



RESPONDING TO THE CLIMATE CHANGE CHALLENGE IN ASIA AND THE PACIFIC: Achieving the Nationally Determined Contributions (NDCs)



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FOREWORD



The Asia-Pacific region is the worst impacted region, suffering the greatest losses from climate change and weather-related disasters. Coupled with its economic dynamism and growing emissions, it has a critical role to play in the global response to climate change and in implementing the Paris Agreement.

Reflecting their different levels of development and economic diversity, countries in the Asia-Pacific region face different challenges related to climate change. These are reflected in their Nationally Determined Contributions (NDCs), the main tool used to communicate countries' climate change priorities, policy responses, and ambitions. The NDCs take into account national circumstances and are a country-driven process, often building on existing national policy frameworks across different sectors to mitigate emissions or adapt to climate change.

Considering that countries in the Asia-Pacific region do not bear the main historical responsibility for climate change, the NDCs across the region, on average, reflect a reasonable degree of ambition. Most countries have managed to set explicit targets that they are aiming to reach in order to mitigate greenhouse emissions that lead to climate change. These take different forms, ranging from emissions reduction targets relative to base year, relative to business as usual, or emissions intensity targets. Many also signal the opportunity for achieving higher ambition, subject to receiving additional financial, technological and capacity-building support from developed countries.

Nevertheless, at current rates, the global carbon budget will be used up in two or three decades. Therefore, the global community must significantly step up its mitigation ambition in order for the world to have a realistic chance of achieving the objectives of the Paris Agreement. The vulnerable countries in our region have a critical stake in ensuring that global emissions trajectories are corrected downward, as they stand to bear the greatest future losses of climate impacts, which exacerbate their existing development challenges to reduce poverty and hunger, grow sustainable cities, and promote health, education and prosperity for all. In this regard, the global stocktake will be a central element to provide collective guidance on how to achieve the Paris Agreement goals in a fair and balanced manner.

As shown in this report, there are plenty of opportunities for the Asia-Pacific region to exploit cost-effective mitigation measures that can help them to achieve the co-benefits of the 2030 Agenda, especially through the increased take-up of energy efficiency measures and renewable energy solutions. In fact, the region is emerging as a global leader capable of serving as an example to show how people can be lifted out of poverty and achieve sustainable development outcomes without relying on fossil fuels.

Carbon pricing, and regional linking of carbon markets, also has a potentially significant role to play in the region to reduce the cost of achieving the NDCs and increasing climate ambition. This is becoming more relevant as carbon pricing initiatives multiply in the region. Notwithstanding these win-win opportunities, it is incumbent on the international community to do more to support the most vulnerable countries in the region, through finance, technology and capacity-building, to help them raise their ambition.

On building resilience, countries in the region have been making considerable effort to develop their National Adaptation Plans. These need to be adequately supported so that countries can better weather the impacts of climate change on their economies, infrastructure and societies.

EXECUTIVE SUMMARY



Emissions in the Asia-Pacific region reach 26,725 million metric tons of CO₂ equivalent gases to the atmosphere in 2012, accounting for more than 50 per cent of global emissions. Across sub-regions, the East and North-East Asia (ENEA) sub-region was the largest emitter in the region, with 55 per cent of the region's total emissions, followed by South and South-West Asia (SSWA), equivalent to 18 per cent. The Pacific countries were responsible for 3 per cent of emissions. In terms of sectors, the energy sector was the largest emitter sector, with 39 per cent of region's CO₂ equivalent emissions, followed by the industrial sector emitting 25 per cent of emissions. Agriculture emissions were also significant, and together with land-use change, emitted 19 per cent of total.

By October 2017, 43 countries in Asia-Pacific had signed and ratified the Paris Agreement, while 8 were still in the process of ratifying it through their national legislatures. One of the central elements of the Paris Agreement are the National Determined Contributions (NDCs), in which member states lay out their national priorities for climate action to mitigate greenhouse gas emissions, and to adapt to climate change. Overall, the existing mitigation commitments under the NDCs represent a serious effort to contribute to the long-term temperature goal limit of the Paris Agreement but studies show that ambition still falls well below efforts needed to close the ambition gap.

This report provides a first assessment by UNESCAP of the NDCs in the Asia-Pacific region, an overview of the region's priorities, progress and opportunities, and the efforts underway to use carbon pricing, and regional linking, as a means to achieve the NDCs in a cost-efficient manner.

Nationally Determined Contributions in the region

Fifty-one countries in the region submitted an NDC with a mitigation target. Countries in the region adopted different types of targets including absolute emission reductions targets, relative emission reductions targets, carbon intensity reductions, peak of carbon emissions, or policies and actions. Most countries included mitigation targets that were both unconditional (lower ambition), and conditional on international financing, technology transfers, or capacity building (higher ambition).

The mitigation targets show that countries are serious about lowering their emissions to contribute to achieving the collective goals. However, the level of diversity of targets adopted across the region make it difficult to assess and compare ambition and identify ambition gaps. Yet, since comparability is essential as countries prepare to adopt co-operative approaches through Article 6.2 on the internationally transferred mitigation outcomes (ITMOs), further efforts will be required to improve it. In addition, it is clear that many countries in the region are ready to increase ambition if they receive the support of the international community through finance, technology, and capacity-building.

Based on countries' sectoral and sub-sectoral mitigation targets contained in the NDCs, several priorities for countries can be identified. Energy emerges as a priority sector, highlighted by 40 countries of the 42 analysed. Many countries in the region declared their intention to increase their share of renewable energy, as well as improve energy efficiency. Agriculture, forestry and other land use was also a common theme of attention, in line with the region's large contribution to global emissions from this sector. Transport received attention from 32 out of 40 parties, including by many Pacific countries, which highlighted measures in the biofuels sub-sector as a way to address emissions coming largely from shipping. Countries with a larger contribution to global manufacturing also paid strong focus on industrial processes, with measures on its energy efficiency. Additionally, many also proposed complementary policy actions in areas such as cleaner coal mining or improved management of hydrocarbon fields.

Regarding building resilience, many NDCs set the path to better synergise disaster risk reduction and climate change adaptation actions to achieve a triple-win of lowering disaster risks, increase resilience to cope with climate change and achieving sustainable development. Agriculture and water were highlighted as major priorities, given their importance in the region and the impacts they have on people's livelihoods, and on communities' vulnerability in the face of climate change.

Measuring progress

Measuring regional progress towards the climate change priorities is challenging *inter alia* due to the diversity of the NDC targets different normative benchmarks against which progress can be measured, the lack of an agreed formula to split the required emissions reductions across regions, and the difficulty of measuring progress on adaptation and strengthening resilience.

The global temperature goal contained in Article 2 of the Paris Agreement, to hold 'the increase in the global average temperature to well below 2°C', is a key normative benchmark against which efforts are being measured. Estimates show that, to achieve this goal with a 66 per cent likelihood, the remaining net global emissions from 2017 are around 800 to 1055 GtCO₂e, which, at current rates, will be used up in around 20 to 30 years. The current global emission pledges contained in the NDCs taken together will give a likely temperature increase of about 3°C by 2100.

For the energy sector, the remaining carbon budget up to 2050 is around 650 GtCO₂e.¹ To achieve this, global energy emissions would need to peak before 2020, and decrease by 1 Gt per annum by 2030. The energy sector is expected to be responsible for about 42 per cent of the Greenhouse Gas Emissions (GHG) emissions reduction needed to get to the 2°C scenario.² About two-thirds of this reduction (4.5 – 5 Gt) scenario is linked to energy efficiency, while 2 – 2.5 Gt will be achieved through the switch to renewable energy.³

In Asia-Pacific, energy-related emissions are currently responsible for around 13Gt GtCO₂e per year. In order to meet the 2°C scenario they should be limited to around 10 GtCO₂e per year by 2030, or less than half of the global total of the energy-related emissions.⁴

Given its dynamic growth path, and its growing energy demand, it is clear that Asia-Pacific will largely shape the progress toward achieving these sustainable energy objectives, including the targets under SDG7. The region consumes more than half of the global energy supply. In 2014, it emitted 55 per cent of global emissions from fuel combustion, nearly two-thirds of which were from coal. The region faces many opportunities to achieve cost-efficient emissions reductions while increasing energy security. Regional economies have already demonstrated a long-term steep decline in energy intensity, falling from 9.1 MJ/\$ in 1990 to 6.0 MJ/\$ in 2014. Progress is also notable in the renewable energy sector, in which the region has emerged as global leader, with more investment, installed capacity, and consumption than any other region.

The emergence of market-based approaches

Market-based approaches are being increasingly embraced as a way to deliver least-cost emission reductions to achieve the NDCs. As stated in their NDCs, over one hundred parties are considering market-based approaches to achieve low carbon climate resilient development.

Twenty-six countries, or around half of the countries in the region, expressed their willingness to use market-based approaches and are exploring the possibility of enhancing regional or bilateral cooperation under the

remit of Article 6 of the Paris Agreement. With several new systems in development in the region, including the Chinese ETS to launch by the end of 2017, it is expected that 20-25 percent of global carbon emissions will soon be covered by a carbon price.⁵

Regional co-operation for carbon pricing offers an opportunity to further exploit cost savings. It can take many forms and ranges from similar programme elements of different systems to full linking, which entails the unrestricted mutual recognition of carbon units. The first steps towards regional co-operation on carbon pricing in the Asia-Pacific region have resulted in the Joint Crediting Mechanism (JCM), a bilateral mechanism between Japan and eleven countries in the region, to facilitate the transmission of low carbon technologies to host countries and implement emissions reductions.

Apart from the cost-savings, and the incentives it provides that can change production and consumption patterns towards greater sustainability, carbon pricing can raise valuable public revenue through the auction of permits and the collection of carbon taxes. Globally, around US\$20bn are raised *per annum*, but there is much greater revenue potential. Developing countries can benefit from selling emission reductions, which have been estimated at 2 – 5 per cent of GDP by 2050. Carbon markets could also give rise to less tangible benefits, such as indirect efficiency gains, enhanced transmission of technical knowledge, or higher regional political commitment to address the climate change agenda and to alleviate competitiveness concerns. However, achieving the maximum effectiveness of carbon markets relies on a strong carbon price, namely \$40-80 per tonne of CO₂ by 2020 and \$50-100 per tonne by 2030.

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ACRONYMS



AFOLU	Agriculture, Forestry and Other Land Use
APA	Ad Hoc Working Group on the Paris Agreement
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
BAU	Business as Usual
CCA	Climate Change Adaptation
CCAP	Climate Change Action Plan
CDM	Clean Development Mechanism
CDP	Carbon Disclosure Project
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPLC	Carbon Pricing Leadership Coalition
CSA	Climate-Smart Agriculture
DRR	Disaster Risk Reduction
ENEA	East and North-East Asia
ETS	Emissions Trading Scheme
EU	European Union
EU-ETS	European Union Emissions Trading Scheme
FITs	Feed-in Tariffs
GHG	Greenhouse Gas Emissions
ICAO	International Civil Aviation Organisation
ITMOs	Internationally Transferred Mitigation Outcomes
JCM	Joint Crediting Mechanism
KAZ-ETS	Kazakhstan Emissions Trading Scheme
KETS	Korea Emissions Trading Scheme
LCCR	Low-Carbon Climate-Resilient
LDCs	Least-Developed Countries
LPG	Liquefied Petroleum Gas
MEPS	Minimum Energy Performance Standards
NAPs	National Adaptation Plans
NCA	North and Central Asia
NDCs	Nationally Determined Contributions
NDRC	National Development and Reform Commission
NGOs	Non-Government Organizations
REDD	Reducing Emissions from Deforestation and Forest Degradation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SDA	Sectoral Decarbonisation Approach
SDM	Sustainable Development Mechanism
SEA	South-East Asia
SSWA	South and South-West Asia
UNFCCC	United Nations Framework Convention on Climate Change
UNGC	United Nations Global Compact
WRI	World Resources Institute
WWF	World Wildlife Fund

CONTENTS



Foreword	iii
Executive summary	iv
Acknowledgements	vii
Acronyms	ix
1. Introduction	1
2. Analysis of the NDCs in Asia-Pacific	2
Regional emissions	2
Mitigation	3
Building resilience	7
Challenges and future agenda	9
Snapshots of the ESCAP subregions	10
3. Measuring progress against benchmarks	17
Global benchmarks and the carbon budget	17
Sectoral benchmarks	18
Progress of Asia-Pacific region towards SDG7 benchmarks	18
4. Market-based approaches to achieve NDCs	20
A. Article 6 provisions	20
Article 6.2: Cooperative approaches	20
Article 6.4: Establishes a mechanism for mitigation (SDM)	20
Article 6.8: Non-market based approaches	21
B. Regional co-operative approaches and linking	22
Regional co-operative approaches and first steps toward linking	23
C. Revenue uses	25
D. Carbon pricing in the private sector	26
E. Challenges and future agenda	26
Conclusion	27
References	30
Annex I – Summary of country NDCs	34

BOXES

Box 1 Key provisions of Art. 6 of the Paris Agreement	4
Box 2 Overview of ETSs in the world	23
Box 3 Uses of carbon pricing revenue in the region and beyond	26

FIGURES

Figure 1 Status of ratification of Paris Agreement in Asia-Pacific (October 2017)	1
Figure 2 Emissions by sector in Asia-Pacific (Million tones of CO ₂ equivalent), 2010	2
Figure 3 Total CO ₂ equivalent Emissions (Million metric tons of CO ₂ e) by sub-region in Asia-Pacific, 2012	2
Figure 4 CO ₂ equivalent Emissions per Capita (Metric tonnes of CO ₂ e per capita) by subregion in Asia-Pacific, 2012	3
Figure 5 Type of Mitigation Targets in Asia-Pacific NDCs	3
Figure 6 Asia-Pacific NDCs conditionality (in number of countries)	6
Figure 7 Number of ESCAP parties that referred to a sector as a priority for mitigation, as communicated in the NDCs.....	7
Figure 8 Number of ESCAP parties that referred to a sector as a priority for adaptation, as communicated in the NDCs.....	9
Figure 9 The NDC emission pledges of the top-4 emitters.....	17

TABLES

Table 1 Mitigation targets across the Asia-Pacific region	5
Table 2 Sectoral targets across the Asia-Pacific region	8

1. INTRODUCTION

The Asia-Pacific region is one of the most vulnerable to climate-induced disasters and extreme weather and suffers the greatest human and economic impacts from these. Over the period 2005-2014 the Asia-Pacific region had 1,625 reported disaster events. Approximately 500,000 people lost their lives, around 1.4 billion people were affected, and there was \$523 billion worth of economic damage.⁶ According to the 2016 Global Climate Risk Index, the ten countries most affected by climate risk from 1995 to 2014 (based on economic loss, number of deaths and frequency) included eight Asian developing economies.⁷

Climate change will increase the frequency and intensity of weather and climatic hazards, such as floods, tropical cyclones, heatwaves and droughts. Side-by-side, changes stemming from ecosystem degradation, the reduced availability of water and food, and impacts on livelihoods, reduce the capacity of local communities to cope with these hazards.⁸

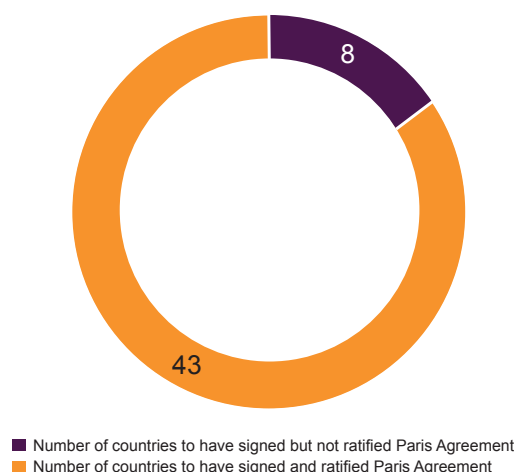
The Paris Agreement on climate change entered into force in November 2016. One of its central elements are the nationally determined contributions (NDCs), in which Parties lay out their national climate actions, including climate related targets, policies and measures they plan to achieve as part of their efforts to achieve the collective long-run temperature goal of 'holding the increase in the global average temperature to well below 2°C above pre-industrial levels', and to increase 'the ability to adapt to the adverse impacts of climate change and foster climate resilience' [Art. 2].

In 2018, Parties will take stock of the collective efforts in relation to progress towards the goals set in the Paris Agreement, and continue to regularly assess this every five years to help inform the ambition needed to achieve their goals and update their NDCs accordingly.

Overall, while the existing commitments under the NDCs represent a serious effort to reaching the long-term temperature goal limit, their ambition still falls well below efforts needed.⁹ According to UNEP, even under a scenario of full implementation of both unconditional and conditional NDCs, by 2030, there would still be a gap of around 12 GtCO₂e under a 2°C scenario, and the emissions reductions achieved would only be sufficient to achieve a 2.9°C scenario. This gap would be even higher under a 1.5°C scenario, reaching an emissions gap of 15 GtCO₂e.¹⁰ To achieve the objectives of the Paris Agreement, countries will need to at least double the efforts expressed in their NDC pledges.¹¹

Without prejudice to the results of the global stocktake, the present report provides a first assessment by UNESCAP of the NDCs in its region, with view to identifying the priorities for the region in its fight against climate change, progress against targets and cost-effective opportunities that the region can pursue to achieve. Section 2 of this report provides a comprehensive assessment of the NDCs in the region, section 3 assesses interim progress and gaps across a few key sectors, based on available studies, section 4 focuses on the role of market-based approaches to achieve cost-effective implementation of the NDCs and progress in this regard, while section 5 concludes.

FIGURE 1. Status of ratification of Paris Agreement in Asia-Pacific (October 2017)



2. ANALYSIS OF THE NDCs IN ASIA-PACIFIC

This section provides an overview of the emissions trends in the region by sector and sub-region and analyses the NDCs communicated by countries in the Asia-Pacific region in order to identify which are the priorities for the region, and the selected approaches and vision for the region's climate change response.

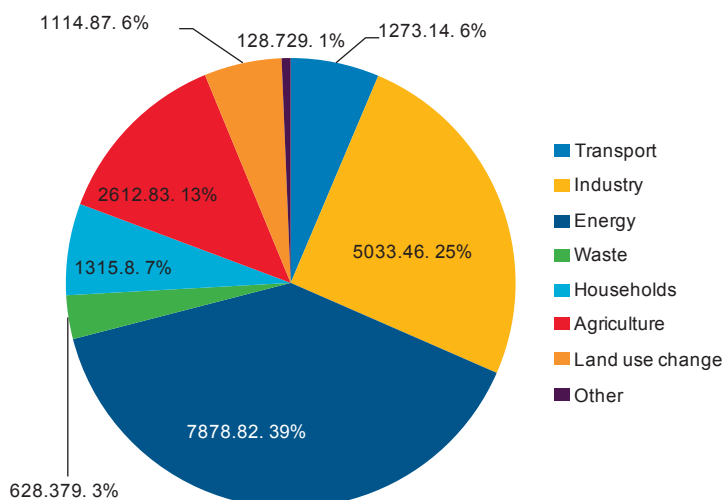
Regional emissions

According to 2010 data, the largest share of the Asia-Pacific region's emissions came from the energy sector, which was responsible for almost half (39 per cent) of CO₂ equivalent emissions. The industrial sector followed, emitting some 25 per cent of total

emissions. Agriculture emissions were also significant, and together with land-use change, emitted 19 per cent of emissions. The remaining sectors' emissions together accounted for roughly those of agriculture, divided across households (7 per cent), transport (6 per cent), waste (3 per cent) and other activities.

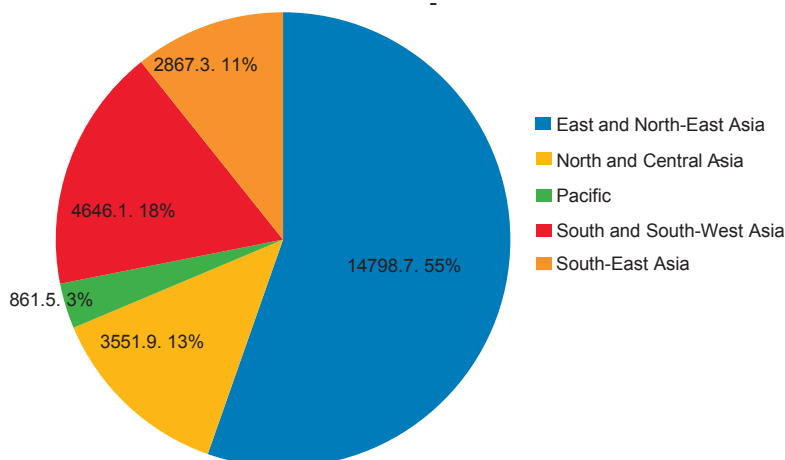
In terms of sub-regions, East and North-East Asia (ENEA) is the largest emitter of CO₂ in the Asia-Pacific due to its economic size. In 2012, the sub-region was responsible for 55 per cent of the region's total emissions, followed by South and South-West Asia (SSWA), equivalent to 18 per cent. Pacific countries were responsible for 3 per cent of emissions. In per capita emissions, the Pacific was the largest emitter in the region, with 22.9 MtCO₂ per capita in 2014, followed

FIGURE 2. Emissions by sector in Asia-Pacific (Million tones of CO₂ equivalent), 2010



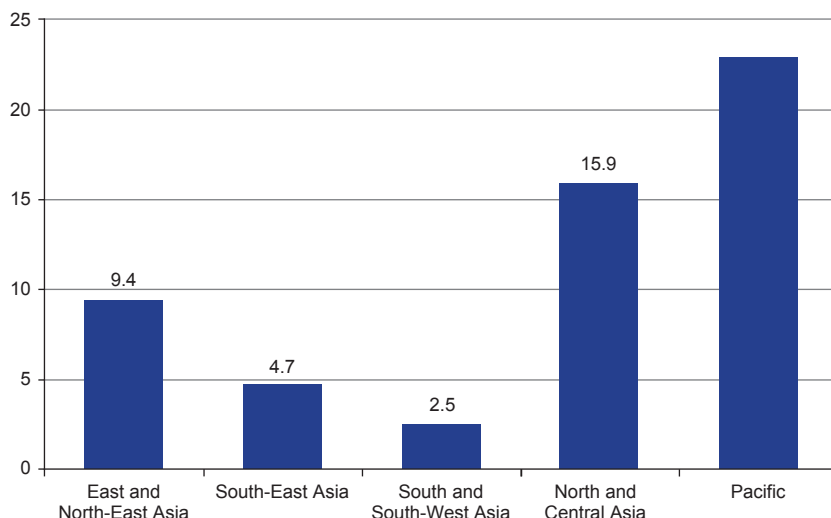
Source: ESCAP statistical database.

FIGURE 3. Total CO₂ equivalent Emissions (Million metric tons of CO₂e) by sub-region in Asia-Pacific, 2012



Source: ESCAP statistical database.

FIGURE 4. CO₂ equivalent Emissions per Capita (Metric tonnes of CO₂e per capita) by subregion in Asia-Pacific, 2012



Source: ESCAP statistical database.

by North and Central Asia (NCA) with 8.4 MtCO₂, East and North-East Asia (ENEA), with 6.9 MtCO₂e SSWA was the sub-region with the smallest emissions share per capita, with 2.5 MtCO₂e.

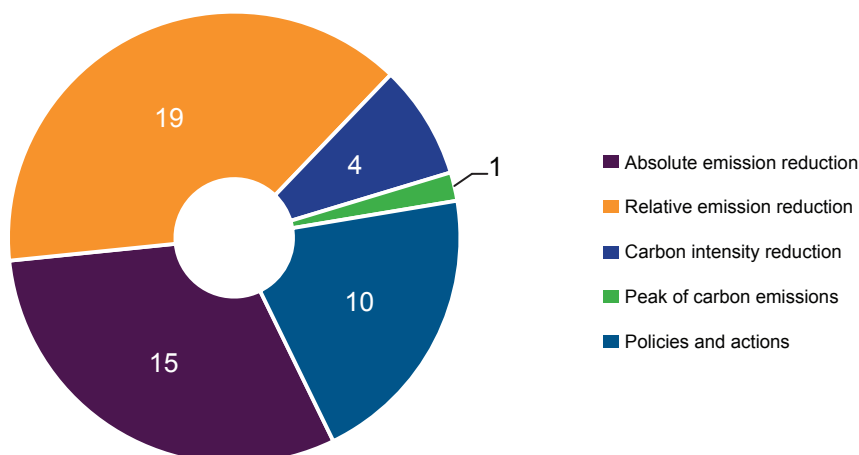
Mitigation

Mitigation targets

Depending on their preferences, countries selected different types of mitigation targets for their NDC pledges. Fifty-one countries in the region submitted

an NDC with a mitigation target. As stipulated by Article 4.4 of the Paris Agreement, developed countries are encouraged to promote economy-wide 'absolute' emission reduction targets, whilst developing countries should aim for economy-wide reduction or limitation targets in their NDCs.¹² The types of targets applied in the Asia-Pacific region were: absolute emission reductions, relative emission reductions, carbon intensity reductions, peak of carbon emissions, or policies and actions.

FIGURE 5. Type of Mitigation Targets in Asia-Pacific NDCs



As shown in Figure 1, 39 per cent of those countries in the region with a mitigation target provided a relative emission reduction goals for the target year 2030, compared with a projected 'business as usual' (BAU) emissions scenario, either for the whole economy or for different sectors. These countries account for the relative small share of global emissions of 8.7 per cent. Most countries aimed for 2030 as the target year, with a few exceptions, such as Nepal which chose 2050, and several Pacific countries which selected 2025.

31 per cent of the countries specified an 'absolute' emissions target, compared to a base year, which varied across countries. In practice, countries typically selected these based on data availability and modelling that had already been undertaken as part of their emissions monitoring and reporting efforts. In the case of Cambodia, the baseline used for its 'absolute' target was an emission quantity of 11,600 GtCO₂e. 'Absolute' targets were prevalent in the North and Central Asia sub-region, and were also present in several Pacific NDCs. The countries with 'absolute' targets in the Asia-Pacific region accounted for 14.2 per cent of global emissions.

Ten countries specified mitigation targets as comprising policies and measures that they aim to undertake, and which can indirectly contribute to GHG emission reductions. Among the proposed measures, the minimum share of renewable energy installed capacity or consumption for a certain target year are the most commonly used types. This type of target is mostly used by small or least-developed countries (LDCs), and is predominant in the Pacific sub-region, where emissions make up a minimal contribution to the global emission account. As this target does not include specific reduction commitments, their reduction sectoral coverage is also not specified.

Carbon intensity reduction targets are pursued by four countries, namely China, India, Malaysia and Singapore. These seek to reduce emissions intensity per unit of GDP, compared to 2005 as a reference year. Although the number of countries using this type of target is low, these four countries together accounted for one-quarter of global emissions. This type of target allows countries to keep a close focus on achieving cost-efficient opportunities that increase energy- and carbon-efficiency across production, which is particularly important for the region as it still lags behind other regions in this regard.

Armenia was the only country in the region that established ceiling on the volume of emissions, and its per capita equivalent, at which emissions will peak by the target year 2030.

Table 1 lists the region's NDC mitigation targets and shows the number of sectoral and economy-wide targets.

Mitigation targets of those countries in the region that presented a relative reduction show, on average, a 16 per cent unconditional reduction pledge, and a 33 per cent conditional pledge. While the conditional targets are in line with the targets of the rest of the regions, the region's unconditional targets may fall below what can be achieved through efficiency improvements.

Conditionality

Financial resources will be crucial for the successful implementation of mitigation and resilience measures. Twenty countries in the region have identified part of their financial needs for achieving their climate change mitigation and resilience targets, totalling US\$3 trillion. Out of this, the biggest share corresponds to the needs expressed by NDCs in the SSWA sub-region, especially India's, which communicated a need of US\$2.5 trillion for its climate actions up to 2030.¹³ To what extent these represent reliable approximations of the real cost of implementing the NDCs is difficult to assess.

Although most countries did not quantify their financial needs, they included mitigation targets that were both unconditional and those that reflected higher ambition but were conditional on receiving financing, technology transfers or capacity-building. Twenty-three countries identified an unconditional mitigation target parallel to an additional, conditional one. Two countries included partially conditioned NDCs, with no specified share for higher ambition, while thirteen NDCs comprised only conditional targets. Only two countries had exclusively unconditional targets. This shows unequivocally that countries in the region are relying on the international community to make good on the pledges to provide financial, technological and capacity building support to the developing countries to support and enhance their ambition.

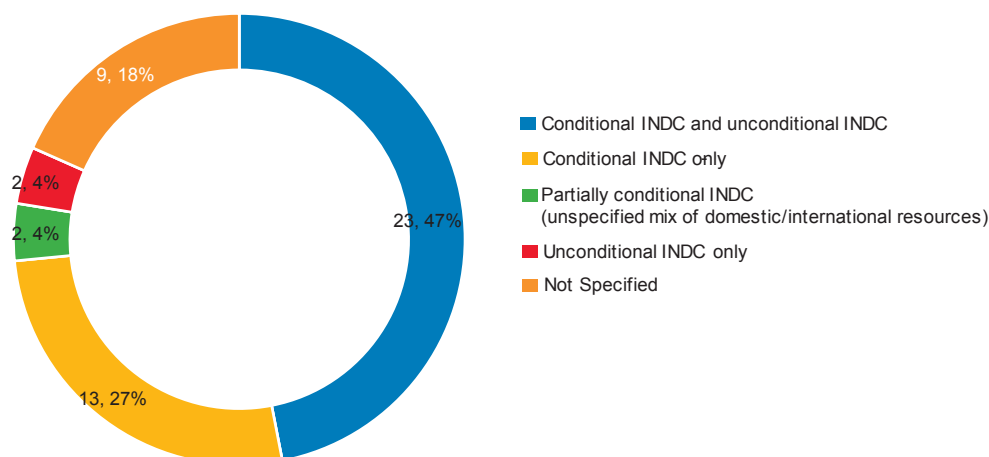
Comparability

The mitigation targets show the level of diversity of target types, and of base and target years adopted across the region, which make it difficult to assess and compare ambition and identify ambition gaps. Nevertheless, comparability is essential as countries prepare to implement Article 6.2 on internationally transferred mitigation outcomes (ITMOs), which will provide a cost-effective way to fulfil or exceed current NDCs. In order to be comparable, targets that are not expressed in 'absolute' terms, such as relative targets or carbon intensity reduction targets, need to be translated into absolute terms to enable accounting

TABLE 1. Mitigation targets across the Asia-Pacific region

Country	Mitigation Target	Baseline	Target Year	Reduction Coverage
Afghanistan	13.60%	BAU	2030	Economy-wide
Armenia	Total emissions will not exceed 663MtCO ₂ e and 189 tonnes per capita	N/A	2030	Economy-wide
Australia	26 to 28%	2005	2030	Economy-wide
Azerbaijan	35%	1990	2030	Economy-wide
Bangladesh	5-15%	BAU	2030	Sectoral
Bhutan	Remain carbon neutral	2000	N/A	Economy-wide
Brunei Darussalam	63% of energy consumption reduction	BAU	2035	n/a
Cambodia	27%	Baseline emissions of 11,600 Gg CO ₂ eq	2030	Sectoral
China	60-65% carbon intensity reduction	2005	2030	Economy-wide
Cook Islands	100% renewable energy share	2006	2020	n/a
Fiji	30% CO ₂ emission reduction in the energy sector	BAU	2030	Sectoral
Georgia	15% unconditional, 25% conditional	BAU	2030	Economy-wide
India	33 to 35% carbon intensity reduction	2005	2030	Economy-wide
Indonesia	29% unconditional, 41% conditional	BAU	2030	Economy-wide
Iran (Islamic Republic of)	4% unconditional, 8% conditional	BAU	2030	Economy-wide
Japan	26%	2013	2030	Sectoral
Kazakhstan	15% unconditional, 25% conditional	1990	2030	Economy-wide
Kiribati	12.8% unconditional, 49% conditional	BAU	2030	Sectoral
Korea (Democratic People's Republic of)	8% unconditional, 40.25% conditional	BAU	2030	Economy-wide
Korea (Republic of)	37%	BAU	2030	Economy-wide
Kyrgyzstan	11.49 to 13.75% unconditional - 29 to 30.89% conditional	BAU	2030	Economy-wide
Lao People's Democratic Republic	30% share of renewable energy in energy consumption	N/A	2020-2025	n/a
Malaysia	35% unconditional plus 10% conditional	2005	2030	Economy-wide
Maldives	10% unconditional - 24% conditional	BAU	2030	Economy-wide
Marshall Islands	32% - indicative target of 45% by 2030	2010	2025-2030	Sectoral
Micronesia (Federated States of)	28% unconditional, 35% conditional	2000	2025	Economy-wide
Mongolia	14%	BAU	2030	Economy-wide
Myanmar	N/A	N/A	2030	n/a
Nauru	N/A	N/A	2030	n/a
Nepal	50% reduction in dependency to fossil fuels	N/A	2050	n/a
New Zealand	30%	2005	2030	Economy-wide
Niue	38% share of renewable energy unconditional, 80% conditional	N/A	2020 and 2025	n/a
Pakistan	20%	BAU	2030	Economy-wide
Palau	22% energy sector emissions reductions, 45% Renewable Energy, 35% Energy Efficiency	2005	2025	n/a
Papua New Guinea	Carbon neutrality	2010	2030	Economy-wide
Philippines	70%	BAU	2030	Economy-wide
Russian Federation	25-30%	1990	2030	Economy-wide
Samoa	100% Renewable energy target	2007	2017 and 2025	n/a
Singapore	36%	2005	2030	Economy-wide
Solomon Islands	12% by 2025 and 30% by 2030	2015	2025/2030	Sectoral
Sri Lanka	7% unconditional, 23% conditional	BAU	2030	Sectoral
Tajikistan	80-90% unconditional - 65-75% conditional	1990	2030	Economy-wide
Thailand	20% unconditional and 25% conditional	BAU	2030	Economy-wide
Timor-Leste (East Timor)	n/a	n/a	n/a	n/a
Tonga	50% of renewable energy share	N/A	2020	n/a
Turkey	21%	BAU	2030	Economy-wide
Turkmenistan	Stabilisation of greenhouse gas emissions	2000	2030	Economy-wide
Tuvalu	60% economy wide, 100% from electricity generation sector	2010	2025	Economy-wide
Uzbekistan	10% reduction of emissions per unit of GDP	2010	2030	Economy-wide
Vanuatu	100% reduction for the power sector, 30% reduction for the energy sector as a whole	BAU	2030	Sectoral
Viet Nam	8% unconditional, 25% conditional	BAU	2030	Economy-wide

FIGURE 6. Asia-Pacific NDCs conditionality (in number of countries)



for international transfer.^{14,15} Countries with absolute targets will have certainty over their targets, and therefore they will have certainty over whether they need to buy or sell international transferred mitigation outcomes or emission reductions under Article 6.¹⁶

Sectoral priorities

Most countries' NDCs contained sectoral and sub-sectoral mitigation targets, reflecting their priorities. Of these, energy emerges as the priority sector highlighted by countries, included in most of the NDCs. Out of 42 analysed, 40 cited energy as their priority for mitigation, with most emphasising the importance attributed to increasing the share of renewable energy. NDC pledges on renewable energy are particularly ambitious in many countries from the SSWA and South-East Asia (SEA) sub-regions, which established these targets as a priority focus. For example, Lao PDR declared its intention to increase the share of renewable energy in generation to 30 per cent by 2025, mainly through hydropower. In India, the Green Generation for Clean & Energy Secure Strategy plans to scale up renewable capacity from 35 GW to 175 GW by 2022, with a focus on solar.

Kyrgyzstan, Uzbekistan and Russia, from the NCA sub-region, were amongst the few countries that did not emphasise renewable energy in their submissions. Given the size of fossil-fuel subsidies in this sub-region, countries should give priority to the phasing these out in order to allow their economies to take full advantage of the decreasing cost of renewable energy.

Energy efficiency emerged as the second main pillar for the energy sector to contribute to low-carbon development. Envisaged measures for energy efficiency improvement are not only targeted towards energy production, but also towards sub-sectors such as transport, households, buildings, industry, services or agriculture. Energy intensity pledges include targets on

energy intensity, such as Thailand's aim to reduce energy intensity by 30 per cent below its 2010 level in 2036, or sectoral commitments, such as those in Vietnam, to apply market instruments to promote structural change and improve energy efficiency in the transport sector.

Agriculture, forestry and other land use (AFOLU) also received strong attention by countries in the region as part of their mitigation commitments, reflecting this sector's significant contribution to GHG emissions in the region, after energy. Asia-Pacific represented the largest share of global AFOLU emissions during the period 1990-2010, accounting for 39%.¹⁷ Its share of emissions is especially significant in the SSWA and SEA sub-regions where agriculture remains an important share of the economy.

Although most countries in Asia-Pacific include mitigation targets related to AFOLU, their NDCs typically did not reflect a comprehensive policy to embrace climate-smart agriculture (CSA), which targets a triple-win of lower emissions, enhanced resilience, and higher productivity.¹⁸

Measures are more far-reaching for the transport sector, which features in the NDCs of 32 countries in the region. The Pacific sub-region has put the highest emphasis on this sector, with 10 Pacific states highlighting it as a priority, reflecting the importance of shipping as a source of emissions. Most mitigation measures concerned biofuels, e.g. using coconut or waste cooking oil as biodiesel. However, the current set of measures contained in the NDCs lacked detail, suggesting the need for further work to define the measures required to translate ambition into concrete action. In this regard, countries can take advantage of the current wave of policy to phase out vehicles with combustion engines. For example, the region has already taken steps into this direction, with India declaring their intention to ban the production of fossil fuels vehicles by 2030, and China currently planning on undertaking a similar timeline.¹⁹

ENEAC countries, where the share of transport emissions is progressively rising due to higher car use and the resulting air pollution is increasingly recognised as a serious health hazard, have put a strong focus on transport.²⁰ Mongolia put forward ambitious measures such as increasing the share of hybrid vehicles to 13 per cent by 2030, and providing tax incentives to support a shift from fuel to liquefied petroleum gas (LPG). China is also committed to developing a more extensive low-carbon transport system, by improving fuel quality, promoting the share of public transport to reach 30 per cent by 2020, and accelerating the development of smart transport and green freight transport measures.

Waste features in 30 NDCs from all sub-regions. In the SSWA and SEA sub-regions, pledges covering the waste sector are characterised by significant ambition, focusing on waste management infrastructure, the implementation of the 'Three R Principle' (Reduce, Reuse, Recycle), and waste-to-energy generation. Almost all the submissions from NCA included waste-to-energy as a priority, but definite measures for this area are not described.

Industrial processes were targeted by 28 countries, attracting a strong focus in the NCA, SSWA, SEA and ENEAC sub-regions, commensurate with their contribution to global manufacturing. Many NCA countries included industry as a priority sector, reflecting the importance of this sector as an emission source, especially in sub-sectors such as cement production, and its high potential for achieving least-cost emissions reductions by enhancing energy efficiency. The NDCs of SSWA countries also envisage strong measures for emissions mitigation

in industrial processes, through a wide array of measures including energy efficiency improvements, but also with complementary measures in areas such as cleaner coal mining, improved management of hydrocarbon fields, advancing technological improvements in the brick making industry, implementing green reporting systems, or upgrading the technical capacity of the mining sub-sector. For China, its NDC proposed to strictly control the expansion of the sector with regard to energy consumption and emissions, accelerating the elimination of outdated production capacity and promoting the expansion of the services industry and other strategic emerging industries.

Table 2 provides an overview of the level of ambition of targets in each sector pledged by countries that communicated a sectoral breakdown of their reduction target.

Building resilience

Considering the catastrophic impacts of extreme weather events on the region, disaster risk reduction (DRR) and building resilience to cope with climate change are indispensable responses. Given the considerable overlap between these, especially at the programme action level, the region's NDCs reflect the need to synergise disaster risk reduction and resilience measures to achieve a triple-win of lower disaster risks, greater resilience and sustainable development.²¹ Twenty-seven countries included disaster risk reduction measures as part of their sectoral pledges to build resilience. Moreover, as shown in the NDCs, some countries are pursuing policies and initiatives specifically tailored to integrate DRR and

FIGURE 7. Number of ESCAP parties that referred to a sector as a priority for mitigation, as communicated in the NDCs

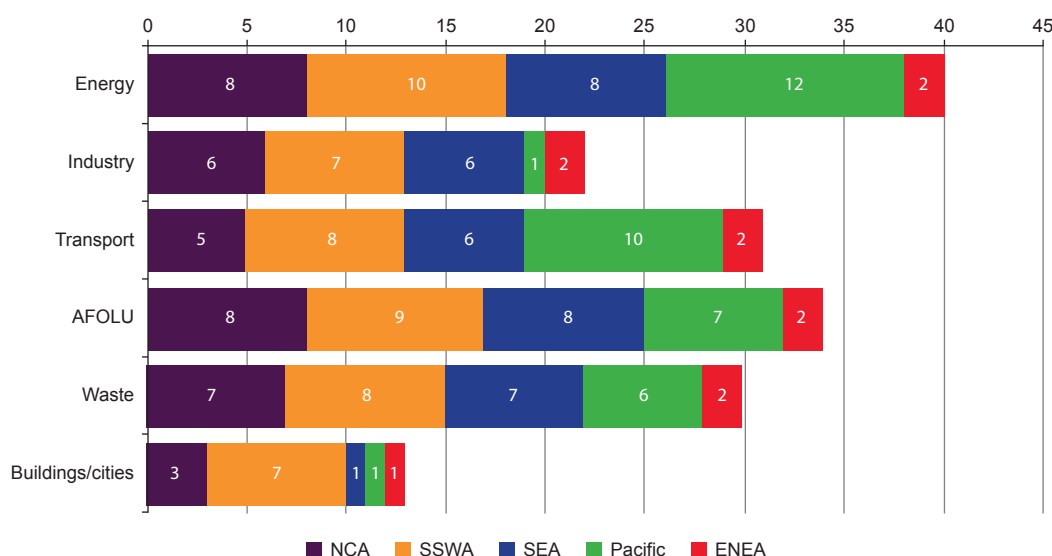


TABLE 2. Sectoral targets across the Asia-Pacific region

Country	Energy	Industry	Transport	AFOLU	Waste	Buildings/ cities
Bangladesh	Unconditional 5% below BAU	Unconditional 4% below BAU	Unconditional 9% below BAU			
	Conditional 18% below BAU	Conditional 10% below BAU	Conditional 18% below BAU			
Cambodia	16% below Baseline	7% below Baseline	3% below Baseline		1% below Baseline	
Fiji	30% below BAU					
Japan	25% below Baseline	7% below Baseline	40% below Baseline	28% below Baseline		
Kiribati	48% below BAU		52% below BAU			
Marshall Islands	66% below Baseline		27% below Baseline		20% below Baseline	
Solomon Islands	39% below Baseline		61% below Baseline			
Sri Lanka	Unconditional 4% below BAU	Unconditional 3% below BAU				
	Conditional 20% below BAU	Conditional 10% below BAU				
Vanuatu	30% below BAU					
Level of Ambition	N/A	Low	Medium	High		
Reduction target percentage		<10%	10%-25%	>25%		

resilience-enhancing approaches. Given their extreme vulnerability, the Pacific SIDS, in particular, highlighted their priority to implement measures to respond to cyclones, floods, and the rise of the sea level.

In terms of sectoral adaptation priorities in the NDCs, water is highlighted by 33 countries in the region. All the countries in SSWA and SEA sub-regions referred to water, which reflects the vulnerabilities that these countries face in relation to water in the form of limited access to water resources, seasonal shortages, salt-water intrusion, health issues due to poor water quality, competing uses of water especially for agriculture and power generation, or trans-boundary water disputes.

Agriculture is another major adaptation priority for the Asia-Pacific region, where just over half of the population still lives in rural areas, and farming and agricultural production still provide livelihoods to a very large share of people.²² Livestock systems, cropping systems, or agroforestry were mentioned as key components of the region's adaptation strategies.

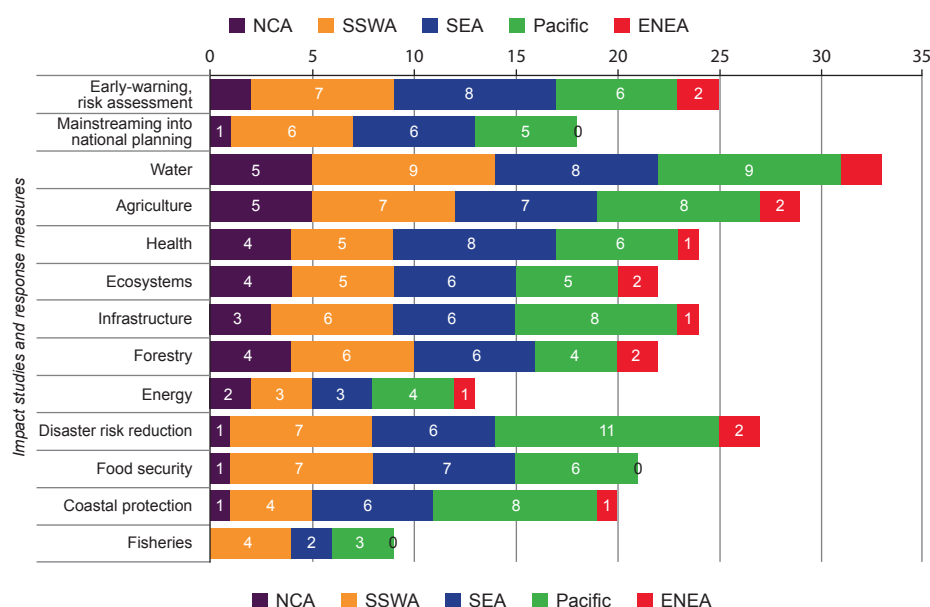
So far, NDCs have not been the main instrument for detailing countries' adaptation priorities and plans. Instead, National Adaptation Plans (NAPs) are currently being formulated across the region as an instrument to determine medium and long-term adaptation needs and develop and implement strategies and programmes to address those needs. As progress moves ahead in formulating the NAPs, one can expect these priorities

and policy actions to be better reflected in future NDCs. To date, 14 countries in the region cross-referenced the NAPs in their NDCs. For example, Sri Lanka, which has already developed its NAP, has listed a comprehensive set of actions to build resilience in sub-sectors such as food security, water resources, coastal and marine protection or infrastructure in its NDC. However, as many as ten countries in the region have not included specific adaptation targets or needs in their NDCs, suggesting that there is a wide margin for improvement regarding the identification of priorities and suitable measures that countries need to overcome this challenge.

Major obstacles for implementation of measures to strengthen resilience in the region include lack of awareness and knowledge about how to strengthen resilience, weak monitoring activity, lack of funding or incentives for investments, weak coordination among stakeholders, poor governance and legal frameworks for integrating measures into national development plans, weak management of disaster risk reduction at local level, lack of human resources capacity, shortage of technological capacities. Many NDCs echoed these challenges, displaying a positive trend towards the strengthening of adaptation strategies. While adaptation action is gaining support in Asia-Pacific, efforts to overcome these barriers should step up rapidly to be able to meet the needs of the region.

Many NDCs also mentioned their needs in regard to implementing priority measures to strengthen

FIGURE 8. Number of ESCAP parties that referred to a sector as a priority for adaptation, as communicated in the NDCs



resilience. Financial support, capacity building and technology transfers were the most commonly cited needs across all regions, whilst areas such as institutional structure, enhanced policy and planning scenarios, or improved knowledge management received more limited attention.²³ Eleven out of 51 countries estimated their financial needs for their NDC adaptation measures, which amounted to US\$612.95 billion.²⁴ Yet, despite efforts to increase the share of climate finance dedicated to building resilience, latest data show that progress is mixed.²⁵

Challenges and future agenda

NDC actions are yet to be delivered on the ground to create tangible results, but constraints for their implementation persist. One of keys for success will be to achieve broad participation from multiple stakeholders in the political and technical processes, but governments and communities in many of the developing countries of the Asia-Pacific lack the capacity to effectively engage. A regional NDC coordinated support that facilitates the transmission of knowledge could help to increase the capacity of countries to better employ their own social resources and local knowledge.

Robust monitoring and evaluation of mitigation and resilience-enhancing actions will also be essential to keep track of progress towards NDC implementation,

as well as to ensure that collective efforts are fully aligned with the globally agreed climate objectives. To date only 11 countries in the region specified the need to develop a national MRV system in their NDCs. Despite the notable advancements on reporting in the region, there is room to further improve the quality of already existing MRV processes, especially in terms of data quality and availability.²⁶ Governments should put more emphasis on monitoring and reporting of climate impacts, progress to improve the quality and frequency of information on GHG emissions, and financial support for climate action. Enhanced tracking capacity can also build additional synergies with other frameworks of sustainable development, such as the SDGs, by enabling accounting systems that serve different indicators simultaneously.²⁷

Looking forward, there is still a considerable gap regarding the assessment of financial costs for actions, the capacity of national public funding for climate action, the share of additional public and private financing required and technical and institutional gaps.

Finally, insufficient financial resources, knowledge and technical capacity in some of the developing countries of the Asia-Pacific continue to act as major barriers to accelerating NDC implementation.²⁸

SNAPSHOTS OF THE ESCAP SUB-REGIONS

EAST AND NORTH-EAST ASIA

High priority area: Energy efficiency and new technologies

Population (in thousands): 1,595,382

**CO₂ Emissions from fuel combustion per capita
(MT of CO₂): 6.9**

Share of global emissions: 30.55%

**Modern Renewable Share of Total Final Energy
Consumption: 6.5%**

**Primary Energy Intensity (Kg of
oil equivalent per 1,000 dollars of
GDP): 159**

**Carbon intensity of the Economy
(Grams per 1 dollar of GDP): 458**

Source: Data for population (2016) and share of emissions (2012) comes from ESCAP statistical data base. The rest of indicators (2014) come from ESCAP Asia Pacific Energy Portal.

Summary:

- Enhanced energy efficiency will be critical to achieve the reductions necessary for the NDC and the Paris Agreement targets. Whereas energy consumption in the sub-region represents a third of global consumption, energy efficiency is still lower than the global average.
- GHG emissions from countries in the ENEA sub-region account for one third of the global total. However, the sub-region holds great potential for rapidly transiting towards more efficient and affordable low carbon technologies.²⁹ This can significantly help in mitigating climate change and setting a new low carbon development pathway for the sub-region.
- After energy, industrial processes are the second major source of emissions in the sub-region. Accordingly, all the NDC documents of ENEA countries included industry as a priority sector, proposing measures on industrial efficiency, shifting from fossil fuels, or technology enhancement.

NORTH AND CENTRAL ASIA

High priority area: Reducing emissions intensity

Population (in thousands): 228,612

CO₂ Emissions from fuel combustion per capita (MT of CO₂): 8.4

Share of global emissions: 6.65%

Modern Renewable Share of Total Final Energy Consumption: 3.2%

Primary Energy Intensity (Kg of oil equivalent per 1,000 dollars of GDP): 206

Carbon intensity of the Economy (Grams per 1 dollar of GDP): 445

Source: Data for population (2016) and share of emissions (2012) comes from ESCAP statistical data base. The rest of indicators (2014) come from ESCAP Asia Pacific Energy Portal.

Summary:

- As a result of reliance on fossil fuels and high carbon intensity of the infrastructure sector, the NCA sub-region has high energy intensity and GHG emissions per unit of GDP. Growing population and income levels will exacerbate this problem unless low-carbon strategies are integrated into national development planning.
- The NDCs signal a positive shift in interest towards energy efficiency improvements and cost-effective low carbon technologies. These need to go hand-in-hand with efforts to reduce fossil fuel subsidies. An important number of cost-saving and low-cost technology options for emission abatement in the energy, transport, and buildings sectors have been identified for the sub-region. However, additional efforts in areas with higher costs will still be necessary to achieve the NDCs and the Paris Agreement scenarios.³⁰
- Due to its climatic and geographical conditions, NCA is especially vulnerable to extreme weather events and climate-related hazard such as droughts, extreme temperatures, torrential rainfall, or landslides. Effects can be especially significant on the water and agriculture sectors, escalating competing resource use due to the importance of the water-energy-food nexus in the sub-region. The sub-region's NDCs took an important step in aligning their adaptation pledges with these priorities. However, three countries still need to incorporate adaptation priorities into their NDCs.

PACIFIC

High priority area: Disaster risk reduction (DRR)

Population (in thousands): 39,887

CO₂ Emissions from fuel combustion per capita
(MT of CO₂): 14.4

Share of global emissions: 1.50%

Modern Renewable Share of Total Final Energy
Consumption: 12.4%

Primary Energy Intensity (Kg of
oil equivalent per 1,000 dollars of
GDP): 121

Carbon intensity of the Economy (Grams per 1
dollar of GDP): 347

Source: Data for population (2016) and share of emissions (2012) comes from ESCAP statistical data base. The rest of indicators (2014) come from ESCAP Asia Pacific Energy Portal.

Summary:

- Due to their geography, Pacific countries are highly exposed to extreme meteorological events such as floods, cyclones, storm surges and droughts. In the sub-region, average annual losses from natural disaster events are estimated at \$284 million. Climate change will increase the force and frequency of extreme weather events in the future. It will be critical to integrate climate change into disaster risk reduction strategies.³¹
- Almost all NDCs in the region exhibit progress in this regard by prioritizing disaster risk reduction measures and strategies, emphasizing policies aimed to integrate climate change adaptation and DRR. Joint action plans on CCA and DRR have been in operation for years, but capacity, financial and technical limitations persist in these countries. Costs of adaptation for the Pacific are estimated at 0.43% of annual GDP during 2010-2050 under a 2°C scenario.³²
- Transport, especially shipping, is the second largest contributing sector to GHG emissions in the Pacific sub-region, accounting for 70% of fuel use.³³ Pacific countries are dependent both on maritime transport and on external energy supplies, facing a double challenge in the form of economic constraints and excessive GHG emissions from the transport sector. Promoting new modes of low-carbon transport becomes therefore a pressing matter for the sub-region, as demonstrated by 10 of its NDCs.

SOUTH-EAST ASIA

High priority area: Agriculture, forestry and land use

Population (thousands): 640,619

CO₂ Emissions from fuel combustion per capita (MT of CO₂): 2.0

Share of global GHG emissions: 4.54%

Modern Renewable Share of Total Final Energy Consumption: 9.0%

Primary Energy Intensity (Kg of oil equivalent per 1,000 dollars of GDP): 104

Carbon intensity of the Economy (Grams per 1 dollar of GDP): 201

Source: Data for population (2016) and share of emissions (2012) comes from ESCAP statistical data base. The rest of indicators (2014) come from ESCAP Asia Pacific Energy Portal.

Summary:

- In parallel to a rapid economic growth, GHG emissions in South-east Asia have increased by nearly 5 per cent annually over the last 2 decades. Economic growth under BAU would lead to a fossil-fuel-dependent, carbon-intensive pathway, with 60 per cent emission growth by 2050 in comparison to 2010 levels.
- Deforestation and land use has accounted for the biggest share of emissions growth. Around half of cumulative emissions abatement by 2030 can derive from Reducing Emissions from Deforestation and Forest Degradation (REDD)/land use, becoming main source of mitigation in the medium term.³⁴ NDCs in the sub-region mark a clear commitment towards this area, with all countries prioritizing the AFOLU sector, and six highlighting the importance of 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 (REDD+) strategies.
- Regarding energy, the use of fossil fuels has been increasing rapidly as a source of primary energy. Additionally, energy efficiency has been improving slower than in other sub-regions. Energy efficiency improvements will be able to account for a major share of the necessary emission reductions in the sub-region, however, the rate of efficiency improvements would need to be much higher than those targeted under NDC scenarios.
- Unconditional NDC projections for the sub-region are only slightly below BAU scenario, while conditional pledges are in line with a 3°C scenario. Consequently, SEA will need to expand its ambition. The cost to achieve a 2°C scenario is expected to be around 2.5 – 3.5 per cent of GDP during 2010-2050. However, co-benefits from reduced air pollution, traffic congestion, and vehicular accidents can offset 40 – 50 per cent of these costs.³⁵

SOUTH AND SOUTH-WEST ASIA

High priority area: Sustainable energy

Population (in thousands): 1,926,390

CO₂ Emissions from fuel combustion per capita
(MT of CO₂): 1.7

Share of global emissions: 10.27%

Modern Renewable Share of Total Final Energy
Consumption: 8.1%

Primary Energy Intensity (Kg of
oil equivalent per 1,000 dollars of
GDP): 116

Carbon intensity of the Economy (Grams per 1
dollar of GDP): 273

Source: Data for population (2016) and share of emissions (2012) comes from ESCAP statistical data base. The rest of indicators (2014) come from ESCAP Asia Pacific Energy Portal.

Summary:

- Although emissions per capita are still very low in the sub-region compared with the global average, their share of global emissions has increased from 6 per cent in 1990 to 8.8 per cent in 2012. The sub-region can contribute to reducing carbon emission by implementing sustainable energy. In line with their NDC measures, countries already have taken significant steps to escalate renewable energy, which holds great potential for expansion. However, coal is likely to remain the main energy source for most countries in the region unless more ambitious measures are promoted. A study of five countries in the region (Bangladesh, Bhutan, Maldives, Nepal, and Sri Lanka) found that a total reduction potential of about 13.3 million tCO₂e emissions could be achieved by 2020 through clean and energy efficient options.³⁶
- SSWA is increasingly vulnerable to the effects of climate change in the form of extreme weather events such as droughts and floods. The sub-region accounts for more than half of all disaster-related fatalities in Asia-Pacific, and for around one third of global mortality caused by disasters. Countries should enhance their efforts at mainstreaming climate change DRR into their sector and development strategies.
- One of the most exposed sectors to climate change is agriculture. Climate change could decrease annual agricultural production by 23 per cent in some countries.³⁷ Through their NDCs and other policy initiatives, countries in the sub-region are moving forward to implement climate smart agriculture. Simulations have shown that improved resilience in agriculture would greatly increase agricultural productivity, with co-benefits of poverty reduction, job creation and enhanced food security.³⁸

INDIA

High priority area: Renewable energy

Population (thousands): 1,326,802

CO₂ Emissions from fuel combustion per capita
(MT of CO₂): 1.6

Share of global emissions: 6.43%

Modern Renewable Share of Total Final Energy
Consumption: 2.3%

Primary Energy Intensity (Kg of
oil equivalent per 1,000 dollars of
GDP): 117

Carbon intensity of the Economy (Grams per 1
dollar of GDP): 287

Source: Data for population (2016) and share of emissions (2012) comes from ESCAP statistical data base. The rest of indicators (2014) come from ESCAP Asia Pacific Energy Portal.

Summary:

- According to its NDC, India is committed to achieve about 40 per cent of non-fossil fuel cumulative electric power capacity by 2030. The country is also seeking to increase its renewable energy capacity level of 2015 five-fold to 175 GW by 2022. This is a very ambitious target that would put India at the forefront of renewable energy. Solar energy generation in India has been hitting new record low levels during recent months.
- During the 2005-2012 period, energy intensity fell 2.5 per cent yearly from 18.2 grams of oil equivalent per rupee of GDP to 15. Moreover, the country is committed to reducing energy intensity by 33-35 per cent by 2030. However, India's energy consumption is expected to grow faster than in any other big economy in the world,³⁹ and its NDC intensity pledges may not match its capacity to implement them.⁴⁰ Accordingly, India could benefit from expanded efforts in energy efficiency.
- India is also progressing with the promotion of waste management strategies, including in the area of waste-to-energy. Progress in this field will not only contribute to emission reduction and energy security, but will also bring synergies for human health, ecosystems and wildlife.
- Adaptation is a priority in India's NDC, with measures targeting agriculture, water or health sectors among others. Despite having increased its adaptation-related expenditure from 1.5 per cent of GDP in 2000 to 2.8 per cent in 2009, India still faces significant financial constraints to address its climate vulnerabilities. According to its NDC, the government estimates that the financial needs for adaptation measures will be around US\$ 206 billion, with additional investment needed for resilience and disaster risk management.

CHINA

High priority area: Energy efficiency

Population (in thousands): 1,382,323

CO₂ Emissions from fuel combustion per capita (MT of CO₂): 6.6

Share of global emissions: 25.93%

Modern Renewable Share of Total Final Energy Consumption: 6.7

Primary Energy Intensity (Kg of oil equivalent per 1,000 dollars of GDP): 178

Carbon intensity of the Economy (Grams per 1 dollar of GDP): 529

Summary:

- In its NDC, China has announced to decrease carbon intensity by 60-50% below 2005 levels by 2030, and peak CO₂ emissions around the same year. Energy intensity in China has largely declined during the last decades, and current trends have already shown that carbon emissions are decoupling from economic growth. However, its level remains well above many advanced economies. Studies have found that China could reach lower intensity rates and peak its emissions earlier than 2030. Chances are that emissions reached its peak already. Enhanced energy efficiency will have a critical role not only by reducing GHG emissions and air pollution, but also by contributing to productivity and economic growth.
- The country also committed to increase the share of non-fossil fuels in primary energy consumption to around 20% by 2030. This will require 800 to 1,000 GW of non-fossil fuel capacity. In this undertaking, China will need to address relevant challenges regarding some key aspects of its low-carbon development agenda, such as the uncertainty of emerging technologies, the safety of nuclear energy, of the environmental impacts of hydropower.
- The NDC introduced a very strong forest sequestration goal, aiming to increase forest carbon stocks by 4.5 billion m³, equivalent to 50-100 million additional hectares of forest. This will constitute around 1 Gt carbon sink. This is a very ambitious goal that will demand additional efforts in terms of rural outreach.
- China also acknowledged the importance of its national carbon emission trading market, which is expected to start functioning before the end of this year. In its NDC, the government recognised the need of developing mechanisms for regulating, reporting, verifying and certificating carbon emission trade.

3. MEASURING PROGRESS AGAINST BENCHMARKS

Global benchmarks and the carbon budget

The global temperature goal contained in Article 2 of the Paris Agreement, to hold ‘the increase in the global average temperature to well below 2°C’ is the key normative benchmark against which efforts are measured. To achieve this goal with a 66 per cent probability, modelling efforts calculate that total remaining net global emissions from 2017 of roughly 800 to 1055 GtCO₂ will be used in around 20 to 30 years at current emission rates.⁴¹ The current emission pledges contained in the NDCs taken together will give a likely temperature increase of about 3°C by 2100.

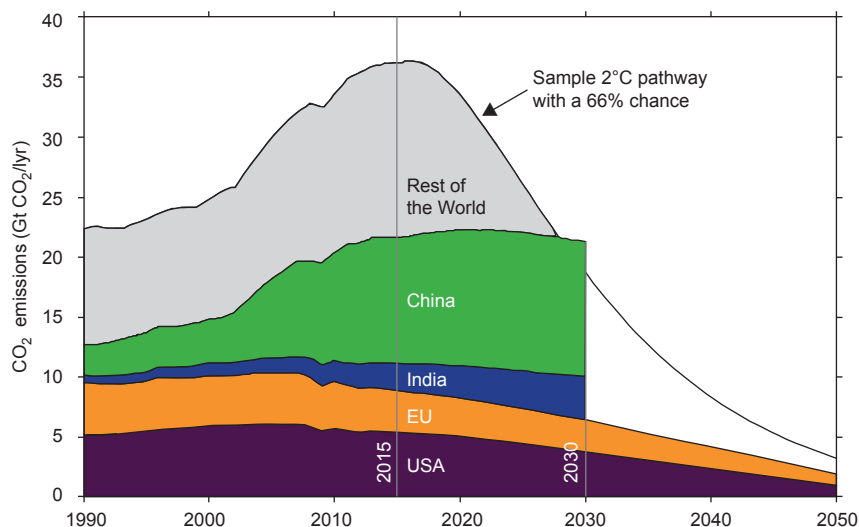
There is no internationally agreed formula to divide the remaining carbon budget across countries. Examples of various approaches that have been considered include attributing cumulative historical emissions from 1751 to the present time; by production; consumption; population; or GDP (market exchange rate or in PPP terms). Each of these approaches yields a different carbon budget for any given country. The European Union (EU) applies an effort-sharing formula to divide

the burden of its aggregate emissions reduction pledge across its member states on the basis of Member States’ relative wealth (measured by Gross Domestic Product per capita) to achieve its intermediate targets.⁴²

In practice, some countries are approaching this challenge by pursuing longer-term decarbonisation targets (dictated by the long-term temperature goals of the Paris Agreement) to reduce greenhouse gas emissions by at least 80 per cent below 1990 levels by 2050. For example, the UK has anchored into law its intention to reduce its emissions by at least 80 per cent of 1990 levels by 2050 as its contribution to attaining the global temperature goal. This entails defining 5-year carbon budgets as intermediate targets which are closely monitored to ensure that they are on track to attain their long-run goal.

Focussing on the top-4 global emitters from fossil fuels and industry, in 2015, these were responsible for 59 per cent of global emissions and comprised China (29 per cent), the United States (15 per cent), the EU28 (10 per cent) and India (6 per cent). Figure 9 shows how their current NDC emission pledges leave no room for other countries to emit under the 2°C emission scenario.

FIGURE 9. The NDC emission pledges of the top-4 emitters



Source: Global Carbon Project, 2017.

The ongoing ‘facilitative dialogue’ under the Paris Agreement is attempting to shed light on how to ratchet up ambition to achieve the collective climate goals. Options include that countries take on more stringent emissions goals by adding to their current pledges, or set future pledges based on project growth. However, this needs to be balanced against the desire to ensure that countries’ pledges are nationally determined.

Sectoral benchmarks

Sectoral benchmarks have been developed in line with the 2°C benchmark.⁴³ For the energy sector, which is the priority sector considering its contribution to GHG emissions, the remaining budget up to 2050 is around 650 GtCO₂e.⁴⁴ To achieve this, global energy emissions would need to peak before 2020, and decrease by 16t per annum by 2030. This would translate into an average reduction rate of 3.5 per cent year up to 2050, or 70 per cent below BAU.⁴⁵

Relative to implemented NDCs, the energy sector will be responsible for about 42 per cent of the GHG emissions reduction needed to get to the 2°C scenario.⁴⁶ About two-thirds of this reduction (4.5 – 5 Gt) scenario is linked to energy efficiency, while 2 – 2.5 Gt is linked to renewable energy.⁴⁷

In Asia-Pacific, energy-related emissions are currently responsible for around 13Gt GtCO₂e per year. In order to meet the 2°C scenario they should be limited to around 10 GtCO₂e /year by 2030, or less than a half of the global total of the energy-related emissions.⁴⁸

Sustainable development goals

Another important benchmark are the sustainable development goals (SDGs). For example, SDG7 aims to ensure access to affordable, reliable, sustainable and modern energy for all and comprises four targets, of which the two related to energy efficiency and renewable energy constitute important yardsticks for the energy sector. These are:

- By 2030, increase substantially the share of renewable energy in the global energy mix; and
- By 2030, double the global rate of improvement in energy efficiency.

The annual average rate of improvement of global primary energy intensity, taken as a proxy for energy efficiency, which would be needed between 2010 and 2030 to meet the SDG7 target of doubling the rate of improvement in energy efficiency is 2.6 per cent.⁴⁹ However, between 2010 and 2015, energy intensity declined by only 10.2% overall – an average annual rate of 2.1%.⁵⁰

Corporate benchmarks

Science Based Targets is an initiative aimed at achieving substantial corporate GHG reduction targets. It calculates “science-based” emission reduction targets for sectors using sector-based methods such as the Sectoral Decarbonisation Approach (SDA), Absolute Emissions Contractions, or economic contractions.⁵¹ Such initiatives are important to link voluntary action by non-state actors, especially private sector entities, to the collective efforts to reduce emissions, to account for and track emissions reductions in a transparent way, and to communicate it.

Progress of Asia-Pacific region towards SDG7 benchmarks⁵²

Economies of the region produce 32 per cent of the world’s GDP and consume more than half of the global energy supply. In 2014, the region was responsible for 55 per cent of global emissions from fuel combustion, nearly two-thirds of which were from coal. The region will largely shape the progress toward achieving global sustainable energy objectives, including the targets under SDG7.

Energy efficiency

The region of Asia and the Pacific has demonstrated a long-term steep decline in energy intensity, falling from 9.1 MJ/\$ in 1990 to 6.0 MJ/\$ in 2014, and progressing toward convergence with the 2014 global average of 5.4 MJ/\$.

Energy intensity in the region has dropped primarily due to significant efficiency gains made in the industrial sector, where China, as a global leader in implementing industrial efficiency policies and measures, has largely driven the regional trend. The industrial sector is responsible for the largest drop in energy intensity in 2012-2014 with a 3.2 per cent average annualized change in energy intensity, though the service (2.5 per cent) and, to a lesser extent, agricultural (0.8 per cent) sectors also showed progress. By contrast, the residential sector saw an acceleration in energy intensity, and the transportation sector experienced a surge in energy consumption as GDP per capita rises and the middle-class population adopts more energy-intensive living standards.

Energy intensity targets have been widely established at the national level among Asia-Pacific countries, as well as at regional levels by Association of Southeast Asian Nations (ASEAN) and Asia-Pacific Economic Cooperation (APEC). They have grown increasingly broad and ambitious in scope, driven by the Paris Agreement. On the demand side, these have been complemented

by significant progress in promoting measures such as minimum energy performance standards (MEPS) and energy conservation, especially for lighting, appliances, space heating and cooling, and water heating. On the supply side, policies geared to minimize transmission and distribution losses and to upgrade inefficient power generation have had positive results, with most countries showing falling loss rates.

Government financial incentives are helping drive investment and participation within the energy efficiency market, and include tax reductions, subsidies, low-interest loans, equity, risk guarantees, and others. In addition, actual or planned carbon pricing is helping to provide incentives to adopt efficiency measures. Several governments have been moving away from direct subsidies for energy efficiency investments, towards market-oriented policies supported by risk guarantees, increased lending, and dedicated credit lines. Led by China, the Asia-Pacific region also emerged as the 2016 global top issuer of green bonds, which have played a significant role in providing capital for energy efficiency as well as renewable energy, especially in transport, industry and the building sectors.

Notwithstanding the region's progress in lowering energy intensity, Asia and the Pacific still remained the most energy-intensive of all global regions in 2014. End-use sectors need to be increasingly covered by standards, and support to the uptake of carbon-saving technologies enhanced. The costs of advanced low-carbon technologies remain prohibitive, especially for developing countries, and a lack of investment and financing remains a major barrier.

Renewable energy

The Asia-Pacific region has emerged as the global leader in renewable energy with more investment, installed capacity, and consumption than any other region. Yet, at the same time, the energy-hungry region's consumption of fossil fuels has risen substantially, limiting the growth of the share of renewable energy (including both traditional and modern forms) within the overall energy mix, and resulting in significant adverse environmental impact.

Renewables are rapidly gaining traction across the region. This trend is underpinned by large increases in hydropower, wind and solar. In 2014, modern renewables in the region reached 6.8 per cent of total final energy consumption, up from 6.2 per cent in 2012, and showed a promising accelerating upward trend.

Supporting this development is the introduction of ambitious targets, financial incentives, public financing measures, and new regulation. Capital subsidies, grants, and rebates for equipment and services are utilized by many countries to attract investment to both on- and off-grid sectors, helping reduce the cost of project development. Until recently, feed-in tariffs (FITs) were driving renewable energy investment in distributed installations, but more recently, auctions have taken over as the preferred instrument. Hydropower remains the least costly among technologies, though onshore wind and solar PV are approaching price parity, and are even beginning to compete with coal in some countries such as China, India, the Philippines and Viet Nam. India demonstrates the lowest costs for solar PV and onshore wind within the region. Biomass and biogas are also highly competitive in some contexts and are on the rise in countries introducing energy crops and taking advantage of agriculture and forestry residues. Looking forward, prices are expected to continue to fall. Supporting this, several countries are investing heavily in technology research and development. Australia, China, India, Indonesia, Japan, and the Republic of Korea have committed to doubling their respective clean energy research and development investment over five years, targeting to invest \$9.85 billion in clean energy research and development by 2021.

However, faster progress is needed to achieve the SDG7 target to substantially increase the share of renewable energy in the region's energy mix. Importantly, across the region, grid system capacity and readiness for variable renewable energy integration remains a key limiting factor, and bigger and faster grids are needed. In addition, the region has yet to show progress in incorporating renewables beyond the power sector, and focus is needed particularly in the transport sector and for heat.

4. MARKET-BASED APPROACHES TO ACHIEVE NDCS

Market-based approaches are emerging as a key policy mechanism to drive emission reductions. On the supply side, they provide incentives for the private sector to develop and apply carbon-saving technologies and manage operations to reduce emissions, or to trade with those who can deliver mitigation in the most cost-efficient way.⁵³ On the demand side, carbon pricing serves as a signalling device to consumers to shape their consumption decisions.

With over one hundred Parties to the Convention considering carbon pricing instruments to be a cost efficient and effective means to help achieve their emission reduction targets, as stated in their NDCs, market based approaches provide a promising path to develop a low carbon climate resilient (LCCR) economy.

Globally, there are 40 national jurisdictions and over 25 cities, states and regions that have put a price on carbon, covering approximately 15 per cent of global GHG emissions.⁵⁴ With several new systems in development, including the Chinese Emissions Trading Scheme (ETS) to launch by the end of 2017, it is expected that 20-25 percent of global carbon emissions will soon be covered by a carbon price.⁵⁵

According to their NDCs, twenty-six countries, or around half of countries in the region, expressed their interest to engage in the use of market-based approaches to enhance the cost-effectiveness of mitigation efforts and are exploring the possibility of enhancing regional or bilateral cooperation under the remit of Article 6 of the Paris Agreement to link emissions trading systems, improve the measurement, reporting and verification systems, or enact gradual increases in prices.

Developing countries could benefit from financial flows by selling emission reductions amounting to 2 – 5 per cent of GDP in 2050. Carbon pricing can raise valuable public revenue through the auction of permits and the collection of carbon taxes. For example, in 2016, governments raised about US\$22bn in carbon pricing revenues from auctions, direct payments for compliance obligations and carbon tax receipts.^{56,57}

Carbon markets could also give rise to less tangible benefits, such as indirect efficiency gains, enhanced transmission of technical knowledge, or higher regional political commitment which could address competitiveness concerns. Securing political buy-in can also be maximised by finding suitable ways to use and invest the revenue that is collected.⁵⁸

A. Article 6 provisions

Article 6 of the Paris Agreement provides the basis for voluntary market-based approaches to raise ambition, while promoting environmental integrity and sustainable development to implement the NDCs. It has three main provisions, the so-called 'cooperative approaches', namely the use of Internationally Transferred Mitigation Outcomes (ITMOs) (Art. 6.2), a Sustainable Development Mechanism (SDM) or successor mechanism to the Clean Development Mechanism (CDM) (Art. 6.4) to contribute to mitigation and sustainable development, and a framework to allow for the holistic integration of non-market approaches and support (Art. 6.8).

Article 6.2: Cooperative approaches

The use of ITMOs are concerned with the exchange or trade of carbon units across borders to achieve the NDCs, promote sustainable development and ensure environmental integrity. This may occur on a bilateral basis, through clustered carbon markets, or possibly through multilateral mitigation activities.

Article 6.4: Establishes a mechanism for mitigation (SDM)

The establishment of a mechanism to contribute to the mitigation of greenhouse gas emissions is widely perceived by many as having similarities to the CDM, but could be broader. Similar to the CDM, it would fall under international oversight, supervised by the United Nations Framework Convention on Climate Change (UNFCCC) process. Emissions reductions would be measurable and derive from a specific scope of activities, verified and certified by designated operational entities, and proceeds would be shared. In developing the new mechanism, there is great opportunity for the region to build on the existing capacity generated by the CDM, especially on methodologies, standardized baselines, and monitoring, reporting and verification activities.

However, as emphasised by the regional non-State actor dialogue on Article 6 last year, the new mechanism would need to address some weaknesses in the CDM, including the delays in approving projects, bureaucratic procedures and high transaction costs. This would suggest a wider scope than project or programme based activities and all countries could both host activities and use emission reductions to achieve NDCs, while avoiding double-counting. It was also pointed out that the new SDM should aim to better incorporate sustainable development co-benefits. To

Box 1 – Key provisions of Art. 6 of the Paris Agreement

2. Parties shall, where engaging on a voluntary basis in cooperative approaches that involve the use of **internationally transferred mitigation outcomes** towards nationally determined contributions, promote sustainable development and ensure environmental integrity and transparency, including in governance, and shall apply robust accounting to ensure, inter alia, the avoidance of double counting, consistent with guidance adopted by the Conference of the Parties serving as the meeting of the Parties to this Agreement.

4. **A mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development** is hereby established under the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Agreement for use by Parties on a voluntary basis. It shall be supervised by a body designated by the Conference of the Parties serving as the meeting of the Parties to this Agreement, and shall aim:

- (a) To promote the mitigation of greenhouse gas emissions while fostering sustainable development;
- (b) To incentivize and facilitate participation in the mitigation of greenhouse gas emissions by public and private entities authorized by a Party;
- (c) To contribute to the reduction of emission levels in the host Party, which will benefit from mitigation activities resulting in emission reductions that can also be used by another Party to fulfil its nationally determined contribution; and
- (d) To deliver an overall mitigation in global emissions.

8. Parties recognize the importance of integrated, holistic and balanced **non-market approaches** being available to Parties to assist in the implementation of their nationally determined contributions, in the context of sustainable development and poverty eradication, in a coordinated and effective manner, including through, inter alia, mitigation, adaptation, finance, technology transfer and capacity building, as appropriate. These approaches shall aim to:

- (a) Promote mitigation and adaptation ambition;
- (b) Enhance public and private sector participation in the implementation of nationally determined contributions; and
- (c) Enable opportunities for coordination across instruments and relevant institutional arrangements

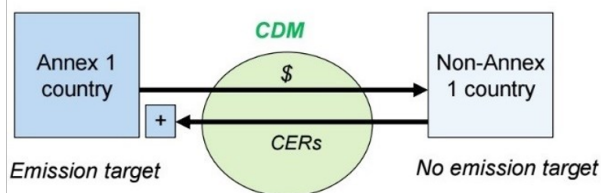
ensure full effectiveness, the SDM could become a broad framework mechanism within which many types of mitigation approaches can be executed, e.g. see below Figure 1, rather than a single purpose mechanism such as the CDM under the Kyoto Protocol.⁵⁹

Article 6.8: Non-market based approaches

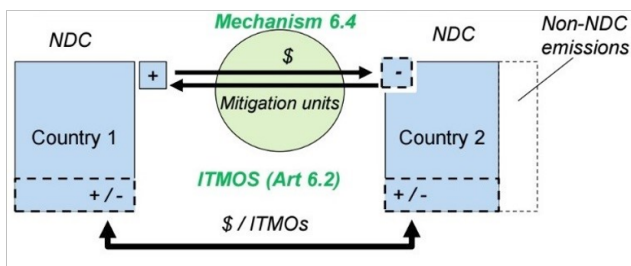
Article 6.8 provides for the use of non-market based approaches to complement the market-based approaches. These may serve a useful role in the policy mix, enhancing the effectiveness of market-based approaches by providing an enabling environment, knowledge transfers, building technical and institutional capacity, and establishing an appropriate regulatory framework. These might include regulatory (technology or performance-oriented regulations, bans on certain products or practices and licensing requirements) and voluntary approaches (ratings, labelling and certification). Non-market based approaches may be effective in circumstances where the price signals have a weak response by economic agents.⁶⁰

Collaborative Instruments

Kyoto Protocol



Paris Agreement



B. Regional co-operative approaches and linking

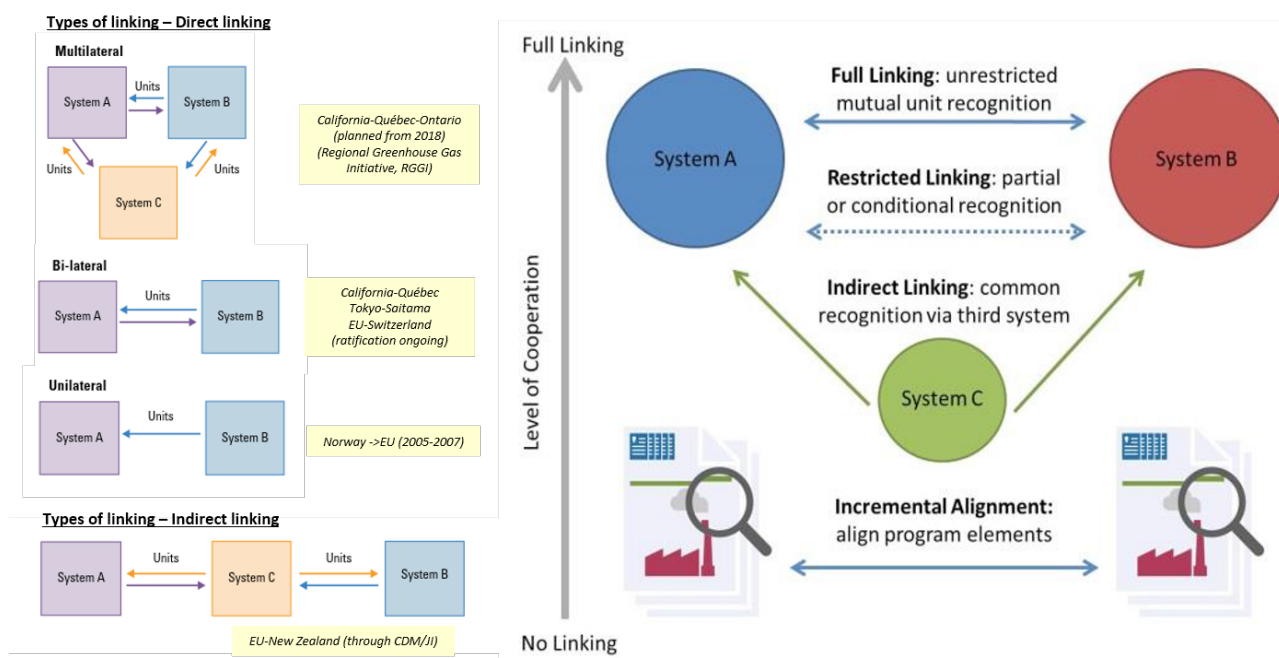
As countries look to more concerted and ambitious actions to cut GHG emissions, linkages between carbon markets will be an important approach. Linking mandatory systems (with absolute caps on emissions) can offer the region many benefits, including reducing the cost of cutting emissions;⁶¹ increasing market liquidity and depth; stabilising carbon prices; alleviating leakage and competitiveness concerns; and strengthening regional cooperation on climate change.

The total cost of achieving the caps of linked systems comes about because the larger linked market allows for more low-cost mitigation options. The system with higher prices can buy allowances from the ones with lower prices. Greater market liquidity is achieved by increasing the number of participants, which prevents or reduces market distortions or market failures. Bigger systems allow for less price volatility and improved price predictability which aids long-term investment decisions. As carbon prices converge across the different systems, the risk of leakage where private sector enterprises relocate to avoid being subjected to a carbon price is reduced, and competitiveness concerns addressed. Joining systems allows for reduced transaction costs, especially for multinational firms. Finally, linking shows political leadership and enhances buy-in and legitimacy of carbon pricing.

Studies show that cooperative climate action through an international carbon market could reduce the cost of the current NDC emission reduction scenario by about a third by 2030 and by 50 per cent by 2050.⁶² This would reduce the total mitigation cost from 0.25 per cent of global GDP to around 0.17 per cent by 2030. This reduction is achieved by providing access to a larger pool of lower cost mitigation options and savings by sharing instruments and represents a very potent argument for the adoption of market-based approaches to implement NDCs and pave the way for higher ambition. Countries with limited mitigation potential would be able to tap into more abundant and lower-cost mitigation options, while those with abundant mitigation options would benefit from green investments.

But, to realise the full potential of cooperative approaches, the systems need to have compatible and robust accounting rules. This should take high priority on the policy agenda. This should also incentivize countries in the region who have not already done so to formulate quantifiable mitigation outcomes and overall reduction targets within their NDCs.

A continuum of linking approaches



Regional co-operative approaches and first steps toward linking

Linking of ETSs typically involves a decision to admit ETS units – either allowances or emissions reduction credits – issued by another system for compliance purposes. Bilateral linking through the transfer of allowances can take place either from one system to another, or through reciprocal arrangements. Indirect linking occurs through the transfer of emissions reduction credits.

Linking can be viewed as a continuum, beginning from alignment of the programme elements of two systems, through indirect linking where common recognition occurs via a third system (e.g. CDM credits), restricted linking where there is partial or conditional recognition of units across systems, e.g. quotas, exchange rates or discount rates, to full linking or unrestricted mutual unit recognition.

The first steps toward linking are already underway in the region. A leading example of a cooperative approach in the Asia-Pacific region is the Joint Crediting Mechanism (JCM), which is a bilateral mechanism of the Government of Japan to facilitate the subsidized diffusion of low carbon technologies into host countries to generate credits that contribute to achieving Japan's emissions reduction target. To date, eleven countries in the Asia-Pacific region host this mechanism.⁶³

Another example of the use of an ITMO is the multilateral linkage of the California-Québec-Ontario emissions trading systems, which combined makes up the largest carbon market in North America. The two regions (California, Québec) have operated joint, bilateral cap-and-trade auctions since 2014,⁶⁴ and as of January 2018, Ontario will be included, which has been operating its own cap-and-trade system since January 2017.⁶⁵

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) agreed in 2016 by the International Civil Aviation Organisation (ICAO) and designed to achieve carbon neutral growth of the aviation sector by 2035, is another example. Aircraft operators will be required to purchase offsets to account for the growth in carbon emissions above 2020 levels. Considered as the first serious step for the aviation sector to address climate change, to date, fifteen countries in our region have already signed up to the voluntary pilot phase, and in its second phase, it will cover all countries in our region except those with special needs.

Box 2 – Overview of ETSs in the world

• ETS currently in force

1. Canada – Ontario Cap – and – Trade Program
2. Canada – Quebec Cap – and – Trade System
3. China – Beijing pilot system
4. China – Chongqing pilot system
5. China – Fujian pilot system
6. China – Guangdong pilot system
7. China – Hubei pilot system
8. China – Shanghai pilot system
9. China – Shenzhen pilot system
10. China – Tianjin pilot system
11. EU ETS
12. Japan – Saitama Target Setting Emissions Trading System
13. Japan – Tokyo Cap-and-Trade Program
14. Korea Emissions Trading Scheme
15. New Zealand Emissions Trading Scheme (NZ ETS)
16. Swiss ETS
17. USA – California Cap – and – Trade Program
18. USA – Regional Greenhouse Gas Initiative (RGGI)

• ETS implementation scheduled

1. Canada – Nova Scotia
2. China national ETS
3. Kazakhstan Emissions Trading Scheme (KAZ ETS)
4. Ukraine

• ETS under consideration

1. Brazil
2. Chile
3. Japan
4. Mexico
5. Russia
6. Taiwan
7. Thailand
8. Turkey
9. USA – Oregon
10. USA – Virginia
11. USA – Washington
12. Vietnam

Of the eighteen ETSs currently in force globally, operating at international, national or subnational level, twelve are in the Asia-Pacific region (see Box 2).

Australia recently debated the introduction of carbon pricing strategies recommended by the Australian climate change authority, including an emission intensity based carbon pricing initiative in the electricity sector, and the enhancement of a safeguard mechanism in other sectors. However, these initiatives have been rejected by the government. To meet its NDC and emission reduction targets, Australia is also considering international crediting as part of the revision of its climate change policies.⁶⁶

China successfully operated eight pilot carbon markets in key cities and provinces and is preparing to launch its nationwide ETS by the end of 2017, covering approximately 40-50 percent of its total GHG emissions and more than 8,000 companies, which will constitute the world's largest carbon market. The National Development and Reform Commission (NDRC) will oversee the national system, which will expand on the existing ETS pilots. The NDRC developed a draft ETS regulation that was submitted to the State Council and Legislative Affairs Office and is preparing technical rules on GHG emissions reporting and verification, accreditation of third party verifiers, trading rules, and offsetting rules. The coverage of GHG emissions under the ETS will be specified after historical data reporting and verification is completed this year.

The scope of the national ETS will encompass coal-fired power plants, cement, aluminium and the aviation sectors. The initial allocations are still under review but phase one (2017-2019) is expected to promote free allocation based on either benchmarking or limited historical emissions intensity used for certain sectors, in line with international experience. The carbon price is expected to be in the range of US\$1 to US\$9 per tCO₂e.

In parallel to the development of the national ETS, the subnational pilot ETSs are still evolving. For example, the Guangdong ETS added aviation and paper as new sectors, increasing the number of included entities from 189 to 280. Fujian province also launched an ETS pilot in December 2016, which applies to 277 entities in the power, industry and aviation sectors with an energy consumption of over tCO₂e per year, which cover about 60 per cent of GHG emissions. Allocation is mainly free on an annual basis, although auctioning is expected to be introduced at a later stage. To increase market liquidity, Fujian introduced a first allowance auction, in which 50,000 allowances from the government reserve were sold.⁶⁷

In Japan, the three current subnational schemes operating in Tokyo, Saitama, and Kyoto cover 8 percent of total GHG emissions in the country.⁶⁸ The Tokyo Metropolitan Government Cap-and-Trade Program, launched in April 2010, is Japan's first mandatory ETS. Under this scheme, large offices and factories are required to reduce emissions by 6 – 8 per cent in the first phase (FY 2010-2014). Now in its second phase, the target has increased to 15 – 17 per cent. In FY2014, emissions by covered entities decreased 25 per cent compared to base-year emissions, equivalent to a 14 million ton reduction in the first compliance period.⁶⁹

The Saitama ETS was established in April 2011 as part of the Saitama Prefecture Global Warming Strategy Promotion Ordinance. Since April 2011, this scheme has been bilaterally linked to that of Tokyo. In FY2014, the Saitama ETS had achieved a 24 per cent reduction below base-year emissions. Credits from excess emission reductions and small- and mid-sized facilities (offsets) are officially eligible for trade between the two jurisdictions. During the first compliance period, 14 credit transfers took place between the two schemes (8 cases from Tokyo to Saitama, 6 cases from Saitama to Tokyo).

South Korea launched its national ETS (KETS) in January 2015. As the first nation-wide cap-and-trade system in operation in East Asia, the KETS covers approximately 525 of the country's largest emitters, amounting to approximately 68 per cent of national GHG emissions, and will be essential to achieve Korea's 2030 NDC target of 37 per cent below BAU.

In the first two years of operation, trade under the KETS has been limited. In response, the authorities increased the liquidity of its ETS market in 2016 by doubling the supply of allowances that companies can borrow to ease the pressure on market participants, from 10 to 20 per cent, adding another 17 MtCO₂e to the cap. An additional 900,000 allowances were offered from the Allowance Reserve at a floor price of around EUR 12 and 2.3 million Korean Offset Credits were added to the market. Furthermore, the Korean government developed new guidelines to simplify the qualification process for earning credits from emission reductions. In April of this year, the government announced additional measures to address the market imbalances for the second phase of the ETS (2018-2021), including fewer free allowances distributed from 2018 to companies with a large surplus. Moreover, the government will allow the use of international credits.⁷⁰

New Zealand has had a national ETS in place since 2008, covering nearly half of the country's emissions.

The country is reviewing its ETS in two stages. The first stage concluded in May 2016, after authorizing the cancelation of the one-for-two transitional measure, which allows non-forestry ETS facilities to yield one emission allowance for every two tons of CO₂e. The second stage will address forestry issues and the supply of emission units in 2020. New Zealand is also considering the introduction of auctioning, a price stability mechanism, and new international carbon credits in its ETS. The government approved a bilateral action plan with China to cooperate on carbon pricing, which promotes partnerships with other countries in Asia-Pacific. New Zealand is conducting discussions with Korea on opportunities for regional carbon markets.⁷¹

Singapore intends to introduce a carbon price in 2019, which will be somewhere between S\$10 and S\$20 per tCO₂e (US\$7 – 14/tCO₂e). Revenues raised will be earmarked to fund industrial emissions reduction measures, 2017.⁷²

There are a number of preparatory initiatives in place to increase readiness of countries for carbon pricing instruments. The UNFCCC has the Collaborative Instruments for Ambitious Climate Action initiative, which works with ASEAN countries and others in the region to promote readiness and build capacity. The Partnership for Market Readiness supports three countries in the region, Thailand, Vietnam and Indonesia, to assess, prepare, and implement carbon pricing instruments in order to scale up greenhouse gas mitigation. The focus has been on establishing sound GHG data registries, setting

baselines, and pilots. It also serves as a platform for countries to share knowledge and work together to shape the future of cost-effective climate change mitigation.⁷³

The key challenge in developing collaborative instruments will be to have well-quantified NDCs and to establish comparable units of accounting so that these can be traded. These are reflected in the views of Asia-Pacific member States on Article 6 issues.

C. Revenue uses

Carbon pricing raises public revenue through the auction of permits and the collection of carbon taxes. Globally, around US\$20bn are raised per annum, but there is much greater revenue potential. Developing countries can benefit from selling emission reductions, which have been estimated at 2 – 5 per cent of GDP by 2050. However, achieving the maximum effectiveness of carbon markets relies on a strong carbon price, namely \$40-80 per tonne of CO₂ by 2020 and \$50-100 per tonne by 2030.

Targeted use of carbon pricing revenues to ensure its effectiveness and increase its political acceptability, especially in cases where carbon taxation acts as a regressive tax, is an opportunity to improve fiscal space while making climate policy more inclusive and progressive, for example, by reducing other taxes and lightening the burden on the poorest households.⁷⁵ Box 3 provides an overview of how such revenues have been used across the region and beyond.

Box 3 – Uses of carbon pricing revenue in the region and beyond

China: The auction revenue from the pilot ETSs in Beijing, Shanghai, Shenzhen, Tianjin, Chongqing and Hubei may be used to compensate firms faced with competitiveness and leakage concerns. The government has also signalled an intention to set aside revenues to support “corporate carbon reduction, carbon market regulation and the carbon trading market”.⁷⁶

The **Australian** Carbon Pricing Mechanism, currently revoked, directed 50 per cent of its revenues to a programme for household remuneration. The support was planned to be implemented through general tax reform instead of through rebates on electricity bills.

India: A tax on coal production (not strictly a carbon price) is used to fund the National Clean Energy Fund to promote low-carbon innovation and green activities and technologies.

Japan: Revenues from Tokyo’s cap-and-trade emissions system are largely targeted at offsetting additional costs and price surges affecting small businesses and households, through tax reductions, credits and low-interest loans to encourage green spending.

Korea: Its ETS revenues (auctioning revenues, penalties, etc.) may be recycled for equipment or green technology development so that the advancement of the green industry will be promoted.

Quebec: The Government has earmarked revenues from its auctions for a Green Fund to finance initiatives from its 2013-2020 Climate Change Action Plan (CCAP 2020) that focus on GHG emission reduction and climate adaptation. The ETS floor price ensures stable and predictable long-term funding for these initiatives. Estimated auction revenues will bring CCAP 2020’s budget up to at least three billion Canadian dollars.⁷⁷

The **European Union** Emissions Trading Scheme (EU-ETS) is undergoing reform. The revised EU ETS Directive established that at least 50 per cent of revenues raised or the equivalent financial value of these revenues should be used for climate and clean energy-related purposes. The revision also put forward an Innovation Fund to support carbon saving projects in energy intensive industries, renewable energy and carbon capture and storage, and a Modernization Fund for energy investments in low-income member states, which will receive auction revenues from 2020. From 2013 to 2015, EU member states spent 85 per cent of total auctioning revenues for climate purposes. Nine per cent of auctioning revenues were recycled to international climate action missions by other sectors globally (in particular the fuel use from international aviation and maritime).

D. Carbon pricing in the private sector

The steady growth of internal private sector carbon pricing is a promising trend showing private sector carbon risk management, capitalizing on emerging opportunities in the transition to a low-carbon economy. According to the Carbon Disclosure Project (CDP), from 150 global companies reporting to CDP in 2014, the number has grown to 1,389 companies in 2017 disclosing to CDP their plans or current practice of putting a price on carbon emissions.⁷⁸ Most notably, there has been a significant increase in the number of companies in Asia that are using internal carbon price in China, Japan, and South Korea, with 359 companies in the Asia-Pacific region now applying shadow pricing. Around 83 per cent of the global total were headquartered in countries where mandatory carbon pricing is in place or scheduled for implementation.

Reported corporate carbon prices range from US\$ 0.3/tCO₂e to US\$ 893/tCO₂e.⁷⁹

E. Challenges and future agenda

The main policy imperative is to increase the effective carbon prices in the region as these are currently too low to provide adequate incentives to pursue a low-carbon path. Meeting the world’s agreed climate goals in the most cost-effective way while fostering growth requires countries to set a strong carbon price, with the goal of reaching \$40-80 per tonne of CO₂ by 2020 and \$50-100 per tonne by 2030.⁸⁰

Second, in the face of short-term rises in the carbon price, the international competitiveness of the region’s energy-intensive industries is always a concern and needs to be balanced against emissions reductions

objectives. The region can learn from the evolving thinking on this issue. In the ongoing reform of EU ETS, the most efficient industrial installations would be protected from the carbon price through free allowances. The recent US Climate Leadership Council proposal of a carbon-tax and dividend solution introduces the notion of a border tax adjustment to deal with competitiveness concerns. The recent proposal for the California ETS post-2020 would introduce a border carbon adjustment on products with a material price difference. This is something that is going to need to be increasingly addressed at the regional or global levels.

Third, the carbon markets in the region must also address future supply glut. This is because carbon pricing systems do not operate in a policy vacuum. Instead they operate side-by-side with policies on renewables, energy efficiency and so on and each carbon saving they achieve reduces the need for allowances, so it is important to continue to adjust the architecture of carbon pricing systems to new realities.

Fourth, the region needs to receive significant support to strengthen the provision of quality data to ensure compliance. For example, implementing CORSIA is going to be challenging for the region because emissions need to be monitored, reported and verified according to harmonized rules and many national authorities lack the capacity to support this.

Fifth, emissions trading works best when its scope is broad. There are huge economic benefits in linking regional or national systems and our region would benefit from this but need to prioritise the introduction of better and harmonized accounting. Other countries in the region might be more suited for carbon taxes especially if their market liquidity is too limited, the quality of data or governance is poor, or if there is political support for such instruments, e.g. built into fuel taxation systems.

Concerning revenue, countries in the region need more support to make evidence-based policy decisions to reap the revenue mobilization potential of carbon pricing, and uses of that revenue. For example, ETs can either be designed to raise maximum revenues through the use of permit auctions or can have hybrid systems combining allocations and auctions. Similarly, carbon taxes can achieve significant revenues or be revenue-neutral. Both systems can gain political support through revenue recycling toward sustainable development priorities.

Finally, carbon pricing goes beyond emissions trading and carbon taxes. It includes eliminating the highly

inefficient fossil fuel subsidies. The Asian region made up around one-third of global energy subsidies in 2013.⁸¹

The renewed political support for carbon pricing is witnessed by the launch of the Carbon Pricing Leadership Coalition (CPLC), which is a voluntary partnership of more than 70 national and sub-national governments, over 1,000 businesses and non-government organizations (NGOs) that agree to advance the uptake of carbon pricing throughout the global economy. Various other political groupings support this objective, including the G7 Carbon Market Platform. The World Bank's Networked Carbon Markets initiative facilitates cross-border emissions trading.⁸² These initiatives and coalitions illustrate that the Governments and the private sector in our region recognize the value of carbon pricing and its potential to induce fundamental long term shifts in infrastructure, technology, and behaviour, which forms the basis of a low carbon economy.

CONCLUSION

Economies of the Asia-Pacific have already set in motion their strategies towards the temperature goal of 'holding the increase in the global average temperature to well below 2°C above pre-industrial levels', and to increase 'the ability to adapt to the adverse impacts of climate change and foster climate resilience' by introducing their NDCs.

NDCs in the region present far-reaching efforts to mitigate emissions and strengthen resilience to shift the paradigm of development onto a low carbon and climate resilient pathway. The region shows promise as a global leader in terms of investment and commitment. For example, in the energy sector, countries in the region have more investments in installed capacity and higher consumption of renewable energy than any other region. They have also achieved a steep decline in energy intensity, which fell from 9.1 MJ/\$ in 1990 to 6.0 MJ/\$ in 2014. Nevertheless, ambition still falls short relative to the attainment of the goals of the Paris Agreement. A key intervention will be to provide greater finance, technology and capacity-building to developing countries in the region to empower them to achieve their conditional mitigation targets.

In relation to the energy sectoral benchmarks linked with the 2°C scenario presented in this analysis, to stay within the energy sector carbon budget, global energy need to decrease at a rate of 3.5 per cent year up to 2050, or 70 per cent below BAU.⁸³ In Asia-Pacific,

energy-related emissions should be limited to around 10 GtCO₂e /year by 2030, or less than a half of the global total of the energy-related emissions.⁸⁴ Countries will also need to escalate their efforts towards the SDGs, and towards corporate benchmarks such as the Science Based Targets. All these frameworks will complement each other to facilitate enhanced commitments. ESCAP is well situated to act as a convening and knowledge platform to escalate these efforts.

This report has also evaluated how market-based approaches can be a cornerstone of the region's efforts to achieve their NDCs in the most cost-effective way. With stronger cooperative approaches, and a higher carbon price (of around \$40-80 per tonne of CO₂ by 2020 and \$50-100 per tonne by 2030), developing countries could benefit from additional public revenue through the auction of permits and the collection of carbon taxes. The region is comparatively advanced in this aspect, with several examples of national trading systems already operational, and with the upcoming launch of the China nationwide ETS expected for the end of 2017, which will cover approximately 40-50 percent of its total GHG emissions and more than 8,000 companies, and will constitute the world's largest carbon market. In 2018, climate action efforts will continue to escalate and parties will take stock of the collective efforts in relation to progress towards the goals set in the Paris Agreement, and continue to regularly assess this every five years to help inform the ambition needed to achieve their goals and update their NDCs.

Endnotes

- 1 IRENA, 2016.
- 2 OECD/IEA, 2017.
- 3 IEA, 2016.
- 4 OECD/IEA and IRENA, 2017.
- 5 WB, Ecofys, Vlvld Economics, 2016.
- 6 ESCAP (2015).
- 7 Kreft (2016).
- 8 UNISDR, 2009.
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- 10 UNEP, 2016a.
- 11 ESCAP, 2016 and ADB, 2016.
- 12 Graichen and Cames, 2016.
- 13 IGES, 2017a.
- 14 Schneider and Broekhoff, 2016.
- 15 Schneider and Broekhoff, 2016; Kreibich and Obergassel, 2016 and Graichen, J. and Cames, M., 2016.
- 16 Graichen, J. and Cames, M., 2016.
- 17 Smith and Bustamante, 2014.
- 18 USAID, 2016.
- 19 Petroff, 2017.
- 20 ADB, 2017.
- 21 ESCAP, 2013.
- 22 ESCAP Statistical Online Database, 2017.
- 23 IGES, 2017b.
- 24 IGES, 2017a.
- 25 CPI, 2017.
- 26 IGES, 2013.
- 27 WRI, 2016
- 28 ESCAP, 2016
- 29 ESCAP, 2017a.
- 30 ADB, 2017.
- 31 ADB, 2013b.
- 32 ADB, 2013c.

- 33 ADB, 2013a.
- 34 ADB, 2015.
- 35 ADB, 2015.
- 36 Manohar Shrestha et al., 2012.
- 37 ESCAP, 2017b.
- 38 ESCAP, 2017.
- 39 The Economic Times, 2017.
- 40 Mitra et al., 2015.
- 41 For the first time, the IPCC AR5 quantified the global “carbon budget,” the amount of carbon dioxide emissions that the world can emit while still having a likely chance of limiting global temperature rise to 2 degrees Celsius above pre-industrial levels. In addition, IEA, Carbon Tracker and the Global Carbon Project provide estimates of the global carbon budget.
- 42 https://ec.europa.eu/clima/policies/effort_en.
- 43 IPCC, 2014.
- 44 IRENA, 2016.
- 45 OECD/IEA and IRENA, 2017.
- 46 OECD/IEA, 2017.
- 47 IEA, 2016.
- 48 OECD/IEA and IRENA, 2017.
- 49 Sustainable Energy for All (SEforALL), 2016.
- 50 REN21, 2017.
- 51 The SDA methodology was developed by the Corporate Disclosure Project (CDP), World Resources Institute (WRI) and World Wildlife Fund (WWF), with technical support of Ecofys, and provides business with evidence-based methodologies to reduce emissions based on the 66 per cent likelihood of reaching the below 2 degree scenario. See CDP, WRI, WWF, 2015.
- 52 This section is a summary of the UNESCAP analysis of the Asia-Pacific region for the SE4ALL global assessment.
- 53 OECD, 2017.
- 54 WB and Ecofys, 2017.
- 55 WB, Ecofys, Vlvld Economics, 2016.
- 56 ICAP, 2017a.
- 57 CPLC, 2017.
- 58 ESCAP, 2016.
- 59 IETA, 2016.
- 60 UNFCCC, 2017a.
- 61 WB and Ecofys, 2016.
- 62 World Bank, 2016.
- 63 Mongolia, Bangladesh, Maldives, Vietnam, Laos, Indonesia, Palau, Cambodia, Myanmar, Thailand and the Philippines.
- 64 California-Quebec Linkage Agreement, 2013.
- 65 ARB, 2017.
- 66 WB and Ecofys, 2017.
- 67 ICAP, 2017.
- 68 WB and Ecofys, 2014.
- 69 ICAP, 2017b.
- 70 WB and Ecofys, 2017.
- 71 Ibid.
- 72 Ibid.
- 73 ESCAP, 2016.
- 74 ESCAP, 2016.
- 75 OECD, 2017.
- 76 OECD, 2017.
- 77 ICAP, 2014.
- 78 CDP, 2017.
- 79 CDP, 2017.
- 80 CPLC, 2017b.
- 81 For regional aggregation, the Asian region is taken to be the ‘Emerging and Developing Asia’ and the ‘Commonwealth of Independent States’, classifications used by Coady et al. (2015) and IMF (2013). However, this omits Afghanistan, Iran, Iraq and Pakistan contained in their ‘Middle East, North Africa and Pakistan’ group, so represents an underestimate.
- 82 ESCAP, 2016
- 83 OECD/IEA and IRENA, 2017.
- 84 OECD/IEA and IRENA, 2017.

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ANNEX I – SUMMARY OF COUNTRY NDCs

Climate Action Tracker (CAT) is an independent scientific analysis that assesses progress towards the globally agreed objective of maintaining temperatures below 2°C. CAT has evaluated the effect of the current policy scenarios, the impact of NDC pledges, and the fairness of efforts of 32 countries that cover around 80 per cent of global emissions. The CAT analysis covers 12 countries in Asia-Pacific. The following table presents a summary of the ambition and progress of NDCs in these countries, according to the CAT assessment.

Bhutan	Bhutan set the objective of remaining carbon neutral by keeping its emission under the absorption capacity of its carbon sink. Emission levels in Bhutan (excl. LULUCF) resulting from a current policy trajectory will reach 5.12 MtCO₂e by 2025 and 6.28 MtCO₂e by 2030, increasing 280% and 366% relative to 1990 levels (1.35 MtCO₂e), respectively, as a consequence of industrial development. Emissions from the electricity sector are expected to reach 2.2 MtCO₂ in 2020. However, emissions will decline compared to BAU thanks to the implementation of a renewable energy target of 20MW by 2020 and additional policy measures. Bhutan target is rated as sufficient.
China	Although China's current policy scenario is enough to achieve its NDC, the latest is insufficient to meet the needs of the below 2°C scenario. It's been observed that China could have already peaked its CO₂ emissions thanks to continued abatement of coal. Under China NDC target scenario, emissions would be of 12.8-14.3GtCO₂e in 2030, entailing a reduction of 64%-70% below emission intensity in 2005. Of this, a total of 9.1-9.4 GtCO₂e in 2-2- and 8.6-10.1 GtCO₂e in 2030 are energy related emissions. This emission increase is situated 2%-4% above 2015 levels in 2020, and 5%-17% in 2030. Accordingly, its pledges are rated as Medium.
India	Policy scenario in India, including the target of 175 GW of renewable power by 2022, is already proper to achieve the NDC pledges. With its Draft Electricity Plan India establishes that no additional coal capacity will be installed after 2022 besides the one currently in construction, thus setting ground for its NDC target of 40% non-fossil capacity installed before 2022. India's NDC also aims to lower the emission intensity of the GDP by 33%-35% by 2030 below 2005. Under an assumption of 7.2% annual GDP growth, the emission levels resulting from the NDC targets will be of 5.9-6GtCO₂e by 2030, or 6 times bigger than 1990 levels. The emission levels will reach 5.2-5.3GtCO₂e with the implementation of the renewable energy target. These efforts are however not yet aligned with the limit warming below 2°C. Therefore, its NDC is rated as Medium
Indonesia	Indonesia's NDC includes an unconditional target of 29% reduction below BAU, and a conditional target of 41% below BAU. Current policy landscape will be only appropriate to achieve the unconditional target, which will motive an absolute emission level of 2,050 mtCO₂e by 2030. In parallel to the ambition of increasing renewables to 23%, Indonesia is also building new coal plants. This will make emissions grow rapidly during the period before 2030. However, to be consistent with the Paris Agreement temperature goal, emissions should stabilize and start to decline by 2030. Therefore, the country pledges receive a Medium rating.
Japan	Japan NDC sets a target of 26% (23% if accounting LULUCF) emission reduction below 2013 by 2030, corresponding to a 18% below 1990 levels (15% if accounting LULUCF). However, for Japan target to be consistent with a 2°C scenario, emissions would need to reach 137 MtCO₂e in 2030, or 89% below 1990 levels. Currently, there 186GW of coal power is being development, which would emit more than 100 MtCO₂e, differing from a low-carbon development perspective. Additionally, current policy trajectory misses NDC target by 20 MtCO₂e. Japan NDC target is rated as inadequate.

Kazakhstan	Kazakhstan unconditional NDC is rated as medium, although it doesn't meet the needs for the below 2°C. The country recognises the need to transition to a low-carbon future, but its policy measures would only translate into an insufficient emission level of 331 MtCO₂e and by 2020 424 MtCO₂e (13% above 1990 levels). The country plans to have a 50% of the energy supply covered by renewable sources, and to decrease energy intensity by 25% compared to 2008 baseline by 2020.
Korea (Republic of)	South Korea's NDC pledges to reduce GHG by 37% below BAU 850.6 MtCO₂e in 2030. This would translate into 536MtCO₂e emitted by 2030, or 81% above 1990 level. The country claims that 25.7% reduction below BAU will be achieved domestically 11.3% will be reached through market mechanisms. NDC Emissions pathway is insufficient to reach a 2°C and would need be below 500 MtCO₂e in order to have the medium rating. Additionally, current policy scenario is expected to be insufficient to meet the NDC targets.
Nepal	Nepal NDC targets include plans on renewable energy capacity increase. Its NDC pathway lacks detail, and CAT was therefore unable to provide a rating. However, under its current policies, Nepal's GHG emissions are only expected to increase between 50–53 MtCO₂e by 2030, being therefore consistent with a scenario below 2°C.
Philippines	Philippines NDC rates as medium due to the uncertainty of its target pathways. The country proposed a conditional reduction of 70% below BAU from all sectors, which would revert emissions to 1990 levels. The planned National Renewable Energy Program and The Energy Efficiency and Conservation Roadmap' would reduce emissions by 12% compared to current policy pathways, but the NDC target could not be achieved in case that the advances current plans of development of 10GW capacity from coal power plants. CAT considers Philippines target as ambitious, but doesn't regard it as consistent with the 2°C pathway.
Russian Federation	Pledges of Russia aiming to reduce emission a 25-30% below 1990 levels are situated above current policy projections and are qualified by the Climate Action Tracker as insufficient to reach the Paris Agreement goals, which is currently not ratified by the country. The target is conditional on a maximum absorbing capacity of forest. Is expected that Russia will emit around 3.2 GtCO₂e in 2030, or 8-13% below LULUCF.
Singapore	Singapore's implemented policies will lead to a 60 MtCO₂ scenario by 2030, which is stronger than the projected under the NDC target. The country NDC proposes to reduce emission intensity of GDP by 36% below 2005 levels by 2030 and peaking emissions in 2030 at 65 MtCO₂e. Its mitigation strategy consists in increasing energy and carbon efficiency, reducing carbon emissions in power generation and developing low-carbon technology. However, the NDC target is, according to CAT, not consistent with the 2°C scenario and the 1.5°C scenario of the Paris Agreement.
Turkey	CAT qualified Turkey's NDC target as inadequate. The country is currently expanding coal power generation, with 6 units under construction and 73 planned, which would lead to a 40% increase of annual emissions. Its NDC sets a target of 21% reduction (-39MtCO₂e/year) by 2030 below BAU, with a target level of 929 MtCO₂e, which would however entail a 97% increase from 2012. According to CAT, this target could be met without additional policy measures and is not consistent with a 2°C scenario.

Source: Climate Action Tracker, 2017.

About ESCAP

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) is the regional development arm of the United Nations for the Asia-Pacific region. Made up of 53 Member States and 9 Associate Members, with a geographical scope that stretches from Turkey in the west to the Pacific island nation of Kiribati in the east, and from the Russian Federation in the north to New Zealand in the south, the region is home to 4.1 billion people, or two thirds of the world's population. This makes ESCAP the most comprehensive of the United Nations five regional commissions, and the largest United Nations body serving the Asia-Pacific region with over 600 staff.