



**BRICS**

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COOPERATING FOR AN INCLUSIVE AND SUSTAINABLE WORLD

# Report on Access to Energy Services



# ABSTRACT

This report provides an overview of the progress, challenges, and opportunities related to expanding access to affordable, reliable, and modern energy services across BRICS countries. It reflects the shared commitment of members to advance universal energy access as a key enabler of sustainable development, social inclusion, and economic growth.

Despite significant achievements in recent decades, important gaps remain, particularly in remote and underserved regions. Addressing these challenges requires integrated approaches that combine infrastructure expansion, decentralized renewable energy solutions, and policies aimed at ensuring affordability and reliability.

Within the BRICS framework, countries bring diverse experiences and policy approaches, offering valuable opportunities for knowledge exchange and cooperation. The report highlights best practices and identifies pathways to accelerate progress, including innovative financing mechanisms, regulatory frameworks, and technological solutions tailored to developing country contexts. By consolidating national experiences and fostering dialogue, this report aims to support collaborative efforts among BRICS members and contribute to advancing Sustainable Development Goal 7. It reinforces the importance of ensuring that energy access efforts are inclusive, resilient, and aligned with broader climate and development objectives.

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# WELCOME REMARKS



**Mr. Alexandre Silveira**

*Minister of Mines and Energy of Brazil*

I am very pleased to come forward with this report, developed during Brazil's tenure as Chair of BRICS on energy access — a cornerstone of sustainable development and a fundamental pillar for social inclusion and economic prosperity.

Despite significant developments in recent decades, millions of people across the globe still lack access to reliable, affordable, and modern energy services. Addressing this gap is not only a development imperative, but also a matter of equity and dignity. Ensuring universal energy access is essential for reducing poverty, enabling education and healthcare, and fostering resilient communities.

Energy access has been for a long time a national priority for Brazil. Through sustained public policies and innovative programs, such as Luz Para Todos, initiated in the first term of President Lula, back in 2003, Brazil has made important strides toward universal electrification, particularly in remote and vulnerable regions. Yet, we are fully aware that this challenge is still lagging globally and requires collective action. Our understanding is that the BRICS countries have a unique role to play in this important matter. As large emerging economies, we share common challenges and opportunities in expanding access to energy while advancing sustainable development. Our cooperation can foster the deployment of decentralized and renewable energy solutions, promote inclusive regulatory frameworks and mobilize investments where they are most needed.

This report reflects our shared commitment to advancing energy access through collaboration, knowledge exchange and concrete initiatives. By working together, we can scale up solutions that are not only technically viable, but also socially inclusive and economically sustainable.

Brazil deeply believes that no one should be left behind in the energy transition. We are unrelentless in the pursuit of this approach. Expanding access to clean and reliable energy is a prerequisite for a just transition and for achieving our broader development goals.

We hope that the findings and recommendations contained in this report will serve as valuable contributions to ongoing efforts within the BRICS and beyond, reinforcing our collective responsibility towards a more inclusive, equitable, and sustainable future.



**Mr. Wang Hongzhi**  
*Administrator of the National  
Energy Administration People's  
Republic of China*

Against the backdrop of profound transformations in the global energy landscape, energy access has become one of the critical issues of shared concern for the international community. The United Nations' 2030 Agenda for Sustainable Development explicitly calls for ensuring universal access to affordable, reliable, sustainable, and modern energy services. Achieving energy access not only contributes to eradicating "energy poverty" but also fosters global economic growth and sustainable development.

In recent years, China has maintained stable macroeconomic growth, with nationwide electricity consumption steadily rising. Through technological innovation, policy coordination, and infrastructure development, clean energy capacity has significantly increased, energy efficiency has continuously improved, and the share of clean cooking and renewable energy for heating and cooling has grown steadily. National power grid coverage and supply reliability have been further enhanced, energy security capabilities have consistently strengthened, and public access to energy has continuously improved. After years of sustained efforts, China has historically resolved the issue of universal energy access and is willing to share relevant experience.

As representatives of global emerging markets and developing countries, BRICS nations face similar challenges in the field of energy access and possess broad cooperation space. China stands ready to share experience and enhance collaboration with all countries, jointly exploring technological pathways and cooperation models suited to different national conditions. Through cooperation, we aim to elevate energy security and accessibility levels, promote shared development, improve people's livelihoods, and inject new impetus into building a more equitable, just, open, and inclusive global energy governance system.



**H.E. Karim Badawi**  
*Minister of Petroleum and  
Mineral Resources of Egypt*

I would like to begin by extending my sincere appreciation to the Federal Republic of Brazil for its distinguished leadership of the BRICS group in 2025. The dedication and commitment demonstrated in advancing the collective interests of member states are truly remarkable.

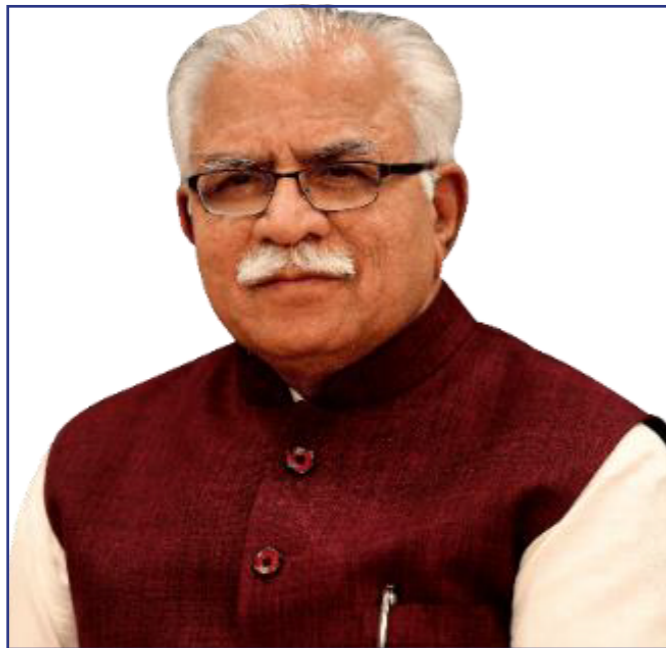
Furthermore, I would like to acknowledge the opportunity to contribute to this BRICS report on access to energy services—an essential subject that plays a pivotal role in shaping economic development, social welfare, and environmental stability. Addressing energy access challenges through collaborative efforts not only fosters inclusive growth but also reinforces global sustainability initiatives.

As the world confronts the triple challenge of providing secure, affordable, and sustainable energy systems amidst growing demands, it becomes increasingly clear that energy access is vital for reshaping economic development. Reliable energy services not only drive industrial growth but also enhance overall welfare and quality of life for communities. By providing access to affordable and sustainable energy, we can empower individuals and foster innovation across various sectors. This transformation is essential for lifting populations out of poverty and promoting social equity. Furthermore, addressing energy access is crucial for supporting global climate goals, as it encourages the adoption of cleaner technologies. Ultimately, ensuring reliable and inexpensive energy for all remains a fundamental challenge and opportunity.

Thus, we want to contribute to ongoing efforts that increase energy access to communities around the world through providing a comprehensive analysis of current energy access, obstacles and solutions, drawing insight from global initiative and successful policies. By highlighting innovative approaches and strategic recommendations.

Last but not Least, we profoundly acknowledge the invaluable contributions of researchers, policymakers, and industry leaders whose insights and perspectives have significantly enriched this discourse. It is through the spirit of collective endeavor and enlightened dialogue that we pave the way toward meaningful and transformative progress.

We hope that this report serves as a valuable resource for stakeholders working towards inclusive and sustainable energy solutions. Thank you for your engagement and commitment to this important issue.



**Manohar Lal**

*Minister of Power and Housing  
and Urban Affairs of the Republic  
of India*

Access to reliable, affordable, and sustainable energy is vital for modern development and human well-being. It powers essential services—homes, schools, hospitals, industries—and drives poverty reduction, health improvement, and economic growth. Yet, millions still lack basic electricity access or rely on unsafe and inefficient energy sources.

Global energy demand continues to rise—not only due to population growth, but also because of increasing needs for thermal comfort, digitalization, and the electrification of end uses. Much of this demand originates from developing countries, driven by rapid economic growth and urbanization.

In 2023, developing nations consumed 56% of global energy and are projected to drive 85% of electricity demand growth through 2027. This makes collaborative action among BRICS nations essential to ensure inclusive, secure, and equitable energy access.

India, with 1.4 billion people and a fast-growing economy, embodies both the challenge and the opportunity. Energy security and access are central to its development agenda. Through a range of initiatives, India is expanding clean, reliable, and affordable energy access across its population.

As the global energy transition accelerates, the decisions made by developing countries will shape the future of energy systems worldwide. Ensuring access to sustainable energy is thus not only critical for development of BRICS countries, but also for global climate and economic stability.

I commend the Federative Republic of Brazil for spearheading this BRICS Report on Access to Energy Services. It highlights shared goals, explores synergies, and addresses common challenges. Through collaboration, we can build a more resilient and inclusive energy future for all.



**Mr. Bahlil Lahadalia**  
*Minister of Energy and Mineral  
Resources of the Republic of  
Indonesia*

Indonesia extends its highest appreciation for the opportunity to join the BRICS family and actively participate in the BRICS Energy Forum. As the newest member, Indonesia views this platform as a vital step toward strengthening international energy cooperation among BRICS countries.

It is with great enthusiasm that I welcome the publication of the BRICS Report on Access to Energy Services. This initiative reflects our shared commitment to ensuring equitable, reliable, and sustainable access to energy — a cornerstone of inclusive development.

Indonesia has made notable progress in expanding electricity access. Over the past decade, our electrification rate rose from 84.35% in 2014 to an estimated 99.83% by 2024, while maintaining a focus on affordability and environmental sustainability.

To meet our target of Net Zero Emissions by 2060 or earlier and to achieve universal energy access, Indonesia is accelerating both on-grid and off-grid renewable energy development. This includes solar, hydro, wind, geothermal, ocean energy, and bioenergy. We are also advancing energy efficiency and conservation measures, including equitable access to cooling services through improved standards, awareness, and technology deployment. In parallel, we are electrifying the demand side through programs targeting two- and four-wheeled vehicles.

Indonesia is also prioritizing the development of new and emerging technologies, including hydrogen, ammonia, nuclear power, and carbon capture and storage (CCS/CCUS). Nuclear energy has been formally integrated into our National Electricity Generation Plan, with the first reactor targeted for operation by 2032 and a projected capacity of 35 GW by 2060. These initiatives are expected to spur job creation, industrial growth, and strengthen local supply chains.

For Indonesia, energy is not merely a commodity — it is a strategic asset. Our national energy strategy is centered on securing long-term energy resilience and sufficiency, including through the downstream processing of critical mineral resources.

Indonesia possesses some of the world's largest reserves and production capacities of critical minerals essential for the global clean energy transition, including ranking first in nickel and tin, and fourth in bauxite. These resources position Indonesia at the heart of the global clean energy revolution. Indonesia affirms the sovereign right of resource-owning countries to regulate and manage their supply chains to ensure value addition, environmental sustainability, and inclusive development.

In conclusion, Indonesia strongly supports collaborative efforts and the exchange of best practices to strengthen global energy cooperation and resilience. We believe BRICS holds the strategic diversity and collective weight needed to contribute meaningfully to the reshaping of



**Mr. Abdollah Nekounam Ghadirli**  
*Ambassador of the I.R. of Iran to Brazil*

It is my honor to address the BRICS Energy Ministerial Meeting. Allow me first to extend my sincere gratitude to our host, the Federative Republic of Brazil, for organizing this important event and for offering us the warm hospitality and vibrant spirit of this great nation.

We are gathered here at a critical juncture in the global energy landscape, one marked by transformation, vulnerability, and opportunity. As energy leaders from key economies, we share a responsibility not only to ensure present-day energy security but also shape a balanced, just, and inclusive energy future for generations to come.

I would like to point out that a rapid transition to clean energy especially through the phasing out of fossil fuels is not compatible with the economies of many countries. It may exacerbate risks to energy security, and may increase energy poverty in the world's most vulnerable communities. That is why we believe that a decarbonized natural gas and oil industry can play a key role in facilitating climate mitigation policies and providing global energy security.

Today, even the most conservative global energy outlooks forecast that oil and gas will continue to account for more than half of global energy needs by 2050. Oil remains the backbone of the global transportation and industrial sectors, while natural gas, with its cleaner-burning profile, flexible application, and expanding infrastructure, is already playing a pivotal role in the energy transition.

The Islamic Republic of Iran, with the world's largest proven reserves of both oil and natural gas combined,

has long stood as a reliable and capable energy producer. We believe that these resources—when utilized responsibly—are not impediments to sustainability, but essential instruments for progress, particularly when accompanied by clean technologies, investment in efficiency, and international cooperation.

Iran, as a founding member of both OPEC and the Gas Exporting Countries Forum, holds strategic capabilities and a wealth of experience in both oil and gas markets. Despite years of unilateral and unfair sanctions and external constraints, we have successfully enhanced both upstream and downstream capacities. Our natural gas production has reached over 270 billion cubic meters annually, and gas now constitutes more than 70% of our domestic energy mix. Additionally, 100% of Iranians have access to electricity. Simultaneously, we continue to invest in upgrading oil extraction, refining, and export infrastructure, guided by the principles of sustainability and efficiency. These achievements reaffirm a vital truth: resilience, innovation, and cooperation are more powerful than pressure and exclusion. The BRICS platform holds exceptional potential for energy collaboration. Together, our nations represent a significant share of the world's energy production, consumption, reserves, and innovation capacity. Let us harness this collective strength to:

- Deepen cooperation on oil and gas investments;
- Promote technology transfer and clean energy innovation;
- Defend the sovereignty of energy trade against unilateral restrictions;
- And strengthen regional energy security and resilience.

We in Iran firmly believe that depoliticizing of energy markets, and the removal of illegitimate sanctions, are essential for restoring stability, promoting development, and achieving our shared energy objectives. Despite formidable challenges, Iran has remained committed to enhancing regional and international partnerships in energy. We are ready to share our infrastructure, expertise, and resources with fellow BRICS nations in pursuit of a cooperative, secure, and sustainable energy future.

The Islamic Republic of Iran stands ready to play a proactive role in BRICS energy collaboration. We bring to this table our vast energy resources, world-class technical expertise, strategic location, and most importantly, a willingness to engage constructively to shape a fair and secure global energy order. We envision a multipolar energy world where oil and gas continue to serve as cornerstones of development—alongside renewable sources—within an integrated and environmentally conscious framework. It is our firm belief that this approach best serves the interests of both producers and consumers, and above all, the future generations to whom we are accountable.

The path to energy security, climate mitigation, and economic resilience lies not in confrontation but in collaboration. Let us reaffirm our commitment to a multipolar energy order, where each resource—whether fossil-based or renewable—has its rightful place, and every nation its sovereign role in shaping its energy destiny.

The Islamic Republic of Iran stands ready to contribute to this endeavor as a major producer of oil and gas and as a partner advocating for inclusivity, fairness, sustainability, and shared prosperity.



**Mr. Sergei Tsivilev**  
*Minister of Energy of The  
Russian Federation*

The Russian Federation fully supports and shares the need to ensure universal access to affordable, reliable, sustainable and modern energy sources (SDG 7).

Energy development should be based on the principles of technological sovereignty and just energy transition, taking into account climate and socio-economic factors in a balanced way. Russia's unique geographic and climate conditions, which span several climatic zones, demand complex solutions in energy supply that combine innovations, reliability and ecological responsibility.

Today, we can confidently say that Russia has provided its citizens with complete energy access contributing to the implementation of the UN Sustainable Development Goals. At the same time, our key priorities are to increase the energy consumption efficiency, modernize the infrastructure and reduce carbon footprint while ensuring unconditional energy security.

Russia has extensive experience in achieving access to energy resources and actively supports international community's measures to overcome energy poverty. Our country promotes the principles of equal cooperation, technological openness and mutual benefit, implementing these principles in bilateral and multilateral formats.

The work of the Federative Republic of Brazil within the framework of the BRICS Chairmanship in 2025 is of utmost importance, particularly the Report "Energy Access in BRICS Countries 2025". This project enables us to identify common challenges and unite best practices of our countries in order to formulate sustainable energy supply models that could be applied on a global scale.



**Mr. Suhail Mohamed Al Mazrouei**  
*UAE Minister of Energy and  
Infrastructure*

The United Arab Emirates has made remarkable progress in achieving universal access to electricity and clean energy services. It has reached 100% access to electricity and clean fuels and technologies for cooking, ranking first globally in both indicators under the SDG 7. This achievement reflects the UAE's strong investments in renewable energy, smart grids, and decentralized systems that extend energy access even to remote and underserved areas. As part of the UAE Net Zero by 2050 Strategy and Energy Strategy 2050, the country is committed to tripling its renewable energy capacity by 2030, enhancing inter-emirate and cross-border grid interconnections, and embedding innovation, equity, and climate resilience into its energy access policies. The UAE's leadership extends globally through its hosting of COP28, co-founding the Global Hydrogen Trade Forum, and launching initiatives such as the Global Energy Efficiency Alliance. Domestically, it has implemented progressive tariff structures and energy efficiency regulations to ensure access remains both affordable and sustainable. Through active engagement in BRICS cooperation and South-South partnerships, the UAE continues to share successful models and champion scalable, inclusive energy access solutions that contribute to global development, resilience, and the achievement of just energy transitions.

# INTRODUCTION

Ensuring access to affordable, reliable, sustainable, and modern energy is at the core of Sustainable Development Goal (SDG) 7, a goal that is particularly crucial for developing countries.

Despite notable progress in some regions, such as Asia and Latin America, many countries—especially those in sub-Saharan Africa—have made little headway in improving access to clean cooking in recent years. In 2022, global electricity access remained at 91%, yet the number of people without access increased by 10 million from the previous year, reaching 685 million. Sub-Saharan Africa accounted for 83% of this deficit. Regarding clean cooking, approximately 74% of the world’s population had access to clean fuels in 2022; however, around 2.1 billion people still relied on conventional fuels and technologies such as charcoal, coal, crop waste, dung, kerosene, and wood. If current trends persist, by 2030, an estimated 660 million people will still lack electricity, while 1.8 billion will remain without access to clean cooking solutions.

The definition of energy poverty varies significantly between the Global North and the Global South due to distinct social and economic realities. In the Global South, energy poverty primarily refers to the absence of physical infrastructure that enables access to modern energy services.<sup>2</sup> These differences reflect national circumstances and have a profound impact on how policies and regulations are designed at the national level.

Among the BRICS countries, there are significant variations in energy self-sufficiency, fuel and energy balance structures, energy infrastructure, and domestic energy market operations. Special consideration must be given to countries where a large portion of the population still lacks affordable access to modern energy.

Affordability plays a fundamental role in energy policy design, as ensuring access to energy services alone is not sufficient if populations cannot afford them. In BRICS countries, in most of which economic disparities are pronounced, policies must be structured to make energy both available and financially accessible, particularly for low-income households. Mechanisms such as targeted subsidies, innovative financing models, and regulatory frameworks that promote fair pricing are crucial in achieving energy security while ensuring that no one is left behind, in particular vulnerable populations. Addressing affordability within energy policies not only fosters social equity but also strengthens economic development by enabling broader participation in modern energy systems.

In this context, BRICS countries need to adopt tailored approaches to advancing their energy policies, focusing on addressing energy poverty by expanding access to essential energy services—including electricity, clean cooking, and thermal comfort—while ensuring affordability. Over the years, BRICS

nations have reinforced their commitment to energy access, fully aligning with SDG 7. This commitment has been consistently reaffirmed in BRICS Energy Ministers’ declarations and BRICS Leaders’ Summit statements.

Strengthening energy cooperation among BRICS countries requires a deeper understanding of how to advance the social dimension of just and inclusive energy transition. This includes addressing challenges related to energy access, promoting knowledge-sharing, low-cost financing, access to technology and fostering innovative solutions such as decentralized renewable energy (DRE) to meet the needs of underserved communities and regions.

In this regard, the BRICS countries—major global energy players that collectively account for half of the world’s primary energy production and consumption—have decided to undertake a study within the framework of the BRICS Energy Research Cooperation Platform. This study aims to analyze BRICS countries’ approaches to energy access.

Building on previous activities of the BRICS Energy Research Cooperation Platform, this report presents a comprehensive analysis of BRICS countries’ perspectives on the following key topics:

- Access to electricity;
- Access to clean cooking solutions;
- Access to heating and cooling services;
- Affordability and the ability to pay for energy services, and how these aspects are integrated into public policy formulation.



**BRICS  
COUNTRIES  
CHAPTERS**



# Brazil's Stand on Access to Energy Services

## Overview

Brazil has made significant efforts to expand universal access to electricity and promote policies that ensure clean and affordable energy for all citizens throughout the past decades. The National Energy Transition Policy (PNTE), established by CNPE Resolution No. 5/2024, aims to guide Brazil's efforts towards a low-carbon energy matrix and contribute to achieving net-zero greenhouse gas emissions. The PNTE coordinates federal policies and actions, aligns with Brazil's international climate commitments, and promotes social inclusion, competitiveness, and value addition in the national economy.

The Resolution also provides formal definitions for key concepts at the national level, including “energy poverty,” described as the condition in which households or communities lack access to a basic set of energy services or have their energy needs insufficiently met. The PNTE is firmly rooted in promoting a just and inclusive transition, emphasizing energy equity, universal access to affordable and sustainable energy, and the active mitigation of socio-economic vulnerabilities caused by systemic changes in the energy sector.

## Access to electricity

The lack of access to public electricity distribution services constitutes a serious social issue, demanding attention and effective action from public authorities. In response to this situation, on November 11, 2003, the Federal Government established, through Decree No. 4,873, the National Program for the Universalization of Access to and Use of Electricity – “Luz para Todos” (Light for All), aimed at delivering electricity to populations in rural areas of Brazil that were still excluded from this essential service.

Designed as an instrument of socioeconomic development and a means to combat energy exclusion, the Program quickly became one of the most emblematic national public policies for social inclusion and the fight against extreme poverty. Since its inception, the challenges to achieving full universal access to electricity in Brazil have been significant. As a result, the Program has been successively extended, reaching approximately 17.6 million people with access to public electricity services by March 2025.

In 2023, the Light for All Program was relaunched as a priority public policy of the Federal Government through Decree No. 11,628, dated August 4, 2023. This new phase reaffirms the Program's commitment to tackling energy poverty and integrating into actions aimed at a just, inclusive, and sustainable energy transition. The program relaunch seeks to accelerate service delivery to rural populations and communities located in remote regions of the Legal Amazon that remain without access to electricity.

According to the new decree, the objectives of the Light for All Program are to:

- I. democratize and enable access to and use of electricity for populations residing in rural areas—primarily through expansion of electricity distribution networks—and in remote regions of the

Legal Amazon, through isolated power generation systems;

II. promote sustainability and continuity in the provision of public electricity distribution services in rural areas and remote regions of the Legal Amazon;

III. reduce social and regional inequalities, promote social and productive inclusion of vulnerable communities, and foster citizenship and quality of life in rural and remote Amazonian regions through the fight against energy poverty;

IV. respect and value the culture of Indigenous peoples, Quilombola communities, and traditional communities, prioritizing their inclusion in the Program;

V. encourage energy decarbonization in the Legal Amazon with clean and renewable energy sources;

VI. respect the environment and the Amazon biome; and

VII. train local labor associated with the provision of public electricity distribution services in remote regions of the Legal Amazon.

The Program's beneficiaries include families, collective spaces, support facilities, and units for local socioeconomic development based on geographic, ethnic and socio-economic criteria. It is essential to emphasize that the Light for All Program aims to foster the social and economic development of the beneficiary communities, encouraging activities that increase household income and promote sustainable use of local natural resources. The Program integrates actions across different levels of government to promote citizenship and dignity among the served population.

In addition to delivering electricity to families living in energy exclusion, the Program also benefits communities in remote areas of the Legal Amazon that still rely on small diesel generators. In such cases, these systems are replaced with clean and renewable energy sources—especially photovoltaic solar systems. This initiative contributes to the elimination of fossil fuel combustion and, consequently, to the reduction of greenhouse gas emissions.

In 2023, the Light for All Program celebrated its 20th anniversary, becoming one of the largest public policies for electricity access universalization worldwide. From 2003 to March 2025, approximately R\$ 26.9 billion were invested, enabling the electrification of around 3.7 million families—benefiting approximately 17.6 million people nationwide.

In the specific context of the Legal Amazon's remote regions, the Program provided electricity access to approximately 60.8 thousand families—or 243.4 thousand people—between February 2020 and March 2025 through clean and renewable power generation systems.

Achieving universal access to electricity in the Legal Amazon remains a challenge due to the dispersed nature of isolated systems, which lack economies of scale or density. These areas, for technical, economic, or environmental reasons, cannot be served by conventional grids or isolated system auctions. Therefore, these communities require tailored approaches involving clean, sustainable power generation technologies integrated with local production processes, ensuring that investments in energy systems support their primary goal of driving socioeconomic development.

Regarding organizational structure, the governance of the Light for All Program is defined by its Operational Manual, which outlines the roles of key stakeholders in implementing this national policy. The Ministry of Mines and Energy (MME) is responsible for overall Program coordination, including the formulation of policy and guidelines and continuous monitoring of the physical and financial execution of contracts under the Program.

According to Decree No. 11,628/2023, the funding for the Light for All Program comes from electricity sector agents; the Energy Development Account (CDE), established as an economic subsidy by Law No. 10,438 of 2002; and other legally authorized sources. A 2024 survey by the Ministry of Mines and Energy (MME), in collaboration with Brazilian Regulatory Electricity Agency (ANEEL) and other federal entities, estimates that approximately 327,000 families—around 1.3 million people—still lack access to electricity in Brazil.

In 2023, the Program served 64,592 new consumer units with access to the public electricity grid—45,041 in rural areas and 19,551 in remote regions of the Legal Amazon—benefiting roughly 258,000 people. Investments in 2023 totaled approximately R\$ 1.4 billion. In 2024, the Program electrified 60,179 new consumer units, benefiting about 240,000 people with R\$ 1.7 billion in investments.

Among the key sustainability indicators used to assess the Program's effectiveness in the Amazon region is an ongoing study in partnership with the Inter-American Development Bank (IDB). Preliminary estimates suggest that the Program's expansion could prevent the deforestation of approximately 31 million trees in the Amazon and avoid the emission of about 114,000 tons of CO<sub>2</sub> annually.

These positive impacts result from electrifying 234,000 families in remote areas of the Legal Amazon through the deployment of renewable and clean power systems, especially solar photovoltaics. Aligned with Brazil's international commitments, the Program's objectives are directly connected to the United Nations' Sustainable Development Goal (SDG) 7, which seeks to “ensure access to affordable, reliable, sustainable, and modern energy for all.”

Finally, for 2025, the Light for All Program aims to serve 89,000 families (PAC target), investing approximately R\$ 4 billion to benefit around 356,000 people in rural and remote areas of the Legal Amazon that still lack access to electricity.

## Access to clean cooking

The Federal Government of Brazil has a long-standing history of implementing public policies aimed at supporting low-income families in covering the cost of acquiring liquefied petroleum gas (LPG). One of the earliest initiatives was the Auxílio-Gás (Brazilian Gas Assistance Program), established by Provisional Measure No. 2,018 of December 28, 2001, and instituted by Decree No. 4,102 of January 24, 2002. This program was part of a broader effort to provide direct subsidies for the purchase of gas cylinders for low-income households.

Public policies aimed at mitigating the impact of LPG prices on low-income families have demonstrated that direct cash transfer initiatives are the most effective. Furthermore, the use of LPG contributes to reducing health problems associated with indoor pollution and burn injuries caused by using alternative fuels such as firewood and alcohol.

According to the National Bureau of Statistics (2024), 93,3% of the Brazilian population has access to modern clean cooking methods, either by liquefied petroleum gas (LPG) or electric appliances. However, according to the Brazilian Energy Research Office (EPE, 2024), in 2019, 14 million Brazilian households (19.2%) also used, or exclusively relied on, rudimentary stoves fueled by traditional biomass sources such as collected or purchased firewood, charcoal, alcohol, or sawdust.

Studies conducted by the EPE evaluated the evolution of the percentage of households cooking food by energy source. According to the Atlas of Energy Efficiency in Brazil, despite the increase in clean cooking sources such as electricity, LPG, and natural gas, the percentage of households using biomass has remained almost stable over the period (EPE, 2022). LPG was present in 95% of Brazilian households in 2021. Additionally, the use of electricity for food preparation has been growing over time, reaching just over 70% of all Brazilian households in 2021. With the advancement of technology and the reduction in costs, the possibility of individuals acquiring these types of electric cooking devices for domestic use has increased, as they are practical and yield good results. This includes appliances such as microwaves, electric ovens and stoves, sandwich makers, grills, toasters, electric fryers, electric pans, among other devices (EPE, 2022).

According to the Atlas of Energy Efficiency in Brazil, the main end-use of energy in households in 2022 is food cooking, followed by food preservation and water heating (EPE, 2022). Access to clean fuels and technologies for cooking is a priority topic in the global debate on combating energy poverty. In Brazil, the issue of food security (cooking) is directly related to access to LPG.

The demand for LPG in Brazil is inelastic, as families tend to face difficulties in changing the primary energy source used for food preparation. Furthermore, the reach of the natural gas network in the residential sector is still limited, and electric cooking appliances tend to be less accessible to lower-income populations. However, a shift towards firewood is observed in some cases.

In 2023, the Brazilian LPG market recorded the sale of 7.41 million tons, with 5.09 million tons (68.7%) delivered to consumers in cylinders of up to 13 kg capacity (ANP, 2023).

The Law No. 14,237, of November 19, 2021, established the Brazilian Gas Assistance Program (PAGB), which has an annual budget of R\$ 3.6 billion, aimed at mitigating the impact of LPG prices on the budgets of low-income families. With a projected duration of five years, the program benefits families registered in the CadÚnico with a per capita monthly income equal to or lower than half the minimum wage, or those with members receiving the Continuous Cash Benefit (BPC).

The Brazilian Gas Assistance Program is highly significant and can be considered a successful experience, as it ensures resources for low-income families to purchase cooking gas. The PAGB, created during the COVID-19 pandemic, was essential in supporting families affected by its impact on household budgets. This financial aid is paid bimonthly to beneficiaries of the Bolsa Família program, Brazil's main social program. Data from the Ministry of Social Development, Family, and Hunger Combat (MDS), as of June 2024, shows that 5.6 million families across Brazil are beneficiaries of the program, with each receiving R\$ 102.00, which corresponds to 100% of the national average price of a 13 kg LPG cylinder, every two months.

Considering that LPG is one of the clean cooking energy sources and that the Ministry of Mines and Energy in Brazil has set priorities to achieve a just and inclusive energy transition and combat energy poverty, including efforts to address social inequality in Brazil through widespread access to clean cooking technologies like LPG, the PAGB has proven effective in its social dimension. However, there are opportunities for improvement in its energy dimension, particularly in terms of the actual use of LPG by the poorest populations and the substitution of firewood use.

In this context, the Federal Government is drafting a bill proposal that “establishes a program aimed at reducing energy poverty and repeals Law No. 14,237, of November 19, 2021,” with the goal of tying the resources transferred to beneficiaries exclusively for the purchase of LPG. This proposal is currently titled the Gas for All Program (GPT).

The next steps for implementing this initiative involve the approval and implementation of the Gas for All Program (GPT), which will provide financial aid to the target population specifically for purchasing LPG. After its approval, the program will gradually expand its target audience, growing from 5.6 million to 21 million families in the coming years.

The Gas for All Program (GPT) proposal establishes a national policy to coordinate actions and define priorities for providing clean and modern cooking energy to vulnerable populations across the country. The program's goal is to propose measures that reduce energy poverty through public policy in the fuel sector, specifically LPG, and contribute to the national energy policy by:

- a) Promoting national interest and development by aiding in the fight against poverty and

inequality, providing access to clean cooking for disadvantaged populations, and contributing to the Brazilian LPG market;

b) Expanding the labor market, given the potential for job and income generation;

c) Protecting consumer interests regarding price, as it would provide low-income populations with more favorable access to LPG; and

d) Ensuring the supply of petroleum derivatives throughout the national territory by facilitating the market dynamization of this product.

On the other hand, the tax reform recently approved by the Brazilian National Congress included a provision for the cashback of taxes paid by low-income consumers on electricity and LPG supply operations, which still requires regulation through a Complementary Law. This mechanism ensures that the tax revenue renunciation by the state is aligned with its purpose, which is to reduce the energy cost burden on these families. This Department believes that the implementation of the cashback mechanism on LPG supply operations for low-income consumers is crucial for expanding efforts to combat energy poverty and reduce social inequality. In the future, this mechanism could also be assessed to refund the total or partial amount spent by citizens on cooking gas.

## Access to heating and cooling services

The history of energy efficiency in Brazil can be traced back to the early 1980s when the country began to formalize its efforts to reduce energy consumption and enhance efficiency, being one of the first countries around the world to take such measures. One of the key milestones was the establishment of the Brazilian Labeling Program (PBE), in 1984, and the creation of the National Program for Electricity Conservation (PROCEL), in 1985, which focused on promoting the rational use and conservation of electricity in various sectors. Furthermore, from the creation of PROCEL until 2023, the Program saved approximately 260 billion kWh, with annual gains of about 22 billion kWh since 2018. Over the years, numerous policies and programs were introduced, such as the Energy Efficiency Law (Law 10,295), in 2001, which defined the setting of minimum energy performance standards for appliances and buildings.

Brazil has been using ODEX (Overall Energy Efficiency Index) as the main indicator to track energy efficiency progress in Brazil. ODEX combines data from various sectors, such as industrial, residential, and transport, to provide a comprehensive picture of the country's energy efficiency improvements. A decrease in ODEX indicates an improvement in energy efficiency, while an increase suggests a decline. Brazil has seen a significant reduction in its ODEX, as the calculated for 2022 show that the country has been around 8.6% more energy efficient than it was in 2005, reflecting advancements in energy-saving technologies and more efficient energy use practices across different sectors.

In recent years, Brazil has implemented several major projects aimed at improving energy efficiency. The Energy Efficiency Program (PEE), regulated by ANEEL (National Electricity Agency), mandates that electricity distributors invest 0.5% of their net operating revenue in energy efficiency projects. Since 2008, the program has resulted in significant investments in sectors such as: low-income residential projects, including appliance replacement programs; public buildings modernization, combined with the implementation of distributed generation; and industrial projects, to improve competitiveness. The Minimum Energy Performance Standards (MEPS), established by Law 10,295 in 2001, plays a crucial role in regulating the energy efficiency of various appliances and equipment, including light bulbs, refrigerators, freezers, air conditioners, gas stoves and ovens, and fans. These standards ensure that only products meeting specific energy performance criteria are available in the market. The synergy between MEPS, the Brazilian Labeling Program (PBE), and endorsement seals has proven to be a highly effective energy efficiency policy. Appliances that meet MEPS guidelines are integrated into the PBE and carry endorsement seals, indicating their compliance with energy efficiency standards.

Regarding the buildings sector, Brazil also has a consistent history of energy efficiency policies and programs. The first movement in this way was made by Energy Efficiency Law, as it defined that the government would develop mechanisms to promote energy efficiency in buildings constructed in the country. In this sense, together with the institution of the interministerial committee that would elaborate MEPS regulations, it was also created the Technical Group for Energy Efficiency in Buildings in Brazil (GT-Edificações). This group provided the basis for the development of the technical requirements and mechanisms for the advance of energy efficiency measures for the buildings sector. With the support of this group, PROCEL created, in 2003, a specific branch to deal with buildings, called PROCEL Edifica, and consequently, PROCEL supported the definition of the National Label for Energy Conservation (ENCE) for buildings in 2009/2010 (PBE Edifica).

In 2014, PROCEL launched the PROCEL Seal for Commercial and Public Buildings, and the Federal Government defined that new federal public buildings to be constructed should accomplish level A in energy performance. In 2020, PROCEL launched the PROCEL Seal for Residential Buildings, and GT-Edificações, with support from PROCEL initiated the development of a regulatory impact assessment in order to propose the establishment of MEPS for buildings. The methodology for evaluating the energy performance of buildings was improved in 2021, and there is the expectation that the first MEPS for buildings will be established in 2025.

Considering all this context, Brazil has been working to improve access to more efficient energy services and offer a better quality of life to its population, especially the most vulnerable. The new MEPS proposal for buildings may consider the public housing programs, guaranteeing that these new buildings comply with energy efficiency standards and seek to maintain adequate thermal comfort. In addition to being a relevant measure of energy efficiency, which will help especially the population located in intertropical regions and which will require a large amount of cooling services, it is an inclusive and just adaptation measure to global warming. Also, the advance in MEPS regulations for cooling and heating equipment will contribute to these objectives, as the costs of energy services may

reduce with the adoption of more efficient appliances. The recently revised regulatory agenda of MEPS establishment includes commercial refrigerators and air conditioners, gas ovens and stoves, gas water heaters, portable fans, among other appliances. Regarding the MEPS regulations already implemented for room air conditioners, it expects to generate savings of 67 TWh and of around USD 5 billion up to 2040, avoiding emissions of 40 million tons of CO<sub>2</sub>e. About domestic refrigerators, the MEPS regulation in implementation expects to generate savings of 11,2 TWh between 2024 and 2030 and avoid emissions of 5.7 million tons of CO<sub>2</sub>e in the same period.

In industrial sector, several strategic programs and partnerships have also been crucial in driving energy efficiency in Brazil. The Brasil Mais Produtivo – Eficiência Energética (B+P EE) program, Aliança Program and PotencializEE program, for instance, focus on enhancing energy efficiency in the industrial sector by providing technical support and promoting the adoption of efficient technologies. Another significant initiative is the Energy Efficiency Learning Networks, for Industry and Public Buildings, which fosters collaboration among businesses and public entities to share best practices and implement energy-saving measures.

All these efforts are complemented by research and development investments, which have seen nearly R\$ 5 billion directed towards energy efficiency projects over the past decade. Overall, Brazil’s approach to energy efficiency encompasses a mix of regulatory measures, financial incentives, and collaborative initiatives aimed at reducing energy consumption and enhancing productivity. The ongoing efforts and significant investments in energy efficiency projects not only contribute to economic growth but also help in addressing environmental concerns. The combination of policy support, technological innovation, and stakeholder engagement is crucial in achieving sustainable energy use and economic development.

### Policies to address affordability

Another relevant public policy in the electric power sector aimed at combating energy poverty and promoting the socioeconomic inclusion of thousands of vulnerable families is the Social Electricity Tariff (TSEE). The TSEE was established by Law No. 10.438, dated April 26, 2002, and regulated by Law No. 12.212, dated January 20, 2010, and Decree No. 7.583, dated October 13, 2011. Through the TSEE, discounts are granted to consumers classified in the Low-Income Residential Subclass, as defined in Section II of Article 5 of Decree No. 11.016, dated March 29, 2022.

Access to electricity is a fundamental right for the exercise of citizenship and the guarantee of a dignified life. In this context, the Social Electricity Tariff stands out as one of the most relevant public policies aimed at addressing energy poverty in Brazil, providing equitable access to an essential service and promoting the socioeconomic inclusion of the most vulnerable populations.

The TSEE aims to provide significant discounts on electricity bills for low-income families registered in the Cadastro Único (Unified Registry) and beneficiaries of the Continuous Cash Benefit (BPC). The

tiered subsidy model, which prioritizes basic and essential electricity consumption, ensures that millions of Brazilians can access continuous energy, reducing the impacts of economic vulnerability and preventing the aspect of energy poverty where the cost of energy becomes an obstacle to a dignified existence.

Consumers in the Low-Income Residential Subclass are exempt from paying the costs of the Energy Development Account (CDE) and the costs of the Program for the Promotion of Alternative Sources of Electric Energy (Proinfa). In addition to these exemptions, discounts are applied cumulatively to the remainder of the residential tariff, as shown in Table 1.

**Table 1 – Discounts monthly applied to the residential tariff for TSEE beneficiaries (Law No. 12.212/2010).**

Consumption	Reduction
0 to 30 kWh	65%
31 to 100 kWh	40%
101 to 220 kWh	10%
>220 kWh	0%

The TSEE also promotes social equity by providing special conditions for indigenous and quilombola communities, ensuring a full exemption for the first 50 kWh consumed by these families. This mechanism acknowledges the specific needs of these traditional groups and reinforces the Brazilian State’s commitment to reducing structural inequalities, as shown in the benefits table in Table 2.

**Table 2 – Discounts monthly applied to the residential tariff for indigenous and quilombola families (Source: Law No. 12.212/2010).**

Consumption	Reduction
0 to 50 kWh	100%
51 to 100 kWh	40%
101 to 220 kWh	10%
>220 kWh	0%

Thus, the right to benefit from the Social Electricity Tariff (TSEE) will be granted to beneficiaries who meet at least one of the following requirements:

- I. Family registered in the Unified Registry for Federal Social Programs, with a per capita monthly income equal to or less than half the national minimum wage;
- II. Elderly individuals aged 65 or older or persons with disabilities, who receive the Continuous Cash Benefit (BPC), according to Articles 20 and 21 of Law No. 8.742, dated December 7, 1993;
- III. Family registered in the Unified Registry with a monthly income of up to three minimum wages, with a member who has a disease or disability (physical, motor, hearing, visual, intellectual, or multiple) requiring continued use of medical equipment, devices, or instruments that consume electricity for their operation.

The importance of the TSEE transcends the economic aspect, serving as a fundamental pillar for the realization of basic human rights. By ensuring affordable electricity, this public policy guarantees that children, women, and the elderly can study at night, that elderly people and those with disabilities have adequate conditions for medical treatments that depend on electrical equipment, and that small family businesses can thrive. In this way, the TSEE not only improves the living conditions of low-income populations but also stimulates the sustainable development of the benefited communities. From a global perspective, the Social Electricity Tariff directly contributes to the achievement of Sustainable Development Goal 7 (SDG 7) of the UN 2030 Agenda, which commits to ensuring universal, reliable, modern, and affordable access to energy.

Between 2022 and 2024, over R\$ 16 billion was invested in the TSEE, benefiting millions of Brazilians and reaffirming the State's commitment to ensuring access to energy as a fundamental right. The continuation and enhancement of this policy are essential for eradicating energy poverty, promoting social justice, and advancing socioeconomic inclusion in Brazil. Currently, 17.3 million families benefit from the Social Electricity Tariff.

In this regard, the TSEE should be recognized not only as an economic support measure but as an essential instrument for human dignity, strengthening citizenship, and building a fairer and more sustainable country. Its direct impact on the lives of the families benefited demonstrates that well-structured public policies can transform realities, promoting access, equity, and effective social development. Currently, there are 17,332,735 (February 2025 reference) beneficiaries of the Social Electricity Tariff in Brazil, with a projected allocation of R\$ 6.683 billion by the end of 2025 to fund the TSEE.

Brazil has been also working to improve the quality of power supply in the Amazon region. The Energies of the Amazon Program, established by Decree No. 11,648 of August 16, 2023, is designed to strengthen the energy transition in the provision of electricity to the population of the Amazon region, benefiting

approximately three million people currently served by isolated systems not connected to the National Interconnected System (SIN).

The Program's efforts are focused on reducing the use of diesel oil in electricity generation to meet demand in the Isolated Systems of the Legal Amazon region. This aims to lower greenhouse gas emissions by replacing conventional generation processes with renewable energy sources. Additionally, the program seeks to contribute to the quality and reliability of the electricity supply while structurally reducing expenditures from the Fuel Consumption Account (CCC).

Through Normative Ordinance GM/MME No. 92, dated November 21, 2024, the Ministry of Mines and Energy (MME) established the guidelines for conducting the first auction for the purchase of electricity and capacity, as well as for the implementation of other measures to ensure the electricity supply in the Isolated Systems, under the framework of the Amazon Energy Program.

The auction comprises three lots covering ten localities—one in the state of Pará and nine in Amazonas—with a combined population of approximately 169,000 people and a required capacity of 49 MW. Innovations were incorporated into the auction model for isolated systems, including a requirement that at least 22% of the energy generated must come from renewable sources, with or without storage solutions. Another significant innovation is the valuation of avoided carbon emissions resulting from the use of renewable sources, which contributes to the proposal ranking methodology based on the lowest sale price, thereby favoring proposals with renewable energy solutions.

Furthermore, proposals must include a fuel supply logistics plan that accounts for contingencies, particularly those related to climate events, to mitigate the risk of supply disruptions that could affect the operational viability of the proposed solutions. This is a critical innovation, especially considering recent extreme drought events.

An important front of the program's implementation is the work carried out by the Management Committee of the Pró-Amazônia Legal Program, established by Decree No. 11,059 of May 3, 2022. This decree regulates the Program for Structural Cost Reduction in Electricity Generation in the Legal Amazon and for Navigability of the Madeira and Tocantins Rivers (Pró-Amazônia Legal), in accordance with Law No. 14,182 of July 12, 2021. To fulfill its mission, the Management Committee issued a public call for proposals aimed at structurally reducing electricity generation costs covered by the Fossil Fuel Consumption Account (CCC) in the Legal Amazon. Selected projects will receive funding from the Legal Amazon Development Account (CDAL), as provided by Law No. 14,182 of July 12, 2021, and Decree No. 11,059 of May 3, 2022.

Among the notable outcomes of the program's initial years are: the launch of the Isolated Systems Data Monitoring Portal (PASI), enhancing transparency in energy generation and demand data; authorization for hybridization of thermal power plants in Amazonas state following identification of opportunities to incorporate renewable generation sources (mainly solar) by energy producers; completion of

interconnection studies for 14 localities in Amazonas, representing R\$ 2.4 billion in investments and benefiting over 245,000 families; and completion of interconnection works in Pará and Amazonas states, reaching over 289,000 people with investments totaling approximately R\$ 289 million. These actions are projected to save over R\$ 900 million annually from the CCC through the decommissioning of thermal plants (totaling 89 MW).





# China's Outlook on Access to Energy Services

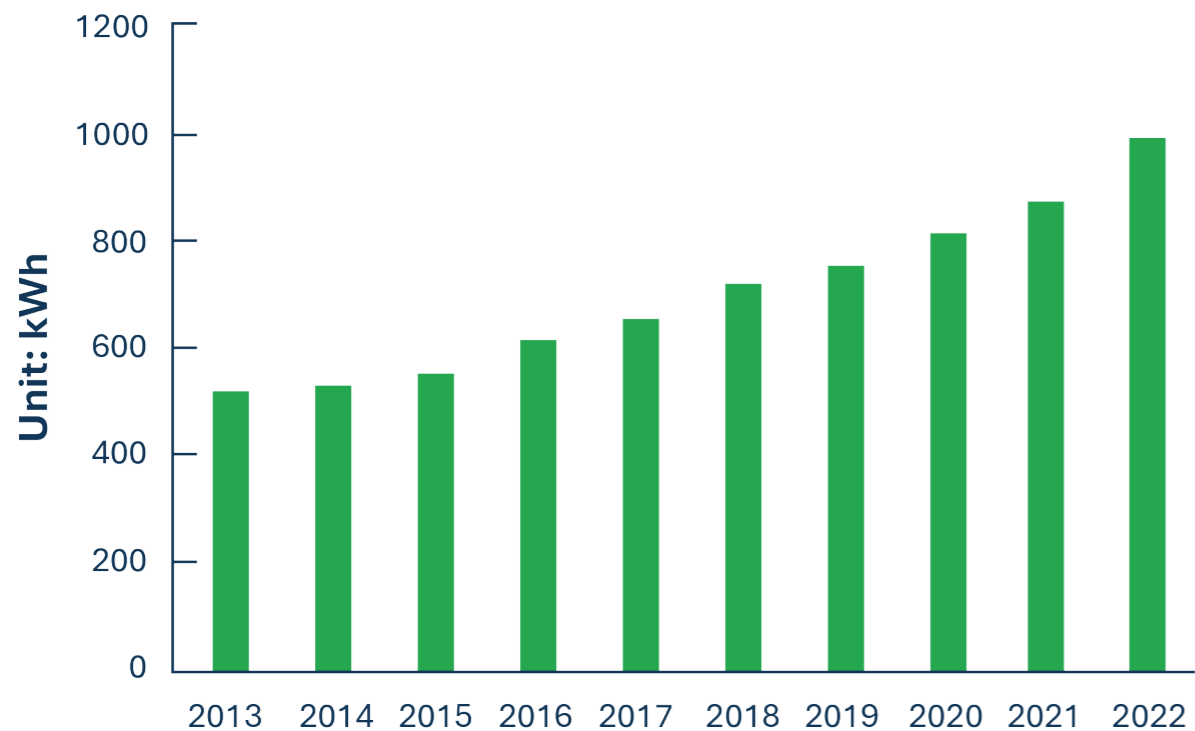
## Overview

In recent years, China's energy industry has achieved remarkable results in production capacity enhancement and low-carbon transition. Energy production capacity has steadily improved. In 2024, China's primary energy production reached approximately 4.98 billion tons of standard coal equivalent, growing by about 4.6% year-on-year, with total electricity generation exceeding 10 trillion kWh. The energy transition has also progressed significantly. By the end of 2024, China's renewable energy installed capacity for hydro power, wind power, and solar power reached nearly 1.9 billion kW, accounting for about 56% of total installed power capacity. Solar power generation capacity reached nearly 900 million kW, growing by over 45% year-on-year; wind power capacity stood at approximately 520 million kW, increasing by 18.0% year-on-year. In 2024, China's clean energy consumption proportion rose by 2.2 percentage points.

## Access to electricity

Regarding electricity coverage and accessibility, China's total electricity consumption reached 9.85 trillion kWh in 2024, growing by 6.8% year-on-year. China had fully completed the construction of power infrastructure in areas without electricity by 2015, solving electricity access problems for 40 million people, which enabled the country to achieve universal electricity access earlier than other developing countries. From 2013 to 2023, China's per-capita residential electricity consumption doubled from 500 kWh to nearly 1,000 kWh. The electricity demand of 1.4 billion people has been effectively safeguarded. Regarding power supply quality accessibility, in 2024, the average annual power outage time per user in China's power grid was 6.71 hours, lower than the global average of 23.3 hours and Asia's average of 9.78 hours. Moreover, the average power supply reliability rates for urban and rural power grids nationwide both exceeded 99.9%.

Regarding sustainable power supply, by the end of 2024, China's total installed power capacity had reached 3.35 billion kW, which denoted a year-on-year growth of 14.6%. Renewable energy generation capacity, including wind power, solar power, and biomass power, reached 1.45 billion kW, surpassing thermal power generation capacity for the first time, demonstrating significant achievements in the power industry's low-carbon transition.



**Figure 1: Per-capita residential electricity consumption**  
(Source: National Bureau of Statistics)

In terms of policy, China has been improving rural power grid infrastructure in recent years to enhance the use of renewable energy. In December 2021, Guiding Opinions on Accelerating Rural Energy Transition and Development to Assist Rural Revitalization was issued, which proposed sustained enhancement of rural grid reliability and rural electrification levels. In July 2023, Guiding Opinions on Implementing Rural Grid Reinforcement Projects was released, aiming to precisely upgrade rural power grids, strengthen grid-source planning coordination, and advance supporting power infrastructure. In March 2024, Guiding Opinions on High-Quality Development of Distribution Networks under New Circumstances was introduced, emphasizing comprehensive improvement of power supply capacity, and strengthening emergency preparedness.

Specific measures include: first, construct and upgrade power grids in underdeveloped regions. This involves upgrading grid framework and equipment, enhancing connections between county-level grids and main grids, and expanding public grid coverage within reasonable supply ranges. Tailored approaches will be adopted to construct and upgrade renewable energy smart micro-grids, so as to improve rural grid equipment standards and promoting digital and intelligent rural grid development. Second, actively promote distributed renewable energy development. Support will be provided for utilizing farmers' idle land and rooftop spaces for distributed wind and solar power installations, with appropriate energy storage configurations for self-generation, local consumption, and surplus electricity fed into the grid. Innovative models like agri-photovoltaic, fishery-photovoltaic, and animal-husbandry-

photovoltaic complementation will be promoted to integrate traditional agricultural activities with renewables industry development. Third, enhance rural grids' resilience against natural disasters. This includes implementing differentiated grid design standards, appropriately raising construction criteria, reinforcing grid equipment against wind damage, and strengthening defenses against typhoons, thunderstorms, and low-temperature rain and snow ice disasters. Local emergency power sources will be developed, with coordinated deployment of mobile emergency power units.

Looking ahead, future challenges and the corresponding strategies for China's electricity accessibility are mainly related to three key areas: First, regional coordination and resource optimization. Western regions rich in renewable resources are developing rapidly, necessitating accelerated inter-regional transmission corridor construction to enhance renewables delivery capabilities while expanding local consumption pathways. Second, addressing extreme climate events. Due to increasingly frequent extreme weather conditions, it is essential to improve grid emergency management systems, strengthen monitoring and early warning systems for ice storms, heavy snow, and other disasters, and reduce the impact of extreme weather on power supply reliability. Third, deepening market mechanisms. Policies such as capacity pricing and auxiliary service markets need implementation to balance synergistic development between fossil fuels and renewables. Thus, long-term power system security can be ensured.

### Access to clean cooking solutions

In recent years, China's clean cooking accessibility rate has continued to rise, which is now above the global average level. According to data from World Bank, China's clean cooking accessibility rate approached 88% in 2022, an increase of 22 percentage points compared to 2013; among this, the clean cooking accessibility rates for rural and urban populations were 76% and over 95% respectively, representing increases of 33 percentage points and 10 percentage points since 2013.

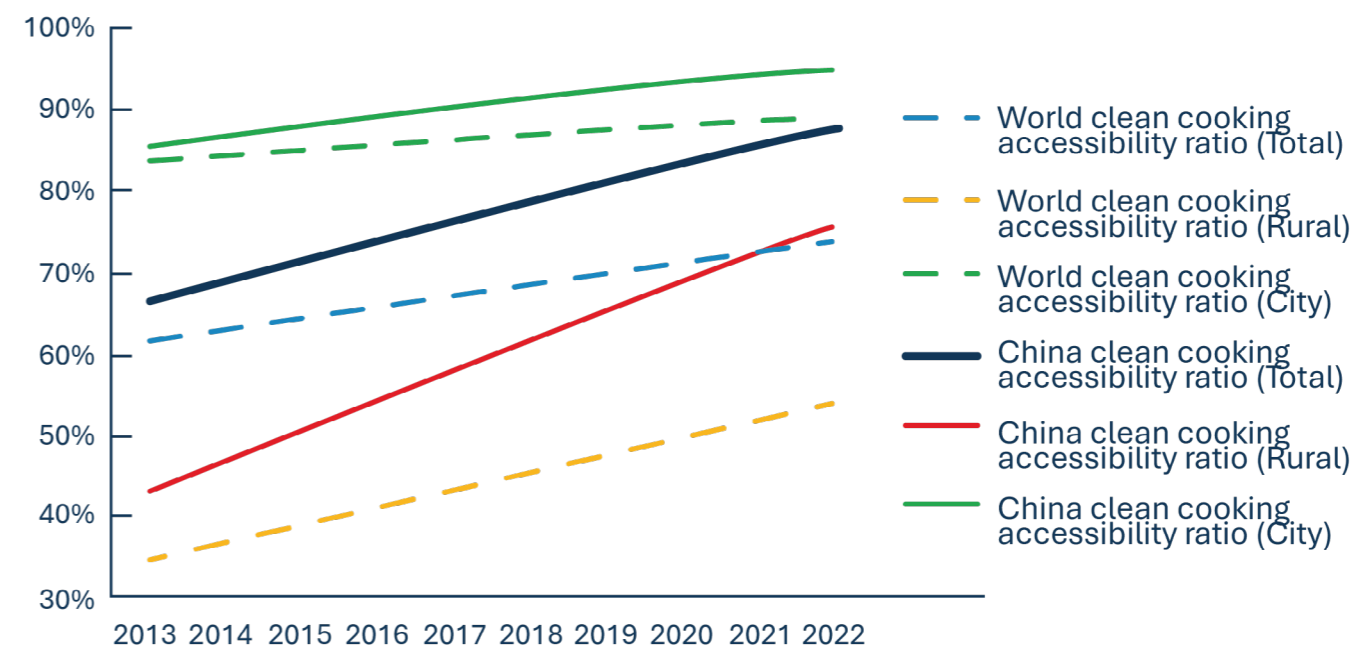


Figure 2: China and the world's clean cooking accessibility ratio (Source: World Bank)

Key driving factors include: First, policy guidance. Documents such as the National Energy Administration’s Guiding Opinions on Rural Energy Transformation and Development have incorporated clean cooking into the rural revitalization strategy, in order to replace raw coal with biomass energy, biogas, and liquefied petroleum gas (LPG). Second, technology promotion. Clean stoves tailored to rural needs (e.g., high-efficiency pellet fuel stoves, biogas stoves) have been widely distributed to rural areas, with cumulative deployment exceeding 50 million units from 2020 to 2022. Third, infrastructure improvement. Rural power grid upgrades and extended gas pipelines now cover 98% of administrative villages, ensuring stable use of electricity- and gas-based clean cooking equipment. Fourth, economic incentives. The central government provides subsidies for stove purchases in poverty-stricken areas, which is a way to lower user cost barriers.

**Table 1: Main standards for clean cooking stoves in China**

Standard Name	Key Indicator
<b>General Technical Requirements for Household Biomass Pellet Fuel Cooking Stoves</b>	- Thermal Efficiency - PM - CO
<b>Emission Limits for Pollutants from Civilian Biomass Solid Fuel Stoves</b>	- PM - NO <sub>x</sub> - Flue Gas Blackness
<b>Safety Technical Specifications for Household Biomass Stoves</b>	Surface Temperature Rise of Furnace Body - Flame Failure Protection Response Time - Air Tightness (Leakage-free)
<b>Performance Test Methods for Household Biomass Cooking Stoves</b>	- Rated Heat Input - Thermal Efficiency Test Method (Water Heating /Evaporation) - Chimney Draft Requirement

### Access to heating and cooling services

In recent years, China has achieved leapfrogging development in renewable heating and cooling, and realized accessibility through low-carbon approaches. Regarding heating, as of the end of 2023, the clean heating area in northern regions increased by 10.7 billion square meters compared to the end of 2016, while the clean heating rate rose by 46 percentage points, reaching nearly 80%. In 2024, China’s geothermal heating (cooling) capacity reached approximately 1.33 billion square meters; biomass clean heating covered about 448 million square meters, with an estimated utilization scale of 20 million tons of biomass molded fuel; solar heating covered 24.05 million square meters, and wind power-based clean heating reached approximately 500 million square meters. Concerning cooling, China

is the world’s largest producer, consumer, and exporter of cooling products. According to statistics from the China Refrigeration Association (CRAA), the total output value of China’s cooling industry exceeded 830 billion yuan in 2023. Annual refrigerant consumption across all types of refrigeration and air-conditioning equipment surpassed 350,000 tons, accounting for about half of global consumption.

On the policy front, China’s policy framework for renewable heating and cooling is becoming increasingly comprehensive. In June 2019, the Green and Efficient Cooling Action Plan was released, setting requirements for indicators such as market share of green and efficient cooling products, overall energy efficiency levels in cooling, and annual electricity savings. In January 2021, the Notice on Adapting Renewable Energy Heating Measures to Local Conditions was issued, advocating the rational selection of diverse clean heating technology pathways. In December 2022, the Opinions on Promoting the Sustainable Development of Clean Heating in Northern Regions was published, encouraging the adoption of safe, efficient, advanced, and reliable clean heating technologies. In May 2024, the 2024–2025 Energy Conservation and Carbon Reduction Action Plan was issued, specifying requirements for the proportion of high-efficiency energy-saving products among existing industrial and commercial cooling equipment, household cooling equipment, and general lighting equipment.

In the future, China’s renewable heating and cooling sector will face four major development trends. First, the national “Carbon Peak and Carbon Neutrality” strategy presents new opportunities. The heating and cooling sector in China accounts for a significant portion of carbon emissions. With the implementation of the national “Carbon Peak and Carbon Neutrality” strategy, the industry faces the challenge of low-carbon transition, creating new opportunities for the development of renewable heating and cooling. Second, the rural energy revolution brings new prospects. The National Energy Administration is carrying out a demonstration action for rural energy revolution pilot counties. Adhere to tailored and comprehensive policies, promote the efficient upgrading of clean heating in rural areas, and promote the development of renewable energy heating and cooling into a new stage. Third, ecological, intelligent, integrated, and efficient are emerging as new priorities. Combination of an intelligent heat supply control system can provide a finer operation and scheduling hear supply system by integrating information and physical systems, and the improvement in energy saving and equipment integration will give a great potential to non-electricity renewable energy utilization market. Fourth, exemplary case studies will guide large-scale industrial application and promotion. Through the collection and compilation of typical cases of renewable energy heating (cooling) nationwide, the development ideas of the industry will be clarified, providing replicable and promotable mature solutions for clean heating in winter in the northern region and warm and cool summer in the southern region. Further promote the application of renewable energy heating in comprehensive utilization, modern agriculture, and industrial carbon reduction, and drive the high-quality and large-scale development of the industry.

### Policies to address affordability

China has strong energy affordability, with electricity prices remaining at relatively low levels globally over the long term—lower than those in most developed and emerging economies—while demonstrating

strong risk resilience. In the past decade, China’s electricity prices have maintained a stable and slightly declining trend. According to BMI data, in 2024, China’s average electricity prices for industrial/commercial use and residential use were 0.068\$/kWh and 0.078\$/kWh, respectively. In recent years, China has fully liberalized coal-fired power grid tariffs and industrial/commercial sales electricity prices, steadily advancing market-based pricing for renewable energy feed-in tariffs and fundamentally transforming the grid operation model from reliance on buy-sell price differentials to income derived from transmission and distribution services.

price formation mechanisms that promote efficient resource allocation and energy pricing policies supporting low-carbon transition. In January 2025, the National Development and Reform Commission and the National Energy Administration jointly released the Notice on Deepening Market-Oriented Reform of Feed-in Tariffs for Renewable Energy to Promote High-Quality Development of Renewable Energy, which outlined multiple measures to advance the full market-based formation of renewable energy feed-in tariffs and establish institutional mechanisms supporting the high-quality development of renewable energy.

Specific measures include: the first is to improve the energy pricing formation mechanism. Deepen market-oriented reforms in energy pricing and orderly promote the participation of various power sources in the market, continuously refining the policy framework for renewable energy feed-in tariffs and fully liberalizing industrial and commercial electricity sales prices. Further improve the coal-fired power capacity pricing mechanism to facilitate its transition from a base-load power source to a supportive and flexible resource. Enhance the refined oil product pricing mechanism to flexibly reflect fluctuations in international crude oil prices and domestic supply-demand dynamics. Advance market-oriented reforms for natural gas gate-station pricing in an orderly manner. Continuously optimize the medium- and long-term coal contract system and market-based pricing mechanisms. The second measure is to refine the energy price regulation system. Establish and improve pricing mechanisms for flexible resources such as gas-fired power generation and energy storage to better support the development of the new electricity system. Implement tiered electricity pricing policies for energy-intensive industries to promote energy conservation and emissions reduction, improving time-of-use pricing policies to guide users in peak shaving, load shifting, and off-peak consumption. Strengthen energy price monitoring, analysis, and risk prevention to enhance price regulation efficacy, and establish mechanisms to prevent and respond to abnormal fluctuations in energy market prices.

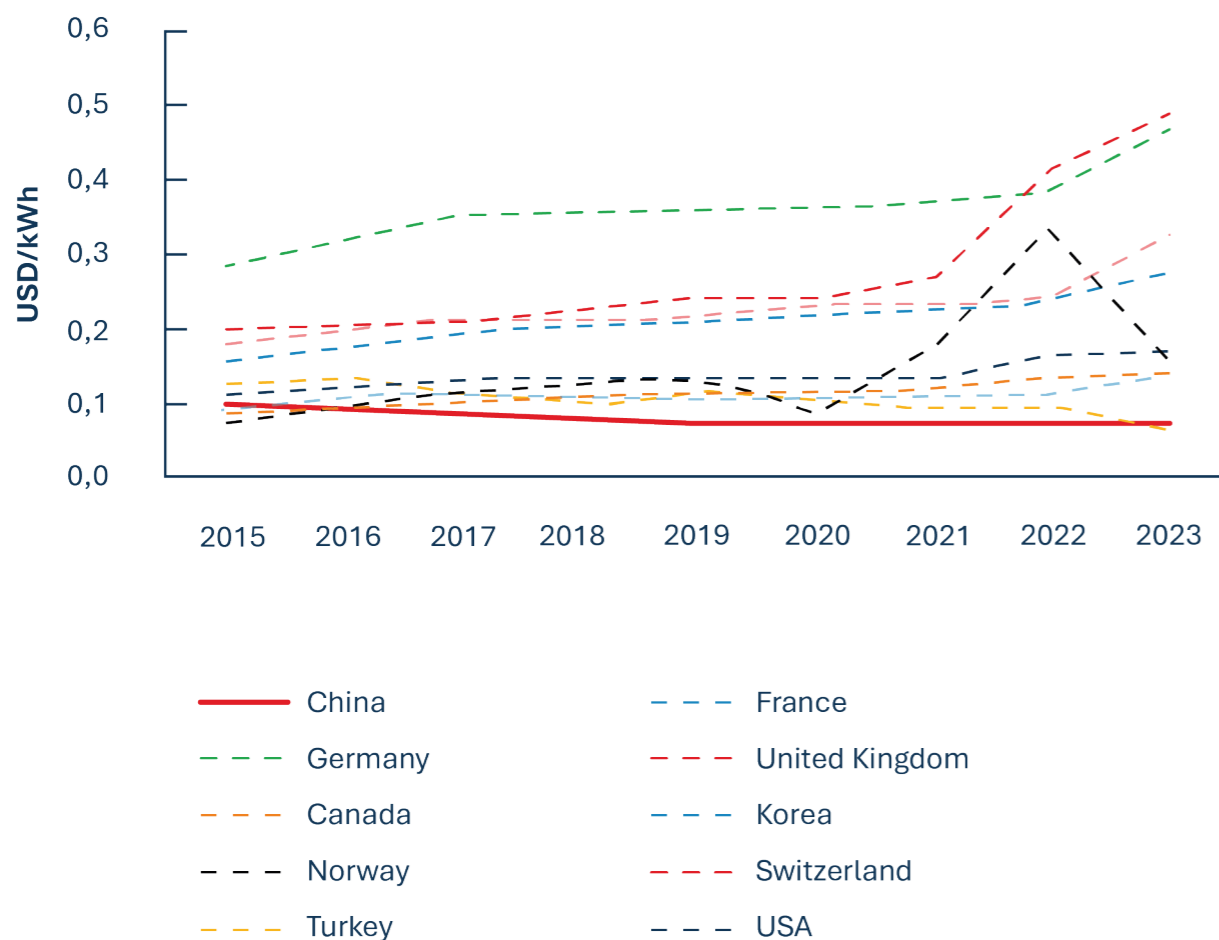
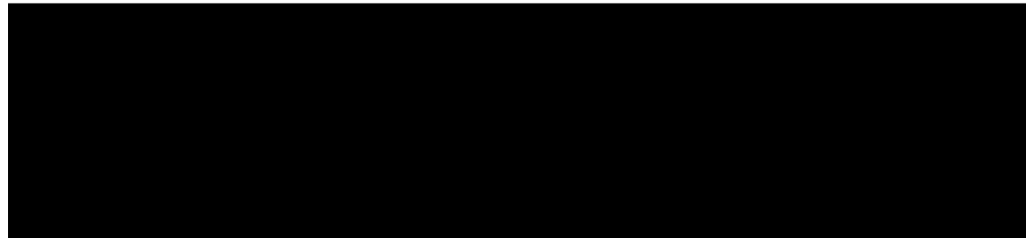


Figure 3: China’s electricity price compared with selected countries (Source: BMI, IEA)

On the policy front, China has issued multiple policies and regulations to optimize energy pricing mechanisms in recent years, further enhancing energy affordability. In November 2024, the Energy Law of the People’s Republic of China was promulgated, stipulating that energy pricing mechanisms shall be determined comprehensively based on factors including energy resource conditions, product and service costs, market supply and demand, and sustainable development. In December 2024, the Opinions on Improving the Price Governance Mechanism was issued, proposing to refine market-based



# Egypt's Thoughts on Access to Energy Services

## Overview

According to the International Energy Agency “IEA” report “A Vision for Clean Cooking Access for All” nearly one third of the global population - still cook their meals over open fires or on basic stoves, breathing in harmful smoke released from burning coal, charcoal, firewood, agricultural wastes, and animal dung. These practices can still be found in 128 countries today—where households do not have the tools or means to reliably cook meals using clean burning fuels. Even the simplest, widely available cooking devices could improve this situation, including devices like camp stoves using liquefied petroleum gases (LPG) and electric hotplates.

Basic cooking methods using wood and charcoal often contribute to deforestation. The demand for firewood and charcoal results in the loss of forests the size of Ireland each year, with the worst effects concentrated in places like east and southern Africa where large populations increasingly rely on dwindling forests. This has also led to food stress in some regions where fruiting trees are cut for firewood. In that sense Egypt has been facilitating and increasing Natural Gas Connection for Households.

The Ministry of Petroleum and Mineral Resources (MOPMR) operates within a strategic framework built upon six core pillars, each aimed at empowering individuals and enhancing the sector’s contribution to Egypt’s Gross Domestic Product (GDP). These pillars include:

Meeting the citizens’ needs for petroleum products by focusing on production and exploration activities.

1. Maximizing the utilization of petroleum resources through refineries and petrochemical to create added value.
2. Re-lunching of the mining sector and maximizing its added value.
3. Working as a one team with the Ministry of Electricity and Renewable Energy to diversify the energy mix, drive growth of the Egyptian economy, and leverage Egypt’s location for hydrogen production and energy trading.
4. Create an attractive investment environment, while maintaining safety, energy efficiency, and reducing emissions.
5. Enhance regional cooperation to attract investments to Egypt and the region.

This integrated approach reflects the Ministry’s commitment to achieve sustainable growth, energy security, and economic advancement.

## Egypt Integrated Sustainable Energy Strategy to 2040

The Sustainable Development Goals (SDGs) establish a comprehensive framework for advancing sustainable energy, recognizing its essential role in driving economic growth and fostering long-term development. SDG7—Affordable and Clean Energy—focuses on ensuring universal access to modern energy, accelerating the adoption of renewable energy sources, and enhancing energy efficiency. These objectives are closely linked to SDG3 (Good Health and Well-Being), which highlights the health benefits of cleaner energy solutions, and SDG13 (Climate Action), which underscores energy’s critical role in mitigating environmental impacts. Together, these goals lay the foundation for a more resilient and equitable energy landscape, supporting sustainable progress worldwide.

In that sense, Approved by the Supreme Energy Council in 2016, the Integrated Sustainable Energy Strategy to 2035 had been developed to meet the growing demand for energy with the increasing population, which includes increasing the use of renewable energy, improving efficiency in the energy sector, and increasing the share of renewable energy, and taking into consideration the continuous developments in the market, and in light of global developments related to renewable energy technologies, advancements in energy storage solutions, and the emerging focus on hydrogen. Egypt had updated its Integrated Sustainable Energy Strategy to 2040. Following that it had updated its NDCs in 2023, accelerating its goal of having renewable energy account for 42% of the energy mix by 2030, instead of 2035. The plan emphasizes expanding solar, wind, hydropower, and concentrating solar power (CSP) capacity, alongside improving energy efficiency and phasing out subsidies to encourage sustainable consumption. Egypt has also invested heavily in infrastructure, increasing grid interconnections with neighboring countries to position itself as an energy hub between Africa, Europe, and Asia. Since the strategy was developed and given the fast-evolving energy landscape.

### Access to Clean Cooking

As part of the political leadership’s support and continuous follow-up of the expansion projects to increase the use of natural gas for households aimed at achieving social justice, especially in the most vulnerable governorates and regions, and at easing the burden on citizens in obtaining LPG cylinders as well as reducing pressure on the state budget by cutting its imports. A significant leap has been achieved over the past ten years in the use of natural gas as an alternative to LPG. This expansion ensures greater access to this modern service, providing a clean cooking access and more cost-effective fuel that lightens the financial load on citizens.

In line with this, a series of projects are being implemented to enhance the national gas grid, aiming to supply residential areas, power stations, industrial zones, and commercial projects across all governorates. The operation and control of Egypt’s national natural gas network are managed using the latest SCADA technology through the National Gas Control Center.

Efforts to expand natural gas connection to residential units continue to advance, with a significant

number of households. This ongoing initiative has steadily increased the total number of connected units since the start of operations, extending service to millions of citizens and contributing substantially to emissions reduction. Looking ahead, the upcoming fiscal year aims to further accelerate connections, ensuring broader access to natural gas. Notably, the adoption of natural gas in households leads to considerable savings in liquefied petroleum gas consumption, replacing multiple cylinders annually for each connected unit and reinforcing the shift toward a more sustainable domestic energy landscape. Another aspect of access to clean energy as a whole is the initiative to convert vehicles to run on natural gas (CNG) aimed at easing the financial burden on the state regarding fuel subsidies by reducing the import bill, as well as supporting the sustainable development strategy and reducing carbon emissions through the use of cleaner, environmentally friendly fuel. The Ministry of Petroleum and Mineral Resources has taken the necessary steps to convert vehicles to run on natural gas (CNG). As the Natural gas is cheaper than gasoline, which helps citizens lower their daily fuel expenses and alleviates financial burdens on households.

### Affordability and Ability to Pay for Energy Services

In order to facilitate the process of the natural gas connection to the residential units, and in line with political directives supporting the expansion of natural gas usage in residential areas, ongoing efforts continue to promote social equity and alleviate financial burdens for citizens, particularly in limited-access communities. Under this framework, the Ministry of Petroleum and Mineral Resources remains dedicated to fulfilling political directives and advancing national initiatives, with a particular focus on the “Decent Life or Haya Karima initiative”. The initiative aims to reduce reliance on liquefied petroleum gas (LPG) cylinders while redirecting subsidies toward more sustainable alternatives, ultimately decreasing imports and easing pressure on the state budget.

Through its efforts, the ministry plays a vital role in the development of rural villages and limited-access areas, working to extend access to natural gas and provide a reliable, efficient energy source. This transition helps alleviate the logistical and financial burdens linked to LPG cylinder dependency, fostering a more sustainable and accessible energy infrastructure for these communities.

To further facilitate residential access to natural gas, the government has introduced a structured installment plan for connection costs. This initiative provides households with the opportunity to connect to the gas network without requiring an upfront payment or incurring interest charges. The installment payments are seamlessly incorporated into the monthly gas consumption bill and spread over a period of seven years, ensuring affordability and reducing financial strain on citizens.

In the context of reducing the financial burden on citizens for petroleum product consumption, the Egyptian government has established a committee titled “Committee for Monitoring the Automatic Pricing Mechanism for Petroleum Products” to Monitor the pricing formula on a quarterly basis and determining the selling price of these products in the local market in accordance with changes in international product costs, the exchange rate, and other fixed costs to achieve the intended goal of

automatic adjustment that grantee the selling price should not exceed the increase of 10% for the consumer.

## Challenges

Achieving universal access to clean energy and clean cooking solutions entails navigating a complex array of technical, economic, and strategic challenges. These include limited local resources, inadequate technological capacity, financial constraints, and political and legal hurdles. Affordability and pricing structures further complicate efforts, particularly in low- and middle-income regions. Additionally, the inherent intermittency of renewable sources like solar and wind—due to their dependence on weather and time of day—necessitates investments in grid modernization, energy storage systems (such as batteries and hydrogen), and new transmission infrastructure.

Many countries also face underdeveloped regulatory and market frameworks. Tariff design, permitting procedures, and grid access regulations must evolve to enable the large-scale integration of renewable energy.

Internationally, the push to diversify and secure energy markets encounters persistent barriers. Fluctuations in oil prices and the anticipated 1.7% annual growth in global primary energy demand through 2030 underscore the ongoing reliance on fossil fuels during the transition. In this regard, the BRICS initiative offers a valuable platform to enhance Egypt's role in global and regional energy cooperation.

Lastly, while technological and policy pathways for clean cooking access are well-established, implementation continues to lag due to limited institutional capacity and insufficient financing.

## Conclusions and Recommendations

In conclusion access to reliable, affordable, and sustainable energy services is essential for Egypt's socio-economic advancement and aligns with global climate and development goals.

Over the past decade, Egypt has achieved significant progress—expanding natural gas networks to over 15 million households, encouraging a large-scale transition of vehicles to compressed natural gas (CNG) as a cleaner and more cost-efficient alternative, reducing dependence on conventional fuels and promoting sustainability in transportation, and updating its Integrated Sustainable Energy Strategy to 2040.

Given the evolving global landscape—marked by volatility in fossil fuel markets and increasing cybersecurity threats—it is imperative to implement strategic reforms that reinforce energy security, economic stability, and environmental sustainability.

To enhance targeted financing and subsidies, the introduction of tiered subsidy structures and loan

programs will facilitate access to natural gas connections and clean cooking technologies, particularly for low-income and rural households.

Regulatory frameworks must be modernized through comprehensive tariff reforms, streamlined permitting procedures, promoting investment in renewable energy and compressed natural gas (CNG) infrastructure, natural gas connection through the implementation of local content policies, ensuring sustainable development and long-term industry growth.

Efforts to expand vehicle conversion should be prioritized by increasing the number of conversion centers, subsidizing conversion kits, and implementing nationwide awareness campaigns that underscore both the economic and environmental advantages of CNG adoption.

Investment in research and development (R&D) and capacity-building should be strengthened through strategic partnerships with academic and research institutions, facilitating expertise development in renewable technologies, cybersecurity, and energy storage solutions.

A centralized monitoring and evaluation framework should be established to track critical metrics, including energy access, affordability, emissions reduction, and investment trends. Annual reviews and data-driven policy adjustments will ensure continued effectiveness and responsiveness to emerging challenges.

By integrating these measures within a coherent policy framework, governments and stakeholders can drive sustainable energy transitions while ensuring long-term resilience in the sector.



# India's Perspective on Access to Energy Services

## Overview

With a population of 1.4 billion and one of the fastest-growing major economies, India's energy security and access are critical for its economic growth. India is committed to diversifying its energy mix to support an inclusive and sustainable growth ensuring a reliable, affordable and sustainable energy supply.

As part of its NDC targets, India is committed to increase the share of non-fossil capacity to 50% of the installed electricity generation capacity mix by 2030. As of March 2025, India's total installed capacity stands at 475 GW with 48% of this capacity already coming from non-fossil fuels making the NDC target well within reach.

India has made impressive progress towards improving access to energy services through various people centric schemes and initiatives underpinned by its commitment to a cleaner and self-reliant energy future.

Access to Electricity India has made remarkable progress in improving electricity access across the country backed by significant reforms in the generation, transmission and distribution sectors. Over the last decade, India's electricity capacity has surged by 90% reaching 475 GW by March 2025 and is expected to reach 900 GW by 2032. Capacity addition in the power sector has seen a strong shift towards non-fossil fuels, with renewable and other clean sources consistently outpacing thermal capacity additions in recent years. This trend is expected to continue, with non-fossil fuel capacity projected to reach 612 GW by 2032, accounting for 68% of the total installed electricity generation capacity.

India has also adopted an ambitious target of achieving 100 GW nuclear power capacity by 2047. Additionally, the government has planned huge capacity additions in energy storage technologies including 35 GW of pumped storage plants and 41GW of battery energy storage systems by 2032.

To support the targeted capacity addition, a national transmission plan has been launched to expand the transmission infrastructure in the country. A capacity addition of 150,000 circuit km transmission length is envisaged under the plan. The plan will help in meeting the increasing electricity demand including green hydrogen loads, facilitating RE integration and enabling cross border interconnections. India has carried out important reforms to achieve 100% electrification, 24x7 energy access across the country, and improving operational efficiency of electricity distribution utilities. Flagship schemes such as Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Integrated Power Development Scheme (IPDS), and SAUBHAGYA have been instrumental in the expansion of rural electricity infrastructure.

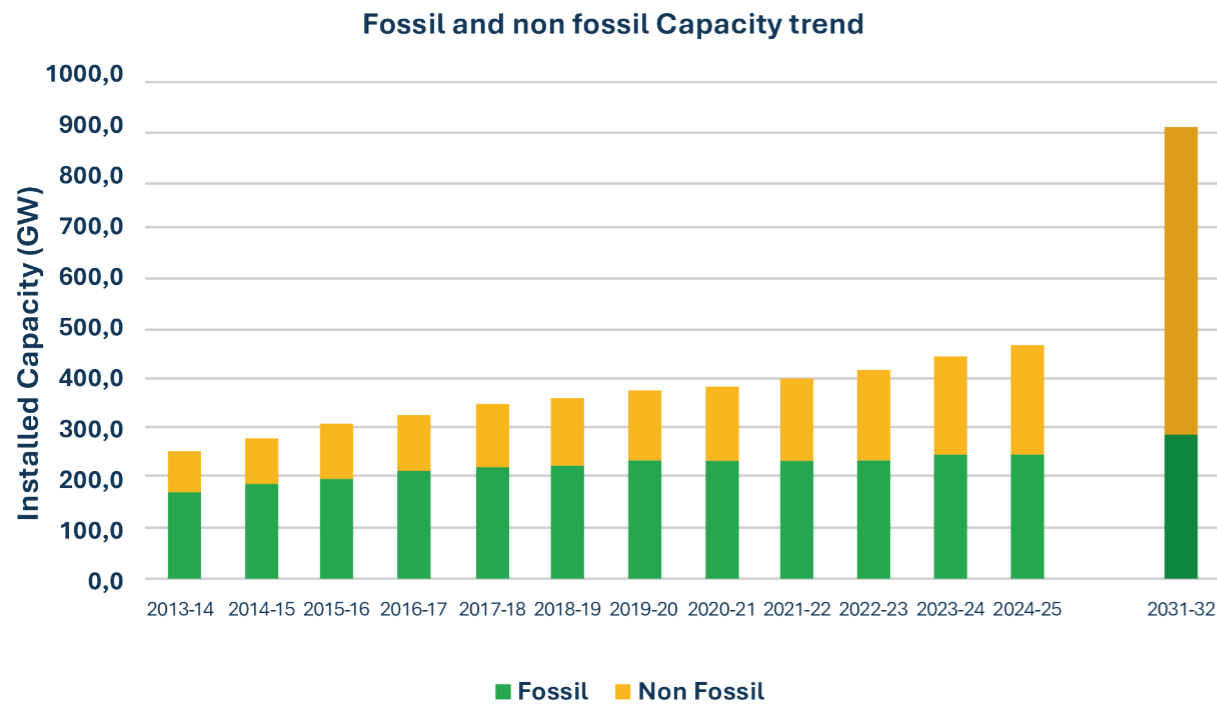


Figure 1: Fossil and Non fossil installed capacity trend

The ongoing Revamped Distribution Sector Scheme (RDSS) has played a key role in improving the operational efficiency of power utilities. Under the scheme, 227 million smart meters have been sanctioned out of which 22 million meters have been deployed till date. Further, on-grid connections are provided to tribal households, including those belonging to Particularly Vulnerable Tribal Groups (PVTGs). PVTG households are identified under the PM-JANMAN (Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan), while other tribal households are identified under the DA-JGUA (Dharti Aaba Janjatiya Gram Utkarsh Abhiyan).

In addition to the reforms across generation, transmission and distribution segments, India is implementing a range of policies, measures, and initiatives aimed at supplementing universal electrification, clean cooking and other energy services. There is a strong focus on promoting distributed renewable energy, energy conservation, electric mobility and creation of green jobs.

Some key initiatives in this regard are outlined below:

**Saubhagya Scheme:**

The scheme was launched to ensure universal electricity access to all households across the country in both rural areas and urban areas. Implementation of this scheme has been instrumental in achieving 100% household electrification. Under the scheme, 28.6 million households were electrified within a short time span of 18 months, making this one of the largest electricity access programs in the world.

**PM Surya Ghar Muft Bijli Yojana:**

Launched in February 2024, this scheme is one of the world’s largest domestic rooftop solar installation initiatives. It aims at transforming India’s energy landscape by providing free and clean electricity to 10 million households by March 2027. Over a million households have already benefitted from the scheme. The idea is not just to power homes and reduce emissions, but also to empower consumers to become prosumers. The scheme is driving India towards a cleaner, greener, and self-reliant future and is estimated to save 8.8 billion USD annually in electricity costs.

**PMKUSUM:**

Launched in 2019, the scheme aims to provide water and energy security to farmers while increasing their incomes and reducing emissions. It promotes installation of standalone solar pumps and solarization of existing grid-connected agricultural pumps. Recognized as one of the world’s largest agricultural solarization initiatives, the scheme has led to over one million installations, benefitting more than 410,000 farmers.

**Unnat Jyoti by Affordable LEDs for All (UJALA):**

Over the past decade, UJALA has emerged as the world’s largest zero-subsidy program for providing affordable energy-efficient LED bulbs, tube lights, and fans to households. It reflects India’s strong commitment to responsible and sustainable energy use. To date, more than 368 million LED bulbs have been distributed, resulting in annual energy savings of 48 billion units and a reduction of 38 million tonnes of CO2 emissions.

**Street Lighting National Programme (SLNP):**

Introduced alongside UJALA in 2015, this programme has been instrumental in reducing electricity consumption of street lights by replacing conventional streetlamps with LED lights in urban and rural areas. Till date, over 13.4 million LED Street lights were installed, resulting in annual energy savings of 9 billion units and a reduction of 6.2 million tonnes of CO2 emissions.

**PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) Scheme:**

The scheme, launched in October 2024, with an outlay of USD 1.3 Billion, aims to accelerate the adoption of Electric Vehicles (EVs), establish charging infrastructure, and build a robust EV manufacturing ecosystem in the country. It serves as a blueprint for accelerating the adoption of electric vehicles by offering financial incentives, promoting indigenous manufacturing and strengthening the EV ecosystem.

**Access to clean cooking solutions**

India is promoting clean cooking technologies, such as improved cookstoves and LPG stoves to ensure clean and affordable access to cooking solutions across the entire spectrum of population. Access to clean cooking is vital to safeguard public health, particularly in rural communities and in this regard, various schemes have been introduced by the government to provide affordable clean cooking solutions to the people.

**Pradhan Mantri UJJWALA Yojna (PMUY):**

This flagship scheme aims to provide clean cooking fuel—Liquefied Petroleum Gas (LPG)—to rural and deprived households that traditionally relied on firewood, coal, or dung cakes. These conventional fuels posed serious health risks, especially to women, and harmed the environment. Over the past decade, access to clean cooking fuel has seen a significant improvement. The LPG customer base has grown from 145 million to 324 million, with 128 million beneficiaries added directly under PMUY. Despite a 63% increase in the average Saudi CP in recent years, the effective price for PMUY beneficiaries has been reduced by 44%, bringing the cost down to around USD 0.41/kg, thereby ensuring affordable access to clean cooking energy.

**E- cooking:**

Post-Ujjwala, India is now advancing towards e-cooking as the next step in clean cooking solutions. Efforts are underway to develop standardized and affordable e-cooking models, with the aim of expanding coverage across all urban areas. E-cooking is also recognized as a vital component of Mission LiFE (Lifestyle for Environment)—India’s global initiative to encourage responsible consumption and promote environmentally sustainable practices at both individual and community levels.

**Access to Cooling Services**

Comfort cooling is increasingly acknowledged as a developmental necessity across the world. In India, cooling demand is projected to increase eight-fold by 2037–38, with space cooling alone expected to account for nearly 30% of total electricity consumption. To address this rising demand sustainably, several policy measures have been introduced to promote energy-efficient and environmentally responsible cooling solutions.

**The Energy Conservation and Sustainable Building Code (ECSBC):**

Energy conservation codes have been laid down for both commercial and residential buildings to promote passive cooling and improve thermal comfort. These policies require the inclusion of design features in new buildings—such as roof and wall insulation, high-reflective paints, optimized window-to-wall ratios, energy-efficient glazing, and the use of sustainable materials like fly ash bricks and autoclaved aerated concrete blocks. Integration of renewable energy systems is also encouraged to reduce overall cooling demand. To further promote energy-efficient construction, the Building Labelling Programme based on energy consumption has been expanded to include Net Zero Energy Buildings (NZEB) and Net Positive Energy Buildings (NPEB), encouraging adoption of cutting-edge sustainable practices.

**Standards & Labelling (S&L) program for Air Conditioners and Fans**

The Standards & Labelling (S&L) programme establishes minimum energy performance standards for appliances and equipment, using a star rating system to inform consumers about their energy efficiency. Room air conditioners (RACs) and ceiling fans—key cooling appliances in India—are covered under the mandatory regime of this programme. Over the past 15 years, the S&L programme has significantly

reduced energy consumption from air conditioners, while also driving technological advancements and innovation. Similarly, the programme is catalyzing a major shift in fan technology, promoting the adoption of energy-efficient Brushless Direct Current (BLDC) fans. As a result, BLDC fans now account for 13% of the market share, up from a negligible share earlier. Beyond RACs and ceiling fans, star labelling has also been extended to other cooling appliances, reinforcing India’s commitment to sustainable and energy-efficient cooling solutions.

**Affordability and Energy Policy**

Affordability and consumers’ ability to pay for energy services are key considerations in India’s energy policy formulation. The Government has adopted a range of targeted measures, including direct subsidy schemes, to protect citizens—especially low-income and vulnerable households—from international price volatility and to ensure universal access to essential energy services.

Nearly 60% of India’s LPG demand is met through imports, and domestic LPG prices are closely linked to international benchmarks such as the Saudi Contract Price (CP). To shield low-income households from global price fluctuations, the Government has introduced several schemes, notably the Pradhan Mantri Ujjwala Yojana (PMUY).

Electricity subsidies—comprising both cross-subsidies and direct subsidies from State Governments—also play a critical role in enhancing affordability, particularly for agricultural users and low-income households. These subsidies help maintain affordable electricity prices for priority consumer categories, striking a balance between social equity and economic viability.

To promote the sustainable growth of the energy sector, India has implemented policies aimed at reducing the cost burden of clean energy adoption. These include capital subsidies, viability gap funding, and concessional financing for renewable energy and energy-efficiency projects. These initiatives have significantly increased the share of non-fossil fuels in the national energy mix, keeping India on track to meet its Nationally Determined Contributions (NDCs) and Sustainable Development Goals (SDGs).

**Balancing Growth, Affordability, and Sustainability**

Like many developing countries, India faces the complex challenge of balancing growing energy demand, ensuring energy security, and meeting environmental goals. This challenge is heightened by India’s low per capita emissions—well below global averages—and its legitimate development needs, which depend on reliable and affordable energy access. Addressing these competing priorities requires a planned and phased energy transition, rather than an abrupt shift.

Rising power demand presents both a challenge and an opportunity. India’s current per capita electricity consumption is 1,395 kWh—about 40% of the global average—indicating significant scope for economic growth and modernization. As the economy expands, both industrial and residential electricity

demand are expected to rise sharply, necessitating large-scale capacity additions and infrastructure development. Meeting this demand while ensuring affordability calls for strategic planning and efficient resource use.

A key challenge is balancing affordability with the costs of transition. The Government's approach combines targeted subsidies for vulnerable households with investment in infrastructure and clean energy projects.

Access to affordable capital, critical minerals, raw materials, and advanced technologies is vital for accelerating the clean energy transition while keeping energy costs manageable, especially for those with limited ability to pay. The Government is addressing this through coordinated expansion of generation, transmission, and distribution infrastructure. Emphasis on low-cost renewable energy—leveraging India's vast solar and wind potential—alongside nationwide energy efficiency measures, supports this balanced approach.

Initiatives such as the Energy Conservation Building Code, Standards & Labelling for appliances, and the upcoming Carbon Credit Trading Scheme for industries reflect a comprehensive strategy to manage demand growth without compromising development goals.

These efforts demonstrate India's strong commitment to achieving SDG-7 and a sustainable, inclusive energy future. They also offer valuable lessons and collaborative opportunities for policymakers, industry leaders, and international partners aiming to scale sustainable energy solutions in other developing countries.





# Indonesia's Views on Access to Energy Services

## Overview

Indonesia holds the most unique position as a large archipelagic country with around 17,000 islands and highly uneven distribution of populations. By these significances, Indonesia encounters enormous challenges in ensuring access to energy across its diverse and remote regions, while transitioning towards more sustainable energy and maintaining economic growth, and prioritising national energy sufficiency and energy resilience.

The Indonesia's Fourth-Amended 1945 Constitution on its Article 33 No.3 mandates that the land and waters and the natural wealth contained in it shall be controlled by the state and utilised for the optimal welfare of the people. Therefore, from those premises, achieving universal energy access is highly essential for all Indonesians across Indonesia's regions, while it also the main key developmental indicator in the Agenda 2030 SDGs especially SDG7 – aiming to ensure access to affordable, reliable, sustainable, and modern energy for all, so that there will be no one left behind.

The second of the eight visions (Asta Cita) of President Prabowo Subianto Djojohadikusumo's Administration aims for "Strengthening the country's defense and security system and encouraging national independence through self-sufficiency in food, energy, water, creative economy, green economy and blue economy." Accordingly, the Presidential Decree No 1 Year 2025 emphasises the acceleration of national energy security through the availability and fulfilment of domestic energy needs, both from oil and gas, electricity, and the development of new and renewable energy.

Therefore, Indonesia's national energy priority aims to achieve national energy self-sufficiency through ensuring energy security and resilience and downstreaming mineral resources. Indonesia's National Energy Governance is intended for the provision, management, and utilisation of energy, as well as the provision of strategic reserves and conservation of energy resources for achieving national energy self-sufficiency, national energy resilience, and for fulfilling Indonesia's commitment in decarbonising the energy sector.

Indonesia's energy development priorities are carried out by considering the balance of economic aspects; affordability; security of energy supply; and environmental preservation. For Indonesia, energy must be viewed not only as a commodity, but as development capital prioritized to meet domestic energy needs and strategic reserves, in order to secure long-term energy supplies. Furthermore, the Presidential Decree No. 96 Year 2024 state that Indonesia should have energy buffer stocks for crude oil, gasoline, and liquefied petroleum gas equivalent to 30 days of net imports by the year 2035.

To this significance, Indonesia welcomes BRICS Brazilian Chairship 2025 to promote just and inclusive energy transitions through ensuring access to energy services and new and sustainable fuels. While achieving universal energy access, the transition must be clean, just, sustainable, affordable, inclusive, and in line with national circumstances, developmental priorities, and technological sovereignty. The energy transition is carried out by ensuring the readiness of the national program as a whole and

maintaining the security of the national energy supply.

### Access to Electricity and its Services

Indonesia remains committed to enhance access to electricity and clean cooking solutions. Indonesia has made significant pathways in expanding electrification rates and implementing clean cooking programs. Indonesia hopes that these efforts will serve as exemplary models of best practices for other countries and contribute to sustainable energy transitions. For Indonesia, these are critical to focus on ensuring equitable access to modern energy services for all citizens, and pivotal to achieve not only the national energy self-sufficiency, but also energy security and energy resilience.

As mandated by the Constitution, considering the national interest in improving the welfare of Indonesians, the whole transmission and distribution of electricity are owned and operated by the Indonesian State Utility i.e. PT PLN, despite of the roles of Independent Power Producers (IPPs) in power productions. Therefore, PT PLN applies public service obligations including discount rate for whole consumers of electricity and continues to subsidise electricity for targeted consumers of low-income households.

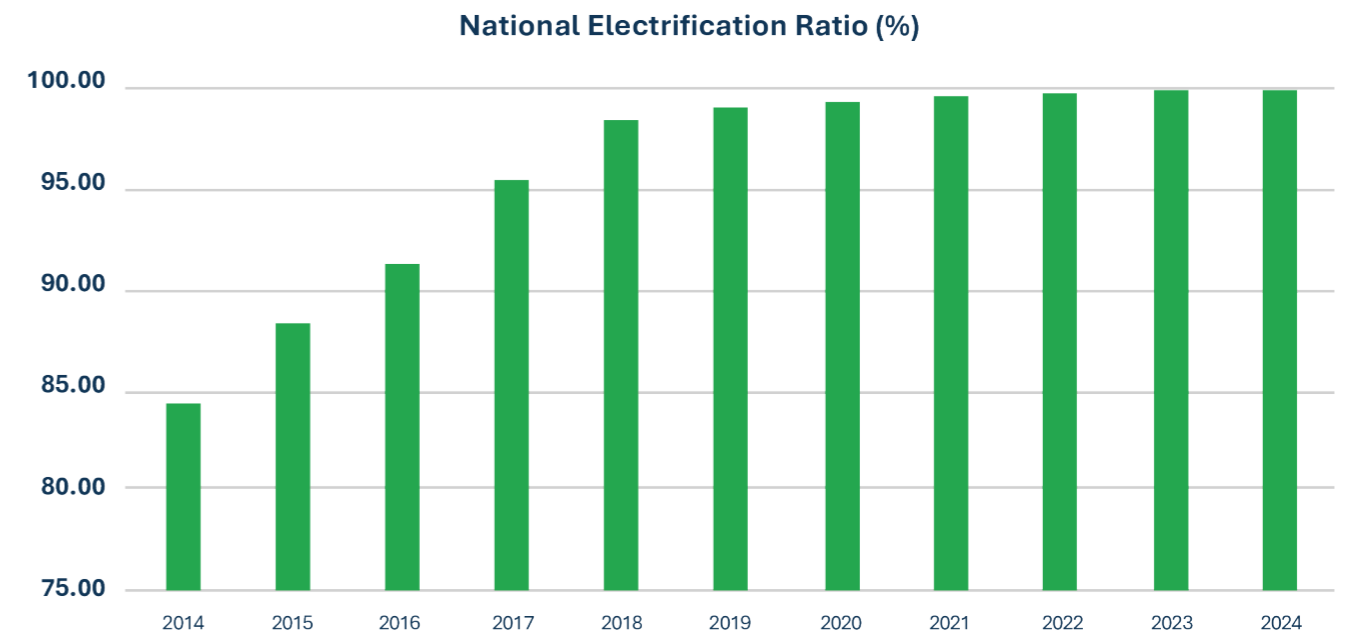
In the first quarter of 2025, the Indonesian Government applied a discount programme for electricity tariff to boost the economy out from stagnancy and deflation. In accordance with the Regulation of the Minister of Energy and Mineral Resources Number 7 of 2024 concerning Electricity Tariffs provided by PT PLN (Persero), electricity tariff adjustments for non-subsidized customers are carried out every 3 months with reference to changes in the realization of macroeconomic parameters, namely: exchange rates, Indonesian Crude Price (ICP), inflation, and Reference Coal Price (Harga Batubara Acuan/HBA). The electricity tariff for the first quarter of 2025 was determined using the realization of macroeconomic parameters from August to October 2024. By considering those parameters, the electricity tariff should experience an increase. However, the Government has decided that the tariff for that quarter should remain the same as the tariff for the last quarter in 2024. The decision will be implemented soon if the Government does not stipulate otherwise.

In addition, to maintain purchasing power and improve people’s welfare, the Government provides electricity cost stimulus which is part of an incentive package in the economic sector in the form of a 50% discount on electricity costs to household customers of PT PLN (Persero) with installed electricity capacity of up to 2,200 VA, targeting around the total of 81.42 million customers.

In accordance with the Decree of the Minister of Energy and Mineral Resources Number 348.K/TL.01/MEM.L/2024 concerning the Provision of Electricity Cost Discounts for Household Consumers of PT Perusahaan Listrik Negara (Persero), a 50% discount is given to household customers of PT PLN (Persero) with a capacity of 450 VA, 900 VA, 1,300 VA, and 2,200 VA which is valid for two months, namely January and February 2025.

Discussing electricity access, over the past decade, Indonesia has made remarkable strides in expanding electricity access, increasing its electrification ratio from 84.35% in 2014 to 99.85% in 2024 while ensuring affordability and sustainability. Here is presented Indonesia’s national electrification ratio in the last decade.

**Graphic 1. Indonesia’s National Electrification Ratio, 2014-2024**



Source: Directorate General of Electricity, Indonesian MEMR, 2024.

Moreover, in terms of electrification ratio, Indonesia’s electricity is almost fully monopolised by PT PLN, as mandated by the Constitution and the Law of Electricity, considered as public goods. In 2024, Indonesia’s electrification ratio from PT PLN’s Grid was 98.45%. The rests of the electrification ratio come from the micro-/mini-grid outside PT PLN, and the Solar Lighting Devices in local communities, which held 0.99% and 0.39% respectively.

**Table 1. Indonesia’s Electrification Ratio Contribution**

Contributors	Electrification Ratio Rate (%)
State Utility – PT PLN	98.45
Non-PLN	0.99
Solar Lighting Devices/LTSHE	0.39

Source: Directorate General of Electricity, Indonesian MEMR, 2024.

The massive geographical challenges of Indonesia have made variations in energy access rate. In terms of electrified villages throughout Indonesia’s territory, Indonesian villages’ percentage with access to electricity was 99.92% by the end of 2024, while the electrified villages percentage with electricity access from State Utility was 93.05%. Therefore, the remaining gap 5.87% of total villages came from the micro-/mini-grid schemes outside PT PLN as illustrated below, which are more significant and hold key roles in providing access for villages.

**Table 2. Indonesia’s Electrified Villages Percentage**

Scope	Percentage of Villages (%)
Electrified Villages Nationwide	99.92%
State Utility / PT PLN	93.05%
Non-PLN	5.87%

Source: Directorate General of Electricity, Indonesian MEMR, 2024.

Indonesia also promotes energy access through Decentralized Renewable Energy (DRE) initiatives, establishing over 1,000 microgrids and clean energy solutions such as solar PV, micro-hydro, and biogas systems, which also support local businesses and reduce diesel dependency. Youth engagement in local energy development, notably through the Patriot Energi Programme, is also important to enhance electricity access and empower local communities in remote areas.

As our strategic policy to support the acceleration of energy transitions and achieving universal energy access at the same time, Indonesia is trying to develop smart grid technologies across the large islands to create better interconnections.

### Access to Energy Services in EV Ecosystem

In Electric Vehicles (EVs), Indonesia has the EV acceleration programme, and including its ecosystem. By 2030, we target to deploy 13 million two-wheeler EVs and 2 million 4-wheeler EVs. These ambitions can slash GHG emissions around 7.23 million tonnes CO2equivalent and save energy around 29.72 million BOE. Following the expanding uses of EVs in urban environment, Indonesia is developing key infrastructures namely the charging stations, both EV-only stations and Integrated with Gas-Stations. The current numbers of those charging stations are 2243 stations.

Moreover, in terms of motorcycle or two-wheeler users, Indonesia has marked some notable ranks among other economies. According to World Population Review, Indonesia has become the second largest country with around 112 million two-wheeler units after India with 221 million motorcycles. Indonesia also becomes the third largest country by two-wheeler percentage to households with 85%

after Thailand (87%) and Vietnam (86%). Therefore, as a country with enormous two-wheeler numbers and two-wheeler percentage of households, Indonesia has been implementing ICE-to-EV two-wheeler programme, and targets to convert 5 million units in coming years.

### Nuclear as the Future Baseload towards Sustainable Energy

As an emerging economy and market, Indonesia’s electricity demand continues to rise. To meet this need, the Indonesian government continues to explore various clean and low-carbon energy options, including nuclear power.

Both Large Scale Nuclear Power Plants (NPPs) and Small Modular Reactor (SMRs) are already considered in the electricity generation planning (namely Rencana Umum Ketenagalistrikan Nasional or RUKN) issued this year. Based on the document, nuclear power will start operating in 2032, and planned to contribute to the share of electricity system for 35 GW by 2060.

To prepare the nuclear energy programme, Minister of Energy and Mineral Resources has set the preparation team across ministries/agencies for establishing the Nuclear Energy Programme Implementation Organisation (NEPIO).

The Planning phase of Nuclear Power Plant implementation is very critical for Indonesia. Indonesia needs to develop many aspects, including the regulatory frameworks, technical and economic aspects, safety and security, and social aspects. Nuclear safety and security are highly crucial ones. Therefore, we emphasize the importance of compliance with international nuclear safety and security standards as established by the International Atomic Energy Agency (IAEA).

Moreover, integrating nuclear power into Indonesia’s electricity system currently still requires comprehensive studies on geological, environmental, and social readiness aspects, economic feasibility, and regulatory frameworks.

In terms of greater economic benefits beyond clean energy supply, NPPs development also has the potential to generate long-term economic impacts for Indonesia, including job creation, the enhancement of domestic industrial capabilities, and the strengthening of local supply chains in the electricity and nuclear technology sectors. However, to ensure that these benefits are fully realised, there are needs for Indonesia to have a clear strategy for technology transfer and human resource capacity building. Another essential factor which needs to be considered is Indonesia’s strategy in handling the nuclear waste.

### Downstreaming Mineral Resources

For Indonesia, downstreaming Mineral Resources is pivotal for ensuring access to more sustainable energy and economy. Indonesia puts emphasis on the rights of resource-owner countries to regulate

and manage the resources' supply chains, including critical minerals; and on ensuring fair value creation and sustainable development in accordance to the national priorities.

Reflecting these views, Indonesia has arranged its national downstreaming roadmap to ensure value addition and sustainable development. This roadmap comprises 28 downstreamed commodities in several economic sectors such as mineral and coal, oil and gas, plantation, marine and fisheries, and forestry with total investment of USD 618 Billion.

From that total investment, USD 567 Billion or 91.7% portion comes from Mineral and Coal and also Oil and Gas. Downstreaming Mineral and Coal is prioritised to key commodities including coal, nickel, tin, copper, bauxite, iron and steel, gold and silver, asphalt, silica sand, manganese, cobalt, and Rare Earth Elements.

For illustrations, the Nickels Downstreaming aims to develop battery industries, since the needs for Nickel components on Nickel-Cobalt-Aluminium (NCA) Batteries and Nickel-Manganese-Cobalt (NMC) amount to 80%. Developing battery industry ecosystem will increase the industries in electric vehicles (EVs), reduce the conventional or Internal Combustion Engine (ICE) vehicles, and slash fuel imports. Hence, Indonesia can improve energy security and energy resilience.

The Downstreaming Policy Strategy comprises the integration of supply chains between mining and smelting facilities and also the user industries in refined minerals materials. Then, this also includes the advanced and applied industries from refined minerals.

To accelerate downstreaming programme, solve problems and barriers, and solve legal issues encountered by mining companies, Indonesian Government has established the National Task Force on Downstreaming and Energy Resilience, which is led directly by the Minister of Energy and Mineral Resources.

These series of efforts reflect the global and national landscapes of energy and mineral resources. In global level, the world is encountering huge transformation in energy sector, especially on the growing demand for sustainable and low-carbon solutions towards energy transitions. The utilisation of new and renewable energy, including battery and storage technologies will increasingly develop in global level, and this development will require critical minerals in colossal scale.

Meanwhile, in national level, Indonesia has vast potentials in critical minerals, among others, the largest one in the global reserve for nickels, the fourth largest in the global reserve for bauxites, the ninth largest global reserve in coppers, and the largest global reserve for tins.

As a country with abundant mineral resources, Indonesia envisages to utilize those resources for enhancing sustainable economic growth, fulfilling energy transition- required materials, and creating job opportunities from downstreaming mineral programmes.

Indonesia is open to cooperate in downstreaming programme with mutual basis. To this view, Indonesia has perspectives which multilateral forums need to address in global mineral cooperation. First, in global contexts, it is important to initiate and strengthen multilateral collaboration which focuses on diversifying supply sources and enhancing data transparency on critical minerals supply chains. Second, producing countries and consuming countries need to build common policy mechanism which will drive investment to geographical areas, therefore, risks on resources dependency to one or two countries will be significantly diminished. Third, moreover, establishing technological-based strategic alliances will be also helpful to create a joint innovation ecosystem in refining and recycling technologies.

### Access to Clean Cooking

In terms of bioenergy-based clean stoves, Indonesia puts efforts to develop biogas digesters and biomass pellet stoves that improve household health and productivity, especially for women and children.

In specific for biogas programme, Indonesian Government with several international partners including the World Bank and HiVos through the Biogas Rumah (BIRU) Programme / Household Biogas Programme and its Foundation has been implementing biogas installations for households in rural and sub-urban areas in Indonesian provinces. This programme was initiated in 2009 with limited scale, and then developed to larger numbers of installations, consumers, and stakeholders.

Biogas Programme provides socio-economic benefits and impacts, and the achievements of various goals in SDGs, including SDG7. Principally, in terms of SDG7, as of 2023 through Programme BIRU, 28,557 Biogas installations have been installed and 9,043 Households use bio-slurry as fertiliser. In terms of SDG13 (Climate Change and Climate Actions), 528,781 Tonnes of CO2 reduced during 2011-2023.

Moreover, in terms of SDG1 (No Poverty), this biogas programme helps local stakeholders save money from pricy imported fuels. Then, it impacts the local economies and boosts local productivity from the local farmers, businesses, and entrepreneurs including women entrepreneurs. In terms of SDG2 (Zero Hunger), at least 9,043 households used bio-slurry resulted from the biogas installations as fertiliser, increasing crop productions and farming productivity.

Furthermore, in terms of SDG5 (Gender Equality) and SDG3 (Good Health and Well Being), there are various benefits. As certified by W+ standard, this programme achieved around 61 minutes time savings per day. These savings reduce the drudgery in kitchen and household activities and result to more time available for economic activities or leisures. No-smoke clean cooking with biogas also provides health benefits for the whole family, especially women and children. In addition, cooking is easier and faster. These benefits empower women, children, and youth.

The women empowerment also comes from providing equal access for men and women to certified biogas training and to utilise bio-slurry as a fertiliser. Women have double-opportunities to benefit from both biogas and bio-slurry. The bio-slurry is an excellent niche and alternative to chemical fertilisers. Bio-slurry has highly positive impacts on agricultural productivity, as shown by various studies.

In the past years, it had been a long way for Indonesia to provide sustainable access and transition from kerosene to gas. Indonesia's nationwide transition from kerosene to LPG has benefited 50 million households and cut CO2 emissions by 15 million tonnes. Moreover, to provide more access to cleaner, reliable, and affordable energy, the Government of Indonesia is currently conducting the city gas network program for households. The clean cooking programme has also become a benchmark for energy access and energy transition programme worldwide.

### Access to Energy Services: The Focus on Cooling Services

To support access to cooling access in specific and to energy efficiency in general, the Indonesian Government promotes energy-efficient appliances. These include, among others, programmes in Energy Conservation, such as Energy Management ISO 50001, Minimum Energy Performance Standards (MEPS) and the Labelling for energy-efficient appliances, energy service companies (ESCO), capacity building, and raising public awareness towards energy efficiency.

The Indonesian Government has launched its first National Cooling Action Plan on 23 August 2024, focusing on air conditioning, food and healthcare cold chains, mobile air conditioning and process cooling. Indonesia's National Cooling Action Plan (I-NCAP) is in line with the country's commitment to reduce greenhouse gas emissions by 32-43 percent by 2030, relative to the business-as-usual scenario, as outlined in its Enhanced Nationally Determined Contributions (ENDC).

According to Institut International du Froid/International Institute of Refrigeration (IIF/IIR), the I-NCAP is a landmark, comprehensive policy roadmap addressing the country's increasing cooling demand, energy efficiency in cooling appliances, and promoting the use of low-global warming potential (GWP) refrigerants.

The I-NCAP focuses on five refrigeration sectors: air conditioning in buildings, food cold chains, healthcare cold chains, mobile air conditioning and process cooling. In 2020, the total electricity consumed by air conditioning in buildings and the food cold chain combined was 79 TWh, equivalent to 30% of the country's total electricity consumption.

According to UN ESCAP, in the absence of effective interventions in the building sector, electricity demand is expected to increase by nearly 400%, from 62 TWh in 2020 to 241 TWh by 2040. Through targeted policy interventions, market enablers and regulatory enforcement, technological and financial interventions, and capacity building strategies, the I-NCAP aims to mitigate this rise by half, limiting electricity demand for air conditioning to 104 TWh by 2040.

The launch of the I-NCAP follows the implementation of several energy conservation policies earlier this year. They are Minimum Energy Performance Standards (MEPS) and energy labelling measures for 7 equipment, including air conditioners, refrigerators, and refrigerated display cabinets.

The I-NCAP is an inter-ministerial policy roadmap led by Indonesia's Directorate General of New, Renewable Energy, and Energy Conservation (EBTKE/DGNREEC), in collaboration with numerous national stakeholders. It was developed with support from the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the United Nations Environment Programme (UNEP) and inputs from Sustainable Energy for All within the framework of the Cool Coalition.

### Affordability and the Ability to Pay for Energy Services, and How These Aspects are Factored into Public Policy Formulation

Indonesia has plenty of natural resources, but many people still struggle to get affordable and equal access to energy especially in Eastern Indonesia. In 2024, 99.85% of the country had access to electricity; however, some regions, particularly in remote areas, still face challenges. Low-income households may spend as much as 15% of their income on energy needs. Many of them still use firewood for cooking, which worsens health and reduces productivity. Around 75% of them uses LPG or electricity, but the rest still rely on kerosene or biomass, showing that not everyone has access to clean energy.

To improve energy affordability, Indonesia has adopted a comprehensive, multi-layered policy approach. At the core of this strategy are extensive subsidy programs. Electricity tariffs are maintained at affordable levels for approximately 25 million low-income households with consumption below 900 VA, supported by a government subsidy of USD 2.5 billion in 2023. Additionally, around 40 million households benefit from subsidised 3-kg LPG cylinders, priced below market rates.

Social protection programs, such as the Program Keluarga Harapan (PKH)/Hopeful Family Programme, incorporate energy-related assistance within conditional cash transfer schemes. Pilot initiatives involving energy vouchers have also been introduced to help cover the costs of off-grid renewable energy solutions in underserved areas.

The transition to renewable energy further contributes to affordability. For instance, the B35 Biodiesel Mandatory Programme helps reduce dependence on imported diesel, while government-supported solar microgrids provide lower-cost electricity to remote communities.

Tariff reforms are designed to protect vulnerable groups. Progressive billing structures ensure that low-volume consumers—those using less than 1,200 kWh per month—pay lower rates, while cross-subsidisation mechanisms require higher contributions from industrial users to help fund residential energy subsidies.

Looking ahead, Indonesia's priorities include enhancing the accuracy of subsidy targeting through digital platforms. This may include linking benefits to the Identity Database of the Electronic-Based

Administration System (Sistem Pemerintahan Berbasis Elektronik/SPBE) Platform; expanding decentralised renewable energy systems such as micro-hydro and solar PV through community-based models; and mobilising green financing tools such as SDG Indonesia One to support clean cooking initiatives.





# Iran's Advancements on Access to Energy Services

## Overview

This report provides an in-depth analysis of Iran's energy landscape, focusing on access to electricity, clean cooking solutions, heating and cooling services, and energy affordability. It also explores the integration of these components into national energy policies.

## Access to Electricity

Iran has achieved near-universal access to electricity. By the end of 2024, 100% of the urban population and over 99.97% of the rural population had access to electricity. The number of electrified villages has increased from fewer than 6,000 in 1979 to over 58,927 by the end of 2024.

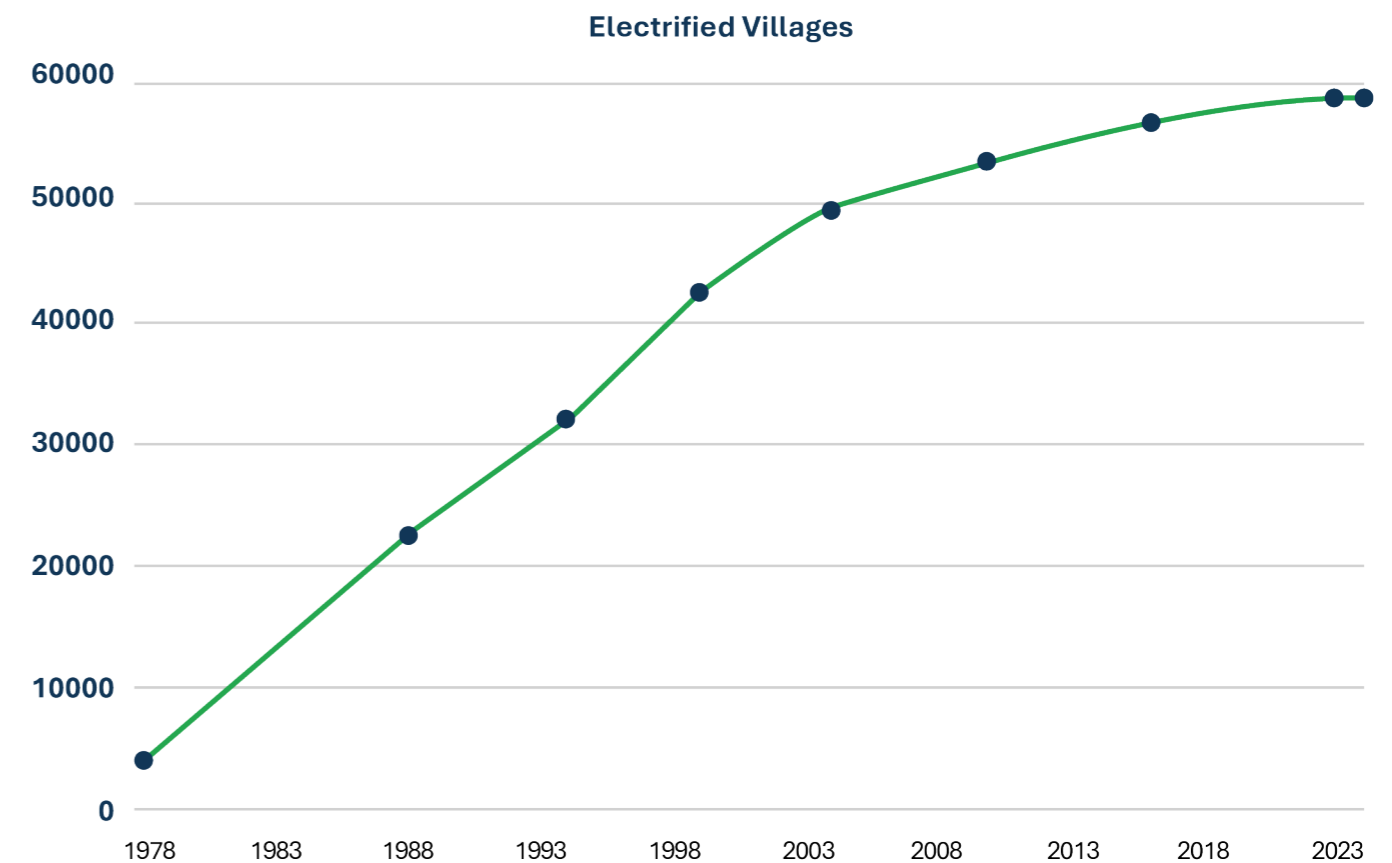


Figure 1. Number of Electrified Villages

The length of transmission and sub-transmission lines grew significantly, more than 10 times compared to 1979.

Lenght of transmission and sub transmission lines (km-circuit)

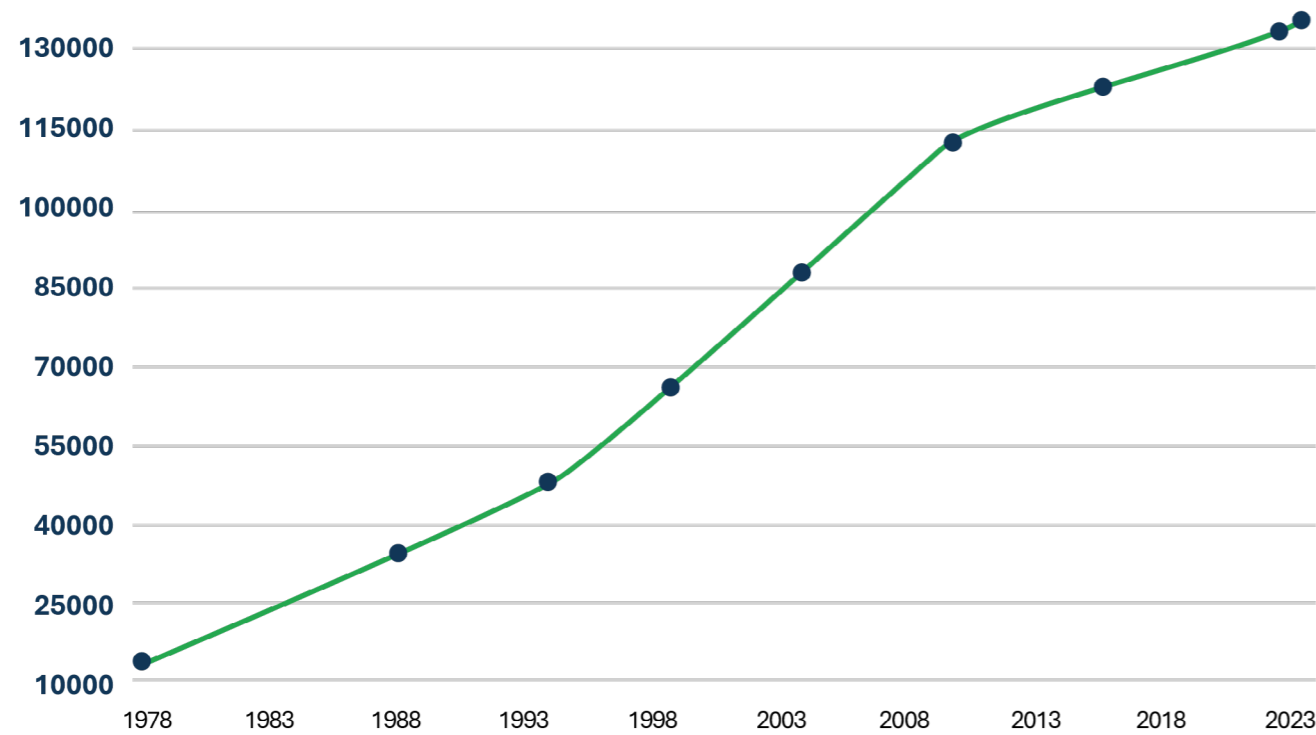


Figure 2. Length of transmission and sub-transmission lines

The number of electricity customers grew significantly, more than 11.4 times compared to 1979, indicating electricity’s transformation from a luxury to a necessity for economic development.

Number of Customers (10<sup>3</sup>)

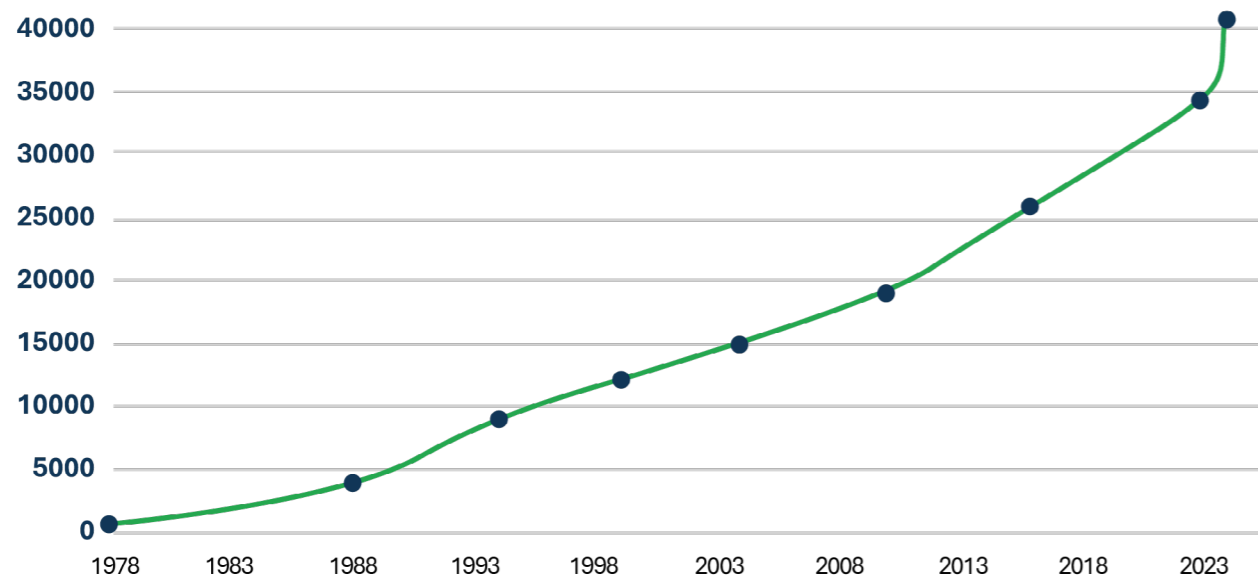


Figure 3. Number of Customers

To support this growth, Iran has invested heavily in the national bulk power grid:

- Medium and low-voltage distribution lines: 848,164 km
- Transmission and sub-transmission lines: 56,879 km and 79,154 km, respectively
- Total substation capacity: Over 477,709 MVA

These figures reflect an extensive and robust national infrastructure designed to ensure electricity availability across urban and rural areas.

### Access to Clean Cooking Solutions

Benefiting from the abundant natural gas reserves, Iran has achieved notable success in providing clean cooking fuel through widespread access to natural gas. As of March 2022:

- 98.75% of urban households
- 86.11% of rural households
- 95.54% of the total population were connected to the national gas grid.

Natural gas is known as the cleanest fossil fuel and definitely a much cleaner alternative to biomass or kerosene. Providing residential consumers with natural gas for cooking and heating application reduces indoor air pollution, making it a practical and healthier energy source for millions of households in Iran.

### Access to Heating and Cooling Services

#### Heating Services

Iran’s extensive natural gas network also supports residential heating, particularly during cold seasons. Over 95% of the population benefits from access to piped natural gas.

During winter months, the residential and commercial sectors consume the majority of gas supplied to the network—up to 70% according to the National Iranian Gas Company (NIGC). This spike in consumption has brought about a challenge to meet the demand during the winter peak times. These challenges underscore both the success of providing the population with the access to clean services, and the need for improved energy efficiency and conservation strategies during winter months.

#### Cooling Services

Cooling services in Iran are electricity-intensive. On hot days, 40% of national electricity consumption is attributed to cooling devices, particularly ACs and water coolers.

Each summer:

- 10 million Air conditioners (ACs) operate across Iran.
- They consume about 20,000 MW, equivalent to 25% of total peak demand.
- About 70% of households rely on ACs or water coolers.

This extensive use highlights both the importance of cooling for household comfort and the pressure it places on the electricity grid, especially during heatwaves.

### Affordability and the Ability to Pay for Energy Services

Iran has long viewed energy affordability as a tool for boosting social equity. Subsidized electricity and gas tariffs ensure broad access, particularly for low-income households. In 2023:

- The average electricity tariff was 3,268 Rials/kWh.
- The actual cost of supply (including financial and exchange-related costs) was 5,398 Rials/kWh.

This price gap reflects the presence of considerable targeted subsidies, which as of 2023 were focused on low-consumption residential and agricultural users.

Historically, the average electricity tariff rose from 1,685 Rials/kWh in 2021 to 3,268 Rials/kWh in 2023, suggesting that policy adjustments are underway to align energy pricing with energy efficiency guidelines.

In 2024, the average electricity consumption of residential customers in Iran reached 3,283 kWh, a significant increase from 1,343 kWh in 1978. This nearly 137% rise over 45 years highlights a consistent upward trend in energy use per household. The growth trajectory reflects various factors, including population expansion, urbanization, increased appliance usage, and lifestyle changes.

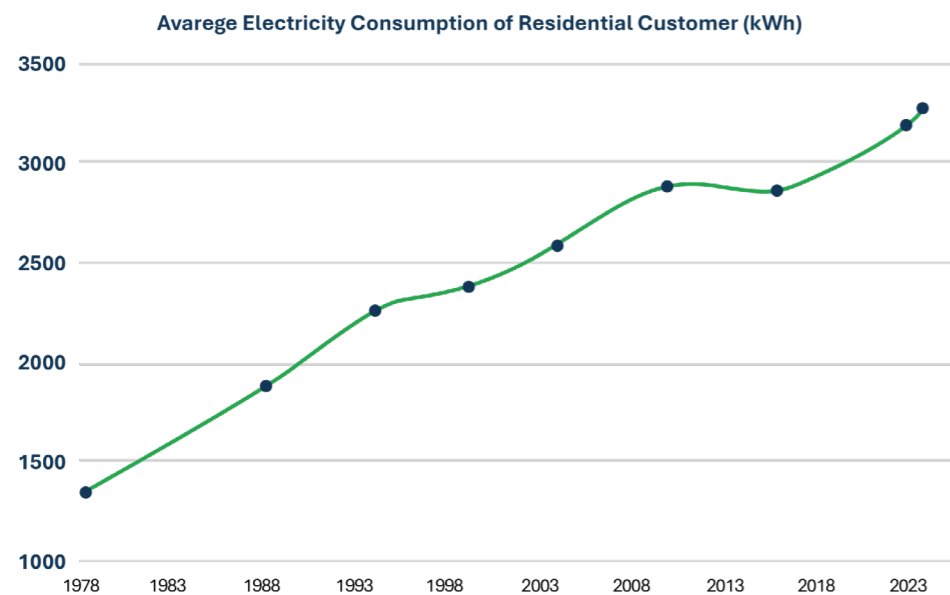


Figure 4. Average Electricity Consumption of Residential Customer

### Integration into Public Policy Formulation

Iran’s public policies reflect a comprehensive approach to energy development, shaped by historical needs and future goals.

### Rural Electrification

The government’s emphasis on rural electrification is evident in the constant rise in the number of electrified villages, supported by grid expansions and infrastructure investments.

### Energy Subsidies

To protect vulnerable consumers, energy subsidies are still in place. But in order to promote energy efficiency and energy conservation, energy subsidies have become more targeted during recent years, focusing on households with consumption below national norms.

### Energy Efficiency

Iran has introduced several policies to promote energy conservation, including:

- Revising building codes
- Enforcing Stricter energy labels for appliances
- Updating air conditioning and cooler standards

Aforementioned initiatives are of high importance due to the fact that 25% of electricity consumption occurs during summer peaks for air conditioning.

### Renewable Energy Development

Iran has made significant strides in solar energy, transitioning from early off-grid systems to a robust rooftop PV program supported by Feed-in Tariffs and government incentives. With over 16,000 rooftop systems generating 180 MW and a national goal of 2,750 MW from 550,000 units, Iran is building strong momentum in renewables. These initiatives underscore the country’s vast, yet still largely untapped, potential in both solar and wind energy. Iran seeks to promote renewable energy through:

- Feed-in Premium policies for renewable energy sources, mainly solar and wind
- Higher tariffs for locally-made equipment
- Mandatory renewable sourcing for government buildings
- Establishment of SATBA (Renewable Energy and Electricity Efficiency Organization)

These efforts are further enhanced by the ongoing construction of innovative renewable energy facilities,

including solar and wind power plants currently under construction.

### Demand-Side Management

Motivated by national initiatives for promoting energy efficiency, electric companies are deploying demand-side management programs to reduce peak loads and improve grid stability, especially during high-demand seasons.

### Pricing Policy Reforms

Ongoing pricing reforms aim to reduce fiscal pressures from subsidies while encouraging efficient use of electricity. Laws such as the “Development of the Electricity Industry” (issued in 2022 by the Parliament) reflect these evolving priorities.

### Conclusion

Iran’s energy sector has realized significant achievement in providing nationwide access to electricity and natural gas, which are essential for residential heating, clean cooking, and cooling across the country’s diverse climate. Having energy accessibility accomplished, energy affordability remains a central aspect of national policy; however, increasing energy demand and fiscal constraints are driving a shift toward targeted subsidies, renewable energy, and efficiency measures. Public policies reflect an evolving yet integrated strategy that addresses social equity, environmental sustainability, and economic viability. Renewable energy expansion, energy efficiency programs, and subsidy reform frameworks indicate a future where energy services are both more accessible and sustainable.





# Russia's Standpoint on Access to Energy Services

## Overview

Along with the rest of the world, Russia fully supports and shares the need to ensure universal access to affordable, reliable, sustainable, and modern energy sources. The development of sustainable energy is one of the key priorities of Russia's state energy policy. The fuel and energy sector (FES) of the Russian Federation ensures a balance between energy security, economic development and environmental protection.

To ensure energy security, Russia proceeds from the priority of a stable supply of affordable energy resources to the domestic market. Russia is one of the world leaders in hydrocarbon reserves, gross output and export of energy resources, as well as in the development, use and export of nuclear energy technologies. The Russian energy infrastructure (which is based on the Unified Energy System (UES) of Russia, the Unified Gas Supply System, and the main trunk pipeline system for transporting crude oil and petroleum products) is one of the longest in the world and operates in various natural and climatic conditions – from the Arctic to Subarctic zones<sup>1</sup>.

Electricity production by the end of 2024 increased by 3.1 % compared to 2023 and reached a record 1,191.7 billion kWh. The volume of new generating capacity commissioned at the end of 2024 amounted to 1.7 GW (0.9 GW in 2023).

In consideration of the projected increase in energy consumption and with due regard to the accelerated growth of the country's economy in 2024, the Russian government has adopted a Master Plan for the placement of electric power facilities until 2042. The Master Plan is intended to ensure the formation of a rational structure of generating capacities and power grid facilities in terms of the long-term balance of production and consumption of electricity and power in the UES of Russia. About half of the total electricity production in Russia comes from gas-fired power generation. At the same time, however, the share of completely carbon-free power generation represented by nuclear power plants, hydroelectric power plants and other renewable energy sources is about 37 % of the total electrical power generation. Thereout, the share of renewable energy sources, including large-scale hydropower, is 18,7 %.

One of the important areas that Russian energy policy is linked to is promoting the achievement of Russia's climate goals, which were outlined within the framework of the Nationally Determined Contributions (NDCs), as well as national program documents, such as the Climate Doctrine and Decree of the President of the Russian Federation No. 666 of November 4, 2020 On Reducing Greenhouse Gas Emissions, which set out key objectives, i.e. ensuring by 2030 a reduction in greenhouse gas emissions by 70 percent compared to the 1990 level, taking into account the maximum possible absorbing capacity of forests and other ecosystems<sup>2</sup>, as well as achieving carbon neutrality by 2060<sup>3</sup>.

In the meanwhile, achieving climate goals should not contradict the goals of Russia's energy security, i.e. maintaining the security of the country's economy and population in terms of ensuring reliable and sustainable provision of Russian citizens with standard-quality energy resources and services, ensuring

accessibility of technology infrastructure, securing the energy supply and improving energy efficiency.<sup>4</sup> Despite the fact that the task of ensuring universal access to energy is not on the agenda in Russia (100 % of the Russian population has access to energy), a targeted policy is being implemented to increase the efficiency of energy production and consumption, reliability and flexibility of the national grid while reducing greenhouse gas emissions in the fuel and energy sector. Increasing the accessibility of energy infrastructure is one of the key priority areas for the development of the Russian FES.

## National Energy Access Policy

Russia is carrying out large-scale work in order to increase the accessibility of energy services for the population, specifically through simplifying connection to electricity and gas supply networks.

A large-scale gasification program is being implemented in Russia to this end. Natural gas, including liquefied gas (LNG), is versatile and the most environmentally friendly among carbon-based energy resources. It can be used as a fuel for almost all types of transport, for generating electrical and thermal energy, and also serve as a feedstock for the production of hydrogen. The use of natural gas helps reduce greenhouse gas emissions and environmental damage.

We plan to further develop gas supply and gasification of the country's regions to achieve 100 % of the technically possible level of gasification by 2030, to meet domestic demand for gas, improve living conditions and improve the level of comfort of the country's residents, including rural community, and to increase economic potential and investment attractiveness of the territorial subjects of the Russian Federation. Over the past 10 years, the level of gasification in the country has increased by 9.3 percentage points and reached 74.7 % in 2024.

In 2021, Russia launched a large-scale social gasification program to provide a free gas supply to the boundaries of land plots wherein citizens' households are located in gasified settlements. According to this program, each owner of a private home can apply for connection. This will be possible provided that in the settlement where the households of individuals are located, gas distribution networks have been laid and gas is being transported. The gasification program for housing and communal services, industrial and other organizations in the current calendar year provides for the construction of gas distribution networks to the boundaries of such a settlement. An important requirement for participation in this program is the use piped gas at home. In the period from 2021 to 2024, the technological capability for connecting to gas networks became feasible for about 1.5 million households. However, network gasification is not the only way to increase the availability of natural gas for the population. In certain areas of the Russian Federation, where gas supply is economically ineffective or impossible due to remoteness and inaccessibility, alternative gasification mechanisms are used, such as liquefied and compressed natural gas, as well as liquefied hydrocarbon gas. One example of such gasification is the project implemented in 2019 to supply LNG to the Kaliningrad Region, a unique region in terms of location, which has no land borders with mainland Russia. As part of the project, a gas receiving terminal was built in the Baltic Sea to provide the ability to moor Marshal Vasilevsky, the country's only

floating regasification unit. This vessel transports LNG and performs its regasification, i.e. conversion from a liquid state to a gaseous state. The project has significantly strengthened the region's energy security and increased the availability of energy supplies for its consumers.

To increase the accessibility of energy infrastructure, systematic work is underway to simplify the connection of consumers to electrical grids, including the construction and modernization of new generating capacities and electric grid facilities. In 2024, significant changes were made to the legislation, providing for a reduction in the number of documents for filing an application for connection to the electric grid. Moreover, it was increased the transparency of the payment mechanism for the service, as well as for investors in the territory of special economic zones.

The construction of new power generation facilities is of particular importance for ensuring access to electricity. Over the past 10 years, generating facilities have been commissioned in Russia, making it possible to ensure uninterrupted power supply to strategically important regions of the country. In particular, in the Kaliningrad Region, which is a region that does not have land borders with Russia, the Mayakovskaya, Talakhovskaya, Pregolskaya and Primorskaya TPPs with a total installed capacity of over 960 MW were commissioned. The world's largest wind farm beyond the Arctic Circle, the Kola Wind Farm with a capacity of 202 MW, was put into operation in the Murmansk Region. A unique facility of its kind – Akademik Lomonosov, a floating nuclear thermal power plant with a 70 MW power unit – the only one of its kind in the world, was put into operation in the Chukotka Autonomous Okrug. It provides light and heat to the northernmost city of the country, Pevek.

To further develop the energy infrastructure and form a rational structure of generating capacities and power grid facilities, to prevent possible shortages of electricity and capacity, the Russian Federation adopted the Master Plan for the placement of electric power facilities until 2042.

Nuclear power remains an important area in providing access to energy services. According to the Master Plan for the placement of electric power facilities until 2042, 11 large-scale and small nuclear power plants will appear in Russia, including the construction of new nuclear power plants for remote areas and isolated electricity systems<sup>5</sup>. Small modular reactor projects are being developed to ensure access to electricity for the most remote settlements and locations.

As part of support for energy technologies, a New Nuclear and Energy Technologies National Project is being implemented in Russia. It includes initiatives aimed at developing closed nuclear fuel cycle technologies, as well as safe solutions in the field of nuclear energy, thermonuclear energy technologies, energy storage technologies, new equipment in the electric power industry, renewable energy sources and the oil and gas industry, including LNG<sup>6</sup>.

Renewable energy projects are under development to improve the quality of energy services, and specifically in remote and isolated areas. Since 2013, Russia has been implementing a program to support renewable energy sources in the wholesale electricity and capacity market. In consideration

of the specified targets, a competitive selection of innovative investment projects for the construction of generating facilities operating on the basis of renewable energy sources is held annually in relation to solar and wind generation, as well as hydropower generation with an installed capacity of less than 25 MW.

The first investment cycle of the state support program for renewable energy sources was implemented in the period 2013-2024. The competition that arose as a result of competitive selections made it possible to significantly reduce the average outlay for projects per 1 kW of installed capacity.

In 2021, the program for supporting the use of renewable energy sources in the wholesale electricity and capacity market was extended for the period 2025-2035. A system for signing contracts for the supply of capacity from renewable energy generating facilities to the wholesale market lies at the heart of this program. However, additional requirements for potential participants in the program are needed both in terms of compliance with indicators for the localization of energy equipment and in terms of the availability of an export supplies portfolio. The implementation of these measures will make it possible, starting from 2036, to stop subsidizing RES facilities using the mechanisms of the wholesale electricity and capacity market and at the same time make the Russian RES industry competitive in the domestic and world markets.

Along with the program for supporting renewable energy sources in the wholesale electricity and capacity market, there is also a program that supports renewable energy generation projects in retail electricity markets through the instrument of regional competitive selection of renewable energy projects, which qualify for the supply of electricity to grid operators (guaranteeing suppliers in isolated electricity systems) at a fixed rate following the results of the competition for a period of 15 years, allowing to recoup the investments made.

In 2024, 446 MW of new power capacity was added from renewables. 18 wind farms with total installed capacity of 10.26 MW, 56 solar farms (12.59 MW), three small hydro power plants (48.77 MW) and three geothermal power plants (69.4 MW) are running to serve small settlements in remote and isolated areas of the Russian Federation. One of the largest wind farms in Russia – the Kola Wind Farm with a capacity of 202.35 MW – is located in the Arctic Zone of the Russian Federation.

Energy efficiency remains an important aspect in the provision of energy services in Russia. A Comprehensive State Program of the Russian Federation Energy Saving and Improving Energy Efficiency was approved in 2023. The program is aimed at increasing energy efficiency in energy sector, industry, transport, housing and utilities. Following the implementation of the program, energy intensity of GDP is expected to be reduced by 35 % in 2035 compared to the 2019 level.

Increasing the energy efficiency of the economy is an important aspect of public policy not only at the federal but also at the regional level. In particular, as of 2022, 62 territorial subjects of the Russian Federation adopted regional programs in the field of energy saving and increasing energy efficiency, and

the actual volume of their financing in 2022 increased by 5.6 % and amounted to RUB 170 billion.

### **Russia's contribution to achieving universal access to affordable, reliable, sustainable and modern energy sources**

Apart from ensuring access to energy on the domestic market, Russia is actively working to assist other countries in providing affordable, reliable and environmentally friendly energy supplies. Russia's fundamental position lies in the fact that decarbonization of the global economy must be combined with the energy poverty eradication policy, providing consumers in all countries of the world with affordable and reliable energy sources, which, in the context of growing energy consumption, at least in the period up to 2050, cannot be achieved through abandoning and replacing traditional energy resources with renewable energy sources. With that knowledge in mind, we need to introduce advanced technologies for the use of hydrocarbons, further develop the gas industry, nuclear and hydrogen energy.

Ranking among the world's leading producers and exporters of oil and natural gas, including LNG, Russia is building its foreign economic activity on the basis of openness, predictability and mutual responsibility, while implementing these principles through active, long-term participation in the OPEC+, GECF formats, helping to ensure stability of energy markets. Russia also provides technical support in the construction and maintenance of power plants, including the BRICS countries.

Sigura Gura HPP (286 MW) in Indonesia and the Bokang Baling HPP (160 MW) in India were designed with the support of Russian companies.<sup>8</sup> Other new hydro projects, pumped storage stations, supply of equipment, and modernization of hydro projects are being implemented in India. In Ethiopia, Melka Wakena (153 MW) hydro power modernization project is being implemented with the support of the Russian side.

Russia's profound experience in the field of nuclear energy and the availability of advanced technologies contribute to expanding the use of peaceful atom in the BRICS countries. The Russian company is actively developing practical cooperation with most BRICS countries, including China, India, Egypt, and Iran.

In addition to practical bilateral cooperation, Russia is active on international platforms, advocating for access to reliable and affordable energy resources to ensure socio-economic development and strengthen energy security. Russia sets itself the task of maintaining the accessibility of energy for the population and businesses at affordable prices. In this regard, the imperative of ensuring access to energy for the population and all sectors of the economy in the Russian Federation is to provide the possibility of an independent choice of the pace and paths of energy transition, specifically based on the national circumstances of the formation of the energy mix and the development of energy sector bearing in mind the priorities of sustainable and balanced socio-economic development.



# United Arab Emirates's Position on Access to Energy Services

## Overview

The United Arab Emirates (UAE) stands as a global exemplar in achieving universal access to energy services through integrated policies, robust infrastructure, and ambitious clean energy goals. Aligned with its Net Zero by 2050 and the UAE Energy Strategy 2050, the country continues to expand inclusive access to electricity, clean cooking, cooling, and sustainable energy solutions. The UAE has already achieved 100% access to electricity and clean cooking fuels and ranked 1st globally in the related SDG7 indicators, driven by government investment, innovation, and strong regulatory frameworks.

### National Energy Policy and Clean Energy Transformation

Through the UAE's economic diversification efforts, the country has made significant progress in reducing its reliance on oil and transitioning toward a competitive, knowledge- and innovation-based economy. Currently, non-oil sectors contribute more than 70% of the total GDP. The renewable energy sector is expanding rapidly, with an 89.2% increase in total renewable capacity recorded between 2022 and 2024.

The UAE Energy Strategy 2050, launched in 2017 and updated in 2023, targets tripling the contribution of renewable energy and mobilizing \$54 billion in investments by 2030 to meet rising demand.

Key targets and initiatives include:

1. Translating the national net-zero goal into actionable policies
2. Increasing clean energy capacity to 30% by 2030
3. Achieving a grid emission factor of 0.27 kg CO<sub>2</sub>/kWh by 2030
4. Raising the energy efficiency target to 42-45% by 2050 through:
  - Building retrofit programs
  - Clean mobility initiatives
  - Energy management for industrial sector
  - And raising the public awareness in community

In 2023, the UAE launched its National Hydrogen Strategy to support low-carbon industries, accelerate Net Zero ambitions, and position the UAE among the world's largest hydrogen producers by 2031.

During COP28, hosted in the UAE, the country played a leading role in securing the Global Renewables and Energy Efficiency Pledge. A total of 133 countries committed to:

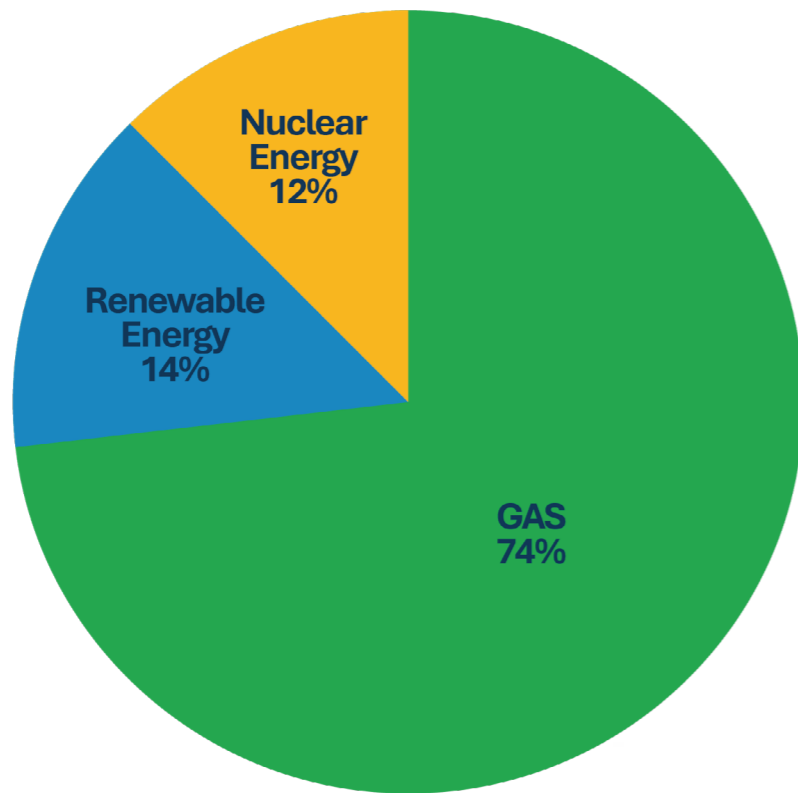
- Tripling global renewable energy capacity to at least 11,000 GW
- Doubling the global energy efficiency improvement rate to over 4% annually by 2030

These two pillars—tripling renewable energy and doubling energy efficiency—formed the core of the UAE Consensus adopted unanimously by 198 Parties.

Electricity Capacity is supported by a mix of energy sources:

- Natural gas remains the dominant source, accounting for 74% of energy capacity as of 2024.
- Renewable energy, including solar (PV and CSP), wind, Waste to Energy which contributed about 12%, with the aim to triple the share of renewable energy by 2030.
- Nuclear power is supplied by the Barakah Nuclear Energy Plant, which, when fully operational, will supply 5.6 GW, accounting for 12% of energy capacity as of 2024, with clean energy targets to exceed 19 GW by 2030.

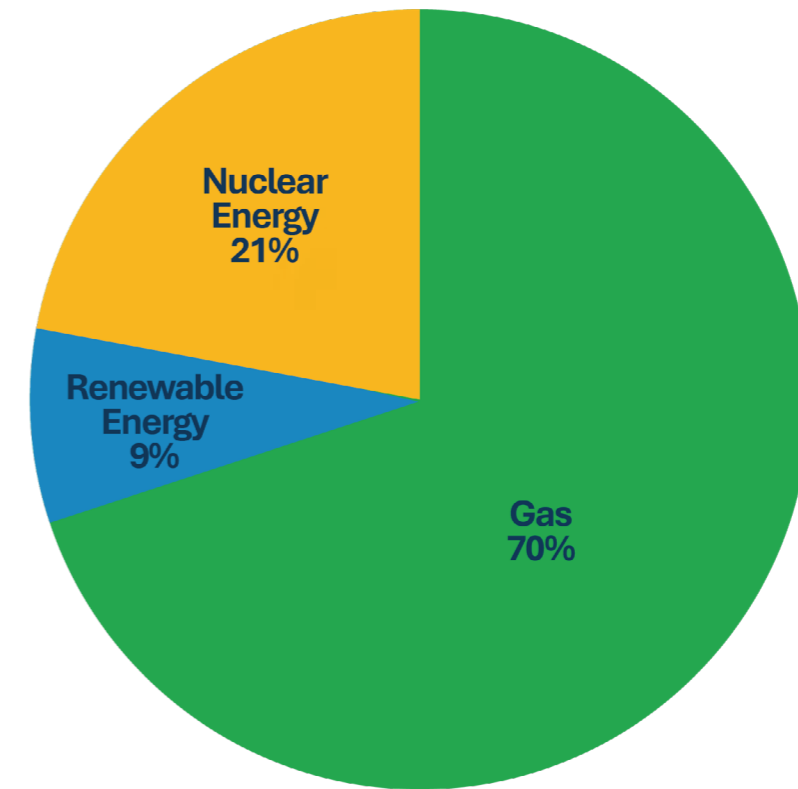
UAE ENERGY MIX CAPACITY (2024)



Electricity Generation is supported by a mix of energy sources:

- Natural gas remains the dominant source, accounting for 70% of power generation as of 2024.
- Renewable energy, which contributed about 9% power generation as of 2024.
- Nuclear power which accounts for 21% of power generation as of 2024.

UAE ENERGY MIX CAPACITY (2024)



### Decentralized and Regional Integration

- The United Arab Emirates is interconnected with the Gulf Cooperation Council states through the Gulf Cooperation Council Interconnection Authority (GCCIA), enhancing regional grid stability and energy security. The UAE actively pursues both bilateral and multilateral partnerships to deepen regional and global energy integration. A prominent example is the UAE’s collaboration with India, which includes efforts to establish a direct power interconnection and joint participation in the India-Middle East-Europe Economic Corridor (IMEC). This strategic corridor aims to bolster economic cooperation, accelerate clean energy deployment, and improve connectivity between Asia, the Middle East, and Europe. Through these initiatives, the UAE is reinforcing its commitment to cross-border energy trade, decarbonization, and global energy security.
- Initiatives are underway to connect renewable and hydrogen value chains across the region via the including unlocking cross-border hydrogen trade corridors and identifying priority actions for governments and industry to advance from announcements to implementation on the ground, under the International Hydrogen Trade form.
- The distributed renewable project with a capacity of more than 700 MW, microgrids, and integrated

water-energy nexus models.

Overall, the UAE's energy and power sector remains dynamic, driven by ongoing efforts to diversify the energy mix, rapidly expand the share of clean energy, and improve efficiency—advancing sustainable practices that support long-term economic resilience and environmental stewardship.

## Access to Electricity

The UAE ranks 1st globally in proportion of population with access to electricity (100%).

The UAE has attained 100% access to electricity across all emirates, urban and rural. Electricity is delivered through a reliable national transmission and distribution system, in addition to that it's connected regionally through the GCC Interconnection Authority (GCCIA).

## Key Global Competitiveness KPIs

The UAE ranks among the top nations globally in several energy access and clean energy competitiveness indicators:

Ranks 1st globally in 2024:

- 100% Electricity access (% of population)
- 100% Access to clean cooking fuel (% of population)
- 100% Rural electricity gap
- 1st globally in the Competitiveness in green hydrogen production index
- 1st globally in the Hydrogen market readiness in the MENA region in 2023

Ranks 2nd globally:

- Speed of energy sector transition in 2023
- Per capita solar energy consumption index (jumped from 6th to 2nd) in 2024

Among the top ten:

- 5th in Energy Infrastructure index in 2024

Electricity affordability is supported through progressive subsidies for citizens and rationalized tariffs for residents. Distributed solar energy and the Federal Decree by Law Regulating the Connection of Renewable Energy Production Units Distributed on the Electrical Grid will enable residential and commercial users to generate their own electricity, currently Shams Dubai first smart initiative to connect solar energy to buildings, a part of the Distributed Renewable Resources Generation programme, with

capacity more than 750 MW.

## Access to Clean Cooking

The UAE ranks 1st globally in SDG 7.1.2: Access to clean fuels and technologies for cooking (100%).

Main cooking energy sources include:

- Liquefied Petroleum Gas (LPG) – regulated distribution and fixed price structure
- Electricity – widely adopted in urban households

Policies and practices:

- Mandatory safety standards for all gas connections (Emirates Authority for Standardization and Metrology)
- Public campaigns on safe LPG use and electric cooking alternatives
- Regular appliance inspections, especially in low-rise residential buildings

Through its advanced infrastructure and near-total urbanization, the UAE eliminated reliance on biomass or solid fuels decades ago. Today, induction stoves, electric ovens, and LPG-fueled systems are commonplace in all emirates.

## Access to Heating and Cooling Services

Cooling is essential in the UAE, where temperatures frequently exceed 45°C. Air conditioning constitutes from 60%- 70% of electricity consumption during summer peaks.

Key policies and initiatives:

- High-efficiency air conditioning mandates through UAE Standard No. 5010
- Cabinet Resolution No. (1) of 2024 Concerning the Technical Regulations on Efficient Energy Consumption for Home Cooling Devices in the United Arab Emirates
- Sustainable Green Building Codes (National Code), Estidama.(Abu Dhabi), Al Sa'fat (Dubai), and Barjeel (Sharjah) green building codes
- Mandatory thermal insulation standards in new constructions

UAE is leading the Global Cooling Pledge which provides an opportunity to commit to sustainable cooling with concrete actions. An initiative of the United Arab Emirates as host of the 2023 United Nations Climate Change Conference (COP28), the Pledge is one of nine non-negotiated declarations, pledges, and charters that constitute key outcomes for the COP28 Presidential Action Agenda. It aims

to raise ambition and international cooperation through collective global targets to reduce cooling related emissions by 68% from today by 2050, significantly increase access to sustainable cooling by 2030, and increase the global average efficiency of new air conditioners by 50%.

Subsidized tariffs ensure citizens' access to affordable cooling. MOEI also promotes the use of energy-efficient ceiling fans, evaporative coolers, and cool roofing materials in public housing schemes.

In terms of heating, demand is minimal due to the mild winter season. Where required, electric water heaters and solar water heating systems (especially in hotels and government buildings) meet thermal needs efficiently.

### Policies to Address Affordability

The United Arab Emirates (UAE) has achieved universal energy access, ensuring that no citizen or resident is left behind. Through continued innovation, regulatory refinement, and international partnerships, the country is positioned to serve as a global model for integrated, just, and future-ready energy access systems. The UAE's journey affirms that universal energy access and climate goals are mutually reinforcing—not mutually exclusive.

To ensure equitable access to energy services, the UAE has implemented a range of policies aimed at maintaining affordability, particularly for low-income and vulnerable populations:

1. **Electricity Subsidies:** The UAE provides subsidized electricity tariffs for Emirati citizens, ensuring that basic energy needs are met at affordable rates. Expatriate residents are subject to tiered tariff structures that encourage energy conservation while maintaining reasonable costs.
2. **LPG Subsidies:** Liquefied Petroleum Gas (LPG), commonly used for cooking, is subsidized to keep prices stable and affordable for households. This policy supports the widespread use of clean cooking fuels across the country.
3. **Energy Efficiency Programs:** The UAE has launched the National Demand Side Management (DSM) Programme to reduce energy consumption, thereby lowering utility bills for consumers.
4. **Targeted Support Programs:** During periods of economic strain, such as the COVID-19 pandemic, the UAE government has provided additional support to households to offset increased energy costs, demonstrating a commitment to energy affordability during crises.

These measures reflect the UAE's dedication to ensuring that energy services remain accessible and affordable for all segments of the population, aligning with the nation's broader goals of sustainability and social equity.

### Governance and Institutional Framework

The UAE's energy access governance is defined by inter-agency coordination, with oversight from: Federal-Level Regulation

The Ministry of Energy and Infrastructure plays a central role in governing the electricity sector at the federal level. It establishes overarching policies and national standards to ensure a reliable, affordable, and sustainable electricity supply across the Emirates. MOEI also oversees federal utilities and supports strategic interconnection, clean energy integration, and national electricity planning.

Emirate-Level Regulation

At the emirate level, dedicated regulatory authorities manage the electricity sector according to regional priorities, under federal policy guidance:

- **Abu Dhabi:** The Department of Energy (DoE) regulates the electricity sector, ensuring sustainability and compliance. The Emirates Water and Electricity Company (EWEC) handles generation and procurement, succeeding ADWEC since 2018.
- **Dubai:** Dubai Electricity and Water Authority (DEWA) is a vertically integrated utility responsible for electricity generation, distribution, and retail. It works alongside the Dubai Supreme Council of Energy (DSCE), which sets energy strategy.
- **Sharjah:** The Sharjah Electricity, Water, and Gas Authority (SEWA) oversees electricity supply, infrastructure development, and pricing within the emirate.
- **Northern Emirates:** Etihad Water and Electricity (EtihadWE), regulated by MOEI, manages electricity services in Ajman, Umm Al Quwain, Ras Al Khaimah, and Fujairah. Established by Federal Decree-Law No. (31) of 2020, EtihadWE succeeded the Federal Electricity and Water Authority (FEWA) to enhance service efficiency. Ownership was transferred to the Emirates Investment Authority.

This multi-tiered regulatory framework reflects the UAE's commitment to local governance while maintaining a coherent national vision for energy access. It provides the flexibility needed to address each emirate's unique energy landscape, enabling the UAE to meet its energy access, security, and sustainability goals. Decision-making is supported by national dashboards, utility-scale data platforms, and regular public engagement.

### International Cooperation

The UAE supports energy access globally through:

- UAE-Caribbean Renewable Energy Fund (US\$50 million)
  - IRENA partnerships hosted in Abu Dhabi
  - Africa Solar Program and the Etihad 7 Initiative (providing 100 million people with electricity)
- \* In 2022, the UAE and the US launched the Partnership for Accelerating Clean Energy, PACE, which is mobilizing 100 billion US dollars to deploy 100 new gigawatts of clean energy by 2035. Key projects under PACE include:
    - \* In September 2024, UAE clean energy company Masdar announced the closing of its acquisition of a 50% stake in Terra-Gen, one of the largest independent renewable power producers in the US. This deal expands Masdar's US renewables portfolio to over 3 GW of solar, wind and storage projects across California, Texas, New Mexico and Nebraska.
    - \* Working with the US Government's Power Africa initiative, UAE-based Averri Finance and AMEA Power will mobilize \$10 billion, build 8 GW of renewable energy and connect 500,000 homes in sub-Saharan Africa to advance clean energy solutions.
    - \* In September 2024, ADNOC announced a 35% stake in ExxonMobil's proposed low-carbon hydrogen and ammonia production facility in Baytown, Texas. The facility aims to produce up to approximately 900,000 tons of low-carbon ammonia per year, enabling the transition to cleaner fuels in hard-to-abate sectors.
- Alterra is the world's largest private climate investment fund, established from the vision and outcomes of COP28 to bring transformative scale to the global climate agenda. It is designed to accelerate the transition to a net-zero, climate-resilient future by mobilizing capital for impactful solutions. With an initial commitment of \$30 billion from the United Arab Emirates, Alterra aims to catalyze up to \$250 billion in investment by 2030. Notably, \$4.5 billion has been dedicated to supporting the development of 15 GW of clean power capacity across Africa by 2030, reinforcing the UAE's commitment to inclusive and equitable climate action.
  - The UAE also promotes just transition models and climate resilience through its leadership in COP28, where it championed:
    - Tripling renewable energy capacity and Doubling the Energy Efficiency by 2030
    - Establishing the Global Alliance for Energy Efficiency
  - Co-founded and co-led the International Hydrogen Trade Forum (IHTF) during 2023–2024, and currently serve as an active member, contributing to global efforts to accelerate the development of a transparent, efficient, and inclusive international hydrogen market.

- Co-led the Clean Energy Marine Hubs initiative, advancing international collaboration to develop low- and zero-emission maritime fuel corridors and support the decarbonization of global shipping.

## Conclusion

The United Arab Emirates (UAE) has achieved comprehensive access to modern energy services, ensuring that no citizen or resident is left behind. Through continued innovation, regulatory refinement, and international partnerships, the country is positioned to serve as a global model for integrated, just, and future-ready energy access systems. The UAE's journey affirms that comprehensive energy access and climate goals are mutually reinforcing—not mutually exclusive.

The UAE's updated Energy Strategy 2050 exemplifies its dedication to a diversified and sustainable energy future. By aiming to triple the contribution of renewable energy and investing up to \$54 billion by 2030, the country is proactively addressing the increasing energy demands of its rapidly growing economy. Initiatives such as the National Hydrogen Strategy further position the UAE as a leader in emerging clean energy technologies.

Affordability remains a cornerstone of the UAE's energy policy. Through measures like subsidized electricity tariffs for citizens, support programs for vulnerable households, and investments in energy efficiency, the UAE ensures that energy remains accessible to all segments of the population.

Internationally, the United Arab Emirates (UAE) continues to play a pivotal role in promoting sustainable energy access through strategic collaborations and initiatives. In partnership with the International Renewable Energy Agency (IRENA), the UAE launched the Beyond Food Clean Cooking Platform in 2022, aiming to provide clean cooking energy and technologies to communities and households worldwide. This initiative focuses on fostering cooperation, coordinating actions, and promoting the deployment of clean cooking solutions across the world, addressing one of the most pressing human development challenges.

Additionally, at COP28 in 2023, the UAE and IRENA introduced the 'Empowering Lives and Livelihoods – Renewables for Climate Action' initiative, which seeks to strengthen climate resilience and adaptation in vulnerable communities by transforming agri-food and health value chains with renewable energy. Through these efforts, the UAE demonstrates its commitment to comprehensive energy solutions that encompass not just electricity but also clean cooking—a vital aspect of energy access in many communities.

In May 2024, the UAE launched a new energy tariff reduction initiative targeting the industrial sector in Ras Al Khaimah, Fujairah, Ajman, and Umm Al Quwain, as part of a collaboration between the Ministry of Industry and Advanced Technology, the Ministry of Energy and Infrastructure, and Etihad Water & Electricity. Designed to reduce operational costs and enhance competitiveness, the initiative offers

energy discounts ranging from 10% to 26% per kilowatt-hour, with the most favorable rate for high-consuming factories. It also includes flexible connection fee options and exemption from insurance fees. This measure aligns with the National Strategy for Industry and Advanced Technology and the UAE Energy Strategy 2050 aiming to support industrial growth, attract investment, and promote technological transformation through enhanced enablers and an integrated business ecosystem.

In conclusion, the UAE's comprehensive approach to energy access—balancing sustainability, affordability, and innovation—serves as a model for nations worldwide. Its journey underscores the principle that universal energy access and climate goals are mutually reinforcing, paving the way for a resilient and inclusive energy future.



## CONCLUSION

The global commitment to achieve Sustainable Development Goal 7 (SDG 7) by 2030 reflects the central role of energy in advancing human development, economic growth, and climate resilience. However, persistent gaps in access to electricity and clean cooking highlight the uneven pace of progress and the growing urgency to accelerate action. Energy poverty continues to affect hundreds of millions of people worldwide, with affordability emerging as a key factor, along with physical availability. These disparities reflect broader systemic challenges, including insufficient infrastructure, economic vulnerability, and limited policy coordination, particularly in developing and emerging economies.

Within this context, BRICS countries face both unique national challenges and shared structural conditions that shape their approach to energy access. Differences in fuel mix, infrastructure maturity, and market models coexist with common concerns around inequality, energy poverty, and the need for inclusive development. In many BRICS countries, large segments of the population still lack access to modern energy services or face affordability barriers that limit the effective use of available infrastructure.

Ensuring that energy is both accessible and affordable has become a strategic priority for all BRICS members. As major energy producers and consumers, BRICS countries are well positioned to advance collaborative solutions—through policy dialogue, knowledge-sharing, and coordinated investments—that can scale up access while promoting just and inclusive energy transitions. Each of these countries has developed public policies that reflect a sustained commitment to expanding access to essential energy services, including electricity, clean cooking, and thermal comfort.

Brazil's progress in expanding energy access reflects a long-standing commitment to social inclusion, regional development, and universal public service provision. Through consistent public policies and large-scale programs such as the 'Ligh for All' program, the country has achieved near-universal access to electricity, including in remote and historically underserved areas such as the Amazon region. This achievement has contributed significantly to improving living conditions, enabling economic activities, and strengthening access to essential services such as healthcare and education. Building on this progress, Brazil is now focused on enhancing the quality, reliability, and sustainability of energy access. Efforts are underway to integrate decentralized renewable energy solutions, particularly in isolated systems, while promoting affordability and reducing regional inequalities. Expanding access to clean cooking solutions and modern energy services remains an important priority, especially for vulnerable populations. Brazil's approach combines strong institutional coordination, regulatory stability, and targeted social policies, ensuring that energy access is not only universal but also equitable and sustainable. Within the BRICS framework, Brazil is committed to sharing its experience and advancing cooperation on innovative solutions, including distributed generation, hybrid systems, and financing mechanisms tailored to developing contexts. By strengthening collaboration, Brazil seeks to contribute to advancing universal, reliable, and sustainable energy access, in line with broader development and climate objectives.

India's transformative journey towards universal energy access showcases its commitment to inclusive development, environmental sustainability, and energy security. Through ambitious policies, infrastructure growth, and people-centric schemes like Saubhagya, PM Ujjwala Yojana, PM Kusum and PM Surya Ghar Muft Bijli Yojana, the country has significantly improved energy access for rural and vulnerable communities, enhancing health, livelihoods, and quality of life. With nearly half its power capacity from non-fossil sources and a roadmap for further diversification, India is on track to meet its NDC commitments, even before schedule, while supporting economic growth. Balancing affordability, sustainability, and rising demand remains a challenge, but the government's focus on energy efficiency, clean technology, and equitable subsidies ensures a just and inclusive transition. India's integrated planning and political will offer valuable lessons for other developing nations striving for universal, affordable, and sustainable energy access.

Having achieved widespread electricity and natural gas access for homes through extensive network investment, Iran's energy sector now prioritizes affordability. With increasing demand and budget constraints, the focus is shifting towards targeted subsidies, renewable energy, and efficiency initiatives. Public policies are evolving to harmonize social equity, environmental sustainability, and economic viability. This is evidenced by the expansion of renewable energy, efficiency programs, and subsidy reforms, all pointing towards more accessible and sustainable energy services in the future.

The United Arab Emirates has achieved universal access to electricity and 100% access to clean fuels for cooking (SDG 7 access metric). This achievement is underpinned by decades of strategic investment in modern infrastructure, smart grid systems, and off-grid energy solutions. The UAE's energy access policies are integrated within its broader national targets, particularly the UAE Energy Strategy 2050 and Net Zero by 2050 Pathway, which aim to triple the share of renewable energy by 2030 and enhance the resilience and affordability of energy services. As climate change intensifies energy demand—especially for cooling—the UAE continues to lead through policy innovation, including social tariffs and building energy codes that protect vulnerable consumers. The country is also advancing grid interconnection projects across the Gulf to improve regional energy resilience and facilitate clean electricity trade. Internationally, the UAE plays a key role in shaping energy diplomacy, scaling sustainable infrastructure, and fostering BRICS-wide cooperation on inclusive access solutions. As an innovation and financing hub, the UAE supports joint R&D, regional investment platforms, and harmonized standards to ensure that energy access is equitable, climate-aligned, and future-ready—domestically and across the Global South.

Ensuring universal access to electricity remains a challenge across BRICS countries, particularly in rural, remote, and low-income areas. Despite notable progress in expanding national grids and deploying off-grid solutions, gaps persist due to factors such as uneven infrastructure development, geographic barriers, financial constraints, and rapid population growth. Overcoming these challenges requires integrated strategies that combine grid extension, decentralized renewable energy systems, and supportive regulatory and financing frameworks tailored to diverse national contexts.

Addressing access to thermal comfort—both heating and cooling—presents an emerging challenge for BRICS countries, especially in the context of accelerating climate change. Rising temperatures, extreme weather events, and increasing urbanization are driving up demand for space cooling, while certain regions continue to face seasonal heating deficits. Expanding access to efficient and sustainable solutions for thermal comfort requires not only technological innovation but also policies that consider local climate conditions, grid capacity, and the affordability of energy-efficient appliances.

Expanding access to clean cooking solutions remains a pressing challenge in several BRICS countries, where a significant share of the population still relies on traditional fuels like wood, charcoal, and kerosene. These practices not only pose serious health risks and environmental impacts but also disproportionately affect women and children. Advancing access to clean cooking requires a combination of affordable technologies, culturally appropriate solutions, targeted public policies, and financing mechanisms that address both supply-side constraints and user adoption barriers.

Energy services that are technically available but economically out of reach fail to meet the needs of vulnerable populations. Effective policies must therefore address affordability through targeted subsidies, progressive tariff structures, and innovative financing mechanisms that prioritize equity, protect low-income households, and enable broad participation in modern energy systems.

To accelerate progress toward universal access to affordable, reliable, sustainable, and modern energy, the BRICS Energy Research Cooperation Platform (ERCP) should prioritize collective efforts that address both structural and context-specific barriers to energy inclusion. The following recommendations are intended to guide future BRICS ERCP collaboration, providing a foundation for joint action on electricity access, clean cooking, thermal comfort, and energy affordability among BRICS countries.

## **1. Promote integrated and people-centered access strategies**

BRICS countries should strengthen cooperation on designing national policies that integrate electricity access, clean cooking, and thermal comfort into unified, socially inclusive strategies. These approaches should prioritize the needs of vulnerable populations, particularly in rural, remote, and underserved areas, and ensure that access policies contribute to broader goals of equity and sustainable development.

## **2. Deepen collaboration on affordability mechanisms**

Access to energy must be accompanied by affordability. BRICS cooperation should support the exchange of experiences and tools—such as targeted subsidies, social tariffs, and progressive pricing models—that reduce the financial burden on low-income households and promote fair access to essential energy services.

## **3. Expand technical cooperation on decentralized and clean energy solutions**

Decentralized renewable energy systems, such as mini-grids and standalone solar technologies, are essential for reaching populations beyond the grid. BRICS countries should share technical standards, business models, and lessons learned to accelerate the deployment of clean, reliable, and context-appropriate off-grid solutions.

## **4. Support harmonized approaches for clean cooking**

Despite growing access to modern cooking fuels, a significant share of the population in BRICS countries still relies on traditional biomass. Cooperation should focus on promoting clean cooking transitions through efficient technologies, supply chain improvements, affordability support, and culturally adapted solutions.

## **5. Advance common frameworks for energy efficiency and thermal comfort**

Improving the efficiency of buildings and appliances, and ensuring thermal comfort, especially in a changing climate, should be central to BRICS collaboration. This includes developing and aligning minimum energy performance standards (MEPS), strengthening labeling programs—including standards for buildings—and promoting efficient appliances for cooling and heating in both urban and rural settings.

## **6. Promote cost reduction of energy access technologies**

Reducing the cost of key technologies—such as solar home systems, clean cookstoves, and energy-efficient appliances—is vital for scaling up access. BRICS countries should work together to foster local manufacturing, bulk procurement mechanisms, and coordinate joint research efforts to drive down prices and enhance affordability for end users.

## **7. Encourage joint innovation and R&D for inclusive energy solutions**

BRICS cooperation should include dedicated support for collaborative research and innovation aimed at developing inclusive, low-cost, and context-sensitive solutions. Priorities may include energy storage systems, hybrid mini-grids, clean cooking devices, and digital platforms to improve energy service delivery in remote areas.

## **8. Strengthen financing and investment channels for energy access**

BRICS countries should collectively advocate for increased financial support for energy access

initiatives, including concessional finance, blended instruments, and green and social bonds. Expanding access to international and regional funding sources will be essential for achieving just and inclusive energy transitions.

By advancing coordinated efforts across these priority areas, BRICS countries can play a leading role in shaping a more inclusive, equitable, and sustainable global energy future. Strengthening cooperation on access to energy services will not only contribute to achieving SDG 7 but also reinforce the group's shared commitment to social development, climate action, and South-South solidarity. A people-centered approach to energy access—grounded in national realities and enabled by international cooperation—will be essential to ensure that no one is left behind in the energy transition.

## DISCLAIMER

This report reflects contributions and information provided by official representatives of the BRICS member countries during Brazil's Presidency, up to 31 December 2025.

Each national chapter was created by official delegates and gathered in this report, while the introduction and conclusion were negotiated in a collective effort to compile national experiences, perspectives, and policy approaches related to energy access.

This publication is intended for informational and analytical purposes and aims to support dialogue and cooperation among BRICS members. It does not constitute legal advice or create binding obligations under national or international law.

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COOPERATING FOR AN INCLUSIVE AND SUSTAINABLE WORLD