



**Asia-Pacific
Economic Cooperation**

The 61st Meeting of APEC Expert Group on Energy Efficiency & Conservation and 59th Meeting of APEC Expert Group on New and Renewable Energy Technology

*"Reinforcing Relevant Laws for a Comprehensive Approach to Energy Efficiency and Conservation,
Renewable Energy, Electric Vehicle, and Sustainability in the APEC Region"*

Unlocking Access to Greater Cooling Efficiency and Next-Generation Refrigerants: Findings of a CLASP Study on Room Air Conditioners in Southeast Asia

18 October 2023

Makati City, Metro Manila, Philippines





Global RAC market overview

- In 2021, **global RAC production** was 188.6 million
 - **China** produced 82.1% or 154.8 million of RACs
 - **Thailand**, a second major RAC producer and exporter globally, produced over 9 million RACs
- In 2021, **global RAC demand** was estimated at 167.3 million
 - **China** has the largest RAC market –51% of total global RAC demand
 - **Asia region (excluding China)** demand - 38.6 million RACs or 23.1% of total global demand
 - RAC demand in **Africa region** is 2.1% of global demand

Overview & Key Findings of Southeast Asia Study (2023)

Scope - geography

Six largest Southeast Asia economies

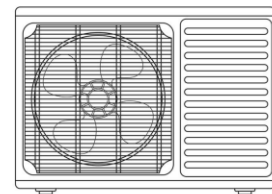
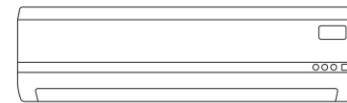
- Indonesia
- Malaysia
- The Philippines
- Singapore
- Thailand
- Vietnam

The six countries account for over 90% of the RAC market in Southeast Asia.

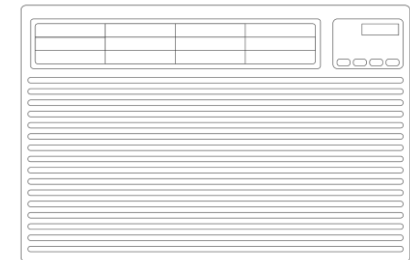
Scope - product

Room air conditioners (RACs)

Single splits



Window
(The Philippines only)



Most popular cooling equipment.

Approach

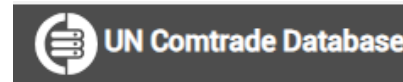
- Data collection and desk research
- Interviews with stakeholders in 5 countries
- Data analysis: market, trade and product-level
- Stock and emissions modeling (indirect and direct) under 4 policy scenarios using [Mepsy](#) to estimate the climate impacts of inefficient, high-GWP RAC use in the region

Data Sources

Primary sources



- Market data
- Model-level data

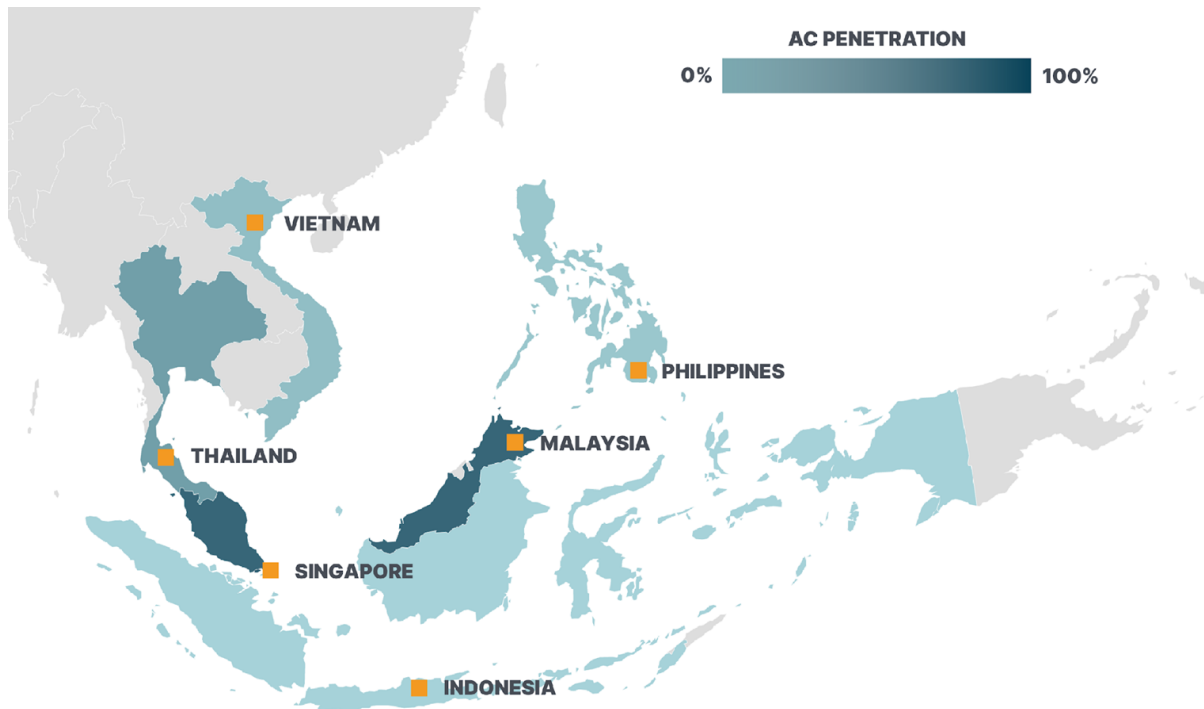


- Import/export data

Other Market Data Sources

- Countries' product registration systems and manufacturer product catalogs
- Euromonitor market size and brand share data
- JRAIA market data
- CLASP 2019 Market Reports for Thailand, Vietnam, The Philippines

Southeast Asia Regional Background

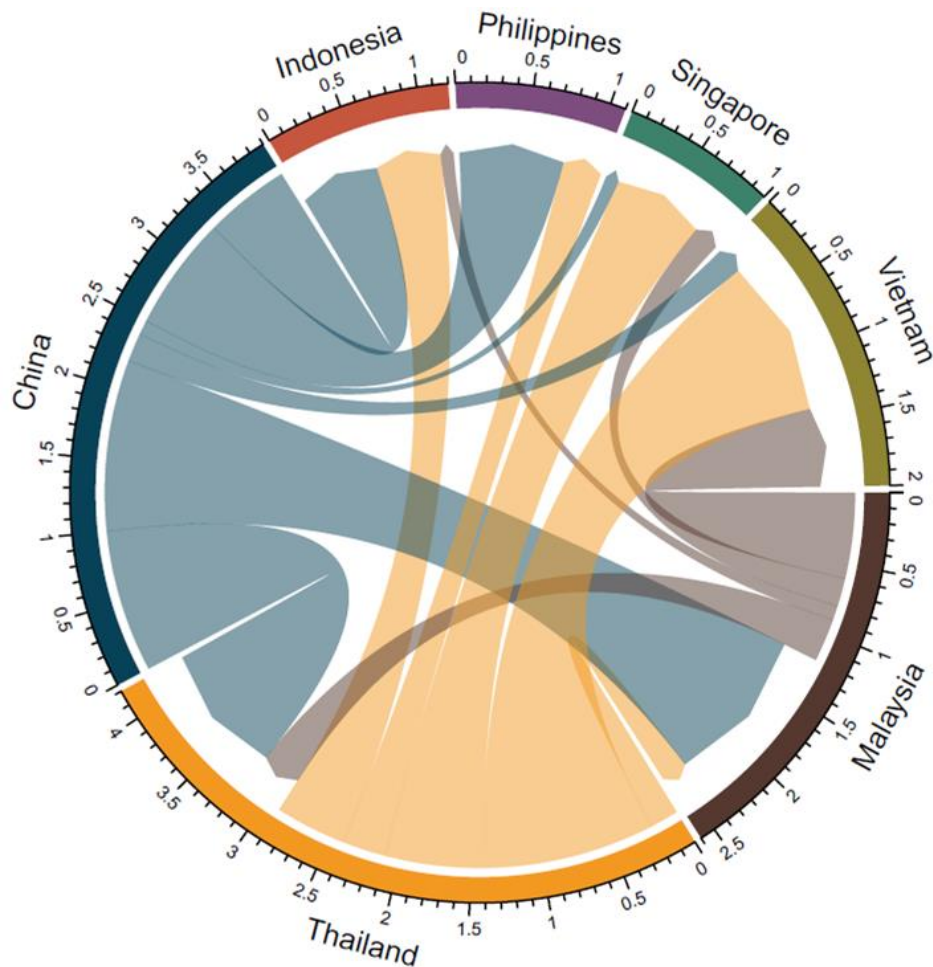


Across the 6 Southeast Asian countries:

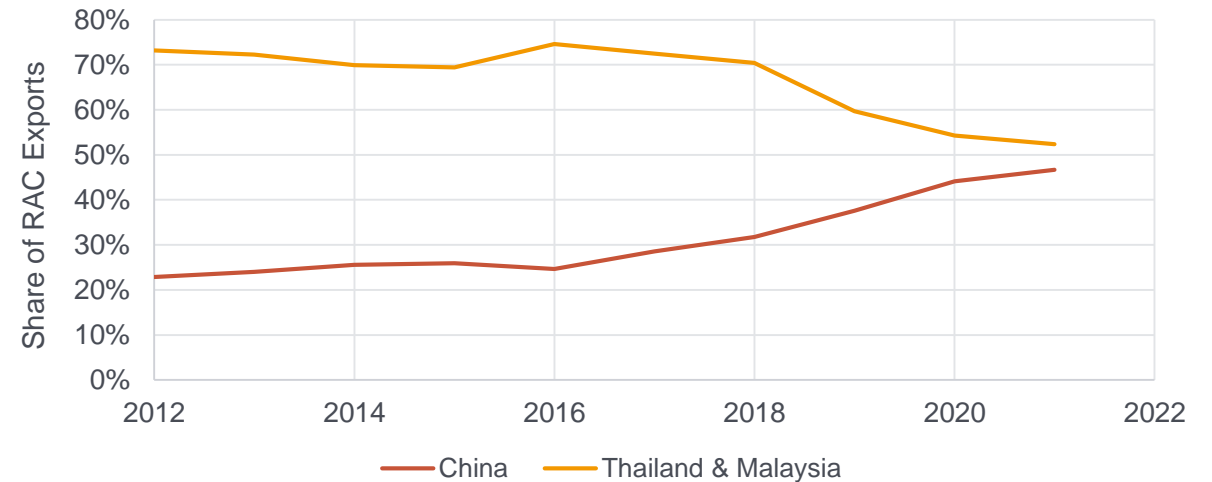
- 2021 RAC market was 8.3 million units
- Singapore and Malaysia have high RAC penetration, Indonesia and the Philippines have low penetration
- RAC market and penetration are both projected to continue growing
- Thailand and Malaysia have large RAC manufacturing bases — annual production of about 9 million and 3 million, respectively for domestic market and exports
- RAC production in Indonesia, Vietnam, and the Philippines is mainly for domestic market
- All economies import RACs

SEA RAC Trade Flows

RAC Trade Flows: Imports & Exports, 2021 (millions of units)



RAC Exports to 6 SEA Markets, 2012-2021

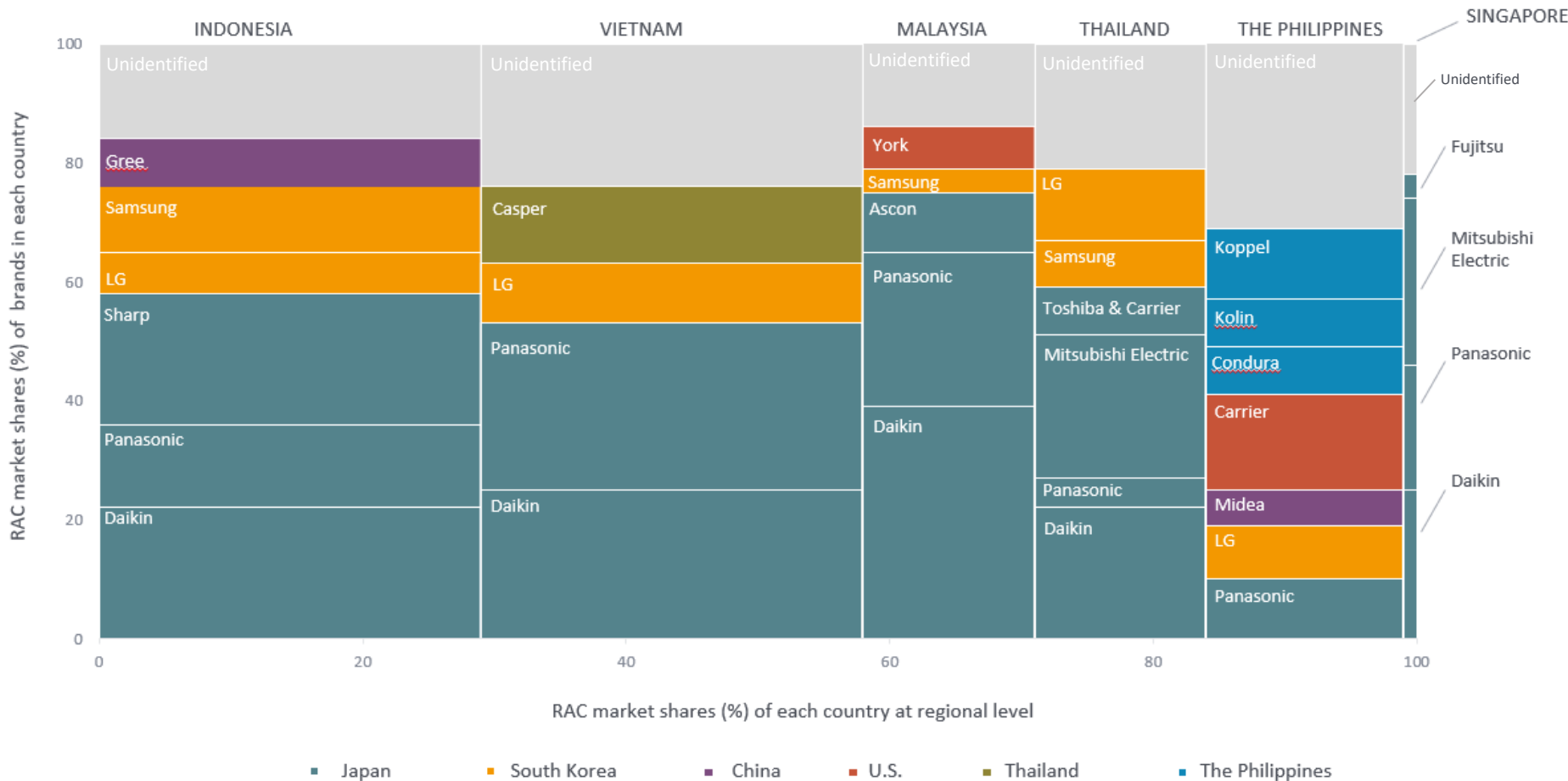


- RACs are primarily imported from China, Thailand, & Malaysia
- **ASEAN Free Trade Area (AFTA)** - 0% tariff for RACs
- **ASEAN-China Free Trade Agreement (ACFTA)** (2009)
 - Indonesia, Malaysia & Singapore – 0%
 - Thailand – 20% to 5% (revised in 2018)
 - The Philippines – 10% to 5% (revised in 2018)
 - Vietnam - 15%
- **Regional Comprehensive Economic Partnership (RCEP)** (2020) - does not benefit RAC trade

Study Findings – Low Efficiency RACs & Refrigerant Transition

SEA RAC Market – Market Size & Brands

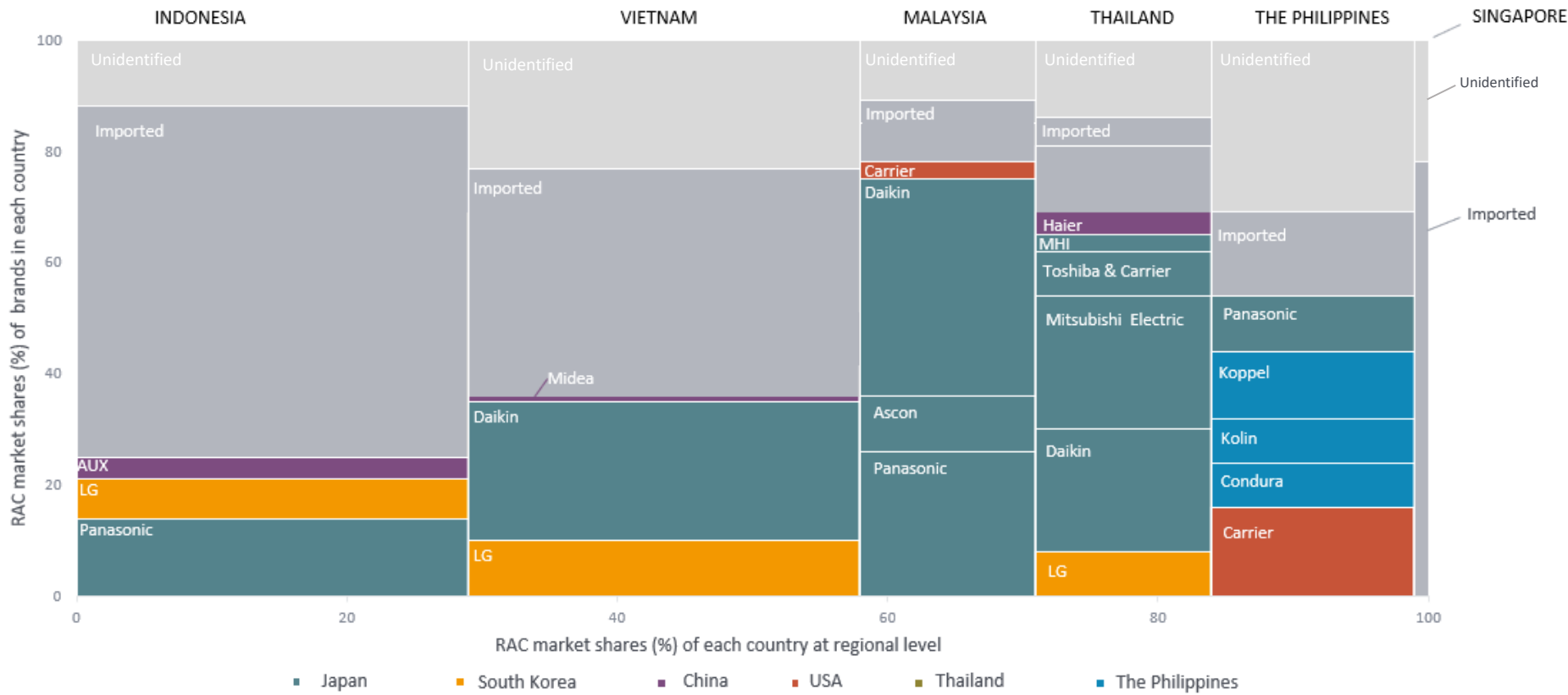
Market Share by Brand vs. Market Size Proportion, by Country



- Identified 27 brands
- Multinational well-known brands based in Japan, South Korea, China, and the U.S. dominate the market
- Japan-based brands hold the largest market share in SEA (47%)
- The most popular brands across the six markets are Daikin (22%), Panasonic (18%), and LG (7%)

Local Manufacturing in SEA Region

Market Shares of Brands with Local Manufacturing in SEA Countries



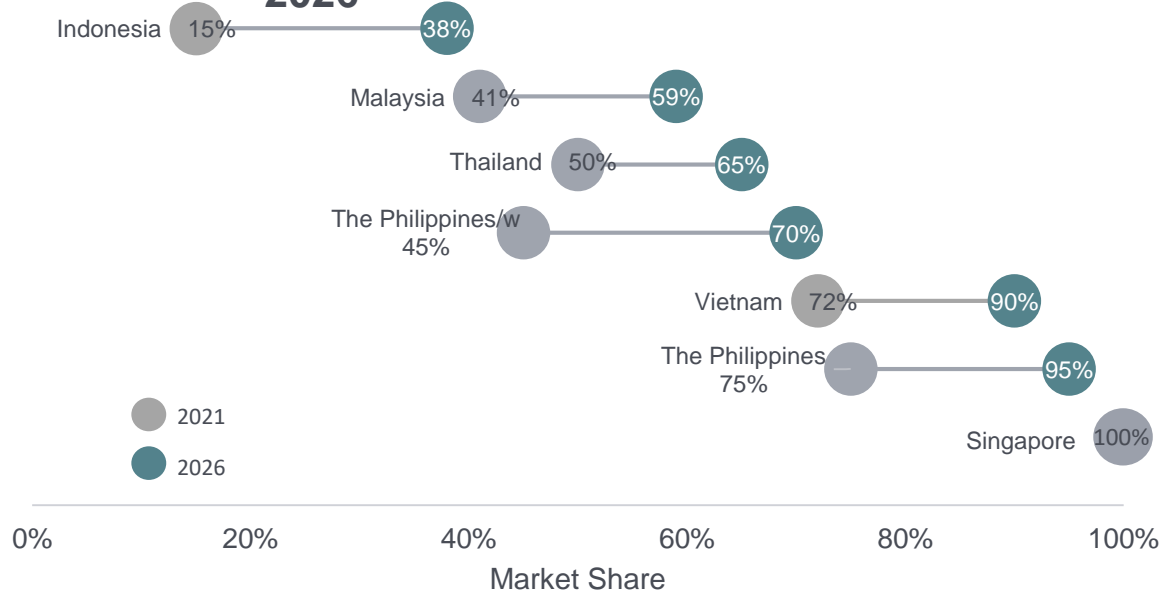
- RAC manufacturing:**
 - Japanese brands primarily manufacture in Thailand & Malaysia
 - Major Chinese & South Korean brands manufacture RACs in Indonesia & Vietnam
- Compressor manufacturing:**
 - China is the main compressor exporter to 5 SEA countries with manufacturing
 - Major Japanese and South Korean brands have compressor production in China
 - Manufacturing of compressors in Thailand, Malaysia & Indonesia

Note: brands shown in the graph have market shares of 3% or more, with exception of Midea which hold about 1% of market share in Vietnam.

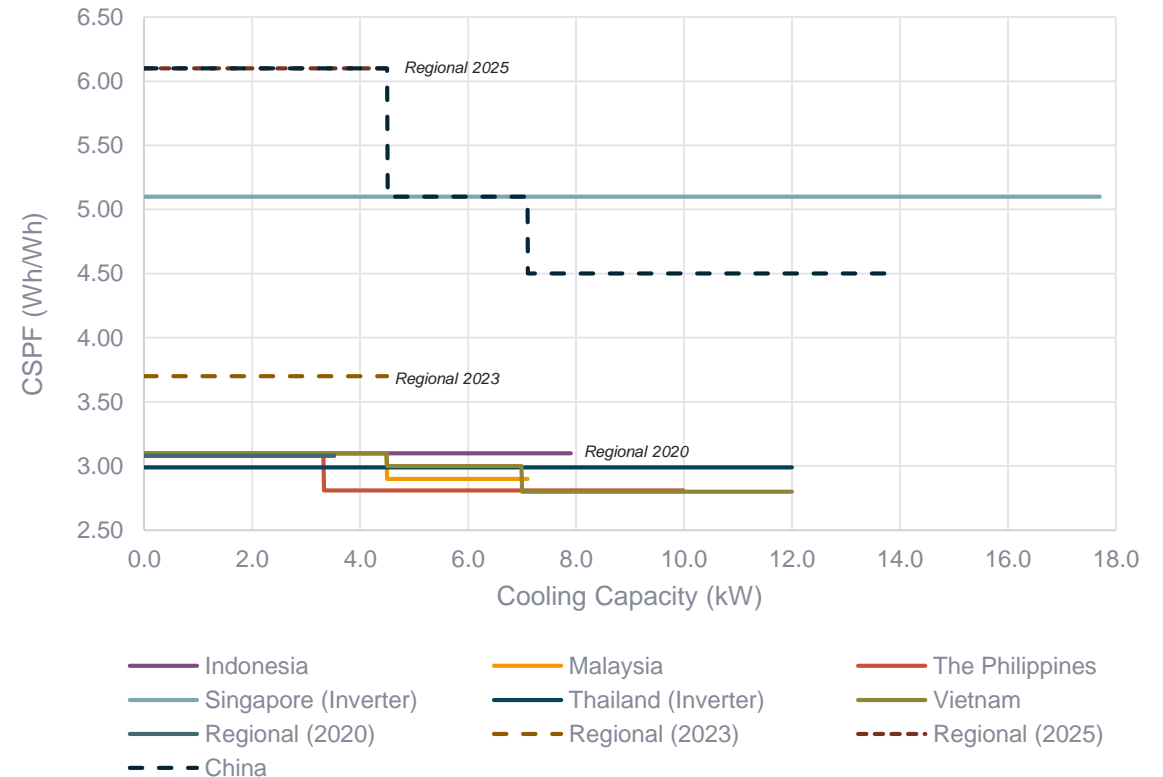
SEA RAC Market – Characteristics



Inverter RAC Penetration, 2021-2026



National and Regional MEPS vs. China MEPS



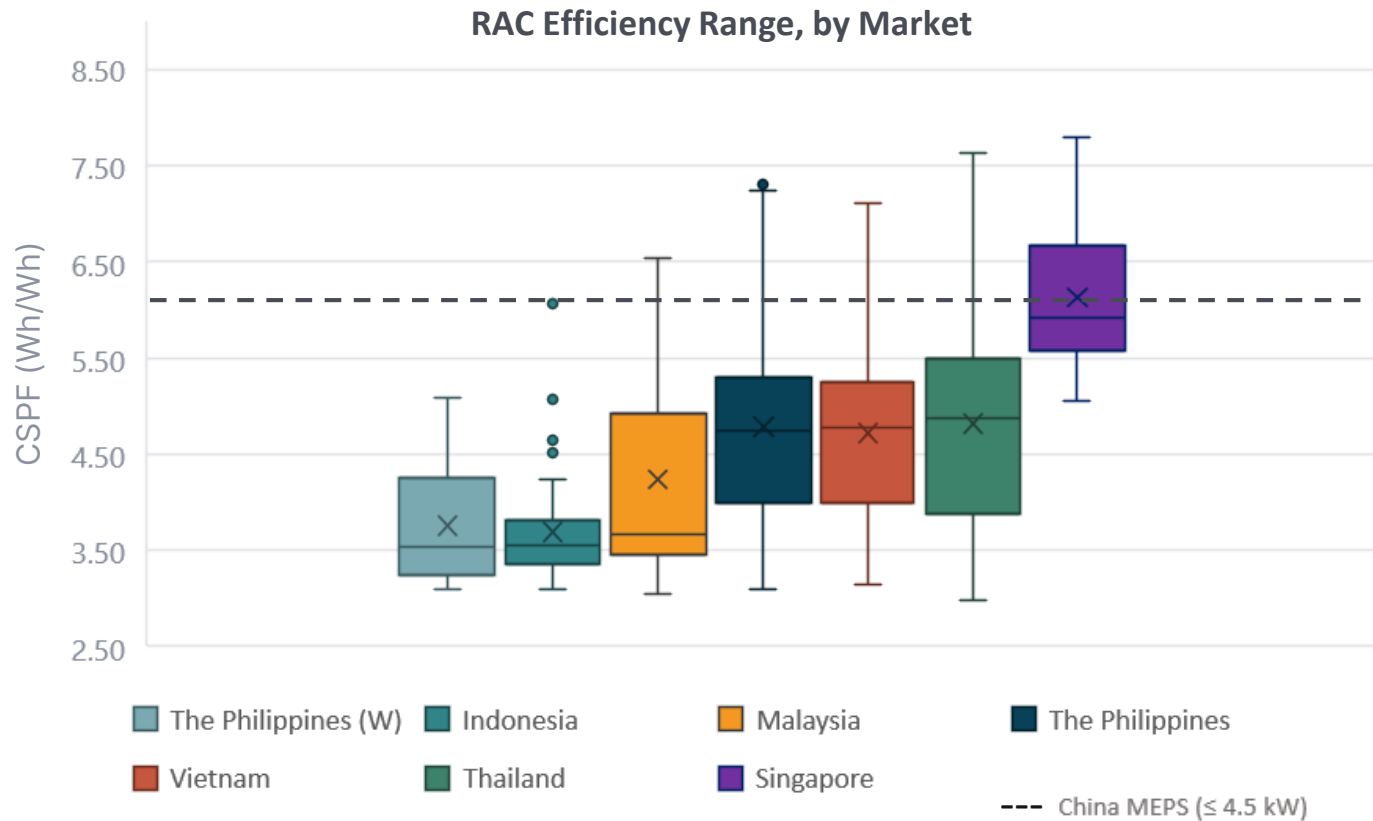
Note: Thailand's MEPS are approximate as performance metric is EER.

MEPS = minimum energy performance standard

- Most markets have relatively low inverter adoption
- The median efficiency for inverter RACs is CSPF 4.8 Wh/Wh and for fixed-speed is CSPF 3.5 Wh/Wh
- Majority of RACs are under 5kW

SEA RAC Markets Are Inefficient

“Low efficiency” threshold: **below China’s MEPS (inverter) CSPF 6.1 Wh/Wh (≤ 4.5 kW)**



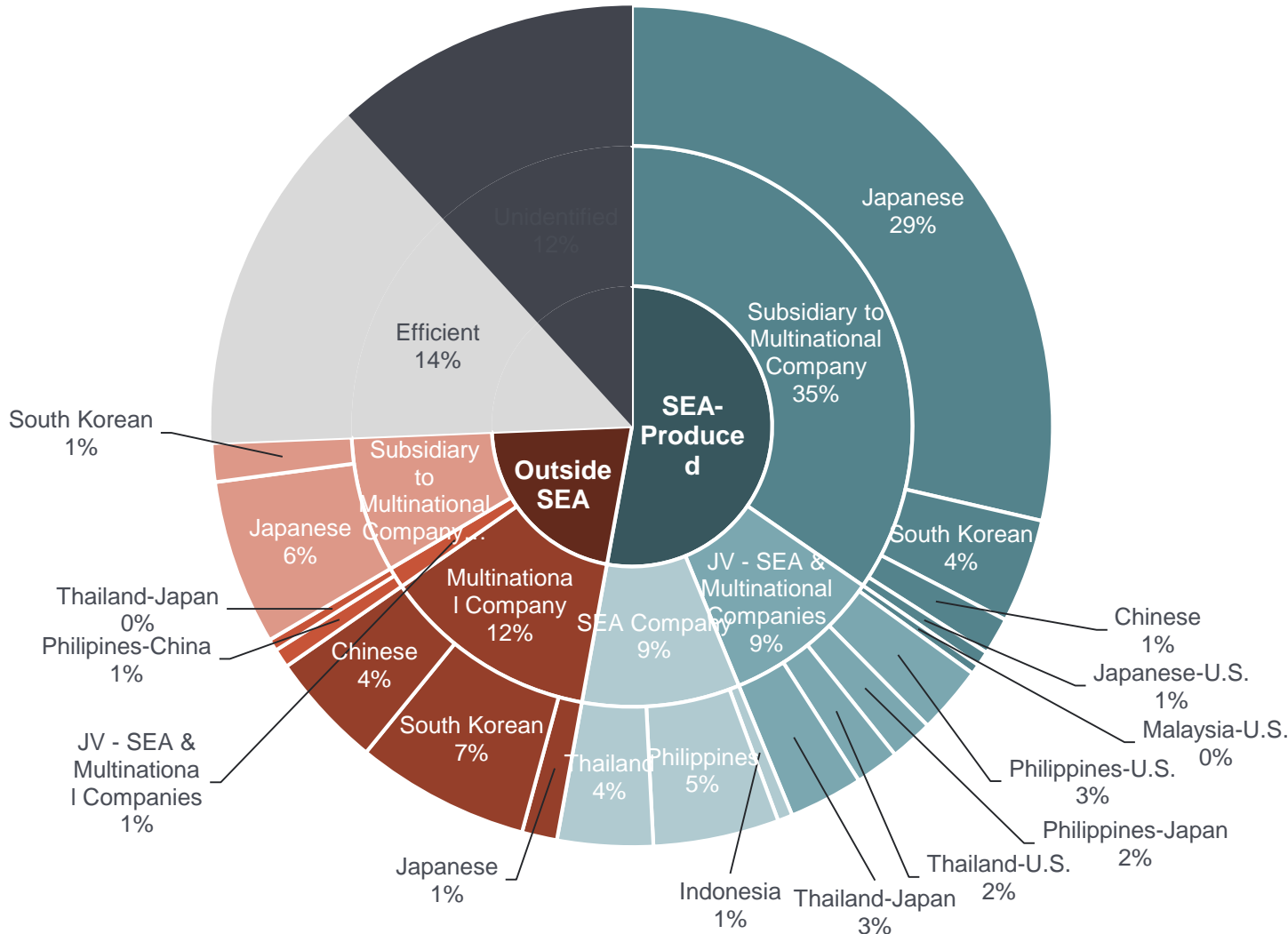
- China MEPS chosen due to alignment with ASEAN 2025 target MEPS and U4E industry model guidelines, as well as China’s export presence
- Overall, **efficiency ranges** from **CSPF 3.0–7.8 Wh/Wh**
- Sales-weighted **median efficiencies**
 - **Overall: CSPF 4.2 Wh/Wh**
 - The Philippines (window), Indonesia & Malaysia: ~CSPF 3.6 Wh/Wh
 - The Philippines, Vietnam, and Thailand: ~CSPF 4.8 Wh/Wh
 - Singapore: CSPF 5.9 Wh/Wh

- Many locally produced RAC efficiencies are at or below ASEAN 2023 MEPS (CSPF 3.7 Wh/Wh)

Low Efficiency RACs: Brand-Countries & Company Types



Brand HQ Countries and Company Types for Low Efficiency RACs Sold Across Six Southeast Asian Countries

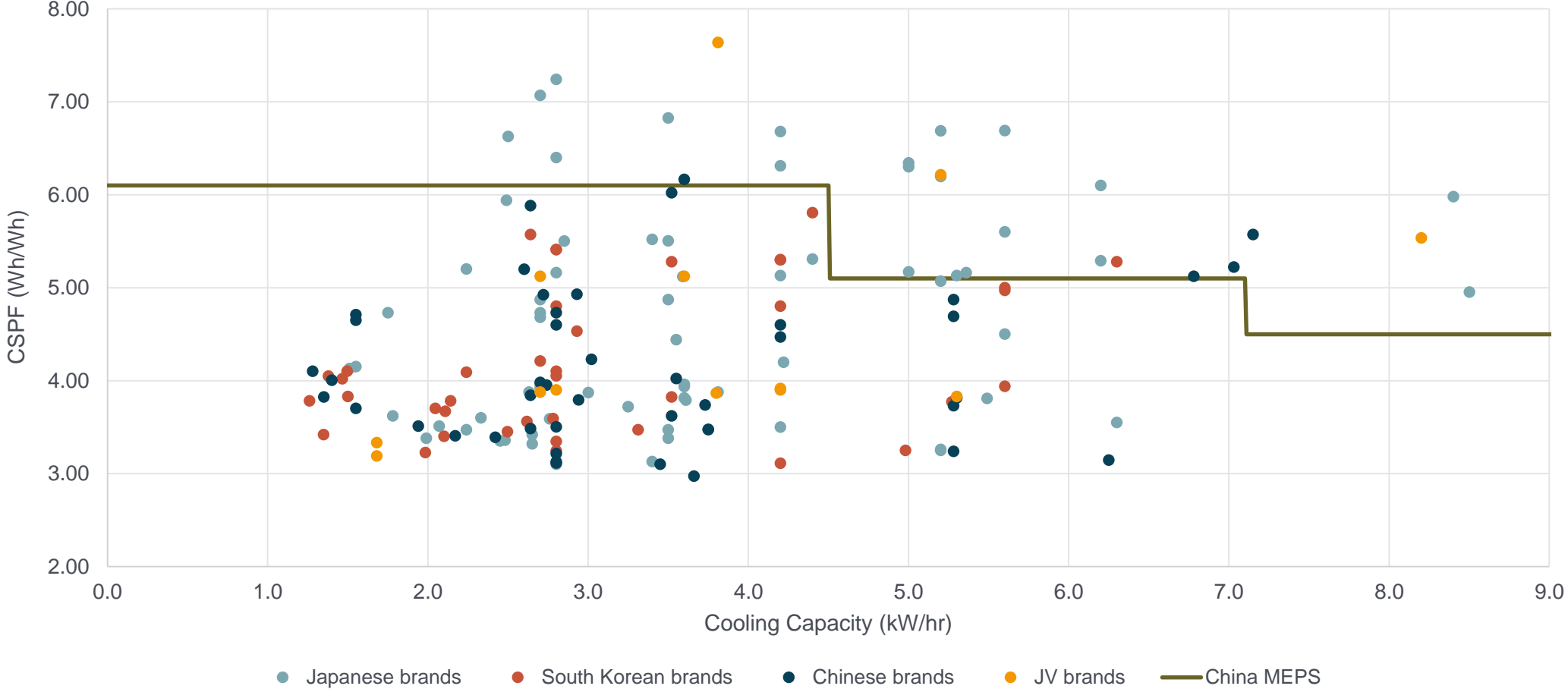


- Estimated 6.2 million low efficiency RACs sold in 2021 among the 6 SEA markets (74% of total sales)
- All identified 27 brands sell low efficiency RACs
- **Most inefficient RACs are produced in the region (71%)**
 - Multinational companies exports technology
 - By local subsidiaries to multinational companies (65%)
 - JV between local and multinational companies (18%)
 - Locally owned companies (17%)
- **29% of inefficient RACs come from outside SEA region:**
 - Over 83% from China, but primarily by South Korean and Japanese multinational brands export

Most RAC Efficiencies Are Below MEPS of Export Countries



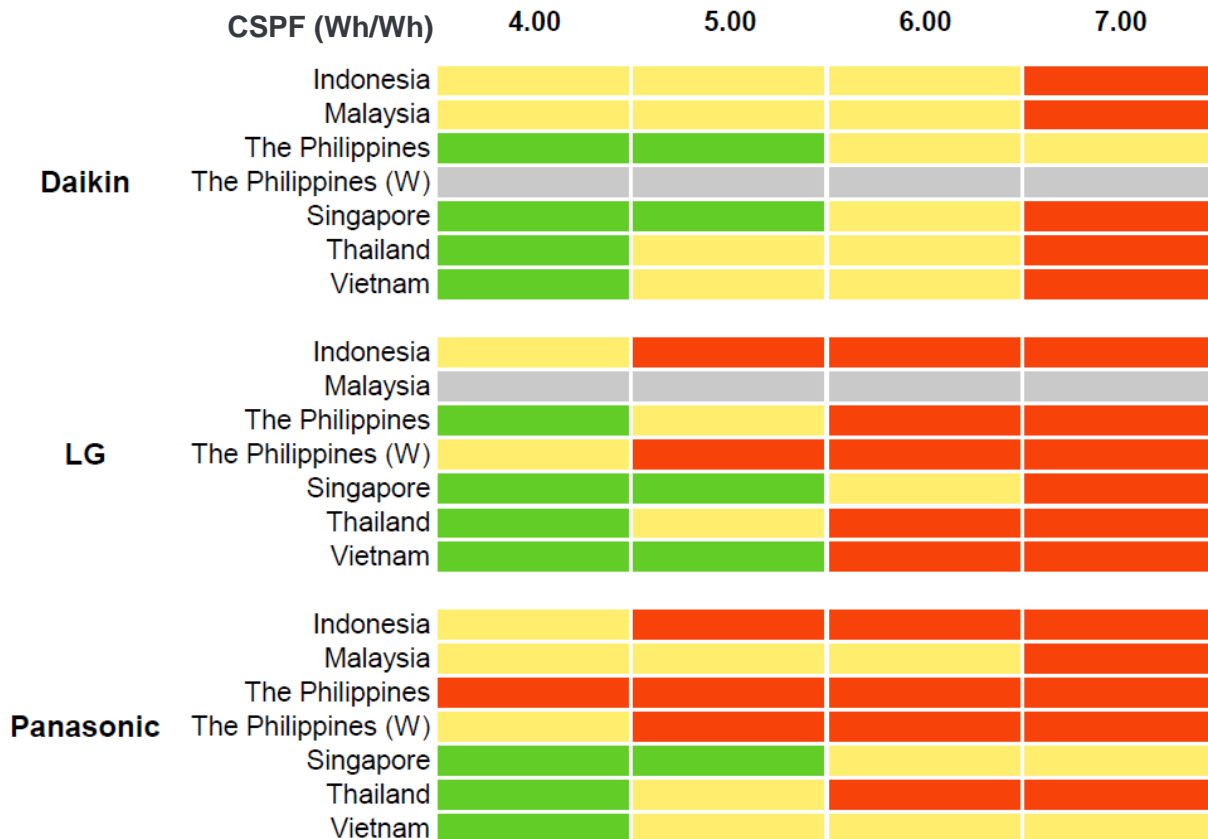
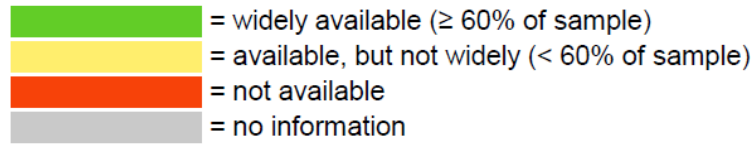
Efficiency vs. Capacity of RAC Exports



3 Most Popular Brands Offer Mostly Inefficient Units



Availability of RAC Model Efficiencies From Daikin, LG, and Panasonic, by Market



- Based on the dataset, Daikin, LG and Panasonic have the largest overall market shares and they each manufacture and sell primarily inefficient units in SEA

- The median efficiency of RACs** offered by each brand **varies substantially between markets**

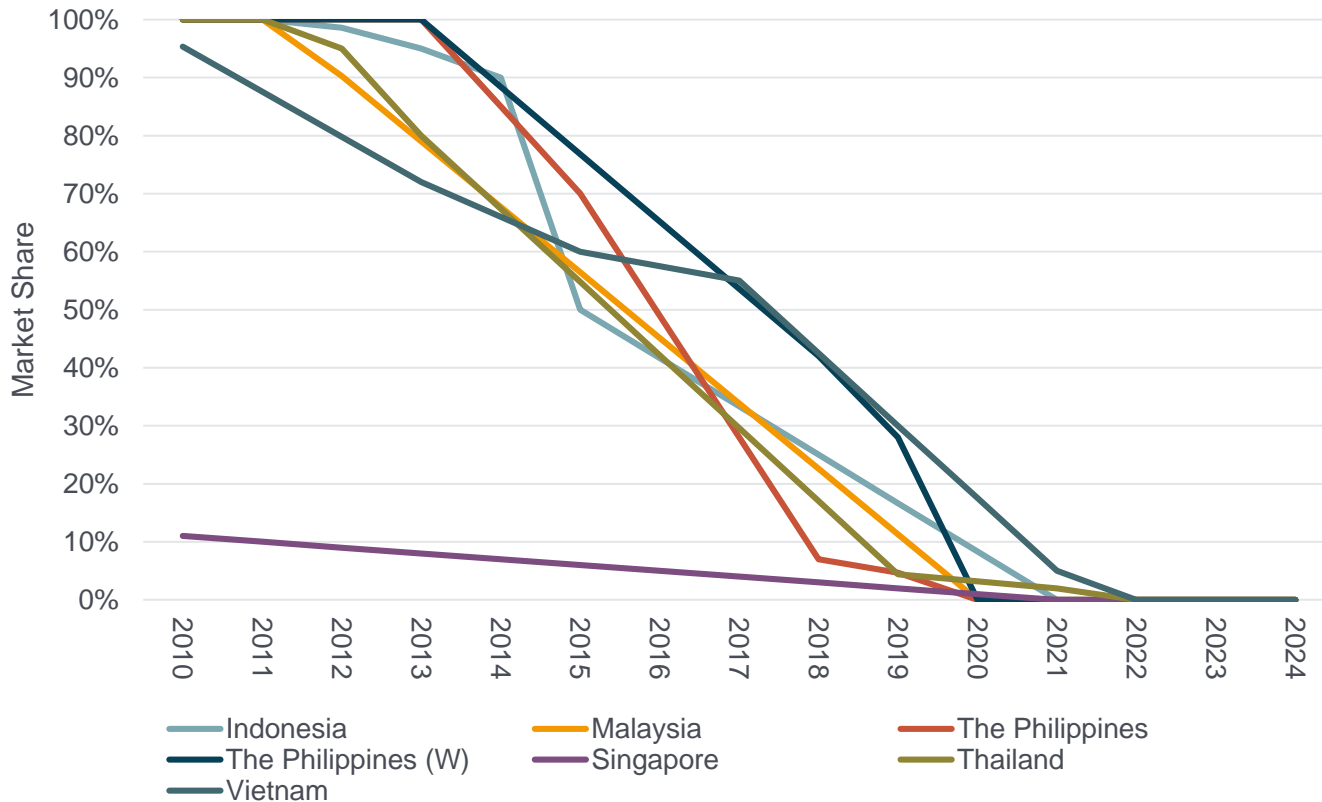
- Daikin:** CSPF 3.62 Wh/Wh (Malaysia) to 5.98 Wh/Wh (Singapore)
- LG:** CSPF 3.69 Wh/Wh (Indonesia) to 5.98 Wh/Wh (Singapore)
- Panasonic:** CSPF 3.35 Wh/Wh (the Philippines) to 5.34 Wh/Wh (Singapore)

- Similar efficiency spreads are highly likely for other brands as well

- Companies must ensure efficient units are widely available across all markets they

Phase Out of R-22

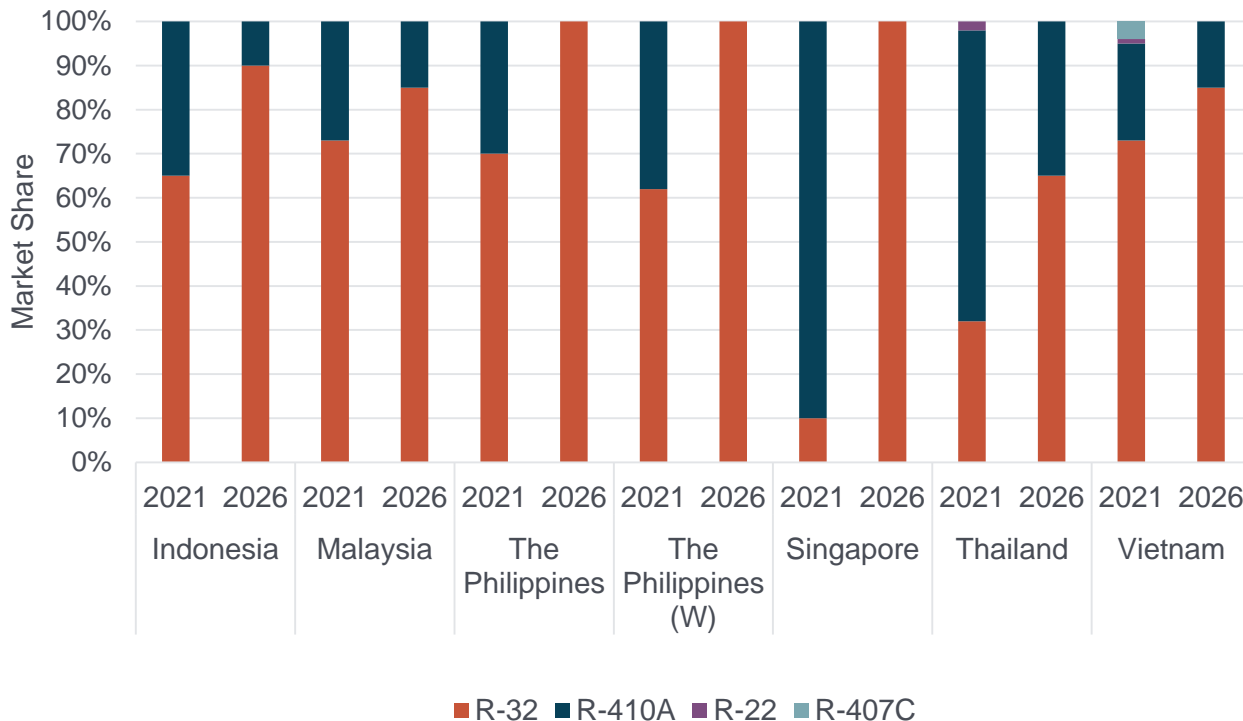
R-22 Market Share, by Country, 2010-2026



- **R-22 has been nearly phased out in the RAC sector.** Only few R-22 units are offered for sales of residual, previously manufactured stock.
- **Refrigerant transition supported by**
 - MLF support for production change to R-32
 - Indonesia: 5 AC enterprises in HPMP Phase I (2011-2018)
 - Thailand: 11 AC enterprises in HPMP Phase I (2013-2018)
 - Vietnam: 4 AC enterprises in HPMP Phase II (2016-2020)
 - Bans on manufacture and import of RACs with R-22: Indonesia (2015), Thailand (2018), and Malaysia (2020)
 - Accelerated transition to R-32 in China (2020)

HFCs & Phase Down

Refrigerant Market Shares, by Country, 2021 vs. 2026



- **In 2021, 35% of RACs used R-410A**, but there is a significant transition to R-32 in the region
- **Except for Singapore, all RACs with R-410A are low efficiency**
- No R-290 RACs identified in the regional market
- In 2022, Singapore enacted ban supply and import of new RAC equipment with refrigerants with GWP over 750
- **Refrigerant transition in China:**
 - China's domestic market transition: nearly 97% only-cooling RACs with R-32 after MEPS adoption
 - China's exports: ~50% RACs with R-32



Impact Analysis

BASE CASE – Business as Usual

- Current efficiencies, RAC market continues to grow at constant compound annual growth rate through 2050
- Markets continue transitioning to R-32, slow transition to R-290 or equivalent starting in 2035

POLICY SCENARIO 1: China inverter MEPS + Unregulated Refrigerant Market

- Adopt China inverter MEPS in 2025 (aligns with ASEAN 2025 target MEPS and U4E MEPS guidelines)

POLICY SCENARIO 2: China inverter MEPS + U4E Refrigerant Regulation

- Adopt China inverter MEPS in 2025 (aligns with ASEAN 2025 target MEPS and U4E MEPS guidelines)
- Require the use of refrigerants with $GWP \leq 750$ and $ODP = 0$ in 2025

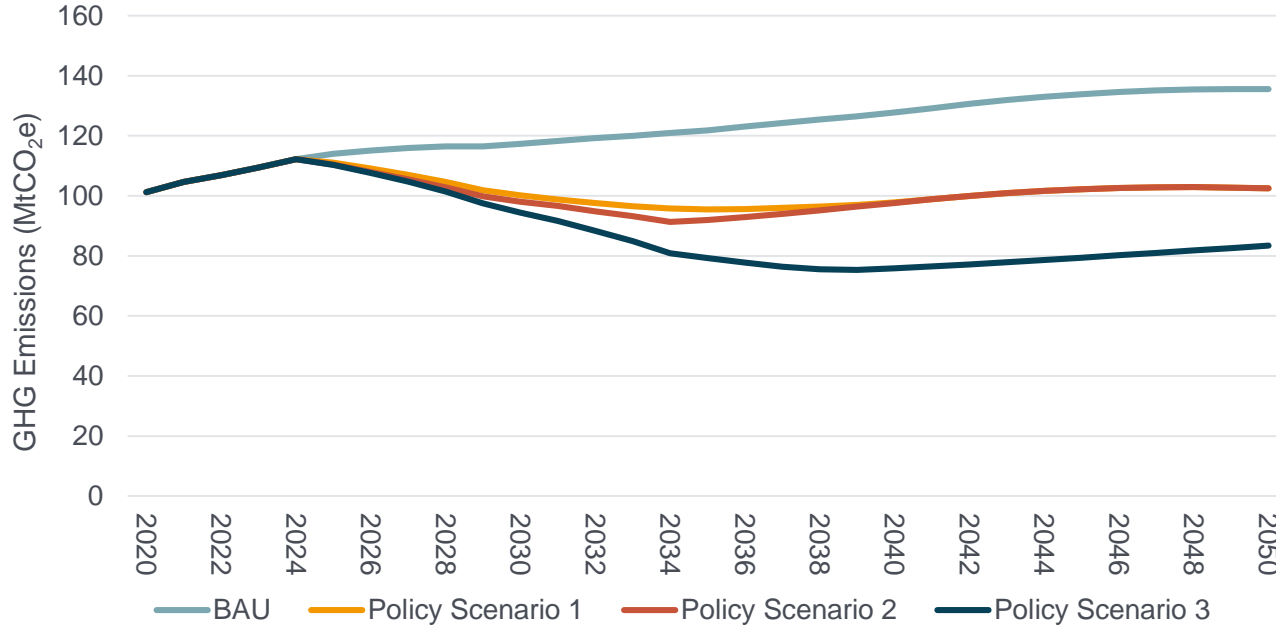
POLICY SCENARIO 3: China inverter MEPS + U4E Refrigerant Regulation + transition to R-290-equivalent starting in 2025

- Adopt China inverter MEPS in 2025 (aligns with ASEAN 2025 target MEPS and U4E MEPS guidelines)
- Require the use of refrigerants with $GWP \leq 750$ and $ODP = 0$ in 2025 and accelerated transition to R-290 ($GWP = 0.02$) or equivalent starting in 2025

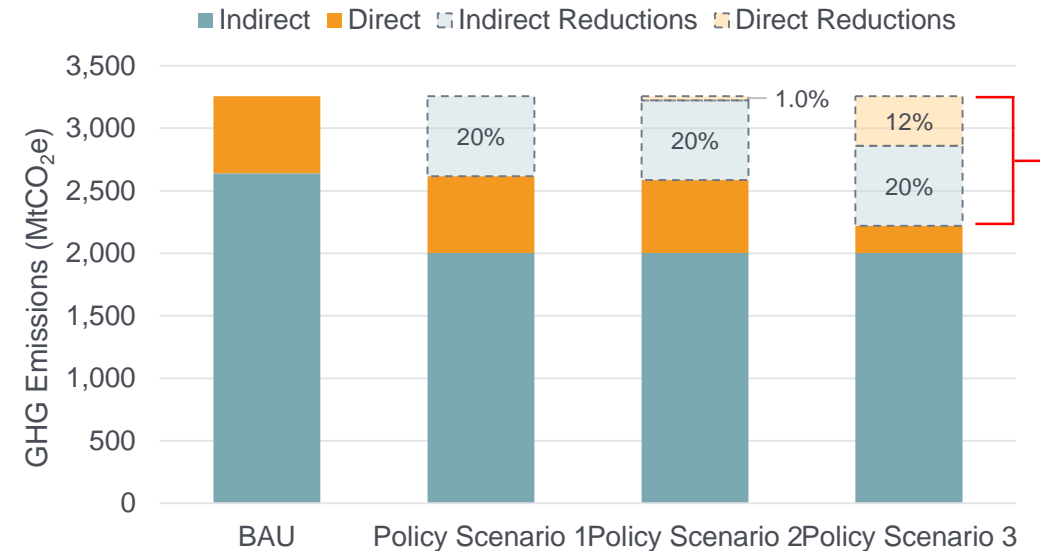
Emissions Impacts Analysis – Regional Projections



Annual Combined Direct and Indirect Emissions for the Aggregated Six Markets, by Policy Scenario, 2020-2050



Cumulative Emissions and Reductions for the Aggregated Six Markets, by Emission Type and Scenario, 2025-2050



Policy 3: cumulative 2025-2050	Indonesia	Malaysia	The Philippines	Singapore	Thailand	Vietnam	Total
Indirect Reductions (Mt)	296	185	120	0.02	14	24	639
Direct Reductions (MtCO ₂ e)	83	75	64	1.9	72	101	398
Total Reductions (MtCO₂e)	379	260	184	1.92	86	125	1,037

It is a shared responsibility. The actions require collaboration with and engagement from importing- and exporting-country stakeholders.



Thank you!
Any questions?



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