



Caribbean Cooling Initiative (C-COOL) Project Status Update Meeting

Department of Labour Training Room

City Corporate Center

Rosetta Street

Nassau, Bahamas

Friday, April 5th, 2019 | 9:00a.m. – 12:00p.m.

C-COOL OVERVIEW



Funding stream



17 donors pledged \$52 million to promote energy-efficient and climate-friendly cooling

Bahamas

Barbados

Jamaica

Dominican Republic

St Lucia

C-COOL

Rwanda (1st National Cooling Strategy developed) → **R-COOL**

Ghana

Senegal

ECOFRIDGES



C-COOL Rationale

➤ Objective

Accelerate the market transition to energy-efficient and climate-friendly cooling solutions

➤ Benefits

- Reduce the waste of electricity and peak demand from a key end-use
- Lower electric bills for residents, hotels and other businesses, government
- Reduce outflow of funds for imported energy and enhance energy security
- Mitigate environmental impact (emissions, pollution, water)
- Progress with Kigali amendment and Paris Climate Agreement

Project Team



Project Coordination



Brian
Holuj



Loreto Duffy-
Mayers



Marco
Durán



LaToya
Johnson

Regional Coordination



Vincent
Sweeney



Roberto
Borjabad



Alexandra
Karekaho



Marco
Pinzón

Financial Mechanism



Daniel
Magallon



Jasmine
Neve



Thomas
Motmans

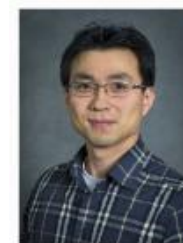
Policy Analysis



Nihar
Shah



Virginie
Letschert



Won Young
Park

Meeting Objectives

- Provide a progress update on C-COOL
- Present the first drafts for input and eventual approval
 - ✓ Market Assessment
 - ✓ National Cooling Strategy
 - ✓ MEPS and Labels
 - ✓ Financial mechanism toolkit
- Identify interests for capacity building
- Ensure alignment with national priorities and related activities

Coordination Efforts/Initiatives

- UN Environment Twinning workshops 2018 - 2019
- GIZ Green Cooling Initiative: capacity building collaboration
- UN Environment Transforming Tourism Value Chains Project
- PTB (German National Metrology Institute) collaboration with CROSQ on CARICOM standards

Regional Engagements

Twinning workshops

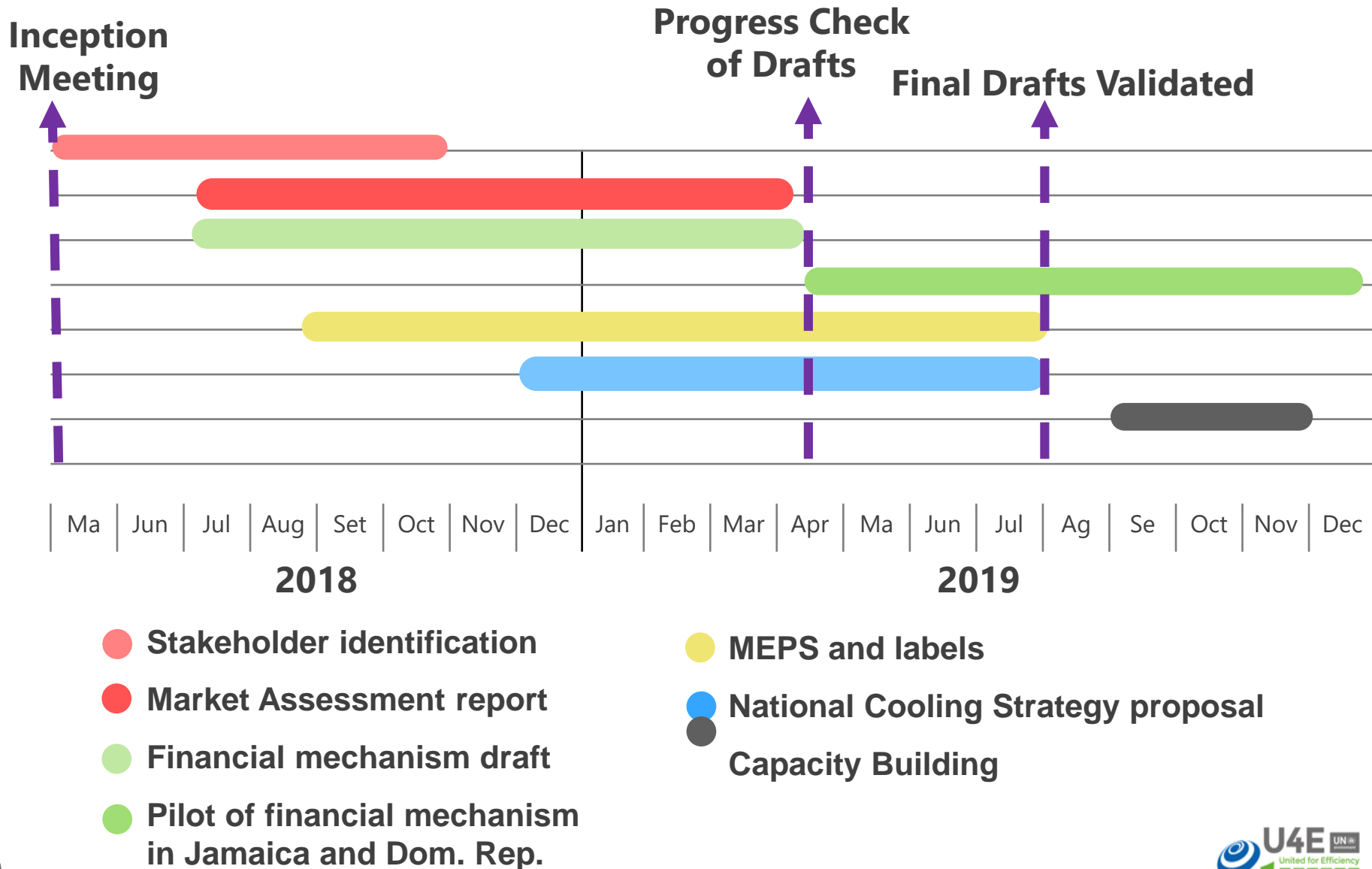
Ecuador 2018



Paris 2019



Work Plan



Market Assessment Key Results

- ✓ Bahamas AC market size: **\$11.5M USD**
- ✓ Large demand for cooling and high utility bills
- ✓ Commercial sector is important; large investments for hotel sector
- ✓ State-of-the-art technologies have large potential for growth
- ✓ Responsibility of provider regarding promised savings fundamental

Market Assessment Methodology

- Outreach to 40+ Stakeholders: Suppliers, End-Users, Government offices, NGOs, etc.
- In-person, phone and email interviews using questionnaires
- Desktop research of existing information (e.g. previous studies by PTB, NREL and others; websites of stores)



Questionnaire for Beneficiaries (Hotels, Offices, etc)

Responses to this questionnaire are of critical importance to properly understand the market for refrigerators and air conditioners in the country. The results will be used by UN Environment to help inform recommendations on policies and programs to increase adoption of energy-efficient products. UN Environment will treat questionnaire responses as business-sensitive information. The findings will be aggregated across the pool of organizations that participate to avoid attribution to any particular entity.

Company	Point of Contact Name	Title	Email	Phone
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General Information

Type of Business	# of employees	Environment/efficiency Labels	Building size (m ²)	# of Floors
(ex. hotel, bank, medical, office...)		(ex. Green Globe, Earth check, ISO, LEED, Green Key...)		

*Hotels only

Category of accommodation	# of rooms	Hotel classification	Annual average occupancy rate (0-100%)
(ex. Full service, apartment, guest house, hotel w/o restaurant)		(Star rating)	

Part A: Air Conditioners

1. Operation profile

During which months is the AC used	Usual hours of use - high demand months (when the offices/rooms are occupied)	Usual hours of use - low demand months (when the offices/rooms are occupied)
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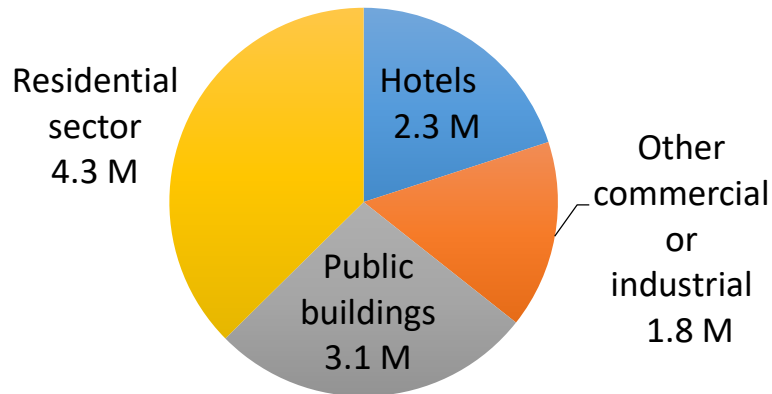
2. Product Characteristics (add rows if necessary):

Type of Air Conditioner	# units in the facility	Brand and Model # <i>(Note: address if needed)</i>	Cooling Capacity (Btu/hr or kW)	Energy Efficiency (EER, SEER, COP, etc.)	Compressor (variable or fixed)	Refrigerant Gas (R-xxx)	Energy Label type, (e.g. energy star)	Purchase Origin (local, imported, imported, other)	Age of unit (years)	Product warranty (years)
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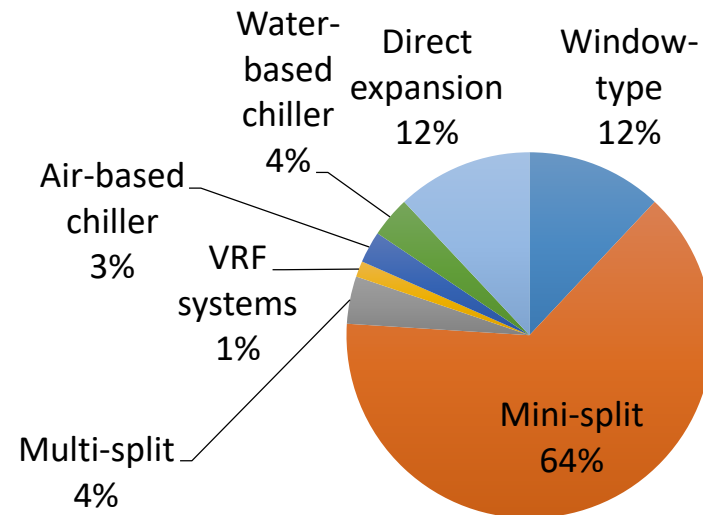
Building Type	Organisation Name	Email	Data Gathering Method
restaurant	restauranters' association		interview w. stakeholder questionnaire
grocery store	Grocers' association		interview w. stakeholder questionnaire
retail store	retailers' association		interview w. stakeholder questionnaire
healthcare facility	healthcare association		interview w. stakeholder questionnaire
office building	office owner/facility manager association		interview w. stakeholder questionnaire
industrial facility / manufacturing	industry / manufacturing association		interview w. stakeholder questionnaire
school	school association for primary / secondary schools		interview w. stakeholder questionnaire
school	university association		interview w. stakeholder questionnaire
multi-family housing (apartments, condos)	Landlords (owners) association		interview w. stakeholder questionnaire
multi-family housing (apartments, condos)	Tenants / renters association		interview w. stakeholder questionnaire
single-family housing	Builders / contractors / engineers association		interview w. stakeholder questionnaire
single-family housing	Homeowners association		interview w. stakeholder questionnaire
hotel	Caribbean Hotel & Tourism Association (CHTA)		open discussion
hotel	national hotel association		open discussion
hotel	individual hotel or chain		interview w. hotel questionnaire
hotel	individual hotel or chain		interview w. hotel questionnaire
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Market by Sector and Technology

National market by sector



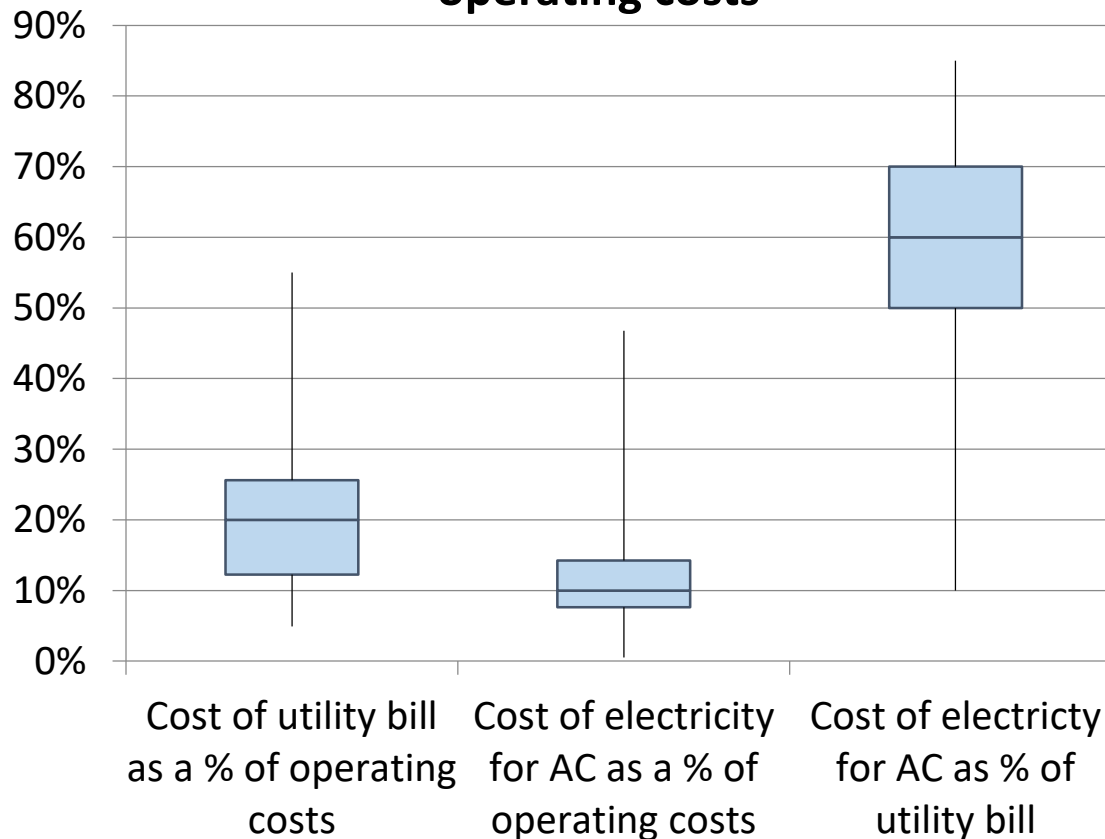
National market by technology



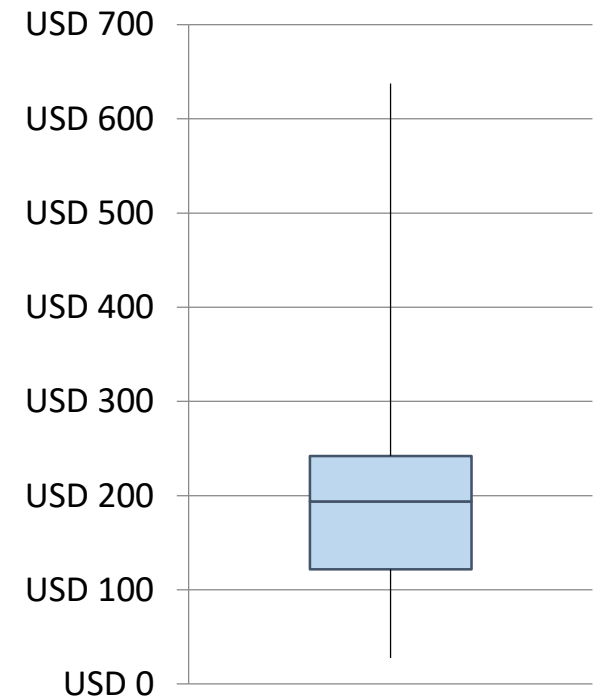
Total AC market in Bahamas: **11.5 MUSD**

AC Consumption and Cost

Cost of electricity for AC as a % of operating costs

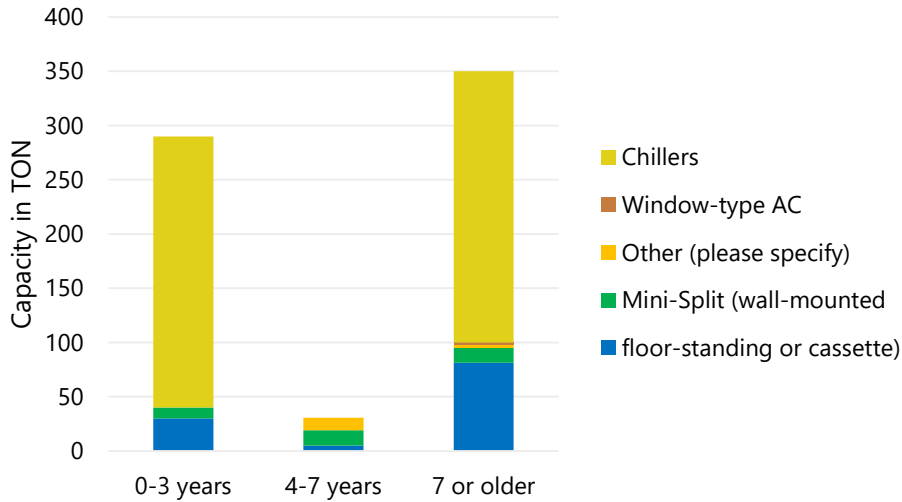


USD per room per month for AC electricity

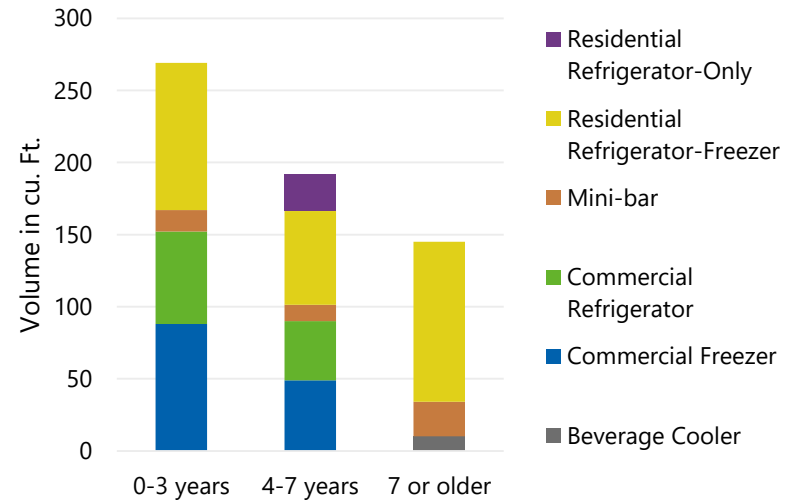


Stock equipment age and characteristics

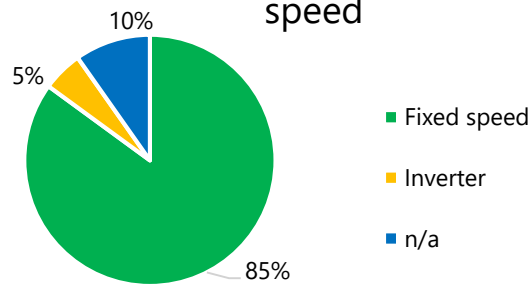
AC's age per technology



Appliance's age per technology



ACs fixed speed vrs variable speed



National Cooling Strategy Overview

- Provides information on the various agreements and treaties that the Bahamas has signed pertaining to climate change and environmental sustainability
 - Montreal Protocol – 1993
 - Small Island Developing States (SIDS) Dock Treaty - 2014
 - Kigali Amendment (HFCs phase down) - 2016
 - Paris Climate Agreement – 2016
- Sustainable Development Goals need to be met in order to protect the country's environment
 - Legislation, policies and programmes needed
- Carbon War Room participation and support for the reduction of dependency on fossil fuels

National Cooling Strategy Overview

- Energy Sector Review
 - National Determined Contributions (NDCs)
 - Carbon emissions expected to decrease by 30% (24k tonnes) of 2002 levels in 2030
 - Clean Energy Goals
 - 30% of energy produced by clean energy by 2030
 - Major Energy Users
 - Hotels, Marinas, Manufacturers, Office Spaces, Grocery Stores
 - Policy Framework
 - More incentives needed to encourage energy-efficiency investments by consumers
 - Regulatory Structure
 - URCA – Regulatory authority
 - The Electricity Act, 2015

National Cooling Strategy Overview

- Summary of Market Assessments
 - Key findings shared on the market profile for AC and Refrigeration products
 - Assumptions made on the quality of products as there are no testing
 - Recommended Regulations
 - Standards and Labeling for Air Conditioning
 - Standards and Labeling for Refrigeration

National Cooling Strategy Development Plan

Today

C-COOL shares the 1st draft and shares with authorities



April - July

Authorities review and include relevant content



July - August

C-COOL integrates input and sends for final approval

- Review of document needed by all relevant stakeholders
- Input from relevant stakeholders to be included in strategy
- Comments compiled to be integrated in the plan and reviewed by stakeholders for final approval

National Cooling Strategy Adoption and Outreach

What is your approach for strategy development and adoption?

How can we assist in the months ahead?

- Statistics and benefits
- Experiences from other countries that work with U4E

What do other countries do?

- Broadcasting by radio, newspapers, social media, web
- Success stories
- Integration with other policies



Focus of Policy Recommendations

Room Air Conditioners



(window, room, through-the-wall, portable)

Refrigerating Appliances

REFRIGERATORS

one or more chilled compartments, generally at various temperature zones between 0°C and 14°C, and which may include an ice-making section



FREEZERS

one or more frozen compartments, usually between -18°C and -6°C

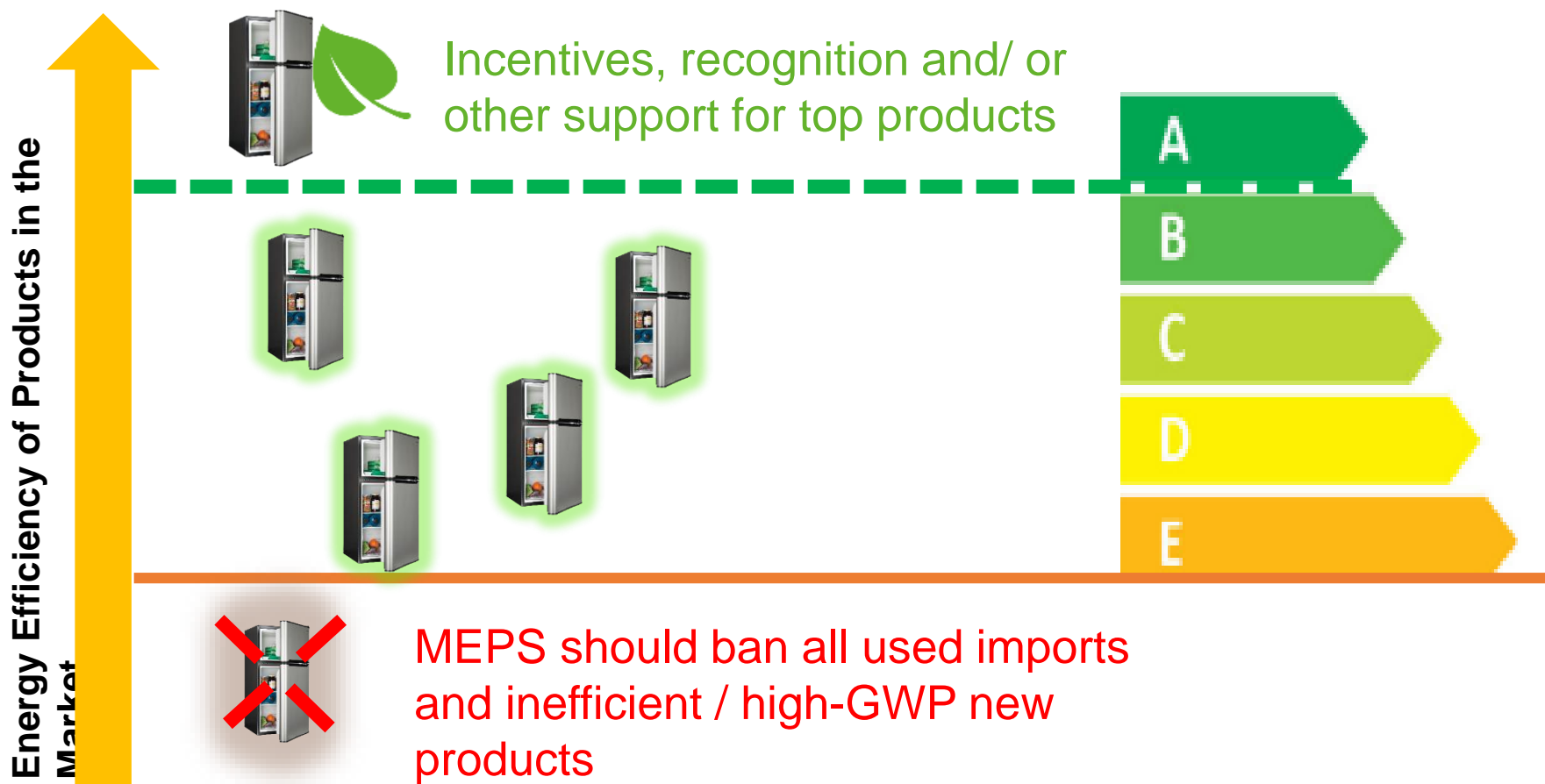


FRIDGE-FREEZERS

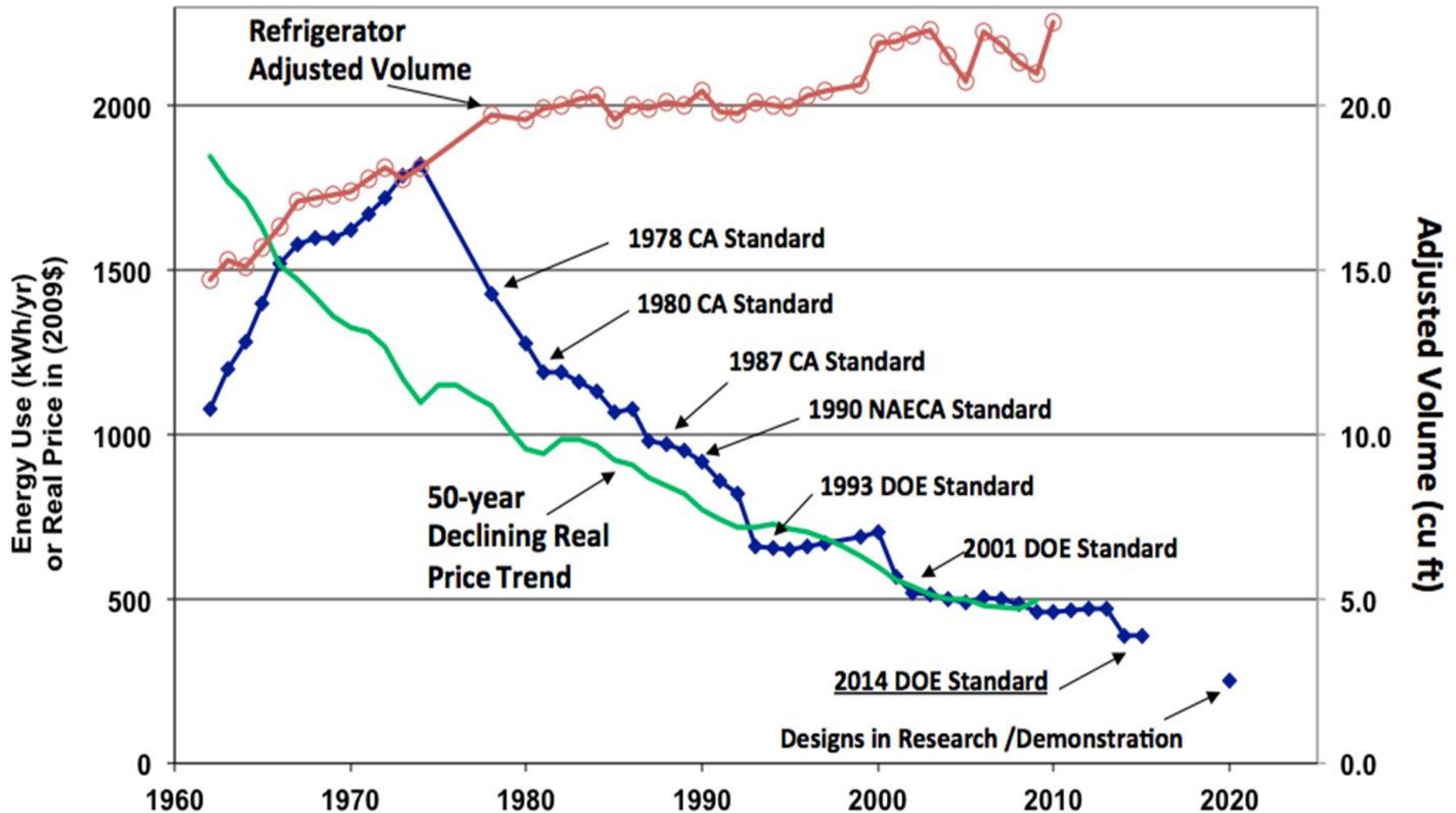
combination of both chilled and frozen compartment(s) in the same appliance



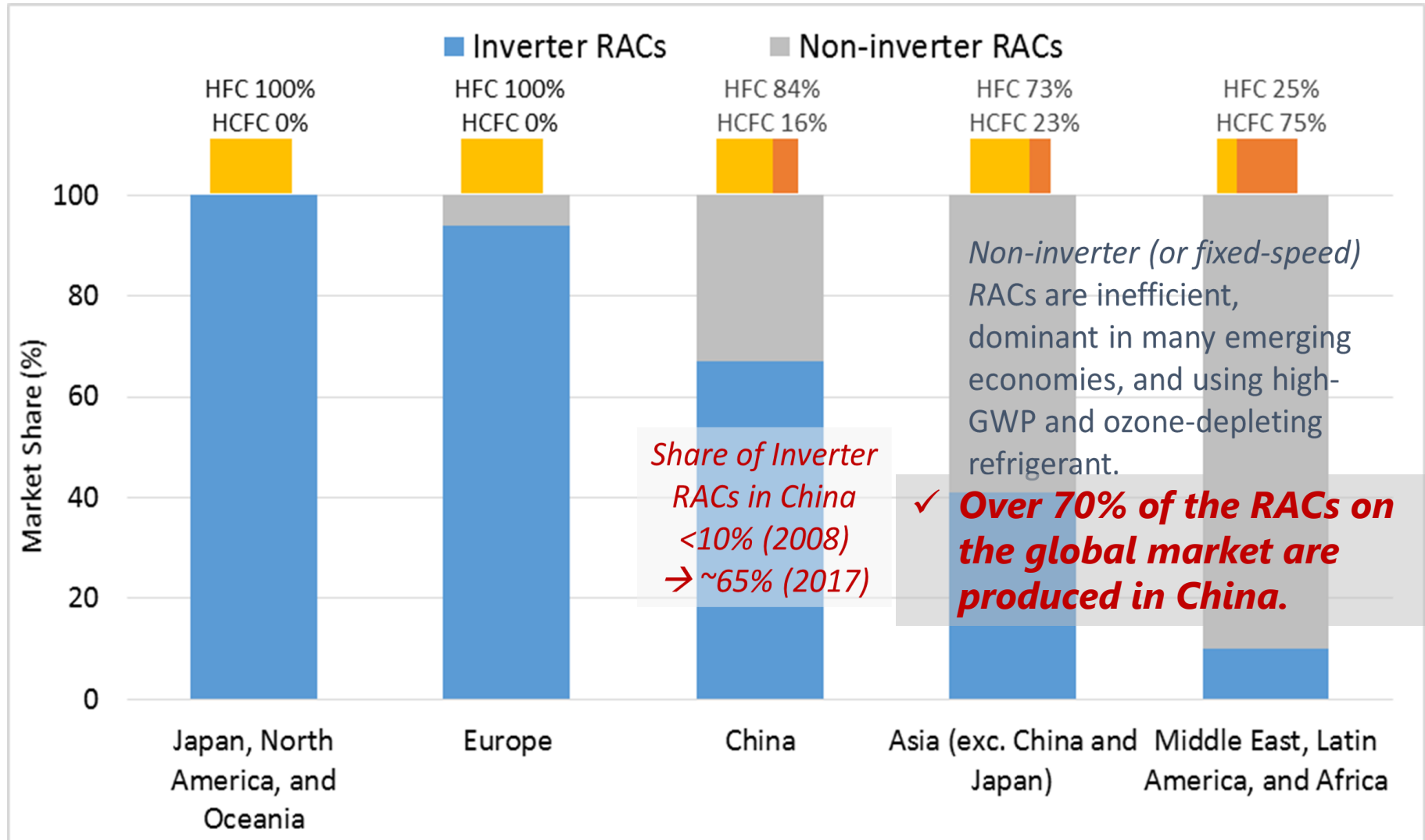
MEPS & High Performance Product Labels



Impacts of Well-Designed and Enforced Policies

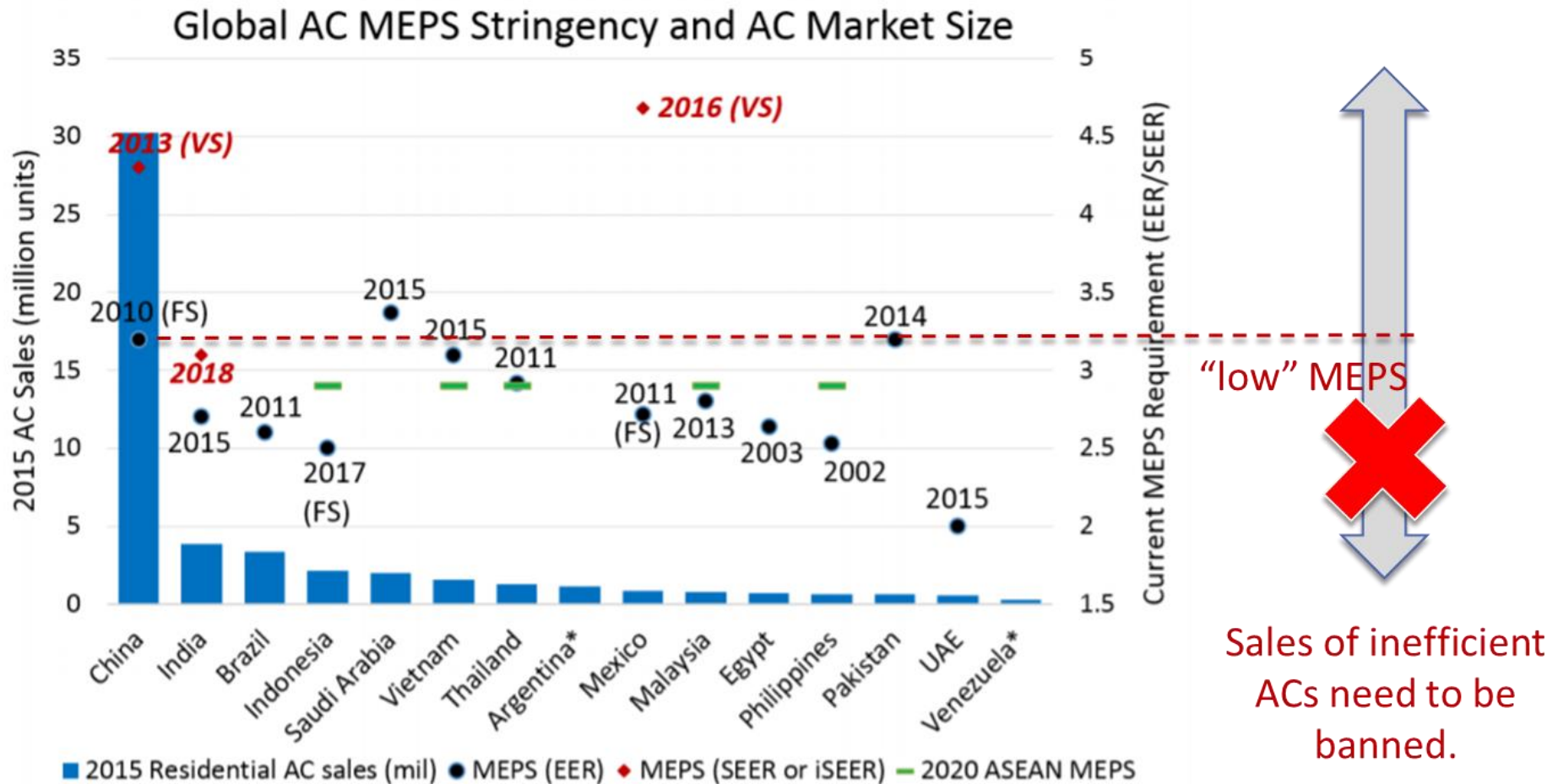


Global AC market in the midst of transition toward Energy-efficient and Sustainable Technologies



Inefficient products need to be banned

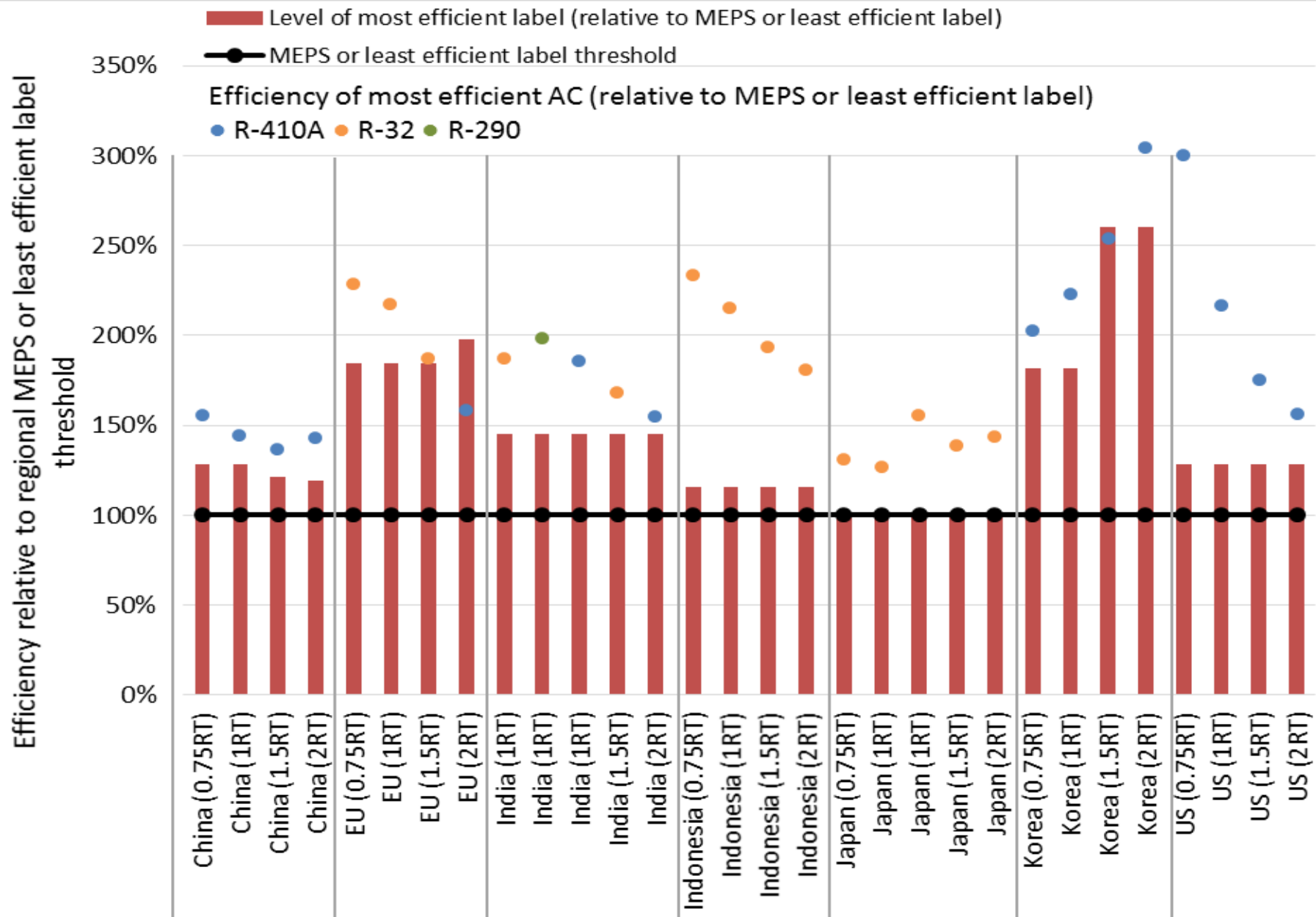
- In the Caribbean, while ~70% of ACs are imported from China, ~50% are less than EER 3.2 (= China MEPS for non-inverter ACs implemented in 2010).



Source: Shah et al. (2017) Opportunities for Simultaneous Efficiency Improvement and Refrigerant Transition in Air Conditioning

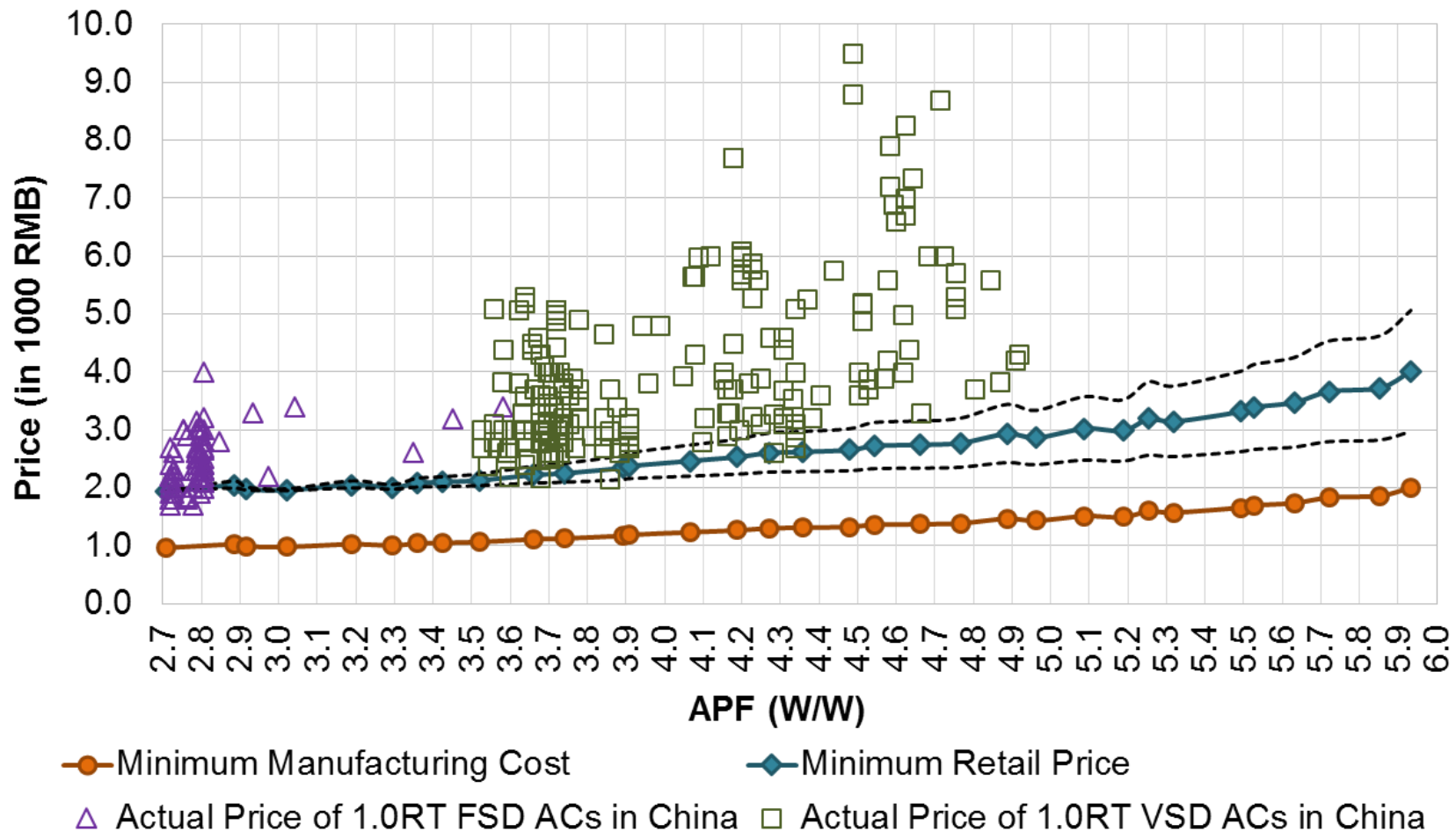
Notes: * denotes no information available on efficiency requirements for current or proposed MEPS.

Significant opportunity to improve AC efficiency with available technology



Good AC Energy Efficiency Inexpensive

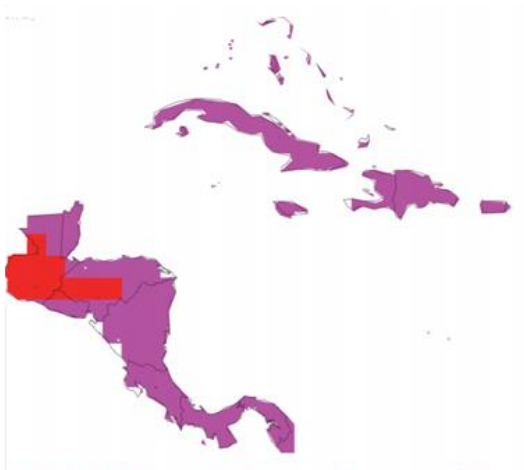
- Manufacturing costs and retail prices do not necessarily increase between low energy efficiency (APF 2.7) and good energy efficiency (APF 3.5).
- Many efficient products are already available (see green squares).



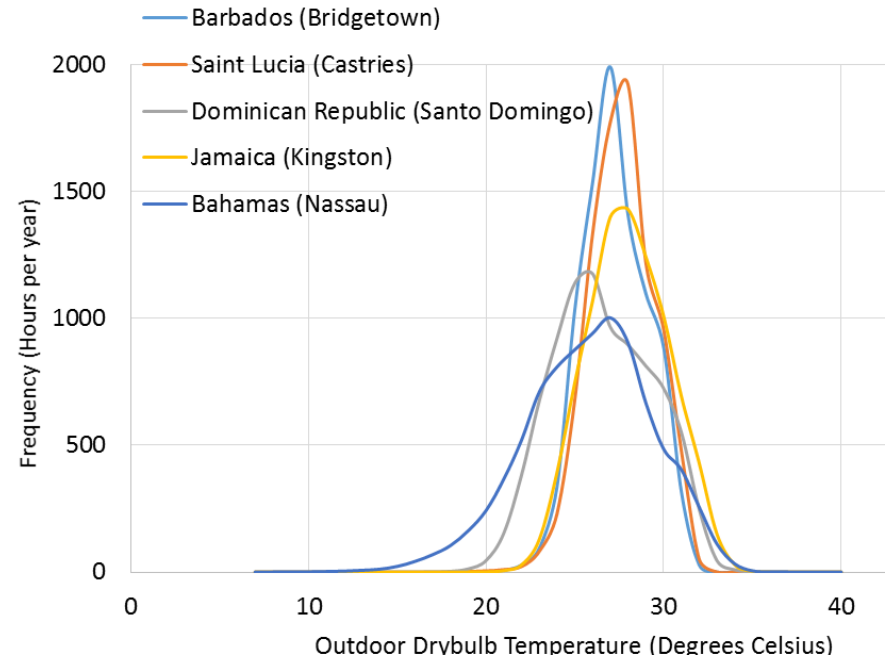
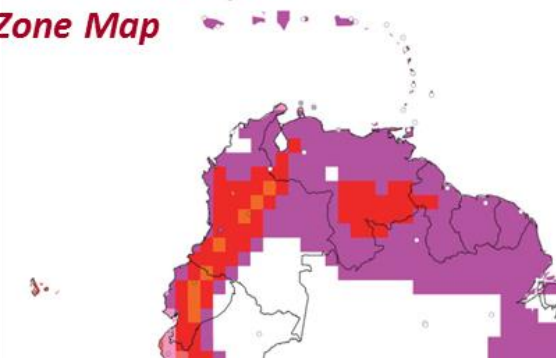
Caribbean countries will benefit from MEPS with the ISO standards that can be harmonized with other economies

- Caribbean countries have *extremely hot-humid (0A)* or *very hot-humid climate (1A)*. Outdoor temps of 24°C (75.2°F) or more over 90% of the year

ASHRAE Central America and Northern Caribbean Climate Zone Map



ASHRAE South America and Southern Caribbean Climate Zone Map

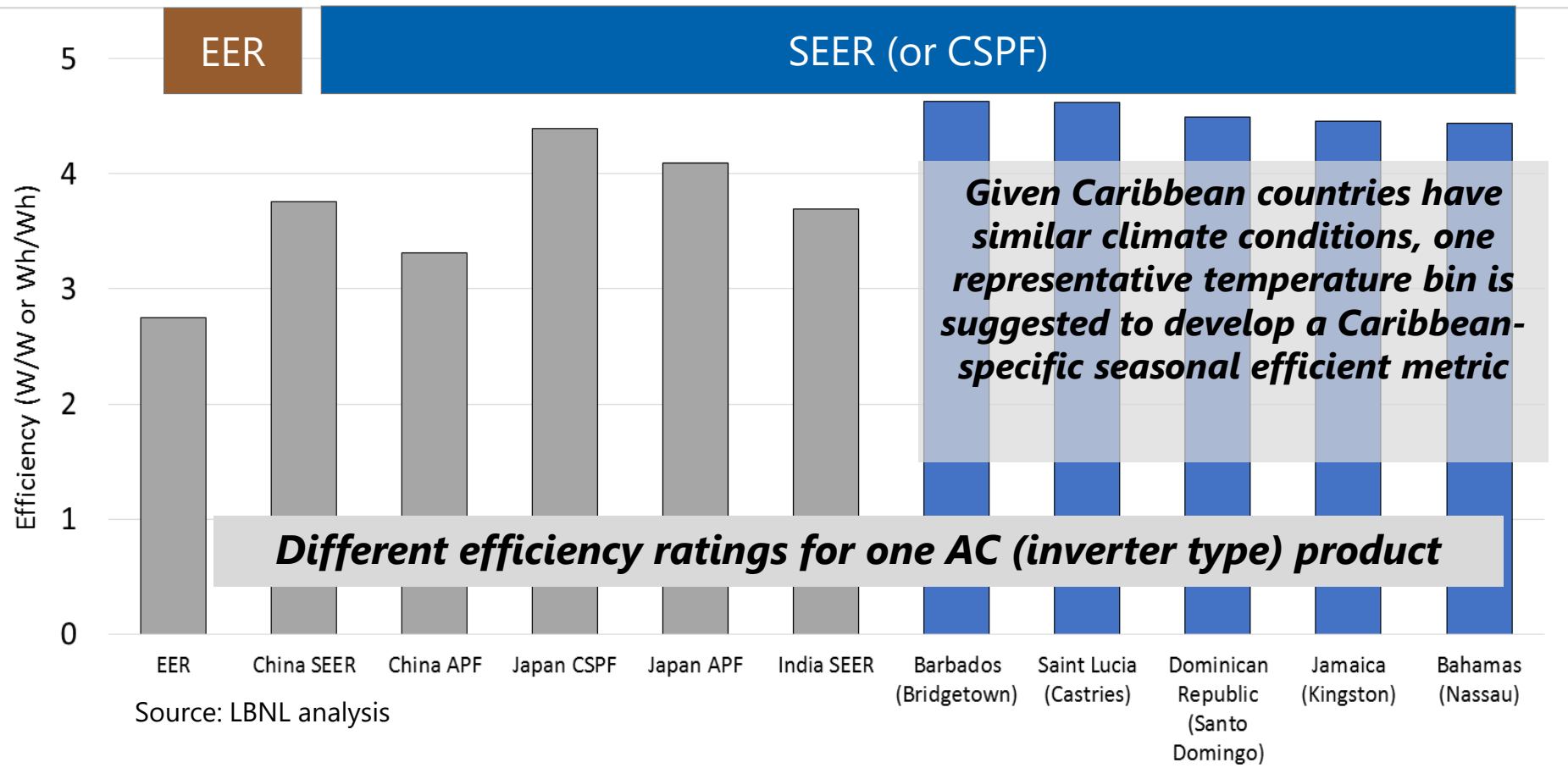


Country	City	Climate Class
Barbados	Bridgetown	0A
St. Lucia	Castries	0A
Dominican Republic	Santo Domingo	0A
Jamaica	Kingston	0A
Bahamas	Nassau	1A

Room AC Summary of Recommendations

- 1. Standards and labeling levels should be set using a seasonal energy efficiency metric.**
- 2. S&L levels set at levels inefficient products cannot meet to prevent “dumping” of inefficient ACs and ACs with high GWP refrigerants.**
- 3. Low-GWP refrigerant criterion be adopted**

1. Standards and labeling (S&L) requirements should be set using a seasonal energy efficiency metric.



2. Set S&L at levels inefficient products cannot meet to prevent “dumping” of inefficient ACs with high GWP refrigerants.

- The CRS proposed standard is lower or similar to current MEPS in China (set in 2010) and Mexico for fixed-speed units, and those in India and Brazil.
- These economies already adopted or soon will adopt seasonal metrics with updated S&Ls.

DRAFT CARICOM REGIONAL STANDARD

Energy efficiency class	Condition
A	$4.00 < \text{EER}$
B	$3.80 \geq \text{EER} > 3.60$
C	$3.60 \geq \text{EER} > 3.40$
D	$3.40 \geq \text{EER} > 3.20$
E	$3.20 \geq \text{EER} > 3.00$

MEPS in Brazil,
China*, India
(1-Star), and
Mexico*

* for fixed-speed units

Increased Standards/Labeling Requirements for Products made in China

China is the world largest producer (~70%) of the world's room ACs.

We recommend S&L levels at the draft (see below) issued for public comment by China, which improves current MEPS for fixed-speed ACs by 32-54% and should drive down the cost of efficient ACs significantly.

Draft China AC S&L for 2020-2022

2010/2013-
Present

Variable-speed

GB 21455-2013

Split VSD, Cooling only		1	2	3
CC≤4500	SEER	5.40	5.00	4.30
4500 < CC≤7100	SEER	5.10	4.40	3.90
7100 < CC≤14000	SEER	4.70	4.00	3.50

(2020) The proposed Grade 1 requirements are more stringent by 7-11% than the current VSD Grade 1 requirements.

	1	2	3
SEER	5.80	5.40	5.00
SEER	5.50	5.10	4.40
SEER	5.20	4.70	4.00

(2020) Proposed MEPS for VSD
13-16% improvement

Fixed-speed

GB12021.3-2010

Split FSD, Cooling only		1	2	3
CC≤4500	EER	3.60	3.40	3.20
4500 < CC≤7100	EER	3.50	3.30	3.10
7100 < CC≤14000	EER	3.40	3.20	3.00

(2022) 32-54% improvement

3. We recommend a low-GWP refrigerant criterion be adopted

- Lower-GWP refrigerants are available; ~55 million units use R-32 (GWP 677) as of June 2018, and Godrej has sold 600,000 with R-290 (GWP 3) in India & SE Asia as of Sept 2018.

	Air Conditioners
GWP	<ul style="list-style-type: none">• 750 (Split system)• 150 (Self-contained system)
ODP	0

Refrigerating Appliance Summary of Recommendations

- 1. Set the S&L scope using IEC 62252:2015 that was developed to harmonize international residential refrigeration testing and efficiency metrics.**
- 2. Set S&L levels that inefficient products cannot meet to prevent “dumping” of inefficient refrigerators with high GWP refrigerants.**
- 3. Adopt a low-GWP refrigerant criterion.**

1. Set the S&L scope using IEC 62252:2015 that was developed to harmonize international residential refrigeration testing and efficiency metrics.

TABLE 1. Maximum energy consumption limits for refrigerators and freezers

	Description of the household appliance	E _{MAX}
one	Single, conventional refrigerator and refrigerator-freezer (R / C) with manual or semi-automatic defrosting.	0.31VA + 248.4
two	Refrigerator-freezer with partially automatic defrosting.	0.31VA + 248.4
3	Refrigerator-freezer with automatic defrosting and freezer mounted on the top, without ice dispenser, and refrigerators alone with automatic defrosting.	0.35VA + 276.0
4	Refrigerator-freezer with automatic defrost and freezer mounted laterally, without ice dispenser.	0.17VA + 507.5
5	Refrigerator-freezer with automatic defrost and freezer mounted on the bottom, without ice dispenser.	0.16VA + 459.0
5A	Refrigerator-freezer with automatic defrost and freezer mounted on the bottom, with ice dispenser through the door.	0.18 VA + 539
6	Refrigerator-freezer with automatic defrost and freezer mounted on the top, with ice dispenser	0.36VA + 356.0
7	Refrigerator-freezer with automatic defrost and freezer mounted laterally, with ice dispenser	0.36VA + 406.0
8	Vertical freezer	0.27VA + 258.3
9	Vertical freezer	0.44VA + 326.1
10	Horizontal freezer	0.35VA + 143.7
10A	Horizontal freezer	0.52 VA + 211.5
eleven	Refrigerator and freezer	0.38VA + 299.0
12	Compact refrigerator-freezer with partially automatic defrosting.	0.25VA + 398.0
13	Compact refrigerator-freezer with automatic defrost and top-mounted freezer and only compact refrigerator with automatic defrost.	0.45VA + 355.0
14	Compact refrigerator-freezer with automatic defrost and freezer mounted laterally.	0.27VA + 501.0
fifteen	Compact refrigerator-freezer with automatic defrosting and freezer mounted on the bottom.	0.46VA + 367.0
16	Compact vertical freezer with manual defrosting.	0.35VA + 250.8
17	Compact vertical freezer with automatic defrosting.	0.40VA + 391.0
18	Compact horizontal freezer.	0.37VA + 152.0

More than 15 product categories?

REFRIGERATORS

one or more chilled compartments, generally at various temperature zones between 0°C and 14°C, and which may include an ice-making section



FREEZERS

one or more frozen compartments, usually between -18°C and -6°C

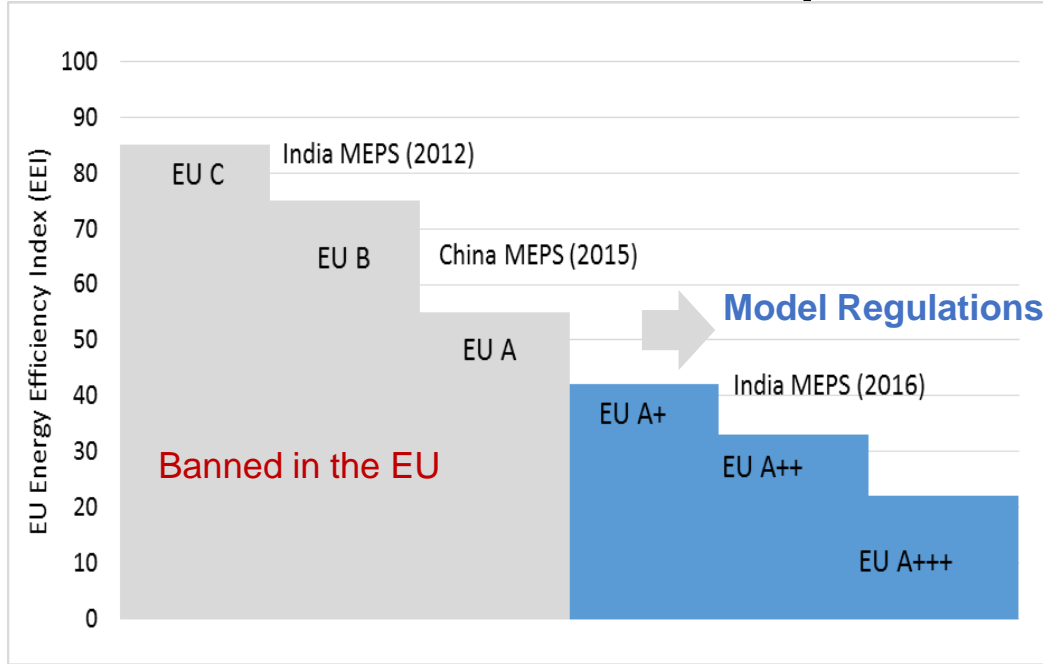


FRIDGE-FREEZERS

combination of both chilled and frozen compartment(s) in the same appliance

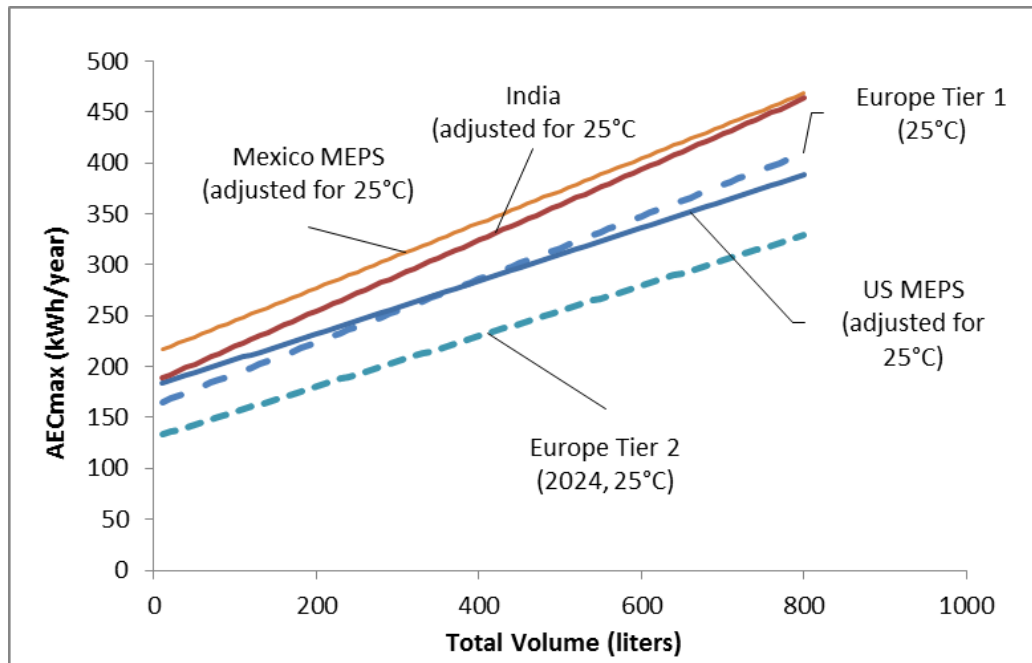


2. Set S&L levels that inefficient products cannot meet to prevent



CRS proposed standard refers to Mexico MEPS NOM-015-ENER-2012.

Refrigerators are available that surpass the highest efficiency levels



Note: US MEPS and Mexico MEPS on the right figure refer to Class 3 "Refrigerator-freezers - automatic defrost with top-mounted freezer without an automatic ice maker" Source: LBNL (draft analysis, illustrative)

3. Adopt a low-GWP refrigerant criterion

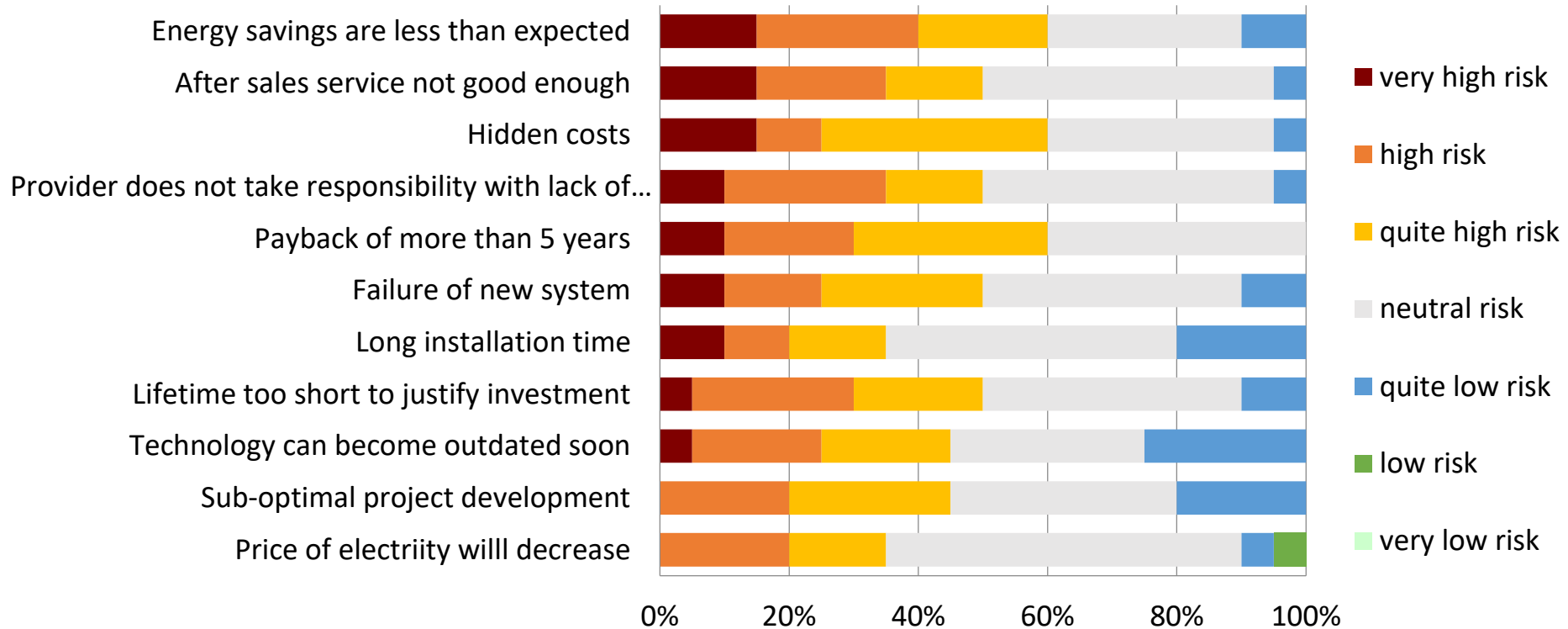
- There is significant opportunity to simultaneously improve refrigerator efficiency and transition to low low-GWP refrigerants using commercially available technology.

	Refrigerators
GWP	20
ODP	0

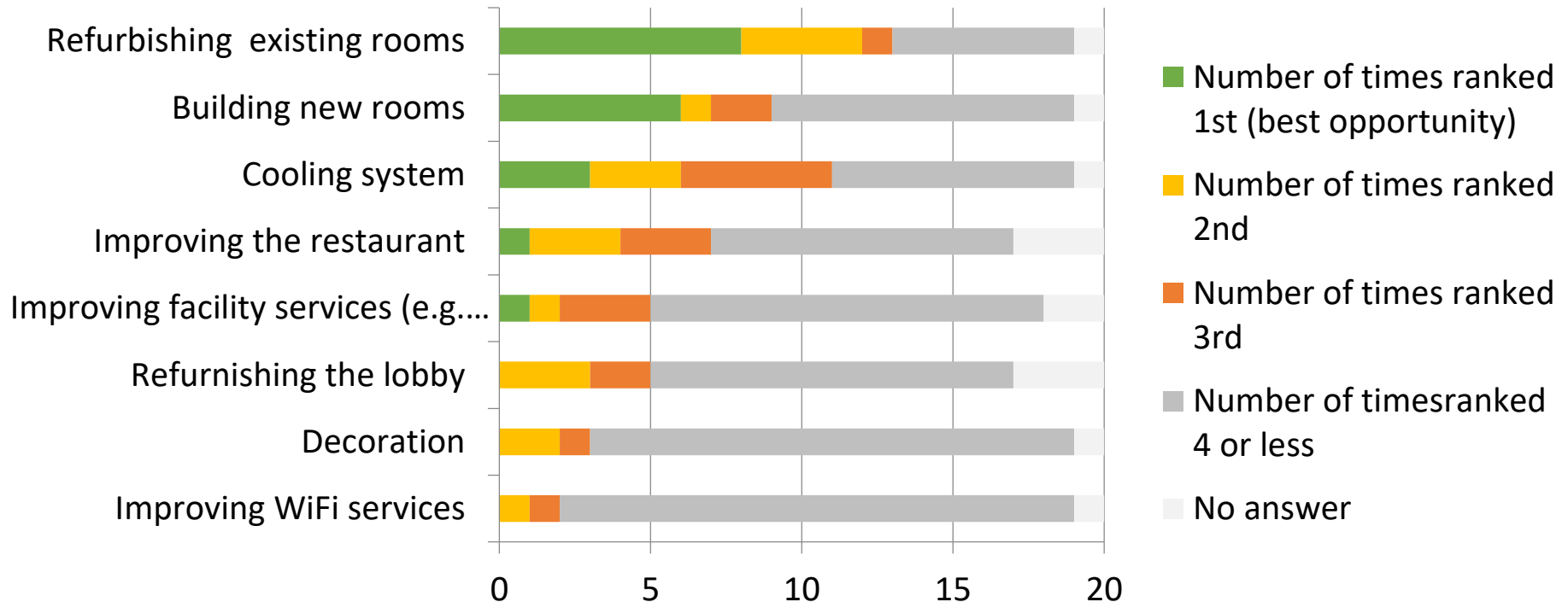
Financial Mechanism Toolkit

1. Investment considerations from Market Assessment
2. Financial mechanism: Cooling as a Service
3. Capacity building: financial mechanism

Main Risks Perceived by Hotels



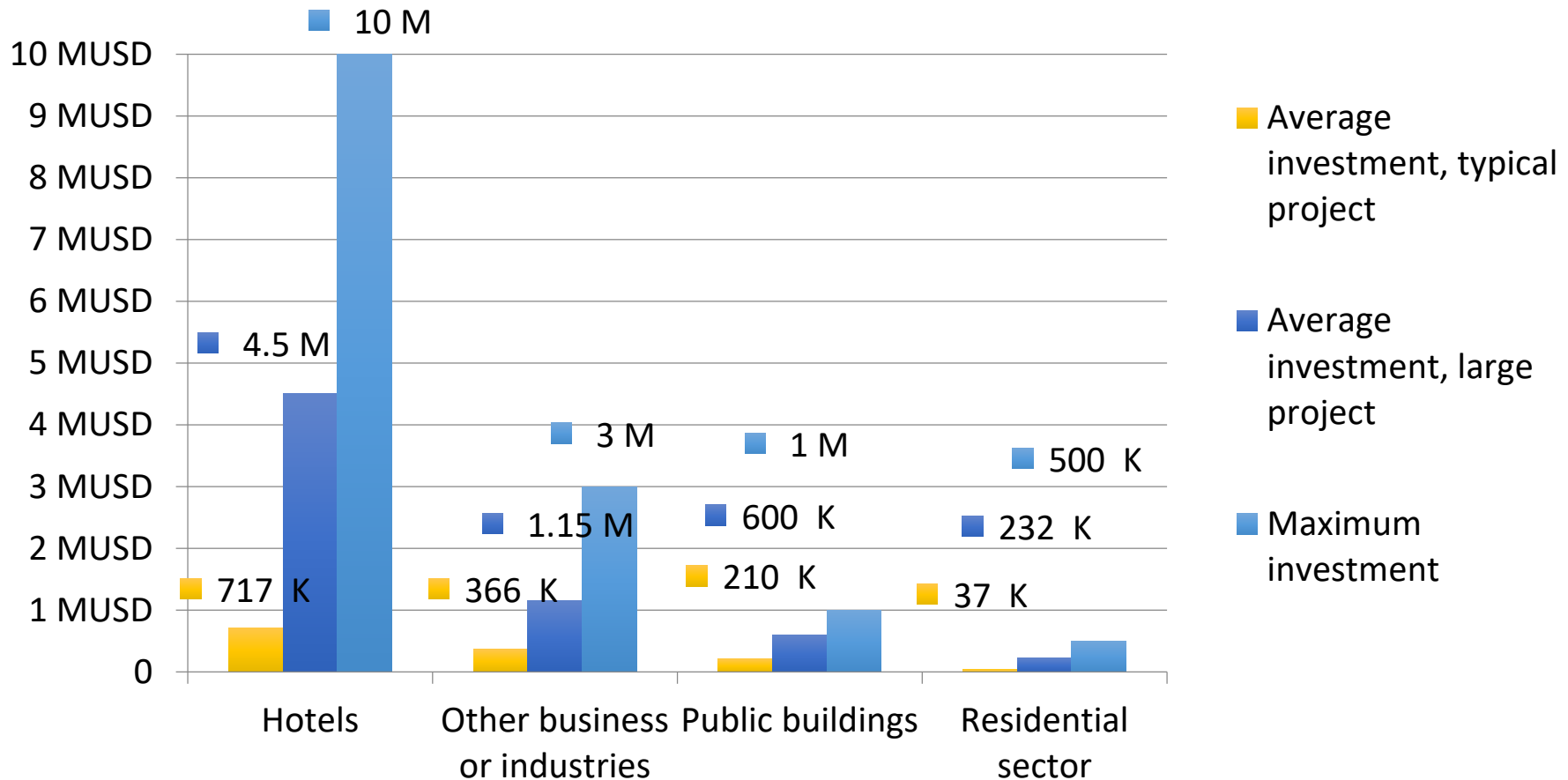
Investment Priorities for Hotels



Cooling has relatively high investment priority (3rd) although far behind refurbishment and expansion of rooms.

→ Hotels consider cooling as an important component of their business

Investment Size per Sector





Financial Mechanism: Cooling as a Service (CaaS)



One of 2019's most innovative financial instruments according to **The Global Innovation Lab for Climate Finance**

- ✓ **Pay-per-service** model (payment based on metered use)
 - ✓ **Providers own** equipment (→ circular economy)
 - ✓ **Performance risk** shifted to provider who takes on **all future costs** inc. maintenance, repairs, electricity, water
 - ✓ CAPEX to OPEX
 - ✓ **Capitalization** of technology providers through SPV or sale-leaseback
- CaaS **aligns incentives** (provider reduces operational costs and client reduces cooling consumption) and **makes EE technology competitive** by making its **lower life-cycle cost** tangible.

Financial Mechanism Training




- ✓ **Content:** Enable technology providers to integrate CaaS in their business model and explain the benefits of CaaS to their clients.
- ✓ **Audience:** Technology providers
- ✓ **Facilitators:**  
- ✓ **Approach:** Toolkit with model CaaS template, economic modelling tool, and explanatory material for the sales pitch (factsheet, presentation). Webinar to introduce the model and toolkit. Address follow-up inquiries.
- ✓ **Timing:** Fall 2019
- ✓ **Location:** Online and over the phone

Technical Training Option 1: Practitioners

- ✓ **Content:** Foster regional capacity building network for technicians per GiZ “Fit for Splits” & “Investment Grade Calculations” modules
- ✓ **Audience:** 2 experts per CCOOL country (e.g. head of technical institute / HVAC association)
- ✓ **Facilitators:**  
- ✓ **Approach:** 4-day workshop and field experience
- ✓ **Timing:** Fall 2019
- ✓ **Location:** Grenada



OR Technical Training Option 2: Enforcement Officials

- ✓ **Content:** Adopting common Product Registration Systems linked to harmonised MEPS and labelling
- ✓ **Audience:** 2 experts per CCOOL country (e.g. energy official and customs agent)
- ✓ **Facilitators:**   
- ✓ **Approach:** 4-day workshop and field experience (test lab, port)
- ✓ **Timing:** Fall 2019
- ✓ **Location:** Grenada or Barbados



Project Next Steps

Activity	Time
Refine the National Cooling Strategy and Policy Recommendations	April – July
Updated National Cooling Strategy and Policy Recommendations hand over to the government for finalization	August
Financial mechanism toolkit and training	Late Fall 2019
Technical training (select option 1 or 2)	Late Fall 2019
Showcase progress by the country in UN communications	As appropriate



CONTACTS

TRANSFORMING MARKETS TO ENERGY-EFFICIENT PRODUCTS



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QUESTIONS???