climate change initiative

LONG-LIVED GREENHOUSE GAS PRODUCTS PERFORMANCES

Impact of HFC Emissions in Togo on Global Temperature

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The HFC Challenge

What are HFCs?

- Hydrofluorocarbons are the second generation of ozone-depleting substance substitutes, widely used in refrigeration, air conditioning, and aerosol propellants.
- While they don't harm the ozone layer, HFCs are powerful greenhouse gases with warming potential 150 to 8,000 times greater than CO_2.

Global Response

- The Kigali Amendment (2016) established phase-down schedules for HFC production and consumption across all nations.
- Togo, as a developing country in Group 1, must reduce HFC use from 2024 to 2048, targeting 15% of reference levels.

Study Objectives

Primary Goal

- Simulate the increase in global average temperature by 2030 attributed solely to HFC emissions in Togo

Projection Method

- Project 2018 HFC emissions forward to 2030 using the LEAP-IBC modeling tool

Climate Impact

- Assess Togo's contribution to the Paris Agreement's 1.5° C temperature limit goal

Research Methodology

1.Data Collection

- Gathered socio-economic parameters, population data, and HFC import quantities from national institutions and the National Ozone Office,

2. Key Assumptions

- HFCs emit during equipment operation and end-of-life; few technicians have recovery devices; low F-gas sales growth; short equipment lifetime ,

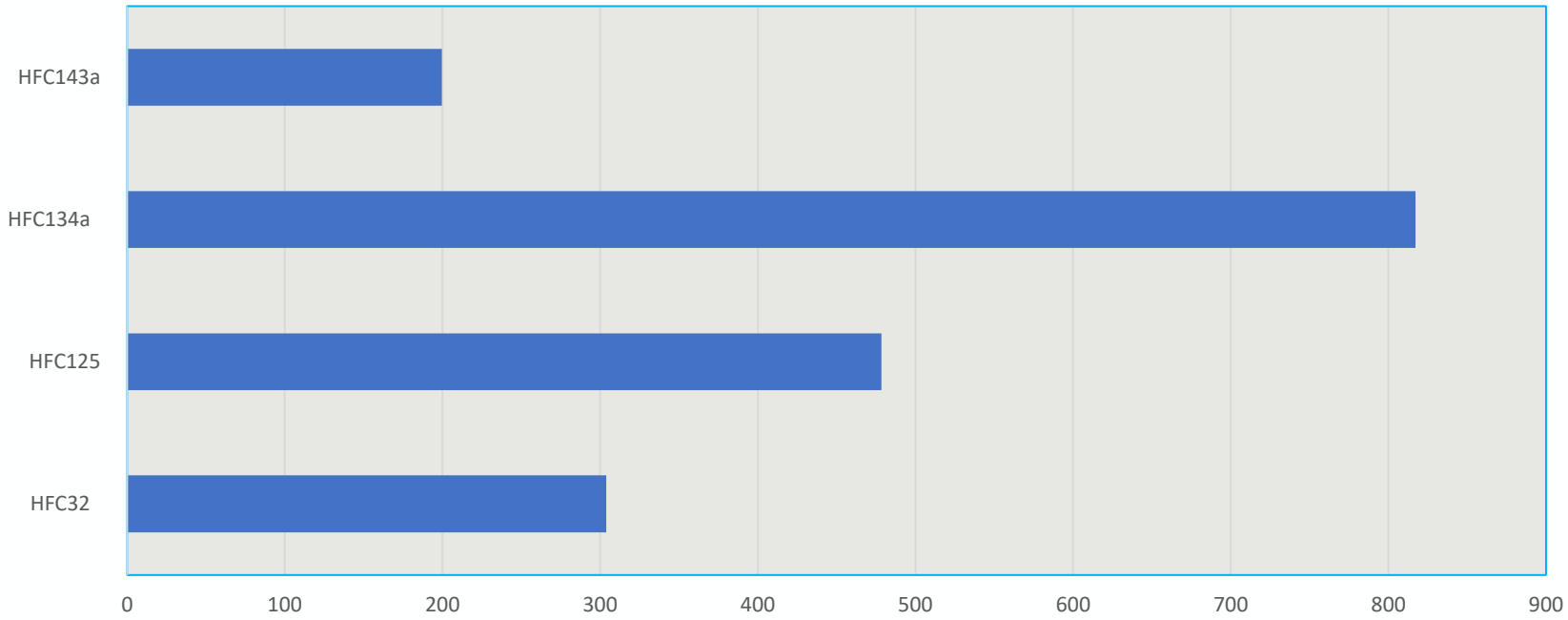
3. LEAP-IBC Modeling

- Used Long-range Energy Alternatives Planning tool with GEOS chemical transport model to project emissions and temperature impacts,

4. Temperature Calculation

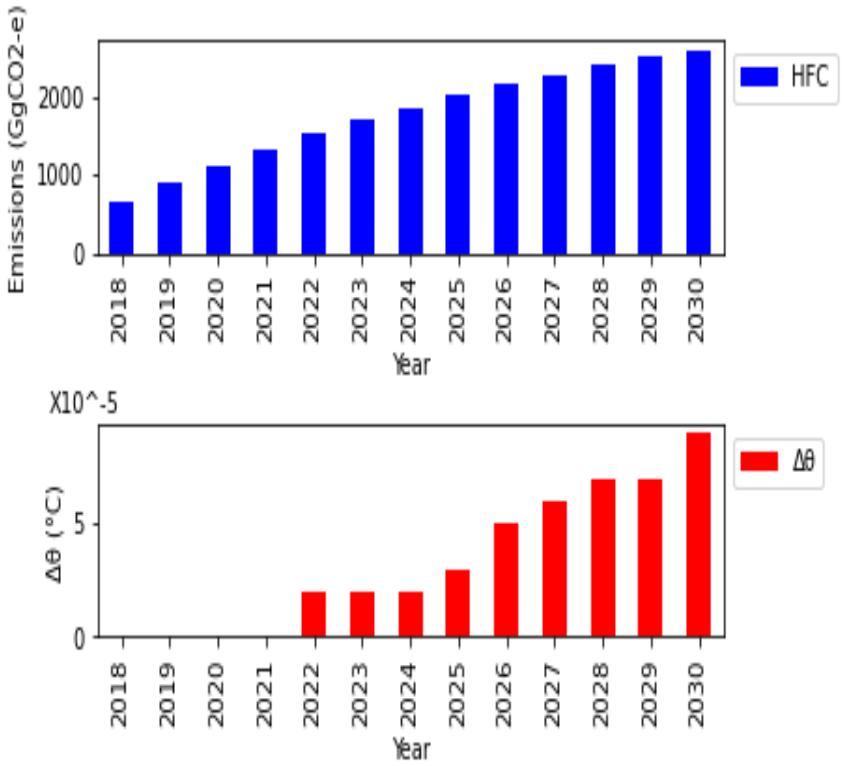
- Applied Shindell equation integrating radiative forcing, regional sensitivities, and climate system inertial response

HFC Imported in Togo (2018)



Total HFC imports reached 1,799.14 metric tons in 2018, with HFC-134a dominating usage in refrigeration and automotive air conditioning sectors

Projected Emissions Growth



- HFC emissions in Togo are projected to surge from 641.78 $GgCO_2$-e in 2018 to 2,598.13 $GgCO_2$-e by 2030 let it be a sharp increase of 305%

305%

Emission Growth

2018 to 2030

- This growth reflects rising demand for residential and automotive air conditioning driven by increasing temperatures in tropical regions, plus expanded cold chain infrastructure for food preservation.

Temperature Impact Timeline

1. 2018-2021

   No measurable temperature impact as emissions haven't reached troposphere

2. 2022-2024

   Temperature rises by 2×10^{-5} °C as HFCs accumulate in atmosphere

3. 2025-2027

   Accelerated warming: 3×10^{-5} °C to 6×10^{-5} °C as emissions intensify

4. 2028-2030

   Reaches 9×10^{-5} °C total increase by 2030

Putting the Numbers in Context

Togo's Share

Of the 0.5° C increase predicted by IPCC scenarios between 2018-2030

While 9×10^{-5} ° C may seem negligible, this represents Togo's HFC sector alone. Combined with other sectors and countries, the cumulative effect drives the 1.5° C threshold predicted by multiple IPCC scenarios (RCP2.4, RCP4.6, RCP6.0).

The IPCC warns that at current emission rates, global temperature will reach 1.5° C between 2030 and 2052 a 0.5° C increase from today's 1° C above pre-industrial levels.

Mitigation Recommendations

1	**Alternative Refrigerants** Promote low-GWP alternatives: R-744 (CO_2), propane (R-290), isobutane (R-600a), R-448A and R-455A (HFC-HFO blends)
2	**Building Standards** Encourage construction with thermal insulation materials to reduce air conditioning demand in residential and commercial buildings
3	**Technical Capacity** Equip refrigeration technicians with F-gas recovery devices and train in proper handling and end-of-life equipment management
4	**Policy Framework** Implement Article 6.4 of Paris Agreement through national contributions in the refrigeration sector

Conclusion & Study Perspectives

Key conclusions

- Without mitigation measures, Togo's HFC emissions will contribute 9×10^{-5} °C to global warming by 2030,
- As a Paris Agreement signatory, Togo must act urgently across all sectors to limit temperature increases below 1.5°C and fulfill its climate commitments.

Future research direction

- Enhancing HFC emission inventories in Togo using integrated satellite and ground observations represents a critical next step for this research ,
- Combining remote sensing data with ground-based measurements will provide more accurate, real-time emission tracking and validation of model projections.

THANK YOU FOR YOUR KIND ATTENTION

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