



Assessing Energy Subsidies Impact on National Industrial Productivity and Efficiency

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Abstract

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Energy subsidies are a pivotal policy tool aimed at bolstering industrial competitiveness and economic growth by stabilizing energy costs for industries. In Indonesia, these subsidies significantly influence the industrial sector, a key driver of GDP and economic transformation. This study evaluates the effectiveness of energy subsidies in enhancing industrial productivity and energy efficiency, exploring their dual impact. While subsidies reduce production costs, foster investment, and support strategic sectors like manufacturing and mining, they may also lead to inefficiencies, market distortions, and dependency, hindering innovation and sustainable practices. Through a qualitative literature review, this research synthesizes findings from scholarly sources to assess how subsidies affect industrial output and efficiency metrics, such as Total Factor Productivity (TFP). The analysis highlights that poorly targeted subsidies can impede technological advancements and exacerbate fiscal burdens, while well-designed policies promote renewable energy adoption and long-term competitiveness. This study offers evidence-based recommendations for reforming energy subsidy policies to align with sustainable industrial development and national economic goals, contributing to the discourse on optimizing fiscal interventions for industrial growth in Indonesia.

1. Introduction

The industrial sector serves as a cornerstone of economic progress, driving job creation, boosting national income, and enhancing global market competitiveness. In Indonesia, this sector is pivotal, contributing significantly to the Gross Domestic Product (GDP) and facilitating the nation's shift from an agrarian to an industrialized economy. The efficiency and productivity of industries reflect not only internal operational capabilities but also their adaptability to global economic shifts. A critical factor in industrial operations is the availability of a reliable and affordable energy supply, as energy, particularly electricity and fossil fuels, is a fundamental input for energy-intensive industries such as manufacturing, cement, steel, and chemicals. Volatility in energy prices can disrupt production cost structures, influence product pricing, and affect profitability, thereby impacting the sector's overall performance.

To mitigate these challenges, governments often implement energy subsidies to stabilize costs, enhance industrial competitiveness, and shield businesses from fluctuations in global energy markets. In Indonesia, energy subsidies have long been a substantial component of public expenditure, often surpassing allocations for critical sectors like education and infrastructure. According to Sulasmi et al. (2023), these subsidies aim to ensure energy affordability for both households and industries while maintaining economic stability. However, their significant fiscal footprint raises questions about their actual effectiveness in improving industrial productivity and fostering energy efficiency. While subsidies are designed to bolster industrial performance, evidence suggests mixed outcomes. Low energy prices, driven by

subsidies, can lead to inefficient consumption patterns and discourage investments in energy-saving technologies or innovative production methods, as noted by Li and Solaymani (2021). This inefficiency can stall the modernization of industries, which is essential for aligning with market-driven efficiency standards.

Moreover, the prolonged reliance on energy subsidies creates structural challenges for industrial development. Subsidized energy prices, which do not reflect true market costs, reduce the incentive for industries to adapt to price dynamics or invest in advanced technologies, as highlighted by Grubb et al. (2021). This dependency can undermine Indonesia's industrial competitiveness, particularly when compared to nations that have reformed subsidy policies to prioritize energy efficiency and sustainability. The fiscal burden of subsidies also constrains government resources, limiting investments in infrastructure, workforce development, or research and development, key drivers of long-term industrial growth. This creates a policy dilemma: balancing the need to support industrial competitiveness with the necessity to manage fiscal sustainability and promote environmentally responsible practices, as emphasized by Albatayneh et al. (2023).

Despite extensive research on energy subsidies, much of the existing literature focuses on their effects on household consumption, poverty alleviation, or income distribution. Studies specifically examining the link between subsidies and industrial productivity, particularly through measurable indicators like technical efficiency or Total Factor Productivity (TFP), remain scarce. This gap underscores the need for a comprehensive evaluation of energy subsidies as a strategic tool for enhancing industrial performance. Understanding whether these subsidies genuinely improve

productivity or inadvertently foster dependency and inefficiency is critical for shaping effective policy frameworks.

This study seeks to address this gap by analyzing the impact of energy subsidies on the productivity and efficiency of Indonesia's industrial sector. It aims to determine whether these subsidies contribute to improved energy efficiency and output or create barriers to innovation and sustainable growth. By synthesizing insights from existing research, the study explores the broader implications of subsidy policies on industrial competitiveness and national economic transformation. Furthermore, it aims to provide actionable, evidence-based recommendations for reforming energy subsidy policies to support sustainable industrial development. In doing so, this research contributes to both academic discourse and practical policymaking, offering insights into how fiscal interventions can be optimized to strengthen Indonesia's industrial sector while aligning with long-term economic and environmental goals.

2. Methods

This study employs a qualitative research approach, utilizing a comprehensive literature review to investigate the impact of energy subsidies on industrial productivity and efficiency. The literature review method is well-suited for this analysis, as it enables an in-depth exploration of existing scholarship and provides a robust framework for understanding the complex relationship between energy subsidy policies and industrial performance. By synthesizing insights from diverse

academic sources, this approach ensures a thorough examination of how subsidies influence productivity metrics within the industrial sector.

Data collection relies exclusively on secondary sources, including peer-reviewed journal articles, academic books, and other credible publications from both national and international contexts. These sources offer valuable perspectives on the interplay between energy subsidies and industrial outcomes, covering aspects such as energy efficiency, production costs, and Total Factor Productivity (TFP). The use of secondary data allows for a broad and nuanced analysis of policy impacts without the need for primary data collection, making it feasible to draw on established research to inform the study's findings.

The analytical process adopts a descriptive-analytical approach, where data from various sources are systematically reviewed, compared, and synthesized to construct a cohesive argument. Productivity in the industrial sector is defined as the ability to optimize output through efficient resource use, including energy inputs and overall production processes. The study focuses on evaluating how energy subsidies affect these productivity indicators, drawing on literature that links fiscal interventions to measurable industrial outcomes.

To ensure the reliability and validity of the findings, the research prioritizes credible, contextually relevant sources and employs cross-referencing to verify consistency across studies. This strategy minimizes potential biases and enhances the robustness of the analysis. By integrating findings from multiple perspectives, the study aims to provide a balanced assessment of energy subsidies' role in shaping industrial productivity. Ultimately, this approach contributes to a deeper

understanding of subsidy policies as strategic tools, offering insights that can guide policymakers and inform future research in the field of industrial and energy economics.

3. Results

3.1. Benefits of Energy Subsidies for Enhancing Industrial Productivity

Energy subsidies are a critical policy mechanism used by governments to stabilize energy costs, boost industrial competitiveness, and drive economic growth. By reducing the financial burden of energy expenses, these subsidies enable industries to lower production costs, improve profitability, and expand operational capacity. In Indonesia, energy subsidies have played a pivotal role in supporting energy-intensive sectors such as manufacturing, textiles, and metal processing. According to Shittu et al. (2024), subsidies for electricity, fuel, and natural gas significantly decrease operational expenses, allowing companies to offer competitive prices in both domestic and global markets. For instance, subsidized electricity for Indonesia's nickel smelting industry has facilitated increased production without raising costs, boosting processed nickel exports and contributing to economic growth.

The cost savings from energy subsidies also enable strategic investments that enhance productivity. Companies can allocate funds to upgrade machinery, train employees, or expand facilities, all of which improve operational efficiency. Shittu et al. (2024) highlight that stable energy prices resulting from subsidies allow industries to plan budgets effectively, avoid disruptions, and maintain consistent production

levels. This stability is particularly beneficial for small and medium enterprises (SMEs) in sectors like food processing and handicrafts, which are sensitive to energy price fluctuations. By shielding these businesses from volatile global energy markets, subsidies help sustain their operations and foster growth.

Furthermore, energy subsidies act as a catalyst for developing high-value industries, particularly in developing economies like Indonesia. Barkhordar et al. (2018) note that affordable energy attracts both domestic and foreign investments in sectors such as mining, petrochemicals, and agribusiness. For example, subsidies for Indonesia's fertilizer industry have increased domestic production, supporting agriculture by ensuring affordable inputs and enhancing food security. This creates a ripple effect, generating jobs, raising local incomes, and stimulating economic activity in industrial regions, thereby amplifying the sector's contribution to GDP.

Subsidies targeting renewable energy sources, such as solar or wind power, also drive technological advancements. Lu et al. (2022) emphasize that incentives for renewable energy encourage industries to adopt energy-efficient technologies, such as automated systems or electricity-based machinery. In Southeast Asia, for instance, subsidies for solar panels have enabled textile industries to reduce energy costs by up to 20%, improving efficiency and competitiveness. These innovations not only lower operational expenses but also align industries with global sustainability trends, attracting environmentally conscious investors and expanding export opportunities.

Additionally, energy subsidies provide a buffer against global energy price volatility, which is critical for maintaining industrial productivity. Wang et al. (2022) argue that stable energy prices allow companies to focus on improving product

quality and process efficiency rather than constantly adjusting to cost fluctuations. For SMEs, fuel subsidies for logistics and transportation have been instrumental in keeping distribution costs low, ensuring operational continuity. This stability fosters economies of scale, enabling industries to increase output and enhance efficiency, ultimately strengthening their position in competitive markets.

3.2. Challenges and Drawbacks of Energy Subsidies on Industrial Productivity

Energy subsidies, while designed to bolster industrial competitiveness, often introduce significant challenges that can undermine long-term productivity and efficiency in the industrial sector. These drawbacks manifest in various forms, including market distortions, structural dependency, barriers to sustainable innovation, unequal distribution of benefits, and environmental consequences. Addressing these issues requires a nuanced understanding of how subsidies impact industries and careful policy design to mitigate their negative effects. The following analysis explores these challenges in depth, drawing on scholarly insights to highlight their implications for Indonesia's industrial sector.

One of the most prominent issues associated with energy subsidies is the market distortion they create. Subsidies artificially lower energy prices, which can lead to inefficient resource use and overconsumption. Albatayneh et al. (2023) argue that when energy costs are kept below their true market value, industries have little incentive to invest in energy-efficient technologies or optimize production processes. This inefficiency is particularly evident in energy-intensive sectors like manufacturing and steel production, where low-cost energy reduces the urgency to

adopt modern, energy-saving equipment. For example, industries benefiting from subsidized fuel prices may continue using outdated machinery, which consumes more energy than necessary, leading to higher operational costs in the long run. These distortions hinder productivity growth, as companies fail to align with global standards that increasingly prioritize efficiency and sustainability. Over time, this can erode Indonesia's industrial competitiveness, particularly in markets where environmentally conscious practices are a prerequisite for trade.

Moreover, market distortions caused by subsidies can lead to suboptimal resource allocation across the economy. Subsidies often prop up less efficient industries, allowing them to survive despite poor productivity simply because they have access to cheap energy. This misallocation stifles the growth of more innovative and efficient sectors that could contribute more significantly to economic development. In Indonesia, for instance, heavy reliance on subsidized fossil fuels in certain manufacturing sectors has slowed the shift toward more sustainable industries, such as those leveraging renewable energy. This not only hampers productivity but also limits the industrial sector's ability to adapt to global economic trends, where efficiency and environmental responsibility are increasingly valued.

Another critical challenge is the structural dependency that energy subsidies foster within the industrial sector. That prolonged reliance on subsidized energy prices makes industries less resilient to changes in global energy markets or domestic policy shifts. When subsidies are reduced or removed, companies face sudden increases in production costs, which can disrupt operations and reduce output. In Indonesia, the gradual phase-out of fuel subsidies serves as a pertinent example.

Many small and medium enterprises (SMEs) in sectors like textiles and food processing experienced significant cost shocks, leading to production declines and, in some cases, business closures. This dependency also discourages innovation, as industries prioritize short-term cost savings over long-term investments in efficiency or technological advancements. Sovacool further argues that such reliance creates a cycle where industries become less adaptive, weakening their ability to compete in dynamic global markets and ultimately undermining productivity.

The reliance on fossil fuel subsidies also poses a significant barrier to transitioning to renewable energy sources, which are critical for sustainable industrial growth. Barkhordar et al. (2018) highlight that low fossil fuel prices reduce the financial incentive for industries to invest in green infrastructure, such as solar panels or biomass power plants. This delay in adopting cleaner technologies not only limits environmental sustainability but also hampers long-term productivity. Industries that fail to align with global trends toward low-carbon production risk losing market share, particularly in export markets with stringent environmental regulations. For example, Indonesian industries heavily dependent on subsidized coal or diesel may struggle to meet the emission standards required by international buyers, leading to reduced demand and lower productivity. This lag in technological innovation also makes it harder for industries to achieve economies of scale or improve operational efficiency, further weakening their competitive edge.

The unequal distribution of subsidy benefits exacerbates disparities within the industrial sector, particularly between large corporations and SMEs. Lin and Xie (2024) argue that large industries often have better access to subsidies due to their

resources, political connections, or ability to navigate bureaucratic processes. In contrast, SMEs frequently face barriers such as complex application procedures or lack of awareness, limiting their ability to benefit from subsidized energy. When subsidies are phased out, SMEs are disproportionately affected, as they lack the financial reserves to absorb rising energy costs. In Indonesia's textile sector, for instance, post-subsidy reform price hikes forced many SMEs to scale back production or shut down, while larger firms with greater capital could adapt more effectively. This disparity widens productivity gaps, as smaller businesses struggle to maintain output, hire workers, or invest in growth, hindering the sector's overall structural transformation.

Additionally, energy subsidies, particularly for fossil fuels, contribute to environmental degradation, which indirectly impacts industrial productivity. Luan and Lin (2022) note that excessive energy consumption driven by subsidies increases carbon emissions, damaging industries' reputations in global markets increasingly focused on sustainability. For example, industries reliant on subsidized fossil fuels may be perceived as environmentally unfriendly, reducing their appeal to international investors or consumers who prioritize green practices. This can lead to declining demand, particularly in export markets with strict environmental standards, ultimately affecting productivity. Furthermore, the environmental consequences of high energy consumption can trigger stricter domestic regulations, increasing compliance costs for industries. These costs divert resources from productive investments, such as upgrading equipment or expanding operations, further constraining productivity growth.

To mitigate these challenges, experts propose several strategic recommendations. Shi and Cheng (2023) advocate for more selective subsidy mechanisms that prioritize high-growth-potential SMEs. By implementing data-driven evaluation systems, governments can ensure subsidies are allocated to sectors that demonstrate a need and potential for productivity gains, minimizing market distortions. Transparency in subsidy distribution is also critical, as Sulasmi et al. (2023) emphasize, to prevent misuse and ensure equitable access across industries. This approach can help balance the benefits of subsidies while reducing inefficiencies and dependency.

Redirecting subsidies from fossil fuels to renewable energy sources is another key recommendation. Kabel and Bassim (2020) suggest that incentives for solar, wind, or biomass energy can encourage industries to adopt environmentally friendly technologies, enhancing efficiency and global competitiveness. For instance, subsidies for renewable energy infrastructure could enable industries to reduce long-term energy costs while aligning with international sustainability standards. To support this transition, training programs are essential to equip industries with the skills needed to adopt new technologies without disrupting productivity.

A gradual approach to subsidy reform is also critical to minimize disruptions. Shao et al. (2021) recommend phasing out subsidies slowly while providing transitional support, such as low-interest loans or technical assistance, to help industries adjust to market-based energy prices. Clear communication with stakeholders is equally important to reduce uncertainty and enable businesses to plan

effectively. This approach can help industries maintain productivity during the transition while fostering resilience to market dynamics.

Finally, Agupugo et al. (2022) propose reallocating subsidy funds to improve energy infrastructure, such as reliable electricity grids or renewable energy storage systems. A stable energy supply is crucial for industrial operations, and investments in infrastructure can reduce reliance on subsidies while boosting productivity. For example, developing energy storage technologies can support the adoption of renewables, ensuring consistent energy access for industries. By addressing these structural challenges, governments can create a more sustainable framework for industrial growth.

In summary, while energy subsidies provide short-term relief, their long-term drawbacks, market distortions, dependency, barriers to renewable energy adoption, unequal benefits, and environmental impacts, pose significant challenges to industrial productivity. Strategic reforms, including targeted subsidies, renewable energy incentives, gradual phase-outs, and infrastructure investments, are essential to mitigate these issues (Trencher et al. 2022). By adopting these measures, Indonesia can optimize the role of energy subsidies in supporting a productive, efficient, and sustainable industrial sector.

4. Conclusion

Energy subsidies significantly shape the productivity of Indonesia's industrial sector by reducing energy costs, enhancing competitiveness, and supporting growth in key industries like manufacturing, mining, and agribusiness. These subsidies

stabilize energy prices, enabling businesses to plan effectively, invest in capacity expansion, and compete in global markets. When directed toward renewable energy, subsidies can also foster technological innovation, aligning industries with sustainable practices and attracting environmentally conscious markets. However, the benefits hinge on strategic policy design to maximize impact while avoiding inefficiencies, making subsidies a vital tool for bolstering industrial output and economic resilience in developing nations like Indonesia.

Despite these advantages, energy subsidies pose challenges when mismanaged, leading to market distortions, dependency, and barriers to sustainable innovation. Subsidies that artificially lower energy costs can discourage efficiency improvements and delay the adoption of renewable technologies, weakening long-term competitiveness. Unequal access often favors large industries, leaving SMEs vulnerable, while fossil fuel subsidies exacerbate environmental concerns, potentially limiting market opportunities. To address these issues, reforms should focus on targeted subsidies, gradual phase-outs, and investments in renewable energy infrastructure. By adopting evidence-based, adaptive policies, Indonesia can leverage energy subsidies to drive sustainable industrial productivity and support long-term economic transformation.

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