



# Consideration of swap battery durability and health monitoring for UN GTR No. 22

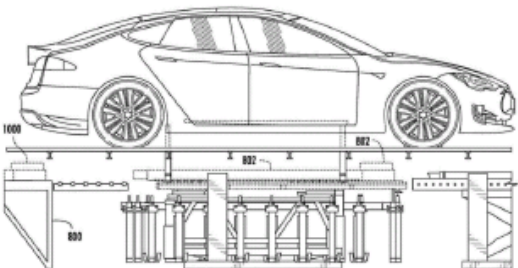
Date: 13/7/2022

Versions:1.0

# History of Battery Swap Development



Better Place, 2007-2013, in Israel, Japan, USA, and Denmark



Tesla, 2013-2015, US

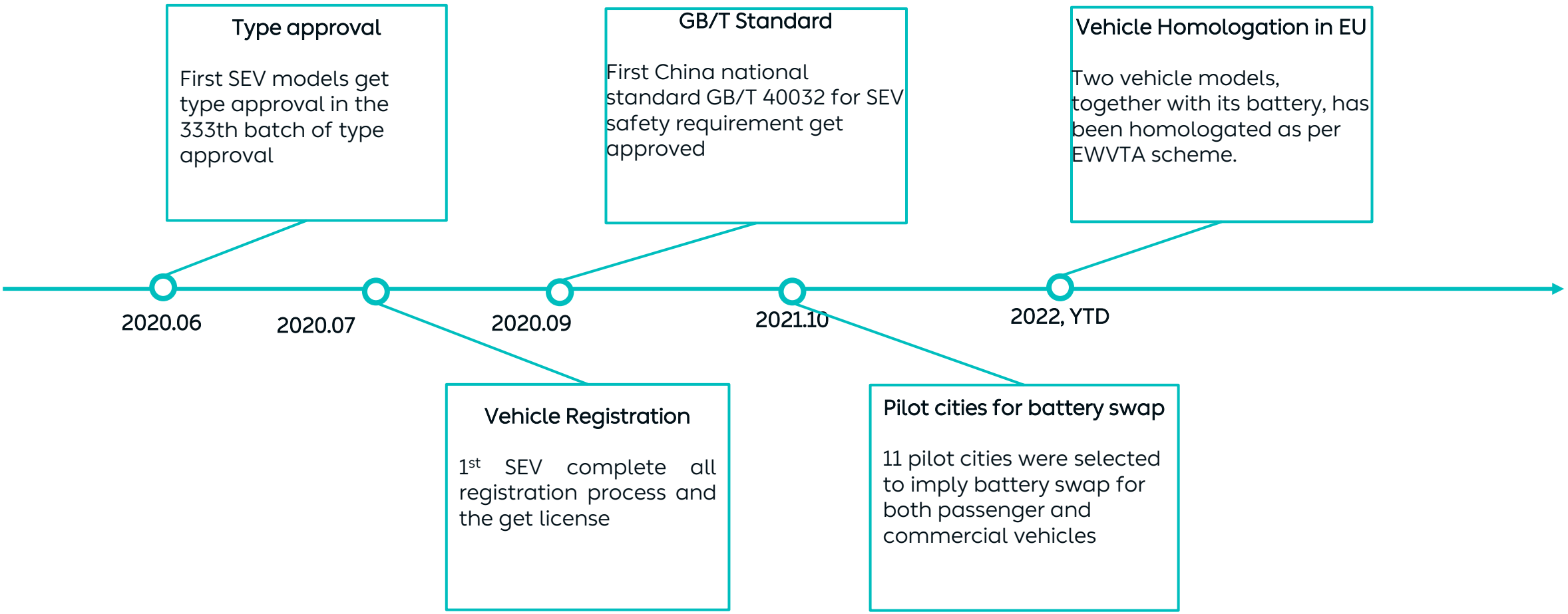
NIO, since 2015, China

BJEV (BAIC), since 2015, China

More and more OEM's start to launch battery swappable vehicles since 2020



# SEV Standard Development in China

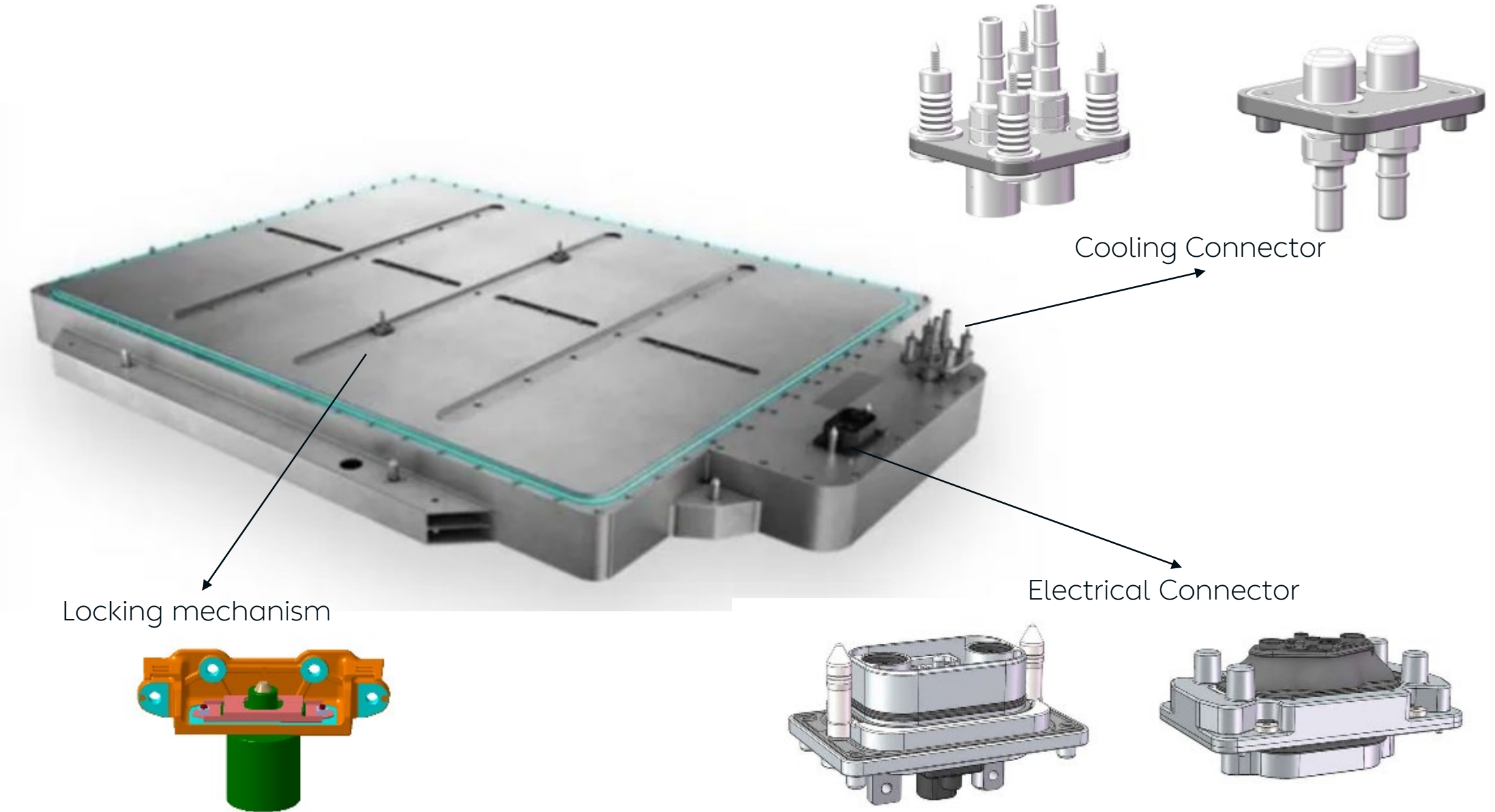


SEV = swappable EV

# Infrastructure Development in China

- 1400+ power swap stations in China by Feb. 2022 (~500 by end 2020)
- Over 200,000 swappable EV's in the market
- More OEM's launch new SEV models since 2021
- Norway has built a power swap station

# Unique design for battery swap (example)



Locking mechanism

Cooling Connector

Electrical Connector

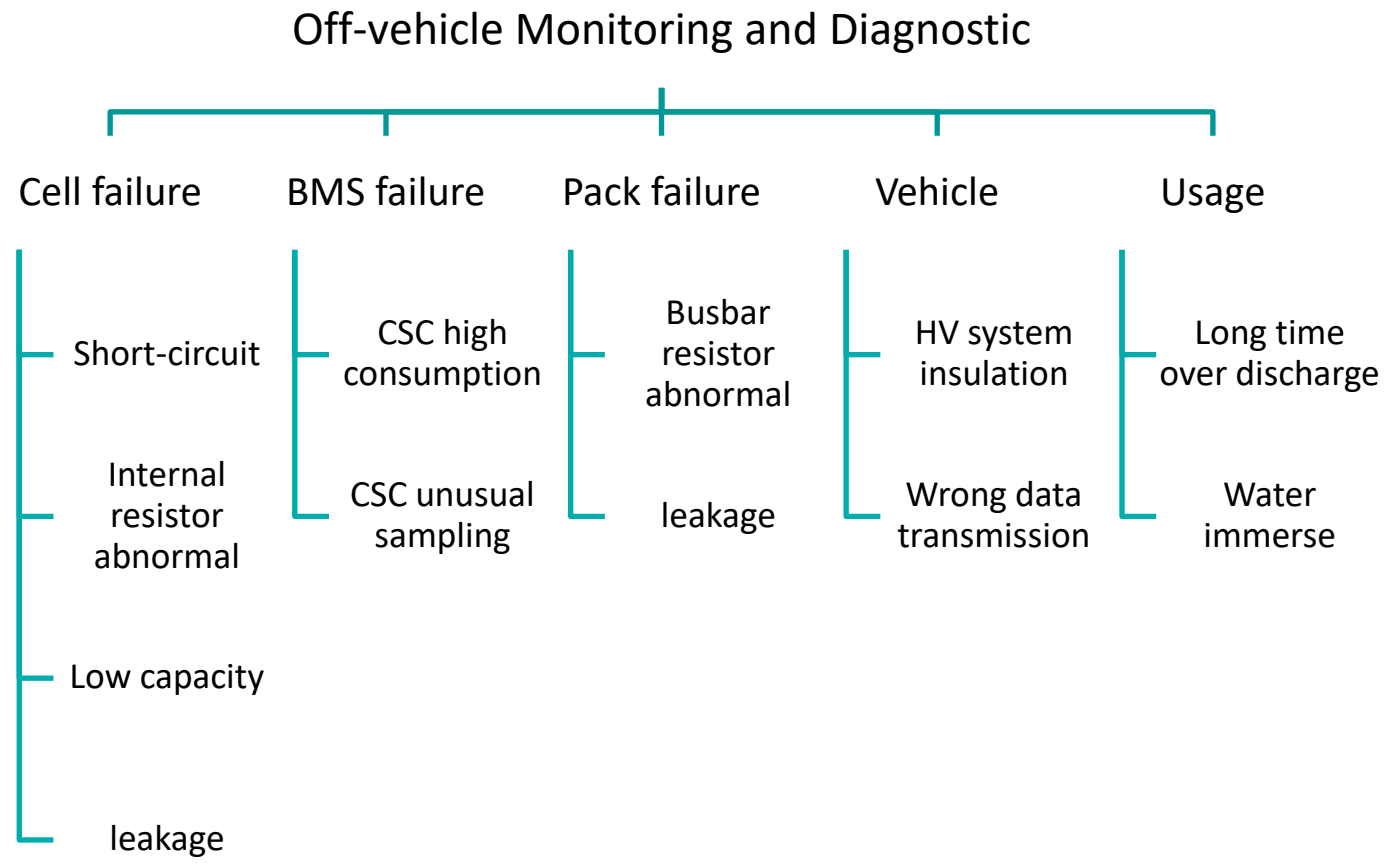
# Battery Swapping and its impacts on battery durability and in-vehicle monitoring

- Monitoring: The health of the battery can be monitored not only in-vehicle but also in the swap station.
- Battery life: Battery use life extended by swapping, centralized charging and maintenance.
- Environmental benefits from reductions in GHG emission



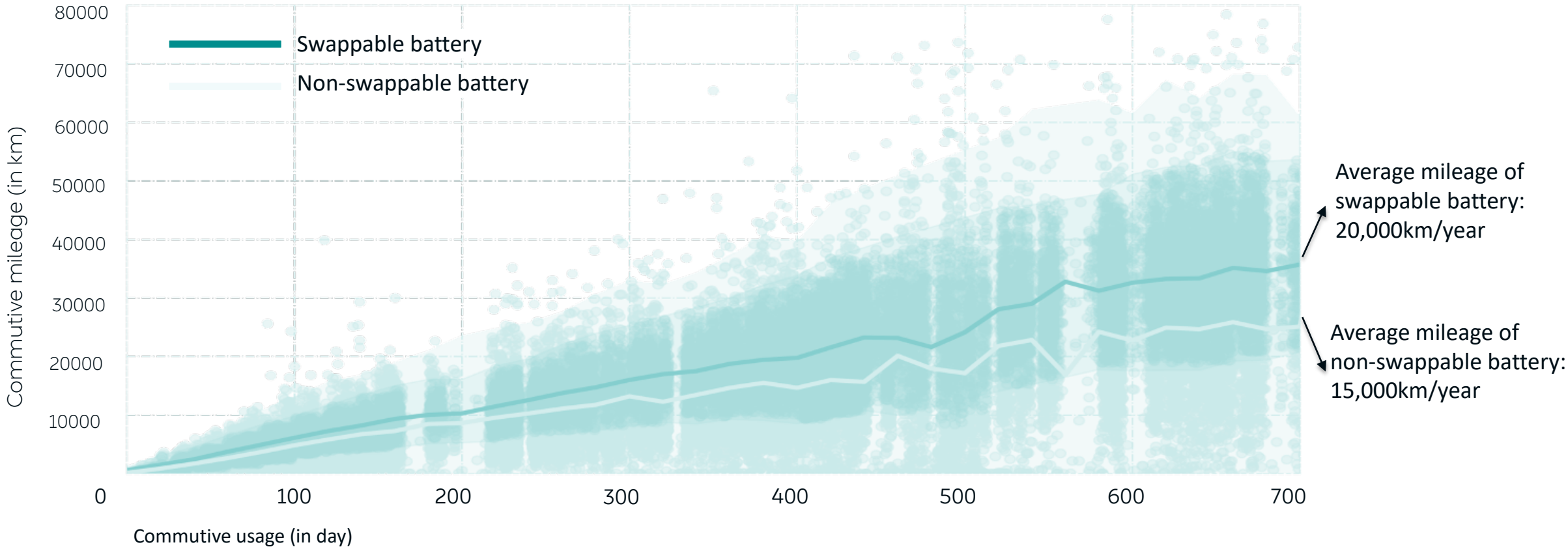
# Off-vehicle monitoring and diagnostic

- Active cooling system
- More accurate SOH evaluation
- Active battery balancing



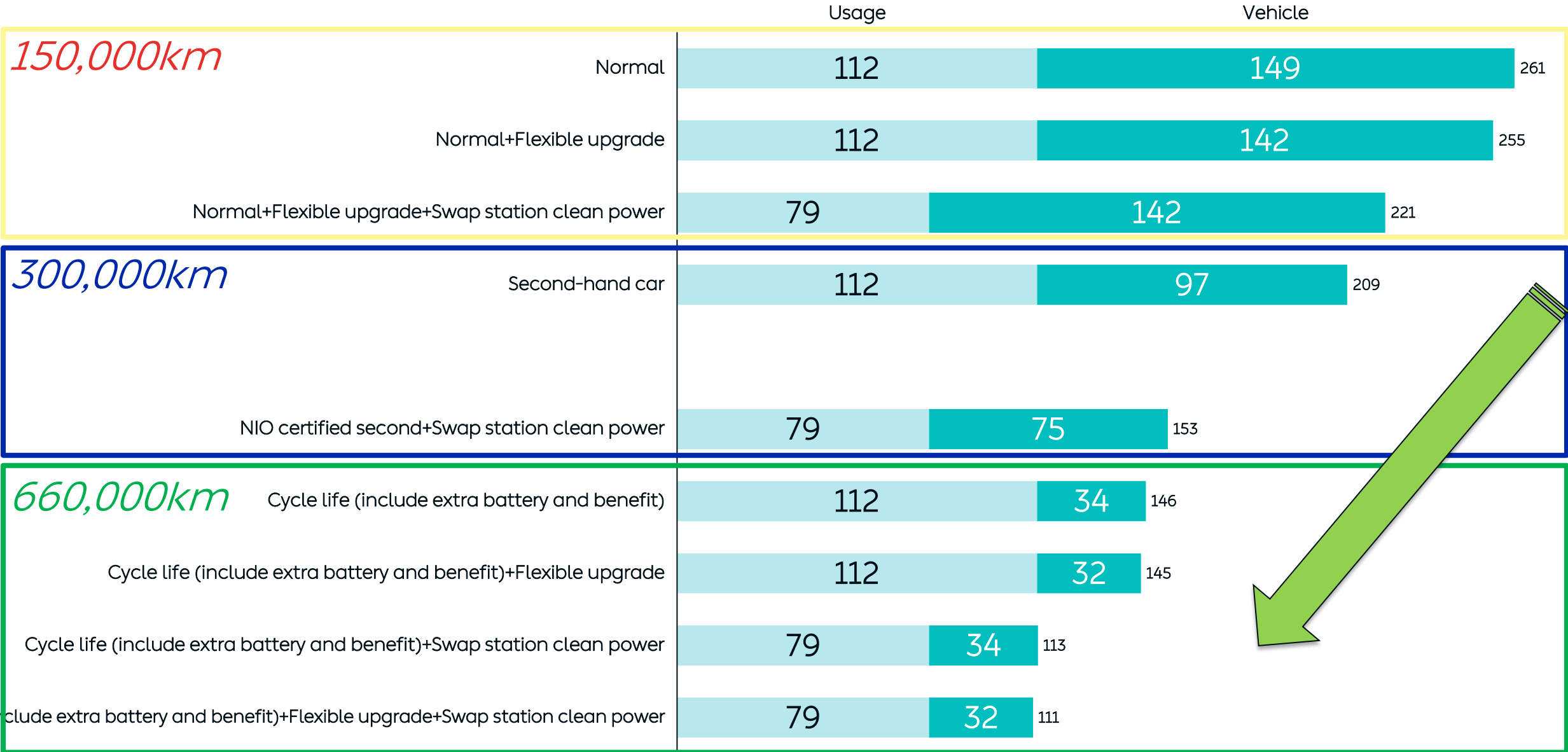


# 10% - 15% Battery life extension by reducing high density usage





# Decarbonization by battery swap and clean power usage



Unit: gCO<sub>2</sub>e/km

# Comments for Battery Durability GTR@EVE58

As battery swappable EV belongs to PEVs, it is suggested to consider the durability of this type of EV into the standard:

- Modify the term definitions relating to swappable battery,
- Distinguish between vehicle durability and battery durability, and
- Modify the technical requirements accordingly

EXAMPLE 1 (1. Scope and application ):

## 1. Scope and application

This GTR applies to vehicles of categories 1-2 and 2, that have a technically permissible maximum laden mass not exceeding 3,855 kg, and to vehicles of category 1-1, that (a) are PEV or OVC-HEV vehicles, and (b) **have an originally installed battery** as defined in this GTR.

In the description of Scope and application, it is required that “an originally installed battery”, it is not apply for the electric vehicle of swappable battery type. It is suggested that :

“For the electric vehicles of swappable battery type , it should confirm that all the batteries in operation meet the regulation.”

# Comments for Battery Durability GTR@EVE58

EXAMPLE 2 (3. Definitions):

## **3. Definitions**

The following definitions shall apply in this Global Technical Regulation.

1. *"Battery"* means, in the context of this GTR, a rechargeable electrical energy storage system (REESS) installed in an electrified vehicle and used mainly for traction purposes.
2. *"Originally installed battery"* means the battery that is installed in the vehicle at the time of manufacture, or if the vehicle is manufactured without an installed battery, the battery that is installed in the vehicle when it is first operated on the road.

In the definitions of terms, there is no "swappable battery pack" related item, It is suggested to add one definition that:

### **Swappable Energy Storage**

Battery packs used to supplement energy in the form of swapping battery packs, which are used to battery swap vehicle. or  
The battery pack used in the electric vehicle of swappable battery type , can supplement energy in the form of swapping the battery pack.

# Comments for Battery Durability GTR@EVE58

## EXAMPLE 3 (3. Definitions): :

3.7 "*Certified range*" ( $\text{Range}_{\text{certified}}$ ) refers to the electric driving range that was determined during certification of the vehicle, according to Annex 3 of this GTR.

3.8 "*Measured range*" ( $\text{Range}_{\text{measured}}$ ) means the electric range determined at the present point in the lifetime of the vehicle by the test procedure used for certification, according to Annex 3 of this GTR.

About "certified range", The vehicle mileage and battery mileage should be distinguished. The battery mileage can be the converted value. It is suggested to add a comment that:

For the electric vehicle of swappable battery type, **the certified range of the battery should be considered, and this value can be converted.**

Or modify the content that:

"Certified range" ( $\text{Range}_{\text{certified}}$ ) refers to the electric driving range that was determined during certification of the battery, according to Annex 3 of this GTR.

# Comments for Battery Durability GTR@EVE58

EXAMPLE 4 (Annex I - Vehicle Owner Interview):

<b>Was the propulsion battery changed or repaired?</b> <i>If yes, the vehicle cannot be selected for testing, but information should be collected</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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This item is not applicable to the electric vehicle of swappable battery type. It is suggested that:

If yes, the vehicle cannot be selected for testing, but information should be collected. However, it does not apply to the electric vehicle of swappable battery type .

There may be other contents in the article that are not applicable to the electric vehicle of swappable battery type which need further study.

Thank you for your listening