THE STATUS OF ELECTRIC ROADS IN CHINA
Or
THE STATUS OF SMART & INTELLIGENT ROAD SYSTEMS IN CHINA

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BACKGROUND:

INVESTIGATION BY PIARC OF GLOBAL ERS IN THE WORLD
CHINA WAS A WHITE SPOT
IN THE PIARC INVESTIGATION
EV GROWTH IN CHINA

China’s January 2019 numbers: EVs are on track for 2 million sales this year.

82% year-on-year growth in volume over 2018 (1.1 million sales)

The EV market share of total vehicle sales will very likely increase from 4.1% in 2018 to 7.5% in 2019.
MAIN PURPOSE OF THE PROJECT

To explore the contemporary ERS situation in China and to establish a basic understanding of the status of Chinese electric roads and their commercialization.

• Estimate the maturity levels of dynamic electric road technologies, expressed in TRV levels
• Explore the driving forces and driving actors in wireless charging
• Explore the process of implementing electric roads in China
THE RESEARCH TEAM

RESEARCHERS:
• Professor, Dr. Mike Danilovic, Halmstad University & Shanghai Dianji University
• PhD. Jasmine Lihua Liu, Halmstad University & Shanghai Dianji University
• Associate Professor, Dr. Bianca Yan Yan, Shanghai Dianji University
• Mr. Wend Ma, Halmstad University

INVESTIGATED (JULY-OCTOBER) AND VISITED WITH TRV IN NOVEMBER 2018:
POLICY AND RESEARCH INSTITUTIONS
• Ministry of Transportation (Policy) in Beijing
• National Energy Administration (NEA) (Policy) in Beijing
• Highway Research Institute, Ministry of Transportation (RIOH), R&D, in Beijing
• China Intelligent Transportation System Association (CITSA), R&D, in Beijing
• China Electric Power Research Institute (CEPRI) (Technology), R&D, in Beijing

UNIVERSITIES
• Tongji University in Shanghai
• Jiao Tong University in Shanghai
• Shanghai Dianji University

INDUSTRY AND BUSINESS ACTORS
• Goldwind, a new energy system developed and manufactured in Beijing
• Wireless charging system developers and commercial actors in Jinan and Shanghai
ELECTRIC ROADS SYSTEMS IN CHINA

There are 3 types of electric roads in China:

• Modern **city-based trams** (electro mechanical technology)
• **Photovoltaic** (PV) roads
• **Inductive charging** technology for static and dynamic wireless charging
OVERVIEW OF THE LOCATIONS OF ELECTRIC ROADS IN CHINA (TRAM, PV AND WIRELESS CHARGING)
LOCATION OF THE MODERN TRAM IN ZHUHUAI (Guandong Province)
LOCATIONS OF PV ROADS IN JINAN
LOCATION OF DYNAMIC WIRELESS CHARGING ROAD IN ZHANGBEI

- 2 Km in 2018
- 19 Km in 2019
- 40 Km in 2022
MAIN CONCLUSIONS

Basically, China is not developing ERS as it is understood in the West.

• The final target for all China is to create smart and intelligent cities interconnected by smart and intelligent roads and transportation systems.

• The next generation of vehicles will be electric, and thus the entire system has to be integrated as a system that can handle autonomous driving, interconnectivity between all elements.

• Even though they are separate and competing with each other, they will gradually be integrated into the smart and intelligent cities.

• In China, political leaders and local actors are talking about superhighways with integrated energy and intelligence linked to urban and social development.

• PV roads will be developed to cover side lanes on roads and collect solar energy as a supplement. These will be integrated with wireless static and dynamic charging, intelligence and interconnectivity.

• Wireless charging will be expanded to all infrastructure systems.

• Tram electro-mechanical systems will be limited to certain urban areas.

• Thus, conductive technologies are not seen as interesting, as these technologies are perceived as outdated technology with limited development functionality and potential.
CHINA MAKE THE TECHNOLOGY LEAP –
FROM ELECTRO-MECHANIC TO ELECTRO-MAGNETIC
MOTIVES FOR CHINA TO DEVELOP ERS

• **Urbanization** creates new challenges, as China’s cities are becoming the largest in the world.
• **Intercity vs. Intracity transportation.** China’s logistics and transportation systems are moving to the next level of intercity and international circulation using the **Belt & Road Initiative program**.
• **One country one infrastructure for train systems** is the systematic approach that is also being applied to the development and implementation of electric roads.
• China has become one a **leader in autonomous driving systems** over the space of just a few years’ time.
• **Political decisiveness** to take China to the next levels in terms of technological and social development.

NEW TECHNOLOGY AREAS

• **Interconnectivity** based on that they have one of the most **advanced E-commerce technologies**, advanced **5G systems**, and a newly developed and launched **GPS navigation system**.
• **Fast 5G diffusion.** China has already become one of the fastest developers and users of 5G communication systems, enabling development of autonomous driving systems for small vehicles, as well as for heavy-duty vehicles.
• **Artificial Intelligence (AI)** where China seeks to become one of the leading actors and to put AI to use in order to improve the safety and security of its transportation systems.
• **Cloud computing** is also becoming a a core strategic area for China.
CHARACTERISTICS OF CHINESE DEVELOPMENT IN WIRELESS CHARGING

• Visionary-driven approach that focuses on smart and intelligent cities that need smart and intelligent road systems.

• Leapfrog from mechanical and electromechanical technology to electromagnetic technology.

• Coexistence of central governance over the development of smart and intelligent cities, societies, and technologies, and at the same time parallel development among local actors.

• A synchronized and harmonized system of central and local governance.

• Systems approach to the design of holistic solutions rather than partial and limited smaller-scale solutions, “salami-slicing approaches”.
BARRIERS TO FURTHER COMMERCIALIZATION OF WIRELESS CHARGING SYSTEMS

• The main problem is lack of business models for commercialization of large-scale diffusion of static and dynamic wireless changing technology.

• The path from policy to R&D to commercialization is short, because the entire society is driven by decisive and fast moving political decision-making.

• By 2019 there will be 19Km, and by 2022 40Km, of wireless charging road in real-world deployment for full-scale testing on a public road.

• The barriers to commercialization of dynamic wireless changing are:
  • Lack of standardization for inter-brand compatibility of solutions.
  • Lack of international standards for use and communication between elements of the dynamic charging systems.
  • Lack of standards for safety and radiation from wireless technologies in use.
  • Lack of appropriate business models for business actors, as well as for the government and institutional actors that can be used for further development of technology and products, commercializing dynamic wireless systems and putting the systems into full-scale use.
1. The old world
2. The new world
3. The upcoming world
4. The future world – EuroAsia

THE WORLD IS CHANGING
WHERE IS THE FUTURE OF ELECTRIC ROAD SYSTEM?
HOW CAN WEST AND EAST MEET ON THE ROADS?

ONE OF THE MOST IMPORTANT BARRIERS TO INNOVATION IS LACK OF STANDARDISATION!
THANK YOU VERY MUCH FOR YOUR ATTENTION!