



Renewable Natural Gas for Transportation

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Renewable Natural Gas



RNG

A “now” and “long-term” renewable transportation fuel;
accessible to all transportation sectors...here's why



Here & Now

- RNG is available here & now
- Drop-in Ready
 - Can be used in ANY EXISTING natural gas engine
- How?
 - Because Natural Gas is an interstate commodity that has “pipeline specifications” that ensures all natural gas meets a minimum set of standards



Here & Now

- Fossil natural gas is more widely available
- RNG production capabilities?
 - Tap into any existing methane (CH₄) generating facility
 - Landfills
 - Animal Farms
 - Waste Water Treatment Plants
 - Organic Waste Processing Facilities



Install a processing skid that turn the raw gas in pipeline quality RNG

Here & Now

- Not just Domestically produced...
 - REGIONALLY produced
 - More local impact economically
 - More local impact environmentally
- Can be locally produced and sold nationally
 - In CA, need gas utilities to be encouraged to accept RNG injection more easily



Here & Now

- Proven propulsion technology is only getting better
 - 1992 – Cummins first CNG engine introduced as the L10G
 - 2016 – CumminsWestport introduced the ISL G Near Zero (NZ)
 - Meets or exceeds:
 - EPA 2016 NOx Limit of 0.2 g/bhp-hr
 - CARB 2023 NOx limit of 0.02g/bhp-hr

8 Years Early!



Long-Term

- There will always be waste!
- Carbon Negative Impact on Quality of Living!
- Future production facilities



Long-Term

- Waste will ALWAYS have to be managed
 - Organic materials from:
 - Food Waste
 - Green Waste
 - Human Waste



Long-Term

- Carbon Negative

- What?

- Fancy word for a “Well-to-Wheel” (or full cycle) fuel profile
 - When RNG is produced with an Anaerobic Digestion system, the RNG is actively cleaning and pulling emissions out of the air
 - How?
 - Because crop use the compostable digestate & CO2 molecules to produce more food

- As of 2016, CARB LCFS CI value of -22*

- CARB Diesel is at 102.01*

- *Based on 2015 LCFS Final Regulation Order



Long-Term

- Landfills
 - Decomposition will occur for decades
 - Higher and better use than flare...and even electrical generation
 - Transportation Fuel
 - Capture it, Process it, Use it
 - 2014, 38%* of California's Waste Stream is Organic & can be used to produce RNG
 - *2014 CalRecycle Disposal Facility Characterization of Solid Waste in California

2014 – 11,600,000 tons!!



Technology

- CumminsWestport ISL-G Near-Zero Engine
 - Bringing NG powered vehicles down to battery level emissions
- Momentum Fuel Technologies' lower pressure regulator
 - 48% improvement over previous model
 - New minimum working pressure of 230 PSI (from 450 PSI)
- Volute's Conformable tank
 - Less wasted spaced
- Cenergy Solution's carbon absorption & filtration technology
 - Increase fuel volume with same tank size



Thank you

