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Can a Quota Deliver? Indonesia's Rooftop Solar Policy after Ministerial Regulation No. 2 of 2024

"Dapatkah Sistem Kuota Mewujudkan Target? Kebijakan PLTS Atap Indonesia setelah Peraturan Menteri ESDM Nomor 2 Tahun 2024"

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ABSTRACT
Indonesia replaced net metering for rooftop solar photovoltaics (PV) in January 2024 with a regime in which exported energy earns nothing and new connections are rationed by a five-year quota proposed by the utility. This policy analysis reads the ministerial regulations of 2018, 2021 and 2024 at article level and sets them against official capacity figures, the 2025–2034 electricity supply plan, the 2025 National Energy Policy and published engineering and techno-economic studies. Rooftop capacity rose from 140 MW (December 2023) to 538 MWp (July 2025) and 895 MW (April 2026), about 60% of all installed solar, while the 2024–2028 quota totals 5,746 MW. Installations since 2023 equal at most 40% of the 2024–2025 quota; filling the quota by 2028 would need about 156 MW per month, roughly four times the recent pace. Without export credit, a system that self-consumes half its output takes twice as long to pay back. The article argues that the quota can deliver the reduced 2 GW goal through industrial self-consumption, but not the household segment or the larger solar ambitions, because it is a ceiling without a floor set by an interested party. Feeder-level hosting-capacity quotas, inverter requirements and storage-linked export credit are proposed.

1. INTRODUCTION

Rooftop solar photovoltaics (PV) is the one part of Indonesia's power sector in which private households and firms, rather than the state utility, decide how fast capacity is built. That is why its regulation has been rewritten so often: five instruments in little more than five years. The Minister of Energy and Mineral Resources (MEMR) first allowed customers of the state electricity company, PT Perusahaan Listrik Negara (Persero) (PLN), to offset their bills with exported solar energy in 2018 [1]; the rule was amended twice in 2019 [2], replaced in 2021 by a more generous one [3], and replaced again on 31 January 2024 by MEMR Regulation No. 2 of 2024 (Peraturan Menteri Energi dan Sumber Daya Mineral Nomor 2 Tahun 2024 tentang Pembangkit Listrik Tenaga Surya Atap yang Terhubung pada Jaringan Tenaga Listrik Pemegang Izin Usaha Penyediaan Tenaga Listrik untuk Kepentingan Umum) [4]. The 2024 regulation ended the crediting of exported energy and introduced a quota: a cap on the rooftop capacity that may be connected to each power system in each year, proposed by the utility and fixed by the ministry.

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The change was made against a record of persistent under-delivery. Rooftop capacity stood at 140 MW in December 2023 against a target of 3.6 GW for 2025, and the renewable share of the energy mix reached 13.1% in 2023 against a target of 17.9% [5]. The ministry presented the new regulation as a way to accelerate deployment [5]; PLN presented the quota as a way to protect system stability against weather-driven swings in solar output [6]; and the Institute for Essential Services Reform (IESR), the most prominent independent observer, warned that the loss of net metering would make the 3.6 GW goal difficult to reach and would weaken the economics of household and small-business systems [7].

Two and a half years later the evidence allows a first assessment, and the stakes have risen. The Electricity Supply Business Plan (Rencana Usaha Penyediaan Tenaga Listrik, RUPTL) for 2025–2034 plans 17.1 GW of solar within 69.5 GW of new capacity [8]; the 2025 National Energy Policy assigns solar a share of primary energy that rises roughly tenfold between 2030 and 2040 [9]; and since August 2025 the government has pursued a programme of 100 GW of solar [10], for which the first 5.3 GWp broke ground on 25 August 2026 [11]. Total installed solar was about 1.5 GW in April 2026, of which 895 MW was on rooftops [12]. Rooftop PV is thus the largest part of what exists and the part governed by the most restrictive instrument.

Scholarly work on Indonesian rooftop PV is abundant but mostly looks elsewhere. Techno-economic studies assess single buildings or cities under a given tariff rule [13], [14], [15], [16]; survey studies examine adopters' perceptions and barriers [17], [18]; strategy studies consider the utility's position [19]; and system studies ask how much variable generation the Java–Bali grid can absorb [20], [21]. A recent review links PV expansion to grid capacity, storage and regulatory uncertainty [22], and utility researchers have forecast rooftop growth under policy constraint [23]. What is missing is an article-level analysis of the quota itself as a piece of regulatory design, tested against the capacity and target figures now available.

This article supplies that analysis. Its thesis is that the quota design of Regulation No. 2 of 2024 can deliver the modest rooftop goal the government now states for 2028, because that goal can be met by commercial and industrial customers who consume their own output, but that it cannot deliver the household segment, the full published quota, or a meaningful rooftop contribution to the RUPTL, National Energy Policy and 100 GW ambitions. The reason is structural rather than incidental. The quota is a ceiling without a floor, proposed by the party whose sales it reduces, justified by an engineering problem it does not measure at the level where the problem occurs, and coupled to a zero export price that removes the incentive of the customers with the most roofs. The contribution is threefold: a provision-by-provision comparison of the regulations; a reconciliation of installed capacity with the quota and the targets; and a set of design changes that would turn the quota from a rationing device into a grid-integration instrument.

The analysis is documentary. It relies on the texts of the regulations, on official statements and figures reported by the ministry, PLN and the national news agency, on IESR reports,

4. RESULTS AND DISCUSSION

2.1 The regulatory path, 2018–2024

Table 1 compares the three principal instruments on the provisions that matter for deployment. Three shifts stand out.

The first concerns the value of exported energy. MEMR Regulation No. 49 of 2018 (*Penggunaan Sistem Pembangkit Listrik Tenaga Surya Atap oleh Konsumen PT Perusahaan Listrik Negara (Persero)*) credited exported kilowatt-hours at 65% of their volume against imports, with any surplus carried forward for at most three months and then voided (Article

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6(1), (4) and (5)) [1]. MEMR Regulation No. 26 of 2021 raised the credit to 100% and lengthened the carry-forward to six months, with surpluses cancelled each July and January (Article 6(1) and (4)) [3]. Regulation No. 2 of 2024 states that surplus energy entering the utility's network "is not counted in determining the amount of the electricity bill" (*tidak diperhitungkan dalam penentuan jumlah tagihan listrik*) (Article 13) [4]. The credit factor thus moved from 0.65 to 1.0 and then to zero. Systems already operating or already approved keep the export–import mechanism for ten years from the date of the utility's approval (Article 47(1)), but any change of capacity brings them under the new rules (Article 47(2)), and applications that were pending on 31 January 2024 are decided under the new rules (Article 48) [4].

The second shift concerns system size. Both earlier regulations capped a rooftop system at 100% of the customer's connected capacity, measured by total inverter capacity (Article 5 of each) [1], [3]. The 2024 regulation removes the cap: capacity follows the customer's needs, subject to the quota (Article 12(1)), or to network conditions where no quota has yet been set (Article 12(2)) [4]. The limit moved from the individual connection to the system as a whole.

The third shift concerns charges and procedure. Under the 2021 regulation, industrial customers paid a monthly capacity charge equal to total inverter capacity multiplied by five hours and by the tariff (Article 20(3)) [3]. The 2024 regulation exempts rooftop systems from parallel-operation charges (Article 29), and the ministry has described this exemption as the incentive that remains [24]. It also moves the cost of the meter from the customer (Article 18(3) of the 2021 regulation [3]) to the utility (Article 28(3)) and requires an advanced, two-way communicating meter for every system (Articles 1(4) and 4(2)) [4]. In exchange, applications are no longer accepted continuously and decided within five working days (Article 7(3) of the 2021 regulation [3]); they may be filed only in January or July (Article 14(2)), and the utility has 30 calendar days after the window closes to decide (Article 15(1)), failing which the application is deemed approved (Article 15(2)) [4].

Table 1. Rooftop solar PV regulations of the Minister of Energy and Mineral Resources, 2018–2024: provisions relevant to deployment

Provision	Reg. No. 49 of 2018	Reg. No. 26 of 2021	Reg. No. 2 of 2024
Promulgated	16 November 2018	20 August 2021	31 January 2024
Status in October 2026	Revoked by No. 26 of 2021	Revoked by No. 2 of 2024	In force
Scope	PLN customers	Customers of all public-supply licence holders	Customers of all public-supply licence holders
Capacity limit	100% of connected capacity (Art. 5(1))	100% of connected capacity for state-owned licence holders (Art. 5(1))	No individual cap; customer need within system quota (Art. 12)
Credit for exported energy	65% of exported kWh (Art. 6(1))	100% of exported kWh (Art. 6(1))	None (Art. 13)
Carry-forward of surplus	3 months (Art. 6(4))	6 months (Art. 6(4))	Not applicable
Capacity charge, industrial	As set by other regulations (Art.	Inverter kW × 5 h × tariff, monthly (Art.	None; no parallel-operation charge (Art.

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Provision	Reg. No. 49 of 2018	Reg. No. 26 of 2021	Reg. No. 2 of 2024
customers	14(2))	20(3))	29)
Application	Any time; decision within 15 working days (Art. 7(6))	Any time; decision within 5 working days (Art. 7(3))	January or July only (Art. 14(2)); decision within 30 days of window closing (Art. 15(1))
System-wide quota	None	None	Five-year quota per power system (Arts. 7–11)
Meter cost	Not examined	Customer (Art. 18(3))	Utility; advanced meter (Art. 28)
Legacy systems	Not applicable	Not applicable	Keep export–import for 10 years (Art. 47(1))

Source: compiled by the authors from the texts of the regulations [1], [3], [4]. "Not examined" means that the provision was not read at article level. The two 2019 amendments of Regulation No. 49, of which the second is [2], were verified from the official record only and are not tabulated.

2.2 How the quota works

The quota provisions occupy Articles 7 to 11 of the 2024 regulation [4]. Each holder of a public electricity supply licence (*Izin Usaha Penyediaan Tenaga Listrik untuk Kepentingan Umum*, IUPTLU), of which PLN is the largest [5], must prepare a rooftop development quota for each of its power systems (Article 7(1)). In doing so it must consider at least the direction of national energy policy, the plan and realisation of its own supply plan, and the reliability of the system under the applicable grid code (Article 7(2)). The quota covers five years and is broken down by calendar year (Article 7(3)). The licence holder submits it with a technical study to the Director General of Electricity (Article 8(1) and (2)), who evaluates and fixes it (Articles 8(5) and 9(1)). The licence holder then divides the quota by "clustering", defined as the network system of each customer service unit, and publishes the clustered quota within ten working days (Article 9(3) to (5)). It may propose changes through the same procedure (Article 10). Quota unused at the end of a year is added to the following year (Article 11). Applicants rejected for lack of quota join a waiting list for later periods (Article 15(8)). An approval lapses if the installation does not obtain its operation-worthiness certificate within six months, or its registration number within three months (Article 26). A licence holder that fails to prepare a quota is liable only to a written reprimand (Article 44(a)).

The first quota for PLN's systems was reported in June 2024: 901 MW for 2024, 1,004 MW for 2025, 1,065 MW for 2026, 1,183 MW for 2027 and 1,593 MW for 2028, in total 5,746 MW, set by power system and at that date not yet divided by cluster [25]. Before 2024 there was no formal quota, but there was an informal one: in June 2023 a PLN executive stated that installations had previously been limited to 10–15% of installed capacity, that the limit would be lifted, and that "a quota still applies", at a time when PLN had roughly 7,000 rooftop customers [26]. The 2024 regulation can thus be read as the legalisation of a practice of administrative limitation that the 2021 regulation had not authorised.

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2.3 The targets rooftop solar is meant to serve

Three layers of targets bear on rooftop PV. The first is the rooftop-specific goal. A National Strategic Project of 2021 set 3.6 GW of rooftop solar for 2025 [7], [5]. In September 2025 the ministry's director for renewable energy spoke instead of 1 GW by the end of 2025 and 2 GW by 2028, the latter divided into 1,850 MW for Java, Madura and Bali, 104 MW for Kalimantan, 95 MW for Sumatra, 17 MW for Sulawesi and 7 MW for Maluku, Papua and Nusa Tenggara [27]. These regional figures sum to 2,073 MW, and neither total matches the 5,746 MW quota reported in 2024; the official document reconciling the two could not be located, and the discrepancy is carried forward in the analysis as it stands.

The second layer is the electricity plan. The RUPTL 2025–2034, approved in May 2025, plans 69.5 GW of additional capacity, of which 42.6 GW is renewable (about 61%), 10.3 GW is storage and 16.6 GW is fossil; solar accounts for 17.1 GW [8], the largest share among renewable sources [28]. The ministry describes a 2034 goal of 17 GW for floating and ground-mounted solar, with rooftop counted separately [27]. The plan is being revised to accommodate the 100 GW programme; PLN has proposed adding more than 50 GWp of solar and 142 GWh of battery storage [8], while the ministry cites an investment need of USD 70–73 billion and PLN plans 48,000 circuit-kilometres of transmission [29].

The third layer is the National Energy Policy (*Kebijakan Energi Nasional*), re-enacted as Government Regulation No. 40 of 2025 (*Peraturan Pemerintah Nomor 40 Tahun 2025 tentang Kebijakan Energi Nasional*). It sets the share of new and renewable energy in primary energy at 19–23% in 2030, 36–40% in 2040, 53–55% in 2050 and 70–72% in 2060 (Article 10(1)(a)), and directs that solar be maximised "as long as its economics are met", with a share of 1.3–1.6% in 2030, 13.1–16.0% in 2040, 23.3–25.3% in 2050 and 29.8–32.0% in 2060 (Article 12(1)(b)(2)) [9]. The realised renewable share at the end of 2025 was 15.75% [10], [30], against the 23% that the previous policy had set for 2025 [7]. The policy also requires that the system be able to accept higher renewable shares reliably (Article 43) and treats storage as part of operating reserves (Article 21(3)) [9].

2.4 Institutions and interests

PLN is at once the network operator that must keep the system stable, the retailer whose sales fall when customers generate their own energy, and the author of the quota proposal. A strategy study based on a survey of rooftop users concluded that PLN is strongly placed to enter the rooftop business itself through vertical integration and diversification [19]. An energy analyst describes the generation market as one in which PLN is in effect the only large buyer and developers face high risk for low return [31], and a study of a utility-scale solar project finds the regulated purchase tariff insufficient for an independent producer while the same project is highly profitable from PLN's side because it displaces diesel [32]. IESR's 2026 outlook describes renewable targets that conflict with PLN's coal plans and a fragmented grid, while judging solar with battery storage already cheaper than diesel and new coal in many regions [33]. IESR's programme manager suggested in February 2024 that PLN's financial constraints were probably a main reason for abolishing net metering [7]. Within the ministry, the Director General of Electricity fixes the quota while the Director General of New and Renewable Energy and Energy Conservation receives applications in copy, operates the national application system and handles complaints (Articles 9, 14, 30 and 35) [4]. The instrument that determines rooftop growth thus sits with the directorate responsible for the utility's supply security rather than with the one responsible for the renewable target.

3. Analysis

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3.1 Capacity against quota and targets

Table 2 assembles the available figures. Three observations follow.

Table 2. Rooftop solar PV in Indonesia: installed capacity, quota and targets

Indicator	Value	Reference date	Source
Rooftop customers (PLN)	about 7,000 (6,897)	June 2023	[26]
Rooftop capacity installed	140 MW	December 2023	[5]
Rooftop capacity added during 2023	68.06 MW	2023	[31]
Rooftop capacity installed	538 MWp, 10,882 customers	July 2025	[27]
Rooftop capacity installed	895 MW	April 2026	[12], [34]
All solar PV installed	717.71 MW	August 2024	[35]
All solar PV installed	1.49 GW (546 MW added in 2025)	End of 2025	[10]
All solar PV installed	about 1.5 GW	April 2026	[12], [11]
Rooftop quota 2024 / 2025 / 2026 / 2027 / 2028	901 / 1,004 / 1,065 / 1,183 / 1,593 MW (total 5,746 MW)	Set 2024	[25]
2024 quota remaining	about 60–90 MW	August 2024	[36]
Quota opened for January 2026	485 MW (304 MW waiting list, 183 MW new customers)	January 2026	[10]
Rooftop target, National Strategic Project	3.6 GW	2025	[5], [7]
Rooftop target, restated	1 GW; 2 GW	End 2025; 2028	[27]
Solar in RUPTL 2025–2034	17.1 GW of 69.5 GW additions	2034	[8]
National solar programme	100 GW	Under way since 2025	[10], [11]

Source: compiled by the authors from the sources indicated. The two components of the January 2026 quota sum to 487 MW in the source.

First, deployment has accelerated since the 2024 regulation, not collapsed. Capacity grew by 398 MW in the 19 months from December 2023 to July 2025, about 21 MW per month, and by 357 MW in the nine months from July 2025 to April 2026, about 40 MW per month [5], [27], [12]. In 2023, the last full year of net metering, rooftop additions were 68.06 MW [31]. The fear that ending net metering would stall the market as a whole has therefore not been borne out. IESR itself attributes the 2025 market to commercial and industrial rooftops and reports that the residential segment lacks incentives [10]. The average system in July 2025 was 49 kWp (538 MWp across 10,882 customers) [27], far above the 2–3 kWp that IESR considers the minimum for a typical household customer [7]; the solar industry association identifies manufacturing as the largest user of rooftop PV [37], and the ministry's secretary general has said that rooftop PV now suits industry better than households [24].

Second, the restated goals are within reach but the original ones are not. The 895 MW of April 2026 is one quarter of the 3.6 GW once targeted for 2025 and still below the 1 GW restated for the end of 2025 [12], [27]. To reach 2 GW by December 2028 requires about 1,105 MW in 32

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months, or 35 MW per month, slightly below the pace of the preceding nine months. To fill the cumulative 2024–2028 quota, by contrast, would require a further 4,991 MW (5,746 MW less the 755 MW added since December 2023), or about 156 MW per month: roughly four times the recent pace.

Third, quota allocated is not capacity built. In August 2024 the ministry reported that only 60–90 MW of the 901 MW quota for 2024 remained [36], yet eleven months later the installed total had risen by only 398 MW since the end of 2023 [27]. The 755 MW added between December 2023 and April 2026 corresponds to at most 40% of the combined 2024 and 2025 quota of 1,905 MW, even before allowing for the 485 MW opened in January 2026 [10]. At the same time developers report that demand exceeds the quota available and that customers are told to wait for the next cycle [38], an industrial estate operator describes companies' demand as a waiting list and names quota as an obstacle [39], and 304 MW of the January 2026 allocation went to applicants already queuing [10]. In April 2026 the ministry, PLN and the industry association jointly launched what was described as 1.3 GW of rooftop solar, without stating how the figure relates to the quota [40]. Scarcity and under-use coexist. The regulation provides mechanisms that would produce exactly this pattern: approvals that reserve quota for up to six months before lapsing (Article 26), allocation by customer service unit so that spare quota in one cluster cannot serve demand in another (Article 9(3) and (4)), and two application windows a year (Article 14(2)) [4]. The published data do not allow the contribution of each to be measured, which is itself a finding: the regulation obliges the utility to publish the clustered quota (Article 9(5)) but not its use.

3.2 The quota as regulatory design

A capacity quota is a legitimate instrument, since distribution networks have finite hosting capacity [41]. The question is whether this quota is built to find and expand hosting capacity or merely to limit connections. Four features point to the latter.

The quota has no floor. Article 7(2) lists what the licence holder must consider, but nothing in Articles 7 to 10 obliges the proposal, or the Director General's decision, to be consistent with a rooftop target, and no rooftop target is fixed in the regulation [4]. The quotas reported for 2024–2028 would, if filled, have exceeded the old 3.6 GW goal; the restated 2 GW goal for 2028 is about one third of them [25], [27]. Nothing prevents a later proposal under Article 10 from shrinking the figures, and the 485 MW opened for January 2026, against 1,065 MW reported in 2024 for that year, suggests that release is in practice staged at the utility's discretion; the ministry was reported to be requesting a further 400 MW [10].

The proposer is an interested party. One of the three mandatory considerations is "the plan and realisation" of the licence holder's own supply plan (Article 7(2)) [4]. In a system where the utility has contracted more generation than it can sell, this criterion argues for a small quota irrespective of the network's physical ability to host rooftop PV. The regulation does not require the technical study that accompanies the proposal (Article 8(2)) to be published, so customers, installers and researchers cannot test whether a given cluster's quota reflects a voltage or thermal limit, a reserve constraint or a commercial preference.

The safeguards are weak and one-sided. A licence holder that prepares no quota receives a written reprimand (Article 44(a)), and capacity is then adjusted to the condition of its network (Article 12(2)) [4], which returns discretion to the utility. Deemed approval (Article 15(2)) protects an applicant against silence, not against a quota that is too small.

The procedure adds delay that has no engineering rationale. An application lodged in February waits until July to be filed and may wait until the end of August for a decision

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(Articles 14(2) and 15(1)) [4]; under the 2021 regulation the same application would have been decided in five working days [3]. For an industrial investor whose capital costs are rising, this matters: one developer reported in September 2026 that capital expenditure for an identical project had risen by about 30% in a year because of higher interest rates and currency depreciation [38].

One further provision reduces the value of rooftop PV for the firms now driving the market. Unless another regulation provides otherwise, the carbon economic value of a rooftop system belongs to the government (Article 40(2)) [4], whereas the 2021 regulation allowed customers to trade carbon (Article 28(1)) [3]. Exporters facing the European Union's Carbon Border Adjustment Mechanism, which the industry association cites among the drivers of industrial demand [37], have reason to want that attribute.

3.3 Grid integration: what the quota does and does not address

PLN's stated justification is technical. Its retail director explained that solar output on a clear day rises from about 07:00, peaks near noon and falls to sunset, but that a sudden change of weather can cut output by up to 95% within five minutes, citing the Cirata floating plant; if other generators cannot compensate, the system could black out, and the quota is meant to match rooftop capacity to a "system strength index" for each system [6]. The ministry's secretary general added that PLN must keep dispatchable capacity ready and therefore needs to know how many megawatts it will have to accommodate each year [24].

The engineering literature confirms that these constraints are real at system level. A unit-commitment study of a simplified Java–Bali system, co-authored by PLN staff, found that the maximum PV share that could be integrated was limited by the technical minimum load and ramping capability of thermal units: 45% on weekdays, 31% at weekends and 17% on the lowest-demand day, rising to 49%, 35% and 23% with battery energy storage systems [20]. IESR's 2025 outlook notes increased ramping needs in the Java–Madura–Bali system attributable to rooftop PV [42]. An earlier simulation of a fully renewable Java–Bali grid identified the daily and seasonal fluctuation of solar as the main challenge [21]. At feeder level, a study of a low-voltage network in Vietnam found that 50% PV penetration at a transformer raised node voltages enough to cause overvoltage near the PV sources, and that reactive power compensation combined with tap adjustment corrected it [43]. Low inertia is a further concern, for which virtual-inertia control in single-phase rooftop inverters has been proposed, together with a rule requiring it [44].

Three points nevertheless separate the engineering problem from the instrument chosen. The first is scale. The limits found in the Java–Bali study are penetration levels of 17% and above [20]; total solar capacity nationwide was about 1.5 GW in April 2026 [12] and variable renewables accounted for about 0.4% of the installed capacity and generation mix in 2023 [42]. The binding constraints today are therefore more likely to be local (voltage and reverse flow on particular feeders) or contractual than system-wide. The second is aggregation. The 95%-in-five-minutes figure describes a single plant under a passing cloud front [6]; whether the aggregate of more than ten thousand dispersed rooftop systems [27] behaves in the same way is an empirical question that the unpublished quota methodology does not answer. The third is granularity. Hosting capacity is a property of individual feeders and transformers, assessed by deterministic, stochastic or time-series methods, and it can be enlarged by on-load tap changers, reactive power control and network reconfiguration, or managed in real time by dynamic operating envelopes that vary each connection's export limit with network conditions [41]. A quota fixed once a year for a customer service unit is too coarse to protect a weak feeder and too blunt to release a strong one.

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More importantly, Regulation No. 2 of 2024 already contains provisions that address the engineering problem directly, which makes the quota's added value harder to see. Every system must have an advanced meter with two-way communication (Articles 1(4) and 4(2)); PLN must build a digital application integrated with its supervisory control and data acquisition system or distribution smart grid (Article 31(1)); industrial customers with systems above 3 MW must supply a weather-forecast database integrated with that system (Article 42); industrial customers must report operating plans (Article 37); batteries are permitted (Article 4(3)); and the technical annex specifies inverter protection [4]. With zero export credit, moreover, rational customers size systems to their daytime load, so the quantity of reverse power flow that a quota might be thought to limit is already suppressed by price. What the regulation does not do is require the grid-support functions that would raise hosting capacity. A review by researchers from Aalborg University and PLN, as reported in the trade press, concluded that the absence of updated grid-code standards is a major bottleneck and recommended low- and high-voltage ride-through, reactive power and power factor control, islanding protection, limits on direct-current injection below 0.5% of nominal current and an information and communication framework for real-time monitoring and control [45]. The National Energy Policy asks for precisely this: technology that reliably accepts higher renewable shares (Article 43) [9]. IESR's work on flexibility, which counts distributed resources among its five pillars, estimates that a flexible low-cost scenario could cut generation costs in Sulawesi by up to 27% by 2060 [46].

Rooftop PV can also relieve the network. A simulation of the Java–Madura–Bali grid to 2060 treats it as negative load that offsets electric-vehicle charging peaks [47]. In Bali, IESR's modelling indicates a need for 2 GW of solar by 2034 against 771 MW allocated in the RUPTL, and identifies rooftops as the practical route because utility-scale projects are slowed by land cost and availability [48]. City-scale assessments point the same way: IESR reports rooftop potential of 476.49 MWp in Batam and 379.23 MWp in Surabaya [11], and a geospatial study of Bandung ranked up to 36,372 buildings as high priority [49]. An earlier assessment cited a national potential of about 207 GWp against some 146 MWp then in use [50].

3.4 Economics for households and industry

The effect of the credit rule on a customer's return can be stated compactly. Let E be annual PV output (kWh), τ the retail tariff, σ the fraction of output consumed on site and k the credit factor applied to exported energy. Annual bill savings are

$$S = E\,\tau\,[\sigma + (1 - \sigma)\,k] = E\,\tau\,\varphi, \quad (1)$$

where $\varphi = \sigma + (1 - \sigma)k$ is the fraction of output that earns the retail tariff. For an investment I, the simple payback period is

$$T = I / S, \text{ so that } T(k) = T(1) / \varphi. \quad (2)$$

The three regulations correspond to $k = 0.65$, $k = 1$ and $k = 0$ [1], [3], [4]. Table 3 evaluates φ and the payback multiplier $1/\varphi$ for a range of self-consumption fractions. The values of σ are illustrative, not measured.

Table 3. Fraction of rooftop PV output valued at the retail tariff (φ) and payback multiplier relative to full credit ($1/\varphi$), by credit factor and self-consumption fraction

Self-consumption fraction σ	φ, k = 0.65 (2018)	φ, k = 1 (2021)	φ, k = 0 (2024)	$1/\varphi$, k = 0.65	$1/\varphi$, k = 0
0.25	0.74	1.00	0.25	1.36	4.00

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Self-consumption fraction σ	φ, k = 0.65 (2018)	φ, k = 1 (2021)	φ, k = 0 (2024)	$1/\varphi$, k = 0.65	$1/\varphi$, k = 0
0.50	0.83	1.00	0.50	1.21	2.00
0.75	0.91	1.00	0.75	1.10	1.33
1.00	1.00	1.00	1.00	1.00	1.00

Source: authors' calculation from equations (1) and (2), using the credit factors in Article 6(1) of Regulation No. 49 of 2018 [1], Article 6(1) of Regulation No. 26 of 2021 [3] and Article 13 of Regulation No. 2 of 2024 [4].

For a customer who consumes everything on site, the credit factor is irrelevant. For a customer who consumes half, payback doubles when the credit goes from one to zero. This is the whole of the distributional effect of Article 13, and it falls on households, whose consumption, as the ministry's secretary general acknowledged, is concentrated at night [24]. A simulation for a Surabaya household using about 13 kWh per day found an optimal system of about 3 kWp covering some 90% of annual demand [51]; a system of that relative size necessarily exports a large part of its midday output unless a battery is added.

The published economics show how little margin households had to lose. With net metering in place, a techno-economic analysis of 2 kWp systems in Jakarta, Denpasar and Kupang found a levelised cost of energy above the electricity price, net present values of −975 to −424 USD, payback periods of 10.3 to 12.5 years and profitability indices of 0.72 to 0.88, and concluded that the scheme was insufficient to make rooftop PV viable without an installation incentive of 20% combined with a 40% higher credit rate [13]. (The abstract does not state which credit factor was modelled.) A cost model assuming a 20-year life, maintenance at 2% of capital cost a year and 20% capacity utilisation concluded that rooftop PV could be competitive for residential customers [14], and a Surabaya simulation put the unit cost at USD 0.08–0.11 per kWh [52]. Table 4 summarises these and other studies. The pattern is consistent: small systems on buildings with weak daytime load (houses, mosques, schools, a hotel, public offices) show paybacks of roughly 10 to 18 years or negative net present value under the rules in force when they were studied, while the one large system on a continuously operating industrial site shows a payback of less than four years. With a 20-year life [14], equation (2) implies that any system whose full-credit payback exceeds ten years cannot recover its cost at σ = 0.5 under the 2024 rule.

Table 4. Published techno-economic results for rooftop PV in Indonesia

Study	Site and size	Main economic result
Pramadya and Kim (2024) [13]	Households, 2 kWp; Jakarta, Denpasar, Kupang	NPV −975 to −424 USD; payback 10.3–12.5 years under net metering
Santoso et al. (2026) [53]	1.82 kWp system, measured against simulation	Output 30.3–40.5% below simulation; payback 9.8 years; LCOE IDR 974.88/kWh
Nurliyanti et al. (2021) [54]	Low-income households (grant scheme)	Cost USD 827.6–1,310.3 per house against 20-year subsidy savings of USD 724.1–744.8
Suparwoko and Qamar (2022) [55]	Mosque, five scenarios	Negative NPV in all configurations under prevailing tariffs and rules

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Study	Site and size	Main economic result
Abdurrohman and Batih (2023) [56]	School	NPV positive only with a funding incentive
Effendy et al. (2024) [57]	Hotel, 37.4 kWp	Negative NPV; payback 13.65 years
Fahmi and Rarasati (2026) [15]	Three public buildings, 18–60 months of operating data	Output 6.05–13.73% below design; payback 12.46–13.61 years; LCOE IDR 1,775–1,889/kWh
Wibowo et al. (2024) [58]	Factory lighting load, 44 kWp	Benefit–cost ratio 1.11; payback in year 18
Utami et al. (2026) [59]	Data centre, PV–battery–diesel hybrid	LCOE USD 0.079/kWh; payback 8.7 years
Galevien et al. (2025) [16]	Consumer-goods factory, 599 kWp	Payback 3.73 years

Source: compiled by the authors from the abstracts of the studies cited. NPV = net present value; LCOE = levelised cost of energy. Results are not harmonised for year, discount rate or tariff rule.

Two further findings deserve emphasis. Measured output is repeatedly below design output: by 6–14% in public buildings over up to five years [15], by 30–41% for a monitored 1.82 kWp system [53], and by more than 70% in one of four 20 kWp plants after a single array fault [60]. Real paybacks are therefore longer than simulated ones, which compounds the effect of zero export credit for small owners without maintenance support. And grants are not a substitute for a functioning tariff rule: giving rooftop systems to low-income households to reduce subsidy spending was found to cost more than it saves [54].

For industry the 2024 regulation is, on balance, an improvement. With daytime load, σ is close to one and Article 13 costs little. The capacity charge under the 2021 regulation was five hours of tariff per kilowatt of inverter per month (Article 20(3)) [3], that is, 60 kWh-equivalents per kilowatt per year; at the 20% capacity utilisation assumed by Tarigan [14], a kilowatt generates 1,752 kWh a year, so the charge was worth about 3.4% of output and its removal raises returns by that amount. The removal of the 100%-of-connected-capacity cap also allows large roofs to be used fully. The solar industry association reports paybacks of four to six years for many industrial projects [37], consistent with the 3.73 years computed for a 599 kWp factory system [16]. For this segment the binding constraint is not economics but access to quota, procedure and the cost of capital [38], [39].

The household segment that Article 13 forecloses is large. A policy institute counts about 2.88 million non-subsidised household customers in the two upper tariff classes and estimates that 1–2 kWp on each would add about 2.9–5.8 GWp without public funds [30]. Surveys of Indonesian adopters and non-adopters identified net-metering policy and economics among the main barriers even before 2024 [17], and businesses reported investment stagnation while rules were under revision [18]. A Vietnamese assessment found that self-consumption becomes viable at a grid tariff of 8.7 euro cents per kWh [61]; the studies in Table 4 indicate that for small Indonesian systems the equivalent threshold has not been securely reached.

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3.5 Can the quota deliver?

The evidence supports a differentiated answer. For the restated rooftop goal of 2 GW by 2028 the answer is yes: the required pace of about 35 MW per month is being achieved, the customers concerned do not depend on export credit, and the 2024 regulation removed two obstacles that mattered to them. This success owes little to the quota. It owes more to the removal of the capacity charge and the size cap, to falling equipment costs, and to pressure from export markets [37].

For everything larger the answer is no. The published quota of 5,746 MW will not be filled at the current pace, and its own design (staged release, clustering, lapse periods, half-yearly windows) slows the customers who are willing to invest. The household segment, which could contribute several gigawatts [30], has been priced out. And rooftop PV is not integrated into the plans that now define the country's solar ambition: the RUPTL's 17.1 GW concerns ground-mounted and floating plants [27], [8], while the 100 GW programme is organised around 80 GW of 1 MW village mini-grids with storage and 20 GW of centralised plants [10], [45]. Reaching 100 GW from about 1.5 GW implies almost a seventy-fold increase, or about 33 GW a year, and IESR has argued that rooftops, especially with quota and incentives for customers who add batteries, are among the fastest routes available [11]. The ministry itself acknowledged in April 2026 that it is discussing deregulation under which rooftop, floating and ground-mounted solar would no longer be treated differently [12]. A regulation whose central device is a ceiling fits poorly with a national programme whose central problem is speed.

4. Implications

4.1 For regulatory design

The quota need not be abolished to be made useful. Five changes, each within the ministry's regulatory competence, would turn it into a grid-integration instrument.

First, give the quota a floor. Article 7(2) should require each proposal to be at least consistent with a rooftop trajectory fixed by the minister and derived from the National Energy Policy's solar shares [9] and the RUPTL, so that the Director General of Electricity decides between technical alternatives rather than on the level of ambition. The criterion referring to the realisation of the licence holder's own supply plan should be removed or confined to demonstrated operational limits.

Second, base the quota on hosting capacity and publish it. The technical study under Article 8(2) should report hosting capacity by feeder or transformer using a stated method, and the licence holder should publish, alongside the clustered quota required by Article 9(5), the quota used, reserved and lapsed in each cluster. Where a cluster is full, the study should state the reinforcement or control measure that would enlarge it [41].

Third, replace the two windows with continuous application. The 30-day decision period and deemed approval of Article 15 can be kept; the restriction to January and July in Article 14(2) serves no technical purpose once quota use is tracked in the electronic system that Article 30 already requires [4].

Fourth, substitute requirements for rationing. Inverter grid-support functions of the kind identified in the grid-code review [45], and virtual-inertia capability where systems are weak [44], should be mandatory for new systems above a size threshold; systems that meet them, or that accept a dynamic export limit, should not count against the quota at all. The advanced

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meter and supervisory-control integration that the regulation already mandates (Articles 4(2) and 31) make this enforceable.

Fifth, restore a limited value for exports where it helps the system. A credit below the retail tariff, set with reference to the utility's avoided cost and, where metering allows, differentiated by time of day, would move k in equation (1) away from zero without restoring credit at the full retail rate. Alternatively, credit could be offered only to customers who install storage and export in the evening, as IESR has proposed in the form of quota and incentives for battery-coupled systems [11]; this aligns the household's incentive with the ramping problem identified in the system studies [20], [42].

4.2 For engineering practice and planning

Utilities and consultants should treat rooftop PV as a planning input rather than a disturbance. Feeder-level hosting-capacity studies, tap-changer and reactive-power strategies of the kind that resolved overvoltage in the Vietnamese case [43], and forecasting from meter data are routine engineering tasks for which the regulation already creates the data flows. Designers should also revise yield assumptions downward and budget for maintenance, since operating data show a persistent shortfall against simulation [15], [53], [60]. Provincial governments, which have access to the national application for monitoring (Article 30(3)) [4], can align building policy with local quota; a rooftop mandate for government buildings has been modelled under several growth scenarios [62]. For the 100 GW programme, the revision of the RUPTL now under way [8] is the occasion to count rooftop capacity explicitly, with its own trajectory, instead of leaving it outside the plan. System modelling indicates that decarbonising PLN's system depends on rapid renewable deployment and de-risked finance rather than on the present low carbon tax or on gas [63], and solar projects respond more strongly than wind to fiscal incentives [64]; rooftop investment by firms and households is the renewable finance that costs the state least.

4.3 Limitations

This analysis has clear limits. The Director General's quota decisions and PLN's technical studies could not be consulted; quota figures come from a trade-press report of the ministry's announcement and capacity figures from news-agency reports of official statements, not from primary statistical releases. The relationship between the 5,746 MW quota reported in 2024 and the 2 GW goal stated in 2025 remains unresolved. Capacity is reported sometimes in MW and sometimes in MWp and at irregular dates, so the pace calculations are approximate, and no official figure was found for rooftop capacity at the end of 2025, for quota use by cluster, or for customer numbers after July 2025. IESR's 2025 and 2026 outlooks were only partly accessible. The economic studies in Table 4 were read at abstract level, use different years, tariffs and discount rates, and in one case do not state the credit factor assumed; equation (2) is a simple-payback identity that ignores discounting, degradation and tariff changes, and the self-consumption fractions in Table 3 are illustrative. The scanned text of Government Regulation No. 40 of 2025 was read through optical character recognition, so its percentages should be checked against the gazetted copy. Finally, the engineering evidence for Indonesian distribution feeders is thin; the low-voltage case cited is from Vietnam, and no published hosting-capacity study of a PLN feeder with high rooftop penetration was found.

Figure 1. Figure Title (below the figure, centred)

5. CONCLUSION

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A concise answer to the research objectives, implications, limitations, and suggestions for further research, written in paragraphs, not bullet points.

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