Assessment Report

Indonesia's PV Local Content Regulations

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This project is part of the International Climate Initiative (IKI). The German Federal ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU) supports this Initiative on the basis of a decision adopted by the German Bundestag.

This publication has been created to assesses the Minister of Industry Regulations No. 4/M-IND/PER/2/2017 & No. 5/M-IND/PER/2/2017 to define the current status and the bottleneck of PV local content requirements implementation in Indonesia and provide recommendations for regulation improvement. All decent attention has been taken in the preparation of this publication. The author, contributors, GIZ, each individual and other parties involved are fully responsible for the contents of this publication.

Executive Summary

Indonesia is rich in solar energy potential, exceeding 500 GW, according to International Renewable Energy Agency (IRENA 2019). Despite this huge energy potential, investment in the solar energy sector still remains low. Hence, solar energy only contributed 1.7% to the country's total electricity production in 2019. The Indonesian Government's strategy concerning acceleration in the solar PV energy industry is to develop and strengthen the local industry, and to improve the existing policies and regulations that would encourage a domestic market for solar energy.

Therefore, the Directorate of Various, New, and Renewable Energy in collaboration with GIZ through ExploRE conducted a study to identify the conditions under which PV local content requirements (LCRs) can serve as an effective policy tool for building a competitive local solar PV industry. The study will focus on assessing solar PV LCR regulations referring to the Ministry of Industry (MoI) Regulations No. 05/M-IND/PER/2/2017 and 04/M-IND/PER/2/2017 and provide policy recommendations on LCR regulation which fit with the current status of the PV market and oriented for the local PV industry development in Indonesia.

The Government of Indonesia (GoI) has introduced LCRs regulations through MoI Regulation No. 05/M-IND/PER/2/2017 as an amendment of MoI Regulation No. 54/M-IND/PER/3/2012 which provides guidelines for the use of domestic products for electricity infrastructure development and MoI No. 4/M-IND/PER/2/2017 which regulates the terms and procedures for assessing LCRs for solar PV power plants. The study found that the LCRs weighting factors specified in the regulations do not reflect the actual conditions in the market and do not consider the current local manufacturing capacity. Moreover, the standard quality of the products is not clearly defined in the regulations, this is important information for project developers that rely on international financing to fund their projects to be able to fulfil specific technical requirements. Localiation of the solar manufacturing industry is intended to drive the green economy and accelerate renewable energy development. However, the empirical literature study and discussion with related stakeholders show that there are a number of initial basic conditions that determine the feasibility of creating domestic solar industries. One of the most cited factors determining the effectiveness of LCRs is the size and stability of the local market. Manufacturing within small or unstable markets is unlikely to reach the economies of scale necessary for cost-effective production. In addition, LCRs must also be supplemented with financial support mechanisms and incentives for investors to use a local product by offering low-interest loans or tax credits tied to the use of local products.

LCRs can only work when the proportion of domestic content required is set at an exact level and is gradually phased in. Exact rates are a function of production volume and opportunity cost of capital. To determine the exact rates of LCRs and weighting provisions for each solar PV component, we strongly encourage further market and industry assessment.

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Abbreviation

AC	Alternating Current
AESI	*Asosiasi Energi Surya Indonesia* (Indonesia Solar PV Association)
APAMSI	*Asosiasi Pabrikan Modul Surya Indonesia* (Indonesian Solar Module Manufacture Association)
APBD	*Anggaran Pendapatan dan Belanja Daerah* (Regional Budget)
APBN	*Anggaran Pendapatan dan Belanja Negara* (National Budget)
BRC	British Reinforced Concrete
CDM	Clean Development Mechanism
DC	Direct Current
DG NREEC	Directorate General of New Renewable Energy and Energy Conservation
EU	European Union
ExploRE	Strategic Exploration of Economic Mitigation Potentials through Renewables
FDI	Foreign Direct Investment
FiT	Feed-in Tariff
GoI	Government of Indonesia
kWp	Kilowatt-Peak
LCRs	Local Content Requirements
LTSHE	*Lampu Tenaga Surya Hemat Energi* (Energy Saving Solar Light)
MEMR	Ministry of Energy and Mineral Resources
MoI	Ministry of Industry
P3DN	Tim Nasional Peningkatan Penggunaan Produksi Dalam Negeri
PLN	*Perusahaan Listrik Negara* (Electricity State-Owned Enterprise)
PV	Photovoltaic
RE	Renewable Energy
RUEN	*Rencana Umum Energi Nasional* (National Energy Plan)
SLO	*Sertifikat Laik Operasi* (Commissioning Certificate)
SHS	Solar Home System
VRLA	Valve Regulated Lead Acid
WTO	World Trade Organization

2. Introduction

2.1. Background

Solar energy is considered to be an important renewable energy source in Indonesia. The country receives 3.6 - 6 kWh/m2/day of solar irradiation intensity, equivalent to an annual power output of 1,170 - 1,530 kWh/kWp. Indonesia also has huge solar energy potential, namely more than 500 GW, which is the largest compared to other renewables resources. Hence, the Indonesian National Energy Plan (RUEN) has set a solar generation target of 6500 MW by 2025 and 45000 MW by 2050.

Figure 1. Local Content Development Workshop with Surveyor Indonesia & DG NREEC (source: ExploRE)

Solar PV Power Plants have been growing year by year and it should ideally be followed by the development of domestic industries by regulating local content requirements. The Government of Indonesia (GoI), through the Ministry of Industrial, has prepared regulations concerning solar PV local content requirements that refer to Minister of Industry Regulation No. 05/M-IND/PER/2/2017 as an amendment of MoI Regulation No. 54/M-IND/PER/3/2012 which provides guidelines for domestic products in electricity infrastructure development and MoI no. 4/M-IND/PER/2/2017 which regulates the terms and procedures for assessing LCRs for Solar PV Power Plants.

However, Indonesia has experienced limited growth in solar deployment, both for utility-scale solar generation and rooftop solar. By November 2019, the total installed capacity of solar power plants has only reached 154 MW. With the current installed capacity, the government needs to develop at least 1,000 MW of solar PV per year from 2020 to 2025 to achieve the 6500 MW RUEN target by the end of 2025. Accordingly, the Indonesian Government has prepared a strategy to strengthen the local industry and improve the existing policies and regulations that would encourage a domestic market for solar energy.

In this case, the Directorate of Various, New, and Renewable Energy, in collaboration with GIZ through ExploRE, has assessed the Minister of Industry Regulations No. 4/M-IND/PER/2/2017 & No. 5/M-

IND/PER/2/2017 to define the current status and the bottleneck of PV LCR mplementation in Indonesia and provide recommendations for PV LCRs regulation improvement which this report discusses in detail.

2.2. Objectives

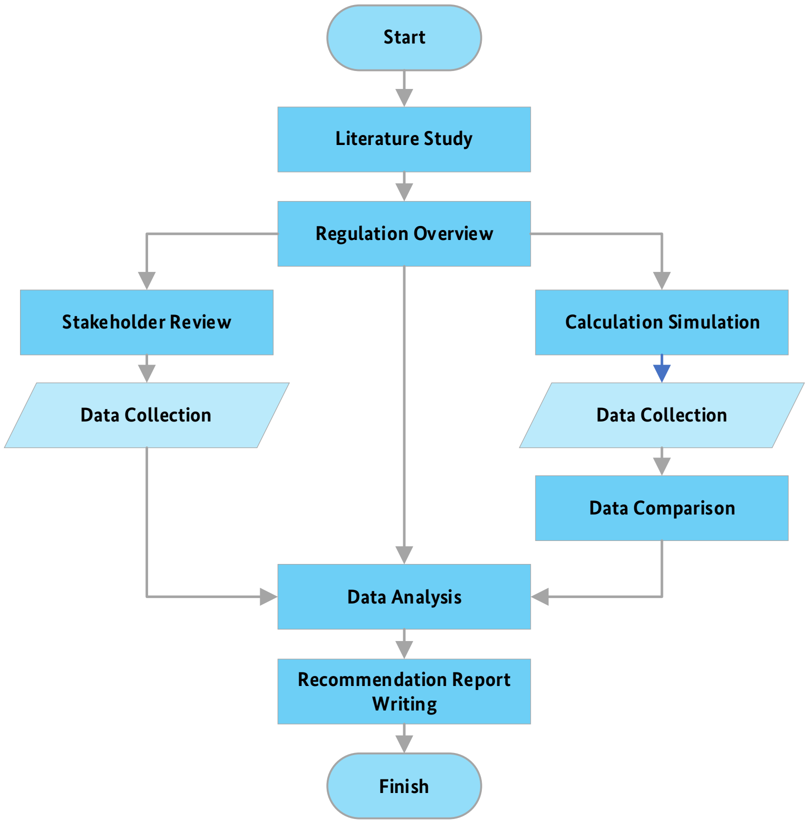
The objectives of this report are:

i. To understand the local content requirements and how it should be implemented to boost the renewable energy market and stimulate the local industry
ii. To provide an assessment on the implementation and bottlenecks of LCRs regulation for the PV system, especially the Minister of Industry Regulation No. 4/M-IND/PER/2/2017 and No. 5/M-IND/PER/2/2017.
iii. To provide policy recommendations on LCRs regulation that fit with the current status of the RE market and is oriented for local RE industry development.

2.3. Methodology

The major duties of the PV local content recommendation report methodology are described briefly in the following sections:

Figure 2. Methodology flowchart



2.3.1. Qualitative methods

i. Literature study
   To provide an overview of the PV local content requirements by identifying and summarizing relevant studies and policies.

ii. Regulation review

To identify issues or challenges in the current PV local content implementation by reviewing the Minister of Industry Regulations No. 4/M-IND/PER/2/2017 & No. 5/M-IND/PER/2/2017.

iii. Stakeholder interview

To collect inputs from DG NREEC, Indonesia Solar Energy Association (AESI), PT Surveyor Indonesia, and other relevant stakeholders to provide a recommendation for the implementation of solar PV LCRs.

iv. Data analysis

To analyze issues or challenges arising from the PV local content regulations review and inputs collected from stakeholder interviews.

2.3.2. Quantitative Methods:

i. Existing data calculation simulation

To calculate the actual PV component weighting percentages by using sample data from the PV power plant project in Indonesia.

ii. Data comparison & analysis

To compare the component weighting percentages for each PV system based on the Minister of Industry Regulation No. 4/M-IND/PER/2/2017 with actual data in the market to determine whether the component weighting percentages specified in the regulation are still relevant with the current condition.

3. Literature Study

3.1. Overview of Indonesia Solar PV Industry

Photovoltaics (PV) offer the ability to generate electricity in a clean, quiet, and reliable manner. PV systems are comprised of photovoltaic cells, devices that directly convert light energy into electricity. There are several types of photovoltaic cells. However, more than 90% of the solar cells made worldwide consist of wafer-based silicon cells, since it is the most efficient material.

Figure 3. Figure 1 On-grid PV system schematic (source: subpng.com)

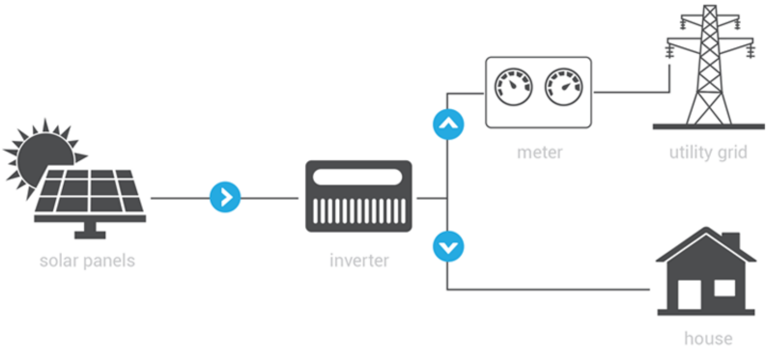
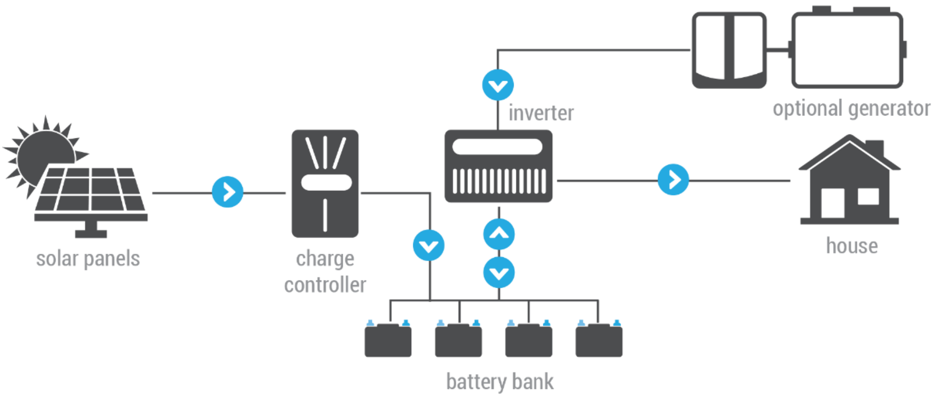
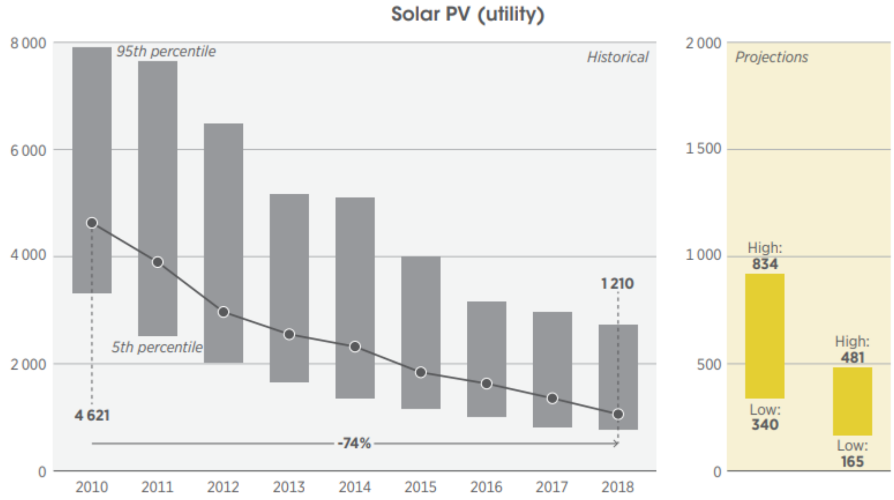


Figure 4. Figure 2 Off-grid PV system schematic (source: subpng.com)



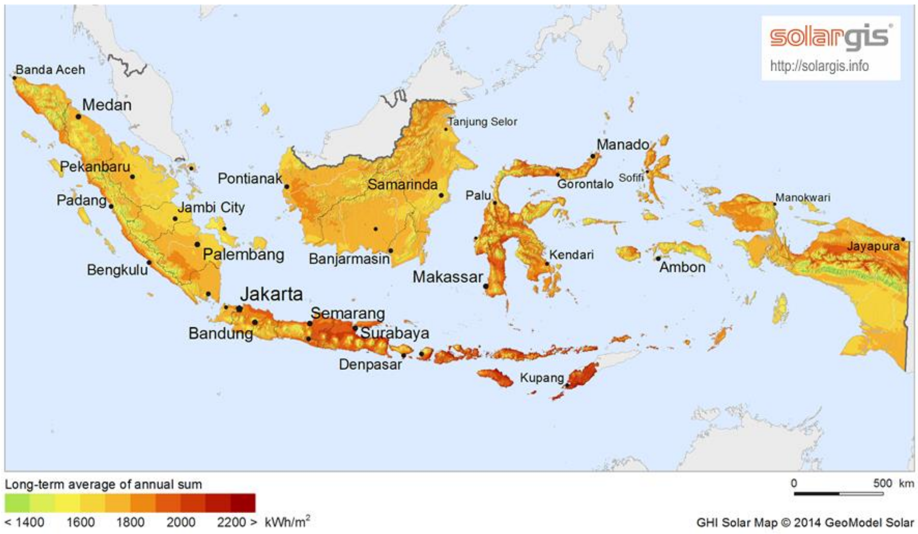
Currently, there are two main types of PV systems. Grid-connected systems (on-grid systems) are connected to the grid and inject the electricity to the grid. For this reason, the direct current produced by the solar modules is converted into a grid-compatible alternating current. However, solar PV power plants can also operate without being connected to the grid, such systems are referred to as autonomous systems (off-grid systems).

Figure 5. Declining cost of solar PV, with cost projections to 2050 (source: IRENA, 2019)



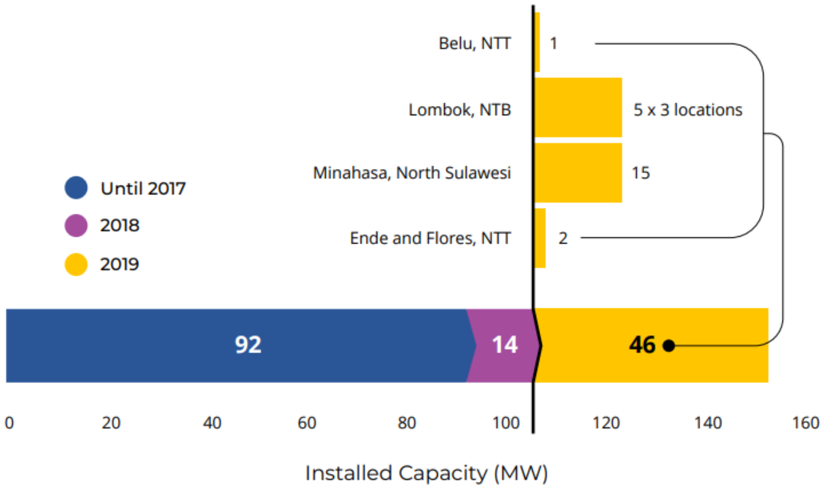
Solar PV is emerging as one of the most competitive sources of new power generation capacity after a decade of significant cost declines. A 74% decline in total installed costs was observed between 2010 and 2018 (Figure 4). Lower solar PV module prices and ongoing reductions in balance-of-system costs remain the main drivers of the declining cost of electricity from solar PV.

Figure 6. Map of Indonesia solar irradiation (source: Solargis, 2019)



Indonesia has huge solar energy potential, exceeding than 500 GW and is the largest compared to other renewables resources the country has or seven times larger than the total installed electricity capacity in the country (approximately 65 GW). IRENA estimated that Indonesia could develop up to 3.1 GW of solar energy per year from 2016 to 2030 and attain 47 GW of solar capacity in 2030. As such, Indonesia has potential to transition to local, emissions-free energy resources.

Figure 7. Solar PV installed capacity (source: IESR 2019)



However, the government plan summarized in the *Rencana Umum Energi Nasional* (RUEN) only sets the target for solar PV power plant capacity at 6.5 GW by 2025. By November 2019, 152 MW of solar PV had been installed. Although higher growth of solar energy was achieved in 2019 (three-fold compared to 2018), with a 44% increment year-on-year, it is still far from the RUEN target at 550 MW by the end of 2019. With current installed capacity, the government needs to develop at least 1,000 MW of solar PV per year from 2020 to 2025 to achieve the 6500 MW RUEN target by the end of 2025.

Table 1. Indonesia solar module manufacturers (source: APAMSI, 2019)

No.	Company	Location	Annual Production Capacity
1	PT Adyawinsa Electrikal & Power	Kaw.Ind. Jababeka II	40 MWp
2	PT Azet Surya Lestari	Bintaro Tangerang	45 MWp
3	PT LEN Industri (Persero)	Bandung	45 MWp
4	PT Surya Utama Putra	Kab. Bandung	45 MWp
5	PT Swadaya Prima Utama	Kab. Karawang	40 MWp
6	PT Wijaya Karya Industri Energi	Jakarta	50 MWp
7	PT Sankeindo	Tangerang	45 MWp
8	PT Jembo Energindo	Tangerang	50 MWp
9	PT Sky Energy Indonesia	Gunungputri Bogor	50 MWp
10	PT Canadian Solar Indonesia	Tangerang	60 MWp
11	PT Deltamas Solusindo	Bogor	30 MWp
12	PT Indodaya Cipta Lestari	Jakarta	30 MWp
	Total		530 MWp

Solar panel manufacturing in Indonesia appears primed to thrive with the increase in solar power projects. The abundance of high concentration silica sand reserves in Indonesia provides great opportunities for the development of the national solar cell industry. However, one of the mainstays in the independence of the supply of raw materials for solar cell components is the mastery of advanced material technology. Therefore, Indonesia's silica sand potential should be followed by the mastery level of technology to produce silicon ingots and solar cells.

3.2. Definition of Local Content Requirements (LCRs)

The increasing deployment of RE technologies needed to mitigate climate change requires government intervention. Consequently, the government aims to make its renewable energy technology deployment strategies politically acceptable by linking them to other socio-economic goals, such as job creation, economic development, and building industrial competitiveness. One of the national industrial policy tools to accelerate RE technology deployment is determined by applying the use of LCRs.

LCRs is a policy measure that requires foreign or domestic investors to source a certain percentage of intermediate goods from local manufactures or producers. These local producers can be either domestic firms or localized foreign-owned enterprises. The overall objective of LCRs is to develop local competitive industries or increase employment, in this case, in the renewable energy sector.

From the limited empirical literature on LCRs, we found that there are a number of initial basic conditions that determine the feasibility of creating domestic industries and, perhaps, subsequent innovators. Therefore, LCRs are often paired with investment incentives, as part of a “carrot and stick” approach. This carrot-and-stick approach has been successfully used by several countries as an integrated package of industrial planning policies.

i. The “stick” side

Governments use performance requirements, which can be generally understood as stipulations concerning local content, technical performance, technology transfer, R&D, employment, and domestic equity/ownership applicable for investors. In this case, investors are required to meet the specified goals with respect to their operations. The specific policy goals are strengthening infant industries, increasing revenue, improving the balance of trade, and lowering unemployment. These measures are widely used by governments to align investment with industrial planning.

ii. The “carrot” side

Governments use a range of investment incentives to offset costs incurred by firms that choose to establish their business. These incentives range from direct transfers e.g. grants (for R&D projects or new capital investment) and dedicated public-private investment funds to indirect transfers, such as low or no-cost government services in marketing and distribution, as well as other financial support mechanisms such as offering low-interest loans or tax credits tied to the use of local products. For the electrification sector, LCRs should also be coupled with a Feed-in Tariff (FiT). If the required share of local content is fulfilled, developers are then eligible to receive the higher FiT.

3.3. Discourse on the Effectiveness of LCRs in the PV Industry

The use of LCRs has been growing for a long time. The opportunities for localizing manufacturing are touted as a way for countries to take advantage of the green economy and drive renewable energy especially solar PV. In order to understand the opportunities and challenges faced, this section offers an overview of the potential benefits of localizing solar manufacturing and the challenge of doing so in today's competitive global market.

3.3.1. Benefits of Using LCRs in the PV Industry

i. Infant industries
   To boost sectoral growth in the fast-growing sector (RE). Fostering infant industries by protecting them from foreign competitors.
ii. Green jobs
   Requiring enterprises to use a certain proportion of inputs from local industries, which some argue would be followed by an increase of employment. Creating job opportunities and new expertise for local workforces.
iii. Tax revenue generation
   As an implication of the growth of the manufacturing industry, the government is expecting an increase in tax revenue.
iv. Renewable energy deployment as the market is developing a new trend
   As the market is developing a new trend, one of the implications from the competition is the decreasing cost in the RE industry. Therefore, more RE businesses will grow, and eventually, an aggregate of environmental impact will be seen in the longer term.
v. Knowledge and technology transfer
   Imposing LCR can benefit the transfer of common technology and knowledge (naturally forced to compete with more modern RE technology) as it is an important component for achieving sustainable growth.

3.3.2. Challenges of Using LCRs in the PV Industry

The arguments against applying LCRs in RE policies are mainly economic arguments. In general, these arguments refer to four areas: inefficient allocation of resources, trade impacts, inflation in retail power price, and employment concerns. When assessing these arguments, the capability of generating environmental benefits in the medium-term is also questioned. Challenges on local content requirements in the RE industry:

i. Impact on trade
   Although trade restriction is not always the primary objective of local content requirements, they can have significant impacts on trade. The effect of LCRs is to hinder imports and reduce competition between domestic manufacturers and their foreign competitors, which will hinder innovation through liberalized trade.
ii. Inflation of power prices
   LCRs could initially drive up manufacturing costs and hence electricity retail prices. This is because LCRs force the producer to purchase local inputs, which are usually more costly than those produced abroad.
iii. Employment concerns
   There are also concerns that LCRs do not generate additional green jobs. The balance between job losses as a result of higher input prices and job gains from financial incentives and in the component-manufacturing industry is very difficult to estimate and depends on sectoral and policy specifications. In addition, the PV module industries worldwide are now shifting to a fully robotic manufacturing process for product competitiveness. Fully robotic manufacturing reducing the need for workforces.
iv. Impact of economic deficiencies on quality and innovation
   High LCRs that are very trade-restrictive may end up harming the transfer of technology. If there are no plans to eventually reduce the LCR or the financial benefits to which it is attached, or if there is no quality assurance program, then such LCRs can lead to a reduction in quality.

3.3.3. Effectiveness Factors Using LCR in the PV Industry

The following section will assess some of the effectiveness factors that empirical analysis generally agrees with. The five factors that are considered as basic conditions, which are necessary for the LCR to create value in the economy:

i. Market size and stability
The role of the LCR will be significant if it is introduced gradually in a stable market with sufficient potential. Otherwise, businesses will not be interested in investing in domestic manufacturing. Apart from market stability, adequate market size is also an important prerequisite for generating the welfare effects of using LCR. This ultimately depends on being able to offer a stable demand. In the absence of such demand, the higher costs of LCR may discourage investors from entering this market.

ii. Limits of LCRs
The LCR can function, but only if the proportion is not too high and done in stages. The LCR works best when the government does not set the required domestic proportion too high. The appropriate rate is a function of the volume of production and the opportunity cost of capital. Since fixed costs (e.g. buildings and machinery) often make up a large part of the total source cost in the local economy, the opportunity cost of capital plays an important role in determining the optimal LCR rate. Production volume is related to market size and demand. If demand is small, production volumes will also be reduced, drastically reducing the level of local content where the maximum net profit is achieved.

iii. Cooperation and financial incentives
Cooperation in the manufacturing sector may include, among other things, the integration of certain activities or services. When the government prepares for the introduction of LCR beforehand with local businesses and when combined with some form of subsidy they are likely to produce positive welfare effects. Preparing LCR with local businesses is intended to increase certainty and information on both sides. The government can learn how to determine the LCR rate, while local businesses can prepare for cooperation to prevent the entry of new foreign intermediate goods manufacturers that could threaten their growth.

iv. The potential for learning by doing and technological knowledge
"Learning-by-doing" is a key argument for LCR proponents for RE. This means that producers can reduce costs only through the efficiencies learned that come from experience. These are so-called "spillover effects" policies, such as LCR, which enhance RE adoption. However, LCR is more effective when there is little local knowledge of the technology whose components now need to be purchased domestically. However, if the knowledge gap between local and foreign companies is too wide, LCR will be ineffective in convincing local firms to jump over the gap.

3.3.4. Barriers to Market Entry to Localize Solar PV Manufacturing

Although the potential benefits of developing the local PV manufacturing industry are numerous and attractive, they are not guaranteed. The global solar industry has grown significantly in recent years, is now relatively mature, and this poses a significant barrier to entry into countries with limited solar manufacturing capabilities.

The feasibility of entering a particular part of the value chain depends on three issues, technical barriers, financial barriers, and global market competition. The barriers for different parts of the PV value chain are summarized in the Table 2 below.

Table 2. Market entry barriers to localizing solar PV manufacturing

Component	Technical Barriers	Financial Barriers	Global Market Competition
Crystalline silicon cells			
Polysilicon feedstock	High technical skills are required. Complex production line	High capital costs ($500m-$1bn per plant), long lead times to add capacity, energy-intensive	Industry dominated by 7 companies supplying around 90 percent of the total polysilicon market
Ingots and wafers	As above	High capital costs but standard production facilities can be bought off the shelf	Dominated by 5 companies sharing over 90 percent of the market
Cells	As above	High capital costs for the manufacturing line, economies of scale needed	Many players. Top 10 producers in 2008 produced just over 50 percent of the total
Thin-film cells	Complex manufacturing line, intensive training of workforce required	Small-scale equipment can be bought off the shelf, but capital costs increase with plant size	Very dynamic, many start-ups
Modules	Low technical skills required	Capital and energy requirements much lower than other processes	Large no. of module manufacturers. Many leading module manufacturers are also cell manufacturers. The main differentiating factor is efficiency
Glass	High technical skills required	Capital and energy-intensive	Very large demand required, only specialized glass can be used for PV applications
Balance of systems			
Inverters	Highly skilled professionals needed for R&D and quality management	High investment cost in manufacturing equipment and quality inspection site	Large demand is required to build a production line. Market dominated by a few global players
Batteries	Medium-skill electronic assembly and quality control	Med-low investment cost	Existing battery manufacturers can also supply standardized batteries for the PV industry
Transformers	Medium skill electrical training	Investment costs are fairly low	Mature and competitive industry, but with room for growth
Steel structures and cables	Low technical skills required	Low investment cost	The existing industry could integrate another product

(Source: Deutsches Institut für Entwicklungspolitik, 2013)

3.4. International Frameworks on Solar PV LCRs

Even though it is explicitly prohibited under the WTO, LCR is still being used for the development of the infant industry worldwide. Both developed and developing countries use it frequently or have suggested using it for RE policies. Following are some examples of LCR implementation in the PV industry in several countries:

Table 3. International frameworks on solar PV LCRs

Country	PV LCRs Policy	Government Target	Installed Capacity per 2019 (IRENA)
China	China's policies continue to provide incentives to investors. This policy encourages technology transfer and technology learning through joint operations to develop the PV industry in China. The Clean Development Mechanism (CDM) program should belong to China.	1.582,9 GW (2030)	205 GW
United States	In the US, many states require domestic content. For example, Massachusetts Commonwealth Solar II provides discounted prices for solar PV installers. In addition, from the basic incentives, further incentives are available for PV with components manufactured in Massachusetts.	135 GW (2030)	60.54 GW
Germany	Germany has an export-based economy. Despite this, the country's PV sector is still highly competitive even without local content requirements in German law. Even if the country uses imported panels, more than 50 percent of the balance value of the system components can still be domestic.	66 GW	48.96 GW
India	The Indian government requires 51% domestic equity ownership for the PV industry. This obligation is intended to encourage technology transfer by global players and to compel multinational companies to use locally sourced components and labor. In 2010, the government launched its most ambitious RE program, India's Jawaharlal Nehru National Solar Power Mission. One of the conditions, the project must use modules produced in India.	100 GW	34.83 GW
Italy	Italy provides an additional 5% to 10% incentive for developers seeking components in the EU region. This makes national legislators unlikely to discriminate against other EU countries.	50 GW (2030)	20.9 GW
Vietnam	There is no local content requirement for PV solar power plants in Vietnam. In addition, solar PV developers must focus on meeting certain technical requirements such as efficiency and module quality.	17.6 GW (2030)	5.6 GW
Canada	Local content requirements are defined as originating from the province. Ontario has implemented PV local content requirements since 2009. Ontario's local content requirements are combined with Feed-in Tariffs (FiT). If the required share of local content is not met, then the PV developer is not eligible to receive a higher FiT.	30% RE mix by 2030 (Solar PV 3%)	3.3 GW
Malaysia	Malaysia's Renewable Energy Bill in 2010 predicts a variable feed-in tariffs related to local PV content requirements. The scheme provides for payment of basic FiT rates. The solar PV producer receives a FiT payout bonus when a local build or assembly component is used.	20% RE mix by 2025, solar PV is the major RE resource	882 MW

3.5. Indonesian Framework on Solar PV LCRs

The policy and regulatory framework are considered to be an important determinant of the exact rate of LCR and the expansion of the solar power market in Indonesia. Currently, local modules are more expensive than imported modules, with import module prices ranging from USD 0.25 - 0.37/Wp compared to USD 0.47/Wp average local modules (IESR 2020). In addition, in some cases, the use of local modules will also reduce the bankability of solar projects because lenders consider local modules to be less durable than imported ones (IEEFA, 2019).

Therefore, the Indonesian government is developing a strategy to strengthen the local solar power industry and refine existing policies and regulations that will boost the domestic solar energy market. Based on Presidential Decree No. 24/2018, the government established a program called the National Team for Increased Use of Domestic Products (P3DN). The intended function is to coordinate, advance, monitor and evaluate the implementation of the use of domestic products in the procurement of goods or services financed by the state budget (APBN) or regional budget (APBD).

Prior to developing a strategy for the development of the domestic solar PV industry, the Government of Indonesia has also enacted a local content requirement regulation through the Ministry of Industry. Currently, solar PV projects tendered by Government Organizations in Indonesia are subject to the LCR regulations stipulated by the Minister of Industry which refers to the Minister of Industry Regulation No. 05/M-IND/PER/2/2017 and No. 04/M-IND/PER/2/2017 as shown below:

i. Minister of Industry Regulation No. 05/M-IND/PER/2/2017[1]
   This regulation provides guidelines for the use of domestic products for the development of electricity infrastructure. This regulation effectively establishes a minimum threshold for local content values for both materials and services used in electricity infrastructure, including power plants, power grids, and substations. In this regulation, Solar PV is categorized as a power plant and is divided into decentralized off-grid PV system, centralized off-grid PV system, and centralized PV on-grid system.
ii. Minister of Industry Regulation No. 4/M-IND/PER/2/2017
   This regulation establishes the terms and procedures for assessing LCR for PV solar power plants. This regulation aims to increase the competitiveness of domestic industries by regulating how to calculate LCR for solar PV systems. In addition, it also informed the procedure for obtaining an LCR certificate from the Ministry of Industry.

[1] As an amendment to Minister of Industry Regulation No. 54/M-IND/PER/3/2012

4. Assessment on the Minister of Industry Regulation No. 5/M-IND/PER/2/2017

4.1. Overview of the Regulation

The Minister of Industry Regulation Number 05/M-IND/PER/2/2017 specifically sets the minimum threshold for local content values for both materials and services used in electricity infrastructure, including solar PV power plants. Specifically, the regulation categorizes the PV power plants into:

i. Decentralized Off-Grid Solar PV System
   Solar PV Systems without distribution line and directly connected to the electric load. Example: Solar Street Light, LTSHE & Solar Home System.
ii. Centralized Off-Grid Solar PV System
   Solar PV Systems that produce and directly distribute the electricity to the load demands, which are not connected to the utility grid (PLN).
iii. Centralized On-Grid Solar PV System
   Solar PV Systems that produce electricity and feed it to the utility grid (PLN).

The LCR details for each solar PV component are mentioned in the table below:

Table 4. Table 1 LCRs for each solar PV components

Decentralized Off-Grid Solar PV System		Centralized Off-Grid Solar PV System		Centralized On-Grid Solar PV System	
Component	**LCRs**	**Component**	**LCRs**	**Component**	**LCRs**
PV Module	40%	PV Module	40%	PV Module	40%
Battery	40%	Battery	40%	Transformer	40%
Battery Control Unit	10%	Protection System	20%	Protection System	20%
Cable	90%	Cable	90%	Cable	90%
PV Mounting (Pole)	42.4%	PV Mounting	42.4%	PV Mounting	42.4%
		DC Combiner Box	20%	DC Combiner Box	20%
		Distribution Panel	40%	Distribution Panel	40%
		Energy Limiter	40%		

4.2. Regulation Analysis

4.2.1. Local manufacturing capacity and market demand

Regulation of the Minister of Industry No. 5/M-IND/PER/2/2017 increased the LCR of PV modules from 40% (2017) to 60% (2019) and back to 40% (2020). In this case, the LCR PV module must be regulated by considering the current local production capacity which is still <600 MW/year, and the readiness of the local industry in providing product quality standards. In order to increase LCR to> 60%, local manufacturers need to enter the upstream industry in cell printing which requires a significant increase in production volume. The current minimum value of LCRs as stipulated in the regulations for main PV components, such as PV modules, batteries, and inverters, will cause a significant increase in costs as contractors need to use local products that are more expensive than imported products. Local products are expensive because local manufacturers cannot operate their factories efficiently due to low market demand.

4.2.2. Access to international funding

The use of local modules can hamper developers from obtaining financing from international lenders as most local producers do not have the international license or tier 1 label required for solar modules to obtain funding.

4.2.3. Private sector involvement

In Minister of Industry Regulation No. 5/M-IND/PER/2/2017, LCR provisions for the procurement of goods/services do not apply to private companies. It only applies to projects that are financed by the state budget/regional budget. However, PLN requires an LCR in the tender for a privately funded power plan for the IPP project.

4.2.4. Labor requirement and production machine ownership

The 100% local labor and ownership of production machines regulated in the Minister of Industry Regulation Number 5/M-IND/PER/2/2017 may potentially discriminate against foreign direct investment (FDI) and is not in accordance with the Minister of Industry Regulation No. 16/M-IND/PER/2/2011 which allows the proportion of domestic and foreign shares.

4.2.5. Bankability and industry readiness

Currently, the LCR target for the balance of system components such as solar cables (90%) and DC combiner box (20%) is difficult to achieve due to international standard reliability testing & certification requirements which are still limited locally. Therefore, most DC cables and DC combiner boxes are still imported. In addition, product quality standards are not clearly defined in regulations to meet specific technical requirements, which are important for project developers who depend on international financing to fund their projects.

4.2.6. Regulation linkages

Minister of Industry Regulation No. 5/M-IND/PER/2/2017 should also refer to other relevant regulations, such as:

i. Minister of Industry Regulation No. 68/M-IND/PER/2015 concerning the Provisions & Procedures for Calculating LCR Value on Electronic & Telematic Products.
ii. Minister of Industry Regulation No.3/M-IND/PER/2014 concerning the Guidelines for Increasing the Use of Domestic Products in Government Procurement that is not Financed from the APBN/APBD.

5. Assessment on the Minister of Industry Regulation No. 4/M-IND/PER/2/2017

5.1. Overview of the Regulation

Minister of Industry Regulation No. 4/M-IND/PER/2/2017 is intended to promote local PV module industries. It establishes the terms and procedures for assessing LCR for PV power plants. It also informs the procedure for obtaining an LCR certificate from the Ministry of Industry. The local content of Solar PV systems is calculated using weighting system for individual good and service components, as follow:

Table 5. Weighted percentages for each solar PV systems

Decentralized Off-Grid		Centralized Off-Grid		Centralized On-Grid	
Components	**Weighting %**	**Components**	**Weighting %**	**Components**	**Weighting %**
Goods					
PV Module	40,50	PV Module	13,14	PV Module	40,50
Battery	22,05	Battery	25,20	Transformer	5,40
Battery Control Unit	10,59	Inverter & SCC	13,50	Inverter	13,50
Cable	7,94	Cable	7,20	Cable	3,60
PV Mounting	6,65	PV Mounting	20,70	PV Mounting	10,80
Accessories	2,65	DC Combiner Box	3,06	DC Combiner Box	5,40
		Distribution Panel	2,70	Distribution Panel	6,30
		Protection System	1,80	Protection System	4,50
		Energy Limiter	2,70		
Services					
Shipping	6,67	Shipping	4,67	Shipping	2,20
Installation	3,33	Installation	3,33	Installation	5,40
		Construction	2,00	Construction	2,40
Total	100		100		100
Required local content value: for materials minimum 39.8% for service 100% combined local content value minimum 45.90%		Required local content value: for materials minimum 37.5% for service 100% combined local content value minimum 43.72%		Required local content value: for materials minimum 34.1% for service 100% combined local content value minimum 40.68%	

Furthermore, the regulation also specifies the weighting percentage of individual sub-components of PV module and its materials:

Table 6. PV module materials weight percentage

PV module	
Items	**Weighting %**
Solar PV Module Materials**	91,00
Labor	5,00
Production Machine	4,00
Total	100

PV module materials	
Items	**Weighting %**
Solar Cell**	50,00
Tempered Glass	12,00
Junction box	8,00
Back sheet	4,00
Frame	9,00
Film Eva	4,00
PV Ribbon	2,00
Solar silicon	2,00
	100

Solar cell	
Items	**Weighting %**
Silica sand supply	2,50
Silicon metallurgical grade making	7,50
Silicon solar grade making	15,00
Ingot making	5,00
Brick making	2,50
Wafer making	2,50
Blue cell making	7,50
Cell printing	7,50
	100

5.2. Comparing regulation's weighting percentage with actual project cost

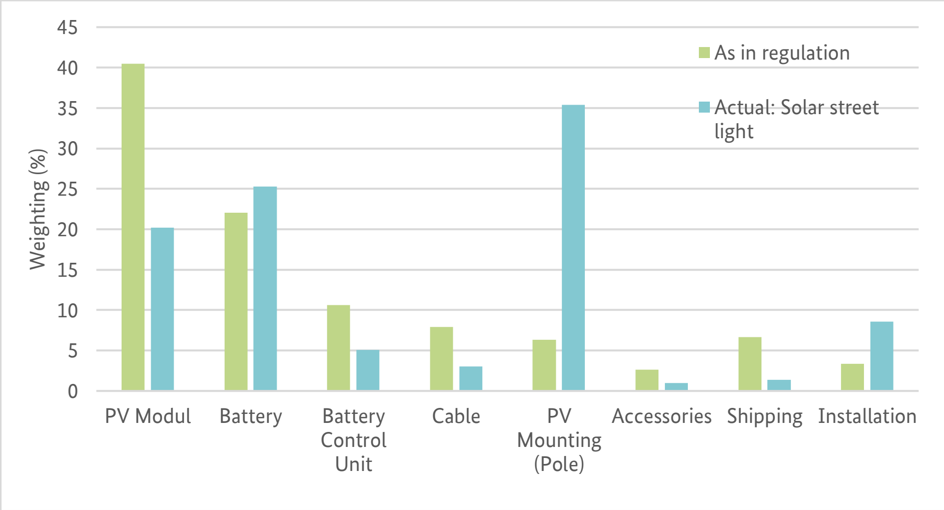
In this section, the component's weighted percentages for each component of the PV system based on the Minister of Industry Regulation No. 4/M-IND/PER/2/2017 are compared with actual cost components of solar PV projects with various system capacities, to see if the weighted percentage for calculating PV project's LCR reflects actual project cost components.

5.2.1. Decentralized Off-Grid Solar PV System

The decentralized off-grid solar PV system has 3 (three) different types of systems: solar streetlight, LTSHE & solar home system (SHS). This system has many configurations, which in the end affect cost components, e.g. solar streetlight which requires battery, LED lighting and pole compared to SHS which do not require dedicated poles or LED lighting

This chart below is an example of comparing the regulatory weight percentage and actual data for a 30-watt solar streetlight. However, several main components have a significant influence on the cost structure which are not mentioned in the regulation, such as LED lamps. Based on the graph below, a significant difference in the weighting percentage was found. For example, a PV Module has a weight of 40.5% in the regulation, but it actually only weighs 20.2% in the estimated cost, which is 50% less. On the other hand, the weight of battery and PV mounting in the regulation are much higher than the actual estimation cost.

Figure 8. Weighting comparison of 30-watt solar streetlight

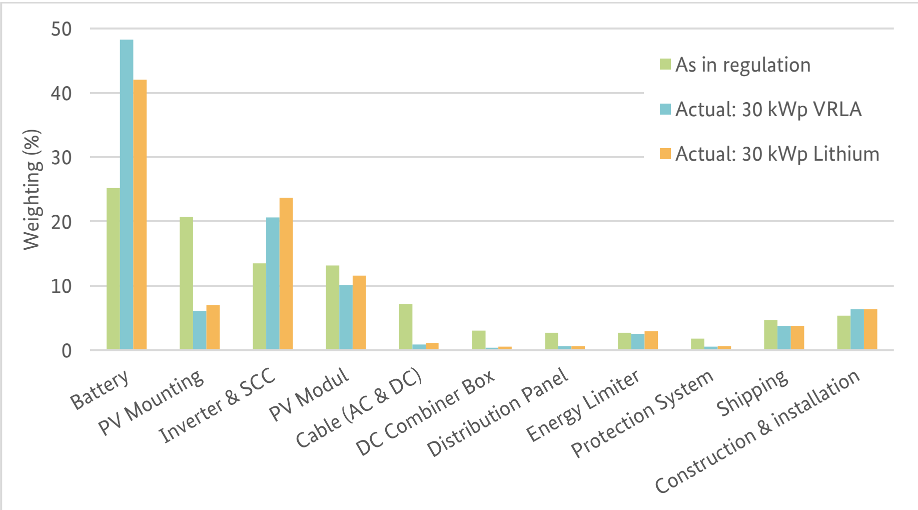


5.2.2. Centralized Off-Grid Solar PV System

Similar to the decentralized off-grid solar PV system, this system has several balance of system components missing that have significant impact on the cost structure such as powerhouse, which would contribute 5-10% of total cost. Based on the regulation there are also weighting provisions for installation which are usually included in the construction cost. Therefore, in this calculation simulation installation costs are combined with construction costs.

Based on the graph below, a significant difference in the actual and weighted percentage was found. Batteries, inverters and solar charge controller generally have higher costs percentage than specified weights in the regulation. In line with this, other components, especially PV mounting, cable and installation cost much less than respective weight percentage in the regulation.

Figure 9. Centralized off-grid solar PV system [2]



[2] PV systems with lithium-ion battery generally costs higher than VRLA battery.

5.2.3. Centralized On-Grid Solar PV System

Based on the type of mounting system, the centralized on-grid solar PV is divided into 2 (two) categories, i.e. centralized on-grid solar PV system (rooftop) and centralized on-grid solar PV system (ground-mounted). The simulation shows that the percentage of the actual weight of the solar module is higher than the set one. The graph also shows that the PV module & installation percentage increases with increasing capacity. For the PV rooftop, mostly there is no need for transformer. For the ground-mounted IPP project, the cost of transformer declines as the PV capacity increases. In this simulation, installation cost is included in construction cost.

Figure 10. Weighting comparison of centralized on-grid solar PV System (rooftop)

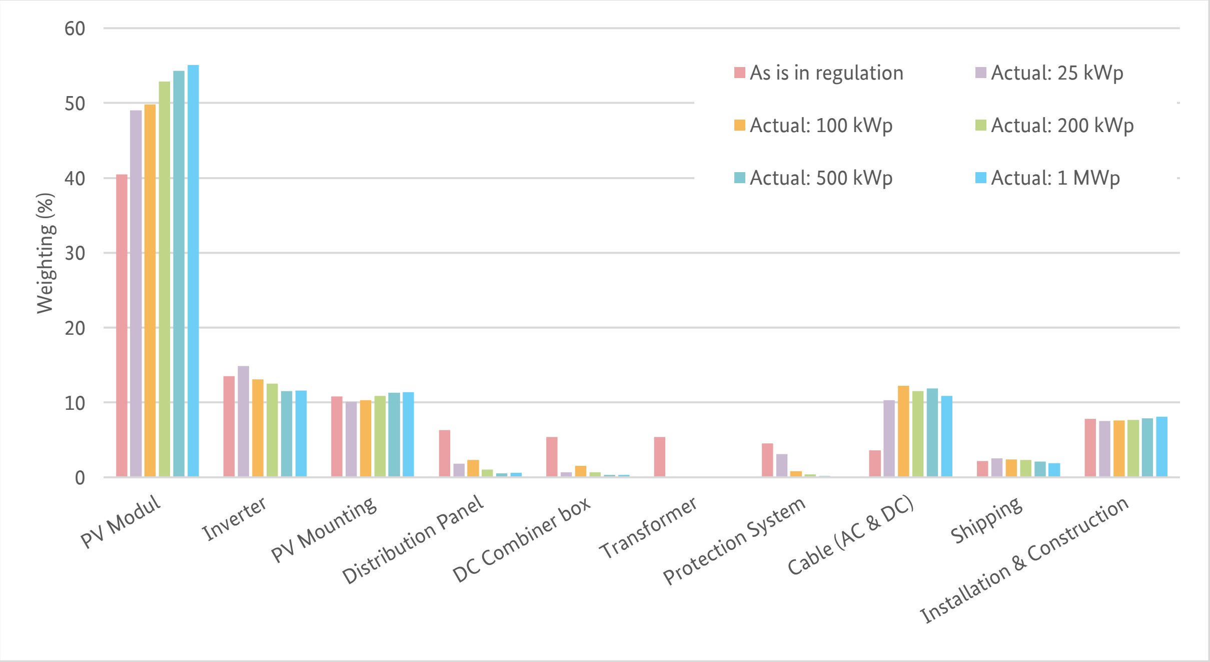
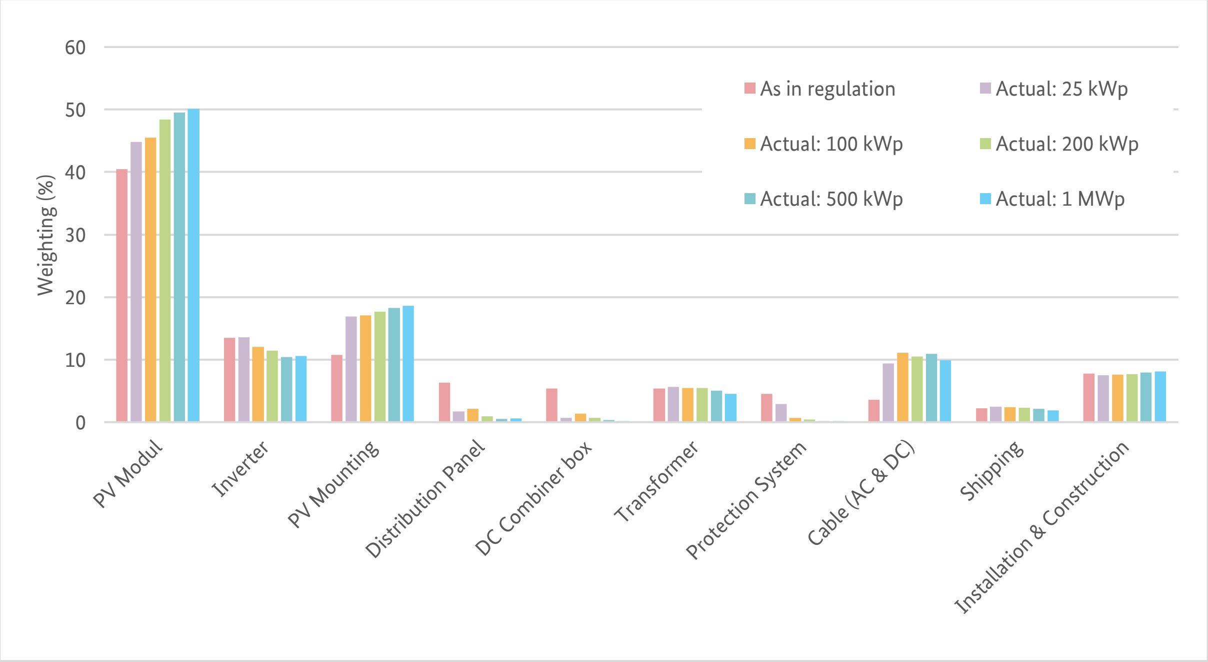


Figure 11. Weighting comparison of centralized on-grid solar PV System (ground-mounted)



5.3. Regulation Analysis

5.3.1. LCRs calculation procedure

The LCR calculation procedure for PV systems uses the weight-based method, which bases on fixed scales for each product and service component. Weight-based method is normally used to promote local production of certain components. The direction to prioritise local production of certain components should also consider the technology innovation potential (ITCSD, 2013).

However, it is observed that the weighting percentage for the same components under different systems is rather inconsistent. For example, weighting percentage of PV module is set at 40.50% for off-grid distributed system and on-grid centralized system but 13.14% for off-grid centralised system. Authors assume that the formulation of weighting percentage in this regulation also considered different system configurations and proportion of component costs.

Improper weighting of PV system components can lead to unfair treatment to manufacturers. For example, most of the weights in current regulations are mainly for PV modules, inverters and batteries which are hardly produced locally at competitive price. Whereas, in current condition, BoS components which are given smaller weighting percentage have greater chance to be made locally at competitive price.

5.3.2. Weighting percentage

Ideally, the weighting percentage should also reflect consistent proportion of system component costs. A significant difference in the weighting percentage is obtained after comparing the actual project costs with those stated in the provisions.

Solar PV system may have different configuration requirements from one project to another. For example, the decentralized off-grid solar PV system consists of 3 (three) different types of systems: solar streetlight, LTSHE & solar home system (SHS). For centralised off-grid system, battery technology and capacity requirement might differ depending on the locations. And for centralised on-grid system, the configuration might differ in the PV mounting methods: rooftop or ground mounted. It is also noted that some components have higher cost percentage as the capacity increases (e.g. PV module). All of this will affect the proportion of system component costs.

On the other hand, Minister of Industry Regulation No. 16/M-IND/PER/2/2011 uses a cost-based calculation where the criteria for calculating the percentage of LCR weight of goods (see Article 2 paragraphs 1-3) are based on the comparison between the price of finished goods minus the price of foreign components. up to the price of the finished goods. This means that all costs related to the product need to be calculated, including direct material costs, direct & indirect labour.

5.3.3. PV module material's weighting provision

Most of the upstream products specified in Minister of Industry Regulation No. 4/M-IND/PER/2/2017, lack consistency in its LCR stipulation, according to Minister of Industry Regulation No. 16/M-IND/PER/2/2011 and Minister of Industry Regulation No. 68/M-IND/PER/8/2015 (if applicable). For example, there is no such weighting definition for LCR blue cell and cell printing in the Indonesian PV industry. Therefore, this requirement will be difficult to achieve, because all upstream products must meet international product certification, reliability testing, and meet bankability standards.

5.3.4. Support components

Other components such as powerhouse and BRC fence are not specified in the LCR calculation procedure. Considering that these components also have a relatively significant impact on the cost structure.

5.3.5. Shipping & installation cost

The predetermined method of calculating shipping and installation costs at 10% of the total costs does not meet the actual cost structure of a project. Most of the products or components made come from the island of Java, whose installation areas are scattered throughout the country. The implication, logistics costs will be different in each location to the total cost. Therefore, the pre-determined 10% share for delivery, installation and/or construction at the LCR cannot be applied as a general rule nationally.

6. Recommendation

6.1. Regulatory and Policy Support

One of the most widely cited factors that determine the effectiveness of an LCR is the size and stability of the local market. Manufacturing in small or volatile markets is unlikely to achieve the economies of scale required for cost-effective production. For example, in order to build a solar cell factory, a market guarantee of 300MW for 5 years is needed to break even considering the huge investment. Therefore, government should provide short term and long-term commitment towards deployment more solar PV systems. This will create a market that manufacturers would be willing to invest in solar cell plants.

Once the market is developed and local products have acceptable quality with competitive price, the government could develop LCR regulation which should be implemented gradually. The LCR implementation should also be complemented with incentives to stimulate local industry. For example, LCR could be combined with Feed-in Tariffs (FiT). If the required share of local content is met, then the PV developer is eligible to receive a higher FiT.

While developing the market, the government should ensure that local products could be in par with widely available international products. This could be done by employing technical standard for available product. The technical standard will ensure smooth operation and safety aspects of PV system while increasing the quality of local products. The government could also provide grants for R&D activities that help local producers adapt and improve technology and processes to meet international standards.

The LCR can only function if the required proportion of domestic content is set at the right level and gradually implemented. The exact rates are a function of production volume and opportunity cost of capital. Therefore, the implementation of the LCR must continue to reflect and adjust policies for improvement.

Local industry development of solar PV should be discussed and coordinated among relevant ministries (e.g. MoI and MEMR), PLN, project developers, financial institutions, EPC company and manufacturers are required to align perspective and formulate policies which balances PV market development and local industry creation.

6.2. Calculation procedure

The inconsistent weighted percentage of the PV components in each type of system needs to be further reviewed to better reflect actual project cost components and various PV system configurations. Different configuration of the PV system will affect share of cost component. Thus, combining smaller-cost components might help reduce complexity and bias in the weighting percentage. E.g. balance of system which includes cable, protection system, transformer, DC combiner box, etc.

The LCR percentage for shipping, installation, and/or construction costs does not meet the actual cost structure of a project due to differences in logistics costs for each location. Therefore, the pre-determined 10% share in the LCR% cannot be applied as a common rule nationally.

6.3. Industry readiness in providing products with standard quality

The current LCR needs to consider the readiness of the industry to provide solar modules and other solar PV components of good quality. Because the product must meet international product certification, reliability testing, and bankability standards. Without the technological skills needed to learn and improve, LCR will only help companies sustain their activities but will not help them develop a competitive advantage.

The LCR targets for components such as solar cables and DC combiner boxes have barely been achieved. Due to international standard certification and reliability testing requirements, most solar cables and DC combiner boxes are still imported. Therefore, this target must be reviewed, as well as other components that consider the capabilities and readiness of local industries.

In a solar PV system, all other components have the opportunity to be produced locally to increase the LCR percentage for a PV system project. Therefore, the Indonesian government must also promote and improve other local solar PV components and maintain their quality so that they meet minimum standards or even higher than international standards.

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