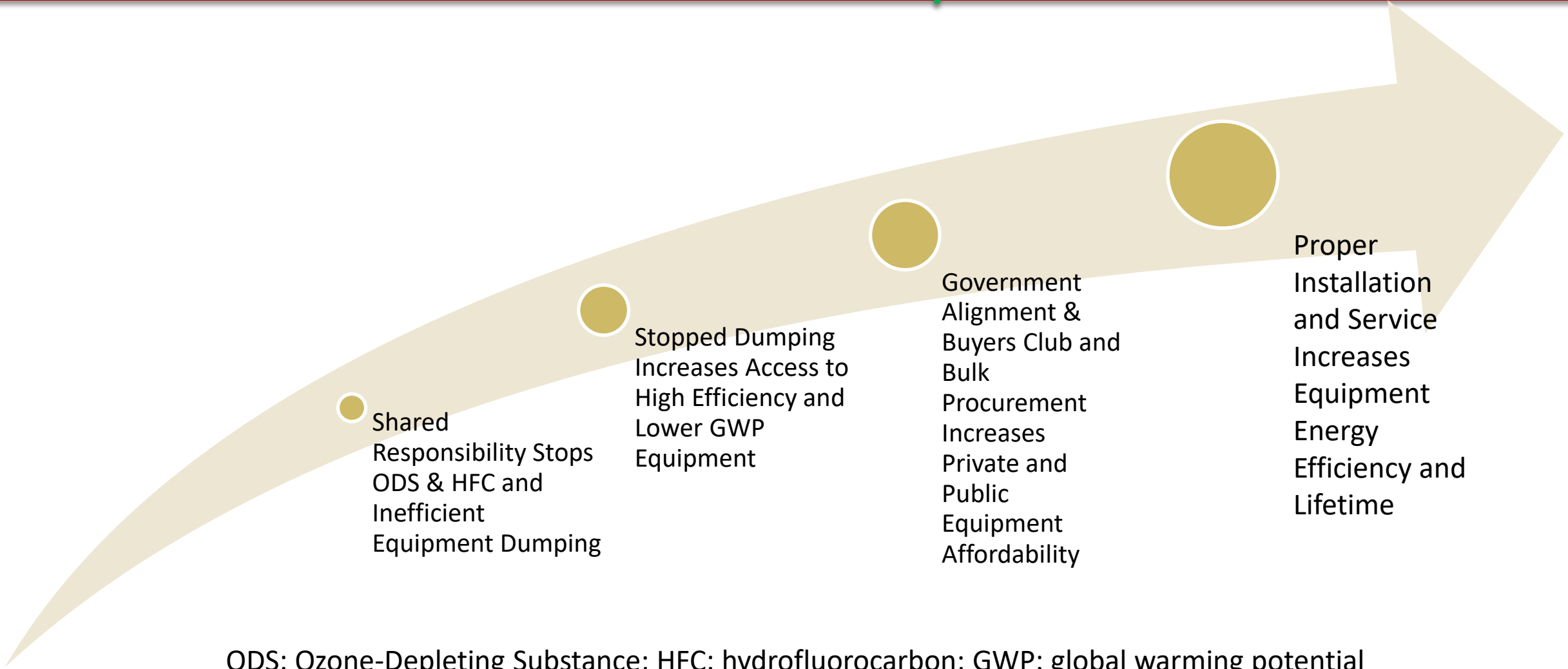


Shared Responsibility for Efficient Cooling with Lower-GWP Refrigerants Drives Market Business Opportunities

Dr. Stephen O. Andersen, Director of Research
Institute for Governance & Sustainable Development (IGSD), Presenter

Replace Dumping with Efficient Low GWP RACs at Affordable Cost **with Proper Installation**



Shared Responsibility Stops ODS & HFC and Inefficient Equipment Dumping

Stopped Dumping Increases Access to High Efficiency and Lower GWP Equipment

Government Alignment & Buyers Club and Bulk Procurement Increases Private and Public Equipment Affordability

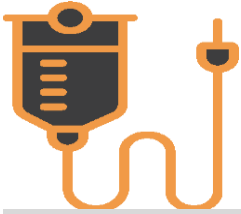
Proper Installation and Service Increases Equipment Energy Efficiency and Lifetime

ODS: Ozone-Depleting Substance; HFC: hydrofluorocarbon; GWP: global warming potential

Bulk Procurement & Buyers Clubs

- RACs dumped in A5 Parties were inefficient when purchased, contain obsolete ODS and HFC refrigerants, and are improperly installed and serviced for energy efficiency.
- The ambition is to replace older RACs with super-efficient, lower-GWP RACs while collecting and destroying recovered refrigerants in local cement kilns
- Lower inventory, sales, and installation costs offset higher manufacturing cost of super-efficient RACs with lower-GWP refrigerants.
- Replacement of older RACs outside of the local cooling season provides year-round employment, which reduces training costs and improves skills.
- The ideal replacement project is multiple building units with ductless RACs on outside walls such as classrooms, apartments, offices, and health care facilities.

Sectors Selected for Case Studies in Brazil and Morocco



Health Sector Brazil

- > 2900 public and > 4300 private **Health Institutions**
- > 445,000 patient rooms, with split and refrigerators installed + central cooling systems
- Major refrigerants: R-22, R-410A, R-134a

Partnership with **Healthy Hospitals (PHS)** and Mitsidi Projects

- Detailed assessment of 33 health institutions that are PHS's members- completed
- Business case development- Procurement guidelines with EE/Low GWP criteria for RAC presented to procurement divisions for implementation- completed
- **Looking for partnerships to scale up the pilot, expanding to more hospitals. Collection and destruction solutions to be developed.**



Bank & Govt. Sector Morocco

Bank of Africa branches in 18 African Countries, respected for knowing small energy savings grow to national fortunes spent locally, self-financed and financing others
Government of Morocco: Leading by example in administrative offices, medical facilities, public housing, schools, and more.

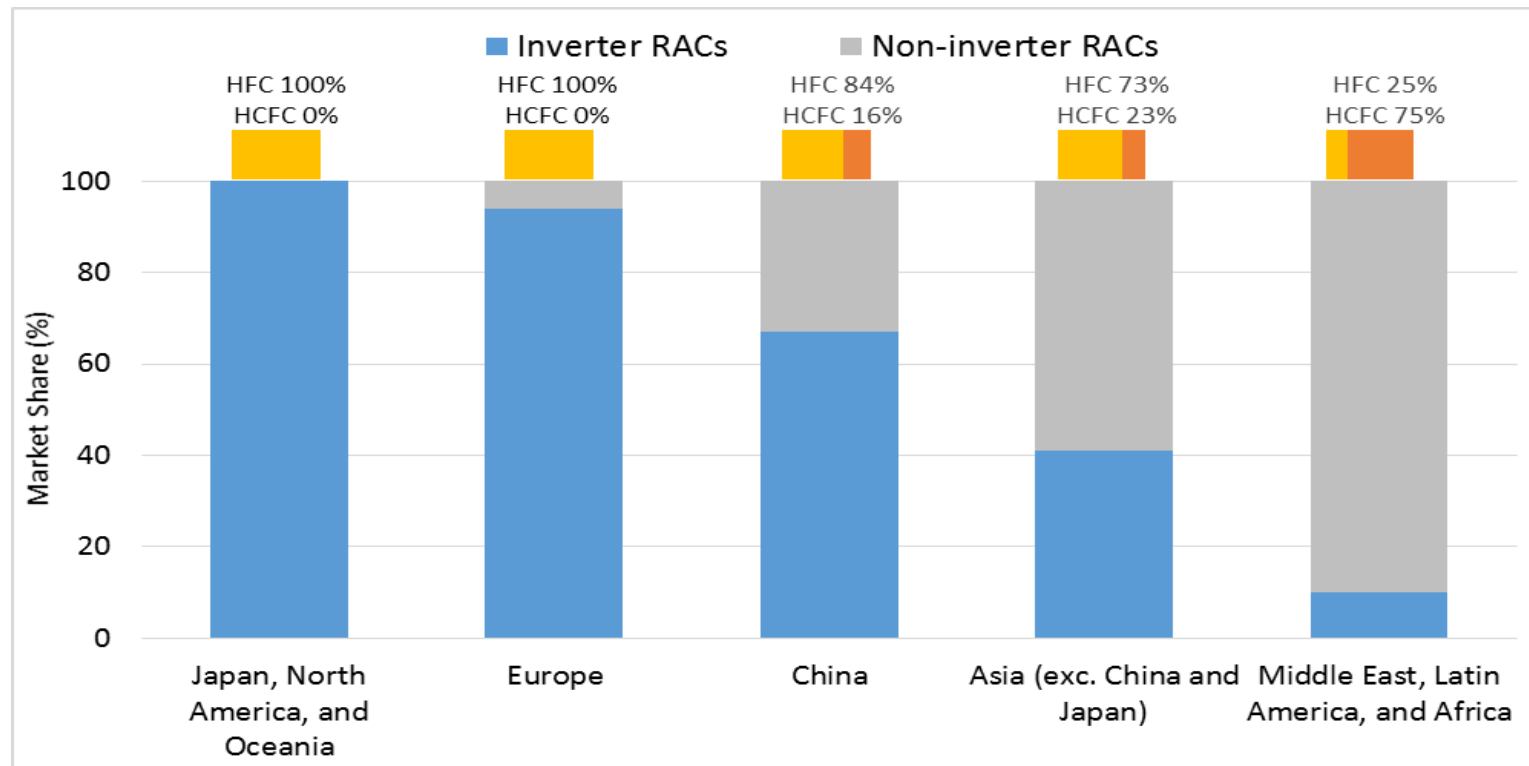
- Developed enhanced and localized life cycle climate performance taking into account local climate carbon intensity of electricity
- Demonstrated energy savings by replacing older single-speed RACs with R-32 inverter RACs
- Socializing strategy in government, power, RAC suppliers, installers, and End of Life (EOL) sectors

Indicative Savings of Efficient Cooling Products Properly Installed

- Combined benefits of more affordable cooling, cleaner air, and avoidance of climate tipping points, with electricity savings spent locally on education, health care, nutrition, and other goods and services improving the quality of life
- Morocco Demonstration with Bank of Africa and Daikin
 - 70% savings from properly installed COP=5.3 inverter R-32 RACs replacing poorly installed and serviced R-22 RACs with COP=2.0 in Marrakesh
- Brazil Demonstration with Japan International Cooperating Agency (JICA) and Daikin
 - 65% savings from inverter RACs tested in 3 cities

Backup Slides

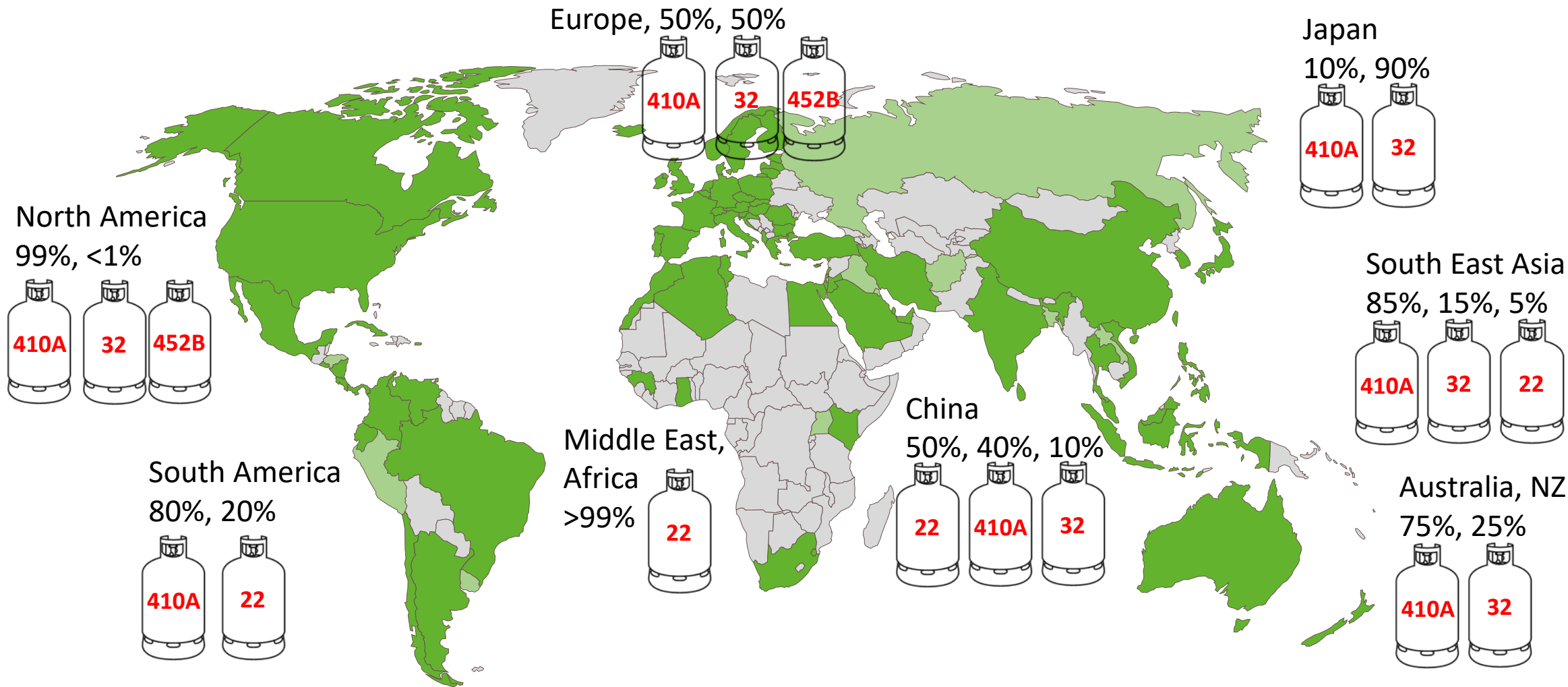
Inefficient Equipment & Obsolete Refrigerants Dominate A5 Markets



Source: The Japan Refrigeration and Air Conditioning Industry Association (JRAIA) and LBNL estimates for Middle East, Latin America and Africa.

- Survey of almost 3000 room RAC compressor models did not identify any variable speed drive HCFC-22 compressors

Air Conditioning MEPS Map (U4E) & Refrigerants in New Cooling Equipment (ASHRAE)



Refrigerant usage estimates from market reports (ASHRAE, 2019)



What is a Buyers Club?

- Buyers Clubs lower the price and increase the environmental performance of RACs by bulk purchase and streamlined distribution and installation according to best practices for sustained efficiency.
- AC Buyers Clubs can purchase the RACs, take delivery, and install the product for members --- or can negotiate a lower price for members who buy from dealers that deliver and install the RACs.
- Optional agreements for supervised installation and improved service to maintain energy efficiency and savings.
- Yes, every Montreal Protocol Implementing Agency should aggregate demand for replacements and bargain for discounts!

Why Equatorial A5 Parties?

- Long, hot cooling seasons made worse by climate change and with expensive and stressed fossil fuel electric supply.
- Low RAC market penetration and high expected growth rate.
- *Champions* of Montreal Protocol HFC Kigali Amendment, *Leadership* in leapfrogging high-GWP HFCs in HCFC phaseout, and *Ambition* to integrate energy efficiency in refrigerant transition.

Why Private Banks in Buyers Clubs?

- Bankers are the masters of rate-of-return and pay-back and know that energy savings can accumulate into fortunes.
- Bankers are concerned and involved in their communities and are trusted advisors in sustainable investment.
- Bankers have access to money for investment and set an example for others wanting to do their part for sustainable prosperity.
- Local Banks are often owned by national or international organizations, allowing success in one location to be quickly replicated.

History of RAC Buyers Clubs & Stop Dumping (1)

- 2006:
 - Atul Bagai and Saurabh Kumar (OzonAction), Sitaram Joshi (Nepal Ozone Officer), Stephen O. Andersen (US EPA & TEAP), and the Hotel Association of Nepal (HAN) plan RAC buyers club for green tourism.
- 2013:
 - Saurabh Kumar moves from OzonAction to India's Energy Efficiency Services Limited (ESSL) as Managing Director.
- 2015
 - Ajay Mathur (India Bureau of Energy Efficiency-BEE) and Stephen O. Andersen begin collaboration with Suely Carvalho (UNDP, retired) and Marco Gonzalez (Ozone Secretariat, retired) on 'government alignment' strategy for energy efficiency.

History of Buyers Clubs and Stop Dumping (2)

- 2016
 - Daikin responds to the Clean Energy Ministerial Advanced Cooling Challenge (ACC) with a pledge to offer a super-efficient ACs using a lower-GWP refrigerant at a favorable price if a government procurement can buy enough to achieve economy of scale.
 - Ajay Mathur became Director General of The Energy & Resources Institute (TERI).
 - Ajay, Stephen, Suely, Marco, and a dozen partners complete government and industry alignment.
 - Kigali Amendment to the Montreal Protocol agreed to phase down hydrofluorocarbons (HFCs).
 - Kigali Energy Efficiency Decision (by Morocco and Rhonda) sets the stage in expanding Montreal Protocol synergy.

History of AC Buyers Clubs and Stop Dumping (4)

- 2017
 - Saurabh Kumar and EESL tender for 100,000 room ACs at ISEER of 5.2 or higher, which is awarded to Panasonic and Godrej.
- 2018
 - IGSD and partners pursue Private Buyers Clubs in Morocco and Brazil with government, banking, and industry partners.
 - ASHRAE (American Society of Heating, Refrigeration, and Air-Conditioning Engineers) publishes Enhanced and Localized Life Cycle Climate Performance Metric (EL-LCCP).
 - CLASP and IGSD document dumping in Africa of inefficient RACs with obsolete ODS and HFC refrigerants.

History of Buyers Clubs and Stop Dumping (5)

- 2019
 - Replacement at Bank of Africa of older inefficient improperly installed RACs with obsolete refrigerants with efficient inverter R-32 RACs reduced electricity consumption by about 70%.
- 2020
 - CLASP and IGSD document dumping of inefficient RACs with obsolete ODS and HFC refrigerants in ten major RAC markets in Africa.
- 2023
 - CLASP and IGSD document dumping of inefficient RACs with obsolete ODS and HFC refrigerants in ten major RAC markets in Southeast Asia
 - CCAC/UNEP/IGSD Stop Dumping Workshop in Paris documents and articulates the case for shared responsibility.
 - Montreal Protocol Decision XXXV/13 on shared responsibility of exporting and importing Parties to stop dumping.

History of AC Buyers Clubs and Stop Dumping (3)

■ 2024

- The Executive Committee of the Multilateral Fund (MLF) for the Implementation of the Montreal Protocol elaborates upon an “Operational Framework” that, among other things:
 - » establishes a mechanism for MLF incentives needed to achieve higher levels of cooling equipment* efficiency;
 - » indicates that no such incentives would be provided for cooling equipment with a target performance below the minimum energy performance level; and
 - » provides that products exported without minimum energy performance standards (MEPS) can only be included in MLF project submissions if said products’ performance is equal to or greater than the national MEPS.

*“Cooling equipment” in the Operational Framework document includes domestic refrigerators, refrigerated display cabinets, chest freezers, residential air conditioners, and commercial air conditioners.

History of AC Buyers Clubs and Stop Dumping (3)

- 2024
 - CCAC / IGSD / World Bank Workshop on Transitioning to Efficient Lower-GWP RACs in A5 Parties (June 2024).
 - International Energy Agency (IEA) 9th Annual Global Conference on Energy Efficiency (May 2024, Nairobi, Kenya), convenes a special event on delivering a super-efficient future for appliances, discussing approaches to boosting higher efficiency appliances in global markets and actions that can address dumping of inefficient new or second-hand models in developing markets.

A5 RAC Market Drivers

- AC demand is driven by low rate of AC market penetration; long, hot, and humid air conditioning seasons and increasingly frequent heat waves; and increasing population, urbanization, wealth, and electrification.
- Expensive electricity generated from fuel imported from foreign countries makes energy efficiency more economic than elsewhere.
- The Kigali Amendment to the Montreal Protocol will phase-down hydrofluorocarbon (HFC) refrigerants and increase energy efficiency.
- The challenge is to gain access to the best next-generation technology while avoiding obsolete technology.
- A Bankers Buyers Club can jump start investment in super-efficiency with climate and clean air benefits.

Selected Bibliography (1)

- Agyarko, Kofi A., Stephen O. Andersen, Richard “Tad” Ferris, Gabrielle “Gabby” B. Dreyfus, Mohamed Rida Derder, Leslie Olonyi Bosire, Laura Bloomer, and Xiaopu Sun. 2022. The Importance of Stopping Environmental Dumping in Ghana: The Case of Inefficient New and Used Cooling Appliances with Obsolete Refrigerants. *32 Duke Environmental Law & Policy Forum* 51-106 (2022) Available at: <https://scholarship.law.duke.edu/delpf/vol32/iss1/2>.
- Agyarko, Kofi A. (Editor). 2023. Report of the Climate and Clean Air Coalition (CCAC) Stop Dumping Workshop. Paris 24-25 August.

Selected Bibliography (2)

- Andersen, Stephen O., Richard Ferris, Romina Picolotti, Durwood Zaelke, Suely Carvalho, and Marco Gonzalez. 2018. *Defining the Legal and Policy Framework to Stop the Dumping of Environmentally Harmful Products*. 29 Duke Environmental Law & Policy Forum 1-48 (2018).
<https://scholarship.law.duke.edu/delpf/vol29/iss1/1>.
- Andersen, Stephen O., James Wolf, Yunho Hwang, and Jiazhen Ling. 2018. *Life-Cycle Climate Performance Metrics and Room AC Carbon Footprint*. ASHRAE Journal, November.
http://www.ceee.umd.edu/sites/default/files/documents/24-35_Hwang%20for%20UMD%20web.pdf.

Selected Bibliography (3)

- CLASP and IGSD. 2023. *Pathways to Prevent Dumping of Climate Harming Room Air Conditioners in Southeast Asia. Final Report*. 20 September. <https://www.clasp.ngo/research/all/pathways-to-prevent-dumping-of-climate-harming-room-air-conditioners-in-southeast-asia/>
- CLASP and IGSD. 2020. *Environmentally Harmful Dumping of Inefficient and Obsolete Air Conditioners in Africa. Final Report*. 24 June. <https://www.clasp.ngo/research/all/environmentally-harmful-dumping-of-inefficient-and-obsolete-air-conditioners-in-africa/>
- CLASP. 2018. *Africa Air Conditioner Market Scoping Study: Final Report*. 15 August. <https://clasp.ngo/updates/2018/clasp-africa-air-conditioner-market-scoping-study-sheds-light-on-growing-ac-markets-in-Africa>.
- IGSD. 2018. *Primer on HFCs*. Lead Authors: Durwood Zaelke, Nathan Borgford-Parnell, and Stephen O. Andersen and Contributing Authors: Kristin Campbell, Xiaopu Sun, Dennis Clare, Claire Phillips, Stela Herschmann, Yuzhe Peng Ling, Alex Milgroom, and Nancy J. Sherman. <http://www.igsd.org/wp-content/uploads/2018/01/HFC-Primer-v11Jan18.pdf>.

Selected Bibliography (4)

- Japan Ministry of Environment (JMOE), Climate and Clean Air Coalition (CCAC), and Initiative on Fluorocarbon Life Cycle Management (FL). 2022. *Resource Book for Life Cycle Management of Fluorocarbons: Global Practice Portfolio for Policymakers*. <https://www.env.go.jp/content/000090572.pdf>.
- Khalfallah, Ezzedine, Rafik Missaoui, Samira El Khamlichi and Hassen Ben Hassine. 2016. *Energy-Efficient Air Conditioning: A Case Study of the Maghreb Opportunities for a more efficient market*. The World Bank Group. April. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/754361472471984998/opportunities-for-a-more-efficient-market>.

Selected Bibliography (5)

- Sebti, Soraya, Saïd Mouline, Yunho Hwang, Stephen O. Andersen, and Mohamed Rida Derder. 2021. *Indicative Saving of Up To 70% with Inverter R-32 Replacement Room ACs at The Bank of Africa*. Report of the Bank of Africa Pilot Project Team. <https://www.igsd.org/wp-content/uploads/2021/05/Morocco-BMCE-Bank-of-Africa-RAC-Pilot-Final-6-April-2021.pdf>.