Climate Super Pollutants
A short guide

Introduction

The global call to action on climate change is clear – to have any chance of limiting warming to 1.5°C, we must reduce global greenhouse gas emissions to at least 43 per cent below 2019 levels by 2030. For this to happen, immediate action must be taken to ensure that global emissions peak before 2025 and are then rapidly and sustainedly reduced for the rest of the decade.

Meeting this target will require substantial reductions in global CO₂ emissions, but there are a number of other greenhouse gases that contribute significantly to climate change and these must also be addressed.

Together, methane, nitrous oxide, F-gases and ozone-depleting substances (ODS) make up more than one-quarter of our annual greenhouse gas emissions globally. To avoid catastrophic climate change, rapid and sustained reductions are also required in emissions of these gases, many of which are short-lived climate pollutants (SLCP) that have a disproportionate impact on warming in the near term.

Non-CO₂ anthropogenic greenhouse gas emissions (Gt CO₂-eq yr⁻¹)

Sources: IPCC, AR6 Working Group III Full Report (CO₂, CH₄, N₂O & F-gases); WMO, Scientific Assessment of Ozone Depletion 2022 (ODS)
Ozone-Depleting Substances (ODS): CFCs & HCFCs

Profile
Global Warming Potentials: GWP100: 46.6-16,200 | GWP20: 168-12,700
Main emission sources: Leaking ‘banks’ of equipment and products containing these chemicals (e.g., cooling equipment and insulation foams) and emissions from industrial fluorochemical production.
Lifetimes in the atmosphere: 0.9-640 years

Impact of emissions
Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) have contributed almost 10 per cent of global warming to date. The phase-out of ODS under the Montreal Protocol will avoid an estimated 0.5-1°C in additional global warming by 2050, with additional warming avoided through mitigating the impact of increased UV radiation on the amount of carbon held in plants and soils. Nonetheless, annual CFC and HCFC emissions are still comparable to those of HFCs in CO₂-equivalent terms and can be significantly reduced.

Future action needed
To safeguard the goal of limiting warming to 1.5°C, radiative forcing from CFCs and HCFCs (i.e., the extent to which they contribute to global warming) must be reduced 12 per cent by 2030 and 38 per cent by 2050.

Immediate action to address CFCs and HCFCs
Parties to the Montreal Protocol should strictly limit current exemptions from the ODS phase-outs that relate to fluorochemical production and support the development of a global mechanism to reduce emissions of ODS through improved life-cycle refrigerant management, including collection and destruction of global ODS banks.

F-gases: Hydrofluorocarbons (HFCs)

Profile
Global Warming Potentials: GWP100: 4.8-14,600 | GWP20: 17.4-12,400
Main emission sources: HFCs are synthetic chemicals used primarily as refrigerants in cooling equipment, as foam-blowing agents and in aerosols and fire protection. Production of HCFC-22, an ODS, primarily for its use as a feedstock to produce other chemicals, results in significant by-product emissions of HFC-23.
Lifetimes in the atmosphere: 0.2-228 years

Impact of emissions
Since 2016, the radiative forcing of HFCs in the atmosphere has increased by about one-third. F-gas emissions (primarily HFCs) have increased by 254 per cent since 1990 and are responsible for 0.1°C of the warming we have experienced so far. HFC emissions alone are responsible for two per cent of current global GHG emissions.

Future action needed
To remain consistent with the 1.5°C pathway, annual emissions of HFCs must be reduced by 75-80 per cent by 2050, compared to 2010 levels.

Immediate action to address HFCs
HFCs are controlled by the Kigali Amendment to the Montreal Protocol, which aims to phase down HFC production and consumption by approximately 80 per cent by 2045. Scientific studies clearly show that the current schedule is not sufficiently ambitious to meet the 1.5°C Paris target, therefore Parties to the Montreal Protocol must look to accelerate the HFC phase-down through an adjustment to the Kigali Amendment. National and sub-national governments, and major corporate end-users, should also take leadership to implement policies consistent with an accelerated phase-down and complete phase-out of HFCs by mid-century.
### Nitrous Oxide (N₂O)

**Profile**
- **Global Warming Potentials:** GWP100: 273 | GWP20: 273
- **Main emission sources:** The major anthropogenic sources of N₂O are agriculture (mostly from nitrogen-based fertilisers), nitric and adipic acid production, fossil fuel power generation, wastewater treatment and biomass burning. Natural sources of N₂O are also prevalent, but these are essential to the proper functioning of the Earth's nitrogen cycle.
- **Lifetimes in the atmosphere:** 109 years

**Impact of emissions**
Human caused N₂O emissions have increased by 33 per cent since 1990 and have already contributed 0.1°C of global warming relative to 1850-1900. N₂O is also the most prevalent ozone-depleting substance in the world today and poses a serious threat to the recovery of the ozone layer.

**Future action needed**
To remain consistent with the 1.5°C pathway, annual emissions of N₂O must be reduced by 22 per cent by 2030 and 25 per cent by 2050, compared to 2015 levels.

**Immediate action to address N₂O**
The technology to abate almost all industrial emissions of N₂O already exists. In countries and regions where there are no requirements to abate industrial N₂O emissions, regulations must be introduced as a priority. This is a clear, cost-effective and immediate opportunity to prevent a substantial quantity of unnecessary greenhouse gas emissions.

### Methane (CH₄)

**Profile**
- **Global Warming Potentials:** GWP100: 27.9 | GWP20: 81.2
- **Main emission sources:** Agriculture (especially from livestock, manure management and rice cultivation), fossil fuel production and use (including from coal and oil extraction, as well as from fossil gas extraction, processing and use), and from waste processes and facilities such as landfills and sewage treatment.
- **Lifetimes in the atmosphere:** 11.8 years

**Impact of emissions**
Methane is the second most important greenhouse gas and accounts for almost one-third of warming observed to date. Emissions of methane have increased by 29 per cent since 1990 and have already contributed 0.5°C of warming relative to 1850-1900.

**Future action needed**
In pathways that limit warming to 1.5°C, with no or limited overshoot, global methane emissions must be reduced by 34 per cent below 2019 levels by 2030, and 44 per cent below 2019 levels by 2040.

**Immediate action to address methane**
At CoP26 in 2021, the EU and US launched the Global Methane Pledge, setting out a collective goal of reducing methane emissions by 30 per cent by 2030. To ensure its implementation, countries need to develop and implement a robust global governance framework around the Global Methane Pledge that incorporates clear national targets and mitigation measures, comprehensive monitoring, reporting and verification (MRV) and a dedicated financial mechanism to ensure sustained financial support and capacity-building.