



Towards a Low-Carbon Future: Comparative Lessons for Thailand's Energy Transition

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Abstract. Thailand's transition to renewable energy is critical for achieving its low-carbon goals; however, it faces significant challenges, including public resistance and economic concerns in fossil fuel-dependent regions. This paper examines how Thailand can leverage community ownership and financial incentives to address these challenges and foster public support for its energy transition. Using a Comparative Case Study Analysis, the study explores how Germany, Australia, and Japan have successfully employed community-centered approaches and financial mechanisms to reduce resistance and engage local communities in renewable energy projects. Germany's cooperative ownership models and feed-in tariffs illustrate how local investment can align community interests with national energy objectives, while Australia's Clean Energy Finance Corporation (CEFC) demonstrates how concessional loans and co-investment opportunities can make renewable energy financially accessible to diverse stakeholders. Japan's targeted subsidies and low-interest loans, particularly in disaster-affected areas, highlight the role of financial support in promoting renewable energy as a driver of regional development. These findings inform a set of policy recommendations tailored for Thailand, suggesting that community ownership and financial incentives can mitigate public resistance by providing direct economic benefits, supporting regional resilience, and promoting inclusivity. By adapting these strategies to its unique socio-economic context, Thailand could foster a more inclusive and sustainable low-carbon future that aligns both national objectives and local community interests.

Keywords: Energy Transition, Transition Governance, Community Ownership, Financial Incentives, Thailand.

1 Introduction

Thailand has set ambitious targets for reducing its reliance on fossil fuels and expanding its renewable energy capacity to promote a sustainable, low-carbon future [1]. However, achieving these goals presents significant challenges, particularly in terms of public resistance. Concerns about economic disruption, skepticism toward renewable technologies, and the vested interests of traditional energy sectors have all contributed to resistance. Addressing these issues requires more than just technological advancements; it demands a comprehensive approach to public engagement that aligns with the economic and social interests of local communities [2].

Countries like Australia, Germany, and Japan offer valuable lessons in how to foster public support for renewable energy transitions. These nations have effectively used

community ownership and financial incentives as central strategies to reduce resistance and build a foundation of public acceptance. Community ownership models, as seen in Germany's citizen-led energy cooperatives and Australia's community solar projects, empower local residents to invest in and benefit directly from renewable energy, fostering a sense of shared responsibility and pride. Financial incentives, such as Germany's feed-in tariffs and Australia's concessional loans, have been instrumental in making renewable energy projects financially viable for both individual investors and communities.

This paper aims to explore how Thailand can adapt these strategies to its unique socio-economic landscape, focusing on community ownership and financial incentives as primary tools for engaging the public in its energy transition. Using a comparative case study analysis, the study examines the approaches taken by Australia, Germany, and Japan to determine how such practices can inform Thailand's policies. By implementing community-centered ownership models and providing targeted financial support, Thailand has the potential to create a more inclusive and resilient path toward renewable energy, reducing public resistance and ensuring a sustainable transition.

2 Research method

This study adopts a comparative case study to examine how community ownership and financial incentives have been implemented in three countries with advanced renewable energy transitions: Australia, Germany, and Japan. Each of these countries provides a unique perspective on how such strategies can foster public engagement and reduce resistance, making their approaches relevant for addressing Thailand's own energy transition challenges.

The case studies were selected to represent diverse approaches to public engagement and financial support for renewable energy. Germany exemplifies the use of cooperative models and feed-in tariffs to encourage local ownership and investment in renewable projects [3]. Australia demonstrates the impact of a dedicated green finance institution, the Clean Energy Finance Corporation (CEFC), which has reduced financial barriers for renewable energy investments [4]. Japan, meanwhile, illustrates the role of targeted subsidies and low-interest loans in promoting renewable projects in regions that are economically vulnerable or recovering from disaster impacts [5].

To gather data, the study relies on secondary sources, including policy documents, government reports, and academic literature, to identify recurring themes in each country's approach. These themes are analyzed with a focus on their applicability to Thailand's socio-economic landscape, drawing insights that inform practical recommendations for Thailand's renewable energy strategy.

However, it is important to acknowledge certain limitations of this comparative approach. The economic structures, policy environments, and regulatory frameworks of Germany, Australia, and Japan differ significantly from those in Thailand. For example, Germany's highly decentralized governance structure and strong tradition of cooperative ownership may present challenges for adaptation in Thailand, where regional governance and financial structures may be less supportive of local ownership models. Similarly, the CEFC's role in Australia reflects a level of governmental support and private sector integration that may require adjustments for effective

implementation in Thailand. Additionally, Japan's targeted financial support mechanisms, which were implemented in the specific context of post-Fukushima recovery, might need to be modified to address Thailand's unique socio-economic challenges and regional disparities. By addressing these contextual differences, this study recognizes that while the selected case studies offer valuable lessons, certain adaptations will be necessary to align these strategies with Thailand's unique circumstances. These adaptations are considered in the comparative lessons and policy recommendations.

3 Key findings

This section presents insights from the comparative analysis of Australia, Germany, and Japan, focusing on how community ownership and financial incentives have been instrumental in fostering public support for renewable energy. These countries have each implemented unique approaches to engaging local communities and making renewable projects financially accessible, which have proven effective in reducing resistance and encouraging public participation. By examining these strategies, the analysis highlights practical approaches that Thailand can adapt to address its own challenges in renewable energy adoption. The findings emphasize the importance of involving communities directly and providing economic benefits that align with local needs, illustrating how community ownership and financial support can facilitate a more inclusive and sustainable energy transition.

3.1 Community ownership

To foster public support for renewable energy, community ownership has emerged as a key strategy in Germany, Australia, and Japan. By giving local communities a direct stake in renewable projects, these countries have shown that community ownership can generate economic benefits while increasing public trust and acceptance of renewable energy.

Germany has been a leader in fostering public engagement through robust community ownership models. The *Energiewende* initiative has facilitated widespread adoption of cooperative models, allowing local citizens to invest directly in renewable energy projects, particularly wind and solar farms [6]. These cooperatives operate on a decentralized basis, empowering communities to take ownership of their energy production while reaping the economic benefits locally. Community members receive dividends from these projects, creating a sense of ownership and pride as they actively contribute to national energy goals [7]. This model can be particularly effective for Thailand, where engaging communities through local investment opportunities could increase support for renewable energy projects. By involving communities directly and offering them tangible economic benefits, Thailand can help ensure that renewable energy is viewed as a positive and beneficial transition for local economies.

In Australia, community ownership has also been promoted, particularly in rural areas that have historically relied on fossil fuel industries. Rural communities often resist renewable energy projects due to concerns about economic disruption; however, community-led renewable initiatives have proven effective in countering these fears [8]. In coal-dependent regions, community solar projects have allowed local residents

to pool their resources and collectively invest in renewable energy, with the profits remaining within the community [9]. This model supports community resilience and provides an alternative source of income, helping to alleviate concerns about job losses in the fossil fuel sector. For Thailand, fostering community ownership in renewable energy—especially in coal-dependent areas—could serve as an effective strategy to address local economic anxieties, while empowering communities to actively participate in the energy transition.

Japan has taken a unique approach to community ownership, emphasizing local autonomy, particularly in the wake of the Fukushima disaster. In response to heightened public concerns about energy security and safety, Japan granted local governments the authority to initiate community energy projects tailored to meet local needs. This has been especially impactful in rural and disaster-affected areas, where localized, community-led energy projects have helped to rebuild trust in energy systems. By allowing local governments and communities to co-invest in renewable energy, Japan has demonstrated a model of community-based energy solutions that prioritize resilience and independence [10]. This approach could be particularly relevant for Thailand, especially in regions vulnerable to energy insecurity. By encouraging local autonomy and providing opportunities for community investment, Thailand could promote renewable energy projects that are more aligned with regional needs, fostering greater public trust and participation in the energy transition.

In summary, community ownership has proven to be a powerful tool for promoting renewable energy by giving local residents a direct economic stake and a sense of shared responsibility. The examples set by Germany, Australia, and Japan illustrate how community-driven renewable energy projects can foster public support, improve local resilience, and reduce resistance to energy transitions. By adopting similar models, Thailand has the potential to create a more inclusive and sustainable energy future that benefits both local communities and the nation as a whole.

3.2 Financial incentives

Financial incentives have been instrumental in driving renewable energy investments in Germany, Australia, and Japan, each country demonstrating unique ways to reduce financial barriers and attract public and private participation. These incentives not only make renewable energy projects economically viable but also encourage small-scale and community-led initiatives that can benefit local economies.

Germany has been a pioneer in the use of feed-in tariffs (FiTs), a system designed to provide stable, long-term payments to renewable energy producers for the electricity they supply to the grid. This approach has made renewable investments more predictable and financially secure, particularly for small-scale producers and community cooperatives. FiTs have been effective in enabling local communities to invest in renewable projects, such as wind farms and solar installations, by offering guaranteed income [11]. For Thailand, a similar FiT system could be established to ensure that local investors, particularly in rural and underserved areas, have the opportunity to benefit economically from renewable energy. This system would not only support the financial viability of small and community-based renewable projects but also help stabilize local economies as part of the energy transition.

In Australia, the Clean Energy Finance Corporation (CEFC) has played a pivotal role by providing concessional loans, co-investment opportunities, and grants to renewable energy projects. This financial support structure reduces the initial costs and financial risks associated with renewable investments, making them more accessible to small and medium-sized enterprises (SMEs) as well as community groups. The CEFC's approach to renewable financing has proven effective in regions economically reliant on fossil fuels, as it supports job creation and economic diversification [12]. A Thai equivalent of the CEFC could be established to finance community-based renewable projects, such as solar cooperatives, and provide targeted financial assistance to coal-dependent regions. Such an institution would enable Thailand to support renewable projects tailored to regional needs while promoting economic resilience and providing new employment opportunities in transitioning areas.

Japan has also utilized financial incentives extensively, particularly in the form of subsidies and low-interest loans aimed at fostering innovative renewable projects. Following the Fukushima disaster, the Japanese government prioritized financial support for renewable projects in disaster-affected and rural areas, creating jobs and revitalizing local economies [13]. By focusing these incentives on regions in need of economic recovery, Japan has demonstrated how financial incentives can help ensure that renewable energy projects contribute positively to community development and economic stability. Thailand could adopt a similar approach by offering low-interest loans or grants to economically vulnerable regions, such as those affected by energy sector changes. This targeted financial support could help address local concerns about the potential economic impacts of renewable energy projects, ensuring that communities are financially supported as they transition to new energy sources.

Financial incentives have proven effective in all three countries by reducing financial risks, encouraging local investment, and promoting community-based renewable projects. Such incentives can address not only economic concerns but also community-specific needs, which in turn fosters public engagement by making renewable energy projects relevant and beneficial at the local level. By implementing mechanisms such as feed-in tariffs, concessional loans, and targeted subsidies, Thailand can provide the economic stability needed to foster public acceptance and participation in renewable energy. These financial supports would not only facilitate Thailand's transition to a low-carbon future but also empower local communities to actively engage in and benefit from the shift to sustainable energy.

The case studies of Germany, Australia, and Japan illustrate how community ownership and financial incentives can foster public support for renewable energy projects. Germany's model of cooperatives and feed-in tariffs demonstrates how empowering local communities through ownership can align individual interests with national energy goals, creating a strong sense of shared responsibility. Australia's Clean Energy Finance Corporation (CEFC) highlights the role of concessional loans and co-investment opportunities in making renewable energy financially accessible to communities, particularly those transitioning from fossil fuels. Japan's approach to regional subsidies and low-interest loans emphasizes the importance of targeted financial support for economically vulnerable areas, demonstrating how renewable projects can contribute to regional development and recovery.

Together, these cases provide key insights into how Thailand can build a supportive environment for its renewable energy transition. By adopting a community-centered

approach and implementing financial mechanisms tailored to local contexts, Thailand has the opportunity to address public concerns, support economic resilience, and foster an inclusive transition.

4 Comparative lessons and policy recommendations for Thailand

The strategies employed by Germany, Australia, and Japan provide valuable lessons on how community ownership and financial incentives can foster public support and reduce resistance to renewable energy transitions. These countries have shown that when local communities are given both economic incentives and ownership opportunities, they are more likely to support renewable energy initiatives and view them as beneficial to their long-term well-being.

Community ownership has been a cornerstone of Germany's renewable energy strategy, particularly through the *Energiewende* initiative. Germany's use of community cooperatives, especially for wind and solar projects, allows local residents to invest in and directly benefit from renewable energy production. For example, citizen-owned wind farms not only generate income for community members but also strengthen public support for renewable energy by fostering a sense of shared responsibility [14]. This model could be particularly impactful for Thailand, where rural communities may have concerns about the economic impacts of transitioning away from fossil fuels. By establishing cooperatives and enabling local ownership of renewable projects, Thailand can ensure that economic benefits stay within the community, which would help mitigate fears about job losses and provide a steady income stream to local stakeholders. Community ownership also aligns local interests with national renewable energy goals, fostering a sense of collective achievement [15].

In Australia, community ownership has similarly been promoted, especially in rural areas where resistance to renewable energy is often linked to economic concerns about the decline of traditional energy sectors. For instance, Australia's community solar projects in coal-dependent regions have allowed local residents to collectively invest in solar installations. Profits generated by these projects remain within the community, supporting resilience and economic stability as traditional industries phase out. This model offers an effective solution for Thailand's coal-dependent regions, where community ownership could empower local residents to transition from fossil fuels to renewables in a way that provides direct economic benefits. Thailand could encourage similar projects by providing grants and logistical support for cooperatives, allowing communities to share the financial gains from renewable energy while contributing to national sustainability goals.

Financial incentives are another critical tool that has helped these countries foster renewable energy investments. Germany's feed-in tariffs (FiTs), for example, guarantee fixed payments to renewable energy producers for electricity supplied to the grid, offering financial stability and predictability. This system has been especially effective for small-scale and community-led projects, which benefit from reliable income streams that make renewable energy investments more accessible and appealing. Thailand could adopt a similar FiT model to attract local investors, particularly in rural areas where renewable projects are often perceived as financially

risky. FiTs would provide these projects with a consistent revenue stream, ensuring that renewable energy is not only economically viable but also sustainable in the long term. By making renewable investments financially secure, Thailand can encourage communities to participate in the energy transition and reduce resistance rooted in economic uncertainty.

Australia's approach with the Clean Energy Finance Corporation (CEFC) illustrates how a dedicated green finance institution can reduce financial barriers to renewable investments. The CEFC provides concessional loans, co-investment opportunities, and grants for renewable projects, making it easier for small and medium-sized enterprises (SMEs) and communities to invest in clean energy. This approach has proven particularly effective in regions transitioning away from fossil fuels, where economic diversification is essential. Thailand could create a similar Green Finance Institution to provide tailored financial support to community-led renewable projects and facilitate the transition for coal-dependent regions. By offering low-interest loans and grants, Thailand's Green Finance Institution could help communities invest in renewable energy, support job retraining programs, and promote economic resilience in areas most affected by the energy transition.

In Japan, financial incentives have been crucial in supporting renewable energy projects in disaster-affected regions following the Fukushima crisis. The Japanese government implemented targeted subsidies and low-interest loans for renewable energy projects, particularly in rural areas that were economically vulnerable. These incentives helped rebuild local economies by creating jobs and encouraging investment in renewable energy as a pathway to recovery. For Thailand, offering regional subsidies and low-interest loans could address the concerns of economically vulnerable areas, particularly those reliant on traditional energy sources. By focusing financial incentives on regions facing economic transitions, Thailand can alleviate fears of job losses and ensure that renewable energy brings tangible benefits to local communities. Subsidies and loans targeted at these regions would help make renewable energy projects financially viable and support broader economic development in accordance with sustainability goals.

5 Concluding remarks

The cases of Australia, Germany, and Japan underscore the effectiveness of community ownership and financial incentives as strategies for building public support for renewable energy transitions. Each of these countries has demonstrated how these approaches can create economic benefits, enhance public trust, and promote local involvement in the energy sector, effectively aligning community interests with national energy goals. By empowering communities to participate directly, these strategies not only foster public acceptance but also build resilience, creating local economic opportunities and fostering a sense of shared responsibility for sustainability.

One major concern for Thailand is the economic impact of transitioning away from fossil fuels, especially in communities where coal and other traditional energy sources have been central to local economies. The cases of Germany and Australia demonstrate that community ownership models, such as cooperatives, can empower local residents to participate directly in renewable energy projects, ensuring that economic benefits

remain within the community. By allowing Thai communities, particularly in coal-dependent regions, to co-own renewable energy projects, Thailand can provide alternative income streams and reduce the economic anxieties that often accompany the decline of fossil fuels.

Public skepticism and concerns about the financial viability of renewable energy are also significant challenges. Germany's successful implementation of feed-in tariffs (FiTs) has shown how guaranteed financial returns can make renewable projects more predictable and attractive for local investors. A similar FiT system in Thailand would enable community-led and small-scale renewable projects to generate consistent income, making renewable energy a financially appealing option for individuals and local businesses. Additionally, Australia's Clean Energy Finance Corporation (CEFC) provides a model for a dedicated green finance institution that can reduce financial barriers through concessional loans and co-investments. Establishing a comparable entity in Thailand could help facilitate community-based renewable projects and support regions in economic transition by offering tailored financial assistance for retraining programs and local investments.

Furthermore, regional disparities in energy infrastructure present a unique challenge for Thailand, especially in economically vulnerable and rural areas. Japan's focus on regional subsidies and low-interest loans has been particularly effective in providing disaster-affected and rural areas with the resources needed to invest in renewable energy, creating jobs and revitalizing local economies. Thailand could adopt a similar approach by targeting financial incentives to regions most affected by the energy transition. By offering subsidies and low-interest loans specifically to these areas, Thailand can ensure that renewable energy projects contribute to regional development and address economic vulnerabilities, fostering a more equitable transition.

In conclusion, community ownership and financial incentives provide a pathway for Thailand to address these challenges while aligning local interests with national sustainability goals. These strategies not only encourage public acceptance but also promote an inclusive transition that supports economic resilience and regional development. By implementing these community-centered financial strategies, Thailand can make renewable energy an attractive and viable option across its diverse regions, paving the way for a low-carbon, sustainable future that benefits both local communities and the nation as a whole.

While this study provides valuable insights by examining renewable energy policies in Germany, Australia, and Japan, it primarily relies on secondary data sources, which may not fully capture recent policy developments or the intricate, localized factors affecting each country's energy transition. Secondary sources such as government reports, policy documents, and academic literature offer a broad understanding but lack the granularity needed to reflect on-the-ground stakeholder perspectives and public sentiment. Future research would enhance this analysis by incorporating primary data collection methods, such as interviews or surveys with key stakeholders. Such approaches would provide a more nuanced view of the challenges and successes within each country's renewable energy landscape and offer deeper insights for adapting these lessons to Thailand's unique socio-economic context.

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