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Summary Report

Net-Zero roadmap for the transport sector in Vietnam

NDC TRANSPORT INITIATIVE FOR ASIA

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IKI INTERNATIONAL CLIMATE INITIATIVE

SUMMARY

Peak emissions will only be achieved when the transport sector develops under a scenario aiming towards net zero emissions by 2050 with international support (NET Scenario).

Emissions are expected to peak in 2030 with about

77.08 million tonnes of CO2eq

By 2050, greenhouse gas (GHG) emissions of the transport sector will reach

30.34 million tonnes of CO2eq

million tonnes of CO_2eq if developed under the net zero emission scenario, equivalent to a reduction of up to 88.9% compared to when the transport sector develops under a business-as-usual scenario.

Total investment needed to achieve the target of net zero emissions by 2050 are estimated at about

1,225.37 billion USD

(This cost does not include investment costs for transport infrastructure).

Developing under the nationally implemented scenario (DOM scenario), the transport sector is forecasted to not be able to reach peak emissions in the period 2025-2050, and the amount of GHG emissions will increase at an average annual rate of about 2.9% per year. By 2050, the amount of GHG emissions of the transport sector will be about

171.64 million tonnes of CO 2eq

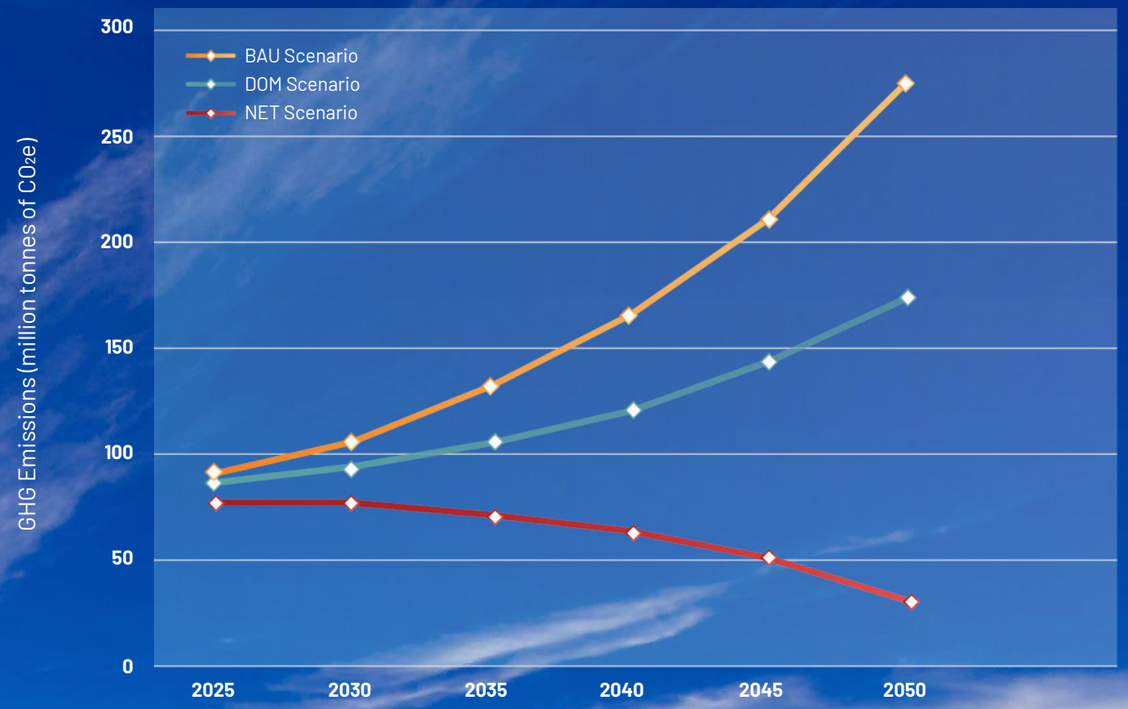
equivalent to a reduction of about 37% compared to when the transport sector develops under the business-as-usual scenario.

The total investment demand for developing the sector according to the national self-implementation scenario is estimated at about

1,176.17 billion USD

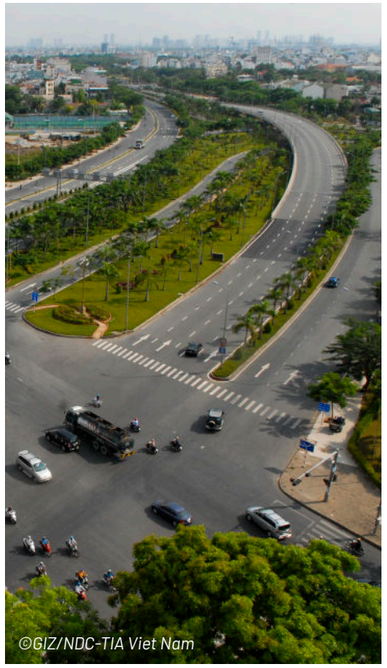
(This cost does not include investment costs for transport infrastructure).

The GHG emission curves to 2050 of the transport sector according to the scenarios are as below:



BAU Scenario: Business as usual scenario
DOM Scenario: Nationally implemented scenario
NET Scenario: Net zero emissions scenario

INCREASING DEMAND OF TRANSPORT IN VIETNAM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The transport sector has achieved strong growth in passenger and freight transport.

In the 2010-2019 period, passenger and freight transport in Vietnam experienced strong growth in most modes of transport, except for railways. The average annual growth rates for passenger and freight traffic during this period were 10% and 3.3%, respectively. During this period, aviation had the highest growth rates (15.5% per year for passengers and 8.9% for freight), followed by road (8.5% and 8.7%, respectively).

Since 2019, transport demand has decreased sharply due to the impact of Covid-19, but it is showing signs of rapid recovery from 2021 with an increase of about 95.7% for passenger volume and 18.6% for freight volume in 2022 compared to 2021 (Figure 1).

The constantly increasing transport demand poses challenges to the transport system, especially in the context of having to implement several transition solutions towards the net zero emission by 2050 target.

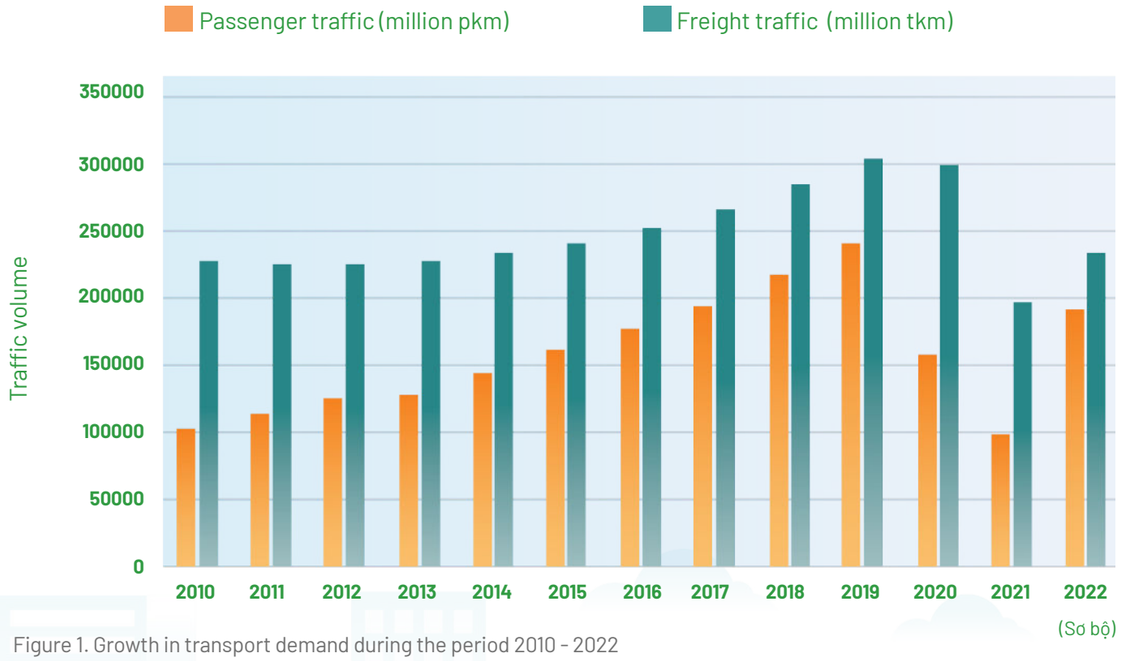

Figure 1. Growth in transport demand during the period 2010 - 2022

Source: General Statistics Office

Transport demand is forecasted to meet the socio-economic development rate by 2050

Transport demand for passengers and freight is forecasted to continue to grow in 2025-2050 with road transport occupying a high proportion. Passenger volume is forecasted to grow at an average rate of 3.2% per year in the 2025-2050 period, reaching about 1.7,106 million pkm by 2050. Freight volume is forecasted to grow at a higher rate of 5.5% per year in the 2025-2050 period, reaching about 1.5*10^6 million tkm by 2050.

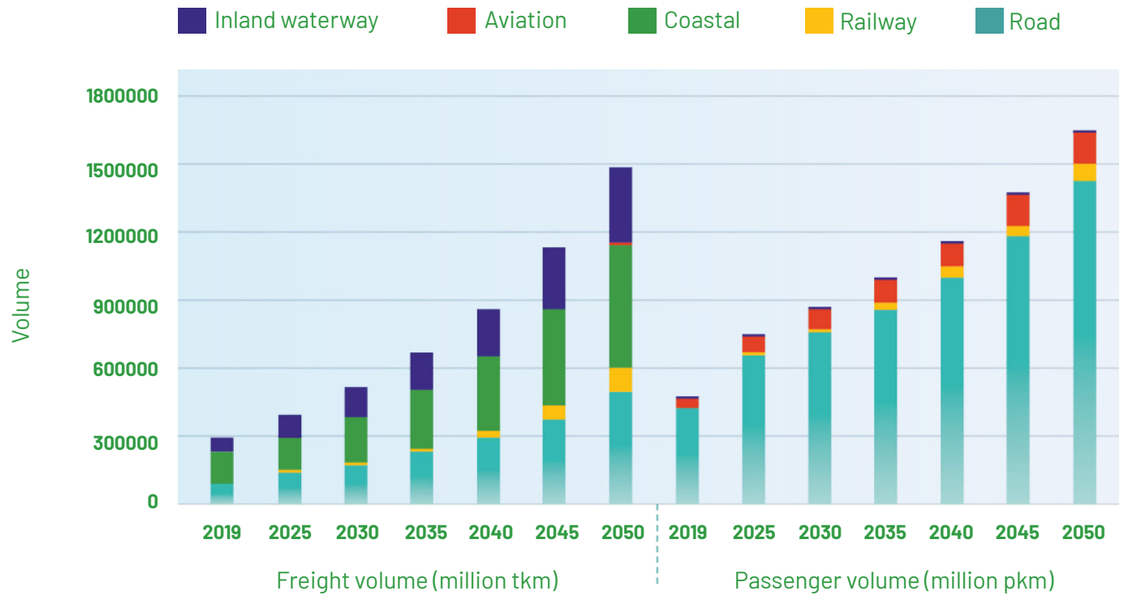

Figure 2. Forecast of transport demand to 2050 by sectors


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ORIENTATION OF GOALS FOR TRANSPORT INFRASTRUCTURE DEVELOPMENT IN VIETNAM

Developing a synchronous and modern transport infrastructure system that responds to climate change is the focus of development according to Resolution 29/NQ-TW.

Vietnam has achieved impressive results in the development of transport infrastructure with

over 24,300 km of national highways

2,000 km of expressways

2.640 national railways

298 ports

6,800 km of inland waterways

22 airports

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The transport sector continues to strive for further breakthroughs in transport infrastructure development in the future. Orientation for transport infrastructure development to 2030 which is consistent with the 10-year socio-economic development strategy for the 2021-2030 period, along with the national master plan and national sectoral plans; and the Government's action programme on green energy transition, carbon and methane emission reduction as follows:

- By 2030, the country will have about 5,000km of expressways; combining synchronous investment in electric charging infrastructure, providing green energy for expressways to support the transition of road vehicles;
- Focus on building the North-South high-speed railway line and speeding up investment in urban railway lines in Hanoi City and Ho Chi Minh City; invest in new railway lines towards electrification; renovate and upgrade the existing railway lines with synchronous infrastructure using electricity and green energy
- Encourage investment in green ports and transport routes with a total investment of projects by 2030 of about 10.8 billion USD for the inland waterway sector, 4.16 billion USD for the maritime sector.

To complete the transport infrastructure system by 2030, the transport sector needs to mobilise about 326 billion USD based on transport planning reports and development plans in localities.

Developing transport infrastructure while implementing green energy transition in the transport sector is an inevitable trend, ensuring synchronous development towards modernisation and sustainability.

Developing transport infrastructure while implementing green energy transition in transport is an inevitable trend, ensuring synchronous development towards modernisation and sustainability. The transport sector has developed five plans for network and infrastructure development in the sector for the 2021-2030 period, with a vision to 2050, to comply with the 2017 Planning Law and to meet the ever-growing transport demand as well as socio-economic development goals. Specifically:

01

Road network planning for the period 2021-2030, with a vision to 2050 (Decision No. 1454/QD-TTg dated September 1, 2021 of the Prime Minister);

02

Railway network planning for the period 2021-2030, with a vision to 2050 (Decision No. 1769/QD-TTg dated October 19, 2021 of the Prime Minister);

03

Inland waterway infrastructure planning for the period 2021-2030, with a vision to 2050 (Decision No. 1829/QD-TTg dated October 31, 2021 of the Prime Minister);

04

Master plan for the development of Vietnam's seaport system for the period 2021-2030, with a vision to 2050 (Decision No. 1579/QD-TTg dated September 22, 2021 of the Prime Minister);

05

Master plan for the development of the national airport and seaport system for the period 2021-2030, with a vision to 2050 (Decision No. 648/QD-TTg dated June 7, 2023).

Along with the development of the transport infrastructure system, the transport sector has also integrated the goal of reducing GHG emissions into programmes and action plans, typically: (1) Action programme for green energy transition, carbon and methane emissions reduction of the transport sector in Decision 876/QD-TTg/2022 and (2) Plan of the Ministry of Transport to implement Decision No. 876/QD-TTg in Decision 1679/QD-BGTVT/2023.

Groups of GHG emission mitigation measures in transport all require synchronous development between infrastructure and energy, as well as technology transition, specifically:

- Infrastructure of electric charging stations, charging stations, and green energy supply in the group of green energy transition measures.
- Infrastructure of national railways and urban railways in the group of GHG emission mitigation measures in the railway sector, shifting transport modes from road to railway, and from personal transport to public transport.
- Infrastructure of inland waterways and maritime in the group of GHG emission mitigation measures in the inland waterway transport sector and coastal as well as the group of measures on shifting transport modes from road to waterway.
- Infrastructure of sectors in the group of measures to improve fuel efficiency and transport demand management.
- Infrastructure of urban transport in the group of measures on converting transport modes from personal transport to public transport.
- Infrastructure supporting transport management, operation, and organisation, logistics infrastructure, infrastructure in digital transition, and other infrastructures in the group of measures for transport demand management.

ANALYSIS RESULTS OF THE TRANSPORT SECTOR'S DEVELOPMENT SCENARIOS

Three scenarios of GHG emissions in the transport sector up to 2050, including the Business as Usual Development Scenario and two scenarios of GHG emission mitigation[1], have been built, analysed, and simulated using the TIMES model.

The key measures integrated in the two emission mitigation scenarios (NET Scenario and DOM Scenario) are summarised in Figure 3. The level of intervention in the measures will be different between the two scenarios.

[1] Business as usual scenario: BAU Scenario
Nationally implemented scenario: DOM Scenario
Net zero emissions scenario: NET Scenario

THE MEASURE FRAMEWORK FOR EMISSION MITIGATION SCENARIOS

Four main pillars of NDC 2022, integrating with additional measures specified/supplemented in Decision 876

1 Energy efficiency
- Limiting energy consumption of motorcycles and cars
- Increasing load factors of trucks

2 Shifting from private vehicles to public transport
- Shifting from private vehicles to buses & urban railways
- Shifting passenger transport from road to high-speed railway

3 Shifting freight transport from road to railway and waterway
- Shipping freight transport from road to railway
- Shipping freight transport from road to inland waterways and maritime (coastal)

4 Fuel/energy transition
- Including 12 measures on using biofuels, alternative fuels to traditional fossil fuels

Two additional pillars

5 TDM
Applicable to all modes of transport

6 CCS
Applicable mainly to inland waterways and maritime vessels

The shift in market shares of transport sectors regarding passenger and freight transport

Regarding passenger transport: Road transport always has the largest market share (> 85%) and there is almost no difference in the market share of road transport in all three scenarios in the period 2025-2030. Aviation has the second largest market share in all three scenarios even though it tends to decrease slightly in the two emission mitigation scenarios. The market share of railways is stable in the BAU Scenario but tends to expand in the two emission mitigation scenarios, especially in the NET Scenario (about 4% in 2050). The market share of inland waterways is the same in all three scenarios and tends to decrease gradually to only about 0.7% in 2050.

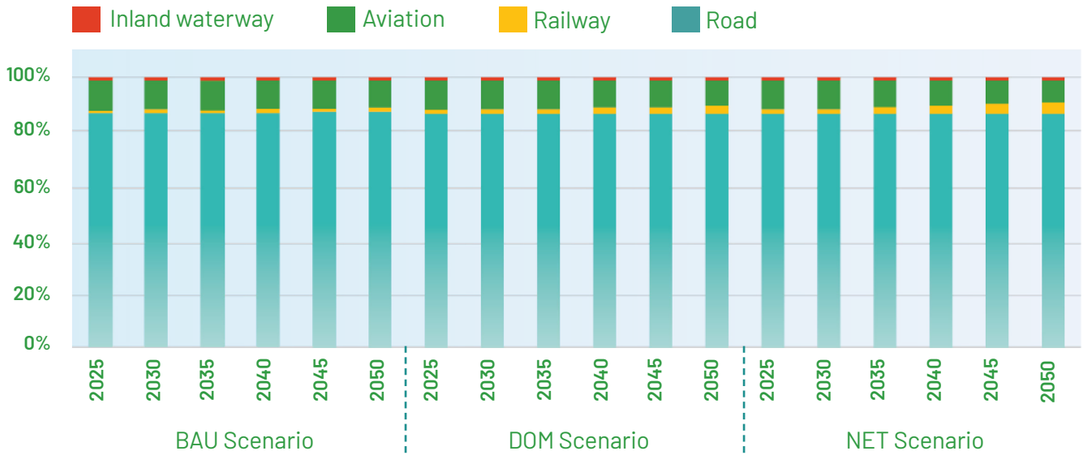


Figure 4. Passenger volume's market share of each transport mode under different scenarios

Regarding freight transport: In all three scenarios, three sectors playing key roles in freight transport include coastal waterways, roads, and railways, with a relatively stable total proportion of about 80% under the BAU and DOM scenarios, and about 75%-77% under the NET Scenario in the 2025-2050 period. There is a shift in the market share structure in three scenarios. Roads still tend to expand their market share and always stand in the No. 1 position, although there is not a big difference in market share compared to the second-ranked sector, coastal waterways, in the BAU and DOM scenarios. On the contrary, the road market share tends to decrease slightly in the NET Scenario and only stands in second place, after coastal waterways.

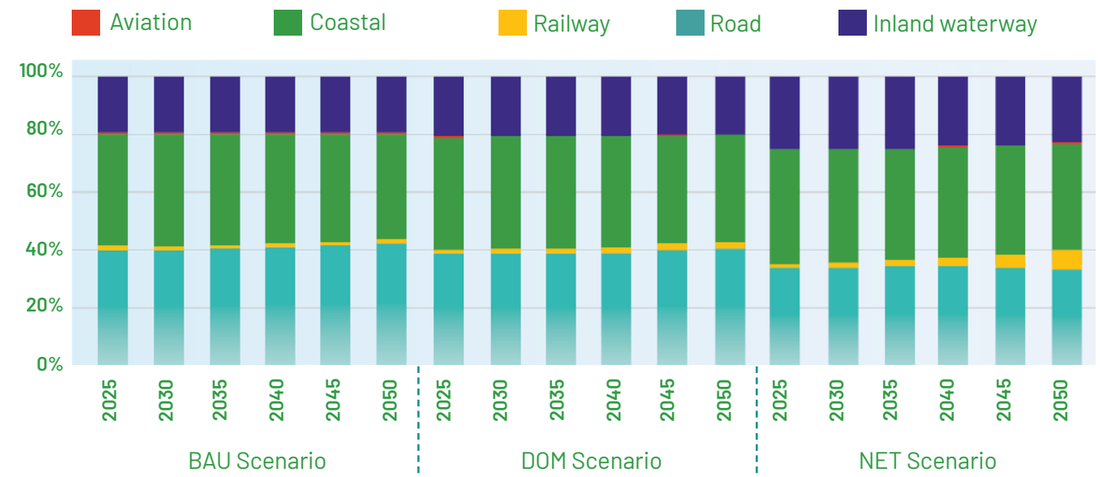


Figure 5. Freight volume's market share of each transport mode under different scenarios

Energy demand of the transport sector to 2050

Continuously increasing in the 2025-2050 period. The average annual growth rate throughout the period is about 4.7% (BAU Scenario), 3.3% (DOM Scenario), and 3.1% (NET Scenario). By 2050, the energy demand under the BAU Scenario, DOM Scenario, and NET Scenario is 88.2 MTOE, 62 MTOE, and 52.4 MTOE, respectively; equivalent to an increase of 3.5 to 5.8 times compared to the base year 2019, especially under the BAU Scenario (Figure 6).

Energy efficiency affects energy demand in emission reduction scenarios. Compared to the BAU Scenario, the projected energy demand is reduced by 1.4 times under the DOM Scenario and 1.7 times under the NET Scenario in 2050 (Figure 6). The lower energy demand in the DOM and NET scenarios than in the BAU Scenario shows that new technologies with higher energy efficiency contribute to reducing the energy demand of the transport sector. Technological innovation and green energy transition are inevitable trends.

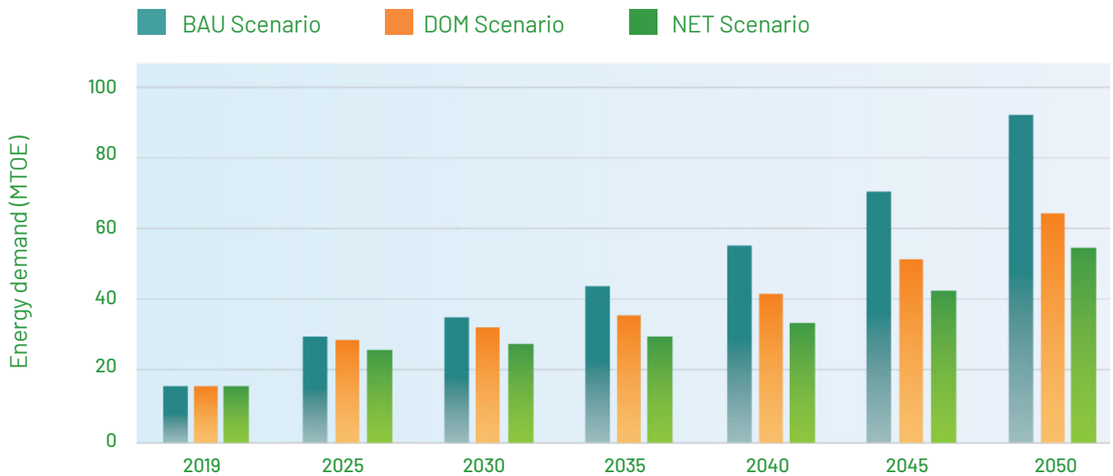


Figure 6. GTVT Energy demand under different transport development scenarios

Green energy transition under the DOM and NET scenarios corresponding to the technology penetration roadmap in periods.

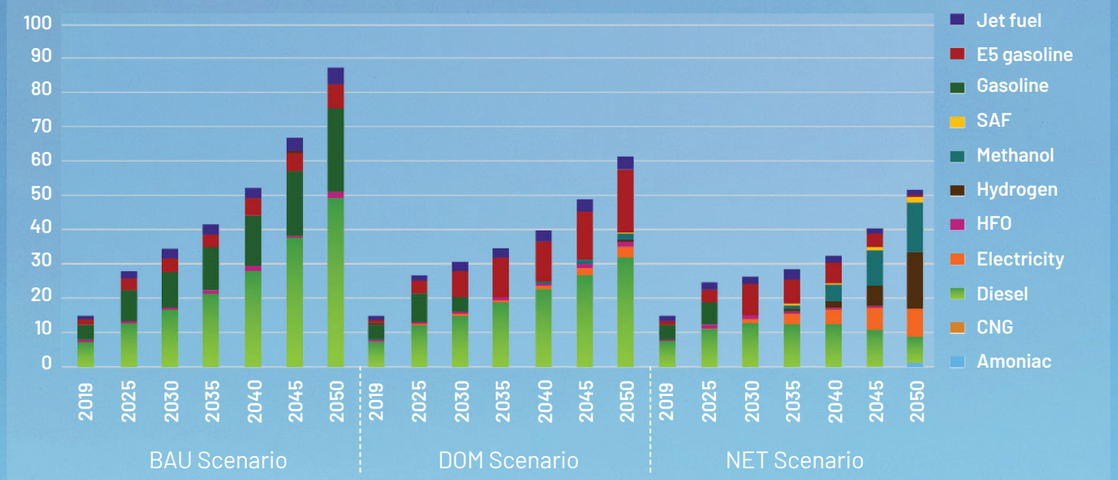


Figure 7. Energy demand according to three transport development scenarios

BAU Scenario

Traditional fuels such as petroleum and diesel will always play a dominant role. By 2050, the share of gasoline and diesel will reach 84.5%. The remainder will be electricity, HFO, E5 gasoline, and jet fuel. Under the BAU Scenario, electricity will be the only green energy used until 2050, but its market share will only reach about 0.05% in 2050.

DOM Scenario

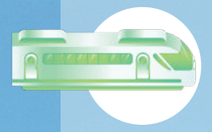
This scenario has a greater penetration of green energy than the BAU scenario. Electricity will be used in the railway sector (urban railway) from 2019 to 2025, and in the inland waterway sector from 2040[2]. Hydrogen and methanol will also be introduced in the transport sector from 2035, first for roads (methanol penetration) and coastal waterways (hydrogen penetration). Hydrogen will then continue to be introduced in railways and inland waterways. Sustainable aviation fuels will be introduced in the aviation sector from 2045. Ammonia is the latest green energy to be introduced in this scenario. From 2050, ammonia will be used for the coastal waterway sector. By 2050, green energy will account for about 39.8% of the total energy demand of the transport sector[3].

NET Scenario

The penetration of green energy forms in the NET Scenario is stronger than in the DOM Scenario. Accordingly, by 2050, the proportion of green energy forms accounts for 82.8% of the total energy demand of the transport sector.

Regarding the road transport sector:

By 2030, biofuels and electric energy will be promoted to gradually replace traditional fuels. After 2030, electric vehicles will continue to grow strongly and reach a rate of about 75% for cars and 100% for motorcycles by 2050; cars using green energy forms (hydrogen, methanol, etc.) will start testing and penetrating after 2030 and gradually increase until 2050, reaching 25% by 2050.



Regarding the railway transport sector:

Electricity will be put into use in urban railways from 2019 to 2025. Hydrogen will be put into use from 2040. By 2050, the proportion of locomotives using diesel, electricity, and hydrogen fuels will reach about 40%, 10%, and 50%, respectively.

Regarding the inland waterway transport sector:

Electricity and Hydrogen will be introduced from 2035, without penetration of other forms of green energy. By 2050, the proportion of inland waterway vessels running on diesel, electricity, and Hydrogen will be 55%, 30%, and 15%, respectively.

Regarding the coastal transport sector:

Ammonia and Hydrogen will be introduced from 2035. By 2050, the proportion of (coastal) vessels running on the heavy oil HFO, Ammonia, and Hydrogen will be 10%, 45%, and 45%, respectively.

Regarding the aviation sector:

Sustainable aviation fuels will be introduced in 2035 with a market share of about 10% of the total energy demand of the aviation sector. Experimental research activities to put SAF into use on aircraft will be conducted earlier. By 2050, SAFs will account for about 50% of the total energy demand of the aviation sector.

Vietnam's energy development planning and strategies meet the energy demand of the transport sector even when it develops under the NET Scenario.

- The final energy demand of the transport sector accounts for about 25%-32% of the total energy according to the National Energy Master Plan.
- The electricity demand of transport modes accounts for about 3.1%-9.8% of the total national commercial electricity demand according to the Power Development Plan VIII.
- The demand for Hydrogen fuel will be about 5.6 million tonnes by 2050, in line with the Hydrogen Energy Development Strategy.

[2] Electricity has been used in the road sector since the base year.
[3] Green energy considered includes: Ammonia, CNG, electricity, Hydrogen, Methanol, SAF, and E5 gasoline.

Greenhouse gas emissions

BAU Scenario

Emissions continue to increase with an average growth rate of 4.7% per year in the 2025-2050 period. By 2050, total GHG emissions from the transport sector are forecast to be around 273.21 million tonnes of CO_2eq, 6.2 times higher than the total GHG inventory in 2021 from transport activities of the entire sector.

DOM Scenario

GHG emission reduction measures contribute to reducing the growth rate of GHG emissions compared to the BAU scenario, to only 2.9% per year. By 2050, GHG emissions from the transport sector will be around 171.64 million tonnes of CO_2eq, down about 37% compared to the BAU Scenario.

NET Scenario

The GHG emission curve under this scenario tends to be different from the BAU Scenario and the DOM Scenario. The peak emission is forecasted to be reached in 2030, with a total GHG emission of the whole sector of 77.08 million tonnes of CO_2eq; then gradually decrease at an average rate of 4.6% per year. By 2050, the GHG emissions of the transport sector are estimated to reach 30.34 million tonnes of CO_2eq, down 88.9% compared to the BAU Scenario. This rate is similar to the calculation results in the National Strategy on Climate Change for the period up to 2050 (Decision No. 896/QD-TTg dated July 26, 2022 of the Prime Minister).

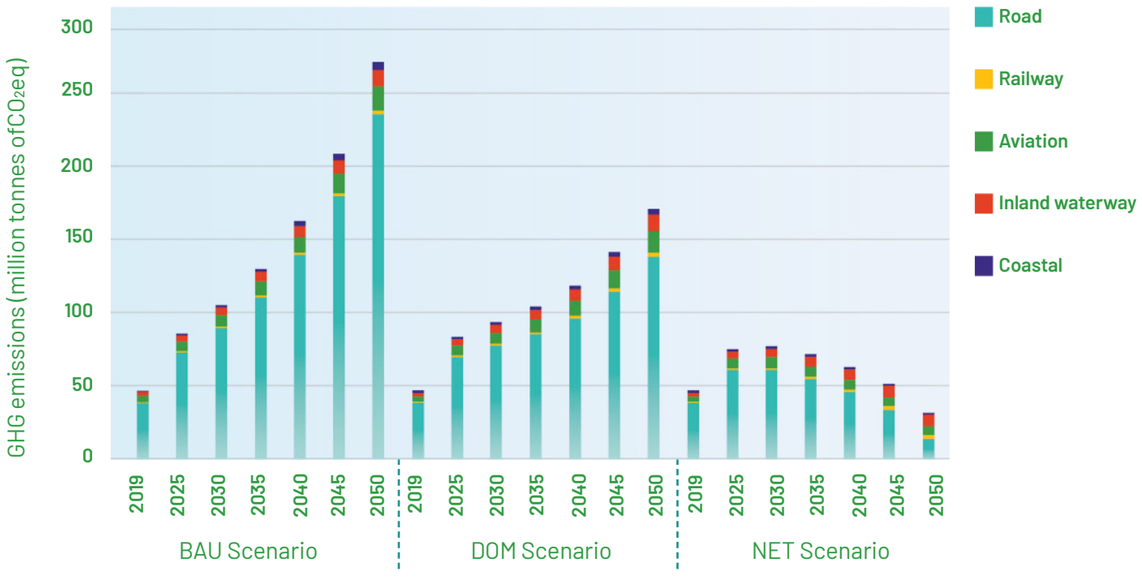


Figure 8. GHG emissions to 2050 by transport sectors under different development scenarios

The road sector has the largest proportion of GHG emissions. During the 2025-2050 period, the proportion of GHG emissions fluctuates between 83% and 87% in the BAU Scenario and between 80% and 83% in the DOM Scenario. In the NET scenario, the proportion of GHG emissions from roads tends to gradually narrow, significantly decreasing compared to the two scenarios above, but roads still have the highest emission proportion. By 2050, the proportion of GHG emissions from roads will be about 44.6% under the NET Scenario. This is the result of the energy transition taking place earlier and more thoroughly with the majority of vehicles being privately owned.

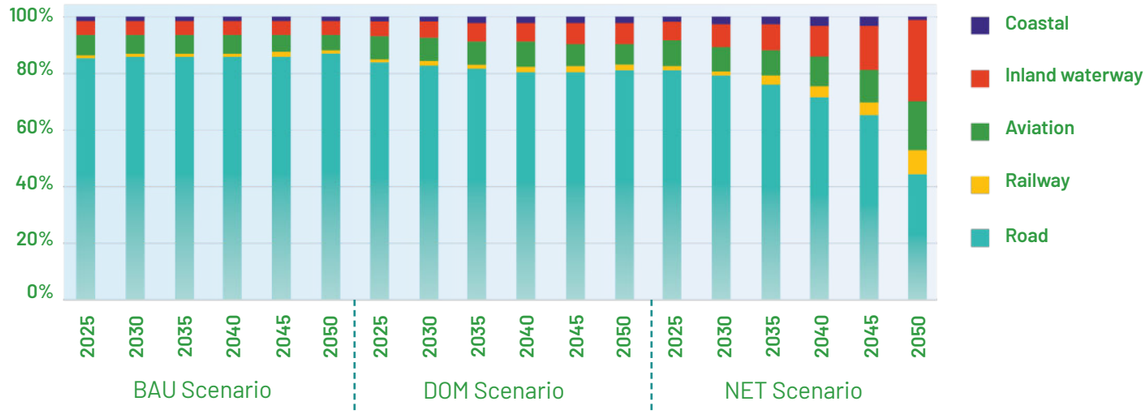


Figure 9. Proportion of GHG emissions in transport sectors by 2050 under different scenarios

Cost of implementing green energy transition in transport under different scenarios

The demand of **cost for transport development** under the scenarios of GHG emission mitigation in the transport sector by 2050 is very high. The estimated direct cost is up to 1085.64 billion USD under the DOM scenario and 1175.51 billion USD under the NET Scenario. In these costs, the majority of direct costs come from investment costs for vehicles with a ratio of 59% to 61%; followed by costs for fuel and energy with a ratio of 21% to 26% (Table 1).

Unit: 10^9 USD

NO.	COST ITEMS FOR THE 2025-2050 PERIOD	TRANSPORT DEVELOPMENT SCENARIO CORRESPONDING TO GHG EMISSION MITIGATION SCENARIO	
		DOM SCENARIO	NET SCENARIO
A	**TOTAL DIRECT COSTS**	**1085.64**	**1175.51**
1	Vehicle investment costs	665.56	705.20
2	Vehicle operating and maintenance costs	163.71	124.97
3	Fuel and energy costs	224.62	254.47
4	Infrastructure costs (electric vehicle charging stations)	31.76	90.88
B	**TOTAL INDIRECT COSTS**	**90.53**	**49.86**
5	GHG emissions costs	16.91	7.38
6	Air pollution costs	73.61	42.48
C	**TOTAL (A+B)**	**1176.17**	**1225.37**

Table 1. Estimated total implementation costs for the 2025-2050 period under emission mitigation scenarios

The GHG emission mitigation scenarios (DOM and NET) have a sharp increase in infrastructure costs (electric vehicle charging stations), but these costs are forecast to be offset by the efficiency brought about by the reduction in investment costs, fuel/energy costs, and lower operating/maintenance costs in the long term.

The capital investment demands of transport infrastructure in all sectors (road, railway, waterway, aviation) according to the development orientation of the transport sector in parallel with the implementation process of GHG emission mitigation measures have also been summarised separately. Based on the plans of the transport sector at both central and local levels, the investment demands for transport infrastructure development to 2030 are summarised at about **326 billion USD.**

CONCLUSION

The GHG emission scenarios in the transport sector up to 2050 have been proposed, consulted, and discussed for consensus before conducting analysis and simulation. From the results of developing and analysing the GHG emission mitigation scenario in the transport sector up to 2050 towards net zero emissions, some initial conclusions are drawn as follows:

01

- The DOM scenario, although lowering the emission curve compared to the BAU scenario, still increases until 2050 (without peak emissions): Emissions of about 171.64 million tonnes of CO_2eq in 2050 (a reduction of 37% compared to the BAU Scenario).

02

- The net-zero emission scenario: Reduces 88.9% of GHG emissions compared to the BAU Scenario in 2050. The GHG emissions in 2050 of the transport sector will be about 30.34 million tonnes of CO_2eq, equivalent to 11.1% compared to the BAU Scenario. This ratio is basically similar to the scenario developed in the National Strategy on Climate Change for the period up to 2050.

03

- Preliminary cost estimate: Although the total cost is only 4-8% higher than under the DOM Scenario, the NET Scenario aims to achieve the goal of net zero emissions by 2050.

04

- Energy and technology transition in transport takes place strongly from 2030 in the road sector. For other sectors, the transition point is clear from 2035. Basically, the direct transition is from fossil fuels to electricity and green energy (hydrogen, methanol, SAF, etc.).

05

- Total demand for new energy and green energy in the transport sector is within the response threshold of the energy sector (according to Power Development Plan VIII and National Energy Master Plan).

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RECOMMENDATIONS

In order to achieve the goals, the measures need to be implemented synchronously and comprehensively on the basis of conformity with world trends and Vietnam's practical response capacity.

RECOMMENDATIONS ON POLICY FRAMEWORK

01 Strengthening state management and inter-sectoral coordination

- Build an inter-sectoral coordination mechanism between relevant ministries and sectors to promote green transition in the transport sector.
- Review, promptly develop, and perfect necessary policies and mechanisms to promote synchronous development of transport infrastructure and sustainable energy infrastructure, develop a synchronous energy market and connect it with regional and world markets to ensure a supply of green and clean energy for the transport sector.
- Complete and develop market-based mechanisms, policies, and tools to promote the green energy transition.
- Complete the system of standards, norms, and regulations for vehicles and infrastructure using green and clean energy; be ready for the process of synchronous and comprehensive technology deployment in the market after 2035.
- Develop cross-sectoral mechanisms and policies to guide the deployment of new solutions and technologies such as carbon capture and storage (CCS) technology.
- Develop and complete policies to promote the development of science, technology, and human resources to be ready to meet the green transition demands in the transport sector.

02 Resource mobilisation and investment capital allocation mechanisms. Special attention is paid to the important role of infrastructure investment to ensure energy transition and mode transition.

- Develop priority policies to attract investment to complete the integrated transport infrastructure system and infrastructure to serve green energy transition in the transport sector (e.g. charging station system, green energy charging system such as Methanol, Hydrogen, SAF, etc.)
- Integrate policies to attract investment in transport infrastructure and measures to reduce GHG emissions through mechanisms that combine integrated tools with the market and land use planning.
- Diversify investment forms (state, local, private, public-private partnerships, etc.) for infrastructure development investment projects and solutions to support energy transition in the transport sector. In which, promote and develop the orientational role in the investment of state-owned enterprises, attract private investment, effectively utilise and use funding sources, support capital arrangement of partners in the process of green and clean energy transition in the transport sector.
- Diversify capital sources and forms of loans, effectively attract domestic and foreign capital sources to develop transport infrastructure combined with green energy transition, ensuring national defence and security and competitiveness in the transport sector. Increase attraction and call for preferential capital sources associated with green energy transition, reducing GHG emissions towards net zero emissions.
- Support and enhance sharing and cooperation to promote the financial mobilisation capacity of enterprises to improve business performance, ensure accumulation, and ensure the equity capital ratio of enterprises according to the requirements of domestic and international financial institutions.
- Continue to attract and effectively use ODA loans and concessional loans from international donors to invest in green transition projects in the transport sector.

03

Developing science and technology, promoting digital transition, promptly responding to green transition in the transport sector

- Form a mechanism to link the force of scientific and technological research and development as well as innovation with enterprises and training institutions through science and technology programmes, integrate into research and development activities in strategies, planning, and plans of the transport and energy sectors.
- Develop and implement a national research programme on technology, vehicles, equipment, systems, and green transition solutions in the transport sector.
- Develop and implement a national research programme on developing smart vehicles, self-driving vehicles, and connected transport systems based on real-time data platforms.
- Coordinate with other sectors to develop and implement a research programme on clean fuels and energy; on technology, equipment for carbon capture and storage (CCS).
- Form a mechanism to support technology development and technology import for enterprises manufacturing vehicles and accessories for large-scale freight and passenger transport such as high-speed railways, ships, and river vessels; urban railways and BRT meet the green transition goals in the transport sector.
- Build mechanisms and policies to promote digital transition including the application of new technologies such as cloud computing, big data, artificial intelligence, Internet of Things, Intelligent Transport System and other digital platforms to effectively implement traffic management, control and transport demand management (TDM) strategies - an important pillar in reducing GHG emissions in the transport sector.

04

Training human resources suitable for green energy transition in the transport sector

- Train, retrain, and improve existing human resources in the transport sector to be ready to receive, transfer, manage, exploit, and operate new technology vehicles and transport infrastructure in the direction of using electricity and green energy.
- Form a mechanism for training human resources to serve the green transition and transport modal shift. Include training high-level human resources to meet the demands of technology acquisition and innovation for high-speed railways, urban railways, inland waterways, and international maritime.
- Promote human resource training for research, development, and production of electric and clean energy vehicles through the development of training programmes and opening new training majors at universities, colleges, and vocational schools on new vehicle technology and ancillary services.
- Train, retrain, and advanced training of human resources to meet the goals of digital transition and transport demand management (TDM).
- Train, retrain, and advanced training of existing human resources in the natural resources and environment sector to be ready to receive and manage waste electric vehicle batteries.

05

Strengthening international cooperation

- Strengthen bilateral and multilateral international cooperation to utilise resources, share information, and receive technology transfer related to green energy transition in the transport sector.
- Strengthen the attraction of investment capital flows, green financial flows from financial institutions and international credit organisations into Vietnam; attract international corporations and multinational corporations to Vietnam to cooperate in implementing projects related to green energy transition in the transport sector.

06

Implementation monitoring mechanism

- Develop a monitoring implementation plan and coordinate with relevant units.
- Develop a database management system, ensuring connection and integration with national development plans, strategies and plans in the fields of investment, energy, environment, and climate change.
- Develop and deploy transport demand management (TDM) tools on a digital platform, connecting the entire industry.
- Update and collect transport, vehicle, fuel/energy, and GHG emissions data regularly and periodically to ensure statistics and policy research.
- Arrange and allocate annual funding resources for related activities such as database development, model analysis and updating, etc.

07

Strengthen communication activities to raise awareness and attract community participation

- Strengthen communication activities to raise awareness and attract community participation in the green energy transition roadmap in the transport sector.

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SPECIFIC MEASURES FOR GREEN ENERGY TRANSITION IN THE TRANSPORT SECTOR

To successfully implement the green energy transition roadmap towards the net zero emission by 2050 target in the transport sector, this report provides a number of recommendations to implement emission mitigation measures as follows:

1. The energy efficiency measure group

1.1. Measures to limit fuel consumption for motorcycles and cars

- Develop and promulgate standards to limit fuel consumption for motorcycles and cars according to the Law on Road Traffic Safety and Order;
- Continue to implement energy labelling for transport vehicle groups (motorcycles and cars) according to Decision No. 04/2017/QD-TTg stipulating the list of transport vehicles and equipment that must have energy labels, apply minimum energy efficiency levels and the implementation roadmap;
- Coordinate with the Vietnam Automobile Manufacturers Association (VAMA) and the Vietnam Motorcycle Manufacturers Association(VAMM)to carry out the following tasks: i)propaganda and popularise regulations on limiting fuel consumption for motorcycles and cars manufactured, assembled, and imported in Vietnam; ii) exchange information to promptly update and amend regulations related to fuel consumption levels; iii) build a comprehensive management database system to support the management of the implementation process of fuel consumption limit standards for motorcycles and passenger cars.

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1.2. Measures to increase the load factor of trucks

- Deploy and complete the construction of digital infrastructure and digital databases on infrastructure, transport networks, and vehicle fleets according to Decision No. 923/QD-TTg on the Project "Application of information technology in transport management and operation, focusing on the road sector" and Decision No. 2269/QD-BGTVT on "Digital Transition Programme of the Ministry of Transport to 2025, with a vision to 2030";
- Develop and promulgate a list of open digital data to share with the private sector to promote the digital economy in transport, including the construction and development of transport exchanges;
- Deploy the investment and construction of warehouse systems, logistics centres, ICDs, inland waterway freight ports, and seaports according to approved national transport sub-sector plans and provincial plans;
- Develop mechanisms and policies to encourage the participation of the private sector, communities and society in building and developing platforms and applications to connect vehicle owners, transport units, and customers to promote the optimisation of freight transport services.

2. Group of measures to shift passenger transport from personal vehicles to public transport

2.1. Shifting from personal vehicles to public buses

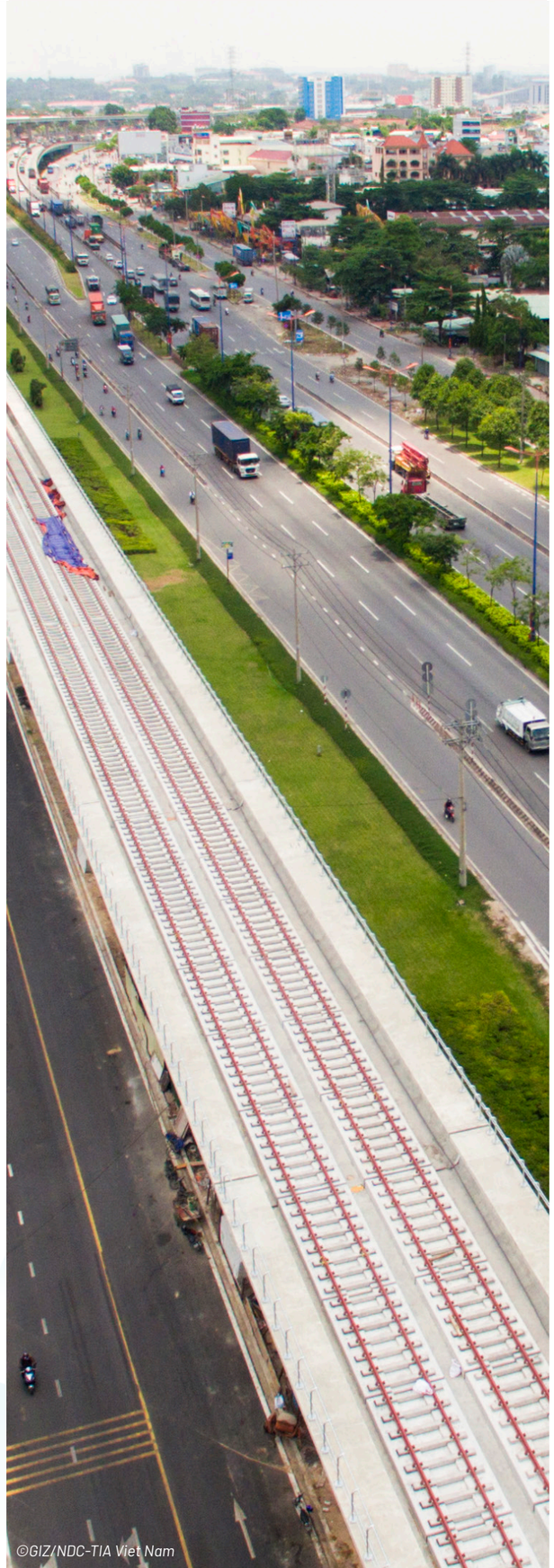
- Provinces and centrally run cities continue to implement Decision No. 13/2015/QD-TTg on mechanisms and policies to encourage the development of public passenger transport by bus;
- Provinces and centrally run cities develop, promulgate, and implement projects to develop public passenger transport by bus systems;
- Develop mechanisms and policies to diversify types of investment capital sources for public passenger transport by bus.

2.2. Shifting from personal vehicles to urban railways

Provinces and centrally run cities prioritise allocating investment capital for urban railway development according to Conclusion No. 49-KL/TW dated February 28, 2023 of the Politburo on the orientation for developing Vietnam's railway transport to 2030, with a vision to 2045; Resolution No. 178/NQ-CP dated October 31, 2023 of the Government on the Government's Action Programme to implement Conclusion No. 49-KL/TW; and approved provincial plans;

- Implementing contents related to urban railways in 11 groups of tasks and measures (e.g. perfecting institutions/policies, perfecting plannings, mobilising investment resources, etc.) set out in Resolution No. 178/NQ-CP;
- Centrally-run cities develop, promulgate, and implement urban railway network development projects;
- Centrally-run cities develop and promulgate mechanisms and policies to encourage people to use urban railways;
- Develop mechanisms and policies to diversify types of investment capital for urban railways;
- Some general recommendations for both measures 2.1 and 2.2 to promote the transition from personal vehicles to public transport in large cities;

- The People's Committees of centrally-run cities develop, promulgate, and implement projects to control personal vehicles according to Decision No. 2060/QD-TTg on approving the National Strategy to ensure road traffic order and safety for the period 2021 - 2030, with a vision to 2045 (National Traffic Safety Strategy 2045) and Resolution No. 48/NQ-CP on strengthening the implementation of ensuring traffic order and safety, preventing traffic congestion for the period 2022-2025 (Resolution 48), including: i) Project to develop limit areas for motorcycles in accordance with the infrastructure and service capacity of the public passenger transport system, moving towards a roadmap to limit or stop motorcycles in some districts after 2030, and ii) Project to collect fees for motor vehicles entering some areas in the city at risk of traffic congestion and environmental pollution;
- Research on the construction and implementation of a ticket payment system connecting public transport modes (bus and urban railway) in large cities;
- Research on the construction and implementation of a modern information system connecting information lookup between public transport modes.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2.3. Shifting from road vehicles to high-speed railways

- Implement the investment, construction, and operation of high-speed railways according to Conclusion No. 49-KL/TW dated February 28, 2023 of the Politburo on the orientation for the development of Vietnam's railway transport to 2030, with a vision to 2045; Resolution No. 178/NQ-CP dated October 31, 2023 of the Government on the Government's Action Program to implement Conclusion No. 49-KL/TW; and the approved National Railway Network Planning;
- Implement contents related to high-speed railways in 11 groups of tasks and measures (e.g. perfecting institutions/policies, perfecting planning, mobilising investment resources, etc.) set out in Resolution No. 178/NQ-CP.

3. Group of measures to convert freight transport from road to railway or waterway

3.1. Shifting from road to inland waterway

- Prioritise the allocation of investment capital for the development of inland waterway infrastructure on transport routes according to Decision No. 1829/QD-TTg dated October 31, 2021 on the Approval of the Inland Waterway Infrastructure Planning for the period 2021 - 2030, with a vision to 2050; Decision No. 1269/QD-TTg dated October 19, 2022 on Plans, policies, and solutions to implement the Inland Waterway Infrastructure Planning for the period 2021 - 2030, with a vision to 2050; and approved Provincial Plans;
- Implement 5 tasks and 8 groups of measures set out in Decision No. 1269/QD-TTg;
- Continue to implement Decision No. 21/2022/QD-TTg on mechanisms and policies to encourage the development of inland waterway transport in Vietnam.

3.2. Shifting from road to maritime

- Prioritise capital allocation for investment in developing the seaport system and the transport system connecting seaports and ICDs according to Decision No. 1579/QD-TTg dated September 22, 2021 and Decision No. 442/QD-TTg dated May 22, 2024 on the Master Plan for the Development of Vietnam's Seaport System for the 2021-2030 period, with a vision to 2050; and Decision No. 886/QD-TTg dated July 24, 2023 on the Plan, Policies, Solutions and Resources for Implementing the Master Plan for the Development of Vietnam's Seaport System for the 2021-2030 period, with a vision to 2050;
- Implement 3 groups of tasks and 8 groups of policies or measures set out in Decision No. 886/QD-TTg.

3.3. Shifting from road to railway

- Prioritise capital allocation to invest in developing new national railway lines and renovating and upgrading existing railway lines according to Conclusion No. 49-KL/TW dated February 28, 2023 of the Politburo on the orientation for developing Vietnam's railway transport to 2030, with a vision to 2045; Resolution No. 178/NQ-CP dated October 31, 2023 of the Government on the Government's Action Program to implement Conclusion No. 49-KL/TW; Decision No. 1769/QD-TTg on Approving the Railway Network Planning for the 2021-2030 period, with a vision to 2050; and Decision No. 396/QD-TTg dated April 17, 2023 on Plans, policies, solutions and resources for implementing the Railway Network Planning for the period 2021 - 2030, with a vision to 2050;
- Implement 11 groups of tasks and measures (e.g. perfecting institutions or policies, perfecting planning, mobilising investment resources, etc.) set out in Resolution No. 178/NQ-CP;
- Implement 9 groups of measures (e.g. attracting investment, developing human resources, developing the railway sector, etc.) set out in Decision No. 396/QD-TTg.

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4.2. Promoting the use of electric and green energy vehicles in the road sector (motorcycles, cars, buses, coaches, and trucks)

- Review, update, and complete regulations on technical safety quality for electric vehicles and charging stations;
- Review, update, and complete regulations on the arrangement of charging locations or charging stations in residential areas (houses and apartments), civil buildings (e.g. schools, hospitals, gymnasiums, commercial centres and agency headquarters), and traffic hubs (bus stations, train stations and airports);
- Develop mechanisms and policies to attract investment and develop public charging stations and green energy supply systems (Methanol and Hydrogen);
- Provinces and centrally-run cities consider developing and implementing projects or plans for the development of electric vehicles, green energy vehicles, and systems of public charging stations and green energy supply stations;
- Research, develop, and implement a policy to stop the production, assembly, and import of new motorcycles and cars using gasoline or oil from 2040[7];
- Develop mechanisms and policies to encourage people and transport businesses to switch to using electric and green energy vehicles.


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4. Fuel and energy transition for vehicle fleets

4.1. Encourage the use of biofuel (E5 gasoline)

- To 2030: continue to implement the use of biogasoline (E5 and E10) according to Decision No. 53/2012/QD-TTg on the roadmap for applying the blending ratio of biofuel with traditional fuel for gasoline engines and diesel engines of road motor vehicles;
- After 2030: Develop, promulgate, and implement mandatory regulations on the blending ratio of biofuels with traditional fuels, towards mandatory use of E10 and B3 gasoline and encouraging the use of E85 and flexible fuels[4];
- Develop and implement a national communication programme on biofuel to promote people's use[5];
- Review, update and amend (if any) the provisions in the National Technical Regulation on equipment and accessories for storing and distributing bio-fuel at petrol stations, and the National Technical Regulation on gasoline, diesel fuel, and bio-fuel[3];
- Review and develop a plan for ethanol supply sources to serve the production of biogasoline[4];
- Review and build a plan for developing the bio gasoline distribution system[5].

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4.4. Promote the shifting of locomotives from using diesel to using electricity and Hydrogen

Regarding new railway lines:

- Electrification according to the provisions of Article 14 of the Railway Law 2017
- Implement investment preparation and investment according to approved plans and schemes

Regarding exiting railway lines:

Period **2025 - 2030**
- Research and develop a Green Energy Transition Project for the fleet of locomotives on existing lines and a Green Energy Transition Project for loading and unloading equipment or vehicles at railway stations.

Period **2031 - 2035**
- Research and develop a pilot Hydrogen energy distribution system for railway transport;
- Research and develop a pilot Hydrogen locomotive on an existing railway line and green energy loading and unloading equipment or vehicles at stations of that line.

Period **2036 - 2050**
- Expand the pilot programme to other railway lines and stations.

4.5. Promoting the transition of inland waterway vessels to using green fuel

Period **2025 - 2030**

Research and develop the following projects:
- Project on electrification of inland passenger waterway fleet, and;
- Project on green energy transition for inland waterway freight transport fleet and loading and unloading equipment/vehicles at inland waterway ports.

Period **2031 - 2035**
- Research and develop pilot electric and Hydrogen energy distribution systems for inland waterway transport;
- Research and develop pilot electric and Hydrogen passenger/cargo inland waterway vessels on some transport routes;
- Research and develop pilot loading and unloading equipment/vehicles using green energy at some inland waterway ports.

Period **2036 - 2050**
- Expand the pilot program to inland waterway transport routes and other inland waterway ports.

4.6. Promoting the transition of ships to using green fuel

Period **2025 - 2030**

Research and develop the following projects:
- Project on shifting to green energy for the fleet of passenger seagoing vessels from shore to islands, and;
- Project on shifting to green energy for the domestic fleet of seagoing vessels and loading or unloading equipment/vehicles at seaports.

Period **2031 - 2035**
- Research and build pilot systems for Ammonia and Hydrogen energy distribution for passenger seagoing vessels;
- Research and build pilot systems for passenger seagoing vessels using Ammonia and Hydrogen energy on some routes from shore to islands.

Period **2036 - 2040**
- Research and build pilot systems for Ammonia and Hydrogen energy distribution for freight seagoing vessels;
- Research and build pilot systems for domestic freight seagoing vessels using Ammonia and Hydrogen energy and green energy loading and unloading vehicles/equipment at some seaports;
- Continue to expand the pilot program for passenger seagoing vessels using Ammonia and Hydrogen energy.

Period **2041 - 2050**
- Expand the pilot programme for freight and passenger seagoing vessels using green energy (Ammonia and Hydrogen) and greenify the loading and unloading vehicles/equipment at seaports.

4.7. Promoting the use of sustainable aviation fuel for aircraft

Period **2025 - 2030**

Research and develop the following projects:
- Project on sustainable fuel development for Vietnam's civil aviation sector until 2030 and orientation to 2050, and;
- Project on greenify equipment/vehicles operating within airports.

Period **2031 - 2035**
- Research and develop the pilot sustainable aviation fuel distribution systems at some airports;
- Research and develop the pilot sustainable aviation fuel aircraft on some domestic routes;
- Research and develop the pilot greening of equipment/vehicles operating at some airports.

Period **2036 - 2050**
- Expand the pilot programme on sustainable aviation fuel aircraft on other domestic routes, and greenify the equipment/vehicles operating within the scope of the airport.

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