Workshop Proceedings Report

# Accelerating Clean Technology Innovations through Anticipatory Policy Analysis

**15-16 April 2026**

Hosted by the Institute for Environment and Sustainability (IES) at the Lee Kuan Yew School of Public Policy (LKYSPP), National University of Singapore (NUS) and Institute for Essential Services Reform (IESR), an Indonesian homegrown think tank focused on energy and the environment.

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# INTRODUCTION

The transition to clean energy is an increasingly urgent policy issue across Southeast Asia. Governments in the region are under pressure to reduce emissions, strengthen energy security, support industrial development, and respond to growing electricity demand. Within this broader transition, solar PV and electric vehicles (EVs) have become two central policy areas. Solar PV plays a key role in expanding renewable electricity supply, while EVs are seen as an important pathway for reducing transport emissions and supporting new industrial opportunities[1], [2].

Indonesia faces these same pressures. The government has set out clear ambitions for clean energy and has introduced a range of policies related to renewable energy and electric mobility[3]. Solar energy has been positioned as a key component of Indonesia's long-term energy transition, including in the NZE 2060 pathway and PLN's 2025-2034 business plan. At the same time, EV development has received strong policy attention as part of Indonesia's broader industrial and energy strategy.

However, progress in both solar and EV development has been uneven. Policy ambition has not always translated into consistent implementation, which is constrained by a set of recurring challenges, including institutional fragmentation, overlapping mandates across agencies, misalignment between policy instruments, and gaps between national targets and on-the-ground execution. These challenges suggest that the issue is not only about introducing more policies, but about how policies are designed, coordinated, and sustained over time. Therefore, strengthening the capacity to diagnose policy bottlenecks and to design more durable policy pathways is critical.

This was the starting point for this regional capacity-building workshop, *"Accelerating Clean Technology Innovations through Anticipatory Policy Analysis",* jointly organized by the Institute for Essential Services Reform (IESR) and the Institute for Environment and Sustainability (IES), Lee Kuan Yew School of Public Policy, National University of Singapore. It aimed to support Indonesian stakeholders in identifying key constraints in solar and EV transitions, and in exploring how policy design can better support long-term change.

The program was structured over two days. Day 1 focused on solar policy under the theme *"Unlocking Indonesia's Solar Future: Identifying Policy Levers and Pathways for Durable Solar Transitions."* Day 2 focused on EV policy under the theme *"Building Diagnostic and Design Capacity for EV Policy in Indonesia."* Each day combined keynote remarks, analytical sessions, and group discussions, allowing participants to move from problem identification to structured reflection and co-creation on policy options. Participants included government officials, representatives from state-owned enterprises, industry associations, think tanks, universities, private sector actors, and international organizations. This mix of participants enabled discussions that cut across sectors and institutional levels.

Overall, the workshop provided a platform to examine key barriers in Indonesia's solar and EV transitions and to explore how more coherent and durable policy pathways can be developed. It also contributed to broader discussions on how countries in the region can move from policy ambition to implementation.

# OBJECTIVES OF THE WORKSHOP

## 01

**Build capacity** among Indonesian policymakers and practitioners to apply IAPD framework and related diagnostic tools in analyzing policy challenges and designing interventions.

## 02

**Co-generate anticipatory policy pathways** that identify feasible and durable interventions for accelerating solar and EV transitions.

## 03

**Strengthen supportive coalitions** by connecting reform-minded officials, industry actors, and knowledge partners through structured policy learning.

## 04

**Produce strategic briefing notes/policy briefs** that synthesize the key insights, levers, and potential pathways discussed—serving as a foundation for future action plans and subsequent design dialogues over the next one to two years.

# ANALYTICAL APPROACH

## IAPD: From Policy Design to Policy Durability

This workshop was guided by the Integrative Anticipatory Policy Design (IAPD) framework. IAPD starts from a core challenge in sustainability governance: policies that appear technically sound and politically promising at the moment of adoption often fail to produce durable outcomes over time. This concern has been highlighted in work on super wicked problems and in broader scholarship on policy durability, path dependence, and sustainability governance[4]. Across these debates, a recurring pattern is that policy initiatives are launched with high expectations but later encounter weak implementation, changing incentives, or declining political support[5].

IAPD responds to this problem by shifting attention from policy adoption alone to policy durability. The central question is not only which policy should be selected, but how policies can be designed to last long enough to achieve and maintain their objectives. In this sense, policy design is treated as an anticipatory exercise. It focuses on how early interventions can shape later political, institutional, and economic conditions in ways that reinforce rather than weaken reform trajectories[6].

At the centre of IAPD is the proposition that policy change unfolds through multi-step pathways rather than through a single shot intervention. This orientation  draws on, and expands, a quarter century of collaborative work on how to design long term policies to be resilient to short term pressures to knock then off course [4], [6], [7], [8], [9].

Policies operate through different causal influences, especially rules, markets, and norms, and the relative weight of these influences changes over time [5], [10], [11]. A reform may begin by altering formal rules, which then reshape market incentives, investment behaviour, and eventually wider expectations about what is feasible, legitimate, or desirable. For this reason, IAPD focuses on policy pathways rather than isolated instruments. It also draws attention to policy feedback effects that may either reinforce or undermine reform over time.

This perspective is particularly useful for complex transition challenges. In such settings, the central problem is often not the absence of policy ideas, but the absence of sufficient attention to how policy choices interact with existing institutions, interests, and future pressures. IAPD therefore treats durability not as an automatic consequence of adoption, but as a design problem that must be addressed explicitly from the outset.

A core concern within IAPD is the distinction between reinforcing and undermining effects. Reinforcing effects strengthen a policy pathway over time. They can deepen commitment, stabilize implementation, broaden support, and improve the likelihood that a reform will persist. Undermining effects move in the opposite direction. They weaken credibility, reduce support, generate resistance, or increase the likelihood of policy reversal. This distinction is analytically important because policies with similar stated goals may generate very different trajectories depending on how they are designed and how they interact with their institutional setting.

To guide this analysis, IAPD uses a set of diagnostic questions. These questions are not intended to replace substantive judgment. Rather, they help structure anticipatory analysis by asking whether a proposed intervention is likely to generate reinforcing or undermining effects along four dimensions:

1. Immediate stickiness / lock-in
   *What can be done to lock in reinforcing (DQ1+) while minimizing undermining effects (DQ1-)*
2. Entrenchment over time
   *What can be done to ensure that support is reinforced (DQ2+) rather than undermined over time (DQ2-)?*
3. Expansion of support
   *What can be done to reinforce expanding support (DQ3+) while minimizing backlash (DQ3-)?*

4. Problem amelioration
   *What can be done to ensure the outcome is consistent with (DQ4+), rather than exacerbates or fall short of (DQ4-), policy objectives advance an impact consistent with the problem at hand?*

Taken together, these questions move analysis beyond short-term feasibility. They direct attention to whether a reform can create early commitments that are difficult to reverse, whether it can strengthen its own support base over time, and whether its longer-term effects remain aligned with the problem it is intended to address. In this way, IAPD supports a more practically oriented form of anticipatory policy analysis, focused on identifying policy levers that may be easier to initiate at the outset but more difficult to reverse later.

## Key Insights: Applying IAPD in Policy Design

*These insights should be understood as indicative entry points for applying the IAPD framework, rather than definitive conclusions. Their value lies in identifying where deeper diagnostic work and iterative policy design efforts must be most productively directed.*

- **Durability, not just adoption:**
  Policy success depends on whether policies can persist and remain effective over time, not just on initial design or political support. This requires paying attention to reinforcing and undermining effects that can be nurtured by path dependent critical junctures, and by strategic decisions of government, private sector and other stakeholders.

- **Multiple step pathways:**
  Policy change unfolds through multiple steps. Critical juncture lock-in moments create structural logics that will shape future steps and as important, as early design choices shape later political, economic, and institutional outcomes. Likewise there is also an important role for agency as active strategic decisions produce logics play as important roles in traveling from step

- **Shifting causal mechanisms:**
  The relative influence of Rules, markets, and norms in driving behavioural change often vary from step to step. Effective design requires anticipating and unleashing the most effective causal mix in the first, and subsequent, steps.

- **Reinforcing vs. undermining effects:**
  Policies can build momentum by expanding support and stabilizing implementation, or weaken themselves through resistance and misalignment.

- **Forward-looking design:**
  Diagnostic questions guide deliberations about what kind of initial policy levers, or mix, might be most capable of producing structural logics, and giving agents the opportunity to reinforce, lock in early gains, build coalitions, expand support, and stay aligned with long-term goals.

# SUMMARY OF SESSION DISCUSSION

## Day 1 - Unlocking Indonesia's Solar Future





## 1. Setting the Stage: The Urgency of Energy Transition

Indonesia's energy transition challenge is not primarily technological or financial, but institutional. Despite substantial renewable potential and ambitious national targets, solar deployment remains limited due to entrenched structural conditions. Three interrelated constraints are repeatedly identified. First, the persistence of fossil-based system configurations, particularly long-term coal contracts and regulated electricity pricing, creates structural disincentives for renewable integration. Second, fragmented governance arrangements distribute authority across multiple agencies without clear coordination mechanisms. Third, existing policy instruments often fail to generate stable expectations for investors and other stakeholders.

Within this context, solar energy is framed not only as a decarbonization tool but as a strategic instrument for energy security, fiscal stability, and industrial development. This reframing shifts the analytical focus from isolated policy instruments to broader system transformation. The session adopts the Integrative Anticipatory Policy Design (IAPD) framework as a guiding approach. The framework emphasizes that policy effectiveness depends on the ability to generate durable feedback effects, particularly through the interaction of rules, markets, and norms over time.

## 2. Turbocharging Energy Transition with Solar Energy

The discussion of solar energy development situates Indonesia within broader global and regional trends. At the global level, solar energy has emerged as the dominant driver of energy transition, largely due to rapid cost reductions and economies of scale. Different policy pathways have shaped deployment across countries, including utility-led expansion (e.g., China, India), market-driven approaches (e.g., EU, US, Australia), and crisis-induced household adoption (e.g., Pakistan). At the same time, solar manufacturing remains highly concentrated in China, although Southeast Asia is increasingly positioning itself as an alternative production base.

Regionally, policy approaches in Southeast Asia have undergone a clear transition. Prior to 2020, solar expansion relied heavily on direct incentives and centralized planning mechanisms, such as feed-in tariffs and net metering schemes. More recently, the focus has shifted toward enabling market formation through grid access reforms, private sector participation, and domestic demand creation. This shift is further reinforced by global trade dynamics, particularly US tariff policies, which have accelerated the relocation of solar manufacturing to the region.

Against this backdrop, Indonesia presents a case of ambition without commensurate deployment. While national targets project annual capacity additions of 1–8 GW through 2060, actual implementation remains significantly below these trajectories. The discussion identifies three interrelated bottlenecks:

1) Regulatory constraints, including contract design, tendering processes, and local content requirements, which introduce uncertainty and slow project realization;
2) System-level limitations, particularly land acquisition challenges and insufficient grid capacity; and
3) Price and tariff misalignment, where renewable energy pricing structures are tied to local generation costs, undermining investment incentives.

Recent policy changes in rooftop solar, specifically the transition from net metering to a quota-based system, further illustrate how regulatory adjustments can reshape market dynamics, while also introducing new constraints. At the same time, the analysis identifies a set of strategic entry points capable of generating reinforcing feedback effects. These include deploying solar to improve electricity reliability in underserved regions, replacing diesel-based generation with solar-plus-storage systems, reducing fiscal exposure to imported fuels, and leveraging solar deployment for distributed job creation.

These pathways share a common characteristic: they produce immediate and tangible economic benefits, which can strengthen political support and accelerate adoption. Therefore, effective policy design must move beyond high-level targets and focus on creating early-stage “wins” that generate momentum. In parallel, sustaining long-term transition requires anchoring domestic demand to support local manufacturing capacity, ensuring that industrial development is not solely dependent on external markets.

## 3. IAPD Case Sharing: Indonesia’s Solar Policy Conundrum

The analysis reframes Indonesia’s solar transition challenge as a problem of policy durability rather than policy absence. Despite strong resource endowments and the adoption of multiple policy instruments, such as feed-in tariffs and net metering, solar deployment has remained limited and unstable. Therefore, conventional explanations focused on technical constraints or financing gaps are insufficient. A dynamic perspective is adopted in which policy outcomes are shaped by feedback effects over time. Policies may generate reinforcing effects that strengthen their continuation, or undermining effects that erode support and lead to reversal. Within this framework, three criteria are central to assessing policy durability:

1) Lock-in (immediacy): the extent to which policies create irreversible commitments or constraints;
2) Entrenchment: the degree to which policies generate sustained support from key actors; and
3) Expansion: the ability to broaden supporting coalitions over time.

Indonesia’s electricity sector is characterized by a set of mutually reinforcing institutional arrangements that stabilize the high-carbon status quo. Long-term coal-based power purchase agreements create financial lock-in through “take-or-pay” clauses, generating resistance to integrating variable renewable energy. Electricity tariffs are politically regulated to maintain affordability, limiting the ability to pass higher renewable costs to consumers. The central role of the state utility (PLN) concentrates operational control and financial risk, making policy outcomes highly contingent on its internal incentives. At the same time, fragmented authority across ministries weakens policy coherence and undermines sustained implementation. Together, these mechanisms form a self-reinforcing equilibrium in which low-carbon policies face structural resistance, even when formally adopted.

A retrospective assessment of key policy instruments shows that many interventions have produced unintended undermining effects. For example, feed-in tariffs, initially designed to reduce investment risk, were later tied to local generation costs and capped, suppressing returns in coal-dominated regions. Similarly, net metering policies expanded rooftop solar adoption but generated concerns over revenue losses and grid stability, leading to their rollback and replacement with a quota-based system. More broadly, the transfer of international policy models without adaptation to domestic institutional conditions resulted in persistent misalignment with existing incentives. These cases illustrate that policy failure often stems not from flawed objectives, but from the absence of mechanisms that sustain policies over time.

Three implications follow for policy design. First, durability must be treated as a core design objective. Policies need to build supportive coalitions early and reduce the scope for discretionary reversal. Second, sequencing is critical. Infrastructure and grid capacity constraints must be addressed alongside, or prior to, scaling deployment to avoid technical and institutional backlash. Third, aligning incentives with key actors is essential, particularly with state-owned utilities, as policies that impose sustained financial or operational losses on central actors are unlikely to persist.

Building on this, several priority domains for policy intervention emerge:

- reforming coal-related lock-in mechanisms, including PPAs and domestic market obligations;
- scaling up large-scale solar procurement through standardized frameworks and risk guarantees;
- redesigning rooftop solar policies to restore investment incentives;
- expanding grid infrastructure and storage capacity to accommodate renewable integration;

- linking solar deployment with domestic manufacturing strategies and broader industrial policy.

In conclusion, accelerating solar deployment in Indonesia therefore requires a shift from instrument-based policy design to pathway-oriented strategies that actively shape incentives, coalitions, and feedback dynamics over time.

## 4. Reviewing Distributed Solar Development in China

The discussion of China's solar development provides a comparative lens for understanding how large-scale renewable transitions can be sustained under different institutional conditions. Over the past 15 years, China's power system has undergone a structural transformation, with wind and solar expanding from a marginal share to core components of the energy mix. This transition has been driven not by simple substitution of fossil fuels, but by a system-wide expansion of generation and grid capacity that enables the coexistence of multiple energy sources.

Coal continues to play a central role in ensuring system stability. Rather than being displaced, it provides flexibility to balance intermittent renewable generation. This "co-expansion" model, in which solar capacity increases alongside coal capacity, has allowed renewable deployment to scale without triggering systemic instability. Recent trends, however, suggest a potential inflection point, as coal generation begins to decline even as installed capacity continues to grow.

China's transition is characterized by a shift in the logic of solar deployment. Growth has increasingly moved from utility-scale projects to distributed systems, including residential rooftops and industrial installations, which now account for a substantial share of total capacity. This shift has enabled geographic rebalancing by promoting localized generation and reducing reliance on long-distance transmission. At the same time, policy instruments have evolved from upfront subsidies to feed-in tariffs and, subsequently, to market-based mechanisms as solar reached cost parity with coal. These changes reflect adaptive policy sequencing in response to evolving technological and market conditions.

This expansion is underpinned by three reinforcing institutional pillars. First, legal and financial frameworks have provided stable support through dedicated legislation and funding mechanisms. Second, vertical political coordination has aligned national targets with local implementation, with subnational governments actively promoting solar deployment. Third, market restructuring has introduced competition among state-owned and private actors, improving efficiency and accelerating deployment. Early-stage pilot programs, such as the Golden Sun initiative, also played a catalytic role. Despite concerns over fiscal sustainability and rent-seeking, these programs facilitated market formation and institutional learning, enabling subsequent policy adjustment.

Based on China's case, several implications emerge. First, the relationship between fossil fuels and renewables is not necessarily zero-sum; integration within shared institutional arrangements can reduce resistance and support system stability. Second, solar deployment has been embedded within broader policy objectives, including industrial upgrading and regional development, expanding the base of political and economic support. Third, institutional flexibility, particularly the ability to adjust policy instruments over time, has been critical to sustaining momentum. Finally, the expansion of distributed solar has introduced bottom-up dynamics that complement top-down policy direction.

Taken together, the China case illustrates that sustained renewable transitions depend on the co-evolution of policy design, institutional arrangements, and market dynamics, rather than on any single policy instrument.

## 5. From Diagnosis to Design: Insights from Practice

The group discussions translate the diagnostic framework into actionable policy insights by drawing on participants' practical experience across sectors. Rather than evaluating policy instruments in isolation, the discussions focus on identifying reinforcing and undermining effects and deriving policy levers that can shift system dynamics.

### Cross-cutting Structural Challenges

Across all groups, several recurring structural constraints are identified.

First, institutional fragmentation and overlapping authority remain central barriers. The distribution of responsibilities across multiple ministries, combined with the dominant position of the state utility (PLN), creates coordination challenges and weakens policy coherence.

Second, misaligned incentives within the system undermine policy effectiveness. In particular, policies that impose financial or operational burdens on PLN, such as rooftop solar expansion or pricing reforms, face resistance and are difficult to sustain.

Third, regulatory rigidity and administrative complexity slow implementation. Lengthy procurement processes, restrictive quotas, and inflexible local content requirements (LCR/TKDN) constrain both deployment and investment.

Fourth, weak and uncertain market signals limit private sector participation. Long-term planning targets are often perceived as unreliable, while the absence of demand guarantees creates risks for investors, particularly in manufacturing.

### Reinforcing and Undermining Effects in Practice

The discussions provide concrete examples of how policy design generates divergent outcomes. Certain instruments have produced reinforcing effects. For instance, early-stage net metering policies and quota mechanisms for rooftop solar helped initiate market formation and signal government support. In some cases, constrained access (e.g., waiting lists) even contributed to sustained demand by creating expectations of future expansion.

However, many policies have generated unintended undermining effects. Short implementation timelines, overlapping regulatory authority, and rigid local content requirements have constrained deployment. Price caps and tariff structures have weakened investment incentives. More fundamentally, the dual role of state-owned entities has created internal conflicts between system operation, financial performance, and policy objectives. These patterns reinforce a central insight. Policy outcomes depend less on stated objectives than on how instruments interact with institutional incentives.

## Emerging Policy Levers and Design Pathways

Building on these observations, several categories of policy levers emerge.

1. Flexibility in regulatory design

Adjusting local content requirements in line with domestic manufacturing capacity, and introducing periodic review mechanisms for rooftop solar quotas, can reduce unintended constraints while maintaining policy objectives.

2. Strengthening market formation mechanisms

Improving transparency in long-term planning, enabling direct power purchase arrangements, and introducing more dynamic pricing and demand-response systems can enhance investor confidence and participation.

3. Institutional coordination and continuity

Creating more stable coordination mechanisms—either through dedicated taskforces or by strengthening the role of permanent bureaucratic institutions—can reduce policy discontinuity associated with political cycles.

4. Aligning incentives with central actors

A recurring priority is to design policies that are compatible with the financial and operational logic of PLN. This includes demonstrating how renewable deployment can support, rather than undermine, revenue streams and system stability.

5. Linking deployment with industrial development

Efforts to expand solar deployment are increasingly connected to domestic manufacturing strategies, including localized supply chains, PPP mechanisms, and targeted fiscal incentives.

Several more specific proposals illustrate how these levers can be operationalized. In rooftop solar, extending installation timelines, introducing adjustable LCR mechanisms, and regularly revising quotas are seen as tractable adjustments with immediate impact. In system planning, increasing transparency of modelling assumptions and opening planning processes to stakeholders can strengthen credibility and reduce investor uncertainty. In large-scale procurement, proposals include standardized PPAs, PPP-based financing structures, and multi-stakeholder coordination platforms to accelerate deployment. In manufacturing and rural deployment, integrating solar with local economic activities (e.g., cold storage, cooperatives) and investing in technical training and maintenance systems are identified as critical for long-term sustainability.

A notable proposal is the creation of a cross-sectoral taskforce to coordinate manufacturing, fiscal policy, and implementation. While such arrangements are not inherently durable, their effectiveness depends on how they are embedded within broader institutional incentives and governance structures.

## Practical Implications

Taken together, the group discussions highlight that the most effective policy interventions are not necessarily large-scale reforms, but targeted, context-specific adjustments that alter incentive structures. As such, two broader implications emerge. First, micro-level policy design matters. Small adjustments, such as modifying quotas, timelines, or regulatory thresholds, can produce system-wide effects if they shift the balance between reinforcing and undermining dynamics. Second, durability depends on alignment rather than ambition. Policies are more likely to persist when they align with the interests of key actors, generate visible short-term benefits, and create pathways for expanding support over time.

These insights reinforce the central premise of the workshop: effective energy transition policy requires designing not only for immediate outcomes, but for self-reinforcing pathways that sustain change over time.

**Key Insights: Solar Transition in Indonesia**

- **Solar deployment is constrained by entrenched system structures.** Fossil-based electricity arrangements, including long-term coal contracts and regulated pricing, create persistent barriers to renewable integration.

- **Fragmented governance weakens policy coordination and implementation.** Overlapping authority across agencies reduces policy coherence and limits the effectiveness of existing instruments.

- **Policy instruments often fail to generate stable investment signals.** Design adjustments and inconsistent implementation have reduced investor confidence and slowed deployment.

- **Early-stage applications must deliver visible economic benefits.** Pathways such as diesel replacement and reliability improvements can generate immediate gains that strengthen political support.

- **System alignment is critical for scaling solar deployment.** Transition depends on coordinating grid capacity, pricing structures, and industrial policy rather than relying on standalone instruments.

# Day 2 – Building Capacity for Indonesia’s EV Transition



## 1. Grounding EV Transition in Transport Realities

The discussion of Day 2 shifts the focus to the specific structure of Indonesia's transport sector, where motorcycles dominate the vehicle fleet. As a result, EV transition is likely to be driven primarily by two-wheelers rather than private cars, requiring a more targeted policy approach. At the same time, a clear gap remains between policy ambition and implementation. Despite a relatively complete EV value chain, adoption is constrained by limited conversion infrastructure and complex administrative procedures, particularly in vehicle registration.

A key implication is that EV policy must be designed around user experience and accessibility, emphasizing tangible benefits such as cost savings and ease of use. More broadly, the effectiveness of EV transition depends on parallel progress in power sector decarbonization, linking transport policy with the wider energy system.

## 2. Indonesia's EV Policy Landscape: Priorities, Constraints, and Implementation Gaps

Indonesia's EV transition is embedded within multiple national policy frameworks, including the National Energy Policy (PP 40/2025), the Grand Energy Strategy (2020–2040), and the RUKN 2025–2060, all of which position electrification, particularly of two-wheelers, as a strategic priority. These frameworks set ambitious targets, including 13 million EV users by 2030, with a combination of new purchases and vehicle conversions.

The urgency of this transition is driven by the structure of the transport system. Indonesia's total vehicle fleet has reached approximately 167 million, of which 147 million are motorcycles, making two-wheelers the dominant mode of transport. The sector is almost entirely dependent on oil, and each litre of subsidised fuel (*Pertalite*) requires government compensation of around IDR 2,000 per litre, creating a sustained fiscal burden. At the same time, revenue from the oil and gas sector is already lower than total subsidy and compensation outflows, indicating an increasingly unsustainable fiscal position.

Transport also constitutes a major source of urban air pollution. In Jakarta alone, there are approximately 9.3 million motorcycles, contributing significantly to declining air quality. This pressure is expected to intensify under adverse climate conditions that have previously worsened urban air quality.

Despite strong policy commitment, scaling remains a central challenge. A critical threshold is identified at 10% of total vehicle adoption, below which the EV ecosystem remains unstable and private sector participation is inconsistent. Current EV growth has not yet outpaced the expansion of the conventional vehicle fleet, making it difficult to reach this tipping point.

The primary constraints lie in implementation rather than technology. In the case of motorcycle conversion, the technical process can be completed within approximately two hours, while administrative procedures, including registration (BPKB/STNK) and compliance testing, can take weeks or longer, particularly outside major urban centers. This imbalance highlights administrative complexity as a core bottleneck.

Policy consistency further shapes market outcomes. In 2023-2024, incentives of IDR 7 million for new electric motorcycles and IDR 10 million for conversions significantly increased adoption. However, uncertainty surrounding the continuation of these incentives in 2025 led to a rapid slowdown in demand and a contraction in manufacturing activity, demonstrating the sensitivity of the market to policy signals.

Additional structural barriers remain. Financing options for electric motorcycles are limited compared to conventional vehicles, where leasing is widely accessible and supported by a strong secondary market. In contrast, the absence of a viable resale market for EVs discourages financial institutions from extending credit. Infrastructure gaps—particularly in charging and battery-swapping systems—further constrain adoption, with standardization of battery systems identified as a critical enabler for scaling.

Overall, the constraint is not the absence of policy, but the absence of conditions for policy to scale. Advancing the EV transition requires restoring policy credibility, simplifying administrative processes, expanding financing and infrastructure, and accelerating progress toward the early adoption threshold necessary for sustained market development.

## 3. Supply-Side Regulation and Market Formation Constraints

Transport decarbonisation in Indonesia is driven by both environmental and fiscal pressures. The transport sector contributes approximately 25% of national emissions (202 $MtCO_2$ in 2024) and accounts for over 90% of fuel consumption in road transport, with total oil use reaching around 450 million barrels in 2024. At the same time, Indonesia produces only around 40% of its oil demand, resulting in net fuel imports of approximately USD 22 billion annually. Fuel subsidies further amplify this burden: every USD 1 increase in oil prices adds around IDR 6.7 trillion to government expenditure. These structural pressures explain why electrification, particularly in road transport, is positioned as a near-term solution within national decarbonisation strategies.

### EV Growth Trajectory and Emerging Scale Constraints

Recent EV growth reflects strong policy support but remains below the level required for market stability. By 2024, EVs accounted for approximately 6.5% of national car sales and up to 25% in Jakarta, indicating rapid growth in specific regions but uneven national adoption.

A critical constraint is the inability to reach the 10% early adoption threshold, below which private sector participation remains uncertain. Although EV prices have declined significantly, falling from approximately IDR 1 billion to IDR 450 million for entry-level vehicles, this has not yet translated into sustained, system-wide adoption.

### Fragility of Demand-Side Policy Support

Demand-side incentives have played a central role in driving early adoption, but their effects have proven highly sensitive to policy continuity.

Following the removal of the IDR 7 million subsidy for electric motorcycles, sales dropped by approximately 80%, with only partial recovery thereafter. In contrast, EV car sales showed a more moderate decline after the removal of VAT incentives, reflecting stronger supply-side support in the automotive sector. This divergence highlights a key structural difference: the car market benefits from a more established domestic industry base, while the motorcycle EV segment remains more dependent on imported units and policy support.

### Consumer Behaviour and Infrastructure Signals

Market development is further shaped by consumer preferences and infrastructure constraints. Despite average daily travel distances of 16–22 km, demand is skewed toward long-range vehicles (approximately 500 km for cars), reflecting persistent range anxiety and limited confidence in charging infrastructure.

Charging behaviour reinforces this pattern. While ultra-fast chargers account for only 11% of installed infrastructure, they contribute to over 50% of total charging transactions, indicating that users treat EV charging as a direct substitute for refuelling. At the same time, home charging remains the dominant mode of use, while public charging infrastructure is unevenly distributed and not yet aligned with user needs.

### Limits of Demand-Side Policy and the Case for Supply-Side Regulation

These dynamics reveal the limits of demand-side incentives as a primary policy tool. While effective in initiating market growth, they do not provide sufficient stability to sustain long-term transition. Market concentration further illustrates this challenge. In 2024, two EV brands accounted for nearly 70% of total sales, while a large share of manufacturers did not participate in the EV market at all.

Supply-side regulation (SSR) therefore emerges as a necessary complement. Key instruments include:

- sales mandates, requiring manufacturers to meet minimum EV shares;
- fuel economy standards, improving fleet-wide efficiency; and
- local production requirements, linking market access to domestic investment.

A phased approach, beginning with hybrid vehicles and gradually transitioning to full electrification, can support both market expansion and industrial development.

Taken together, EV transition in Indonesia is constrained not only by adoption rates, but by the structure of market formation. Demand-side incentives can initiate growth, but sustained transition depends on supply-side mechanisms that stabilize expectations, anchor industrial investment, and enable the system to scale beyond early adoption stages.

## 4. EV Policy Diagnosis through IAPD

The application of the IAPD framework shifts the focus from individual policy instruments to the conditions under which policies become durable over time. Rather than evaluating EV policies based on stated objectives, the framework examines how policies shape behaviour through the interaction of rules, markets, and norms, and how these interactions generate reinforcing or undermining effects.

Three mechanisms are central. Rules influence behaviour not only through formal legislation, but through enforcement and penalties that determine actual compliance. Markets shape incentives by altering price structures, subsidies, and mandates. Norms affect behaviour through legitimacy, peer expectations, and perceptions of appropriateness. Durable policy outcomes emerge when these mechanisms operate in alignment rather than in isolation.

To assess whether such alignment is achieved, three diagnostic criteria are applied. First, stickiness refers to the extent to which policies create irreversible commitments, such as sunk investments or physical infrastructure. Second, entrenchment captures whether policies generate sustained economic and political returns that make reversal costly. Third, expansion of support examines whether policies broaden their coalition base through positive feedback loops and new alliances.

Applying this framework to Indonesia's EV transition highlights several structural mismatches across the value chain. At the upstream level, the challenge lies in aligning resource-based industrial policy with evolving battery technologies. While nickel-based strategies provide a foundation, uncertainty around future technologies (e.g., solid-state batteries) raises questions about long-term compatibility. At the midstream level, manufacturing capacity remains uneven. Gaps in technological capability and industrial depth limit the ability to translate upstream advantages into competitive vehicle production. At the downstream level, adoption is constrained by affordability, financing, and consumer acceptance. These constraints weaken both entrenchment (DQ2) and expansion (DQ3), as market participation remains limited. At the ecosystem level, broader coordination challenges persist, including skills gaps, infrastructure alignment, and the integration of renewable energy into the electricity mix.

Taken together, these mismatches suggest that EV policy is not failing due to lack of ambition, but due to misalignment across rules, markets, and norms, which prevents reinforcing feedback effects from emerging.

Durable policy pathways depend on the ability to align diverse actors with different motivations. The "Baptists-and-Bootleggers" framework illustrates how coalitions can form when actors support the same policy for different reasons, normative, economic, or strategic.

In the context of Indonesia's EV transition, coalition-building efforts demonstrate attempts to align incentives across the value chain. These efforts include the creation of cross-sectoral platforms linking state-owned enterprises and industrial actors. However, such arrangements do not automatically generate durable outcomes. Their effectiveness depends on whether they create sustained economic returns (DQ2) and expand the base of support beyond initial participants (DQ3), rather than relying solely on institutional design or administrative coordination.

The IAPD framework highlights that EV transition is not simply a matter of scaling technology or increasing incentives. The central challenge lies in designing policies that generate self-reinforcing dynamics, where investments, incentives, and social legitimacy evolve together over time. Without such alignment, policies risk remaining dependent on short-term interventions and may fail to achieve the durability required for large-scale transition.

## 5. From Discussion to Co-creation: Identification of Micro-Level Levers

The group discussions operationalize the IAPD framework by shifting from abstract diagnosis to context-specific policy design, with a focus on identifying reinforcing and undermining effects in practice.

Across all groups, a consistent pattern emerges. Indonesia's EV transition is constrained less by technological limitations than by administrative complexity, institutional fragmentation, and weak market formation mechanisms. Key bottlenecks include fragmented authority across ministries, the absence of demand certainty for domestic battery production, misalignment between charging infrastructure and user behaviour, and the lack of a functioning secondary market for EVs.

At the same time, the group discussions highlight that many of the most tractable policy interventions lie at the micro level. Rather than large-scale reforms, participants identify specific design levers with disproportionate impact. These include simplifying motorcycle conversion registration processes, introducing differentiated licence plate systems to create behavioural incentives, extending traffic restrictions with EV exemptions, and aligning infrastructure deployment with actual usage patterns.

A central insight is that administrative barriers often outweigh technical constraints. For example, motorcycle conversion can be completed within hours, yet registration and compliance procedures take significantly longer, creating a binding constraint on adoption. Similar patterns are observed across infrastructure deployment and market entry processes.

The discussions also emphasize the importance of sequencing and contextual design. The Asmat case illustrates how electrification and EV adoption can be mutually reinforcing when policy begins with local system conditions, specifically, by investing in electricity access first and allowing EV adoption to follow. This reverses the conventional assumption that EV uptake requires prior economic development.

Across groups, several cross-cutting enabling conditions are identified. First, secondary market development is critical for both consumer adoption and financing, as the absence of resale value constrains lending and increases perceived risk. Second, battery lifecycle management emerges as an urgent but underdeveloped policy area, with early interventions such as battery passport systems and mandatory return schemes identified as feasible entry points. Third, consumer behaviour is treated as a design input rather than a constraint, with preferences for range, charging speed, and brand trust shaping policy effectiveness. Finally, the discussions reinforce the importance of coalition-building for policy durability, while also highlighting its complexity. Aligning actors with different motivations, such as industrial, financial, and normative, is necessary but not sufficient; durability depends on whether such coalitions generate sustained economic returns and expand over time.

Overall, the group discussions demonstrate that effective EV policy design depends on identifying specific leverage points within the system, where small adjustments can generate reinforcing dynamics. This co-creation process complements the analytical framework by grounding it in real-world constraints and implementation pathways.

**Key Insights: EV Transition in Indonesia**

- **EV transition is shaped by transport structure, not just technology.**
  The dominance of motorcycles means adoption will be driven by two-wheelers, requiring targeted and user-centered policy design.

- **Administrative complexity is a binding constraint on adoption.**
  Lengthy registration and compliance procedures significantly delay scaling, even when technical conversion is straightforward.

- **Market formation depends on policy credibility and continuity.**
  Fluctuations in incentives and unclear policy direction have led to rapid changes in demand and weakened industry confidence.

- **Crossing early adoption thresholds is critical for scaling.**
  Without sufficient uptake, private sector participation remains limited and the EV ecosystem cannot stabilize.

- **Supply-side mechanisms are needed to sustain long-term growth.**
  Demand-side incentives alone cannot anchor investment or support industrial development at scale.

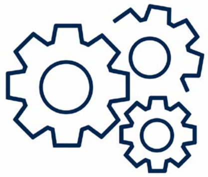
# CROSS-CUTTING INSIGHTS

**Durable transition requires policy design that anticipates feedback over time.**
In both sectors, policy outcomes depend not only on initial adoption, but on whether early interventions generate reinforcing dynamics rather than later backlash.

**Transition policies must be designed around real system conditions.**
Across both sessions, policies proved more effective when they responded to actual institutional arrangements, operational constraints, and user behaviour, rather than relying on abstract best-practice models.

**Credible early signals matter for market formation.**
In both solar and EV development, early-stage progress depends on policy signals that investors, firms, and users see as stable enough to justify participation.

**Sequencing is as important as instrument choice.**
The discussions repeatedly showed that policy effectiveness depends on when and in what order interventions are introduced, especially where infrastructure, regulation, and demand must develop together.



**Targeted micro-level adjustments can unlock broader transition pathways.**
Small changes in procedures, incentives, coordination mechanisms, or implementation rules can have system-wide effects when they remove practical bottlenecks and build confidence.

**Future policy work should focus on pathway-building, not only target-setting.**
Across both days, a shared lesson was that long-term transitions are more likely to succeed when policies are designed to build coalitions, stabilize expectations, and expand support step by step.

**Note:**

The insights summarized here are not prescriptive recommendations, but highlight priority areas identified during the workshop for further assessment and collaboration. The IAPD framework is intended to guide a structured, deliberative process to examine how these areas can be translated into more durable policy pathways.

# FUTURE DIRECTIONS

a) **Shift from target-setting to pathway-based policy design.**
Future efforts should focus on sequencing interventions and building reinforcing dynamics, rather than relying primarily on long-term targets or standalone instruments.

b) **Prioritize early-stage interventions that can generate momentum.**
Scaling "early wins" can help build political support, strengthen market confidence, and accelerate adoption.

c) **Strengthen policy credibility and continuity.**
Stable and predictable policy signals are critical for sustaining private investment and market participation.

d) **Align incentives with key actors and reduce administrative barriers.**
Policies must be compatible with the financial and operational logic of central actors, while simplifying procedures that constrain implementation.

e) **Support market formation through coordinated policy mixes.**
Combining supply-side regulation, demand incentives, and infrastructure development is essential for scaling transitions.

## NEXT STEPS

Participants expressed strong interest in continuing cross-sector dialogue on Indonesia's energy transition. Suggested actions included the preparation of a workshop report, as well as targeted policy briefs or white papers to consolidate existing knowledge on solar and EV transitions and support the development of more durable policy pathways.

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# APPENDIX

## Appendix A. Workshop Agenda

### Day 1 (Wednesday, 15 April 2026)

**Theme:** Unlocking Indonesia's Solar Future - Identifying Policy Levers and Pathways for Durable Solar Transitions

**Expected Output:** A synthesized set of feasible and durable policy levers and their associated causal pathways for solar reform

| Time | Agenda |
|---|---|
| 08:30 – 09:00 [30'] | **Registration** |
| 09:00 – 09:30 [30'] | **Welcoming Remarks**<br>• **Mr. Fabby Tumiwa,** Chief Executive Officer (CEO), Institute for Essential Services Reform<br>• **Prof. Tan-Soo Jie-Sheng,** Assistant Professor and Director, Institute for Environment and Sustainability, Lee Kuan Yew School of Public Policy, National University of Singapore |
| 09:35 – 09:40 [5'] | **Group Photo** |
| 09:40 – 10:30 [50'] | **Framework Introduction**<br>• **Prof. Benjamin Cashore,** Li Ka Shing Professor in Public Management, Lee Kuan Yew School of Public Policy, National University of Singapore<br>• Introduction on the principles of anticipatory policy design and the Policy Design Learning Protocol<br>• Illustration of how policies can shape reinforcing coalitions through global examples (e.g., community forestry, legality verification) |
| 10:30 – 10:45 [15'] | **Coffee Break** |

| Time | Agenda |
|---|---|
| 10:45 – 11:15 [30'] | **IESR Context-Setting Presentation**<br>• **Alvin Putra Sisdwinugraha,** Head of Power System Modelling at IESR<br>• Indonesia's new energy policy (Government Regulation No. 40/2025) with solar energy as the backbone for the NZE 2060 target<br>• PLN's Business Plan (2025–2034), 17.1 GW of planned solar capacity with BESS and PHES<br>• President Prabowo's 100 GW solar program for village-level electrification<br>• Progress on rooftop solar deployment under the new quota regime |
| 11:15 – 11:40 [25'] | **IES IAPD Case Sharing - Indonesia's Solar Conundrum**<br>• **He Liuyang,** Postdoctoral Fellow at IES<br>• Presentation of recent research findings on Indonesia's solar stagnation, institutional challenges, and potential policy entry points |
| 11:40 – 12:05 [25'] | **Agora Case Sharing - Driving Distributed Solar in China: Policy Design and Evolution**<br>• **Zou Yining,** Research Associate at China Power, Agora Energy China |
| 12:05 – 13:45 [105'] | **Networking Lunch** |
| 13:45 – 14:45 [60'] | **Policy Dialogue Session (Breakout Discussion)**<br>• Participant reflections, reactions, and proposals for policy interventions<br>• Discussion of reinforcing and undermining effects |
| 14:45 – 15:15 [30'] | **Coffee Break** |
| 15:15 – 16:15 [60'] | **Group Presentations and Collective Reflections**<br>• Group presentations on reinforcing and undermining effects and policy levers<br>• Whole-room discussion on feasibility, potential impact, foreseeable challenges, and pathway strengthening options |
| 16:15 – 16:30 [15'] | **Wrap-up Session**<br>• Prof. Benjamin Cashore, Lee Kuan Yew School of Public Policy, National University of Singapore<br>• Final reflections and synthesis |

## Day 2 (Thursday, 16 April 2026)

**Theme:** Building Diagnostic and Design Capacity for EV Policy in Indonesia – Anticipatory Policy Design Capacity Building

**Expected Output:** Enhanced diagnostic and design capacity for Indonesian EV policymakers, and a set of plausible policy intervention points informed by anticipatory, system-oriented policy reasoning.

| Time | Agenda |
|---|---|
| 08:30 – 09:00 [30’] | **Registration** |
| 09:00 – 09:15 [15’] | **Welcome Remarks**<br>• **Dr Marlistya Citraningrum**, Director of Communication and Outreach, Institute for Essential Services Reform (IESR)<br>• **Prof. Tan-Soo Jie-Sheng**, Assistant Professor and Director, Institute for Environment and Sustainability (IES), Lee Kuan Yew School of Public Policy, National University of Singapore |
| 09:15 – 10:00 [45’] | **Keynote Opening and Indonesia’s EV Policy Context**<br>• **Dr. Ir. Sripeni Inten Cahyani,** MM., IPM., ASEAN Eng.,Stakeholder Members of National Energy Council (DEN), Industrial Sector<br>• Indonesia’s National Energy Council (DEN) priority for EV within the 2026-2030 period.<br>• EV policy outlook beyond 2030 |
| 10:00 – 10:05 [5’] | **Group Photo** |
| 10:05 – 10:50[45’] | **Introduction to Integrative Anticipatory Policy Design (IAPD)**<br>• **Prof. Benjamin Cashore,** Li Ka Shing Professor in Public Management, Lee Kuan Yew School of Public Policy, National University of Singapore<br>• Introduction to the IAPD framework, with emphasis on the three causal mechanisms of policy change and three diagnostic questions for identifying bottlenecks, trade-offs, and future risks<br>• Moving from descriptive policy analysis to anticipatory policy design |
| 10:50– 11:15 [25’] | **Coffee Break** |
| 11:15 – 12:05 [50’] | **Diagnosing Indonesia’s EV Development: Evidence and Policy Tensions**<br>• **Ilham R.F. Surya,** Head of Transition and Decarbonization Policy, IESR |

| Time | Agenda |
| --- | --- |
| | ◦ Supply side regulation (sales mandate, fuel economy, etc.)<br>• **Ye Chunhua,** Research Fellow at IES<br>◦ Overview of BEV-related policies across the EV value chain<br>◦ Identification of mismatches between stated policy goals, existing instruments and industrial realities<br>◦ Illustration of how IAPD can be applied to Indonesian EV policy cases |
| 12:05 – 14:00 [115’] | **Networking Lunch** |
| 14:00 – 15:00 [60’] | **Applied Group Exercise: Applying IAPD to Indonesia’s EV Policy Challenges**<br>• Small-group application of IAPD to selected EV policy challenges, with each group being supported by two moderators (one from IESR and one from IES)<br>• Mapping causal pathways, policy interactions, and coordination failures<br>• Identification of trade-offs, risks, coordination failures, and policy intervention points |
| 15:00 – 15:30 [30’] | **Coffee Break** |
| 15:30 – 16:15 [45’] | **Group Presentations and Plenary Discussion**<br>• Group summaries of key diagnostic insights and leverage points<br>• Plenary reflection on cross-cutting patterns and priority follow-up areas |
| 16:15 – 16:30 [15’] | **Wrap-up Session**<br>• **Prof. Benjamin Cashore,** Lee Kuan Yew School of Public Policy, National University of Singapore<br>• Final reflections and synthesis |

# Appendix B. List of Participating Organizations

| Session | Category | Organization |
|---|---|---|
| Solar | Government / SOE | Ministry of Villages and Development of Disadvantaged Regions |
| | | Ministry of Energy and Mineral Resources (MEMR) |
| | | Coordinating Ministry for Economic Affairs |
| | | National Energy Council |
| | | PT PLN |
| | Industry / Private sector | Indonesia Chamber of Commerce and Industry (KADIN) |
| | | JA Solar |
| | | LONGi Green Energy Technology Co., Ltd. |
| | Research / Think tank | Institute for Essential Services Reform (IESR) |
| | | Masyarakat Konservasi dan Efisiensi Energi Indonesia (MASKEEI) |
| | | Indonesia Renewable Energy Society (METI) |
| | | Institute for Environment and Sustainability (IES), Lee Kuan Yew School of Public Policy, National University of Singapore |
| | | The National Research and Innovation Agency of the Republic of Indonesia (BRIN) |
| | | The University of Rhode Island |
| | | Institute for Economic and Social Research, University of Indonesia (LPEM-FEBUI) |
| | | Universitas Airlangga |
| | | Agora Energy China |
| | | Institute for Economic and Social Research (LPEM), University of Indonesia |
| | International org | World Resource Institute (WRI), Indonesia |
| | | Tony Blair Institute for Global Change |
| **EV** | Government / SOE | Ministry of Energy and Mineral Resources (MEMR) |
| | | Coordinating Ministry for Economic Affairs |
| | | Ministry of Transportation |
| | | Pusdatin Dishub, MOT |
| | | Dinas Perhubungan DKI Jakarta |
| | | National Energy Council (DEN) |
| | | Indonesia Battery Corporation (IBC) |
| | Industry / Private sector | Indonesian Electric Vehicle Industry Association (PERIKLINDO) |
| | | Electric Mobility Ecosystem Association (AEML) |
| | | Indonesia Chamber of Commerce and Industry (KADIN) |
| | Research / Think tank | Institute for Essential Services Reform (IESR) |
| | | Masyarakat Konservasi dan Efisiensi Energi Indonesia (MASKEEI) |

| | | |
|---|---|---|
| | | Institute for Environment and Sustainability (IES), Lee Kuan Yew School of Public Policy, National University of Singapore |
| | | Institute for Economic and Social Research, University of Indonesia (LPEM-FEBUI) |
| | | The National Research and Innovation Agency of the Republic of Indonesia (BRIN) |
| | | Universitas Airlangga |
| | | Agora Energy China |
| | | National Battery Research Institute (NBRI) |
| | International org | ITDP Indonesia |
| | | World Resource Institute (WRI), Indonesia |
| | | Tony Blair Institute for Global Change |
| | | ERIA |