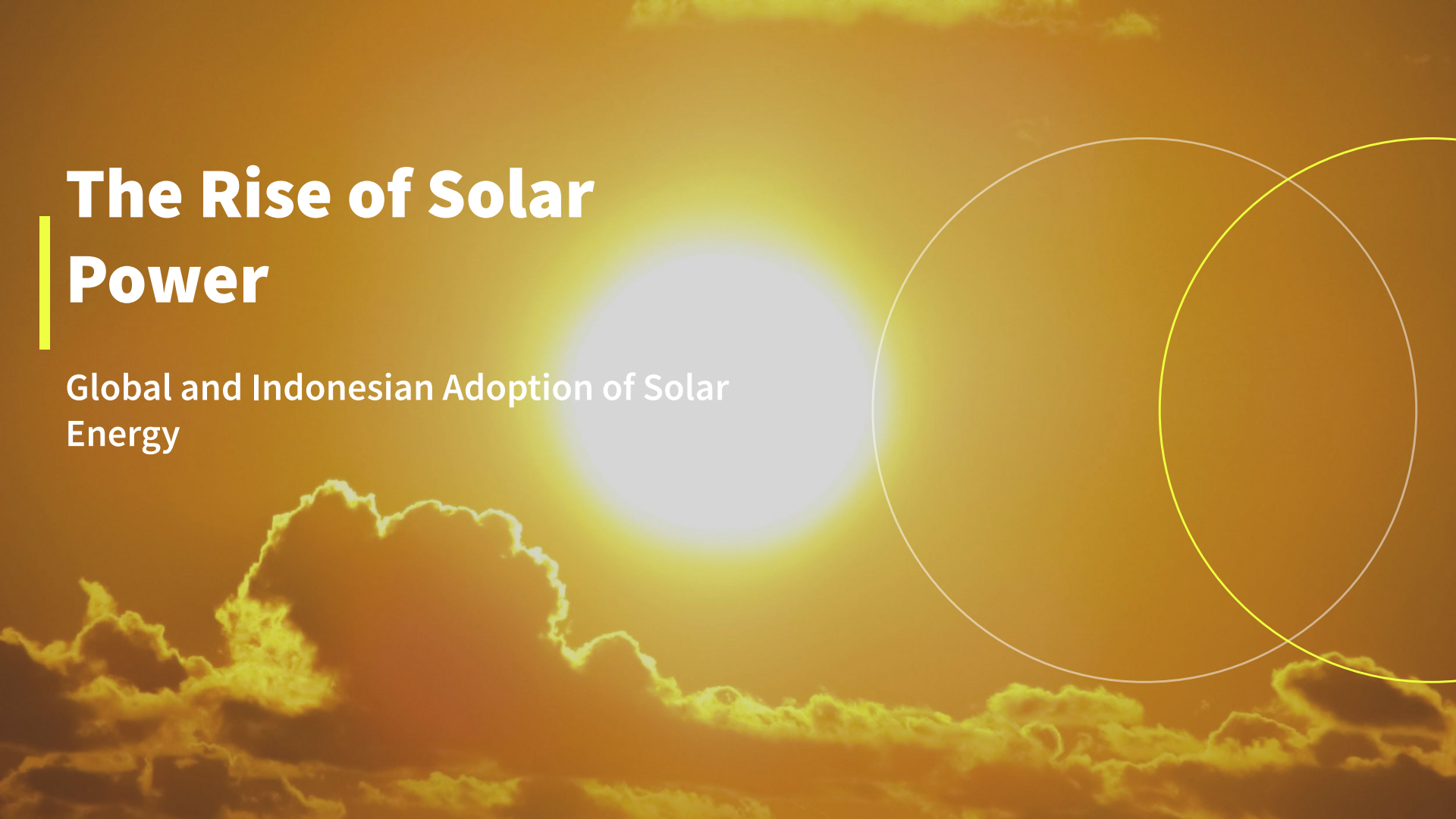
Indonesia Solar Energy Outlook 2025

The rising importance of solar energy in leading Indonesia's energy transition

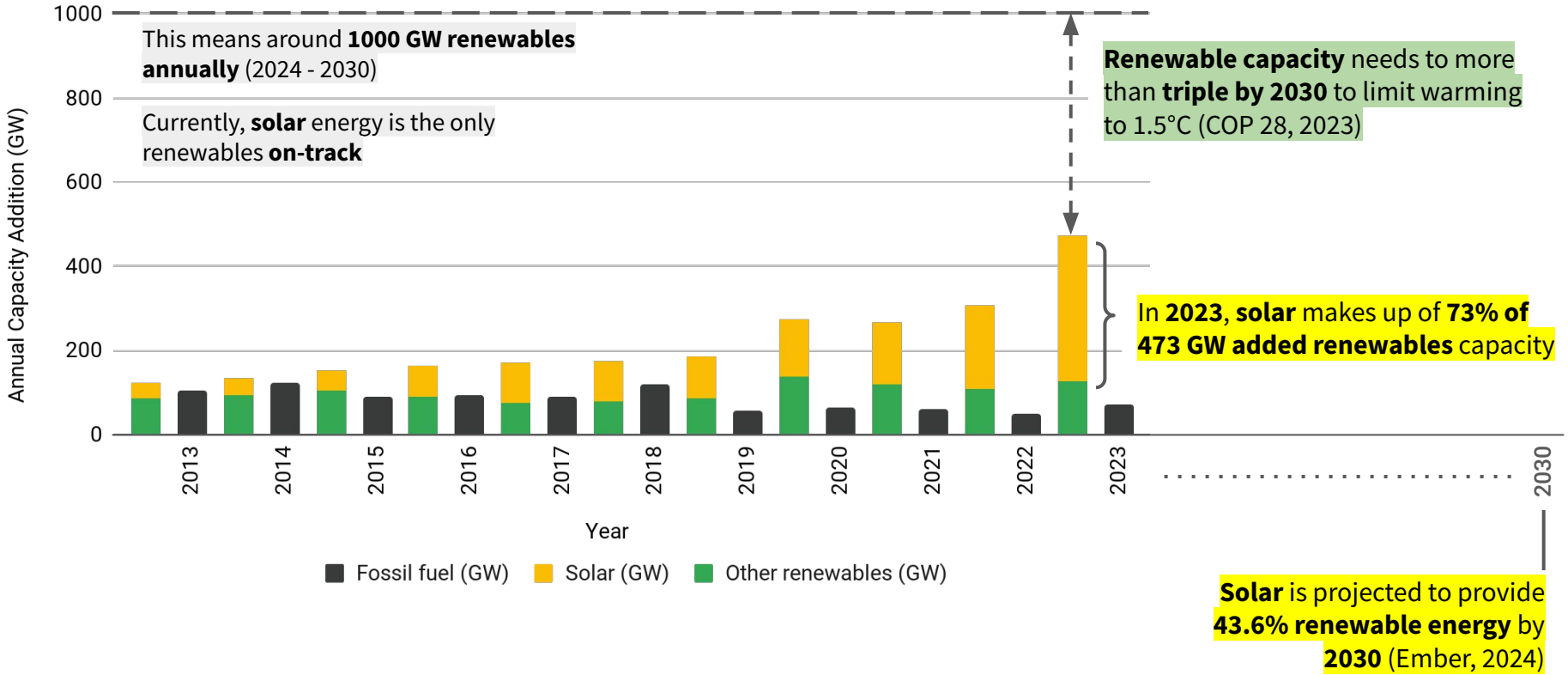
IESR
Institute for Essential Services Reform

The Rise of Solar Power

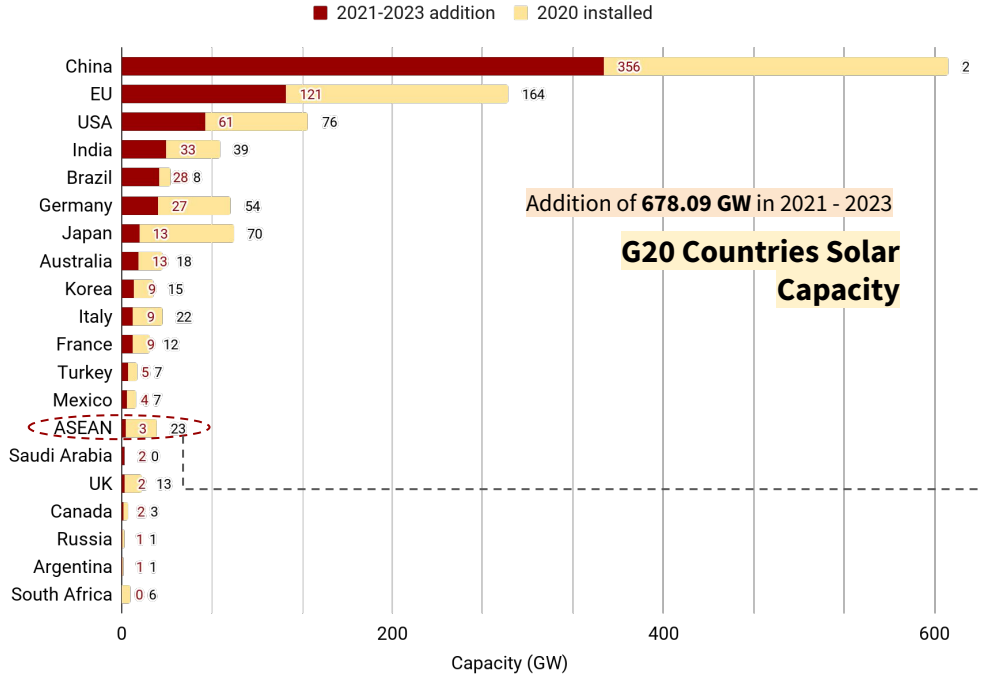
Global and Indonesian Adoption of Solar Energy

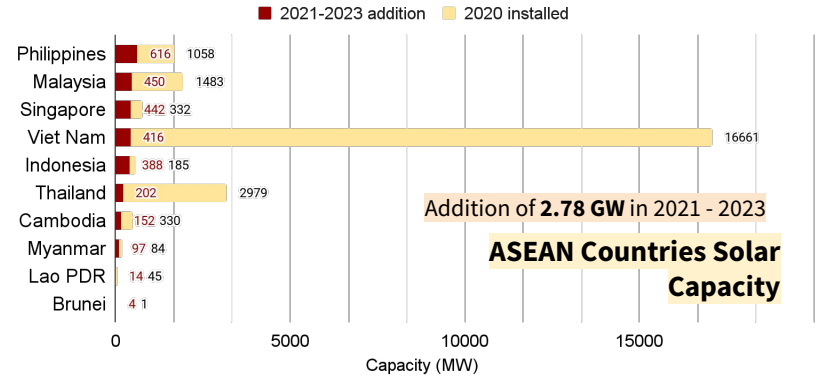


Global Solar Energy Adoption



Global Solar Energy Adoption

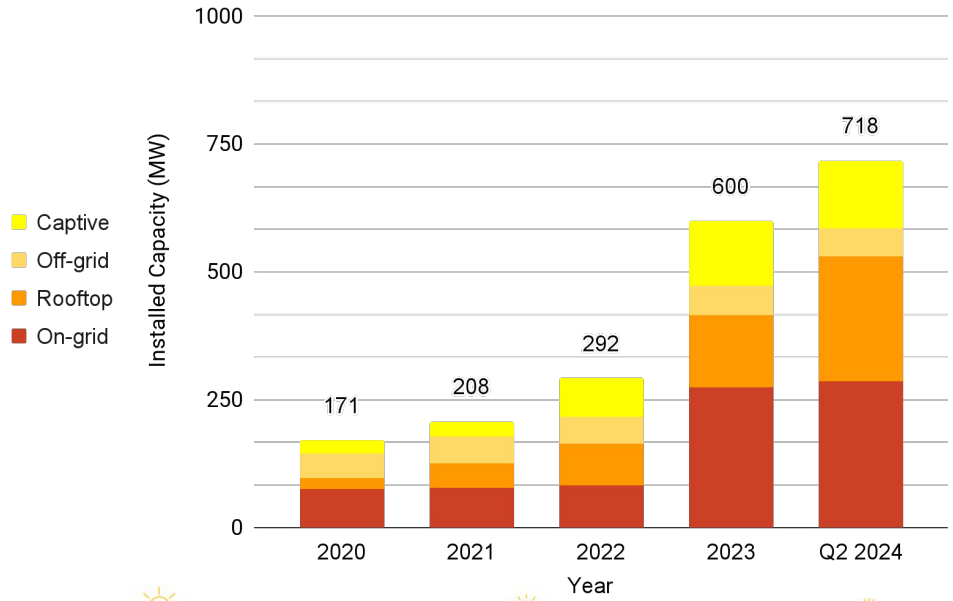


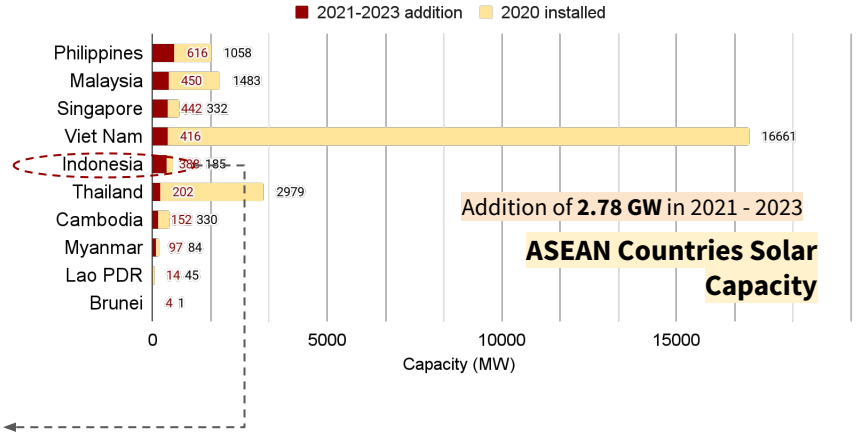


G20 Countries Highlight	
China	356 GW, more than **half** of **global installations**
India	33 GW, rise in **auctions** to meet 50 GW target consistently reaching USD 3/kWh
Brazil	28 GW, growth driven by **distributed installations** due to increasing electricity tariffs, net-metering, and credit schemes

ASEAN Countries Highlight	
Philippines	616 MWp, **net-metering** schemes and **fiscal incentives**
Malaysia	450 MWp, **large-scale solar tenders** (LSS)
Singapore	442 MWp, **The Singapore Green Plan 2030** which prioritizes solar
Indonesia	388 MWp, **all-high** 260 MW new solar capacity in 2023

Adoption





Currently, utility-scale stands at 48% of total solar capacity installed, with Cirata 145 MWac being the highest addition in 2023

Utility-Scale	Distributed	Off-grid	Captive
285 MWp	245 MWp	56 MWp* (50 MWp**)	131 MWp*

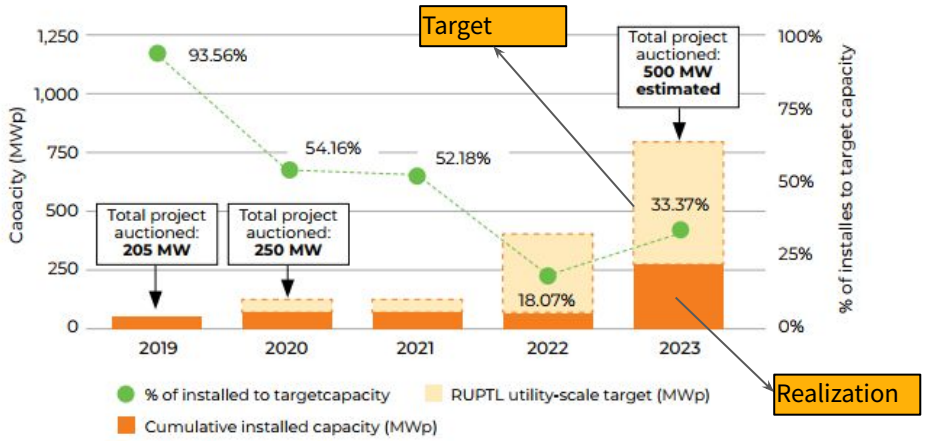
Currently there are at least **718 MWp** of Solar Energy Capacity in Indonesia

*) Data from March 2024
**) Pra-electrification solar programs such as LTSHE, PJU-TS, SPEL-APDAL

Utility-scale Solar Adoption

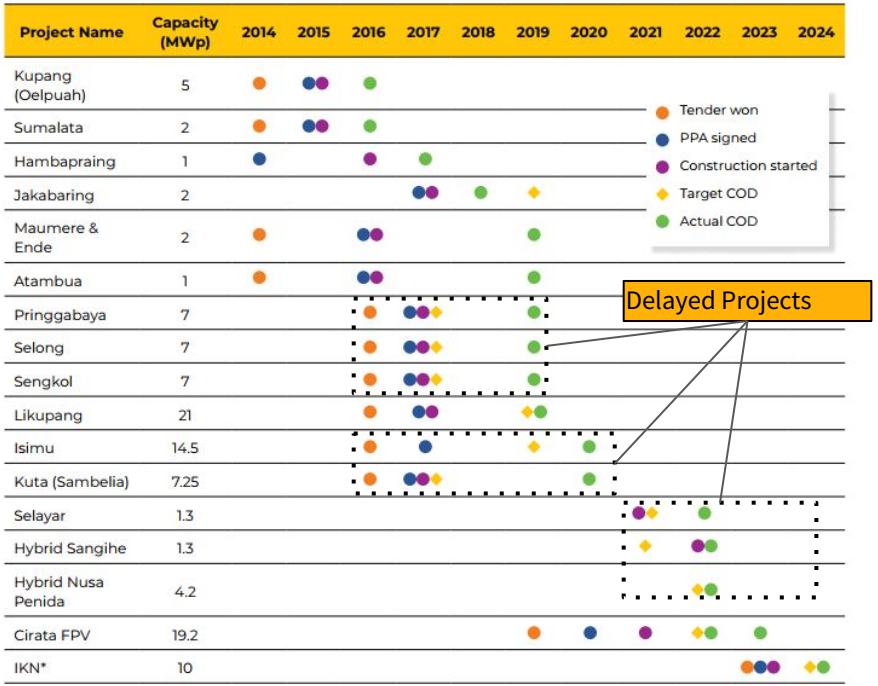
- Only **1/3** of utility-scale solar projects **have been realized** in PLN's RUPTL by 2023
- Around **2/3** of the utility-scale solar projects in PLN's RUPTL are **delayed** by **1 - 3 years** by Q2 2024

Indonesia's utility-scale solar installed and target capacity, 2019-2023



Source: IESR analysis based on compiled sources of PLN, MEMR, and company press releases (2024).

Utility-scale solar power plant development timeline, Q1 2014 - Q2 2024



Source: IESR analysis based on compiled sources of PLN, MEMR, and company press releases (2024).

*The target COD for IKN solar power plant is not listed in RUPTL, but rather the target stated by PLN Nusantara Power in accordance with the development of the new capital. Completion in February 2024 is for phase I only. COD for phase II is planned for May 2024, with a capacity of 40 MWp. As of June 2024, phase II is still in construction (EMedia DPR RI, 2024).

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Successful utility-scale projects

A. Hijaunesia Projects: Successful equity auctions since 2019

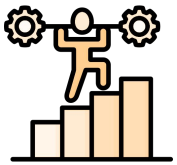
B. Showcase Projects:

a. 2018 Asian Games: Jakabaring project

b. 2022 G20 Summit: Nusa Penida hybrid PV system

c. IKN Development: 50 MW solar power plant

Barriers and Lesson Learned in Development:



A. Realization:

a. **Oversupply** concerns

b. **Grid immaturity:** e.g., 2017 sumatra solar auction

c. **Regulatory changes**: e.g., 2016 feed-in tariff auction

B. **Delay:**

a. **Unrealistic targets** in early RUPTL versions –→ e.g. Lesson learned PPA negotiations (1-2 years) and construction lead times (1-3 years)

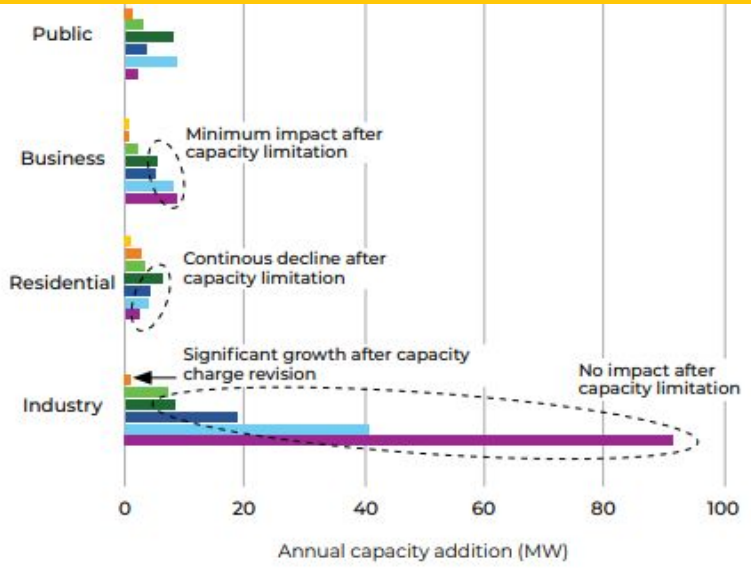
b. Land acquisition issues: e.g., Sambelia project

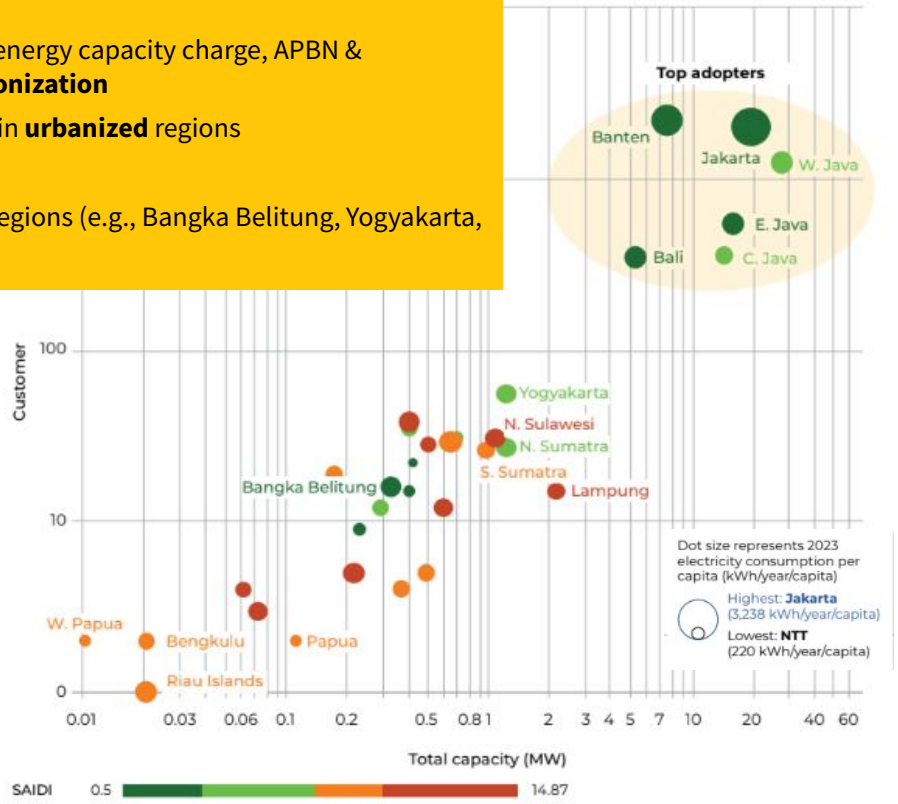
c. Capacity adjustments requiring better demand forecasting and grid planning**:** e.g., Likupang project

Adoption

Key Insights - ANNUAL CAPACITY GROWTH OF 138%

- Major drivers and constraints of development is **regulatory-based** (removal of energy capacity charge, APBN & non-APBN prorams, capacity limitation, current policy) and **market for decarbonization**
- Large-scale installations in **industrialized** regions and small-scale installations in **urbanized** regions
- **Grid reliability** (low SAIDI) has **easier permit approvals** and **higher adoption**
- There is still **untapped potential** in **high** electricity **consumption** & **low SAIDI** regions (e.g., Bangka Belitung, Yogyakarta, North Sumatera).

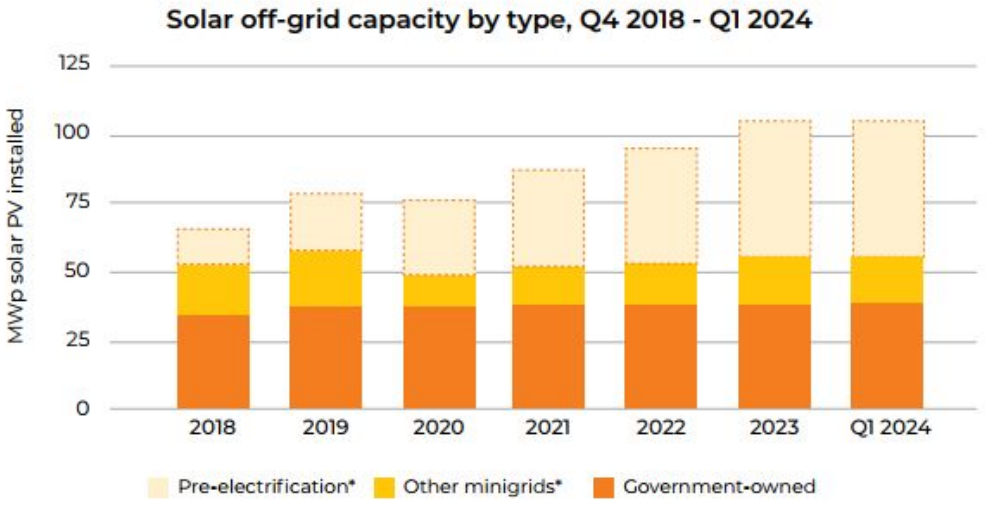




Off-grid and Captive Solar Energy Adoption

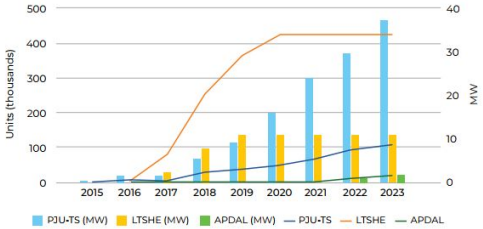
Current Trends:

- Globally, **solar** is increasingly used in **electrification** in **isolated areas**
- To electrify all its households, Indonesia has a substantial amount of **pre-electrification** programs (3.4% of electrification)
- But this classifies as MTF Framework Tier-1 due to limited power capacity and reliability -> must transition to **mini-grids**
- But for the past few years, **65 - 75%** of annual off-grid capacity comes from **mini-grids** (IRENA, 2023).
- Challenges in transitioning to **mini-grids:**
  - High connection costs of 20 times higher in 3T regions

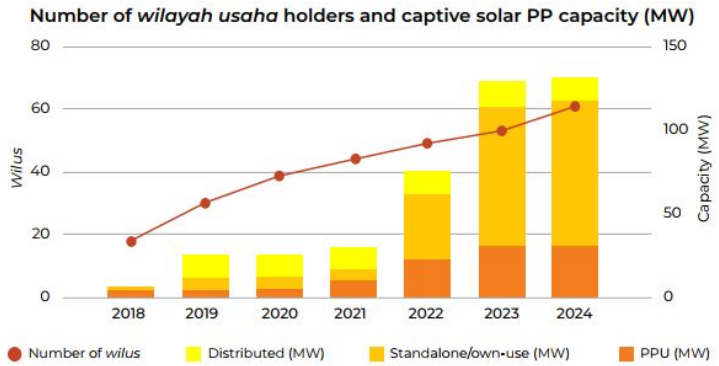


Source: Data shared by MEMR (March 2024).

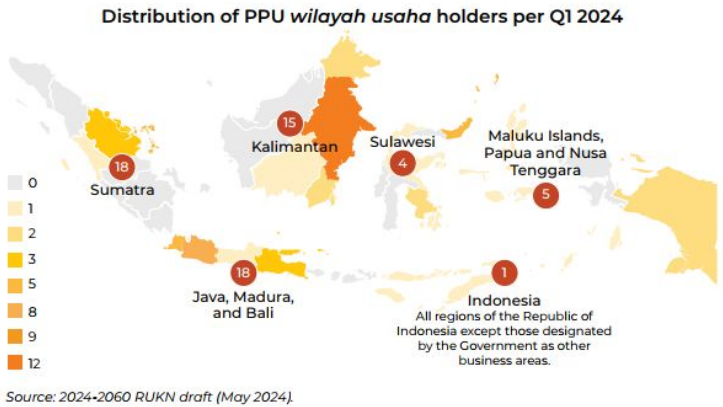
*) IESR estimation based on the shared data



Off-grid and Captive Solar Energy Adoption



Source: IESR analysis based on data shared by MEMR (March 2024).



Source: 2024-2060 RUKN draft (May 2024).

***Wilayah usaha (wilus)* has tripled since 2017.**

There has been a **growing increase** of Private Power Utilities (PPUs) installing and permitting installation of **solar** in their *wilus* due to the **increasing ESG and green initiatives.**

Example: **Jababeka** Industrial Park:

- **21.2 MWp** of solar capacity in 2023
- **70% increase** from 2022

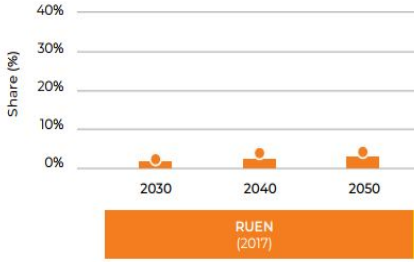
These are opportunities to:

- Making **green industrial parks**, for example, in *wilus* which are attractive for industries with NZE targets.
- **PPUs and wilus holders** can offer streamlined permits and ready grid infrastructure.

But there are challenges:

- Lack of **transparency** in system planning, data, and permitting in wilayah usaha domains.
- **Government mandate** needed to improve transparency for developers and the public - a positive development is **Simantap Application**

Plans



- **RUEN (2017)**
  - Solar energy projected to contribute only 3% of primary energy by 2050
  - Minimal role in achieving 31% renewable energy target by 2050
  - Helped leading to MEMR 49/2018 and MEMR 26/2021
- **RUKN (2019 - 2038)**
  - Solar capacity: 3 GW by 2030

RUEN (2017)
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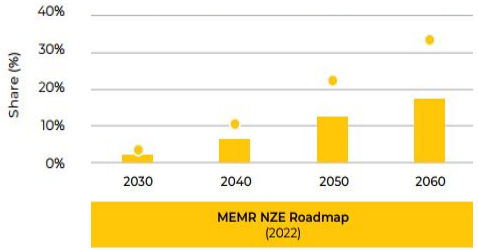
Initial Perception



- **MEMR x IEA NZE 2060 Roadmap (2022)**
- In COP-26 (in 2021) Indonesia declared net-zero by 2060 or sooner
  - Solar installation targets: 32 GW by 2030, 421 GW by 2060
  - Other scenario: 500 GW by 2050
- Increase in solar potential in 2021 from 207 GW stated to 3,294 GW (EBTKE, 2021)

AFTER COP-26 in 2021 (2022)
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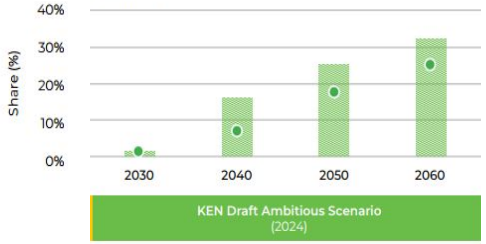
Change in Perception



- **KEN Draft (July 2024):**
  - Solar supply 1.6% of primary energy by 2030
  - Ambitious scenario: 32% solar contribution by 2060
  - Solar installation targets: 7 GW by 2030, 309 GW by 2060
- **RUKN Draft (May 2024):**
  - Solar installation targets: 14 GW by 2030, 134 GW by 2060

NEWER DRAFTS (2024)
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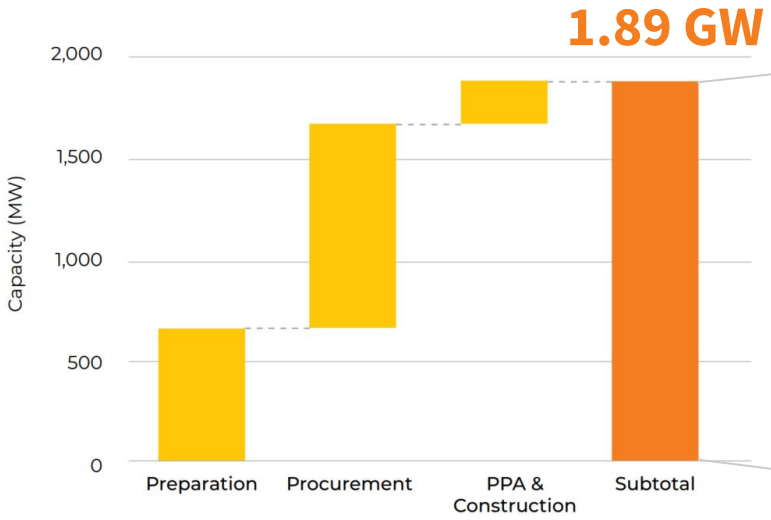
More Ambitious

Embracing the Solar Revolution

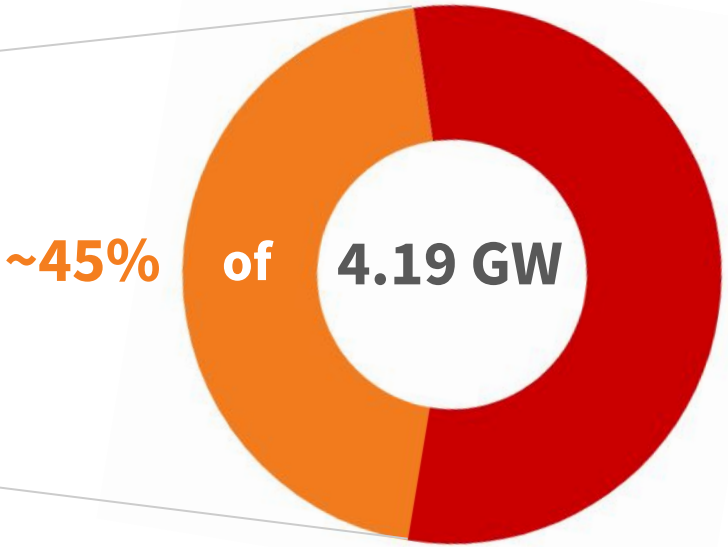
Updates on Project Pipeline and Future Trends

Utility-scale Solar Pipeline

Utility-scale solar project in the pipeline, COD 2024-2027



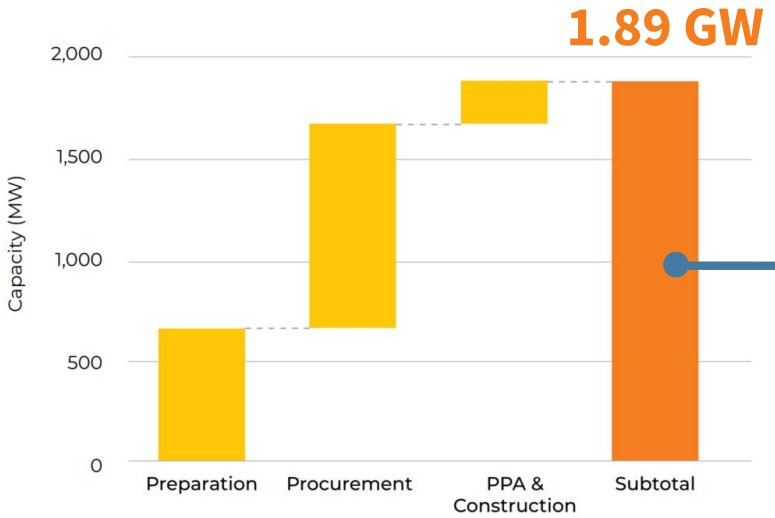
Solar target for 2027 in latest RUPTL



Source: Interview with PLN's DIV MEB, Nusantara Power (2023b).

Utility-scale Solar Pipeline

Utility-scale solar project in the pipeline, COD 2024-2027



Large-scale projects procurement

PLN Indonesia Power

Hijaunesia Project
500 MW
Floating PV

PLN Nusantara Power

Project X Nusantara
740 MW
Ground-mounted PV

Source: Interview with PLN's DIV MEB, Nusantara Power (2023b).

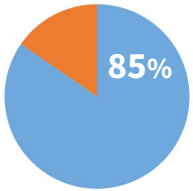
Highlight: Floating Solar PV

Floating PV can spearhead utility-scale solar capacity addition in Indonesia

1 Cirata's Success Story

- FPV pilot project
- 145 MWac/192 MWp
- Largest FPV in SEA
- Largest utility-scale solar power plant in Indonesia

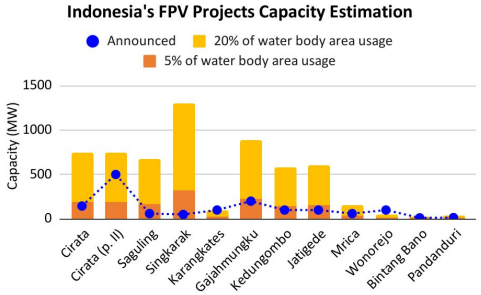
2 Avoiding Land-use Issues



of FPV projects in PLN pipeline co-located with hydropower

- Mostly on PUPR dams
- Existing hydroelectric infrastructure
- Hybrid operation with hydro brings benefits

3 Expansion potential



- Expansion supported by MPWH Regulation no. 7/2023
- 340% capacity increase from announced
- Further opportunities on natural water bodies

Rooftop Solar New Regulation

MEMR Regulation no. 2/2024

Capacity Limit:
15% of installed electricity capacity

New Quota System:

- Allocation per system and sub-system
- Application every Jan & Jul
- 1.59 GW available for 2024-2028

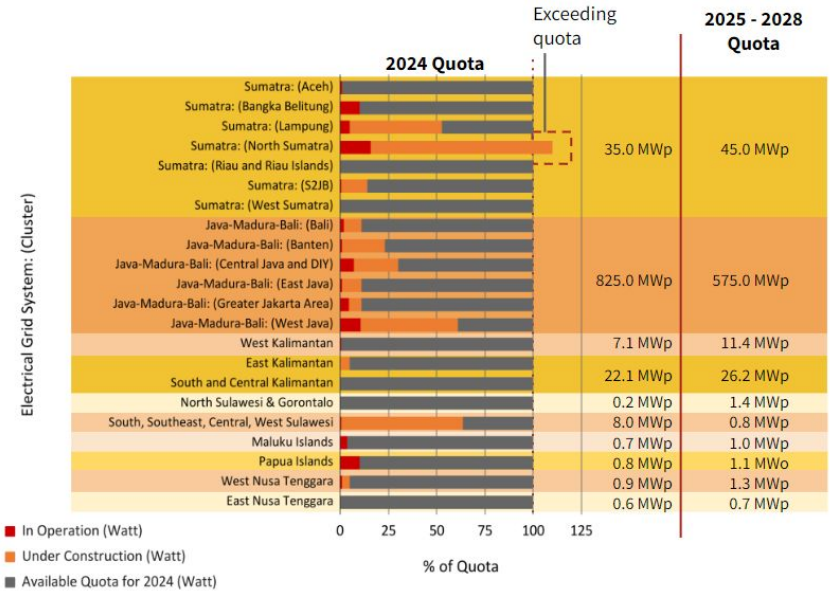
Net metering:
1:1 Export-import

No Net Metering:
Electricity export from rooftop solar is not deducted from customer's bills

Rooftop Solar New Regulation

Impact of new regulation

New Quota System



- C&I customers eager to apply for quota allocation to maximise capacity
- Greater transparency needed in the quota reallocation process

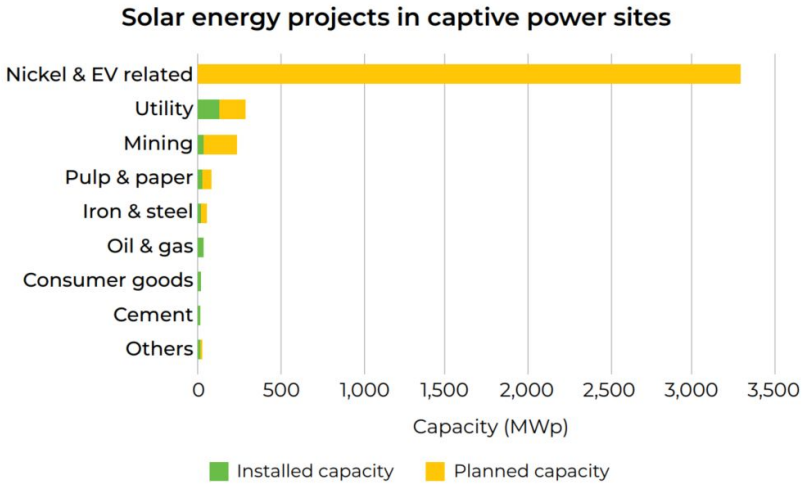
No Net Metering

Study case		3.5 kWp residential	6.6 kWp commercial	200 kWp industrial
1:1 export - import scheme	IRR (%)	12.49%	9.81%	7.73%
	Total savings (USD)	15,303.60	24,660.66	532,644.72
Zero-export scheme	IRR (%)	4.94%	9.08%	7.73%
	Total savings (USD)	9,220.51	23,524.27	532,564.20
Savings difference (%)		-40%	-5%	-0.015%

Source: IESR analysis. Electricity price from October- December 2023 electricity tariff adjustment by PLN. Indonesian sectoral load curves from McNeil (2019).

- Residential customers would need alternative incentives
- Might trigger behavioural shift to rely on BESS

Captive Solar PV Power Plant



Source: IESR analysis from company releases (2024).

Drivers of Growth

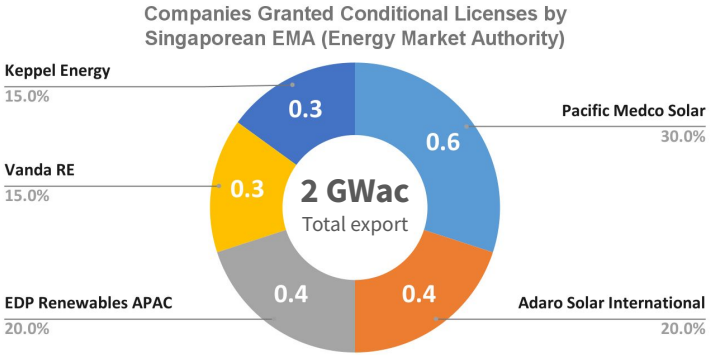
Nickel, EV, Mining

- Capitalize on growing EV and battery market
- International market increasingly requiring sustainability across supply chain (e.g. EU battery passport)
- Sustainable practices can become competitive advantage

Utility Companies

- Rising trend of “Green Industrial Parks”
- MoI is formulating the regulation for Green Industrial Park criteria
- *Wilus* owners required to achieve electricity mix target in RUKN

Indonesia - Singapore Green Electricity Export



+ Conditional Approval granted to 2 companies for **1.4 GWac export**

3.4 GWac Total Export

Opportunity for Indonesia

Domestic Solar Supply Chain Benefit through LCR

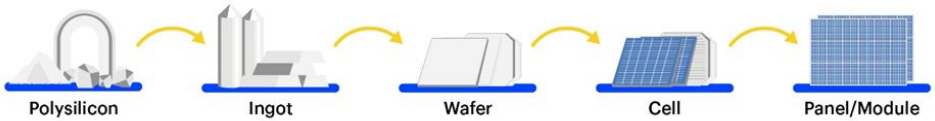
- MEMR Reg. no. 11/2024 art. 18 on determining minimum LCR for cross-border RE projects
- Planned to be 60% LCR
- Several CL grantees are in the process of partnering with global manufacturers to open production sites in Indonesia

Government-led Project

- Need legal basis to affirm PLN's role
- Gov. Reg. 42/2012 has requirements for cross-border energy trade but no specified roles
- MEMR Reg. no. 11/2021 regulates electricity export only for 5-year period, no guarantee for extension

Domestic Solar Supply Chain

Solar PV Supply Chain



Indonesia solar module supply chain progress, June 2024

	Polysilicon production	Wafer production	Cell manufacturing	Module assembly
Existing	No available production capacity	No available production capacity	No available production capacity	**2.3 GW** annual production capacity
Construction		**5 GW** Annual production capacity	**3.5 GW** Annual production capacity	**3.5 GW** Annual production capacity
Planned/ agreement signed	**200,000 million tonnes** Annual production capacity	**6 GW** Annual production capacity	**13.5 GW** Annual production capacity	**15.5 GW** Annual production capacity

Source: IESR analysis (2024).

Challenges

1	Unpredictable demand	Low utilisation rate	No incentive to increase prod. capacity
2	Component import tax & low prod. volume	Local modules 30-40% more expensive	Competition with cheaper imports
3	Low bankability	Tier 1 status unobtainable	Competition with Tier 1 imports

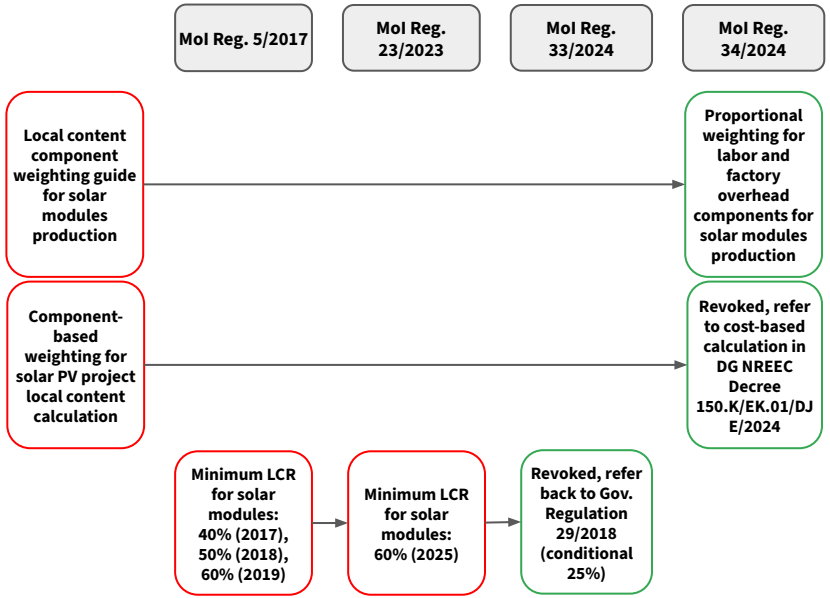
Drivers

1	LCR req. in ID-SG Green Corridor Project	Global brands opening factories	Production capacity addition
2	Trade tensions b/w China and USA	Access to export markets through ID	Production capacity addition

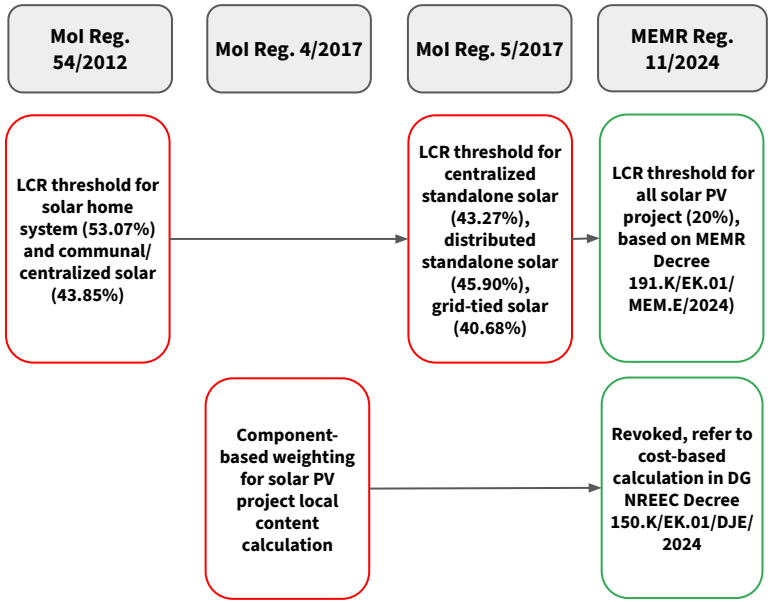
Domestic Solar Supply Chain

Local Content Requirement (LCR) Policy Dynamics

Regulation updates on minimum LCR for **solar module**



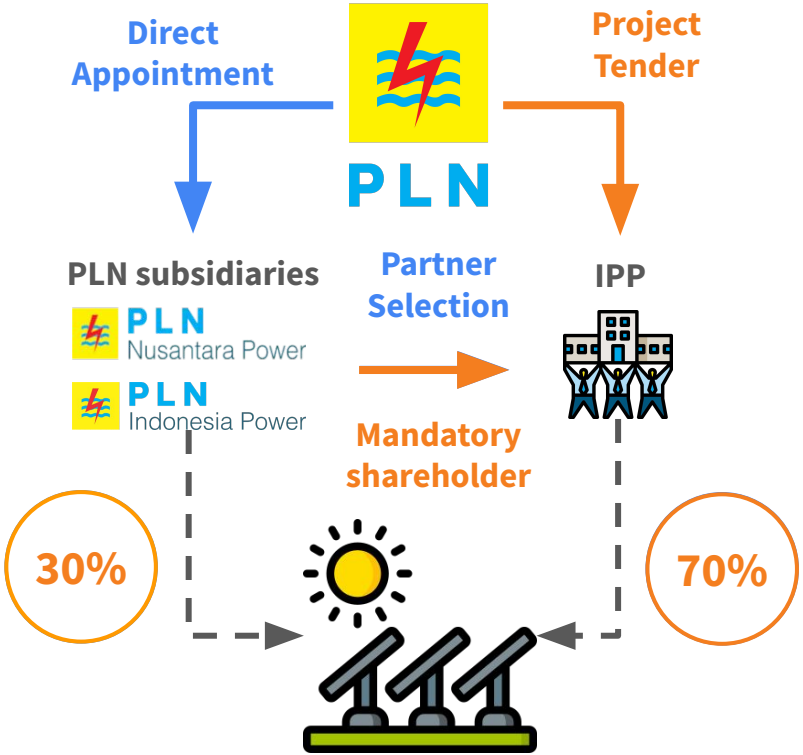
Regulation updates on minimum LCR for **solar projects**



Nurturing Solar Energy Growth

Call to Actions to Keep Solar Momentum Going

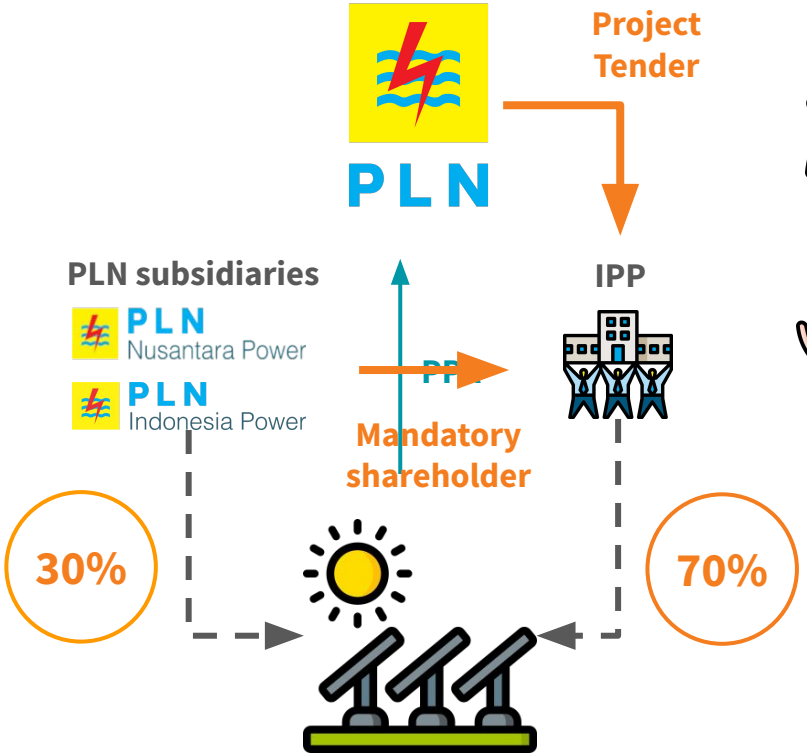
Building Strategic Partnership



Minority Partnership Scheme (IPP owned)

541.6 MW

Building Strategic Partnership



Solar power project pipeline breakdown,

- Improve process transparency
- Fair risk-sharing with developer partner
- Increase tender regularity and volume

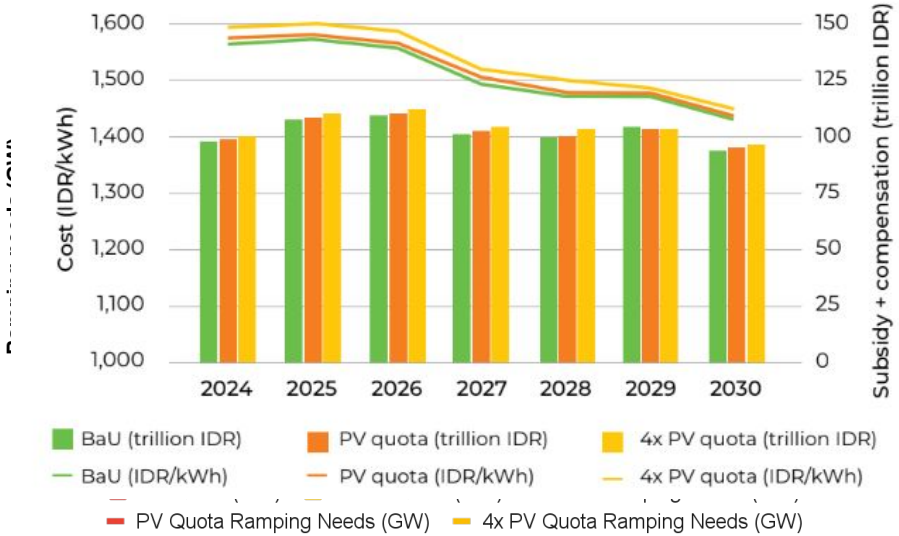
PV + BESS hybrid | Ground-mounted, | Ground-mounted, | Ground-mounted, | Floating

*Partnership PLN's subholding, but no specific scheme (majority/minority) mentioned.

Balancing The Grid

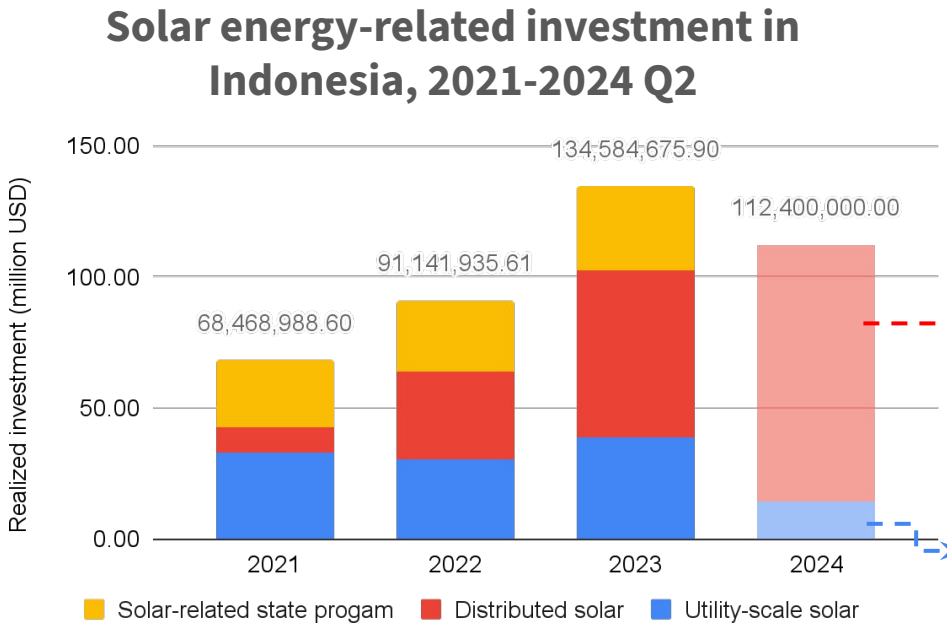
Electricity cost in Java-Bali System in several rooftop PV penetration scenarios

Ramping needs in Java-Bali System in several rooftop PV penetration scenarios



- Defining ancillary services in grid code
- Establishing business model for ancillary services
- Updating distribution code to better involve distribution system operators
- Utilizing fossil power plant flexibility

Fueling The Shift

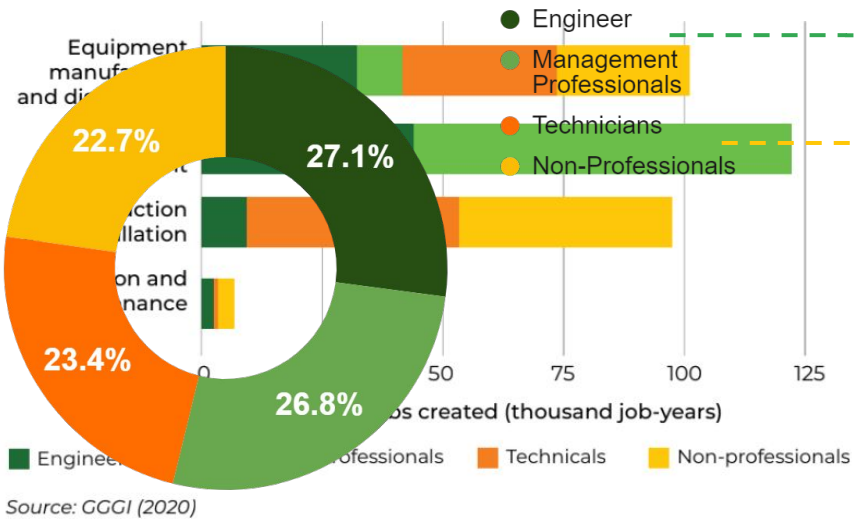


- MEMR Regulation 2/2024 has introduce market certainty
- Higher barrier-to-entry for certain market segments, **customer-side direct subsidy might be needed**

- Limited number of project to be financed, but **big projects in the pipeline set to boost investment**
- LCR relaxation for development financed projects might **improve access to low-cost financing**

Making the Shift Works

Proportion of direct jobs created from solar energy sector in Indonesia



Source: GGGI (2020)

- Ensuring a firm solar energy demand in the foreseeable future to **create strong industry fundamentals**
- Building **long-term partnership** between established **industry and academic institutions**

Regular vocational training in regional level to **increase access to trained labour**

Pushing Industrial Competitiveness

Lower LCR for Module & Projects

+ More solar projects due to ability to use cheaper imported modules
- Low incentive to invest in domestic products/ manufacturing

Global Brands Investing in Indonesia

+ Production capacity addition, strengthening domestic supply chain
- Risk of only being a factory site

Build Strong Solar Project Pipeline

- Ambitious planning in RUPTL
- Demand signaling
- Increase utilisation rate
- Increase prod. Volume
- Reduce prices

Explore Export Markets

- Make use of production capacity additions
- Capitalise on geopolitical advantages in some foreign markets

Invest in PV Technology R&D

- Ensure knowledge transfer from global companies
- Build workforce expertise

Develop Wafer & Cell Production

- Reduce dependency on imports
- Ease component import tax
- Reduce prices

The year 2025 being the first reality checkpoint of the new solar energy promise