



# The Role of Natural Gas in Sustainable Transportation



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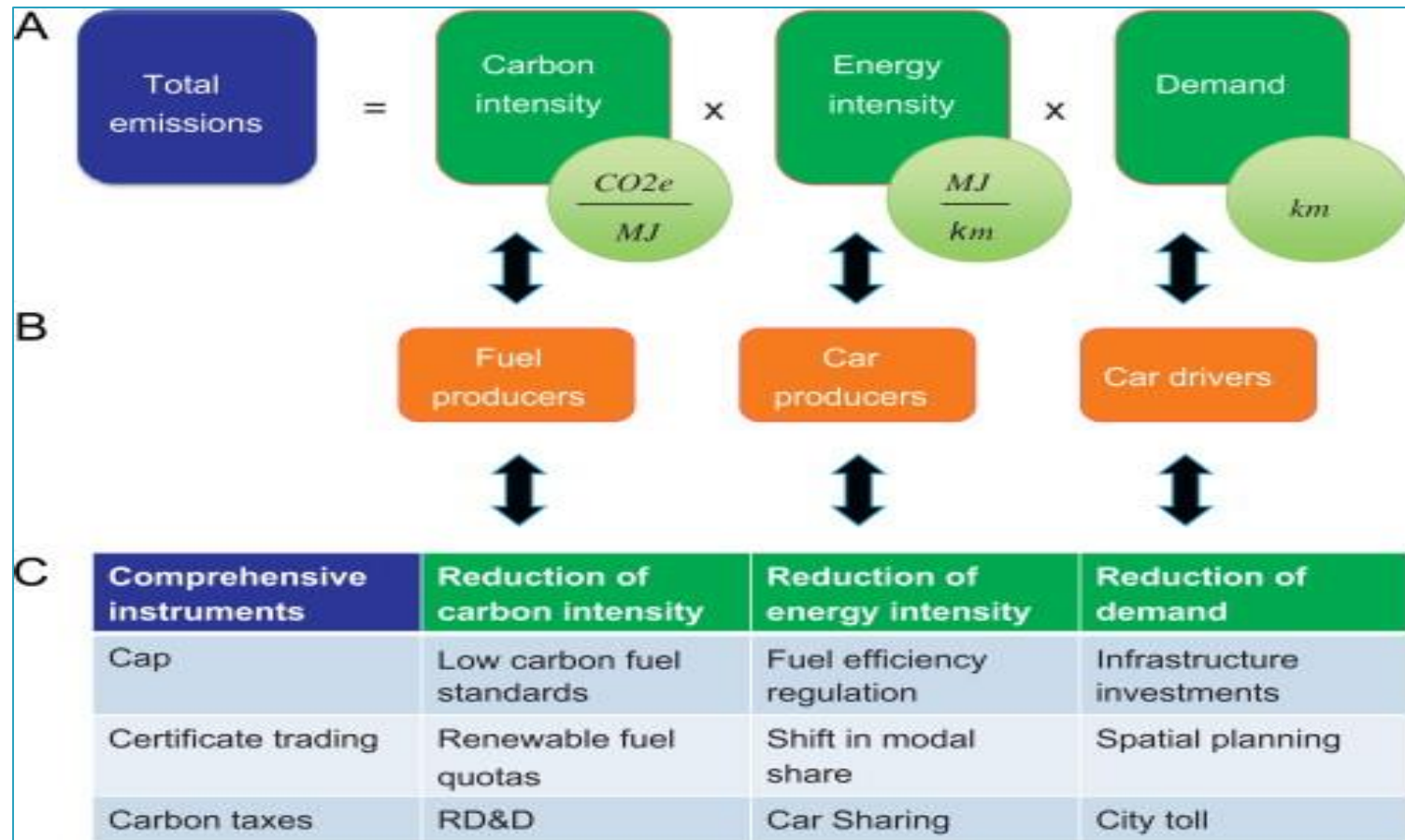
SNI Energy Forum, 29 April, 2013

# Climate Policies for Road Transport

- ▶ Sustainable Low Carbon transportation is emerging as a focus area for longer term action (post-Kyoto)
- ▶ Alternative fuels, technologies and transport modes are being introduced to reduce the carbon intensity of the transport sector
- ▶ Current climate policies for road transport:
  - Target fuel producers and/or car manufacturers, and
  - Influence use of alternative fuels, technologies and modes
- ▶ With emerging new fuel supply chains, carbon intensity of fuels and energy efficiency of vehicles, an integrated policy of consistent measures is essential
- ▶ Vehicles are best regulated in terms of energy usage per distance travelled without specifying fuel type
- ▶ A sustainable transport system ought to be evaluated in terms of its total emissions



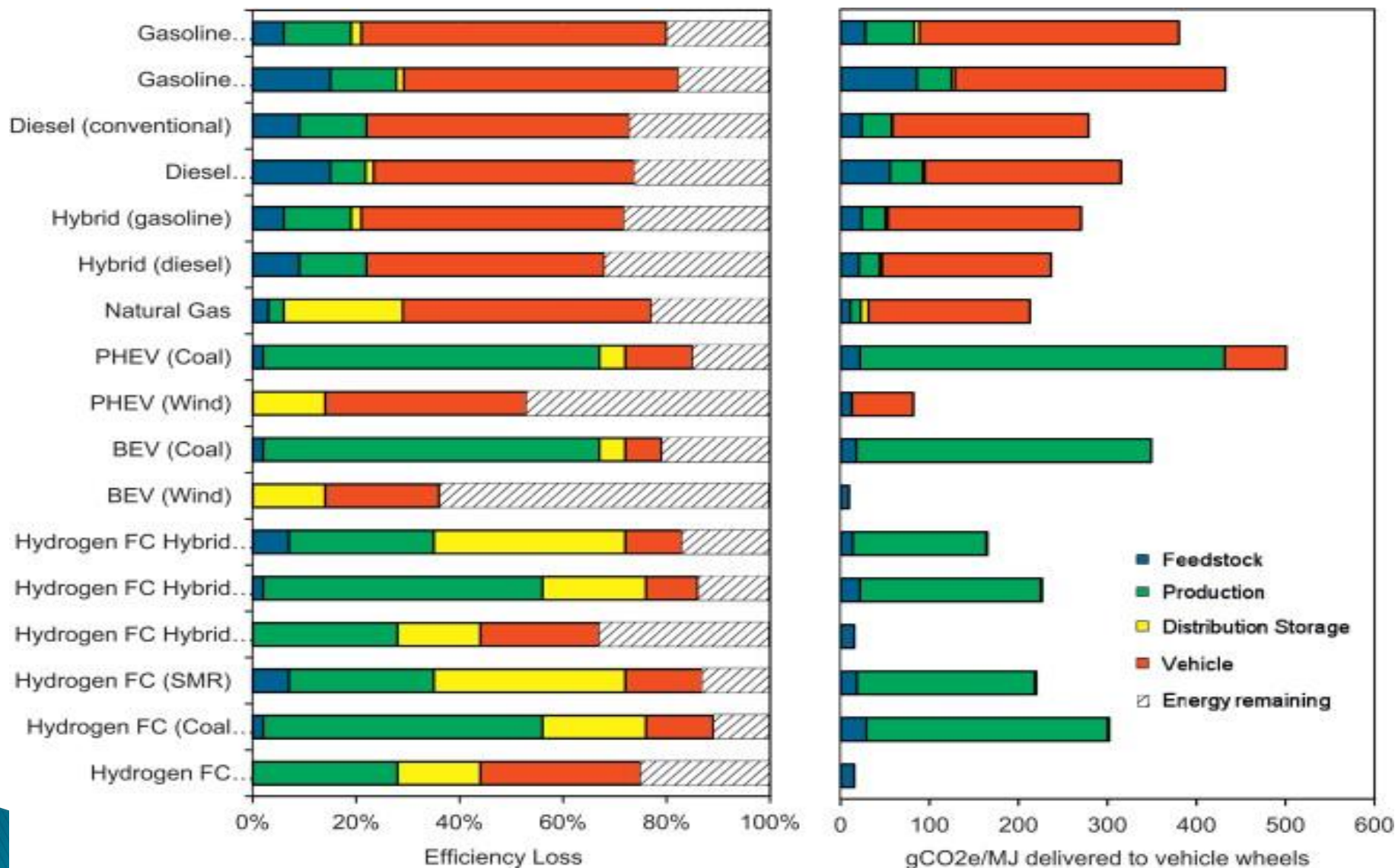
# Three Main Factors Contribute to Emissions from Transportation



Source: Energy Policy, Volume 39, May 2011, Pp. 2396–2406



# Efficiency and Intensity of Different Fuels



Source: Energy Policy, Volume 39, May 2011, Pp. 2396-2406



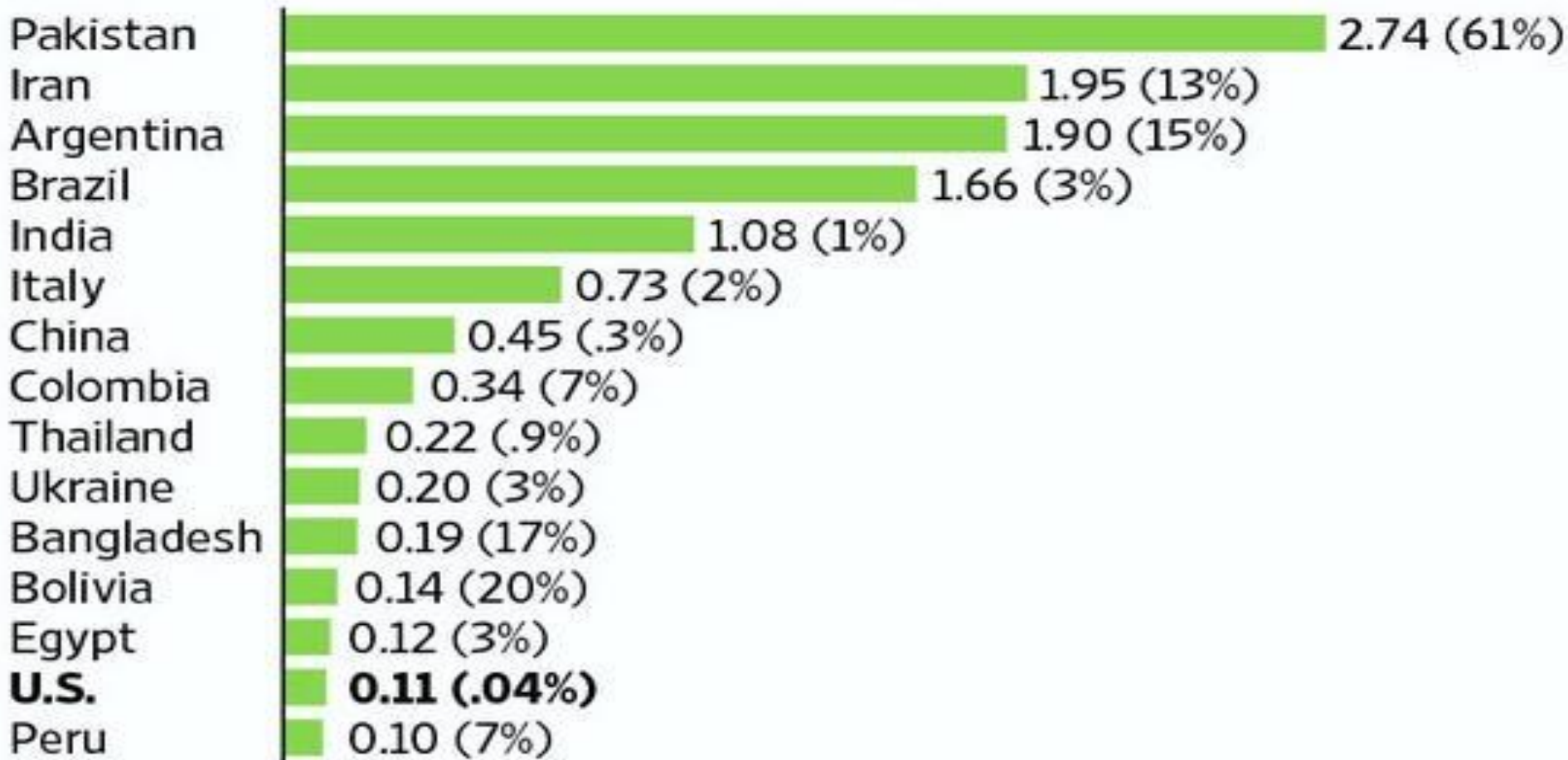
# Focus on Natural Gas Vehicles

- ▶ The number of natural gas vehicles (NGVs) continues to grow – yet still a niche market
  - Less than 1% of world road fuel consumption
  - Less than 1% of world gas demand
- ▶ Natural gas can play a significant role in reducing vehicle CO<sub>2</sub> emissions
  - Biogas or bio-synthetic gas are especially important for cutting emissions from heavy-duty vehicles (HDVs)
- ▶ Vehicle and fuel technology for natural gas is available today and is relatively affordable, particularly in comparison with other alternative fuel vehicles (AFVs)



# Global Gas

Top nations in 2010 with vehicles powered by natural gas, in millions (and percentage of those vehicles among all vehicles in the country)



Note: Vehicle numbers include motorcycles and mopeds Source: NGV Global

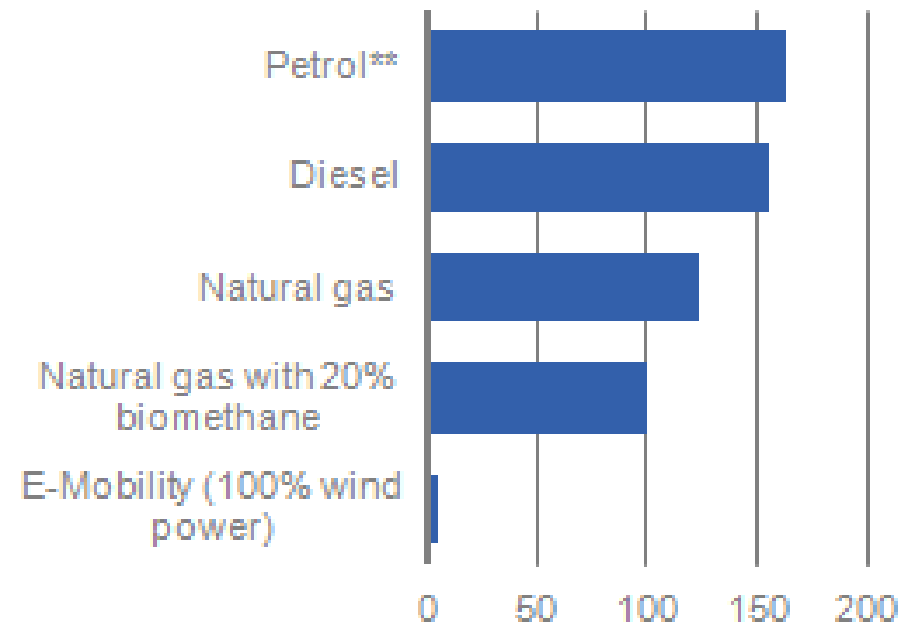


# Role of NGV in “Green” Development

- ▶ Replacing a typical older in-use vehicle with a new NGV provides the following reductions in exhaust emissions
  - CO by 70%–90%
  - Non-Methane Volatiles by 75%
  - NOx by 75%–95%
  - CO<sub>2</sub> by 20%–30%
- ▶ Biogas (bio-methane) significantly lowers carbon emissions compared to diesel fuel for heavy duty vehicles (HDVs)
- ▶ NGVs can also provide a pathway to hydrogen fuel

## Natural gas: good CO<sub>2</sub> performance

Greenhouse gas emissions, grammes of CO<sub>2</sub> equivalents per kilometre driven\*



\* Greenhouse gas performance "from well to wheel".

\*\* Benchmark vehicle: petrol engine with fuel consumption of 7 litres per 100 kilometres.

Source: Deutsche Energie-Agentur



# Natural Gas Transportation Benefits

- ▶ The benefits of using natural gas as a transportation fuel depends on specific local circumstances
- ▶ Natural gas can be competitive with gasoline where transmission and distribution grids are present
- ▶ Main benefits include:
  - Improving urban and regional air quality
  - Reducing noise in urban areas
  - Reducing the domestic consumption of petroleum products
  - Improving energy security

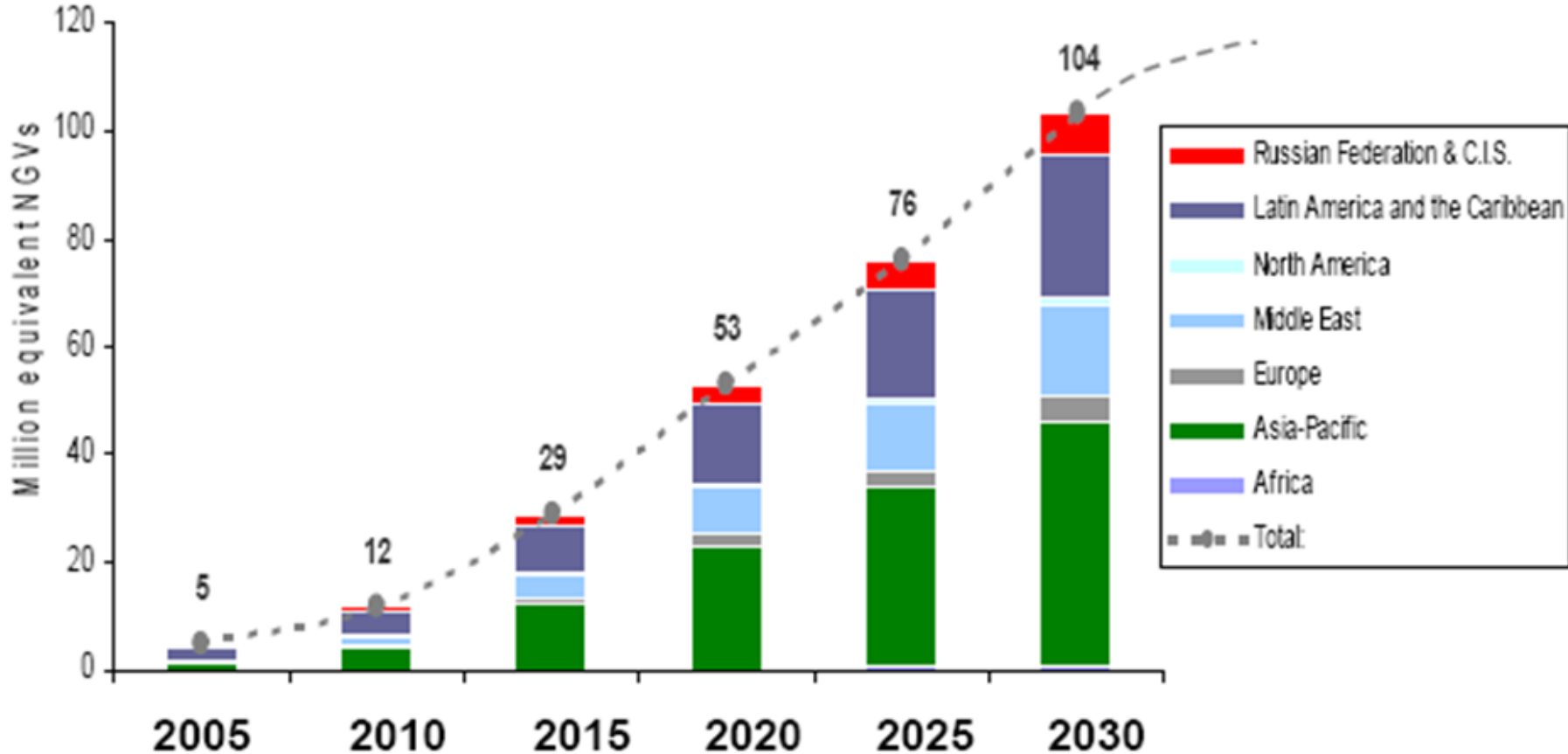




# Projected World NGV Growth to 2030

[business as usual scenario]

Million Equivalent NGVs



# Types of Natural Gas Vehicles

- ▶ There are three types of NGVs:
  - Dedicated: These vehicles are designed to run only on natural gas
  - Bi-fuel: These vehicles have two separate fueling systems that enable them to run on either natural gas or gasoline
  - Dual-fuel: These vehicles are traditionally limited to heavy-duty applications, have fuel systems that run on natural gas, and use diesel fuel for ignition assistance
- ▶ Light-duty vehicles: typically dedicated or bi-fuel modes
- ▶ Heavy-duty vehicles: typically dedicated or dual-fuel modes
- ▶ Natural gas can be stored in tanks as CNG, or LNG
- ▶ Energy density of LNG is greater than that of CNG
  - LNG is well-suited for Class 7 and 8 trucks that need a greater range
- ▶ Dedicated NGVs demonstrate better performance and have lower emissions than bi-fuel vehicles



# Barriers to NGVs Introduction

- ▶ Limited models and sizes of vehicles
  - More bi-fuel pick-up trucks are being introduced in 2013
- ▶ Slow development of engines of different sizes and applications
- ▶ Fuel availability and insufficient fueling stations to secure longer driving ranges
- ▶ Poor performance of retrofitted vehicles
- ▶ Persistent perception of natural gas safety issues



# Case Studies: U.S. Vehicle Fleets

## ▶ UPS

- Colorado and California CNG vehicle: more than 1,100 trucks.
- Along West Coast – close to 60 LNG powered trucks,
- Since 2000, UPS "green fleet" traveled more than 165 million miles:
  - CO – 75% lower
  - NO<sub>x</sub> – 49% lower
  - CO<sub>2</sub> – 7% lower

## ▶ AT&T

- Invested \$565 million in the last 10 years to replace about 15,000 fleet trucks with alternative-fuel vehicles – more than half powered by CNG
- Plans to purchase around 6,000 additional CNG vehicles over the next five years.
- AT&T's alternative fuel vehicle initiative:
  - Reduced CO<sub>2</sub> by 211,000 metric tons
  - Saved the company 49 million gallons (190 million liters) of gasoline over the 10-year deployment period.



# Case Studies: Public Transportation

## ▶ Los Angeles Metropolitan Transit Authority

- The transit bus system has nearly 400 million annual passenger boardings, and 1.5 billion miles a year.
- It experimented with Methanol and Ethanol buses that proved too corrosive for bus engines
- In 2011 it switched completely to CNG engines, reducing particulate emissions by 80%
- It runs today 2,221 CNG buses, 1 electric and 6 gasoline–electric hybrid buses in its fleet.
- CNG buses cost about 10 to 15% more to operate than standard diesel engine buses, due to maintenance costs
- The county saves about \$40 million in fuel costs every year because the price of natural gas sold as transportation fuel is less than diesel.

## ▶ Lithuanian CNG Bus Fleet Expansion

- New CNG buses with roof–mounted cylinders made from special composite material with a total capacity of about 1,300 liters of gas.
- The CNG engines meet Euro 5 and EEV standards.
- Scheduled bus service life – 15 years and 1.5 million kilometers.



# Case Study: Biomethane Trucks

## ▶ French Supermarket Chain Carrefour

- Testing trucks that will be running on bio-methane fuel produced using waste from 15 stores in the Lille region of France
- They will use an innovative methanization process that includes transformation of organic waste to bio-methane to power the delivery vehicles
- Using this new mode of transport will
  - Reduce emission levels by 80%,
  - Cut noise pollution in half,
  - Stop emissions of fine particles, and
  - Address the problem of food waste
- Truck characteristics:
  - Operating range: 400 to 600 kms
  - Engine power: 330 hp (for 42/43 tons)
  - Can carry a payload of 25 tons, as same size conventional fuel vehicle.



# In Summary

- ▶ Emissions from the transportation system are due to three main factors:
  - Type of fuels,
  - Energy intensity of the vehicle system, and
  - Total distance travelled
- ▶ As discussed, different policy instruments are required to address each of these factors
- ▶ The benefits of using natural gas as a transportation fuel depends on specific local circumstances



# Thank you for your attention

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