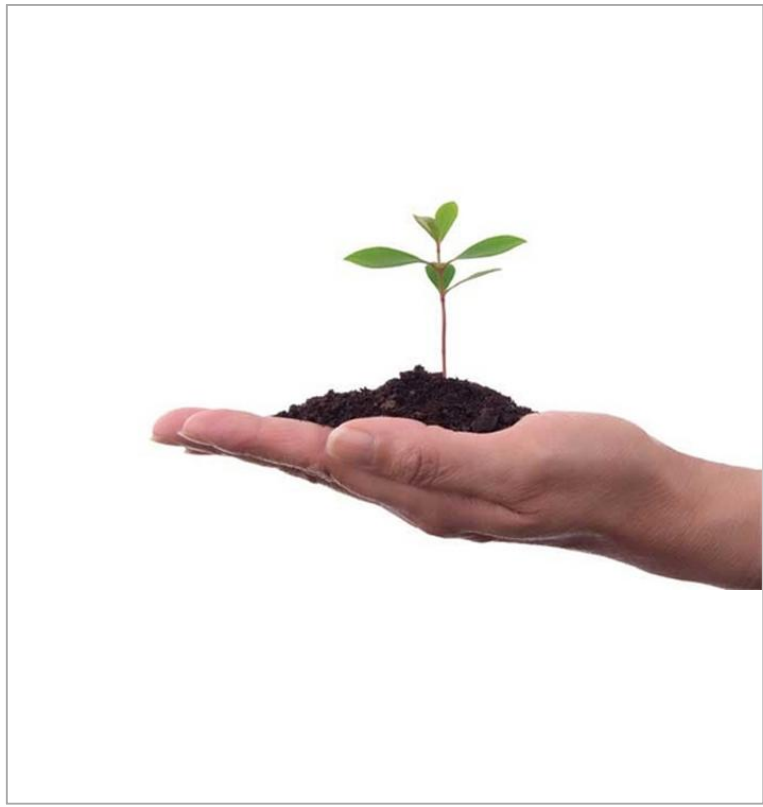
EV Reference Guide

Discussion of Draft #3

prepared for:

EVE IWG



Geneva, January 7, 2014

Content

- **Summary of changes**
- **Current guide snapshot**
  - Chapter 3 – findings
  - Chapter 4 – activity levels
  - Chapter 5 – recommendations
- **Open discussion items**
  - Cross-reference chart for EV terminology
  - Walk-ins

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Summary of changes

- Added attribute definitions before each section in Chapter 3

> **3.6 Battery Performance**
> **Attribute Definition:** *Methods and conditions for testing and measuring battery power delivery capability, energy storage capacity, battery charge, etc.*
>
> Figure 14 provides a global picture of the responses received concerning battery performance requirements. This can also be observed from the first column in Figure 13.

- Consistent use of term electrified vehicle throughout guide
  - Term encompasses HEV, PHEV, BEV (NOVC-HEV, OVC-HEV, PEV)
  - FCV/FCEV excluded
  - Abbreviation EV used throughout guide, explained at beginning

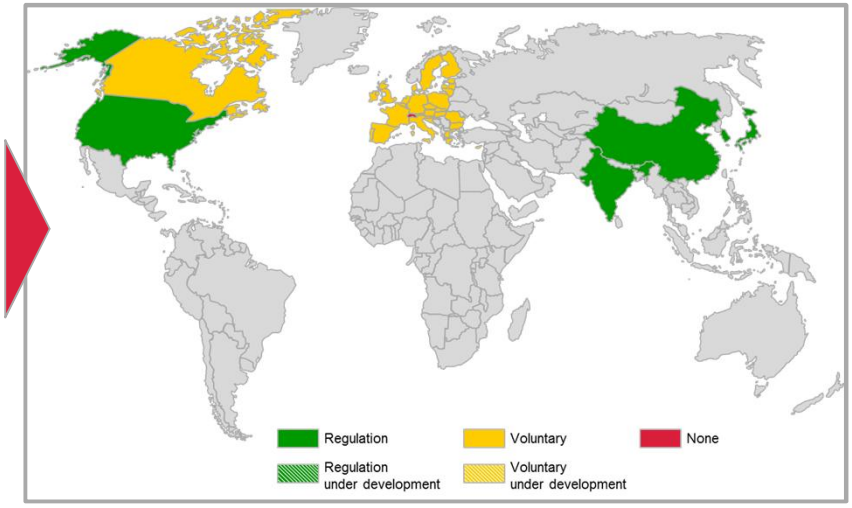
> **1.1 Overview of EVE IWG**
> Note: The abbreviation EV as used in this text stands for 'electrified vehicles' and therefore includes all-configurations of hybrid electric vehicles, in addition to pure electric vehicles. Fuel cell vehicles (FCV/FCEV) are excluded.

Summary of changes

- Added disclaimer concerning time of writing and source of information

> **1.2.1 Document aim, intended audience**
> The EV Reference Guide is intended to serve as a single point of reference relative to the worldwide, environmentally-related EV requirements landscape as it is at the time of this writing (September 2013). The document captures, based on the information provided by Contracting Parties and other WP.29 members, the existence and extent of regulations

- Maps updated to include remainder of world geography



Summary of changes

- Added WLTP line item to traffic light charts for vehicle and battery attributes
- Adopted alphabetical format for country/region listing

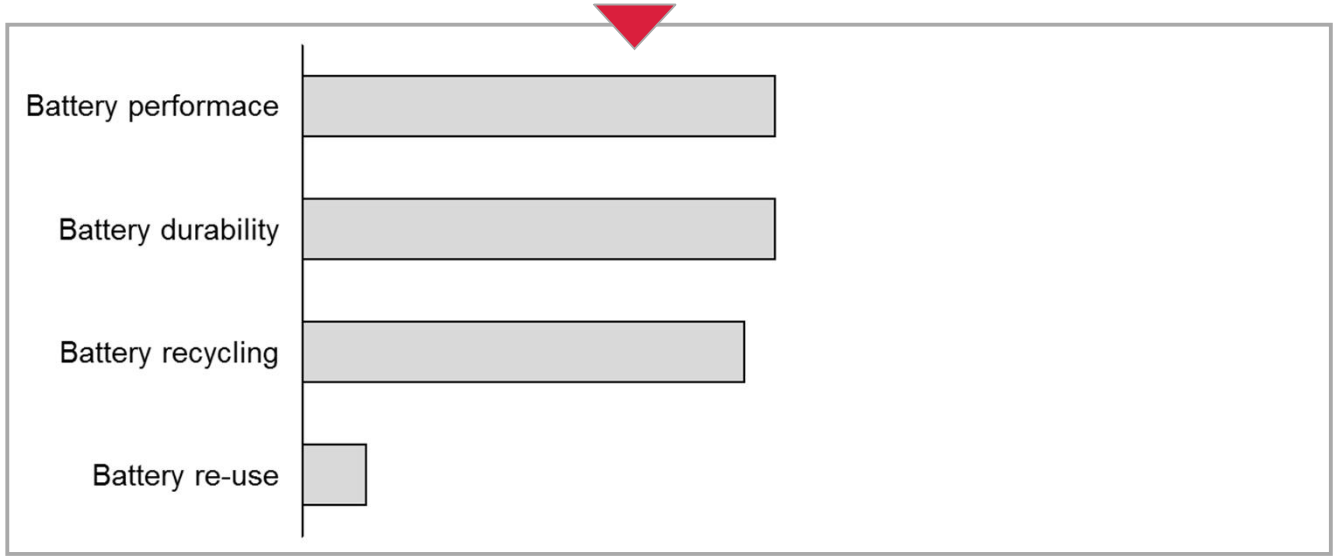
	Battery Performance	Battery Durability	Battery Recycling	Battery Re-use (2nd use)
Canada	none	partial	regulation	none
China	regulation	regulation	under development	under development
EU	voluntary	under development	regulation	none
India	voluntary	none	none	none
Japan	partial	none	regulation	none
Korea	voluntary	voluntary	none	none
Switzerland	none	none	regulation	none
USA	voluntary	partial	none	none
WLTP		WLTP activity ongoing		

- Included exclusion of noise-related attributes from guide

Note: Noise-related attributes are not addressed as part of this reference guide.

Summary of changes

- Simplified activity charts



- Numerous clarifications, corrections, omissions and enhancements from EVE IWG leadership team, contracting parties and industry stakeholders
  - Canada, China, EU, Japan, South Korea, Switzerland, USA
  - Recharge batteries, Toyota, OICA, Glass for Europe

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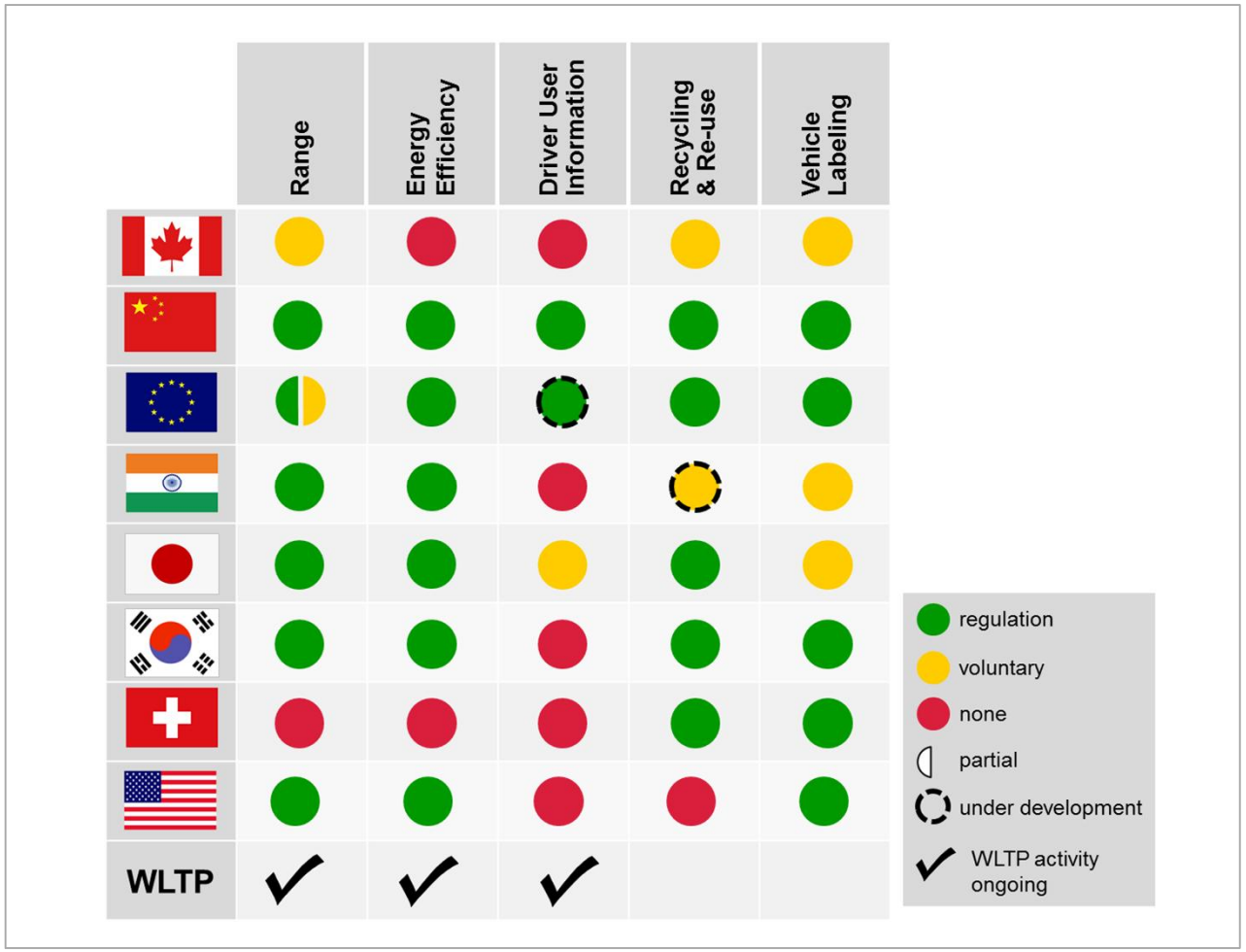
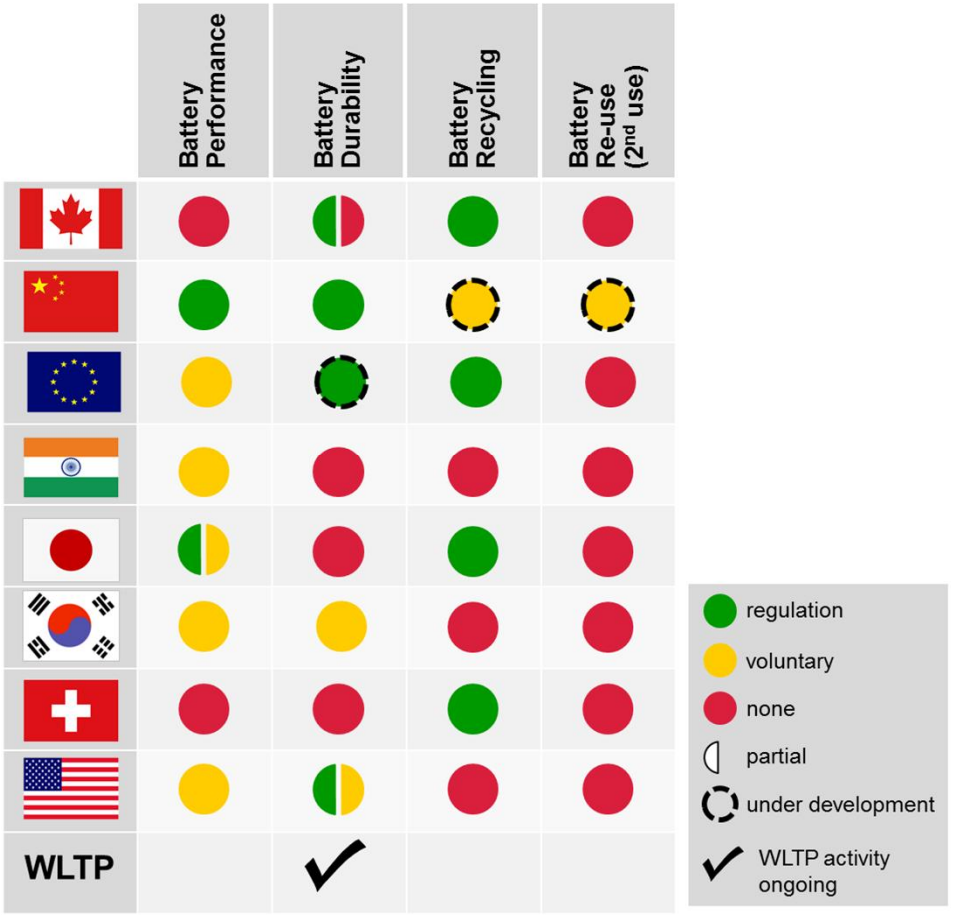
Chapter 3 – Vehicle Attributes



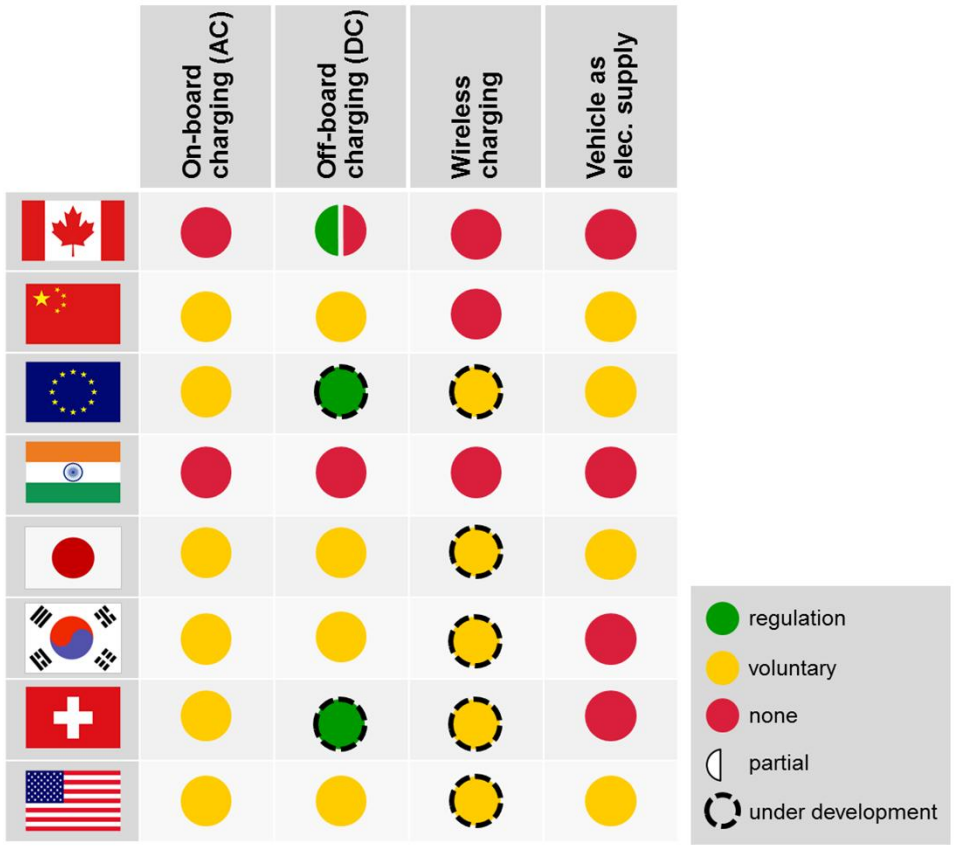
- Updates made to Canada, China, EU, and Japan based on reviewer feedback
- Captured on-going WLTP activities in the areas of range, energy efficiency and driver user information

Chapter 3 – Battery Attributes



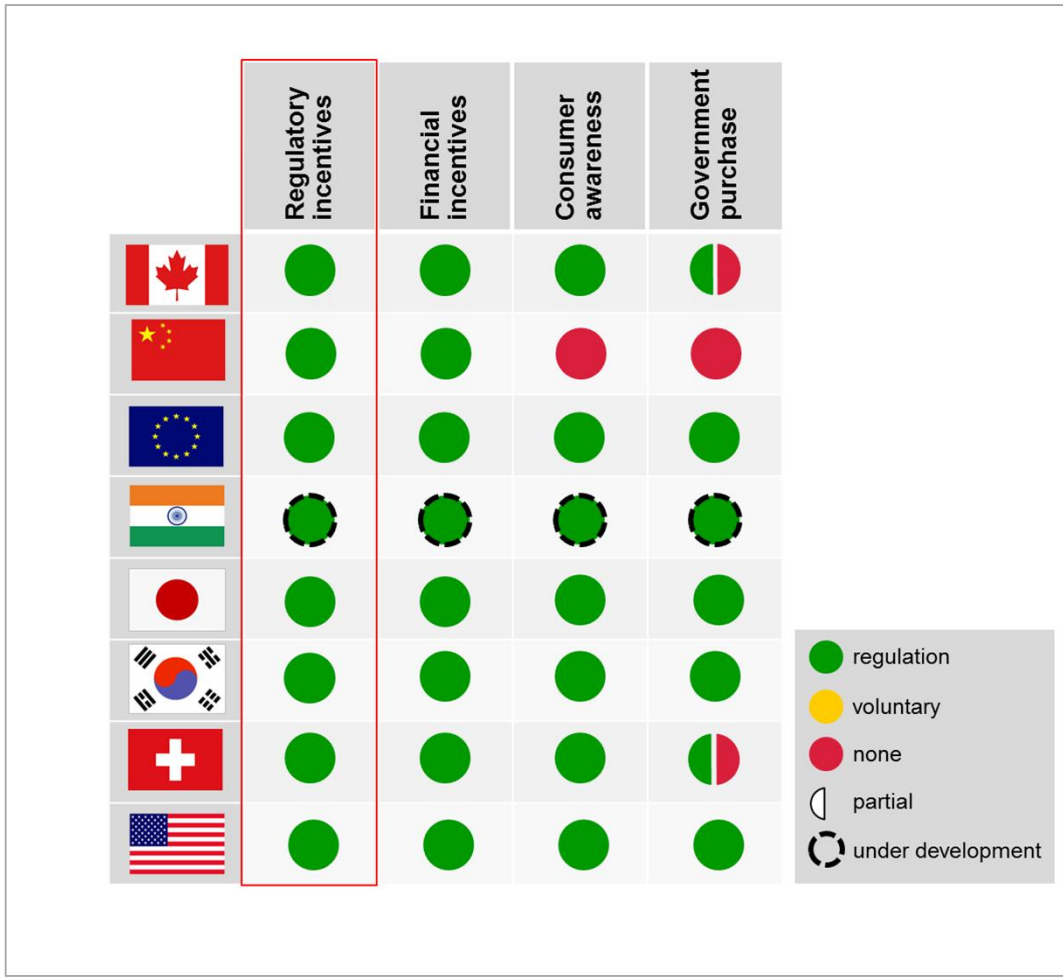
- Updates made to China, Japan, South Korea, and Switzerland, based on reviewer feedback
- Captured on-going WLTP activities in the area of battery durability

Chapter 3 – Infrastructure Attributes



- Updates made to Canada, Japan, South Korea, and Switzerland based on reviewer feedback

Chapter 3 – Market Deployment Attributes



- Updates made to Canada, Japan, South Korea, and Switzerland based on reviewer feedback

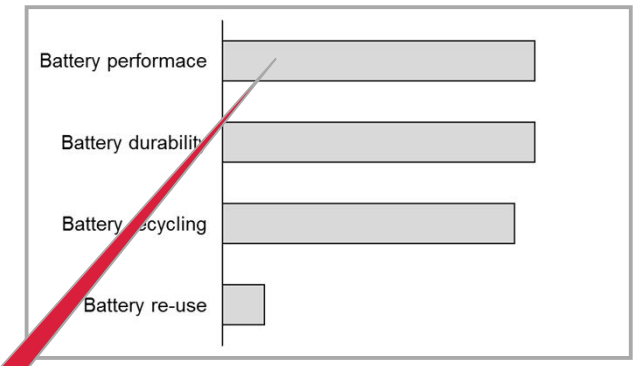
Chapter 4 – Activity Levels

Explanation of scoring system

Symbol							
Score	2	2	1	1	1	½	0	0

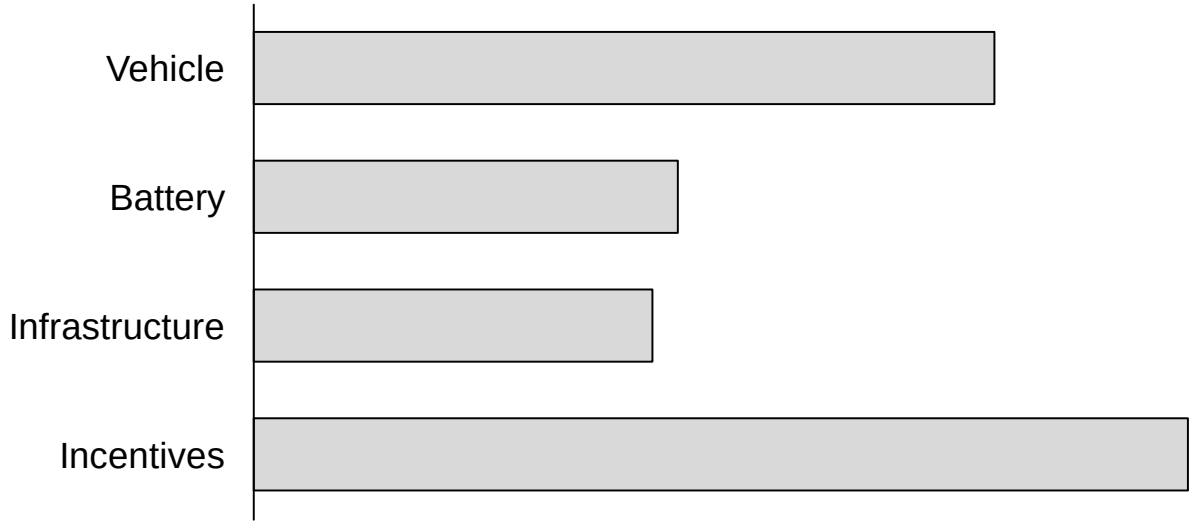
		0
		2
		1
		1
		1½
		1
		0
		1
Total		7½

Example: battery performance



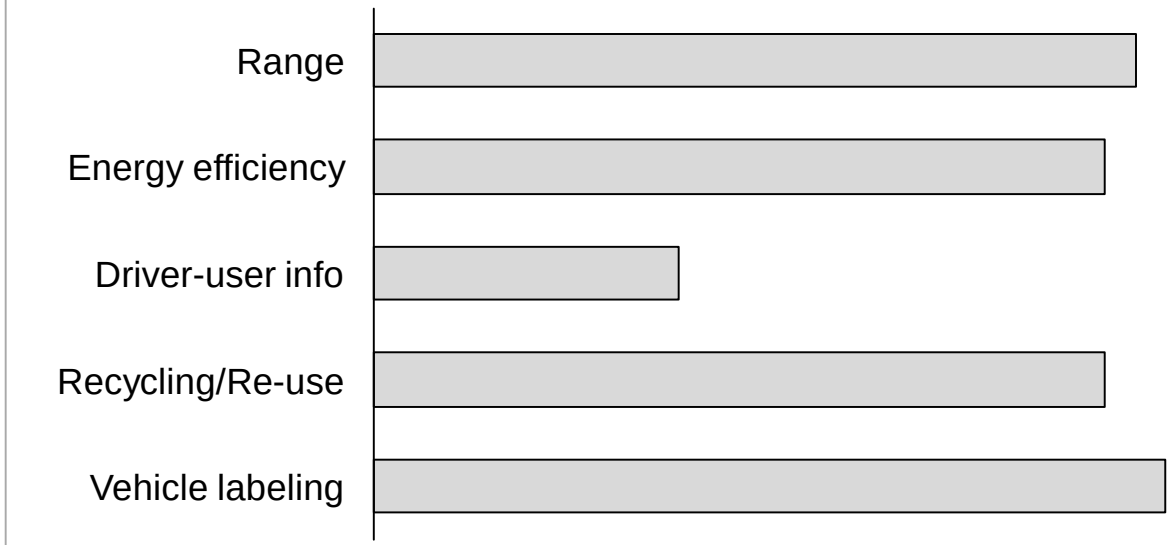
- Simple dimensionless scoring system employed
- Facilitates relative comparison of activity levels pertaining to various EV attributes
- Comparison is by attribute only, no direct comparisons of countries/regions

Chapter 4 – Activity Levels, Attribute Groups



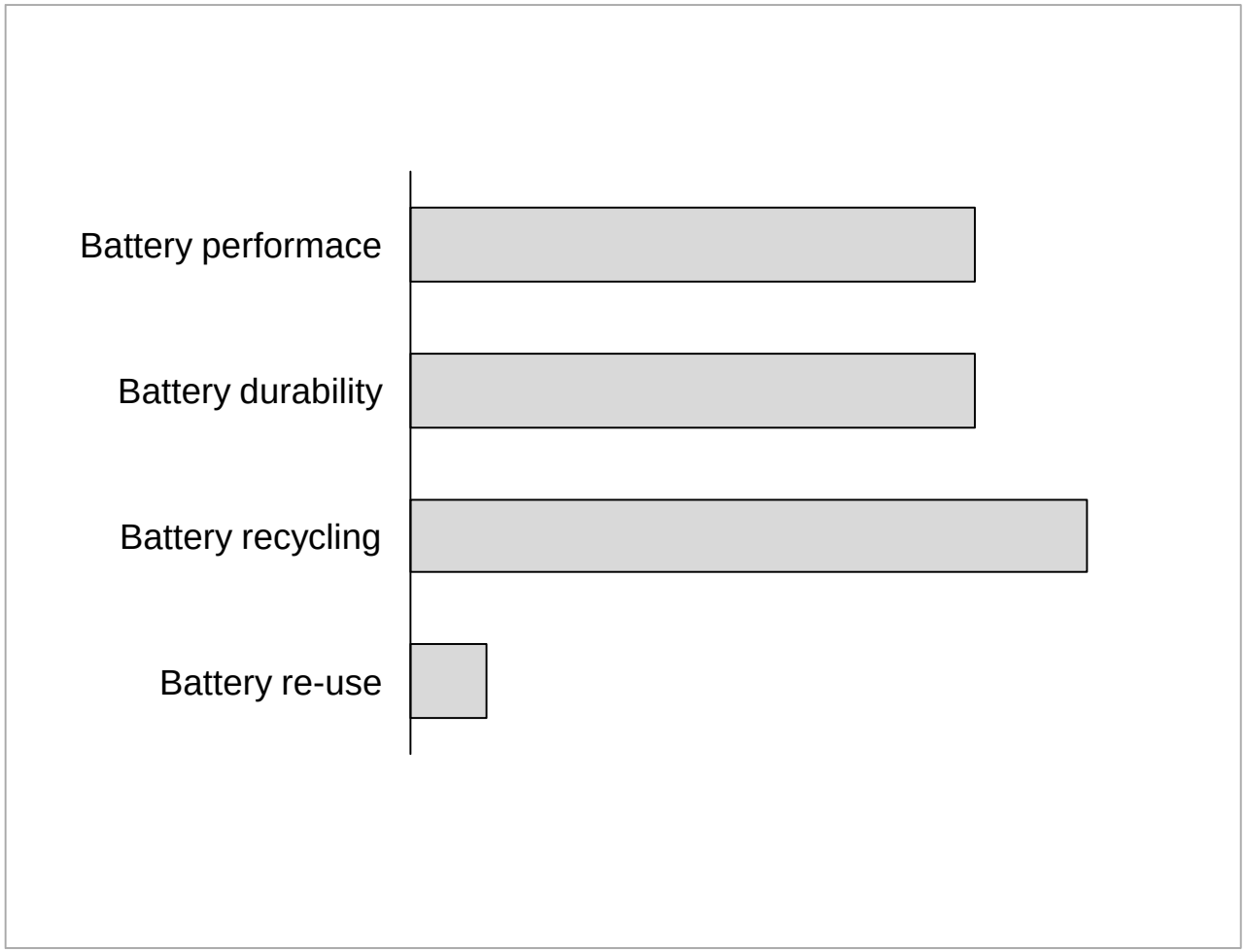
- Relatively high levels of activity in the context of vehicle requirements and market deployment incentives
- Generally lower levels of activity in terms of EV battery and infrastructure requirements

Chapter 4 – Activity Levels, Vehicle Attributes



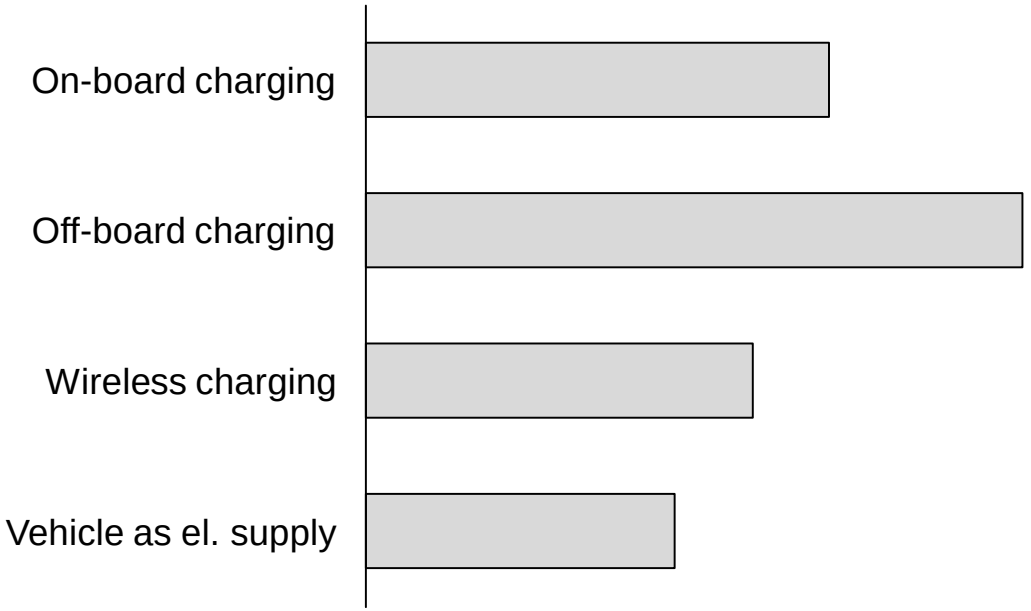
- High activity levels for vehicle-level attributes with the exception of driver-user information

Chapter 4 – Activity Levels, Battery Attributes



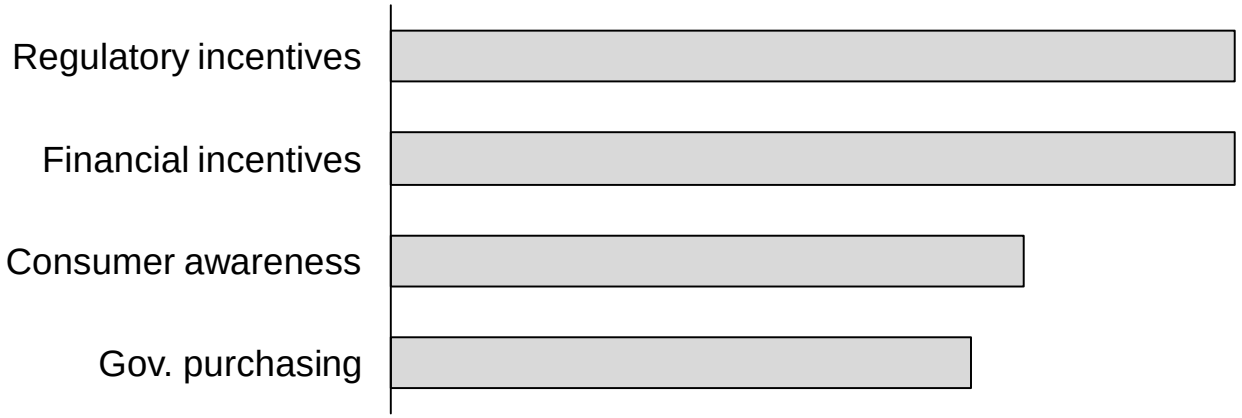
- Very low activity level in the context of battery post-mobility use
- Somewhat low levels of activity in the context of battery performance, durability, and recycling

Chapter 4 – Activity Levels, Infrastructure Attributes



- Relatively low activity level for infrastructure attributes in general
- Most infrastructure attributes are developing topics in the EV world
- Clear path visible for comprehensive development of necessary requirements

Chapter 4 – Activity Levels, Market Deployment Attributes



- Very high activity levels in the context of market deployment attributes
- Guide primarily concerned with regulatory incentives which are already in place or in development (India) for all countries/regions surveyed
- Financial incentives also overwhelmingly present in all countries/regions

Chapter 5 – Recommendations

Vehicle Range & Energy Efficiency Testing

Key Aspects	■ Ensure that EV testing occurs at high and low ambient temperatures with heating and air conditioning systems in operation ■ Sufficient flexibility to account for a range of technologies, both cost and efficiency focused ■ Resistive heating, electric AC, heat pump, radiant heating, cooled seats, heat-reflective glass, active catalyst heating etc.
Benefits	■ Provides consumers with realistic estimates of range and efficiency under an array of seasons and climatic conditions ■ Allows advanced technologies to ‘shine’ and justify their added cost
Consider	■ Potential to address through existing efforts of WLTP? ■ Status of mandate from WP.29 for phase 2 of WLTP GTR (low ambient conditions)? ■ Consider separate GTR as necessary ■ Research to better quantify impact of climate control and auxiliary system operation on range and energy efficiency under different environmental conditions ■ Findings of study potentially applied to test protocol development

Chapter 5 – Recommendations

Method of Stating Energy Efficiency

Key Aspects

- Standardized formula for calculating and stating energy consumption of EVs
- Adopted globally and across vehicle OEMs
- Sufficiently flexible to cover a wide range of current and future propulsion systems
- Easily understood by non-technical consumers
- Accounts for upstream efficiency associated with electricity generation

Benefits

- Provides consumers with a uniform, consistent and intuitive way to evaluate and compare vehicle technologies
- Helps to demystify EV technology (in comparison to conventional ICE technology)

Consider

- Account for variation in liquid lower heating values (energy content) by location and season
- Consider reporting of upstream CO_2 emissions based on method and efficiency of electricity generation
- Consider adopting upstream CO_2 emissions into CAFÉ/GHG legislation?
- GTR or recommendation?

Chapter 5 – Recommendations

Battery Performance & Durability

Key Aspects

- Standardized test procedure to address performance and durability of EV batteries
- Needs to account for performance degradation over the life cycle of the battery
- Key life cycle milestones where standardized performance is measured and reported
- Potential to cascade results to vehicle level and report impact on range/efficiency

Benefits

- Better understanding (for the consumer) of the reliability and durability of EVs which is key for adoption
- Helps to de-risk and demystify EV technology

Consider

- Existing ISO and IEC standards as basis
- Potential to address through existing efforts of WLTP?
- Status of mandate from WP.29 for phase 2 of WLTP GTR (durability)?
- Consider separate GTR as necessary
- Potential to influence vehicle label

Chapter 5 – Recommendations

Battery Recyclability

Key Aspects

- Battery recycling not addressed → outside of WP.29 scope
- Development of manufacturing for recyclability guidelines/requirements
- Requires evaluation of manufacturing processes, materials, chemistry
- Requires evaluation of consequences on performance, durability, cost

Benefits

- Key pre-cursor to creation of better battery recycling requirements
- Supports productivity and efficiency of downstream recycling of batteries

Consider

- Separate GTR recommended
- Research phase proposed to outline feasibility, risks and opportunities
- Complex but strong potential benefit to environment

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EV Terminology Cross-reference Chart

Current Usage	VPSD Equivalent
HEV Hybrid electric vehicle	NOVC-HEV Non off-vehicle-chargeable hybrid electric vehicle
PHEV* Plug-in hybrid electric vehicle	OVC-HEV Off-vehicle-chargeable hybrid electric vehicle
BEV Battery electric vehicle	PEV Pure electric vehicle

*Occasionally referred to as a REEV (range-extended electric vehicle)

- Survey responses generally comprised of HEV, PHEV, BEV terminology
- Guide currently reflects above
- Not consistent with VPSD terminology
- Recommend solution that allows VPSD terminology to be captured but preserves commonly used terminology so as to maximize readability of guide

THANK YOU FOR YOUR PARTICIPATION