard Credits (LCFS)

Renewable Energy Credits (RECs)

Voluntary

Corporate Responsibility

- Corporations define parameters and value

Walmart

NewLight Tech

Google

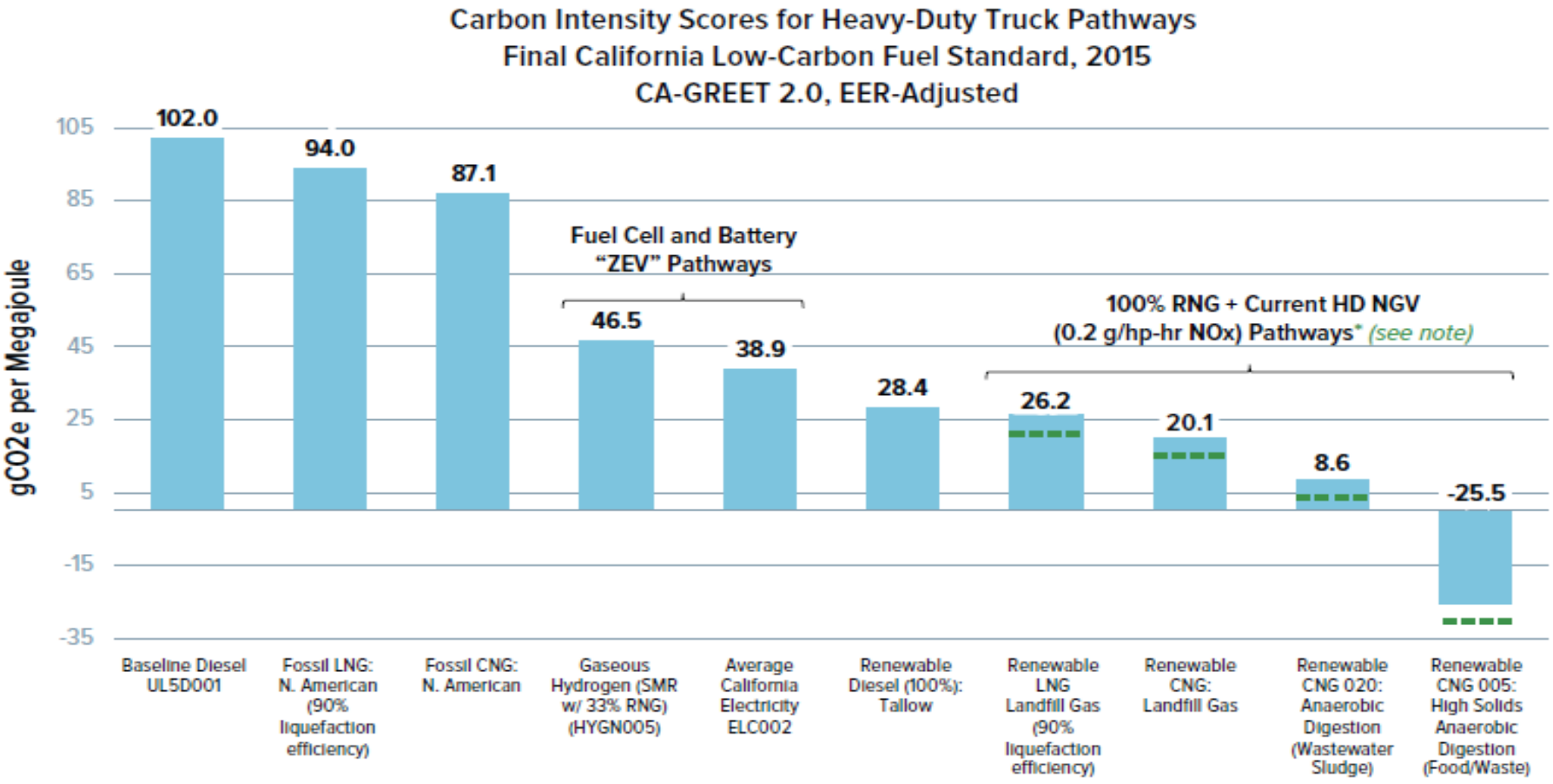
SAFEWAY

Apple

No obligation = No Currency

What's Next: Next Gen NGV Engines + RNG

RNG = Best GHG Reduction on Lifecyle Basis

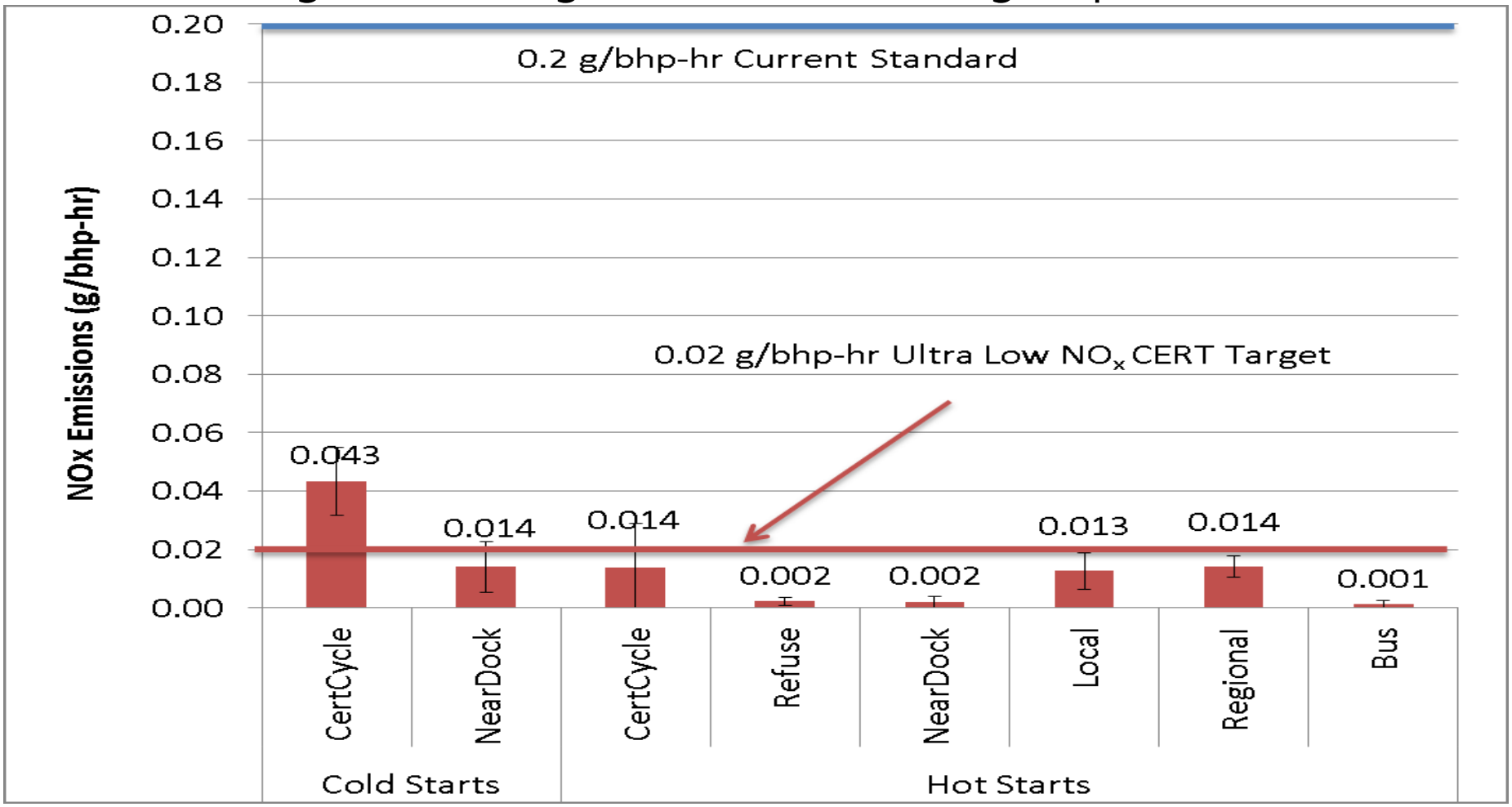


*** Note:** using the new "NZ" NG engine (0.02 g/hp-hr) **will further reduce the CI scores of these RNG pathways by about 4 gCO_2e/MJ** (closed crankcase ventilation reduces methane by 70%).

Source: California Air Resources Board, "LCFS Illustrative Fuel Pathway Carbon Intensity Determined using CA-GREET2.0," discussion presented by staff on 9/17/15 and/or CARB LCFS Final Regulation Order, Table 6; note that *HSAD pathway is EER-adjusted by the CARB formula (-22.93 base CI divided by EER of .9), even though this improves its CI score.

How Low Can We Go? ULNOX Engines

Volume Weighted Average Emissions : 0.018 g/bhp-hr



From Johnson et al (2016), Final report "In-Use Ultra-Low NOx Natural Gas Vehicle Evaluation ISL G NZ 8.9", Feb 2016. SCAQMD Funding.

How Much Can We Produce?

- 2016 GGEs sold: 120mm
- 2017 Industry Estimate: 250mm GGEs of RNG sold
- 2018 Industry Estimate: 400mm GGEs of RNG sold
- CA rapidly approaching 100% RNG for CNG/LNG vehicle fuel demand
- In 2013: 14mm GGEs sold (rapid, exponential growth)
- UC Davis estimates sufficient biomass for 1.8 billion GGEs of RNG in CA alone (60% of diesel use)
- NPC estimates 35 billion GGEs nationwide possible – 1.2 times total diesel consumed by freight trucks

Source: 2016-2018 information from Coalition for Renewable Natural Gas, EPA data. CA RNG use from LCFS data provided by California Air Resources Board.

Challenges

- **COST:** Cost of RNG Production is Significantly Higher than Long Term Natural Gas Prices
  - Economically sustainable production depends on long term monetization of environmental attributes at price sufficient to close gap or breakthrough in production
  - Regulatory programs (LCFS, RFS, RPS programs) drive market and are inherently uncertain

- **DEMAND:** We need more RNG trucks on the Road
  - "With Friends Like These….." Increasingly vocal portion of the environmental community opposes any programs that involve internal combustion engine which will hamper efforts to build RNG vehicle fuel demand

- **INFRASTRUCTURE:** Infrastructure Challenges:connecting the biomass feedstocks for RNG to existing distribution systems is expensive and unclear who will provide the capital to do so in a cost effective way