

Morocco Buyers Club

Seeking Affordable Super-Efficient Low-GWP ACs

Update to the World Bank

28 November 2018

Drs. Stephen O. Andersen & Suely Carvalho



What is an AC Buyers Club?

- A public or private AC Buyers Club lowers the price and increases the quality of selected products by buying in bulk and streamlining distribution and installation
- AC Buyers Clubs can make the purchase, take delivery, and distribute the product to subscribers --- or can negotiate a lower price for members who buy from dealers that deliver and install the ACs
- Optional agreements for supervised installation and/or service to maintain energy efficiency and savings
- Lowered price of efficient ACs can accelerate strengthening of Minimum Efficiency Performance Standards (MEPS)

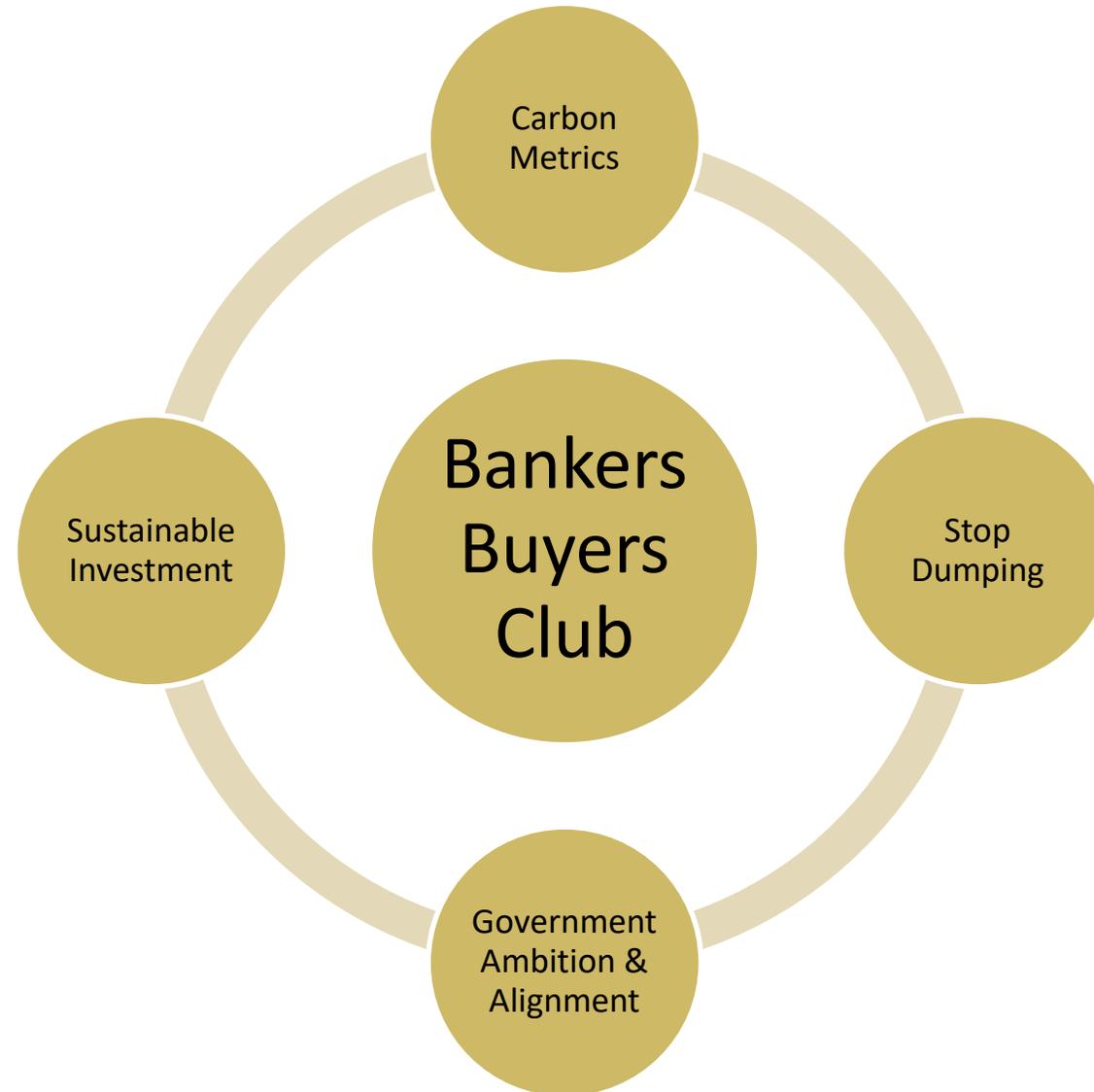
2017 EESL Path-Breaking Bulk Procurement

- EESL Bulk procurement stimulates price competition, achieves economy-of-scale in domestic manufacturing, saves buyers millions of dollars, and helps clean the air and protect the climate
- Ajay Mathur and Stephen O. Andersen co-chaired the alignment of Indian government policy in support EESL pioneering the first bulk procurement to make super-efficient room ACs price competitive
- Others can proceed confidently to procure higher-efficiency and lower-GWP ACs at affordable prices
- Each procurement raises the bar on what A5 Parties can demand

Why a Private Buyers Club?

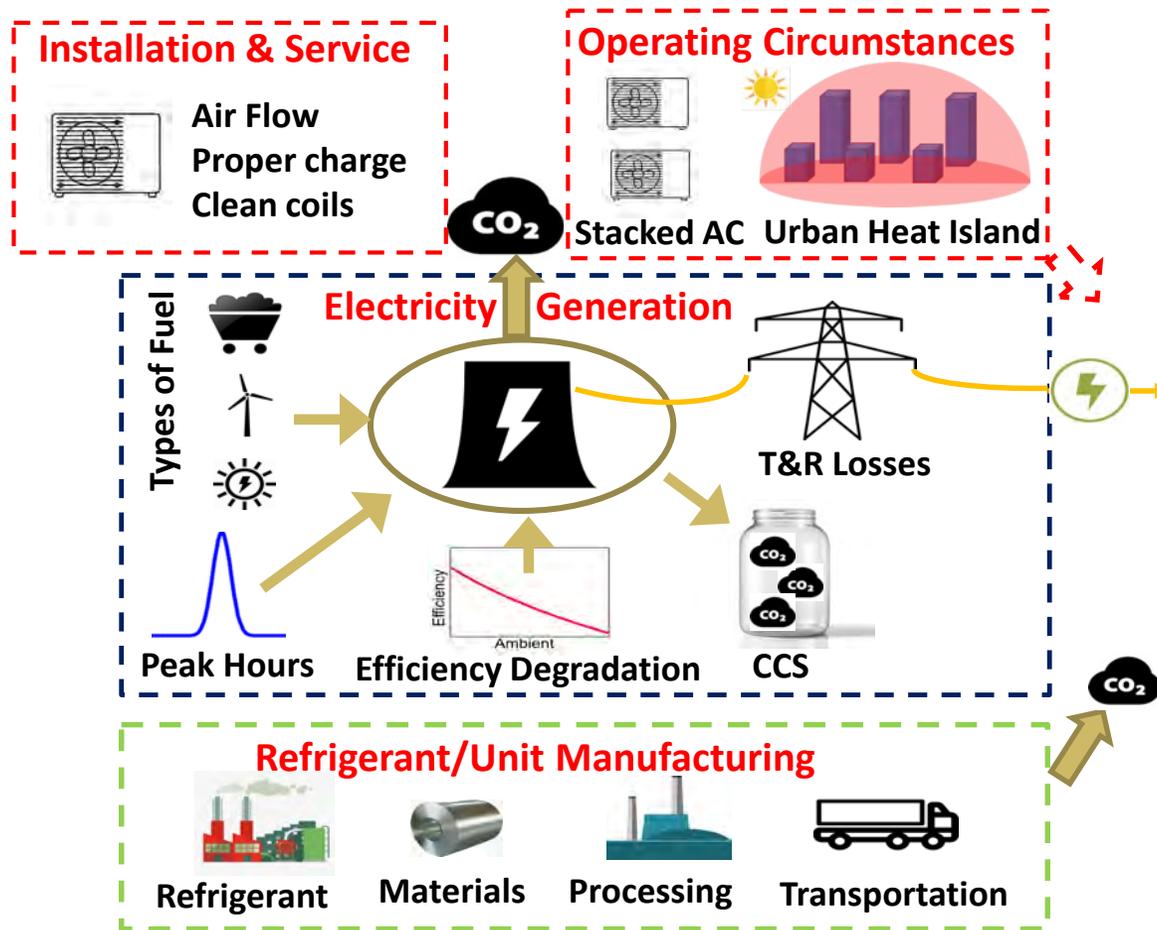
- Not inhibited by boilerplate government procurement rules
 - 100-page EESL contract, deposit to bid, three bids minimum, prescribed delivery schedule, hold-back to assure warrantee service, etc.
 - Substantial influence of national stakeholders and multinational companies
- Full control over tender specifications for lowest carbon footprint
- Simple, transparent, and easy to replicate

Buyers Club Synchronization

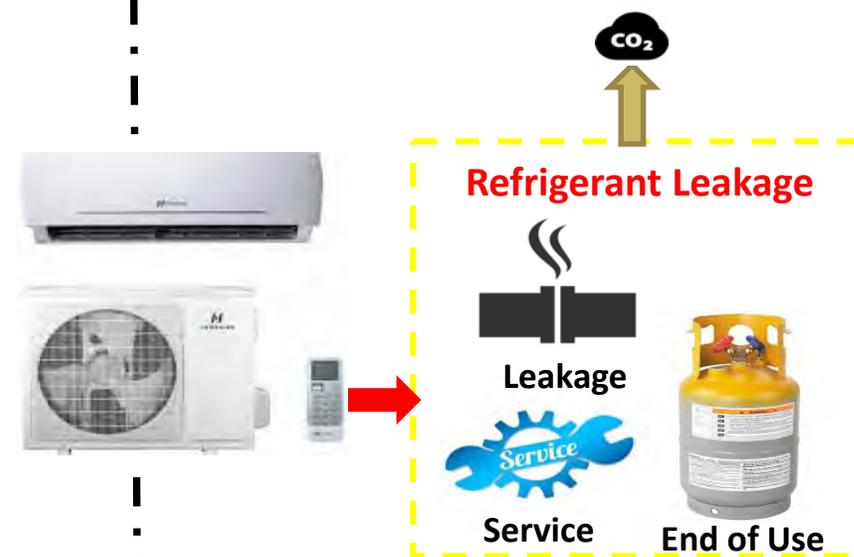


Localized Life-Cycle Climate Performance (LCCP)

Indirect Emission



Direct Emission



Temperature Bins Ignore:

Heat Islands, Stacking, Clustering & Poor Install

		Marrakech	Tangier	Casablanca
Bin Number	Temperature Bins (°C)	Bin Hours	Bin Hours	Bin Hours
1	18.3-21.1	1,213	1,388	1,862
2	21.1-23.8	811	953	1,645
3	23.9-26.6	887	867	688
4	26.7-29.3	650	366	116
5	29.4-32.1	501	150	16
6	32.2-34.9	298	43	0
7	35-37.7	207	14	0
8	37.8-40	161	1	0

Improper Installation Increases Energy Use

Buyers Club can include best practices and inspection

Overhang Obstructs Airflow

Improper Spacing for Air Intake

Air Intake Blocked by Roof Beam

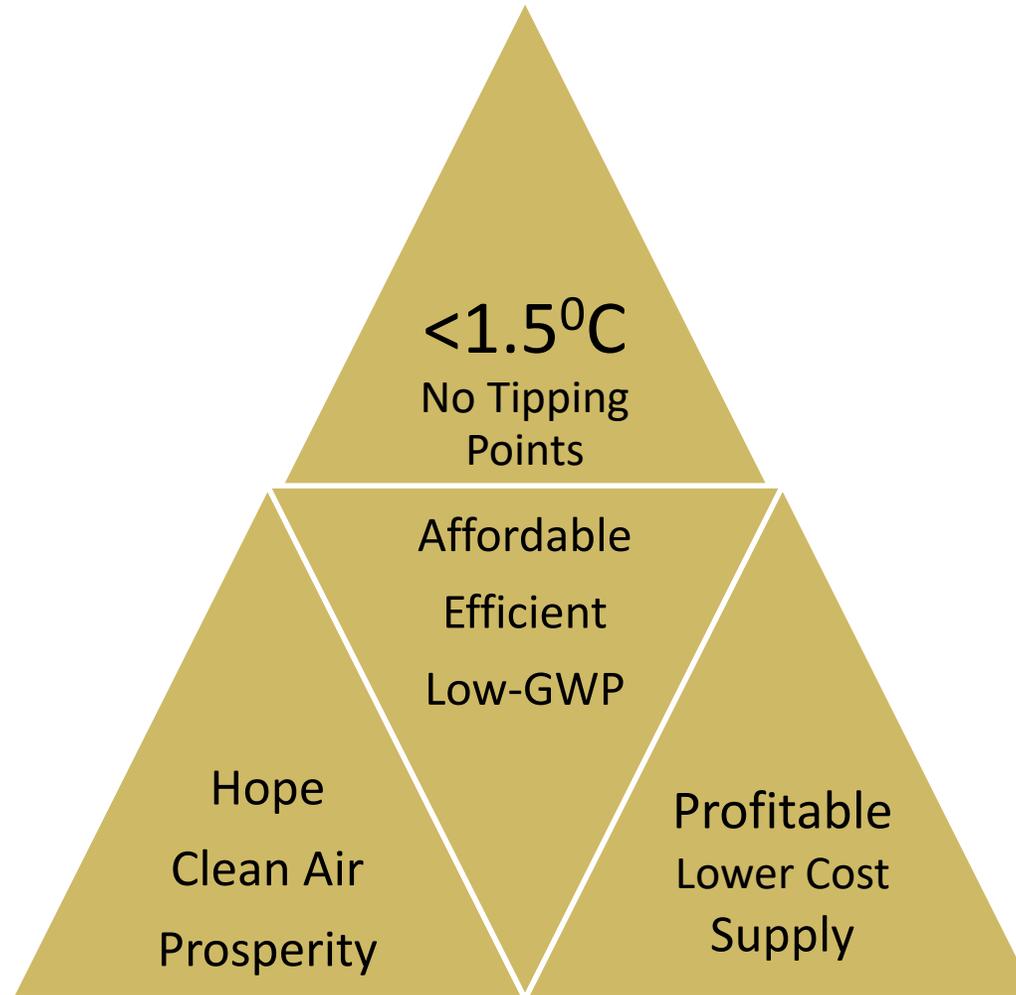


Proper Installation for Maximum Efficiency



Unobstructed Heat Discharge

Sustainable Investment



IGSD Anti-Dumping Campaign

- Obsolete and Inefficient HCFC-22 and HFC-410A Room ACs are Dumped in A5 Markets
- Dumping Harms AC Owners, Local Communities, Nations, and Climate
 - Money spent on electricity is wasted on imported fuel and power plants
 - Money saved on electricity is spent locally
 - Local spending recirculates, creating local jobs and prosperity
- IGSD Stop Dumping Tools Consistent with Trade Rules
 - Now:
law.duke.edu/scholarship/journals/articles/IGSD_Article_Sneak_Peek.pdf
 - Final: Duke Environmental Law and Policy Forum: delpf.law.duke.edu/

Profitable Lower Cost Supply

- Sustainable procurement requires continuously profitable supply chains to motivate research, development and commercialization, to achieve economy of scale, and to enter all A5 markets
- The Buyers Club strategy is to reduce the cost of supply by rewarding companies competing for quality and low-carbon performance and to reduce the cost of marketing, distribution, installation, inspection, service, and recover/recycle at end of product life
- Green is the new Gold

Why Africa?

- Long, hot cooling seasons with challenging electric supply
- Low AC market penetration and high expected growth rate (>8%/yr.)
- Only six African countries have MEPS and none higher than 3.0 W/W
- ACs for the African Market are primarily from China, Republic of Korea with some in-country assembly in Egypt and Nigeria
- Lack of strong energy efficiency policy and MEPS allow foreign manufacturers to dump poor quality and inefficient ACs that waste African wealth on imported power plants and fuel

Why Morocco?

- Early advocates of Montreal Protocol HFC Amendment; Leadership in leapfrogging high-GWP HFCs in HCFC phaseout and ambition to integrate energy efficiency in refrigerant transition
- Influential in the Arab Maghreb Union (AMU), the Community of Sahel-Saharan States (CEN- SAD), the Greater Arab Free Trade Agreement (GAFTA), and the Euro-Mediterranean Partnership (EUROMED)
- Moroccan banks operate in 25+ African countries
- Annual purchase of 130,000 to 240,000 obsolete HCFC-22 and HFC-410A ACs with only 30% more efficient inverter designs

Why Morocco Banks?

- 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

Next Steps: Coordinated Morocco Pilots

- Five Independent but Coordinated Pilot Projects in Morocco with the Advice and Council of partner African NOUs and Banks
 - 1) Pilot localized life-cycle carbon footprint analytical metric
 - 2) Pilot business plan to upgrade of ACs at BMCE Bank of Africa
 - 3) Pilot government green procurement plan for government buildings
 - 4) Liaise likely suppliers of super-efficient ACs to Morocco
 - 5) Undertake private and public buyers club procurement for Morocco
- Learn-by-Doing and Take Lessons Forward
- Harmonize Procurement Specifications and Procedures Taking Into Account Financial Incentives and Paris Agreement Obligations

Buyers Club World Bank & IFC Opportunity

- Kigali Impact Investment with Montreal Protocol Synergy
- Grants and Loans Contingent on Government Alignment
 - Pioneer utility recovery of public efficiency investment
 - Motivate life-cycle MEPS and accurate & localized AC test procedures
- Targeting Parties Without the Conflict of Local Manufacturing
- Specifically:
 - Super-Efficient Room ACs
 - Inverter/Motor/Compressor Package
 - AC Service Tools (leak detection, recovery/recycle)

Contacts for More Buyers Club Information

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Backup Slides Morocco & Brazil

History of AC Buyers Club

- 2006:
 - Atul Bagai & Saurabh Kumar (OzonAction), Sitaram Joshi (Nepal Ozone Officer), Stephen O. Andersen (US EPA), and Hotel Association of Nepal (HAN) plan AC buyers club for green tourism
- 2013:
 - Saurabh Kumar moves from OzonAction to Energy Efficiency Services Limited (EESL) as Managing Director
- 2015
 - Ajay Mathur (India Bureau of Energy Efficiency-BEE) & Stephen Andersen begin collaboration with Suely Carvalho (UNDP, retired) and Marco Gonzalez (Ozone Secretariat, retired) on 'government alignment' strategy for energy efficiency
- 2016
 - Daikin responds to the Clean Energy Ministerial Advanced Cooling Challenge (ACC) with a pledge to offer a super-efficient AC 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 & Karan complete government and industry alignment
 - Kigali Amendment to the Montreal Protocol agreed to phase down hydrofluorocarbons (HFCs)
- 2017
 - Saurabh Kumar and EESL issue tender for 100,000 room ACs with ISEER of 5.2 (or higher), which is awarded to Panasonic and Godrej
- 2018
 - IGSD, TERI & Partners rapidly pursue Private Buyers Clubs in Morocco and Brazil with government, banking, and industry partners

Published by OzonAction and IGSD
In cooperation with TERI, EESL and TERRE

<http://www.igsd.org/wp-content/uploads/2018/01/Buyers-Club-Handbook-2018.pdf>

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Buyers Club Handbook Outline

- Air Conditioning Impact on Ozone Depletion and Climate Change
- Kigali Super-Efficient AC Imperative w/Lower-GWP Refrigerants
- Available and Emerging Lower-GWP Refrigerant Choices
- Opportunities for Affordable and Efficient Room ACs
- Old and New Approaches for Improving Energy Efficiency
 - Minimum Energy Performance Standards (MEPS), labelling, and incentives
 - Life-Cycle Climate Performance (LCCP) for MLF and carbon finance
 - Prior Informed Consent and other tools to stop dumping of obsolete, inefficient or unsafe equipment
- Buyers Club for Affordable, Super-Efficient, Lower-GWP ACs

Africa 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, 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 dumping of obsolete technology
- A Bankers Buyers Club in Morocco Pilot can jump start investment in super-efficiency with climate and clean air benefits

2018 Fast Action on Morocco Buyers Club

- 1 March: Casablanca Organizing Meeting
- 20 April: Agence Marocaine de l'Éfficacité Énergétique (AMEE) and IGSD Sign Carbon Metrics MOU
- 9 July: Side Event @ Montreal Protocol Vienna OEWG
- 15 October: BMCE Bank Buyers Club Pilots Elaboration Agreed
- 23 October: Ministre de l'Énergie, des Mines et du Développement Durable (MEMSD)/IGSD Cooperation
- 7 November: Side Event @ Montreal Protocol Quito Ecuador MOP
- In Press Life-Cycle Carbon Metric in Nov. 2018 ASHRAE Journal

Casablanca: 1 March 2018 Meeting Participants!

- Agence Marocaine de l'Efficacité Énergétique (AMEE)
- Moroccan Ministry of Industry and National Ozone Unit
- Association Marocaine Professionnel du Froid
- Banks including Attijari Wafabanque, Banque Populaire, BMCE, CIH bank, Central Bank of Morocco and Nigeria Central Bank
- Nigeria Ozone Unit
- AOB Business Consultant Group
- The Energy and Resources Institute of India (TERI)
- ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)
- Daikin Middle East
- IGSD
- Various Local & Regional Press

October 2018 Study & Agree

- IGSD:
 - Dr. Stephen O. Andersen, Dr. Suely Carvalho, Mr. Mohamed Rida Derder, and Mr. Marco Gonzalez
- University of Maryland
 - Dr. Yunho Hwang
- World Bank
 - Dr. Ashok Sarkar
- Workshops and Brainstorming
 - BMCE Africa Bank experts in business development, economic intelligence, entrepreneurship, finance, foreign financial institutions, international cooperation, procurement, and sustainable development
 - Government and Non-Government champions of energy efficiency

Washington DC: 20 April 2018 AMEE/IGSD MOU!

- Moroccan Agency for Energy Efficiency (AMEE) and IGSD signed Memorandum of Understanding (MOU) to determine: The ownership savings of higher energy efficiency
 - The community savings of cleaner air
 - The national savings of avoided power plants/fuel with savings spent locally
 - The global savings of the combined carbon-equivalent direct refrigerant greenhouse gas (GHG) and indirect fossil fuel and biomass GHG emissions
- Calculated for local climate conditions and heat islands, electricity price, and time-of-day carbon intensity of electricity

Vienna: 9 July Side Event at Montreal Protocol

- Ms. Shamila Nair-Bedouelle, Head of OzonAction, Paris
- Dr. Ajay Mathur, Executive Director, The Energy and Resources Institute (TERI)
- Dr. Stephen O. Andersen, Director of Research, IGSD
- Dr. Amal Benaissa, Manager, Impact Finance, BMCE Bank of Africa
- Mr. Radouane Yessouf, Agence Marocaine de l'Efficacité Énergétique AMEE
- Mr. Marco Gonzalez, Ozone Secretariat, retired
- Dr. Suely M. Carvalho, UNEP, retired
- Mr. Rajendra Shende, Chairman, TERRE

Casablanca: 1 March 2018 Meeting Outcomes!

- Banks are considering replacement of old ACs if reputable manufacturers will sell, install, and service super-efficient ACs using lower-GWP refrigerants providing lower ownership cost and higher climate benefits
- Daikin will offer super-efficient ACs with a lower-GWP refrigerant designed for high ambient temperatures if Banks agree to coordinate purchase and installation to achieve economy of scale and efficient use of crews; IGSD is recruiting Chinese manufacturers
- The Moroccan Agency for Energy Efficiency agreed to cooperate with IGSD to develop a simple metric for estimating environmental and financial net benefits from super-efficiency lower-GWP AC investment

AMEE / IGSD Morocco Carbon Metrics Team

■ Co-Chairs

- Mr. Saïd MOULINE, CEO AMEE, and President, Commission Economie Verte, Confederation Generale de Entreprises du Maroc,
- Dr. Stephen O. ANDERSEN, Director of Research IGSD

■ Expert Members

- Dr. Suely CARVALHO, Senior Expert Adviser, iCA Brazil, Montreal Protocol Technology and Economics Assessment Panel (TEAP)
- Mr. Abderrahim CHAKOUR, Chef/ Division des Industries Chimiques et Para-chimiques, Ministere de l'Industrie du Morocco
- Mr. Mohamed EL HAOUARI, Director of Energy Efficiency and Renewable Energy, AMEE
- Dr. Yunho HWANG, Center of Environmental Energy Engineering, University of Maryland
- Mr. Radouan YESSOUF, Chef de Service Bâtiment, AMEE

Pilot Business Plan: BMCE Bank of Africa

- Inventory existing ACs for capacity, refrigerant & nameplate efficiency
- Craft investment criteria for accelerated replacement based on financial and environmental rate of return
- Determine the sensitivity of results to differences in interest rates and the global value of lifecycle avoided direct refrigerant and indirect fossil and biomass electricity greenhouse gas (GHG) emissions
- Publish results and welcome peer review and local wisdom

Fast Start with Bank Branches

- Banks in many countries use small air-conditioners for automated teller machine (ATM) rooms and bank lobby and office areas
- Most Bank ACs are old, inefficient, expensive to operate and increasingly unreliable; newer ACs can also be inefficient
- Replacement super-efficient ACs rapidly pay back cost in hot and humid climates, particularly if purchased through a Buyers Club
- Banks can finance AC replacement and track and communicate the savings in the banking network and to customers
- Banks buying ACs made affordable through Buyers Clubs can also be made available to customers as part of the procurement agreement

Cultivate African Super-Efficient R-32 AC Supply

- Many A5 Parties plan to leapfrog from HCFC-22 to HFC-32
- More than a dozen manufacturers have already sold 55 million HFC-32 ACs worldwide
- Japan has completed the transition from HFC-410A to HFC-32
- Daikin has already joined the Morocco Buyers Club Project and is ready to participate in testing of their super-efficient model designed for high ambient temperature African climates
- Other suppliers are invited and welcome

Cultivate African Super-Efficient HC-290 AC Supply

- HC-290 ACs can achieve the lowest carbon footprint at cooling capacities where the safe minimum charge allows energy efficiency
- So far, HC-290 market penetration is far less than HFC-32 ACs, but recent approval for sale in Germany is considered a breakthrough
- IGSD has invited Haier, Midea and TCL to participate in the Morocco Buyers Club project, but agreement is not yet reached
- Public and private Buyers Clubs depend on open competitive bidding

Kigali Success With Help From Our Friends

- Locally-Appropriate Carbon Footprint Metrics Guide Choice
- Participation of Global Suppliers of Super-Efficient Lower-GWP ACs
- Respect National Choice of Affordable GWP and Energy Efficiency
- Backup with Stronger MEPS Justified by Lower Buyers Club Price From Economy-of-Scale and Competition

Three Selected Cities

- Marrakech (Marrakesh)
 - Population: 928,850
 - Coordinates: $31^{\circ} 37'N$; $8^{\circ} 0'W$
- Tangier
 - Population: 947,952
 - Coordinates: $35^{\circ} 46'N$; $5^{\circ} 48'W$
- Casablanca
 - Population: 3,359,818
 - Coordinates: $33^{\circ} 32'N$; $7^{\circ} 35'W$



Selected Morocco Bibliography

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- IGSD. 2018. Primer on HFCs: Fast action under the Montreal Protocol can limit growth of hydrofluorocarbons (HFCs), prevent 100 to 200 billion tonnes of CO₂-eq by 2050, and avoid up to 0.5° C of warming by 2100. 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>

Progress on Brazil Buyers Club

Dr. Suely Carvalho

Why Brazil?

- Huge population with increasing income in increasingly hot and humid climate where windows must be closed against crime, noise, pollution, and disease-bearing insects
- ACs will be the major source of electricity consumption in the residential and commercial sectors driving peak loads, increasing power generation costs, and contributing to higher electricity tariffs

Buyers Club Opportunity in Brazil

- Rapidly strengthen the MEPS and current labelling system to push the market to more efficient ACs
- Market higher efficiency products at competitive prices
 - No clear correlation between price and labelled efficiency for non-inverter ACs of the same capacity
 - Inverters that currently more expensive can dominate if test methodologies take into account partial load and if lower Buyers Club prices and incentives boost market transformation

- Institute Climate and Society (iCS): Strengthening Policy and Labelling
- IGSD and iCS: Support market transformation activities *and* Partners:
 - The National Bank for Economic and Social Development -- BNDES
 - The Brazilian Federation of Banks -- FEBRABAN
 - Interested Manufacturers of ACs
 - Interested Private and Public Banks
 - Utilities with AC Replacement Programmes
- Energy Efficiency-Testing:
Underway (with Daikin) in 3 cities with different efficiencies for both HFC-410A and HFC-32 split ACs

LBNL Estimated Benefits of Increased Residential AC Energy Efficiency in Brazil

30% energy efficiency increase above COP=2.9 W/W base case using refrigerant gases with lower GWP than HFC-410A:

- Brazil 2030 reduction in the peak consumption between 15 and 36 GW
- Avoiding the construction of 31 to 72 500 MW Power Plants

Note: The estimates in the LBNL 2015 report are being verified in the Brazilian Regulatory Impact Study under way. GHG emissions will be re-calculated for current situation in Brazil.



LBNL-1003671

ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY

**Benefits of Leapfrogging to
Superefficiency and Low Global
Warming Potential Refrigerants in
Room Air Conditioning**

Nihar Shah, Max Wei, Virginie Letschert, Amol Phadke

Energy Technologies Area
October 2015

Why Brazil Air Conditioner Buyers Club ?

- ACs are already responsible for 15% of electricity consumption in the Brazilian residential sector. ACs will be the major source of electricity consumption in the residential and commercial sectors in the coming years
- Average of 3.1 hours per day AC use during peak load for the residential sector and 3.9 hours per day during peak load for the commercial sector
- The average represents the AC use for both summer and winter seasons and the whole country