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ELECTRIC VEHICLE CHARGING: THE INFRASTUCTURE OF THE FUTURE

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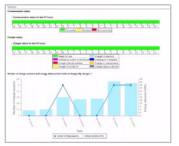
ABB EV Charging Infrastructure

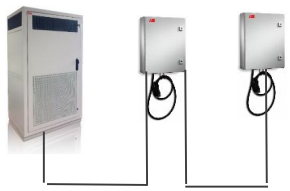
Connectivity — Remote diagnostics, service, connection to payment, API's



Car Charging → **Heavy Vehicle charging**

50kW All-in-one

50kW-150kW with sequential charging



150kW-350kW with liquid cooled cable

150kW-600kW with Automated Connection

Grid Integration — Compact substations, transformers, switchgear

Service & maintenance — Local service, spare parts, maintenance & 3rd party training

EV fast charging and global standardization

ABB leading in major developments this decade

CHAdeMO

2010
Founding of CHAdeMO
ABB was involved from the start

2010
Launch ABB Terra 51
50 kW CHAdeMO charger

2012
Founding of CCS alliance
ABB was involved from the start, basis for IEC standard

2013
Launch CCS & multi -standard Terra 53
CCS + CHAdeMO + AC

2013-2015
Launch global variants Terra 53
China, USA, APAC

2016
First eBus chargers in EU
Global partnerships with bus OEMs

2018
First eTruck chargers
Global partnerships with OEMs

CHAdeMO → CCS alliance → Multi -standard → E-bus → Higher power → Near future

Pilots → First EV's → IEC 61851-23 → Global EV spread → OppCharge → DC home

2010
First 50 kW charger in EU
Based on proprietary standard, no consumer EV's available

2010
First EV's with DC charging
Nissan Leaf & Mitsubishi iMieV

2012
First demo of CCS charging
ABB & CCS alliance at EVS26 Los Angeles, USA

2012 - 2013
First nationwide DC networks
ABB in Estonia, Denmark, Netherlands

2012, >
ABB leading Connectivity & uptime
ABB has industry leading uptime by remote mgmt

2014 - >
DC networks spread globally
Europe, USA, Asia

2017
Launch of high power for cars
150-350kW fast charging for next generation EV's

2018
Gen2 charge post and Terra 54HV
Next steps in High Voltage charging

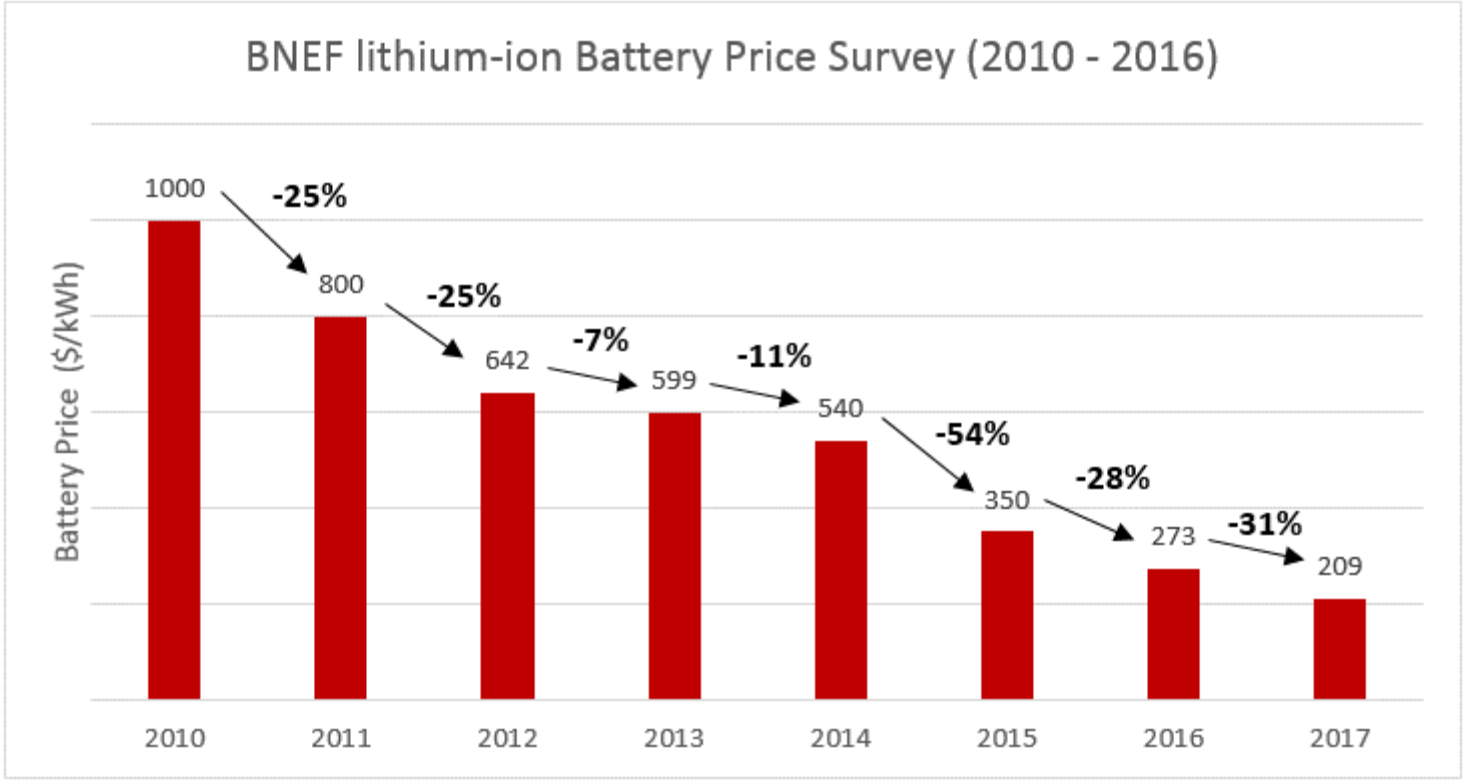
Major public DC charging infrastructure deployments

- **Ionity** - ultra -fast 150kW to 350kW charging stations across European highways
- **Electrify America** - ultra -fast 150kW to 350kW charging stations across USA
- **Electrify Canada** - ultra -fast 150kW to 350kW charging stations across Canada
- **Circuit électrique** – 1600 DC Fast Chargers in 10 years across Quebec

Electric Vehicle Charging

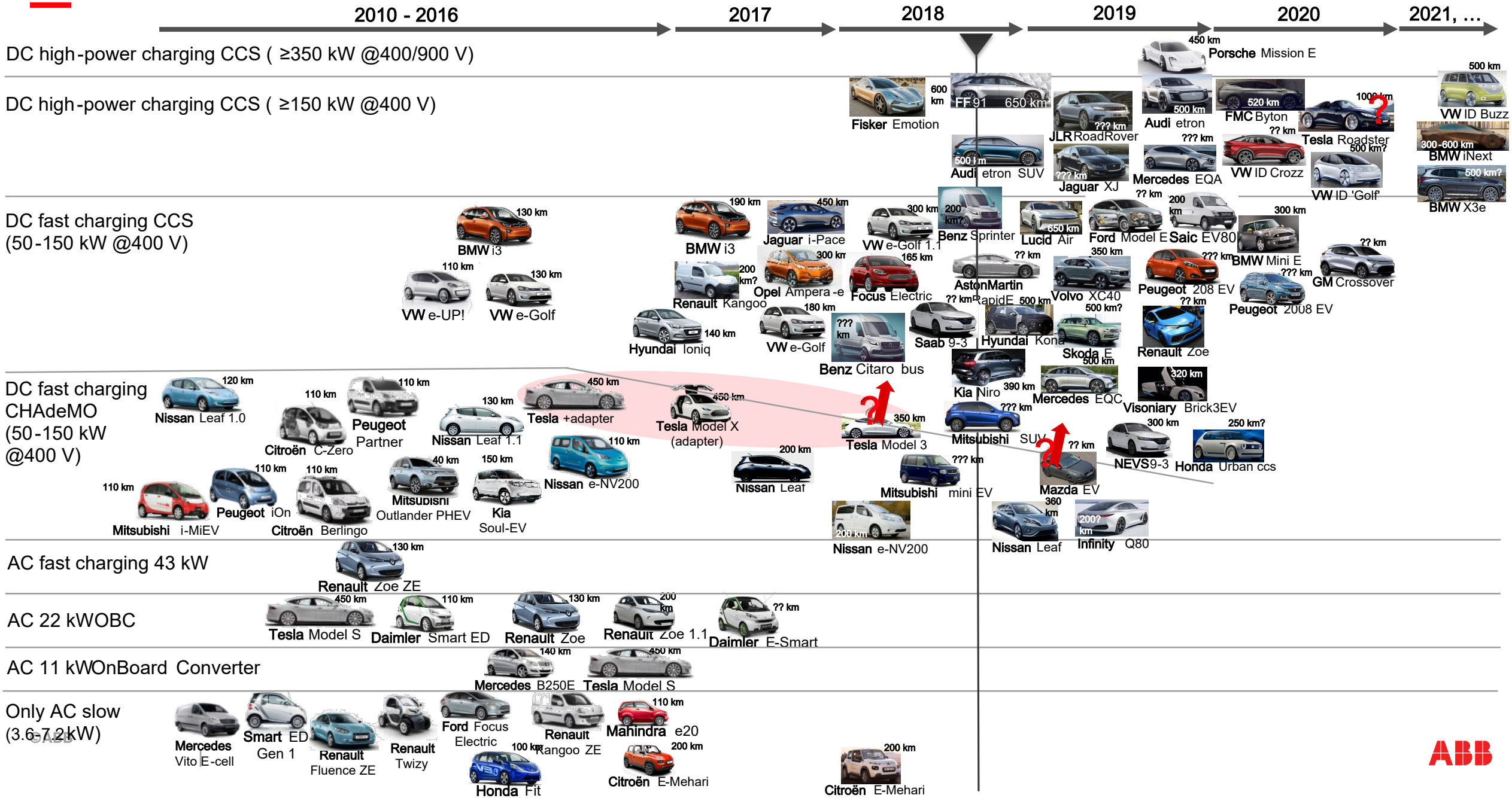
Battery Improvements - Driven by the car industry

- **Cost reduction** allowing a better market penetration
- Energy density improvement allowing now to answer customer needs for range by **increasing battery capacity** for same vehicle efficiency
- Tipping Point for EV adoption $100/kWh (est. 2025) electric vehicles reach unsubsidized upfront cost parity with fuel vehicle



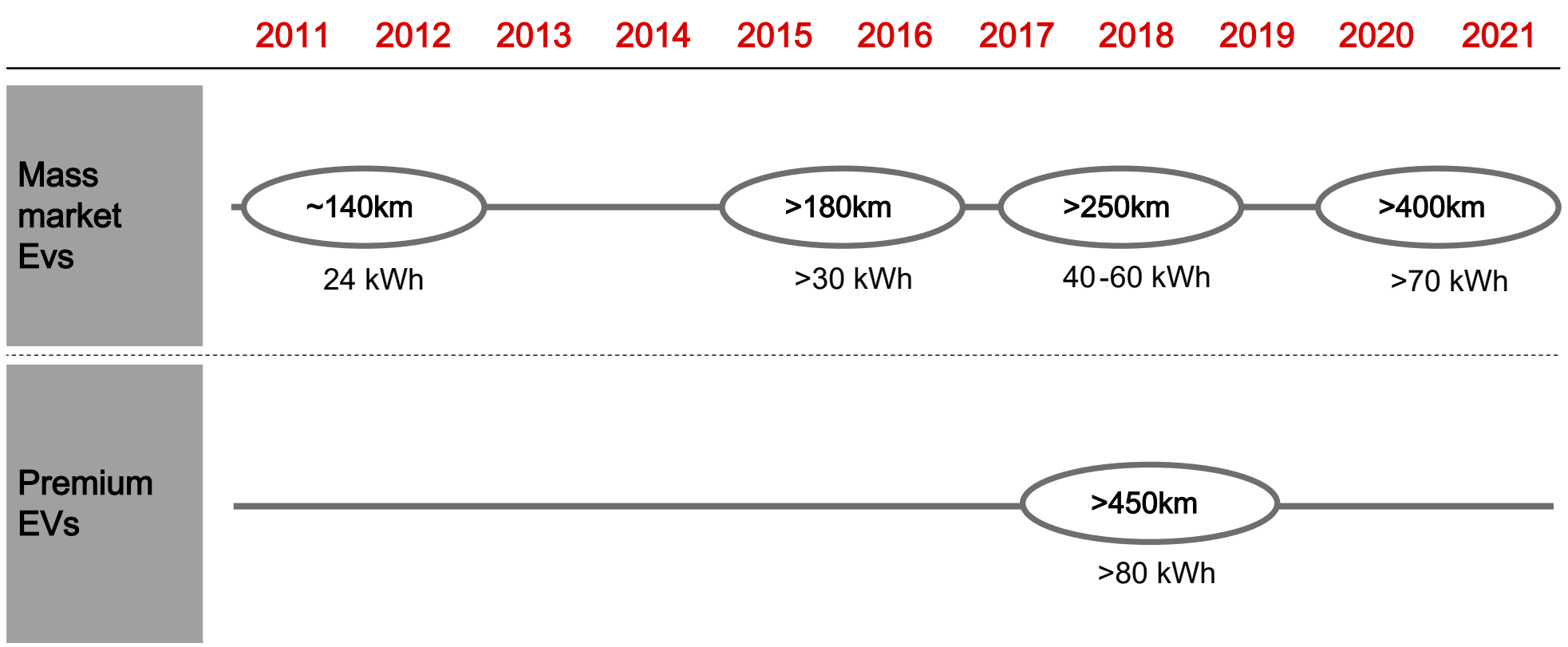
*Source Bloomberg New Energy Finance

Follow the car, and open standard protocols



Driver: The EV range roadmap

Batteries get bigger, range gets longer, DC Charging power increases in the coming years



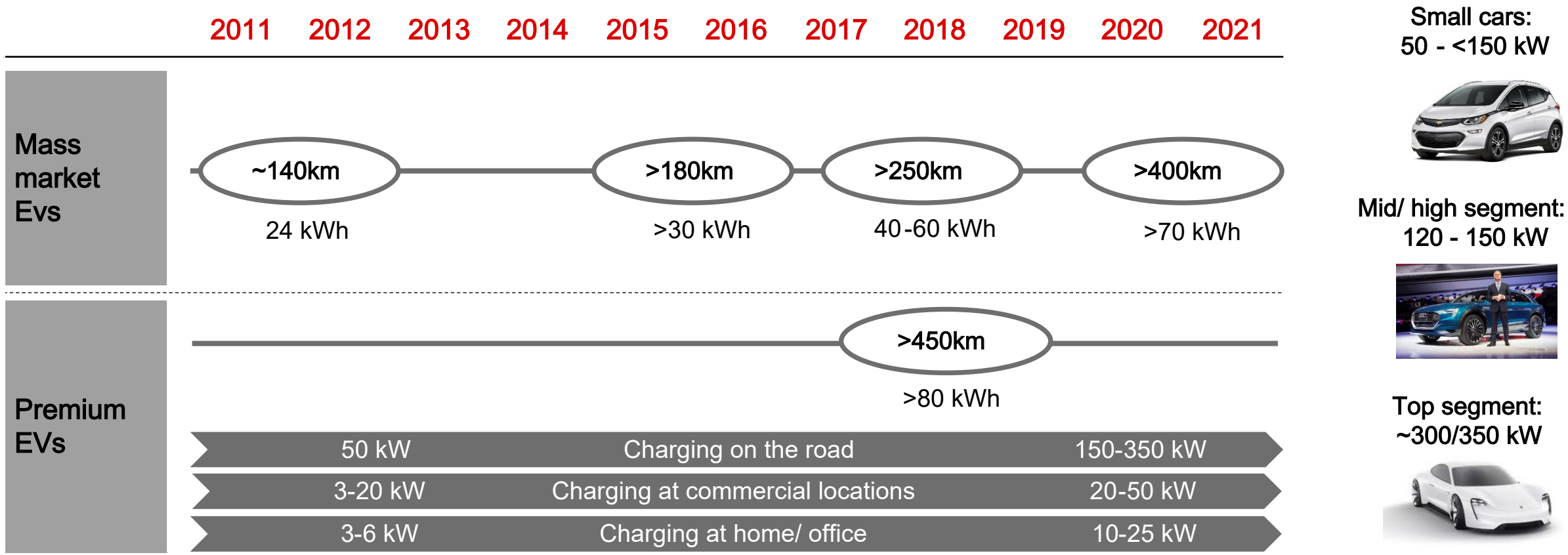
Small cars:
50 - <150 kW

Mid/ high segment:
120 - 150 kW

Top segment:
~300/350 kW

Driver: The EV range roadmap

Batteries get bigger, range gets longer



Considerations for electric charging needs of the future

- More electric vehicles on the road
  - Larger electric fleets
  - Other types of electric transport (long and short haul trucks, etc)
- Impacts on the grid
  - Demand response / Global adjustment
  - Energy storage, smart charging