BOSCH BARI

RB/GF 182 reviewed by Arvizzigno and Damiani on 25.08.2017

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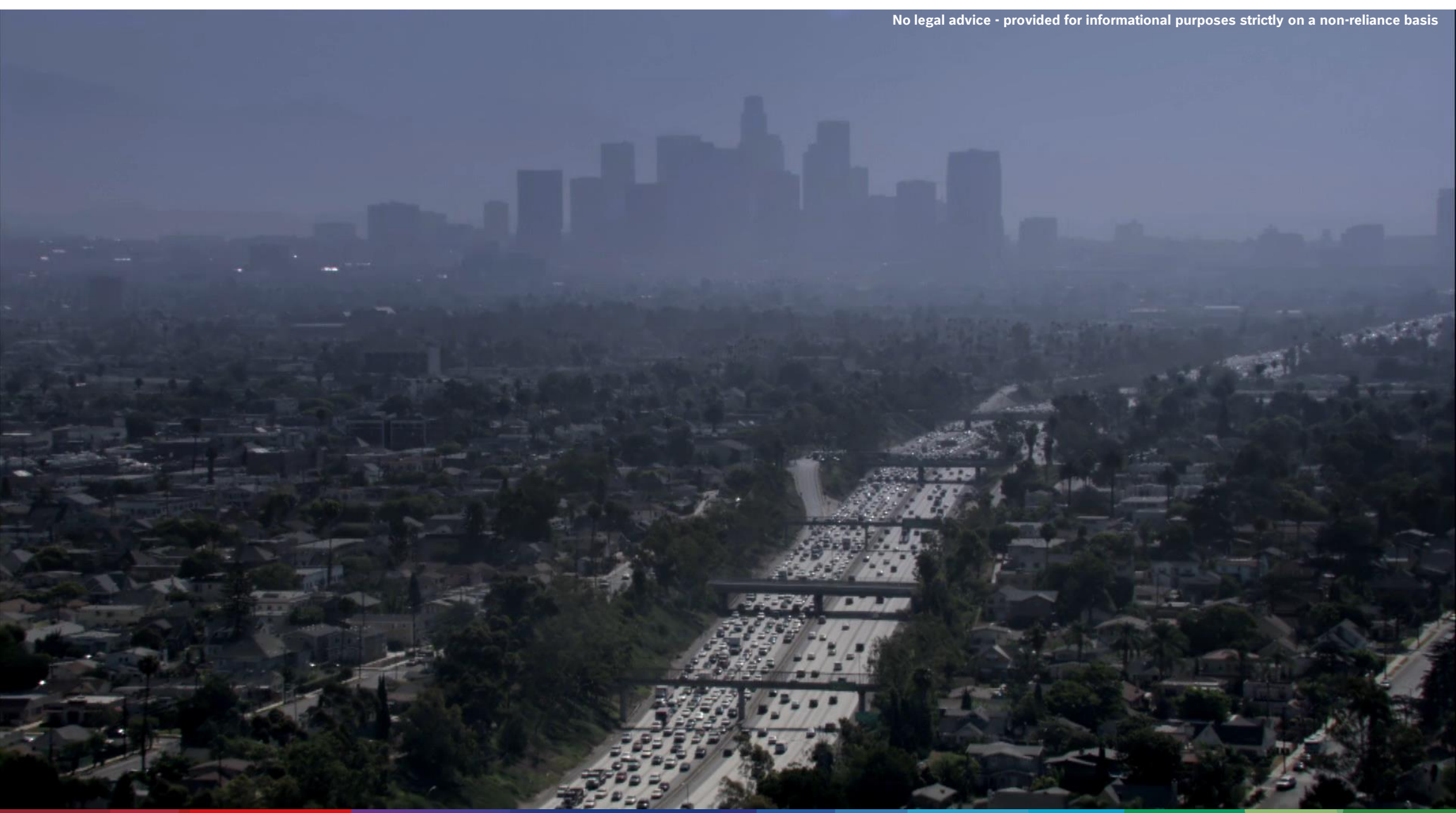


Mobility & Urbanisation - Cities of the Future

Three paths to the attractive and sustainable car of the future

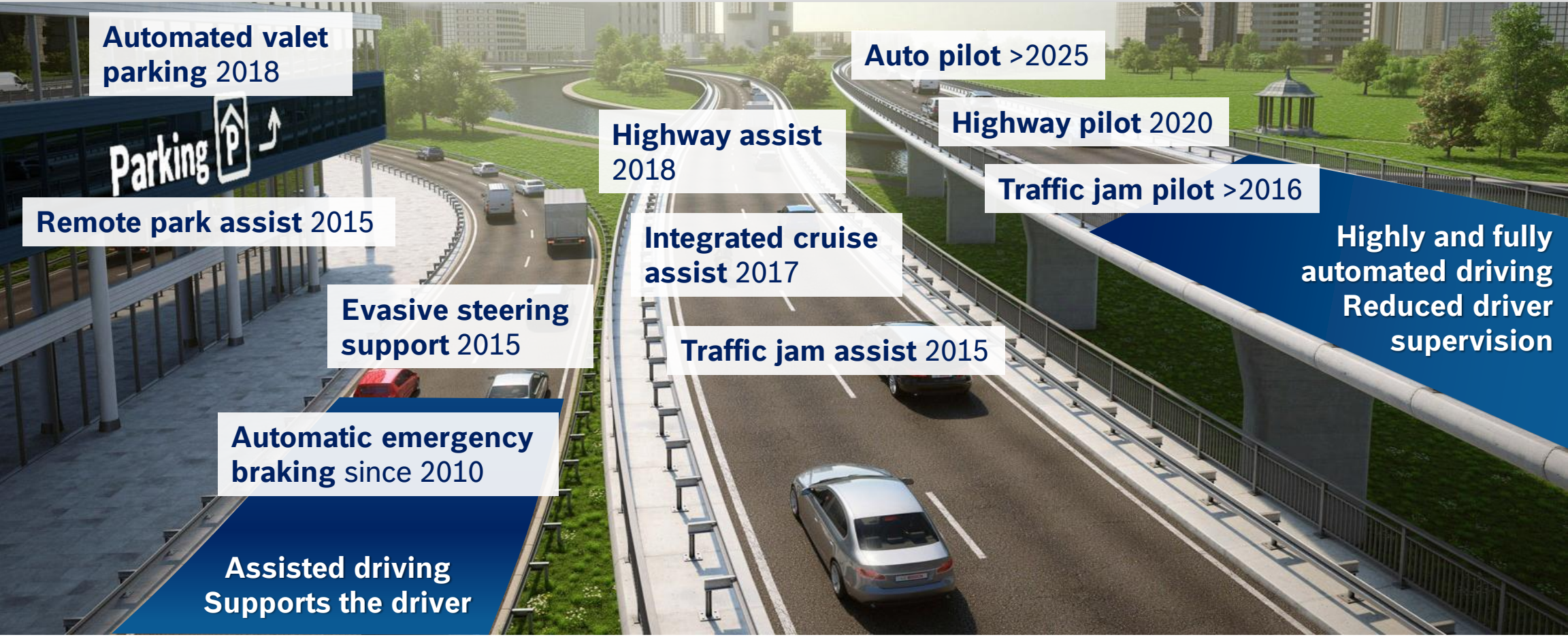
costs
hybrid
electric motor
roaming
power electronics
e-bike
electrified
range
driving enjoyment
charging infrastructure
market ramp-up
battery
e-scooter
smart charging
plug-in

legislation
assistance systems
emergency braking assistant
automated
auto pilot
highway pilot
sensors
redundancy
electric steering
valet parking
digital environment

augmented reality
electronic horizon
internet of things
smartphone integration
connected
vehicle to vehicle
cloud
vehicle to infrastructure
services
fleet management
entertainment
eCall

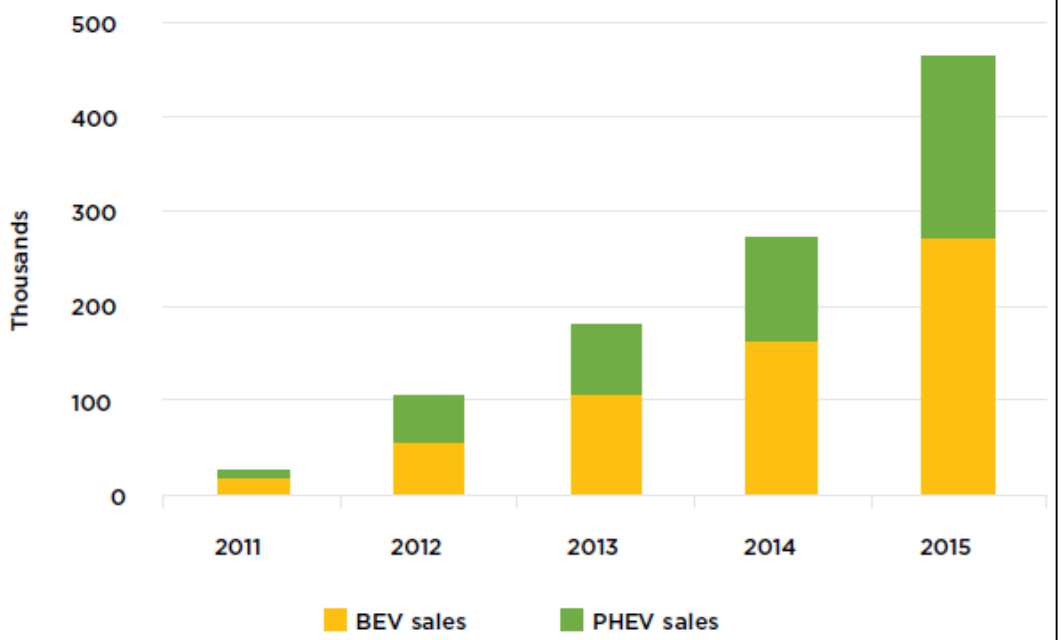
Mobility & Urbanisation - Cities of the Future

Autonomous driving: A revolution coming step by step



Electric Vehicles
Actual status of EV sales

Electric vehicle sales in world's eight largest markets, by type



Source: UC Davis market data

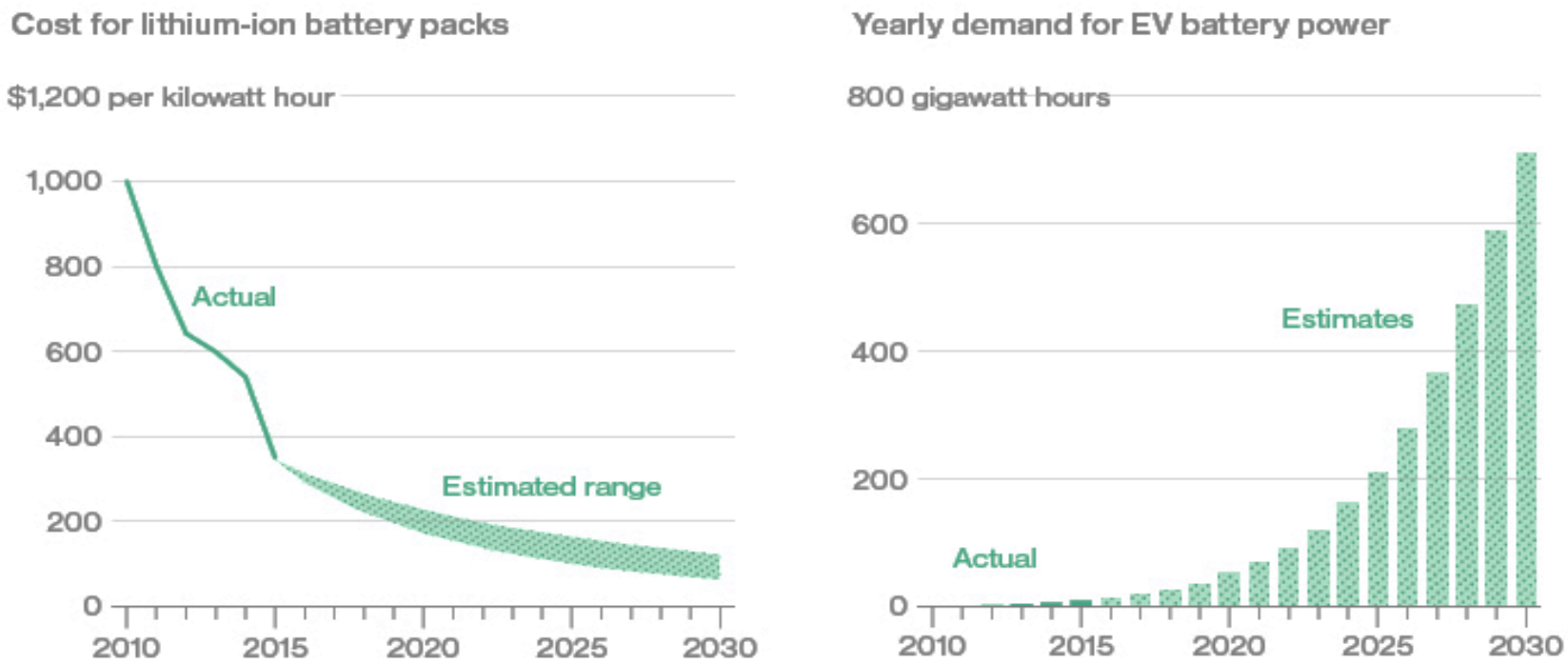
Global EV sales by country, 8 biggest markets

	Country	Est Total PEVs. Feb 2016	Est. PEV Sales 2015	PEVs as % of 2015 market	Total LDV market 2015
1	USA	>415 000	>115 000	0.6%	17 500 000
	California	>189 000	>62 000	3.1%	2 100 000
2	China	300 000	207 000	0.8 %	22 000 000
3	Japan (est)	150 000	25 000	>1.0 %	4 200 000
4	Netherlands	91 000	43 000	9.6%	420 000
5	Norway	90 000	34 000	>20%	170 000
6	France	>70 000	27 000	1.5%	2 000 000
7	Germany	>50 000	24 000	0.75%	3 500 000
8	UK (est)	>38 000	>28 000	>1.0%	2 700 000
	Europe		>193 000		
	World	>1 100 000	>450 000	0.5%	88 000 000

Source: UC Davis market data

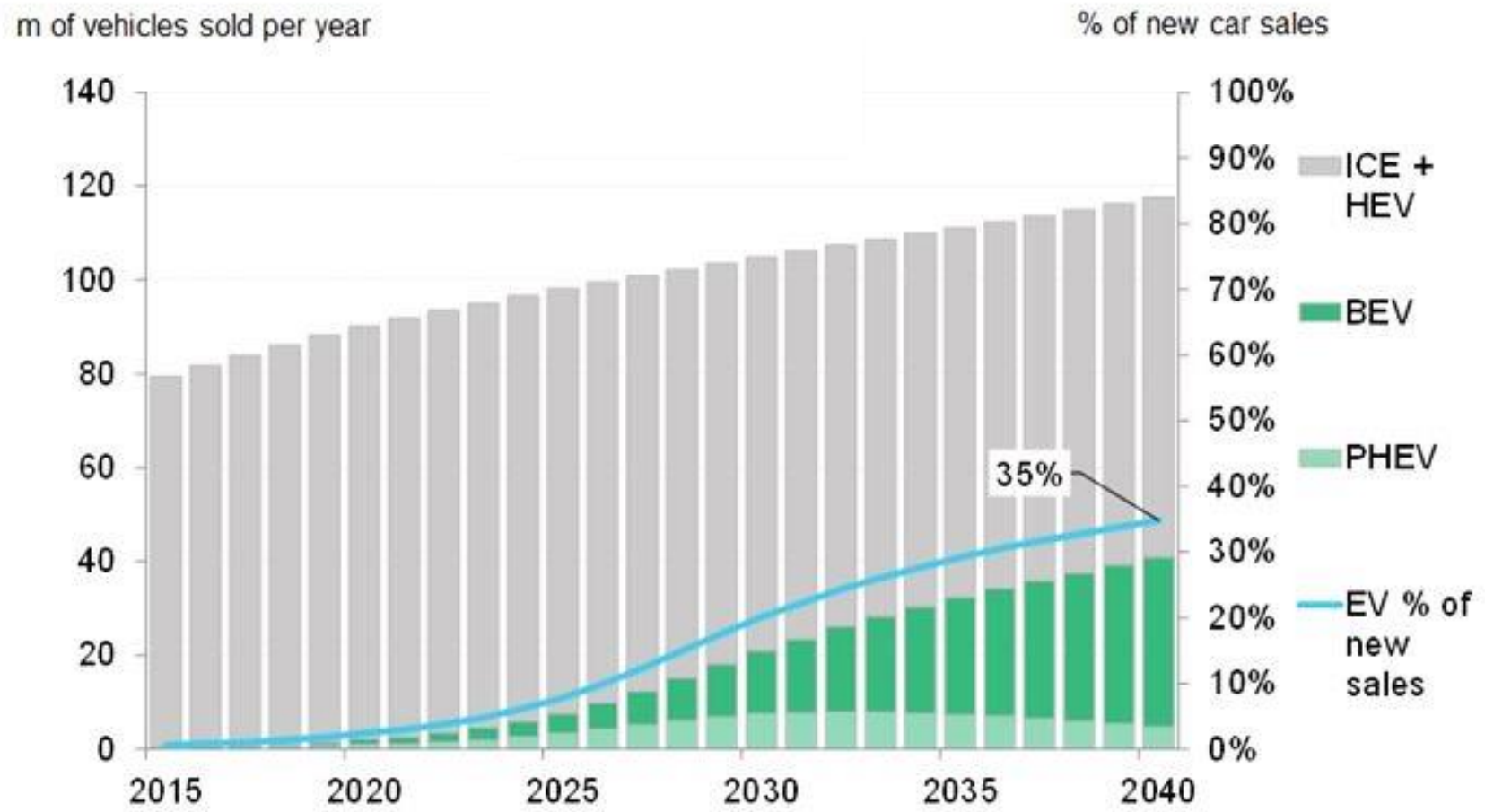
Behaviour of the battery cost

Batteries make up a third of the cost of an electric vehicle.
As battery costs continue to fall, demand for EVs will rise.



Source: Data compiled by Bloomberg New Energy Finance

Market forecast for Electric Vehicles



[Source: Bloomerg New Energy Finance]

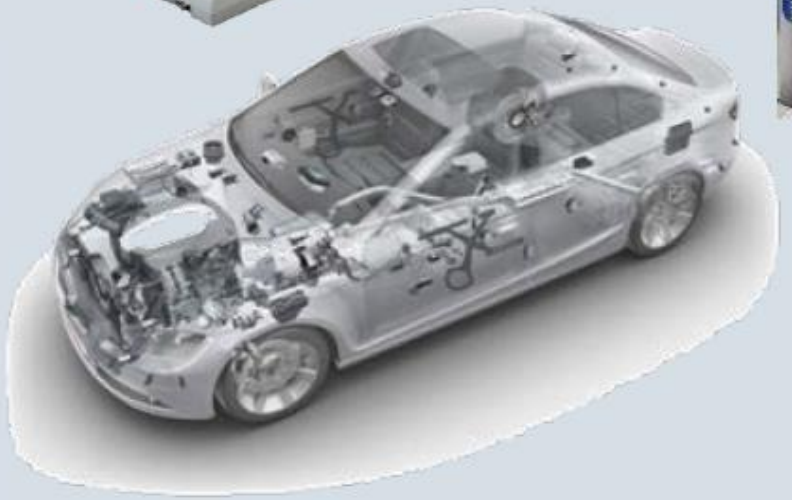
Electrification Activities of Bosch group

Drives for e-bikes

Electrical drives for passenger cars Hybrids, Plug-in & EV

Hydraulic hybrid system & electrical drives for commercial vehicles

Battery systems



Starters and generators for Start/Stop Systems

Aftermarket

Recuperative braking systems

Navigation systems

Chargers for EV / PHEV

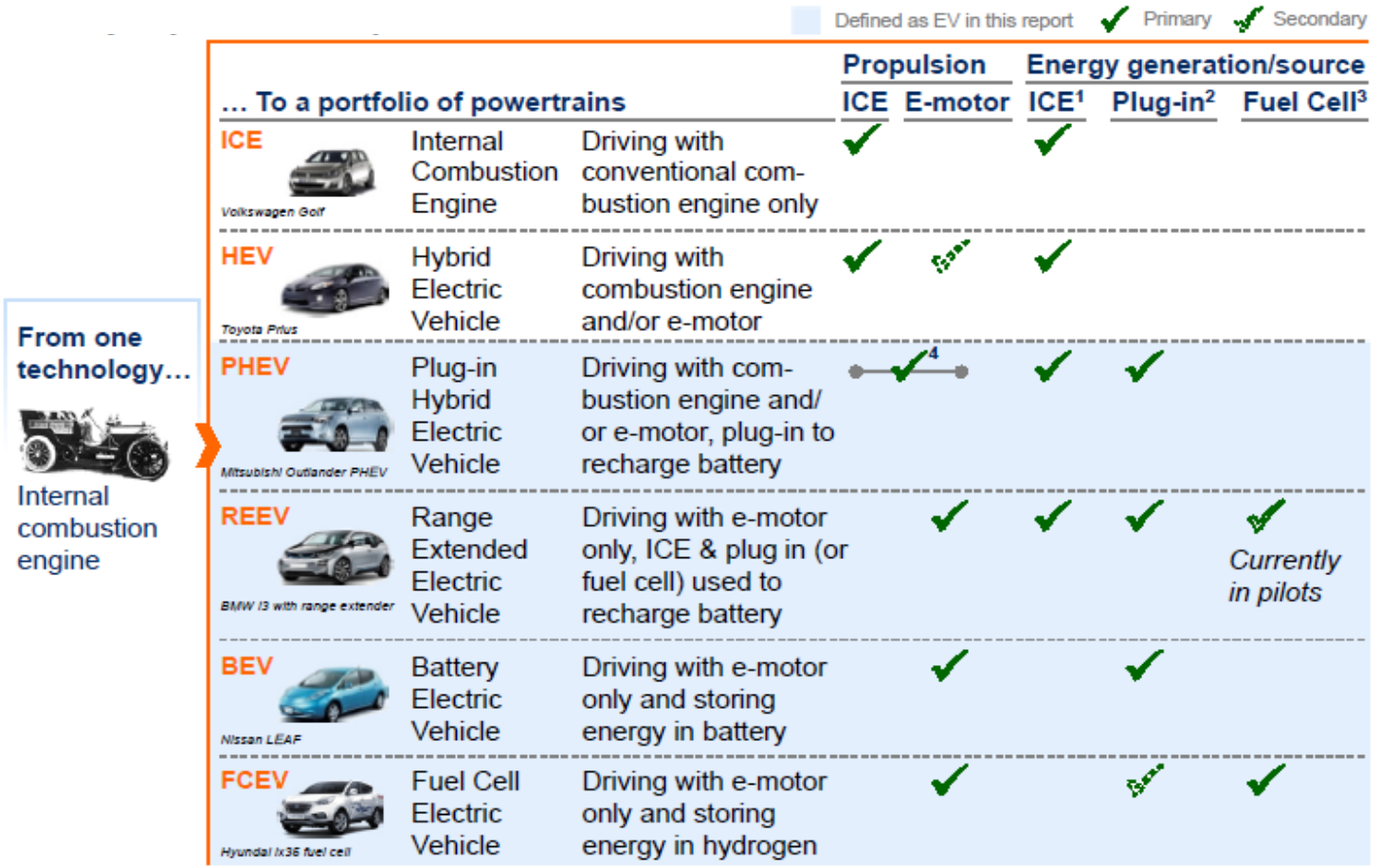
Charging stations for electric vehicles

Software for infra-structure integration

Research and pre-development for future electrical vehicle concepts

BOSCH

Today's Powertrain portfolio



1 In HEV, PHEV and REEV, energy is also generated through regenerative braking 2 To charge battery
3 Usually generates electricity that directly powers drivetrain; alternative concepts in discussion (e.g. fuel cell as range extender or FCEV with plug-in)
4 Primacy of ICE or E-motor in PHEV varies across models
SOURCE: McKinsey

Bosch Bari | Site presentation
CVIT Overview

Bosch Bari CVIT

Company: Centro Studi Componenti per Veicoli S.p.A.

Division: DS-B2

Business: Platform development
Plant Support ww for Common Rail High Pressure Pump
Research & Calibration on engine and Vehicles

Revenues: 30 mio Eur (FY 2015)
~ 220 patents (until 2015)

Employees: 269 (Status 01.01.2016)
80% graduated, 25% female

History

1985: Start of research activities

1988: First vehicle FIAT CROMA

1997: SOP CR system PC

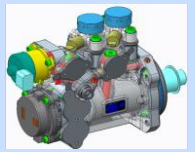
1999: Development start CP for CV

2003: First calibration project for Fiat 16

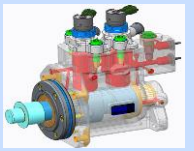
2015: Start new building

2016: Full responsibilities CP for CV

Pump Development



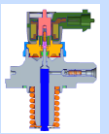
CPN6 DAI



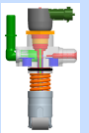
CPN6 oil

CPN6 fuel

CP4 2nd Gen.



CP4i



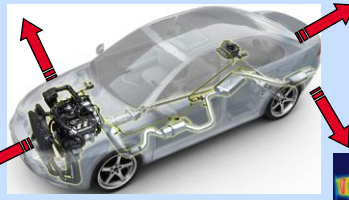
CP4 27/30

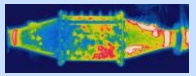
Research & Application

Diesel Combustion optimization

DeNOx Calibration

Electronic unit for engine control





Strategy for DPF Regeneration

Electrified Vehicles using Bosch Products *extract*

PSA 3800 SHEV

BMW Hybrid 5/ 3 SHEV

PAG Cayenne S/PHEV

Volvo V60 PHEV

Porsche Panamera PHEV

Daimler S- class PHEV

BMW i3 EV@ **REX**

SAIC EP11 **EV**

VW Golf **EV**

VW up **EV**

Smart **EV**

Chrysler F500 **EV**

Bosch worldwide experience in powertrain electrification