

## Connecting Systems Transformation: The Transport-Energy Nexus for Decarbonisation, Shared Prosperity and Resilience

**Energy and transport are deeply interconnected:** Transport relies on energy to move people and goods, and energy systems evolve in response to transport needs. As economies grow, transport increases demand for fuels, electricity, and infrastructure. The energy sector underpins energy supply, while the transport sector drives energy demand. **Aligning and accelerating decarbonisation and sustainability actions across these two sectors is crucial: progress in one unlocks transformative opportunities in the other.**

Transport electrification and renewable fuels for transport lie at the **heart of decarbonising energy and transport systems**. Renewable energy systems enable sustainable transport through cleaner and more **efficient energy** supply. Transport acts as both a driver and enabler of the clean energy transition. Shifting transport away from fossil fuels helps countries strengthen **energy security**, build **resilience** to global shocks, and **reduce the costs of fuel imports** and exposure to volatile energy markets.

**This mutually reinforcing transport-energy nexus is central to implementing the outcomes of the first Global Stocktake (GST) under the Paris Agreement**, as agreed by countries at COP28 in Dubai. The nexus is essential to achieving the global targets to **triple renewable energy** and **double energy efficiency** (GST paragraph 28(a), accelerating **emissions reduction in road transport** on a range of pathways (GST paragraph 28(g)), and **transitioning away from fossil fuels** in energy systems, in a just, orderly and equitable manner (GST paragraph (d)).

**Scaling up renewables in transport advances the global target of tripling renewable energy, while accelerating transport decarbonisation through electrification and renewable fuels -** This shift is especially critical, given that, in 2023, **transport remained the second largest and fastest-growing emitting sector**, responsible for 15.9% of global greenhouse gas emissions and 21.9% of CO<sub>2</sub> emissions. Yet **95.4% of the energy consumed in transport is still fossil-based**. This share has remained virtually unchanged for the past five decades and is a major contributor to both high emissions and air pollution from transport activity.

**Expanding clean, energy-efficient solutions for passenger and freight transport advances the global target of doubling energy efficiency, while reducing transport emissions.** In 2023, transport was also the **fastest growing energy-use sector** in 2023, consuming **27% of global end-use energy**.

Together, these transformations make the **transport–energy nexus** a **cornerstone for implementing countries’ Nationally Determined Contributions (NDCs)** under the Paris Agreement, in line with the outcomes of the first Global Stocktake — **advancing decarbonisation, shared prosperity, and resilience**.

*Cross-sector synergies between transport and energy that accelerate system-wide decarbonisation and sustainable transformation:*

Transport	Nexus Levers	Energy
Land Transport	a) Enables Clean Electrification b) Improves Energy Efficiency c) Reduces Energy intensity	Electrifying land transport drives demand for renewable energy and helps make energy systems more flexible. Greater efficiency in transport reduces overall energy use and strengthens system resilience, while advances in batteries and smart grids deepen links between the transport and energy sectors.
Aviation	Scales up renewable-based liquid fuels	Aviation decarbonisation expands renewable liquid fuel production and reduces fossil fuel dependence in hard-to-abate transport segments.
Shipping	a) Advances global coordination on renewable fuel deployment b) Facilitates green corridors; e-fuels (ammonia, methanol, hydrogen) production and; port electrification	Shipping decarbonisation aligns renewable fuel supply with maritime demand and supports integration with renewable energy infrastructure. Creates predictability and stability for renewable fuel investment.
Freight	Enables diffusion and distribution of low-carbon technologies	Freight enables low-carbon technologies like solar panels and products to reach markets at scale, thereby reducing energy intensity and emissions.

**21.9%** of global CO<sub>2</sub> emissions  
from transport (2023)

**4.6%** of transport's energy consumption  
from renewables (2023)

## Biofuels

**175.2 billion**

**litres** Global demand of biofuels,  
mostly used in road transport

▶ **3.5%**  
of energy demand in transport  
covered by biofuels (2022)

▶ **0.2%**  
used in aviation as Sustainable Aviation  
Fuel (SAF) (2023)

**52 countries**

have biofuel policies  
in place (2024)

Out of which

**35 countries**

with blending mandates  
(2024)

**Brazil:** 21.4% (2025)

→ 50% (2033)

**Indonesia:** 35% (2023)

→ 50% (2026)

## Challenges

Feedstock demand: 92% of  
total by 2030 . Land used: 32  
million ha (2023)

Emission trade-off: forests  
could save 428 Mt CO<sub>2</sub>/yr,  
biofuels save 233 Mt CO<sub>2</sub>/yr

## Way forward 4 million barrels of oil per day

Potential oil savings by 2028 Shift to  
advanced biofuels; EU RED III: 1% (2025) →  
5.5% (2030)

Role peaks by 2035, declines post-2050

## Hydrogen

▶ **40+** National strategies,  
focus on HDVs,  
shipping, aviation



### Hydrogen use

**and type** Used as gas/liquid or for synthetic fuels  
Types: gray, blue, turquoise, green



## Challenges

High production costs  
Limited infrastructure  
Regulatory uncertainty

## Way forward

### Projects for 2050

Road Fuels 16% | Shipping 19% |  
Aviation (synthetic) 37%

## Electricity

▶ **EVs are 4.5%  
of global fleet**

58 million EVs (2024) → 4.5% of fleet;  
EV sales: 17.5 million (21.7% of total)

**757 USD  
billion**

invested in electrified  
transport in 2024



**1.32 million oil  
barrels  
displaced**



EVs displaced an estimated 1.32  
million barrels of oil per day (Mbd)  
in 2024

## Challenges

Align EV growth ↔ renewable power  
and grid expansion  
Meet rising EV demand → sustainably •  
reliably • affordably

## Way forward

### EV adoption targets

- Passenger cars: 100% new sales → by  
2030 (OECD + China), 2040 (others)
- Trucks: 100% → by 2035 (OECD + China),  
2040 (others)
- Urban buses: 100% → by 2027 (OECD +  
China), 2030 (others)

**Electricity share in road transport projected  
to rise from 22% in 2035 to 74% in 2050.**

**68 countries** have EV targets in 2024, **43 countries** (EU+ others) banning ICEs by target years.