



**CCG WORKING PAPER SERIES: E-MOBILITY
AND RENEWABLE ENERGY INTEGRATION**

ENABLING ENVIRONMENTS FOR E-MOBILITY AND RENEWABLE ENERGY INTEGRATION IN SOUTHEAST ASIA



AUTHORS: James Dixon ¹, Zhaoqi Zhou ¹,
Stephanie Hirmer ², Pamela Chiang³

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KEY MESSAGES

- No countries in the Southeast Asian region have specific transport sector greenhouse gas (GHG) emission targets in their Nationally Determined Contributions (NDCs) for the Paris Agreement. Singapore, Cambodia, and Thailand are the only Southeast Asian nations that have overall net zero GHG targets for 2050 or shortly afterwards.
- The switch to e-mobility is an important source of climate change mitigation as the demand for transport of people and goods continues to grow. Integrating new e-mobility with an expansion in renewables ensures that transport electrification delivers decarbonization and can foster sustainable growth in the region.
- This paper sets out **16 practical actions** to be taken by key stakeholders – governments, international organizations, financial institutions, and the private sector – in promoting enabling environments for e-mobility and renewable energy integration in Southeast Asia.
- Through these 16 actions, we point to the need for **(i) long-term policy planning** to increase the level of certainty afforded to business actors, **(ii) innovative financing** to de-risk investment in new technology, and **(iii) integrated governance** at all levels to break the silos between the transport and electricity sectors that are hampering the low-carbon transition.

AFFILIATIONS

1. Transport Studies Unit, University of Oxford, Oxford, UK
2. Energy and Power Group, University of Oxford, Oxford, UK
3. Transport Sector Group, Asian Development Bank, Manila, Philippines

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CRedit Author Statement

James Dixon (Conceptualization, Methodology, Formal analysis, Writing – Original draft, Writing – review & editing), *Zhaoqi Zhou* (data curation, formal analysis), *Stephanie Hirmer* (conceptualization, methodology, writing – original draft, writing – review & editing), *Pamela Chiang* (writing – review & editing)

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ABBREVIATIONS

ADB	Asian Development Bank	LMIC	Low- and Middle-Income Country
ASEAN	Association of Southeast Asian Nations	MDB	Multilateral development bank
BRT	Bus Rapid Transit	NGO	Non-governmental organization
CCG	Climate Compatible Growth	P2P	Peer-to-peer
EV	Electric vehicle	PPP	Public-private partnership
FCDO	Foreign, Commonwealth and Development Office	UNEP	United Nations Environment Programme
IO	International organization	V2G	Vehicle-to-grid

EXECUTIVE SUMMARY: PRACTICAL ACTIONS AND RESPONSIBILITIES FOR ENABLING ENVIRONMENTS TOWARDS E-MOBILITY AND RENEWABLE ENERGY INTEGRATION

In spite of the transport sector contributing approximately 16% of global emissions [1], only 8% of Nationally Determined Contributions (NDCs) to the Paris Agreement contain transport-specific greenhouse gas (GHG) targets as of November 2021 [2]. There are no countries in Southeast Asia with transport-specific GHG targets [3] (though some countries do have transport electrification and renewables growth targets).

Most transport decarbonization pathways worldwide rely on the parallel electrification of the majority of surface transport modes and growth in renewable electricity generation [4]. This process can be made to work more effectively through fostering links between the transport and electricity sectors, specifically by e-mobility and renewable energy integration [5].

This working paper sets out **16 practical actions** for key stakeholders – governments, international organizations, financial institutions, and the private sector – to aid in creating enabling environments for e-mobility and renewable energy integration, thus locking in *climate compatible growth* across the transport and electricity sectors in the region. As the paper is concerned with mechanisms supported by international organizations, the results presented have come from analysis of interviews with expert stakeholders across secretariats of the Asian Development Bank and the United Nations Environment Programme.

The practical actions are aimed at unlocking the enormous potential for win-win solutions – in terms of emissions mitigation, affordability, and reliability – across the transport–energy nexus as these sectors are brought together. By linking growth in e-mobility to growth in renewable electricity generation, solutions in this space can be sustainable and cost-effective.

Practically speaking, this relies on creating and maintaining enabling environments for integrated solutions to thrive. There are ways these environments can be promoted; in this paper, we aim to communicate that this depends on encouraging novel business models that are supported by the policy mix, green finance, and good governance. Accordingly, the practical actions are split across four categories: Business Models, Policy Mix, Green Finance, and Governance.





















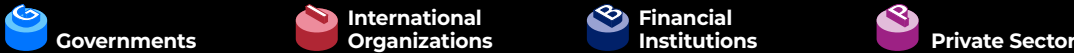
A recurring theme in this work surrounds the breaking of silos and the need to support cross-sectoral governance. Consistently, interviewees referred to breaking down the barriers resulting from the lack of coordination between government departments and the lack of development of co-dependent sectors as enablers to the low-carbon transition in both transport and electricity.

Of course, there are no one-size-fits-all solutions for a region as large and diverse as Southeast Asia. The practical actions are accordingly designed to be

general enough to work across regional and national contexts and would need to be contextualized depending on the country they are applied to.

Table 1 shows the 16 practical actions and associated responsibilities. Each practical action is backed up by data from the interviews, as described in Section 4.

Table 1: Roles and responsibilities of practical actions for creating enabling environments for e-mobility and renewable energy integration ¹

 BUSINESS MODELS	 POLICY MIX	 GREEN FINANCE	 GOVERNANCE
Establish the size of markets in e-mobility and renewable energy growth to attract private sector investment 	Develop long-term transport electrification and renewables growth strategies 	Provide concessional loans for potential e-mobility customers 	Align decarbonization policies across transport and electricity sectors 
Support business models based on bringing in disruptive low-carbon technologies 	Electrify government fleets and integrate with renewable energy 	Promote blended finance for integrated e-mobility and renewable energy projects 	Integrate management of projects across transport and electricity sectors 
Support integrated business models across e-mobility and renewables 	Include transport-specific targets in NDCs and establish national transport strategies to convert ambitions to policies on the ground 	Align finance streams (both costs and revenues) across e-mobility and renewable energy 	Support integrated governance of transport and electricity through inter-departmental integration 
	Develop standards for e-mobility and renewables integration at national and subnational levels 	Include financing commitments in long-term decarbonization strategies, including the need for international finance 	Support international working groups to address cross-sectoral challenges 
		Use green bonds to support integration of e-mobility and renewable energy 	
			

¹ **Governments** includes national and subnational public sector bodies. **International organizations** include multilateral development banks (MDBs, such as the ADB), intergovernmental organizations (such as the UN) and non-governmental organizations (NGOs). **Financial institutions** include retail banks, central banks, credit unions, investment banks, and insurance companies. **Private sector** refers to all other for-profit companies operating in this space.

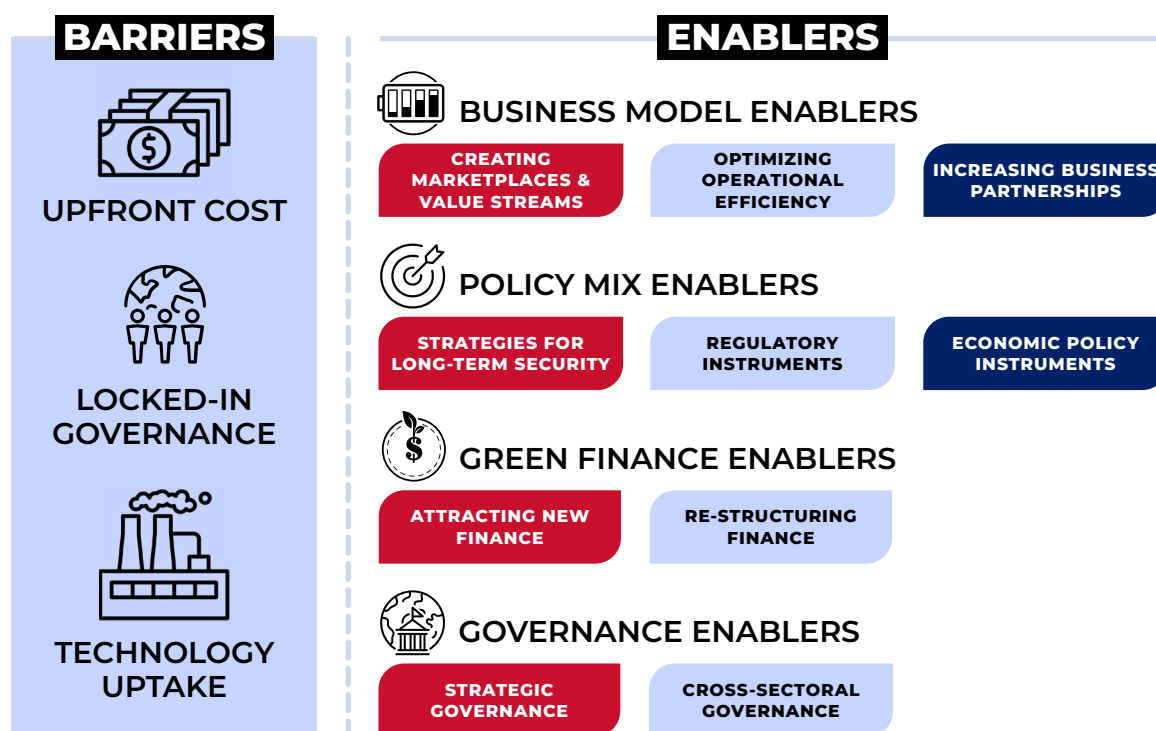
1 E-MOBILITY AND RENEWABLE ENERGY INTEGRATION

The aim of this working paper is to explore how relevant stakeholders can support enabling environments for the integration of e-mobility and renewable energy. It builds upon, re-contextualizes, and adds focus to the findings from the first working paper on e-mobility and renewable energy integration². In the first paper, a set of barriers to successful integration were identified and a framework of enablers for overcoming these barriers was developed [6]. This is

summarised in Figure 1. For more details, readers are referred to [6].

Deep and drastic cuts of greenhouse gas emissions are urgently needed from all sectors of the global economy to avoid irreversible climate and ecological breakdown. The majority of transport decarbonization pathways rely on two parallel activities: (i) the electrification of the majority of modes of surface transport, including road and rail, and

Figure 1: Barriers and enablers to e-mobility and renewable energy integration. Adapted from separate figures originally published in [6]



² The initial working paper was published in January 2022 and led by the Climate Compatible Growth (CCG) programme and supported by the Asian Development Bank (ADB). Its focus was on the results from a workshop carried out in October 2021 involving 27 stakeholders from CCG, ADB, and UK Foreign, Commonwealth and Development Office (FCDO).

even short-distance shipping and aviation; and (ii) significant growth in renewable electricity generation [4]. Making this work effectively will require the interaction of two previously siloed sectors: electricity and transport [5].

E-mobility and renewable energy integration means linking the growth of electrified transport with growth in renewable electricity generation and the elimination of fossil fuels. This can help support countries' transition to low-carbon, low-cost, and high-reliability transport-energy systems (**Figure 2**) because:

- i. Electric vehicles (EVs), including 2- and 3-wheelers, passenger cars, mini-buses, buses, and trains, can act as an 'anchor load' for power systems [7]. This can create a new and consistent electrical demand that incentivizes the development of generation and grid infrastructure, thus improving the

ability of the power system to provide a reliable supply. Payments can be ring-fenced and secured, de-risking investment [5].

- ii. The flexibility of charging demand, whether this be done via battery swap stations or EV charge points, naturally favours low-cost variable renewable energy like wind and solar [8] as it can maximize the utilization of these sources when supply is high or other demands are low [9]. EV charging can respond in real time to the needs of a grid, providing an integrated system with improved stability and quality of supply [9–10].

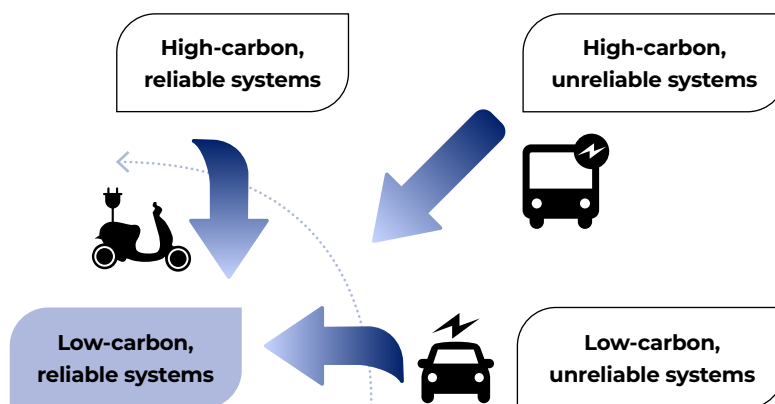
E-mobility and renewable energy can be integrated at the same time and place, such as a battery swap stations providing electricity storage capacity for local solar generation, or they can be brought together at a higher level, such as by

Figure 2: Effective e-mobility and renewable energy integration as a pathway from high-carbon, unreliable power systems to low-carbon, reliable power systems (originally published in [6])

EFFECTIVE E-MOBILITY/RENEWABLE ENERGY INTEGRATION

CAN REDUCE CARBON EMISSIONS

- Flexible anchor load **incentivizes** installation of renewables
- Controlled charging can **maximize utilization** of variable renewables



CAN INCREASE RELIABILITY

- Increased electricity demand **incentivizes** grid development
- Electric vehicles used as **storage**

when parked can provide backup power in unreliable systems and help smooth out peaks and troughs in renewable electricity supply

linking supply chains and financing for e-mobility and renewable energy projects.

Southeast Asia has significant potential for renewable energy production, and all Association of Southeast Asian Nations (ASEAN) countries (Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam) have targets to increase the share of renewable generation in their electricity mixes [12]; the ambition

of these targets ranges from 3% of electricity generation from solar in Singapore by 2030 [13] to 62% from all renewable sources in Myanmar by the same year [14]. As well as a growing policy backbone in setting transport electrification targets across ASEAN countries, more countries are seeing expansion in e-mobility, including the development of electric bus rapid transit (BRT) systems in Lao PDR [15] and the rapid expansion of the electric 2-wheeler market in Viet Nam [16].

Table 2 Renewable electricity and electric vehicle adoption/ ICE phase-out targets by ASEAN country (as of 2022)

COUNTRY	RENEWABLES TARGET	ELECTRIC VEHICLE ADOPTION/ICE PHASE-OUT TARGET
Brunei Darussalam	10% of generation mix from renewables by 2035 [17]	60% sales of new vehicles to be electric by 2035 [18]
Cambodia	20% of generation mix from renewables by 2023 [19]	40% of car/bus fleet, 70% of 2-wheeler fleet to be electric by 2050 [20]
Indonesia	23% of generation mix from renewables by 2025 [21]	Uptake targets of 2,200 electric cars and 2.1 million electric 2-wheelers by 2050 [22]
Lao PDR	30% of generation mix from renewables by 2025 [23]	1% of vehicle sales to be electric by 2025, rising to 30% by 2030 [24]
Malaysia	31% of installed capacity renewable by 2025 [25]	No specific target (EV roadmap to be announced in 2022 [26])
Myanmar	62% of generation mix from renewables by 2030 [14]	No specific target
Philippines	35% of generation mix from renewables by 2030 [27]	No specific target
Singapore	3% of generation mix from solar by 2030 [13]	Phase-out of ICE vehicles by 2040 [28]
Thailand	30% of generation mix from renewables by 2036 [29]	Phase-out of ICE vehicles by 2035 [30]
Viet Nam	21% of installed capacity renewable by 2030 [31]	No specific target

While there is widespread recognition regarding the issues that hinder the uptake of EVs, there is a need

to better understand how these may be overcome. This is explored in the sections that follow.

2

VIEWS FROM EXPERT STAKEHOLDERS. SEMI-STRUCTURED INTERVIEWS AND ANALYSIS

The results in this paper are based on a set of 6 expert stakeholder interviews with staff of the Asian Development Bank (ADB) and United Nations Environment Programme (UNEP) across specialisms including transport, energy, investment, private sector financing, and public-private partnerships (PPPs)³.

In each interview, lasting between 45 minutes and 1 hour, questions centred around the barriers and enablers relating to e-mobility and renewable energy integration in Southeast Asia, and how practical actions may be developed in establishing successful integration. The interviews were semi-structured in nature and were broadly guided by the following questions (additional questions were added based on the discussion):

1. What do you see as the greatest barriers to integration of e-mobility and renewable energy in Southeast Asia?
2. What do you see as the greatest enablers to overcome these barriers?
3. How much do you communicate with your counterparts across i) other departments within your international organization⁴, ii) the private sector, and iii) the public

sector concerning integration of e-mobility and renewable energy in Southeast Asia?

4. What is the role of international organizations, such as ADB and UNEP, in establishing integration of e-mobility and renewable energy in Southeast Asia?
5. Are you aware of any case studies in the region where growth in electricity demand (whether from e-mobility or not) has been used to promote growth in electricity system infrastructure? If so, please give a brief description of these case studies. What were the barriers in each case, and how were these overcome?

The interviews were transcribed for analysis, and coded thematically (known as deductive coding) based on the barriers and enablers shown in **Figure 1**. Analysis of the interviews is used to support the arguments made in this paper. Direct quotes are given where relevant, though all names and references to specific individuals and companies are removed to protect the participants' identity.

The interviews were conducted by research staff at University of Oxford during the period of February and March 2022.

³ PPP refers to an arrangement between public and private sector organizations used to finance investments.

⁴ This was phrased as ADB for ADB staff and UNEP for UNEP staff.

3

REVISITING THE BARRIERS TO AND ENABLERS FOR EFFECTIVE E-MOBILITY AND RENEWABLE ENERGY INTEGRATION: THE SOUTHEAST ASIAN CONTEXT

The interviews were coded according to the barriers and enablers in Figure 1. The central pie chart in **Figure 3** show the number of mentions of each barrier category across all the interviews. It is shown that locked-in governance (23 mentions) is by far the most mentioned barrier, compared to upfront cost (13), technology uptake (12), and other barriers (4), which may suggest that it is viewed as the most significant. Specific barriers under each category are identified in Figure 3, each with supporting quotes from the interviews.

Figure 3: Barriers to e-mobility and renewable energy integration in Southeast Asia: analysis from interviews with expert stakeholders. The central pie chart shows the number of mentions of each barrier type in all interviews.

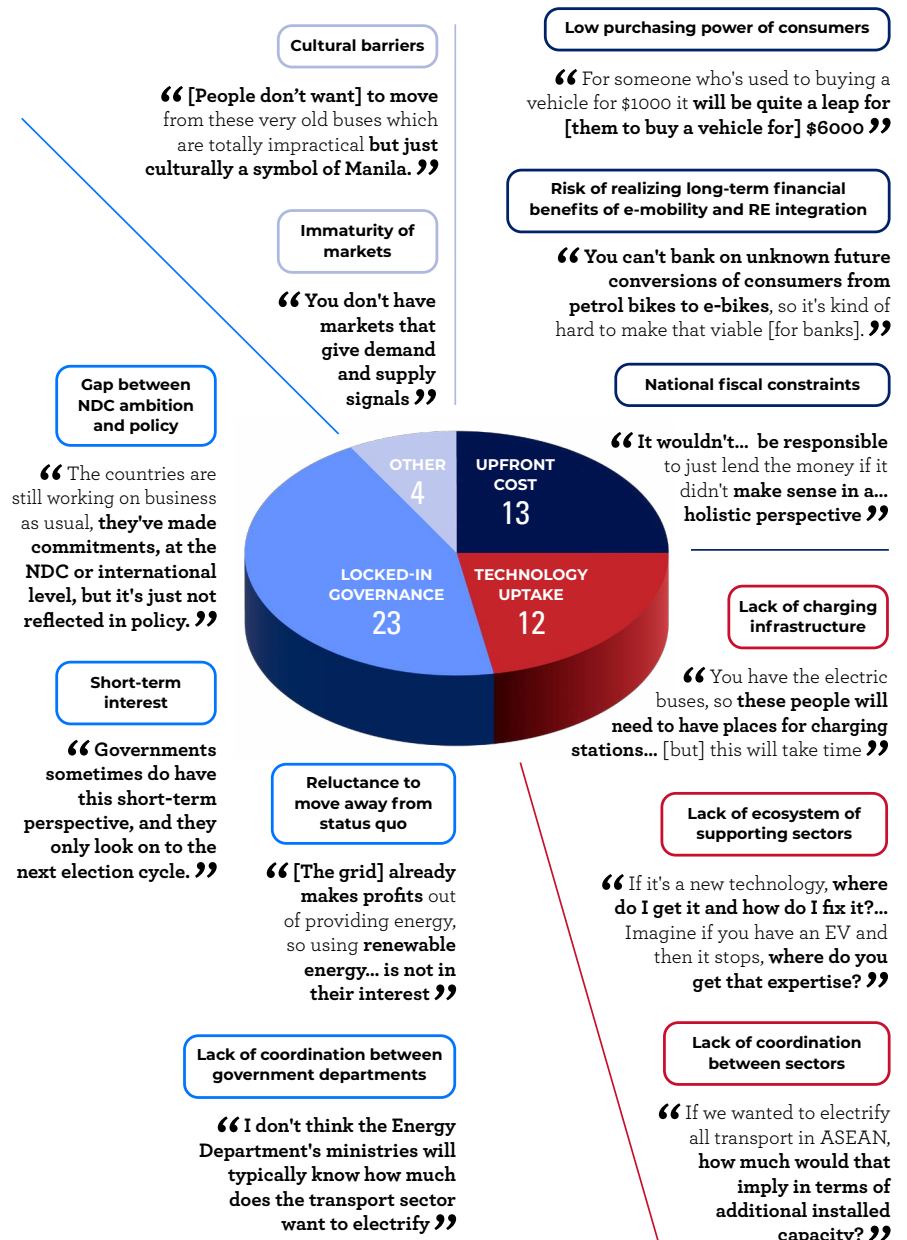
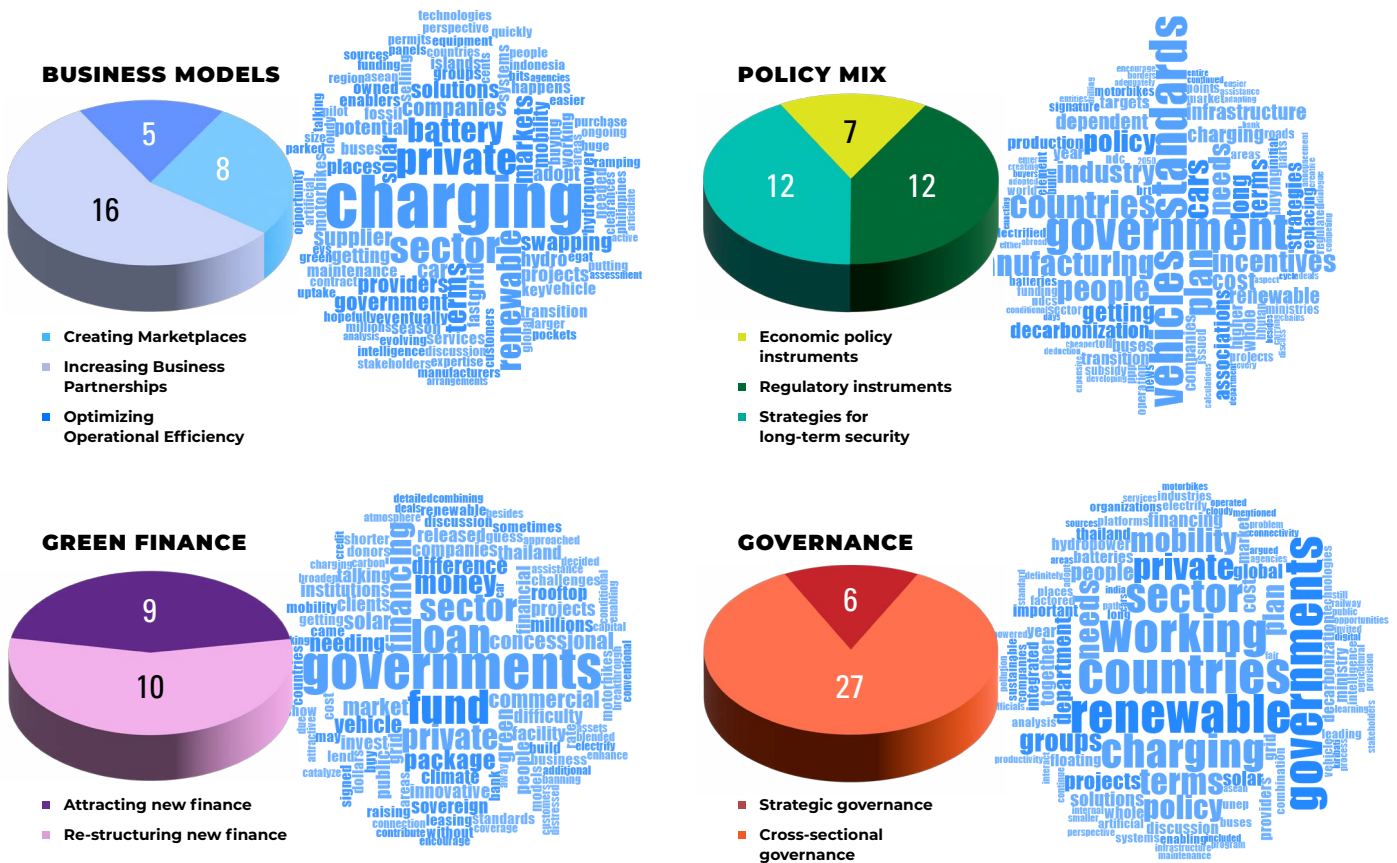


Figure 4 shows analysis of the interviews by the classifications of enablers identified in Figure 1 (the enablers are broken down into further subcategories; the rationale for this is explained in the first working paper [6]). The word clouds are included to portray the main topics of conversation under each enabler category (synonyms are included). With 33 mentions, governance was the

most-mentioned category of enablers, compared to policy mix (31), business models (29), and green finance (19). Within the categories, the subcategory of cross-sectional governance was mentioned 27 times across all interviews. This reinforces the key message that a recurring theme in these interviews centred around breaking down silos between sectors.

Figure 4: Enablers for e-mobility and renewable energy integration in Southeast Asia: analysis from interviews with expert stakeholders (clockwise from top-left: business models, policy mix, governance, green finance). The pie charts show the number of mentions of each enabler type by number



From analysis of the interviews, we identify a set of 16 practical actions for creating enabling environments. These actions expand on those from the previous working paper: Making e-mobility and renewable energy integration work in Asia and the Pacific [6]. These are presented in the next

section according to the relevant enabler categories (business models, policy mix, green finance⁵, and governance). See Figure 1 in the Section 1 for a mapping of this. Each practical action identified is discussed and supported using direct quotes from the interviews.

⁵ In this article we use 'green finance' to refer to finance that supports decarbonization pathways.

4

PRACTICAL ACTIONS FOR CREATING ENABLING ENVIRONMENTS: A RECURRENT THEME IN BREAKING SILOS

4.1 BUSINESS MODELS

Establish the potential size of markets in e-mobility and renewable energy

It was widely recognized amongst interviewees that bringing in private sector investment can unlock economic growth in both the e-mobility and renewable energy sectors. However, without knowledge of the size of the market – for example, the demand for electric motorcycles expected in a given region over a specified time period and the corresponding growth in electricity demand (and potentially storage provision) from those electric motorcycles – it is difficult to make a business case for investment in any emerging business models. Interviewees point to a need to understand the potential market size:

*“What’s the **size of the market** and what’s the **overall potential** here. That’s what we’ll probably get **manufacturers or suppliers excited** about it. So, an **assessment of that would be useful.**”*

Getting “manufacturers or suppliers excited” is clearly viewed as an impetus for growth in this sector. As another interviewee explains, the perception of value of these business cases from the point of view of investors is important:

“for that Big Bang kind of transition to happen you need to be able to get the key stakeholders to see value in this.”

Interviewees also highlighted the potential positive reinforcement effect offered by private sector involvement in promoting public sector involvement:

*“the larger markets [are] driving this because **larger and more mature markets will have an active vibrant private sector.** There will be competition, there is transparency, and therefore the government will always look at this from a perspective of **‘if this is something that the private sector can deliver, let them do it.’**”*

Support business models based on bringing in disruptive low-carbon technologies

Business models centred around the introduction of new and disruptive technologies were frequently mentioned. In e-mobility and renewable energy integration these technologies have two key aspects: grid-side solutions, such as smart charging, vehicle-to-grid (V2G)⁶, and peer-to-peer (P2P)⁷ energy trading;

⁶ V2G refers to a controlled two-way flow of electricity from/to an EV to/from a power grid.

⁷ P2P refers to the buying or selling of energy between consumers without the intermediation by a third party (such as an energy supplier).

and mobility-side solutions, including shared mobility^a and the use of artificial intelligence in predicting the movement of vehicles around a city or region (and thus the location and timing of both electricity demand and potential storage from vehicle batteries). Bringing these technologies together in innovative business models that support the integration of these sectors was seen as a way of advancing innovations to market, as emphasized by two interviewees:

“a lot of charging [happens] at peak hours, and so [there is value in using] **smart technologies** to smooth that out. So, there's going to be a **two-way communication between the supply and demand** and some kind of **optimization**.”

“There [are] a lot of projects increasingly that are looking at the **combination of renewables but also digital technologies and artificial intelligence**.”

Support integrated business models across e-mobility and renewables

Business models can integrate revenue streams across the e-mobility and renewable energy sectors to improve the financial viability of solutions.

One such business model is battery-as-a-service (or battery leasing), in which the customer buys only the vehicle shell upfront and enters a rental contract to pay for the battery over a longer period. These rental contracts typically include servicing of the batteries. As highlighted by one interviewee, these business

models can be used to incentivize EV uptake:

“the company that we're studying in Viet Nam... [is using] the **battery leasing model**. This is frequently used as incentive for the customer to **buy an EV upfront and then incur battery cost later on during the use [of the EV]**.”

Battery-as-a-service naturally lends itself to battery swapping solutions. Battery swapping stations for electric scooters have been hugely successful in the Gogoro network in Taipei [32] to encourage uptake of e-mobility. In integrating revenue streams across the e-mobility/electricity divide, these battery swap stations are also used to provide grid services via Vehicle-to-Grid (V2G), supplying energy from the battery swap stations to the grid when those batteries are not being used by customers for transport [33]. One interviewee was quick to point out the co-benefits of battery swap infrastructure in being able to i) better optimize the power flows to and from multiple batteries at a single point source (rather than a distributed set of individual batteries) and ii) better manage the collection and recycling of batteries:

“[In a battery swapping system] you can **ensure the batteries are better managed**... It's also easier to manage all the **recycling and collection of these batteries**.”

For the integration of revenue streams in business models to work, solutions must be viewed through the lens of the consumer. This was well articulated by one of the interviewees:

^a Shared mobility – “the shared use of a vehicle, bicycle, or other mode – is an innovative transportation strategy that enables users to gain short-term access to transportation modes on an “as-needed” basis.” The term shared mobility includes transport sharing such as carpooling and transit services such as paratransit. [35]

“It’s really about trying to not look at solutions with the lens of a single sector but trying to understand this in terms of what does it mean for the end customer who is going to be using that service? It is not just about buying a vehicle but what’s the value chain like, who’s going to produce it, who’s going to service it, how to charge it.”

For these business models to be effective, they need to be supported by the policy mix, green finance, and governance, which are discussed next.

4.2 POLICY MIX

Develop long-term transport electrification and renewables growth strategies

Interviewees consistently stressed the importance of creating long-term strategies to de-risk companies’ business planning in the e-mobility and renewables space (this is related to companies’ ability to assess the size of potential markets, as earlier discussed). This could include businesses that offer charging facilities, battery swap stations, or shared mobility platforms. This raises a number of interesting questions as this one interviewee highlights:

“In a lot of countries electrification of transport is going to cause a flip in terms of demand, unlike the typical [historical] organic growth... How will your entire system of generation, transmission, and distribution react? Does it get reflected in a 5-year plan or a 10-year plan, or a 15-year plan in terms of what needs to be [built] to meet that demand?”

Establishing long-term transport electrification and renewable energy growth plans enables longer-term planning and helps predict how the market might respond, which is relevant for business model design. International organizations (IOs) – including multilateral development banks (MDBs) such as the ADB and intergovernmental organizations such as UNEP – have an important role to play in this. They support national decarbonization roadmaps, undertake market analysis, and help with the development of long-term strategies (where help is needed). This is particularly relevant where countries are heading into uncharted territory such as the decarbonization of transport, which is relatively new.

Electrify government fleets and integrate with renewable energy

Interviewees also identified the introduction of EVs into government fleets as a practical step that could be taken to pilot and promote e-mobility. This can help to kick-start the market and is already evident in some countries, as this interviewee highlights:

“In larger markets, in India, China, and Bangladesh, you’re seeing a lot more obvious push towards getting government fleets to electric vehicles, so that’s kind of helping build some kind of initial momentum.”

It should be noted that this requires careful planning. If e-mobility is to be rolled out in government fleets as part of their role in kick-starting the transition to EVs, then it is imperative that there

is enough infrastructure (in terms of electricity generation and transmission and EV charging equipment) to facilitate roll-out.

Include transport-specific targets in NDCs and establish national transport strategies to convert ambitions to policies on the ground

Including transport-specific targets in countries' NDCs is a vital step for the sector's decarbonization. For countries that at least mention transport in their NDCs – such as in vehicle electrification targets – there is often a disconnect between these ambitions and lacklustre or non-existent policies [34]. Interviewees identified that ambitious NDCs must be translated into effective policies on the ground, including setting out how much international financial support is needed for their realization:

“There needs to be a *policy dialogue of all these things that they've put in their NDCs, how they're going to implement them, where do they need funding from abroad, because some of these things are conditional on getting that funding from the developed countries.*”

Develop standards for e-mobility and renewables integration at national and subnational levels

Finally, the development of standards – particularly for charge points, communications, and grid-side operation – was highlighted as imperative in ensuring that the integration of e-mobility and renewable energy works effectively and does not produce

unwanted emergent behaviours. This was categorized as a regulatory instrument that can de-risk companies' business plans, but it was highlighted in the context of helping a system with a high amount of renewable energy deal with variation in energy supply:

“Charge points and so on, all of these things have *associated standards... I think we're going to need some kind of smart element to be able to manage this adequately once we have systems getting closer to 70 or 80% renewable energy resources.*”

4.3 GREEN FINANCE

Provide concessional loans for potential e-mobility customers

Interviewees spoke about working with local banks to provide concessional loans to stimulate e-mobility and renewable energy growth and to highlight the benefits to providing loans in this growth area:

“People need to get loans to get these *[electric] motorbikes and maybe [we could be] working with some of the local commercial banks to offer lower interest loans.*”

It was also highlighted that MDBs could help local banks carry the risk of offering loans within these new, emerging sectors (including to customers with low credit ratings). It was suggested by one interviewee that if initial loans (provided by local banks but supported by MDBs) were successfully repaid, the mindset of local banks in providing these loans could change for the better:

“MDBs can also help the local banks to start being able to finance these new areas that [the banks] probably wouldn't. ... So, we need to change that mindset and once there is a breakthrough and there is regulation to support them, that tends to happen.”

While this was suggested, it should be pointed out that local banks, particularly across many Low- and Middle-Income Countries (LMICs), may lack the knowledge base to deal with high-risk investments in new technology and innovations.

Promote blended finance for integrated e-mobility and renewable energy projects

Interviewees consistently mentioned working with financial institutions, banks, and governments in promoting blended finance¹⁰, with the objective of bringing in donors, climate finance, and the private sector to release associated capital for investment. One interviewee articulated the goal of international organizations (IOs) in promoting blended finance:

“ [IOs] can work with other development organizations with donors to bring that money to the government and support them and their policies... and trying to bring in the private sector.”

Other interviewees talked about specific country case studies or organizations who could be brought into blended finance options designed by the ADB:

“ if you're talking about millions of dollars of investment for Lao PDR or for

Thailand, then we can't do it without the private sector, so that's where [MDBs] can come in.”

“ We try to bring a number of stakeholders to bring through blended finance so we can bring some money from the Green Climate Fund, some from donors like the UK, and IO money to structure it in a way that can support the government's needs.”

One interviewee suggested that IOs could help build a pipeline of projects, built on blended finance, that could be offered to a conglomerate of financial institutions and banks to increase the attractiveness of investment:

“ we [could] try to help the banks build a pipeline of projects by setting up a facility maybe, or a number of banks to get together to set up a facility. It can then finance e-mobility and renewable energy.”

Align finance streams from e-mobility and renewable energy

It was identified that aligning finance streams (both costs and revenues) for e-mobility and renewable energy can serve to broaden capital markets, increasing the appeal for banks, governments, and private sector companies. As one interviewee states:

“ as an international player, we also can tap into the other development financial institutions that the client may not have connection with, and we can introduce [companies] to them to broaden the capital market for them.”

¹⁰ Blended finance refers to the strategic use of development finance, such as ADB funds, to help mobilize the flow of private capital in encouraging sustained economic growth.

Another interviewee raised the case study of e-ferry deployment in Thailand and stressed the importance of restructuring the financing of the project in maximizing its viability:

“ [the e-ferry owner] is having difficulty raising funds from the commercial banks due to the ridership risk and the technology risk that is foreseen in the project. Without this financing, the company is facing difficulty in managing their project and liquidity. So, that’s why we decided to... structure the deal so that it is feasible for the commercial banks and some development financial institution to join hands with us. ”

Include financing commitments in long-term decarbonization strategies, including the need for international finance

Interviewees highlighted that financing commitments can be used to enhance long-term policy strategies and to help deliver security for private companies, such as e-mobility providers, charging infrastructure operations, and bus operators in this space. This is strongly linked with practical actions in both the business models and policy mix spaces. As one interviewee stated:

“ If it’s clear that there’s a gap, then it makes sense for the government to step in and say well for the first 5 years or 10 years we need support and can [MDBs] help us through the sovereign route or through climate funding... to kickstart something on this. ”

Use green bonds to support integration of e-mobility and renewable energy

The ultimate end goal of effective e-mobility and renewable energy integration is to ensure that affordable low-carbon electricity is powering an efficient vehicle fleet. It was raised in the interviews that financing can be used as a tool for making this happen. Specifically, one interviewee raised the possibility of using green bonds¹¹ to ensure effective integration:

“ So, in a few Pacific countries there may be discussions about the green bond, which means you should not just electrify transport; you also want to ensure that the energy that goes into it is relatively clean. ”

4.4 GOVERNANCE

Align decarbonization policies across transport and electricity sectors

Bringing together decarbonization policies across multiple sectors means ensuring that a decarbonization objective in one sector, such as transport decarbonization through electrification, is matched to decarbonization objectives in other sectors, such as electricity decarbonization through growth in renewable generation and the elimination of fossil fuels. This was consistently brought up by interviewees as an important way of ensuring e-mobility and renewable energy integration meets its stated aims. The need for this kind of

¹¹ Green bonds are fixed-income financial instruments which are used to fund projects that have positive environmental and/or climate benefits.

systems thinking is highlighted by one interviewee:

“from a transport perspective you now have to look at the energy source... it's just not enough that you just could say we're going to replace a number of internal combustion engines... We have to look at the *long-term sustainability and look at how the country is decarbonizing.*”

One interviewee credited progress in Southeast Asian countries where siloed government departments are beginning to communicate in bringing together joined-up decarbonization strategies:

“Silos [are] being broken in government and consequently... there's also that interest to try and see how can we solve this problem by bringing various schemes together. The *new policy is increasingly moving away from conventional energy-based solutions.*”

It was also highlighted that the integration of decarbonization pathways could be extended to other areas of society, including improving health outcomes. The idea of monetizing these benefits was spoken about as a way to integrate cost-benefit assessments of policies:

“There is less pollution and therefore it's better for the society as a whole because cost of lung disease in the region will decrease and the productivity will increase. *So, there's a lot of these things that you can do to offset, define the cost of it; and of course if you're travelling in a cleaner and more efficient way, of course the efficiency and productivity*

***will also go up and this is often factored into the whole calculation of cost-benefit analysis.*”**

Integrate management of projects across transport and electricity sectors

Individual projects can be integrated across sectors to streamline their financing. While experience of doing so in the e-mobility and renewables space is relatively low, interviewees highlighted case studies where this had happened in other sectors. For example, one interviewee spoke of projects where growth in floating solar has been integrated with agricultural energy demand:

“We are doing floating solar in places like Bangladesh, Kiribati, Tuvalu, and Viet Nam. For example, there's work that's happening now in Kiribati and Tuvalu where we're looking at floating solar platforms that will also help with marine aquaculture, so *it's about identifying certain areas where you can have a combination of resources, both energy and agricultural output, being produced.*”

Another interviewee stated that ADB are no longer doing 'pure' energy projects, implying that there are consistently ties to other sectors. While there was no example in e-mobility and renewable energy integration to draw upon, they illustrated this point using an example of integrating ocean thermal energy conversion with desalination needs:

“For a long time now *we're actually not doing pure energy projects.* In places

like [the] Pacific... we [are] looking at work on **ocean thermal [energy conversion]**, and what does that mean from meeting **desalination needs** and things like that.”

Support integrated governance of transport and electricity through inter-departmental integration

The merging of government departments, or the creation of new government departments that sit over existing departments, were both talked about as means of promoting joined-up policy across interacting sectors, including transport and electricity. The need for this joining up of departments is exemplified by the fact that it is already happening in some Asian countries. For example, one interviewee reported the merging of separate divisions of government to work on integrated transport–energy projects in South Asia:

“In places like South Asia we see the **transport, the energy, the urban development divisions come together** to do work on things like **industrial corridors**, which again it's no longer just a single-sector focused intervention.”

This is not only true for governance at government level. There is also a need for this process to translate to supporting institutions where governance of transport and electricity sector are siloed. This has been effectively achieved in the ADB in China, as this interviewee highlights:

“In China for example, **the energy and transport divisions have actually merged into a sustainable structure division** in ADB to meet demands from

the Chinese government on how do you decarbonize cities in China.”

Support international working groups to address cross-sectoral challenges

International working groups are commonly used for action-oriented activities in bringing together decision-makers and actors that do not ordinarily work together. Interviewees consistently raised the idea of creating international working groups in this space in order to address the challenges in e-mobility and renewable energy growth and the integration of the two sectors.

One interviewee stated that international working groups with the aim of bringing together stakeholders across projects are already active in China and India:

“We are inviting [companies] to these working groups. [In] the electric 2 and 3-wheeler working group we have invited a private sector [company] in India, a Chinese company, and <redacted> to be part of this **global working group on electric mobility**.”

The same interviewee used the example above to postulate the idea of an e-mobility and renewable energy integration working group, that could be tasked specifically with bringing the two sectors together:

“It could be another working group which is specific to this renewable energy and integration like this. Renewable energy providers and grid operators, or **it could possibly be integrated into existing ones on batteries charging and renewable energy**.”

CONCLUSION

E-mobility and renewable energy integration can bring about a range of win-win solutions in terms cross-sector decarbonization and increased access to both mobility and electricity.

With high levels of potential for renewable energy production and a growing level of policy support for renewables deployment and transport electrification, Southeast Asian countries are primed to realize the co-benefits of this joined-up transition.

In this paper, senior staff at the Asian Development Bank and the United Nations Environmental Programme were interviewed to generate learning on how these co-benefits can be realized. From analysis of the interviews, we have outlined a set of 16 practical actions (Table 1) to be taken by governments, international organizations, financial institutions, and the private sector in promoting successful e-mobility and renewable energy integration.

Fundamentally, these practical actions are aimed at supporting business models that bring these sectors together. The sectors can be brought together in the same time and place, such as battery swap stations for electric 2-wheelers providing grid services from vehicle-to-grid (V2G), or they can be brought together at a higher level, such as by linking supply chains and financing for e-mobility and renewable energy projects.

Business models need to be supported through the policy mix, green finance, and governance. Through effective policy setting, long-term strategies can help de-risk investment in e-mobility and renewable energy integration by allowing businesses to establish the size of potential markets and de-risk their expansion plans. Green finance can play a role by aligning streams of finance across these adjoining sectors, and governance can provide effective coordination to these efforts.

A recurring theme in the interviews was one of silos, and the need to break them. Consistently, interviewees referred to barriers resulting from the lack of coordination between government departments and the lack of development of co-dependent sectors. It was raised repeatedly that there are unwanted silos between sectors and stakeholders that are inhibiting progress in transition to e-mobility and renewables integration. Likewise, interviewees consistently talked about breaking these silos as an enabler to the transition.

The 16 practical actions presented in this working paper are intended to be high-level. Of course, there are no one-size-fits-all solutions for a region as large and diverse as Southeast Asia. As the next step in this research, these practical actions should be used in investigating country-specific pathways for the successful integration of e-mobility and renewable energy.

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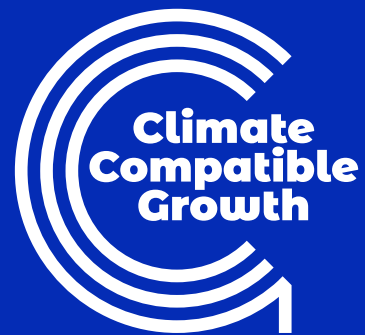
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