Task Force 6
Accelerating SDGs: Exploring New Pathways to the 2030 Agenda

DEVELOPING A GLOBAL NITROUS OXIDE REDUCTION POLICY FOR A FOOD-SECURE FUTURE

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Abstract

Multilateral approaches to nitrogen pollution are generating synergies between climate change and food security and presenting opportunities to reduce nitrous oxide (N_2O) globally. N_2O is the most abundant ozone-depleting substance not yet regulated by the Montreal Protocol and a powerful greenhouse gas. Failure to reduce emissions will delay ozone layer recovery and worsen the climate crisis. While cost-effective mitigation technologies to reduce N_2O emissions are available, policies and incentives to encourage the uptake of such measures are lacking. The G20, whose membership includes the world's largest food exporters and fertiliser consumers, is positioned to advance N_2O mitigation by supporting coordinated multilateral action. G20 leadership on N_2O can support food security by preventing drastic impacts of climate change on food production and safeguarding the ozone layer, which protects agriculture and biodiversity from harmful ultra-violet B radiation. It can also support the achievement of countries' net-zero climate goals and nationally determined contributions.

The Challenge

1

Quickly cutting global anthropogenic nitrous oxide (N_2O) emissions must be part of any fast climate mitigation strategy to bend down the warming curve in the near-term to slow self-amplifying feedbacks and avoid, or at least slow, passing irreversible and potentially catastrophic tipping points.[1] N_2O is an ozone-depleting substance (ODS) and a potent greenhouse gas (GHG). Its global warming potential over 20 years (GWP_{20}) and 100 years (GWP_{100}) is 273 times greater than total carbon dioxide (CO_2),[2] making it a significant contributor to climate change. Moreover, with the success of the Montreal Protocol in phasing out other ODSs, continued N_2O emissions could delay full recovery of the ozone layer,[3] and may damage crop productivity as a result of exposure to ultraviolet radiation and climate change.[4] Thus, fast action on N_2O is essential, and mitigation pathways limiting warming to less than 2°C require lower N_2O emissions.[5]

Anthropogenic N_2O emissions have increased over the last 20 years and now exceed the highest projections.[6] Fortunately, cost-effective measures to mitigate emissions are ready for quick deployment. Emissions are concentrated in two sectors: industry and agriculture. For industry, most emissions are produced in the manufacture of nitric and adipic acids: nitric acid is used as feedstock to create synthetic commercial fertilisers; and adipic acid is used to create synthetic fibres and lubricants. For agriculture, the over-application of nitrogen fertilisers is responsible for significant increases in direct soil N_2O emissions because plants cannot absorb nitrogen from synthetic nitrogen fertilisers beyond what they need to grow,[7] leaving around 50 percent of them to pollute water sources or for bacteria in the soil to convert into N_2O.[8]

There are a number of opportunities for N_2O reduction that could bring multiple climate, ozone, environmental, and economic benefits. Proven abatement technology at nitric and adipic acid production facilities could reduce 86 percent of projected industrial N_2O emissions by 2030.[9] For agriculture, available, cost-effective technology can reduce N_2O emissions by 50 percent.[10] Adopting N_2O emission management measures for these activities could provide environmental and food security co-benefits. Optimising fertiliser use

will reduce nitrogen pollution and its ill effects on the environment, such as encouraging the growth of invasive plant species.[11] It will also lower production and supply chain costs, as well as dependence on fertiliser supplies that are easily disrupted by climate change and conflict.

The G20's Role

2

The members of the G20 are in a unique position to support the establishment of a framework to identify the most beneficial and feasible N_2O mitigation measures and support their quick adoption. Among the members of the G20 are the top nitric acid exporters,[12] fertiliser producers,[13] and food exporters in the world.[14] The G20's policy choices will significantly impact the development and adoption of N_2O mitigation measures.

Furthermore, fast action on N_2O emissions would help G20 members achieve food security. Rising costs of fertiliser production due to geopolitical stressors have strained agricultural production and caused food price hikes. G20 countries have implemented export restrictions[15] and agricultural subsidies[16] to curtail negative pricing effects. These stop-gap measures prioritise production without regard for adverse impacts to the climate and the environment or whether they provide effective assistance to farmers.[17] Adopting N_2O policy measures that reduce fertiliser demand with minimal to no impact on crop yields will be key in ensuring the long-term stability and sustainability of agricultural production and, thus, food security.

Some G20 members already have or are working towards policies that reduce N_2O emissions. For example, the European Union's Emissions Trading Scheme covers N_2O emissions from adipic and nitric acid manufacturing.[18] The proposed Carbon Border Adjustment Mechanism could also cover N_2O as a by-product of producing raw materials for fertilisers.[19] The United States launched the Fertiliser Challenge in 2022 to invest US$ 100 million in research, demonstration, and training in countries with excessive fertiliser usage and loss, and reduce agricultural N_2O emissions.[20] In 2015, China's Ministry of Agriculture issued the Action Plan on Zero Growth of Fertiliser Use by 2020.[21] This Plan promoted soil testing and use of fertilisers formulated to address local nutrient needs, improved fertilisation methods, new fertilisers and technologies, organic fertilisers, and improved cropland quality.[22] Fertiliser application in China's grain production decreased by about 11 percent from 2015 levels as a result of the policy.[23] China is also aiming to increase chemical-fertiliser utilisation efficiency to 43 percent by 2025.[24]

These types of measures are vital to addressing industrial and agricultural N_2O emissions, but more needs to be done. The G20 members should support inclusion of N_2O within multilateral environmental agreements, particularly as an ODS within the Montreal Protocol process. Furthermore, G20 members should support global initiatives that contribute to N_2O emissions reduction.

Recommendations to the G20

3

Policy Proposal 1: Take the lead within the Montreal Protocol process in advancing consideration of N_2O emissions, particularly in the industrial sector.

As an ODS, N_2O falls within the scope of the Montreal Protocol, but it is not currently regulated under the protocol. The most recent Quadrennial Assessment Report of the Protocol's Scientific Assessment Panel states that N_2O emissions accelerated over the last 20 years and now exceeded the highest projections.[25] It is currently the most abundant ODS present in the atmosphere. When compared to the ozone-depleting potential of CFC-11, anthropogenic N_2O emissions between 2016 and 2020 were estimated to be twice all the CFC emissions in 2020 and approximately 20 percent of peak CFC emissions in 1987.[26]

As a powerful GHG, N_2O contributes the equivalent of about 10 percent of today's CO_2 warming.[27] Controlling N_2O emissions could provide climate mitigation of about 1.67 $GtCO_2e$ GWP_{100} by 2050 with 0.94 $GtCO_2e$ from agriculture and about 0.6 $GtCO_2e$ from industry in 2050.[28]

The G20 should encourage the Montreal Protocol forum to consider options to reduce N_2O emissions, prioritising the industrial sector. G20 countries could request the Assessment Panels to produce additional reports on the ozone impacts of N_2O and highlight existing, cost-effective solutions for mitigating industrial N_2O emissions. Industrial N_2O emissions are point-source emissions that could be controlled similarly to HFC-23 under the Kigali Amendment, i.e., by installing proven abatement technology. Developing country Parties with acid production plants could then be empowered to adopt abatement technology through capacity-building, information-sharing, and financing.

Policy Proposal 2: Catalyse financing to strengthen nitrogen research and mitigation.

G20 members should support financing for action on N_2O in existing multilateral agreements, like the Montreal Protocol, the UN Framework Convention on Climate Change, and the Convention on Biological Diversity. The global value of nitrogen lost to the environment amounts to about US$ 200 billion per year in economic losses.[29] Counting the impact of nitrogen pollution to human

health, climate, and ecosystems can raise the cost of inaction on nitrogen and N_2O to US$3,400 billion annually.[30]

Policy Proposal 3: Advance a system that enables development and adoption of national nitrogen action plans (NNAPs).

1. The Nitrogen Reduction Target and the Nitrogen Secretariat

The G20 should propose a UNEA Resolution or a similar instrument adopting the nitrogen reduction target set in the 2019 UNEP-sponsored Colombo Declaration on Sustainable Nitrogen Management (Colombo Declaration) and extending the mandate of the UN Nitrogen Working Group to form a Nitrogen Secretariat. The Colombo Declaration is a pledge adopted in 2019 by 15 countries, including Germany and Brazil which are G20 members,[31] to halve nitrogen waste by 2050.[32] N_2O, resulting in part from excess nitrogen in cropland, is covered by the nitrogen target.

The Nitrogen Secretariat should have three main functions: (a) to receive national nitrogen action plans (NNAP) and quantify their contribution towards the global nitrogen reduction goal; (b) to provide up-to-date scientific information and technical solutions to address nitrogen losses; and (c) to explore financing opportunities to support development and implementation of NNAPs in developing countries.

2. National Nitrogen Action Plans

G20 members should consider adopting NNAPs within their own jurisdictions, paying close attention to industrial and agricultural N_2O emissions. The NNAPs are valuable tools for countries to map their nitrogen pollution sources. They embody the vision for sustainable nitrogen management based on assessments of nitrogen flows, their impacts, and policies to control them, with measurable, time-bound, and integrated objectives, and an enforceable implementation and evaluation strategy.[33] To monitor progress, NNAPs should set out short- and long-term numerical targets to reduce nitrogen emissions according to the nitrogen reduction goals of the Colombo Declaration.

3. Scientific and Technical Panels with Regional Nitrogen Hubs

Scientific and technical assessment panels should be established to

inform the work of the Nitrogen Secretariat and to formalise the work of organisations like the International Nitrogen Management System as expert advisers to UNEA. The panels should be mandated to monitor N_2O emissions and solutions trends and generate interim reports that will guide countries in implementing their NNAPs.

The complexity of agricultural production in different regions necessitates solutions tailored to local and regional conditions. Thus, the scientific and technical panels should have expertise that assesses regional conditions that produce nitrogen pollution and, consequently, N_2O emissions. They should be able to project regional trends as determined by domestic policies, and recommend cost-effective, scalable, and responsive solutions.

Furthermore, the panels should note the work of scientific bodies under other multilateral environmental agreements, such as the Task Force on Reactive Nitrogen under the Convention on Long-Range Transboundary Air Pollution, and the Scientific, Technical, and Economic Assessment Panels of the Montreal Protocol, and the Intergovernmental Panel on Climate Change.

The G20 should encourage research and development for mitigation technology, support development of NNAPs, provide capacity-building for low- and no-cost solutions, and strengthen awareness on the need for action on N_2O at all levels.

Attribution: Vibha Dhawan, David R. Kanter and Renee Valerie Fajardo, “Developing a Global Nitrous Oxide Reduction Policy for A Food-Secure Future,” *T20 Policy Brief*, July 2023.

Appendix

Examples of Policies Affecting N_2O Emissions in Select G20 Countries

Country	Policy Description
Argentina	• Launched the National Plan of Agriculture Soils to promote conservation, management, and restoration to maximise productivity and provision of ecosystem services[34] • Committed to implementing policies to reduce N_2O emissions from nitric acid manufacturing with assistance from the Nitric Acid Climate Action Group.[35]
Australia	• Investment in new "smart fertilisers" with increased nitrogen use efficiency by up to 20%[36] • Financing landholders, communities, and businesses that develop projects avoiding the release of greenhouse gas emissions, including emissions from agriculture[37]
Brazil	• Launched the National Fertiliser Plan 2050, which includes exploring alternative raw materials for fertilisers, reducing GHG emissions from industrial processes, and stimulating and disseminating good practices in fertiliser production and inputs[38]
Canada	• Announced plans to support voluntary measures to reduce nitrous oxide emissions from farming[39] • Entered into the Sustainable Canadian Agricultural Partnership, a five-year US$ 2.2 billion initiative between the federal, provincial, and territorial governments to encourage innovation in farming and to provide financing assistance for projects.[40]
China	• Imposed the Zero Growth in Fertiliser Use program in 2015,[41] promoting soil testing and use of fertilisers formulated to address local nutrient needs, improved fertilisation methods, new fertilisers and technology, and organic fertilisers, and improved of cropland quality.[42]
France	• Adopted the Climate and Resilience Law with a goal of reducing N_2O emissions by 15% by 2030 compared to 2015 levels by adopting a national action plan to improve agriculture practices and supporting development of alternative solutions[43]
India	• Implemented nutrient-based subsidy schemes to make alternative fertilisers affordable for farmers[44] • Supported use of neem-coated urea to increase nitrogen use efficiency[45]

Country	Policy Description
Indonesia	• Included in its recent nationally determined contribution the goal of reducing application of synthetic nitrogen fertilisers and increasing application of organic fertilisers[46] • Adopted the Long-Term Strategy for Low Carbon and Climate Resilience 2050, which includes reducing use of synthetic fertilisers[47]
Japan	• Plans to subsidise local municipalities to build facilities to extract phosphorus from sewage sludge and mass produce phosphorus fertilisers domestically[48]
Mexico	• Expanded its National Fertiliser Program, which includes extension services to train farmers on the correct use and dosage of fertilisers and the use of organic fertilisers[49]
United Kingdom	• Committed to reducing nitrogen pollution from agriculture into the water by at least 40% by 2038, compared to a 2018 baseline[50]
United States	• Requires new adipic and nitric acid production plants that emit N_2O at a certain threshold to install abatement technology[51] • Launched the Global Fertilizer Challenge to invest US$ 100 million in research, demonstration, and training in countries with excessive fertilizer usage and loss and to encourage adoption of efficient nutrient management and alternative solutions.[52]
European Union	• Regulates nitrogen pollution sources through directives like the Sludge Directive[53] and the Nitrates Directive[54] • Includes N_2O from adipic and nitric acid production in its emissions trading scheme[55] • Proposed inclusion of fertilisers in the carbon border adjustment mechanism[56]

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