

SOCIALLY INCLUSIVE AND SUSTAINABLE ENERGY TRANSITION (SISSET) TOOLKIT AND ROADMAP:

Integrating Renewable Energy into Regional
Development Planning in Indonesia

July 2026



SOCIALLY INCLUSIVE AND SUSTAINABLE ENERGY TRANSITION (SISET) TOOLKIT AND ROADMAP: Integrating Renewable Energy into Development Planning in Indonesia

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Foreword

In line with the National Long-Term Development Plan (RPJPN) 2025–2045 and the National Medium-Term Development Plan (RPJMN) 2025–2029, the energy transition has become one of Indonesia's strategic national priorities. It not only supports the achievement of greenhouse gas emission reduction targets and national energy security, but also serves as a catalyst for economic transformation, enhanced competitiveness, and more inclusive and equitable development. Ultimately, the success of the energy transition depends on its implementation at the subnational level. Provincial and local governments play a critical role in translating national policies into development planning, budgeting, investment, and programme implementation that reflect the unique characteristics and development priorities of their respective regions.

The Socially Inclusive and Sustainable Energy Transition (SISSET) Toolkit and Roadmap has been developed to move beyond a business-as-usual approach that views renewable energy merely as another development indicator. Instead, it provides practical guidance for subnational governments on how renewable energy can become a key driver of economic transformation, social development, and sustainable development. Drawing on experiences and lessons learned from South Sulawesi, the toolkit presents practical approaches, good practices, analytical tools, and recommendations that can be adapted to different local contexts.

This document is organised into seven modules covering: (1) introduction to the energy transition and the renewable energy context in South Sulawesi; (2) mapping cross-sector synergies and opportunities for renewable energy integration; (3) small-scale productive use cases and examples; (4) lessons from large-scale renewable energy projects; (5) lessons from other provinces and governance roadmap for renewable energy integration; (6) capacity gap assessment, technical assistance needs, and actions for renewable energy integration; and (7) a multi-agency coordination framework and roadmap. The toolkit is the product of collaboration among a wide range of stakeholders. We would like to express our sincere appreciation to UNEP Copenhagen Climate Centre (UNEP-CCC), Dala Institute, local governments particularly South Sulawesi Provincial Government, academia, civil society organisations, development partners, the private sector, and all those who contributed to its development.

Jakarta, July 2026

**Director of Energy, Mineral, and Mining Resources
Ministry of National Development Planning/
National Development Planning Agency (Bappenas)
Togu Santoso Pardede**

Introduction

About Siset

The Socially Inclusive and Sustainable Energy Transition (Siset) project was designed to support subnational stakeholders in Indonesia in integrating renewable energy considerations into regional development planning. The project aimed to ensure that the energy transition contributes not only to decarbonisation and energy security objectives, but also to inclusive economic development, improved livelihoods, social equity, and strengthened institutional capacity at the local level. The Siset project was implemented over the period 2024 to 2026. It was carried out in phased stages, evolving from analytical and scoping work in 2024 to implementation-oriented activities in 2025, and concluding with validation, dissemination, and knowledge-sharing in 2026.

Why Focus on the Subnational Level?

While national governments establish overarching energy transition targets and policy frameworks, the implementation of these ambitions ultimately takes place at the subnational level. Provincial and local governments play a critical role in translating national objectives into concrete development plans, investment priorities, infrastructure decisions, and stakeholder engagement processes.

At this level, energy transitions are not solely about decarbonisation; they also generate a range of co-benefits that are central to broader national development goals. These include employment creation, industrial upgrading, improved energy access and reliability, poverty reduction, strengthened local value chains, and enhanced social inclusion. In this sense, energy transition planning becomes a multi-objective governance exercise, where climate mitigation objectives are pursued alongside economic transformation and social development outcomes.

Subnational governments are therefore responsible for navigating and aligning these interconnected objectives, ensuring that energy transition pathways are embedded within wider territorial development strategies such as land-use planning, regional competitiveness, and inclusive growth agendas.

Moreover, despite their importance, provincial governments often face capacity constraints, fragmented institutional mandates, limited coordination mechanisms, and insufficient tools to systematically integrate energy transition considerations

into regional planning processes. These challenges can limit the ability of stakeholders to move beyond sectoral approaches and develop integrated strategies that link renewable energy deployment with broader development objectives.

Siset was designed to address these gaps through a combination of technical assistance, stakeholder engagement, awareness-raising activities, capacity-building workshops, and the development of practical analytical tools. By strengthening local ownership, institutional coordination, and planning capacity, the project sought to support more inclusive, context-specific, and sustainable energy transitions at the provincial level.

Why South Sulawesi?

South Sulawesi was selected as the primary focal province due to its strategic relevance to Indonesia's energy transition and regional development agenda.

The province has significant renewable energy resources, particularly solar and wind potential, while also serving as one of the most important economic and logistical hubs in Eastern Indonesia. As a gateway connecting Eastern and Western Indonesia, South Sulawesi plays a central role in trade, industry, transportation, and regional economic integration. Its growing economy and expanding industrial base create increasing demand for reliable and sustainable electricity, making it a particularly relevant context for examining the opportunities and challenges associated with renewable energy deployment.

Beyond its technical potential, South Sulawesi offers an important governance perspective. The province illustrates how subnational governments can influence energy transition outcomes through policy alignment, institutional coordination, development planning, and stakeholder engagement. Effective provincial leadership can demonstrate how renewable energy deployment can simultaneously contribute to national climate and energy objectives while advancing local economic development, industrial competitiveness, and social inclusion goals.

The Siset project selected South Sulawesi as a provincial focal point to develop a contextual understanding of provincial-level energy planning and implementation processes. The project also sought to understand how different stakeholder groups including government agencies, development actors, private sector representatives, civil society organisations, academia,

and local communities perceive the opportunities, challenges, and requirements associated with a just and inclusive energy transition.

An additional consideration was the intention to maximise the project's added value by focusing on a province where targeted support could generate meaningful impact, while avoiding locations already receiving significant attention and investment from multiple development initiatives. This approach allowed SISSET to complement existing efforts rather than duplicate them.

The final selection also drew upon insights from previous work undertaken by the UNEP Copenhagen Climate Centre (UNEP-CCC), Dala Institute, ongoing programmes funded by the Danish International Development Agency (DANIDA), and recommendations from key national institutions, including National Development Planning Agency (Badan Perencanaan Pembangunan Nasional–Bappenas), the National Energy Council (Dewan Energi Nasional–DEN), and Ministry of Energy and Mineral Resources (MEMR). This ensured that the project remained aligned with Indonesia's broader energy development agenda and emerging national policy priorities.

Project Implementation

The SISSET project successfully engaged Bappenas as its principal political partner at the national level. Bappenas provided strategic guidance, and committed to providing an endorsement letter to facilitate engagement with relevant stakeholders.

At the subnational level, Bappelitbangda Sulawesi Selatan played a critical role in providing political support, convening stakeholders, and facilitating coordination across provincial agencies. This institutional support was essential in fostering cross-sector dialogue and ensuring that project activities remained aligned with provincial development priorities.

Implemented in collaboration with the national partner, Dala Institute, SISSET followed a phased and adaptive approach combining research, stakeholder engagement, policy dialogue, capacity building, and practical tool development.

The first phase commenced in 2024 with a province selection analysis and baseline assessment. This phase involved literature reviews, policy analysis, and interviews with stakeholders at both

national and provincial levels. National consultations in Jakarta and field visits to South Sulawesi and West Java provided further insights into local planning dynamics, institutional challenges, stakeholder relationships, and opportunities for integrating socio-economic dimensions into energy transition planning.

During 2025, the project was in implementation-oriented phase. Activities focused on supporting policy discussions linked to the preparation of the RPJMD in South Sulawesi, facilitating capacity-building workshops, strengthening cross-sector stakeholder engagement, and supporting the establishment of an informal coordination forum involving Bappelitbangda and Dinas ESDM. During this period, SISSET also developed a multi-module toolkit, drawing on stakeholder feedback and practical experiences, to support the integration of renewable energy, socio-economic development, gender equality, and social inclusion considerations into regional planning processes.

The final phase in 2026 focused on dissemination, validation, and knowledge sharing. Workshops and consultations were conducted with provincial and national stakeholders to test and refine the toolkit and its associated methodologies. The project concluded with the finalisation of the toolkit and the preparation of this report, which captures key findings, lessons learned, and future opportunities for advancing socially inclusive and sustainable energy transitions at the subnational level.

Ultimately, the SISSET project sought to demonstrate that energy transitions are not solely technical processes, but also opportunities to advance broader development objectives. By supporting the integration of renewable energy considerations into regional planning and strengthening stakeholder capacity, SISSET aimed to better align energy transition efforts with socio-economic priorities at the provincial level.

While the project focused on South Sulawesi as a single provincial case, the lessons, approaches, and insights generated through the process extend beyond the province itself. It is hoped that these experiences can inform and support other provinces across Indonesia as they pursue their own energy transition pathways and seek to align renewable energy development with broader socio-economic priorities. In this regard, SISSET sought to provide a practical pathway for advancing a just, inclusive, and sustainable energy transition that contributes not only to decarbonisation and energy security, but also to broader development objectives and Indonesia's long-term energy transition ambitions.

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Glossary

APBD (Anggaran Pendapatan dan Belanja Daerah / Regional Revenue and Expenditure Budget)	The annual regional government budget used to finance programs, activities, and development priorities at the provincial or district level.
BUMDes (Badan Usaha Milik Desa / Village-Owned Enterprise)	A village-level economic institution owned by the village government and community that manages local economic activities and services, including renewable energy systems.
CSR (Corporate Social Responsibility)	Programs implemented by private companies to provide social, environmental, or economic benefits to communities surrounding their operations.
GEDSI (Gender, Equity, Disability, and Social Inclusion)	An approach ensuring that policies and programs address inequalities and promote equitable participation and benefits for women, vulnerable groups, and marginalized communities.
IKU (Indikator Kinerja Utama / Key Performance Indicator)	Strategic performance indicators used to measure the contribution of government agencies (OPD) to broader regional development outcomes.
IKK (Indikator Kinerja Kegiatan / Activity Performance Indicator)	Indicators used to measure intermediate results produced by specific programs or activities that contribute to IKU.
JETP (Just Energy Transition Partnership)	An international financing and cooperation initiative supporting Indonesia's transition to clean energy while ensuring affordability and social justice.
KEN (Kebijakan Energi Nasional / National Energy Policy)	Indonesia's overarching national policy that sets long-term direction and targets for the country's energy system.
OPD (Organisasi Perangkat Daerah / Regional Government Agency)	Government agencies at the provincial or district level responsible for implementing sectoral policies and development programs.
RKA (Rencana Kerja dan Anggaran / Work Plan and Budget)	A budgeting document prepared by government agencies that details planned expenditures based on the annual work plan (Renja).
Renja PD (Rencana Kerja Perangkat Daerah / Agency Annual Work Plan)	The annual planning document prepared by each government agency outlining programs, activities, outputs, and budget needs.

Renstra PD (Rencana Strategis Perangkat Daerah / Agency Strategic Plan)	A five-year strategic planning document prepared by each government agency aligned with the RPJMD.
RKPD (Rencana Kerja Pemerintah Daerah / Regional Government Work Plan)	The annual regional development plan that translates RPJMD priorities into yearly programs and activities.
RPJMD (Rencana Pembangunan Jangka Menengah Daerah / Regional Medium-Term Development Plan)	The five-year development plan of a province or district that sets development priorities, targets, and policy directions.
RUED (Rencana Umum Energi Daerah / Regional Energy Plan)	A provincial-level energy planning document aligned with RUEN that outlines regional energy targets, strategies, and programs.
RUEN (Rencana Umum Energi Nasional / National Energy Plan)	Indonesia's national long-term energy planning framework developed by the National Energy Council (DEN).
RUPTL (Rencana Usaha Penyediaan Tenaga Listrik / Electricity Supply Business Plan)	PLN's long-term electricity development plan outlining generation capacity additions and infrastructure expansion.
Small-scale Renewable Energy	Renewable energy systems with relatively small generation capacity that typically serve communities, villages, or productive sectors.
Large-scale Renewable Energy	Utility-scale renewable energy projects designed to supply electricity directly to the national grid.
Socially Inclusive Energy Transition	An energy transition approach that ensures fair participation, equitable distribution of benefits, and recognition of diverse social groups.
Spatial Planning (RTRW / Rencana Tata Ruang Wilayah – Regional Spatial Plan; RDTR / Rencana Detail Tata Ruang – Detailed Spatial Plan)	Planning instruments that regulate land use and spatial allocation for infrastructure, economic activities, and environmental protection.
TVET (Technical and Vocational Education and Training)	Education and training programs designed to develop practical technical skills for sectors such as renewable energy installation and maintenance.

Background

Why This Toolkit?

Energy transition is not solely a technical challenge; it is fundamentally a social transformation that affects livelihoods, requires new skills, demands institutional coordination, and creates opportunities for inclusive economic development. The transition to renewable energy in South Sulawesi must be managed in ways that:

- › Ensure inclusive benefits across diverse communities, sectors, and demographic groups
- › Build local capacity for planning, implementing, and maintaining renewable energy systems
- › Foster coordination among multiple government agencies, private sector actors, and civil society organizations
- › Leverage synergies between energy, development, and other sectoral priorities such as agriculture, fisheries, industry, and education

Within the context of the energy transition, inclusive benefits refer not only to expanded access to energy services powered by renewable sources, but also equitable participation in decision-making, fair distribution of economic opportunities, improved access to skills and finance, and strengthened control over productive assets. Inclusivity ensures that women, youth, rural communities, indigenous peoples, and other underrepresented groups are not merely recipients of the benefits, but also given agency in planning, implementation, operation, and governance.

Gender equality, inclusion and skill development are therefore fundamental rather than peripheral social considerations. They are determinants of the success of the energy transition. Integrating gender-responsive approaches into planning, budgeting, workforce development, and monitoring enhances policy effectiveness and strengthens economic resilience.¹

Without attention to these socio-economic dimensions, renewable energy projects risk being unsustainable, failing to deliver anticipated benefits, or exacerbating existing inequalities. If structural inequalities are unaddressed, benefits risk being further concentrated among already advantaged actors, undermining social cohesion and limiting long-term sustainability.

What gap does the Toolkit address?

Indonesia's development planning follows a system where national and regional medium-term plans (RPJMN and RPJMD) form the basis for ministries and sectoral agencies (including energy/RE) to formulate their 5-year Strategic Plans (Renstra K/L), which are further elaborated into annual working plans (Renja K/L) and budgets. The toolkit will try to align with this established planning process.

Current challenges include the disconnect between national targets and provincial renewable energy potential, as well as with provincial development plans, highlighting the need for better integration of provincial planning with sectoral and national frameworks. The toolkit attempts to address this gap by providing practical guidance, steps and insights.

Successful renewable energy planning and implementation in Indonesian provinces requires enhanced vertical and horizontal collaboration between national and provincial levels, across sectoral agencies at the provincial level, and with local levels (city/regency level and village level), which the toolkit and the expected coordination forum should facilitate. Lacking this coordination risks fragmented planning across OPDs, concentration of benefits among capital-intensive actors, and missed opportunities to multiply local economic impacts.

¹ As such, gender mainstreaming is mandated across various Indonesian policies, requiring sectoral programs to integrate gender analysis, gender-responsive budgeting, and performance monitoring (e.g., Presidential Instruction No. 9/2000, Minister of Home Affairs Regulation No. 67/2011). These commitments are embedded within national and regional development planning instruments.

Objective and Purpose of the Toolkit

This SISSET (Socially Inclusive Sustainable Energy Transition) Toolkit aims to:

- › Provide contextual understanding of the landscape at a sub-national level in South Sulawesi, including the regulatory framework, current initiatives, and social considerations
- › Map synergies and opportunities for integrating renewable energy across multiple sectors (agriculture, fisheries, animal husbandry, industry, transportation) and cross-cutting themes (workforce development, gender inclusion, MSMEs development and village capacity development)
- › Encourage the establishment of coordination mechanisms that facilitate collaboration among technical and non-technical government agencies (OPDs), private sector, civil society organisations, universities/academia and local communities.
- › Document practical examples from both large-scale and small-scale renewable energy projects, highlighting lessons learned and replicable approaches
- › Identify capacity gaps and resources for building technical, institutional, and social competencies needed for successful energy transition
- › Support informed decision-making by provincial and city/regency-level planners, sectoral agencies, and development partners
- › Provide an indicative roadmap for provinces to progressively integrate renewable energy into development planning, capacity building, and coordination mechanisms.

Social inclusion is the alignment of renewable energy investments with local economies and development planning with an aim to make progress on social equity objectives. This increases return on public investment by stimulating value chains and job creation, thereby increasing resilience in the local economy.

Target Audience

This toolkit is designed for:

- › Provincial and district government agencies (OPDs), responsible for energy, development planning, agriculture, fisheries, animal husbandry, industry, education, workforce, women empowerment and other relevant sectors
- › Development planning bodies (Bappeda) at the provincial and district levels

- › Energy sector agencies (ESDM) and utilities involved in renewable energy deployment
- › Civil society organizations and NGOs working on energy access, rural development, and community empowerment
- › Private sector actors, including renewable energy developers, cooperatives, and SMEs
- › Academic and research institutions engaged in energy transition studies, pilot demonstrations, vocational training and capacity building
- › International development partners supporting Indonesia's energy transition goals

The toolkit adopts a practical, action-oriented approach with real examples from South Sulawesi and other regions of Indonesia, making it accessible to readers with varying levels of technical expertise in renewable energy.

Toolkit Structure and How to Use It

This toolkit consists of seven interconnected modules that can be read either sequentially or separately, depending on the interests, priorities, and relevance for different stakeholders and sectors across provinces in Indonesia. The modules are designed to provide both contextual understanding and practical examples to support renewable energy integration at the subnational level, while also offering lessons and approaches that may be adapted to other provincial contexts beyond South Sulawesi.

The seven modules include:

Module 1: Introduction to Energy Transition and Renewable Energy Context in South Sulawesi

Module 2: Mapping Synergies across Sectors and Thematic Topics and Opportunities to Leverage Further

Module 3: Small-scale Productive Use Cases and Examples

Module 4: Lessons from Large-scale RE Projects

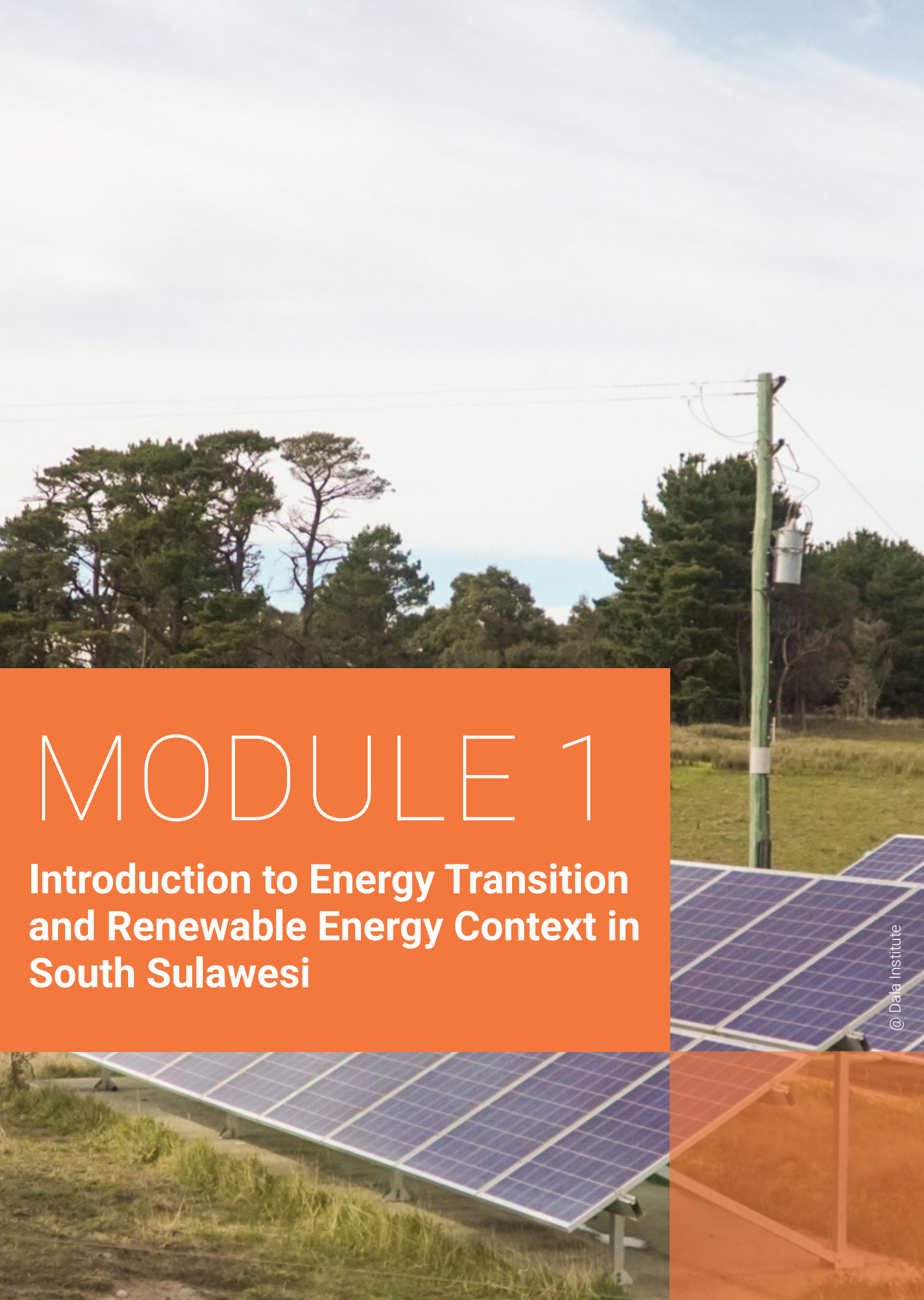
Module 5: Lessons from Other Provinces and Governance Roadmap for Renewable Energy Integration

Module 6: Capacity Gaps, technical assistance needs and actions for renewable energy integration

Module 7: Multi-Agency Coordination Framework and Roadmap

The SISSET package is both a toolkit and an indicative roadmap. Modules 1–4 provide concepts, cases and tools, while Modules 5–7 outline governance, capacity-building and coordination roadmap actions that provincial actors can adapt over time. Stakeholders are encouraged to access the modules most relevant to their sector, institutional role, and planning needs.





MODULE 1

**Introduction to Energy Transition
and Renewable Energy Context in
South Sulawesi**

1.1 National Commitments and Momentum

Indonesia is currently engaged in the pursuit of sustainable energy solutions to decrease its dependence on fossil fuels and reduce its carbon footprint. This commitment is demonstrated by Indonesia's new Enhanced Nationally Determined Contribution (E-NDC) emission reduction targets of 31.89%

unconditionally (with its own efforts) and 43.20% conditionally (with international support) by 2030, with the energy sector aiming to achieve 12.5% and 15.5% ([MOEF, 2022](#)). The share of renewable energy is expected to be 17-19% in 2030, 36%-40% in 2040, and 70%-72% in 2060 with a focus on geothermal, nuclear, hydrogen, and ammonia as emerging energy sources, in line with the New and Renewable Energy Bill (RUU EBT) currently under deliberation, aimed at accelerating the energy transition and achieving Net Zero Emissions (NZE) by 2060.

Box 1.1

Understanding Renewable Energy

According to [United Nations \(n.d.\)](#), renewable energy (RE) is energy derived from natural sources (such as solar, wind, water, biomass and geothermal) that are replenished at a higher rate than they are consumed – constantly replaced and never run out. It produces lower emission than fossil fuels– transitioning from fossil fuels to renewable energy is key to addressing the climate crisis–and can support local economic activities and energy access.

Is renewable energy more expensive than fossil fuels?

The cost comparison between fossil energy and renewable energy is not always straightforward and depends on several factors:

- › Upfront cost vs long-term cost
 - › Renewable energy often has higher initial investment costs
 - › However, operational costs are very low (no fuel cost), making it cheaper over time
- › Fossil energy appears cheaper, however
 - › Fossil fuels benefit from existing infrastructure and subsidies
 - › Their costs do not fully reflect environmental and health impacts
- › In many contexts, renewable energy is already cost-competitive, according to [IEA \(2024\)](#)
 - › Globally, solar and wind are among the cheapest sources of electricity
 - › In Indonesia, costs can vary depending on:
 - › Location and grid access
 - › Financing conditions
 - › Technology availability



Notably, since 2022, Indonesia’s clean energy transition efforts have gained significant momentum, spurred particularly by the launch of the Just Energy Transition Partnership (JETP) (Inayah et al., 2023). This initiative serves as a crucial vehicle to finance the upgrading of Indonesia’s energy infrastructure and accelerate its journey toward net-zero emissions in a just and ‘affordable’ manner (Fiscal Policy Agency, 2022). This momentum was further reinforced domestically by Presidential Regulation No. 112/2022 on the Acceleration of Renewable Energy for Electricity Supply, which outlines plans for the early retirement of coal-fired power plants with several exemptions.

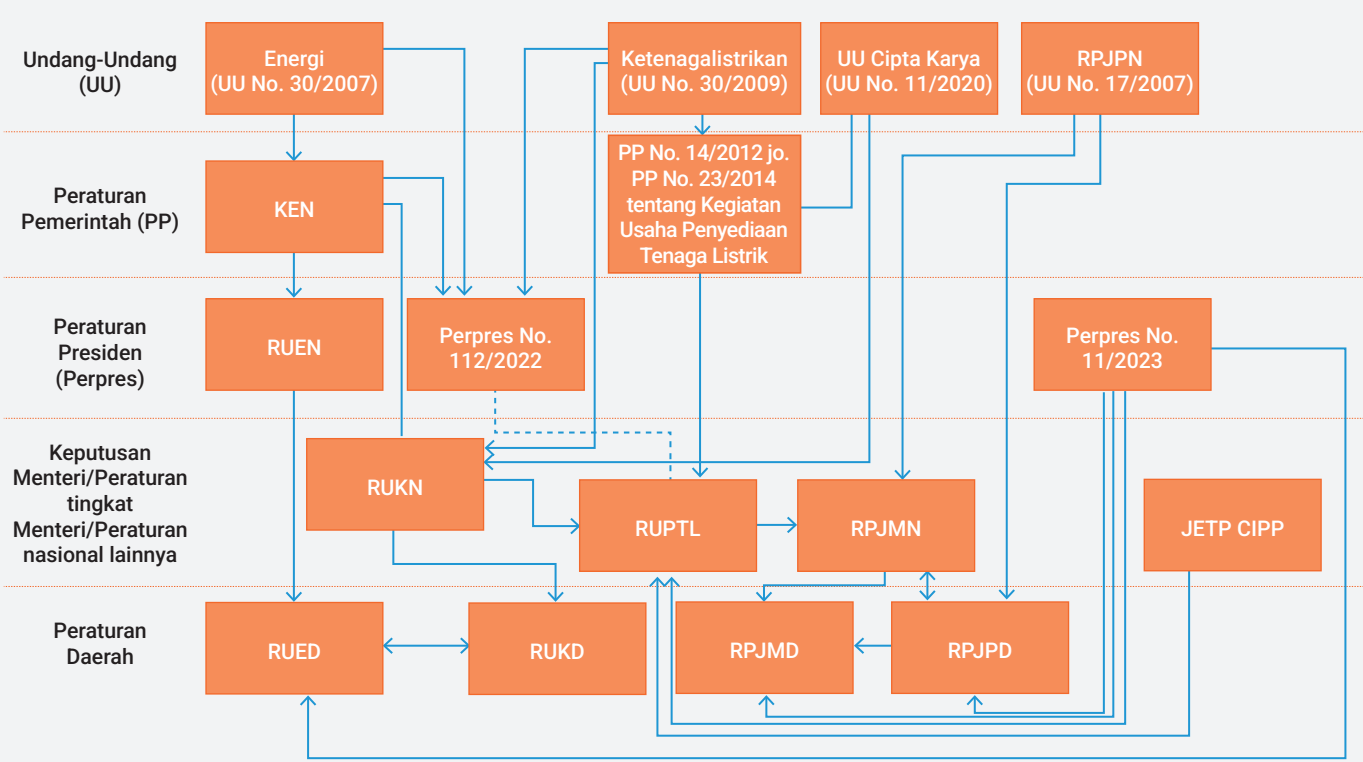
Indonesia has also made important strides in institutionalizing energy planning under the responsibility of the National Energy Council (DEN) - through the National Energy Plans (RUEN) and mandating Regional Energy Plans (RUEDs) at the sub-national or provincial level. However, the vertical linkages across governance levels, i.e., the national and sub-national levels for renewable energy planning and implementation, continue to remain weak.

1.2 The Subnational Gap

Achieving Indonesia’s just energy transition requires strong coordination across national and subnational governments, considering the country’s diverse local contexts across provinces and districts. While Indonesia already has national and regional energy planning frameworks (see Figure 1.1) – including National Energy Policy/KEN, National Energy Plan/RUEN, Electricity Supply Business Plan/RUPTL, Regional Energy Plan/RUED, Regional Medium-Term Development Plan/RPJMD, and Regional Electricity Plan/RUKD – implementation at the subnational level remains uneven.

One key challenge is the integration of energy transition targets into broader regional development planning and budgeting processes. In many cases, renewable energy planning is still treated separately from sectoral development priorities and annual budget allocation processes.

Figure 1.1
National and subnational energy-development planning frameworks



Source: The SISSET team

1.2.1 Expanding Authority, Navigating Limited Resources

Presidential Regulation No. 11/2023 expanded provincial authority in managing renewable energy resources such as solar, wind, biomass, biogas, and hydropower. This creates opportunities for provinces to play a more active role in advancing renewable energy initiatives, particularly at small and medium scales.

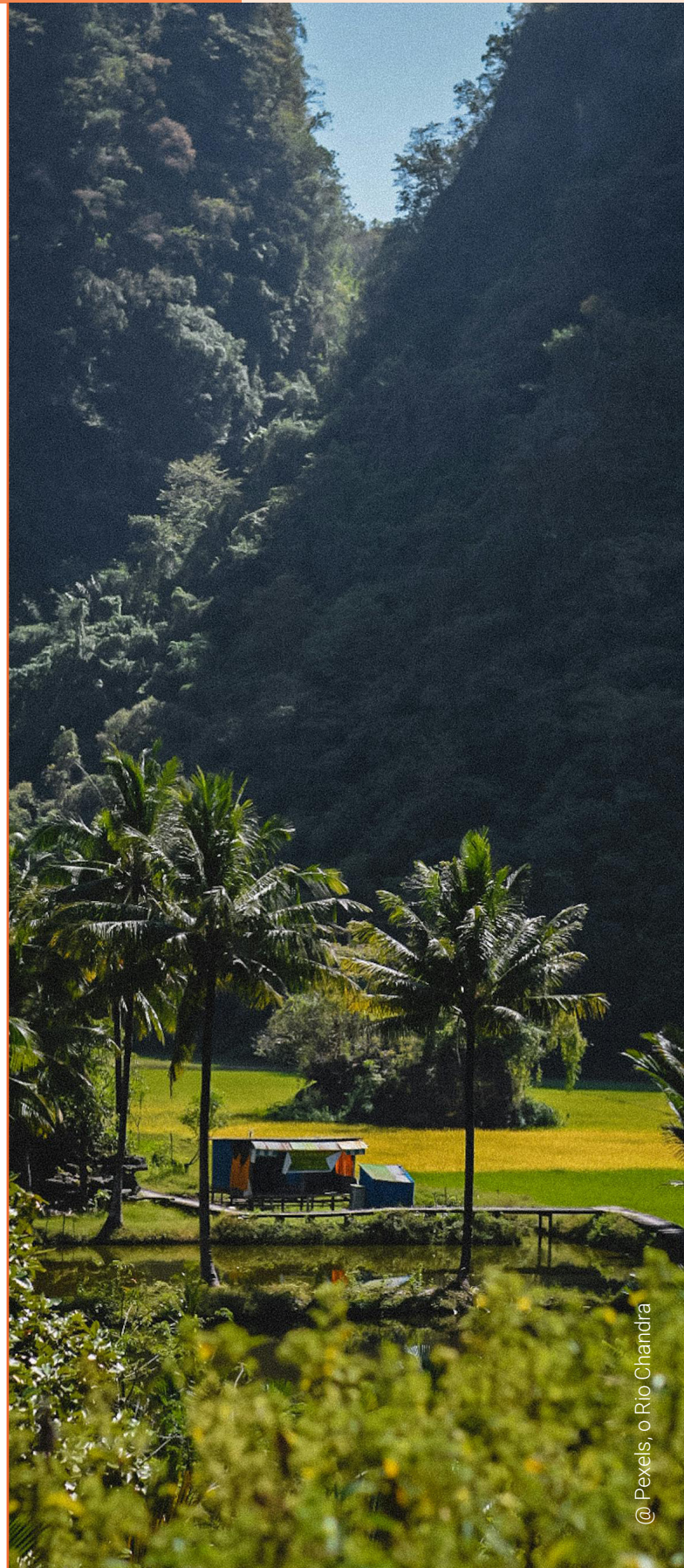
However, implementation remains influenced by several factors, including institutional coordination, technical capacity, and funding availability. At the same time, large-scale electricity planning and grid management remain under the authority of State-Owned Electricity Company (Perusahaan Listrik Negara/ PLN) and the central government. As a result, provincial governments often focus on facilitation roles, including coordination, planning alignment, and support for local implementation initiatives.

Despite these limitations, several provinces have started to develop innovative approaches and partnerships to advance renewable energy development, including through small-scale and community-based initiatives (further discussed in Module 5).

1.2.2 The Energy Planning Paradox

Provincial governments (through Energy Agency/Dinas ESDM) are mandated to develop Regional Energy Plans (RUED) aligned with national energy targets. RUED serves as an important instrument to guide renewable energy development and support broader energy transition goals at the regional level. However, in practice, the integration between RUED and regional development planning documents (such as RPJMD, RKPD, Renstra, and Renja)² is still evolving. Differences in institutional authority, planning processes, and budget mechanisms can affect implementation and coordination across sectors.

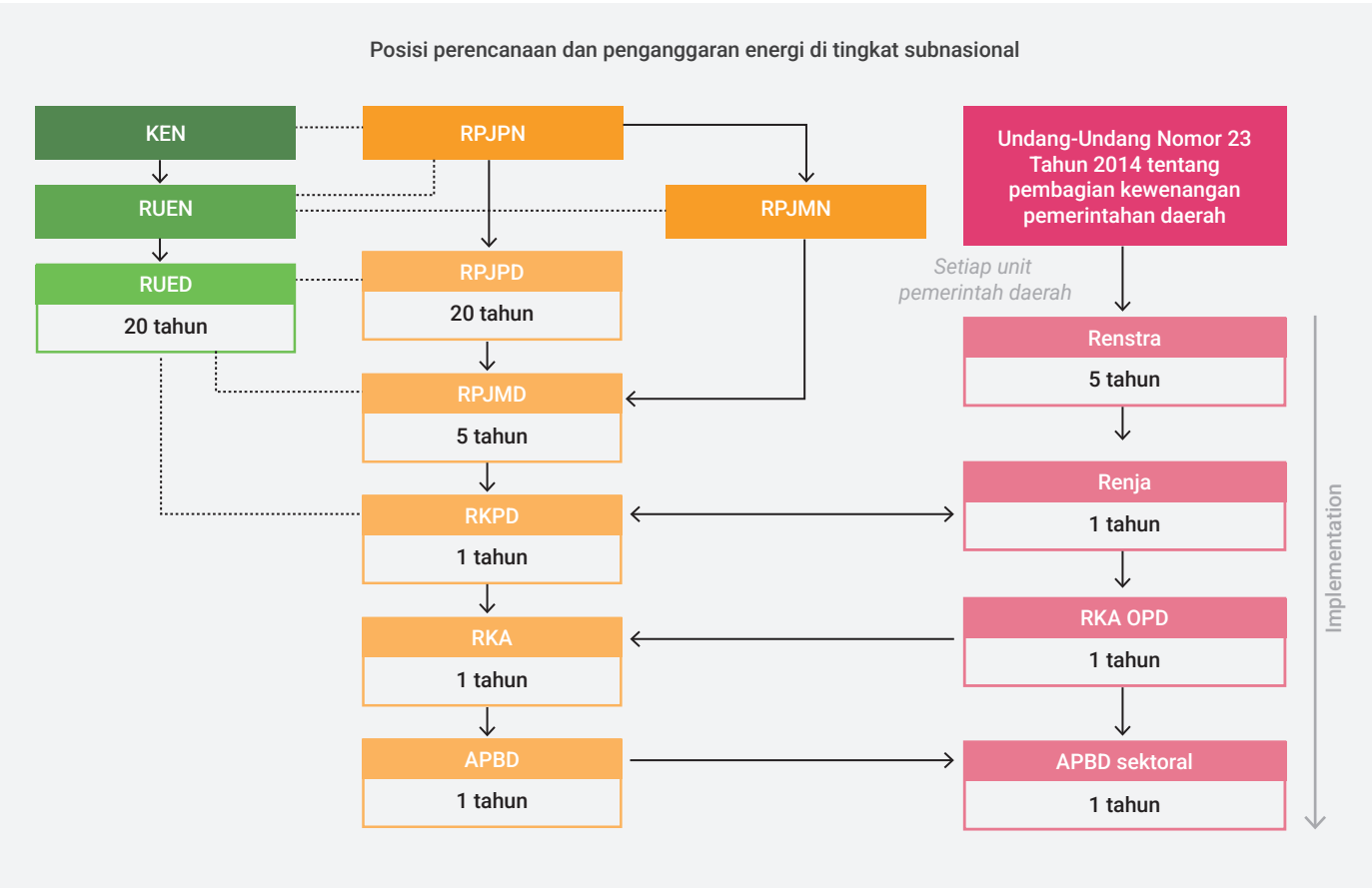
Strengthening the linkage between RUED, sectoral planning, and regional budgeting processes can help improve the implementation of renewable energy initiatives at the subnational level³. This also requires stronger coordination, improved capacity, and collaboration across government agencies and stakeholders.



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- 2 Development planning frameworks include Regional Medium-Term Development Plans (RPJMD) (5-year), Annual Regional Work Plans (RKPD) (1-year), Sectoral Strategic Plans (Renstra) (5-year), and Sectoral Annual Work Plans (Renja) (1-year).
- 3 To enhance the impact of RUED on subnational energy transition, it is important to strengthen its role as the basis for the energy agency's annual work plan (RKA DESDM), integrate energy transition initiatives aligned with subnational authorities and sectoral agencies into RUED, and develop an energy-specific budget plan with diverse funding sources (IESR, 2025).

Figure 1.2
Position of energy planning and budgeting at the subnational



Source: IESR Energy Transition Outlook 2025 (IESR 2024)

1.3 Case Study: South Sulawesi

1.3.1 South Sulawesi and the Energy Transition Context

South Sulawesi demonstrates both the opportunities and challenges of integrating renewable energy into regional development. The province has made significant progress in renewable energy deployment through hydropower, biomass co-firing, and large-scale projects such as the Sidrap and Jeneponto wind farms. However, renewable energy is still not fully integrated into broader sectoral and development planning processes.

This is important because South Sulawesi's economy is strongly driven by sectors such as agriculture, fisheries, animal husbandry, Micro, Small, and Medium Enterprises (MSMEs), and resource-based industries, which are closely linked to the province's blue and green economy priorities. These sectors are highly energy-dependent and offer strong opportunities for decentralized and productive-use renewable energy solutions.

South Sulawesi also has abundant renewable energy potential, including solar, wind, biomass, and marine-based resources, alongside growing energy demand from industrial development and the nickel supply chain. If managed inclusively, renewable energy development can support economic growth, green jobs, local value chains, and more equitable development outcomes.

Current Energy Landscape and Projections

According to the 2024 ESDM Handbook, South Sulawesi's installed electricity capacity is approximately 1,622 MW, with hydropower contributing around 756 MW (MEMR, 2024). Under RUED and PLN's Electricity Supply Business Plan (RUPTL), the province targets a 35% renewable energy share by 2030, while electricity demand is projected to continue increasing, particularly from industrial and smelter activities.

While utility-scale renewable energy projects dominate current development, decentralized renewable energy remains underutilized as a tool for local economic development. Many productive sectors still rely heavily on diesel for irrigation, cold storage, processing, and transport, resulting in high operational costs and vulnerability to fuel price fluctuations.

Decentralized Renewable Energy and Socio-Economic Opportunities

Experiences from initiatives such as solar-powered irrigation systems in Gowa demonstrate how small-scale renewable energy can help reduce operational costs, improve productivity, and strengthen local livelihoods. Similar approaches can support fisheries, MSMEs, remote islands, and coastal communities through more reliable and affordable energy access.

These examples show that renewable energy should not only be viewed as an infrastructure or electricity issue, but also as an enabler of broader development priorities, including local economic development, workforce development, and inclusive livelihoods.

Integrating Energy Transition into Sectoral Development (Horizontal Linkages)

To maximize these benefits, renewable energy needs to be integrated into regional planning and sectoral development strategies. Achieving renewable energy targets is not solely the responsibility of the energy sector, but also requires contributions from sectors such as agriculture, fisheries, industry, education, women's empowerment, and workforce

development (See Module 2 for further explanation on the cross-sectoral integration/synergy).

Subnational governments are pivotal in translating the energy transition into tangible co-benefits: job creation, skills development, economic growth, local value chain development, research and development capacity, and equitable energy access. Strategic governance at the provincial and regency levels will determine whether South Sulawesi's energy transition amplifies opportunity or deepens existing disparities.

Therefore, it is important for all OPDs to understand the policy direction and renewable energy development targets that have been established at both the national and provincial levels. Achieving these indicators does not rely solely on the energy sector but also requires contributions from various development sectors such as agriculture, fisheries, industry, education, women's empowerment, and others.

As an initial overview, Table 1.1 presents several key indicators for renewable energy development along with relevant targets for the provincial government and related sectors. This information is expected to help OPDs understand the contributions they can make in collectively supporting the achievement of energy transition targets.

Tabel 1.1
Renewable Energy in the South Sulawesi Regional Medium-Term Development Plan (RPJMD) 2025-2029

Mission	Target	Outcome	Indicator	Program
4. Continuing equitable infrastructure development, resilient to disasters and climate change, to support the acceleration of economic growth	17. Improved environmental quality and resilience in disaster adaptation and mitigation as well as climate change	Increased amount of energy generated from New and Renewable Energy (NRE)	Target indicators: IS.6.2.1. Disaster Risk Index IS.6.2.2. Environmental Quality Index (IKLH) Outcome indicator: Amount of energy generated from new and renewable energy (NRE) infrastructure	New and Renewable Energy Management Program



1.4 Energy Transition as a Socio-Economic Opportunity

The SISSET framework demonstrates how renewable energy development can generate broad socio-economic benefits when deliberately integrated into planning and policy. Rather than treating the energy transition as purely technical infrastructure or as only for the sake of reducing GHG emissions, this approach identifies four interconnected pillars that transform renewable energy into a driver of inclusive economic development.



Tabel 1.2
Four interconnected pillars of SISSET framework

Productive Use and Economic Development	Beyond resilience, renewable energy technologies can directly strengthen key productive sectors like agriculture, fisheries, tourism, and small industries through locally appropriate solutions. Solar irrigation pumps, dryers, milling machines, cooling systems, and captive power with storage for small industries can boost productivity and incomes while reducing GHG emissions. The spillover effects are substantial: enhanced agricultural yields, reliable solar irrigation, reduced food loss through improved cold chains, and new employment opportunities linked to RE technologies, among others. By aligning RE with sectoral objectives, the energy transition becomes a vehicle for provincial economic development.
Local skills and workforce development	Addressing the skills gap between renewable energy sector needs and available workforce capacity is critical. Provincial governments must lead workforce planning through industry-based training programs that connect educational institutions, technical-vocational education and training (TVET-technical-vocational education and training) centers, and renewable energy companies. Without deliberate investment in local capacity building, the region risks importing expertise while local communities remain excluded from the economic opportunities the transition creates.
Mainstreaming gender inclusion and representation of vulnerable groups	An equitable energy transition requires applying a GEDSI (Gender, Equity, Disability, and Social Inclusion) lens throughout planning and implementation. Women, people with disabilities, indigenous communities, and the poor remain largely excluded from the energy sector in technical roles, economic participation, and decision-making. This exclusion stems from unequal access to skills training, limited information, and insufficient inclusive policies. Provincial governments must ensure that energy projects deliver tangible benefits to these groups, not just technical infrastructure. Inclusion is not ancillary; it determines whether the transition reduces or reinforces existing inequalities.
Strengthening local value chains	Deepening local industrial participation in renewable energy development can strengthen domestic value chains, enable self-sufficiency, and drive regional development. This means enabling MSMEs, local companies, and other local entities to supply components and installation services, along with operation and maintenance services. Current barriers include limited local industrial capacity, import dependence, and inadequate support for MSMEs accessing RE business opportunities. Provincial governments are uniquely positioned to address these challenges through local content policies, favorable regulatory conditions, and targeted incentives for MSMEs and such local service providers.

1.5 The Path Forward

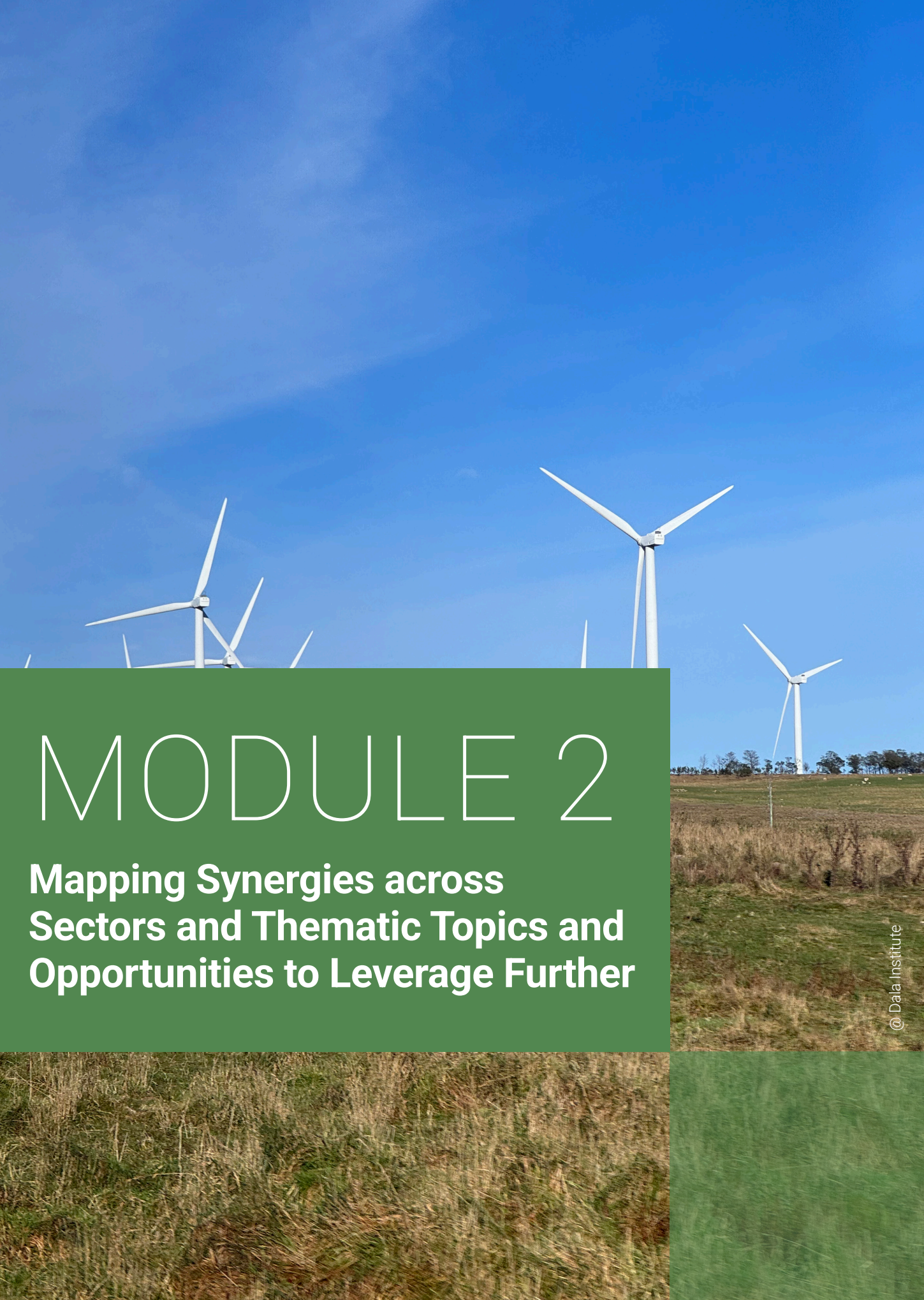
Despite its potential, green technology adoption faces persistent obstacles: limited technology access, high upfront costs, and insufficient community training in operation and maintenance. Sub-national /provincial governments can overcome these barriers through adoption incentives, financing schemes for small businesses, and comprehensive community training programs that build local ownership and self-sufficiency.

The Siset approach fundamentally reframes renewable energy development—from a narrow focus on technical capacity and decarbonization targets to a comprehensive development strategy. In South Sulawesi's context, this means tracking not only GHG reductions and renewable energy percentages but also income growth, poverty reduction, and productivity gains. By investing in workforce skills, ensuring inclusive participation, building local industrial capacity, and optimizing green technology for community productive needs, the energy transition becomes a catalyst for equitable and sustainable economic development—not merely an infrastructure upgrade or only an energy access point of view.

Some of the key actions that sub-national authorities can take include:

- › Align RUED with RPJMD and sectoral plans
- › Integrate energy priorities into regional budgets
- › Establish joint planning forums across agencies
- › Mainstream gender and youth in energy-linked programs
- › Promote participatory approaches and local ownership



The background of the slide is a photograph of several white wind turbines in a grassy field under a clear blue sky. The turbines are positioned at different heights and angles, creating a sense of depth. The foreground shows a close-up of dry, yellowish-brown grass. A dark green horizontal band is overlaid on the middle of the image, containing the text.

MODULE 2

**Mapping Synergies across
Sectors and Thematic Topics and
Opportunities to Leverage Further**

As outlined in Module 1, Indonesia has developed an energy planning framework through the National Energy Plan (RUEN) at the national level and the Regional Energy Plan (RUED) at the provincial level. However, significant gaps remain in how these energy plans are integrated with broader development planning frameworks and also how sectoral integration is coordinated for mainstreaming renewables, i.e., weak horizontal linkages for renewable energy planning and implementation at a sub-national level.

Limited Inclusivity: Gender and youth considerations are rarely mainstreamed into energy planning, despite their relevance for workforce development and empowerment. This reduces the potential workforce, weakens community ownership, and increases project risk.

These challenges are significant because they influence the extent to which energy can effectively support sectoral development priorities.

2.1 Key Challenges

Siloed Planning: RUEDs often remain confined within energy agencies and are not embedded into planning cycles for agriculture, industry, transport, or workforce development. This limits the transformative potential of energy as a cross-sectoral enabler.

Missed Synergies: Opportunities such as aligning solar irrigation with agricultural targets or integrating renewable energy into industrial zones are under-leveraged.

Budget Disconnects: Lack of coordination between RUEDs and RPJMDs means energy priorities are not reflected in budget allocations or implementation strategies. This weakens the ability of sub-national governments to mobilize resources, attract investment, and deliver energy-linked development outcomes.

2.2 Why Integration Matters?

RE acts as a cross-sectoral enabler of transformation across multiple development priorities. Integrating renewable energy with the key provincial development sectors helps reduce costs, improve productivity, strengthen resilience, and expand socio-economic opportunities. The sectors highlighted below are representing South Sulawesi's major production systems and the thematic support systems needed to enable sustainable and inclusive energy adoption. To support OPD in identifying their respective roles within the energy transition agenda, Figure 2.1 outlines the key sectors that hold potential synergies with renewable energy development in South Sulawesi. Meanwhile, Figure 2.2 shows cross-cutting thematic sectors that enable skills, governance, and system readiness for scalable, inclusive and sustainable RE integration.

Figure 2.1

Production sectors – Renewable energy as a driver of productivity and economic transformation

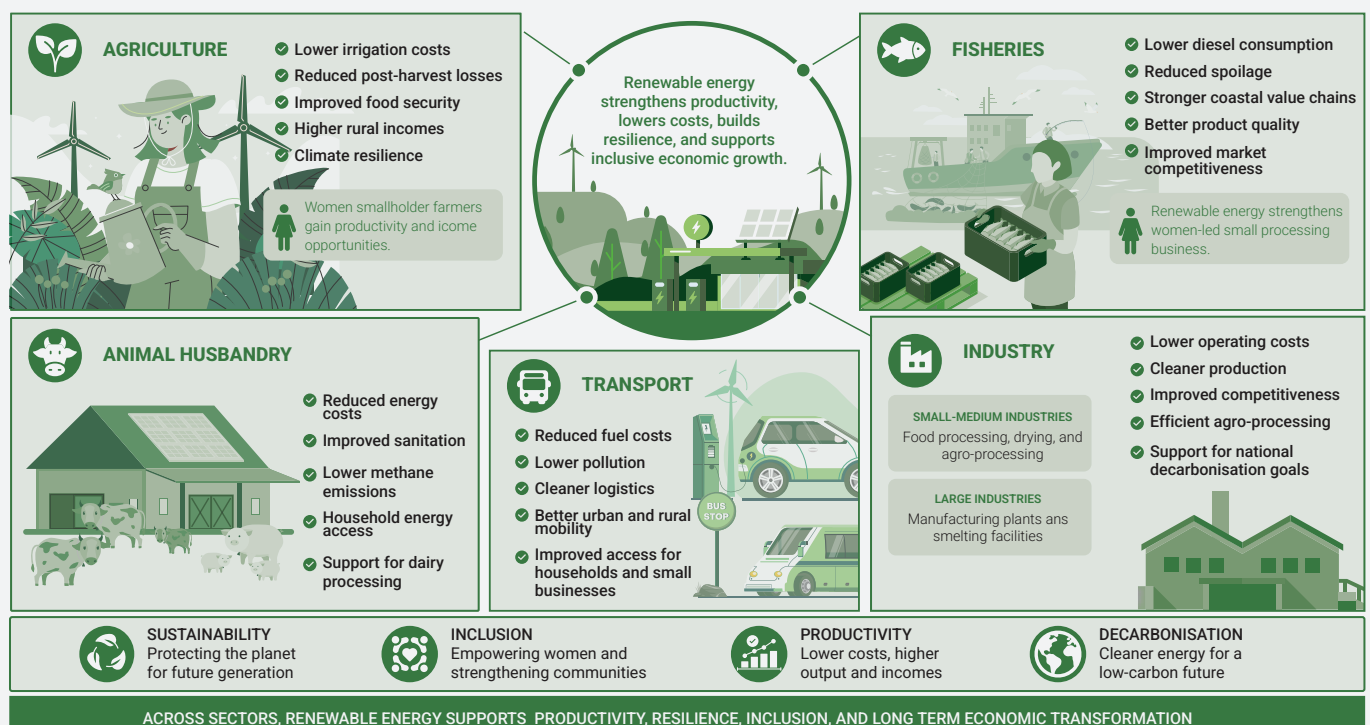


Figure 2.2
Sectors that enable scalable, inclusive and sustainable RE integration



Unlocking the socio-economic benefits requires strong and deliberate coordination across sectors and levels of government. Renewable energy intersects with production sectors—agriculture, fisheries, livestock, industry, and transport—but its full value can only be realised when supported by cross-cutting systems such as vocational training, gender-responsive programming, spatial planning, local governance, and MSME development. In Indonesia’s decentralized governance structure, sub-national (provincial, regency, subdistrict and village) governments play a critical role in planning and implementation in aligning these sectors.

Strengthening these institutional linkages ensures that renewable energy is not treated as a standalone technical solution, but as a strategic driver of productivity, inclusivity, and sustainable regional development. It is a strategic imperative for Indonesia’s decentralized governance. When energy is effectively integrated into cross-sectoral planning, local governments can strengthen policy coordination, improve the efficiency of resource utilization, and expand the economic development impacts at the local level.

To illustrate the types of cross-sectoral integration that improved coordination can unlock, the following table (Table 2.1) presents a structured overview of synergy opportunities between energy and other key development sectors. It highlights how renewable energy can be integrated across the production sectors and thematic supporting sectors to unlock productivity, sustainability, and inclusive development outcomes. Each row outlines:

- › Sectors involved and examples of activities where renewable energy can be deployed.
- › Key sectoral benefits, including cost savings, productivity gains, and environmental improvements.
- › Foreseen cross-cutting coordination mechanisms, such as joint planning or supportive policies.
- › Development impacts, such as rural income growth, job creation, and gender empowerment.
- › Stakeholders, though not yet fully detailed, indicate the need to clarify technical and thematic supporting roles and responsibilities.



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Table 2.1
Opportunities for Regional Cross-Sectoral Development Synergy

Sector	Agriculture	Fisheries	Animal Husbandry	Industry	Transport
Example of RE uses / activities	› Solar-powered irrigation and agro-processing › Cold storage powered by solar › Bioenergy from agricultural waste	› Solar-powered cold storage for fish preservation › Solar-powered ice-making machines › Solar-powered aerators for aquaculture › Solar/hybrid systems for small-scale fish processing units	› Biogas digesters using livestock waste (e.g., cow/buffalo manure) › Solar-powered water pumps for livestock drinking water › Solar-powered ventilation and lighting for barns › Hybrid RE systems for small-scale dairy processing or feed production	› Rooftop solar PV for small and medium industries. › Solar-powered or hybrid RE systems for drying, milling, cooling, or heating processes. › Biomass/biogas systems using agricultural residues. › Energy efficiency and energy management improvements for SMEs. › Identification of RE potential for larger-scale captive power options in industrial zones.	› Electric two-wheelers and three-wheelers for urban logistics and deliveries. › Electric buses for BRT corridors and city transport. › -Solar-powered charging public stations. › Integration of RE into port operations (shore power, cold storage). › Hybrid solar–battery systems for small fishing or river transport vessels.
Key benefits	› Lower irrigation cost › Reduced post-harvest loss › Higher crop productivity › Stable cold-chain for perishables › Increased rural income.	› Reduced spoilage › Higher hygiene and ice reliability › Lower diesel dependency › Improved coastal value-chain competitiveness	› Lower feed/water pumping cost › Reduced methane › Cleaner barns › Stable dairy cooling › Improved livestock health	› Lower energy cost › Higher process reliability › Cleaner production › Reduced waste heat › Improved product standards	› Lower fuel cost › Cleaner air › Reliable cold-chain mobility › Safer logistics › Improved port/terminal efficiency
Technical stakeholders	› Agriculture Agency (provincial/ city/regency) › -Energy Agency (provincial) › Bappelitbangda /Bappeda (provincial/ city/regency) › Subdistrict governments › Village governments	› Marine & Fisheries Agency (provincial/ city/regency) › -Energy Agency (provincial) › Bappelitbangda /Bappeda (provincial/ city/regency) › Subdistrict governments › Village governments	› Animal Husbandry Agency (provincial/ city/regency) › -Energy Agency (provincial) › Bappelitbangda /Bappeda (provincial/ city/regency) › Subdistrict governments › Village governments	› Industry & Trade Agency (provincial/ city/regency) › -Energy Agency (provincial) › Bappelitbangda / Bappeda (provincial/ city/regency) › Subdistrict governments › Village governments	› Transportation Agency (provincial/ city/regency) › -Energy Agency (provincial) › Bappelitbangda /Bappeda (provincial/ city/regency) › Subdistrict governments › Village governments

Table 2.1 Continuation

Sector	Agriculture	Fisheries	Animal Husbandry	Industry	Transport
Foreseen cross-cutting thematic coordination (applies to all sectors)	Energy (technical coordination)				
	› Alignment between ESDM and productive sectors on RE technical standards (solar pumps, cold-chain, biogas, EV charging). › Joint O&M guidelines & troubleshooting support for small-scale RE systems. › Coordination with PLN for hybrid / mini-grid readiness where needed. › Development of monitoring systems for the utilization and performance of renewable energy technologies to support program evaluation and cross-sectoral learning.				
	Environment				
	› Integration renewable energy development with regional climate change mitigation and environmental management programs. › Utilization renewable energy to support regional greenhouse gas emissions reduction efforts.				
	Education & Workforce				
	› Integration of RE O&M and safety modules into TVET, vocational schools, and polytechnics. › Joint technician certification (PV, biogas, solar pumps, cold-chain, EV). › Co-financing via education/skills budgets, not solely energy budgets. › Sector–education alignment so skills match deployment scale and locations.				
	Gender & Inclusivity				
	› Inclusion of youth and women groups in RE O&M and productive-use training. › RE services designed to reduce labour burden and improve income control (solar dryers, cold storage, EV fleets, biogas processing). › Women-only cohorts to increase retention in technical roles. › Outreach, assessments, and oversight on the socioeconomic impacts of renewable energy programs implemented by other OPDs.				
	Local governance				
	› Village Funds & BUMDes used for service-based O&M models (solar pumps, cold storage, EV charging). › Legal alignment for village-level RE budget allocation. › Regency governments integrate RE in RPJMD/Renstra. › Clear ownership setup: village-owned RE assets, community-managed O&M.				
	MSMEs & Cooperatives				
	› Cooperative-based RE productive hubs (drying, cold-chain, dairy processing) › Government MSME upgrading schemes include RE productivity budgets › Development of renewable energy financing schemes for productive sectors through collaboration between local governments, regional banks, and financing institutions.				
	Spatial planning				
	› Sectoral-RE siting reflected in RTRW/RDTR › Prevents land-use conflicts and accelerates deployment through clear permitting. › Ensures climate-responsive land allocation linked with food supply, coastal resilience, and rural logistics.				

Table 2.1 Continuation ►

Table 2.1 Continuation

Sector	Agriculture	Fisheries	Animal Husbandry	Industry	Transport
Cross-cutting development impacts (applies to all sectors, entry points for alignment with regional planning)	Energy				
	› Improved reliability and uptime of small-scale RE systems. › Reduced diesel dependency and operational costs across productive sectors. › Lower energy costs for production activities in productive sectors.				
	Environment				
	› Reduced cumulative and annual greenhouse gas (GHG) emissions › Improved Environmental Quality Index › Reduction of local air pollution.				
	Education & Workforce				
	› Increase in the number of locally certified workers in renewable energy technologies. › Higher absorption of vocational education graduates into energy-related jobs or productive sectors utilizing renewable energy. › Strengthened alignment between vocational education curricula and skill demands in the regional energy and productive sectors.				
	Gender & Inclusivity				
	› Increased participation of women and youth in technical training and renewable energy-based economic activities. › Growth in income from enterprises managed by women's groups or vulnerable groups through the use of renewable energy technologies. › Greater involvement of women in technical roles, business management, or decision-making within energy-based economic activities. › Availability of data and learning on the social and economic impacts of renewable energy utilization to support more inclusive regional policy planning.				
	Local governance				
	› Increase in the number of renewable energy systems sustainably managed by villages, village-owned enterprises (BUMDes), or community groups. › Establishment of clear asset ownership, operation, and maintenance mechanisms for renewable energy systems at the village or community level. › Improved coordination between local governments and village governments in planning and utilizing renewable energy for productive activities.				
	MSMEs & Cooperatives				
	› Improved productivity and product quality of MSMEs through the use of renewable energy technologies. › Reduced energy operational costs for MSMEs and agro-processing or fisheries processing businesses. › Increased production volume or value addition for MSME products utilizing renewable energy technologies. › Expanded access of MSMEs to financing schemes for renewable energy technology investments. › Spatial planning › Integration of renewable energy development sites into spatial plans (RTRW and RDTR) to support sectoral economic activities. › Reduced land-use conflicts through clearer spatial allocation for energy infrastructure and productive activities. › Improved rural logistics efficiency and distribution of production outputs through more reliable energy availability				

Table 2.1 Continuation ►

◀ Table 2.1 Continuation

Sector	Agriculture	Fisheries	Animal Husbandry	Industry	Transport
Thematic stakeholders (applies to all sectors)	Energy				
	› Energy Agency (provincial)				
	› Regional PLN				
	› Regional IPPs				
	Environment				
	› Environment Agency (provincial/city/regency)				
	Education & Workforce				
	› Education Agency (provincial/ city/regency)				
	› Workforce Agency (provincial/ city/regency)				
	› TVET/Training centres				
	› Vocational schools/SMK				
	› Polytechnics /Vocational institutions				
	› Local universities				
	Gender & Inclusivity				
	› Women's Empowerment Agency (provincial /city/regency)				
	Local governance				
	› Village and Community Development Agency (provincial/ city/regency)				
	› BUMDes				
	› Local community groups				
	MSMEs & Cooperatives				
	› Cooperatives and MSME Agency (provincial/ city/regency)				
	› Village and Community Development Agency (provincial/ city/regency)				
	› Village cooperatives				
	› Local MSMEs				
	Spatial planning				
	› Spatial planning Agency (provincial/ city/regency)				

The above table serves as a strategic framework for identifying and enhancing multi-sectoral synergies driven by renewable energy. It illustrates how energy can catalyze improvements in productivity, sustainability, and equity across sectors, while also highlighting the need for stronger institutional coordination, especially between RUED and broader development planning (RPJMD, Renstra, Renja). Further detailed synergy table is presented in **Annex A**.

Strengthening these linkages is essential to ensure that energy investments translate into tangible development outcomes that requires deliberate institutional coordination. This means involving Bappelitbangda, sectoral agencies and local stakeholders in the formulation and updating of RUEDs and development plans. It also calls for harmonising planning timelines, aligning indicators, and creating joint monitoring

mechanisms to ensure coherence between energy and development goals. In short, while the policy architecture is in place, the challenge now lies in operationalising integration so that energy planning is developmentally relevant and institutionally embedded across sectors.

2.3 Integration to Sectoral Planning

This section explains how RE integration can be embedded into sectoral planning, using the South Sulawesi Marine and Fisheries Agency (*Dinas Kelautan dan Perikanan/DKP*) as an example. It demonstrates how RE technologies, such as solar-powered cold storage, can support sectoral development objectives without introducing new or parallel planning structures.

Understanding the Sectoral Planning Framework

Local government planning follows a hierarchical structure regulated by national frameworks, particularly:

- › Ministry of Home Affairs (MoHA) Regulation No. 86/2017, which regulates regional development planning procedures;

- › MoHA Regulation No. 90/2019, which standardizes program and activity nomenclature;
- › and is operationalized through the Regional Government Information System (SIPD).

Within this system, every OPD translates regional development priorities into a layered planning structure that moves from strategic intent to operational execution.

Planning follows a cascading structure as follows:

RPJMD (Medium Regional Development Plan) → Renstra PD (Agency Strategic Plan) → Renja PD (Agency Annual Plan) → RKA (Workplan and Budget Plan) → APBD (Regional Revenue and Expenditure Budget)

Table 2.2

Indicator Structure in the Regional Planning System

Level	Document	Indicator Type	Function
Regional	RPJMD	Regional Development Indicators	Measure overall development outcomes
Strategic (OPD)	Renstra PD	IKU	Measure OPD strategic performance
Program/Activity	Renstra PD/Renja PD	IKK	Measure contribution of activities
Operational	Renja/RKA	Output Indicators	Measure direct physical/non-physical outputs

Indicators are structured in layers, each serving a distinct function:

- › **RPJMD Indicators** (Regional Development Indicators) are formulated at the regional level within the RPJMD document and are used to measure overall development outcomes at a macro and cross-sectoral level. These indicators reflect societal well-being, regional economic performance, environmental quality, and other social dimensions that constitute the objectives of medium-term regional development. RPJMD indicators are outcome- and impact-orientated and serve as the primary reference for assessing the overall performance of the regional government.
- › **IKU** (Indikator Kinerja Utama / Key Performance Indicators) are formulated at the Renstra OPD level and measure the strategic performance of the agency in contributing to regional development outcomes. IKU reflects medium-term objectives and represents the highest level of accountability within the OPD's mandate.
- › **IKK** (Indikator Kinerja Kegiatan / Activity Performance Indicators) are formulated at the program or activity

level and measure intermediate results generated through specific interventions. IKK demonstrates how programs and activities contribute to the achievement of IKU and provide a measurable link between strategic objectives and operational implementation.

- › **Output indicators** are defined at the sub-activity level (Renja/RKA) and measure the direct, tangible results of implementation—whether physical (e.g., infrastructure installed) or non-physical (e.g., beneficiaries trained, services delivered). Outputs represent the most immediate level of performance measurement and form the basis for budgeting and reporting within SIPD.

In addition to IKU and IKK, at the program level there are (sometimes) IKP (Indikator Kinerja Program / Program Performance Indicator), which measure program achievements. IKK are positioned below the program level and support the achievement of IKP.

RE can be integrated through the indicators above, even though program, activity, and sub-activity names remain fixed according to the existing nomenclature under Minister of Home Affairs Regulation No. 90/2019 (Permendagri 90/2019).

Positioning Renewable Energy within the Planning Framework

Renewable energy should be positioned primarily as an **enabling input or implementation approach or output**, rather than as a standalone development objectives/outcome, except in the case of technical energy agencies (e.g. Dinas ESDM). In most non-energy agencies, renewable energy functions as:

- › A productivity-enhancing tool,
- › A cost-reduction mechanism,
- › A service reliability solution,
- › Or a resilience-enhancing infrastructure.

Therefore:

- › At the **IKU level**, renewable energy usually does not appear explicitly (except for technical agencies, i.e., ESDM).
- › At the **IKK level**, RE-related intermediate outcomes can be measured.
- › At the **Output level**, RE becomes visible in installed systems, trained beneficiaries, or operational facilities.

Mainstreaming RE requires a clear casual logic where operational improvement (output) will affect intermediate indicator change (IKK) and later the strategic performance improvement (IKU)

Case in Fisheries Sector

In the fisheries sector, common development challenges include high post-harvest losses, high operational costs (fuel, electricity), and limited value addition. Relevant intervention may include solar-powered cold storage installation. Which then expected to reduce losses, reduce fuel costs, or increase storage time. In this case, RE is not the objective, but an enabling instrument to achieve sectoral outcomes. In this case, indicators may be presented below:

- › RPJMD Target Indicator – Contribution of agriculture and fishery sectors to GRDP
- › IKU - Increase fisheries productivity and income
- › IKK - Percentage reduction in post-harvest losses (%)
- › Output - Number of solar-powered cold storage units installed

2.3.1 Integrating Renewable Energy into Renstra OPD

Step 1: Strategic Alignment with Existing IKU

Before defining activities, outputs, or budget allocations, OPDs must first test whether a renewable energy (RE) intervention is strategically aligned with their existing IKU (*Indikator Kinerja Utama*) in the Renstra.

RE technology contributes to the agency's performance targets and strategic sectoral objectives. The table below highlights the existing Key Performance Indicators (*Indikator Kinerja Utama/IKU*) in DKP Renstra and illustrates how RE technology, particularly solar cold storage, could support the achievement of these IKUs.

Table 2.3
IKUs and relevant RE contributions

Existing Renstra IKUs	How Solar Cold Storage Contributes
Increase fisheries production and productivity	Cold storage reduces post-harvest losses, enabling shorter fishing trips
Improve income for the fishing community	Higher product quality, access to premium markets, and value addition
Strengthening fishing community organizations	Collective ownership of cold storage builds cooperation
Develop processing and value addition	Solar-powered processing enables local value chains
Improve coastal community welfare	Reliable energy access for productive activities
Sustainable fisheries management	Better preservation reduces pressure to overfish

At this stage, no activities, sub-activities, or outputs are defined. The purpose is solely to confirm that RE-enabled interventions are relevant to and supportive of existing IKUs and are therefore legitimate within the OPD's strategic mandate.

Step 2: Translating Strategic IKU into Intermediate Results (IKK)

Once strategic alignment is established (agency responsibility, see Step 1), RE-related impacts can be captured at the IKK level (division/department responsibility), which reflects intermediate outcomes at the program or activity level.

While IKU reflect the OPD's medium-term strategic accountability, IKK captures intermediate outcomes generated through specific interventions. Therefore, IKKs are more flexible and can explicitly reflect changes enabled by RE interventions.

The DKP, in consultation with Bappelitbangda and Dinas ESDM, may explore additional or revised indicators at the IKK level. IKKs must clearly derive from existing IKUs and demonstrate how sectoral outcomes are being achieved.

For example, cold storage reduces post-harvest losses, thereby increasing fisheries production. A possible IKK could therefore be the "percentage reduction in post-harvest losses.". This indicator directly supports the IKU on increased fisheries production and productivity.

Table 2.4

Examples of potential new or modified IKKs

Existing <i>Renstra</i> IKUs	New/Modified IKKs to Add
Increase fisheries production and productivity	Reduction in post-harvest losses (% or tons) Increase in fish product quality (% premium grade)
Improve income for the fishing community	Average income increases for fishermen using cold storage (%) Reduction in energy costs for fisheries enterprises (%)
Strengthening fishing community organizations	Number of renewable energy-based productive business units Number of women engaged in fish processing enterprises
Develop processing and value addition	Number of solar-powered processing units operational Utilization rate of cold storage facilities (%) Energy cost savings compared to diesel-powered cold storage (%)
Improve coastal community welfare	Number of fishing communities with reliable electricity access Reduction in energy costs for fisheries enterprises (%) Vulnerable groups (women and youth) utilizing renewable energy (%)
Sustainable fisheries management	Integration of cold chain with sustainable fishing practices

IKK can only be proposed while the *Renstra* documents are still being drafted or revised, as once they are ratified, these indicators become formally locked.

2.3.2 Integration into Annual Renja Activities

While IKUs and IKKs focus on outcomes, the Renja translates these outcomes into concrete annual actions. At this stage, renewable energy-supported interventions, such as solar-powered cold storage, can be proposed at the sub-activity level through output-level indicators.

Step 1: From IKK to Sub-Activity Design

If the IKK reflects an intermediate change (e.g., reduction in post-harvest losses), Renja must specify sub-activities that generate outputs enabling that change.

If the IKK is: Percentage reduction in post-harvest losses (%)

The corresponding sub-activities may include:

- › Training fishermen groups to operate and maintain solar-powered cold storage
- › Installing rooftop solar PV systems at landing sites
- › Establishing cooperatives responsible for managing RE facilities
- › Supporting women-led fish processing enterprises with reliable energy access

Nevertheless, given that sub-activities are rigidly defined within the regional government nomenclature under Minister of Home Affairs Regulation No. 90/2019 (Permendagri No. 90/2019), related initiatives can still be integrated as outputs within relevant sub-activities in accordance with the existing nomenclature.

Step 2: Defining output indicators

Each sub-activity must include measurable output indicators. These represent the direct deliverables of implementation.

Outputs are not sectoral outcomes. They are the tangible results that enable intermediate performance improvements.

Table 2.5

Relevant output indicators for solar-powered cold storage

Proposed Sub-Activity	Relevant Outputs	Relevant Sub-Activities Based on Government Nomenclature (Ministerial Decree No. 900/2025)
Install rooftop solar PV systems at fish landing sites.	› Number of solar-powered processing units in operation › Number of solar-powered ice machines › Total installed PV capacity in fisheries facilities (kWp)	Provision of capture fisheries business facilities (3.25.03.1.01.0010)
Train fisher groups to operate and maintain solar-powered cold storage facilities.	› Number of fishers/women trained in facility operation › Number of fisher groups capable of operating and maintaining solar-powered cold storage facilities	› Capacity development for coastal and small island communities (3.25.02.1.03.0001) › Strengthening and development of coastal and small island community institutions (3.25.02.1.03.0002)
Establish cooperatives responsible for managing renewable energy facilities.	› Number of cooperatives/fisheries business groups operationally managing RE facilities	› Provision of mentoring, improved access to knowledge, technology, and information, as well as the organization of education and training (3.25.02.1.03.0004)
Support women-led fish processing enterprises through access to reliable energy.	› Number of women-led fish processing enterprises utilizing renewable energy facilities	



2.3.3 Linking Renja to Budgeting (RKA and APBD)

Renja OPD is the formal entry point into the regional budgeting cycle. In practice, the process flows as follows:

Renstra (5-year strategy) → Renja (annual plan) → RKA (Budget Work Plan and Budget) →
→ APBD (approved regional budget)

Step 1: Ensure Nomenclature Alignment

Before budgeting, confirm that the RE intervention is embedded within an existing program, activities, and subactivities under MoHA Regulation No. 90/2019 (with detailed listings in Ministerial Decree No. 900/2025). This means that the intervention falls within the government affairs under the authority of the relevant OPD.

Within the **sub-activity level**, solar-powered cold storage is introduced as a technical approach to delivering post-harvest infrastructure. Other solutions may include solar ice makers or solar-powered processing units. The use of renewable energy in this context is not positioned as a development goal in itself but as a method to improve reliability, reduce costs, and enhance the sustainability of fisheries services.

Table 2.6

RE with program, activity, and subactivity level

Program/ Activity/ Sub-Activity	Program Performance Indicators / Activity Performance Indicators / Outputs
Marine, Coastal, and Small Islands Management Program (3.25.02)	› Expansion of sustainably managed marine conservation areas › Volume of community-based salt production
Empowerment of Coastal and Small Island Communities (3.25.02.1.03)	› Average increase in the income of fishers using cold storage (%) › Reduction in energy costs for fisheries businesses (%) › Number of renewable energy-based productive business units
Capacity Development for Coastal and Small Island Communities (3.25.02.1.03.0001)	› Number of fishers/women trained in facility operation › Number of fisher groups capable of operating and maintaining solar-powered cold storage facilities
Provision of mentoring, improved access to knowledge, technology, and information, and the organization of education and training (3.25.02.1.03.0004)	› Number of cooperatives/fisheries business groups operationally managing renewable energy facilities › Number of women-led fish processing enterprises utilizing renewable energy facilities
Capture Fisheries Management Program (3.25.03)	› Value of capture fisheries production (IDR thousand) › Capture fisheries production (tons) › Coverage of facilitation for fisher groups › Percentage of fisher group production (%) › Percentage of fishing ports equipped with facilities and infrastructure that meet operational standards (%)
Fish Capture Management in Marine Areas up to 12 Nautical Miles (3.25.03.1.01)	› Reduction in post-harvest losses (% or tons) › Improvement in fish product quality (% premium quality)
Provision of Capture Fisheries Business Facilities (3.25.03.1.01.0010)	› Number of solar-powered processing units in operation › Number of solar-powered ice machines › Total installed PV capacity in fisheries facilities (kWp)

Step 2: Define Cost Structure

In preparing the RKA, renewable energy development is not limited to Dinas ESDM. Various types of regional expenditures can be utilized by sectoral OPDs to support the use of RE in productive activities and regional development.

Table 2.7

Types of expenditures and examples RE activities

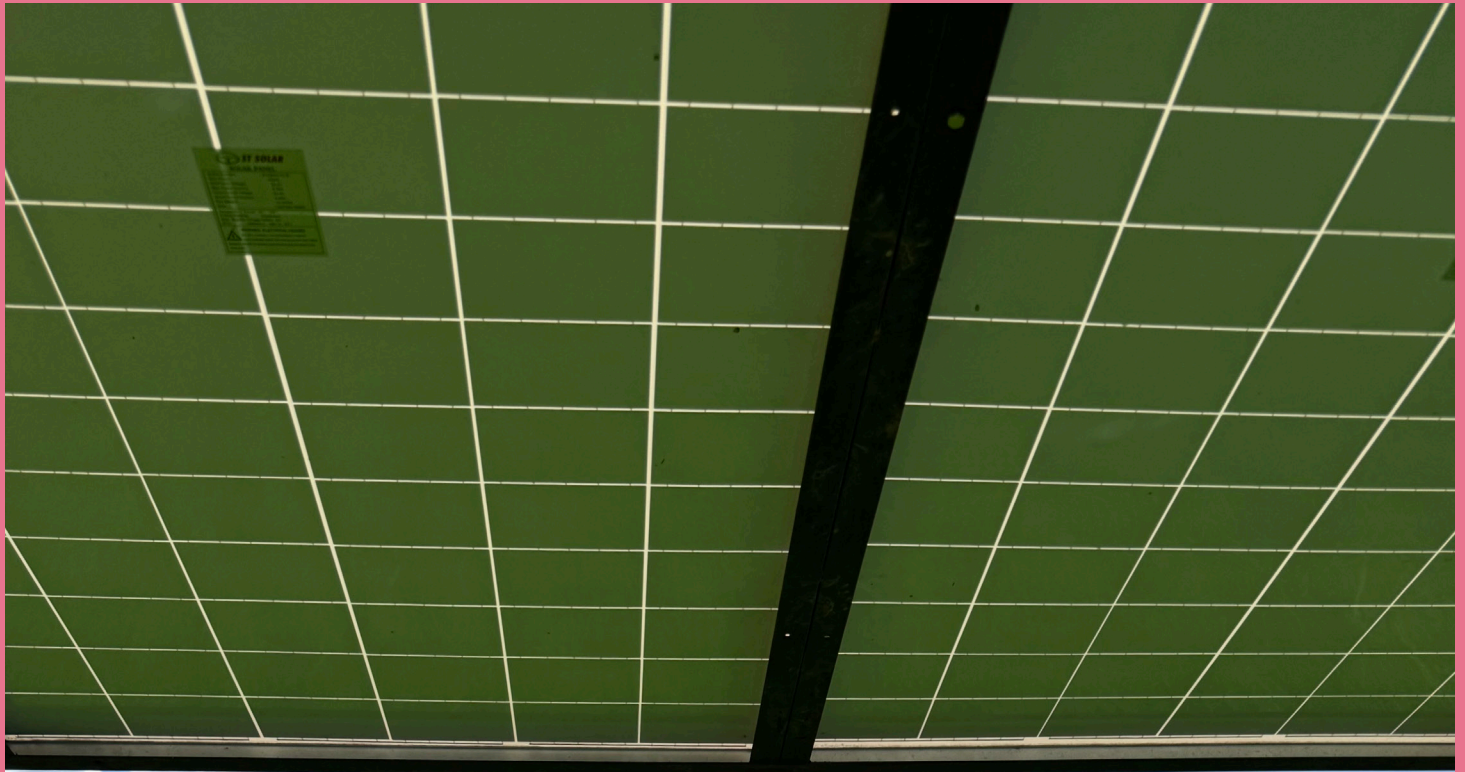
Type of Expenditure	Description	Examples of Activities
Goods and Services Expenditure	Used for non-infrastructure activities such as training, studies, outreach, cross-sector coordination, or the development of monitoring systems. This type of expenditure can be utilized by various OPDs to support renewable energy (RE) utilization without directly procuring energy infrastructure.	Training on the operation and maintenance (O&M) of renewable energy systems for fisher groups, farmers, or MSMEs (Dinas ESDM, Dinas Perikanan, Dinas Pertanian, Dinas Koperasi & UMKM). Preparation of feasibility studies or plans for RE use in productive sectors (Bappeda, Dinas ESDM, Dinas Perindustrian). Outreach on RE technologies for coastal communities, villages, and businesses (Dinas ESDM, Diskominfo, Dinas PMD). Development of monitoring systems and data collection on the socio-economic impacts of RE utilization (Bappeda, Dinas ESDM, Dinsos, DP3A). Preparation of technical guidelines for the operation and maintenance of small-scale RE systems (Dinas ESDM). Development of renewable energy potential maps and their integration into regional planning (Bappeda, Dinas ESDM).
Capital Expenditure	Used for the procurement or construction of assets that provide benefits for more than one year. This expenditure can support the procurement of RE technologies or infrastructure for productive activities. Maintenance and operational considerations should be taken into account.	Installation of solar-powered water pumps for agricultural irrigation (Dinas Pertanian, Dinas ESDM). Provision of cold storage facilities or solar-powered ice machines for the fisheries sector (Dinas Perikanan, Dinas ESDM). Installation of rooftop solar PV systems at public facilities such as markets, fish landing sites, or MSME centers (Dinas ESDM, Dinas Perdagangan, Dinas Perikanan). Development of communal biogas systems in livestock farming areas (Dinas Peternakan, Dinas ESDM). Provision of electric vehicle charging stations to support mobility and logistics for small businesses (Dinas Perhubungan, Dinas ESDM).
Grant Expenditure	Used to provide support in the form of money, goods, or services to community groups, cooperatives, village-owned enterprises (BUMDes), or other institutions. Grant schemes are often used so that equipment or infrastructure utilized by communities does not become a regional government asset, allowing maintenance to be managed by the beneficiaries.	Grants of solar dryers to groups processing agricultural or fisheries products (Dinas Pertanian, Dinas Perikanan). Grants of renewable energy systems to cooperatives or BUMDes to support local economic activities (Dinas Koperasi & UMKM, Dinas PMD). Grants of energy facilities for food processing businesses managed by women's groups (DP3A, Dinas Koperasi & UMKM). Grants of energy systems for village public service facilities (Dinas ESDM, Dinas PMD).

Table 2.7 Continuation ►

◀ Table 2.7 Continuation

Type of Expenditure	Description	Examples of Activities
Social Assistance Expenditure	Used to support individuals or community groups in need. In the context of renewable energy, social assistance can be used to expand energy access for vulnerable communities or remote areas.	Assistance for household solar energy systems for low-income communities (Dinsos, Dinas ESDM). Assistance for energy equipment to support economic activities of poor or vulnerable community groups (Dinsos, Dinas Koperasi & UMKM).
Transfer Expenditure / Financial Assistance	Used to provide financial assistance to village governments or other regional governments. This scheme can support renewable energy development through village development programs or local economic activities.	Financial assistance to villages for the development of village renewable energy systems (Bappeda, Village Community Empowerment Office, Energy Office). Financial support for villages or BUMDes to develop energy facilities for productive activities (Village Community Empowerment Office, Bappeda). Initial financing support for the development of renewable energy-based business centers at the village level (Village Community Empowerment Office, Cooperatives & MSMEs Office).





MODULE 3:

Small-scale Productive Use Cases and Examples



3.1 What is small-scale renewable energy?

Small-scale renewable energy refers to low- to medium-capacity electricity generation systems that rely on locally available renewable resources and operate in a decentralised manner. These systems typically serve villages, communities, productive sectors, or isolated grids and may operate off-grid, within mini-grids, or connected to the PLN network through dedicated power purchase arrangements. In practice, small-scale systems are generally below utility-scale and are often developed to support local energy access, productive uses, and regional development objectives.

Under Presidential Regulation (Perpres) No. 112/2022 on the Acceleration of Renewable Energy Development for Electricity Supply, renewable energy is defined broadly to include geothermal, wind, bioenergy, solar, hydropower, ocean energy, and other sustainable sources. The regulation also provides the framework for PLN to procure electricity from renewable energy-based generators, with tariffs jointly determined by the Ministry of Energy and Mineral Resources (MEMR) and PLN and formalised through Power Purchase Agreements (PPAs).

It is important to note that PLN power purchases under the Perpres 112/2022 apply primarily to non-rooftop, grid-connected renewable energy projects, including small hydropower, bioenergy/biomass, biogas, and other distributed generation facilities that feed electricity into the grid under contractual arrangements. This framework does not constitute net metering for rooftop solar PV, which is currently not in place in Indonesia. Rooftop PV systems are therefore treated differently and are generally limited to behind-the-meter consumption, subject to capacity quotas and technical approval by PLN.

Small-scale renewable energy systems that operate off-grid—such as village-scale solar PV, solar irrigation, cold storage, micro-hydro, community biogas digesters, and hybrid mini-grids, are typically governed through sectoral programmes, village development mechanisms, and local ownership models rather than electricity market transactions. These systems play a critical role in expanding access to energy, reducing diesel dependence, and supporting productive activities in rural and remote areas.

Overall, small-scale renewable energy in Indonesia spans a range of technologies and governance models, from community-managed off-grid systems to grid-connected non-rooftop projects under PPAs with PLN. While provincial governments have limited authority over electricity procurement, they play an important enabling role by integrating energy planning (RUED) with sectoral development planning instruments, including the RPJMD and sectoral Renstra.

3.2 How small-scale renewable energy contributes to productive use?

Small-scale renewable systems play a critical role in expanding equitable and reliable energy access, particularly for Indonesia's many remote, rural, and island communities where extending PLN's grid is technically challenging or economically unfeasible. These systems help reduce dependence on diesel generators, lower household energy costs, and improve self-reliance and local resilience against fuel price shocks and logistical disruptions (see Box 3.1. for indicative cost calculation of small-scale renewable energy).

Box 3.1

Example of cost calculation for small-scale renewable energy

Case: solar-powered irrigation (PLTS for water pumping – smallholder agriculture)

Typical comparison: diesel pump vs solar pump

Component	Diesel pump	Solar pump (solar panel)
Initial investment	Low	Higher
Operating cost	High (fuel)	Very low
Maintenance	Moderate	Low
Fuel dependency	Yes	No

Simple cost illustration (indicative)

Diesel pump fuel cost:	Solar pump:
± IDR 30,000–50,000 per day	Initial cost: ± IDR 15–25 million
± IDR 900,000–1,500,000 per month	Monthly energy cost: ~0 (no fuel)

With diesel costs of about IDR 1,000,000 per month, the solar system can pay for itself in around 1.5–2 years, after which energy is essentially free.

Various studies show that solar-powered irrigation systems have lower operational costs and can recover investment within ~5–7 years, making them more cost-effective than diesel systems over time (Aini et al., 2021; Amir, 2021).

Beyond electrification, small-scale renewable energy directly supports local productivity and livelihoods. Stable and affordable electricity enables productive uses such as irrigation pumping, fish cold storage, agro-processing, small manufacturing, tourism services, and digital connectivity, which strengthen local economies and diversify income sources. This can lead to spillover benefits such as local skill development, new jobs, innovation capacities and entrepreneurship potential. When developed through community-based or mixed governance arrangements, small-scale EBT also enhances local ownership, institutional capacity, and long-term sustainability, ensuring that energy solutions are embedded in community priorities and social contexts.

3.3 Key Lessons Learned

This section summarises key lessons from the implementation of small-scale renewable energy projects in Indonesia, drawing on a range of case studies sourced from literature and development partners. It highlights the factors that enable inclusive and sustainable development.

The case studies reviewed include:

- › MENTARI Programme. *Viability Gap Fund and demonstration projects* (Mata Redi and Mata Woga, East Nusa Tenggara).
- › Hadji Kalla Foundation. *Kampung Hijau Energi (Green Energy Village) programme*, South Sulawesi.
- › Climate Policy Initiative (CPI). *Enhancing Decentralized Renewable Energy Investment to Achieve Indonesia's Nationally Determined Contribution (Case Studies: Community-based RE Projects in Eastern Indonesia)*.
- › Universitas Negeri Makassar (UNM). *Solar-powered irrigation pump initiative* in Gowa, Takalar, and Jeneponto.
- › United Nations Development Programme (UNDP). *Accelerating Clean Energy Access to Reduce Inequality (ACCESS) Project*.

Table 3.1 provides detailed information on lessons learned from the case studies above.

Table 3.1
Core Insights, Evidence, and Actionable Steps for Renewable Energy Integration from Case Studies

Core insights	Evidence	Actionable Steps
Economic and Productive Linkages		
Productive energy use creates economic incentives that fund operations and maintenance, reducing external dependency and strengthening community ownership. Income from productive uses can cover O&M costs while improving livelihoods and local value chains.	› Lenggora Pantai, Southeast Sulawesi: The village enterprise (BUMDesa) operates two interconnected business units, electricity services and ice-making for fisheries. The ice-maker business generates IDR 4-5 million monthly (USD 230-330), eliminating fishermen's risky boat travel to neighboring villages for ice and enabling better fish preservation and market prices. Since inception, BUMDesa accumulated IDR 30.8 million (USD 2,000) in savings while the electricity unit saved IDR 97.8 million (USD 6,300). Solar power also enabled Ms. Tawaria, a 60-year-old widow, to scale her dried fish business, earning IDR 500,000 monthly (USD 33), income that didn't exist before. › Kamanggih Village, East Sumba: Community generated collective income by selling surplus power from their micro-hydro plant to PLN through a Power Purchase Agreement. › Tepal Hamlet: Electricity powered coffee processing, strengthening local value chains and improving livelihoods (Rospriandana et al., 2023). › Mata Redi and Mata Woga, Central Sumba: Solar PV access catalyzed 16 new small businesses, 15 of them women-led, processing agricultural commodities including candlenuts, citronella, ginger, and lemongrass. › East Kalimantan: RE integration enabled swallow's nest farming using sound systems and powered schools and health clinics (Solagratia et al., 2024).	› Identify where energy is critical to sectoral programs and activities › Map how RE can advance local economic indicators (income, productivity, employment) › Coordinate with energy offices (Dinas ESDM) to align sectoral and energy policies › Support integration of energy access with existing productive sector value chains

◀ Table 3.1 Continuation

Core insights	Evidence	Actionable Steps
	› Green Energy Village, across South Sulawesi: Biogas works because it ties directly to farmers' needs: Free cooking gas, high-value organic fertilizer, potential fuel for tractors. Small agro-industries, such as palm sugar producers, are shifting to biogas, reducing operational costs while farmers selling organic fertilizers create new livelihood opportunities (Hadji Kalla Foundation). › Lempangang Village, Gowa: Solar-powered irrigation pumps directly reduced farmers' production costs—previously, diesel pumps cost approximately IDR 1,000,000 per pumping cycle to irrigate about 1 hectare, requiring 3-4 days of operation at 4-6 hours per day. After the initial solar system investment, operational costs became close to zero. The solar-powered system can irrigate approximately 600 m² per day, operating autonomously during daylight hours, enabling more stable water flow and freeing farmers' time for other agricultural tasks (UNM).	
Institutional Arrangements and Ownership		
Transparent distribution of technical, financial, and administrative responsibilities prevents confusion and maintains operational continuity. Formal structures enable sustained operations even after external funding ends.	› Muara Enggelam Village, East Kalimantan: The village-owned enterprise (BUMDes) manages the solar mini-grid, collecting fees, funding maintenance, and reporting to village government and energy offices—ensuring continuity beyond donor support (Solagratia et al., 2024). › Lenggora Pantai Village, Southeast Sulawesi: BUMDesa manages both electricity and ice-making businesses with transparent fee structures legalized in Village Regulations. All payments are made regularly, ensuring sustainability, with accumulated savings demonstrating financial viability (UNDP Access). › Mata Redi and Mata Woga, Central Sumba: After project handover, BUMDes Hali Dewa manages the solar PV system with active government support—the Ministry of Villages provides ongoing maintenance through Dana Desa (Village Fund) as part of rural electrification efforts, demonstrating multi-level institutional commitment (Mentari). › Titab Mini Hydro, Bali: The 1.4 MW project demonstrates formal institutional arrangements between government (dam owner: Ministry of Public Works) and private operator (PT Brantas Energi), enabled through blended financing with PT SMI and UK government support (Mentari). › Green Energy Village, across South Sulawesi: Naturally formed groups (kelompok organik) work better than formal village organizations. These groups have internal trust and shared motivations such as fertilizer shortage, rising energy cost (Hadji Kalla Foundation). › Lempangang Village, Gowa: The solar-powered irrigation system was initially implemented by Universitas Negeri Makassar (UNM) and granted to two farmers who now own, manage, and maintain the system. The partnership model between academia, local government, and communities was formally supported by subdistrict leaders and village officials, creating an entry point for local management (UNM).	› Formalize mandates and legal status of RE operators (BUMDes, cooperatives, public-community partnerships) › Mandate post-installation provisions in procurement agreements: maintenance funds, warranties, spare parts (per LKPP Regulation No. 12/2021) › Require transparent revenue management and periodic audits › Establish clear coordination mechanisms between village enterprises, local government, and national agencies › Support BUMDes capacity in business management and financial sustainability

Table 3.1 Continuation ▶

◀ Table 3.1 Continuation

Core insights	Evidence	Actionable Steps
Capacity Building and Social Inclusion		
Skilled operators reduce downtime and costs; inclusive participation builds legitimacy and trust. Women's involvement expands economic opportunities and strengthens social cohesion, creating multiple pathways for community benefit beyond basic electrification.	› Mata Redi and Mata Woga, Central Sumba: Ten local operators received certification in solar PV operation and maintenance, building sustainable technical capacity. Women's leadership proved transformative: 15 of 16 new businesses are women-led, demonstrating how involving women champions leads to stronger socio-economic outcomes in rural communities (Solagratia et al., 2024). › Lenggora Pantai Village, Southeast Sulawesi: Women's economic participation increased significantly—solar electricity enabled women like Ms. Tawaria to operate micro-businesses at night, buying and processing dried fish from other village women and strengthening household income and resilience (UNDP Access). › Green Energy Village, across South Sulawesi: Community Education Centers are central for capacity building and demonstrating visible benefits and practicality. The model spreads through demonstration plots, peer-to-peer learning, and practical evidence (Hadji Kalla Foundation). › Multiple sites: Communities with trained operators and embedded learning systems better maintained installations over time (Saribanon et al., 2025; IESR, 2025; Hadji Kalla Foundation). › Lempangang Village, Gowa: Two-day technical training for local community members with basic electrical backgrounds, recommended by the village head, proved effective in building technical capacity and fostering ownership. Demonstration-based approaches and practical hands-on training were effective in changing community perceptions about renewable energy.	› Integrate awareness programs through existing channels (agriculture, fisheries, community development, social services) › Partner with vocational schools and polytechnics for operator training and certification › Facilitate peer learning networks among communities with similar RE initiatives › Embed customary governance structures (adat councils, village deliberations) into planning processes › Create mechanisms ensuring women and youth access to training, management, and leadership opportunities.
Financing and Multi-Stakeholder Collaboration		
Blended financing models and strong multi-level coordination ensure operational continuity beyond initial project phases. Diverse funding mechanisms can unlock significantly larger investments.	› Titab Mini Hydro, Bali: The Viability Gap Fund (VGF) mechanism demonstrates how strategic capital grants can unlock commercial financing. UK government contributed IDR 2.6 billion (15% of CAPEX), enabling the project to access PT SMI financing and developer equity. This blended approach (grant + loan + equity) delivered a 1.4 MW plant serving 600 households. Overall, VGF support unlocked potential investment up to 10 times the VGF's cost, demonstrating the multiplier effect of strategic public funding. › Mata Redi and Mata Woga, Central Sumba: 100% donor-funded during implementation, but sustainability ensured through post-handover institutional support—Ministry of Villages now provides ongoing maintenance through Dana Desa, demonstrating how government can sustain donor-initiated projects. › Muara Enggelam and Mata Redi: BUMDes and cooperatives collect tariffs and reinvest surplus into maintenance and productive use, sustaining operations independently (Solagratia et al., 2024).	› Design financing mechanisms that blend public, donor, and community revenue streams › Establish multi-stakeholder coordination platforms involving energy offices, sectoral agencies, communities, donors, and financial institutions › Support BUMDes and cooperatives in developing financial management capacity

◀ Table 3.1 Continuation

Core insights	Evidence	Actionable Steps
	› Green Energy Village, across South Sulawesi: Ownership clarity is essential for system longevity. Community Education Centers require clear land ownership through a formal donation statement (<i>grant/hibah</i>) (Hadji Kalla Foundation). › Lempangang Village, Gowa: Despite strong community acceptance, weak coordination with regency and provincial governments limited replication and policy support. The system was not supported by local financial mechanisms or incentives (e.g., BUMDes, Village Funds), which contributed to one of three units becoming non-functional. Village Funds and BUMDes could be potential options to support farmers in sustaining the system and its operations and maintenance along with opportunities to attract financing for scale (UNM).	› Build maintenance reserves into tariff structures from project inception › Explore innovative mechanisms like VGF to de-risk projects and attract commercial financing › Maintain post-project relationships with key stakeholders (BUMDes, local government, ministries) to safeguard long-term sustainability › Align project timelines with available funding windows and institutional capacities.
Government Policy Support and Replication		
Government support transforms pilot projects into scalable models, ensures long-term maintenance funding, and embeds lessons into policy frameworks. Multi-level government engagement (village, district, provincial, national) creates resilience against changes.	› Mata Redi and Mata Woga, Central Sumba: The Indonesian Ministry of Villages is scaling the MENTARI model to 42 additional communities across Sumba, demonstrating government buy-in and replication potential. The ministry actively supports maintenance through Dana Desa allocation. › Titab Mini Hydro, Bali: Strong buy-in from PT SMI (state infrastructure financier) and government of Indonesia, with PT SMI using the VGF approach as a blended finance case study for other projects. › NTT Regional Energy Planning: GEDSI mainstreaming was integrated into RUED, institutionalizing inclusive approaches beyond individual projects. › Lempangang Village, Gowa: The project's success motivated the village government to support installations in two additional locations using their own resources, although the technology and equipment were still supplied by UNM through the grant programme. This demonstrates local government willingness to invest when benefits are visible and practical (UNM).	› National: Develop enabling policies and financing mechanisms (like VGF) that support small-scale RE projects › Provincial: Integrate RE and GEDSI principles into regional energy planning › District: Coordinate across sectoral offices to align energy access with productive sector development › Provincial and District: Support village government in allocating budget for small-scale RE projects (ie. budget planning and nomenclature). › Village: Strengthen BUMDes governance and establish transparent financial management systems

Cross-Cutting Lessons

Successful small-scale RE projects are not just technical installations—they are socio-economic systems. Evidence from Lenggora Pantai, Mata Redi, Titab Dam, and other sites demonstrates that sustainability depends on:

1. **Productive use alignment** generating income and economic value
2. **Local institutional embedding** (especially BUMDes) with clear governance
3. **Inclusive capacity building** particularly of women and youth
4. **Blended financing** combining public, donor, and community resources
5. **Multi-level government commitment** from village to national agencies

When these five enablers work together, communities don't just receive energy—they own it, operate it, and use it to transform their economic prospects. Moreover, for socio-economic benefits to emerge, these enablers must be intentionally embedded in the project design. The evidence shows remarkable impacts: from ice-making businesses that eliminate losses in the fish value chains, to women-led enterprises processing agricultural products, to solar irrigation systems that eliminate diesel costs, to biogas systems providing free cooking gas and organic fertilizer, to government replication of successful models across dozens of new communities. These projects succeed because they integrate technical solutions with economic opportunity, social inclusion, and institutional sustainability.







MODULE 4:

Lessons from Large-scale RE Projects

@ Data Institute



4.1 Introduction: Defining the Scale

While small-scale systems focus on decentralized community access and productive use of energy, large-scale renewable energy (EBT) projects in Indonesia—such as the Sidrap Wind Farm (75 MW) and the Cirata Floating Solar plant—operate at a utility scale to power the national grid and support regional industrial growth. These projects are critical for achieving Indonesia's decarbonization targets, yet they operate under a distinct set of technical, institutional, and socioeconomic complexities compared to small-scale initiatives.

Renewable energy (EBT) projects in Indonesia are broadly categorized by their capacity, which dictates their regulatory path, financing structure, and impact on the national grid. Understanding these distinctions is crucial for regional planning:

- › Small-scale EBT (< 1 MW): Primarily decentralized systems designed for local energy access. This includes off-grid systems, mini-grids, and rooftop PV. These are often paired with Productive Use of Energy (PUE) applications, such as solar-powered irrigation pumps or solar cold storage for fisheries, directly benefiting village economies.
- › Mid-scale EBT (1–20 MW): Often acting as “distributed generation,” these projects—such as micro-hydro or standalone solar—can bridge the gap between local needs and grid support. In many Indonesian regulations (such as PR 112/2022), projects below 20 MW are eligible for higher ceiling prices to account for their higher relative development costs.
- › Large-scale/Utility-scale EBT (> 20 MW): These are high-capacity facilities—like the 75 MW Sidrap Wind Farm or the 145 MW Cirata Floating Solar—designed to feed directly into the PLN transmission network.

Table 4.1

Overview of Existing and Planned Large-scale Projects

 Project	 Technology	 Capacity	 Status	 Notable Points
 PLTB Sidrap 1	Wind	75 MW	 Operational	First utility-scale wind farm in Indonesia; CSR contribution of IDR 1 billion per year; most job creation occurred during the construction phase.
 PLTB Sidrap 2	Wind	60 MW	 Planned	Expansion of the existing site; development affected by institutional and permitting constraints.
 PLTB Sidrap 3	Wind	151 MW	 Planned	Project targets up to 60% local workforce participation.
 PLTS Terapung Sidenreng	Floating solar PV	150 MW	 Under development	Expected to employ a largely domestic workforce; aligned with the province's green and blue economy agenda.
 PLTS Terapung Cirata	floating solar PV	192 MW	 Operational	Southeast Asia's largest floating solar PV project at the time of commissioning; developed through a PLN–Masdar partnership; provides lessons on utility-scale renewable energy deployment, stakeholder coordination, and environmental and social management.
 PLTB Jeneponto	Wind	72 MW	 Operational	One of the utility-scale wind projects in South Sulawesi that demonstrates the province's continued potential for wind energy development and complements the experience gained from the Sidrap wind farm.

4.1.1 Complexity and Opportunity in Large-Scale Deployment

Large-scale deployment is characterized by high upfront capital expenditure (CAPEX) and requires rigorous regulatory certainty, land/water rights clarity, and predictable offtake arrangements with PLN. However, the transition from construction to long-term operation often reveals gaps in local benefit-sharing and workforce integration.

This module synthesizes critical lessons from Indonesia's first generation of large-scale wind and solar projects to guide future expansions like Sidrap Phases 2 and 3. By understanding the institutional misalignments and workforce gaps identified in these early cases, provincial and national agencies can better align the RUED with the RUPTL. This ensures that large-scale EBT delivers clean power and moves beyond being "isolated infrastructure" to become a cornerstone of sustainable regional development.

4.2 Key Lessons Learned

Table 4.2. Core Insights, Evidence, and Lessons for Renewable Energy Integration

Core insights	Evidence	Lessons
Local socio-economic benefits do not materialize automatically – Sidrap & Cirata show why they must be designed from the start	Large-scale wind and solar projects—such as Sidrap Wind Farm (75 MW) and Cirata Floating Solar (national reference)—demonstrate a pattern: › Most jobs occur only during the construction period, with limited long-term O&M roles. › Developers often depend on CSR initiatives to maintain local goodwill and fulfill community expectations – as also witnessed in both Sidrap and Cirata – where community benefits are channeled through structured CSR programmes, for benefit-sharing. › Expansions like Sidrap 2 and 3 aim for higher local workforce participation to correct earlier gaps. › Based on fieldwork before and after construction, Cirata's floating PV reconfigured local relationships to the reservoir (partial enclosure of water space), triggered livelihood displacement (especially among water-based livelihoods), and contestation over compensation and employment—underscoring why locally designed benefit-sharing and livelihood transition measures must be explicit from the outset.	Equitable community benefits must be formally built into project design, not left to goodwill. That includes: codified CSR agreements, inclusion of local SMEs in supply chains, long-term service contracts (vegetation management, environmental monitoring, cleaning, security, representation of women and marginalized groups in community liaison workshops and committees), and mechanisms for community co-ownership or benefit-sharing where possible.
Institutional misalignment slows deployment – Sidrap's expansion phases illustrate this clearly	The Sidrap pipeline (Phase 2 at 60 MW and Phase 3 at 151 MW) highlights how delays arise from: › misalignment between provincial RUED and national RUPTL, › slow quota approval processes for new generation capacity, › unclear role of local-level Bappeda in planning and permitting, and › weak coordination between provincial, district, national agencies, and PLN. These issues have tangible impacts: even technically ready projects face long administrative lead times.	Future large-scale RE deployment requires: › a provincial Renewable Energy Working Group to align RUED-RPJMD-RUPTL, › stronger, earlier engagement of local governments in project scoping, › predictable quota and permitting timelines, and › standardized multistakeholder forums involving PLN, OPDs, Bappeda, and developers.

◀ Table 4.2 Continuation

Core insights	Evidence	Lessons
Large-scale wind and floating solar face similar structural risks – Sidrap and Cirata confirm three recurring challenges	Both Sidrap (wind) and Cirata (floating solar) demonstrate three major barriers that repeatedly slow implementation: 1. High upfront capital costs CAPEX Utility-scale RE has significant early-stage costs; bankability hinges on regulatory certainty, land rights clarity, and predictable offtake regimes. 2. Land/water area acquisition and community interface › Sidrap required long negotiation processes with local landholders. › Cirata required extensive coordination with water-area authorities and local communities for lake-use permissions, and its water-space enclosure altered access for fishers and other users. 3. Limited local technical capacity › Sidrap imported specialists during EPC. › Cirata required specialized floating-solar expertise, consistent with findings that O&M skills often need to be imported unless local training pipelines exist.	These challenges require early resolution mechanisms, such as: › provincial facilitation of land and water-use agreements, › early community engagement to minimize conflict, › investments in specialised training for floating solar O&M and wind farm operations.
Large-scale RE co-benefits are often undocumented unless mandated	› Although projects like Sidrap deliver meaningful local benefits, these are not systematically captured. › Integrating co-benefits into RUED, RPJMD, Renstra, and monitoring indicators is essential to ensure that projects support: › local jobs › women and vulnerable groups › SME participation › environmental gains beyond emissions › long-term community ownership models	To avoid repeating these gaps as new large-scale projects roll out (Sidrap 2 & 3, Bantaeng PLTS/PLTB, PT Vale floating solar), provinces should embed co-benefit metrics in: › RPJMD and Renstra indicators and KPIs, › project approval criteria, › and periodic inter-OPD reviews (energy, workforce, SME, and social protection).
Workforce development must anticipate project needs – Sidrap Phase 3 shows how the model is evolving	The earlier Sidrap project provided limited long-term jobs due to inadequate planning and skill development of local workforce, but Sidrap Phase 3 now aims for up to 60% local workforce, reflecting lessons learned. This shift highlights two realities: 1. Skills must be built before large-scale projects break ground, not after. 2. Projects need tailored skill pipelines (wind technicians, floating solar O&M teams, safety compliance roles, environmental monitoring)	South Sulawesi's training ecosystem (BBPVP, PNUP, UNHAS, vocational schools) should align upcoming curricula with large-scale project types: › wind maintenance and turbine diagnostics, › floating solar O&M skills › HSE systems for high-risk RE infrastructure, › environmental and aquatic ecosystem monitoring.

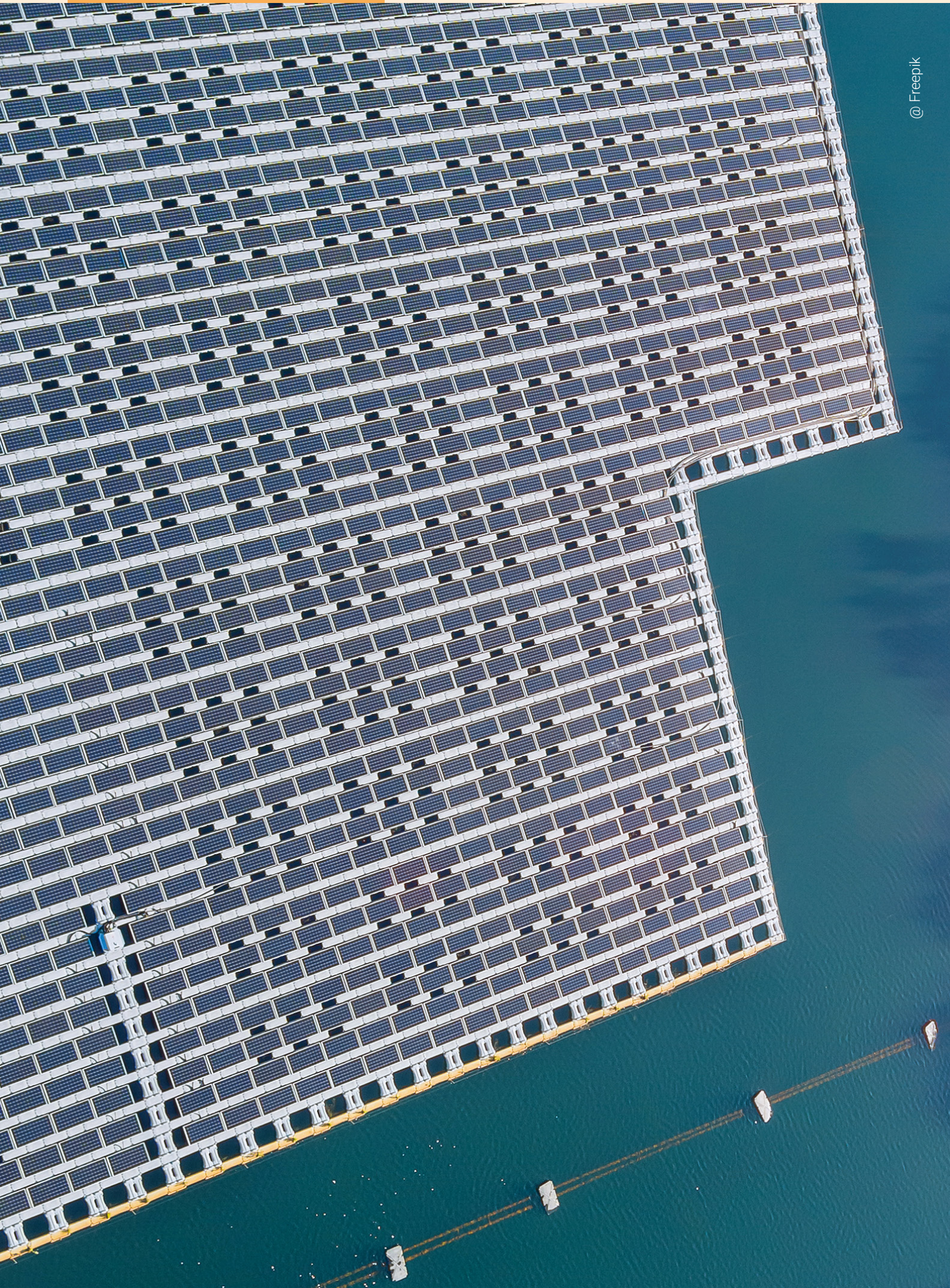
Table 4.2 Continuation ▶

◀ Table 4.2 Continuation

Core insights	Evidence	Lessons
Floating solar holds major potential but requires specialised O&M systems – lessons from Cirata and the Sidenreng plan	Floating solar introduces unique O&M needs: › mooring stability under varying water levels, › biofouling management, › impacts on aquatic ecosystems, › maintenance access on floating platforms. Cirata’s early experience and Sidrap’s planned 150 MW floating solar on Lake Sidenreng underscore the need for: › specialised local technicians, › safety training for water-based operations, › regular environmental monitoring frameworks, › and contingency plans for climate-driven water level variability.	Floating PV cannot simply adopt rooftop/ground-mount practices; it must be treated as a distinct technology in planning, training, and budgeting.

Source: Adapted from IFC and World Bank (2020); Rudolph et al. (2025); Cheng et al. (2025); Owusu-Obeng et al. (2025); Sukmawan et al. (2021); and IEA (2022).







MODULE 5

Lessons from Other Provinces and Governance Roadmap for Renewable Energy Integration



Capacity development depends on the availability of skilled local workers, capable institutions, inclusive governance structures, and accessible financing mechanisms that enable communities and enterprises to participate in emerging value chains. As discussed in the previous module, renewable energy (RE) can be understood not only as a technological option but also as a cross-sectoral development opportunity. While RE planning and implementation have traditionally been associated with technical agencies such as the Energy and Mineral Resources Office (ESDM), the potential benefits extend well beyond the energy sector. Multiple sectoral agencies, spanning agriculture, fisheries, industry, education, and others, can leverage RE integration to advance their own development objectives, foster inclusive economic growth, and strengthen coordination across planning frameworks.

This module examines lessons from four provinces, Bali, Central Java, West Java, and the Special Region of Yogyakarta, in integrating renewable energy into their regional development planning systems. Experience at the provincial level shows that integration does not begin with technology alone. It begins with how renewable energy is politically framed and legally embedded within regional governance structures.

These early stages, **political framing** and **regulatory codification**, are critical. They determine whether renewable energy evolves into a cross-sectoral development agenda or

remains confined as a marginal technical issue within a single agency. Later, RE will then be synchronized within the regional planning system. Without this **planning synchronization**, even well-framed and legally codified commitments risk remaining symbolic rather than operational. This module offers a practical roadmap in three stages: political framing, codification, and planning synchronization.

5.1 Political Framing: How Provinces Positioned Renewable Energy

Rhetorical change represents the initial stage of institutionalization. It refers to shifts in how renewable energy is publicly framed in political speeches, media communication, planning narratives, and executive signaling (Marquardt et al., 2025).

At this stage, formal rules may not yet change, and institutional structures may remain intact. However, renewable energy begins to be positioned as a governance priority.

In the four provinces analyzed below, rhetorical positioning preceded deeper regulatory and organizational changes.

Table 5.1
Political Framing Across Provinces

Province	Context	RE Framing
Bali	› Highly dependent on tourism › Faces energy security pressures › High energy costs and reliance on imported fuels increase economic vulnerability › Energy-related challenges (air pollution, climate risks) are highly visible	› Supporting sustainability and economic resilience › Reducing vulnerability associated with imported fuels › Positioning energy transition as part of tourism risk management › Aligning with commitment toward Net Zero Emissions by 2045 (earlier than national target)
Central Java	› RUED formalized through Perda (2018) › Synchronization between RUED and RPJMD 2025–2029 › Early implementation through rooftop solar (Central Java Solar Province initiative) › Growing industrial interest in solar PV › Tightening regional budgets requiring strategic shift › Engagement with multiple agencies (environment, industry, investment)	› Linking renewable energy to industrial development and competitiveness › Framing RE and emissions reduction as pathways for local industry development › Positioning RE as supporting job creation and community empowerment › Connecting low-carbon energy with agriculture (e.g., low-carbon rice initiative) and green industry

◀ Table 5.1 Continuation

Province	Context	RE Framing
West Java	› RUED adopted through Perda › Synchronization between RUED and RPJMD 2025–2029 › Establishment of Regional Energy Forum under Governor’s Decree › Annual West Java Energy Forum (WJEF) involving multi-stakeholder dialogue	› Framing renewable energy within development planning alignment › Positioning rooftop solar PV as practical and scalable pathway › Emphasizing strategic investment priorities and transition strategies › Embedding RE within evidence-based planning and cross-sector coordination discourse
Special Region of Yogyakarta	› RUED adopted through Regional Regulation (Perda) No. 6/2020 › Dissemination of RUED to communities and stakeholders › Establishment of Regional Energy Task Force via Governor’s Decree › Participation in capacity-building programs (e.g., RENEW-SEA with ICLEI) › Funding specified from APBD and other legitimate sources	› Framing renewable energy within public governance and institutional coordination › Emphasizing multi-stakeholder collaboration › Positioning RE as part of formal energy management and governance strengthening › Embedding energy planning into regional public governance structures

Source: Adapted from IESR (2022, n.d.), Province of Central Java (2018), Province of West Java (2019, 2023), Province of the Special Region of Yogyakarta (2020, 2025), and Setyowati and Quist (2022).

From the table above, several patterns can be observed:

1. In all four provinces, renewable energy was linked to broader development themes (economic resilience, industry, governance, planning alignment).
2. Governors played visible roles in signaling commitment.
3. Renewable energy appeared in development planning discussions, not only in energy sector documents.
4. Public communication and executive instruments (circular letters, speeches, regulatory references) signaled political endorsement.

These rhetorical shifts created the conditions necessary for subsequent policy codification and organizational restructuring. Without this initial positioning, renewable energy would likely remain confined within sectoral planning.

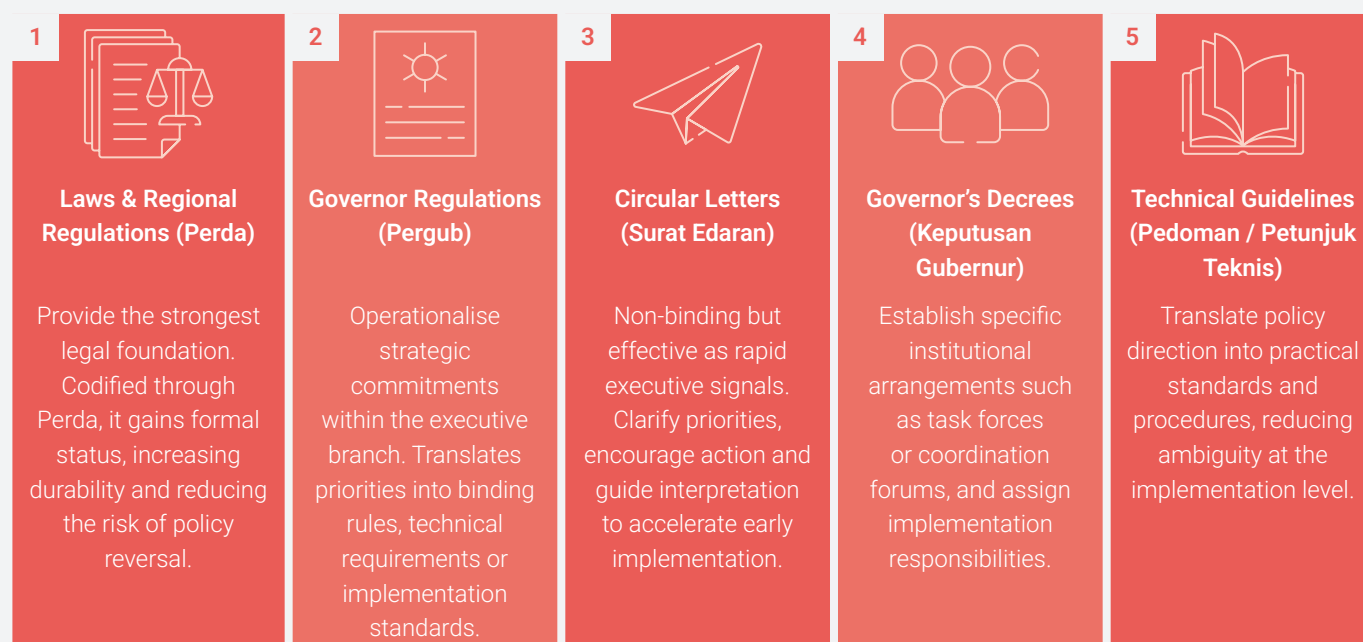
5.2 Policy and Regulatory Codification: Translating Framing into Instruments

Following rhetorical positioning, provinces **translated renewable energy commitments into formal governance instruments**. At this stage, rhetorical support for renewable energy is no longer expressed only through speeches or public positioning. Instead, it is embedded into legally recognized or administratively binding instruments that shape decision-making, coordination, and implementation (Marquardt et al., 2025). In the provincial context, this embedding can take several forms as shown below:



Figure 5.1

Legal Framework for RE at the Regional Level



In the provincial cases analyzed, codification did not occur through a single instrument. Instead, provinces used combinations of regulatory and administrative tools to operationalize renewable energy priorities. In several provinces, Governor's Decrees have also been

used to establish coordination platforms that facilitate cross-sector collaboration in renewable energy development. The institutional design and operationalization of such coordination forums will be discussed further in Module 7.

Table 5.2

Cases of Regional Government Commitment and Codification Pattern for Renewable Energy Integration

Instruments Issued	Codification Pattern
Bali	
› Governor Regulation No. 45/2019 (Bali Clean Energy) › Introduced mandatory rooftop solar PV installation on government buildings, hotels, restaurants, and luxury residences › Governor Regulation No. 48/2019 › Promoted battery-based electric vehicles and development of domestic EV ecosystem › Governor's Circular Letter to OPDs No. 17254/2021 › Instructed installation of rooftop solar PV on public buildings and state-owned enterprises › Minimum threshold: 20% of installed capacity or roof area › Governor's Decree No. 879/2022 › Provided technical guidance for implementation of green buildings (Bangunan Gedung Hijau)	› Executive regulations (Pergub) establishing mandatory provisions › Follow-up circulars reinforcing implementation within government apparatus › Technical guidance translating regulatory provisions into applicable standards › Linkage of these instruments to RPJMD and RKPD processes

◀ Table 5.2 Continuation

Instruments Issued	Codification Pattern
Central Java	
› RUED formalised as Local Regulation (Perda) No. 12/2018 › Governor's Circular Letter No. 671.25/0004468 (2019) › Appeal to government units, commercial entities, and industries to install rooftop solar PV › Provincial Secretary's Letter No. 671/4649 (2019) › Mandated rooftop solar PV installation on government buildings for 2020 › Provincial Secretary's Letter No. 671/0015817 (2021) › Accelerated rooftop solar PV installation in government buildings and commercial & industrial sectors › Governor's Decree No. 100.3.3.1/398/2025 › Established Central Java Provincial Energy Forum with structured governance (Steering Committee, executive body, working groups)	› Formalisation of RUED through Perda › Use of circular and secretary letters to encourage and later mandate rooftop solar adoption › Establishment of a structured coordination platform through Governor's Decree › Recognition of budget constraints and shift toward facilitation and collaboration
West Java	
› RUED adopted through Perda No. 2/2019 › Established the province's long-term energy framework prioritising renewable energy and energy efficiency. › Governor's Decree No. 31/Kep-9/DESDM/2023 › Established the Regional Energy Forum (Forum Energi Daerah) as a formal coordination platform across government and stakeholders. › Integration into RPJMD 2025–2029 and operationalisation through RKPDP › Embedded RUED priorities into provincial development planning and annual implementation processes.	› Formal legal adoption of RUED › Creation of institutional coordination mechanism via decree › Embedding of renewable energy priorities within development planning instruments › Use of annual West Java Energy Forum (WJEF) as platform linked to formal structure
Special Region of Yogyakarta	
› Regional Regulation (Perda) No. 6/2020 on RUED › Established RUED as a legally binding long-term energy roadmap (2020–2050) and embedded energy planning within provincial governance. › Governor's Decree No. 174/2025 › Established Regional Energy Task Force › Funding Provision in the Decree › Specified that RUED implementation would be financed through APBD and other legitimate funding sources, clarifying financial authority. › MoU for capacity-building programs › Strengthened provincial capacity for renewable energy planning and governance implementation.	› RUED formalised as legally binding regulation › Institutionalisation of a multi-stakeholder coordinating body › Explicit clarification of funding authority › Embedding implementation review through regular coordination meetings

Box 5.1

Practical Guidance

1

STAGE 1: POLITICAL FRAMING

Before drafting new regulations or programmes, ask:



Development issue

What strategic development issue does renewable energy help address in your province?



RPJMD alignment

Is renewable energy clearly linked to RPJMD strategic issues?



Leadership ownership

Has provincial leadership publicly associated itself with the agenda?



Cross-sector relevance

Can other OPDs see how renewable energy supports their sector outcomes?

Institutionalisation begins with political positioning, not technical planning.

If renewable energy remains framed only as an ESDM responsibility, cross-sector integration will be limited.



Translate political commitment into formal instruments



2

STAGE 2: POLICY AND REGULATORY CODIFICATION

When moving from political framing to action, clarify your objective:

IF YOU WANT TO:		USE:
Send a quick executive signal	→	Circular Letter
Establish binding implementation rules	→	Governor Regulation (Pergub)
Provide long-term legal foundation	→	Provincial Regulation (Perda)
Create coordination structure	→	Governor's Decree (Kepgub)
Clarify implementation standards	→	Technical Guidelines (Pedoman Teknis)

Do not rely on a single instrument. Provincial experience shows that layering instruments strengthen durability.



REFLECTION QUESTIONS

Before moving to planning synchronisation:

- ☐ Has renewable energy been codified in at least one formal instrument?
- ☐ Is there clarity on which agency leads coordination?
- ☐ Are implementation roles formally assigned?
- ☐ Is renewable energy referenced in development planning documents (RPJMD/RKPD)?



If the answer is no, focus first on strengthening codification.

5.3 Planning Synchronization Roadmap

Synchronizing RUED with regional development planning is not automatic. Although RUED establishes energy transition

commitments at the provincial level, these commitments do not automatically translate into sectoral mandates, annual priorities, or budget allocations. Effective synchronization requires deliberate translation of RUED targets into cross-sector development objectives embedded within RPJMD, Renstra PD, RKPD, Renja PD, and ultimately APBD.

Figure 5.2
Step-by-step Guide to Operationalize RUED







MODULE 6

Capacity Gaps, Technical Assistance Needs and Actions for Renewable Energy Integration



@ Dala Institute

The capacity gap in a socially inclusive RE transition represents the discrepancy between a local government's justice goals or mandates (specifically distributional, procedural, and recognition justice) and its practical ability to execute them. This gap stems from institutional, technical, financial, and socio-political shortfalls that hinder the integration of equity into energy governance and the effective operationalization of inclusive principles.

In the context of Indonesia's provincial and district levels, capacity gaps are multidimensional. They undermine equity and inclusion unless explicitly identified and addressed. This module classifies capacity gaps within four categories, namely (i) institutional and governance capacity gaps, (ii) human and

technical capacity gaps, (iii) financial and economic capacity gaps, and (iv) participation and social inclusion capacity gaps.

6.1 A. Institutional and Governance Capacity Gaps

Institutional and governance capacity gaps refer to weaknesses in systems, structures, and functions of governing bodies that are needed to coordinate RE and energy transition planning and implementation.

Table 6.1

Institutional and governance capacity gaps and actionable activities

Gaps	Actionable activities to close the gaps
A.1. Connecting development priorities and energy planning	
- While national energy frameworks (KEN, RUEN, RUPTL) provide a strategic foundation, their integration remains fragmented across governance levels. Weak linkages exist between national development goals and energy policy, as well as in their vertical translation into sub-national instruments (RUED, RPJMD, RUKD, Renstra). This misalignment is three-fold: a disconnect between national development and energy objectives; inconsistent translation from national to local levels; and horizontal gaps between local development plans (RPJMD) and energy plans (RUED). Consequently, energy targets are often detached from local development priorities and the budget allocations to operationalize them. - The energy plans frequently operate independently of broader development planning, leading to a lack of sectoral integration. The province's RUED insufficiently captures energy demand across key productive sectors (i.e., agriculture, fishery, transport), while the RPJMD treats energy mainly as a standalone sector rather than a driver of economic transformation. Although many energy-intensive sectors are well-suited for decentralized renewable solutions, provincial plans underutilize their potential to enhance value addition, productivity, and inclusive employment, and continue to rely heavily on fossil fuel (diesel). - RE has not yet been fully integrated into the Provincial Spatial Planning (RTRW). Potential RE sites are not clearly designated in spatial plans, leading to overlaps with agricultural land, forest areas, and coastal livelihoods. As a result, developers frequently encounter land-use conflicts and regulatory uncertainty.	- Technical assistance for Integrating energy into local development planning and budgeting through the temporary assignment of a dedicated staff, with a designated workspace, to work directly with provincial agencies and support coordination and implementation. - Establish a standardized policy translation framework (national–subnational energy planning alignment guidelines), providing methodologies for aligning energy targets with regional development priorities, sectoral strategies, and fiscal planning / sectoral budget. - Develop sector specific RE integration guidelines; - Include RE actions in sectoral Renstra and Renja planning cycles. - Introduce energy-linked development indicators in planning frameworks. - Develop an integrated monitoring and policy alignment platform - Capacity building - Resource support

Table 6.1 Continuation ►

Table 6.1 Continuation

Gaps	Actionable activities to close the gaps
A.1. Connecting development priorities and energy planning	
- Despite Indonesia holding the world's largest nickel reserves, these critical minerals remain poorly integrated into sub-national frameworks like the RUED and RPJMD. While Indonesia's "downstreaming" (<i>hilirisasi</i>) policy has driven a captive coal capacity for processing, the lack of sub-national planning alignment misses vital opportunities for local value-added employment and multidimensional poverty reduction. Consequently, the global energy transition's reliance on Indonesian nickel is not yet translating into localized socio-economic benefits or specific budget allocations for regional development. - There is also a persistent gap in linking RE targets with climate commitments, social equity objectives, co-benefits, and (international) financing mechanisms. RE planning remains largely disconnected from climate mitigation strategies and local development priorities. Despite clear opportunities to align RE initiatives with the SDGs, the Green Development Index, and net-zero emission targets, this fragmentation prevents the "mainstreaming" of energy as a cross-cutting solution, treating it instead as a narrow infrastructure concern rather than a vehicle for holistic sustainable and equitable development.	- Knowledge exchange, sharing best practices activities, and peer to peer learning - Development of knowledge repository - Conduct RUED–RPJMD alignment workshops; - Mentoring, and coaching on Renewable Energy, Conservation, and Energy Efficiency (National action plan on gender and climate change, 2024) - Formalize / institutionalize collaboration (forum) between ministries, CSOs, private sector, and international organizations to create both top-down and bottom-up momentum - Map RE potential zones and formally integrate them into spatial plans and conduct participatory land-use planning involving affected communities.
A.2. Jurisdiction and authority	
- Although provincial governments have been formally granted expanded authority to manage renewable energy resources, this shift has not translated into meaningful operational power.⁴ Strategic decision-making over grid-scale electricity, rooftop solar quotas, and utility-scale renewable energy projects remains highly centralized. In practice, subnational governments are largely confined to facilitative and coordinative roles, with substantive authority limited to specific renewable energy types, primarily biomass and biofuel, off-grid renewables (such as solar PV and micro-hydro), and biogas or waste-to-energy initiatives. This constrained mandate narrows their ability to influence broader energy transition pathways within their jurisdictions. - Subnational governments (e.g., Dinas ESDM) are mandated to develop RUED aligned with RUEN and ensure it also serves as a reference for regional development planning documents. However, while provinces are required to align and implement these plans, they often lack clear operational guidance on how to integrate RUED into development planning processes. This challenge is compounded by limited authority, capacity constraints, and insufficient institutional support.	<i>Similar to proposed actions under A.1.</i>

Table 6.1 Continuation

⁴ Under Presidential Regulation No. 11/2023

Table 6.1 Continuation

Gaps	Actionable activities to close the gaps
A.3. Coordination Mechanism	
› Coordination among government agencies is challenging due to the absence of clear mandates and operating procedures for multi-agency coordination on renewable energy-linked development programs. Furthermore, there are insufficient platforms for sustained coordination among government agencies, CSOs, private sectors, and other stakeholders. At the sub-national level, responsibilities for energy, sectoral development, financing, and community empowerment are distributed across multiple OPDs, yet coordination mechanisms remain ad hoc and personally-driven rather than institutionalized. Most actors tend to operate independently, with limited platforms for joint planning, co-design, or shared monitoring. This results in fragmented initiatives, duplication of efforts, and missed opportunities to align technical support, financing, and capacity building. › Significant coordination gaps between provincial, regency/district, and village administrations continue to hinder the integration of RE into mainstream development planning. Village governments and local entities (such as BUMDes, farmers' cooperatives, and fisheries organizations) have the local presence needed to manage small-scale RE systems, yet they are often sidelined from higher-level planning processes. They frequently lack clear guidance and confidence in areas such as budgeting and post-installation management, while higher-level agencies may not fully account for local governance realities and capacity constraints. The absence of a structured mechanism and adequate facilitation capacity to sustain both vertical and horizontal coordination ultimately prevents alignment between grassroots management capabilities and provincial or regency/district technical and budgetary frameworks, leaving decentralized RE potential underutilized. › Structural barriers to gender integration remain significant, with persistent gaps in institutional coordination posing a key obstacle to effective gender mainstreaming in RE and development planning. The absence of structured engagement with formal mechanisms, such as the Gender Mainstreaming Working Group (Pokja PUG), undermines policy coherence and weakens compliance with national gender integration mandates. Without formal coordination channels and clearly defined roles, gender considerations are treated as ad hoc additions rather than embedded components of planning, budgeting, and implementation processes.	At the provincial level: › Establish a provincial multi-stakeholder coordination platform / working group for RE led by Bappeda, preferably formally through a formal decree or regulation; › Institutionalize collaboration with the Gender Mainstreaming Working Group (Pokja PUG) in RE-related planning processes. › Conduct regular coordination meetings involving energy agencies, planning agencies, environment offices, CSOs, private sector actors, and development partners › Develop gender-responsive coordination guidelines for RE and development programs. › Ensure representation of women's groups and gender experts in coordination platforms. › Conduct gender analysis and gender-responsive budgeting workshops for government agencies and partners At the village or community level: › Institutionalize Vertical Coordination Mechanisms (Province–District–Village) › Introduce coordination focal points in each administrative level to ensure continuous communication. › Organize annual multi-level planning forums where village representatives, BUMDes, and local cooperatives participate in RE planning discussions › Develop village-level RE management guidelines and RE integration into village development plans and budgets guidelines › Create a provincial facilitation team consisting of technical experts, community engagement specialists, and policy advisors. › Pilot community-owned RE models managed through BUMDes/farmers or fisheries organisation/cooperatives, document the experience as lessons learned, and facilitate knowledge sharing among villages and community level organizations. › Training for trainers (ToT) programs at the community, and make sure to include women is part of the group.

Table 6.1 Continuation

Gaps	Actionable activities to close the gaps
A.4. Institutional Memory	
Frequent staff rotation and relatively rapid role shifts within government institutions act as a significant barrier to institutional memory, creating a “reset button” effect that halts momentum. In the absence of a standardized handover mechanism or comprehensive transition notes, incoming officials are often thrust into complex RE portfolios with little to no context regarding previous multi-stakeholder negotiations or technical feasibility studies. This information vacuum disrupts the continuity of long-term projects, as new personnel may inadvertently backtrack on established agreements or fail to uphold the specific social safeguards required for inclusive development. Consequently, the lack of a structured knowledge transfer process does not just delay administrative timelines, it actively erodes the trust of local communities and private investors, undermining the sustainability of energy transitions that require stable, consistent, and socially sensitive governance over many years.	› Introduce a standardized handover protocol with written transition notes when officials rotate between positions. › For projects that are being identified as strategic, introduce a handover template summarizing key information, such as project overview, project status, key decisions taken, stakeholder agreements, technical studies conducted, pending actions and risks. › Ensure that the document is formally recorded, maintained, and archived. › Develop a short onboarding package or rapid orientation modules for incoming officials › Set up a minimum overlap period (when possible) between outgoing and incoming staff.



6.2 B. Human and Technical Capacity Gaps

Human and technical capacity gaps involve awareness, skills, expertise, training, and technical knowledge necessary for renewable planning and implementation.

Table 6.2
Human and technical capacity gaps and actionable activities

Gaps	Actionable activities to close the gaps
B.1. Awareness and Understanding Gaps	
› The awareness gaps related to RE are not primarily about lack of knowledge of technologies, but about a limited understanding of RE as a cross-sectoral development enabler and insufficient energy justice literacy among planners and policymakers, leading to limited integration of just and inclusive principles into regional planning. Many non-energy agencies do not yet recognize how RE can directly contribute to their sectoral performance indicators (IKU/IKK), resulting in missed synergies and siloed planning. RE is therefore often perceived as a technical mandate of Dinas ESDM rather than as an instrument to support productive sectors (i.e., agriculture, fisheries, MSMEs, industry, transport) or workforce development targets. › At the community level, awareness of RE tends to emerge through practical, demonstration-based experience, rather than through abstract information campaigns. Evidence from small-scale projects shows that communities develop trust in and understanding of RE only after they observe tangible benefits, such as reduced energy costs, improved productivity, or new income-generating activities. Where RE is introduced without clear links to livelihoods or productive use, community understanding and long-term engagement remain weak, limiting sustainability and ownership. › A fundamental lack of conceptual clarity regarding the pillars of social inclusion in the renewable energy sector has resulted in the systemic exclusion of gender and youth considerations from formal energy planning. Despite the critical role these demographics play in building a resilient future workforce and driving local economic empowerment, they are rarely integrated into strategic frameworks. This oversight creates a missed opportunity to align energy transitions with broader human capital development goals, ultimately hindering the long-term sustainability and social license of RE projects.	› Capacity building on climate-energy-social inclusion intersection for OPD’s program planners › Introduction to “Integrated Energy Planning,” where every megawatt of clean energy is explicitly mapped to its carbon reduction potential, its contribution to social equity, and its ability to attract green climate finance.

Table 6.2 Continuation

Gaps	Actionable activities to close the gaps
B.2. Technical and planning gaps	
› A key technical constraint is the limited capacity of sectoral OPDs to translate RUED targets into sector-specific programs, activities, and sub-activities within Renstra and Renja documents. While the formal planning process is generally understood, challenges arise in identifying appropriate entry points, including suitable programs, activities, indicators, and output definitions through which RE can be meaningfully embedded in sectoral planning frameworks. Persistent challenge is identified in harmonising indicators, timelines, and budgets across RUED, RPJMD, Renstra, and Renja. This challenge is not procedural, but analytical and strategic. Many agencies lack experience in articulating how RE interventions contribute to sectoral outcomes such as productivity gains, income increases, or service delivery improvements. As a result, RE priorities often fail to pass internal screening processes or are excluded from budget allocations. › At the community level, technical capacity gaps manifest in limited skills for operation, maintenance, as well as weak understanding of lifecycle costs and long-term sustainability. Where local operators are not trained or where technical support systems are not embedded, RE installations face higher risks of underperformance or abandonment despite initial acceptance. Furthermore, underutilization of women and youth as potential technical workforce reduces the available labour pool and increases dependency on external contractors. Absence of mentorship and retention mechanisms limits diversity in technical roles, affecting long-term workforce sustainability. › Monitoring and evaluation of RE projects largely overlook social dimensions, focusing primarily on technical indicators such as installed capacity (MW) rather than broader impacts. Metrics rarely capture outcomes related to local employment, gender inclusion, or community benefit-sharing, leaving the social benefits of projects under-assessed. As a result, the success of the energy transition is measured mainly by infrastructure growth, rather than by how equitably and inclusively it improves livelihoods and strengthens community participation. › Institutional Dependency on External Consultant. A critical bottleneck in the regional energy transition is the limited internal technical capacity RE resource assessment within Dinas ESDM. The agency often faces significant constraints in independently evaluating resource maps, verifying generation forecasts, and conducting robust feasibility reviews. This gap creates an over-reliance on external consultants, which often leads to a “knowledge silo” where critical project data and analytical expertise remain outside the government’s institutional memory. Without the internal ability to scrutinize technical data, the ESDM agency risks approving projects based on inaccurate assessments. Furthermore, the inability to internalize these technical skills hinders the province’s power to negotiate effectively with private developers and prevents the development of a long-term, data-driven regional energy roadmap.	› Provide training for government agencies on gender-responsive and socially inclusive monitoring. › Facilitate community-based monitoring mechanisms to capture local feedback and benefit-sharing outcomes. › Develop standard reporting templates for renewable energy projects that include social impact indicators › Increase capacity for tracking progress with robust indicators and high-quality gender-disaggregated data, including finance flows, leadership positions, and income. › Training on renewable energy resource assessment basics › Join technical training with polytechnic › Collaboration on shared renewable energy data platform with PLN

◀ Table 6.2 Continuation

Gaps	Actionable activities to close the gaps
B.3. Operation and Maintenance Gap	
There is a limited understanding of small-scale RE maintenance requirements among policymakers. While significant attention is given to project approval and the rollout of RE programs, far less emphasis is placed on overseeing long-term operational performance, maintenance planning, and the development of local technical workforce capacity. This gap in knowledge and oversight weakens system sustainability.	› Workshops on renewable O&M lifecycle › Development of local workforce planning strategies to maintain the small scale RE
B.4. Negotiating Local Benefits	
Local governments often face weak negotiation capacity for securing CSR contributions and local benefit-sharing from large-scale RE projects. While opportunities exist to access CSR programs, community development funds, and profit-sharing arrangements, particularly from large-scale wind or solar projects, local officials frequently lack the technical skills, experience, and strategic knowledge needed to effectively engage with private developers. This limits the communities' ability to capture financial and social benefits, reducing the overall local impact of RE investments.	› Build capacity on public-private negotiation and benefit-sharing frameworks › Capacity building on developing CSR planning with companies & Blueprint of Development and Community Empowerment (PPM) › Facilitate dialogues between developers, local governments, and communities. › Training on negotiation strategies, contract management, and stakeholder engagement, as well as offering technical advisory support for structuring CSR agreements, profit-sharing schemes, and community development funds.
B.5. Workforce preparation vs. educational institutions	
Aligning renewable energy initiatives with vocational schools, TVET centers, workforce agencies, and other educational institutions helps build a local pool of skilled technicians and operators. Currently, educational institutions are not fully connected with government agencies, private companies, or industry associations, limiting their ability to design programs and curricula that reflect market needs and future workforce demands. Collaboration with training centers (BLK) and relevant government departments is essential to plan specialized renewable energy programs, ensuring that workforce development is practical, demand-driven, and capable of supporting the sector's growth.	› Curriculum Alignment: Collaborate with vocational schools, TVET centers, and universities to integrate renewable energy modules into existing programs, reflecting both technical skills and emerging market needs. › Industry–Academia Partnerships: Establish formal partnerships between educational institutions, private companies, and government agencies to co-develop training programs, internships, and apprenticeships in renewable energy. › Capacity Building for Educators: Provide specialized training for teachers and trainers to enhance their technical knowledge, hands-on skills, and awareness of evolving renewable energy technologies. › Specialized Training Programs with BLK: Coordinate with training centers (BLK) to design short-term, targeted courses on solar, wind, and other renewable technologies, tailored for local workforce demands. › Forecast-Driven Workforce Planning: Conduct regular labor market assessments and skills gap analyses to inform educational program design, ensuring alignment with projected renewable energy sector growth. › Incentivize Private Sector Engagement: Encourage companies to contribute to training programs via funding, equipment donations, or mentoring, creating real-world exposure for students. › Monitoring and Evaluation: Track graduate placement, skill acquisition, and employer satisfaction to continuously refine curricula and training approaches.
Examples of existing programs, platforms, and learning resources related to renewable energy education and workforce development can be found in Annex B.	

6.3 C. Financial and Economic Capacity Gaps

Financial and economic capacity gaps are barriers related to funding, investment readiness, and economic incentives for the social inclusion of renewable energy deployment.

Table 6.3

Financial and economic capacity gaps and actionable activities

Gaps	Actionable activities to close the gaps
C.1. The Fiscal-Planning Gap: Integrating Energy with Sectoral Budgets	
A persistent budgetary disconnect exists between regional energy roadmaps and sectoral programming. Although RE initiatives are formally identified within the RUED, they are not systematically translated into actionable provincial or sectoral budget allocations (APBD). This implementation gap is particularly evident in sectors such as agriculture, fisheries, and workforce development; while these sectors acknowledge the potential of RE at a conceptual level, this recognition rarely manifests in dedicated funding streams or integrated cross-sector programs. Consequently, without a synchronized fiscal mechanism to “lock in” budgetary commitments, strategic energy targets remain un-operationalized.	› Develop RE investment plans linked to sector development priorities. › Introduce climate and energy budget tagging through the Ministry of Home Affairs, similar to the existing gender mainstreaming budget tagging system. › Support Bappeda in integrating RE into sector investment planning.
C.2. Financing gender responsive community-based RE project	
› Access to affordable credit remains a major barrier for community solar projects. Local cooperatives and MSMEs often face high collateral requirements, while financial institutions frequently lack familiarity with RE business models, limiting their willingness to provide financing. This combination of financial and knowledge constraints restricts the development and scaling of community-led renewable energy initiatives. › There is a lack of integration between gender-responsive budgeting frameworks and climate or energy finance instruments reduces the distributive impact of public expenditure. Women-led MSMEs and cooperatives may face disproportionate barriers in accessing credit for renewable energy investments. Absence of inclusion-sensitive eligibility criteria in financing schemes may unintentionally reinforce existing inequalities. Gender-responsive financing increases the efficiency and impact of climate finance and energy policies and these mechanisms are critical enablers of just transitions.	› Workshops for banks and microfinance institutions on community-based RE projects to raise financial institutions’ understanding on climate change and RE and help provide customized financial solutions (e.g., microcredits, exploring the possibility of ‘Koperasi Merah Putih’ in financing energy projects). › Facilitate exchange sessions with successful community based RE projects to demonstrate viable models › Technical assistance, business development services, and training for women’s groups, cooperatives, and women-led MSMEs on financial management, project management, and proposal development of bankable RE projects to strengthen their ability to access climate and energy finance › Workshop for SMEs to adopt electric technology with RE sources to improve efficiency › Revise financing scheme eligibility criteria to include gender- and inclusion-sensitive requirements that support women-led MSMEs and cooperatives.

◀ Table 6.3 Continuation

Gaps	Actionable activities to close the gaps
	› Develop monitoring systems with gender-disaggregated indicators › Introduce gender- and climate-responsive budget tagging systems › Use finance as an enabler through innovative financing models and gender-responsive budgeting of projects
C.3. Capital Focus over Asset Longevity (maintenance cost)	
› A critical barrier to the sustainability of RE systems is the persistent underfunding of operation and maintenance). Sub-national budget planning remains heavily skewed toward capital expenditure (<i>Belanja Modal</i>), prioritizing the initial procurement and construction of infrastructure, while allocating insufficient resources for ongoing operational and maintenance needs. This “build-and-neglect” cycle accelerates asset degradation, causing high-value installations, such as community-based solar PV systems or micro-hydro plants, to become non-functional well before their intended technical lifespan. › The challenge is further compounded at the community level. Local users and management groups often lack dedicated budgets for routine maintenance and repairs, and their limited technical knowledge, financial literacy, and asset management capacity constrain long-term planning for operation and maintenance costs. Without adequate financial planning, skills transfer, and institutional support, communities struggle to anticipate lifecycle expenses, mobilize maintenance funds, or manage revenue streams effectively, ultimately undermining the durability and impact of RE investments.	› Develop guidelines for life-cycle budgeting of RE infrastructure › Support local governments in allocating operation and maintenance budgets/or collaborate with village governments or PLN on maintenance. › Build capacity on asset management and maintenance planning.

6.4 D. Participation and Social Inclusion Capacity Gaps

Participation and social inclusion capacity gaps refer to the inability of governance systems to ensure meaningful stakeholder engagement, especially for vulnerable groups (e.g., indigenous peoples, women, rural and local community). Socially inclusive energy transition emphasizes participatory planning, highlighting local demand for capacity building in participatory governance. Participation gaps in ensuring social inclusion in renewable energy development may take one of these forms:

- › **Representation gaps:** Under-representation of local or marginalized voices in formal decision-making; inclusion requires representation in decision-making bodies, not only attendance in consultations.
- › **Consultation quality gaps:** Superficial or tokenistic engagement processes. Otherwise, consultation processes often occur late in project cycles, limiting meaningful influence.
- › **Feedback and accountability gaps:** Weak mechanisms for communities to provide input into project monitoring and adjustments. Absence of structured feedback and grievance mechanisms reduces trust and increases contestation risk.

Table 6.4
Participation and social capacity gaps and actionable activities

Gaps	Actionable activities to close the gaps
D.1. The engagement gap: transitioning from consultation to collaboration	
› There is a significant lack of structured and institutionalized mechanisms to ensure meaningful stakeholder engagement in energy planning. RE planning processes are often conducted in a top-down manner, with limited transparency and few formal channels for participation. As a result, local communities, Indigenous peoples, women’s groups, and MSME associations are not consistently involved in decision-making processes. This exclusion weakens social legitimacy, reduces the relevance of interventions to local needs and capacities, and increases the risk of implementation challenges due to limited community ownership and support. › Public consultation for large-scale RE projects is often limited to formal hearings that fulfill procedural requirements rather than fostering meaningful participation. In many cases, community engagement takes place only after key decisions have already been made, leaving little room for genuine influence over project design or implementation. These meetings tend to focus on one-way information dissemination instead of participatory dialogue or co-design processes. As a result, consultation can become largely tokenistic that is more about ticking regulatory boxes than gathering substantive input, feedback, and perspectives from local communities and marginalized groups, resulting in weakening trust, inclusivity, and long-term project sustainability.	› Capacity building of provincial and district government through targeted training on implementing Free, Prior, and Informed Consent (FPIC) mechanisms, emphasizing practical application of FPIC principles, particularly in land acquisition and livelihood restoration for RE projects, and ensuring consultations are participatory, inclusive, and rights-based. › Training to enhance women’s leadership in decision-making within households and social settings to support the transformation process into RE (National action plan gender and climate change, 2024). › Establish participatory planning forum during RE project development





MODULE 7:

Multi-Agency Coordination Framework and Roadmap



7.1 Context and rationale

The successful implementation of energy transition and renewable energy programs in South Sulawesi depends on effective coordination and synergy among provincial (and to some degrees, district) government agencies, state-owned enterprises, and non-government stakeholders. However, as discussed in Module 6, one of the key institutional gaps in South Sulawesi is the absence of a structured coordination mechanism across government agencies and stakeholders. Currently, institutional arrangements often operate in sectoral silos, with limited interaction, fragmented planning processes and overlapping mandates. This lack of integration hinders the province's ability to translate policy commitments such as

Regional General Energy Plan (*Rencana Umum Energi Daerah* or RUED) and Medium-term Regional Development Plan (*Rencana Pembangunan Jangka Menengah Daerah* or RPJMD) into coherent and synergized actions across all sectors.

However, in South Sulawesi, the coordination mechanism envisioned in these policies has not yet been fully leveraged to address renewable energy development and energy transition in a multisectoral development. Therefore, establishing a coordination platform (such as a multistakeholder forum) for energy transition and renewable energy development offers a practical and adaptive approach to strengthen inter-agency collaboration, align policy directions, and enhance provincial ownership of the energy transition agenda.

Box 7.1

Policy for cross-sectoral coordination in energy transition

Several national and regional regulations already emphasize the importance of multisectoral coordination to support the implementation of energy transition policies.

At the national level, Law No. 23/2014 on Regional Governance, The Government Regulation (PP) No. 40/2025 replacing the PP No. 79/2014 on National Energy Policy (*Kebijakan Energi Nasional* or KEN), the Presidential Regulation No. 22/2017 on National General Energy Master Plan (*Rencana Umum Energi Nasional* or RUEN) underline the cross-sectoral coordination as a key principle in achieving energy transition objectives.

At the provincial level, the Regional Regulation of South Sulawesi No. 2/2022 on provincial RUED reinforces this principle by mandating the integration and coordination of energy planning across sectors. The regulation also highlights the importance of public participation and the integration of the RUED with regional development plans.

7.2 Key insights from the Makassar Workshop

During the Siset workshops in Makassar in 2025 & 2026, provincial stakeholders collectively identified coordination as a major enabler of renewable energy integration into economic development. Key insights from the discussion include:

- › **Shared understanding that renewable energy is a cross-cutting issue requiring collaboration beyond the energy sector.** Participants highlighting that energy issues are often treated as a technical matter within the Dinas ESDM, rather than as a cross-cutting development priority that intersects with economic, industrial, environmental, and social aspects.
- › **Agreement on establishing a coordination platform or forum.** There was a strong consensus that a dedicated coordination mechanism (whether formal or informal)

should be created to improve cross-sectoral dialogue and initiatives within renewable energy development. Bappelitbangda was recognized as the most suitable agency to lead and facilitate such a forum, given its cross-sectoral mandate coordination and convening power, while Dinas ESDM was seen as a co-lead to provide technical guidance and data inputs related to the energy sector.

- › **Limited collaboration with non-government actors.** Participants noted that collaboration with academia, civil society organizations, and the private sector has so far been sporadic and project-driven rather than systematic. These actors, however, play a critical role in supporting innovation, data generation, capacity building, and community engagement in energy transition initiatives. Strengthening partnerships with non-government stakeholders through a structured and inclusive coordination mechanism was therefore identified as a key area for improvement.

› **Learning from existing coordination mechanisms.**

Several existing platforms in South Sulawesi were identified as relevant examples that could inspire the RE coordination forum, such as the *Forum Gas Rumah Kaca*, the *Kelompok Kerja (Pokja) Pengarusutamaan Gender*, and *Tim Koordinasi Penanggulangan Kemiskinan (TKPK)*. These examples demonstrate how structured collaboration can work across institutions with rotating leadership, shared data systems, and periodic review mechanisms. The RE coordination forum can learn from their structure, governance model, and communication practices to maximize synergy.

The workshops demonstrated a shared recognition that stronger coordination, both across government agencies and with external stakeholders, is essential to operationalize South Sulawesi's energy transition agenda and align it with broader socio-economic development priorities.

7.3 Learning from other regions: coordination mechanisms

Similar coordination mechanisms have been established in other provinces, providing valuable lessons for South Sulawesi in designing an effective and sustainable forum. As introduced in Module 5, coordination platforms play an important role in strengthening collaboration across agencies and stakeholders in advancing renewable energy and energy transition initiatives.

Building on that discussion, this section explores the experiences of other provinces in more detail, highlighting how provincial governments have structured multi-stakeholder coordination and ensured institutional continuity through formal mandates (see Boxes below).

Box 7.2

Regional Energy Forum West Java

The West Java Provincial Regional Energy Forum (FED) was officially established based on West Java Governor Decree Number 31/kep-9/DESDM of 2023 concerning the West Java Provincial Regional Energy Forum, which was enacted on January 12, 2023 (West Java Energy and Mineral Resources Agency, 2023). The forum comprises cross-sectoral stakeholders in the energy resources sector who are working to accelerate the energy transition to New and Renewable Energy (NRE).

The structure of the FED is led by the regional secretary of West Java Province, the daily chairman is the regional assistant for economy affairs and development, and the secretary is the head of energy and mineral resources agency. While the governor is the advisor of the FED. The member of FED consists of 26 regional agencies within west java province, 28 head of regency planning (Bappeda) in the whole province, 6 state owned enterprises in energy sector, 5 provincial state-owned enterprises, and 6 representatives of academic institution, 13 professional association, and 6 other members that consist of communities and agencies. The FED is designed to discuss and address strategic issues in the field of energy resources from various perspectives to provide input for policies by the RUED and national energy policies.



Box 7.3

Regional Energy Forum (FED) and Regional Consultation Forum (RCF) East Kalimantan

Regional Energy Forum East Kalimantan

East Kalimantan Government also established the Regional Energy Forum based on the Governor Decision No. 100.3.3.1/K.274/2025. The aims of the regional energy forum are to implement cross-sectoral energy planning and management that synergises with the targets of their RUED.

The functions of this forum are designing and formulating policies and strategic steps for cross-sectoral energy management to achieve the RUED; overseeing the implementation of the RUED; providing advice and recommendations on the implementation of the RUED; evaluating, reviewing, and updating the RUED to ensure its relevance to current energy issues; disseminating the RUED; coordinating with various parties to carry out the FED's duties.

Regional Consultation Forum on Accelerating Economic Transformation East Kalimantan

The East Kalimantan Provincial Bappeda organises a Regional Consultative Forum (RCF) on Accelerating Economic Transformation to transition from a coal-producing region to a more sustainable economy. The forum was established by Governor Decision East Kalimantan No. 100.3.3.1/K.421/2024. This forum aims to accelerate economic transformation in East Kalimantan through strategy development, discussion of challenges, and coordination of measures to support sustainable and inclusive economic growth in East Kalimantan. According to Regional Development Planning Agency of East Kalimantan Province (2025), the forum consisted of several meeting sessions:

1. Formulating the main action plan related to increasing productivity, aspiration, and resilience.
2. Discussing supporting action plans to support the implementation of the main action.
3. Determining scenarios, projecting impacts, and strengthening commitment to the entire action plan.
4. Establish monitoring and control mechanisms for the action plan to ensure effective implementation.

This forum formulates planning policies related to economic transformation. The forum's first task will be to establish working groups (Pokja) for regional stakeholders, working groups for the regional superior commodities (agriculture, forestry, and mining), processing industry and tourism sectors, working groups for goods and services, and working groups for transformation foundation and just transition to ensure the just economic transformation (Voxnews.id, 2025).



Box 7.4

Transition Forum Sriwijaya (Energy Transition Forum) and On-going development Regional Consultation Forum South Sumatera

Transition Forum Sriwijaya (Energy Transition Forum) South Sumatera

To accelerate economic transformation, South Sumatra established a stakeholder consultation forum based on the 2025-2045 South Sumatra Provincial Medium-Term Development Plan (RPJPD) to assist in the economic transformation and equitable energy transition process (Regional Development Planning Agency of South Sumatra Province, 2024). The forum called *Forum Transisi Sriwijaya* or *SiHijau* (The green). This forum established to identify, mitigate, and adapt to the energy transition in South Sumatra Province. This forum serves as a forum for communication, coordination, and consultation among stakeholders to identify, mitigate, anticipate, and adapt to the energy transition in South Sumatra Province.

The stakeholder consultation forum is consisting of working groups whose membership is based on recommendations from institutions, including representatives from government, academics, certified workers, NGOs, mass media, and business.

There are two scenarios for the Economic Transformation Acceleration Forum:

1. Based on the South Sumatra Provincial Medium-Term Development Plan (RPJPD) for 2025-2045 (still under evaluation), SiHijau can be included in the working group according to the position title within the organization.
2. Based on the South Sumatra Provincial Regional Development Plan for 2020-2050, SiHijau can also be included in the Regional Energy Forum.

Regional Consultation Forum on Acceleration Economic Transformation South Sumatera

Based on Governor Decision No. 95/KPTS/BAPPEDA/2025 on Establishment Consultation Forum to Accelerate Economic Transformation in South Sumatera, the government have developed a forum to coordinate and facilitate capacity building on energy transition. There are several functions of the forum, which are:

- › Coordinate activities to accelerate economic and social transformation for affected communities, including vulnerable and marginalized communities.
- › Facilitate capacity building for stakeholders on economic transformation and a just energy transition.
- › Encourage the formation and strengthening of regulations related to the acceleration of economic and social transformation.
- › Provide input to the government regarding the acceleration of economic, social transformation, and a just energy transition.

All costs incurred in connection with this decision will be borne by the South Sumatra provincial budget and other legitimate sources in accordance with regulations. This forum is chaired directly by the Governor of South Sumatra and consists of three working groups: the economic, energy, workforce and social sectors.

7.4 South Sulawesi coordination forum mechanism

This section outlined a coordination mechanism recommended for consideration by the South Sulawesi provincial government. It builds on the discussions held during the Makassar workshops. The purpose is to provide

a conceptual blueprint that can guide the formation and gradual institutionalization of a dedicated RE coordination forum. The proposed mechanism is envisioned as an adaptive coordination forum or platform that evolves from an informal into a formal provincial forum or working group.

The following elements can serve as key reference points for establishing the RE coordination forum.

7.4.1 Objectives of the forum

The proposed forum would aim to:

1. **Cross-sectoral planning:** Facilitate policy coordination and collaboration among provincial sectoral agencies / OPD and stakeholders to integrate renewable energy into sectoral programs and projects.
2. **Policy alignment:** Ensure renewable energy priorities are aligned across provincial planning instruments, including RUED, RPJMD, sectoral Renstra, and spatial planning frameworks.
3. **Knowledge hub:** Serve as a collaborative learning space to share technical information and best practices, discuss challenges and identify opportunities for cross-sectoral synergy.
4. **Collaboration fora:** Act as a convergence point for technical assistance and donor engagement on renewable energy development and energy transition.

7.4.2 Structure, membership and institutional arrangement

Structure & membership

The proposed coordination forum could adopt an inclusive and functional structure, designed to ensure representation from all relevant provincial agencies, while also fostering collaboration with non-government stakeholders. Stakeholder membership should also reflect gender diversity across sectors and can coordinate with, e.g., Pokja PUG as a resource to provide more institutional anchoring. It is envisioned as a multi-stakeholder platform that combines technical expertise, policy coordination and participatory engagement under the facilitation of South Sulawesi Bappelitbangda. The proposed structure is as follows:

› Lead and secretariat

Bappelitbangda would serve as the lead convener and secretariat, responsible for overall coordination, meeting facilitation, documentation, and ensuring the integration of forum outcomes into provincial planning processes. The Dinas ESDM would act as the technical co-lead, providing data, analysis, and guidance on renewable energy policies and implementation.

› Core members

Core members would comprise all sectoral agencies / OPD whose mandates are directly linked to renewable energy and its socio-economic benefits. The involvement of all sectoral agencies is important to ensure that renewable energy planning and implementation reflect cross-sectoral development objectives and sustainability priorities.

› Extended members

The forum would also include extended members from non-governmental actors such as PLN, academic institutions, civil society / non-governmental organizations, foundations, and private sector representatives and associations.

However, this list can be further elaborated and developed as the coordination forum evolves, taking into account new actors, initiatives, and sectoral priorities related to renewable energy and energy transition. The membership composition should remain dynamic and adaptive as long as the formalization process has not been completed through a Governor's Decree.

This flexibility will allow Bappelitbangda, as the lead coordinator, to invite or engage additional agencies, development partners, and community-based organizations based on emerging needs and relevance to the forum's agenda. Once the formal decree is issued, the membership structure can then be reviewed and confirmed as part of the forum's institutional arrangement, ensuring both inclusivity and clarity of roles.

Institutional arrangement

The coordination forum is envisioned as a provincial mechanism for sustained collaboration, not limited to any single project. While it may initially begin as an informal platform convened by Bappelitbangda with participation from relevant agencies, it is important that the forum be institutionalized within the provincial governance structure to ensure continuity and authority.

Institutionalization could be pursued through a Governor's Decree or Circular, issued with the support of the Regional Secretary (Setda), who is responsible for facilitating cross-sectoral coordination at the provincial level. This formalization would provide the forum with a clear legal basis, defined mandates, and reporting mechanisms aligned with existing coordination structures under the provincial government.

Once formalized, the forum would function as a permanent coordination platform facilitated by Bappelitbangda, supported by Setda, and co-led by *Dinas ESDM*, with regular meetings, thematic working groups as needed, and clear linkages to the RUED, RPJMD, and other provincial planning instruments. It would also serve as a provincial entry point for collaboration with national ministries, development partners, and the private sector.

Through this arrangement, the coordination forum can strengthen policy coherence, enhance multi-level and multi-stakeholder coordination, and ensure that renewable energy and energy transition priorities are embedded within South Sulawesi's long-term development agenda.

7.5 Proposed activities

To operationalize its role and sustain engagement over time, the coordination forum could implement a range of activities that promote collaboration, policy alignment, and knowledge

exchange among provincial and non-government stakeholders. These activities are intended as **illustrative options** for the provincial government to consider and adapt according to its priorities and resources.

Table 7.1
Suggested activities

Aim	Operational Activities
Cross-sectoral planning	› Convene regular coordination meetings chaired by Bappelitbangda and Setda to facilitate dialogue among OPD on renewable energy and energy transition priorities. › Identify opportunities to integrate renewable energy into sectoral programs (e.g., agriculture, fisheries, industry, transport, MSMEs). › Discuss cross-sector initiatives where renewable energy can support productivity, service delivery, and local economic development. › Identify overlapping programs and coordination challenges between agencies and explore opportunities for joint implementation.
Policy alignment	› Facilitate joint review sessions to align RUED implementation with RPJMD priorities and sectoral plans (Renstra OPD). › Review renewable energy priorities across provincial planning instruments, including RUED, RPJMD, sectoral Renstra, and spatial planning frameworks. › Identify policy gaps or inconsistencies between energy planning and sectoral development plans. › Encourage agencies to identify energy-related linkages within their programs and propose joint activities for inclusion in annual planning processes (RKPD and Renja OPD).
Knowledge hub	› Organise thematic discussions or workshops on key topics such as renewable energy financing, productive use of renewable energy in agriculture or fisheries, and integration of gender and social inclusion in energy planning. › Invite academia, private sector actors, and civil society organisations to present research findings, technical insights, and innovative approaches. › Share technical information, data, and experiences related to renewable energy implementation across sectors and districts. › Document and disseminate lessons learned and good practices from renewable energy initiatives.
Collaboration fora	› Establish a dialogue platform connecting provincial agencies with private investors, development partners, and research institutions working on renewable energy and energy transition. › Facilitate coordination of technical assistance and donor-supported initiatives to ensure alignment with provincial priorities. › Coordinate training sessions and peer-learning exchanges between provincial and regency governments on energy planning, project development, and stakeholder engagement. › Promote collaboration with universities and development partners to deliver technical training modules and support capacity building.

7.6 Indicative roadmap for RE integration

While the coordination forum facilitates coordination and collaboration across sectors, a practical implementation

pathway is needed to translate these activities into concrete programs. The following indicative five-year roadmap provides guidance on how OPD can progressively integrate renewable energy into sectoral planning, budgeting, and implementation.

Table 7.2

Indicative Five-Year Implementation Roadmap for Renewable Energy Integration across OPD (Facilitated through the Coordination Forum)

Year	Key Activities	Implementing Agency (roles)
Year 1: Institutional setup and coordination	› Establish the coordination forum through a Governor's Decree, defining membership, roles, and coordination mechanisms. › Convene initial coordination meetings chaired by Bappelitbangda and Setda to introduce renewable energy integration priorities across OPD. › Map sectoral programs where renewable energy could support productivity (agriculture, fisheries, MSMEs, industry). › Identify overlapping programs and coordination gaps between agencies. › Organise thematic workshops to share experiences from other provinces and discuss potential entry points for integration.	Bappelitbangda, Setda (lead coordination and convene forum). Dinas ESDM (technical input on renewable energy opportunities). Sectoral OPD: Agriculture, Fisheries, Industry, Cooperatives & MSME, Transport, Environment, Spatial Planning (identify sectoral entry points).
Year 2: Planning and policy alignment	› Facilitate joint review sessions to align RUED priorities with RPJMD, Renstra OPD, and spatial planning frameworks. › Encourage OPD to identify energy-related components within their programs and integrate them into RKPD and Renja OPD proposals. › Identify policy gaps or inconsistencies between energy planning and sectoral development plans.	Bappelitbangda (align planning instruments and facilitate cross-sector review). Dinas ESDM (technical guidance and data). Sectoral OPD: Agriculture, Fisheries, Industry, MSME, Transport, Education, Environment (integrate renewable energy components into sector plans).
Year 3: Pilot implementation and knowledge exchange	› Facilitate collaboration between OPD to launch pilot initiatives integrating renewable energy into sector programs (e.g., solar irrigation, cold storage, productive energy use). › Use the forum as a platform to document lessons and share implementation experiences. › Organise peer-learning exchanges between provincial and district governments implementing pilot projects.	Sectoral OPD: Agriculture, Fisheries, Industry, MSME, Transport (implement sector-based pilot initiatives). Dinas ESDM (technical support and feasibility advice). Bappelitbangda (monitor progress and facilitate knowledge exchange). Universities, private sector, development partners (technical support and investment collaboration).

◀ Table 7.2 Continuation

Year	Key Activities	Implementing Agency (roles)
Year 4: Scaling and partnership development	› Use the forum to connect OPD with private investors, development partners, and research institutions. › Share successful pilot experiences and identify opportunities to scale initiatives across districts or sectors. › Facilitate technical training and capacity-building sessions with universities and development partners.	Bappelitbangda, Dinas ESDM (facilitate partnerships and coordination). Sectoral OPD: Agriculture, Fisheries, Industry, MSME, Transport (replicate and scale initiatives). Universities, private sector, development partners (technical support and investment collaboration).
Year 5: Monitoring, learning, and institutionalisation	› Review progress on renewable energy integration across sectors through forum meetings. › Compile lessons learned and good practices from cross-sector initiatives. › Strengthen data sharing and monitoring across OPD. › Identify policy improvements and institutional arrangements needed to sustain renewable energy integration in provincial planning.	Bappelitbangda (lead monitoring, evaluation, and planning integration). Dinas ESDM (technical monitoring of renewable energy initiatives). Sectoral OPD (share implementation results and sector impacts).



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ANNEX A

Table A.1.

Opportunities for Cross-Sectoral Development Synergy

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Renewable energy in Agriculture					
Energy	› Solar-powered irrigation and agro-processing › Cold storage powered by solar › Bioenergy from agricultural waste	› Joint planning between Agriculture Agency (TPH Bun) and Energy Agency (Dinas ESDM) › Supportive tariffs and incentives for productive energy use › Integration of agricultural programs with RUED	› Reduced irrigation cost › Increased agriculture productivity › Reduced post-harvest losses › Energy cost savings	› Higher rural incomes › Improved food security › Empowerment of smallholder farmers	› Dinas ESDM South Sulawesi › Dinas TPH Bun South Sulawesi › Dinas TPH Bun at the regency level › Local/Regional PLN › Bappelitbangda South Sulawesi › Bappeda at the regency level
Education and workforce	› Skills training for solar irrigation and agro-energy applications › Curriculum integration of renewable energy and agricultural vocational school/ university programs › Certification for RE system operation and maintenance (O&M)	› Coordination between vocational schools/ vocational institutions, universities, Agriculture Agency, Energy Agency, and TVET/training centres › Alignment of training modules with local RE deployment needs in Agriculture (irrigation, storage, agro-processing) › Joint planning to match skills supply with community demand for RE O&M	› Improved technical competence for operating solar pumps and agro-energy systems, allowing workforce readiness and new employment opportunities › Increased youth and women participation in RE-based agricultural activities › Local availability of trained technicians reduces downtime and maintenance cost	› Reduced skills mismatch in rural areas › New employment pathways for green rural jobs › Enhanced sustainability of RE systems due to trained local operators	› Dinas ESDM South Sulawesi › Dinas TPH Bun South Sulawesi › Dinas TPH Bun at the regency level › Bappelitbangda South Sulawesi › Bappeda at the city/regency level › Provincial Education Agency › City/Regency Education Agency › Provincial Workforce Agency › City/Regency Education Agency › Subdistrict government › TVET/Training centres › Vocational schools/SMK › Polytechnics /Vocational institutions › Local universities

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Renewable energy in Agriculture					
Gender and inclusivity	- Renewable-energy powered tools that reduce women's labour burden (pumping, drying, processing) - Inclusion of women's farmer groups in the planning and utilisation of solar irrigation and agro-processing systems	- Integration of gender tagging in RE-based agricultural programs - Collaboration between Women's Empowerment Agency and Agriculture Agency to identify women's needs for RE technologies - Involvement of women's farmers groups in O&M roles or as system users (e.g. agro-processing)	- Reduced manual labour for women farmers - Increased access to technology for women-led agricultural activities - Enhanced decision-making roles for women in RE-based agricultural production	- Women's economic empowerment - Greater participation of women in productive agriculture - More inclusive RE adoption at the village level	- Dinas ESDM South Sulawesi - Dinas TPH Bun South Sulawesi - Dinas TPH Bun at the regency level - Bappelitbangda South Sulawesi - Bappeda at the city/regency level - Provincial Women's Empowerment Agency - City/Regency Women's Empowerment Agency - Subdistrict government - Village government - Women's farmers group (village level)
Local & village development	- Village-owned RE services through BUMDes (e.g., renting solar pumps, fee-for-service irrigation) - Participatory energy needs assessments to match RE technologies with farming cycles - Local monitoring and maintenance systems	- Collaboration between village governments and technical agencies (Agriculture + Energy) - Integration of RE productive-use initiatives into Village Development Plans (RPJMDs/RKPDs) - Use of Village Funds (Dana Desa) or BUMDes capital for O&M	- Stronger local ownership of RE systems - Sustainable financing models for RE-based agriculture - Improved village community participation in planning and maintenance	- Strengthen local governance - More resilient and self-sustaining agricultural communities - Community income generation from RE service	- Dinas ESDM South Sulawesi - Dinas TPH Bun South Sulawesi - Dinas TPH Bun at the regency level - Bappelitbangda South Sulawesi - Bappeda at the city/regency level - Provincial Village and Community Development Agency - City/Regency Village and Community Development Agency - Subdistrict government - Village government - BUMDes - Farmers groups

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
MSMEs	› Solar-powered agro-processing (dryers, milling, storage) › Development of green MSME models (value-added processing using RE)	› Coordination between Cooperatives and MSME Agency, Agricultural Agency and Energy Agency to support adoption of RE technologies › Development of green financing schemes for agro-MSMEs › Integration into cooperatives for collective access to RE assets	› Lower operating costs for rural MSMEs › Improved quality and competitiveness of agro-products › Cleaner and more efficient production processes	› Stronger rural MSME value chains › Improved market access for processed agricultural goods › Emergence of new green business models	› Dinas ESDM South Sulawesi › Dinas TPH Bun South Sulawesi › Dinas TPH Bun at the regency level › Bappelitbangda South Sulawesi › Bappeda at the city/regency level › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency › City/Regency Industry/Trade Agency › Provincial Village and Community Development Agency › City/Regency Village and Community Development Agency › Subdistrict government › Village government › Village Cooperatives › Agricultural MSMEs (subdistrict and village)
Spatial	› Integrating RE irrigation and agro-processing zones into regional spatial plans › Siting criteria for solar irrigation, solar dryers, and bioenergy facilities › Mapping of RE potential overlaid with agricultural production zones	› Alignment between Spatial Planning Agency, Agriculture Agency, and Energy Agency for RE site selection › Integration of RE-productive use areas into RTRW, RDTR, and RPJMD planning › Coordination for streamlined permitting and land-use designation	› Reduced land-use conflict between agriculture, settlement, and RE facilities › Streamlined approval process for RE systems in agricultural areas	› Better land management › Accelerated deployment of solar and bioenergy technologies › Conflict-sensitive agricultural development	› Dinas ESDM South Sulawesi › Dinas TPH Bun South Sulawesi › Dinas TPH Bun at the regency level › Bappelitbangda South Sulawesi › Bappeda at the city/regency level › Provincial Spatial Planning Agency › City/Regency Spatial Planning Agency › Subdistrict government › Village government

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Renewable energy in Fisheries					
Energy	› Solar-powered cold storage for fish preservation › Solar-powered ice-making machines › Solar-powered aerators for aquaculture › Solar/hybrid systems for small-scale fish processing units	› Joint planning between Marine and Fisheries Agency and Energy Agency › Development of technical standards for cold storage and aquaculture systems › Coordination with PLN where grid connection or hybrid systems are required › Alignment between RUED and fisheries and coastal development priorities	› Reduced post-harvest losses and improved fish freshness › Lower dependence on diesel for cooling and processing › Lower operational costs for small fishers and processors	› Increased income for fisher households › Stronger and more resilient fisheries value chains › Improved food quality and reduced waste	› Provincial Energy Agency › Provincial Marine and Fisheries Agency › City/Regency Marine and Fisheries Agency › Provincial Bappelitbangda › City/Regency Bappeda › Local/Regional PLN
Education and workforce	› Technical training for operating and maintaining solar-powered cold storage and ice machines, as well as other solar/hybrid systems › RE safety and practical training for youth and fisher groups › Integration of RE topics into fisheries vocational curricula	› Collaboration between Marine and Fisheries Agency, Energy Agency, Education Agency, Workforce Agency, vocational schools/institutions, TVET/training centres, and universities › Certification schemes for RE-powered cold chain and aquaculture systems › Partnerships with RE suppliers for hands-on training	› Improved technical capacity in coastal communities › Reduced downtime due to local availability of trained O&M personnel › Increased youth employment in green fisheries-related jobs	› Local job creation › Better long-term maintenance of RE systems › Strengthened human capital in coastal areas	› Provincial Energy Agency › Provincial Marine and Fisheries Agency › City/Regency Marine and Fisheries Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Education Agency › City/Regency Education Agency › Provincial Workforce Agency › City/Regency Education Agency › TVET/Training centres › Vocational schools/SMK › Polytechnics /Vocational institutions › Local universities

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Gender and inclusivity	› Solar-powered dryers for women-led fish processing groups › Training for women on RE-powered processing technologies › Inclusive participation mechanisms in planning and training activities	› Coordination between Women's Empowerment Agency and Marine and Fisheries Agency › Identification of women-led fisheries MSMEs that can benefit from RE technologies › Gender tagging in RE and fisheries programs	› Reduced physical labour for women in processing › Higher product quality and better market access › Greater engagement of women in productive fisheries activities	› Women's economic empowerment › More inclusive coastal and fisheries development › Improved household livelihoods	› Provincial Energy Agency › Provincial Marine and Fisheries Agency › City/Regency Marine and Fisheries Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Women's Empowerment Agency › City/Regency Women's Empowerment Agency › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency › Subdistrict government › Village government › Women-led fish processing groups
Local & village development	› BUMDes-managed RE-based fishing and processing facilities as a community service › Village-level committees for monitoring and maintaining RE systems › Use of Village Funds to support RE O&M	› Collaboration between Village Government, Subdistrict Government, Village and Community Development Agency, Marine and Fisheries Agency and Energy Agency for village-level planning and budgeting mechanism for RE based activities › Integration of RE fisheries needs into RPJMDes and RKPDes	› Stronger local ownership and higher sustainability › Better alignment between RE adoption and village needs › Community-driven O&M structures for RE-based fisheries facilities	› Strengthen local governance › More resilient and self-sustaining coastal and fisheries communities › Local reinvestment of revenue generated through BUMDes-operated services	› Provincial Energy Agency › Provincial Marine and Fisheries Agency › City/Regency Marine and Fisheries Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Village and Community Development Agency › City/Regency Village and Community Development Agency › Subdistrict government › Village government › BUMDes › Fisher groups

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
MSMEs	- Solar-powered ice-making machines for micro and small seafood businesses - RE-based fish drying, smoking, and processing technologies - Energy efficiency upgrades for coastal processing MSMEs - RE-powered mini cold chain units for small processors	- Coordination between Cooperatives and MSME Agency, Marine and Fisheries Agency, and Energy Agency to support MSME adoption of RE technology - Integration of RE technologies into MSME support, cooperatives, and coastal enterprise programs - Development of accessible green financing mechanisms for small fish processors - Cooperative-based models for shared RE assets (dryers, ice-making, cold storage)	- Lower operational and production costs - Increased product quality and consistency - Improved competitiveness in local and regional markets - Reduced reliance on diesel for processing and cooling	- Strengthened coastal MSME value chains - Expanded market access and improved food safety compliance - Emergence of green business models in fisheries processing	- Provincial Energy Agency - Provincial Marine and Fisheries Agency - City/Regency Marine and Fisheries Agency - Provincial Bappelitbangda - City/Regency Bappeda - Provincial Cooperatives and MSME Agency - City/Regency Cooperatives and MSME Agency - Provincial Village and Community Development Agency - City/Regency Village and Community Development Agency - Subdistrict government - Village government - Village cooperatives - Small seafood-processing MSMEs (subdistrict and village) - Microfinance and green financing institutions

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Renewable energy in Animal Husbandry					
Energy	› Biogas digesters using livestock waste (e.g., cow/buffalo manure) › Solar-powered water pumps for livestock drinking water › Solar-powered ventilation and lighting for barns › Hybrid RE systems for small-scale dairy processing or feed production	› Joint planning between Animal Husbandry Agency, Energy Agency, and Environmental Agency › Integration of biogas and solar adoption into RUED, livestock development plans, and waste management programs › Technical guidelines for household-level biogas and small-scale RE systems	› Reduced energy costs on farms › Improved waste management and reduced methane emissions › Better animal health through improved ventilation and lighting	› Lower production costs for farmers › Improved livestock productivity › Reduced environmental impacts from animal waste	› Provincial Energy Agency › Provincial Animal Husbandry Agency › City/Regency Animal Husbandry Agency › Provincial Environmental Agency › City/Regency Environmental Agency › Provincial Bappelitbangda › City/Regency Bappeda
Education and workforce	› Training on biogas construction, operation, and maintenance › Skills development for solar-powered livestock systems (pumps, lighting, ventilation) › Integration of RE-for-livestock modules in vocational schools/institutions	› Collaboration between Animal Husbandry Agency, Energy Agency, Education Agency, Workforce Agency, vocational schools/institutions, TVET/training centres, and universities › Certification schemes for biogas technicians or RE maintenance providers › On-farm demonstration training in collaboration with farming groups	› Increased capacity for farmers to maintain RE systems independently › Youth employment opportunities in biogas and solar O&M › Reduced reliance on external technicians	› Local technical self-sufficiency › Strengthened human capital in livestock communities › Improved sustainability of RE systems	› Provincial Energy Agency › Provincial Animal Husbandry Agency › City/Regency Animal Husbandry Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Education Agency › City/Regency Education Agency › Provincial Workforce Agency › City/Regency Education Agency › TVET/Training centres › Vocational schools/SMK › Polytechnics /Vocational institutions › Local universities

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Gender and inclusivity	› Biogas digesters that reduce women's labour burden (no firewood collection, cleaner cooking) › Solar-powered tools for women-led dairy processing (mixers, grinders) › Inclusion of women in biogas and RE operation training	› Coordination between Women's Empowerment Agency and Animal Husbandry Agency › Gender-responsive planning in livestock development programs › Identification of women-led dairy or livestock-related MSMEs suitable for RE adoption	› Reduced household labour burden for women › Improved health outcomes (reduced indoor smoke) › Access to more efficient processing tools	› Women's economic empowerment in dairy and livestock value chains › Improved wellbeing and time savings › Inclusive participation in livestock-related livelihoods	› Provincial Energy Agency › Provincial Animal Husbandry Agency › City/Regency Animal Husbandry Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Women's Empowerment Agency › City/Regency Women's Empowerment Agency › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency › Subdistrict government › Village government › Women livestock farmer groups
Local & village development	› Village-supported biogas adoption through Dana Desa › BUMDes operation of communal biogas or RE-powered feed mills › Village-level farmer group committees for O&M › Participatory livestock-waste-to-energy assessments	› Collaboration between Village Government, Subdistrict Government, Village and Community Development Agency, Animal Husbandry Agency and Energy Agency for village-level planning and budgeting mechanism for RE based activities › Integration into village development plans (RPJMDes and RKPDes)	› Community-owned RE solutions › Sustainable livestock waste management › Improved village services through BUMDes-operated systems	› Increased village resilience › Community-driven RE adoption › Environmental improvements from reduced waste pollution	› Provincial Energy Agency › Provincial Animal Husbandry Agency › City/Regency Animal Husbandry Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Village and Community Development Agency › City/Regency Village and Community Development Agency › Subdistrict government › Village government › BUMDes › Livestock farmer groups

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
MSMEs	› RE-powered dairy processing (cooling, mixing, pasteurising) › Biogas for small-scale livestock product processing (milk, yogurt, cheese, animal feed) › Energy-efficient equipment for livestock MSMEs › Cooperative-led RE adoption for livestock value chains	› Coordination between Cooperatives and MSME Agency, Animal Husbandry Agency, and Energy Agency to support MSME adoption of RE technology › Development of green financing for livestock MSMEs › Cooperative-based models for shared processing equipment	› Lower production costs for dairy/livestock MSMEs › Increased product quality and hygiene › Improved competitiveness	› Stronger livestock value chains › Expanded market opportunities › Growth of rural, RE-powered MSMEs	› Provincial Energy Agency › Provincial Animal Husbandry Agency › City/Regency Animal Husbandry Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency › Provincial Village and Community Development Agency › City/Regency Village and Community Development Agency › Subdistrict government › Village government › Village cooperatives › Dairy/livestock product MSMEs

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Renewable energy in Industry					
Energy	› Rooftop solar PV for small and medium industries (food processing, seaweed, cocoa, coffee, metalworks). › Solar-powered or hybrid RE systems for drying, milling, cooling, or heating processes. › Biomass/biogas systems using agricultural residues (rice husks, coconut shells, cassava waste). › Energy efficiency and energy management improvements for SMEs. › Identification of RE potential for larger-scale captive power options in industrial zones	› Coordination between Energy Agency, Industry Agency, and PLN for technical compliance, rooftop solar processes, and industrial energy management. › Alignment with provincial industrial development priorities (RPIP) for promoting RE uptake in small-medium industries. › Provincial government in coordination with national government and PLN to support early data sharing, mapping, or recommendations on RE potential to inform national industrial planning (RIPIN) for captive RE in industrial zones.	› Reduced operational costs for SMEs. › More stable and efficient processing operations. › Cleaner production and improved product quality. › Better alignment with national RE and industrial decarbonisation initiatives.	› Strengthened competitiveness of local industries. › Increased value-added through improved processing efficiency. › Enhanced attractiveness for investment in clean-processing supply chains.	› Provincial Energy Agency › Provincial Industrial and Trade Agency › City/Regency Industrial and Trade Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency › PLN

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Spatial	› Integrating rooftop solar potential and small-scale RE siting into detailed spatial planning (RDTR) for light and medium industrial areas. › Identifying suitable sites for small RE-supported processing hubs (drying/processing centres). › Sharing inputs on RE resource potential for planning captive RE in larger industrial zones.	› Joint planning between Spatial Planning Agency, Energy Agency, Industry Agency and Bappelitbangda/ Bappeda. › Alignment of RDTR and RTRW for accommodating small–medium industrial RE facilities (solar rooftops, biomass storage, small hybrid systems). › Facilitating micro-zoning for RE-supported small industrial clusters.	› Reduced land-use overlap for processing centres and biomass facilities. › Smoother site preparation and licensing for RE-supported SME clusters. › Improved coordination between renewable energy and industrial spatial needs.	› More organised small–medium industrial clusters. › Stronger integration between RE and industrial development.	› Provincial Energy Agency › Provincial Industrial and Trade Agency › City/Regency Industrial and Trade Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Spatial Planning Agency › City/Regency Spatial Planning Agency
Education and workforce	› Technical training for solar PV and RE-powered industrial machinery. › Training on energy-efficient industrial processes. › Certification for industrial technicians and energy managers. › Development of RE-related modules in technical and industrial vocational schools/ polytechnics	› Collaboration between Workforce Agency, Energy Agency, Industrial dan Trade Agency, TVET/training centres, and industries for training delivery › Joint curriculum development with Education Agency, vocational schools, polytechnics and universities › Partnership with RE suppliers for hands-on learning	› Strengthened technical skills for industrial workers. › Reduced downtime due to better maintenance. › Better safety and operational standards.	› More competitive industrial labour force. › Increased availability of green jobs. › Higher productivity in SME industrial facilities.	› Provincial Energy Agency › Provincial Industrial and Trade Agency › City/Regency Industrial and Trade Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Education Agency › City/Regency Education Agency › Provincial Workforce Agency › City/Regency Workforce Agency › TVET/Training centres › Vocational schools/SMK › Polytechnics /Vocational institutions › Local universities › RE suppliers

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Gender and Inclusivity	› Inclusion of women workers and women-led MSMEs in RE-related training. › Introduction of cleaner RE-powered processing technologies that reduce health risks. › Support for women-led processing groups to access RE equipment.	› Coordination between Women's Empowerment Agency, Industrial and Trade Agency, and Cooperatives and MSME Agency to map women-led processing businesses that can benefit from RE. › Gender-responsive monitoring of RE-supported industrial interventions.	› Expanded access for women to technical and processing roles. › Improved occupational health. › More equitable access to RE-supported productivity improvements.	› Increased economic empowerment of women in industrial value chains. › More inclusive industrial upgrading. › Stronger household resilience.	› Provincial Energy Agency › Provincial Industrial and Trade Agency › City/Regency Industrial and Trade Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Women's Empowerment Agency › City/Regency Women's Empowerment Agency › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency
MSMEs	› Solar-powered drying, milling, cooling, and processing for small industries. › RE-based production upgrades for food, seaweed, and agro-industrial MSMEs. › Cooperative-based shared RE systems for processing centres. › Access to energy-efficient industrial equipment.	› Joint support from Cooperatives and MSME Agency, Industrial and Trade Agency, and Energy Agency. › Development of MSME-friendly green financing. › Collaboration with cooperatives for shared RE-based assets.	› Reduced production and energy costs. › Higher product quality and compliance with standards. › Enhanced competitiveness and resilience.	› Stronger local processing industries. › Increased value-added production. › Growth of green MSMEs.	› Provincial Energy Agency › Provincial Industrial and Trade Agency › City/Regency Industrial and Trade Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Renewable energy in Transportation					
Energy	› Electric two-wheelers and three-wheelers for urban logistics and deliveries. › Electric buses for BRT corridors and city transport. › Solar-powered charging stations at public facilities, terminals, and government buildings. › Integration of renewable energy into port operations (shore power, cold storage). › Hybrid solar–battery systems for small fishing or river transport vessels.	› Collaboration between Transport Agency and Energy Agency on EV charging standards and renewable-powered transport infrastructure. › Alignment with PLN for grid readiness and charging infrastructure. › Coordination with provincial and district transport plans (RPJMD, Sistranas, SistraDa). › Engagement with vehicle distributors and EV programme partners.	› Reduced fuel dependency and transport operational costs. › Lower emissions in urban areas. › Improved reliability for logistics operators using EVs. › Higher energy efficiency for public transportation.	› Cleaner and healthier urban environments. › Strengthened green mobility transitions. › More efficient logistics for small businesses and SMEs.	› Provincial Energy Agency › Provincial Transport Agency › City/Regency Transport Agency › Provincial Bappelitbangda › City/Regency Bappeda › PLN
Spatial	› Identification of priority locations for EV charging stations through RDTR. › Allocation of space for solar-powered charging facilities in public areas. › Integration of EV mobility corridors into urban spatial plans. › Zoning support for small renewable-powered transport hubs.	› Joint planning and work between Spatial Planning Agency, Transport Agency, Energy Agency, and Bappeda. › Alignment of RDTR and RTRW with electric transport needs. › Review of transport nodes (terminals, ports) for RE integration opportunities.	› Improved readiness for EV charging infrastructure. › Reduced land-use conflicts for transport energy facilities. › Stronger alignment between mobility planning and energy priorities.	› More organised urban transport ecosystem. › Better quality of public spaces and mobility networks. › Increased investor confidence for EV infrastructure projects.	› Provincial Energy Agency › Provincial Transport Agency › City/Regency Transport Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Spatial Planning › City/Regency Spatial Planning

Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Education and workforce	› Technical training for automotive and EV maintenance technicians. › Skills development on battery safety, charging systems, and electric motor diagnostics. › Training for public transport operators on RE-integrated mobility. › Curriculum insertion for EV technology in vocational schools and polytechnics.	› Collaboration between Workforce Agency, Education Agency, Energy Agency, Transport Agency, TVET/Training centres, vocational schools, polytechnics and universities for EV-related modules. › Partnerships with EV distributors and RE suppliers for practical training. › Coordination with Transport Agency for operator certification and safety standards.	› Availability of local EV technicians. › Increased safety and quality of EV operations. › Lower maintenance downtime for EV fleets.	› Creation of new green jobs. › Stronger industrial base for EV adoption. › Enhanced technical capacity for transport electrification.	› Provincial Energy Agency › Provincial Transport Agency › City/Regency Transport Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Workforce Agency › City/Regency Workforce Agency › Provincial Education Agency › City/Regency Education Agency › TVET/Training centres › Vocational schools/SMK › Polytechnics /Vocational institutions › Local universities › Transport operators › EV distributors
MSMEs	› Use of electric motorbikes for food delivery, courier services, and micro-logistics. › RE-powered charging stations tailored for SME delivery fleets. › Energy-efficient cold chain transport using solar-assisted refrigeration units. › Credit/financing schemes for EV adoption by small businesses.	› Joint programmes by Cooperatives and MSME Agency, Transport Agency, and Energy Agency to promote EVs for SMEs. › Coordination with banks and microfinance institutions for EV financing. › Partnership with cooperatives for group-based EV ownership or leasing.	› Lower fuel costs for SMEs. › Improved delivery efficiency for small producers. › Enhanced competitiveness for small businesses using clean mobility.	› Growth of green MSME logistics sectors. › Increased productivity for last-mile delivery businesses. › Greater adoption of clean technologies by small enterprises.	› Provincial Energy Agency › Provincial Transport Agency › City/Regency Transport Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency

◀ Table A.1 Continuation

Cross-cutting thematic sector	Example of activities	Foreseen coordination	Key benefits	Development impact	Stakeholders to be involved
Gender and Inclusivity	› Inclusion of women delivery drivers or small business owners in EV adoption programmes. › Safe and accessible transport systems benefiting women and vulnerable groups. › Targeted EV training for women in automotive and transport sectors. › Support for women-led MSMEs adopting EVs in logistics or processing.	› Coordination between Women's Empowerment Agency, Transport Agency, and Cooperatives and MSME Agency › Gender-sensitive planning for EV infrastructure (safety, lighting, accessibility). › Targeted training for women through TVET/training centres and vocational schools.	› Lower mobility costs for women-led businesses. › Safer and cleaner mobility systems. › More inclusive access to transport-related jobs.	› Greater economic participation of women in urban logistics and transport services. › Reduced exposure to air pollution and unsafe transport environments. › Wider inclusion in green jobs and green enterprise activities.	› Provincial Women's Empowerment Agency › City/Regency Women's Empowerment Agency › Provincial Transport Agency › City/Regency Transport Agency › Provincial Bappelitbangda › City/Regency Bappeda › Provincial Cooperatives and MSME Agency › City/Regency Cooperatives and MSME Agency › Provincial Workforce Agency › City/Regency Workforce Agency › TVET/Training centres

ANNEX B

The table below (Table B.1) presents selected programs, platforms, and resources related to education, training, and capacity development in renewable energy. While not intended to be exhaustive, it serves as an illustrative reference for provincial governments, educational institutions, and training centers to identify learning opportunities, foster collaboration, and build locally relevant capacity development programs. By leveraging existing resources and initiatives, stakeholders can strengthen local readiness for renewable energy development while supporting the development of a skilled local workforce.

Table B.1.

Existing education and training programs / platforms in Indonesia

Program/Project/ Resource/Platform	Implementer	Accessible Region	Brief description	Source
Renewable Energy Skills Development (RESO) project (component 1)	Ministry of Energy and Mineral Resources (MEMR); Ministry of Education, Culture, Research, and Technology; and State Secretariat for Economic Affairs (SECO)	Makassar, South Sulawesi	Development of a one-year D4 Specialization Program (Semesters 7 & 8) in Renewable Energy in the fields of Solar, Hydro, and Hybrid at five state polytechnics under the collaboration between SECO, MEMR and the Ministry of Education, Culture, Research, and Technology. One example of program implementation is in collaboration with the Ujung Pandang Polytechnic, Makassar.	Renewable Energy Indonesia, 2023, project campaign
Kampung Hijau Energi	Yayasan Hadji Kalla	Several regencies, South Sulawesi	Green knowledge-based community development integration program, including training for resilient village cadres for biogas and bioslurry.	https://www.yayasanhadjikalla.or.id/humanityandenvironmentcare/kampung-hijau-energi/
Renewable Energy Skills Development (RESO) project (component 2)	PPSDM KEBTKE (MEMR); Ministry of Workforce; TVETs under Ministry of Workforce, & SECO	National	Competency-based job training for Solar Power Plant Technicians (PLTS), Micro Hydro Power Plant Technicians (PLTMH), and Hybrid Power Plant Technicians at five training centers (provinces) under the Ministry of Energy and Mineral Resources and the Ministry of Manpower.	Renewable Energy Indonesia, 2023, project campaign
Sumba Iconic Island initiative	Hivos	Sumba, NTT	Training programs to over 40 local renewable energy entrepreneurs and designated village technicians Sumba Iconic Island Initiative. This training focused on procurement, installation, and Operation and Maintenance (O&M) of solar panels.	Sumba Iconic Island Progress Report 2019

Table B.1 Continuation

Program/Project/ Resource/Platform	Implementer	Accessible Region	Brief description	Source
Renewable Energy Indonesia (REI)	Government of Indonesia, led by the MEMR, in collaboration with the Ministry of Education, Culture, Research and Technology, the Ministry of Workforce, the Ministry of National Development Planning (BAPPENAS), and the National Professional Certification Agency (BNSP).	National	The Renewable Energy Indonesia platform provides a range of information on renewable energy development in Indonesia, including resources related to education, training, workforce development, and industry trends.	https://renewableenergy.id
Energy Academy Indonesia (ECADIN)	Energy Academy Indonesia (ECADIN)	National	Convening platform for RE through dialogue, workshop, and webinars.	https://www.ecadin.org/
Society of Renewable Energy (SRE)	Society of Renewable Energy (SRE)	National	A capacity building platform through webinar, seminar, and trainings.	https://www.sre.co.id
Akademi Transisi Energi	IESR	National	An online platform to support skills development in RE.	https://akademi.transisienergi.id/
Solar Power Plants Training & Competency Certification	Warung Energi	National	PLTS competency training based preparing for BNSP-licensed LSP-ET certification in centralized off-grid and on-grid schemes.	https://www.warungenergi.com/
Training and competency certification programs	PPSDM KEBTKE (MEMR)	National	Training and competency tests for individuals seeking to acquire expertise in these fields. Examples include training in geothermal energy, solar power, and bioenergy.	https://ppsdmkebtke.esdm.go.id/

◀ Table B.1 Continuation

Program/Project/ Resource/Platform	Implementer	Accessible Region	Brief description	Source
An educational digital platform	Enerka	National	Educational digital platform, including: › Enerklaz: A web-based online course focusing on various energy topic › Enerka Live Training on Energy (EnerLite), provided for students and/or professionals with topics discussed in a total of 8-12 learning hours, held in two or three days. › Enershow: Free webinars open to the public in collaboration with student organizations, discussing various energy topics. › Enerclub: A club that facilitates collaborations between practitioners and students, to conduct research that results in publication › RE Geomonday: FREE Webinars on renewable energy topics held bi-weekly, in collaboration with PT SMI.	https://enerklaz.com/
ZE Academy	ZonaEBT	National	Platform on upskilling for the renewable energy and carbon sectors. ZE Academy topics include Carbon Solar Panels, Hydropower, Nuclear, Biofuel, Biomass, Wind, Geothermal, Energy Efficiency, Climate Change, Green Jobs, Electric Vehicles, Green Buildings, Waste & Biogas.	https://zonaebt.com/ze-academy/
V-LAB EBT Kompresi UNS	Universitas Sebelas Maret (UNS)	National	V-LAB EBT Kompresi UNS is an interactive learning platform developed at Universitas Sebelas Maret (UNS), Solo, Central Java in Indonesia focused on Renewable Energy. It provides virtual laboratories, digital simulations, and educational materials to help students easily understand and explore concepts like solar panels, wind turbines, and water turbines.	https://kompresi-web.vercel.app/

