

Future of battery testing : State of Health, what else ?

AGEING

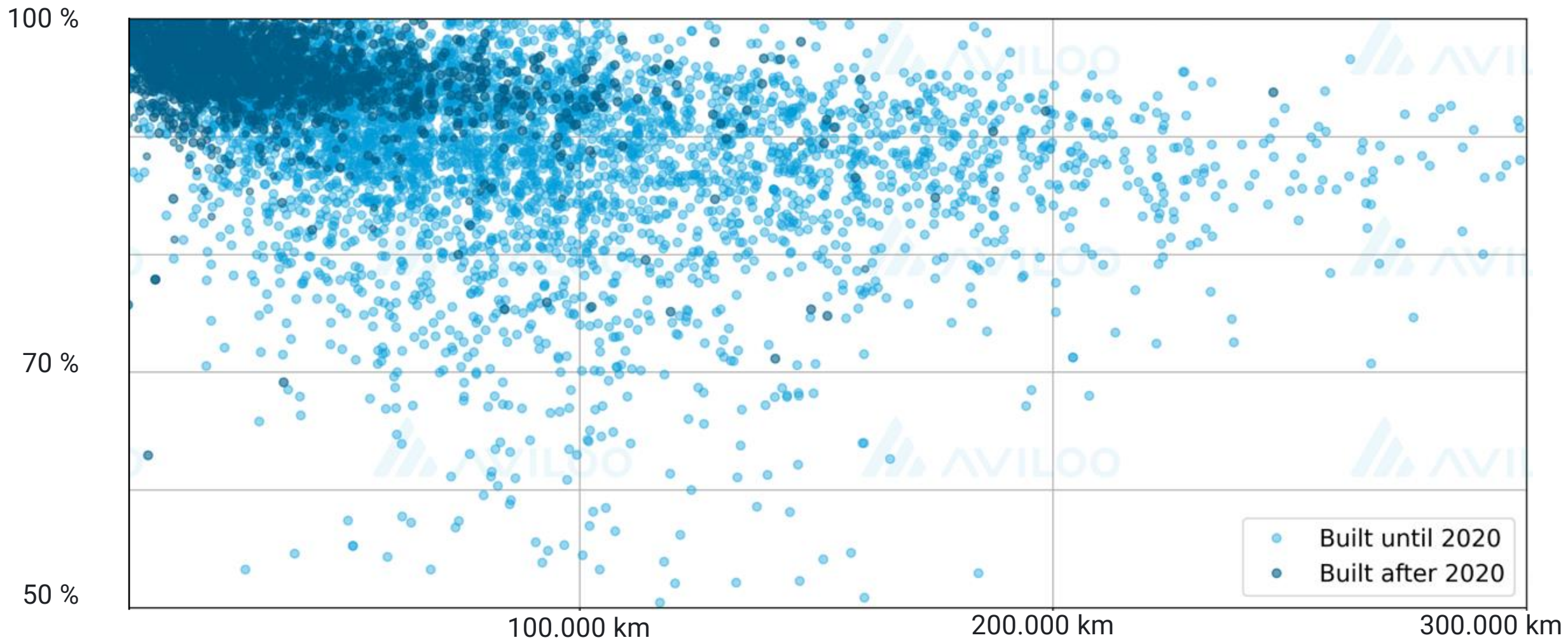
Human beings are ageing on average
homogeneous

B U T

**SAFETY
PROBLEMS
DEFECTS**

need a regular deep diagnostic to detect
diseases or special problems!

AGEING BEHAVIOUR – UP TO 300.000 km



Category	Standardized solutions today	Future standardized solutions
AGEING (regular)	n.a.	GTR 22 (end 2026)
SAFETY ISSUES PROBLEMS DEFECTS	n.a.	n.a.

GTR ... Global Technical Regulation
SoH ... State of Health

Human beings are ageing on average homogeneous BUT need a regular deep diagnostic to detect diseases or special problems!

AGEING

State of Health (SOCE, SoH – percentage of battery range)

- Usable energy decaying (SOCE) – (GTR 22, ...)
- WLTP-range decays (SOCR) – (GTR 22, ...)

SAFETY PROBLEMS DEFECTS

Problems within battery compartment

- Cell defects, BMS defects, balancing problems, sensor problems, weak performance in charging or driving
- Error codes

SoH – at least 3 possibilities for OEMs

- SoH Resistance based
- SoH Capacity based
- SoH Energy based

SOCR ... State Of Certified Range
SOCE ... State Of Certified Energy

For current vehicles the OEM can use any SoH calculation
→ read out SoH is not comparable (may vary by SW update)

~~SoH – at least 3 possibilities for OEMs~~

- ~~• SoH Resistance based~~
- ~~• SoH Capacity based~~
- **SoH Energy based**

SOCE ... State Of Certified Energy
SOCR ... State Of Certified Range
GTR ... General Technical Regulation

SoH energy based: SOCE and SOCR (GTR22) for future vehicles

$$\text{SOCE} = \frac{\text{Energy (kWh) used car}}{\text{Energy (kWh) usable new}}$$

$$\text{SOCR} = \frac{\text{WLTP (km) used car}}{\text{WLTP (km) new}}$$

Equals an
energy
based SoH

→ CLEAR definition for OEMs for EURO 7 (end 2026)

SOCE ... State Of Certified Energy
SOCR ... State Of Certified Range

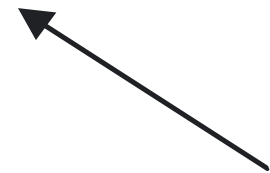
Energy based SoH vs. SOCE and SOCR

Measured by
independent Tester

Test bench (dyno test)
very high costs



$$\frac{\text{Energy (kWh) used car}}{\text{Energy (kWh) usable new}} = \text{SOCE} = \text{SoH}_{\text{energy}} = \text{SOCR} = \frac{\text{WLTP (km) used car}}{\text{WLTP (km) new}}$$



OEM datasheet

SoH.....State of Health

GTR 22 includes

- Energy based SoH is the way to go Alternative of SOCR shown
- Basic calculation for SOCE defined

GTR 22 EXCLUDES

- How SoH (SOCE) is calculated calculated
- How SoH is read out
- All other important battery characteristics

GTR.....Global Technical Regulation

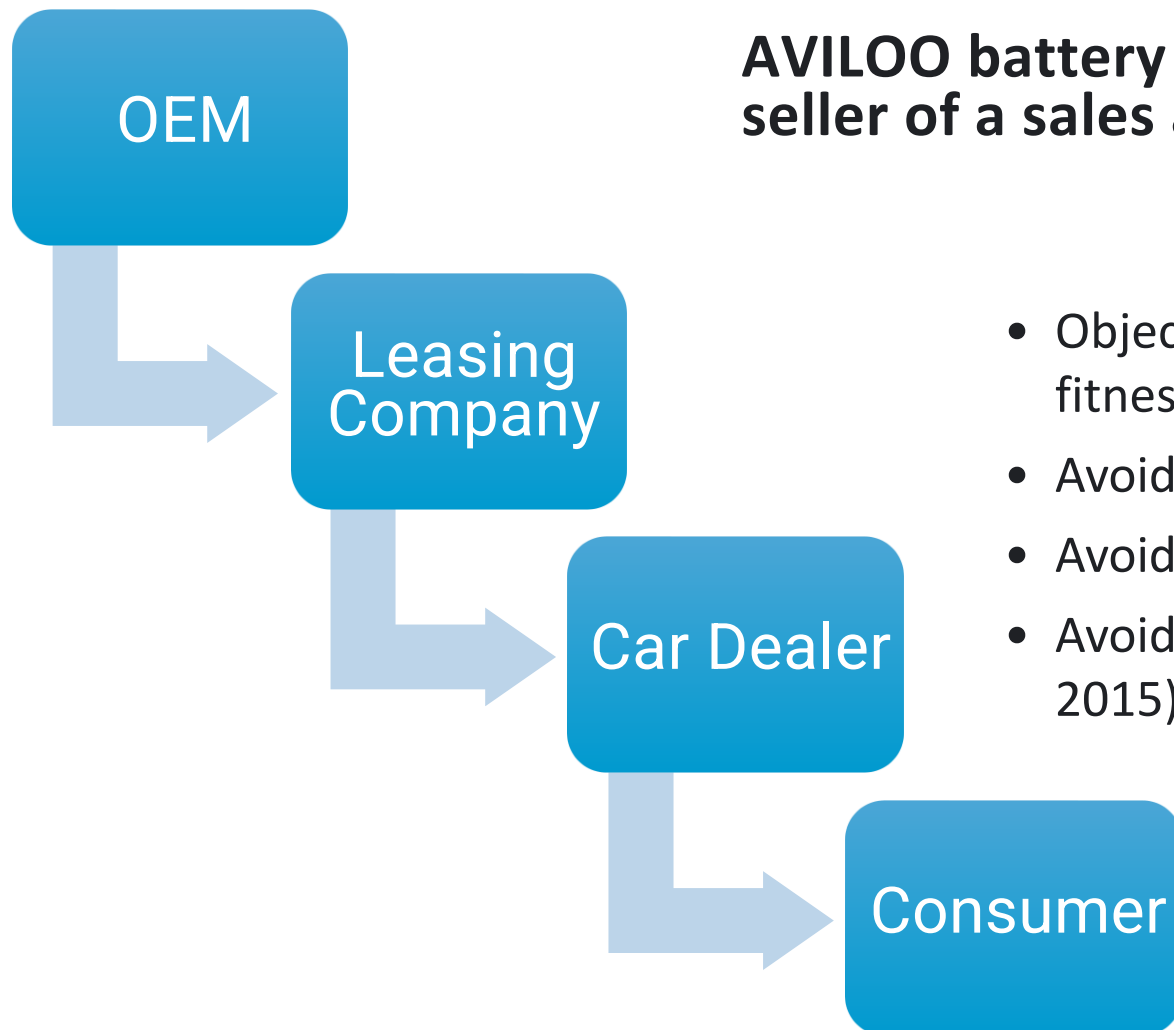
- CARA certification
- Independency
- Easy to implement for all vehicle types (plug and play)
- Same standardized process for all customers and vehicles
- Compareable SoH (harmonization of different OEMs measurements – till end of 2026)
- Competent customer support
- 2nd level support – also for repairs
- API access – easy implementation in customer SW
- Battery defect and anomaly detection
- Battery error codes
- Accuracy

→ **Gain of trust**

GTR.....Global Technical Regulation

Legally secure sales agreements with battery tests

AVILOO battery test provide security for buyer and seller of a sales agreement above the SOCE.



- Objectively and independently prove the quality and fitness of the battery
- Avoid implied terms about quality and fitness
- Avoid / prove breach of condition or warranty
- Avoid assumption of non-conformance (Sec 19 (14) CRA 2015)



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