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中美新能源标准交流会

北京市渔阳饭店（地址：北京朝阳区新源西里中街 18 号）

2012 年 7 月 23 日

主办单位: 中国标准化协会（CAS）
美国国家标准协会（ANSI）

0830-090	国内外参会代表签到
0850-0900	领导与国内外主讲嘉宾见面会
交流会开幕式 会议主持：中国标准化协会 赵伟凯	
0900-0940	▪ 中国标准化协会副理事长/秘书长马林聪 致辞 ▪ 美国国家标准协会（ANSI）主席及首席执行官巴迪亚 致辞 ▪ 美国商务部官员 Craig Allen 致辞 ▪ 国家标准委领导 讲话
专家演讲 会议主持：中国标准化协会 俞彪	
0940-1005	**美国电动汽车部署的标准化路线图** 美国国家标准协会高级总监 Jim McCabe 先生
1005-1010	提问和回答问题
1010-1035	**中国电动汽车标准化工作线路图** 中国汽车技术研究中心首席专家 周荣
1035-1040	提问和回答问题
1040-1100	茶歇
专家演讲 会议主持：中国标准化协会 俞彪	
1100-1120	**全球标准，环境，质量与安全** Better Place 国际标准化副总裁 Ziva Patir 女士
1120-1125	提问和回答问题
1125-1145	**电动汽车无线充电** 高通公司高级总监 Mark Klerer 先生
1145-1150	提问和回答问题
1150-1210	**电动汽车充电装置** 斯必克机电产品（苏州）有限公司 方伦乐
1210-1215	提问和回答问题
1215-1330	午餐

专家演讲 会议主持：美国标准协会国际发展总监 Elise Owen	
1330-1350	**传导充电接口** 通用汽车，电气化战略中国经理 David Reeck 先生
1350-1355	提问和回答问题
1355-1415	**中国电动汽车的标准化** 大众汽车（中国）投资有限公司 技术总监 冯星野
1415-1420	提问和回答问题
1420-1440	**电动汽车用驱动电机系统标准体系** 北京理工大学电动车辆国家工程实验室 宋强
1440-1445	提问和回答问题
1445-1505	**电动汽车推进系统标准化探讨** Magna E-Car, 推进系统 业务总监 Zhao Zilai 先生
1505-1510	提问和回答问题
1510-1530	茶歇
专家演讲 会议主持：美国标准协会国际发展总监 Elise Owen	
1530-1550	**电动汽车基础设施和电池的安全** UL 能源， 主管工程师 Ken Boyce 先生
1550-1555	提问和回答问题
1555-1615	**安全检测、法规和标准** 天祥, 电动汽车和能源储存全球技术主管 Rich Byczek 先生
1615-1620	提问和回答问题
1620-1640	**V2G Communications，电池及燃料电池标准化工作** SAE.亚太区总监 Gary S. Schkade 先生
1640-1645	提问和回答问题
1645-1705	**适应标准，打造标准** 国电联合动力技术有限公司 所旭
1705-1710	提问和回答问题
1710-1725	与会者自由发言
1725-1730	闭幕词 ▪ 美国国家标准协会主席巴迪亚先生
交流会结束	

Sino-U.S. Workshop on New Energy Standardization

Technical Exchange on Electric Vehicles Standardization

Yuyang Hotel, Beijing
No.18 Xinyuan Xili Street, Chaoyang District, Beijing

July 23, 2012

Organizers: China Association for Standardization (CAS)
American National Standards Institute (ANSI)

0830-090	Registration	
0850-0900	Networking with speakers and VIP guests	
Opening Ceremony		
Moderator：CAS		Zhao Weikai
0900-0910	**Kick-off and introduction of VIP guests**	
0910-0940	Opening remarks	
	▪ Ma Lincong, Secretary General	CAS
	▪ S. Joe Bhatia, President and CEO	ANSI
	▪ Craig Allen，Deputy Assistant Secretary	U.S. Department of Commerce
	▪ Senior PRC Official TBD	SAC
Session One：Keynote speeches		
Moderator：CAS		Yu Biao
0940-1005	**Standardization roadmap for electric vehicle deployment in the United States**	
	Jim McCabe, Sr. Director-Standards Facilitation	ANSI
1005-1010	Q&A	
1010-1035	**Overview of the Chinese roadmap for EV standardization**	
	Zhou Rong, Chief Expert	CATARC
1035-1040	Q&A	
1040-1100	Tea break	
Session Two：New and innovative charging systems		
Moderator：CAS		Yu Biao
1100-1120	**Global Standards, environment, quality and safety**	
	Ziva Patir, Vice President-International Standardization	Better Place
1120-1125	Q&A	
1125-1145	**Wireless charging of electric vehicles**	
	Mark Klerer, Senior Director	QUALCOMM
1145-1150	Q&A	
1150-1210	**Electric vehicle supply equipment**	
	Allen Fang, SPX Mechanical and Electrical Products (Suzhou) Co., Ltd.	
1210-1215	Q&A	
1215-1330	Luncheon	

Session Three：Vehicle system and connectors		
Moderator：ANSI		Elise Owen
1330-1350	**Conductive charging interface**	
	David Reeck, China Manager - Electrification Strategy	General Motors
1350-1355	Q&A	
1355-1415	**E-mobility standardization in China**	
	Feng Xingye, Technical Director	Volkswagen Group China
1415-1420	Q&A	
1420-1440	**Standard system for electric machine system of EV**	
	Song Qiang	Beijing Polytechnic EV National Engineering Laboratory
1440-1445	Q&A	
1445-1505	**Electric vehicle propulsion systems standardization discussion – U.S. perspective**	
	Zilai Zhao, Business Line Director, Propulsion Systems	Magna E-car
1505-1510	Q&A	
1510-1530	Tea break	
Session Four：Safety infrastructure and other essential standards		
Moderator：ANSI		Elise Owen
1530-1550	**Safety of EV infrastructure and batteries**	
	Ken Boyce, Principal Engineer	UL Energy
1550-1555	Q&A	
1555-1615	**Safety testing, regulations, and standards**	
	Rich Byczek, Global Technical Lead - EV & Energy Storage	Intertek
1615-1620	Q&A	
1620-1640	**V2G communications, battery & fuel cell standardization**	
	SAE standards to support electro-mobility	
	Gary S. Schkade, Managing Director, Asia-Pacific	SAE Int'l
1640-1645	Q&A	
1645-1705	**Meet standards, innovate standards**	
	Suo Xu, Deputy chief engineer	Guodian United Power Technology Company Limited
1705-1710	Q&A	
1710-1725	**Open Q&A and Discussion**	
1725-1730	**Closing remarks**	
	▪ S. Joe Bhatia, President and CEO	ANSI
	Workshop Concludes	

S. Joe Bhatia

S. JOE BHATIA

President and CEO
American National Standards Institute (ANSI)

S. Joe Bhatia began his tenure as president and chief executive officer of the American National Standards Institute (ANSI) on January 1, 2006.

Prior to joining ANSI, Mr. Bhatia held the position of executive vice president and chief operating officer of the international group at Underwriters Laboratories Inc. (UL). During his 35-year tenure with the organization Mr. Bhatia assumed positions of progressive leadership in global business operations. His areas of responsibility included engineering, governmental and congressional liaisons, external affairs, follow-up (certification) services and direction of UL's $300+ million international operations.

In 2009, Mr. Bhatia was elected to serve as vice president for the Pan American Standards Commission (COPANT) for a two-year term. He also serves as vice chairman of the Industry Trade Advisory Committee on Standards and Technical Trade Barriers (ITAC 16), a joint program of the U.S. Department of Commerce and U.S. Trade Representative. A member of the International Organization for Standardization (ISO) Council and its Standing Committee on Strategies, Mr. Bhatia also holds a seat on the Oakton Community College Education Foundation Board and recently retired as a member of the National Fire Protection Association Board of Directors. In addition to his numerous professional affiliations, Mr. Bhatia is a frequent lecturer in the U.S. and around the world on topics such as international trade, technical developments, commercial market access, and health, safety and environmental concerns.

Mr. Bhatia holds a Bachelor of Science in electrical engineering and a Master of Science in business management. He and his wife, Punita, have two sons.

Opening Remarks

S. Joe Bhatia

Good morning, everyone.

My name is Joe Bhatia, and I am the president and CEO of ANSI, the American National Standards Institute.

Many thanks to the Standardization Administration of China (SAC) and the China Association for Standardization (CAS). I am pleased that ANSI has the opportunity to co-organize such an important workshop on electric vehicles standardization.

The U.S. and China have had an excellent working relationship – sharing information, ideas, and best practices in multiple venues, including ISO, IEC, regional, and bilateral meetings. We are very proud of our long-term cooperation with SAC, which has included successful projects like the Standards Portal – our shared online resource for global trade.

This is also not the first time that ANSI and CAS have worked together. Over the past several years, we have cooperated on workshops addressing key topics such as the "International Urban Water Resource Protection Standards Forum" in 2009, and the "International Energy Saving and Emission Reduction Standards Workshop" in 2010.

At the 2009 workshop, my opening remarks were read aloud at the meeting. This time, I am glad to be here to personally deliver the remarks.

We are here today because this is a critical time in the development of electric vehicles. It is also a critical time to put in place the charging infrastructure and support systems that are needed to fully realize the vast market for this technology.

In the United States, consumers, the government, and industry are all working to facilitate the widespread availability of these new cars, and to make sure that they are safe, efficient, and used properly.

An IBM study last year indicated that 20 percent of U.S. drivers are “likely” or “very likely” to consider purchasing an all-electric vehicle for their next car. With close to 200 million drivers on U.S. roads today, that works out to about 40 million consumers who are interested in going electric.

While American consumers are eager to demonstrate their commitment to the environment and to reducing our nation’s dependence on foreign oil by buying a hybrid or electric vehicle, we have a long way to go in terms of meeting demand.

President Obama has announced the goal of putting one million electric vehicles on U.S. highways by 2015. And the Administration has invested upwards of eight billion dollars on electric vehicle research and infrastructure over the last two years. Here in China, I know that you have similar policy goals, and that you are making electric vehicles a major priority.

Yet even with both of our governments and industry stepping up with the necessary resources and innovations, mass deployment will only be realized if the standardization community also does its job, and if major world economies work together to exchange ideas and experience.

ANSI is eager to deepen our relationship with Chinese experts, and to increase cooperation that will enhance development, improve the environment, and allow important technologies like electric vehicles to take root and thrive. Technical cooperation between the U.S. and China is already taking place – our experts are working together in international standards fora such as ISO and IEC, through governmental cooperation mechanisms, and through more informal channels.

I hope that today’s event will help reinforce the framework for communication and further strengthen these existing linkages.

In today's program, you will hear from a number of U.S. technical experts who will share the latest information about their areas of expertise. I know that the U.S. delegation is also eager to hear presentations from this group of esteemed leaders and top experts from China. I hope that this workshop will help stakeholders in both countries see the "big picture" of EV standardization in the U.S. and China, and identify new areas for collaboration.

Today, ANSI will also give a presentation on the activities of our Electric Vehicles Standards Panel, also known as EVSP. In April, the EVSP released a Standardization Roadmap that assesses the standards, codes, and regulations, as well as conformance and training programs, needed to facilitate the safe, mass deployment of electric vehicles and charging infrastructure in the United States.

The development of the Roadmap relied upon the collaborative work of experts from the public and private sectors and from the automotive, electrotechnical, and utilities industries.

The Roadmap is also intended to identify and maximize opportunities for coordination and harmonization within the standards and conformance environment, both domestically and with international partners – especially with leading countries such as China.

That is a big part of what we hope to achieve in today's dialogue, but we cannot expect to find every solution during a single meeting. What we need is a long and healthy cooperation, and dialogue, between the U.S. and China on this issue. I look forward to working with all of you and to hearing your unique perspectives – today and into the future.

Thank you for your attention.

CRAIG ALLEN 简介

CRAIG ALLEN

Deputy Assistant Secretary for Asia
U.S. Department of Commerce
International Trade Administration

Craig Allen has worked for the Department of Commerce's International Trade Administration since 1985. He entered government as a Presidential Management Intern and, in this capacity, rotated through the four branches of the ITA. From 1986 to 1988, he worked as an International Economist in the ITA China Office.

In 1988, Craig transferred from Washington to the American Institute in Taiwan where he served as the Director of the American Trade Center in Taipei. He held in this position until 1992.

In 1992, Craig returned from the American Institute in Taiwan and re-joined the Department of Commerce for a three-year posting in Beijing. During this period, he served as Commercial Attaché with responsibilities for the chemical sector, consumer goods and medical equipment.

In 1995, Craig and his family transferred from the American Embassy in Beijing to the American Embassy in Tokyo. Initially, Craig served as a Commercial Attaché with responsibilities for consumer goods and standards. In 1998, however, he was promoted to the Deputy Senior Commercial Officer position with responsibilities for the entire section. In 1999, Craig became a member of the Senior Foreign Service.

In 2000, Craig and his family departed Tokyo for a two year tour of duty at the National Center for APEC in Seattle. In Seattle, he worked on the APEC Summits in Brunei, China and Mexico.

In 2002, Craig and his family moved to Beijing for a three year tour as the Senior Commercial Officer at the U.S. Mission to China. In this position, Craig managed the entire complement of 126 DOC staff in China from multiple DOC agencies. In Beijing, Craig was promoted to the Minister Counselor rank of the Senior Foreign Service.

In 2006, Craig and family transferred from the U.S. Embassy in Beijing to the U.S. Embassy in Johannesburg, South Africa to serve a four year tour as the Senior Commercial Officer in South Africa with responsibilities for all 16 SADC countries.

Craig received a B.A. from the University of Michigan in Political Science and Asian Studies in 1979. He received a Masters of Science for the Foreign Service from Georgetown University in 1985. While at Georgetown, Craig worked for the U.S. Congress on issues associated with technology transfer to China.

In total, Craig has lived in Asia for 27 years, including 16 years in Japan and approximately 11 years in China or Taiwan. He has visited every country in Asia with the exception of Laos, North Korea and Bhutan. His most recent language scores were 3+/4 in Japanese and 4/4 in Mandarin Chinese.

Craig is married and has two children. Craig spends his free time running and regularly competes in marathons and ultra marathon races.

Jim McCabe

Jim McCabe
Senior Director, Standards Facilitation
American National Standards Institute (ANSI)

Jim McCabe currently serves as Senior Director, Standards Facilitation, at the American National Standards Institute (ANSI). In that capacity, he manages the Institute's domestic and international standards coordination activities related to electric vehicles, namely the Electric Vehicles Standards Panel, or EVSP.

Mr. McCabe joined ANSI in 1995. Other program management areas of focus have included identity theft, personal data privacy, occupational safety and health, consumer affairs, government relations and public policy, and corporate member services.

<u>About ANSI</u>
The American National Standards Institute (ANSI) is a non-profit organization that coordinates the U.S. private sector standards and conformance system – a system that relies upon close collaboration and partnership between the public and private sectors. ANSI represents thousands of member companies, organizations, and individuals who rely upon standards and conformance to increase efficiency, create market acceptance, improve competitiveness, and foster international commerce. For more than ninety years, ANSI and its members have worked to demonstrate the strength of private sector-led and public sector-supported, market-driven, standards-based solutions that are characterized by consensus, openness, and balance. ANSI is the U.S. member of the International Organization for Standardization (ISO) and, via the U.S. National Committee, the International Electrotechnical Commission (IEC).

<u>About the ANSI Electric Vehicles Standards Panel (EVSP)</u>
The EVSP is a cross-sector coordinating body whose objective is to foster coordination and collaboration on standardization matters among public and private sector stakeholders that will enable the safe, mass deployment of electric vehicles and charging infrastructure in the United States, with international coordination, adaptability, and engagement.

Standardization Roadmap for Electric Vehicle Deployment in the United States

Presented by:

Jim McCabe
Senior Director, Standards Facilitation
American National Standards Institute

ANSI American National Standards Institute

Sino-U.S. Workshop on New Energy Standardization
July 23, 2012

Why did the U.S. need a Standardization Roadmap?

EVSP

- Help achieve U.S. government public policy objectives: reduced petroleum consumption and greenhouse gas emissions, energy independence and security, and enhanced economic growth
- Foster the dissemination of safe, interoperable technology for electric vehicles (EVs) and charging infrastructure
- Respond to consumer expectations regarding safety, interoperability, performance, cost, and environmental impact
- Maximize coordination among standards developing organizations and provide guidance on standards participation and progress
- Keep pace with international EV initiatives and enable the U.S. to speak more coherently with international partners in policy and technical discussions regarding EVs

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ANSI's Electric Vehicles Standards Panel (ANSI EVSP)

- Mission: To foster coordination and collaboration on standardization matters among public and private sector stakeholders to enable the safe, mass deployment of electric vehicles and associated infrastructure in the U.S. with international coordination, adaptability and engagement
- Some 80 private and public sector organizations are involved from the automotive, utility, and electrotechnical industries, standards developing organizations (SDOs), and U.S. government agencies
- ANSI EVSP is a coordinating body only; it does not develop standards

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ANSI EVSP Roadmap | Sino-U.S. Workshop Slide 3

ANSI EVSP Deliverables

On April 23, 2012, the ANSI EVSP released:

- *Standardization Roadmap for Electric Vehicles, Version 1.0*
- *ANSI EVSP Standards Compendium*, a searchable spreadsheet of standards related to issues identified in the roadmap

Both are available as free downloads at www.ansi.org/evsp

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ANSI EVSP Roadmap | Sino-U.S. Workshop Slide 4

Roadmap Overview

- Identifies the standards, codes, and regulations that exist or that are in development, gaps where new or revised standards are needed, conformance and training programs, as well as domestic and international harmonization efforts
- Includes prioritized timelines for when standardization should occur and identifies organizations that may be able to do the work
- Focus is on-road plug-in EVs, both battery electric and plug-in hybrids, for the U.S. market as well as charging infrastructure and associated support services (emergency responders, service technicians, electrical installers and inspectors)

Roadmap Structure

- Issues assigned to one of 3 domains: Vehicle, Infrastructure, Support Services
- Within those domains, 7 topical areas were identified which correspond to the working groups that studied the issues:
  - Vehicle (Energy Storage Systems, Vehicle Components, Vehicle User Interface)
  - Infrastructure (Charging Systems, Communications, Installation)
  - Support Services (Education and Training)
- While some issues apply to one domain, issues are generally highly interrelated and interdependent

Roadmap Conclusions

- 365 standards identified from 34 organizations
- Many SDOs (both U.S. based and non-U.S. based) produce globally relevant standards following an open, consensus-based process
  - SAE, UL, NFPA, IEEE, ISO, IEC and others
- 36 gaps or partial gaps identified
  - A "gap" means no standard or conformance program currently exists to address a safety, performance, or interoperability issue
  - 22 are near-term priorities (should be addressed in 0-2 years)
  - 12 are mid-term priorities (should be addressed in 2-5 years)
  - 2 are long-term priorities (should be addressed in 5+ years)
  - Gaps relating to today's agenda appear on next several slides (all are near or mid-term priorities)

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Battery Swapping

Battery Swapping

- Define minimum requirements for the safe operation of battery swapping stations
- Define interoperability standards related to battery swapping
- Building on Chinese work, IEC/TC 69 is taking up this subject

Packaging and Transport of Batteries to Workshops or Battery Swapping Stations

- Intermediate packaging is required between the import location and battery swapping stations and needs to be standardized around geometry, safety and matching to UN packaging requirements

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Wireless Charging, Propulsion Systems, and Conductive Charging

Wireless Charging

- Complete the wireless charging design standard SAE J2954 and the safety standard UL 2750

Power Rating Methods

- Complete work on the power rating standards SAE J2907 and SAE J2908 to rate the performance of EV propulsion systems

Power Quality

- Complete work on power quality test procedures SAE J2894, Part 2

Electric Vehicle Supply Equipment (EVSE) Charging Levels

- Complete the DC charging levels in SAE J1772™, the de facto U.S. standard for EV and PHEV conductive charge couplers, which is among the connectors included in the IEC 61851 series. Now out for ballot.

Conductive Charging (contd.)

Off-Board Chargers and Supply Equipment

- Finish harmonization of safety requirements for off-board charging stations and portable EV cord sets in North America, based on UL 2594, Standard for EVSE. This is a cooperative effort between UL, CSA, ANCE (Mexico), and NEMA. Now out for ballot.
- Harmonize safety requirements for off-board chargers in North America, based on UL 2202, Standard for EV Charging Equipment. Not yet begun.
- Work to harmonize the IEC 61851 series of standards and the North American standards to address safety of off-board chargers, off-board charging stations, and portable EV cord sets. Specific aspects being introduced as opportunities arise.

Conductive Charging (contd.)

EV Couplers

- Finish harmonization of EV coupler safety standards in North America, based on UL 2251, Standard for Plugs, Receptacles and Couplers for EVs. This is a cooperative effort between UL, CSA, ANCE (Mexico), and NEMA. Now out for ballot.
- Work to harmonize the IEC 62196 series of standards and the North American EV coupler safety standards. Will be considered at CANENA.
- Work to harmonize EV coupler configurations internationally, especially for DC charging. SAE J1772™ included in IEC 62196.
- Complete work on SAE J2953, PEV Interoperability with EVSE, and establish conformance programs on EV / EVSE interoperability for the U.S. market, based on SAE J1772™, SAE J2953 and a UL verification program under development

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EV Infrastructure Safety

Labeling of EVSE and Load Management Disconnects

- EVSE manufacturers should develop standardized graphical symbols, disconnect instructions, and safety warning labels on their equipment

Guarding / Protecting the EVSE

- Guidelines or standards related to guarding / protecting EVSE (e.g. from crashes) should be developed

Accessibility for Persons with Disabilities to EVSE

- Guidelines or standards relating to accessibility for persons with disabilities to EVSE should be developed

Cable Management

- Guidelines or standards relating to EVSE cable management should be developed

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Battery Safety

<u>Delayed Battery Overheating Events</u>

- Address delayed battery overheating events in future revisions of SAE J2929, Electric and Hybrid Vehicle Propulsion Battery System Safety Standard Lithium-based Rechargeable Cells

<u>Loss of Control / Dual Mode Failure in the Battery</u>

- Address events such as a failure of overcharge protection when the battery is overheated, overheating during a crash event, or a cell thermal runaway event in the battery, in future revisions of SAE J2929

<u>Safe Storage of Lithium-ion Batteries</u>

- Develop a standard on safe storage practices for EV batteries, addressing both new and waste batteries and the wide range of storage situations that may exist

Battery Safety (contd.)

<u>Vehicle Emergency Shutoff and Labeling</u>

- Develop standards for safety labels for EV batteries, power cables, and disconnect devices to enable emergency responders and service personnel to quickly and easily recognize them and avoid electrical shock hazards. Under discussion in SAE.

<u>Safe Battery Discharge and Recharge in Emergencies</u>

- Standards and/or guidelines for safe battery discharge and recharge in emergencies are needed to help emergency responders. Work underway in SAE.

Vehicle-to-Grid Communications

Vehicle as Supply (Vehicle as a Distributed Energy Resource)

- Complete communications and safety aspects of reverse power flow in SAE J2836/3™ and SAE J2836/5™, and SAE J2847/3 and SAE J2847/5. Address reverse power flow safety aspects in IEEE 1547 series of standards

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Other Identified Gaps (Not on Today's Agenda)

- Electric vehicle terminology
- Battery performance parameters and durability testing
- Packaging and transport of waste batteries
- Battery recycling (long-term priority)
- Battery secondary uses (long-term priority)
- Audible warning systems (global technical regulation in development)
- Graphical symbols for electric vehicles
- Use of alternative power sources for vehicle charging
- Locating and reserving a public charging station
- Charging of roaming EVs between EV service providers (billing issue)
- Access control at charging stations
- Communication of standardized EV sub-metering data (billing issue)

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Other Issues Studied: No Gaps Identified at this Time (Existing Standards / Regulations are Adequate)

- Crash tests / safety
- Internal high voltage cables, on-board wiring, component ratings and charging accessories
- Vehicle diagnostics – emissions
- Telematics – driver distraction
- Fuel efficiency, emissions and labeling
- Electromagnetic compatibility (EMC)
- Telematics – communications interoperability
- EVSE installation site assessment / power capacity assessment
- EV charging and parking in urban planning
- Charging station permitting (residential / commercial / public)

Other Issues Studied: No Gaps (contd.)

- Environmental and use conditions for EVSE (e.g. exposure to the elements, hazardous locations)
- Ventilation indoors where there are multiple charging vehicles
- EVSE maintenance
- Workplace safety related to EVSE installations
- OEM emergency response guides
- Workforce training (for emergency first responders, law enforcement officials, vehicle service technicians, electrical installers and inspectors, and in college / university programs)

Moving Forward

- We are working to promote the roadmap and tracking implementation of its recommendations
- The roadmap will be updated as standardization work progresses with a targeted release of Version 2.0 in or about April 2013
- We are at a critical time in the development of electric vehicle technology and standards, where decisions that are made today will affect the market for EVs for years to come
- China is a very important international partner and leader in this area, and so this dialogue with you comes at an opportune time
- We are planning a similar workshop with CEN CENELEC in Europe
- We look forward to hearing about your work and we very much want to cooperate with you on standardization for electric vehicles

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Thank You!

Questions?

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Slide 20

周 荣

周荣，研究员级高级工程师，中国汽车技术研究中心首席专家，汽车标准化研究所总工程师。先后主持或独自承担了国家科技部863项目、原机械工业部、天津市科委和中国汽车技术研究中心的科研项目20多项。获中国汽车科技进步奖三等奖2项，天津市科技进步二等奖1项，获国家发明专利（已授权）2项，实用新型专利（已授权）7项，主持编写电动汽车国家标准2项，编辑出版专著1本， 在核心科技刊物上发表20多篇论文，主持翻译的FMVSS、ECE、EC等国外汽车法规和SAE等汽车标准超过1500万字并在行业得到应用。在电动汽车产品开发和标准制定、国外汽车法规和标准研究、汽车产品出口认证等方面具有丰富的经验。

Zhou Rong, researcher-level senior engineer, chief expert of China Automotive Technology and Research Center, chief engineer of Institute of Automotive Standardization. He has presided over or taken charge on his own more than 20 projects 863 project of Ministry of Science and Technology, formerly Ministry of industry machinery, Tianjin science commission and China Automotive Technology and Research Center; Won 2 third prizes of science progress award for China automotive and 1 second prize of Tianjin science progress award; Won 2 national invention patents and 7 utility model patents; formulated 2 national standards for electric vehicle; edited and published 1 academic work and more than 20 academic articles in core scientific journals. The translation of FMVSS, ECE, EC and other foreign automotive regulations and SAE automotive standards he resided over, more than 15 million words, has been applied in the industry. He has extensive experience in product development and standard formulation of electric vehicle, research of foreign automotive regulations and standards and automotive products export certification.

中国电动汽车标准化

工 作 路 线 图

中国汽车技术研究中心

周 荣

提 纲

一、现状与需求

二、体系与分类

三、支撑与保证

标准化目标

- 支撑政府部门进行管理
  - 市场准入
  - 市场管理

  } 形式认证、检测

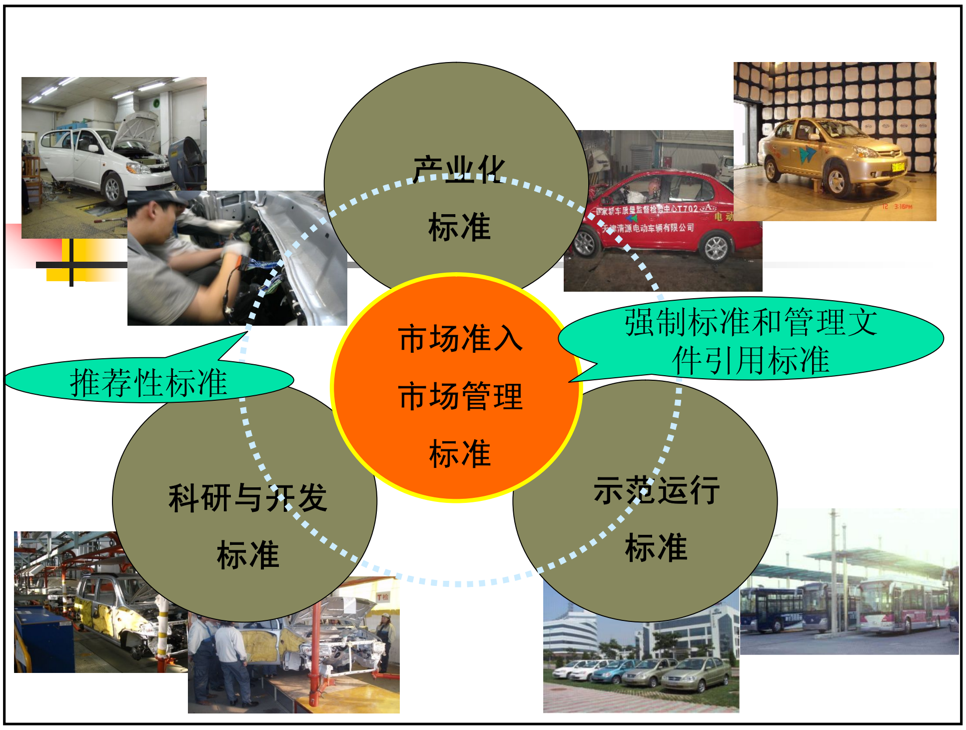
- 规范产业化
  - 提高产品质量
  - 降低成本

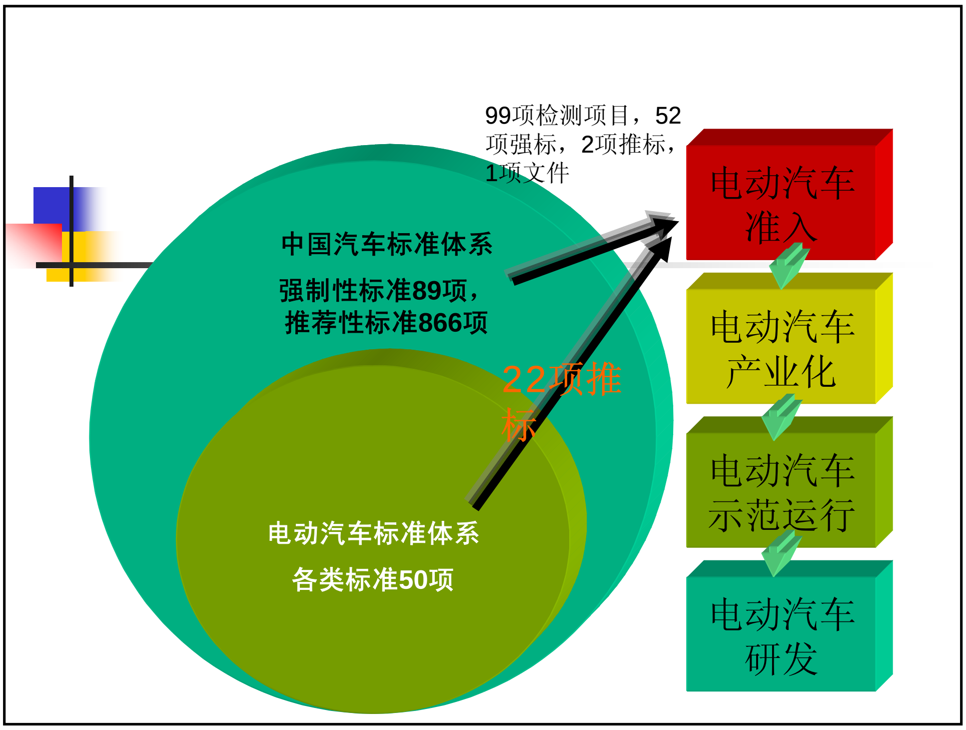
  } 技术条件、互换性

- 促进示范运行
  - 统一界面
  - 规范充电站建设

  } 接口、协议、互换性、安全性

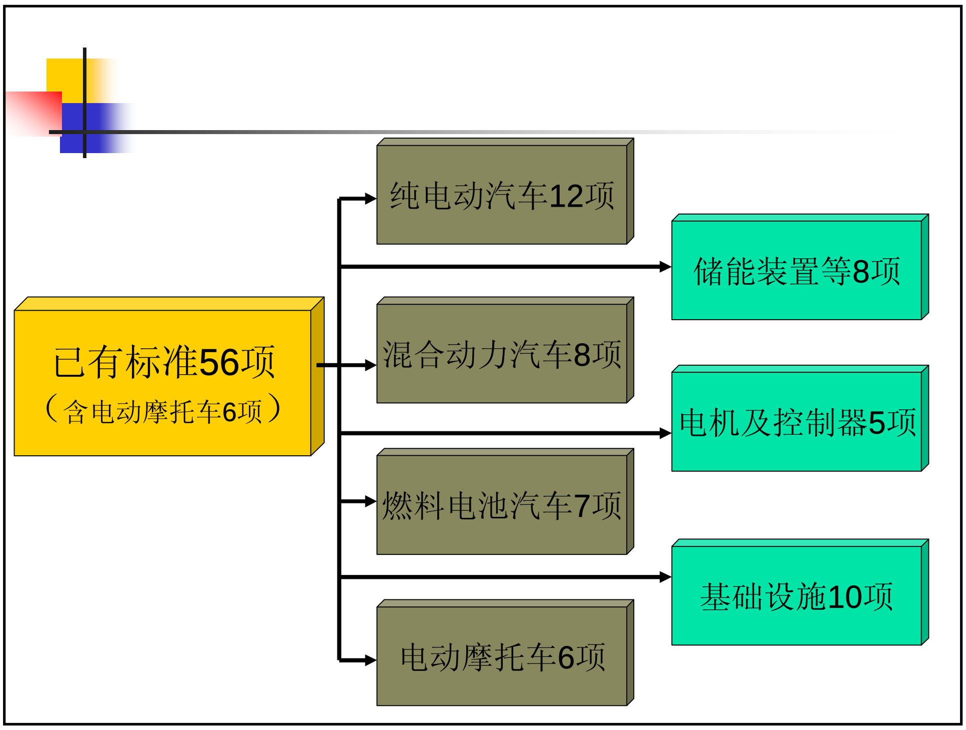
- 引导科研和产品开发
  - 促进新材料、新技术和新工艺应用
  - 促进技术交流





准入执行标准和检验项目

- 必须满足现有的常规汽车检测项目
- 须满足电动汽车相关专项标准并提供检测报告
- 储能装置须满足QC/T741~744，锌空气电池须满足GB/Z18333.2-2001



电动汽车标准应用执行情况

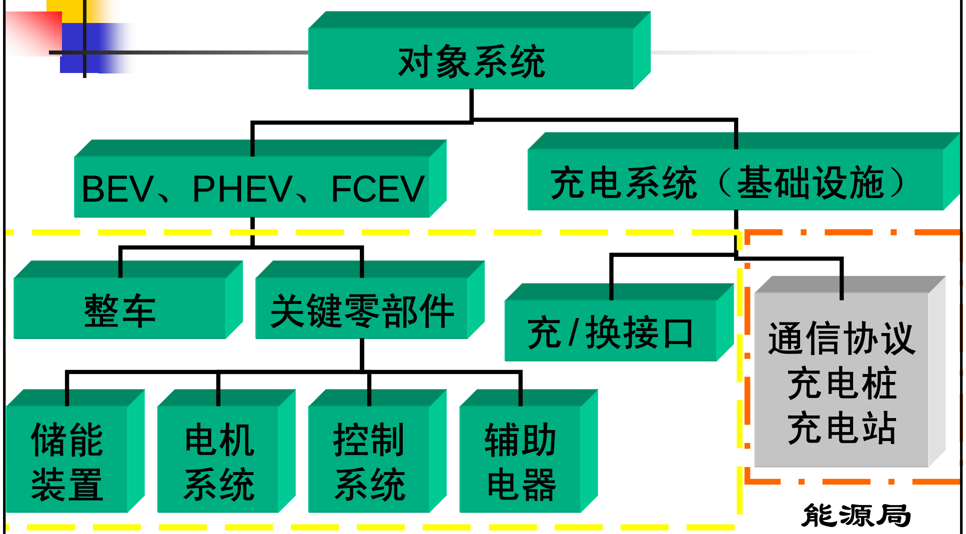
- 从2001年发布第一批电动汽车标准以来，标准成为863计划等电动汽车项目立项和验收的依据和技术支撑，也成为电动汽车科技创新、十城千辆、上海世博会示范运行等计划的重要技术支撑。
- 2009年6月工业和信息化部发布了《新能源汽车生产企业及产品准入管理规则》，规定了电动汽车必须满足现有的、且适用的常规汽车检验项目，另外还需满足电动汽车相关专项标准。
- 电动汽车需要满足的专项检测标准共26（22+4）项，全部来自于全国汽标委电动汽车分标委制定的国家标准或行业标准，到2010年底依据这些标准共有350多款电动汽车上了公告。
- 在支持电动汽车产业化、企业和产品准入、私人购买新能源汽车直接补贴等工作中，电动汽车标准发挥了重要作用。

提　纲

一、现状与需求

二、体系与分类

三、支撑与保证

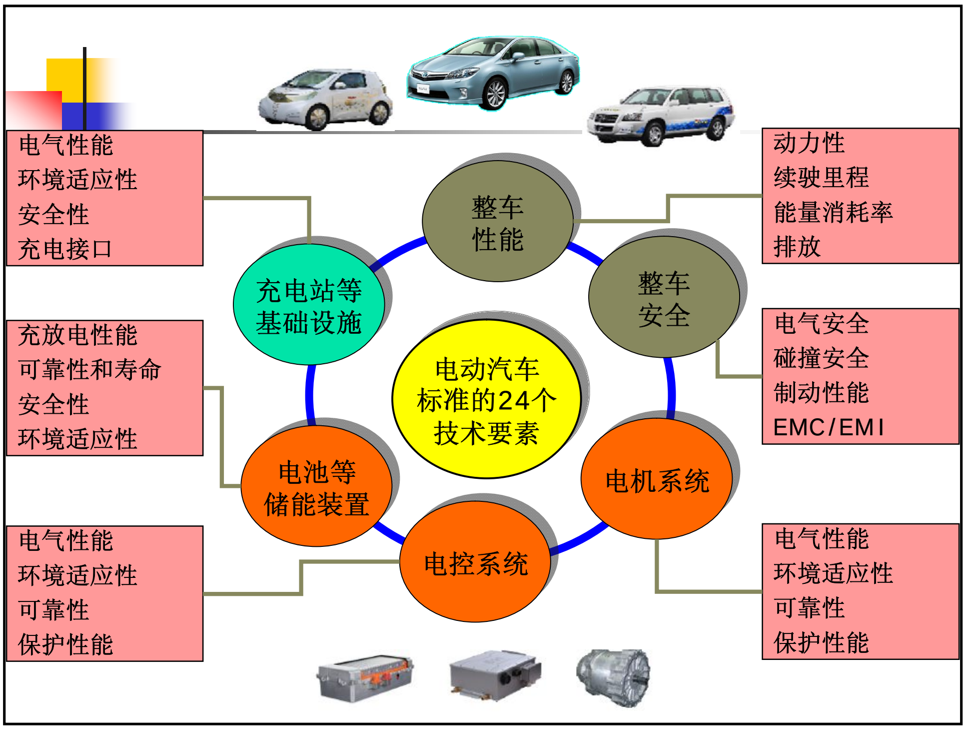


TC114为主、涉及到TC77、TC67、TC26、 TC69、TC457

能源局
管理
中电联

市场准入和管理标准

安全
绿色（节能和环保）
基础设施



电气性能
环境适应性
安全性
充电接口
充放电性能
可靠性和寿命
安全性
环境适应性
电气性能
环境适应性
可靠性
保护性能
整车性能
充电站等基础设施
整车安全
电动汽车标准的24个技术要素
电池等储能装置
电机系统
电控系统
动力性
续驶里程
能量消耗率
排放
电气安全
碰撞安全
制动性能
EMC/EMI
电气性能
环境适应性
可靠性
保护性能

标准化工作思路

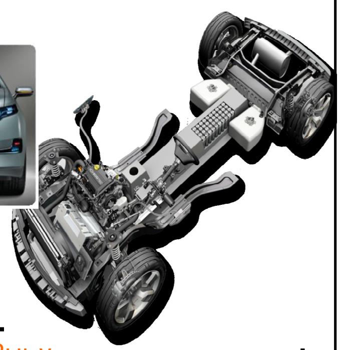
电动汽车整车

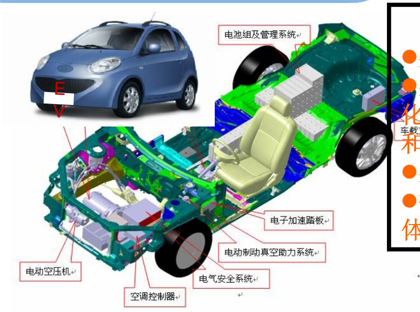
- 整车基础和通用标准
- 整车一般安全和碰撞安全标准
- 整车能耗和排放（绿色）标准
- 整车电磁兼容标准
- 整车技术条件和规范

BEV/PHEV整车标准

BEV

- 整车集成化开发与设计
- 动力系统匹配与标定技术研究
- 整车安全设计
- 增程器（选装）的匹配与优化技术开发
- 产业化技术研究
- 市场推广技术研究

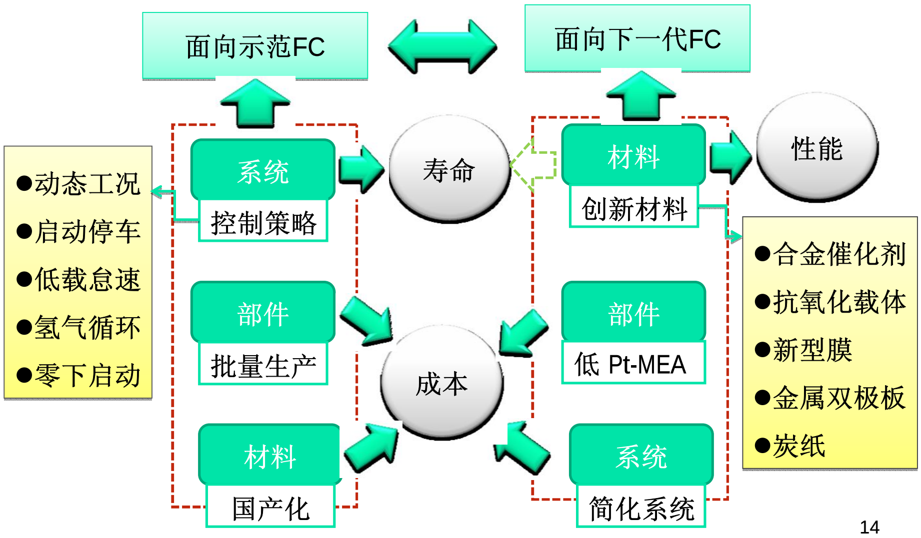




PHEV

- 整车优化设计及整车与动力系统集成匹配；
- 整车和系统的可靠性、耐久性研究，通过强化试验完成整车和系统的可靠性、耐久性考核和改进；
- 整车和系统的成本控制技术；
- 批量化生产装备建设与工艺研究及质量管理体系建设。

燃料电池汽车标准



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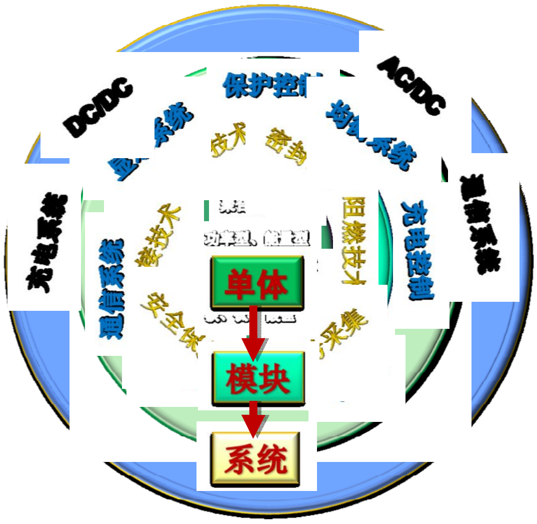
标准化工作思路

储能装置

- 锂离子（磷酸铁锂、锰酸锂、三元材料等）电池
- 超级电容
- 镍氢电池
- 新型电池（锌空气、钠硫电池等）

机械滥用	温度滥用	电气滥用	故障分析
• 振动/跌落/冲击	• 火烧	• 短路	• 故障分类
• 湿度/海水浸泡	• 热冲击循环	• 过充/过放	• 故障等级
• 压缩变形	• 无热管理循环	• 高压电防护	• 故障码

动力电池（储能系统）标准



强化系统集成

降低成本

回收利用

安全性

互换性

循环寿命

电池包和系统

标准化工作思路

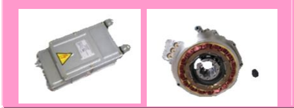
电机及电机控制器

- 各类（交流、永磁等）电机的技术条件和通用要求
- 电机控制器的技术条件和通用要求
- 电力电子、功率器件技术条件

性能	机械	电气	安全
• 转矩/转速/效率	• 结构强度	•绝缘	• 高压电保护
• 功率输出	• 环境适应性	• 介电强度	• 电磁兼容
• 温升	• 换向器试验	• 电压/电流控制	

电机（电驱动）系统标准

高密度电机系统技术

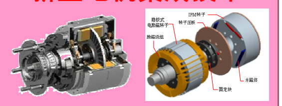


- 高性价比的关键材料与关键部件
- 提高系统性能指标和集成度
- 可靠性、耐久性与环境适应性
- 低成本高品质先进制造
- 专用加工设备和测试设备
- 电机系统产品化应用

高品质电机系统技术

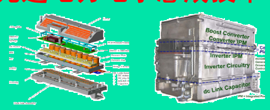
- 中小型车用模块并联技术
- 低成本电力电子总成产品开发
- 提高客车电机及其控制系统集成度，降低重量
- 系列化纯车用电机及其控制系统产品系列，提高产品通用性

新型电机集成技术



- 集成化的电动轮毂技术
- 混合励磁电机技术
- 轴向磁路电机技术
- 双机械端口能量变换器电机
- 主辅牵引电机技术

先进电力电子总成技术



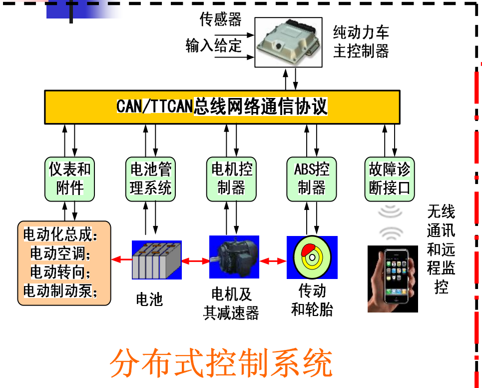
- 电力电子集成封装与互连技术
- 机、电、热、磁集成设计技术
- 叠层母排与膜电容模块化结构设计
- 全数字控制电路小型化与EMC技术
- 集成控制器多参量实验测试方法
- 大功率双向DC-DC变换器技术

标准化工作思路

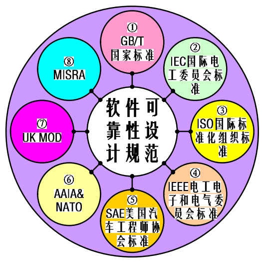
电控系统标准

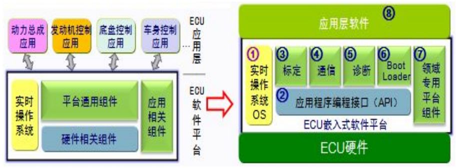
- 整车通信协议
- 整车控制器、多能源控制器技术条件
- 国际开发标准和质量标准的转化和应用
- 车网融合（V2G、V2H）标准研究

电控系统标准



整车/多能源控制器

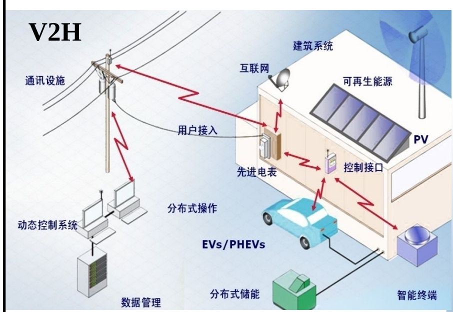




下一代电动汽车电控

电动车ITS与车网融合（V2G,V2H）

- 车辆到信息再到电网的一体化集成(V2G, V2H)



◆研究身份识别/ETC电子收费系统/安全防盗等系统协同工作;
◆导航系统和能量管理系统信息融合技术；完善的远程监控和诊断系统。

标准化工作思路

辅助电器标准

- 电动空调
- 电动转向器
- 电制动器和能量回收系统
- 电动汽车专用仪表
- 高压连接器和线束

车载电子仪表、信息系统

电动转向系统

辅助装置

电动空调系统

车载充电器

标准化工作思路

充电系统/快速换电系统

- 充电接口（交流、直流、大电流快充等）
- 换电接口
- 充电电缆及线束
- 通信协议
- 车载充电设备

满足基础设施建设的标准

“点-线-面”结合的能源供给体系

◆在示范城市群及周边区域建成2000座充/换站，40万个充电桩，形成“点-线-面”结合，充电、换电兼容的电动汽车能源补给网络。
◆研发“点-线-面”一体化集成网络信息化服务系统，包括用户身份识别、智能计量、结算体系，GPS站点巡航定位、ITS集成及V2G技术等。

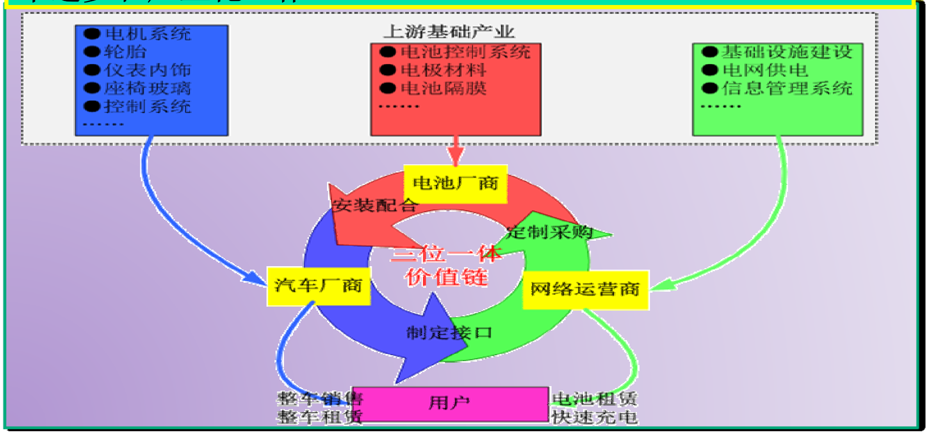
提　纲

一、现状与需求

二、体系与分类

三、支撑与保证

在国标委、工信部的指导下，充分发挥电动汽车产业链上各方的积极性，不断完善电动汽车标准和标准体系，做到企业标准、行业标准、国家标准协调发展，推动电动汽车的技术进步和产业化工作。



开展国际合作

中德合作

国标委、工信部与德国经济部主导的中德标准合作。

- E1充电系统
- E2通信协议
- E3碰撞安全
- E4充电站与智能电网

中欧合作

工信部、欧盟工业总司主导的中国欧盟世贸项目。

- 汽车能耗
- 动力电池
- EV能耗评价

中美合作

科技部、美国能源部主导的中美新能源合作项目。

- 先进电池研发
- EV能耗分析
- EV示范运行
- EV标准与评价方法研究

中日合作

质检总局、日本经产省主导的动力电池研究合作交流协议。

- CATARC
- TIPS
- JARI
- JSAE

GTR

ISO | WP29 | IEC

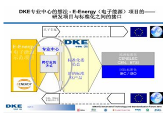
中国电动汽车标准与标准体系

电动汽车整车与零部件研发成果

电动汽车产业化成果

电动汽车示范运行与商业化成果

国际标准和先进国家标准成果



谢　谢！

Overview of the Chinese Roadmap for EV standardization

China Automotive Technology and Research Center

Zhou Rong

Outlines

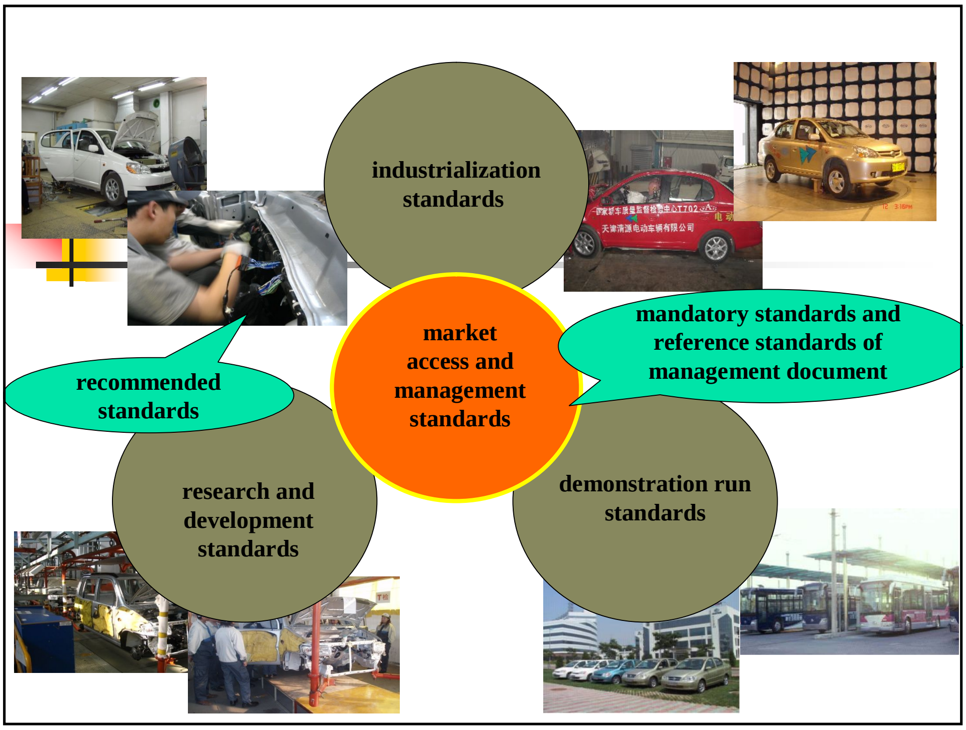
Ⅰ. Situation and Need

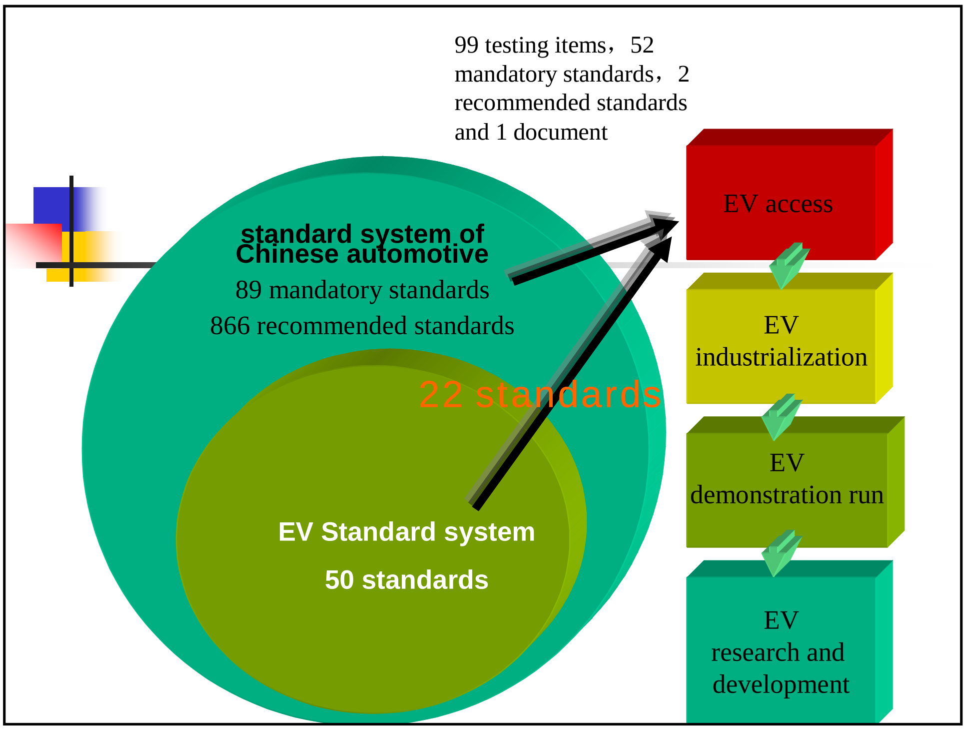
Ⅱ. System and Classification

Ⅲ. Support and Warranties

Objects of standardization

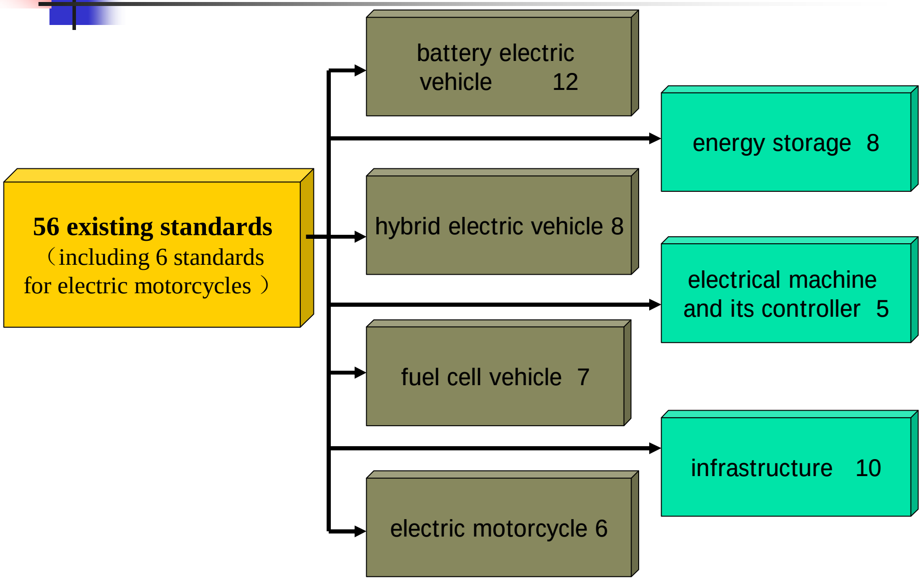
- **Support the management of government departments**
  - Market access
  - Market management
  - } certification and testing
- **Industrialization**
  - Improve product quality
  - Reduce costs
  - } technical conditions and interchangeability
- **demonstration run**
  - Unified interface
  - Regulate construction of charging station
  - } interface, agreement, interchangeability and security
- **Guide science research and product development**
  - Promote application of new materials and technology
  - Promote technical exchange





Access standards and testing items

- Meet the existing conventional vehicle testing items;
- Meet special standards for electric vehicles and provide these test report.
- Energy storage should meet QC/T 741~744, and zinc oxygen batteries should meet GB/Z 18333.2-2001.



About application of standards for EV

- Since 2001, release of the first standard for electric vehicle, standard has become basis and technical support for electric vehicle projects like 863 projects 863 and also become important technical support like technology innovation of electric vehicle, demonstration of Shanghai World Expo.

- *Management rules for enterprises and products of new energy vehicles* released by MIIT in June 2009 provided for routine test items and special standards electric vehicle must meet.

- Electric vehicle must meet 26 special test standards form sub-committee of the national automobile standardization committee, according to these standards, a total of more than 350 electric vehicles were on the bulletin by the end of 2010.

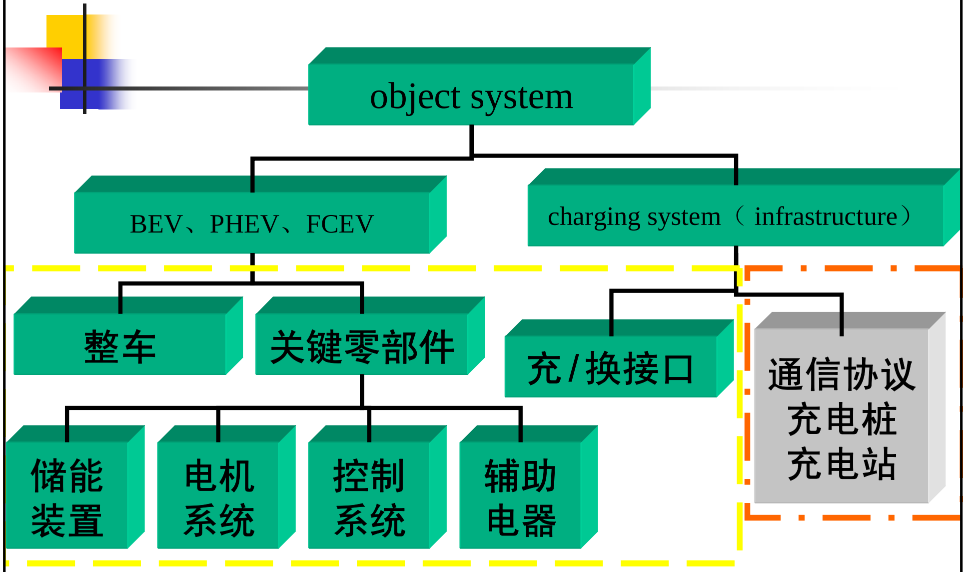
- Standards for electric vehicle play an important role for supporting industrialization, enterprises and products access and direct subsidies for private purchase of new energy vehicles.

Outlines

Ⅰ. Situation and Need

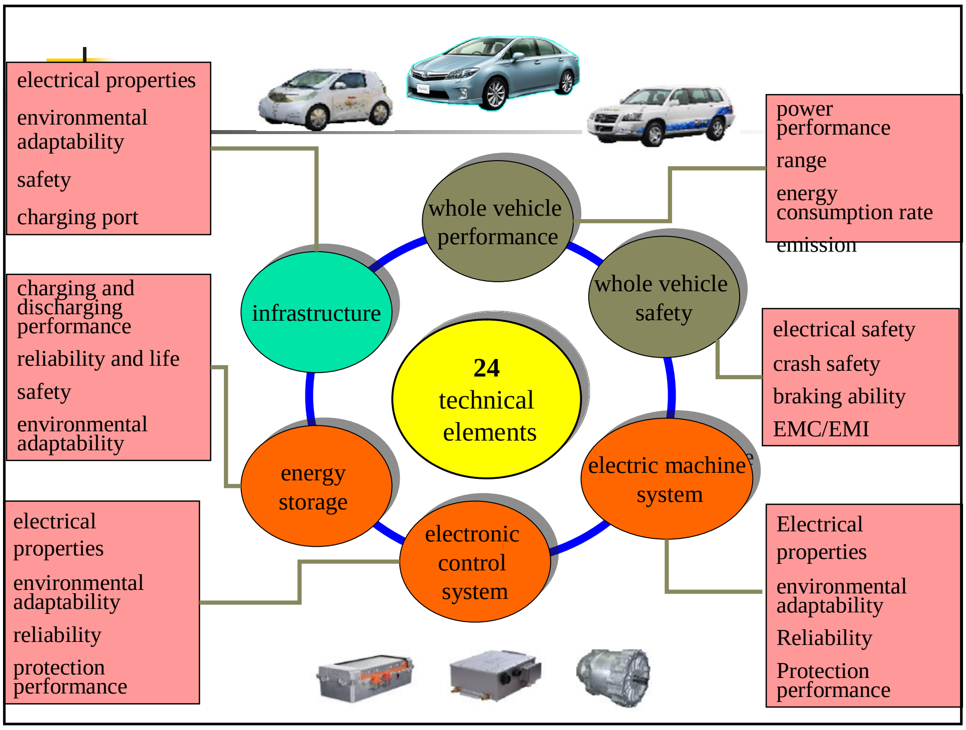
Ⅱ. System and Classification

Ⅲ. Support and Warranties



TC114, TC77, TC67, TC26, TC69, TC457

Standards for market access and management

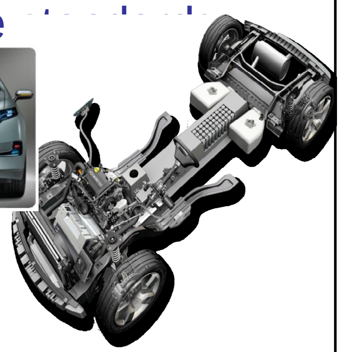


Standardization ideas

EV

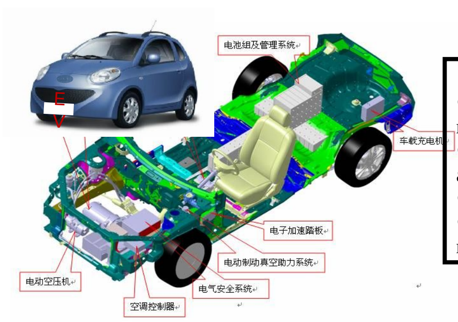
- Basic and general standards
- General safety and crash safety standards
- Energy consumption and emission standards
- Electromagnetic compatibility standards
- Technical conditions and specifications

BEV/PHEV complete vehicle



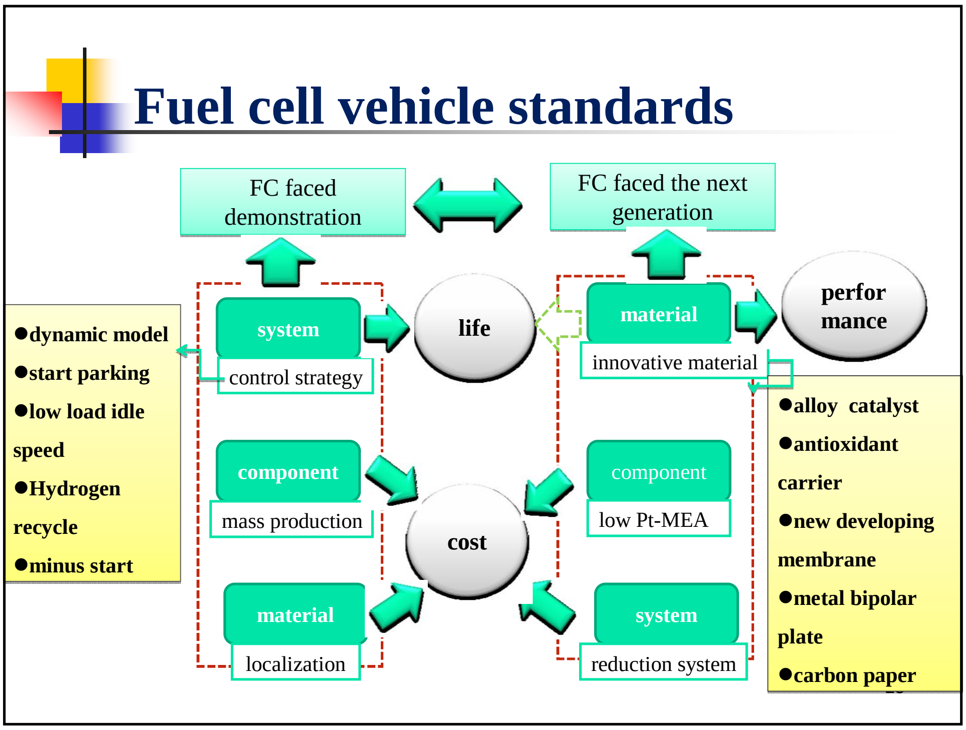
BEV

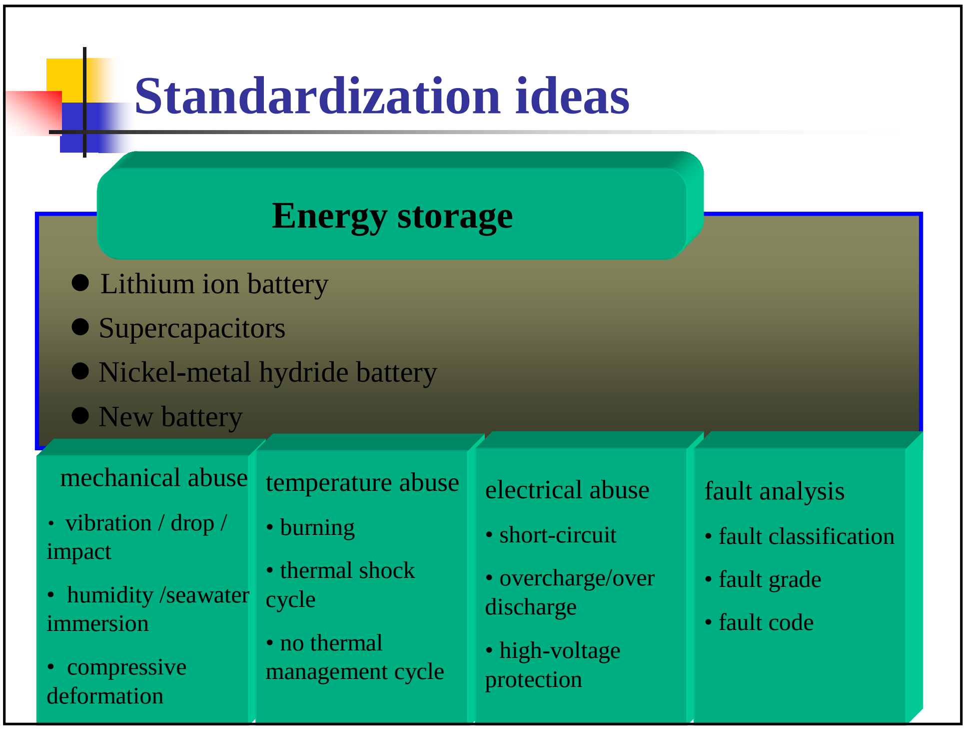
- Integrated development and design
- Matching and calibration of power system
- Complete vehicle safety design
- Matching and optimization of range extender
- Industrialization technology research
- Marketing technology research



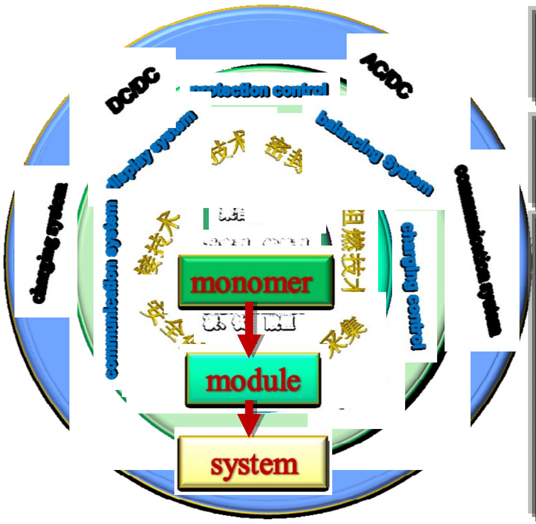
PHEV

- Optimization design of complete vehicle and integrated matching between complete vehicle and power system
- Reliability and durability research of complete vehicle and system
- Cost control techniques of complete vehicle and system
- Equipment construction of mass production, technology research and quality management system construction


Fuel cell vehicle standards
FC faced demonstration
FC faced the next generation
●dynamic model
●start parking
●low load idle speed
●Hydrogen recycle
●minus start
system
control strategy
component
mass production
material
localization
life
cost
material
innovative material
component
low Pt-MEA
system
reduction system
perfor mance
●alloy catalyst
●antioxidant carrier
●new developing membrane
●metal bipolar plate
●carbon paper


Standardization ideas
Energy storage
● Lithium ion battery
● Supercapacitors
● Nickel-metal hydride battery
● New battery
mechanical abuse
• vibration / drop / impact
• humidity /seawater immersion
• compressive deformation
temperature abuse
• burning
• thermal shock cycle
• no thermal management cycle
electrical abuse
• short-circuit
• overcharge/over discharge
• high-voltage protection
fault analysis
• fault classification
• fault grade
• fault code

Power battery (energy storage) standards



- strengthen system integration
- cost reduction
- recycling
- safety
- interchangeability
- cycle life
- battery pack and system

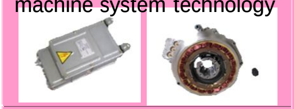
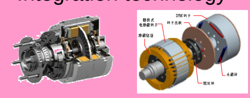
Standardization ideas

Electrical machines and controller

- Technical conditions and general requirements of electrical machine
- Technical conditions and general requirements of electrical machine controller
- Technical conditions of power electronics and power devices

performance	machinery	electric	safety
• torque / speed / efficiency • power output • temperature rise	• structure strength • environmental suitability • commutator test	• insulation • dielectric strength • voltage / current control	• high-voltage protection • electromagnetic compatibility

Electrical machine system standards

High-density electric machine system technology	High quality electric machine system technology	New electric machine Integration technology
		
● Key materials and components with cost-effective ● Improve system performance and integration ● Reliability, durability and adaptability to environment ● Low-cost , high quality and advanced manufacturing ● Special process processing equipment and test equipment ● Production application of electric machine	● Small and medium vehicle modules parallel technology ● Low-cost power electronics assembly product development ● Improve passenger electric machine and control system integration to reduce weight ●Serialization of product line of electric machine and control system to improve product versatility	• Integrated electric wheel technology • Hybrid excitation electric machine technology • Axial magnetic circuit electric machine technology • Dual Mechanical Ports energy converter electric machine • Main and auxiliary traction electric machine technology

先进电力电子总成技术

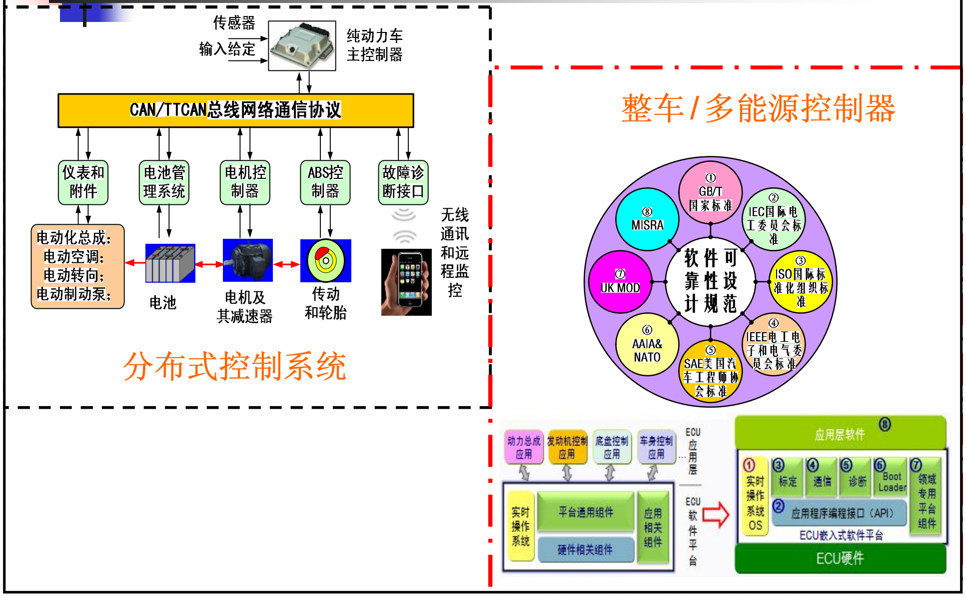
- Integrated packaging and interconnection technology of power electronic
- Integrated design technology with machine, electricity, heat and magnet
- Structure design of membrane capacitance modular
- Miniaturization of full digital control circuit and EMC technology
- Multi-parameter experimental test method of integrated controller
- High-power bi-directional DC-DC converter technology

Standardization ideas

Electric control system standards

- Communication agreement
- Technical conditions of controller
- Transformation and application of international development and quality standards
- Standard research of V2G and V2H

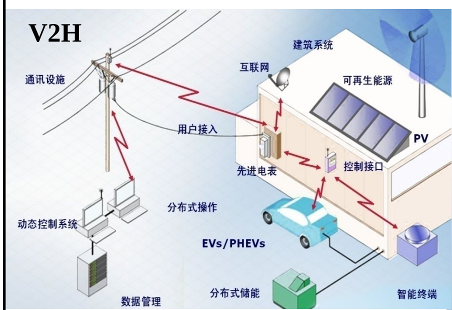
Electric control system standards

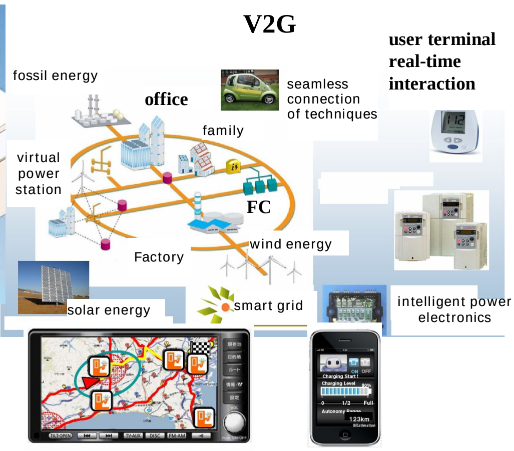


Next-generation EV electronic control

Integration for ITS and vehicle network of electric vehicles（V2G,V2H）

- Integration from vehicle to information to grid(V2G, V2H)





◆ Identification research/Electronic Toll collection system of ETC/Cooperative work between systems

◆ Information fusion between navigation system and energy management system/Best remote monitoring and diagnosis systems

Standardization ideas

Assistive electrical devices standards

- Electric air conditioning
- Electric steering gear
- Electric brake and Energy recovery system
- Special instruments for electric vehicle
- High-voltage connector and wiring harness

on-board electronic instruments and information systems

electric steering system

auxiliary system

electric air conditioning system

on-board charger

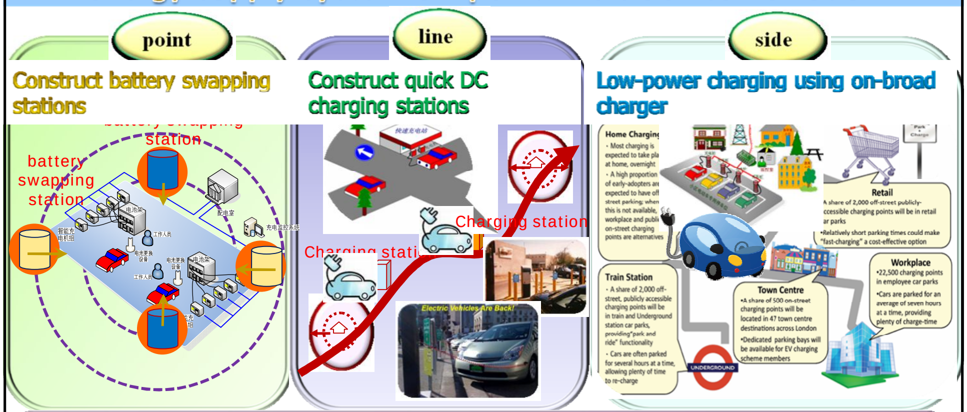
Standardization ideas

Charging system/Short battery swapping system

- Charging port
- Battery swapping port
- Charging cable and wiring harness
- Communication agreement
- On-board charging equipment

Standards for infrastructure

energy supply system of "point-line-side" combination



◆ Construct 2000 charging/battery swapping stations, 40,000 charging piles in demonstration urban agglomeration to be electric vehicle energy supply network of "point-line-side" combination with charging and battery swapping function.

◆ Develop "point-line-side" integration network information service system, including user identification , intelligent measuring, settlement system, GPS site cruise positioning, ITS integration and V2G technology

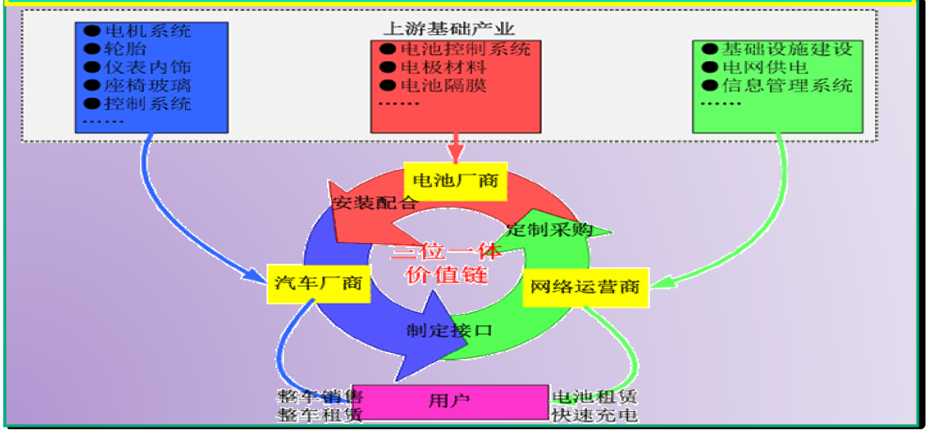
Outlines

Ⅰ. Situation and Need

Ⅱ. System and Classification

Ⅲ. Support and and Warranties

Under the guidance of SAC and MIIT, constantly improve EV standards and standard systems to promote technical progress and industrialization.



International cooperation

China and Germany

- E1 charging system
- E2 communication agreement
- E3 crash safety
- E4 charging station and smart grid

China and Europe

- energy consumption
- power battery
- EV energy consumption evaluation

China and America

- battery R & D
- EV energy consumption analysis
- EV demonstration run
- EV standards and evaluation method

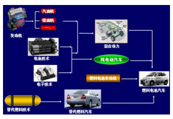
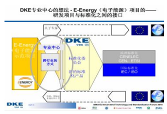
China and Japan

- CATARC
- TIPS
- JARI
- JSAE

GTR

ISO | WP29 | IEC

Standards and standard systems for Chinese EV

the whole vehicle and parts research results	industrialization results	demonstration run and commercialization results	international standards and advanced national standards results
			

Thank you!

Ziva Patir

Ziva Patir

Vice President, International Standardization and IMS [Quality, Safety, environment]

Ziva Patir leads international standardization efforts for Better Place, defining technical standards and ensuring compliance with requirements set by international standards organizations and regulatory bodies. In this role, she oversees collaboration with Better Place partners on existing and future standards to promote the industry-wide consensus necessary for mass deployment of electric vehicles and ensure the public safety interest is well served.

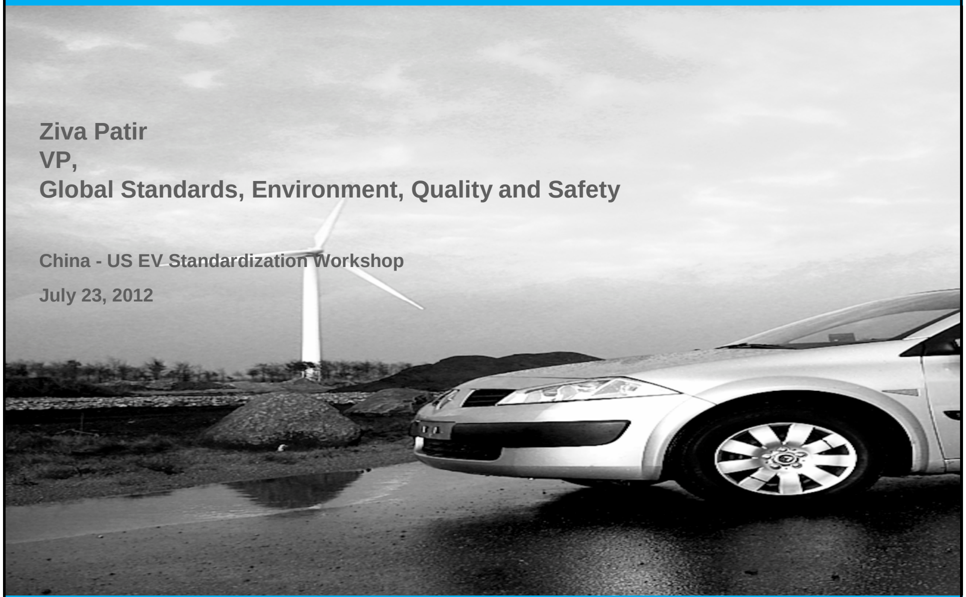
Ziva is in charge of the company's policy and implementation of Quality, safety and environment management system [IMS] to include compliance to ISO 9001, ISO 140001 and SI 18001 as an integrated system.

Prior to joining Better Place, Patir held the position of director general of the Standards Institution of Israel (SII) for over a decade. Patir also served as Vice President of the International Organization for Standardization (ISO), Chair of the Technical Management Board [2003-2007]. She was the first woman elected to this position.

Last year she served on the CEN/CENELEC Focus group on electro-mobility leading the PT on batteries.

She also served as Chair of the Board of the Road Safety Authority (RSA) in Israel. Chair of the chapter of IWF [International women forum]. Serves on various boards of directors in Academia and the business sector.

better place



Ziva Patir
VP,
Global Standards, Environment, Quality and Safety

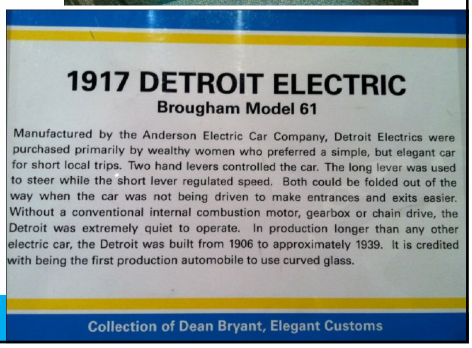
China - US EV Standardization Workshop

July 23, 2012

Electric Vehicles – Not As New As You Think

Thomas Edison and an electric car in 1913

The Henney Kilowatt, a 1961 production electric car based on the Renault Dauphine



1917 DETROIT ELECTRIC
Brougham Model 61

Manufactured by the Anderson Electric Car Company, Detroit Electrics were purchased primarily by wealthy women who preferred a simple, but elegant car for short local trips. Two hand levers controlled the car. The long lever was used to steer while the short lever regulated speed. Both could be folded out of the way when the car was not being driven to make entrances and exits easier. Without a conventional internal combustion motor, gearbox or chain drive, the Detroit was extremely quiet to operate. In production longer than any other electric car, the Detroit was built from 1906 to approximately 1939. It is credited with being the first production automobile to use curved glass.

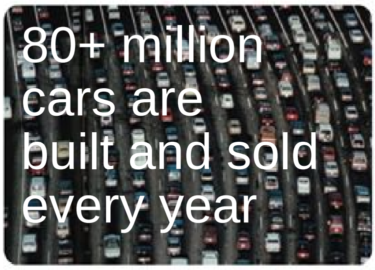
Collection of Dean Bryant, Elegant Customs

Electric Vehicles history

- Electric cars were popular in the late-19th century and early 20th century
- Before the 1920s, electric automobiles were competing with petroleum-fueled cars for urban use of a quality service car
- Proposed as early as 1896 in order to overcome the lack of recharging infrastructure, an exchangeable battery service was first put into practice by Hartford Electric Light Company for electric trucks
- Electric cars were often marketed as suitable vehicles for women drivers due to their ease of operation, and lack of vibration, smell, and noise associated with gasoline cars

A world with 2 billion cars

900 million cars today



EVs are just a small fracture

Major challenges: pollution, resource depletion, congestion and global warming

Standards are necessary to show the way

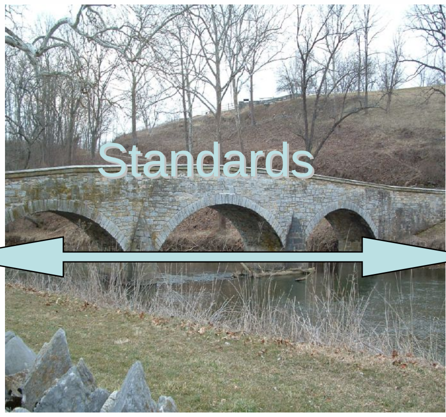
Standards are a Bridge to the Future

User Needs:

consumers, companies, industries,

government,

testing & certification

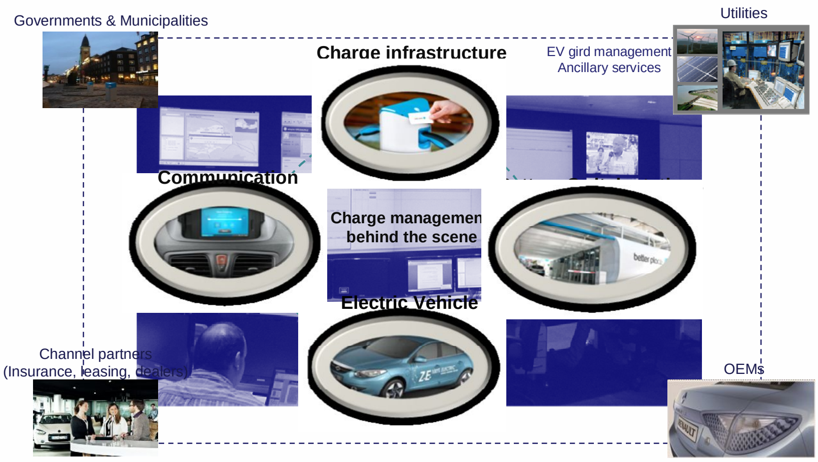


Technology:

creative ideas, concepts, values, perspectives, methods, products& services

Standards form a bridge between technology and users to create new future

The Eco-System of EVs



Inherent limitations of Electric Vehicle:
Range, availability and scaling of infrastructure

Range Extension Options

- Slow Charge, Either DC or AC
- Fast Charge, Either DC or AC

- Battery Exchange system

Key Battery switch Concerns

- Safety
- Interchangeability
- Performance

CEN /CENELEC Activities on E-Mobility

- June 2010: Commission officially submitted a Mandate (M468) to the European Standardization Organizations ETSI, CEN and CENELEC
- CEN/CLC were requested to develop standards or to review existing standards in order to:
  - Ensure interoperability between the charging system for batteries used in electric vehicles and all types of batteries.
  - Ensure that the charging system for batteries used in electric vehicles can be connected and operated in all EU States.
  - Appropriately consider safety risks and electromagnetic compatibility of this charging system in the field of Directive 2006/95/EC (LVD) and Directive 2004/108 (EMC).
- The Focus Group on E-Mobility (EV FG) was created consisting of experts from all stakeholders involved in E-Mobility in order to evaluate the European needs for standardization within this field
- The final report [July 2011] besides many other recommendations, includes a recommendation to standardize exchangeable batteries

U.S. Standardization - ANSI EVSP

- ANSI Established the **Electric Vehicles Standards Panel (EVSP)** to lay the groundwork for a strategic roadmap that will define the standards and conformance programs needed to enable the widespread acceptance and deployment of EVs and associated infrastructure in the U.S.
- Version 1.0 was published April 2012
- The EVSP report recommends ,besides many recommendations] the standardization of Battery exchange stations as a range extension for electric vehicles.

China Standardization of Battery switch stations

- 11 battery switching station related standards are in final stages of developing.
- The standards are very well drafted and deal with all major issues of BSS, including technical requirements, construction codes, acceptance tests and safety issues
- China has submitted a new work item proposal for the standardization of Battery Switch Station safety of for IEC TC 69.

Switch solutions emerge in China, with global disruptive potential

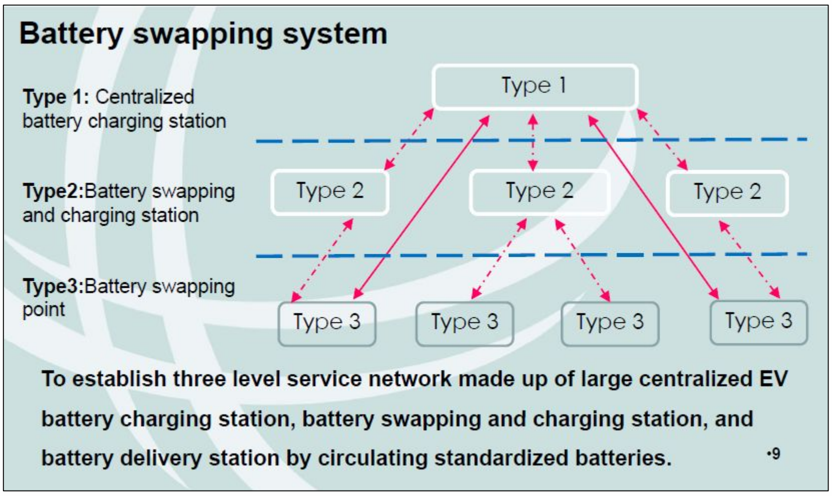
▪ Many Chinese switchable solutions in different development phases

SGCC	• Switch main model, charge supplementary, centralized battery charge. • Has several battery switch stations already installed 
Potevio (CNOOC + SGCC)	• CNOOC - battery supplier (Qingdao) • Focused on switch for cars, changed to charge & buses
Key Power	• Founded by Tsinghua university professors, strong support from MIIT • Aim to supply switch solutions to SGCC, solution looks similar to BPLC (were Potevio partners) • Work with State Grid and CSG on battery standardization, driven by China government

Switch solutions emerge in China, with global disruptive potential

IAT 	• Auto engineering services and components supplier • Displayed a simple switch mockup at the Beijing Auto Show in 2010 • Did XBEV prototype for Foton; have similar contracts with other Chinese OEMs
Dianba	• Developed switch technology for buses, developing solution for passengers cars • Has a switch station in Guangzhou, losing money, aim to hand over the operation to CSG.
BIT	• Developed bus switch solution for Beijing Olympic games. 
Other: **1.Siemens** **2.Titans**	• Displayed animated e2e EV solutions on video and presentations, no operational BSS solutions so far

China BSS Standard Model



From a report by Shandong Electric Power Research Institute – a subsidiary of State Grid
Terminology of Electric Vehicle Charging Battery Swap Infrastructure

Chinese battery swap station – Standards requirement

- Can be fully automated
- Less than 300 seconds swap time
- Batteries charged in the battery storage area
- Can supply batteries for mobile/small Battery Swap Points

Recommendations

- Create a follow up group to ensure all technologies are covered to ensure interchangeability
- Continue alignment to ensure efficient supply chain
- Try and coordinate various SDOs standards working on the same subjects

Mark Klerer

Mark Klerer,
Senior Director, Technology
Qualcomm Inc.
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Tel: 908-443-8092

Summary

Mark Klerer is a Senior Director of Technology at Qualcomm where he shares in the responsibilities of the standardization of wireless technologies, smart grid activities and wireless electric vehicle charging technologies.

Mark is Vice-chair of the US Smart Grid Interoperability Panel (SGIP) and also a sub-task-force leader on communications in support of Wireless Charging of Electric vehicles in the SAE J2954 Task Force as well as the J2836 Task Force. Mark is also e member of the steering committee of the ANSI EVSP.

Mark has extensive work experience in both power systems engineering and in communications systems engineering. He started his career in power engineering and substation design and subsequently worked at Bell Laboratories data communications and network management. Mark has extensive experience in leading and managing standards activities. He has served on the Boards of several successful industry standards forums (the OIF, NMF and MSF) and he has chaired numerous standards committees in the ITU-T, ITU-R, ISO, ATIS, MESA and IEEE.

Mark has a BS degree in Electrical Engineering from the City College of New York, a Masters degree in Systems Engineering for Stanford University and a Masters degree in Business Administration form Pace University.

WIRELESS CHARGING OF ELECTRIC VEHICLES

Sino-U.S. Workshop on New Energy Standardization

July 23, 2012

Mark Klerer
Qualcomm, Inc.

Overview

- Wireless EV Charging Vision
- Standardization Areas and Constraints
- EMC and Regulatory Compliance
- SAE WEVC Standardization Activities
  - J2954 WEVC
  - J2836/6, J2847, J2931 and J2953 WEVC Communications

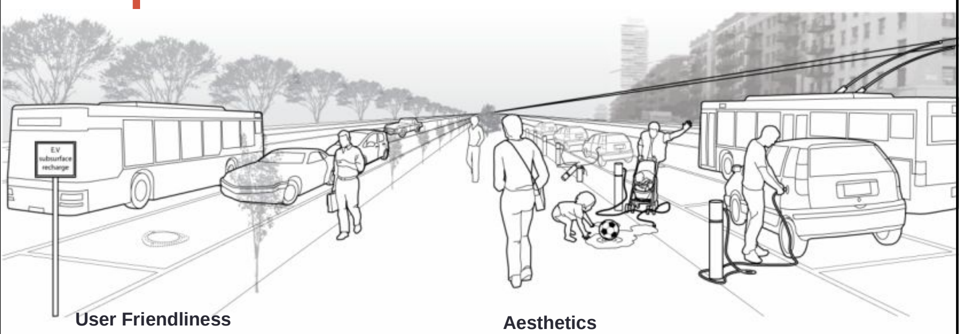
3

Electric Vehicle Charging Vision

- Improved experience for drivers of Electric Vehicles provided by static wireless charging of EVs
- Evolution to quasi-dynamic charging for opportunistic charging
- Dynamic charging and electrified highways

4

Wireless Charging – Enabling EV Adoption



User Friendliness

- Just park and charge automatically
- No cord set to handle
- No moving parts
- Extremely rugged and tough
- Impervious to chemicals, debris
- Low profile, crash-safe
- Vandal-proof, theft-proof

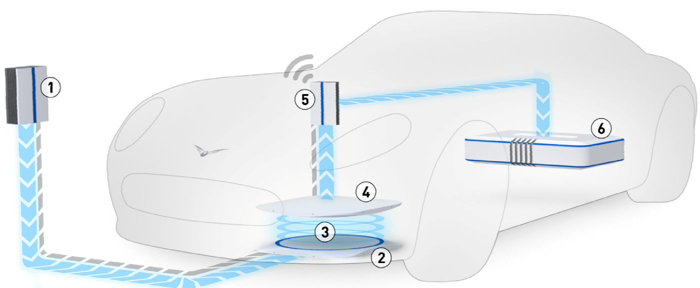
Aesthetics

- Doesn’t damage historic city aesthetics
- Avoids unnecessary street clutter
- Maintains precious footpath area
- Eyesore of overhead cables is removed for buses

Roadside Conductive EV Charging !!

Typical Wireless Charging System – Static Charging

① Power Supply
② Transmitter Pad
③ Wireless Electricity & Data Transfer
④ Receiver Pad
⑤ System Controller
⑥ Battery



7

Standardization Areas and Constraints

- Interoperability Requirements
  - Operating Frequency – range under consideration 20 – 150 kHz
  - Magnetic interoperability – ability of on-board pad to couple to base pad
  - Vehicle to Charger communications
  - Pad Positioning on Vehicle and Ground
  - Availability of vehicle and base alignment mechanism
- Performance
  - Power Levels
  - Efficiency levels
  - Air gap and misalignment tolerance
- Constraints and Compliance Requirements
  - EMC regulations
  - Radiated emissions requirements
  - Foreign object detection

8

EMC and Regulatory Requirements

9

WEVC Emissions Requirements

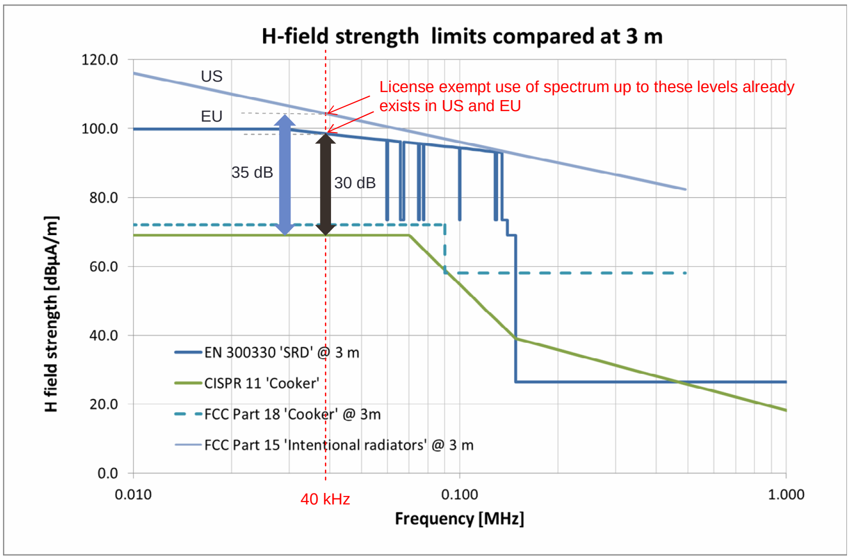
Emission type	Purpose	Physical quantity to be tested	Standard
Radiated emissions	EMF exposure of living matter	Magnetic field strength (Flux density)	ICNIRP 1998/2010
		Electric field	ICNIRP 1998/2010
		Body induced currents J and induced E	ICNIRP 1998/2010
	EMF exposure of sensitive medical implants	Magnetic field strength (Flux density)	EN 45502-2
			ANSI/AAMI PC69:2007, EN 45502-1-1
	Radio interference	Magnetic field strength	CISPR11 / EN 55011
			FCC Part 18
Conducted emissions	Radio interference	EMI voltage at AC power line terminal	CISPR11 / EN 55011
			FCC Part 18
	Harmonic current emissions	AC current harmonics at AC power line terminal	IEC 61000-3-2
	Voltage fluctuations	Voltage fluct. and flicker at AC power line terminal	IEC 61000-3-3

Note: List is not exhaustive

10

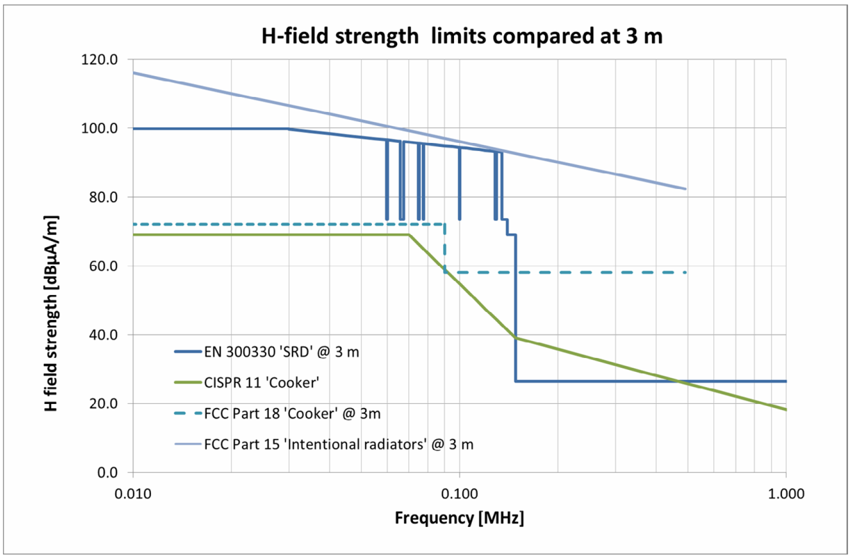
Standards - Radio interference

Comparison of H-field limits at WEVC fundamental frequencies



Standards - Radio interference

Comparison of H-field limits at WEVC harmonic frequencies



ICNIRP Basic Restrictions

- ICNIRP 1998 and 2010 standards for induced current density (*J*) and induced electric field (*E*) between 1 Hz and 10 MHz to prevent nerve stimulation in both central and peripheral nervous systems (CNS and PNS)
  - 2010 standard specifies the *E* limits for both CNS and PNS
  - 1998 standard was based on effects seen in CNS from biological studies but specifies the induced *J* limits for **all tissues** in head and trunk regions
- As of today, ICNIRP 2010 standard has not been adopted by regulatory bodies. Hence, human exposure should be qualified for all exposure quantities

RF Exposure Limits for General Population							
	SAR **[W/kg] (Whole Body Average)**	***SAR*** **[W/kg] (Head/Trunk)**	***SAR*** **[W/kg] (Limbs)**	**Induced *E*** ($2x2x2\ mm^3$-avg) **[V/m] (CNS & PNS)**	**Induced *J*** ($1\ cm^2$ - avg) **[mA/m^2] (Head/Trunk)**	**Applicable frequency range**
ICNIRP 1998	0.08	2 (10-g)	4 (10-g)	--	f/500	1 Hz to 10 MHz
ICNIRP 2010	0.08	2 (10-g)	4 (10-g)	1.35×10^{-4} f	--	1 Hz to 10 MHz
FCC	0.08	1.6 (1-g)	4 (10-g)	--	--	100 kHz to 6 GHz

RF Exposure - ICNIRP Reference Levels

- ICNIRP 1998 states that the reference levels do not take into account the human body factor enhancement

REFERENCE LEVELS

Where appropriate, the reference levels are obtained from the basic restrictions by mathematical modeling and by extrapolation from the results of laboratory investigations at specific frequencies. They are given for the condition of maximum coupling of the field to the exposed individual, thereby providing maximum protection. Tables 6 and 7 summarize the reference levels for occupational exposure and exposure of the general public, respectively, and the reference levels are illustrated in Figs. 1 and 2. The reference levels are intended to be spatially averaged values over the entire body of the exposed individual, but with the important proviso that the basic restrictions on localized exposure are not exceeded.

For low-frequency fields, several computational and measurement methods have been developed for deriving field-strength reference levels from the basic restrictions.

The simplifications that have been used to date did not account for phenomena such as the inhomogeneous distribution and anisotropy of the electrical conductivity and other tissue factors of importance for these calculations.

Implantable Medical Device Requirements

- ANSI/AAMI PC 69: 2007

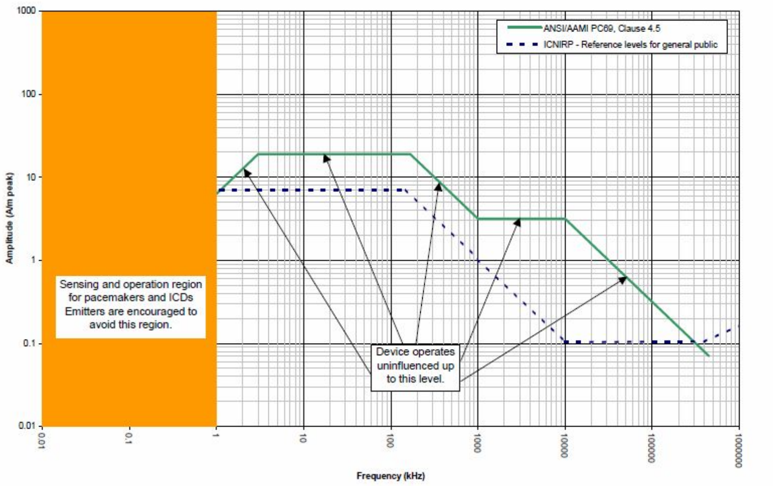
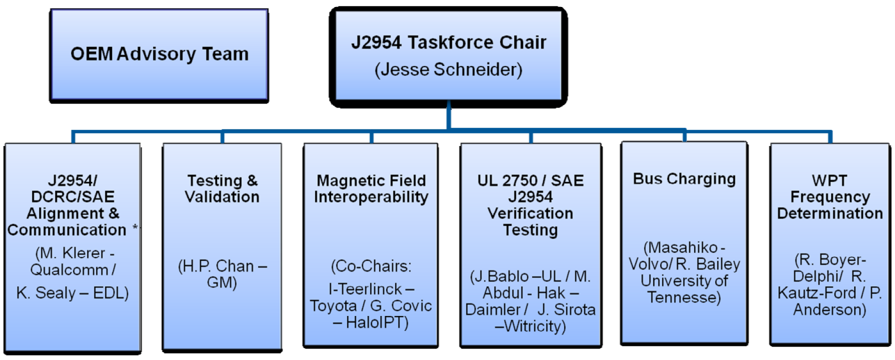


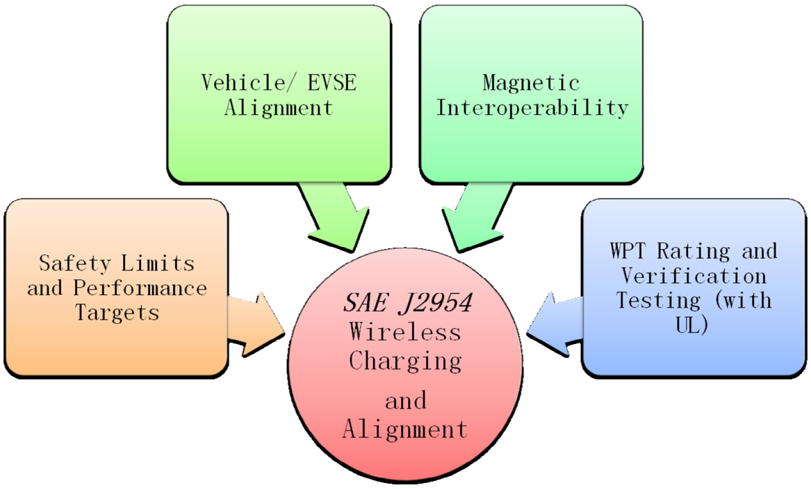
Figure M.2—Magnetic field amplitudes producing test limits

SAE WEVC Standardization Activities

SAE J2954 WEVC Standardization



J2954 Scope?



Guideline (TIR) 2013 - Standard 2015

J2954 – Draft Interoperability Table

DRAFT SAE J2954 Interoperability Table (based on inital Proposal from JARI, OEMs)

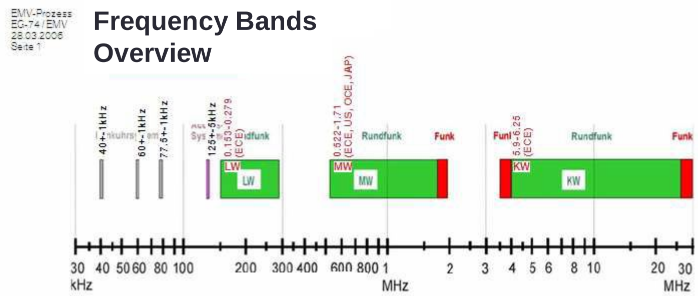
1. Classification (Performance Specs and Physical Configurations) with updated WPT 2 Catagory

Classification (example for discussion)			Power Class		
			WPT1 L.D. Home	WPT2 L.D. High Power	WPT3 Bus
A	EVSE: Primary	**Maximum EVSE Power Source**	**3.6 kW**	**19.2 kW**	**150 kW**
		Min. Efficiency at Rated Power* (Grid to Battery Input>*SAE J2954/ SAE Standard Test with defined Equipment and Ground Clearance Category)	90%	90%	90%
B		Coil / Field Specification (see study)	TBD (Options 1-4)		TBD (Options 1-4)
C		Frequency	*One Frequency for Interoperability*		
		Communications/ Alignment	DSRC/RFID	DSRC/RFID	DSRC/RFID
D		Coil Location in Parking Space (more for buses)	Center Axis of Vehicle/ Y direction TBD		Center Axis of Vehicle/ Y direction TBD
E	Vehicle: Secondary	Coil Location on vehicle (more for Bus only)	Center Axis of Vehicle/ Y direction TBD		Center Axis of Vehicle/ Y direction TBD
F		Receiver Coil must be compatible within Power Classes	TBD (Options 1-4)		TBD (Options 1-4)
		Required Tolerance Primary Coil to Secondary Coil Misalignment	Lateral TBD (X,Y)	Lateral TBD (X,Y)	Lateral TBD (X,Y)
		Communications / Alignment	DSRC/RFID	DSRC/RFID	DSRC/RFID
G		Vehicle Category ? Ground Clearance (e.g. VDE M1=120mm)	M1, N1	M2, N2	M3, M3
H		Ground Clearance Tolerance	M1= Z +/-, TBD	TBD	TBD

19

SAE J2954 Request for Information of Interference Frequencies

- Frequency Determination Plan> Create a short list for frequency bands
- Survey WPT Industry on Charging Frequencies (J2954 WPT Technology Table)
- Survey Industry Groups on „Interference Frequencies“
- Create „Frequency Interference Landscape Table“. Identify Find Potential Bands
- Make Frequency Consensus Decision based on OEM / Industry /Government



SAE J2836, J2847, J2931 and J2953 Task Force

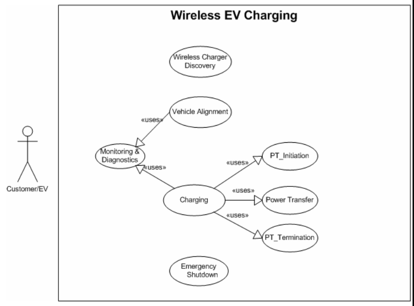
- Wireless Charging Communications
  - J2836/6 – Use Cases for Wireless Charging Communication between Plug-in Electric Vehicles and the Utility Grid
  - J2847/6 – Messages for Wireless Charging Communication between Plug-in Electric Vehicles and the Utility Grid
  - J2931/6 – Protocol for Wireless Charging Communication between Plug-in Electric Vehicles and the Utility Grid

J2836/6™ - Wireless Charging

- Scope of J2836/6 is Use Cases for Support of Wireless Charging across the wireless communications interface between the EV and EVSE.
- Communications between the EVSE and Grid, the EVSE and the user and the service provider and the user will follow the same paradigm as for conductive charging.
- Wireless PHY and MAC selection currently investigating use of DSRC in order to leverage vehicle ITS communications capabilities.

Wireless Charging Use Cases

Use Case Descriptions	
Charger Discovery	Allows the user to discover the location of an available wireless charger in close proximity.
Vehicle Alignment	Supports correct alignment of vehicle charge unit with the base unit (located underneath the vehicle).
Charging	**Power Transfer Initiation**: Determine charging can safely occur and negotiate charging parameters
	Power Transfer: Actual **c**harging phase, charging process is monitored and controlled by both the vehicle and EVSE equipment.
	Power Transfer Termination: Orderly termination of charging process and completion of session.
Monitoring & Diagnostics	This is a "utility" use-case that communicates information in support of detection of events that impact the ability to continue the charging process. Events may be transient and charging may resume after the event clears.
Emergency Shutdown	This use case supports immediate and safe shutdown of the charging process upon occurrence of emergency conditions . The connection can only be restored by authorized personnel.



Thank You

SPX SERVICE SOLUTIONS

Electric Vehicle Supply Equipment
电动汽车充电桩

GLOBAL INFRASTRUCTURE X PROCESS EQUIPMENT X DIAGNOSTIC TOOLS

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Agenda

- The Market of Electric Vehicle

  电动汽车市场

- The Introduction of EVSE

  电动汽车充电桩的介绍

- SPX Corporation EVSE Product “Power Xpress” Introduction and The Installation Case Globally

  SPX公司成熟EVSE产品以及安装实例介绍

- Conclusion

  总结

GLOBAL INFRASTRUCTURE X PROCESS EQUIPMENT X DIAGNOSTIC TOOLS

PAGE 2

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EV Market 电动汽车市场

- Every Major – and many small companies – will release an Electric Vehicle in MY 2010-2012

Plug-in PHEV

Extended Range Electric Vehicle EREV

PHEV

Plug In Global - Plug-in Vehicle Tracker

EV Market 电动汽车市场

2010 BYD E6

2010 Chery S18

2012 Ford Escape

2010 Mitsubishi i MiEv

2011 Toyota Prius

2009 Ford Transit Connect

2009 Subaru Stella

2010 Dodge Circuit

2009 BMW Mini E

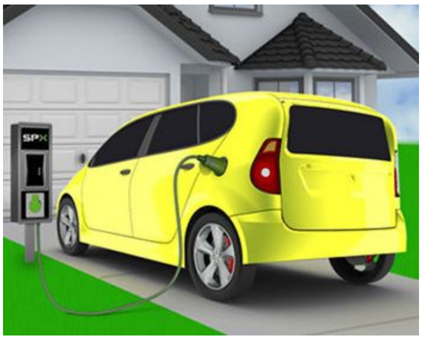
2010 Tazzari Zero

Plug In Global - Plug-in Vehicle Tracker

The Standardize of EVSE benefit Electric Vehicle.
充电桩的标准化帮助电动汽车发展

SPX SERVICE SOLUTIONS

- Safety
  安全
- Convenience
  便捷
- Environment Protect
  环保



The Standardize of EVSE benefit Electric Vehicle.

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EVSE Definition
电动汽车充电桩的定义

SPX SERVICE SOLUTIONS

- EVSE Definition 电动汽车充电桩定义:
  - The conductors, electric vehicle connectors, attachment plugs and all other fittings, devices, and apparatuses installed specifically for the purpose of “SAFELY” delivering Energy from the electric grid to the Electric Vehicle (EV)
  - 包含导体，电动汽车连接器，附带插头以及所有其他接头，装置的一个设备总成。主要用来“安全的”将电传输进入电动汽车
- EVSE IS NOT a Charger
  电动汽车充电桩不是一个充电器
- EVSE is a Safety Appliance
  电动汽车充电桩是一个安全的装置

EVSE = Electric Vehicle Supply Equipment

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EV Basic Schematic
电动汽车系统基本概念图

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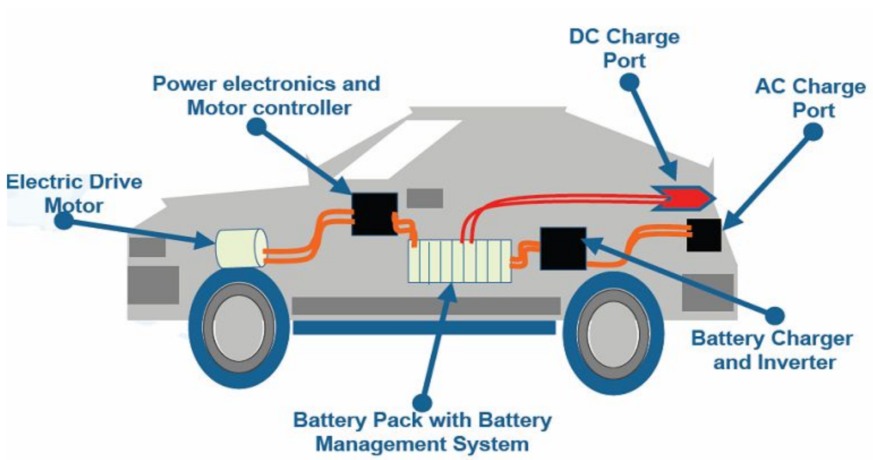

Basic EV Drive, Energy Storage & Charging System

Typical EVSE Installation Customers
典型电动汽车充电桩客户

SPX SERVICE SOLUTIONS

- OE Dealerships OE代理商

- Independent Garages 修理厂

- Commercial / Fleets 商用车/车队

- Residential / Homes 住宅

- Government 政府共用设施

Typical EVSE Installation Customers

EVSE Categories
充电桩分类

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Charge Method 充电方式	Nominal Supply Voltage – INPUT (Volts) 供电电压	Maximum Current – OUTPUT (Amperes) 最大电流输出	NISSAN Nissan Leaf Charge Time 	GM Chevy Volt Charge Time 
AC Level 1	120 V AC, 1-phase	12-16 A	16 Hours	8 Hours
AC Level 2	208 to 240 V AC, 1-phase	≤ 80 A	4 Hours	3 Hours
DC Level 3	440V, 3-phase (600V max)	150 - 400 A	30 Minutes	30 Minutes

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EVSE Categories

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How EVSE Works
充电桩如何工作

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- How EVSE Works 充电桩如何工作
  - Plug not powered until plugged into and commanded by vehicle
  - 插头不会通电知道插入插座并且收到汽车的命令
  - Electric Vehicle Supply Equipment signals presence of AC input power
  - 充电桩用信号传达输入交流电的存在
  - Vehicle detects plug via proximity circuit (prevents drive away while connected)
  - 汽车通过充电连接电路探测插头（防止连接过程中开车离开）

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How EVSE Works

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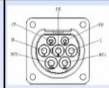
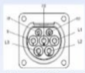
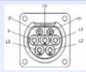
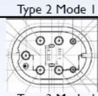
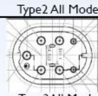
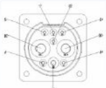
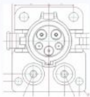
Standardized Charge Coupler
各地标准化的充电接头

International Summary

		China	US	Japan	EU (IEC-62196)	
AC	Single Phase	 Type 2	 J1772	 J1772	 J1772-Type1	
	1 Phase or 3 phase				 Type 2 Mode 1	 Type2 All Modes
	1 Phase or 3 phase				 Type 3 Mode 1	 Type3All Modes
DC 200A 350A 400A		 Mode 3	 J1772 "Hybrid"	 CHAdeMo	Type 2 "Hybrid"	

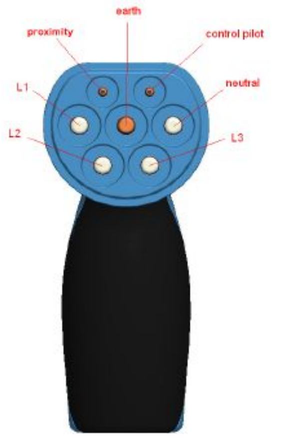
Pin Functions of Charge Coupler
充电接头的管脚定义

- J1772 Charge Coupler
  J1772标准的充电快速接头
  - Two pins for power (AC Line1 & AC Line 2/neutral)
  - 2个通电的管脚
  - One pin for Ground
  - 1个接地的管脚
  - One pin for signal to determine amount of current (amperes) allowed for the vehicle being charged
  - 1个管脚是通过信号来决定充电电流大小
  - One pin for preventing the car from being moved while charging
  - 1个管脚是用来防止充电过程中开动车

EVSE Connector for Europe/China
欧洲/中国标准的充电桩标准接头

SPX SERVICE SOLUTIONS

- IEC 62196 Coupler, Type 1, Type 2
- IEC 62196 Plug, Type 2, Type 3



SPX EVSE for Europe/China – Connector – Type 2 & 3

Basic Design Features
基本设计特性

SPX SERVICE SOLUTIONS

- EVSE Basic Design Features
  充电桩基本设计特性
  - Measurement and Control of Charging Process
  - 测量并且控制充电过程
  - Ground Fault Interrupter (GFI)
  - 接地错误打断
  - Ground monitor
  - 接地检测
  - Communication with the vehicle On Board Computer (OBC)
  - 和汽车OBC通讯
  - Automatic recovery and re-start (after ground fault interrupt or mains power loss)
  - 自动回复重启（在接地打断或者主电源丢失之后）

EVSE Basic Design Features

SPX's Product "Power Xpress"
SPX公司的充电桩产品

SPX EVSE "Power Xpress"

Basic Technical Specification
基本技术参数

- Operating Voltage 95 VAC – 264 VAC
- 操作电压范围
- Amperage 32A 最大充电电流
- Operating Frequency 50/60 Hz
- 操作频率
- Ground Fault Trip Level 17.5 mA (20mA Max)
- 接地错误等级
- Auto Test & Reset 自动检测和重启
- Encapsulated Circuits for Harsh Environment
- 为了应付严酷环境的封装电路
- De-energized Cable upon strain
- 拉紧力保护的不断电电缆
- Expanded Functionality / UART port
- 通过UART端口的扩展功能
- Firmware Upgrades Field Reprogrammed
- 软件升级
- Diagnostic Trouble Codes Field Accessible
- 故障诊断
- Mounting - Via Slide Mounting to wall bracket
- 可以固定在墙上

Basic Technical Specification

Products Categories
产品分类

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Plug-in 即插型

Bollard 立柱式

Wall-Mount
挂墙式

Products Categories

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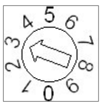
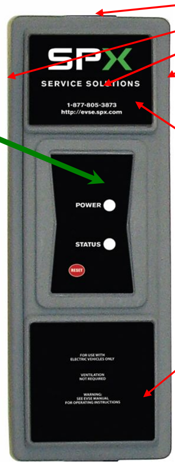
The Structure
安装结构

SPX SERVICE SOLUTIONS

Service Wire Chamber
输入线束盒

Inputs: Left, Right, Top & Back
输入：4个方位各有一个输入口





Line Side Service Wire Chamber
isolated from
Vehicle Side Coupler Wire Chamber
输入端盒和汽车端盒线束分离

Coupler Wire Chamber 汽车端线束盒

The Structure of SPX Products

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SPX SERVICE SOLUTIONS

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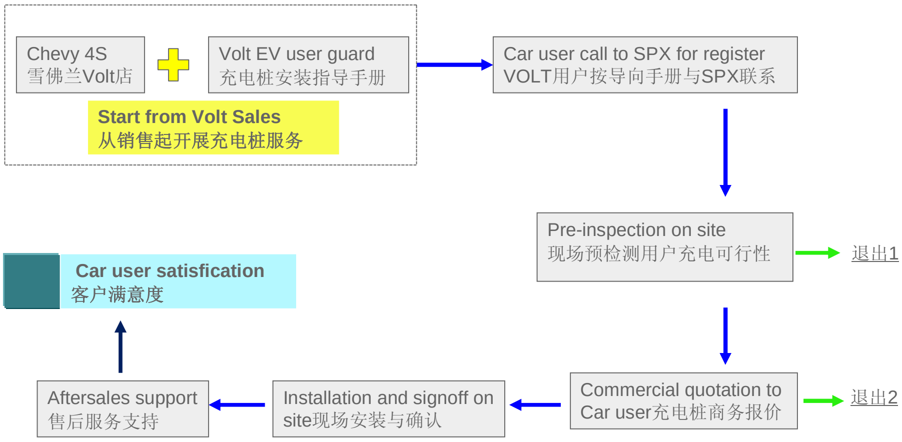
Installation Service Main Process
安装服务的主要流程



退出1:是指用户只接受仅使用车用充电桩的情况下退出商用充电桩安装服务请求;

退出2:是指用户不接受商用充电充桩安装服务的商务报价的前提

EVSE Installation Service Main Process

Main Customer: Volt
主要客户：通用沃蓝达

Main EVSE Customer of SPX: Volt

Main Customer: Smart
主要客户：奔驰Smart

Main EVSE Customer of SPX: Smart

Successful Installation Case in NA
北美的成功安装案例

SPX "Power Xpress" Bollard @ Portland "Electric Avenue"

Successful Installation Case Around the World: NA

Successful Installation Case in China
中国的成功安装案例

SPX "Power Xpress" Bollard @ Beijing Exhibition 北京展会

Successful Installation Case Around the World: China

Successful Installation Case in China
中国的成功安装案例

SPX "Power Xpress" Wall-Mount @ SGM 上海通用

Successful Installation Case Around the World: China

Conclusion 总结

With the development of China and the increase of environment protection mind. The Emission of Vehicle will be limited more and more strictly.
随着中国的高速发展以及民众环保意思的提高，对于汽车排放的限制会越来越严格。
So the EV will be a very good solution of the environment protection. Meanwhile, the development and the standalization of EVSE should meet the step of EV in order to remove the obstacle on convenience and safety.
所以，电动汽车就是一个非常好的解决方案。同时，电动汽车充电桩的标准化发展也需要跟上脚步，为电动汽车的推广扫除使用方便性以及安全性的障碍。
I believe that with the spread of EVSE, it must will do help to the environment potential work of China.
我相信，充电桩的推广使用一定会对中国环保国策的执行起到关键作用

David Reeck

David Reeck

General Motors China – Electrification Strategy

David Reeck started his Automotive career at a GM manufacturing plant in 1967 as a University student (Electrical Engineering), working part-time.

After earning a Master's Degree in Electrical Engineering – Control Systems, David worked as Manufacturing Engineer of CNC Computer Numerical Control at a General Motors manufacturing plant.

His career then included Product Engineering in Vehicle Advanced Design, before moving to Purchasing and Supplier Quality in GM Powertrain for Engine and Transmission Control components (US$ 4 Billion annual purchase value).

He worked in Japan at Isuzu Diesel Powertrain Purchasing, and also the GM-Isuzu Diesel joint venture.

In 2004, David moved to the Shanghai-GM joint venture as Senior Manager of Powertrain Purchasing, and then in 2007, to GM Powertrain Product Engineering, GM China.

Since 2009, David's responsibility transitioned to Electrification Strategy and Infrastructure for GM Operations in China, including assessment of Electrification suppliers and charging infrastructure.

Charging Workshop
充电研讨会

David Reeck, GM China Manager – Electrification Strategy

Gery Kissel, Engineering Specialist, Plug In Vehicle Codes and Standards

1

Comparison charging systems IEC vs. GB 比较IEC与GB充电系统后
Question towards State Grid 对电网/充电机的一些问题

1. Will every charging station provide an 1kHz PWM signal? 是否所有的充电都会提供1kHz的PWM信号作为导引？ Yes currently in published GB standard. There are 10k State Grid charging stations that do not have a PWM CP. Depending on the local utility company request, the charge stations could be updated to include a PWM CP.
2. Which duty cycle graph will be used? Old CN, IEC 61851, new one, no one, when we can expect a decision? 在充电机内，将使用何种PWM占空比对应电流的定义？ Decision no earlier than end of 2012. OEM demonstrate using IEC/SAE PWM and request charge stations in certain EV demonstration zones / cities (Beijing and Tianjin?). Put real cars in the hands of officials and attempt to install home charging. MIIT, NDRC, CATARC and State Grid.
3. Proposal for GB Combo DC charging. What is the roadmap? 如果可能实现GB的Combo 直流充电系统，将要按照何种程序走？ There are initial discussions using GB AC for DC charging 10-20kw. No plans for GB combo. Propose demonstrating Combo charging using a GB DC combo. Would show capability of the system and demonstrate the need for PWM definition. Also helps demonstrate swap stations are not a viable solution. Would Southern Grid be more open to the GB combo concept? Discuss plans with SAIC E50 EV.
4. How State Grid ensure that infrastructure provides an over current protection of the cable? 电网如何确保在电网设施端为线束提供过流保护？
5. How to ensure protection against hot disconnect on Infrastructure side? Locking Mandatory or proxy switch? 如何确认在充电机端的热插拔保护？加入强制的锁止结构还是使用接近开关？
6. Which Household connector can be used for a Mode2 Cable?16A or 10A both? 那种家用插头用在模式2充电中
7. Is there an nationwide valid working flow for charging stations? E.g, when interrupting the charging process from car side (CC S3 pushed) the charging process must restart automatically after S3 closed, no need for RFID card authorization or similar as long the car was not disconnected.充电机是否有全国统一的工作次序？例如当充电端出现中断后，当开关S3关闭的时候，在不需要RFID卡的认证或者类似的时候，充电过程能自动重启。
8. How to serve our customers with private Infrastructure, is there any strategy or already implemented process how EV customers can apply for private charging infrastructure? 如何服务个人客户，是否有针对个人电动车主的充电设施导入的流程？
9. How can individual EV customers use public charging infrastructure? Till now private EV's have no access to those charging infrastructure. In addition the pillars using different Standards and billing/access systems in different regions/city's 个人客户如何使用公共充电设施？现在个人客户很难使用公共的充电设施，而且不同区域的设施采用不同的计费和接入系统。

2

Contents 内容

- Global Charging Standards Status
  全球充电标准状态

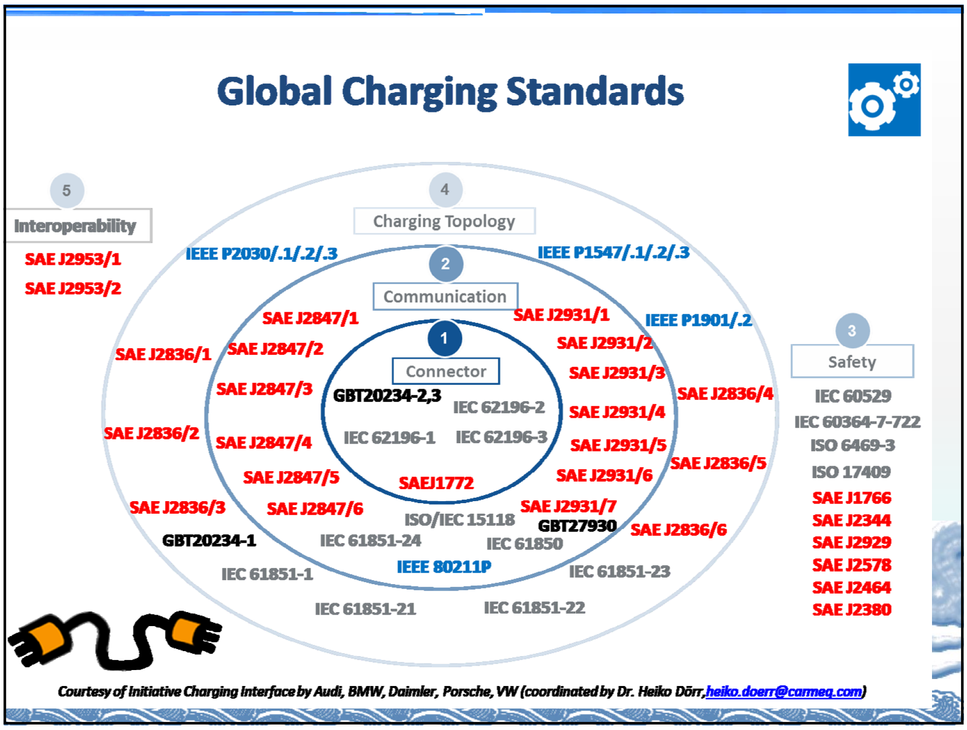
- Harmonization Issues
  兼容性问题
  - AC Charging 交流充电
  - DC Charging 直流充电

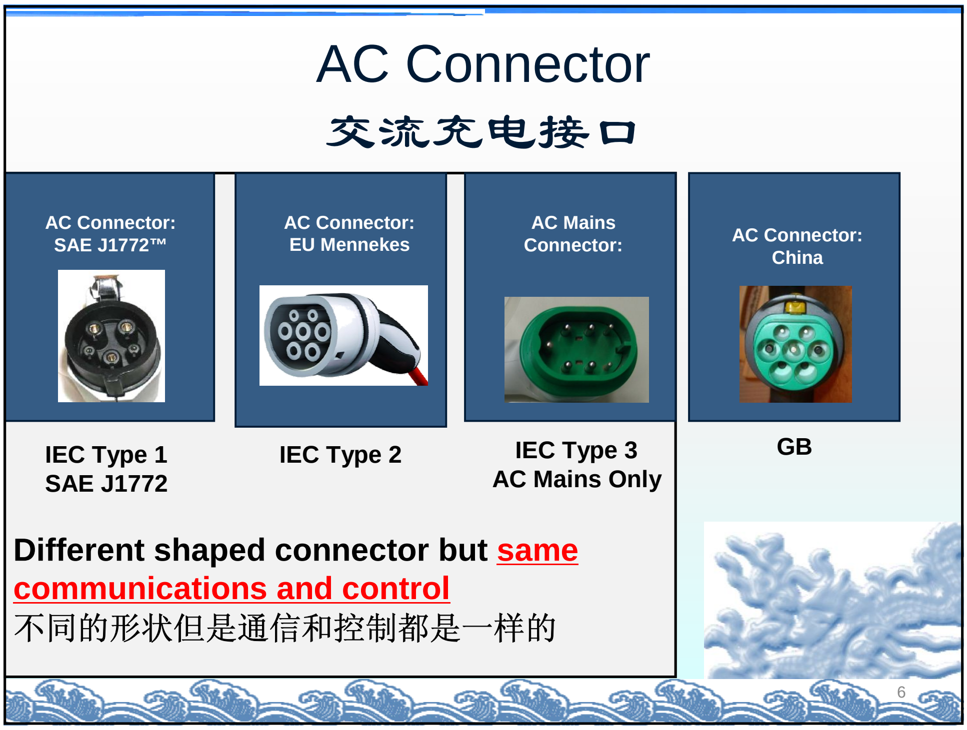
3

Harmonization Concerns
兼容性考虑

GLOBAL CHARGING STANDARDS STATUS
全球充电标准状态

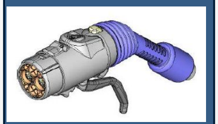
4


Global Charging Standards
5
Interoperability
SAE J2953/1
SAE J2953/2
4
Charging Topology
IEEE P2030/.1/.2/.3
IEEE P1547/.1/.2/.3
2
Communication
SAE J2847/1
SAE J2847/2
SAE J2847/3
SAE J2847/4
SAE J2847/5
SAE J2847/6
SAE J2931/1
SAE J2931/2
SAE J2931/3
SAE J2931/4
SAE J2931/5
SAE J2931/6
SAE J2931/7
IEEE P1901/.2
1
Connector
GBT20234-2,3
IEC 62196-2
IEC 62196-1
IEC 62196-3
SAEJ1772
SAE J2836/1
SAE J2836/2
SAE J2836/3
SAE J2836/4
SAE J2836/5
SAE J2836/6
ISO/IEC 15118
GBT27930
GBT20234-1
IEC 61851-24
IEC 61850
IEEE 80211P
IEC 61851-1
IEC 61851-23
IEC 61851-21
IEC 61851-22
3
Safety
IEC 60529
IEC 60364-7-722
ISO 6469-3
ISO 17409
SAE J1766
SAE J2344
SAE J2929
SAE J2578
SAE J2464
SAE J2380
Courtesy of Initiative Charging Interface by Audi, BMW, Daimler, Porsche, VW (coordinated by Dr. Heiko Dörr, heiko.doerr@carmeq.com)


AC Connector
交流充电接口
AC Connector:
SAE J1772™
AC Connector:
EU Mennekes
AC Mains
Connector:
AC Connector:
China
IEC Type 1
SAE J1772
IEC Type 2
IEC Type 3
AC Mains Only
GB
Different shaped connector but same communications and control
不同的形状但是通信和控制都是一样的
6

DC Connector直流充电接口

DC Connector:
CHADEMO
Japan



IEC
Configuration A

DC Connector:
China

IEC
Configuration B

AC/DC Connector:
IEC 62196-3
EU Combo 2

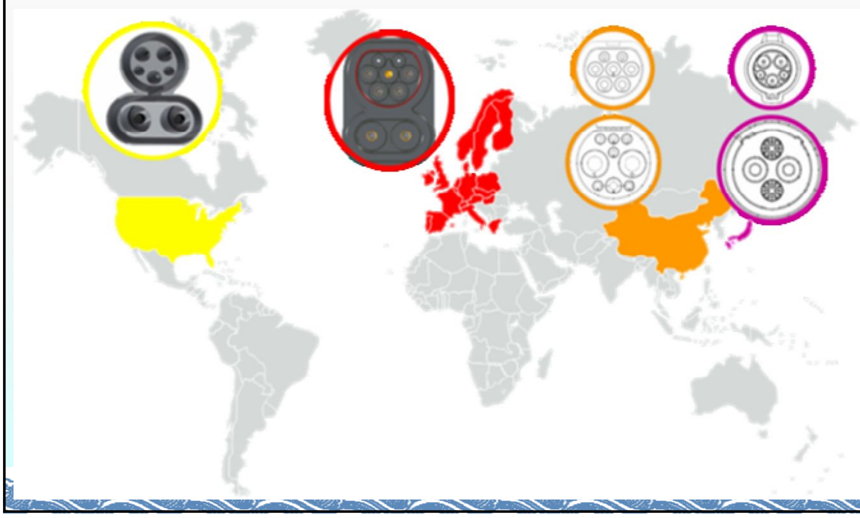
AC/DC Connector:
SAE J1772™
NA Combo 1

IEC
Configuration C
"Combo"

Different shaped connector but <u>same communications and control</u>
不同的形状但是通信和控制都是一样的

7

Charging Topology
充电拓扑



8

AC HARMONIZATION ISSUES

交流充电兼容性问题

9

Control Pilot PWM

控制引导 PWM

- Control Pilot Pulse Width Modulation (PWM) informs vehicle how much current the vehicle may use to charge

CP 脉冲宽度调制（PWM）向车辆确认可用的充电电流

- Available charge current is based on:

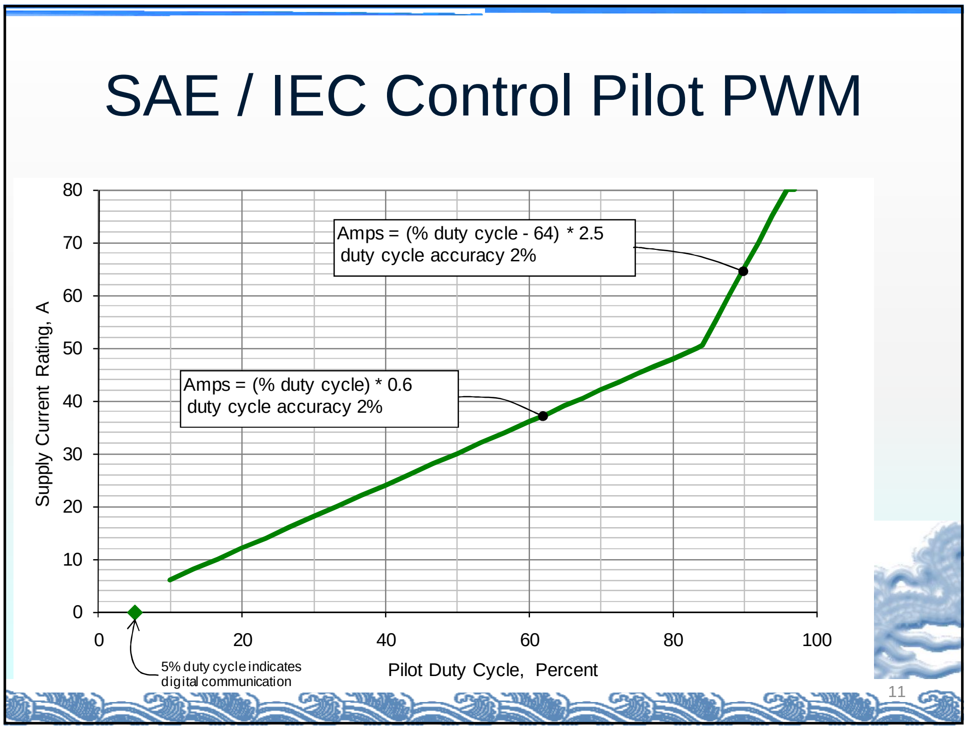
  可用的充电电流是基于
  - Available current from grid / circuit电网和线路的可用电流
  - Charge cable wire size 充电线束的线径
  - Charge connector current rating 充电接口的额定电流

- Available charge current important to Safety

  可用充电电流对于安全性是非常重要的
  - Prevents charge equipment and vehicle wire and cable damage due to excessive charge current

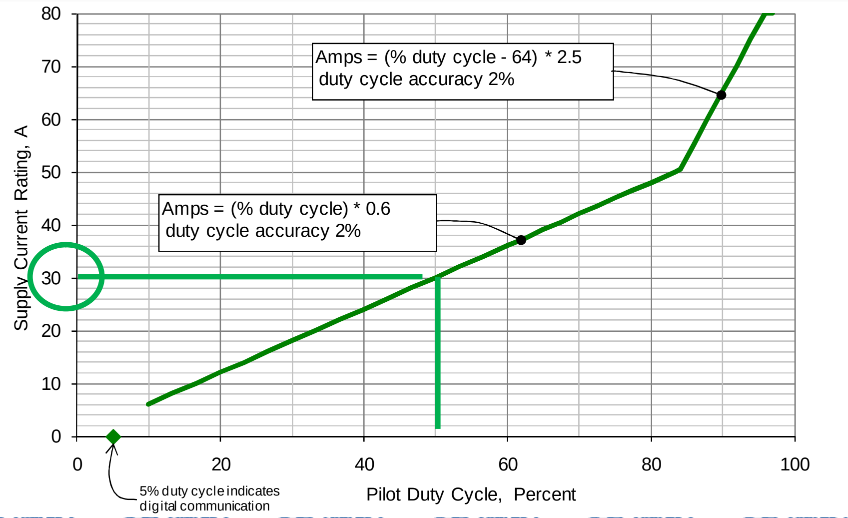
    防止由于超额的电流，使得充电设备和车辆线束损坏

10


SAE / IEC Control Pilot PWM
Amps = (% duty cycle - 64) * 2.5
duty cycle accuracy 2%
Amps = (% duty cycle) * 0.6
duty cycle accuracy 2%
Supply Current Rating, A
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
5% duty cycle indicates
digital communication
Pilot Duty Cycle, Percent
11

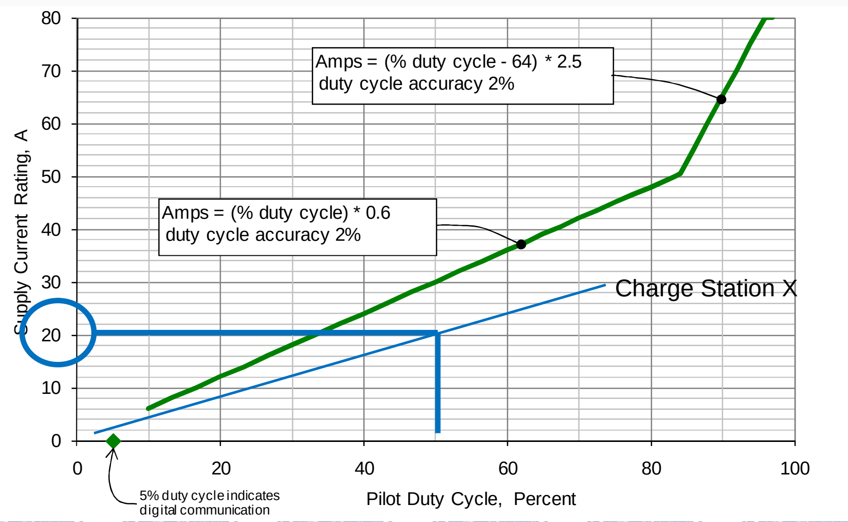

China Control Pilot PWM & Duty Cycle
?
12

SAE / IEC Control Pilot PWM



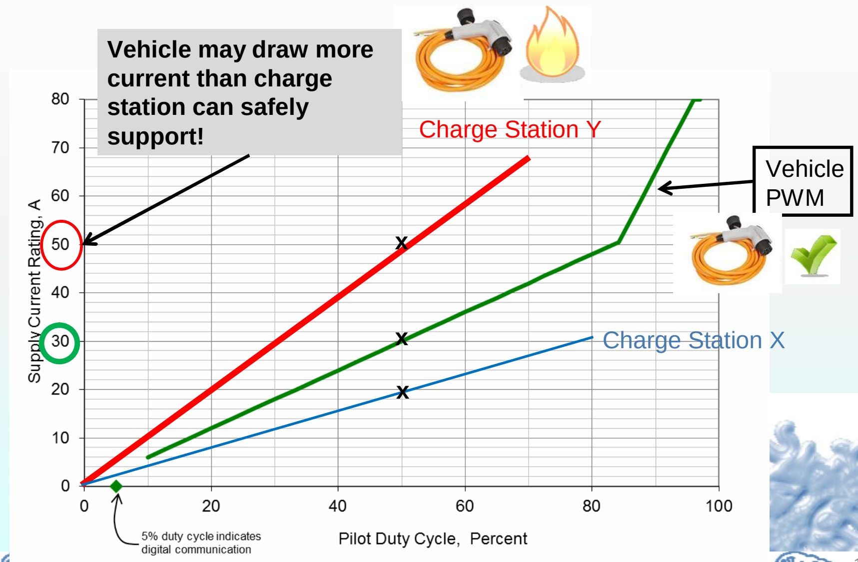
13

Unknown Control Pilot PWM



14

PWM Concern



PWM Concern
PWM考虑

- Green line is the PWM the vehicle is expecting
 绿线是车辆期望的PWM信号
- Charge stations X and Y provide different PWM signal than vehicle is expecting
 如果充电桩提供的是曲线X和Y，与车辆预期不同
- Charge station Y - PWM may result in overheating of charge cable, connector or vehicle wiring
 曲线X可能导致充电线、连接器和车辆线束过热
- **PWM must be standardized to help prevent safety hazards!**
 PWM 信号必须有定义来防止安全危害。

DC HARMONIZATION ISSUES
直流充电问题

17

Design Principle for the Combined Charging System 组合的充电系统的设计原理

Backward Compatibility: The Combo Inlet accepts existing conventional AC Connectors as well as new, high power Combo Connectors.

Combo的接口能接受原有的传统交流充电接口，又能兼容直流充电接口

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Comparison Combo and separated Inlets

The Combo inlet fits into an ordinary tank inlet.

CHAdeMO + AC Type 1

DC China + AC China

Combo

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Propose China DC Combo Charging For <u>Passenger</u> Vehicles?

- China Combo using China AC coupler
- Use GB AC coupler, CP and CC communications and controls with SAE/IEC PLC communications
- Use current GB DC system for larger vehicles such as trucks and buses

Combo Harmonization

COMBO supports all charging modes → Therefore all <u>different OEM strategies</u>!

	Max. Output
Mode 2 - 3,6KW	3,6 kW
Mode 3 1ph - 7kW	19 kW
Mode 3 3ph - 22kW Combo 2 only	43 kW
Mode 4 - 10kW Home Use (input 3x16 A AC, 380/400V)	10 kW
Mode 4 - 100kW Public Use	100 kW

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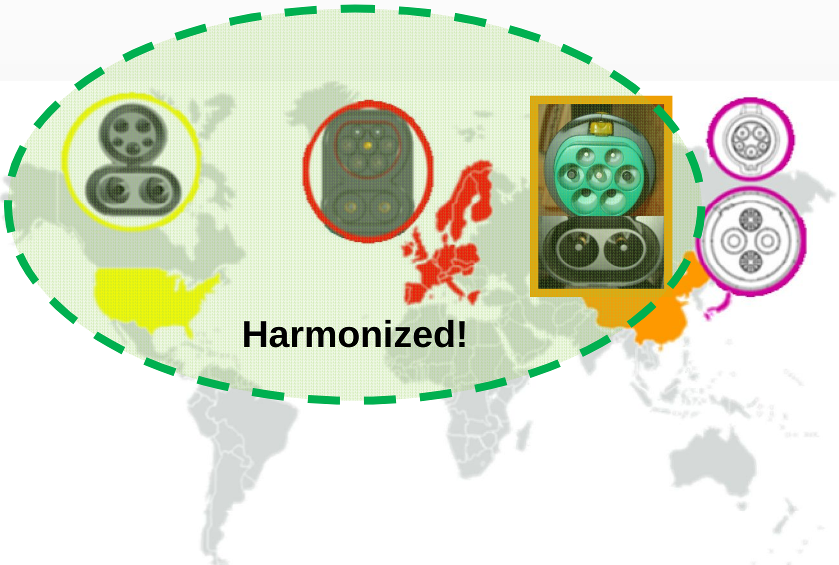
Combo Harmonization



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Combo Harmonization
Combo的兼容性

- Harmonization helps to expedite the global acceptance of electrified vehicles
  充电方面的兼容性可以帮助电动化车辆的接受度
  - Helps vehicle OEMs to develop common global components
    帮助OEM来开发一致的部件
  - Helps to develop common global infrastructure. Customer charging experience the same globally, similar to fueling a vehicle with gasoline
    帮助充电设施在全球范围内，实现较大程度的兼容和充电体验的一致性
- Regions with similar charge strategies have the most potential to harmonize
  有相似的充电战略的区域是最有可能实现兼容的

23

Combo Harmonization
Combo的兼容性

- Home Plug Green PHY Power Line Communications (PLC) technology enables additional use cases and services:
  家用绿色插头电力线载波通信技术可实现用户使用和服务
  - Vehicle and payment authorization 车辆和付费授权
  - Charge monitoring, metering and control 充电监测、计量和控制
  - Customer remote charge control 客户远程充电控制
  - Remote vehicle service and repair 远程车辆服务和维修
  - Movie, music, etc. access 电影、音乐或者其他服务

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What if we do not harmonize charging standards?

如果不能在充电方面实现兼容

- Vehicle OEMs need to package different charge receptacles and have <u>different vehicle controls and communication software and hardware</u>

  车辆OEM必须在每个地区使用不同的控制和通信（硬件和软件）
- Infrastructure cannot be shared by different vehicles

  充电设施无法给不同的车辆提供支援
- Costs are higher (vehicle and infrastructure) with no benefit to customers

  从车辆和设施的角度来看，成本都很高，最终会转嫁到消费者身上，影响汽车电动化进程

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THANK YOU!

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VOLKSWAGEN
GROUP CHINA

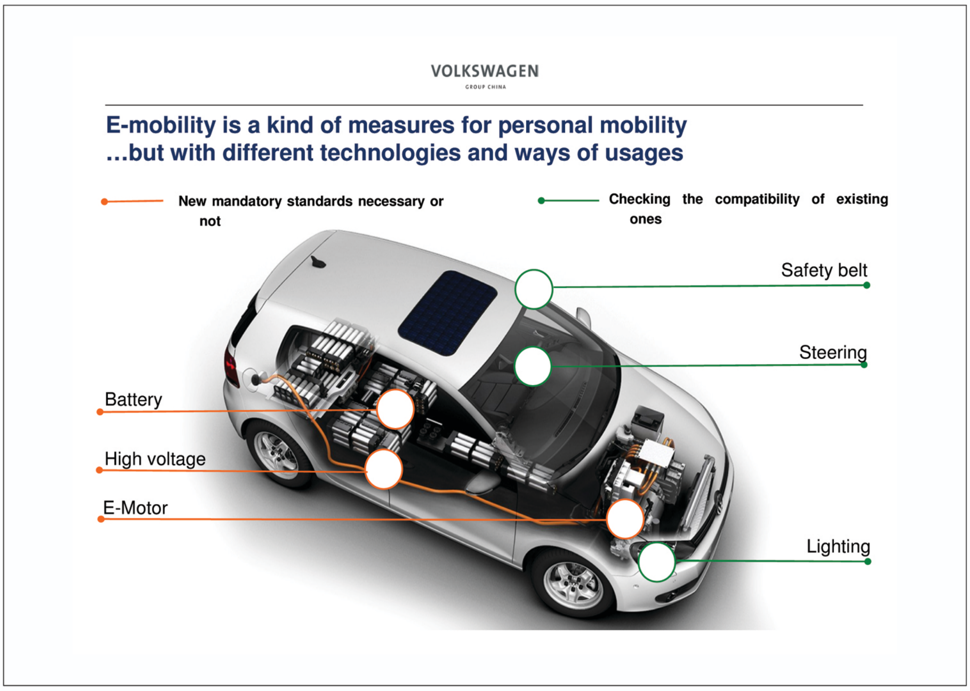
E-mobility standardization in China

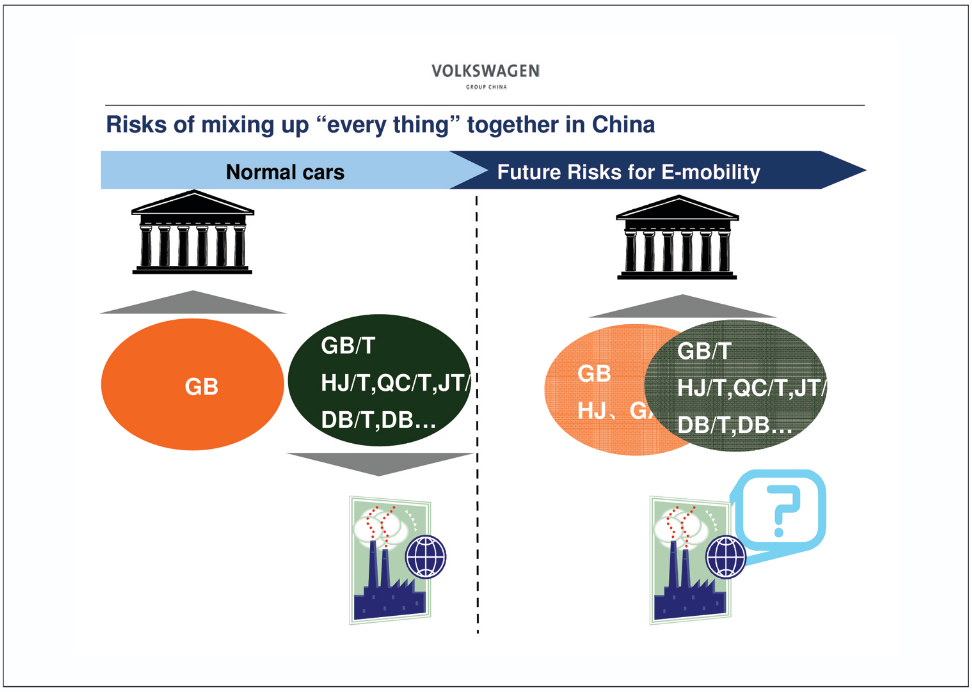
July 23rd of 2012, Feng Xingye

VOLKSWAGEN
GROUP CHINA

Questions have to be answered for the E-mobility standardization

- Is E-mobility comparable with normal gasoline or diesel cars?
- Can the mandatory technical standards for gasoline or diesel cars simply apply to the E-mobility?
- What kinds of additional mandatory standards would be necessary for E-mobility?
  - Safety
  - Environment protection
  - Others, e.g. charging couplers


VOLKSWAGEN
GROUP CHINA
E-mobility is a kind of measures for personal mobility
…but with different technologies and ways of usages
New mandatory standards necessary or not
Checking the compatibility of existing ones
Safety belt
Steering
Battery
High voltage
E-Motor
Lighting

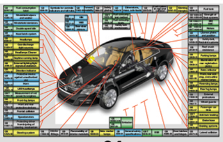

VOLKSWAGEN
GROUP CHINA
Risks of mixing up "every thing" together in China
Normal cars
Future Risks for E-mobility
GB
GB/T
HJ/T,QC/T,JT/
DB/T,DB…
GB
HJ、G
GB/T
HJ/T,QC/T,JT/
DB/T,DB…

VOLKSWAGEN
GROUP CHINA

Existing / future mandatory standards for E-mobility - Overview

Existing / future mandatory standards for E-mobility

Mandatory standards for ICE cars	Additional mandatory standards for E-mobility



64

BEV

19

HEV

18

Fuel cell

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Reference standards (in total around 1000)	Reference standards (in total around 100)

Future standards for E-mobility

The amount is expected to significantly increase in the coming years

2012-7-11 Department: Homologation/Technical Lobby 5

中美新能源标准交流会-北京

电动汽车用驱动电机系统 标准体系

宋强
北京理工大学
2012年7月23日

内容

- 前期工作
- 现有标准体系
- 新标准体系

前期工作

- 2002年，国家科技部在北京理工大学建立电动汽车电机系统检测基地，从事电机系统的试验检测技术研究。
- 2008年，国内第一家通过相关领域的国家级CNAS和CMA认证。
- 至今，已经完成国内外200余套车用电机系统的试验检测工作。
- 参与多项国家标准和行业标准的起草

前期工作

- 具备电机系统测试台架以及大型检测设备50台套，测试能力覆盖至920KW，测试数据获得广泛的认可。
- 测量功率：单个平台最大~ **460kW**；
- 测量转速：**0 ~ 20000r/min**；
- 测量转矩：**0 ~ 3600Nm**；
- 电压：**~ 1000V**
- 电流：**~ 600A**

前期工作

2008年之前

- □GB/T18488.1-2001 电动汽车用电机及其控制器技术条件
- □GB/T18488.2-2001 电动汽车用电机及其控制器试验方法
- □《电动汽车用电机及其控制器试验规范》
  - 相关的国家标准
  - 各种电机系统的性能指标
  - 2005开始建立指标体系

前期工作

2008年前测试指标日趋增多

外形尺寸、重量
温升
电动额定特性
容差特性
短时过载特性
堵转测试
最高工作转速
系统电动效率测试
馈电测试
超速试验
绝缘测试

＋

温升试验
  连续工作温升
  峰值工作温升
连续工作特性试验
高效区测试
外特性测试
电机比功率
速度阶跃响应
转速转矩控制精度

＋

电动外特性测试
  额定电压/最低电压;
馈电外特性测试
  额定电压/最高电压;
电动高效区测试
  额定电压/最低电压;
馈电高效区测试
  额定电压/最高电压;
控制转矩误差
  电动/馈电状态

前期工作

	测试时间	参加单位	电机数量	技术文件	试验项目
第一轮测试	2003年	5家	8套系统	6＋9	13
第二轮测试	2004年	8家	16套系统	9＋19	16
第三轮测试	2005年	8家	14套系统	14＋18	20
第四轮测试	2007年	9家	19套系统	19	20
第五轮测试	2008年	9家	26套系统	26	20

现有标准体系

2008年之后，中国电动汽车技术发展出现了新的变化：

- 产业化发展加速，更多企业从事电动汽车的生产。
- 在电动汽车产品公告之前，电机和电池的性能需要获得认证
- 原有的2001版标准从事了修订，2006版开始实施。
  - GB/T18488.1-2006电动汽车用电机及其控制器 第1部分：技术条件
  - GB/T18488.2-2006 电动汽车用电机及其控制器 第2部分：试验方法
- 公布了《节能与新能源汽车节油率与最大电功率比检验大纲》

现有标准体系

□ 2008年之后按照现有2项国家标准测试

外观、尺寸、重量
电机自由转动
绕组电阻
控制器机械强度
绝缘性
绕组匝间绝缘
耐电压
堵转
控制器保护功能
安全接地检查
水冷系统密封性

盐雾及高低温试验	振动
温升限值	电磁兼容性
转矩-转速特性及效率	可靠性、耐久性
再生能量回馈特性	噪声
最高工作转速	接触电流
超速	
电压波动	
系统过载能力	
峰值功率	额定功率
防护等级	额定转矩

现有标准体系

遇到的问题

□试验测试技术和检测设备获得快速发展

□现有标准中的试验项目不够完整

□部分试验方法不尽合理

□标准中的术语定义缺乏，部分描述引起歧义

在国家标准化管理委员会协调下，联合国内20余家整车、电机企业进行标准的修订和补充完善工作，并邀请国外的汽车和零部件企业参与标准内容的讨论。

通过标准化工作，规范和引导企业行为，具有先进性和可操作性，促进经济效益和社会效益的发展。

新标准体系

3项国家标准：

- ☐GB/T18488.1-201* Drive motor system for electric vehicles ——Part 1: Specification(电动汽车用驱动电机系统——第1部分：技术条件)
- ☐GB/T18488.2-201* Drive motor system for electric vehicles ——Part 2: Test method(电动汽车用驱动电机系统——第2部分：试验方法)
- ☐GB/T*****-201* The reliability test methods of drive motor system for electric vehicles (电动汽车用驱动电机系统可靠性试验方法)

新标准体系

3 项行业标准：

- ☐QC/T893-2011 Failure Classification of Drive motor system for Electric Vehicle(电动汽车用驱动电机系统故障分类及判断)
- ☐QC/T896-2011 Interface of electrical motor system for electric vehicle (电动汽车用驱动电机系统接口)
- ☐QC/T*****-20** The reliability test methods for ISG powertrain system of hybrid electric vehicles (ISG动力总成可靠性试验方法)

新标准体系

现有2项国家标准的修订

- 增加了型号的命名规则
- 增加了技术条件和试验项目：如控制器额定/最大输出电流、最高效率、高效工作区、速度/转矩控制精度、峰值/额定转矩、峰值/额定功率、控制器支撑电容放电时间、低温贮存和工作、高温和工作、可靠性等。
- 提高了试验方法的可执行性和评价方法的客观性：细化了密封状态的试验方法，调整了控制器壳体机械强度的试验方法，详细规定了电压电流或者转速转矩的测量点以及对测量值的规定等。
- 取消了部分试验内容：如噪声、振动、接触电流等。

新标准体系

试验准备

- 对试验环境做了规定。
- 补充了试验仪器仪表的准确度。
- 明确了对试验电源的精度要求
- 规定了布线规格和长度、试验冷却、信号屏蔽等方面的要求。

新标准体系

试验内容

□控制器壳体机械强度：根据压强大小确定了试验方法，并对最小施力范围做了规定。

□液冷系统冷却回路密封性能：明确了试验介质的工作温度要求，及不泄露的标准。

□电机定子绕组冷态直流电阻：增加了判别标准，增强了试验的可行性。

□绝缘电阻：根据最大电压值选择兆欧表，明确了控制器的测点。

□耐电压：根据电机结构，设置了不同的耐压等级。

新标准体系

试验内容

□温升：测量的温升是在电机绕组断能时刻的温升。

□转速-转矩特性和效率：明确了试验和计算方法，包括关键特征参数、测点和测量参数的选择、试验条件的设置、试验方法、试验结果的修正、效率的测量和计算等内容。

□电机系统的响应时间：规定的速度响应时间和转矩响应时间。

□电机系统控制精度：规定了电机系统速度控制精度和转矩控制精度。

新标准体系

试验内容

□**安全性试验：** 增加了控制器支撑电容的被动放电时间和主动放电时间。

□**环境适应性试验：** 增加了低温/高温贮存试验，增加了低温/高温工作试验，以及试验后性能复测。

新标准体系

<table>
<tr><th colspan="4">specification</th></tr>
<tr><td rowspan="10">General specification（一般性项目）
(14)</td><td colspan="3">Appearance(外观)</td></tr>
<tr><td colspan="3">Shape and dimension(外形和安装尺寸)</td></tr>
<tr><td colspan="3">Mass(质量)</td></tr>
<tr><td colspan="3">Hard of controller shell(驱动电机控制器壳体机械强度)</td></tr>
<tr><td colspan="3">Seal performance of cooling system(液冷系统冷却回路密封性能)</td></tr>
<tr><td colspan="3">Resistance of stator(驱动电机定子绕组冷态直流电阻)</td></tr>
<tr><td>Insulation(绝缘)</td><td colspan="2">Between stator and controller shell(驱动电机定子绕组对机壳的绝缘电阻);Between stator and temperature sensor(驱动电机定子绕组对温度传感器的绝缘电阻);Insulation of controller(驱动电机控制器绝缘电阻)</td></tr>
<tr><td rowspan="2">Sustain high voltage(耐压)</td><td colspan="2">Shock voltage between armatures(驱动电机绕组的匝间冲击耐电压)</td></tr>
<tr><td>工频耐电压 Under 50Hz</td><td>Between armature and motor shell(驱动电机绕组对机壳的工频耐电压);Between armature and temperature sensor(驱动电机绕组对温度传感器的工频耐电压);Sustain high voltage of controller(驱动电机控制器工频耐电压)</td></tr>
<tr><td colspan="3">Over speed----超速</td></tr>
</table>

新标准体系

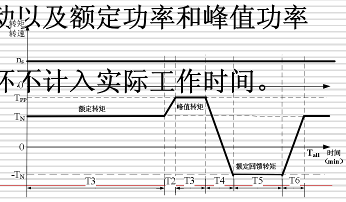
specification		
(1) Temperature rise(温升)		
Input and output performance(输入输出特性 (18)	Working voltage(工作电压范围)	
	Torque-speed character(转矩—转速特性)	
	Continuous torque(持续转矩)	
	Continuous power(持续功率)	
	Peak torque(峰值转矩)	
	Peak power(峰值功率)	
	Block torque(堵转转矩)	
	Maximum working speed(最高工作转速)	
	Efficienc(驱动电机系统效率)	Maximum efficiency of driving motor system(驱动电机系统最高效率);High-efficiency working scope of drive motor system(驱动电机系统高效工作区)
	Control accuracy (控制精度)	Speed control accuracy(转速控制精度);Torque control accuracy(转矩控制精度)
	Response time (响应时间)	Speed response time(转速响应时间);Torque response time(转矩响应时间)
	Output current 控制器输出电流	Continuous working current of controller(驱动电机控制器持续工作电流);Short time working current of controller(驱动电机控制器短时工作电流);maximum working current of controller(驱动电机控制器最大工作电流)
	Feedback character(馈电特性)	

新标准体系

specification		
Safety (安全性) (3)	Grounding check(安全接地检查)	
	Protection function(驱动电机控制器的保护功能)	
	drive motor controller support capacitor discharge duration(驱动电机控制器支撑电容放电时间)	
Enviroment accommodation(环境适应性) (6)	Low temperature(低温)	
	High temperature(高温)	
	Temperature and humidity(湿热)	
	Vibration(耐振动)	
	IP grade (防水、防尘)	
	salt erode(盐雾)	
	IMC/EMC(电磁兼容性	EMC(电磁辐射骚扰)
		IMC(电磁辐射抗扰性)
(1) Relibility(可靠性)		

新标准体系

- 《电动汽车用驱动电机系统可靠性试验方法》
  - 试验时间：402工作小时。
  - 母线电压：设置了额定、最高和最低工作电压考核工况。
  - 负荷规范
    - 考核额定功率、峰值功率和功率回馈三种状态。
    - 负荷规范主要体现在发电、电动以及额定功率和峰值功率时间分配上。
    - 停机时和恢复工作后的若干循环不计入实际工作时间。



新标准体系

- QC/T893-2011 《电动汽车用驱动电机系统故障分类和判断》

故障类型
严重故障
重大故障
一般故障
轻微故障

故障模式：

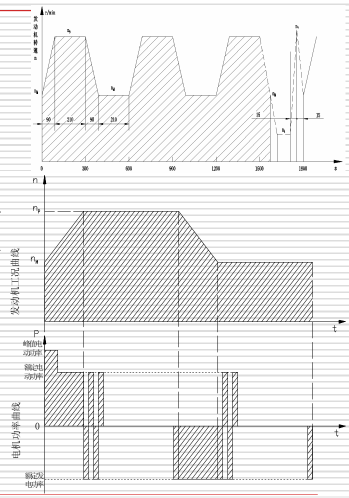
1 损坏型
2 退化型
3 松脱型
4 失调型
5 堵塞与渗漏型
6 性能衰退或功能失效型

新标准体系

- QC/T896-2011 《电动汽车用驱动电机系统接口》
  - 接口定义以功能为主，包括线的颜色和管脚定义
  - 电气接口（电气和控制部分）
  - 机械接口（电机连接和冷却液）

新标准体系

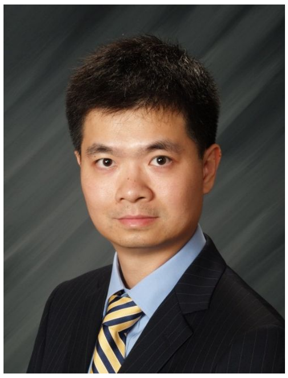
- 《ISG总成可靠性试验方法》
  - 400小时工作循环
  - 考虑到发动机的最大负荷以及电动机电动峰值、额定和发电特性
  - 性能的初始和复试
  - 台架安装示例
  - 故障处理方法



致谢

感谢关注！

Zilai ZHAO



Mr. Zilai Zhao is currently the Business Line Director of Propulsion Systems at Magna E-Car Systems, Rochester Hills, Michigan, U.S.A. He oversees two major global product lines: inverters and electric motors for electric, hybrid and fuel cell vehicles.

Mr. Zhao has a Bachelor's degree from Tsinghua University, an MSEE degree from the University of California – Los Angeles and an MBA degree from the University of Michigan – Ann Arbor.

Mr. Zhao has been working on vehicle electrification since late 90's first as controls engineer and later moving into various business leadership roles. He led product and technology development projects such as Steer-By-Wire system, Electric All-Wheel-Drive and high power density inverter and power module. The 2012 Ford Focus Electric uses inverter and electric motor designed and produced by Mr. Zhao's Business Line at Magna E-Car.

Mr. Zhao held 5 US patents on various vehicle electric propulsion technologies.

Prior to joining Magna E-Car, Mr. Zhao worked for Magna Electronics, Infineon, Wavecrest Laboratories and Visteon.

赵紫来先生任职于在美国密歇根州罗切斯特山市的麦格纳电动车系统。赵先生的职位是驱动系统业务总监，负责两大全球产品线，电机控制器与电机，的商业运作。这些产品主要是应用于驱动电动车，油电混合动力车以及氢燃料电池车。

赵先生是清华大学自动化系的工程学士，美国加州大学洛杉矶分校电气工程系的科学硕士以及美国密歇根州大学安娜堡分校的工商管理硕士。

赵先生从 90 年代末开始从事汽车电气化的工作。历任控制工程师，市场应用经理，产品经理，业务总监等职。他负责过的产品及技术开发项目包括汽车电动转向系统，电动四轮驱动系统，高功率密度逆变器及功率模块等等。福特 2012 年推出的纯电动福克斯使用的就是在赵先生领导下研制生产的 100 千瓦逆变器与电机。

赵先生拥有 5 项关于汽车电驱动技术的美国专利。

在加入麦格纳电动车系统之前，赵先生曾分别任职于麦格纳电子公司，英飞凌美国，波峰实验室以及伟世通。

Sino-U.S. Workshop on New Energy Standardization, July 23 2012

Electric Vehicle Propulsion Systems Standardization Discussion – U.S. Perspective (Abstract)

Zilai Zhao, Propulsion Systems Business Line Director, Magna E-Car Systems

Although electric motors and motor controllers are not fundamentally new technologies, using them as primary propulsion systems of modern automobiles posts unique challenges. Many existing automotive and industrial standards are used to guide electric vehicle propulsion systems design, testing and manufacturing while more are being developed. These standards range from component quality to interfaces to safety. However, adaptation of exiting standards to electric vehicles has not been straight forward. This presentation will focus on some of the key challenges in adapting existing standards and developing new standards for electric vehicle propulsion systems. These challenges include, but certainly not limited to: quality standard for new and existing component and system technologies, propulsion system performance and testing, electromagnetic compatibility specification and testing and safety. This presentation will also touch upon the business of propulsion systems. Due to low production volume and variability in new energy vehicle design, the business case for propulsion systems has been a tough one. Vehicle structure and performance goal seem to always push propulsion system beyond the designed scalability. In order to optimize cost and performance, both OEMs and suppliers must both make some compromises. Finally, this presentation will highlight some of the latest development in propulsion system technologies in the U.S.

电动车驱动系统标准化的探讨 – 美国的角度（摘要）

赵紫来，驱动系统业务总监，麦格纳电动车系统

虽然电机与电机控制器并不是全新的技术领域，但是把这些技术应用到现代车辆的主驱动上给业界带来了很多独特的挑战。许多汽车和各种工业的技术标准可以被用以指导电动车驱动系统的设计，测试与制造。与此同时，一些新的技术标准也被陆续推出。这些现有以及新的标准包括了零部件质量、各种接口、安全性、等等领域。然而，把现有的标准应用到电动车上并不简单。本报告将重点讨论在应用现有标准和建立新标准中的关键挑战。这些挑战包括，但不局限于，以下几条：新与现有的零部件与系统的质量标准，驱动系统的性能及其测试，电磁兼容性，以及安全性。本报告还将触及驱动系统的业务状况。由于相对低的新能源汽车产量和新能源汽车本身的多样性，驱动系统在商业角度来说是仍不乐观。汽车内部结构安排和性能指标似乎总是超出了驱动系统的设计内可扩展性。为了优化成本与性能，汽车厂与供应商都必须作一定的妥协。最后，本报告将重点介绍一些驱动系统技术在美国的最新动向。

Ken Boyce

Ken Boyce is Principal Engineer Manager – Energy at UL LLC. Ken has over 25 years of experience in safety engineering across a wide range of product sectors including industrial, high-tech, appliance, and innovative products. He is presently the technical manager for energy technologies, overseeing standards development and technical operations for renewable energy, energy storage, electric vehicle, biofuel and other equipment. Ken is active in the code-development community, serving as a longstanding member of National Electrical Code Panel 1 and authoring several code proposals. He works closely with US National Laboratories, including the completion of a number of significant research projects. Ken is a graduate of the Illinois Institute of Technology and is a Registered Professional Engineer in Illinois.

Safety of EV Infrastructure and Batteries

Sino-US Workshop on New Energy Standardization
Beijing, China
23 July, 2012

Ken Boyce
Principal Engineer Manager - Energy
UL LLC

Overview

Existing Technologies

Emerging Technologies

Standards Development

Areas of Involvement

EV Safety Challenges

- **Electrical Hazards: e.g. shock, external short-circuit, overcharge, over-discharge, imbalance**
- **Mechanical Hazards: e.g. shock, drop, crush, intrusion, vibration, mechanical abuse and crash response**
- **Thermal Hazards: e.g. overheating, thermal cycling**
- **Insufficient or lack of QC measurements – complicated by global supply base of raw materials and components**

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Some Key EV Equipment Safety Standards

Products	Standards	Scope
EVSE	ANSI/UL 2594 IEC/EN 61851	EVSE products such as EV Cord Sets, EV Charge Stations, and EV Power Outlets supplying power to an on board charger
Personnel Protection System	UL 2231-1 ANSI/UL 2231-2	Personnel Protection Equipment (PPE) as required by the NEC to protect against electric shock
Cables	ANSI/UL 62 UL Subs 2733, 2734 IEC 60245	Type EV cables in accordance with the National Electrical Code, ANSI/NFPA 70, and on-board cables
Wireless Charging Systems	UL 2750* SAE J2954*	Wireless power transmission. UL 2750 addresses safety; SAE J2954 addresses process/communications
Plug/Coupler	ANSI/UL 2251 IEC/EN 62196	EV connector and inlet (coupler) for connecting power to an electric vehicle
Chargers	UL 2202 IEC/EN 61851, 61558 ISO 17409*	On-board or off-board products supplying DC charging current to a battery
Batteries	ANSI/UL 2580 UL Sub 2271 SAE J2929*	Batteries and battery packs of Li-ion or other technologies (depending on scope of standard; UL 2580 is technology independent). ISO is also working on a battery safety standard.
On-board converter/inverter	UL Sub 458A IEC/EN 60730	On-board converters & inverters to modify voltage levels
V2X	UL 9741*	Safety and connectivity of Vehicle-to-Premises and Vehicle-to-Grid power transfer
		* Under development

Infrastructure equipment

In the US, EV built infrastructure is subject to compliance with NFPA 70/National Electrical Code (NEC) compliance (including Article 625); enforced by local regulatory authorities

The NEC addresses safe EV charging environment; certification of infrastructure equipment is required.

NEC presently undergoing regular 3-year revision cycle with many changes on EV equipment; scheduled to be finished mid-2013.

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On-board equipment

In the US, overall vehicle safety addressed by US Department of Transportation NHTSA regulations and conformance scheme

On-board equipment is not mandated to be certified

Compliance with applicable standards provides a level of due diligence, demonstrates supply chain confidence, and differentiates from competitors

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Overview

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Electric Vehicle Batteries

The US Safety Standard is ANSI/UL 2580 – Standard for Plugs, Receptacles and Couplers for Electric Vehicles

The Scope covers Electric Energy Storage Assembly (EESA) of EV batteries (not chemistry specific), electrochemical capacitors, hybrid systems of batteries and electrochemical capacitors for use in on-road vehicles and industrial off-road vehicles

The safety requirements address electric shock, fire, personal injury (from explosion, mechanical hazards and toxic releases)

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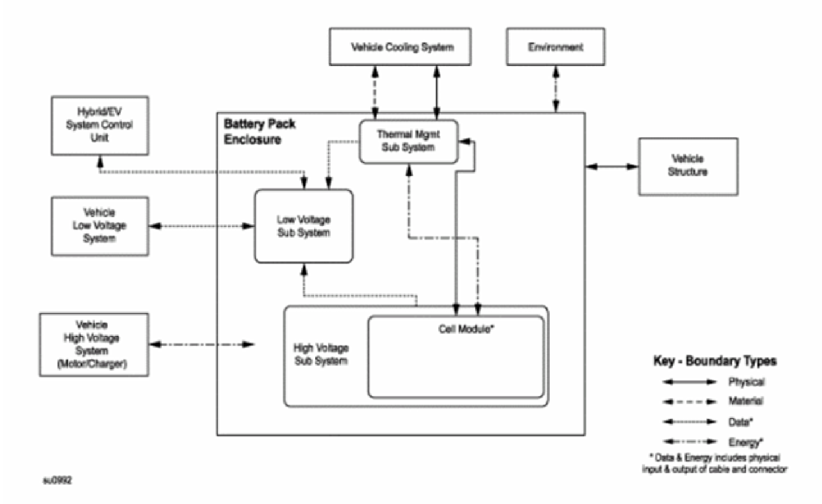
Electric Energy Storage Assembly (EESA) Boundary Diagram



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Key UL 2580 Requirements

- **Cells/capacitors need to comply with applicable safety standards**
- **Requires 2-pole Manual disconnect and automatic disconnect on detection of isolation loss (<100 Ω/V)**
- **Electrical tests include overcharge, short circuit, over-discharge protection, imbalanced charging, isolation resistance, and failure of cooling system**
- **Mechanical tests include vibration endurance, rotation, shock, drop, crush**
- **Environmental tests include thermal cycling, salt spray, immersion, internal fire exposure, and external fire exposure**
- **Combustible concentration and toxic gas monitoring methods are used**

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Connectors and Inlets

The US Safety Standard is ANSI/UL 2251 – Standard for Batteries for Use in Electric Vehicle Applications

The Scope covers devices rated up to 600 V ac or dc, and up to 800 A ac or dc, open to any and all configurations

Cable may or may not be provided; Type EV cable is Listed to UL 62, the Standard for Flexible Cords and Cables.

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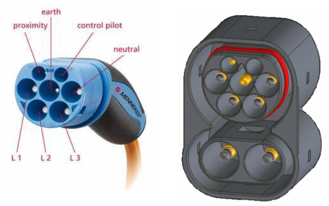
Different Connector/Inlet Configurations

SAE J1772

Source: jessicafen.en.ec21.com

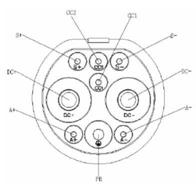


Mennekes

Source: www.mennekes.com

CHAdeMO (Japan)

Source: www.teslamotorsclub.com



DC Connector (China)

Source: IEC 62196

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SAE Specifications for Connectors and Inlets

SAE Level Definitions

AC Level 1: Voltage rating of 120 V ac, single phase; Current rating of 12 or 16 A; Maximum power of 1.44 or 1.92 kW	DC Level 1: Voltage rating of 200 – 500 V dc; Current rating ≤ 80 A; Maximum power of ≤ 40 kW
AC Level 2: Voltage rating of 240 V ac, single phase; Current rating ≤ 80 A; Maximum power of ≤ 19.2 kW	DC Level 2: Voltage rating of 200 – 500 V dc; Current rating ≤ 200 A; Maximum power of ≤ 100 kW
AC Level 3: Under Consideration	DC Level 3: Under Consideration

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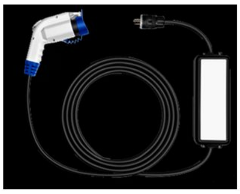
Charge Stations and Charge Cables

Charge Stations may be:

- **Indoor or outdoor use**
- **Cord Connected or Hardwired**



Charge stations and Charge Cables have an ac output and are intended to provide power to an on-board charger.

Must be provided with Personnel Protection Systems in accordance UL 2231, the Standard for Personnel Protection Systems for EV Supply Circuits.

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Charge Stations and Charge Cables

The safety standard is UL 2594, Standard for Electric Vehicle Supply Equipment.

The scope covers products intended to provide output power to an EV on-board charger, and can be rated up to 250 V ac input

This standard covers all equipment that is commonly designated as Electric Vehicle Supply Equipment (EVSE)

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Chargers

Chargers may be:

- Indoor or outdoor
- On-board or off-board
- Cord connected or hardwired

Off-board chargers supply a dc output to the vehicle in order to directly charge the vehicle battery; On-board chargers convert EVSE ac output to a dc charging voltage for the vehicle battery.

All off-board chargers are provided with Personnel Protection Systems in accordance with UL 2231.

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Chargers

Standard in ANSI/UL 2202, Standard for Electric Vehicle (EV) Charging System Equipment

Scope covers devices that have a dc output and are intended to provide that output directly to the vehicle battery for the purposes of recharging that battery. Device may be rated up to 600 V ac input.

Overview

Existing Technologies

Emerging Technologies

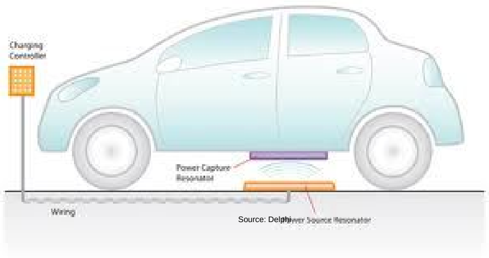
Standards Development

Areas of Involvement

Wireless Charging

Wireless charging is an area of great interest for new product development

Wireless charging offers many advantages by removing the need for a physical connection



Source: Delphi

However, the nature of wireless charging causes new safety issues to emerge

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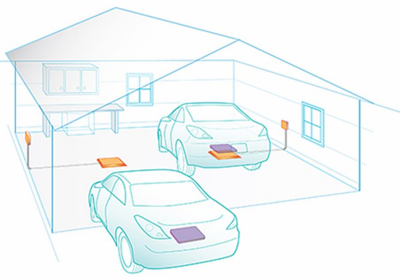
Wireless Charging Systems

Wireless charging systems consist of an off-board power source with a primary coil, and a secondary coil located on the vehicle.



When the vehicle is parked over the primary coil, charging occurs by inductive transmission.

Systems may be residential or commercial (e.g. installed in public parking lots).

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Nissan Leaf Wireless Charging

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Wireless Charging Safety Issues

Due to the lack of physical connection to the vehicle, these issues may significantly affect safety:

- **Human exposure to charging field**
- **Vehicle misalignment to charger**
- **Interposed objects which may be a fire or health hazard**

Responses to these issues and safety mitigation are likely to be addressed by on-board vehicle systems and vehicle-to-charger communication

UL is working with industry to develop safety solutions for these issues.

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Bidirectional Vehicle Power: V2X

"V2X" is used to refer to transmission or power from the EV battery to other systems, such as Vehicle to Home (V2H)/ Premises(V2P) or Vehicle to Grid (V2G)

V2X technology may be used in applications such as:

- **Connection of EVs to a home or premises power system for emergency or peak demand power from the vehicle battery.**
- **Connection of a vehicle fleet to provide premises or grid power during down times, such as a fleet of idle electric school buses during the summer months.**

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V2X Challenges

There are specific concerns that need to be worked through in relation to this technology. These include:

- **Code rules related to connection of separately derived power systems**
- **Grid connection means and grid compatibility**
- **Back feed protection methods from the EV**
- **Functioning of the personnel protection system**

These issues are being addressed in various forums.

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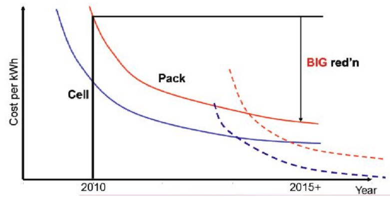
Battery Technologies

Batteries account for a significant portion of the EV cost and mass

The drive for increased battery economy, energy density, and performance leads to continual exploration of new battery technologies – for example lithium phosphate, lithium air, or lithium-sulfur



Source: Nissan

Future battery technologies

UL 2580 is not focused on a specific battery technology, however new technologies may present new and unique safety challenges.

UL is active in industry collaboration and technical research in order to address and support the introduction of new technologies for EV batteries in the future

Overview

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Crucial role of safety standards

- The rapidly evolving EV technology and global supply base demands standardization relative to infrastructure, designs & safety
- A safe and secure infrastructure is key to successfully deploying EVs
- UL is actively working with stakeholders to develop standards and test methods for safe EV use

North American Harmonization

Currently harmonizing tri-national standards with Canada and Mexico, using UL standards as the base:

- **UL 2594 → ANSI-UL 2594/CSA 280/ANCE XXX**
- **UL 2251 → ANSI-UL 2251/CSA 282/ANCE XXX**
- **UL 2231-1 → ANSI-UL 2231-1/CSA 281.1/ANCE XXX**
- **UL 2231-2 → ANSI-UL 2231-2/CSA 281.2/ANCE XXX**

All documents are scheduled to be published Q3 2012.

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Standard Development Efforts

As previously noted, UL has also been developing requirements for emerging technologies.

- **Wireless Charging safety standard UL 2750, Wireless Electric Vehicle Charging Systems is drafted; it is being coordinated with SAE J2954, Wireless Charging of Plug-In Vehicles and Positioning Communications.**
- **Vehicle to Premises/Grid safety standard UL 9741, Bidirectional Electric Vehicle Charging Systems and Equipment is being drafted.**

Other safety standard needs are continually being monitored and addressed.

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Global Standards Development

UL participates on many different committees and working groups as technical experts in order to further the development and alignment of safety standards.

These activities include participation on:

- **Society of Automotive Engineers (SAE) committees**
- **IEC Technical Committees**
- **ISO Technical Committees**
- **Society of Automotive Engineers of Japan (JSAE) committees**

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Quick Overview

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UL Involvement

UL collaborates with the many organizations on the development of EV safety and infrastructure safety, including:

- National Highway Traffic Safety Administration (NHTSA)
- National Fire Protection Association (NFPA)
- US National Labs
- National Electrical Manufacturers Association (NEMA)

In addition, UL staff serve as participants and chairs on the development and implementation of the ANSI Road Map for Electric Vehicle Safety.

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Providing Assistance

UL is on the ground in many locations providing assistance in program development, requirement development, and training. These areas include:

- US
- Canada
- China
- Japan
- Singapore
- Australia
- South Korea

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Summary

EV safety standards & regulations are in a very dynamic state

Much work is being done on a national, regional, and international scale

UL is committed to supporting safe and effective deployment of electric vehicles through standards, research, testing, certification and training

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Thank you

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Rich Byczek

Rich Byczek is the Global Technical Lead for Electric Vehicle and Energy Storage at Intertek. Based in Detroit, Michigan, Rich is responsible for the technical development of Intertek's EV and Battery testing labs across North America, Europe and Asia for th past 2 years. Previously, he was the Operations Manager of Intertek's Detroit site for 5 years, directly responsible for all battery performance, safety and transportation testing, as well as reliability and certification testing of Electric Vehicle charging stations and support electronics. Rich has over 17 years experience in product validation, EMC testing, and automotive product development. He sits on several performance and safety standards committees related to batteries and electric vehicle systems, and is the chair of the SAE Battery Test Equipment committee. Rich holds a Bachelor of Science in Electrical Engineering from Lawrence Technological University.

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Safety Testing, Regulations, and Standards

Rich Byczek
Global Technical Lead – EV and Energy Storage

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Objectives

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- Understand the Electric Vehicle-Related certification requirements & process for North America
- Identify relevant standards for Electric Vehicle Supply Equipment
- Identify component specific and special cases for certification

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Who are the governing bodies?

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In the United States – NFPA

- NFPA – National Fire Protection Association
- Develops Standards, including NFPA 70
  - NFPA 70 is **The U.S. National Electric Code (NEC)**
  - Adopted within local U.S. building and construction codes

NFPA®

- **Article 625 of the U.S. National Electric Code** indicates that all Electric Vehicle Supply Equipment (EVSE) materials, devices, fittings and associated equipment shall be **listed or labeled**

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Who are the governing bodies?

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Aren't manufacturers required to use UL for their compliance testing? Isn't this mandated by the standards themselves?

- The simple answer to both questions is "no"
- To satisfy the prerequisite of having your products tested by an independent organization, the true legal requirement is that the laboratory which performs the testing be a Nationally Recognized Testing Laboratory (NRTL) recognized by OSHA

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Who are the governing bodies?

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In the United States – OSHA

- OSHA (U.S. Department of Labor: Occupational Safety & Health Administration) oversees workplace safety regulations, which are US law and contain requirements for "approval" (i.e. testing & certification) of certain products by an **NRTL – Nationally Recognized Testing Laboratory**
- Requirements are found in Title 29 of the U.S. Code of Federal Regulations and the provisions for NRTL certification are generally in Part 1910 (29 CFR Part 1910)

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Who are the governing bodies?

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An NRTL is an organization that OSHA has "recognized"

- An NRTL is authorized to provide an independent evaluation, testing and certification of electrically operated or gas- and oil-fired products based on standards developed by U.S.-consensus standards organizations such as the American National Standards Institute (ANSI) and Underwriters Laboratories (UL)
- "Recognition" includes demonstrating to OSHA the capability, control programs, independence, reporting and complaint handling procedures to test and certify specific types of products for workplace safety

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Who are the governing bodies?

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What does a safety mark tell me?

- Safety marks such as ETL, UL, and CSA signify that the product has been tested to, and found to comply with, national safety standards by a qualified, independent testing laboratory
- The presence of a safety mark also means the product is 'listed' in the NRTL's "directory" – public record.
- And, is part of an on-going follow-up program that ensures the products continuously comply with the applicable standards

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Who are the governing bodies?

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What about "CE Mark", or equipment certified by foreign testing organizations?

- The CE mark is a generic mark used in the European Union (EU) to indicate that a manufacturer has declared that the product meets EU safety requirements
- CE is unrelated to the requirements in the US
- In the US, the product must have the specific mark of a recognized NRTL
- However, data used to attain NRTL certification, may be applicable to declaration of compliance for CE marking
- CE marking is based on compliance with EU directives and EN-based product standards.
- Also applies to CHADEMO-certified DC Chargers. Does not influence US-safety listing

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Who are the governing bodies?

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What other "international" requirements exist?

IEC

- The International Electrotechnical Commission (IEC) is a non-profit standards organization that writes International Standards for all electrical, electronic and related technologies

IECEE

- IEC System for Conformity Testing and Certification of Electrotechnical Equipment and Components), known as the **CB Scheme**

IEC IECEE CB SCHEME

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Who are the governing bodies?

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CB Scheme?

- The CB Scheme is an international program (under IECEE) for the exchange and acceptance of product safety test results among participating laboratories and certification organizations around the world
- The CB Scheme offers manufacturers a simplified way of obtaining multiple national safety certifications for their products — providing entry into over 45 countries

IEC IECEE CB SCHEME

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Who are the governing bodies?

CB Scheme, continued…

Category ELVH

This new category includes Electric Vehicle Supply Equipment, Cables and Connectors

IEC 61851-1 is the relevant main standard for EVSE in this category.

IEC 62196 (EVSE Connectors) are included in this category

*** NOTE: these are not currently harmonized with US standards.**

IEC 60950 (Telecommunications Equipment) may be included to cover installed credit card readers, bluetooth devices, or Wi-Fi options within EVSE

Self Declaration vs Product Safety Listing

Self Declaration:

- In the U.S. most **onboard vehicle** components are certified through a “self-declaration” process

- Manufacturer or Supplier performs required testing in-house, or through a 3rd party laboratory organization, with compliance determined by the Automotive OEM.

Product Safety Listing:

- **Off the vehicle** – EV Charge Stations & Components require “Listing” to applicable national or international standards

Component Recognition:

- Components within listed products: may have specific requirements

- Similar to Product listing, but denotes an incomplete product or specific usage limits.

EVSE – Standards In the United States

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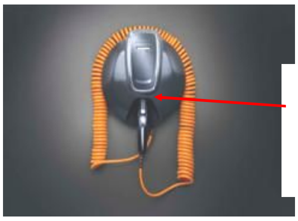

Charging Station (EVSE)
UL Subject 2594, IEC 61851
Personnel Protection Circuitry
UL 2231-1 and UL 2231-2

Charging Plug / Outlet
UL 2251, IEC 62196,
SAE J1772

13 www.intertek.com

EVSE – Standards In the United States

Intertek
Valued Quality. Delivered.

Charge Stations – AC Output

UL Subject 2594
OUTLINE OF INVESTIGATION FOR Electric Vehicle Supply Equipment

This outline covers electric vehicle (EV) supply equipment, rated at a maximum of 250 V ac with a frequency of 60 Hz and intended to provide power to an electric vehicle with on-board charging unit.

Wall Mount Charge Station for homeowners – typically mounted in the homeowner's garage and connected to 240VAC 60Hz source for high amperage charging.

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EVSE – Standards In the United States

Intertek
Valued Quality. Delivered.

Travel Cordset Charge Station for homeowners – device is typically carried in the vehicle for charging while on the road. Typically connects to 120VAC 60Hz source. Lower amperage charging.

Municipal Charge Station – can be provided with both 120VAC 60Hz and 240VAC 60 Hz sources. Can be mounted anywhere: parking lots, hotels, etc. May be provided with a variety of options for things such as credit card readers, I/O ports for recording data etc.

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EVSE – Standards In the United States

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Battery Chargers – DC Output

UL 2202
UL Standard for Electric Vehicle (EV) Charging System Equipment, Second Edition

Supplied by circuit of 600Volt or less

For recharging batteries over the road EV's

On-board or Off-board the vehicle

"Chademo" Quick Chargers fall under this standard

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EVSE – Standards In the United States

Intertek

Valued Quality. Delivered.

CCID – Charge Circuit Interrupting Device

Devices covered by UL 2231-1 and UL 2231-2 are typically control circuits that are not complete products but are circuit boards to be fitted into a Charging Station.

* Often certified as “recognized components”, rather than listed products

UL 2231-1

Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements for First Edition, revised

These requirements cover devices and systems intended for use in accordance with the National Electrical Code (NEC), ANSI/NFPA 70, Article 625, to reduce the risk of electric shock to the user from accessible parts, in grounded or isolated circuits for charging electric vehicles. These circuits are extended to, or on-board, the vehicle.

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EVSE – Standards In the United States

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UL 2231-2

UL Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems, First Edition, revised

This standard is intended to be read together with the Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements, UL 2231-1. The requirements of UL 2231-1 apply unless modified by this standard. This Part contains the construction and performance requirements that are applied to a device that is intended to become an integral part of an overall device or charging system.

- CCID: Charge Current Interrupt Device
- Isolation Monitors

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EVSE – Standards In the United States

Charge Connectors

* Often certified as “recognized components”, rather than listed products

UL 2251
UL Standard for Safety for Plugs, Receptacles and Couplers for Electric Vehicles, Second Edition

These requirements cover plugs, receptacles, vehicle inlets and connectors, rated up to 800 amperes and up to 600 volts ac or dc

Intended for conductive connection systems

Vehicle Coupler – Coupler for providing power to the on-board charger. Typically, part of the EVSE, but may an “extension cord” with coupler on both ends.

SAE/ IEC/ CHADEMO

Vehicle Inlet – Standard power inlet on vehicle

Charging Performance

SAE J1772: AC Level 1 and Level 2

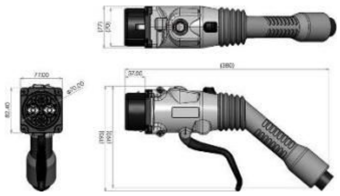
(in process): DC Level 1 and Level 2 incorporated

IEC 62196: Single and 3phase AC adapters

CHADEMO: Japanese DC adapter and protocol

DC Quick Charging: CHADEMO

Currently in field in Japan and US (SAE J1772 DC connector pending)
Uses CAN (Controller Area Network) Bus interface
Battery direct communication to Control Charge Current
Max power: 50kW
Max Voltage: 500VDC
Maximum Charge Current: 125ADC



Field Labels

For Custom-built systems (one-of-a-kind or few-of-a-kind), or unlisted products that are "red-tagged" by the Local Inspector.

Field Label Program: An NRTL Engineer will evaluate the product in its installed location, to the appropriate safety standard and applicable NEC/NFPA requirements.

Example:

Japanese CHANDEMO product installed in US facility, demonstration model/prototype installed at client location.

NRTL will evaluate the INSTALLATION according to Article 625 of the National Electric Code, apply the mark directly to the product, and submit report directly to the local authority.

Thank You !

Rich Byczek, Global Technical Lead

Intertek

rich.byczek@intertek.com

+1 734 591 9161

Gary S. Schkade

Gary S. Schkade
General Manager, China
Managing Director, Asia-Pacific
SAE International

Mr. Schkade is the General Manager of SAE's operations in China. In early 2012, he launched SAE's newly formed wholly owned foreign enterprise in Shanghai. Since 2004, he has lead SAE's operations and business development in the overall Asia-Pacific region. Prior to his current assignment, he has also been responsible for advancing SAE International's special initiatives in Mobility Electronics.

Before SAE International, Mr. Schkade was with General Motors, starting in 1980 at the GM Research Laboratories working in Advanced Powertrains and then Chassis Systems. He became a Section Head in Systems Engineering. Subsequent positions included Engineering Group Manager with the GM Truck Group followed by Resident Manager for Truck Product Development at the GM Proving Grounds in Arizona in the United States.

Mr. Schkade has a Bachelor of Science Degree in Mechanical Engineering from Kettering University and a MBA in International Management from the Thunderbird School of Global Management.

SAE International

V2G Communications, Battery & Fuel Cell Standardization

SAE Standards to Support Electro-Mobility

Gary Schkade,
General Manager, China
SAE International

Agenda

V2G Communications, Battery & Fuel Cell Standardization

SAE Standards to Support Electro-Mobility

- The Future of Vehicle Electrification - Successful Implementation
- Electro Mobility Technology Enablers
- Conductive and Inductive Charging Interface Standards Overview
- Vehicle Battery Standards
- Future Focus – Hydrogen Fuel Cell Standard Activities
- New Standards Committees to Address Technology Trends

The Future of Electrification - Successful Implementation

Challenges:
- **Technology**
- **Governmental Regulations**
- **Consumer Needs**
- **New Infrastructures**

Slide: courtesy of Magna Int'l.

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The Future of Electrification - Successful Implementation

SAE J2953 – "Plug-In Electric Vehicle
eroperability with Electric
upply Equipment (EVSE)" –
rogress

ent/Industry Research

ect: Advanced Vehicle
nd Evaluation - Infrastructure
Evaluation

requirements, specifications,
dures and certification
s to ensure the
ability of PEV's and PHEV's
ric Vehicle Supply Equipment

- Interoperability
- Reliability
- Charger efficiency
- Vehicle to grid communication

Is it going to work?

Every time? All the time?

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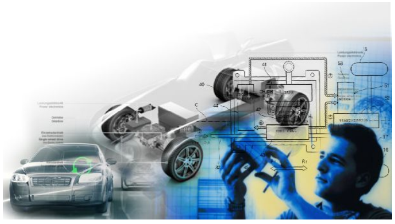
Electric Vehicle Technology Development

Technology Enablers

New EV Technologies require knowledge and expertise gained through Collaboration

- Vehicle Electrification
- Energy Storage Devices
- Power Electronics and Power Motors
- V2V and V2I DSRC Communications
- Conductive Charging
- Inductive Charging
- EV Safety (First and Second responders)
- Grid Interface & Communications



Slide courtesy of Magna Int'l.

- Research
- Collaborative Efforts
- Industry Standards

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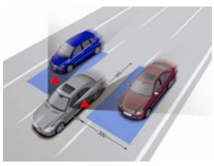
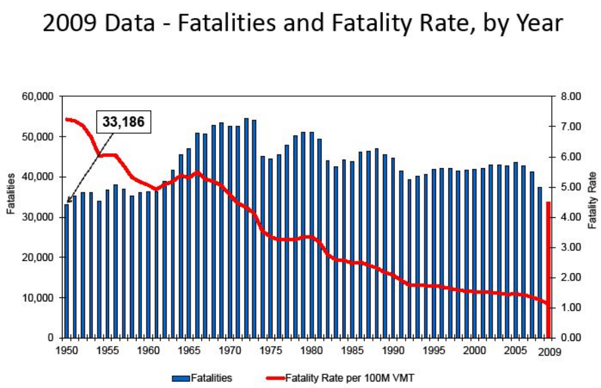
Technology Enablers

Implementing New Technologies: This is where our industry shines

Safety Systems (Passive, Functional & Active)





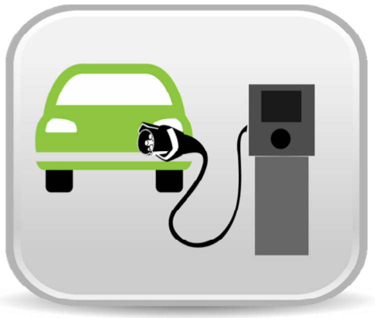
An 85% fatality rate reduction has been realized in the US from 1950 to 2009 as a result of cooperative industry efforts for advancements in automotive safety. We can *and should* expect similar results in vehicle electrification.

Technology Enablers

SAE Electro-Mobility Ground Vehicle Standards Development Activities

Volunteer, consensus based standards development process

- Total Committees: 580
- Total Committee Members: 8,064
- Total Standards Published : 10,077 (Ground Vehicle 2,081)
- Active Standards: 8,635 (Ground Vehicle 1,681)
- Standards In Development /Review: 657



Vehicle Electrification
- EV, PHEV's
- Batteries
- Smart Grid
- J1772™ Connector

Leading SDO in NIST Roadmap for Smart Grid interoperability

- 29 active committees
- 774 committee members
- 52 standards developed or in process

SAE International is a leading standards organization identified in the NIST Framework and Roadmap for Smart Grid and "Interoperability Standards to Support Plug-In Electric Vehicles."

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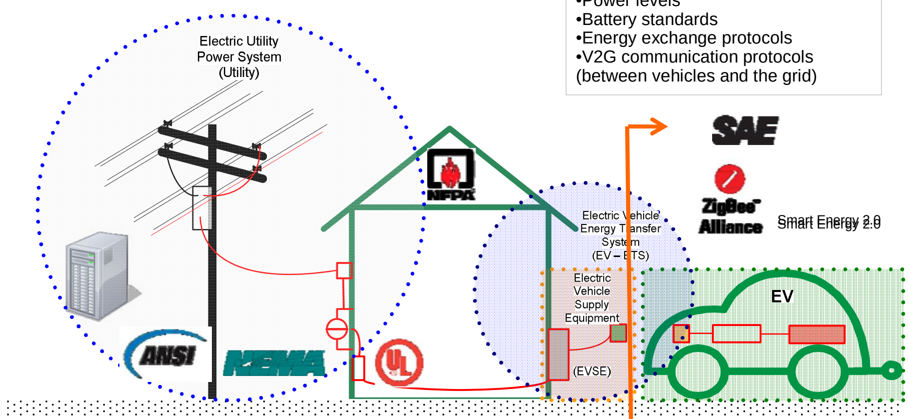
SAE International

Technology Enablers

Simply Connecting?

EV or PHEV require multitude of standards:
- Physical connectors
- Interfaces
- Power levels
- Battery standards
- Energy exchange protocols
- V2G communication protocols (between vehicles and the grid)



OASIS EPRI ELECTRIC POWER RESEARCH INSTITUTE IEC ISO IEEE SAE

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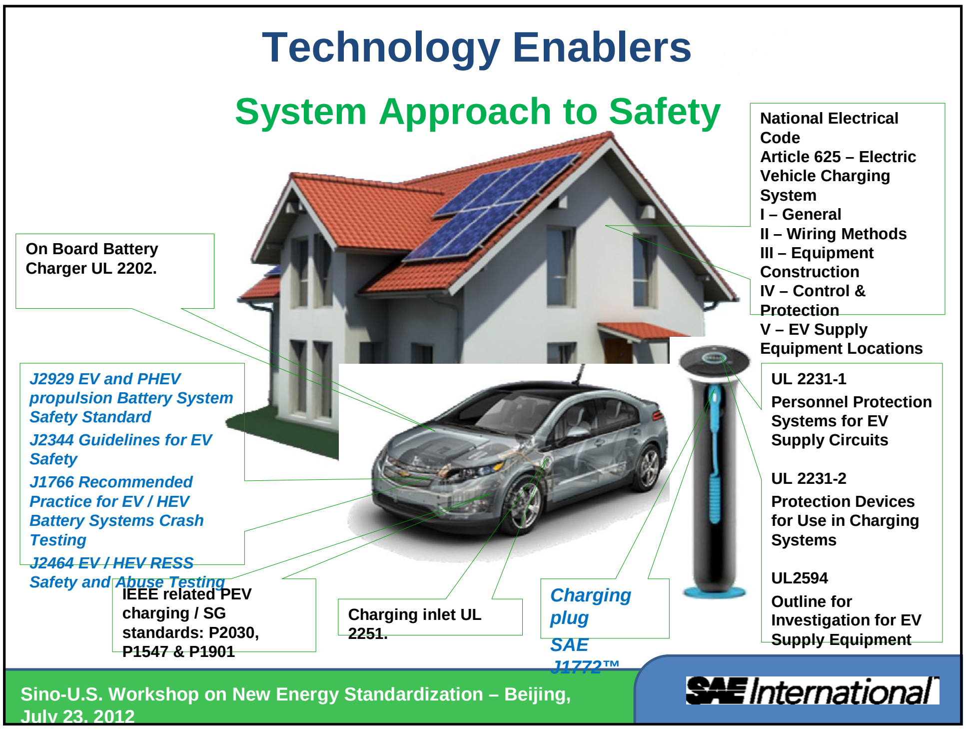
SAE International



Technology Enablers
System Approach to Safety
On Board Battery Charger UL 2202.
National Electrical Code
Article 625 – Electric Vehicle Charging System
I – General
II – Wiring Methods
III – Equipment Construction
IV – Control & Protection
V – EV Supply Equipment Locations
J2929 EV and PHEV propulsion Battery System Safety Standard
J2344 Guidelines for EV Safety
J1766 Recommended Practice for EV / HEV Battery Systems Crash Testing
J2464 EV / HEV RESS Safety and Abuse Testing
UL 2231-1
Personnel Protection Systems for EV Supply Circuits
UL 2231-2
Protection Devices for Use in Charging Systems
UL2594
Outline for Investigation for EV Supply Equipment
IEEE related PEV charging / SG standards: P2030, P1547 & P1901
Charging inlet UL 2251.
Charging plug SAE J1772™
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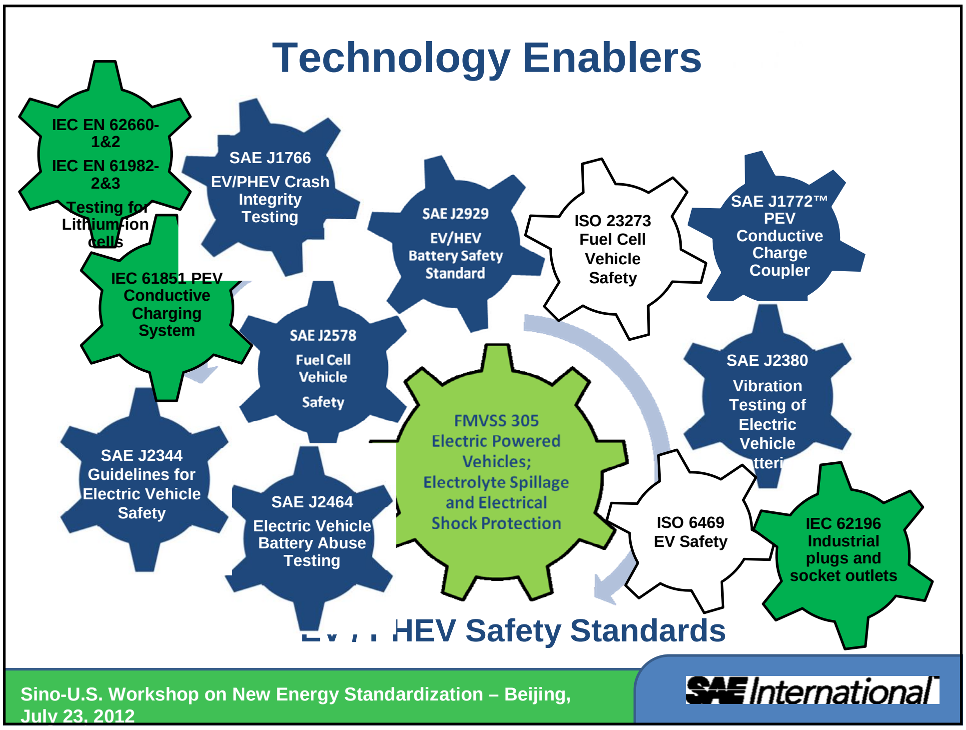

Technology Enablers
IEC EN 62660-1&2
IEC EN 61982-2&3
Testing for Lithium-ion cells
SAE J1766 EV/PHEV Crash Integrity Testing
SAE J2929 EV/HEV Battery Safety Standard
ISO 23273 Fuel Cell Vehicle Safety
SAE J1772™ PEV Conductive Charge Coupler
IEC 61851 PEV Conductive Charging System
SAE J2578 Fuel Cell Vehicle Safety
FMVSS 305 Electric Powered Vehicles; Electrolyte Spillage and Electrical Shock Protection
SAE J2380 Vibration Testing of Electric Vehicle
SAE J2344 Guidelines for Electric Vehicle Safety
SAE J2464 Electric Vehicle Battery Abuse Testing
ISO 6469 EV Safety
IEC 62196 Industrial plugs and socket outlets
HEV Safety Standards
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Technology Enablers

EV / PHEV Charging Interface

SAE Hybrid Vehicle Committees are leading the effort to define charging functionality and standardize the connection hardware from EV to EVSE

SAE-J1772 Standard defines:

•Charging capacity & operating voltage by "Level" – AC 1 & 2

•Electrical safety & circuit protection of EVSE

•Physical properties of the connector

•EV to EVSE communications & charging controls

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Technology Enablers

Next Generation – SAE Combo Connector

The SAE Combo Charge Connector" standard sets the foundation for a combined charging system for electric vehicles in Europe and North America

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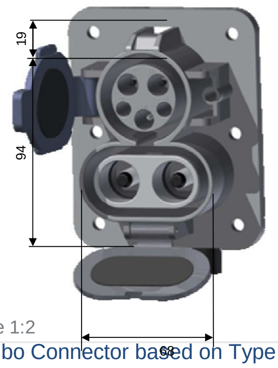
Technology Enablers

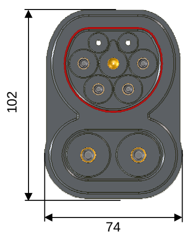
DC Combo Inlet Design

Integration of AC and DC into a single inlet provide high freedom for vehicle design.

Combo 1 Inlet for US	Combo 2 Inlet for Europe



Harmonized Approach



Combo Connector based on Type 1 and Type 2 have been submitted to IEC in a single document by Germany and US. Both Combo Connectors have identical package and fixation.

Courtesy of Initiative Charging Interface by Audi, BMW, Daimler, Porsche, VW (coordinated by Dr. Heiko Dörr, heiko.doerr@carmeq.com)

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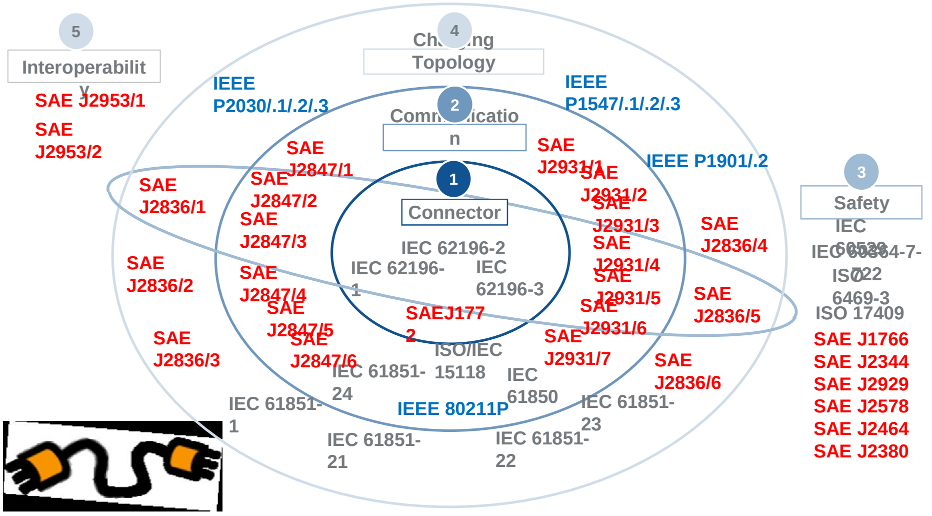
Technology Enablers

Relevant Standards for the Charging Interface (Europe and US)



Courtesy of Initiative Charging Interface by Audi, BMW, Daimler, Porsche, VW (coordinated by Dr. Heiko Dörr, heiko.doerr@carmeq.com)

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Technology Enablers

SAE Communication Standards

SAE J2836 ™ Use cases	Scope		Scope	SAE J2847 Detailed Info Messages
/1	Utility Programs *	⟷	Utility Programs *	/1
/2	Off-Board Charger Communications	⟷	Off-Board Charger Communications	/2
/3	Reverse Energy Flow	⟷	Reverse Energy Flow	/3
/4	Diagnostics	⟷	Diagnostics	/4
/5	Customer and HAN	⟷	Customer and HAN	/5
/6	Wireless charging	⟷	Wireless Charging	/6

Note: J2836/3 (Reverse Power Flow) use cases (WIP) coordinated with IEEE 1547.4 & .8 specs.

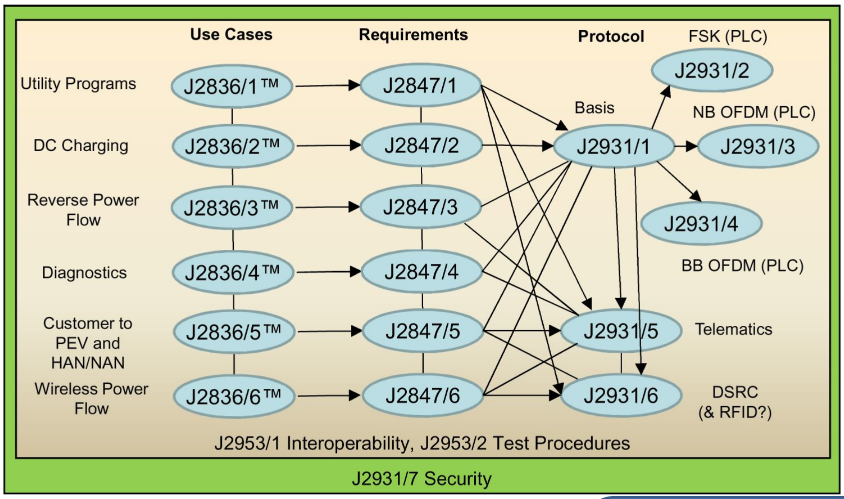
Technology Enablers

SAE Communication Standards

SAE J2931	Scope
/1	Power Line Carrier Communications for Plug-in Electric Vehicles
/2	In-Band Signaling Communication for Plug-in Electric Vehicles
/3	PLC Communication for Plug-in Electric Vehicles
/4	Broadband PLC Communication for Plug-in Electric Vehicles
/5	Telematics Smart Grid Communications between Customers, Plug-In Electric Vehicles (PEV), Energy Service Providers (ESP) and Home Area Networks (HAN)
/6	Digital Communication for Wireless Charging Plug-in Electric Vehicles
/7	Security for Plug-in Electric Vehicle Communications

Technology Enablers

SAE Communication Standards



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Technology Enablers

Inductive Charging of EV's & PHEV's

SAE J2954 Standard in Development

- Inductive Charging Technologies
- Wireless Connection
- Power Transfer Communications
- Smart Grid Interoperability / Programmability
- Level 2 Charging (3.3 kWh)
- Battery System Fault Monitoring
- Automatic Shutdown Capability

Potential Charging Locations:

- Residential
- Public
- On-Road
- Static (parking lots, curb side)
- Dynamic (embedded in roadway)

Who's Involved?

- Auto and Commercial Vehicle OEM's (11)
- Automotive Suppliers
- Organizations (laboratories, government agencies, universities, SDO's, power companies)

Technology Enablers

Wireless Charging of EV's & PHEV's J2954

SAE Standard will Define:
- Performance
- Safety
- Testing Methodologies
- Charge Levels
- Location
- Communications

Transfer: Frequency, Power Level, Efficiency, Topology

Comm.: Message Sets, Identification

Position: Alignment, Gap, Geometry / Shape

Safety: Detection (-debris, -organic), E-Field, B-Field

Technology Enablers

SAE Vehicle Battery Standards Committee

- The SAE Battery Standards Committee leads the way in standardization for batteries which will play a predominate roll in transportation of the future
- Standardization efforts cover all aspects of the cell, module, pack or vehicle for form-fit-function, safety, testing, validation, manufacturing, shipping, transportation, emergency response, service, recovery and recycling thro[illegible] value chain in society

SAE International

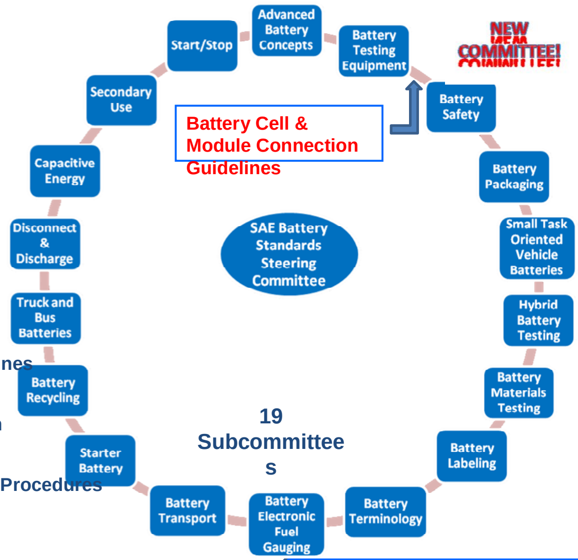
Technology Enablers

Battery Standards Steering Committee

- Started – Nov. 2009
- Current Committee Membership
- >420 Representatives
- >175 Individual Participants
- >140 Companies
  - OEM's
  - Suppliers
  - Government
  - Academia

New Committees under Development

- Aerospace Battery
- ✓ Secondary Use Application Guidelines
- ✓ Capacitive Energy Storage
- Unified Battery Warranty Approach
- ✓ 1st and 2nd Responders Committee
- Battery Disconnect and Discharge Procedures



Slide: courtesy of Magna Int'l.

SAE International

Technology Enablers

A Look into the Future – Hydrogen Fuel Cell Vehicle Standards

- SAE is involved with the US DOE and NREL to develop standards relating to fuel cell vehicles
- Fuel Cell Standards developed and in-process include:
  - Terminology (J2760 & J2574)
  - Safety (J2578, J1766)
  - Performance Interoperability
  - Vehicle Communications (J2601 & J2799)
  - Emissions & Recyclability (J2594)
  - Fuel Consumption & Range ((J2572)
  - Fueling Protocols & Devices (J2600 & J2783)
  - Testing Methodologies (J2615/16,/17 & J2722)
  - Fuel Quality (J2719)

In-Step with Technology Trends

New SAE Standards Committees:

Driver Distraction (Driver-Vehicle Interface)

Wireless charging

Vehicle Electronics Cyber Security

Autonomous Vehicle

Active Safety

Intelligent Transportation Systems

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SAE International

SAE Contact

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Troy, MI 48084-4903 USA
Office: 248.273.2470
email: kwilson@sae.org

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SAE International

适应标准、打造标准

——国电联合动力技术有限公司的标准化工作

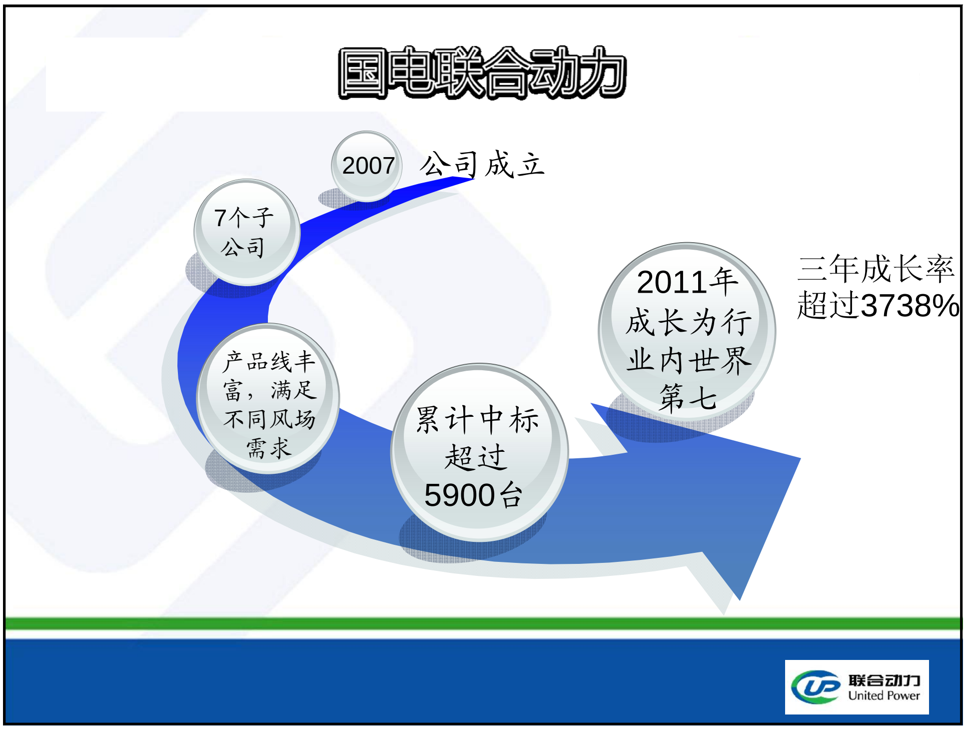
国电联合动力技术有限公司

2012年7月

提纲 Content

- 国电联合动力技术有限公司简介
  GDUPC introduction
- 国电联合动力在适应风电国标方面所做的工作
  GDUPC effort on adopting the industry standards
- 国电联合动力已经建立一整套企业标准体系及管理制度
  GDUPC has established Corp. Standards
- 国电联合动力承担部分风电国家标准的修订制定工作
  GDUPC participates the process of drifting / reversion of national standards


国电联合动力
公司简介
隶属于中国国电集团公司，总部位于北京。在保定、连云港、赤峰、长春、潍坊、包头、宜兴设有七个风电设备及零部件生产、研发基地
主营业务
风电机组设计、生产制造、工程承包、研究开发，销售风机配套产品、提供系统化专业方案以及各种与此相关的机电设备产品和技术服务。国内领先的风电系统解决方案提供商。
核心产品
•1.5MW常温/低温型双馈风机
•1.5MW潮间带型双馈风机
•1.5MW60Hz出口型双馈风机
•2MW常温/低温型双馈风机
•2MW低风速型双馈风机
•3MW海/陆两用双馈风机
•6MW海上双馈风电机组
联合动力
United Power


国电联合动力
2007 公司成立
7个子公司
产品线丰富，满足不同风场需求
累计中标超过5900台
2011年成长为行业内世界第七
三年成长率超过3738%
联合动力
United Power

国电联合动力

具备持续创新能力的研发体系
a R&D system with sustaining innovation

一流的研发平台+优秀的研发团队

- 国家能源潮汐海洋能发电技术重点实验室
- 北京市风电设备可靠性工程技术研究中心
- 科技部风电设备及控制国家重点试验室
- 国电新能源技术研究院风电设备及控制技术研究所

- 整机全功率试验台
- 电控及并网技术实验室
- SCADA系统实验室
- 叶片及材料试验平台

联合动力 United Power

适应风电并网导则

- 吉林双龙风场UP1500-82 Jilin
  - 2010/5 中国电科院 by China EPRI
  - 本次测试是国内首次通过低穿测试
    Frist one to pass the LVRT test in China
- 尚义石人风场UP1500-77（ZVRT） Hebei
  - 2011/4，德国GL-Wintest ，By GL-Windtest
  - 本次测试是国内首次通过零穿测试
    Frist one to pass the ZVRT in China
- 赤峰大于营风场UP1500-77 Inner Mongolia
  - 2011/11，东北电科院 by North East EPRI

联合动力 United Power

适应风电并网导则

- 赤峰西大梁风场UP1500-77 Inner Mongolia
  - 2011/12, 中国电科院, By China EPRI
- 张北试验基地UP2000-96（新国标） Hebei
  - 2012/6, 中国电科院, By China EPRI
  - 动态无功电流的的要求
    adopted the guideline on reactive power injection during grid fault
- 山东潍坊风场UP3000-100（新国标） HeBei
  - 2012/6, 中国电科院和德国GL, By China EPRI and GL
  - 动态无功电流的的要求
    adopted the guideline on reactive power injection during grid fault

联合动力 United Power

国电联合动力企业标准

- 采标197项，包含国标、行业标准以及部分国际标准
  Selected 197 National, Industrial, and International Standards as part of Corp. Standards
- 形成公司产品技术标准
  Published Corp. Standards according to the growth of the company

联合动力 United Power

承担国家标准的修订制定

- 参与部分国家标准的编、修订工作
  Participated the reversion of National Standards
  - 《台风型风力发电机组》
  - 《风电机组 电能质量测量和评估方法》
  - 《风力发电机组 高速轴液压盘式制动器》
  - 《风力发电机组 偏航液压盘式制动器》
- 主持修订国家标准
  Took charge of the reversion of National Standards
  - GB/T 21407《双馈式风力发电机组》

感谢关注联合动力
Thank you

绿色梦想 联合创造
Green Dream United Creation