



Toward an Equitable Energy Transition

Promoting Subsidies for Electric Boat Engines
in Indonesia's Small-Scale Fisheries

Executive Summary

Indonesia's updated Nationally Determined Contribution (NDC) targets a 29% reduction in emissions by 2030. The marine and fisheries sector can contribute to this goal by accelerating the energy transition at sea, including through the adoption of electric boat engines by Indonesia's small-scale fishermen.

The use of electric boat engines equipped with solar panels installed on the boats' roofs can significantly reduce carbon emissions while also lowering operational costs. Currently, fuel expenses account for up to 70% of the total operational costs of small-scale fishermen. In addition to being energy and cost-efficient, this technology produces minimal noise, is environmentally friendly, and is highly suitable for use in shallow waters and conservation areas.

The primary challenges to the adoption of electric engines include the high initial investment costs (approximately IDR 200–250 million per unit), limited access to financing, the absence of specific subsidy regulations, and the lack of supporting infrastructure such as charging stations at fishing ports.

The current fuel subsidy policy does not address long-term issues and fails to incentivize a shift toward clean energy. Moreover, the National Energy Plan (RUEN) and Regional Energy Plans (RUED) have yet to specifically incorporate the fisheries sector into the national energy transition roadmap.

Introduction

Traditional fishermen form the backbone of Indonesia's capture fisheries sector. However, they are increasingly facing economic pressure due to the high cost of fuel. Field findings show that fuel expenses account for approximately 60–70% of their total operational costs, making it the largest component of their fishing expenditures. When fuel prices rise or distribution is disrupted, fishermen are often forced to reduce the frequency of their fishing trips, shorten their fishing routes, or even cease fishing activities altogether. Under such conditions, many are compelled to incur debt to cover their operational expenses and household needs, often only available from predatory private businesses otherwise known as loan sharks.

The Indonesian government has long implemented fuel subsidy policies to help fishermen reduce their operational costs. However, in practice, access to subsidized fuel remains challenging, particularly for fishermen in remote coastal areas, and is often marred by corruption. Bureaucratic hurdles in obtaining recommendations, limited fuel quotas, and uneven distribution have been major obstacles on the ground. According to the Indonesian Ombudsman's 2023 report, only about 40% of fishermen are able to easily access subsidized fuel. As a result, many are forced to purchase unsubsidized fuel at significantly higher retail prices, further worsening their economic conditions and deepening regional disparities.

Beyond increasing operational costs, dependence on fossil fuels in Indonesia's fisheries sector poses serious environmental and health challenges. Fuel-powered fishing vessels contribute significantly to greenhouse gas (GHG) emissions and marine pollution. Indonesia is among the top contributors of GHG emissions from small-scale fisheries globally, driven by the extensive use of outdated and inefficient engines (ICCT, 2023). According to the 2023 Capture Fisheries Statistics by the Ministry of Marine Affairs and Fisheries, approximately 89% of Indonesia's fishing fleet—over 653,000 vessels under 10 GT—operate daily using fossil fuel engines.

This heavy reliance undermines Indonesia's climate commitments under the Paris Agreement and its national target of achieving net-zero emissions by 2060. Furthermore, emissions from small marine engines contribute to localized air and water pollution, which can harm the health of coastal communities reliant on clean marine ecosystems for their livelihoods. Transitioning to cleaner, renewable energy-powered vessels offers a critical opportunity to reduce emissions, protect marine environments, and enhance the resilience and well-being of small-scale fishing communities.

Ironically, fishermen—who heavily depend on stable marine ecosystems—are among the groups most vulnerable to the impacts of climate change. Extreme weather events, high waves, coastal erosion, and shifting fish migration patterns have led to declining fish catches and increased safety risks at sea. Unpredictable seasons and weather conditions have further shortened fishing periods, limiting fishermen's ability to maintain stable incomes. As a result, fishermen are caught between rising operational costs and diminishing returns. Without targeted policy interventions to strengthen their resilience and adaptive capacity, fishermen will continue to face escalating pressures from multiple fronts. This, in turn, risks deepening poverty in coastal communities and widening regional development disparities.

Electric Boat Engine Technology

Indonesia's marine and fisheries sector holds significant potential for the adoption of renewable energy technologies, including the transition to electric boat engines. Gempacs, a private company, has developed safe, non-nickel battery-powered electric boat engines specifically designed to meet the needs of Indonesia's small-scale fishermen. These environmentally friendly engines are designed to be operated with solar panels installed on the boat roofs, providing an



additional clean and sustainable energy source. This private sector innovation demonstrates that scalable solutions are already available and only require the right policy support for widespread adoption.

This technology enables boats to operate with zero emissions, minimal vibrations, and low noise, making them particularly well-suited for use in shallow waters, coastal fishing zones, and marine conservation areas. The characteristics of small-scale fishing activities—such as short-range, daily operations—further align with the practical capabilities of electric boat engines, ensuring their usability and relevance for traditional fishermen.

In addition to reducing carbon emissions, the adoption of electric boat engines supports Indonesia's Updated Nationally Determined Contribution (NDC) targets and its broader commitment to achieving net-zero emissions by 2060. Furthermore, by decreasing dependence on volatile fossil fuel markets, electric boats offer fishermen greater financial predictability and long-term operational resilience.

Challenges in Adopting Electric Boat Engines

The adoption of electric boat engine technology in Indonesia's traditional fisheries sector faces a number of interrelated structural challenges. The most fundamental barrier is the high initial investment cost required to acquire an electric boat unit. The price of a complete unit—including the electric engine and solar panels—ranges from IDR 200 to 250 million, a figure that remains out of reach for the majority of small-scale fishermen.

Despite their willingness to adopt environmentally friendly technologies, small-scale fishermen face significant barriers in accessing financing. Most lack the formal legal documents or collateral typically required by financial institutions—requirements that do not reflect the realities of their livelihoods. Seasonal and unpredictable income patterns further label them as high-risk borrowers, effectively shutting them out of conventional financial systems. As a result, many fishermen are left without the means to invest in technologies such as electric boat engines, even though such innovations could strengthen their economic resilience and support Indonesia's broader environmental goals. Bridging this financing gap is essential to ensure that fishermen are not left behind in the national energy transition.

On the social front, the adoption of electric boat engine technology faces cultural and behavioral barriers. Having relied on fuel-powered engines for decades, many fishermen are understandably cautious about transitioning to unfamiliar technologies. Limited exposure to the long-term benefits, concerns over the reliability of new systems, and apprehension about changes to established work patterns contribute to a slower rate of acceptance at the community level. Building trust and confidence through sustained education, demonstration, and peer-to-peer learning will be critical to fostering broader technology adoption.

At the institutional level, the absence of a national policy framework specifically supporting electric boat engine development in the fisheries sector remains a critical gap. Although Presidential Regulation No. 79 of 2023 addresses electric vehicles for land transportation, it does not yet recognize or regulate marine-based electric technologies such as electric boats. At the same time, there are no targeted subsidy programs, fiscal incentives, tax breaks, or microfinance mechanisms designed to accommodate the unique economic realities of small-scale fishermen. Fragmented coordination among government agencies overseeing energy, fisheries, and financial sectors further compounds the challenge, leaving fishermen without a clear pathway to access or adopt clean energy solutions. Without immediate regulatory attention, efforts to transition Indonesia's fisheries sector toward low-emission technologies risk stagnating at a small, localized scale rather than achieving widespread impact.

Without supportive and structured policies, the adoption of electric boat engine innovations will remain out of reach for the majority of traditional fishermen. This technological divide risks deepening inequalities within the fisheries sector, as only a small segment will be able to access clean energy solutions while vulnerable groups remain trapped in reliance on costly and volatile fossil fuels. Ensuring equitable access to sustainable technologies is therefore essential to avoid exacerbating existing economic disparities and to realize an inclusive energy transition for Indonesia's coastal communities.

Policy Recommendations

To overcome the barriers to adopting electric boat engines among small-scale fishermen, a comprehensive and fishermen-centered policy framework is urgently needed. The following strategic actions are recommended:

1. Updating Regulations on Electric Vehicles (EVs) for Marine Use

The government must urgently update and expand current electric vehicle (EV) regulations to explicitly include marine-based applications. While Presidential Regulation No. 79 of 2023 addresses land transport, it does not sufficiently regulate electric boats. A clear and dedicated regulatory framework is needed to facilitate the formal development, registration, and operation of electric boats in Indonesia's fisheries sector.

2. Revision of Energy Planning Documents

Indonesia's National Energy Plan (RUEN) and Regional Energy Plans (RUED) should be revised to explicitly incorporate the marine and fisheries sectors as part of the national renewable energy strategy. Emission reduction targets and improvements in coastal energy efficiency must be directly tied to the widespread adoption of electric boat engine technologies among fishing communities.

3. Development of a National Electric Boat Engine Subsidy Roadmap

The central government, together with relevant technical ministries, should develop a comprehensive roadmap for electric boat engine subsidies. This roadmap must outline target beneficiaries, priority regions, levels of assistance, and phased implementation plans. It will serve as the foundation for coordinated inter-agency efforts and provide clear policy certainty for manufacturers, investors, and fishermen.

4. Establishment of Targeted Subsidy Schemes

Dedicated financial support schemes should be introduced to make electric boat engine technologies accessible to small-scale fishermen. Subsidies could take the form of direct price reductions, component subsidies for batteries and solar panels, or bundled technical assistance. These mechanisms must be designed to accommodate fishermen without formal asset guarantees or traditional credit histories.

5. Introduction of Supporting Fiscal Policies

The government should introduce fiscal incentives such as import duty exemptions, tax reductions, and VAT relief for the importation or domestic production of electric boat engine components, including batteries, solar panels, and power controllers. These measures would lower retail prices, stimulate domestic innovation, and strengthen Indonesia's clean energy value chains.

6. Promotion of Community-Scale Solar Charging Stations

Local governments, supported by private sector partners and financial institutions, should prioritize the development of community-scale solar-powered charging stations at small fishing ports. Accessible and reliable charging infrastructure is critical to ensuring the long-term viability of electric boat operations.

7. Integration of Training and Mentoring Programs

Financial assistance must be complemented by technical training and mentoring initiatives. Fishermen should be empowered as capable users who can operate, maintain, and optimize electric boat engines over time. Collaboration with universities, vocational centers, and civil society organizations will be essential to deliver effective training programs and foster community-based technology adoption.

8. Community Engagement and Public Education

Community engagement strategies should involve fishermen's groups, cooperatives, and local leaders from the outset. Outreach initiatives must focus on building trust, increasing awareness of the long-term benefits, and addressing concerns about system reliability. Public education will play a critical role in overcoming cultural barriers and ensuring broad community support for the energy transition.



Conclusion

Ensuring that Indonesia's small-scale fishermen are not left behind in the national energy transition is both an environmental imperative and a matter of economic justice. By implementing targeted, inclusive policies that enable access to clean technologies such as electric boat engines, the government can unlock new opportunities for sustainable coastal development, reduce emissions, and strengthen the resilience of vulnerable communities. A proactive and coordinated policy approach today will determine whether the benefits of Indonesia's renewable energy future are shared equitably across all sectors of society—including those whose lives and livelihoods depend most directly on the sea. Indonesia has an opportunity not only to lead a just energy transition at sea but also to build stronger, more resilient coastal communities for generations to come.

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