

Business Model for School Rooftop Solar Power Acceleration in West Java





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Business Model for School Rooftop Solar Power Acceleration in West Java

SUMMARY FOR POLICYMAKER

The challenges in the implementation of rooftop solar power plant, which is one of the priorities of the West Java Provincial Government to accelerate the utilization of renewable energy, include two main things. First, PLN's basic electricity tariff (TDL) for school customers belongs to the 'S-2' social category which tends to be very low, so that if the value of electricity utilization from rooftop solar power plants is used to compensate for the return on investment, the return on investment period becomes too long¹. Secondly, schools are only allowed to pay bills for 'electricity usage' to PLN², therefore making it difficult to make payments for investment in electrical equipment with a substantial value (up to several hundred million rupiah per school for example).

To overcome these challenges, as a first step this study seeks to clarify two preliminary questions, namely [a] how to provide a large amount of financing for the procurement of rooftop solar power plants, and [b] how the technical procedures for payment (return of initial investment) should be completed to the rooftop solar power plant equipment provider/supplier.

The accelerated implementation of rooftop solar PV in West Java can be pushed for the next few decades, starting with public sector funding support (State Budget/Regional Budget) and then pushed faster with financing contributions from private businesses and non-profit organizations/other development partners. The implementation challenges of funding-business coordination, system-technical coordination and personnel-management coordination into three sides of the development of a management entity (in this study can be called a UPT-like entity) are elaborated to provide some proposals for the structure and work pattern of the 'platform manager', accompanied by examples of activity descriptions and work documents that can be an initial reference.

The BUMD, which this year will be assigned to accelerate the implementation of rooftop solar PV, PT Migas Hulu Jabar (MUJ), which has been operating in the energy sector, can play a basic role in the formation of a business entity that can operate immediately. The initial budget for the operating capital of the MUJ entity to be formed can be started from the West Java Regional Budget with a pattern of equipment procurement work that has often been done in the provincial environment, utilizing MUJ equity. This entity will later be able to continue raising business capital, either through cooperation with private business entities, solar power plants equipment suppliers, banks or other financial services providers, as well as other non-profit institutions that can manage development partner funds / other private funding. Consideration should also be given to ensuring the long-term operational and financial sustainability of the entity, given that rooftop solar PV installations are expected to operate well for up to 20 years, or more.

Business model for rooftop solar PV implementation, JV business-partnership scheme

The work plan through BUMD operations will also need to follow the governance rules related to the management of West Java Province's budget allocation. Specific regulatory studies will be important to guide the work of the business entity (with operations similar to UPT, within the BUMD organization, or

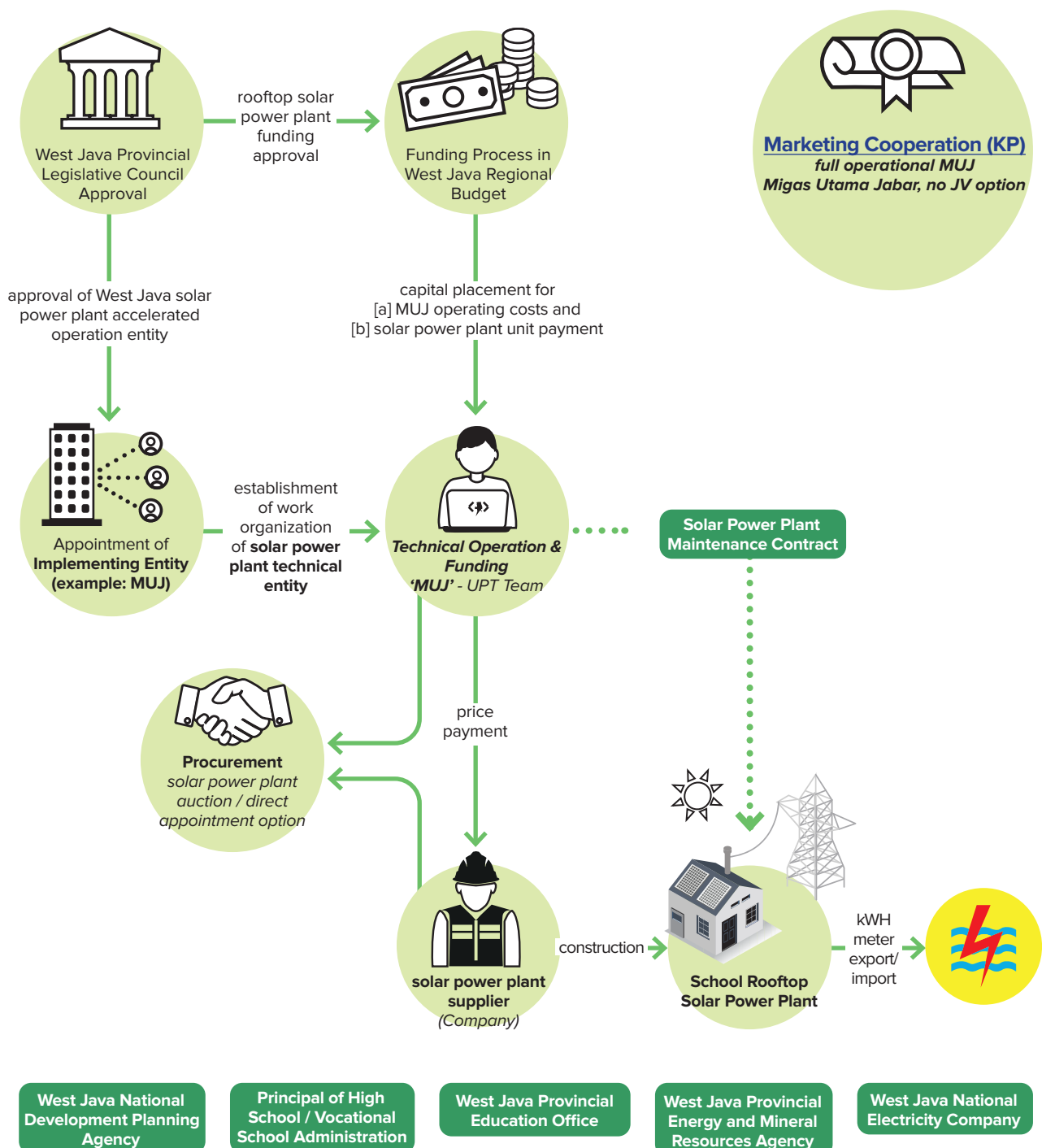
¹ Investment in rooftop solar power plants for school buildings can be substantial, and generally gets a return on investment from electricity bill relief after rooftop solar power plants operation (savings with export-import kWh meters). However, if the public schools (SMA/SMK) are generally connected to the TDL-PLN social tariff group, S-2 group for example, then the electricity price tends to be low (below Rp 1000 / kWh). The low social tariff of SMA/SMK makes the cost savings also lower, so the return on investment is affected smaller in magnitude, thus the return on investment period is longer. ►

² The school operational budget in West Java province only regulates PLN electricity payments, so it cannot be directly used to pay for "monthly installments of rooftop solar panels" ► a separate problem for the suppliers of solar power plants, which will be different from the procurement of solar power plants for other customers, for example for 5 - 10 years payback period (how is the application of budget rules in West Java, in one fiscal year, or can be multi-year)

a separate legal entity option) regarding the initial funding or additional equity of the business entity as a ‘platform manager’ for [a] working capital costs, working capital, and [b] solar power plants equipment investment costs. In addition, efforts to accelerate the installation of rooftop solar power plants will need to involve sources of capital outside of the West Java public budget, such as a joint venture scheme, a JV with the business entity supplying the solar power plants equipment (or a JV partnership option that could also involve local financial institutions, or Bank Jabar Banten BJB for example).

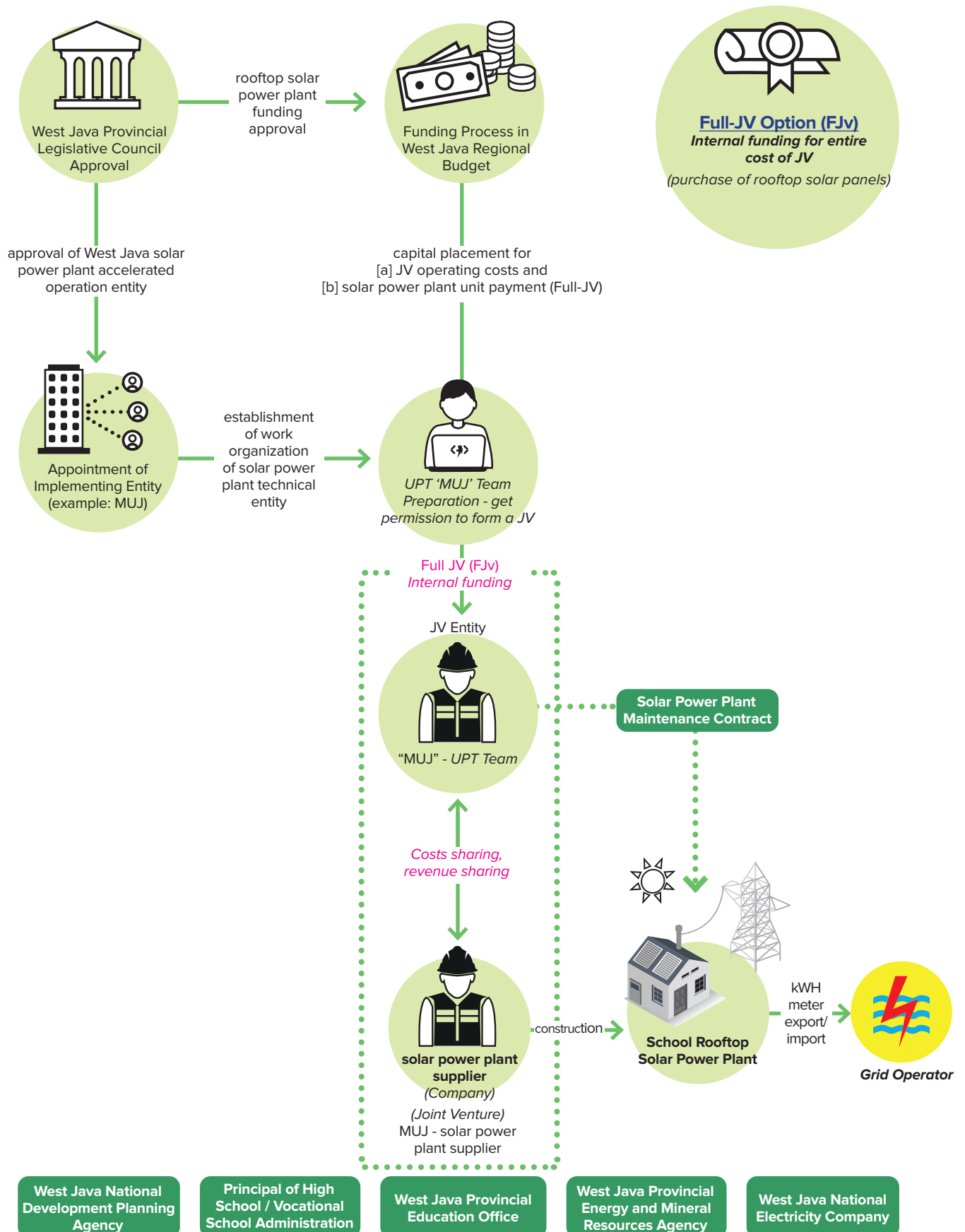
Starting with a simpler approach, a business model for a marketing partnership [KP] can be developed for a new business entity at a BUMD that has been assigned to implement rooftop solar PV. This model is a development of a common working structure, with a direct marketing [PL] scheme that has been applied to several schools and government buildings in Bandung.

Marketing cooperation [KP] scheme without JV entity



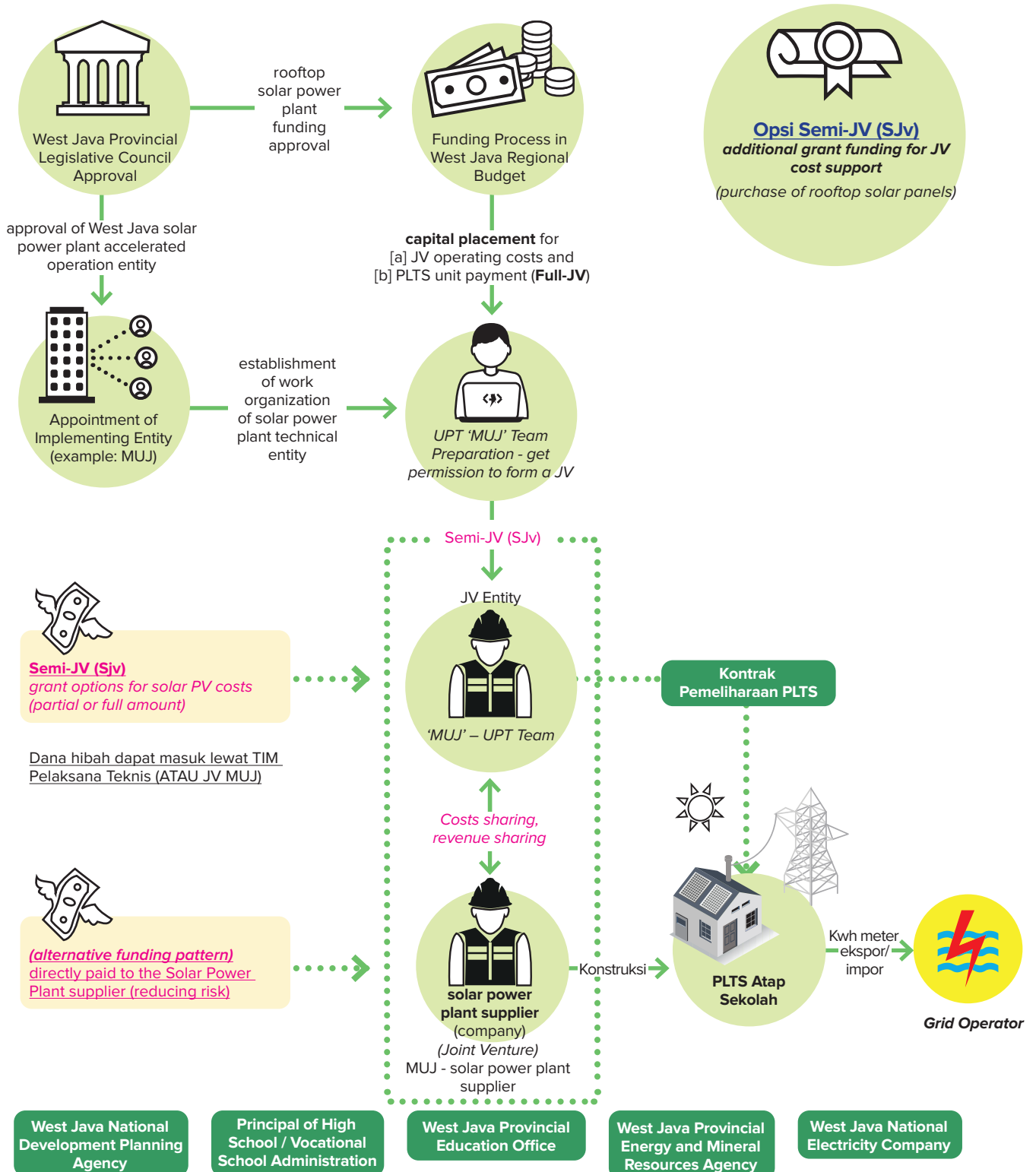
To provide effective synergies for capital capacity building and technical services, a full-commercial joint venture [FJv] scheme between the enterprises involved is described in this study.

Full commercial venture [FJv] partnership scheme, Full-JV



As an option to obtain alternative sources of financing such as blended-financing, other public funding sources, as well as grant schemes and innovative funding involving the private sector, a similar semi-JV [SJv] business model is also outlined. This business model can be one of the solutions for utilizing the budget of the West Java Provincial Government, through BUMDs, supported by other private funding. The implementation of this [SJv] business model can be more complex in terms of accountability of blended-finance funds, which requires support for human resource capacity and institutional managerial skills that are agile and transparent, to ensure funding services for ‘clients’ (school managers) as well as long-term business sustainability.

Semi-commercial business [SJv] partnership scheme, Semi-JV

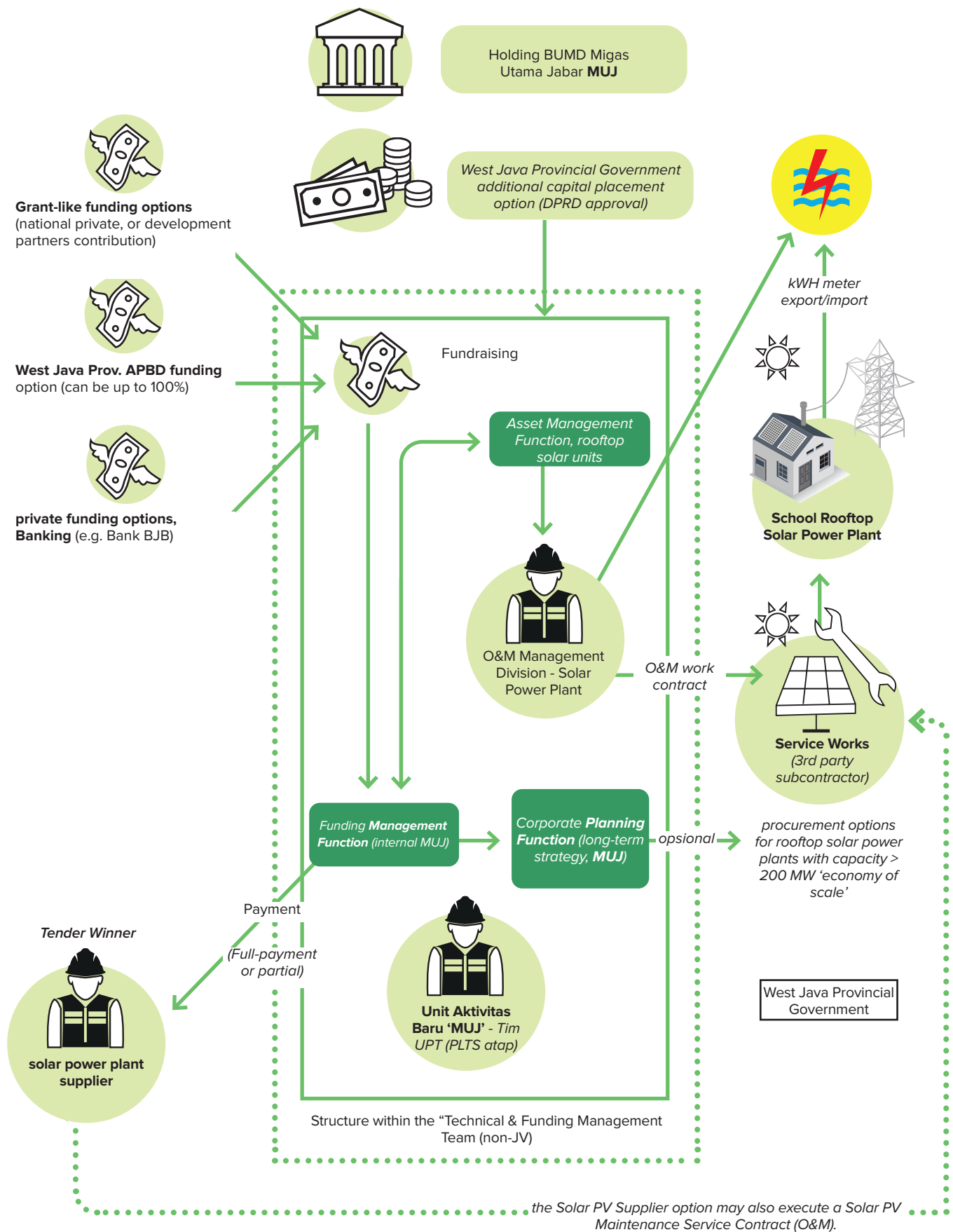


Furthermore, efforts to reduce the investment cost of rooftop solar PV equipment are important, considering that the current price per unit capacity, kWp is still considerably large. In addition, the urgency to be able to expand the reach of school locations in various parts of West Java is the impetus for efforts to accelerate the implementation of rooftop solar power plants. For this reason, a return on investment strategy can be prepared by calculating monthly installments, for example, which may be implemented directly by the School Management, or with assistance in operating costs from relevant private entities in achieving the target amount of cleaner renewable energy installations. As a follow-up, a focused study on local financial administration regulations and practices will be required, which can confirm the details of budget management for the return on investment needs of this rooftop solar power plant, through a monthly payment strategy or other relevant financial options, so that the capital owned can be further extended to the installation of solar power plants in the next location.

Internal coordination structure of the school rooftop solar power plant management entity

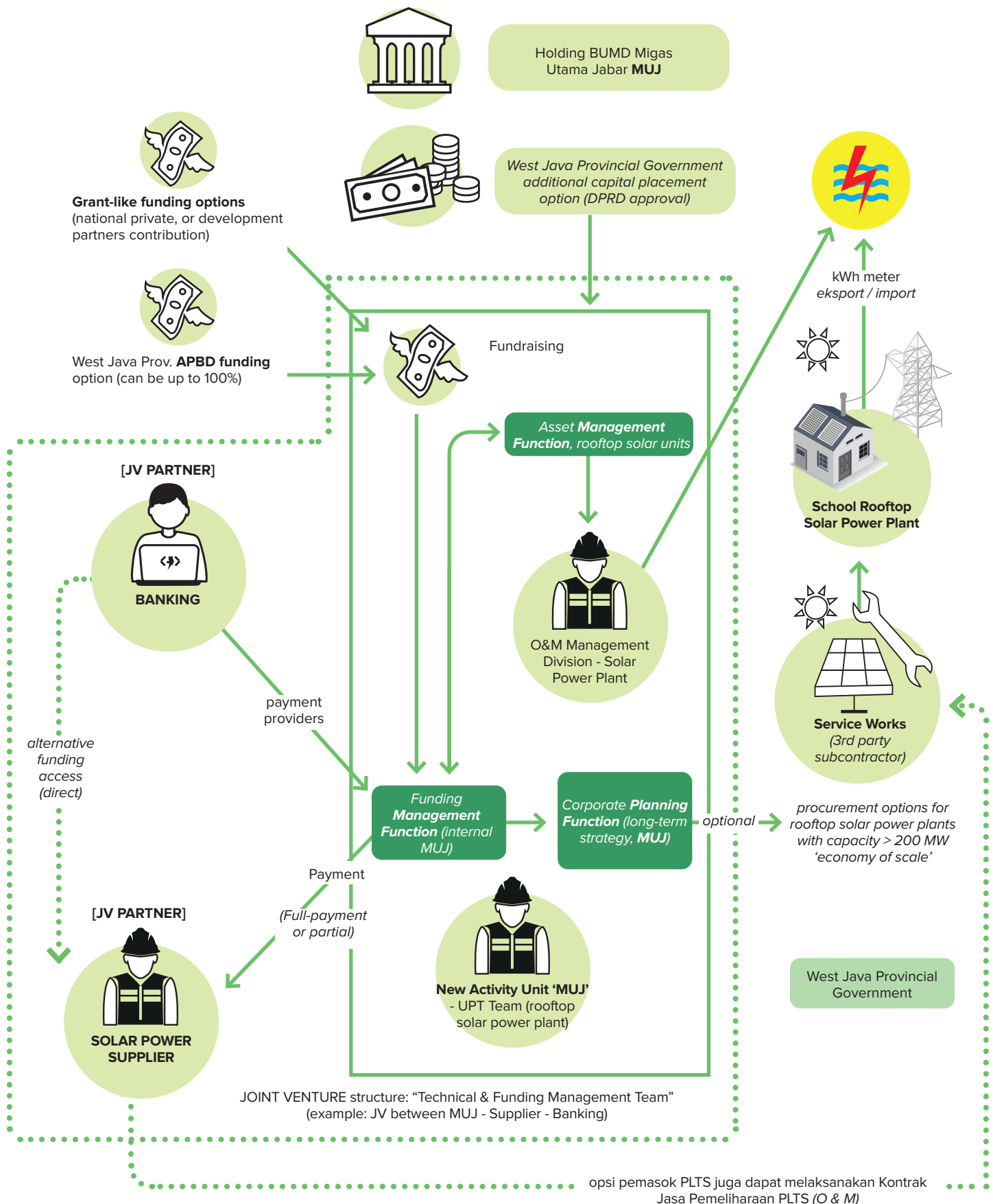
The operation of the rooftop solar power plant managing entity can be independent (without JV partnership), or, if required, it can also use the JV business-partnership option. In the rooftop solar power plant implementation entity ('platform manager') structure, the rooftop solar power plant generally performs [a] the Funding Management Function (pooling several funding sources and managing the rooftop solar power plant unit price payment scheme, including monthly installment options), and [b] the Asset Management Function (with maintenance/O&M contracts that ensure the long-term sustainability of the rooftop solar power plant operation). In addition, the implementing entity may in the long run also perform [c] Corporate Planning Function, depicted in the following scheme.

[basic scheme] Without JV Partnership, the internal coordination structure is simpler



In comparison to the JV option (e.g. partnership with the solar PV supplier and the banking/financing provider), the working structure within the executing entity is illustrated as follows.

[scheme JV-2] JV Partnership with Solar PV Supplier Company Partner and Banking Partner

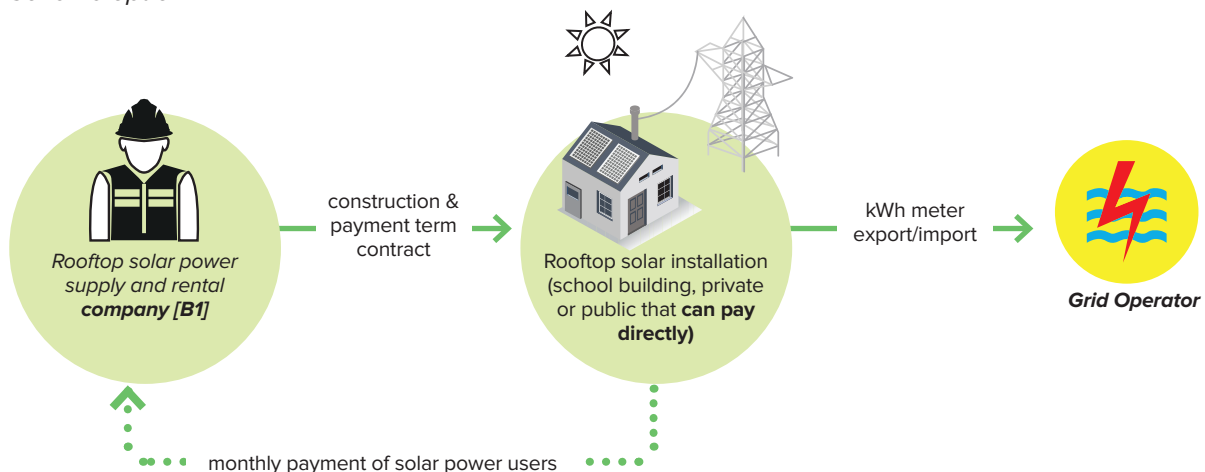


Fixed or variable fee agreement in a monthly payment scheme

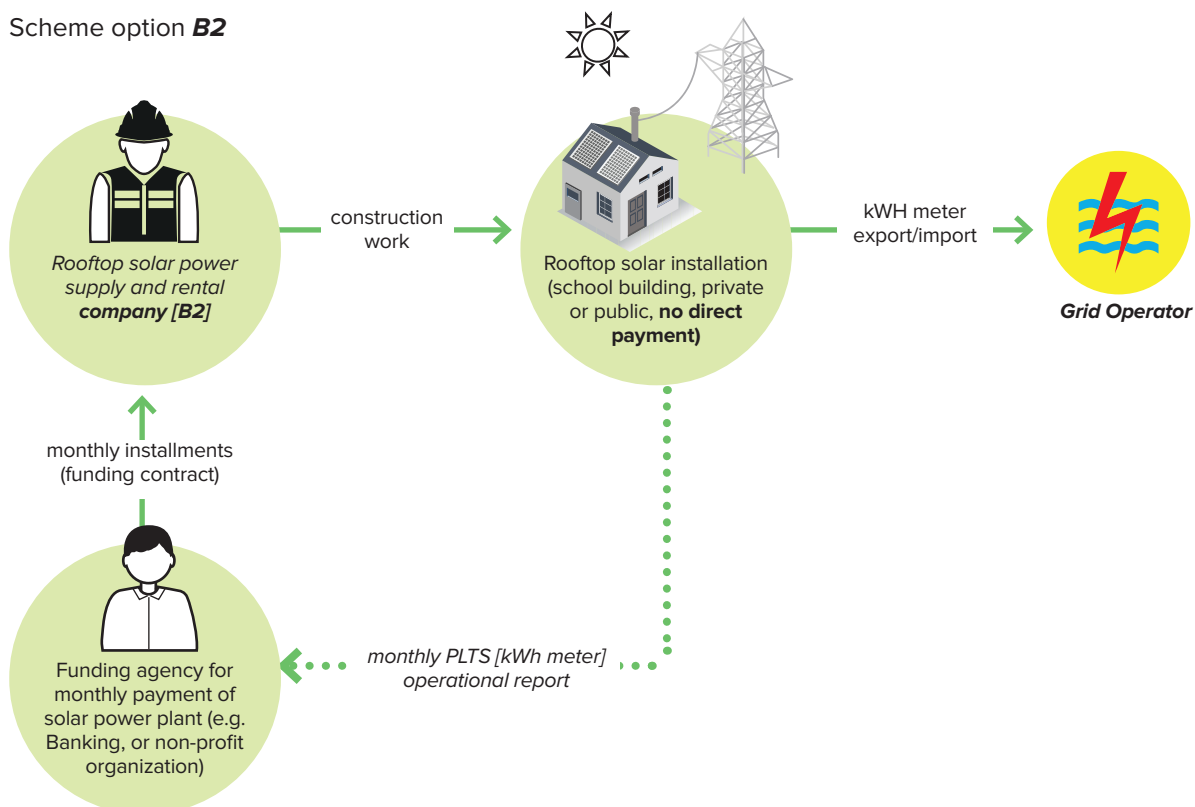
To maintain the financial sustainability of the school rooftop solar power plant management entity, it is hoped that it will be able to obtain a return on the initial investment from each school. The monthly installment payment scheme to recover the initial investment cost of the school rooftop solar power plant is described in the following diagram. In simple terms, scheme option B1 provides a pattern of direct payment from the School, while scheme option B2 illustrates a school that may be constrained by regulations to not be able to pay monthly installments for electricity consumption (for example, because applicable regulations only allow paying limited electricity consumption expenses to PLN).

[payment scheme] Schools that can pay the installment fee directly (B1), or it is not possible to pay directly (B2)

Scheme option B1



Scheme option B2



Alternative scheme B2 illustrates the possibility of an external institution that can act as a funder/payment manager. For example, a financial institution could play a role in managing the funds for the solar power plant, using existing budgets for example, or external funding such as philanthropic funds or other public grants, or financing initiatives similar to impact investment. The B2 scheme does not require the School Management to pay a monthly fee (if the prevailing regulations still do not allow the School to pay electricity expenses to parties other than PLN). The monthly payment obligation may be covered from the funding institution, to the rooftop solar PV supplier (or 'rental' service provider). In addition, the School Management must also provide continuous solar power plants operational reports, whose data can be obtained, among others, from the installation of export / import kWh meters (kWh ex-im). Thus, it becomes clear that the operational benefits of the school rooftop solar power plant installation are conveyed in periodic reports to the funding agency.

This study seeks to address two challenges to the implementation of school rooftop solar PV, namely the relatively low TDL of PLN for school customers (Social tariff, generally 'S-2') and the provision of electricity payments from school budgets only to PLN (unable to make payments to parties outside PLN for the provision of electricity, for example if generated from rooftop solar PV financed by non-PLN private parties). The urgency of two preliminary questions that were considered relevant, as mentioned earlier, have been answered in this study. First, the provision of financing for the procurement of rooftop solar PV is sought initially through the budget of the West Java Provincial Government, which could partly take the form of equity participation in BUMDs. Subsequently, the investment financing needs may be covered from non-budgetary fund contributions, such as from development-partners, grant-like funds and other philanthropy, both from public and private sources (from individuals, groups or corporations). Secondly, addressing the technical financing procedures that need to be resolved with the rooftop solar PV supplier, the proposed establishment of a cooperation or business-partnership/JV scheme could be an alternative solution, which could involve the solar PV supplier company and other financial, banking institutions. Good technical coordination within the rooftop solar power plants management entity (can be BUMD, or JV for example) can facilitate the need for initial investment payment, or if required a lighter monthly installment scheme, or a combination of both, given the challenges of payment procedures from the school for rooftop solar power plants procurement that may need to be overcome by multi-stakeholder funding collaboration.

Investments in solar power plants equipment in the early stages of the accelerated school rooftop solar power plants program may be able to utilize part of the budget allocation (Regional Budget for example) from the West Java Provincial Government to increase the capital of BUMD as the management entity. For example, in the first 5 - 8 schools, a public procurement could be applied to a solar power plants provider business entity, e.g. 10 kWp complete installation per school. For the next phase, it may be necessary to seek access to innovative sources of financing, such as third-party placements (e.g. banks, financial institutions) or blended-finance sources.

Further unanswered questions in this study include how the most effective strategy is to make the budget allocation to the JV entity (BUMD as 'platform manager') more catalytic in encouraging the implementation of blended-finance schemes, [SJv] an important finding of this study. A more detailed technical implementation will require a variety of technical information, data and recent work experience, in the field situation for the implementation of school rooftop solar power plants in West Java, because the technical data obtained from the field work is important in developing a strategy for managing funds from various blended-financing sources. Only by utilizing the West Java Provincial Government's capital placement in the JV entity as a catalyst, rather than as the main source of investment, can the acceleration of solar power plants capacity cover a much wider area of work, and not be limited only by the size of the available budget.

The analysis of this study concludes that the business model option that can meet the needs of accelerating rooftop solar power plants in West Java is managed by an entity formed by BUMD such as PT Migas Utama Jabar, MUJ. The structure of the managing entity can later partner with other suitable business parties, for example in a joint venture scheme. Recommendations can be made regarding [a] the business model implementation plan (available and accessible funding sources, managing various mixed funding sources, and alternative options in the carbon economic value instrument scheme); and [b] operational reporting of

school rooftop solar power plants (compiled as part of the West Java GHG inventory, and also included in climate change mitigation actions by expanding the scope of work that can be managed with the rooftop solar power plant business model as an accelerated increase in installed capacity that reaches general users, communities and businesses in West Java; and integration of PPRKD reporting schemes).

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ABSTRACT

The acceleration of clean energy utilization in West Java is implemented through rooftop solar power plants. The objective conditions for the use of electricity installations in school buildings, related to the rooftop solar power plant installation plan, are the imposition of the 'S-2' social PLN TDL (basic electricity tariff) group which is considerably cheap, still below Rp 1000/kWh, and the provision of school operational budgets for electricity use can only be paid to PLN (not to other business entities, thus posing a challenge for private investment that will enter the school rooftop solar power plant business).

The government budget allocation for the procurement of rooftop solar PV installations in local governments and schools in West Java has been running for the past three years, for 10 locations, and the investment costs are still not very competitive. This poses an additional challenge to accelerate the implementation of rooftop solar PV, as further allocations from the Provincial Government budget may be managed by a competent BUMD in the energy sector, PT Migas Hulu Jabar (Perseroda), 'MUJ'. The situation of limited budget encourages the identification of a business model that can operate more efficiently and eventually cover up to hundreds of schools that can install rooftop solar power plants.

The two preliminary questions of this study are how to provide a large amount of financing for the procurement of rooftop solar PV and how the technical procedure of payment (return of initial investment) should be completed to the rooftop solar PV equipment provider/supplier, are explained in several business model options. The study attempts to find a suitable business model structure, which could be a joint venture-partnership scheme: BUMD, Banking (Bank Jabar, BJB) and private business entities (technology provider, rooftop solar PV installation) collaborate to support the acceleration of rooftop solar PV implementation. The findings of this study are mainly in the form of a semi-joint-venture [SJv] scheme option. This scheme is expected to contribute to managing various sources of financing from government budget allocations, third-party funding/banking, private investment and development partners organization funds, as well as other grant or philanthropy schemes. The management of these mixed funding sources, which can be considerably complex, challenges the design of the JV entity's institutional structure and competent, professional human resources to maintain accountability for different funding allocations.

In addition to these findings, policy adjustment efforts, which can support the acceleration of clean energy utilization in West Java, will be required in the next few years. Detailed regulatory review, which has not been covered in this study, will be important to streamline school rooftop solar PV procurement initiatives in various cities/districts. The results of such efforts will be transformative for clean energy equipment procurement activities that need to achieve large-scale targets, and open up opportunities for private investment cooperation that are in line with the national roadmap to a low-carbon economy.

CLEAN ENERGY

FOR WEST JAVA

School Rooftop

Solar Power



Chapter 1 Introduction

1.1. Introduction

1.1.1. General condition

Over the past decade, developments in the implementation of the energy transition as an effort to mitigate global climate change start with the SARS-COV2 pandemic situation, show that the pattern of energy use is shifting from the need for transportation fuels to the wider use of electrical energy. This proves the existence of human adaptability in different activity patterns than before. The decrease in transportation activities around cities, as well as inter-regional travel, has proven to improve air quality that is directly felt by the wider community. In addition, the popularity of electric vehicles in this decade, starting from private vehicles and increasing to public transportation (electric buses and trains) has further encouraged energy transition efforts in many countries, towards the use of cleaner energy.

The Government of Indonesia is responding to the collective awareness to initiate a national energy transition, in line with the start of the 'commitment period' of the Paris Agreement³ this decade. The government's science-based policy understands that the energy sector is projected to be the sector with the highest GHG emissions by 2030, pushing Indonesia's energy transition to become one of the priorities of decarbonization efforts that began immediately last year. A massive increase in renewable energy capacity is seen as a global solution option, not just in Indonesia. In addition, the shift from fossil-based transportation fuels to electric vehicles, as well as the electrification of industrial and domestic energy supplies, are instrumental in decarbonizing the energy sector.

Indonesia's commitment is conveyed in the 2021 NDC-update and Enhanced-NDC⁴ (ENDC 2022, Annex-1) considers the renewable energy subsector to be very important. Rooftop solar PV is written specifically for residential applications, commercial and industrial buildings, in addition to integrated solar PV in electricity business areas (rooftop solar, PV-Wilus, Hydro-Wilus, Off-grid RE by 2030 to install 15,483 MW; and additional RE in Power according to RUPTL by 2030 to install 20,923 MW). The increase in ENDC ambition from 29% to 31.89% (unconditional) or up from 41% to 43.2% (conditional) means that the contribution of renewable energy becomes even more important.

Support from domestic (SOEs and national private sector) and international parties such as ADB (ETM, energy transition mechanism), UN-OPS (ETP, energy transition partnership), IEA (Energy-sector Roadmap to net-zero-emissions in Indonesia), G7 (JETP, just energy transition partnership), UNDP Indonesia and others strengthened this year. The active role of implementing regulations such as Presidential Regulation 98/2021 on the Implementation of Carbon Economic Value for Achieving NDC Targets and Controlling GHG Emissions has the potential to develop an emission permit scheme that encourages the implementation of rooftop solar PV as an option for compliance with its emission limits. The carbon tax scheme in the Law on Harmonization of Tax Regulations (HPP, Law 7/2021) can gradually suppress the operation of coal-fired power plants, in the national energy transition to renewable energy, also encouraged by the implementation of Presidential Regulation 112/2022 on the Acceleration of Renewable Energy for the supply of Electricity.

³ Paris Agreement works on a 5- year cycle of increasingly ambitious climate action carried out by countries. By 2020, countries submit their plans for climate action known as NDCs (verbatim) <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

⁴ Enhanced Nationally Determined Contribution (ENDC Indonesia, Sep.2022) <https://unfccc.int/sites/default/files/NDC/2022-09/ENDC%20Indonesia.pdf>

Stakeholders at the provincial level are also active in the implementation of Regional Low Carbon Development Planning, PPRKD in coordination with each Bappeda. Periodic reporting of PPRK-Aksara platform⁵ of Bappenas proves the commitment to low-carbon and climate-resilient development in this RPJMN 2020-2024. Some of the implementation in regional budget planning, the Provincial Regional Budget, is one of the evaluations of decarbonization commitment at the sub-national level, such as the increasing role of renewable energy. Gradually, the implementation of Bappenas⁶ for green economic development towards a net-zero-emission (NZE) target by 2060 or sooner is one of the main references for stakeholders. An active role in the provision of green finance coordinated by the Ministry of Finance is essential, given the limited domestic capacity and increasing opportunities for multilateral cooperation and domestic and foreign private institutions, which can accelerate regional physical development. Growing rooftop solar PV investment can become more integrated with the GHG inventory of businesses and user institutions, which will need to pay attention to the emission ceiling. The involvement of energy users in carbon economic value instrument schemes can be greater in the future, for example as an alternative funding option through the emission permit trading platform developed by the Ministry of Finance and the Financial Services Authority, OJK.

The PPRKD initiative of Bappeda West Java together with the Directorate of Environment, Bappenas (the memorandum of understanding of PPRK West Java Province was signed with Bappenas on April 2, 2019) puts the regional action plan “rooftop hybrid power plant” with a target size⁷ that is still temporarily low, where accelerated efforts with the Energy and Mineral Resources Office⁸ continues to be encouraged together with the Regional Heads. RPJMD⁹ of West Java explained the Government - Business Entity Cooperation (PPP) on one of the Strategic Projects (Construction of Rooftop Solar Power Plant at the Provincial Government Building), and Regional Development Priorities (ease of investing and assistance in the construction of power plants and EBT roadmap).

1.1.2. Study background

Indonesia’s clean energy transition seeks to replace fossil energy resources with renewable ones. The Ministry of Energy and Mineral Resources developed a renewable energy roadmap that also includes solar power, including the implementation of rooftop solar power plants in coordination with the Energy and Mineral Resources Office of West Java Province. The Champion Energy Program in the RPJMD-change includes developing the application of new renewable energy and energy diversification, namely by providing ease of investment, regulatory support, power plant construction (Regional Development Priorities 2018 - 2023, page VI-135). One of the greatest potentials in the tropics, for example, solar power plants (solar power plants) are widely applied on a micro scale (per unit of electric light for example), small (household scale, SHS solar home system), medium (building or group-building scale, area) to large scale (electricity interconnection network generation, utility-scale power grid) with some specific operating and investment characteristics.

The term ‘solar power plants’ because of its similarity with the naming of other commonly known types of power plants such as hydropower, PLTU, PLTP, PLTG and others (abbreviated as PLT- (*Pembangkit Listrik Tenaga*), from ‘Power Plant -’) is often connoted as a large system that operates

⁵ Implementation of low-carbon and climate-resilient activities as one of the Priority Programs in the RPJMN (Presidential Regulation 18/2020), with targets of [PN6 PP-3] Reducing greenhouse gas emissions by 27.3% and reducing emissions intensity by 31% in 2024; and [PN6 PP-2]. Monitoring, evaluation and reporting of PPRK-AKSARA is present as a transparent, accurate, complete, consistent and integrated platform for recording national low carbon development actions. <https://pprk.bappenas.go.id/aksara/>

⁶ PPRK Report 2021, A Green Economy for a Net-Zero Future: How Indonesia can Build Back Better after COVID-19 with the Low Carbon Development Initiative (LCDI, Sep.2021) <https://lcdi-indonesia.id/wp-content/uploads/2021/10/GE-Report-English-8-Oct-lowres.pdf>

⁷ List of action plans of West Java Province (3428 Total DRR Action Activities implemented) https://pprk.bappenas.go.id/aksara/aksara_dashboard_provinsi/

⁸ Strategic Plan of West Java Energy and Mineral Resources Office, 2018 – 2023 <https://esdm.jabarprov.go.id/wp-content/uploads/2019/09/Renstra-DESDM-2018-2023.pdf>

⁹ Amendment to West Java RPJMD 2018-2023, Table 2.101 “Strategic Projects with PPP Scheme”, solar power plants-roof: [2020] Planning Stage already has FS made by the British Embassy; [2021] Preparation of OBC; [2022] Preparation of FBC; [2023] Preparation of Market Sounding and Tariff Agreement. http://bappeda.jabarprov.go.id/wp-content/uploads/2022/07/Perubahan-RPJMD-2018-2023_V-08.12.2021.pdf

commercially. However, micro- to medium-scale solar power plants often use very simple equipment systems, usually having a fairly compact sheet of PV panels (photovoltaics) and power-electronics components, unlike other ‘power plants’ which tend to be complex. In addition, micro, small and medium-scale solar power plants generally supply the generated electricity to internal loads at the local site, and only if specifically designed will there be the option of distributing the electricity to loads outside the local power grid (so-called grid-connected), and limited to a certain number of times when it is appropriate.

The United Nations Partnership for Action on Green Economy (UN-PAGE) project through UNDP in collaboration with the Directorate of Environment-Bappenas, together with the West Java Provincial Government through the West Java Provincial Bappeda and other relevant Provincial Government Technical Offices and Bureaus developed several business model options for accelerating the implementation of school rooftop solar power plants, which are the development of rooftop solar power plant initiatives with business models that have been running, among others, at SMAN 3 and SMKN 4 Bandung. Focusing more on the work interaction and division of roles between several relevant parties in the school rooftop solar power plant business model, this brief study does not intend to explain the technical implementation in great detail, such as the condition of technical electricity connection, budgeting of investment costs or other operation-maintenance costs.

The results of this study are expected to provide input for an implementation plan that will integrate funding resources, technical management capabilities and procurement administration within the Provincial Government, regional-owned enterprises and school administrators. The acceleration of rooftop solar PV in West Java will be more optimal if the budget utilization does not burden the Provincial Government’s financial capacity for the long-term operation of the rooftop solar PV management entity (considering that the technical age of the equipment can be more than 20 years), with the support of other funding sources outside the Government budget.

1.2. Fundamental issues, objectives

1.2.1. Basic comprehension of business model

In simple terms, a business model is often understood as a business strategy for commercial interests, aiming for business profits that provide a return on initial investment as well as business scale development for competitive-edge business capabilities. Given the role of public schools, which are the target of this rooftop solar power plant implementation, as non-commercial entities, and the funding ability that mostly (if not entirely) comes from the government budget, the application of the business model will not necessarily be able to use business indicators in general business development strategies. Furthermore, the business model developed in this study needs to be adjusted to the rules for the use of the budget in West Java, including reviewing the possible types of financial resources that can be applied, to the technical installation of rooftop solar power plants which will give an indication of the need for initial investment costs (capex) and operating costs (opex) as well as financial management efforts and working relationships / interactions between business entities and PLN as a reference for technical electricity administration governance for customers.

The starting point of this study can be taken from the results of the school rooftop solar power plants procurement at the SMKN 4 Bandung building installation three years ago using the Government budget, and the solar power plants assets remain owned by the Government (as the budget provider) for later asset transfer to the school building manager. This pattern of procurement of solar power plants installations is similar to similar initiatives at the time for SMAN 3 and the Energy and Mineral Resources Office building in Bandung. The implementation of this activity can be called

the simplest business model, with direct marketing (PLN, from the solar power plants equipment supplier to the buyer, without the need for a management entity in between).

Possible basic variants of this direct marketing model are for example that [i] payment can be made by the budget owner¹⁰ who becomes the asset owner of solar power plants, while the solar power plants asset will be regulated in the handover procedure to the school building later; or [ii] payment can be made by the owner of the school building so that the installation of the solar power plants asset is also owned by the building. This simplest business model can be used as a comparison for the initial development of school rooftop solar power plants in this study, while recognizing that financial asset management and funding governance may not be fully commercial, as in general business entities. To the extent possible, the business model can make more optimal use of the budget that will be provided later, and can seek additional support from other non-budgetary financing resources.

1.2.2. Goals to be achieved, objectives

Acceleration of renewable energy utilization in West Java, among others through the implementation of rooftop solar power plants, is the objective of this program. This business model study seeks to provide an understanding of the strategic options that can be taken, for example by development planners in West Java (Provincial Bappeda) and policy makers (Governor, Parliament) for optimization and options to increase the impact / benefits of existing budgets, through effective synergies with financing formats from other public or private sources. Through the discussion of cooperation schemes between the Provincial Government and other business entities, to integrated business-partnerships, it is hoped that it will provide sufficient support for the implementation of school rooftop solar PV management in the long term, given the scope of this initiative in various regions of West Java.

Follow-up plans that can be implemented include formalizing the form of cooperation between business entities (such as BUMD, solar power plants equipment suppliers, Banks in West Java) in accordance with the strategic considerations selected from the business model of this study. Furthermore, the operational preparation stage of the school rooftop solar power plant management entity can begin to be formulated, after the formation of a cooperation team that can begin to work definitively. Thus, the results of this study will be an input for the continuation of managerial improvement efforts and more effective investment financing strategies, continuous improvement, in the West Java region to the wider needs in the future.

1.3. Scope of study and limitation

Utilization of solar power plants on school rooftops generally uses the connection of PLN customers in the school, with the connection of export-import kWh meters (kWh ex-im) following the provisions of PLN generally, in schools with social TDL 'S-2', without electricity sales transactions from school solar power plants to PLN because the amount of electricity supplied to PLN will be calculated net figure / *net-metering*¹¹, every month. This study is not for solar power plants that have PPA contracts or power purchase agreements, such as private power plants with PLN, so the planned return on the initial investment in solar power plants is not derived from the revenue of the 'selling

¹⁰ the budget owner herein can be the Government for public schools, or the Foundation for private educational institutions, which will be included in its financial records or internal books according to reasonable / non-privileged governance rules.

¹¹ 'net-metering' is interpreted as the number of kWh coming from PLN to the school, or import, minus the number of kWh going out of the school, or export, where the import number is considered to be always greater than the export (solar power plants do not operate in the afternoon / evening without the sun, where the electricity consumption load is generally greater at night), so that on a 'net' basis the school building consumes more kWh of electricity supply from PLN when compared to the excess kWh from solar power plants that are channeled out / to PLN (in payment transactions, the amount of obligation to pay the school will be greater than the 'supply benefits' of solar power plants out of the school area)

electricity' business, but rather from the 'cost savings' of electricity consumption in school buildings. This situation, coupled with the limitation on the use of school operational funds for payment of electricity consumption, which can only be paid to PLN as the public electricity supplier, poses its own challenges to the selection of a business strategy with the business model developed in this study. In addition, there is sometimes a perception that if the investment in installing rooftop solar power plants must be returned within 5 years (or for example in a period of less than 10 years), the monthly payment burden for 'installments' of the installation price of solar power plants becomes substantial. This amount may be perceived as greater than the calculated savings in monthly electricity consumption at present, leading to different opinions such as 'why install solar power plants if the monthly payment is more expensive than the benefits'. To set the record straight on this out-of-context opinion, it is necessary to understand the long term. Technically, the lifespan of solar power plants can be over 20 years (if there is a need for minor component repairs only), while the need to 'pay installments' may only be around 10 years or less. Thus, after the completion of the installment payment period, there is no longer a need for user fees, so the electricity supply from rooftop solar power plants will be used for free. That is often not seen at first, by only comparing the costs incurred in the installment period with the reduction in the current monthly electricity bill. So when compared to the entire operating period of solar power plants (over 20 years), the total cost will be much cheaper than the electricity tariff of PLN, which has recently indicated that it will gradually increase in the situation of the energy crisis that occurs in the future (projected oil and gas and coal prices may continue to rise, to exceed two or three times the price of last year, which will also bring consumer electricity prices tend to be higher in the next 10-20 years).

The business model proposed by this study also needs to have a time perspective of up to 20 years or more, with accelerated efforts for greater capacity increases, or investment in solar power plants in more school locations. Recognizing the limited potential budget available for the initial investment, it is expected that the initial budget can be allocated to efforts to build the work system and institutions of the management entity, institutional building. This entity could possibly utilize an existing institutional structure, such as a regional-owned enterprise (BUMD).

The magnitude of the total cost requirements for the hundreds of schools that could be installed with rooftop solar power plants compared to the budget that can be allocated, will lead to efforts to develop a business model later to be able to utilize additional external financing, or non-budgetary sources. In addition, this study will not include identification of the need for de-risking instruments, which may be more relevant for large project funding (well above the value of rooftop solar power plants per school site, perhaps in the range of half a billion rupiah, or below).

1.4. Work phases

The Consultant Team has conducted online meetings with several parties, including:

- [31/01/2022] CPI and Bappeda
- [10/02/2022] Bappeda and SMKN 4 Bandung
- [04/04/2022] Education Office
- [xx/03/2022] Energy and Mineral Resources Office
- [12/04/2022] PLN West Java
- [18/04/2022] Bureau of BUMD, Investment and Development Administration (Biro BIA)
- [19/04/2022] Regional Financial and Asset Management Bureau (BPKAD)
- [20/04/2022] Bureau of Government Procurement (BPBJ)

The following are some of the responses from meeting participants at the online meeting sessions.

- The West Java Provincial Government has completed the installation of rooftop solar power plants in 7 locations, including at SMKN 4 Bandung City with an installed capacity of up to 25 kWp at a cost of nearly Rp 800 million. The operation of the rooftop solar power plants is still under the control of the West Java Energy and Mineral Resources Office (technical administrative procedures for handover to the school have not yet been completed);
- Furthermore, the Energy and Mineral Resources Office plans to implement renewable energy with increasing capacity in West Java, among others through the installation of rooftop solar power plants in more than 170 schools (SMAN and SMKN). The preparation of Detailed Engineering Design (DED) documents is expected to be completed by the middle of this year. It is planned that the installation of rooftop solar power plants will use funding from the Provincial Regional Budget;
- PT Migas Hulu Jabar (Perseroda) is expected to be the party that will be assigned to install the rooftop solar power plants, for which PT Migas Hulu Jabar is expected to obtain funding from the local government through the placement of local government capital;
- The return on investment of installing rooftop solar power plants in each school is expected to occur through savings on PLN electricity bill payments. However, with school electricity tariffs falling into the social tariff bracket [S-2], the return on investment is likely to occur over a long period of time. Thus, the investment in rooftop solar power plants is not only expected to save operational costs, but also for other purposes, such as achieving GHG emission reduction targets and renewable energy targets in the energy mix.;
- Given the large amount of funding required for investment in rooftop solar power plants in more than 170 schools in West Java, it is necessary to consider funding options other than the Regional Budget, for example from Bank Jabar Banten (BJB) or even through cooperation with other parties. In this case, the BUMD can be assigned to cooperate with the private sector or even the private sector can cooperate directly with each school. This cooperation can be in the form of investment cooperation only, or can be extended to operation and maintenance cooperation;
- PLN West Java supports the investment in rooftop solar power plants, but more detailed discussions are required regarding the capacity of rooftop solar power plants that will be installed in each school;
- The installation of rooftop solar power plants is expected to be carried out not only in public schools, but also in schools owned by various non-governmental organizations.
- Pemasangan PLTS Atap diharapkan tidak hanya dilakukan di sekolah-sekolah negeri, tetapi juga di sekolah-sekolah yang dimiliki oleh berbagai Lembaga Non-Pemerintah.

[Box 01] Rectify more appropriate perceptions

Understanding the characteristics of rooftop solar power plants that are planned to be applied to school buildings in West Java, clarifications for users (such as school managers, PLN officials and other related parties) will include ‘rooftop solar power plants will not sell the electricity generated to PLN’, or ‘the price of solar power plants is more expensive if paid in monthly installments than the cost savings on electricity bills’ and other similar opinions. The first understanding was sometimes interpreted improperly, for example, there was information on the kpbu.jabarprov.go.id webpage that mentioned the quote “The Provincial Government will collaborate with business entities to procure Solar Panels and Business Entities get incentives from selling electricity to PLN (status: preparation of preliminary studies)”. The appearance of the phrase ‘incentives from electricity sales to PLN’ suggests that the sale will indeed take place. For rooftop solar power plants, the term incentive refers to savings in electricity consumption costs / PLN bills, while the term sales is more appropriate for the operation of private solar power plants on the ground / ground-mounted solarfarm-IPP.



[West Java KPBU website] <http://kpbu.jabarprov.go.id/post/pembangunan-plts-di-atap-gedung-gedung-pemerintah-provinsi> accessed on August 2022

On the other hand, the use of rooftop solar power plants in different building locations can provide different electricity cost savings calculations. For schools with social TDL electricity tariffs, for example, a subscription fee of less than Rp 1000/kWh is charged, so that if the electricity production of solar power plants, for example, is 1000 kWh/month, it will provide savings of Rp 1.0 million/month, while exactly the same rooftop solar power plants if installed in residential houses or office buildings with general TDL tariffs of up to Rp 1450/kWh, for example, the savings results can reach Rp 1.45 million/month. Whereas if the investment cost of solar power plants is ‘paid in installments’ for 12 years, for example, then after the completion of the installment period (for example from year 12 to year 22) there are no longer these monthly expenses, and the electricity from solar power plants can later be enjoyed directly without routine costs.

This perception can be corrected by looking not only at the monthly savings, but over the technical lifetime, for example at

least 20 years (or 240 months). Even though rooftop solar power plants are installed in schools with lower TDL, if the savings of Rp 1 million/month are calculated for 240 months, it becomes Rp 240 million in total. This is still assuming that PLN’s TDL will be constant for 20 years, where the tendency to increase TDL has been widely informed to the public. If PLN’s TDL simply rises by 10% ‘flat’, then the savings could be Rp 264 million in total, while projections for up to 20 years are likely to rise far above the 10% assumption (given that primary energy prices are likely to rise in the range of up to hundreds of percent in the next 20-25 years, the energy transition in Indonesia). These estimates make it clear that the investment in rooftop solar power plants is ‘no loss’ in total, and provides broader environmental benefits as well. The results of implementing rooftop solar power plants in many office buildings so far, and also in various public and private schools, prove this better perception.

Chapter 2 Business Model Development Options

2.1. Preliminary information on the development of a business model for rooftop solar power plants in West Java

2.1.1. Implementation condition of school rooftop solar power plant business model

As a follow-up to the previous activities in the information obtained from Bappeda and the Technical Offices and Bureaus of the West Java Provincial Government, several options of business model have been introduced for the procurement and operation of school rooftop solar power plants. The challenging situation within the West Java Provincial Government shows some of the challenges of implementing the business model. Basically, what is required is a scheme to settle the payment of equipment and installation costs, which can reach several hundred million rupiah for a single school site. As a first step, this study seeks to clarify two preliminary questions: first, how to provide financing for the procurement of rooftop solar power plants, and second, what are the technical procedures for payments to be settled with rooftop solar power plants equipment providers/suppliers.

Answering the first question related to the source of financing, identification efforts through several technical discussion sessions gave an indication of the source of financing from the West Java Provincial Regional Budget (for the direct procurement, prepayment option), or from school operational costs (for the monthly bill payment option). A previous study by the West Java Provincial Energy and Mineral Resources Office is being finalized for a feasibility study for more than 170 SMAN and SMKN in various districts/cities (indicative cost may be above Rp 0.5 billion per school, on average, where some schools may have lower costs, and others may have higher costs).

The second question related to the technical procedure of payment, may be implemented with a contract offer document (sale and purchase agreement) with the provider / supplier of solar power plants equipment which includes equipment materials and installation services at the school site (to be used / operated by the school). Thus, in this basic option, the party placing the order for solar power plants can be the Education Office (as the budget user authority, which is authorized to complete the payment / settlement in advance, to the supplier of solar power plants), and the party receiving the solar power plants equipment from the school (handing over the equipment to the Principal). Another option, as a simple alternative, if it has not settled the initial payment, may be to pay monthly bills by the school, to the supplier of the solar power plants; or it may be to use an advanced alternative option, which is facilitated by another third party who is allowed to issue monthly bills for the school to pay. As an example of this further alternative, the third party could be [a] some kind of financial/funding institution, or [b] another business entity such as a designated West Java BUMD. This [a] or [b] party could provide financing to pay off the purchase price of the solar power plants from the solar power plants supplier during the initial installation period.

With these two preliminary questions clarified, this study will then elaborate on several possible overall business models, involving several parties in the West Java Provincial Government, the schools that will operate the rooftop solar power plants, the suppliers of the solar power plants and other supporting parties / BUMDs such as Bank Jabar Banten (BJB), PT Migas Hulu Jabar (MUJ) or other relevant BUMDs. Development of a managing entity, a 'platform manager' for the procurement

of rooftop solar power plants assets and their operations, which in this study can be referred to as an entity similar to UPT (unit pelaksanaan teknis/technical implementation unit)¹². This could be in the form of a full BUMD or an independent business unit of a BUMD with separate operations. The design of this entity would be an option for a technical and financial operational management structure that focuses on accelerating the implementation of rooftop solar power plants.

2.1.2. Technical implementation options for school solar power plants in West Java

The initiative to accelerate solar power plants on school rooftops, which begins with funding from the West Java Provincial Government budget, requires the ability of a managing entity that can begin to structure the implementation team in a short time. As one of the available technical implementation options, regionally-owned enterprises (BUMD) have sufficient capacity both in terms of managerial and technical administration that is compatible with the work patterns of the Provincial Government. For the technical fields of infrastructure and energy, BUMDs PT Jasa Sarana and PT Migas Hulu Jabar have the opportunity to play an important role later.

In particular, PT Migas Utama Jabar (Perseroda) 'MUJ' which has been authorized as a 'Holding BUMD' in the energy and mineral resources sector since July 2022 as a transformation of PT Migas Hulu Jabar. Having subsidiaries engaged in upstream oil and gas as well as energy and electricity infrastructure PT Energi Negeri Mandiri, ENM, which was originally an energy engineering support service company, has also mastered the field of integrated energy management work, including renewable energy and solar power plants on the roof of commercial business buildings. Its headquarters (MUJ and ENM) has operated rooftop solar power plants from state-owned PT LEN¹³ to encourage the development of potential solar power plants business units in many West Java government offices. In strengthening financing capabilities, MUJ has also synergized with another financial BUMD, Bank Jabar BJB since 2020.

BUMD MUJ's financial capabilities are required to provide capital for the initial investment in solar power plants on school roofs. The formation of Holding MUJ provides additional capital participation from the Provincial Government of up to Rp 140 billion this year, up from the previous Rp 50 billion quoted directly from the muj.co.id page. Indications are that the capital will be more focused on primary businesses in the upstream oil and gas sector, while innovative developments such as rooftop solar power plants will require financing support from various other non-budgetary sources, which may be above Rp 100 billion for the planned >170 school locations. The information extracted through the discussion session of this study indicates that BUMD MUJ will be able to obtain assignments for the implementation of rooftop solar power plants, within the scope of its work.

¹² This study can use the term UPT in business entities (such as BUMD, or private business entity cooperation), where 'UPT' referred to here is not entirely the same as UPT in government institutions, or UPT local government. The term 'UPT' is used here because of its function that is often recognized, as a work unit that is able to operate independently (both financially, personnel-management to other technical and administrative systems), and is not interpreted as commercial work that is required to generate business investment profits (so that in this study it does not use the term 'business unit' whose meaning tends to be commercial in nature)

¹³ "PT LEN Agra Surya Energy is working on several projects to build solar power plants, namely at the Nusantara Building of the House of Representatives and the Head Office of PT MUJ" / PT Energi Negeri Mandiri [quoted from the page <https://dprd.jabarprov.go.id/berita/kerjasama-pengadaan-listrik-harus-menguntungkan-daerah> , accessed in August 2022] ; "PT MUJ Corporate Secretary Muhammad Sani said that his party had initiated a solar panel pilot project to determine the economic potential. Then we can develop it into another business, this is also at the same time supporting the Provincial Government's program, he told Bisnis recently. MUJ started the pilot project by installing a rooftop solar power plant (rooftop plts) at their office on Jalan Jakarta, Bandung City. Sani said solar panel business opportunities are open with priority clients such as government offices and thousands of public vocational high schools in West Java. [quoted from <https://bandung.bisnis.com/read/20220206/550/1497199/go-ebt-muj-bidik-bisnis-plts-atap>, accessed on August 2022]

2.2. Description of the rooftop solar power plant business model

2.2.1. General description of the solar power plant business model

The ability of schools to operate rooftop solar power plants is a particular concern of this study, given that there are hundreds of secondary schools in West Java Province that may have the potential to implement them. In the next section, this study can specifically focus first on public schools (SMAN and SMKN), with the possibility that other institutions such as private schools (educational foundations) and Islamic boarding schools can also install rooftop solar power plants.

In general, the proposed business model for rooftop solar power plants for West Java school buildings can use two approaches, namely [A] the conventional model, small-scale direct purchase [PLK] for example in private schools/Islamic boarding school (this is similar to the purchase of rooftop solar power plants for residential houses, or buildings in general); or [B] the external funding intervention model (can be applied to public schools for example, as well as other private schools). Model [B] basically has two main components (access to funding sources and return-on-investment schemes), and one additional component (operational-maintenance schemes, subcontractors).

The approach in this study is described in the following table, with the consideration that option [A] of small-scale direct-purchase [LPO] for rooftop solar power plant installations may be relatively lower cost if the installed capacity is taken somewhat lower (still below the total electricity consumption of the user schools), e.g. up to 4 kWp, without battery units. This is possible because rooftop solar power plants can be modular, with an initial small-scale installation, and can be scaled up in subsequent years of work with similar capacities until they gradually reach the expected installed capacity.

In addition, the option [B] approach utilizes external school funding interventions that are expected to be available up to around Rp 100 million per school installation (estimated for installed capacities below 4 kWp), or for example up to Rp 200 million per school (for capacities up to 8 kWp).

Table 2. Conventional Model [A] and Intervention Model [B], for funding school rooftop solar power plants

Conventional Model [A] Direct purchase of small-scale rooftop solar power plants (IHPs with internal school funding)	Intervention Model [B] Funding from sources external to the school (provincial government budget, cooperative financing)
Implementation example [A1] Small capacity installations, up to 3 kWp ► on Private School/Islamic boarding school buildings, or others. If internal financial capability is sufficient, it can also be for [A2] Medium (3-10 kWp) or large (above 10 kWp capacity)	Implementation example [B1] Large capacity grants (up to 9 kWp or >10 kWp) [B2] ESCo with medium or large capacity (>10 kWp)
Investasi (CAPEX, akses ke sumber pendanaan) Purchase of equipment with internal finances of the school owner (Foundation or Islamic boarding school, or from local government grants for example), can be with direct payment at the beginning, or an installment scheme (?)	Investment (CAPEX, access to funding sources) ► access to grant funds can be through public sector financing, or private sector such as CSR funds. ► if external funding is from ESCo (private commercial) then the contract signatory must be able to pay monthly

Operations, maintenance and cost (OPEX and investment return) The direct purchase scheme with early repayment does not require monthly payments (for the return on investment), so [A1] may require minimal O&M costs, if any, over a 10-15 year duration (e.g., the cost of a team to administer regular kWh electricity production reports, as a guarantee of the solar power plants' performance).). But if direct purchase [A2] down payment & installment scheme then the school / boarding school owner may have monthly payments?	Operations, maintenance and cost (OPEX and investment return) Schemes with payments from grants [B1] do not need to have monthly payments as well, like [A1], but need to check the 'terms & conditions clause' of the grant will need to have any work team obligations? If with ESCo scheme [B2] then there can be monthly payments for investment returns, for example paid to the JV work unit, from the beginning it needs to be clear who will be able to pay monthly?
Other notes (transfer, maintenance scheme for working team, etc.) After the installation of the solar power plant system in the school, the handover of assets may be slightly different, if the scheme [A1] then the assets can be directly the responsibility of the School (O&M work by the school's internal team), but if the scheme [A2] maybe the ownership of assets may remain with the Supplier for a certain number of years of installments (review on certain clauses in the contract with the Supplier is necessary for clarity), and what is the handover procedure afterwards.	Other notes (transfer, maintenance scheme for working team, etc.) After the installation of the solar power plant system in the school, the asset handover may be slightly different, if the scheme [B1] then the asset can be directly the responsibility of the School (O&M work by the school's internal team), but if the scheme [B2] maybe the ownership of the asset remains under ESCo (not directly handed over to the school, unless there are certain clauses governing this issue, for example how the O&M team costs during the economic life of the asset, etc.).

2.2.2. Business model needs for solar PV for public secondary schools, special conditions

a. Business model study approach for school rooftop solar power plants

As explained in sub-chapter 2.1, the focus of this phase of the study is initially on public high schools to complement the efforts of the West Java Energy and Mineral Resources Office on the installation of rooftop solar power plants in more than 170 SMAN and SMKN, for which a feasibility study is expected to be completed before the middle of this year. For the time being, the conventional model column [A] in Table 2 above has not been applied further¹⁴. Therefore, this study will mostly examine the intervention model [B] where the funding for the repayment of rooftop solar power plants does not come from the school's internal financial resources, but is financed from external sources such as the Regional Budget, or other third-party funding (which can be facilitated through relevant BUMDs, among others). BJB¹⁵, MUJ¹⁶, or others).

b. Provincial Government budget constraints and non-budgetary fundraising initiatives

The West Java Regional Budget has a 'regional financing' line item which includes 'regional capital participation'. West Java Regional Regulation No. 13/2021 in Article 7 mentions the amount of 'regional capital participation' up to Rp 402 billion. Annex XII of the 2022 Regional Budget describes it as capital participation in PT Bank Jabar Banten, Tbk worth Rp 402 billion in this 2022 fiscal year.

If it takes an average of Rp 800 million per school location (up to 25 kWp capacity for example) then for the planned implementation of school rooftop solar power plants at more than 170 school locations (2021 study data) it reaches Rp 138 billion. The total estimated budget requirement for the procurement of school rooftop solar power plants assets could reach 170 billion (with the ratio of

¹⁴ the conventional model [A] is only used as one illustration-comparison, to show how its technical implementation differs from the other options described in this study.

¹⁵ Bank Jabar Banten (BJB) <https://bankbjb.co.id/page/tentang-bank-bjb>

¹⁶ PT Migas Utama Jabar (Perseroda), previously PT Migas Hulu Jabar (MUJ) <https://muji.co.id/laporan-tahunan/>

long-term management service costs assumed to be up to 20% of the equipment investment cost). The cost burden of this budget, reaching 2/5 of the entire capital participation budget in the 2022 Regional Budget as mentioned above, will be substantial if it must be entirely absorbed by the West Java Regional Budget (if using the business model of direct purchase to the company providing solar power plants, with the usual procurement rules).

Therefore, it is necessary to consider efforts to ease the burden on the budget, with efforts to obtain additional funding from outside the scope of the Regional Budget. To this end, some of the business models developed emphasize cooperation and partnership factors, which are explained later in this study. Chapter 3, for example, introduces the option of installment payments or engaging the private sector to raise additional investment, which eases the burden of initial capital requirements for the management entity.

[Box 02] Budget requirements for rooftop solar power plants and budget capacity of the West Java Provincial Government

The operation of rooftop solar power plants is not new in West Java. The rooftop solar power plant investment experience at SMKN 4 Bandung of up to 25 kWp (kilowatt-peak, installed capacity) received a budget of >Rp 800 million from the Ministry of Energy and Mineral Resources, through the West Java Energy and Mineral Resources Office. If it is simply assumed that all schools on average use a similar budget for 173 SMAN and SMKN then the total is almost 140 billion. This estimate only covers the initial investment needs, and does not include the operational costs of management personnel as long-term daily executors (for example, a ratio of 20% of equipment investment needs is taken, or it can be more, according to the work efficiency of the management entity), considering the technical age of solar power plants equipment reaches 25 years.

In anticipation of the operation of the rooftop solar power plants management entity (BUMD work unit, for example), the capital participation received from the West Java Provincial Government budget may be better if it is focused on the performance of the management entity itself for institutional development, institutional building. This includes the recruitment of senior professionals who are proven capable of managing mixed-funding schemes, from public sector funds such as BUMD and also capital from private contributions elaborated in the next sub-chapter. The institutional development of the managing entity (BUMD unit or business-partnership) can be seen as more important than the amount of investment for the purchase of the rooftop solar power plants themselves, by looking at the potential role of the private sector in helping to capitalize the installation of solar power plants in each school location.

Another example of multiyear private investment in the West Java economic report, May 2022 from Bank Indonesia mentions “[3] Development of solar power plants for households without electricity in Karawang with the installation of 1000 free solar power plants. As of April 2022, solar power plants have been installed for 25 households” (sub-chapter 7.2.1, page 144). The news illustration in *bisnis.com* on BUMD ‘MUJ’ contribution to the program, in Karawang, explains BUMD ‘MUJ’ attention to the business potential of rooftop solar power plants, which is relevant to this study. The direct contribution of multiyear private investment, later not limited to large-scale infrastructure but also starting to touch the small-scale renewable energy sector (under Rp 100 million for example) may provide an indication for further business modeling in this study, as well as private sector engagement strategies for fundraising later.



[B.I. Economic Report] <https://www.bi.go.id/id/publikasi/laporan/lpp/Documents/Laporan%20Perekonomian%20Provinsi%20Jawa%20Barat%20Mei%202022.pdf>

[bisnis.com] <https://bandung.bisnis.com/read/20220519/550/1534783/muj-onwj-akselerasi-program-1000-plts-bagi-rumah-tangga-tanpa-aliran-listrik-di-karawang>

[West Java Regional Budget 2022] <https://peraturan.bpk.go.id/Home/Details/204694/perda-prov-jawa-barat-no-13-tahun-2021>

This private sector engagement capability will be essential for the implementation of the business model with the blended-finance initiative in this study. The managing party for the rooftop solar power plants in West Java could be a direct entity within the assigned BUMD, or a joint venture entity that will manage the blended-finance initiative. The managing entity will need to carry out professional working principles (citing Article 2 letters a and e, Regulation of the Minister of SOEs No. 07 of 2021 on guidelines for BUMN cooperation¹⁷) in the following principles:

- transparency,
- independence,
- accountability,
- accountability,
- expediency, and
- fairness, and
- in accordance with the provisions of laws and regulations,
- the Board of Directors is responsible for the implementation of Cooperation for the benefit of the company, and guarantees that it is free from pressure, coercion and interference from other parties.
- in addition, it is necessary to maintain the completeness of the data and the speed of data updates, as well as the
- the principle of balanced partnership, related to the use of the capital budget (according to the amount of initial capital).

2.3. Business model for rooftop solar power plant in public schools

2.3.1. General understanding

By understanding the technical operations of public schools that are fully funded from the government budget (in the form of school operation assistance (*bantuan operasional sekolah*/ BOS) funds), we can provide a better understanding of the operational aspects of public schools¹⁸. For the purpose of other costs in the field of education, at the SMAN/SMKN level, the West Java Provincial Education Office can act as the Budget User Authority (KPA), to carry out the proposed costs for the procurement of goods, which can be in the form of a purchase contract (including settling the costs). For the purposes of other costs in the field of education, at the SMAN / SMKN level, the West Java Provincial Education Office can act as the Budget User Authority (KPA), to carry out the proposed costs in the procurement of goods, which can be in the form of a purchase contract (including completing the payment). Direct marketing scheme [PL] from the business entity supplying the rooftop solar power plants to the education office is the basic option in this study.

Besides the option of direct marketing of rooftop solar power plants to the KPA Education Office [PL], then the West Java Provincial Government also considers a kind of assignment of West Java BUMD (PT Migas Hulu Jabar, MUJ, which obtained the related assignment in the Regional Regulation¹⁹) to contribute directly in increasing the investment capacity of school rooftop solar power plants with options up to Megawatt-peak (MWp) scale. MUJ's role in supporting the provision of financing for the purchase of school rooftop solar power plants units can be in the form of marketing cooperation [KP] with the equipment provider/installation supplier, as well as the option of a full joint-venture [FJv] or semi joint-venture [SJv]²⁰ scheme.

¹⁷ Regulation of the Minister of BUMN No. PER-03/MBU/08/2017 concerning Guidelines for BUMN Cooperation jo. PER-04/MBU/09/2017 jo. PER-07/MBU/04/2021 on the Second Amendment to BUMN Cooperation Guidelines <https://jdih.bumn.go.id/lihat/PER-07/MBU/04/2021>

¹⁸ School Operation Assistance (BOS) is implemented in all public schools in Indonesia (implementation of the regulation of the Minister of Education & Culture)

¹⁹ West Java Regional Regulation No. 3/2022 on Transformation of Legal Form of BUMD into PT Migas Utama Jabar (Perseroda), which includes the business field of "developing investment in the field of Energy and environmentally sound mineral resources" (Article 7).

²⁰ Why is the term 'semi joint-venture' used? Because the basis of joint ventures is often to obtain commercial benefits (profits from the business, for which this study uses the term 'full commercial joint-venture' (FJv). Whereas if the work of the enterprise also includes a significant amount of non-profit activities (management of philanthropic funds, sourced from public and private funds for example, or other similar funding schemes such as from development partners) that are not intended for commercial gain, it becomes somewhat different from the purpose of the enterprise's work in general, so in this study it is referred to as a 'semi joint-venture'. [SJv]

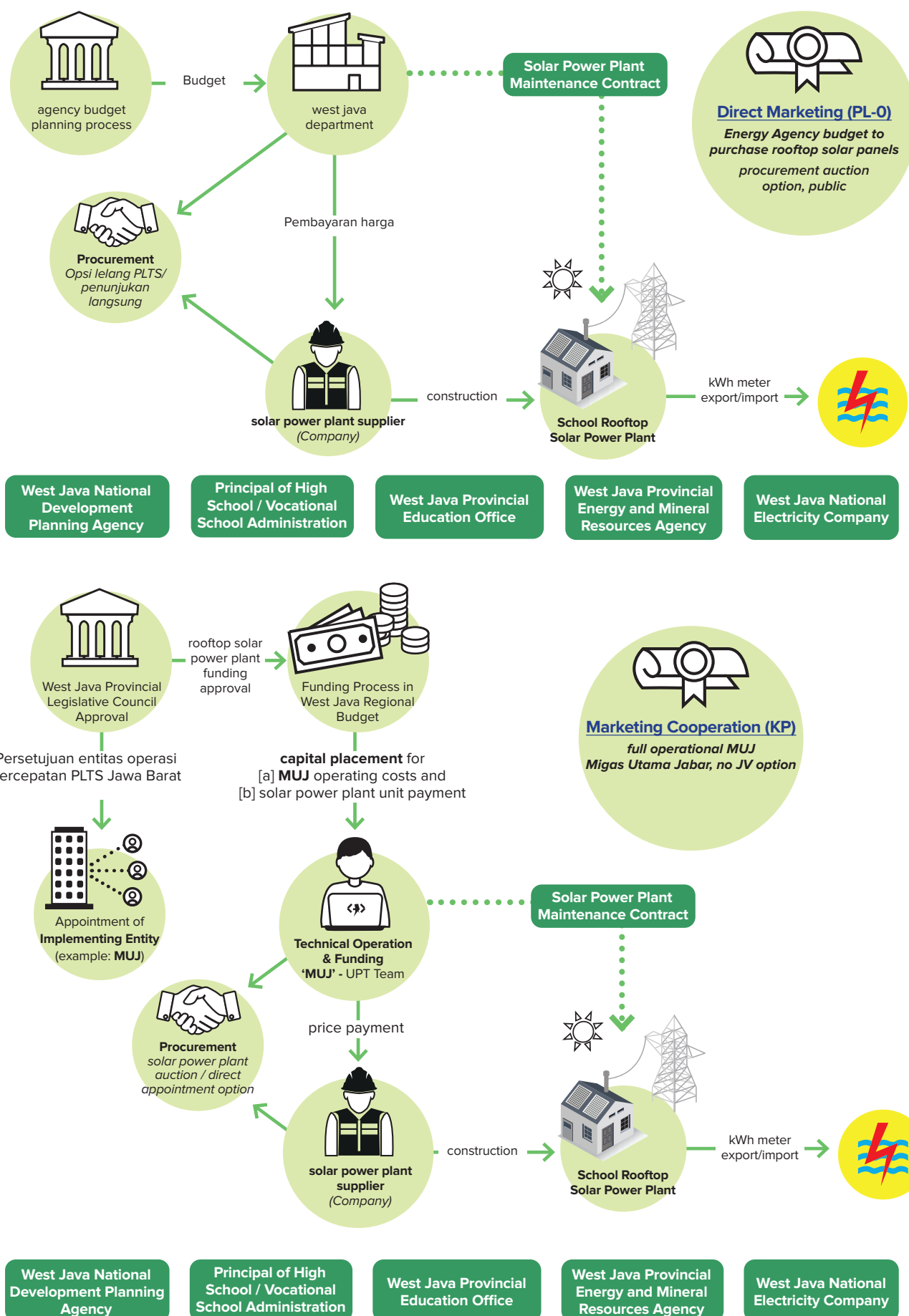
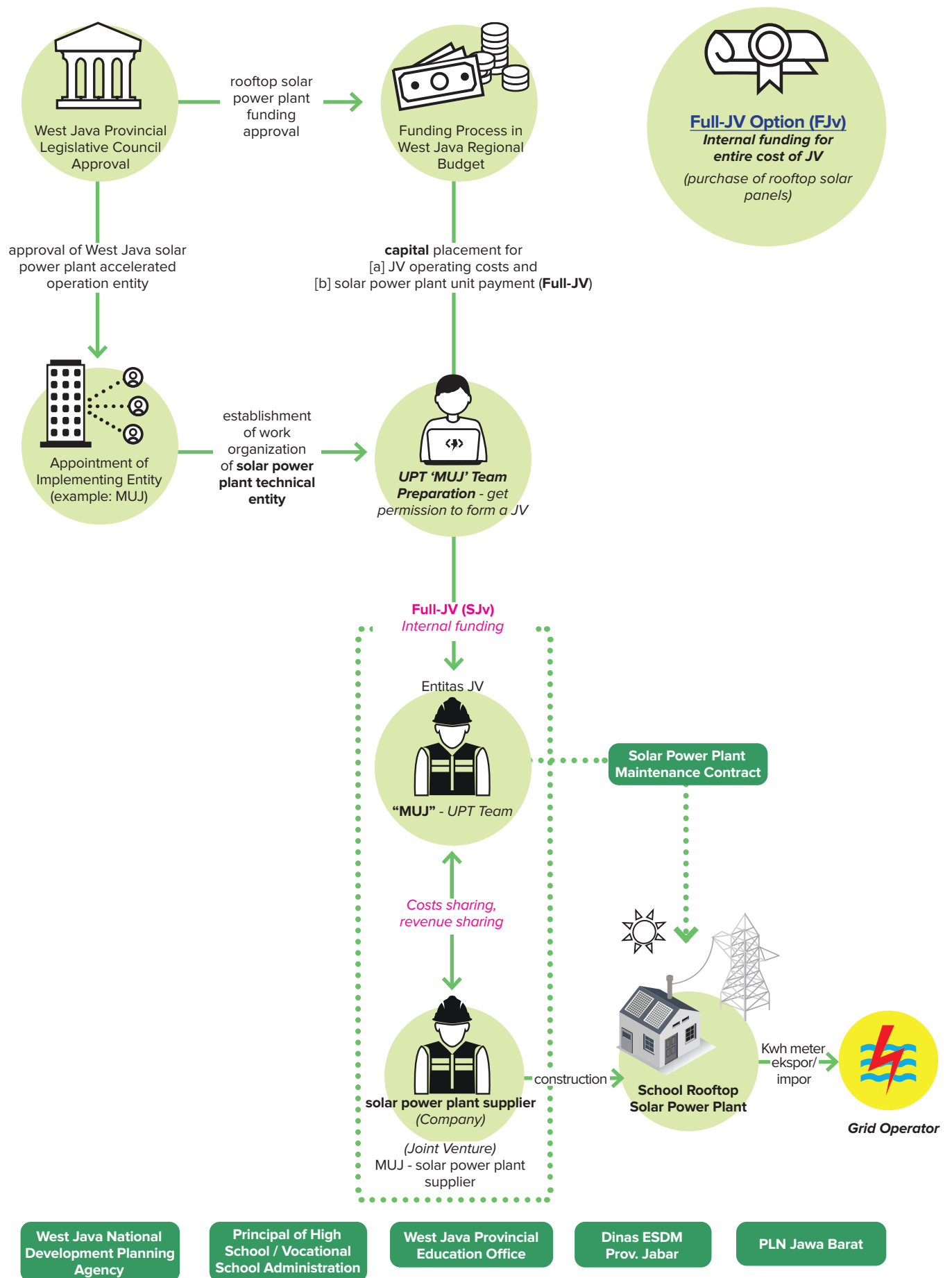


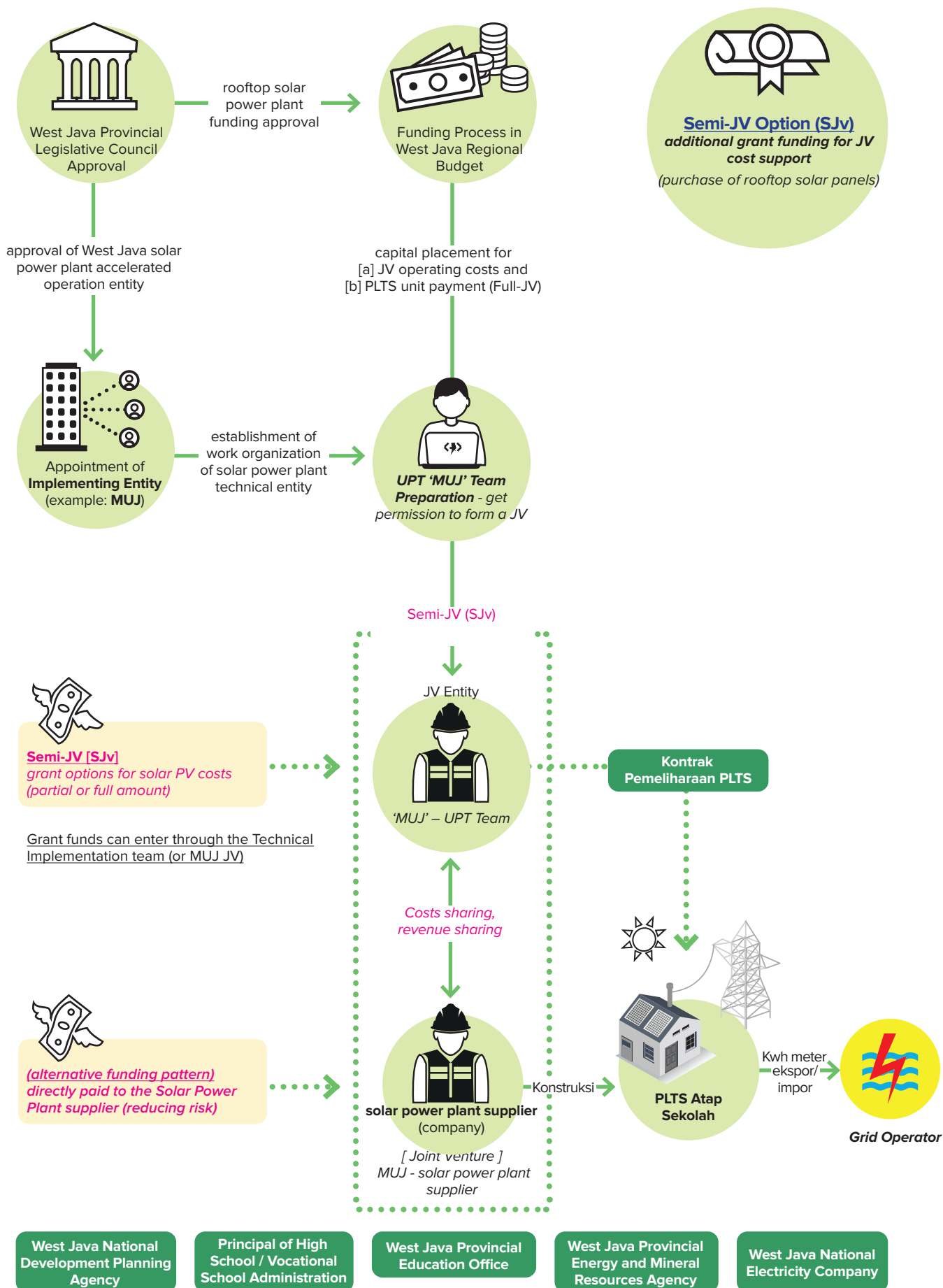
Figure 2. Initial business model of the study: direct marketing scheme [PL], and cooperative marketing option [KP].

2.3.2. Skema kemitraan usaha untuk pembiayaan PLTS atap

In general, efforts to identify alternative business models can be done through a joint venture, or similar, in accordance with applicable regulations, for example for BUMDs that will receive assignments. JV cooperation can be arranged between several business entities that will partner. In general, the JV agreement is arranged between the partnering parties: [i] providing **capital** (bearing financial & market risk), with [ii] providing **technology** (bearing technical system performance risk), with [iii] providing **management services** (bearing coordination risk of professionals & other human resources), which will be elaborated in the following sub-chapter 3.1.

The work activities of the JV entity with external parties ('clients') can be structured in several types of work agreement documents (Cooperation Contracts) that regulate the rights and obligations of the first party (JV entity) and the second party (client, for example the person in charge of the School, or other agencies). This includes the obligation of the first party (JV) to provide a reliable rooftop solar power plant system, to be operated by the second party (school) who will be obliged to provide regular payments, monthly / semester / year according to the capacity of the installation used (and the electricity generation).





Gambar 3. Model pengembangan: skema kemitraan full-JV [FJv] dan semi-JV [SJv], misalnya BUMD Migas Utama Jabar

It is important to identify the ‘client’ (in this case, the School Management) of the JV entity who is willing to operate the rooftop solar power plant system at its location (with technical support/supervision from the JV team) and the ‘client’ is able to make regular payments to the JV. The role of the client and its legal responsibilities are important to safeguard the business risks of the JV in the long term (e.g. payments do not stop midway, equipment remains in good working order, risk of units breaking down, and other issues).

Furthermore, it will be necessary to identify which officials within the school can carry out the ‘client’ responsibilities (contractual obligations), according to their legal capacity within the school institution. This is important, given that rooftop solar power plants can be fully operational in the long term, up to 15-20 years after installation, or longer, so that the risk of asset ownership dynamics and JV client operations can be properly managed).

[Box 03] Understanding the term ‘semi joint venture’ [SJv] ?

The operation of a rooftop solar power plant management entity (from a BUMD, for example, or a JV business-partnership, as per the regulations in West Java) begins with the placement of a capital base, for the investment of equipment for the rooftop solar power plant system. If several companies choose the business-partnership pattern, each partnering company will place its initial capital in the JV management entity. The amount of initial capital accumulated in the JV entity gives an indication of the scale of the business that will run, on a typical commercial basis (the initial investment will generate business profits, which are used to increase the scale of the business and increase the amount of business capital structure). The typical commercial JV scheme is referred to as a full-JV [FJv], in this study.

A non-full-commercial JV scheme may need to be developed for the acceleration of rooftop solar power plants in West Java. The urgency of increasing the installed capacity of solar power plants in hundreds of existing schools may not allow sufficient time for business development in general, where business capital only increases from reasonable business profits. Additional capital capacity is specifically sought, among others, in financing opportunities:

- Private enterprise funds, which can be in the form of grants, CSR, or other forms of contribution that are allowed by governance rules;
- Development partner organization funds, which can be in the form of investment funding programs or technical assistance for the BUMD or JV management entity team;
- General philanthropy funds, which can be from groups, institutions or individuals that may be related to specific interests, for example the location of schools in the southern coastal area of West Java, or some schools with difficult electricity conditions.;
- School alumni funds, which can be from individuals or alumni groups/institutions, with certain emotional ties.

The establishment of a JV business-partnership structure, as part of the BUMD business field in West Java can be done, in accordance with relevant regulations. For example, at the national level, it is possible for SOEs to establish business cooperation with Investment Management Institutions in the form of power of management, KSO, JV, asset lease, BOT and so on (where the BUMD governance can follow similar rules, as a derivative). Further detailed governance and regulatory studies will be required for the implementation of JV business-partnership structure involving BUMD in West Java.

To summarize, the **business model options for cooperation between BUMDs and companies supplying solar power plants** can be organized into **4 types of Schemes**, namely [PL], [KP], [FJv], and [SJv] with an overview of their respective business roles and capitalization in the following table.

Tabel 3. Deskripsi awal untuk model bisnis yang mendukung penyediaan pembiayaan PLTS atap

[PL scheme] Direct Marketing Scheme ► sell solar power plants directly to buyers	[KP scheme] Marketing Cooperation Scheme ► each capital remains separate (non-JV)	[FJv scheme] Full-JV-full-commercial scheme ► <i>share of venture capital</i> (at the beginning)	[SJv scheme] Semi-JV scheme ► <i>share venture capital from the start + receive grants</i>
Brief description [PL] The first party [supplier] sells the solar power plants to the second party [buyer, could be the education office] at a certain agreed price for each unit of solar power plants, along with technical installation & service services. The second party can then pay cash to the supplier, or perhaps negotiate options for down payments and monthly installments.	Brief description [KP] The first party [supplier] sells solar power plants to the second party [BUMD] at a cash price for each unit of solar power plants, accompanied by technical installation & service services. The second party [BUMD] buys solar power plants from the first party [supplier] and then sells solar power plants to the School, with a down payment and monthly installments scheme.	Brief description [FJv] <i>Initial capital sharing (e.g. 60:40, or 50:50) between BUMD Jabar and solar power plants supplier companies, which can later run ESCo-like services to school / boarding school locations that are interested in buying solar power plants with a down payment and monthly installment scheme.</i>	Brief description [SJv] Sharing of initial capital does not need to be too large, only for administrative operations (for example 60:40, or 50:50) between BUMD Jabar and the company supplying solar power plants, then receiving grants worth the price of solar power plants to be given to various schools / islamic boarding school appointed with operational cooperation (no need to pay monthly).
Form of contract between Supplier – Education Office/School Public procurement contract	Form of contract between BUMD –Supplier business entity Public procurement contract	Form of contract between BUMD – Supplier business entity Business-partnership contract, JV (with working capital sharing)	Form of contract between BUMD – Supplier business entity Business-partnership contract, JV (with working capital sharing)
Why is this [PL] scheme important? Accelerate implementation, with existing regulatory tools only, if the urgency of achieving results is more important (and have not had time to complete the preparation of the management entity institution, BUMD or JV)	Why is this [KP] scheme important? If the management institution has been established but the JV / business-partnership option is not yet possible (related to BUMD regulations in West Java) then the [KP] scheme can be quickly implemented.	Why is this [FJv] scheme important? Can reduce the need for capital from the BUMD budget (because it is added from the capital of the JV partner, such as if there is external funding / Banking, or working capital from the business entity supplying solar power plants)	Why is this [SJv] scheme important? If it turns out that there is an institution / source of grant funding that wants to be applied, then the work of this JV-BUMD is more on implementing equipment maintenance (and receiving routine O & M equipment work payments)

2.3.3. The role of BUMD funding in the rooftop solar power plant financing cooperation scheme

a. Acceleration of solar power plants on school rooftops through the management of BUMDs that have the assignment

The importance of the position of BUMDs in efforts to accelerate the implementation of rooftop solar power plants has been explained in the previous section. West Java BUMDs engaged in energy-related fields (where rooftop solar power plants are part of the renewable energy subsector) include “MUJ” PT Migas Hulu Jabar (Perseroda), in addition to several other companies such as Migas Hilir Jabar, Jasa Sarana (Jabar), and others. Given the operational conditions of MUJ, which may be considered better than other similar Perseroda, indications are that the West Java Provincial Government will support the assignment of MUJ for the development of the renewable energy subsector. However, specifically for the implementation plan of rooftop solar power plants that could reach more than 170 school locations (2021 study data), the asset procurement needs of rooftop solar power plants could exceed Rp 200 billion. This amount may burden MUJ²¹ later on, if it has to provide for the procurement of such a large asset from MUJ’s internal funding.

Given the limited internal funding capacity of MUJ, an initial assumption is temporarily used to finance the initial investment for up to 50 schools, for example. The average investment in rooftop solar power plants, for example, may be above Rp 300 million per school (this initial estimate may need to be revised later, given the downward trend in the purchase price²² of solar power plants system this decade). With this estimated value, in simple terms, MUJ will need to finance up to Rp 15 billion from its internal funding capacity. While this investment requirement is seen as substantial, it may not be able to meet the target of up to 170 schools initially planned.

Recognizing this, it will be necessary to identify alternative financing opportunities beyond the 50 schools described above. For example, if the capacity for each school rooftop solar power plant site is just under 10 kWp then, with efforts to reduce the unit price of rooftop solar power plants, the investment value may still be in the range of Rp 150 - 250 million per school. This cost-efficiency effort could make the investment value more attractive for the inclusion of other alternative funding sources, given the potential magnitude of benefits that could be extended to a larger number of schools.

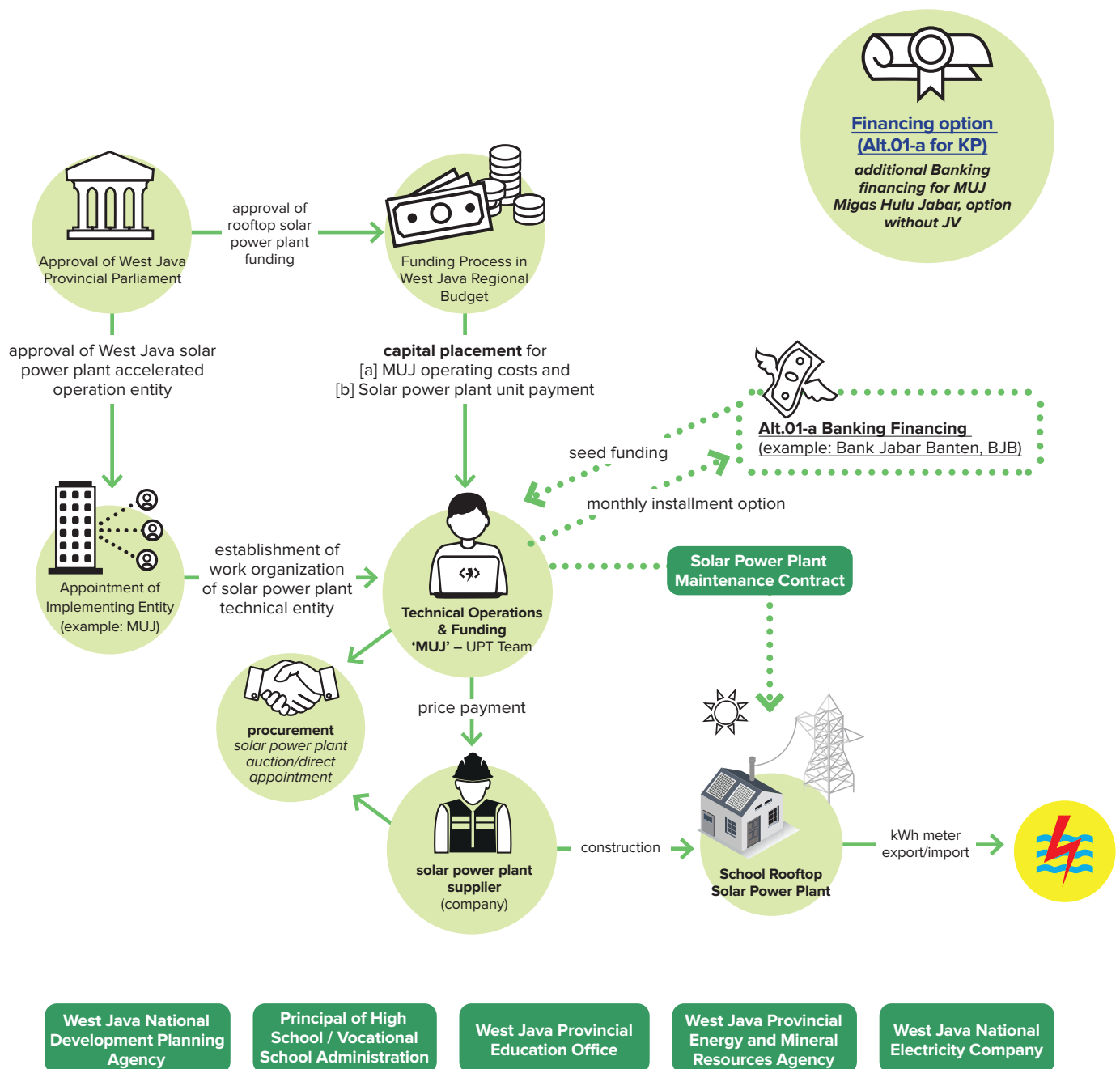
b. BUMD entity’s venture capital for school rooftop solar power plants

Possible funding options for MUJ include additional capital placement from the West Java Provincial Government, which may burden the capital expenditure requirements of the Regional Budget, and require the preparation of a new Regional Regulation (Perda) for additional provincial government capital placement. Another alternative option in the form of a capital loan (long-term, either directly from the West Java Government Regional Budget or through a commercial loan agreement from Bank Jabar Banten / loan agreement) is still possible, but still requires the repayment of the entire amount of the principal capital in the next few years, so MUJ management needs to manage its funding very carefully for the implementation of this option.

As an alternative to the placement of additional BUMD capital from the West Java Provincial Government budget (base option), it may be possible to pursue a similar financing structure with additional Banking financing options (investment capital loans) for the Marketing Cooperation scheme [KP, without JV scheme], as well as on the implementation of the business-partnership scheme [FJV]. Some of these capital alternatives are described as follows.

²¹ MUJ total assets Rp 344 billion, net profit Rp 158 billion [2021 Annual Report] <https://www.migashulujabar.co.id/language/en/annual-report/>

²² Installation costs three years ago, rooftop solar power plants installed at SMKN 4 Bandung were around Rp 800 million, with a capacity of 25 kWp, now the price may have decreased significantly.



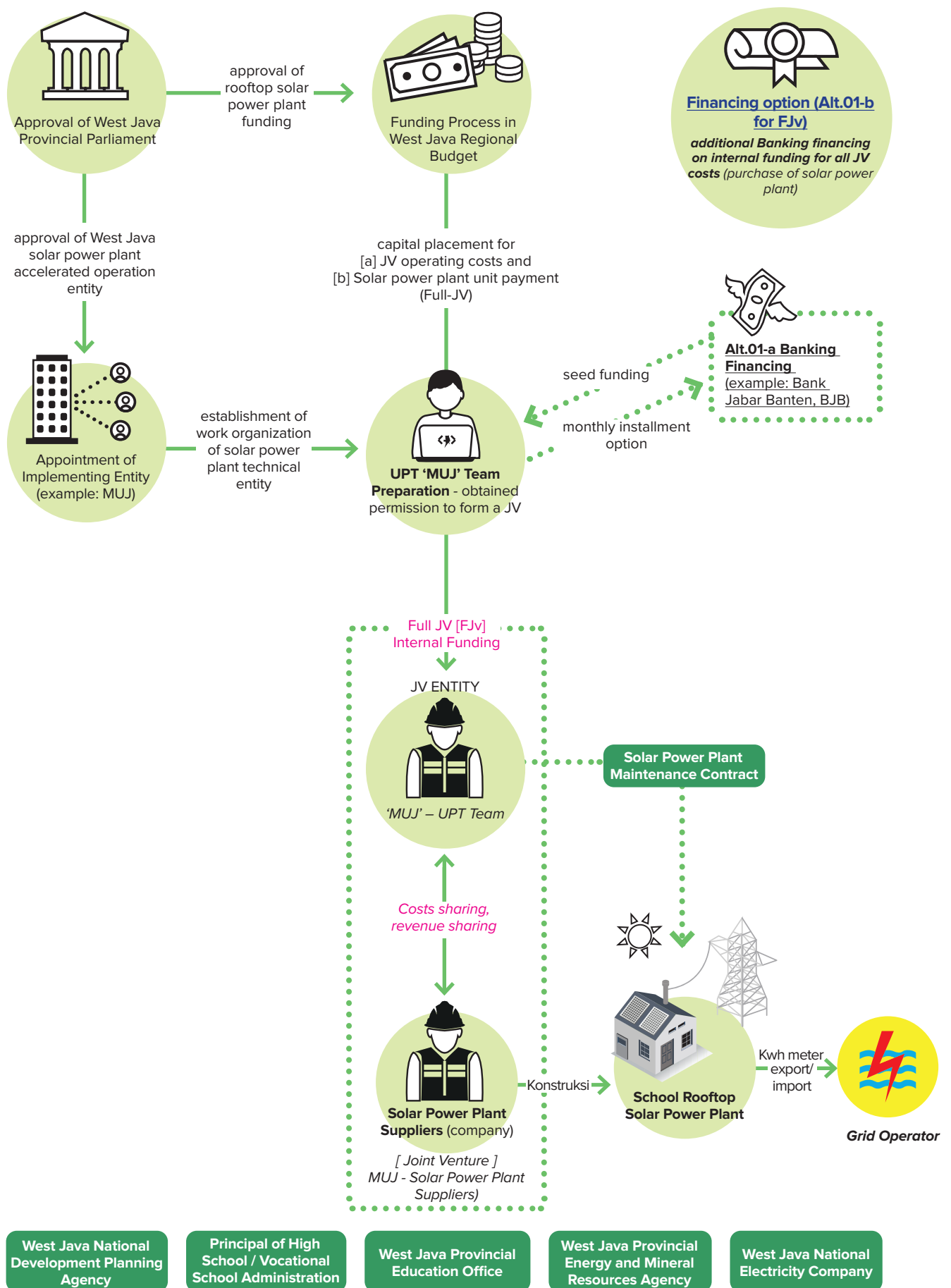


Figure 4. Alternative Banking financing schemes, for funding support options on [KP] and [FJV]

Similar to the financing support from Banks for the Marketing Cooperation [KP] scheme, its application to the JV business-partnership scheme can also provide investment capital loans (initial funding and monthly installment returns) to the JV entity that will manage the technical implementation and funding for the school rooftop solar power plants, in figure 4 above. In more detail, the funding structure and internal coordination are described in the following sections.

c. Funding structure and internal coordination in the JV management entity

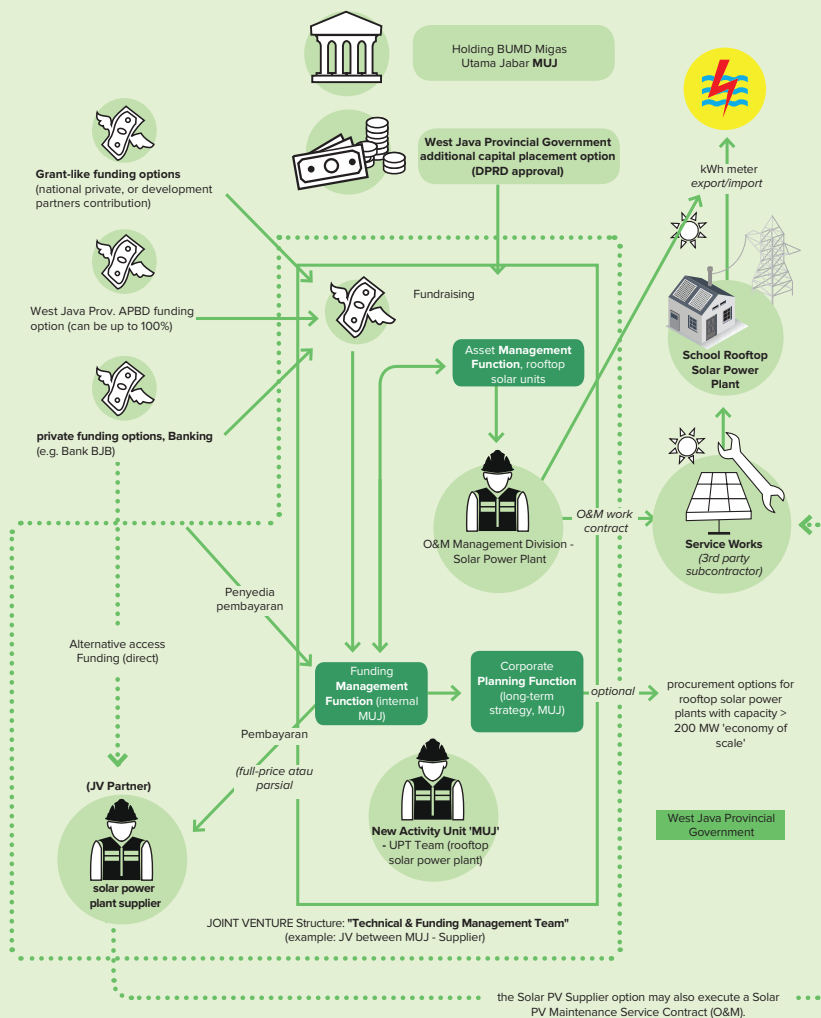
Planning a JV capital scheme begins with the identification of the JV partner entities. JV partnerships can be structured between two parties only, or more than two entities (e.g. three or four business entities in one JV agreement). Consideration of the JV partnership structure is tailored to practical needs, such as whether or not to partner with an investment funding provider. As such, JV partnership options can be adjusted as time progresses in the future, or if there are technical considerations in a particular work area for example.

Of the several JV joint venture options, the simplest form (between BUMD MUJ and the solar power plants Supplier Company) is the most likely to be implemented. A JV agreement with one solar power plants supply company partner can be structured more easily by BUMD MUJ, as it only involves two business entities.

[Box 04] Opsi Kemitraan Usaha (JV)

The operations of the entity managing the rooftop solar power plants can be self-sustaining (without a JV partnership), or, if required, can also use a JV business-partnership option. Within the structure of the Implementing Entity, rooftop solar power plants as 'platform managers' generally perform [a] a Funding Management Function (pooling multiple funding sources and managing the payment scheme for the unit price of rooftop solar power plants, including monthly installment options), and [b] an Asset Management Function (with maintenance/O&M contracts that ensure the long-term continuity of operation of the solar power plants). In addition, the Executing Entity may in the long run also perform [c] Corporate Planning Functions, depicted in the following scheme.

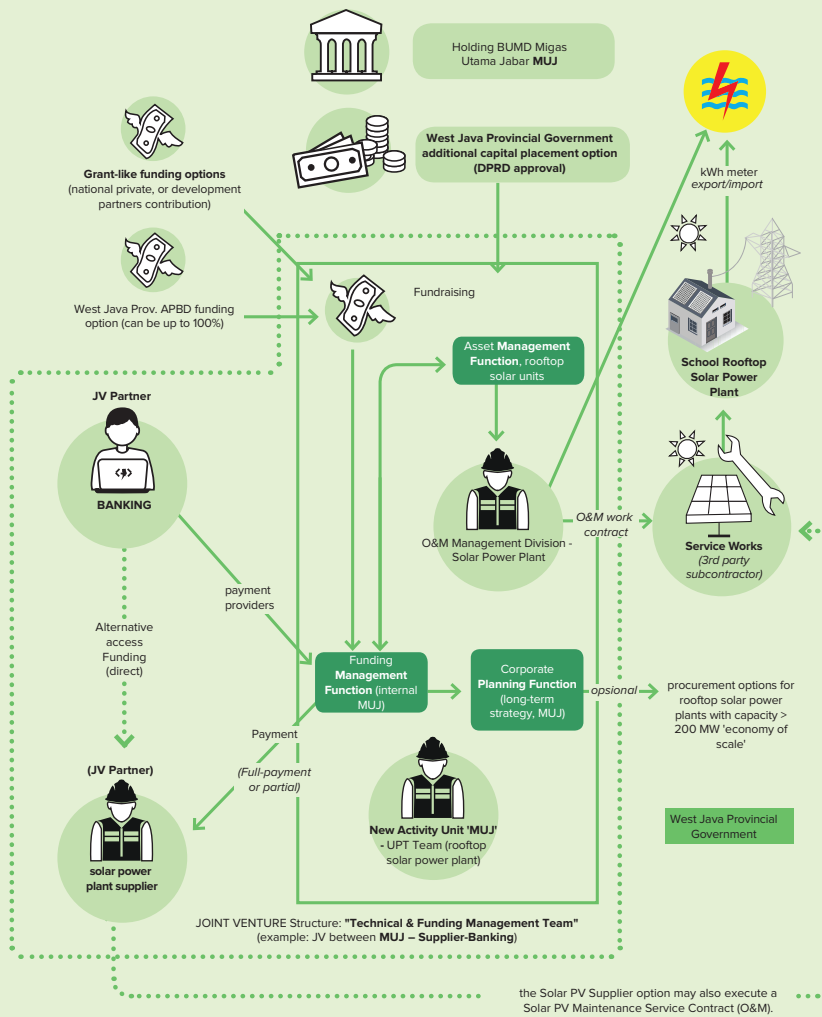
[basic scheme, for comparison] **Without JV**



This basic scheme is similar to the [PL]/[KP] option.

→ This diagram provides an illustration for the interactions within the managing/non-JV entity, which can structure each component work function within it.

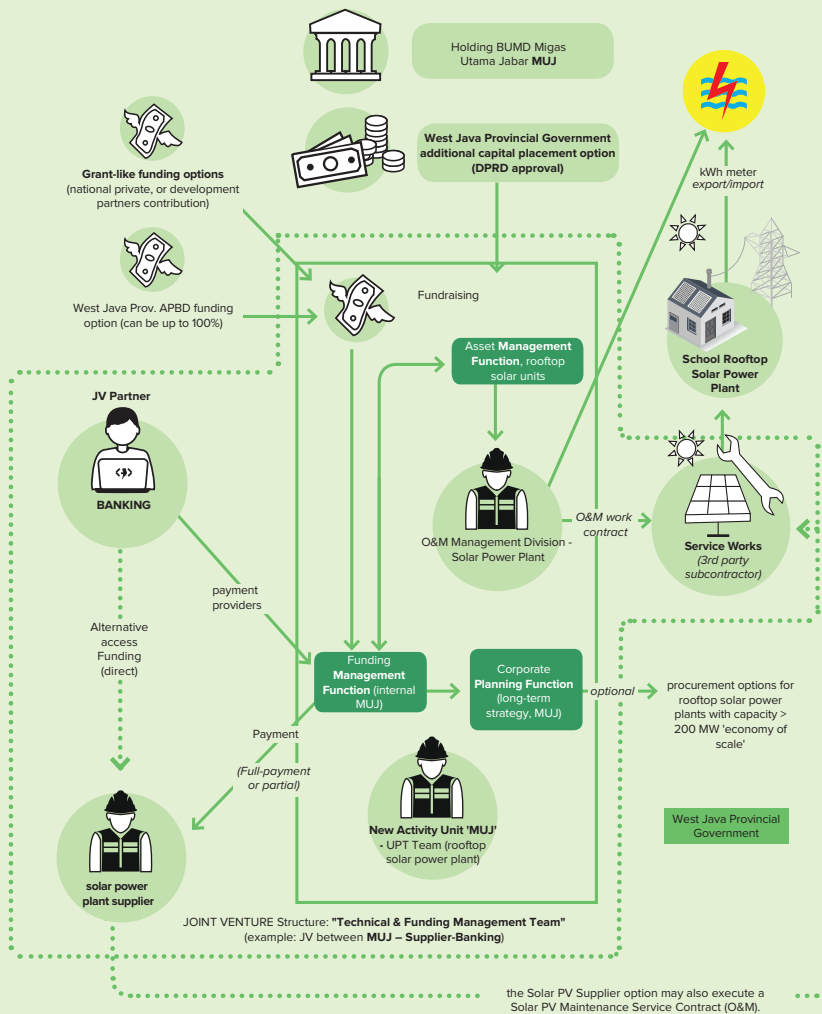
[JV-1 scheme] **JV with Corporate Partner Supplier of solar power plants**



This basic scheme is similar to the [FJV]/[SJV] option, if the partnership is structured with the Supplier of solar power plants (example of two-party partnership option)

→ This diagram illustrates the internal interactions of the managing entity / JV, which can structure each component work function within it.

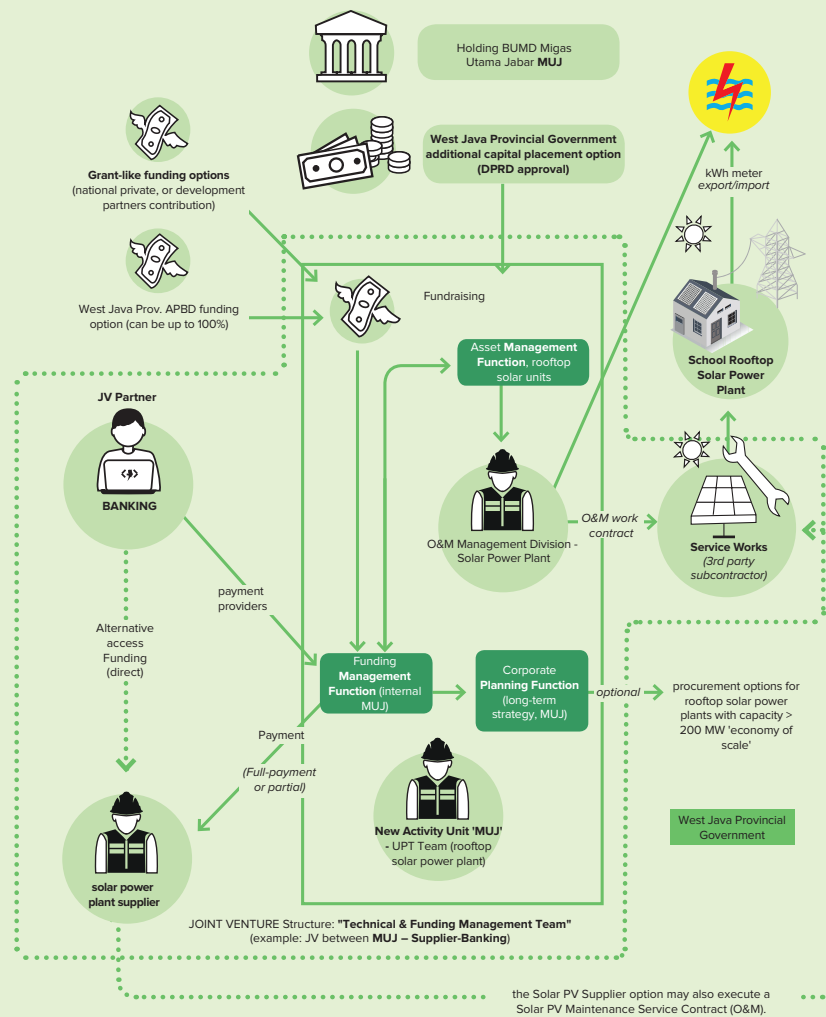
[JV-2 scheme] **JV Partnerships with Corporate Partners Supplying solar power plants and Banking Partners**



This basic scheme is similar to the [FJv]/[SJv] option, if the partnership is structured with a Supplier of solar power plants, and a Banking/funding party (example of a three-party partnership option)

→ This diagram illustrates the internal interactions of the managing entity / JV, which can structure each component work function within it.

[JV-3 scheme] **JV partnership with solar power plants suppliers, banking partners and solar power plants maintenance service partners**



This basic scheme is similar to the [FJv]/[SJv] option, if the partnership is structured with the Supplier of solar power plants, and the Banking party, and the maintenance / O&M service provider of solar power plants (example of four-party partnership option)

→ This diagram illustrates the internal interactions of the managing entity / JV, which can structure each component work function within it.

In the future, it is possible to set up a JV partnership structure with more than two business entities, such as with a Banking Partner and a Solar Power Plants Maintenance Company Partner, if there are significant advantages. This is likely to be required in the installation of rooftop solar power plants in more school buildings, up to hundreds of locations in various cities and districts throughout West Java, with investment needs that can be immense in total.

2.3.4. Handover period of rooftop solar power plant assets to school managers

a. Estimasi nilai investasi dan perhitungan pembayaran cicilan bulanan

The implementation plan for the purchase of complete rooftop solar power plants equipment to be handed over to each school with the funding role of BUMD, such as in the [KP] and [FJv]/[SJv] schemes, may involve a loan-to-use option for a certain period of time (up to 10 years, or more). The period of the borrow-to-use option can be determined from a fixed amount of monthly bills. The amount of the monthly bill can be issued from the BUMD to the school management, as one of the

electricity services charges (as part of the operational cost for each school). The larger the monthly bill that can be paid, the shorter the leasing period, so that the rooftop solar power plant assets can be handed over to the school at the end of the monthly bill payment period.

With this monthly bill payment, the BUMD's initial investment to purchase the rooftop solar power plants equipment can be paid back, with a simple minimum condition without the application of interest rate (if the BUMD's initial investment is considered as an interest-free loan). Receipt of the monthly bill payment can maintain the BUMD's capital/financial condition to remain in reasonable condition. However, the BUMD also needs to finance the internal routine operations of the employees, so the return of the initial capital needs to be supplemented with a reasonable little interest, in a low level that does not make excessive profit for the BUMD (so the return with minimum interest-free condition should not be applied). It is considerably reasonable for the BUMD to also provide technical services to the school in the operation of rooftop solar power plants, for which the BUMD needs to obtain payment from the technical services. The additional payment will be beneficial in maintaining the equipment quality and electricity production quantity of the rooftop solar power plants in the long run, until the economic life of the solar power plants is more than 20 years.

Another thing that will also affect the length of the borrowing period (before the handover of solar power plants to schools) is the amount of BUMD's investment to procure one unit of rooftop solar power plants for one school, exemplified in the following table (tentative cost and bill payment period). The following assumptions are still in the minimum condition (without the application of interest, for the BUMD's capital return)).

Table 4. Estimated monthly bill payment period before handing over the solar power plants to the school.

Installation example	Lower monthly bills	Medium monthly bills	Higher monthly bills
General capacity [10 kWp]	.	.	.
Assumed cost of the procurement of rooftop solar power plants up to Rp 15.000.000 per kWp, unit-price [initial investment of Rp 150million]	Initial investment cost of Rp 150 million Monthly bills of Rp 700.000/month 18 years until the handover of solar power plants	Initial investment cost of Rp 150 million Monthly bills of Rp 1,1million/month 11 years until the handover of solar power plants	Initial investment cost of Rp 150 million Monthly bills of Rp 1,6million/month 8 years until the handover of solar power plants
Assumed cost of the procurement of rooftop solar power plants up to Rp 20.000.000 per kWp, unit-price [initial investment of Rp 200million]	Initial investment cost of Rp 200 million Monthly bills of Rp 700.000/month 24 years until the handover of solar power plants	Initial investment cost of Rp 200 million Monthly bills of Rp 1,1million/month 15 years until the handover of solar power plants	Initial investment cost of Rp 200 million Monthly bills of Rp 1,6million/month 10 years until the handover of solar power plants
Assumed cost of the procurement of rooftop solar power plants up to Rp 25.000.000 per kWp, unit-price [initial investment of Rp 250 million]	Initial investment cost of Rp 250 million Monthly bills of Rp 700.000/month 30 years until the handover of solar power plants	Initial investment cost of Rp 250 million Monthly bills of Rp 1,1million/month 19 years until the handover of solar power plants	Initial investment cost of Rp 250 million Monthly bills of Rp 1,6million/month 13 years until the handover of solar power plants

Installation example	Lower monthly bills	Medium monthly bills	Higher monthly bills
Assumed cost of the procurement of rooftop solar power plants up to Rp 30.000.000 per kWp, unit-price [initial investment of Rp 300 million]	Initial investment cost of Rp 300 million Monthly bills of Rp 700.000/month 36 years until the handover of solar power plants	Initial investment cost of Rp 300 million Monthly bills of Rp 1,1million/month 23 years until the handover of solar power plants	Initial investment cost of Rp 300 million Monthly bills of Rp 1,6million/month 16 years until the handover of solar power plants
Low capacity [6 kWp]	.	.	.
Assumed cost of the procurement of rooftop solar power plants up to Rp 15.000.000 per kWp, unit-price [initial investment of Rp 90million]	Initial investment cost of Rp 90 million Monthly bills of Rp 700.000/month 11 years until the handover of solar power plants	Initial investment cost of Rp 90 million Monthly bills of Rp 1,1million/month 7 years until the handover of solar power plants	Initial investment cost of Rp 90 million Monthly bills of Rp 1,6million/month 5 years until the handover of solar power plants
Assumed cost of the procurement of rooftop solar power plants up to Rp 20.000.000 per kWp, unit-price [initial investment of Rp 120million]	Initial investment cost of Rp 120 million Monthly bills of Rp 700.000/month 14 years until the handover of solar power plants	Initial investment cost of Rp 120 million Monthly bills of Rp 1,1million/month	Initial investment cost of Rp 120 million Monthly bills of Rp 1,6million/month
Assumed cost of the procurement of rooftop solar power plants up to Rp 25.000.000 per kWp, unit-price [initial investment of Rp 150 million]	Initial investment cost of Rp 150 million Monthly bills of Rp 700.000/month 18 years until the handover of solar power plants	Initial investment cost of Rp 150 million Monthly bills of Rp 1,1million/month 11 years until the handover of solar power plants	Initial investment cost of Rp 150 million Monthly bills of Rp 1,6million/month 8 years until the handover of solar power plants
Assumed cost of the procurement of rooftop solar power plants up to Rp 30.000.000 per kWp, unit-price [initial investment of Rp 180 million]	Initial investment cost of Rp 180 million Monthly bills of Rp 700.000/month 21 years until the handover of solar power plants	Initial investment cost of Rp 180 million Monthly bills of Rp 1,1million/month 14 years until the handover of solar power plants	Initial investment cost of Rp 180 million Monthly bills of Rp 1,6million/month 9 years until the handover of solar power plants

Catatan untuk estimasi penghematan pembayaran biaya listrik PLN, pelanggan :

At installed capacity of 10 kWp → assumed electricity production of 880 kWh per month [school with social tariff S-2 Rp 980/kWh] = saving of Rp 862,400/month

At installed capacity of 6 kWp → assumed electricity production of 528 kWh per month [school with S-2 social tariff Rp 980/kWh] = saving of Rp 517,440/month

[a] In the example above, the type of PLN electricity connection for schools in the social tariff group [S-2] is indeed considerably cheap, still below Rp 1000 per kWh. So, if you will receive monthly bill payments according to the number of kWh produced, the value may not be too large (to cover the return on initial investment).

[b] In the table above, determining the amount of the monthly bill can be easier if it is set at a constant amount (e.g. fixed at Rp 1.1 million per month (or any other reasonable amount during the bill payment period), the figure does not need to change in value according to the number of kWh produced, as an initial assumption.

[c] It should be understood that the estimated amount of savings in electricity payments for PLN subscriptions is likely to be smaller than the need for bill payments to return the investment in rooftop solar power plants, considering that later after the completion of the monthly bill payment period, the School will get a significant savings value (because there is no longer any expenditure on these costs)

[d] Recognizing these considerations, the purpose of installing rooftop solar power plants is intended to increase the amount of renewable energy production in West Java, so it is not solely aimed at the amount of economic value alone

[e] Options to reduce the burden of paying the monthly bills above include efforts to obtain grant budgets in a blended financing-structure, to alleviate the remaining costs that become monthly bills or the remaining bill period can be shorter (if the grant funds can be used as a kind of down payment)

Although the table above assumes a minimum interest-free repayment period, the simple estimation above gives an initial idea of the length of the monthly installment period for the return of the investment value of rooftop solar power plants. Some things that can be considered in planning the funding scheme (for example through BUMD) include the following.

- Medium capacity installations (assumed to be typically 10 kWp per school) can provide a monthly billing period of under 10 years, only if the unit price of rooftop solar power plants is not more expensive than Rp 20,000,000 per kWp of installed capacity (and the monthly billing payment reaches Rp 1,600,000 per month).
 - ◆ if the monthly bill is only around Rp 1,100,000 per month (or lower) the billing period becomes too long, above 15 years, which becomes less attractive for investment, and
 - ◆ if the unit price of rooftop solar power plants can be obtained lower than Rp 20,000,000 per kWp of capacity (e.g. by seeking some external grant funds, for an additional upfront payment) then the amount of the monthly bill that needs to be paid by the school (the Education Office budget) can be reduced.
- Low capacity installations (assumed to be only 6 kWp per school) can give a monthly billing period of under 10 years, only if the monthly bill payment reaches Rp 1,600,000 per month or more, whereas if the monthly bill is only around Rp 1,100,000 per month (or lower) the billing period will tend to be longer, which becomes less attractive for investment.
- The installation cost per kWp capacity (unit price) tends to be more expensive for small capacity orders, and can be less expensive if the installation capacity ordered for rooftop solar power plants is larger.
 - ◆ costs can be reduced below Rp 20,000,000 per kWp if the order in one package can reach the order of megawatts (e.g. 2 MWp capacity), for several scattered school buildings, and
 - ◆ the cost of installation also depends on the location of the school to be installed rooftop solar power plants, for example if several schools that are close together (for example in adjacent villages / sub-districts) can order in one package of installation work that can be done in a relatively short time then the cost quote from the provider / supplier company can be recalculated to be more cost efficient.
- Considering that rooftop solar power plants are modular in capacity, there is no maximum limit on the capacity of rooftop solar power plants at one school location.
 - ◆ in the initial stage can be installed with a lower capacity (only 6 kWp, or 10 kWp first), and
 - ◆ after a few years, it can be added with a higher capacity, according to the development of electricity needs for the school's operations.
- The West Java Energy and Mineral Resources Office expects the target of implementing the increasing capacity of rooftop solar power plants to be substantial, so that the installations that will be installed later should not be too low in capacity.
 - ◆ realizing that a larger capacity of rooftop solar power plants would also increase the overall cost requirement (e.g. the 25 kWp capacity at SMKN 4 Bandung cost almost Rp 800 million during an installation three years ago).;
 - ◆ considering the downward trend of solar power plant installation prices over the decade, if in the next few years there may be additional solar power plant capacity, the cost will be lower (not just stop at the initial capacity which may be lower, it can be added later).).

[Box 05] Capital structure of BUMD entity for rooftop solar power plants investment

Operational entities managing rooftop solar power plants can obtain initial capital from the West Java Provincial Government budget allocation. If it is simply assumed that the investment cost of rooftop solar power plants for one school is Rp 200 million (10 kWp capacity for example), then for each capital allocation of Rp 10 billion to BUMD, it can encourage a business model for rooftop solar power plants in 50 schools. With the ability to pay monthly installments of Rp 1.1 million/month ('willingness to pay' of school managers is still not too big) then after 15 years the initial investment costs can be recovered.

If the first investment is implemented in 2023 in these 50 schools (total capacity of 0.5 MWp), then in the range of 2038 / 2039 rooftop solar power plants will begin to be installed in the next 50 schools. In simple terms, the total installed capacity could reach 1 MWp, with the initial capitalization of Rp 10 billion, before 2040.

This simple estimate can only be achieved assuming ideal conditions, with no technical or financial risks. If the level of risk or potential investment failure could reach 50% for example (given that this business model has never been implemented before) then the implementation of rooftop solar power plants could only reach a total installed capacity of 0.5 MWp. This may require an initial capitalization of more than Rp 10 billion, which will hopefully also cover the cost of repairing any installation damage that may occur, so that the operational reliability of rooftop solar power plants can be maintained at optimum capacity.

b. Example of a working document for the procurement of rooftop solar power plants, until handover to the school

In brief, as part of the procurement process until the handover of the rooftop solar power plants, the overall BUMD work uses work contract documents for each rooftop solar power plant unit. The details will be explained in Chapter 3, which includes the technical installation plan (bidding documents for the solar power plants and equipment purchase/ordering contract documents to the installation inspection/commissioning documents), the financing plan (funding agency approval documents for the investment cost of each school installation, or options for Regional Budget loan schemes for relevant school groups), as well as the monthly fee collection plan (cooperation documents with the school, or the Education Office/Energy and Mineral Resources Office/others).

Tabel 5. Ilustrasi tahapan aktivitas perencanaan dan operasional instalasi PLTS atap sekolah

#.##	Example of planning & installation activity stage	[relevant parties] Relevant documents, option [PL] / [KP] / [Jv]
5.a	Direct Marketing Option [PL]	
5.a-1	The school / Education Office / Energy and Mineral Resources Office publicly discloses the plan to install rooftop solar power plants in school #aa, #bb, #cc, etc.	[Education Office / Energy and Mineral Resources Office] Information documents requesting specific price quotes for #abc, #def, other locations (from providers / suppliers) e.g. announcements in the media
5.a-2	The provider / supplier provides a specific price quote for rooftop solar power plants as requested earlier	[Supplier] Price & specification quotation documents as required, including payment terms and installation rights/obligations until the handover of rooftop solar power plants (completion of payment, or other options)
5.a-3	Approval of price quotes & specifications of rooftop solar power plants according to the location, according to procurement procedures at the location	[Education Office / Energy and Mineral Resources Office] Approval statement document of the price quote (or for example also certain negotiation results)
5.a-4	Signing of the contract for ordering the equipment and technical installation, technical design & relevant quality	[Supplier] Contract documents and technical attachments for installation, quality testing / operational performance until equipment handover

#.##	Example of planning & installation activity stage	[relevant parties] Relevant documents, option [PL] / [KP] / [Jv]
5.a-5	Collection of payment from the provider / supplier	[Supplier] Payment invoice documents, as per contract, progress etc.
5.a-6	Settlement of payment from West Java Provincial Government	[Authorized Budget User, West Java provincial government] Proof of bill payment
5.a-7	Testing results of all rooftop solar power plants and operational technical guidance for labor from the school team	[Supplier] Commissioning and performance test documents, including technical training materials for school staff / West Java provincial government
5.a-8	Handover of the rooftop solar power plants units from the supplier to the schools	[Supplier] Handover documents of rooftop solar power plants for #abc, #def locations
5.a-9	Operation of rooftop solar power plants by the school	[School] PLN operational & cost-saving work results document
5.a-10	Periodic maintenance needs of solar power plants, from the school	[School] Maintenance service work request document to Supplier
5.a-11	Payment collection from the supplier	[Supplier] Payment invoice document, maintenance service work
5.a-12	Settlement of payment from West Java Provincial Government	[Authorized Budget User, West Java provincial government] Proof of bill payment
5.b	Direct Marketing Option [KP]	
5.b-1	The school / Education Office / Energy and Mineral Resources Office submits to the BUMD, the plan to install rooftop solar power plants for school #aa, #bb, #cc, others	[Education Office / Energy and Mineral Resources Office] Information documents requesting specific price quotes for #abc, #def, other locations (from suppliers) can be submitted directly to the BUMD (e.g. Migas Hulu Jabar)
5.b-2	The BUMD requests a price quote and specifications of rooftop solar power plants to the provider / supplier (info on the specific location from the Education Office, with the current condition of the roof structure)	[BUMD] Technical installation plan documents to request price quotes and specifications of solar power plants (and estimation of monthly bill payment capability from BUMD to the school / Education Office)
5.b-3	The provider/supplier provides a specific price quote for rooftop solar power plants as previously requested	[Supplier] Price & specification quotation documents as required, including payment terms and installation rights/obligations until handover of rooftop solar power plants (completion of payment, or other options)
5.b-4	The BUMD explains to the Education Office that it will be able to pay a monthly bill with a certain amount of value (for a payment period of xyz years)	[BUMD & Education Office / Energy and Mineral Resources Office] Document of agreement between BUMD and West Java provincial government to agree to install the unit location #abc, #def can pay the monthly bill later for the full period
5.b-5	Approval of the price quote & specifications of the rooftop solar power plants according to the location, according to the procurement procedures at the location	[BUMD] Approval statement document of the price quote (or for example also certain negotiation results)
5.b-6	Signing of contract to order technical equipment and installation, technical design & relevant quality	[Supplier] Contract documents and technical attachments for installation, quality testing / operational performance until handover of equipment to BUMD
5.b-7	Collection of payment from the provider / supplier	[Supplier] Payment invoice document, as per contract, progress etc.

#.##	Example of planning & installation activity stage	[relevant parties] Relevant documents, option [PL] / [KP] / [Jv]
5.b-8	Settlement of payment from West Java Provincial Government	[BUMD] Proof of bill payment
5.b-9	Testing results of all rooftop solar power plants and operational technical guidance for labor from BUMD and school team	[Supplier] Performance test (commissioning) documents and attachments, including technical training materials for BUMD staff & school work team
5.b-10	Monthly payment billing from BUMD to Authorized Budget User, for rooftop solar power plants in schools #aa, #bb, #cc	[BUMD] Payment invoice document, as agreed by BUMD and Education Office / Energy and Mineral Resources Office for location #abc, #def, others
5.b-11	Monthly bill payment to BUMD, during the 'installment' period, according to the initial investment value of rooftop solar power plants from BUMD	[Authorized Budget User, West Java Provincial Government] Proof of monthly bill payment to BUMD, during the whole bill payment period
5.b-12	Completion of monthly bill payment period, from BUMD	[BUMD] Document of settlement of all monthly bills (closing)
5.b-13	Handover of rooftop solar power plants units from BUMD to schools	[BUMD] Handover document of rooftop solar power plants for location #aa, #bb, #cc
5.b-14	Operation of rooftop solar power plants by the school	[School] Operational work result & cost saving document of PLN
5.b-15	Periodic maintenance needs of the solar power plants, from the school team	[School] Maintenance service work request document to BUMD
5.b-16	Collection of payment for maintenance services, from BUMD	[BUMD] Payment invoice document, maintenance service work
5.b-17	Settlement of payment from West Java Provincial Government	[Authorized Budget User, West Java Provincial Government] Proof of bill payment
5.c	JV-BUMD Business Cooperation Option [FJv] / [SJv]	
5.c-1	The school / Education Office / Energy and Mineral Resources Office submits to the JV-BUMD, the plan to install rooftop solar power plants for the school #ABC, #DEF, etc.	[Education Office / Energy and Mineral Resources Office] Information document requesting specific price quotes for #abc, #def, other locations (from providers / suppliers) e.g. announcement in the media
5.c-2	The JV-BUMD provides a specific price quote for rooftop solar power plants as requested previously	[JV-BUMD] Price & specification bidding documents as required, and estimated ability to pay monthly bills from JV-BUMD to the school / Education Office
5.c-3	The JV-BUMD party explains to the Education Office that they will be able to pay a monthly bill of a certain amount (for a payment period of xyz years).	[JV-BUMD & Education Office / Energy and Mineral Resources Office] Agreement document between JV-BUMD and West Java provincial government to agree to install the unit location #abc, #def can pay the monthly bill later, full period
5.c-4	Approval of the price quote & specifications of the rooftop solar power plants according to the location, according to the procurement procedures at the location	[Education Office / Energy and Mineral Resources Office] Declaration document of approval of the price quotation (or for example there is also a certain negotiation result)
5.c-5	Signing of contracts for ordering equipment and technical installation, technical design & relevant quality	[JV-BUMD] Contract documents and technical attachments for installation, quality testing / operational performance until equipment handover
5.c-6	Collection of down payments from JV-BUMD, in the amount agreed for school #aa, #bb, #cc	[JV-BUMD] Payment invoice document, according to the agreement for a certain amount of down payment

#.##	Example of planning & installation activity stage	[relevant parties] Relevant documents, option [PL] / [KP] / [JV]
5.c-7	Settlement of down payment, from West Java Provincial Government	[Authorized Budget User, West Java Provincial Government] Proof of bill payment
5.c-8	Testing results of all rooftop solar power plants and operational technical guidance for labor from JV-BUMD & school team	[JV-BUMD] Performance test (commissioning) documents and completions, including technical training materials for JV-BUMD staff & school team
5.c-9	Billing of monthly payments from the JVBUMD to the Budget User Authority, for rooftop solar power plants in schools #aa, #bb, #cc	[JV-BUMD] Payment invoice document, as agreed by BUMD and Education Office / Energy and Mineral Resources Office for location #aa, #bb, #cc
5.c-10	Payment of monthly bills to JV-BUMD, during the 'installment' period (as per the initial investment value of rooftop solar power plants from JV-BUMD)	[Authorized Budget User, West Java Provincial Government] Proof of monthly bill payment to JV-BUMD, during the whole bill payment period
5.c-11	Completion of monthly bill payment period, from JV-BUMD	[JV-BUMD] Document of settlement of all monthly bills (closing)
5.c-12	Handover of rooftop solar power plants units from JV-BUMD to schools	[JV-BUMD] Handover documents of rooftop solar power plants for locations #aa, #bb, #cc
5.c-13	Routine operation of rooftop solar power plants by the school	[School] PLN operational & cost saving work result document
5.c-14	Periodic maintenance requirement of the solar power plants, from the school	[School] Maintenance service work request document to JV-BUMD
5.c-15	Collection of maintenance service payment, from JV-BUMD	[JV-BUMD] Maintenance service work payment invoice document
5.c-16	Settlement of payment from West Java Provincial Government	[Authorized Budget User, West Java Provincial Government] Proof of bill payment

Chapter 3 Analysis on Business Model Implementation

3.1. Coordination of institutions and their roles in the West Java Provincial Government

3.1.1. Identification of the role of Institutions

The enabling conditions that encourage the implementation of solar power plants on school rooftops in West Java Province originate from the role of Technical Institutions and Offices in the Provincial government. Three roles as prerequisites for implementation, namely the funding coordination role (financial resources), the system-technical coordination role (technological resources), and the implementation coordination role (human resources) are described in the following table.

Table 6. Institutional role for implementation of rooftop solar power plants, West Java

Role	[a] Business-Financing Coordination	[b] System-Technical Affairs Coordination	[c] Manpower-Executor Coordination
Organization/ institution	West Java DPRD, Bureau of BUMD Investment Development Administration, BPKAD Regional Financial & Asset Management Agency, West Java Regional Secretary / Regional Assistant for Economic & Development,	Technical enterprises (example: MUJ), Private enterprises Suppliers of solar power plants, O&M service subcontractors, School managers of rooftop solar power plants, PLN West Java (technical & commercial)	EMR Office, Education Office, Housing and Settlement Office, Bappeda West Java, Technical BUMD (e.g. MUJ), School Managers of rooftop solar power plants
Basic roles required (each role type)	DPRD can issue a budget approval for BUMD capitalization, and Bureau of BUMD-Investment agrees to give assignment to BUMD 'MUJ' for example (can be directly to MUJ Management, or form an independent working team within MUJ), and Bureau of Procurement-Barjas gives MUJ permission to make direct purchase (appointment) to suppliers.	MUJ prepare internal capacity for the entity managing the procurement of rooftop solar power plants, and cooperate with business entities supplying solar power plants equipment for price certainty, payment terms, technical specifications, work schedules etc., and coordinate with School Managers for the design of existing roof structures and electrical installations on the provisions of PLN certification.	<u>Energy and Mineral Resources Office and Education Office coordinate School Managers to prepare school staff to operate and maintain rooftop solar power plants, and prepare procedures for handing over assets to School Managers, including O&M work cost plans (and options for contracting solar power plants maintenance services to third parties).</u>

Role	[a] Business-Financing Coordination	[b] System-Technical Affairs Coordination	[c] Manpower-Executor Coordination
Gap analysis	BUMD capital has not been prepared for investment in rooftop solar power plants for up to 170 schools in West Java, and BUMDs that have been assigned rooftop solar power plants have not been clarified for technical, institutional preparation etc.	Clarification of prices & technical specifications of rooftop solar power plants has not been agreed upon (as well as payment terms and installments of return on investment in solar power plants), also the technical needs for the support of PLN's involvement in the acceleration of rooftop solar power plants has not been clarified.	School Managers have not received clarification on the design of rooftop solar power plants to be installed (school team training plan needs), and the amount of financing budget that needs to be paid by the school (initial investment or monthly installments), there is a tendency for the Energy and Mineral Resources Office / Education Office not to involve the school from the beginning of the plan (so that when the asset handover can be burdensome for the school later).
Mitigating the gap	Identify sources of investment capital outside the Regional Budget in BUMDs and transparently inform BUMDs that have been assigned rooftop solar power plants.	Develop a long-term cooperation plan with solar power plants suppliers to agree on the initial payment scheme and monthly installment scheme.	Encourage the role of solar power plants associations to establish more effective technical communication with schools, as part of the work planning of rooftop solar power plants.

a. Business-funding coordination (financial resources)

The role of funding coordination for the implementation of rooftop solar power plants starts with the provision of budgets from several possible funding sources, such as the West Java Regional Budget (or State Budget / budget from the Ministry, if any), private direct investment, banking / financial institutions, or other non-governmental organizations and development partners. A certain amount of budget can be allocated by the West Java Provincial Government to accelerate the implementation of solar power plants on school rooftops through certain assignments to the competent BUMD work structure, which can obtain budget approval from the West Java DPRD, for example through the ratification of the current Regional Budget.

Funding coordination support is required starting from capital allocation for the focused work activities of rooftop solar power plants for entities that are similar to UPT²³ as 'platform manager', as well as cooperation with other private business units. Once the UPT is established and operating normally, working capital management will need to seek additional capital from other available sources. The importance of this additional capital is so that it can reach more schools in the region, which also implement rooftop solar power plants later, so that it is not limited to a limited number of solar power plants whose procurement can be fulfilled with the initial working capital alone.

Furthermore, the coordination of financial resources will need to support the UPT's work options either separately (only as a business unit of the BUMD) as in the [PL] and [KP] schemes, or more integrated in a partnership scheme, either [FJv] or [SJv]. The operational independence of the business unit, [PL] / [KP] / [FJv] / [SJv] needs to be supported by long-term sustainable financial resources. The development of funding coordination in each scheme that can be taken will need to be detailed in the focus of the discussion of technical and financial implementation in the next study.

²³ Can be in the form of a full BUMD or an independent business unit of a BUMD with separate operations.

b. System-technical affairs coordination (technology resources)

Private enterprises that play a role in the implementation, for example, in the field of supplying rooftop solar power plants (initial installation, construction) as well as in the field of operation and maintenance technical services (O&M, replacement needs for other solar power plants / inverter components, or further development of the school electricity system). Other issues include the future development of the technology market, among others related to the 'efficiency' of the solar power plants system (which has a direct effect on the financial estimate for the next installation). On the other hand, the state of development of PLN's grid-code²⁴ It has a major impact on the technical specifications of the equipment, such as changes in the magnitude of electrical voltage/current, load distribution, and power-system-reliability & safety-related parameters. Quality standards for equipment and components are an important consideration, such as the need to meet Tier-1.

The biggest challenge that may need to be addressed is the intermittency of the solar power plants' generation flow into the PLN network. With the current quality and capacity of the PLN interconnection network, which does not yet have the characteristics of a smart-grid system, there are restrictions on the amount of capacity of rooftop solar power plants that can be installed at school sites. Efforts to overcome this challenge with local battery energy storage (BESS) installations will have a direct effect on the installation costs and economics of business entities that manage the initiative to accelerate solar power plants, such as BUMDs, or JV entities. Recognizing this, efforts to encourage open and objective communication between policy makers (the Technical Office, PLN West Java, as well as the Ministry of Energy and Mineral Resources and Bappenas / Bappeda) to identify options for mitigating technical risks that arise.

c. Koordinasi tenaga-pelaksana (sumberdaya manusia)

Lessons learned from the implementation of rooftop solar power plants at SMAN 3 and SMKN 4 Bandung using government funding sources, implemented by Energy and Mineral Resources Office West Java. After more than 3 years of operation, the asset ownership of rooftop solar power plants equipment at the SMAN 3 and SMKN 4 Bandung locations has not yet completed the goods handover stage (from Energy and Mineral Resources Office to the School Managers). It is planned that the handover stage will be completed this year.

The executors who are actively assigned to the UPT for school rooftop solar power plants need to have sufficient system-technical and management/managerial skills, to further invest in a wider range of school sites in different parts of West Java. Coordination with Energy and Mineral Resources Office staff in charge of electrical installations and Housing and Settlement Office staff in charge of building structures can provide a good understanding for system-technical implementation. In addition, coordination with employees of the Bureau of BUMD Investment & Development Administration and the Regional Financial & Asset Management Agency can provide a good understanding of the implementation of asset management, capital and access to funding for wider development.

3.1.2. Business cooperation agreement, funding and technical-operational planning)

The implementation of solar power plants on school rooftops involves two types of cooperation, namely at the beginning (the financing side of the solar power plants, until the return of investment if required) and at the end (the operational side-maintenance of solar power plants, until the coordination of electrical installation permits with PLN).

²⁴ The role of PLN West Java in operations at the provincial and district / city levels covers two aspects: technical-electrical and commercial-legal for customers (in this case the School Management), so the challenge of accelerating large-scale rooftop solar power plants will be greatly influenced by PLN's technical considerations, which currently tend to be restrictive, but in the future are expected to be more supportive.

a. Cooperation between BUMD (MUJ) and financing institutions (Bank Jabar BJB, or others))

Further elaboration of sub-chapter 2.3.3 'funding role of BUMD' may include the option of co-financing with Banking entities or similar Financing Institutions, which stipulates several agreement clauses among others:

- the ceiling on the amount of funding provided for the implementation of solar power plants on school rooftops (or also the target number of school locations, per year);
- disbursement period for financing solar power plants (options for disbursement of funds from the bank to the UPT BUMD, or direct disbursement to business partners supplying solar power plants, or other options for investment in solar power plants);
- the refund period of solar power plants, such as the maximum number of years, the monthly payment period, the recipient account of the initial investment refund payment; and
- risk management and financing risk mitigation clauses, such as guarantees to UPT BUMD or schools receiving rooftop solar power plants.

Other options such as blended-finance schemes, can be to UPT BUMD for example, as well as the possibility of receiving investment costs for solar power plants from other possible sources in the future (such as grant scheme funding, CSR or other development partner / philanthropy funds) will also be able to formulate technical-financial clauses such as funding from Banks above, in further studies later, including business-partnership patterns, JVs with relevant BUMDs, in accordance with applicable regulations in West Java, for example the capital participation of the West Java provincial government to BUMDs regulated in West Java Regional Regulation 10 / 2017, or the establishment of business plans, budgets and BUMD cooperation regulated in Regulation of the Minister of Home Affairs 118 / 2018, as well as similar governance rules.

b. Electricity licensing (SLO²⁵) for rooftop solar power plants

On the system-technical implementation side, business cooperation can include installation and operation certificate (SLO) management services submitted through a technical service provider business entity (which has a business license for electricity supporting services / IUJPTL, which can be from the rooftop solar power plants supplier company, or from other technical business entities with similar licenses). Regulation of the Minister of Energy and Mineral Resources 26/2021 on Rooftop solar power plants²⁶ stipulates the following :

- installed capacity limitation, and test parameters/construction of solar power plants, licensing, certificate of operation;
- provisions of power measurement, kWh meters export - import of solar power plants and payment of electricity customer bills;
- criteria for safety and stability of PLN's electricity network, in the operation of solar power plants, and reporting;
- license application and reporting formats, electricity safety statements and other technical matters.

In addition, the technical and administrative provisions of electric power supporting service business entities and their licenses, IUJPTL are also regulated separately, which are also the scope of work of BUMD or JV entities for the implementation of school rooftop solar power plants. The

²⁵ Sertifikat Laik Operasi (SLO) dan Izin Usaha Penyediaan Tenaga Listrik untuk kepentingan umum (IUPTLU) https://gatrik.esdm.go.id/assets/uploads/download_index/files/25b77-20210323-bahan-paparan-webinar-perizinan-ketenagalistrikan-r3-update-rba.pdf

²⁶ Permen ESDM 26 / 2021 PLTS Atap yang terhubung jaringan listrik pemegang izin IUPTLU <https://jdih.esdm.go.id/index.php/web/result/2225/detail> https://jdih.esdm.go.id/storage/document/Permen%20ESDM%20No.%2026%20Tahun%202021%20tentang%20PLTS%20Atap_Salinan%20Sesuai%20Aslinya.pdf

development of a JV business-partnership scheme with a technology provider (PV supplier) will be more effective by understanding the applicable licensing provisions, as well as building synergies in managing business risks related to technical installations and users of school rooftop solar power plants (division of work risk mitigation roles).

3.2. Active role of private enterprises

3.2.1. Rooftop solar equipment suppliers (suppliers, solar system developers)

a. Larger scale procurement volume of rooftop solar power plants, to be more competitive

Cost considerations were the primary concern from discussions with several rooftop solar power plant equipment providers. Private companies (mostly based in Jakarta) being solar system developers have the technical and financial capability to build systems with capacities of up to several hundred kWp, or up to 1 MWp for example, in up to 6 months (depending on the capacity ordered, for lower capacities it can also be completed in less than 3 months). Subsequently, the built generation system can be handed over to the user, who receives the payment of the invoice for the entire system. It is possible for the solar power plants development company to obtain a short-term partial-loan from a commercial bank during the equipment purchase and installation period as working capital, which can be repaid as soon as it receives the invoice payment from the users of the solar power plants.

Solar power plant companies' efforts to improve the cost-competitive installation of solar power plants are generally expected to result in installation capacities that are not too small, to be done in a short period of time. If the capacity of rooftop solar power plants installed is only around 100 kWp (or still below 200 kWp), the cost of procuring the system offered may not be able to be reduced to a low price. However, if the system order can be designed larger, such as for several school buildings that are relatively close together (e.g. in several adjacent sub-districts) with a total rooftop solar power plant system capacity of up to 300 kWp for the location of these school building units, then the PTLs system construction work package can be recalculated to be more cost-efficient, to give a more competitive overall bid value.

On the other hand, the payment period of the system installation bill will be important as a consideration for the user of the solar power plants. For solar power plant capacity orders on the Megawatt-peak order, for example 2 MWp in a single order package to a single system development company, it may be possible to consider a staged payment scheme, over a period of several months (or several years), so that the initial payment can be lighter. Investigation of this payment period option could be organized in another focused study.

b. Product quality standards for components of rooftop solar power plants

The utilization of bank financing or blended funding sources often requires quality standards for rooftop solar power plant components with Tier-1 level system installations. Financiers need to ensure the long-term (e.g. >20 years) reliable operation of rooftop solar power plants, which will also support the return on investment of rooftop solar power plant assets if the system performance is guaranteed. Procurement of suitable Tier-1-level components can be obtained from domestic and foreign equipment sources, with proven long-term performance as many have used so far.

BUMD management entities need to understand the need for this product quality standard, as commercial funding support is essential to meet the large-scale target of hundreds of school sites in West Java. The use of high quality products, which not only rely on the speed of procurement of ready-stock products but still maintain working standards that meet the needs of the funding provider (considering the risk of return on investment, banks tend not to be able to provide funding

for equipment systems with Tier-2 or below), will be one of the parameters of the management of the management entity (BUMD). The importance of building a corporate image as a business entity that applies quality standards is considerably crucial, given the 20-year lifespan of rooftop solar power plants.

3.2.2. Capital support options on a monthly payment scheme

a. Payback requirement with monthly payments

The investment feasibility parameters of the business entity / UPT managing school rooftop solar power plants can include the value of the initial investment and routine operational costs (overhead costs) as well as the opportunity to return investment costs from the monthly payment option of the School Management. The cost recovery structure can improve the investment feasibility value of solar power plants, which utilizes the equity capital of the business entity / UPT manager, or can also be supported from outside entities / Banks / other financial service institutions. The financing clause of the solar power plants unit can be accompanied by a repayment period. For example, feasible monthly installments according to the repayment period, which has been elaborated in sub-chapter 2.3.3 (figure 4) and sub-chapter 2.3.4 (table 4) above.

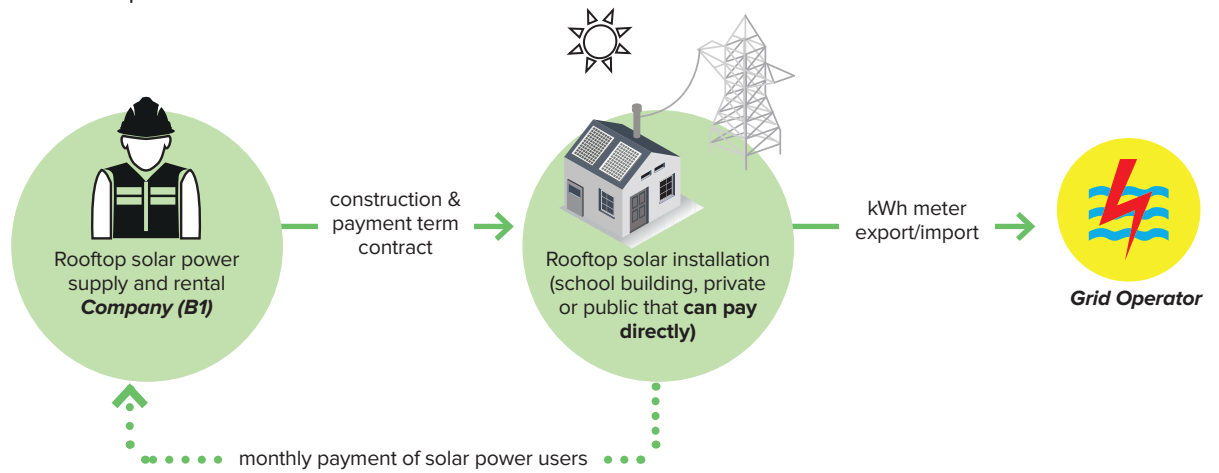
If the prevailing regulatory conditions allow School Managers to pay monthly installments directly²⁷ to the business entity supplying the solar power plants, then the monthly payment can simply use a simple, direct scheme. However, in certain school conditions that may be constrained by the ability to pay monthly installments, which are not necessarily fully able to be made directly by the School Management (in accordance with existing provisions in West Java, for example to make payments for the purchase of equipment, given the price of solar power plants that can be considerably high / exceed the habitual amount of school operational expenses). Faced with such a situation, it is necessary to seek alternative payment schemes that support the investment needs of school rooftop solar power plants, for example illustrated in the following section (example of scheme B2, figure-5).

b. Fixed or variable fee agreement in a monthly payment scheme

The monthly installment payment scheme to recover the initial investment cost of rooftop solar power plants is described in Figure 5 below. In simple terms, scheme option B1 provides a pattern of direct payment from the School, while scheme option B2 illustrates a school that may be constrained by regulations to not be able to pay monthly installments for electricity consumption (because applicable regulations only allow paying limited electricity consumption expenses to PLN, for example).

²⁷ Boarding schools can often manage routine expenditures for electricity payments, or goods expenditures for example, more independently, so that school operational rules do not become an obstacle - this may be somewhat different from public schools that are obliged to follow the school management budget rules as stipulated by the Education Office or local government elements.

Scheme option B1



Scheme option B2

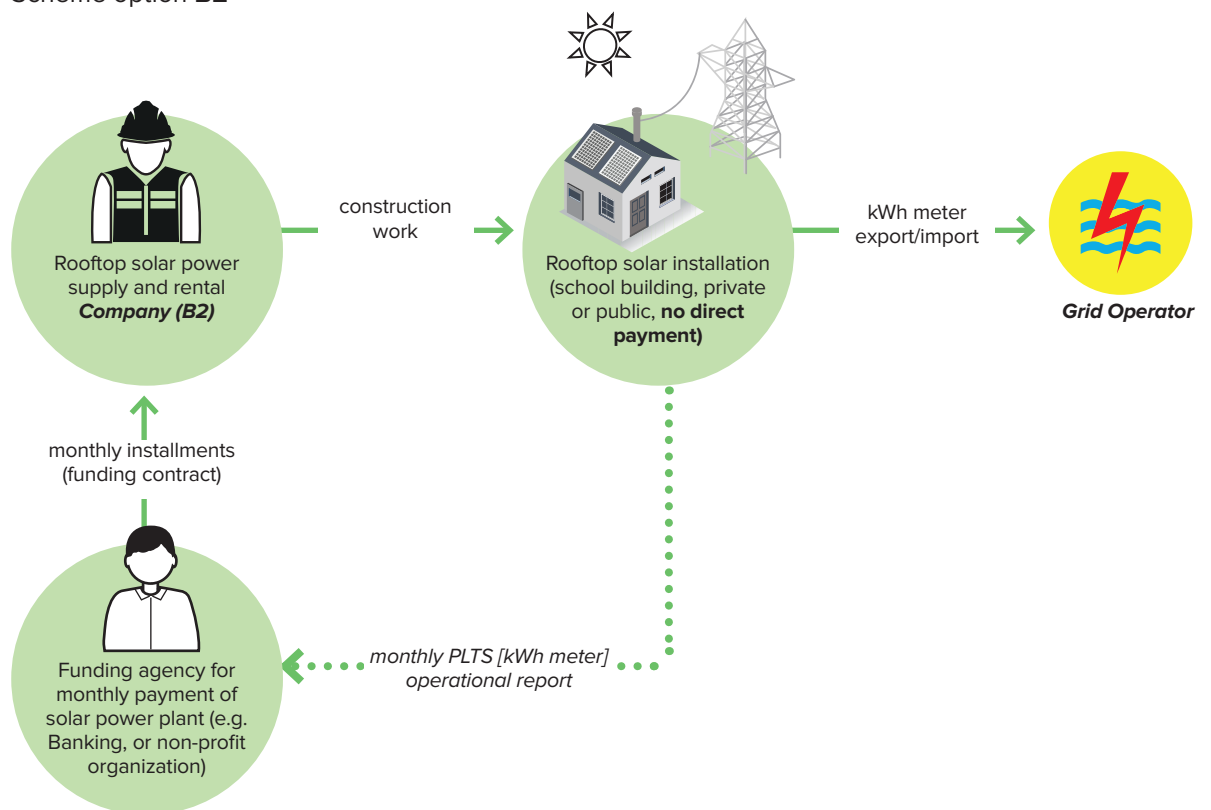


Figure 5. Schools that can pay the installment fee directly (**B1**), or where it is not possible to pay directly (**B2**)

Alternative scheme B2 illustrates the possibility of an external institution that can act as a funder/ payment manager. For example, a financial institution could play a role in managing funds for solar power plants, using existing budgets for example, or external funding such as philanthropic funds or other public grants, or financing initiatives similar to impact investment. The B2 scheme does not require the School Management to pay a monthly fee (if the prevailing regulations still do not allow the School to pay electricity expenses to a party other than PLN). The monthly payment obligation may be covered from the funding institution, to the company supplying (or 'renting') the rooftop solar power plants. In addition, the School Management must also provide continuous reports on the operation of solar power plants, whose data can be obtained, among others, from the installation of export / import kWh meters (kWh ex-im). Thus, it becomes clear that the operational benefits of the school rooftop solar power plants installation are conveyed in periodic reports to the funding agency.

c. Possible proposed rooftop solar power plants equipment 'rental' scheme

Alternatively, a rooftop solar power plants equipment 'rental' scheme is important to provide opportunities for School Managers who may experience situations where the procurement of rooftop solar power plants at their location is hampered. This may be due, among other things, to the fact that the regulations applicable to schools do not allow for the procurement of assets with an adequate value, as part of the operational costs of education that runs in schools.

The alternative option of the rental scheme is expected to encourage further private sector investment in the installation of solar power plants on school rooftops, in a wider working area. In this scheme, the equipment of the rooftop solar power plants does not become the asset ownership of the school management (there is no planned asset handover at a certain time later). The ownership of the rooftop solar power plants assets remains with the solar power plants supply/rent business entity, which will receive regular monthly payments, for example, in a certain amount.

Discussions with the Energy and Mineral Resources Office, Education Office and Bappeda West Java indicated a tendency to arrange a fixed-price, monthly rental fee as the first option. This is said to make it easier for School Managers and the West Java Provincial Government to approve the cost budget, with a fixed amount each month (not depending on the amount of kWh of electricity generated by solar power plants at school locations, in the current month). In the second option, where the School Management will need to pay a variable amount according to the amount of kWh of electricity produced by rooftop solar power plants, it may be less favorable because it can create uncertainty in the amount of budget requirements when compared to the first option above (which has the potential to complicate budget approval procedures from the relevant Offices, or the West Java Provincial Government budget), explained as follows.

[Box 06] Monthly payment procedures in school rooftop solar power plant equipment 'rental' schemes

The business model developed in this study builds on previous plans for rooftop solar power plants, which generally also include a plan to transfer ownership of the solar power plant assets to the School Management (as purchaser of the solar power plants, or grantee).

In other proposed schemes, if the ownership of the assets is not expected to transfer from the supplier of the solar power plants to the user (the school), the burden on the user in such an alternative 'rental' scheme may be lighter.

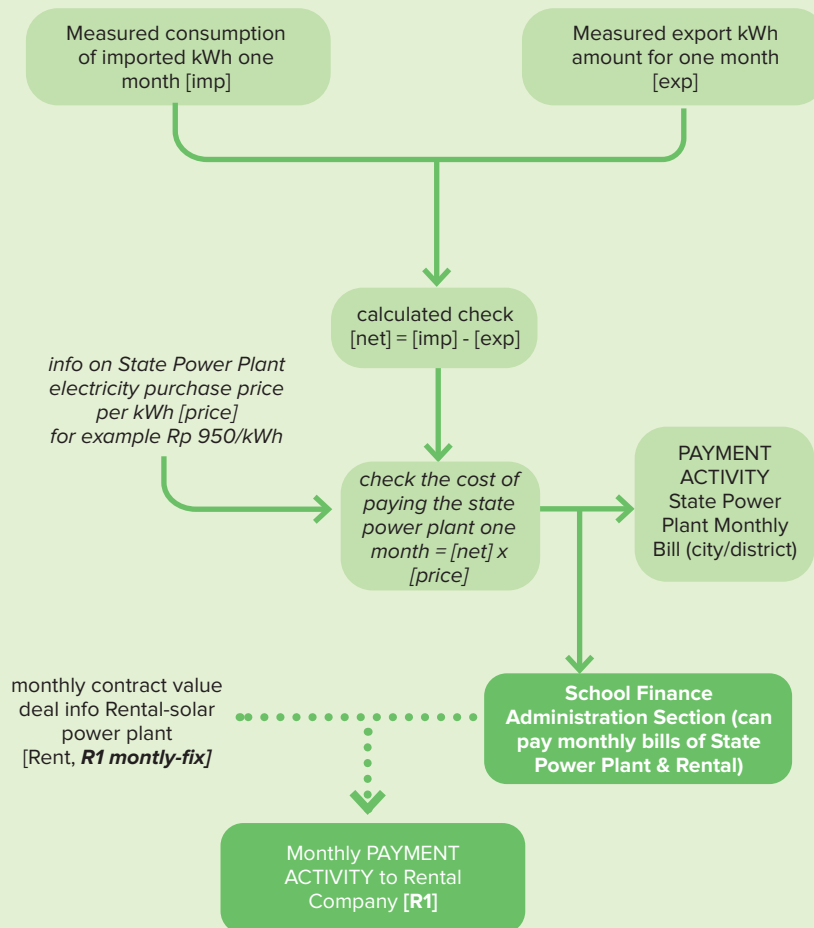
The user could make monthly service payments (to the solar power plant supplier, in the form of a 'service job') that could be determined based on a fixed-price agreement, or determined monthly according to the kWh of electricity used (variable costs, monthly), as illustrated below:

[rental company R1] receive monthly payments according to the initial agreement, fixed, or

[rental company R2] receive payment according to the amount of monthly electricity kWh, variable.

*Option to Pay Fix-costs
to Rental Company -
R1 [Fix]*

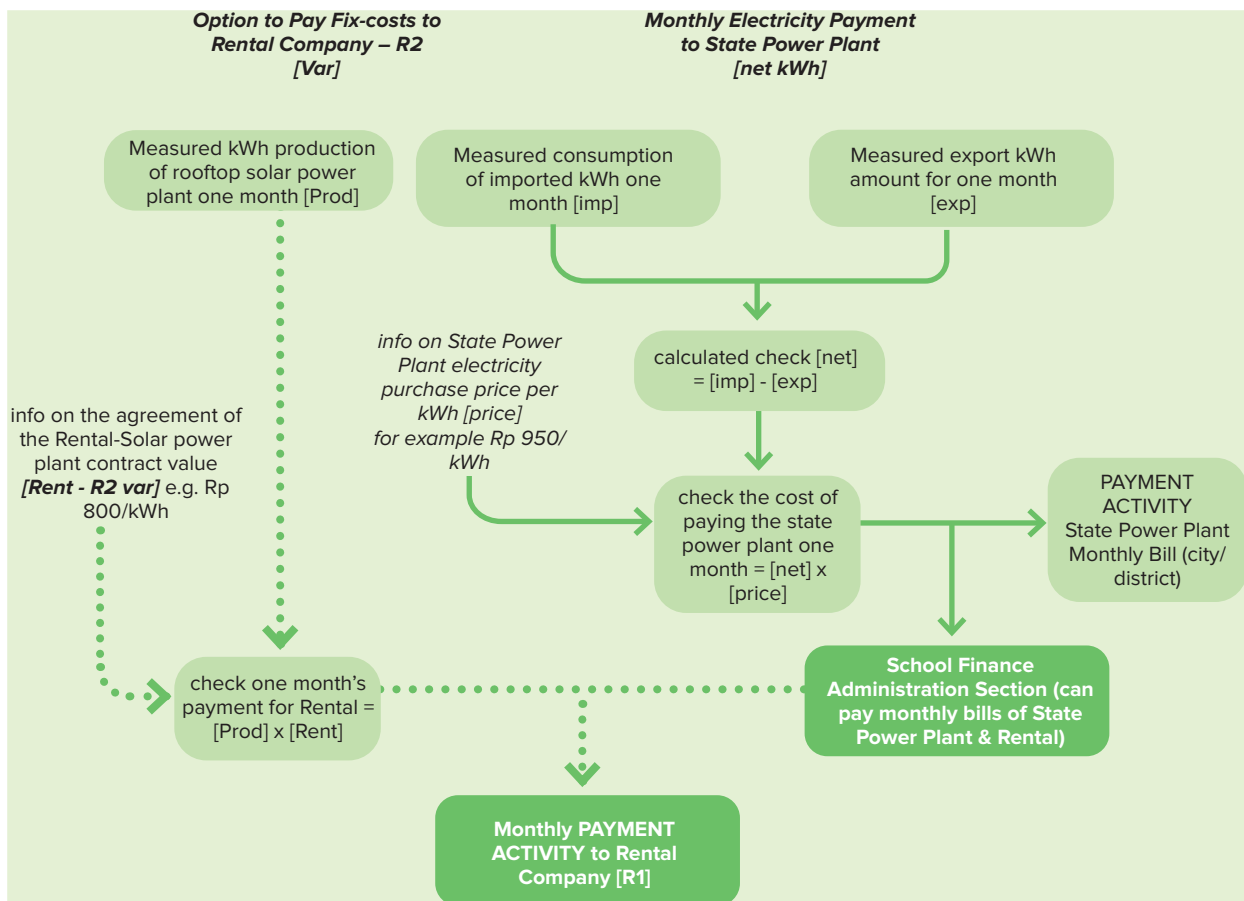
**Monthly Electricity Payment to
State Power Plant (net kWh)**



Fixed rental fee agreement

- Monthly fix-price option
 - ◆ Monthly payment to rental company **R1**
- PLN regular electricity bills
 - ◆ kWhmeter net = (import – export)
 - ◆ PLN electricity tariff (electricity basic tariff, TDL = S-2)

PLN monthly bills can be paid from School Finance Administration



Measurement of solar power plants' kWh production, and net electricity consumption (**var**)

- Option of payment amount based on kWh production (*monthly variable costs*)
 - ◆ Measure kWh production
 - ◆ Rental contract value agreed, e.g. a certain amount of Rp/kWh
 - ◆ Monthly payment to rental company R1
- Regular PLN electricity bills
 - ◆ $\text{kWh}_{\text{meter net}} = (\text{import} - \text{export})$
 - ◆ PLN electricity price (basic electricity tariff, TDL = S-2)
 - ◆ PLN monthly bills can be paid from the funding agency, external entity, that supports the implementation of rooftop solar power plants (payment on behalf of the School Financial Administration)

Issue, challenges on the proposed rental scheme

[multiyear contracting issue] Difficulties in administrative procedures tied to long-term cooperation contracts, considering that if the rental scheme is used, the duration of the rental cooperation contract can be above 10 years (for example, up to 15-20 years). This is mainly because the amount of monthly rental service payments cannot be too high, so that the period of return on the initial investment cost of solar power plants becomes longer (also considering that the cost of PLN bills for schools is considerably cheap, below Rp 1000 / kWh, so the rental fee may have to be more competitive than that, for example, the rental fee per month is around Rp 1 million only).

3.2.3. Preparation of cooperation plan for financing solar power plants investment

a. Direct funding schemes and blended funding options

The elaboration of the funding scheme from the early part of chapter 3 is applied to the direct funding scheme for operational costs (working capital, overhead costs) of BUMDs, or UPT-like work units, that are assigned to accelerate the implementation of rooftop solar power plants. Realizing the large investment financing needs of rooftop solar power plants for hundreds of school locations in remote areas of West Java, the financial burden will be too heavy if it must be borne entirely from the West Java Regional Budget. In the next implementation, funding support of up to Rp 200 billion will be required²⁸, to cover all targeted schools.

Funding from private entities may also have limitations in the amount that can be invested, as the cost per unit is still considerably high (can reach Rp 30 million / kWp capacity solar power plants, without battery systems) while the ability to return the investment (or considered as monthly installments) is still limited. This is partly due to the fact that currently the School Managers are only subject to monthly PLN payments with social tariffs that are still below Rp 1000/kWh of PLN electricity consumption.

The School Managers' ability to pay, or willingness to pay, will tend to be influenced by the School's electricity bill payment habits so far. If, for example, the monthly PLN bill is only around Rp 1 million, it may be a bit more difficult to convince school managers to be willing to pay more, for monthly installments of solar power plants on their school roofs. Developing an effective communication strategy to school managers or the Office budget user authority to allow for a larger allocation of monthly installment costs is required, so that the payback period for rooftop solar power plants is no longer than 10 years, for example.

Some issues related to the long payback period of rooftop solar power plants can be anticipated through blended-finance schemes. The details of the blended-finance structure can be the focus of further study in the next phase. The structure will take into account the rapid development of blended-finance variants, both those that can be facilitated by the Government (or Local Government), as well as inter-agency (B-to-B) schemes, for example through non-profit institutions or other development-partners. To develop a blended financing scheme that is suitable for the characteristics of the implementation of solar power plants on school rooftops, it is necessary to obtain an initial agreement for the management organization structure that is assigned in West Java, such as through a direct BUMD, or a JV partnership pattern or other structure. Based on the agreed management structure, the manager of the blended-finance scheme has sufficient credibility (accountability), so that it can fulfill the pre-conditions towards signing a partnership pattern with a blended-finance option.

In addition, to obtain other public funding support (from development partners organizations) or private funding assistance (grants/CSR, contributions from companies or public private organizations), such additional financing packages are also part of the blended-finance scheme. In order to encourage public or private funding to enter the school rooftop solar power plants program, the managing entity ('platform manager') will need to develop several types of financing packages, which provide clarity for funders to choose the financing package that suits their characteristics, and facilitate the quick disbursement of funds. The strategy of 'marketing' similar financing packages is mostly done through existing digital platforms, e-marketing approach. Some examples of funder engagement strategies that have been undertaken by companies supplying solar power plants in

²⁸ For example, the 2022 Regional Budget has a 'regional capital participation' budget of Rp 402 billion (to Bank BJB), so if the possibility of an additional burden of 200 billion for the acceleration of rooftop solar power plants is required, it could potentially increase the burden by 50% of the capital participation budget, which is burdensome for the Regional Budget., <https://peraturan.bpk.go.id/Home/Details/204694/perda-prov-jawa-barat-no-13-tahun-2021>

Indonesia, through company websites for example, or other digital platforms, such as ‘fundraise campaigns’ (in the form of mobile apps etc.), could be developed specifically for this accelerated scheme of rooftop solar power plants.

[Box 07] Development of offering package for financing school rooftop solar power plants, funder-engagement

To ease the burden of the regional capital placement budget to BUMD, the implementation of blended-funding options involving potential external funders (development-partners program, private grants, CSR, philanthropy or other private contributions) can be designed as one of the work programs of the rooftop solar power plants management entity (BUMD or JV). Potential funders for investment in rooftop solar power plants at each school location can be tapped by providing information that is attractive, concise, targeted and based on actual data that can be technically verified to facilitate accountability of funds.

Some indications that can be considered in the financing package for rooftop solar power plants for schools include the following.

- *Large-scale public funder-engagement packages, without digital marketing*
 - o Development-partners programs, for example from multilateral financial institutions, similar global-scale organizations, can be ‘pursued’ with the preparation of professional work plan documents, and intense communication from the start with the support of the West Java Regional Government, as well as relevant national Ministries / Institutions;
 - o Medium/long-term agreements can be developed with relevant development partner programs, equipped with accountability reports according to work agreements, with reporting formats that are acceptable to funding agencies;
 - o Funding targets can be focused on large-scale school locations, where initial investment needs are considerably high (up to Rp 500 million per school, or more).
- *Medium-large general funder-engagement package, with digital marketing tools*
 - o In addition to funding opportunities from programs of development partner agencies or similar organizations, the utilization of marketing strategies for rooftop solar power plants utilizing existing digital fundraising platforms (such as Kitabisa, etc.) can be developed to introduce rooftop solar power plants in West Java;
 - o A simple digital marketing strategy could look at the example of an animal sacrifice program or similar, which includes technical information on the type of recipient group, location, benefits and other information (generally viewed as philanthropic fundraising, for private funders such as organizations or companies);
 - o Target funding can be focused on small-scale schools, with lower initial investment needs (range of Rp 100-200 million per school);
 - o The amount of funding per school location can be set as a single funder (e.g. if one school needs Rp 150 million then one funder gives the full Rp 150 million); or as a collective funder if up to 10 funders give Rp 15 million then collectively Rp 150 million is raised for that one school.
- *Small-scale group funder-engagement package, with digital marketing tools*
 - o Small general funders, retailers may be able to contribute to the installation of solar power plants on the roof of the school with a relatively limited amount of contribution per funder, but in a number of funders that can be substantial;
 - o Examples of small lenders include school alumni groups, or neighborhood groups, or groups of businesses in a region;
 - o The platform may be similar to the previous option above, with an emphasis on information about the schools receiving the solar power plants that may be persuasive, emotionally engaging for example (as it applies to school alumni groups), or demonstrating social responsibility in the area (for corporate groups);
 - o The management of this small-scale funder engagement package may be separate, given the number of funders that can be substantial, so that the form of accountability of the proceeds obtained for the investment in rooftop solar power plants may be specifically structured, for a target audience according to the specific group of contributing funders.

b. Parameters of blended-finance implementation

The urgency of involving lenders in the preparation of blended-finance work plans, as well as the accountability of non-budget funds managed by BUMD / JV entities needs to apply several working principles, including the following.

- The target of achieving the installed capacity of rooftop solar power plants is expected to help West Java meet its clean energy commitments, so the installed capacity per school is also expected to be larger
 - ◆ If possible, each school should reach 20 kWp or more (considering that some small schools can use capacities below 10 kWp, but still need to prioritize target schools later);
 - ◆ Opportunities to expand the activities of managing entities in islamic boarding school educational institutions (outside SMAN / SMKN) need more attention, considering that the electrical power load of islamic boarding school with islamic student dormitories can be substantial, it is also necessary to focus on raising large-scale non-government budget funds for this (in other words: dream big, then the achievements will be at least close to large-scale).
- Private funds or development-partner institutions that do not target specific school locations (more general) might be prioritized to pay the down payment of rooftop solar power plants equipment, for example up to 50% of the initial investment amount, so that the shortfall is resolved with a monthly installment scheme
 - ◆ Funding support from banks or suitable financial institutions (in the form of commercial loans for example, similar to leasing) can be combined with the above private fundraising, so that the total repayment period of monthly installments is not too long (e.g. under 5 years).
- Data transparency principles are encouraged at the managing entity, BUMD or JV
 - ◆ Professional challenge for the managing entity to understand the blended-funding scheme;
 - ◆ Intense coordination with the team at the central government level, which interacts more frequently with financial institutions or multilateral organizations that are familiar with blended-finance reporting.

c. Potential risks and general mitigation options

Relevant risk categories may include [A] business-financial management risk, [B] system-technical management risk, and [C] personnel-executor management risk, exemplified in the following table.

Tabel 7. General risk mitigation options

##	Risk identification, school rooftop solar power plants	Risk mitigation options [general]
A	<i><u>Business-Financial Management Risks</u></i>	
A1	The unit price of rooftop solar power plants is still high, Rp 20-25million/kWp (could be more) so the target number of schools may not be achieved	Order large scale units <200 kWp, close proximity competitive price but manager must be well prepared (more complex planning)
A2	Ability to pay monthly installments is low < Rp 10million/month	Mixed-funding options: semi-commercial + group grants

##	Risk identification, school rooftop solar power plants	Risk mitigation options [general]
A3	Monthly payments for rooftop solar power plants are not always a priority for school administrators (money available is required for other things that could suddenly become necessary later)	School solar power plants continue to operate even on holidays (reducing monthly PLN bills), with more regular technical assistance to anticipate the risk of monthly payment constraints.
A4	Newly formed entities may be less efficient, costly or have less professional management (strategic planning related to funding may miss the mark)	Recruitment of management staff, management level needs to be very careful, especially in JV schemes involving blended-funding structures, blended financing (grants, other public funds)
B	<u>System-Technical Management Risks</u>	
B1	Electricity production from solar power plants tends to be low (kWh/month)	School solar power plants continue to operate even on holidays, the slope of the installation face of solar power plants is chosen by the school building which is more optimal
B2	Downtime (broken components) & long time to complete repairs	Routine service work, anticipated preventive maintenance, rotation of work teams
B3	Existing school roof construction is not adequate, load limited	More detailed installation design, additional construction if the selected roof position direction needs structural reinforcement
B4	Obstacles to equipment stock availability (logistical issues)	Medium-term work planning (not just short-term)
C	<u>Manpower-Executor Management Risks</u>	
C1	Limited availability of field technical personnel for certification of operability-SLO for each new location	Accelerate technical service companies to obtain IUJPTL accreditation (business license for electricity supporting services), training technical human resources.
C2	Technical communication between PLN and the management team (UPT) can be constrained by PLN's internal solar power plants policy which changes quickly	Energy and Mineral Resources Office Jabar communicates more intensely with the Directorate General of EBTKE (the Ministry of Energy and Mineral Resources) to anticipate changes in regulations, and information in the field.
C3	Technical communication between the Provincial Government / Office and the management team (UPT) can be constrained by the lack of flexibility in the governance of budget rules in West Java (or other technical rules)	Coordination with regional leaders needs to be more intense to anticipate capital needs, related to budget allocations and governance for BUMD, or forms of JV business partnerships
C4	The technical ability to report on the operating performance of solar power plants in each work area is constrained by the consistency of report quality (potential risk of blended-finance implementation)	HR training for mixed funding schemes, philanthropy, development partners funds to understand the details of data requirements and administration of periodic reporting
C5	<i>Leadership vision, the speed of organizational development of the management entity is not sufficient to immediately provide access to solar power plants on school roofs in remote locations in West Java</i>	Coordination with other business entities (e.g. from Jakarta) to expand the scope of work on rooftop solar power plants to the Greater Jakarta area, so as to get more up-to-date and accurate information

3.3. Alternative notes on the implementation of rooftop solar PV for school buildings

3.3.1. Initial cooperation pattern, opportunities for improvement on previous implementation

Some lessons learned from the Direct Marketing [PL] scheme implemented in the installation of rooftop solar power plants at SMAN 3 and SMKN 4 Bandung include:

- **Increased involvement** of school management from the beginning of the work period (planning, construction design, installation of mechanical and electrical structures, to the operation and maintenance of rooftop solar power plants) which has not been done from the beginning, needs to be improved for the technical capabilities of local executors;
- **The importance of having a sense of ownership** on the part of the school management to be better prepared for the handover of ownership of rooftop solar power plants assets that should operate for a long term of > 20 years, which until now (running 3 years) has not yet completed the handover of rooftop solar power plants assets to the school management;
- **The large initial investment costs** (above Rp 20 million/kWp capacity) that should be reduced to be more cost-efficient (Rp 15 million/kWp, or lower), so that the total available investment budget can reach more school locations targeted by rooftop solar power plants.

[Box 08] Note for procurement of rooftop solar power plants - scheme [PL]

Procurement procedures from the School/Education Office/EMR Office can use auctions as usual, requiring no special arrangements.

As such, this direct marketing [PL] option will not be discussed in detail in this study.

Potential drawbacks of this option: the procurement cost burden for the West Java Regional Budget could be large, due to 100% repayment at the beginning (like normal procurement); and the number of procurement contracts becomes substantial which requires monitoring of progress-report status, so that potential obstacles can appear more often in the future (such as delayed payments.).

In addition, the Marketing Cooperation [KP] scheme, if it is to be implemented through BUMDs that are assigned to implement rooftop solar power plants, can initiate limited marketing cooperation efforts with business entities supplying rooftop solar power plants. The advantages and disadvantages, challenges of the [KP] scheme include:

- Convenience :
 - ◆ The structure of the Management Institution (BUMD, or similar work unit UPT) does not need to be too complex, so that it can operate faster, for example, it can use existing business units;
 - ◆ Operational cost requirements can be lower, because the management structure is not too complex;
- Challenges :
 - ◆ Financial capacity tends to be limited, as it relies solely on internal capital structures, without seeking partnerships with other business entities to access funding sources beyond internal capabilities;
 - ◆ Marketing partnerships tend to be temporary, ad-hoc, so that accessing commercial banking funding is not considered as equity for leveraging loan proposals, if required later

(this can be different from the JV partnership pattern, which may be able to combine the capital capabilities of each JV partnering entity in one legal entity, so that the total equity is shared).

[Box 09] Note for procurement of rooftop solar power plants - scheme [KP]

The basic need for the implementation of this option [KP] is to relieve the West Java Regional Budget in providing initial capital for the procurement of all rooftop solar power plants in hundreds of schools, which can provide an opportunity for the school's operational budget to pay the bills from the BUMD in a lighter fixed amount gradually per month (or annually).

The significance of the BUMD placement is to make it easier to reach an agreement on the calculation of the cost of the bill that needs to be paid by the School / Education Office (because it does not have to pay to an external party such as a private business entity, which raises other potential financial risks), because both the party paying the bill and the one receiving the payment are also part of the West Java Provincial Government (controlled risk).

BUMDs such as Migas Hulu Jabar, MUJ can play a role in supporting the procurement of equipment for solar power plants on school rooftops, which have sufficient ability to pay upfront, the installation costs of solar power plants (to the provider / supplier), as well as good business managerial skills for the administration of work contracts related to technical and financial installations.

The financial capability of this BUMD (e.g. MUJ) can be supported by other financing institutions such as Bank Jabar Banten BJB, or other philanthropic/grant funds that may be obtained from contributions of relevant private enterprises, as well as other open funding sources.

3.3.2. Alternative cooperation pattern with internal capital

The alternative of a full JV [**FJv**] partnership can provide a more independent working atmosphere for the JV entity (similar to the UPT manager of BUMD 'MUJ') and be financially sustainable in the long term. This is driven by the responsibility of the JV entity manager for the equity capital invested from the parent business entity, which is expected to generate a certain amount of business profit required to cover the operational costs of the team and ensure the business continuity of the JV entity, as a 'platform manager'. In the original plan, the [**FJv**] scheme was not expected to obtain non-commercial funding support, such as grants or contributions from development-partners.

Realizing this situation, the business pattern of the JV entity must be designed to be cost-efficient, supported by a work organization structure with effective allocation of human resources, like the work pattern of other private business entities. A professional and visionary JV management team and Board of Directors will be required, with a strategic mindset to build business capital synergies from JV partners, such as with rooftop solar power plants supplier business entities (contractors, solar power plants system manufacturers) that have adequate capital capacity at a substantial scale to meet the economies of scale).

Some of the potential risks that can arise in the [**FJv**] scheme include:

- **Selection of JV partners** with solar power plants supplying entities that are committed to developing joint markets (as JV partnerships may tend to be exclusive, only to selected JV partners);
- **Procedures for disbursement of funds** from each JV partner that are professional and not interrupted by developments outside the JV team's operations later (potential risk of investment budget difficulties after several years of operations);

- **Challenges of regulatory availability** in West Java for the development of JV entities from BUMDs with other business entity partnerships, related to flexibility of financial accountability and existing BUMD rules.

[Box 10] Note for procurement of rooftop solar power plants - [FJv] or [SJv] scheme

Similar to the [KP] option, the basic need to implement the [FJv]/[SJv] option is to relieve the West Java Regional Budget in providing the initial capital for the procurement of all rooftop solar power plants in hundreds of schools, which can allow the school's operational budget to pay the bills from the BUMD in a lighter fixed amount gradually per month (or annually).

The significance of a joint-venture (JV) of the BUMD with other private business entities (such as providers/suppliers of solar power plants, or other relevant businesses) is not only to facilitate an agreement on the calculation of the bill that needs to be paid, but also to ease the capital burden of the BUMD (as the capital requirement can be shared among the JV partners).

JVs of BUMDs such as Migas Hulu Jabar, MUJ can play a role in supporting the procurement of equipment for rooftop solar power plants. As a 'platform-manager', the managing entity needs to anticipate the complexity of JV partnerships, prepare technical, financial and administrative clauses that must be agreed upon by each JV partner, and recruit professionals with proven business managerial skills for the administration of work contracts related to technical and financial installations.

The financial capability of the JV-BUMD can be supported by other financing institutions such as Bank Jabar Banten BJB, or other philanthropic/grant funds that may be obtained from contributions from relevant private business entities, as well as other open funding sources

3.3.3. Alternative cooperation patterns with blended-financing options

On the other hand, the alternative non-full JV partnership [SJv], as well as the Marketing Cooperation [KP] scheme with mixed funding options can later increase the capital capacity of the rooftop solar power plants management institution if it obtains additional allocations of other non-commercial funds, to accelerate the installation of solar power plants in other school locations to remote areas of West Java.

Examples of potential risks that can arise in the [SJv] or [KP] scheme with mixed-funding options include, among others :

- **The duration of the planning phase**, where blended-financing schemes can be delayed and the timeline lengthened, has a direct effect on the expected availability of investment funds for solar power plants;
- **Implementation/disbursement procedures** for solar power plants investment budget requirements from blended-funding allocations, which tend to be more complex, can be hampered by the reporting scheme of work results that must meet the criteria of the report structure agreed in advance for blended-financing funds;
- **The increasing complexity** of the managed blended-financing has the potential to increase the need for experienced professional executors, to fulfill each stage of accountability obligations to each source of funding providers, blended-financing.

The two most interested parties in the implementation of rooftop solar power plants are the management entity (could be BUMD, or JV) and the business entity supplying the installation of

solar power plants. For better acceleration, it is necessary to identify their respective interests (profits, interests, etc.) in each of the following [PL]/[KP]/[FJv]/[SJv] scheme descriptions, with some associated risk factors.

Table 8. Summary of implications for BUMDs tasked with implementing school rooftop solar power plants and suppliers

[PL scheme] Direct Marketing Scheme ► sell solar power plants directly to buyers	[KP scheme] Marketing Cooperation Scheme ► each party's capital remains separate (non-JV)	[FJv scheme] Full-JV-full-commercial scheme ► sharing of venture capital (at the beginning)	[SJv scheme] Semi-JV scheme ► sharing of venture capital from the beginning + receive grants
<u>What are the benefits for the supplier of solar power plants in [PL scheme]</u> Simpler procedures, such as general procurement of goods (tend to be fast, already familiar)	<u>What are the benefits for the supplier of solar power plants in [KP scheme]</u> Simple procedures, higher product sales volume	<u>What are the benefits for the supplier of solar power plants in [FJv scheme]</u> Certainty of marketing volume can be substantial, according to the JV operational target agreement (negotiable)	<u>What are the benefits for the supplier of solar power plants in [SJv scheme]</u> Certainty of marketing volume can be considerably large, according to the JV operational target agreement (negotiable)
<u>What are the benefits for the school / Education Office in [PL scheme]</u> Simpler procedures, standard procurement contract clauses, not many terms to negotiate.	<u>What are the benefits for BUMD in [KP scheme]</u> Simple procedure, some clauses of the purchase contract can be negotiated with the supplier (competitive price, easy to manage)	<u>What are the benefits for BUMD in [FJv scheme]</u> JV business capitalization can be lighter, funding coordination with JV partners, equipment logistics more transparent, fast response	<u>What are the benefits for BUMD in [SJv scheme]</u> Less capitalization of JV ventures, coordination of funding with donor agencies, development partners and private enterprises and other public funds
<u>Apa resiko utama pada [skema PL]</u> Biaya investasi lebih besar, resiko target jumlah sekolah penerima tidak tercapai (anggaran terbatas)	<u>Apa resiko utama pada [skema KP]</u> Kebutuhan anggaran modal BUMD cukup besar, resiko target jumlah sekolah penerima tidak tercapai (anggaran terbatas)	<u>Apa resiko utama pada [skema FJv]</u> Inisiatif JV belum terlalu dikenal pada BUMD, resiko regulasi yang bisa memperpanjang waktu persiapan pembentukan entitas JV	<u>Apa resiko utama pada [skema SJv]</u> Kompleksitas pengelolaan dana (modal internal, kontribusi dana pihak luar) perlu penguasaan manajemen pelaporan yang baik
<u>Apa resiko sekunder pada [skema PL]</u> Pembayaran bisa jadi terhambat karena perlu memantau jumlah kontrak individu jadi lebih banyak	<u>Apa resiko sekunder pada [skema KP]</u> Negosiasi kontrak kelompok sekolah penerima bisa panjang, perlu penyesuaian klausul kontrak	<u>Apa resiko sekunder pada [skema FJv]</u> Kepastian perijinan operasional entitas JV (dari BUMD, yang harus ikut kebijakan Pemprov Jabar) bisa berubah lagi nantinya	<u>Apa resiko sekunder pada [skema SJv]</u> Kepastian perijinan operasional entitas JV (dari BUMD, yang harus ikut kebijakan Pemprov Jabar) bisa berubah lagi nantinya

Chapter 4 Conclusion and Recommendation

4.1. Conclusion

The energy transition is proceeding simultaneously in various regions in Indonesia, consistent with the government's commitment to the global community. As one of the efforts to provide distributed energy generation, rooftop solar power plants have the opportunity to take advantage of the availability of relatively low costs, from energy users in the home environment, individual and commercial businesses to other public sector actors. The procurement of rooftop solar power plants from national private providers can be managed with several payment schemes, such as one-off purchase, leasing, or rental, to joint marketing schemes with several business entities in partnership agreements, for example. The selection of procurement schemes is relevant to the capabilities of the energy users, whether they have to carry out all stages of the installation themselves (such as limited financial capacity so that they can only use simple schemes, leasing / rental), or can appoint a technical management party if there is one (BUMD, cooperative / BUMDes, or equivalent).

The acceleration of the implementation of solar power plants on school rooftops in West Java can be pushed for the next few decades, starting with public sector funding support (State Budget / Regional Budget) and then pushed faster with financing contributions from private businesses and non-profit organizations / other development partners. The implementation challenges of funding-business coordination, system-technical coordination and personnel-executor coordination into three sides of the development of the management entity (in this study it can be called a UPT-like entity) are elaborated to provide some proposals for the structure and work patterns of the 'platform manager', along with examples of activity descriptions and work documents that can be an initial reference.

A series of information obtained through discussions with the West Java Provincial Office and Bappeda indicate that the BUMD that will be assigned this year to accelerate the implementation of rooftop solar power plants, PT Migas Hulu Jabar (MUJ), which has been operating in the energy sector, can play a basic role in the formation of a business entity that can operate immediately. The initial budget for the operating capital of the MUJ entity to be formed can be started from the West Java Regional Budget with a work pattern of procurement of equipment that has often been done within the province, utilizing MUJ equity. This entity will be able to continue raising capital for the business, either through cooperation with private businesses, solar power plant equipment suppliers, banks or other financial services providers, or other non-profit organizations that can manage development partner funds / other private funding. Consideration should also be given to ensuring the long-term operational and financial sustainability of the entity, given that rooftop solar power plants are expected to operate well into their 20-year lifespan, or beyond.

The work plan through the operation of the BUMD will also need to follow the governance rules related to the management of the West Java Provincial budget allocation. Specific regulatory studies will be important for guiding the work of business entities (with operations similar to UPT, within the BUMD organization, or separate legal entity options) related to initial funding, additional equity of the business entity (as 'platform manager') for [a] working capital costs, working capital, and [b] investment costs for solar power plants equipment. In addition, efforts to accelerate the installation of solar power plants on school rooftops will need to involve sources of capital outside of the West Java public budget, such as a joint venture scheme, a JV with the business entity supplying the solar power plant equipment (or a JV partnership option that could also involve a local financial institution, or Bank Jabar Banten BJB for example).

Starting with a simpler approach, this study seeks to find effective business model options for implementation, such as a marketing partnership **[KP]** that can be structured for new business entities in BUMDs that are assigned to implement rooftop solar power plants. This model is a development of a common working structure, with a direct marketing **[PL]** scheme that has been applied to several schools and government buildings in Bandung. To provide effective synergies for capital capacity building and technical services, a full commercial joint venture **[FJv]** scheme between several involved enterprises is described in this study. As an option to obtain alternative financing sources such as blended-financing, other public funding sources, as well as grant schemes and innovative funding involving the private sector, a similar semi-JV **[SJv]** business model is also described. This business model can be one of the solutions for utilizing the budget of the West Java Provincial Government, through BUMDs, supported by other private funding. One of the findings of this study is that the implementation of the **[SJv]** business model could be more complex in terms of blended-finance accountability requirements. This important finding will require the support of human resource capacity and institutional managerial skills that are agile and transparent, to ensure funding services for 'clients' (school managers) and long-term business sustainability.

Furthermore, efforts to reduce the investment cost of rooftop solar power plants are important, given that the current price per unit capacity, kWp, is still considerably high. In addition, the urgency to be able to expand the reach of school locations in various parts of West Java is the impetus for efforts to accelerate the implementation of rooftop solar power plants. For this reason, a return on investment strategy can be prepared with a monthly installment calculation, for example, which may be implemented directly by the School Management, or with assistance in operating costs from relevant private entities in achieving the target amount of cleaner renewable energy installations. As a follow-up, a focused study on local financial administration regulations and practices will be required, which can confirm the details of budget management for the return on investment needs of these rooftop solar power plants, through monthly payment strategies or other relevant financial options, so that the capital owned can be further rolled over to the installation of solar power plants in the next location.

This study seeks to address two challenges to the implementation of rooftop solar power plants, namely the relatively low TDL of PLN for school customers (generally S-2) and the provision of electricity payments from school budgets only to PLN (unable to make payments to parties outside PLN for the provision of electricity, for example if generated from rooftop solar power plants financed by non-PLN private parties). The urgency of two preliminary questions that were considered relevant, as mentioned earlier, have been answered in this study. First, the provision of financing for the procurement of rooftop solar power plants is sought initially through the budget of the West Java Provincial Government, which could partly take the form of equity participation in BUMDs. Subsequently, the investment financing needs may be covered from non-budgetary fund contributions, such as from development-partners, grant-like funds and other philanthropy, both from public and private sources (from individuals, groups or corporations). Secondly, addressing the technical financing procedures that need to be resolved with the providers of rooftop solar power plants, the proposed establishment of a cooperation or business-partnership/JV scheme could be an alternative solution, which could involve the companies supplying the solar power plants and financial institutions, other banks. Good technical coordination within the entity managing the rooftop solar power plants (could be BUMD, or JV for example) could facilitate the need for initial investment payments, or if required a lighter monthly installment scheme, or a combination of the two, given the challenges of payment procedures from schools for the procurement of rooftop solar power plants that may need to be overcome by multi-stakeholder funding collaboration.

Investments in solar power plants equipment in the early stages of the accelerated program of rooftop solar power plants may be able to utilize part of the budget allocation (Regional Budget for example) from the West Java Provincial Government to increase the capital of BUMD as the managing entity. For example, in the first 5 - 8 schools a public procurement could be applied to business entities providing solar power plants, e.g. 10 kWp complete installations per school. For the next phase, it may be necessary to seek access to innovative sources of financing, such as third-party placements (e.g. banks, financial institutions) as well as blended-finance sources.

Further unanswered questions in this study include what is the most effective strategy to make the budget allocation to the JV entity (BUMD as 'platform manager') more catalytic in encouraging the implementation of the blended-funding scheme, [SJv] as an important finding of this study. A more detailed technical implementation will require a variety of technical information, data and recent work experience, in the field situation for the implementation of school rooftop solar power plants in West Java, as the technical data obtained from the field work is important in developing a strategy for managing funds from various blended-financing sources. Only by utilizing the West Java Provincial Government's capital placement in the JV entity as a catalyst, rather than as the main source of investment, can the accelerated capacity of solar power plants cover a much wider area of work, and not be limited by the size of the available budget.

4.2. Recommendation

The challenges of implementing rooftop solar power plants may not be easy, among others, with lessons learned from the installation of rooftop solar power plants at SMAN 3 and SMKN 4 Bandung since three years ago, with plans to hand over the assets of solar power plants to the School Management from the Department to be completed this year, with the following groups of Recommendations.

a. Key recommendations for school rooftop solar power plants policy

The analysis of this study concludes that the business model option that can meet the needs of accelerating solar power plants on school rooftops in West Java is managed by an entity formed by a BUMD such as PT Migas Utama Jabar, MUJ. The management entity structure prepared by MUJ can operate immediately, with initial capital from the parent company, as an effort to gain technical and administrative management experience according to current conditions. The structure can later partner with other suitable business parties, for example in a joint venture scheme. Recommendations that can be conveyed are mainly as follows.

First, the business model implementation plan needs to consider several things, including:

- The need to provide funding for investment in school rooftop solar power plants systems, related to funding sources available and accessible to the management entity;
- Encourage funding commitments from existing BUMDs, and optimization of capital placed by the provincial government for the managing entity of school rooftop solar power plants;
- Managing various sources of blended funding, which can begin to be structured with plans for cooperation with appropriate financing institutions, both at the national and West Java levels; and
- Alternative options by utilizing additional funding opportunities in the carbon economic value instrument scheme (which in the future, in addition to being applied to coal-fired power plants, will also be applied to other general actor entities), so that rooftop solar power plants investments can also play a role in the implementation of the scheme.

(Note: constraints on the determination of carbon rights claimed in PLN's control in solar power plant applications need to be addressed, for example by revising the rules of customer contracts, PPAs / similar agreements, such as returning carbon rights to solar power plant investments).

Second, the operational reporting of school rooftop solar power plants is prepared as part of the GHG inventory of the West Java provincial government, among others :

- Monitoring the achievement of West Java GHG emission reduction targets in the Energy sector, which can ensure the performance / capacity of renewable energy generation in the long term (technical work & administrative work);
- Inclusion in climate change mitigation actions (part of provincial obligations in achieving NDC targets, Presidential Regulation 98/2021) so that it is necessary to consider expanding the scope of work that can be managed with the rooftop solar power plants business model, accelerating the increase in installed capacity that reaches general users, communities and businesses in West Java; and
- Integration of the PPRKD (regional low carbon development planning) reporting scheme, as well as a direct impact later on the application of emission ceiling options for businesses and other user institutions;

b. Additional recommendations for the technical implementation of school rooftop solar power plants

Some technical Recommendations that can be conveyed in this initial study for the preparation of the implementation of solar power plants on school roofs include the following.

- Recommendation on the need for funding management(financial resources)
 - ◆ The management entity needs to pro-actively simplify the way of investment / external contributions such as compiling investment packages for rooftop solar power plants in a standardized form at several school locations and utilizing digital media platforms for example (e-marketing). This strategy is important to make it easier for various parties, funders with an interest in increasing renewable energy capacity in West Java, to directly and practically select investment packages that fit their desired characteristics;
 - ◆ Actively communicate to Departments / Bureaus in the West Java Provincial Government related to the implementation experience of clean energy equipment procurement with blended-finance schemes (to develop internal capabilities in BUMD management entities, for example at the Board of Directors or Central Management level that can coordinate with other alternative funding providers), including acceptable quality standards for solar power plants equipment.
- Recommendation on the need for system-technical management (technology resources)
 - ◆ Coordinate intensively with solar energy associations and similar groups to understand current conditions and more effective technical implementation strategies, such as conditions for the availability of various types of components, information on prices and order volumes, and other non-technical cooperation support;
 - ◆ Actively encourage the production of domestic solar power plant components to meet Tier-1 criteria (better quality), with consideration in the procurement of rooftop solar power plant installations that will need to meet Tier-1 criteria to be able to utilize banking financing sources or other foreign funding schemes, blended-finance.

- Recommendation on the need for manpower-executor management (human resources)
 - ◆ Ensure that only professionals are directly involved with the implementation of rooftop solar power plants, rather than simply assigning people without understanding their capabilities and work experience, for example by applying a fit & proper scheme to the management team;
 - ◆ Close coordination with funding agencies at the national, or multilateral, level that develop blended-finance schemes, to keep up-to-date with the latest capabilities and information for the adoption of public and private funding resources that can support the management budget.
- Recommendation on the technical element of operations and maintenance
 - ◆ Intense communication with PLN West Java to understand the working conditions of the electricity network relevant to the school location, related to import-export kWh supply, minimizing curtailment conditions or PLN customer administration according to applicable regulations (as well as possible changes in PLN regulations);
 - ◆ Empowering maintenance experts who work effectively to ensure the operation of rooftop solar power plants in many locations remains in optimum electricity generation conditions, can use internal school personnel, and with the assistance of experienced third-party teams.
- Prinsip-prinsip yang direkomendasikan untuk entitas pengelola PLTS atap sekolah
 - ◆ Data transparency principles are encouraged in the managing entity, BUMD or JV;
 - ◆ Professional challenges for managing entities that understand blended-finance schemes;
 - ◆ Intense coordination with the team at the central government level, which interacts more frequently with financial institutions or multilateral organizations that are familiar with blended-finance reporting.

Annex 1

Brief information on PT Migas Utama Jabar (Perseroda) previously PT Migas Hulu Jabar

BUMD MUJ Activities

MUJ or PT Migas Utama Jabar (Perseroda) was established²⁹ on 2022 as a name change from PT Migas Hulu Jabar which has been operating for almost 10 years, and has become a Holding BUMD, holding company in the energy and mineral resources sector. MUJ's subsidiaries (<https://muj.co.id/>), namely PT MUJ ONWJ, PT Energi Negeri Mandiri ENM, and PT MUJ Energi Indonesia, as MUJ holding provide the business field of office and commercial rooftop solar power plants, in the ENM business entity (<https://energinegeri.co.id/>), as quoted from the Company Profile (<https://muj.co.id/company-profile/>).

Business development in the renewable energy sector such as rooftop solar power plants is still in side business development with limited value. However, the work experience of MUJ-holding (and ENM as an independent entity that has run a commercial business for solar power plants on the roof of industrial buildings) is an important factor for the formation of an entity that manages solar power plants on school roofs, with a considerably wide scope of work throughout West Java, up to hundreds of school locations that can become business targets.

It is possible that in the next decade MUJ can enter the commercial solar power plants business as a private generator, IPP that has a power purchase agreement, PJBL with PLN West Java, among others, supported by the issuance of Presidential Regulation 112 / 2022 concerning the Acceleration of Renewable Energy Development³⁰. The operation of large-scale solar power plants, utility-scale solar farms can utilize digital technologies that provide technical capabilities for MUJ teams that are more competitive. Furthermore, monitoring the operation of rooftop solar power plants at various school sites can take advantage of digital data communication functions on inverter systems with integrated wireless control, as well as the development of PV command-center platforms later for technical system management support (monitoring optimization of generation performance, kWh per hour / day) and commercial side management (anticipation, mitigation of monthly financial risks). With the results of the technical ability to manage rooftop solar power plants, MUJ can continue to improve project financing capabilities for more school locations, and prove the confidence of funding agency partners, both local and foreign, through the reliability of solar energy technology facilities and electricity backup storage to be operated.

Demand for rooftop solar power plants has indicated an increase in the number of residential and industrial customers, following the recent increase in PLN's non-subsidized TDL electricity tariff. The value of cost savings for PLN customers has increased significantly, driving an increase in the market with the lower cost of rooftop solar power plants. With no increase in the S-2 social PLN tariff.³¹ For school customers, the increased cost savings may not be felt immediately. However, the MUJ business opportunity for entities managing solar power plants to increase the marketing of their products can be an important consideration for the future development of the business scope. Two things are important here for [a] improving the technical capabilities of MUJ management entity staff by handling more installations of solar power plants, and [b] improving the funding flow for MUJ management by adding solar power plant customers outside schools (large residences or industries that have a better ability to pay and immediately get significant savings in electricity bills).

²⁹ Jabar jadikan MUJ, BUMD Induk Bidang ESDM <https://muj.co.id/tok-sah-jabar-jadikan-muj-bumd-induk-bidang-energi-dan-sumber-daya-mineral/>

³⁰ Perpres 112 / 2022 <https://drive.esdm.go.id/wl?id=o8WDM5f2AXpP9Aw2y4CFnvB3t2JdOaf> <https://ebtke.esdm.go.id/post/2022/09/15/3261/telah.terbit.peraturan.presiden.ri.nomor.112.tahun.2022.tentang.percepatan.pengembangan.energi.terbarukan.untuk.penyediaan.tenaga.listrik>

³¹ nilai TDL PLN yang ditetapkan Peraturan Presiden 8 / 2011 untuk pelanggan sosial S-2 (sambungan daya 3.5 – 200 kVA) Rp 755/kWh sempat naik pada 2013 lalu menjadi Rp 789/kWh (Permen ESDM 30 / 2012) dan hingga sekarang tarif sosial S-2 diatas Rp 900/kWh

ENM's business field in renewable energy can include solar power plants in the future, among others with the cooperation of BUMN PT LEN (Persero) as a component manufacturer in Bandung, as well as the supply of manufacturing systems for other solar power plants. The installation of solar power plants on the roof of MUJ's head office, which was purchased from a subsidiary of PT LEN Agra Surya Energi earlier this year as a pilot of initial technical capabilities in the solar power plants business for MUJ holding, can arrange business cooperation with other strategic partners. Furthermore, it is necessary to look for other Tier-1 solar power plant component suppliers in Indonesia, capable of handling larger capacities up to the Megawatt-peak order, for example.

Support for the ability to pay from the company to ensure the availability of goods to be prepared before installation in school or industrial / residential buildings needs to be encouraged by the capital capabilities provided by MUJ holding to the management entity (ENM for example, if it requires the supply of equipment up to 100 kWp capacity as inventory reserves, it needs the ability to pay up to Rp 2 billion to the supplier / manufacturer, and so on). As an initial consideration, if one school requires solar power plants with a capacity of 5 - 10 kWp, the 100 kWp inventory reserve can only fulfill less than 20 school locations. To achieve the target number of school sites, the MUJ management entity (ENM for example) will require higher capitalization capabilities, up to Rp 20 billion or more.

If a business partnership, joint-venture is arranged by MUJ holding with strategic partners such as business entities supplying solar power plants or funding providers / Banks, then the capital needs of MUJ in a substantial amount may be lighter for MUJ later.



Figure A1. Headquarters of BUMD Migas Utama Jabar (previously Migas Hulu Jabar), installation of rooftop solar power plants

Source : MUJ webpage <https://muji.co.id/energi-terbarukan/> <https://g.page/mujonwj?share>

Holding MUJ also plans to develop public electric vehicle charging stations (stasiun pengisian kendaraan listrik umum / SPKLU³²) to 100 locations in Bandung. West Java Governor who³³ MUJ headquarters on September 19, 2019 and its rooftop solar power plants want MUJ to become a leading BUMD in renewable energy and encourage the conversion of electric vehicles, starting from Bandung.

³² The business model needs to be studied separately, due to the much greater investment needs of SPKLU, and the difference in SPKLU income.

³³ Inauguration of MUJ office rooftop solar power plants <https://jabar.jpnn.com/jabar-terkini/6149/ridwan-kamil-dorong-pt-muj-lakukan-pengembangan-dan-pemanfaatan-ebt?page=2>

Financial Capability of BUMD MUJ

MUJ's annual report of 2020³⁴ describes retained earnings, appropriated as Rp 86 billion, up from Rp 67 billion at the end of 2019 (MUJ 2020 current assets up to Rp 288 billion, up from Rp 107 billion in 2019). Furthermore, the MUJ 2021 annual report explains that the balance of profit (retained earnings, appropriated) increased again to Rp 127 billion, and MUJ 2020 current assets continued to rise to Rp 501 billion. MUJ's retained earnings became equity attributable to owners, reaching Rp 345 billion (2021), up from the previous year's Rp 221 billion (2020).

The business focus of the BUMD holding company as a whole, starting from the participating interest field-ONWJ, still remains the main one for MUJ, for the development plan out to the Aceh oil field. Considering the financial capability of MUJ holding in its annual report, it may be a bit tough for MUJ to provide capital placement to the entity managing rooftop solar power plants if the need will be more than Rp 20 billion for example. As the basis of the capital of the solar power plants management entity, which is required for institutional development, both technical and administrative financing for the management of the new rooftop solar power plants management entity, to cover the investment costs of rooftop solar power plants in all schools.

Consideration of the magnitude of the funding needs encourages the urgency of forming a business partnership scheme, joint-venture. If partnerships with financing institutions (Bank Jabar, BJB for example) can help manage the provision of funding, including periodic payments to business entities supplying solar power plants for example, or other third-party payments, then the capital requirements of the MUJ holding (or placement of Provincial Government capital) will be lighter.

Technical capacity building for MUJ Management and entities managing rooftop solar power plants

The three essentials for a well-developed and financially sustainable rooftop solar power plant operation in the long term include [a] quality selection of components and installation systems; [b] competence of executors who work efficiently, and [c] knowledge management that is seriously managed as a reference for well-implemented work standards.

Owning and operating rooftop solar power plants is insufficient to manage financing sources and return on investment. The management entity needs to develop a digitized operation and maintenance (O&M) monitoring system integrated with central management and dispersed executors. The stages of starting a business activity from the establishment of a management entity and initial work experience, to operating a technical network in cities and districts in West Java can be structured as follows ('indications' are the prerequisite conditions, and 'priorities' are targets that require focused efforts).

- Start-up of management entity (2022–2023)
 - ◆ [indication] Holding MUJ may form a rooftop solar power plants management entity that operates independently, for example with the coordination of a subsidiary (ENM), and obtain capital placement for investment in rooftop solar power plants for schools, and get a 'green light' coordination of Energy and Mineral Resources Office / Education Office West Java for certainty of management of ownership of rooftop solar power plants assets;
 - ◆ [priority] Installation of rooftop solar power plants at a number of school locations, according to the capital capacity of the management entity, with the option of third-party cooperation;
 - ◆ [phase-a] Establishment of a management entity, with the provision of competent management and executor personnel for the rooftop solar power plants business, as well as work procedures for procurement of equipment in accordance with regulations;

³⁴ Financial Report, PT Migas Utama Jabar - Annual Report, MUJ webpage <https://muj.co.id/laporan-tahunan/> <https://drive.google.com/file/d/1VE-2fAjpoeejj11lhbyt33fUrB6bJLCR/view>

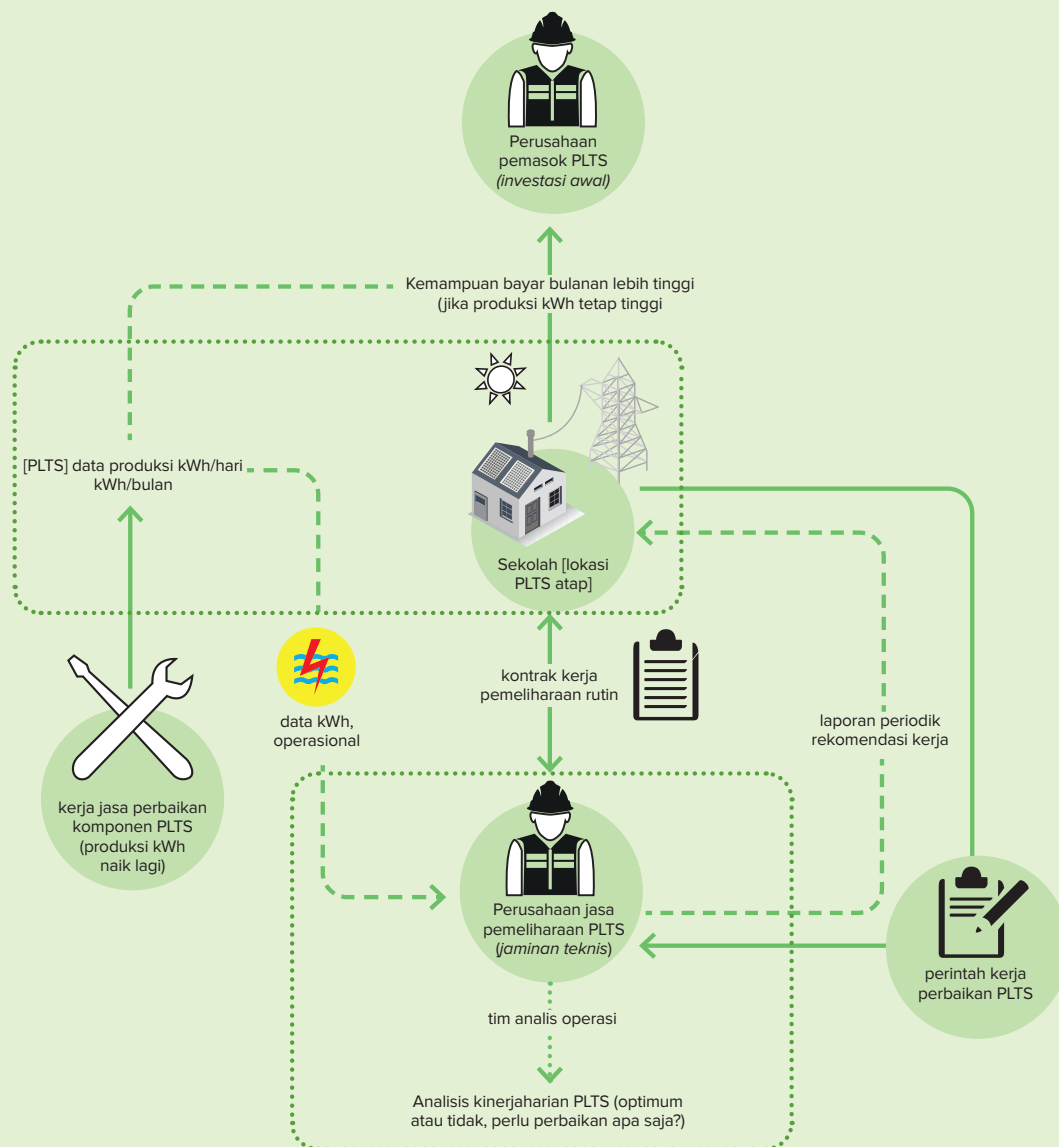
- ◆ [phase-b] Preparation of technical information of business entities supplying rooftop solar power plants installations relevant for the West Java market, technical specifications / prices to guarantee after-sales performance (kWh generated);
- ◆ [phase-c] Implementation of the procurement phase of rooftop solar power plants, up to the completion of installation and commissioning of the units;
- ◆ [phase-d] Monitoring the operation and maintenance of the solar power plants, from MUJ/managing entity technical personnel, as well as third-party service options;
- ◆ [phase-e] Evaluation of the performance of the installed solar power plants, improvement of the work efficiency of the management team to the replacement of systems / components that are not on target, if necessary;
- ◆ [phase-f] Increase the capacity of the work team, expand the service area of rooftop solar power plants to several cities and regencies, according to the strategic plan of BUMD MUJ;
- ◆ [phase-g] Start considering partnership plans, joint-venture options;
- ◆ [phase-h] Identify alternative funding sources-mixed, blended-finance.
- Follow-up development (2023–2029)
 - ◆ [indication] Banks that partner with entities managing rooftop solar power plants (MUJs) can provide financing schemes for solar power plants for public school sites, and can also run installment payments for investment returns (so as to finance solar power plants at subsequent school sites);
 - ◆ [priority] The managing entity of rooftop solar power plants completes the installation of more than 100 school sites, or has reached a capacity scale of >1 MWp in total;
 - ◆ [phase-a] Managing entity partners with a solar power plants system supplier in West Java, to jointly build an efficient and integrated business model (from initial installation to long-term performance guarantee), including the option of using Tier-1 solar power plants components;
 - ◆ [phase-b] Build strategic partnerships with Banks or funding institutions, to manage the initial investment and return on investment, such as blended-finance options;
 - ◆ [phase-c] Grow a network of rooftop solar power plant managers in several priority cities, e.g. school groups, or groups of rooftop solar power plant service providers (operation and maintenance, O&M) to build a communication database, specific generations, unit performance & local issues resolved;
 - ◆ [phase-d] Start considering battery electricity storage systems that match the capacity of rooftop solar power plants, with the agreement of PLN West Java for virtual power plant options (or also power wheeling).
- Follow-up development, second alternative in private schools, Islamic boarding school (2023–2029)
 - ◆ [indication] Banks in partnership with the entity managing rooftop solar power plants (MUJ) provide financing schemes for solar power plants units for private school sites, Islamic boarding schools and can also run installment payments for investment returns;
 - ◆ [priority], [phase a - d] Similar to above.
- Future options, long-term (2030–.....)
 - ◆ [indication] PLN can receive supply from large-scale centralized solar power plants (>10 MWp) in West Java;
 - ◆ [priority] Holding MUJ has a total capacity of solar power plants (rooftop installations and centralized systems/IPPs) of >1 GWp in West Java, and is beginning to identify potential development areas outside of West Java;
 - ◆ [phase-a] The technical capabilities of the staff and management of the entities managing solar power plants (e.g. ENM subsidiaries) are proven to be capable of managing the procurement of new solar power plants installations up to MWp/year scale;
 - ◆ [phase-b] Additional capacity of solar power plants managed by MUJ holding can be in the form of centralized solar power plants (IPP contracts, independent power producers) in the West Java region, for example in collaboration with lake / reservoir management for floating solar power plants

and also with solar power plant equipment supply business entities that have the ability to supply large volumes (contractor options);

- ◆ [phase-c] Increasing the capacity of domestic manufacturers of solar power plant components can be encouraged by MUJ holding through managing financing for plant expansion in West Java, for example the target towards 100 MWp / year for accelerating clean energy and substituting imported products for solar power plant components;
- ◆ [phase-d] Holding MUJ can manage battery recycling facilities for solar power plants (for new product manufacturing), as well as the utilization of leftover EV batteries for centralized energy storage installations such as stationary electric storage units).

[Box A1] Operation and maintenance activities, O&M

In order to properly achieve the basic goal of generating a certain amount of clean energy, operational and maintenance work planning is an absolute prerequisite for school parties with a direct interest. Through a series of works and evaluations to analyze the performance of the installed rooftop solar power plants, the O&M team (which can be composed in-house, or utilize the services of a third party such as a maintenance company for example) will collect various technical operation data, including electricity production kWh/day, or kWh/month.



Data processing and analysis by the O&M team can be compiled into Periodic Reports and Recommendations for maintenance work on rooftop solar power plants. School administrators who read the solar power plant performance reports can take note of the relevant technical Recommendations, and then give prioritized maintenance work instructions, to keep the solar power plants' electricity production optimum in the long term. The importance of good maintenance results will provide significant savings in the cost of PLN electricity bills, for the benefit of the investment in rooftop solar power plants (which better guarantees the return on investment, on a monthly payment basis for example).

Furthermore, the MUJ management entity needs to formulate a work plan that is in line with the objectives of its initial establishment, or the assignment from the West Java Provincial Government for the management of rooftop solar power plants. In MUJ's strategic planning, the management or board of directors will answer several existence questions for the MUJ management entity, which can be structured like a checklist to set the direction of the work plan, the business-plan of BUMD MUJ for example as follows.

- Is MUJ interested in entering the IPP solar power plants business?? → as the development of the company's technical capabilities
 - ◆ if the Capex is above Rp 20 billion per MWp, would it still be interested?
 - ◆ if the asking price is USD 4 cents/kWh (or Rp 600/kWh), would it still be interested??;
- Can MUJ accept if the solar power plants business capital of up to Rp 20 billion is planned for no return on investment, because the nature of this capital is invested to provide technical knowledge for the MUJ team for the operation of solar power plants?
 - ◆ if the owner of the West Java Provincial Government building is willing to pay monthly installments of Rp 160 million/month for 1 MWp capacity (or 140,000 kWh per month of electricity production, or the equivalent price of an electricity bill of Rp 1150/kWh), how does MUJ expect the building owner to pay it?
 - ◆ if it turns out that the monthly burden is considered too high, and can only pay Rp 100 million/month for example, for the same capacity (or the equivalent price of Rp 700/kWh electricity bill only), then is MUJ or the funder willing to cover the shortfall of investment costs up to the remaining Rp 8 billion?
 - ◆ What grants or contributions from other sources of funding could reach the required Rp 8 billion??
- Has MUJ implemented an annual sustainability reporting?

Additional recommendation for the need of a follow-up information and analysis

Other recommendations for follow-up studies and more detailed analysis include the following.

- The details of the blended-finance structure can be the focus of further study in the next phase. The structure will take into account the rapid development of blended-finance variants, both those that can be facilitated by the Government (or Local Government), as well as inter-agency (B-to-B) schemes, for example through non-profit institutions or other development partner institutions, development-partners;
- Formulation of technical-financial clauses such as funding from Banks (can be in the form of investment capital to the management entity, or installment returns from each unit of solar power plants), including business-partnership patterns, JVs with relevant BUMDs, in accordance with applicable regulations in West Java;
- Determination of the most effective strategy to make the budget allocation to the JV entity (BUMD as platform manager) to be more 'catalytic' in encouraging the implementation of the blended-funding scheme; and
- Further detailed governance and regulatory studies will be required for the implementation of JV business-partnership structures involving BUMDs in West Java.

The implementation stages of the MUJ management entity fulfill several provisions that apply to BUMD, BUMN and the governance rules of the West Java Provincial Government.

[Box A2] Several implementation rules related to BUMD and governance within West Java Province

Peraturan Pemerintah RI No.54 Tahun 2017 tentang BUMD <https://peraturan.go.id/common/dokumen/ln/2017/pp54-2017bt.pdf>

Peraturan Menteri Dalam Negeri Nomor 118 Tahun 2018 Tentang Pedoman Kerjasama BUMD <https://peraturan.go.id/common/dokumen/bn/2019/bn155%20-%202019.pdf>

Peraturan Menteri Dalam Negeri Nomor 19 Tahun 2016 tentang Pedoman Pengelolaan Barang Milik Daerah <https://peraturan.bpk.go.id/Home/Details/137669/permendagri-no-19-tahun-2016>

Peraturan Menteri BUMN Nomor PER-07/MBU/04/2021 tanggal 21 April 2021, tentang Perubahan Kedua Atas Peraturan Menteri Badan Usaha Milik Negara Nomor PER-03/MBU/08/2017 Tentang Pedoman Kerja Sama Badan Usaha Milik Negara <https://jdih.bumn.go.id/lihat/PER-07/MBU/04/2021> <https://jdih.bumn.go.id/lihat/PER-03/MBU/08/2017>

Peraturan Daerah Provinsi Jawa Barat Nomor 10 Tahun 2017 tentang Penyertaan Modal Pemerintah Provinsi Jawa Barat <https://jdih.jabarprov.go.id/page/info/produk/7364>

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Peraturan Bupati Bandung No.53 Tahun 2017 tentang Bandung tentang Penghapusan Barang Milik Daerah di lingkungan Pemerintah Kabupaten Bandung <https://jdih.bandungkab.go.id/uploads/2018/04/PERBUP-53-Tahun-2017.pdf>

Peraturan Walikota Bekasi Nomor 03 Tahun 2019 tentang PEDOMAN PELAKSANAAN PENGELOLAAN BADAN USAHA MILIK DAERAH <https://jdih.bekasikota.go.id/peraturan-walikota/view?id=1731>

Peraturan Daerah Provinsi Jawa Barat Nomor 2 Tahun 2013 tentang Pedoman TJSL Perusahaan serta Program Kemitraan dan Bina Lingkungan di Jawa Barat <https://www.bphn.go.id/data/documents/provinsijawabarat-2013-2.pdf>

Annex 2

Estimated operating budget of the Managing Entity, MUJ

Possible Managing Entity's proposed budget plan (baseline estimate, for Scenario One)

The initial assumption for the Managing Entity's operating budget is that it will be sufficient with an IRR of 9% (this estimate is slightly above the inflation rate, in the range of 4 - 6%).

The installation of solar power plants on school rooftops that the Managing Entity will invest in is expected to be able to obtain a return on investment (which comes from the value of electricity bill savings, with the Social S-2 tariff of Rp 900/kWh multiplied by the estimated annual electricity production of rooftop solar power plants) over the 25-year operating life, with the calculation of NPV (discount rate = IRR expected) which will be calculated as follows, for the installation of solar power plants per 1 kWp.

[a] Calculation of annual electricity production

Daily effective operating hours = 5 hours/day

Annual effective operating days = 260 days/year

(note: calculation of working days outside of Saturday-Sunday, given the PLN policy which currently tends to be restrictive, so it is estimated that there is no export of electricity from solar power plants to the PLN network on Saturday-Sunday)

Annual effective operating hours = $5 \times 260 = 1300$ hours/year

Subtracting the absorption of non-existent load during school holidays, multiplied by 44 days / year off (or effectively 2 months), multiplied by 5 hours / day (as in the calculation of hours above), to be reduced by 220 hours / year

(note: many schools also have more than 44 days off, this estimate is for the low end only.)

→ Effective operating hours, non-holidays = $1300 - 220 = 1080$ hours/year

1 kWp solar power plant unit → $1 \text{ kWp} \times 1080 \text{ hours/year} = \mathbf{1080 \text{ kWh/year}}$ (per capacity of 1 kWp)

[b] Potential electricity cost savings

S-2 school electricity tariff = Rp 900/kWh

Electricity cost savings of solar power plants = $\text{Rp } 900/\text{kWh} \times 1080 \text{ kWh/year} = \text{Rp } 972 \text{ thousand/year}$

The value of this cost savings becomes the "ability to pay for rooftop solar power plants for the initial investment cost"

[c] NPV of cost savings Rp 972 thousand/year, for 25 years

The net present value of the 25-year savings is calculated assuming a 9% discount rate (IRR).

NPV (9%) = Rp 9,550,000 (per capacity of 1 kWp)

Furthermore, by estimating the investment cost of rooftop solar power plants per 1 kWp at Rp 15 million, the NPV value of cost savings over the 25-year operating life is still insufficient to cover the initial investment cost. Therefore, the need for additional budget from outside the Managing Entity (such as grants or other third-party programs) becomes $\text{Rp } 15 \text{ million} - \text{Rp } 9.55 \text{ million} = \mathbf{(\text{Rp } 5,45 \text{ million}) / kWp solar power plants.}$

[d] Allocation of discount rate, Managing Entity margin

The above calculation uses an assumption of a 9% discount rate, which can only apply if the investment in rooftop solar power plants is financed through a funding scheme with low interest, a maximum of 5% p.a. This is intended so that the operations of the Managing Entity have a margin slightly above the amount of interest, with the following calculation.

[d.1] Ability to pay for rooftop solar power plants for their initial investment costs (point 'b' above)

From the ability to pay for rooftop solar power plants of Rp 972 thousand / year, giving an NPV value (25 years) of Rp 9.55 million (9% discount rate).

If the investment in rooftop solar power plants uses 5% low interest funding only, then with several iterations of calculations to obtain the same NPV (Rp 9.55 million from 25 years NPV) requires an 'annual budget' equivalent to an amount of Rp 677 thousand / year, to cover the investment costs of rooftop solar power plants.

Thus, the difference in the 'annual budget' of Rp 972 thousand - Rp 677 thousand = Rp 295 thousand / year is the 'potential annual gross revenue, per 1 kWp of capacity' for the Managing Entity (with an expected 9% IRR) after deducting the budget to cover the initial investment cost of the rooftop solar power plants above, for each 1 kWp of installed capacity.

[d.2] Allocation for the Managing Entity's business operating budget (and other additional funding requirements)

If the total installed capacity of rooftop solar power plants throughout West Java is expected to reach 10 MWp, then the potential annual gross receipts could reach 10,000 multiplied by Rp 295 thousand/year to Rp 2.95 billion/year.

This potential annual gross revenue can be allocated as 'working capital of the Managing Entity'.

Please note that this calculation still requires the need for additional budget from outside the Managing Entity, such as grants or other third party programs, amounting to (Rp 5.45 million) / kWp solar power plants, as explained above, the total third party program funds required are 10,000 multiplied by Rp 5.45 million, to be (Rp 54.5 billion), for a total capacity of 10 MWp.

[d.3] Alternatives to increase the Managing Entity's business operating budget

If, for example, in the alternative scenario, an interest-free (0%) funding source can be obtained for the initial investment of rooftop solar power plants, then to provide the same NPV (25 years) value (i.e. Rp 9.55 million) an 'alternative annual budget' equivalent to Rp 382 thousand / year (0% discount rate) is required, to cover the investment costs of rooftop solar power plants.

Thus, the difference in this 'alternative annual budget' becomes Rp 972 thousand - Rp 382 thousand = Rp 590 thousand/year.

If the total installed capacity of rooftop solar power plants across West Java is expected to reach 10 MWp, then the potential annual gross revenue could reach 10,000 multiplied by Rp 590 thousand/year to Rp 5.9 billion/year, which could be allocated as 'working capital of the Managing Entity' (alternative scenario, with interest-free funding sources, 0% discount rate).

This condition still requires the fulfillment of additional budgetary needs from outside the Managing Entity, such as grants or other third-party programs, amounting to (Rp 5.45 million) / kWp solar power plants, as described above.

Sensitivity analysis, for extreme conditions, funding with commercial loans (Second Scenario)

In this second scenario, commercial loans for initial investment in rooftop solar power plants are assumed at an interest rate of 10%, which also raises the IRR assumption to 14% for calculations similar to Scenario One above.

[e] Calculation of annual electricity production

→ Effective operating hours, non-holidays = $1300 - 220 = 1080$ hours/year

1 kWp solar power plant unit → $1 \text{ kWp} \times 1190 \text{ hours/year} = 1080 \text{ kWh/year}$ (per capacity of 1 kWp)

[f] Potential electricity cost savings

Solar power plants electricity cost savings = $\text{Rp } 900/\text{kWh} \times 1080 \text{ kWh/year} = \text{Rp } 972 \text{ thousand / year}$

[g] NPV of cost savings Rp 972 thousand/year, for 25 years

The net present value of the 25-year savings is calculated assuming a 14% discount rate (IRR).

NPV (14%) = Rp 6,680,000 (per capacity of 1 kWp)

As above, by estimating the investment cost of rooftop solar power plants per 1 kWp at Rp 15 million, the NPV value of cost savings over the 25-year operating life is still insufficient to cover the initial investment cost. Thus, the need for additional budget from outside the Managing Entity (such as grants or other third-party programs) is as follows $\text{Rp } 15 \text{ million} - \text{Rp } 6,68 \text{ million} = (\text{Rp } 8,32 \text{ million}) / \text{kWp}$ of solar power plants, for this Second Scenario (assuming 14% discount rate).

[h] Allocation of discount rate, Managing Entity margin

The above calculation uses an assumption of 14% discount rate, for financing investment in rooftop solar power plants with a commercial interest rate of 10% p.a. It is intended that the operations of the Managing Entity have a margin slightly above the amount of interest, with the following calculation.

[h.1] Ability to pay for rooftop solar power plants for their initial investment costs (point 'f' above)

From the ability to pay for rooftop solar power plants of Rp 972 thousand / year, gives an NPV (25 years) of Rp 6.68 million (14% discount rate).

If the investment in rooftop solar power plants uses 10% commercial interest funding, then with several iterations of calculations to obtain the same NPV (Rp 9.55 million from 25 years NPV) requires an equivalent 'annual budget' amount of Rp 736 thousand/year, to cover the investment costs of rooftop solar power plants.

Thus, the difference in 'annual budget' of Rp 972 thousand - Rp 736 thousand = Rp 236 thousand/year is the 'potential annual gross revenue, per 1 kWp of capacity' for the Managing Entity (with an expected 14% IRR) after deducting the budget to cover the initial investment cost of the solar power plants.

[h.2] Allocation for the Managing Entity's business operating budget (and other additional funding requirements))

If it is expected that the total installed capacity of solar power plants on school rooftops throughout West Java reaches 10 MWp, then the potential annual gross revenue can reach 10,000 multiplied by Rp 236 thousand / year to amount to Rp 2,36 billion / year.

This potential annual gross revenue can be allocated as 'working capital of the Managing Entity'.

Please note that this calculation still requires the need for additional budget from outside the Managing Entity, such as grants or other third-party programs, in the amount of (Rp 8,32 million)

/ kWp of solar power plants, as referred to above the total third-party program funds required by 10,000 multiplied by Rp 8.32 million earlier, to be in the amount of (Rp 83,2 billion), for a total capacity of 10 MWp.

Sensitivity analysis, for other extreme conditions, without obtaining third-party grant/program funding support for initial investment in rooftop solar power plants (Third Scenario)

This third scenario is intended as a comparative illustration only.

If it is not expected that there will be support from grants or other third-party programs to help finance the initial investment in rooftop solar power plants, then the next iteration of the calculation is carried out to calculate the payback period, with the initial assumption of no interest.

In simple terms, as before the 'potential cost savings' for rooftop solar power plants with a capacity of 1 kWp (1080 kWh) amount to Rp 972 thousand per year. The assumption of no cost depreciation (0% discount rate) would give a period of up to 15.4 years simple payback.

However, if the initial investment cost is included using a low interest loan at 5% discount rate, then the next iteration provides a duration of return on the initial investment to exceed 30 years payback period. Even if the initial investment cost is included using a 10% discount rate commercial interest loan, the next iteration will not be able to provide a return on the initial investment even though it has exceeded the 100-year payback period.

Thus, the Third Scenario is not feasible (because even if a low interest loan of 5% p.a. is used, it would still require a payback period of over 30 years, which is longer than the lifetime of the rooftop solar power plants themselves of 25 years). To be able to provide a return on the initial investment, additional support will still be required from grants or other third-party program funds (which are gifts, without requiring a return of funds).

Other cost reserves, for operational work and maintenance of rooftop solar power plants

The three scenarios above do not include the need for maintenance cost reserves for rooftop solar power plants. Indeed, this does not provide a realistic calculation, where if additional costs for maintenance work are required later, they will be provided by the Managing Entity (which may have a small reserve of its business budget from the above calculations). This is due to the uncertainty of the maintenance costs, which are currently unknown, given that the Managing Entity does not have much experience in the technicalities of rooftop solar power plants. With the operation of the solar power plants in the next few years, the estimated maintenance costs may be better known, and it is possible that the amount of costs may also decrease periodically later.

Summary, general data

Unit capacity of rooftop solar power plants	for each 1 kWp
Annual effective operating hours	1080 hours/year
School electricity tariff, S-2	Rp 900 / kWh
Electricity cost savings of solar power plants	Rp 972,000 / year
Initial investment cost of rooftop solar power plants	Rp 15,000,000 / kWp
Simple payback	Above 15 years

Cost calculation

Parameter	Funding with 0% interest	Funding with 5% interest	Funding with 10% interest
25-year NPV	Rp 9.550.000 (9% disc.)	Rp 9.550.000 (9% disc.)	Rp 6.680.000 (14% disc.)
Additional grant funding requirement, per kWp of installed capacity	Rp 5.450.000 / kWp	Rp 5.450.000 / kWp	Rp 8.320.000 / kWp
Additional grant funding required, per 10 MWp of installed capacity	Rp 54.500.000.000 per 10 MWp	Rp 54.500.000.000 per 10 MWp	Rp 83.200.000.000 per 10 MWp
Annual budget for the cost of returning the initial investment	Rp 382.000 / kWp per year	Rp 677.000 / kWp per year	Rp 736.000 / kWp per year
Potential gross revenue for the Managing Entity, per year	Rp 590.000 / kWp, or Rp 5,9 billion / 10 MWp	Rp 295.000 / kWp, or Rp 2,95 billion / 10 MWp	Rp 236.000 / kWp, or Rp 2,36 billion / 10 MWp
Note	<i>Investment funding at 0% interest is difficult to obtain from regular financial institutions</i>	<i>Investment funding at 5% interest needs to be pursued with technical negotiations</i>	<i>Commercial funding at 10% interest may be available from financial institutions</i>

PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

Indonesia has made significant progress in mainstreaming green economy activities into the country's macroeconomic and national development plans. The country has also increased their global climate commitments – including setting a net zero emissions target by 2060. However, the energy sector in Indonesia remains the country's second-largest carbon emitter, with national power generation being highly dependent on fossil fuels – particularly coal. As such, energy transition is a critical mechanism to achieving Indonesia's climate targets and green economy ambitions.

Energy transition will, however, create significant employment changes in the energy and electricity sectors. In the face of such changes, developing a supportive policy ecosystem to enable future green jobs growth and to ensure a Just Transition is critical. This green jobs policy readiness assessment aims to develop a baseline perspective of current green jobs and Just Transition policy frameworks in Indonesia, with a focus on the energy sector. To this end, the report explores recommendations for measures aimed at supporting the labour market, from both the supply and demand sides, as well as for overarching measures that will promote the enabling environment needed to ensure a Just Transition process.

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