ENHANCING ENERGY EFFICIENCY OF THE FREIGHT TRANSPORT SECTOR IN ASIA AND THE PACIFIC

INITIATIVES TO SUPPORT SUSTAINABLE AND ENERGY-EFFICIENT ROAD FREIGHT TRANSPORT SECTOR

PRESENTER: ANDREY YERSHOV, KAZAKHSTAN

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Introduction

Part I – Technologies for Sustainable Mobility (clean energy vehicles, alternative fuels, renewables, systems, infrastructure)

Part II – Policy and Regulatory Measures (standards, financial incentives, national strategies, global climate initiatives)

Examples of Country Targets for Sustainable Mobility
“Climate change is here, it is terrifying, and it is just the beginning. The era of global warming has ended; the era of global boiling has arrived.” – UN Secretary General Antonio Guterres, July 2023

- Global temperatures in July 2023 month have shattered records, according to the World Meteorological Organization (WMO) and the EU’s Copernicus Earth observation programme.
According to 'Our World in Data,' the transport sector was the second-largest emitter of greenhouse gases (GHG) in 2019 (over 8 bn t), underscoring its significant contribution to global climate change.

Road transport accounts for approximately 72% of GHG emissions from the global transportation sector (Axsen et al., 2020). Freight transport is responsible for about 40% of CO₂ emissions from road transport globally.

Energy efficiency in transport is a critical component in the collective global effort to combat climate change and create a sustainable future.
PART I – TECHNOLOGIES FOR SUSTAINABLE MOBILITY

CLEAN ENERGY VEHICLES ● ALTERNATIVE FUELS ● RENEWABLES ● SYSTEMS ● INFRASTRUCTURE
All-electric vehicles (EVs) are propelled by an electric motor, powered by rechargeable battery packs, eliminating tailpipe emissions.

Advancements in battery technology are leading to longer ranges and faster charging times, making EVs more appealing to consumers.

Government incentives and policies are accelerating EV adoption rates worldwide.

Plug-in Hybrid Electric Vehicles (PHEVs) use batteries to power an electric motor and another fuel to power ICE.

PHEV batteries can be charged using a wall outlet or charging equipment, by the ICE, or through regenerative braking.

The vehicle typically runs on electric power until the battery is nearly depleted, and then the car automatically switches over to use the ICE.

Image credits: Alternative Fuels Data Center (https://afdc.energy.gov/)
Hybrid Electric Vehicles (HEVs) are powered by an ICE and electric motor(s), which uses energy stored in batteries. HEV cannot be plugged in to charge the battery that is charged through regenerative braking and by the ICE. The electric motor can allow for a smaller ICE. The battery can also power auxiliary loads and reduce engine idling when stopped. Together, these features result in better fuel economy without sacrificing performance.

Fuels cell vehicles (FCVs) combine hydrogen and oxygen to produce electricity, with water as the only emission. FCVs can be refueled in under five minutes and can travel up to 500-600 kms on a single tank. Infrastructure remains a key challenge for FCVs. However, advancements in hydrogen production and distribution are underway.
HIGHLY AND FULLY AUTONOMOUS VEHICLES

- **Level 3 to 4 automation (HAVs):**
  - HAVs have advanced features but human intervention is required. These include adaptive cruise control, automated lane changing, and self-parking. HAVs are equipped with sensors, cameras, LiDAR, and AI algorithms to interact with the environment. Potential benefits include increased safety and fuel efficiency.

- **Level 5 automation (FAVs):**
  - FAVs can perform all driving functions without any human input. They can navigate complex urban and highway scenarios, including handling of unexpected situations. Prospects include reduced traffic congestion, lower energy consumption, and enhanced mobility for non-drivers.

- **Challenges and Implications:**
  - Technological - the ability to handle unpredictable traffic situations.
  - Regulatory and insurance considerations.
  - Concerns about cybersecurity, data privacy, and the potential impact on driver jobs.
- Examples of ITS include traffic management systems, real-time navigation and traffic information, and cooperative ITS which allow vehicles to communicate with each other and with infrastructure.
- ITS can play a pivotal role in reducing energy consumption and emissions by enhancing traffic flow, reducing congestion, and promoting efficient use of transport modes.

- Advanced ICT infrastructure is crucial for enabling ITS and other digital technologies in transport.
- Infrastructure elements include broadband connectivity, cloud services, data centers, and cybersecurity measures.
- ICT can facilitate energy efficiency measures such as real-time route optimization, efficient fleet management, and digital platforms for cargo consolidation.
Benefits of Alternative Fuels:
- Lower GHG emissions, reduced air pollution.
- Reduced dependence on oil imports, diversification of energy sources.
- Spur development in energy-efficient technologies.

Challenges in Application:
- Requirement for new refuelling or charging infrastructure.
- Many alternative fuels require specific engine configurations or vehicle designs.
- Alternative fuels can be more expensive than conventional fuels, particularly in early stages of development.

Trends in Application:
- Growing use of biofuels and natural gas in commercial freight vehicles.
- Intense adoption of electric vehicles worldwide.
- Emerging interest in hydrogen fuel cell vehicles.
The primary types of renewable energy sources potentially applicable to road transport include wind power, hydropower, solar energy, and biomass energy.

Potential ‘entry points’ for the renewables to the transport sector include:

- 'Green' electricity from renewable sources to power EVs;
- 'Green' hydrogen, produced using renewable energy to power fuel cell electric vehicles (FCEVs), including those suitable for heavy-duty and long-haul transport;
- Advanced biofuels, produced using biomass feedstocks;
- Integration of renewable energy into transport infrastructure, such as solar panels at transport hubs and wind turbines in suitable locations.
LEVERAGING NUCLEAR ENERGY FOR TRANSPORT SECTOR

- **Potential Applications:**
  - Generation of electricity for charging freight EVs.
  - Powering high-temperature electrolysis, producing hydrogen for FCVs more efficiently and sustainably.

- **Benefits:**
  - Reducing the GHG emissions from the freight transport sector.
  - Reliable and constant supply of power regardless of weather conditions.

- **Challenges:**
  - Safety concerns about nuclear power plants and the handling and disposal of nuclear waste are major challenges.
  - Gaining public acceptance for nuclear power, given its association with nuclear weapons and nuclear accidents, is a significant challenge.

- More research is needed to further explore and validate the potential of nuclear energy in the transportation sector.
- Global collaboration on safety standards, research, and technology sharing is crucial to promote nuclear power as a viable option for sustainable freight transport.
CONSTRUCTION AND MODERNIZATION OF INFRASTRUCTURE

- A network of charging stations that provide electric power for recharging electric vehicles, promoting their widespread use.
- Infrastructure for biofuel blending and distribution infrastructure
- Hydrogen fuelling infrastructure
- Overhead catenary for electric trucks
- Railway electrification
- ICT infrastructure to support the operation of automated vehicles and ITS

Germany: A5 Autobahn’s Catenary Overhead Lines For xEV Trucks

TECHNOLOGIES FOR SUSTAINABLE MOBILITY
PART II – POLICY AND REGULATORY MEASURES

STANDARDS ● FINANCIAL INCENTIVES ● NATIONAL STRATEGIES ● GLOBAL CLIMATE INITIATIVES
## POLICY AND REGULATORY MEASURES (1/3)

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<th>Incentive</th>
<th>Description</th>
<th>Examples of application</th>
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<td><strong>Financial incentives and subsidies</strong></td>
<td>Governments can offer tax breaks, rebates, or grants, to promote the adoption of energy-efficient vehicles and renewable energy sources. Contrarily, increasing vehicle purchase/usage taxes may be considered for the most polluting ICE vehicles.</td>
<td>India's FAME II scheme provides subsidies for electric vehicles, including electric trucks and buses, to accelerate their adoption. For example, in 2021 it provided incentives of INR 10,000 (approx. USD 133) per kWh of battery capacity for electric commercial vehicles, subject to a cap of 20% of the vehicle's cost.</td>
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<td><strong>Carbon pricing and emissions trading schemes</strong></td>
<td>By implementing carbon pricing and emissions trading schemes, countries can create economic incentives for businesses to reduce their carbon footprint.</td>
<td>In EU, the cap on emissions under the Emissions Trading System (ETS) will be reduced by 2.2% annually between 2021 and 2030, leading to an overall reduction of 43% compared to 2005 levels.</td>
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<td><strong>Fuel efficiency standards</strong></td>
<td>By enforcing stringent fuel efficiency standards for vehicles, governments can push manufacturers to develop more energy-efficient vehicles.</td>
<td>China VI-a standards enhance fuel efficiency of HDVs, with improvements ranging from 43.0 L/100 km for 40-ton long-haul tractors to 49.0 L/100 km for 13.7-meter coaches, driving significant advancements in engine technology and vehicle design.</td>
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### POLICY AND REGULATORY INCENTIVES (2/3)

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<td><strong>Vehicle emission standards</strong></td>
<td>Emissions standards are regulations set by governments to limit the amount of air pollutants, such as nitrogen oxides (NOx), particulate matter (PM), carbon monoxide (CO), and hydrocarbons (HC), that can be emitted by vehicles.</td>
<td>Japan has established standards for HDVs, with the most recent standard (JP 2015) targeting a 13.4% reduction in fuel consumption compared to the 2005 levels.</td>
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<td><strong>Low Emission Zones (LEZs) and congestion charges</strong></td>
<td>Designation of specific areas with restricted access for high-emission vehicles, encouraging the use of low-emission and zero-emission vehicles in urban areas.</td>
<td>In London’s Ultra-LEZ, non-compliant vehicles face daily fees of $15.50 for cars, motorcycles, vans, and $124 for heavier vehicles like buses and trucks.</td>
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<td><strong>Renewable energy infrastructure</strong></td>
<td>Governments can invest in renewable energy infrastructure, such as solar-powered charging stations, to support the widespread adoption of electric vehicles in the freight sector.</td>
<td>South Korea’s government supports electric truck adoption by investing $665 million in charging infrastructure development from 2021 to 2025.</td>
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<td>Research and development support</td>
<td>Providing funding and support for research and development in energy-efficient technologies can foster innovation in the freight transport sector.</td>
<td>The US Department of Energy's SuperTruck initiative invests over $240 million targeting a 50% improvement in freight efficiency and a 30% reduction in fuel consumption vs. 2009 baseline.</td>
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<td>Green public procurement</td>
<td>Governments can lead by example by implementing green public procurement policies that prioritize the purchase of energy-efficient vehicles and renewable energy sources for public fleets.</td>
<td>In Japan, the government aims to increase the share of electric and fuel cell vehicles in public fleets to 10% for heavy-duty vehicles (HDVs) by 2030, promoting greener transportation.</td>
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<td>Vehicle scrappage schemes</td>
<td>By introducing vehicle scrappage schemes, governments can incentivize the replacement of older, less efficient vehicles with newer, more energy-efficient models</td>
<td>Turkey's vehicle scrappage program incentivizes the retirement of old HDVs by offering up to $25,000 in financial support, stimulating demand for environmentally-friendly transportation options.</td>
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<td>Education and awareness campaigns</td>
<td>Promoting the benefits of energy-efficient vehicles and renewable energy sources through education and awareness campaigns can drive consumer demand in the freight sector.</td>
<td>In Australia, the Green Vehicle Guide provides information on vehicle emissions and fuel efficiency to help consumers make informed choices.</td>
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SHOWCASING COUNTRY TARGETS FOR SUSTAINABLE AND GREEN MOBILITY

- **EU**
  - 30 million zero-emission vehicles on European roads by 2030
  - Banning sale of new petrol and diesel cars from 2035
  - 45% reduction in CO2 emissions from HDVs by 2030; 65% reduction by 2035, and 90% reduction by 2040 compared to the 2019/2020 baseline

- **India**
  - 100% of road vehicles to be electric by 2030
  - Blend 20% ethanol in petrol by 2025

- **Japan**
  - Reduce HDV average fuel consumption by 12% by 2025 compared to 2015 baseline

- **Russian Federation**
  - EVs to reach 10% of all cars built by the end of 2030

- **South Korea**
  - 1.13 million EVs, 500,000 EV charging stations and 200,000 hydrogen vehicles on the roads by 2025
  - 6.2 million fuel cell vehicles and 1,200 hydrogen refueling stations by 2040

- **Thailand**
  - 1.2 million EVs on the roads by 2036
  - Reduce energy intensity by 25% by 2030, compared to 2005 levels

- **USA**
  - 50% of new vehicles sold be electric by 2030
INTERNATIONAL CLIMATE INITIATIVES (1/2)

- **United Nations Framework Convention on Climate Change (UNFCCC):**
  - The UNFCCC, adopted in 1992, aims to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous human-induced interference with the climate system. The transport sector, including freight transport, is a significant contributor to GHG emissions, and therefore, the UNFCCC plays a crucial role in shaping policies to promote sustainable freight transport.

- **The Paris Agreement:**
  - Signed in 2015 under the UNFCCC, it is an international treaty that aims to limit global warming to well below 2 degrees Celsius above pre-industrial levels, with an aspirational goal of limiting the temperature increase to 1.5 degrees Celsius. The agreement requires countries to submit Nationally Determined Contributions (NDCs) outlining their plans for reducing GHG emissions, including those from the transport sector.

- **The Kyoto Protocol:**
  - Adopted in 1997 under the UNFCCC, it sets binding targets for industrialized countries to reduce their GHG emissions. Although the protocol does not specifically address the transport sector, the emission reduction targets have implications for freight transport and other sectors contributing to GHG emissions.
The United Nations Sustainable Development Goals (SDGs):
- The SDGs, adopted in 2015, are a set of 17 global goals aimed at achieving a more sustainable future by addressing various social, economic, and environmental challenges. Several of the SDGs have implications for sustainable freight transport, including Goal 7 (Affordable and Clean Energy), Goal 9 (Industry, Innovation, and Infrastructure), Goal 11 (Sustainable Cities and Communities), and Goal 13 (Climate Action).

The Energy Efficiency Design Index (EEDI) and Ship Energy Efficiency Management Plan (SEEMP):
- The EEDI and SEEMP are mandatory energy efficiency measures adopted by the IMO, aiming to reduce CO2 emissions from international shipping. The EEDI sets minimum energy efficiency requirements for new ships, while the SEEMP requires ships to implement a management plan for improving their energy efficiency.

International Maritime Organization (IMO) Conventions:
- The IMO has adopted several conventions related to sustainable shipping and maritime transport, including the International Convention for the Prevention of Pollution from Ships (MARPOL), which sets regulations to minimize pollution from ships, and the International Convention on the Control of Harmful Anti-fouling Systems on Ships, which aims to reduce the negative environmental impacts of anti-fouling coatings.
INTERGOVERNMENTAL ORGANIZATIONS AND INITIATIVES

- The United Nations Environment Program’s (UNEP) Global Electric Mobility Program
- The United Nations Climate Change Conference (Conference of the Parties, COP)
- The United Nations Economic Commission for Europe (UNECE)
- The European Union's Clean Vehicles Directive (CVD)
- G20 Energy Efficiency Leading Program (EELP)
- The Smart Freight Centre's Global Logistics Emissions Council (GLEC) Framework
- The Transport Decarbonization Alliance (TDA)
- Central Asia Regional Economic Cooperation (CAREC)
THANK YOU FOR YOUR ATTENTION!