

Renewable Energy Manufacturing: Opportunities for Southeast Asia

Executive summary of presentation by McKinsey at ADB Southeast Asia Development Symposium on 30 March 2023: “Southeast Asia to Scale Up Renewable Energy Manufacturing”, with comments from ADB, SEforALL, Bloomberg Philanthropies and ClimateWorks Foundation

Climate change is a real threat that will significantly impact lives and economies. Today, 5 out of 10 economies in Southeast Asia rank among the world’s top 20 countries most vulnerable to climate change¹. According to estimates by Swiss Re Institute, the region can lose up to 30% of its GDP by 2050 due to increases in global temperature and extreme weather events.²

Emissions in Southeast Asia must be reduced by approximately 10 to 25%³ by 2030 (relative to its current trajectory) to limit global warming to a 1.5°C pathway and to mitigate the worst of its effects. Substantial, collective action by governments and businesses is required. About half⁴ of all governments globally and within Southeast Asia have already committed to net zero targets.

Ramping up renewable energy deployment in Southeast Asia could enable the region to transition to clean energy and to combat climate change. According to McKinsey’s estimates, Asia has a \$5 trillion addressable market size for green businesses in 2030, with low carbon mobility and clean power contributing 35-40%. In Southeast Asia, the contribution of these two segments is estimated at \$90-100 billion, which will need to be enabled by a significant scale up in renewable energy inputs and end-products (e.g., solar PV, electric vehicles, batteries). This could lead to significant economic development opportunities. By 2050, approximately 30 million renewable energy jobs will be created globally, with 6 million in Southeast Asia, according to IRENA estimates.⁵

Southeast Asia could be a key contributor to global decarbonization by building on its natural advantages. The region boasts about 16 TW of solar technical potential⁶, approximately 25 and 10% of global nickel and cobalt reserves respectively⁷, and collectively makes up about 25% of the world’s two-wheeler (2W) market. It has attracted several international and local players to set up facilities for solar photovoltaic (PV) module manufacturing, two-wheeler electric vehicles (E2W) assembly and battery cell manufacturing.

Southeast Asian economies have an opportunity to become viable global renewable energy manufacturing hubs in solar PV, E2W and batteries based on these existing strengths:

¹ GermanWatch.org, Global Climate Risk Index (2021). Based on Germanwatch’s Long Term Climate Risk Index in its Global Climate Risk Index 2021 report; countries are scored based on impact from no. of fatalities, GDP loss and number of events arising from climate change across 2000-19

² Swiss Re Institute, “The Economics of Climate Change: Impacts for Asia”. May 2021. <https://www.swissre.com/risk-knowledge/mitigating-climate-risk/economics-of-climate-change-impacts-for-asia.html>. Accessed in March 2023. GDP loss estimates based on a 2-2.6C increase in global temperatures, considered as the “likely range of global temperature increase from pre-industrial times to mid-century”

³ S. Paltsev, M. Mehling, N. Winchester, J. Morris and K. Ledvina (2018). “Pathways to Paris: ASEAN”. *MIT Joint Program Special Report*. According to the report, ASEAN needs to reduce its emissions by 11% under the unconditional pledges, and by 24% under the conditional pledges, by 2030 to meet Paris commitments.

⁴ McKinsey Global Energy Perspectives as of November 2022

⁵ IRENA Global Renewables Outlook (2020). 30mn and 6mn refer to the difference in the number of additional jobs (including in manufacturing renewable energy systems) in renewables in 2050 vs 2017 in IRENA’s Transforming Energy Scenario (TES)

⁶ IRENA Renewable Energy Outlook for ASEAN (2022)

⁷ US Geological Survey estimates as of 2022

- **Solar PV** (Appendix, Figure 1): Today, installed solar PV capacity in Southeast Asia is ~25GW and is expected to double by 2030 if all governments' announced plans⁸ to scale up solar PV deployment materialize. Countries like Malaysia, Vietnam, Thailand, Cambodia and Singapore collectively produce ~30GT in polysilicon (3% of global production), 10GW of wafer production (2%), ~50GW of solar PV cells (9%) and ~70GW of solar PV modules (10%). Per the World Bank's RISE indicators, most Southeast Asian economies have scores between 39 to 84⁹. Other key drivers which would need to be in place for further uptake of solar PV include levelized cost of electricity parity with other generation sources, grid infrastructure availability (including the ASEAN Power Grid), flexible storage to manage intermittency, and policies to promote domestic manufacturing and end-product demand.
- **Electric 2-wheelers** (Appendix, Figure 2): According to McKinsey estimates, Southeast Asia accounts for 12 million 2W sales (~25% of global volumes), expected to grow to over 20 million by 2030¹⁰. The two largest markets, Vietnam and Indonesia, currently drive 2/3 of sales. The region contributes 6 to 10% of global production capacity^{11,12} (from Vietnam and Indonesia primarily), with component manufacturing footprint (e.g., of electric motors, controllers) present in some of the larger regional economies. Seven countries in the region have set vehicle electrification targets (e.g., 100% E2W sales by 2040 in the case of Indonesia and Vietnam¹³), and this is expected to lead to significant increases in E2W penetration rates (e.g., from <1% today in most Southeast Asian countries, to between 20 to 30% in markets like Indonesia and Thailand by 2030¹⁴). As a result, E2W sales are projected to reach 4.3 million by this timeframe. Key drivers that are necessary to enable further E2W adoption include E2W total cost of ownership competitiveness with fossil-fuel powered 2W, availability of battery swapping infrastructure, the availability of customer-centric offerings by manufacturers, and policy initiatives to promote E2W manufacturing.
- **Batteries** (Appendix, Figure 3): Battery demand is currently limited at ~2GWh in 2022, but is expected to increase significantly to reach ~80GWh by 2030 and ~175GWh by 2035¹⁵. Indonesia and Philippines have significant shares of world's nickel (~25%) and cobalt (~10%) reserves¹⁶, critical raw materials in battery manufacturing. Moreover, several foreign players have in recent years announced plans to set up operations in Southeast Asia, ranging from mineral mining and refining (in Indonesia and Philippines), to manufacturing of battery components and cells. Southeast Asia today contributes to less than 0.5% of global battery cell production¹⁷, primarily from Vietnam and Indonesia. This presents both risks and 'early mover' opportunities for countries that pursue manufacturing in this sector. Some governments (e.g., Indonesia, Thailand) have established policies specifically to promote battery manufacturing. Additional factors that will influence battery demand include the

⁸ Latest announced country power development plans (PDPs), where available

⁹ Regulatory Indicators for Sustainable Energy (2021). RISE is a global policy scorecard which grades 111 countries in the areas of energy access, energy efficiency and renewable energy

¹⁰ McKinsey Center for Future Mobility estimates as of 2022

¹¹A. Mahalana, Z. Yang and F. Posada (2021). "Indonesia transport electrification strategy". *International Council on Clean Transportation Working Paper 2021-36*

¹² Based on company announcements (latest available information accessed in March 2023). Assumes 30-50% avg. utilization rate for E2W production facilities

¹³ Government announcements (latest available information accessed in March 2023)

¹⁴ McKinsey Center for Future Mobility estimates as of March 2023

¹⁵ McKinsey Battery Insights estimates as of Dec 2022

¹⁶ US Geological Survey estimates as of 2022

¹⁷ McKinsey Battery Insights estimates as of Dec 2022

levelized cost of storage in each Southeast Asian country, the evolution in global prices of commodities, innovations in nickel refining, and cell chemistry and manufacturing processes, and government policies to promote battery manufacturing, recycling and recovery of battery metals.

Cooperation between an array of international and regional stakeholders is required to ensure that Southeast Asia secures its place as a global “center of gravity” for renewable energy manufacturing, and to grow the overall aspiration for the region as a whole. They could deploy several levers to scale up renewable energy manufacturing in Southeast Asia:

- *Policy:* Multilateral, international, and non-profit organizations and industry associations could support to convene governments and the private sector. Governments could establish the right regulations and standards to promote demand and foster international and regional trade agreements to enable manufacturing at scale, while manufacturers could actively provide input during the policy-making process to allow for development of policies that are conducive to end demand and business growth.
- *Financing:* Multilateral and international organizations, philanthropies, governments and other stakeholders could support manufacturers through relevant tools (which vary by stakeholder) such as cash loans, grants and equity investments.
- *Business support:* Stakeholders with expertise (e.g., multilateral, international and non-profit organizations) could provide technical assistance (e.g., training courses, establishing sharing platforms to disseminate knowledge across industry players), and grow the availability of talent in renewable energy manufacturing.
- *Coordination:* Governments can ensure cross-ministerial coordination (e.g., between ministries of finance, energy, trade and industry) on policy-making and implementation of plans to scale renewable energy manufacturing. Industry players could enhance collaboration with international players (e.g., from China and India), secure commitments from early adopters to de-risk projects, and build ecosystems of supply chain partners to drive down input costs.

Appendix – Market landscape overview for solar PV, Electric 2-wheelers and Batteries

Solar PV: Significant potential in some SEA countries¹ driven by domestic demand, manufacturing capabilities and regulations

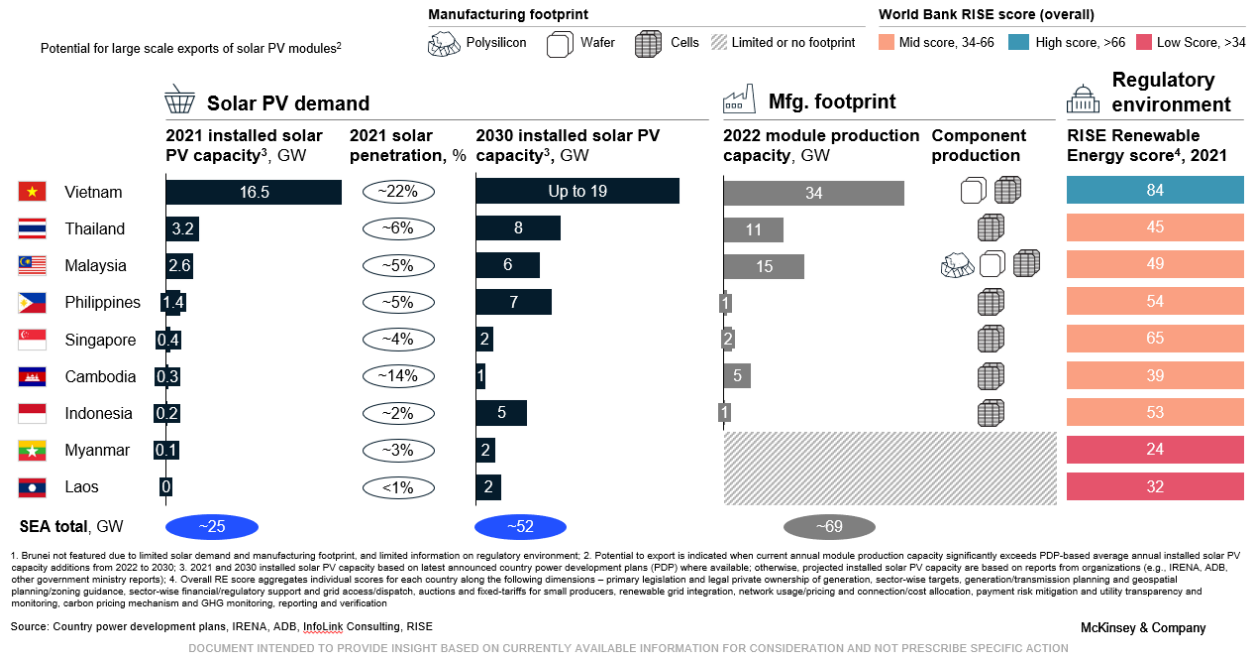


Figure 1. Solar PV landscape in Southeast Asia

Electric 2-wheelers: Indonesia and Vietnam have particularly high demand and large assembly capacities

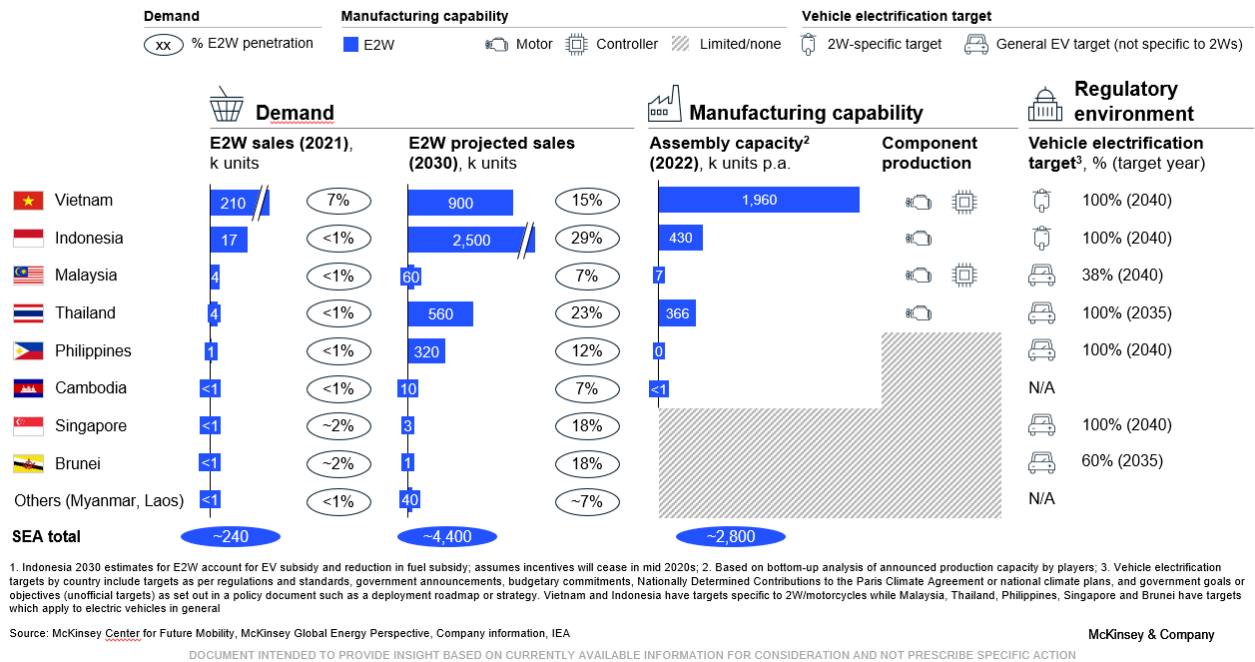
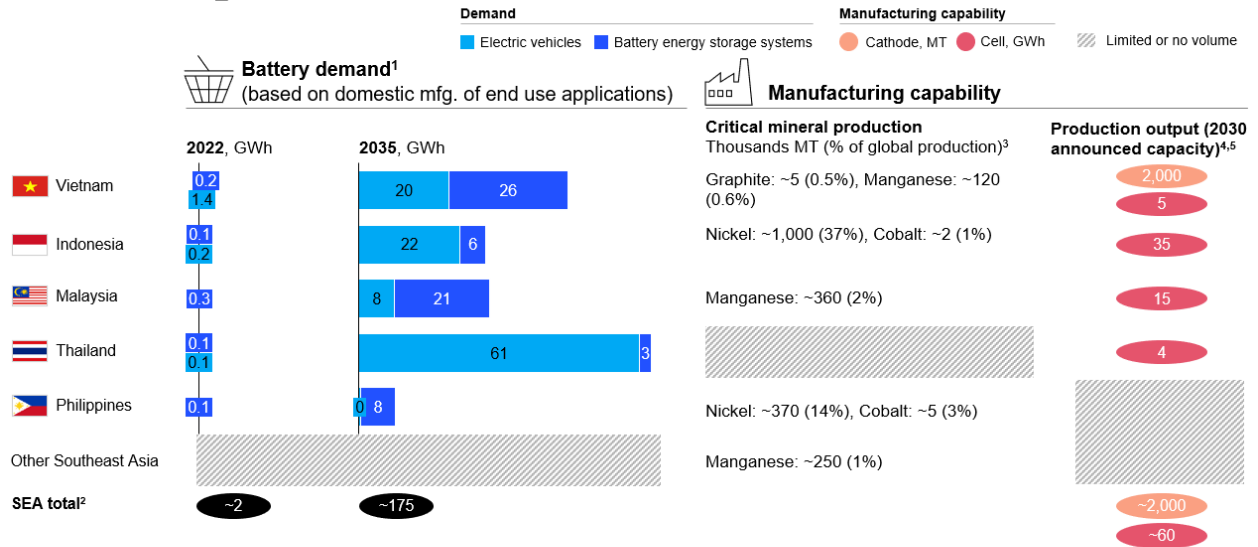


Figure 2. E2W landscape in Southeast Asia

Batteries: Demand expected to accelerate in some Southeast Asian economies post 2025



1. EV demand is estimated based on company announcements on production plans, analysis of historic growth, customer demand, regulatory trends and EV cost projections in a current trajectory scenario. BESS demand is estimated bottom up (for residential), least cost optimization for meeting power requirement, and company announcements on production plans; 2. Cambodia, Myanmar, Laos, Singapore, Brunei are excluded due to limited battery demand, mineral reserves, and production output; 3. Thousands of metric tonnes (MT); 4. Based on company announcements where information on capacity output and start of commercial operations are known, does not account for delays and unrealized plans. Excludes any unannounced projects / future developments as of Feb 2023; 5. Limited production across SEA in 2023 with the exception of Vietnam (2k MT cathodes)

Source: McKinsey Battery Insights, McKinsey Power Model, McKinsey Center of Future Mobility, IEA Southeast Asia Energy Outlook 2022, United States Geological Survey, International Copper Study Group McKinsey & Company

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Figure 3. Batteries landscape in Southeast Asia