

Encouraging Public Participation: Insights from Indonesian Solar EPC Managers on Increasing Citizen Engagement in Community Energy Storage

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Abstract

This study explores strategies to increase public participation in Community Energy Storage (CES) in Indonesia by analyzing the perspectives of managers from two prominent Solar EPCs. Using a comparative qualitative approach, the research identifies four critical pillars for enhancing citizen engagement: trust, active involvement, education, and acceptance factors. Results indicate that fostering trust requires a synergy between regulatory and economic certainty and technical reliability. Furthermore, citizen engagement must evolve from passive consumption toward "prosumerism," necessitating social engineering to integrate CES into communal social identities. The study also highlights a dual-track education strategy: targeted outreach for early adopters and structural integration into national curricula for long-term cultural change. Finally, citizen acceptance is driven by a balance between moral environmental norms and pragmatic values such as cost-efficiency and after-sales service. This paper concludes that Indonesian Solar EPC managers must shift from purely technical approaches to socio-technical strategies. By combining economic incentives, tailored communication, and reliable service, providers can effectively transform citizens from "bill payers" into active energy stakeholders.

Keywords

Exploratory Study, Citizen Engagement, Community Energy Storage, Indonesia, Solar EPCs.

1. Introduction

Endorsed by the United Nations in 2015, the 17 Sustainable Development Goals (SDGs) aim to end poverty, protect the planet, and ensure peace and prosperity for all by 2030. SDG-13 specifically addresses urgent measures to combat climate change and its impacts (UNDP, 2015). This climate change combat includes the urgency of transitioning to renewable energy sources to achieve net-zero emissions (Gozali et al., 2026; Jiang et al., 2025). Indonesia, as a

developing country, has a target of 31% renewable energy mix by 2050. This is Indonesia's commitment to reducing greenhouse gas emissions and achieving net-zero emissions by 2060 (IEA, 2022).

Currently, the energy system is shifting from centralization to decentralization (Beermann & Tews, 2017; Bouffard & Kirschen, 2008). This shift is marked by the emergence of the concept of "Community Energy Storage," in which individuals can play roles as consumers, buyers, and collective energy managers. Community Energy Storage (CES) is a local energy storage unit or group of units owned and governed by the community. These units can operate together to increase renewable energy use, lower reliance on fossil fuels, reduce energy costs, and generate revenue through various energy services (Koirala et al., 2019).

In Indonesia, the Community Energy Storage concept has only been implemented in rural areas and near renewable energy sources, such as micro-hydro, but has not yet been implemented in urban residential areas (Guerreiro & Botetzagias, 2018). Urban residential areas are the sector that consumes the most electricity, especially as cities grow rapidly, automation advances, and various daily activities become electrified (Chakir et al., 2022). Engaging residents in renewable energy initiatives fosters ownership, encourages behavioral change, and supports ongoing reliance on renewable energy (Budiman, 2018). Residential areas that implement community energy storage systems can achieve greater energy independence by reducing reliance on electricity from the public grid (Parra et al., 2017). These systems enhance grid stability by providing localized energy storage. In the event of a power outage, the stored energy serves as an emergency power supply. Additionally, independent consumption of stored energy can lower electricity costs.

The following is Figure 1 illustrates the concept of community energy storage in urban living. Residential areas often face constraints in available land, making rooftop solar photovoltaic (PV) systems a viable solution for densely populated urban environments (Ihsan et al., 2023). Rooftop solar photovoltaic (PV) systems are installed on the roofs of guest houses or central gathering areas within urban housing. These locations provide suitable spaces for rooftop solar photovoltaic PV installations, as guest houses frequently have unused roof areas. This approach maintains the aesthetic integrity of the urban housing. Additionally, residents can charge their electric vehicles at the guest house or in the central gathering areas.

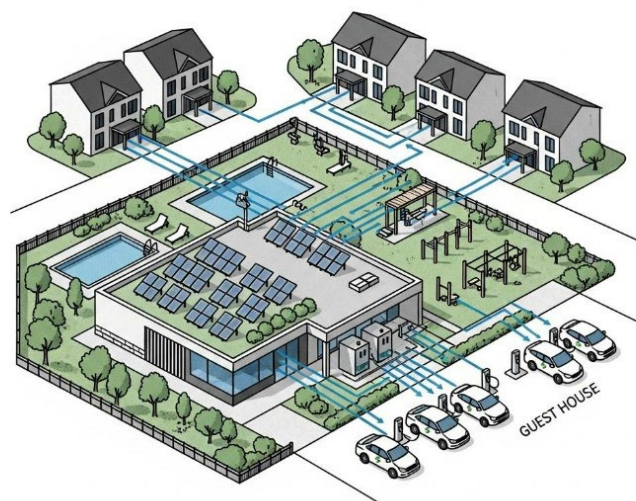


Figure 1. Conceptual of Community Energy Storage in Urban Living

Community energy storage faces not only technological, economic, and environmental challenges, but also social ones, particularly in attracting residents to participate (Prianjani et al., 2024). If residents hesitate to join due to uncertainty, limited understanding, trust concerns, or unclear benefits, investment in community energy storage may stall. EPC company managers act as strategists who recognize these obstacles. Their insights on increasing citizen engagement are essential for shaping Indonesia's renewable energy roadmap. This study investigates the perspectives of solar power plant engineering, procurement, and construction (EPC) managers regarding strategies to promote

citizen participation in community energy storage. The findings aim to inform approaches that could accelerate the adoption and acceptance of community energy storage among Indonesians, should it be implemented in the future.

1.1 Objectives

This study investigates the perceptions of EPC Solar PV Chief Executive Officers about how to encourage citizen participation in community energy storage and regarding the primary barriers to Indonesians participating in energy storage communities. The findings will inform whether the future adoption of energy storage communities in residential areas necessitates consideration of social factors, especially about willingness to join.

1.2 Research Propositions

To address the identified research gap, this study examines four conceptual pillars anticipated to influence public engagement in community energy systems (CES): (1) trust, (2) active citizens' involvement, (3) renewable energy education, and (4) citizen acceptance.

2. Literature Review

Recent global studies highlight that successful energy transitions require attention to social dynamics, not just technical solutions. Research in Europe and Asia identifies various psychological and structural drivers of participation. For example, studies in Germany show that community identity, trust, social norms, and environmental concerns are linked to willingness to join community energy projects, such as volunteering or investing (Kalkbrenner & Roosen, 2016). In China, residents' motivations for joining renewable energy communities differ by scientific attitudes, risk tolerance, and openness to new products, resulting in early, mid-term, and late adopter segments (Wang et al., 2022). Dutch research finds that cultural capital is a key factor in promoting energy citizenship (Jansma et al., 2023). These findings have important policy implications. Local and national governments should support workshops that build knowledge of climate change and renewable energy, and encourage public engagement. Italian research concludes that technology and funding alone are not enough; social factors and human interaction are essential for successful energy communities (Caferra et al., 2023). Collectively, these studies show that financial incentives must be supported by social trust and community identity. The 'trust' identified in Germany (Kalkbrenner & Roosen, 2016) aligns with the 'cultural capital' in the Netherlands (Jansma et al., 2023), indicating that public acceptance involves ethical, social, and practical considerations.

Previous research has largely focused on citizens as potential community members, leaving a gap in understanding the 'supply-side' perspective of infrastructure providers. Most studies treat citizens as isolated decision-makers and overlook the role of Solar EPC managers, who connect technology with the public. Interviewing these managers provides valuable insights due to their experience with renewable energy installations and diverse consumers. This study addresses this gap by integrating managerial perspectives into a socio-technical framework, which is especially relevant to early-stage markets such as Indonesia. The study develops four key propositions to examine how Indonesian EPC managers view the relationships among trust, citizen involvement, renewable energy education, and acceptance in the context of CES acceptance.

3. Methods

A qualitative exploratory approach was employed in this study. Managers from EPC Solar PV companies in Indonesia with at least 10 years of managerial experience were selected as participants. Two managers from distinct companies provided their perspectives. Company A specializes in selling residential solar PV systems. Company B not only sells solar PV systems but also manufactures batteries for energy storage. Comparing the perspectives of these two managers offers complementary insights to inform strategies for increasing citizen engagement in Community Energy Storage. These companies were selected using purposive sampling. Semi-structured in-depth interviews provided managers with space to share their empirical experiences. Thematic analysis was used to group managers' responses into categories: trust, active citizen involvement, education, and factors driving citizen acceptance. The interview with the EPC Solar manager was conducted online using Zoom and lasted approximately 1.5 hours. The interviews with both managers were conducted separately rather than simultaneously. This approach was intended to ensure consistent responses and prevent potential influence among participants.

4. Data Collection

Data for this study were collected through semi-structured interviews, questionnaires, and the analysis of secondary sources, including company documents and websites. Interview questions were adapted from previous literature on willing citizens joining Community Energy and are presented in Table 1.

Table 1. Interview Questions

Aspect	Source	Question
Company profile		1. When was EPC Firms of Solar EV established? 2. Which products does the company manufacture? 3. Where are the products distributed?
Trust	(Kalkbrenner & Roosen, 2016)	How does the citizens' level of trust in technology and community management influence their decision to participate in energy storage systems?
Active citizen involvement	(Heuninckx et al., 2023)	What is the active role of citizens in influencing changes in public perceptions and behaviors regarding energy storage technology?
Renewable Energy Education	(Koirala et al., 2018)	What is the role of renewable energy education in increasing citizen understanding and acceptance of community energy storage systems?
Factors driving citizen acceptance	(Conradie et al., 2021)	What factors influence citizens' acceptance of community energy storage?

4.1 Company Profile

Company A

The first company participating in this study was established in 2016. The products offered include the sale and installation of on-grid, off-grid, and hybrid solar PV systems, as well as batteries for storing solar PV energy. The company has completed over 500 residential solar PV installations and more than 230 project sites in Indonesia, as well as projects in Vietnam, Thailand, and Australia.

Company B

The second company participating in this study was founded as a laboratory-scale battery company in 2015. Then, it became the first lithium battery producer in Indonesia since 2020. The company offers 18650 LiFePO₄ batteries, e-bikes, and solar photovoltaic (PV)-powered LED lights integrated with lithium batteries. These products are distributed exclusively within Indonesia.

4.1 Aspect Trust

Manager Company A

“Citizen trust will be trust to join Community Energy Storage if regulations support community members to gain economic benefits.”

Manager Company B

“People are more likely to trust the Community Energy Storage if they know the products are high quality, the service is reliable, after-sales support is available, and everything is easy to use.”

4.2 Aspect Active Citizen Involvement

Manager Company A

“Citizens play an active role in promoting changes in perspective and behavior regarding energy storage technology, as they increasingly become prosumers, individuals who both produce and consume goods and services.”

Manager Company B

“Citizens play a crucial role in promoting shifts in perspectives and behaviors regarding energy storage technology. This process begins with acknowledging the significance of the energy transition and its potential macroeconomic benefits, and continues through the implementation of social engineering strategies within communities as early adopters.”

4.3 Aspect Renewable Energy Education

Manager Company A

“The role of renewable energy education in increasing citizens' understanding and acceptance of community energy storage systems is most effective for individuals who are sensitive to technological advances and environmentally conscious.”

Manager Company B

“Incorporating clean energy education into curricula from elementary through higher education is likely to enhance public understanding and acceptance of community energy storage systems.”

4.4 Aspect Factors Driving Citizen Acceptance

Manager Company A

“Citizens' acceptance of community energy storage is influenced by concerns about global warming, environmental awareness, and affordability.”

Manager Company B

“Citizens' acceptance of community energy storage depends on product expectations, energy management and after-sales services, cost efficiency, and product value.”

5. Results and Discussion

This section presents a comparative analysis of the perspectives of two EPC Solar PV company managers, focusing on trust, active citizen involvement, renewable energy education, and factors influencing citizen acceptance.

5.1 Aspect Trust

The exploration of trust was guided by the interview questions detailed in Table 1, which aimed to uncover how the citizens' level of trust in technology and community management influences their decision to participate in energy storage systems. An analysis of the two managers' statements reveals two distinct yet complementary perspectives on fostering public trust in Community Energy Storage. The perspectives of Managers A and B indicate that the energy transition involves developing a comprehensive ecosystem rather than merely installing large-scale batteries in communities. Manager A focuses on establishing the regulatory and economic framework, while Manager B addresses technological advancement and service quality. In the absence of economic incentives, as emphasized by Manager A, advanced technologies are likely to be perceived as financial liabilities. Conversely, as Manager B notes, insufficient service quality may render substantial government subsidies ineffective, as public dissatisfaction with technical shortcomings would persist. Trust does play a vital role in the dynamics of community renewable energy projects as well as in the outcomes that can be achieved (Walker et al., 2010).

5.2 Aspect Active Citizen Involvement

Expanding upon the inquiry into active citizen roles presented in Table 1, both the Manager of Company A and the Manager of Company B address Active Citizen Involvement, yet interpret the “active role” through distinct frameworks. The Manager of Company A adopts an economic-technical perspective, emphasizing prosumerism and individual production capacity. In contrast, the Manager of Company B approaches the issue from a social behavior change perspective, prioritizing group dynamics and social engineering. In the context of Community Energy Storage, Manager B's perspective is particularly relevant, as successful implementation requires coordination among multiple households rather than reliance on individual decision-making. Effective citizen engagement is achieved by integrating economic incentives for prosumers, as advocated by Manager A, with social support and a clear vision, as emphasized by Manager B. This combined approach enables communities to perceive new technologies as integral to their social identity rather than merely as financial investments. The Manager of Company B underscores the necessity for structured intervention, asserting that the adoption of new energy technologies demands tailored communication strategies instead of assuming organic uptake. Ultimately, the energy transition entails redefining citizens' roles from “bill payers” to “stakeholders” who exercise control over their resources.

5.3 Aspect Renewable Energy Education

Consistent with the educational focus outlined in Table 1, the two company managers expressed contrasting perspectives. The manager of Company A considered energy education most effective when directed toward individuals possessing existing technological knowledge and environmental awareness. This targeted strategy prioritized those already predisposed to accept energy storage systems, as these products aligned with their values. In contrast, the manager of Company B adopted a structural approach, seeking to establish a foundational knowledge

standard for all citizens by integrating energy education into the national curriculum. The objective was to normalize clean energy as part of everyday life. Both managers agreed that the primary challenge for community energy storage is not technological limitations, but rather a lack of public knowledge. They asserted that education can mitigate fears regarding technical risks and foster trust in the system. The manager from Company A aimed to reduce resistance among key stakeholder groups, whereas the manager from Company B focused on addressing concerns about future generations.

5.4 Aspect Factors Driving Citizen Acceptance

The exploration of citizen acceptance was guided by the interview questions detailed in Table 1, which aimed to identify the factors influencing citizens' acceptance of community energy storage. The manager of Company A believes citizens will accept this technology if they are concerned about the earth's future, a motivation known as a personal norm. Acceptance, in this view, is rooted in moral responsibility. In contrast, the manager of Company B sees citizens as discerning customers who require more than environmental awareness. They need confidence in the system's reliability, ease of use, and after-sales support, which relates to technical trust. Citizen acceptance is therefore influenced by both emotional concern for the environment and practical considerations of service quality. To persuade the public, service providers must go beyond promoting environmental benefits. They should also demonstrate the technology's added value and efficiency in daily life. While demonstrating the added value and efficiency of community energy storage technology in daily life, citizen complaints and claims can serve as valuable internal data sources for identifying customer needs during product development (Suef et al., 2017). The most effective strategy is to present the technology as both an ethical choice and a technically and financially superior solution.

Figure 2 provides a visual summary of the four pillars influencing public participation in Indonesian Community Energy Systems (CES). The research demonstrates that Trust (P1) arises from both regulatory and technical reliability. Active Involvement (P2) necessitates a transition toward prosumerism, facilitated by social engineering. Renewable Energy Education (P3) is most effective when employing a dual-track strategy that combines targeted outreach for early adopters with integration into national curricula. Citizen Acceptance (P4) is shaped by the interplay between moral environmental norms and practical financial considerations. This thematic map consolidates qualitative findings into a practical socio-technical framework to guide future CES implementation.

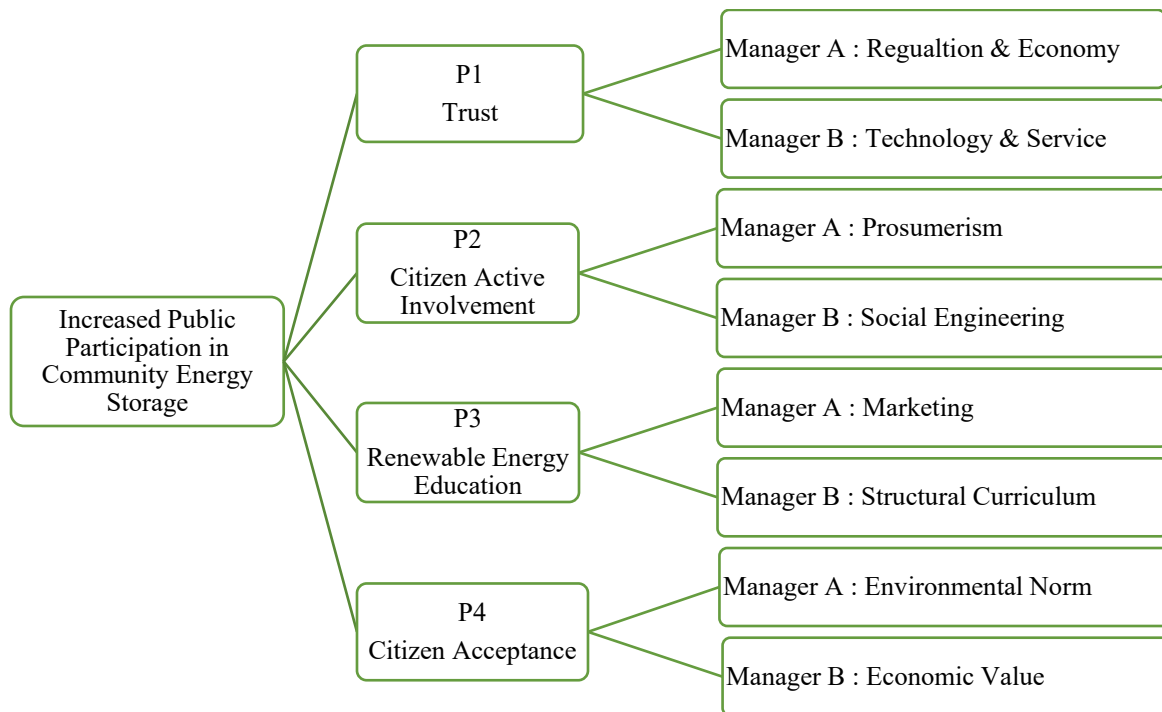


Figure 2. Visual summary of research funding

5.4 Comparison with Previous Studies

The findings of this study reinforce and extend several key theories identified in the literature review. Regarding social dynamics, the results are consistent with studies from Italy and Germany, supporting the theory that technical solutions alone are insufficient for successful energy transitions. The managers' emphasis on trust and social engineering aligns with Caferra et al. (2023), who concluded that human interaction is essential.

In terms of trust and identity, the "Synergy of Trust" identified by Managers A and B, which combines economic certainty and technical reliability, parallels the "community identity and trust" observed in Germany and the "cultural capital" discussed in the Netherlands.

Concerning adoption theory, while Wang et al. (2022) focused on resident innovativeness in China, the present study extends this perspective by proposing a "dual-track education" strategy. This approach targets not only early adopters but also advocates for the structural integration of renewable energy into national curricula to normalize it.

5.5 Applicability Outside Indonesia and Local Context Uniqueness

The four identified pillars—Trust, Citizen Active Involvement, Renewable Energy Education, and Citizen Acceptance—constitute a socio-technical framework that is broadly applicable to other developing nations transitioning to decentralized energy systems. The transition from viewing individuals as "bill payers" to recognizing them as "stakeholders," along with balancing moral and pragmatic motivations, represents universal challenges in community energy projects.

Uniqueness of the Indonesian Context: However, these findings are specifically influenced by Indonesia's current policy environment as a developing nation.

- 1) **Regulatory Uncertainty:** Manager A's emphasis on the need for "economic and regulatory certainty" is especially significant in Indonesia, where specific feed-in tariffs and clear financial incentives for community energy systems (CES) in urban residential areas remain under development.
- 2) **Cultural Collectivity:** Manager B's focus on "social engineering" reflects Indonesia's strong communal culture (*Gotong Royong*), indicating that CES adoption in Indonesia should prioritize communal approaches over individual ones.
- 3) **Geography-Driven Reliability:** Indonesia's archipelagic geography makes the "after-sales service" pillar more critical than in geographically compact European countries, as technical reliability depends on the provider's capacity to service remote or distributed project sites.

6. Conclusion

Public participation in community energy storage in Indonesia requires more than just technology. It depends on four key pillars: synergy of trust, role transformation, dual-track education, and balanced motivation. **Synergy of Trust:** Building citizen trust requires both regulatory and economic certainty, such as financial incentives, and technical reliability, including product quality and after-sales service. Without both, CES technology may be seen as a burden rather than an asset. **Role Transformation (Prosumer & Collectivity):** To encourage active involvement, citizens must shift from passive consumers to stakeholders, or prosumers. Because CES is communal, social strategies are needed to foster inter-household coordination and integrate the technology into the community's social identity. **Dual-Track Education:** Energy literacy should be promoted through targeted outreach to environmentally conscious groups to accelerate adoption and through educational curricula to address technical concerns and build a lasting, energy-conscious culture. **Motivational Balance:** Public acceptance depends on both moral norms, such as environmental concern, and practical values, like cost efficiency. Participation increases when CES is seen as both ethical and financially advantageous.

Recommendation for EPC managers in the future if the concept of community energy storage is implemented: To improve public engagement, EPC companies in Indonesia should adopt socio-technical strategies rather than rely solely on technical solutions. Achieving success in the energy transition necessitates providing clear economic

benefits, tailored communication, and consistent service quality. This study presents the perspective of one of the actors in Community Energy Storage.

Future research should involve interviews with all actors in Community Energy Storage, including regulatory actors who create regulations, solar PV infrastructure actors who install renewable energy systems, and prospective community members (who could also include academics, homeowners, and renewable energy researchers).

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