2024 Review of Climate Ambition in Asia and the Pacific

From Ambitions to Results: Sectoral Solutions and Integrated Action

ESCAP
Economic and Social Commission for Asia and the Pacific

UN environment programme

UNITED NATIONS SUSTAINABLE DEVELOPMENT GROUP

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Foreword

The 2024 Review of Climate Ambition in Asia and the Pacific: From Ambitions to Results: Sectoral Solutions and Integrated Action is the fourth in a series of annual reports on regional climate action.

It has been produced against a backdrop of intensifying and evolving climate crisis, a narrowing window for action and amidst the third cycle of the Nationally Determined Contributions, also known as NDCs 3.0.

Governments are focused on deepening greenhouse gas emission reductions and strengthening climate actions by 2035. Global and regional assessments of progress, including the UNFCCC 2023 Global Stocktake and the *UNEP Emissions Gap Report 2024* show that emissions reductions targeted and delivered to date fall far short of the levels required to contribute effectively to achieving the goals of the Paris Agreement. Our assessments for Asia-Pacific region have largely echoed these conclusions.

This report responds to the climate challenges facing the region and contributes to strengthening climate action in three important ways.

First, it calls attention to the need for explicit and quantified greenhouse gas emission reduction targets as a basis for action. Our projections show that the dominant approaches to target-setting are likely to deliver increased emissions or marginal emissions reductions at best, instead of the deep cuts needed. Effectively framed targets are missing from some of the highest-emitting countries of the region, compromising NDC implementation.

Second, our report provides an overview of drivers of emissions, technological responses and policy priorities in the energy and transport sectors of the region – two sectors that are among the top emitters and of common concern to all countries.

Third, it supports efforts of countries to narrow adaptation financing gaps. It outlines opportunities and practical approaches for integrating adaptation and mitigation which also contribute to strengthening climate resilience.

Joining the international community in calling for redoubling all efforts, UNEP and ESCAP are pleased to collaborate with members of the United Nations Issue-Based Coalition on Raising Ambitions on Climate Action in Asia and the Pacific to produce this report.

Armida Salsiah Alisjahbana
Under-Secretary-General of the UN and Executive Secretary of ESCAP
Co-chair of the UN Regional Collaborative Platform for Asia and the Pacific

Executive Summary

The urgency of enhanced climate mitigation ambition in the NDCs and better alignment with recommendations of the IPCC cannot be overstated. The Asia and the Pacific region accounts for approximately 60 per cent of global greenhouse gas (GHG) emissions with an annual growth rate of 2 per cent on average since 2010. Countries in the region must significantly raise the ambition of their Nationally Determined Contributions (NDCs) to align with the 1.5°C pathway recommended by the Intergovernmental Panel on Climate Change (IPCC). Regional emissions will continue to grow even with the full implementation of current conditional NDCs.

Setting up robust and effective emission reduction targets is an important foundation for the third round of Nationally Determined Contributions (NDC 3.0) updates in 2025. Seventeen countries generate about 97 per cent of the total regional GHG emissions. However, many of the highest-emitting countries have framed emission reduction targets using approaches that are projected to result in marginal emissions reductions, or increased emissions by 2030. The opportunity to re-evaluate current NDCs, align ambitions with the Paris Agreement and outcomes of the COP28 UAE Presidency consensus, and to reflect on the conclusions of the first Global Stocktake of progress, must not be missed. Realistic and ambitious sectoral low-emission reduction strategies that provide policy direction for boosting technology transfer and resource mobilization must be implemented.

The climate finance required by developing countries of the Asia-Pacific region, excluding China is estimated at US$ 1.3 trillion per year. Current climate finance flows fall well short of the required levels, particularly in low-income countries. Adaptation projects, particularly in sectors like agriculture and water, are particularly underfunded, and there is need to expand the development of innovative financing solutions such as green bonds across all countries.

The energy and transport sectors are critical arenas for action by all countries. Energy used for electricity and heat production is by far the fastest rising and dominant source of carbon dioxide (CO_2) emissions in the region. In addition, every country faces the challenge of reducing emissions from the transport sector, a major and rising source of carbon emissions. While the IPCC recommends that countries reduce emissions to the level consistent with a 1.5°C pathway, conditional and unconditional commitments in the NDCs of Asia-Pacific member States are insufficient to even contain global warming to below 2°C. This calls for concerted effort to not only set ambitious targets in the NDC 3.0 cycle but also match them with strategic interventions.

The region's energy mix is a fundamental challenge, despite accelerating investments in renewable energy. Heavy reliance on fossil fuels, rapid urbanization, rising standards of living and expanding mobility needs are key drivers. Carbon dioxide emissions from energy use accounted for over half of global emissions in 2023 in the Asia-Pacific region. Emissions continue to rise despite policy and technological interventions that have enabled the region to deliver a 9.3 per cent increase in renewable energy capacity in 2022, compared with 2021, driven by solar and hydropower.

Coal dependency remains a major barrier to the region's energy transition. The Asia-Pacific region accounts for 45 per cent of global energy supply and 52.2 per cent of CO_2 emissions from energy, with coal comprising 56 per cent of electricity generation. While countries are gradually adopting renewable energy sources, coal demand is projected to decrease by only 0.91 per cent under current policies. This emphasizes the urgent need for accelerated coal phase-out initiatives and expanded renewable energy investments. Governments are urged to set ambitious renewable energy targets, accelerate decarbonization of the power sector, and phase out fossil fuel subsidies to decarbonize the energy sector and reduce dependency on coal. Equity must guide climate actions, ensuring that the shift to low-carbon economies supports vulnerable populations. Social protection mechanisms and inclusive policy frameworks are needed for a fair transition.

Renewable energy has the greatest potential for narrowing emission gaps and setting more ambitious targets, and technological innovation must be accelerated. To align with the COP28 goal of tripling renewable capacity to 11,000 GW by 2030, Asia-Pacific countries must add approximately 7,000 GW in just six years. However, even with current policies, projected capacity additions fall 30 per cent short of the target. China and India lead in renewable energy with commitments to 3,000 GW and 486 GW by 2030, respectively, but further expansion across the region is essential for a sustainable energy future. Asia-Pacific countries excluding China need an estimated $800 billion annually in energy investments to achieve sustainable energy transitions. However, clean energy investments for this group of countries are projected at $300 billion per year leaving significant financing gaps remain, especially in grid development and storage solutions. Scaling up renewable technologies, such as solar and wind, along with innovations in battery storage and green hydrogen will drive sustainable energy growth and support ambitious NDCs. Increased international support, innovative financing mechanisms and domestic public-private partnerships are vital to close these gaps and ensure delivery on NDC targets.

Transition to electric mobility is key and requires significant investment. Asia and the Pacific accounted for 31 per cent of global transport emissions of CO_2 in 2022, with emissions from this sector increasing more quickly than in other sectors between 2010 and 2019. While electric mobility is gaining traction in the region, only eight Asia-Pacific countries have concrete transport-related emissions targets in their NDCs. The sector also needs to address financing gaps, estimated at $500–600 billion, and develop robust electric vehicle infrastructure critical to scaling sustainable transport solutions across the region.

Growing demand for passenger and freight transport necessitates sustainable solutions. Demand for passenger and freight transport in the Asia-Pacific region is projected to increase by 79 per cent and nearly 100 per cent, respectively, by 2050. The sharpest growth is expected in South and South-West Asia, where freight demand could increase by up to 490 per cent. Sustainable solutions such as shifting from road to rail and increasing the adoption of electric mass transit are essential to manage this surge while reducing emissions.

Integrated climate strategies can narrow financing gaps, support climate-resilient development, address the threats to high-risk populations and enhance policy coherence. In a recent survey conducted in the Asia-Pacific region, 23 per cent of respondents identified Agriculture, Forestry, and Other Land Use (AFOLU) as the top sector for synergistic adaptation and mitigation impacts, followed by energy systems (12 per cent) and food systems (10 per cent). These sectors hold

significant potential for climate-resilient pathways, and for bringing NDCs together with National Adaptation Plans (NAPs) to maximize co-benefits, and narrow financing gaps. Linking climate adaptation and mitigation strategies through nature-based solutions, including in urban contexts, can simultaneously enhance climate resilience and reduce emissions. Integrated approaches are particularly important for addressing increasingly urgent adaptation needs. With a growing need to use a systems approach in responding to the impacts of climate change, integrated approaches that address both adaptation and mitigation ambitions are becoming more imperative. Over 30 per cent employment is in natural resource-based sectors conditioned by climate and 70 per cent of the population susceptible to sea-level rise. Integrated approaches such as mangrove management can offer a host of practical benefits for people, climate and nature. Climate finance mobilized for integrated adaptation and mitigation projects must be scaled up; it remains limited although useful examples are emerging.

Key recommendations for strengthening Asia-Pacific NDCs

Many countries in the region have recognized the urgent need to transition towards greener energy and transport sectors. However, while progress has been made, significant gaps remain in capacity, financing and implementation that must be addressed to fulfill these ambitious goals.

Energy Sector:

- Develop and implement more ambitious renewable energy targets in line with the global pledge to triple renewable energy production.
- Accelerate decarbonization of the power sector.
- Phase out fossil fuel subsidies in the energy sector.
- Strengthen regional cooperation on mitigation efforts.
- Develop regional carbon trading schemes.

Transport Sector:

- Set national greenhouse gas emissions targets for transport with clear data collection processes for effective tracking and monitoring.
- Update NDCs to align with national transport policies and targets.
- Strengthen cross-sectoral collaboration between transport and environment ministries.

- Support technological advancements in transport beyond electrification.
- Foster international collaboration to raise funding for transport sector decarbonization and incentivize private sector investment.

Integrated Approaches:

- Establish a cross-sectoral coordination mechanism to enhance collaboration among ministries.
- Promote nature-based solutions in climate policies to maximize co-benefits for biodiversity and climate resilience.
- Enhance capacity-building and knowledge-sharing platforms for integrated climate action.
- Incorporate a gender responsive and human rights-based approach, with a focus on social protection mechanisms to support vulnerable communities in the transition to low-carbon economies.
- Integrate climate action into national development plans to streamline resource allocation.
- Monitor and evaluate integrated approaches to refine strategies and ensure progress.

A whole-of-society approach is essential for the Asia-Pacific region to meet the 1.5°C target. Sectoral transformations in energy and transport, bolstered by climate finance and regional cooperation, can position Asia-Pacific countries as leaders in the global climate effort. These measures not only support climate goals but also drive sustainable economic growth and energy security for a resilient, low-carbon future.

Explanatory Notes

This report includes 49 of the ESCAP member States in Asia and the Pacific, which are listed in groupings of countries and territories/areas listed alphabetically as follows:

- **49 ESCAP member States:** Afghanistan; Armenia; Australia; Azerbaijan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; China; The Democratic People's Republic of Korea (the); Fiji; Georgia; India; Indonesia; Iran (Islamic Republic of); Japan; Kazakhstan; Kiribati; Kyrgyzstan; the Lao People's Democratic Republic; Malaysia; Maldives; Marshall Islands; Micronesia (Federated States of); Mongolia; Myanmar; Nauru; Nepal; New Zealand; Pakistan; Palau; Papua New Guinea; the Philippines; Republic of Korea (the); Russian Federation (the); Samoa; Singapore; Solomon Islands; Sri Lanka; Tajikistan; Thailand; Timor-Leste; Tonga; Türkiye; Turkmenistan; Tuvalu; Uzbekistan; Vanuatu; and Viet Nam.

- **Least developed countries:** Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, the Lao People's Democratic Republic, Myanmar, Nepal, Solomon Islands, Timor-Leste, Tuvalu, and Vanuatu. Samoa was part of the least developed countries prior to its graduation in 2014.

- **Landlocked developing countries:** Afghanistan, Armenia, Azerbaijan, Bhutan, Kazakhstan, Kyrgyzstan, the Lao People's Democratic Republic, Mongolia, Nepal, Tajikistan, Turkmenistan, and Uzbekistan.

- **Small island developing States:** Cook Islands, Fiji, Kiribati, Maldives, Marshall Islands, Micronesia (Federated States of), Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor Leste, Tonga, Tuvalu, and Vanuatu.

- **East and North-East Asia:** China; The Democratic People's Republic of Korea (the); Hong Kong, China; Japan; Macao, China; Mongolia; and Republic of Korea (the).

- **North and Central Asia:** Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Russian Federation (the), Tajikistan, Turkmenistan, and Uzbekistan.

- **Pacific:** American Samoa, Australia, Cook Islands, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

- **South and South-West Asia:** Afghanistan, Bangladesh, Bhutan, India, Iran (Islamic Republic of), Maldives, Nepal, Pakistan, Sri Lanka, and Türkiye.

- The following member States that are contributing to other regional greenhouse gas emission assessments are not included in this report: France, the Netherlands, United Kingdom and Northern Ireland (the), the United States of America.

- **The Report does not include the associated member States:** American Samoa; Cook Islands (the); French Polynesia; Guam; Hong Kong, China; Macao, China; Northern Mariana Islands

Bibliographical and other references have not been verified. The United Nations bears no responsibility for the availability or functioning of URLs.

Data for this assessment report was used from a consistent and credible scientific source: https://edgar.jrc.ec.europa.eu/ and https://github.com/owid/co2-data.

Abbreviations

ADB	Asian Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
APS	Announced Pledges Scenario
ASEAN	Association of Southeast Asian Nations
ATO	Asian Transport Outlook
BAU	business as usual
BESS	Battery Energy Storage Systems
BEVs	battery electric vehicles
BMUV	Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection
CCUS	carbon capture, utilization, and storage
CFN	Climate Finance Network
COP	Conference of Parties
CRED	Climate Resilient Economic Development
CSP	concentrated solar power
EGM	Expert Group Meeting
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
ETF	Enhanced Transparency Framework
ETS	emissions trading systems
Evs	electric vehicles
FCEVs	Fuel Cell Electric Vehicles
GCF	Green Climate Fund
GSC	Green shipping corridors
GST	Global Stocktake
$GtCO_2e$	gigatons of carbon dioxide equivalent
GWh	Gigawatt/hour
HNAP	health national adaptation plans
ICCT	International Council on Clean Transportation
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
KCI	Katowice Committee of Experts on the Impacts of the Implementation of Response Measures
LCOE	levelised cost of electricity
kWh	kilowatt/hour
$MtCO_2e$	metric ton of carbon dioxide equivalent
Mtce	million ton coal equivalent
MRV	Monitoring, Reporting, and Verification
NAPs	National Adaptation Plans
NbS	Nature-based Solutions
NDCIP	NDC Implementation Plan
NDCs	Nationally Determined Contributions
ODA	official development assistance
PDP	Philippine Development Plan
PHEV	Plug-in Hybrid Electric Vehicles
PV	photovoltaic
SAF	sustainable aviation fuels
SAPs	Sectoral Adaptation Plans
SDGs	Sustainable Development Goals
SHDP	Sustainable Hydropower Development Policy
SIDS	small island development States
SLCP	Sloping Land Conversion Programme
SMRs	small modular reactors
SSC	South-South cooperation
STEPS	Stated Policies Scenario
SUFAL	sustainable forests and livelihoods
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFCCC/RCC Asia-Pacific	The Regional Collaboration Centre for Asia and the Pacific of the United Nations Framework Convention on Climate Change Secretariat
UNHCHR	United Nations Human Rights Office of the High Commissioner
UNICEF	United Nations International Children's Emergency Fund
UNIDO	United Nations Industrial Development Organization
UN Women	United Nations Entity for Gender Equality and the Empowerment of Women
WHO	World Health Organization
YECAP	Youth Empowerment in Climate Action Platform

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Introduction

Greenhouse gas (GHG) emissions in the Asia-Pacific region have shown significant growth over the past few decades, largely driven by declining poverty rates and increasing affluence, rapid industrialization, urbanization, economic expansion, and high reliance on fossil fuel. The region contributes approximately 60 per cent of global greenhouse gas emissions; 97 per cent of regional emissions are from 17 countries i.e., Australia, Bangladesh, China, India, Indonesia, the Islamic Republic of Iran, Japan, Kazakhstan, Malaysia, Pakistan, the Philippines, the Russian Federation, the Republic of Korea, Thailand, Türkiye, Uzbekistan and Viet Nam. Further, 35 per cent of global energy-related carbon dioxide emissions come from developing Asia.

Furthermore, prospects for achieving the goal of limiting global warming to 1.5°C are narrowing despite commitments to reduce emissions through Nationally Determined Contributions (NDCs), current policy, technological interventions increased investments in renewable energy and its share in the energy mix, and in electric mobility.

The first Global Stocktake (GST) encouraged Parties to submit the next cycle of NDCs with focus on further reducing greenhouse gas emissions by 2035, also known as NDCs 3.0 (FCCC/PA/CMA/2023/16/Add.1). It encouraged Parties to come forward in their NDCs 3.0 with ambitious, economy-wide emission reduction targets, covering all greenhouse gases, sectors and categories, and aligning with limiting global warming to 1.5°C, as informed by the latest science, in the light of different national circumstances. The GST recommendations further highlighted energy and transport among key sectors where emissions reduction ambitions need to be increased.

- **Energy transition:** The GST points the need to triple renewable energy capacity and double annual energy efficiency improvement by 2030 as essential enablers of efforts to achieve the 1.5°C target and drivers of sustainable prosperity. It has emphasized that accelerating the transition from fossil fuel to renewable energy is key to meeting climate goals including achieving net-zero emissions by mid-century. The transition would require stronger policies supporting solar and wind energy, along with enhanced regional cooperation for technology transfer and infrastructure development.

- **Sustainable transport:** The GST emphasizes the need to promote electric vehicles (EVs) and upgrading public transport to reduce emissions. Systemic changes in the transport and energy sectors are crucial to lowering GHG emissions.

The GST further highlights the critical need for an economy-wide transformation to meet climate goals, urging countries to pursue both mitigation and adaptation strategies across all sectors. In addition, the GST also encourages Parties to implement climate policy and action that is gender responsive, fully respects human rights, and empowers youth and children. It also calls for whole-of-society engagement, and the need for gender-responsive and participatory approaches, ensuring that all stakeholders, including vulnerable groups and marginalized communities, are involved in shaping climate policies. It also stresses the importance of a just transition, supporting communities dependent on fossil fuels while safeguarding vulnerable groups that have been disproportionately affected by climate change. In addition, the GST also encourages Parties to implement climate policy and action that is gender responsive, fully respects human rights, and empowers youth and children. An integrated approach combining mitigation efforts with adaptation, such as nature-based solutions (NbS), will be essential for building a climate-resilient future while achieving global climate goals.

Following recommendations from the GST, several member States are already working towards their NDC 3.0 commitments, focusing on, among others, long-term carbon neutrality goals, green hydrogen and electrification of transport. These nations provide valuable lessons for other Asia-Pacific member States, particularly regarding the integration of renewable energy and sustainable transport into national climate strategies. While Asia-Pacific member States are developing their NDC 3.0, the implementation of NDC 2.0 continues.

To lower GHG emissions, systemic changes in the energy and transport sectors are crucial as well as policies promoting low-emission technologies to accelerate climate action and achieving the goals of the Paris Agreement. A whole-of-society approach, incorporating clean energy use and shifts in transportation systems, is essential for sustainable development and meeting global climate targets. The scale of the challenge ahead requires a clear understanding of emissions trajectories, the role of key sectors and the financial commitments required to steer the region toward a sustainable future.

This report highlights the need for meaningful targets that provide a foundation for effective planning and goal setting within two pivotal sectors for addressing climate change at the regional level. It highlights actions to maximize GHG reduction potential, key messages and recommendations for policymakers of the Asia-Pacific region, particularly in the context of energy and transport. It also recognizes that adaptation is an immediate and mounting challenge facing all nations and communities, and provides recommendations for integrating mitigation and adaptation measures.

Chapter 1

EMISSIONS DYNAMICS IN ASIA AND THE PACIFIC

1.1 Overview

The dynamics of emissions in the Asia-Pacific region present a complex landscape marked by both challenges and signs of progress. There have been indications of plateauing emissions and reductions during the COVID-19 pandemic, although these trends came at a significant cost to health, economies and livelihoods. Between 2019 and 2021, greenhouse gas (GHG) emissions slowed, with variations evident across the region. Despite this slowdown, GHG emissions continue to grow driven primarily by industrial activities, energy production and transportation.

According to the latest research, the region accounts for approximately 60 per cent of global GHG emissions, with a large share contributed by coal-dependent energy systems and fast-expanding transport sectors as many member States undergo rapid industrialization and urbanization. Despite some progress in renewable energy adoption, particularly in countries like China and India, the overall emissions trajectory remains misaligned with global climate goals, notably the IPCC's 1.5°C pathway (United Nations Climate Change, 2023).

In line with the five-year cycle of the Paris Agreement, countries in the Asia-Pacific region submitted their updated NDCs between 2020-2023, collectively known as NDC 2.0. These submissions reflect enhanced ambitions to curb emissions and adapt to climate impacts. However, when assessed against the IPCC's recommended emissions reduction trajectory for limiting global warming to 1.5°C, the commitments still fall far short of containing global warming to well below 2°C. Even the full implementation of conditional commitments under the current NDCs would only reduce GHG emissions to 26.73 $GtCO_2e$ annually.

If Asia-Pacific member States maintain the same level of commitment as in the NDCs 2.0, the annual GHG emissions will be 1.5 times higher than the level recommended by the IPCC in 2030, noting the recommendations to reduce emissions by 43 per cent, 60 per cent and 84 per cent relative to 2019 levels by 2030, 2035 and 2050, respectively, to limit temperature rise to 1.5°C. For the Asia-Pacific region, this recommendation translates into overall GHG emission levels of 17.02 $GtCO_2e$ by 2030, 11.94 $GtCO_2e$ by 2035 and 4.78 $GtCO_2e$ by 2050, assuming an application of the IPCC-recommended reductions across all regions (ESCAP, and others, 2023). This calls for joint efforts by member States to re-calibrate their overall and sectoral GHG emission reduction targets during the NDC 3.0 cycle.

The energy and transport sectors continue to be among the top emitting sectors. The region accounts for 52.2 per cent of global energy-related CO_2 emissions, with a growth rate of 33 per cent from the 2010 emission levels. Transport, driven by rapid urbanization and rising vehicle ownership, is another critical emitter, contributing around 14 per cent of emissions globally, and an even larger share in rapidly urbanizing economies especially in South-East Asia. Previous reports on the Review of Climate Ambition in Asia and the Pacific underscored the need for systematic sectoral transformations to mitigate these emissions and emphasized the urgency of addressing emissions from energy and transport systems to align with global climate targets.

The 2023 review of NDC 2.0 submissions from the Asia-Pacific member States made several suggestions to narrow both emission and implementation gaps which can support the efforts of member States to strengthen their response as they develop NDC 3.0.

- **Align NDC 3.0 targets with net-zero pledges and updated LT-LEDS:** the NDC commitments, carbon neutrality pledges and long-term low emission development strategies (LT-LEDS) of many countries are not fully synchronized. Better alignment of NDCs 3.0 with the updated LT-LEDS and their net-zero pledges could offer a more strategic pathway for countries to lower emissions including transitioning away from fossil fuel such as coal in countries like India and Indonesia. Also, insufficient attention to the AFOLU sector in some countries, including countries with a good track record of sustainable management of their lands is observed. By enhanced alignment, countries can gradually phase out coal while accelerating the adoption of renewable energy solutions.

- **Address implementation gaps of NDC 2.0:** even where countries have set ambitious targets, implementation often lags due to lack of infrastructure, technical capacity, and/or lack of financing to support implementation. Moreover, there has been limited progress on improving regulatory and policy frameworks for implementation of NDC targets, including codification of these goals into law, the existence and quality of implementation plans and the alignment of near-term emissions trajectories with net-zero targets.

- **Implement transformational change urgently in key sectors:** there is a pressing need for systemic transformation in high-emitting sectors such as energy production, industries, transport, agriculture etc. This transformation also requires reducing reliance on fossil fuels, scaling up renewable energy and electrifying transportation systems.

- **Ensure equity and just transition:** recognizes the socioeconomic disparities across the Asia-Pacific region and emphasizes the need for a just transition, ensuring that the shift to low-carbon economies does not disproportionately impact vulnerable populations.

- **Leverage the untapped potential of nature-based solutions (NbS):** highlights the enormous carbon sequestration potential of ecosystems such as mangrove forests in the Asia-Pacific region. However, the high rate of disappearance in some countries coupled with limited investments in NbS limit the maximization of environmental benefits of these ecosystems. This calls for concerted efforts by regional member States to invest in NbS to preserve these ecosystems and leverage their contribution to climate action.

- **Decarbonize energy and transport systems:** highlights need to accelerate deployment of renewable energy including scale-up deployment of solar, wind and hydropower technologies, and encourage investments in electric vehicles (EVs) and public transportation infrastructure to reduce emissions from the transport sector.

- **Develop integrated approaches and ensure policy coherence:** emphasizes the need to promote integrated policy frameworks that align climate goals with economic and social objectives, particularly through the development of green infrastructure and climate-resilient systems. Policy coherence is needed, including setting clear emissions reduction targets by sectors, and interventions that are aligned with sectoral and national development plans.

- **Enhance financing mechanisms:** emphasizes the need for innovative financial instruments such as green bonds to unlock climate finance at the scale needed.

1.2 Nature of NDC commitments and gaps

The level of ambition in the NDC 2.0 of Asia-Pacific member States is not homogenous and varies between countries. It should be noted that 47 Asia-Pacific member States have updated their NDCs. Examining the submissions reveals three approaches adopted by countries in setting their emission reduction targets:

- Setting absolute values of GHG emissions to be reduced by 2030 (16 member States);
- Setting targets in terms of reductions in emissions intensity of gross domestic product (GDP) (6 member States);
- Targets based on business-as-usual (BAU) baselines (22 member States).

Of the 17 countries[1] that contribute 97 per cent of the regional GHG emissions, i.e., less than one-third have set absolute year targets, about half have set reduction targets based on BAU, 4 have set targets based on intensity and 14 have set carbon neutrality targets (Table 1).

All countries are called to be more ambitious and to set specific clear, explicit and realistic targets for reducing overall and sectoral emissions, but for the top 17 emitters in particular, the quality of targets will shape the region's response.

Figure 1 describes how far NDC 2.0 GHG emission reduction trajectories are aligned with the IPCC recommended trajectory for keeping global warming within 1.5°C. The analysis demonstrates that 16 member States[2] chose to set an "absolute" emissions reduction targets by either explicitly mentioning a specific value of emissions to be reduced by 2030, or a percentage reduction rate from a predetermined baseline year. Examining those emissions reduction trajectories reveals that such commitment leads to actual reductions of emission by 1,386 $MtCO_2e$ (25 per cent) from 5,552 $MtCO_2e$ in 2019 to 4,170 $MtCO_2e$ by 2030. This reduction however falls short of the required ambition, as the emission levels under current NDCs (4,170 $MtCO_2e$) will be 1.3 times higher than their desired levels (3,164 $MtCO_2e$) by 2030.

[1] Australia, Bangladesh, China, India, Indonesia, the Islamic Republic of Iran, Japan, Kazakhstan, Malaysia, Pakistan, Philippines, the Russian Federation, the Republic of Korea, Thailand, Türkiye, Viet Nam and Uzbekistan.

Table 1 **Target-setting of the top 17 emitting countries in Asia and the Pacific**

Country	Nature of NDC target setting approach	Baseline year	Carbon neutrality target
Absolute year targets			
Australia	43 per cent reduction below 2005 levels by 2030	2005	2050
Japan	46 per cent reduction below 2013 GHG emission levels by 2030	2013	2050
Kazakhstan	15 per cent reduction below 1990 levels by 2030	1990	2060
The Republic of Korea	40 per cent reduction below 2018 levels by 2030	2018	2050
The Russian Federation	30 per cent reduction below 1990 levels by 2030	1990	2060
Intensity-based targets			
China	Reduce carbon intensity by 65 per cent from 2005 levels by 2030	2005	2060
India	45 per cent reduction in emissions intensity from 2005 levels by 2030	2005	2070
Malaysia	45 per cent reduction in emissions intensity from 2005 levels by 2030	2005	2050
Uzbekistan	35 per cent reduction in carbon intensity per GDP unit from 2010 levels by 2030	2010	2060
BAU-based targets			
Bangladesh	Reduce GHG emissions by 6.7 per cent unconditionally, up to 15 per cent conditionally by 2030	-	-
Indonesia	31.89 per cent reduction below BAU by 2030 unconditionally; 43.2 per cent with international support	2010	2060
The Islamic Republic of Iran	4 per cent unconditional reduction below BAU by 2030; conditional 12 per cent reduction	-	-
Pakistan	15 per cent emissions reduction by 2030; conditionally up to 50 per cent with international assistance	-	2050
Philippines	75 per cent reduction in emissions and avoidance (mostly conditional) by 2030	2020	-
Thailand	20 per cent reduction below BAU by 2030; could reach 25 per cent with support	2005	2040
Türkiye	21 per cent reduction in emissions below BAU by 2030	-	2053
Viet Nam	9 per cent unconditional reduction below BAU by 2030; up to 27 per cent with support	-	2050

Further examination of the intensity-based trajectories, which six regional member States[3] have chosen as their mode of developing NDC 2.0 commitments, indicate some, but very modest reduction in emissions by 2030 (around 769 $MtCO_2e$) and is significantly above the levels required to align with the 1.5°C pathway. The current trajectory remains over 7,000 $MtCO_2e$ above the recommended 1.5°C levels by 2030. In other words, while regional member States with intensity-based targets will manage to reduce emissions by 4 per cent relative to 2019 levels, emissions under the NDCs 2.0 (18,001 $MtCO_2e$) will lead to 1.9 times higher levels of emissions than the desired levels (10,773 $MtCO_2e$). This indicates that emissions intensity targets alone cannot lead to significant economy-wide low-carbon transition required.

The BAU scenario has been used by 22 member States[4] to establish their emission reduction targets. For this group of member States, instead of reducing emissions towards the IPCC-recommended levels, emissions are expected to increase by around 353 $MtCO_2e$ by 2030, reflecting the limited effectiveness of current NDCs in reducing overall emissions. This scenario demonstrates a clear gap between current NDC commitments and the 1.5°C pathway, which requires halving emissions to about 2933 $MtCO_2e$ by 2030, from 5146 $MtCO_2e$ in 2019. In other words, rather than reduce emissions, current NDCs will result in an increase in emission levels by 7 per cent relative to 2019 levels. Put differently, for member States with BAU-based targets, emissions under current NDCs (5499 $MtCO_2e$) will be 1.7 times higher than desired or recommended levels of 2933 $MtCO_2e$. The growth in emissions – rather than reduction – under the BAU approach signals an urgent need for more ambitious, realistic and concrete emissions reduction strategies.

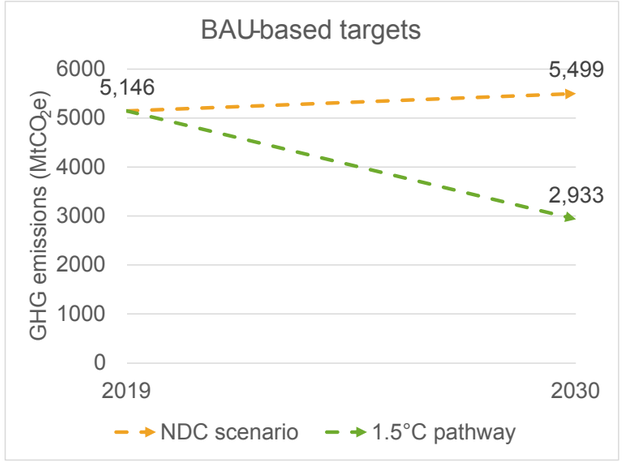
In summary, both the intensity and BAU approaches show significant misalignment with the 1.5°C pathway outlined by the IPCC. While the intensity-based targets aim to reduce emissions relative to economic output, they do not necessarily lead to significant reduction in emissions, which, by far, still exceed the required levels for limiting global warming. On the other hand, the BAU scenario anticipates continued emissions growth, diverging away from the 1.5°C pathway and exacerbating the climate challenge. The only scenario that leads to alignment with the IPCC recommended GHG emission reduction trajectory is by choosing an absolute emission reduction target. When the baseline year is closest to the IPCC recommended 2019 year, then the emission reduction trajectory supports alignment with the required levels of emission reduction.

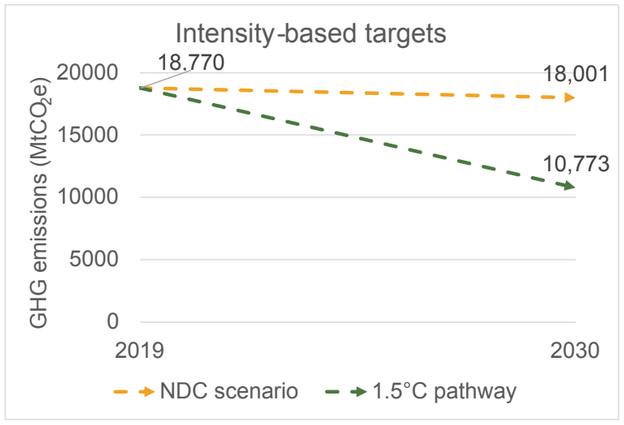
It is also observed that, although 47 regional member States have submitted updated NDCs, only 12 of them have more than one update: Australia, Japan, Bangladesh, Indonesia, the Marshall Islands, Pakistan, the Republic of Korea, Sri Lanka, Singapore, Thailand, Vanuatu and Viet Nam.

The submission of an updated NDC is a necessary and commendable act but has not been proven sufficient to raise ambition to achieve the 1.5°C pathway. Some member States with considerable gaps in achieving the required 1.5°C pathway have simply adopted earlier BAU scenarios during their update process, without considering the progress achieved in implementing previous NDC

[2] Armenia, Australia, Azerbaijan, Georgia, Japan, Kazakhstan, Marshall Islands (the), Micronesia, New Zealand, Palau, Papua New Guinea, Republic of Korea (the), Russian Federation (the), Samoa, Tajikistan, Tonga.

Figure 1 **Emission reduction trajectories based on BAU-based targets, intensity-based targets and absolute targets compared with required reduction towards the 1.5°C pathway.**





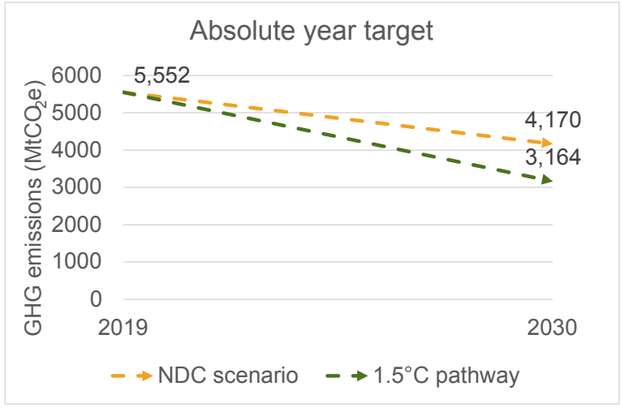
commitments and the historical levels of GHG emissions. This has devalued the whole review process and weakened overall ambition in the region (ESCAP, and others, 2023). The next NDC update cycle (2024-2025), is an opportunity for Asia-Pacific member States to critically review their previous BAU scenarios for 2030, adopt the most recent historical emissions levels for the baseline year and consider setting absolute targets.

Some member States which have pledged carbon neutrality by 2050, stand out as more proactive actors in the region. On the other hand, countries like the Philippines and Viet Nam show progress in renewable energy, despite significant challenges in decarbonizing their energy and transport sectors due to financial and infrastructural limitations.

To meet the critical 1.5°C global warming goal, the GHG emission trajectories and scenarios, the Asia-Pacific region needs to transition from intensity-based and BAU mode to a rigorous commitment to absolute emissions reduction targets, and preferably based on 2019 GHG emission levels. Such an approach will allow countries to define realistic economy-wide scenarios for unconditional and conditional emission reduction projections and to assess the needs for additional funding by critical sectors, such as energy and transport, as well as the deployment of NbS for offsetting emissions. This shift is essential, as it will define a clear benchmark for progress to monitor and will respond to the urgency of reducing

[3] Malaysia, China, India, Singapore, Uzbekistan, Turkmenistan.

[4] Cambodia, Nepal, Indonesia, the Lao People's Democratic Republic, Pakistan, Viet Nam, Bangladesh, Sri Lanka, Thailand, Mongolia, Myanmar, the Philippines, the Islamic Republic of Iran, Kiribati, Kyrgyzstan, Maldives, Afghanistan, Türkiye, Solomon Islands, Fiji, Brunei Darussalam.



Source: ESCAP, based on data from NDC submissions.

overall emissions to align with IPCC recommended level.

Achieving these targets necessitates the adoption of robust enabling environments and comprehensive policy measures that stimulate the growth of renewable energy within the energy production mix.

Additionally, enhancing energy efficiency and driving decarbonization across key sectors, such as transportation, industry and agriculture, will be vital. These efforts should include investments in clean technologies, incentives for sustainable practices and regulatory frameworks that support innovation and transition to low-carbon alternatives. Strengthening Nationally Determined Contributions (NDCs) in the upcoming revision cycles will be critical for aligning with the IPCC-recommended emissions trajectories necessary to achieve net zero by 2050.

Countries in Asia and the Pacific are already showing leadership in deploying renewable and electric mobility. By taking decisive action now, countries in this region can not only raise their ambition in fulfilling their international climate commitments but also position themselves as leaders in the global effort to combat climate change. This proactive stance will foster sustainable development, create green jobs and enhance energy security, ultimately contributing to a more resilient and sustainable future for the region and the planet.

1.3 Climate financing gaps

Achieving the climate goals set by the Asia-Pacific region requires significant financial investment. The UNFCCC Standing Committee on Finance estimates that trillions of dollars will be needed to meet the climate financing needs of developing nations in the region. While developed countries have pledged financial support for $100 billion per year, a commitment which was met in 2022, significant gaps remain.

The global financial needs for necessary investments by 2030 in a just energy transition, adaptation and resilience, loss and damage, and the conservation and restoration of nature in all the developing countries, excluding China, have been estimated at $2.4 trillion annually. Among these global financial needs, the energy transition accounts for the largest share (62.5 per cent or $1.5 trillion) followed

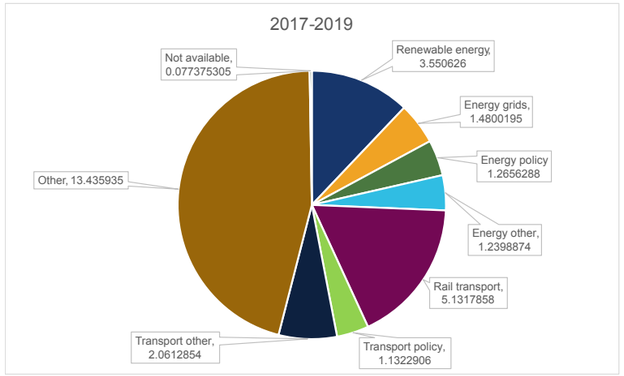
by loss and damage ($300 billion), natural capital and sustainable agriculture ($300 billion), and adaptation and resilience ($250 billion).

A global financing gap of $1.8 trillion per annum is estimated as the difference between the global financial needs ($2.4 trillion annually) and current investments financed from all sources (estimated at $600 billion per annum). Closing this gap is crucial not only for cutting emissions but also for building resilience against climate impacts that are already being felt across the region and compensating victims of climate-related disasters and nature restoration (Bhattacharya, and others, 2023).

The developing countries of Asia and the Pacific, excluding China, account for 55 per cent of the GDP of all developing countries, excluding China. Assuming that financial needs are proportional to the GDP, we can estimate the Asia-Pacific climate finance needs at $1.3 trillion per year, for all developing countries excluding China. An important question is "where will the money come from?" Considering the distribution proposed by the Independent High-Level Expert Group on Climate Finance, $760 billion would come from domestic public and private resources, between $270 billion and $330 billion from external private finance, and between $230 billion and $270 billion from bilateral and multilateral public finance (Bhattacharya, and others 2023). However, the share of external resources should be much higher in least developed countries and small island developing States.

In the energy sector, investments in clean energy in emerging and developing economies, excluding China, are projected to exceed $300 billion in 2024. However, this is just 15 per cent of the global total and far below the levels required to meet energy demand and climate goals (IEA, 2024e). Furthermore, the finance provided by developed countries to the developing countries in the Asia-Pacific region, excluding China, amounted to only $3.4 billion annually between 2021 and 2022, for renewable energy and energy efficiency (figure 2). Meanwhile, China remains the top investor in clean energy, projected to spend $675 billion in 2024, primarily in solar, lithium batteries and electric vehicles (IEA, 2024e).

Figure 2 Annual average official climate finance flows to the developing countries of Asia and the Pacific, 2017-2019 and 2021-2022



Source: ESCAP based on data from Organisation for Economic Cooperation and Development (OECD) "Development Finance for Climate and Environment" dataset CRDF-RP-2000-2022.xlsx, n.d. Available at https://webfs.oecd.org/climate/RecipientPerspective/

During the 2021-2022 period, the average annual flows provided by developed countries to renewable energy included renewable energy using multiple technologies ($1 billion); hydro-electric power plants ($710 million); solar energy ($660 million); wind energy ($450 million); and energy conservation and efficiency ($310 million) (OECD, n.d.).

In the same period, the energy sector received $1.7 billion per annum for electric power transmission and $1.2 billion for support in energy policy and administrative management. Notably, financing from developed countries for coal-fired and natural gas-fired electric power plants, dropped from $1.24 billion in 2017-2019 to $0.19 billion in 2021-2022 (OECD, n.d.).

With regards to transport, the World Bank estimates that global transport infrastructure investments must increase by approximately $417 billion annually through 2030 to meet the Paris Agreement objectives (Bakatjan, 2024). The developing countries of Asia and the Pacific received $5.1 billion per annum in 2017-2019 and $7.2 billion per annum in 2021-2022 from developed countries for investments in rail transport, but investments in road, maritime and aviation have remained stagnant (figure 2).

The sheer scale of the financial need emphasizes the importance of strengthening synergistic actions and collective efforts across sectors, particularly energy and transport, which are crucial for driving decarbonization in the Asia-Pacific region. Integrating adaptation and mitigation efforts is another important response to the wide gaps in funding in adaptation, in particular.

Key challenges include:

- Insufficient financial flows: Current climate finance flows fall well short of the required levels, particularly in low-income countries like Bangladesh and Cambodia.
- Underfunded areas: Adaptation projects, particularly in sectors like agriculture and water resources, are significantly underfunded.
- Low scale of innovative financing solutions: Several countries have begun exploring creative financing mechanisms such as green bonds and climate-focused development banks. For example, Malaysia has successfully issued green bonds to fund renewable energy projects. However, the scale of such innovative financial solutions remains quite low and scaling them up across other member States offers an opportunity to raise overall climate finance in the region.

1.4 Overview of the *2024 Review of Climate Ambition in Asia and the Pacific* report

This *2024 Review of Climate Ambition in Asia and the Pacific report* provides a comprehensive assessment of the region's progress in reducing GHG emissions, with a particular focus on sectoral solutions. It highlights how energy and transport sectors are crucial to achieving the region's NDC goals and raising emissions reduction ambition in NDC 3.0. The report offers insights into how countries are scaling up renewable energy, promoting EV adoption and implementing smart city initiatives to mitigate transport emissions.

Chapter 2 of the report highlights the importance of focusing on energy and transport as key sectors for raising emissions reduction ambition in the Asia-Pacific region. The chapter provides a deep dive into the emissions dynamics and trends for the two sectors and offers insights and opportunities for member States to further enhance sustainability of the sectors as a way of reducing overall emissions at the regional level. Chapter 3 of the report then discusses the existing efforts by regional member States to undertake integrated responses linking adaptation and mitigation. The chapter offers experiences of proactive countries in this field, draws lessons learned for other member States and highlights opportunities and challenges for scaling up integrated responses in the Asia-Pacific region. Finally, chapter 4 provides key messages and recommendations for member States to raise ambition in the NDC 3.0 cycle.

Chapter 2

TRANSFORMING ENERGY AND TRANSPORT SECTORS FOR A LOW-CARBON FUTURE IN ASIA AND THE PACIFIC

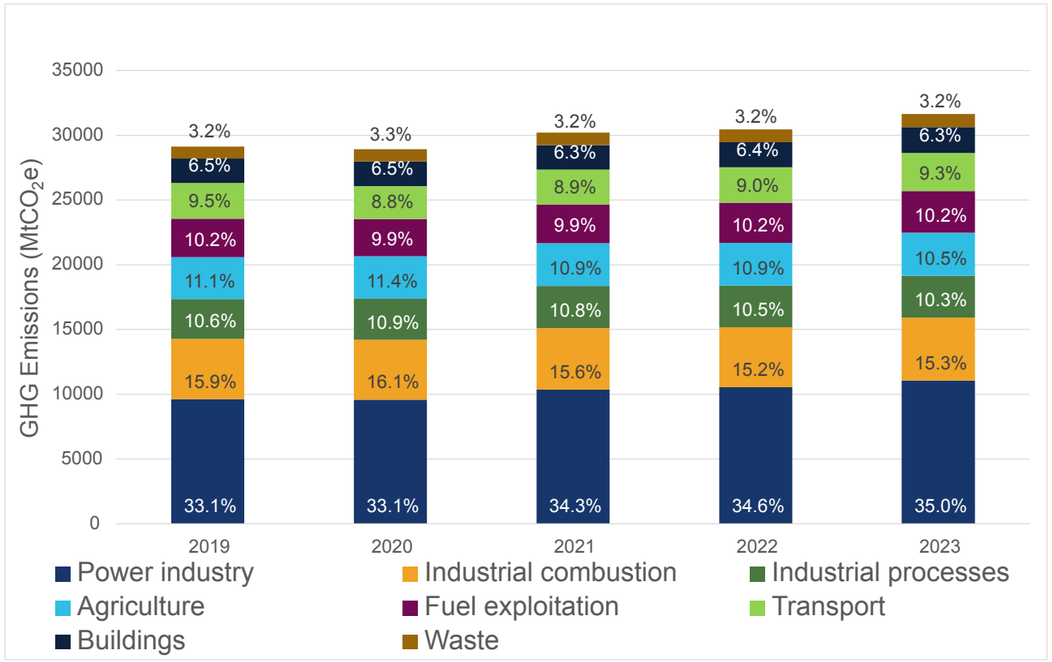
2.1 Setting the scene

Overall emissions of GHG from 2019 to 2023 have exhibited an increasing trend in the Asia-Pacific region, being largely driven by the power industry (33 to 35 per cent) and industrial combustion (around 15 per cent). Emissions from agriculture, process, fuel extraction and transport are around 9 to 10 per cent. Certain sectors show promising reductions in emissions, notably agriculture, buildings, and processes, while others, particularly the power industry, continue to see increases, indicating rising demand. The decline in emissions in the transport sector in the post-pandemic period highlights the impact of changing behaviours and the continued growth of e-vehicles, while the waste sector remains largely unchanged, (figure 3).

Chapter 1 of this report focuses on the pivotal role of the energy and transport sectors in driving down emissions and aligning the Asia-Pacific region with global climate goals.

Meanwhile transport is a rapidly growing contributor to regional GHG emissions, as rates of urbanization rise, private vehicle ownership expands and energy demands rapidly increase with the growing share of urban populations and freight demand. The *2023 Review of Climate Ambition in Asia and the Pacific* reveals that, even for the 12 countries that had submitted two or more NDC updates, the transport share of total emissions in 2022 was relatively high in some countries: 15.8

Figure 3 **Asia-Pacific GHG emissions, sectoral share, 2019-2023**

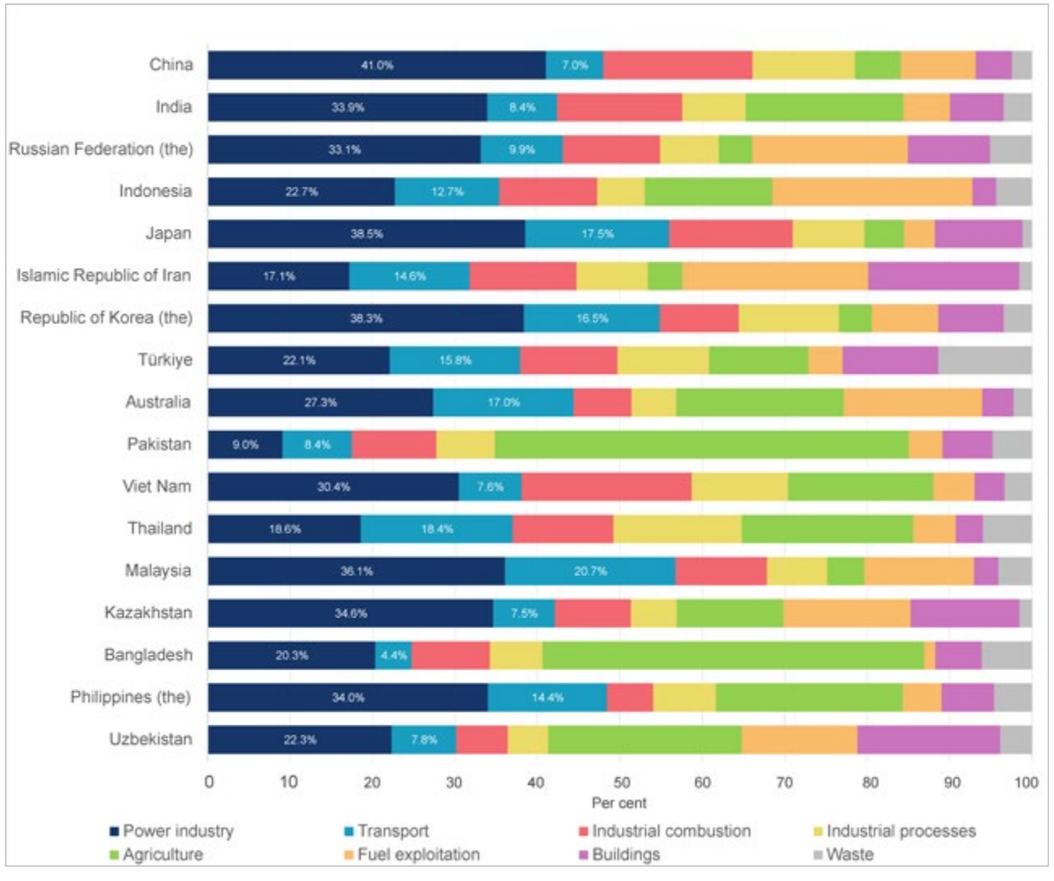


Source: Developed by the authors based on European Commission, "EDGAR – Emissions Database for Global Atmospheric Research", 2024. Available at https://edgar.jrc.ec.europa.eu

per cent in Türkiye, 16.5 per cent in Republic of Korea, 17 per cent in Australia, 17.5 per cent in Japan, 18.4 per cent in Thailand and 20.7 per cent in Malaysia (figure 4) (ESCAP, and others, 2023). This warrants prioritization of the sector for further decarbonization and overall increase in emission reduction ambition during the NDC 3.0 cycle.

Generally, transformations in both energy and transport sectors are urgently needed to meet the goals of the Paris Agreement and to ensure a sustainable, low-carbon future.

Figure 4 Breakdown of sectoral shares from total emissions for the top emitting 17 member States 2023



Source: Developed by the authors based on European Commission, "EDGAR – Emissions Database for Global Atmospheric Research", 2024. Available at https://edgar.jrc.ec.europa.eu

In this chapter, we will explore the current state of energy and transport systems in the Asia-Pacific region, assessing their emissions trajectories and identifying key challenges and opportunities. The focus will be on how the region can transition away from fossil fuels, increase renewable energy adoption, and decarbonize transport through, among other innovations, electrification and improved infrastructure planning and design. Special attention will be given to examples of successful initiatives, such as the expansion of electric vehicle infrastructure, investments in sustainable public transport and active mobility.

By examining the systemic changes needed in energy and transport, this chapter provides a roadmap for how the Asia-Pacific region can accelerate its transition to low-emission systems. It will also highlight policy recommendations, financial investments, and technological innovations required to ensure these sectors play their part in achieving net-zero emissions by mid-century.

2.2 The energy sector

Most countries in the region remain dependent on coal and other fossil fuels, limiting their ability to meet ambitious targets. Some regional member States are increasingly prioritizing the transition from this coal dependency, promising gradual decarbonization of the energy sector. For example, China and India have made significant contributions to the global renewable energy transition, showing potential to shift from coal reliance in the coming years through the development and application of just transition principles. However, while China has become a leader in renewable energy, particularly in solar and wind power, its continued investment in coal-fired power plants undermines the sustainability of its energy sector. Similarly, India's growing energy demands are being met through increasing renewable capacity, but coal remains a critical component of its energy mix. Addressing such policy inconsistencies and incoherencies holds potential for the countries to embark on sustainable decarbonization. By fully embracing just transition strategies, both countries could further reduce coal dependency and accelerate their shift toward sustainable energy solutions. Such energy dynamics in some of the region's major emitting countries have critical implications for the overall emission reduction ambition at the regional level.

2.2.1 Energy sector in the NDCs of Asia and the Pacific

Energy sector growth scenario

The Asia-Pacific region accounts for 45 per cent of world energy supply, 43.2 per cent of total final energy consumption and 50 per cent of world electricity generation. The region accounts for 52.2 per cent of global energy related CO_2 emissions, with a growth rate of 33 per cent from the 2010 emission levels. In the Stated Policies Scenario (STEPS), the growth rate of the emission is expected to remain around 31 per cent and expected to reduce to 16 per cent in the Announced Pledges Scenario (APS). Electricity and heat generation is the largest emission source representing 48.5 per cent of the total emissions in the region (calculated using data from IEA, 2023).

The energy demand of Asia and Pacific region increases from 281 exajoules (EJ) in 2022 to around 310 EJ by 2030, corresponding to annual average growth of 1.2 per cent in the STEPS. In the APS, annual average growth decreases to 0.4 per cent in 2030 (calculated using data from IEA, 2023).

Total sectoral final energy consumption (TFC) is 52 per cent in the industry sector, 17 per cent in transport, 25 per cent in buildings and the remaining in other sectors. The energy consumption of the buildings sector is projected to fall below the 2022 level by 2030 in APS. The TFC for each scenario and percentage change is provided in table 2:

The total energy demand is dominated by coal at 4,631 million ton coal equivalent (Mtce), which is 80 per cent of the world's demand. The demand for coal is projected to decrease in both scenarios while the demand for oil and natural gas is expected to increase. Table 3 shows the scenario wise demand and percentage changes in 2030.

Table 2 **TFC by sector under the STEPS and APS scenario**

TFC Sector (EJ)	2022	2030		Percentage	
		STEPS	APS	STEPS	APS
Industry	99.26	113.90	108.78	1.7	1.2
Transport	32.06	37.96	36.23	2.1	1.5
Buildings	48.53	51.80	44.46	0.8	-1.1
Others	11.06	12.54	11.70	1.6	0.7

Source: Dataset from the International Energy Agency (IEA), "World Energy Outlook 2023 Extended Dataset", Paris, 2023. Available at https://www.iea.org/data-and-statistics/data-product/world-energy-outlook-2023-extended-dataset

Coal accounts for 56 per cent of electricity generation, with renewables contributing 27.1 per cent and the rest are from natural gas, nuclear and other sources. The projections for electricity generation by 2030 under STEP and APS highlight a significant shift in the energy mix, driven primarily by a decline in coal usage and an increase in renewable energy sources. Reflecting the efforts to reduce dependence on coal correlated by the projected decrease in demand of coal, the share of electricity generation is expected to drop to 39 per cent in STEPS and 33 per cent in APS. Conversely, the renewable generation is set to increase to 46 per cent and 51 per cent in STEPS and APS, respectively, signifying the stronger commitments to embrace cleaner and sustainable sources to meet energy demand.

Table 3 **Total energy demand by fuel under different scenario**

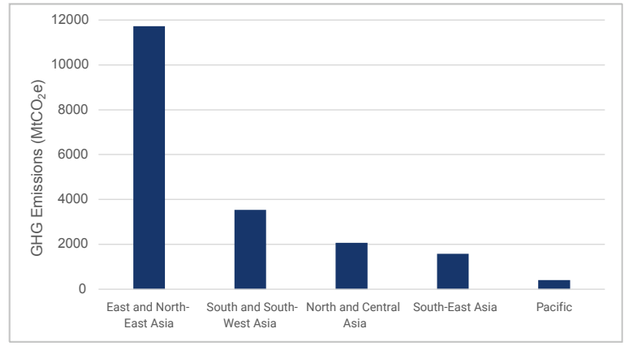
Fuel Types (units)	2022	2030		Percentage	
		STEPS	APS	STEPS	APS
Coal (million ton coal equivalent) (Mtce)	4631	4305	3763	-0.91	-2.56
Oil (million barrels per day) (mbd)	32.9	37.6	34.6	1.68	0.63
Natural gas (billion cubic metres) (bcm)	900	1034	954	1.75	0.73

Source: Dataset from the International Energy Agency (IEA), "World Energy Outlook 2023 Extended Dataset", Paris, 2023. Available at https://www.iea.org/data-and-statistics/data-product/world-energy-outlook-2023-extended-dataset

Summary of energy sector-specific NDC targets in the Asia-Pacific region

The climate pathway shows the requirement of a 45 per cent reduction in global CO_2 emissions by 2030 compared to 2010 levels. Since the 2019 emissions surpassed 2010 emission levels, this limit is crucial for both scenarios. GHG emissions from combustion of fossil fuels were 19.3 billion tons of carbon dioxide equivalent (tCO_2e) in 2019. This represents an increase at an average annual rate of 4 per cent between 2000 and 2019 (ESCAP, 2024a). In terms of subregions, the East and Nort-East Asia had the largest share of emissions in 2019, at 55 per cent. This was followed by South and South-West Asia at 16.6 per cent, North and Central Asia at 9.7 per cent, South-East Asia at 7.4 per cent and the remaining 2 per cent was from the Pacific – mainly from Australia and New Zealand (figure 5). The share of emissions from China was 51.6 per cent, followed by India at 11.8 per cent, the Russian Federation at 8.5 per cent, Japan at 5.4 per cent and the remaining 22.7 per cent was from rest of the region (figure 6).

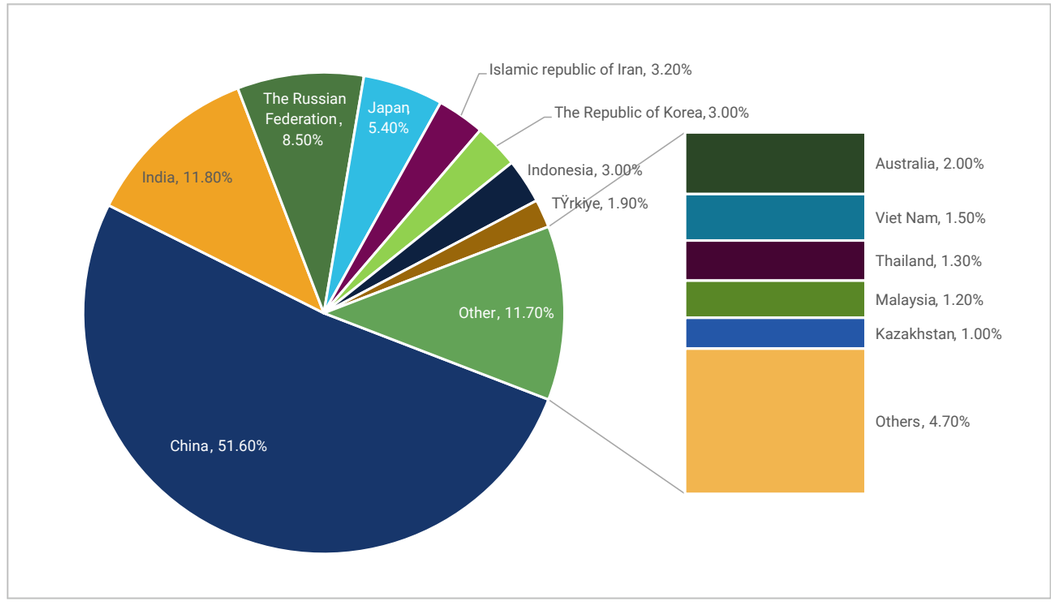
Figure 5 **Emissions by subregion in 2019**



Source: Developed by ESCAP, based on United Nations Climate Change, "Nationally Determined Contributions Registry", n.d.b. Available at https://unfccc.int/NDCREG

There are different estimates on how the emissions will grow leading up to the 2030 and 2050 goals of the NDCs and net zero carbon emissions, as there are many different policy options to consider. While there have been positive announcements by some countries in the region towards net-zero emissions, coal phase down, etc., the extent to which these announcements will be reflected into actions is unknown. These matters thus create an uncertainty into emissions forecast. The Climate Action Tracker estimates that policy actions of China (the largest emitter in the region) are highly insufficient in meeting the 2030 emissions target and are expected to grow from 10 billion tCO_2e in 2019 to 14.6 billion tCO_2e by 2030 (Climate Action Tracker, n.d.). It suggests that under an optimistic scenario based on ambitious targets, its emissions (excluding LULUCF) could peak around 2023 and then decline at an annual rate of 1 per cent to about 13.9 billion tCO_2e by 2030. A similar scenario exists for India, the second largest emitter, where emissions are expected to grow from 2.3 billion tCO_2e in 2019 to about 4.0 billion tCO_2e by 2030. The emissions trajectory for the Russian Federation is estimated to be 'critically insufficient' to meet its fair share of emissions goal since a few of its relevant policies are unambitious or have an unclear expected effect on emissions, despite the Government's intention to reach net-zero GHG emissions by 2060.

Figure 6 **Emissions by country in 2019**



Source: Developed by ESCAP, based on United Nations Climate Change, "Nationally Determined Contributions Registry", n.d.b. Available at https://unfccc.int/NDCREG

However, in relation to the decarbonization race towards 1.5°C pathway, it appears that the Asia-Pacific region has performed better than other key regions/groups in 2021. It has achieved a decarbonization rate of 1.2 per cent on average, compared to the world's overall decarbonization effort of 0.5 per cent in the same period (PwC, 2024). But this is highly insufficient given the 15.2 per cent decarbonization rate required to limit global warming to 1.5°C above pre-industrial levels.

Overall, the commitments of countries to reduce emissions as set out in their NDCs are typically a percentage reduction from a defined baseline based on projections of emissions in a set year or base year. All countries noted that the electricity sector was covered in their NDCs, while, the specific targets and benchmarks that need to be accomplished were excluded by most. As many of the countries in the Asia and the Pacific region are not listed in Annex I of the UNFCCC, the NDC targets are mostly conditional and subject to international support.

The NDC targets specific to the energy sector, the emission levels of 2010 and 2019, and the emission targets for selected countries in Asia and the Pacific are provided in table 4.

Table 4 **NDC targets and baseline emissions in the energy sector**

Sl.#	Country	2010 CO_2 emission ($MtCO_2e$)	2019 CO_2 emission ($MtCO_2e$)	2030 BAU emissions ($MtCO_2e$)	Conditional reduction ($MtCO_2e$)	Description
1	Afghanistan	8.6	10.9	12.1	4	To reduce 13.6 per cent relative to BAU 2030 Conditional
2	Australia	445.7	455.4	401.0	400	To reduce 43 per cent below 2005 levels by 2030.
3	Bangladesh	63.2	106.2	195.0	160	To reduce 6.73 per cent relative to BAU 2030, 21.85 per cent conditional
4	Brunei Darussalam	9.2	9	19.2	16	To reduce 20 per cent relative to BAU 2030
5	Cambodia	6.9	14.6	15.6	11	To reduce 41.7 per cent relative to BAU 2030
6	China	8,525.70	10,631.60	14,000.0	9,810.00	CO_2 emission intensity of its economy by over 65 per cent below 2005 levels by 2030, having its CO_2 emissions peak before 2030, achieving carbon neutrality before 2060, increasing the share of non-fossil fuels in primary energy consumption to around 25 per cent by 2030, increasing forest stocks by 6 billion cubic metres and its total installed capacity of wind and solar power to over 1200 GW by 2030.

Sl.#	Country	2010 CO_2 emission ($MtCO_2e$)	2019 CO_2 emission ($MtCO_2e$)	2030 BAU emissions ($MtCO_2e$)	Conditional reduction ($MtCO_2e$)	Description
7	Fiji	1.1	1.4	2.0	1.5	To reduce 10 per cent relative to BAU 2030, and up to 30 per cent conditional
8	India	1760	2506.7	4,200.0	2740	Emission intensity of its economy by 45 per cent below 2005 levels by 2030, at achieving about 50 per cent electric power installed capacity from non-fossil fuel-based energy resources by 2030 and at creating 2.5 to 3 billion tons of CO_2 equivalent additional forest carbon sink by 2030
9	Indonesia	475	657.7	1,933.2	1350	To reduce 43.20 per cent relative to BAU 2030 conditional
10	Japan	1142	1056.3	813.0	690	To reduce 46 per cent below 2013 levels by 2030
11	The Republic of Korea	575	609.3	501.0	320	To reduce 40 per cent below 2018 levels by 2030
12	The Democratic People's Republic of Korea	66	71.6	115.2	99	To reduce 16.4 per cent relative BAU2030, and 36 per cent conditional
13	Lao People's Democratic Republic (the)	3.8	18.6	16.0	10	To reduce 60 per cent relative to BAU 2030
14	Malaysia	216	260.4	420.5	290	To reduce 45 per cent below 2005 levels by BAU 2030
15	Mongolia	14	23.1	39.3	32	To reduce 22.7 per cent relative to BAU 2030
16	Myanmar	19	42.7	297.0	38	To reduce 414.75 $MtCO_2e$ by 2030
17	Pakistan	170	211.9	570.0	380	To reduce 15 per cent relative to BAU 2030, and 50 per cent conditional
18	Philippines	82	142.3	92.8	53	To reduce 2.71 per cent relative to BAU by 2030, and up to 75 per cent conditional
19	Singapore	42	45.3	60.0	50	Capping at around 60 $MtCO_2e$ by 2030
20	Solomon Island	0.3	0.3	0.3	0.2	To reduce 33 per cent relative to BAU 2030, and up to 45 per cent conditional
21	Thailand	244	275.6	280.0	200	To reduce 30 per cent relative to BAU 2030, or up to 40 per cent conditional
22	Viet Nam	162	312.2	645.8	450	To reduce 15.8 per cent relative to BAU 2030, and by up to 43.5 per cent conditional
	TOTAL	**14,032**	**17,463**	**24,628.8**	**17,105**	

Source: Compiled using International Energy Agency (IEA), "Climate Pledges Explorer", 24 September 2024. Available at https://www.iea.org/data-and-statistics/data-tools/climate-pledges-explorer

The conditional NDC targets in the energy sector reflect an increase in emissions from the 2010 levels as opposed to the requirement for 45 per cent reduction to achieve the desired climate pathway. Compared to 2019 emissions, there is a reduction of only 2.1 per cent by 2030, compared to the IPCC recommendation of 43 per cent reduction. Six countries, Afghanistan, Australia, Japan, the Republic of Korea, the Philippines and Thailand projected lower emissions compared to 2010 level while 10 countries (additional countries, Cambodia, China, the Laos People's Democratic Republic, Myanmar) project lower emissions by 2030 as compared to 2019 levels.

Summary of current and announced policies in the energy sector and their alignment with NDC targets

As emissions from the energy sector are substantial, major transitions in the energy sector are required in terms of fossil fuel use, energy efficiency, electrification and renewable energy to achieve the desired climate pathway. Countries in Asia-Pacific region are implementing various policies in the energy sector with major focus on reducing coal dependency, expanding of renewable energy capacity and improving energy efficiency in alignment with their NDCs. The electricity sector has made unprecedented progress in deployment of renewable energy in recent years driven by supportive policies and falling costs of technology. At COP28, countries committed to tripling renewable energy and doubling the global average annual rate of energy efficiency improvements by 2030 (COP28 Secretariat, 2023).

Some countries had announced specific targets in renewable energy as key strategies to ensure achievement of their NDC commitments. For instance, China, has committed to peak carbon emissions before 2030 and achieve carbon neutrality by 2060, stimulated by substantial investments in solar, wind, and nuclear power. As of 2023, China has installed 1052 GW solar and wind and is set to surpass the commitment of 1,200 GW of combined wind and solar capacity by 2030 well ahead of time (IRENA, 2024b). India, another major player, has set ambitious goals to achieve 500 GW of non-fossil fuel electricity capacity by 2030 and meet 50 per cent of its energy needs from renewables.

India has installed 176 GW (IRENA, 2024b) of renewables in 2033 corresponding to a renewable energy capacity of 19.5 per cent. In December 2023, India updated its NDC target to achieve cumulative electric power installed capacity from non-fossil fuel-based energy resources to 50 per

cent by 2030, and to reduce emissions intensity of its GDP to 45 per cent by 2030 from 2005 levels (India, Ministry of Environment, Forest and Climate Change, 2023). The International Energy Agency (IEA) estimates that tripling of renewable energy by 2030 would need the capacity to be over 11,000 GW. While countries have been intensifying their renewable energy targets and even if all these countries were to fully implement their current ambitions, the world would still fall 30 per cent short of this target (IEA, 2024).

Energy storage is essential for a reliable electricity supply from renewable energy resources. In 2021, China announced plans to install about 30 GW of new energy storage by 2025. As of June 2023, China has installed 21 GW of new energy storage (CNESA, 2024). India's National Electricity Plan has the target to install 47.24 GW of battery energy storage by 2032 (Central Electricity Authority, 2023). Additionally, Australia announced funding support for a total of 2GW/4.2GWh of grid scale storage capacity encompassing seven grid scale battery projects across the country through the Australian Renewable Energy Agency (ESJ, 2022).

Another critical area of focus is energy efficiency in power generation, industry and buildings and transport sector. The Association of Southeast Asian Nations (ASEAN) has made a collective target to reduce energy intensity of 20 per cent by 2020 and 32 per cent by 2025, relative to the base year of 2005. While these countries have achieved reduction in energy intensity by 24.5 per cent by 2022, it still falls short in achieving the 32 per cent reduction by 2025 (ACE, 2024).

There is a growing commitment to phase out coal as evident in the projections for coal demand. Some countries in Asia and the Pacific are participating in the initiative of phasing down unabated coal power and phasing out inefficient fossil fuel subsidies pledge. For instance, Japan and the Republic of Korea committed to stop international coal financing and in 2021, China pledged to halt overseas coal projects and support low carbon and green energy (Ma, 2022). In 2022, Indonesia and Viet Nam announced two new Just Energy Transition Partnerships to support the decarbonization efforts including phasing out of coal power. Simultaneously, many nations are moving to natural gas as a cost-effective bridge between their current reliance on coal and an eventual transition to renewables.

The NDCs of countries in the Asia-Pacific region reflect commitments to reducing greenhouse gas emissions. The current energy policies in the region show a strong alignment with these NDC commitments. The focus on renewable energy directly supports the NDC goals of many countries to increase the share of renewables in their energy mix. Additionally, carbon market mechanisms can support NDC objectives by providing financial incentives for emissions reduction and energy efficiency measures contribute to many NDCs by reducing overall energy demand and associated emissions.

There are immense opportunities for clean energy technologies demonstrated by rapid development and rollout of both renewable energy and energy efficiency solutions. However, this requires strengthened collaborations to enhance resource-sharing, technology transfer and capacity-building.

Despite these promising developments, the countries in the region face significant challenges in meeting their NDC targets. Many countries in the region remain highly dependent on coal, hindering the efforts to meet the NDC targets. There are policy inconsistencies, like continued subsidies for fossil fuels in some countries in Asia as seen from the fossil fuel subsidy of 10 countries in Asia (Bangladesh, China, India, Indonesia, Kazakhstan, Malaysia, Pakistan, Sri Lanka, Thailand and Viet Nam) amounting to $348 billion in 2022 (calculated from IEA, 2024b).

While full implementation of the current NDC commitments is not sufficient to meet the climate pathway, the adherence to implementation of these commitments is important. It is also crucial to undertake ambitious update and low-carbon emissions development strategies with higher GHG emission reductions in each of the sectors. This is essential for curbing global GHG emissions to keep within the 1.5°C climate pathway. For monitoring and transparency, it would be crucial to have specific targets in the energy sector, considering the contribution and impacts of the energy sector. The survey conducted by IRENA on NDCs indicated that many countries intended the need to specify GHG emission reduction targets from the energy sector while sharing the challenges faced in estimation of the same (IRENA, 2024a).

2.2.2 Technological interventions in the energy sector

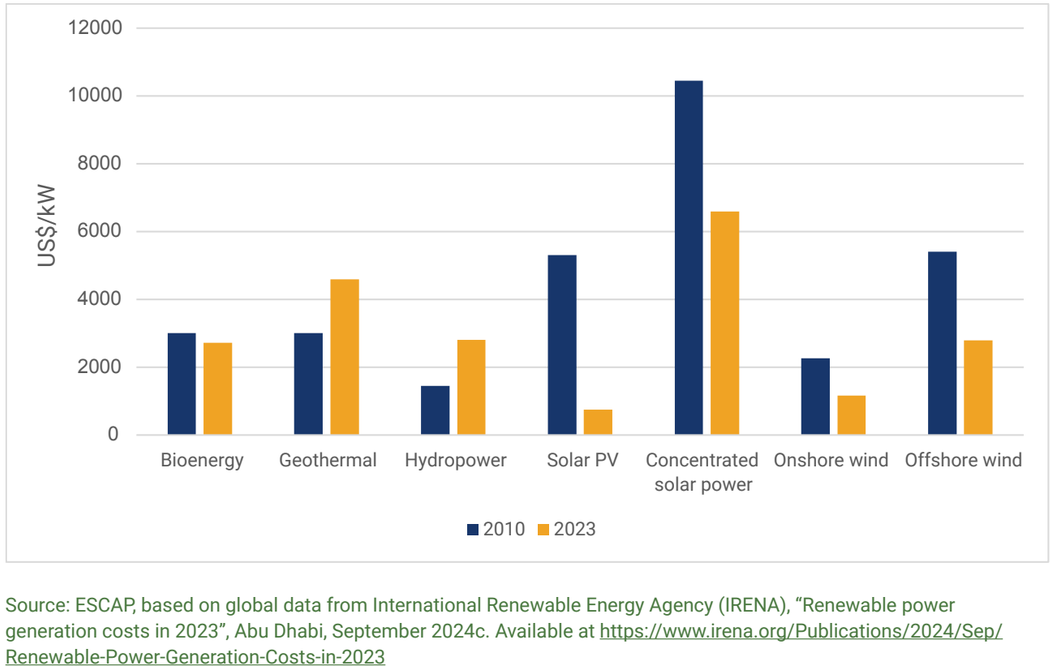
Summary of existing technologies in the energy sector to drive emission reductions

The energy sector has a range of existing technologies that are crucial in driving emissions reductions, each with varying costs and applications.

Solar photovoltaic (PV) technology has become one of the most widely deployed renewable energy solutions with 73 per cent deployment in 2023. The weighted average levelized cost of electricity (LCOE) of utility-scale solar PV has significantly dropped by 90 per cent from $0.46/kWh in 2010 to $0.044/kWh as of 2023, making it a cost-effective option power generation. Similarly, wind energy, harnessed through onshore and offshore wind turbines, plays a major role in energy transition. Onshore wind, the second most deployed technology with 23 per cent in 2023 is cost-effective and, averages around $0.033/kWh, while offshore wind, despite higher costs at approximately $0.075/kWh, provides significant energy potential, especially in coastal regions (IRENA, 2024c). Figure 7 shows the total installed cost of the different technologies for the years 2010 and 2023, and it is evident that the price of solar PV has decreased by 86 per cent while the same for hydropower and geothermal has increased by 92 per cent and 52 per cent respectively (elaborated from IRENA, 2024c).

Although the cost of concentrated solar power (CSP) has decreased, its capacity addition is slow with an addition of 300 MW in 2023. The cost of hydropower and geothermal has increased to $0.057/kWh and $0.071/kWh, respectively, which is still lower than the price of fossil fuel of $0.100/kWh.

Figure 7 **Installed cost of different renewable energy technologies in 2010 and 2023**



Source: ESCAP, based on global data from International Renewable Energy Agency (IRENA), "Renewable power generation costs in 2023", Abu Dhabi, September 2024c. Available at https://www.irena.org/Publications/2024/Sep/Renewable-Power-Generation-Costs-in-2023

The continued advancements in solar PV modules and wind turbine technology have significantly improved capacity factors especially utility-scale solar PV and onshore wind. It is clear that solar and wind power technologies will have the biggest impact on tripling renewable energy capacity and these need to be accompanied by key enablers, notably grid expansion and storage.

While the path to achieving NDC targets using existing technologies is complex and costly, the ongoing reduction in technology costs, coupled with supportive policies and international funding, provides a clear opportunity to drive significant emissions reductions. These technologies, if scaled effectively, have the potential to transform the energy landscape and help nations meet their climate commitments.

Challenges and opportunities to achieve the NDC targets using technological interventions

Despite the record renewable additions in 2023, the world is still falling short of requirements to achieve the goal adopted at COP28 of tripling installed renewable power capacity to 11,000 GW by 2030. To achieve this target, approximately 7000 GW of renewable energy must be installed over the next six years.

Only few countries have explicitly mentioned renewable energy capacity additions in their current NDCs. Table 5 shows renewable energy capacity addition plans for two biggest economies – China and India.

Table 5 **Renewable energy capacity addition plans for China and India**

Countries	Renewable energy capacity addition by 2030 (GW)					Investment needed US$ billion
	Solar	Wind	Hydro	Bioenergy	Total	
China*	1,948	1,052			**3,000**	**1,806**
India	293	100	78	15	**486**	**598**

Source: Dataset from the International Energy Agency (IEA), "World Energy Outlook 2023 Extended Dataset", Paris, 2023. Available at https://www.iea.org/data-and-statistics/data-product/world-energy-outlook-2023-extended-dataset

Note: *Based on China's decarbonization ambition

The Asia-Pacific region presents a mix of challenges and opportunities for achieving NDC targets through these technologies. Although capacity additions and investment gaps pose significant hurdles, supportive policies and technological advancements provide a promising pathway to achieving its climate goals.

Gaps to achieve NDC targets with existing technology

The gaps in achieving NDCs in the Asia-Pacific region under the current policy scenario with existing technologies are evident from the 2030 emission projections. Current NDC commitments in the region reflect low ambition which is insufficient to meet global climate targets. Projections indicate that even with full implementation of existing NDCs, the region's GHG emissions would still exceed 2010 levels, highlighting the need for more ambitious action.

From the existing technologies, solar PV continues to be the preferred technology for deployment followed by onshore wind technology. Offshore wind technology is mentioned by Japan, Philippines and Viet Nam. Other types of renewable energy technology deployment are limited. India and Viet Nam have plans for hydropower and bioenergy, while Japan plans for bioenergy and geothermal. Indonesia, the Philippines and New Zealand also mention geothermal technology. However, many countries have not included these technologies for deployment due to challenges like the long lead times of hydropower and geothermal projects, as well as supply chain issues in bioenergy.

Emerging energy technologies that may assist bridge gaps in achieving NDC targets

Emerging technologies in the energy sector are essential for addressing gaps in achieving NDCs in the Asia-Pacific region. Battery energy storage systems (BESS) are increasingly critical for storing

excess electricity from renewable sources mitigating the intermittency issues and providing grid stability. BESS technology also provides the most scalable type of grid-scale storage and can be installed anywhere. Between 2010 and 2023, the costs of battery storage projects declined by 89 per cent, from $2511/kWh to $273/kWh (IRENA, 2024c). Smart grid technologies to integrate renewable energy for real time monitoring and management would further improve efficiency and reduce energy related emissions.

Green hydrogen, produced by renewable energy is another transformative technology with significant potential to decarbonize heavy industries. Although the current cost of production in the ASEAN region is high from between $8/kg to $13/ kg, the levelized cost of $4/kg to $6.2/ kg is expected by 2030 (ERIA, 2024). As the cost of renewable energy and electrolyser decreases and the challenges of supply chain networks get resolved, the costs of hydrogen fuel could be competitive in decarbonizing the energy sector.

Carbon Capture, Utilization, and Storage (CCUS) is another promising technology to achieve emission reduction in heavy industrial sectors such as steel, cement and chemical. CCUS technology captures CO_2 emissions from industrial processes and power plants for storage underground or for use in various industrial applications. The costs of CCUS vary by CO_2 source ranging from $15/t$CO_2$ to $25/ t$CO_2$ for industrial process and $40/t$CO_2$ to $120/ t$CO_2$ captured for processes with “dilute gas”. The cost of transport and storage further increases the costs (IRENA, 2024c).

Small modular reactors (SMRs), advanced nuclear reactors with power capacity of up to 300 megawatts electric (MWe) per unit, offer a lower-cost and reduced risk alternative compared to traditional nuclear plants., With construction costs estimated between $5,000/kW to $10,000/ kW, SMRs have the potential to repurpose retired power plants and offer a cost effective solution for electricity generation and hydrogen production (IRENA, 2024c).

By leveraging these emerging technologies in addition to the conventional renewable energy technologies, countries in the Asia-Pacific region can effectively address key challenges in the achievement of their NDC commitments.

2.2.3 Raising ambition under current policies, technologies and costs

To raise climate ambition in the energy sector under the current policy regime in the Asia-Pacific region, scaling of renewable energy is crucial, as current capacity additions are insufficient to meet emission reduction targets. The transition of the energy sector and expansion of renewable energy require investments in transmission grids and regional grids to accommodate and optimize the intermitted sources. Energy storage technology needs to be expanded and emerging technologies like CCUS, battery storage and green hydrogen need to be leveraged.

At the national level, climate ambitions should be raised by strengthening policy frameworks and integrating climate goals into national development plans and regularly updating NDCs. Enhanced climate finance is crucial, with a focus on mobilizing domestic resources and actively pursuing international financing. Promoting renewable energy development by setting clear targets and investing in grid infrastructure will facilitate a transition to sustainable energy sources. Further, strengthening data and monitoring systems to track emissions and policy effectiveness will enhance transparency and accountability. Carbon markets provide a potential financing source to enhance renewable energy capacity. With the anticipated launch of Article 6.4 markets under the Paris Agreement at COP 29, countries in the Asia-Pacific region must put in place the required institutional arrangements and policy frameworks to participate effectively.

Opportunities for raising climate ambition in the energy sector

The energy sector has significant opportunities to enhance climate ambition and raise NDCs through the deployment of emerging technologies and the introduction of practical policies alongside incentives. The focus of China on energy storage by publishing the Guidance on accelerating the Development of New-Type Energy Storage has resulted in plans to deploy 60 GW of energy storage capacity, surpassing the planned target of 30GW. This initiative is fostering the development of an energy storage market that encompasses everything from battery systems to raw material manufacturing (Zhang, 2023a). The Action Plan on Energy Conservation and Carbon Reduction of China is further expected to reduce fossil fuel consumption, accelerate construction of transmission lines to increase the capacity for absorbing renewable energy, promote energy conservation and carbon reduction in the industries and buildings sector (Zhang, 2023a).

Carbon capture, utilization and storage (CCUS) has high potential in the region. Countries like Australia, China, Indonesia and Malaysia are focusing on this emerging technology while the policies are at the developmental stage for most countries. Australia has legal and regulatory frameworks with an incentive scheme called the Australian Carbon Credit Unit. In China, storage hubs are being assessed for inclusion in National Emission Trading Scheme. Indonesia has released two regulations for CCUS and has set up structures to monetize carbon credits and allow credits to be traded when the market framework is established. In Malaysia, the availability of loans for small and medium companies, 10-year investment tax incentives and import duty exemptions for companies involved in the technology is provided. An 8-year corporate income tax exemption is provided for petrochemical and natural gas plants implementing CCUS with provision on CCUS framework in the Petroleum Act in Thailand.

Given that countries are focusing on emerging technologies in clean energy transmission, with evolving policies and incentive schemes provided, there is opportunity to raise the climate ambition while also enhancing their national energy security drives.

Cost estimates (additional to that under the current policy scenario) to achieve the ambitious target

The requirements for the energy sector are estimated at US$800 billion annually for Asia-Pacific developing countries excluding China, based on estimates of global climate needs and climate

action in developing countries excluding China (Bhattacharya, and others, 2023), and an estimated share of the energy sector requirement of 62.5 per cent of global needs.

The energy investment in the Asia-Pacific region in 2024 is set to reach $1.3 trillion, with $978 billion going to clean energy. Investments in renewables of $470 billion surpassed all other generation sources combined. Recognizing the importance of grid for renewable energy deployment, investment in electricity network is projected at $150 billion. Investment in battery storage is estimated to be $22 billion. 23 per cent of the investment has been projected for end-use energy efficiency. The overall energy investment in Asia and the Pacific and use of clean energy is comparable to the advanced economies with China accounting for 69 per cent of the clean energy investment in the region (IEA, 2024a).

Challenges and opportunities to raise ambition

Implementing NDCs requires significant financial investments, and many countries have NDCs which include "conditional" climate pledges, which they intend to achieve only with international support. Further raising climate ambition in the energy sector would require additional financial investments, capacity-building and technology transfer.

However, there are notable opportunities to address these challenges. Innovative financing models like green bonds and blended finance can attract capital for renewable projects. Participation in carbon markets, particularly under Article 6.2 and 6.4 of the Paris Agreement, can generate revenues which can be ploughed back into renewable energy investments. Therefore, comprehensive policy frameworks that promote renewable energy standards and carbon pricing can provide stability for investment and innovation. Additionally, engaging local communities in energy planning fosters public support and ensures transitions are just and equitable, addressing specific needs and concerns. Investments in renewable and clean energy can create clean jobs as witnessed in the Asia-Pacific region with 7.8 million employment opportunities (IRENA & ILO, 2003).

2.2.4 Conclusions and recommendations

Conclusions

All the countries in Asia and the Pacific have submitted their NDCs and updates to the NDCs with varying ambition levels. The enhancement of NDCs in the energy sector in Asia and the Pacific will require a coordinated implementation of technological, institutional and policy mechanisms. Renewable energy technologies, energy storage systems and smart grids must be deployed at scale, supported by robust institutions that promote regional cooperation, public-private partnerships and effective monitoring systems.

Each country in the Asia-Pacific region faces unique challenges and opportunities in raising their energy sector ambitions to meet their NDC commitments. For instance, China and India, two of the biggest countries in the region in terms of their GHG emissions as well as population size, have committed to carbon neutrality and net-zero GHG emissions by 2060 and 2070 respectively, showing political commitment to align their national goals with those of the Paris Agreement.

Policy frameworks that set ambitious renewable energy targets, promote energy efficiency, reform fossil fuel subsidies and introduce carbon pricing will further accelerate the transition to a low-carbon energy sector. Asia-Pacific member States should critically review their previous business-as-usual scenarios for 2030 and adopt the most recent historical emissions levels for the baseline year. This will allow countries to capture the importance of their unconditional commitments and to demonstrate higher ambition aligned with their carbon neutrality pledges to attract financial, capacity-building and technical support from the international community.

South-South cooperation (SSC) plays a crucial role in enabling countries in the Asia-Pacific region to meet their NDCs in the energy sector. Through SSC, developing countries can share innovative technologies, knowledge and best practices that are specifically tailored to the regional context, fostering collaborative solutions for clean energy transitions. This cooperation helps reduce reliance on external aid and strengthens regional resilience by promoting homegrown solutions, joint research and capacity-building in renewable energy, energy efficiency and low-carbon development. By leveraging the strengths of each country, SSC accelerates progress toward NDC commitments, supports regional energy security and addresses the challenges of climate change in a more inclusive and equitable manner. Through these efforts, the region can contribute significantly to global climate goals while ensuring sustainable economic development.

Recommendations for Governments to enhance climate ambitions at the national level

There is a need to develop more ambitious climate mitigation and adaptation commitments in the next update of NDCs scheduled for 2025. The next NDC cycle offers an opportunity to reassess the level of ambition in the current NDC and speed up the transition by raising the ambition taking into account the new IPCC recommended trajectory of the energy sector. However, these would require the following:

RENEWABLE ENERGY TARGETS AND INCENTIVES

Many countries in the region have established ambitious renewable energy targets aligned with their NDCs. To foster the growth of clean energy sources, policies such as feed-in tariffs, renewable energy auctions, tax incentives and subsidies for renewable projects have been put in place. For instance, India's National Solar Mission aims to reach 100 GW of solar capacity by 2022, while China has rolled out various subsidies and incentives to boost solar and wind energy development.

ENERGY EFFICIENCY POLICIES

Enhancing energy efficiency can lead to significant reductions in emissions within the energy sector. Numerous countries have implemented energy efficiency standards for appliances, buildings and industrial processes. The Top Runner Program in Japan and the Energy Conservation Law in China serve as examples of effective energy efficiency policies that have achieved notable decreases in energy consumption.

FOSSIL FUEL SUBSIDY REFORM

Eliminating fossil fuel subsidies is a vital step in advancing clean energy. Countries like Indonesia and India have begun to reduce or phase out these subsidies, which disrupt the energy market and impede the shift to renewable sources. By reallocating these funds towards clean energy investments, countries could greatly improve their NDC objectives.

CARBON PRICING AND EMISSIONS TRADING SYSTEMS (ETS)

Implementing carbon pricing mechanisms, such as carbon taxes or emissions trading systems, can create financial incentives for emission reductions. The national ETS in China, launched in 2021, is the largest in the world, initially covering the power sector with plans to extend to other industries. Additionally, several countries, including the Republic of Korea, New Zealand and Japan, have adopted carbon pricing schemes, achieving varying degrees of success. While domestic carbon markets work in countries with strong emission targets and stringent regulatory frameworks, access to international carbon markets for smaller countries is severely restricted.

ROLE OF UN AGENCIES AND OTHER INTERNATIONAL ORGANIZATIONS IN SUPPORTING AND ACCELERATING CLIMATE AMBITIONS AND FACILITATE INCORPORATION OF THESE TARGETS IN NDC 3.0

UN agencies and other international organizations can strengthen regional cooperation and can play a key role in sharing knowledge, best practices and technological innovations. UN agencies and international organizations can also provide valuable platforms for collaboration and learning from successful clean energy transitions. This can be achieved through capacity-building and technical support, such as training workshops and tailored assistance in key areas like renewable energy and climate adaptation.

International and regional organizations can also establish technology hubs and knowledge-sharing platforms, including regional forums which allow countries to exchange best practices and lessons learned. Additionally, facilitating access to climate finance through mechanisms like the Green Climate Fund and Mitigation Action Facility, among others, can help nations implement ambitious projects.

Furthermore, UN and other organizations can support in harmonizing regional policies and creating joint commitments to enhance coherence among countries, while shared data collection initiatives can improve understanding of vulnerabilities and opportunities. Sharing the experiences of the UN and other international organizations in engaging local communities and civil society in the climate planning process using safeguard policies and practices ensures that strategies are inclusive and relevant.

One particular area of support that UN agencies and other organizations can provide is local capacity development for the member States of the Asia-Pacific region in reporting climate change, developing robust domestic MRV systems as well as preparing countries to participate in carbon markets, both mandated and voluntary.

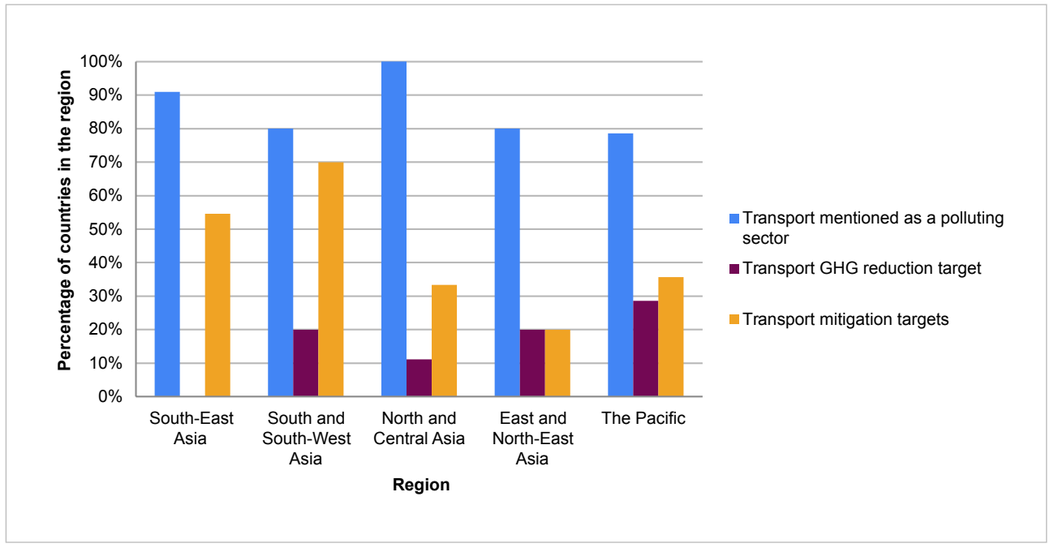
2.3 The transport sector

2.3.1 Introduction

Decarbonizing the transport sector is fundamental for meeting the goals of the Paris Agreement for limiting global temperature rise to well below 2°C, and ideally to 1.5°C. In 2022, the transport sector accounted for 20 per cent of global CO_2 emissions, with the Asia-Pacific region responsible for about 31 per cent of that total (EDGAR, 2023). Despite growing awareness and efforts, emissions from the transport sector increased faster than in other sectors between 2010 and 2019, and the emissions trajectory is off track to limit the global average temperature rise to well below 2°C above pre-industrial levels (ESCAP and others, 2021; EDGAR, 2023). Thus, accelerating the transition to low-carbon transport is crucial for achieving climate targets and net-zero emissions including the adoption of a diverse range of transport technologies and innovations that fit within the national context.

Addressing the ongoing climate challenges cannot rely solely on traditional methods or a one-size-fits-all approach. As countries prepare to submit their next NDCs in 2025, it is vital to enhance ambition for GHG reductions in the transport sector and shift commitment from mitigation measures

Figure 8 Transport mentioned in NDCs of Asia-Pacific countries



Source: Developed by ESCAP, based on United Nations Climate Change, "Nationally Determined Contributions Registry", n.d.b. Available at https://unfccc.int/NDCREG

Note: "Transport mentioned as a polluting sector" refers to transport being mentioned as a sector that emits GHG emissions in a country's NDCs. "Transport GHG reduction target" refers to the country having a quantitative target to reduce transport-related GHG emissions in its NDCs. "Transport mitigation measures" refer to the country having any measures outlined that aim to reduce emissions in the transport sector in their NDCs but without a quantitative emission reduction target.

to absolute reduction targets. Clear decarbonization goals within NDCs can bolster climate action and attract financing for low-carbon initiatives.

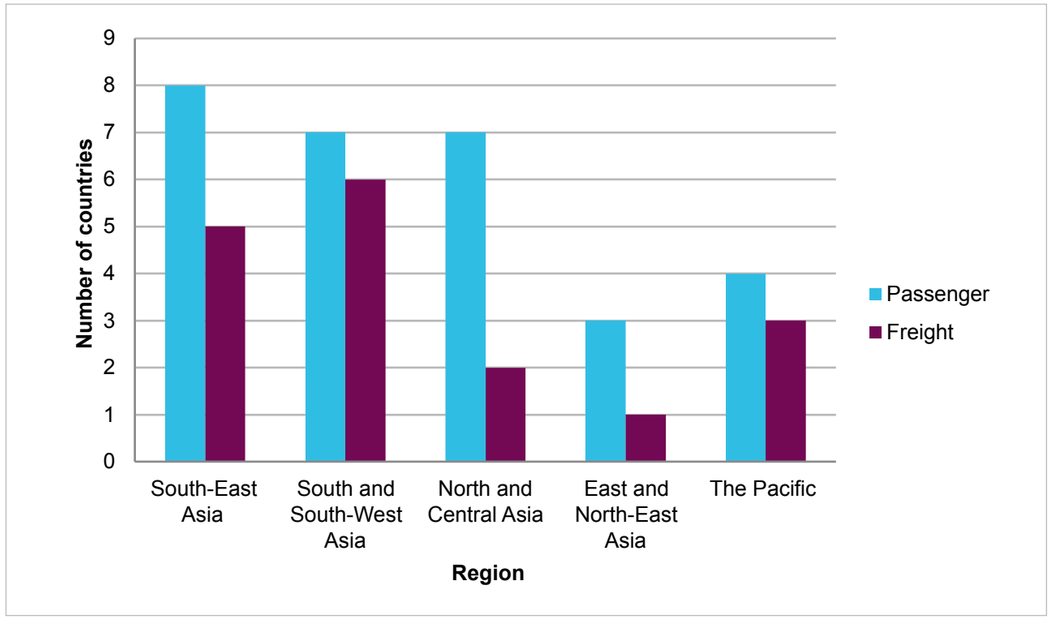
This section reviews current transport measures in NDCs and highlights potential technologies across various transport modes that countries in Asia and the Pacific can adopt in their upcoming NDCs to achieve climate goals.

2.3.2 Transport sector commitments

The need to decarbonize the transport sector is recognized across Asia and the Pacific. This section presents the results derived from the review of transport targets included in existing NDCs of ESCAP member States.

It was found that while 86 per cent of the submitted NDCs identified transport as a contributor to climate change and 45 per cent included specific transport emission mitigation measures in their NDCs, only 16 per cent of ESCAP member States included a transport-related GHG emission reduction target. An in-depth review of the submitted NDCs also revealed three distinct features, as

Figure 9 **Passenger and freight transport mentioned in NDCs of member States of the Asia-Pacific region**



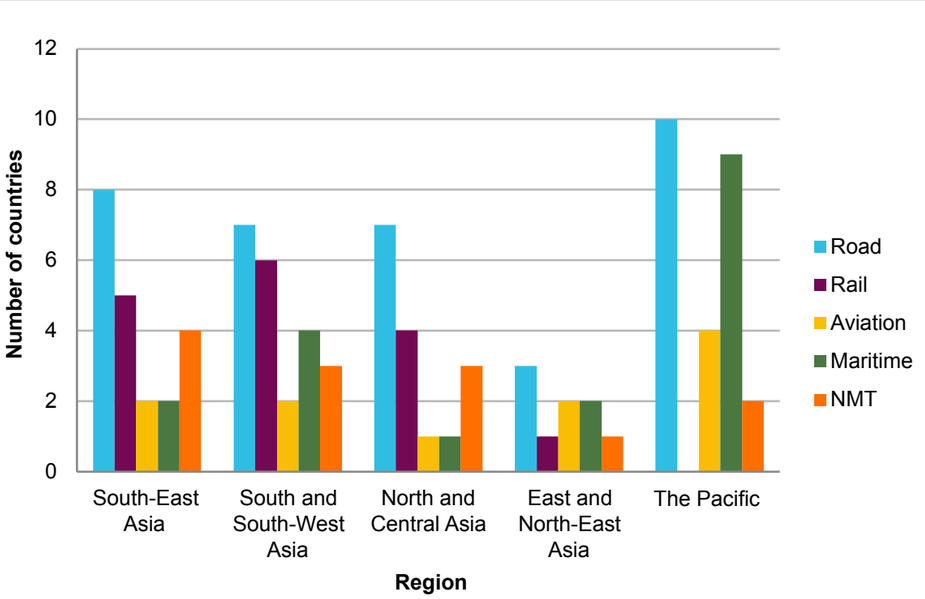
Source: Developed by ESCAP, based on United Nations Climate Change, "Nationally Determined Contributions Registry", n.d.b. Available at https://unfccc.int/NDCREG

previously defined by Löhr and others (2017), which are 1) transport was mentioned as a polluting sector, 2) transport was included as a GHG reduction target, and 3) transport mitigation policies were outlined. Commitments have found to vary across subregions, which include South-East Asia, South and South-West Asia, North and Central Asia, East and North-East Asia, and the Pacific among ESCAP countries. Only 8 countries included transport-related GHG reduction targets, while 22 countries included transport-related climate mitigation measures. Notably, the South and South-West Asia region has the largest number of countries that included transport mitigation measures in their NDCs (figure 8).

Furthermore, submitted NDCs mentioned both passenger transport and freight transport and can be divided into five different modes: road, rail, aviation, maritime and non-motorized transport (NMT). In the Asia-Pacific region, passenger transport is more frequently mentioned in the NDCs (58 per cent of countries) than freight transport (35 per cent). Notably, rail and heavy-duty vehicles were the most referenced forms of freight transport in South and South-West Asia, where 60 per cent of countries included them in their NDCs, compared to the regional average of 31 per cent (figure 9).

The results of the NDCs analysis also revealed that the trends in the popularity of different transport modes vary by subregion (figure 10). In South and South-West Asia, rail was the most frequently

Figure 10 **Mode of transport mentioned in the NDCs of member States of the Asia-Pacific region**



Source: Developed by ESCAP, based on United Nations Climate Change, "Nationally Determined Contributions Registry", n.d.b. Available at https://unfccc.int/NDCREG

mentioned mode, with 6 out of 10 countries highlighting related measures. Aviation saw minimal mention, referenced by only 22 per cent of Asia and the Pacific countries. Maritime transport was notably popular in the Pacific, included in the NDCs of 9 out of 14 countries, and mentioned by 4 of 10 countries in South and South-West Asia, specifically Bangladesh, Pakistan, Sri Lanka and Türkiye. Non-motorized transport, encompassing walking and cycling, was noted by 13 of the 49 Asia and the Pacific member States, with the highest frequency in South-East Asia (4 out of 11 countries).

In the NDCs of Asia-Pacific countries, the most frequently mentioned technological innovations in transport include electric mobility and vehicles, public transport (especially bus rapid transit), traffic management systems and alternative fuels. Each transport mode has specific technologies and innovations available that can help in mitigating and adapting to climate change. As countries prepare to revise their NDCs, there are numerous innovations to explore and incorporate to help meet GHG emissions reduction commitments.

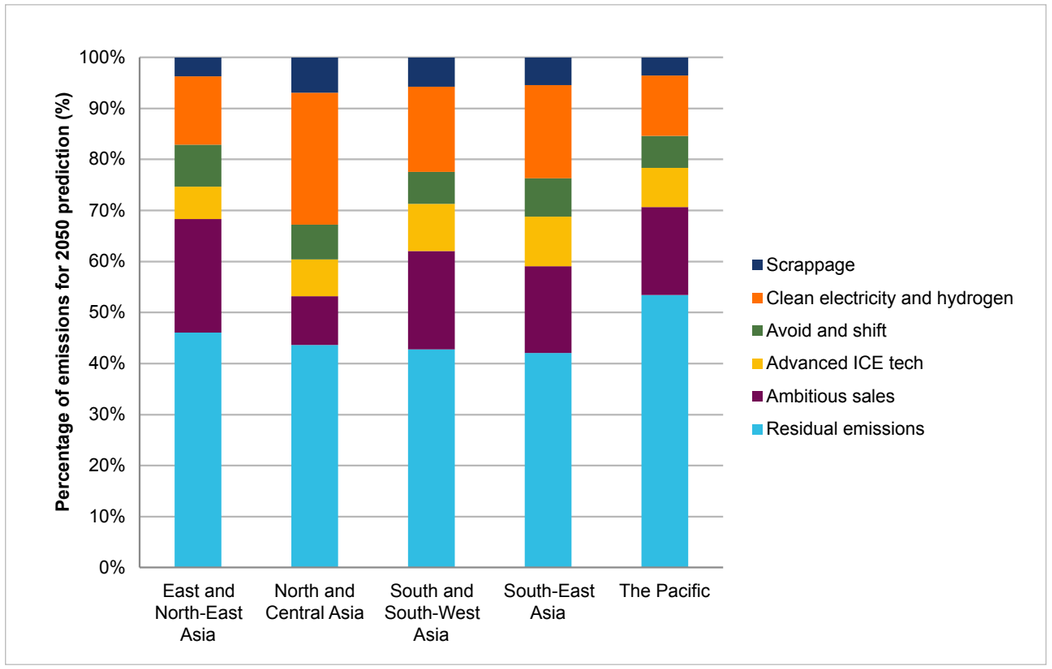
2.3.3 Transport sector growth and CO_2 emissions reduction potential

Both passenger and freight demand are projected to continue to grow significantly between 2019 and 2050 globally, increasing by 79 per cent and almost 100 per cent respectively (ITF, 2019). Most of this growth will emerge from Asia and the Pacific, where passenger demand will more than double in South-East Asia, and grow by 92 per cent in South and South-West Asia, while East and North-East Asia has been projected to have the lowest growth, increasing by 44 per cent. Demand in freight transport will be affected by changes in trade and commodities being transported. It is expected to increase by more than 300 per cent between 2019 and 2050 in South-East Asia and by an even greater factor of 4.9 in South and South-West Asia, while more than doubling in East and North-East Asia. The Asian Transport Outlook projected increase of both the passenger and freight demand but the increase in freight transport demand will outpace passenger demand in Asia and the Pacific by 2030, with East Asia contributing to approximately two-thirds of domestic regional freight activity (ATO, 2024).

With the increasing transport demand in Asia and the Pacific for the next few decades, ambitious policies with adequate and appropriate infrastructure, technology and institutional capacity would need to be implemented to allow the sector to contribute to the advancement of the Paris Agreement and the relevant SDGs.

According to the International Council on Clean Transportation (ICCT) Roadmap model, accelerating the transition to zero-emission vehicles, such as battery electric and hydrogen fuel cell vehicles, along with measures that can reduce transport activities (in distance travelled or number of trips) and trigger modal shift to more sustainable alternatives, could help peak vehicle emissions by 2027, keeping countries on track to meet the 2°C target (figure 11) (Sen and others, 2023).

Figure 11 Cumulative avoided transport CO_2 emissions for the Asia-Pacific region



Source: Arijit Sen and others, "Vision 2050: Strategies to align global road transport with well below 2°C", International Council on Clean Transportation (ICCT), 2023. Available at https://theicct.org/wp-content/uploads/2023/11/ID-22-%E2%80%93-1.5-C-strategies-report-A4-65005-v8.pdf

Note: Residual emissions refer to those for which abatement remains uneconomical or technically infeasible under the assumptions of a specific model and mitigation scenario. "Ambitious ZEV sales" refers to accelerating the transition to zero-emission vehicles. "Advanced ICE tech" refers to decarbonizing the electricity and hydrogen used in zero-emission vehicles. "Avoid and shift" refers to reducing the dependence on cars in urban areas and improving freight logistics. "Clean electricity and hydrogen" refers to decarbonizing the electricity and hydrogen used in zero-emission vehicles. The scenario calculations were based on on-road transport emissions only.

Required policies will be contingent upon technologies such as zero-emission vehicles and those that can improve the fuel efficiency of vehicles. Based on the ICCT calculations, accelerating the sales of zero-emission vehicles has the potential to reduce transport sector emissions (17 per cent) for Asia and the Pacific, a reduction rate higher than all other policies. There is also a need to decarbonize the electricity and hydrogen used in zero-emission vehicles (Sen and others, 2023). Such policies can help reduce up to 26 per cent of emissions in North and Central Asia, and an average of 17 per cent for the Asia-Pacific region. However, there is still a gap between transport policies included in current NDCs and the sector's decarbonization goal. With the current mitigation targets outlined in the

NDCs, existing targets are insufficient to guide countries in Asia and the Pacific to decarbonize their transport sectors. Using the ICCT model, transport carbon emission reduction targets included in all NDCs of countries in the region have been computed to show their impact on the overall emission reduction for each ESCAP subregion as shown in table 6.

Additional transport targets need to be developed and implemented to support higher levels of emission reductions as shown in the scenarios developed by the ICCT. For example, for the South-East Asia and East and North-East Asia subregions, a combination of the policies outlined in the ICCT calculations can lead to 58 per cent and 54 per cent reduction in emissions from the baseline projected for 2050 respectively (table 6). The percentages of CO_2 emission reduction based on NDC GHG targets presented in Table 6 revealed that South-East Asia shows zero reduction in their transport carbon emissions, as countries in this subregion have not included any quantitative transport carbon emission reduction targets while East and North-East Asia shows a reduction of 35 per cent, which is the most ambitious subregion in Asia and the Pacific.

The results of the scenarios highlight an urgent need to fill in investment gaps and scale up the role of international cooperation to finance the implementation of required low or zero carbon transport policies. An estimated $500 to $600 billion is needed to transition the transport systems in Asia and the Pacific to meet the objectives of the Sustainable Development Goals and climate ambitions (Sivakumaran, 2024). High initial costs and limited access to capital are major financial barriers to low-carbon transport projects. Another barrier that currently impedes access to finance for zero-carbon transport projects would be identifying bankable projects and being able to access the right financing sources. Therefore, a country's NDC and climate change national plans are a starting point that provide the foundation of an enabling environment for countries to access financing as they provide the necessary coherence between policy commitments and regulatory frameworks. The NDCs are an opportunity to develop effective financing strategies as they are led by authorities with clear mandates, which signal credible transition pathways with interim targets and clear resource mobilization plans (Sivakumaran, 2024).

Table 6 **Percentage of CO_2 reduction from baseline emissions from 2050 in the ICCT Roadmap model**

ESCAP subregion	Residual emissions	Ambitious sales	Advanced ICE tech	Avoid and shift	Clean electricity and hydrogen	Scrappage	Total from ICCT policies	Reduction based on NDC GHG targets
East and North-East Asia	46%	22%	6%	8%	13%	4%	54%	35%
North and Central Asia	44%	10%	7%	7%	26%	7%	56%	15%
South and South-West Asia	43%	19%	9%	6%	17%	6%	57%	15%
South-East Asia	42%	17%	10%	8%	18%	5%	58%	0%
The Pacific	53%	17%	8%	6%	12%	4%	47%	30%

Source: ESCAP analysis from review of NDC reports and from Arijit Sen and others, "Vision 2050: Strategies to align global road transport with well below 2°C", International Council on Clean Transportation (ICCT), 2023. Available at https://theicct.org/wp-content/uploads/2023/11/ID-22-%E2%80%93-1.5-C-strategies-report-A4-65005-v8.pdf

Note: Residual emissions refer to those for which abatement remains uneconomical or technically infeasible under the assumptions of a specific model and mitigation scenario. "Ambitious ZEV sales" refers to accelerating the transition to zero-emission vehicles. "Advanced ICE tech" refers to decarbonizing the electricity and hydrogen used in zero-emission vehicles. "Avoid and shift" refers to reducing the dependence on cars in urban areas and improving freight logistics. "Clean electricity and hydrogen" refers to decarbonizing the electricity and hydrogen used in zero-emission vehicles. "Reduction based on NDC GHG targets" was estimated by the authors. The scenario calculations were based on on-road transport emissions only.

Technological innovations for more ambitious targets

From the review of the current NDCs, there is a lack of technological innovations and approaches mentioned that can help advance the goals of the Paris Agreement and increase the ambitions of current targets. Although 42 countries in Asia and the Pacific mentioned transport as a polluting sector in their NDCs, only 8 have CO_2 emissions reduction targets for the transport sector resulting in significant gaps between current NDC commitments and goals. In addition, though many countries mention electric mobility as a solution to move towards low carbon transport, there is a range of other mobility solutions that can also help to decarbonize the transport sector and can be a better fit in the context of different priorities and needs across countries in Asia and the Pacific. Twenty countries in Asia and the Pacific mentioned electric mobility as a way to mitigate transport emissions, making it one of the key transport trends mentioned across all NDCs (NDC Partnership, n.d.). However, electrification is only one solution out of many and should be considered along with other complementary policies that can optimize transport systems for greater efficiency and inclusivity.

The following sections summarize technological innovations and approaches that will help to increase transport ambitions in NDC 3.0 for different modes of transport based on the NDC assessment conducted and as described in the preceding sections. In addition, policy measures outlined in existing NDCs were also compared with other national transport policy targets not included in the NDCs. Although there is great potential for technological innovations to reduce transport CO_2 emissions, policies that will shift behaviour to accelerate electric vehicles adoption, reduce the dependence on private vehicles in urban areas and improve freight logistics efficiency are equally important.

2.3.4 Transport demand and activity

Innovations in transport can avoid unnecessary vehicle kilometres for passenger and freight transport through compact land use development, increasing accessibility to services, optimizing freight operations and route choices. For example, passenger transport demand can be reduced through the number of trips taken or distance travelled, which can be achieved through integrated land use and transport planning, such as transit-oriented development, the creation of 20-minute towns (Land Transport Authority, Singapore, 2024), where essential goods and services are accessible close to residential areas, and through telecommuting and flexible work arrangements (ESCAP, 2021c).

Smart mobility can also help optimize routes, which can help reduce transport distance and thereby reduce emissions. For example, first and last-mile innovation in logistics and smart transport that help optimize traffic flow can reduce vehicular emissions. The rise in e-commerce and changing consumer preferences are shaping urban logistics due to an increase in need for on-demand and last-mile delivery services. This trend is driving innovations in logistics, including the use of drones, autonomous delivery vehicles, and micro-fulfilment centres to ensure efficient and timely delivery of goods. Last-mile deliveries have specific characteristics that pose a challenge, as they often navigate through high-traffic areas and the increased number of trips results in higher emissions of pollutants (ESCAP, 2021b). To address challenges related to last-mile deliveries, several trends have emerged to reduce trips and trip length despite growing demand. These include the expansion of warehousing networks and e-commerce companies establishing their own delivery services to gain more control over order fulfilment. In addition, logistics providers are setting targets to reduce the environmental impact of last-mile deliveries. For example, the DHL Group announced it will operate 70 per cent of its own first- and last-mile services with clean pick-up and delivery solutions, such as by bike and electric vehicle, by 2025 and aims to electrify 60 per cent of its last-mile by 2030 (DHL, 2024).

Mode shift

Cities in Asia and the Pacific experience high CO_2 emissions from urban road transport. According to C40, the average CO_2 emissions from road transport was 4,747,628 metric tons due to various factors, including reliance on carbon-emitting private vehicles and a lack of infrastructure to support active mobility such as walking and cycling. For many cities, the accessibility of public transport is hindered by poor first- and last-mile connections, which affect overall public transport adoption and appeal. The Asia-Pacific region is performing below the global average for access to public transport of 52 per cent, with a regional average of 44 per cent (ESCAP, 2024c).

For urban areas, non-motorized transport is a zero-carbon transport alternative. Walking and cycling, though not a technological innovation per se, will require sound urban planning to make it a safe and convenient option for all. For example, in Beijing, China, the development of a 6.5-kilometre elevated bike lane encouraged 23 per cent of commuters to shift away from driving as their primary transport mode, which has eased congestion between dense residential and office districts (Liu, 2023). Despite this, infrastructure for active mobility is overall underfunded in the region, with many transport planning processes still prioritizing private motorized transport (Crawford, 2024). Consequently, the modal share of active transport has stagnated in Asia, from an average of 13 per cent for walking and 2 per cent for cycling in 2015, to 12 per cent and 3 per cent in 2020, respectively (ADB Transport, 2022).

Moreover, in recent years, app-based mobility services have rapidly grown and evolved in the Asia-Pacific region. In South-East Asia, there has been a rise of “Super Apps” that combine mobility, delivery and ancillary services in one smartphone app. As of early 2020, ride-hailing services were available in more than 500 cities in the subregion (ITF, 2023). An example of this is Grab, a multi-channel mobility service. These services can help to increase the convenience of first- and last-mile access to public transport. The combination of widespread use of shared mobility services and existing public transport services, with clear regulations, could lead to a 51 per cent reduction of total vehicle kilometres travelled and a 34 per cent reduction in CO_2 emissions by 2050 globally, compared with 2019 baseline levels (ITF, 2019). In addition, there have been campaigns undertaken by these services to increase electric two-wheelers and cars as options on the platform (Grab, 2024).

Micromobility, such as electric scooters or bicycles, are also transport innovations that can help increase the adoption and efficiency of non-motorized transport within cities. Between 2015 to 2021, the adoption of micromobility in Asia has witnessed a modest increase with the modal share increasing from 1 per cent to 2.2 per cent over the six years. Studies from the Asia-Pacific region also show how micromobility can help to reduce GHG emissions from road transport by supplementing active mobility and public transport adoption. A study from the Republic of Korea found that commuters perceive shared e-scooters as an alternative to walking (Baek, 2021). Similarly, in Singapore, e-scooters were found to be a viable first- and last-mile alternative for short-distance trips in the Singapore Central Area, where they accommodate routes with higher levels of transit indirectness, more transfers and longer access-egress walking distance (Cao), and others, 2021, p. 178).

For freight transport, rail is the least emissions-intensive mode for land transport. Therefore, increased adoption and expansion of rail and a modal shift from road to rail freight transport can help to reduce overall emissions (IEA, n.d.), especially since electric rail does not emit any direct CO_2 emissions. Urban rail systems, such as metro and light rail, also typically generate much lower emissions than other motorized urban transport modes, such as private motorized vehicles, as they are electrically powered, have higher energy efficiency and support higher occupancy rates.

In the Asia-Pacific region, India is an example of a country investing in the road-to-rail modal shift, with a target to reach 100 per cent rail track electrification by 2024. Already, the share of electrified track has increased from 45 per cent in 2015 to 80 per cent in 2022 (IEA, n.d.). China also has an extensive network that is currently the largest high-speed rail system in the world, with a network that has grown by 100 times in the past 20 years. By 2025, China has a target to further expand its rail network by 50,000 kilometres. A study based on high-speed rail expansion in China found that high speed rail can decrease carbon emissions by an average of 2.3 per cent (Zhang, 2023b).

Over the past decade, urban and high-speed rail infrastructure has expanded significantly, creating the foundation for it to become an attractive option for convenient, low-emission transport within and between urban areas (IEA, n.d.). Rail emissions per passenger per kilometre are approximately one-fifth of those from air travel. Electrified passenger rail produces even less emissions, especially when it is powered by renewables or nuclear power (IEA, n.d.). The transition from road-to-rail and the

electrification of rail network is one of the key technological trends included in current NDCs, where 31 per cent of countries in Asia and the Pacific mentioned rail. However, the targets and measures outlined in the NDCs might not accurately reflect the entirety of commitments countries have for rail. In a transport targets overview, the Asian Transport Outlook (ATO) found that 27 countries in Asia and the Pacific have rail mentioned in their national policies (ATO, 2022), which is higher than the 16 countries that have referred to rail transport in their NDCs, implying a need to harmonize national transport policies and NDCs.

Moreover, inland waterways offer a lower-emission mode of transport than road transport. Inland waterway transport is one of the most CO_2 efficient transport modes per ton of goods carried (Think Tank European Parliament, 2022). This mode of transport is prevalent throughout the Asia-Pacific region, especially in countries with extensive river systems. For example, in the Mekong region, inland waterway transport offers a solution that can balance socioeconomic development with environmental sustainability. In Bangladesh, there are efforts in undergoing a modal-shift from road to inland waterways (World Bank Group, 2020). The shift would not only help to reduce emissions from the country's transport sector in line with its NDC, but also lower transaction costs for suppliers and improve the reliability and efficiency of freight transport (World Bank Group, 2020).

Improvements in vehicle and vessel technology

Technological innovations have improved the energy efficiency of vehicles and vessels, and with the use of renewable energy sources, zero-carbon emission transport could also be achieved. Heavy duty trucks, light duty vehicles, and light commercial trucks contribute 75 per cent of transport CO_2 emissions in Asia, providing a significant potential market to decarbonize (ATO, 2023, p.42).

The key technological innovation that can help to reduce GHG emissions from light-duty vehicles is to transition them to zero-emission vehicles. Currently, the main zero-emission options for light-duty vehicles are:

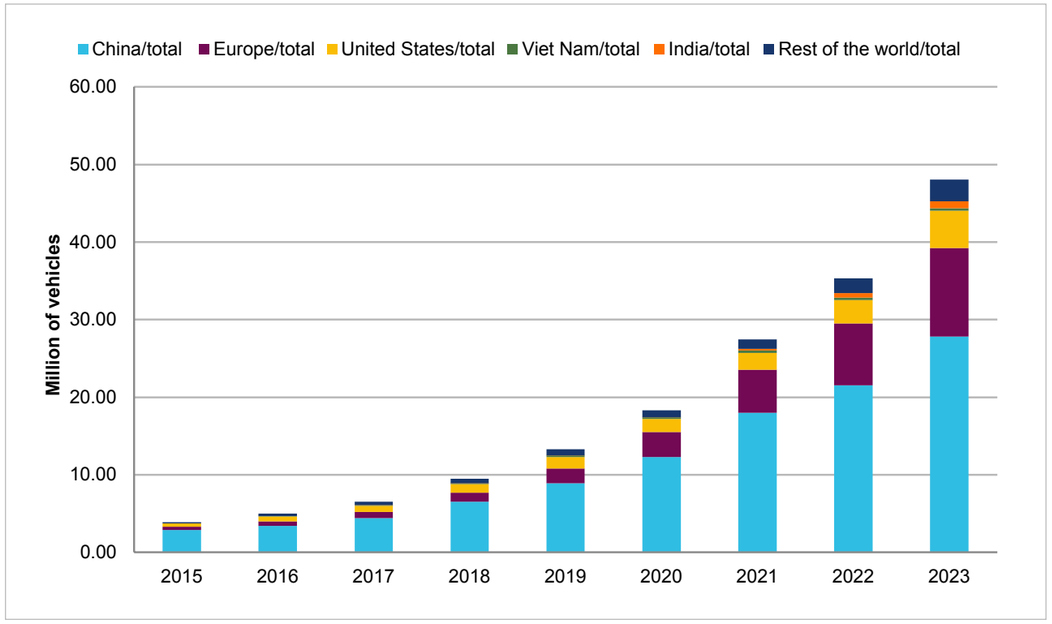
- Battery electric vehicles (BEVs): These vehicles are powered by electricity stored in batteries and emit no tailpipe emissions.
- Fuel cell electric vehicles (FCEVs): These vehicles use hydrogen fuel cells to produce electricity, resulting in zero tailpipe emissions.
- Plug-in hybrid electric vehicles (PHEVs): These vehicles have both a gasoline engine and an electric motor. They can be plugged in to recharge their batteries, reducing the need for gasoline usage and associated emissions.

In the Asia-Pacific region and globally, BEVs are growing in popularity. In 2023, electric car sales were 3.5 million higher than sales in 2022, representing a 35 per cent year-on-year increase. This sales figure is more than six times greater than the sales for electric cars in 2018 (figure 12) (IEA, 2024d). China is the largest market for BEVs in the Asia-Pacific region. Electric buses have played a key role in helping the country transition to low-carbon urban transport and are a cornerstone in their transport-related NDC measures (ADB, 2018). As a case study, China illustrates how public funding can be focused on supporting the provision of charging infrastructure and encouraging private sector investments in electric vehicles.

Electric mobility is one of the most prominent technological innovations included across NDCs submitted by countries in the Asia-Pacific region. Twenty countries in the region specifically mention electric mobility or electric vehicles as a mitigation measure to reduce emissions from transport. However, the level of detail in national electric mobility targets may not be reflected in a country's NDC. For example, the Republic of Korea has quite detailed electric vehicles targets included as part of its Hydrogen Energy Road Map and the 2050 Carbon Neutral Strategy of the Republic of Korea (ATO, 2022). As part of the latter, the Republic of Korea aims to make electric vehicles and hydrogen vehicles account for a third of new vehicle sales in 2030 and deploy 3 million units of electric vehicles and 0.85 million units of hydrogen vehicles by 2030 (Republic of Korea, 2020, p. 79). Such details are not reflected in the country's NDC.

Beyond electric vehicles, hydrogen fuel-cell vehicles also provide a zero-emission solution for light-duty vehicles as the only by-product of hydrogen vehicles is water vapor (PSI, 2024). However, hydrogen vehicles are mentioned to be much less than electric vehicles, with only four countries

Figure 12 Global electric vehicle sales and registration (2015-2023)



Source: International Energy Agency (IEA), "Global electric car stock, 2013-2023", Paris, 2024c. Available at https://www.iea.org/data-and-statistics/charts/global-electric-car-stock-2013-2023

mentioning hydrogen in relation to transport in their NDCs. The key advantages of hydrogen fuel-cell cars over battery-electric vehicles are that they have a longer range than BEVs and can have a quick refuelling period (Toyota, 2024). The challenge with hydrogen is that the infrastructure for producing, storing and distributing hydrogen is still developing. There are also cost and safety concerns as hydrogen, in addition to being a highly flammable gas, can be more expensive than gasoline or electricity.

Maritime transport generates around 940 million tons of carbon dioxide annually and is responsible for about 2.5 per cent of global GHG emissions (ESCAP, 2021a, p. 24). Vessels controlled by owners in China, Japan and Greece account for the largest share of CO_2 emissions (UNCTAD, 2023). Green shipping corridors (GSC) have emerged as an approach to accelerate the decarbonization of the maritime transport sector. A green shipping corridor is a zero-emission maritime route between two or more ports with an aim of achieving decarbonization of the maritime industry (Kim, 2023). The longest green corridor currently is the Green and Digital Corridor between Singapore and Rotterdam (ESCAP, 2023a, p. 43). In addition, there are a variety of alternative fuels under review that can replace fossil fuels, such as hydrogen, ammonia, liquefied natural gas, synthetic carbon, recycled fuels and biofuels for maritime transport (ESCAP, 2021a, p. 24).

Adoption of alternative fuels

Shifting away from conventional fossil fuels while increasing the use of alternative fuels offer decarbonization opportunities for the sector. For example, there is a growing number of viable alternative fuels for transport that offer low-carbon options. For example, biodiesel, which is made from vegetable oils, animal fats, or waste cooking oil can be used in its pure form or blended with petroleum diesel.

Whilst aviation accounts for a relatively small share of global GHG emissions, it is one of the most challenging modes of transport to decarbonize. Aviation was also not often mentioned in the NDCs of Asia-Pacific countries, and only 13 countries in the region mentioned an aviation-related target or mitigation measure (United Nations Climate Change, n.d.b.). Still, aviation demand is rapidly growing and decarbonizing aviation will be critical to reach climate targets as well. Technological innovation across the sector is needed to help reach viable solutions for decarbonized aviation, such as the production of low-emission fuels, improvements in aircraft and engine designs, as well as enhancing operational efficiency.

Sustainable aviation fuels (SAF) are a key innovation that can help to decarbonize aviation. SAF is a type of biofuel that has the potential to cut aviation's GHG emissions by up to 80 per cent compared with traditional jet fuels (Shine, 2023). Currently, the demand for aviation fuel is dominated by jet kerosene, while SAF accounts for less than 0.1 per cent of all aviation fuels consumed. Increasing the use of SAF in aviation will require a substantial increase in investment for SAF production capacity along with supportive policies like fuel taxes and low-carbon fuel standards to help push the transition.

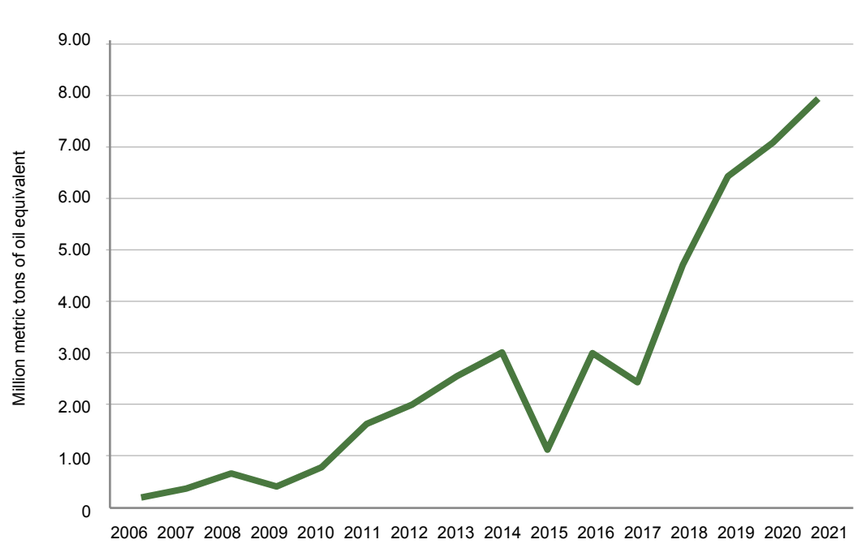
2.3.5 Policy options for raising ambition in the transport sector

As countries are in the process of revising their NDCs, it is critical that ambitious transport carbon emission reduction targets are defined to ensure that countries can reduce their total carbon emissions. The review of the current NDCs suggests that there is room for improvement in the development of transport targets for Asia-Pacific countries.

Box 1 Biofuel as an alternative transport energy in Indonesia

Indonesia has been actively promoting and developing biofuel alternatives as part of its transport decarbonization strategy. The country aims to have biofuel reach 23 per cent of its renewable energy portfolio by 2025 and 31 per cent by 2050. The total energy production of biofuel has grown from just 60,000 tons in 2006 to 8.11 million tons in 2021.[a] So far, the growth of biofuel production and adoption has hinged on its domestic palm oil industry and government support.[b]

Figure 13 Biofuel production in Indonesia (2015-2023)



Source: Asian Transport Outlook (ATO), "2023 Climate Tracker for Transport in Asia and the Pacific: An input to COP28", 8 November 2023. Available at https://asiantransportoutlook.com/documents/70/ATO_COP28_Climate_tracker_-_final.pdf

[a] Asian Transport Outlook (ATO), "2023 Climate Tracker for Transport in Asia and the Pacific: An input to COP28", 8 November 2023. Available at https://asiantransportoutlook.com/documents/70/ATO_COP28_Climate_tracker_-_final.pdf

[b] Economic Research Institute for ASEAN and East Asia (ERIA) (2024). Developing biofuel-based road transport industry: Market penetration assessment of biodiesel (B100) and bioethanol (E100) as road transport fuels in Indonesia. 23 August.

Develop national GHG emissions targets and implementation timelines for transport

Although 42 countries in Asia and the Pacific have mentioned transport as a polluting sector, only 8 of them have defined a transport-related GHG reduction target. These countries include Bangladesh, Sri Lanka, Georgia, Japan, Vanuatu, Fiji, Samoa and Tonga. For performance management and review, there should be an increase in quantitative targets and relevant data collection processes for the transport section to be reflected in the NDCs. More ambitious GHG emissions reduction targets can help countries identify their own decarbonizing transport pathways and subsequent implementation plans. Moreover, a lot of transport strategies are not included in the NDCs. Once national transport low-carbon strategies or action plans are developed, they should be included in the country's NDCs as well to better inform all stakeholders and identify synergies across sectors.

Update NDCs to align with national transport policies and targets

The comparison between the transport policies mentioned in NDCs and transport policies presented in national policy documents reflects that the NDCs do not highlight all the transport and climate change policies in place. NDCs can be revised to better reflect the range of transport policies available and those with potential to enhance GHG emissions reduction. Road transport was mentioned in 69 per cent of the NDC's from Asia-Pacific countries whilst rail transport was only mentioned in 31 per cent of them. Though there may be a large disparity in the number of transport modes in the NDCs, countries may already have targets and mitigation measures in place at the national level that are not outlined in their NDCs. Ensuring that the NDCs include national policy targets and comprehensive transport modes can help increase a country's climate ambition and enable a more comprehensive set of action to be included in the NDCs.

Cross-sectoral collaboration between transport and environment ministries

There is a need for increased collaboration across ministries, especially between the Ministry of Environment and the Ministry of Transport. To better align NDCs with national policy commitments, the transport ministries can also be mobilized to proactively participate in the preparation and drafting phases of the NDC 3.0 cycle. Some countries are already moving in a promising direction, for example, Tonga has quite a detailed NDC, where there is a transport-related GHG reduction target as well as transport mitigation measures. The country's NDC also outlines both passenger and freight transport, as well as different modes of transport - road, aviation, maritime and non-motorized transport. This may be attributed to the involvement of the Ministry of Infrastructure, Department of Transport, in the drafting process (Kingdom of Tonga, 2020).

Another example of successful inter-ministerial coordination is Indonesia. In setting the national target for their enhanced NDC, the Ministry of Environment and Forestry hold regular meetings to coordinate with line ministries in every sector relevant to climate change action (Indonesia, Ministry of Transportation, 2024). These meetings helped to support multi-stakeholder engagement, strengthen cross-sectoral collaboration to align the common goals and actions needed to reduce overall GHG emissions.

2.3.6 Conclusions and recommendations

There is a broad range of decarbonizing transport policies that have been proven to be effective, which can be categorized into action that will improve the design, operations and planning of transport systems. These policy initiatives are meant to increase energy and vehicle efficiency, such as electrification, encourage the switch to low-carbon fuels and energy sources, shift transport modes and manage demand, as well as support innovation in the transport sector (ITF, 2024). Recent innovation to decarbonize transport in Asia and the Pacific include bike sharing. The region has the world's second-largest bike-sharing market, with nearly 800 bike-sharing schemes operating across the region, helping to increase accessibility of non-motorized transport modes. Public transport infrastructure has also expanded rapidly, more than doubling since 2010. The region also leads in electric mobility globally, accounting for 95 per cent of the world's electric road vehicles fleet in 2023 (Murdock and Sairam, 2023). Moreover, decarbonization efforts extend beyond land transport, with countries such as Japan, Fiji and the Marshall Islands committing to the implementation of green shipping corridors and decarbonizing the shipping sector (SLOCAT, 2023).

The establishment and implementation of low carbon transport targets and timelines in Asia and the Pacific is a topic that has been identified by ESCAP member States for in-depth analysis and technical assistance due to existing gaps in the technical, institutional and financial support that they are currently experiencing in the transition to low or zero carbon transport. Most countries in Asia and the Pacific already have national transport and climate change action plans and road maps, often with ambitious goals and targets. However, some still lack the capacity to develop specific targets and timelines to align policies with these goals. In particular, they require more precise targets and mitigation timelines to support these action plans that should then be aligned with NDCs and LT-LEDs to guide the transition to low carbon transport in an efficient and inclusive manner. More ambitious low carbon transport targets would also need to be determined, especially since CO_2 emissions from the transport sector must fall by more than 3 per cent by 2030 to be decarbonized by 2050. Strong regulations and fiscal incentives, as well as considerable investment in infrastructure to enable low and zero emission vehicle operations and modal shifts, will be needed to achieve these emissions reductions. ESCAP, through its Regional Cooperation Mechanism on Low Carbon Transport in Asia and the Pacific and the Asia-Pacific Initiative on Electric Mobility, will continue to support the development and implementation of transport and climate change mitigation plans of member States.

With more ambitious policies, there is potential for the sector to meet its climate target by 2050. However, countries need to further integrate innovative transport solutions in their climate mitigation plans, as well as ensure that clear GHG emissions reduction targets are outlined. The next cycle of the NDC revision process will provide the technical and political opportunity to enhance transport targets for Asia-Pacific countries.

Chapter 3

INTEGRATED APPROACHES: LINKING ADAPTATION AND MITIGATION

3.1 Setting the scene

With a growing need to use a systems approach in responding to the impacts of climate change, integrated approaches that address both adaptation and mitigation ambitions are becoming more imperative. Climate change is a multifaceted issue that cannot be resolved easily, even with ideal greenhouse gas emissions reduction scenarios. Its impact will persist due to the energy already trapped in the atmosphere. Mitigation efforts are insufficiently rapid to avert significant effects, necessitating robust adaptation strategies. Conversely, adaptation alone cannot fully address the extensive consequences of substantial climate change, underscoring the importance of sustained mitigation efforts and the management of residual impacts related to loss and damage.

An integrated approach is becoming a practical reality with the realization that climate change calls for new strategies that interact with complex ecosystems, including climate, social, economic and ecological factors. The aim is to reduce the costs of measures associated with climate change while maximizing benefits and reducing trade-offs from siloed actions, with a particular focus on avoiding the worse impacts of climate calamity that is hammering nations. Climate-resilient pathways represent development trajectories that combine adaptation and mitigation to achieve sustainable development (Denton, and others, 2014).

3.2 Brief history to advance understanding of adaptation and mitigation interlinkages

The interrelationship between climate change adaptation and mitigation has gained attention since the release of the IPCC's *Fourth Assessment Report* (AR4) in 2007 (IPCC, 2007). There is a growing understanding of the possibilities to choose from and implement climate response options in several sectors, aiming to create synergies and minimize conflicts between adaptation and mitigation. The IPCC's *Fifth and Sixth Assessment Reports* and special reports on *Global Warming of 1.5°C* and *Climate Change and Land* highlighted that understanding the links, synergies and trade-offs between climate change adaptation and mitigation is crucial for effective policy decision-making. Additional research and scientific literature over time has suggested that national-level policies must address and acknowledge the connection between adaptation and mitigation, as well as investigate the fair balance between the two. In the long run, mitigation responses will influence future adaptation needs and shape climate-resilient pathways.

The Paris Agreement aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty. Article 2 encourages "…a pathway towards low greenhouse gas emissions and climate-resilient development". Article 7 elaborates the global goal on adaptation to enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change, aligned with the temperature goal under Article 2; (UNFCCC, 2015). It also recognizes the substantial need for adaptation, while noting that higher levels of mitigation can reduce the need for further adaptation efforts. It introduced the need for

Parties to formulate and implement national adaptation plans (NAPs) and submit adaptation communications (adcomms) in conjunction with other communications or documents, including the nationally determined contribution (NDC), among others. The Paris Agreement focuses primarily on the mitigation co-benefits arising from Parties' adaptation actions and economic diversification, but does not emphasize the reverse (Annex 1). Historically, mitigation has been prioritized over adaptation in international climate governance. When the UN Framework Convention on Climate Change (UNFCCC) was established, mitigation was the main focus, as the impacts of climate change were not yet widely felt and adaptation was not a significant concern (Hall and Persson, 2018). Over the past 30 years, the UNFCCC has seen major shifts, including the breakdown of the Annex system, the growth of non-state actors, and increasing integration of mitigation, adaptation and finance.

3.3 Overcoming the adaptation-mitigation divide for the implementation of climate actions

Integrating adaptation and mitigation can accelerate climate action in an equitable manner, offering multiple co-benefits while minimizing potential trade-offs. A deep understanding of the linkages, synergies and trade-offs between adaptation and mitigation is essential to guide informed policy decisions. Following are some examples of actions or activities in the region and across the globe:

- In 2018, the Support Project for the Implementation of the Paris Agreement (SPA) focused on aligning adaptation, mitigation and the Sustainable Development Goals (SDGs) while drafting and submitting their climate action and implementation plan (IKI, n.d.). Central to this initiative was the conceptualization of the Adapted Resilience Gap Model (Annex 2) designed to explain adaptation and mitigation linkages within an overarching development framework. This model facilitated political dialogue among stakeholders with diverse priorities and capabilities, and demonstrated how resilience building, particularly through a focus on livelihoods, can bridge the divide between adaptation and mitigation strategies.

- In 2020, G20 countries under the Presidency of the Kingdom of Saudi Arabia focused on better alignment of climate adaptation and mitigation efforts. They aimed to identify the linkages between adaptation and mitigation measures while exploring the potential of NbS to foster synergies (OECD, 2021). One key conclusion was the need for more research to build a robust evidence base that supports designing policies which reflect synergies and trade-offs across different geographic contexts.

- In 2021, the NAP Global Network and the Low Emission Development Strategies Global Partnerships (LEDS GP), with support from the GIZ SPA project, jointly organized a Peer Learning Summit to facilitate a robust set of peer-to-peer learning and capacity development activities to support countries apply integrated approaches across adaptation, mitigation and development agendas (NAP Global Network, 2021). It presented a pathway (Annex 3) to advance the understanding of these interrelationships and offered entry points for synergistic planning and implementation both in the adaptation and mitigation planning cycles.

- Addressing the objectives of its 2019-2021 flexible workplan, the Adaptation Committee of the UNFCCC, prepared an information paper in 2022 to increase the understanding of how linkages between mitigation and adaptation have been addressed within different sectors and under the UNFCCC (UNFCCC, 2022). The paper discussed three types of linkages:

    - Adaptation actions that have consequences for mitigation: These have been addressed under different sectors such as ecosystems, agriculture, energy and infrastructure, and at different scales, including at individual and community levels.

    - Mitigation actions that have consequences for adaptation: These include energy efficiency and renewable sources, better management of land use and forests, emission reductions in agricultural practices and mitigation through urban planning can have positive effects for adaptation by promoting local economies and livelihoods and enhancing adaptive capacity.

    - Inter-relationships between adaptation and mitigation options and sustainable development, including those under 1.5°C pathways: These include ecosystem-based adaptation responses and REDD+ have co-benefits for mitigation through carbon sequestration as well as for SDGs.

- GIZ Global Programme "Policy Advice for Climate Resilient Economic Development" (CRED), 2019-2025: This programme is piloting methods and instruments for modelling economic climate change impacts and integrating the results into policy design. Ministries of Economy/Planning in three pilot countries (Kazakhstan, Viet Nam and Georgia) supported modelling and development of climate-resilient economic policies and effective adaptation planning based on the results. An integrative approach to climate action, linking adaptation and mitigation, has been embedded in all the pilot countries' LT-LEDS development and planning. In Viet Nam, this approach was applied within the framework of the Green Growth Strategy by extending its macroeconomic model and it is now planned to extend in assessing effects of the net-zero transition. In Georgia, policy discussions were conducted as part of the Green Economy transition dialogue, covering climate risks to sectors as well as effects of increasing use of renewable energy. In Kazakhstan, adaptation has been integrated into the Strategy for Achieving Carbon Neutrality by 2060 (LT-LEDS) in cooperation with GIZ project "Supporting Green Economy in Kazakhstan and Central Asia for a Low-Carbon Economic Development".

Sectors that offer more opportunities for synergies between adaptation and mitigation (such as agriculture, energy, forestry and biodiversity, urban planning and water) and measures such as nature-based solutions could be the starting points for more integrated climate adaptation and mitigation measures (Annex 4). Learning from these sectors can open avenues for other areas where a synergistic approach is not as apparent.

3.4 Exploring interlinkages between adaptation and mitigation in the region

3.4.1 Alignment of NDCs, NAPs and LT-LED

Climate change adaptation and mitigation are often pursued separately from each other; they are driven by different objectives, developed by different government ministries or departments and implemented at different institutional, spatial and temporal scales. However, adaptation and mitigation are not independent processes; they often interact in policy, producing co-benefits (whereby mitigation measures benefit adaptation objectives or vice versa) or trade-offs (whereby mitigation measures undermine adaptation objectives or vice versa). A siloed approach to climate policy – whereby adaptation and mitigation are pursued as independent policy objectives – neglects these potential co-benefits and trade-offs, and thus can have detrimental consequences for climate policy, including stranded assets, inefficient use of resources and higher overall project costs. Instead of taking an integrated approach to adaptation and mitigation policy, policymakers can strengthen synergies and help manage trade-offs, allocate resources more efficiently and reduce project costs.

The national adaptation plan (NAP) process is a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programs to address those needs (United Nations Climate Change, 2021). As of 20 September 2024, 15 ESCAP member States[5] from the region have submitted their NAPs and countries are requested setting of NAPs by 2025. Aligning NAPs and NDCs are critical for countries. For example, the Philippines highlights in its NAP that it is crucial to strike a balance between adaptation and mitigation efforts, especially since the current energy and transport systems are major GHG emitters, and infrastructure systems rank among the most vulnerable to climate change globally, endangering various communities and organizations reliant on these services. All Parties should strive to formulate and communicate long-term low GHG emission development strategies (LT-LEDS), in the light of different national circumstances. From the region, 21 ESCAP member States have submitted their LT-LEDS (United Nations Climate change, n.d.a). Almost all LT-LEDS considered multiple synergies and trade-offs between sustainable development, emission reduction and adaptation to climate change.

[5] Armenia, Bangladesh, Bhutan, Cambodia, Fiji, Kiribati, the Marshall Islands, Nepal, Pakistan, Papua New Guinea, the Philippines, Sri Lanka, Thailand, Timor-Leste, Tonga.

Many countries in the region have already recognized the value of integrating their climate adaptation and mitigation measures; of the 48 NDCs of ESCAP member States that were analysed, 20 made explicit reference to the importance of adopting this integrated approach to climate policy instead of taking a siloed approach, while many others implicitly recognized the significance of an integrated policy approach. Some of these NDCs went further, laying out mitigation measures which incorporated climate change adaptation into the policy formulation. The most common sectors in which this integrated approach has been taken are outlined below, along with selected examples from countries' NDCs and NAPs to illustrate them:

- Agriculture - The Strategic Roadmap for the production and processing of agricultural products in the *Azerbaijan* covers a number of preventive and adaptation policies related to climate change. *Viet Nam* highlights the importance of implementing climate-smart agricultural solutions for enhancing resilience and adaptive capacity of natural, social and economic systems for sustainable livelihoods. It is also emphasizes that loss and damage caused by climate change may reverse long-term gains, and measures to reduce methane emissions in subsectors of agriculture are carried out for the implementation of Viet Nam's statement at COP26.

- Biodiversity and Ecosystems - *Pakistan* commits to 'mainstreaming adaptation and mitigation' through initiatives for biodiversity conservation and ecosystem rehabilitation, including setting up an Eco-System Restoration Fund to finance the initiatives.

- Ocean Governance – *Fiji* includes blue economy ambitions in its NDC targets through enhanced ocean governance to not only achieve national ocean conservation but also contribute towards enhancing the ocean as a carbon sink, including a section on 'Fiji's Commitment to Adaptation Actions with Mitigation Co-benefits'.

- Energy - *Armenia* emphasizes the development of renewable energy sources and energy efficient technologies, which will abate emissions as well as expand access to 'affordable and reliable energy supply'. The Sustainable Hydropower Development Policy (SHDP) 2021 of *Bhutan* enhances hydropower policy by integrating climate resilience and mitigation.

- Forestry - *Sri Lanka* mentions that forestry and biodiversity sectors have enormous adaptation and mitigation co-benefits. Examples from Sri Lanka show that mangroves have protected communities from coastal degradation and forests on steep slopes have prevented landslides. Soft solutions for shoreline management, such as mangrove restoration, has mitigation co-benefits forestry sector and contributes to adaptation benefits in the Biodiversity Sector of its NDC. Some of the mitigation co-benefits of biodiversity including carbon sequestration is captured under the Forestry Sector of its NDC. *Bangladesh* is implementing the Sustainable Forests and Livelihoods Project (SUFAL), which seeks to improve forest management while simultaneously increasing benefits for forest dependent communities and promoting sustainable livelihoods.

- Health – While most NDCs reference health (i.e., climate change interlinkages, impacts and/or co-benefits), current efforts aim to increase sophistication of health elements (WHO, 2023). Existing NDCs consider health co-benefits by coupling: mitigation of greenhouse gases with reducing air pollution and associated disease burden/cost; low-emission transportation options for pedestrian mobility with improved fitness; and sustainable agriculture practices with improved and healthier dietary choices that avoid high-emission agricultural and livestock products.

- Transport – *the Republic of Korea* is seeking to reduce emissions from private vehicles, including through the improvement of public transports. This signals a commitment to consumer welfare via the expansion of low-cost public transport alternatives.

- Urban Planning/buildings - *The Marshall Islands* plan to review building insulation levels with the express secondary objective of achieving savings through improved building codes and/or building retrofits.

- Water Management - *Bangladesh* seeks to revitalise natural springs and sustainably manage waterbodies, thus contributing to reductions in water scarcity and the restoration and conservation of ecosystems and biodiversity. The adaptation component describes what Bangladesh has already done on adaptation and what are the priorities for the future long-term vision for adaptation keeping synergies with mitigation actions.

- Natural Disaster Defence - *Pakistan* seeks to identify and introduce NbS to foster resilience to flooding and storm surges, such as urban forest projects and wetlands, thereby promoting adaptation and carbon sinks simultaneously.

- Ecosystem-based Adaptation (EbA) - In *Armenia*, EbA is expected to become part of the policy mix in each sector, as reflected in Sectoral Adaptation Plans (SAPs). This ensures that mechanisms and policies supporting improved biodiversity and ecosystem services, income generation, poverty reduction, adoptive development or resilience of infrastructure and carbon emission mitigation co-benefits are integrated into sectoral and sub-national activities to reduce the country's overall vulnerability to climate change.

- Policy Implementation - *Thailand* highlights that climate change adaptation and mitigation are becoming more deeply embedded in governmental structures in line with the increasing profile of climate actions in national agendas. Capacity-building of sectoral and subnational agencies to integrate adaptation and mitigation measures into their respective planning processes are mentioned. *Australia* established a Department of Climate Change, Energy, the Environment and Water, so that climate mitigation and adaptation, as well as the climate and biodiversity crises, can be addressed holistically. *Cambodia* is proposing an ambitious set of sectoral reduction targets and structured and comprehensive adaptation actions.

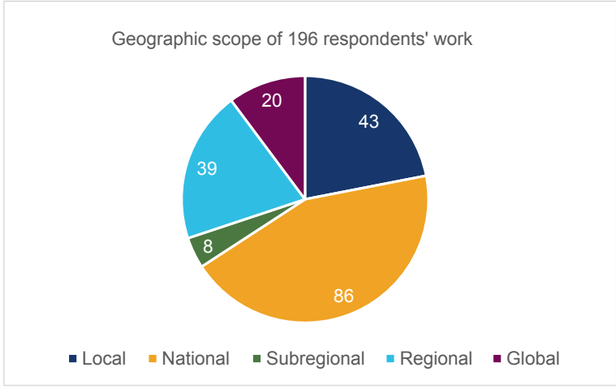
3.4.2 Scoping study on addressing climate action through integrated approaches: Linking adaptation and mitigation

ESCAP administered a survey titled "Addressing climate change through integrated approaches: Linking adaptation and mitigation" between 8 May - 15 June 2024 in the region. The survey aimed to seek professional views and gain insights on levels of awareness of interest, practical examples, challenges, opportunities and enabling factors on integrated approaches to inform this chapter.

Findings

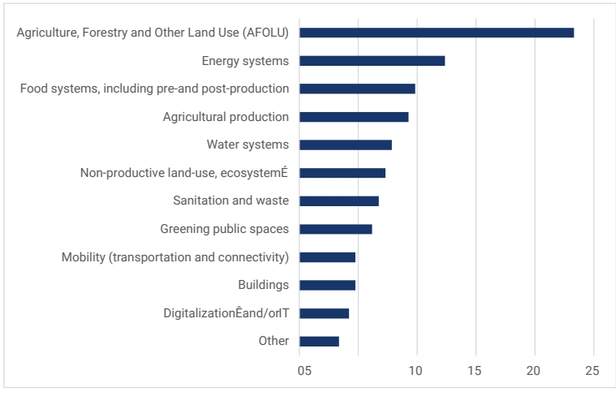
The survey collected responses from a diverse group of actors. Out of the 196 responses to the question regarding geographical scope of work, 86 responses were identified to national-level institutions; followed by local-level and regional institutions having 43 and 39 responses, respectively (figure 14). When asked about sectors offering the greatest opportunities for synergistic adaptation and mitigation impacts, 356 responses were received, of which 83 responses (23 per cent) identified Agriculture, Forestry, and Other Land Use (AFOLU) as the top area, followed by energy systems with 44 responses (12 per cent) and food systems, including pre- and post-production processes with 35 responses (10 per cent) (figure 15). In addition, urban planning and development is another area identified as an entry point that emerged during literature review and discussions with experts.

Figure 14 Survey results: Respondents' geographical scope of work



Source: Based on a survey conducted by ESCAP, "Addressing climate change through integrated approaches: Linking adaptation and mitigation", 2024.

Figure 15 Survey results: Areas for synergistic impacts of integrating adaptation and mitigation



Source: Based on a survey conducted by ESCAP, "Addressing climate change through integrated approaches: Linking adaptation and mitigation", 2024.

Some highlights from the survey's responses include:

- Disaster risk resilience, livelihood options, resource use efficiency were the key adaptation co-benefits that could arise from mitigation activities.
- Reduced energy use and energy efficiency, reduced GHG emissions and carbon sequestration were the mitigation co-benefits that can arise from adaptation actions.
- Addressing increased climate disaster vulnerabilities, negative impacts on biodiversity and ecosystems, loss of livelihoods, increased GHG emissions were identified as some of the lost opportunities when adaptation and mitigation actions operate in siloes.
- The enabling factors to support integrated actions were identified as stakeholder engagement, followed by political commitment, technology and policy/program implementation respectively (table 7).
- When asked about the most important barriers to mainstreaming integrated approaches into national climate actions, 117 responses were received, of which 36 responses (31 per cent) highlighted lack of capacity, followed by data limitations with 23 responses (20 per cent), insufficient awareness of available opportunities with 22 responses (19 per cent) and organizational silos with 19 responses (16 per cent) (figure 16).

Table 7 Survey Results: Enabling factors for integrating adaptation and mitigation

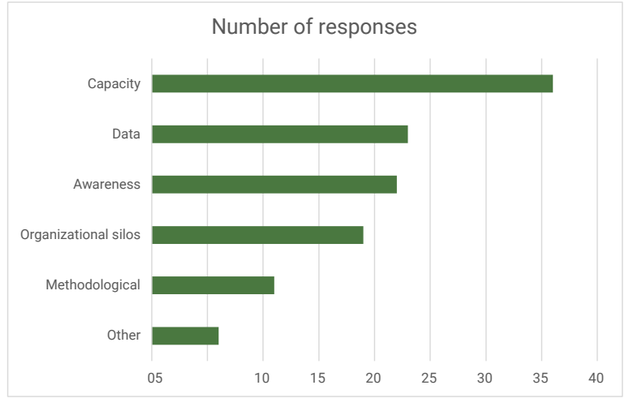
Enabling factors for integrating adaptation and mitigation	Frequency
Stakeholder engagement	71
Political commitment	59
Technology	55
Policy/program implementation	54
Scientific research	36
Public-private partnerships	30
Data analysis and scenario development	29
Governance	26
Urban planning and development	21
Other	4
Total responses	**385**

Source: Based on a survey conducted by ESCAP, "Addressing climate change through integrated approaches: Linking adaptation and mitigation", 2024.

Expert Group Meeting

Subsequently, an Expert Group Meeting (EGM) was organized on 23 August 2024 to shape ESCAP's preliminary findings from the survey and individual discussions with experts (ESCAP, 2024b). The EGM discussed co-benefits and barriers to integrated measures for adaptation and mitigation, including, for addressing climate finance gaps, enhancing private sector engagement, aligning national strategies and policies, coordinating stakeholder engagement, vertical and horizontal governance, and encouraging research and data-informed policymaking. It was noted that integrated measures complement the climate-nature-people nexus and the understanding of integrated actions have advanced over time. The effectiveness of demand-side solutions which can lead to more sustainable economic growth with lower emissions, as well as the importance of systemic changes, particularly in integrating private sector finance into climate actions by building the business opportunity was emphasized. In this regard, synergies could be sought across several sectors, including energy, agriculture and livestock, forestry, transport, water, and urban planning and development through initiatives that foster adaptation and mitigation interlinkages.

Figure 16 Survey results: Barriers to integration of mitigation and adaptation into NDCs or NAPs or other national/local communications



Source: Based on a survey conducted by ESCAP, "Addressing climate change through integrated approaches: Linking adaptation and mitigation", 2024.

3.5 Programs and initiatives fostering integration of adaptation and mitigation

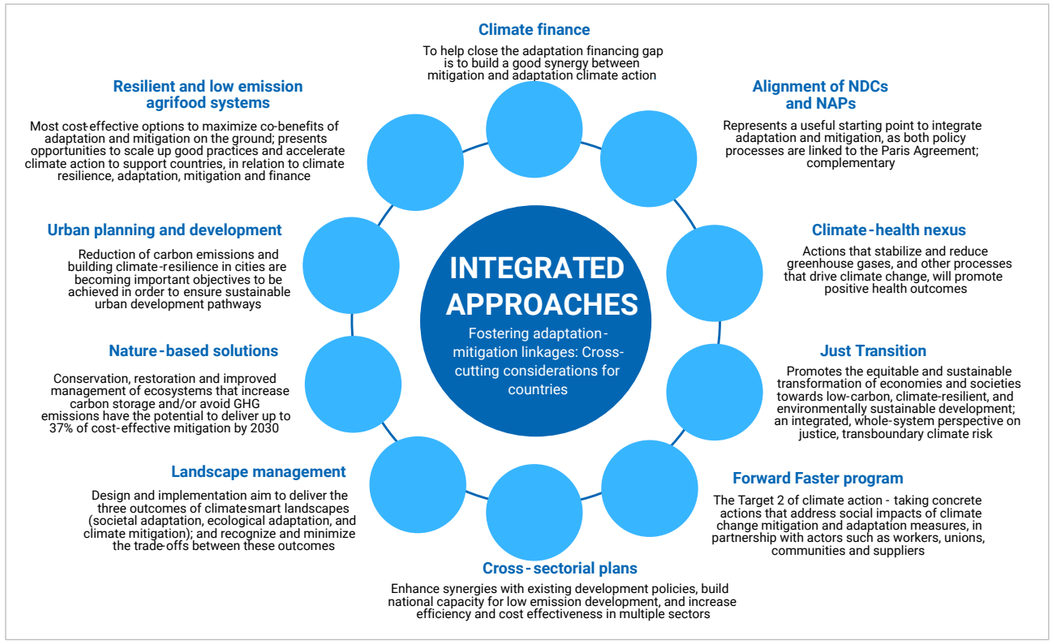
The Paris Agreement called for the establishment of a Global Goal on Adaptation, the adaptation equivalent of the global mitigation goal to limit temperature rise to 1.5°C. The Glasgow Climate Pact (COP26) included key pledges to help the world adapt to climate change and launched the two-year Glasgow-Sharm el-Sheik Work Programme on the Global Goal or Adaptation (UNFCCC, n.d.). This goal is important for providing a system for tracking countries' adaptation progress and continues to advance the urgency of adaptative actions. In addition, the adoption of the UAE Framework for Global Climate Resilience where Parties were requested to include quantitative and qualitative information on GGA targets in their respective adcomms, NAPs and NDCs, among others is encouraging countries to align their adaptation and mitigation strategies.

In its decisions, COP28 "encourages the implementation of integrated, multi-sectoral solutions, such as land-use management, sustainable agriculture, resilient food systems, nature-based solutions and ecosystem-based approaches, …. For activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries; and alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests, while reaffirming the importance of incentivizing, as appropriate, non-carbon benefits

associated with such approaches" (FCCC/PA/CMA/2023/L.17).

The complex nature of adaptation and mitigation approaches, rather than being seen as challenges, could provide opportunities for integrated approaches to climate action that address both simultaneously. These include addressing knowledge gaps, limiting siloed work on climate action, enhancing co-benefits of climate action and minimizing unintended trade-offs, modelling tools to build evidence base, collecting data to support policymaking, and enabling climate-resilient economic growth. Some windows of opportunities for tackling climate change already integrate adaptation and mitigation and offer co-benefits and development partners in the regions are coming together to support member States in this regard. This section captures some of the areas of work or ongoing initiatives that have offered windows of opportunity (figure 17).

Figure 17 **Areas of work to advance integrated approaches**



Source: ESCAP.

3.5.1 Climate-health nexus

Climate change impacts multiple dimensions of human rights particularly related to health through acute or chronic hazards, as well as by influencing human vulnerability and exposure to harm in the region (table 8).

Table 8 **Climate change and health: Impacts and risks in the Asia-Pacific region**

12 countries among the 50 most at-risk in UNICEF's Children's Climate Risk Index (UNICEF, 2021)	80 per cent of global displacements triggered by climate-induced disasters; majority of whom are women (ESCAP, 2022)	Over 9 million people were directly affected by disaster events (31 per cent floods, 68 per. Cent storms), including 2000 fatalities in 2023 (WMO, 2024)	70 per cent of the population is susceptible to sea-level rise (2.4 billion) (UNDP, 2024)	Over 30 per cent employment is in natural resource-based sectors conditioned by climate (e.g., agriculture and fisheries) (UNDP, 2024)

Climate actions that integrate adaptation and mitigation will optimize health benefits, while supporting achievement of the health-related Sustainable Development Goals (WHO, 2022). Actions that stabilize and reduce GHGs, and other processes that drive climate change, will promote positive health outcomes (WHO, 2022). This is particularly important in the Asia-Pacific region which is responsible for 85 per cent of all energy consumption globally (UNDP, 2024a). Drawing on the UNFCCC objective to combat "adverse impacts to health" (Article 3) (United Nations, 1992), efforts to integrate health into NDCs continue to advance worldwide (table 9). However, current references to health in NDCs are insufficient to address all health impacts a country face (UNDP, and WHO, 2024). The assessment of health impacts arising from climate change in Asia-Pacific continue to advance in depth and breadth and be recognized in the NDCs.

The Lao People's Democratic Republic includes an indicator on community mental health in its adaptation strategy for climate-informed health programs. Viet Nam's NDC discusses mental health disease as an aspect of post-disaster non-economic loss and damage. Sri Lanka's NDC flags the importance of assessing chronic kidney disease of unknown origin, an under addressed public health concern worldwide. Cambodia identifies economic impacts of reduced labour productivity due to heat stress. Fiji facilitated a memorandum of agreement between its Ministry of Health and the national meteorological service, fast tracking and expanding information-sharing between experts, to improve responses to climate-sensitive health risks through early warning systems.

The way forward for integrating and strengthening health in NDCs will include analysing underrecognized health impacts of climate change, and will also include emissions estimates from

Table 9 **Integration of health in the NDCs of Asia-Pacific member States**

Health in NDCs in Asia and the Pacific			
Subregion	**Human health (general, communicable and noncommunicable disease)**	**Food and nutrition security**	**Water**
East Asia and the Pacific	41 per cent	59 per cent	50 per cent
South-East Asia	50 per cent	63 per cent	63 per cent

Source: Adapted from Taryn Fransen, and others, "The State of Nationally Determined Contributions: 2022" (Washington, D.C.: World Resources Institute, 2022). Available at https://www.wri.org/research/state-nationally-determined-contributions-2022

Note: "Health" in this figure encompasses elements within the traditional scope of public health, including communicable and noncommunicable disease (referred to as 'human health' in source data), nutrition, and water.

the health sector, costing of health investments and the climate burden of disease, and outlines for coordinated institutional arrangements and technical support (UNDP and WHO, 2024). Some countries are already advancing these aspects. Mongolia's NDC addresses food security, water security, healthcare services and social safeguards. Viet Nam will examine health impacts to coastal and low-lying areas, emissions from the health sector and costing of health investments in its next NDC update.

In addition to NDCs, countries employ several other policies, plans, and programmes to address climate change and health in the region. For instance, Australia and Fiji have national climate change and health strategies. China's National Climate Change Adaptation Strategy 2035, jointly launched by 17 government departments to build a climate-resilient society, aims to balance mitigation and adaptation, and among other items, improve the monitoring, early warning, prevention and control of climate change-induced communicable and noncommunicable diseases (National Center for Climate Change Strategy and International Cooperation, 2022).

3.5.2 Just transition

A just and equitable transition to a net-zero future is key to unlocking the Paris Agreement's global climate goals. Just transition is a process that promotes the equitable and sustainable transformation of economies and societies towards low-carbon, climate-resilient and environmentally sustainable development (ESCAP, and others, 2023). It can provide an integrated, whole-system perspective on transboundary climate risk, avoid maladaptive measures or negative spillover effects that can help in identifying systemic solutions to address changing climate along with environmental and socioeconomic concerns. It is increasingly being seen as a window of opportunity to link adaptation and mitigation actions.

As an instance, the 2023 Global Stocktake report underscores the critical role of social protection in facilitating a just transition towards a low-carbon economy. Similarly, the 2024 ESCAP flagship report, *Social Outlook for Asia and the Pacific: Protecting our Future Today* (ESCAP, 2024d), emphasizes the urgent need to strengthen synergies between social protection and climate change policies. At the eighth session of the Committee on Social Development, countries acknowledged the urgency and need to harness the intersection of social protection and climate change policy as a key driver to foster more resilient societies and promote a just transition to a sustainable future in their new NDCs (ESCAP, 2024a).

Social protection systems play a key role in supporting the implementation of climate change mitigation and adaptation strategies. Public employment programs support wages as well as foster sustainable natural resource management practices, such as mangrove restoration, which are integral to climate adaptation and mitigation. Synergies with existing social protection mechanisms can be leveraged to deliver loss and damage funds to respond to economic and non-economic loss and damage due to climate change. There is increasing acknowledgement by multilateral climate funds of the importance of investing in social protection to address the social dimension of climate change policies. In 2022, a total of eight social protection related projects were funded through multilateral climate funds with a total budget of $154 million. Through strengthened policy integration and coordination between social protection and climate change, policymakers can ensure that people are not left behind in the shift to a low carbon economy and importantly, that they are equipped with the resilience and skills required to navigate this transition and cultivate a more sustainable future.

Box 2 **Green skills for employability – address climate change in an integrated way**

UNISOLVE is a digital platform that helps young people develop the critical skills they need to transition to a low-carbon economy and is functioning in India, the Maldives and Bhutan. UNICEF works with governments to incorporate the platform into national education systems, encouraging real-world skills development while inspiring young people to find a sense of purpose. UNISOLVE has shown promising results in India. Initially piloted in 4,000 schools in India, where nearly 25,000 students gained skills to help build their futures, the project has already expanded to more than 10,000 schools.

Youth Co-Lab is a platform for young people to build entrepeurship skills and contribute to the Green Transition. The Youth Co: Lab is functional in 28 countries and territories, with 280,000 participants engaged and 2600+ youth-led social innovation and entrepreneurship teams supported. The participants are developing/implementing social/environmental business ideas ranging from clean water and sanitation (Sudrain - Cambodia), sustainable agriculture (Cultivera - Japan), air pollution monitoring and control (Urban Air Labs - India), and carbon mobility (MILE - Bangladesh).

3.5.3 Forward Faster programme of UN Global Compact[6]

Box 3 Case study - PROGRESS: Promoting climate adaptation and mitigation for SMEs

PROGRESS is a digital climate assessment tool that assists SMEs in addressing climate adaptation and mitigation through comprehensive assessments and actionable plans. This tool has been developed by UN Global Compact Network Malaysia and Brunei ("UNGCMYB"). By focusing on climate governance, GHG emissions and business integration, PROGRESS equips SMEs with the knowledge and actions to navigate climate risks. The tool provides SMEs with a Climate Maturity Report and a customized Climate Transition Action Plan, depending on their climate maturity level. These resources help businesses identify areas for improvement and implement strategies to reduce their carbon footprint. Additionally, the tool offers emissions data inputs to get a better understanding. Through training and resources, SMEs gain the skills and knowledge needed to integrate climate considerations into their decision-making processes and policies. This empowerment ensures that SMEs are not only prepared to mitigate their environmental impact but also to adapt to climate-related challenges. Furthermore, through partnership with Alliance Bank, PROGRESS connects SMEs to financial incentives and green solutions, making the transition to sustainable practices economically viable. This financial support is crucial in helping SMEs invest in necessary adaptative measures and connecting them with solution providers.

Overall, PROGRESS makes the private sector, particularly SMEs, more resilient to climate change by offering vital knowledge and financing opportunities, thereby fostering a sustainable and adaptive business environment.

Source: Contribution from the UN Global Compact Network Malaysia and Brunei

Advancing a just transition is a priority area for the UN Global Compact through its Forward Faster programme (United Nations Global Compact, n.d.b). It challenges businesses to raise their ambition levels by taking tangible, accountable actions in five areas: gender equality; climate action; living wage; water resilience; and finance and investment. The Target 2 of climate action calls on companies to contribute to a just transition by taking concrete actions that address social impacts of climate change mitigation and adaptation measures, in partnership with actors such as workers, unions, communities and suppliers.

3.5.4 Resilient and low emission agrifood systems

Climate action through agrifood systems offers some of the most cost-effective options to maximize co-benefits of adaptation and mitigation on the ground. This sector presents opportunities to scale up good practices and accelerate climate action to support countries, as appropriate, in relation to climate resilience, adaptation, mitigation and finance across agrifood systems and in addressing gaps in the implementation of the goals of the Paris Agreement.

[6] For more information, see United Nations Global Compact, "Just transition: Accelerating action for a just transition", n.d.b. Available at https://unglobalcompact.org/take-action/think-labs/just-transition

Box 4 The Food and Agriculture Organization's (FAO) key initiatives, tools and strategies in Asia and the Pacific to integrate adaptation and mitigation through

1. **Climate Smart Agriculture (CSA):** An approach that helps guide actions to transform agrifood systems towards green and climate resilient practices. CSA supports reaching internationally agreed goals, such as the SDGs and the Paris Agreement, by working toward three objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible.

2. **Sustainable Rice Landscapes Initiative:** The Sustainable Rice Landscapes Initiative (SRLI) provides a vehicle to deliver CSA and integrated adaptation and mitigation on the ground through nature-based-solutions, while achieving a broad set of co-benefits across multiple geographies. With support from the Global Environment Facility (GEF), SRLI projects or projects with a SRLI related component are now under implementation or development in 12 countries across Asia, mobilizing around $94.9 million of GEF resources and over $833 million of public and private sector co-financing. The initial crop of SRLI projects will target 1.47 million beneficiaries, 50 per cent of whom are women leading to improved management practices on over 6 million hectares of land and the projected reduction in around 135.1 million metric tons of CO_2 equivalent of GHG emissions from agricultural production systems.

3. **Support Programme on Scaling up Climate Ambition on Land Use and Agriculture through NDCs and NAPs (SCALA):** The SCALA programme is a €20 million initiative implemented by FAO and UNDP and funded by IKI BMU Germany (2020-2025). The Programme will support 12 countries in Africa, Asia and Latin America including Cambodia, Mongolia, Nepal and Thailand specifically in Asia. The objective of the programme is for countries to have translated their NDC and/or NAPs into actionable and transformative climate solutions in land-use and agriculture with multi-stakeholder engagement. It emphasises collaboration between the public and private sectors to drive implementation and addresses several cross-cutting issues

4. **Food and Agriculture for Sustainable Transformation (FAST)** is another initiative that aims to implement concrete actions to improve the quantity and quality of climate finance contributions to transform agriculture and food systems by 2030, to support adaptation and maintain a 1.5°C pathway whilst supporting food and economic security.

Renewed ambitions for climate adaptation and mitigation through food systems transformation must build and capitalize on years of work by governments, civil society, private sector, local communities and international organizations. Countries have highlighted the importance of agricultural adaptation and mitigation as part of their NDCs under the Paris Agreement. Under the current NDCs in Asia and the Pacific, 98 per cent highlight adaptation policies and measures, while 70 per cent highlight agriculture specific mitigation targets and/or policies and measures. Shared NDC priorities for agricultural adaptation and mitigation have informed regional collaboration through groups, such as the ASEAN Climate Resilience Network and the ASEAN Negotiators Group on Agriculture, and regional support for the Koronivia and Sharm El Sheik Joint Work Programmes on Agriculture under the UNFCCC.

3.5.5 Ecosystem-based management or nature-based solutions

Box 5 Importance of peatland management in Asia and the Pacific to integrate adaptation and mitigation

In Asia including Indonesia, Malaysia, as well as the Philippines and Thailand, peatlands are commonly utilized for various types of land usage such as conservation, cultivation either by community or private sector, industries, etc. The stakeholders involved in the peatland ecosystem are varied, encompassing the community, business entities, government bodies, each with distinct levels of economic status, educational background, and authority. Hence, conservation and sustainable management should include both the approaches - mitigation to reduce potential GHG emission and adaptation to optimize peatland ecosystem services for community and other stakeholders in sustainable manners – and should be implemented in an integrated way. Indonesia has established the National NDCs covering peatland ecosystem conservation and restoration as well as the FOLU NET SINK 2030. In the Indonesian NDCs and FOLU NET SINK 2030 document, the methodology for water level measurement in collaboration with the GHG emission reduction on peatland ecosystem conservation and sustainable management is highlighted.

Nature-based Solutions (NbS) offer a host of practical benefits for people, climate and nature. For example, the extensive reforestation efforts in the Republic of Korea through five National Forest Plans, spanning from 1973-2017, contributed to restoring more than a million hectares of denuded forest with fast-growing tree species, which reduced disaster risk, notable from drought (OECD, 2017), and increased carbon sequestration (Lee, and others, 2018). Forestry measures hold a large potential to pursue the twin goals of climate policy. Soil conservation and reforestation policies, such as the Sloping Land Conversion Programme (SLCP) and the Reforestation Program in China, have managed to increase carbon sequestration while enhancing soil retention services (Hardelin, and Lankoski, 2018). A number of studies have aimed to value both adaptation and mitigation benefits of NbS. For example, it is estimated that in India mangroves protect 3.3 million people from flooding and $9 billion worth of property from flood damage annually in addition to acting as a carbon sink (Menéndez, and others, 2020). Peatlands are also significant sinks, and despite their small land coverage of about 2 to 3 per cent of global terrestrial area, they store about 25 per cent of the world's carbon (Leifeld, and Menichetti, 2018). Better peatland management can be deployed as a nature-based solution to halt biodiversity loss, support climate change adaptation, build climate resilience and support the wellbeing of communities living in these landscapes (UNEP, 2022).

Many countries articulate a broadly 'nature-based' or 'ecosystem-orientated' vision for mitigation and adaptation in their NDCs and propose a range of 'green' actions and targets to achieve these visions. Despite the recognized benefits of NbS, their implementation has been constrained by a number of factors. Building the required evidence base is particularly challenging as NbS often involve the use of ecosystems that are themselves vulnerable to climate change (Seddon, and others, 2020), and the effectiveness of NbS measures is context specific.

In 2022, the Net-Zero Nature-Positive Accelerator Integrated Program (NZNP Accelerator IP) was launched as a GEF initiative aiming to support countries to develop and implement integrated solutions to reach the long-term goals of the Paris Agreement (GEF, and World Bank Group, 2022). Actions supported by this IP will include: (i) investments in new technologies for sectors like energy and transportation; (ii) investments in land use and conservation actions; and (iii) investments in nature-based solutions across all sectors focused on tackling the drivers of environmental degradation and advancing systems transformation through integrated approaches. Many countries have initiated developing projects to complement national efforts to transition to inclusive, sustainable economic pathways, including the development of net-zero public budgets and scale up blended financing to realize the investment needed to develop and implement green economic policy, including Thailand and Viet Nam.

3.5.6 Urban planning and management

Cities and other subnational actors played a larger role at COP28, and it was a decisive moment for cities and regions. The COP28 Global Stocktake urges Parties to engage in inclusive, multilevel, gender-responsive cooperative action while providing direction for the next round of NDCs due in early 2025. Reduction of carbon emissions and building climate-resilience in cities are becoming important objectives to be achieved in order to ensure sustainable urban development pathways. Urban level integrated adaptation and mitigation approaches work quite efficiently to raise climate ambition, through NbS, storm water collection, sustainable transport and e-mobility, smart cities, etc.

For example, the Ministry of Environment and Forestry of the Government of Indonesia initiated a program in 2012 termed 'The Kampung Iklim (Climate Village)

Box 6 Case study from Ahmedabad Municipal Corporation (AMC), India

The Ahmedabad Municipal Corporation (AMC), with support from ICLEI South Asia under Swiss Agency for Development and Cooperation (SDC) funded CapaCITIES Phase II project, has developed the Climate Resilient City Action Plan (Towards a Net Zero Future by 2070) – Ahmedabad CRCAP. The action plan includes a comprehensive assessment of gaps in urban systems, and a climate risk and vulnerability assessment along with climate change impacts on urban infrastructure. The plan outlines a Progressive Action Scenario and a Net Zero Pathway for future planning to mitigate GHG emissions along with sectoral goals and mitigation targets for 2030, 2050 and 2070. The plan also details potential adaptation and mitigation strategies and actions to improve the city's climate resilience. The action plan serves as a comprehensive roadmap to address the climate impacts by implementing 28 strategies and 85 actions across 8 urban sectors: 1) built environment and energy; 2) transport; 3) water; 4) wastewater; 5) storm water; 6) solid waste; 7) urban greening and biodiversity; and 8) air quality. It is estimated that the city will require approximately INR 4,400 billion to become a net-zero city by 2070.

Source: Contribution by ICLEI South Asia office

Programme' (ProKlim). Indonesia's ProKlim Project supports its NDC commitments by coordinating national climate-related targets with local-level actions (Naik, 2023). The goal of the program is to address the climate vulnerability of the local communities by helping them to adapt and mitigate its effects. The program promotes a low-carbon lifestyle by disseminating and exchanging knowledge and best practices on climate change adaptation, improving the adaptive capacities of the local community, involving stakeholders, addressing waste and land management, reforestation and renewable energy, and encouraging energy conservation.

3.5.7 Landscape management

Landscape management design and implementation aims to deliver the three outcomes of climate-smart landscapes (societal adaptation, ecological adaptation and climate mitigation) and recognize and minimize the trade-offs between these outcomes. Landscape management can be an effective response to climate change by: (i) contributing to mitigation by storing carbon, reducing carbon emissions from deforestation and forest degradation, or reducing non-CO_2 emissions from agriculture, such as climate-smart landscapes, agriculture or forestry have been proposed; (ii) helping people adapt to climate variations (Pramova, and others, 2012): e.g., adequate agricultural management enhances food security, forests regulate the microclimate locally (in cities) and water regionally

Box 7 **Case study - LANDMARC**

The EU-funded LANDMARC is a 4-year project (2020-24), with a consortium of 19 nineteen partners, that aim to improve understanding of how and where land-based mitigation technologies (LMTs) can be most effectively deployed. The project runs from 2020 to 2024 and is bringing together stakeholders, Earth observation technology and computer modelling to estimate the global realistic potential of the Earth's land surface in absorbing additional carbon from the atmosphere. New assessment methodologies and tools aim to help governments identify suitable LMTs for their countries and quantify their impact. The project applies Earth observation monitoring, a mix of climate, land-use and economic simulation models as well as local and regional stakeholder engagement activities across 16 case studies and 5 regional platforms. The approach taken in LANDMARC provides a more comprehensive assessment of quantifiable and non-quantifiable environmental, and socioeconomic trade-offs and co-benefits of land-use based mitigation technologies. However, many LMTs with lower mitigation potential provide greater co-benefits, including other environmental, social, cultural and economic benefits, climate adaptation and resilience at the local level. Further research, adopting a system-based approach, analysing the suitability and effectiveness of the different available options aiming to identify carbon removal goals arising as co-benefits from interventions aimed at social improvements is needed.

Source: Landmarc, "About our Project", n.d. Available at https://www.landmarc2020.eu/about

(in watersheds), and mangroves buffer the impacts of extreme climate events in coastal areas. In addition, adaptation measures can be implemented to reduce the vulnerability of agriculture and forestry to climate change (Guariguata, and others, 2008).

Land-based negative emission solutions are included as a mitigation measure in the NDCs under the Paris Agreement.

3.5.8 Financing for integrated approaches

Box 8 **GCF projects financing integrated approaches**

1. An example of Green Climate Fund project on integrated response for climate change adaptation and mitigation for agriculture was in Samoa, Vanuatu and Tonga. This project has been designed to support farmers to adapt to its impacts as well as to mitigate the production of GHG from agriculture in these countries. The project has the goal of "establishing resilient, low carbon agricultural systems in Tonga, Vanuatu and Samoa". Activities with leading commercial producers and stakeholders will initially pilot regenerative organic farming and associated technologies and practices, and following validation, these will be shared more widely. The Pacific Community (SPC) is the accredited entity for this project with a mix of private sector and government agencies engaged in local implementation.

2. The Financing Mitigation and Adaptation Projects (FMAP) in Indian micro, small, and medium enterprises (MSMEs) in another example. MSMEs are a major contributor to GDP and employment in India. The MSME sector is also a significant emitter of greenhouse gases and at the same time faces high vulnerability to extreme weather events. Barriers such as a lack of affordable financing and limited technical know-how severely restrict the urgent adoption of low emission and climate-resilient practices among Indian MSMEs which is being addressed through this project.

One of the opportunities to help close the adaptation financing gap, according to Klein, Schipper, and Dessai (2005), is to build a good synergy between mitigation and adaptation climate action. Synergies can also be used to leverage climate finance and maximize efforts to meet climate targets. Historically, climate finance has been allocated to either mitigation or adaptation, with funding instruments not explicitly encouraging mitigation and adaptation synergies. Climate finance contributed and mobilized for mitigation and adaptation synergies tended to increase between 2016 and 2020 but remains much smaller than the volume of adaptation or mitigation finance (The Climate Change Center, and others, 2023).

The FCDO-supported Climate Finance Network (CFN) is the primary programme on climate finance in UNDP's Regional Hub in Bangkok (UNDP, 2024b). Through the workstreams, CFN reform tools,

methodologies, assessments and convenings facilitate the linkage of mitigation and adaptation with other socioeconomic objectives, primarily focused on IPCC's third category on inter-relationships between adaptation and mitigation options and sustainable development, including those under 1.5°C pathways. The CFN is developing a modelling tool to assess impact of climate change on the economy and effects on a just transition. This endeavour aims to provide governments with additional empirical data to inform decision-making on climate action. Given the gap in adaptation finance flows globally and in the region, the CFN has also undertaken analysis determining investments with dual benefits to adaptation and mitigation as well as synergies with nature-based solutions and disaster risk reduction and review of the enabling environment needed to improve fund flows. To aid countries mobilize finance and exercise ownership of the process, the CFN developed an adaptation financing strategy guideline. Anchored on tools likewise useful for financing mitigation-related sectors, the guideline also endeavours to contribute to NDC implementation where it often includes intended adaptation outcomes.

The CFN is currently implemented in 17 countries, namely: Bangladesh, Cambodia, Fiji, India, Indonesia, Kiribati, Malaysia, the Maldives, Nepal, the Philippines, Solomon Islands, Sri Lanka, Thailand, Tonga, Tuvalu, Vanuatu, and Viet Nam. Since the first phase of the Sweden-supported Governance of Climate Change Finance and now CFN, UNDP has supported the Government of Indonesia with tagging climate adaptation and mitigation activities at the national level. Such information has been used to inform UNFCCC reporting requirements and have become the information basis to issue green and blue bonds. Through the public financial management tool of climate budget tagging, the Government was able to leverage domestic public finance for access to innovative finance.

3.6 NDCs 3.0: An opportunity to strengthen the linkages

As highlighted in the previous sections, it is worthwhile to advance integrated approaches so as not to lose opportunities of being able to set ambitious goals, reduce trade-offs, amplify synergies and achieve tangible targets. Several ongoing programs and initiatives have the integrated angle embedded as a co-benefit and this opportunity needs to be seized. For instance, investment in urban green spaces (green roofs and urban trees) offers the potential triple dividend of carbon sequestration, cooling and improved biodiversity. Similarly, protecting and enhancing mangroves (coastal defence through tree planting and dune establishment) provides 'blue carbon' mitigation benefits, protection from storm surges, stabilization of coastlines and improves safeguarding of biodiversity of marine species. Also, adopting more balanced low-carbon diets combined with climate-smart agriculture (including regenerative agriculture, no-till farming, climate-resilient crop varieties, agroforestry and reduced-methane livestock farming) could not only decrease GHG emissions from food systems but also increase the climate resilience of food production and security.

As part of the GST outcome, Governments were called on to consider ecosystems, biodiversity and carbon stores, such as forests, when developing their stronger national climate action plans - NDCs 3.0 due by February 2025. Nature-based solutions were also recognized in the Global Stocktake (United Nations Climate Change, n.d.c), recognizing that nature and biodiversity are keys to mitigating a heating planet and protecting vulnerable communities from the impacts of a changing climate and underpinned by human rights, including gender equality (FCCC/PA/CMA/2023/L.17). The underlined message during COP28 on the nexus between climate and food systems, climate and cities, climate and health continues to unfold new dimensions on the road to COP29. With the formulation of several initiatives to strengthen the elements of such nexuses, countries are gearing up for developing stronger national plans.

In the shores of Indonesia, mangrove ecosystems are widely distributed and the coastal societies could benefit through their valuable ecosystem goods and services. These coastal forests sequester and store large amounts of atmospheric carbon, help in better preparedness of climate risks and vulnerabilities in the context of natural disaster risks, and assist in designing effective programs. This substantial carbon storage capacity is now being recognized and promoted in nature-based climate change mitigation and adaptation strategies. With the announcement that the Indonesia NDCs 3.0 could cover several subsectors of the marine sector that focus on managing coastal and marine ecosystems, national governments could identify important coastal zones which might be important for national climate action (adaptation and mitigation goals).

In its NDC, the Philippines has committed to a projected GHG emissions reduction and avoidance of 75 per cent from 2020 to 2030. It articulates that the country's climate change mitigation actions shall strengthen the resilience and adaptive capacity of the country. To operationalize the NDC targets, the NDC Implementation Plan (NDCIP) 2023-2030 identifies the country's priority policies and measures for reducing/avoiding emissions across the agriculture, waste, industry, transport and energy sectors. The Philippine Development Plan (PDP) 2023-2028 sets the overarching climate agenda with adaptation as the anchor strategy. Mainstreaming climate change priorities in the PDP is critical, as it is the basis for developing or updating sectoral, regional and local plans and guides the preparation of the National Expenditure Program.

Actions need to go beyond adaptation and mitigation framings and aim for broader policy integration beyond climate, including nature-based solutions and climate-resilient agriculture, sustainable land use planning, renewable energy solutions, urban infrastructure planning and development, and community-based and -led approaches. Adaptation and mitigation actions are a critical need for the countries in their preparatory phase for NDCs 3.0. It is logical to consider adaptation and mitigation side by side. The lack of evidence-based data is one of the main bottlenecks to influence national policies and strategies. Consequently, to effectively integrate mitigation and adaptation and create a meaningful impact, we require better information, enhanced analytical capabilities, and informed policymaking (Wilbanks and Sathaye, 2007).

Chapter 4

THE WAY FORWARD

4.1 Enhance ambitions in the key actions for 2025 NDC 3.0 commitments

As member States of the Asia-Pacific region approach finalizing their NDC 3.0 commitments in 2025, the overall preparation of elevating their climate ambitions is increasingly apparent. Many countries in the region have recognized the urgent need to transition towards greener energy and transport sectors, driven by the dual pressures of climate change and public demand for sustainable development. The commitment to reduce greenhouse gas emissions and enhance resilience is reflected in the growing number of national adaptation plans (NAPs) and long-term low-emission development strategies (LT-LEDS) submitted by the countries. However, while progress has been made, significant gaps remain in capacity, financing and implementation that must be addressed to fulfill these ambitious goals.

To align with the Intergovernmental Panel on Climate Change (IPCC) trajectories, countries must undertake bold actions that encompass both adaptation and mitigation measures across multiple sectors. This includes a comprehensive transformation of energy systems, prioritizing renewable energy sources and phasing out fossil fuels. Investments in energy efficiency and the electrification of transport systems are essential steps toward achieving the ambitious targets set forth by the IPCC. Furthermore, countries should integrate climate considerations into urban planning and development strategies, enhance public transportation networks and promote low-carbon mobility options. Such measures not only help in meeting emission reduction targets but also enhance climate resilience and foster sustainable economic growth. The following actions are recommended for countries to consider in their NDC 3.0.

- **Align the third cycle of NDC 3.0 with the LT-LEDS:** Synchronize short-term and long-term climate targets by revisiting and updating NDCs targets and net-zero pledges and reflect recent science to set clear sectoral targets aligned with the recommended IPCC pathways. This will provide a clear pathway to climate goals, attract international support and ensure accountability.

- **Accelerate the transition to renewable energy:** Include a clear pathway to shift from fossil fuel dependency to renewable energy sources to achieve net-zero emissions. Implement policies and increase investments in renewable energy infrastructure (solar, wind, hydroelectric power and storage) and phase out coal, with a focus on just transition strategies. Create transition plans for workers in fossil fuel industries, involve marginalized communities in decision-making and ensure gender-responsive policies. This will also strengthen energy security and support sustainable development.

- **Promote sustainable transport solutions:** Advance electric mobility and improve public transportation for decarbonizing transport sector. Increase investment in electric vehicle (EV) infrastructure, support public transportation upgrades and introduce incentives for EV adoption. In addition to climate benefits, it will also reduce urban air pollution and improve public health.

- **Enhance energy efficiency in industry and buildings:** Encourage lower energy consumption across sectors through improved energy efficiency. Enhance energy efficiency standards for appliances, encourage retrofitting buildings and provide incentives for industries to adopt energy-efficient practices. This will reduce demand for the power grid, decrease energy costs and build resilience against energy price fluctuations.

- **Strengthen nature-based solutions and conservation:** Invest in ecosystem preservation, promote sustainable agricultural practices and integrate nature-based solutions into national climate policies. It will enhance biodiversity, increase carbon storage capacity and improve local livelihoods.

4.2 Enable actions by scaling up climate finance

Achieving climate goals in the developing countries of Asia and the Pacific, excluding China, is estimated to require $1.3 trillion annually. Current investments fall significantly short, and the energy sector alone needs 62.5 per cent of the total, or over $800 billion annually, for the required low-carbon transition. Therefore, scaling up climate finance is a critical component of achieving these ambitious commitments. Countries need to mobilize both public and private financing to support the transition to low-emission and climate-resilient economies. This includes accessing international climate funds, enhancing domestic resource mobilization, and promoting investment in green technologies and infrastructure. Additionally, fostering partnerships between governments, the private sector and civil society can unlock new sources of innovation and funding, ensuring that climate actions are not only ambitious but also feasible and effective. While finance provided by MDBs, bilateral donors, and international private finance should play a very important role, especially in least developed countries and small island developing States, for the region it is estimated that more than half of the finance would need to come from domestic public and private resources. By prioritizing financial flows toward climate initiatives, countries can bridge the existing funding gaps and accelerate the implementation of their NDCs.

- **Set up carbon pricing and implement market mechanisms:** Create financial incentives for emissions reduction and adopt carbon taxes or emissions trading systems to fund renewable energy and low-carbon projects. This will encourage companies to reduce emissions, promote green investment and provide government revenue for climate initiatives.

- **Expand climate finance and investment mechanisms:** To bridge the financing gap for climate-related projects, build capacity to utilize green bonds, blended finance and international funds like the Green Climate Fund to support large-scale renewable and resilience projects. Encourage regional cooperation for resource-sharing, technology transfer and financing models that are better suited to regional challenges.

4.3 Engage stakeholders effectively

Finally, effective stakeholder engagement and knowledge-sharing will play a pivotal role in the success of the 2025 NDC 3.0 commitments. Governments must establish inclusive governance frameworks that involve local communities, indigenous peoples and vulnerable groups in decision-making processes. Enhancing collaboration between national and subnational levels will ensure that policies are context-specific and address local needs while aligning with broader climate goals. By fostering a culture of cooperation and knowledge exchange, countries can enhance their capacity to implement integrated approaches that link mitigation and adaptation efforts, ultimately paving the way for a sustainable and resilient future. In this connection, it is critical to strengthen regional collaboration and South-South cooperation through using the exiting regional technology-sharing platforms to share knowledge, best practices and resources among Asia-Pacific countries to enhance collective action. This will enhance capacity across the region, foster innovation and enhance collective resilience against climate risks.

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