CEC VGI F2F Meeting

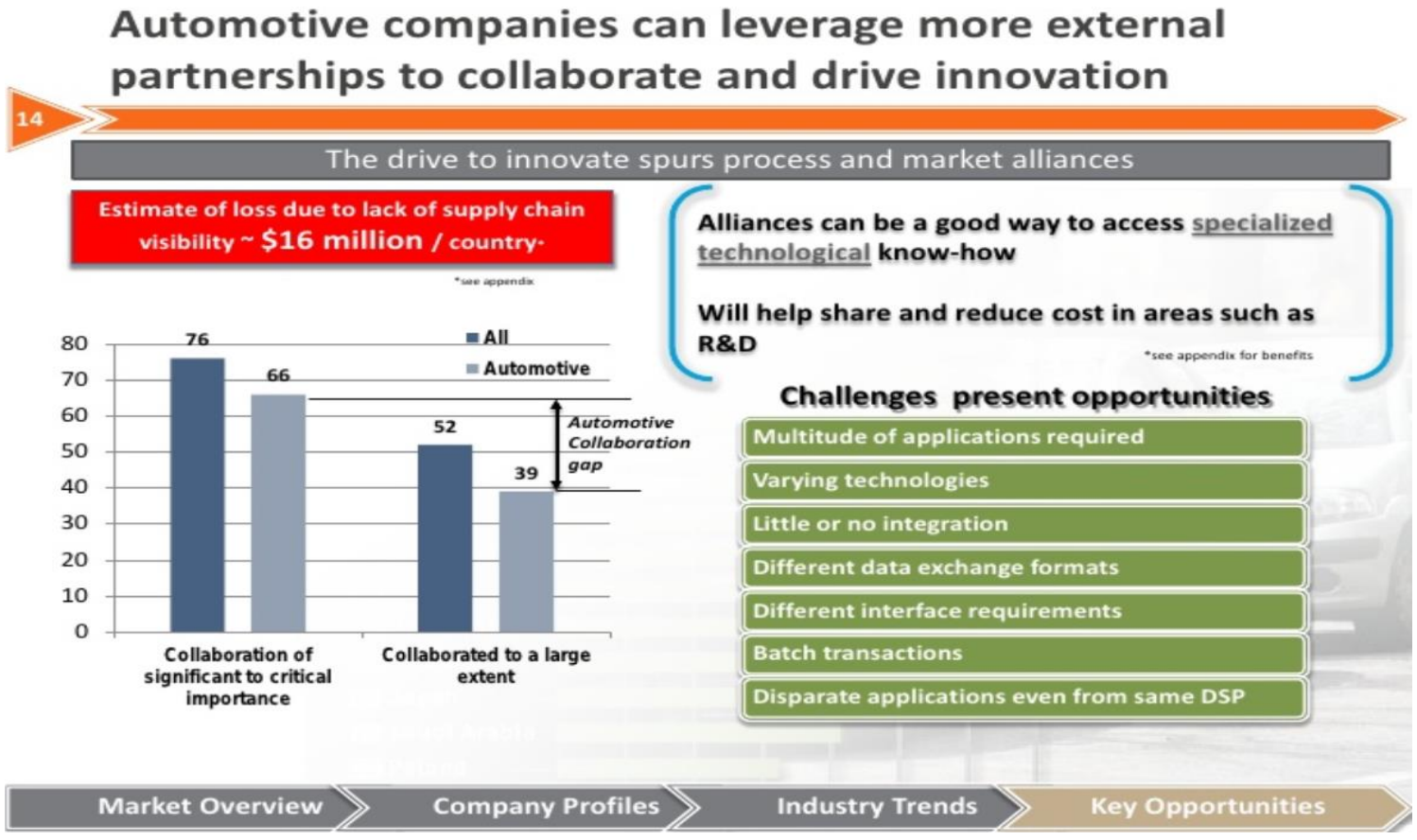
San Francisco, California

Judy J Brunson
eMobility, HV Systems & Quality
Mercedes-Benz Research & Development North America, Inc.
August 7, 2017

Mercedes-Benz

Benefits of Collaboration and Economies of Scale

"In this day and age, the research and development of a new vehicle for a major automaker has become a global project and can cost billions of dollars, the more of that cost you can share with another automaker, the better…" **Tim Urquhart, Principal Analyst at IHS Automotive**



Source: [1] https://www.slideshare.net/mattblair09/automotive-industry-analysis-of-the-big-3 [2] http://www.autoguide.com/auto-news/2015/07/why-are-so-many-automakers-partnering-up-.html

OEM collaboration not only reduces development and production costs but also enables achievement of broader research and development goals

Common Electric Vehicle Components
Non-Intelligent vs Intelligent

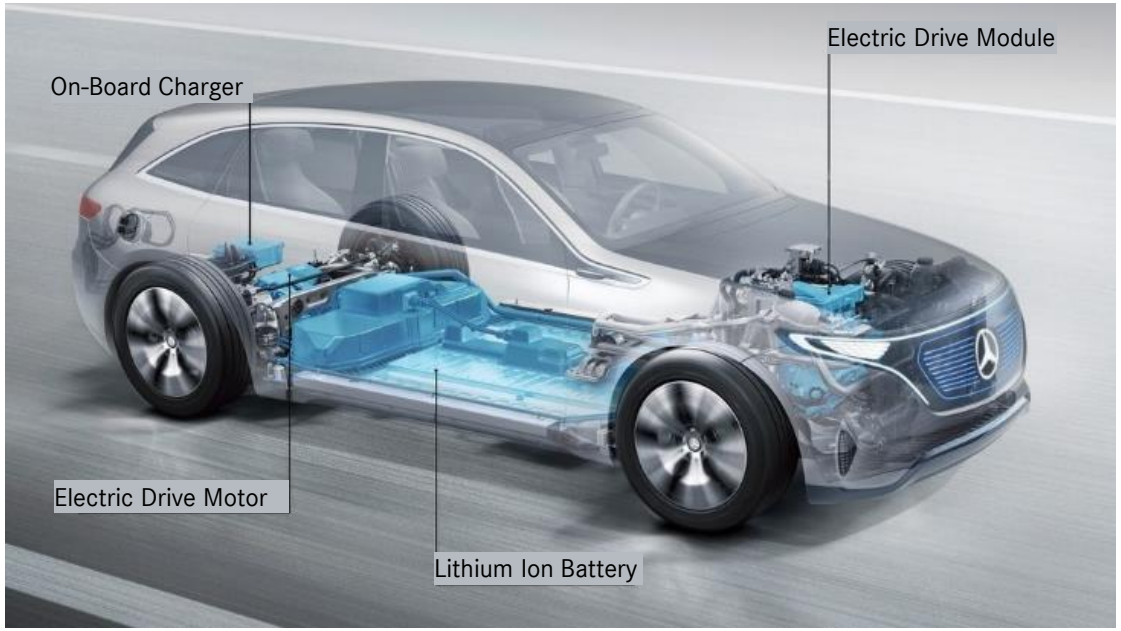


Figure 1: Non-Intelligent Electric Vehicle

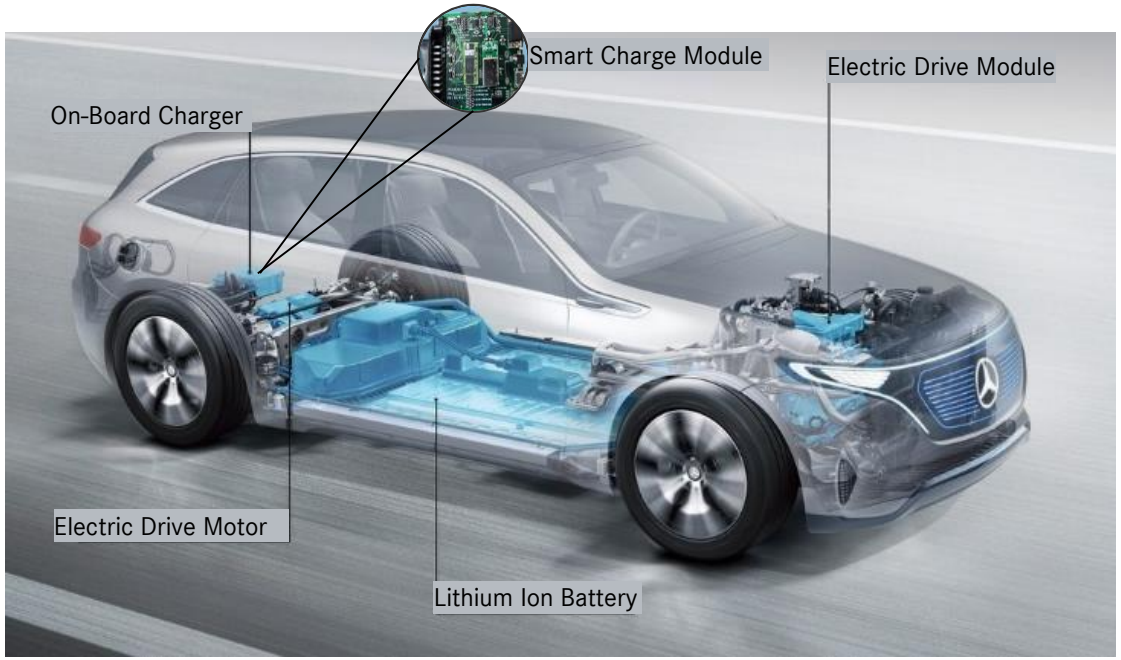
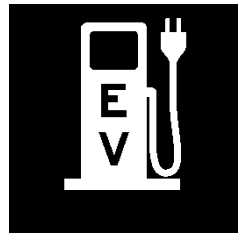


Figure 2: Intelligent Electric Vehicle with Smart Charge Communication

Minimal investment required to go from a Non-intelligent eV to an Intelligent eV

ISO[1] – 15118 eV[2] Intelligence



Additional SW[3]/HW[4] Development Required

CEC[5] assistance may help to get cost efficient solutions similar to DC

Cost

Small delta due to reuse of chip and basic messaging

ISO 15118 Capable AC Charging

PLC-Chip required

Sunk costs for Smart eV and Porsche

ISO 15118 Capable AC Charging

PLC-Chip required

0

AC Messaging PnC[7] + Loadb[8]

Basic AC

Basic AC

PLC-Chip optional

Basic AC

PLC-Chip optional

ISO 15118 Capable DC Charging

PLC[6]-Chip mandatory

ISO 15118 Capable DC Charging

PLC-Chip mandatory

ISO 15118 Capable DC Charging

(PLC-Chip mandatory)

Sunk Costs

DC only

DC + AC add on

AC only

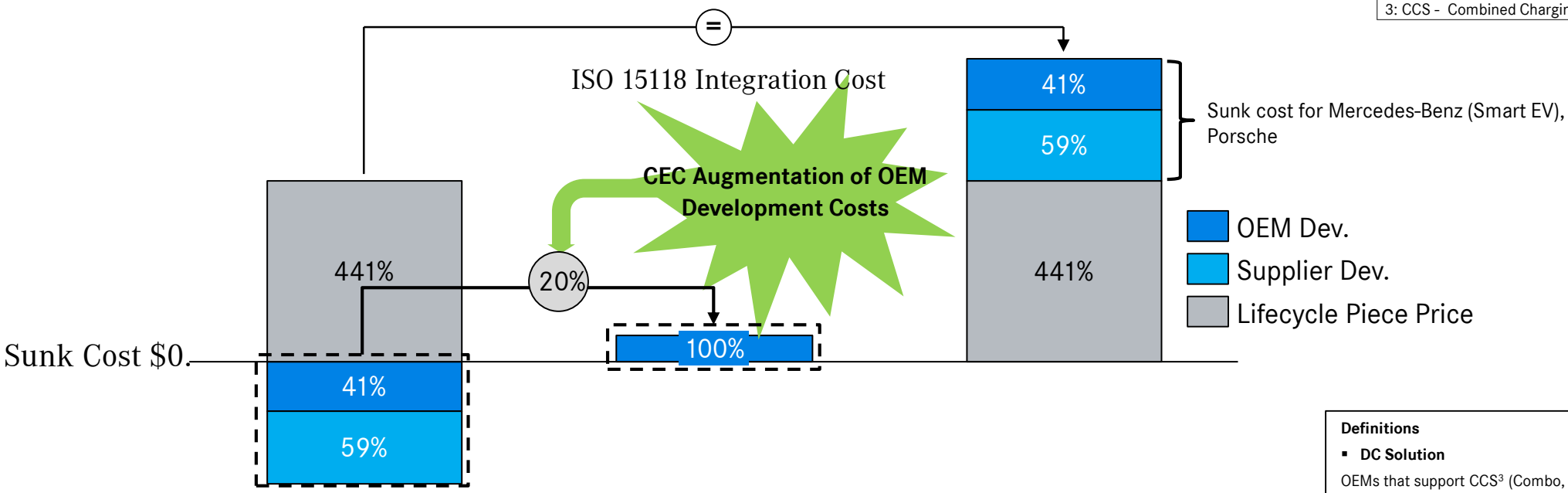
DC only

AC only

1: ISO – International Organization for Standardization
2: eV – Electric Vehicle
3: SW – Software
4: HW – Hardware
5: CEC - California Energy Commission
6: PLC – Powerline Communication
7: PnC – Plug and Charge
8: Loadb – Load Balancing

Integration of eV[1] Intelligence via ISO[2] 15118

1: eV – Electric Vehicle
2: ISO – International Organization for Standardization
3: CCS - Combined Charging System



Definitions

- **DC Solution**

OEMs that support CCS[3] (Combo, AC & DC), but have integrated ISO 15118 only for DC Charging

- **AC Solution (with available DC)**

OEMs that support CCS (Combo, AC & DC), and have integrated ISO 15118 for AC & DC Charging both

- **AC Solution (without DC)**

OEMs that support AC charging only, and have integrated ISO 15118 for AC charging

Cost Reduction proposals for Intelligent eVs:

(a) Government grants to reduce OEM development costs,

(b) Economies of scale: OEM collaboration to reduce piece price

Importance of Interoperability

1: eV – Electric Vehicle
2: EVSE – Electric Vehicle Supply Equipment
3: V2X – Vehicle-to-Everything

What to Standardize?

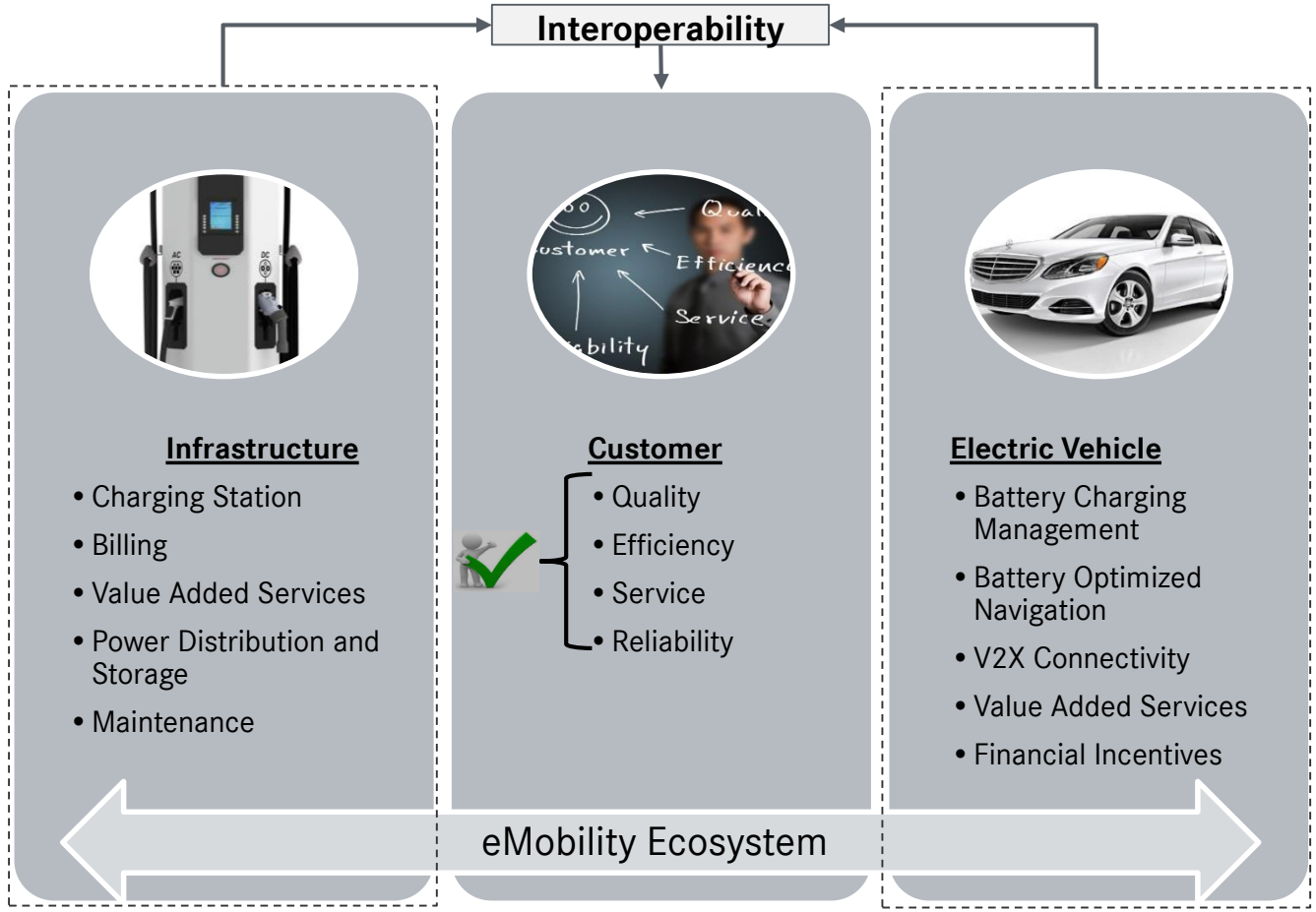
1. eV to EVSE interface
   - -Associated communication messages and protocols
   - -Hardware/Software Interfaces
2. Cybersecurity Requirements

Customer Benefits of Standardization?

1. Accessibility to eMobility infrastructure (e.g. Vehicle Roaming, Charging connectors/stations)
2. Enhanced customer experience (e.g. Plug n Charge)

Infrastructure Benefits of Standardization/Interoperability?

1. Cost effective integration of eMobility assets
2. Efficient grid/Load Management (e.g. Demand Response)
3. Reduced green house gas emissions



Interoperability between the eV and the charging station ensures quality, efficiency, service and reliability of the consumer charging experience

Next Steps: California State Government Funding

1. **Likelihood of California government funding for OEM programs?**

- **Government Funding to augment OEM development and hasten market introductions**
- **Smart Charging**:
  - Associated OEM cost to move from an ISO[1] 15118 enabled DC architecture to an ISO 15118 enabled AC/DC architecture ensuring Load balancing
  - enhanced utilization of available grid capacity

2. **Are all eV[2] cost categories eligible for government funding?**

- Associated eV development Costs
  - Engineering Development Costs (material, hardware, software, engineering resources)
  - Supplier Development Costs (A-Sample, B-Sample, etc)

3. **Reporting Requirements associated with receipt of government funds**

1: ISO – International Organization for Standardization
2: eV – Electric Vehicle

Thanks for Your Attention

Backup

Appendix 2: Examples of collaboration and how it can help

20

	**Engine co-operations**	Selling or sharing core business to/with other OEMs to realize scale effects ▪ BMW – PSA ▪ Daimler – Renault
	**Platform sharing**	Selling or sharing core business to/with other OEMs to reduce investments ▪ Volvo – Ford ▪ PSA – Toyota
	**Process sharing**	Adaption of the best practice processes ▪ Toyota processes for production ▪ PSA processes for purchasing
	**Development of new business fields**	Providing car sharing service to establish oneself on a long term base as mobility provider ▪ Car2go from Daimler ▪ Mu by Peugeot
	**Cooperation with electric companies**	Participation in the development of smart grids ▪ Daimler AG/Fiat – RWE ▪ Renault – Better Place
	**Strategic partnerships with suppliers**	OEMs define strategic partnerships with suppliers for e.g. transmissions, fuel injection systems to realize scale effects and to shift investments to the suppliers ➔ leads to a consolidation and globalization process within the supplier industry

Source:
https://www.slideshare.net/mattblair09/automotive-industry-analysis-of-the-big-3

ISO – 15118 eV Intelligence