MODULE 4:

Lessons from Large-scale RE Projects

@ Dala 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 ▶

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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

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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).

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