**Supplementary Material 1**

**Integration of Short-Lived Climate Pollutant and Air Pollutant Mitigation in Nationally Determined Contributions**

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**Table S1:** Overview of framework for assessment of integration of SLCPs and air pollutant within NDC document, and associated plans, strategies and reports

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| --- | --- | --- |
| Area | Analytical Questions | Data Extracted |
| General |  |  |
| Information included in NDC | * Does the NDC include a quantitative GHG reduction target? * Does the NDC include policies and measures to achieve target? * Does the NDC include implementation mechanisms to achieve the target? * How does the NDC relate to other climate change plans and reporting (NC, BURs, CCAP, Long-term strategies etc.)? | Yes/No  Yes/No  Yes/No  Description of relationship |
|  |  |  |
| SLCP/Air Pollution Focused |  |  |
| Framing | * Does the NDC mention ‘health’ as a co-benefit of climate change mitigation? * Does the NDC refer to ‘SLCPs’? * Does the NDC mention ‘air pollution’ | Yes/No  Yes/No  Yes/No |
| Targets | * Does the NDC include a target to reduce black carbon? * Does the NDC contain a target for methane mitigation? * Does the NDC contain a target for HFC mitigation? | Yes/No; level of ambition  Yes/No; level of ambition  Yes/No; level of ambition |
| Mitigation Measures (described in Table 2) | * Does the NDC contain specific mitigation measures in key SLCP and air pollutant emitting source sectors? | Yes/No; specific mitigation measures grouped according to definitions in Table 2 |

**Table S2:** Number of countries including specific mitigation measures relevant for SLCP and air pollutant mitigation in pre-2020 (n = 159) and post-2020 (n = 167) NDCs. Note post-2020 NDCs includes submissions from 39 countries submitted before 2020 that have not updated their NDC after 2020.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Source | Measure | Main pollutants reduced by implementation | No. of countries including in pre-2020 NDCs | Percent countries including in pre-2020 NDCs | No. of countries including in post-2020 NDCs | Percent countries including in post-2020 NDCs |
| 1 | Energy-Transport | Introduction of vehicle emission standards (e.g. Euro standards), including vehicle inspection and maintenance programmes | Black Carbon, air pollutants | 36 | 22.6 | 52 | 31.1 |
| 2 | Energy-Transport | Increase percentage of electric vehicles in vehicle fleet | GHGs, SLCPs and air pollutants | 33 | 20.8 | 89 | 53.3 |
| 3 | Energy-Transport | Increase percentage of hydrogen vehicles in vehicle fleet | GHGs, SLCPs and air pollutants | 1 | 0.6 | 10 | 6.0 |
| 4 | Energy-Transport | Increase efficiency of vehicles (e.g. hybrid vehicles, efficiency standards) | CO2 | 69 | 43.4 | 83 | 49.7 |
| 5 | Energy-Transport | Modal shift for passenger transport through shift to increased use of public transport, and increases in walking and cycling, to reduce number of journeys taken by passenger cars | GHGs, SLCPs and air pollutants | 70 | 44.0 | 87 | 52.1 |
| 6 | Energy-Transport | Improve quality of fuels (i.e. reduced sulphur content) | SO2 | 11 | 6.9 | 10 | 6.0 |
| 7 | Energy-Transport | Increase percentage of vehicles using natural gas and LNG, and CNG | GHGs, SLCPs and air pollutants | 16 | 10.1 | 26 | 15.6 |
| 8 | Energy-Transport | Modal shift for freight transport (e.g. road to rail, shipping or aviation) | GHGs, SLCPs and air pollutants | 15 | 9.4 | 27 | 16.2 |
| 9 | Energy-Transport | Improve road networks/infrastructure to improve efficiency and decrease traffic | GHGs, SLCPs and air pollutants | 23 | 14.5 | 28 | 16.8 |
| 10 | Energy-Transport | Increase proportion of biofuels in transport fuel mix | CO2 | 28 | 17.6 | 32 | 19.2 |
| 11 | Energy-Transport | Fuel switch in rail from diesel/coal to electricity (i.e. electrification of railways) | GHGs, SLCPs and air pollutants | 7 | 4.4 | 12 | 7.2 |
| 12 | Energy-Transport | Fuel switch to cleaner fuels/increase energy efficiency in aviation and shipping transport | GHGs, SLCPs and air pollutants | 7 | 4.4 | 24 | 14.4 |
| 13 | Energy- Residential | Increase percentage of households cooking and heating using more efficient biomass stoves | GHGs, SLCPs and air pollutants | 48 | 30.2 | 54 | 32.3 |
| 14 | Energy- Residential | Increase percentage of households cooking and heating using less polluting fuels (e.g. LPG, electricity) | GHGs, SLCPs and air pollutants | 38 | 23.9 | 48 | 28.7 |
| 15 | Energy- Residential | Increase energy efficiency in the residential sector (e.g. increasing efficiency of appliances, retrofitting homes) | GHGs, SLCPs and air pollutants | 110 | 69.2 | 132 | 79.0 |
| 16 | Energy- Residential | Increase proportion of population using solar water heaters | GHGs, SLCPs and air pollutants | 17 | 10.7 | 22 | 13.2 |
| 17 | Energy- Residential | Reduce proportion of households using kerosene for lighting | GHGs, SLCPs and air pollutants | 4 | 2.5 | 6 | 3.6 |
| 18 | Energy - Industry | Replace traditional brick kilns with more efficient brick production techniques | GHGs, SLCPs and air pollutants | 3 | 1.9 | 8 | 4.8 |
| 19 | Energy - Industry | Improve energy efficiency in industry | GHGs, SLCPs and air pollutants | 86 | 54.1 | 99 | 59.3 |
| 20 | Energy - Industry | Fuel switch to less polluting fuels in industry | GHGs, SLCPs and air pollutants | 24 | 15.1 | 45 | 26.9 |
| 21 | Energy - Industry | Increase efficiency of carbonisation in charcoal production (i.e. more efficiency charcoal kilns) | GHGs, SLCPs and air pollutants | 12 | 7.5 | 12 | 7.2 |
| 22 | Energy - Electricity Generation | Replace fossil fuel-based electricity generation with renewable alternatives (on- and off-grid) including wind, solar, geothermal, tidal, nuclear | GHGs, SLCPs and air pollutants | 138 | 86.8 | 154 | 92.2 |
| 23 | Energy - Electricity Generation | Reduce transmission and distribution losses from electricity grid | GHGs, SLCPs and air pollutants | 39 | 24.5 | 70 | 41.9 |
| 24 | Energy - Electricity Generation | Increase efficiency of fossil-fuel based power generation | GHGs, SLCPs and air pollutants | 35 | 22.0 | 40 | 24.0 |
| 25 | Energy - Electricity Generation | Switch electricity generation from coal, fuel oil, or diesel to natural gas or biomass | GHGs, SLCPs and air pollutants | 18 | 11.3 | 20 | 12.0 |
| 26 | Energy - Commercial and Public Services | Increase energy efficiency in commercial and public services sector | GHGs, SLCPs and air pollutants | 105 | 66.0 | 126 | 75.4 |
| 27 | Energy - Commercial and Public Services | Fuel switch to lower polluting fuels in the commercial and public services sector | GHGs, SLCPs and air pollutants | 11 | 6.9 | 20 | 12.0 |
| 28 | Energy - Oil, Gas and Coal Production | Reduce gas flaring in oil and gas sector | CO2, balck carbon, methane, VOCs | 14 | 8.8 | 18 | 10.8 |
| 29 | Energy - Oil, Gas and Coal Production | Minimise venting, flaring and fugitive emissions from oil and gas sector | CH4, VOCs, CO2 | 19 | 11.9 | 29 | 17.4 |
| 30 | Energy - Oil, Gas and Coal Production | Minimise methane emissions from coal mining | CH4 | 4 | 2.5 | 4 | 2.4 |
| 31 | Energy - Oil, Gas and Coal Production | No further exploration, expansion of oil and gas infrastructure | CO2, balck carbon, methane, VOCs | 0 | 0.0 | 1 | 0.6 |
| 32 | Energy - Agriculture | Increase energy efficieny and/or switch to lower polluting fuels in agriculture | GHGs, SLCPs and air pollutants | 13 | 8.2 | 29 | 17.4 |
| 33 | Industrial Processes and Product Use | Replace HFC with alternatives in contained and emissive applications (e.g. implementation of Kigali Amendment) | HFCs | 13 | 8.2 | 46 | 27.5 |
| 34 | Industrial Processes and Product Use | Replace clinker with alternatives in cement production | CO2 | 14 | 8.8 | 33 | 19.8 |
| 35 | Agriculture | Reduce emissions from livestock enteric fermentation (e.g. through feed optimization, breeding and genetic improvements) | Methane | 21 | 13.2 | 48 | 28.7 |
| 36 | Agriculture | Reduce emissions from livestock manure management | Methane, N2O, NH3 | 33 | 20.8 | 57 | 34.1 |
| 37 | Agriculture | Implement intermittent aeration of continuously flooded rice paddy fields | Methane | 19 | 11.9 | 32 | 19.2 |
| 38 | Agriculture | Eliminate open burning of agricultural waste (including by using residue as feed/fuel, or incorporating back into soil) | Black Carbon, air pollutants | 16 | 10.1 | 22 | 13.2 |
| 39 | Agriculture | Increase efficiency of synthetic and organic fertilizer application | N2O, NH3 | 19 | 11.9 | 34 | 20.4 |
| 40 | Agriculture | Increase soil organic carbon and/or implement conservation agriculture techniques | CO2 | 30 | 18.9 | 46 | 27.5 |
| 41 | Agriculture | Increase proportion of people with diets that have lower climate impact (e.g. reducing red meat consumption) | CO2, Methane, N2O, NH3 | 1 | 0.6 | 3 | 1.8 |
| 42 | Agriculture | Reduce proportion of food wasted | CO2, Methane, N2O, NH3 | 0 | 0.0 | 8 | 4.8 |
| 43 | Waste | Reduce methane emissions from solid waste at landfill sites (including methane capture and use for waste to energy) | Methane | 72 | 45.3 | 101 | 60.5 |
| 44 | Waste | Reduce open burning of municipal solid waste (including by increasing waste collection) | Black carbon, air pollutants | 11 | 6.9 | 19 | 11.4 |
| 45 | Waste | Increase percentage of solid waste separated and diverted to be recycled or composted | Methane | 51 | 32.1 | 91 | 54.5 |
| 46 | Waste | Reduce solid waste generation at source | Methane, Black Carbon, air pollutants | 14 | 8.8 | 30 | 18.0 |
| 47 | Waste | Upgrade wastewater treatment plants with methane gas recovery (or use biodigesters) | Methane | 30 | 18.9 | 54 | 32.3 |
| 48 | Forestry and Other Land Use | Control forest and peatland fires | GHGs, SLCPs and air pollutants | 17 | 10.7 | 21 | 12.6 |
| 49 | Forestry and Other Land Use | Increase reforestation and avoid deforestation | CO2 | 92 | 57.9 | 123 | 73.7 |
| 50 | Forestry and Other Land Use | Reduce land degradation | CO2 | 73 | 45.9 | 108 | 64.7 |