Energy Security: Energy Planning of West Java

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Abstract. The study aims to examine the picture of the condition of energy management in West Java in the future, which is the result of projections of energy supply needs that the Regional Government will carry out concerning current conditions, indicators, and parameters that influence and the vision and mission of regional development. This research method is qualitative with a normative approach. The studies carried out in this research are mainly on Presidential Regulation 22/2017 concerning the National Energy General Plan and West Java Province Regional Regulation Number 2 of 2019 concerning the West Java Province Energy General Plan (RUED-WJP). The RUED-WJP elaborates on the results of modeling energy demand and supply for 2015-2050. Which also includes policies, strategies, energy development programs, and activities that refer to the National Energy Policy's targets, with sustainable and environmentally sound principles for creating energy independence and resilience in West Java Province.

Keywords: Energy Planning; West Java; Regional Energy General Plan

1 Introduction

Sustainable energy management is crucial for enhancing the economy and national resilience. Indonesia faces challenges in energy security, as indicated by the 4-A indicators (availability, accessibility, affordability, and acceptability). It is essential to develop an energy strategy to bridge the gap and address this issue [1,2].

Among the provinces in Indonesia, West Java Province (WJP) stands out as one of the most developed regions, with a population of approximately 46 million. Achieving energy independence and security in this province requires establishing an adequate energy supply and infrastructure. Energy planning plays a crucial role in ensuring the availability of infrastructure at the national, provincial, and district/city levels. These planning efforts are essential for sustainable energy management and are mandated by Law Number (LN) 30/2007 on energy [3].

In the context of WJP, the preparation of the Regional General Energy Plan (RUED-WJP) takes an integrated approach, incorporating planning documents from various fields. These include the Regional Long Term Development Plan (RPJPD) [4,5] and the Regional Medium Term Development Plan (RPJMD) [6].

The formulation of the RUED-WJP adheres to the guidelines outlined in Article 18 of Law No.30/2007 on Energy [3]. The guidelines are derived from Presidential Regulation Number 1 of 2014, which provides comprehensive instructions for developing the General National Energy Plan (RUEN) [7]. Moreover, the content of RUED-WJP is primarily based on the Presidential Regulation of the Republic of Indonesia (PR-RI) Number 22/2017, which delineates the RUEN [8]. The RUED-WJP encompasses the timeframe from 2018 to 2050 and

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is in alignment with the specified period stated in the RUEN as mandated by PR-RI 22/2017 [8].

The RUED-WJP serves as a guideline for energy management in West Java Province, encompassing supply and utilization aspects [9]. It aims to develop the energy potential in the regency/city regions and promote energy utilization in other sectors. This study focuses on assessing the projected energy supply needs based on current conditions, indicators, and parameters that influence the regional development vision

2 Literature Review

The primary challenge in addressing energy requirements revolves around the utilization of new and renewable energy sources (EBT) while mitigating the effects of climate change [10]. To address these concerns and meet the social and economic demands for energy, there has been a shift towards adopting new paradigms in energy production and consumption, with the dominance of a techno-market approach [11,12,13,14]. The approach relies on price signals to drive changes within the energy system, not only by altering the energy mix and transitioning from fossil to renewables, also by fostering consumer responsiveness to demand. Notably, several European countries have witnessed the competitiveness of wind and solar photovoltaic power plants, as their average production costs have become comparable to those of fossil fuels [15].

Efforts to decarbonize energy systems are being explored by implementing "smart grid" methodologies, incorporating advanced technologies like artificial intelligence and blockchain [16,11,13]. Smart grids enable demand-responsive consumer-enabled electricity systems, integrating renewable generation and consumer technologies [17,13,18,14].

Two main methods are employed to achieve climate change goals: the economic approach and the regulatory approach. Europe, for instance, utilizes regulations as tools for energy transition. In addition to providing economic incentives to reduce emissions, Europe has set targets for renewable energy usage, greenhouse gas emission reduction, and energy efficiency improvement [21,22]. Regulations have been implemented to bill buildings based on actual consumption, promoting energy conservation and efficiency. These efforts are projected to reduce end-user demand for energy by 10% to 20% [23].

3 Method

The research conducted follows a qualitative approach, with a descriptive nature. The methodology employed does not involve fieldwork but instead relies on normative research, utilizing secondary data obtained from various relevant sources such as literature, documents, journals, regulations, and applicable provisions. The primary focus of this research is the analysis of two key documents: PR-RI 22/2017, which outlines the National Energy General Plan (RUEN), and WJP Regional Regulation 2/2019, which pertains to the West Java Province Regional Energy General Plan (RUED-WJP).

4 Result and Discussion

The RUEN is governed by Government Regulation (GR) 79/2014, which focuses on the National Energy Policy (KEN) [24]. Similarly, the RUED-WJP is implemented according to PR-RI 22/2017, which outlines main and supporting policies [7].

a) The main policies address key areas, including ensuring energy availability for the needs of West Java Province, prioritizing energy development, utilizing local energy resources, and managing energy reserves effectively.
b) The supporting policies encompass energy conservation, preservation of energy resources, energy diversification, environmental protection, safety measures, infrastructure development, equitable access to energy for the community and the energy industry, research and development of energy technology, as well as establishing relevant institutions and funding mechanisms.

Various objectives must be accomplished to attain energy independence and security in West Java Province. These objectives encompass utilizing energy resources as fundamental assets for development, achieving energy management independence, ensuring energy availability to meet the province's energy demands, and managing energy resources optimally, integrally, and sustainably. The objectives include promoting efficient energy use across all sectors, ensuring fair and equitable access to energy for the community, and fostering the development of domestic technology, energy industry, and energy services to enhance self-sufficiency and human resource capacity. Furthermore, these objectives emphasize preserving environmental functions and mitigating climate change impacts [9].

In realizing energy independence and security in West Java Province, energy development adheres to the following principles:

a) First, Optimizing the utilization of energy resources owned. So far, several primary energy supplies, especially natural gas, fuel oil, and coal, have been imported from other regions or imported.
b) Second, Increasing adequate energy supply infrastructure. Some fuel is imported from other regions (imported) because the capacity of the oil refineries owned is insufficient. Increasing refinery capacity is expected to provide added value and absorb labor.
c) Third, promoting the development and utilization of EBT. The RUED-WJP plan places a high priority on meeting future energy needs through the use of EBT, with a particular emphasis on solar energy generation.

The formulation of RUED-WJP takes into account various regulations and legislation related to energy and planning at both the central and regional levels. These include important laws such as LN 22/2001 on Oil and Gas, LN 26/2007 on Spatial Planning, LN 30/2007 on Energy, LN 30/2009 on Electricity, LN 21/2014 on Geothermal, and LN 23/2014 on Regional Government (amended by LN 9/2015) [9]. Additionally, it considers relevant government regulations (GR), such as GR 70/2009 on Energy Conservation, PR-RI 61/2011 on the National Action Plan for Reducing Greenhouse Gas Emissions, PR-RI 79/2014 on the National Energy Policy, and PR-RI 22/2017 on the National Energy General Plan (RUEN) [9].

The RUED-WJP sets forth several targets that need to be achieved, including:

a) Establishing a new perspective that recognizes energy as a crucial asset for the province's overall development.
b) Achieving an optimal mix of primary energy sources, with renewable energy accounting for at least 17% by 2025 and at least 20% by 2050. Additionally, reducing the dependency

on oil to less than 30% by 2025 and less than 17% by 2050, maintaining coal at approximately 20% by 2025 and around 30% by 2050, and ensuring that natural gas constitutes at least 25% in both 2025 and 2050.

c) Meeting the primary energy supply requirements, estimated to be around 51.98 MTOE (Million Tonnes of Oil Equivalent) by 2025 and approximately 137.55 MTOE by 2050.
d) We are achieving a per capita primary energy utilization of approximately 0.97 TOE (Tonnes of Oil Equivalent) by 2025 and around 2.15 TOE by 2050.
e) We are fulfilling the power generation capacity needs, with an estimated capacity of around 22.59 GW (Gigawatts) by 2025 and approximately 78,031 GW by 2050.
f) Ensuring electricity utilization per capita reaches approximately 1,692.5 kWh (Kilowatt-hours) by 2025 and around 4,767.9 kWh by 2050.
g) We are achieving an energy elasticity of less than one by 2025, in alignment with the target of economic growth.

By setting these targets, West Java Province aims to strategically plan and manage its energy resources, promote sustainable energy practices, and support economic growth while meeting the energy needs of its population. These objectives provide a roadmap for the province's energy development and lay the foundation for a more resilient and efficient energy sector.

West Java Province is still entangled in energy problems, namely:

a) Dependence on Fossil Energy and Low Fossil Energy Resources. In 2015, final energy consumption in the Province of West Java reached 19.19 MTOE (Million Ton Oil Equivalent). This data reveals that approximately 94% of the final energy consumption in West Java is derived from fossil fuels.
b) Limited Utilization of New Renewable Energy (EBT). Indonesia possesses substantial potential for harnessing various forms of EBT. However, in 2015 the portion of fossil energy in the West Java province's energy mix was 90%, while EBT was 10%.
c) Low Energy Consumption. In 2016 Indonesia's energy consumption reached 0.87 MWh/per capita. This figure is considered far from the average energy consumption of each country which is 3.1 MWh/capita. With the advantage of having a constant temperature, plans to increase energy consumption in West Java can be directed to its use to support economic growth compared to areas located in temperate climates where the largest energy use is for temperature regulation activities.
d) Inefficient Use of Energy. Inefficient energy use can be seen from energy use efficiency indicators; namely, energy elasticity was still more than 1 in 2015. It shows that West Java province needs to be more efficient in energy utilization.

It will implement the West Java province energy development program during 2015-2050. The target of final energy use are:

a) Transportation Sector. The contribution of the transportation sector's final energy needs to the final energy mix in 2025 is 31, and 2050 it will be 24.5%.
b) Industrial Sector. The final energy mix for 2025 is 14.7 MTOE (42.9%) for the industrial sector. In 2050, the final energy demand in the final energy mix will reach 39.4 MTOE.
c) Household Sector. In the household sector, the final energy mix in 2025 will reach 6.1 MTOE (15.7%), and in 2050 it will reach 19 MTOE (10.1%).
d) Commercial Sector. The projected final energy demand for the commercial sector in the final energy mix in 2025 is 1.15 MTOE (3.4%); in 2050, it will be 3.59 MTOE (4.2%).

e) Other Sectors. The final energy demand of other sectors in the final energy mix in 2025 will be 0.02 MTOE (0.05%) and 0.02 MTOE (0.03%) 2050.

The projected primary energy supply of new and EBT in the primary energy mix in 2025 will reach 22.94%, and in 2050 it will reach 20.13%. All projections of final energy demand and primary energy supply have included conservation and efficiency programs. The implementation of achieving the RUED-WJP targets involves institutions that are cross-sectoral in supporting the achievement of the KEN targets

5 Conclusion

The Regional Energy General Plan (RUED-WJP) is a cross-sectoral elaboration and implementation plan for the National Energy General Plan (RUEN). The elaboration in RUED-WJP contains the results of modeling energy demand and supply for 2015-2050. Which also includes policies, strategies, energy development programs, and activities that refer to the National Energy Policy (KEN) targets, with sustainable and environmentally sound principles to create energy independence and resilience in West Java Province (WJP). As an embodiment of energy management that pays attention to the balance of energy, economy, energy supply security, and preservation of environmental functions, it needs to be supported by comprehensive studies. For this reason, it is necessary to make study topics that can serve as guidelines in understanding problems related to national and regional energy and policy alternatives that can be selected as solutions to achieve the stated National Energy Policy objectives, especially after the COVID-19 Pandemic, which resulted in changes to the planned targets.

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