



In-vehicle Battery Durability

Panagiota Dilara
DG-GROW, European Commission

EVE IWG
19/5/2020

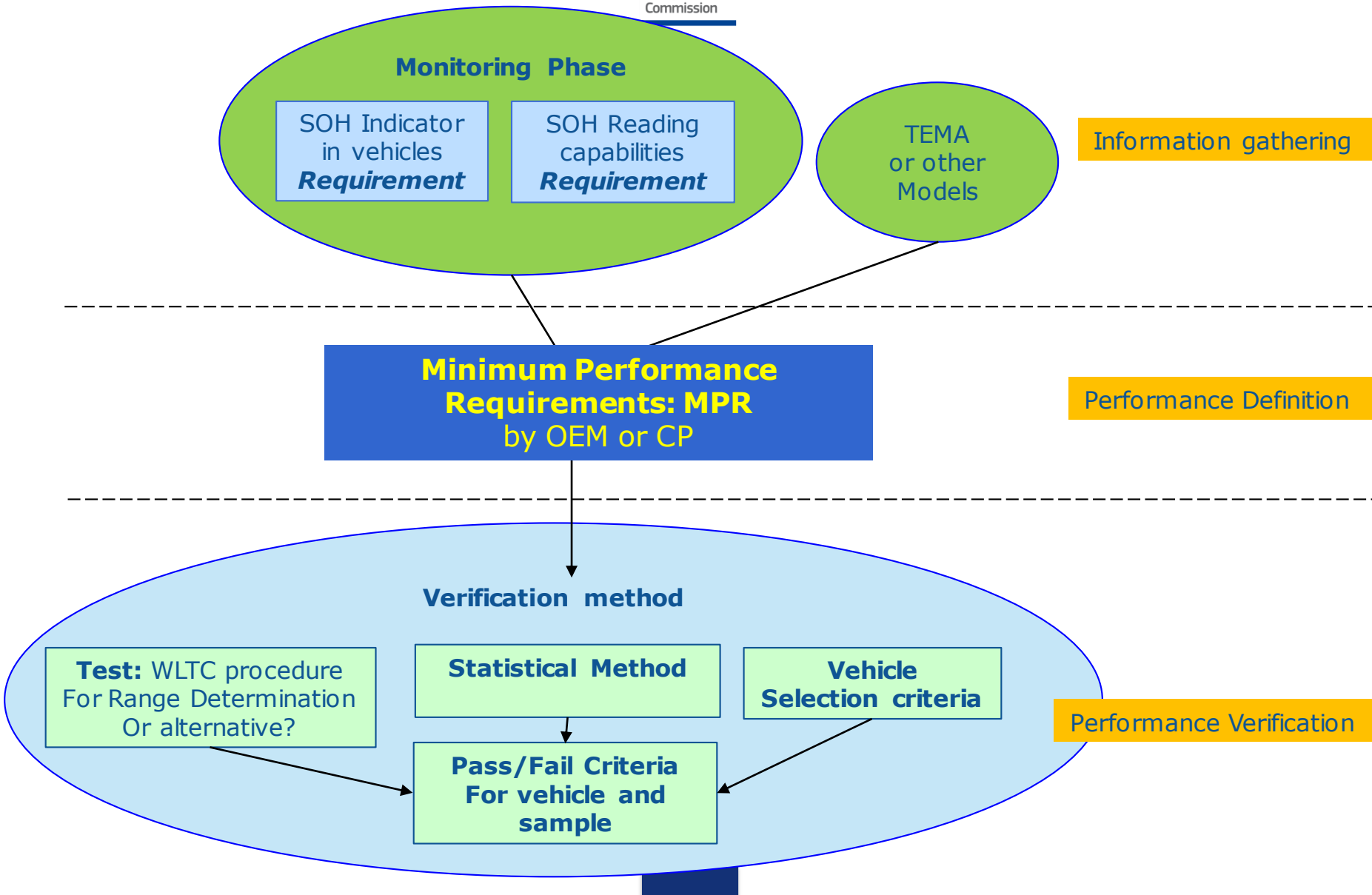
In-vehicle battery durability

- *Request to develop GTR, Phase 1:*
- *(a) Deliver a first version of a UN GTR on in-vehicle battery durability to AC.3 by November 2021 with;*
 - (i) definition of and requirements for electrified vehicle battery performance criteria
 - (ii) requirements for reading and/or displaying battery health information and usage data from the vehicle; and
 - **(ii) a provisional in-service conformity test which will include generic usage criteria and a statistical method.**

Verification/In-Service Conformity

- *Should include the possibility to check via independent means the range (not simply reading an ECU signal)*
- *Testing according the WLTP is currently the only option*
- *Rules are obviously needed on sample size, tolerances, etc..*

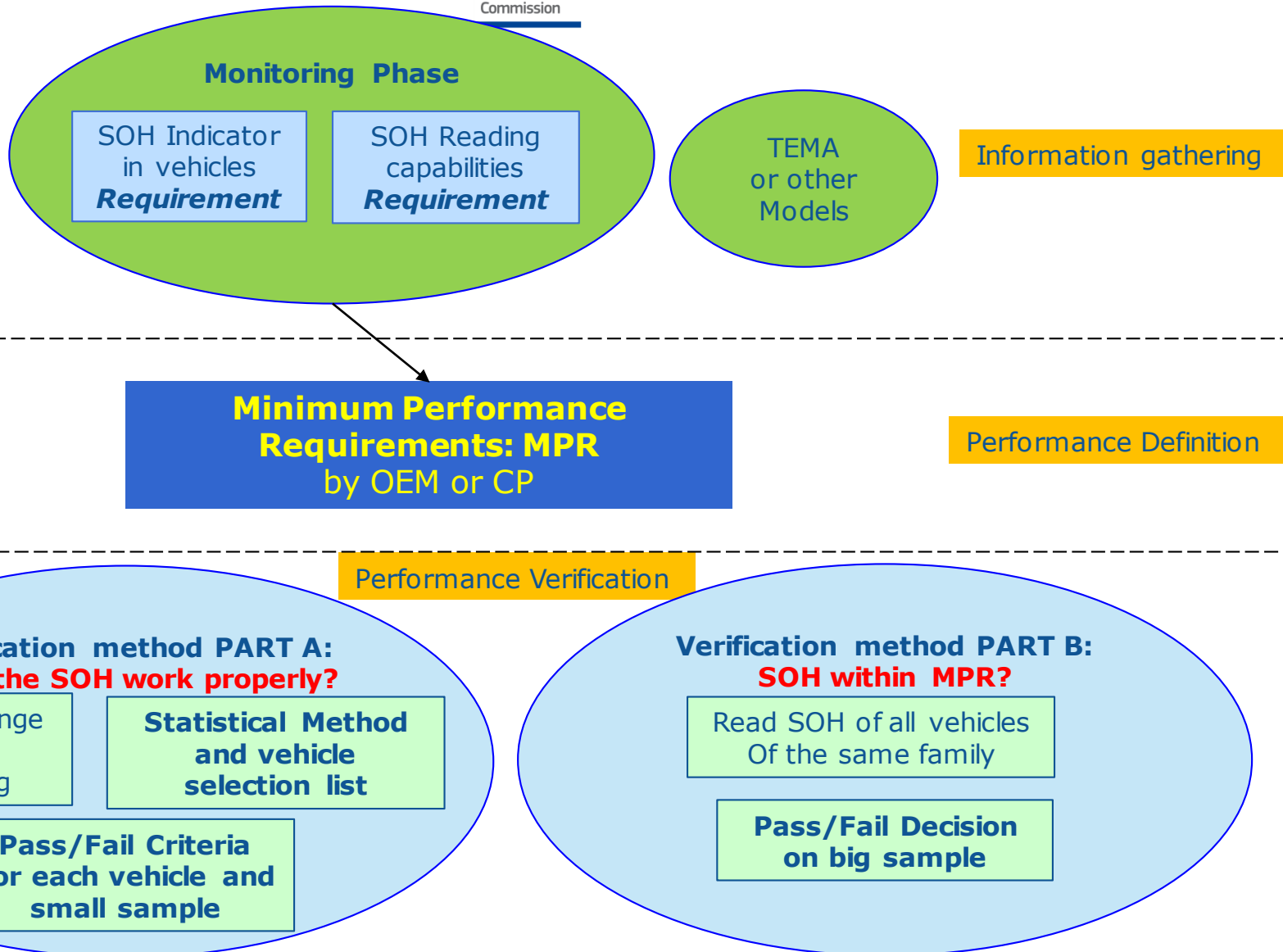
Previous proposal



Issues

- *Decision for the whole type of vehicles taken only based on few vehicles*
- *Requires that extremely used vehicles that can influence the decision unfairly are excluded*
- *Could potentially lead to recalls of all vehicles with the same type, even when not all vehicles might have a battery issue*
- *Big data (i.e. SOH) used only for information gathering and not for performance verification*

Improved proposal



Battery Performance Verification

PART A: SOH Verification

Does the SOH work properly?

Test: TEST Range
against
SOH reading

**Statistical Method
and vehicle
selection list**

**Pass/Fail Criteria
For each vehicle and
small sample**

SOH
Pass

SOH
Fail

Recall and fix SOH indicators
Repeat SOH verification after
the fix
and proceed with part B.

PART B: Battery durability verification

SOH within MPR?

Read SOH of all vehicles
Of the same family

**Pass/Fail Decision
on big sample
Against MPR**

Fleet SOH
Fail

Fleet SOH
Pass

Recall and
fix batteries
with low SOH

Performance
Verification
Pass

Benefits/ implications of new proposal

Benefits	Consequence
Decision on performance of SOH indicator/reading made separately on smaller number of tests , where accuracy of SOH is checked.	<ul style="list-style-type: none">• Vehicles selection done based on the list• Small number of vehicles need to be tested for each type• Recalls on SOH might be needed
Decision on the performance of batteries made on big sample , so statistically extreme use is insignificant	<ul style="list-style-type: none">• No need for Normal Usage Indices• Recall is made when the battery has a problem (only on those vehicles with poor SOH)
Less need for complex data reading	<ul style="list-style-type: none">• SOH + some basic data reading capabilities

PART A: Elements needed

Information Elements

- *Annual report on warranty claims, repairs for batteries to be provided by manufacturer to the authorities*
- *List of faulty vehicles found during ISC vehicle selection*

Definition of SOH

- *Algorithm can be OEM proprietary, but verifiable*

PART A: Selection Criteria for vehicles

Vehicle examination and interview with owner

- *Using the proposed list*
- *Regular and appropriate maintenance (with proof)*
- *No unauthorised major repair to engine or vehicle*
- *No unauthorised change or repair of battery*
- *No evident safety problems*

PART A: Testing

- *Families with similarities on their battery characteristics/drivetrain need to be defined*
- *Testing performed every X years throughout lifetime of vehicle*
- *Method of testing according to what was used for the original definition of range/capacity*
 - **WLTP in Europe**

PART A: Sample Statistics

- *3- 10 vehicles tested for range*
- *Tested Range/Declared Range within x% of SOH*

10									-1
9								-1	-1
8						-1	-1	-1	-1
7					-1	-1	-1	-1	-1
6				-1	-1	-1	-1	-1	-1
5			-1	-1	-1	0	0	0	1
4		-1	-1	0	0	0	0	0	1
3	-1	-1	0	0	0	0	0	1	1
2	0	0	0	0	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1
	3	4	5	6	7	8	9	10	
FAIL	3	3	4	5	5	6	6	6	
PASS	0	1	1	1	2	2	3	5	

PART B: Data collection

- *Data collected yearly from all registered vehicles*
 - **During Periodic Technical Inspection**
 - **Over the air**
- *Appropriate yearly analysis to show if fleet SOH is above the Minimum Performance Requirements*
- *Might be necessary to define MPR targets that vary with the age of the vehicle, not only the final target*
- *Recall may be necessary for those vehicles with SOH below MPR only*

Conclusion

- *New method proposed is simpler and avoid taking decisions on the battery durability based on testing few vehicles*
- *Testing can prove whether SOH is accurate*
- *Collection of SOH from all vehicles can support analysis of fleet average values*
- *Focused decision for recall, when and where needed*



Thank you for your attention!