SUSTAINABLE TRANSPORTATION - DEFINITIONS AND MODELS



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INTRO: THE URGENCY FOR SUSTAINABLE TRANSPORT

- The escalating climate crisis demands urgent action across all sectors, particularly transportation.
- Transportation's oversized role in GHG emissions is fueled by fossil fuel dependence.
- The sector's reliance on petroleum-based products makes transitioning away from fossil fuels difficult.
- Sustainable transportation emerges as the necessary alternative, integrating environmental, social, and economic considerations.
- This report will quantify the emissions problem and define sustainable transportation principles and components.

Section 1
Quantifying the Problem: Transport Emissions Driven by Fossil Fuels

QUANTIFYING THE PROBLEM

CHALLENGES

In 2019, the transport sector accounted for around 23% of global energy-related CO2 emissions.

Road transport, especially cars and trucks, is the primary source of transport emissions.

Current policies are insufficient to meet the Paris Agreement's goal of limiting warming to 1.5°C.

The global trend of transport emissions continues to rise due to increased transport activity.

TRANSPORT EMISSIONS: THE GLOBAL PICTURE

- In 2022, transport emissions accounted for 8 Gigatonnes (Gt) of CO2 globally (23% of total).
- 1990-2021 saw global GHG emissions increase by 51%, due to fossil fuel combustion.
- EU transport emissions are higher (29%), increasing 26% since 1990.
- US transport emissions are the highest (38%), with a 6% decline from 2005-2021 due to power sector efficiency gains.
- China's transport emissions were flat in 2022, due to pandemic restrictions and economic factors.
- Globally, increasing transport activity is outpacing efficiency gains.

THE AMBITION GAP

- Transport CO2 emissions projected to increase 16-50% by 2050 under current policies.
- Paris Agreement requires 59% reduction in transport CO2 emissions by 2050.
- IEA's Net Zero Emissions scenario requires >3% annual decline in transport emissions through 2030.
- EU policies project only 14% emission reduction by 2030, 37% by 2050.
- There’s an "Ambition gap" that exists between current policies and climate goals.

Section 2
Defining Sustainable Transportation: Principles and Components

CORE PRINCIPLES: ENVIRONMENTAL, SOCIAL, AND ECONOMIC DIMENSIONS

Sustainable transportation meets current needs without compromising future generations. Three interconnected pillars: environmental, social, and economic sustainability.

- Environmental: Minimize ecological footprint by reducing emissions, pollution, and resource consumption.
- Social: Equitable access to transport, improved safety and health, enhanced quality of life.
- Economic: Efficient, affordable systems supporting long-term economic health.

Integrated approach is essential, as the three pillars are deeply intertwined.



SUSTAINABLE SYSTEM VS. FOSSIL FUEL DEPENDENCY

- Fossil Fuel Transport: High energy intensity, finite resources, negative externalities, urban sprawl, car dependency.
- Sustainable Transport: Lower energy intensity, renewable sources, minimizes externalities, efficient land use, prioritizes efficient modes.
- Avoid-Shift-Improve Framework: Avoid motorized travel, shift to efficient modes, improve vehicle efficiency.
- Integrated land use and transport planning is essential for success.



SUSTAINABLE TRANSPORT COMPONENTS



- Sustainable Transportation Components: Public Transport, Active Mobility, Electrification of Vehicles
- Public Transport: lower GHG emissions, reduces congestion and pollution, affordable and accessible, stimulates economic development.
- Public Transport Infrastructure: priority lanes for buses, accessible stations, mobility hubs, electrification infrastructure.
- Service Quality: reliability, frequency, speed, comfort, safety, and accessibility are key to ridership and modal shift.
- Active Mobility (Walking & Cycling) Infrastructure: sidewalks, protected bike lanes, cycle highways, bike parking, pedestrian zones.
- Active Mobility Benefits: zero-emission, improves public health, social equity, community connectivity, urban livability, and economic benefits.
- The Safety Perception Challenge: A critical barrier to wider adoption, particularly for cycling, is safety concerns

Section 3
Policy Levers for Change: The European Union Context

EU POLICY FOR SUSTAINABLE TRANSPORT



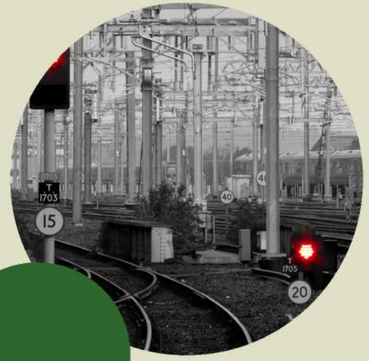
ELECTRIC BUSES

Electric buses provide clean public transport options that reduce urban air pollution.



CYCLING INFRASTRUCTURE

Investing in cycling promotes active travel, reducing congestion and emissions in cities.



RAIL NETWORKS

Enhanced rail networks offer efficient and low-emission travel options across European countries.



EU POLICY FOR SUSTAINABLE TRANSPORT

- EU Green Deal: Achieve climate neutrality by 2050.
- 'Fit for 55' Package: Reduce net GHG emissions by at least 55% by 2030.
- Sustainable and Smart Mobility Strategy: Outlines roadmap with specific milestones for sustainable transport.
- Urban Mobility Package (UMP): Supports cities in sustainable transport solutions.
- SUMPs (Sustainable Urban Mobility Plans): Strategic plans to meet the mobility needs of people and businesses.



LOW EMISSION ZONES (LEZ'S)

- Low Emission Zones (LEZs) and Zero Emission Zones (ZEZs) are increasingly used in European cities to regulate polluting vehicles.
- LEZs improve air quality by reducing NO2 and PM, and help meet climate goals by cutting CO2 emissions and promoting cleaner vehicles.
- Effectiveness depends on design, including area covered, emission standards, vehicle types, hours of operation, and enforcement.
- Social fairness is a key challenge, as LEZs can disproportionately affect lower-income groups reliant on older vehicles.
- Successful implementation requires careful planning, phased introduction, and complementary measures like financial support or improved alternative transport.

Section 4
Transforming Freight: Sustainable Logistics and Goods Movement



FREIGHT TRANSPORT: THE CARBON CULPRIT

- Freight transport caused 42% of global transport CO2 emissions in 2019.
- Road freight is the primary source of freight emissions.
- Urban freight movements are essential but cause congestion, pollution and CO2 emissions.
- Freight's dependence on fossil fuels is almost total.
- Global freight demand may double by 2050.
- Decarbonizing freight is challenging due to technological and infrastructural hurdles.
- Net-zero freight requires a multi-pronged strategy: tech innovation and systemic change.



DECARBONIZING PASSENGER TRAVEL

- Avoid: Reduce unnecessary travel, carpooling, and teleconferencing.
- Shift: Encourage use of public transport, cycling, and walking.
- Improve: Increase vehicle efficiency and occupancy rates.
- Transition to low-carbon fuels and electric vehicles.
- Support sustainable modes with infrastructure investment.



INNOVATIONS IN URBAN LOGISTICS

- Urban Consolidation Centres (UCCs) and Micro-hubs enable consolidated goods delivery, optimizing routing and using smaller, cleaner vehicles for last-mile delivery.
- Cargo bikes and electric vans are increasingly used for urban deliveries, reducing emissions and costs.
- Parcel lockers and PUDO points reduce failed home deliveries and consolidate drop-offs.
- Collaborative logistics models enable resource sharing among companies, increasing efficiency.
- Sustainable Urban Logistics Plans (SULPs), in conjunction with SUMPs, enable strategic planning.
- The Physical Internet (PI) vision aims for a globally interconnected logistics system, increasing efficiency and reducing waste.
- Collaboration between public and private sectors is essential for scaling sustainable urban logistics.

Section 5
Measuring Progress: Emission Reductions and Real-World Examples

PROVEN IMPACTS OF SUSTAINABLE TRANSPORT



- Public Transport: Reduces carbon footprint by 45%, saves billions of gallons of gas, and improves air quality and economic outcomes.
- Active Mobility: Avoids pollution, increases physical activity, boosts local economies and enhances urban livability.
- Electric Vehicles: Reduces CO2 and PM emissions, improves public health and saves money.
- Low Emission Zones: Proven to cut air pollution and CO2 emissions in European cities.
- Integrated Approaches (SUMPs): Sustainable Urban Mobility Plans have shown to reduce emissions, improve modal shift and create cost savings in Burgos, Spain and Yaoundé, Cameroon.

ILLUSTRATIVE CASE STUDIES



- Ghent, Belgium: Integrated SUMP with 50% sustainable transport modal share target by 2030.
- Freiburg Vauban, Germany: Eco-district designed for car-light living with high-density, mixed-use development and restrictive parking.
- Copenhagen, Denmark: High cycling share (16% total, 26% <5km) due to safe cycling infrastructure and cultural support.
- Utrecht, Netherlands: Pioneering V2G tech with bidirectional chargers and research projects (e.g., IRIS).
- CIVITAS Initiative (EU): 80+ cities testing urban mobility measures, with successes in Stockholm, Nantes, Gothenburg, and La Rochelle.
- Physical Internet (PI) Pilots (EU): Testing PI concepts like shared assets and data exchange for hyper-efficient logistics.

Section 6:
Navigating the Transition: Challenges and Barriers



ECONOMIC HURDLES TO TRANSITION

- Sustainable transport requires high upfront investments in infrastructure, vehicles, and technology.
- Funding is a challenge due to public transport's reliance on volatile fare revenues and lack of stable, long-term funding.
- Many sustainable transport investments offer long-term economic benefits and lower lifecycle costs.
- EVs have lower fuel and maintenance costs than ICE vehicles.
- Public and active transport can lead to societal savings through reduced congestion and healthcare costs.



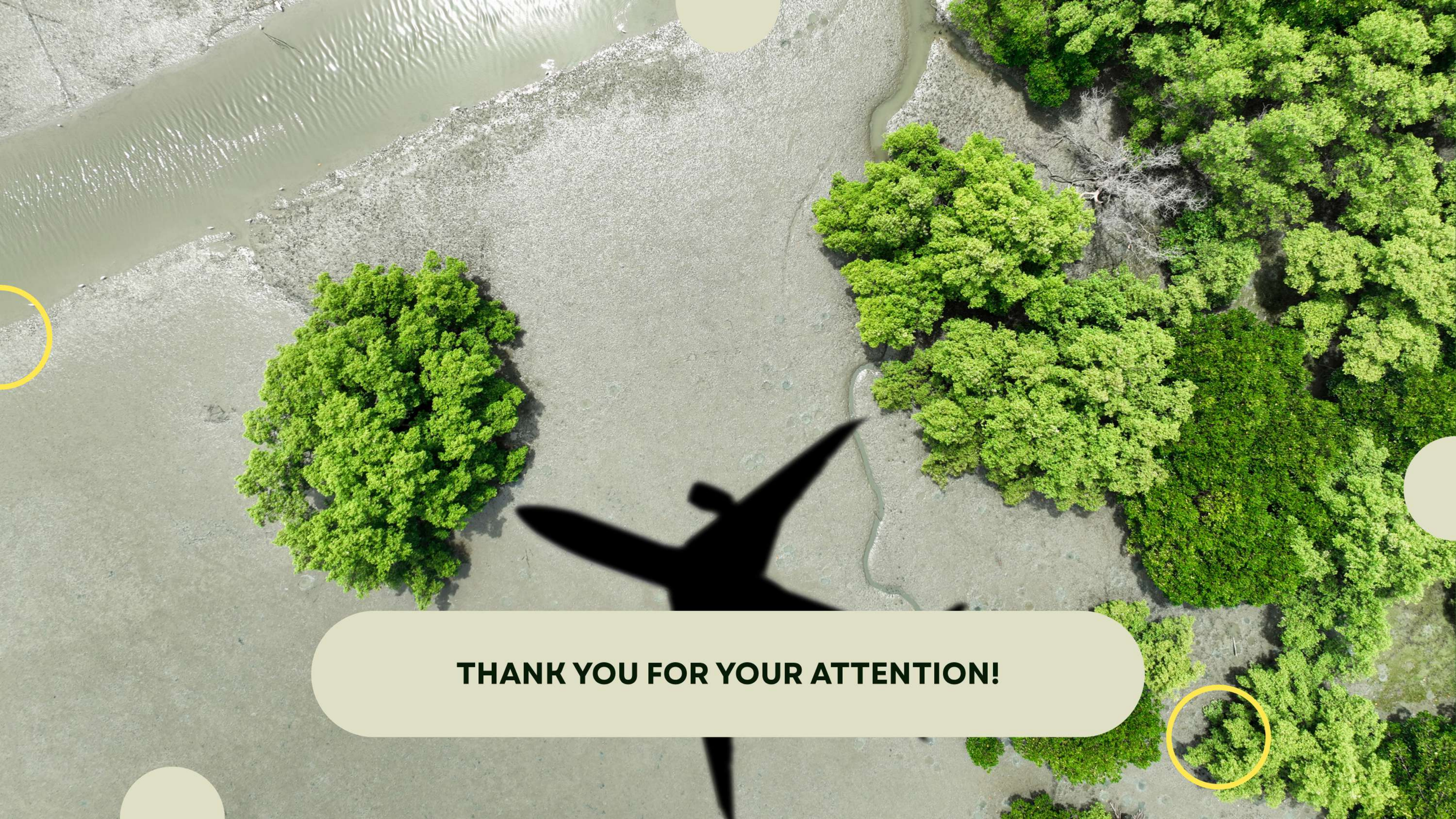
POLICY AND REGULATORY CHALLENGES

- Lack of Standardization: Emerging areas like V2G and MaaS lack universal standards, hindering interoperability and market growth.
- Land Use and Transport Integration Failure: Conflicting priorities and lack of coordination hinder integrated land use and transport planning.
- Governance Complexity: Sustainable transport involves multiple government levels and private sector players, making coordination difficult.
- Regulatory Gaps and Uncertainty: Rapid technology evolution outpaces regulation, creating uncertainty and deterring investment.
- Institutional Inertia: Existing systems favor fossil fuels, resisting change.



THE FUTURE OF SUSTAINABLE TRANSPORT

- Technological advancements and evolving service models are shaping the future of transportation.
- Connected and Automated Vehicles (CAVs), especially Shared Autonomous Vehicles (SAVs), could revolutionize urban mobility.
- Battery breakthroughs like Solid-State Batteries (SSBs) promise higher energy density, faster charging, and improved safety.
- Vehicle-to-Grid (V2G) technology enables EVs to support the power grid.
- Mobility as a Service (MaaS) integrates various transport modes into a single, user-friendly platform.
- Artificial intelligence (AI) optimizes traffic flow, predicts maintenance needs, and personalizes travel experiences.


THANK YOU FOR YOUR ATTENTION!

Thank you for participating! Works cited:

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