

Bali's energy paradiplomacy: Subnational quest for net zero emissions by 2045

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Abstract

This paper examines how Bali Province leverages paradiplomacy, the international engagement of subnational governments, to advance its Net Zero Emissions (NZE) 2045 target in the energy sector. Through qualitative document-based analysis of official regulations, strategic roadmaps, bilateral memoranda, and secondary sources, this study identifies the regulatory architecture, international partnership channels, and flagship projects that constitute Bali's energy paradiplomacy. Findings reveal that Bali has constructed a sophisticated policy framework comprising governor regulations, regional legislation, and a technically detailed electricity roadmap requiring over \$44 billion in investment. The province engages international actors through multilateral development finance (ADB, AIIB, and World Bank); European bilateral partnerships (KfW, AFD, EU, and UK); Japanese city-to-city cooperation; US technical assistance; and philanthropic coalitions. The 2022 G20 Summit catalyzed a "paradiplomacy multiplier effect," generating national-level commitments, including the \$20 billion JETP that feeds back into provincial programs. However, a significant implementation gap persists: renewable energy contributes just 1.48% of Bali's electricity against a 2025 target of 11.15%, constrained by grid fragility, land scarcity, legacy fossil fuel contracts, and centralized utility governance. This paper contributes to international relations scholarship by extending paradiplomacy theory into subnational renewable energy governance and proposing the concept of event-driven paradiplomacy multiplier effects.

Keywords: paradiplomacy, energy diplomacy, net zero emissions, Bali, subnational governance, renewable energy

1. INTRODUCTION

The architecture of global climate governance is undergoing a significant structural transformation. For decades, the nation-state has served as the exclusive agent of international environmental diplomacy, possessing the sole authority to negotiate treaties and determine domestic implementation pathways. However, the escalating climate crisis has exposed the limitations of this state-centric

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model. National governments have frequently failed to meet the ambitious targets necessary to limit global warming to 1.5 degrees Celsius, constrained by complex political economies, fossil fuel industry lobbying, and bureaucratic inertia. In response, subnational entities, provinces, states, cities, and regions have increasingly assumed climate leadership through a strategy termed "paradiplomacy," directly engaging with international actors to advance local priorities [1].

Indonesia offers a telling example of this divergence. The data suggests a continued reliance on carbon-heavy baseload power in a context where a national grid in 2024 still generates some 61.5% of electricity from coal [2]. The dependence is in fact reflective of a broader regional trend: the region has seen an unprecedented growth in energy demand that has been largely met by fossil fuels, raising concerns about energy security, local pollution, and climate change and underscoring the urgency of a sustainable energy transition [3]. Studies of energy use across Asian economies further confirm the region's deep dependence on coal, oil, and natural gas, with economic growth remaining a consistent driver of increased use [4].

While national trends in Indonesia demonstrate an energy mix overwhelmingly dominated by fossil fuels, Bali Province has sought to bypass this trajectory by establishing a distinctive diplomatic and environmental profile on the global stage. Bali has declared its commitment to achieving Net Zero Emissions (NZE) by 2045, fifteen years ahead of the national target of 2060 [5]. This expedited timeline serves not merely as a technical blueprint but as a strategic assertion of energy autonomy, motivated by the island's susceptibility to external power interruptions and an aspiration to decouple its economic prospects from the central grid's dependence on fossil fuels [5,6].

The provincial government has used major international events, like the G20 Summit, to promote projects like the Nusa Penida 100% renewable energy pilot. This is in line with the Nangun Sat Kerthi Loka Bali philosophy, which stresses the importance of keeping Bali's natural environment sacred and in harmony. The province has tried to rebrand itself as a place for green investment and make direct partnerships with global organizations [5,6] by getting involved in these activities. This paper examines Bali's strategy towards the NZE target, investigating how paradiplomatic initiatives by subnational governments can generate leverage to obtain international backing for local priorities, thereby incorporating Bali into the overarching global sustainability discourse. This paper enhances international relations by expanding the paradiplomacy framework, usually applied to cultural or economic exchanges, into the technical and strategic realm of renewable energy governance.

Previous studies have investigated associated dimensions. Pratiwi and Yumitro [7] examined Bali's NZE 2045 pathway through a collaborative governance lens, discovering that hybrid financing facilitated gradual technical solutions but failed to stimulate structural institutional transformation. Harakan et al. [8] investigated "investment paradiplomacy" in South Sulawesi, illustrating how local governments attract foreign investment for wind energy by streamlining permit processes and effectively promoting the region. Rustam et al. [9] analyzed West Nusa Tenggara's participation in COP26, showcasing how the province navigated national bureaucratic constraints through robust local legislation and proactive environmental diplomacy, securing support from Denmark and the United Kingdom. This study expands upon this research by examining how subnational governments, particularly Bali Province, employ paradiplomacy to achieve Net Zero Emissions (NZE) in the energy sector. The analysis utilizes governmental regulations, strategic planning documents, and bilateral cooperation agreements to identify the critical success factors that can assist other subnational governments in fulfilling their global climate obligations.

2. LITERATURE REVIEW: PARADIPLOMACY AND ENERGY DIPLOMACY

The architecture of the international system, traditionally framed through the Westphalian paradigm of sovereign states, is experiencing significant structural upheaval [10]. The notion of the nation-state as the singular, indivisible entity of international relations has been deconstructed, exposing a complex internal framework of subnational actors that increasingly circumvent central authorities to interact directly with the global system [11]. Paradiplomacy represents a fundamental shift in global governance, redistributing diplomatic agency from the national capital to the provincial seat and the municipal hall [1]. Duchacek's [12] foundational work established that paradiplomacy encompasses the increasing participation of regional governments in international relations. The motivations for subnational visibility in the international arena are predominantly economic, cultural, and political: investment for regional development, market access, and technology for modernization [13]. In Indonesia, paradiplomacy has been frequently associated with foreign direct investment, with local governments leveraging this potential as an extension of central government economic welfare initiatives [14].

Duchacek's [15] foundational typology distinguishes four interconnected forms of noncentral diplomacy: transborder regional microdiplomacy, conditioned by geographic proximity and shared technical concerns; transregional microdiplomacy, involving institutionalized contacts between non-contiguous noncentral governments; global paradiplomacy, comprising direct relationships with distant centers of economic, political, and cultural power; and protodiplomacy, in which subnational external activity carries an explicit or latent secessionist message. Bali's energy paradiplomacy fits predominantly within the third category, global paradiplomacy, as the province cultivates direct linkages with multilateral banks (Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB), and the World Bank), bilateral partners across Europe and Japan, and transnational philanthropic coalitions located far beyond Indonesian borders. The Toyama City-Bali partnership and the Clean Authority of Tokyo's Suwung feasibility study additionally exhibit transregional microdiplomacy in Duchacek's sense: institutionalized exchanges between non-contiguous subnational governments whose national governments are themselves geographically separated. Critically, Bali's energy paradiplomacy lacks the protodiplomatic dimension; its assertiveness on climate is anchored in *Tri Hita Karana* and *Nangun Sat Kerthi Loka Bali* rather than in any centrifugal political project.

The conceptual lens that best captures the structural condition under which Bali's energy paradiplomacy operates is Duchacek et al., [16] notion of "perforated sovereignties." In their formulation, the contemporary increase of subnational, transnational, and transborder traffic does not abolish the sovereign state but rather perforates its boundaries, allowing trans-sovereign flows of information, finance, technology, and norms in both directions. Indonesia's unitary architecture, expressed through Law No. 37/1999 and the "one-gate policy" administered by the Ministry of Foreign Affairs, exemplifies a sovereignty that remains formally intact yet is empirically perforated by Bali's direct engagement with *Kreditanstalt für Wiederaufbau* (KfW), Agence française de développement (AFD), the EU, Joint Crediting Mechanism (JCM) partners, and philanthropic foundations. The perforation operates asymmetrically: Bali receives technical assistance, climate finance, and normative support from external actors while remaining bound by central licensing of formal agreements [17]. This asymmetry suggests that perforated sovereignty in unitary developing states is more porous on the inflow of resources than on the codification of binding commitments, a finding that reframes Bali's case as a useful empirical extension of Duchacek's framework beyond the federal democracies in which it was originally developed.

Duchacek [18] further proposes five drivers of subnational international assertion that map closely onto Bali's case: the expansion of the field of foreign policy from defense and status

into economic, environmental, and cultural issue areas; the imperatives of global and regional interdependence; the tutelary welfare roles assumed by all governments; growing awareness of vulnerability to distant events; and an emulative “me-tooism” facilitated by modern communications. The first four drivers manifest visibly in Bali. The province’s energy diplomacy is grounded in environmental and welfare issue areas rather than security; its NZE 2045 commitment is unintelligible without the climate-interdependence imperative; the provincial government’s responsibility for tourism, public health, and social welfare directly motivates clean-energy planning; and the May 2025 island-wide blackout dramatized vulnerability to distant grid events at the Java end. Even “me-tooism” is observable in Bali’s positioning vis-à-vis other subnational climate leaders, including West Nusa Tenggara [9], whose precedents shape both the rhetoric of the NZE Declaration and the architecture of partnerships pursued. Reading Bali’s energy paradiplomacy through Duchacek’s drivers thus situates the province within a broader, theoretically anchored class of subnational actors rather than treating it as a *sui generis* case, while simultaneously highlighting that the unitary, “one-gate” Indonesian institutional context introduces constraints largely absent from the federal cases that originally generated paradiplomacy theory.

The regulation of paradiplomacy in Indonesia is characterized by a paradoxical legal architecture that grants subnational entities international engagement capacity while enforcing rigorous state-centric control. *Undang-Undang Nomor 37 Tahun 1999 tentang Hubungan Luar Negeri* (Law No. 37 of 1999) and *Undang-Undang Nomor 24 Tahun 2000 tentang Perjanjian Internasional* (Law No. 24 of 2000) establish that while regional governments are recognized actors in international relations, their authority is strictly derivative. This framework functions as a “one-gate policy,” where the Ministry of Foreign Affairs serves as the obligatory conduit for all subnational external activities. Local governments lack inherent treaty-making power; they require a letter of mandate (*surat kuasa*) from the minister of foreign affairs to sign agreements, a centralized gatekeeping instrument preserving the unitary state structure [17].

Energy diplomacy is typically defined as the strategic utilization of foreign policy tools to ensure access to energy resources and markets [19]. Griffiths [20] expands this definition to encompass governmental actions meeting national energy needs while creating commercial opportunities, though historical precedents for deploying diplomatic techniques expressly for energy transition remain limited. Effective transition-oriented diplomacy requires dedicated bilateral agreements, whole-of-government engagement, strategic soft power deployment, and active participation in global forums [20]. Duggan [21] argues that energy transition is progressively being implemented through local diplomacy, observing that subnational governments can execute transformations more swiftly than national governments encumbered by geopolitical conflicts.

This paper defines paradiplomacy, in this context, as the approach employed by provinces and cities to address the climate leadership deficit created by inadequate national action, thereby reinforcing subnational authority to secure international support and expedite local objectives. This extends the conventional framework to encompass the technical and strategic dimensions of renewable energy governance. For Bali, energy diplomacy is fundamentally connected to its proactive paradiplomacy, which enables direct foreign relationships and technical support essential for net zero objectives. This convergence of paradiplomacy and energy diplomacy constitutes the analytical framework through which this paper examines Bali’s international energy engagement.

3. METHODS AND MATERIALS

This research employs a qualitative methodology to examine paradiplomacy conducted by Bali Province in pursuit of its NZE 2045 target. As argued by Bakry [22], qualitative methods are essential for comprehensive understanding of specific case studies. This research adopts a

document-based or archival approach, relying on primary documents (original records created by individuals with direct access to the events described) and secondary documents that analyze these primary sources [22]. Primary data comprise official provincial documents concerning Bali's international cooperation, including governor regulations, the regional energy general plan, the NZE 2045 Declaration, the Institute for Essential Services Reform (IESR) electricity roadmap, bilateral memoranda, and JCM project documentation. Secondary sources, academic literature, international development organization reports, press releases, and prior case studies are analyzed to ensure data triangulation.

4. RESULTS AND DISCUSSION

4.1. Foundation for Bali's energy paradiplomacy

The objective of the Bali Provincial Government to achieve net zero emissions by 2045 highlights a distinct policy divergence within the Indonesian archipelago. While the central government has established a 2060 timeline under its Long-Term Strategy for Low Carbon and Climate Resilience, Bali possesses a significantly abbreviated timeline functioning as both a technical objective and strategic instrument to attract climate finance and environmentally conscious tourism. The vision of *Nangun Sat Kerthi Loka Bali*, maintaining the sanctity and harmony of nature, reinforces this objective and is supported by regional legislation establishing renewable energy mandates exceeding national regulations [23].

The institutional framework underpinning Bali's decarbonization is established through three principal instruments. Peraturan Gubernur (Pergub), or Governor Regulation No. 45/2019 on "Bali Energi Bersih," mandates the transition from coal- and oil-fired power plants to clean energy and sets rooftop solar targets at a minimum of 20% capacity for government, commercial, and industrial structures. Pergub No. 48/2019 promotes transport electrification, requiring government entities to adopt battery-based electric vehicles and permitting low-emission zones. These executive regulations are grounded within *Peraturan Daerah* (Perda) or Regional Regulation No. 9/2020, articulating a long-term energy roadmap (2020–2050) that eliminates coal by 2050 [24]. These instruments collectively ensure policy coherence while creating a robust ecosystem for renewable deployment, connecting policymaking with implementation through specialized bodies and fiscal incentives for clean energy investment.

The Bali NZE 2045 Electricity Roadmap, launched in July 2025 as a joint initiative between the provincial government and IESR, represents Indonesia's most technically detailed subnational energy transition plan [28]. It structures the transition across four phases: Phase 1 (2025–2029, \$5.8 billion, 1.5 gigawatts (GW)); Phase 2 (2030–2034, \$1.6–1.7 billion, 1.4 GW plus 400 Megawatthours (MWh) storage); Phase 3 (2035–2039, \$1.76–4.76 billion, 1.24 GW); and Phase 4 (2040–2045, \$26.72–34.9 billion, 13–17.2 GW plus 33–54 gigawatt-hour (GWh) storage). The cumulative investment exceeds \$44 billion [5]. Critically, the roadmap delineates implementation gaps requiring cross-border partnerships, establishing demand for foreign investment and technical cooperation as fundamental elements of Bali's strategy. In theoretical terms, this regulatory architecture functions as "regulatory readiness," the institutional precondition signaling to international partners that domestic mechanisms are in place, thereby creating demand for paradiplomatic engagement.

Table 1: *Bali Province Renewable Energy Regulatory Framework (2018–2025)*

Regulation	Year	Key Provisions
Pergub No. 45/2019	2019	Bali Energi Bersih: transition from coal/oil to clean energy, rooftop solar mandate (min. 20%), and green tariff incentives.
Pergub No. 48/2019	2019	Battery EVs: mandatory EV use in government agencies, low-emission zones in tourist areas, and an EV acceleration committee.
Perda No. 9/2020 (Rencana Umum Energi Daerah (RUED))	2020	Regional Energy General Plan 2020–2050: RE targets of 11.15% by 2025 and 20.1% by 2050; coal elimination by 2050.
Surat Keputusan Gubernur (Governor's Decree) No. 879/2022	2022	Green building guidelines targeting 50% carbon reduction from buildings.
NZE 2045 Declaration	2023	Governor Koster declares NZE target 15 years ahead of the national 2060 goal, backed by IESR, WRI Indonesia, and Bloomberg Philanthropies.
NZE 2045 Electricity Roadmap	2025	IESR-developed 4-phase roadmap for 100% RE electricity by 2045; \$44+ billion investment.

Note: Compiled from [25]; [26]; Perda Provinsi Bali No. 9/2020; [24]; [27, 5, 28]; [29].

Table 2: *NZE 2045 Electricity Roadmap Investment Phases*

Phase	Period	Investment (USD)	Capacity & Objectives
Phase 1: Preparation	2025–2029	\$5.8 billion	1.5 GW solar, biomass, mini-hydro, waste, wind; –2.8 Mt CO ₂
Phase 2: Expansion	2030–2034	\$1.6–1.7 billion	1.4 GW generation + 400 MWh storage
Phase 3: Consolidation	2035–2039	\$1.76–4.76 billion	1.24 GW; offshore wind, ocean energy
Phase 4: Maturity	2040–2045	\$26.72–34.9 billion	13–17.2 GW + 33–54 GWh storage; 100% RE
TOTAL	2025–2045	\$44+ billion	Full decarbonization of Bali's electricity sector

Note: Adapted from [5]. Values represent midpoint estimates where ranges are given.

4.2. The G20 Summit as a paradiplomacy catalyst

The November 2022 G20 Summit in Bali represented a transformative moment, generating three outcomes that shape Bali's energy future. First, the Bali Compact's nine guiding principles for accelerating clean energy transitions were agreed upon at the Energy Transitions Ministerial Meeting in Nusa Dua on September 2, 2022, establishing a multilateral framework referencing Bali by name [30]. Second, the Just Energy Transition Partnership (JETP) was announced on November 15, 2022, a \$20 billion commitment from ten partner countries to accelerate Indonesia's energy transition [31,32]. While a national-level instrument, its announcement in Bali created what this paper terms a "paradiplomacy multiplier effect," a phenomenon whereby a subnational hosting event generates national-level commitments that subsequently feed back into provincial programs. The European Commission [33] noted that the JETP targets a 290 million metric tonnes of carbon dioxide (Mt CO₂) emissions cap and 34% renewable energy by 2030.

Third, IRENA convened its inaugural Investment Forum in Bali (August–September 2022) to mobilize Southeast Asian energy transition investment [34]. Concurrently, ADB and the Indonesian Electrical Company or *Perusahaan Listrik Negara* (PLN) signed an MoU for early retirement of Indonesia's first coal plant under the Energy Transition Mechanism. The simultaneous occurrence of these developments demonstrates event-driven paradiplomacy's capacity to accelerate climate

commitments across governance levels [35,36]. In theoretical terms, this extends Duchacek's [12] paradiplomacy typology by demonstrating that subnational actors can generate international outcomes through catalytic hosting effects that create commitment cascades, rather than solely through direct bilateral engagement. The paradiplomacy multiplier effect, defined as the mechanism by which subnational event-hosting generates escalating commitments across multiple governance tiers that flow back to the hosting jurisdiction, represents this paper's central conceptual contribution. The G20→JETP→Bali. The NZE sequence empirically demonstrates this mechanism, though the JETP's slow disbursement (approximately \$3.1 billion approved by late 2025) reveals the limits of commitment-level paradiplomacy when decoupled from implementation capacity.

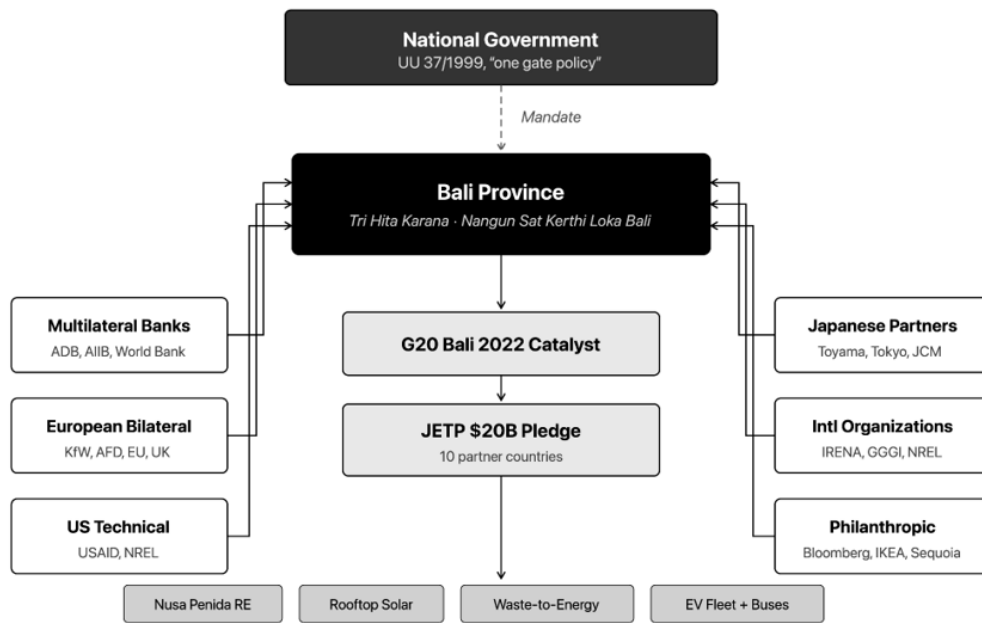


Figure 1: Bali's energy paradiplomacy framework for Net Zero Emissions 2045
Source: Compiled by Author

Figure 1 illustrates the multi-level governance architecture through which Bali Province engages international actors. The national government exercises regulatory oversight through the "one gate policy" (UU 37/1999), while Balinese, anchored in Tri Hita Karana¹ and Nangun Sat Kerthi Loka Bali², cultivates direct partnerships with multilateral banks, bilateral partners, city-to-city partners, international organizations, and philanthropic coalitions. The G20 Bali 2022 Summit functions as a central catalyst, generating the \$20 billion JETP pledge feeding into flagship project outcomes. Solid arrows represent resource and knowledge flows; dashed arrows represent the regulatory mandate. Source: Author's construction.

¹Tri Hita Karana is a life philosophy of the Balinese people in Indonesia, rooted in Hindu teachings to achieve happiness and life balance. Etymologically, it comes from Sanskrit: Tri (three), Hita (happiness/prosperity), and Karana (cause), which means three causes of happiness through harmonious relationships.

²Nangun Sat Kerthi Loka Bali is the development vision of the Bali Provincial Government, which means maintaining the purity and harmony of Bali's nature and its contents. This vision aims to realize a prosperous and happy life for the Balinese community (both seen and unseen) through a comprehensive planned development pattern that encompasses three main aspects: nature, community, and Balinese culture.

4.3. Multilateral development finance for the Java-Bali grid

Multilateral banks channel the largest financial flows into Bali's grid infrastructure. ADB approved a \$224 million loan for the Java-Bali 500 kV Power Transmission Crossing, adding 1,500 MW cross-strait capacity [37]. This is critical given Bali imports approximately 30% of electricity from Java's Paiton complex, a vulnerability exposed by the May 2, 2025, island-wide blackout affecting 940,000 customers [38]. In November 2025, ADB approved a \$470 million results-based loan for grid strengthening across Java-Madura-Bali, co-financed by AFD, KfW, the European Union (EU), and the United Kingdom (UK), employing a unified disbursement-linked indicator matrix [39, 40]. AIIB provided \$310 million for PLN distribution strengthening, and the World Bank approved \$500 million for the Indonesia Energy Transition (I-ENET) program, integrating 300 MW of rooftop solar, part of a \$2.5 billion multiphase approach [41].

These commitments add up to more than \$2 billion and show how international development goals affect and shape subnational grid infrastructure. In the context of energy paradiplomacy, this exemplifies what Griffiths [20] describes as the intersection of diplomatic involvement with tangible infrastructure results. However, it is important to note that these flows are facilitated by national institutions (PLN, PT Sarana Multi Infrastruktur (Persero) (PT SMI)) rather than being directly managed by provincial authorities. This highlights the structural tensions present in paradiplomacy within unitary states, where the "one-gate policy" [17] directs international resources through centralized intermediaries.

4.4. Bilateral partnerships

4.4.1 European partners

European engagement operates across multiple channels. Germany's KfW signed a €1.2 billion MoU with PLN at Conference of the Parties 29 (November 2024) for the 1,000 MW Grindulu Pumped Storage Hydropower Plant, directly strengthening the Java-Bali grid [42]. The EU, KfW, and AFD jointly support PT SMI's sustainable infrastructure platform, with the EU contributing EUR 2.4 billion through Team Europe to Indonesia's JETP [43]. The UK's MENTARI program (£2.7 million) distributed grants, including for Titab hydropower in Bali [44, 45]. Global Buildings Partnered Network (GBPN) partnered with Center of Excellence Community Based Renewable Energy (CORE) Udayana University on clean energy building regulation guidelines [46].

4.4.2 Japanese city-to-city partnerships

Japanese partnerships represent Bali's longest-standing energy paradiplomacy channel, exemplifying direct subnational-to-subnational engagement. A Letter of Intent between Bali and Toyama City (2011), formalized under the JCM city-to-city framework, explored fuel conversion, solar Photovoltaics (PV), and micro-hydropower at the Jatiluwih UNESCO World Heritage Site [47, 48]. The Clean Authority of Tokyo conducted a JCM feasibility study for waste-to-energy at TPA Suwung [49]. The 9th JCM Joint Committee meeting in Bali (October 2019) further anchored the island in Japan-Indonesia subnational energy cooperation [50]. These partnerships demonstrate the core paradiplomacy mechanism identified by Duchacek [12]: subnational actors bypassing state-centric processes to access international technology and finance.

4.4.3 USAID/NREL technical cooperation

United States Agency for International Development (USAID) and National Renewable Energy Laboratory (NREL) conducted economic impact analyses of distributed PV deployment in the Java-Bali grid, finding that net revenue impacts from up to 4 GW of solar would be minimal—less than 0.2% above 3 GW [51]. This external technical validation functions as “knowledge diplomacy,” providing the evidentiary basis to overcome institutional resistance within PLN’s centralized utility model.

4.4.4 Other international actors

Global Green Growth Institute (GGGI) is preparing Bali’s EV and green transportation roadmap funded by South Korea, which also donated 10 electric buses valued at Indonesian Rupiah (IDR) 75 billion [52,53]. Denmark launched the Sustainable Island Initiative [54,55]. A philanthropic coalition, Bloomberg Philanthropies, IKEA Foundation, and Sequoia Climate Foundation, supports NZE roadmap development [29]. The December 2024 INZET³-Sustainability Economics MoU covers clean energy and AI data centers [56]. These philanthropic coalitions represent an emerging paradiplomacy form bypassing both state and multilateral channels.

4.5. Flagship Projects

4.5.1 Nusa Penida 100% renewable energy pilot

Nusa Penida (population 62,000) operates 17.06 MW primarily diesel capacity, serving 23,000+ customers, with a 3.5 MWp (megawatt peak) hybrid solar plant achieving 24% RE penetration [57]. IESR and CORE Udayana mapped 3,219 MW of technical potential [58,59]. The three-phase roadmap (2024–2030) targets rooftop solar maximization, diesel reduction via biodiesel and ocean current exploration, and seawater pumped hydro storage. Investment is \$100 million, with projected cost reductions of 30–40% from the current Rp 4,500/kWh diesel cost (Tanahair.net, [60]). Hitachi Energy deployed a smart microgrid for the G20 Summit [61]. A cautionary precedent exists: nine wind turbines (700 kW) installed at Puncak Mundi in 2007 were nearly all non-operational by 2014 due to spare parts unavailability [36].

4.5.2 Rooftop solar deployment

Rooftop solar potential is estimated at 3.3–10.9 GW, yet installed capacity remains 7.45 MW [62]. Notable installations include PLN systems across 35 offices (489.72 kWp) and Padma Resort Legian (388.1 kWp, 70% energy coverage). IESR found 23% of households (256,000) represent viable customers [6,36].

4.5.3 Waste-to-energy

TPA Suwung receives 800–1,500 tons daily, with closure extended to March 2026 [63]. Under Indonesia’s national 30-facility WtE megaproject, Denpasar is in the Weiming batch; Zhejiang Weiming was selected as operator at \$154–197 million, targeting 2027–2028 [64].

³INZET is a non-profit unit of the Amerta Bali Lestari Foundation that acts as a local advisor and advocate for Bali’s transition to net-zero emissions.

4.5.4 Electric vehicle adoption

Registered EVs reached 5,596 by 2023 (5.2% national adoption), with PLN operating 74 SPKLU and 166 Stasiun Pengisian Listrik Umum (SPLU) or public electricity stations [36]. Trans Metro Dewata launched electric bus pilots in August 2025, targeting fully electric fleets by 2028 [52, 65, 66].

Table 3: *Bali's International Energy Partnerships and Finance Flows*

Partner	Type	Finance	Focus Area
ADB	Multilateral	\$224M loan	Java-Bali 500 kV Transmission (1,500 MW)
ADB + AFD, KfW, EU, UK	Multilateral	\$470M Results-Based Loan	Grid strengthening; Java-Madura-Bali
AIIB	Multilateral	\$310M	PLN East Java and Bali distribution
World Bank	Multilateral	\$500M	I-ENET: 300 MW rooftop solar integration
KfW (Germany)	Bilateral	€1.2B MoU	Grindulu Pumped Storage (1,000 MW)
UK MENTARI	Bilateral	£2.7M	Hydropower including Titab, Bali
Toyama City	City-to-city	JCM funded	Solar PV, micro-hydro at Jatiluwih
Clean Auth. Tokyo	City-to-city	JCM funded	WtE feasibility at TPA Suwung
USAID + NREL	Bilateral	TA grant	Distributed PV impact on Java-Bali grid
GGGI + S. Korea	Multilateral	IDR 75B	EV roadmap: 10 electric buses
JETP (G20 Bali)	Multilateral	\$20B pledge	National energy transition
Bloomberg/IKEA Sequoia	Philanthropic	Grants	NZE Coalition; roadmap development

Note: Compiled from [37, 39]; [41]; [42]; [43]; [31]; [34]; [49, 48]; [52]; [29].

Table 4: *Flagship Renewable Energy Projects in Bali Province*

Project	Target	Investment	Status & Key Data
Nusa Penida 100% RE	100% RE by 2030	~\$100M	17.06 MW; 3.5 MWp solar (24% RE); Hitachi microgrid
Rooftop Solar	3.3–10.9 GW potential	Various	~7.45 MW installed; 23% households viable
Waste-to-Energy	37 MW potential	\$154–197M	Denpasar in national WtE batch; target 2027–2028
EV Adoption	Full electric buses 2028	Various	5,596 EVs (2023); 74 Stasiun Pengisian Kendaraan Listrik Umum (SPKLU) or Public Electric Vehicle Charging Stations; electric bus pilot Aug 2025
Biodigester Programs	Community scale	Carbon offset	Hivos BIRU (Biogas for Rural Household ⁴ (2.6 tCO ₂ /yr/unit); su-re.co IKI (40 units)

Note: Compiled from [27, 6, 5, 28, 62, 57, 58]; [61]; [36]; [64]; [65].

4.6. Structural constraints and the implementation gap

Bali's current energy reality starkly contrasts with its paradiplomacy ambitions. Total generating capacity is approximately 1,461 MW, dominated by the 380 MW Celukan Bawang coal plant, gas facilities at Pesanggaran (426 MW), Gilimanuk (134 MW), and Pemaron (98 MW). Four submarine cables from Java supply 270–400 MW, roughly 30% of electricity from East Java coal. Renewable energy contributes just 1.48% from 7.45 MW, far below the 11.15% RUED target for 2025 [6, 36]. Peak demand of 1,200 MW grows at 7–8% annually, driven by tourism (40–50% of consumption). The May 2, 2025 blackout (940,000 customers for 3.5 hours) underscored grid fragility [38].

⁴An initiative with a focus on carbon offset (IKI: International Climate Initiative).

Five structural constraints define Bali's challenge. First, grid fragility: submarine cables at near-full capacity, with the planned fifth cable and ADB 500 kV crossing years away [37]. Second, land scarcity: dense population, cultural landscape (temples, rice terraces, and sacred forests), and tourism infrastructure constrain large-scale renewables; the Bedugul geothermal project was blocked in a protected forest [36]. Third, take-or-pay fossil fuel contracts reduce PLN flexibility, elevating Nusa Penida costs from 9.45 to 11.32 cents/kWh [57]. Fourth, 100% RE by 2045 requires 54 GWh of storage [5]. Fifth, the 2020 Omnibus Law potentially recentralized energy authority, and PLN's monopoly constrains independent producers [67].

Despite these constraints, environmental concern ranks as the top Balinese priority, the highest of all Indonesian provinces, providing robust social license [6, 68]. This aligns with *Tri Hita Karana* and *Nangun Sat Kerthi Loka Bali*, establishing the ideational foundation for domestic policy and international engagement [29, 69]. The implementation gap between 1.48% actual and 11.15% targeted RE share represents the central tension of Bali's energy paradiplomacy. This gap suggests that subnational diplomatic success in securing international commitments does not automatically translate into installed renewable capacity. Paradiplomacy, at least in its current form in Bali, appears more effective at norm-setting and resource commitment than at driving actual deployments, a finding that challenges optimistic accounts of subnational climate leadership and warrants critical examination of the structural barriers that decouple diplomatic capital from material outcomes.

5. THEORETICAL IMPLICATIONS: PARADIPLMACY AND ENERGY DIPLOMACY

The empirical reconstruction presented in the preceding section, such as the regulatory architecture, the multi-channel partnership portfolio, the G20-driven multiplier sequence, and the implementation gap—invites theoretical reflection that extends well beyond the descriptive boundaries of a single case. Read together, these findings refine and qualify core propositions of the paradiplomacy and energy-diplomacy literatures, and they suggest several adjustments to the conceptual apparatus through which subnational climate engagement is currently theorized. Bali, in this reading, serves less as an exemplar than as an analytical lens through which the assumptions, scope conditions, and limits of the prevailing frameworks become visible.

Most immediately, the case challenges the constitutional scope conditions that paradiplomacy theory has implicitly inherited from its origins in federal and decentralized democracies. Bali enjoys no comparable constitutional standing, operating inside Indonesia's unitary "one-gate" architecture, yet it generates an externally oriented practice that displays the substantive features of both global paradiplomacy and transregional microdiplomacy. The implication is that the existence of paradiplomacy depends not on federalism as a structural precondition but on a more contingent set of enabling factors: regulatory readiness, ideational identity, and the availability of issue areas in which the central government tolerates or invites subnational engagement. The ideational dimension warrants particular emphasis. *Tri Hita Karana* and *Nangun Sat Kerthi Loka Bali* operate not as decorative branding but as conceptual scaffolds shaping partnership selection and public legitimation [29, 69], suggesting that paradiplomatic capacity in the Global South is built as much on indigenous philosophical traditions as on the materialist and rationalist drivers around which much of the existing theory has been organized.

This observation, however, only describes the surprising fact of Bali's external action; explaining how that action is structurally possible requires turning to the "perforated sovereignties" framework [16] and refining it for the unitary-state context. The Bali findings reveal an asymmetry that the original formulation, again drawn from federal cases, did not foreground. Sovereignty is perforated readily on inflows—climate finance, technical assistance, and normative templates—but

remains comparatively closed on the codifications that would allow the subnational actor to commit the state externally. The \$20 billion JETP cascading from the Bali-hosted summit reaches the province as resources, while the provincial government itself cannot sign a binding international agreement absent a surat kuasa [17]. This asymmetric perforation is conceptually consequential: paradiplomacy in unitary developing states is best understood as a one-way valve in which sovereignty is open to inputs and closed to outputs, producing coordination problems and accountability gaps that are largely absent from the federal cases through which the concept was originally elaborated.

The Bali sequence further suggests that the typological repertoire developed by Duchacek [15] and elaborated by subsequent scholarship [12, 13] is incomplete. Existing categories—transborder regional microdiplomacy, transregional microdiplomacy, global paradiplomacy, and protodiplomacy—share an implicit assumption: that the subnational actor functions primarily as the originator of bilateral or multilateral relationships. The G20 → Bali Compact → JETP → Bali NZE sequence reveals a distinct modality not captured by this assumption, namely the subnational actor as catalytic host. In this modality, the province does not directly negotiate the cascading commitments that flow back to it; rather, by hosting an international event of sufficient political salience, it creates conditions under which national governments and multilateral institutions generate commitments that subsequently re-enter the provincial policy space as resources, programs, and political cover. The “paradiplomacy multiplier effect” thus identifies an event-driven mechanism with a distinctive temporal signature—an intense burst of commitment around the event followed by slow disbursement—and a dependence on the political logic of states seeking to perform climate leadership at international moments. Theoretically, this modality enriches the existing typology with a category that is neither purely subnational nor purely national but emergent from their interaction at hosted events.

A parallel revision is required of the energy-diplomacy literature, which has been framed predominantly around resource access and national-level commercial opportunity [20]. The Bali case demonstrates that subnational energy diplomacy operates through a substantively different toolkit: climate finance instruments such as disbursement-linked-indicator and results-based loans, technical-assistance vehicles such as the USAID/NREL studies and the GBPN-CORE Udayana partnership, and city-to-city transfer programs operating under the JCM and the Toyama-Bali memorandum. The orientation, correspondingly, is transitional rather than acquisitive: the strategic objective is to phase out incumbent fossil supplies and replace them with renewables, not to secure access to new energy resources. Adequately analyzing this practice, therefore, requires looking beyond the bilateral oil-and-gas deal to a more diffuse set of instruments, partners, and beneficiaries, and recognizing that subnational governments often hold the operational agenda even when central governments retain formal authority. In an era of climate transition, energy diplomacy is becoming increasingly and substantively transition diplomacy, a category whose contours the Bali case helps to delineate.

These extensions, however, must be tempered by what may be the most analytically consequential finding to emerge from the case: the systematic decoupling of diplomatic capital from material outcomes. Bali has accumulated more than two billion dollars in committed multilateral finance, a \$44 billion-plus roadmap, and partnerships with at least a dozen international actors, yet renewable energy contributes only 1.48% of provincial electricity against an 11.15% target for 2025 [6, 36]. The pattern suggests that paradiplomacy and energy diplomacy, on the evidence of this case, are most effective at norm-setting, regulatory readiness, and commitment cascading and least effective at moving installed capacity against the resistance of grid topology, land scarcity, legacy contracts, storage requirements, and centralized utility governance. This is conceptually significant because it forces a distinction that the existing literature tends to elide. Commitment-

paradiplomacy—the cultivation, signaling, and accumulation of international engagements—is not the same phenomenon as deployment-paradiplomacy, the conversion of those engagements into installed infrastructure and structural transformation. The conditions under which the former produces the latter constitute a research frontier that current theory leaves underspecified, and the Bali case, with its rich diplomatic capital and modest deployment, marks that frontier with unusual clarity.

6. CONCLUSION

This study has examined how Bali Province leverages paradiplomacy to advance its NZE 2045 target in the energy sector, addressing a gap at the intersection of paradiplomacy theory and subnational renewable energy governance. Three principal findings emerge.

First, Bali has constructed one of Southeast Asia's most sophisticated subnational clean energy policy frameworks, progressively layering executive regulations (Pergub 45/2019 and 48/2019), regional legislation (Perda No. 9/2020), and strategic roadmaps (NZE 2045 Electricity Roadmap) to create "regulatory readiness," the institutional precondition for effective energy paradiplomacy. This architecture simultaneously serves domestic governance needs and signals institutional preparedness to international partners [5,29].

Second, Bali's energy paradiplomacy operates through multiple complementary channels: multilateral finance (ADB, AIIB, and World Bank, collectively exceeding \$2 billion); European bilateral partnerships (KfW, AFD, the EU, and the UK); Japanese city-to-city cooperation through the JCM; US technical assistance (USAID/NREL); and an emerging philanthropic coalition. The G20 Summit served as a critical "paradiplomacy multiplier," generating national-level commitments, notably the \$20 billion JETP that feeds back into provincial programs. This multiplier effect extends existing paradiplomacy typologies [1,12] into the domain of event-driven climate diplomacy.

Third, a significant implementation gap persists: RE contributes just 1.48% of electricity against a 2025 target of 11.15% [6,36]. Five constraints—grid fragility, land scarcity, legacy contracts, storage requirements, and centralized governance—impede the conversion of diplomatic capital into installed capacity. This suggests that paradiplomacy in developing-country subnational contexts may be more effective at norm-setting than at driving deployment, warranting comparative investigation across Indonesian provinces [8,9].

The culturally distinctive character of Bali's paradiplomacy anchored in *Tri Hita Karana* and *Nangun Sat Kerthi Loka Bali* functions not merely as branding but as a framework shaping partnership selection, policy design, and public legitimation [68,69]. This study is limited by its reliance on publicly available documents rather than primary interviews, its snapshot of rapidly evolving partnerships, and its exclusive focus on the energy sector. Future research should pursue comparative analysis across Indonesian provinces, longitudinal studies tracking commitment-to-capacity conversion rates, and critical examination of the distributional consequences of subnational green branding. Despite these limitations, this paper demonstrates that subnational energy diplomacy represents a viable, if constrained, mechanism through which provinces in developing countries can localize global climate commitments.

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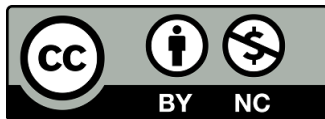
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