# California Natural Gas Vehicle Coalition

# Presentation to California Energy Commission

## January 2009

# Natural Gas

## The Essential Transportation Fuel for California: 2020 and 2050

AB 32, Low Carbon Fuel Standard, and Governor's Executive Order S-03-05: California is committed to reducing Greenhouse Gas emissions to 1990 levels by 2020 and 80% below 1990 levels by 2050

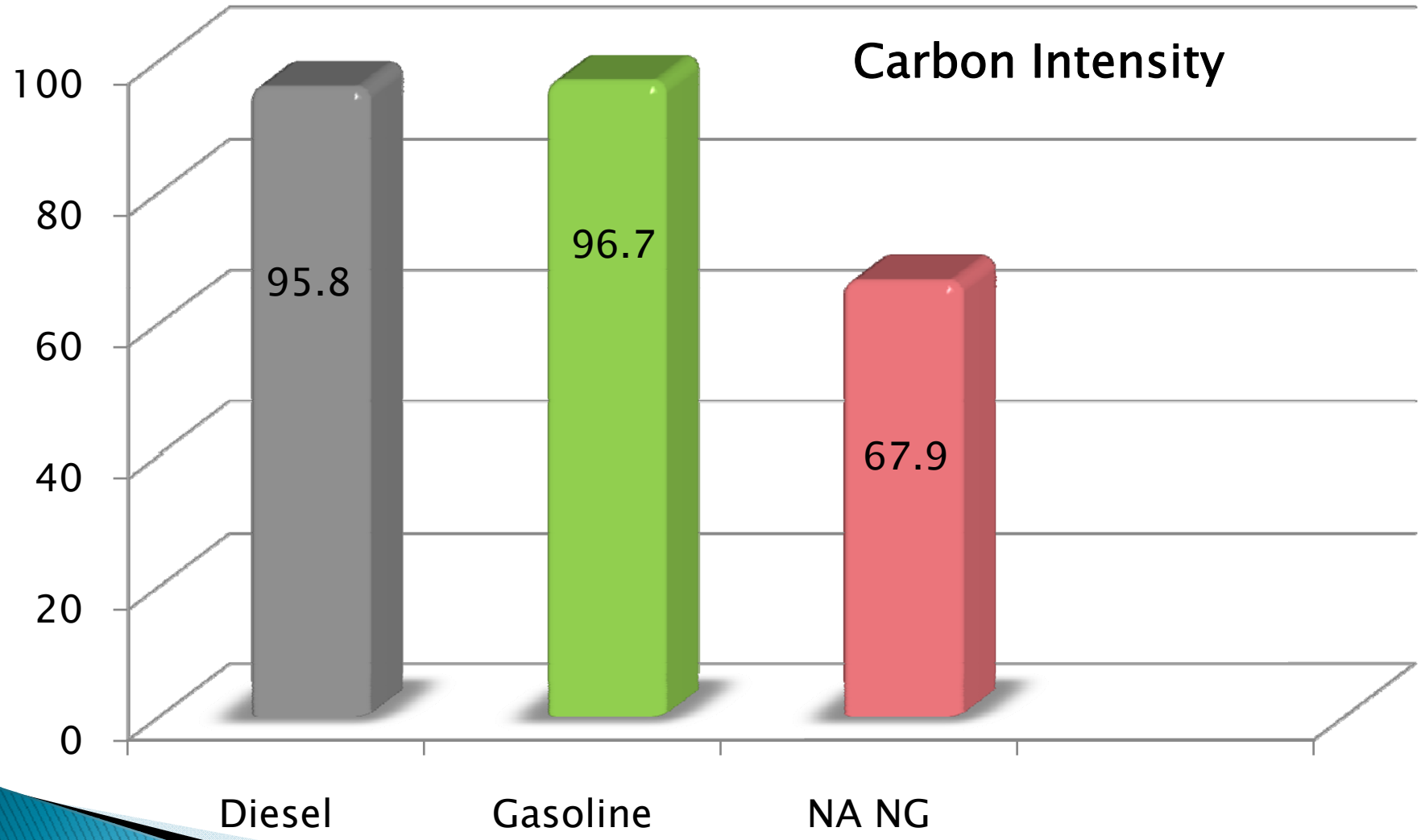
- 2020: Conventional natural gas is clean, low carbon, affordable, and available
- 2050: Renewable biogas from landfills, animal waste and wastewater treatment is a Super Ultra Low Carbon fuel that transforms an environmental problem into a greenhouse gas solution

# Natural Gas is Clean

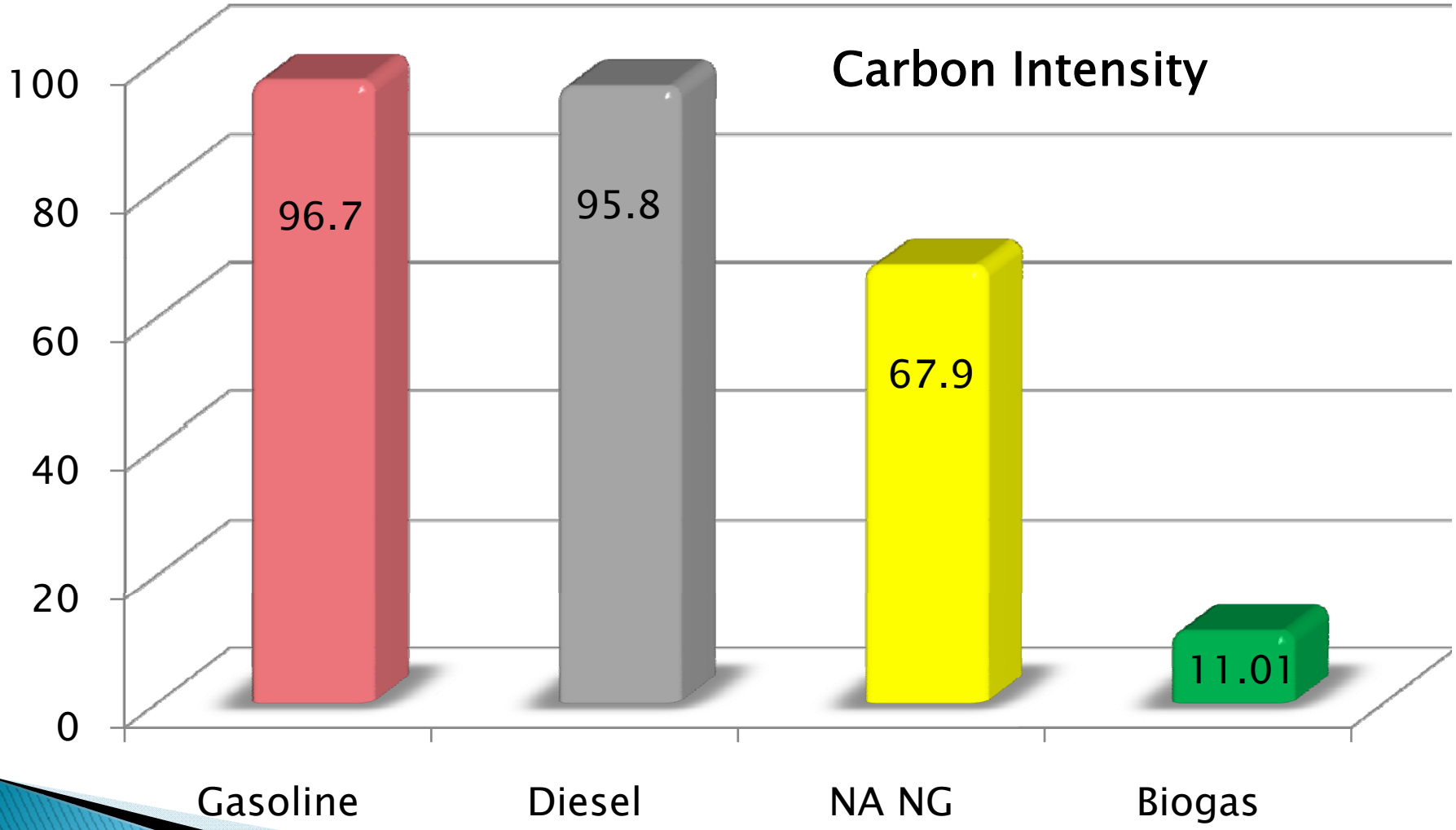
Natural Gas is an inherently cleaner burning fuel that lowers tailpipe emissions of criteria air pollutants.

- Light Duty NGVs certified as cleanest fossil fueled vehicles
- Heavy Duty NGVs meet 2010 0.2g NOx standard, 6x lower than current NOx standard

# Natural Gas is a Low Carbon Fuel



# And Renewable Biogas is a Super Ultra Low Carbon Fuel



# NATURAL GAS IS LOW COST

**West Coast Average Fuel Prices Oct. 2007 – Oct. 2008** (Clean Cities Survey)

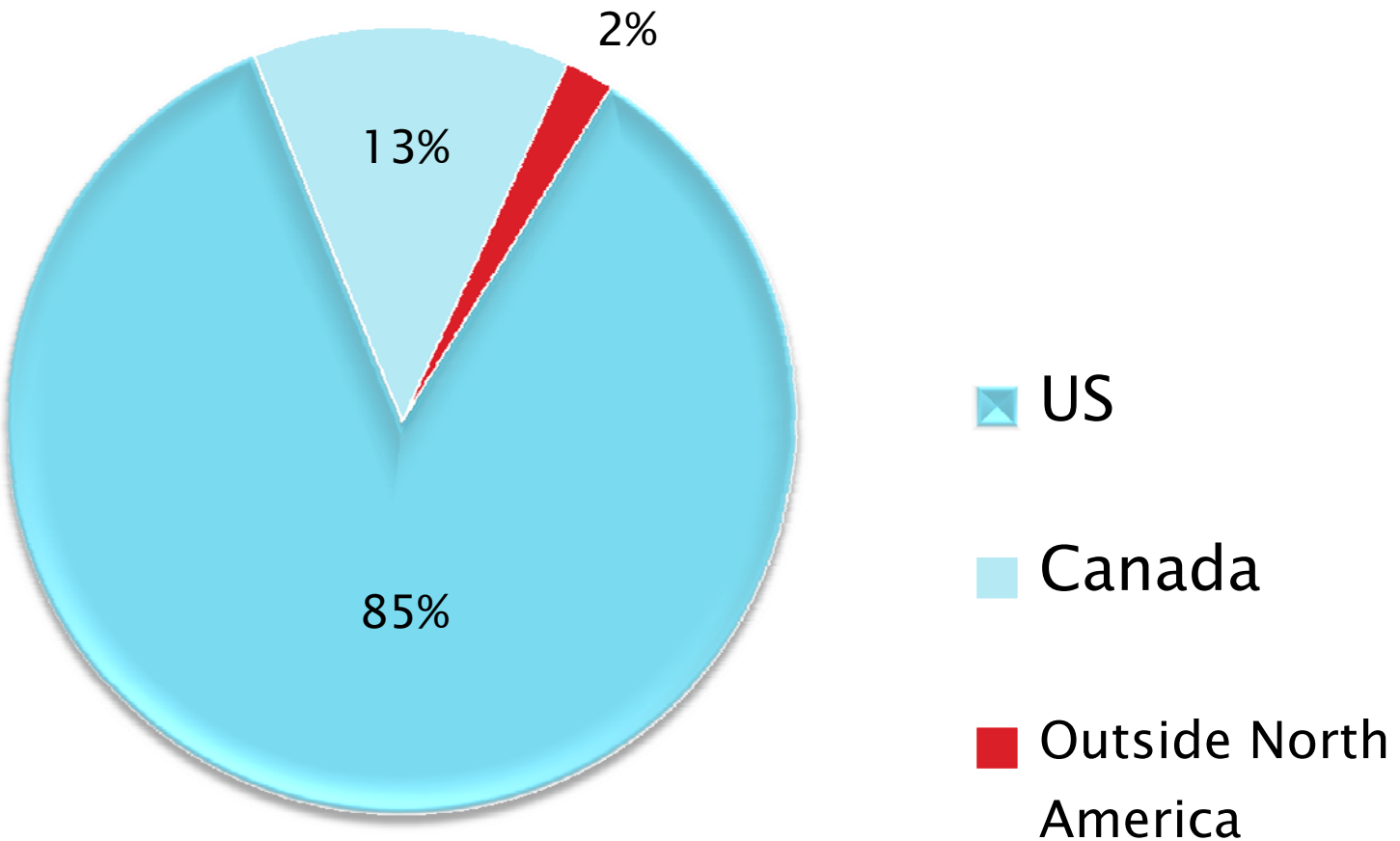
| | | | |
|---|---|---|---|
| Gasoline | $3.49/gal | CNG (gasoline gallon equiv.) | $2.60/gal |
| Diesel | $4.01/gal | CNG (diesel gallon equiv.) | $2.90/gal |

Prices for high fuel use fleets (transit buses, school buses, refuse trucks) are even lower: $1.45-$1.85/gal. ~90% of CA CNG used by high use fleets.

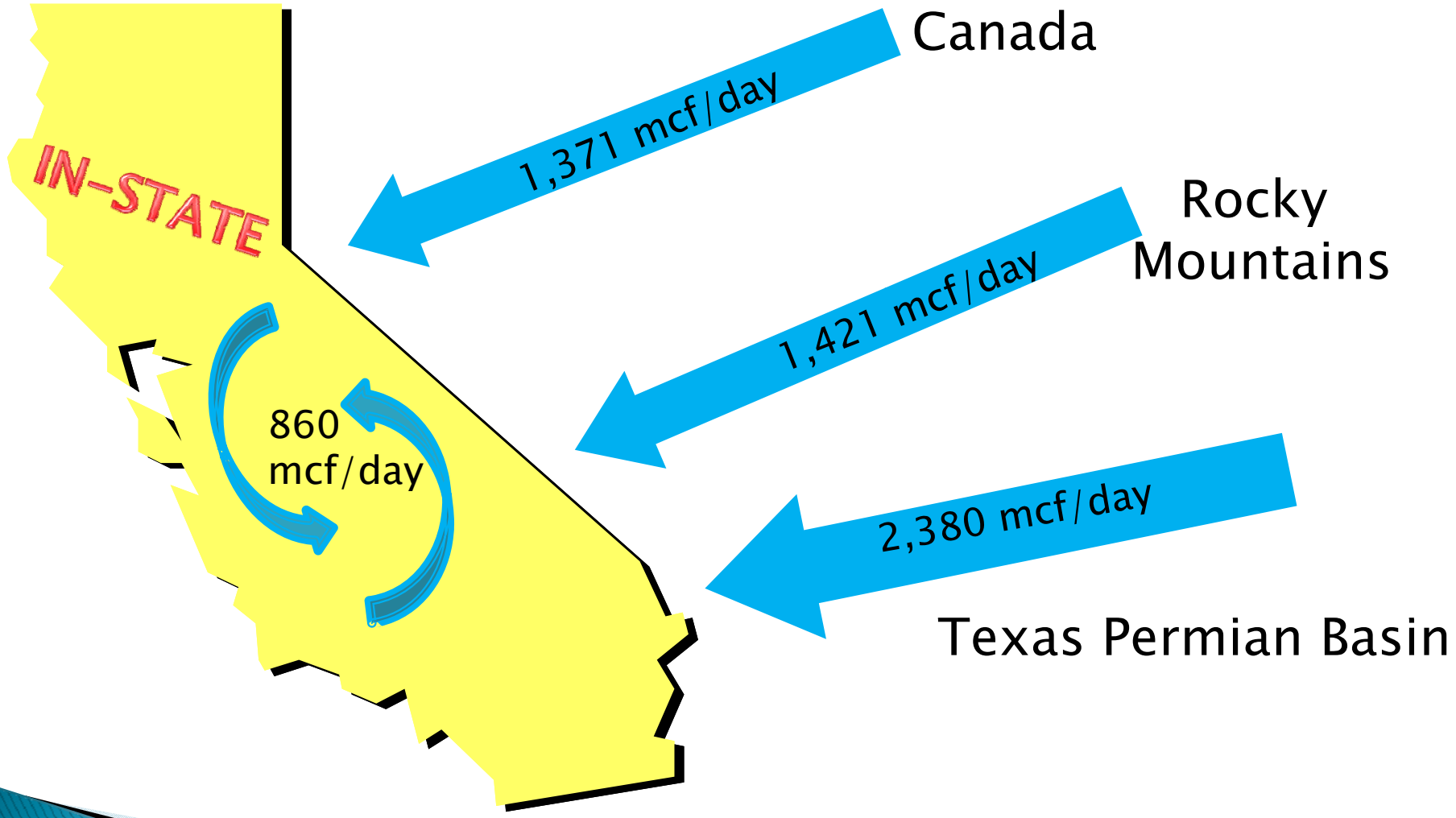
"*NGVs will have a significant advantage in life-cycle costs when crude oil is priced at $60/barrel (in 2005 $$) on an average life-cycle basis*." (TIAX, 2005)

| | Break-Even Price of Oil | Annual Benefit @ $60/barrel |
|---|---|---|
| Refuse Trucks | $21/barrel | $4,700 |
| Transit Buses | $30/barrel | $2,900 |
| Trucks | $28/barrel | $5,300 |

# Natural Gas is Abundant, Available and Secure

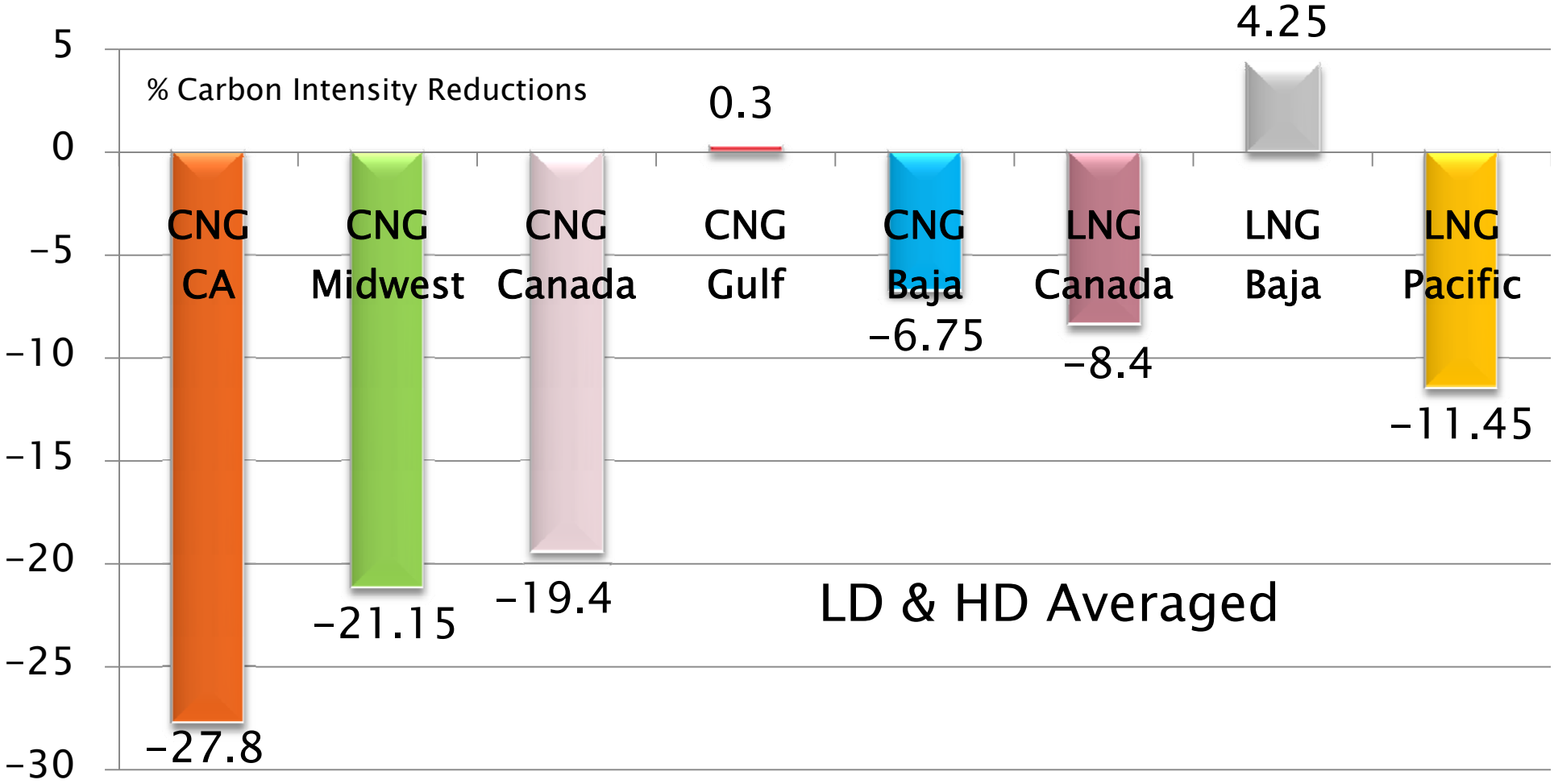


# Natural Gas Pathways



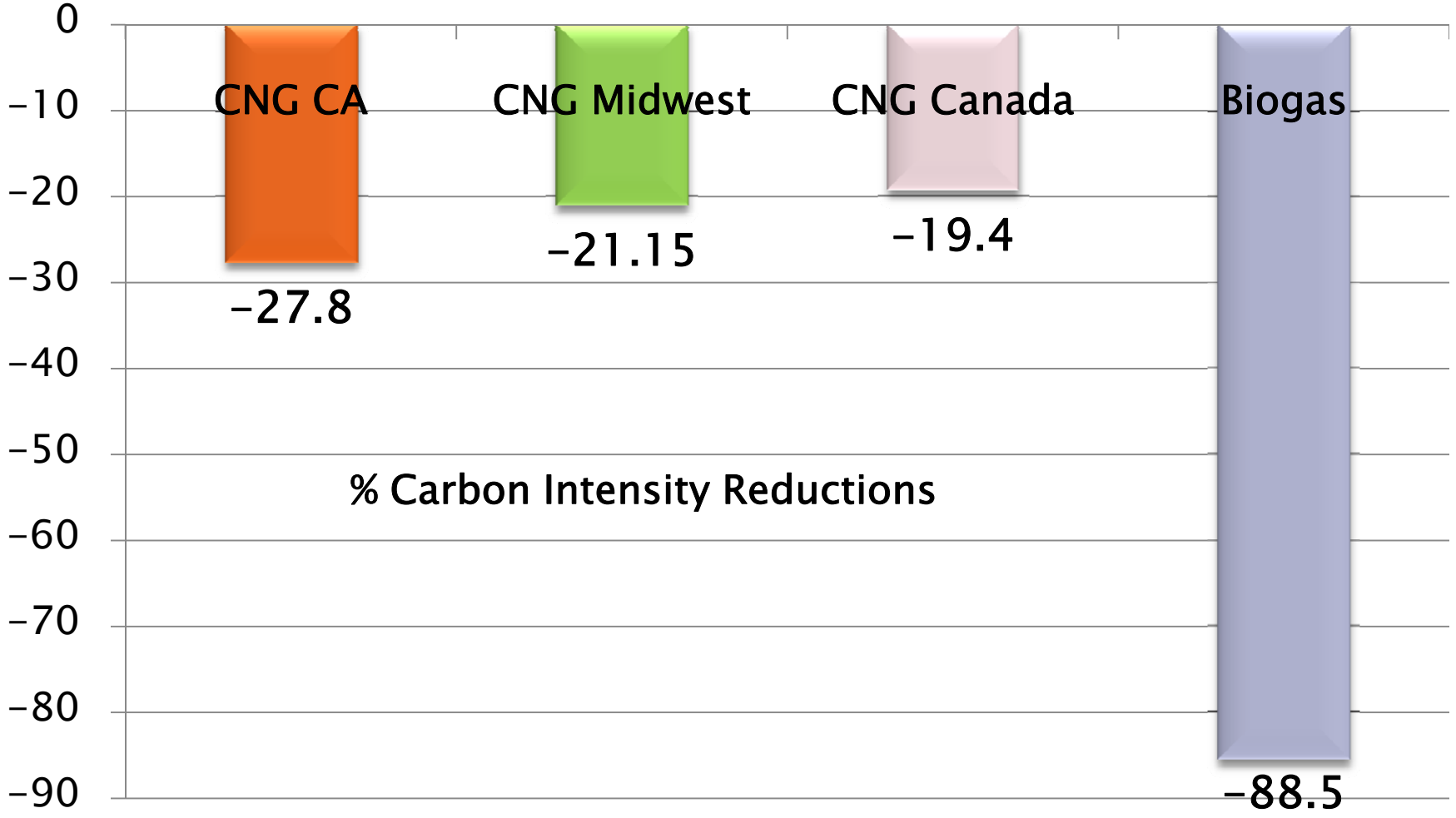

CEC Energy Almanac, 2006 Data

# ARB Pathway Analysis of Natural Gas Carbon Intensity vs CARB diesel




## ARB Analysis

# Carbon Intensity Reductions from Current and Likely Future Pathways of California Natural Gas




LD & HD Averaged

# Renewable Biogas

A Super Ultra Low Carbon Renewable Transportation Fuel
Made From Human and Animal Waste

Landfill

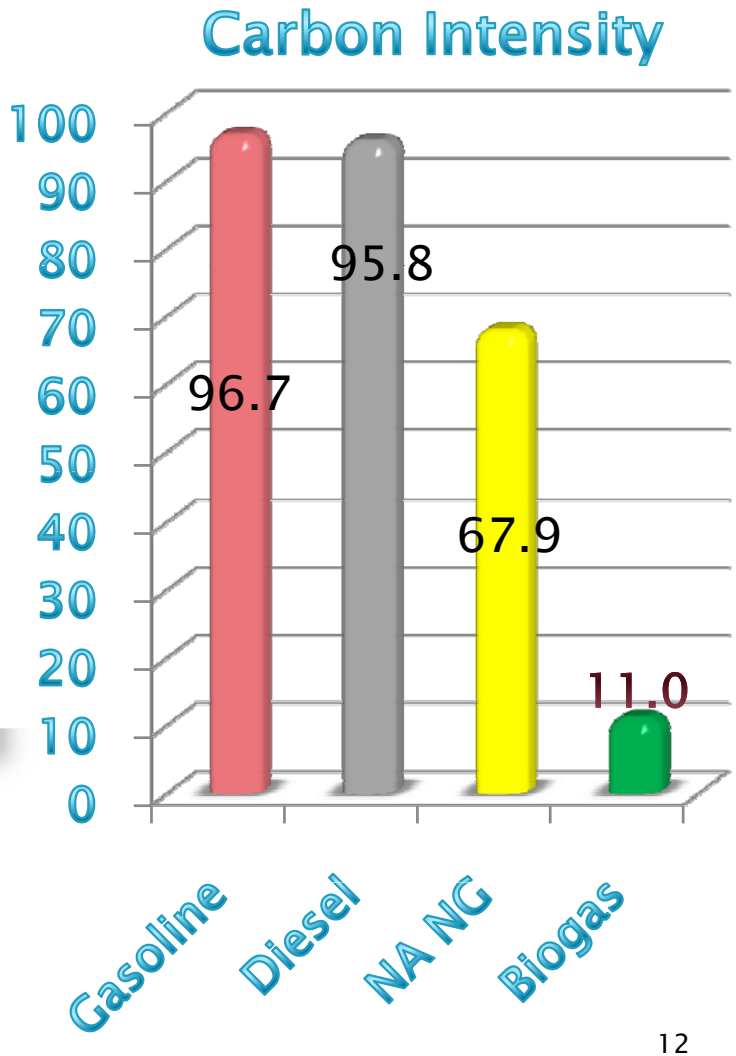
CAFO

Confined Animal Feed Operations

Wastewater Treatment

# Renewable Biogas
# Near Zero GHG Emissions WTW

| | GHG Emissions (gCO2e/MJ) |
|---|---|
| LFG Recovery | 0.49 |
| LFG Transport | 0.00 |
| LFG Processing | -49.34 |
| Transportation &Distribution | 0.06 |
| Compression at Station | 2.01 |
| **Total (WTT)** | **46.69** |
| Carbon in Fuel | 55.2 |
| Vehicle CH4 & N2O | 2.5 |
| **Total WTW** | 11.01 |




ARB, GREET Analysis for CNG from landfill gas, Oct. 2008

# How Much Renewable Biogas Available in California?

## Estimates of feasibly recoverable biogas per year

| | |
|---|---|
| Landfill Gas & Wastewater treatment: | 106 bcf |
| Dairy Waste: | 15 bcf |
| **TOTAL** | **121 bcf** |

Billion cubic feet

CEC, A Roadmap for the Development of Biomass in California, Nov. 2006

U. Of San Diego, Energy Policy Initiative Center, Biogas Production and Uses on California Dairy Farms, Aug, 2007

# Recoverable biogas can displace 29% of diesel currently used in California and reduce 8.05 MMTCO2e

- 121 bcf biogas recoverable in California
- 121 bcf equals .86 billion DGE
- 3.0 billion gallons diesel used in California as transportation fuel in 2007
- .86 billion DGE biogas would displace 29% of all diesel transportation fuel used in 2007

- This equals a reduction of 8.05 MMTCO2e

# How Much Renewable Biogas Available in California?

Estimates of future feasibly recoverable bio gas per year

Gasification: 250 bcf

**Together with 121 bcf from landfill, waste water and dairy, future Bio-SNG reserves can displace a total of 60% of diesel currently used in California and reduce 16.22 MMTCO2e.**

CEC, A Roadmap for the Development of Biomass in California, Nov. 2006

# Renewable Biogas: in California and Beyond

## Altamont

Will produce 13,000 gallons per day and over 4 million gallons annually of LNG as a bio-fuels product in California.

## McCommas Landfill, TX

- 3rd largest landfill in US
- Producing 3.6 million cubic feet of gas per day

Sweden's highly developed natural gas and biogas infrastructure provides 25% of its energy from biomass.

# Natural Gas Vehicles


- 150,000 Natural Gas Vehicles in U.S.
- 27,000 Natural Gas Vehicles in California

8.6 million worldwide

In other countries drivers have a wide choice of NGVs.

# World Manufacturers of Natural Gas Vehicles

| | | | |
|---|---|---|---|
| GM/Opel | Chevrolet | Ford | Mercedes |
| Volkswagen | Fiat | Citroen | Hyundai |
| Renault | Peugeot | Tata | Mitsubishi |
| Toyota | Honda | Nissan | Isuzu |
| Skoda | Volvo | Geely | Lifan |

**GM alone makes 18 NGV models worldwide**

# Austria – Aug 2008 NGV Vehicles


| Standard Factory Models |
|---|
| Citroen (3) |
| Fiat (7) |
| Ford (3) |
| Iveco (1) |
| Mercedes (3) |
| Opel (3) |
| Peugeot (2) |
| Renault (1) |
| Skoda (1) |
| Volkswagen (4) |
| **Total 28 Factory Models** |

# U.S. NGV Applications















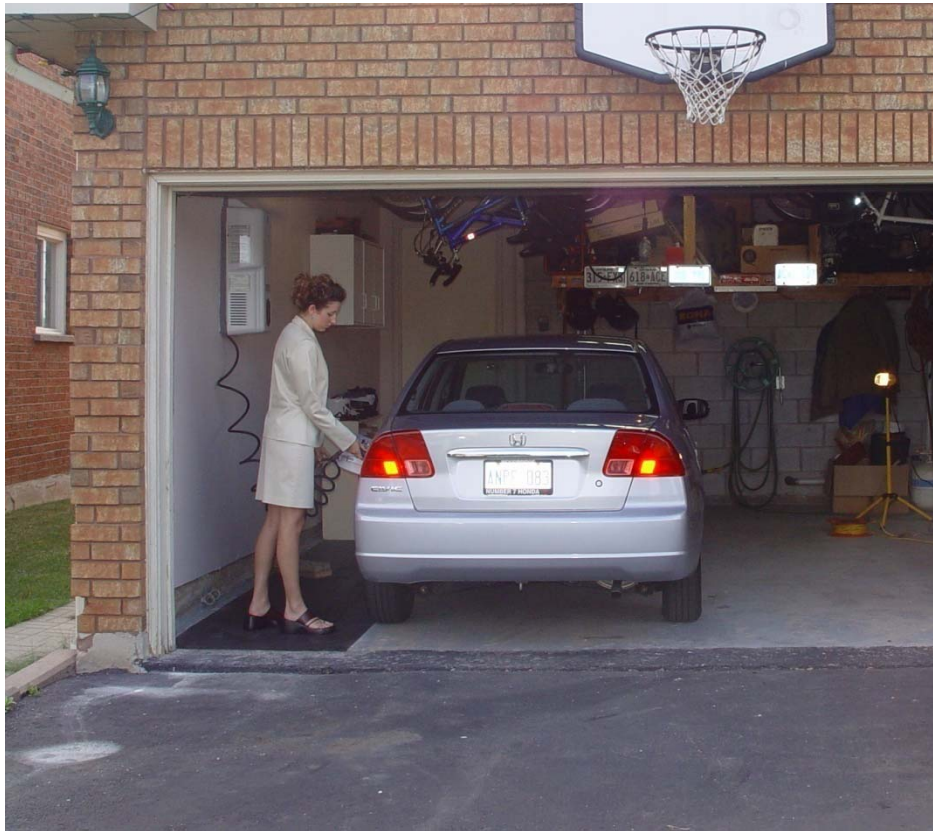







# Natural Gas Fueling Infrastructure

- In California we have 425 natural gas fueling stations –more than any other alternative fuel



City of Burbank's 24-hour CNG Fueling Station

Natural Gas Vehicles may also be refueled at home re-fueling stations

# What more is needed?

CEC Draft Investment Plan of Dec. 2008 proposes several important project categories that will significantly benefit the expansion of clean renewable gas and are consistent with CNGVC recommendations, including:

- Incentives for LD, MD, and HD natural gas vehicles for OEM and upfitted vehicles
- Support development of advanced MD/HD natural gas engines and fueling and fuel storage technologies
- Increase government fleets and fueling infrastructure
- Provide incentives for waste water, dairy, landfill and Bio-SNG production
- Promote mixed use H2 and H2/CNG fueling infrastructure as bridge to hydrogen deployment
- Support for low cost production of H2 from biomethane

# Opportunities for Expanding Clean Natural Gas Vehicles in California

- Vehicle Incentive/Buydowns
- Renewable Natural Gas for Vehicle Fuel
- Vehicle Certification
- Natural Gas Blends
- Natural Gas-Hybrids
- NGV Infrastructure Incentives