



POLITECNICO
MILANO 1863



L'auto elettrica e l'evoluzione dei modelli di mobilità

(Atto n. 396, XVIII Legislatura - Affare sul settore dell'automotive italiano e sulle implicazioni in termini di competitività conseguenti alla transizione alla propulsione elettrica)

Roma, 4 Febbraio 2020

10a Commissione Permanente del Senato

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“Mega-trends” in personal mobility



Big & heavy



Small & light



Fossil-fuel



Electric



Personal



Shared/Service



Human-driven



Autonomous



+ «connected» (transversal feature)

Mega-trends “self-reinforcement” towards electrification

Size-reduction



Autonomous car and car-sharing will catalyze the electric car adoption

Electrification



Service-ization of the mobility (sharing)



Automation of the driver

Towards the self-driving car



Roadmap to AV

Defined levels of automation

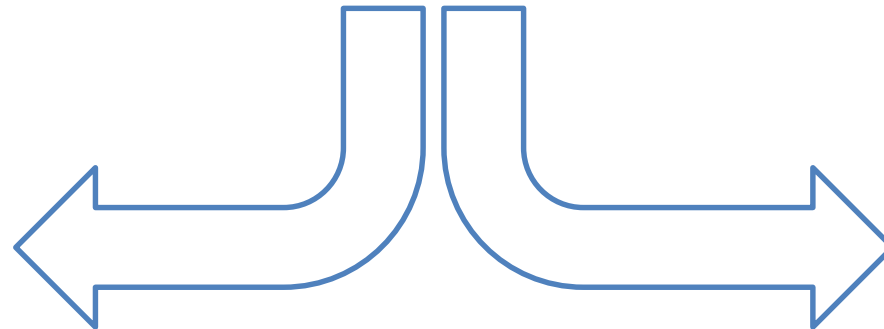
Level	L0	L1	L2	L3	L4	L5
Driver	Driver only	Assisted	Partial Automation	Conditional automation	High automation	Full automation
Automation ⁽¹⁾	Driver continuously in control of speed and direction	Driver continuously performs the longitudinal or lateral dynamic driving task	Driver must monitor the dynamic driving task and the driving environment at all times	Driver does not need to monitor the dynamic driving task nor the driving environment at all times; must always be in a position to resume control	Driver is not required during defined use case	System performs the lateral and longitudinal dynamic driving task in all situations encountered during the entire journey. No driver required
Example	N/A	Park Assist	Traffic Jam Assist	Highway Patrol	Urban Automated Driving	Full end-to-end Journey

L3: similar to large airplanes auto-pilot

Today: we are on «the edge» between L2 and L3



The “bifurcation” in cars



This “bifurcation” will occur (in 15-20 years?)



Today: most cars are «all purpose» - function & fun

shared «robo-taxi» (**largest % long-term**)



Emotional «red» cars (long-term «**niche**»)



Technology content for the Robo-Taxi

Focus on the autonomous vehicle “robo-taxi” (L4 or L5)



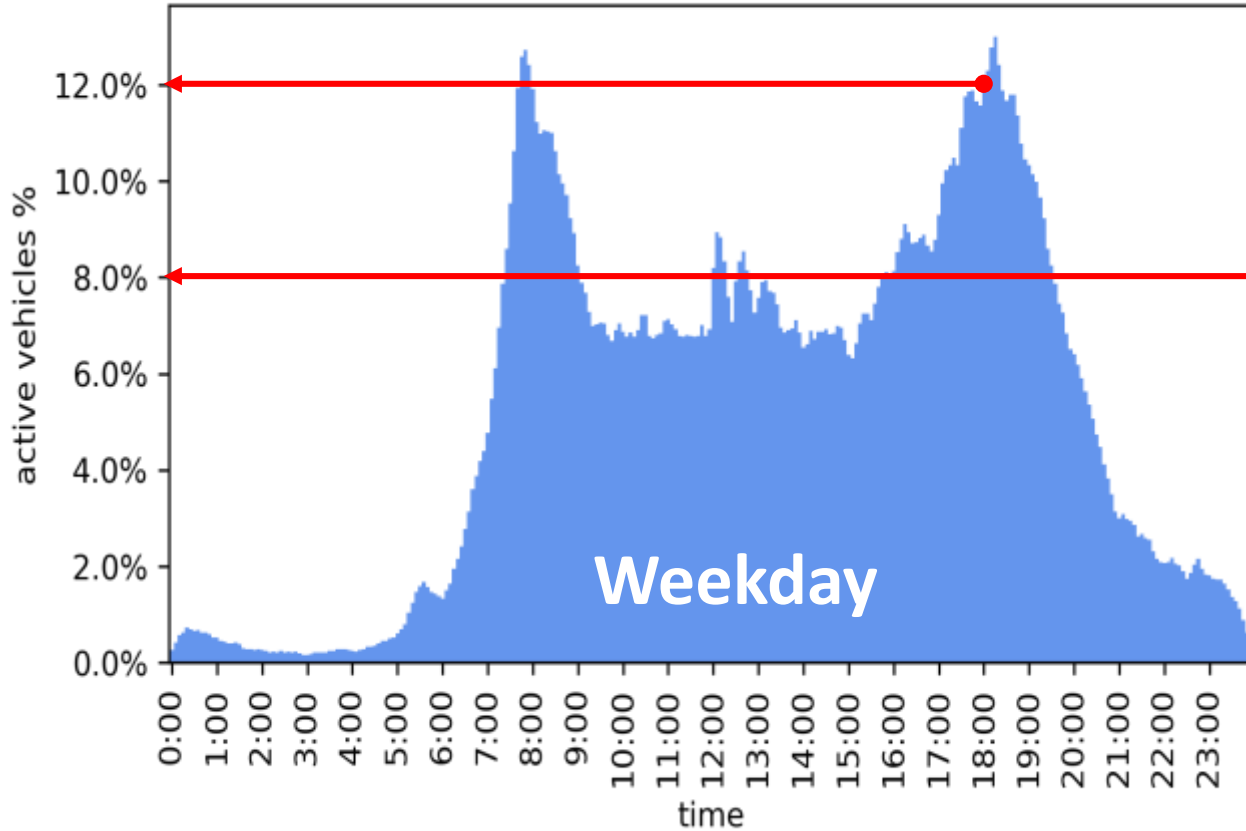
- Much less than today personal cars in **volumes**
- Much more used than today personal cars in **time/km**
- Much more **expensive**
- Much more **Automation-technology-equipped**



NOT a «mass market device»
More a «professional vehicle»

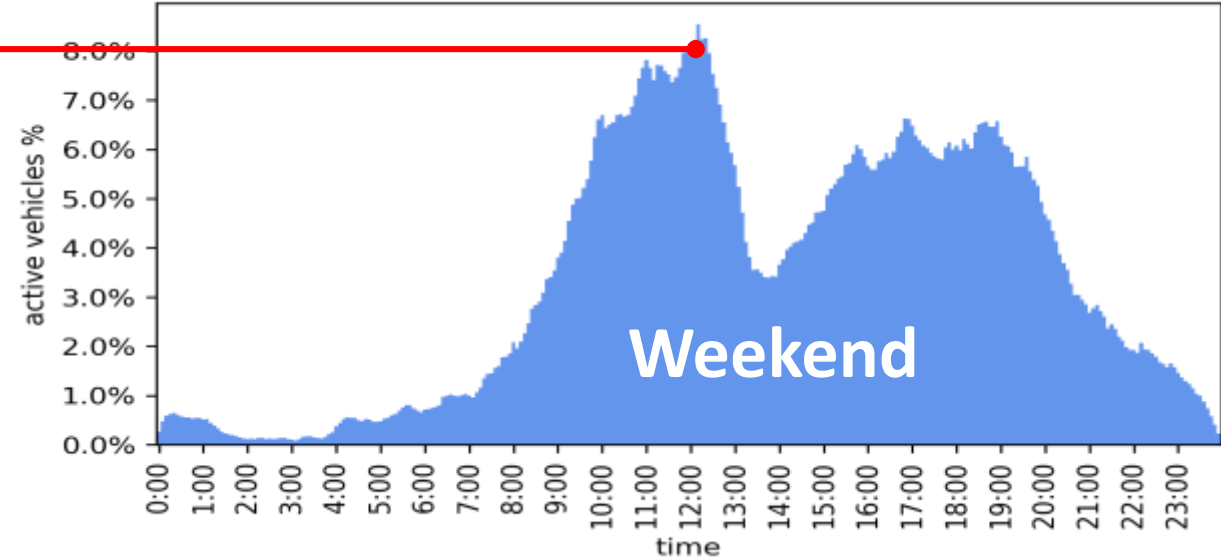
Simultaneously-used cars: real data!!!!

active vehicles during a weekday (thu 07/03/2018)



8% of the today cars can almost perfectly fulfill the need of the population without any change of behaviour, just by «sharing»

active vehicles during a weekend day (sun 18/03/2018)

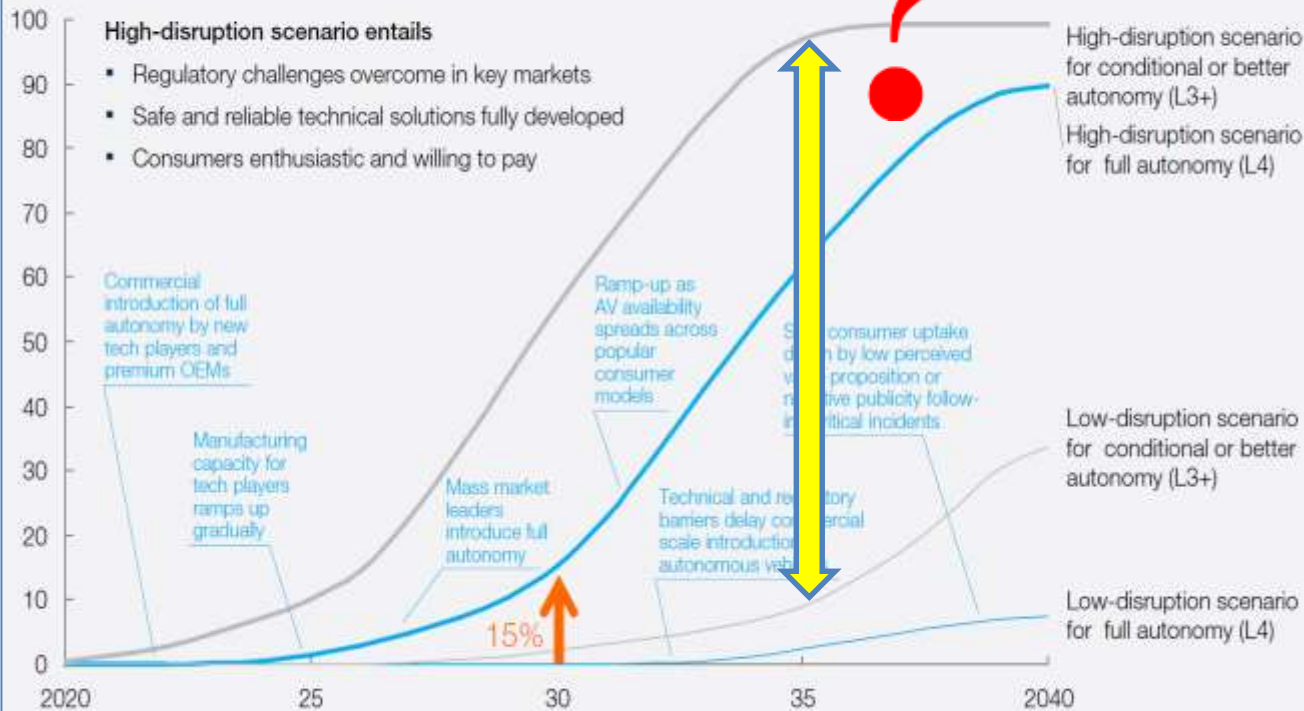


A 1:10 increase of the average mileage of a car creates a **major opportunity for upgrading car technology (less cars, more technology-equipped)**, at constant market revenues

Roadmap to AV: timing?

Subject to progress on the technical, infrastructure, and regulatory challenges, up to 15% of all new vehicles sold in 2030 could be fully autonomous

New vehicle market share of fully autonomous vehicles
Percent



SOURCE: McKinsey

L3, 2035 prediction:
10%-95% range...



10:1 reduction...or even more?

Bifurcation of mobility...

Personal mobility megatrends...



Big & heavy



Small & light



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Electric



Personal



Shared/Service



Human-driven



Autonomous

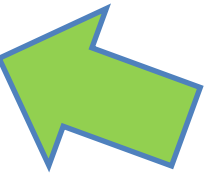


Bifurcations: the virtual way...



ICT technologies are evolving MUCH faster than vehicles and transport systems **(no safety issues; no major infrastructure investments)**

A (near) future with limited personal mobility?



AMAZON-ization of mobility? (people-moving or goods-moving?)



Google



Google-ization: mobility as a service



amazon



Amazon-ization: goods-mobility

The YAPE (Your Autonomous Pony Express) spinoff project



IL ROBOT ITALIANO YAPE FA LE CONSEGNE FINO IN GIAPPONE



PRODOTTO - PRODOTTO ...
JUDGEMENT - STATEMENT OF THE JURY ...

YAPE
Società a partecipazione paritetica



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Conclusions: the **physical**-mobility “survivors” (horizon: 10-20 years?)



#1: Manufacturers of the «robot-taxi»

Dramatic reduction of the **number** of vehicles (1:10?)

Weak market **segmentation** (debate on this issue)

Few manufacturers; high-tech **robotization/automation technology**



#2: Manufacturers of «emotional vehicles»

Leisure vehicles for affluent people

Possibly long-term **confined** to race circuits (if autonomous mode not available)



#3: Soft-mobility



E-bikes!



#4: Commercial vehicles for goods transportation and delivery

Long-haul: largely-autonomous;
Diesel, CNG, H2-energized



Small-metropolitan trucks: **partly-autonomous**; mostly **electric**



Trend: “**drone-ization**” (swarm of fully-autonomous or 5G-remote-controlled drones)



#5: Agriculture-machines

Large tractors for **extensive** crops:
Diesel/CNG; largely autonomous

Intensive agriculture: **drone-zation**
(swarm of electric drones) to achieve:

- Minimum energy consumption
- Minimum water consumption
- Minimum pesticides consumption
- Dedicated local treatments
-



The electric car

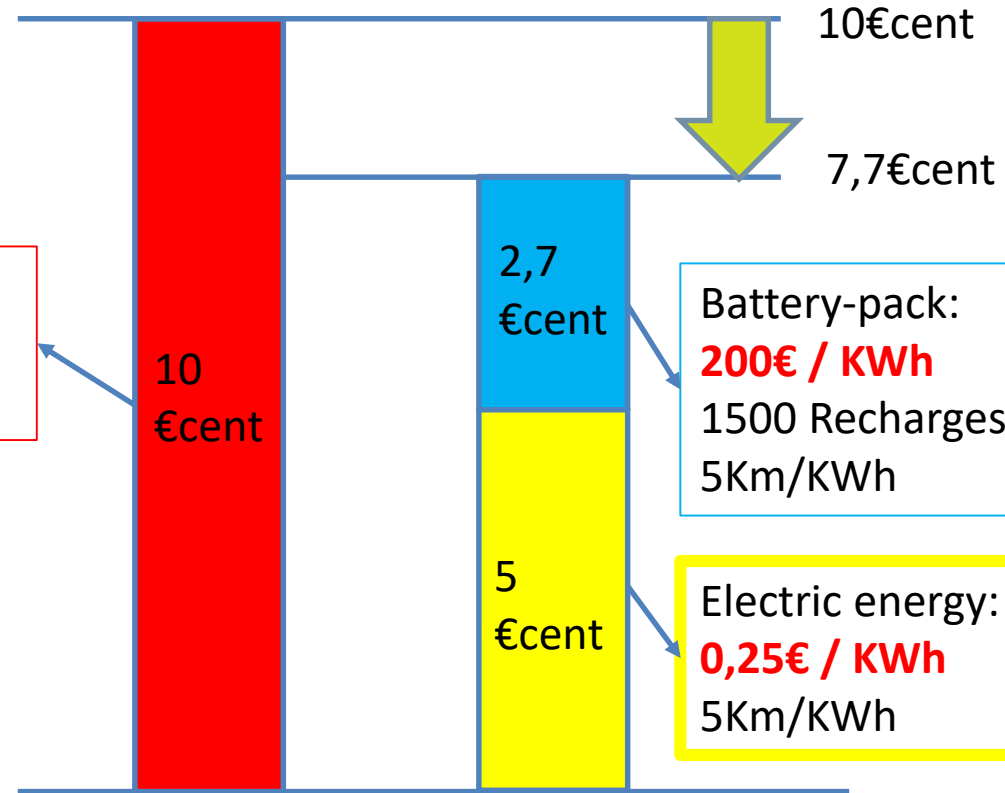


ICE vs. Electric in a nutshell: a clear winner TODAY (at current energy cost)...BUT...

Economics (valid for any size of the battery – can be influenced by taxes)



Fossil-fuel:
1,6€ /liter
16Km/liter



Battery-pack:
200€ / KWh
1500 Recharges
5Km/KWh

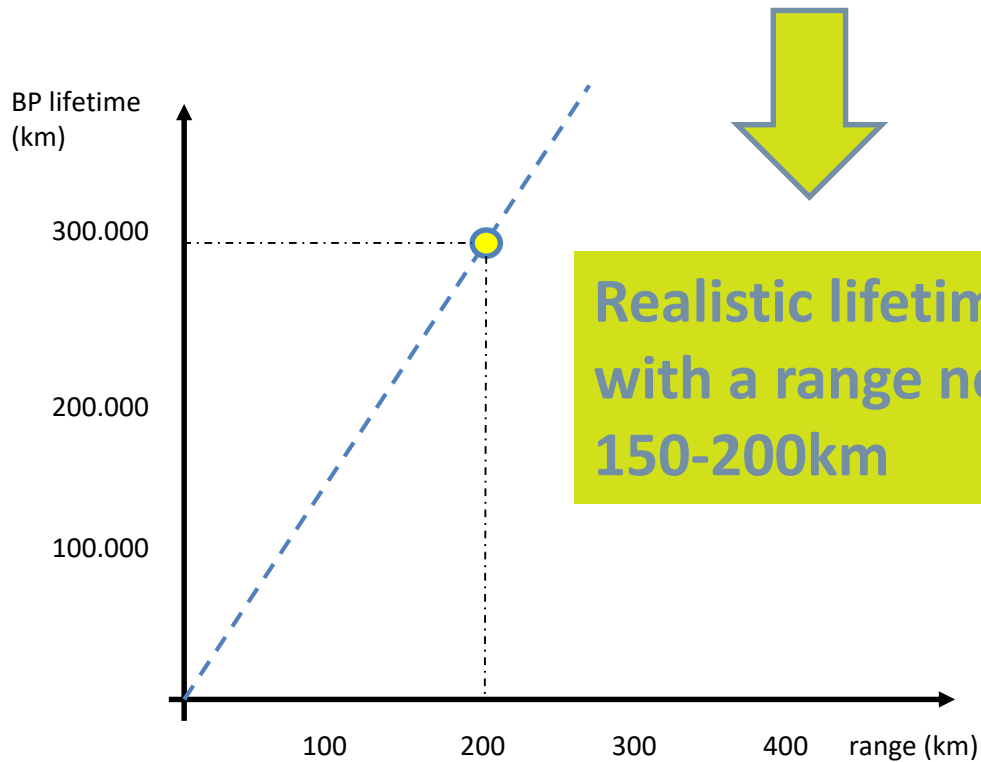
Electric energy:
0,25€ / KWh
5Km/KWh



«misperception»

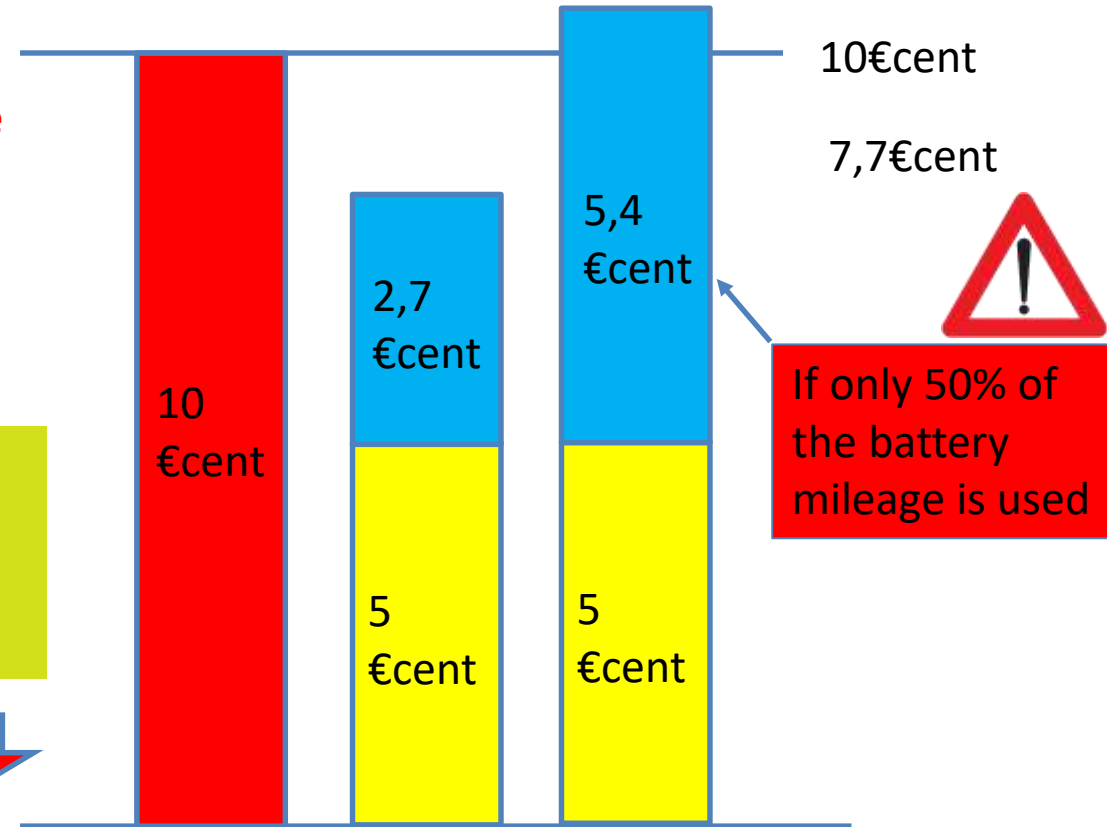
“BUT”#2: battery-pack (over)lifetime

The longer the range, the longer the lifetime
For a 1500 cycles battery : **200Km range = 300.000Km lifetime**

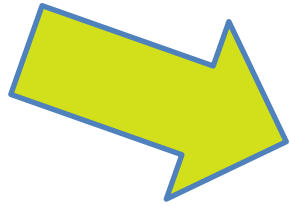


Realistic lifetime for a car with a range no larger than 150-200km

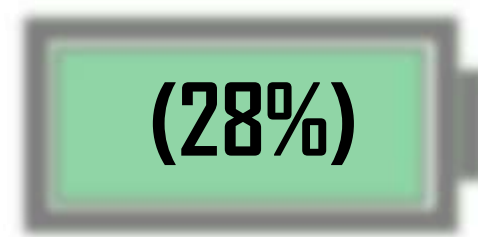
«misperception»



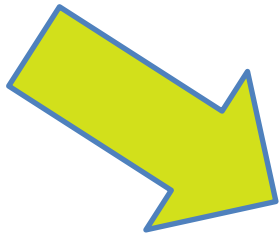
Evaluate User's suitability for 200km range EV: 28% ready for EV!



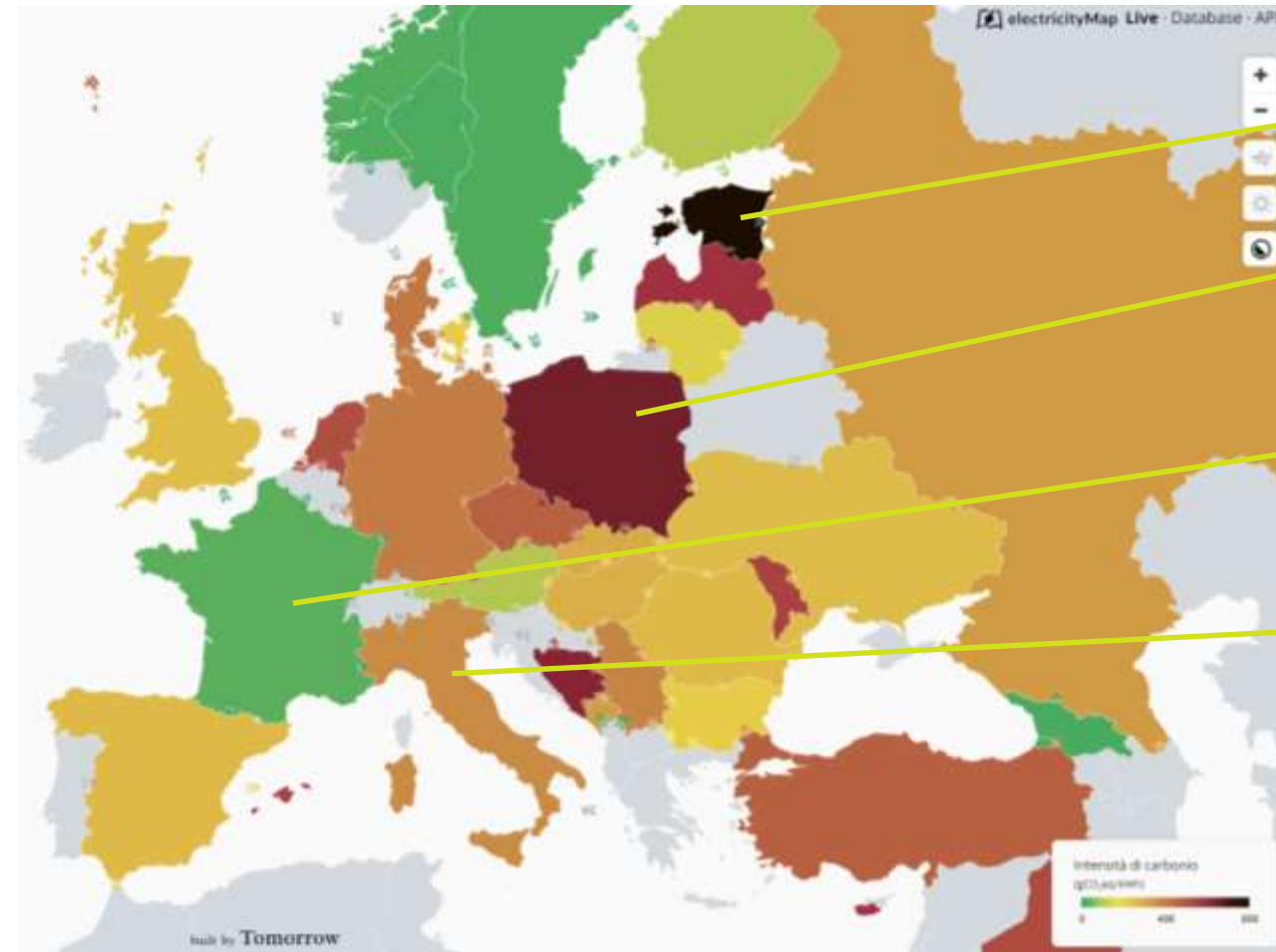
Perfectly Suitable for 200 Km range (never, during the year, more than 200K in a single day!!!):



- strong mis-perception of real **COST**
- strong mis-perception of **BATTERY LIFETIME**
- strong mis-perception of **RANGE** real NEED



Remark: the electricity production (snapshot on July 2nd 2108)



Estonia: **1176** g/kWh

Poland: 665 g/kWh

France: **51** g/kWh

Italy: **371** g/kWh

CO₂ footprint of an electric vehicle is strongly dependent on the electric-energy source; **EU not uniform; Italy still high**

The “rolling-chassis” trend



South Hall 2, booth 26030
Las Vegas Convention Center
January 7-10, 2020



ROBY
The Thinking Body of
Autonomous Vehicles

Gli «strati
tecnologici»
della nuova
industria
dell’auto e della
mobilità saranno
completamente
rivisti

Thanks for your attention



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