



DEVELOPMENT DIRECTION AND ROADMAP OF COMBINED CHARGING SYSTEM (CCS)

09.05.2019, IEVEXPOJEJU

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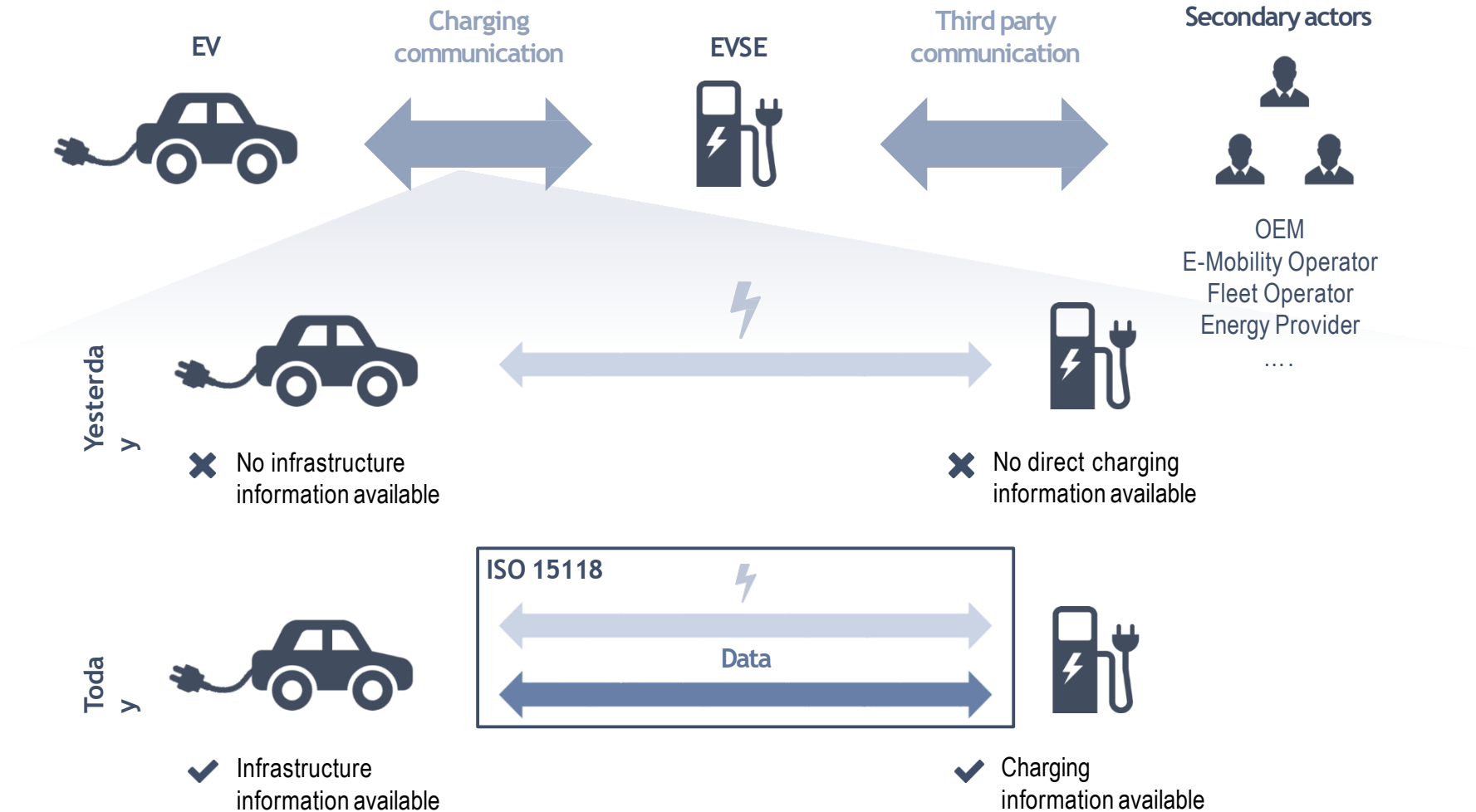
**BMW
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CHARGING COMMUNICATION INTRODUCTION.



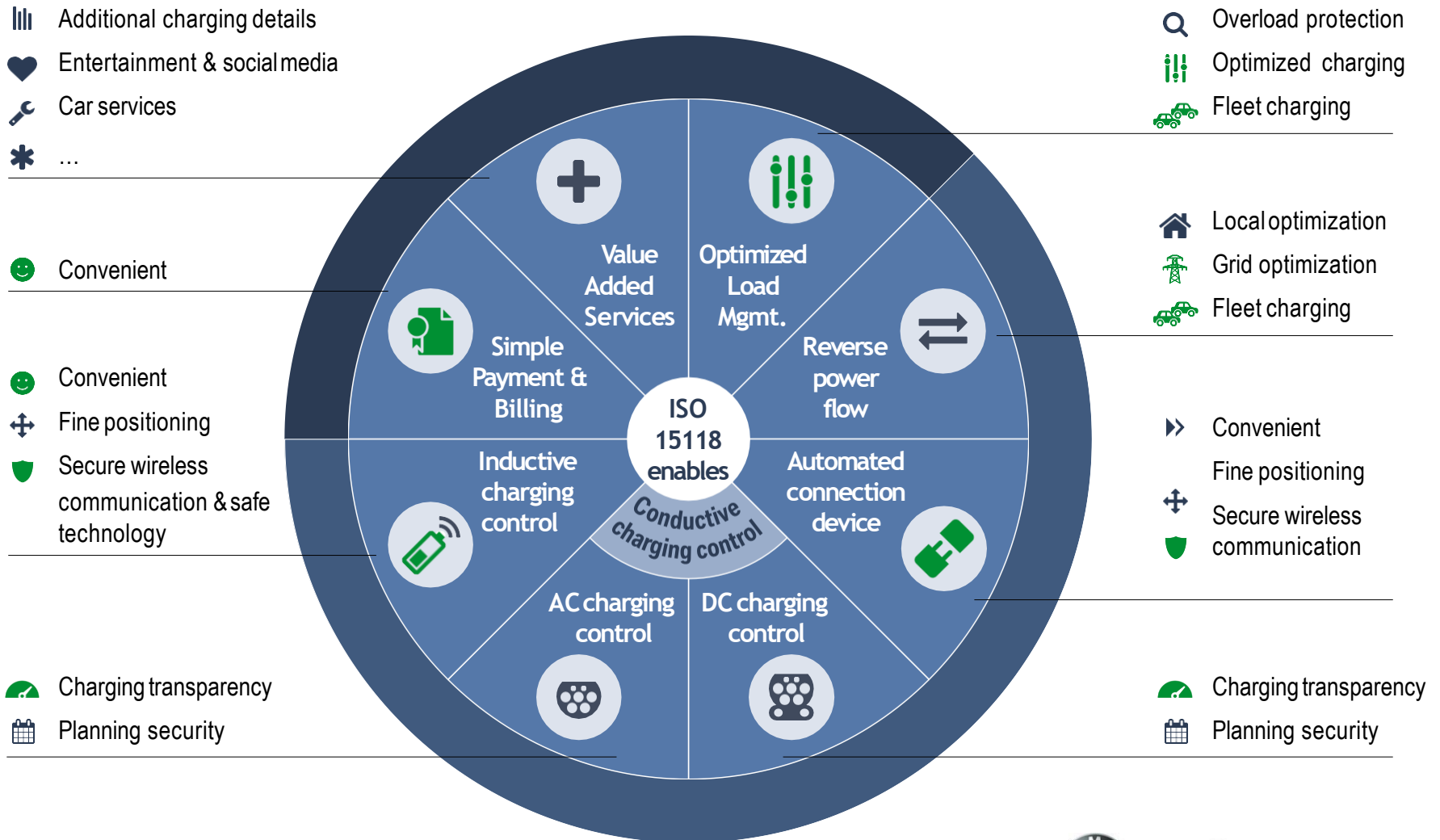
ISO15118 is a key enabler for realizing new Use Cases and business models



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USE CASES.



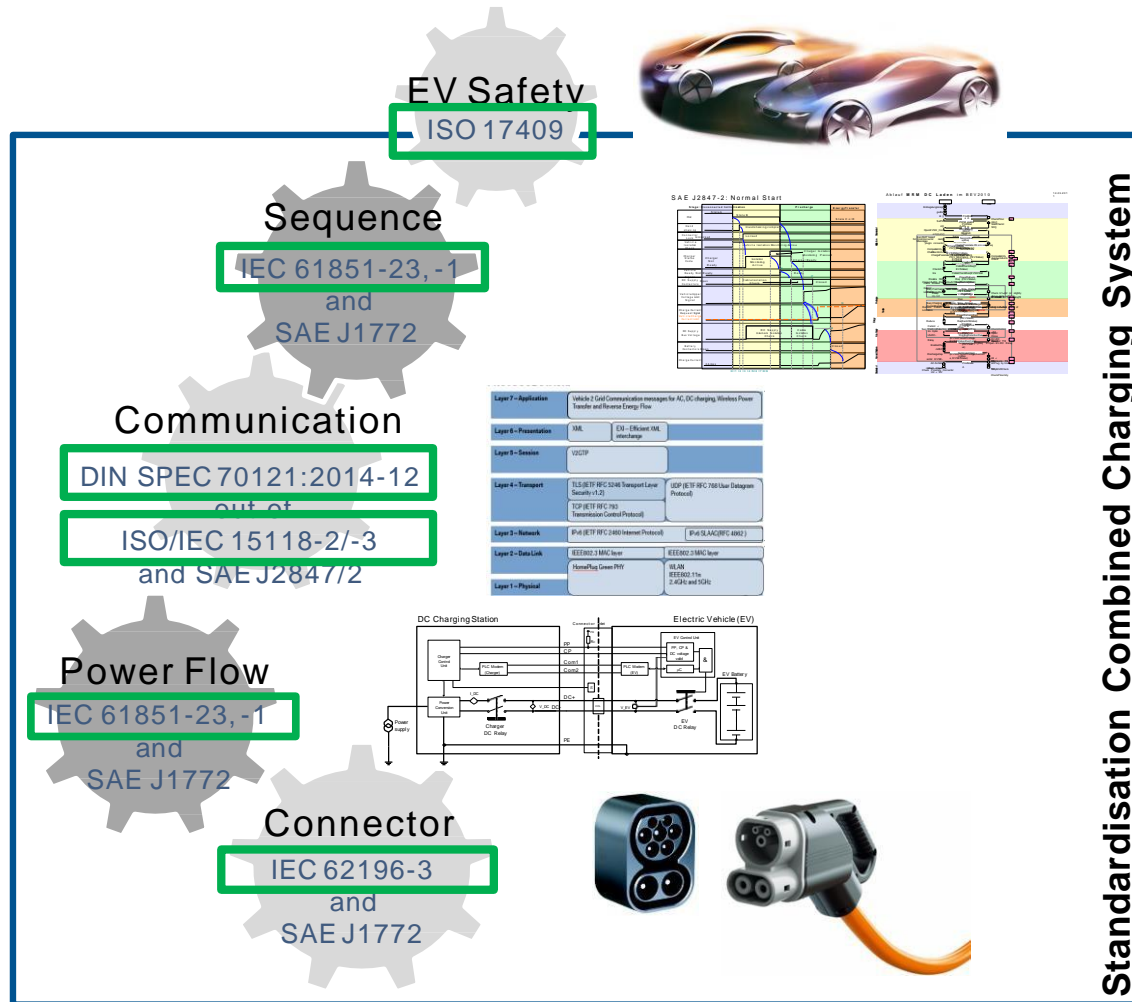
ISO15118 addresses all Electric Vehicle Use cases



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STANDARDS OVERVIEW



Combined Charging System is based on
ISO and IEC Standards, ISO 15118 is part of it



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CHARGING COMMUNICATION EVOLUTION.

DIN SPEC 70121 was published in 2012 (updated 2014) and allows simple DC charging.

ISO15118 adds additional features and charging methods

	DC	AC	Security	Plug and Charge	Smart Charging	Wireless PowerT	Reverse PowerT	ACD
DIN SPEC 70121 2012	X							
ISO15118-2 Ed1 2014	X	X	X	X	X			
ISO15118-20 ~2020	X	X	X	X	X	X	X	X



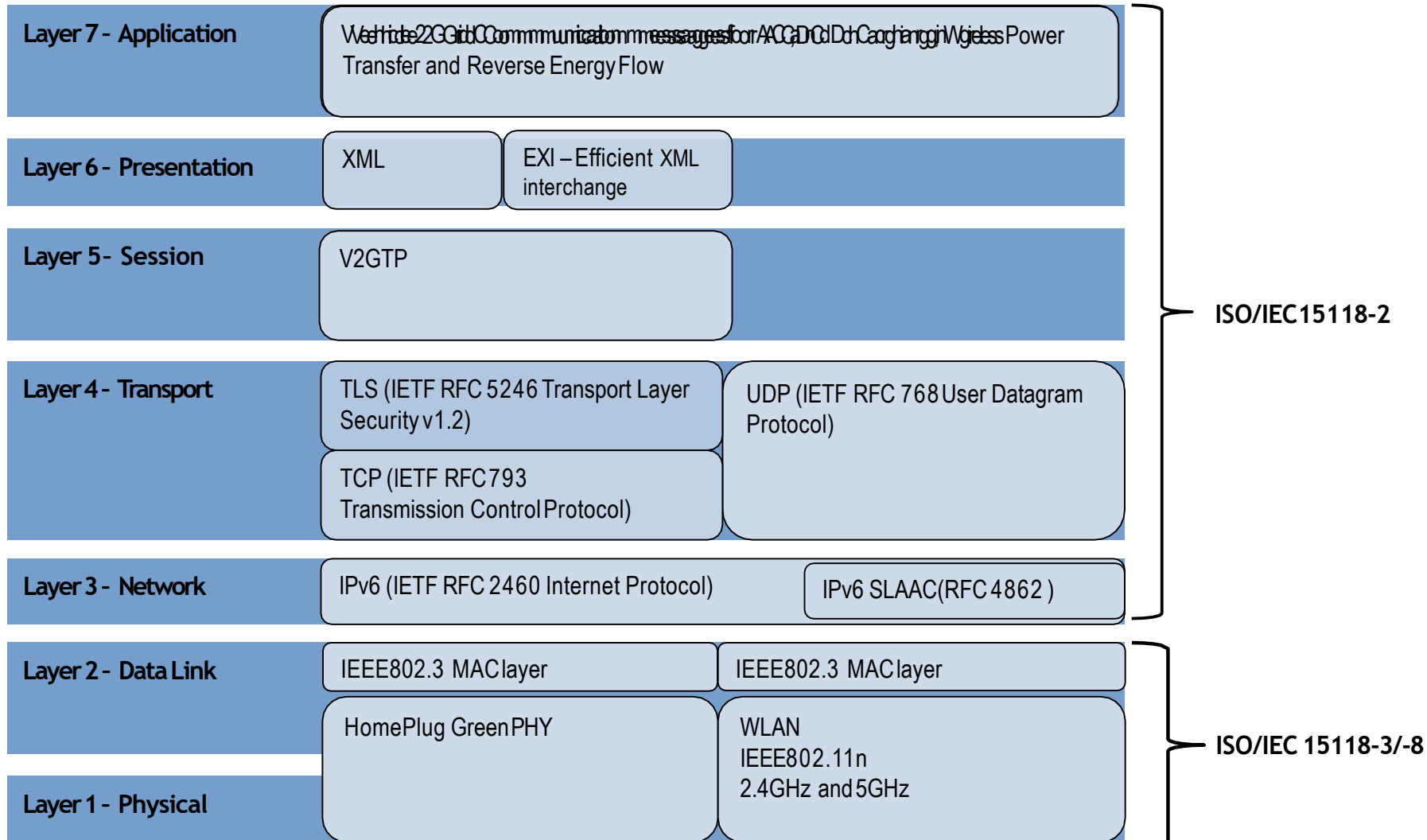
ISO 15118 serves all use cases to enable seamless market introduction of EVs



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ISO15118 PROTOCOL STACK.



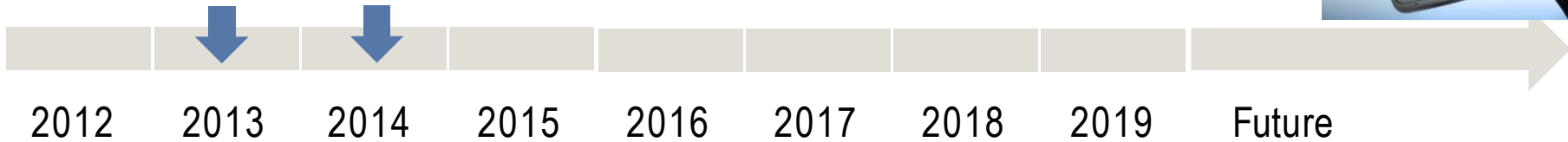
One protocol stack for all charging needs



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DC CCS VEHICLES.



GM ChevySpark



VWXL-1



VWe-golf



Porsche 918Spyder



VWe-up!



BMW i3



2014 - 6 vehicles with DC CCS on the market



























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DC CCS CHARGING STATIONS.



2012 2013 2014 2015 2016 2017 2018 2019 Future

Company	Origin		Company	Origin		Company	Origin
ABB			Fuji Electric			EVTEC	
efacec			JoongAng Control			CirControl / Endesa	
EVTRONIC			IES/Bosch			EBG complejo	
Delta			DBT			Walthert Werke	
							
GH electrotermia			Enel			Kostad	
Lafon			BTC Power			Swarco (Circontrol)	
Magnum CAP			Ensto			Ekoenergetyka	
Tritium			Signet			Designwerk	

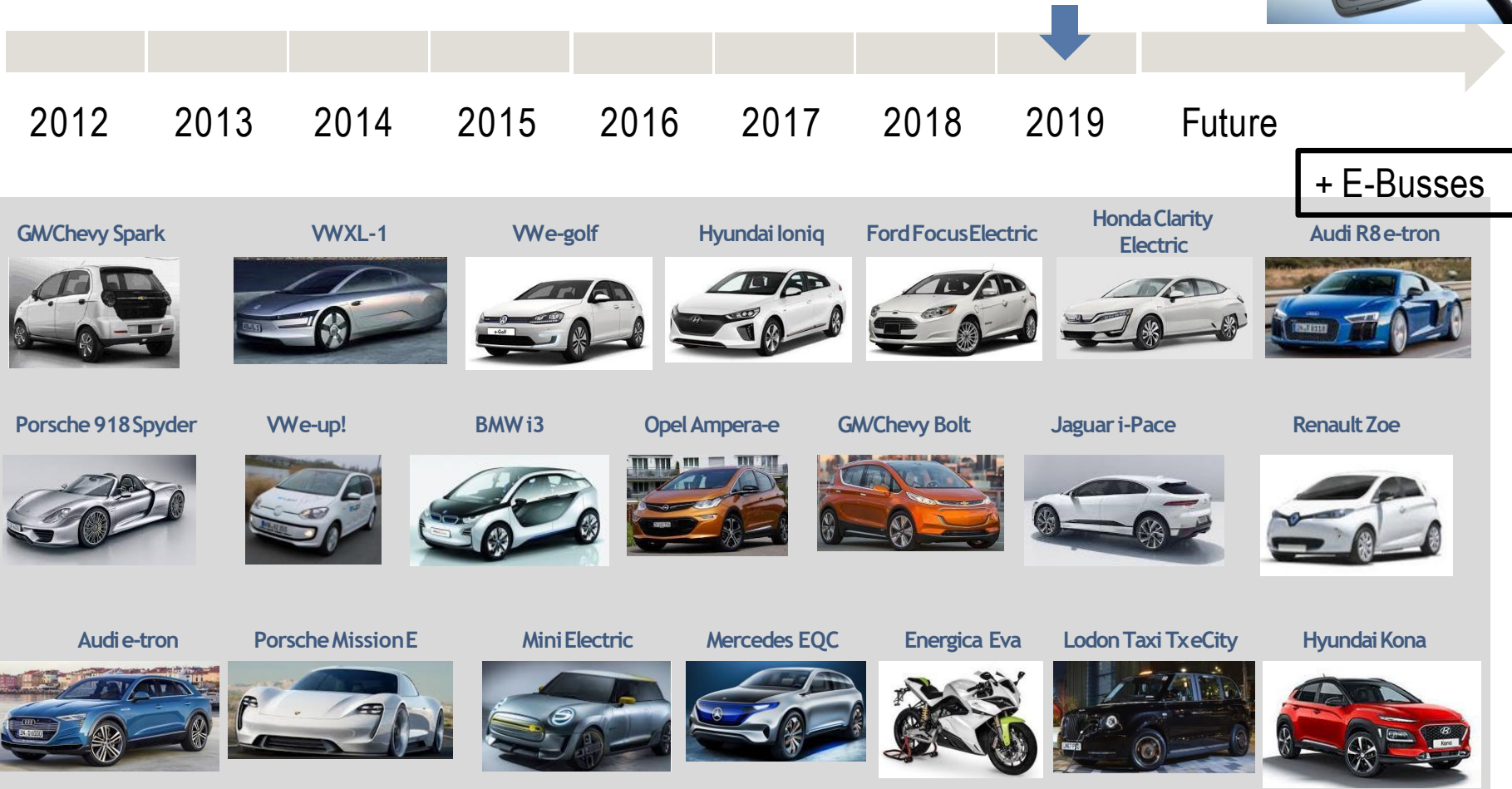
2015 - 1st Charging Stations
with DC CCS on the market



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DC CCS VEHICLES ON MARKET OR ANNOUNCED.



2019 - more than 21 vehicles with DC CCS on the market or announced ...

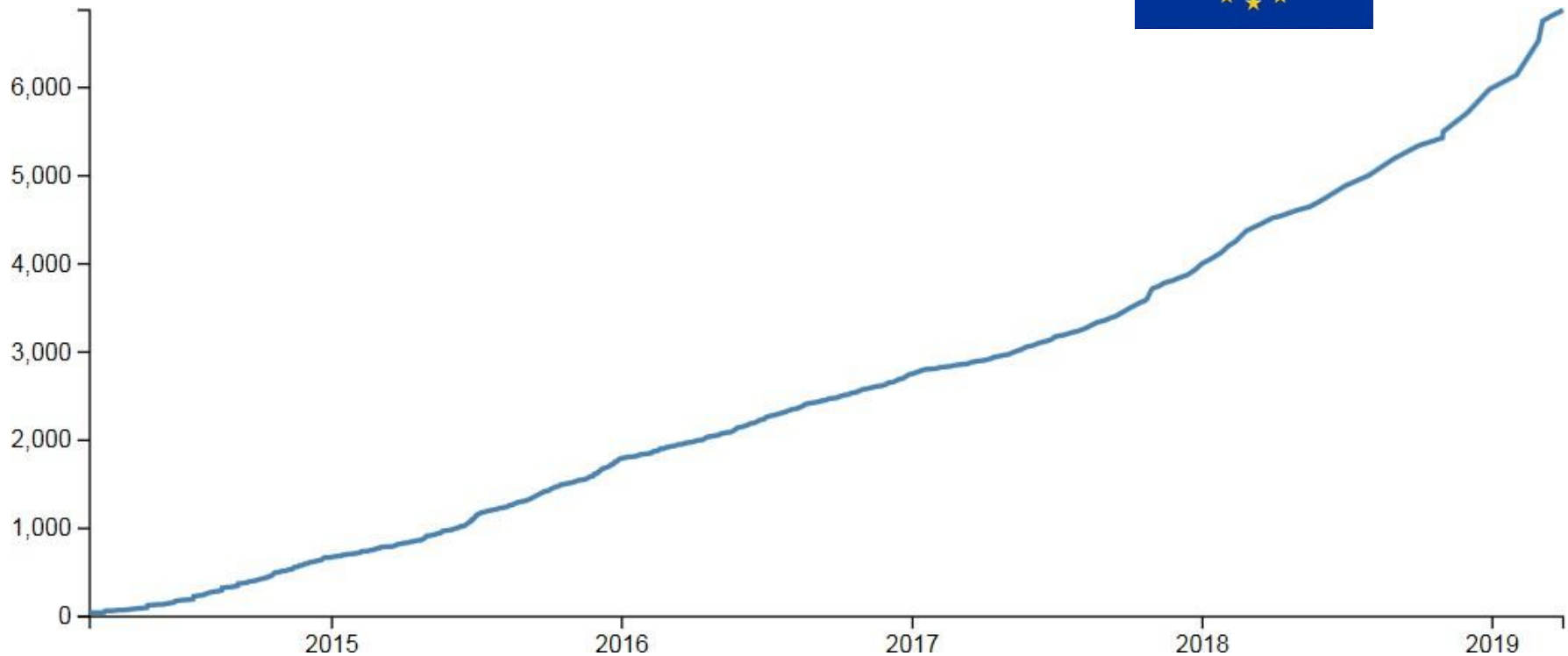


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OF PUBLIC DC CCS CHARGER IN EUROPE.

of Installed DC CCS
Chargers in Europe



**Rollout of Combined Charging System
DC charger in Europe ongoing**

Source: <http://ccs-map.eu/stats/>



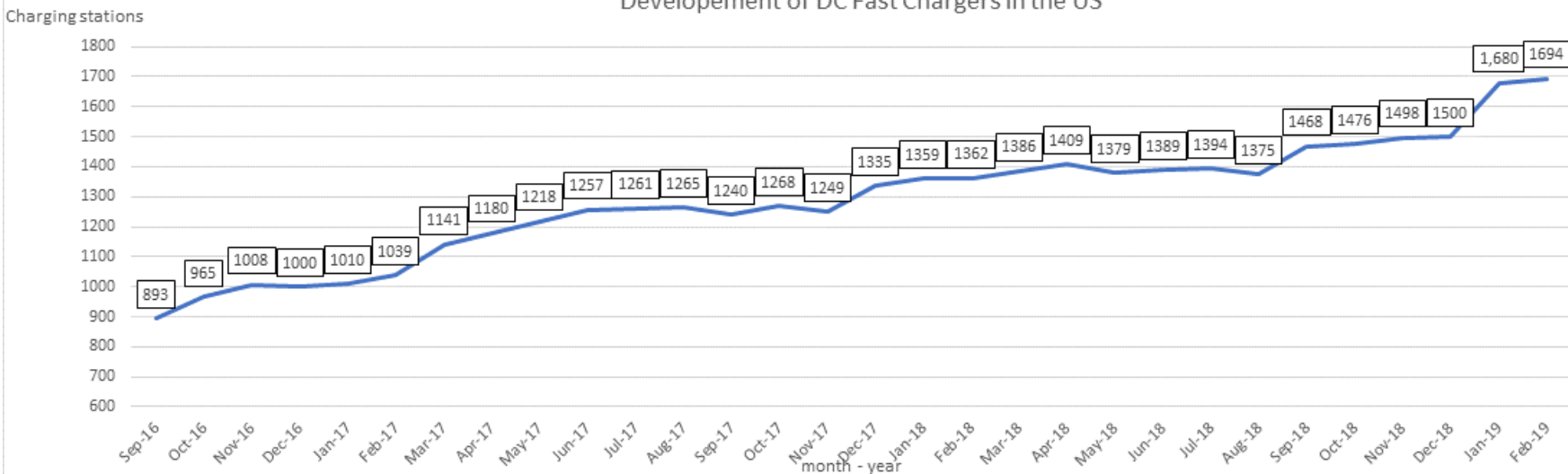
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OF PUBLIC DC CCS CHARGER IN USA.



Development of DC Fast Chargers in the US



**Rollout of Combined Charging System
DC charger in US ongoing**



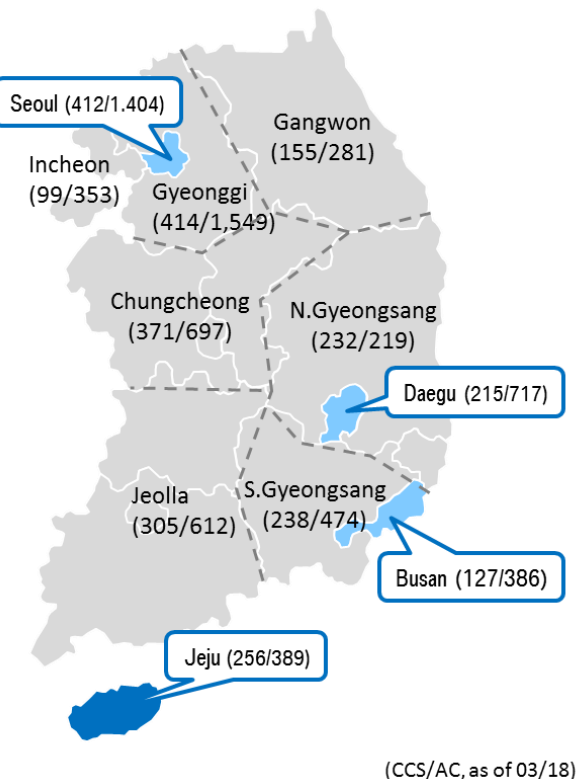
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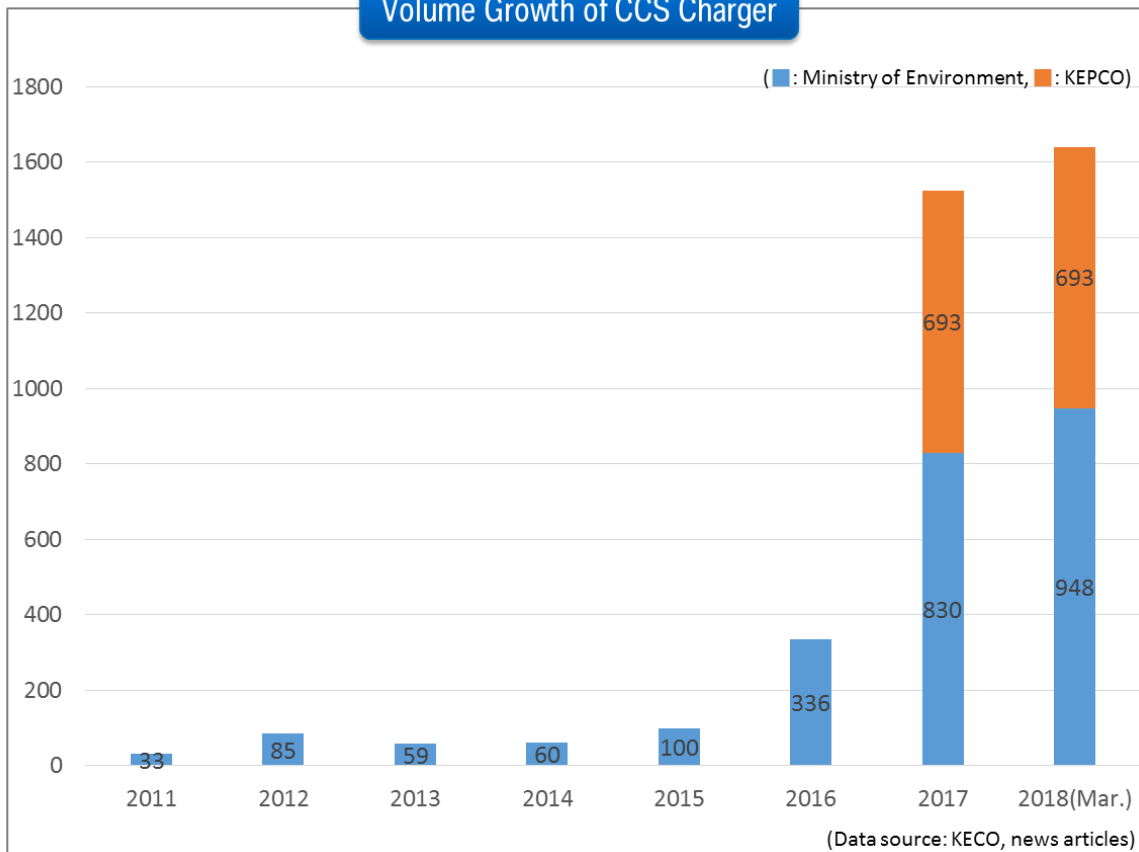
OF DC CCS CHARGER IN KOREA.



EV Charging stations in Korea



Volume Growth of CCS Charger



Rollout of Combined Charging System DC charger in Europe, USA, Korea and Canada ongoing



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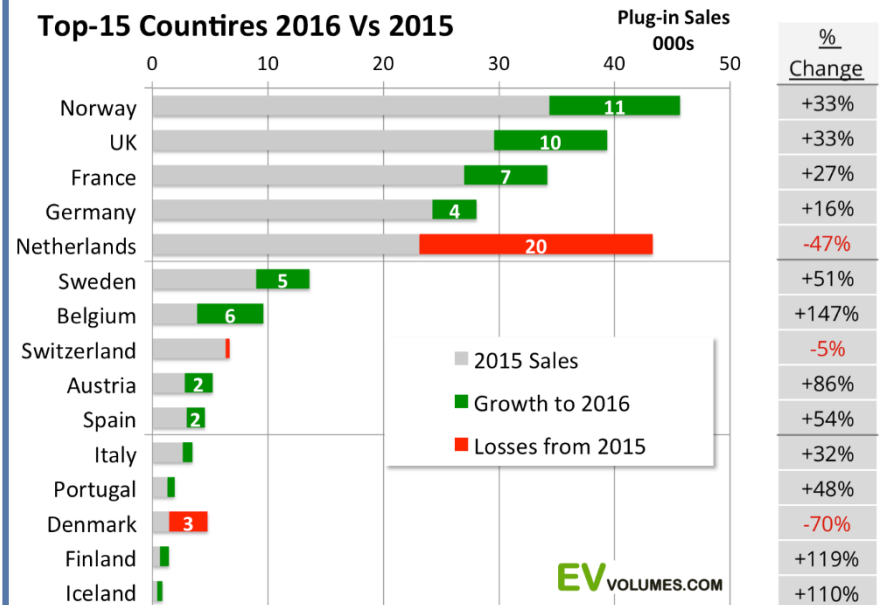
PUBLIC DC CCS CHARGER AND EV SALES IN EUROPE PER COUNTRY.

Public DC CCS Charger in Europe

Country	Total	March 2017	February 2017	January 2017	December 2016	November 2016	October 2016
1. UK	597	3	2	1		1	8
2. Germany	568	15	14	22	53	7	18
3. Norway	338	2	12	8	26	15	11
4. France	284	5	1	2	5	12	10
5. Sweden	223	6		3	7	7	9
6. Austria	141	2	1	5	2	3	7
7. Denmark	130	1		1		1	1
8. Netherlands	120	2	2	2	1	4	2
9. Switzerland	116	2	5	8	8	2	3
10. Spain	74			5	1	3	4
11. Finland	54			1	3	2	1
12. Ireland	40						2
13. Slovenia	31	1					
14. Belgium	31	2			1		4
15. Czech Republic	27	1		2			1

EV Sales in Europe

Top-15 Countries 2016 Vs 2015



of chargers are directly linked to EV sales

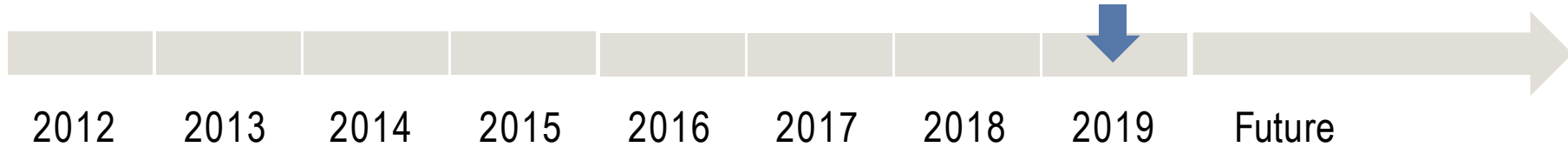
Source: <http://ccs-map.eu/stats> - <http://www.ev-volumes.com>



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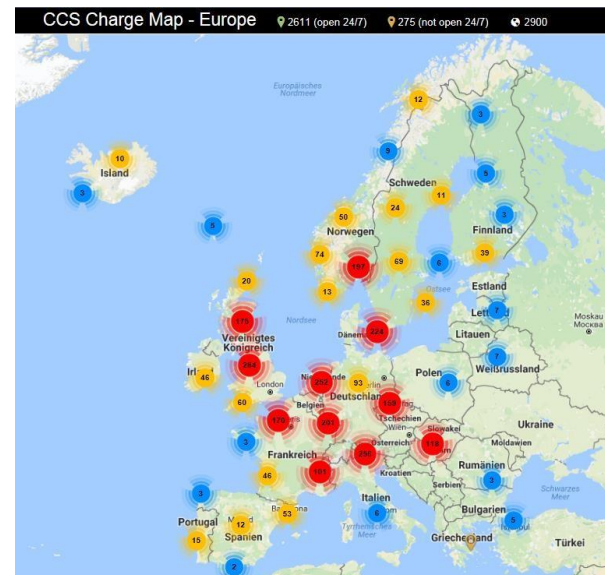
DEVELOPMENT SUMMARY.



CCS Status Summary

- In 2010 development of CCS was started
- In 2011 development of first CCS vehicle and charger was finished
- In 2013 harmonization with SAE achieved
- Only 9 years later there are
 - more then 9000DC CCS charger installed worldwide
 - more then 100.000DC CCS vehicles on the road

DC CCS Charging Stations



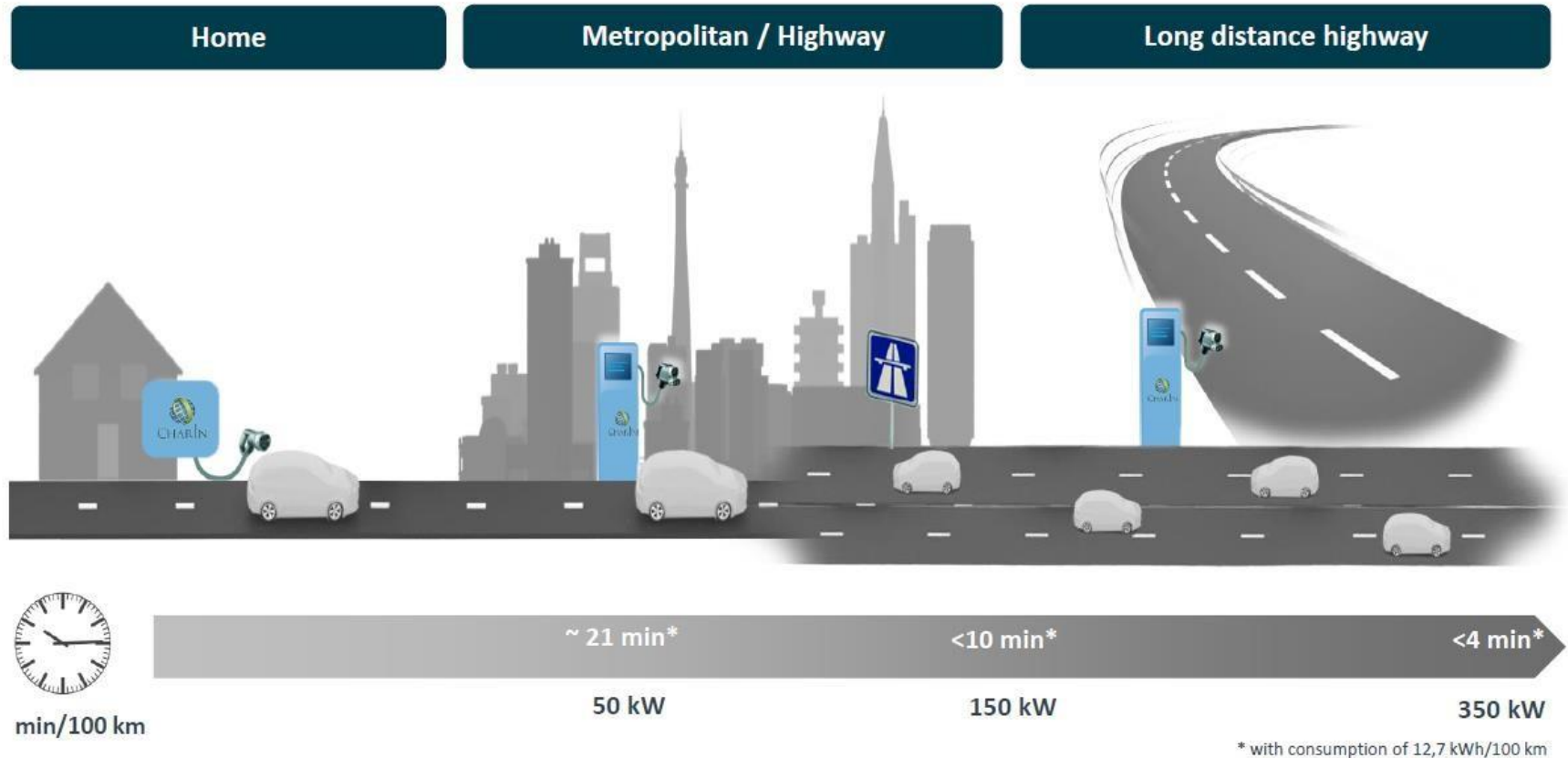
From nothing to a worldwide adopted and used standard in 9 years



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CCS ROADMAP.



CCS next level offers more flexibility in mobility

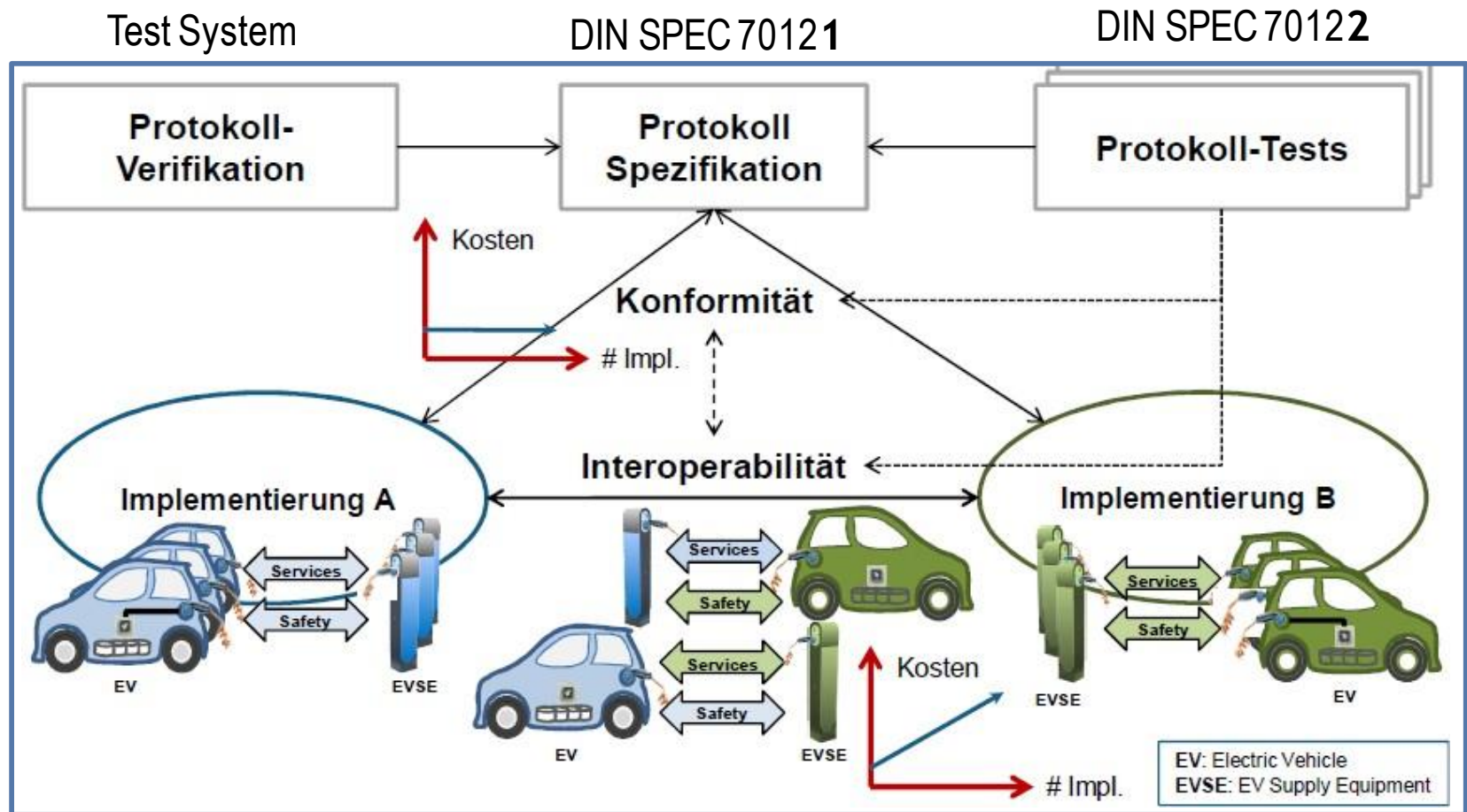
50kW DC CCS charger in field since 2013
150kW and 350kW DC CCS charger rolled out now



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CONFORMANCEVS. INTEROPERABILITY



Conformance is related to requirements in standards and is basis for Interoperability



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ISO15118 AND CCS TEST SYMPOSIUM

10. CCS & ISO 15118 Testing Symposium, 11/2018, @ ELAAD, Arnhem,

7. Int. CCS & ISO 15118 Testing Symposium, 11/2017, @ CSA GROUP, Mississauga

1. Int. ISO 15118 Festival, 11/2014, @ ANL, Chicago

2. Int. ISO 15118, 11/2015 @ CNI, Dortmund

4. Int. CCS & ISO 15118 Testing Symposium, 04/2016, @ CSE, San Diego

9. CCS & ISO 15118 Testing Symposium, 09/2018, @ NextEnergy, Detroit

6. Int. CCS & ISO 15118 Testing Symposium, 06/2017, @ VEDECOM, Versailles

3. Int. ISO 15118, 11/2015 @ CNI, Dortmund

5. Int. ISO 15118, 04/2015, @ TRI, Tokyo

ANNIVERSARY
In neuer Registerkarte öffnen

TS TESTING SYMPOSIUM

www.testing-symposium.net

10th International ISO/IEC 15118 & CCS Testing Symposium ANNIVERSARY EDITION
Interoperability & Conformance Testing Event for the Combined Charging System
Invitation
(updated 2018-09-14)

TS TESTING SYMPOSIUM

November 15th – 16th 2018
Arnhem, Netherlands
- EV, EVSE & ECU Test Event -

Please visit our website for further information & news
www.testing-symposium.net

The 10th International ISO/IEC 15118 & CCS Testing Symposium is hosted by:

Organized by: **ElaadNL**

Supported by: **tu/e**, **ISO**, **IEC**, **CHARIN**, **Verisco**

Organized by: **CNI** Communication Networks Institute **ISO** **IEC**

Supported by: **CHARIN** **Verisco** Verified Smart Communication



Intensive Interop Testing for last 5 years done



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SPECIFICATIONS AND TESTCASES.

	Specification	Test Cases
Use Cases	ISO15118-1 04/2013	-
Protocol and Messages	ISO15118-2 03/2014	ISO15118-4 04/2018
PLC-HW	ISO15118-3 05/2015	ISO15118-5 04/2018
WLAN-HW	ISO15118-8 04/2018	ISO15118-9 Started 2018

For DIN SPEC 70121:2014 Conformance Tests are specified in DIN SPEC 70122:2018



**Conformance Test documents published
First Conformance Test systems available**



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CHARIN POWER CLASSES OVERVIEW.



Power Class	Voltage range		Min Current*	Current Range	Power Range	Communication
DC5	200V	500V	1A @500V	$\geq 10A@500V$	$\geq 5kW$	DIN 70121
DC10	200V	500V	1A @500V	$\geq 20A@500V$	$\geq 10kW$	DIN 70121
DC20	200V	500V	1A @500V	$\geq 40A @500V$	$\geq 20kW$	DIN 70121
FC50	200V	500V	1A @500V	$\geq 100A @500V$	$\geq 50kW$	DIN 70121
HPC150	200V	920V	5A @500V 5A @920V	$\geq 300A @500V$ $\geq 163A @920V$	$\geq 150kW$	DIN 70121 & ISO15118
HPC250	200V	920V	5A @500V 5A @920V	$\geq 500A @500V$ $\geq 271A @920V$	$\geq 250kW$	DIN 70121 & ISO15118
HPC350	200V	920V	5A @500V 5A @920V	$\geq 500A@500V$ $\geq 380A@920V$	$\geq 350kW$	DIN 70121 & ISO15118



Power Classes help infrastructure provider to choose appropriate charging stations

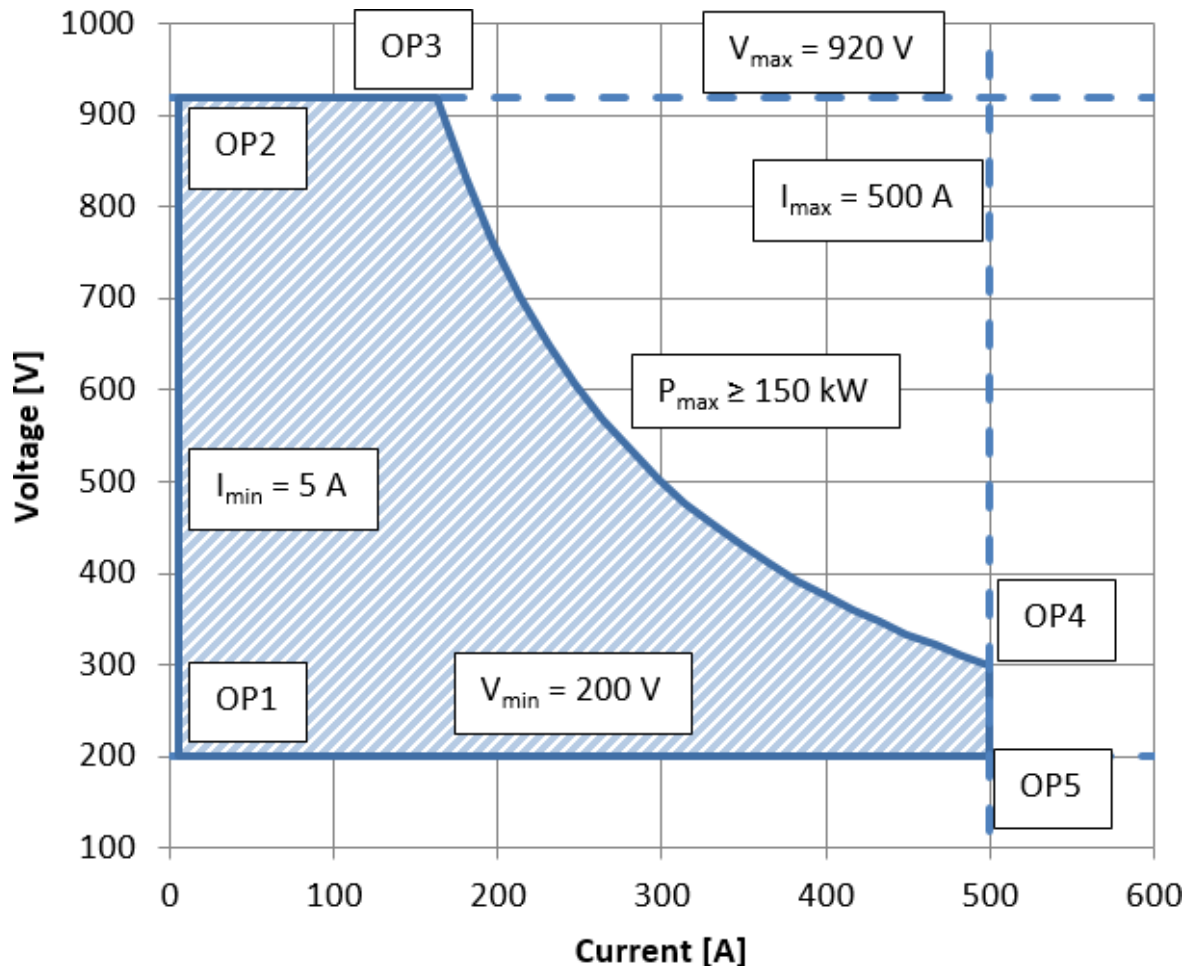


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CHARIN HPC150 POWER CLASS.

The dashed blue area must be supported by the EVSE to achieve HPC150 class



Power Classes assure interoperability for next generation 800V vehicles



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SUMMARY.



- One Inlet for AC and DC charging at the vehicle
- One communication (PLC) for AC and DC Charging
- Additional features like Plug and Charge and Security (TLS) already specified
- Bandwidth of PLC scaleable up to 200Mb/s à usable for future use-cases e.g. videostreaming
- New 350kW HPC charger allow short charging times
- CharIN Power Classes and Conformance Tests assure future interoperability



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QUESTIONS?



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