National Capacity Building Workshop on “Enhancing energy efficiency of the freight transport sector in Asia and the Pacific

Future Trends in Smart E-transport Technologies

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Countries have signed the Paris Agreement

By February 2021, 194 countries and the EU have signed The Paris Agreement, which sets out the legislative framework for **decarbonizing the global economy**.

Global Capital Investment in Electrification Technologies

It is expected to rise to about $4 trillion in **2030**, which is 3 times as much as in 2020. —— *IEA Net Zero by 2050 Report*

The global industries are transitioning to an **electrified future**.
The **EV (electric vehicles) revolution** is a key driver of the growth in the transport electrification, with passenger electric cars surging in popularity. China is the **largest EV market** with about 8 million units in 2023 and **59 %** of global EV sales.

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**Battery Electric Vehicles (BEV) + Plug-in Hybrids (PHEV) Sales and %Growth for 2023 vs 2022**

- **Europe (W&C)**: 3,146,000 (2023) vs 2,683,000 (2022), +17% vs +14.0%
- **China**: 8,413,000 (2023) vs 6,181,000 (2022), +36% vs +6.0%
- **Northern America**: 1,617,000 (2023) vs 1,104,000 (2022), +46% vs +12.3%
- **Other**: 1,006,000 (2023) vs 556,000 (2022), +81% vs +11.6%

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**Proportion of global sales in 2023**

- Europe: 12%
- China: 59%
- Northern America: 7%
- Other: 22%

After more than 20 years of development, China has made great achievements in **smart E-transportation**. A safe, efficient, low-carbon and efficient transport network is being built.

### Transportation Infrastructure
- More than **3,500km** of roads have been upgraded to smart roads
- More than **20** automated container terminals have been built or are under construction
- The railway electrification rate exceeded **70%** by the end of 2022

### New Energy Intelligent Vehicle
- New energy vehicles holdings increased by **55.97%** annually
- Market penetration rate of assisted driving systems exceeded **40%**
- More than **5,000km** of intelligent connected vehicle test roads have been opened nationwide

### Integrated Transportation System
- **Complete abolition** of expressway toll gate on provincial borders
- **327 cities** across the country have realized transportation card connectivity
- Actively exploring new modes of **MaaS** in major cities
Smart e-transport combines electric energy and intelligence, and provides integrated comprehensive transportation services.
Advances of smart e-transport in China
New energy vehicles have achieved **leapfrog development** in China.

**New energy vehicles have become the future trend in China**

**New Energy Vehicle Sales**

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>110.9</td>
</tr>
<tr>
<td>2021</td>
<td>200</td>
</tr>
<tr>
<td>2022</td>
<td>400</td>
</tr>
<tr>
<td>2023</td>
<td>800</td>
</tr>
<tr>
<td>2024E</td>
<td>1000</td>
</tr>
</tbody>
</table>

**New Energy Vehicle Penetration Rate**

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>0%</td>
</tr>
<tr>
<td>2015</td>
<td>1%</td>
</tr>
<tr>
<td>2019</td>
<td>5%</td>
</tr>
<tr>
<td>2023</td>
<td>40%</td>
</tr>
<tr>
<td>2025E</td>
<td>50%</td>
</tr>
</tbody>
</table>

Nearly **10 times growth** in 5 years
The **technological advancements** have effectively improved the performance and market competitiveness of China’s new energy vehicles.
Smart E-Vehicles

From electric to smart

Smart Cabin

- Intelligent Voice Interaction
  AI large model; Supports voice print recognition, provides personalized voice interaction

- AR-HUD (Head Up Display)
  Blending real scenes; Ultra high definition, high precision display

- Multi-Device Interconnection
  Mobile phones and tablets can be connected with the car, sharing software (application) and hardware (camera, audio)

Smart Driving

- Intelligent Driving Assistance
  Radar + Camera fusion sensing system; Don't rely on high-precision maps, support nationwide use

- Active Safety
  Recognition rate of abnormality obstacle reached 99.9%; Maximum AEB braking speed increased to 120km/h

- Automatic Valet Parking
  Support remote control parking; Support extremely narrow parking space of 20cm on both sides

Smart Control

- Four-wheel Independent Drive
  Four-wheel independent torque vector control; Greatly improve vehicle safety and stability

- Intelligent Suspension Control System
  Response speed up to 10ms; Can recover energy and charge batteries

- Vehicle mounted UAV system
  One-click takeoff and landing; Precise control; Automatic charging and changing
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Smart E-Vehicles

From electric to smart

The **cross-industry integration** of the automobile industry has entered a new stage, more and more **brand linkage** has appeared.

Smart cabin configurations are penetrating faster in China than globally. It is expected to reach **75%** by 2025.

High level intelligent driving covers almost **80%** of the models of new power enterprises.

In 2023, the loading rate of auxiliary driving functions of L2 level and above of new energy passenger vehicles has reached **55.3%**

Smart transformation promotes China's new energy vehicles to higher level
The high-speed rail mileage has reached 45,000+ kilometers, and China’s railway sector handled a record-high 3.68 billion passenger trips in 2023. The railway electrification rate exceeded 73.8% by the end of 2023.

- Excellent experience: smooth and stable
- From over 3 hours to less than 1 hour, saving 71.4% time: from over 3 hours shorten to less than 1 hour
- Carbon emissions have been reduced by 20,000 tons with electric railway and intelligent railway infrastructure.
- Saving more than 20% energy
The charging stations are becoming essential in new energy vehicles. In 2023, there are 8.596 million charging stations in China, providing 82.8 million kw charging power in total.

Integrated optical storage and charging:
- Liquid cooled DC charging
- Fastest charging: 5 mins to charge 300 kms
- Integrated charging and discharging terminal

Shared charging station:
- Operation efficiency and service experience
- Investment costs: 20% lower than traditional models
- 2.726 million public charging stations in total, annual increase of 51.7%

The charging station industry provides a solid foundation for the popularization of new energy vehicles.
With the popularization of new energy vehicles, charging methods have become a focus of attention, mainly including **fast charging**, **slow charging**, and emerging charging modes - **battery swapping**.

### Slow Charging
- Using low-power AC charging, the charging power is generally 3kw or 7kw
- Reduce charging costs
- Protect battery life

### Fast Charging
- Using high-power DC charging
- Charging power can reach over 40kw
- Fully charged to 80% of its capacity within an hour

### Battery Swapping
- Integrating battery charging, logistics allocation, and battery swapping services
- Fully charged within 20 seconds
- Taking 1 to 3 minutes

The combination of fast charging, slow charging, and battery swapping technologies provides more convenient and efficient charging services for new energy vehicles.
Many highways in China use distributed wind energy, photovoltaic energy, hydrogen energy and so on to achieve self-sufficiency. In the future, E-roads are able to generate and store clean electricity themselves in order to realize multiple intelligent functions.

Energy Self-Sufficient Eco-Smart Highway

- Renewable energy generation
- Hydrogen production
- Comprehensive energy utilization
- Smart energy monitoring

Millions kilowatt hours of self-generation electricity that improves the operational efficiency and lower the energy consumption of smart transportation system.
China has built 18 automated container terminals, and 27 container terminals under construction, including renovation, ranking first in the world.

### Port Electrification

- **400,000 square meters** distributed photovoltaic area in Shandong Port, providing green power of **150 million KWH/year**
- Cleaning energy used by port vehicles and equipment has been increased to **62%**
- **100%** of berths onshore power in Qingdao Port, expected to deliver **more than 8 million kWh** of electricity this year

### Port automation

- Yangshan Port —— the most sustainable and intelligent automated port.
- **Unmanned automated guided vehicle** for container transfer. **Autonomous truck fleet** for container shipping outside the port
- Reduces the labor cost by **70%**, and the labor productivity reaches **213%** of the traditional terminal

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Green and smart transformation has become the only way for ports’ high-quality development.
Flexible smart parking lot improves parking efficiency and the overall experience while reducing traffic congestion both inside and outside the lot, leading to a decrease of carbon emissions.
China has constructed the drones network for logistics. Drone’s speed can reach 60~100 km/h, which can reduce delivery time by over 50% and cut carbon emissions from delivery by more than 60%.

Clustered and intelligent delivery drones will undertake most of the backend delivery, achieving minute-level delivery, as well as zero emissions.
Logistics Drone
JD.com utilizes drones to provide convenient and rapid logistics services for agricultural products in villages with poor transportation, helping villagers to lift themselves out of poverty and become prosperous.

Logistics WMR
A single vehicle can transport over a thousand parcels per day, which is 3 to 6 times more efficient than manual labor, effectively solving the transportation problem from logistics centers to user communities.

Logistics Cableway
Solve the logistics problem for villagers in remote mountainous areas, open up the “last mile” of rural logistics, and improve the efficiency of logistics and reduce transportation costs in rural areas.
Future trends in smart e-transport technologies
The connected vehicle technology is mainly used to provide traffic information auxiliary services. In the future, the connected vehicle technology will deeply participate in highly automated driving services.

### Stage 1: Real-time interaction of information
- Warning of traffic accident
- Real-time traffic information
- Extreme weather forecasting

- Assisted driving
  - Lane keeping/adaptive cruise

### Stage 2: Resilient adaptation of supply and demand
- Connected infrastructure for real-time management and control of traffic condition
- Driving route optimization

- L1-L2 autonomous driving
  - Lane change assist/auto parking

### Stage 3: Vehicle-road integrated Intelligence
- High-precision global sensing
- Intelligence-augmented decision-making and control of vehicles

- Highly automated driving
  - Unmanned driving/remote control
Digital twins is the combination of physical and virtual systems. It enables the accurate mapping of various dynamic and static elements on the digital platform through high-precision modeling, which is helpful for infrastructure monitoring, analysis, and optimization.
Digitalization is the unified **digital reproduction** and **understanding** of transport infrastructure. It conducts comprehensive digital collection of transport infrastructure through the computer means (GIS, remote sensing, telemetry, network, multimedia, virtual reality, etc.), enabling effective **decision-making** and **future predicting** of transport system.

- Real-time road condition monitoring
- Providing support such as **maintenance decisions** and **route optimization**.

- A mechanism model of the bridge
- Accurate bridge stress analysis
Future trends in smart E-transport

Present
Intelligence of single vehicle

Autonomous driving L3-L4
Sensing and decision-making by vehicle itself: high environmental requirements.

Future
Vehicle-road integrated Intelligence

Smarter roads
Real-time traffic management

• Comprehensive traffic information sharing, enabling highly automated driving technology.
• Cooperative control of roads and vehicles, improving transport efficiency and safety.

Smarter vehicles
Cluster intelligence
Integration of transport services

- Comprehensive transport hubs for zero-distance transfer.
- "One-stop service" for passenger transportation.

- Individual transportation information push.
- Accurate matching of public transport capacity and individual needs.

- Achieve the transport service from "passive adaptation" to "active response".
- Develop unmanned deliveries, improving the efficiency and convenience of delivery.
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THANK YOU
谢谢

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