Transport: investment need to 2050

2021-2050 annual average investment	Share of total low-carbon investments
$240 bn	7%

Investment needs

2050 targets

Road: Near-total decarbonisation of road transport ~2bn electric cars and ~200m electric trucks and buses.

Aviation: Sustainable Aviation Fuels (SAF) accounts for 100% of final jet fuel demand by 2050, with production up by a factor of 5,000x from today.

Shipping: Ammonia/methanol, produced using low/zero carbon hydrogen, is the primary fuel choice for shipping, reaching >75% market share by 2050.

Investment needs

Road charging and refueling infrastructure: including 850m private chargers, ~60m public chargers, 40m overnight chargers for trucking, 200,000 refueling stations.

Aviation: construction of SAF production plants, purchase of more expensive electric and hydrogen planes.

Shipping: infrastructure and production facilities for ammonia or methanol synthesis, storage and bunkering and investment in new and retrofit ships.

*+ Investments in **clean electricity generation** (for both direct electrification and green hydrogen production) for transport decarbonisation of around **$390bn** a year – see Power sector.*

Investment milestones

$5bn today → $190bn/year by 2030 → $340bn/year by 2040

Where?

Investment dominated by high income countries and China this decade to rapidly rollout electric vehicles (EVs) (uptake much slower in middle- and low-income given car sales dominated by imports of second hand internal combustion engine (ICE) cars) and scale up SAF and ammonia production.

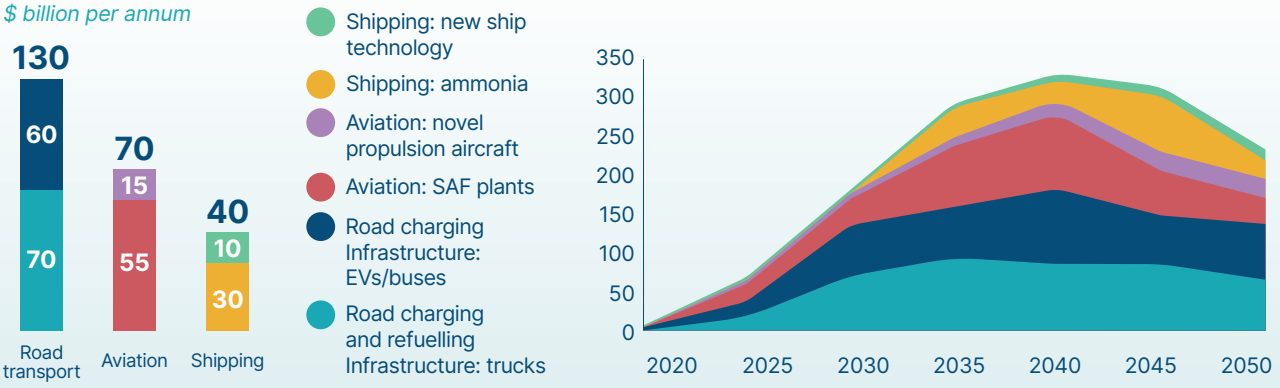
Gross or net?[1]

Investments in charging infrastructure is shown on a gross basis even though some of this would occur anyway in a business as usual (BAU) scenario given the favourable economics of EVs. The cost of purchasing EVs is not included since EVs are expected to reach cost parity with ICE vehicles during the 2020s.

Investments in aviation and shipping capture the incremental investment, on top of a BAU, needed to build zero carbon assets instead of high carbon assets.

Global annual investment

$ billion per annum



Outlook to 2030

- Passenger EVs are already cost competitive with ICEs on a total cost of ownership (TCO) basis and are expected to become cheaper to purchase upfront by the mid-2020s.
- TCO parity between zero emission vs diesel/gasoline trucks expected 2022-2034, varying across different regions
- Green premiums will persist in shipping and aviation – requiring strong real economy policies such as carbon pricing and low-carbon fuel mandates (see next page)

2030 target

$190 bn investment

x30 scale up

Sources: SYSTEMIQ analysis for the ETC (2022); MPP (2022), *Making Zero Emissions Trucking Possible*; MPP (2022), *Making Net-Zero Aviation Possible*; UMAS (2020), *Aggregate Investment for the Decarbonisation of the Shipping Industry (for GMF)*; Penn World Tables (2019) - Capital detail database.

[1] The ETC's investment estimates differ in approach by sector. Gross investment refers to the total investment required under a 1.5 degree net zero pathway, regardless of how much investment would have occurred anyway. Net investment is the incremental investment required compared to a BAU scenario.

Note: All figures are in US dollars

Transport: how to mobilise finance

Required real economy policies

	Challenges	Real economy policies needed — Priority policy
Create a clear strategic vision	• Lack of widespread or ambitious targets for banning of new ICE cars. • Uncertainty over which technology option is likely to dominate for shipping.	• Translation of **sector transition strategies** into national targets and plans. + • Clear targets for decarbonisation of power system to support clean electrification. • Firm legislated dates for the banning of new ICE car sales (e.g., by 2035 at the latest).
Address the "green premium" challenge	• Green premiums for low-carbon shipping and aviation above conventional fossil fuels. • Globally fragmented nature of the shipping and aviation sectors reduce incentives for any one party to invest.	• Create voluntary demand signals via **offtake agreements.** + • Subsidies to support R&D and scale up of new technologies. • Mandate low-carbon fuel and blending rates. • Establish green public procurement (e.g., zero-carbon public buses). • Carbon pricing. • Promote fuel efficiency improvements to counterbalance green premium of clean fuels.
Reduce downside risks	• First-mover risk of investing into first of a kind (FOAK) production plants due to low technological readiness. • Uncertainty of returns while demand is scaling up across sectors.	• **De-risk** first of a kind (FOAK) projects via public-private partnerships (e.g., guarantees). + • Guarantee utilisation levels of key infrastructure. • Create cross-value chain and cross-sectoral industry consortia to share risks and unlock synergies between actors and sectors. • Demonstration/piloting of FOAK projects.
Remove supply bottlenecks	• Lack of enabling infrastructure (e.g., refuelling stations). • Risk of insufficient availability of sustainable resources to produce low-carbon fuels (e.g,. clean electricity, hydrogen, biomass and captured CO_2).	• Scale up **clean electricity** as fast as possible, and make sustainable biomass feedstock available as fast as possible. + • National strategies to address potential supply-side bottlenecks (e.g., prioritisation of feedstock for aviation). • Identify low-carbon fuel hubs to cluster investment and develop value chains. • International collaboration to identify, align and develop key infrastructure needs.

What obstacles cannot be fully addressed by real economy policies?

Some additional action required

- **Further de-risking required:** even with well-designed real economy policy, new technologies that have not reached scale yet can struggle to secure financing.
- **Additional support required to scale up key infrastructure:** investment in transport can be held back by the "chicken and egg" problem of uncertain demand – investment relies on the supporting infrastructure (e.g., EV charging network) being in place.

Additional actions required

Public finance

- Financial incentives (e.g., grants, loans or tax breaks) to support R&D and early stage scale up.
- Public provision of EV charging and refuelling networks where private networks don't reach.

Public investment banks

- Investments and/or access to low-cost finance to support demonstrations, pilots, first and second of a kind SAF plants and low-carbon shipping fuel projects.
- De-risking via blended finance (e.g., guarantees) to mobilise private capital.

Financial institutions

- Set out strategies for low-carbon investment in aviation and shipping.
- Develop expert teams and capabilities in evaluating FOAK projects (e.g., risks and market opportunities) to increase lending.
- Technology specific investment funds to help pool expertise and aggregate capital.