

SOLAR ENERGY INDONESIA

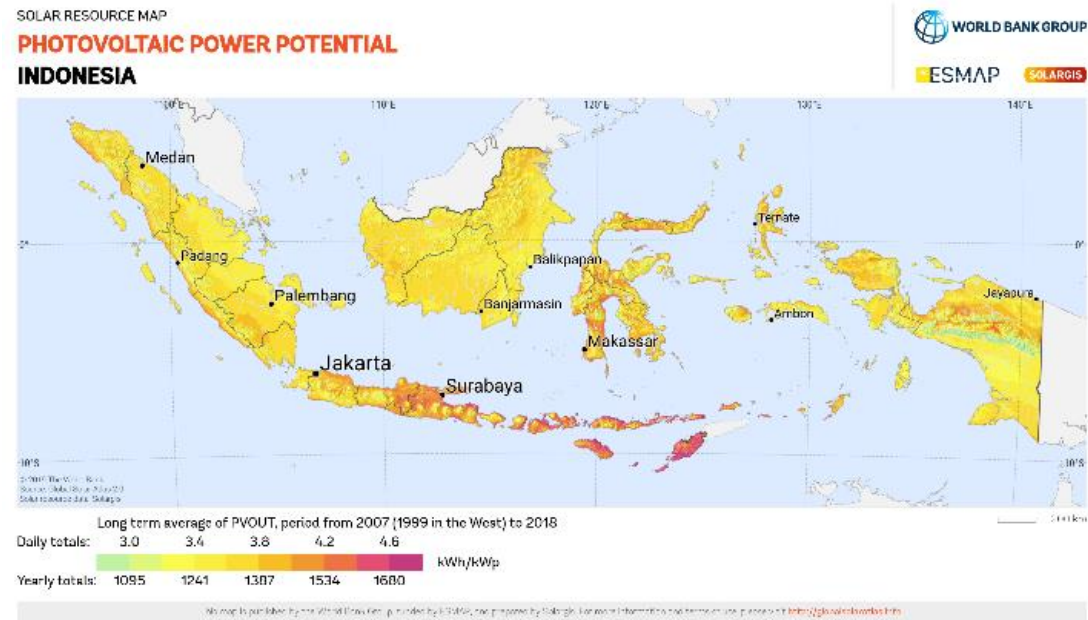
Overview
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1 Indonesia Energy Situation

- ✓ Population: 267.7 million
- ✓ Country Area: 1,919,440 km²
- ✓ **Largest energy user in South East Asia**
- ✓ **World's fourth-largest producer of coal** and Southeast Asia's biggest gas supplier
- ✓ Total electrical capacity installed: 71 GW (Year 2020-ESDM)
- ✓ Total **electricity generation: 295.5 TWh** (Year 2019-IEA)
 - Electricity generation mix dominated by fossil fuels (85%) with renewables playing a smaller role (15%)
 - Major Sources of Electricity: Coal (60%), Oil (4%), Gas (21%), Hydro (7%), Geothermal (5%), Biofuels (3.6%), Wind/Solar/Waste (<1%)
- ✓ **Electricity final consumption: 275.2 TWh** (Year 2019-IEA)
- ✓ **Electrification ratio: 99.5%** (IEA 2019)
- ✓ Expected average of **5% electricity demand growth** until 2028 (IESR - 2020)
- ✓ **Total Solar PV Installed Capacity: ~ 181 MW** (IESR-2021)
- ✓ **Solar PV generation: 98 GWh** (Year 2019-IEA)



2 Indonesia Solar Energy Potential

- ✓ Indonesia is located at the equator, with:
 - **High Solar Global Horizontal Irradiation** 3.6-6 kWh/m²/day (average 4.8 kWh/m²/day)
 - **Annual power output 1,170 kWh/kWp – 1,530 kWh** for each installed kWp of solar panels (Solargis-ESMAP 2019)
- ✓ Recent analysis finds that **Indonesia's solar PV ground-mounted technical potential capacity ranges between 3,396 GWp up to 19,835 GWp** depending on land-use exclusions scenarios (IESR-2021), well above the current MEMR's official estimate 207 GWp (RUEN 2017)
- ✓ Indonesia has **residential rooftop PV potential** market of 34.5 – 116.3 GWp (IESR-2019)
- ✓ **Eastern Indonesia** is particularly suitable for solar development due to dry climate, high solar radiation levels, land availability and high electricity generation costs (extensive use of diesel power plants)
- ✓ **Great technical potential** in Kalimantan, Sumatra, West Java, and East Java (IESR)





3 Solar Technology for Indonesia

1. Solar **PV Systems converts sunlight into electricity:**

- **On-Grid PV systems;** connected into the distribution grid, that in Indonesia is operated by State Electricity Company PLN. With battery storage is referred to as **Hybrid Solar System**.
- **Off-Grid or Stand-Alone PV systems;** small systems for remote locations not connected into the grid, equipped with energy storage system (battery) and generally with back-up system (ex. Gen-set).
- **Mini-Grid PV systems** where PV is supported by types of electricity generators (ex.diesel, micro-hydro or home biogas) and with battery storage, provide small isolated distribution grid for local consumers usually in remote rural areas and off-shore islands.

According to the **mounting system of PV modules, systems can be:**

- **PV Rooftop and Building Integrated Systems:** PV panels mounted on roofs and/or façades of residential and commercial buildings
- **Large utility-scale solar power plants (solar farms):** PV modules are ground-mounted or “floating systems” installed on water bodies.

2. Low-temperature Solar **Thermal Systems, which captures the sun’s heat.** *Note: Concentrated Solar Power not considered in this presentation.*

4 Policies Relevant to Renewable Energy/Solar

2004	Green Energy Policy (Ministerial Decree No. 2/2004) identifies Indonesia strategy to maximize renewable energy potential
2005	Blueprint of National Energy Management (2005-2025) identifies short and long-term development objectives in the electricity sector. It establishes targets for electricity production from various renewable energy sources.
2006	Medium-Scale Power Generation using Renewable Energy (Ministerial Regulation No. 2/2006) obliges electric utility PLN to purchase electricity generated from renewable energy facilities with capacity 1 MW up to 10 MW.
2007	Energy Law No. 30/2007 established a specific legal basis for national energy management
2009	Electricity Law (No.30/2009): It promotes use of renewable energy resources. The regulation set by this law "Purchasing Price by PT PLN of Generated Electricity from Small and Medium Scale Renewable Energy Power Plant or Excess Power"
2011	(RAN-GRK) National Action Plan for GHG Emission Reduction by Presidential Regulation (No.61/2011)
2012	Ministerial Regulation No 04/2012 on Electricity Purchase from Small and Medium Scale Renewable Energy and Excess Power introduces new differentiated feed-in tariff levels in Indonesia.
2013	Power purchase from solar PV plants (Ministerial Regulation No. 17/2013) introduces solar auction programme
2014	(KEN) National Energy Policy (Government Regulation No.79 – 2014)
2016	Solar Feed-In Tariff of Indonesia (MEMR No. 19/2016)
2017	(RUEN) General Plan for National Energy (Presidential Regulation No.22 Year 2017). Regulation No. 10 of 2017 on Power Purchase Agreement Principles. Regulation No. 12 of 2017 on Utilization of Renewable Energy Resources for Provision of Electricity, later replaced by MEMR Regulation No. 50 of 2017 , that regulates the tariff regimes for renewable electricity generation amended by MEMR Regulation No. 4 of 2020
2018	MEMR Regulation No. 49 of 2018 , that regulates Solar Rooftop Power Generation Systems amended by MEMR Regulation No. 13 of 2019 and MEMR Regulation No. 16 of 2019 (together, "MEMR 49 as amended").

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Indonesia Renewable Energy/Solar Targets

- Indonesia has ratified the legally-binding global climate change target, Paris Agreement, through Law No.16/2016.
- The Country's target: 29% (41% conditional on international support) GHG emission reduction by 2030 by promotion of clean and renewable energy and energy conservation.
- New and Renewable Energy (NRE) target in the primary energy mix: 23% (10% bioenergy, 7% geothermal, 3% hydropower and 3% others ex. solar/wind) by 2025 and 31% by 2050, by Government Regulation No.79 of 2014 regarding National Energy Policy - KEN, from around 14% share at present.
- Government's solar PV target: 6,500 MW by 2025 and 45,000 MW by 2050, by endorsing the mandatory use of solar panels covering a minimum of 30% and 25% of the rooftops of government buildings and houses/apartments respectively (RUEN 2017)
- MEMR in 2017 launched the "One Million Rooftop Solar Initiative (GNSSA)" to target one million homes/buildings, each with minimal installed capacity of 1 kWp rooftop solar (cumulative installed capacity of 1 GWp)
- Latest PLN's Electricity Business Plan (2019-2028 RUPTL): The use of rooftop solar photovoltaic projected at 3.2 GW. Solar power plant target to reach 908 MW by 2028

6 Indonesia Solar PV Projects (PLTS > 1MW)

Name/Location	Capacity MWp	Status	Developer/Owner
Bangli and Karangasem, Bali	2 (2x1MWp)	Operational 2013	PT Solar Energy INDOTAMA
Kupang, East Nusa Tenggara	5	Operational 2016	PT LEN Industri (Persero)
Sumalata, Gorontalo, Sulawesi	2	Operational 2016	PT Brantas Energi
Lombok (1,2 & 3 Sites)	21 (3x7MWp)	Operational 2019	Vena Energy
“Minut” Solar, Likupang, North Sulawesi	21	Operational 2019	Vena Energy
Isimu, Gorontalo, Sulawesi	14.5	Operational 2019	Quantum Energi
Sambelia, Lombok	5.4	Operational 2019	
Cirata Floating Solar Power Plant, East Java (National Strategic Project)	50 (first stage) 145MW by 2022	Operational 2020	PT PJB Masdar Solar Energi
Coca-Cola Amatil, West Cikarang	7.3 (solar roof)	Operational 2020	Amatil Indonesia
Danone AQUA, Klaten CENTRAL JAVA	2.9 (solar roof)	Operational 2020	PT Tirta Investama

Note: This list contains main utility-scale and rooftop solar PV projects, but it is not the full list.

Indonesian utility PT PLN (Persero) pre-qualification process on its procurement portal to choose independent power producers IPPs to develop utility-scale solar plants. <https://eproc.pln.co.id>



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Challenges

- Need of **accurate validated solar and meteorological data** for development and cost-effective operation of solar power plants.
- Need to **update the Government's nation-wide solar power technical potential figure**, to reflect real potential
- **Need of established competitive purchase tariff** and an established regulatory & procurement framework for IPP's Utility-Scale Solar PV Projects
- **Reform of current Net metering Policy** to have positive impact on solar rooftop PV market
- Need of supporting regulations with fiscal and financial incentives to encourage homeowner to install solar PV
- **Land procurement difficulties** for developing large-scale solar power plants
- **Challenges in grid integration of variable renewable energy (VRE)** given grid's highly fragmented nature
- Mismatch between **Local Content Requirements LCRs for solar modules**, local manufacturing capacity and market demand
- **Limited availability of certified providers** for some areas in Indonesia for solar rooftop installation

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Opportunities

- **Reduce Indonesia's dependence on fossil fuels** for power generation, provide clean electricity to a nation in need of power, **reduce air pollution and GHG emissions**
- Attractive option for small scale provision of electricity **in remote locations**, supports development opportunities
- **Competitive Technology transfer: continuous decrease in cost** of PV systems, Batteries & Storage Technologies
- Potential synergy with gas-fired power plants or combination with other renewable energy sources (mainly hydro) to help deal with variability of solar resource
- **Socio-economic benefits**: local green jobs creation and enterprise development, local economy growth
- **High technical potential for rooftop PV** in large shopping malls and stores, large industries as well as public buildings including universities and hospitals
- **Huge potential for development of "floating solar"** due to large water catchment area (86,000 ha)
- **Great potential of Solar Thermal for water heating and cooling in buildings**; need of design standards, inclusion in building codes, demonstration projects. Solar thermal storage and/or hybrid solutions for new industrial plants.



Annex

References

- IEA Indonesia Country Profile: Data and Statistics www.iea.org
- "Solar Resource and Photovoltaic Potential of Indonesia", The World Bank, funded by ESMAP – May 2017
- "REmap, A Renewable Energy Roadmap – Indonesia", IRENA March 2017 www.irena.org
- "Power in Indonesia", PWC – Nov 2018 www.pwc.com/id
- "Getting to 23 Per Cent: Strategies to scale up renewables in Indonesia", IISD Global Subsidies Initiative (GSI) – July 2019 www.iisd.org/gsi
- "Solar Resource Maps of Indonesia", The World Bank, funded by ESMAP – 2019 www.solargis.com
- "Under the Same Sun: A Cross Country Comparison on Condition and Policy Supports for Utility-Scale Solar Photovoltaic Projects", IESR (2019) <https://iesr.or.id>
- "Residential Rooftop Solar Potential: Technical and Market Potential in 34 Provinces in Indonesia" - Institute for Essential Services Reform (IESR-2019) <https://iesr.or.id>
- "Indonesia Clean Energy Outlook: Tracking Progress and Review of Clean Energy Development in Indonesia" – IESR, 2019 <https://iesr.or.id>
- "Meeting Indonesia's National Renewable Energy Target", Enlit Asia – 14.09.20 www.enlit.world.com
- "National Energy General Plan (RUEN): Existing Plan, Current Policies Implication, and Energy Transition Scenario" – IESR, 2020 <https://iesr.or.id>
- "Indonesia Energy Transition Outlook 2021: Tracking Progress of Energy Transition in Indonesia" – IESR 2021 <https://iesr.or.id>
- "Beyond 207 Gigawatts: Unleashing Indonesia's Solar Potential" - IESR 2021 <https://iesr.or.id>
- ESDM One Map - Exploring Energy and Mineral Resources of Indonesia <https://geoportal.esdm.go.id>



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