Energy Efficiency Policy Workshop 2019

Overview of the suite of policy measures to improve vehicle fuel economy

Name Elizabeth Yeaman

Institution Retyna Ltd, New Zealand

Date 18 March 2019, Hong Kong

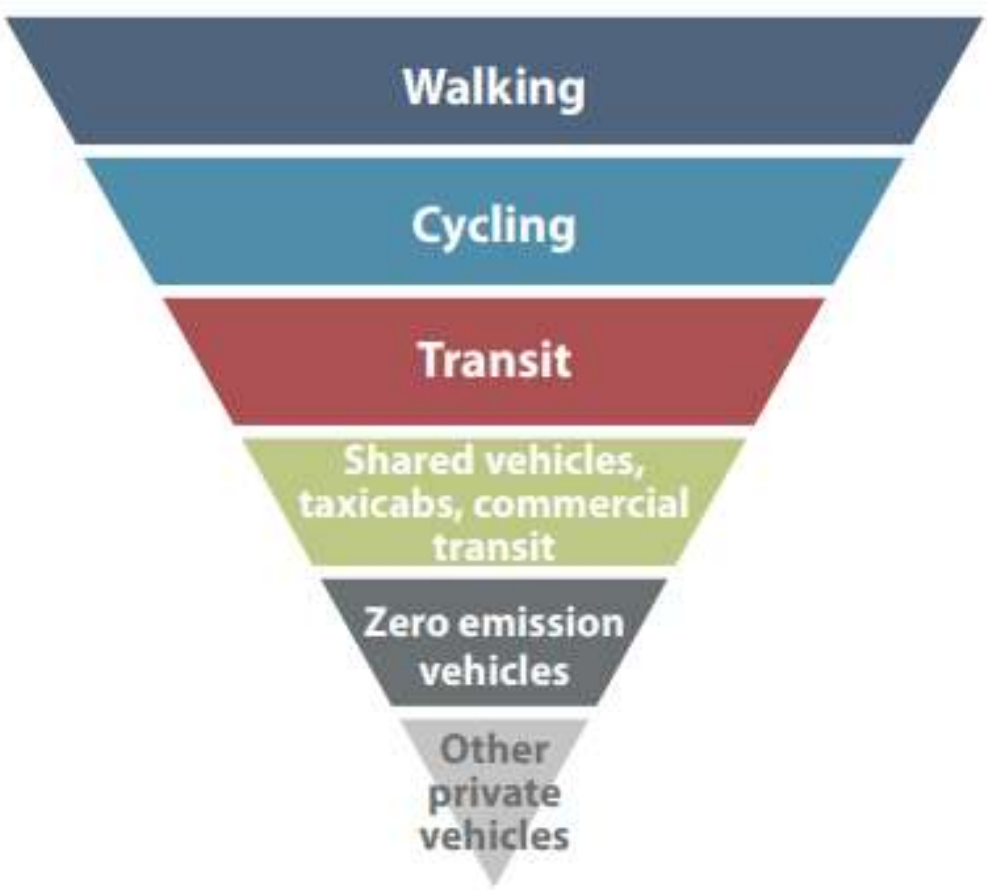
APERC Asia Pacific Energy Research Centre

APEC Asia-Pacific Economic Cooperation

Focus for this presentation

- Investing in public transport, encouraging active modes (walking, cycling) through infrastructure and urban form, land-use planning, and pricing signals are all vital for a low carbon future, which also addresses congestion
- This presentation focuses on the suite of policies that can encourage a shift to more fuel/energy efficient light-duty vehicles (LDV), including electric vehicles (EVs), to reduce CO_2 emissions

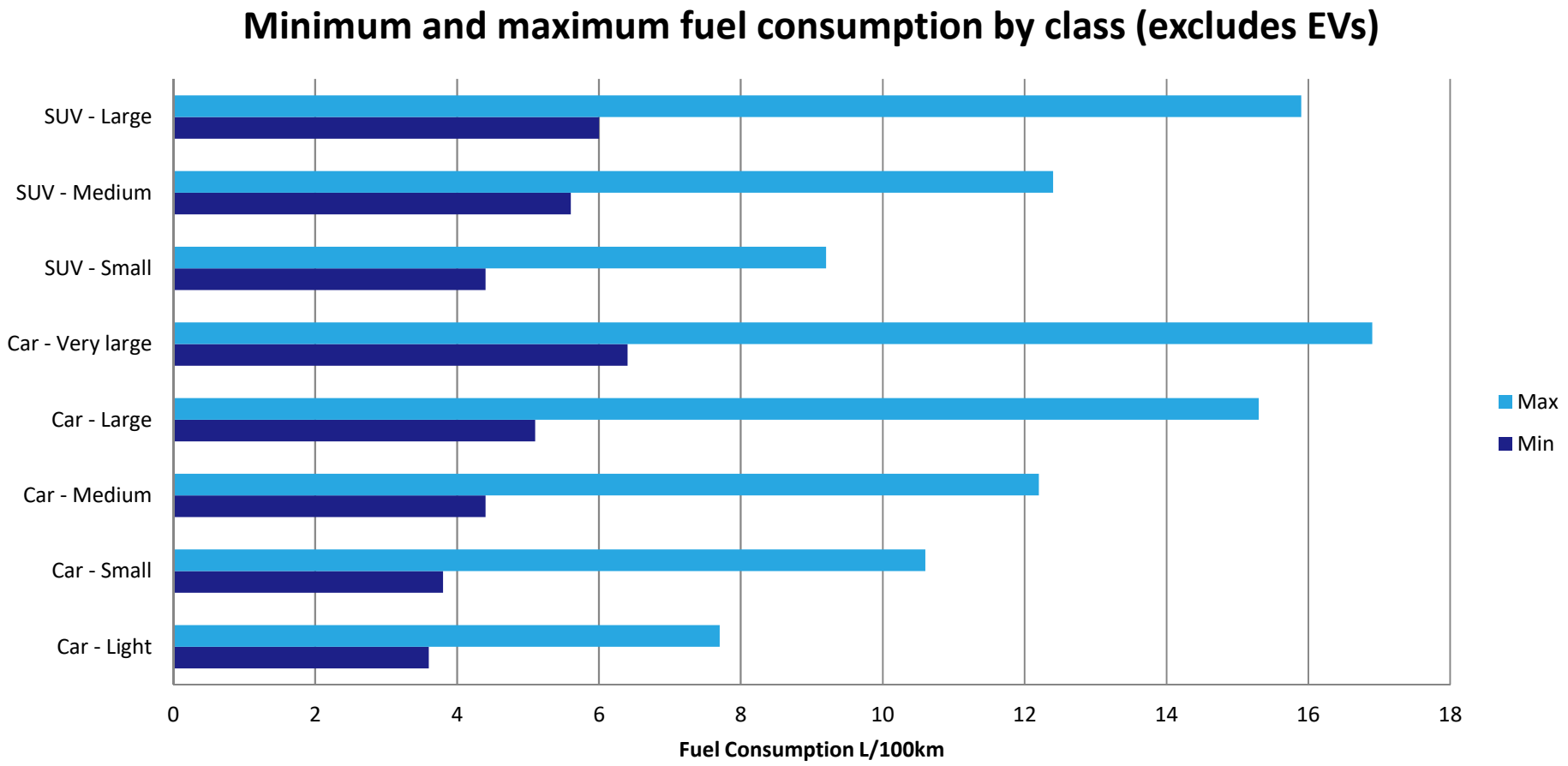
Transport hierarchy of people movement



Source: Portland EV Strategy 2017, https://www.portlandoregon.gov/bps/article/619275

- The purpose of transport is to help people access goods and services, work and education, family and friends
- Policies which encourage fuel efficient and low/zero emission vehicles should complement other transport policy measures reducing overall CO_2

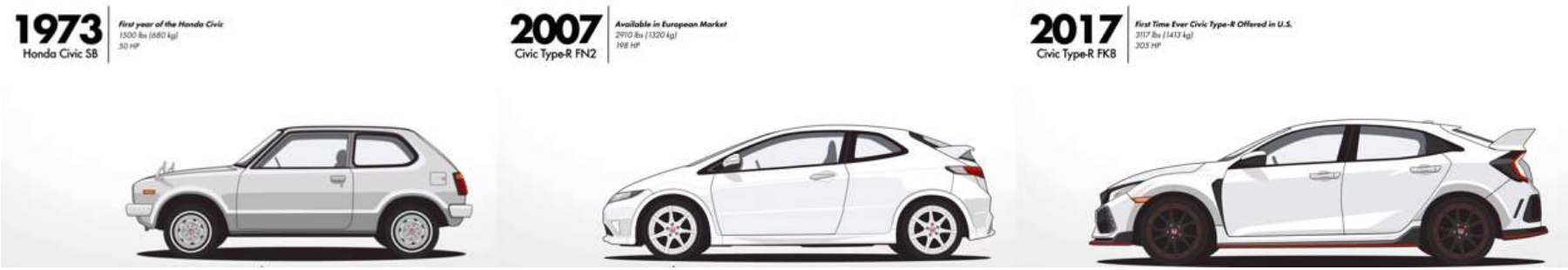
Big difference in fuel consumption within vehicle class



Data source: Yeaman, Car fuel efficiency labelling review, APEC TPT-39, Christchurch, 2014

Justification for intervention in the market

- **Unpriced externalities:** GHG emissions, air quality emissions
- **Imperfect information:** vehicle buyers tend to underestimate or don't know fuel costs over the time they own the vehicle
- **Split incentives:** vehicle sellers tend to make bigger profits on larger, less fuel efficient vehicles, but do not pay ongoing fuel costs - the same model of vehicle gets larger over the years with each redesign, as bigger vehicles equal bigger profits

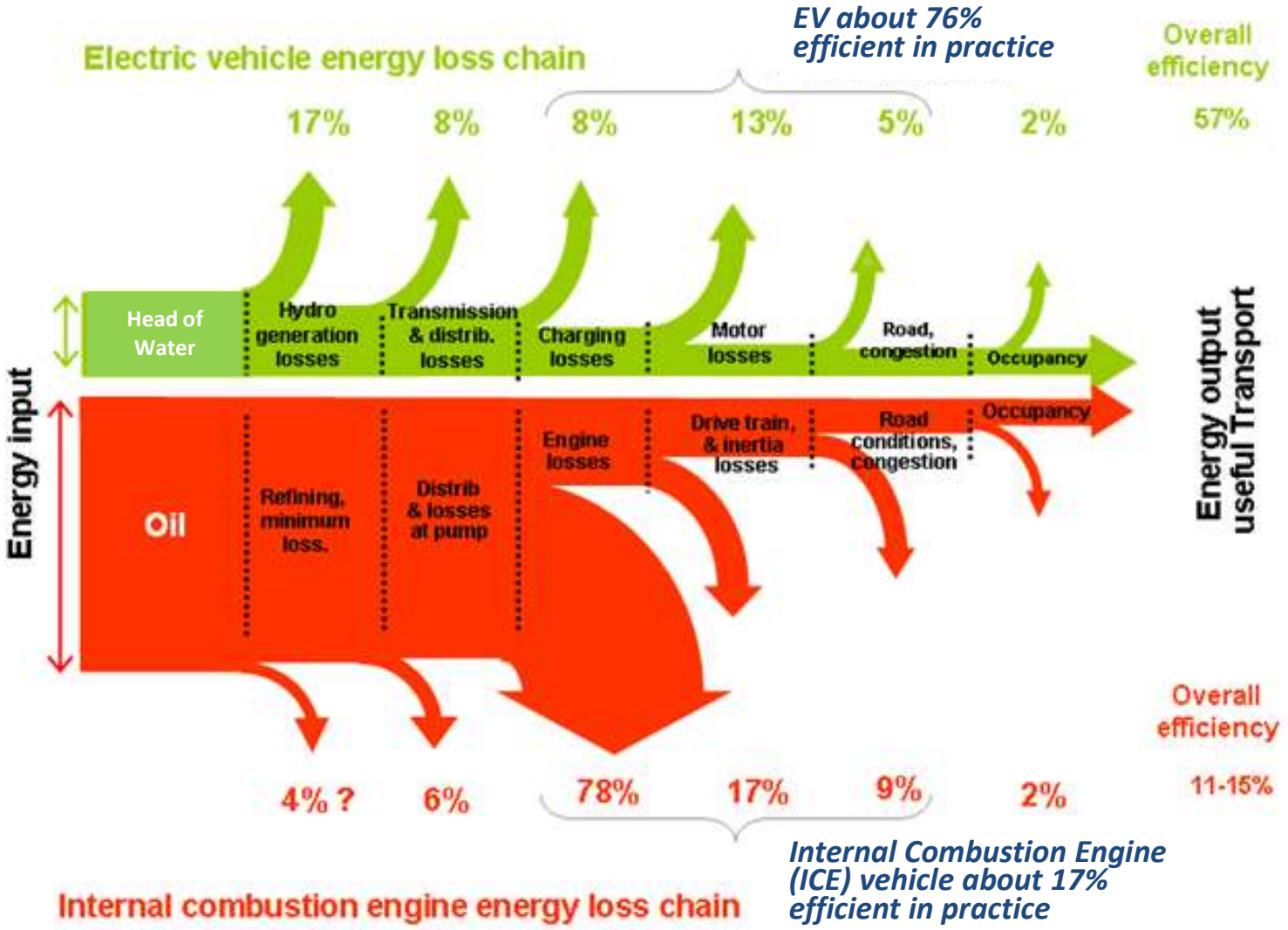


Technology changes have improved fuel efficiency

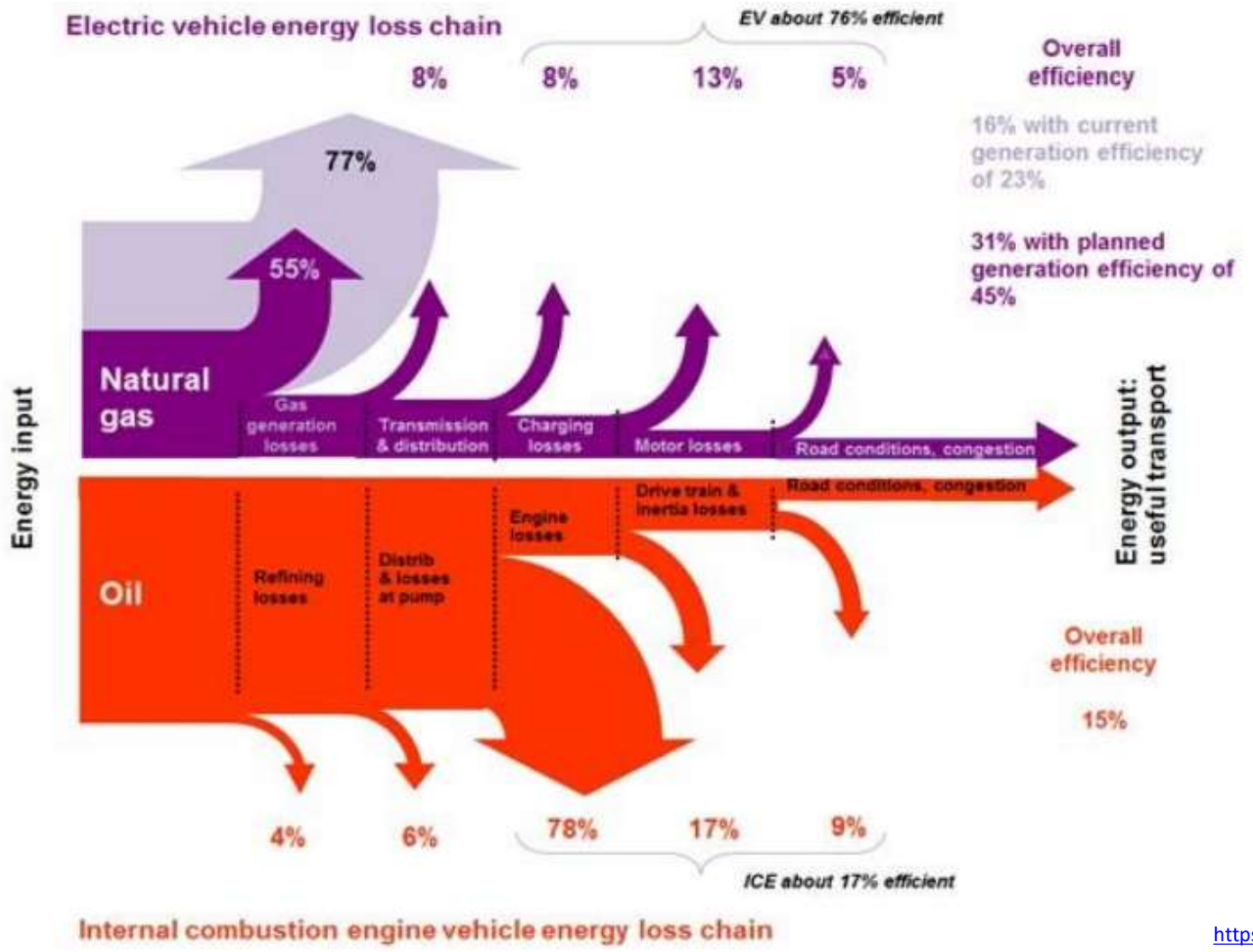
- Driven by policy, technology changes have resulted in significant fuel consumption improvements for internal combustion engine (ICE) vehicles

9.0 L/100 km	8.1 L/100 km	6.5 L/100 km
11 km/L	12.3 km/L	15.3 km/L
26 mpg	29 mpg	36 mpg

EVs are a step change in energy efficiency

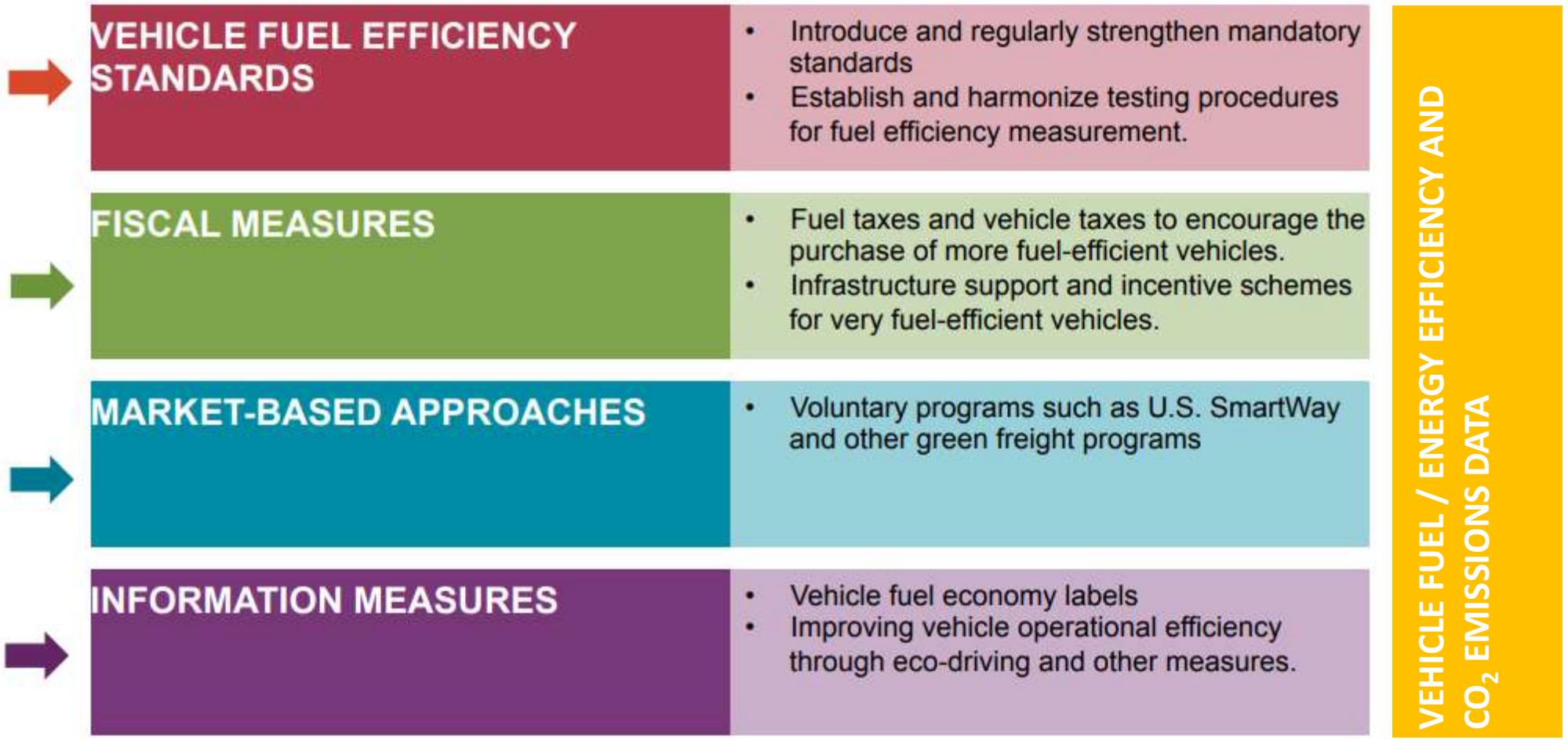


CO_2 benefits of EVs with fossil fuel electricity generation



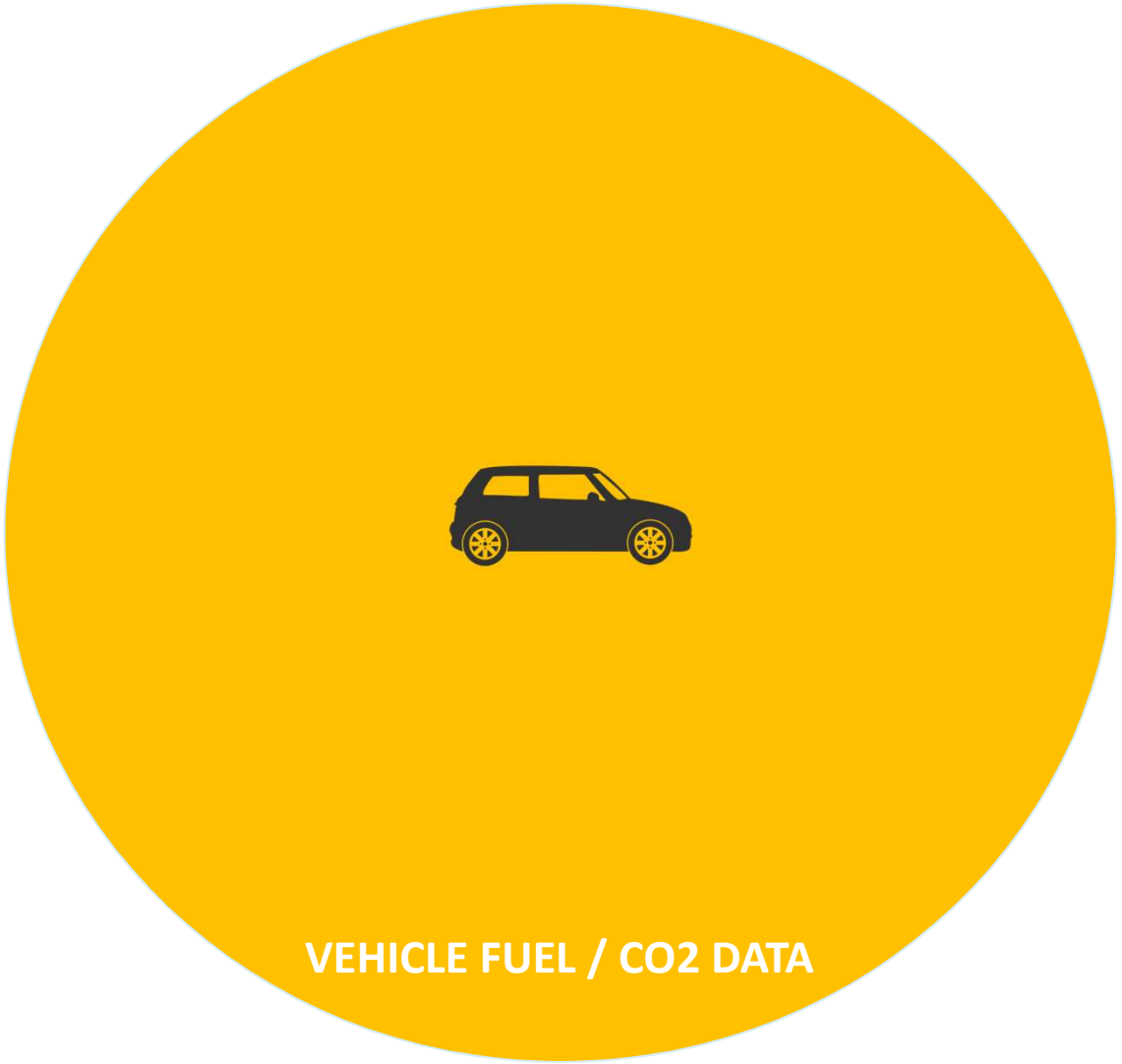
https://aperc.ieej.or.jp/file/2014/2/5/PREE_201311_Brunei_Darussalam.pdf

Suite of vehicle fuel efficiency / CO_2 policies



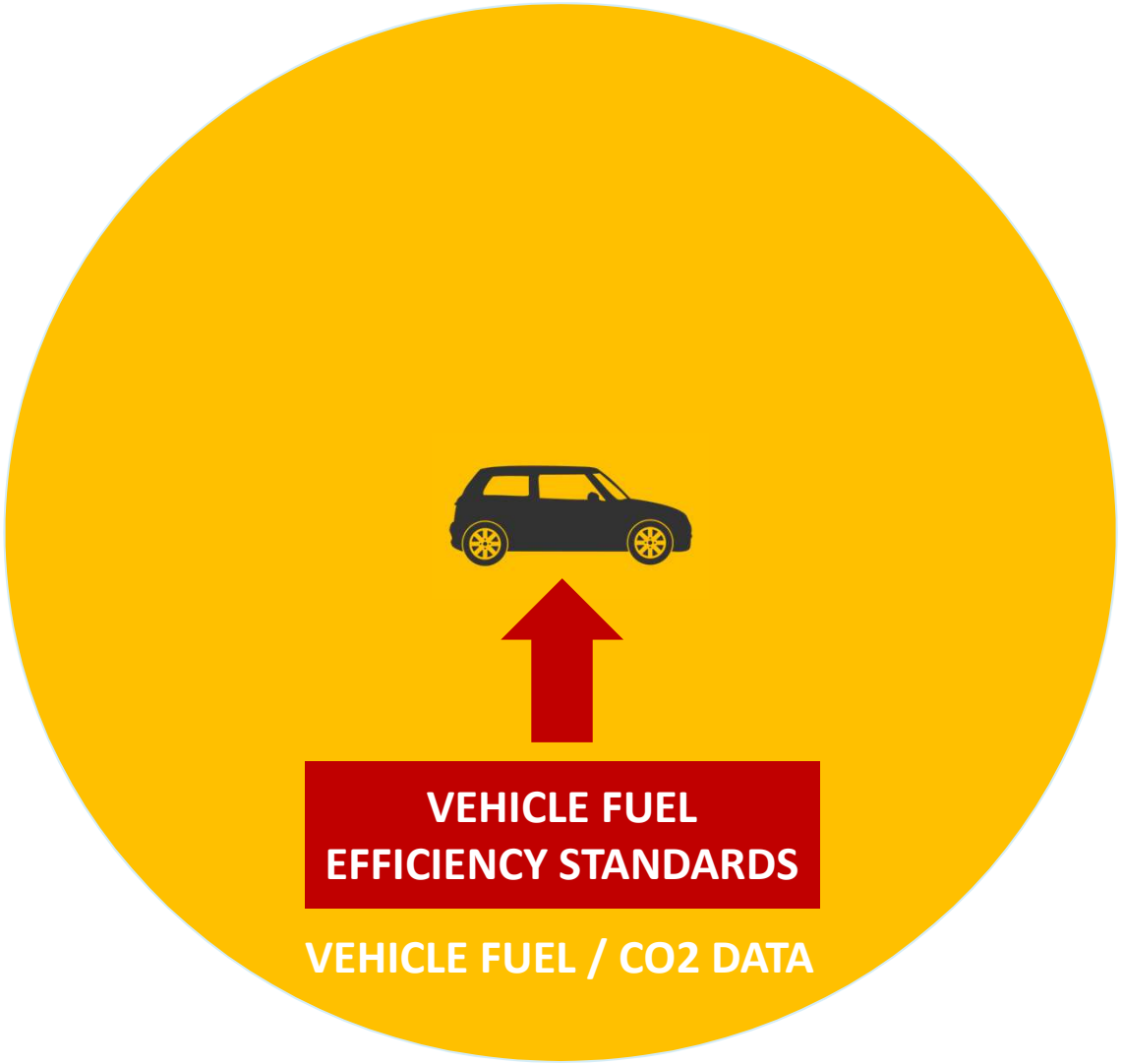
Adapted from International Council on Clean Transportation (ICCT), 2018

There are strong synergies between the measures



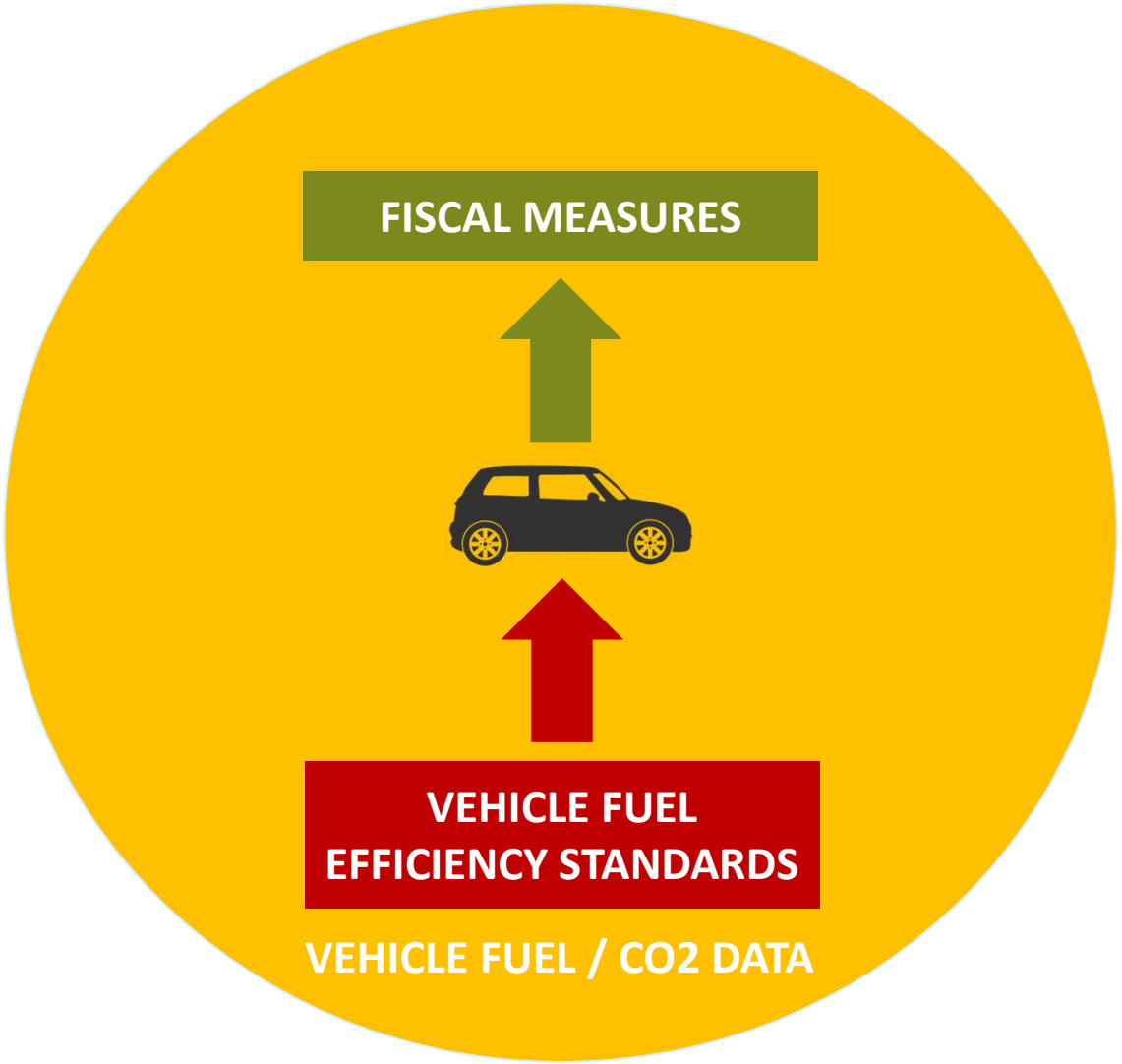
- Data underpins everything

There are strong synergies between the measures



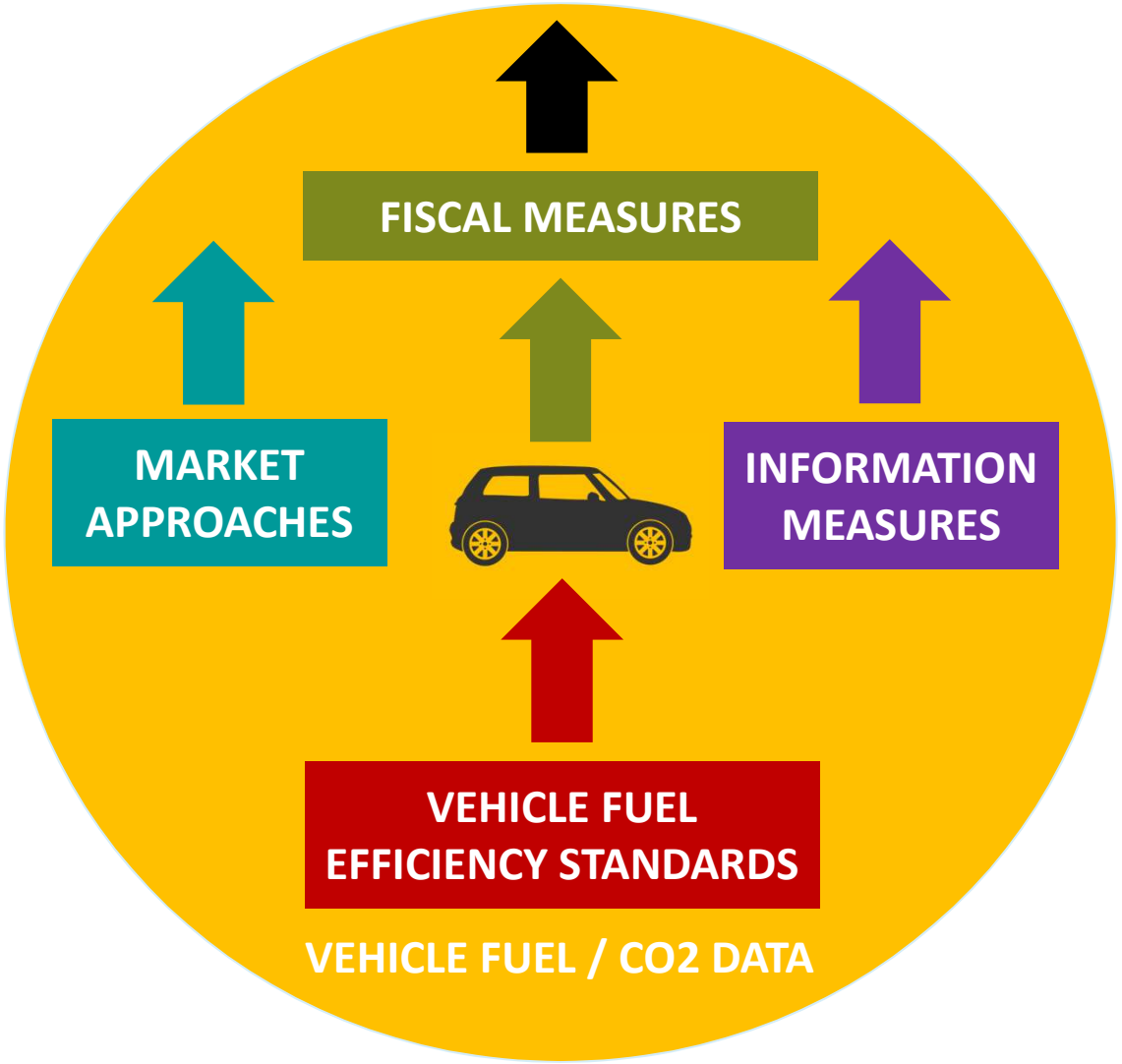
- Vehicle fuel efficiency/CO_2 standards create market push - encourage manufacturers to **supply** lower CO_2 vehicles
- Data underpins everything

There are strong synergies between the measures



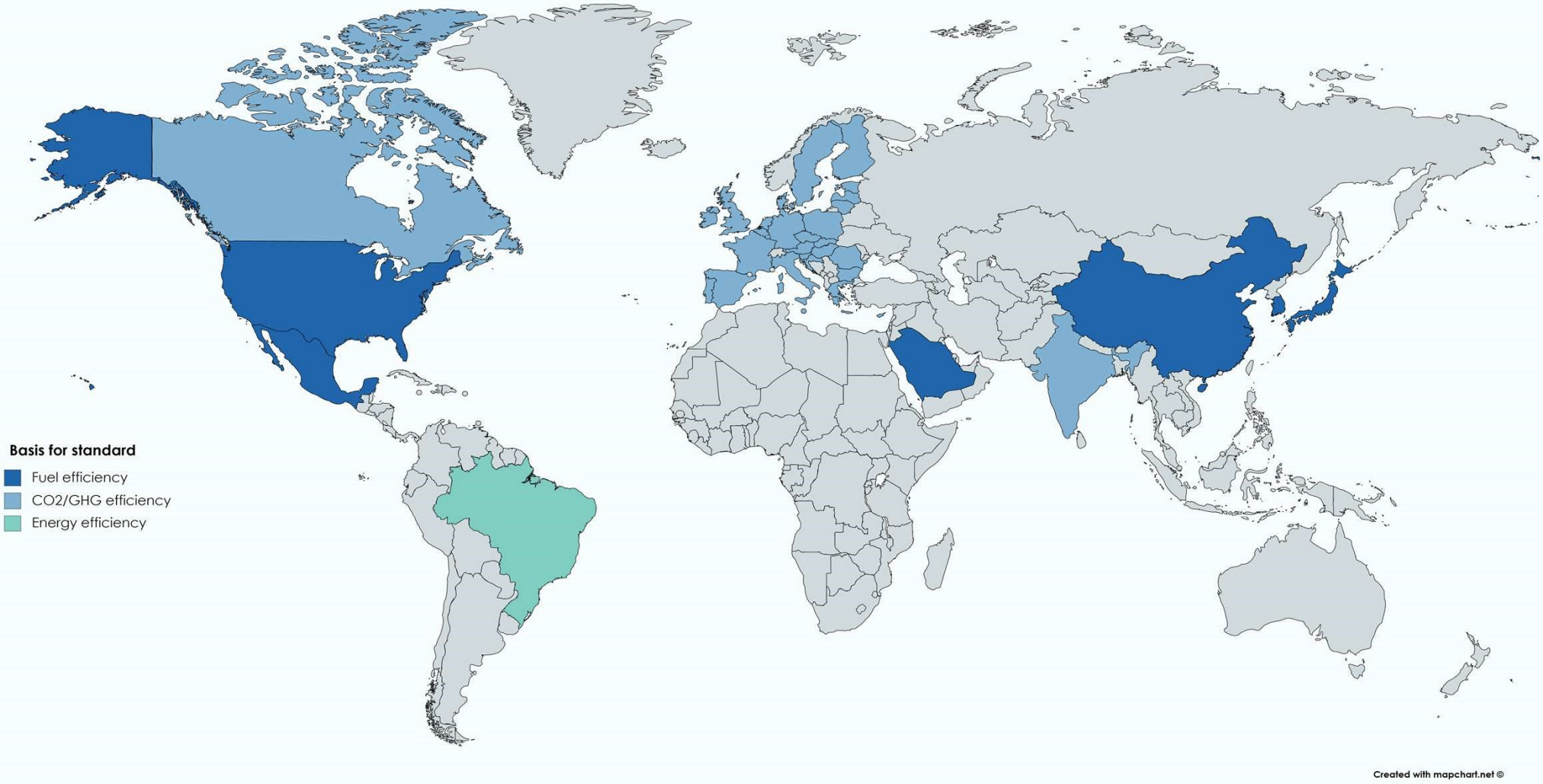
- Fiscal incentives create market pull - **demand** from buyers for efficient vehicles
-
- Vehicle fuel efficiency/CO_2 standards create market push - encourage manufacturers to **supply** lower CO_2 vehicles
- Data underpins everything

There are strong synergies between the measures



- Fiscal incentives create market pull - **demand** from buyers for efficient vehicles
- Support from information and market measures
- Vehicle fuel efficiency/CO_2 standards create market push - encourage manufacturers to **supply** lower CO_2 vehicles
- Data underpins everything

Where vehicle fuel efficiency/CO_2 standards operate



Corporate average standards are the norm

Region	Target Year	Regulated metric	Unadjusted Fleet Target/Measure	Form of target curve	Test Cycle
Brazil	2017	Energy consumption	1.82 MJ/km	Weight-based corporate average	U.S. combined
Canada	2016 2025	GHG	217 gCO_2/mi[1] N/A[2]	Footprint-based corporate average	U.S. combined
China	2015 2020	Fuel consumption	6.9 L/100km 5 L/100km	Weight-class based corporate average	NEDC
EU	2015 2021	CO_2	130 gCO_2/km 95 gCO_2/km	Weight-based corporate average	NEDC[4]
India	2017 2022	CO_2	130 g/km 113 g/km	Weight-based corporate average	NEDC for low-powered vehicle
Japan	2015 2020	Fuel economy	16.8 km/L 20.3 km/L	Weight-class based corporate average	JC08[4]
Mexico	2016	Fuel economy/ GHG	39.3 mpg or 140 g/km	Footprint-based corporate average	U.S. combined
Saudi Arabia	2020	Fuel economy	17 km/L	Footprint-based corporate average	U.S. combined
South Korea	2015 2020	Fuel economy/ GHG	17 km/L or 140 gCO_2/km 24 km/L or 97 gCO_2/km	Weight-based corporate average	U.S. combined
U.S.	2016 2025	Fuel economy/ GHG	36.2 mpg[3] and 225 gCO_2/mi 55.2 mpg[3] and 147 gCO_2/mi	Footprint-based corporate average	U.S. combined

Data source: : https://www.theicct.org/publications/2017-global-update-LDV-GHG-FE-standards

How corporate average standards work

- The average fuel/energy consumption or CO_2 emissions of all light duty passenger vehicles manufactured, sold or imported by one particular auto company must be within a certain level over a set period of time, or they face penalties
- This incentivises auto manufacturers/importers to develop, offer, promote and favourably price more efficient and lower CO_2 vehicles (including EVs)
- Different to a Minimum Energy Performance Standard (MEPS) as no individual vehicles are restricted
- Happens “behind the scenes” regarding consumers

Weight based vs footprint based targets

Basis for target	
Absolute	
Relative	Footprint based
	Weight based

- The heavier a vehicle is, the greater its fuel consumption
- Footprint is a measure of vehicle size defined as the area enclosed by the tyres of the vehicle (wheelbase x track width)
- Footprint based targets encourage light-weighting of vehicles
- Weight based targets recognize the utility of different types of vehicles, hybrid/EV battery weight and weight data available

https://www.globalfueleconomy.org/data-and-research/publications/gfei-working-paper-17

Mix of weight-based and footprint-based targets

Region	Target Year	Regulated metric	Unadjusted Fleet Target/Measure	Form of target curve	Test Cycle
Brazil	2017	Energy consumption	1.82 MJ/km	Weight-based corporate average	U.S. combined
Canada	2016 2025	GHG	217 gCO_2/mi[1] N/A[2]	Footprint-based corporate average	U.S. combined
China	2015 2020	Fuel consumption	6.9 L/100km 5 L/100km	Weight-class based corporate average	NEDC
EU	2015 2021	CO_2	130 gCO_2/km 95 gCO_2/km	Weight-based corporate average	NEDC[4]
India	2017 2022	CO_2	130 g/km 113 g/km	Weight-based corporate average	NEDC for low-powered vehicle
Japan	2015 2020	Fuel economy	16.8 km/L 20.3 km/L	Weight-class based corporate average	JC08[4]
Mexico	2016	Fuel economy/ GHG	39.3 mpg or 140 g/km	Footprint-based corporate average	U.S. combined
Saudi Arabia	2020	Fuel economy	17 km/L	Footprint-based corporate average	U.S. combined
South Korea	2015 2020	Fuel economy/ GHG	17 km/L or 140 gCO_2/km 24 km/L or 97 gCO_2/km	Weight-based corporate average	U.S. combined
U.S.	2016 2025	Fuel economy/ GHG	36.2 mpg[3] and 225 gCO_2/mi 55.2 mpg[3] and 147 gCO_2/mi	Footprint-based corporate average	U.S. combined

Data source: : https://www.theicct.org/publications/2017-global-update-LDV-GHG-FE-standards

CO_2 emissions from LDV: historical and current standards

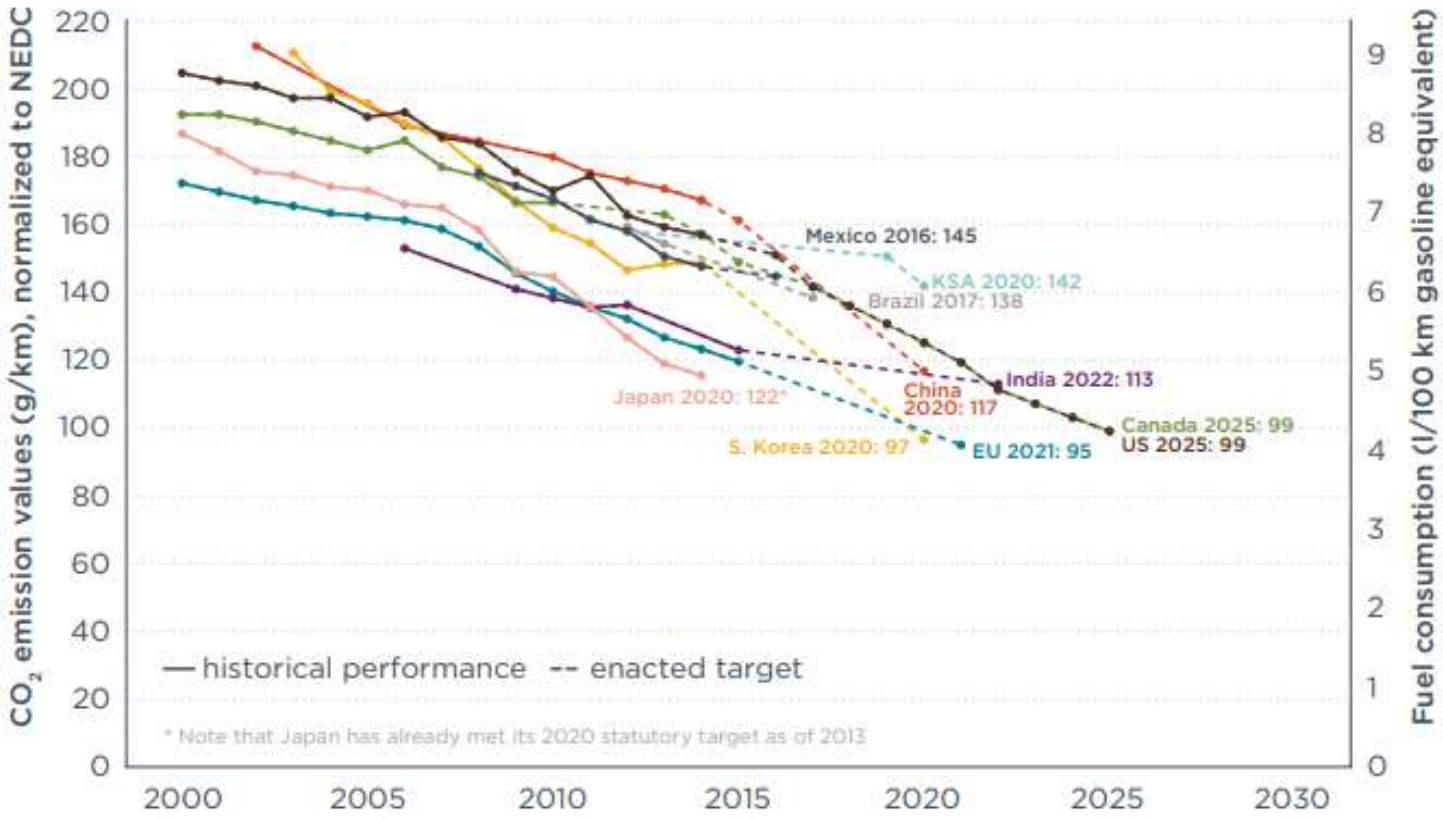


Figure 2. Historical fleet CO_2 emissions performance and current standards (gCO_2/km normalized to NEDC) for passenger cars

Data source: https://www.theicct.org/publications/2017-global-update-LDV-GHG-FE-standards

How this compares to an economy with no standards

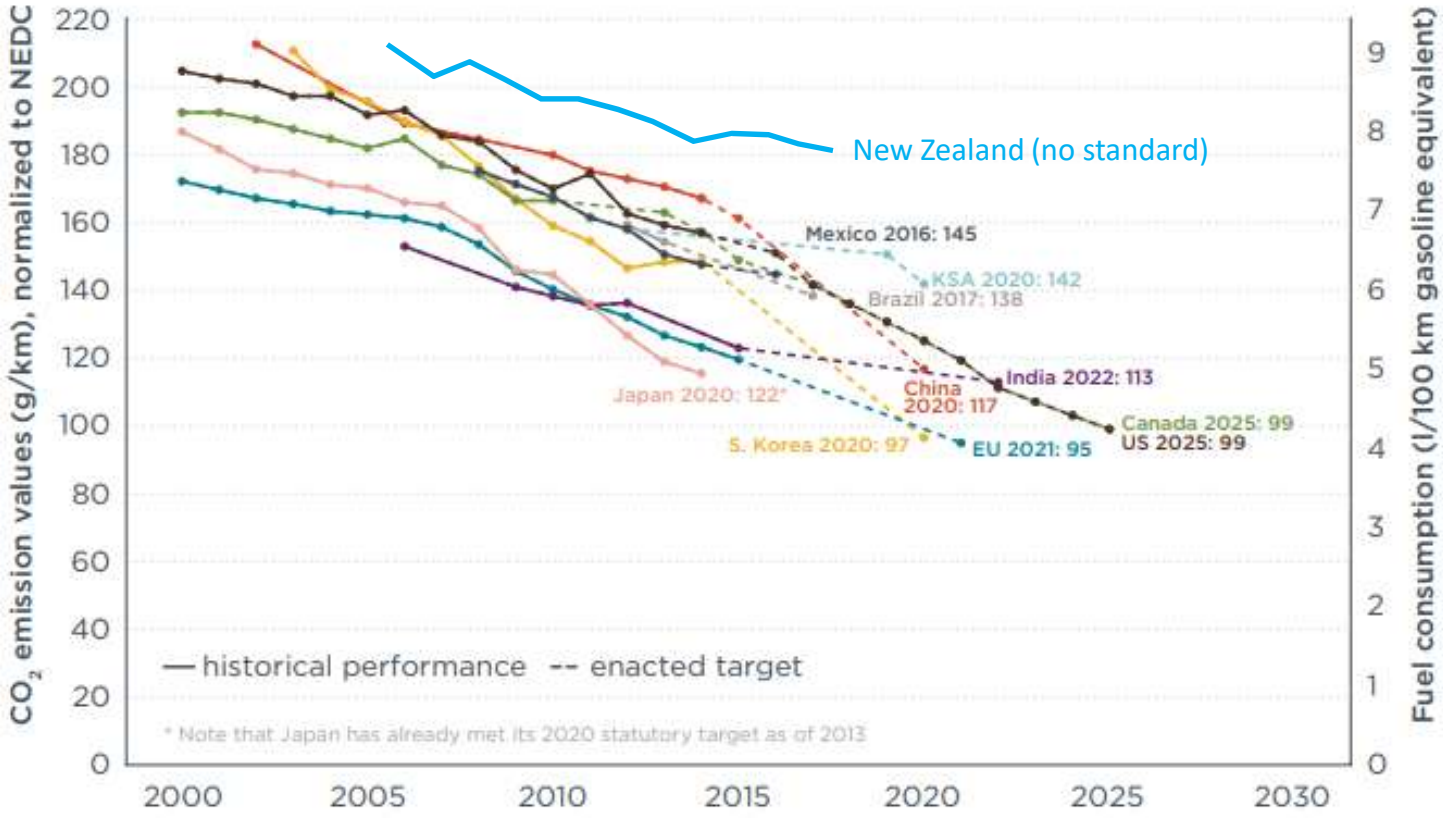
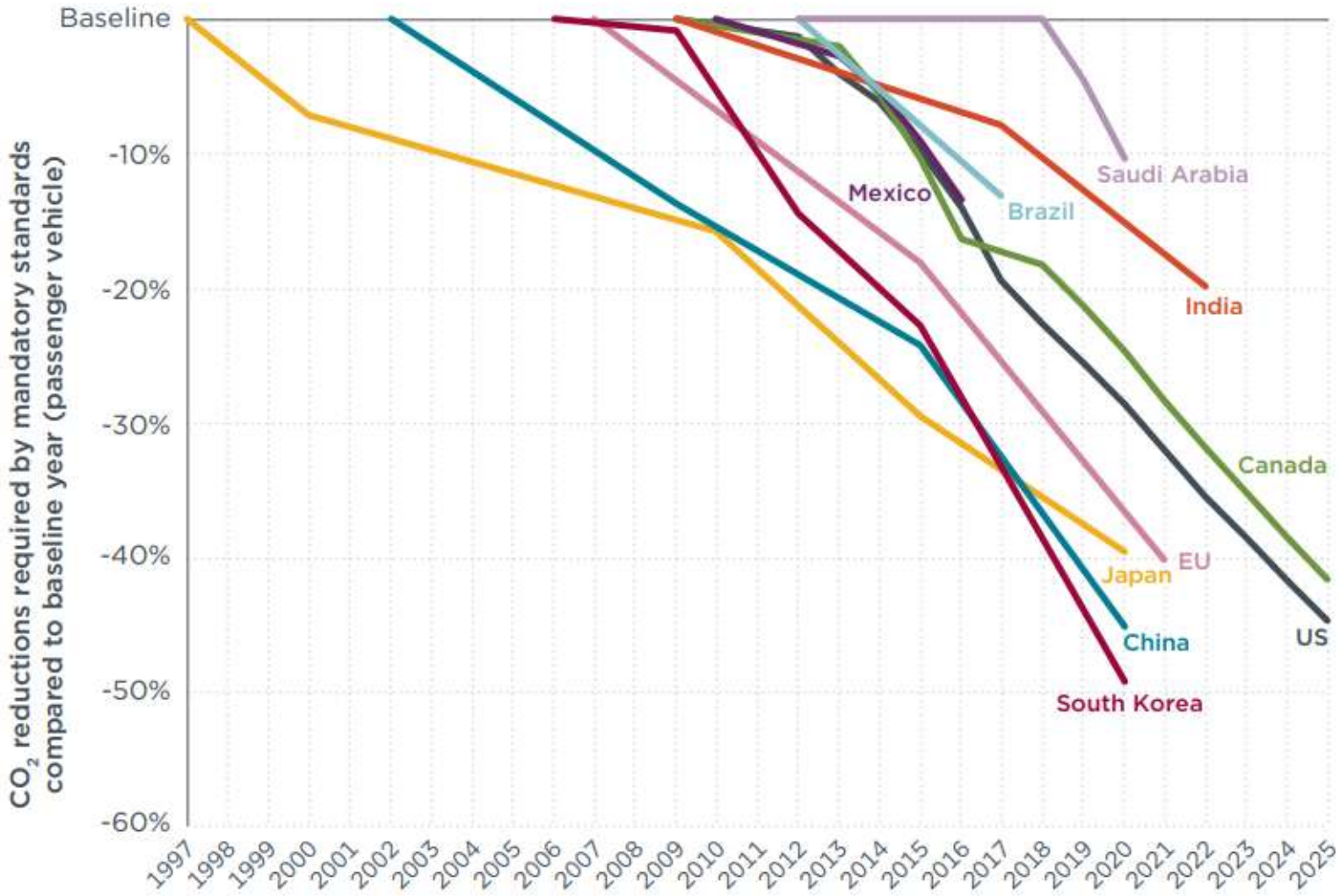


Figure 2. Historical fleet CO_2 emissions performance and current standards (gCO_2/km normalized to NEDC) for passenger cars

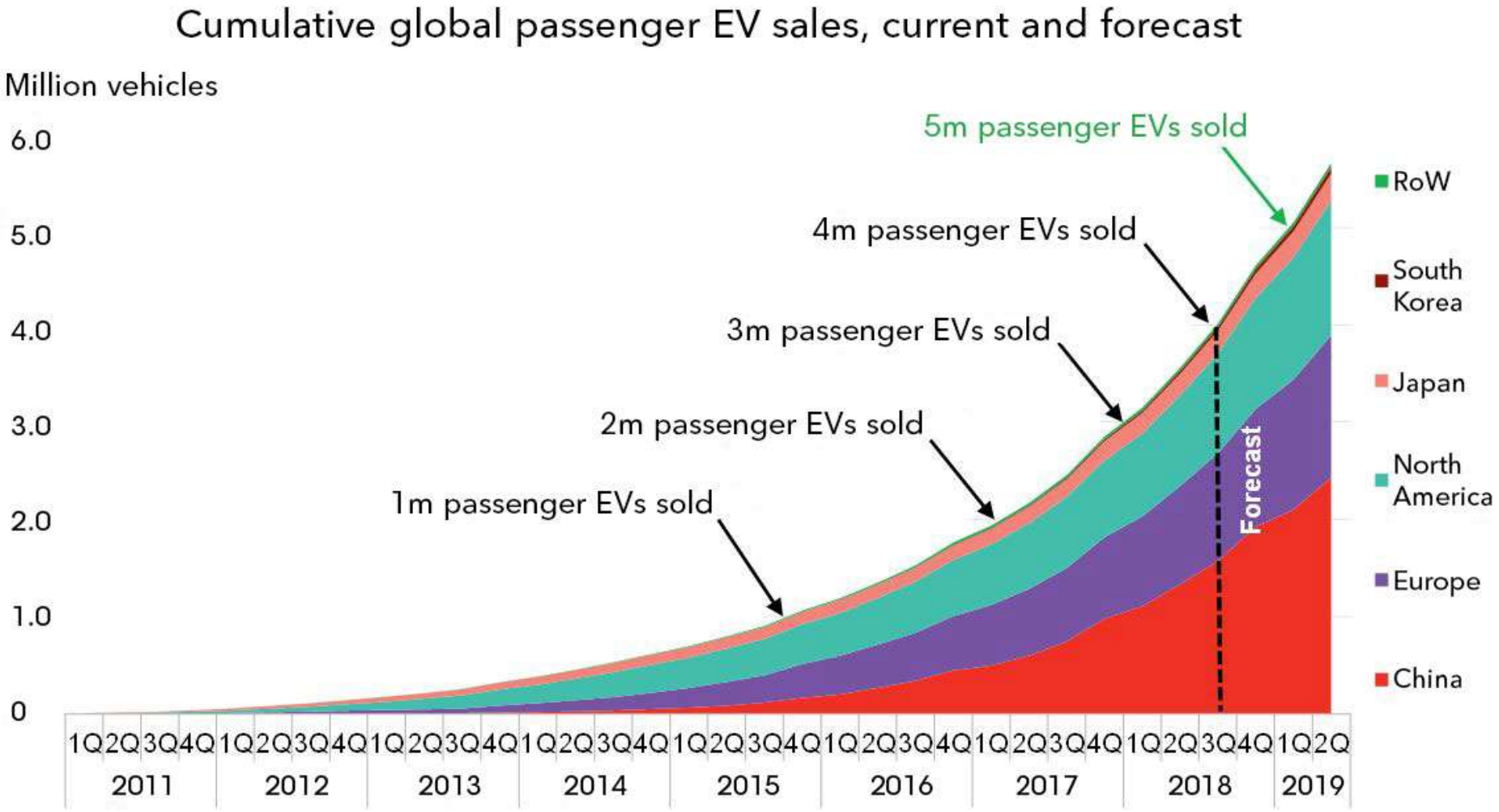
Data source: https://www.theicct.org/publications/2017-global-update-LDV-GHG-FE-standards

CO_2 emissions reductions from standards



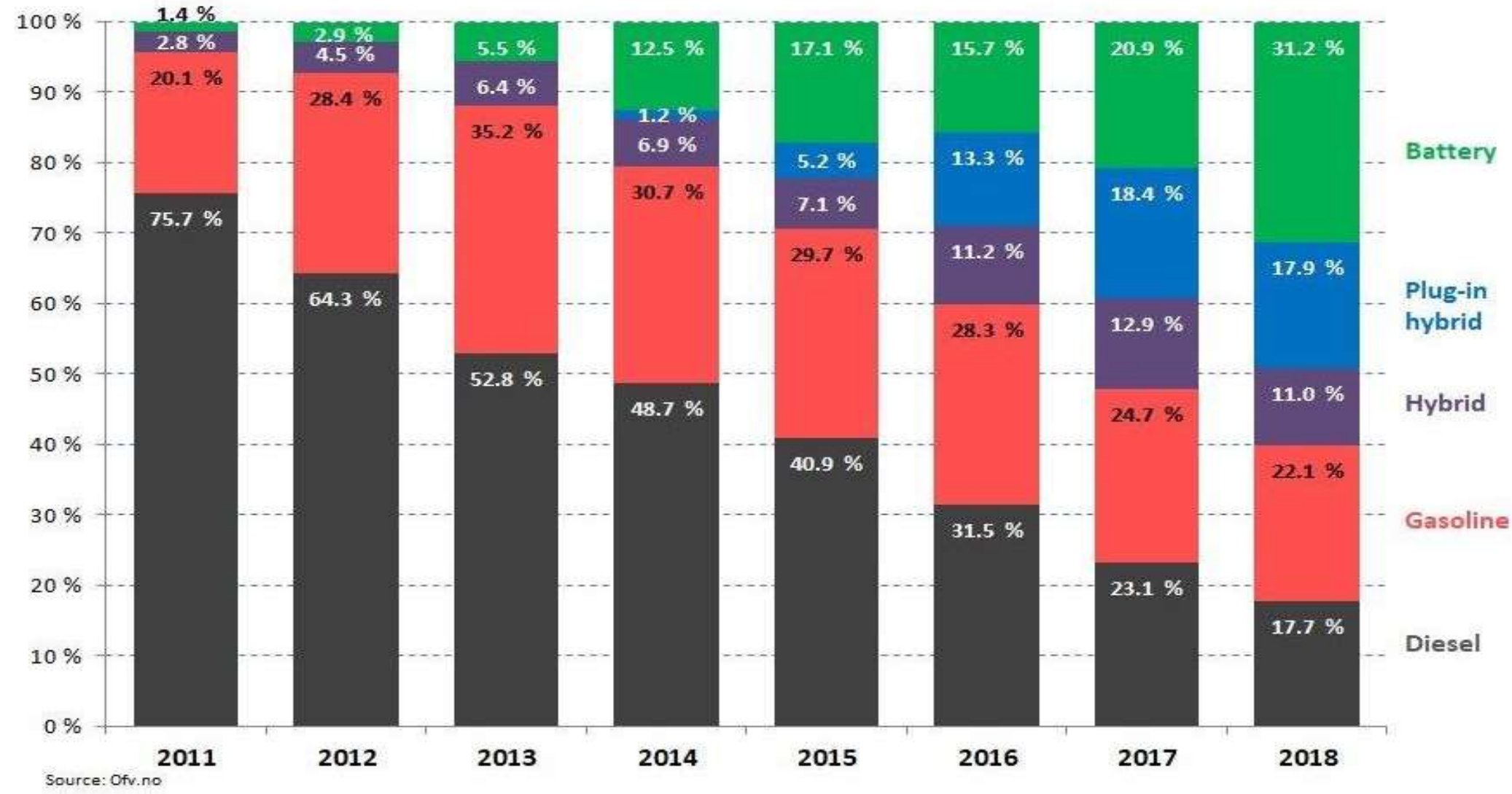
Data source: https://www.theicct.org/publications/2017-global-update-LDV-GHG-FE-standards

Global EV sales are growing exponentially



Source: Bloomberg NEF

Norwegian new car sales by fuel type, 2011-2018



Source: Ofv.no

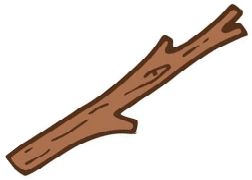
Strongest policy signal: ICE vehicle ban

Economy	Ban commences	Ban announced
Costa Rica	2021	2018
Denmark	2030	2019
Ireland	2030	2018
India	2030	2017
Israel	2030	2018
Netherlands	2030	2017
Norway	2030	2017
Sweden	2030	2019
Scotland	2032	2017
China	2040	2017
France	2040	2017
UK (except Scotland)	2040	2017

Data source: https://en.wikipedia.org/wiki/Phase-out_of_fossil_fuel_vehicles#List_of_jurisdictions

Fiscal measures

Taxes/fees



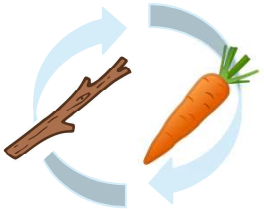
Vehicle sales taxes increase with fuel use or CO_2

Vehicle registration and annual licensing fees

Fuel taxes and price on carbon

Driving restrictions; zero emission zones

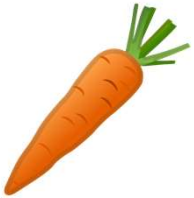
Feebates



A fiscally neutral combination of fees and rebates

May be more politically acceptable

Incentives



Purchase price subsidies for low carbon vehicles

Exemptions from fees and tolls; free parking

Infrastructure incentives for EV charging

Priority access or parking for EVs

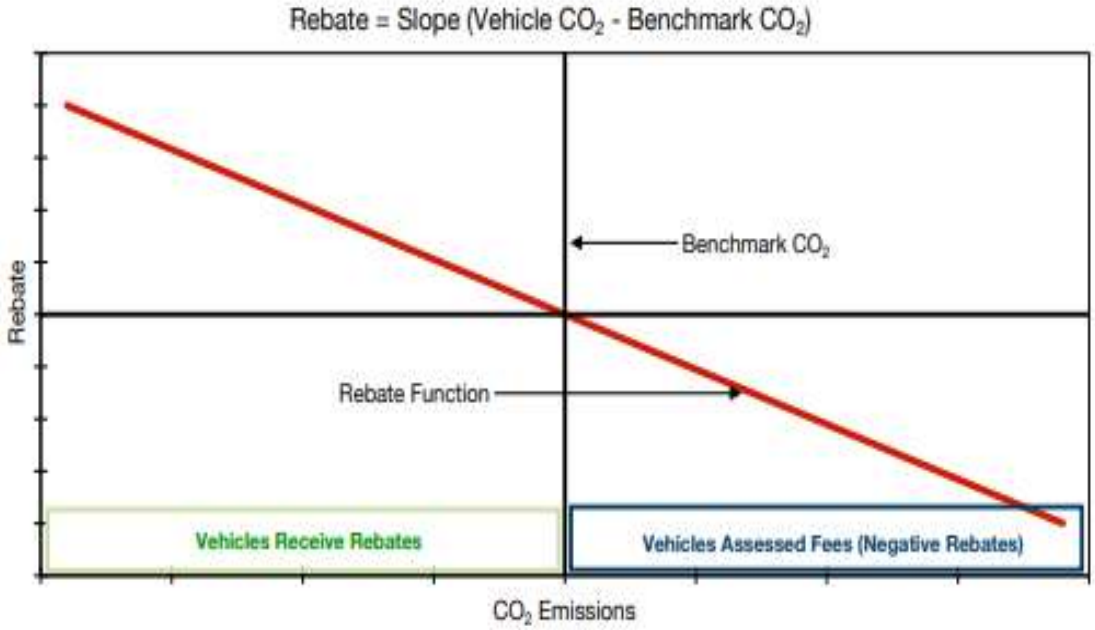
Example: Singapore car registration feebate system

	Cars Registered From 1 July 2015 to 31 December 2017		
Band	Carbon Dioxide Emission (CO_2 g/km)	Rebate	Surcharge
A1	$CO_2 \leq 95$	S$30,000	
A2	$95 < CO_2 \leq 105$	S$15,000	
A3	$105 < CO_2 \leq 120$	S$10,000	
A4	$120 < CO_2 \leq 135$	S$5,000	
B	$135 < CO_2 \leq 185$	S$0	S$0
C1	$185 < CO_2 \leq 200$		S$5,000
C2	$200 < CO_2 \leq 215$		S$10,000
C3	$215 < CO_2 \leq 230$		S$15,000
C4	$230 < CO_2$		S$30,000

https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/owning-a-vehicle/costs-of-owning-a-vehicle/tax-structure-for-cars.html

ICCT: Elements of a best practice feebate scheme

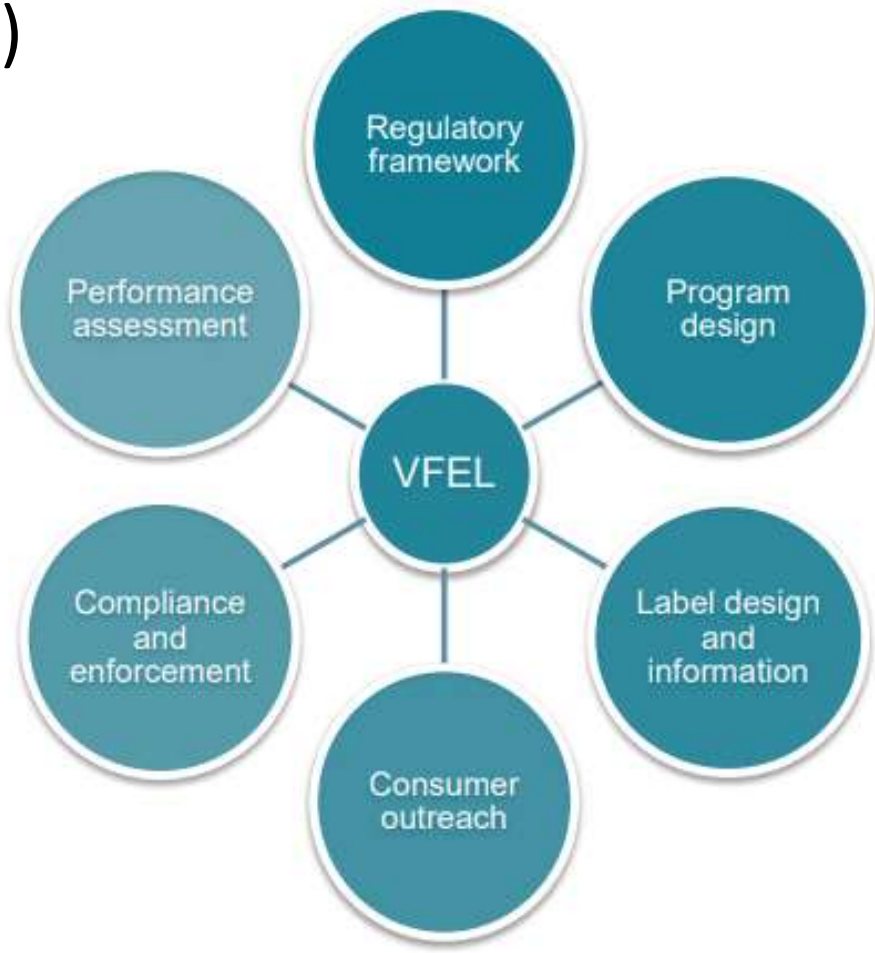
- A continuous, linear feebate rate line
- A pivot point making the system self-funding and sustainable
- A linear metric, such as CO_2 emissions or fuel consumption per unit of distance
- An attribute adjustment (if used) based on vehicle size, not weight



https://www.theicct.org/publications/best-practices-feebate-program-design-and-implementation

Information measures

- Vehicle fuel efficiency labels (VFEL)
- Websites, promotional materials



http://publications.apec.org/Publications/2015/12/A-Review-and-Evaluation-of-Vehicle-Fuel-Efficiency-Labeling-and-Consumer-Information-Programs

Market measures

- Voluntary sign-up programmes which provide facilitation support and recognition to fleets buying efficient and low CO_2 vehicles and supporting efficient driver training

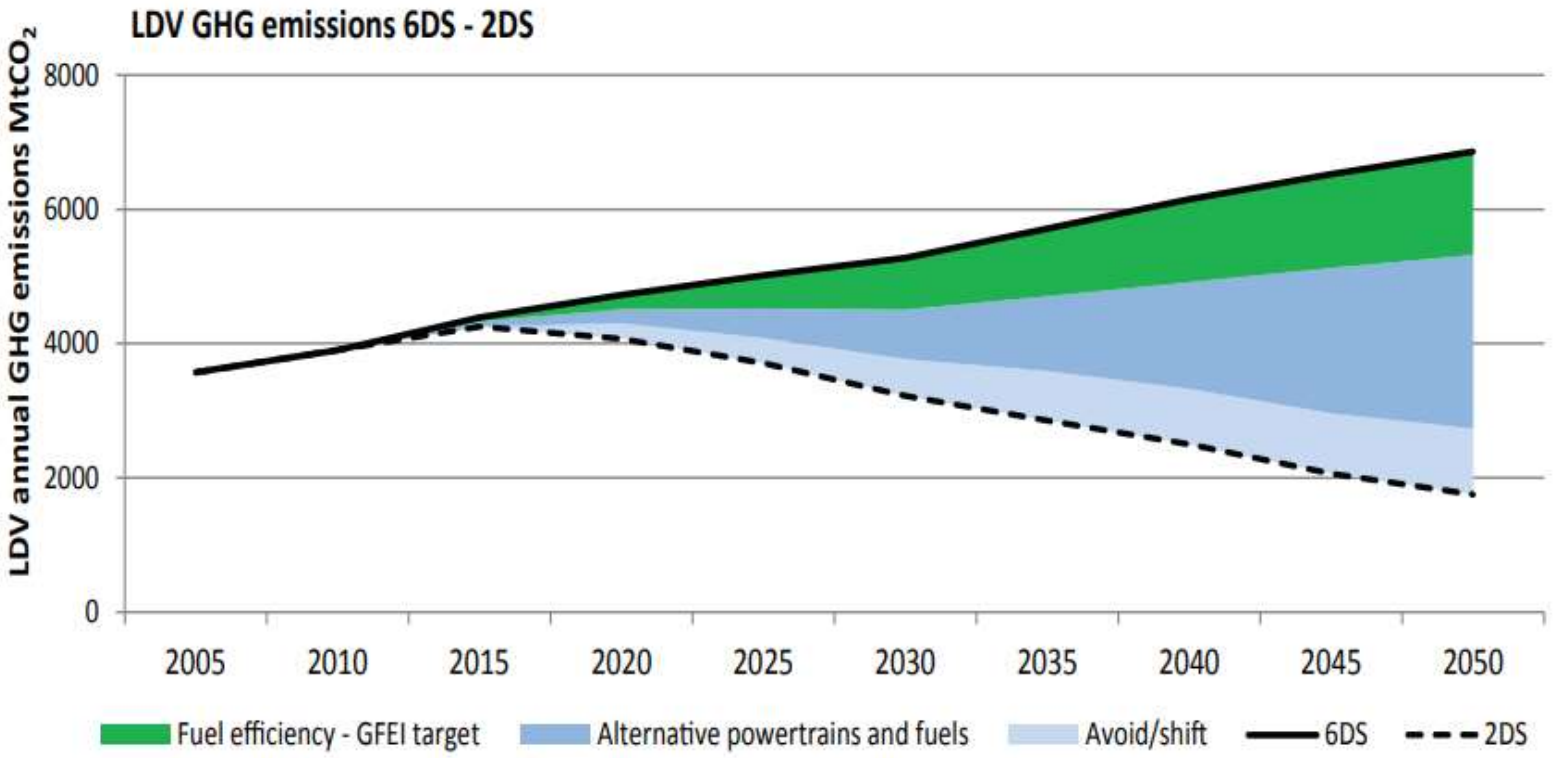
SmartWay℠ Transport Partnership
U.S. Environmental Protection Agency

CGFI
中国绿色货运行动
CHINA GREEN FREIGHT INITIATIVE

Summary – vehicle fuel economy standards

- Approved and accepted vehicle fuel/energy consumption data is a vital enabler
- Corporate average vehicle fuel efficiency/CO_2 standards encourage manufacturers to make, sell and promote lower CO_2 vehicles
- Fiscal measures including feebates encourage consumers to buy lower CO_2 vehicles, creating demand
- Information and other measures can provide important support but are insufficient on their own

How standards contribute to meeting IPCC targets



This analysis includes a 20% reduction in new car fuel consumption (Lge/100km) in the 6DS; an additional 30% reduction is reflected in the 2DS scenario, reaching the GFEI target.

https://www.globalfueleconomy.org/media/460944/cop23-update-report.pdf

GFEI
GLOBAL FUEL ECONOMY INITIATIVE

Thank you

APERC
Asia Pacific Energy Research Centre