APPENDIX 1: Workshop Agenda

APEC Asia-Pacific Economic Cooperation

APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)
Under the APEC Energy Working Group

Energy Efficiency Policy Workshop
Developing Fuel Economy Regulations

Bringing together policymakers and experts to understand and share national experiences on developing vehicle fuel economy regulations to reduce emissions from the transport sector and mitigate the escalating threat of climate change.

18 March 2019

Regal Kowloon Hotel, Hong Kong, China

8:30 - 9:00	**Registration**	
Welcome and introduction to the Workshop		
9:00 - 9:05	Brief introduction to the Workshop	Hugh Marshall-Tate, APERC
9:05 - 9:10	Welcoming remarks by the host economy	Vy Ek Chin, EMSD, Hong Kong, China
9:10 - 9:15	Opening remarks by the EGEEC Chair	Mr. Pengcheng Li, China
9:15 – 9:25	Introduction to the Energy Efficiency Policy Workshop series, the topic of vehicle fuel economy regulations, and Workshop agenda	Hugh Marshall-Tate, APERC
Session 1:	**Context for vehicle fuel economy regulations**	
9:25 - 9:45	Transport contribution to GHG emissions in APEC economies	Alexey Kabalinskiy, APERC
9:45 - 10:30	Overview of the suite of policy measures to improve vehicle fuel economy	Elizabeth Yeaman, Retyna Ltd, New Zealand
10:30 – 11:00	**Tea and Coffee Break**	
Session 2:	**Vehicle fuel economy policies in APEC economies**	
11:00 - 11:30	Chile’s proposed fuel economy standards: the process of developing new legislation and features of the standard	Luz Ubilla, Ministerio de Energía, Chile

11:30 – 12:10	Test protocols underpinning fuel economy regulations: the transition to Worldwide Harmonised Light Vehicle Test Procedure (WLTP) and its inclusion in CO_2 policies	Andrew Campbell, Fuel Technology Ltd, New Zealand/Philippines
12:10 - 12:30	Panel discussion with Session 1 and 2 speakers	Moderated by Retyna
12:30 - 13:30	**Lunch**	
Session 3: Facilitating low emission vehicles in APEC economies		
13:30 – 13:50	Wide scale promotion of low emission vehicles for HK – challenges and opportunities	Ir. Raymond CHOI, Hong Kong Power Company
13:50 – 14:20	Facilitating locally designed and manufactured electric vehicles in the Philippines	Andrew Campbell, Fuel Technology Ltd
14:20 – 14:45	Growth of electric vehicles in New Zealand	Elizabeth Yeaman, Retyna, New Zealand
14:45 – 15:15	**Tea and Coffee Break**	
Session 4: Workshop – Facilitating EVs and other very low carbon vehicles		
15:15 - 16:00	Participants will break into smaller groups to discuss: • **Status:** What is the status of vehicle fuel economy policies and policies facilitating low carbon vehicles in your economy? • **Barriers:** What are the barriers to introducing or updating policies in your economy? • **Priorities:** Identify the top three activities that could be undertaken to progress policies in your economy • **APEC facilitation:** Identify any activities that APEC could have a role in advancing	All Participants, facilitated by Retyna
16:00 - 16:20	**Report Back** Presentations by breakout session leaders and group discussion	Facilitated by Fuel Technology
16:20 – 16:30	Summary of the Workshop, potential next steps and lessons learned	Elizabeth Yeaman, Retyna

APPENDIX 2: Introduction to the Workshop Series

Workshop Background

- Since 2009 with current format started in 2014
- Previous topics have included
  - Government and donor funding mechanisms
  - Policy and program evaluation
  - Conformity Assessment

2019 Workshop Topic

Transport fuel economy standards

- Testing protocols
- GHG emissions
- Vehicle fuel economy policy
- Policy drivers
- Policies in APEC economies
- Advanced Vehicles

The Workshop Organiser

ELIZABETH YEAMAN

Managing Director, Retyna Ltd

APERC 1

Todays Agenda

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Todays Agenda

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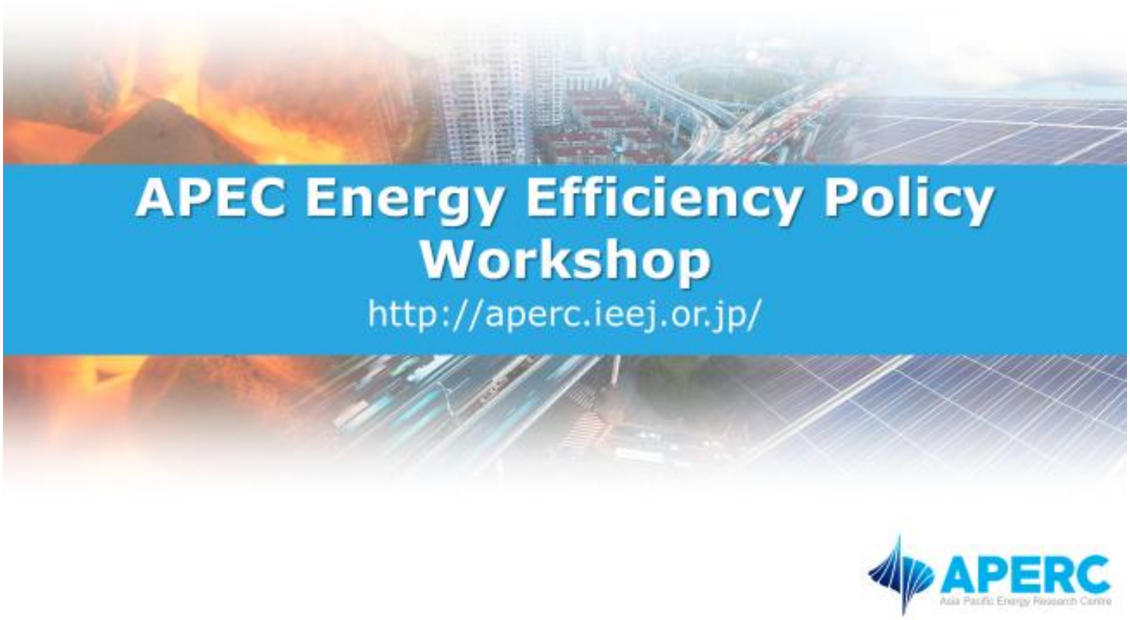
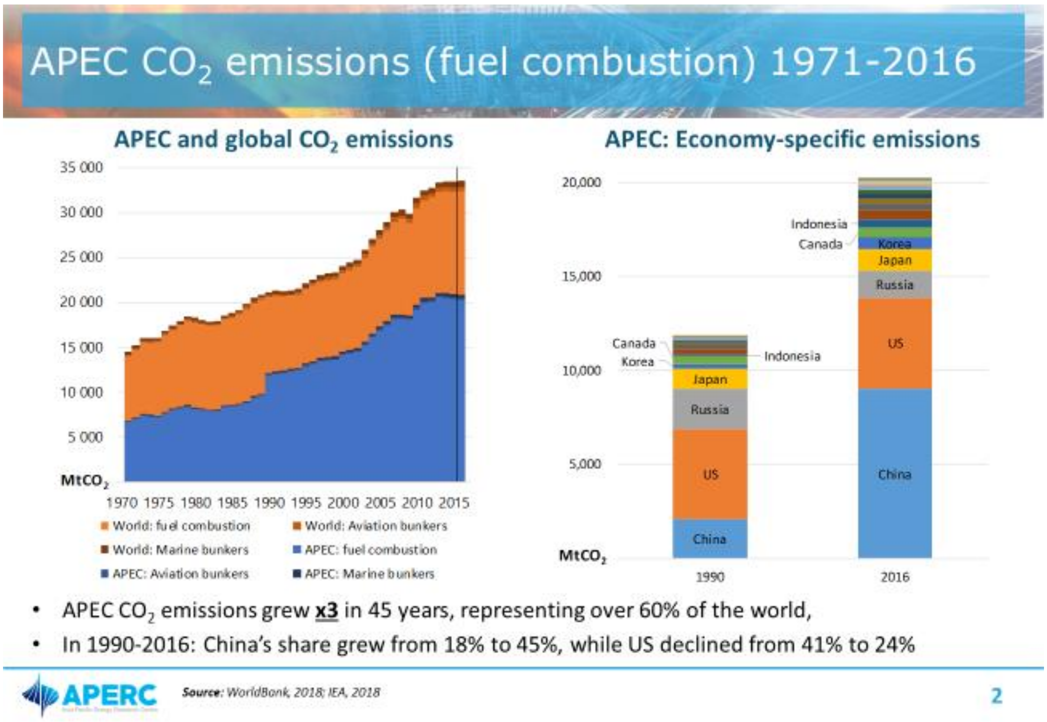
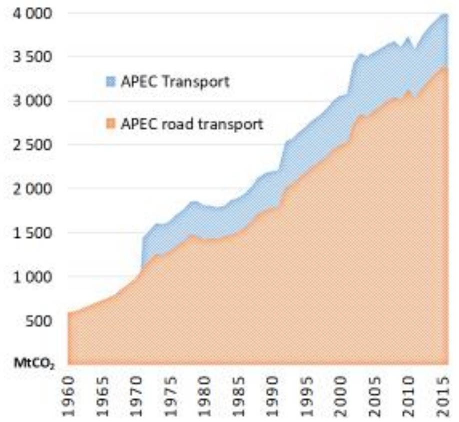


APPENDIX 3: Transport CO_2 emissions in APEC 2000-50

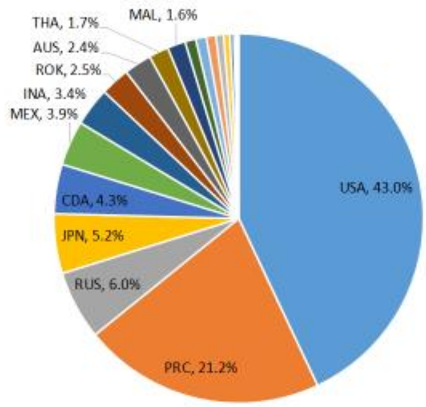


APEC transport CO_2 emissions 1960-2016

APEC transport CO_2 emissions



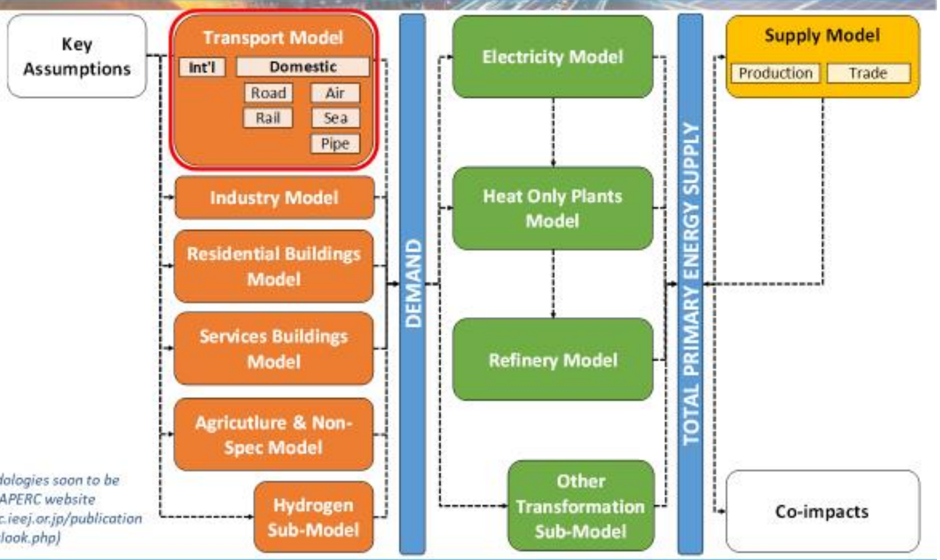
APEC transport emissions in 2016



- Since 1971 road emissions grew **x3** in line with total emissions, road share grew from 78% to 85%,
- In 2016 China and the US were responsible for nearly 2/3 of APEC's transport emissions

APERC **Source:** *IEA, 2018; WorldBank, 2018* 3

APERC uses a suite of nine models for Outlook 7th Edition



Note: *methodologies soon to be published on APERC website (https://aperc.ieej.or.jp/publications/reports/outlook.php)*

APERC 4

Outlook 7th Edition: transport model

- Transport model projects APEC's transportation sector (following IEA's World Energy Balances) fuels demand,
- The model utilizes Excel and GAMS software packages,
- Passenger and freight activity are the key drivers
- International bunker fuels are modelled as f(GDP),
- Domestic non-road transport is split in passenger and freight and modelled top-down,
- Domestic road is modelled bottom-up with five vehicle types and ten powertrain technologies

Sub-sector	Passenger	Freight	Approach
International	-	-	Top-down
Aviation bunkers	-	-	Top-down
Marine bunkers	-	-	Top-down
Domestic	Y	Y	Mixed
Road	Y	Y	Bottom-up
2W	Y	Y	Bottom-up
LV	Y	-	Bottom-up
LT	-	Y	Bottom-up
BUS	Y	-	Bottom-up
HT	-	Y	Bottom-up
Rail	Y	Y	Top-down
Air	Y	Y	Top-down
Sea	Y	Y	Top-down
Pipe	-	Y	Top-down

APERC ***Notes**: vehicle types include 2W* (2-wheelers), LV (Light vehicles), LT (Light trucks), BUS (Buses), HT (Heavy trucks); road vehicle technologies include ICEG, ICED, HYBG, HYBD, LPGD, CNGD, FLEX, PHEV, BEVD and FCEV 5

Outlook 7th Edition includes three scenarios

- **Business-as-usual (BAU) scenario:**
  The BAU scenario reflects current policies and trends within the APEC energy sector. In turn, it largely projects past trends into the future.
  - Road vehicle fuel efficiency assumptions reflect current policy,
  - Otherwise 'passive' improvement of new vehicles at 0.5-2.0%/yr until 2030
- **APEC Target (TGT) scenario:**
  The TGT scenario is driven by APEC's goals of reducing energy intensity while increasing the share of renewables.
  - Progressively improving Passenger and Freight transportation activity,
  - Accelerated fuel efficiency improvement: current policy and 0.5-1.0%/yr improvement in 2030-40, and
  - Increased share of biofuels
- **2 Degree Celsius (2DC) scenario:**
  2DC follows the carbon emissions reductions included in the Energy Technology Perspectives by IEA.
  - Decoupling the transportation activity and economic growth,
  - Reduced vehicle ownership and vehicle mileage compared to TGT,
  - Fuel efficiency and energy intensity consistent with TGT,
  - Support for advanced fuels and vehicles, mode/technology shifting.

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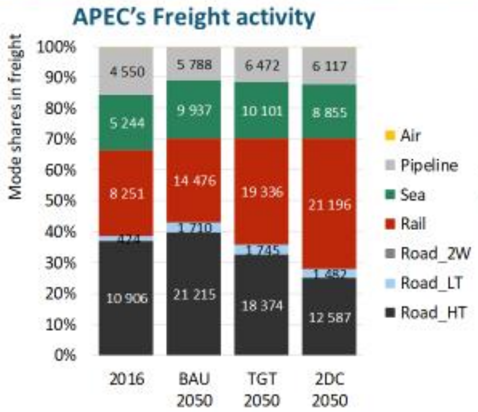
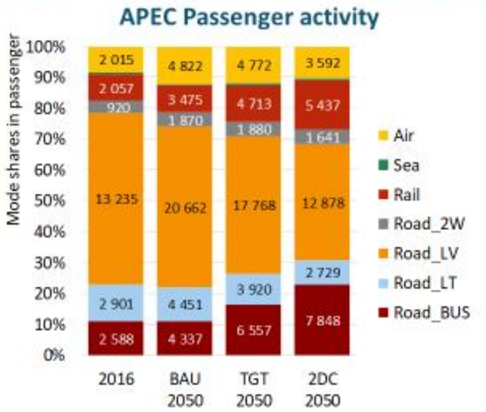
Freight and passenger is dominated by road





Source: APERC analysis;
Note: units are billion tonne-kilometres (Gtkm) for freight, and billion passenger-kilometres (Gpkm).

- Road freight expands under BAU, share of Rail grows in TGT and 2DC
- Road passenger is over 70% of , public transport grows in TGT and 2DC

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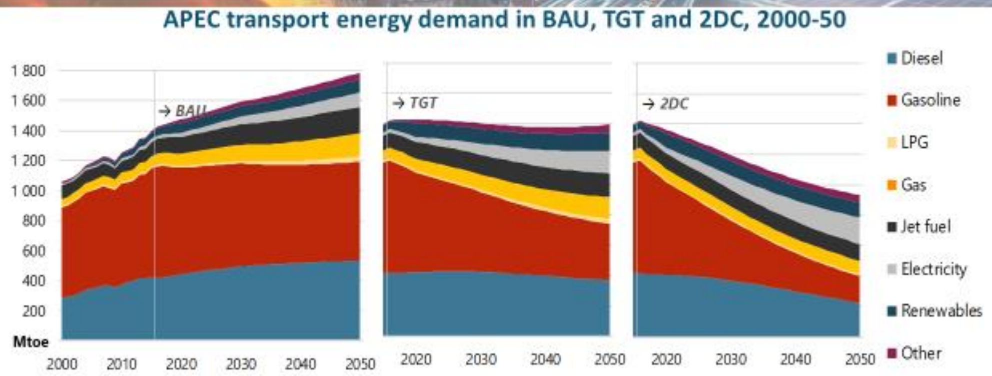
Gasoline and diesel are key in BAU, electricity grows fastest in all scenarios



- Conventional fuels dominate under BAU,
- Gasoline for passenger transport declines in TGT and 2DC,
- Diesel remains strong in all scenarios for Road freight;
- Demand grows 25% in BAU, remains flat (-2.1%) in TGT and drops 35% in 2DC

Source: IEA, 2018; APERC analysis

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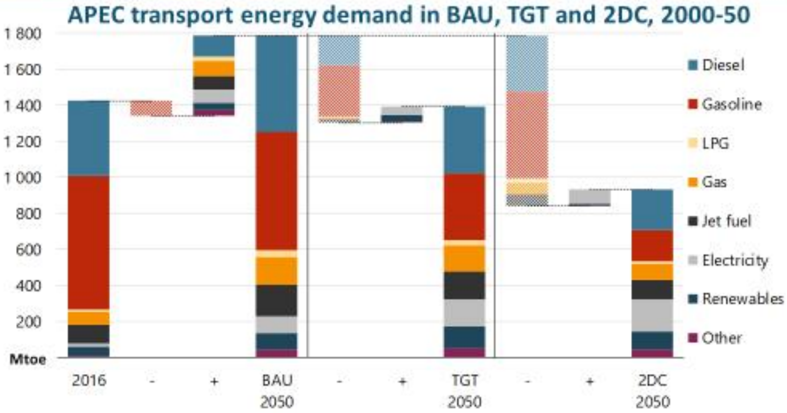
Gasoline and Diesel are key in BAU, Electricity and biofuels grow in all scenarios

APEC transport energy demand in BAU, TGT and 2DC, 2000-50

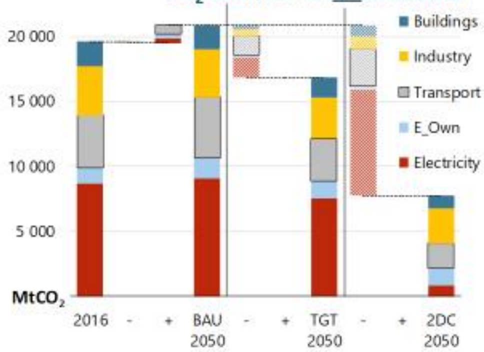


- BAU: in gasoline (-12%),
- TGT compared to BAU: electricity (+52%) and biofuels (+42%); gasoline (-43%) and diesel (-31%),
- 2DC compared to BAU: growth only in electricity (+82%) and biofuels (+13%); declines in other fuels, especially gasoline (-74%) and diesel (-58%)

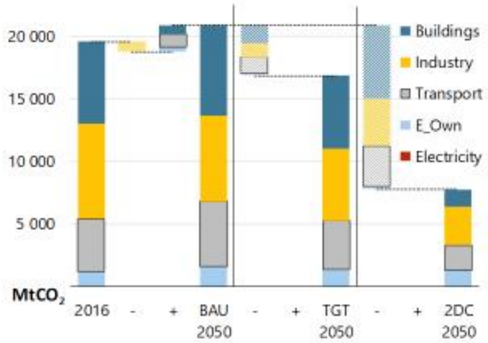
APERC *Source: IEA, 2018, APERC analysis* 9

Although important, domestic transport is not the main source of direct and indirect CO2 emissions

CO_2 emissions: unallocated



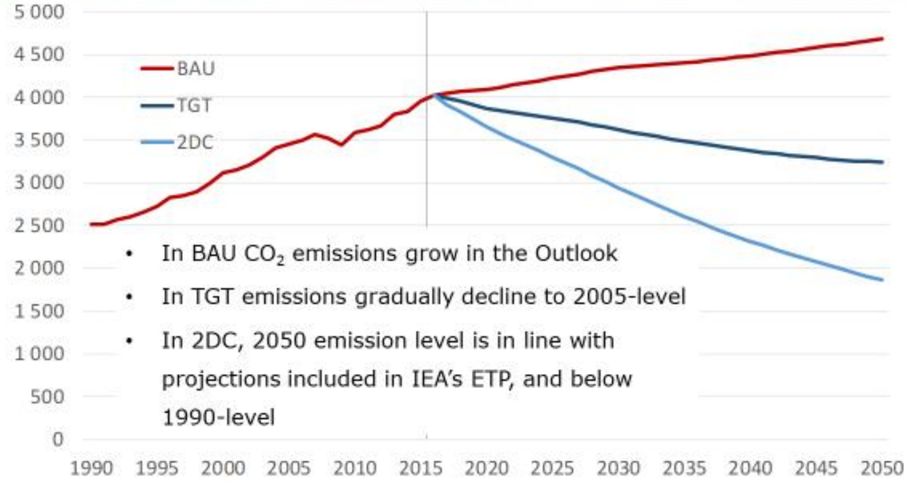
CO_2 emissions: allocated



- If CO_2 unallocated: transport share is about 19-22%, second after electricity (43-45%); except in 2DC: electricity drops to 11%, and transport (24%) is second to industry (35%),
- If CO_2 allocated: transport share is about 21-25% in all scenarios; significant share of buildings (33-35%), except 18% in 2DC; industry is the hardest to decarbonise with 33-39% share

APERC *Source: IEA 2018, APERC analysis* 10

In BAU, economic growth drives the demand, in TGT and 2DC: historical trend is reversed



- In BAU CO_2 emissions grow in the Outlook
- In TGT emissions gradually decline to 2005-level
- In 2DC, 2050 emission level is in line with projections included in IEA's ETP, and below 1990-level

Source: IEA 2018, APERC analysis

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Conclusions

- **Strong demand for freight and passenger transport until 2050,**
- **Under BAU: increasing fuel demand and CO_2 emissions,**
- **In TGT: fuel demand plateaus, but emissions decline:**
  - **Through mode switching,**
  - **Longer-term and wider adoption of fuel efficiency policy,**
  - **Efficient public transport,**
  - **Hybrids as transition technology and natural gas as transition fuel,**
- **In 2DC: opportunities for deep decarbonization:**
  - **Alternative fuels and techs: hybrids, EVs and biofuels (although limited),**
  - **Fast and comfortable public transport for cities (80% of APEC residents),**
  - **Maximise alternative fuels and modes for freight**

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http://aperc.ieej.or.jp/
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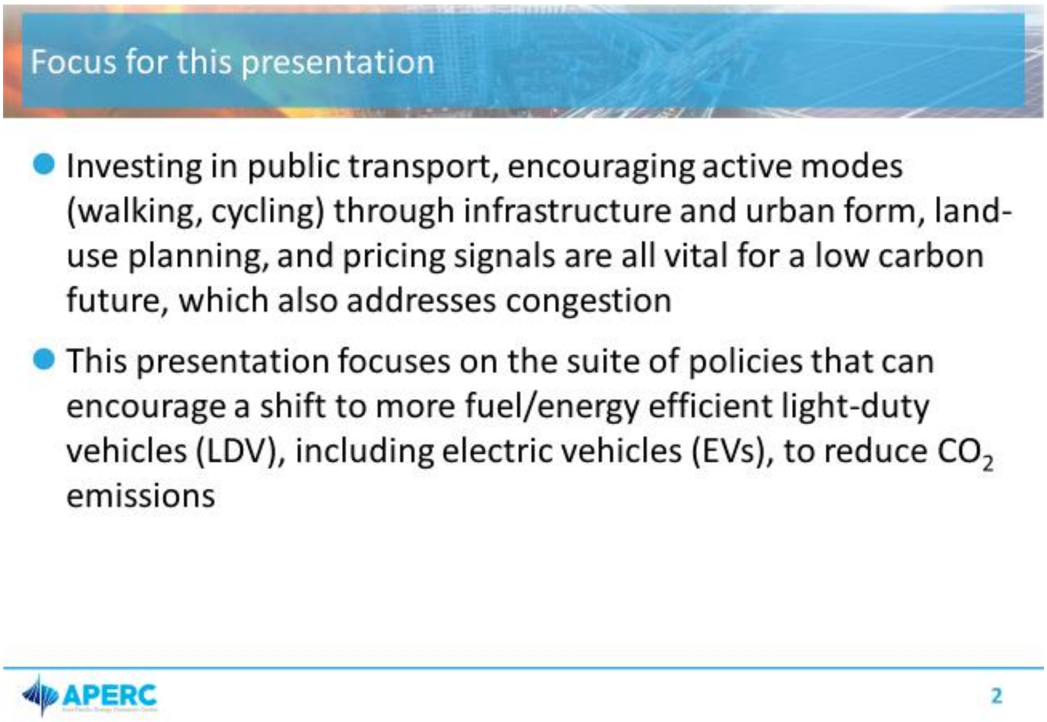
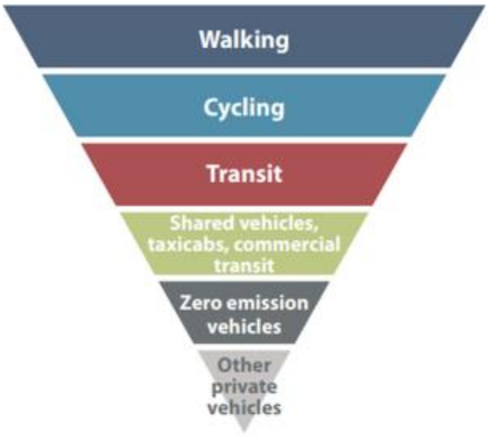
APPENDIX 4: Overview of the suite of policy measures to improve vehicle fuel economy



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

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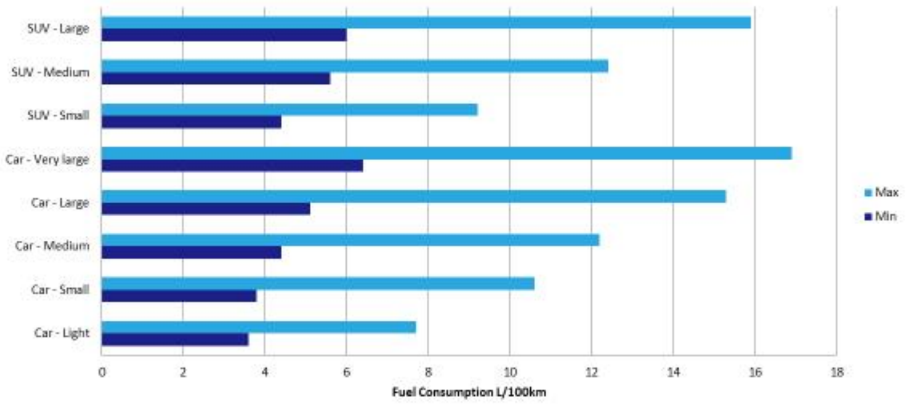
Big difference in fuel consumption within vehicle class

Minimum and maximum fuel consumption by class (excludes EVs)



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

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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

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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

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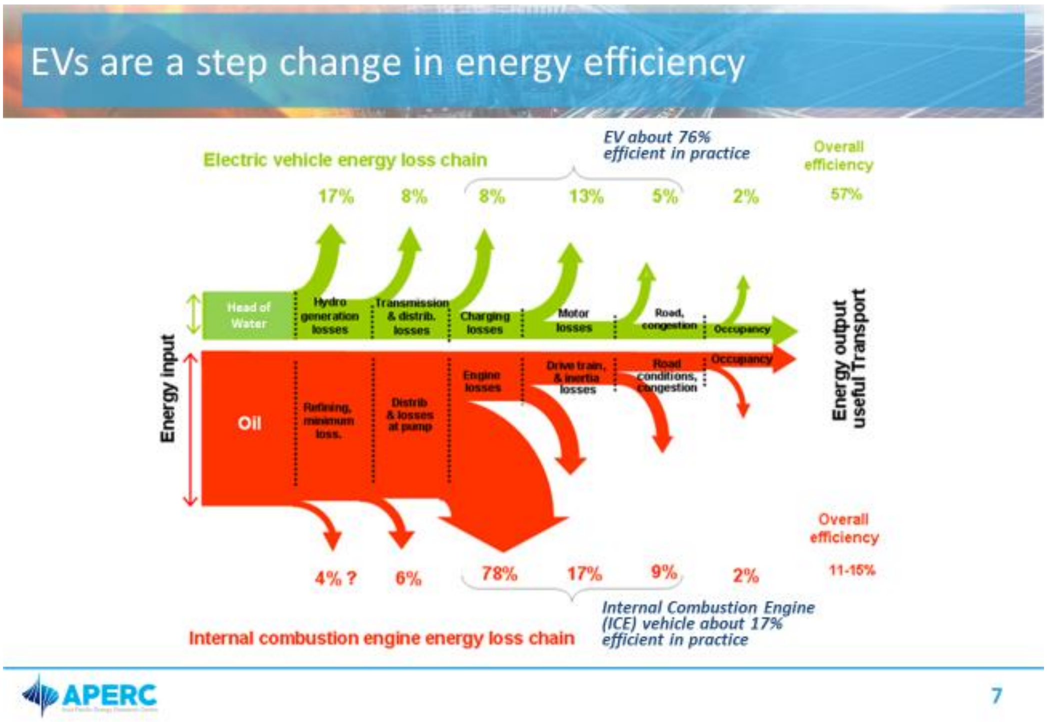

EVs are a step change in energy efficiency
Electric vehicle energy loss chain
EV about 76% efficient in practice
Overall efficiency
17%
8%
8%
13%
5%
2%
57%
Head of Water
Hydro generation losses
Transmission & distrib. losses
Charging losses
Motor losses
Road, congestion
Occupancy
Energy input
Oil
Refining, minimum loss.
Distrib & losses at pump
Engine losses
Drive train, & inertia losses
Road conditions, congestion
Occupancy
Energy output useful Transport
Overall efficiency
11-15%
4% ?
6%
78%
17%
9%
2%
Internal Combustion Engine (ICE) vehicle about 17% efficient in practice
Internal combustion engine energy loss chain
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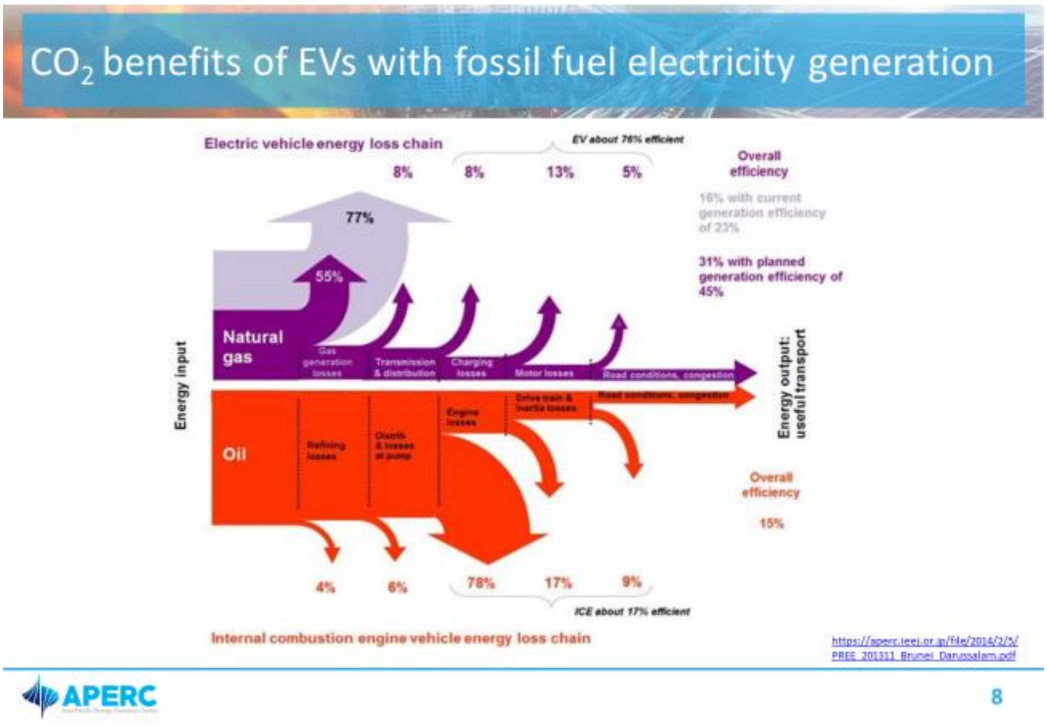

CO2 benefits of EVs with fossil fuel electricity generation
Electric vehicle energy loss chain
EV about 76% efficient
8%
8%
13%
5%
Overall efficiency
16% with current generation efficiency of 23%
31% with planned generation efficiency of 45%
77%
55%
Energy input
Natural gas
Gas generation losses
Transmission & distribution
Charging losses
Motor losses
Road conditions, congestion
Oil
Refining losses
Distrib & losses at pump
Engine losses
Drive train & inertia losses
Road conditions, congestion
Energy output: useful transport
Overall efficiency
15%
4%
6%
78%
17%
9%
ICE about 17% efficient
Internal combustion engine vehicle energy loss chain
https://aperc.ieej.or.jp/file/2014/2/5/PREE_201311_Brunei_Darussalam.pdf
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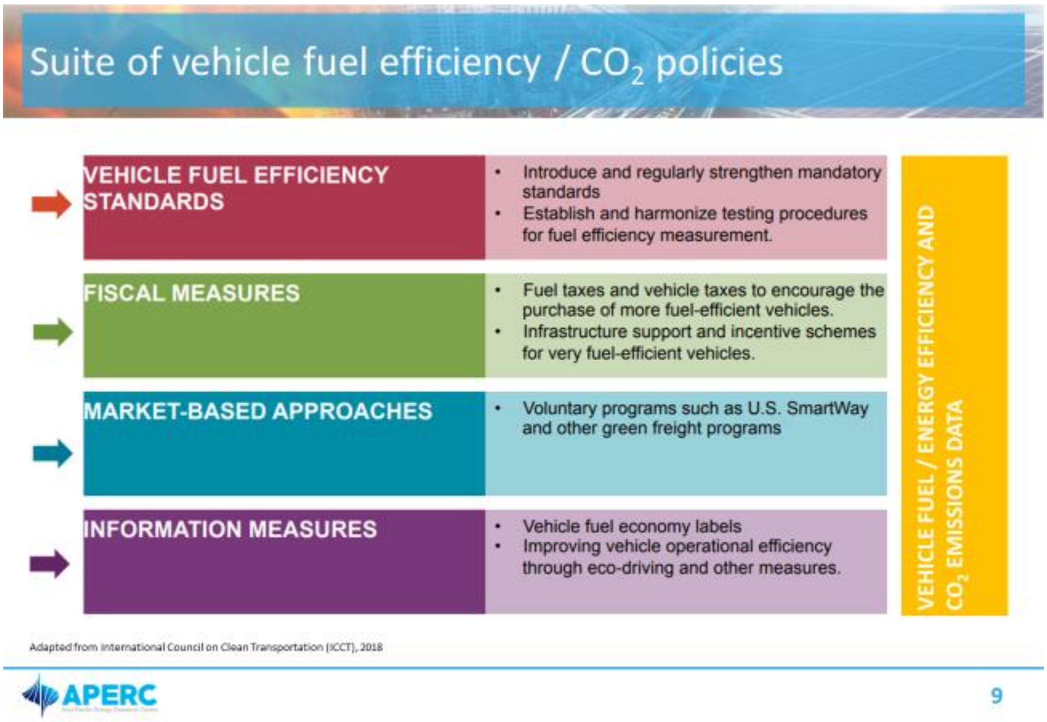
Suite of vehicle fuel efficiency / CO_2 policies
VEHICLE FUEL EFFICIENCY STANDARDS
• Introduce and regularly strengthen mandatory standards
• Establish and harmonize testing procedures for fuel efficiency measurement.
FISCAL MEASURES
• Fuel taxes and vehicle taxes to encourage the purchase of more fuel-efficient vehicles.
• Infrastructure support and incentive schemes for very fuel-efficient vehicles.
MARKET-BASED APPROACHES
• Voluntary programs such as U.S. SmartWay and other green freight programs
INFORMATION MEASURES
• Vehicle fuel economy labels
• Improving vehicle operational efficiency through eco-driving and other measures.
VEHICLE FUEL / ENERGY EFFICIENCY AND CO_2 EMISSIONS DATA
Adapted from International Council on Clean Transportation (ICCT), 2018
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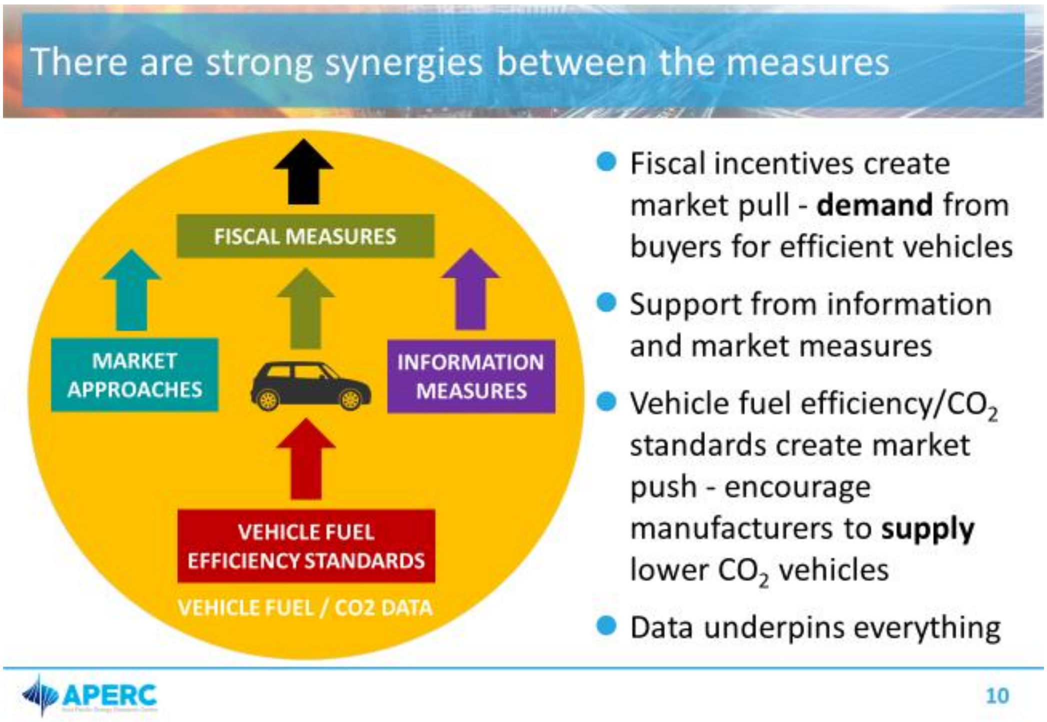
There are strong synergies between the measures
FISCAL MEASURES
MARKET APPROACHES
INFORMATION MEASURES
VEHICLE FUEL EFFICIENCY STANDARDS
VEHICLE FUEL / CO2 DATA
• Fiscal incentives create market pull - **demand** from buyers for efficient vehicles
• Support from information and market measures
• Vehicle fuel efficiency/CO_2 standards create market push - encourage manufacturers to **supply** lower CO_2 vehicles
• Data underpins everything
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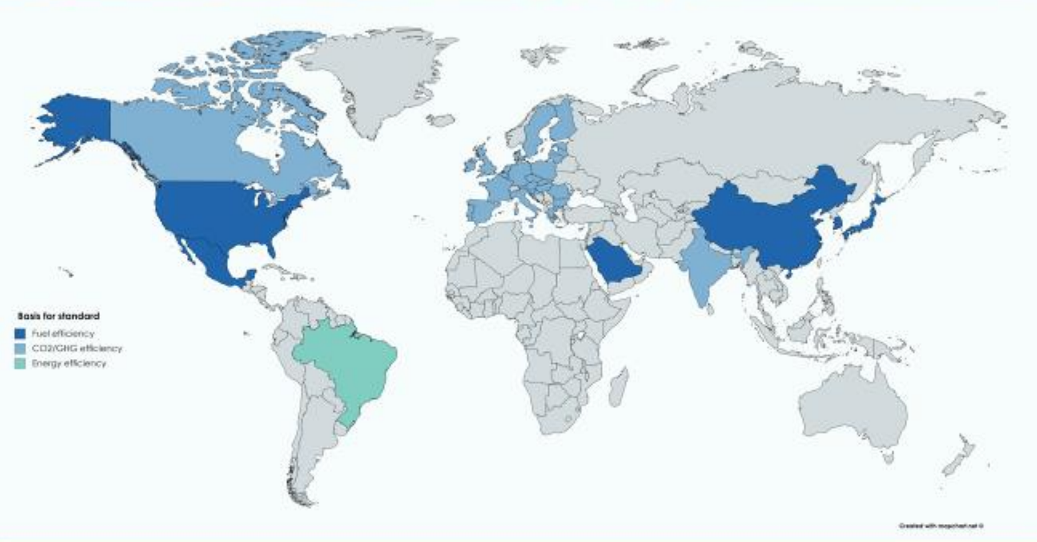
Where vehicle fuel efficiency/CO_2 standards operate



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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

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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

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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

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Mix of weight-based and footprint-based targets

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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

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CO_2 emissions from LDV: historical and current standards

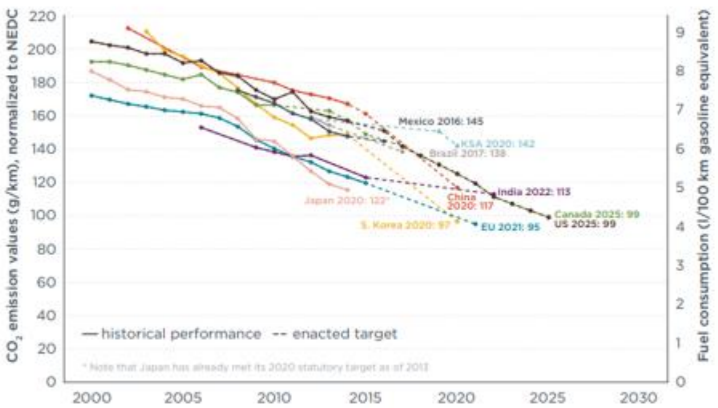

Figure 2. Historical fleet CO_2 emissions performance and current standards (gCO_2/km normalized to NEDC) for passenger cars

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

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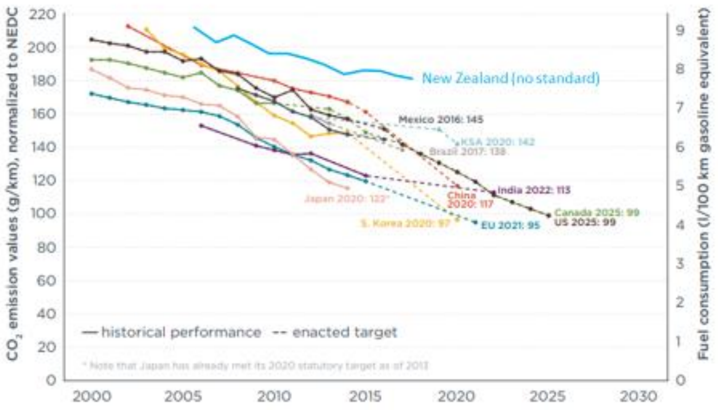
How this compares to an economy with no standards



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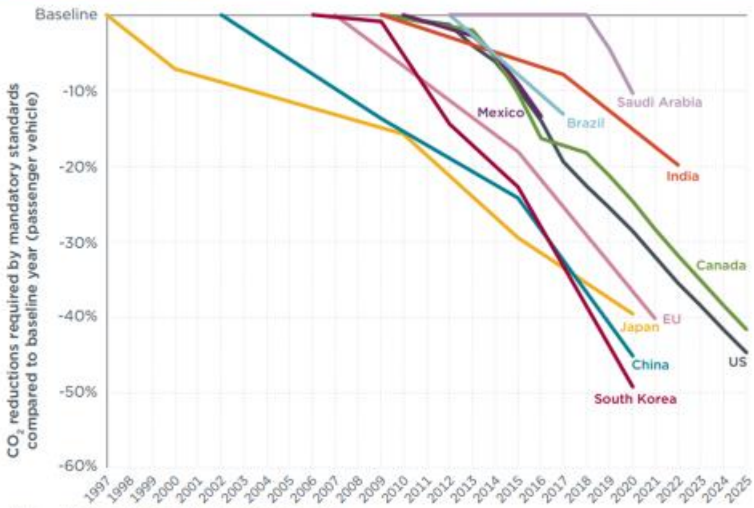
CO_2 emissions reductions from standards



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

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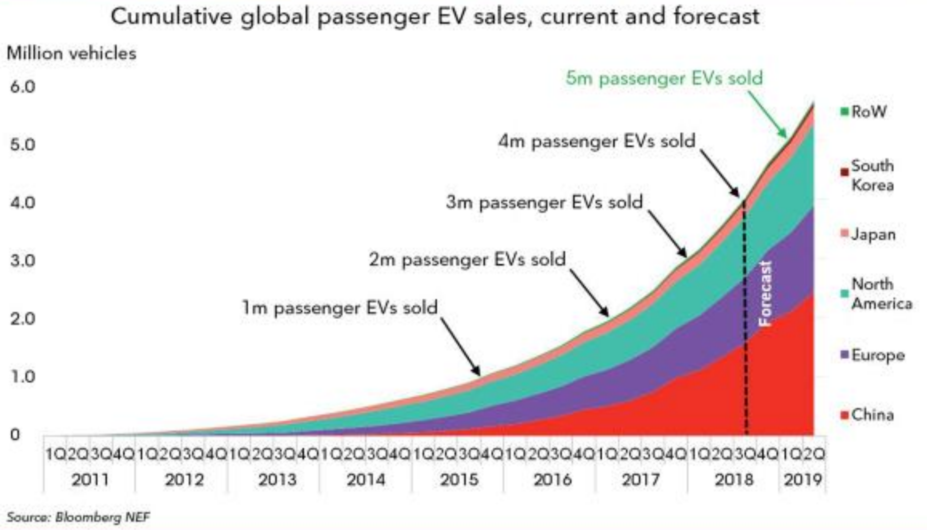
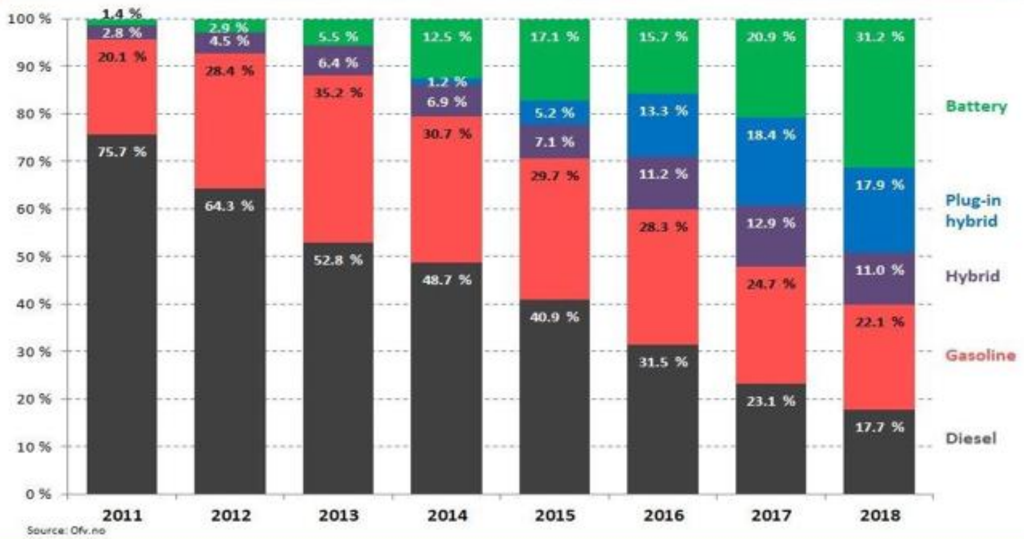
Global EV sales are growing exponentially



APERC 19

Norwegian new car sales by fuel type, 2011-2018



APERC 20

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

APERC 21

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

APERC 22

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

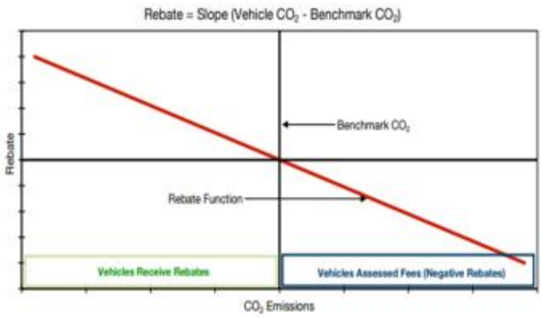
https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/owning-a-vehicle/costs-of-owning-a-vehicle/tax-structure-for-cars.html

APERC

23

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

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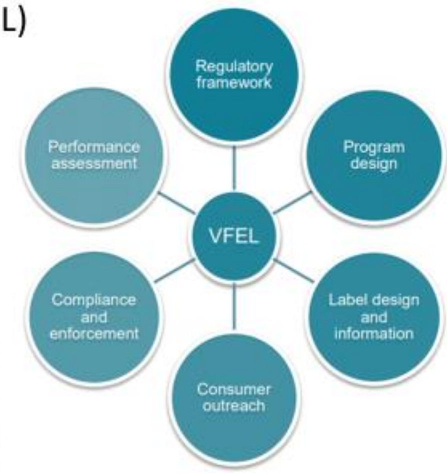
24

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

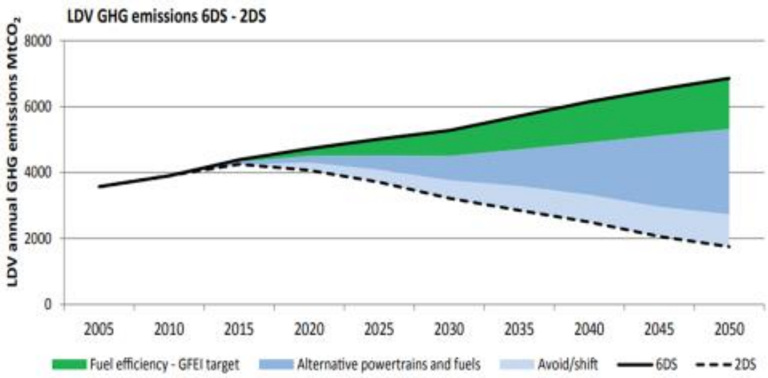
CGFI
中国绿色货运行动
CHINA GREEN FREIGHT INITIATIVE

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

APERC 27

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.

GFEI GLOBAL FUEL ECONOMY INITIATIVE

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

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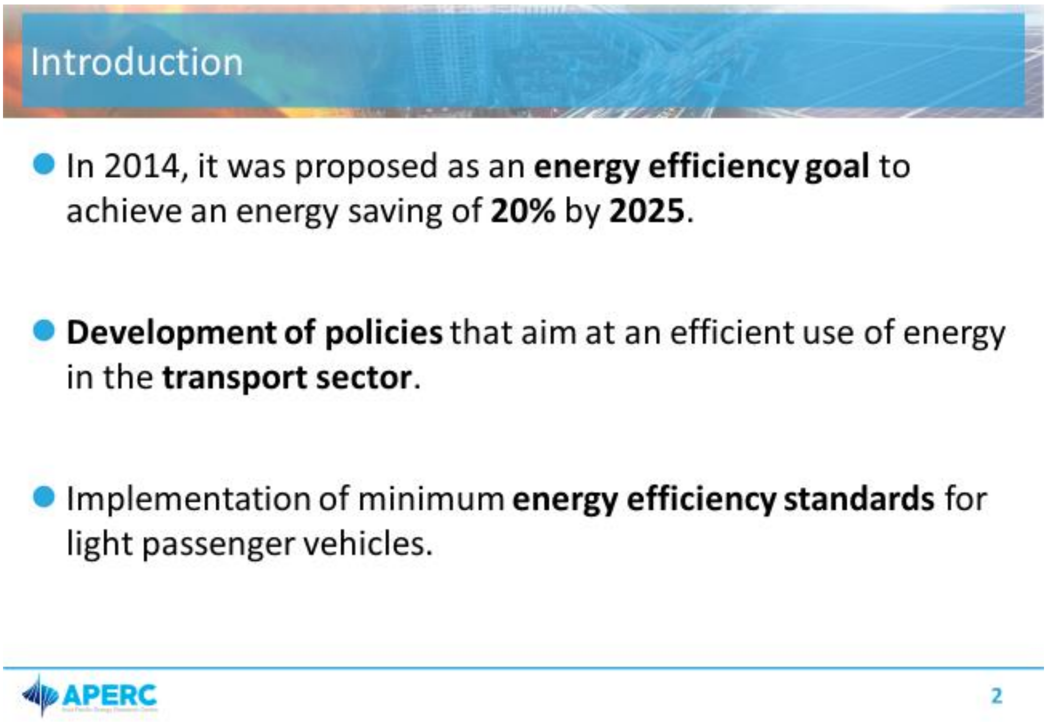
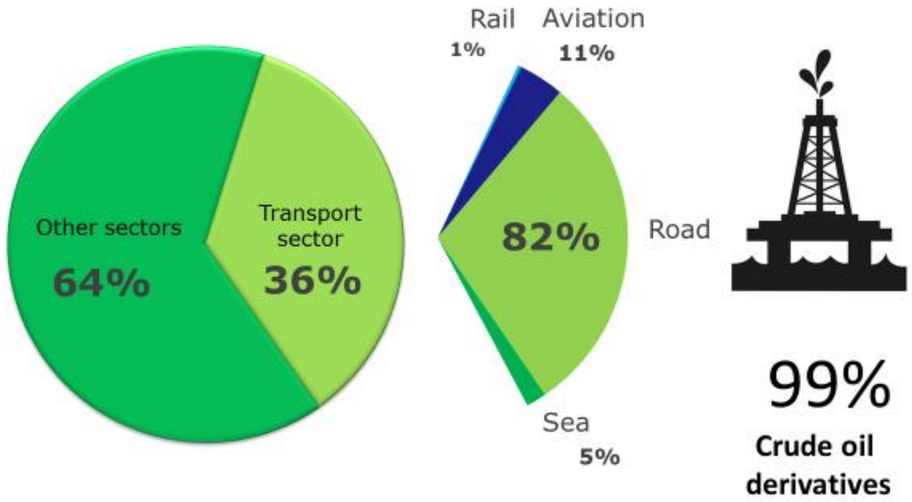
Asia Pacific Energy Research Centre

APPENDIX 5: Chile’s path to develop fuel economy standards

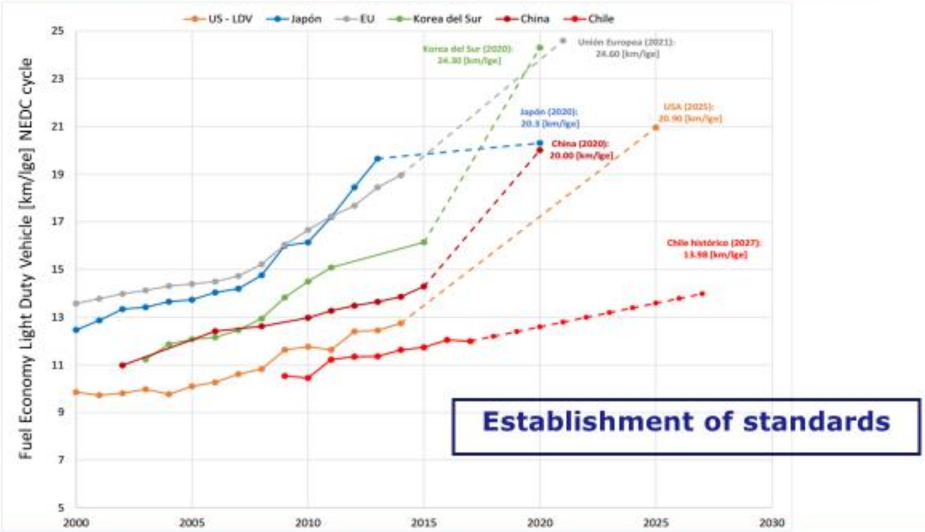


Transport sector in Chile: energy consumption



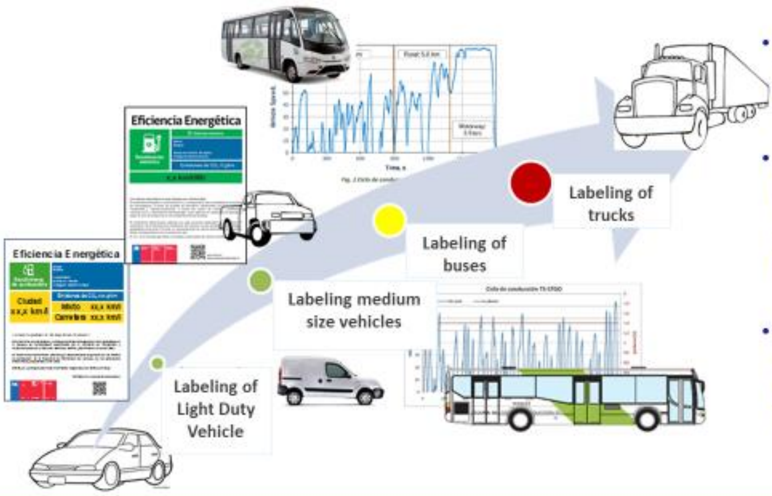
APERC 3

International context



APERC 4

Outlook



- More than 350,000 new vehicle per year
- Collaboration between the Transport, Energy and Environment Ministries
- 3CV - Center of Control and Certification of Vehicles.

APERC 5

Proposed bill of law

Objective: To establish an energy efficiency standard for the motorized vehicle fleet.

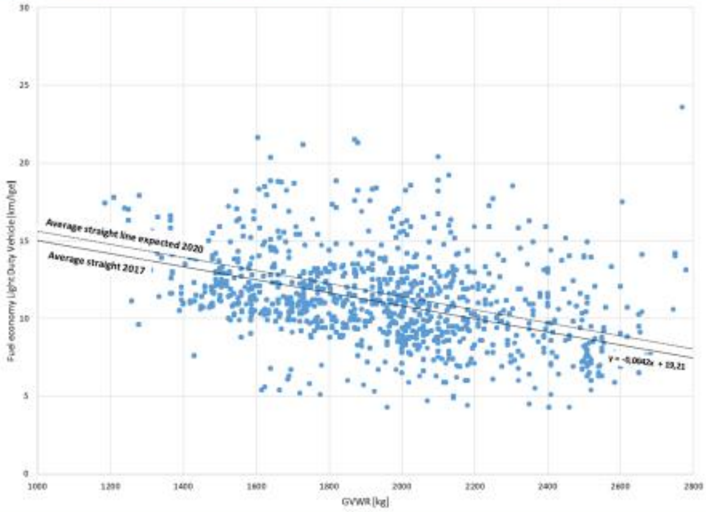
Standard: Will be set by the Energy and Transportation Ministries together, through fuel economy goals that must be met by manufacturers, importers or their representatives, with respect to the vehicles they commercialize.

Metric: Energy efficiency in kilometers per liters of gasoline equivalent and its equivalence in grams of CO2 per kilometer, determined using the values obtained in the homologation of the vehicle.

APERC 6

How is the standard established?

- **At least two years (2016-2017) of a complete universe of light vehicles were studied.**
- **A common energy unit was taken.**



APERC

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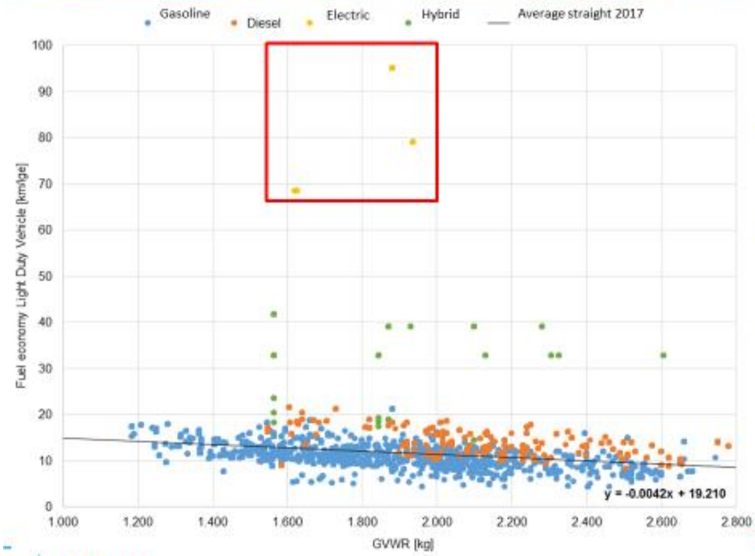
How is the standard established?

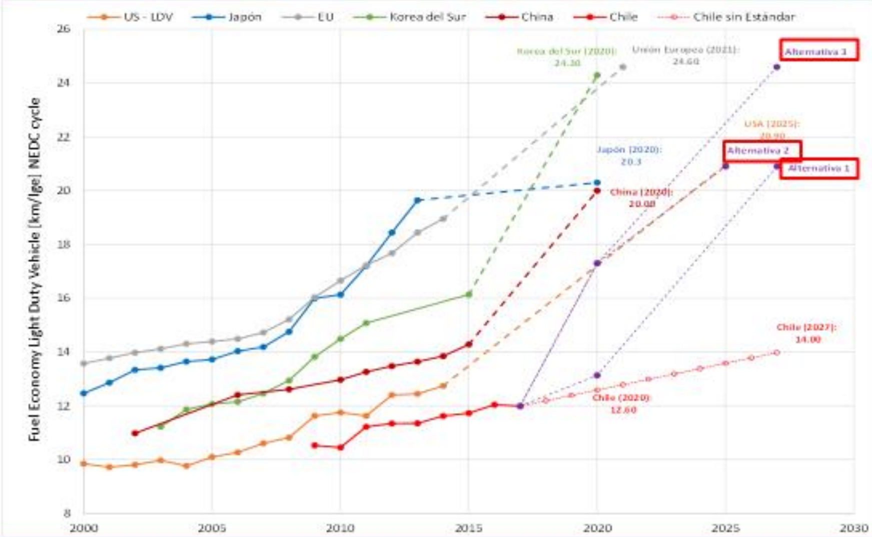


- **Performance with their respective technologies.**
- **Electric vehicle is more efficient.**
- **Wink to electromobility.**

APERC

8

Application of EE vehicle standards



APERC

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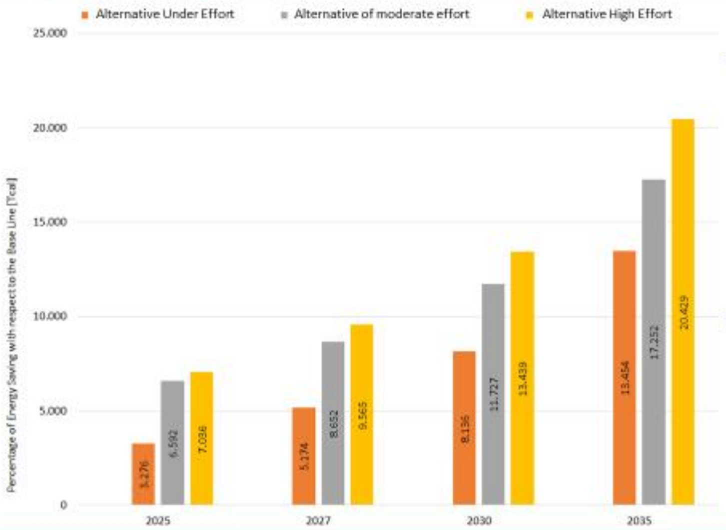
Quantifying savings by alternative



- **The establishment of standards can contribute between 19,3% and 40,9% to the fulfillment of energy efficiency goals.**
- **A contribution that is greater than the current proportion of the energy consumtion by light vehicles (13,5%).**

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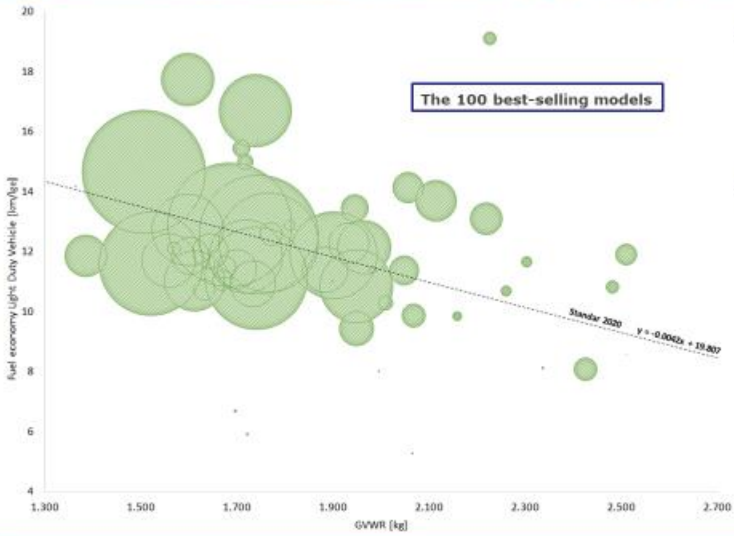
10

Impact on supply



- In the segment of smaller vehicles there are multiple options that are above average.
- In the segments of greater weight, it was observed that for each of these there is an alternative that does not require a considerable increase in the price or a reduction in the size of the vehicle.

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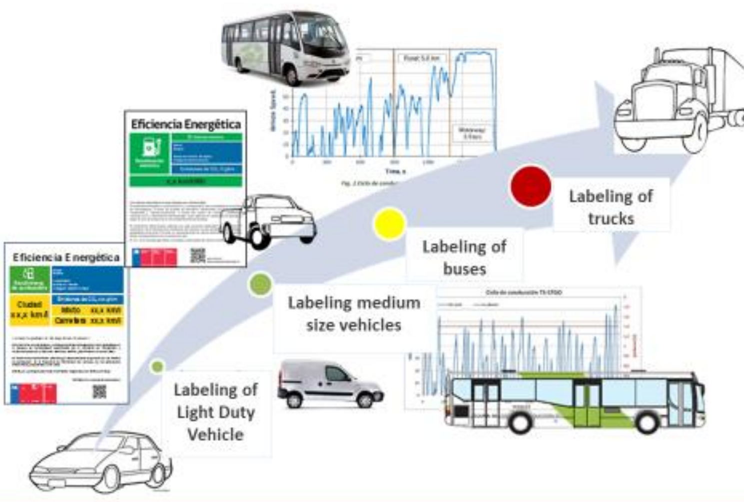
Conclusion



- Faculties for labeling in all vehicles, we are with light and medium vehicles.
- As of July 2018 we have a technical protocol to obtaing energy consumption in urban public transport buses in the city of Santiago.

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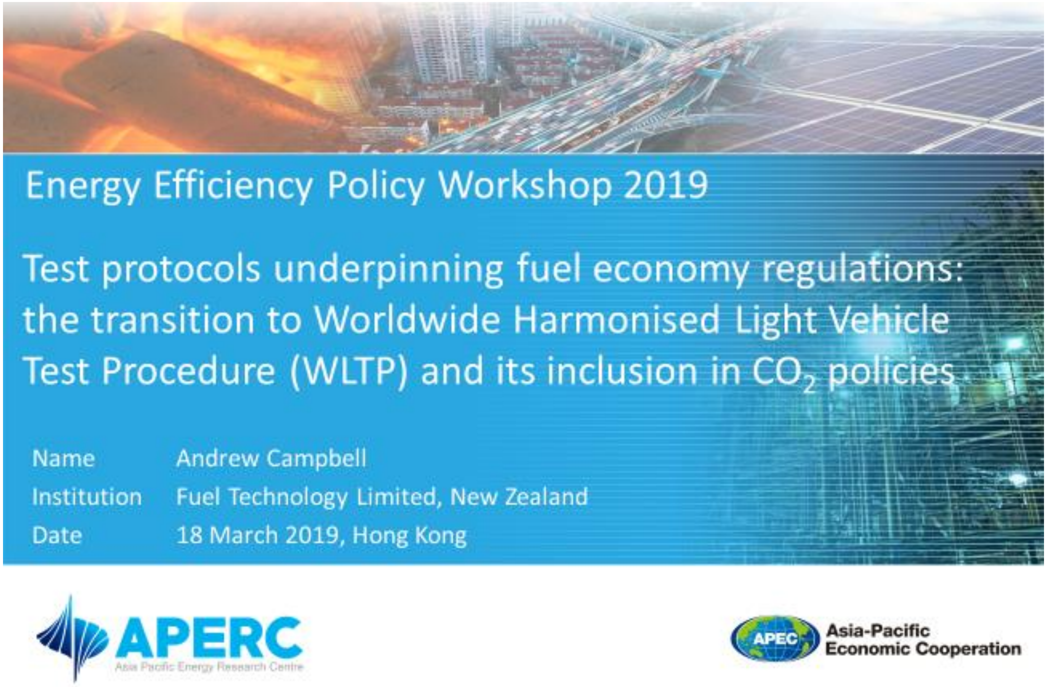
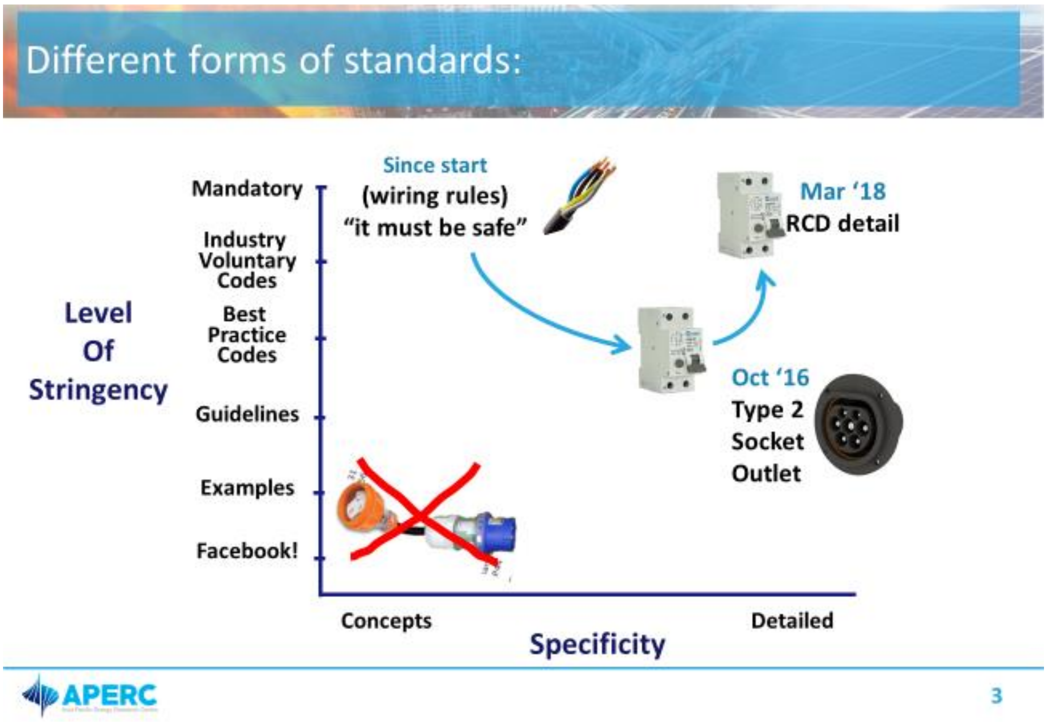
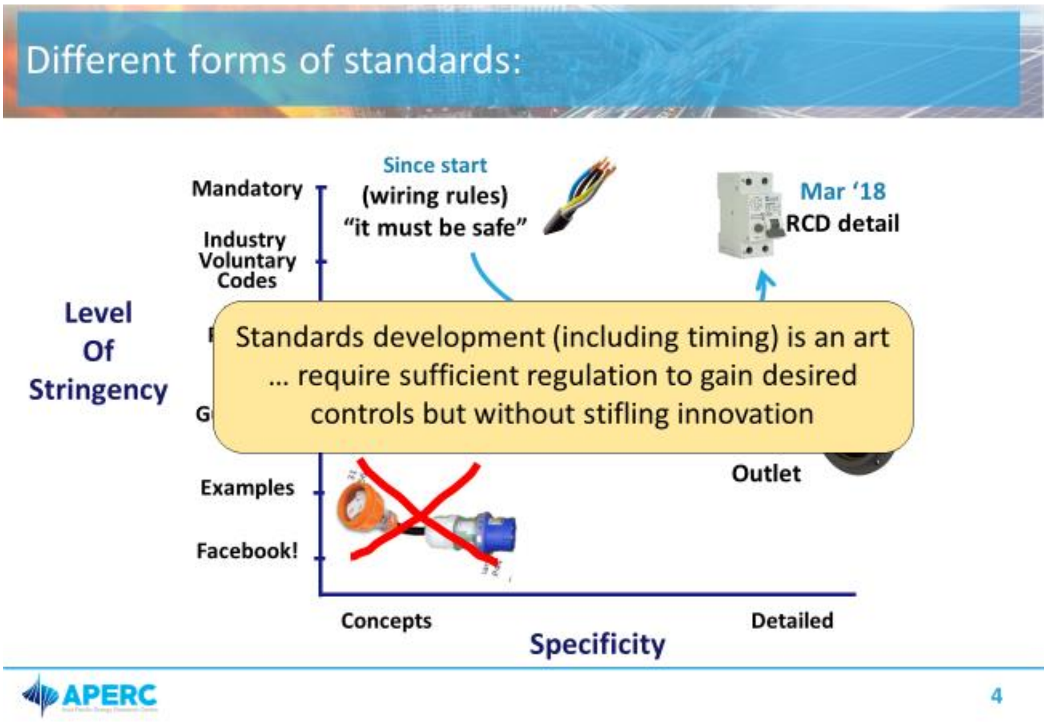
12


Thank you!
lubilla@minenergia.cl
APERC
Asia Pacific Energy Research Centre

APPENDIX 6: Test protocols underpinning fuel economy regulations: the transition to WLTP and its inclusion in CO_2 policies




Different forms of standards:
Since start
(wiring rules)
"it must be safe"
Mar '18
RCD detail
Oct '16
Type 2
Socket
Outlet
Level
Of
Stringency
Mandatory
Industry
Voluntary
Codes
Best
Practice
Codes
Guidelines
Examples
Facebook!
Concepts
Specificity
Detailed
APERC
3

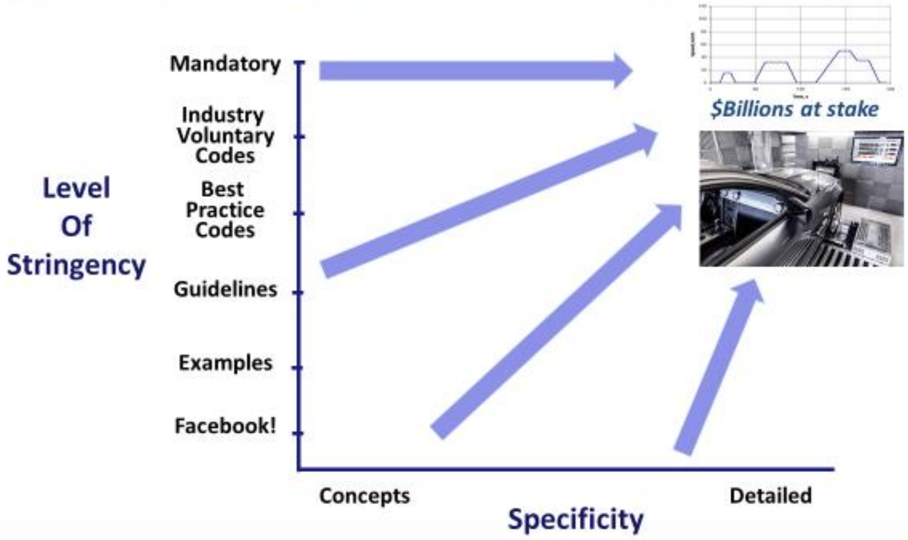

Different forms of standards:
Since start
(wiring rules)
"it must be safe"
Mar '18
RCD detail
Level
Of
Stringency
Mandatory
Industry
Voluntary
Codes
Standards development (including timing) is an art
… require sufficient regulation to gain desired
controls but without stifling innovation
Outlet
Examples
Facebook!
Concepts
Specificity
Detailed
APERC
4

Vehicle Testing History

- 1950-60s: US studies identified vehicles as significant source of air pollution.
- 1960s: establishment of environmental agencies in California, then across US, for developing and administering emissions standards for vehicles.
- 1970s: Establishment of similar initiatives in Western Europe, Canada, Australia and Japan.
- Required reference to results from a repeatable test that aimed to simulate typical vehicle use.
- Mid 1970s: tightening emission standards required de-tuning of engine higher fuel consumption.
- Energy crisis of 1970-80s → fuel consumption result underpinned many energy reduction policy initiatives.
- Fuel consumption result now underpins many GHG reduction policy initiatives.

APERC 5

Vehicle Emissions (and Fuel Consumption) Testing:



APERC 6

Vehicle Emissions (and Fuel Consumption) Testing:

- $Billions at stake – test must be acceptable industry wide, repeatable and robust.
- Ideally providing a range of speeds and loads (and operating temperatures) representing typical vehicle use.
- Standardised: accurately specified to provide repeatability.
- Despite tight specification and staged development of previous tests:
  - Experienced testers could "game" and get better results.
  - Vehicles could be calibrated to perform well under the specific test conditions.
  - Test cycle specification considered vehicle technology available at the time.
- Over time greater divergence of test results and "real world" results.
- New technologies (e.g., EVs) not well catered for (New European Driving Cycle 20 years old).
- Different test cycles in different jurisdictions. Global vehicle supply more efficient/cost effective with one test (homologation).

→ **undermining policy efforts**

APERC

7

Introduction of the Worldwide Harmonised Light Vehicle Test Procedure (WLTP)

- Development process began in 2007.
- Developed by the UN ECE GRPE (Working Party on Pollution and Energy) with inputs from wide-ranging economies.
- An approximation of real-world operation.
- Stricter test conditions, higher speeds, longer test duration.
- Consideration of vehicle's "special equipment", including weight of A/C units, aerodynamics, and others.
- Consideration of different power trains … EV technology.

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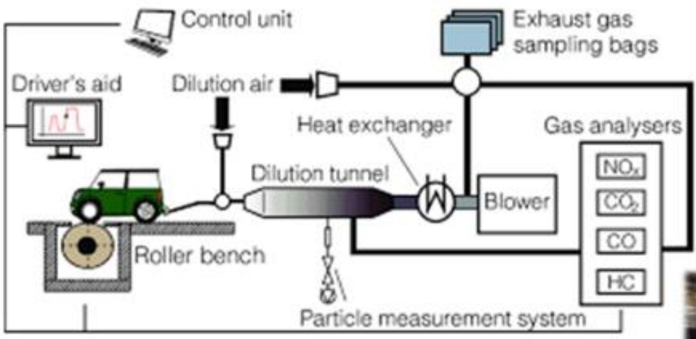
8

The Test Arrangement



APERC

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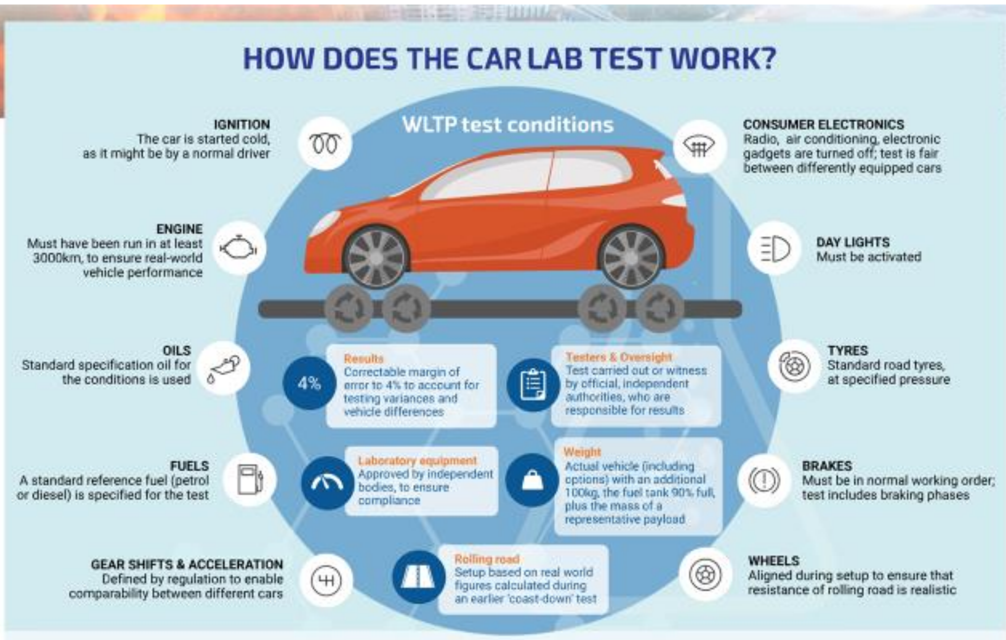

APERC

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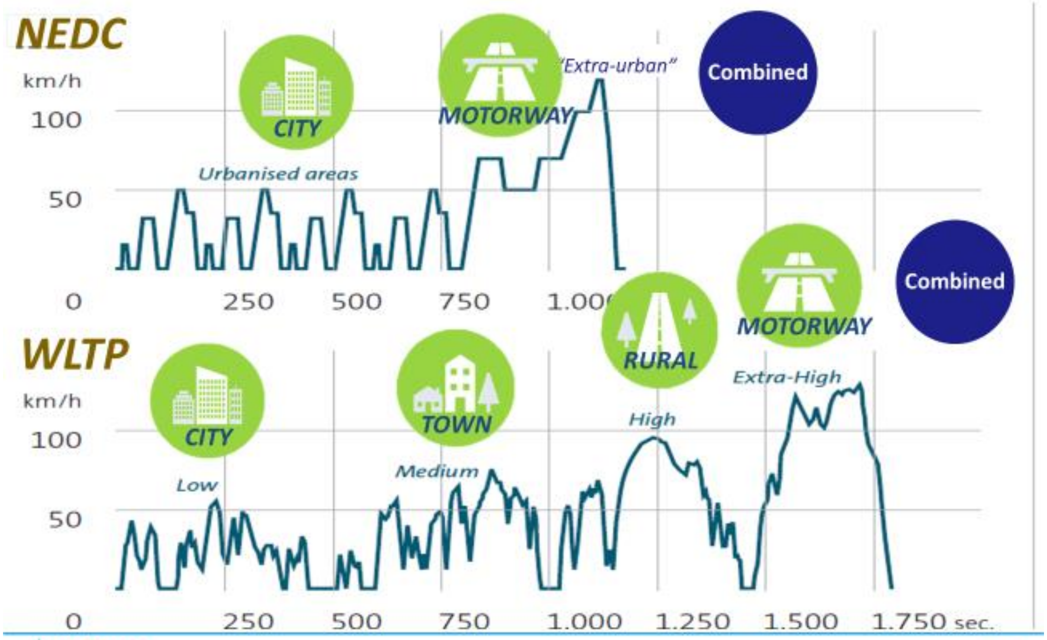

APERC 11

New European Drive Cycle (NEDC) vs Worldwide Harmonised Light Vehicle Test Procedure (WLTP)

	NEDC	WLTP
Starting temp.	cold	cold
Duration	1.180 sec.	1.800 sec.
Idle time	25 %	13 %
Distance	10.966 m	23.274 m
Phases	2 phases: Urban and long-distance trip	Up to 4 phases: "Low", "Medium", "High" and "Extra-High"
Speed	mean: 34 km/h – maximum: 120 km/h	mean: 47 km/h – maximum: 131 km/h
Acceleration	mean: 0,50 m/s² – maximum: 1,04 m/s²	mean: 0,39 m/s² – maximum: 1,58 m/s²

APERC 12

The WLTC for PEVs, PHEVs and (Non-P)HEVs

APERC

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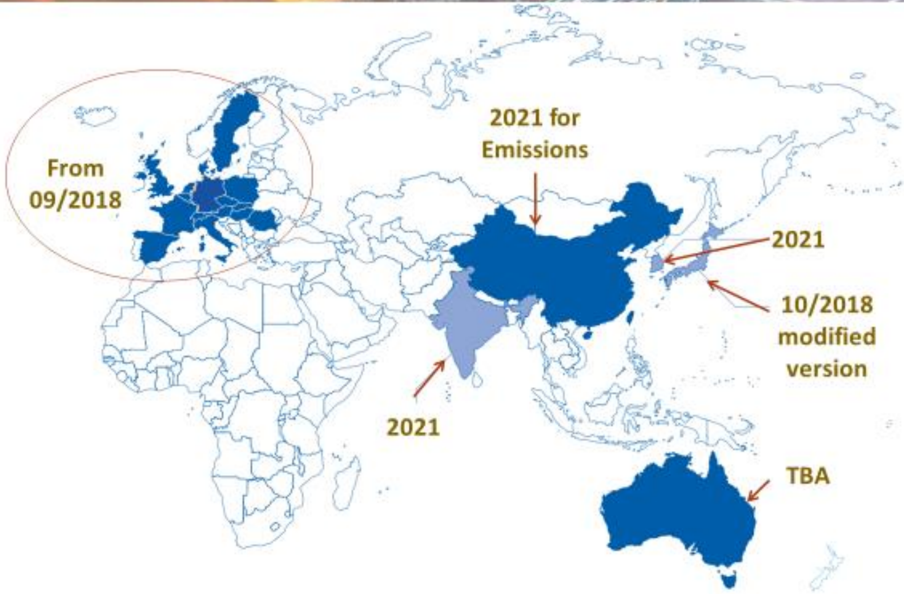
Introduction of World Harmonized



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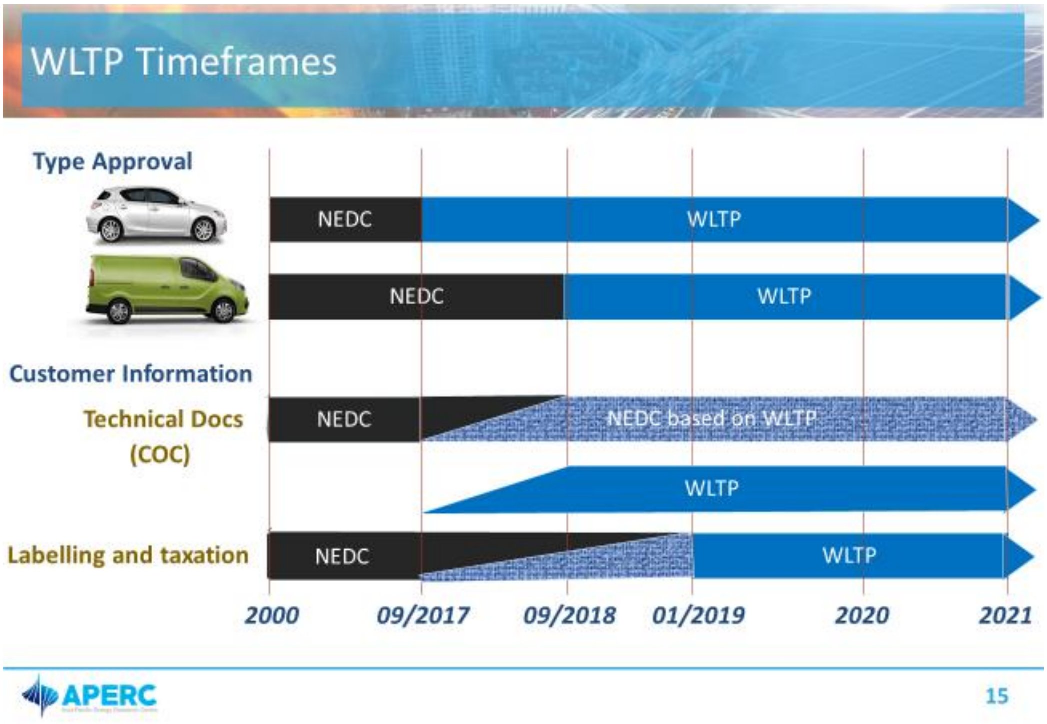
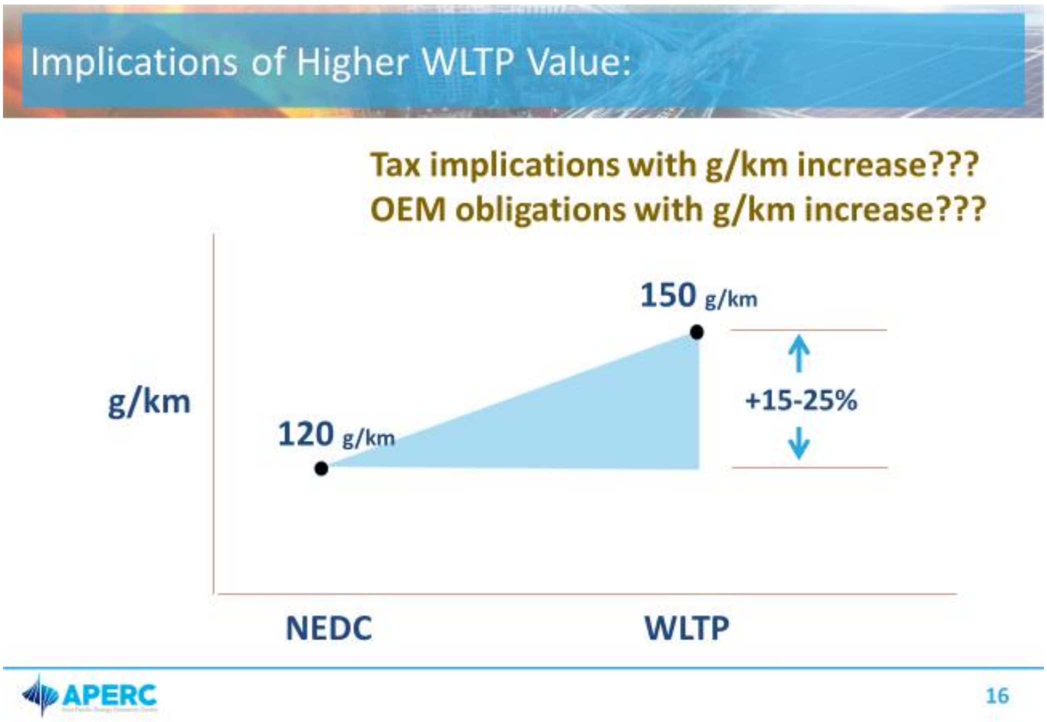

WLTP Timeframes
Type Approval
NEDC
WLTP
NEDC
WLTP
Customer Information
Technical Docs (COC)
NEDC
NEDC based on WLTP
WLTP
Labelling and taxation
NEDC
WLTP
2000
09/2017
09/2018
01/2019
2020
2021
APERC
15


Implications of Higher WLTP Value:
Tax implications with g/km increase???
OEM obligations with g/km increase???
g/km
150 g/km
120 g/km
+15-25%
NEDC
WLTP
APERC
16

Consequences of WLTP Introduction

- Vehicle Type Approval data uses WLTP test, but labelling still requires NEDC data → high risk of confusing consumers where both NEDC and WLTP are displayed.
- European Union CO_2 targets for 2021, for vehicle manufacturers, based on old NEDC test.
  - European Commission developed a WLTP→NEDC translation algorithm.
  - Not exact, which has potential for significant cost implications.
- UK as an example of considerations: changes to the label are proposed for April 2020, when taxation will switch from NEDC to WLTP. Yet to be determined how difference in fuel consumption result/tax will be managed.
- EU automotive industry suggesting revision of labelling once WLTP transition complete → harmonised consumer information.

APERC 17

WLTP Summary

- Developed by the UN ECE GRPE (Working Party on Pollution and Energy)
- Part of the Worldwide harmonized Light vehicles Test Procedures (WLTP). The WLTP procedures define a number of other procedures.
- Cycle based on real-driving data with low, medium, high and extra high speed sections → expect closer to real-world fuel consumption.
- Phase-in began 2017. Few light vehicle models/vehicles now not tested to WLTP protocol.
- Introduction of modified form in Japan, and for exhaust emissions in China. Australia, India and South Korea will also implement the WLTP at a later stage
- Many factors involved in vehicle's fuel consumption and CO_2 emissions. Despite expected improvements, care still required interpreting WLTP.
- Fuel consumption labelling and other use of WLTP data yet to catch up.

APERC 18


Thank You
http://aperc.ieej.or.jp/
Thanks also to Gloria Esposita
for supporting materials
LowCVP
Low Carbon Vehicle Partnership
APERC
Asia Pacific Energy Research Centre

ASIA-PACIFIC ECONOMIC COOPERATION (APEC)
APEC Workshops

Wide Scale Promotion of Low-emission Vehicles for Hong Kong – Challenges and Opportunities

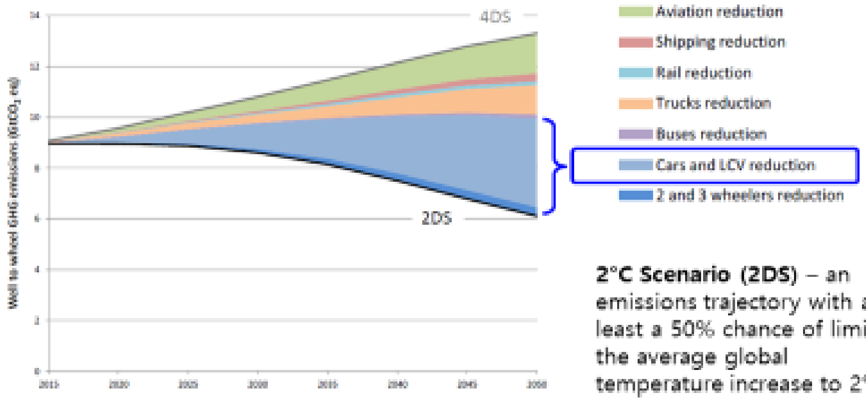
Mr. Raymond Choi
General Manager (Customer Services)
HK Electric

Date: 18 March 2019

Hong Kong, China

GHG Emissions – Transport

- Low-emission vehicles (i.e. electric vehicles) are a major component of the 2DS, and vital to achieving "well below 2 degree" ambitions

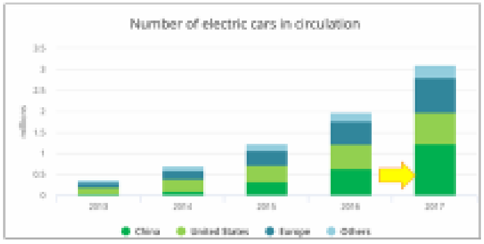


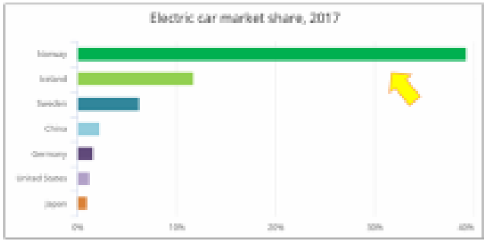
2°C Scenario (2DS) – an emissions trajectory with at least a 50% chance of limiting the average global temperature increase to 2°C

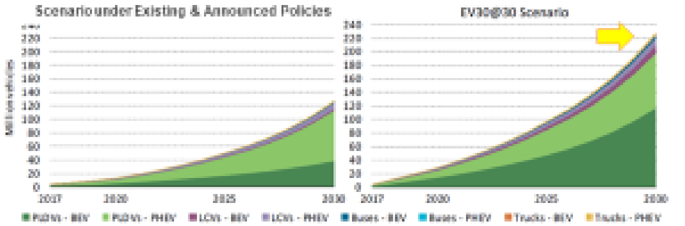
Source: Accelerating electric vehicle deployment and support policies (2016), International Energy Agency

Hong Kong, China

Global Outlook of EV







IEA Global EV Outlook 2018 (EV30@30)

- EV accounts for 30% new vehicle sales by 2030
- 220 million EVs on the road by 2030

Notes: PLDVs = passenger light duty vehicles; LCVs = light commercial vehicles; BEVs = battery electric vehicles; PHEV = plug-in hybrid electric vehicles.

Source: © OECD/IEA Global EV Outlook 2019, IEA Publishing. Licence: www.iea.org/t&c

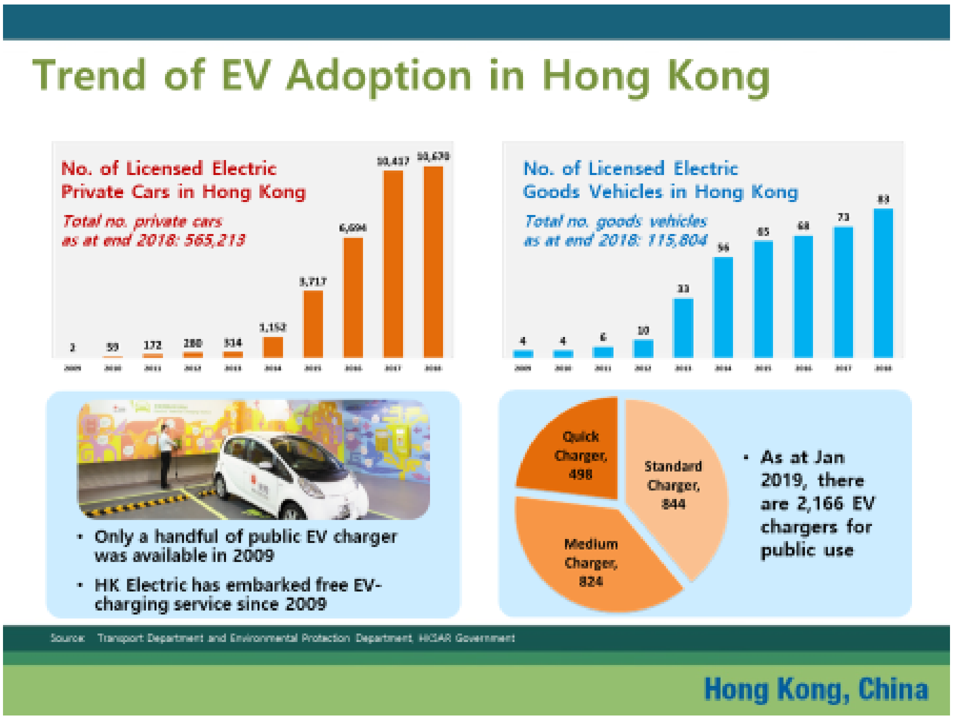
Hong Kong, China

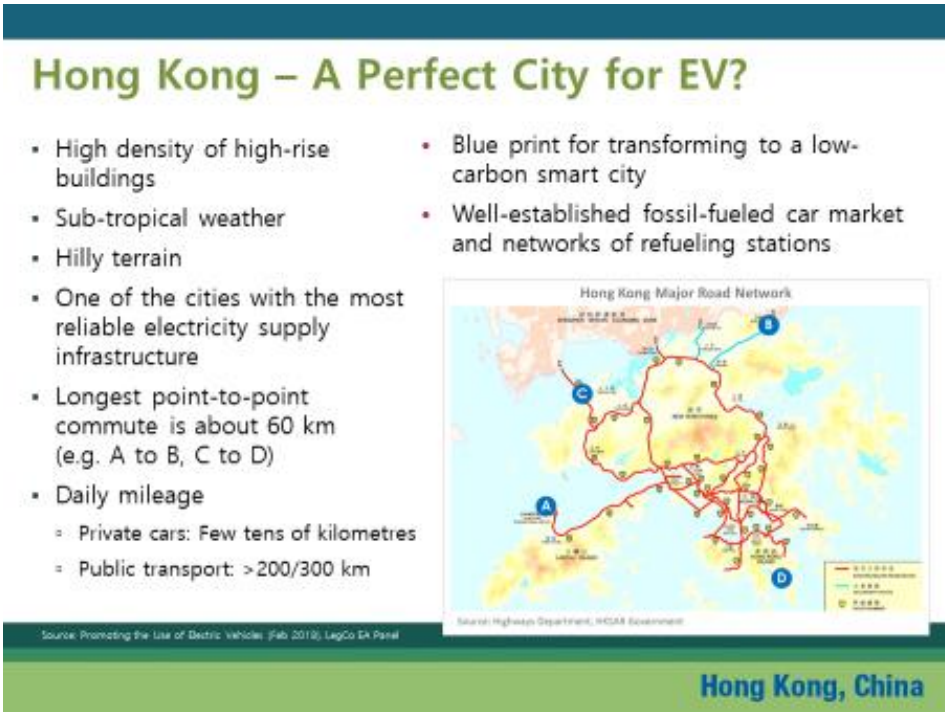
Electrification of Road Transport in Hong Kong

As at Dec 2018	Average Daily Passenger Journeys	Licensed Fleet	Electrified	
			No.	%
Franchised Buses	4.1 M	6,294 buses	33	0.5%
Public Light Buses	1.8 M	4,323 buses	0	0%
Taxis	0.9 M	18,143 taxis	0	0%
Private cars		**565,213**	**10,670**	**~2%**
Goods vehicles		115,804	83	~0.1%
Motor cycles		54,856	10	~0.1%
Government & Special vehicles		1,763	91	~1%
Other Buses/Coaches		7,629	8	~0.1%
Private Light Buses		3,346	6	~0.2%

Source: Transport Department, HKSAR Government

Hong Kong, China

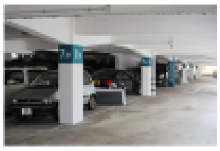

Trend of EV Adoption in Hong Kong
No. of Licensed Electric Private Cars in Hong Kong
Total no. private cars as at end 2018: 565,213
2
59
172
280
514
1,152
3,717
6,694
10,417
10,670
No. of Licensed Electric Goods Vehicles in Hong Kong
Total no. goods vehicles as at end 2018: 115,804
4
4
6
10
33
56
65
68
73
83
Only a handful of public EV charger was available in 2009
HK Electric has embarked free EV-charging service since 2009
Quick Charger, 498
Standard Charger, 844
Medium Charger, 824
As at Jan 2019, there are 2,166 EV chargers for public use
Source: Transport Department and Environmental Protection Department, HKSAR Government
Hong Kong, China


Hong Kong – A Perfect City for EV?
High density of high-rise buildings
Sub-tropical weather
Hilly terrain
One of the cities with the most reliable electricity supply infrastructure
Longest point-to-point commute is about 60 km (e.g. A to B, C to D)
Daily mileage
Private cars: Few tens of kilometres
Public transport: >200/300 km
Blue print for transforming to a low-carbon smart city
Well-established fossil-fueled car market and networks of refueling stations
Hong Kong Major Road Network
A
B
C
D
Hong Kong, China

Wider Adoption of EV in HK - Challenges

High density of high-rise buildings

- Cars are parked in multi-storey car parks with parking bays either owned or rented by the drivers
- Existing car parks are not designed for EV charger installation
- Aged buildings may not have spare communal power capacity for EV chargers
- Permissions from the building owners and other parking bay owners/users are required for EV charger installation and associated wiring work



Sub-tropical weather

- Air-conditioning is a must in hot and humid days, especially during traffic congestion

Hilly terrain

- Uphill climbing ability is a must, especially for buses & light buses

Long travel range for public transport

- Sufficient top-up/quick chargers or spare vehicles are required for fleet operation

Well-established fossil-fueled car market

- Keen competition with fossil-fueled cars on choices, prices and refueling convenience

Hong Kong, China

Wider Adoption of EV in HK -Opportunities

Aspiration for becoming a low-carbon smart city

- Policy support for EV development in Hong Kong as one of the means to reduce carbon intensity, improve air quality and transform to a smart city

High density of high-rise buildings

- EV as a key means to solve roadside emission problem given buildings are packed along road sides especially in urban areas

Private cars' short commute distance

- Present EVs are able to cope with the driving range requirement; "refueling" frequency can be on par with fossil-fueled cars

Reliable electricity supply infrastructure

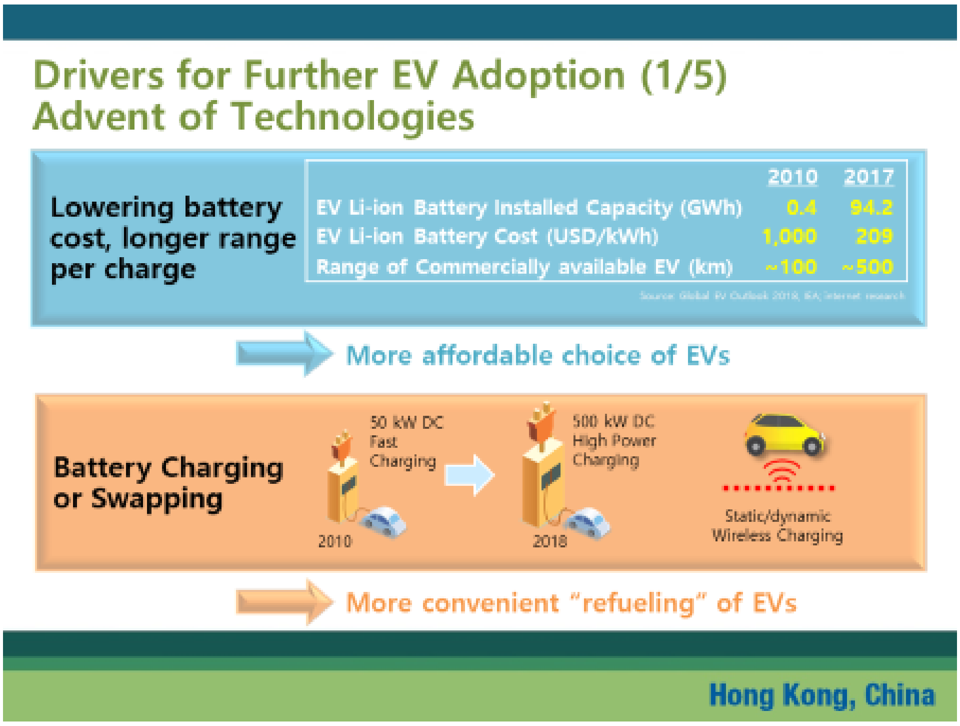
- Adequate and reliable electricity supply supports the EV charging infrastructure development, especially top-up quick chargers

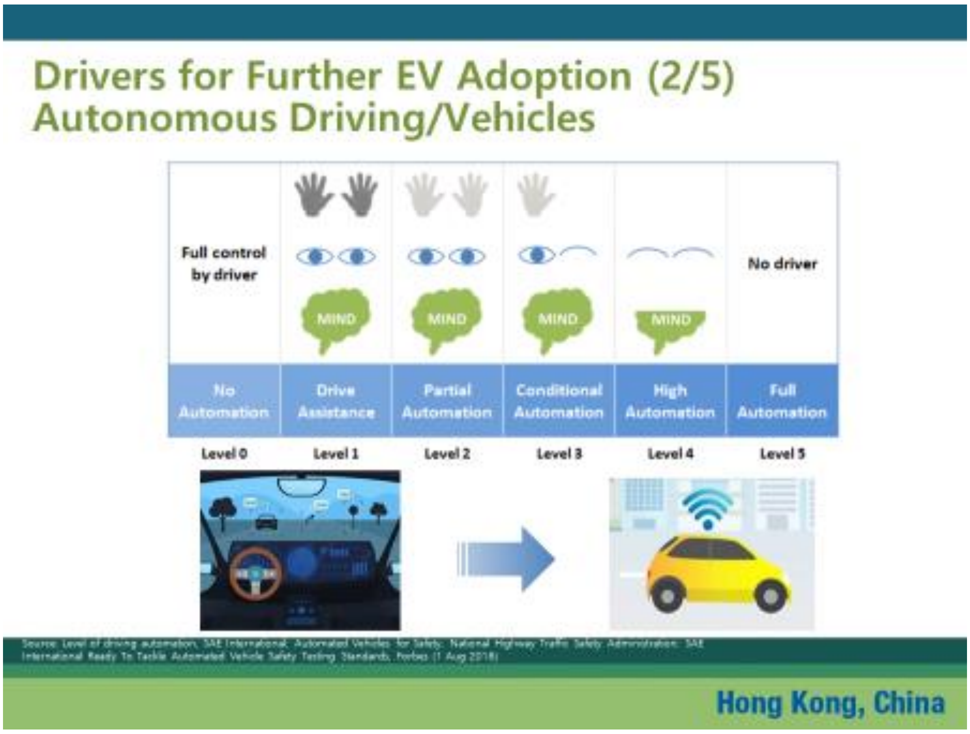
Source: Smartcity.gov.hk; Hong Kong's Climate Action Plan 2030+, Environment Bureau, HKSAR Government

Hong Kong, China


Overcome Challenges & Seize Opportunities
Governments' Policies
• First registration tax (FRT) concessions for EV
• 100% profits tax deduction for the capital expenditure on EVs in the first year of procurement
• A HK$300 million Pilot Green Transport Fund to encourage trial of green innovative and low carbon transport technologies (including electric commercial vehicles)
• $180 million for franchised bus companies to purchase 36 single-deck electric buses
• Gross Floor Area concession for new development with all parking spaces EV charging – enabled
• Guidelines for setting up EV chargers
• 2018 Policy Address: consider ceasing the first registration of diesel private cars subject to consultation with stakeholders
• 2019-20 Budget: $120 million to extend the public EV charging networks at government car parks
Source: Hong Kong's Climate Action Plan 2030+, Environment Bureau, HKSAR Government
Hong Kong, China


Overcome Challenges & Seize Opportunities
HK Electric's Endeavours
Supply reliability of > 99.999% since 1997
Introduced EVs in early 1980's,
> 40% EVs in corporate fleet as at today
Free EV charging service since 2009
We Power Hong Kong's
Formula E
EV Battery
Champion Proposal
電動車 充電易
Drive EV · Charge Easy
• Grid supply capacity checks, site inspections and technical advisory services
• 2016-2018: helped customers install over 150 EV chargers at their premises
Hong Kong, China


Drivers for Further EV Adoption (1/5)
Advent of Technologies
Lowering battery cost, longer range per charge
2010 2017
EV Li-ion Battery Installed Capacity (GWh) 0.4 94.2
EV Li-ion Battery Cost (USD/kWh) 1,000 209
Range of Commercially available EV (km) ~100 ~500
Source: Global EV Outlook 2018, IEA; Internet research
More affordable choice of EVs
Battery Charging or Swapping
50 kW DC Fast Charging
2010
500 kW DC High Power Charging
2018
Static/dynamic Wireless Charging
More convenient "refueling" of EVs
Hong Kong, China


Drivers for Further EV Adoption (2/5)
Autonomous Driving/Vehicles
Full control by driver
No driver
MIND
No Automation
Drive Assistance
Partial Automation
Conditional Automation
High Automation
Full Automation
Level 0
Level 1
Level 2
Level 3
Level 4
Level 5
Source: Level of driving automation, SAE International; Automated Vehicles for Safety, National Highway Traffic Safety Administration; SAE International Ready To Tackle Automated Vehicle Safety Testing Standards, Forbes (1 Aug 2018)
Hong Kong, China

Drivers for Further EV Adoption (3/5)
On-demand & Sharing E-mobility

Photo taken in Berlin - sharing Segway

- BlueSG: 1,000 sharing EVs and 500 charging stations in Singapore (100 stations opened as at Oct 2018)
- VW will provide 2,000 sharing EVs in Berlin starting from Q2 2019

Photo taken in Berlin – sharing e-scooter (A Vattenfall-Emmy partnership)

Ford GoBike added in Apr 2018 250 power-assisted e-bikes to its bike sharing fleet in San Francisco

Hong Kong, China

Drivers for Further EV Adoption (4/5)
Regulations & Policies

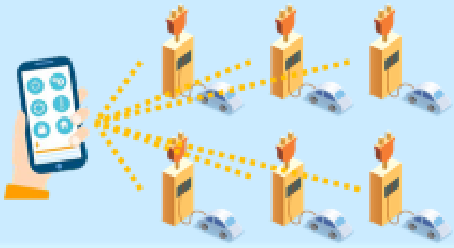
Banning on Sales of Fossil Fuel Vehicles

Region	Ban by	G: Gasoline D: Diesel
Austria	2025	G+D
Demark	2030	G+D
France	2040	G+D
Germany	2030	G+D
Hong Kong	TBC	D
India	2030	G+D
Netherlands	2030	G+D
Norway	2025	G+D
United Kingdom	2040	G+D

Incentives for EV

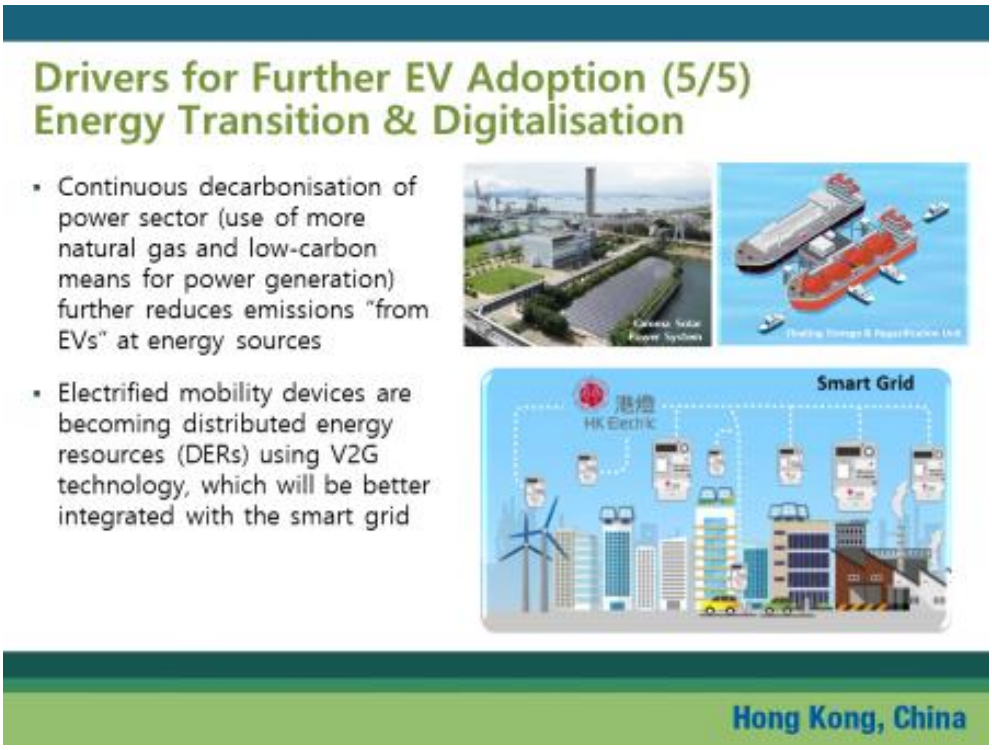
- Tax/levy waivers for owning EVs
- Incentives for EV charging infrastructure
- EV user incentives/privileges

Clarity of policies, legislations, regulations and insurance for personal & sharing mobility



Source: Internet research

Hong Kong, China

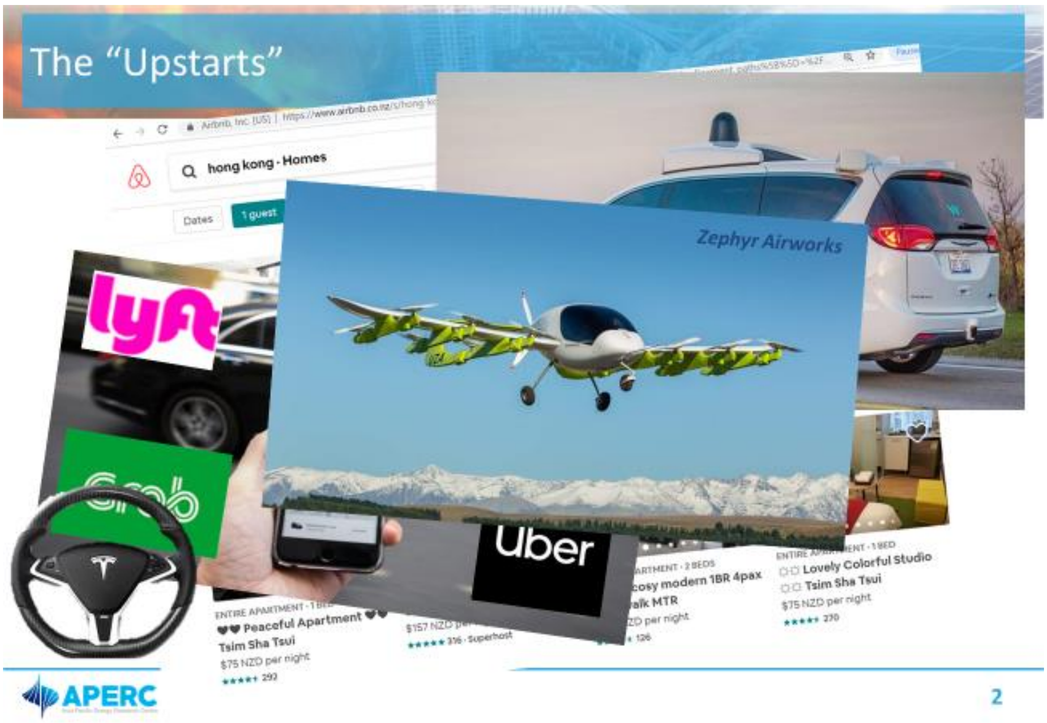

Drivers for Further EV Adoption (5/5)
Energy Transition & Digitalisation
▪ Continuous decarbonisation of power sector (use of more natural gas and low-carbon means for power generation) further reduces emissions "from EVs" at energy sources
▪ Electrified mobility devices are becoming distributed energy resources (DERs) using V2G technology, which will be better integrated with the smart grid
Smart Grid
港燈
HK Electric
Hong Kong, China

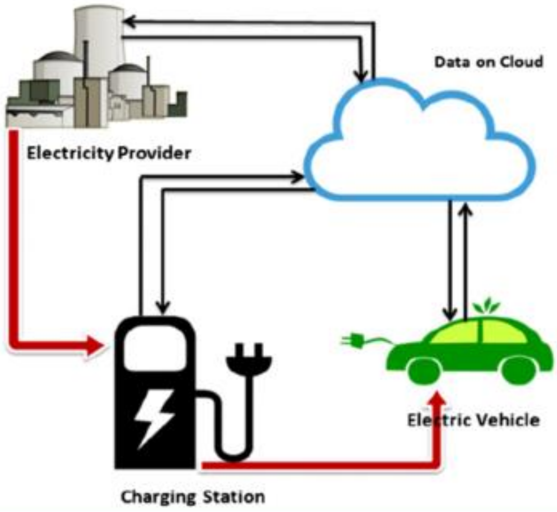

Concluding Remark – A Visionary Picture of EV
A solution to improve environment
A commute alternative to diesel vehicles
Discrete standalone vehicles
Integrated solution & key smart city ingredient
Safe
Intelligent
Connected
On-demand/sharing
Environmental
Convenient
Efficient
We see challenges, but we see more opportunities
Image: e-Palette Concept Vehicle, Toyota
Hong Kong, China

Thank You

Hong Kong, China

APPENDIX 8: Developing Strategies for EVs: Case Study from the Philippines





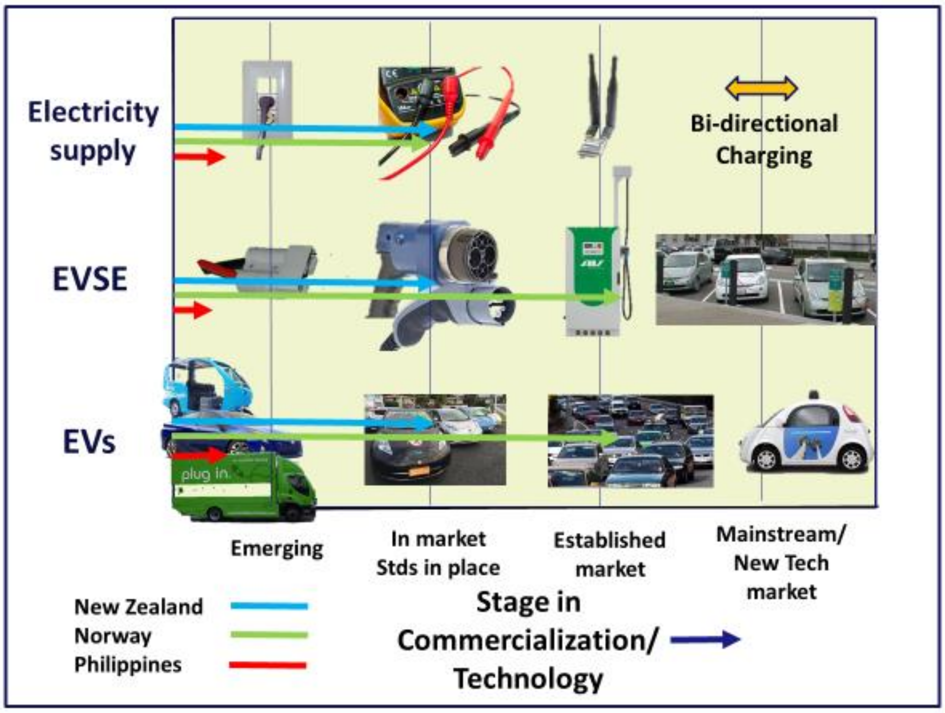
Life is changing …

- Cheap electronics, cheap communications, and cheap data.
- Advances in battery technology and cost reduction.
- OEMs well aware of likely disruption to their business:
  - Flexible ownership and usership: car sharing, fractional ownership, pay-as-you-go.
  - Provision of (single trip) multi-modal urban solutions.
  - "Dynamic shuttles": near-taxi convenience and near-mass transit price.
  - Autonomy from assist to full control (Ford, Uber, Google … early target is SAE Level 4-capable autonomous vehicle for ride-hailing or ride-sharing services).

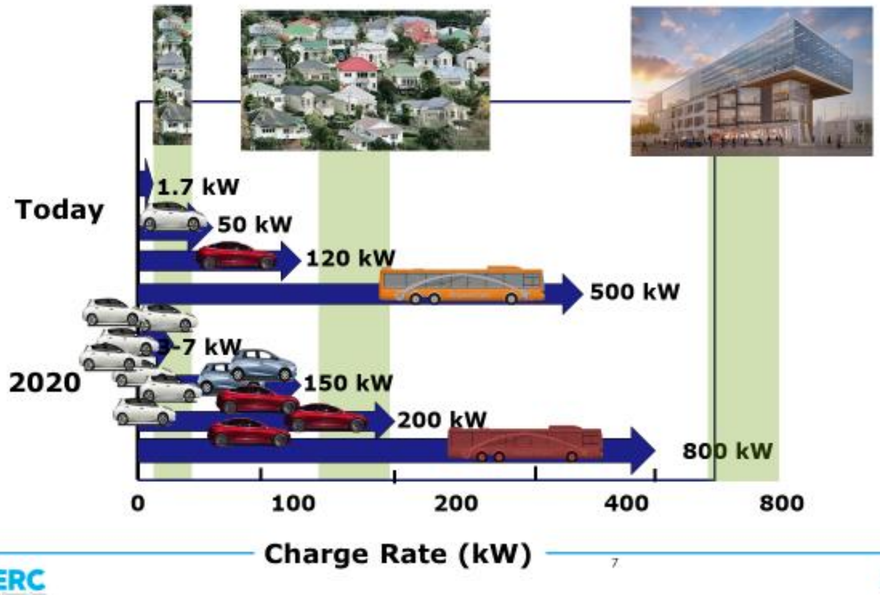
Also changing in the electricity supply sector …

- "Important changes underway in the provision of electricity" Utility of the future MIT
- Significant decrease in cost of enabling technology (hardware, data, comms and systems) → available, practical and affordable.
- → enabling management of electricity supply network:
  - Shifting demand to times when network use "free"
  - Opportunity for "Mum and Dad" "aggregators"
  - Response to supply-side: voltage and other management, load shedding …
  - More efficient consumption of electricity (network and local).
  - Greater utilization of lower GHG generation options.

APERC 5

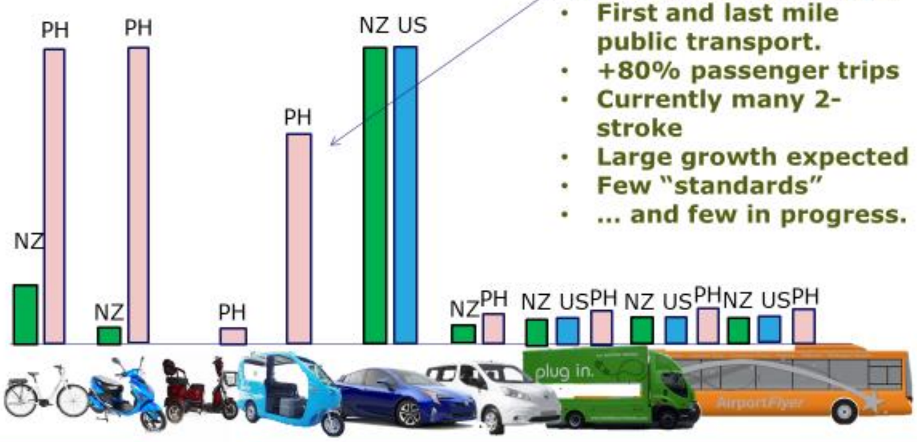


Charging requirements changing …



APERC 7

What Vehicles are Important to Your Economy?



Very important for many Asian countries:

- First and last mile public transport.
- +80% passenger trips
- Currently many 2-stroke
- Large growth expected
- Few "standards"
- … and few in progress.

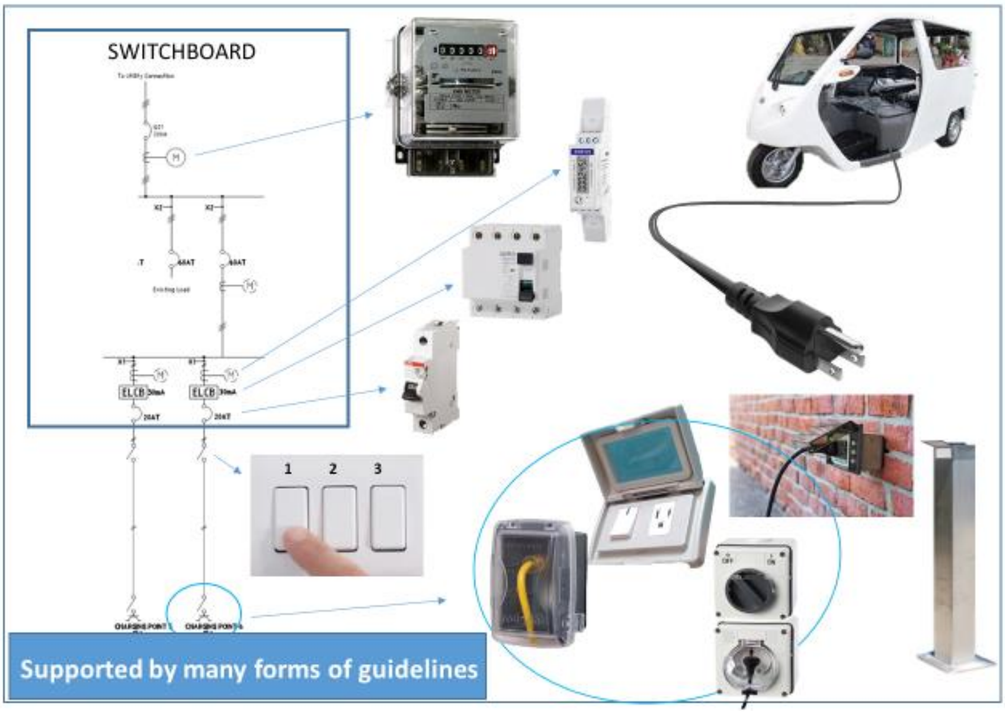
APERC 8

Philippines Department of Energy E-Trike Project

DOE E-trike Project Summary

- 3000 e-trikes to be deployed by May 2019.
- Manufactured in Philippines
- Design applicable to many Asian countries.
- Automotive-grade Li-ion batteries … and supply chain.
- Targeting (first-mile, last-mile) public passenger transport (and removal of two-stroke tricycles).
- Deployed through Local Government Units (who are responsible for setting up charging stations where at-home charging is not sufficient).
- Has stimulated private sector uptake of e-trikes.

APERC 10


SWITCHBOARD
ELCB
ELCB
1
2
3
Supported by many forms of guidelines


Why e-trikes?
APERC
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The New Zealand Herald

BUSINESS

Electric scooter giant Lime recalled scooters amid fears that some could catch on fire

4 minutes to read

31 Oct, 2018 12:45pm

Time in Life Cycle	Electric Vehicles	Charging Infrastructure	Electricity to the Plug/Charger
Design	Standards, tech development, meeting market. Micro, LEVs, HEVs	Charging and related hardware and IT, NZ Inc. plan, compatibility. Connectors: Micro, LEVs, HEVs	NZ Inc. electricity supply system, planning. Looking at hard demand management tools
Build	Capacity, market demand by vehicle class	Capacity, demand by different type	Gen Co.s/Line Co.s
Supply	Availability, meeting demand, shipping, import, certification.	Availability, meeting demand, shipping, import, certification.	Gen Co.s/Lines Co.s, general information on
Purchase (and resell)	Awareness/information, experience, overcoming barriers, EV performance, fit for purpose, decision, available models.	Fit-for-purpose purchase decisions, future-proofing, grid-aligned, compatibility, available models	Gen/network upgrade, generation type switching ... company and NZ Inc. plans
Installation	Insurance, warranty, registration, identification, WoF	Approval, site works, certification, industry training.	Gen Co.s/Lines Co.s
In-service operation	Monitoring	Monitoring	Monitoring
General use	Understanding, best driving practices.	Access/restrictions, signage, availability, NZ Inc map.	Awareness, controls (pricing and other).
Charging	Understanding of, options, costs, best practice	Understanding of, connectivity, time of charge, billing.	Connectivity, management time/rate of charging, billing
Servicing/ maintenance	Understanding of, industry capability and capacity, industry training	WoF, certification, industry training.	Gen Co.s/Lines Co.s
Breakdown	Guidelines/best practice	Response, industry training, map.	Gen Co.s/Lines Co.s
Accident	1st response, repair, fleet re-entry	1st response, repair, re-cert.	Gen Co.s/Lines Co.s
Retirement	Decision to, reuse of battery/electrics through scrap/recycle.	Decision to, re-use/upgrade through scrap	Gen Co.s/Lines Co.s

Background: APEC Electric Vehicle RoadMap History

- **2014:** APEC Trade and Foreign Ministers endorsed APEC Actions for promotion of EVs.
- **2015:** APEC EV Roadmap developed by Automotive Dialogue, Energy Working Group and Transportation Working Groups.
- **2016-2018** delivery of Roadmap Workshops
- **Identified areas for further work:**
  - Recycling (including protocols for re-use and re-manufacture of batteries)
  - Cybersecurity (hacking prevention)
  - Personal data (including autonomous vehicle routing info, driver info)
  - Emergency response (protocols/manuals, ability to convey help required)
  - Interoperability and related standards (high power, wireless, building/grid integration)
  - Standards for other EV types (2- and 3-wheel, emerging user models)
  - … and harmonisation of these standards ….

APERC 15

Example: First Response

APERC 16

Summary Position of First Response

- **Two-step approach to managing risks:**
  - **Identify the risk**
  - **Manage the risk**
- **EVs introduces new battery types (and makeup is changing).**
  - **→ different response required, for fire and (water) emersion.**
- **Introduces high voltages:**
  - **→ Need to carefully identify cables if cutting (LV) to isolate.**
  - **→ Poor/no use of high voltage colour coding in 2- and 3-wheelers!**
  - **→ A minimum requirement?**
- **Several guidelines available (e.g., US: National Fire Protection Association (NFPA), but poor dissemination.**

APERC 17

Battery Fire Quiz

Q. What method is recommended to respond to a fire of an electric vehicle?

a) **Dry powder or CO_2 (i.e., electrical fire extinguishers).**
b) **Water.**
c) **Get out the marshmallows and watch.**

APERC 18

Battery Fire Quiz

Answer:

b) Water based fire extinguishing agents best.

- Suppress and cool.
- Chance of re-ignition ……… days later
- Remove vehicle to safe location.

- Gas extinguishing agents and dry powder extinguishing agents are ineffective

APERC 19

Why do we have standards?

Safety

- Minimum performance
- Compatibility
- Security
- …

APERC 20

Challenges to EV Commercialization

- Cost of developing technologies
  - Low return on investment
  - Limited R&D $$$ for multiple technology trajectories
  - Batteries about half cost of EV and development critical
  - Govt support in latter has been critical.
- Adequacy of infrastructure
  - Must have interoperable network
  - The grid will be affected at all levels (generation, transmission and distribution) → critical for industries to collaborate.
- Regulatory environment
  - Still significant cost difference between EV and ICE
  - Constant updating making standardisation difficult
  - Support from government, universities and industry partnerships critical to make most of $$$ available
  - Regulatory predictability and transparency are key.

APERC

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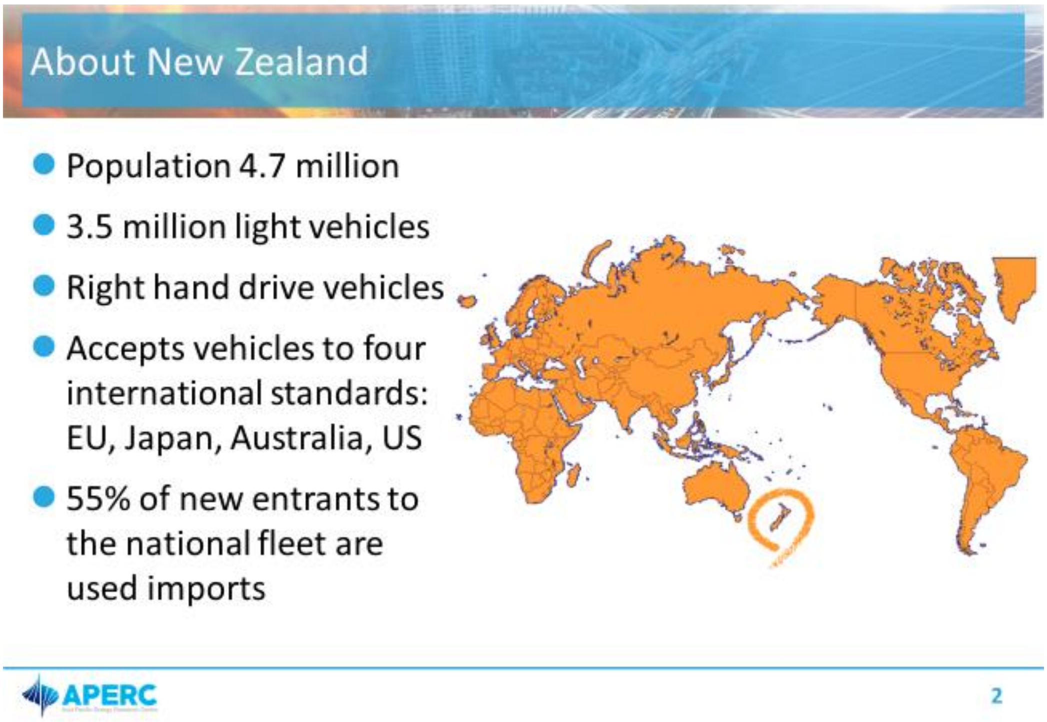
Thank You

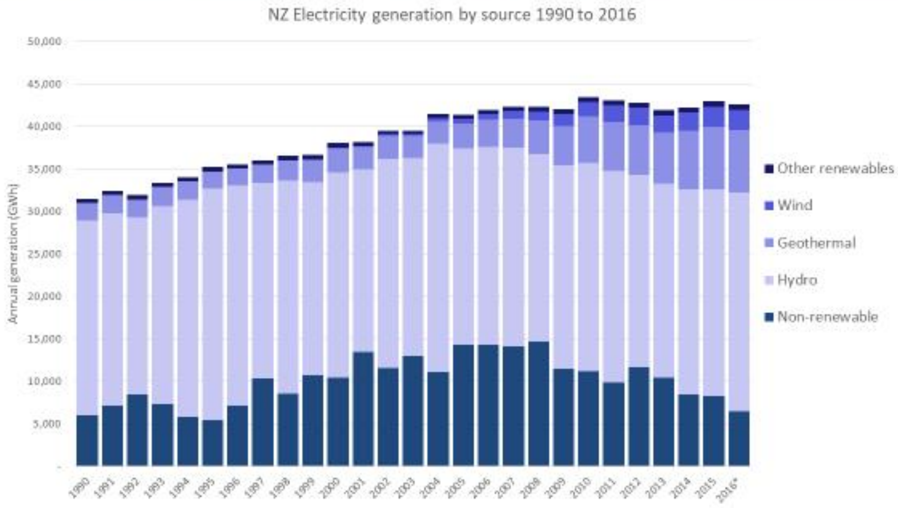
http://aperc.ieej.or.jp/

APERC
Asia Pacific Energy Research Centre

APPENDIX 9: Growth of electric vehicles in New Zealand



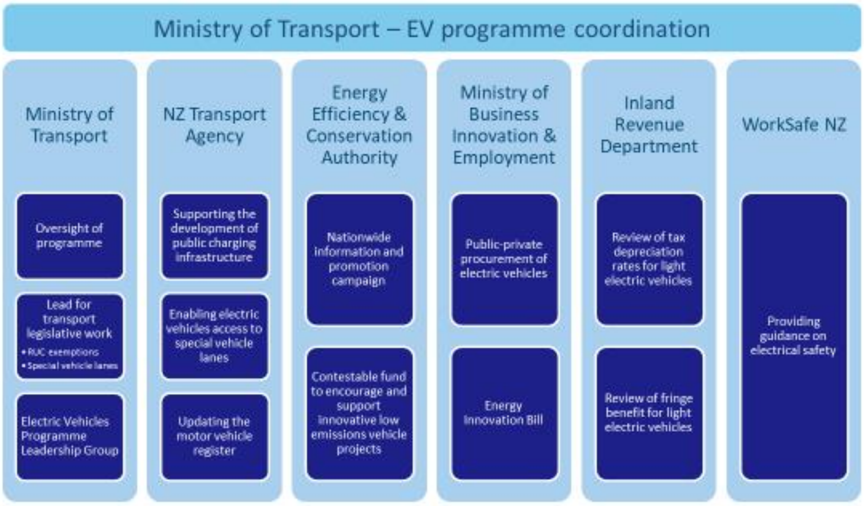
85% of electricity generation in NZ is renewable



Advantages of EVs in New Zealand

- 80% reduction in CO_2 emissions compared with petrol vehicles
- Electricity for EV driving ≡ NZ$0.30 per litre (USD0.20/L) compared with NZ$1.80-$2.20 per litre for petrol
- Driving range of entry level EVs meets majority of driving tasks
- 85% of NZ residences have off-street parking

EV policy in New Zealand



APERC 5

Some fiscal support for EVs

- Petrol vehicles pay fuel excise at the pump, all other vehicles including EVs and diesel vehicles pay Road User Charges (RUC) for each km driven
- **Light vehicles:** Light EVs (eg cars and vans) exempt from RUC until 2021
- **Heavy vehicles:** Heavy EVs are exempt from RUC until they make up 2% of the heavy vehicle fleet

NZD1.00≈USD0.67

Vehicle type	Definition	RUC rate	Example annual distance	Example RUC exemption saving
Light vehicle	Under 3.5 tonnes	NZ$62 / 1,000 km	15,000 km	NZ$ 930 / year
Small delivery truck	Under 6 tonnes, dual rear wheels	NZ$66 / 1,000 km	30,000 km	NZ$1,980 / year
Medium freight truck	12 – 18 tonnes, 3 axle	NZ$292 / 1,000 km	75,000 km	NZ$21,900 / year

APERC 6

EECA Low Emission Vehicles Contestable Fund

- Funding of $7 million/year to co-fund innovative projects
- Industry are the innovators and can move quickly. Fund is a clever way to encourage this private-sector growth and help overcome first mover risk.
- Foreign companies can be partners in a project in NZ, but the funding application must be led by NZ organisation
- www.eeca.govt.nz/funding-and-support/low-emission-vehicles-contestable-fund/

APERC 7

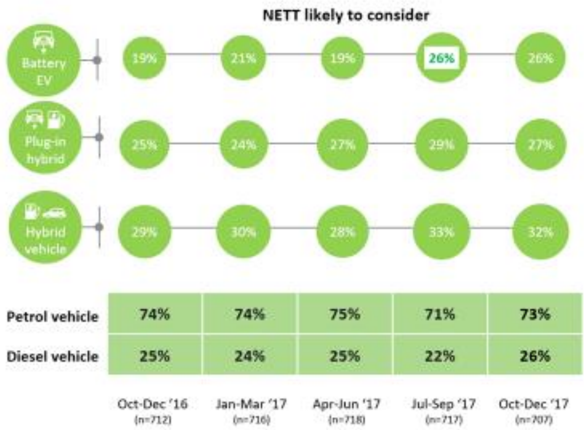
Examples of projects supported by the fund

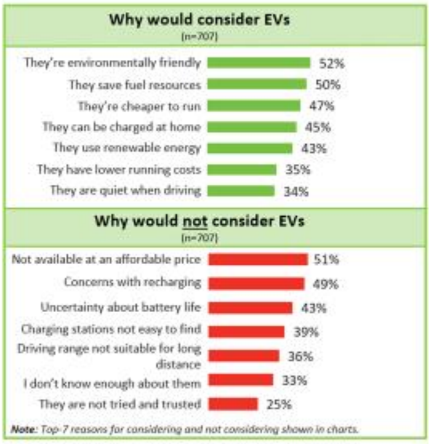
APERC 8

Support for fast charging infrastructure

- Over 90% of charging is at home
- Private investment in public 50 kW DC fast charging with co-funding from the EECA Fund
- Public charging guidelines in place
- Over 150 fast chargers covering 95% of state highway network
- NZTA national pubic EV charging database "EV Roam" provides API for apps and navigations systems

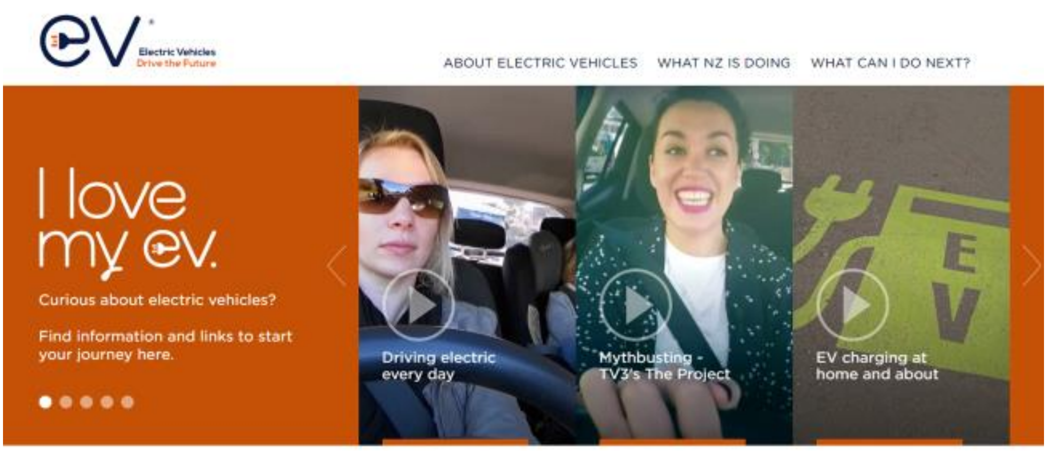
Promotional activities underpinned by market research



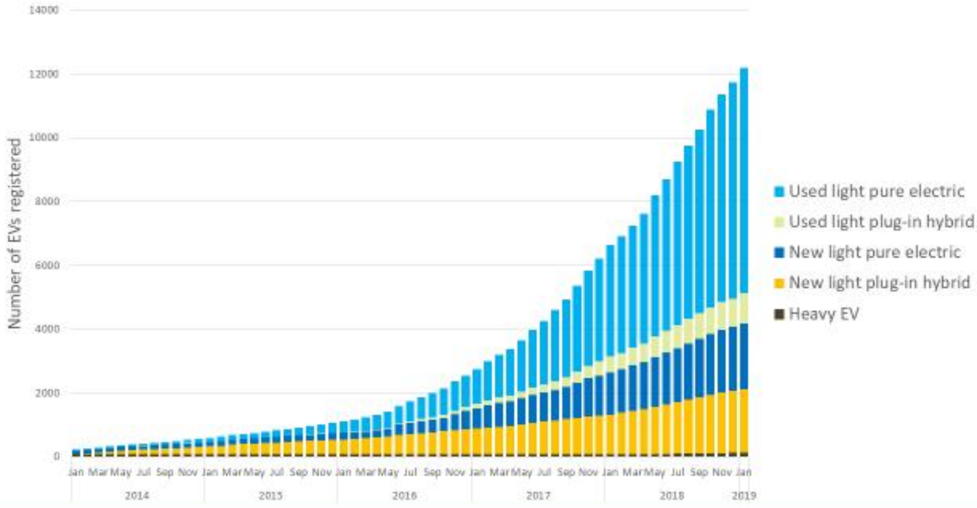


Public outreach important part of government campaign

Information resources: www.electricvehicles.govt.nz



Growth of EV registrations in New Zealand



APERC

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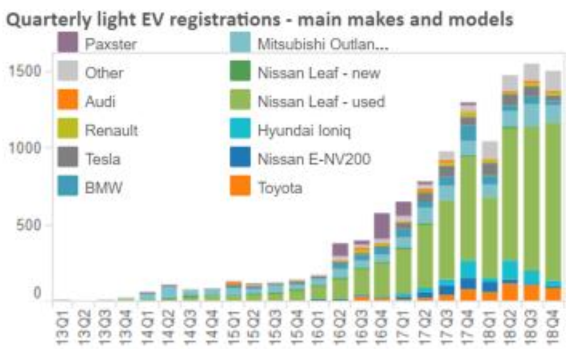
EVs now over 2% of all light vehicle registrations



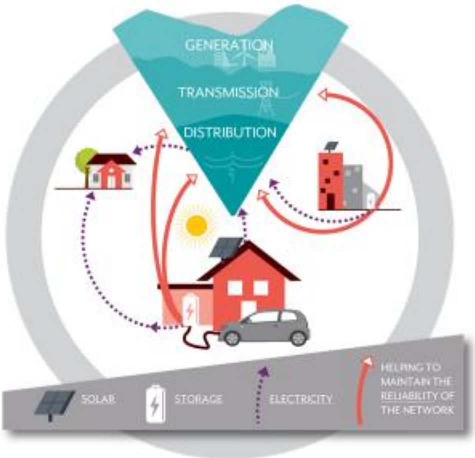
https://www.transport.govt.nz/mot-resources/vehicle-fleet-statistics/monthly-electric-and-hybrid-light-vehicle-registrations/

APERC

14

NZ's open and competitive electricity system

- Open, competitive, permissive electricity market
- Half-hourly spot market with wide diurnal and seasonal variations
- Markets for frequency keeping, voltage support, black start and demand response; hedge market
- 80%+ voluntary smart meter uptake
- 37 electricity retailers compete, setting their own pricing; annual switching rate over 20%
- 8 major generators, 650 small generators + PV



APERC 15

Some retailers offer special EV tariffs for EV owners

APERC 16

Innovation in retailing electricity

- Some retailers offer half-hourly spot market pricing to residential customers, plus fixed margin
- Customers set phones to receive an alert when prices or CO_2 emissions are low or high
- EV owners can use alerts to know when to start or stop charging

APERC 17

Most New Zealanders willing to charge off-peak

http://flipthefleet.org/2017/media-release-ev-owners-targeting-night-time-charging-deals/

APERC 18

What’s coming next in NZ: 100% electric 130 pax ferry

APERC 19

Summary

- 85% renewable electricity generation
- Fiscal support: NZ$7 million/year fund for innovative EV projects and RUC exemption but no purchase price subsidies (previous failures with CNG and LPG vehicle subsidies)
- 95% state highway coverage with 50 kW DC fast chargers
- EVs now over 2% market share with no purchase price subsidies but with used-EV imports at close to price parity
- Electricity retail pricing innovation enabling platform for next generation of charging ... aggregated/managed charging

APERC 20


Kia ora
APERC