Toward a Shared Zero-Carbon Energy Future: A Global Analysis of Rural Energy Cooperatives

Executive Summary

ES / November 2024

About RMI

RMI is an independent nonprofit, founded in 1982 as Rocky Mountain Institute, that transforms global energy systems through market-driven solutions to align with a 1.5°C future and secure a clean, prosperous, zero-carbon future for all. We work in the world's most critical geographies and engage businesses, policymakers, communities, and NGOs to identify and scale energy system interventions that will cut climate pollution at least 50 percent by 2030. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; Abuja, Nigeria; and Beijing, People's Republic of China.

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Global Context of Rural Energy Transition

The Urgency for Rural Energy Transition in Developing Countries

The global landscape is increasingly affected by escalating regional conflicts and unprecedented climate events, fundamentally reshaping international priorities regarding energy security and affordability. Rural regions, which accommodate approximately half of the global population, face disproportionately complex challenges in terms of energy accessibility, infrastructure reliability, and long-term sustainability compared with their urban counterparts.

The energy access challenges are even more acute in developing countries. The International Energy Agency reports that despite a significant 45% reduction in global energy poverty since 2010, approximately 760 million individuals remained without electricity access as of 2022, representing a persistent development challenge.[1] Furthermore, around 2.4 billion people relied on traditional biomass, coal, or kerosene for cooking, resulting in long-term exposure to indoor air pollution, primarily affecting women and children.[2] This population largely resides in rural areas of sub-Saharan Africa and developing Asian countries. Even in regions with electricity supply, issues including unstable power availability, high energy costs, and excessive reliance on fossil fuels persist. Therefore, people living in rural areas urgently need access to sustainable, cost-effective clean energy, which will greatly improve their quality of life and help address health issues.

Rural areas also present new opportunities to contribute to a sustainable national energy landscape and drive innovative economic growth. Abundant renewable resources, such as wind, solar, and agroforestry biomass, are essential for establishing a modern energy system. Expanding clean energy in rural areas can help bridge the urban-rural development gap by enabling the use of affordable and sustainable clean energy in both production and daily life. Furthermore, the growth of new energy industries in rural areas can stimulate economic opportunities and job creation, further supporting rural revitalization and alleviating energy poverty.

In this context, the rural energy transition will not only expand access to reliable, clean, and affordable energy but also drive local economic growth, ultimately fostering more resilient and prosperous rural communities.

Putting People First: Addressing Critical Barriers in the Rural Energy Transition

The implementation of rural energy transition initiatives has revealed persistent structural challenges. The interplay of technical, financial, and organizational barriers has historically marginalized rural communities, limiting their participation in the construction and development of energy systems and making decisions about them as well as opportunities for sharing the benefits. Over time, this lack of local involvement can weaken the resilience of energy projects and exacerbate social and economic disparities in a variety of ways:

- Infrastructure gaps in many rural areas, including the lagged development of upgraded grids and efficient energy storage systems, greatly impede the advancement of renewable energy in these regions.

- High up-front costs of renewable energy technologies pose a significant barrier for rural

communities, where lower income levels and limited financing options hinder initial investments in clean energy systems.

- Profit distribution disparities, irregular practices by energy project developers, and a lack of regulation restrict local benefits from an energy transition and often place undue burdens on communities. The absence of local involvement in renewable energy projects hinders the maximization of benefits for these communities and obstructs the achievement of local energy consumption priorities.

Therefore, a people-centered approach emphasizing local engagement, equitable access, and benefit sharing represents a fundamental prerequisite for fostering a sustainable rural energy transition and shaping an inclusive national energy landscape.

Rural Energy Cooperatives as an Emerging, Effective, and Equitable Model for Rural Energy Transition

A people-centered approach in rural energy transition is one that promotes energy equity and prioritizes the well-being of community members. By involving residents as active and important participants and decision makers, it aims to facilitate a sustainable and resilient rural energy system that alleviates energy poverty and fosters economic prosperity.

Globally, many countries have launched community-based energy projects that encourage the involvement of community members and local stakeholders, emphasizing local engagement and benefit sharing. Rural energy cooperatives, a member-owned organization for collectively managing energy production and consumption, are emerging as key players in climate action and energy transition worldwide, reflecting a trend toward people-centered, participatory, community-driven, and equitable energy transitions.

The practices and experience of energy cooperatives in Europe, the United States, and many other countries demonstrate that the cooperative model could be an effective mechanism to accelerate regional and national clean energy transition. This cooperative model promotes equitable energy transitions and fosters inclusive energy systems by empowering local communities, optimizing local resource utilization, and engaging members as both producers and consumers. Furthermore, it ensures long-term project sustainability through collective decision-making and benefit sharing among stakeholders.

The Evolution of Rural Energy Cooperatives Around the World

Definition and Features

Rural energy cooperatives are organizations owned by their members, usually residents in rural areas, to collectively develop, manage, and use natural resources, including fossil fuels and renewable energy resources such as wind, solar, biomass, and geothermal energy. Their goal is to enhance local energy supply and promote sustainable development.

Although different terms are used for rural energy cooperatives globally, such as rural electric cooperatives and energy communities, they all share common principles defined by the International Cooperatives Alliance.[3] Based on global case studies and benchmarking, some of these distinguishing features have been identified as essential for the success and prosperity of rural energy cooperatives (see Exhibit ES1).

Exhibit ES1 Core Principles and Distinguishing Features of Rural Energy Cooperatives

Principles	Features
Voluntary Membership	The membership structure emphasizes the voluntary involvement of community residents, who jointly own energy projects and participate in the development and operation of the cooperative.
Collective Decision-Making	Cooperative members actively participate in policymaking and decision-making, with equal rights, such as through a one-member, one-vote system. Governance is typically carried out through an elected board of directors.
Autonomy and Independence	Cooperatives are controlled by their members, especially when negotiating agreements and securing funding from external sources.
Benefit Sharing	The collaborative framework ensures equitable distribution of economic and social benefits derived from energy-development initiatives.
Community Reciprocation	Cooperatives promote sustainable development in the local community in various ways, aiming to enhance their members' well-being.

RMI Graphic.

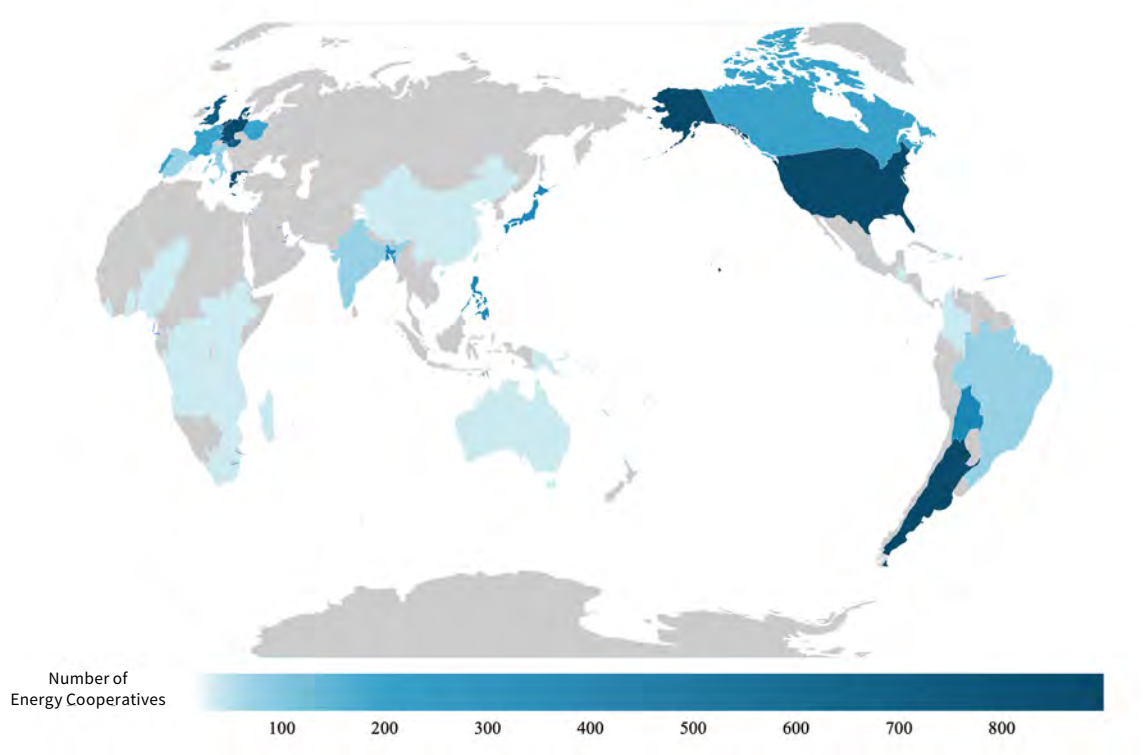
Although energy cooperatives are found in both rural and urban settings, their impact is particularly significant in rural areas. They help address challenges such as energy poverty and lack of infrastructure and public services, offering broader environmental, social, and economic benefits. Rural energy cooperatives also play a key role in leveraging local renewable energy resources, offering greater potential for clean energy development compared with urban areas. These cooperatives provide valuable insights for global efforts to address energy access and sustainability in developing regions.

Historical Development and Current Landscape

The evolution of rural energy cooperatives as member-owned entities has demonstrated remarkable advancement across diverse national contexts, revolutionizing local approaches to energy management and distribution. They have contributed to energy access, the promotion of renewable energy, energy

transition, and energy democracy. Today, rural energy cooperatives are an effective solution to address energy accessibility challenges and prioritize local interests in many regions (see Exhibit ES2).

Exhibit ES2 **Number of Energy Cooperatives by Country**



RMI Graphic. Source: RMI Analysis, based on publicly available data, non-exhaustive

United States: Rural Electric Cooperatives as Nonprofit Electric Utilities

The emergence of rural electric cooperatives in the United States during the 1930s represented a strategic response to severe rural electrification deficits, with grid connectivity reaching merely 10% of rural households prior to intervention. The government passed the Rural Electrification Act of 1936, which provided low-cost loans to form cooperatives, enabling them to build transmission lines and deliver electricity to rural residents. By 1953, over 90% of US farms had access to electricity. Today, nearly 1,000 rural electric cooperatives serve over 42 million people across 56% of US land, providing more than 10% of the nation's electricity, primarily supporting rural communities.[4]

The European Union: Legislation to Promote a Distributed Energy Market

The genesis of European energy cooperatives is intrinsically linked to the convergence of the 1970s oil crisis and antinuclear movements, which catalyzed a fundamental shift toward alternative energy paradigms and accelerated national energy transitions. The rise of energy cooperatives was both a technological move toward renewables and a transformation of energy ownership, fostering community-driven, decentralized energy solutions. According to the European Commission, community-led cooperative initiatives are expected to own 17% of wind generation capacity and 21% of solar installation capacity by 2030, representing a significant transformation in energy ownership patterns.[5]

The European Union (EU) has established a comprehensive regulatory framework for clean and fair energy transition through the Clean Energy for All Europeans package. As part of the package, the EU legislatively identified both renewable energy communities (RECs) and citizen energy communities (CECs) as foundational elements of the distributed energy market, advocating for distributed energy generation, peer-to-peer trading, and energy sharing. Some EU Member States have already begun implementing policies and measures for energy communities, while others are in the process of developing regulatory frameworks.

Germany: Energy Communities for Energy Transition

Germany's energy cooperatives have a long history. These cooperative structures, initially conceived in the early 20th century as mechanisms for rural electrification through conventional fossil fuel systems, have evolved strategically to become instrumental drivers of Germany's comprehensive energy transition agenda. Originating in the 1970s, this transition was shaped by the combined influence of climate concerns, energy security needs, and antinuclear movements. At that time, large utilities and energy corporations were reluctant to invest in renewables, creating an opportunity for cooperatives to emerge as key players in the renewable energy landscape.

Renewable-focused energy cooperatives empower citizens to become energy producers and foster a collective approach to local energy goals. By engaging diverse stakeholders — including local policymakers, community-oriented businesses, and regional associations — these cooperatives harness local support to meet renewable energy targets. Although renewable energy cooperatives emerged relatively late, they have grown rapidly, with a strong focus on solar energy. Currently, Germany has 951 energy cooperatives, with a total of 220,000 members.[6]

Netherlands: Energy Democracy and Citizen Participation

In response to the 1970s oil crisis, European nations, including the Netherlands, sought to diversify their energy sources for energy security. The Netherlands introduced its first renewable energy policy in 1979, which granted local grid access in 1980. This enabled farmers and communities to produce and supply their own energy, breaking traditional power monopolies and paving the way for the emergence of energy cooperatives.

Following nuclear incidents in other countries, public interest in clean community-based energy grew in the Netherlands. In the 1980s, environmental pioneers launched small wind cooperatives, promoting energy independence and democratic participation. The 1989 Electricity Act strengthened this model by mandating grid access and standard rates for local producers. With energy market liberalization in the 21st century, cooperatives expanded rapidly, driven by the motto energie van, voor en door ons zelf (energy from, for, and by ourselves). Today, over 700 energy cooperatives with more than 130,000 members drive green energy and community energy ownership across the Netherlands.[7]

Denmark: The Energy Cooperative Model as a Key Pillar of Energy Supply

Denmark has a long history of citizen involvement in power and heat supply. Even before EU energy market liberalization, electricity and heat were considered public goods in Denmark. Since the 1970s, Denmark's government has established policies to promote renewable energy and community ownership, particularly for wind energy, in response to the oil crisis. Key policy measures in Denmark include tax exemptions on income from community-owned wind farms, guaranteed grid access, purchase obligations, priority dispatch, and feed-in tariffs (FITs) to support energy communities. In the 1980s, supportive legislation led to many citizen-driven wind projects forming as general partnerships, known as wind cooperatives (Vindmøllelaug). Currently, energy cooperatives in Denmark own more than

23% of the country's wind power capacity and supply approximately 40% of its district heating systems.[8]

United Kingdom: Community Energy for Renewable Energy Promotion
In the UK, rural energy cooperatives emerged in the 1990s, driven by energy market privatization and the promotion of renewable energy policies. The Community Energy Program was launched in 1997, and the first energy cooperative, Baywind, was established the same year. In 2002, Baywind members founded Energy4All to support the growth of other community energy projects.

Renewable energy cooperatives have continued to emerge in the UK, driven by increased government support, technological advancements, and the need for cooperation due to land privatization, especially in rural areas. A key turning point came in 2009, when the introduction of FITs provided incentives for renewable energy projects in the UK.

The release of the UK's Community Energy Strategy in 2014 was also a significant development. The strategy highlighted the importance of empowering citizens and communities to engage in renewable energy production and operation, energy efficiency management, and energy procurement to achieve national energy security and climate goals. The strategy also committed to supporting and unlocking the vast potential of community energy, leading to a surge in the number of community renewable energy projects.

Japan: Rural Cooperative Models for Energy Supply Diversification
Cooperatives have long played a key role in Japan's agricultural and rural development, and today, the growth of renewable energy has further expanded their role. After the 2011 Fukushima nuclear disaster, Japan significantly reduced its reliance on nuclear power and urgently sought to diversify its energy supply. Supported by government policies, especially the 2011 Renewable Energy Act, cooperatives gained access to FITs, financial incentives, and regulatory frameworks designed to promote local renewable energy projects. The 2013 Rural Renewable Energy Law emphasizes returning profits to local communities and preventing unplanned renewable energy development that could harm agricultural production. These legislative frameworks together with other targeted policies have enabled cooperatives to generate community-focused benefits, boost renewable energy growth, and promote agricultural development, laying a supportive foundation for cooperatives to undertake energy projects in rural Japan.

Other Countries: A Mix of Approaches and Maturity

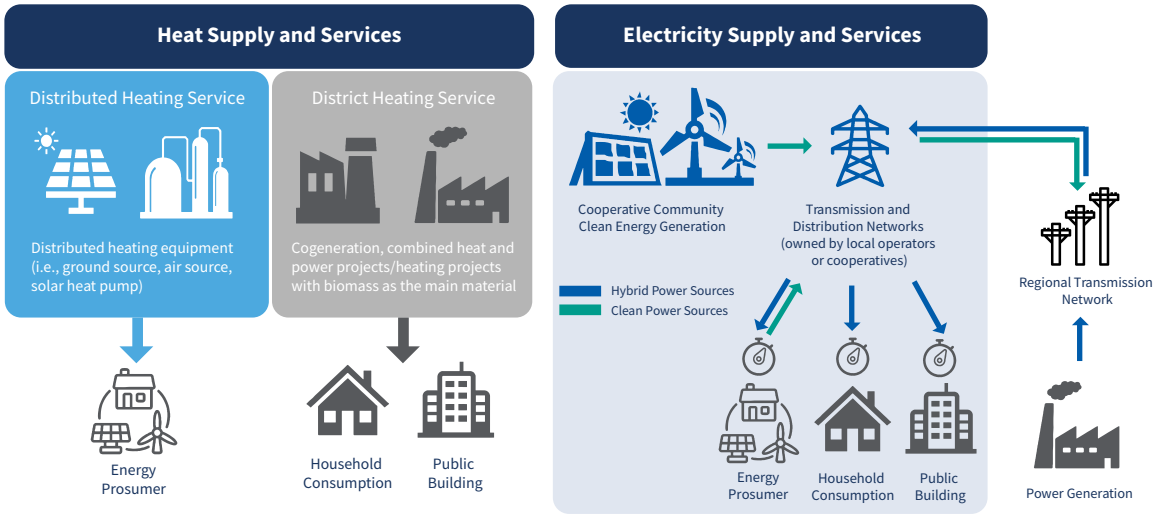
In some South American and Asian countries, the energy cooperative model closely resembles the US model of cooperatives functioning as utilities to supply electricity to rural areas. For example, Argentina has 600 cooperatives serving 58% of its rural population, with cooperatives owning 80% of rural electrification networks.[9] Bolivia is home to the world's largest rural electric cooperative,[10] and about 50% of rural households in the Philippines and 85% of townships in Bangladesh rely on energy cooperatives. In contrast,[11] many Asian countries, such as China and India, have limited energy cooperative models, and Australia has only around a dozen energy cooperatives officially registered.[12] Similarly, the development of energy cooperatives in Africa is still in the early stages, with many relying on international aid.

Value Chain of Rural Energy Cooperatives

The value chain of energy cooperatives spans a wide range of activities, from electricity and heat production to supply, distribution, and energy services (see Exhibit ES3). Whereas many cooperatives still focus on local renewable energy generation and supply, others operate across the full value chain.

Globally, cooperatives differ in asset ownership and energy sources. In the United States, rural electricity cooperatives manage 42% of the nation's distribution grid and primarily serve rural areas,[13] often maintaining long-term power purchase agreements that create a near-vertical integration with generation cooperatives. In contrast, most European cooperatives own only generation assets, although recent EU regulations have expanded community rights to manage local distribution networks. As for energy sources, cooperatives in Europe and Japan focus on renewables, whereas in the United States, the Philippines, and Bangladesh, fossil fuels still dominate.

Exhibit ES3 Main Energy Activity Modes of Rural Energy Cooperatives



Note: Prosumer refers to someone who both produces and consumes energy.

RMI Graphic.

Business Models of Rural Energy Cooperatives: Financing, Revenue Streams, and Equitable Benefit Sharing

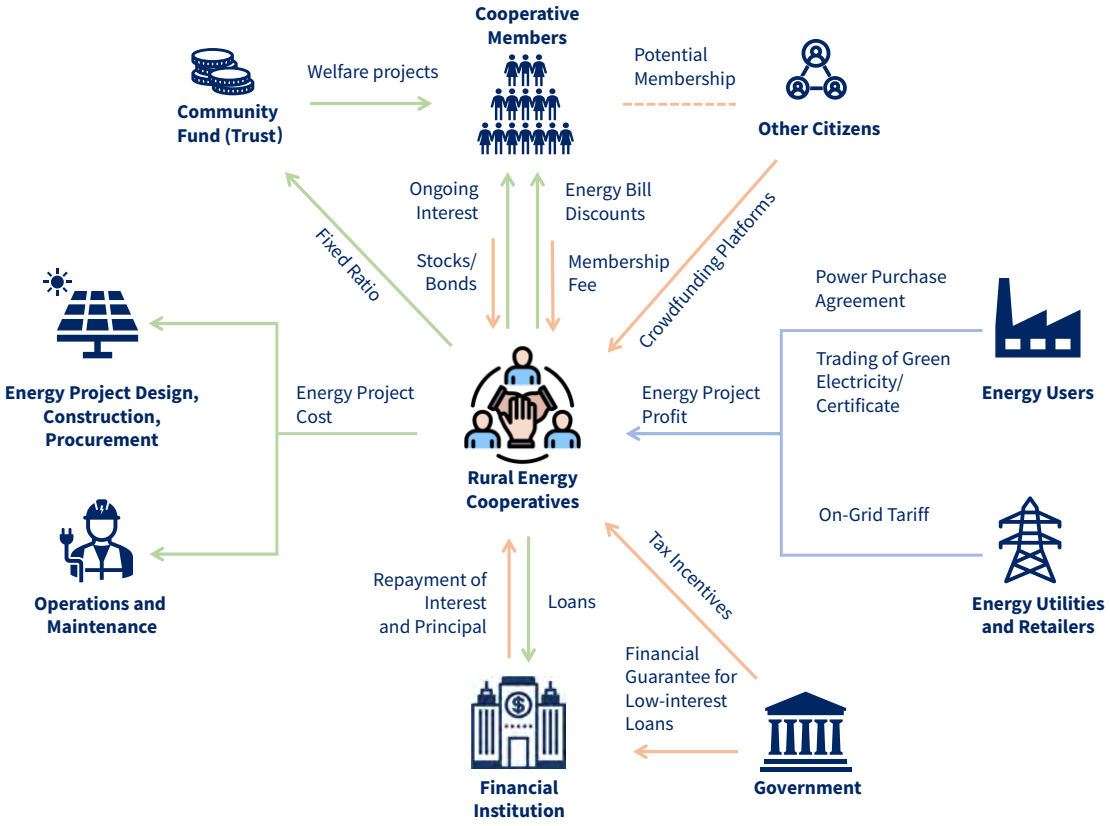
The financing, revenue sources, and profit distribution methods of rural energy cooperatives vary widely, shaped by their socioeconomic contexts, geographical features, policy frameworks, and strategic goals. By diversifying their financing methods, rural energy cooperatives effectively harness local and external resources, enabling them to offer affordable energy services to members and reinvest in the welfare of the broader community (see Exhibit ES4).

Rural energy cooperatives use various financing methods to fund renewable energy projects, cover operational costs, and enhance infrastructure and assets. Key financing channels include commercial loans from financial institutions, government-guaranteed low-interest or interest-free loans, and equity or bond sales. During project development, cooperatives often secure power purchase agreements to ensure long-term buyers, which strengthens their position when securing loans. Working with public credit agencies, cooperatives can sell equity or bonds to customers to create a financing stream and attract new members through ownership and energy services benefits. Cooperatives may also rely on membership fees and crowdfunding platforms to secure up-front funding and allow members to access enhanced energy services. In addition, government policies play a vital role in cooperative development, providing crucial support such as preferential loans, tax incentives, and subsidies that help cover feasibility studies and support investments in fixed assets. These measures significantly lower financial barriers and promote the development of renewable energy cooperatives.

The revenue generation of rural energy cooperatives stems primarily from energy production, supply, and related services. Cooperatives can also generate revenue from green attribute premiums for renewable energy projects. Cooperatives generate modest profits by selling energy, including electricity and heating, directly to members or external markets, and by offering energy-related services such as efficiency consulting and retrofitting. Government subsidies for renewable energy projects, often in the form of FITs, feed-in premiums (FIPs), or contracts for difference (CfDs), also contribute to revenue and help guarantee the price stability of energy. Cooperatives can also trade renewable energy certificates, carbon credits, and other certifications to capture the green premium. These certificates can be sold to enterprises seeking to meet renewable energy mandates or voluntary sustainability goals, further enhancing the cooperative's financial viability.

In terms of profit distribution, rural energy cooperatives enjoy autonomy in deciding how to allocate surplus earnings — typically through voting or board decisions — after covering expenses for project construction, operation, maintenance, and loan repayments. Profits are generally allocated in three ways: (1) cooperatives pay dividends or interest to members, either through proportional returns based on initial investment or at rates lower than commercial loans; (2) profits could be reinvested in new or purchased renewable energy projects; and (3) cooperatives usually allocate 1% to 10% of energy revenue to community development funds, supporting local welfare and growth initiatives.

Exhibit ES4 Financing and Revenue Streams of Rural Energy Cooperatives



Note: The orange arrows represent the cooperative's initial funding sources, the blue arrows represent revenue streams from cooperative-owned energy projects, and the green arrows represent expenditures on the energy projects as well as other outflows.

RMI Graphic.

Exploring the Benefits, Challenges, and Emerging Trends of Rural Energy Cooperatives

Promising Benefits of the Rural Energy Cooperative Model

The rural energy cooperative model offers a promising solution for a community-based energy transition, which can yield significant shared environmental, social, and economic benefits, and effectively address some of the key challenges now faced by developing economies.

From an environmental perspective, rural energy cooperatives play a pivotal role in promoting renewable energy and transitioning local energy consumption patterns. By engaging local residents in the development process, cooperatives effectively mitigate NIMBY (not in my backyard) attitudes. The adoption of clean fuels and efficient stoves decreases indoor air pollution, relieves health problems, and ultimately contributes to achieving the United Nations' Sustainable Development Goals (SDGs), including Good Health and Well-Being (SDG 3) and Climate Action (SDG 13). Additionally, cooperatives can leverage their funding to support local environmental projects aimed at improving energy efficiency and sustainability.

In terms of social inclusiveness, rural energy cooperatives prioritize member welfare, enhance equal participation, and provide public good. Cooperatives improve energy accessibility by enhancing infrastructure in rural and remote areas. At the same time, cooperatives' principles, such as collective decision-making and open and voluntary membership, drive community engagement and equal participation in the energy sector. Furthermore, cooperatives establish funds dedicated to local welfare enhancement and provide professional training and public energy education programs, some of which target females and youth, largely facilitating next-generation energy innovation and enhancing female leadership.

Economically, rural energy cooperatives help relieve the financial burden of energy use and boost the local economy. By leveraging a cost-effective energy supply, developing renewable energy sources, and promoting self-consumption, cooperatives further minimize transmission losses and reduce energy expenses for members. In addition, cooperatives generate employment and stimulate local economies through multiple service supply and infrastructure investments. Unlike privately owned commercial enterprises, cooperatives retain much of their economic benefits locally, maximizing local job creation, providing financial returns to community investors, and supporting sustainable local development.

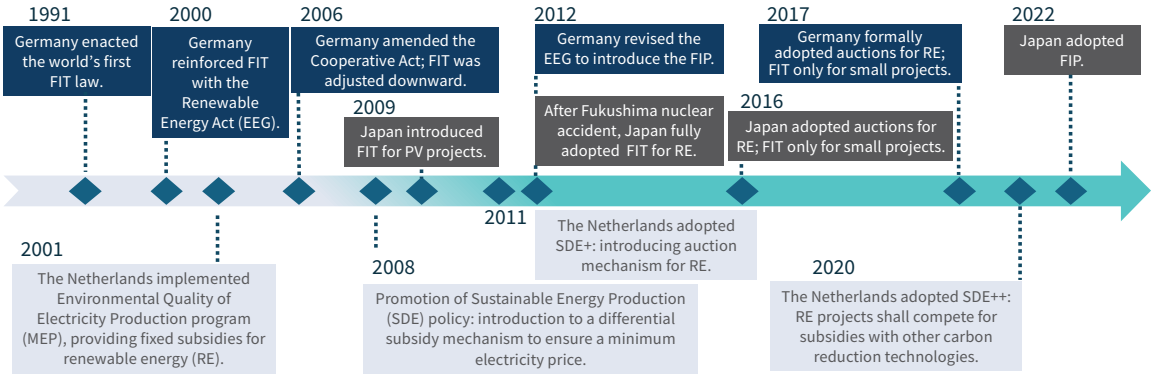
Challenges and Emerging Trends for Rural Energy Cooperatives

Rural energy cooperatives offer a path toward sustainable development, economic revitalization, and climate resilience. However, challenges such as legal ambiguity, unstable funding, and lack of operational expertise often hinder the further progress of cooperatives.

A primary obstacle is the sustainability of financing and investment. Limited access to external capital often makes it difficult for cooperatives to secure adequate funding for renewable energy projects. Additionally, the ambiguous legal identity of cooperatives often disadvantages them in multistakeholder coordination, leading to regulatory challenges and fundraising difficulties.

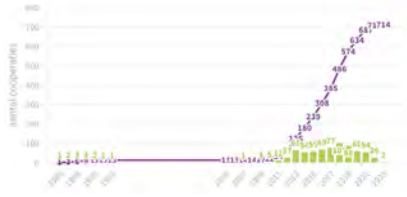
Operationally, maintaining renewable energy systems in rural and remote areas poses significant challenges due to a shortage of skilled technicians and professional staff. Highly localized cooperatives often face internal issues related to bureaucracies marked by nepotism and abuse of power. This highlights the need for capacity building and skills development in rural areas to ensure the longevity and efficiency of renewable energy systems.

Exhibit ES5 Trends in Renewable Energy Subsidy Policies and Energy Cooperative Growth in Germany (Bottom Left) and the Netherlands (Bottom Right)



Renewable energy cooperatives are up for adaptive transformation in the context of declining incentives.

- From 2006 to 2012, Germany experienced rapid growth in cooperatives, increasing by over 100 new co-ops per year.
- Since 2012, the number of new cooperatives in Germany has been decreasing.



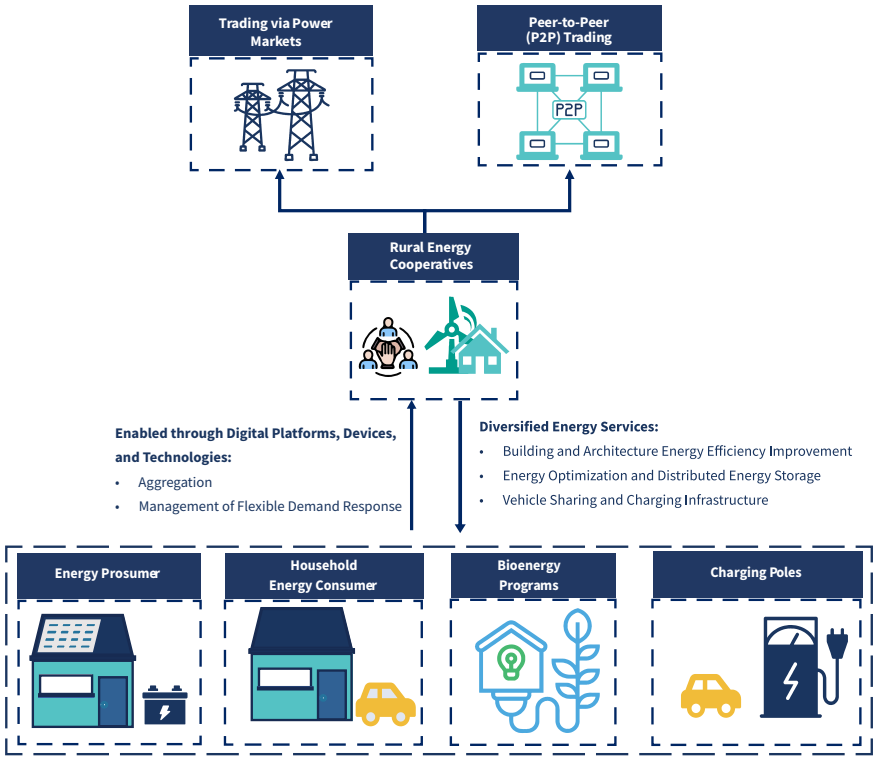
- From 2011 to 2020, the number of cooperatives in the Netherlands increased significantly.
- Since 2020, the growth of cooperatives in the Netherlands has slowed, but the average size has continued to grow.

RMI Graphic. Source: Graphics of changes in the number of energy cooperatives in Germany and the Netherlands are from Report Community Energy in Germany (2019), **https://www.unendlich-viel-energie.de/media/file/3591.89_Renews_Spezial_Community_energy_LECo.pdf** and the HIER Monitoring Report (2023) on Energy Cooperatives in the Netherlands, **https://www.hier.nu/lokale-energie-monitor-2023/burgercollectieven, respectively**.

Moreover, the diminished financial incentives for renewable energy projects have slowed the growth of rural energy cooperatives. As renewable energy policies have evolved, many countries have gradually scaled back subsidies, leading to a need for cooperatives to adapt and transform. Early incentives, such as FITs in countries like Germany, the Netherlands, and Japan, boosted the development of energy cooperatives (see Exhibit ES5). However, the recent shift toward market-oriented approaches has introduced mechanisms such as FIPs and CfDs. These changes, while aiming to lower transition costs, have diminished incentives for cooperative growth. Given this context, it is essential for energy cooperatives to explore new organizational models, reduce project costs, and adapt their operations.

Despite these challenges, new trends in the digital era are emerging that may enhance the effectiveness of rural energy cooperatives. As distributed renewable energy production increases, digital technologies such as smart meters, blockchain, and distributed ledger systems are crucial for managing complex energy systems. These technologies help cooperatives optimize energy use, integrate renewable resources such as solar and wind, enable peer-to-peer energy trading, and give consumers more control over their energy choices. They also improve the resilience and reliability of energy systems. By embracing these tools, rural energy cooperatives can play a stronger role in energy markets and contribute to the shift toward cleaner, decentralized energy systems (see Exhibit ES6).

Exhibit ES6 New Development Models and Functions Derived by Digitalization



RMI Graphic.

Strategic Insights for the Future Development of Energy Cooperatives in China and Emerging Economies

Accelerating Energy Transition and Addressing Challenges in Rural China

RMI has long been focused on a people-centered, development-oriented approach to equitable rural energy transition. This approach places people at the center of the rural energy transition. Using market-driven and business-led theories of change, RMI aims to explore replicable models that can drive inclusive and equitable energy solutions in developing countries.

In the 2023 report titled *The Rural Equitable Climate Transition toward Carbon Neutrality and Shared Prosperity,* RMI analyzed the potential and challenges of energy transition in rural China.[14] In this report, RMI provided insights into innovative models for transforming the rural energy landscape, drawing on a global review of rural energy cooperative history and an analysis of their business mechanisms.

Since the late 20th century, China has vigorously expanded electricity infrastructure in previously unelectrified areas, upgraded rural power grids, and implemented price reforms, achieving universal electricity access with a unified pricing system. In recent years, the Chinese government has introduced a series of policies and national pilot programs (see Exhibit ES7), including Whole County PV Program and PV Poverty Alleviation, to accelerate the rural energy revolution, positioning distributed energy as a critical contributor to the national renewable energy development plan and carbon neutrality goals. As of the end of 2023, China's cumulative installed capacity for distributed solar photovoltaic (PV) reached 254 gigawatts (GW), accounting for 42% of the total solar PV capacity, with residential solar PV exceeding 100 GW.[15] Distributed energy is anticipated to be a key pillar in achieving China's so-called Triple Renewables by 2030 target and in building a modern energy system.

However, China's rural energy transition faces both common global challenges as discussed previously, and unique pressures due to the rapid growth of renewables. In many regions, renewable energy projects are primarily led by commercial enterprises. In such cases, local communities often receive limited benefits, such as from rooftops or land leases, are excluded from broader profit sharing, and frequently face additional, undue risks due to inadequate regulation or nonstandardized energy project recording and filing. Furthermore, renewable installations have outpaced local demand and grid capacity, resulting in inefficient energy utilization and increased operational risks. The mismatch between energy production and consumption in rural areas highlights the urgent need for a transformation in rural energy consumption patterns and scenarios to keep pace with renewable energy development and to enhance an equitable and sustainable rural energy transition.

In the past two years, the Chinese government has been encouraging innovation in institutional mechanisms and business models to drive rural energy transition and rural revitalization, aiming to overcome bottlenecks in distributed renewable energy development. Regions such as Zhejiang and Inner Mongolia are exploring models of collective energy ownership. In these practices, the village collectives operate as the investment and management entity and secure external funding and technical support, while the residents join as shareholders, free from the concern of operational cost, and benefit from the surplus income from energy generation. However, renewable energy community projects that employ the cooperative model remain relatively rare in China.

Exhibit ES7 Policies Issued by the Chinese Government to Support Rural Energy Transition

Date	Policies
Oct. 2024	Guiding Opinions on Vigorously Implementing Renewable Energy Substitution Actions
Feb. 2024	Opinions on Learning and Applying the Experience of the "Thousand Villages Demonstration, Ten Thousand Villages Governance" Project to Effectively Promote Comprehensive Rural Revitalization
Dec. 2023	Announcement on the List of Pilot Counties for Rural Energy Revolution (First Batch)
July 2023	Guiding Opinions on Implementing the Rural Power Grid Consolidation and Enhancement Project
March 2023	Notice on Organizing the Construction of Pilot Counties for Rural Energy Revolution
May 2022	Implementation Plan for Promoting High-Quality Development of New Energy in the New Era
Jan. 2022	Opinions on Improving the Institutions, Mechanisms, and Policy Measures for Green and Low-Carbon Energy Transition
Dec. 2021	Implementation Opinions on Accelerating Rural Energy Transition Development to Support Rural Revitalization
Sep. 2021	Announcement on the Pilot List of Whole Counties Distributed Rooftop Photovoltaic Development

Note: This is not a comprehensive list.

RMI Graphic. Source: The State Council of China, **https://www.gov.cn/**

The Vision of a Collaborative, Inclusive, and Shared Energy Future for Rural Areas

The rural energy cooperatives model, widely implemented in Europe, North America, and Southeast Asia, presents a viable solution to the challenges in the energy transition faced by the Global South. Analysis of the advantages and challenges of rural energy cooperatives suggests that community-driven, benefit-sharing structures can enable local populations to access clean energy equitably and benefit from renewable energy projects. This model overcomes the initial technical and financial barriers of energy projects while ensuring the equitable distribution of benefits through local ownership and participation. By stimulating local economies, creating jobs, and improving well-being, such cooperatives play a key role in debottlenecking the growth of renewable energy and advancing a fair, sustainable energy transition in rural areas.

For China and many other countries and regions actively promoting rural energy transition, a shared ownership model — led by rural energy cooperatives, guided by the government, and involving professional enterprises — could provide an effective approach. Rural energy cooperatives could serve as central hubs in building collaborative networks with multiple professional enterprises and administrative authorities. Local power agencies and energy companies could provide technical support for rural energy cooperatives during the development of new energy projects, which highly increases the project feasibility. The involvement of administrative agencies would facilitate resource integration and risk sharing for energy projects. Structured local engagement could optimize diverse energy sources and mobilize local stakeholders. The exploration of innovative mechanisms for linking interest parties and

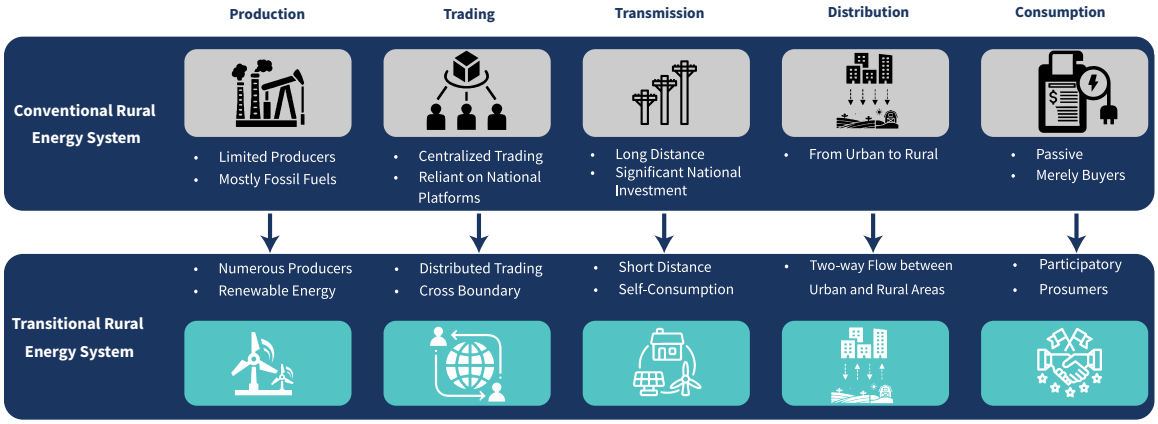
forming organizations can help develop a diversified, inclusive, and equitable modern rural renewable energy development system. In this way, rural energy cooperatives, together with partner entities, can effectively align stakeholder interests and maximize the economic, social, and environmental benefits of clean energy.

Based on international experience in energy cooperative development, key success factors include government incentives for renewable energy, financial support for community energy projects, and the foundational principles of voluntary participation and collective management. To foster the growth of cooperatives, it is essential to establish a robust regulatory framework and explore diverse policy tools that offer clear guidance, standards, and incentives. At the same time, market mechanisms should be leveraged to support cooperatives at various stages of development. Amid energy market reforms, enhancing the flexibility of distributed renewable energy integration and sales will enable energy prosumers such as rural energy cooperatives to play a larger role in regional energy markets. The growth of rural energy cooperatives should be tailored to each region's unique conditions, considering factors such as local development status, geographical characteristics, and resource availability. Additionally, these cooperatives should align closely with local industries to promote synergies between energy supply and local demand.

For the cooperatives themselves, it is essential to focus on project feasibility assessments, internal management, professional development, the proactive adoption of digital technologies and equipment, and the transformation of public-facing services during development. These factors will greatly contribute to overcoming challenges such as the reduction of policy incentives and subsidies, internal operational inefficiencies, uncertainties in both public and private financing, and the need to adapt to technological advancements.

Looking ahead, the emerging model of rural energy transition, led by energy cooperatives, will drive many developing countries from centralized energy systems to participatory, decentralized, and low-carbon approaches (see Exhibit ES8). This shift holds the potential to achieve the optimal balance in the "energy trilemma" of economic, environmental, and security goals.

Exhibit ES8 Transition Toward a Participatory, Decentralized, and Low-Carbon Rural Energy System



RMI Graphic.

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