MEETING CALIFORNIA'S AIR QUALITY GOALS THROUGH CLEAN HD VEHICLE MARKET COMMERCIALIZATION

Prepared for the California Dairy Digester Working Group
9/7/2017

California's Robust GHG Emission Reduction Goals

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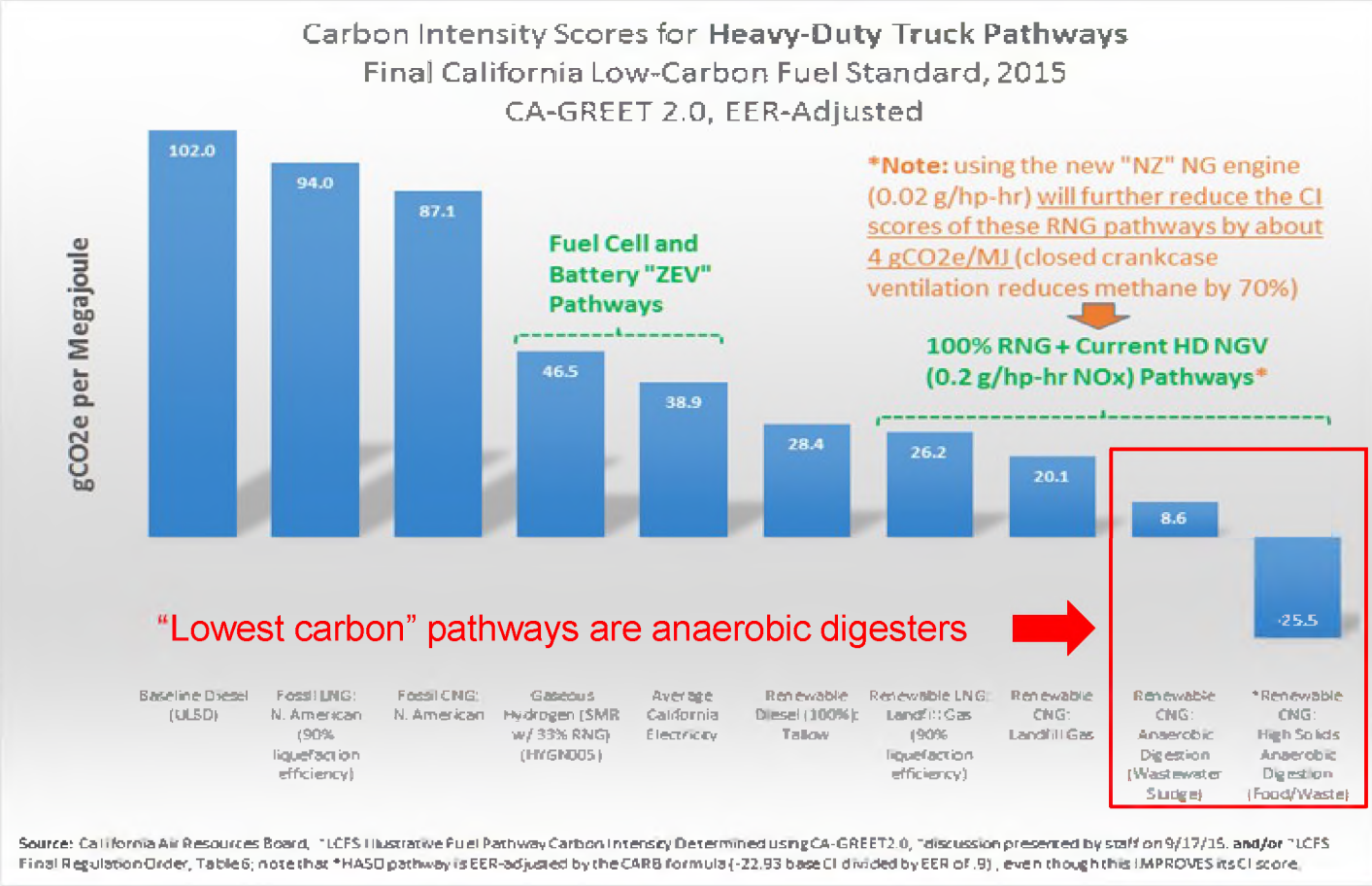
Renewable natural gas created by digesters can help the state get there

SB 350
Cut GHG emissions 40% below 1990 levels by 2030, and 80% by 2050

SB 1383
Cut dairy and livestock methane emissions 40% from 2013 levels by 2030

- 26 million metric tons of CO_2e[(1)]



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 "LCFS Final Regulation Order, Table 6; note that *HASD pathway is EER-adjusted by the CARB formula (-22.93 base CI divided by EER of .9), even though this IMPROVES its CI score.

(1) CARB SLCP Reduction study, March 2017, Table 8

Dairy and Livestock RNG Development Opportunity

1. Contribute to the state's GHG reduction goals
2. Produce a very low carbon intensity fuel
3. Reduce harmful air pollutants (NOx) through the deployment of new NZ transportation technologies
4. Support the California economy by creating a "demand pull" for RNG:
   - Creating jobs
   - Creating additional tax revenue
   - Promoting technological development/advancement

"**California's dairy and livestock industries account for more than half of the State's total methane emissions** and for about five percent of the State's GHG inventory."
-CARB SLCP Strategy

Table 8: Proposed New Methane Emission Reduction Measures and 2030 Estimated Emission Reductions ($MMTCO_2e$)[1]

Measure	2030 Annual Emission Reductions	2030 Annual Emissions
2030 BAU[2]		117
Dairy and Other Livestock (Manure and Enteric Fermentation)	26	
Landfill	4	
Wastewater, Industrial and Other Miscellaneous Sources	7	
Oil and Gas Sector	8	
2030 BAU with new measures		71[3]

Meeting SB 1383 Goals with RNG in Transportation

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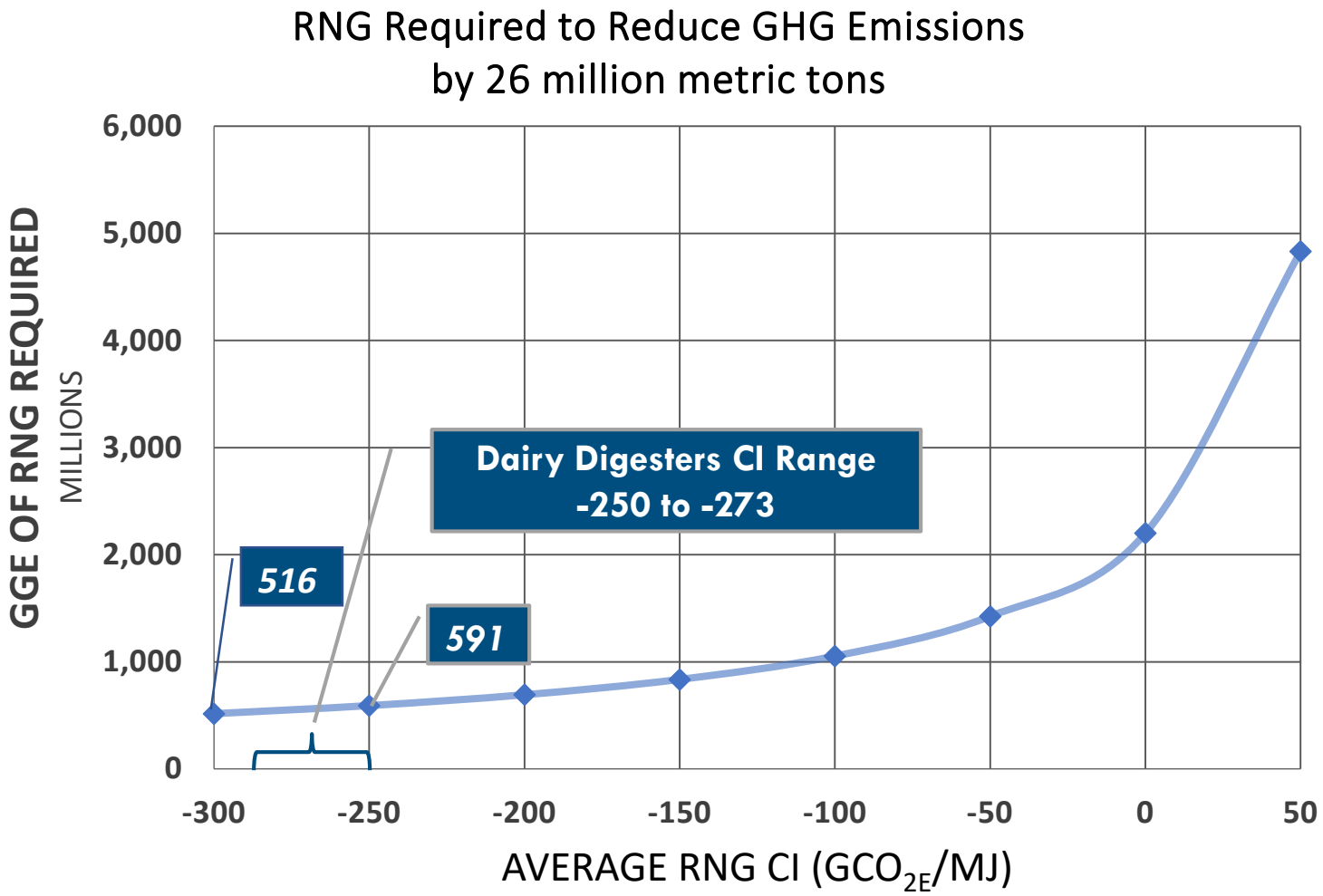


Benefits of RNG as a Transportation Fuel

Captures and redeploys GHG emissions to the benefit of the California economy

- Supports state's GHG goals, creates jobs, advances technology
- Reduces harmful emissions in the most polluted areas in the state with NZ technology

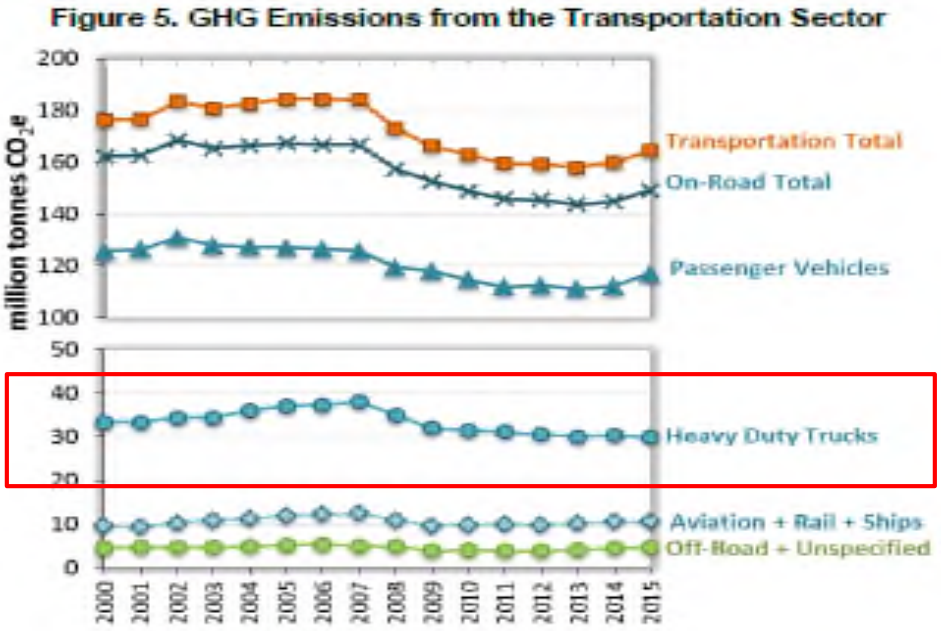
Reduces the risk associated with agricultural RNG development

- Clean fuel programs – RIN, LCFS
- Contracted offtake
- Indirect grants for end users (trucks)

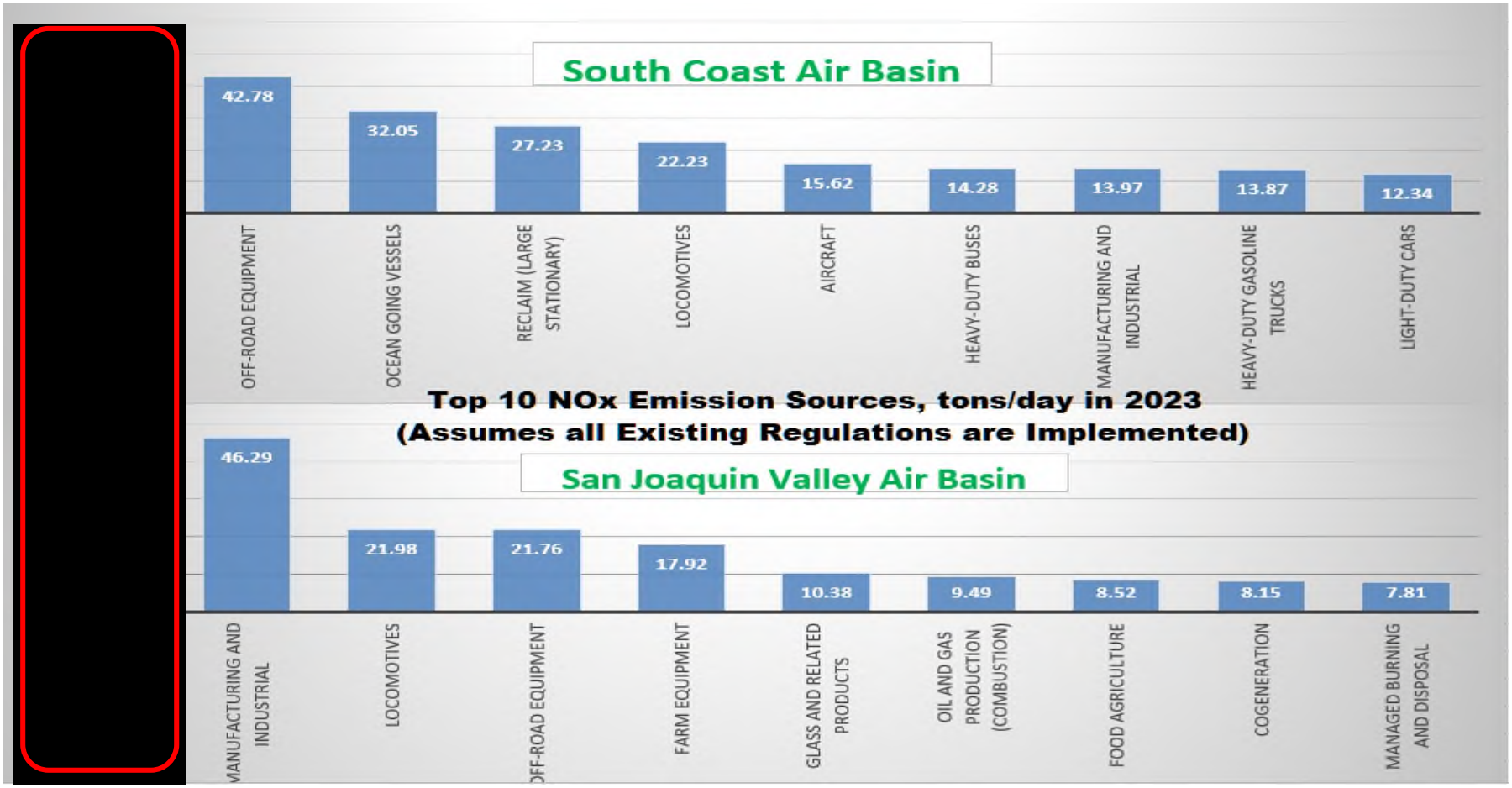
Targets largest GHG source: transportation

- HDVs are "low hanging fruit"
- High mileage, high fuel consumption
- HD NZ technology is available today
- Capability to deploy in large numbers

"The **transportation sector remains the largest source of GHG emissions in the state**, accounting for 37% of the inventory, and had an increase in emissions in 2015."
CARB 2017 GHG Inventory



HD diesel trucks are "low hanging fruit" for NOx reduction



CA's current approach to cleaning up heavy duty truck emissions

Regulatory: Truck & Bus, Vehicle standards, Anti-idling. ***Results in fleets meeting minimum standard to reduce cost and maintain service.***

Incentive Based:

- NGVIP @ $25k maximum
  - Insufficient funding to achieve market penetration
- HVIP @ $15k maximum for low NOx engine
  - Insufficient funding to achieve market penetration
- Prop1B @ $100k maximum
  - Requires scrappage of older vehicles (pre 2009)
- Carl Moyer @ $60k maximum
  - Insufficient funding to achieve market penetration.
  - Requires scrappage of older vehicles (pre 2010)
- MSRC Infrastructure @ $325K maximum
  - Only one air district
  - Doesn't focus on corridor completion

Current incentive challenges:

- Not aligned with market conditions to incentivize HD commercial carriers
- Focus is on older truck replacement
- Not sector focused in most cases
- Not comprehensive

What does this mean?

- Conversion economics don't pencil out for most fleets, conversion rate is slow
- Smaller fleets with older, higher polluting trucks can't afford a new HD AFV
- The larger, more financially capable fleets are turned away due to "newness" of fleet, and conversion economics

Infrastructure Deployment is Still Needed

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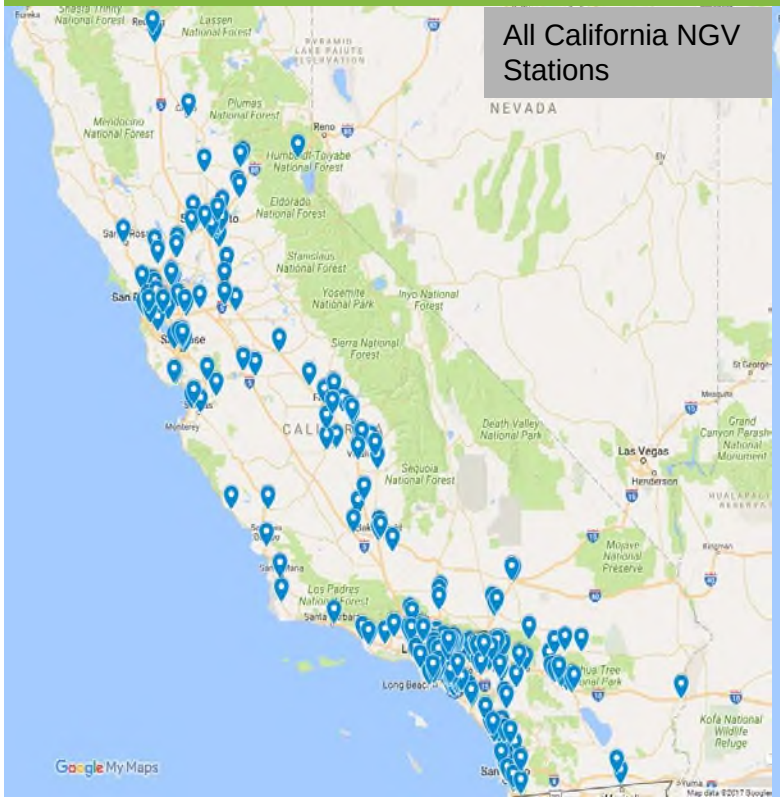
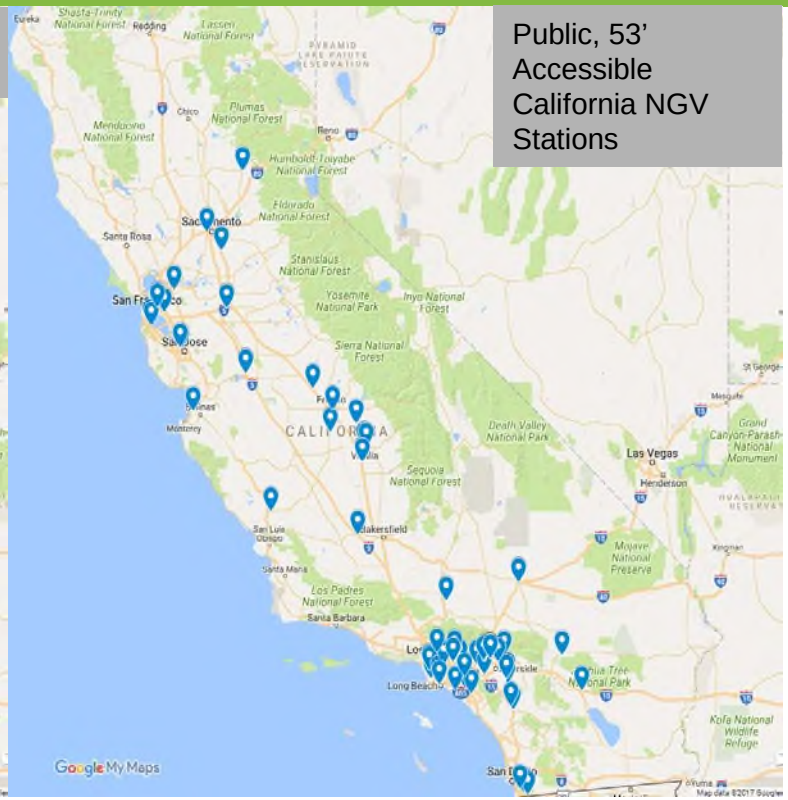
While CA has a significant number of NGV stations, many fail to meet the needs of large fleets:

slow filling (inconvenient) | not located along major routes | not 53’ truck accessible





- 418 CNG and LNG stations in CA.
- 76 are public and accessible to 53’ trucks.
- Only 18% of NGV stations meet the needs of large fleets.

"Effective" RNG Deployment in Transportation is needed to meet the State's GHG Goals

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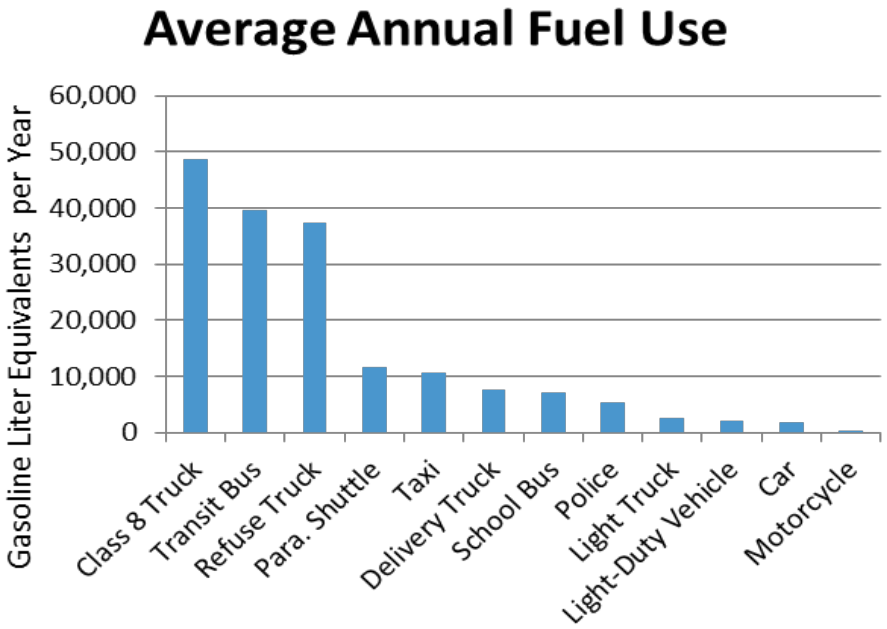
Define the target segment and eliminate barriers to conversion

- Different sectors need different levels of support to reach "commercialization"
- Focus should be on "fleet economics"
- Highest potential fleets with capability
- Commercialization requires a primary and a secondary market

Create appropriate incentives

- Consider "fleet economics"
  - Fuel costs; Vehicle costs; Residual Value; Maintenance costs; Convenience
  - Package approach: Vehicle, Infrastructure, Facilities, Training



To meet aggressive GHG goals, the state requires a comprehensive incentive program that presents attractive conversion economics for fleet operators

Achieving true market commercialization

Align incentives appropriately to attract large user deployment to tip the scale and bring down costs for all users

Align incentives with fleet economics

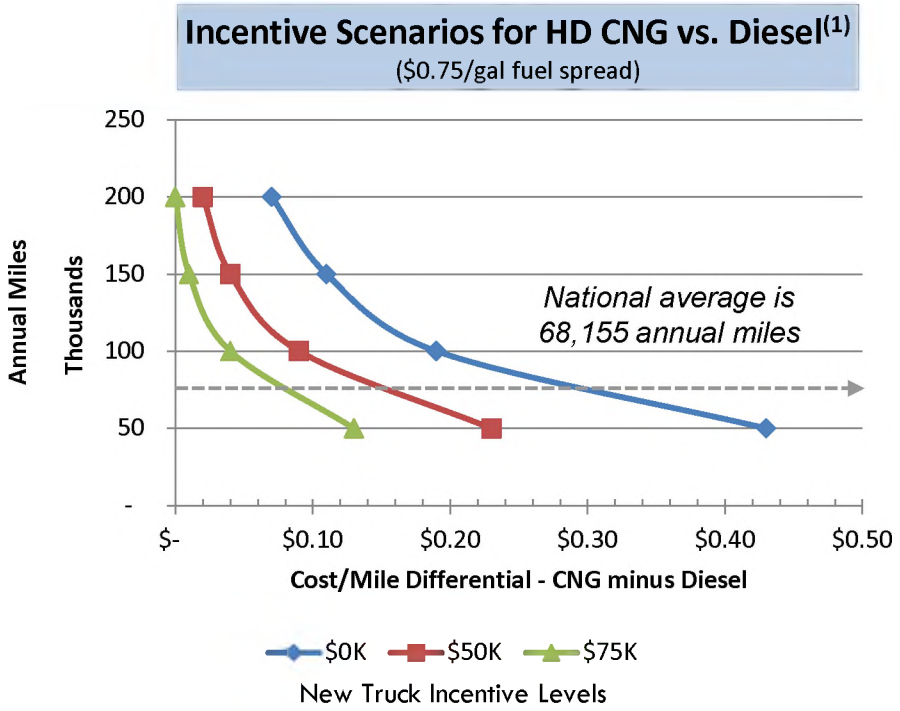
- Sector specific, comprehensive
- Aim for equivalent or better fleet economics
- Larger fleets are better suited for early adoption

Rethink scrappage and replacement focus

- Larger fleets have newer units - locked out
- Residual truck value impacts fleet economics
- Secondary truck market has real value towards market commercialization and emission goals

Comprehensive approach

- Attractive vehicle incentives that achieve equivalent or better cost per mile
- Address public infrastructure gaps
- Technician training, OEM support network
- Facility modifications



1) *Cost per Mile (CPM) Model developed by ACT Research: $0.75/gge spread between Diesel/CNG; trade in cycle 48/60 mos.; residual values $45K,/$25K; annual maintenance $15K/$30K; tires and insurance $11.5K for both*

Summary Slide

- **CA has ambitious emissions reduction goals, which include dairies. RNG can help dairies meet these goals with less risk and a positive ROI**
  - RNG reduces emissions, reduce development risk, create jobs and accelerate a new industry
  - Transportation represents California's largest single source of emissions. RNG used in transportation offers a realistic pathway to meet both the state's GHG and air quality goals
  - The NZ engine can help address largest single source of NOx emissions for South Coast & San Joaquin Air Basins – HD Trucks – while contributing to GHG reduction goals

- **There is no silver bullet to achieving market penetration: a long term, comprehensive, flexible and market relevant approach is needed**
  - **Current vehicle incentives do not move the market –** Incentives aimed at fostering fleet conversion to RNG must tie to positive fleet economics
  - **Infrastructure support is much needed -** California still has insufficient HD natural gas fueling infrastructure to meet the needs of HD goods movement. Focus should be on filling gaps in public refueling infrastructure along major freight corridors to facilitate broad deployment

Questions?

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