FOR PARTICIPANTS ONLY 18 October 2021 ENGLISH ONLY

UNITED NATIONS CENTRE FOR REGIONAL DEVELOPMENT

In collaboration with

Asian Development Bank Ministry of the Environment, Government of Japan United Nations Economic and Social Commission for Asia & the Pacific

HIGH-LEVEL 14th REGIONAL ENVIRONMENTALLY SUSTAINABLE TRANSPORT (EST) FORUM IN ASIA

18-20 OCTOBER 2021 Tokoname City, Aichi, Japan

Decarbonizing Land Transport in Asia – Policy Options, Institutional Arrangements, Financing Options and Technological Interventions (Background Paper for EST Plenary Session-1)

Final paper

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Decarbonizing Land Transport in Asia: Policy Options, Institutional Arrangements, Financing Options and Technological

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Interventions

14th Regional EST Forum in Asia November 2021, Aichi, Japan

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Acknowledgements

This background paper has been prepared by Mr. Holger Dalkmann, for the 14th Regional EST Forum in Asia. The paper was benefited from Mr. Nikola Medimorec, and Mr. Karl Peet significant.

The author would like to thank Dr. Ganesh Raj Joshi (UNCRD), Mr. CRC Mohanty (UNCRD), and Joanne Green for their helpful reviews and guidance.

Chapter 1: Introduction and Background

This year's Conference of the Parties (COP26) plays a fundamental role in the fight against climate change. Five years after the Paris Agreement, delegates from up to 197 countries will meet in Glasgow (United Kingdom). They will take stock of the progress made to reduce GHG emissions to reach net carbon neutrality by 2050 and keep global warming well below 2 °C by the year 2100. In 2015 in Paris, the countries committed to submit their updated National Determined Contribution (NDC) every five years to show their ambition and plans to tackle climate change. Unfortunately, so far, these efforts are not sufficient to reach the agreed targets. In its latest report, the IPCC (2021) shared the latest evidence on human induced climate change resulting from the increase of GHG emissions over the last decades. They concluded that each of the last four decades had been warmer than any decade preceding since records began in 1850. With a likely global surface temperature increase already in the range of 0.8 to 1.3 °C during the period 1850 to 2019, the announced target within the Paris Agreement from 2015 of 1.5 °C will be very hard to achieve.

Transport currently accounts for 23 % energy related CO₂ emissions and 30% of global final energy demand and thus is a key sector, which needs to be targeted for decarbonisation (SLOCAT, 2021). Despite all global efforts, transport emissions have increased faster than any other sector in the last decade. The impact of transport emission reductions due to the pandemic has demonstrated the level of change needed to reach annual emissions reductions to be aligned with the Paris objectives. According to UNEP (2020) an annual reduction in CO₂ emissions from transport of 7.6 % is needed to be on a pathway to decarbonisation this decade. This is exactly the amount of emissions globally reduced during COVID-19. However, while certainly some enhanced COVID-19 related actions such as teleworking and improvement of walking and cycling infrastructure are part of a future solution, the short-term reduction was not sustainable, and we already observe that transport emissions are on pre-COVID-19 levels.



Figure 1: Transport CO₂ emissions emitted by region and country in relation to GDP per capita, 2019

Note: The size of the square represents the amount of CO_2 emitted (the bigger square the more CO_2) and the color reflects the GDP per capita (the darker color the higher the GDP per capita).

Asia is a key region to consider to target to tackle climate change, accounting for 39% of global GDP and responsible for 38% of global transport emissions. Asia has also seen the highest growth of transport related CO₂ emissions between 2010 and 2019 among all global regions. Figure 1 shows transport CO₂ emissions emitted by regions and countries in 2019. This shows that Asian countries (led by China and India) have very high transport CO₂ emission levels despite lower GDP per capita.

The 14th Environmental Sustainable Transport Forum (EST), to be hosted by UNCRD in Japan in October 2021, will be a crucial event at which to identify options for the region to decarbonise transport. The conference this year, entitled "Next Generation Transport Systems for Achieving SDGs and Carbon Neutrality – for a Safer, Affordable, Accessible and Resilient Asia", will identify and discuss opportunities for changing the course of Asia's transport sector for achieving 2030 Agenda of Sustainable Development/SDGs, and Paris Agreement on climate change.

This paper presents some of the latest data on climate and transport in Asia and will lay out policy options to decarbonise the sector. The paper is based on data and information collected by the SLOCAT Partnership on Sustainable, Low Carbon Transport as recently published in the SLOCAT Transport and Climate Change Global Status Report – 2^{nd} Edition (2021) and the Asian Transport Outlook (ATO) (2021).

Chapter 2 will describe the status quo of key transport and emission related indicators and show that, besides the short-term emission reduction due to the impacts of the COVID-19 pandemic, the Asian transport sector is not on track to decarbonise. Chapter 3 will highlight the scale of the challenge that the region is facing to decarbonise transport and will share the ambition, but also the shortcomings of the current transport related commitments within the National Determined Contribution (NDCs) of selected Asian countries. Building on the analysis in Chapter 2, Chapter 4 will present selected policies addressing the major drivers of transport growth such as greening freight, renewable electrification of transport and managing motorisation will be shared by using some successful Asian case studies. Chapter 5 closes the paper with some recommendations to the EST Forum on how to enhance the national adaptation of those polices in the coming decade. It is important to note that while urban transport, international aviation and shipping are key sources of emission, this paper focuses on trends and policy options for national policy makers and therefore these sectors are not in the focus of this paper. However, several described policy areas, like managing motorisation and electrification will have a significant impact on improving the situation in cities and reduce their local carbon footprint.

Chapter 2: Status quo of transport and climate in Asia

To identify policy solutions to move towards decarbonising transport in Asia, there is a need to better understand the status-quo of transport and climate related data in the region. This chapter shares first some information on CO_2 emissions followed by an analysis of transport related information.

2.1 CO_2 Emission trends: Rapid increase with short-term unsustainable reduction due to COVID-19

The largest transport emitters in Asia are China, India, Indonesia and Japan¹. In 2020, global transport CO_2 emissions dropped 19.4% below ²2019 levels due to the pandemic, the biggest decrease of any sector; however, this decline is projected to be short-lived. China and India experienced declines of 12.5% and 13.8% respectively. (SLOCAT, 2021) Figure 2: Per capita transport CO_2 emissions in Asia, 2019 (SLOCAT, 2021)





¹ SLOCAT calculations based on M. Crippa et al. (2020), Fossil CO₂ Emissions of All World Countries, JRC Science for Policy Report, Publications Office of the European Union, Luxembourg, <u>https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/fossil-co2-emissions-all-</u> <u>world-countries-2020-report</u>

² Reductions compared to 2019:56.4% in international aviation; 31.9% in domestic aviation; 24.8% in international shipping; 14.6% in ground transport (road and railways) (SLOCAT 201)

shows the per capita transport emissions. The three highest emitting countries per capita are all oil producing countries which provide a high level of gasoline subsidies. The high dependence on road transport in those countries explains their high level of emissions.

Figure 2: Per capita transport CO₂ emissions in Asia, 2019 (SLOCAT, 2021)



Transport CO₂ emissions per capita, 2019

In the last decade Asia had the largest increase in transport related CO_2 emissions globally with an increase of 41% compared to a global increase of 17%. While the Higher Income Countries (HIC) in Asia such as Japan, Singapore and Korea either had a modest increase or even a reduction of transport related CO_2 emissions, other emerging economies increased their emissions due to strong economic growth and an increase in freight activity as well as through increased private vehicle motorisation (see Figure 3). However, these countries still have a lower per capita emission rate than the Asian HICs. Asia, with overall average emissions of CO_2 of 0.57 tonnes per capita had three times lower transport CO_2 emissions per capita than Europe (1.64 tonnes) and ten times less than the USA (5.35 tonnes). (SLOCAT, 2021) To keep the global temperature rise below 1.5 °C, total annual transport CO2 emissions must drop globally to 2-3 Gt, which means reducing per capita transport emissions from 0.88 tonnes in 2019 to 0.2 tonnes in 2050 (SLOCAT, 2021).



Figure 3: Change in transport emissions in selected Asian countries, 2010-2019

Change in transport CO₂ emissions, 2010-2019

Source: SLOCAT 2021

The vast majority of the transport related CO₂ emissions are from road transport. Amongst EST countries, 88% of emissions are from transport which is 12 percentage points higher than the global share. Inland waterways and shipping and aviation represent only half the emission share compared to the share in global transport emissions (see Figure 4).

Figure 4:Transport CO₂ emissions by mode, 2018



Source: ADB, Asian Transport Outlook (ATO ATO indicators CLC-VRE-054, CLC-VRE-055, CLC-VRE-056, CLC-VRE-057, based on EDGAR v5.0 Global Greenhouse Gas Emissions

2.2 Transport trends: Freight and motorisation the main causes for increased \mbox{CO}_2 emissions

Almost half of CO_2 emissions from the road transport in Asia are caused by the freight sector and this sub-sector therefore requires more political attention. The share of emissions in the different countries, however, varies enormously. In 2010 more than half of the transport related emissions in India came from freight, China 43%, while Pakistan only 29% and the island state of Indonesia only 16% (IsDB 2019). Overall, railway freight's share of inland transport freight activity decreased in the majority of Asian countries, falling from 63% during the period 1990-2000 to 42% in 2018 (the global average for 2018 is 27%).³

Future action on decarbonisation in the passenger transport sector is needed not only to the urban transport sector with a share of Asian transport emissions of 17.7% in 2015, but also to the non-urban passenger transport with 24% of the transport emissions (ITF, 2019).

In last year's EST contribution by Dalkmann (2020), three major sources for CO_2 emission growth were identified: motorisation, freight and urban transport. The latest trends for these sources will be described below.

Car ownership is one of major drivers for the CO₂ increase in Asia. As Figure 6 shows there is large increase in Asia's car ownership with a rate of 87% from 2005 to 2015 (latest available data), more than three times the global average (SLOCAT, 2021). With China, India and Indonesia the countries with the highest population in the country doubling respective tripling the ownership. However, those countries all still just lower or close to the Asian average of 100/vehicles per capita and therefore a substantial continuous increase is expected. In contrast HIC countries in Asia are close to a car peak, for example Japan and Singapore saw almost no ownership increase over this period as despite economic growth, both countries put new policies towards sustainable transport in place (see the following chapters). However, the model of individual car ownership seems still a desire of part of the Asian population. This is also shown by the latest numbers on new passenger vehicles sales in Asia:

- 33% increase in new passenger car sales (2010-2019)
- Over 35 million new passenger cars sold (2019)

The trend also shows that sales from higher emitting private vehicles are rapidly growing. Sport Utility Vehicles (SUVs) were the biggest driver of transport emissions between 2010 and 2018, contributing 533 million tonnes of CO_2 during this period. In China and India the share of SUV sales of annual passenger car sale increased from 14% to 44% and 11% to 34% respectively between 2010 and 2019s (SLOCAT, 2021).

Another important aspect is the role of second hand cars. Particularly in Lower Income Countries (LICs) in Asia, imported used vehicles account for a high share of car ownership (e.g. Bangladesh, Cambodia, Myanmar, Pakistan and Sri Lanka), contributing to declining air quality and increasing congestion.

³ <u>http://slocat.net/wp-content/uploads/2021/06/4.-Rail-Freight-Mode-Shift-Policies-in-Asia.pdf</u>



Figure 5: Car ownership rate per 1000 people in Asia, 2005-2015

Figure 6: Growth in car ownership in Asia, 2005-2015



At the same time, the use of two-wheelers is increasing at a much faster speed than cars. The world's largest motorcycle fleets are in China, India, Indonesia, Pakistan and Vietnam. Figure 7 shows the increase of motorcycles and two-wheelers in India with 149% increase and Vietnam of 80% between 2010 and 2019.

Figure 7: Change in motorcycle fleet in India and Vietnam, 2010-2019 (SLOCAT 201)

J	3					
	Total registere	d two-wheelers in India (r	nillion units)		000	050
0 0 0	50	100	150		200	250
2010						-
2011						
2012					Cha	ange from
2013					201	0 to 2019:
2014						149%
2015						//
2016						9
2017						
2018						
2019						
	Total registere	d two-wheelers in Vietnar 20	n (million units) 30	40	50	60
2010						
2011					-	
2012					Cha 201	ange from
2013					201	2019. 20%
2014						00%
2015						
2016						
2017						
2018						
2019						

S. CCAT Transport and Climate Change Global Status Report - 2nd edition www.tcc-gsr.com

Figure 6. Change of motorcycle fleet in India and Vietnam. 2010-2019

Inter-city passenger transport accounts for roughly a third of total transport emissions due to longer distances and fewer public transport options. (SLOCAT, 2021). In Asia inter-city railway development has been focussed on only a handful of countries (e.g., half of the global high-speed rail network is in China). (SLOCAT, 2021)

2.3 Sustainable development trends: Air-quality, road safety and economic improvements: The need for an alternative narrative towards green growth and public health

While Asian countries are committed to reducing the impact on climate change and therefore trying to reduce the CO_2 emissions from transport, it could be argued, that the per capita emissions are still lower than in HICs and that there is a historical responsibility of those countries contributing to climate change over decades. While the urgency requires all countries to act, other benefits of a decarbonisation pathway might help to convince countries to act.

According to the World Health Organisation (WHO) estimates, exposure to hazardous air pollution causes 7 million premature deaths annually (WHO, 2018). Approximately 90% of these deaths occur in low and middle-income countries, with about one-third of these, i.e. 2.2 million deaths occurring in Asia-Pacific region (WHO, 2016). Further, WHO Guidelines also indicate that only 8% of the total population in Asia-Pacific live in conditions where the air quality does not pose significant health risks. Furthermore, WHO database documenting 4300 cities and settlements worldwide suggests that 97% of the cities with more than 100,000 inhabitants in LMICs fail to meet WHO air quality guidelines, thereby positioning air quality management as primarily an urban challenge.

Table 1: Annual mean PM10 and PM2.5 levels in selected capital cities in Asia-Pacific (Source: UN-Habitat & ESCAP, based on WHO Ambient Pollution in Cities Database, 2014)

Particulate matter type		PM ₁₀		PM _{2.5}	PM _{2.5}	
City	Country	Annual mean, µg/m³	Year	Annual mean, µg/m³	Year	
Delhi	India	286	2010	153	2013	
Kabul	Afghanistan	260	2009	86	2009	
Dhaka	Bangladesh	180	2013	86	2013	
Ulaanbaatar	Mongolia	148	2010	68	2013	
Beijing	China	121	2010	56	2013	
Kathmandu	Nepal	114	2008	50	2013	
Tehran	Iran	91	2010	30	2013	
Hà Noi	Viet Nam	86	2009	39	2013	
Colombo	Sri Lanka	64	2010	28	2013	
Seoul	Republic of Korea	49	2010	22	2013	
Metro Manila	Philippines	49	2010	22	2013	
Jakarta	Indonesia	48	2010	21	2013	
Bangkok	Thailand	38	2012	20	2013	
Singapore	Singapore	27	2011	17	2011	
Wellington	New Zealand	13	2012	6	2011	
Canberra	Australia	12	2012	7	2012	

Note: Recommended WHO standards for PM_{10} and PM_{25} are 50 and 25 $\mu\text{g/m}^3$ respectively.

The most deteriorated air quality conditions are observed in the megacities in Asia, as highlighted in Table 1. In these cities, the levels of pollutants, especially Particulate Matter (PM 2.5 and PM 10), exceeds 4 to 6 times the safe standards recommended by WHO (UN-Habitat and ESCAP). Diesel vehicles have the potential to reduce transport sector CO_2 emission. However, they also emit the highest proportion of particulate matter (PM1.0 and PM2.5) and black carbon and cause the highest health-related impacts (WHO, 2011).

The total number of road traffic crash deaths in the ATO economies⁴ continue to rise steadily, from 0.68 million in 2000 to 0.8 million in 2016. Since 2000, road traffic crash fatalities have reduced in about one-third of economies (mainly high and upper-middle-income economies). In ADB regional members, road traffic crash fatalities contributed about 3% of total deaths (it varies from 1.3% in Fiji to 4.3% in Malaysia) (SLOCAT, 2021).

Financing has not kept pace with growing needs for sustainable, low carbon transport in most cities and countries. Climate-focused transport spending has been overshadowed by "brown investments" in highways and other carbon-intensive transport infrastructure, with two-thirds of infrastructure investments (totalling USD 586 billion per year in the 50 largest economies) in 2015 going to road transport. On average, Asian economies have added about 380,000 kilometres of road infrastructure every year, most growth occurring in upper-middle income countries (SLOCAT, 2021) At the same time, rail investment in Asia is still much lower in comparison to the road sector and focused in places like China on High Speed Rail (ITF 2020). Fossil fuel subsidies to outpace renewable energy spending in transport budgets by orders of magnitude. In 2019, Asian countries spent nearly 34 billion USD for subsidising the use of

⁴ ATO economies cover the 51 regional members of the Asian Development Bank plus Iran and Russia. (ADB, 2021)

fossil fuels in the transport sector, that counts for about 44% of the global transport sector fossil fuel subsidy and 28% of the total fossil fuel subsidy across all sectors.⁵

Similarly, many COVID-19 recovery packages and bailout programmes have invested more heavily in fossil fuel-related companies than in clean energy, a trend that is likely to drive transport emissions upward.

With the increasing awareness of public health challenges and the importance of the economy, any future decarbonisation strategy needs to take these aspects stronger into account. Often climate is still seen by politicians as well as the public as an abstract threat, while direct impact to health through air quality and insufficient road safety and the key role of the economy by providing goods and services as well as job creation relate much stronger to the day to day decision making.

⁵ <u>http://slocat.net/wp-content/uploads/2021/06/11.-Status-of-Fossil-Fuel-Subsidy-in-Transport-Sector-in-Asia.pdf</u>

Chapter 3: Towards zero-carbon transport for Asia

The last chapter showed, that despite political efforts and some policy actions, transport related CO_2 emissions in almost all Asian countries are still growing. This chapter will show the scale of the challenge for Asian countries and will compare this with the current level of ambition in the countries latest submissions of the National Determined Contributions (NDCs).

3.1 Enormous scale reductions needed for Asian countries to be Paris aligned

As described in Box 1, ITF (2019) predicts, in its business-as-usual scenario, a global increase of CO_2 emissions, which is substantially driven by Asia's increase of freight and its motorisation, while for urban mobility a more positive projection is given through already established solutions.

Therefore, Asian countries need urgent actions to mitigate their emissions of greenhouse gases and to achieve the targets laid out in the Paris Agreement and the SDGs. Only a substantial transformation of the transport sector will bring Asian countries on a pathway to reach those targets.

The International Transport Forum (ITF), in their business as usual scenario, predicts a global increase of CO_2 emissions from transport by 60% by the year 2050 on the base year of 2015 (ITF 2019). ITF assumes that the main increase will come from freight. The largest increase of global surface freight demand is predicted for Asia. By 2050 Asia will be responsible for 56% of the global surface freight demand (ITF 2019).

According to a projection of mitigation measures by ITF, the prospects for CO_2 emission reductions has the highest potential from the urban mobility sector. In ITF's ambitious scenario (reducing CO_2 emissions from transport by 60% percent), the share of passenger kilometres in cities using private vehicles is reduced from 70% in 2015 to 40% by 2050. ITF assumes that shared modes (ride-hailing, bike sharing, e-scooter, etc.) will grow and account for over 20% of the total demand in cities. Public transport would have a modest increase from 30 to 35%. ITF predicts that these changes and an improvement in fuel efficiency of passenger cars would lead to a 20% reduction in CO_2 emissions by 2050 compared to 2015 though the passenger kilometres double.

ITF see personal motorisation as one of the major drivers increasing GHG emissions, contributing 24% of direct CO₂ emissions globally. ITF (2019) as well as the International Energy Agency (IEA, 2020) predict that the global car fleet will more than double from 1 billion to over 2 billion by 2050 while the average annual distance travelled is assumed to keep on the 2015 level. The largest growth is expected to be outside the OECD where Asia is covering the largest increase.

Source: Dalkmann (2020)

Box 1: ITF scenario (2019)

Building on existing scenarios such as from IEA, ITF and SLOCAT (2021) assumes an increase of 46% by 2035 and it could reach up to 80% by 2050 (see Figure 8). To reach an alignment with the Paris Agreement, transport emission growth in Asia needs to at least level off in this decade and then decline by up to 90% until 2050 (compared to 2020 levels) (see Figure 8). However, as indicated below in the latest analysis of the country's mitigation studies for

transport indicates, there is a need for a radical shift to move away from the current BAU towards decarbonisation of the sector.



Figure 8: Potential pathways for transport GHG emissions in Asia

3.2 Asian NDCs need to include enhanced transport targets and actions

A key part of the Paris Agreement on Climate Change is the so-called Nationally Determined Contributions (NDCs). Each national government is required to share their effort to reduce national emissions and adapt to the impacts of climate change (UNFCCC, n.d.).

Many first NDCs submitted to the UNFCCC in 2015 and 2016 contained only limited strategies on transport. Two exceptions to this in Asia were Thailand and Vietnam which had already developed their transport strategies before the NDC submission and were therefore able to share more details. Countries like Japan and Singapore created detailed transport policies after the initial submission and integrated those into their climate policy documents. Both countries benefited from the Bangkok Declaration on Environmentally Sustainable Transport approved by the EST Forum hosted by UNCRD. For example, Thailand's Transport Masterplan used the Avoid-Shift and Improve (A-S-I) Framework in their annual country report under the declaration as well as in a policy document referred to in the first NDC.

While there seems globally to be an increase of ambition and action in the new generation of NDCs, so far only 13 second-generation NDCs have set higher targets for reducing economywide emissions. A recent assessment estimates that current pledges would still lead to warming of 2.6 °C by 2100, far exceeding Paris Agreement goals.

The second generation NDC submissions from Asian countries show a commitment to contribute to the reduction of transport related CO_2 emissions as listed in Table 2, but do not achieve the scale needed as laid out in Figure 8. With one of the highest per capita transport emissions in the region, Japan repeated its initial transport target from its first climate plan submission, reducing by 27%. Countries like Bangladesh and Sri Lanka announced their reduction targets against a BAU projection. Some others shared their sub-sector targets, such as Fiji who plan to reduce their domestic shipping emissions by 40%.

Other countries did not define a specific transport or sub-sector transport target, but shared some action oriented policy goals.

For example:

- Brunei Darussalam aims for electric vehicles to represent 60% of total annual vehicle sales by 2035.
- Nepal aims by 2030 for 90% of private passenger cars and two-wheelers sold and 60% of public transport vehicles in operation to be electric.

While transport mitigation measures seem to gain increasing traction by Asian countries, the vast majority seem not to address the impact of climate change on the transport sector in their NDCs. As one of the few exceptions, Cambodia aims to develop climate-proofing road standards by 2022 and to implement them on all roads by 2030.

Country	Transport emission mitigation target		
Bangladesh	Reduction of 10.86% below 2030 BAU		
Fiji	Reduce domestic maritime shipping emissions by 40%.		
Japan	Transport emissions to be at 163 million tCO ₂ by 2030, 27% below 2013 levels (continuation from first NDC)		
Sri Lanka	4% reduction of transport emission compared to 2030 BAU (1% unconditionally, 3% conditionally)		

Table 2:	Transport-s	pecific GHG	emission	mitigation	targets
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Source: SLOCAT (2021)

While NDCs are a key policy document to bring all climate actions together and enable transparency and international accountability, recent work by the ADB has shown that many countries do not include all their climate related transport actions in the NDCs. At the same time there seems to be a policy gap at national level when it comes to overall transport plans. Therefore, there is not only a need for more specific climate related transport planning, but an overall vision and plan for transport, which should mainstream climate mitigation and adaptation at the same time.

Based on earlier publications (Dalkmann (2020, 2021), Bongardt (2019)) eight lessons can be learned for Asian countries for transport:

- 1. Create a long term vision aligning with shorter term policies for transport <u>and</u> climate.
- 2. Set specific transport related targets and SDG related sub-goals.
- 3. Create detailed policies which are part of the NDCs and align with the SDG goals.
- 4. Balance the transport decarbonising strategy to use AVOID, SHIFT and IMPROVE measures.

5. Identify specific challenges for the transport sector and create a transport related strategy for resilience.

- 6. Engage and coordinate with all ministries when formulating an NDC
- 7. Ensure the NDC is well communicated to the general public as well as all stakeholder groups
- 8. Ensure transport related policies are linked with other policies (e.g. energy)

Chapter 4: Policy actions to decarbonise transport in Asia

The previous chapter highlighted the importance of climate and transport policy targets and the need for a clear integrated vision realising the long-term decarbonisation of the sector. While a vision and targets are the foundation for decarbonising transport in Asia, policies are needed to be in place to ensure that countries can start their transition towards decarbonisation of the sector. To create such a roadmap, it is crucial to understand the national situation and to identify the main policies which need to be put in place. Data and policy collation initiatives like the Asian Transport Outlook (ATO)⁶ by the ADB (2021) and fora like the annual EST Forum, can help countries to shape their own strategies and learn lessons from other countries. In chapter 2 the main key areas for urgent action to decarbonise transport in Asia were identified. This chapter reflects on policy options arranged in wider solution clusters for national decision-maker addressing those main areas with the largest carbon footprint in Asia and share some examples of a successful transition/application. The solution cluster covering a wide range of policy options considered here are:

- Greening Freight
- Transport Electrification through Renewables
- Managing Motorisation

Each section will discuss reflect on the technical and financial aspects and where information available on the institutional dimension.

Many of the solution clusters are strongly linked to each other, for example the electrification of freight vehicles, discussed in chapter 4.1 is also a key part of the solution for greening freight (4.2) as well as managing motorisation (4.3).

As discussed before, it is also crucial to provide decision-makers with additional arguments beyond decarbonisation, so therefore the additional "sustainable development objectives" will be shared.

4.1 Greening freight

While passenger transport, and particularly urban transport, gains most attention from the political debate on transport decarbonisation, the freight sector is a fundamental part for any future decarbonisation strategy.

Figure 9 below shows predicted road freight activity in different business as usual scenarios in India and demonstrates the scale of the future challenge.

Figure 9: Projected road freight activity growth in business-as-usual-scenario (India)

⁶ <u>Asian Transport Outlook Database | ADB Data Library | Asian Development Bank</u>



Source: TERI (2021)

For future strategies, it important to distinguish between urban, national and international freight to identify the right strategies. These will be discussed in turn below.

In cities urban freight growth is often driven by extreme increases in urban deliveries through online shopping which is accelerating its contribution not only to growing CO_2 emissions, but also to congestion, local air pollution and increased road fatalities and accidents.

ICLEI (2020) distinguishes between four key strategies to decarbonise urban freight: policy based interventions, infrastructure based interventions, technology interventions and behaviour and awareness based actions. Examples of each are provided below:

- An example for a policy-based intervention are Low Emissions Zones (LEZ), where in dedicated areas certain higher polluting vehicles are either not allowed to enter or have to pay to enter. In some places like London so called Ultra Low Emissions Zones (ULEZ) are in places with strict emission standards (Euro V/VI). In Asia between 2018 and 2020, at least nine cities in China (including Beijing, Shanghai and Shenzhen) introduced LEZs focused on freight vehicles. In these cities, access for deliveries is restricted to certain hours, and permits are prioritised for zero-emission commercial vehicles under 4.5 tonnes. (SLOCAT 2021)
- Infrastructure based interventions vary from creating designated areas for loading and unloading to establishing consolidation centers to improve the logistic efficiency in cities and improving the supply chain for the private sector. The Indian government, for example, have discussed the establishment of a Multi Modal Logistic Park program (Business Standard, n.d.) as a Private Public Partnership activity.

- Technology interventions are often focused on vehicles including establishing dynamic routing systems as well as cleaner vehicles, which will be discussed in chapter 4.2.
- Behaviours and awareness based actions such as employ eco-driving techniques which aim to improve driver behaviours leading to safer and energy efficient driving. For example, in 2020, Clean Air Asia concluded a five-year eco-driving programme in Indonesia, with private sector companies and other stakeholders seeking to reduce freight emissions (SLOCAT 2021)

On a national level the shift from road to rail freight transport is fundamental for a decarbonisation. However, Figure 10 below shows that for almost all Asian countries the share in rail freight declines in the two decades.



Figure 10: Rail Share of Freight Inland Transport, Multiple Years

Source: UIC, Country Statistical Yearbooks, World Bank

ATO data used - TAS-FRA-004, TAS-FRA-005

Some Asian countries had recognised the importance of the freight rail sector and set themselves modal share targets in national plans (see

Table 3).

Country	Modal share target	Target year		
India	Railways – freight load of 1.9 billion tonnes	2022-23		
	(in 2022-23) and an improved modal share of			
	40 per cent of freight movement (from the			
	current level of 33 per cent)			
Pakistan	Increase the share of railways in national	2030		
	freight from present 4 percent (6 billion tonne-			
	km) to 22 percent (81 billion-ton km)			
Sri Lanka	Increase freight transport share of the railway	2020		
	from 1% to 5% by 2020			
Thailand	Domestic freight transport railway share from	2021		
	1.4% to 4%			
Vietnam	Railways freight mode share to be 1-3%	2020		
Source: http://slocat.net/wp-content/uploads/2021/06/4 -Rail-Freight-Mode-Shift-Policies-in-Asia.pdf				

Table 3: Railfreight targets in selected national plans.

4.2 Transport electrification through Renewables

The electrification of the vehicle fleet through renewables is one of the most important elements for future transport decarbonisation strategies globally as well as in Asia. In the last years there has been a rapid growth in electric passenger cars around the world with almost half of the global fleet of 11 million electric vehicles in Asia with the vast majority in

China (see Figure 11)

Figure 11: Global electric car stock by region, 2010-2020



Often the electrification of transport is associated with four-wheeled private passenger vehicles, but in the Asian context, two and three wheelers, buses and freight vehicles need to be considered as part of a future strategy. With more than 100,000 electric buses and more than 300 two wheelers, China is by far a world leader in that segment.

In Vietnam, a transition from conventional to electric motorcycles was seen as having the largest potential to mitigate emissions by 2030.

To create a national electric vehicle strategy a wide range of aspects have to be considered. In an forthcoming publication from SUM4All (2021), six core factors have to be taken into account: economics, financing, energy supply, governance, social and material (see Figure 12). These factors will be briefly discussed in the following pages.

Figure 12: Electromobility Consideration in the Global South (SUM4ALL, 2021)



While there is growing evidence that electric vehicles have a lower carbon footprint than internal combustion engines cars regardless of the source of energy, to reduce global transport emissions by 70 to 75% the electricity needs to come from renewable energy sources. However, in 2020 95% of global energy needs were met by oil and petroleum and only a small percentage were covered by biofuels (3 %) and renewable electricity (0.3%) (REN-21 2021).

There is therefore a need to better decarbonise the electricity system in parallel with the transport system. The carbon intensity of the electricity system varies between countries as Figure 13 shows. The reduction potential in countries with higher carbon systems to produce electricity are facing a lower advantage to decarbonise their economy through strengthen electromobility. At the same time, for countries with low carbon systems could benefit even more by reducing emissions through electromobility. In Figure 13 a "break-even"⁷ point is identified, whereby electricity generation is sufficiently clean, and the transition to

⁷ This breakeven point is shown in Figure 13, in which the carbon intensity x of electricity generation is plotted against the quality (reliability) of supply (index 1-7) (SUM4ALL, 2021)

electromobility will reduce overall emissions in a country (SUM4ALL, 2021). With the exception of Mongolia, where the electricity system is relying on coal, all other LMICs in Asia would already have a positive decarbonisation effect in case of future electrifying the transport sector assuming their current energy mix. Nevertheless, further cleaning the grid by increasing the capacity in renewable energy will contribute to a lower carbon footprint.

In addition, energy and transport policies are currently not aligned and need to be better coordinated. From a social aspect, it is important that higher demand for energy by electric vehicles does not impact the availability of much needed electricity supplies for poorer households. Instead, opportunities need to be identified, how to make use of a secured and funded renewable based electricity demand through electric vehicle fleets.

Figure 13: Low carbon generation (%) vs. carbon intensity of electricity (gCO₂/kWh) for 85 Low and Middle Income Countries (SUM4ALL, 2021)



In Asia there are growing examples of energy companies which are starting to invest in electric vehicle technology. For example, Thailand's second largest electric utility, Energy Absolute, created its Mine Mobility subsidiary to manufacture electric vehicles.

In India, three state-owned oil companies, accounting for 90% of the fuel retail market, have invested in electric vehicle battery charging and battery swapping infrastructure, in partnership with ride hailing and metro rail companies whose parking lots will house battery swapping stations for three-wheelers. (SLOCAT 2021)

Policy measures to enhance electric vehicles need to consider three complementary elements, which are often not considered together:

- A push for electric vehicles through targets and subsidies
- A pull through internal combustion engine (ICE) phase out targets as well as local restrictions

- A regional coordinated second-hand vehicle policy to manage import and export between early electric vehicles adopters (often HICs) and later stage electric vehicle followers (often LICs)

While there are a growing number of Asian countries setting targets for EVs, only Singapore and Japan have so far have committed to an ICE phase out. Singapore has committed to a ICE sales ban target by 2030, while Japan announced a target of 100% electric cars by mid 2030 though it would still allow the sales of hybrid electric vehicles (ICCT 2020).

The electrification of the passenger car fleet is in the heart of Japan's, Singapore's, Vietnam's and Thailand's strategy. Singapore aims to phase out internal combustion engine vehicles by 2030 and have all vehicles running on cleaner energy. In addition, they plan for all new public bus purchases to be cleaner energy buses, including fully electric or hybrid models. To encourage take-up of cleaner vehicles, new EV purchases will receive rebates for a three-year period from January 2021.

Whilst advances are being made in the region to adopt electric vehicles, Japan remains the largest exporter of second-hand cars in the world. Between 2015 and 2018, Japan exported 27% of the global market equivalent a total of 14 million passenger vehicles (UNEP 2020). There is growing concern, that the export of older vehicles can increase pollution and climate emissions; increase accidents and road fatalities through the poor quality and safety of used vehicles. With the increase of electric vehicles, there is a high risk of an increase in future exports. Therefore, a regional level harmonized regulation restricting export and import of older higher polluting vehicles would strongly contribute to minimize such a negative side effect of electrification.

To encourage the uptake of electric vehicles there is growing financial and capacity building support. For example, the Global Fuel Economy Initiative (GFEI partner the United Nations Environment Programme (UNEP)) is ramping up its support to developing countries to transition to electric vehicles. As part of a new Global Environment Facility (GEF) global electric mobility programme the GFEI is building on and expanding existing support (policy advice and capacity building) to countries around efficient and electric vehicles, with a focus on supporting countries to develop policies to promote low-carbon road transport. The project will support 29 country projects in all regions – these projects will introduce pilot programs and national policies/ roadmaps for electric mobility. At a regional level, UNEP will lead the Africa platform and co-lead the LAC platform; ADB the Asia platform; and European Bank for Reconstruction and Development (EBRD) the West Asia/ Eastern Europe platform. (GFEI 2021)

Technology improvement is also key for mainstreaming EVs in Asia. The rapid development of battery technology with significant increase in capacity and falling prices by about a factor 10 at the same time shows the opportunities and the dynamic in the market (Bloomberg NEF, 2021).

An example for an upcoming technology improvements are vehicle-to-grid solutions. This allows electric vehicles to store and return electricity to the grid. In 2020, Shanghai completed its first pilot project using electric vehicles as a flexible energy storage source in the power grid. (NRDC, 2020)

For the freight sector, there are a growing number of electric two wheelers and light trucks for local deliveries in place. For example, INGKA Group, an IKEA franchisee that provides lastmile delivery services, achieved 100% electric home delivery in Shanghai in 2019, a year ahead of its 2020 target. With the government leading the charge for electric vehicle adoption, DHL Express Thailand got a head-start with its recent addition of 50 electric motorcycles to its delivery fleet. While an increasing amount of industry players are starting to produce heavy duty trucks, like Mercedes, who started to produce its eActros model with a range of up to 400km (Green Car Congress, 2021). However, these vehicles are currently up to three times more expensive and can be mainly used for regional transport. Therefore, the need for investing in rail for longer ranges will be required for the long-term future.

4.3 Managing Motorisation

With the predicted growth of demand in vehicle ownership in the coming years, there is not only the need to provide better alternatives, in the form of walking, cycling, shared modes and public transport in the urban context, and to invest in rail and bus based alternatives for nonurban passenger transport, but also to steer the future demand. The growing market for electric two wheelers is one option to improve access for people in an urban and particular rural context, the other is to further manage motorisation in its transition to electric vehicles. UNEP has worked with electric vehicle associations in Malaysia, the Philippines, Singapore and Thailand to develop comprehensive recommendations for policymakers to spur the adoption of electric two- and three-wheelers (UNEP 2020).

Some of these measures include manufacturing and consumer subsidies, tax and insurance adjustments for electric versus more pollutive vehicles and mandating fuel economy standards and consumption limits.

Some countries in the region have made headway with some of these measures. Thailand, for example, is aiming to produce 53,000 electric motorcycles by 2025 and is planning a trade-in scheme to make electric vehicles cheaper. Indonesia has plans to phase-out conventional motorcycles from 2025. And Malaysia and other countries have developed extensive motorcycle-only infrastructure that encourages their uptake (GFEI, 2021). While the support for electric two-wheelers not reduce motorisation growth, it provides a lower carbon alternative and more affordable alternative to passenger cars.

Another option is to improve fuel and vehicle efficiency. Here fuel and emissions standards can play a vital role. According to the ASEAN (2018) the fuel efficiency of passenger cars in Thailand, Indonesia, Malaysia, the Philippines and Singapore is slightly higher than with 7.2 liters gasoline/km compared to the world average (7.0 gasoline liters/km) (see

Figure 14).



Figure 14: Fuel Economy Baselines Study conducted by GFEI in ASEAN and the World

ASEAN created in 2018 the vision to become the most fuel efficient region in the world by introducing ambitious fuel efficiency standards, reducing the average fuel consumption of sold vehicles by 26% from 2015 to 2025.

Figure 15: ASEAN Light Duty Vehicle (LDV) fuel standard goals in comparison to other countries.



Figure 16 summarises the main actions and goals of the roadmap. In January 2021, a followup initiative in a partnership between the International Transport Forum (ITF) and ASEAN supported by GFEI, was kicked off to strengthen the international collaboration to implement the roadmap (ITF, 2021).



Transform the ASEAN light duty vehicle market into one of the world's most fuel efficient by 2025, helping to meet regional and national goals for sustainable transport, energy efficiency and climate change mitigation, while supporting the vision of the



China is even more ambitious. In 2019, China published its fuel economy targets for light-duty vehicles for 2025, which propose reducing the average fuel consumption of new passenger cars to 4 litres per 100 kilometres compared to the global average of 7 litres per 100 kilometers.

Similar initiatives would be needed for heavy duty vehicles. Currently Canada, the USA and the EU (including the UK) are the only entities with fuel economy standards for heavy-duty vehicles outside Asia. In Asia, China, India and Japan have set up targets so far.

Phase III standards in China, the world's largest heavy-duty vehicle market, took effect in July 2019, helping to improve the efficiency of new buses and trucks sold in the country. In March 2019, Japan updated its fuel efficiency standards for trucks and buses, mandating improvements of 13.4% for trucks and 14.3% for buses by 2025 (compared with 2015) (SLOCAT 2021).

A final element to manage motorisation can be achieved through the removal of fuel subsidies and the introduction of fuel taxes can have an impact on the growing motorisation and on car use in the urban settings through the increase of fuel prices.⁸

As a comparison between car use in the US and Europe has proven, demand usually declines in response to increases in price (Klier, Linn 2013). Despite the geographic and cultural differences, the low price of fuel and increasing car ownership are the main factors driving growing motorisation in Asia. At the same time, it can contribute to the shift to electric vehicles and complement the efforts on increasing fuel efficiency standards as discussed in the previous chapter.

Several Asian countries already undergone national reviews with efforts to reduce their fossil fuel subsidies:

⁸ The relationship between changes in price and changes in demand is known as the "price elasticity of demand", which measures the responsiveness of demand to changes in price (UNDP 2012).

- The 2016 G20 peer review of fossil fuel subsidies from China listed subsidies worth USD 14.5 billion and included a reform plan and timeline. Since then China has continued to undergo petroleum pricing reforms reducing central government outlays by 50% between 2014 and 2017.
- From 2014 to 2017, India incrementally reduced oil and gas subsidies 75%, while increasing renewable energies funding sixfold.
- In 2015, Indonesia completed petrol and diesel subsidy reforms, saving up to USD 15.5 billion; however, it has not implemented fuel price changes in a regular manner, with gaps between price adjustments increasing over time.
- In January 2015, Thailand set a uniform LPG wholesale price across all sectors to better reflect international market prices and start publishing it monthly. In 2016, it deregulated prices for Compressed Natural Gas (CNG). (IEA, 2017)

Chapter 5: Towards national and regional action decarbonisation transport under the Aichi Declaration

The paper has shown the scale of the decarbonisation challenge and the urgency to act to decarbonise the transport sector in Asia. The new Aichi Declaration was approved by the EST Members during the 14th EST Forum. It shows that EST member countries are willing to contribute to the Paris Agreement and the SDGs (UNCRD, 2021). It is the first time in the context of the EST Forum, that specific goals are set on climate change: In Goal 1a on Environment sustainability the countries aim "by 2030 to peak transport CO₂ emissions and initiate reductions in transport related CO₂ emissions with the intention to move towards decarbonization of the transport sector by 2050 or shortly after" (UNCRD, 2021). To achieve the goal the major trends described in the paper such as ongoing motorisation, growth in freight transport through a rapid growing economy and insufficient ambition of climate related national transport actions all need to be tackled. The three major identified solution clusters (greening freight, renewable electrification of transport and managing motorisation) provide a wide set of policy options for national decision makers focusing on land transport as part of a wider transition towards an inclusive and sustainable green growth for transport. This also has to include other subsectors such as urban mobility, where city stakeholders need to take action.

All efforts require a long-term integrated transport and climate action vision combined with a short-term policy action plan linked with a budget. As countries were encouraged to enhance their NDC ambition to be shared at the next COP27 in Egypt, EST member countries have the opportunity to revisit their NDC submission. However, particular Asian LICs will need strong international financial, institutional, and technical support to enable green economic growth while decoupling from increased GHG emissions (see

Table 4).

Table 4: Summary table on solution clusters, policy actions, impacts and sustainable development benefits for decarbonisation in Asia for national decision-maker

Solution	Policy Action	Impact	Sustainable	
cluster		(time)	development Benefit	
Integrated	Long-term Strategy, National	Short,	Air quality, road	
Transport and	Determined Contribution	medium and	safety, economy	
Climate Vision	(Transport)	long-term		
and Action Plan				
Greening	Urban Freight: Policy (e.g.	Short and	Air quality, road	
Freight	LEZ); Infrastructure	medium-	safety, economy	
	(Consolidation center, loading	term		
	zones); technology (dynamic			
	routing system, blockchain),			
	behaviour change (eco-driving)			
	Rail infrastructure investment	Medium and	Air quality, road	
		long-term	safety, economy	
Renewable	National Electric Vehicle	Long-term	Air quality, economy	
transport	Strategy (infrastructure,			
electrification	investment, campaign,			
	technology)			
	Combined Energy and	Long-term	Economy	
	Transport policy (e.g. de-			
	risking renewable energy			
	investment)			
	Electric vehicle targets	Short and	Economy	
		medium-		
		term		
	ICE phase out	Long-term	Economy, air quality	
	Secondhand vehicle regulation	Medium-	Economy, air quality,	
		term	safety	
Managing	Electrifying two wheelers	Medium-	Economy, air quality	
Motorisation		term		
	Fuel economic	Medium-	Economy, air quality	
	standards/roadmap (light duty	term		
	and heavy duty)			
	Fossil fuel subsidy reform	Medium-	Economy	
		term		

To convince national decision-makers to act on tackling climate change impacts from transport, providing facts and arguments beyond carbon benefits such as improved public health and economic benefits. Those arguments might strengthen the opportunity to scale existing and proven solutions like rail investment as well as future technology options through electrifying the transport fleet and contribute to countries transition towards decarbonsing transport.

While the discussed policy options most relevant to the specific situation in a country should start to be implemented in the next years, the final impact of these will often only be seen in the long-term. The table above summarises the discussed solutions, the expected time for seeing measurable impacts, and sustainable development benefits. In a contribution to this year's EST Forum, Newman (2021) highlighted the opportunity to build sustainable transport action into the COVID-19 recovery plans. For example, countries like Bangladesh, P.R. China, Indonesia, Nepal and Pakistan included electric vehicle promotion and charging infrastructure into their financial plans. With most of the recovery budget not spent, there is an opportunity for countries to review their spending plan and discover further options for investment towards low carbon transport.

The 14th EST Forum in Asia was a milestone for the future collaboration of countries. Ten years after the Bangkok 2020 Declaration, where EST member countries committed to take action towards sustainable transport, and have since shared their progress and good practices, the new Aichi declaration will further strengthen the role of the forum. The direct link to the international agreements, in particular the Paris Agreement and the SDGs, will allow countries to better track their progress and share their experiences in a regional context.

The new declaration also opens opportunities for non-governmental stakeholders (development community, private sector and civil society) to support the implementation of the Aichi Declaration by setting up so-called Communities of Interest (CoI) (Paragraph 10, Aichi Declaration). Such a CoI could allow the coordinated support for NDCs in countries through technical assistance and capacity building as well as enabling access to climate finance. For example, the current initiative by GIZ (NDC-TIA, 2021) is an example of such an initiative, which could be opened up to EST Member countries.

The paper utilised the recent initiative by the ADB to track Asian transport and climate related data and policies. Aligning the EST Forum with a regular updating and closing of data gaps will help the countries to better assess their situation and allow better target-oriented policies. Most of the suggested solution clusters would benefit from better regional collaboration. The ASEAN roadmap on fuel efficiency is an example for a future regional collaboration under the EST banner. For example, the discussed challenges arising from growing electrification, such as the increase of second-hand exports and imports, could be discussed and common regulations considered.

The electrification of transport will require a technological improvement, which could be enhanced through specific regulations and standards (e.g. for EV infrastructure). Again, an option for strengthening regional collaboration and exchange.

The recent COP26 in Glasgow has shown that there is fast growing attention to the need to decarbonise transport to fulfil the Paris Agreement. With the Aichi Declaration, the EST Forum and its country members will have a framework to strengthen its future action and collaboration on an inclusive decarbonisation pathway.

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