

Pathways to Transport Decarbonization in Nepal

November 2021



Transport and climate change

Globally, transport is one of the major contributors to carbon emissions. Transport accounts for nearly one-quarter of global energy-related carbon-dioxide (CO₂) emissions, the second largest source after electricity and heat producers. It is also the fastest growing source of carbon emissions, with its emission rising more than 27% from 2005 to 2018.¹

The “Transport and Climate Change Global Status Report (2018)”² suggests that “without rapid and ambitious mitigation action, transport emissions could more than double by 2050; thus, it is evident that any path to a 1.5°C must include low carbon transport as a central element.” The “Transport for under two degrees –the way forward (T4<2°) (2020) Report”³ also states that a full decarbonization of the transport sector must happen by 2050 in order to reach the Paris Agreement goals.

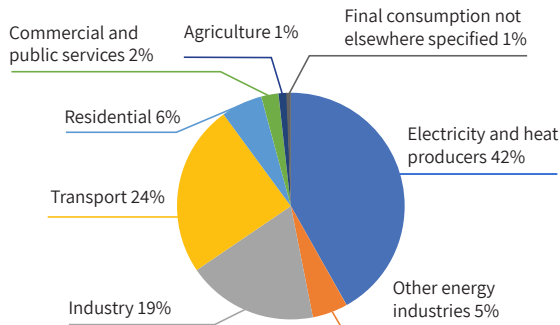
1 International Energy Agency (IEA), 2019.

2 ‘Transport and Climate Change Global Status Report 2018’. SLoCaT, 2018.<http://slocat.net/tcc-gsr>.

3 ‘Transport for under Two Degrees – the Way Forward. 10 Key Insights for the Decarbonization of the Transport Sector.’ Agora Verkehrswende, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), World Economic Forum (WEF), 2020.<https://www.t4under2.org>.



World's CO₂ Emission from Fuel Combustion, 2019



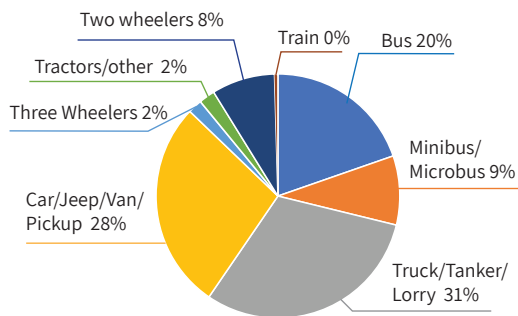
Source : IEA, 2021

In Nepal too, transport is one of the major contributors to energy-related carbon emissions, also the fastest growing source. According to Nepal's Third National Communication submitted to The United Nations Framework Convention

on Climate Change (TNCR)⁴, in 2011, transport (including aviation)—the second largest source after manufacturing industries—emitted 1709 Gg of CO₂ emissions, which is 36% of Nepal's total energy-related carbon emissions. Road-transport accounted for only 1626 Gg of CO₂ emissions. Between 2011 and 2016, Nepal's road-transport CO₂ emissions grew 113%.⁵ Nepal is one of the top ten countries where the transport emissions are projected to grow most from 2010 to 2050.⁶

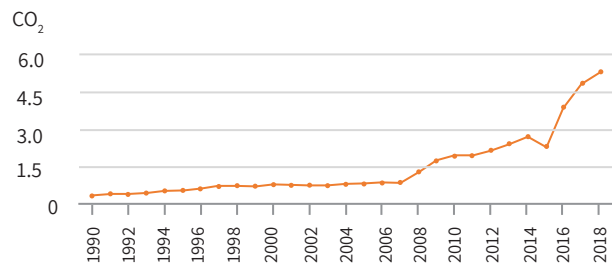
Freight and public transport are the largest sources of carbon emissions. According to the TNCR, freight transport (truck), which constitutes only 9.5% of total vehicle fleet registered in Nepal, contributes 31% of transport CO₂ emissions (excluding aviation in transport emission), followed by public transport (31%) and cars (28%).

Nepal's CO₂ Emissions from Transport (excluding aviation), 2011



Source: Nepal's Third Communication to the UNFCCC, Ministry of Forests and Environment

Nepal's CO₂ Emission-Transport, 1990-2018



Source: CAIT/Climate Watch

4 'Nepal's Third National Communication to the United Nations Framework Convention on Climate Change (UNFCCC)'. Ministry of Forest and Environment, Nepal, June 2021.

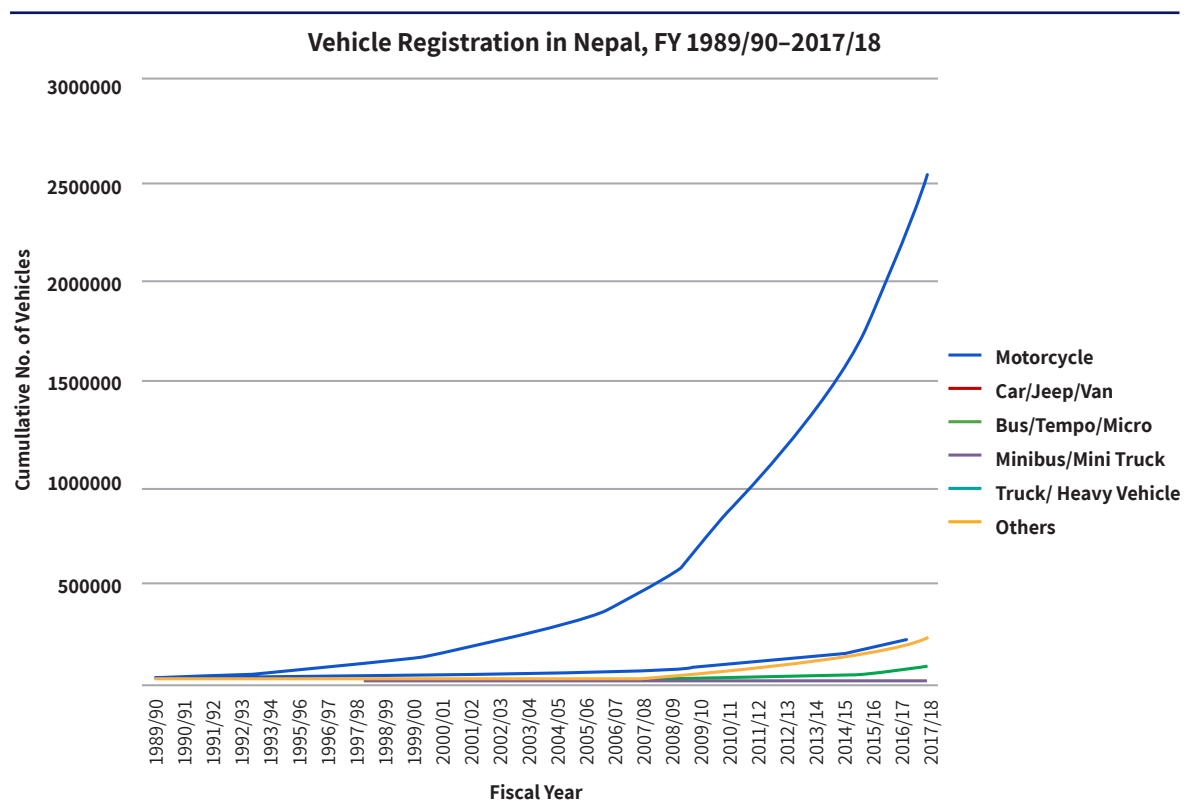
5 NEEMI-Tech

6 Sudhir Gota, Cornie Huizenga, and Karl Peet. 'Implications of 2DS and 1.5DS for Land Transport Carbon Emissions in 2050'. Partnership on Sustainable Low-carbon Transport (SLoCaT), November 2016. <https://slocat.net/publications/land-transport-carbon-emissions-2050/>.

Nepal is experiencing rapid motorization and urbanization. The average annual motor vehicle growth in the fiscal years 2007/08–2017/18 is 16%. By 2017/18, 3.22 million motor vehicles were registered in Nepal, of which 86% of are private motor-vehicles (cars and motorbikes).⁷ 36% of total motor vehicles registered in Nepal are in the Kathmandu Valley. Since 2000, the number of motor vehicles has increased ten-fold. The mode share of private vehicles is also increasing rapidly. In the Valley, while the share of walking and cycling have

reduced, the share of private vehicles has increased significantly from 13.1% in 1991 to 30.2% in 2011, and the public transport share has remained static.⁸

Nepal is the fastest urbanizing country in South Asia and the Kathmandu Valley is one of the fastest-growing metropolitan regions in South Asia.⁹ Without sustainable transport measures and proper urban planning, Nepal is going to experience rapid motorization and consequently increased carbon emissions.



Source: Department of Transport Management, 2020

7 Department of Transport Management, 2020.
 8 'Final Report: Data Collection Survey on Traffic Improvement in Kathmandu Valley'. Japanese International Cooperation Agency, Ministry of Physical Infrastructure and Transport, 2012.
 9 Elisa Muzzini and Gabriela Aparicio. Urban Growth and Spatial Transition in Nepal: An Initial Assessment. Washington, D.C.: World Bank, 2013. http://public.eblib.com/choice/publicfullrecord.aspx?p=1165942_0.

With the rapid motorization, petroleum consumption is increasing at a higher rate. Nepal's fossil fuel import for the last 10 years (2009/10–2018/19) has been growing at an average annual growth rate of 18% for diesel and 15% for petrol. To meet this increasing demand of fossil fuels, Nepal spends a significant budget on petroleum import; it is the major contributor to the country's trade deficit. According to the Department of Customs, during the fiscal year 2018/2019, Nepal imported petrol and diesel worth Rs 155.43 billion.¹⁰

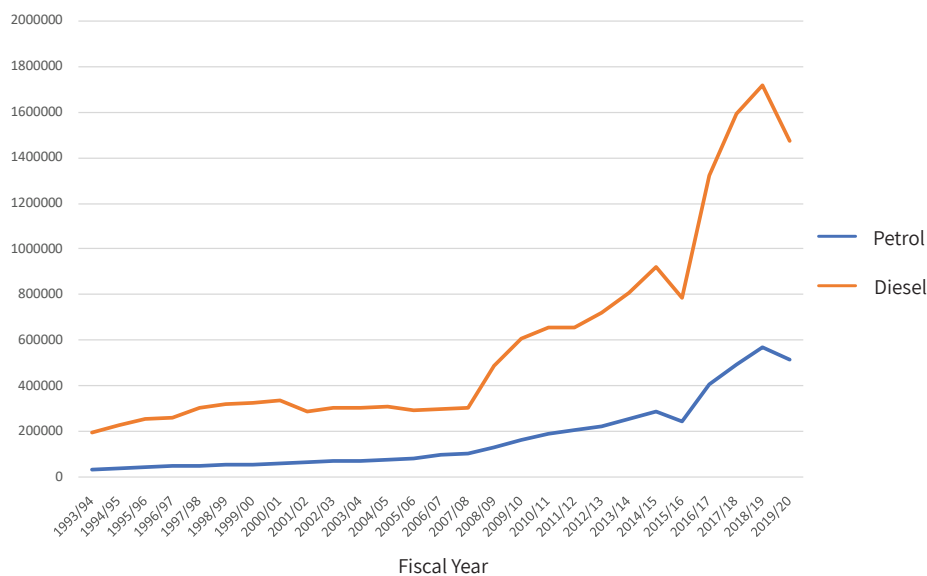
In 2018/19, petroleum oil contributed 18.8% to the total energy consumption, compared to 8.2% in 2004/05. Transport consumes about 63% of total imported petroleum oil.¹¹ Approximately one-third of the energy in the transport sector is consumed by vehicles registered in the Kathmandu Valley

(Bagmati Zone) alone: this accounts for 50% of the national petrol consumption and 27% of the national diesel consumption in the valley.¹² Diesel consumption is 3–3.5 times the petrol consumption. Freight and public transport are the major consumers of diesel, while cars and motorcycles are the major consumers of petrol.

Transport is one of the major contributors to urban air pollution. Air pollution is one of the biggest public health risks in Nepal. The WHO estimates 21,908 deaths in 2016 are attributed to ambient air pollution.¹³

In the Kathmandu Valley—one of the most polluted cities in the world—the level of fine particulate matter daily PM2.5 level is 3–5 times higher than the National Ambient Air Quality Standards,¹⁴ which

Import of Petroleum Fuels in Nepal, 1993/94-2019/20



Source: Nepal Oil Corporation

- 10 TseringNgodup Lama. 'Electric Vehicles Are the Future of Mobility, but Is Nepal Ready?' The Kathmandu Post, 26 October 2019. <https://kathmandupost.com/37/2019/10/26/electric-vehicles-are-the-future-of-mobility-but-is-nepal-ready>.
- 11 'Energy Sector Synopsis Report'. Kathmandu, Nepal: Water and Energy Commission Secretariat (WECS), 2010.
- 12 Pankaj Sadavarte, MaheswarRupakheti, Prakash Bhawe, Kiran Shaky, and Mark Lawrence. 'Nepal Emission Inventory – Part I: Technologies and Combustion Sources (NEEMI-Tech) for 2001–2016'. Atmospheric Chemistry and Physics, 18 October 2019. <https://doi.org/10.5194/acp-19-12953-2019>.
- 13 World Health Organization, 2018. <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/ambient-air-pollution-attributable-deaths>
- 14 Khem Bahadur Karki, PurushottamDhakal, Srijan Lal Shrestha, Hari Datt Joshi, Krishna Kumar Aryal, Anil Poudyal, SajanPuri, et al. 'Situation Analysis of Ambient Air Pollution and Respiratory Health Effects in Kathmandu Valley, 2015'. Kathmandu, Nepal: Nepal Health Research Council, 2016.

means up to 13 times higher than the updated WHO guidelines. Diesel vehicles (truck and public transport) are the major sources of fine particulate matter (PM_{2.5}) and black carbon (BC). On the other hand, private vehicles (largely petrol) emit significantly higher amounts of carbon monoxide (CO), methane (CH₄), and non-volatile organic compounds (NMVOCs) compared to diesel vehicles (freight and public transport).

Nepal's commitments and policies related on decarbonizing transport

Aligning with “The Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5°C”, Nepal has pledged to reduce its carbon emissions and reach net-zero by 2045 in its Long-term Strategy for Net-Zero Emissions.

The second Nationally Determined Contribution (NDC) (2020) targets to increase sales of e-vehicles to cover 25% of all private passenger vehicle sales (including two-wheelers) and 20% of all four-wheeler public passenger vehicle sales (excludes e-rickshaws and e-tempos) by 2025, and 90% of all private passenger vehicle sales and 60% of all four-wheeler public passenger vehicle sales by 2030. These targets are estimated to reduce emissions from a projected business as usual of 3,640 Gg CO₂ eq. in 2030 to 2,619 Gg CO₂ eq., which is around 28% decrease in emissions. The NDC also includes plans to develop 200 km of the electric rail network by 2030, and to operate electric public transport in at least three provinces. It also says, by 2025, all metropolitan cities will have roads paved with bicycle and pedestrian lanes.

In 2013, Nepal formulated the Environment Friendly Vehicle and Transport Policy (2013), which is the guiding policy document for promoting electric mobility. It includes targets to increase the electric vehicles share to 20% by 2020 (which wasn't achieved; less than 1% vehicles are electric), and policies to encourage conversion of fossil fuel vehicles to electric ones, provide tax exemption

for encouraging use of electric vehicles, and build charging stations and cycle lanes. The revised National Climate Change Policy (2019) envisions to “promote green economy by adopting the concept of low carbon emission development”. The National Environment Policy (2019) and National Transport Policy (2001) also support promoting electric and sustainable mobility.

The Fifteenth Plan (2019/20–2023/24) emphasizes the use of sustainable and environment- friendly vehicles, including prioritizing a bus rapid transit (BRT) system and electric vehicles usage. The Ministry of Energy, Water Resources and Irrigation's White Paper (2018) targets that half of the vehicles imported in the country to be electric ones by 2023 to encourage the usage of electricity.

Setting higher ambition than the NDC targets, the federal fiscal budget 2021/22 has adopted the policy to phase-out light duty fossil fuel vehicles and switch to electric ones by 2031. It also includes a plan to build 500 charging stations throughout the country in a year, give renewal and road taxes exemption for 5 years to vehicles that have been converted from internal combustion engines to electric, operate a minimum of 100 electric buses in the Kathmandu Valley, and provide financial support to develop electric public transportation in major cities. As a part of its policy to replace fossil fuel vehicles by 2028, the Bagmati province in its fiscal budget 2021/2022 plans to introduce electric buses, build charging stations, and promote electric vehicles in the province including in government offices.

Even though the government has several policies and plans in papers that support electric mobility, it has largely failed to implement them. The government has been allocating budget to purchase electric buses since 2018 but it has not materialized. There are policies, plans, and actions that are incoherent and conflicting. In its first NDC, Nepal committed to reduce its fossil fuel consumption by half by 2050 but contrary to it, Nepal built a

petroleum pipeline from India undermining its own climate commitment. Achieving NDC targets and implementing policies require sincerity and political leadership.

Pathways to decarbonizing transport

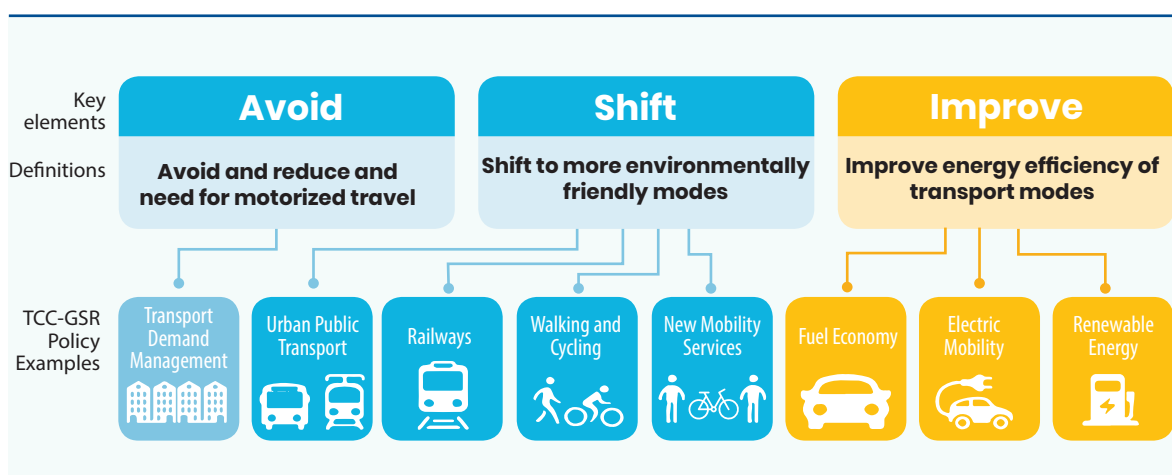
In order to curb carbon emissions, urban air pollution and increasing reliance on imported fossil fuels, and improve the country’s economy, Nepal needs to move towards decarbonizing the transport system. Electrifying transport through a clean, renewable energy mix will be the key to low-carbon development pathways. However, as the “SLOCAT Transport and Climate Change Global Status Report – 2nd edition” points out, “electric mobility is not a silver bullet for transport decarbonization and requires a holistic notion of sustainable mobility.” Nepal has an opportunity to achieve its Sustainable Development Goals and climate commitment, strengthen the economy, and improve the quality of life by moving away from fossil fuel dependent transport regimes and prioritizing the most efficient mobility system.

However, transformation of the country's transport system is not just about the environment, it should also address inequality in mobility access, road safety, and congestion to create just mobility systems. Achieving the transformation will require reducing both transport emissions and private vehicle dependency. Sustainable urban planning is essential to reduce transport demand, thereby transport emissions and cost, and also to make transport systems climate resilient.

The transformation should create more jobs and protect the livelihoods of those dependent on the existing transport regime. These require comprehensive transport (and low-carbon development) policies that combine social, economic, and ecological goals, which are integrated to overall sustainable development agendas.

The Avoid-Shift-Improve Framework (ASIF) provides an approach to reduce transport emissions as well as to achieve a comprehensive sustainable mobility. The country’s pathways to achieve transport decarbonization are described below:

Avoid-Shift-Improve Framework on Sustainable Mobility and Transport Decarbonization



Source: SLOCAT

The electric mobility policy's priority should be on public transportation, not on private vehicles.

The government policies and dialogues on electric mobility are largely focused on electric cars. Such mobility plans fail to address mobility inequity, traffic congestion, spatial inequality, road fatalities, and inequitable allocation of resources for road infrastructures. The government's priority should be not on electric private vehicles but on promoting electric public transportation, which will provide an array of social and economic co-benefits. Improving public transport also means making transport gender-friendly and accessible for low-income communities, women, young and elderly people, and people with disabilities. Reducing the dependency on private vehicles, which is the least efficient transport mode, should be at the crux of the electric mobility policies and plans.

For reducing transport emissions from the current level, Nepal should set targets that are more ambitious than those included in the NDC. Nepal should restrict import and new sales of fossil fuel private vehicles by 2030 as suggested in the 2021/22 fiscal budget policy and set a timeline to phase-out existing fossil fuel private vehicles. New registration of fossil fuel vehicles for urban public transportation should be banned by 2025 and target to make public transport 100% electric by 2030.

Rapid decarbonization of the transport system requires the government to invest massively in electric buses and their infrastructure, rather than just relying on the private sector to fund as well as to operate as is the case today. For bigger cities like the Kathmandu Valley, an electric Bus Rapid Transit (eBRT) system can provide a high-quality, efficient, and cost-effective public transport service compared to other mass transit systems. BRT is a long-term mobility solution for the city that can be built in a short period of time, within 2–3 years. eBRT will not only help to reduce the city's air pollution, but will also provide affordable, high-quality, inclusive, and gender-friendly public transport service. Whereas

in smaller cities and towns, *safa tempos*—the country's ingenuity in providing public transport service in the Kathmandu Valley since 2001—could provide zero-emission public transport service, as well as feeder service in bigger cities.

According to the Global BRT Data, 176 cities around the world have BRT systems with a total length of over 5,300 km. Many other cities, especially in developing countries, are currently constructing or planning BRT systems. The BRT system in Jakarta (TransJakarta)—the largest BRT system in the world with a system length of 251 km—has over a million daily ridership and serves 83% of the city's residents. It is currently piloting electric buses and planning to upgrade its fleet to 100% electric by 2030. Shenzhen is an exemplary city in the world in electric mobility: the city entirely runs on electric buses of over 16,500 fleets, becoming the world's first city to run fully with electric buses. It also has over 22,000 electric taxi fleets serving the city.

Decarbonizing freight transport is challenging but important. Freight transport (truck, tanker, pickup van) is overlooked in transport and environmental policies, although it is the major source of transport carbon emissions and air pollution in the country. Thus, the strategies to decarbonize transport should take freight emission into account.

In urban areas, fossil-fuel freight can be phased-out by 2030 with electric, electric-assist, and pedal-only cargo vehicles. For longer freight transport, improving vehicle emission standards and fuel economy in freight industry—which are low-cost strategies— as well as alternative modes such as electric railway as included in the government plan will help to reduce the emission. Trade, import, industrial, and other economic policies will also determine freight transport emission. Thus, strategies to reduce the freight transport emission should look beyond just improving fuel efficiency of the vehicles to comprehensive trade and economic policies.

Promoting walking and cycling should be the priority in low-carbon transport plans and strategies.

In urban areas, promoting walking and cycling can play a significant role in reducing car and motorbike travel. Besides reducing transport emission, walkable and cycle-friendly cities offer a variety of co-benefits: improved public health, better air quality, reduced traffic congestion, social equality, safer roads, and economic gains. They eventually improve the overall quality of life in cities. Now with electric assist bicycle technology, more people can comfortably travel longer distances and with bicycle-sharing systems, more people have access to cycling.

Many cities around the world are integrating walking and cycling in their transport and climate change policies and plans. Copenhagen is one of the exemplary cities, which has pledged to become carbon-neutral by 2025 and increasing cycling mode share is one of its key strategies to achieve the goal. An important lesson: the city has strategically tied cycling with the idea of the city's livability. Currently, 62% of Copenhagen residents use bicycles to work or school.

A 2011 study¹⁵ shows that the average trip distance of private vehicles in the Kathmandu Valley is 5 km and 90% of walking and cycling trips finish within 30 minutes, which means the majority of the city's motorized trips can be easily substituted with walking and cycling. Currently, Kathmandu has very low cycling mode share, 1.5%, and Tarai cities have higher cycling mode share. The city governments should aim to achieve 20-25% cycling mode share by 2030 in their cities.

Increasing walking and cycling share will require investment on safer pedestrian and cycling infrastructures, redesigning roads to make it people-centric, and embracing Transit Oriented Development planning, as well as building the

government's institutional capacity to implement them. The T4<2° report also suggests that “public transport, active modes of transport, shared mobility services as well as sustainable urban planning will be the backbone of climate-friendly urban transport. Therefore, investments in public transport along with the promotion of cycling and walking have to be prioritized.”

Increasing share of renewable energy in the country's energy mix is essential to meet the future electricity demand and make the energy system resilient.

Electrifying Nepal's transport systems means a large demand for electricity. Just to transform existing public transport fleets to electric, the country will require roughly 5,800 MW of electricity, which is equivalent to 13 Upper Tamakoshi Hydropower projects—the largest hydropower in Nepal. Much more electricity will be required to power personal mobility (cars and motorbikes) and freights and to cater future transportation demand.

Renewable energy from decentralized—not large-scale concentrated power plants—can play a major role to meet the future electricity demand in transport sector. The advantages of a renewable energy system are that it can be installed in a shorter time-period, can engage individuals, institutions, and communities to generate the energy, and can lessen the burden on the national grid through a decentralized energy system. Most importantly, Nepal needs to adopt an energy-mix policy by diversifying its energy source —rather than relying on hydropower-dominated systems—for energy resiliency and future energy security by aggressively deploying mainly solar, wind, and bio-energy. Nepal needs to move away from building large hydropower projects, which not only have large social, economic, and environmental impacts, but are also vulnerable to earthquakes, GLOFs, floods, droughts, and other climate disasters in the longer run.

15 'Final Report: Data Collection Survey on Traffic Improvement in Kathmandu Valley'. Japanese International Cooperation Agency, Ministry of Physical Infrastructure and Transport, 2012.

India is planning to produce a renewable energy capacity of 500GW by 2030 and also upgrading its grid system to accommodate transmission of electricity from renewable energy. More than half of the Delhi metro train power consumption is now supplied by solar power. In Turkey's Izmir city, 835KW of solar power is installed on the rooftop of a bus workshop to power 20 electric buses.

An ambitious long-term renewable energy target with a clear comprehensive policy framework will encourage private sector investment in renewable energy. Upgrading the current infrastructures such as grid (and its management), transmission lines, storage, net-metering system is crucial to support renewable energy generation and distribution. However, the renewable energy projects should not spawn arable land grabbing (rather they should cooperate with farmers to generate renewable energy), clearance of forests, displacement of people, or any other social and ecological impacts, as usually done by large hydropower projects. Decentralized renewable systems, with rooftop solar PV, and wind power (in some regions) in the country's energy mix are crucial to just energy.

Biogas from municipal waste can power cities' public transportation. Cities have the opportunity to produce biogas from their municipal waste and sewage sludge and use it to power public transport. This will help not only to reduce dependency on imported fossil fuel but also help to manage municipal waste and reduce methane emission from landfills. Agriculture residue could also be used to generate biogas and electricity, which in turn will also help to mitigate air pollution from agricultural residue burning.

Many European cities are successfully running bus fleets fueled by biogas or biomethane from municipal waste that has helped to reduce transport carbon emissions. Sweden is a pioneer for using biogas in transport: more than 30 municipalities use biogas to power public buses and taxis. Karachi city in Pakistan is also implementing a Bus Rapid

Transit (BRT) system using biogas-powered buses with the financing from the Green Climate Fund and Asian Development Bank.

Prioritize regulations over fiscal incentivization for rapid transformation of transport. Nepal has so far focused on promoting electric mobility through reducing fiscal taxes, which hasn't yielded desirable results. Public subsidies and fiscal policies and taxes are important but not enough. The regulation to impose 100% ban on the import and sale of fossil fuel-powered private vehicles and to electrify public transport and urban freight would only be able to transform the transport system. The T4<2° report also recommends that "decision-makers have to prioritize regulatory action over incentivization and thereby provide a sound political framework for transformation of transport."

Radical transformation of Nepal's transport system requires restructuring of existing institutions and mobilizing city governments. Many policies and plans in Nepal support electric mobility and sustainable transport but they are not translated into actions. The failure to implement the policies and plans can be attributed to lack of political leadership and accountability, top-down planning, ineffective institutional setup, lack of coordination among the agencies, and failure to reflect policies in the fiscal plans and budgets.

The implementing agencies or departments under the Ministry of Physical Infrastructures and Transport do not have a mandate and an institutional framework to plan and implement sustainable transport systems and electric mobility. Implementing ambitious targets on transport decarbonization requires a strong institution with supportive institutional framework and adequate resources. However, rather than forming a new agency or authority at federal level, the Ministry should set up a dedicated unit within and restructure the Department of Roads and Department of Transport Management with an institutional structure and clear mandate to work

on electric and sustainable mobility. They need to divert from their traditional roles focused on building roads and licensing vehicles.

Most importantly, the role of local governments will be crucial for transforming transport as well as for revolutionizing renewable energy. In cities around the world, it's largely the city governments, not the federal or national governments, that plan, fund, manage, and even operate the public transport system and build transport infrastructures, including walking and cycling infrastructures. However, the local or city governments—which currently lack institutional structure, resources, know-how to work on transport require support and funds from the federal level to plan and implement electric mobility, especially public transportation, and to build walkable and cyclable cities. Most importantly, the jurisdiction over roads and transport should be handed to the local or city governments.

The Environment-friendly Vehicle and Transport Policy (2013) has envisioned 'Environment-friendly Vehicle and Transport Coordination Committee' under the Ministry of Physical Infrastructure and Transport, but it is yet to be formed. The formation of the coordination committee making it inclusive of provincial governments would help coordinate among different agencies including federal and local governments. The envisioned working committees at central and local level would be helpful to implement the policies and plans at local level. Partnership between federal, provincial and local governments is important for effective and rapid implementation of transport decarbonization plans.

A long-term program with a dedicated sustainable fund is required to accelerate electric mobility. Rather than relying on fiscal policies and plans, which are often short-term, unpredictable, and undirected, a long-term program helps to

ensure the clear pathway to electric mobility and create confidence among stakeholders. A dedicated sustainable funding mechanism is a prerequisite for the smooth implementation of the long-term electric mobility plans. The Environment-friendly Vehicle and Transport Policy (2013) has also provision to establish an 'Environment-friendly Vehicle and Transport Development Fund', which is yet to be realized. The fund can be established with existing tax regimes such as pollution tax, road tax, vehicle tax, including additional novel funding sources. Nearly NRs. 10 billion raised from each liter of petrol and diesel sold as a pollution tax has remained unutilized.¹⁶

Especially in electric public transport regulations and tax incentives need to be complemented with investment from the government because of its high capital cost. The rapid development of sustainable mobility and electrification of urban public transport systems will require the federal government to support city governments financially and technically to implement the plans. Moving away from allocating its fiscal transport budget entirely for roads, the government should ensure that the majority of the transport budget is allocated for the plans that support a sustainable, environment-friendly, and equitable transport system.

Leveraging international and private sector funding helps to provide additional support for sustainable mobility and renewable energy development. Decarbonizing the transport system and scaling up renewable energy requires a huge investment. The multilateral development banks (MDBs), bilateral development funds, and other international funds are increasingly supporting climate mitigation projects that also include transport decarbonization and renewable energy development, which Nepal can cash in on. In 2016, the eight largest MDBs reportedly provided USD 4.7 billion to climate finance for mitigation in the

16 'Editorial — Use the Fund Properly'. The Himalayan Times. 26 August 2021.

transport sector, representing 22% of the total mitigation finance of USD 27.4 billion.¹⁷ Some of the major International Climate Finance Instruments that Nepal can leverage are: the Green Climate Fund (GCF), Clean Development Mechanism (CDM), the Clean Technology Fund (CTF), the Global Environment Facility (GEF), and Nationally Appropriate Mitigation Actions (NAMA).

Decarbonizing transport should go hand in hand with making it climate resilient. On the one hand, transport contributes to carbon emissions, while on the other, transport infrastructures are vulnerable to climate change. And the health of a country's transport system will determine resilience of the

communities and economies. In Nepal, transport system will be directly and indirectly impacted by various climatic disasters such as floods, GLOFs (glacier lake outburst floods), landslides, storms, extreme temperatures, etc.

Thus, low-carbon development pathways should take into account making transport infrastructures (road, bridges, charging stations, depots, bus stations, etc.) and services resilient to climate change. Powering the transport system with a mix of renewable energy rather than just hydropower will also help to make resilient transport system for the future.

17 Sudhir Gota, Cornie Huizenga, and Karl Peet. 'Implications of 2DS and 1.5DS for Land Transport Carbon Emissions in 2050'. Partnership on Sustainable Low-carbon Transport (SLoCaT), November 2016. <https://slocat.net/publications/land-transport-carbon-emissions-2050/>.

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