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Gender, Energy, and Diplomacy: India's Digital Contribution to the Solar for She Program

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Abstract

The International Solar Alliance's (ISA) Solar for She initiative seeks to advance gender equity and social inclusion by increasing women's access to solar energy, creating livelihood opportunities, and building local capacities in solar technologies. This paper situates Solar for She within India's broader solar diplomacy and examines how India's digital leadership—through capacity-building platforms, data-driven project design, and multilateral convening—strengthens global collaboration on gender-responsive solar deployment. Drawing on ISA policy documents, government releases, and contemporary analyses, this article maps the initiative's objectives, instruments, and potential impacts while identifying implementation challenges and policy recommendations to maximize developmental and diplomatic returns.

Keywords: *Solar for She; International Solar Alliance; solar diplomacy; gender and energy; India; digital leadership; solar capacity building.*

Introduction

Energy access and gender equality are mutually reinforcing development priorities: lack of reliable electricity disproportionately affects women's education, health, and economic opportunities. The ISA launched Solar for She as a Gender Equity and Social Inclusion (GESI) initiative to target these intersections—promoting women's participation in the solar economy through training, entrepreneurship support, and access to solar solutions.

Background: India,ISA and Solar Diplomacy

The ISA is a member-driven intergovernmental organization co-initiated by India and France to accelerate global solar deployment and mobilize finance, technology, and capacity building among "sunshine" countries (ISA, n.d.). India's diplomatic leadership in ISA aligns with its domestic solar ambitions and broader foreign-policy goals: strengthening South–South cooperation, projecting soft power, and catalyzing investment flows into the Global South (Press Information Bureau, 2024). Recent ISA financing and project announcements—targeted at mini-grids, rooftops, and capacity-building—underscore the alliance's operational pivot toward deployable projects in Africa and Asia. This strategic posture gives India an avenue to practice "solar diplomacy": using clean-energy cooperation to build bilateral and multilateral ties.

Literature Review

Gender, Energy, and Development

Scholars widely recognize that access to modern energy is a precondition for achieving gender equality (Clancy, 2018; Parikh, 2020). Women often bear the brunt of energy poverty through unpaid labor in fuel collection, health risks from indoor air pollution, and restricted mobility for economic activities. Interventions in renewable energy, especially solar, have demonstrated measurable improvements in women's livelihoods, income generation, and social empowerment (Oparaocha & Dutta, 2011). Programs such as Solar Sister in sub-Saharan Africa and Barefoot College's "Solar Mamas" in India and Africa have created successful models of women-centered solar deployment (UN Women, 2021).

Solar Diplomacy and India's Leadership

India's solar diplomacy emerges from its ambition to be both a clean-energy leader and a development partner in the Global South. Scholars such as Bhattacharya (2021) frame the International Solar Alliance as a platform through which India extends soft power while addressing collective climate action. The ISA not only enables technology transfer and joint financing but also projects India as a "norm entrepreneur" advocating for equitable energy transitions (Kapur, 2022). In this diplomatic framing, Solar for She is not merely a social program but a diplomatic tool that deepens India's role as a leader in inclusive sustainable development.

Digital Leadership for Global Collaboration

India's digital governance initiatives (such as Aadhaar, Digital India, and e-learning platforms) demonstrate scalable models for global development partnerships (Singh, 2020). Digital learning and fintech solutions reduce barriers to training, entrepreneurship, and market participation. In the renewable energy sector, digital dashboards, mobile apps, and e-learning portals have enhanced transparency, accountability, and cost-effectiveness (World Bank, 2021). Embedding digital platforms within ISA programs, including Solar for She, thus strengthens both global collaboration and localized impact.

Solar for She: Objectives and Program Design

Solar for She is explicitly framed to address multiple Sustainable Development Goals (SDGs)—notably SDG 5 (gender equality) and SDG 7 (affordable and clean energy). The initiative's core objectives include: (a) skilling women in solar technology and entrepreneurship, (b) improving access to clean energy products and services for women, and (c) fostering women-led micro- and small-enterprises in the solar value chain.ISA documents describe the program as a pilot-ready initiative with plans for market research, baseline studies, and in-country rollouts—particularly in Africa and other member countries where energy poverty and gender gaps are acute.

Key instruments and activities

1. Skilling and certification — Technical and vocational training modules aimed at women technicians and entrepreneurs to operate and maintain distributed solar systems. ISA envisions partnerships with local training institutions and NGOs to deliver culturally adapted curricula.

2. Seed finance and market linkages — Small grants, risk-mitigation instruments, or blended-finance windows to enable women entrepreneurs to procure inventory, tools, or microgrids. These mechanisms are intended to be combined with market access interventions.

3. Digital platforms for training and market aggregation — Online learning portals, digital certification, and mobile-enabled marketplaces to overcome geographic barriers and create scale. ISA's broader programming has highlighted digital channels in flagship initiatives, and Solar for She is designed to leverage similar approaches.

India's digital leadership: A comparative advantage

India brings several digital advantages to ISA programming: a large base of solar-skilled training providers, experience scaling government digital services (e.g., digital ID, e-learning), and a thriving start-up ecosystem focused on clean-tech and fintech. By exporting digitally enabled training modules, remote monitoring tools, and platforms for last-mile payments and supply-chain coordination, India can help reduce transaction costs and accelerate women's entry into the solar economy.

Digital tools can deliver three specific diplomatic benefits: (1) scalability—online skilling reaches dispersed populations across member states; (2) transparency—digital monitoring and dashboards increase accountability to donors and governments; and (3) interoperability—common digital standards permit cross-border collaboration on certification and quality control. ISA's governance documents list digital-enabled flagship programs among its priorities, signaling organizational readiness to adopt these tools within Solar for She.

Methodology

To assess the effectiveness of Solar for She, a mixed-methods empirical evaluation plan can be proposed:

1. Research Design

Quasi-experimental approach: Compare communities receiving Solar for She interventions with matched control communities without intervention.

Longitudinal surveys: Collect baseline, midline, and endline data to capture changes over time in energy access, women's participation, and economic outcomes.

2. Data Collection

Quantitative data:

Household energy access indicators (hours of electricity, types of appliances powered).

Economic outcomes (income from solar-related activities, business ownership).

Social outcomes (women's decision-making autonomy, education enrollment of girls).

Qualitative data:

Focus group discussions with women beneficiaries.

Key informant interviews with community leaders, trainers, and ISA officials.

Case narratives of women entrepreneurs who graduate from the program.

3. Digital Monitoring Tools

Mobile-based reporting apps for field agents to log training sessions, installations, and enterprise creation.

Remote monitoring systems on solar devices to record usage patterns.

Online dashboards for real-time tracking of gender-disaggregated data.

4. Analytical Methods

Descriptive statistics for adoption rates and participation levels.

Difference-in-differences (DiD) analysis to assess causal effects on key outcomes.

Thematic coding of interviews to uncover perceptions of empowerment and barriers.

5. Evaluation Metrics

Number of women trained and certified.

Share of women-owned solar enterprises established.

Percentage increase in household income linked to solar activities.

Community-level improvements in energy access and gender equity indices.

This evaluation plan ensures both statistical rigor and contextual sensitivity, providing evidence for policymakers, donors, and ISA member states.

Country Case Study: Tanzania

Tanzania offers a useful lens to contextualize Solar for She due to its active engagement in decentralized solar programs and strong gender-energy nexus.

Context: Over 60% of Tanzanian households lack access to grid electricity, with rural women disproportionately affected (IEA, 2022).

Women-centered models: Programs like Solar Sister and Barefoot College's "Solar Mamas" have trained hundreds of Tanzanian women as solar entrepreneurs who distribute lanterns and home systems (UNDP, 2021). These initiatives demonstrate the viability of integrating women into solar supply chains.

Digital dimension: Mobile-money platforms such as M-Pesa have enabled women entrepreneurs to conduct solar-related transactions securely, showing how digital finance complements renewable energy adoption.

ISA opportunities: Embedding Solar for She pilots in Tanzania could leverage existing networks of women entrepreneurs, digital payment systems, and government support for off-grid electrification.

Lessons for Solar for She

1. Partnerships matter: Collaboration with NGOs and microfinance institutions helps overcome barriers of capital and trust.

2. Cultural adaptation: Training modules must reflect local languages and socio-cultural realities to maximize participation.

3. Digital-finance linkages: Integration of mobile-money services ensures women can manage payments, savings, and business operations without exclusion.

Tanzania's case illustrates how ISA can tailor Solar for She to national contexts while drawing on India's digital expertise and South–South cooperation frameworks.

Challenges and Risks

1. Contextual barriers to women's participation. Social norms, mobility constraints, and domestic responsibilities limit women's ability to enroll in training or run businesses. Programs must include gender-sensitive scheduling, childcare support, and community engagement.

2. Financing and sustainability. Seed funding without sustainable revenue models risks short-lived enterprises. Blended finance and linkages to local microfinance must be carefully designed to avoid over-indebtedness.

3. Digital divide. Reliance on digital platforms can exclude women who lack smartphones, digital literacy, or reliable connectivity. Hybrid (digital + in-person) delivery and low-bandwidth solutions are essential.

4. Monitoring and impact measurement. To claim developmental and diplomatic wins, ISA and partners must invest in rigorous baseline studies, gender-disaggregated metrics, and third-party evaluations—activities ISA's early RfPs signal are planned.

Policy Recommendations

1. Design locally adaptive training modules. Combine short, competency-based e-learning with community-level practical labs and accredited certifications that are portable across ISA member countries. (ISA, n.d.).

2. Use blended finance and pay-for-performance grants. Link seed support to measurable outcomes (jobs created, households served) and crowd in private-sector supply-chain partners.

3. Invest in low-bandwidth, mobile-first digital tools. Ensure platforms work offline and incorporate interactive voice response (IVR) and regional languages to widen inclusion.

4. Mainstream gender-sensitive monitoring. Mandate gender-disaggregated indicators in all funded projects and commission independent evaluations to build an evidence base for replication.

5. Leverage India's diplomatic networks for south–south knowledge exchange. Facilitate exchange visits, virtual mentorship, and a "digital library" of curricular resources to accelerate cross-border adoption.

Conclusion

Solar for She offers a policy-congruent pathway to marry gender equality and clean-energy goals. Positioned within India's solar diplomacy, the initiative can amplify development returns while strengthening India's multilateral leadership—provided it invests in inclusive design, blended financing, and digitally enabled delivery mechanisms.Success will hinge on rigorous measurement, sustained financing, and local ownership—elements that must be prioritized to transform pilot activity into durable socio-economic and diplomatic gains.

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