

# **THE BREAKTHROUGH EFFECT IN ASEAN: HOW TO TRIGGER A CASCADE OF TIPPING POINTS TO ACCELERATE ASEAN'S GREEN GROWTH**

**G20 Bali GBFA-China-ASEAN Capacity Building on Blended Finance**

Bali, January 23, 2024

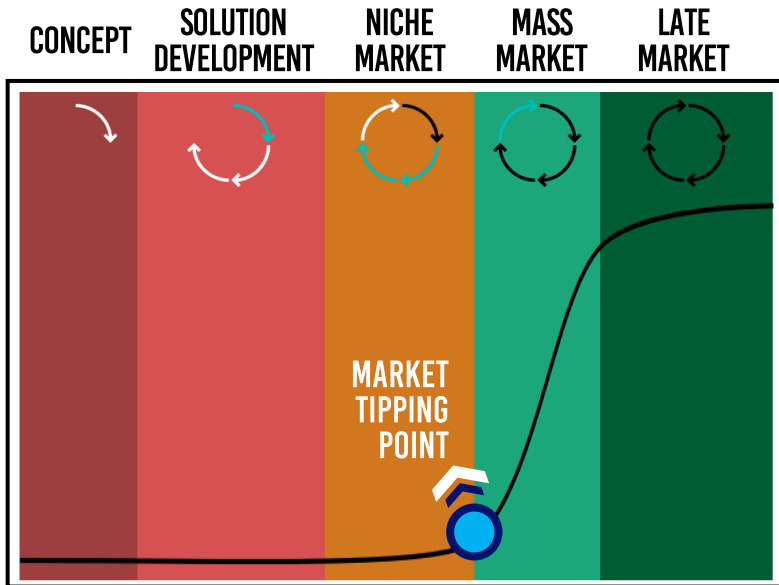


# IDENTIFYING TIPPING POINTS TO ACCELERATE ASEAN'S GREEN GROWTH

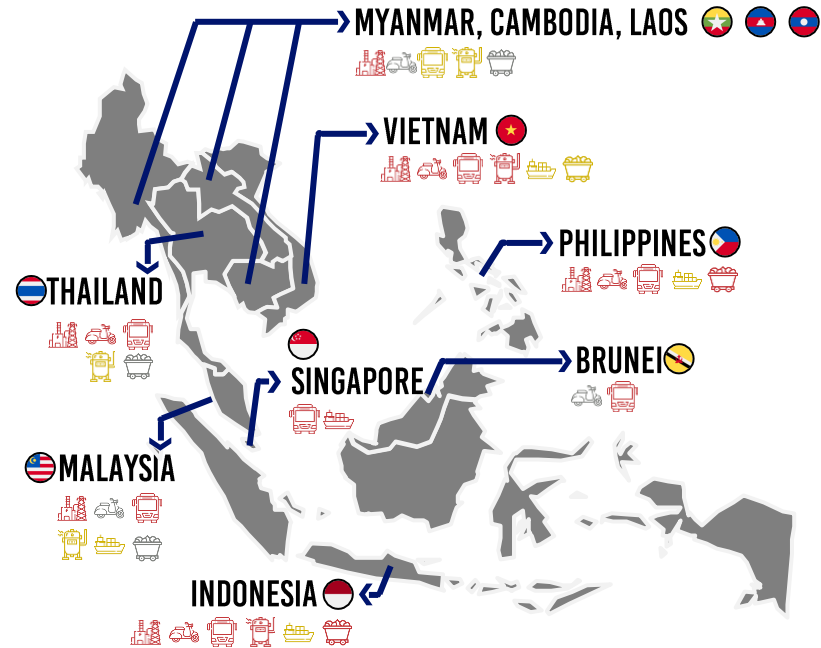
Identification of **key factors for market tipping points** will **accelerate** mass adoption of low-carbon solutions

**Initial tipping points analysis** will cover strategic sectors that covers **~40% of ASEAN GHG emissions**

Acting on **policy, market, and industry levers** are key to achieve tipping points



## SECTOR & COUNTRY RELEVANCE



## PULLING LEVERS FOR CLOSE-TO-TIPPING SECTORS

- POLICY**  
e.g., subsidies
- MARKET**  
e.g., green premium
- INDUSTRY**  
e.g., product R&D

## REACHING SECTOR TIPPING POINTS



## ACCELERATING ASEAN'S GREEN GROWTH



Reaching tipping points in **strategic sectors** will create **cascading effects** for ASEAN's Net-Zero transition, **accelerating ASEAN's green growth.**

## ENABLING CONDITIONS

- AFFORDABILITY**
- ATTRACTIVENESS**
- ACCESSIBILITY**

## INITIAL LIST FOR TIPPING POINT ANALYSIS

- Power
- Buses
- Industrial heat<sup>2</sup>
- 2-Wheelers
- Shipping
- Mineral refinery

## ECONOMIC & EMISSIONS RELEVANCE:

- High
- Relevant
- Low



# WHAT IS A TIPPING POINT?

Figure 1: The historical adoption of a sample of infrastructure and energy systems

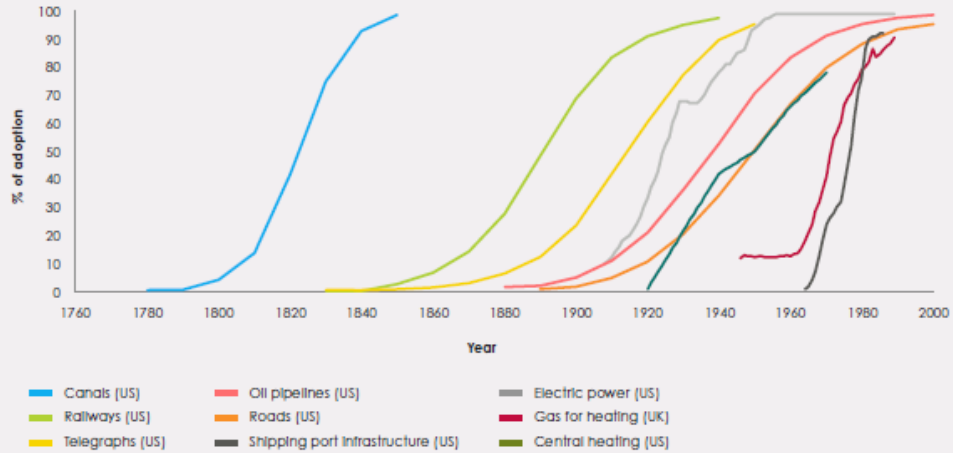
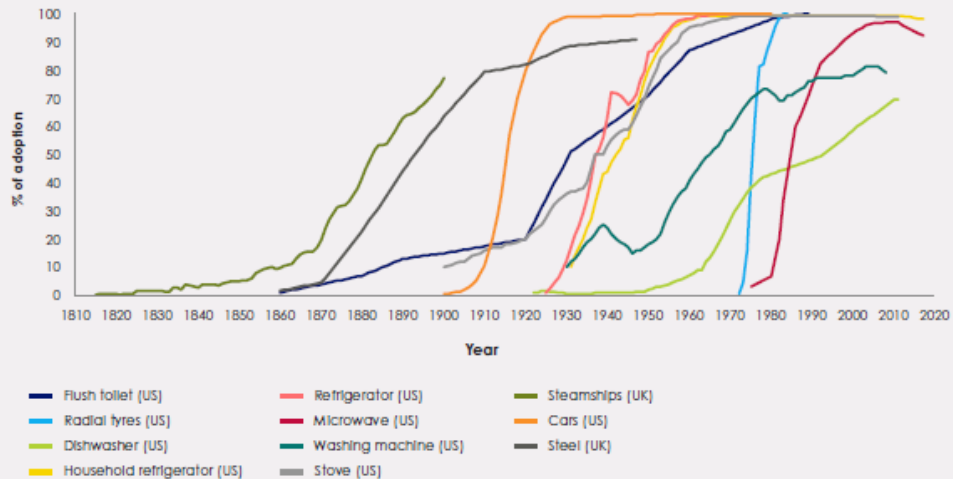


Figure 2: The historical adoption of a sample of manufactured goods



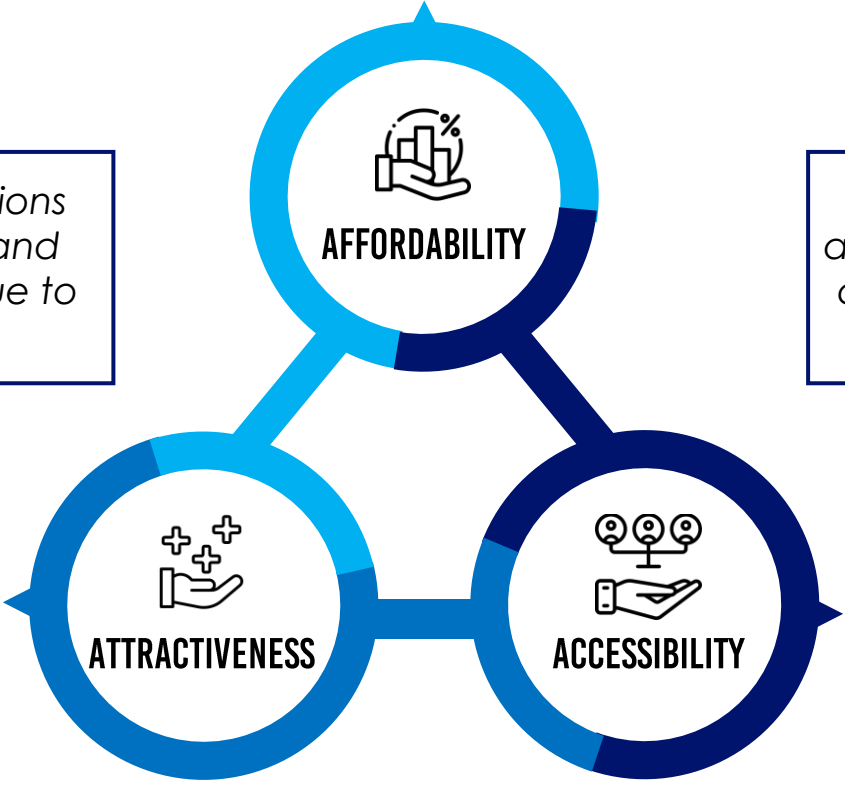
- Socio-economic tipping points happen when a **new solution** (technologies, practices etc.) advances to a level where it starts to rapidly **outcompete and replace the existing solution**.
- Once you cross a tipping point, the new solution **grows exponentially** and forces the old one out of the market quicker than anyone could have predicted.
- Triggering tipping points could offer an opportunity to **rapidly increase the deployment of low-carbon solutions** and drastically cut global emissions.
- Many **examples in history** of new inventions hitting tipping points - some **reached full adoption** incredibly quickly (especially in a pre-internet era).

# TIPPING POINTS CAN BE TRIGGERED THROUGH ADDRESSING 3 KEY ASPECTS: AFFORDABILITY, ATTRACTIVENESS, AND ACCESSIBILITY

**Cost-competitiveness.** Critical variable in relation to tipping points is cost-competitiveness of low-carbon solutions, which depends crucially on scale.  
*e.g., improved TCO of e-buses*

*In some sectors, the low-carbon solutions have already reached affordability and accessibility but are not attractive due to lack of infrastructure.*

*Sectors may also reach affordability and accessibility, but struggle with attractiveness due to lack of product-market fit or lack of push from regulatory/consumer side.*



**Non-cost benefits or improved performance** from low-carbon solution relative to the existing solution in place  
*e.g., early buyers in China driven by increased vehicle range and reliability of electric 2-wheelers*

**Supporting infrastructure.** Many low-carbon solutions require supporting infrastructure to be in place before large-scale adoption.  
*e.g., telecommunications infrastructure build-out enabling online services (e.g., ride-hailing, e-commerce)*

*Low-carbon solutions may also be accessible and attractive, but not yet affordable due to high technology price or lack of subsidy/incentive to switch.*

# WE PRIORITISE 6 SECTORS BASED ON GEOGRAPHIC RELEVANCE, GHG EMISSIONS REDUCTION POTENTIAL, GLOBAL IMPACT AND LOW-CARBON SOLUTION READINESS

Legend: ● HIGH ● MEDIUM ● LOW ● VERY LOW □ PRIORITY SECTORS















	POWER	2-/3-WHEELERS	BUSES	INDUSTRIAL HEAT	SHIPPING	MINERALS REFINERY	CEMENT	STEEL	RESIDENTIAL	FERTILIZER	LAND USE - DEFORESTATION	LAND USE - FOOD
<b>GEOGRAPHIC RELEVANCE<sup>1</sup></b>	HIGH Important for low-carbon economy	HIGH Current main mode of transport	HIGH Long-term solution for road transport	HIGH Cross-sectoral, incl. textile, F&B, pulp & paper	MEDIUM ASEAN is the intersection of many corridors	HIGH High growth, especially Philippines & Indonesia's reserve	HIGH Key industry for infrastructure	HIGH Key industry for infrastructure	MEDIUM High population numbers	HIGH Used for agriculture mainly by farmers	HIGH One of the largest forest covers globally	MEDIUM Big part of culture and economy
<b>GHG EMISSIONS (MTCO2E AND % TO TOTAL)<sup>1</sup></b>	675 25%	100 4%	70 2%	105 4%	65 3%	30 1%	135 5%	55 2%	50 2%	45 2%	575 22%	400 14%
<b>IMPACT TO GLOBAL ECONOMY<sup>2</sup></b>	▼	▼	▼	▲	▲	▲	▬	▬	▼	▼	▲	▼
<b>LOW-CARBON SOLUTION &amp; DEPLOYMENT READINESS<sup>3</sup></b>	Solar (VRE) + storage 10	Electric vehicles 10	Electric vehicles 10	Direct electrification 6-8	Green Ammonia for fuel 5	VRE + storage, Heat: direct electrification 8	No clear cut solutions ?	H2-based Direct Reduced Iron 6	Electrified Cooling 10	Green Ammonia 7	No clear cut solutions ?	Alternative Proteins 5

**Prioritisation rationale.** These 6 sectors have high regional socio-economic relevance, global trade impact, regional emissions contribution (cumulatively ~40% of ASEAN total), and the state of readiness of respective low-carbon solutions (e.g., solar & e-mobility).

Notes: 1) Emissions in 2020, approximate calculation from IEA and Systemiq analysis. ; 2) Relevancy is based on a) country's production within the sector and projected contribution to economic growth and strategic positioning in the global economy; 3) Larger number indicates better readiness and adoption status for the technology.



# ASEAN MUST FOCUS ON ACHIEVING ENABLING CONDITIONS IN POWER, ROAD TRANSPORT, AND LOW-TEMPERATURE INDUSTRIAL HEAT TO REACH RESPECTIVE TIPPING POINTS

SECTOR	EMISSIONS	RELEVANT COUNTRIES	SOLUTION IN FOCUS	SOLUTION STATUS	ENABLING CONDITIONS TO REACH MARKET	TIPPING POINT ENABLING CONDITIONS			NEXT STEPS
						AFFORDABILITY	ATTRACTIVENESS	ACCESSIBILITY	
 <b>Power (Group 1)</b>	25%		<b>Solar + storage</b>	Niche market	<ul style="list-style-type: none"> <li>More competitive LCOE</li> <li>Procurement adjustment</li> <li>Grid reliability &amp; flexibility</li> </ul>	Low barriers	High barriers	Improve efforts to reach tipping point	
 <b>Power (Group 2)</b>			<b>Solar</b>	Niche-to-mass market	<ul style="list-style-type: none"> <li>Achieve competitive LCOE</li> <li>Supportive policy</li> <li>Procurement adjustment</li> <li>Existing PPA restructuring</li> </ul>	Several barriers	High barriers		
 <b>2-wheeler in road transport</b>	5%		<b>Electric 2-wheelers</b>	Niche-to-mass market	<ul style="list-style-type: none"> <li>Sticker price</li> <li>Product-market fit</li> <li>Charging infrastructure</li> </ul>	Several barriers	High barriers	Clear blockers to reach tipping points	
 <b>Buses in road transport</b>	7%		<b>Electric bus</b>	Niche-to-mass market	<ul style="list-style-type: none"> <li>Competitive TCO across regions</li> <li>Risk-sharing business model</li> <li>Charging infrastructure</li> </ul>	Several barriers	High barriers		
 <b>Industrial heat (Low, &lt;150°C)</b>	2%		<b>Air-sourced Heat pumps</b>	Solution development	<ul style="list-style-type: none"> <li>Tech introduction</li> <li>Supportive industrial parks</li> <li>Streamlined VRE permitting</li> <li>More competitive LCOE</li> </ul>	Several barriers	High barriers	Improve efforts to reach tipping point	
 <b>Industrial heat (Med-high 150-600°C)</b>	2%		<b>Electro-thermal Energy Storage</b>	Solution development	<ul style="list-style-type: none"> <li>Tech introduction</li> <li>Streamlined VRE permitting</li> <li>More competitive LCOE</li> </ul>	High barriers	Several barriers		
 <b>Shipping</b>	3%		<b>Green ammonia</b>	Solution development	<ul style="list-style-type: none"> <li>Infrastructure, fuel production, ship engine readiness</li> <li>Regulatory &amp; market push</li> </ul>	High barriers	Several barriers	High barriers	Clear blockers to reach tipping points

Legend: ■ Low barriers ■ Several barriers ■ High barriers

# GREEN AMMONIA FOR FUEL IN SHIPPING

3% OF TOTAL ASEAN  
GHG EMISSIONS 2020

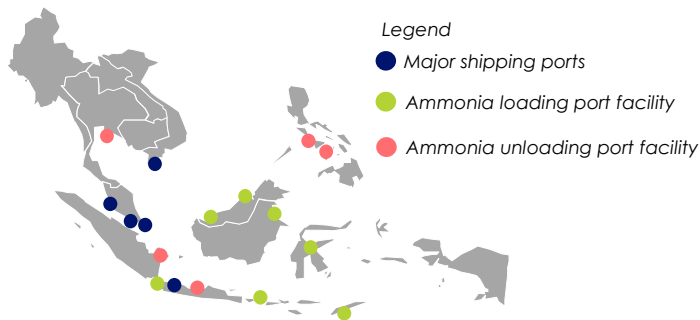
3%



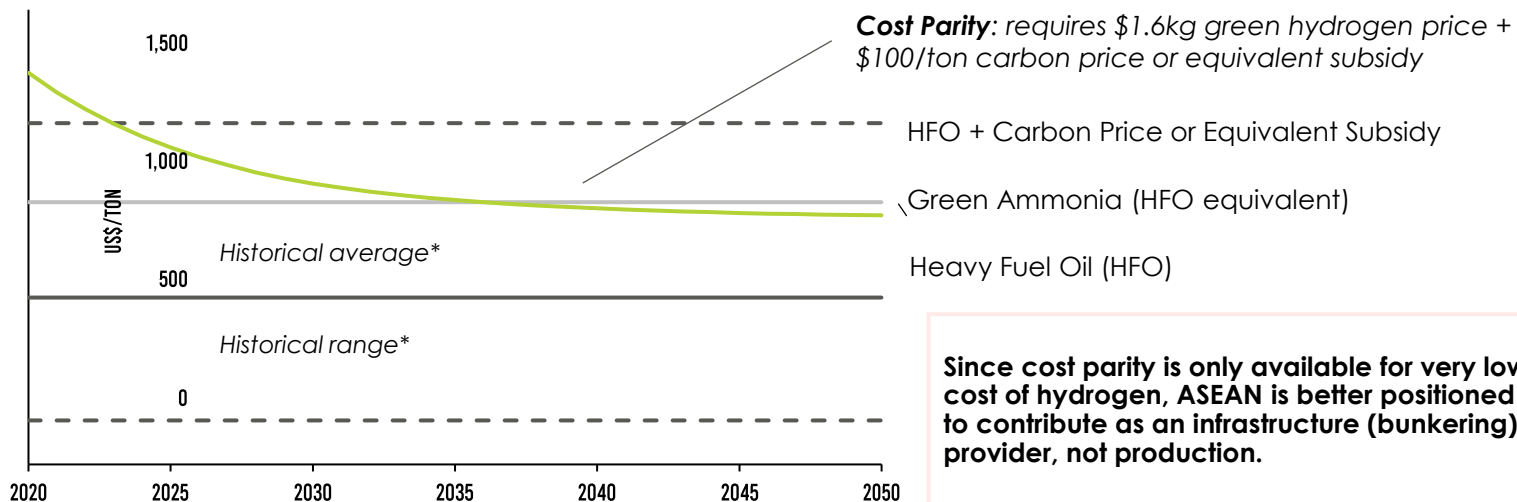
## SECTORAL CONTEXT

- Shipping accounts for 2 to 3% global CO<sub>2</sub>e emissions. ~85% from heavy/very-heavy ships (e.g., containers, dry bulk).
- Low-carbon solution focus will be on green ammonia as shipping fuel given energy density limits for electric ships & hydrogen.
- Green ammonia for shipping requires 4 aspects to be fulfilled: 1) Bunkering infrastructure; 2) Green ammonia production; 3) Ship engine development; 4) Handling safety.
- ASEAN's position in shipping corridors, existing ammonia infrastructure, and Singapore's 20+% share of global bunkering demand makes ASEAN significant for global shipping.

### KEY SHIPPING AND AMMONIA VALUE CHAIN LOCATION IN ASEAN



## TIPPING POINT LEVERS



Since cost parity is only available for very low cost of hydrogen, ASEAN is better positioned to contribute as an infrastructure (bunkering) provider, not production.

## TIPPING POINT STATUS

Legend:  Mostly reached  Reached in certain cases  Not yet reached

**TIPPING POINT 1**  
Cost of Green Ammonia (\$/ton) vs Heavy Fuel Oil

- Tipping point will be focused on the cost of green ammonia vs Heavy Fuel Oil.
- Since this solution is in development stage, the tipping point has not been reached yet.

## PROGRESS & NEXT STEPS

Legend:  Low barriers  Several barriers  High barriers

### PROGRESS

### KEY ACTIONS



- Policy adjustments:** Carbon tax for HFO usage in shipping.
- Green ammonia development.** Incentive for green corridor development, including ammonia bunkering and other technology investments.



- Policy and regulation adjustments.** Stricter regulation in ports related to pollution and emissions.
- Market incentive.** Green premium for ships using low-carbon or alternative fuel.
- Facilitate market coalitions for green shipping.**



- Facility readiness:** Improve bunkering capabilities.
- Ship design:** Accelerate manufacturing capabilities of green ammonia-fueled ships.
- Regulatory change:** Incorporate ammonia handling/usage in global safety standards and regulations.

# DIRECT ELECTRIFICATION OF INDUSTRIAL HEAT

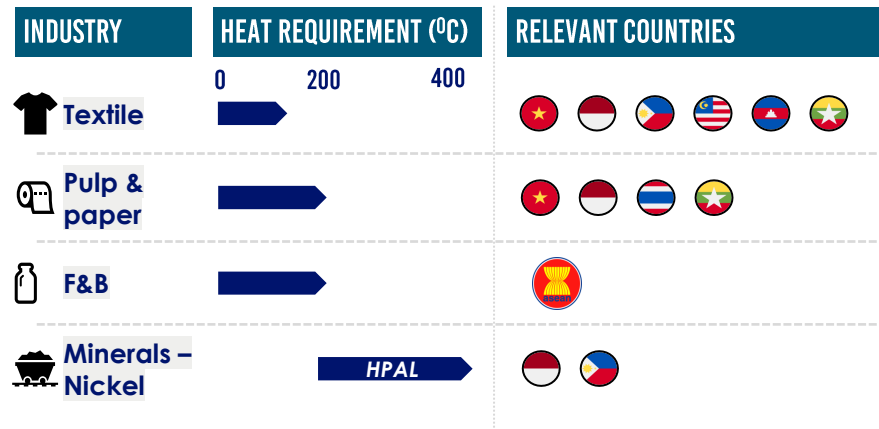
4% OF TOTAL ASEAN  
GHG EMISSIONS 2020

4%

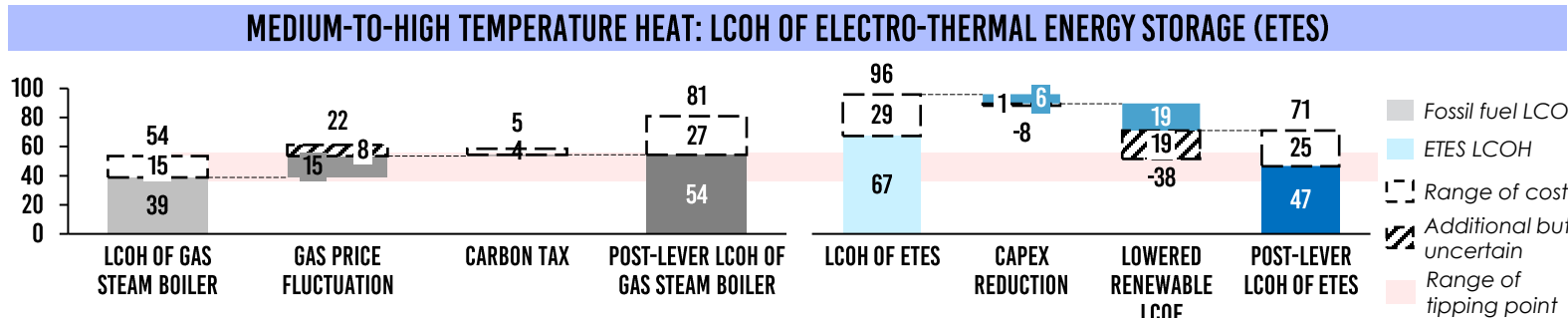
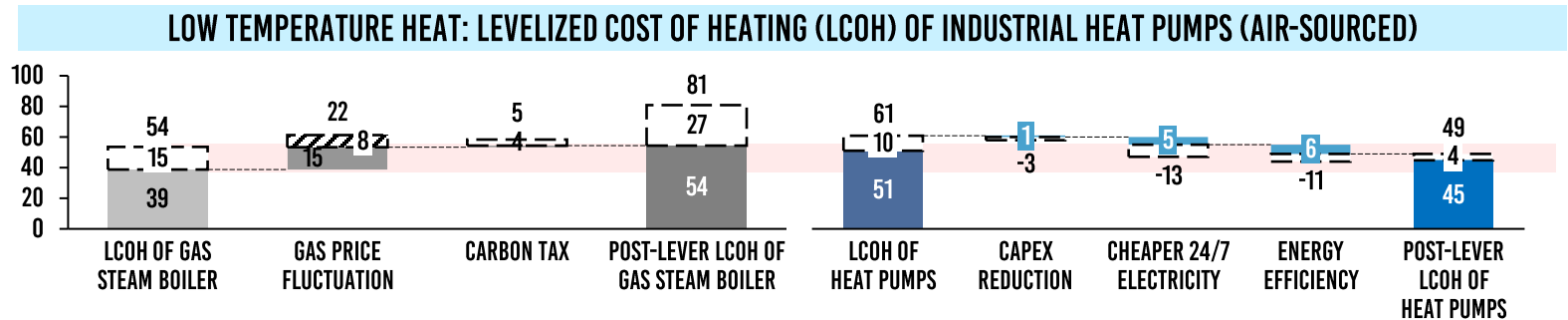


## SECTORAL CONTEXT

- Industrial heating accounts for ~50% final energy consumption (107 EJ), where coal (40%) is dominant.
- Focus of analysis is on direct electrification of heat.
- 2 solutions that were analysed: Heat pumps & Electro-Thermal Energy Storage (ETES)



## TIPPING POINT LEVELS



## TIPPING POINT STATUS

Legend: ✔ Mostly reached ⊙ Reached in certain cases ❌ Not yet reached

- LOW HEAT TIPPING POINT**  
LCOH of Heat Pumps < LCOH Gas for Low Heat
  - MED-HIGH HEAT TIPPING POINT**  
LCOH of ETES < Gas for Medium-High Heat
- Low-temperature heat has a closer path to the tipping point.** Determined by market conditions, particularly energy costs (i.e., coal/gas vs. electricity prices).
  - Medium-to-high heat through ETES has not yet reached tipping point** due to the technology's readiness (still early commercial deployment stage).

## PROGRESS & NEXT STEPS

Legend: ○ Low barriers ○ Several barriers ○ High barriers

- | PROGRESS   | KEY ACTIONS   |
|--|---|
| <span style="color: red;">○</span> AFFORDABILITY     | <ul style="list-style-type: none"> <li><b>Policy adjustment:</b> Preferential electricity price for clean heat or carbon taxation to support direct electrification of heat</li> <li><b>Financial support:</b> Grants, tax incentives, lending mechanism, and access to low-cost financing.</li> <li><b>Commercial pilot project</b> in ASEAN</li> </ul>  |
| <span style="color: orange;">○</span> ATTRACTIVENESS | <ul style="list-style-type: none"> <li><b>Policy adjustment:</b> Enabling power wheeling access to lower-cost PPAs from renewables developers."</li> <li><b>Energy efficiency or emissions standard:</b> Mandate to improve industry energy-efficiency standards.</li> <li><b>Market advocacy:</b> Key end-markets that are buyers of products from ASEAN (e.g., fashion brands buying textiles) should signal the need for low-carbon products.</li> </ul> |
| <span style="color: yellow;">○</span> ACCESSIBILITY  | <ul style="list-style-type: none"> <li><b>Increase reliability of grid:</b> To increase accessibility of heat pumps even in remote industrial locations.</li> <li><b>Accelerate technology introduction:</b> Soliciting OEMs should be courted to introduce tech in ASEAN.</li> <li><b>Industrial park electrification mandate:</b> Increasing uptake in electrification through industrial park managing entities.</li> </ul>                              |



# ELECTRIC 2-WHEELER IN ROAD TRANSPORT

4% OF TOTAL ASEAN  
GHG EMISSIONS 2020

4%



## SECTORAL CONTEXT

- **Electrification is faster in 2-wheelers than cars.** Sales of E2W accounted for 44% of new BEV sales last year, dominated by China. 20% of global 2W are in ASEAN.
- **Indonesia (47%), Vietnam (31%), Thailand (9%) are 2W hotspots,** accounting for **90%** of ASEAN 2W fleet.
- **Fleets are main driver in electrification.** Mass adoption from fleets, e.g., ride hailing or logistics, will be key in triggering scale needed for tipping point.
- **Penetration rate of E2W is not at expected rate.** Issues ranging from accessibility (e.g., charging stations, supplier capability for mass orders) and attractiveness (e.g., branding, product-market fit, charging time) persists.

## TIPPING POINT STATUS

Legend: ✔ Mostly reached ⊙ Reached in certain cases □ Not yet reached



**TIPPING POINT 1**  
TCO of E2W < TCO of ICE 2W/3W

- **This has been reached in major ASEAN countries.** Vietnam, Thailand, Malaysia, Philippines have reached this due to lower operational expenses subsidies and regulation.



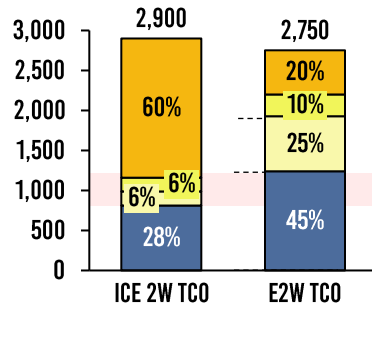
**TIPPING POINT 2**  
Sticker price of E2W < Sticker price ICE 2W

- **This tipping point can be viewed from cashflow perspective:** higher cashflow payments due to sticker price, even with similar financing costs, discourages mass market adoption.

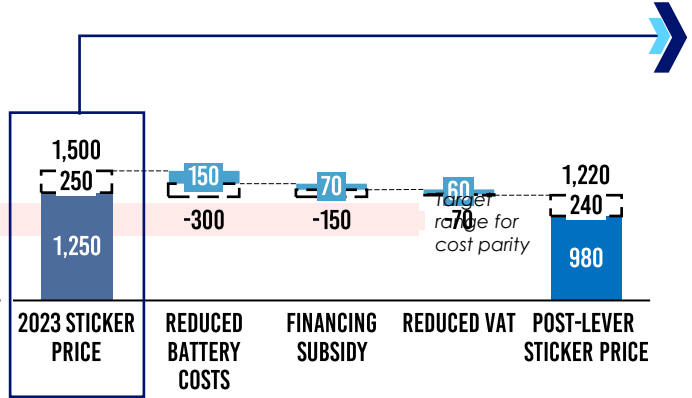
**Even though TCO has been reached, very high sticker price and financing cost inflates the payment terms that is not competitive and aligned with target market's cashflow status**

## TIPPING POINT LEVERS

5-YEAR TOTAL COST OF OWNERSHIP (TCO) FOR E2W VS ICE (\$)



MASS-MARKET STICKER PRICE E2W REDUCTION LEVERS (\$)



**Reduced battery cost could significantly help achieve sticker price parity, although more help from better financing rates will help increase attractiveness.**

■ Sticker Price ■ Financing Cost ■ Fuel & OM ■ VAT ■ Battery ■ Suspension ■ Electronics ■ Chassis ■ Range of cost

## PROGRESS & NEXT STEPS

Legend: ○ Low barriers ○ Several barriers ○ High barriers

### PROGRESS



- ❑ **Policy adjustment:** Introduce additional policy to incentivize E2W penetration to manufacturer, to further reduce costs.
- ❑ **Investment for battery:** Scale up battery production to obtain benefit from the economies of scale.
- ❑ **Improved financing costs:** Enable banks and lenders to reduce the cost of financing and lease rates.



- ❑ **Support R&D for OEM:** Develop domestic R&D achieve product-market fit and reduce manufacturing costs.
- ❑ **Introduce more incentives:** Identify non-cost incentives to further attract markets.
- ❑ **Improved financing costs:** Enable banks and lenders to reduce the cost of financing and lease rates.



- ❑ **Infrastructure advancement:** Enhance public charging infrastructure and electricity reliability.



# E-BUS IN ROAD TRANSPORT

2% OF TOTAL ASEAN  
GHG EMISSIONS 2020

2%



## SECTORAL CONTEXT

- **Electrification of public transportation** is important to reducing 5-7% of global emissions, and major cities has started the process.
- **Low penetration.** With a still growing bus fleet, penetration rate of E-buses in ASEAN is still quite low, estimated to be under 5%, even though ASEAN countries have E-bus manufacturing capability.
- In ASEAN, there are **2 tipping points**: 1) Total Cost of Ownership (TCO) of e-Bus < TCO of ICE Bus; and 2) Retirement of existing ICE Bus fleet.

## TIPPING POINT STATUS

Legend: Mostly reached Reached in certain cases Not yet reached



**TIPPING POINT 1**  
TCO of e-Bus < TCO of ICE Bus

- **1<sup>st</sup> tipping point has been reached in certain cases/regions**, due to lower fuel cost (electricity vs. fuel) and O&M.
- **Reduced sticker price and build-out of charging points** will be key in improving TCO of E-buses.

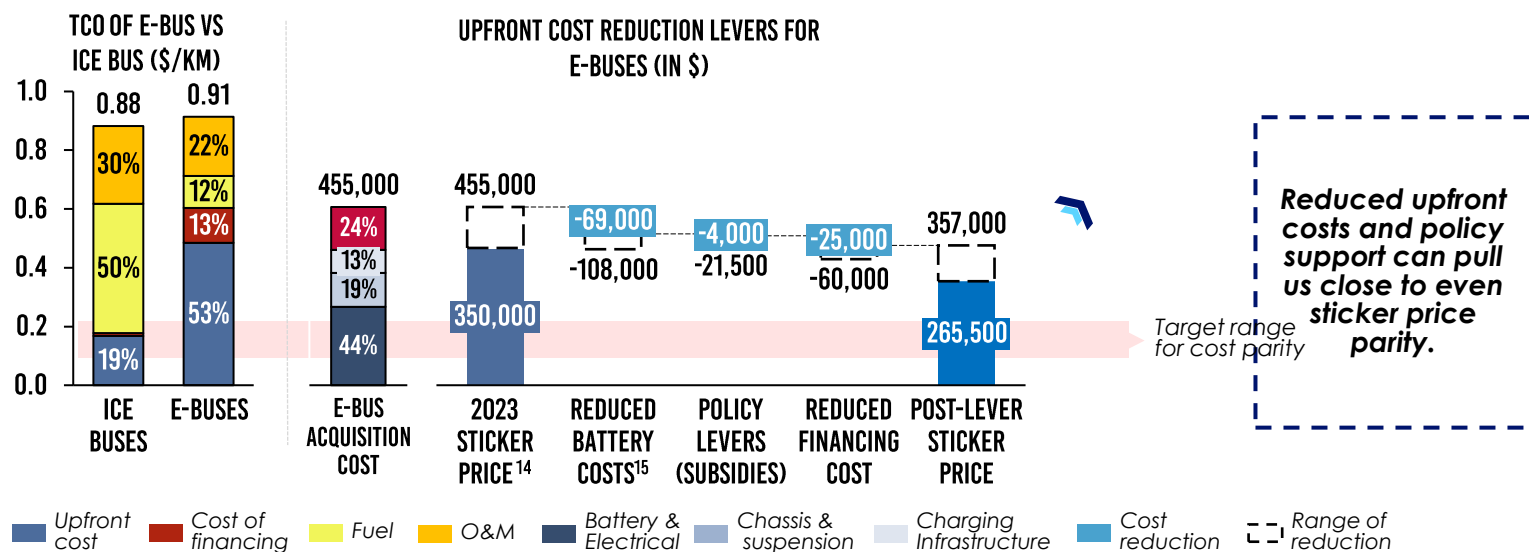


**TIPPING POINT 2**  
Early retirement of existing ICE Bus fleet

- Whilst this is not a socio-economic tipping point, operators with **younger ICE fleets has seen this as a barrier** for E-bus adoption.
- Resolving this issue is an important tipping point to **unlock large-scale adoption**.

*Even though TCO has been reached, very high sticker price and transitional changes such as behavioural and regulatory has been another non-cost barrier that is slowing down the uptake of electric buses*

## TIPPING POINT LEVELS



## PROGRESS & NEXT STEPS

Legend: Low barriers Several barriers High barriers

### PROGRESS

### KEY ACTIONS



AFFORDABILITY

- Policy adjustment:** Regulatory support (e.g., procurement process or permits for non-operators to contract with transport authorities) for innovative business models.
- Investment for battery:** Scaling up battery production to obtain benefit from the economies of scale.
- Innovative business financing:** Continued efforts to access carbon financing or set-up of financing facilities.



ATTRACTIVENESS

- Policy adjustments:** Regulatory support for innovative business models to be successfully implemented.
- Societal push:** Further strengthen the push for better air quality in metropolitan cities.



ACCESSIBILITY

- Policy adjustments:** <see above>.
- Innovative business model/financing:** <see above>.

# SOLAR & STORAGE IN POWER – COUNTRY GROUP 1

25% OF TOTAL ASEAN GHG EMISSIONS 2020

25%



## SECTORAL CONTEXT

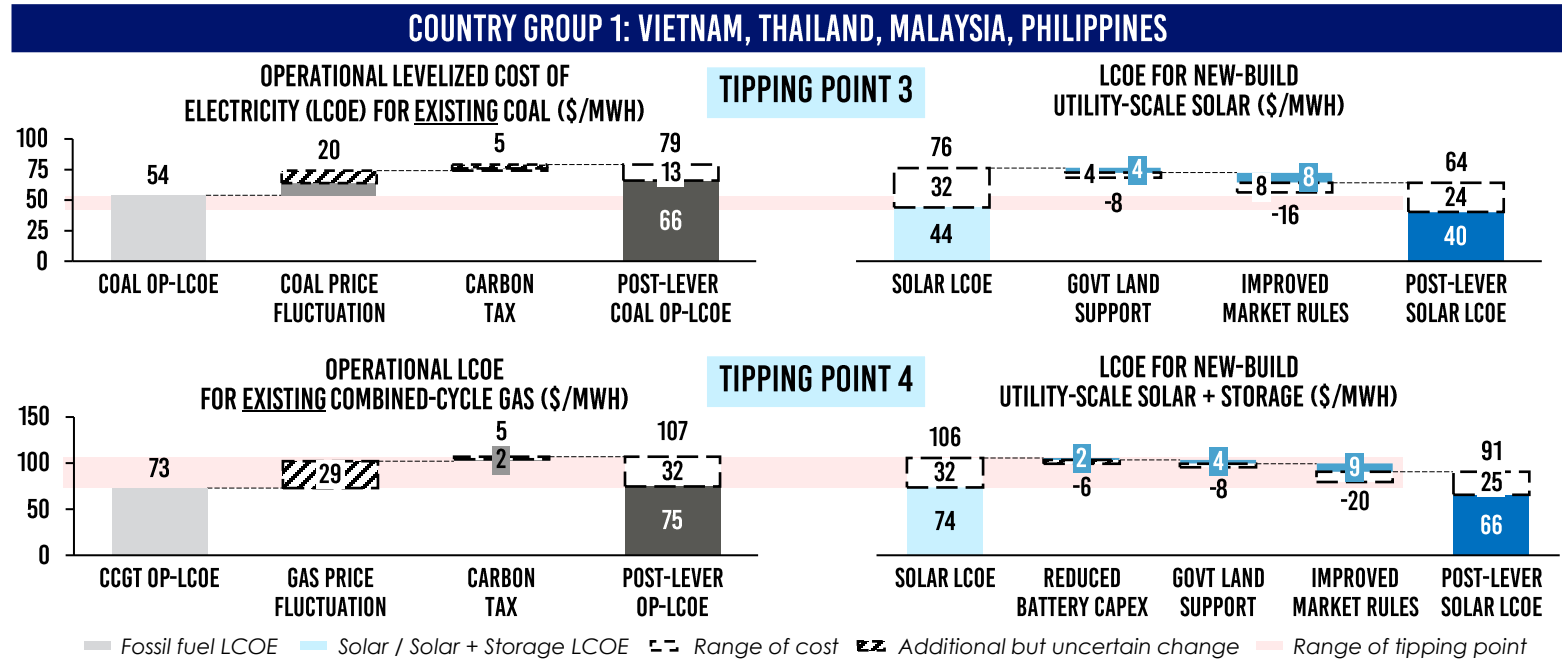
- Group 1** consists of countries with higher solar deployment (>1.5 GW), stronger enabling policy environment, more mature market (lower risk), and more ambitious VRE planning in its PDP\* (by 2030)
- Vietnam leads with 13% of VRE penetration** (Phase 3 of VRE integration), whereas the rest are still in Phase 1 (<5% VRE).
- Other countries in Group 1** may soon reach **Phase 2** (5-10% VRE) and must start planning investment in transmission & distribution to prevent near-future power system imbalance and curtailment.

## TIPPING POINT STATUS

Legend: ✔ Mostly reached ☉ Reached in certain cases ☐ Not yet reached

- ✔ **TIPPING POINT 1**  
LCOE of solar < **new** coal/gas  
 • **Tipping point 1 has been reached in Group 1 countries.** Coal moratorium is also in place in most of the countries.
- ☉ **TIPPING POINT 2**  
LCOE solar + storage < **new** coal/gas  
 • **Tipping point 2 has been reached in certain cases, especially against CCGT.** Against coal it may happen if there is no domestic price cap
- ✔ **TIPPING POINT 3**  
LCOE of solar < **existing** coal/gas  
 • **Tipping point 3 has been reached in Group 1, mainly due to coal and gas price fluctuation**
- ☉ **TIPPING POINT 4**  
LCOE solar + storage < **existing** coal/gas  
 • **Tipping point has not consistently been reached in ASEAN.** This is relevant particularly for Vietnam. High battery prices are the main barrier.

## TIPPING POINT LEVERS



## PROGRESS & NEXT STEPS

Legend: ● Low barriers ● Several barriers ● High barriers

### PROGRESS

### KEY ACTIONS



- Policy adjustment:** Set ambitious VRE deployment target to make full use of solar (+storage) tipping points.
- Procurement adjustment:** Utilize large-scale solar auctions to further bring down LCOE of solar (+ storage).



- Policy adjustments:** Plan for flexibility needs in the power system (toward net zero); Streamline rigid PPA renegotiation to unlock more system flexibility.
- Procurement adjustment:** Take benefit of the price discovery effect of reverse auction-based procurement.



- Investment for grid:** Attract foreign direct investments to further develop grid ability for increased renewable penetration.
- Infrastructure advancement:** Invest in new technology to improve grid connectivity and energy access.

# SOLAR & STORAGE IN POWER – COUNTRY GROUP 2

25% OF TOTAL ASEAN GHG EMISSIONS 2020 25%



## SECTORAL CONTEXT

- **Group 2** consists of countries with **lower solar deployment** (<500 MW), **less ambitious VRE planning**, **less mature market**, which resulted from **weaker enabling policy environment**.
- **All countries except Cambodia (4% VRE)** have <0.4% of VRE penetration. Each has its own specific barriers e.g., system overcapacity, carbon lock-in, rigid market, political instability.
- **Group 2 countries have existing technical flexibility** (via gas or hydro) to accommodate first 5% of VRE penetration without the need for deploying storage solutions.

## TIPPING POINT STATUS

Legend: ✔ Mostly reached ☉ Reached in certain cases ☐ Not yet reached

TIPPING POINT 1  
LCOE of solar < **new** coal/gas

• **Tipping point 1 has been reached in Group 1 countries.** This is still relevant for the group since coal moratorium is found only in Indonesia.

TIPPING POINT 2  
LCOE solar + storage < **new** coal/gas

• *Tipping point 2 is not relevant yet.*

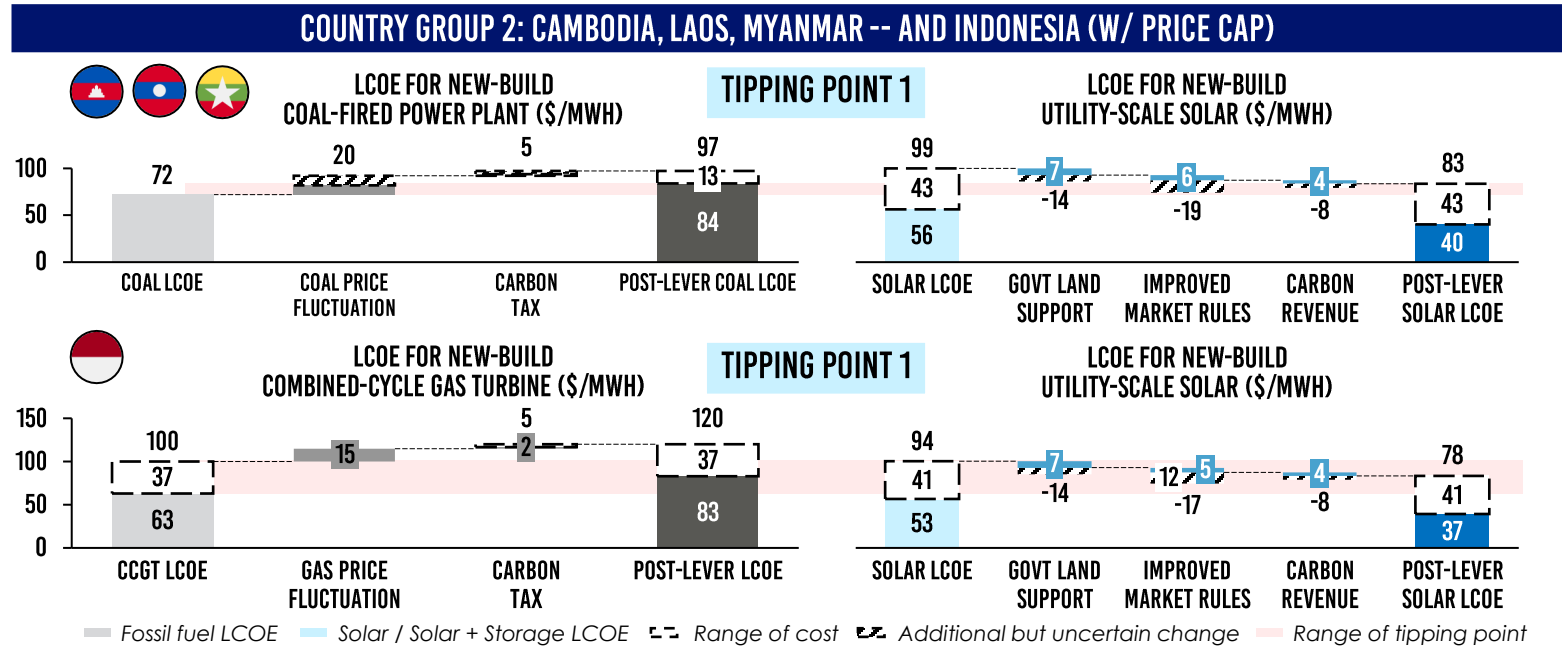
TIPPING POINT 3  
LCOE of solar < **existing** coal/gas

• **Tipping point 3 has been reached in Group 2**, mainly due to coal and gas price fluctuation, except Indonesia (due to domestic coal price cap)

TIPPING POINT 4  
LCOE solar + storage < **existing** coal/gas

• *Tipping point 4 is not relevant yet.*

## TIPPING POINT LEVERS



## PROGRESS & NEXT STEPS

Legend: ● Low barriers ● Several barriers ● High barriers

### PROGRESS

### KEY ACTIONS



- ❑ **Policy adjustment:** Plan a gradual phase down of fossil fuel subsidies to create a level playing field for renewables. Accelerated coal phase out financing will also help.
- ❑ **Market design adjustment:** Improve market rules by creating market certainty, improving fair allocation of risks for PPAs, and providing clear & consistent regulation.



- ❑ **Policy adjustment:** Streamlining national coal phase-out strategy and rigid coal PPA renegotiation to enable higher system flexibility.
- ❑ **Procurement adjustment:** Developing gigawatt-scale solar pipelines and design large-scale solar auction to bring down "local" solar LCOEs through economies of scale.

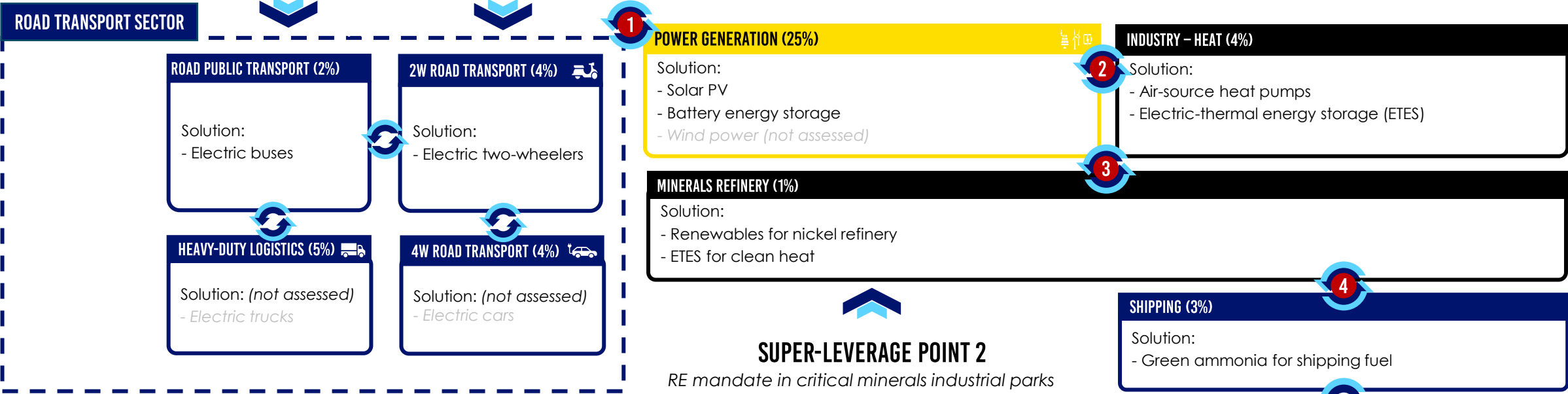


- ❑ **Policy adjustments:** Enable power wheeling to increase accessibility to renewable energy.
- ❑ **Transmission infrastructure investment:** Invest in improving transmission lines.
- ❑ **Interconnectivity improvement:** Accelerate interconnection execution to accelerate renewable build-out.

# TWO SUPER-LEVERAGE POINTS COULD TRIGGER A CASCADE OF TIPPING POINTS FOR ZERO-CARBON SOLUTIONS IN SECTORS ACROSS ASEAN

## SUPER-LEVERAGE POINT 1

Zero-emission vehicles mandate to two-wheelers and buses  
(30% ZEV mandate amounts to minimum of ~75 GWh battery demand)



## SUPER-LEVERAGE POINT 2

RE mandate in critical minerals industrial parks to increase uptake of low-carbon power & heat








### CROSS-CUTTING KEY ACTIONS:

- 1 Continue investments & development of battery industry
- 2 Develop local manufacturing capability for solar PV
- 3 Incentivize industrial park to push for clean electricity and direct electrification of heat
- 4 Identify potential Special Economic Zones to implement low-carbon technology

**LEGEND:**

- TRANSPORT (Blue box)
- INDUSTRY (Black box)
- POWER (Yellow box)
- FOOD & LAND USE (Green box)
- (X%) % OF ASEAN EMISSIONS
- CROSS-CUTTING ACTION (Red border)
- CROSS-INDUSTRY CONNECTION (Blue circular arrow)

# HOW BLENDED FINANCE COULD HELP CATALYZE THE TRIGGERING OF THE TIPPING POINTS

SECTOR	SOLUTION IN FOCUS	TIPPING POINT'S ENABLING CONDITIONS			INSTRUMENTS TO CATALYZE THE TRIGGERING OF THE TIPPING POINTS
		AFFORDABILITY	ATTRACTIVENESS	ACCESSIBILITY	
 <b>POWER</b>	Solar (VRE) + storage	GROUP 1			<ul style="list-style-type: none"> <li>- Technical assistance to support the low-carbon power system transition (VRE adoption or coal retirement)</li> <li>- Guarantees (e.g., first-loss mechanism) for VRE projects</li> <li>- Guarantees or concessional loans for power grids (T&amp;D) expansion or upgrade</li> <li>- Concessional loans/grants for early coal retirement (from philanthropic and public capital, i.e., MDBs)</li> </ul>
 <b>2-WHEELERS IN ROAD TRANSPORT</b>	Electric two-wheelers				<ul style="list-style-type: none"> <li>- Concessional loans for e-buses (mass) procurement and charging infrastructure</li> <li>- Technical assistance to support the government in creating the enabling policy and environment to attract investment</li> </ul>
 <b>BUSES IN ROAD TRANSPORT</b>	Electric bus				<ul style="list-style-type: none"> <li>- Grants/technical assistance for feasibility studies for low-carbon industrial heat projects</li> <li>- Grants for low-carbon industrial heat technology's proof-of-concept (R&amp;D)</li> <li>- Concessional loans for first-of-a-kind (FOAK) low-carbon industrial heat projects</li> <li>- Equity investment for early-stage technology providers/companies, especially for ETES</li> </ul>
 <b>INDUSTRIAL HEAT</b>	Industrial heat pumps				<ul style="list-style-type: none"> <li>- Concessional loans for green ammonia refueling and bunkering infrastructure (port)</li> <li>- Grants/technical assistance on supporting studies to accelerate green ammonia-fueled ships uptake (ship engine development and handling safety)</li> </ul>
	Electric thermal energy storage				
 <b>SHIPPING</b>	Green ammonia				<ul style="list-style-type: none"> <li>- Concessional loans for VRE + storage and/or ETES adoption and local grid upgrade</li> <li>- Innovative financing to accompany capital investment in green industrial parks</li> </ul>
 <b>INDUSTRIAL PARKS</b>	VRE + storage and ETES				

Source: Systemiq analysis. Notes: Company-level blended finance refers to the use of catalytic capital from public or philanthropic sources directly into the capital of a company (balance sheet). Typical instruments include equity investments, below-market loans, or credit guarantees. Project-level blended finance, on the other hand, refers to that same use of catalytic capital but at a project-level (usually through a special purpose company/vehicle) common in infrastructure projects, relying mostly on the viability of the cash flows of the project alone (project finance). The most common forms of project-level blended finance are guarantees and insurance.

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# THANK YOU

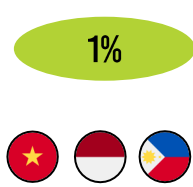
You can download our report here:





# SOLAR & STORAGE AND ELECTRIFICATION OF HEAT IN NICKEL REFINERY

1% OF TOTAL ASEAN GHG EMISSIONS 2020, MIGHT GO UP TO 5% IN FUTURE



ASEAN HAS WORLD-LEADING NICKEL RESERVE AND IS FOCUSING ON DOWNSTREAMING THE NICKEL INDUSTRY

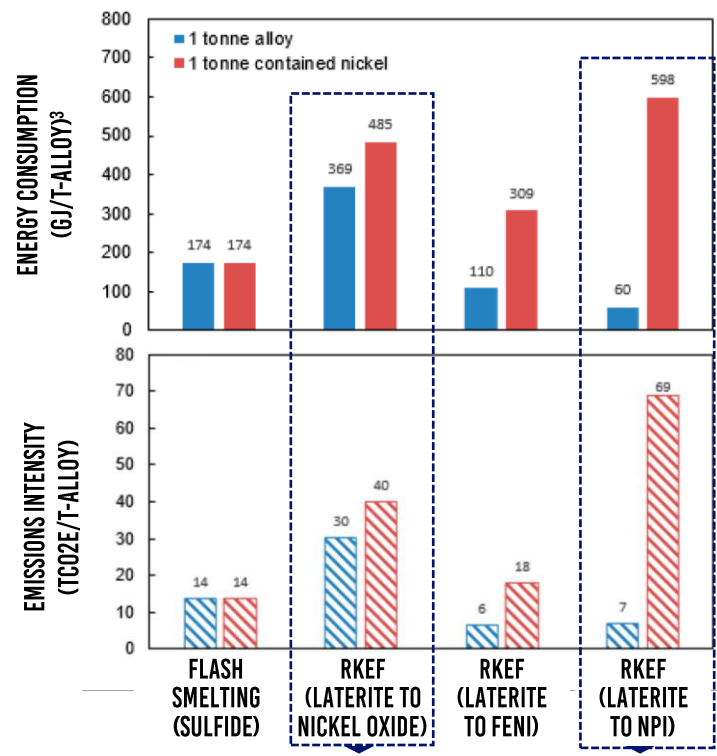
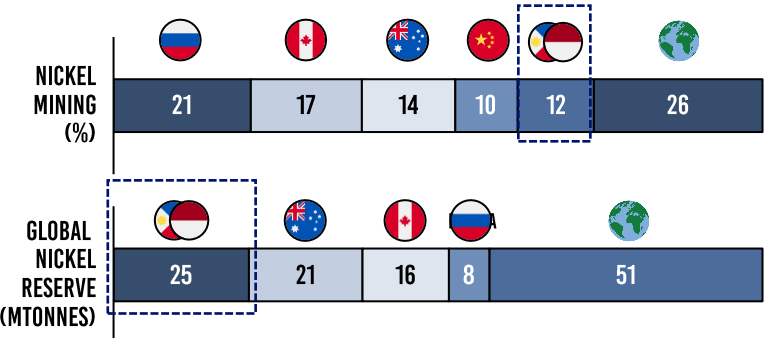
EXISTING NICKEL PRODUCTION IS ENERGY INTENSIVE, DUE TO HIGH ELECTRICITY & HEAT CONSUMPTION

INTEGRATING VRE IN NICKEL PROCESSING CAN CREATE UP TO 2.8 GW DEMAND OF VRE SOLUTIONS

- Nickel will be an important mineral for energy transition. Low-carbon technologies for the transition, especially batteries that use CAM technology, need Grade I Nickel<sup>1</sup>

LOW-CARBON TECHNOLOGY	NICKEL
UTILITY-SCALE BATTERIES	HIGH
EV BATTERIES	HIGH
EV CHARGERS	MODERATE
SOLAR PV	MODERATE
WIND	LOW

- Indonesia & Philippines are key players in nickel value chain. These 2 ASEAN countries has ~10% of global nickel mining and possess ~25% of global reserve.<sup>2</sup>



Current Grade I nickel processing in Indonesia is very energy and emissions intensive. Rotary Kiln Electric Furnace (RKEF) and Nickel Pig Iron (NPI) method, both of which are emissions intensive due to reliance on coal, are main methods for production.

- Using projected Nickel production routes, mandating renewables use can create ~1.7 to 2.8 GW demand for low-carbon solutions for power<sup>4</sup>, depending on scenario.

- With the right timing, Indonesia can further unlock enabling conditions for power and medium-to-high industrial heat, creating a cascading effect into the low-carbon solution ecosystem.

- Achieving low-carbon nickel production will also attract new markets, thus adding the potential of establishing green corridors to battery production regions (e.g., EU), creating cascading effect to the shipping sector.

Notes: 1) IFC (2022), Net Zero Roadmap for Copper and Nickel; 2) McKinsey (2020), How clean can the nickel industry become? and Bloomberg NEF; 3) Wei et al (2020), Energy Consumption and Greenhouse Gas Emissions of Nickel Products; 4) Systemiq analysis using assumptions: Class I Nickel through 50% RKEF-NiO and 25% RKEF-FeNi, at 23 MWh/tonne Ni

