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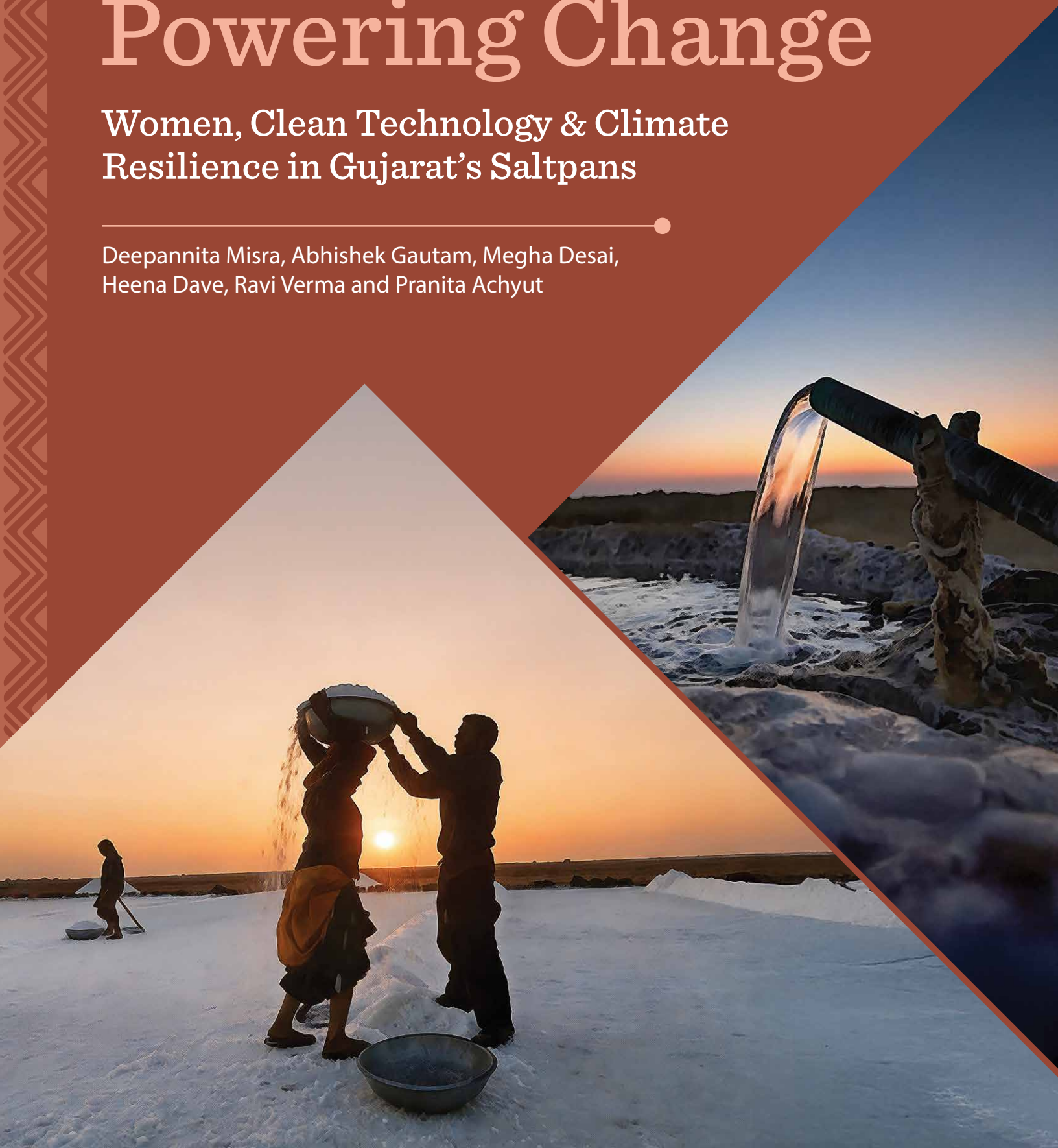
Powering Change

Women, Clean Technology & Climate Resilience in Gujarat's Saltpans

Deepannita Misra, Abhishek Gautam, Megha Desai, Heena Dave, Ravi Verma and Pranita Achyut



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The International Center for Research on Women (ICRW) is a decentralized global network comprising three autonomous regional entities - ICRW-Africa, ICRW-Americas, and ICRW-Asia. For nearly 50 years, ICRW has set the global agenda for gender equity, inclusion, and shared prosperity with action-oriented research and solutions. Our global experts generate groundbreaking insights and develop gender transformative strategies on topics like economic opportunity and security, health and reproductive rights, gender norms, and climate action. Our vision is to create an equitable, sustainable, and prosperous world where women, girls, and structurally excluded populations lead and thrive.

About SEWA

The Self-Employed Women's Association (SEWA) is a national trade union of women workers in the informal economy, founded in 1972 by Ela Bhatt. With a membership of more than 3.78 million women across India, it is the country's largest central trade union of self-employed women workers. Guided by the goals of full employment and self-reliance, SEWA works to strengthen women's livelihoods through collective organizing, access to finance, social protection, capacity building, market linkages, and other integrated approaches that address poverty, vulnerability, and resilience.

Suggested Citation

Misra, D., Gautam, A., Desai, M., Dave, H., Verma, R., & Achyut, P. (2026). Powering Change: Women, Clean Technology & Climate Resilience in Gujarat's Saltpans. New Delhi: International Center for Research on Women (ICRW)-Asia and Self Employed Women's Association (SEWA).

Acknowledgments

We extend our deepest gratitude to the Agariya women salt workers whose participation was foundational for this study. We are also grateful to Reema Nanavaty (Director, Economic and Rural Development, SEWA) and SEWA Board members, Mr. Arun Sharma and Dr. Jun Zhang, for their invaluable strategic insights into the program.

This work was made possible through the support of the Rockefeller Foundation, the Gujarat Forest Department, and the Industries and Mines Department, Government of Gujarat.

Finally, we thank the research team and staff members at both SEWA and ICRW for their collaborative efforts in ensuring the study's successful completion.

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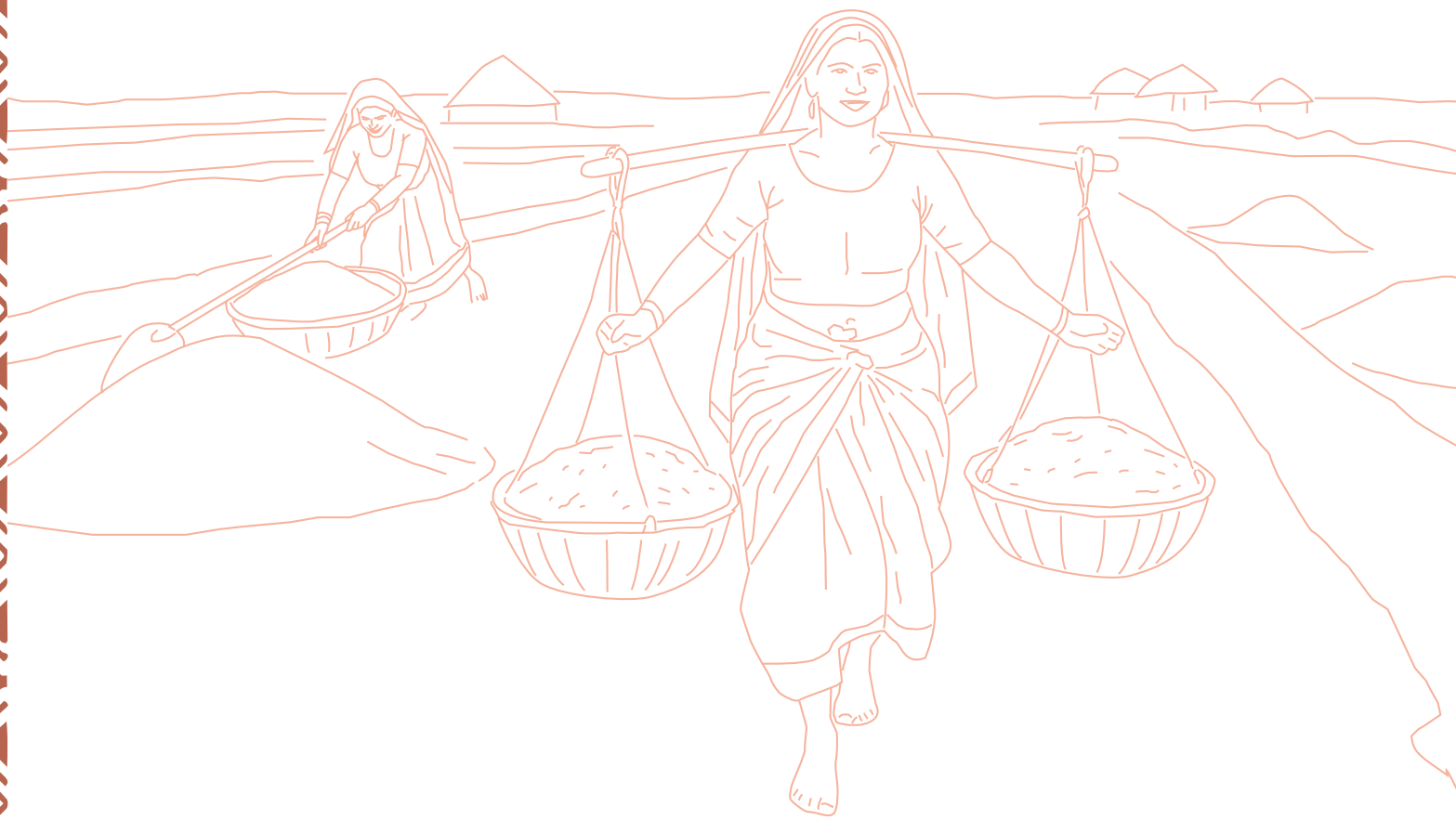

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Executive Summary

Women salt workers in Gujarat's Little Rann of Kutch (LRK) region operate within one of India's most climate-vulnerable and resource-constrained environments, where livelihoods are closely tied to the Rann's landscape and natural systems and are increasingly exposed to rising temperatures and climate stress. Situated within India's broader renewable energy transition and global climate commitments, this brief examines how the shift to solar pumps in salt farming is reshaping women's work, wellbeing, and resilience, while highlighting inequalities that shape access, ownership, and benefits.

The brief positions solar technology as both a climate adaptation strategy and a pathway for strengthening women's economic resilience.

Drawing on a mixed-methods study conducted between 2023 and 2025 with Agariya women salt farmers, the study combines quantitative surveys and qualitative methods to examine changes in energy use, socio-economic outcomes, and women's lived experiences of adopting solar technology.

The transition to solar technology has delivered significant economic, social, and environmental benefits. Women reported reduced input costs, increased production, and higher savings, which were reinvested in housing, education, and health. Importantly, women's ownership of assets and participation in decision-making increased significantly, with many gaining greater bargaining power in both markets and households.

However, the study demonstrates that technology alone is insufficient; its success depends on supportive ecosystems, including access to finance, enabling policy environments and sustained capacity building. SEWA has played a central role in enabling this transition through trainings, financing, facilitation, and collectivisation.

The evidence underscores that clean energy transitions can drive inclusive and resilient development. However, the impact is transformative only when supported by gender-responsive systems that center women's participation, ownership, and leadership. The key recommendations are as follows:

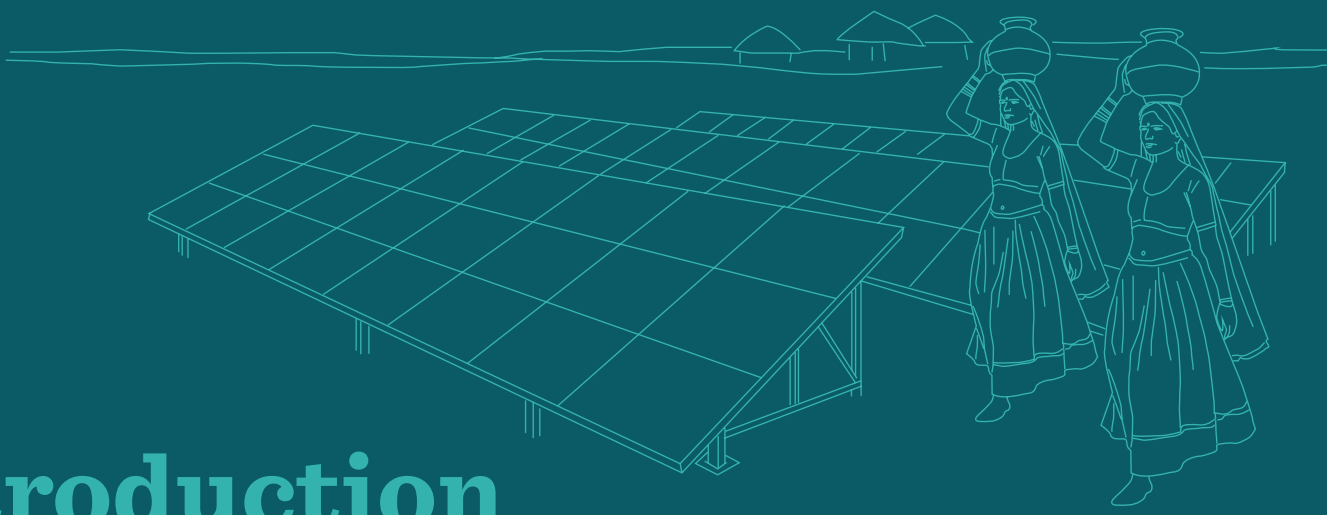
Centering women in technology design and deployment - Ensuring that women's lived experiences inform the design, adoption, and governance of clean technologies to improve usability, uptake, and long-term sustainability.

Expanding access and affordable financing - Scaling gender-responsive financing models, including subsidies, flexible loans, and de-risking mechanisms, to enable equitable access to clean energy technologies.

Building capacities - Strengthening women's technical and managerial skills in operating, repairing, and managing renewable energy systems, while supporting collective platforms that enhance leadership and peer learning.

Strengthening enabling policy and institutional ecosystems - Integrating gender considerations into climate and energy policies while aligning subsidies and regulatory frameworks and ensuring long-term support for decentralized renewable systems.

Advancing women's agency and ownership - Promoting women's asset ownership, expanding financial literacy and strengthening women's role in household and market-level decision-making.



Introduction

In recent years, technological innovation has emerged as a key driver of renewable energy transitions. Countries like Brazil, Germany and Denmark are demonstrating increasing reliance on wind, hydropower, and other clean energy sources. Global strategies increasingly emphasize the importance of synergies between energy, climate, and other economic policies which, if effectively leveraged, can drive GDP growth and create substantial employment opportunities (Gielen et al. 2019).

Climate strategies today prominently feature the adoption of electric vehicles (EVs), the deployment of large-scale renewables, and investment in carbon management solutions (IEA, 2021). These align with the Paris Agreement of 2015, which set out the global ambition to limit temperature rise to well below 2°C above pre-industrial levels, and preferably to 1.5°C.

India's leadership in renewable energy is now globally acknowledged. Non-fossil fuel sources account for nearly half of the country's total installed power capacity, marking significant progress towards its net-zero ambitions. Despite contributing only 2.1 tons of carbon emissions per capita, India continues to demonstrate that economic growth and climate responsibility can advance together, showcasing the potential of technology-driven inclusive and sustainable transitions.

In India, women's livelihoods remain closely tied to natural resources through their work in agriculture, fisheries, and forest-based activities (Elias et al., 2024). A large proportion of women are engaged in agriculture; nearly 65% of the workforce being women, compared to 42% of men working in this sector (Pattnaik et al., 2018, as cited in Pattnaik & Lahiri-Dutt, 2022). This gendered division of labor, coupled with precarious working conditions and restrictive social norms, leaves women disproportionately vulnerable to climate shocks and rising heat stress, with cascading effects on their productivity, livelihoods, and overall well-being (Rao et al., 2017; UN Women, 2022).

In the state of Gujarat, nearly half of the working population is engaged in agriculture, even as the state faces mounting climate risks. The World Bank estimates that by 2050, 19 districts of the state could become climate "hotspots", with temperatures rising by 2–2.5°C (Government of Gujarat, 2021). Within this landscape, the Little Rann of Kutch (LRK)—home to the Agariya community of salt farmers—stands out as one of the harshest and most climate-vulnerable terrains. The region experiences extreme seasonal variations, with salt marshes dominating in summers and winters, and wetlands forming during the monsoon (Natural Resources Defense Council & SEWA, 2018). Women are central to the salt economy in the LRK, sustaining its production systems through their labor, expertise, and adaptive practices.

While global commitments and technological advancements offer a promising vision, the real test lies on the ground where climate change directly impacts lives and livelihoods.

In 2022, the Self-Employed Women's Association (SEWA), India's largest trade union of women workers engaged in informal economies launched the Cleaner Sky (Swachh Akash) Campaign as a comprehensive umbrella campaign to address the intersecting challenges of climate change for women workers. Under this, SEWA, in collaboration with women workers, is consolidating earlier learnings and implementing need-based climate interventions to mitigate adverse impacts on their health and livelihoods. This includes the initiative with Agariya women working in salt farming, to facilitate their transition to clean energy by improving the accessibility and affordability of green technologies and boosting household income.

As renewable energy and technology-driven interventions with these Agariya women advance, it becomes essential to examine how these transitions address their unique vulnerabilities and ensure equitable benefits, particularly in the context where they remain at the forefront of production, yet excluded from ownership and decision-making.

International Center for Research on Women (ICRW), in partnership with SEWA, and supported by the Rockefeller Foundation, undertook collaborative research between 2023 and 2025, documenting women-led climate action and the gendered dimensions of just transitions under the Cleaner Sky Campaign.

This research brief examines how the adoption of clean technology—specifically the transition from diesel to solar-powered water pumps—has acted as a catalyst for Agariya women's economic empowerment as well as bolstering climate resilience. It also explores how gender shapes every stage of this transition—from women's access to information, finance, and ownership of technology, to their participation in decision-making around financial issues and the use and maintenance of technology.

The brief also identifies the enabling factors that make such transitions possible, along with the institutional conditions required to ensure that the benefits are equitable, sustained, and scalable. Finally, it underscores the broader policy imperative of embedding gender equity within India's just energy transition—so that technological progress not only advances renewable energy goals but also transforms gender relations, expands women's agency, and strengthens inclusive, climate-resilient livelihoods.

Methodology

This research was guided by the central question: How do women-led clean energy initiatives, embedded within a women's economic empowerment model, lead to measurable carbon reductions and strengthened economic resilience?

The study adopted a mixed-methods design, integrating both quantitative and qualitative approaches. It was conducted across three blocks—Halvad, Patdi, and Dhrangadhra—in Surendranagar and Morbi districts of Gujarat.

Quantitative Component

This included two interlinked surveys:

An Energy-use survey, which assessed changes in fuel consumption, reliance on diesel, and greenhouse-gas (GHG) emissions. The survey was conducted in three rounds (January–February 2024, March–April 2024, and May–June 2024) with 70 Agariya women. Of these 70 women, 33 were using solar pumps, 36 were using diesel pumps, and one woman was using both. Together, the three rounds generated 210 data points for analysis, providing longitudinal insights into energy use and emissions.

A Socio-economic survey, which helped to understand household characteristics, costs, savings, and perceptions of clean technology, as well as the process and impacts of women's transition to green energy.

Sampling for the Socio-economic Survey:

A systematic random-sampling approach was used to select respondents from a pre-identified list of Agariya women engaged in salt farming in the LRK and having a solar pump. Separate sampling frames were prepared for SEWA and non-SEWA members to ensure balanced representation. The lists included 837 SEWA members and 246 non-SEWA members. To avoid duplication, women who participated in the Energy-use survey were excluded from this sampling frame. Subsequently, every 'nth' eligible woman was selected for the survey, based on population size and required sample. This approach yielded a fair and unbiased representation of households with and without collective support, but equally dependent on salt farming and technology.

The socio-economic survey covered 545 Agariya women (363 SEWA members and 182 non-SEWA members), capturing data on socio-economic conditions, access to solar technology, costs and subsidies, perceived impacts of climate change, and evolving perspectives on renewable energy adoption.

Participatory approach was adopted for data collection, in which a local data-collection team of literate young Agariya women was recruited and trained. These enumerators were trained in research ethics, survey administration, and the use of a Computer-Assisted Personal Interviews (CAPI) tool for data collection, ensuring contextual familiarity and reliable data capture.

Qualitative Component

This included In-Depth Interviews (IDIs), Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs) to capture women's lived experiences, leadership roles, and the programmatic evolution of technology adoption and use among Agariya women engaged in salt farming in LRK within the larger Cleaner Sky initiative.

In-depth Interviews (IDIs): 14 interviews (ten with SEWA members and four with non-SEWA members) explored the women's lived experiences, voice and agency, and perceived impacts of solar adoption.

Key Informant Interviews (KIIs): These were conducted with program stakeholders to trace the design of the initiative, understand the challenges encountered, and plot the pivotal milestones in supporting women's transition to solar energy.

Focus Group Discussions (FGDs) and Observations: Five FGDs (three with SEWA members and two with non-members) examined how solar adoption has influenced salt-farming practices and the everyday lives of the women. Additionally, two SEWA trade committee meetings were observed to understand the collective decision-making processes and women's leadership within the salt-farming sector.

Findings

Salt farming as a traditional livelihood in the Little Rann of Kutch

For centuries, LRK's traditional communities have pursued seasonal livelihoods such as salt making, fishing, and pastoralism, with salt farming deeply embedded in the lives of the Chunvalia Kolis, also known as the Agariyas (after the Gujarati word, agar, meaning "salt farm"). While the precise historical origins of salt farming in LRK are uncertain, oral traditions and existing scholarship suggests that the Agariyas have long maintained customary rights over salt production through a decentralized system of resource management. Over time, their knowledge and techniques became integral to the regional salt economy (Patel, 2025). This continuity was confirmed in our fieldwork. Most of the interviewed women reported being raised entirely within salt-farming families, acquiring skills in their childhood, and continuing the craft.

Salt farming comprises several steps, including mud work (*gara kaam* in Gujarati), digging wells, and monitoring and raking the salt pans to collect the salt after the brine dries up. Women salt farmers play an indispensable, yet often unacknowledged role, in this process. Most of these steps are laborious, requiring women to team up with their husbands and other family members to complete the tasks successfully within a limited timeframe. As revealed by the survey respondents, a majority of women are involved in each of the activities leading up to the harvest, with 60–64% women involved to a great extent and 28–33% involved to some extent in digging wells, mud work, and raking the salt pans. As one of the interview respondents pointed out:

> *At the beginning of the salt season, there are a lot of hardships in the salt pan work. Right now, when we go in the desert there will be 'garo' (wet mud) and we will have to walk on that with our drinking water, fuelwood, groceries...all that has to be taken there because we are 14 kms away from anything....*
>
> -IDI with Woman Worker

The physical isolation of the salt pans, which spreads across the desolate expanse of the Rann, compounds this labor intensity. Families migrate to these sites for eight months each year, setting up makeshift shelters with no electricity, sanitation, or schooling. The workday stretches from dawn to dusk under searing heat, with salinity from the brine corroding the skin and eyes. Recognizing this dimension is crucial, as it situates the Agariyas' labor not just within an economic system but within broader climate and gendered vulnerabilities, and lays the foundation for solar innovation and adoption in the terrain.

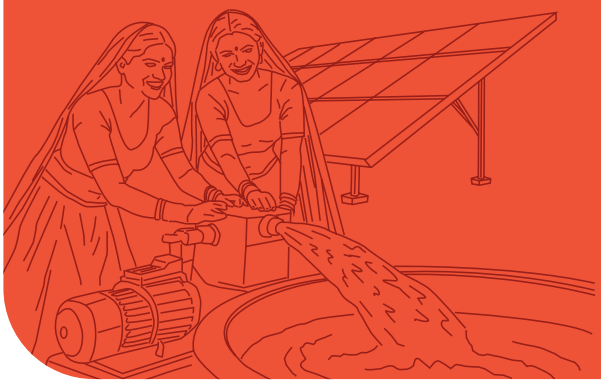
From problem to prototype: The role of technology in building just transition solutions

For decades, Agariya families in the LRK relied on diesel-powered water pumps to draw brine for salt production. While essential for their livelihoods, these pumps consumed large amounts of fuel, locking the Agariyas into a cycle of high operational costs and low profit margins that reinforced their poverty. Climate variability—erratic rainfall, rising temperatures, extended dry spells, and depleting ground water levels—further increased their dependence on diesel, amplifying both economic and environmental strain.

In response to these challenges, SEWA and its subsidiary, the Grassroot Trading Network for Women (GTNfW), first piloted a solar-powered water pumping system in 2012, nearly a decade before the launch of the Cleaner Sky (*Swachha Aakash*) campaign. Although the GTNfW pilot began in 2012 and was well ahead of the Paris Agreement, it was developed within an evolving national policy environment that already encouraged innovations in renewable energy. India's National Action Plan on Climate Change (NAPCC), published in 2008, established a policy framework that linked development objectives with climate co-benefits and created a push for clean energy and adaptation measures at the national level. Building further on that, the Jawaharlal Nehru National Solar Mission (launched in January 2010) provided an explicit national focus on deploying solar technologies at scale, and on experimenting with off-grid and decentralized solar solutions.

Drawing inspiration from the solar irrigation models of agriculture, GTNfW adapted the technology to the harsh terrain of LRK. The solar plant comprised solar panels, a submersible pump (1–2 HP), a support structure, and a variable-frequency drive (VFD), designed to meet the specific needs of women salt farmers. Through iterative testing and feedback from women workers, the technology was refined for practicality, cost-effectiveness, and user-friendliness. Importantly, design modifications were not merely technical but also addressed ergonomic considerations. For instance, the height of the pump stand was adjusted based on women's feedback to ensure ease of operation and management. Such changes, though seemingly minor, reflect a deliberate shift from community-level provisioning to a more explicitly women-centered approach to technology design.

As one of the GTNfW staff members recalled:



> *"[We] started this in 2012–2013. We monitored [it for] one full season to see how much diesel is saved and [if] women are saving [any money]. Then in the second year, we increased and gave solar plants to 200 women with pumps. Then we increased it year on year...."*

The pilot results demonstrated the value of the solar technology, its responsiveness to the unique conditions of the Rann and the specific needs of women salt pan workers. By switching from diesel to solar, women nearly halved their fuel consumption, resulting in a substantial reduction in production costs. This initial success provided the empirical foundation for a scalable, gender-inclusive, and climate-resilient solution.

Building on this decade of learning, SEWA launched the Cleaner Sky (*Swachha Aakash*) campaign in 2022 to accelerate women-centered climate adaptation and mitigation efforts. The campaign consolidated earlier pilots and scaled the solar transition model across LRK, aligning closely with India's renewable energy priorities and translating national commitments on off-grid innovation and inclusive climate action into practice.

Strategic financing to enable access to affordable clean technology

Building on the successful pilots and learnings, SEWA recognized that scaling the solar model would not only require technological refinement but also accessible financing, as access to solar technology for Agariya women was largely constrained by limited access to credit.

To address these credit barriers, SEWA designed a comprehensive financial product tailored to the community's socio-economic realities (ref. Box 1). To minimize credit risk, the product coupled seasonal repayment scheduling—which mirrors the borrowers' actual income patterns—with a "first-loss" guarantee fund to cover any remaining capital losses for the bank. The product was structured to de-risk women's investments in clean technology, subsidizing the commercial loan and substantially reducing the bank's lending risk.

Box 1. De-risking investment to access clean technology

- Linking the payment of their loan instalments to the cash flow of the women workers.
- Securing a grant to act as a "first loss" fund, which subsidized the commercial loan and significantly lowered the risk for the bank.

This strategic financing structure enabled the women to secure affordable loans and overcome the credit barrier to technology adoption.

As a program expert noted:

"[We] got the banks to put up a loan package for the salt pan workers...[where] 60% of the savings from switching to solar power was considered as the affordability for salt pan workers. And the duration of the loan was considered to be up to four years. With that we calculate[d] the cost of getting the solar panels, the pumps, cost of the maintenance and other costs....[Then] we managed to get a grant to subsidize the commercial loan. [We] use[d] that grant for de-risking... used as the "first loss" fund in case any salt pan workers cannot repay for whatever reason... [That] made that loan very safe, even safer than most of their [SEWA Bank's] consumer lending."

This financing structure proved transformative. It enabled Agariya women to invest in solar technology, while the near-zero loan-delinquency rate demonstrated both the financial viability of the model and the high creditworthiness of women borrowers.

By directly addressing the financial barrier to clean technology adoption, the initiative transformed the landscape for women from being locked into debt due to diesel expenses, to becoming reliable investors in renewable energy.

Scaling the solution: Weaving in policy changes and capacity-building

The early success of solar pumps strengthened both the economic and environmental case for scaling this model. Building further on this momentum, SEWA advocated for wider access to affordable solar technology for Agariya women.

In response, the state government introduced a landmark subsidy scheme (from 2017–2018 to 2022–2023), which covered 80% of the cost of solar plants, to be paid after installation. The government's assurance of subsidy encouraged banks, traders, and solar vendors to facilitate purchases for all women salt farmers, creating a market ecosystem that enabled large-scale adoption.

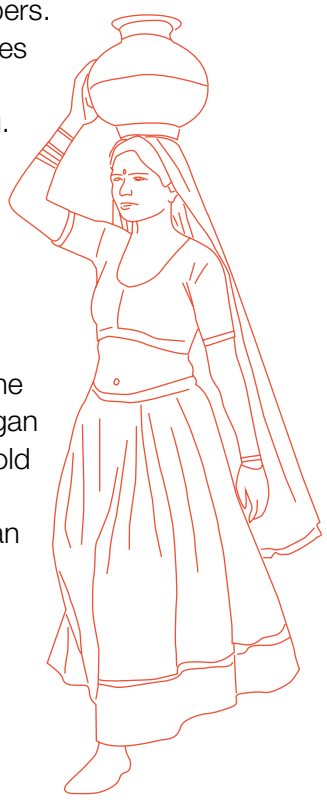
The socio-economic survey showed that SEWA membership impacted the depth and quality of solar adoption in the LRK region. Data showed that SEWA households (HHs) purchased more solar plants (average 1.3 per HH) compared to non-SEWA households (average 1 per HH). Access to loans and subsidies contributed to this majorly. SEWA HHs took loans for 86% of the solar plants and received subsidies for 70%, while non-SEWA HHs only took loans for 59% of the solar plants and received subsidies for 45%. Taken together, these patterns point to SEWA's crucial intermediary role in lowering informational and financial barriers to solar adoption, which then shaped women's longer-term financial autonomy and technological choices.

Alongside policy assurance and market participation, SEWA also invested in capacity building of Agariya women to ensure lasting impact. Training modules covered a wide range of skills, including financial literacy (38%), repair of solar equipment (40%), costing and marketing of salt (57%), and salt production and quality (60%), all of which were exclusive to SEWA members. The usefulness of these trainings was rated overwhelmingly high: over 85% found them "very useful" across modules, with 95% rating the solar-repair training as "very useful".

Moreover, SEWA members were far more engaged in awareness and outreach activities within their communities: 36% of SEWA members reported participating in awareness drives in the past year compared to less than 1% of non-members. This indicates that SEWA's capacity-building approach not only enhanced women's technical competence but also fostered greater leadership and participation in community learning spaces.

Importantly, this has translated into tangible asset ownership. The socio-economic survey findings revealed that majority of the solar plants (59%) were purchased in women's names. The difference between SEWA and non-SEWA members was striking: 83% of SEWA members reported solar plants registered in their own names, compared to just 3% of non-members. This highlights the structural changes in asset registration brought about through collectivization and training.

These structural and capacity gains laid the foundation for broader social change. Economic stability and asset ownership, combined with technical skills that these women developed through the transition to solar pumps, soon began to reshape their daily lives, household decisions, and aspirations, underlining the ripple effects of clean technology adoption.



Ripple effects of solar pump adoption on women's lives

Box 2. Economic and Social Shifts on the Ground

- 68% reported reduction in input cost
- 53% reported increased production
- 93% reported more money in hand, leading to greater investment in health, education, and housing
- 80% reported having the final say or sharing decisions equally on key household and livelihood matters
- Reduction in respiratory discomfort, headaches, injuries, and exposure to diesel fumes
- 23KT reduction in CO_2 emissions in a single season
- Measurable economic gains and expanded bargaining power

The transition from diesel to solar pumps has not only reshaped women's work but also their households and communities. As seen above (ref. Box 2.), SEWA's training, facilitation, and collective platforms played a crucial role in enabling women to adopt and effectively manage the technology. Hence, the impacts described here reflect not just access to solar plants but also to the support structures surrounding them.

Economic benefits

Nearly all the participants in the socio-economic survey reported tangible gains from adopting solar. Nearly two-thirds of the women mentioned that their input cost, mainly on diesel, had reduced, and half of them mentioned an increase in salt production after adopting solar. This resulted in more money in hand for various household expenditures (reported by 93%). More than one-third (35%) of the women were able to improve their housing, often moving into *pucca* structures. They also described how the money, once drained by diesel pumps, was now being redirected towards children's education, health expenses, purchasing motorcycles and building their savings.

Data from the energy-use survey showed that the average cost of the solar plant and the maintenance cost for a season (approximately INR 258,000)[1] was slightly higher than the cost of diesel equipment and the recurring cost of purchasing diesel and maintenance for a season (approximately INR 240,000).

While overwhelmingly positive, solar adoption did bring a few challenges: mainly the additional responsibility for equipment upkeep (6%) and higher transportation costs (2%). Yet, with 88% reporting no negative impacts and virtually no loan defaults, the transition proved both economically viable and sustainable for Agariya women.

[1] The cost is not normalized for the current price

Agency and decision-making

Perhaps the most profound change brought about by the solar transition has been in improving women's agency and decision-making power. Nearly 80% of women reported having the final say now, or at least sharing decisions equally, on key household and livelihood matters. SEWA members reported greater participation than non-members, underscoring how collective platforms amplify women's voices. Some women even engaged directly in pricing negotiations with traders, traditionally a domain reserved for men. As one respondent shared:

> *"When the loan and subsidy came in our names, people had to listen to us. Traders who earlier ignored us now sit at the table with us."*
>
> -IDI with Woman Worker

Health and environmental benefits

The adoption of clean technology has also had health-based and environmental dividends. Women reported reduced exposure to diesel fumes, as well as fewer headaches, lesser respiratory discomfort and skin irritation—common issues due to long working hours at the salt pans. During the discussion, several women shared that operating diesel generators exposed them to the risk of injury. In contrast, they noted that solar pumps reduce these safety concerns and offer "greater peace of mind", as they do not require constant supervision.

Environmentally, the transition was equally significant: collectively, 8,000 women prevented approximately 23,000 tons of CO_2 emissions in a single salt season.

Other social benefits

The ripple effects have extended across generations. Due to solar adoption, increased savings have allowed families to invest in mobility (bicycles and motorcycles), and 84% of women affirmed the importance of education for girls, signaling a shift in aspirations for the future.

Conclusion

The story of the Agariya women reflects India's broader vision for equitable and sustainable energy transitions. As highlighted during the Bharat Climate Forum held in January 2025, energy transitions must balance sustainability, smart planning, and social equity—principles that underpin India's climate leadership journey. The shift towards clean energy in the salt pans of Gujarat illustrates these ideals in action, translating national ambition into tangible grassroots change.

The experience of the Agariya women in the Little Rann of Kutch demonstrates how adopting clean technology can serve as both an economic and social equalizer. The shift from diesel to solar pumps reduced input costs, unlocked savings, improved health, and created new spaces for women's decision-making and leadership.

However, technology alone cannot transform women's lives or gender relations. Its potential is realized only when it is responsive to lived realities; when it is accessible, affordable and supported by mechanisms that enhance women's agency and control over resources. Ensuring women's active participation in the design, ownership, and governance of clean technologies is therefore essential for achieving deeper and more sustainable gender outcomes.

What began as a prototype has evolved into a scalable, women-led and-centered, clean energy transition, supported by strategic financing, state policy, and capacity-building. It is transforming a livelihood, once bound by diesel dependency, into one powered by renewable energy and grounded in climate resilience and women's agency.

The journey of the Agariyas highlights a critical lesson for global climate governance and development policy. When women are recognized as engines of change, enabled to adopt and manage clean technologies, the results extend far beyond reduction in emissions. They generate lasting economic empowerment, strengthen collective voices, and build pathways for just transitions in some of the harshest climate-affected landscapes. This example of the Agariyas provides tangible, grassroots evidence that aligns with global frameworks such as the Sustainable Development Goals (SDGs) and the Conference of Parties' (COP) commitment to inclusive climate action; it illustrates how local innovation in clean technology by women could inform international dialogue on just, equitable, and sustainable transitions.

Way Forward

The transition from diesel to solar pumps in the Little Rann of Kutch underscores the transformative power of clean technology in women's livelihoods and resilience. To sustain and scale this momentum, four interlinked priorities emerge:

Centering women's voices

Centering women's voices in technological innovation is essential for just and effective clean-energy transitions. The LRK experience shows that when women's lived realities shape the design and use of solar technology, adoption is faster, usability improves, and benefits are more sustainable.

This aligns with COP30's push to operationalize the Global Goal on Adaptation (GGA) through people-centered, locally grounded, and equity-focused approaches. Embedding women's perspectives in clean-energy planning strengthens both gender-responsive outcomes and the translation of global climate commitments into meaningful, on-the-ground adaptation.

Expanding access and affordability

Ensuring access to clean-energy technology requires financing models that reach the last mile. In LRK, a combination of state subsidy and a SEWA-facilitated financial product with de-risking mechanism made solar pumps affordable for women salt pan workers, who otherwise faced structural barriers to finance.

Comparable global examples include the Solar Sister in Kenya, which mobilized over 10,000 women entrepreneurs to distribute solar products, reaching nearly five million women (IFC, 2024). In Bangladesh, the Global Agriculture and Food Security Program–Food and Agriculture Organization (GAFSP–FAO) programs show how women smallholders continue to struggle with access to finance, technology, and information (FAO/GAFSP, 2023). These cases highlight that gender-responsive subsidies and credit mechanisms are not only matters of equity; they are proven strategies for accelerating clean-energy uptake and enabling community-level adaptation.

The effectiveness of such approaches, however, depends on their duration and continuity. In the LRK, a time-bound subsidy scheme yielded substantial benefits but was insufficient for universal transition. Many Agariyas continued to struggle with the high upfront costs of purchasing solar infrastructure after subsidies were discontinued. This underscores the need for longer-term subsidy frameworks or de-risking funds that allow households to transition at different paces, aligning with seasonal incomes and thus reducing dependence on high-cost borrowing. Evidence from the Global South, such as Bangladesh's long-running, well-designed subsidy and financing program (IDCOL Solar Home Systems) corroborates the same (GOGLA, 2024). It emphasizes that sustained public support, combined with microfinance and supply-

side interventions, can create viable markets for new technology, drive down prices, and reduce long-term fiscal costs as markets mature. Similarly, the World Bank's analysis (2015) stresses that sustained de-risking (subsidies, soft loans, viability-gap funding, after-sales service financing) is needed to scale off-grid technologies without leaving vulnerable users behind.

This long-term approach is therefore critical to ensuring that clean-energy transitions are inclusive and durable.

Building capacities for technology adoption and ownership

Strengthening women's technical and managerial skills is essential to ensure that they lead, rather than simply use clean energy systems. Global experiences reinforce this: Barefoot College's Solar Engineer Program has trained over 1,700 rural women across 96 countries to install and repair solar systems, enabling more than 75,000 households to shift away from kerosene. In LRK, SEWA's partnerships with United Nations Environment Program (UNEP) and ReNew Power to train women as solar pump and panel technicians demonstrate how skill-building deepens adoption, reduces dependence on external service providers, and creates pathways for new livelihoods. When women are equipped to operate, repair, and manage renewable energy systems, communities benefit from stronger ownership, improved system performance, and more resilient local adaptation strategies.

Integrating the gender lens in policy

Evaluations consistently show that without explicit targeting, financial support, and monitoring criteria for women, clean-energy policies do not translate into meaningful or sustained technology adoption. India has several relevant schemes—from PM-KUSUM and state solar policies to Ujjwala and universal electrification under the Revamped Distribution Sector Scheme (RDSS)—but most operate in silos rather than as part of a cohesive, gender-responsive strategy.

Additionally, regulatory frameworks governing land, environment, and electricity markets significantly shape renewable energy uptake for ecologically sensitive livelihoods. In regions like LRK, the feasibility of ground-mounted solar off-grid systems and related infrastructure in salt pan landscapes is guided by provisions under the EIA Notification (2006), the Wildlife (Protection) Act, 1972, and the Coastal Regulation Zone (CRZ) Notification, 2019. Further, state electricity regulations, particularly the Gujarat Electricity Regulatory Commission (GERC) provisions, on net-metering, banking, and open access, determine whether decentralised and community-owned solar systems can viably feed surplus power to the grid. These regulatory instruments are rarely addressed in gender-energy policy discussions, yet decisively influence women's ability to adopt, own, and benefit from clean-energy technologies.

Therefore, embedding women-centered, clean technology priorities directly into climate and development policy frameworks would help move beyond fragmented efforts and enable a focused just-transition approach that recognizes women as key agents of adaptation and clean-energy transformation.

These priorities align with India's national renewable energy mission, which emphasizes solar manufacturing, off-grid connectivity, and green livelihood creation as pathways to sustainability and economic opportunity. The LRK experience demonstrates how context-specific technological and financial innovations, coupled with women's leadership, can accelerate this transition. By linking women's voices and agency with technological innovation and national ambition, India can continue to demonstrate climate leadership grounded in inclusion and fairness. Pursuing these pathways will help move clean-energy adoption from localized success to a scalable model of women-led climate resilience and economic empowerment.

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