Accelerating Electrification in Southeast Asia

Opportunities, implications and priority actions



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Abstract

Southeast Asia is one of the world's fastest-growing energy regions, with rising incomes, industrialisation and urbanisation driving rapid growth in energy and electricity demand. At a time when energy security concerns are moving higher on the policy agenda, the region's increasing reliance on imported fossil fuels exposes countries to elevated price risks and supply disruptions. By reducing dependence on imported fossil fuels and making greater use of domestic and regional electricity resources, electrification can strengthen energy security while supporting economic growth and development. Electrification can be a central pillar of strategies to meet growing energy service needs while strengthening resilience, improving efficiency and reducing emissions. In this context, electrification refers to expanding the use of electricity to meet end-use energy needs both by increasing uses that already rely on electricity and replacing fossil fuel-based technologies with electric alternatives.

This report examines how electrification is increasingly driving and reshaping energy demand across Southeast Asia and assesses opportunities to accelerate electrification across the transport, buildings and industry sectors. It reviews current electrification trends, the policy landscape and investment in electrification. Drawing on IEA analysis from the Electrification Special Report and Southeast Asia Energy Outlook 2026, the report provides the regional outlook for electrification under the IEA Stated Policies Scenario (STEPS) and the High Electrification Scenario (HES). The report also discusses key drivers and challenges for electrification for the region, including cost competitiveness, electrified technology, energy prices and subsidies.

The report analyses the energy security, economic, social and environmental implications of faster electrification pathways. Realising electrification potential will require enabling policy, regulatory and market frameworks and priority actions across energy systems, end-use sectors, power systems, financing frameworks and regional co-operation.

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Executive summary

Southeast Asia's economies are growing rapidly but are vulnerable to increasing reliance on fuel imports

Southeast Asia is one of the world's fastest-growing economic regions with a rapidly rising energy consumption. Since 2015, total final energy consumption has risen by more than 30%, driven mainly by industry and transport, followed by buildings. Electricity consumption grew nearly twice as fast as overall energy use.

Fossil fuels continue to dominate energy supply, with increasing reliance on fuel imports. Coal and oil each account for around 30% of total energy supply, while gas plays a key role in some countries. Prior to the recent conflict in the Strait of Hormuz, the region sourced around 60% of its crude oil imports and one-third of its natural gas imports from the Middle East. Growing dependence on fuel imports exposes economies to external energy shocks through supply disruptions and geopolitical risks, leading to higher energy prices.

The energy crisis is boosting electrification momentum

Electricity is the region's second-largest energy product after oil. The regional share of electricity in total final energy consumption rose from 12% in 2000 to 25% in 2025, higher than the global average of 23%. Most growth occurred in already electrified end uses, such as space cooling and appliances. Buildings are the most electrified sector at 56%, with data centres emerging as a fast-growing driver. Industry electrification has risen to 29%, but many industrial processes that require high-temperature heat continue to rely on fuels. Transport electrification stands at less than 0.5%. Country trends vary: Viet Nam is nearly 30% electrified, but some economies are at less than 20%.

Amid the current energy crisis and affordability concerns, momentum for electrification is growing. Energy security concerns have prompted countries to strengthen measures to reduce dependence on fuel imports and related exposure to price shocks. Policy support for electric mobility and biofuel blending, electric cooking, energy efficiency and industrial electrification is creating opportunities for replacement of fuel-based technologies. In 2025, regional electric car sales more than doubled year-on-year to account for nearly 20% of total car sales. In the first half of 2026, the share of electric cars jumped to around 30% of all car sales, bringing it to a level comparable to Europe. Use of electric two- and three-wheelers is expanding, particularly in Viet Nam. Electrification in end-use energy investment rose from 22% in 2015 to 34% in 2025, driven largely by investment in transport.

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Improving economics and technological progress can further accelerate electrification

Southeast Asia's electrification rate would reach 37% if today's cost-competitive electrification potential were fully realised. The largest opportunities are in road transport, cooking, water heating, industrial motors and low- and medium-temperature industrial heat, where commercially available technologies can already provide energy services efficiently and competitively.

Realising this potential depends on strengthening the economic case and addressing adoption barriers. Although electricity often costs more per unit of energy than fossil fuels, efficient electric technologies can reduce overall energy consumption and lower energy bills, depending on electricity-to-fuel price ratios. Across selected ASEAN countries, electricity prices range from 0.7 to 1.9 times gasoline and diesel prices per unit of energy. For transport, ratios below 2 are aligned with international observations on cost-parity between electric vehicles (EVs) and internal combustion engines. However, energy subsidies, taxes and tariffs can distort this economic picture. Consumers can face barriers financing upfront technology costs even when economically attractive. Some applications also require new infrastructure, such as EV charging points and grid upgrades.

Accelerated progress also depends on technology and supply chain development. In transport, expanding domestic EV manufacturing and battery supply chains in Thailand and Viet Nam, along with lowering import tariffs, has improved the affordability of EVs. Most electric technologies for buildings and industry, such as cooking and low- and medium-temperature heat, have reached a high maturity level, while high-temperature process heat for steel, cement and chemicals are at earlier stages. The role of critical minerals in electrification requires the management of potential risks related to geographic concentration.

Faster electrification increases energy security benefits

Based on today's policies and technology trends, Southeast Asia's electrification rate is set to rise from 25% in 2025 to 32% by 2035. Energy consumption is expected to grow by 25% and fossil fuel consumption by 14% while fuel import dependence continues to expand. Under the Stated Policies Scenario, the region is projected to rely on imports to meet one-third of its natural gas demand and 80% of its oil demand by 2035, with fossil fuel import bills rising to more than USD 200 billion annually, from just over USD 100 billion in 2025. Direct emissions from final energy consumption are expected to expand from around 1.0 Gt CO_2 in 2025 to 1.2 Gt CO_2 in 2035.

Faster electrification can strengthen energy security through diversification, avoided fuel demand and lower fuel import bills. Under the High Electrification

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Scenario, the share of electricity increases to 41% by 2035. While electricity use expands by nearly 65% (900 terawatt-hours), energy consumption rises only 2%, despite delivering the same level of services. Buildings electrification rises to 80%, driven by all-electric uses and fuel switching to electric cooking and water heating. Industry electrification grows to 43% but continues to face constraints for high-temperature process heat. Transport electrification grows close to 9% by 2035, led by electric cars and two- and three-wheelers. Avoided oil demand from EV adoption climbs to almost 0.9 million barrels per day (mb/d). Increased reliance on domestic and regional sources of electricity generates annual fuel import savings by 2035 equivalent to almost 30% of the region's fuel import bills in 2025, or nearly 1% of regional GDP in the High Electrification Scenario.

Electrification can support economic development and sustainability. Reduced reliance on fuel imports eases budgetary pressures with lower outlays for subsidies. Less exposure to elevated fuel prices can limit cost pressures on goods and services, enhancing affordability. Clean cooking, efficient appliances and electric mobility lower exposure to household and urban air pollution. In the High Electrification Scenario, switching to electricity, combined with energy efficiency and increased direct use of low-emission fuels, lowers CO_2 emissions from end-uses by nearly 25% by 2035. Combining with a shift to cleaner power sources would further reduce overall energy-related emissions.

Realising the multiple benefits of electrification depends on developing reliable and affordable clean power

Regional power supply currently relies on fossil fuels, but growing use of renewables would magnify the positive impacts of electrification. Coal-fired power met over 60% of electricity demand growth over the past decade and currently accounts for almost half of generation, while gas comprises nearly a quarter. Renewables met around 40% of new demand and now account for over a quarter of generation, led by hydropower, accompanied by rapid growth in solar PV and wind. Expanding renewables can further reduce fuel imports, notably gas for power and diesel for microgrids in remote areas. This would lower the emissions intensity of power generation, enabling emission reductions beyond fuel switching. To fully meet new demand in the High Electrification Scenario, renewable generation would need to more than triple from today's level by 2035.

Secure, reliable and affordable electrification requires the development of clean power, grids and flexibility resources in concert. Rapidly falling costs for solar PV, wind and batteries are making electrification more cost-competitive with direct fuel use. New demand and increased variable renewables will also reshape locational and temporal electricity profiles. This will require more effective system balancing, with better use of existing resources plus new investments.

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Co-ordinated actions and economy-wide strategies can play key roles in accelerating electrification

Accelerating electrification requires an economy-wide and energy-systems approach. Electrification strategies should align demand growth with measures to strengthen power sector security and resilience while developing robust industrial supply chains. Co-ordinated planning across power and end-use sectors is essential, given the different lead times for the development of power generation and infrastructure and the adoption of electrified equipment. Strengthening the economics of electrification requires addressing energy price distortions through better-targeted subsidies, tariff reforms and balanced taxation between electricity and fossil fuels. It also requires tackling barriers that prevent consumers from financing upfront costs. Developing domestic supply chains around electrification can potentially reduce dependencies on imported technology.

End-use sectoral measures should focus on boosting adoption of efficient electrified technologies by strengthening energy performance standards, information programmes and economic incentives. Labour skills development and capacity building around supply chains and implementation are also essential. Widespread enabling infrastructure, such as EV charging points, distribution upgrades and grid-interactive buildings, will be key to supporting technology uptake and integration.

With a larger role in the economy, the power sector needs to evolve in a secure and sustainable manner while addressing greater exposure to weather and cybersecurity risks. Accelerating clean electrification depends on timely grid expansion and modernisation, well-designed policy, and market mechanisms to procure low-carbon power – including from renewables and nuclear – as well as mechanisms to unlock flexibility through storage and demand-side resources.

Expanding financing and promoting new business models will help unlock opportunities for all consumers, supporting service-based models and reducing costs for households and businesses. Targeted measures, such as lowering consumption taxes, fees and tariffs, and providing concessional finance, can catalyse uptake, especially for low-income groups and small businesses.

Regional co-operation can play an important role in tackling common technical, economic and integration challenges. This includes developing regional approaches to energy planning, appliance standards, interoperability and data sharing. Adopting common standards, testing procedures and labelling supports faster deployment of efficient electric technologies. The ASEAN Power Grid can enable affordable electrification with higher shares of renewables, while the ASEAN Plan of Action for Energy Cooperation can serve as a tool for aligning electrification, renewables, efficiency and grid priorities.

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Near-term priorities for electrification to enhance security and affordability

The IEA 2026 ASEAN Energy Security Review highlights three strategies for the region to strengthen energy security, considering the varied energy risks by country and fuel: diversifying energy supply sources and routes, making greater use of domestically available energy resources, and accelerating electrification alongside efficiency improvements.

In the near term, electrification "quick wins" can provide economic relief from the current energy crisis while supporting longer-term energy security and electricity adoption. The IEA 2026 Energy Crisis Policy Response Tracker has identified priority policies and interventions that can be readily carried out by governments, are already successfully addressing current energy supply pressures, and can provide long-lasting system benefits. While many of the government's measures to respond to the crisis have been short-term demand reduction and energy conservation through behavioural changes, durable policy measures for supporting electrification include:

- faster procurement of renewables, battery storage and smart-grid tools to unlock existing network capacity
- stronger efficiency standards for cooling and industrial motors
- targeted finance for purchasing efficient electric equipment
- managed charging practices for public fleets and buses to ease peak demand and lower energy bills.

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Introduction

The world has entered the Age of Electricity. Electricity is playing an increasingly central role in energy systems, economies, services and daily life. Over the past decade, global electricity demand grew at nearly twice the rate of overall energy demand, supported by increased electrification in industry, transport and buildings. Despite this rapid growth, electricity accounted for only 23% of global total final energy consumption (TFEC) in 2025. This indicates a potential for it to play a much greater role in economic activity and energy services, leveraging increasingly efficient and mature electric end-use technologies.

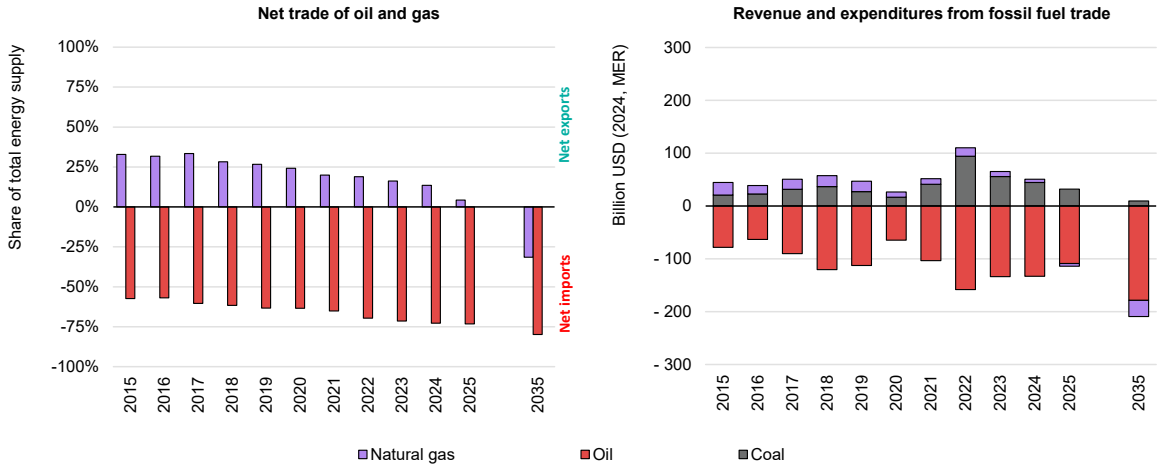
Southeast Asia is one of the world's fastest-growing economic regions. This growth is underpinned by an expanding population, industrialisation, urbanisation and rising incomes. Since 2015, the region's total energy demand has risen by 40%, on the back of a more than 30% rise in TFEC. At the same time, electricity demand has increased by more than 60%. This rise in energy demand has been met largely by fossil fuels, which have supplied over 70% of the growth. In 2025, coal and oil each accounted for around 30% of the region's total energy supply.

The region has also become increasingly reliant on fuel imports, with crude oil and oil products accounting for much of this dependency. This exposes the region to greater risks from global price shocks and supply disruptions. The Middle East conflict has exacerbated such vulnerabilities. Ahead of that crisis, Southeast Asia sourced around 60% of its crude oil imports and one-third of its natural gas imports from the Middle East. Based on today's policy settings and technology trends in the region, this dependence is likely to increase. By 2035, Southeast Asia – which currently exports small volumes of natural gas – is projected to become a net importer. Imports are expected to meet one-third of natural gas demand, driven largely by liquefied natural gas imports. Imports are also projected to account for around 80% of oil demand by 2035. This growing dependence on fuel imports contributes to challenges for energy security and affordability.

Shifting final energy consumption from fossil fuels towards electricity that is generated domestically and regionally from low-emissions power sources can help meet the region's rising demand needs while reducing dependence on imported fuels, strengthening resilience and reducing emissions.

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Net trade of oil and gas as a share of total energy supply in Southeast Asia (left) and revenues and expenditures from fossil fuel trade (right) in the Stated Energy Policies Scenario, 2015-2035

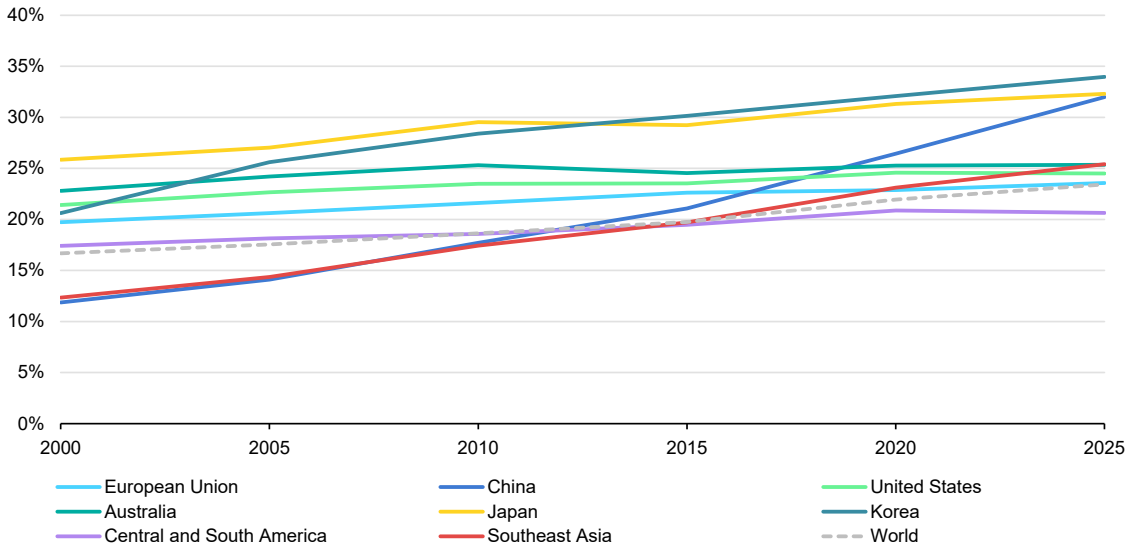


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Notes: MER = market exchange rate. Total energy supply includes international bunkers.

Electrification is already reshaping Southeast Asia's industry, transport and buildings sectors. The regional electrification rate rose from just above 12% in 2000 to around 25% in 2025, higher than the global average. Nevertheless, this trend varies considerably across countries and sectors within the region, reflecting differences in economic structure, technology adoption, electricity access, climate conditions and patterns of energy use.

Electrification rate in selected regions and economies, 2000-2025



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The role of electrification in energy

Electrification refers to the expanding use of electricity to meet end-use energy needs and is measured as electricity consumption as a share of TFEC. Electrification includes both the expansion of uses that already rely on electricity, such as cooling and appliances, and the replacement of fossil fuel-based technologies with electric alternatives, such as electric vehicles, electric cookstoves and electric motors.

Electrification can contribute to energy security and enable greater use of low-emissions electricity, including renewables and nuclear power. Electrification also enhances energy efficiency. Electric devices generally deliver more useful energy per unit of energy input compared with fuel-based alternatives. For example, electric vehicles have an efficiency of around 85% to 90%, compared to around 25% to 35% for vehicles with internal combustion engines (ICE). Such efficiency gains can reduce operating costs, though overall economic benefits will depend on capital costs, the enabling infrastructure and the relative prices of electricity and fuels.

Reliable and affordable electricity is important for economic development. High-value economic sectors, including advanced manufacturing, digital services and artificial intelligence (AI) depend on secure and reliable electricity supply. Electrification is therefore key to enabling more effective planning and operations around end-use consumption, energy savings and flexibility, with economic, security and sustainability benefits.

Chapter 1 of this report examines the current role of electrification in Southeast Asia. Chapter 2 analyses opportunities and drivers to expand electrification across end-use sectors under both the IEA Stated Policies Scenario (STEPS) and the High Electrification Scenario (HES). Chapter 3 assesses the implications of faster electrification and identifies enabling conditions and policy actions to accelerate electrification across the region in a secure and cost-effective manner.

Scenarios used in this report

The analysis in this report is based on two IEA scenarios. These scenarios project future energy systems based on sets of conditions; they do not represent forecasts. The two scenarios make different assumptions about policy settings and technology deployment but share the same pathways for population and economic growth.

- The **Stated Policies Scenario (STEPS)** reflects the prevailing direction of travel of today's policies and technology trends.
- The **High Electrification Scenario (HES)** sets out a pathway to a global electrification rate of 35% by 2035. This level of electrification for end uses, when

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combined with other actions, such as those to promote efficiency, is aligned with the IEA's Net Zero Emissions by 2050 Scenario, which limits warming to 1.5°C by 2100. Like all IEA scenarios, the HES reflects a detailed assessment of the potential for electrification of end uses by sector and region through technologies such as electric vehicles and heat pumps. It also sees strong growth in already electrified end uses such as air conditioning, data centres, appliances and advanced manufacturing. Driven by rising incomes, growth in these uses is particularly strong in emerging market and developing economies, where many consumers are set to make their first purchases of appliances and equipment. However, the HES does not make any assumptions about how the level of electricity demand that it foresees is met.

The energy definitions used in this report

Electrification rate is defined as final electricity consumption divided by TFEC, excluding non-energy use. Electricity consumption includes that for hydrogen production when the hydrogen is used on-site and excludes electricity for district heat or offsite hydrogen use.

Energy services are personal or societal gain from the use of energy. Includes, inter alia, heating, cooling, lighting, entertainment, mobility, nourishment, hygiene and education.

Total final energy consumption (TFEC) involves the use of energy products by end users to produce energy services. It incorporates total final consumption by end-use sectors, but excludes non-energy uses.

Useful energy refers to the energy available for end users to satisfy their need for energy services such as heating, cooling, lighting and mobility.

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Chapter 1. Electrification in Southeast Asia today

Electrification is an increasingly important pillar of energy security[1] in Southeast Asia. Since 2015, annual electricity demand growth has averaged 6%, one of the fastest growth rates globally. Electricity is the region's second most consumed energy product after oil. This chapter assesses the current progress of electrification in Southeast Asia by taking stock of trends in electricity consumption in each sector, electricity supply, policy landscapes and investment activity.

Electrification trends and sectoral progress

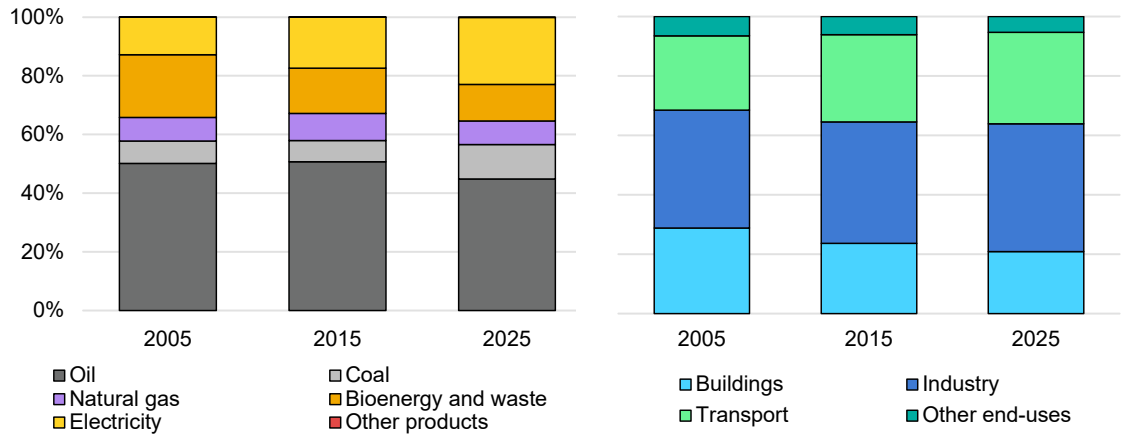
There is a diverse and growing role for electricity in the region's rapidly expanding energy consumption

Between 2015 and 2025, Southeast Asia's total final consumption (TFC) in end-use sectors increased by over 30%, led by industry and transport. Final consumption in the transport sector rose by almost 40%, driven by rising road freight activity and increasing car ownership. Most of this increase was supplied from oil. Final consumption in buildings increased more gradually, shaped by rising incomes, urbanisation, population growth, expanding electricity access and rising appliance ownership. Industry emerged as the main driver of final consumption growth. In 2025, it accounted for around 45% of TFC, led by non-energy-intensive industries and non-ferrous metals production. Electricity and coal increased their shares of final consumption over the period.

[1] This report evaluates energy security across several dimensions, including fuel import dependence, affordability, exposure to supply disruptions and the resilience of energy systems.

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Share of final consumption by product (left) and end-use sector (right) in Southeast Asia, 2005, 2015 and 2025



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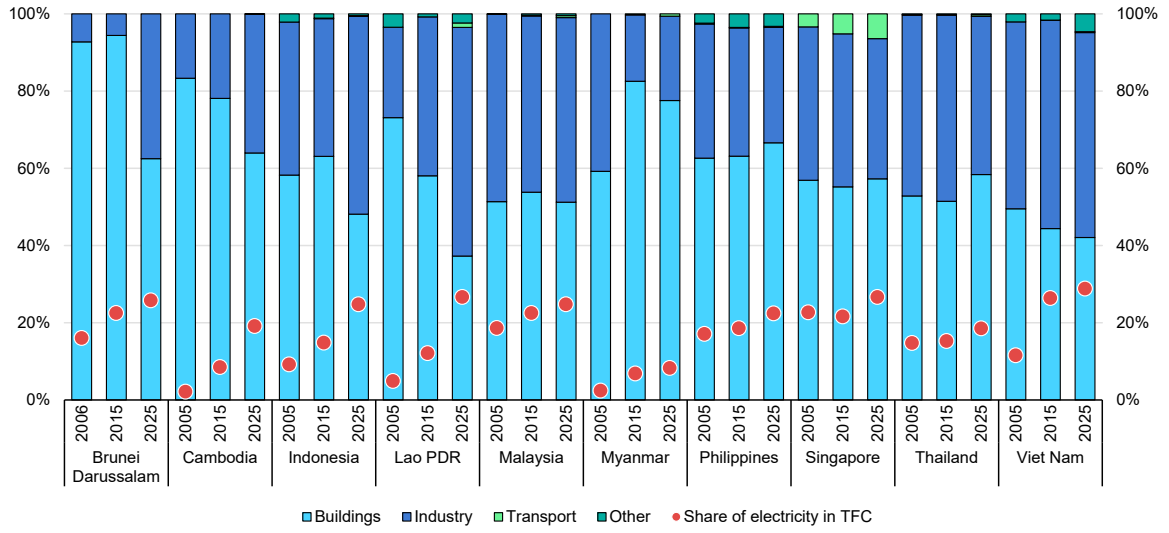
Notes: Electricity is reported irrespective of the source used to generate it. "Other products" include solar and geothermal energy used directly in end-use sectors. "Buildings" comprises residential and commercial/public services. "Other end uses" comprises agriculture and other non-energy use. Both charts exclude Timor-Leste due to data availability.

Electrification is growing across the region but at different speeds across sectors and countries, reflecting differences in development levels, economic structures, energy systems, climate and policy. Total regional electricity demand already exceeded 1 300 terawatt-hours (TWh) in 2025 while electricity as a share of total final energy consumption (TFEC) stood at around 25%. In most countries in the region, the share of electricity in TFC also accounted for around 25%.[2] Viet Nam achieved the highest share in Southeast Asia at nearly 30%, followed by Lao People's Democratic Republic (Lao PDR), Singapore and Brunei Darussalam, each of which had at least 25%.

[2] Country electrification trends here and in the figure on electricity shares by country are exceptionally presented as a share of TFC due to data availability constraints around non-energy use at country level. For context, the regional electrification rate in 2025 based on TFC is 2-3 percentage points lower than that for TFEC.

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Electricity consumption shares by end-use sector and by country, 2005, 2015 and 2025



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Notes: Lao PDR = Lao People's Democratic Republic; TFC = total final consumption. Brunei Darussalam shows 2006 instead of 2005 due to data availability. No data available for Timor-Leste. "Buildings" comprises the residential and services sub-sectors. "Other" includes agriculture and other non-energy use.

Source: Updated from IEA (2026), Southeast Asia Energy Outlook 2026.

Electrification is progressing at different rates across end-use sectors

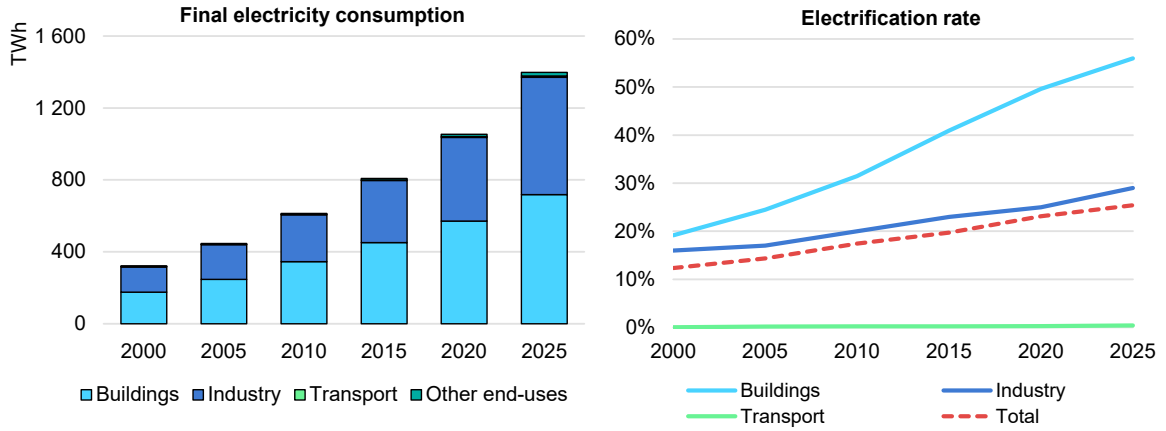
The electrification rate depends on the extent to which individual sectors use electricity and the relative share of those sectors in overall energy consumption. While overall regional energy consumption is increasingly dominated by industry and transport, Southeast Asia's electricity use today tends to be concentrated in buildings, which accounted for around 51% of the region's electricity consumption in 2025, followed by industry at 47%, while transport was the least electrified sector at less than 1%.

Buildings is the most electrified end-use sector. The electrification rate in the buildings sector rose from around 40% in 2015 to 56% in 2025, driven by expanding electricity access, urbanisation, rising cooling demand, digitalisation and data centres. Southeast Asia's electricity access rate increased from 86% in 2015 to 98% in 2025. Electricity consumption for space cooling doubled between 2015 and 2025 to account for nearly 13% of total electricity consumption. Appliance ownership has expanded rapidly, increasing residential electricity consumption from appliances by 62% from 2015 to 2025. Greater access to clean cooking has also contributed to rising electricity consumption from cookstoves. This has reduced household reliance on traditional biomass, though has also involved switching to other modern fuels. Digitalisation and growing needs for computing power to support AI development are creating an additional source of electricity demand growth in buildings. Although such demand remains modest, it

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is rising quickly. While most data centres in the region are presently concentrated in Malaysia and Singapore, they are also expanding in Indonesia and Thailand.

Final electricity consumption (left) and electrification rates (right) by end-use sector in Southeast Asia, 2005, 2015 and 2025



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Notes: TWh = terawatt-hours. "Other end uses" comprises agriculture and forestry, fishing and non-specified end uses. Sectoral rates represent electricity consumption in each sector as a share of that sector's final energy consumption. The industry electrification rate excludes non-energy use. "Buildings" comprises residential and commercial/public services.

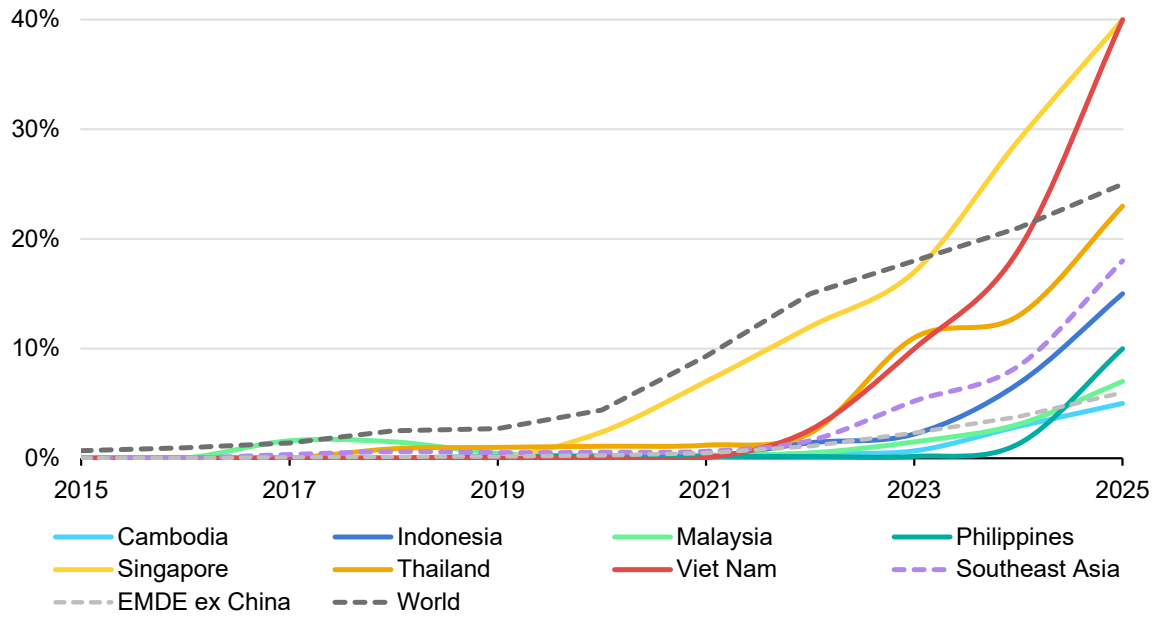
In industry, the share of regional's electricity consumption rose to around 47% in 2025, due to rapidly growing manufacturing over the past decade. In Viet Nam and Indonesia, industry's share of electricity consumption now exceeds 50%. The electrification rate in industry increased from around 23% in 2015 to 29% in 2025, driven by non-energy-intensive industries such as food processing and textiles. Progress in electrification varies across industrial sectors. Energy-intensive industries continue to rely heavily on fuels for high-temperature heat, while non-energy-intensive industries have generally increased their electrification rates, albeit with substantial differences in the share of electricity across sub-sectors. While electrification progress in the chemicals sector stagnated over the past five years, aluminium, machinery and mining achieved modest gains, with electrification rates in those sectors rising by 2 to 3 percentage points.

Transport remains the least electrified end-use sector in Southeast Asia, with electricity accounting for less than 0.5% of the sector's energy consumption in 2025. Transport's electricity consumption has more than doubled since 2015, though still stood at only around 8 TWh. Despite starting from a low base, electric road mobility has gained momentum in recent years, led by electric vehicles (EVs). In 2025, electric car sales in the region more than doubled year-on-year to account for nearly 20% of all new car sales. While the region has the world's largest two- and three-wheeler fleet, electric models accounted for only 6% of new sales in 2025, highlighting significant opportunities, given these vehicles' cost competitiveness and importance to regional mobility. Regional uptake was less

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advanced for buses, vans and trucks, with electric models representing less than 1% of new sales in each of these segments.

Share of electric cars in total car sales in selected countries in Southeast Asia, 2015-2025



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Notes: EMDE = emerging market and developing economies. Electric cars include battery electric and plug-in hybrid electric passenger light-duty vehicles, including sport utility vehicles and light trucks.
Source: IEA (2026), Global EV Outlook 2026.

Amid the current energy crisis and elevated global oil prices, Southeast Asia's electric car sales were 75% higher in the first half of 2026 than during the same period of 2025. The electric share of regional car sales rose around 10 percentage points to reach nearly 30% in the first half of 2026, a level comparable to that of Europe. In 2025, electric cars accounted for an even higher share (around 40%) of sales in both Singapore and Viet Nam. While electricity already meets around one-third of energy consumption in the rail segment, aviation and shipping continue to rely on energy-dense fuels that today's electric technologies are not able to readily replace.

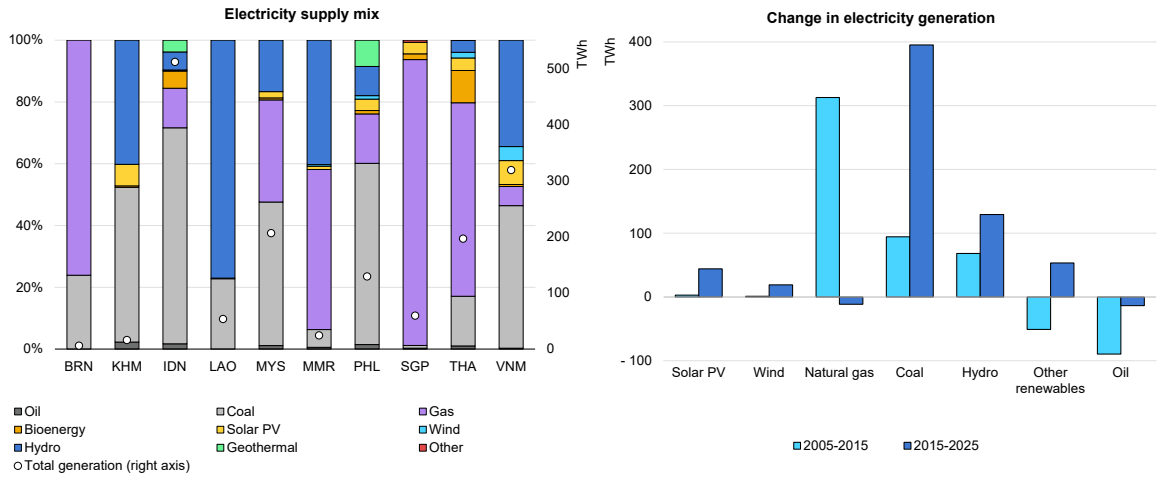
Overall, these trends highlight the different starting points and drivers of electrification across sectors and provide a baseline for assessing opportunities in Chapter 2.

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While new power demand has been met mostly by coal, renewables increasingly supply electrification needs

Despite strong growth in renewable energy over the past decade, electricity demand growth has been met mostly by coal, which raised its share of the regional electricity generation mix to nearly 50%. Coal accounted for around 70% of generation in Indonesia, almost 60% in the Philippines and nearly 50% in Viet Nam in 2025. Gas-fired generation also plays an important role in several countries, particularly Brunei Darussalam, Singapore and Thailand. However, its overall level has slightly decreased over the past decade, while gas import supplies have come under pressure during the current energy crisis.

Electricity supply mix and total generation by country, 2025 (left) and change in Southeast Asia electricity generation by fuel, 2005-2015 and 2015-2025 (right)



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Notes: "Other" includes manufacturing gases, chemical heat, industrial waste, non-renewable municipal waste and any other non-specified. "Other renewables" include geothermal and bioenergy. Three-letter country codes: BRN = Brunei Darussalam; KHM = Cambodia; IDN = Indonesia; LAO = Lao PDR; MYS = Malaysia; MMR = Myanmar; PHL = Philippines; SGP = Singapore; THA = Thailand; VNM = Viet Nam.

Growth in renewable power accounted for around 40% of new electricity generation over the past decade, as its share in the power generation mix rose from 17% to over 25% between 2015 and 2025. Hydropower is currently the largest regional renewable source, dominating the generation mix in Lao PDR while contributing substantially to generation in Cambodia, Myanmar and Viet Nam. There has been a rapid increase in wind and solar PV generation, which together rose from 4 TWh in 2015 to more than 65 TWh in 2025, bringing their combined share to just over 4% of regional generation. While the share of renewables is growing, these sources have not yet begun to displace existing fossil fuel-based generation at scale.

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Policy support and investment in electrification

Countries have introduced policies to support electrification

Several countries in Southeast Asia have introduced policies to support electrification and fuel switching as part of broader efforts to strengthen energy security, improve efficiency, support industrial development and advance clean energy objectives. These measures include financial incentives and investment support, as well as regulatory and performance-based approaches.

In transport, countries have adopted policy support and regulations that include incentives for EV adoption and domestic manufacturing in Thailand and Viet Nam, deployment of charging infrastructure in Singapore, and electrification of government vehicles and public transport in Indonesia. Indonesia, Malaysia and Singapore have introduced a range of measures to support the uptake of efficient electric technologies in buildings and industry, including investments in energy-efficient equipment and the promotion of electric cooking. Most countries have set minimum energy performance standards (MEPS) and labelling programmes for appliances, air conditioners (ACs) and motors. Several countries are preparing decarbonisation roadmaps for industry where electrification is one of the key measures for reducing industrial emissions. Chapter 3 provides more detailed analysis of policy priorities for accelerating electrification across the region.

Electricity incentives and regulatory policy examples in selected countries in Southeast Asia

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Incentives and investments						
Buildings	● ○	●	●	●	●	●
Industry				●		
Transport	●	●	●	●	●	●
Performance-based and prescriptive regulations						
Buildings	●	●	●	●	●	●
Industry	●			●	●	●
Transport	○		●	●		

Policy in place: ● In force ○ Announced

Notes: Policies decided before 2015 are excluded. “Incentives and investments” covers public spending and investment programmes (energy access, rail and charging infrastructure, transport and buildings), subsidies, fee exemptions and trade measures. “Performance-based and prescriptive regulations” covers mandatory rules: appliance and motor MEPS, building energy codes, sales bans and fleet mandates.

Sources: IEA (2026), Global Energy Policies Hub (accessed 9 October 2026). NewClimate Institute (2025), Climate Policy Database (accessed 20 September 2026).

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The effectiveness of sectoral policies for electrification is influenced by the presence of inefficient subsidies for fuel and electricity, as well as by underlying energy tariff structures and price signals. For example, in most countries, electricity tariffs for industrial and commercial consumers are lower than those for households, affecting the economics of electrification across end-use sectors. Electrification measures also depend on complementary investments in enabling infrastructure, including electricity distribution networks, charging infrastructure and digital technologies. Such factors are discussed further in the following chapters.

The recent Middle East crisis has exposed the region's structural vulnerabilities, including its dependence on imported fossil fuels, its limited supplier diversification and its significant reliance on trade routes through the Strait of Hormuz. Governments across Southeast Asia have introduced a range of policies in response to the crisis. While the focus has been on demand-side and short-term measures to curb consumption and ease affordability pressures on consumers, long-term structural measures have also been introduced in many countries. For example, the 2026 crisis has spurred further interest in and implementation of electrification policies in many of the region's countries. This policy response may have the further benefit of accelerating the rollout of electrification-related technologies and markets.

Energy crisis policy responses: electrification examples in Southeast Asia

Country	Policy response example
Cambodia	Reducing import tariffs on electric vehicles, electric stoves, appliances and renewables
Indonesia	Accelerating conversion of gasoline-powered motorcycles to electricity
Lao PDR	Lowering fees and taxes on EVs; suspending imports of vehicles powered by fossil fuels
Myanmar	Introducing ICE vehicle to EV trade-in scheme
Thailand	Providing low-interest loans for EVs
Viet Nam	Reducing special consumption tax on EVs

Note: EVs = electric vehicles; ICE = internal combustion engine.
Sources: IEA (2026), Energy Crisis Policy Response Tracker (accessed 16 October 2026); IEA (2026), Electrification Special Report.

Electrification accounts for a growing share of energy investment

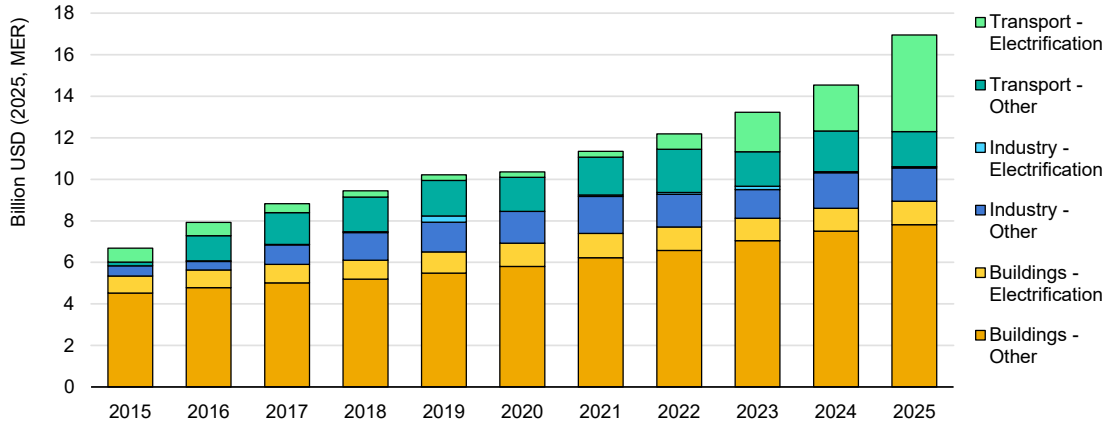
Investment in electrification in Southeast Asia was USD 5.8 billion in 2025, or around 34% of regional energy end-use investment, up from 22% in 2015[3]. This

[3] All tracked energy end-use investment – including energy efficiency, electrification and direct use of renewable energy – is considered to be clean energy. The IEA World Energy Investment guide to tracking energy investment provides further detail.

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growth was driven by transport electrification, which increased from just over 10% of total investment in 2015 to around 27% in 2025. Transport electrification investment has been driven by the increasing cost competitiveness of EVs compared to Internal combustion engine (ICE) vehicles. Investment in buildings electrification grew from USD 0.8 billion to USD 1.1 billion over the same period, while industrial electrification investment mostly remained flat. However, the data on capital expenditures for electrification presented here understate actual spending on electrified equipment. This is because the IEA tracks investment in some end-use technologies, such as more efficient ACs for cooling, as incremental efficiency spending to acquire equipment that consumes less energy to provide the service.

Clean energy investment in end-use sectors in Southeast Asia, 2015-2025



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Notes: MER = market exchange rate. In each end-use sector; "Other" corresponds to investment in energy efficiency or direct use of renewable energy, as per the IEA World Energy Investment guide to tracking energy investment.
Source: IEA (2026), World Energy Investment 2026.

The financing of electrification is closely tied to household and corporate spending decisions. This points to the importance of consumer-level factors, including disposable income levels, technology prices, preferences and perceptions. Investment decisions are influenced by the relative prices of electricity and fuels, which affect the economic case for electrification (as discussed in Chapter 2). They are also shaped by overall policy support, including direct purchase incentives, financial assistance and information programmes for raising awareness (as discussed in Chapter 3).

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Chapter 2. Outlook and opportunities to accelerate electrification

Southeast Asia has significant potential to accelerate electrification over the next decade. This chapter first presents the overall potential and outlook for electrification of end uses in the region through two scenarios: the Stated Policies Scenario (STEPS) and the High Electrification Scenario (HES)[4]. It then assesses the sectoral outlook and opportunities for electrification by end-use sectors along with their associated drivers and challenges. Finally, the chapter looks at key drivers that shape the economic case for adopting electrification. The discussion provides a basis for recommending priority policy actions to accelerate electrification in the next chapter.

Electrification potential, outlook and impacts

Southeast Asia has high electrification potential

Southeast Asia has significant economic potential to accelerate electrification across transport, buildings and industry. If today's cost-competitive electrification potential were fully realised, the region's electrification rate would reach 37%, compared to 25% today. This potential is based on 2025 technology costs, energy prices and financing conditions. Realising this potential depends on dynamic and market-specific factors, such as energy prices, taxes and subsidies, electric technology costs, and the cost and availability of finance for investments. Continued declines in technology costs will increase the economic potential. The last section of this chapter discusses such factors further.

Electrification to rise across all end-use sectors by 2035

The regional electrification rate increases from around 25% today to 32% by 2035 under the STEPS. A faster electrification pathway raises it to 41% in the HES, which assumes improved enabling conditions. While the electrification rate in the HES outlook represents an achievable benchmark over the next decade, fully tapping this potential requires addressing technical challenges, enhancing

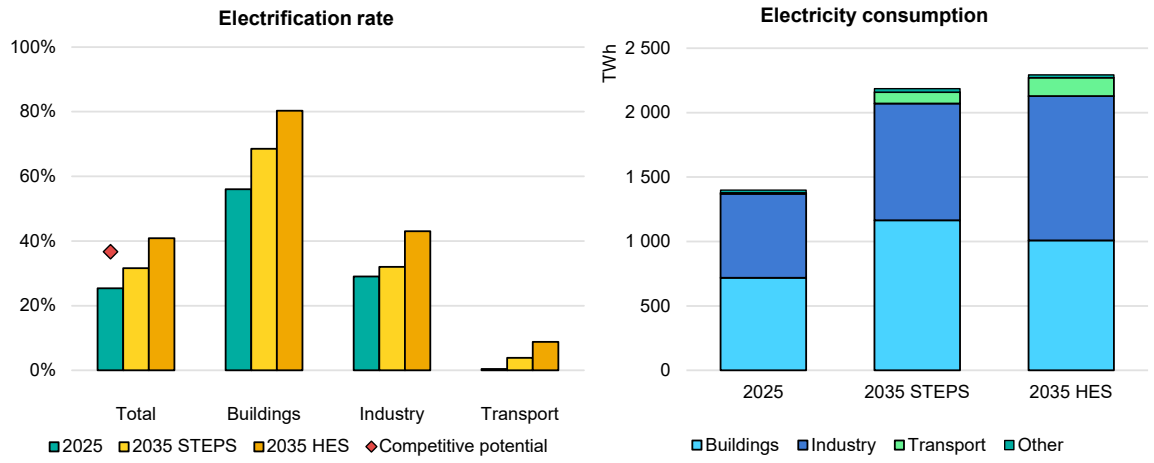
[4] The increasing electrification rate across IEA scenarios is the result of three evolving trends: higher activity in electricity-only end uses, the electrification of multifuel end uses and energy efficiency. Details are provided in the Annex.

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the economic case and putting in place supportive policies, as discussed in this chapter and in Chapter 3.

Electrification rates rise across all end-use sectors in both scenarios, but the scale varies by sector. Buildings remain the most electrified sector. The share of electricity in their total final energy consumption (TFEC) rises from 56% in 2025 to 69% in the STEPS and 80% in the HES by 2035. This is driven in large part by growth in all-electric end uses, such as appliances, but also some fuel switching. The rise is more gradual in industry, where electricity's share increases from 29% in 2025 to 32% in the STEPS and 43% in the HES by 2035. This is due in part to persistent requirements for high-temperature process heat, which is difficult to electrify. Transport remains the least electrified sector but is the fastest-growing, with the share of electricity rising from less than 0.5% in 2025 to around 4% in the STEPS and close to 9% in the HES by 2035. This growth is led by electric cars and two- and three-wheelers. These trends reinforce electricity's role as an increasingly important provider of energy services across the economy.

Electrification rate (left) and electricity consumption (right) by sector in the Stated Policies Scenario and the High Electrification Scenario, 2025 and 2035



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Notes: The competitive potential shows the electrification rate if all competitively electrifiable demand today is electrified, accounting for efficiency gains and keeping all else equal.
Source: IEA (2026), Electrification Special Report.

Regional electricity consumption rises by more than 55% (790 TWh) by 2035 under the STEPS, with buildings accounting for close to 60% of the expansion and industry around one-third. In the HES, electricity consumption grows by nearly 65% or 900 TWh. Industry accounts for over half of electricity consumption growth in the HES, driven by faster uptake of fuel switching technologies. Buildings comprise only one-third of electricity consumption growth in the HES, due to faster uptake of more efficient equipment for already electrified end uses. This helps to

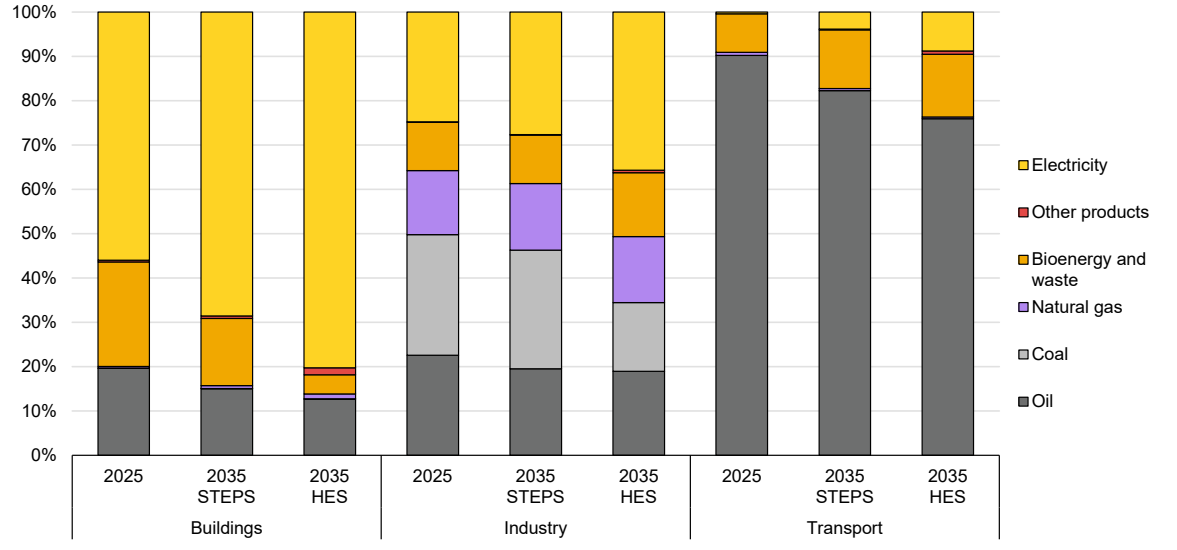
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counteract electricity demand growth under this scenario compared with the STEPS. Though smaller on an absolute basis, transport electricity demand grows rapidly in both scenarios by 2035, reaching eleven times the current level under the STEPS and eighteen times that level under the HES.

Faster electrification reduces reliance on fossil fuels and lowers emissions

A key benefit of faster electrification is improved energy efficiency from electric technologies. This helps moderate growth in energy consumption while reducing the region's reliance on fossil fuels. Under the STEPS, end-use consumption of fossil fuels increases by around 14% between 2025 and 2035 as demand for oil, natural gas and coal for direct fuel combustion continue to grow. However, consumption of fossil fuels under the HES falls by almost 20% from 2025 levels, with the largest reductions in buildings at 32% and transport at 28%, compared to only around 9% in industry.

Share of total final consumption by end-use sector and product in the Stated Policies Scenario and the High Electrification Scenario, 2025 and 2035



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Notes: For industry, the consumption is exceptionally presented as a share of toral final consumption due to data availability constraints around non-energy use per fuel at the end-use sector level. For buildings and transport, the consumption is expressed as a share of TFEC. "Other products" includes hydrogen, solar thermal, district heat and geothermal.

Reduced consumption of fossil fuels under the HES has the key benefit of lowering the region's dependence on fuel imports. While Southeast Asia remains a net importer of oil and natural gas in both scenarios, end-use electrification in the HES avoids around one-third of the oil and gas imports that occur in the STEPS by 2035. Faster electrification provides an opportunity to reduce exposure to external

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supply disruptions and fuel-price risks, particularly when electricity demand is met domestically and regionally by low-emissions resources.

Electrification combined with energy efficiency and increased direct use of low-emission fuels also supports emissions reduction objectives. Under the STEPS, direct CO_2 emissions from total final consumption rise by around 15% between 2025 and 2035, from just above 1.0 Gt CO_2 to nearly 1.2 Gt CO_2. In the HES, they instead fall by nearly 25% to around 0.8 Gt CO_2, with industry remaining the largest-emitting sector. The decline of direct CO_2 emissions in the HES stems from the efficiency and fuel switching impacts of electrification, complemented by other measures such as the deployment of biofuels, hydrogen and hydrogen-based fuels, and additional efficiency improvements. While the emissions reduction in end uses does not include potential changes to electricity supply, an accompanying shift to cleaner power sources would further reduce overall energy-related emissions and fuel import dependence. Such implications are discussed further in Chapter 3.

Sectoral outlooks and opportunities

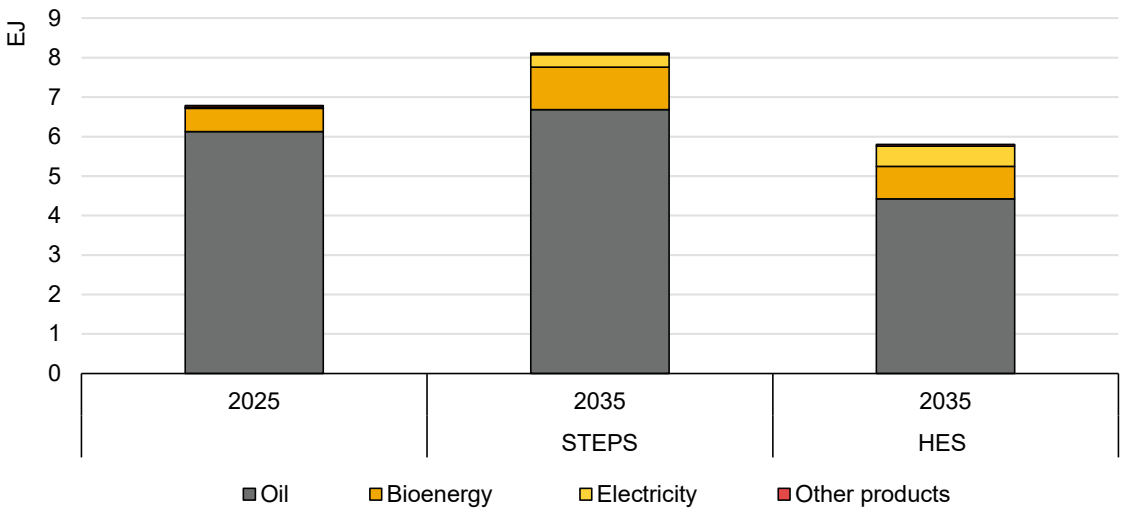
Transport electrification

Transport presents an opportunity for rapid electrification through fuel switching, especially in road transport, albeit from a low base. Transport energy consumption rises by 20% in the STEPS, from around 7 EJ in 2025 to over 8 EJ by 2035. However, it falls by around 14% in the HES to less than 6 EJ, despite continued expansion of mobility services. Road transport continues to dominate transport energy consumption over the next decade. Oil remains the main energy source in transport, accounting for more than 80% of energy consumption in the STEPS by 2035, compared with 90% today. Its share falls to just over 75% in the HES.

Electricity's share of transport energy consumption rises from less than 0.5% in 2025 to around 4% in the STEPS and close to 9% in the HES by 2035. The accelerated uptake of electric vehicles (EVs) in the HES reduces overall transport energy consumption due to the higher efficiency of electric drivetrains over combustion engines.

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Transport energy consumption by product in the Stated Policies Scenario and the High Electrification Scenario, 2025 and 2035



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Notes: "Transport" includes energy used for road and rail transport, domestic navigation including domestic maritime and inland-waterway transport, domestic aviation and pipeline transport. International aviation and marine bunkers are excluded. "Other products" includes natural gas and hydrogen.
Source: IEA (2026), Global EV Outlook 2026.

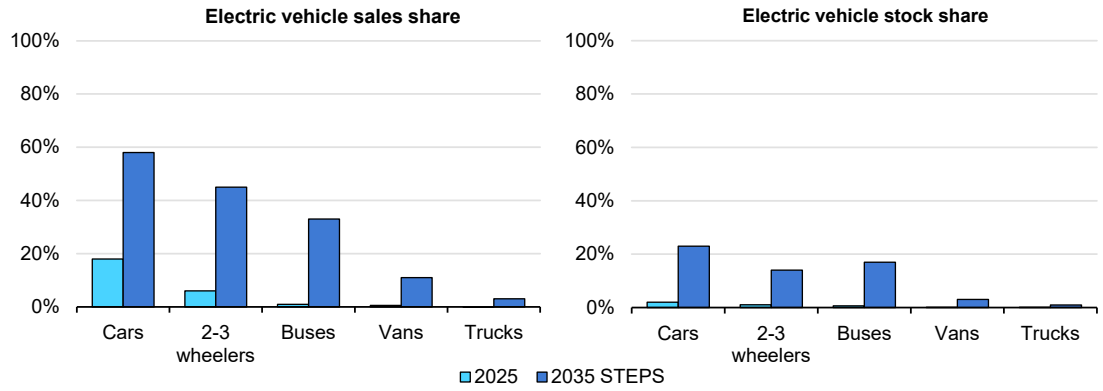
Electrification of road transport

Regional electric vehicle uptake accelerates across all road transport segments in the STEPS by 2035. On the back of improving economics, sales of electric cars increase from nearly 20% of new sales in 2025 to 58% by 2035. In some markets, such as Thailand and Viet Nam, EV purchase prices are currently already on par with those of conventional vehicles. Electric two- and three-wheelers, which accounted for around 6% of sales in 2025, rise to 45% of sales in 2035, reflecting improving payback periods (3 to 5 years), as well as more prevalent charging stations, battery swapping and home charging. Still, limits on the availability of models and financing, as well as concerns over reliability and resale value, continue to constrain their uptake.

As a result of these trends, the electrified share of vehicle fleet stocks in the STEPS rises from 2% in 2025 to over 20% for passenger light-duty vehicles in 2035, and from around 1% to nearly 15% for two- and three-wheelers. Faster improvements in affordability, model availability, access to finance and charging infrastructure would accelerate uptake, with fleet stock shares reaching nearly 30% and 35% by 2035 in the HES.

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Electric vehicle sales share (left) and electric vehicle fleet stock share (right) in the Stated Policies Scenario, 2025 and 2035



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Notes: "Sales share" refers to electric vehicles as a share of new vehicle sales within each vehicle segment. "Cars" includes passenger light-duty vehicles, including sport utility vehicles and light trucks. Electric vehicle stock shares are calculated as electric vehicle stock divided by total vehicle stock.

Source: IEA (2026), Global EV Outlook 2026.

The share of electric buses in total bus sales rises from less than 1% in 2025 to 33% by 2035 in the STEPS, supported by city bus electrification programmes, such as in Viet Nam, and the relative ease of electrifying predictable urban routes. Electric vans and trucks, which account for just 11% and 3% of sales, play a smaller role, with their relatively large batteries and more intensive use requiring more charging and grid upgrades. These sales take time to turn over fleets, which currently have large existing stocks of fuel-based vehicles. Faster electrification of buses, vans and trucks will depend on more targeted financial support and infrastructure planning to address greater upfront-cost and charging constraints.

Electrification of other transport segments

Rail was the most electrified transport segment in Southeast Asia in 2025, with electricity comprising around one-third of final energy consumption. The rail electrification rate is set to grow to nearly half by 2035 under the STEPS, supported by high-speed rail projects in Thailand and Viet Nam. By contrast, the use of electricity in the aviation segment is projected to remain negligible through 2035, given the early stage of electric aviation technology readiness.

Regional maritime electrification expands but remains modest in the STEPS, at under 1% by 2035. Opportunities are concentrated in harbour craft, ferries and domestic or short-sea services that operate on short, predictable routes. Accelerating electrification would require upgrades to vessels and charging systems, adequate grid connections, and common safety and technical standards. Nevertheless, early developments are providing a foundation for wider electrification. For example, Thailand has adopted electric ferries along Bangkok's Chao Phraya River. In Singapore, all new harbour craft operating in port waters

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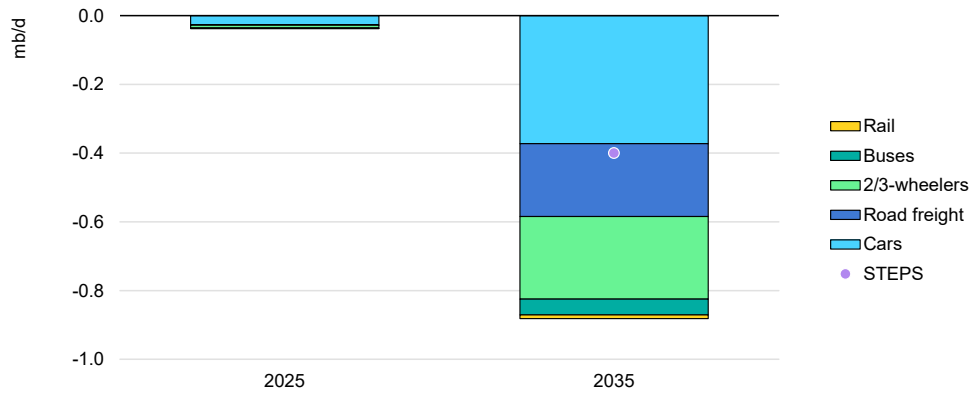
must be fully electric, capable of using 100% biofuel or compatible with net zero fuels from 2030. Singapore is also developing a broader framework for vessel electrification, including technical standards for electric charging infrastructure. Progress in Singapore also extends to ports. By the 2040s, container handling operations for Tuas Port are set to be powered by electricity, supplemented by low- or zero-carbon energy sources. Scaling these early applications across domestic maritime transport, alongside the electrification of port equipment and landside operations, could unlock further progress.

Impacts of transport electrification

Electrification of the transport sector reduces regional oil demand. Compared with an oil demand trajectory without new electrification, the increased role of electricity in transport in the STEPS displaces over 0.4 million barrels per day (mb/d) of oil demand in Southeast Asia by 2035. In the HES, oil demand displacement climbs to almost 0.9 mb/d, which is equivalent to 31% of road-transport oil demand without electrification. Electric cars make the largest contribution to this reduction, accounting for over 40% of oil savings in the HES. Two- and three-wheelers and road freight electrification also play an increasingly important role, together delivering more than half of the region's oil savings by 2035 in the HES, with electrification of buses and rail accounting for the remaining savings.

Combining electrification with increased direct use of renewable energy can further displace oil consumption. In the STEPS, increased electrification from EVs and greater uptake of biofuels for transport together displace around 1 mb/d of regional oil demand in 2035, saving USD 25 billion in oil imports and reducing exposure to oil price risks.

Reduced oil demand from transport electrification by mode in the Stated Policies Scenario and the High Electrification Scenario, 2025 and 2035



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Notes: Rail refers to non-urban rail only. Oil displacement is estimated based on the fuel consumption of conventional vehicles, required to travel the same distance as the EV fleet by assuming that the total distance travelled annually by EVs, would otherwise have been travelled by conventional vehicles.
Source: IEA (2026), Global EV Outlook 2026.

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Viet Nam's comprehensive approach to accelerating electric mobility

Viet Nam has emerged as Southeast Asia's largest electric car market. Annual sales more than doubled between 2024 and 2025 to reach nearly 180 000, or around 40% of total car sales. Supportive policies have underpinned growth. For example, first-time registration fee waivers for battery electric cars (in place since 2022) and reduced excise tax rates on EVs have both been extended through 2030. The excise tax extension in particular assists buyers in the face of constrained fossil fuel supplies and price fluctuations.

Policy ambitions extend beyond passenger cars, with national targets calling for 50% of urban vehicles and all urban buses and taxis to use electricity or green energy by 2030. The government is also supporting the expansion of EV charging infrastructure through new standards and planning reforms.

Domestic manufacturing has been a key driver. VinFast, the country's largest EV manufacturer, ceased production of ICE cars and shifted fully towards EV production in 2022, rapidly scaling capacity and models to capture more than 99% of domestic electric car sales in 2025. GSM, VinFast's electric taxi and leasing arm (established in 2023), and V-Green, its charging infrastructure arm (spun off in 2024), helped create early demand and expand charging access.

Progress is also evident across other segments. Viet Nam was Southeast Asia's largest market for electric two-wheelers in 2025, with sales more than doubling from 2024 to around 740 000 vehicles. In early 2026, electric buses accounted for around half of Ho Chi Minh City's bus fleet. Low-emission zones in Hanoi (expected from 2026) and planned in Ho Chi Minh City (from 2027) could further accelerate adoption overall. Sustained progress hinges on the timely rollout of EV charging infrastructure.

Buildings electrification

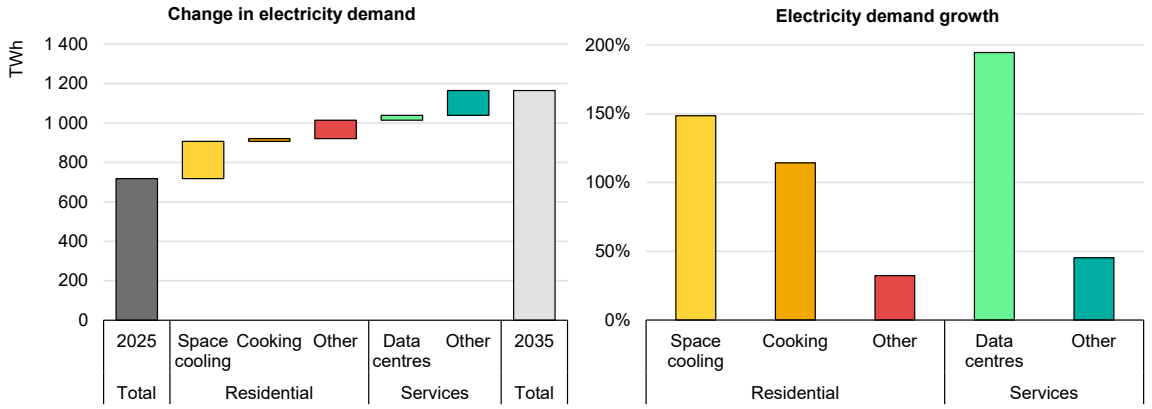
Buildings are already the most electrified end-use sector in Southeast Asia, with electricity providing cooling, lighting, appliances and a growing range of commercial services, including data centres. The opportunities for further electrification in buildings are different from that in industry and transport because much of the growth in electricity consumption in buildings is set to come from end uses that already have been electrified rather than from fuel switching. The main fuel switching opportunities in buildings in Southeast Asia are in cooking and (in some markets) water heating.

Buildings account for the largest increase in electricity consumption to 2035 under the STEPS, growing by 62%. Nearly 90% of this expansion comes from end uses that are already mostly electrified, with residential and service-sector space

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cooling together accounting for 54% of the growth. While electrification can enhance energy security by moderating overall energy needs and reducing reliance on imported fossil fuels, meeting this rising electricity demand increases the importance of efficient equipment, well-designed building envelopes and effective power system management, especially for concentrated and weather-sensitive loads.

Building electricity demand growth by sub-sector in the Stated Policies Scenario, 2025-2035



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Notes: "Other residential" includes residential appliances (refrigeration and cleaning), lighting and water heating. "Other services" include services appliances, space cooling, lighting, water heating, cooking and desalination.

Under the HES, the buildings electrification rate reaches 80% by 2035, compared with 69% in the STEPS, despite lower absolute growth in electricity consumption in the HES. This result stems from faster deployment of efficient electric cooking and other mature electric technologies alongside targeted support to overcome barriers related to upfront costs and infrastructure. In areas where networks are constrained, prioritising efficiency improvements and demand-side flexibility in buildings can support electricity security alongside increased electrification.

Residential electrification

Southeast Asia's hot and humid climate is driving growing cooling needs, while rising incomes and urbanisation are boosting access to a range of household appliances and equipment, including refrigerators, washing machines, fans, televisions and ACs.

In 2024, around 30% of households owned an AC, though ownership rates range from around 80% in Brunei Darussalam and Singapore and nearly 70% in Malaysia to fewer than one in twenty in Myanmar. In the STEPS, AC ownership rises to over 50% of households in the region as a whole by 2035, multiplying

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residential space cooling electricity consumption by nearly 2.5. This projection assumes some tightening of existing MEPS that improve AC efficiency.

Cooking and (to a lesser extent) water heating provide the main fuel switching electrification opportunities in buildings. Residential electricity consumption for cooking more than doubles between 2025 and 2035 under the STEPS, while use of traditional biomass contracts by 17%. However, liquefied petroleum gas (LPG) remains the primary cooking fuel for around three-quarters of Southeast Asia's population.

Electric cooking provides multiple benefits. From an efficiency standpoint, induction or resistance stoves harness 80% to 85% of input energy for cooking, compared with 50% for gas or LPG stoves and 10% for traditional wood stoves. Cooking electrification also reduces exposure to imported LPG and improves indoor air quality. Water heating may also provide a fuel switching opportunity in some markets, depending on existing fuel use and local demand patterns.

Residential electricity consumption for appliances increases by 38% in the STEPS between 2025 and 2035. Since many appliances have few direct non-electric substitutes, the main electrification opportunities are in promoting efficient purchasing decisions.

Enhancing access to electrified cooking in Indonesia

Efforts to expand access to clean cooking in Indonesia are increasingly focused on transitioning to electricity. This follows previous shifts from kerosene and traditional biomass to LPG. Experience so far demonstrates how the electrification of cooking can reduce subsidy and import exposure, enabled by reliable supply and affordable implementation.

An LPG conversion programme operating since 2007 has been able to reach 50 million households and raised clean cooking access from 40% in 2010 to nearly 90% by 2022. However, Indonesia relies on imports for more than three-quarters of its LPG supply. The country now aims to have 19 million induction stove users by 2030, with pilots in Surakarta and Bali testing equipment, user support and power connections.

A new electric cookstove programme is under preparation for a possible 2027 start with the Minister of Energy and Mineral Resources (MEMR) referring to a IDR 600 billion for stove procurement. The initial focus will be on households using subsidised 3-kg LPG low-power stoves in areas that can provide connections of around 900 VA, a reliable electricity supply and sufficient generation capacity.

Scaling the programme will depend on affordability, consumer acceptance and power system readiness. In this light, the MEMR, state-owned utility Perusahaan

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Listrik Negara (PLN) and Universitas Gadjah Mada are studying grid and household connection readiness, stove technologies (including induction and halogen options), the impacts of tariffs and operating costs, cooking habits, procurement, and factors for region and beneficiary selection.

Electrification of the services sector

Appliances continue to account for the largest share of electricity consumption in the services sector, which includes commercial and public service buildings. Similar to the situation in the residential sector, space cooling continues to grow rapidly, and cooking and water heating remain the main opportunities for fuel switching.

Southeast Asia's data centres currently consume more than 13 TWh of electricity, concentrated in Indonesia, Malaysia, Singapore and Thailand, though consumption is expected to nearly triple by 2035 in the STEPS. While electricity demand from data centres is projected to grow the fastest among all buildings sub-sectors, its absolute contribution in percentage terms is expected to remain modest relative to other end-uses, particularly cooling and appliances.

Industry electrification

Industrial process heat accounts for the largest share of industrial energy consumption, at close to 70% in 2025. Low- and medium-temperature heat processes account for around 55% of process heat energy consumption, compared with 40% globally, with the remainder from high-temperature processes. Since low- and medium-temperature processes can be readily electrified with existing technologies, they present significant potential for industrial electrification as economies expand their manufacturing bases.

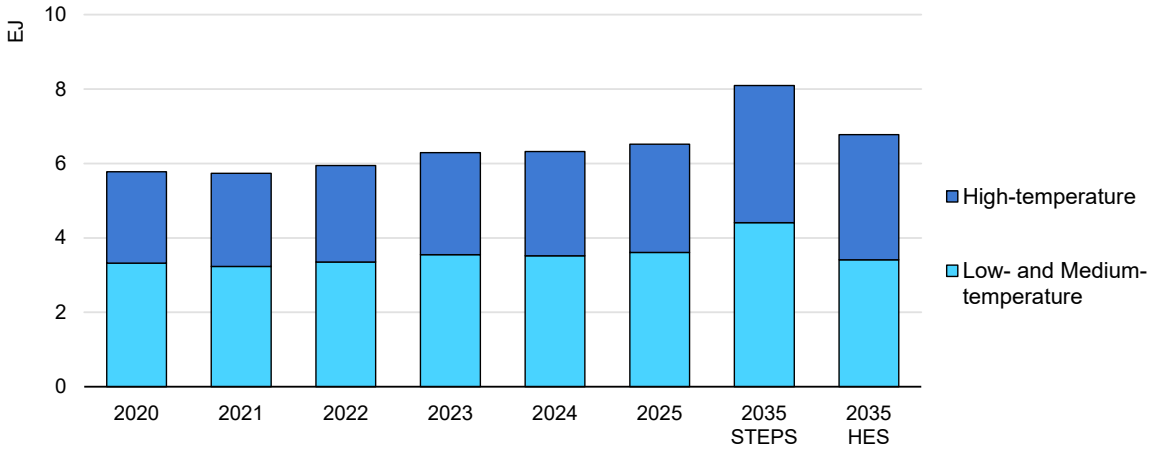
Under the STEPS, industrial heat energy consumption grows by nearly a quarter across all temperature ranges between 2025 and 2035. Its share in industrial energy consumption and the roles of different temperature processes remain relatively steady. By contrast, under the HES, increased electrification of low- and medium-temperature heat and associated efficiency gains help to limit total process heat consumption growth to less than 5%. The share of heat in industrial energy consumption falls to 60% and the role of low- and medium-temperature processes in heat declines to around 50%. High-temperature heat consumption continues to grow in both scenarios, as electrification opportunities remain limited.

In the STEPS, industrial electricity consumption rises by around 40% between 2025 and 2035, led by non-energy-intensive industries such as food processing, machinery and mining. While this increase (around 250 TWh) is smaller than that

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in buildings (around 450 TWh), it slightly exceeds the growth in space cooling, which is the largest-growing energy end-use in buildings under the STEPS. In the HES, faster deployment of electric technologies, particularly for fuel switching, boosts industrial electricity consumption by more than 70%, making the industrial sector the largest driver of absolute electricity demand growth in that scenario.

Final energy consumption of industrial heat in Southeast Asia in the Stated Policies Scenario and the High Electrification Scenario, 2020-2025 and 2035



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Note: Low- and medium-temperature heat refers to heat consumed below 400°C, and high-temperature heat refers to heat consumed above 400°C.

Industrial electrification by sub-sector

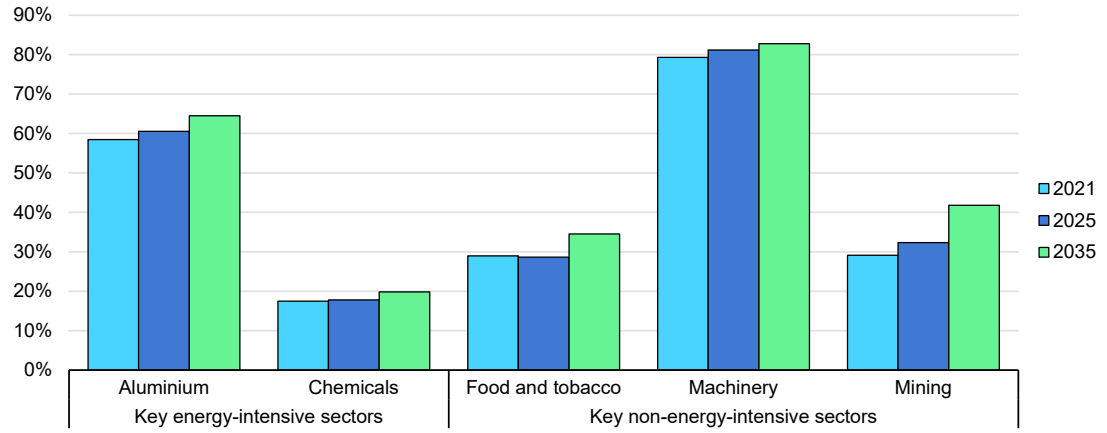
The overall industry electrification rate rises from 29% in 2025 to 32% in 2035 in the STEPS, but progress varies considerably across sub-sectors. Those based on low- and medium-temperature heat processes increasingly adopt electric technologies, whereas sub-sectors requiring high-temperature heat face more limited options. The relatively non-energy-intensive sectors of mining and food and tobacco see the largest increase in electrification rates, at around 9 and 6 percentage points, respectively, between 2025 and 2035. Machinery, already the most electrified industrial sub-sector, sees a rise of nearly 2 percentage points. By comparison, the energy-intensive industries of aluminium and chemicals see electrification rates increase by only around 4 and 2 percentage points.

Differences in requirements for process heat, the availability of commercially mature electric technologies, the age of existing industrial plants, and the prevalence of enabling infrastructure help explain the differences in electrification across sub-sectors in the STEPS. Addressing such factors will be critical to unlocking the accelerated potential of the HES, in which overall industry electrification is projected to rise to 43% by 2035. These factors are further

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discussed in the box on industrial parks, the section on economic and technology drivers and in the industry priority actions in Chapter 3.

Electrification rates in key industrial sub-sectors in the Stated Policies Scenario, 2021, 2025 and 2035



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Enabling industrial electrification in Southeast Asia with industrial parks

Industrial parks can provide the infrastructure and co-ordination needed to aggregate demand and expand opportunities for electrification. They serve as key platforms for manufacturing activity and foreign direct investment in Southeast Asia. More than a thousand industrial parks and special economic zones are scattered across the region, including large-scale clusters such as the Viet Nam-Singapore Industrial Park, Thailand's Eastern Seaboard Industrial Estates, Malaysia's Penang Free Industrial Zone, the First Philippine Industrial Park, and Indonesia's Jababeka Industrial Estate and Batamindo Industrial Park.

Concentration of industrial facilities can leverage economies of scale and shared infrastructure to electrify industrial heat. Common grid connections, renewable electricity supply and thermal storage facilities can be planned, procured and integrated at the park level, lowering costs and enhancing overall system efficiency.

Some parks are installing large-scale rooftop solar PV systems, providing onsite renewable electricity to multiple users and exploring the use of excess generation to charge thermal storage, which can then be used in heating processes. Co-location of industries creates opportunities for cascading heat use, waste heat recovery and thermal networks. Industrial parks can also serve as demonstration hubs for electric technologies and workforce training that catalyse wider rollouts.

Tapping the electrification potential of industrial parks requires careful planning around industrial processes and locational alignment with renewable resources and

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grid development. While parks with grid constraints and firm power needs may rely on captive power with shared energy management – for example in critical minerals processing – approaches that lack co-ordination and clean energy standards risk locking in emissions-intensive options.

Source: IEA (2025), Renewables for Industry: Electrification of low-temperature heat and steam.

Economic and technology drivers for accelerated electrification

Boosting electrification over the next decade and meeting the accelerated goals of the HES will depend on addressing the economic case for electrification – in addition to technical, policy and financing considerations. This section discusses the key drivers, while the next chapter presents priorities for enhancing them.

Enhancing the cost competitiveness of electrification

Southeast Asia's rising energy demand makes cost-effective switching from fuels to electricity increasingly important. Electrification becomes economically attractive when electric technologies provide the same service with lower final energy use and energy bill savings than diesel, LPG, natural gas, coal or biomass. Although electricity often costs more per unit of energy than gas or oil, the higher efficiency of electrified applications may enable energy bill savings, particularly for electric motors, heat pumps, vehicles and cookstoves.[5]

The cost competitiveness of electrification depends on the relative prices of electricity and fuels, which can be reflected through the electricity-to-fuel price ratio.[6] Breakeven ratios for electrification differ by electric technology and market. They depend on capital costs, financing, maintenance, utilisation, equipment lifetime, and relative prices for electricity and fuels.

Data from selected countries in Southeast Asia in 2024 show that residential, commercial and service electricity prices range from 0.7 to 1.6 times the price for gasoline and from 0.8 to 1.9 times the price for automotive diesel. For transport electrification, lower electricity-to-fuel price ratios suggest more economic opportunities for switching from internal combustion engines to EVs. Ratios below

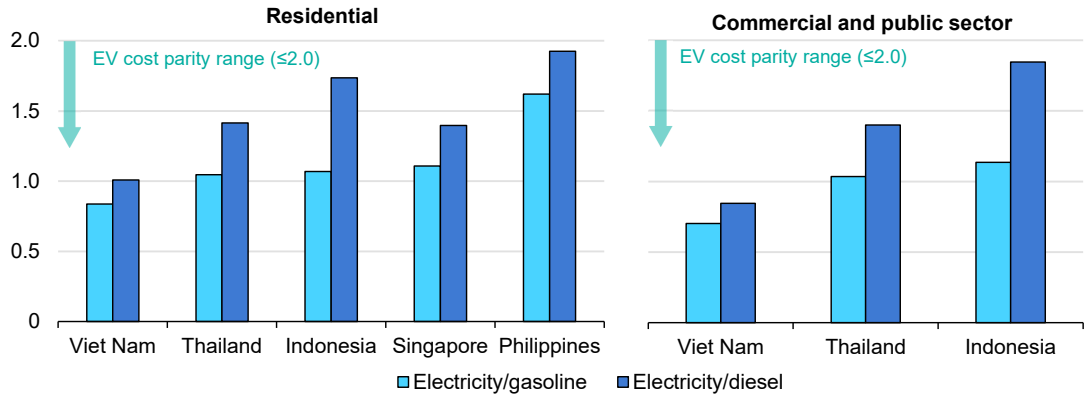
[5] Globally, on average and on a final energy basis, one US dollar purchases around 17 kWh of natural gas or 10 kWh of oil products, compared with about 7 kWh of electricity. Electricity generally costs more due to greater capital infrastructure requirements and losses from combustion-based generation, with typical efficiencies ranging between 30% and 60%.
[6] The electricity-to-fuel price ratio compares end-use electricity prices with alternative fuel prices and provides a simple indicator of electrification competitiveness. In general, lower ratios improve the economic attractiveness of electrification.

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2 align with international observations on cost-parity points for EVs, indicating existing cost-competitive potential across a number of markets in the region.

These indicators provide only a starting point for analysing cost competitiveness. Fuel and electricity price subsidies in countries including Indonesia, Thailand and Viet Nam can distort the economic comparison, while in Singapore both fuel and electricity prices tend to be high in the face of domestic supply constraints and relatively high energy use per capita. Moreover, competitiveness and the actual uptake of electric applications depend on market-specific factors related to pricing, utilisation and adoption barriers. Such barriers include access to finance (especially for lower-income consumers) to cover the upfront costs of electric technologies even when the economic case is attractive. They also include the availability of appropriate energy infrastructure, such as EV charging points and distribution grid upgrades, all of which vary across countries and applications.

Electricity-to-fuel price ratios for oil products in selected countries in Southeast Asia, 2024



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Notes: The electricity-to-fuel price ratio is calculated by dividing the end-use residential as well as commercial and public electricity prices by the price of gasoline or automotive diesel. A lower ratio indicates that electricity is less expensive relative to the corresponding fuel; ratios greater than one can still indicate cost competitiveness given the higher efficiency of electrified technologies.

Source: IEA (2026), End-use Energy Prices (accessed 1 October 2026).

Scaling electric technology and supply chain development

The growing maturity of electric technologies is helping drive electrification across Southeast Asia. At a time of rapidly growing demand for energy services in the region, many key technologies that enable electrification are already commercially available and deployed at scale globally. Based on the IEA Technology Readiness Level (TRL) framework, most battery, EV and low- and medium-temperature heat technologies have reached the highest maturity level (TRL 9), meaning that they are operating and commercially available with technology guarantees. This

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includes heat pumps and electric boilers and motors, in particular in the food and tobacco, textiles, and pulp and paper sectors.

Some electrified applications require further development to demonstrate both technical and commercial viability. These include technologies for high-temperature process heat for steel, cement and chemicals, as well as technologies for long-distance transport modes such as aviation and shipping. In Southeast Asia, around 45% of industrial heat demand is for temperatures above 400°C in processes such as melting, calcining and sintering in energy-intensive industries. Since most electric technologies for high-temperature heat have yet to pass the demonstration stage, energy-intensive industries such as aluminium and chemicals see only a modest rise in electrification, as discussed in the sectoral outlook section. Nevertheless, early initiatives are beginning to emerge in these harder-to-abate sectors.

Maturity of selected electrification technologies and processes by sector

Sector	Category	Technology/Process	Maturity
Buildings	Cooking	Electric cooking	
	Operations and equipment	Space and water heating	
Industry	Pulp and paper	Drying processes	
	Iron and steel production	Primary steel	
		Secondary steel (electric arc furnace)	
	Chemicals	Electric steam cracking	
	Aluminium	Electrified Bayer process	
	Cement and concrete	Electric kilns	
	Industrial electrical heating	Low- and medium-temperature	
		High-temperature	
Transport	Aviation	Electric aircraft	
	Road transport	Electric vehicle (passenger, bus, truck)	
		EV charging equipment	
	Maritime	Battery electric ship (short distance)*	
	Rail	Electric train	

*Electrification of long oceanic routes is still not mature due to a combination of insufficient energy density of batteries, too-costly discharged electricity (small number of cycles that the batteries would complete in a year), or both.

Notes: Technology and process groupings are based on the IEA (2026), IEA Energy Technology Perspectives (ETP) Clean Energy Technology Guide and reflect the technical maturity of selected electrification technologies. Colours indicate the overall maturity level within each group, ranging from mature (green) to demonstration and large prototype operated in real conditions (yellow) and concept or other prototypes (red). Individual technologies/processes within each category may correspond to a range of maturity levels.

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Achieving faster electrification will depend not only on technology readiness and ambitious government targets, but also on competitive and resilient supply chains. Expansion of domestic EV manufacturing capacity, which is expected to reach more than 1 million units by 2030, is driving growth in battery supply chains. Across Southeast Asia, committed battery projects are expected to quadruple battery cell manufacturing capacity by 2030. Over the past 5 years, Southeast Asia has been a preferred destination for Chinese overseas investment in EV manufacturing. Viet Nam has emerged as the region's largest EV producer while Thailand is also developing EV manufacturing capacity. Viet Nam and Indonesia host sizeable electric two-wheeler manufacturing capacity. Indonesia is emerging as a major player in battery manufacturing, supported by its nickel industry and EV industrial policies. Domestic EV manufacturing, along with lowering import tariffs on electrified equipment, have improved the affordability of EVs.

Improving the cost effectiveness of power supply

Declining global costs for clean energy technologies create a major opportunity for more cost-effective electricity supply and economically attractive electrification. Based on levelised costs of electricity, renewables remained the most cost-competitive option for new electricity generation in 2025. The weighted average levelised cost for onshore wind was USD 0.033/kWh and USD 0.044/kWh for solar PV, with low module costs continuing to drive solar PV deployment globally. Battery cost declines strengthened this effect: battery prices fell by 90% between 2010 and 2025, helping global additions of battery storage reach 108 GW in 2025, which was 40% more than in 2024. Together, lower-cost solar PV, wind, batteries and demand-side flexibility[7] can reduce delivered electricity costs and make electrification more competitive compared with direct fuel use. These global trends create opportunities for Southeast Asia to lower electricity costs with renewables-based development. However, the economic benefits will depend on addressing several local factors, including financing costs, project development conditions and grid investment requirements.

Realising these cost advantages requires investment. Regional capital spending on renewables, grids and end-use sectors is anticipated to reach USD 57 billion in 2026, including USD 22 billion for renewables and USD 15 billion for grids. However, the high cost of capital and limited project pipelines could increase the costs of electricity and slow expansion. Faster permitting, market designs that reward flexibility, affordable finance, cost-reflective tariffs and fewer price distortions will be key to helping electricity better compete with direct fuel use.

[7] Demand-side flexibility is the ability to change the timing or level of electricity use in response to system needs or signals.

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Addressing distortions in energy subsidies and prices

Enhancing the competitiveness of electrification also depends on optimising the energy prices and tariffs faced by consumers. In a number of emerging market and developing economies, natural gas and oil are taxed less than electricity or are even subsidised. Electricity prices vary across Southeast Asia due to a combination of differences in market structure, generation mix and financing costs – which can be twice as high as those in advanced economies. Energy prices in the region are often influenced by fossil fuel subsidies and regulated tariffs to support households and ensure affordability. While these measures can provide social and economic benefits, subsidising fossil fuels weakens incentives to switch to electricity, particularly in transport and cooking.

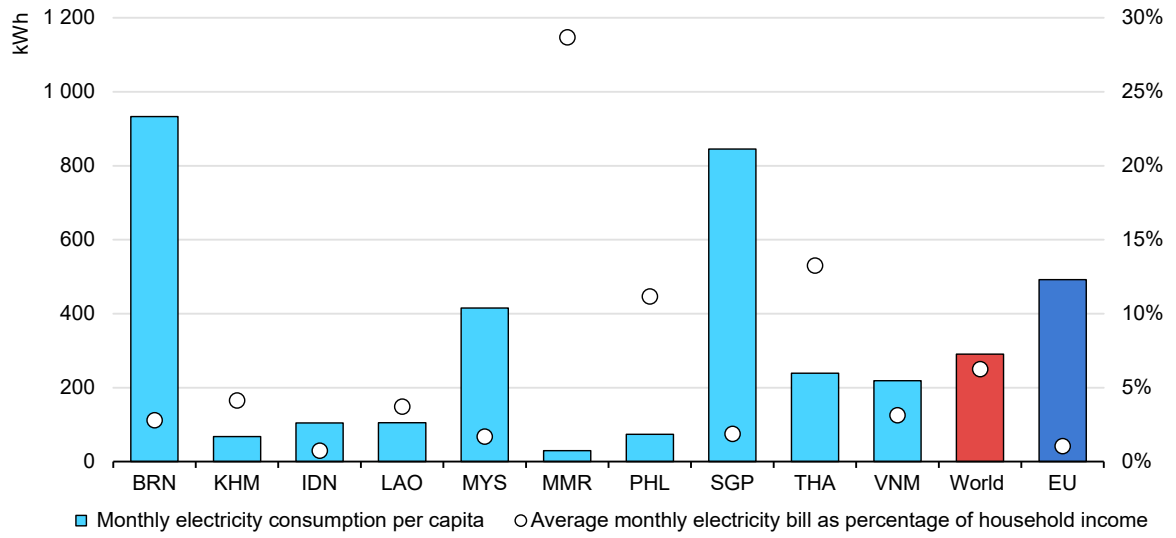
Electrification offers the opportunity to reduce regional spending on energy subsidies, particularly for oil and gas. Such subsidies, which stood at around USD 40 billion in 2024, are set to rise sharply in 2026 and are macroeconomically and fiscally significant. Moreover, reforming energy subsidies and taxes (for both fuels and electricity) represents an important step to correcting price distortions that undermine electrification. Subsidies on fuels keep their costs artificially low. Reforming these would help to immediately enhance the competitiveness of electrification.

Although reducing subsidies for electricity may reduce the attractiveness of electrification in the short term, such subsidies are often poorly targeted to higher-income households and undermine the overall financial performance of the power sector, thereby affecting long-term electrification prospects. More cost-reflective tariffs, fewer price distortions and a more targeted approach to subsidies according to household needs would better incentivise investment in efficiency, low-emissions power, distributed energy resources (DERs) and grid infrastructure, all of which would support electrification progress over time.

At the same time, affordability concerns for vulnerable consumers will need to be managed, since electricity bills account for a large share of household incomes in some Southeast Asian countries, limiting the scope for market price pass-through.

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Monthly electricity consumption and electricity bills as a percentage of average household income in Southeast Asia, 2024



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Notes: kWh = kilowatt-hours; three-letter country codes: BRN = Brunei Darussalam; KHM = Cambodia; IDN = Indonesia; LAO = Lao People's Democratic Republic; MYS = Malaysia; MMR = Myanmar; PHL = the Philippines; SGP = Singapore; THA = Thailand; VNM = Viet Nam; EU = European Union.

Source: IEA (2025), Integrating Solar and Wind in Southeast Asia.

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Chapter 3. Implications and priorities for high electrification in Southeast Asia

Accelerating electrification can strengthen Southeast Asia's energy security, improve efficiency and reduce exposure to volatile fossil fuel markets. However, faster electrification needs to be accompanied by the development of a secure, affordable and sustainable electricity sector, alongside targeted support for consumers and businesses. Sequencing policy and investment priorities should consider technology maturity, energy security, economic benefits, grid impacts, investment capacity and national circumstances. This chapter analyses the energy security, economic, social and environmental implications of boosting electrification in line with the goals of the High Electrification Scenario (HES). It then sets out the priority policy actions and enabling conditions for accelerating electrification in Southeast Asia.

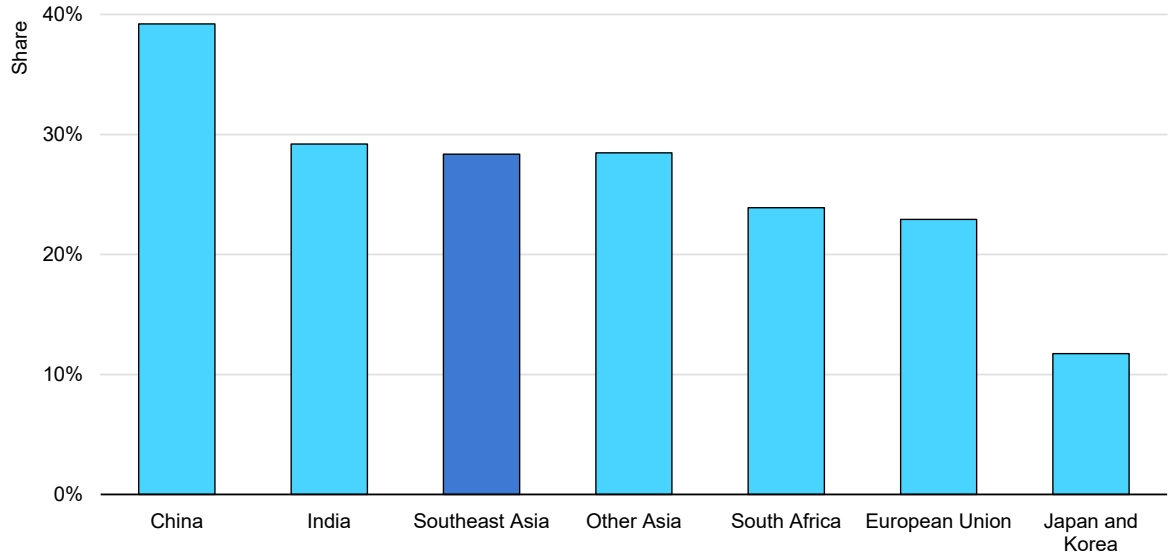
Implications of faster electrification

Energy security implications

Faster electrification can strengthen Southeast Asia's energy security by replacing direct fuel use with electricity and reducing imported fossil fuels. Under today's policy settings, even as electrification grows and the region's share of oil in transport energy use falls over time, Southeast Asia's reliance on fuel imports is set to rise, increasing its exposure to global price risks and pressure on public budgets and consumers. In the HES, however, faster electrification with greater reliance on domestic and regional sources of electricity generates annual fuel import savings by 2035 that are equivalent to nearly 30% of the region's 2025 fuel import bills, driven mainly by transport electrification. These savings are equivalent to nearly 1% of the regional GDP in 2025.

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Avoided import bill from end-use electrification as a share of the 2025 import bill by net importing region in the High Electrification Scenario, 2035



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Source: IEA (2026), Electrification Special Report.

Electricity security is becoming increasingly vital as economies depend more on electricity. Electricity security encompasses system adequacy, reliability, flexibility and resilience. Power systems will need to reliably manage growing and evolving electricity demand while accommodating rising shares of solar and wind generation – which increase variability and uncertainty. New loads, particularly from electric vehicles (EVs), cooling, industry and data centres, will reshape the locational and temporal profiles of electricity demand. These changes increase the need for flexibility to balance supply and demand across different timescales. They also increase the importance of forward-looking planning, investment and optimised operations by governments, utilities and system operators. Securely unlocking electrification potential will require co-ordinated and integrated planning, modernised grids and flexibility resources.

Greater reliance on electricity introduces concerns about resilience. The interconnected nature of power systems means that disruptions from extreme weather, equipment failures or cyberattacks can cause widespread damage. Southeast Asia is among the regions most exposed to extreme weather, and its infrastructure is particularly vulnerable to weather-related hazards. As heatwaves, floods, droughts and tropical cyclones become more frequent and intense, electricity systems will need to develop greater resilience to absorb, accommodate and recover from short-term shocks and structural shifts. Such capabilities come from embedding climate resilience, cybersecurity and critical-infrastructure protection into grid expansion and digitalisation from the outset. For remote areas, islands and critical facilities, local resilience increasingly

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depends on microgrids, distributed energy resources (DERs) and storage to maintain essential services during wider grid disruptions.

A more electrified energy system changes the nature of supply chain risks. Greater deployment of electrification technologies and flexibility resources may increase dependence on certain geographically concentrated supply chains for critical minerals, specialised manufacturing and components. However, the nature of such risks has less impact on energy operations than dependence on imported fuels does, since electrification relies on upfront investment in technologies and materials that can be managed through adequate diversification, recycling, substitution or stockpiling. Expanding and diversifying regional manufacturing early on can help reduce risks of dependence and capture potential industrial opportunities for Southeast Asia.

Economic, social and environmental implications

Accelerated electrification delivers benefits when electricity is reliable, affordable and increasingly low-emissions, and when enabling infrastructure and policy frameworks are in place. Under these conditions, efficient electric technologies become more accessible to households, firms and public service providers, while demand growth can support the development of related technology and supply chains. In turn, electrification can reduce energy-service costs and exposure to fossil fuel price risks. Electrification can also improve the reliability of essential services, enhancing productivity and competitiveness. However, upfront costs, limited access to finance and poorly designed tariffs could weaken affordability gains and widen gaps between consumer groups. Targeted subsidies, fair tariff design and appropriate financing solutions can help broaden access without placing excessive burdens on public budgets or consumers.

The quality and affordability of low-emissions electricity also shape the wider social and environmental outcomes of electrification. Clean cooking, efficient appliances and electric mobility can improve welfare and reduce household and urban air pollution, thereby lowering the health impacts of direct fuel combustion.

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Clean power supply can magnify the impacts of electrification

Developing clean power supply in concert with electrification can magnify the multiple benefits of reduced direct fossil fuel use. Meeting growing electricity demand with renewable power can help reduce fuel imports, lower the emissions intensity of power supply and enable wider emission reductions. Rapidly falling costs of renewable technologies and battery storage create opportunities for enhancing the cost-effectiveness of electricity applications. However, to fully meet new electricity demand in the HES, renewables would need to more than triple from today's level by 2035.

Priority actions to accelerate electrification

Energy system priorities

Achieving accelerated electrification requires a systems approach to developing national energy strategies and integrated planning and to reforming tariffs and subsidies. Integrating electrification efficiently across the energy system minimises unnecessary pressure on networks and generation assets while maximising emissions reductions and economic benefits for the consumer.

Accelerating electrification requires governments to move from technology-specific measures to economy-wide electrification strategies that align demand growth, power-sector planning, investment and affordability. For example, Singapore's Green Plan 2030 links power-sector decarbonisation, transport, electrification, buildings and green economy priorities under a cross-government strategy. National strategies supported by sectoral targets and integrated planning can help ministries, regulators, utilities and investors anticipate where demand will grow so that they can prioritise supply-side, grid-infrastructure and flexibility investments. Stable targets, transparent incentive adjustments and consistent standards can provide predictable market signals, reduce risk premiums and incentivise private capital to enter new markets. Progress can be monitored through indicators such as energy savings, peak demand reduction, electrification investment and emissions reduction.

Policy and investment priorities for electrification can be assessed against five criteria: potential to reduce imported fuel use; lifecycle cost and affordability benefits; technology maturity and supply-chain readiness; grid and infrastructure requirements; and wider economic, social and environmental benefits. Near-term actions should focus on mature applications that combine energy security benefits with manageable system impacts. This is likely to include the electrification of two-

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and three-wheelers, cars, urban buses and high-utilisation transport fleets; cooking and water heating; industrial motors; and low- and medium-temperature industrial heat. Prioritising commercially and technically mature opportunities helps to ensure cost-effective electrification. Energy-management systems and efficiency obligations can help identify and enable these opportunities. Longer-term actions can focus on laying the groundwork for applications requiring further technology development or major infrastructure upgrades.

Co-ordinated and integrated planning better aligns electrification with energy, power system and industrial development. Energy planning should move beyond traditional approaches focused solely on supply expansion to integrate end-use electrification alongside the development of fuel supply, low-emissions generation, grids, storage and demand-side flexibility. This can help align the location of new demand – including charging infrastructure and industrial development – with electricity supply, renewable energy zones and grid development, while supporting emission goals. Viet Nam's Revised Power Development Plan 8, for example, sets out long-term electricity demand, generation and grid development priorities, including measures to integrate higher shares of renewables. Governments, together with regulators, utilities and large industrial consumers, also have an opportunity to align industrial development strategies with utility planning and decentralised energy solutions through policies for industrial parks. Integrating electrification into broader diversification efforts can help address potential supply chain dependencies and capture high-value industrial opportunities. From a power system perspective, identifying concentrations of new demand from EVs, cooling, data centres or industrial parks in specific locations and during peak periods can help better match renewables output with demand profiles, assess where clean power is required, prioritise grid development, and calibrate non-wire approaches through demand-side flexibility.

Accelerating electrification also depends on addressing price distortions through better-targeted subsidies and tariffs. Fossil fuel subsidies make competing fuels artificially cheap, slowing electrification. Poorly designed electricity tariffs discourage the uptake of efficient electric technologies, even where they reduce total energy service costs. Subsidy reforms are most successful when carried out gradually and paired with targeted cash transfers or bill support for vulnerable households and small firms. Such reforms can be fiscally neutral compared to an existing incentive programme if well-calibrated to household needs. In Malaysia, targeted electricity subsidies have shifted support away from broad subsidies while retaining protection for lower-consumption households. Tariff reforms, including time-differentiated tariffs, should aim to better reflect system costs in electricity pricing while encouraging efficient consumption, smart charging and investment in DERs. In Indonesia, the electricity tariff adjustment mechanism provides a basis for periodically reflecting fuel and macroeconomic cost changes in electricity prices while maintaining targeted

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support. Consistent implementation of such measures over time is critical to realising their energy and economic benefits.

Near-term priorities for electrification to enhance security and affordability

The 2026 ASEAN Energy Security Review highlights three strategies for the region to strengthen energy security, considering the varied energy risks by country and fuel: diversifying energy supply sources and routes, making greater use of domestically available energy resources, and accelerating electrification alongside efficiency improvements.

In the near term, electrification "quick wins" can provide economic relief from the current energy crisis while supporting longer-term energy security and electricity adoption. The IEA 2026 Energy Crisis Policy Response Tracker has identified priority policies and interventions that can be readily carried out by governments, are already successfully addressing current energy supply pressures, and can provide long-lasting system benefits. While many of the government's measures to respond to the crisis have been short-term demand reduction and energy conservation through behavioural changes, durable policy measures for supporting electrification include:

- faster procurement of renewables, battery storage and smart-grid tools to unlock existing network capacity
- stronger efficiency standards for cooling and industrial motors
- targeted finance for purchasing efficient electric equipment
- managed charging practices for public fleets and buses

End-use priorities

Sectoral measures to support efficient electrified technologies underpin any widespread shift towards greater use of electricity in end-use applications.

Cross-cutting

While sector-specific opportunities differ, common enabling measures can support electrification across transport, buildings and industry.

Strengthening standards, incentives and information programmes can accelerate the uptake of efficient electric technologies. Measures include energy performance standards, interoperable charging standards, clear labelling for lifecycle costs, accessible finance and effective enforcement. Singapore's Energy Efficiency Grant co-funds investment in energy-efficient equipment. Most

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countries in Southeast Asia have minimum energy performance standards (MEPS) and labelling in place for appliances, although coverage and stringency vary. Singapore's AC MEPS are among the most stringent globally. The effectiveness of MEPS and labelling programmes depends on establishing stringent standards, regular monitoring and robust enforcement, while regional and international alignment supports implementation and reduces costs.

Boosting electrification across all sectors depends on widespread development of labour skills, supply chains and implementation capacity. Enhancing capabilities for the installation, operation and maintenance of electrified technologies through training programmes and incentives can support adoption across sectors. In the Philippines, designated energy-consuming establishments are required to appoint certified energy professionals and undertake periodic energy audits. This helps strengthen their capacity to identify and implement efficiency improvements, including those stemming from electrification.

Transport sector

Improving EV affordability and widening EV model availability can be achieved through targeted economic support for consumers and fleet operators, combined with policies that encourage competitive manufacturing, market entry and reliable after-sale services. In Thailand, the 30@30 vehicle policy is an effective policy package. It combines CO_2-differentiated vehicle excise taxes, vehicle energy labelling and incentives from Thailand's EV 3.5 programme to support investments in EV manufacturing and consumer adoption. Governments can also improve affordability by facilitating access to second-hand EVs with minimum quality, safety and battery performance standards.

Governments can catalyse early demand for charging infrastructure by adopting EVs in public transport and other high-utilisation fleets. The predictable charging needs of these fleets can improve charger utilisation and economics, while helping utilities anticipate and manage the electricity demand. Governments can also support public, workplace and shared residential charging, particularly in dense urban areas where access to home charging is limited. Public procurement and fleet targets can strengthen demand and provide clearer investment signals. In Indonesia, the government is transitioning to electrified official vehicles and targeting the full electrification of public bus fleets in Jakarta by 2030.

Developing charging strategies tailored to different road-vehicle segments can reduce infrastructure and grid integration costs. Charging strategies should reflect differences in vehicle use and operating patterns. Two- and three-wheelers can rely more extensively on home and workplace charging and battery swapping solutions. Electric cars can rely on home and workplace charging,

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complemented by public and shared residential charging. Buses and freight vehicles require high-capacity charging at depots, fleet hubs and freight corridors.

Targeted strategies can unlock opportunities to electrify domestic maritime transport and port operations. Harbour craft, ferries and other vessels operating on short, predictable routes require co-ordinated planning for suitable vessel technologies, charging infrastructure and grid connections, supported by common safety and technical standards. To support electrification, Singapore is developing a charging infrastructure plan for electric harbour craft. Port equipment and other landside operations represent additional electrification opportunities.

Buildings sector

Strong building energy codes can ensure that buildings are electrification-ready and highly efficient. Improved building envelopes, passive design and energy-management systems can help contain rising energy demand, especially for cooling. Building codes should also make provisions for efficient electric equipment, charging infrastructure and demand-side flexibility where possible. In Singapore, developments with specified major building or electrical works are required to install EV charging infrastructure through passive electrical capacity and, where applicable, active charging points. While most countries in the region have building energy codes, there is scope to expand coverage, strengthen requirements and ensure regular updates. The growth in the number of new buildings makes this a key area of focus. However, increased support is needed for large building retrofit programmes to future-proof the existing building stock.

Other measures can mitigate demand and ensure better system integration. Stringent and regularly updated MEPS for appliances and lighting can help ensure efficient replacement of electric equipment**.** Enabling efficient grid-interactive buildings can support grid services and system security. Rooftop solar, storage and smart building management systems can reduce peak loads where regulatory and network conditions allow**.**

Industry sector

Industrial parks can provide effective organising platforms, promoting the aggregation of demand and shared energy infrastructure. This allows firms to lower the cost of electricity, better integrate renewable electricity and storage, and spread project development risks. Co-ordination of renewable resource availability and reliable grid development are key for sustainably meeting demand. Enabling timely and cost-effective grid connections through co-ordinated planning between system planners and large industrial consumers is important for ensuring that network capacity keeps pace with industrial demand, which avoids connection delays and reduces investment risks. Supporting energy managers through

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capacity building and energy audits can further enhance the attractiveness of electrification opportunities, particularly for micro, small and medium-sized enterprises (MSMEs). Thailand's Smart Park Industrial Estate illustrates how clean electricity and enabling infrastructure can be planned at the park level, including through smart-grid technologies and floating and rooftop solar PV.

Power sector priorities

Accelerating clean electrification requires power systems to evolve alongside end-use demand and technologies supported by timely grid expansion and modernisation. As variable renewable energy (VRE) reaches higher shares of generation, there should also be a growing range of flexible resources.

Well-designed policy, regulatory and market mechanisms can support the deployment of low-emissions generation. This can enable clean power supply to keep pace with electrification and mobilise greater private investment. Regulated pricing instruments such as feed-in tariffs (FiTs) can support early-stage renewable deployment, while market-based approaches such as direct power purchase agreements (DPPAs) and competitive auction schemes can scale up investment. Malaysia, Thailand and Viet Nam have introduced DPPAs following implementation of FiTs. By providing predictable routes to market and revenue certainty, these mechanisms can help attract private capital. Competitive procurement, transparent project pipelines and standardised contracts can further lower financing costs and electricity prices, thereby strengthening the affordability case for electrification. Procurement should be designed to reflect system value in meeting evolving hourly and seasonal load profiles rather than just total annual energy. Clearer permitting, land access and grid-connection timelines and processes can reduce uncertainty and help planners sequence investments.

Timely electricity grid expansion and modernisation are the infrastructure backbone supporting the electrification of end-use sectors. New grid infrastructure takes considerably longer to plan, permit and build than many of the electrification technologies on either the supply or demand side, such as renewable energy projects, EV charging infrastructure or data centres. Without timely investment, grid constraints could delay electrification, raise connection costs and weaken electricity security. While new grid capacity is being developed, system planners can improve the utilisation of existing networks and unlock untapped capacity using three complementary tools: digitalisation, grid-enhancing technologies, and AI. Key technologies and applications include dynamic line ratings, advanced monitoring and control systems, smart inverters, and automation measures. Thailand's grid modernisation efforts illustrate how the adoption of digital technologies can strengthen system reliability and resilience.

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Unlocking system flexibility becomes increasingly important as VRE accounts for higher shares of generation. Although most Southeast Asian power systems have not yet reached high phases of VRE integration, (marked by increasing impact of VRE on the power system), flexibility is already important in locations facing network constraints, rapid demand growth or high concentrations of distributed generation. Over time, a portfolio of well-designed flexibility resources can lower grid expansion costs and reliably balance supply and demand across different timescales in a more electrified system. Such flexibility resources include flexible dispatchable power plants, grids, storage, demand response and DERs. Managed EV charging, smart energy management systems, thermal storage and demand response can limit peak demand and reduce unnecessary network investment. These are enabled by smart metering, tailored tariff structures and clear frameworks for aggregators and virtual power plants. Battery storage can provide fast response, reduce curtailment, defer network upgrades and support charging hubs and industrial electrification, particularly where grids are constrained.

Demand-side flexibility and demand response can reduce peak demand, manage local network constraints and integrate VRE at lower costs than relying only on new generation and grids. Existing industrial arrangements in the region, including interruptible-load schemes and voluntary demand reductions during periods of low hydropower availability, provide a foundation that can be expanded. Establishing clear demand response frameworks and enabling aggregators and virtual power plants can help bring smaller flexible resources into electricity and ancillary service markets. Monetising these opportunities depends on regulatory and market arrangements that provide clear and predictable revenue streams. Such arrangements can include peak rebates, ancillary service procurement, capacity mechanisms and flexible DER procurement. For example, the Philippines has developed a 2025-2034 Ancillary Service Agreement Procurement Plan to support grid reliability, stability and operational efficiency.

Financing and business model priorities

Improving affordability, enhancing access to finance and promoting new business models help mobilise investment in electrification across all sectors.

Fiscal resources should target affordable electrification opportunities for low-income consumers and MSMEs. Well-designed economic and financial incentives can cost-effectively catalyse the uptake of efficient appliances, electric two- and three-wheelers, and other end-uses more widely across population segments. Incentives can include lowering consumption taxes, fees and tariffs, providing targeted concessional finance and promoting information programmes.

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Promoting leasing and service-based business models can help households, small firms and fleet operators reduce high upfront investment costs. Such business models include energy service companies (ESCOs) and utility on-bill financing mechanisms. The development of super ESCOs with publicly backed balance sheets can further support bulk procurement and equipment cost reductions.

Improving access to finance for MSMEs is important for expanding electrification opportunities to industries such as agribusiness and food processing, local hospitality and retail, and small logistics companies. These often face short payback expectations, strong competition, small transaction sizes and perceived lack of creditworthiness. Financial products such as on-lending, aggregation and credit guarantees can support electrification investments, while technical assistance can help businesses identify and structure a pipeline of electrification projects.

Taking a dynamic approach and designing electrification incentives with clear exit strategies will help to manage public resources across all sectors. As the competitiveness of electrification opportunities improves, incentives should shift to more targeted support that addresses remaining barriers, such as access to charging facilities, affordability for low-income households and grid readiness.

Regional co-operation priorities

Given uneven progress on electrification across countries in Southeast Asia, regional co-operation to address common technical, economic and integration challenges can help enable a high-electrification pathway.

The ASEAN Plan of Action for Energy Cooperation (APAEC) can serve as a tool to align electrification, renewables, energy efficiency and grid priorities. Regional co-operation through APAEC can support common standards, stronger implementation across countries, capacity building and knowledge sharing. Electrification targets could also be included as part of APAEC targets.

Regional approaches to appliance standards, EV charging interoperability and data sharing can support accelerated electrification. ASEAN is working on harmonising MEPS to lower equipment costs, reduce market fragmentation and support faster deployment of efficient electric technologies. Adopting common testing procedures, product labelling and implementation frameworks can further strengthen enforcement and facilitate compliant equipment trade across markets.

Implementation of the ASEAN Power Grid (APG) can support affordable electrification by enabling resource sharing, integrating VRE and lowering system costs. Advancing the APG will require effective co-operation arrangements among participating countries to move from vision to implementation. This

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includes governance and regulatory frameworks, and technical and commercial arrangements that participating countries should align to develop and operate cross-border interconnectors for power trade. Priority areas for co-operation arrangements include institutional co-ordination, transparent approaches to transmission tariffs, cross-border cost-benefit analysis and cost allocation, cross-border Renewable Energy Certificate recognition, co-ordinated system planning, grid code interoperability, and data sharing. These arrangements will be important for facilitating cross-border power trade, attracting investment in regional interconnectors and enabling the APG to support electrification in ASEAN.

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Annexes

Scenarios

The increasing electrification rate across IEA scenarios is the result of three evolving trends as explained in the IEA (2026) Electrification Special Report:

- **Higher activity in electricity-only end uses:** Across all IEA scenarios, electricity consumption grows faster than total energy consumption, due to the faster growth of already electrified end uses. These include electrical appliances and air conditioners in homes and offices, and the rise of data centres and other digital infrastructure. The faster growth of these end uses contributes to the overall increase in the rate of electrification.
- **Electrifying multi-fuel end uses:** End uses can practically and economically be met by multiple fuels, and the consumer opts to adopt the electric one over other fuels including coal, natural gas, gasoline and diesel. This includes consumers opting to switch from a non-electric to an electric technology.
- **Efficiency:** Efficiency measures in end uses help to slow demand growth, which tends to reduce the role of fuels more than electricity. By reducing total final energy consumption, which is the denominator of the electrification rate, this contributes to increasing the role of electricity. Key measures include fuel economy standards, buildings retrofits, and energy efficiency investments in factories. The stringency of such measures varies across IEA scenarios and is strongest in the HES.

Abbreviations and acronyms

AC	Air conditioner
AI	Artificial intelligence
APAEC	ASEAN Plan of Action for Energy Cooperation
APG	ASEAN Power Grid
ASEAN	Association of Southeast Asian Nations
CO_2	Carbon dioxide
DERs	Distributed energy resources
DPPAs	Direct power purchase agreements
EMDE	Emerging market and developing economies
ESCOs	Energy service companies
EV	Electric vehicle
FiTs	Feed-in tariffs
GDP	Gross domestic product
HES	High Electrification Scenario
ICE	Internal combustion engine

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Lao PDR	Lao People's Democratic Republic
LPG	liquefied petroleum gas
MEPS	Minimum energy performance standard(s)
MERs	Market exchange rate
MSMEs	Micro, small and medium-sized enterprises
PV	Photovoltaic
STEPS	Stated Policies Scenario
TFC	Total final consumption
TFEC	Total final energy consumption
TRL	Technology Readiness Level
VRE	Variable renewable energy

Glossary

EJ	exajoule
Gt	gigatonne
GW	gigawatt
kWh	kilowatt hour
mb/d	million barrels per day
TWh	terawatt hour
USD	United States Dollar

See the IEA glossary for a further explanation of many of the terms used in this report.

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