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Nationally determined contributions under the Paris Agreement

Synthesis report by the secretariat

Addendum

Additional information on domestic mitigation measures

Summary

This addendum provides additional information on domestic mitigation measures synthesized from the 164 latest available nationally determined contributions communicated by the 191 Parties to the Paris Agreement and recorded in the interim registry of nationally determined contributions as at 30 July 2021.

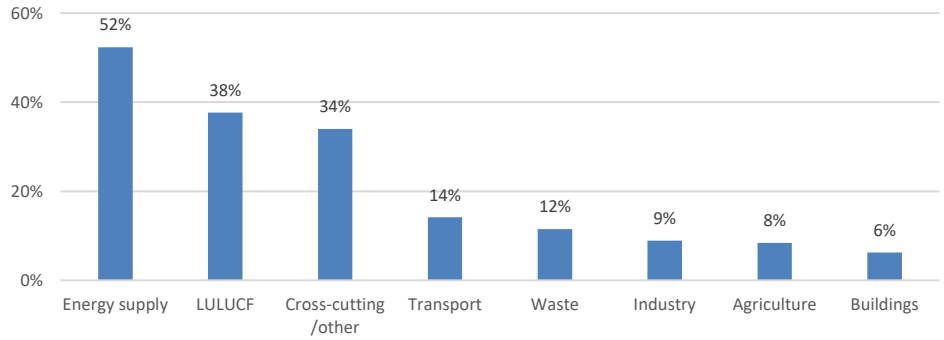
Abbreviations and acronyms

CCS	carbon dioxide capture and storage
CCUS	carbon dioxide capture, utilization and storage
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
F-gas	fluorinated gas
GHG	greenhouse gas
GWP	global warming potential
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LT-LEDS	long-term low-emission development strategy(ies)
LULUCF	land use, land-use change and forestry
MRV	measurement, reporting and verification
N_2O	nitrous oxide
NDC	nationally determined contribution
R&D	research and development
SLCP	short-lived climate pollutant
SR1.5	Intergovernmental Panel on Climate Change Special Report on Global Warming of 1.5 °C

I. Quantitative mitigation targets specific to priority areas or sub-areas

1. Figure 1 shows the percentage of Parties that identified quantitative mitigation targets specific to priority areas or sub-areas for domestic mitigation measures[1] in their NDCs. Such targets were provided most frequently for energy supply, followed by LULUCF and cross-cutting or other[2] (see the table below for examples). In many cases, the type (e.g. absolute emission reduction target, 'business as usual' emission reduction target), base year (e.g. 2010, 2013) and target year (e.g. 2025, 2030) of the Parties' targets are consistent with those of their overall NDC mitigation targets in order to effectively underpin them. Such consistency is more frequently observed where the overall NDC mitigation targets were determined by calculating the aggregate mitigation potential of the domestic mitigation measures using a bottom-up approach.

Figure 1
Share of Parties providing quantitative mitigation targets specific to priority areas or sub-areas in nationally determined contributions



Note: If a Party provided more than one quantitative mitigation target specific to a priority area or sub-area, it was counted as one Party providing targets for that area.

Examples of quantitative mitigation targets specific to priority areas or sub-areas

Priority area	*Examples*
Energy supply	▪ Reduce GHG emissions from electricity generation by 30 per cent below the 2015 level by 2030
	▪ Achieve 100 per cent renewable energy in electricity generation by 2030
	▪ Increase the share of renewable energy in final energy consumption to at least 32 per cent by 2030
Transport	▪ Reduce GHG emissions from land transport by 21 per cent below the 2005 level by 2030
	▪ Reduce GHG emissions from domestic shipping by 40 per cent below the 2010 level by 2030
Buildings	▪ Reduce annual CO_2 emissions from residential buildings to 122 Mt CO_2 by 2030 compared with 201 Mt CO_2 in 2013
Industry	▪ Reduce GHG emissions from industry by at least 30 per cent below the 2015 level by 2030
	▪ Reduce GHG emissions by 8.1 per cent below the 'business as usual' level by 2030

[1] Refers in this report to specific domestic policies and actions that contribute to achieving mitigation objectives identified in NDCs, including adaptation actions and economic diversification plans with mitigation co-benefits.

[2] Covers domestic mitigation measures applicable to more than one or none of the priority areas, such as measures for multisector energy efficiency improvement.

Priority area	*Examples*
Agriculture	▪ Reduce GHG emissions by 2.8 per cent below the 'business as usual' level by 2030
LULUCF	▪ Increase annual CO_2 removals by sinks to 37 Mt CO_2 by 2030 compared with 27.8 Mt CO_2 in 2013 ▪ Ensure that emissions do not exceed removals in 2030 ▪ Increase national forest cover by 33 per cent above the 2019 level by 2030
Waste	▪ Reduce GHG emissions by 8.1 per cent below the 'business as usual' level by 2030
Cross-cutting /other	▪ Reduce CH_4 emissions by 12.3 per cent below the 2013 level by 2030 ▪ Reduce final and primary energy consumption by at least 32.5 per cent compared with a historical baseline by 2030 as energy efficiency target for 2030 ▪ Reduce GHG emissions from the energy sector by 1.5 Mt CO_2 below the 'business as usual' level by 2030

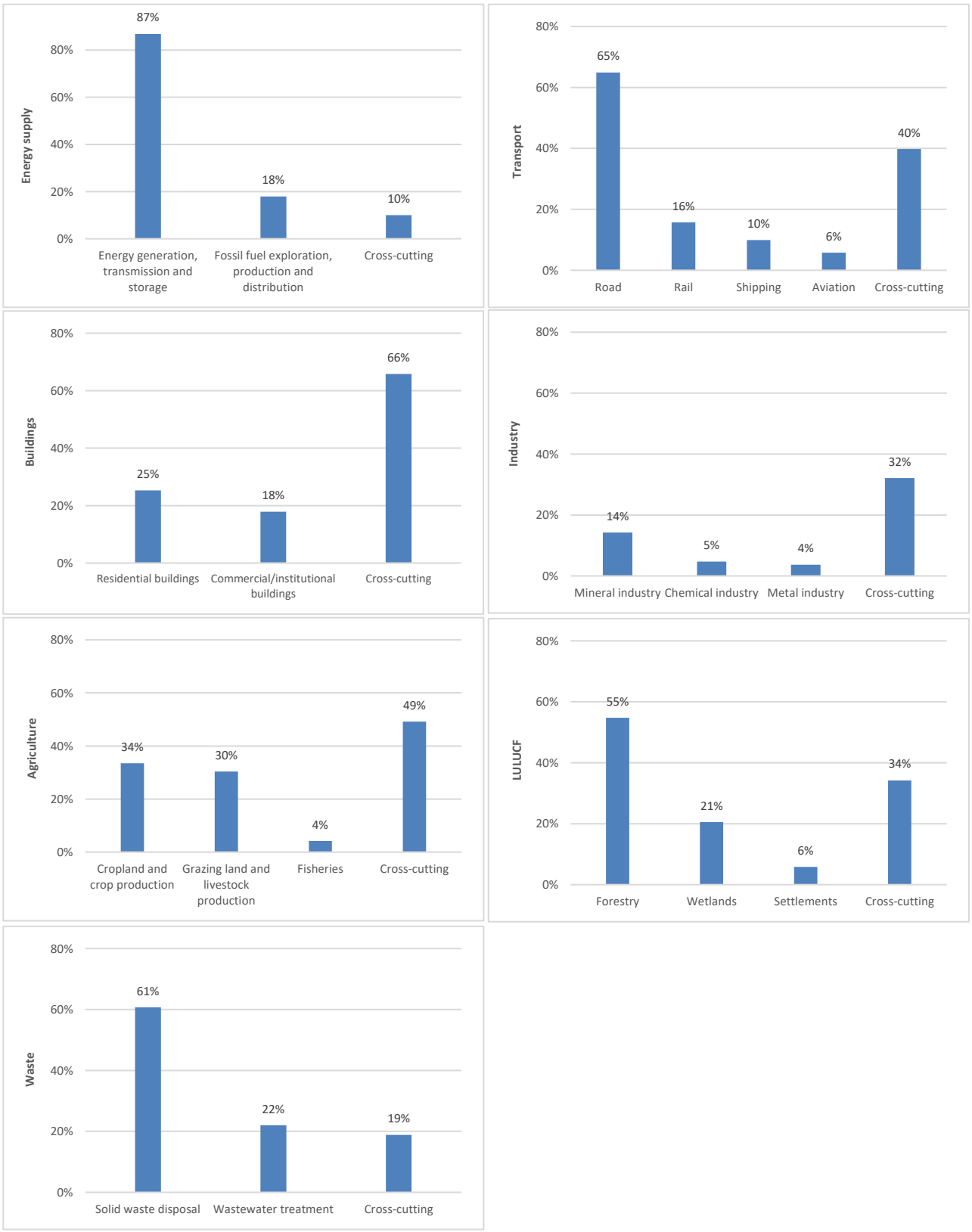
II. Sub-areas and mitigation options under priority areas

2. Figures 2–3 show the percentage of Parties that communicated sub-areas of the priority areas and mitigation options[3] under the priority areas, respectively.

[3] Refers in this report to expected key mitigation effects or categories of domestic mitigation measures, which were identified by analysing the trend in the measures set out in the new or updated NDCs and by referring to those identified in the previous NDC synthesis report and relevant IPCC reports, including the SR1.5 (see footnote 12 below).

Figure 2

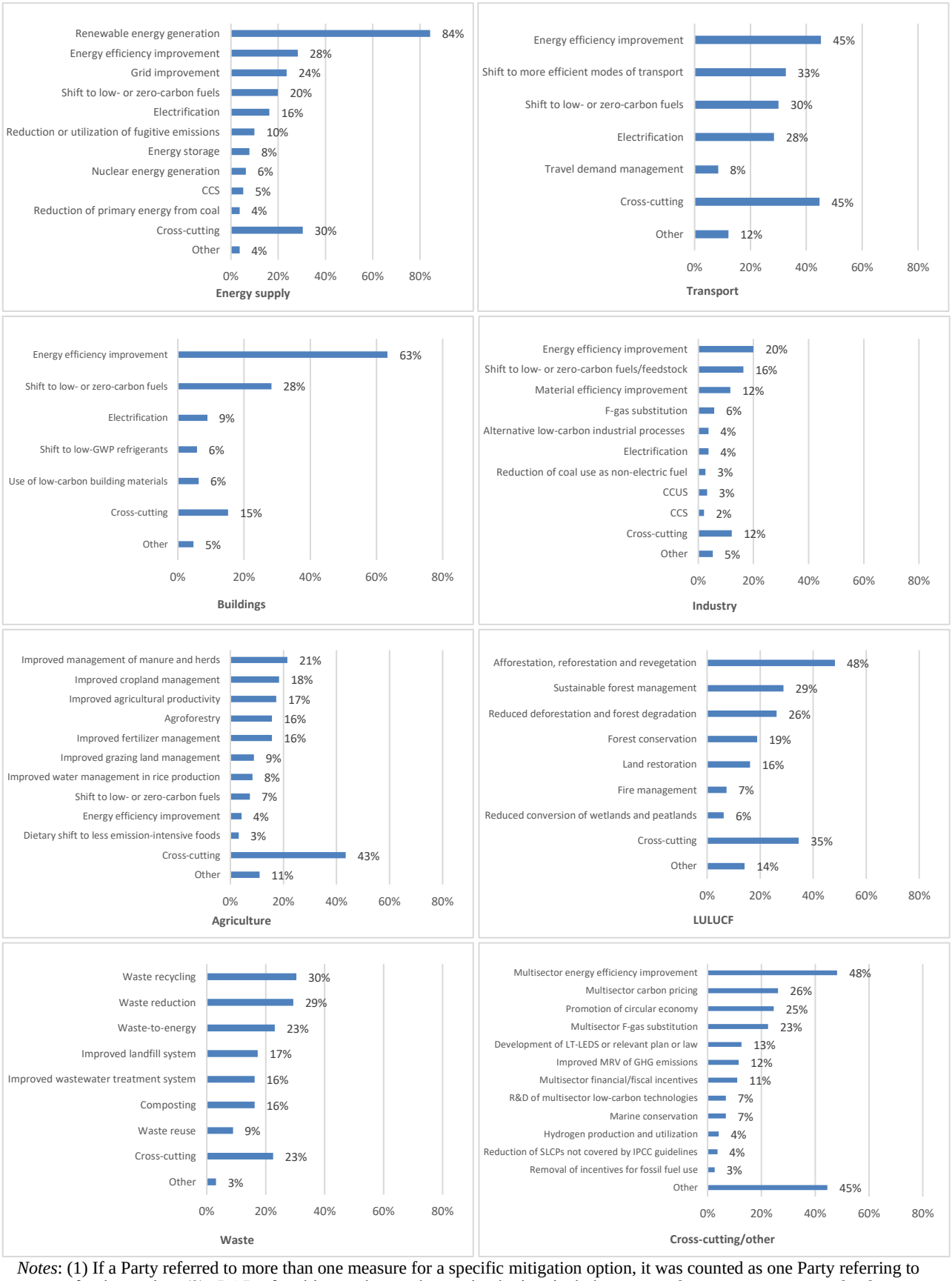
Share of Parties referring to sub-areas of priority areas for domestic mitigation measures in nationally determined contributions



Note: If a Party referred to more than one measure for a specific sub-area, it was counted as one Party referring to measures for that sub-area.

Figure 3

Share of Parties referring to mitigation options under priority areas for domestic mitigation measures in nationally determined contributions



Notes: (1) If a Party referred to more than one measure for a specific mitigation option, it was counted as one Party referring to measures for that option; (2) "R&D of multisector low-carbon technologies" includes zero- and negative-emission technologies.

A. Energy supply

3. In the priority area of energy supply,[4] energy generation, transmission and storage was by far the most frequently identified sub-area for domestic mitigation measures (see figure 2). Globally, energy generation was the largest source of energy-related CO_2 emissions in 2018, accounting for 13.8 Gt CO_2 or around 40 per cent of direct energy-related CO_2 emissions.[5] Some[6] Parties communicated measures for reducing emissions from fossil fuel exploration, production and distribution, and some identified measures in the cross-cutting sub-area.[7]

4. The mitigation options indicated by Parties in this area include renewable energy generation (e.g. solar, wind, biomass, hydropower, geothermal); nuclear energy generation; reducing primary energy from coal; energy storage; grid improvement; shifting to low- or zero-carbon fuels; energy efficiency improvement; CCS; electrification; and reducing or utilizing fugitive emissions.

5. Renewable energy generation was by far the most frequently indicated mitigation option in this area (see figure 3), with many Parties mentioning cross-cutting renewable energy generation,[8] some solar power generation, some hydropower generation and some wind power generation. Measures relevant to these options include (1) cross-cutting renewable energy generation: conducting a study for developing a road map for integrating renewable sources into the energy mix, with the aim of achieving a 25 per cent renewable energy share by 2030; and adopting an act for promoting use of renewable energy sources; (2) solar power generation: installing solar mini-grids in off-grid rural areas by 2030; and deploying innovative modes of solar photovoltaics, such as floating and building-integrated photovoltaic systems, through research, development and demonstration; and (3) hydropower generation: developing a pumped-storage hydropower project to both utilize surplus solar power and meet electricity demand during peak hours or as needed; and installing small hydroelectric power plants by 2025, with a focus on co-benefits for irrigation.

6. Many Parties set out quantitative targets for increasing renewable energy, expressed, for example, in terms of installed capacity, electricity generation or final energy consumption. Some communicated quantitative targets for the share (ranging from 15 to 100 per cent) of renewable energy in electricity generation by 2030; and many of those target shares fall within or above the IPCC range of 47–65 (median 54) per cent consistent with 1.5 °C emission pathways.[9]

7. For the 113 Parties that communicated new or updated NDCs, renewable energy generation continued as in their previous NDCs to be the most frequently indicated mitigation option in this priority area, with the share of Parties indicating this option sharply increasing from 48 to 85 per cent since their previous NDCs. Similarly, renewable energy remained a major focus of quantitative mitigation targets specific to this area, with the share of Parties communicating such renewable energy targets also sharply increasing from 34 to 59 per cent since their previous NDCs.

8. In terms of the other most frequently indicated mitigation options in this area, some Parties indicated cross-cutting options,[10] while some mentioned energy efficiency

[4] Covers measures targeting emissions from energy supply, such as electricity and heat generation. Measures targeting emissions from fuel use under transport, buildings, industry, agriculture, LULUCF and waste were allocated to the respective priority areas.

[5] See IEA global energy-related CO_2 emissions by sector, available at https://www.iea.org/data-and-statistics/charts/global-energy-related-co2-emissions-by-sector (accessed 11 June 2021).

[6] The following terms are used in this report to indicate the percentage of Parties whose NDCs mention particular information: "a few" for less than 10 per cent; "some" for 10–40 per cent; "many" for 41–70 per cent; "most" for 71–90 per cent; and "almost all" for more than 90 per cent.

[7] Covers measures applicable to more than one sub-area of a priority area. For example, under energy supply it covers measures applicable to both energy generation, transmission and storage, and fossil fuel exploration, production and distribution.

[8] Covers measures that contribute to more than one type of renewable energy generation.

[9] The interquartile range of global renewable energy share in electricity generation by 2030 on the modelled emission pathways that limit global warming to 1.5 °C with no or limited overshoot in the SR1.5.

[10] Covers measures that relate to more than one mitigation option in a priority area.

improvement, some grid improvement and some shifting to low- or zero-carbon fuels. Measures relevant to these options include (1) cross-cutting: implementing integrated national energy and climate plans for 2021–2030 to achieve energy and climate targets; and developing climate policies for the petroleum sector, involving CO_2 taxes and CCS, for example; (2) energy efficiency improvement: reducing partial load operation and establishing a minimum efficiency level of 48 per cent for all new power plants; and significantly increasing cogeneration in thermal power plants by 2030; (3) grid improvement: upgrading grids to reduce grid loss of electricity to 5 per cent or lower; and strengthening electricity transmission and distribution links to support upscaling of e-cooking, e-heating, e-transport and charging stations; and (4) shifting to low- or zero-carbon fuels: replacing fuel oil with natural gas in dual thermal power plants; and replacing diesel with liquefied natural gas in electricity generation.

9. A few Parties specified reducing primary energy from coal as a mitigation option in this area, for example by banning construction of coal-fired power plants and replacing them with combined-cycle gas power plants. Coal-fired power generation was the single largest source of energy-related CO_2 emissions globally in 2018, accounting for 10 Gt CO_2 or 29 per cent.[11] According to the SR1.5,[12] investment in unabated coal is to be halted by 2030 in most available 1.5 °C-consistent scenarios.[13] A few Parties communicated corresponding measures, including phasing out use of unabated coal for producing electricity by 2025.

B. Transport

10. Transport accounted for around 7.9 Gt CO_2, or 23 per cent[14] of direct energy-related CO_2 emissions, globally in 2018. In this priority area,[15] road transport was by far the most frequently identified sub-area for domestic mitigation measures (see figure 2). Some Parties communicated measures for reducing emissions in the cross-cutting sub-area, while some identified measures for rail, some for shipping and a few for aviation.

11. Energy efficiency improvement and cross-cutting options, especially in the sub-area of road transport, were the mitigation options most frequently indicated by Parties in this area (see figure 3). Measures relevant to these options include (1) energy efficiency improvement: introducing fuel efficiency standards; providing fiscal, financial or customs incentives for purchasing more efficient light-duty vehicles, to boost energy efficiency of newly purchased light-duty vehicles by 2 per cent per year; establishing mandatory energy efficiency labelling for light-duty combustion engine vehicles by 2025; and modernizing cargo vehicles that exceed the thresholds set for their gross weight and age; and (2) cross-cutting: developing urban plans to promote efficient public transportation systems; and introducing vehicle emission standards, including tax incentives and inspections.

12. In terms of the other most frequently indicated mitigation options in this area, some Parties indicated shifting to more efficient modes of transport, some shifting to low- or zero-carbon fuels and some electrification. Measures relevant to these options include (1) shifting to more efficient modes of transport: promoting use of public transport and restricting car traffic, aimed at maintaining zero growth in car traffic in major urban areas; investing in infrastructure for a wider array of forms of transport, including rail, cycling and walking, to reduce vehicle miles travelled; and introducing mass rapid transit and expanding rail

[11] As footnote 5 above.

[12] IPCC. 2018. *IPCC Special Report on the Impacts of Global Warming of 1.5 °C above Pre-industrial Levels and Related Global Greenhouse Gas Emission Pathways in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*. V Masson-Delmotte, P Zhai, H-O Pörtner, et al. (eds.). Geneva: World Meteorological Organization. Available at https://www.ipcc.ch/sr15/.

[13] In the IEA report on Net Zero by 2050 (see footnote 23 below), unabated coal-fired electricity generation is projected to be phased out in developed country Parties by 2030 and in all other regions by 2040 in its 1.5 °C-consistent 'net zero emissions by 2050' scenario, the aim of which is to ensure that energy-related and industrial process CO_2 emissions are consistent up to 2030 with the emission pathways to 1.5 °C with no or limited overshoot in the SR1.5.

[14] As footnote 5 above.

[15] Covers measures targeting emissions from fuel use in transport.

networks; (2) shifting to low- or zero-carbon fuels: developing a regulation to increase the required share of renewables in gasoline to 15 per cent by 2030; increasing the share of trucks and buses using compressed natural gas to 25 per cent by 2030; achieving an average national blending rate of ethanol with gasoline of 20 per cent; and increasing the amount of ships fuelled by liquified natural gas; and (3) electrification: developing a network of charging stations for electric vehicles; developing 'gigafactories' for producing batteries for electric vehicles at scale; and exempting electric vehicles from value added and registration tax.

13. For the 113 Parties that communicated new or updated NDCs, energy efficiency improvement, electrification and shifting to more efficient modes of transport continued as in their previous NDCs to be the most frequently indicated mitigation options in this priority area.

14. According to the SR1.5, electrification[16] is one of the primary means of decarbonizing energy end-use sectors, including transport and buildings, with the electricity sector to be completely decarbonized by mid-century on 1.5 °C-consistent emission pathways. In this context, it identifies phasing out the sale of fossil fuel passenger vehicles by 2035–2050 as a benchmark for aligning with 1.5 °C-consistent pathways. A few Parties communicated measures compatible with that benchmark, including ending the sale of new petrol and diesel cars and vans by 2030, with all vehicles required to have zero-emission capability from 2030; and banning new registration of diesel and gasoline vehicles after 2030.

C. Buildings

15. Buildings accounted for around 3.5 Gt CO_2, or 10 per cent[17] of direct energy-related CO_2 emissions, globally in 2018. In this priority area,[18] cross-cutting was by far the most frequently identified sub-area (see figure 2). Some Parties indicated measures targeting emissions from residential buildings and some measures for commercial or institutional buildings.

16. Energy efficiency improvement was the mitigation option by far most frequently indicated by Parties in all sub-areas (see figure 3). Measures for improving energy efficiency include disseminating modern and efficient cookstoves to reduce firewood and fossil fuel consumption; promoting use of thermal insulation in renovating houses; and introducing minimum energy performance standards and appliance labelling schemes.

17. In terms of the other most frequently indicated mitigation options in this area, some Parties indicated shifting to low- or zero-carbon fuels and some mentioned cross-cutting options. Measures relevant to these options include (1) shifting to low- or zero-carbon fuels: offering loans and grants for installing solar thermal water heaters; blending hydrogen into the gas distribution grid for lower-carbon domestic heating and cooking without affecting customer experience; and banning use of mineral oil for heating buildings; and (2) cross-cutting: introducing a future home standard to reduce the buildings' CO_2 emissions by 75–80 per cent; and implementing sustainability guidelines for hotels and requiring monthly reporting of their CO_2 emissions.

18. The SR1.5 states that, since the buildings sector is characterized by very long-standing infrastructure, steps must be taken immediately to avoid lock-in of inefficient carbon- and energy-intensive buildings. In this context, by 2020 newly constructed buildings were projected to need to be nearly zero energy to be aligned with 1.5 °C-consistent emission pathways.[19] Some Parties communicated corresponding measures, such as requiring buildings constructed since 1 January 2020 to be nearly zero energy; and requiring all new buildings to be nearly zero energy by 31 December 2020 by implementing a national plan

[16] In the IEA report on Net Zero by 2050, electric vehicles are projected to account for 64 per cent of car sales in 2030 in its 1.5 °C-consistent scenario, compared with 5 per cent in 2020.

[17] As footnote 5 above.

[18] Covers measures targeting emissions from fuel use in buildings.

[19] According to the 1.5 °C-consistent emissions scenario in the IEA report on Net Zero by 2050, all new buildings need to comply with 'zero carbon ready' building standards by 2030 and around 20 per cent of existing buildings need to be retrofitted by 2030.

for increasing the number of nearly-zero-energy buildings with targets differentiated by building category.

D. Industry

19. Industry accounted for around 7.9 Gt CO_2, or 23 per cent[20] of direct energy-related CO_2 emissions, globally in 2018. Parties mentioned domestic mitigation measures in this priority area[21] much less frequently than in the other areas,[22] although many covered industrial processes and product use as one of the sectors in their NDCs.

20. Cross-cutting was the main sub-area for measures (see figure 2). Some Parties communicated measures targeting emissions from mineral industry (e.g. cement, ceramics), a few measures specific to chemical industry (e.g. ammonia, adipic acid) and a few measures for metal industry (e.g. iron and steel, aluminium).

21. Unlike in the other priority areas, no mitigation option was particularly frequently referred to in this area, but the most frequently indicated was energy efficiency improvement (see figure 3), particularly in the cross-cutting sub-area. Measures for improving energy efficiency include using waste heat from cement plants; evaluating the performance of installed air-conditioning and refrigeration systems and developing recommendations for improving them through industrial energy efficiency audits; and introducing grant schemes to cover the high upfront cost of investing in improving energy efficiency.

22. The other mitigation options referred to in this area include shifting to low- or zero-carbon fuels or feedstock, material efficiency improvement and cross-cutting options. Measures relevant to these options include (1) shifting to low- or zero-carbon fuels or feedstock: using alternative fuels, such as biomass, as a substitute for fossil fuels in cement production; and adopting pollution control laws to encourage industries to switch to cleaner fuel sources such as natural gas; (2) material efficiency improvement: chemical recycling of waste plastic at steel plants; and using fly ash, natural pozzolans or other materials as substitutes for clinker in cement production; and amending national standards for cement production to increase ash and other materials used as substitutes for clinker in line with industry standards; and (3) cross-cutting: expediting the adoption of clean technologies by large emitters through a fund; and improving industry regulation, including via periodic energy audits and controls.

23. According to the IEA reports on Net Zero by 2050[23] and Energy Technology Perspectives 2017,[24] energy efficiency improvement, material efficiency improvement and shifting to low- or zero- carbon fuels (see para. 22 above) play the most important role in their 1.5 °C-consistent scenarios up to 2030; while alternative low-carbon industrial processes, CCS[25] and CCUS are crucial in the longer term[26] and will thus need to be scaled up by 2030. A few Parties communicated measures for shifting to alternative low-carbon industrial processes, such as introducing next-generation coke-making processes and deploying hydrogen reduction steelmaking. A few Parties mentioned CCS and/or CCUS, indicating measures for investing in research, development and demonstration to improve the commercial viability of CCUS technologies; introducing an investment tax credit for capital

[20] As footnote 5 above.

[21] Covers measures targeting emissions from fuel use in industry, industrial process emissions and emissions from product use.

[22] See document FCCC/PA/CMA/2021/8, figures 3 and 12.

[23] IEA. 2021. *Net Zero by 2050: A Roadmap for the Global Energy Sector*. Paris: IEA. Available at https://www.iea.org/reports/net-zero-by-2050.

[24] IEA. 2017. *Energy Technology Perspectives 2017: Catalysing Energy Technology Transformations*. Paris: IEA. Available at https://www.iea.org/reports/energy-technology-perspectives-2017.

[25] The SR1.5 states that CCS will play a major role in decarbonizing the industry sector, especially for industries with higher process emissions, such as cement, iron and steel, and that the projected long lead times and need for technological innovation will necessitate early scale-up of CCS in the industry sector in the context of 1.5 and 2 °C pathways.

[26] According to the 1.5 °C-consistent emissions scenario in the IEA report on Net Zero by 2050, almost 60 per cent of emission reductions in the industry sector by 2050 are to be achieved using technologies that are currently under development, such as CCUS and hydrogen technologies.

invested in CCUS projects, with the aim of capturing at least 15 Mt CO_2 annually; and establishing CCUS in two industrial clusters by the mid-2020s and four industrial clusters by 2030 with a view to capturing up to 10 Mt CO_2 annually.

E. Agriculture

24. In the priority area of agriculture,[27] cross-cutting was the most frequently identified sub-area (see figure 2). Some Parties identified domestic mitigation measures targeting emissions from cropland and crop production, some measures for grazing land and livestock production and a few measures for fisheries.

25. Cross-cutting mitigation options were by far the most frequently indicated in this area (see figure 3). Relevant measures include promoting post-harvest grazing of cereal regrowth to reduce land-use residues and mitigate enteric emissions from livestock; implementing sustainable soil management, including precision, conservation and organic agriculture; and applying management and technology solutions in cultivation and husbandry.

26. The other most frequently indicated mitigation options in this area include improved management of manure and herds, improved cropland management, improved agricultural productivity, agroforestry and improved fertilizer management. Measures relevant to these options include (1) improved management of manure and herds: constructing biodigesters for farmers, aimed at reducing CH_4 emissions by 85 per cent below the 2000 level and reducing use of fuelwood; introducing a delivery support scheme to increase livestock manure use for biogas production; and promoting use of specific livestock feed (i.e. legume fodder species) for reducing CH_4 emissions from enteric fermentation; (2) improved cropland management: introducing crop rotation, terracing and multi-cropping; implementing no-till farming; and introducing further permanent agricultural systems to replace traditional shifting-cultivation methods; (3) improved agricultural productivity: mass adoption of rice production technology to increase yield and reduce waste; and setting up hydro- and agrometeorological stations and a climate data centre, and holding participatory technical round tables to develop an agroclimatic information system by 2025; (4) agroforestry: increasing cocoa cultivation in agroforestry systems to enhance carbon stock; and introducing agroforestry and silvopastoral systems to restore degraded land by 2050; and (5) improved fertilizer management: increasing the number of organic fertilizer production plants to 100 by 2030; and introducing slow-release fertilizers and/or adjusting the timing of fertilizer application in at least 20 per cent of the area used for winter agricultural crops, including corn and sorghum, by 2025.

27. According to the SR1.5, to be consistent with 1.5 °C pathways with limited or no overshoot, CH_4[28] and N_2O emissions from agriculture need to decrease by 11–30 per cent and –4–21 per cent,[29] respectively, below the 2010 level by 2030. Mitigation options relevant to reducing CH_4 and N_2O emissions include improved management of manure and herds, improved fertilizer management (see para. 26 above) and improved water management in rice production. A few Parties communicated measures for improving water management in rice production, such as converting irrigated rice fields to intensive rice production systems, thus reducing both the volume of water used and the amount of CH_4 emitted; and introducing intermittent irrigation technology with alternate wetting and drying of soils in at least 10 per cent of the rice crop area by 2025.

28. A few Parties mentioned dietary shift to less-emission-intensive foods, indicating measures for promoting consumption of local produce and establishing a sustainable food system that contributes to reducing GHG emissions. The SR1.5 projects that dietary shift to

[27] Covers measures targeting emissions from fuel use in agriculture and non-fuel sources such as livestock and soil management.

[28] In the SR1.5, it is estimated that emissions from the livestock supply chain amount to 7.1 Gt CO_2 annually, equivalent to 14.5 per cent of global anthropogenic GHG emissions, and that CH_4 emissions from rumen fermentation of cattle account for about two thirds of that total.

[29] The interquartile ranges pertaining to the reduction of global agricultural CH_4 and N_2O emissions by 2030 (below the 2010 level) in the modelled emission pathways that limit global warming to 1.5 °C with no or limited overshoot in the SR1.5.

less-emission-intensive foods could account for 20 per cent of the mitigation needed to hold global warming below 2 °C as well as reduce demand for land, including for production of livestock feed and bioenergy.

F. Land use, land-use change and forestry

29. In the priority area of LULUCF,[30] the two main sub-areas of domestic mitigation measures identified by Parties were cross-cutting and forestry (see figure 2). Some Parties communicated measures targeting emissions from wetlands and a few those from settlements.

30. Of the mitigation options indicated in this area, afforestation, reforestation and revegetation was most frequently mentioned (see figure 3). Relevant measures include increasing reforestation rates through public–private partnership using endemic tree species that are more resistant to pests and diseases; planting and developing forests, prioritizing production forests, large timber forests and coastal forests; and increasing seedling density in forest land to enhance net carbon sequestration.

31. In terms of the other most frequently indicated mitigation options in this area, some Parties indicated cross-cutting options, some sustainable forest management and some reduced deforestation and forest degradation. Measures relevant to these options include (1) cross-cutting: expanding the national protection system for forest and wetlands; implementing regulations to ensure that emissions do not exceed removals; and developing a capacity-building plan for institutions responsible for monitoring forest and land-use change; (2) sustainable forest management: developing mechanisms to promote sustainable community use of key mangroves to improve livelihoods; implementing sustainable logging policies, quantifying forest carbon sequestration and protecting forests above 400 m contour; and increasing forests under community-based management to at least 60 per cent of the national forest cover, and achieving 50 per cent female representation in the management committees; and (3) reduced deforestation and forest degradation: expanding early warning systems for deforestation; promoting downstream processing of logs; and drafting and implementing zero-deforestation agreements with meat chains and palm oil and cocoa farmers.

32. For the 113 Parties that communicated new or updated NDCs, afforestation, reforestation and revegetation, and sustainable forest management continued as in their previous NDCs to be the most frequently indicated mitigation options in this priority area.

33. According to the SR1.5, to be consistent with 1.5 °C pathways with limited or no overshoot, measures need to be taken to remove 100–1,000 Gt CO_2[31] by 2100, with measures related to agriculture, forestry and other land use projected to remove 0–5 Gt CO_2 in 2030. In this context, the SR1.5 projects a significant increase in forest cover on 1.5 and 2 °C pathways compared with 'no climate policy' baselines[32] as a result of reduced deforestation and forest degradation, and afforestation, reforestation and revegetation (see paras. 30–31 above). A few Parties communicated quantitative targets for increasing national forest cover, such as increasing forest cover to 60 per cent of the national territory without competing for land with the agriculture sector.

[30] Covers measures targeting emissions from fuel use in forestry and non-fuel emissions sources such as land-use change and changes to carbon pools in land-use categories, except cropland and grazing land, which are covered under agriculture.

[31] In the context of 1.5 °C-consistent pathways, such measures serve to offset residual emissions and, in most cases, help to achieve net negative emissions in order to return to a 1.5 °C pathway following an overshoot.

[32] According to the SR1.5, on 1.5 °C-consistent pathways, land needs to be converted to forest land at a rate of –4.8–23.7 Mha/year in 2010–2030 compared with 'no climate policy' baselines of –13.6–3.3 Mha/year. The extent of expansion of forest cover varies greatly across the models in the SR1.5, with some projecting virtually constant and some slightly declining forest cover.

G. Waste

34. In the priority area of waste,[33] solid waste disposal was by far the most frequently identified sub-area (see figure 2). Some Parties communicated measures targeting emissions from wastewater treatment and some indicated measures in the cross-cutting sub-area.

35. The most frequently indicated mitigation option in this area was waste recycling (see figure 3). Relevant measures include operating a centralized facility for recycling industrial waste from the clothing sector; promoting sorted collection and recycling of plastic containers and packaging; and implementing waste regulations to increase recycling for a number of waste types and introducing a tax on drinks packaging.

36. The other most frequently indicated mitigation options in this area include waste reduction, waste-to-energy and cross-cutting options. Measures relevant to these options include (1) waste reduction: taking action through voluntary agreements with food industry and expanding food waste collection to ensure that no food waste goes to landfill by 2030; reducing single-use plastic waste and the resulting emissions from its incineration; and encouraging the hospitality sector to adopt efficient food production practices through a nationwide food waste pledge aimed at halving food waste by 2030; (2) waste-to-energy: promoting energy generation from sewage systems; extracting and using landfill gas for power generation; and introducing CH_4 capture and burning in solid waste disposal systems for power generation; and (3) cross-cutting: developing a national organic waste strategy to increase recovery of municipal organic waste; and creating an enabling environment for both the public and private sector to treat industrial and municipal waste, including faecal sludge, by 2030.

37. According to the SR1.5, decreasing food waste and loss[34] could not only help to reduce direct emissions from the decomposition of organic waste, but also facilitate land transitions in line with 1.5 °C-consistent pathways by reducing demand for land, including for production of food and livestock feed, that may compete with demand for land for afforestation. A few Parties communicated measures for reducing food waste as part of waste reduction (see para. 36 above). A few indicated measures for reducing post-harvest losses in agriculture, such as improving food storage systems.

H. Cross-cutting or other

38. In the area of cross-cutting or other, multisector energy efficiency improvement was the mitigation option by far most frequently indicated by Parties (see figure 3). Relevant measures include introducing periodic tariff reforms for residential, commercial and industrial power consumption to advance cost-reflective pricing and encourage energy conservation; implementing energy management systems in line with national and international standards, including those of the International Organization for Standardization; implementing minimum energy performance standards and labelling regulations; and raising public awareness of means of reducing energy use.

39. For the 113 Parties that communicated new or updated NDCs, multisector energy efficiency improvement continued as in their previous NDCs to be the main mitigation option identified in this priority area.

40. The other most frequently indicated mitigation options in this area include multisector carbon pricing, promotion of circular economy and multisector F-gas substitution. Measures relevant to these options include (1) multisector carbon pricing: expanding coverage of the national emissions trading scheme to reduce GHG emissions efficiently; promoting a

[33] Covers measures targeting emissions from fuel use in waste and waste management and non-fuel sources such as decomposition of organic materials in solid waste and wastewater.

[34] The SR1.5 refers to food waste as inappropriate human consumption that leads to food spoilage associated with inferior quality or overproduction, and food loss as the decrease in mass and nutritional value of food due to poor infrastructure, logistics and lack of storage technologies. It is projected in the SR1.5 that food loss and waste may lead to a projected annual increase in emissions of 1.9–2.5 Gt CO_2 eq.

domestic carbon offsetting scheme to facilitate mobilization of funds for domestic mitigation measures; and imposing a carbon tax on facilities directly emitting GHGs beyond a fixed threshold; (2) promotion of circular economy: developing a circular economy road map for 2020–2040 with short-, medium- and long-term measures; establishing metrics and indicators for circularity; and banning import, manufacture, distribution and use of single-use plastic bags and straws; and (3) multisector F-gas substitution: implementing a regulation aimed at reducing F-gas emissions by 66 per cent below the 2014 level by 2030 by limiting total sales of certain F-gases, banning use of F-gases in many new types of equipment and preventing emissions of F-gases from existing equipment; and phasing out use of hydrofluorocarbons, including in refrigeration equipment for food storage and distribution, and promoting uptake of sustainable refrigeration and cold chain technologies.

41. Mitigation options related to circular economy[35] were also identified in other priority areas, such as waste reduction, waste recycling, waste-to-energy and composting under waste, and material efficiency improvement under industry.

42. A few Parties mentioned promoting production and use of hydrogen, indicating measures for scaling up new energy sources and carriers such as carbon-free hydrogen; fostering growth in the hydrogen industry, such as developing technologies for hydrogen production, storage and use; and establishing a hydrogen export hub to boost the hydrogen industry, and funding research collaboration and supply chain studies to enable demonstration and deployment. The SR1.5 states that hydrogen will play a considerable role as a substitute for fossil-based non-electrical energy on some 1.5 °C-consistent pathways.[36]

[35] Circular economy refers to the continual use of resources and minimization of waste to reduce demand for exploiting new resources, including minerals, fossil fuels and biomass.

[36] According to the 1.5 °C-consistent scenario in the IEA report on Net Zero by 2050, global annual use of hydrogen is projected to expand from less than 90 Mt to more than 200 Mt in 2020–2030 and the proportion of low-carbon hydrogen in the global annual use is projected to rise from 10 to 70 per cent in 2020–2030 as a result of using low-carbon hydrogen in place of fossil fuels, such as for generating electricity in power plants and blending with natural gas in the grid.