

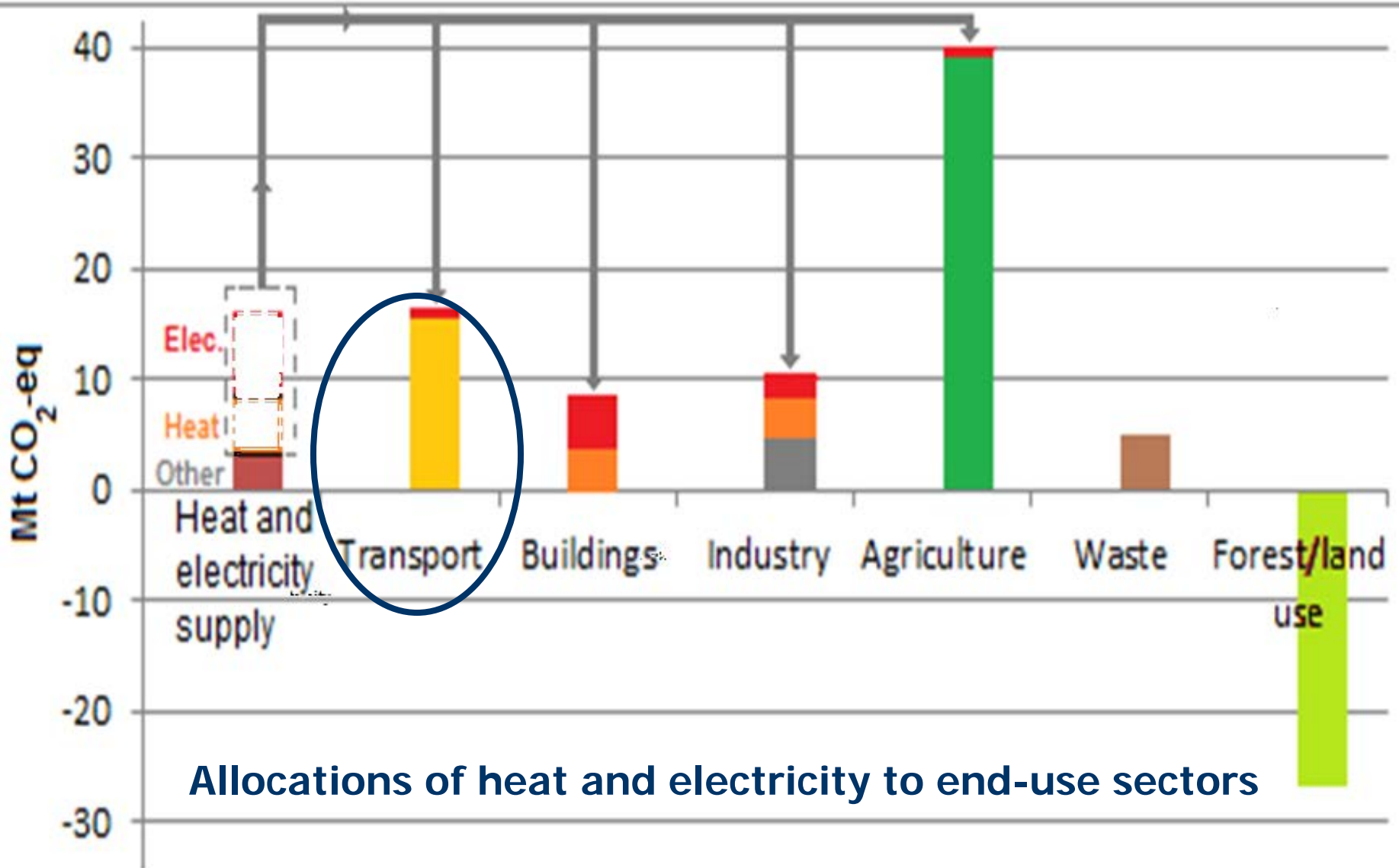
Asia-Pacific Energy Leader's Summit  
Wellington, 16-17 March, 2016

**Transport mitigation is  
not easy!**

Prof Ralph Sims  
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R.E.Sims@massey.ac.nz

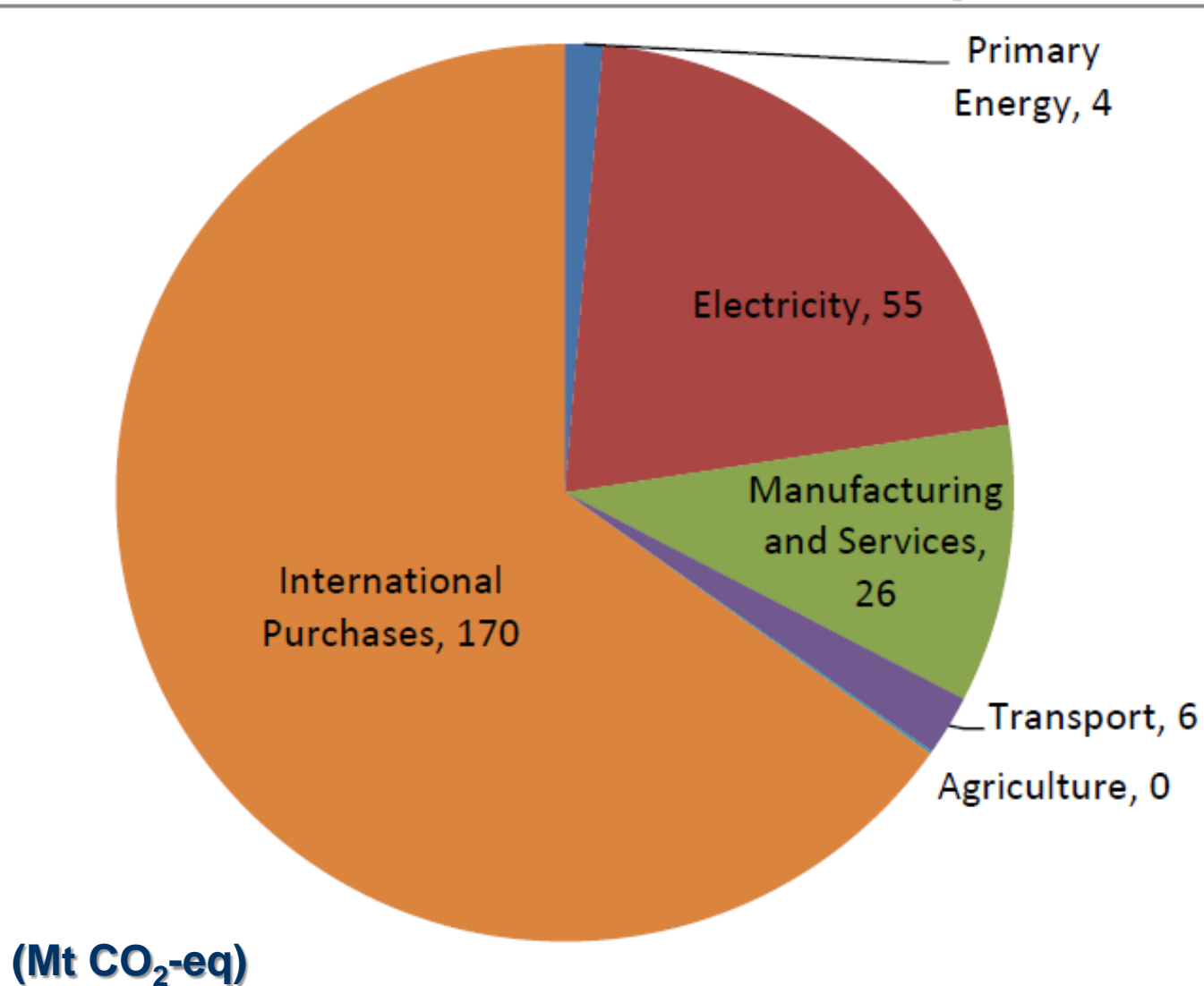
# New Zealand's 2013 GHG emissions by sector

Gross 81.6 Mt CO<sub>2</sub>-eq; Net (less forest sinks) 54.9 Mt CO<sub>2</sub>-eq

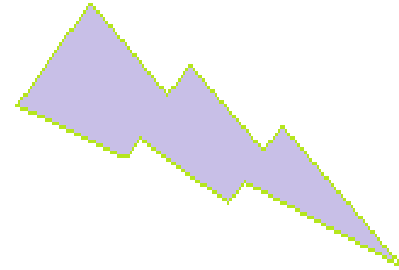
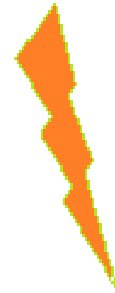
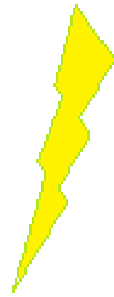
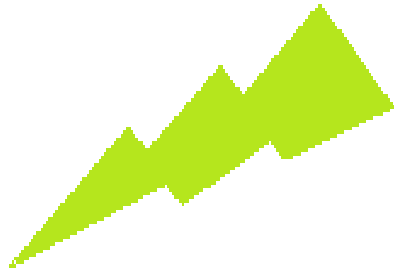


Allocations of heat and electricity to end-use sectors

# NZ GHG mitigation potential by source – cumulative emissions over 2021-2030 period.



# TOTAL GHG emissions



**Fuel carbon intensity**  
(gCO<sub>2-eq</sub> / MJ)

**Energy intensity**  
(MJ / km)  
(MJ / t km)

**Journey**  
(km / yr)  
(t km / yr)

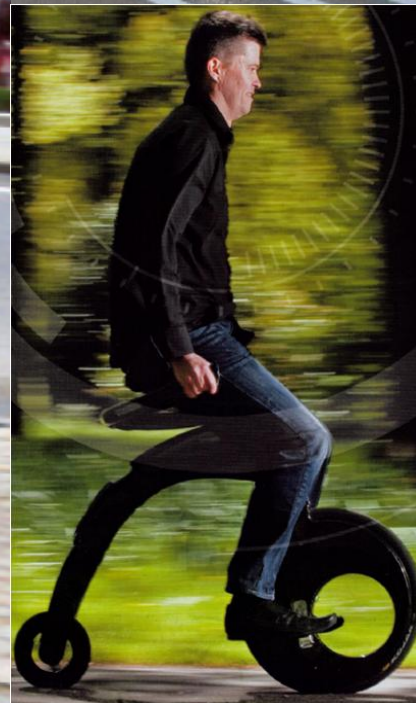
**System - infrastructure modal choice**

Diesel  
Gasoline  
Biofuels  
Electricity  
Hydrogen

LDV / HDV / Bikes  
Rail  
Marine  
Aviation  
Mass transit  
Cycling / walking

Distance to travel  
Combine trip objectives  
Avoidance  
Internet shopping

Urban planning  
Roading / airports / railways / ports  
Choice between speed / comfort / cost / convenience



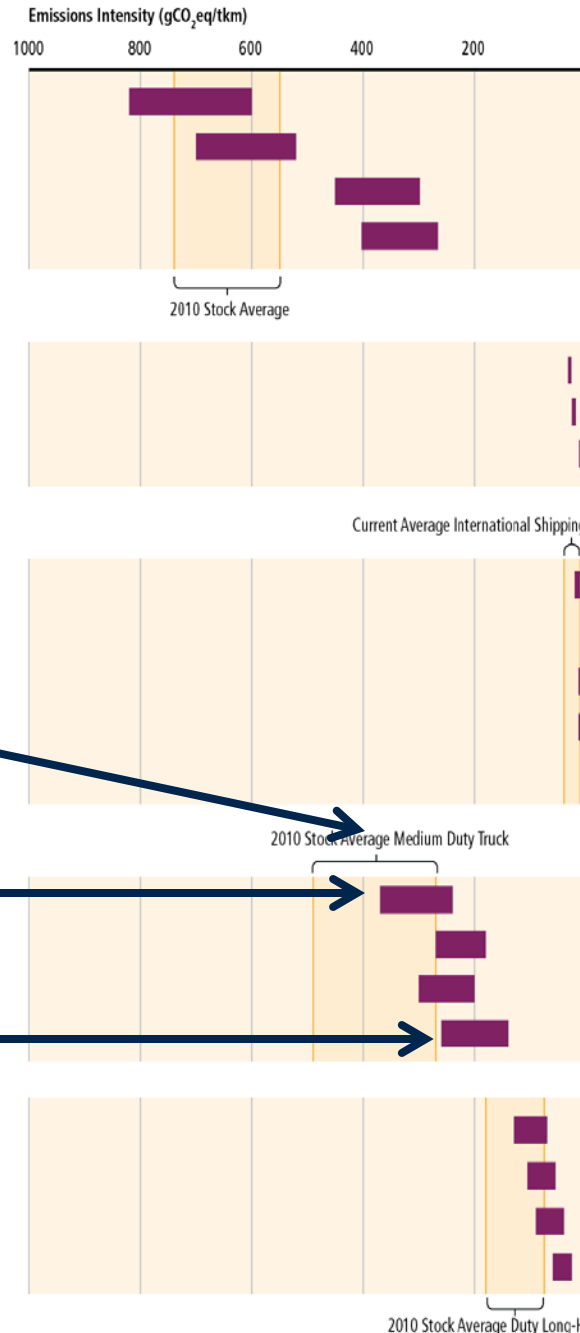
# Potential emission reductions (g CO<sub>2</sub> / t km) and mitigation costs (\$/tCO<sub>2</sub>) for the various modes of transport.

Stock average vehicle fleet compared with:

2010 new vehicles

Projected 2030 new vehicles and fuels.

## Freight transport

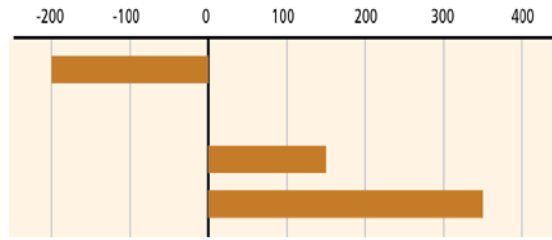


### Aviation

(Commercial, Medium to Long Haul)

- 2010 Dedicated Airfreighter
- 2010 Belly-Hold
- 2030 Improved Aircraft
- 2030 Improved, Open Rotor Engine

Levelized Cost of Conserved Carbon at 5% WACC [USD<sub>2010</sub>/t CO<sub>2</sub>]



### Rail (Freight Train)

- 2010 Diesel, Light Goods
- 2010 Diesel, Heavy Goods
- 2010 Electric, 200g CO<sub>2</sub>/kWh<sub>e</sub>

### Waterborne

- 2010 New Large International Container Vessel
- 2010 Large Bulk Carrier/Tanker
- 2010 LNG Bulk Carrier
- 2030 Optimized Container Vessel
- 2030 Optimized Bulk Carrier

### Road

#### New Medium Duty Trucks

- 2010 Diesel
- 2010 Diesel Hybrid
- 2010 Compressed Natural Gas
- 2030 Diesel

#### New Heavy Duty, Long-Haul Trucks

- 2010 Diesel
- 2010 Compressed Natural Gas
- 2030 Diesel
- 2030 Diesel/Biofuel (50/50 Share)\*

#### Baselines for LCCC Calculation

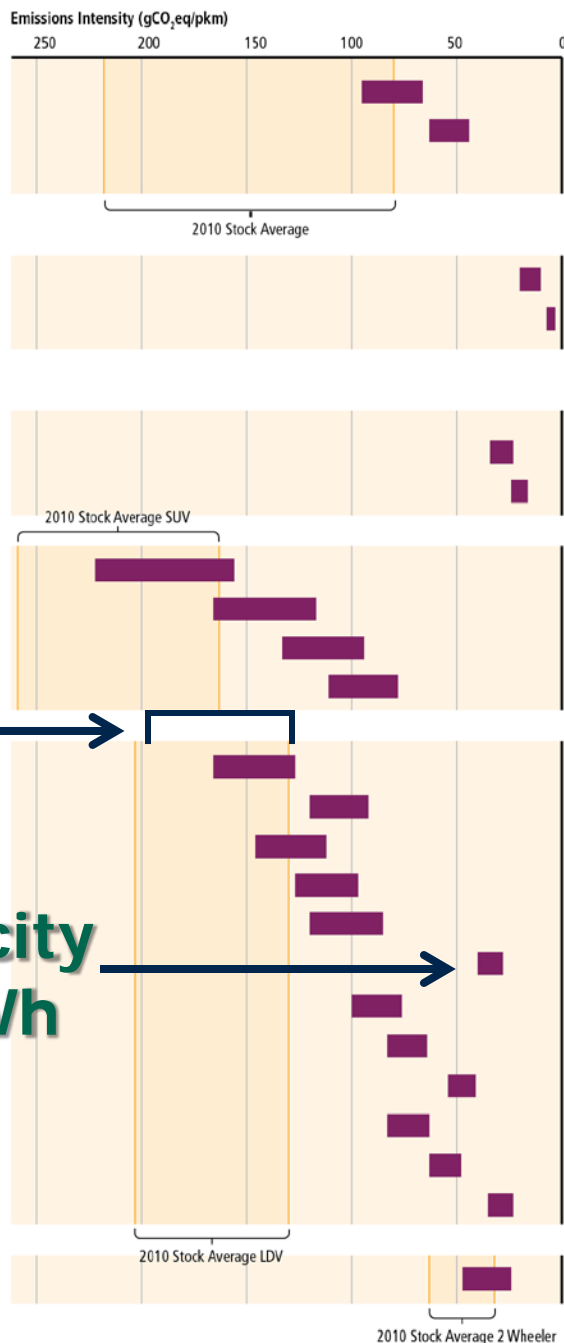
- Average New Aircraft (2010)
- New Diesel Medium Duty(2010)
- New Diesel Long-Haul (2010)
- New Bulk Carrier/ Container Vessel (2010)

\*Assuming 70% Less CO<sub>2</sub>/MJ Biofuel than /MJ Diesel

# Passenger transport

Potential emission reductions (g CO<sub>2</sub> / km) and mitigation costs (\$/tCO<sub>2</sub>) for various modes of transport. Stock average car fleet 2010

EVs with electricity at 200 g CO<sub>2</sub>/kWh



## Aviation (Commercial, Medium to Long Haul)

- 2010 Narrow and Wide Body
- 2030 Narrow Body
- 2030 Narrow Body, Open Rotor Engine

## Rail (Light Rail Car)

- 2010 Electric, 600 g CO<sub>2</sub>/kWh<sub>el</sub>
- 2010 Electric, 200 g CO<sub>2</sub>/kWh<sub>el</sub>

## Road

### New Buses, Large Size

- 2010 Diesel
- 2010 Hybrid Diesel

### New Sport Utility Vehicles (SUV), Mid-Size

- 2010 Gasoline
- 2010 Hybrid Gasoline
- 2030 Gasoline
- 2030 Hybrid Gasoline

### New Light Duty Vehicles (LDV), Mid-Size

- 2010 Gasoline
- 2010 Hybrid Gasoline
- 2010 Diesel
- 2010 Compressed Natural Gas
- 2010 Electric, 600 g CO<sub>2</sub>/kWh<sub>el</sub>
- 2010 Electric, 200 g CO<sub>2</sub>/kWh<sub>el</sub>
- 2030 Gasoline
- 2030 Hybrid Gasoline
- 2030 Hybrid Gasoline/Biofuel\* (50/50 Share)
- 2030 Diesel
- 2030 CNG
- 2030 Electric, 200 g CO<sub>2</sub>/kWh<sub>el</sub>

### New 2 Wheelers (Scooter up to 200 cm<sup>3</sup> cylinder capacity)

- 2010 Gasoline



**Baselines for LCCC Calculation**

- Average New Aircraft (2010)
- New Gasoline SUV (2010)
- New Gasoline LDV (2010)
- Optimized Gasoline SUV (2030)
- Optimized Gasoline LDV (2030)

\* Assuming 70% less CO<sub>2</sub>/MJ of Biofuel than per MJ of Gasoline

# Key messages

- **GHG emissions from the transport sector can be reduced e.g. by fuel efficiency standards to encourage lower emission vehicles.**
- **Light duty vehicle use can be reduced through urban design that prioritises walking and cycling, widely accessible public transport, and adoption of smart transport technologies.**
- **Large scale commercialisation of biofuels, such as for aviation, remain costly.**
- **Moving freight by rail or coastal shipping has much lower emissions per tonne than by road.**



**BLACK CARBON MITIGATION  
AND THE ROLE OF THE GLOBAL  
ENVIRONMENT FACILITY:**

A STAP Advisory Document

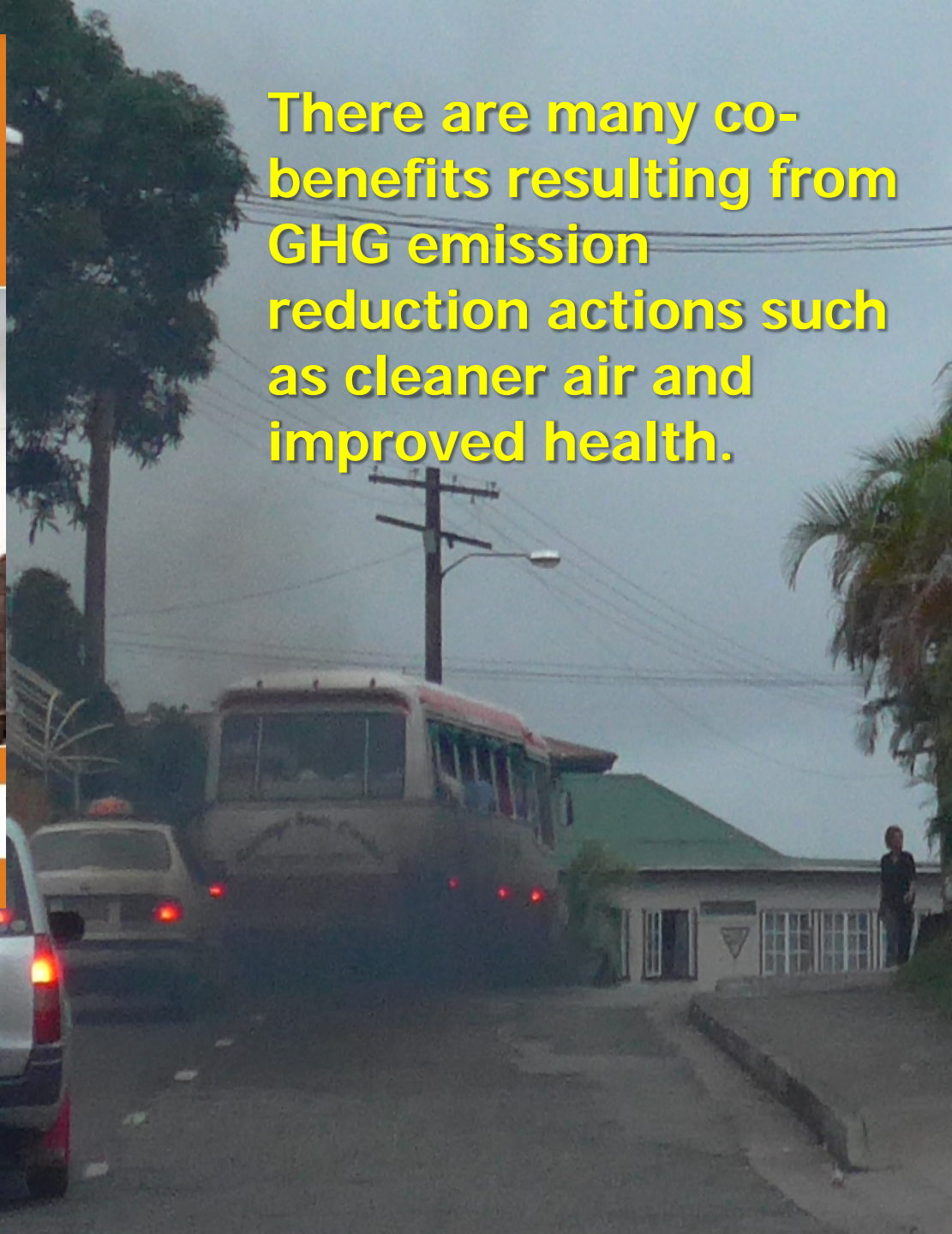


**Scientific and Technical Advisory Panel**

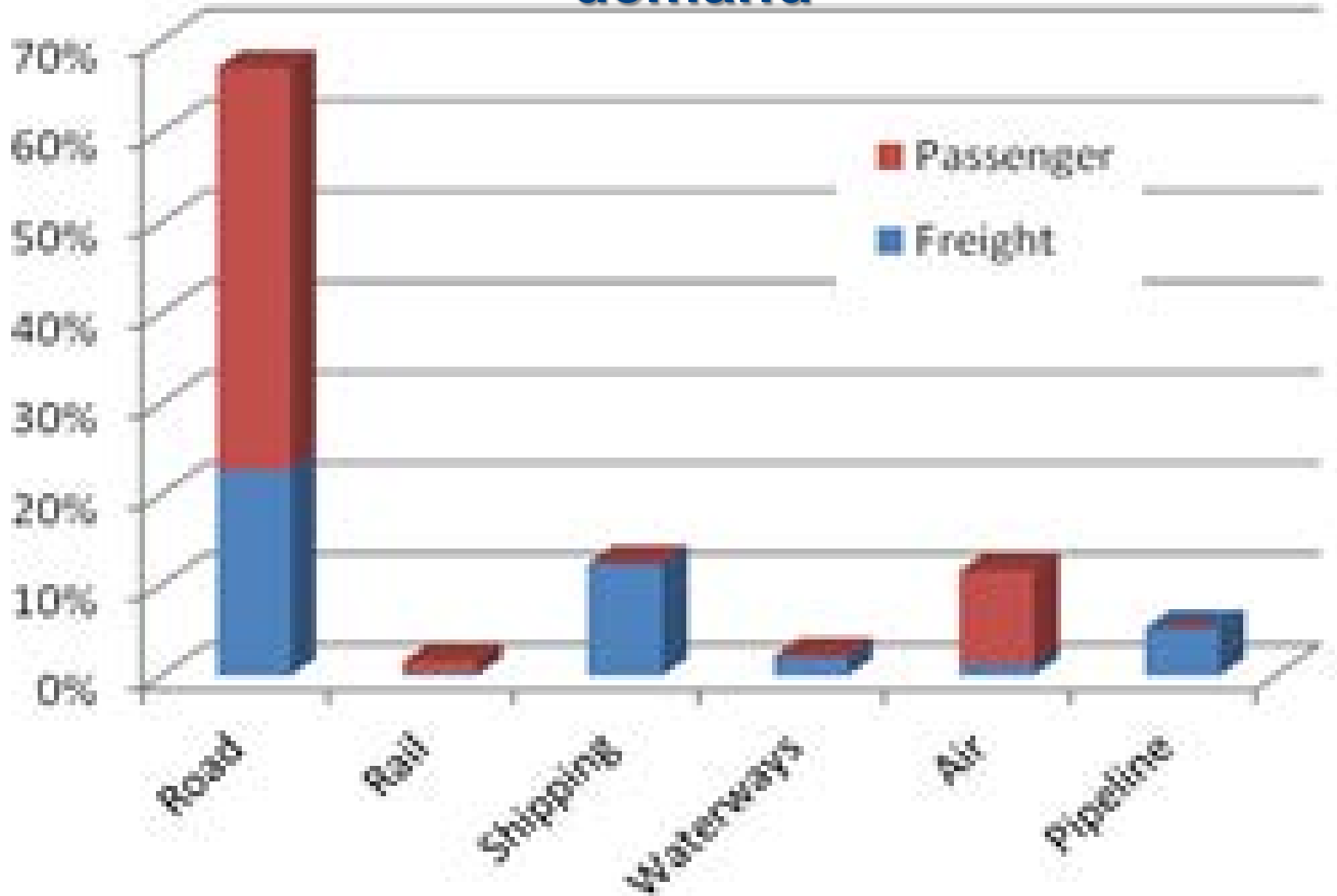
An independent group of scientists which advises the Global Environment Facility



**There are many co-benefits resulting from GHG emission reduction actions such as cleaner air and improved health.**

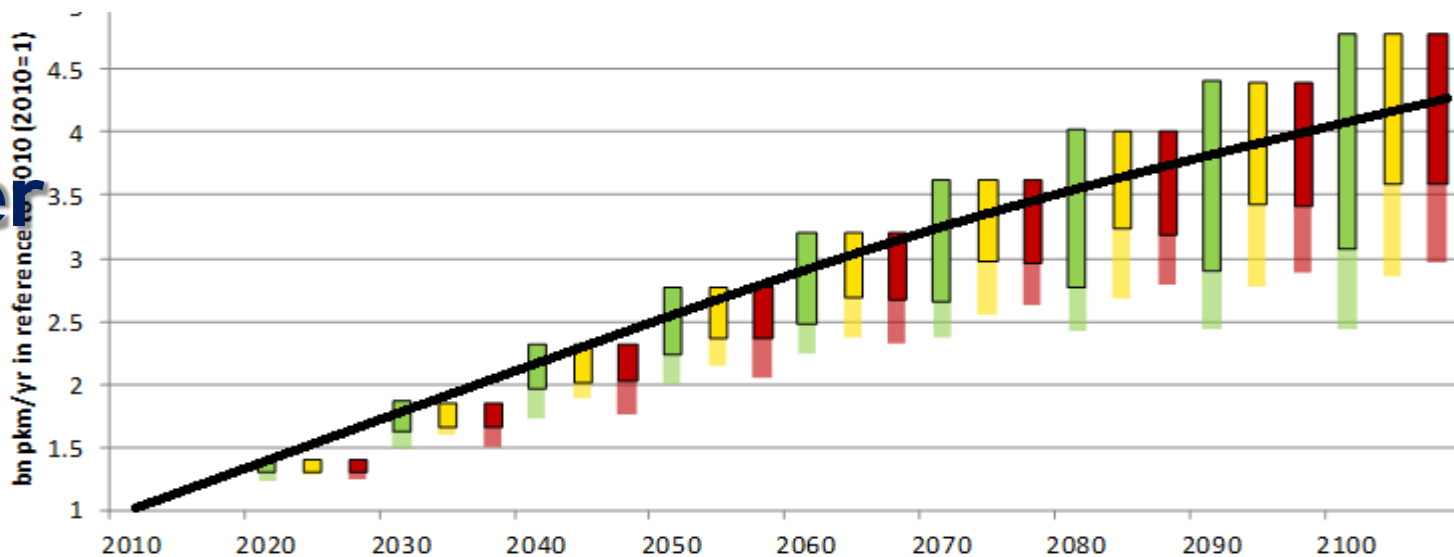


# Global shares of total transport energy demand

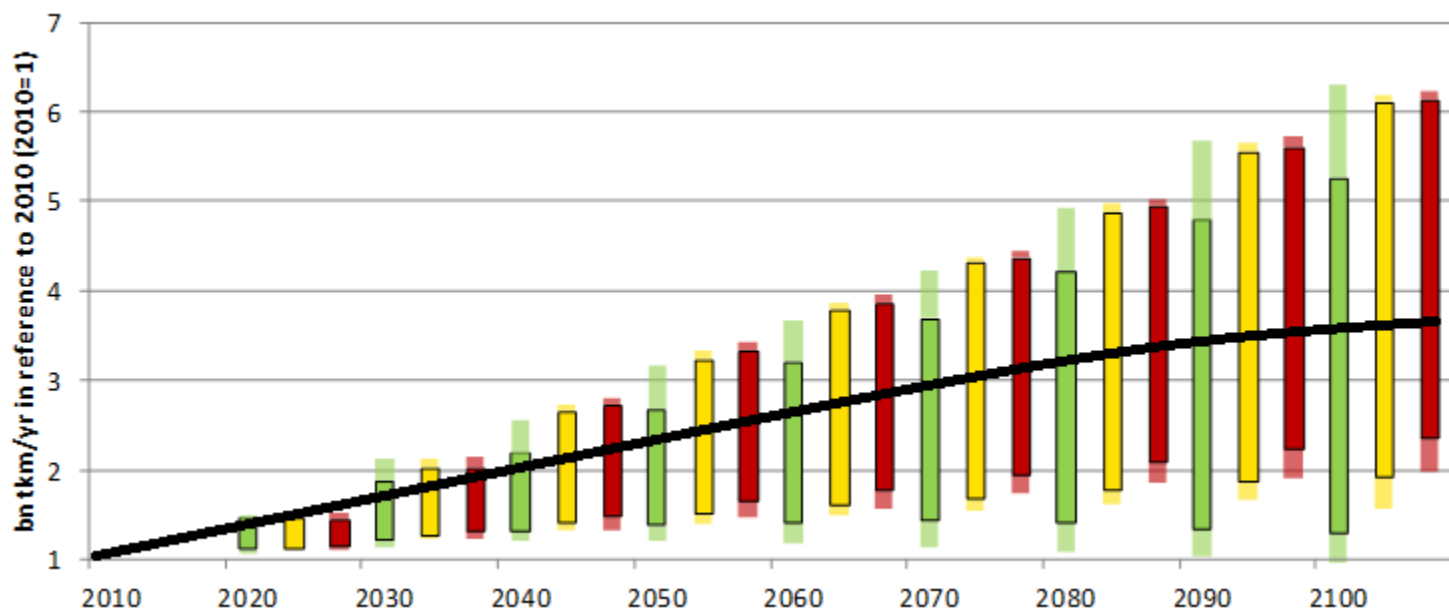


# BAU global transport demand projections compared with 2010 baseline (>600 scenarios)

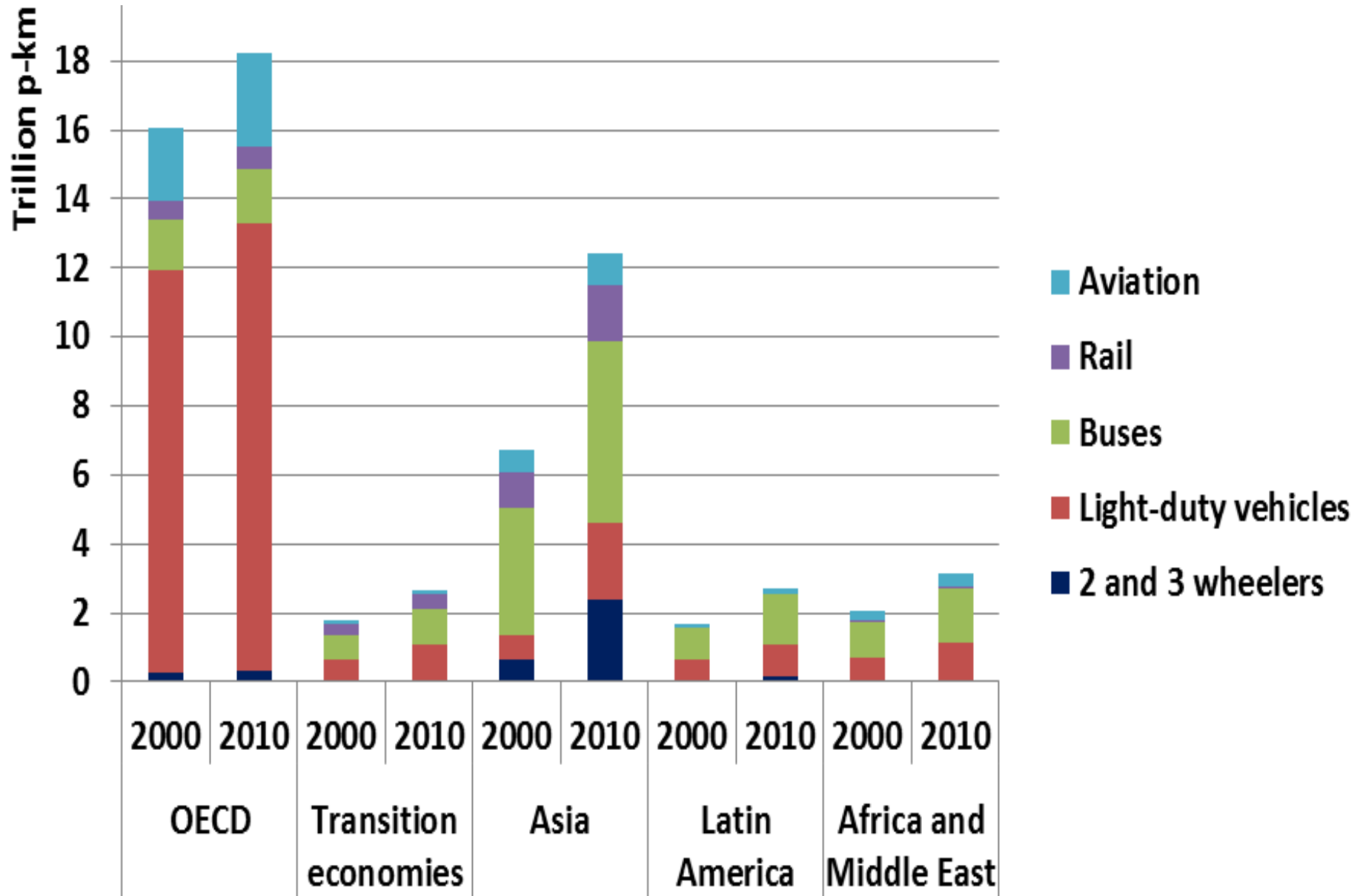
**Billion passenger km /yr**



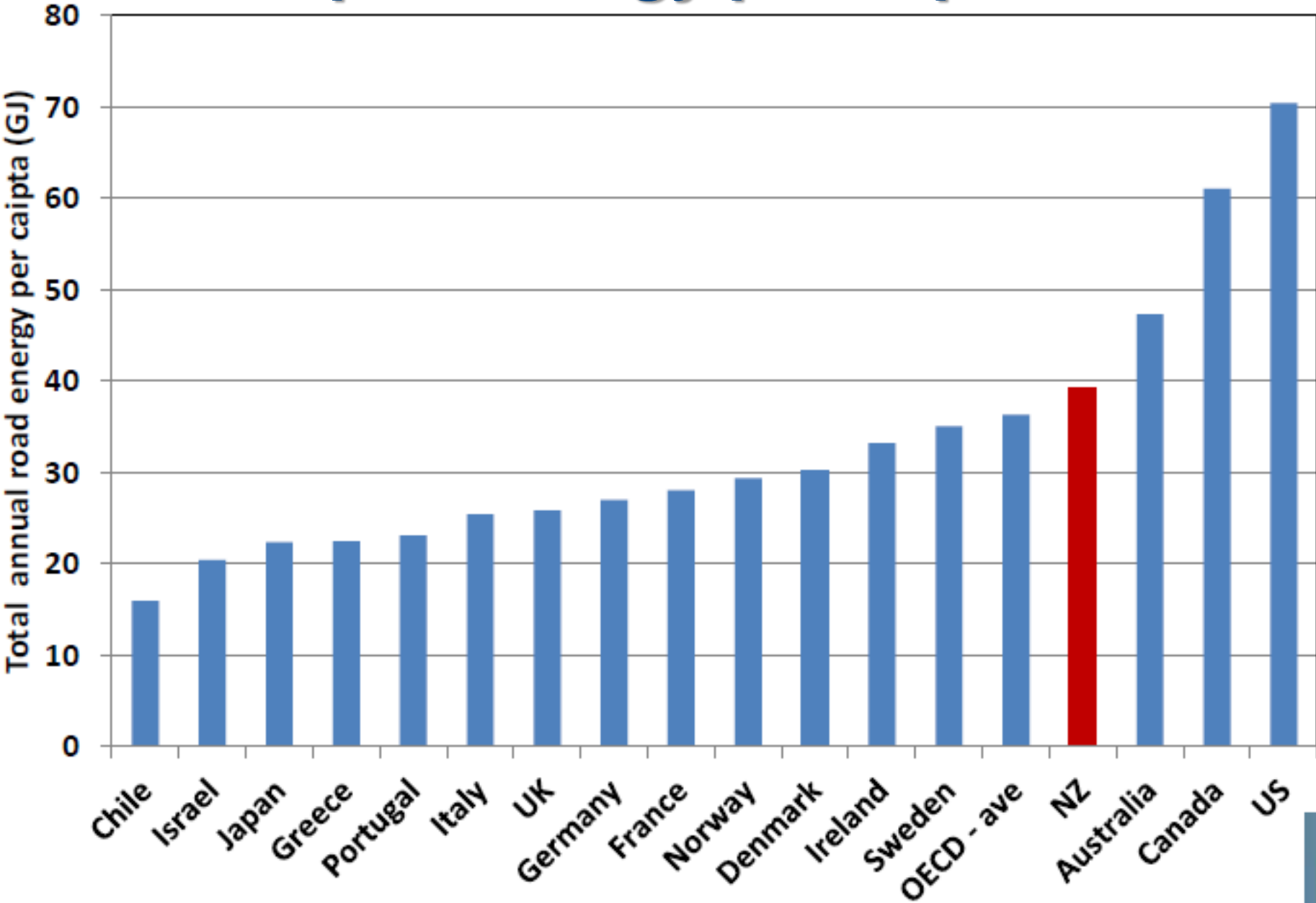
**Freight billion t-km/yr**



# Regional differences in passenger transport modes.



# Road transport energy per capita varies

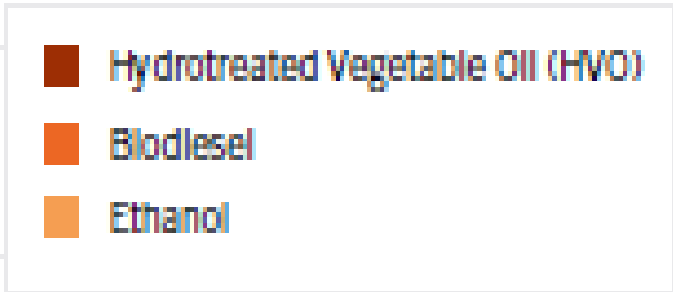


Billion Litres

# Liquid Biofuels

World Total

116.5 Billion Litres



2000

2001

2002

2003

2004

2005

2006

2007

2008

2009

2010

2011

2012

2013