

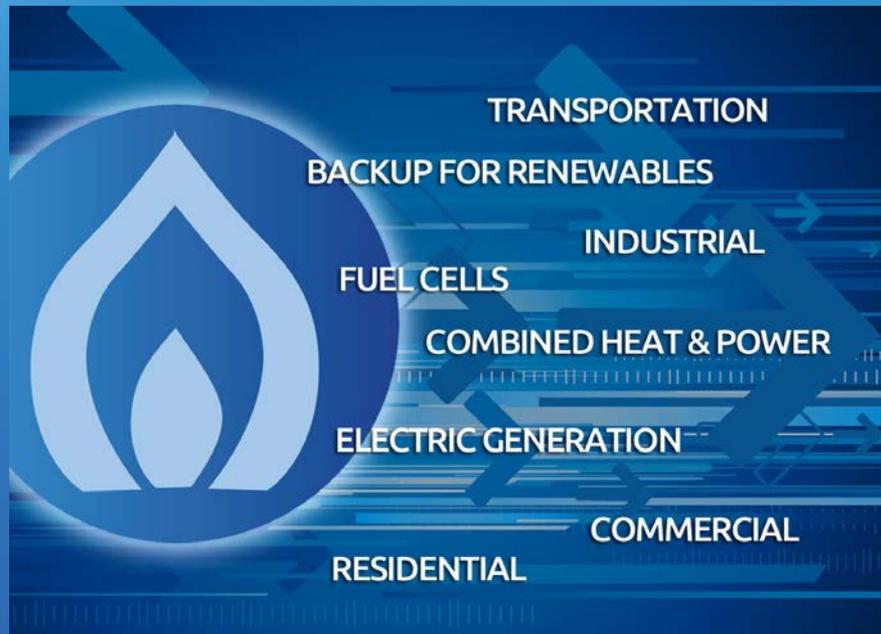
Natural Gas Pathways:

Natural Gas Vehicles in California

**George Minter, Senior Director
Policy & Environmental Solutions
Southern California Gas Company**

**2014 IEPR Update Workshop #7 -
Transportation, Electricity, and Natural Gas
June 23, 2014**

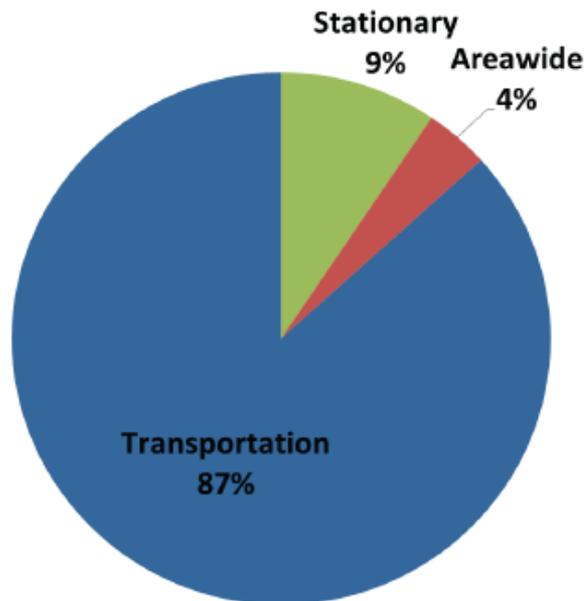
California's Long-term Energy Policy: Make Room for "Near-Zero" Natural Gas End Uses ... and Low Carbon Gas Supply



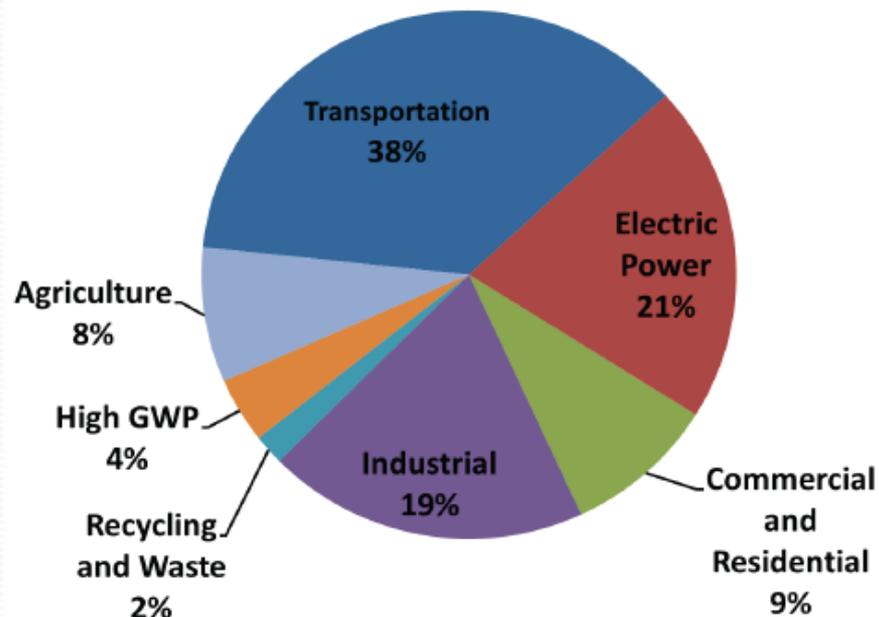
- California focused on electrifying end uses and “de-carbonizing” electricity
 - Electrify transportation
 - Electrify energy end uses
 - Decarbonize generation
- SCG focused on “near zero” end use technology and facilitating “de-carbonization” of the pipeline
 - Near zero NGV’s
 - Near zero gas technology
 - New methane feedstocks/blends

Reducing Transportation Emissions Critical to Meeting Ozone and GHG Goals

South Coast NOx Emissions

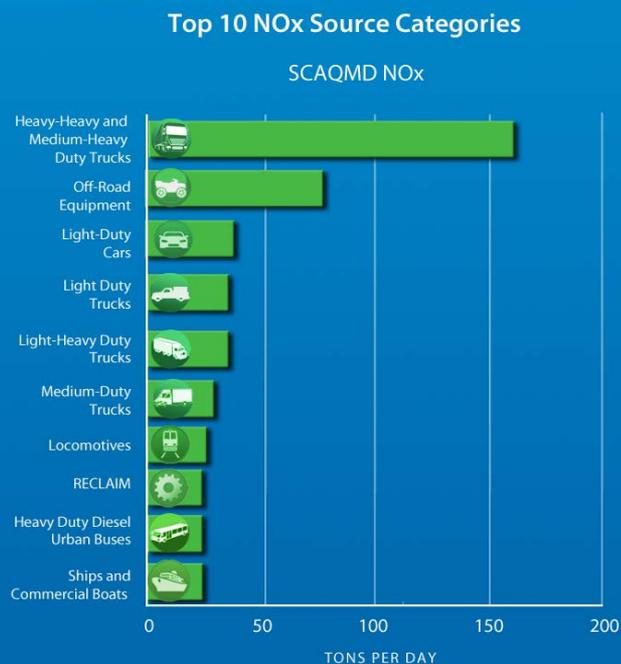


Statewide GHG Emissions



Source: California Air Resources Board

Natural Gas Transportation Pathways Can Improve the Environment – *Today!*



Note: Based on the 2012 NOx inventory from the California Air Resource Board(CARB)
Source: CARB StfAf Report for 8-Hour Ozone State Implementation Plan Emission Inventory Submittal



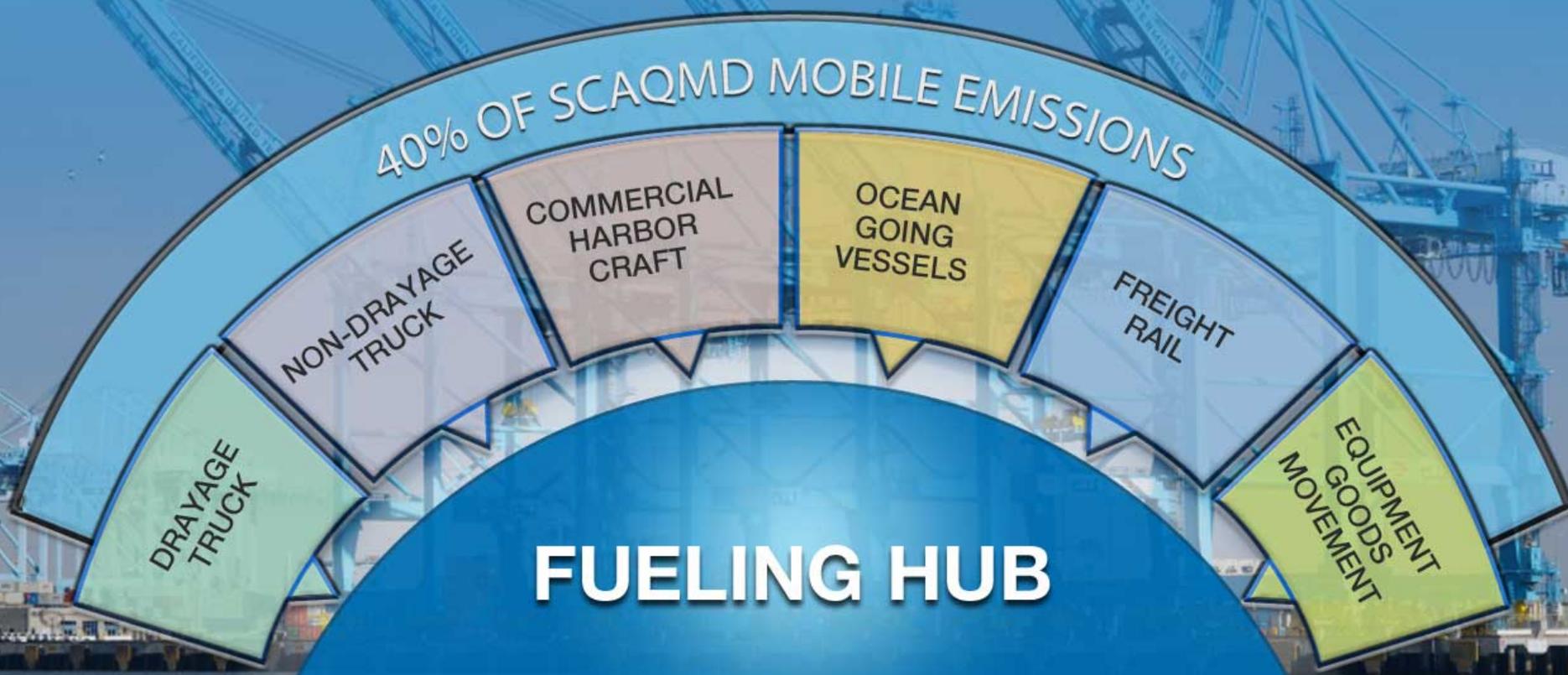
**South Coast Needs 75%-90% NOx reduction in the next 20 years.
Critical to start deployment of near-zero trucks in the next few years.**

Opportunity to Accelerate Emission Reductions through Fuel Conversion



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Siting Natural Gas Infrastructure in Proximity to Other Fleets Can Speed Up Conversion to Lower Emission Vehicles: Ports Example



Drivers for Heavy-duty NGV Growth



Tractor Line Haul



Tractor Regional



Tractor Drayage



Transit Bus

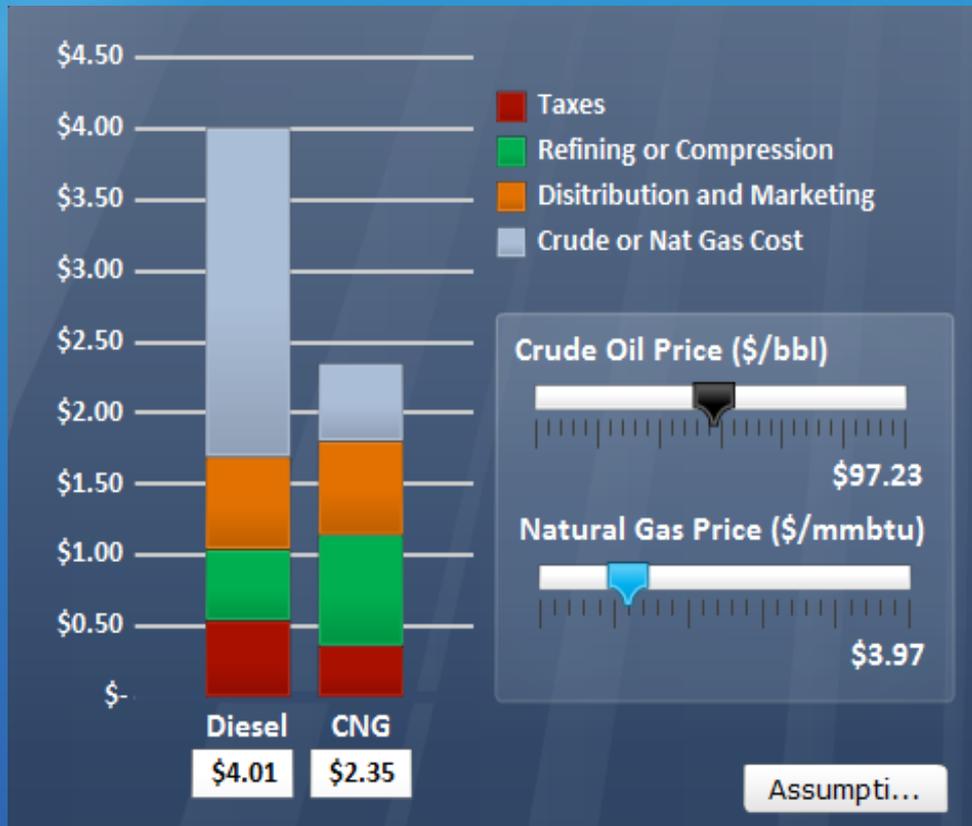


Refuse

Primary drivers of change for Heavy-duty Transportation

- **Continuation of CNG vs Diesel price differential**
 - Low pump price volatility provides fleets with price certainty
- **Increasing regulatory pressure to lower NOx Emissions especially in the South Coast and SJV**
 - NG engines are best chance to achieve 75% and 90% reduction in the near-term
- **Increasing regulatory pressure on greenhouse gases and truck efficiency**
 - EPA/NHTSA to adopt greater fuel economy standards
 - Increasing interest in renewable natural gas

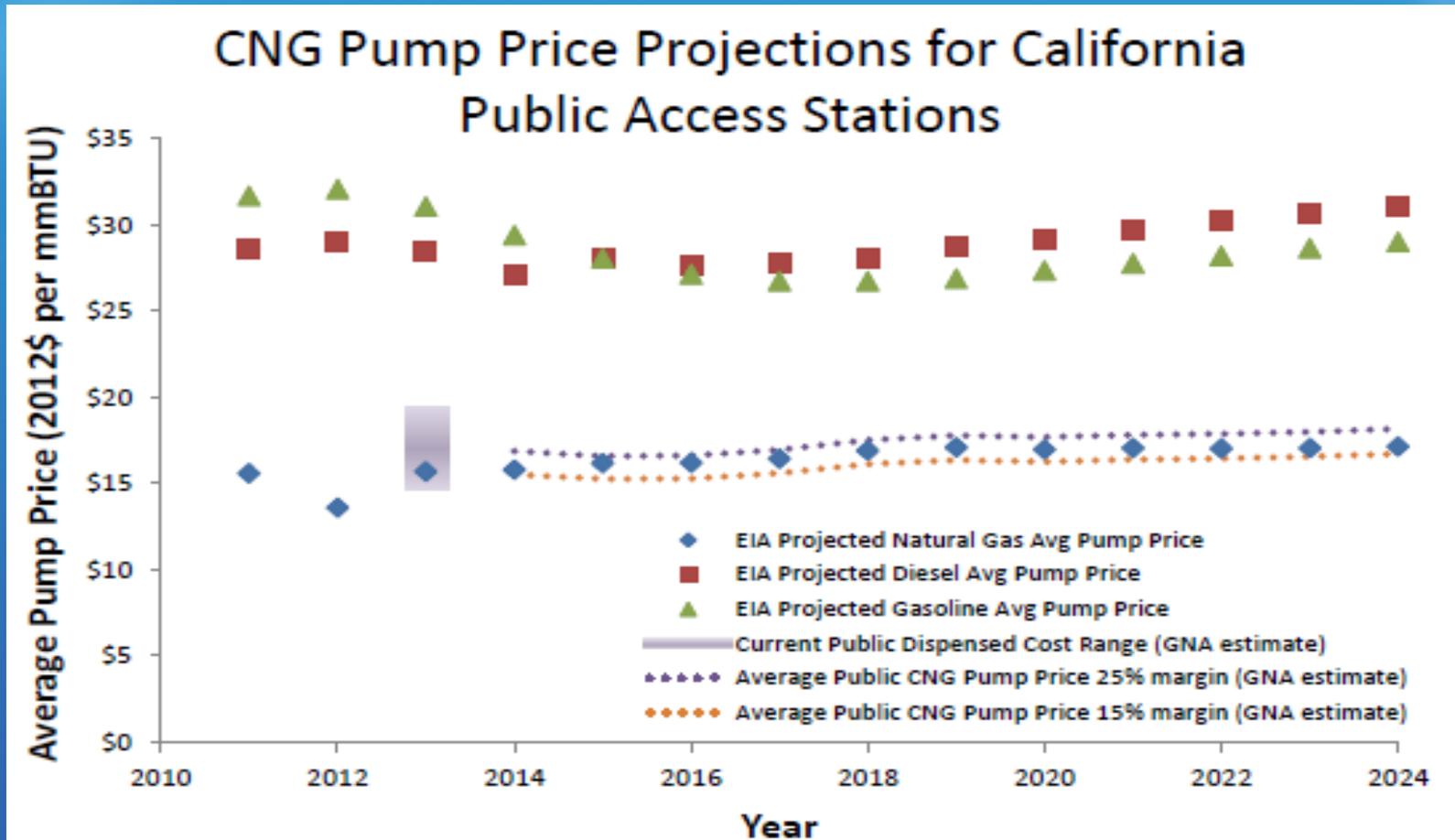
CNG vs Diesel Price Differential Creates Opportunity for Cleaner Trucks



- Doubling natural gas commodity price would increase the CNG pump price by \$0.50 per diesel gallon equivalent.
- Fuel savings for heavy-duty vehicles with high vehicle miles travelled creates an incentive to convert to CNG.

Source: NGVAmerica Heavy-duty Fuel Savings Calculator

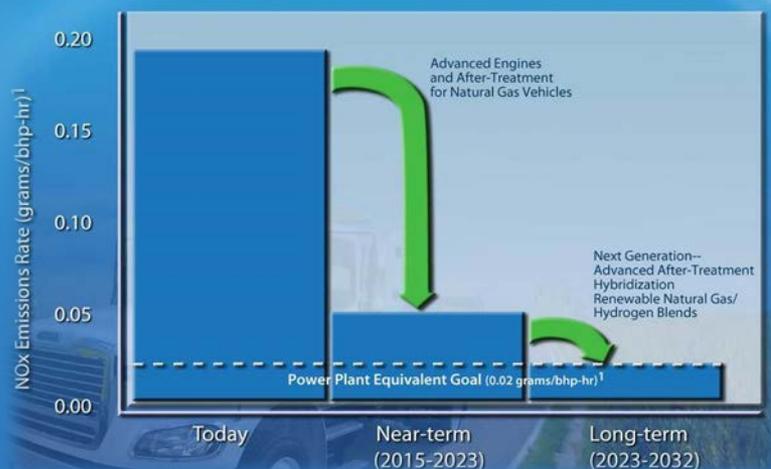
CNG Price Differential Expected to Continue Long-term



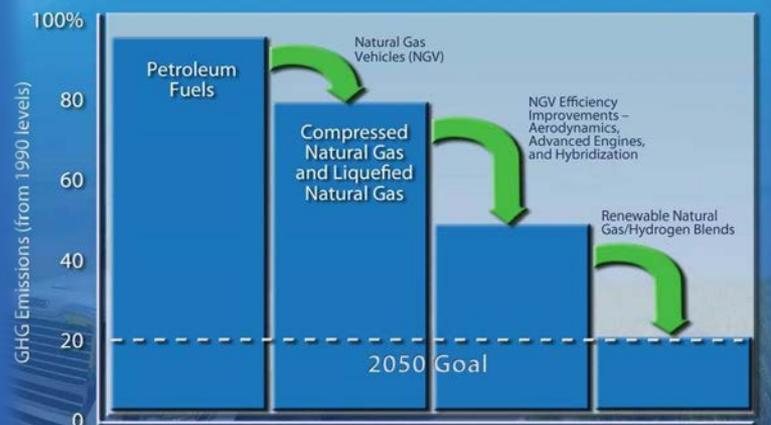
Source: Gladstein Neandross Associates, EIA 2014 Energy Outlook

Natural Gas Pathways

Address Short/Mid-term Ozone Goals and Long Term GHG Goals



- Short and mid term Ozone Goals with “near zero” end use technologies

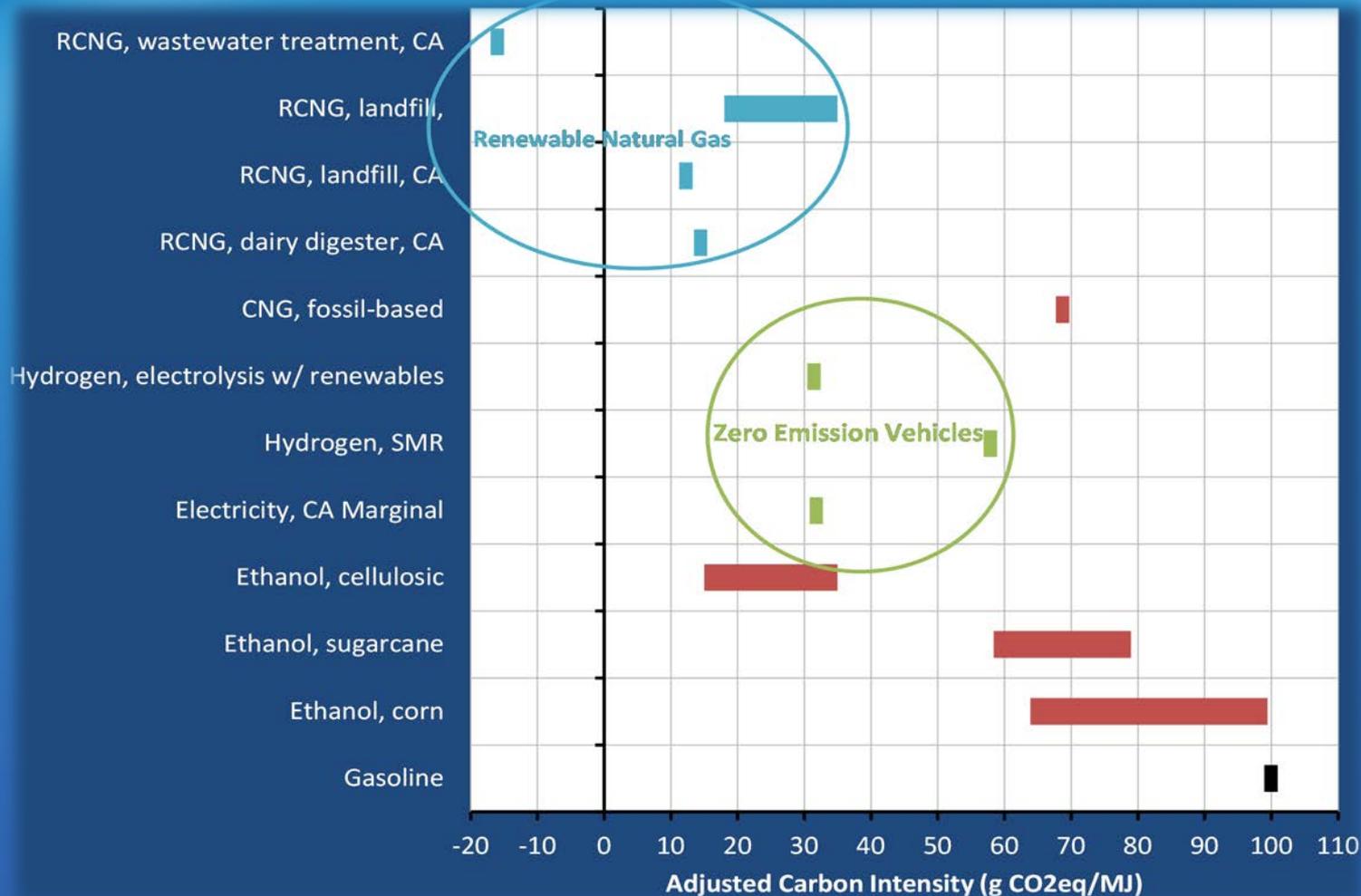


- Long Term GHG Goals with “de-carbonization” of the pipeline
 - Biomethane
 - Hydrogen
 - Hydrogen blends and methanation

Renewable Natural Gas: A Low Carbon Option to Meet GHG Goals

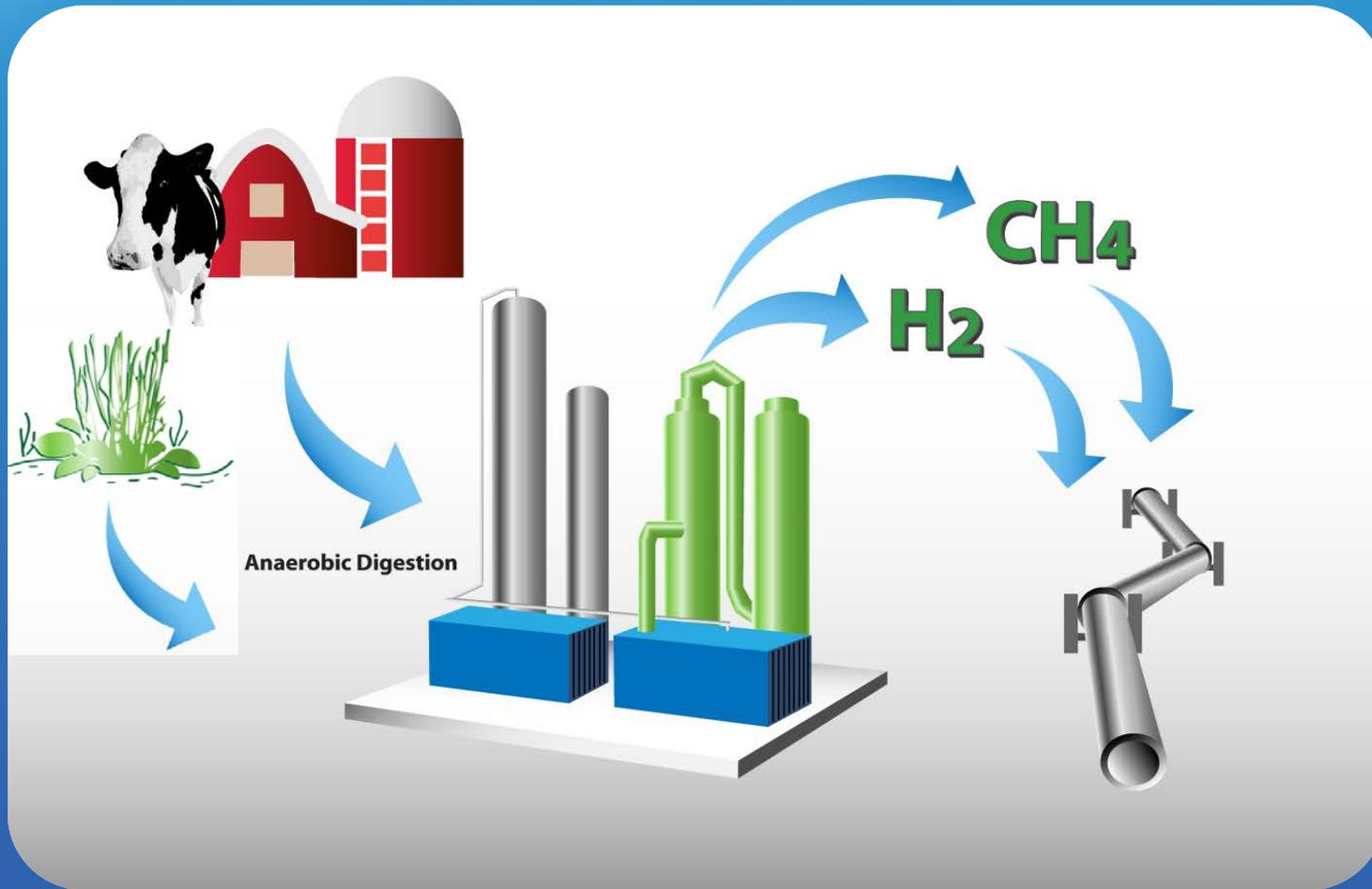


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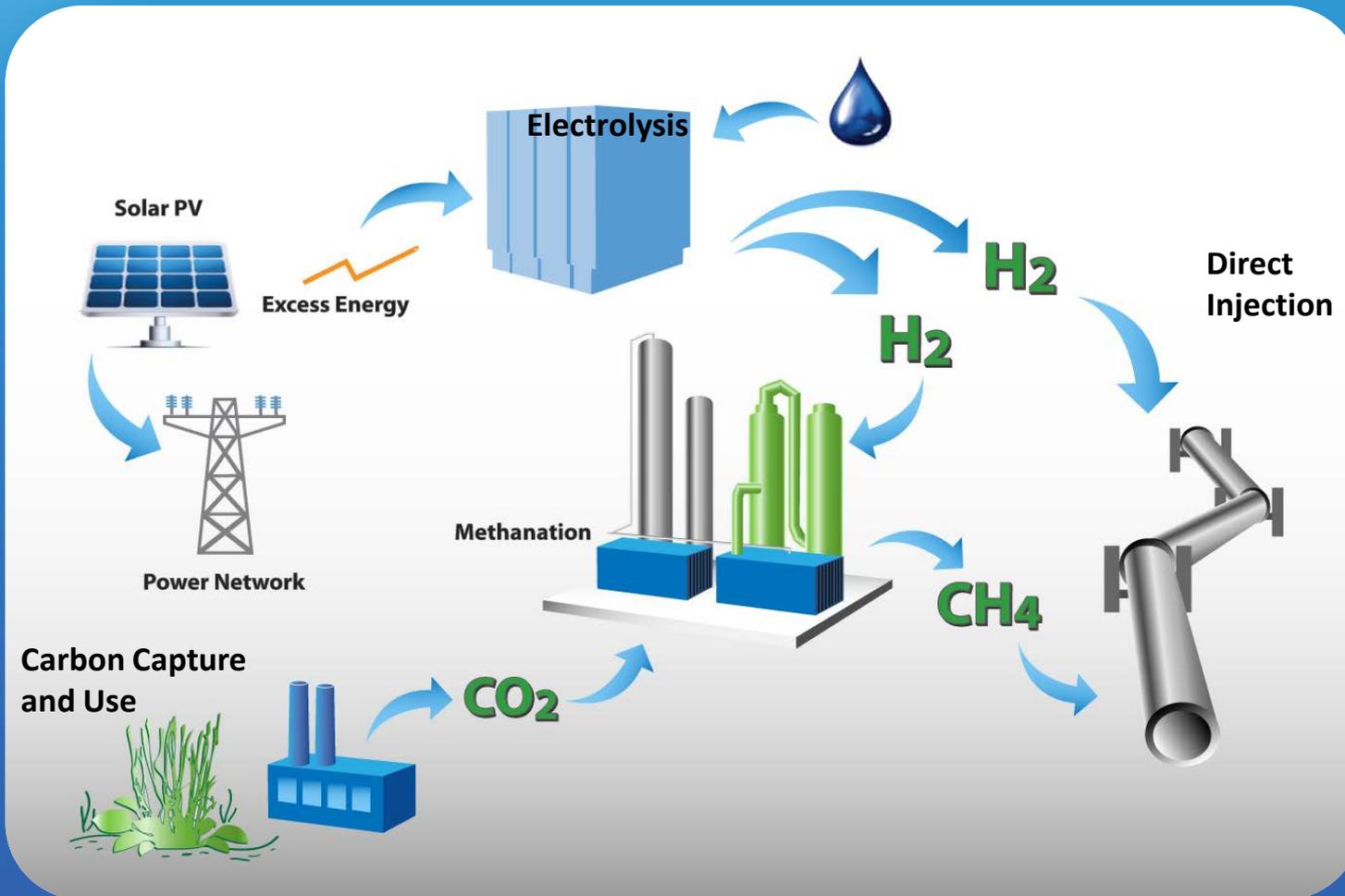


Carbon intensity adjusted for EER values, chart from ICF based on CARB LCFS Program Gasoline Comparison

From Organic Waste to Renewable Natural Gas: De-Carbonizing the Pipeline



From Renewable Power-to-Gas: De-Carbonizing the Pipeline



Government Support Required to Accelerate NGV Pathway



- Use emissions standards to encourage innovation
 - Avoid technology mandates
 - Optional low NOx engine standards, align incentives
 - EPA GHG/CAFÉ standards for HD vehicles



- Support policies and incentives for near-term deployment of pathway technologies; and demonstration and commercialization for mid and long term technologies



- RD&D funding
- Deployment funding, e.g. Carl Moyer
- Public-private partnerships
- Intermodal/proximity fueling strategy



Natural Gas: A Foundational Fuel for California

- ✓ Abundant
- ✓ Affordable
- ✓ Domestic
- ✓ Clean



Supplemental Slides on Methane Emissions

Tackling the Methane Emissions Challenge

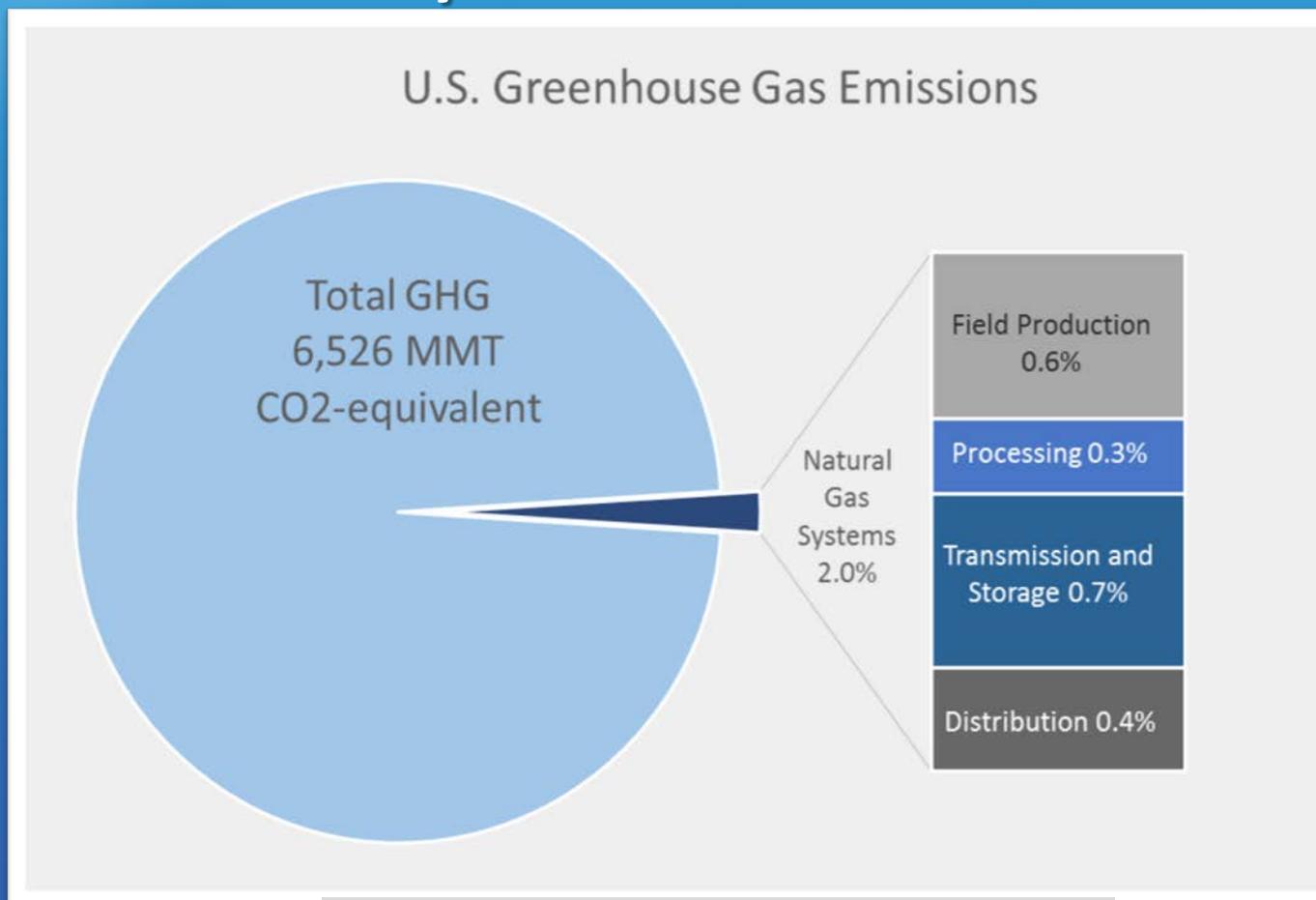


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- Emissions from utility distribution systems dropped 22% since 1990
- SoCalGas one of the first to join EPA program to adopt low-cost technologies/best practices
- EDF, CARB, CEC studies will help determine credible estimate of leakage rates

Natural Gas Systems: Small Share of Total GHGs – 2% Distribution Systems – 0.4%

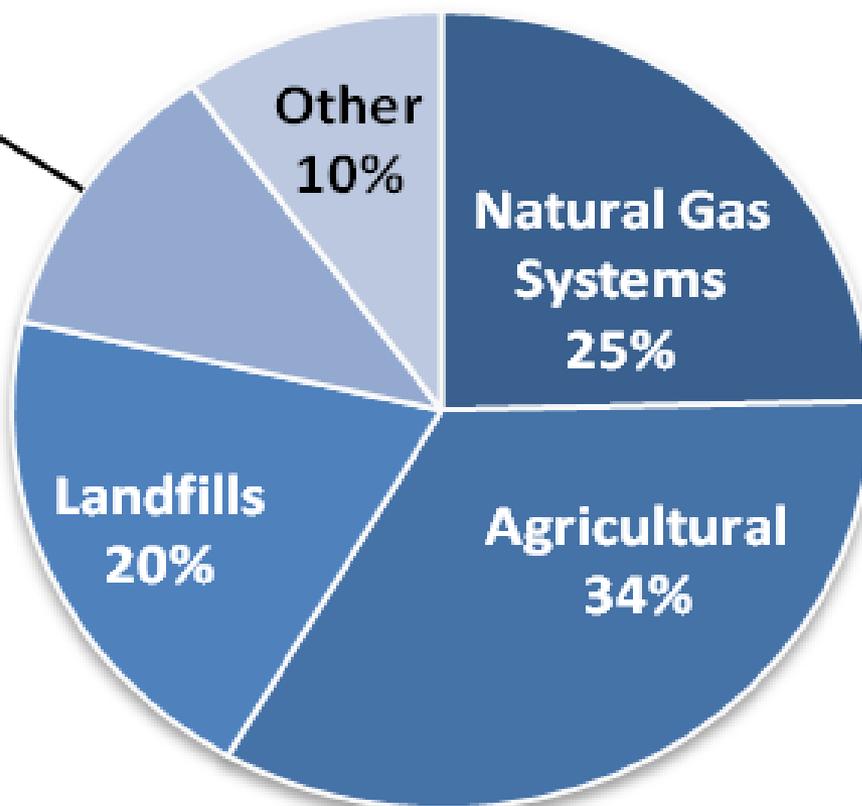


Source: *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2012*, Environmental Protection Agency

Natural Gas Systems: Relative Share of All Methane Emissions

Sources of Methane Emissions

Coal Mining
&
Abandoned
11%



Methane Emissions and Climate Benefit of Natural Gas



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“So how do we keep the potential blessings of natural gas from becoming a curse? It all comes down to a number: [0.8%.]¹ That’s the total amount of methane, scientists say, we can afford to let escape system wide before environmental costs start to outweigh benefits.” – EDF



- From 1990-2014 consumption increased 32%, while methane losses dropped 22%
- Losses from natural gas value chain are **1.3%**; down from 2.1%.
- Trajectory of methane losses from natural gas system continues **downward**.



- Studies in Progress.
- Replace 1996 Emission Factors for Meter & Regulatory Stations, Plastic, Cast Iron, Steel Gas Mains to reflect technology and practices in use today.



- Study of methane losses in production, gathering, processing, transmission, local distribution, and pump to wheels emission levels due this year.
- SoCalGas participating in local distribution and pump to wheels (natural gas vehicle and fueling stations) studies.

¹Recently recalculated (from 1%) per IPCC’s fifth assessment (AR5)

Emission Studies in the Field



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Methane Emissions Studies Timeline

