Environmentally Harmful Dumping of Inefficient and Obsolete Air Conditioners in Africa

Executive Summary

The demand for air conditioners that provide thermal comfort and sustain health is steadily growing across the African continent as consumers seek to improve their quality of life in the face of urbanization and rising global temperatures. From 2005 to 2019, Africa's market for new split room air conditioners (RACs) grew by an estimated 14%, cumulatively.[1] Although a few African countries assemble RACs from imported parts for domestic and regional markets, most African countries rely exclusively on imported products manufactured in other countries. As manufacturing and industrialized economies place increasingly stringent minimum energy performance standards (MEPS) and refrigerant global warming potential (GWP) limits on RACs sold domestically, importing African countries risk becoming even greater dumping grounds for inefficient, environmentally harmful products using obsolete refrigerants that no longer have a viable domestic market in their places of origin and soon worldwide. Weak or non-existent MEPS and the lack of proactive anti-environmental dumping policies in many African countries have facilitated environmentally harmful dumping of inefficient, high-GWP[2] air conditioner products into African markets.

IGSD defined environmentally harmful dumping (henceforth, "environmental dumping") as "the practice of exporting products to another country or territory that: 1) Contain hazardous substances; 2) Have environmental performance lower than is in the interest of consumers or that is contrary to the interests of the local and global commons, or; 3) Can undermine the ability of the importing country to fulfill international environmental treaty commitments."[3]

CLASP conducted a wide-ranging review of relevant markets and trading practices in African countries to determine where environmental dumping of inefficient, high-GWP RACs is occurring and to identify the factors creating a favorable environment for such practices. CLASP analyzed available market data collected by Building Services Research and Information Association (BSRIA)[4] for products sold in 2018, conducted desk research into the policy landscape in Africa, and interviewed policymakers in the region. This report presents our assessment of the split RAC market for four regions and 10 focus countries: North Africa (Algeria, Egypt, Morocco, and Tunisia), West Africa (Ghana and Nigeria), East Africa (Ethiopia, Kenya, and Tanzania), and Southern Africa (South Africa).

CLASP and IGSD welcome additional data including more detailed information on products sales, point of manufacture, energy efficiency, and refrigerant and also welcome suggestions on how to smoothly transition from obsolete to next-generation RAC technology.

The remainder of this Executive Summary presents our major findings on the extent and impact of the environmental dumping of RACs in Africa.

[1] Euromonitor 2019. Euromonitor provides reported and modeled estimates for RAC market size by country. For most countries on the African continent, Euromonitor does not have reported sales from trade sources, and instead models approximate market size using national statistics (population, number of households, etc.).

[2] Throughout the report, CLASP will refer to the GWP of refrigerants. To align with Montreal Protocol tracking, CLASP uses IPCC AR4 100-year GWP values. https://www.ipcc.ch/site/assets/uploads/2018/05/ar4_wg1_full_report-1.pdf

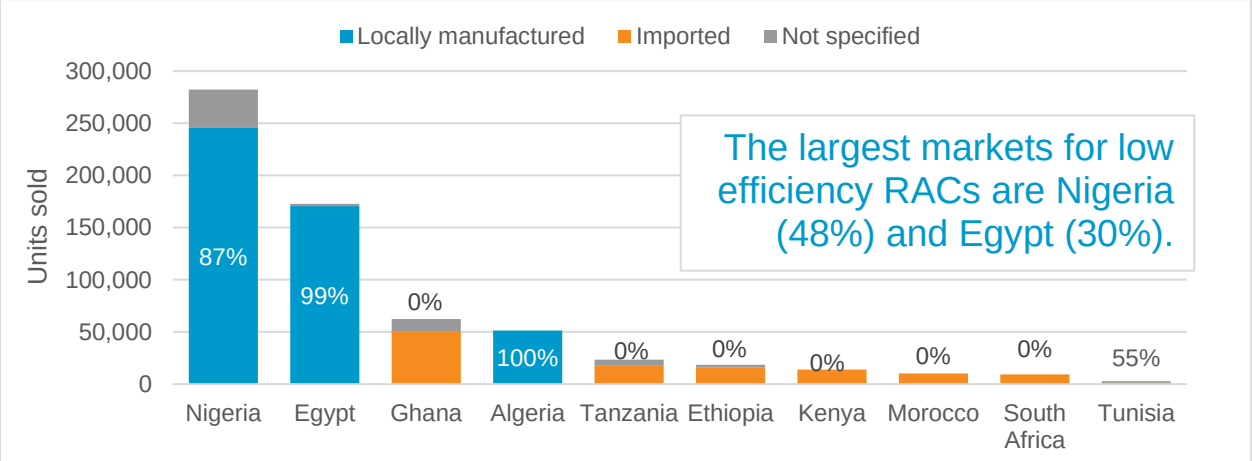
[3] Andersen, Stephen O., Ferris, R., Picolotti, R., Zaelke, D., Carvalho, S., Gonzalez, M. (2018). Defining the legal and policy framework to stop the dumping of environmentally harmful products. Duke Environmental Law & Policy Forum: Vol. XXIX:1. http://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=1356&context=delpf

[4] Building Services Research and Information Association (BSRIA) is a market research firm.

Market evidence of environmental dumping of low efficiency RACs into African markets

- RACs with energy efficiency ratios (EERs) less than 3.0 W/W (henceforth referred to as "low efficiency" RACs) make up 35% of the overall RAC sales in the ten focus countries. The market size for these low efficiency units is about 650,000 units annually. Most RAC manufacturing economies like China, South Korea, Japan, and the US have minimum energy performance standards (MEPS) above 3.0 W/W, meaning such products could not be sold in the countries where they are manufactured.
- At least 50% of the imported low efficiency units are imported from China, with Korea (3.9%), the US (3.2%) and Japan (1.7%) accounting for the other major non-African sources of low efficiency AC equipment. These fractions could be higher since information on the source country was not available for 39% of the imported low efficiency dataset.[5]
- Non-African local subsidiaries or joint ventures with African companies in Egypt and Nigeria assemble the majority (80%) of low-efficiency RACs sold in the ten focus countries,[6] as discussed later.

Figure 1: Low efficiency RACs sold in 10 African countries with locally manufactured share indicated



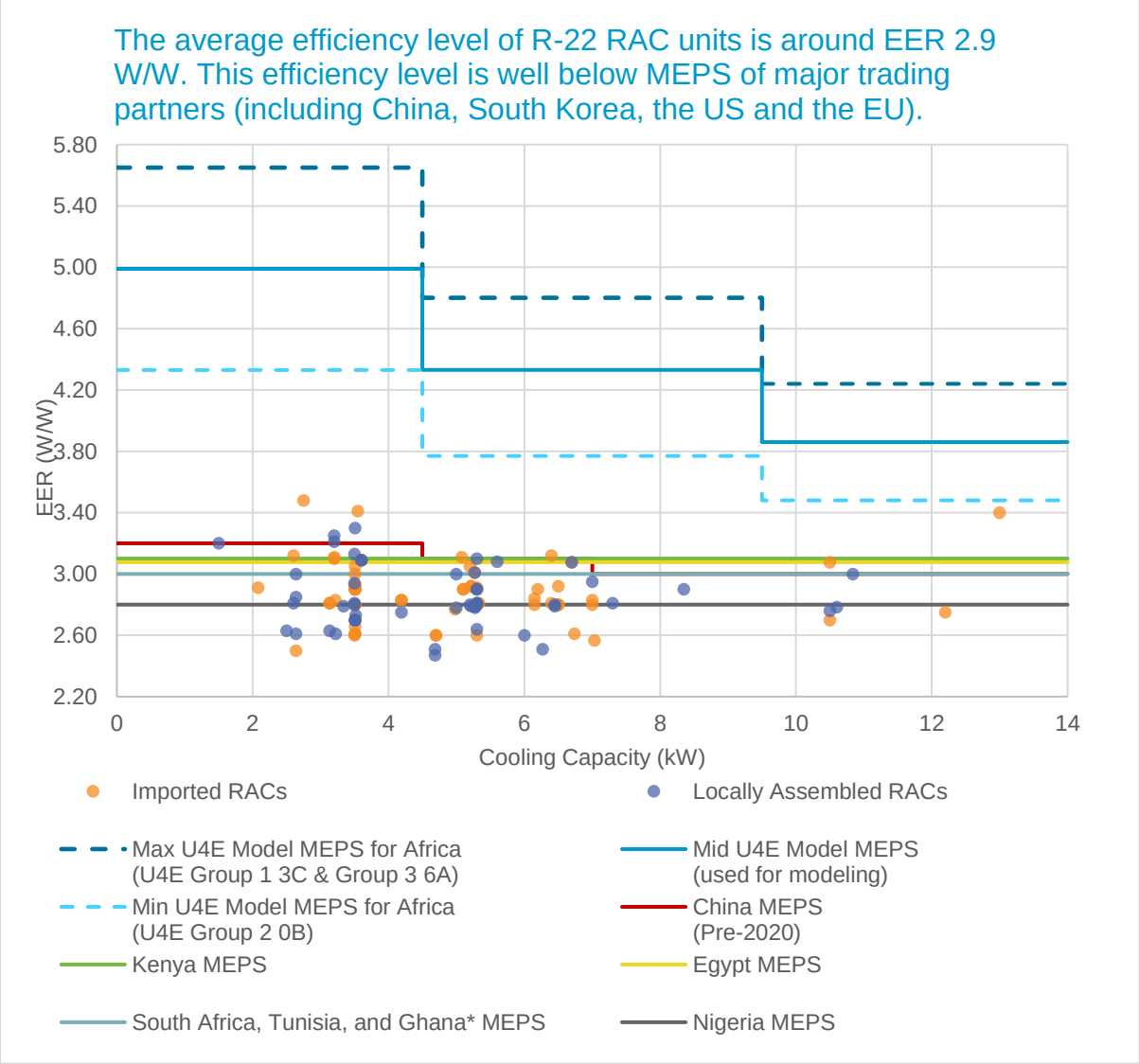
Market evidence of environmental dumping of high-GWP RACs into African markets

- R-22[7] is an obsolete ozone-depleting greenhouse gas (GHG) in the final stage of phase out under the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) while R-410A[8] is an obsolete ozone-safe GHG that will soon be phased down under the Kigali Amendment to the Montreal Protocol.
- RACs containing R-22 still account for 47% of overall sales in the ten African focus countries,[9] with a market size of about 800,000 units. Most of the remainder of overall sales in the ten countries use R-410A, with a very small percentage of lower GWP R-32[10] RACs sold exclusively in South Africa.

[5] Based on analysis of BSRIA 2018 RAC sales data. See Methodology section for further details.
[6] Based on analysis of BSRIA 2018 RAC sales data. See Methodology section for further details.
[7] R-22, a hydrochlorofluorocarbon (HCFC) refrigerant with a GWP of 1,810 over a 100-year time horizon (IPCC AR4), is scheduled to be phased out globally in accordance with the Montreal Protocol.
[8] R-410A, a hydrofluorocarbon (HFC) refrigerant blend with a GWP of 2,088 over a 100-year time horizon (IPCC AR4) is scheduled to be phased down under the Kigali Amendment to the Montreal Protocol.
[9] Based on BSRIA sales weighted data for 10 countries. R-410A RACs accounted for 49% of sales, R-32 RACs accounted for 1% of sales, and refrigerant type was not available for the remaining 3%.
[10] R-32 is a low-GWP hydrofluorocarbon (HFC) refrigerant blend with a GWP of 675 over a 100-year time horizon (IPCC AR4).

- A large portion of R-22 units are assembled locally (82%), half of which come from joint ventures between local Egyptian or Nigerian assemblers and international Asian companies.
- China is the largest source of imported R-22 RACs (57%), followed by Egypt (11%), the US (3%), Nigeria (1.6%), and South Korea (0.6%). This share of imports from each country could be even larger - country of origin was not available for 27% of the imported R-22 RAC models in the BSRIA dataset.[11]

Figure 2: R-22 RACs in Africa compared to MEPS (N=114, V=789,778) [12]



*Ghana recently committed to raising the MEPS for RACs from 2.80 W/W to 3.0 W/W

[11] Based on analysis of BSRIA 2018 RAC sales data. See Methodology section for further details.
[12] MEPS levels in the chart are reported in EER. For the max, mid, and min U4E model MEPS, the levels were converted from ISO CSPF to EER using the formula EER = CSPF / 1.062 in accordance with ISO Testing Standard 16358-1:2013. https://www.iea.org/policies/6832-minimum-energy-performance-standards-and-labelling-for-air-conditioners-with-cooling-capacity-71kw

Identifying the sources of obsolete RACs and RAC components

While there is local assembly of air conditioners in some African countries, particularly Algeria, Egypt, Nigeria, and Tunisia, most African economies import their RACs from major RAC manufacturing economies such as China, South Korea, the US, and Japan. According to Comtrade import statistics, in 2018, China supplied approximately 80% of the RACs imported by the 10 focus countries, followed by Thailand (6%), Turkey (3%), and South Korea (2%).[13] As well, China supplies 71% of the compressors used in refrigeration equipment imported by the focus countries. Other major sources for compressors include Thailand (7%), Germany (3%), France (2%) and Spain (2%).[14]

African countries with significant local assembly of cooling products typically have national requirements and policies that provide incentives for national assembly (i.e., lower import duties for components, domestic content requirements) or bans on the import of assembled units.

A large portion of new, low efficiency RACs using obsolete refrigerants are imported into Africa from major non-African manufacturing countries. However, this research uncovered that there are other major sources for obsolete technology in Africa. Specifically, locally assembled RACs, produced by joint ventures (JVs) between local African companies and large non-African manufacturing companies, produce a significant amount of the low efficiency products utilizing R-22 and R-410A refrigerants. Often, the products produced by these joint ventures are less efficient than those produced by the non-African joint venture member companies for their own domestic markets.

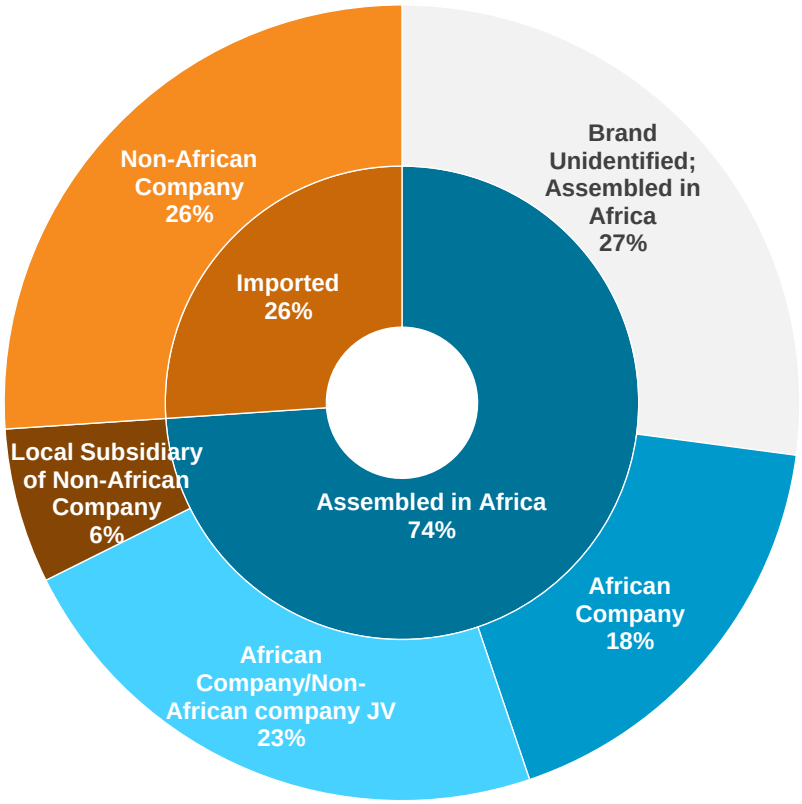
This research identified that environmental dumping of obsolete space cooling technology is occurring in Africa, and the four main sources of environmental dumping are:

- Non-African companies exporting low efficiency RACs containing obsolete refrigerant technologies (at least 26% of the low efficiency RAC market in the focus countries).
- Local subsidiaries of non-African companies assembling RACs in Africa, using imported components for products that are too inefficient to be sold in the domestic market of the non-African companies. These products are sold under the branding of the non-African company (at least 6% of the low efficiency RAC market).
- Joint ventures between smaller African assemblers and large, non-African RAC manufacturers assembling low efficiency RACs that would not be marketable in the home territories of the non-Africa joint venture partner (at least 23% of the low efficiency RAC market). These joint ventures sometimes sell products under the internationally recognized brand names of the non-African JV partners, but also sometimes sell products under brand names unique to the African market.[15]
- Wholly independent African RAC assemblers, not part of a joint venture, importing components[16] for and assembling low efficiency RACs (at least 18% of the low efficiency RAC market). Consider also that African RAC assemblers are hampered in supplying superior products because they compete against low prices of products that are indistinguishable in appearance.

[13] BSRIA's data set is more detailed, but covers a smaller sample size than Comtrade, thus why CLASP references the overall RAC imports/exports shares calculated from Comtrade's data.
[14] U.N. Comtrade statistics for 2018 for the 10 focus countries. HS code 841510 is used for all RACs and HS code 841430 is used for compressors. See Methodology section for further details.
[15] For example, the Miraco Carrier joint venture in Egypt assembles Carrier, Midea, and Toshiba branded products. In Nigeria, the Haier Thermocool joint venture brands their products as Haier Thermocool.
[16] China is the major manufacturer and exporter of key RAC components, in particular compressors. See: Nicholson, Scott R, and Charles W Booten. 2019. "Mapping the Supply Chain for Room Air Conditioning Compressors." https://doi.org/10.2172/1524770

Figure 3: Origins of low efficiency RACs sold in 10 African countries (N=651,273)

The majority (74%) of the low efficiency units are assembled in Africa, primarily in Egypt and Nigeria. These RACs are assembled either by local African companies, local subsidiaries of non-African companies, or joint ventures between an African company and one or more non-African companies.



Impacts of environmental dumping of inefficient, high-GWP RACs

The prevalence of low efficiency RACs puts extra strain on governments' and consumers' budgets. Customers pay higher electricity bills and countries pay more for electricity generation facilities, imported fuel, and electricity transmission, and distribution infrastructure. Transitioning to high efficiency RACs can reduce the burden not only on consumers, but also on governments - for example, a World Bank study on northern Africa's RAC market estimated the per AC unit avoided capacity investment cost could reach an average of $234 in 2030.[17] This money could be saved by setting and strengthening MEPS and by prohibiting RACs with HCFC and high-GWP (R-410A) refrigerants as is done in developed countries.

Environmental dumping of air conditioning products with obsolete R-22 and R-410A increases the future demand for these damaging refrigerants at a time when they will be expensive or unavailable in some markets, creating incentive for illegal chemical manufacture and trade.

Some African countries have implemented energy performance standards and bans on secondhand ("used") equipment, to prevent the influx of low efficiency, obsolete refrigeration and air conditioning appliances into their markets. However, numerous countries in Africa have not implemented any form of anti-environmental dumping policy for new products and therefore import products that would be prohibited in the countries where the products were manufactured.

[17] 2030 savings in 2014 dollars. See: Khalfallah, Ezzedine; Missaoui, Rafik; El Khamlichi, Samira; Ben Hassine, Hassen. 2016. *Energy-efficient air conditioning : a case study of the Maghreb : Opportunities for a more efficient market (English)*. Middle East And North Africa (MENA) Energy Series. Washington, D.C. : World Bank Group. p. 57. http://documents.worldbank.org/curated/en/754361472471984998/Opportunities-for-a-more-efficient-market

CLASP modeled the potential impact of four policy alternatives to demonstrate the additional GHG emissions that result from environmental dumping of RACs in Africa. Each unit contributes to GHG emissions in two ways: indirect GHG emissions result from the fossil fuel electricity used to power the RACs over their life cycle, and direct GHG emissions result from leakage and refilling of high-GWP refrigerants over the RAC life cycle, and end-of-life venting if not properly captured, recycled, or destroyed. The four scenarios we modeled are:

- **Base Case (No Efficiency Policy + Unregulated Refrigerant Market):** A business-as-usual scenario that assumes that the RAC market continues to grow at a constant rate annually through 2030, and that the current market shares of R-22, R-410A, and R-32 RACs gradually change in accordance with Montreal Protocol (MP) phase-out schedules for R-22 and phase-down schedule for R-410A. No additional energy efficiency policies or refrigerant requirements are assumed in this scenario.
- **Policy Scenario 1 (U4E MEPS[18] + Unregulated Refrigerant Market)**: A scenario in which the countries in each region adopt RAC energy efficiency standards equivalent to the U4E Model MEPS in 2022. There are no requirements for the GWP of refrigerants used in RACs in this scenario.
- **Policy Scenario 2 (U4E MEPS + U4E Refrigerant Regulation):** A scenario in which the countries in each region adopt RAC energy efficiency standards equivalent to the U4E Model MEPS in 2022 and require the use of refrigerants with GWP ≤ 750 in 2022. For the purpose of modeling, this scenario assumes that all RACs on the market from 2022 onwards use R-32 refrigerant, which has a GWP of 675.
- **Policy Scenario 3 (U4E MEPS + BAT Refrigerant Policy)**: A scenario in which the countries in each region adopt RAC energy efficiency standards equivalent to the U4E Model MEPS in 2022 and require the use of best-available-technology (BAT) refrigerants with GWP < 150 in 2022. For the purpose of modeling, this scenario assumes that all RACs on the market from 2022 onwards use R-290 refrigerant. Recent research estimates that R-290 has a GWP of <1;[19] however, without a more specific value and to keep estimated impacts conservative, CLASP assumes a 100-yr GWP of 1 for the R-290 refrigerant in this scenario. [20]

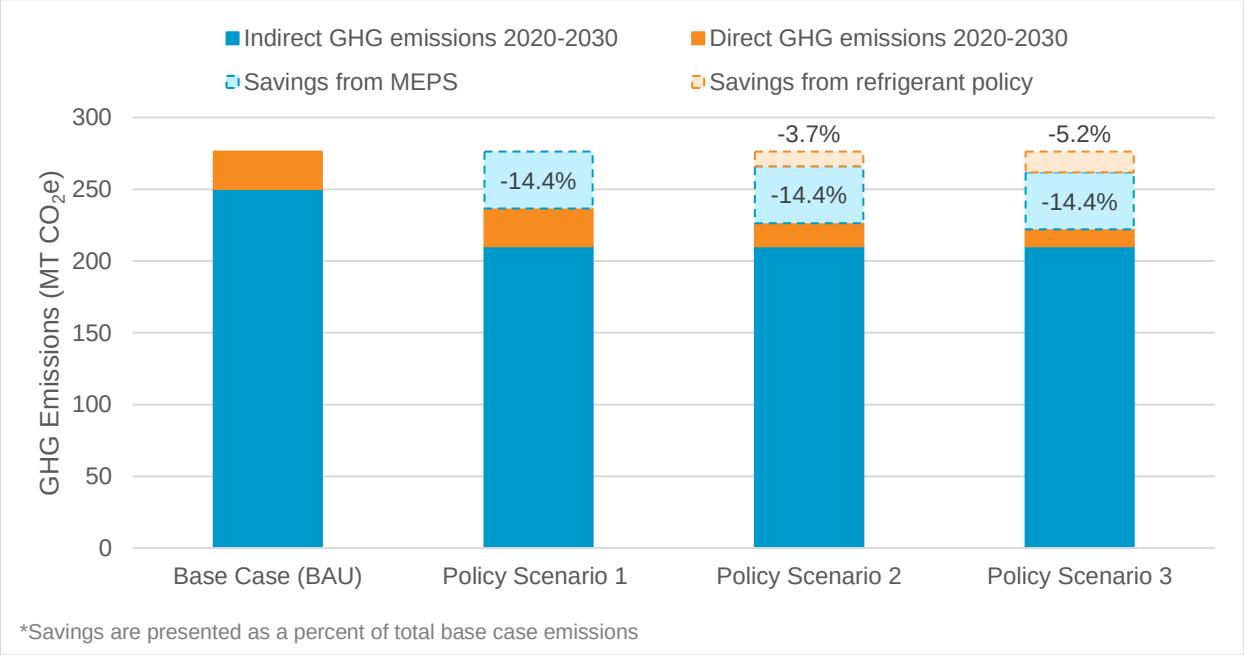
Adopting U4E Model MEPS in 2022 could reduce cumulative 2022-2030 GHG emissions in the four regions by **40 megatonnes (MT) of CO_2e**. Simultaneously adopting the U4E guidance to disallow refrigerants with GWPs greater than 750 could avoid an additional **10 to 15 MT CO_2e** through 2030, depending on the level of ambition.

[18] In September 2019, United for Efficiency (U4E) published model energy performance standards and labeling guidance to assist governments in developing and emerging economies in establishing or strengthening their regulations. These guidelines present an opportunity for African countries to harmonize around ambitious and achievable MEPS and refrigerant requirements. https://united4efficiency.org/resources/model-regulation-guidelines-for-energy-efficient-and-climate-friendly-air-conditioners/

[19] See Appendix A in WMO (World Meteorological Organization), Scientific Assessment of Ozone Depletion: 2018, Global Ozone Research and Monitoring Project – Report No. 58, 588 pp., Geneva, Switzerland, 2018. https://www.esrl.noaa.gov/csd/assessments/ozone/2018/

[20] Some of the African countries studied are (high ambient temperature) HAT countries, which implies a high load scenario – based on current IEC (International Electrotechnical Commission) safety standards, A3 refrigerants can be used for up to 7 kW units only.

Figure 4: Cumulative 2020-2030 GHG emissions from RACs in Southern Africa under four scenarios



Tools for policymakers to prevent environmental dumping of RACs

African policymakers can take action to halt environmental RAC dumping and set in motion a transition to highly-efficient, low-GWP RACs. Measures like energy efficiency policies and energy efficiency-minded trade policy can work together to support African countries in achieving development and climate objectives while limiting emissions from the cooling sector. African consumers will also benefit by having access to high-quality, high-efficiency, affordable products.

Drawing from IGSD's anti-environmental dumping "toolkit", described in "Defining the legal and Policy Framework to Stop the Dumping of Environmentally Harmful Products," these actions include:

1. **Ratify the Kigali Amendment to the Montreal Protocol and adopt implementing policies.** Ratifying and implementing the Kigali amendment, for those African countries that have not already done so, demonstrates a commitment to pursuing a low-GWP path for cooling technologies. R-22 RACs are still highly prevalent in Africa, however as African countries prepare to phase out R-22 under the Montreal Protocol, in the absence of other policies, R-410A RACS are expected to flood the market, especially as other countries adopt early HFC phasedown strategies. Ratifying and implementing the Kigali Amendment will convey the message to local and non-African RAC manufacturers and exporters that the African market for RACs will require alternative refrigerants. Manufacturers may be more encouraged to bring R-32 and R-290 products into the African market more quickly.
2. **Design and implement MEPS & labeling policies consistent with major AC-exporting countries.** Currently, the MEPS for RACs in the few African countries with MEPS tend to be low in comparison to the MEPS in place in the countries that manufacture RACs and RAC components. Implementing MEPS at levels comparable to MEPS in RAC source countries can prevent the environmental dumping of inefficient products and provide substantial GHG emissions savings over time. Adopting U4E's model regulations for RACs may offer African countries a means to prevent the environmental dumping of inefficient RACs, as these guidelines present an opportunity to harmonize around ambitious and achievable MEPS and refrigerant requirements.

3. **Strengthen institutional arrangements.** Institutional arrangements, including how administrative responsibilities for energy efficiency and refrigerants are allocated within a particular government, are critical for efforts to minimize dumping of cooling equipment and components. This includes efforts to combat fraud in MEPS certifications, labeling and product performance claims. Similarly, coordination between authorities responsible for implementing energy efficiency and Montreal Protocol policies, including energy and customs authorities, is essential. Political support is critical for allied responses of champions within agencies and departments to combat anti-dumping.
4. **Revise tariffs on RACs to ensure compatibility with energy efficiency goals.** Trade policies can support or hinder energy efficiency policies. High import tariffs, like those protecting local RAC manufacturers in Egypt and Algeria from foreign competition, may perversely prevent newer technologies from entering the market and decrease the level of ambition from local assemblers and joint ventures. Similarly, high tariffs may drive the creation of black markets for unregulated or secondhand products, as observed in Tunisia. Preferential tariffs should be carefully evaluated to ensure that they do not perversely incentivize the assembly and sale of low efficiency products and should be coupled with robust MEPS.
5. **Ban the import of secondhand, including refurbished, and inefficient RACs and widely publicize and enforce the ban.** Bans on secondhand products, if properly enforced and publicized as in Ghana, can eliminate one official channel for out-of-date or unregulated products. Bans can specify financial penalties for everyone and every enterprise involved in the illegal supply chain.
6. **Organize bulk purchase and buyers' clubs:** Bulk purchases and buyers' clubs help to aggregate demand and purchase high efficiency and low GWP RACs at affordable prices. This type of program can be designed to target replacement of older and inefficient RAC equipment that contains high-GWP refrigerants. Replacement programs are a tool that governments can deploy to respond to economic downturn, as they create jobs in the service sector and benefit consumers by reducing electricity bills.
7. **Properly recycle and dispose of obsolete room ACs:** Policies to regulate the disposal of obsolete air conditioning and refrigeration equipment can help to reduce the environmental impacts of high-GWP refrigerants, by avoiding end-of-life leakage and preventing refurbishing and redeployment of used equipment in the secondhand market.[21]
8. **Elevate solutions to regional level.** Countries will be most successful in addressing environmental dumping when working together regionally to adopt and implement these recommendations (including harmonization around U4E model regulations). Absent regional coordination, if one country adopts policies to avoid environmental dumping, but a neighboring country does not, the neighboring country not only risks greater environmental dumping in its market, but also risks becoming a conduit for continued dumping into its neighbor due to the porous nature of many borders.
9. **Engage local groups profiting under current system by trading in obsolete equipment to be part of the solution.** For example, Ghana's Energy Commission brought together those involved in trading used cooling products to form an Association with elected leaders to facilitate agreement on a transition plan. For new equipment manufactured or assembled in Africa, identify financial incentives to allow local assemblers to modernize their equipment, organize buyers clubs and trainings so as to empower and engage local groups in the transition towards assemble more efficient RACs and Refrigerants.

[21] In regions without existing infrastructure for disposal, refrigerant can be collected and destroyed in local cement kilns and old equipment can be recycled for parts and materials.

Directions for Future Research by CLASP, IGSD and Cooperating Partners

On-the-ground market research to gather information on the informal, and sometimes illegal, secondhand product market. This report is based on available market research and data by BSRIA and other respected sources. One of the main challenges in conducting the research was the lack of available data on secondhand air conditioner markets in Africa. In countries without specific bans on the import and sale of secondhand (or used) RACs there are not standard systems in place for tracking the sales of these products, this additional on-the-ground market research can fill that gap.

Research in the supply chain of the air conditioning components market. There is a significant amount of assembly of inefficient air conditioners using obsolete refrigerants in Africa, despite that many of the major non-African manufacturers associated with assembling, or providing the components for assembly of, these products have access to better components. Future environmental dumping research should examine the forces behind the environmental dumping via these mechanisms.

Research on tools for African markets to leapfrog from R-22 RACs to R-32, R-290 RACs or other refrigerant blends with GWP under 750. This report identifies that African countries moving away from R-22 are transitioning mostly to R-410A equipment. This trend exists despite similar efficiency levels and prices for R-410A and R-32 RACs. Further research can determine why this trend exists and identify tools available to policymakers to leapfrog AC market to other refrigerant blends with GWP under 750.

Research on illegal trade of ozone depleting substances into Africa. Currently, assessing the extent of illegal trade from Asian into Africa of ODSs and products using ODSs is made difficult by a lack of data and reporting on such trade. However, there appears to be some data and reports on such trade between Asian countries.

Research on the scale of non-compliance with MEPS in Africa. There is little information on the extent of compliance issues in Africa countries were MEPS have been implemented. Further study is needed to determine the scale of non-compliant activities such as false/counterfeit labeling, false statements of compliance with MEPS by local assemblers, suppliers and manufacturers, and false product performance claims.

Environmentally Harmful Dumping of Inefficient and Obsolete Air Conditioners in Africa is available at CLASP.ngo