Company participation in supporting national energy security through collective installation of rooftop solar panel of employees' houses as an effort to accelerate increased utilization of solar energy

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Abstract. To support the achievement of government targets in the New and Renewable Energy Program, and to play an active role in responding to global issues related to energy, environment, global warming, and energy conservation issues, large and medium-sized companies can encourage them to use renewable energy. energy through a campaign for all employees to take advantage of the solar panel system in every home, which can be integrated with the electricity grid of the State Electricity Company (PLN). The direct benefit that employees get from using a solar panel system is that it can reduce household electricity bills. The campaign was continued by realizing a collective rooftop solar panel installation program for employee rooftops with an installment system that was not burdensome for 24 to 36 months, which was deducted from wages through the payroll system, of course taking into account the Company's ability to fund the purchase and installation of rooftop solar panels. With this program, assuming a total capacity of 200 kWP in each company (around 100 employee houses), the maximum cost impact for the company is around Rp. 3.6 billion. If this program can be implemented simultaneously by all large and medium-sized companies in Indonesia, the potential for achieving solar energy use in 7 months could reach 6.72 GWp. Meanwhile, the Indonesian government is targeting the use of solar energy for the national energy mix in 2025 at 6.5 GW. With the participation of companies and supporting them, it is one way to achieve the target of using solar energy in Indonesia, which is 6.5 GW by 2025.

1. Introduction

Electrical energy is one of the most important basic needs in human life today, where almost all human activities are related to electrical energy. The power generation system in Indonesia mostly uses fossil fuels as an energy source in producing electrical energy[1]. Besides the decreasing reserves, the use of fossil energy also has an impact on the environment, especially the effects of global warming[2, 3]. To ensure the sustainability of energy and development, the Government of Indonesia through the National Energy Plan (RUEN) has targeted the use of renewable energy by 23% by 2025[4-6].
Solar energy is a renewable energy source that can be used easily and cheaply. Solar panels need an open area and free from objects or shadows that block sunlight from hitting the panel. One solution for the placement of solar panels is the use of a building roof[7]. Not only office buildings, but rooftop solar panels can also be applied to the roof of private houses that are on the grid with the electricity network from PLN. The household sector is one of the targets for implementing solar panels which is the hope of the Government of Indonesia in achieving the target of using renewable energy[8-10].

The Regulation of the Minister of Energy and Mineral Resources Number 49 of 2018 regulates the use of rooftop solar power generation systems by PLN consumers[11]. Through this regulation, the public can pay cheaper electricity bills through the "export-import" of electricity with PLN[12]. The amount of savings varies depending on the power capacity generated and the amount of household electricity usage as a whole[13]. In addition to providing opportunities for citizens to use environmentally friendly renewable energy, this Government policy aims to increase the role of new and renewable energy in the national energy mix, accelerate the increase in the use of solar energy, and reduce greenhouse gas emissions[14].

The company’s participation has contributed to achieving the national energy mix and accelerating the use of solar energy not only for production operations and office buildings but also by involving employees to install rooftop solar panels in their respective homes.

2. Potential rooftop solar panels of employees’ homes

PLN electricity customers are grouped based on household customers, industrial customers, business customers, social customers, government office building customers, and public street lighting. Based on the PT PLN Electricity Supply Business Plan (RUPTL) for 2019-2028, household customers are the largest group[15].

![Figure 1](image1.png)  
*Figure 1* Number of PLN Customers in Indonesia (processed from RUPTL PLN 2019-2028)

![Figure 2](image2.png)  
*Figure 2* Electricity Consumption (processed from RUPTL PLN 2019 - 2028)
As explained above, it is possible to achieve the energy mix target by accelerating the use of solar energy using rooftop solar panels in households because of the large consumption.

2.1. Large and Medium Industries in Indonesia
How does the company play a role in achieving the energy mix target? Indonesia has many companies from large scale to household scale. The Indonesian Central Bureau of Statistics (BPS) recorded the number of large and medium-scale companies with data such as the chart below:

![Figure 3: Number of Large and Medium Industrial Companies in Indonesia (compiled from the Indonesian Central Bureau of Statistics)](image1)

Based on the number of workers employed, BPS classifies four (4) groups. Included in the Large Industry group are companies with 100 employees or more. Medium Industry Group, namely companies that have employees of 20 to 99 people. Small Industry Group, namely companies that have 5 to 19 employees. Meanwhile, companies that are included in the Home Industry category are companies that have as many as 1 to 4 employees.

In this study, the author focuses on the Large and Medium Industry groups. As a reference, the object of study is in an Indonesian oil and gas company that has more than 100 employees. Overall, the number of employees working in large and medium industries in Indonesia can be seen in the following graph:

![Figure 4: Number of Employees in Large and Medium Industries in Indonesia (processed from the Indonesian Central Statistics Agency)](image2)
2.2. The potential of rooftop solar panels for large and medium industrial employees

Based on the 2018 PLN statistical book, almost 98% of the dominant customers are household customers who are in the R-1 tariff group, namely with an installed power of 1300 - 2200 VA[16].

Assuming that each employee in large and medium-sized industries already owns their own house and PLN customers with installed power at the R-1 tariff class, the potential for rooftop solar panels can reach 13 GWp.

3. Rooftop solar panel collective installation and company financial condition

3.1. Collective installation of rooftop solar panels

To increase the use of renewable energy, especially solar energy, the Company can conduct campaigns for all employees to take advantage of the Solar Panel System which can be integrated with the PLN electricity network. The company's appeal to its employees can start with education on household electricity use.
Households are one of the users of electrical energy who use a lot of electronic equipment, but energy consumption among households is considered wasteful. Awareness in consuming electrical energy that is not good is one of the causes of the high level of waste in household energy use. The benefits obtained by employees for the installation of Solar Rooftop Panels are that the electrical energy generated can replace the PLN function during the day, besides that the excess power from the Solar Panel can also be exported to the PLN network through export-import (Exim) Meters where the electrical energy is export to the PLN network can be a deduction for household electricity bills.

3.2. Impact of company costs and cash flow
The company as an initiator can develop a collective installation scheme for Rooftop Solar Panels for its employees with an interest-free installment scheme. Installments are paid by employees through salaries which are deducted every month as much as the agreement between the Company and the employee. Companies must consider the ability of their employees for the length of the installment period. To find out this, the Company can conduct a special survey of its employees first. The total installation target is also determined by the Company's ability to pre-fund the purchase and installation costs of the Solar Rooftop Panels. In essence, the program can be carried out if it is not burdensome for the Company to bear funds in advance or for employees who pay installments to the Company.

PT Energi Mega Persada is one of the major companies in Indonesia which is engaged in the energy sector, through its subsidiary, PT EMP Energi Terbarukan initiating the collective installation of rooftop solar panels with an installment scheme. With the assumption that the average capacity of the Rooftop Solar Panel that will be installed in each house of the interested employee is 2 kWP, and the price ranges from Rp. 40 million (including the Exim meter), then the employee makes installments of around Rp. 1.5 million for 24 months or Rp. 1.1 million for 36 months.

The program is run in stages with a capacity of 200 kWP per year. The company requires capital in one program stage of Rp. 3.4 billion for the 24-month installment scheme and Rp. 3.6 billion for a 36-month installment scheme. The assumption that the period for installing the Rooftop Solar Panel per month is 18 houses, that is, each house requires 5 days of installation including team mobilization and demobilization, and the number of teams is 3 teams. Completion of work can be done within 7 (seven) months. In order not to burden the company's cash flow, the payment system to suppliers based on work progress and installments from employees starts after the Solar Rooftop Panel is installed on the roof of the house and administrative matters with PLN are completed.

![Figure 7 Company financial condition with 24-months installment scheme](image-url)
4. Conclusions

The company's participation in achieving the national energy mix and accelerating the use of solar energy is not only for production operations and office buildings but can also involve employees to install rooftop solar panels in employees' homes with a collective installation scheme from the Company and employee installments through deductions from each wage per month.

Based on data from large and medium companies in 2017, amounting to 33,577 companies and if each company has a collective installation program of 200 kWp of rooftop solar panels and implemented simultaneously, then within 7 months the utilization of solar energy will reach 6.72 GWp. Meanwhile, the Indonesian government is targeting the use of solar energy for the national energy mix in 2025 at 6.5 GW. Therefore, involving companies and supporting them can be one way to achieve the target of using solar energy in Indonesia.

References

[1] R Dutu, 2016,"Challenges and policies in Indonesia's energy sector," Energy Policy, 98, pp. 513-519.
[2] X Zhou and C Feng, 2017, "The impact of environmental regulation on fossil energy consumption in China: Direct and indirect effects," Journal of Cleaner Production, 142, pp. 3174-3183.
[3] A Carfora and G Scandurra, 2019, "The impact of climate funds on economic growth and their role in substituting fossil energy sources," Energy Policy, 129, pp. 182-192.
[4] W G Santika, M Anisuzzaman, Y Sams, P A. Bahri, G Shafiullah, and T Urmee, 2020, "Implications of the Sustainable Development Goals on national energy demand: The case of Indonesia," Energy, 196, p. 117100.
[5] E Erdiwansyah et al., 2020, "Investigation of availability, demand, targets, economic growth, and development of Renewable Energy in 2017-2050: A case study in Indonesia.
[6] P P R I. Nomor, "Tahun 2017 Tentang Rencana Umum Energi Nasional (RUEN)."
[7] A Belenov, V. V. Daus, S. Rakitov, I. Yudaev, and V. Kharchenko, "The experience of operation of the solar power plant on the roof of the administrative building in the town of Kamyshe, Volgograd oblast," Applied Solar Energy, 52, no. 2, pp. 105-108, 2016.
[8] G Comodi, L. Cioccolanti, and M. Renzi, 2014, "Modelling the Italian household sector at the municipal scale: Micro-CHP, renewables and energy efficiency," Energy, 68, pp. 92-103.
[9] Y Shigetomi et al., 2018, "Driving forces underlying sub-national carbon dioxide emissions within the household sector and implications for the Paris Agreement targets in Japan," Applied Energy, 228, pp. 2321-2332.
[10] M Maulidia, P. Dargusch, P. Ashworth, and F. Ardiansyah, 2019, "Rethinking renewable energy targets and electricity sector reform in Indonesia: A private sector perspective," Renewable and Sustainable Energy Reviews, vol. 101, pp. 231-247.

[11] R Indonesia, "Peraturan Menteri ESDM Nomor 49 Tahun 2018 tentang Penggunaan Sistem Pembangkit Listrik Tenaga Surya Atap Tahun 2018," ed: Jakarta, 2018.

[12] A Prastyo, C. Ekaputri, and M. Reza, 2019, "Implementation of power inverter on grid connected photovoltaic generator system," in Journal of Physics: Conference Series, 1367, no. 1: IOP Publishing, p. 012048.

[13] M E Wijaya and T Tezuka, 2013, "A comparative study of households' electricity consumption characteristics in Indonesia: A techno-socioeconomic analysis," Energy for Sustainable Development, vol. 17, no. 6, pp. 596-604.

[14] A Hidayatno, A. D. Setiawan, I. M. W. Supartha, A. O. Moeis, I. Rahman, and E. Widiono, 2020, "Investigating policies on improving household rooftop photovoltaics adoption in Indonesia," Renewable Energy.

[15] P PLN, 2019, "RUPTL: Rencana Usaha Penyediaan Tenaga Listrik 2019-2028," Indonesia: PT PLN Persero.

[16] P J Burke and S Kurniawati, 2018, "Electricity subsidy reform in Indonesia: Demand-side effects on electricity use," Energy Policy, vol. 116, pp. 410-421.