Energy Efficiency Policy Workshop 2019

Test protocols underpinning fuel economy regulations: the transition to Worldwide Harmonised Light Vehicle Test Procedure (WLTP) and its inclusion in CO_2 policies

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APERC
Asia Pacific Energy Research Centre

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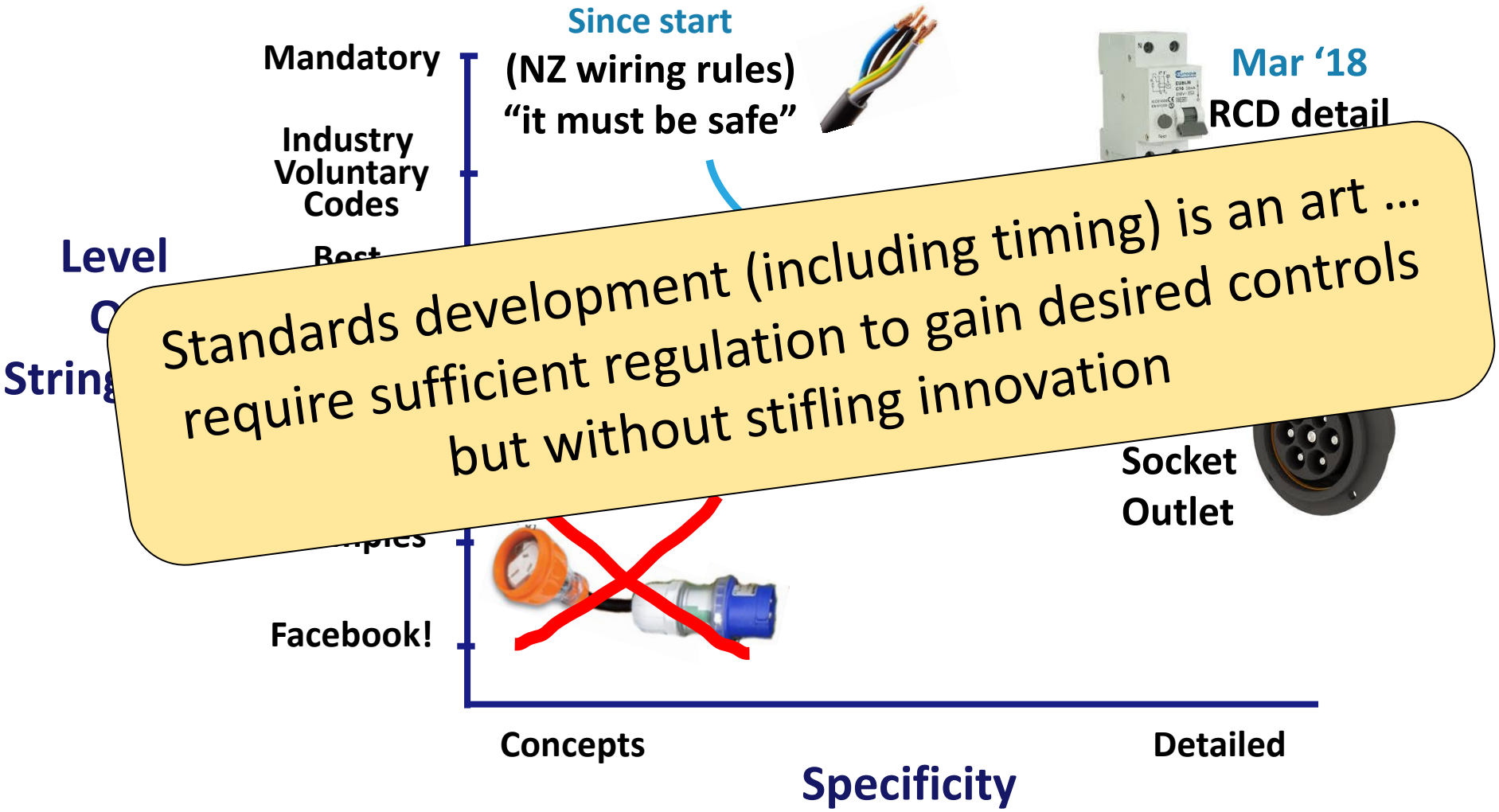
Asia-Pacific Economic Cooperation

Why do we have standards?

Different forms of standards:

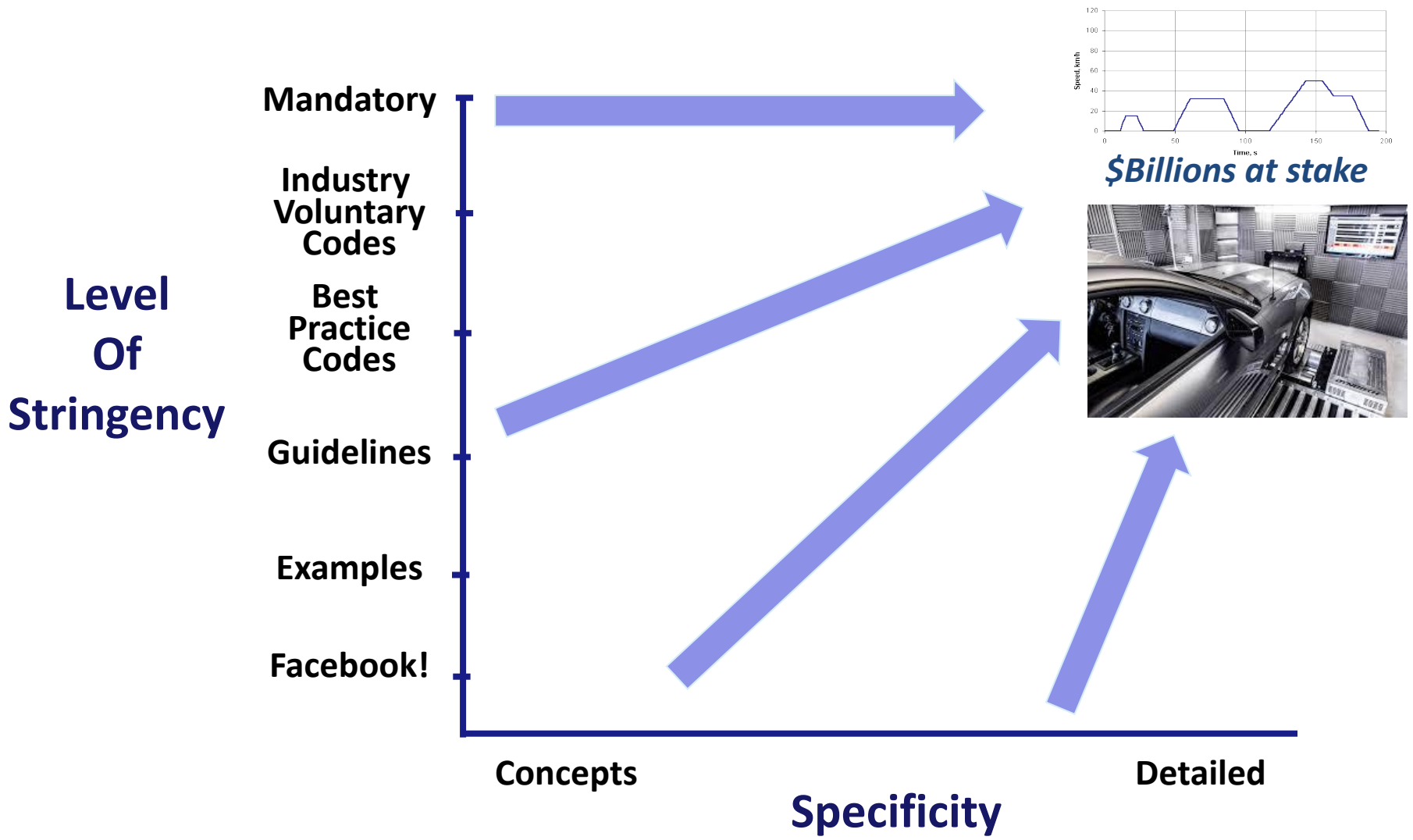


Standards development (including timing) is an art …
require sufficient regulation to gain desired controls
but without stifling innovation

Vehicle Testing History

- 1950-60s: US studies identified vehicles as significant source of air pollution.
- 1960-70s: establishment of environmental agencies in California, then across US, later across Western Europe, Canada, Australia and Japan.
- Required ability to refer to results from a repeatable test that aimed to simulate typical vehicle use.
- Mid 1970s: tightening emission standards required de-tuning of engine resulting in 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.

Vehicle Emissions (and Fuel Consumption) Testing:



Vehicle Emissions (and Fuel Consumption) Testing:

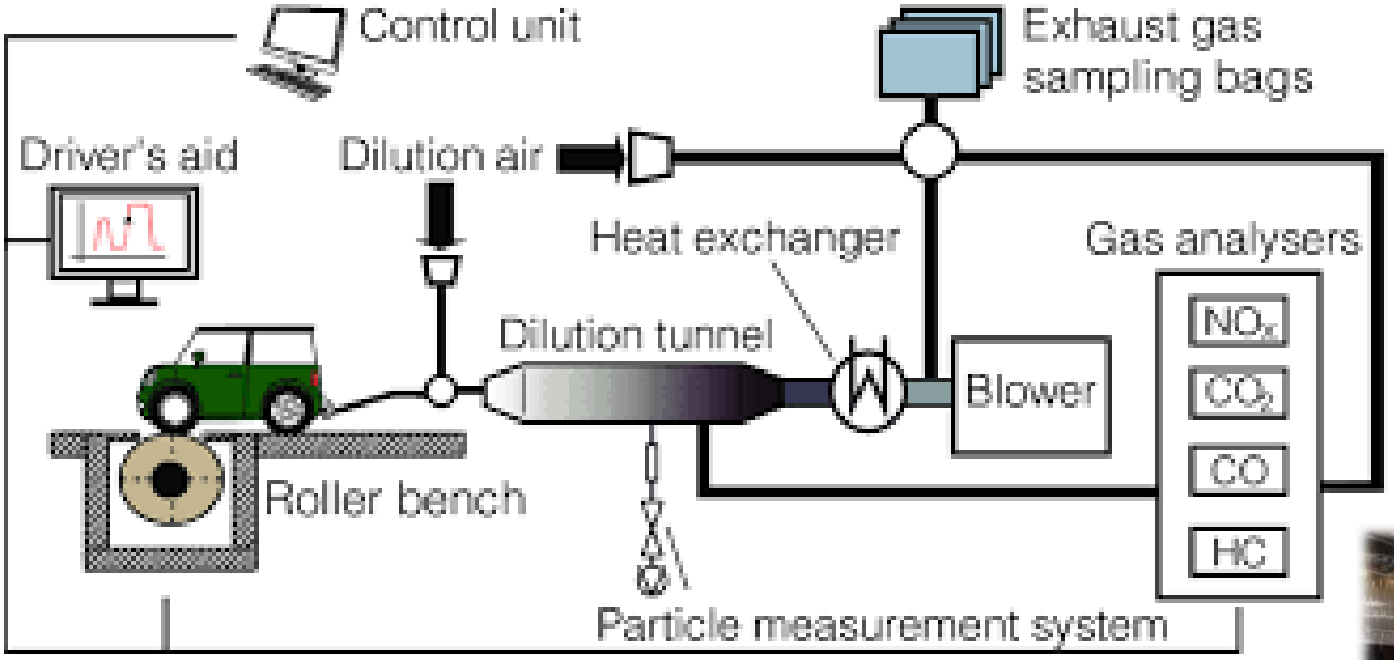
- $Billions at stake – test must be acceptable industry wide, repeatable and robust.
- Ideally providing a range of speeds and loads (and operating temperatures) representing typical vehicle use.
- Standardised: accurately specified to provide repeatability.
- Despite tight specification and staged development of previous tests:
  - Experienced testers could "game" and get better results.
  - Vehicles could be calibrated to (recognize and) 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).

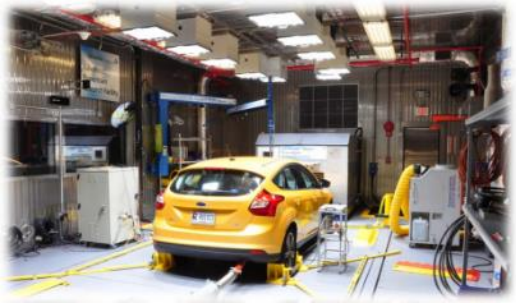
→ undermining policy efforts

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

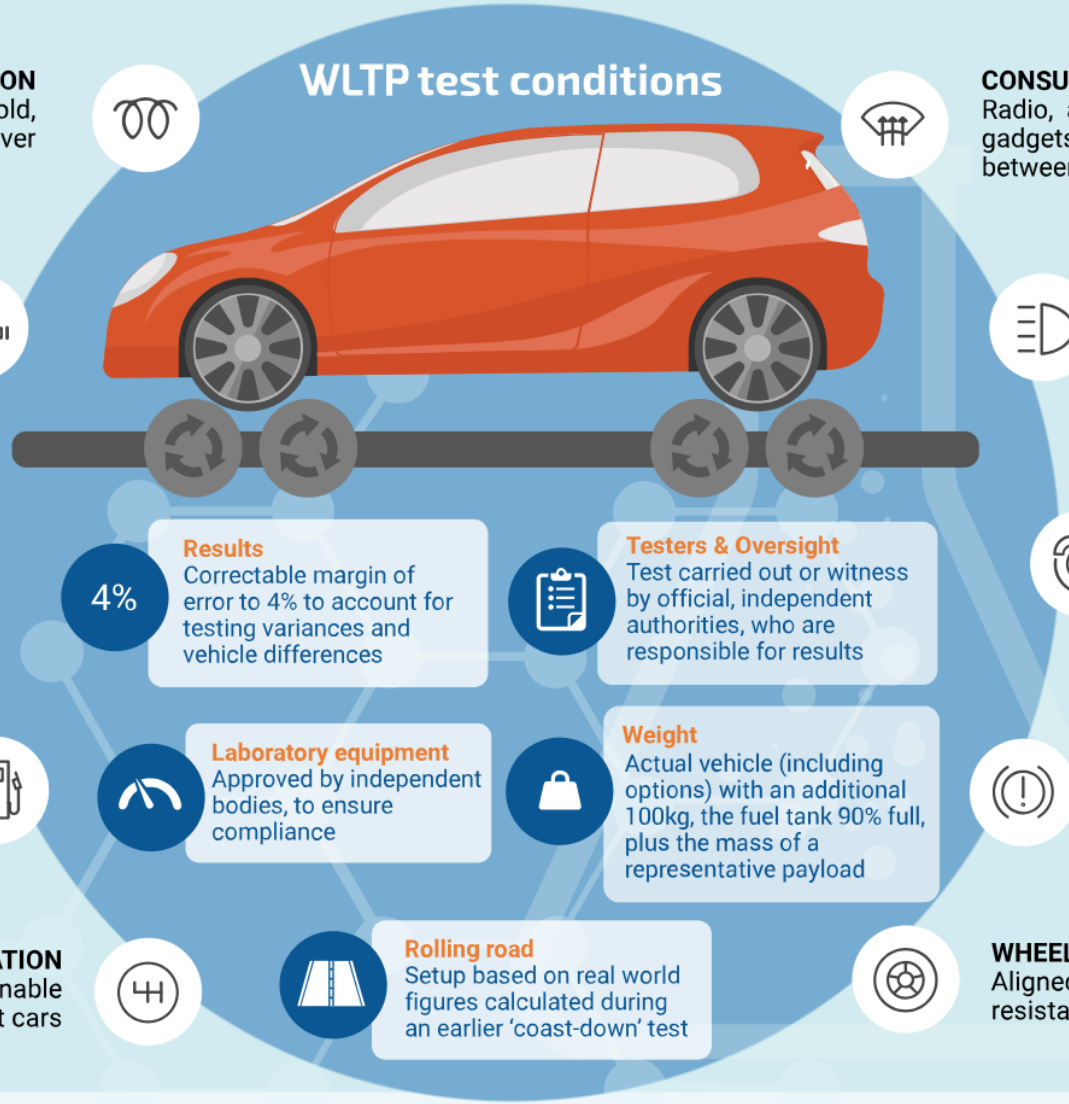
- Development process began in 2007.
- Developed by the UN ECE GRPE (Working Party on Pollution and Energy) with inputs from wide-ranging economies.
- An approximation of real-world operation.
- Stricter test conditions, higher speeds, longer test duration.
- Consideration of vehicle's "special equipment",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

The Test Arrangement





HOW DOES THE CAR LAB TEST WORK?



IGNITION
The car is started cold, as it might be by a normal driver

ENGINE
Must have been run in at least 3000km, to ensure real-world vehicle performance

OILS
Standard specification oil for the conditions is used

FUELS
A standard reference fuel (petrol or diesel) is specified for the test

GEAR SHIFTS & ACCELERATION
Defined by regulation to enable comparability between different cars

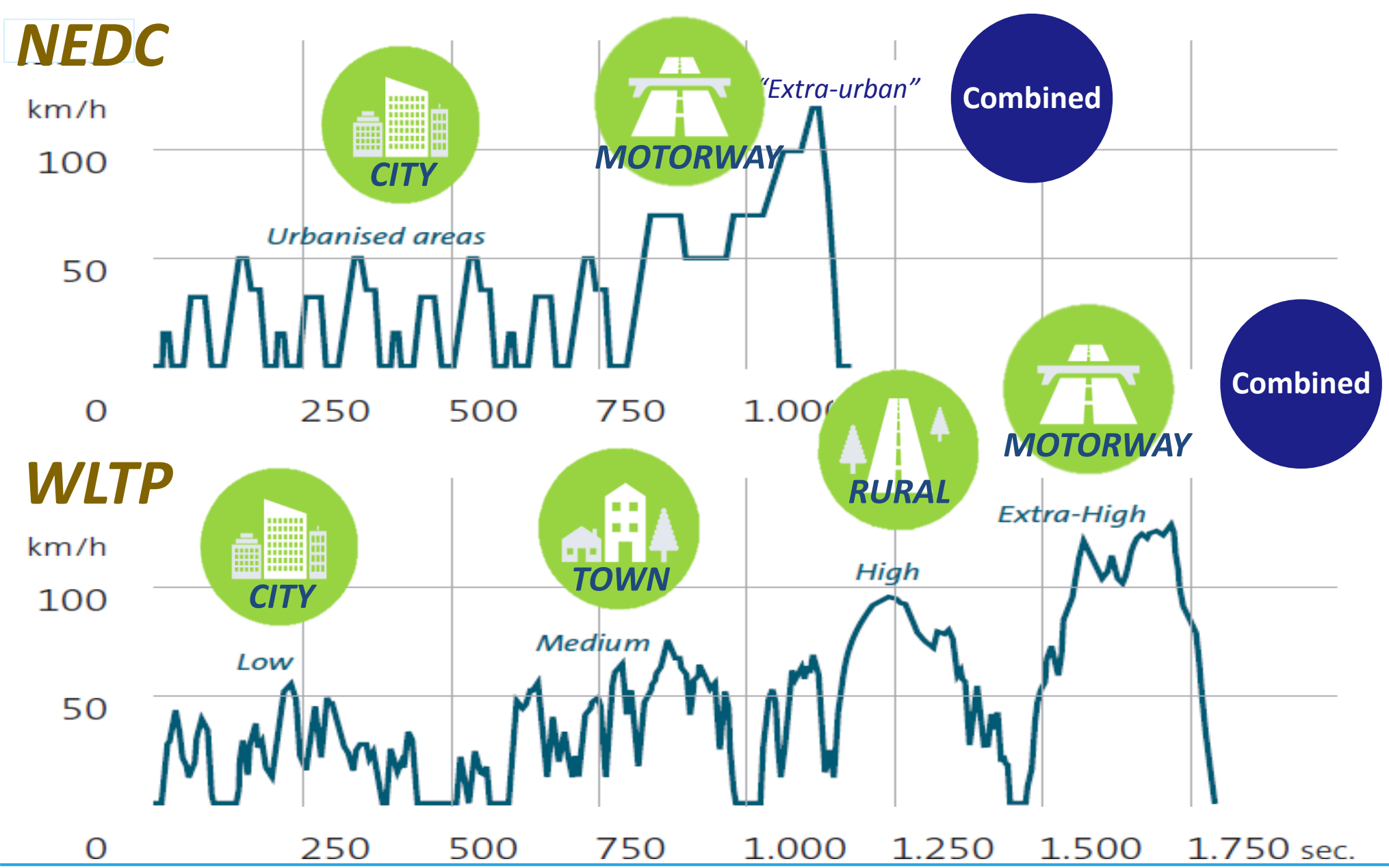
CONSUMER ELECTRONICS
Radio, air conditioning, electronic gadgets are turned off; test is fair between differently equipped cars

DAY LIGHTS
Must be activated

TYRES
Standard road tyres, at specified pressure

BRAKES
Must be in normal working order; test includes braking phases

WHEELS
Aligned during setup to ensure that resistance of rolling road is realistic

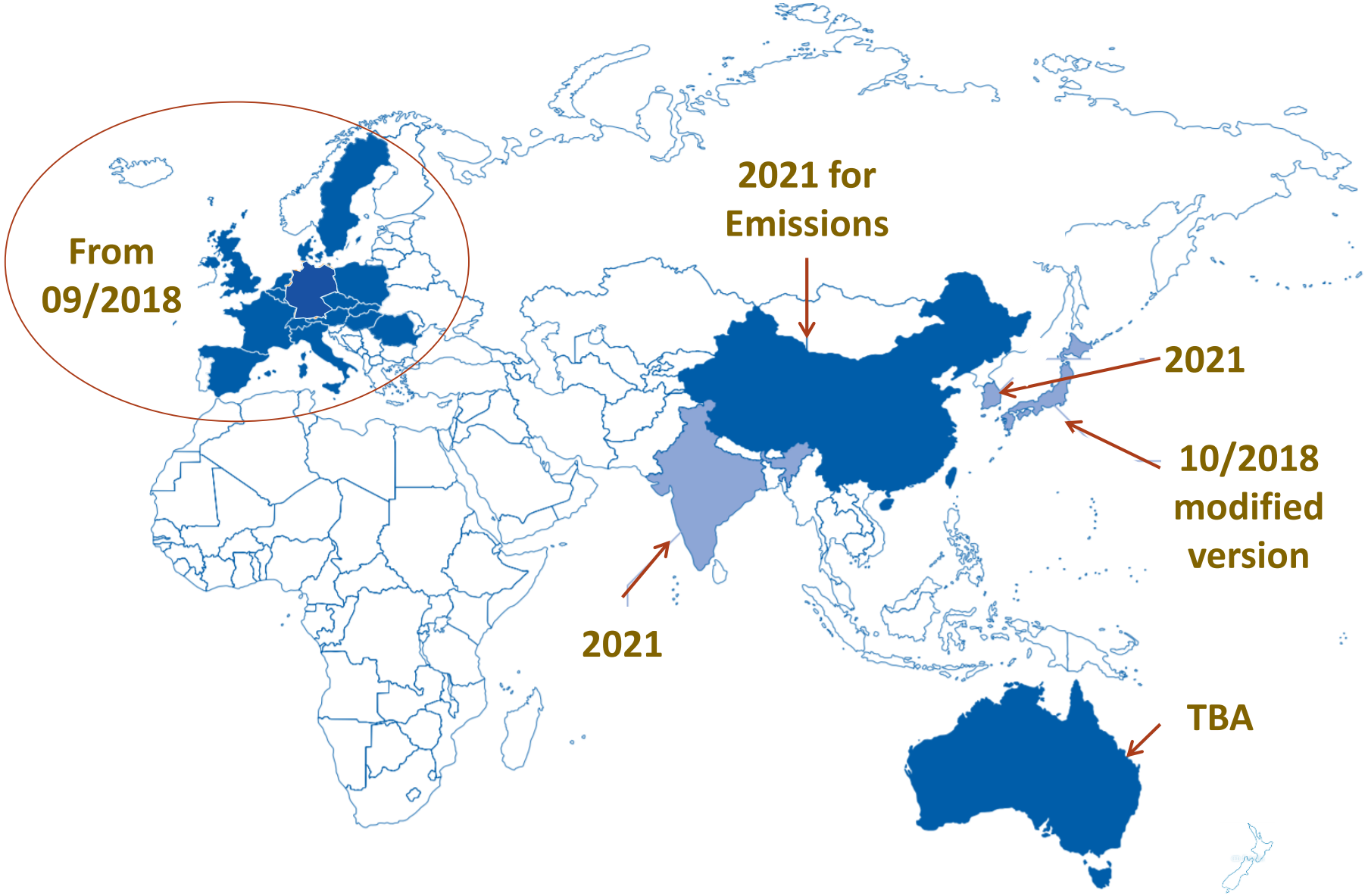

NEDC
km/h
100
50
0
250
500
750
1.000
CITY
Urbanised areas
MOTORWAY
"Extra-urban"
Combined
WLTP
km/h
100
50
0
250
500
750
1.000
1.250
1.500
1.750 sec.
CITY
Low
TOWN
Medium
RURAL
High
MOTORWAY
Extra-High
Combined

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

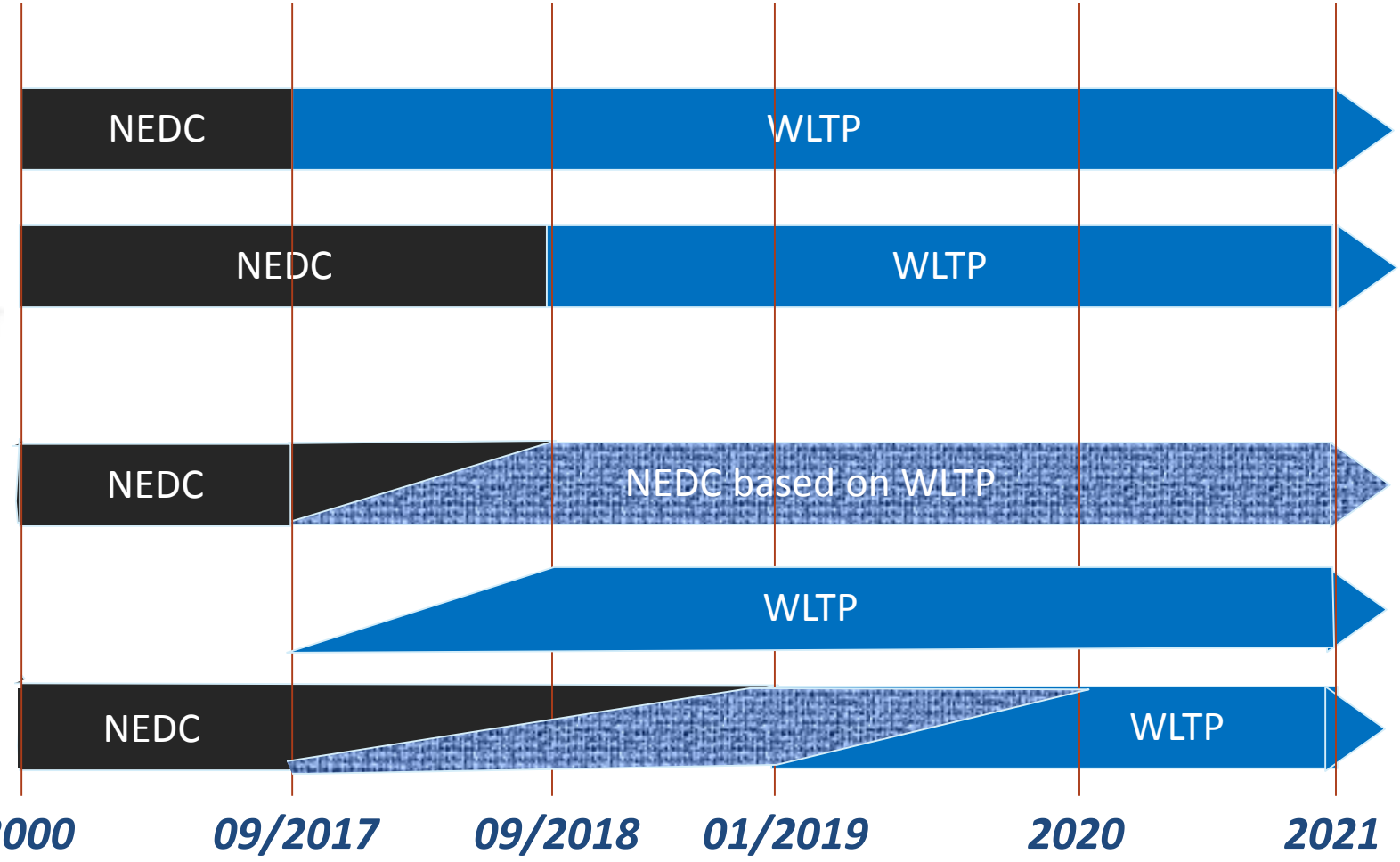
	NEDC	WLTP
Starting temp.	cold	cold
Duration	1.180 sec.	1.800 sec.
Idle time	25 %	13 %
Distance	10.966 m	23.274 m
Phases	2 phases: Urban and long-distance trip	Up to 4 phases: “Low”, “Medium”, “High” and “Extra-High”
Speed	mean: 34 km/h – maximum: 120 km/h	mean: 47 km/h – maximum: 131 km/h
Acceleration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

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

Introduction of World Harmonized Light Vehicle Test Procedure (WLTP)

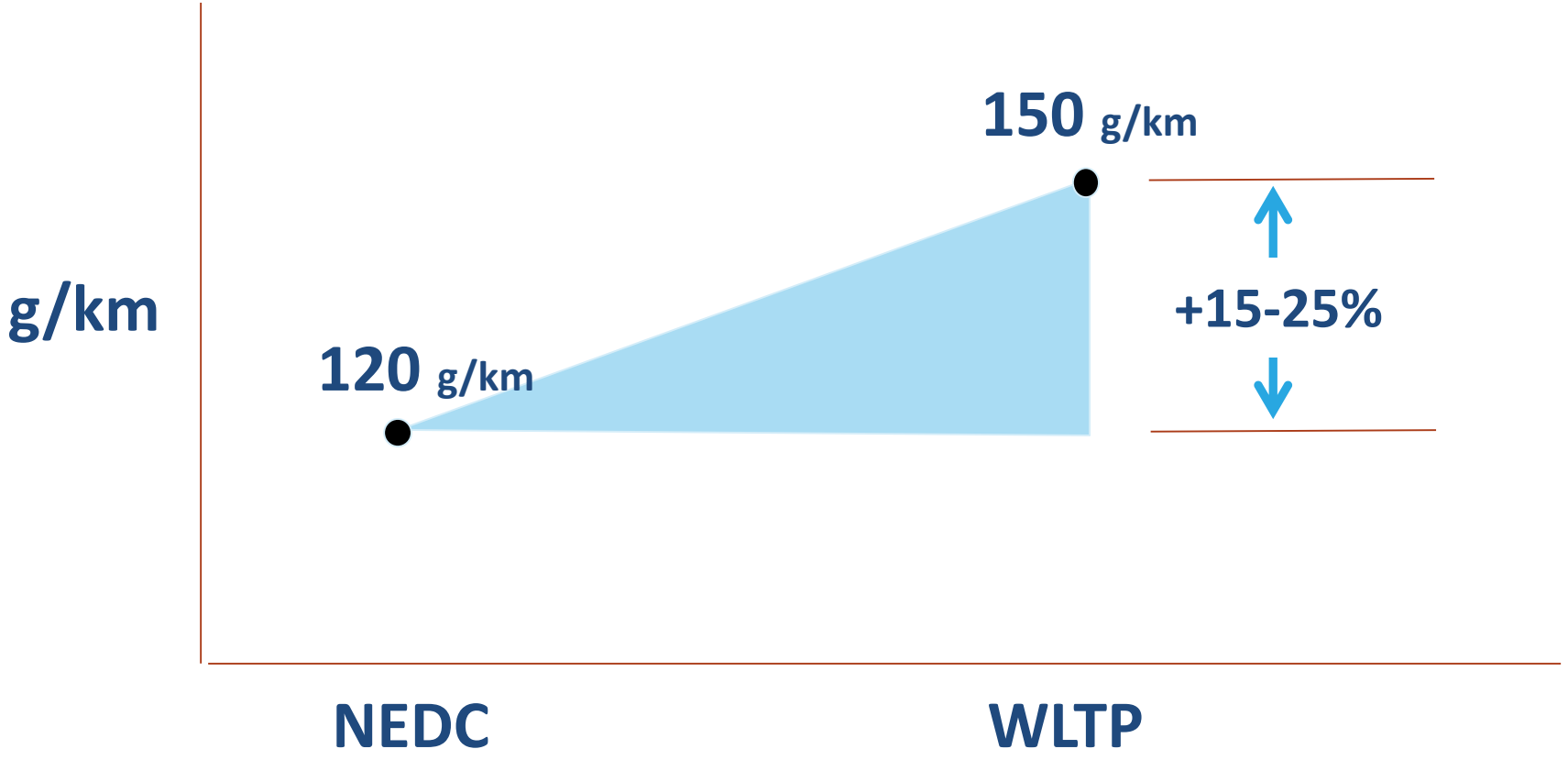


EU target WLTP timeframes



Implications of Higher WLTP Value:

Tax implications with g/km increase???
OEM obligations with g/km increase???



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 example: 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.

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.

Thank You

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

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LowCVP
Low Carbon Vehicle Partnership

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