

LEONI

Harness Market Teach-in

April 8th, 2019

Research & Development
Wiring Systems Division



LEONI

Agenda

1

- › Brief intro to wiring harnesses and car types

2

- › We see five key trends impacting our market

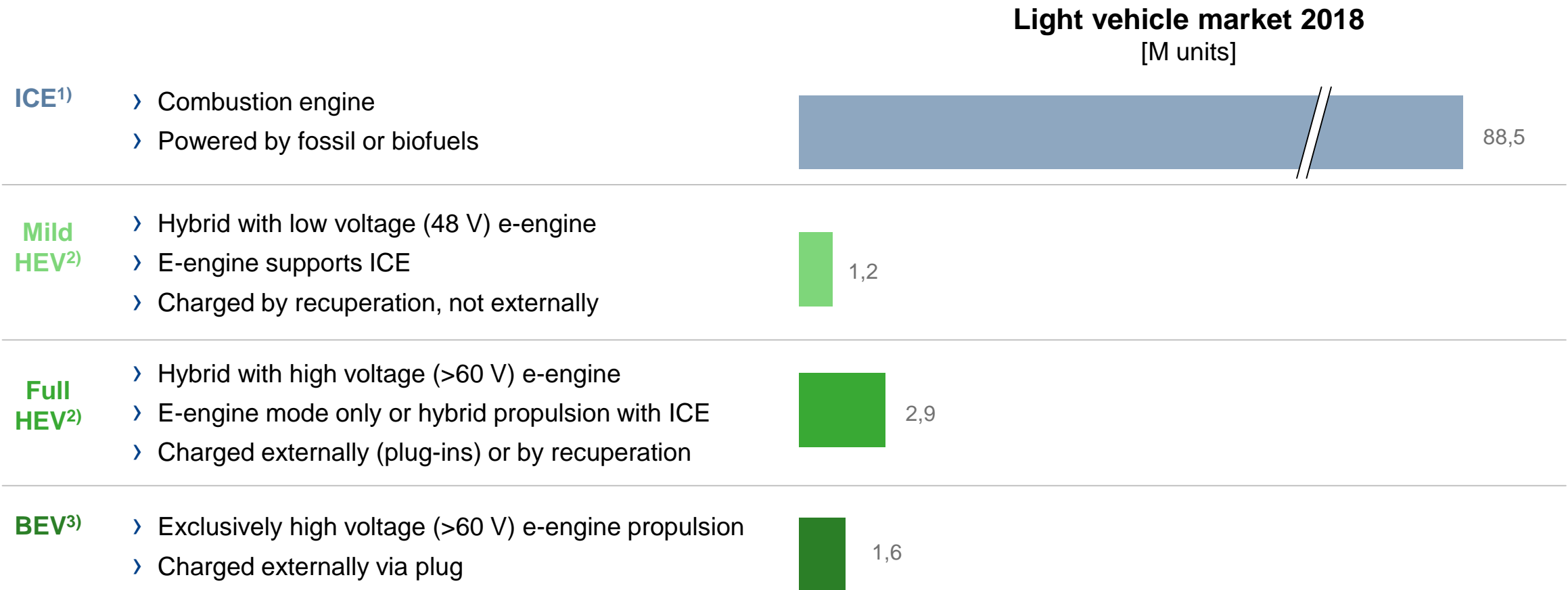
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- › Our view on the future wiring harness market and the LEONI positioning

4

- › Let's discuss – Q&A

Cars fall into four categories based on their type of propulsion



¹⁾Internal Combustion Engine ²⁾Hybrid Electric Vehicle ³⁾Battery Electric Vehicle
Source: IHS Light Vehicle Overview & IHS Alternative Propulsion Report, February 2019 (Fuel cell vehicles excluded)

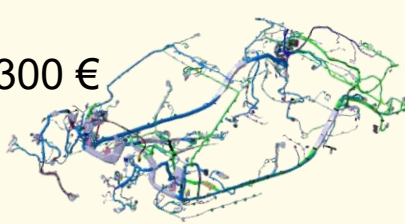
Each car type has multiple low and high voltage harness components to meet the vehicle's energy and data needs

Low voltage harness (<60 V)

Energy and data wiring for all electrical components with low to intermediate¹⁾ power consumption

› Main

~100 – 300 €



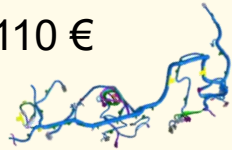
› Auxiliaries²⁾

~45 – 90 €



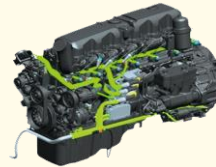
› Cockpit³⁾

~90 – 110 €



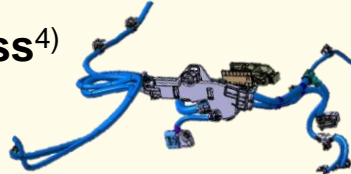
› ICE harness

~40 – 55 €



› E-motor harness⁴⁾

~15 – 80 €

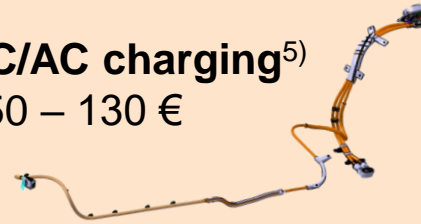


High voltage harness (>60 V)

Wiring for HV-battery, charging and e-engine with high power consumption

› DC/AC charging⁵⁾

~50 – 130 €



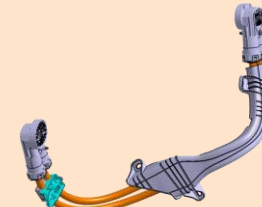
› HV auxiliaries

~40 – 70 €



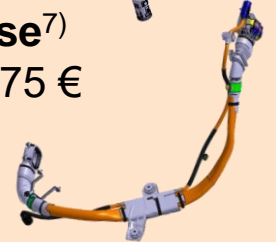
› Traction⁶⁾

~40 – 130 €



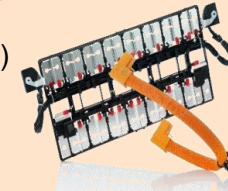
› 3-Phase⁷⁾

~60 – 75 €



› Battery harness⁸⁾

Price depending on final product



¹⁾E.g. lighting, motor control, entertainment, HVAC ²⁾Door harness shown ³⁾Incl. audio harness ⁴⁾Upper price incl. control unit in PHEVs, lower price for single axle propulsion ⁵⁾Lower price only AC charging ⁶⁾BEV variant shown ⁷⁾PHEV variant shown ⁸⁾DIEHL cooperation, in development; Note: Prices across B to D automotive segments; Source: LEONI WSD business units

Type of required harness is dependent on level of vehicle electrification

	Main	Cockpit	Auxiliaries	ICE harness	E-motor harness	DC/AC charging	HV auxiliaries	Traction	3-Phase	Battery harness	
	Low voltage harness (<60 V)				High voltage harness (>60 V)						Typical price ¹⁾
ICE	✓	✓	✓	✓	●	●	●	●	●	●	~270 – 540 €
Mild HEV	✓	✓	✓	✓	✓	●	●	●	●	●	~330 – 620 €
Full HEV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~550 – 870 €
BEV	✓	✓	✓	●	✓	✓	✓	✓	✓	✓	~620 – 900 €

¹⁾2018 prices across B to D automotive segments, battery harness not included
Source: LEONI WSD business units

What's to keep in mind about the wiring harness business?



- › Flawless logistics and customer proximity
- › Tailor-made, customer-specific product
- › High degree of manual work, increasing chances for automation
- › High need for project and production experience
- › No further scale effects beyond certain size
- › Design by OEM in the past, now increasingly by Tier 1

Source: LEONI WSD and CS

5 key trends with overall positive effect on harness market value



E-mobility

BEVs¹⁾ and hybrid vehicles to take over market in 2030 with ~50% more content than ICEs



Autonomous driving

Multitude of additional sensors requiring redundant and highly reliable data & energy connectivity



New functionalities

Increased comfort features (e.g. chassis functions or entertainment) and OTA²⁾ feature activation



Simplified high voltage architecture

Simplification of early-stage HV³⁾ design opposed by extension into battery harnesses & added HV features



New E/E⁴⁾ architecture

Simplified architecture with reduced number of ECUs, screen-based driver controls

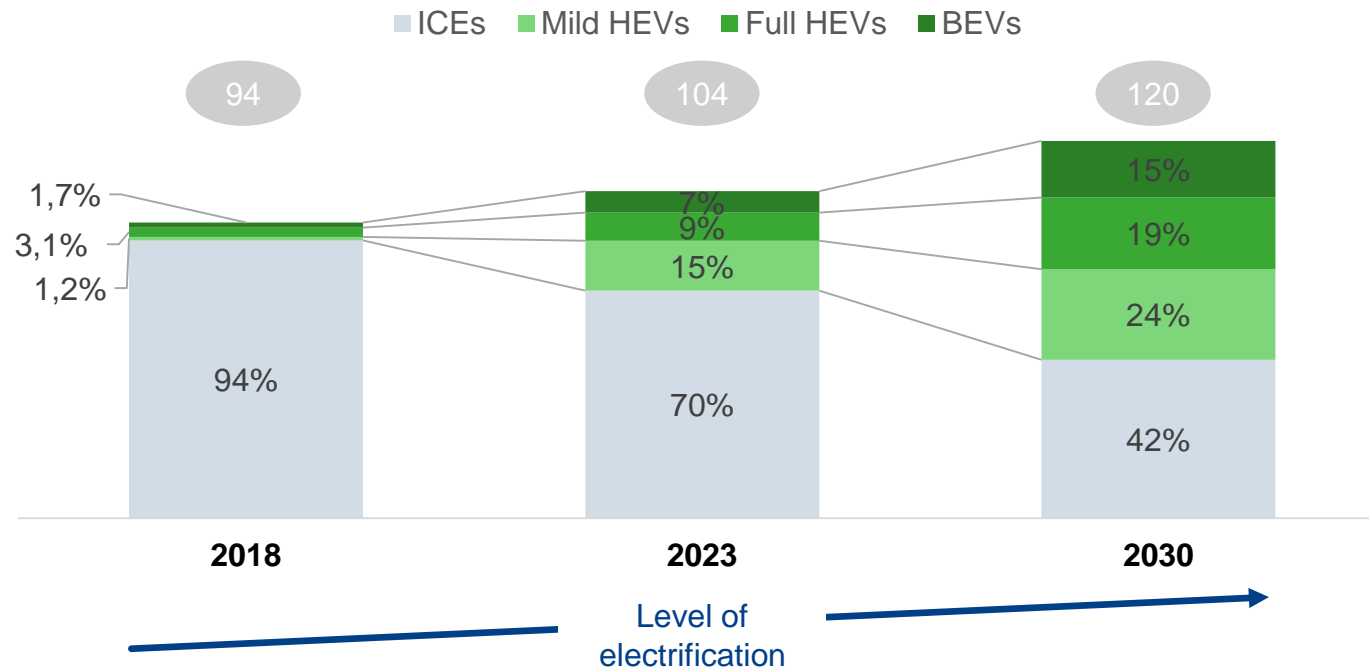
● Increase in content ● Both increase and reduction ● Reduction in content

¹⁾Battery Electric Vehicles ²⁾Over-the-air ³⁾High voltage ⁴⁾Electric/Electronic
Source: LEONI WSD R&D and CS

Electric cars expected to strongly grow in coming decade with HEVs in the lead over BEVs

1

Light vehicle market
[M units]



- › Shift from lower content combustion engine vehicles to higher content hybrids and BEVs
- › High voltage harnesses with strong growth over coming decade
- › Higher EV content and volumes to counter harness simplifications and price decline

Note: Percentages may deviate from 100% due to rounding differences

Source: IHS Light Vehicle Overview & IHS Alternative Propulsion Report, February 2019 (Fuel cell vehicles excluded)

Autonomous driving to lead to increased number of sensors that require robust and redundant energy and data connectivity

2

	Autonomous driving level	Cars in 2030	Number of sensors	Need for redundancy
Level 5	Hands off, driver off, no more steering by driver	~ 2%	25	
Level 4	Hands off, mind off, human steering possible if desired	~ 4%	22	
Level 3	Hands off, eyes off, driver needs to stay vigilant for take over	~ 8%	13	
2+ Level	Driver's hands off for longer periods, monitoring of driver (enhanced level 2)	~ 40%	10	
2	Driver's hands temporarily off, continuous vigilance			
Level 1	Driver steering with lateral or longitudinal assistance	~ 23%		
Level 0	Driver fully in charge, no automation	~ 24%		

Note: Percentages do not sum to 100% due to rounding differences
 Source: Qube, LEONI TC EDS and R&D

Additional functionalities through comfort and activatable features

3

Comfort features

- › Complex chassis functions for ride
- › High power demand

>> Increase in harness content

- › New interior for entertainment
- › High data demand

>> Increase in harness content and requirements

**Driving
Experience
(comfort &
on-demand)**

Activatable features

- › New OEM business models for shared mobility or premium
- › Pay-per-use / subscription / FOTA¹⁾ with recurring sales for customer/OEM
- › All functions integrated from start with activation on-demand

>> 100% harness content build-in for all functionalities

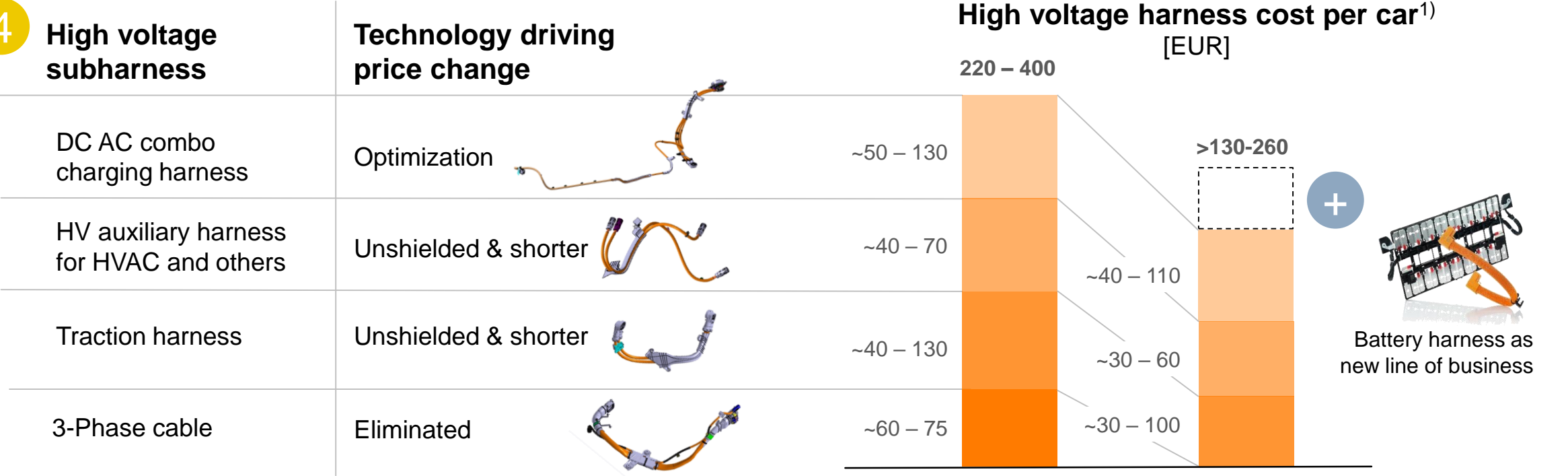
>> Additional requirements on data infrastructure




More wiring harness content for power and data to enable new on-demand services

¹⁾Function over-the-air
Source: LEONI WSD R&D

Evolverment of high voltage harness





High voltage harness with price decline, yet additional features (e.g. 4-wheel drive, inductive charging) and extension into battery harness to increase LEONI content

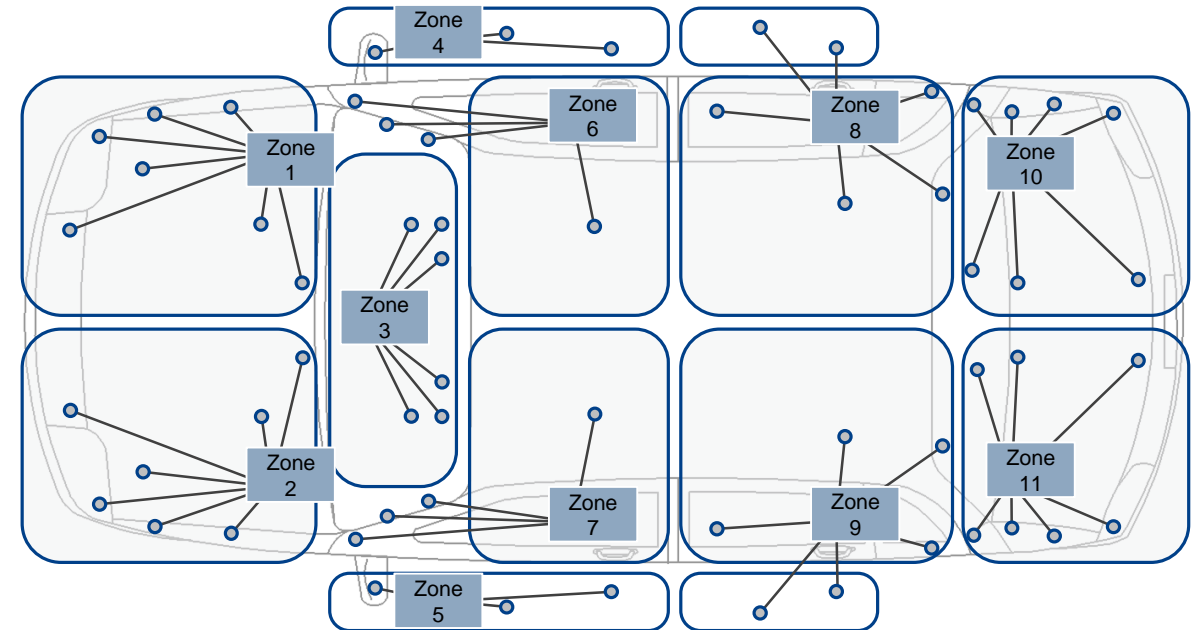
¹⁾Ranges covering both BEVs and HEVs across automotive segments B to D; sums of subharnesses deviate from overall price ranges as these are based on specific subharness combinations, i.e. lowest/highest cost per subharness does not necessarily yield lowest/highest cost of overall harness
Source: LEONI WSD R&D, EMO and business units

New low voltage E/E architecture and radical simplifications

5

Key trends will demand new E/E architecture

- › Integration of high performance ECUs and zonal approach
- › Zonal control units to substitute function/domain control units
- › Centralized computing, enabled by high speed data distribution
- › Fibre optic data backbone to partly substitute copper
- › Centralized MMI¹⁾ to decrease switches and wire content
- › Overall reduction of harness complexity
- › Harness zones as an enabler of automation



Zonal approach



New architectures and simplifications open up opportunities in streamlined production, increased automation, and simplified logistics

¹⁾Man-machine-interface
Source: LEONI WSD R&D

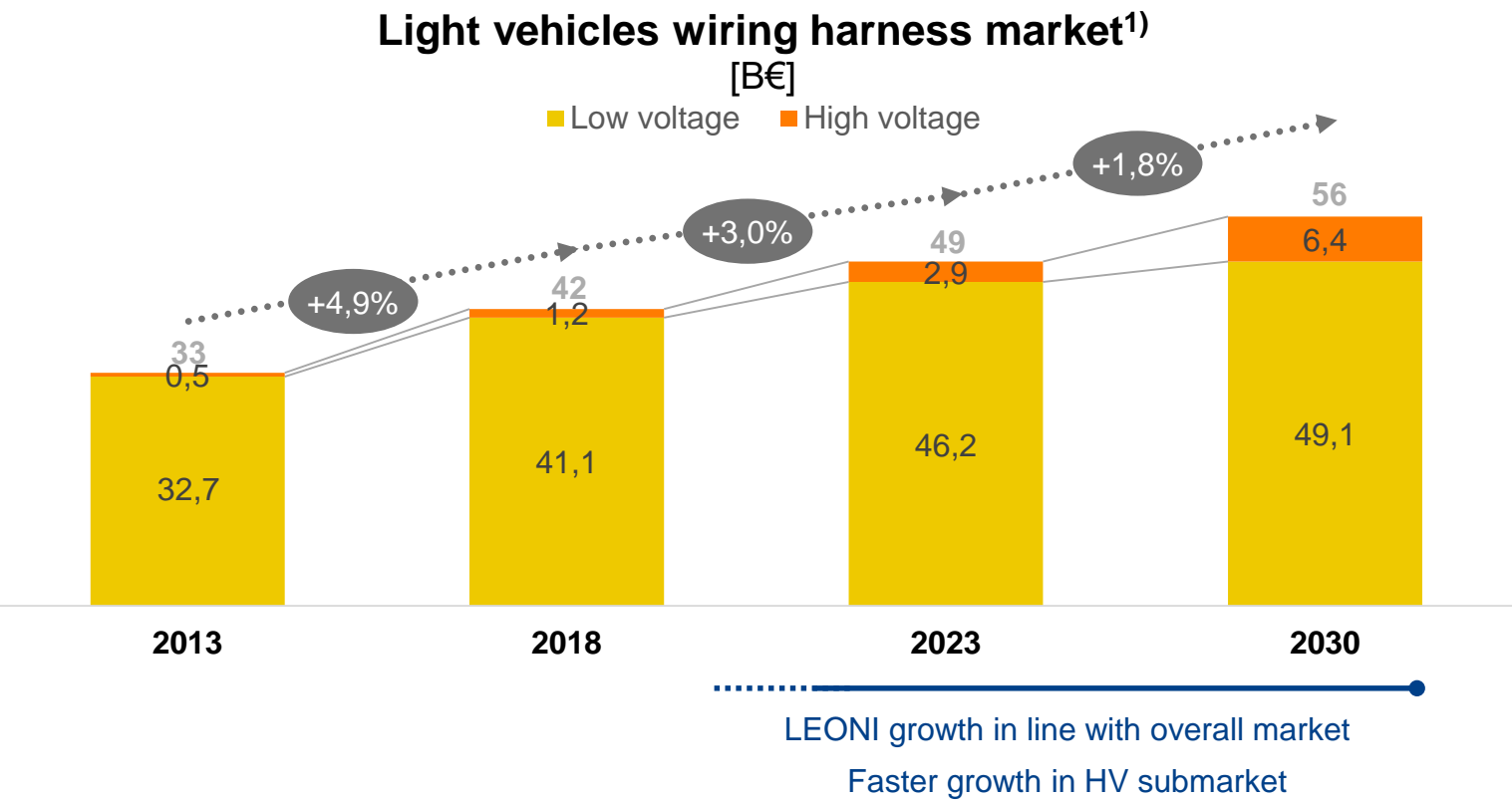
Despite price pressure, average harness cost stabilized by shift towards e-mobility

	2018	2030
Volume-weighted ø	450 €	460 €
ICE	~270 – 540 €	~240 – 470 €
Mild HEV	~330 – 620 €	~300 – 550 €
Full HEV	~550 – 870 €	~420 – 670 €
BEV	~620 – 900 €	~460 – 670 €



Source: LEONI WSD and CS wiring harness market model

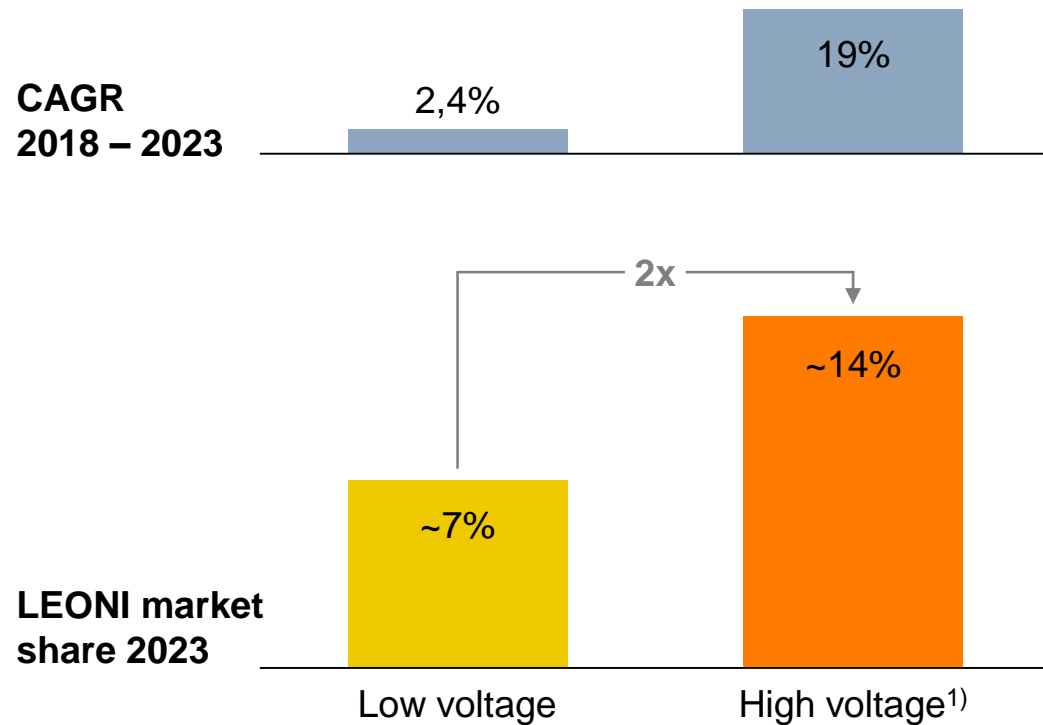
Harness market with ongoing robust growth into 2030 expected



› LEONI to be highly selective towards new business and to grow in line with market in the future

¹⁾Excluding commercial vehicles (CV), including both low voltage and high voltage components for light vehicles, excluding HV battery harness and FINA / electronics
Source: LEONI WSD and CS wiring harness market model

LEONI WSD well positioned for e-mobility transition with upcoming customer projects in 2023

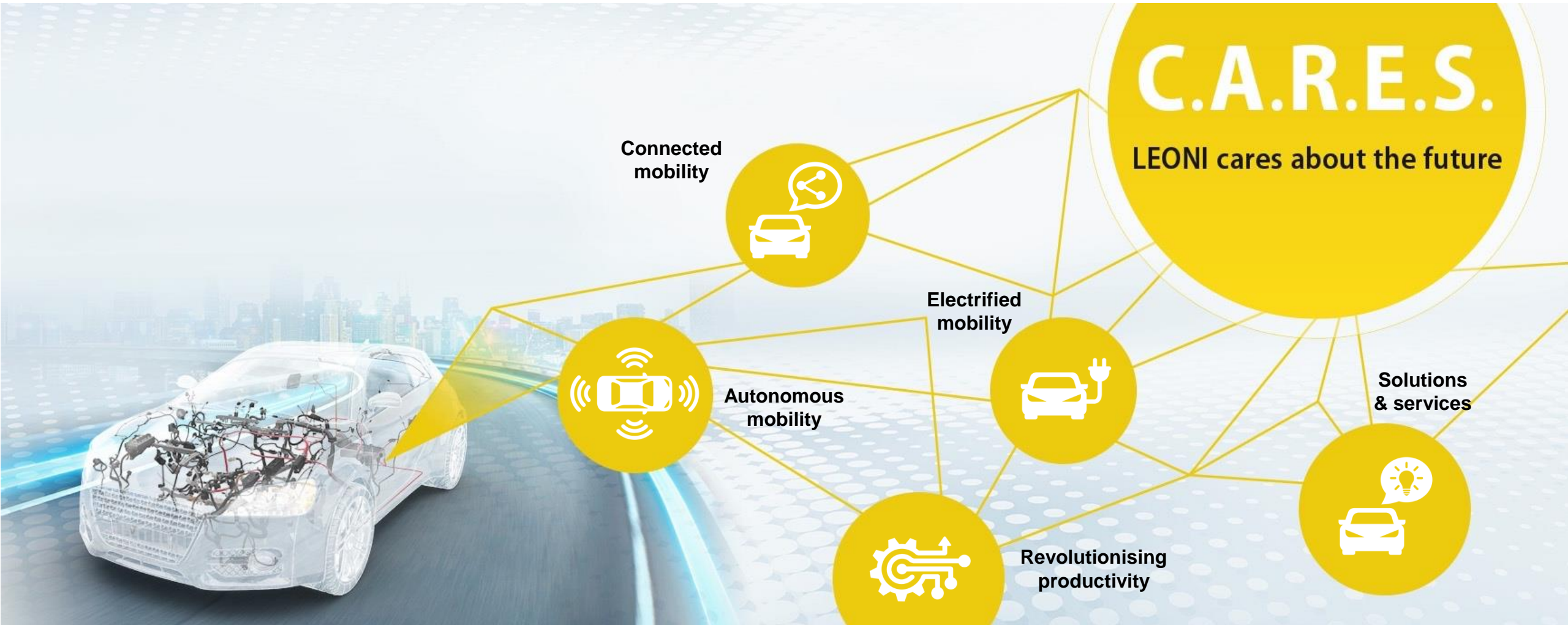


- › High voltage business to grow significantly stronger than low voltage business
- › LEONI strongly positioned for upcoming high voltage business based on order book
- › Expected market share in high voltage segment twice as large as in low voltage segment

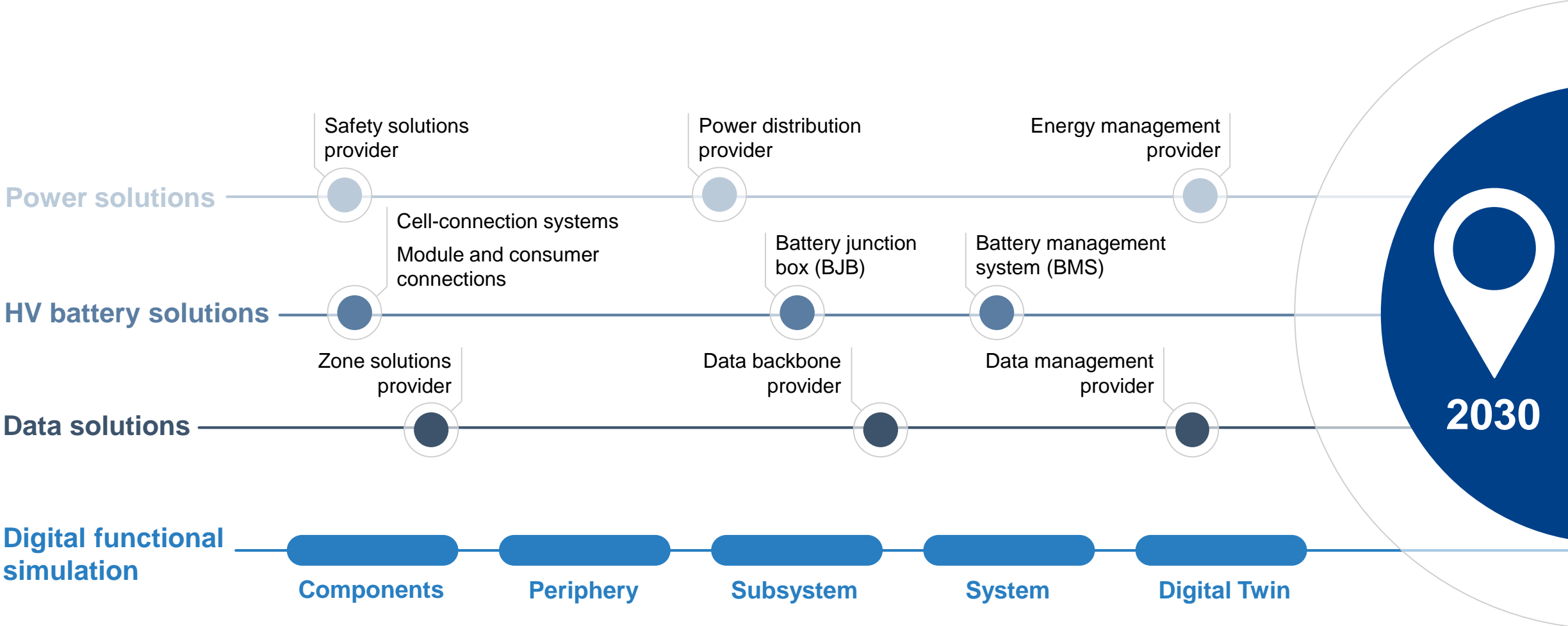
¹⁾HV content in BEVs/Full hybrids

Source: LEONI WSD TC EMO, WSD and CS wiring harness market model

Wrap-up: LEONI's core innovation fields for intelligent energy and data solutions for the car of the future



LEONI's path to become a solutions provider until 2030



Source: LEONI WSD R&D

Contact

Your contact



Your Contact

- › Corporate Press Officer
- › Investor Relations

Sven Schmidt
Frank Steinhart

- › Address

Marienstrasse 7
90402 Nuremberg
Germany

- › Phone
- › Fax

+49 911 2023-467 / 203
+49 911 2023-10467

- › E-mail

presse@leoni.com
invest@leoni.com

- › Homepage

www.leoni.com