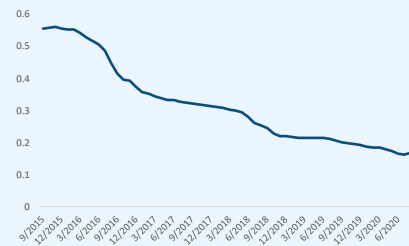


## SOLAR POWER DEVELOPER

Energy sector | Indonesia | 8 September 2020

### KEY INDEXES

#### Module Price (USD/watt)



Source: Bloomberg

#### Polysilicon Grade (USD/kg)



Source: Bloomberg

#### Multi 156mm Wafer (USD/piece)



Source: Bloomberg

### Moderate outlook amid mixed signals

- Better regulations to support solar landscape in Indonesia.
- Expect tone-downed solar demand following ongoing pandemic.
- Reversed polysilicon price trend after previous downtrend.

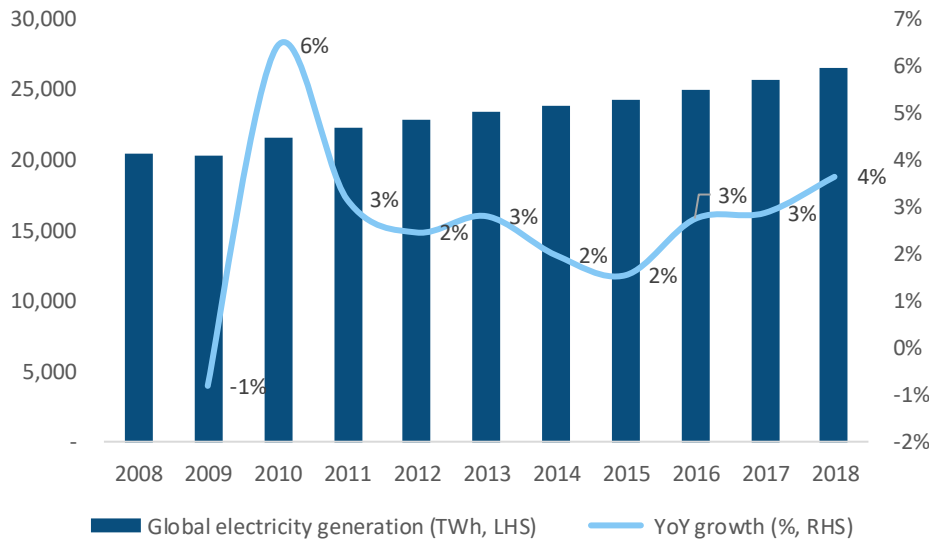
**More lenient solar regulations.** KRI views positively on Ministry of Energy and Mineral Resources' (MEMR) Reg. No. 4/2020 which has revoked the Build Own Operate Transfer (BOOT) scheme, which has been a major concern for solar independent power producer (IPP) since 2017. This second amendment has eased pressure on earlier projects and finalized tenders, also has increased return on solar projects. We expect the amendment will accelerate total national solar PV installed, where previously only reached 152MW as of recent (2019 - 2028 IPP + PLN target: 908MW).

**Rooftop solar demand to weaken.** We are of the view that the solar landscape in Indonesia is not exempted from COVID-19 pandemic effect, which may hurt discretionary spending due to economic downturn. Although industry players usually offer less electricity cost for solar powered electricity, installing solar system requires a large upfront payment. Albeit slower demand outlook, we believe the demand will still be in upward trajectory in the long run due to renewable energy trend, as rooftop solar user has reached over 1,600 users as of Feb 2020 (Jan 2019: 609).

**Polysilicon price driven up by Chinese plant explosion.** Material prices across the supply chain had been declining until recent event in July of explosions at GCL-Poly's Xinjiang plant at its distillation facility, which has prompted the closure of the polysilicon plant. BNEF estimated that the event could cut about 9% of global polysilicon supply. Following the event, we saw an increase of PV Grade Polysilicon by 41.5% mom as of the end of Aug 2020. We are wary of the impact of the price increase as developers still import the material due to relatively cheaper price.

## Demand side: Electricity generation

### Global electricity consumption

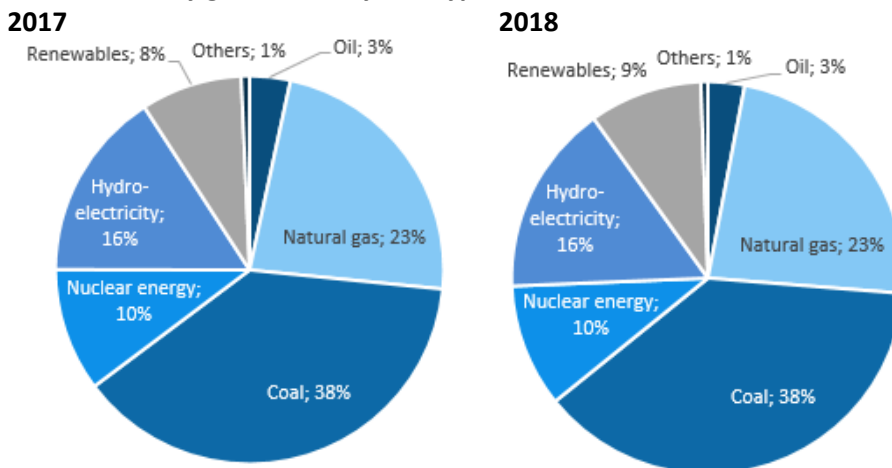


Source: BP Statistical Review 2019

We could look at the demand side of solar power service provider (both renewables-based and fossil-fuel based electricity) from the electricity generation (consumption). The electricity generation increased by 3.7% in 2018, which we believe is still growing steadily with average global electricity generation yearly growth from 2014 – 2018 of 2.6%.

As stated in BP Statistical Review 2019, it is due to the growth in China which contributed more than half of the growth, with India and the US following. Hence, we believe that going forward, China and US will still be the two key countries to contribute to electricity demand. The only region showing negative growth in 2018 is South & Central America (-0.5%). The global electricity demand in 2018 is dominated by Asia Pacific region (46.1%) with China solely alone accounting to 26.7%.

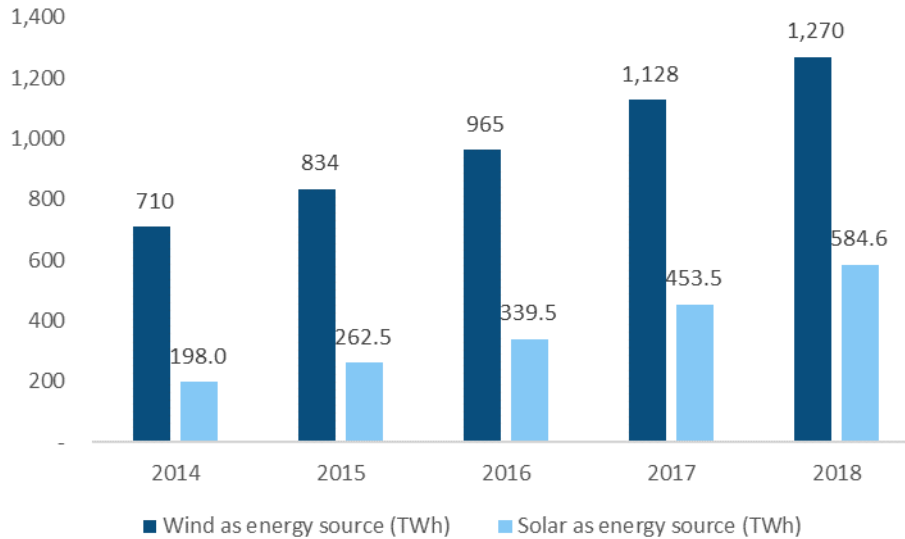
### Global electricity generation by fuel type



Source: 2019 BP Statistical Review

Despite coal still booking the highest share of power generation at unchanged of 38% in 2018, we saw higher contribution from renewables. The increase in renewables contributed to 33.5% increase of global electricity generation in 2018, followed by an increase of its share from 8.4% in 2017 to 9.3% in 2018.

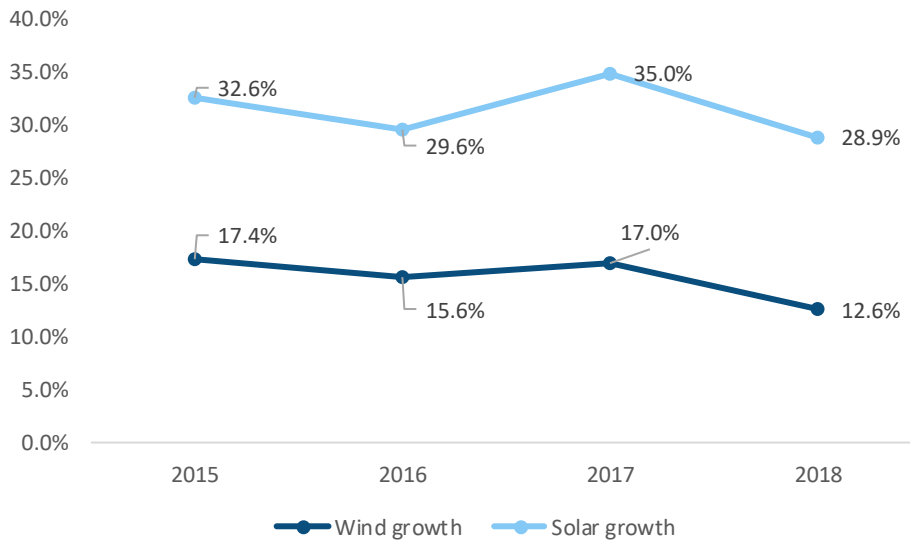
### Renewable energy: Generation by sources



Source: 2019 BP Statistical Review

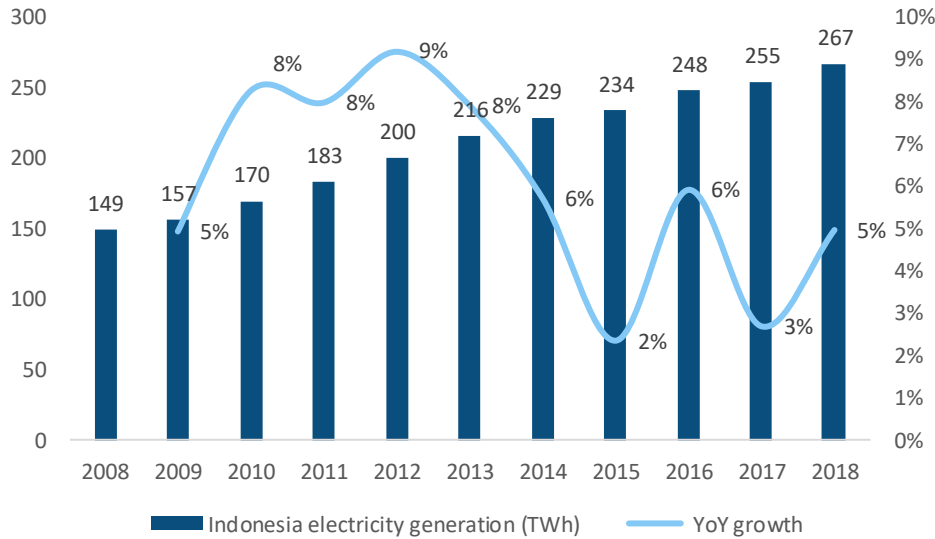
Top two renewable energies for electricity production are the wind and solar energy. According to 2019 BP Statistical Review, the renewable energy used in power (electricity) generation (excluding hydro) increased by 14.5% in 2018; slightly below its 10-year average growth of 16%. Although wind grew consistently slower than solar, it contributed more (142 TWh) to renewable generation growth than solar (131 TWh).

### Solar and wind as energy source yearly growth



Source: 2019 BP Statistical Review

## Indonesia electricity generation: growing steadily



Source: PLN Statistics 2018

Indonesia's electricity demand grew by 5.0% in 2018, below its 10-year average growth of 6.0%. As of today, it is reported that Indonesia's electrification rate stood at 99.48% and the Energy Ministry targets 100% as of 2024. According to the minister, Indonesia's electricity consumption per capita stood at 1,084 KWh in 2019; still below target of 1,200 kWh per capita.

Electricity sales, according to PLN Statistics in 2018, is dominated by household segment by 42%, followed by industry segment of 33% and commercial segment by 19%. We believe the opportunities for energy developers still lie primarily in these three segments.

## Indonesia's power generation: heavily dominated by coal

Indonesia electricity generation by fuel			
	2008	2017	2018
Oil	14.0%	7.4%	7.6%
Natural gas	32.0%	22.0%	22.0%
Coal	41.0%	48.0%	58.0%
Nuclear	0.0%	0.0%	0.0%
Hydro	7.7%	7.3%	6.1%
Renewables	5.6%	5.3%	5.5%

Source: PLN Statistics 2018

Indonesia's power generation is heavily dominated by coal as a result of the country ranking 6<sup>th</sup> in coal reserve and 1<sup>st</sup> as net exporter (according to 2019 BP Statistical Review of World Energy). Over 2008 – 2018, Indonesia is showed to rely more to coal and less to other energy sources, especially renewables. However, while hydro energy share dropped by 120bps yoy in 2018, renewables share rose by 20bps while the figure is still 10bps lower than 2008 figure of 5.6%.

**Solar energy for electricity generation in Indonesia**

	2013	2014	2015	2017	2018
Electricity generated by solar power (GWh)	9.02	11.59	5.28	5.99	6.67
Electricity generated by micro hydro power (GWh)	361.26	436.25	541.3	532.4	581.48
Electricity generated by gas machine power plant (GWh)	1,651.34	1,929.08	1,582.84	787.96	689.93

Source: PLN Statistics 2018

The solar energy is not the most popular source of renewable energy for power generation as shown in the table; in which solar power is the least used renewable energy to be used for power generation. Use of micro hydro power is significantly higher by 104x. In 2018, solar electricity generated by PT PLN alone accounted for 68.4%.

**Commercial and industry solar power demand opportunities from “green” branding purposes and industrial estate development**

According to IESR, globally there are over 200 companies to have committed to using 100% renewables. In Indonesia, there were three multinational companies in Indonesia which have pledged to use renewables and started to use rooftop solar PV in their facilities as of November 2019.

Aside from that, we believe demand could also come from development of industrial estate, in which local developers typically receive project from industrial estate clients and developer itself. For instance, local solar modules manufacturer PT Sky Energy Indonesia had a project in Suryacipta Industrial Area to provide solar-powered wastewater treatment plant. Going forward, industrial estate developers will focus to build outside of Bekasi area. In 2020, PT Surya Semesta Internusa targets to launch Subang City of Industry and PT Intiland is also developing Ngoro Industrial Park Phase-I.

**Supply side: Availability of solar energy and current capacity**
**Renewable energy potential in Indonesia**

	Geothermal	Hydro	Mini-micro Hydro	Bioenergy	Solar	Wind	Wave
<b>Potential capacity (MW)</b>	29,544	75,091	19,385	32,654	207,898	60,647	17,989
<b>Installed capacity (MW)</b>	1,439	4,827	197	1,671	79	3	0
<b>Utilization (%)</b>	4.869%	6.428%	1.018%	5.117%	0.038%	0.005%	0.002%

Source: Peraturan Presiden Nomor 22 Tahun 2017 tentang Rencana Umum Energi Nasional (RUEN); Status as of FY15

Despite being one of the least popular renewables in Indonesia, we believe solar power is gradually gaining attention as cost problem is diminishing and there is more urgency to reduce global carbon emission now. As of 2015, the Energy Ministry estimated only 0.038% utilization of solar potential capacity, and solar power’s potential capacity is highest among other renewables. This could be explained by Indonesia’s climate in which the country receives 3.6 –

6 kWh/m<sup>2</sup>/day of solar irradiation intensity, which translates to annual power output of 1,170 – 1,530 kWh/kWp (World Bank & Solargis, 2017).

**Comparison of solar power potential in some comparable countries**

	Indonesia	India	Mexico	UAE	Brazil
Irradiation (kWh/m <sup>2</sup> /day)	3.6 - 6	6 - 7	4.6 - 6.6	6.5	4.5 - 6.3
Ambient temperature (celcius)	26 - 28	14 - 34	12 - 28	55 - 68	49 - 79
Relative humidity (%)	75 - 85	50 - 80	52 - 71	55 - 68	49 - 79
Annual power output (kWh/Wp)	1,170 - 1,530	1,400 - 1,600	1,620	1,753 - 2,192	1,230
Installed capacity (MW)*	0	24,200	3,000	487	2,193
Ongoing project (MW)**	48	17,700	1,800	2,027	4,920

\*) size of installaion > 10 MW per project or per location

\*\*) as of April 2019

Source: Institute for Essential Services Reform (IESR)

According to IESR in its report *Under the Same Sun: A Cross-Country Comparison of Condition and Policy Supports for Utility-Scale Solar Photovoltaic Projects*, Indonesia has a competitive solar power development compared to its peers with similar climate. Among these, India leads with highest irradiation; translating to highest installed capacity of 24,200MW. Indonesia is the laggard with zero large (>10 MW) installed capacity (power plant).

**Market attractiveness of solar power**

Despite high uncaptured potential of solar power, there is little interest shown by Indonesia’s government to develop them. According to IESR, there is 152 MW of solar PV installed (+44% yoy) by November 2019, but the figure is still well-below RUEN (Rencana Umum Energi Nasional) target of 550 MW by the end of 2019. Government also lowered its interest in solar power as shown in PT PLN (Indonesia’s SOE which supplies electricity)’s RUPTL 2019 – 2028 target of 908MW (RUPTL 2018 – 2027: 1,047 MW; -13%).

Government solar projects are also deemed costly, as estimated by IESR: The generation cost of the 5 MW Solar PV Project in Kupang in 2014 was USDc 25/kWh; well-above the average cost in other countries of USDc 5/kWh. IESR in its report stated that reasons could come from small project size, high system cost that year, and high financing cost (high interest rate and expected IRR).

While the government’s interest is driven by national target, we believe the private sector’s interest is mainly driven by demand, local policies, and cost trend.

**Local solar manufacturers in Indonesia**

No.	Solar Panel Manufacturer	Year of Establishment	Manufacturing Capacity (MWp/Year)	Apamsi Members	Local Content
1	PT LEN Industry (Persero)	1991	30	Yes	40.11-43.79%
2	PT Surya Utama Putra	2009	20	Yes	40.47-48.76%
3	PT Swadaya Prima Utama	2010	20	Yes	40.05-44.12%
4	PT Adyawinsa Electrical & Power	2009	10	Yes	40.18-40.98%
5	PT Azet Surya Lestari	2003	10	Yes	40.04-40.66%
6	PT Wijaya Karya Industri Energi	1993	10	Yes	40.18-44.19%
7	PT Sankeindo	1988		Yes	40.01-56.79%
8	PT Sky Energy Indonesia	2008	50	Yes	40.18-47.53%
9	PT Jembo Energindo	2013		Yes	40.19-42.09%
10	PT Canadian Solar Indonesia - PT Daya Terbarukan Nusantara (Solaris Group)	2015	60	No	40.18%
11	PT Skytech Indonesia			No	40.04%-43.60%

Note: Indonesian Solar Module Manufacturer Association (APAMSI).

**Regulations around Renewable Energy Service Company (RESCO)**

The regulations about solar power in Indonesia is heavily concentrated to regulating PT PLN, PT PLN's customers, and local solar manufacturers who won government solar project auctions. Recent local policies tend to promote use of solar power as a commitment to create more sustainable environment.

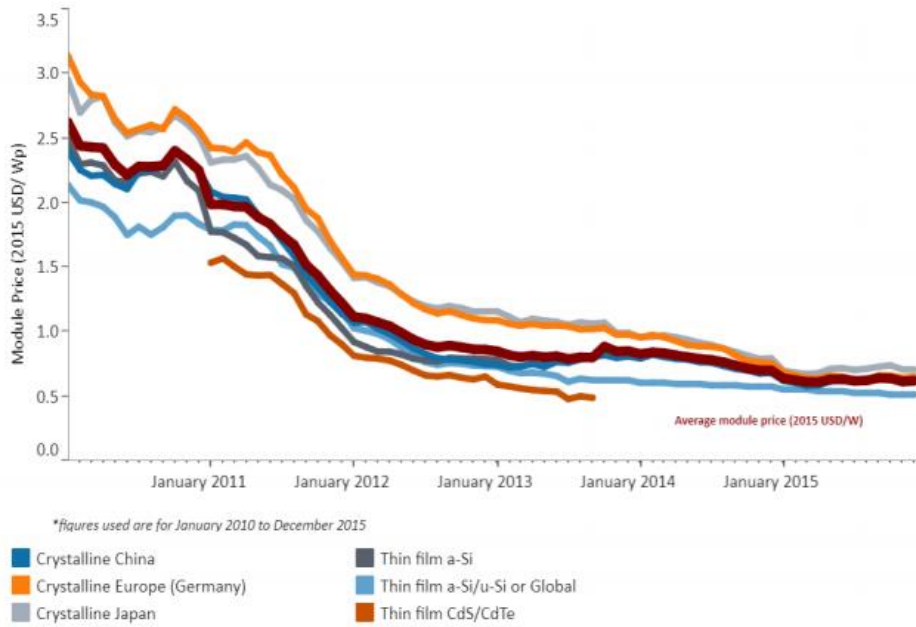
The governor of Jakarta issued Governor Instruction No. 66/2019 which mandates the use of rooftop solar PV on public schools (2019 realization: 80 schools; 2020 target: 234 schools), sport facilities, and medical facility from 2019 – 2022.

Government of Central Java aims to be the first solar province in Indonesia and they encourage use of rooftop solar PV (2019 realization: 3 government buildings and 80 kWp in industrial complexes; 2020 target: 17 government buildings).

Bali province has Governor Reg. No 45/2019, in which government buildings and buildings with area of >500 m2 are required to use rooftop PV. The government also provide incentives of building tax reduction and ease of financing (2019 realization: 1 government building and 2 schools).

## Ongoing decline of solar module cost constrained by local policy

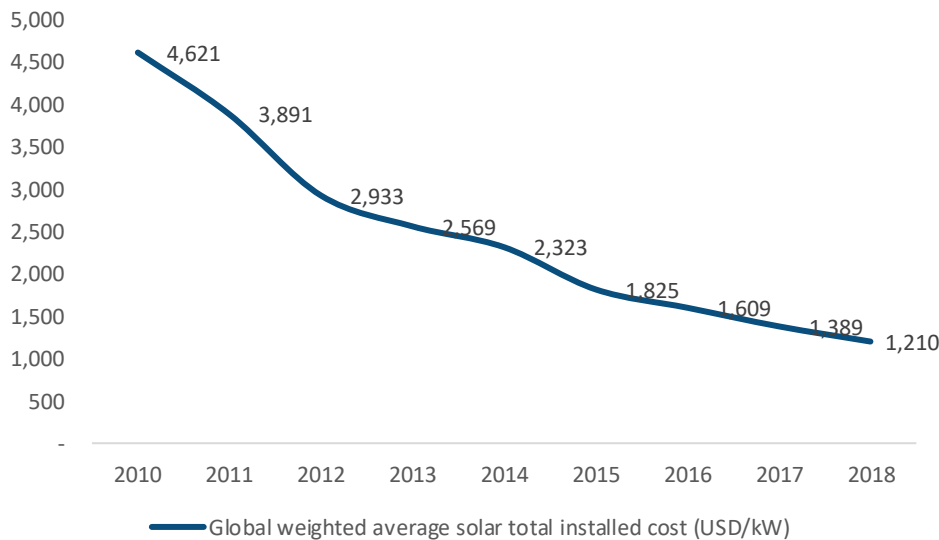
### Solar Module Price Historical Trend



Source: Institute for Essential Services Reform (IESR)

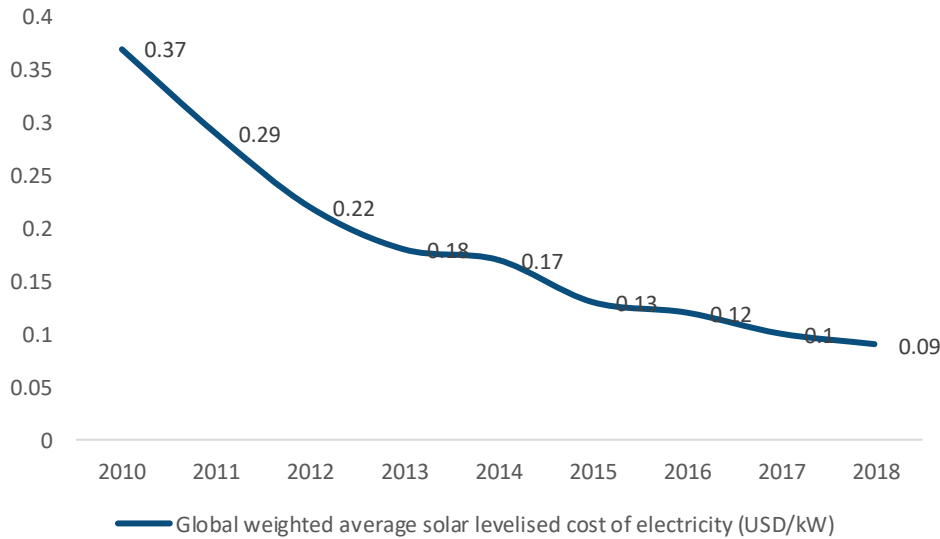
PV module prices, which are the main solar power project cost component, have been declining as shown in German crystalline of USD3.129/Wp in 2010 to USD 0.53/Wp in 2015. According to IESR, the downtrend of PV module prices are fueled by factors such as R&D, economies of scale, and supportive policies. Furthermore, International Renewable Energy Agency (IRENA) has forecasted that solar PV cost will be reduced by 59% by 2025.

### Global weighted average total installed cost



Source: Institute for Essential Services Reform (IESR)



**Global weighted average levelised cost of electricity**


Source: Institute for Essential Services Reform (IESR)

Despite lower global average cost, pricing of solar power in Indonesia is constrained by local regulation in 2019 which increases the local content requirement (LCRs) for solar modules from 40.68% in 2017 to 60% in 2019. According to IESR, on average the local content of solar modules can only reach 42% and an upgrade in glass components (as the most doable improvement) will only improve the local content to 56%.

Aside from quality and capacity, the cost to use local modules is higher, leading to higher project cost. According to IESR, local modules are priced on average at USD0.47/Wp, more expensive than imported modules at USD0.25 – 0.37/Wp (include tier-1 manufacturers from China).

Another cost constraint comes from high cost of funding, in which IESR reported that average interest rates offered by local banks in Indonesia are in the range 10% – 12% and 14% – 15% in some cases. This is due to the perception that renewable projects are risky and unfamiliarity with renewable projects.