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## Academic Thesis Publication on LRM by Like-minded Experts

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# Lifecycle Refrigerant Management in Ozone and Climate Regimes -Toward Strengthened Implementation through a Harmonized and Mutually Complementary Approach-

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**Abstract**

The Montreal Protocol and its Kigali Amendment primarily regulate production and consumption of ozone depleting substances (ODSs) and hydrofluorocarbons (HFCs), while the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement focus on reduction of greenhouse gas (GHG) emissions including HFCs for mitigation of climate change. There is increasing attention to lifecycle refrigerant management (LRM) in the cooling sector as an effective measure for realizing mitigation potentials, and LRM has been elevated into an important part of the agendas of both the "ozone regime" and the "climate regime," distinct policy and administrative systems that have evolved separately. This paper compares various aspects of the two regimes, such as norm setting, planning and implementation instruments, accounting and transparency through reporting, and financial mechanisms. It also points out gaps and proposes key areas of actions to accelerate LRM with strengthened implementation using a harmonized and mutually complementary approach.

**Key words:** financial mechanisms, inventory and transparency, National Cooling Action Plan (NCAP), Nationally Determined Contributions (NDCs), norm setting

**Table 1** Potential areas of coordinated actions for LRM.

| | Action area | Ozone regime | Climate regime |
|---|---|---|---|
| (i) | **Mitigation** | **NCAP**<br>A comprehensive strategy adopted by a country to promote sustainable and efficient cooling practices.<br>Some countries include actions such as reclamation and recycling and establishment of destruction facilities, as well as technical training, thereby addressing ODS and HFC emissions (UNDP, 2023).<br>*Note: NCAP is not a mandate and is primarily initiated outside of the Montreal Protocol. However, it provides relevant facilitation for integrating LRM.*<br>NCAP may contain interventions with different time frames, in<br>✧ immediate (2021–2025)<br>✧ mid-term (2025–2030), and<br>✧ long-term (2030–2040) periods. | **NDC**<br>Each party submits a quantitative mitigation commitment between 2021-2030 (and now until 2035 under NDC3.0) through actions in sectors and projects, and via policy measures<br>Some parties have committed not only to phase-downs but also to HFC emission reductions through LRM under the Kigali Amendment (UNFCCC, 2025).<br>**Long-term strategy**<br>All parties are encouraged to submit long-term low-GHG-emission development strategies. By aligning the NDC with long-term strategies, the parties will further strive toward net zero emissions in the latter half of this century (UNFCCC, 2024b). |
| (ii) | **Transparency* and MRV** | **Bank inventories**<br>Inventories taken to quantify ODSs and HFCs contained in in a country's cooling and other equipment. Quantification is usually conducted on a statistical basis.<br>Bank inventories provide an important basis for determining future amounts vented and potential emission reductions of ODSs and HFCs through LRM (ExCom of the MLF, 2022a, 2022b). | **National GHG inventories**<br>Inventories taken for a comprehensive accounting of a country's GHG emissions and removals. The national GHG inventory indicates emission sources and magnitudes, and facilitates planning and implementation, as well as MRV for emission reduction action.<br>Implementation of LRM, can be reflected in the inventory by reduced HFC emissions. |
| | | (National data reporting)<br>Parties to the Montreal Protocol report their national data annually but these are limited to production, consumption and import/export data not directly relevant to LRM. Data on recycled and reclaimed substances imported or exported, however, can be integrated on voluntary basis.<br>(Report on HPMP and KIP)<br>These reports do not focus directly on LRM, but they contain information relevant to national policies and project investment. | **BTR**<br>Under the Enhanced Transparency Framework (ETF), the BTR serves as common vehicle for all parties to report progress biannually toward implementing their NDCs, including NDCs in Common Tabular Format (CTF), together with their national GHG inventory.<br>Some parties have included LRM as a mitigation action, implementing HFC reduction in their BTRs (UNFCCC, 2024a). |
| (iii) | **Finance** | **MLF** | **GEF** |

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| (iii) | **Finance** | **MLF**<br>The Multilateral Fund (MLF) is a financial mechanism developed under the Montreal Protocol. The MLF supports developed countries' efforts to implement phase-out of ODSs and phase-downs of HFCs through industrial conversion, technical assistance and training, and capacity building. It also supports investment projects financially.<br>The MLF has supported some LRM investment projects, such as development of used-refrigerant destruction facilities.<br>The MLF supports development of ODS and HFC inventories and action plans for the management of ODS/HFC banks.<br>*Note: there is ongoing discussion regarding a funding window related to potential extension to LRM implementation.* | **GEF**<br>The Global Environment Facility (GEF) provides financial support for transparency-related activities (e.g. BTR) by developing countries.<br>Some projects have included capacity building components for LRM.<br><br>**GCF**<br>The Green Climate Fund (GCF) supports developing countries in realizing their NDC ambitions towards low-emission, climate-resilient pathways. The GCF highlights transformational planning and programming, catalyzing climate innovation, de-risking investment, and mainstreaming climate risks and opportunities into investment decision-making.<br>The GCF has provided support through its Readiness Programme, related to energy efficiency and alternative refrigerant appliances in several countries. These projects only touch upon the shift to alternatives with lower GWPs or upon F-gas and have not covered LRM. |
| | **Technology** | (Technology transfer supported under the MFL)<br>Some LRM projects have been implemented as pilot projects. | **CTCN**<br>The Climate Technology Centre and Network (CTCN) provides technical assistance on climate technologies related to mitigation and adaptation. The delivery of support is realized in a relatively short time on a small scale, but can be used in combination with other financing.<br>To date, it has supported projects related to energy efficiency in the cooling sector, but with only one exception, no significant cases of LRM (UNCTCN, n.d.). |

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| (v) | **Others** | | **<u>CDM (under the Kyoto Protocol)</u>**<br>The CDM was implemented as a project-based mechanism in which certified emission reduction (CER) credits are issued for GHG emission reductions in developing countries that can be traded with developed countries for the purpose of meeting the Kyoto Targets.<br>Nineteen HFC-related projects have been registered but they have focused only on HFC emission reduction as by-product of HCFC production in factories and do not address the HFC bank in cooling equipment already on the market.<br><br>**<u>Article 6.2 and 6.4 Mechanisms (under the Paris Agreement)</u>**<br>Article 6.2 focuses on cooperative approaches between countries, allowing for the trading of mitigation outcomes (ITMOs) to achieve their Nationally Determined Contributions (NDCs). Article 6.4 establishes a centralized mechanism, the Paris Agreement Crediting Mechanism, to facilitate emission reductions and removals through a system of rules and oversight. |