

## SUMSEL-1 ROOFTOP SOLAR PV PROJECT

Responding to Presidential Regulation No. 112/2022, which sets the goal of reaching peak emissions by 2030 and achieving net-zero emissions by 2050, PLN, the government-owned utility, is pivoting towards renewable energy. This adjustment mirrors global trends in reducing carbon emissions and underscores PLN's commitment to sustainability. As part of this commitment, the Sumsel-1 Power Plant, aligning with China Datang Overseas Investment Co., Ltd.'s ("Datang Overseas Investment") global business framework of "one base, two wings, and six wheels," intends to develop a Distributed Rooftop Photovoltaic (PV) Project. This initiative follows an Initial Energy Audit conducted by PT Konservasi Energy Indonesia in 2023, which recommended the installation of solar cells for lighting purposes. Consequently, Sumsel-1 has already installed PV solar panels on the rooftop of the security office building, generating approximately 4.5 kWp to fulfill the building's lighting requirements. Plans are underway to expand PV Solar Panel installations to more locations within IPP 1 Sumsel, leveraging renewable energy to reduce carbon emissions and promote sustainable development. The basic information of the project is reported as follows:

### 1. Project Overview

The Sumsel-1 power plant distributed rooftop photovoltaic project area has a potential for approximately  $\pm 3,400$  Ha. The rooftop potential area is illustrated in Figure 1.



Figure 1-1 Site layout of potential area

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## 2. Location and Coordinates

The photovoltaic project is located in Musi Banyuasin Regency, South Sumatera Province, Indonesia. Coordinates: Latitude - 2.156610930627537 Longitude 103.75357559539937.

## 3. Solar Resource Situation

Located near the equator, Indonesia benefits from an average annual solar radiation between 1389 and 2222 kWh/m<sup>2</sup> and enjoys an annual sunshine duration of 1719 to 2430 hours. The average daily solar radiation on a horizontal surface is about 4.8 kWh/m<sup>2</sup>/day. Based on the current photovoltaic installation at the Sumsel-1 security office building, the productive solar hours per day are around 5 to 5.5 hours.

## 4. Land Use and Area

Due to regulations from the Ministry of Energy and Mineral Resources of the Republic of Indonesia (Ministerial Regulation No. 2 of 2024, which requires PLN approval for projects exceeding 500 kW) and financial constraints, the project will be constructed in the following locations:

Name of Shed	Proposed Capacity (kWp)
Admin Building	95.58
Dormitory	82.6
I&C Building	74.34
Warehouse & Workshop	151.04
<b>Total</b>	<b>403.56</b>

## 5. Installation Scale

The installed solar plant with the type of system is on-grid and the capacity is 404 kWp, with the plant capacity capped by rooftop availability. The generation is subject to 1,456 kWh/m<sup>2</sup>/year of Global Horizontal Irradiation and shadow-free conditions.

## 6. Electricity Generation

The estimated annual electricity generation for the first year is approximately 474,264 kWh, based on data from the feasibility report. Factors influencing photovoltaic power generation include sunlight, weather conditions, temperature, pollution, shading, the

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quality and design of solar panels, the efficiency of batteries and inverters, and the maintenance and operation of the system, among others.

### **7. Operating Lifespan**

The conventional design lifespan is 25 years.

### **8. Construction Period**

The construction period is estimated to be 4-6 months.

### **9. Grid Connection**

The generated electricity will not be exported but will be connected to the grid without being fed back. Two proposed methods are either connecting to the factory's 380V low-voltage distribution cabinet or directly linking to the electrical cabinet of the dormitory or office building.

### **10. Investment Amount**

Based on current estimations, the investment amount is 306,154 USD.

### **Analysis of High Photovoltaic Prices**

Factors contributing to high photovoltaic prices include unclear policies regarding photovoltaics in Indonesia, frequent policy changes, and inconsistent policy implementation across different regions. Moreover, restrictions on importing photovoltaic components from China result in prices that are roughly 40% higher than domestic rates.

### **11. Investment Return**

For the 404 kWp of solar panel project generating with 5 hours of sunshine per day, producing 1,717 kWh/day, the annual electricity generation is estimated at 626,705 kWh. Assuming coal consumption for electricity generation in a year is 532,699.25 kg and the coal price is 0.0303 USD/kWh, the annual income is approximately 16,166.04 USD and the carbon reduction in a year is approximately 682,481.75 kg CO<sub>2</sub>e, leading to a payback period of around 12 years. This calculation already includes income from carbon emissions, solar energy cost reduction, and factors such as PLN's backfeeding power supply during unit maintenance.

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## SUMSEL-1 屋顶太阳能发电项目

响应第112/2022号总统令，该法令旨在2030年前达到排放峰值，并在2050年前实现净零排放，国有电力公司PLN正转向可再生能源。这一调整与全球减少碳排放的趋势一致，突显了PLN对可持续发展的承诺。作为这一承诺的一部分，Sumsel-1发电厂将与中国大唐海外投资有限公司（“Datang Overseas Investment”）的“一基地，两翼，六轮”全球业务框架保持一致，打算开发分布式屋顶光伏（PV）项目。此举是根据2023年PT Konservasi Energy Indonesia进行的初始能源审计提出的建议，该审计建议安装太阳能电池板用于照明。因此，Sumsel-1已在保安办公楼的屋顶安装了PV太阳能电池板，产生约4.5 kWp的电力，以满足建筑物的照明需求。计划在IPP 1 Sumsel内的更多地点扩展光伏太阳能电池板的安装，利用可再生能源减少碳排放，促进可持续发展。项目的基本信息如下：

### 1. 项目概述

Sumsel-1电厂分布式屋顶光伏项目的潜在区域约为± 3,400公顷。屋顶的潜在面积如图1所示。



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## 2. 位置和坐标

光伏项目位于印度尼西亚南苏门答腊省的Musi Banyuasin Regency。坐标：纬度 -2.156610930627537， 经度 103.75357559539937。

## 3. 太阳能资源情况

位于赤道附近的印度尼西亚，每年平均太阳辐射量在1389到2222 kWh/m<sup>2</sup> 之间，年日照时长在1719到2430小时之间。水平面上的平均每日太阳辐射量约为4.8 kWh/m<sup>2</sup> /天。根据目前在Sumse1-1保安办公室建筑上的光伏安装，每天的有效太阳能生产时间约为5到5.5小时

## 4. 土地使用和面积

由于印度尼西亚能源和矿产资源部的规定（2024年第2号部长条例，要求PLN批准超过500 kW的项目）和财务限制，项目将分布在以下位置进行建设：

棚屋名称	拟定容量 (kWp)
行政楼	95.58
宿舍	82.6
I&C 楼	74.34
仓库和车间	151.04
<b>总计</b>	<b>403.56</b>

## 5. 安装规模

安装的太阳能电站系统类型为并网系统，容量为404 kWp，电站容量受限于可用的屋顶面积。发电量受1,456 kWh/m<sup>2</sup> /年的全球水平辐射和无阴影条件的影响。

## 6. 发电量

第一年的预计年发电量约为474,264 kWh，具体数据需以可行性报告提供的准确数据为准。影响光伏发电的因素包括阳光、天气、温度、污染和遮挡、太阳能板的质量和设计、电池和逆变器的效率、系统维护和操作等。

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## 7. 使用寿命

常规设计使用寿命为25年。

## 8. 建设周期

建设周期预计为4-6个月。

## 9. 并网

所发电力将不会送出，而是接入电网但不回馈电网。提出了两种方法：连接到工厂的380V低压配电柜或直接连接到宿舍或办公楼的电柜。

## 10. 投资金额

根据当前估算，投资金额为306,154美元。

### 光伏价格高的原因分析

光伏价格高的原因包括印度尼西亚光伏政策不明确、政策变化大以及各地区政策实施不一致。此外，印度尼西亚对中国进口光伏组件的限制导致价格比国内价格高出约40%。

## 11. 投资回报

对于404 kWp的太阳能电池板项目，每天有5小时的日照时间，发电量为1,717 kWh/天，年发电量估计为626,705 kWh。假设一年的煤炭消耗为532,699.25 kg，煤炭价格为0.0303美元/kWh，年收入约为16,166.04美元，一年的碳减排量约为682,481.75 kg CO<sub>2</sub>e，回收期约为12年。此计算已包含碳排放收入、太阳能成本降低以及PLN在设备维护期间的回馈电力等因素。

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