The Future of Cooling in Southeast Asia

October 2019

Introduction

This report examines the potential impacts of a growing demand for space cooling, primarily through the use of air conditioners (ACs), in the ten countries of the Association of Southeast Asian Nations (ASEAN): Cambodia, Brunei, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.

In addition to an analysis of trends and drivers, the report compares two scenarios describing potential increases in energy consumption, peak electricity demand and CO_2 emissions from space cooling across ASEAN countries. These scenarios were developed as part of the IEA's Southeast Asia Energy Outlook 2019.

A Stated Policies Scenario (STEPS) assumes existing policy frameworks and ambitions together with the continued evolution of known technologies.

A Sustainable Development Scenario (SDS), in contrast, assumes countries enact all the cost effective policies and measures necessary to reach energy-related components of the United Nations Sustainable Development Goals (UN SDGs): delivering on the Paris Agreement, achieving universal access to modern energy services by 2030, and dramatically reducing the region's energy-related air pollution. Strong policies to increase the average efficiency of ACs, as well as other building energy efficiency improvements, are at the heart of the SDS.

This report also provides policy recommendations to increase the efficiency of ACs sold in Southeast Asia, based on a strategy that reduces risks for manufacturers and is in line with ASEAN's regional economic integration agenda.

The analysis contained here builds on the work carried out in 2018 by the IEA in its Future of Cooling report, which examines the rising demand for space cooling globally, the potential for efficiency improvement and the associated policy implications. The analysis benefits from market data made available by the Kigali Cooling Efficiency Program.

This work is part of the ASEAN-IEA Cooling Partnership, which was a key outcome of the 36th ASEAN Ministers of Energy Meeting in 2018 and supports the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025.

Executive Summary

Energy use for air conditioners (ACs) in ASEAN countries increased 7.5 times over 30 years, equivalent to South Korea's annual household electricity consumption.

At the same time, AC ownership in the region remains low in comparison to many developed economies with less challenging climates, suggesting significant potential for market growth.

Access to affordable cooling is key to the economic and social development objectives of ASEAN countries. Policies are needed to ensure increased access to cooling is sustainable for energy systems and the climate.

Based on current and planned policies in the Stated Policies Scenario (STEPS), ASEAN countries will need to add an additional 200 GW of capacity by 2040, roughly equivalent to Germany's total current electricity capacity, to meet growing energy demand from ACs.

In the Sustainable Development Scenario (SDS), deploying more efficient ACs, along with other efficient equipment and building efficiency improvements, would permit ASEAN countries to save 110 TWh of electricity by 2040, nearly equivalent to the current electricity production of Malaysia, Philippines and Viet Nam combined.

ASEAN governments have scope to significantly raise their minimum energy performance standards (MEPS) for ACs in line with the SDS, without harming local industry or raising costs for consumers.

A gradual 'ratcheting up' of MEPS, resulting in an increase in AC efficiency standards over time, has been successful in several countries. The IEA recommends a medium term (2030) target for all ASEAN countries to establish MEPS at almost double today's levels. This medium term target should be paired with a long term target to reach an average market efficiency by 2040 in line with the SDS.

International best practice in procurement, harmonised efficiency standards for motors and product registration systems offer valuable precedents for ASEAN country efforts to increase AC efficiency.

Regional coordination and national cooling action plans, which cover other sources of cooling energy use such as refrigeration, are recommended for consideration by ASEAN countries.

In addition to increasing AC efficiency, cooling needs to be considered holistically to include building design, consumer engagement and private sector innovation.

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- 1.1 Current levels of cooling use and AC access
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Current levels of cooling use and AC access

Space cooling is on the rise in the ASEAN region which is one of the hottest parts of the world.

Electricity use for cooling in buildings across the region increased 7.5 times over 30 years, from 10 terawatt hours (TWh) in 1990 to almost 75 TWh in 2017. That is more than South Korea's annual household electricity consumption. Only China and India have seen a comparable increase in cooling related electricity use during the same period.

At the same time, AC ownership is still relatively low in the region. Only 15% of households in ASEAN countries have an AC, compared with more than 90% of households in some developed economies. There are also large differences in ownership across the region, with almost 80% of households in Singapore and Malaysia having an AC, compared to less than 10% in Indonesia, Philippines and Viet Nam.

This suggests there is significant potential for AC market growth in several countries in the region, notably in countries like Indonesia and Thailand.

Undoubtedly, as incomes rise and livelihoods improve, access to electricity and cooling services will increase.

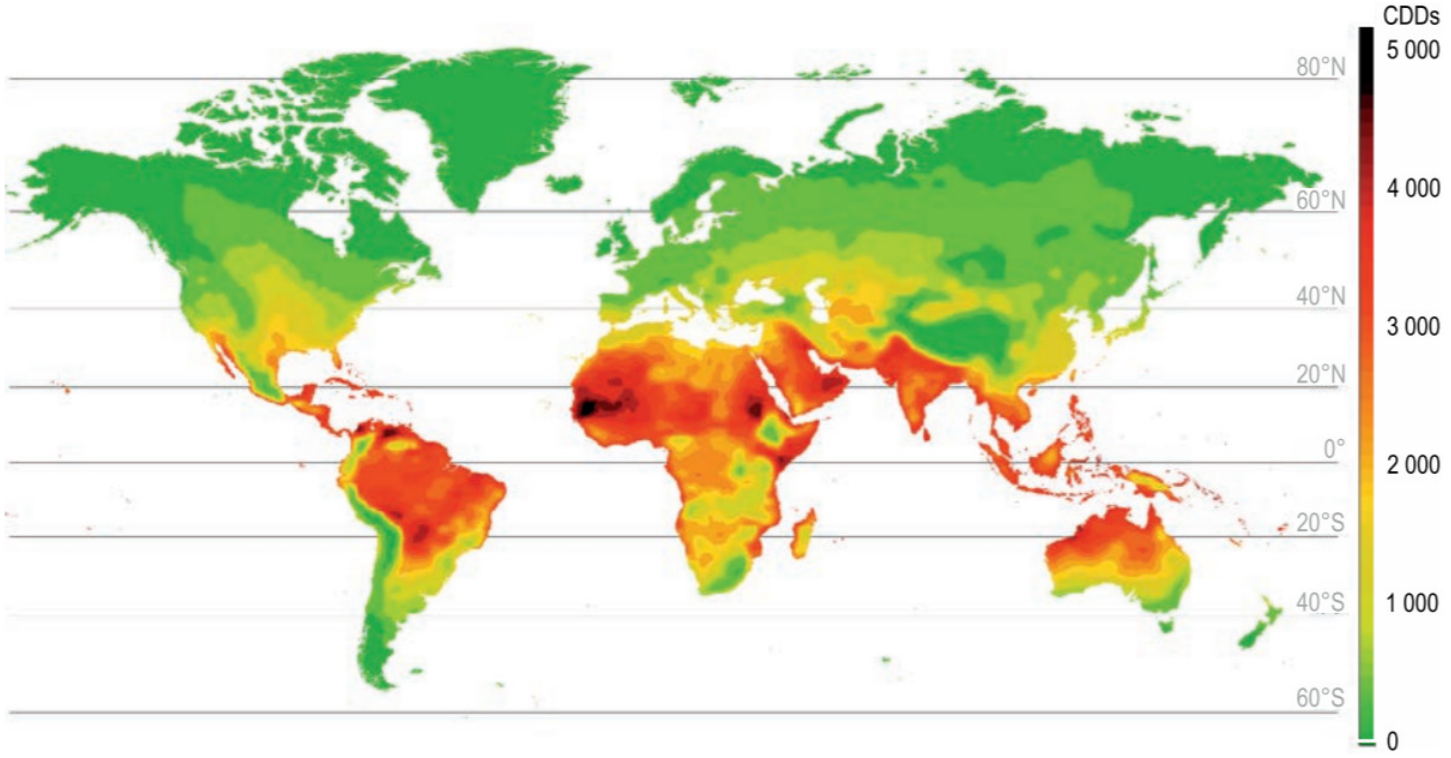
Urbanisation across the region is also likely to accentuate the increase in demand for cooling. In urban areas, compared with rural areas, incomes tend to be higher, as do temperatures, due to urban heat island effects.

For many poorer households, being able to afford an AC for the first time will yield a tremendous improvement in quality of life. Indeed, access to affordable cooling is clearly a key part of the economic and social development of ASEAN countries.

Policy makers in the region will need to consider ways to ensure that the expected increased in cooling demand and AC ownership is sustainable, notably in terms of impacts on energy systems and greenhouse gas emissions.

Southeast Asia is one of the regions where the need for space cooling is highest

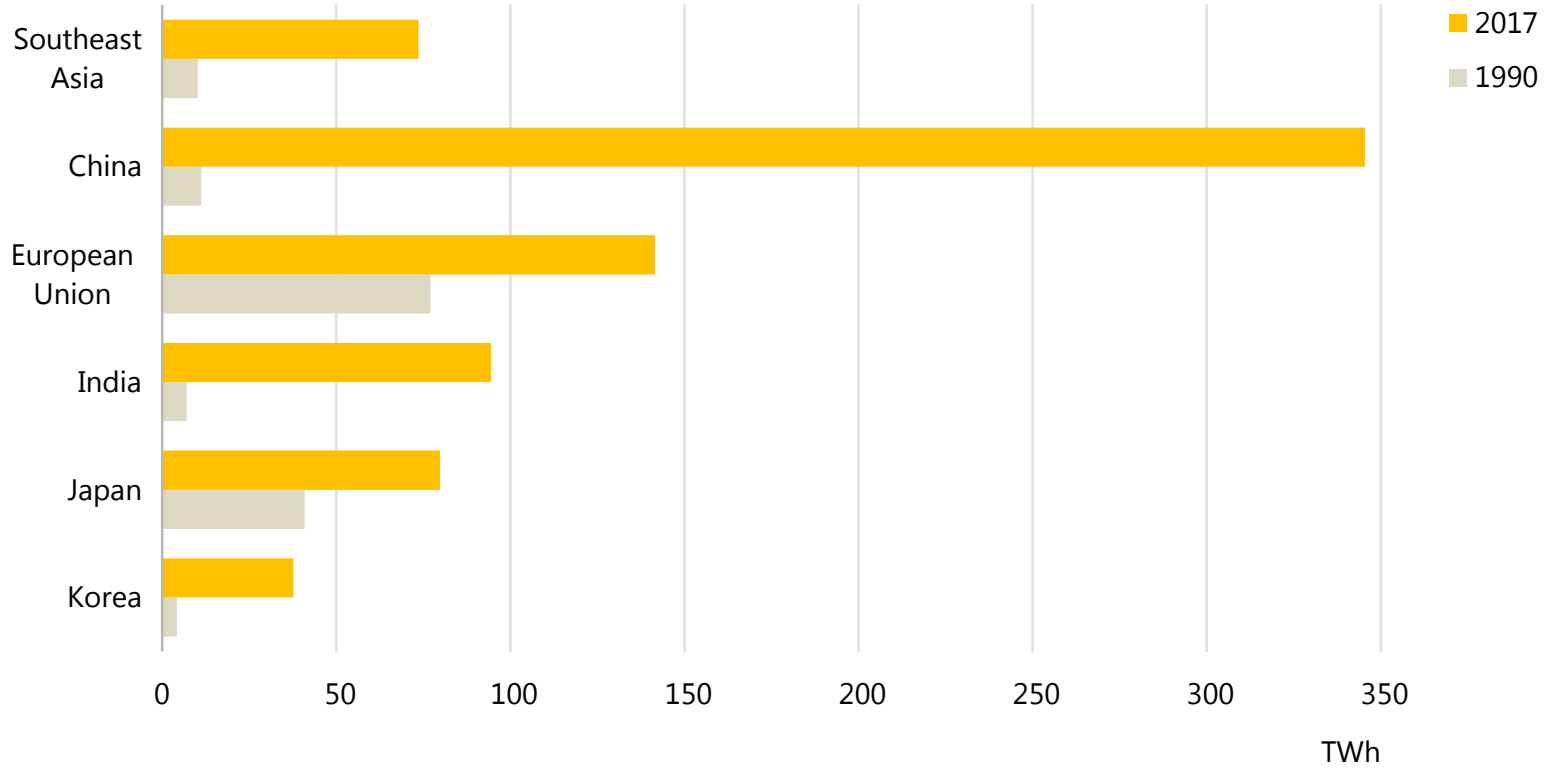
Cooling Degree Days (CDDs) across the world, mean annual average 2007-17



Notes: A degree day measures how cold or warm a given location is, by comparing the mean of the high and low outdoor temperatures recorded each day to a standard temperature. For the purpose of this report, CDDs are measured in °C, standardised to 18°C in all countries. CDDs measure how much the mean temperature exceeds the standard temperature each day over a given period. To account for the influence of humidity, a heat index, which corrects CDDs by combining air temperature and relative humidity in order to determine the temperature as perceived by humans, is used. The resulting number is weighted by population across a country or region and the entire year.

Energy consumption for cooling in Southeast Asia has already started growing

Electricity consumption of air conditioning systems in residential and commercial buildings by country or region

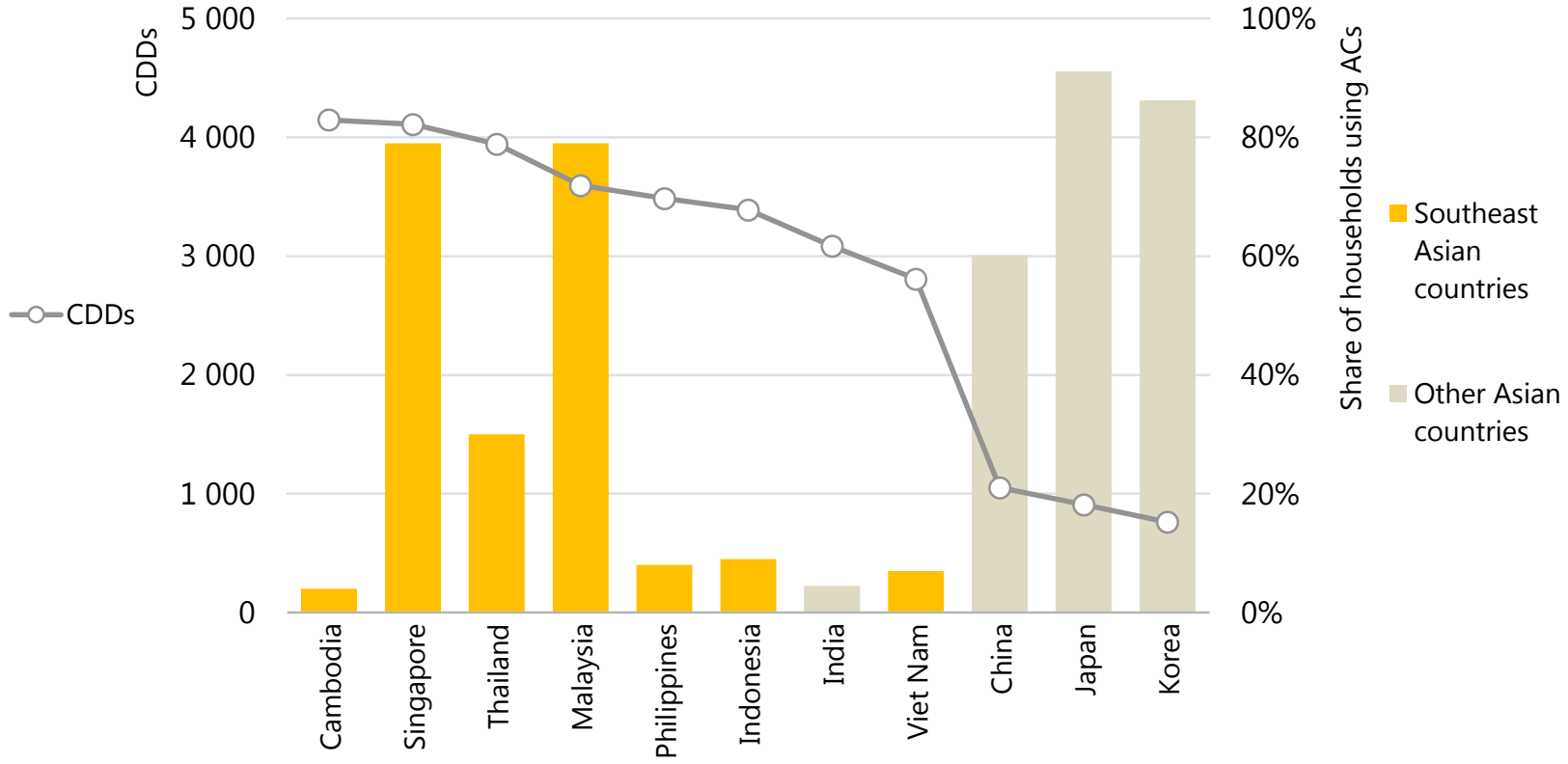


Note: TWh = Terawatt hours.

Source: IEA (2019) Southeast Asia Energy Outlook

… however, most households have yet to purchase their first air conditioning unit

Cooling degree days and share of households using air conditioning systems by country, 2017



Note: CDDs = Cooling degree days; ACs = Air conditioners

Source: IEA (2019) Southeast Asia Energy Outlook

Projected increase in cooling demand in the State Policies Scenario (STEPS)

In the STEPS, the stock of ACs in ASEAN countries reaches 300 million units in 2040, compared with 40 million units in 2017. Indonesia accounts for half of this growth.

This increase in AC stocks is strongly linked to economic growth and rising incomes, which increase both the share of households owning an AC and the number of ACs owned per household. By 2040, 60% of households in ASEAN countries would have access to cooling, with almost two ACs on average per household.

Rising temperatures will also play a part in these growth rates. The number of cooling degree days (CDDs) in ASEAN countries is already over four times as high as in Japan. Rising temperatures and humidity mean that ACs will also be used more frequently than today, with most ASEAN countries seeing an increase in their already high number of CDDs of up to 10% above 2017 levels.

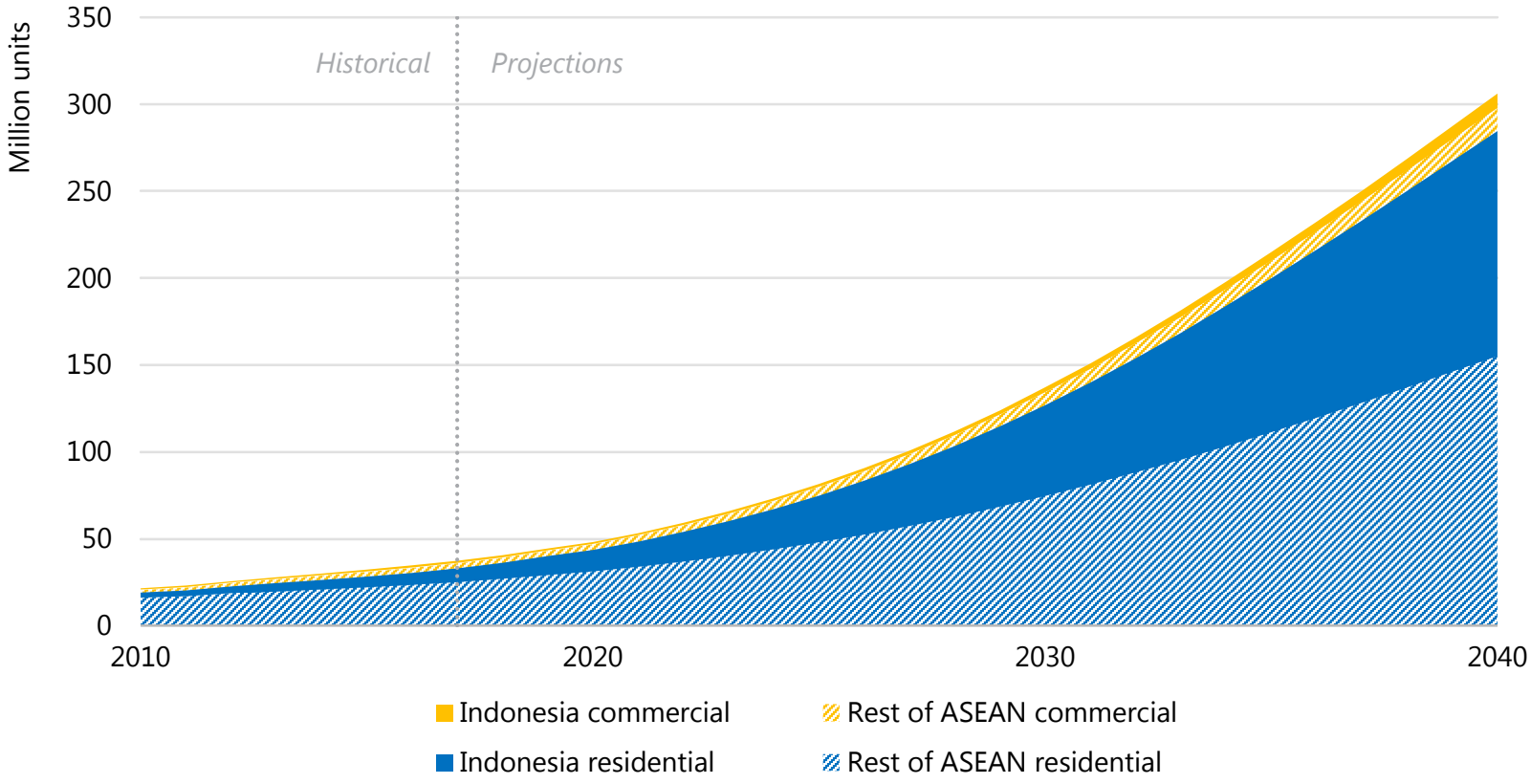
The amount of energy needed for space cooling in the STEPS grows from 75 TWh in 2017 to 300 TWh in 2040, greater than India's current annual household electricity consumption. Cooling will also account for an increasing share of households' energy use in the STEPS: By 2040, the share of cooling in total electricity consumption in ASEAN countries will more than double to almost 19%, up from 8% in 2017.

Energy systems will feel the strain from these considerable increases in cooling related energy demand in the STEPS. By 2040, cooling will account for 30% of peak electricity demand in ASEAN countries, up from around 10% today. An additional 200 GW of capacity, roughly equivalent to Germany's total current electricity capacity, will be needed to meet this demand.

However, in the Sustainable Development Scenario (SDS), the share of cooling in peak demand can be reduced to below 20% by the 2040. These and other opportunities in the SDS are discussed in more detail in section 2.

In the STEPS, the stock of ACs in ASEAN countries grows rapidly…

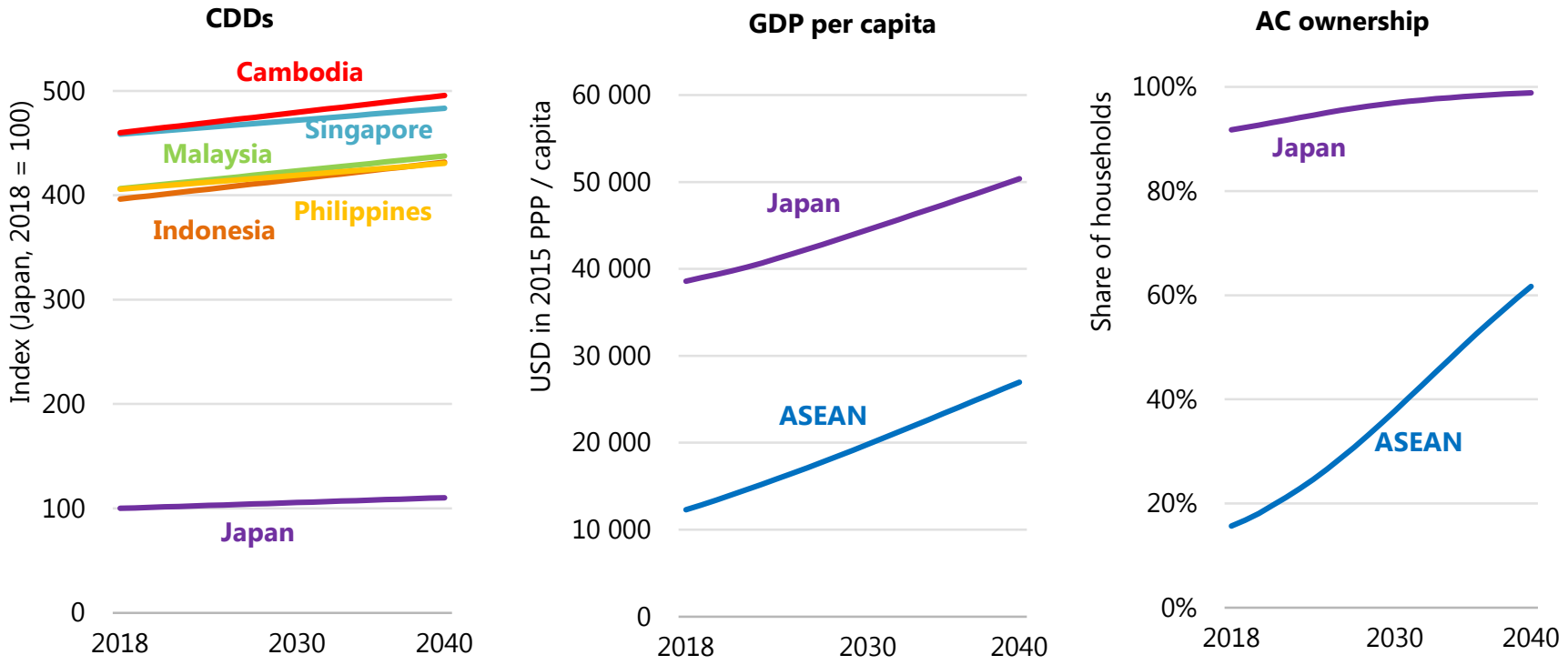
Stock of air conditioning units in Southeast Asia in the Stated Policies Scenario (STEPS)



Source: IEA (2019) Southeast Asia Energy Outlook

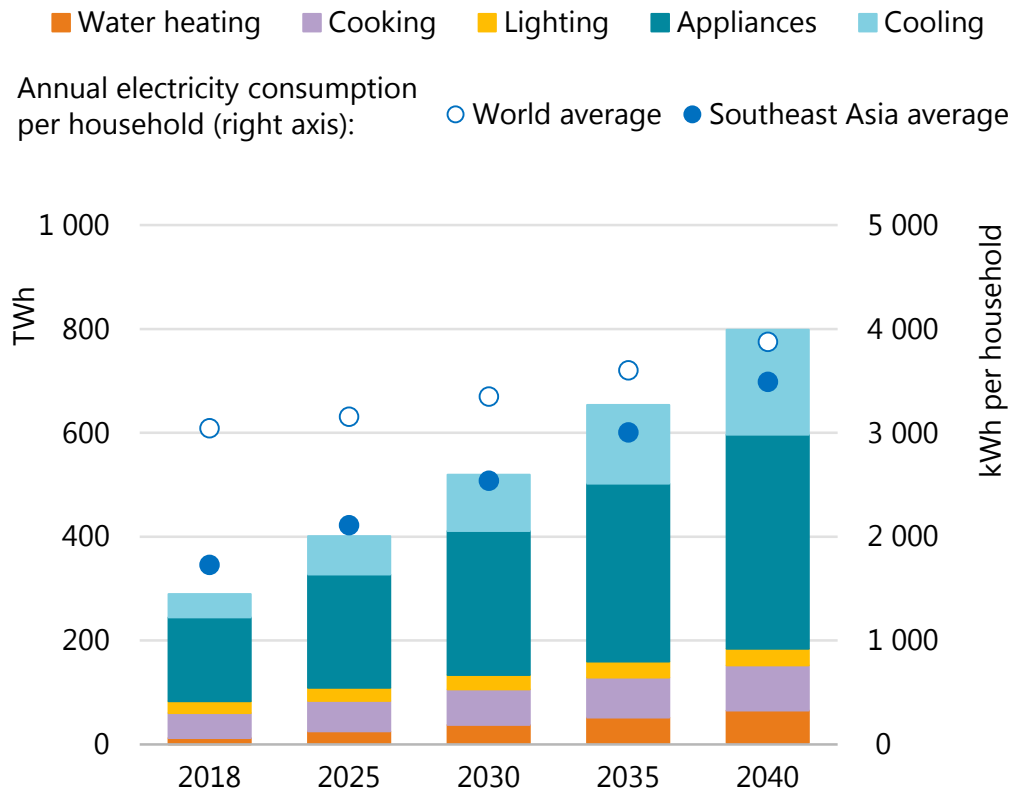
…driven by higher temperatures, but more importantly, higher incomes

Number of cooling degree days (CDDs), gross domestic product per capita (GDP/capita), and share of households with air conditioning (AC), in Southeast Asia and Japan in the Stated Policies Scenario

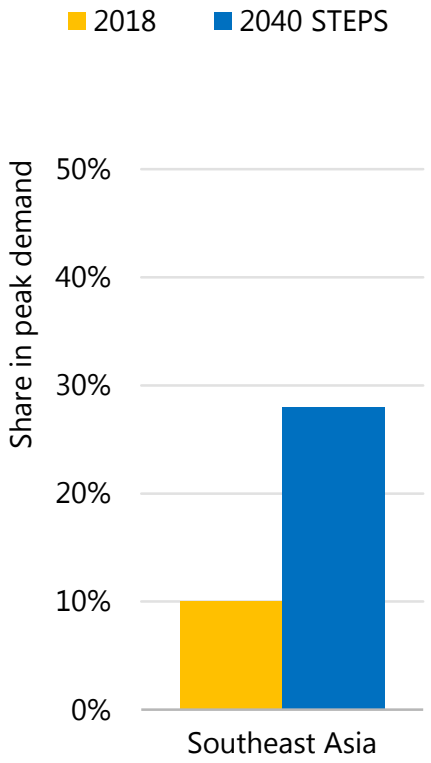


Cooling accounts for a growing share of total household electricity demand and without stronger policies, peak demand for cooling could strain power systems

Residential electricity demand by end-use and electricity consumption per household, per year in Southeast Asia in the STEPS



Share of cooling in peak electricity demand in 2018 and in 2040 in the STEPS



Notes: TWh = terawatt-hours; kWh = kilowatt-hour. Appliances include large appliances such as refrigerators, freezers, washing machines, clothes dryers, dishwashers, and small appliances such as televisions and microwaves. Penetration rates for basic appliances like refrigerators are already high.

Source: IEA (2019) Southeast Asia Energy Outlook

2 SDS opportunities and pathways for ASEAN

- 2.1 Opportunities for ASEAN countries in the Sustainable Development Scenario (SDS)
- 2.2 Taking stock and charting a path towards SDS

Opportunities for ASEAN countries in the Sustainable Development Scenario (SDS)

Cooling is a key component in ASEAN countries' transition towards a sustainable, low carbon future as outlined in the SDS, which assumes the achievement of universal energy access in electricity and cooking, a reduction in harmful local air pollution and a reversal of CO_2 emissions growth trends.

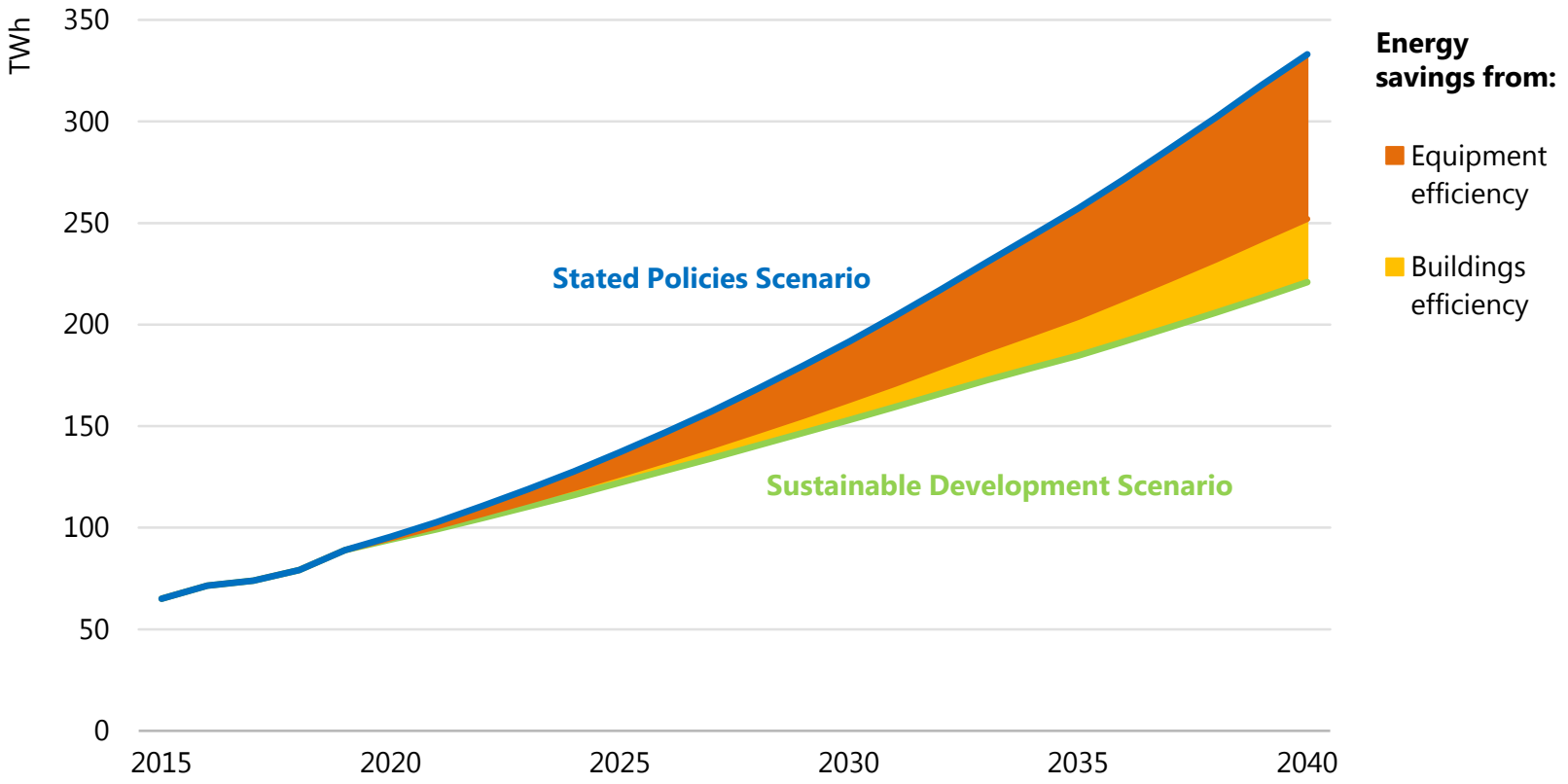
Deploying more efficient ACs along with building efficiency improvements, contributes 110 TWh of electricity savings in the SDS by 2040. This is nearly equivalent to the current electricity production of Malaysia, Philippines and Viet Nam combined.

In addition to reducing CO_2 emissions by almost 30 million tonnes – equivalent to the emissions of more than 6 million cars – these savings would reduce generation capacity needs for cooling to around 100 GW by 2040, nearly half of the additional capacity needs compared with the STEPS.

Other benefits include avoidance of emissions that impact public health: a 75% reduction in CO_2 and NOx emissions, an 80% reduction in SO_2 emissions, and up to a 95% reduction in PM2.5 emissions by 2040, compared with the STEPS. This is especially relevant for Southeast Asian countries, where as well as causing hundreds of thousands of premature deaths, the long-term economic costs of poor air quality could reduce their GDPs by 1.0% to 1.5% (OECD, 2016).

More efficient air conditioners and buildings would bring huge benefits for the region in terms of energy savings…

Reduction in cooling energy demand in the SDS compared to the STEPS



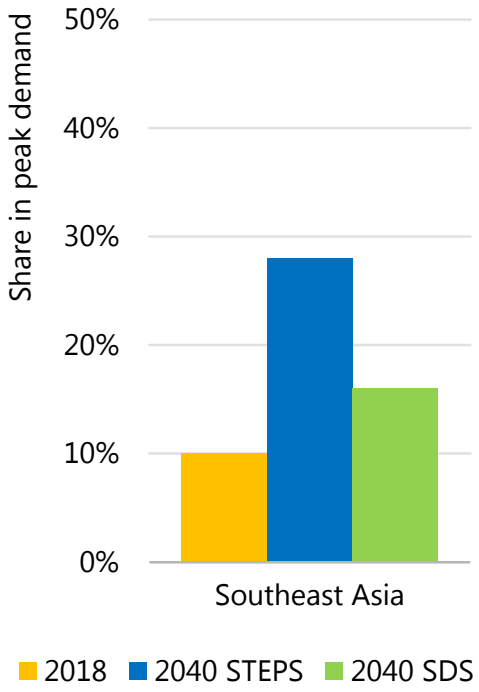
Note: TWh = Terawatt hours

Buildings efficiency measures include the building envelope such as insulation, roofs, walls, and windows.

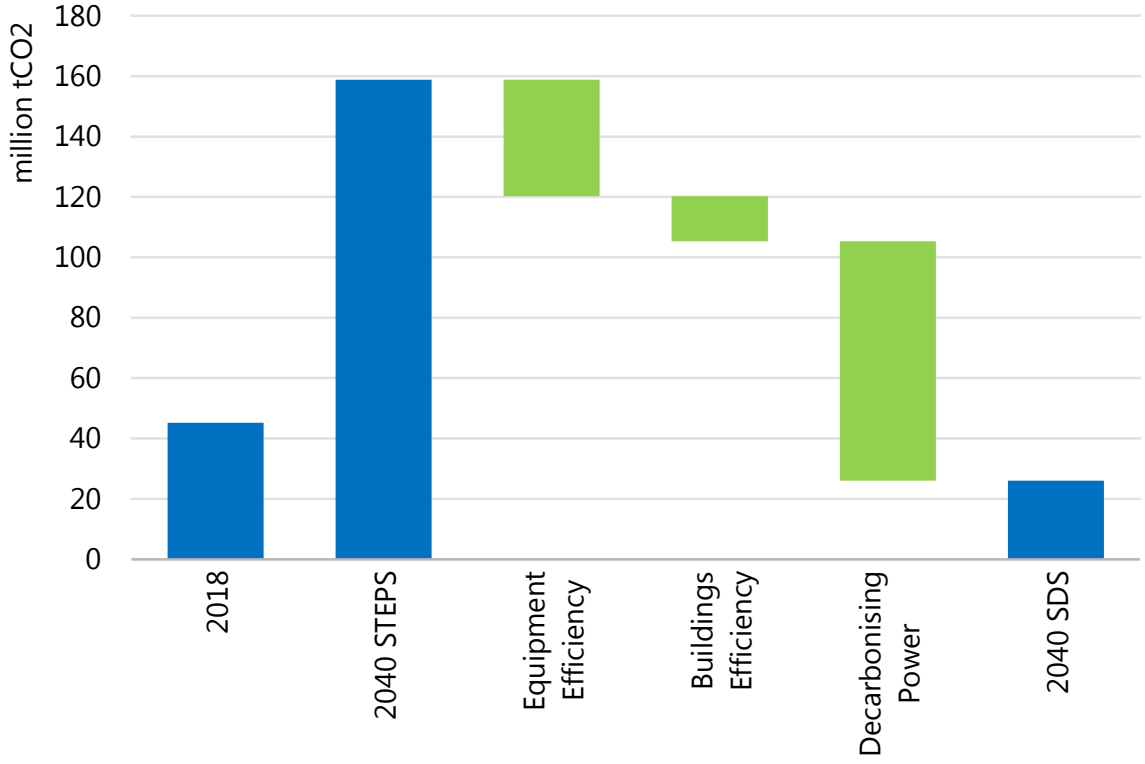
Source: IEA (2019) Southeast Asia Energy Outlook

… reduction of cooling's share in peak demand, and reduction of carbon emissions.

Reduction in cooling's share in peak demand in the SDS

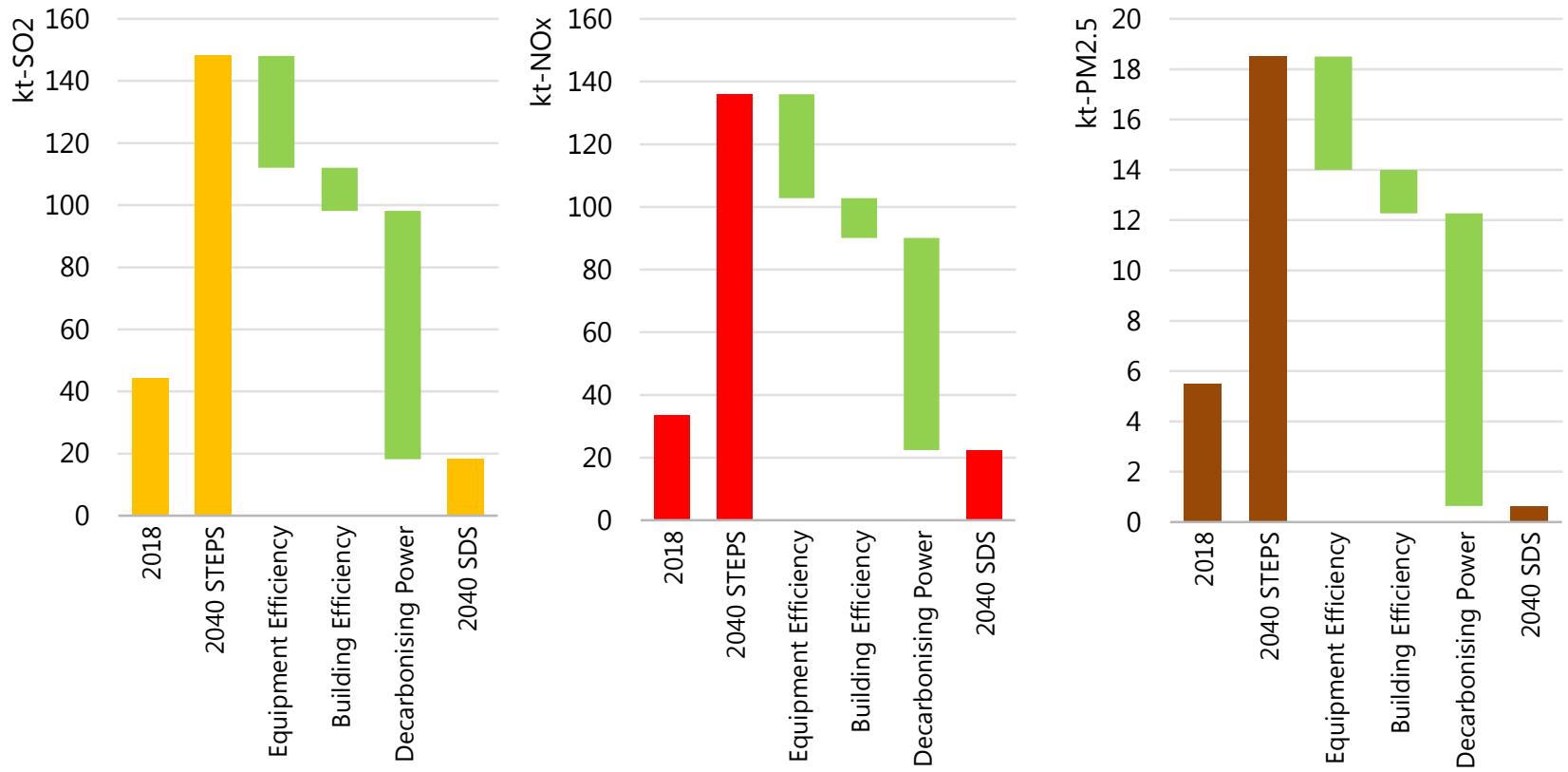


Decomposition of factors for reduction of CO_2 emissions between the STEPS and SDS



More efficient air conditioners and buildings would also improve air quality by avoiding emissions of common pollutants that impact health

Decomposition of factors for reduction of SO_2, NOx, and PM2.5 emissions between the STEPS and SDS



Taking stock and charting a path towards SDS

At global level, for the cooling sector to contribute in full to achieving the SDS, the average efficiency of ACs available needs to double.

In ASEAN countries, the average efficiency of air conditioners sold today is well below the efficiency of the best-performing models in each market. Indeed, the best available AC technologies are already more than twice as efficient as the market average, indicating a large untapped potential for efficient cooling in the region.

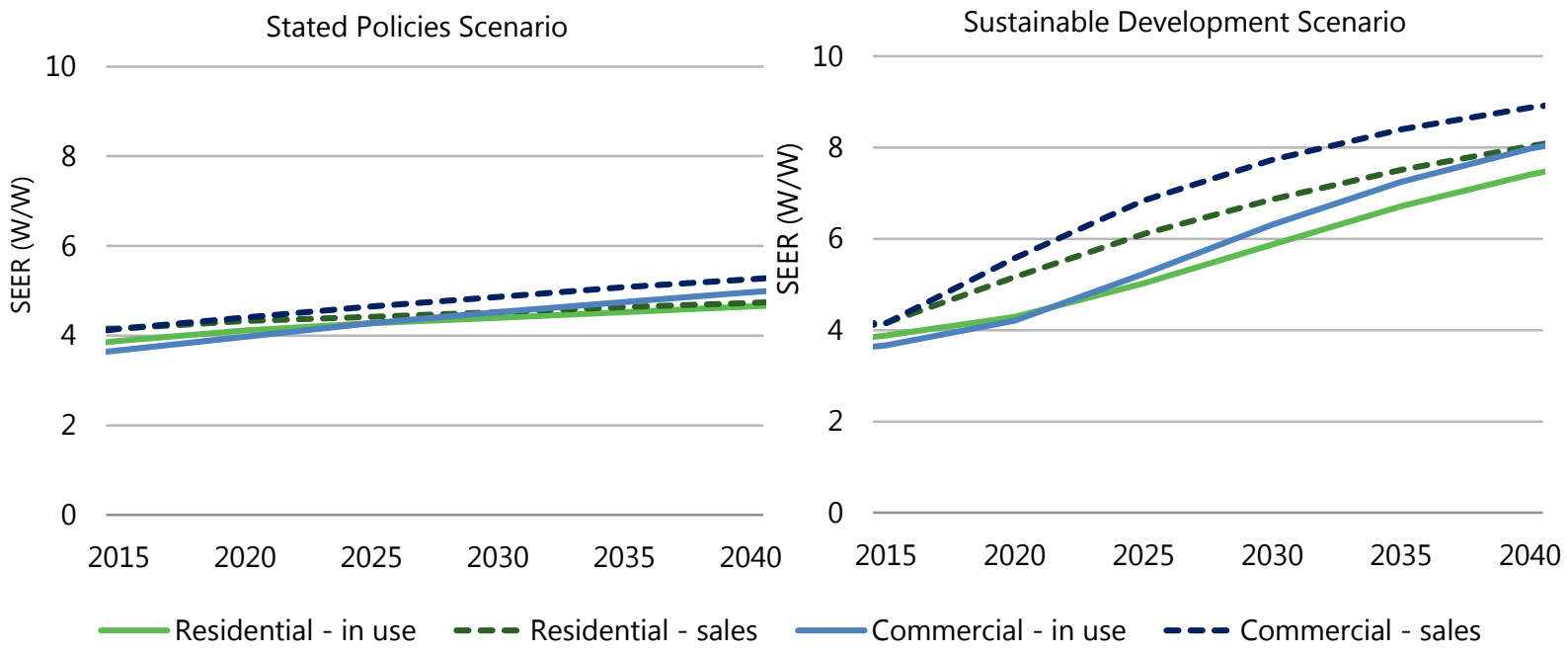
Analysis of AC markets in five ASEAN countries shows that more efficient ACs are not only readily available they are not necessarily more expensive than less efficient alternatives. In addition, the analysis suggests that local manufacturers have the technical capability to increase the efficiency of their products significantly within only one production cycle.

However, there is little correlation in these markets between retail price and efficiency, with significant variations in efficiency for the same price and capacity. In addition, a lack or ineffectiveness of AC labelling programmes means more efficient ACs are not necessarily being purchased by consumers, even if those ACs are priced competitively and offer better long term value through lower electricity consumption. In many ASEAN countries, the majority of products are in the top label category. This means that consumers are not able to differentiate the most efficient products.

This analysis suggests that ASEAN governments have scope to significantly raise their minimum energy performance standards (MEPS) for ACs in line with the SDS, without harming local industry or raising costs for consumers. In addition, there is potential for the development, or enhancement, of labelling programmes that raise consumer awareness and increase the share of more efficient ACs in region.

To achieve the SDS, global AC efficiencies must double

Global Average Seasonal Energy Efficiency Ratings (SEERs) of ACs in the Stated Policies Scenario and the Sustainable Development Scenario

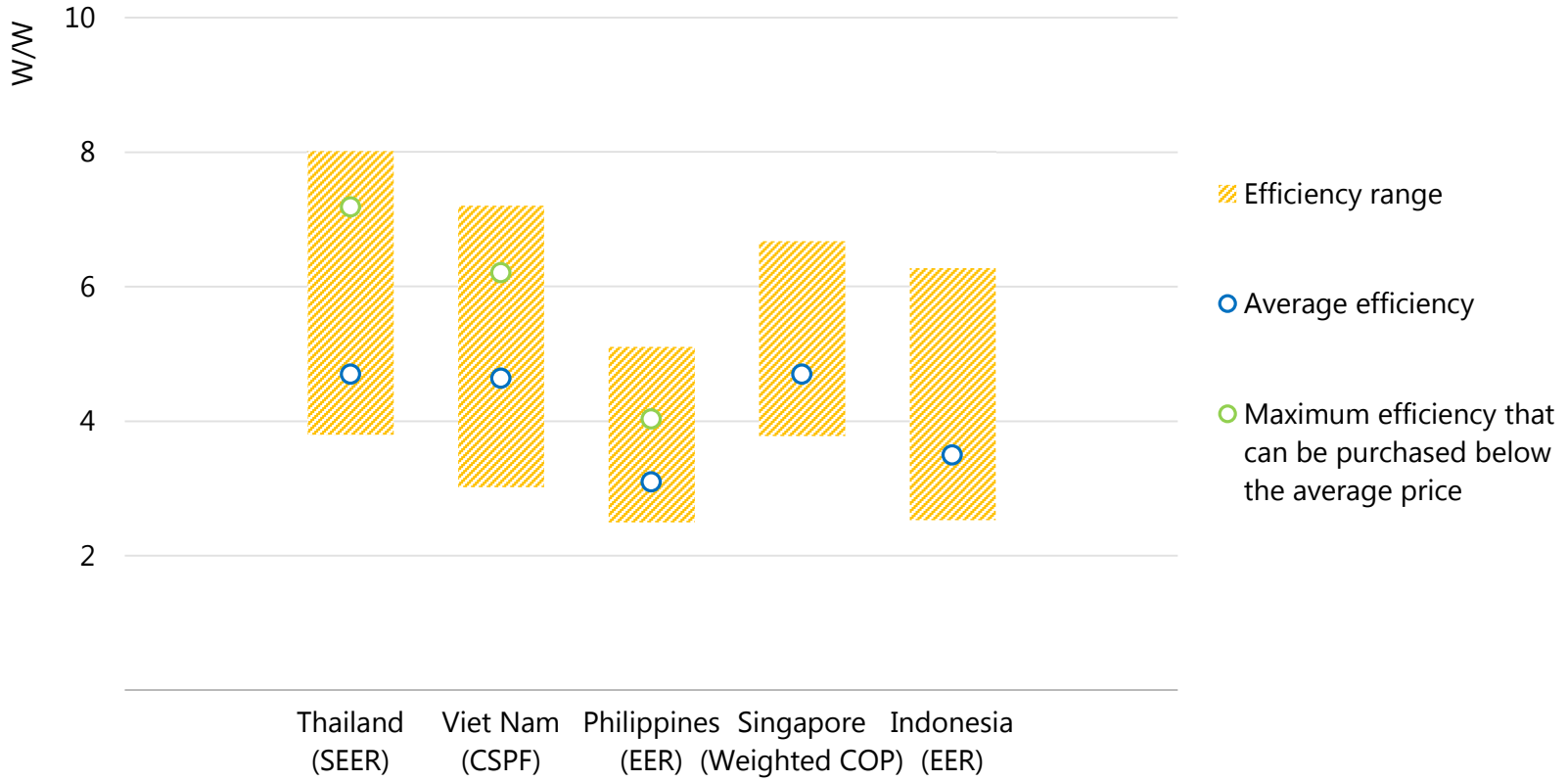


Adapted from IEA (2018) The Future of Cooling

Note: SEER is a commonly used measure of the efficiency of cooling equipment that takes into account changes in operating conditions throughout the cooling season **OK ?**

The average efficiency of air conditioners sold today is well below the efficiency of the best-performing models in each market

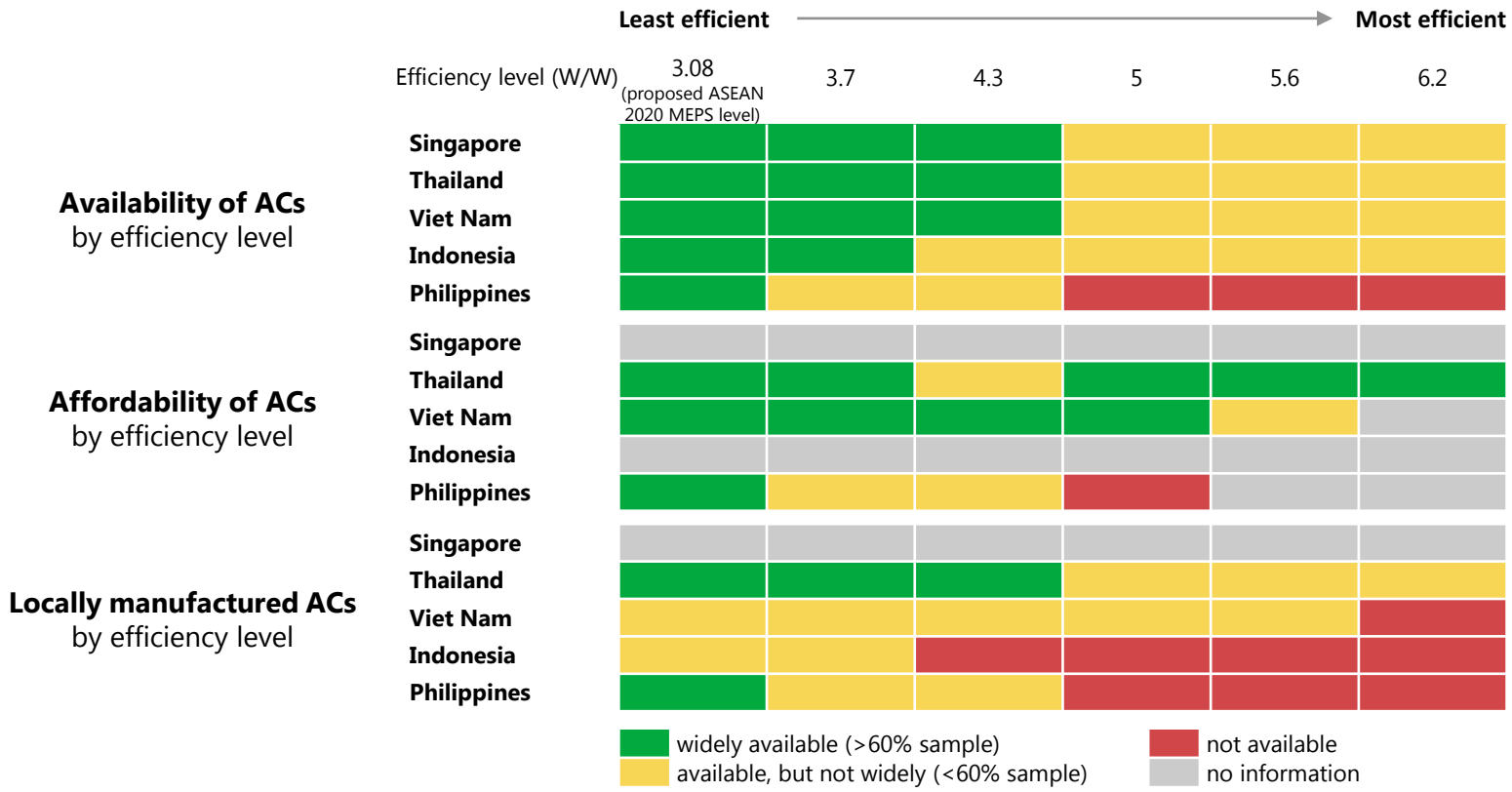
Average efficiency, efficiency range, and maximum efficiency at average price of air conditioning units in selected markets in Southeast Asia, 2017



Notes: Results shown for models with cooling capacity less 15,000 BTU/h. SEER = the ratio of output cooling to electrical energy input, adjusted for the overall performance of the device for the weather over a typical cooling season in each given country; CSPF = cooling seasonal performance factor (higher values equal greater efficiency); EER = the ratio of the output of cooling energy to input energy; Weighted COP = 0.4 x COP at 100% capacity + 0.6 x COP at 50% capacity, where COP = Coefficient of Performance; W/W = watt per watt.

More efficient air conditioners are already available in the Southeast Asian market and they do not have to be more expensive or imported

Results of air conditioning market analysis in selected Southeast Asian countries



Sources: IEA analysis based on information from CLASP, the Kigali Cooling Efficiency Program and the National registration databases of Indonesia and Singapore

Notes: Results shown for models with cooling capacity <15,000 BTU/h; MEPS = minimum energy performance standards; Efficiency level defined in terms of Seasonal Energy Efficiency Ratio (SEER) where higher values equal greater efficiency. "Widely available" means that at least 60% of models in the sample are of equal efficiency or higher than the efficiency level shown. **Availability of ACs** mean that models exist on the market which have an efficiency greater than the efficiency tested; **Affordability of ACs** means that models with efficiency greater than the efficiency tested are available at a price that is lower than the average price of models in that category. Price has been normalised by capacity. **Locally manufactured ACs** means that models with efficiency greater than the efficiency tested are available by a manufacturer from that country

3 Policy recommendations and case studies

- 3.1 A roadmap for improving minimum energy performance standards
- 3.2 Case studies

A roadmap for improving minimum energy performance standards

The IEA has developed a series of policy recommendations to transform the AC market in ASEAN countries, including a roadmap for AC MEPS.

The IEA recommends a medium term (2030) target for all ASEAN countries to establish MEPS at almost double today's levels. This medium term target should be paired with a long term target to reach an average market efficiency by 2040 in line with the SDS.

These MEPS targets were established based on an analysis of market data collected from five ASEAN countries, that shows that all these markets have the potential to increase MEPS at no additional cost to consumers or local industry. It is noteworthy that several markets across the region already have ACs that are aligned with the medium term MEPS target, are manufactured locally, and are priced competitively compared with less efficient alternatives.

Given the disparities between ASEAN country AC markets, each country may adopt its own starting point and timeline, as well as different aspirational 2030 targets. At the same time, MEPS levels must be coordinated, and the timeline must be clear, in order to take advantage of the region's market of more than 620 million people. Clear regulations and economies of scale can help reduce investment risk for manufacturers.

Further engagement with individual countries is needed to define the appropriate MEPS levels, roadmaps, and accompanying suite of policies to help secure demand and scale for more efficient ACs, but a preliminary proposal is set out in the following pages.

Minimum energy performance standards can ‘push’ the market towards energy efficient products…

PUSH

Why?

- Remove inefficient products from the market
- Regular and predictable replacement of less efficient ACs allows for a smooth transition for manufacturers

How?

Minimum energy performance standards (MEPS) ladder

- Enables countries to choose a starting point and commit to defined steps and timeframe to transition to higher MEPS levels
- Builds on existing activities in the region led by ASEAN Energy Efficiency & Conservation Sub-Sector Network (EE&C-SSN), for example, ASEAN SHINE
- Is effective as progressive MEPS have consistently increased efficiency of markets while not impacting long-term purchase prices (Sources: IEA, SEAD, 4E)
- Aggregates markets for efficient products reducing their cost for all

… while securing the demand can 'pull' the market…

PULL

Why?

- Provide certainty of demand for more efficient products
- Assuring market demand reduces risk to manufacturers and lowers prices of more efficient goods for consumers

How?

High Energy Performance Standards (HEPS)

- Method for defining and updating HEPS related to MEPS ladder

Equipment lists

- List of energy efficient equipment meeting HEPS
- Endorsed equipment list allows for price competition among the listed products

Incentives

- Loans, rebates and/or tax incentives linked to HEPS and equipment lists

Public Sector Procurement

- Requirements for governments to buy the most efficient ACs
- Most efficient ACs linked to HEPS

Bulk procurement

- bulk purchase of more efficient goods linked to HEPs for lower prices through corporate social responsibility initiatives or buyers groups

… alongside other actions to facilitate the overall process

FACILITATE

Why?

- Eases the process for consumers and manufacturers by providing information, capacity and incentives

How?

Registration systems

- Coordinated database allows for easy verification and regular analysis of market
- Can be managed through the use of smartphone apps and enhanced using QR codes to provide additional consumer information

Labels

- Allow consumers to choose based on their own needs and purchasing power
- Must be regularly analysed to make sure the rating system reflects lowest to highest efficiency available on market

Awareness and capacity building

- Campaigns to highlight value of more efficient air conditioners and their efficient operation
- Capacity building for testing and verification to ensure compliance with regulations

Incentives

- Rebates for the purchase of more efficient products
- On-bill financing to encourage consumers to invest in energy efficient products
- Early replacement incentives to avoid lock-in of inefficient appliances
- Industry transformation grants and sharing of intellectual property rights

Going up the ladder: regional coordination to increase AC efficiency

The ASEAN SHINE Initiative is a major regional effort by the ASEAN countries to transform the market towards higher energy by 2020 to harmonise test methods and evaluation methodologies based on international standards by 2020, and to establish a regional product database at the ASEAN Centre for Energy.

This regional coordination helps reduce the barriers to trade within the ASEAN region which is in line with the with the ASEAN regional economic integration strategy, effectively lowering the costs for the traded products.

Today, ASEAN countries are at varying stages of implementation of the SHINE initiative. Nonetheless, the countries are still on track to meet the objectives, with some having MEPS levels for fixed-speed ACs and variable-speed ACs[1] above the ASEAN SHINE 2020 targets.

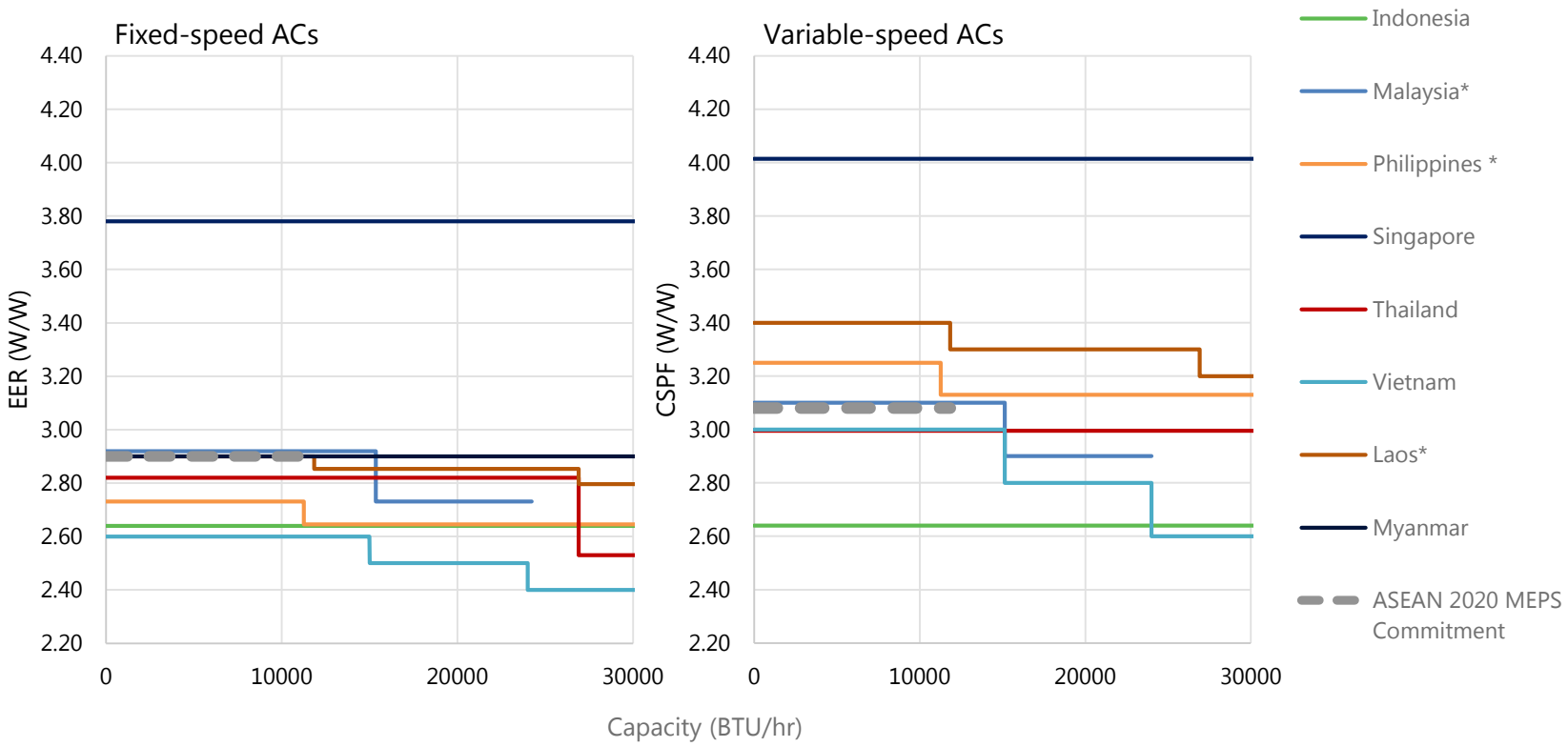
The ASEAN countries could use the ASEAN SHINE initiative as a platform to pursue the progressive strengthening of MEPS in line with the Sustainable Development Scenario. A regionally-coordinated MEPS ladder could help guide national policymakers in the continuous strengthening of their MEPS levels.

With a defined timeline and MEPS setting, it would increase the market predictability for the AC manufacturers and lower investment risks. This would allow ASEAN consumers to purchase higher efficiency ACs at lower costs.

1 Fixed-speed ACs have a single speed setting and turns on and off to satisfy cooling needs. Variable-speed ACs can operate at different speeds to satisfy cooling needs more precisely

Efficiency levels of ACs in Southeast Asian countries today

Levels of minimum energy performance standards in Southeast Asian countries for fixed-speed and variable-speed ACs based on cooling capacity (2019)

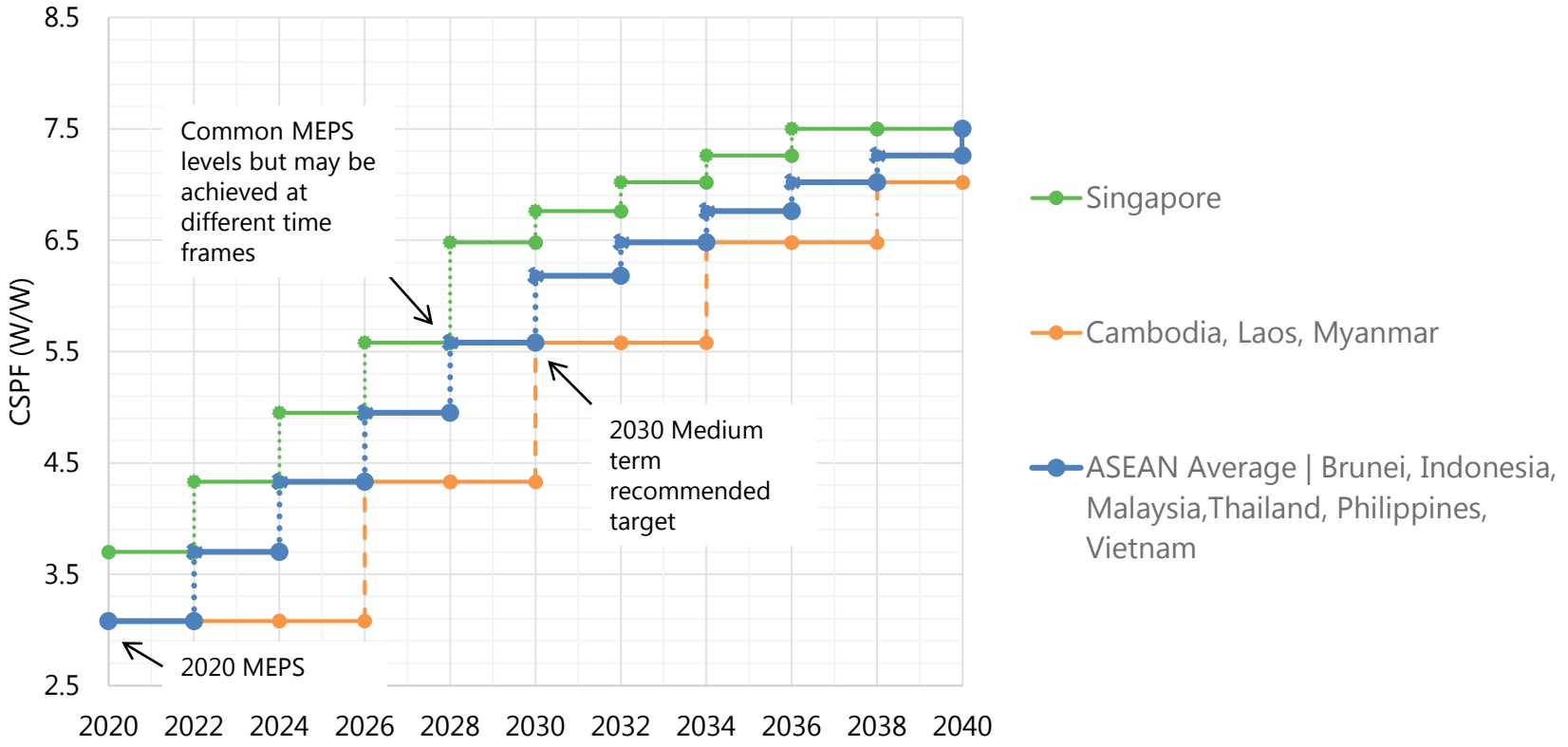


*MEPS setting legislated directly in terms of Cooling Seasonal Performance Factor (CSPF). CSPF = 1.062 x EER. CSPF is similar to SEER where the cooling performance is measured according to changes in operating conditions throughout the cooling season

Sources: ICA (2017) Evaluation of the ASEAN SHINE Program, ST (2018) Guide for MEPS ACs https://bit.ly/2Q4mCPt; NEA (2018) Minimum Energy Performance Standards https://bit.ly/2PZKBQ1; DoE (2019) Particular Product Requirements: Air Conditioners https://bit.ly/2Vznhyy; TISI (2010) Standard for ACs https://bit.ly/2mnYxbK; Correspondence with Ministry of Energy and Mines (Laos PDR). Brunei Darussalam and Cambodia are still in the process of developing mandatory MEPS in the time of writing.

Proposal for a regionally coordinated MEPS ladder to guide policymakers and increase market predictability for manufacturers to lower costs

Proposal for progression of minimum performance standards based on pre-defined levels, with suggested targets for each ASEAN country



A harmonised roadmap for the gradual increase in MEPS to a minimum level of 6.2 by 2030.

Each country could decide its own starting level and target and commit to revising its MEPS every 2-3 years. Countries with MEPS starting at a higher level such as Singapore could adopt a more ambitious timeline. Other countries could choose progress at a slower rate but would require larger changes every revision. MEPS should use the CSPF metric using harmonised testing and evaluation methods as agreed in the ASEAN SHINE Initiative.

Case study: Ratcheting up AC standards in Australia, New Zealand and India

MEPS have had a large impact on the efficiency and innovation of the air conditioner market in Australia and New Zealand, where cooling can account for 20% to 50% of energy use, depending on the climate zone. Due to a gradual ratcheting up of standards, today's least efficient AC sold on markets in Australia and New Zealand is more efficient than the most efficient model available in 2001.

India, the first emerging economy to have a common rating plan for fixed-speed and variable-speed room ACs, has been successively ratcheting up MEPS since 2006, when the first voluntary energy label for fixed speed ACs was launched. The label features a star rating with ranges from 1 to 5 in which 5 stars indicates the highest efficiency.

This voluntary label became mandatory in 2009 and in 2015 coverage was extended to include variable-speed ACs. The same year, a new methodology was introduced to factor in temperature variations across India's different climate zones. Over time, MEPS were gradually increased, so that ACs with a 5-star label in 2009 would only receive a 1-star label in 2018. This represented an increase in stringency of 35% at the 1-star level and 45% at the 5-star level.

In addition to increasing efficiency, this systematic approach also helped shift the market with inverter ACs penetration increasing to 30% in 2018, from less than 1% in 2015, and the average EER and ISEER[1] of air conditioners in terms of units of production increasing by nearly 30% from financial year 2011/12 to financial year 2017/18 in terms of product (CLASP, 2019).

1 ISEER is the Indian Seasonal Energy Efficiency Ratio.

Case study: Learning from harmonised efficiency levels for motors

Efficient motors used in pumps, compressors, aerators, blowers, fans, or any motor-driven systems are gaining an increasing share of the global market, assisted by a framework of international standards that classifies motors according to their energy efficiency. This framework, developed by the International Electro-technical Commission, supports energy efficiency policy making through a classification scheme comprising four levels of motor efficiency:

- IE1 Standard Efficiency
- IE2 High Efficiency
- IE3 Premium Efficiency
- IE4 Super premium Efficiency

The classes are pitched to require a drop in losses of around 20% to increase efficiency between successive higher levels (IEA 4E EMSA, 2015). These IE classes allow governments to specify the efficiency levels for their MEPS. For example, the European Union, South Korea, US and Mexico have MEPS for motors at IE3; while Australia, China and Brazil have MEPS equivalent to IE2 and Costa Rica, Chile and Vietnam have MEPS at IE1.

The classification system has enabled a high level of international harmonisation for a globally traded product, recognising at the same time that MEPS can differ according to the market situation of different countries.

A further benefit of the scheme is that it provides motor buyers and motor providers a simple way of describing how efficient a motor is, contributing to increased market transparency. The transparent nomenclature and definitions of the IE Class also reduces barriers to trade (IEC, 2018).

This concept is applied to the MEPS ladder proposal for ACs in ASEAN in order to allow for market aggregation and predictability, thereby lowering the costs for higher efficiency products.

Case study: Procurement of efficient equipment in India and South Korea

Procurement strategies around the world could help facilitate the entry of higher efficiency products into the market.

India's Super-Efficient Air Conditioning Programme builds on the bulk procurement model developed under the successful large-scale lighting programme known as UJALA implemented by Energy Efficiency Services Limited (EESL), a government joint venture company. Under the first distribution phase in 2019, EESL aims to distribute 50,000 super-efficient and climate friendly ACs across India by partnering with electricity distribution companies. These super-efficient ACs will have a 5-star (most efficient) rating and are nearly 44% more efficient than the 3-star models and reduce operating costs by up to 50%. EESL has also set up an online platform to enable consumers to order ACs on a first come first serve basis (EESL Mart, 2019, EESL, 2019).

In South Korea, products that acquire the 1st-grade energy efficiency rating (a high energy performance rating), operate with low standby power consumption or have smart functionality can enjoy the privilege of priority purchasing through the government's Public Procurement Service. These products benefit from requirements for highly efficient equipment that must be used by public organisations. They are also specified in building standards; can attract tax breaks on investments; loans through the Energy Use Rationalization Fund; and testing fee waivers (MOTIE and Korea Energy Agency, 2015).

These measures provide policy makers with procurement tools while helping transform markets towards higher efficiency products.

Case study: Registration systems

Many countries, such as Australia, Canada, China, Brazil, India and the US have mandatory registration systems for products with an energy label and/or MEPS.

Combined with public databases, these registration systems provide an up-to-date and accurate picture of the market, a basis for decisions on policies, access to individual product details, and support to market surveillance activities.

Registration systems provide an easily accessible overview of efficiency, energy consumption, size/volume, technology and other relevant parameters of all models on the market. In this way, they can help consumers find products fitting their needs and support energy efficient purchasing decisions. Registration systems can also reduce the burden on suppliers through streamlining of information and reporting requirements.

Furthermore, analysis of registration data over time can help to track market developments. Data can be used to support decisions on label scales, performance requirements and timeframes for revisions. The ability to systematically track market developments can also help in the monitoring of the impact of policies.

MEPS and labelling programmes that are implemented without the support of a registration system tend to lack consistent market data, that can lead to requirements not being appropriate.

Ineffective effective market surveillance can substantially reduce expected energy savings from energy efficiency standards and labelling programmes. In the European Union (EU), for example, it was estimated that 10-25% of products on the market did not fully comply with energy efficiency labelling regulations and that around 10% of potential energy savings were lost due to non-compliance (European Commission, 2019).

In light of the need to improve market surveillance and to access other benefits associated with product registries, a new EU-wide registration system was established in 2019. The registry will make key information centrally available, thereby streamlining market control activity and supporting national market surveillance authorities. The registry will also help inform consumers about the energy efficiency of products and provide the Commission with up-to-date information for reviewing energy labels.

4 Additional considerations

Efficient space cooling doesn't depend on ACs alone

To maximise the efficiency of ACs and other cooling technologies, it is critical to consider efficient building design. Building envelope improvements, such as improved windows, insulation in external walls and roofs, as well as air tightness and solar shading, can ensure that buildings do not absorb excess heat from their surroundings, reducing the load on ACs. In addition to considering buildings more holistically, governments can also roll out awareness raising measures to inform consumers about efficiency.

In parallel, private sector innovations and engagement can extend beyond improving the efficiency individual technologies like ACs. This can include prioritising passive or hybrid strategies, the incorporation of thermal storage technologies, hybrid cooling systems and smart controls, as well as effective energy management and operation.

There are also other building design interventions that can be taken into account. In the Philippines, apartment buildings are often built with ready-made window slot openings for AC placement. This can influence the dwellers to buy less efficient window-type ACs as it avoids the extra costs of installing split-type ACs and sealing the open slot.

These examples highlight how cooling is affected by multiple parameters within a system, and as such must be approached with a system-wide perspective.

Creating national cooling action plans

The urgency of addressing the future of space cooling is being recognised widely, especially in countries exposed to the effects of increasing temperatures. Climate change will not just affect space cooling, but will also affect food and medicine provision which travels through the cold chain, meaning supply chains involving refrigerated warehouses and trucks.

In March 2019, India launched its Cooling Action Plan. The plan seeks to reduce cooling demand across sectors by 20% to 25%, reduce refrigerant demand by 25% to 30% and reduce cooling energy requirements by 25% to 40% by financial year 2037-38. The plan covers space cooling in buildings, AC technology, cold-chain and refrigeration, and transport air-conditioning. Furthermore, it sets out targets to by 2037-38 and to stimulate research and development in the area of cooling and ensure training and capacity building of 100,000 servicing sector technicians by 2022-23 (MoEFCC, 2019).

In June 2019, China's National Development and Reform Commission released the Green Cooling Action Plan that sets forth the country's near-term and midterm cooling targets to promote the supply of climate-friendly and efficient cooling products while enabling more investment in sustainable cooling technologies and industry. Under the plan, the energy efficiency of major cooling products is targeted to improve by at least 30% by 2022. The market share of climate-friendly and efficient cooling products is set to increase by 20% during the same period. Meanwhile, the plan aims to improve the energy efficiency of large public buildings by 30% by 2030 (China Daily, 2019).

ASEAN member countries could create their own national cooling action plans, ensuring that the different sectors of their economy work together on this key issue. There is an opportunity as well for ASEAN to coordinate these plans from a regional perspective. Pooling of resources could lower the costs of research and development, and regional market integration could help in increasing access to more efficient products from manufacturers.

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