VAAGDHARA

ENERGY ACCESS AND ENERGY POVERTY AMONG INDIGENOUS HOUSEHOLDS IN CENTRAL WESTERN INDIA

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PREFACE

The principles of *Swaraj* and sovereignty have always been at the core of VAAGDHARA's efforts. In the early years, energy was rarely part of the conversations, whether in policy forums, government dialogues, or market spaces. Today, energy is at the heart of every major discussion—be it subsidies, technologies, programs, or policies. Through years of reflection we realised that no conversation about *Swaraj* is complete without talking about energy.

This report is rooted in the lived experiences of our villages—shaped by the rhythms of land, water, and forest, and by the voices of people who inhabit them. At VAAGDHARA, we have always believed that real change begins when communities define their own aspirations with responsibilities and lead with sustainability. For VAAGDHARA, *Swaraj* is not an abstract concept—it is a living, breathing practice. It means that every person and village has the right, responsibility, and ability to make appropriate decisions, manage resources, and secure future.

Over the years, we have seen traditional tribal and rural energy systems give way to new challenges: a changing climate, dwindling natural resources, and growing market dependencies. Energy now affects every part of life—farming, children's education, women's safety and drudgery, health, and the rural economy itself. This report arises from that lived reality and seeks to explore energy not just as a technical issue, but as a question of justice, access, and self-reliance.

This study is the outcome of the *Pad-Yatras-24 (*Foot March 2024*)*, which incorporated co-creating knowledge through participatory research. Across 200 villages, 12 blocks and 6 districts, we engaged with women, youth, and people's institutions to understand energy access, use, and gaps. Each insight comes from the ground—every household's routine, every woman's struggle, every young person's hope.

But our goal is not only to document problems, but to co-create solutions with the people. Through decentralized solar systems, community microgrids, and energy literacy, we have seen the seeds of *True Swaraj* in energy. We believe development becomes meaningful when it is led by the community, when energy planning is not imposed, but envisioned and executed by communities themselves.

This report is a collective thought-outcome to move towards an energy-secure, self-reliant future. A future shaped not by top-down agendas, but by the resolve of communities standing in their truth. Hope this report serve as a source of inspiration for all the stakeholders, so that every village can reclaim its right to *Swaraj*, to sovereignty, and to energy.

I extend my heartfelt gratitude to all those who made this possible, especially the women, youth, and village institutions who shared their journeys, ideas, and strength with us.

Jayesh Joshi
Secretary, VAAGDHARA

Abbreviations

ACRRDA	Assessment of Climate Change Risks and Resilience of Development Actions
BMZ	German Federal Ministry of Economic Cooperation and Development
CBO	Community Based Organizations
CCRD	Climate Change Resilient Development
CRES	Climate Resilient Energy System
CSA	Climate Smart Agriculture
CSO	Civil Society Organization
EEF	Equality Empowerment Foundation
FFS	Farmers Field Schools
FGD	Focus Group Discussions
GPDP	Gram Panchayat Development Plan
GSS	Gram Swaraj Sangathan
IFS	Integrated Farming System
KASM	Krish Evam Adivasi Swaraj Manch
KASS	Krish Evam Adivasi Swaraj Sangathan
KIII	Key Informant and individual Interviews
LFM	Logical Framework Matrix
M P	Madhya Pradesh
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MIS	Management Information System
MMKM	Mahi Mahila Kisan Manch
MMR	Maternal Mortality Rate
NAPCC	National Action Plan for Climate Change
NGO	Non-Government Organization
PRA	Participatory Rural Appraisal
PRI	Panchayat Raj Institutes
RSAPCC	Rajasthan State Action Plan for Climate Change
SC	Schedule Castes
SC	Sub Centre
SDG	Sustainable Development Goal
SHG	Self Help Groups
SS	Saksham Samuh
ST	Schedule Tribes
ToR	Terms of Reference
UNDP	United Nations Development Program

Executive Summary

Energy poverty is a persistent and multidimensional barrier for indigenous communities in the at the junction of the states of Rajasthan, Gujarat, and Madhya Pradesh. Despite decades of development interventions, thousands of Bhil families remain without reliable, affordable, or sustainable energy access. This deprivation curtails livelihoods and aspirations and undermines fundamental rights, deepens vulnerability, and perpetuates systemic inequality.

VAAGDHARA, drawing on over three decades of grassroots engagement, undertook this participatory study across 200 villages in 12 blocks and six districts. The approach focused on community knowledge-especially from youth, women, and local collectives. As practical tools for change such as energy audits, climate-resilient planning, and localized energy solutions.

Key Findings

- **Energy Use and Dependency**: The assessment reveals that agricultural activities are dominated by manual and animal power (56.5%), with fossil fuels accounting for 30.5% and renewable sources just 1.6%. At the household level, manual and animal energy (38%) and electricity (32%) are prevalent, while renewable energy adoption is higher (7.3%) but still limited. Community infrastructure relies heavily on electricity (51.5%), with renewable integration remaining modest (7.6%).

- **Awareness and Knowledge Gaps**: Communities demonstrated awareness about 65% of identified energy sources, but 5% were entirely unaware, indicating a need for targeted awareness and literacy programs. This gap is both informational and structural, hindering the transition to cleaner, more efficient energy options.

- **Barriers to Clean Energy**: Persistent reliance on biomass and fossil fuels is driven by behavioural inertia, low awareness, inadequate infrastructure, and limited access to government schemes. Climate-related disruptions, such as heatwaves and erratic rainfall, further exacerbate these challenges, undermining fragile energy systems.

- **Institutional and Leadership Challenges**: Community-based organizations (CBOs) and leadership structures often lack the capacity to plan, advocate for, or maintain clean energy solutions. Strengthening these institutions through participatory training and energy literacy is essential for sustained progress.

- **Socio-Economic and Climate Impacts**: Energy poverty increases household expenses, limits productive opportunities, and contributes to rural migration. Conversely, energy-efficient practices and clean technologies can reduce costs, enhance financial stability, and improve psychological well-being.

Methodology and Data Collection

The study's participatory, mixed-methods approach included:

- Stakeholder mapping and engagement even at micro levels.
- Field visits and focus group discussions with women's and youth collectives.
- Piloted energy audits to measure use and unmet needs.
- Data triangulation and community validation workshops.

This process generated actionable insights on energy utilization patterns, unmet needs, and the community's capacity for adaptation and collaboration.

Key Reflections

1. **Recognize Energy as a Developmental Right:** Reliable, clean, and affordable energy must be treated as foundational for livelihoods, health, education, women's safety, digital inclusion, and climate resilience. Decentralized energy access should be a core priority in all development efforts.
2. **Localize and Democratize Solutions:** Promote community-managed, climate-resilient energy systems-such as solar microgrids and clean cooking alternatives-embedded in frameworks of self-governance and local ownership.
3. **Institutionalize Grassroots Energy Auditing:** Use household and village-level energy audits to build knowledge, drive behaviour change, and inform planning. Engage and train youth and women's collectives to lead these efforts.
4. **Strengthen Civil Society Capacities:** Invest in ongoing capacity-building for CSOs on energy justice, decentralized governance, technology options, and climate adaptation, using participatory and action-oriented training.
5. **Enable Multi-Stakeholder Collaboration:** Foster partnerships across government, academia, the private sector, and philanthropy to design integrated energy-livelihood-climate programs and leverage government schemes.
6. **Address Climate Vulnerabilities:** Design energy systems to withstand extreme weather, investing in climate-proof technologies and local maintenance mechanisms.
7. **Promote Policy Convergence:** Align grassroots efforts with national and state action plans on climate change, and connect communities to programs such as PM Surya Ghar Yojana (solar rooftops), PM KUSUM (solar pumps), and the National Biogas Programme.
8. **Enhance Monitoring and Data Systems:** Establish robust metrics and review mechanisms to track progress, anticipate risks, and adapt interventions in real time.

Opportunities for Scalable Impact

The study identifies clear opportunities for convergence with government programs and for leveraging local institutions to drive change. VAAGDHARA's established presence through CBOs and multi-level collectives provides a strong foundation for promoting energy

transformation, building climate resilience, and strengthening policy advocacy. Formal partnerships with local governments, civil society, and technical institutions can enhance community awareness, preparedness, and sustainable adoption of energy practices.

Conclusion

Energy poverty among indigenous communities is not merely a technical or infrastructural issue. It is a societal challenge that perpetuates inequality, deepens climate vulnerability, and erodes the right to a dignified life. Addressing it requires urgent, context-specific, and community-driven responses that treat energy as a right and a lever for transformational. By harnessing the renewable energy, strengthening local capacities, and fostering convergence across stakeholders, such regions can move towards energy sovereignty, improved livelihoods, and sustainable development. This study provides a roadmap for such a transition, emphasizing the need for integrated, participatory, and resilient solutions that leave no one behind.

Background

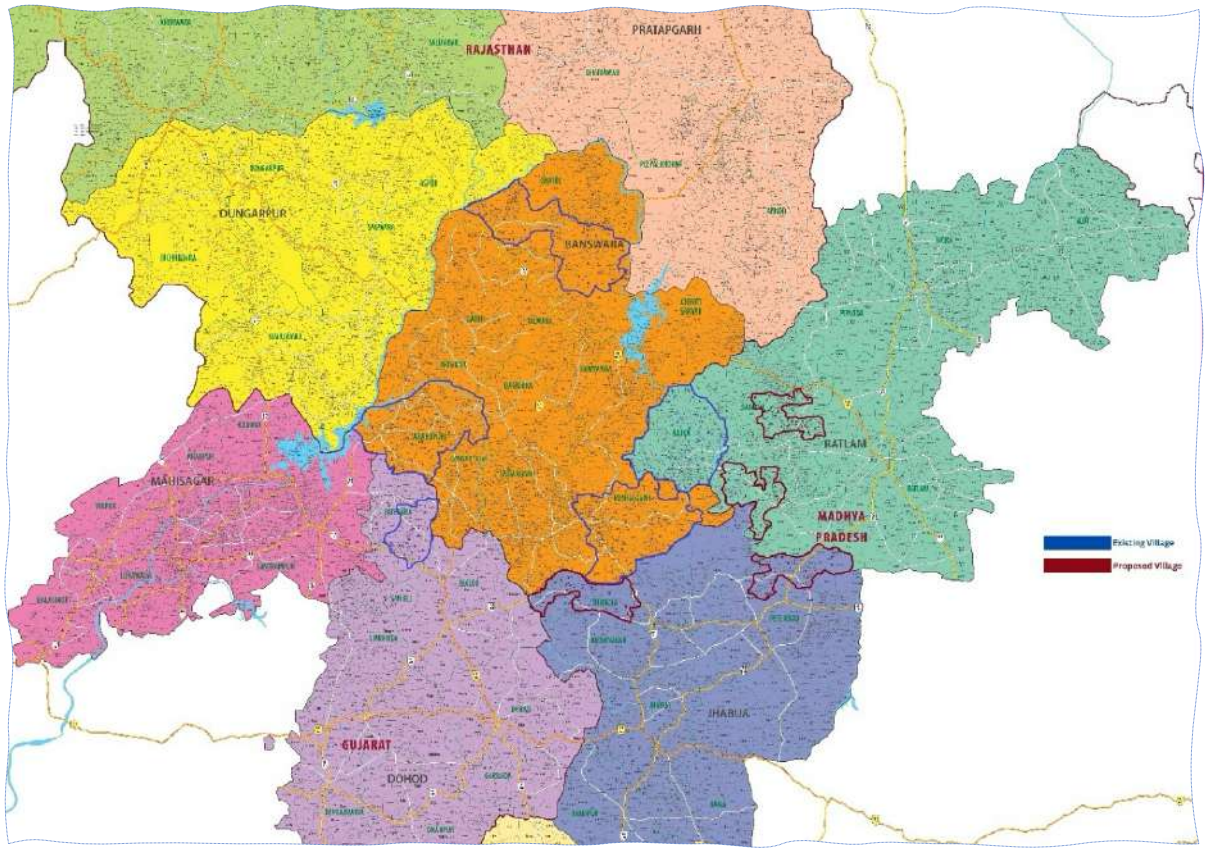
Energy poverty is increasingly recognized as both a symptom and a driver of structural inequality. It limits access to education, healthcare, livelihoods, and safety—particularly for women and children—and makes communities more vulnerable to climate shocks. Despite growing global attention, energy poverty remains deeply entrenched in many parts of the world, especially in remote, Indigenous, and climate-sensitive regions.

In 2010, the United Nations Secretary-General's Advisory Group on Energy and Climate Change (AGECC) called for universal energy access by 2030, framing energy as a foundational enabler of sustainable development. The International Energy Agency's special report, *"How to Make Modern Energy Access Universal?"* echoed this urgency. Yet, energy poverty continues to persist due to intersecting challenges such as weak infrastructure, inadequate data systems, and the limited reach of public programs in marginalized areas.

Measuring and addressing energy poverty is complex. It cannot be separated from broader socio-economic factors such as income, education, gender equity, infrastructure, and political voice. Moreover, energy poverty is not just about electricity—it includes clean cooking, lighting, heating, digital access, and the ability to adapt to changing climates. Unfortunately, most policy responses continue to be top-down and technocratic, failing to reflect the lived realities and priorities of Indigenous communities.

Informed by these global debates and grounded in over three decades of grassroots work, VAAGDHARA—an organization rooted in the principles of Swaraj (self-reliance and self-governance)—recognizes that energy poverty is a barrier to dignity, justice, and resilience for the Bhil tribal communities of western India. In this context, VAAGDHARA conducted an in-depth, community-led study across 200 villages, spanning 12 development blocks in six districts across Rajasthan, Gujarat, and Madhya Pradesh. The study assesses the current status of household energy access, maps existing gaps and vulnerabilities, and explores locally-rooted, sustainable energy pathways to enhance living incomes and climate resilience.

This background sets the stage for urgent, context-specific, and community-driven responses that treat energy not merely as a service, but as a right—and a lever for transformational change.



Graph: Map of Tri-junction Region of Rajasthan, Madhya Pradesh, and Gujarat

Purpose of the Study

This study was designed to ground-truth the concept of energy-poverty linkage in Indigenous communities and to de-risk the development of a full proposal by systematically mapping prerequisites, opportunities, and challenges. Its insights will guide the design of a realistic, cost-effective, and impact-oriented strategy for improving energy access and boosting living incomes in tribal areas. Specifically, the study aims to:

Contextual analysis: Examine energy challenges at *Meso level* **(**District- and block-level institutions, networks, and service providers) and *Micro level (*Village-level governance bodies, local energy committees, and informal community systems)

- **Stakeholder Mapping:** Identify and characterize all relevant actors—from Bhil tribal collectives, women's and youth groups, and traditional leaders, to local entrepreneurs, NGOs, and government agencies—who influence energy access and can drive or block.

- **Program & Partnership Scan:** Assess existing government schemes, NGO initiatives, and private-sector pilots for clean cooking, solar lighting, micro-grids, and resilient infrastructure to spot gaps, overlaps, and synergy opportunities.

- **Monitoring & Risk Framework:** Propose metrics and review mechanisms to track progress, anticipate risks (technical, financial, social), and adapt interventions in real time.

Methodology

To ensure that findings are both rigorous and rooted in lived experience, the study employed a mixed-methods, participatory approach:

1. **Stakeholder Workshops & Interviews:**
    - Convened sessions with VAAGDHARA leadership and technical teams to refine the study's scope, tools, and risk assumptions.
    - Conducted semi-structured interviews with district- and block-level officials, utilities representatives, and CSO partners.

2. **Field Visits & Focus Group Discussions (FGDs):**
    - Visited 200 villages across 12 blocks in six districts spanning Rajasthan, Gujarat, and Madhya Pradesh.
    - Facilitated FGDs with women's cooperatives, youth collectives, elders, and energy-user groups to surface priorities, barriers, and local coping strategies.

3. **Household Energy Audits:**
    - Piloted simple audit tools with trained community volunteers to measure current energy use, expenditures, and unmet needs at the household level.

4. **Data Triangulation & Validation:**
    - Cross-referenced primary findings with secondary data (census, state energy reports, NGO studies).
    - Held feedback workshops in sample villages to validate early insights and ensure community ownership of recommendations.

Data Collection

The study sought to generate actionable insights on the ground realities of energy access, usage patterns, and the barriers Indigenous communities face in building energy resilience. It was designed to not only capture current needs but also explore the community's capacity for adaptation, collaboration, and leadership in addressing energy poverty.

Specifically, the data collection process focused on:

- **Mapping Energy Utilization Patterns:** Collected detailed data on household and community-level energy use—including sources, reliability, cost, and seasonal variation—to understand the depth and dimensions of energy poverty.

- **Identifying Unmet Needs & Aspirations:** Engaged directly with tribal families, women's groups, youth, and elders to document unmet energy needs and their links with health, education, livelihood, and safety.

- **Assessing System Readiness:** Evaluated the preparedness and adaptability of VAAGDHARA's field teams, community-based institutions, and local leadership to work on decentralized, sustainable energy solutions.

- **Exploring Stakeholder Synergies:** Mapped existing linkages with government departments, local entrepreneurs, civil society organizations, and energy service providers to identify opportunities for convergence, co-creation, and policy advocacy.

By grounding the data in lived experience and building a cross-sectoral understanding of the issue, the study creates a strong foundation for scalable interventions that can reduce energy poverty and improve overall well-being in tribal regions.

Community Awareness and Energy

The increasing emphasis on sustainability and resource conservation is driving a transformative shift in agricultural practices worldwide. Agriculture, being central to food security and rural livelihoods, also consumes significant energy, from tilling to irrigation, livestock rearing to household cooking. As concerns over climate change intensify, there is an urgent need to optimize energy consumption in this sector, not just to boost productivity but to reduce environmental impact.

Farming activities contribute substantially to greenhouse gas emissions — particularly methane from livestock and carbon dioxide from machinery and fuel combustion. Add to this the emissions from fertilizers, pesticides, and rural transportation, and the energy-climate link becomes clear. This growing concern has spurred global efforts to promote energy-efficient tools, renewable energy adoption, and climate-smart agricultural practices.

Yet, our recent assessment across 200 villages in southern Rajasthan shows that while energy touches every part of rural life, community awareness about energy sources, usage patterns, and alternatives remains uneven. Many households rely on traditional fuels like diesel, human labor, or firewood, with limited understanding of renewable options such as biomass, solar, or wind. While over 60% could identify common energy sources, 5% of the energy types remained completely unfamiliar to participants.

This gap in awareness isn't just informational — it's structural. Without knowledge, people cannot demand or transition to cleaner, more efficient options. That's why tools like energy usage cards, community mapping, and group discussions used in our study were so effective: they turned passive users into active thinkers. Villagers began seeing the ‘hidden cost’ of their current energy habits — both in terms of money and environmental health.

Looking ahead, energy availability will be key to sustaining agriculture, especially as labor shortages make mechanization more essential. Energy audits at the community level can guide smarter investments in technology, prioritize renewable energy integration, and promote sustainable resource use.

Building community awareness is the foundation of energy sovereignty. It empowers people to make informed choices, reduces their dependency on polluting fuels, and strengthens their ability to adapt to climate challenges. The path to sustainable farming is not just technical — it is also social, and it begins with awareness.

Table 1: Based on the source, energy can be classified as direct and indirect energy

	Direct Energy	Indirect Energy
Renewable Energy	Humans, animals, solar and wind energy, fuelwood, agricultural waste, etc.	Seeds and fertilizers can be considered renewable indirect sources of energy as they can be replenished over time.
Non Renewable Energy	There are energy sources that are non-renewable (at least for the next 100 years), such as coal and fossil fuel-powered dynamic mechanical or electrical power units, including diesel engines, electric motors, power tillers, and tractors.	Energy sources that are not replenished fall under non-renewable indirect sources of energy. Chemicals, fertilizers, and machinery manufacturing are non-renewable indirect sources of energy.

Commercial and Non-Commercial Energy

Based on comparative economic processes and value, energy can be classified as commercial and non-commercial.

S. No.	Commercial	Non Commercial
1	Energy sources such as petroleum products (diesel, petrol, and kerosene) and electricity, which are capital-intensive.	Commonly available and low-cost materials such as human labor, bullock power, wood, and twigs, leaves, agricultural waste, and animal dung, etc.
2	Commercial energy has an economic and transactional value for each energy source.	Non-commercial energy has some economic value for each energy source.
3	Capital Intensive	Available on less capital
4	Many of the commercialized sources are also non-renewable	Most of the non commercial sources are renewable
5	Imported at some extent	Available at local level

Energy Audit

Energy auditing is a vital tool for understanding and optimizing the energy requirements of agriculture, from human labor and animals to machinery and fuel. By assessing the energy needed for every farming activity, communities can make informed decisions that boost productivity and reduce environmental impact.

A comprehensive energy audit involves calculating the energy consumed across a wide range of tasks: land preparation, wetland puddling, nursery management, seed sowing or drilling, transplanting, intercropping, weeding, soil cutting, topping, residue removal, harvesting, and post-harvest processing. It accounts for the contributions of various energy sources, including human effort, animal traction, diesel-powered tractors, electricity-driven pumping units, and other farm machinery.

Inputs such as organic manure, seeds, fertilizers, plant protection chemicals, and irrigation systems all carry embedded energy costs. When properly measured and evaluated, these insights help farmers and communities identify where energy is being overused or wasted — and where shifts to efficient or renewable alternatives can make the most impact.

Today, energy audits are more than technical assessments; they are strategic tools for sustainable farming. They guide transitions toward energy sovereignty by aligning agricultural practices with ecological limits and local needs. A village or farmer who knows how much energy each activity requires is better prepared to manage costs, reduce dependency on fossil fuels, and adopt cleaner, more resilient technologies.

Assessment of Energy Sources

Energy shapes everyday life — from the fields where crops grow to the homes where families cook and gather. It influences not only agricultural productivity and household efficiency but also the overall well-being and self-reliance of a community. The way energy is sourced, used, and managed has deep implications for economic resilience, environmental health, and social development.

Despite its centrality, many communities continue to rely on inherited practices and intuitive knowledge about energy, often without a clear understanding of its long-term economic and ecological costs. There is a visible gap in awareness about the types of energy available — whether fossil-based or renewable, commercial or non-commercial — and their usage across different domains of life.

To address this, a participatory energy assessment tool was introduced. It was designed not just to gather data but to initiate a reflective conversation within the community — about where energy comes from, how it is used, and how it could be better managed for a sustainable future.

1. Energy Sources Considered

• Fossil Fuels (Diesel, Petrol, Kerosene) • Electricity (Grid-based or Off-grid)	• Animal & Human Energy (Manual labor, Bullock power) • Green Energy (Solar, Wind, Biomass)

2. Activities Assessed Across Three Spheres

- Agricultural Practices – Sowing, weeding, irrigation, fodder management, packaging and storage
- Household Tasks – Lighting, cooking, flour grinding, stitching, etc.
- Community Infrastructure – Drinking water supply, school energy use, local transport, energy in panchayat offices.

3. How the Assessment Was Conducted

- Community members were asked to identify the energy sources used in each activity.
- For every energy source used, a checkmark was placed in the corresponding box.
- If multiple energy sources were used for an activity, all relevant boxes were marked.
- In the final step, checkmarks were totalled to analyse patterns and draw insights into energy dependency and diversity.

Photo: Community Level Group Exercises for Assessing Energy Sources

4. Key Insights and Outcomes

The process not only mapped how energy flows through a village's daily life — it surfaced hidden patterns, sparked awareness, and revealed knowledge gaps. Some participants showed a strong grasp of renewable and conventional sources, while others were surprised to learn how much they depended on fossil fuels for routine tasks.

By using this simple yet powerful tool, the community was able to:

- Understand its own energy footprint
- Identify areas where awareness and training are needed
- Lay the groundwork for transitioning to cleaner and more sustainable energy options

This kind of grassroots energy literacy is essential for building energy swaraj, where people not only consume but consciously choose and manage their energy. It's a small but powerful step toward a future where energy is not just available, but empowering.

Compilation & Analysis

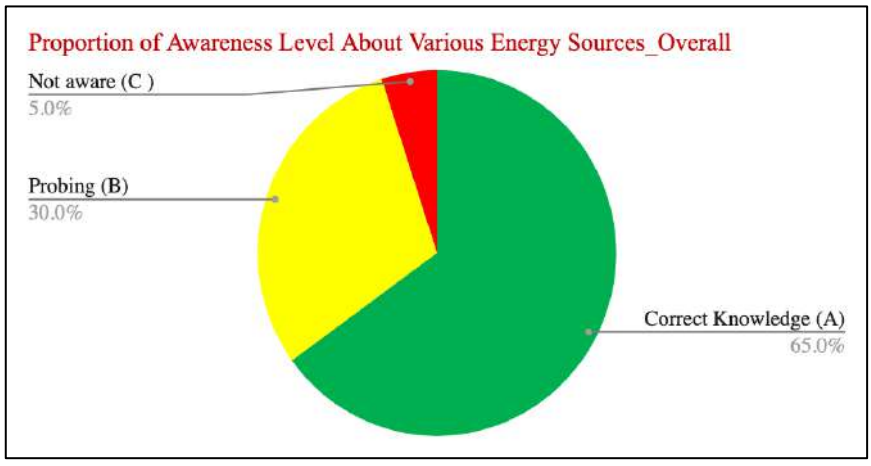
Following the completion of the energy assessments across 200 villages, data from the Mahi, Hiran, Mangarh, and Mahi-MP units were meticulously compiled and analyzed. This unit-wise evaluation unveiled regional disparities in energy awareness and utilization, providing a foundation for designing targeted energy programs tailored to each area's unique needs.

Key Insights from the Assessment Tool

- Dominant Energy Sources: The tool effectively identified the primary energy sources utilized across various settings—agricultural, household, and community levels.
- Fossil Fuel vs. Renewable Energy: It illuminated the communities' reliance on fossil fuels compared to renewable sources, highlighting areas where cleaner alternatives could be introduced.
- Opportunities for Cleaner Energy: The assessment pinpointed specific activities and sectors where the adoption of cleaner and more efficient energy alternatives is both feasible and beneficial.

Awareness Level about Energy Sources

An analysis across all participating villages revealed that communities were familiar with approximately 65% of the 20 different energy sources identified. Upon further inquiry, they demonstrated accurate knowledge of an additional 30%, correctly identifying their usage and classification. However, 5% of the energy sources remained entirely unfamiliar, underscoring the need for targeted awareness programs to bridge this knowledge gap and promote informed energy choices. Notably, the Mahi unit exhibited the highest percentage of correct knowledge about energy sources at 70.1%, closely followed by the Mahi-MP unit at 66.8%. Interestingly, these units also had the highest percentage of energy sources that were unfamiliar to the communities, indicating a dichotomy between awareness and exposure.



Graph 1: Awareness level about various energy sources in all the villages

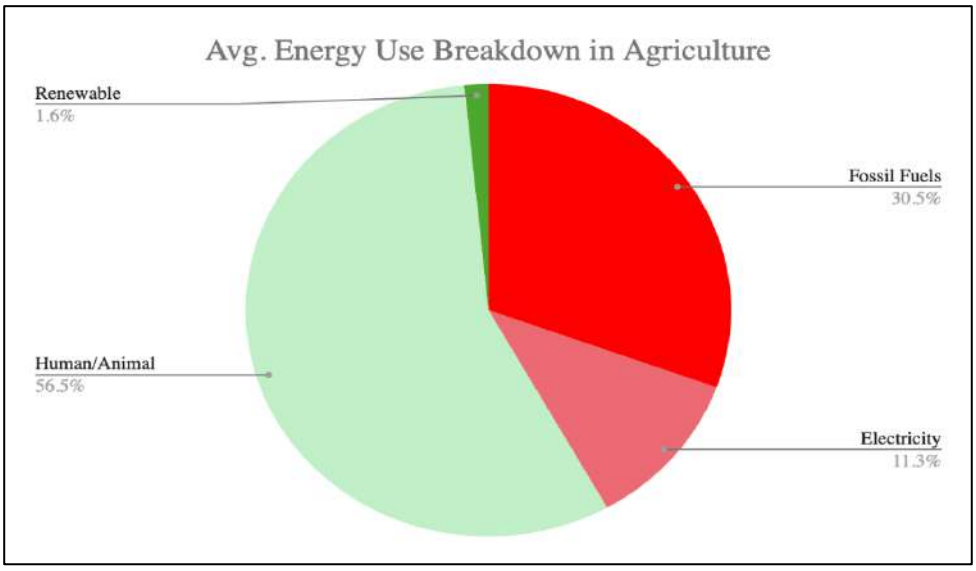
Energy Usage Patterns

Understanding not just who is energy-poor, but how and why energy poverty manifests, is crucial. Traditional measures often link energy poverty to a lack of physical access to modern energy. However, comprehensive assessments reveal a more nuanced picture, especially in predominantly indigenous and rural areas.

A. Energy Usage in Agriculture

The analysis indicated that:

- Human and Animal Power: 56.5% of agricultural activities rely on manual labor and animal power.
- Fossil Fuels: Diesel and petrol account for 30.5% of energy usage.
- Electricity: Utilized in 11% of agricultural activities.
- Renewable Energy: A mere 1.6% of activities employ renewable sources, primarily solar power.

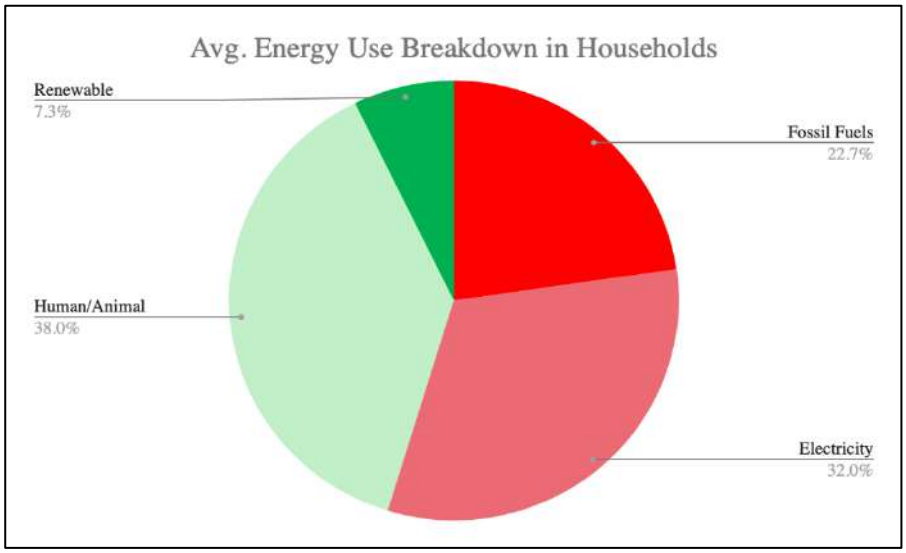


Graph 2: Proportion of energy usage in Agriculture in all the villages

These findings highlight a significant dependence on traditional energy sources, with minimal integration of renewable energy, emphasizing the need for increased investment in sustainable and efficient energy solutions within the agricultural sector.

B. Energy Usage at Household level

- Human and Animal Energy: 38% of tasks are performed using manual labor and animal power.
- Electricity: Powers 32% of household activities.
- Fossil Fuels: Account for 22.7% of energy usage.
- Renewable Energy: Utilized in 7.3% of household tasks, indicating a higher adoption rate compared to agriculture.



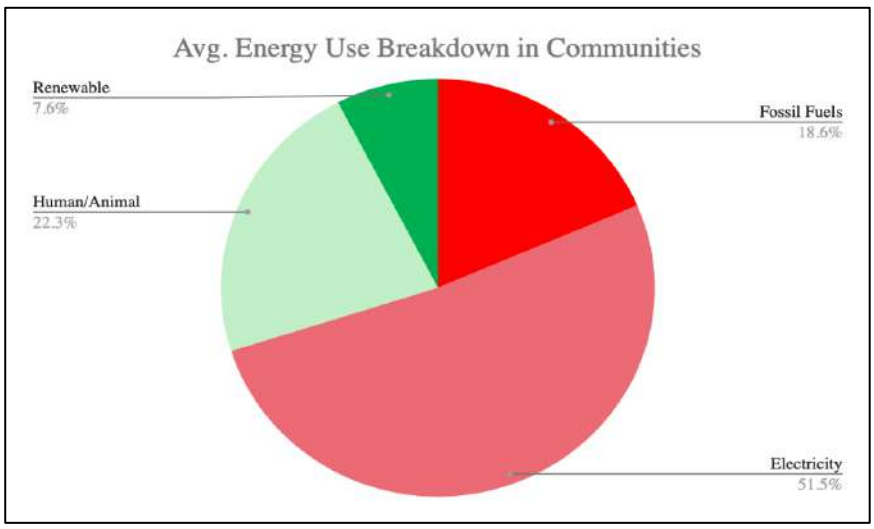
Graph 3 : Proportion of energy usage at Household level in all the villages

The data suggests a diverse energy mix in households, with Mahi leading in renewable energy adoption. However, the continued reliance on traditional and fossil fuel sources underscores the need for promoting cleaner energy alternatives.

C. Energy Usage at Community Level

Community-level activities demonstrated:

- Electricity: Dominant at 51.5% usage, reflecting its critical role in community infrastructure.
- Human and Animal Energy: Constituting 22.3% of energy usage.
- Fossil Fuels: Accounting for 18.6%.
- Renewable Energy: Employed in approximately 7.6% of community activities.



Graph 4: Proportion of energy usage at community level in all the units

The significant reliance on electricity for community functions is evident. However, the comparatively low adoption of renewable energy indicates untapped potential for cleaner solutions. This scenario calls for strategic investments and awareness campaigns to promote sustainable energy practices in community operations.

The comprehensive assessment across 200 villages reveals a predominant reliance on traditional and fossil fuel energy sources across agricultural, household, and community sectors. While electricity plays a vital role, especially at the community level, the integration of renewable energy remains limited. Addressing this requires:

- Targeted Awareness Programs: To bridge knowledge gaps and promote informed energy choices.
- Investment in Renewable Energy Infrastructure: Enhancing access and affordability of clean energy solutions.
- Policy Interventions: Supporting the transition towards sustainable energy through subsidies and incentives.

By focusing on these areas, we can pave the way for energy sovereignty, improved livelihoods, and sustainable development in rural and indigenous communities.

Energy Poverty of Indigenous Communities

Understanding and addressing energy poverty is a crucial step toward enabling sustainable development in Indigenous communities. A clear, structured approach is needed—one that defines, measures, monitors, and reports energy poverty using appropriate indicators. This is especially important to track progress and assess the broader benefits of energy programs. In the Bhil tribal communities, energy needs are evolving alongside changing lifestyles. Yet, the community remains progressive and adaptable—open to adopting eco-friendly technologies when given the right exposure and support.

Types of Energy Needs

At the village level, energy requirements fall into two broad categories:

1. **Household Energy Needs**: This includes lighting, cooling, heating, cooking, small-scale processing, and other daily activities.
2. **Production and Livelihood Needs**: These include agricultural activities like ploughing, sowing, harvesting, seed management, transportation, storage, and animal husbandry.

Table 2 The key energy challenges faced by the Indigenous community includes

Energy Challenge	Details
Poor power-supply infrastructure	Many tribal homes are scattered across farmlands, making efficient and consistent power supply system's difficult. The infrastructure often fails during extreme weather. Families rely on kerosene, inverters, and generators for backup.
Agriculture and traditional energy use	Agriculture traditionally relied on animal power and crop residues. Animals were fed biomass leftovers, and dung was used as manure. This system was circular and low-energy but is now being replaced.
Emissions from composting and new practices	Composting practices emit methane and nitrous oxide. Increased use of seeds, fertilizers, pesticides, and fuel-based transport has led to higher energy use and greater carbon emissions.
Fossil fuel dependency	Indigenous families increasingly use motorcycles for daily activities, even unnecessarily. On average, Rs. 100 is spent daily on petrol (Rs. 36,500 annually), accounting for 35–40% of household expenditure.
Decline in traditional fuel sources	Communities earlier grew cotton and pigeon-pea twigs, which supplied cooking fuel for 6–7 months in a renewable cycle. This practice is fading.
Barriers to solar adoption	Government's "Solar Free Electricity" scheme offers rooftop solar and net-metering. However, poor promotion, lack of investment, and limited awareness keep Indigenous people from benefiting.
Lack of awareness about alternative energy innovations	Several innovations exist (mechanical, solar, biogas, energy plantations, etc.), but without awareness or energy audits, people waste energy and suffer losses.
Exclusion from solar-lift schemes	Solar-lift pumps require minimum land size, excluding smallholders. Solar lighting is rare; only a few houses have emergency solar lights.
Need for integrated energy planning	A comprehensive energy-audit-based plan using solar, electric, biogas, human, and animal power is needed to optimize usage and reduce carbon footprints.
Economic constraints	Poverty limits investment in clean energy options. High upfront costs make renewable adoption challenging.
Shift in housing and construction	Modern houses use costly external materials and need less maintenance but are not suited to all weather. Traditional houses were eco-friendly and made with local support but required regular upkeep.
Impact of housing on energy needs	New house designs alter energy needs. Traditional homes were seasonal and low-cost but demanded frequent repairs, increasing women's workload.
Cooking fuel and Ujjwala scheme	Earlier cooking used wood and dung cakes. Government's Ujjwala promotes LPG, a fossil fuel. Most still use crop waste (90–95%), which is renewable if linked with energy plantations, improved combustion, or biogas.
Irregular electricity supply	Electricity is mainly used for lighting, threshing, water lifting, fans, and mobile charging. Supply is unreliable, especially during extreme weather events.

Energy Efficiency Related Behaviour

While access to electricity and LPG has expanded across India over the past few decades, the use of traditional biomass fuels has not declined—in fact, it continues to dominate rural energy consumption. About 64% of rural households still depend on firewood for cooking, and another 26% rely on crop residues or animal waste. This persistent reliance on biomass indicates a strong behavioural and infrastructural inertia. Modern biomass conversion technologies—such as combustion, pyrolysis, gasification, fermentation, and anaerobic digestion—can convert agricultural waste into heat, electricity, biogas, and even transport fuels. India has a vast potential for such energy, especially in rural areas where agricultural residues are abundant. However, this opportunity remains underutilized.

Despite the availability of resources, several behavioural and systemic issues prevent efficient energy use:

- **Low awareness of energy patterns**: Small and marginal households in tribal villages often lack understanding of how they consume energy. This leads to avoidable wastage, higher energy costs, and greater climate vulnerability.

- **Climate-related access issues**: Indigenous communities already face limited access to markets, employment, and government schemes. Climate change further disrupts energy supply and access, deepening marginalisation.

- **Poor energy planning**: Without a basic understanding of energy flows, families experience both higher energy losses and increasing input demands in agriculture and allied activities—adding to both cost and emissions.

- **Weather disruptions**: Heatwaves, erratic rainfall, and temperature extremes affect already fragile energy systems in remote regions. Supply becomes unreliable, and backup options are expensive or inaccessible.

- **Leadership and planning gaps**: Tribal leaders often lack the capacity or tools to plan or advocate for clean energy solutions. This limits the community's ability to build resilience against climate risks.

- **Weak institutional support**: Community-Based Organisations (CBOs) in the region, such as KASS, MMKM, and GSS, are not equipped to support Gram Panchayats (GPs) on climate-resilient energy planning. Strengthening these institutions through participatory training, energy literacy, and stakeholder collaboration is essential.

India's rural biomass resource offers great promise. But without a shift in behaviour, stronger institutional support, and integrated planning, tribal regions will continue to experience both energy poverty and climate exposure.

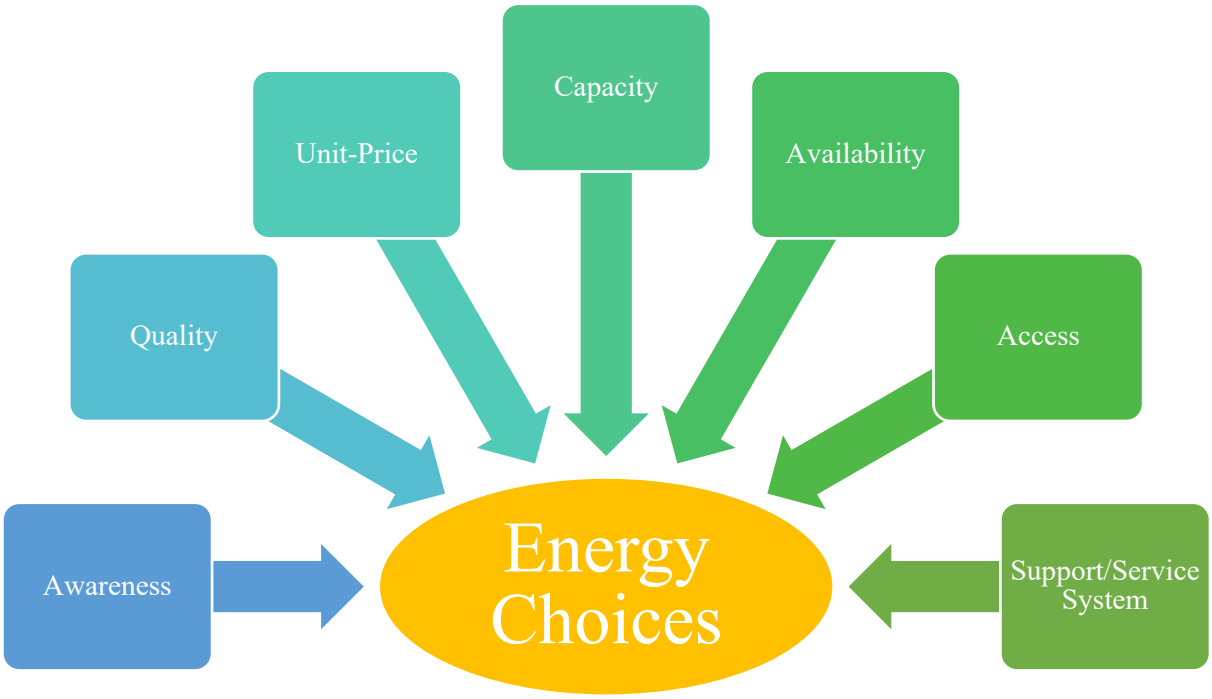


Figure: Factors Affecting Energy Choices as per Focus Group Discussion

Key Factors Influencing Household Energy Choices

Household decisions to adopt, retain, or switch energy sources are shaped by a mix of institutional, behavioural, and systemic factors. The following critical elements emerged from the study:

- **Strengthening Community Institutions**: VAAGDHARA's established presence through local structures—Gram Swaraj Samuh and Saksham Samuh (village level), KASS (cluster), KASM (district), and MMKM (state level)—offers a strong foundation for promoting energy transformation. Collaboration with 30 active CBOs can drive efficient energy transitions, build climate resilience, and strengthen policy advocacy for entitlements.

- **Stakeholder Collaboration**: Formal partnerships with a range of stakeholders—local governments, civil society, and technical institutions—can significantly improve community awareness of energy issues. These collaborations can also enhance preparedness and sustainable adoption of energy practices.

- **Awareness and Adoption of Clean Energy**: Improved understanding of renewable energy tools—such as biogas, solar cookstoves, and microgrids—can encourage

adoption. Widespread awareness is needed to increase the number of households shifting to clean and sustainable energy options.

- **Access to Government Schemes**: The study highlights the urgent need for an enabling environment that improves access to energy-related subsidies, programs, and services. Ensuring smooth and informed access can accelerate the uptake of renewable technologies.

- **Sustainability Through Local Empowerment**: Building community ownership is vital. This involves mobilising local bodies to integrate climate concerns into their GPDPs (Gram Panchayat Development Plans), encouraging climate-friendly learning activities, and promoting community contributions to the planning process.

- **Capacity and Leadership Development**: Skills training, climate literacy, and local leadership development—especially through CBOs like KASS and KASM—are key to sustaining energy transitions. Creating a cadre of trained individuals who understand climate mitigation and modern energy systems will strengthen community resilience.

- **Operation and Maintenance of Clean Technologies**: For long-term impact, local youth and households must be trained in the upkeep of climate-smart, high-efficiency energy devices. This ensures longevity and reliability of the technologies adopted.

- **Economic and Social Benefits**: Energy-efficient practices reduce household energy expenses and improve financial stability. Even small, consistent economic gains from energy savings can contribute significantly to household sustainability. These savings also support psychological well-being, reduce the hardships of energy poverty, and help limit rural migration.

- **Scalability and Sustainability**: The cumulative benefits—economic, social, and emotional—of clean energy adoption create a ripple effect. As more families experience success, adoption rates rise, scalability improves, and the model becomes self-sustaining.

Opportunities, Synergies, and Risks

India's National Action Plan on Climate Change (NAPCC) outlines key missions to improve understanding and action on climate science, adaptation, mitigation, energy efficiency, and natural resource conservation. Guided by the NAPCC, the states of Rajasthan, Gujarat, and Madhya Pradesh have developed their respective State Action Plans on Climate Change (SAPCCs). These action plans adopt a multiplier approach—scaling efforts through institutional linkages. However, for this approach to succeed, consistent follow-up and grounded implementation are essential.

VAAGDHARA, through its strong grassroots presence, can play a pivotal role in this. By equipping and mobilizing CBOs and KASS, it can:

- Facilitate integration of climate-related advisory services.
- Build local capacities for sustained energy and climate action.
- Support professionals working on energy and climate resilience in tribal regions.

Convergence with Government Programs

To meet energy needs sustainably, the study suggests convergence with existing and emerging government programs on green energy and climate resilience. Such convergence should be seen not just as administrative efficiency but as a climate-sensitive strategy. Key actions include:

- Aligning grassroots efforts with national and state-level missions.
- Facilitating linkages through lobbying, advocacy, and collaborative platforms.
- Connecting communities to programs like the PM Surya Ghar Yojana, which provides solar rooftops for free electricity.

Risks and Lessons from the Past

One major risk lies in low community uptake of past programs, such as biogas initiatives launched two decades ago. Many of these efforts fell short due to poor community experience and lack of sustained support.

To counter this:

- VAAGDHARA should re-evaluate biogas technology through a climate resilience lens.
- The co-benefits of biogas—clean energy, climate-smart farming, and improved soil health—should be clearly demonstrated.
- Lessons from pilot successes should be documented and presented through policy briefs to influence future programming and funding.

Potential Government Programs for Convergence

Here are key government programs that offer synergy opportunities for clean energy, sustainable farming, and climate resilience:

1. National Green Corps (Eco Club Program)
2. National Nature Camping Programme (NNCP)
3. Capacity Building Activities (CBA) for Environmental Awareness
4. PM KUSUM – For solar pumps and decentralized solar energy
5. PM JANMAN Solar Scheme – New solar power schemes for PVTG habitations
6. Pradhan Mantri Suryakiran Yojana – Rooftop solar for households
7. PM Krishi Sinchai Yojana – Efficient irrigation
8. Biogas Program – Ministry of New and Renewable Energy
9. National Solar Mission

10. National Mission for Enhanced Energy Efficiency (NMEEE)
11. National Mission on Sustainable Habitat (NMSH)
12. National Mission for a Green India (GIM)

Conclusion

The study of energy use across 200 villages reveals a critical dependence on traditional and fossil fuel-based energy sources, particularly in households and community spaces. Despite the obvious need for a transition, renewable energy adoption remains minimal. This underscores a significant gap that requires immediate attention. There is an urgent need for policies, investments, and awareness programs to boost the integration of solar, wind, biomass, and other clean energy sources across various sectors, particularly in agriculture and rural communities. The transition to renewable energy is not just an environmental imperative; it is a pathway to greater economic efficiency and social sustainability.

- **The Challenge of Energy Access:** For rural communities, providing reliable, affordable, and clean energy is fundamental to poverty alleviation. While these communities traditionally rely on firewood, charcoal, and agricultural residues, these fuels have dire consequences—polluting the air, degrading the environment, and posing health risks. Additionally, the time invested in gathering and utilizing these resources limits opportunities for productive work and education, creating a cycle of poverty and limited opportunity.

- **The Role of Energy Audits:** Conducting energy audits in villages is essential to understanding energy consumption patterns, identifying inefficiencies, and exploring cleaner alternatives. These audits help communities assess the true environmental and economic costs of their energy choices, particularly in agricultural settings where energy use is high. Addressing inefficiencies through solar-powered irrigation systems, energy-efficient tools, and waste management can drastically reduce energy consumption while improving productivity.

- **Biomass as a Renewable Energy Source:** Biomass, traditionally a major energy source, is often used inefficiently through direct combustion in outdated devices. This inefficiency not only strains resources but also contributes to environmental harm. There is a significant opportunity to explore biomass as a cleaner, more efficient renewable energy source. The potential of biogas, in particular, for clean energy, climate-smart farming, and soil health improvement should be emphasized, especially through targeted government programs such as the National Biogas Programme.

- **Energy Poverty and Its Impact on Livelihoods:** Energy poverty hampers economic productivity and contributes to migration from rural areas, particularly those vulnerable to climate risks. Agricultural practices vary widely across regions, and these differences in energy consumption practices present both challenges and opportunities. While rural and tribal communities still rely on human and animal labor, as well as fossil fuels, the

transition to renewable energy sources—particularly solar—holds immense promise for more sustainable agricultural practices.

- **Potential of Off-Grid Renewable Energy Solutions:** As highlighted by studies like those from MIT, off-grid renewable energy solutions, such as solar-powered lanterns, home systems, and microgrids, provide critical energy services to remote and underserved communities. These technologies not only enable access to electricity but also transform lives, reducing dependency on fossil fuels and improving the overall quality of life. Expanding these off-grid solutions can be a key strategy for enhancing energy access in marginalized regions.

- **Strengthening Monitoring and Data Systems:** Effective energy access programs must be grounded in robust data systems. There is a need for consistent energy poverty metrics to evaluate the real impact of interventions. A deeper understanding of energy choices and access issues in indigenous and remote communities will enable the development of targeted policies and solutions. This data-driven approach will help ensure that energy access interventions meet the diverse needs of these populations.

- **Linking to SDG Goal 7:** This study aligns with **SDG Goal 7 – Affordable and Clean Energy**, emphasizing the need for universal access to clean and affordable energy. Historically, communities in these areas have relied on human, animal, and biomass energy, with limited access to modern energy sources. However, as development interventions bring more electricity into these regions, the reliance on fossil fuels is increasing, pushing communities into deeper energy poverty. A shift towards renewable energy is essential for reversing this trend and ensuring long-term sustainability.

In conclusion, the path to a sustainable energy future for rural and indigenous communities lies in adopting clean, efficient, and locally appropriate energy solutions. By harnessing the potential of renewable energy and strengthening local capacities through targeted interventions, communities can break free from the cycle of energy poverty, fostering economic growth, environmental resilience, and social well-being.

ANNEXURE

ANNEXURE 1: Tool 1: Assessing Knowledge About Different Sources of Energy

This tool is designed to evaluate how well community members understand different sources of energy, their availability, and their classification as commercial or non-commercial.

Part 1: Card Game Sheet

To facilitate learning and engagement, a set of visual cards was created. Each card depicted a different energy source, such as:

- Natural sources – Sun, Water, Soil
- Fossil fuels – Petrol, Diesel
- Renewable sources – Wind, Biomass, Hydropower

Figure 1 Energy Sources Assessment

Framework Structure:

- X-axis (Mode of Availability of Energy Sources)
    - Naturally Available
    - Can Be Made Available with Some Effort
    - Cannot Be Made or Renewed
- Y-axis (Categorization of Energy)
    - Commercial Energy (purchased energy with economic value)
    - Non-Commercial Energy (readily available, low-cost energy sources)

This framework allowed participants to categorize energy sources based on their availability and economic implications, making the activity both educational and interactive.

Part 2: Energy Assessment Sheet

To document and analyse community responses, a structured Energy Assessment Sheet was used. This sheet contained three scoring columns to record responses for each energy source:

- Green Column (Correct Knowledge): If participants correctly placed the energy card in the appropriate category without any assistance.
- Yellow Column (Partial Knowledge): If participants needed reminders or probing before correctly placing the card.
- Red Column (No Knowledge): If participants were unaware of the energy source and unable to categorize it.

Facilitation Process

1. Discussion: The facilitator asked community members about the different sources of energy they use daily or are familiar with.
2. Card Distribution: As participants named an energy source, the facilitator handed them the respective energy card, and they placed it in the relevant category on the framework.
3. Scoring: a) Correct placement without probing - Green Column; b) Placement after probing - Yellow Column; c) No knowledge about the energy source - Red Column
4. *Probing for Additional Energy Sources: If participants did not mention all energy sources, the facilitator encouraged discussion to explore other sources. If they recognized a source after prompting and placed the card correctly, their response was recorded in the Yellow Column.*

स्वराज सन्देश संवाद पदयात्रा -2024

ऊर्जा/ताकत सम्बंधित ज्ञान एवं जानकारी

गाँव का नाम ..... पंचायत का नाम ..... दिनांक .....

कृषि एवं आदिवासी स्वराज संगठन..... ब्लॉक..... जिला..... समूह कार्य संख्या .....

नियम : समुदाय द्वारा ऊर्जा/शक्ति के स्त्रोतों का खेल खेलते समय ही इस प्रपत्र का उपयोग करना है। समुदाय द्वारा प्रत्येक स्त्रोतों पर चर्चा होने एवं उससे सम्बंधित कार्ड को समुदाय द्वारा सुझाए गए स्थान पर रखने के बाद, इस प्रपत्र में A, B, C कॉलम में दिए गए निर्देशानुसार (✔) का निशान लगाएँ और अंत में जोड़ करें।

क्र. सं.	ज्ञान/जानकारी / ऊर्जा के स्त्रोत	सही जानकारी है (A)	पूछने/समझाने पर बताया (ऊर्जा स्त्रोतों की जानकारी तो है, परन्तु भूल गए है और सही जगह कार्ड को रख पाते है) (B)	जानकारी नहीं है (स्त्रोत की जानकारी नहीं है) (C)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
	कुल योग			

विश्लेषण

श्रेणी / अंक	कुल योग अंक	कुल अंक	प्रतिशत
सही जानकारी है			
पूछने/समझाने पर बताया			
जानकारी नहीं है			

स्वराज सन्देश संवाद पदयात्रा - 2024

किसान समूह का उर्जा उत्पादन-उपभोग स्तर एवं उर्जा-दक्षता नियोजन

गाँव का नाम..... **दिनांक .....**

कृषि एवं आदिवासी स्वराज संगठन .....ब्लॉक.....जिला.....

समूह कार्य संख्या.....

किसान समूह के साथ वर्तमान स्थिति पर चर्चा का पत्रक (समूह में कितने प्रतिशत परिवार किस संसाधन का उपयोग कर रहे हैं, इसमें सबका टोटल 100 प्रतिशत होने जरुरी नहीं है, क्योंकि कुछ परिवार एक से अधिक उर्जा स्त्रोत भी काम में ले रहे हो सकते हैं |

समूह कार्य

क्रमांक	विवरण	डीज़ल, पैट्रोल, केरोसिन, रसोई गैस, जलाऊ लकड़ी इत्यादि	बिजली व्यवस्था	पशुधन एवं मानव शक्ति	नवीकरणीय उर्जा (सौर, पवन, बायोगैस, अन्य)	उर्जा-दक्षता नियोजन गतिविधि
A	**कृषि आजीविका**					
A.1	बीजाई					
A.2	कटाई					
A.3	जुताई					
A.4	सिंचाई					
A.5	निंदाई-गुड़ाई					
A.6	छटाई					
A.7	भण्डारण					
A.8	चारा प्रबंधन					
A.9	पैकेजिंग					
A.10	प्रसंस्करण					
A.11	परिवहन					
A.12	खाद का उपयोग					
A.13	रासायनिक उपयोग					

A.14						
A.15						
	कुल योग (A)					
B	**घरेलु उर्जा प्रबंधन**					
B.1	रोशनी					
B.2	रसोई बनाना					
B.3	दूध का प्रसंस्करण (छाछ/घी/मावा/ पनीर बनाना					
B.4	पिसाई (आटा दलिया/बांटा)					
B.5	सिलाई/कड़ाई					
B.6	पशु-आहार					
B.7	पेय-जल व्यवस्था					
B.8	गीज़र, कूलर, AC, हीटर आदि					
B.9	आवागमन साधन					
B.10						
B.11						
	कुल योग (B)					
C	**सामूहिक उर्जा उपयोग**					
C.1.	विद्यालय भवन/अस्पताल					
C.2	पंचायत / बस-स्टैंड					
C.3.	पेयजल स्त्रोत					
C.4	मार्ग की रोशनी					
C.5.	सामुदायिक सिंचाई					
C.6.						
C.7.						
	कुल योग (C)					

ANNEXURE 3 : ***Stakeholders and Potential Partners***

External Actors	Nature of the inputs
Janjatiya Swaraj Kendra, Kupda	Studies and action research for the proposed CCRD study, preparing policy briefs, organizing events for TDF etc.
Regional, District, Village, and local level tribal leadership/CBOs	Lead campaign of tribal sovereignty, take responsibility for preparing meaningful tribal leadership, playing pivotal role of policy/people advocacy for preparing the GPDP on CCRD lines and its actions for convergence.
Government Departments (Education, PHED, TAD, Rural Development, Social welfare. etc.)	Technical, financial and governance support from the departments and policy level collaboration for convergence of the interventions under GPDP and tribal sovereignty
State power generation and distribution companies,	Involvement in Energy Audit and implementation of status and development report actions.
Department of renewable energy promotion	Assessment of "Energy poverty" and improved access of indigenous community to Energy programs
State and National Network of CSOs	Policy level advocacy, latest information, lobbying support, linkages, moral boost up and other required cooperation
Tribal University	Collaborative studies, research, providing input for various policy issues, and sharing of learning
State run programs and schemes	Improving access to various programs, demonstrate innovative ideas and technologies and advocate for new financial tools associated with circularity within farming system and energy access potential
Media (print and electronic)	In preparing case-studies for replication and propagation of CCRD actions and their outcomes to the public.
CBOs, CSO, NGOs and other Church based organizations.	Technical and resource-based collaboration, group initiatives on tribal sovereignty along with orientation and exposure visits. Involve as a network organization for the Krishi Evam Adivasi Swaraj Manch-KASM and sharing of learning for Sovereignty to Sustainability.

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