GOGLA

POWERING PROGRESS FOR PURE

Boosting performance through gender-inclusive business

IKEA Foundation

DISTILL INCLUSION

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GOGLA
GOGLA is the global association for the off-grid solar energy industry. Established in 2012, GOGLA now represents over 200 members as a neutral, independent, not-for-profit industry association. Its mission is to help its members build sustainable markets to deliver high-quality products and services to customers with no, or insufficient access to electricity. These include solar lighting, power, irrigation, cooling, and communications technologies. Our members' products and solutions already power millions of homes, businesses, and public services. They improve health and education, create jobs and income opportunities, and help consumers save money.
To find out more, go to www.gogla.org.

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The IKEA Foundation is a Dutch not-for-profit organization founded in 1982 by Ingvar Kamprad. The IKEA Foundation is a strategic philanthropy that focuses its grant-making efforts on tackling poverty and climate change. To find out more, go to: https://ikeafoundation.org/

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Distill Inclusion is a women-led management consultancy firm based in Sub-Saharan Africa that enables stakeholders in the energy, water, transport, and climate change sectors to think practically about issues of gender equality and social inclusion challenges and opportunities. We have a range of specialists available to work with you on designing innovative approaches and spearheading research, including data collection, capacity building and training, project implementation, monitoring and evaluation, and knowledge development. We aim to help you gain clarity in your gender and social inclusion journey. For more information, visit: www.distillinclusion.com.

LIST OF ACRONYMS

AC	Alternate Current
ADB	Asian Development Bank
ATF	Appropriate Technology Forum
A2EI	Access to Energy Institute
B2B	Business-to-Business
B2C	Business-to-Consumer
BII	British International Investment (previously CDC)
CaaS	Cooling-as-a-Service
CDC	Commonwealth Development Corporation (now BII)
CEEW	Council on Energy, Environment and Water
CGAP	Consultative Group to Assist the Poor
CGIAR	Consultative Group on International Agricultural Research
CInI	Collectives for Integrated Livelihood Initiatives
CLASP	Collaborative Labeling and Appliance Standards Program
COPD	Chronic Obstructive Pulmonary Disease
CSR	Corporate Social Responsibility
DC	Direct Current
DFC	Development Finance Corporation
DFI	Development Finance Institution
DRE	Distributed Renewable Energy
EAC	East African Community
ESG	Environmental, Social, and Governance
ESI	Energy Sector Investments
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GOGLA	Global Off-Grid Lighting Association
ICS	Improved Cook Stoves
ICT	Information and Communication Technology
IFC	International Finance Corporation
ILO	International Labour Organization
IRENA	International Renewable Energy Agency
KII	Key Informant Interview
KPI	Key Performance Indicator
kW	Kilowatt
kWp	Kilowatt peak
MFI	Microfinance Institution
MSMEs	Micro, Small and Medium Enterprises
NGO	Non-Governmental Organization
OECD	Organisation for Economic Co-operation and Development
PAYGo	Pay-As-You-Go
PUE	Productive Uses of Energy
PULSE	Productive Use Leveraging Solar Energy
PURE	Productive Use of Renewable Energy
RBF	Results-Based Financing
ROSCA	Rotating Savings and Credit Association
SACCO	Savings and Credit Cooperative
SDG	Sustainable Development Goal
SHG	Self Help Group
SHS	Solar Home System
SME	Small and Medium Enterprise
SNV	Netherlands Development Organisation
SRU	Solar Refrigeration Unit
SSA	Sub-Saharan Africa
SWP	Solar Water Pump
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
VSLA	Village Savings and Loan Association
WHO	World Health Organization
WMSMEs	Women-led or Women-owned Micro, Small and Medium Enterprises

EXECUTIVE SUMMARY

THE GENDER GAP IN PRODUCTIVE ENERGY USE

Women are vital yet frequently invisible drivers of economic activity across the developing world, playing essential roles in agriculture, food processing, retail trade, and small-scale manufacturing. Their labour underpins many crucial economic sectors, from tending crops and managing livestock to processing agricultural products and running informal food businesses. However, their contributions frequently go unrecognized because traditional approaches to energy access and productive technologies have been largely gender-neutral, failing to account for how men and women engage differently with energy services and productive assets. This oversight has led to the development of technologies and business models that inadvertently exclude or underserve women despite their significant economic presence.

The scale of women's economic participation is substantial - they make up 40 per cent of the global agricultural workforce, rising to 60 per cent in many regions. In Africa, women represent 58 per cent of the self-employed population and contribute approximately 13 per cent of the continent's GDP. Despite these substantial economic contributions, women face persistent barriers in accessing and benefiting from Productive Use of Renewable Energy (PURE) technologies, limiting their productivity and growth potential.

RESEARCH APPROACH AND KEY FINDINGS

This research, commissioned by GOGLA with support from the IKEA Foundation, examines how PURE companies can build gender-inclusive businesses that effectively serve women's energy needs while developing sustainable business models. Through comprehensive desk research, key informant interviews with stakeholders including PURE companies and subject matter experts, and detailed case studies, the study maps the PURE ecosystem through a gender lens. It identifies practical strategies for developing gender-smart business approaches.

The report first establishes the current landscape of women's roles across key value chains, followed by an analysis of existing gender gaps in PURE technology access. It then presents detailed case studies of successful gender-smart business models, outlines a framework for implementation across the customer journey, and concludes with specific policy recommendations to enable scaling.

Understanding women's distinct roles across sectors is fundamental to developing effective PURE solutions. In Sub-Saharan Africa, women perform 60-80 per cent of food production labour, spending an average of seven hours per week collecting water for irrigation alone. In India, they account for 75 per cent of full-time farm workers. The dairy sector further highlights women's crucial yet underserved role, with over 80 per cent of India's 100 million dairy farmers being women. In retail and food processing, women dominate the informal sector, running 57 per cent of wholesale and retail businesses in Kenya.

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Market data reveals significant gender disparities in PURE technology access. While 68 per cent of registered energy customers are men, women account for only one-third of end-users. However, when women gain access to these technologies, the impact is remarkable - 81 per cent of customers engaged in productive use report increased income, with benefits often greater for women than men.

Understanding barriers to adoption is critical for PURE companies aiming to serve women customers more effectively. Women face multiple intersecting constraints including, limited household decision-making power, restricted access to financing due to lack of collateral, severe time poverty, and limited mobility, which affects their ability to access information and markets. The digital gender gap further compounds these challenges - while 73 per cent of women purchased energy products on credit, their lower access to mobile phones and digital financial services constrains their participation in modern payment systems. PURE companies that understand and address these barriers through thoughtful product design, innovative financing, and targeted support services are better positioned to tap into this underserved market while delivering meaningful impact.

BUILDING GENDER-SMART PURE BUSINESS MODELS

Successful gender-smart approaches require moving beyond simple product modifications to developing comprehensive ecosystems that address women's constraints while leveraging their strengths as customers, entrepreneurs, and agents of change. The study highlights three detailed case studies of companies already implementing gender-smart strategies:

- Agsol designs solar mills with women users in mind, featuring lightweight construction and automated operation. Small batch processing and simplified maintenance make the technology accessible to women farmers.

- SureChill's Cooling-as-a-Service requires minimal deposits and assesses business viability instead of collateral, achieving 50 per cent women customers across dairy, retail, and small shops.

- Oorja's "Farming as a Service" model removes land ownership barriers and mandates women's participation. Their pay-per-use approach makes solar irrigation accessible despite limited financing.

Working closely with these companies, the research team conducted in-depth interviews and focus groups with women customers. This primary research, combined with broader market analysis, informed the development of detailed customer personas and journey maps to identify opportunities for improving gender-inclusive business practices.

The customer personas capture key dimensions including demographics, behavioural drivers, livelihood patterns, technological access, and specific challenges in adopting PURE technologies. For example, SureChill identified distinct segments ranging from "survivors" running small retail shops to "visionaries" seeking to expand across multiple locations, enabling them to tailor their financing and support services accordingly. This systematic approach to understanding women customers helped companies identify concrete opportunities to strengthen their gender-smart business models across product design, marketing, financing, and ongoing support services.

To become truly gender-smart, PURE companies must transform their approach across the entire customer journey. Drawing from successful examples, the research identifies five essential elements:

- **Research and Product Development:** Deeply understand women's context and constraints. Design products that align with their ergonomic needs, safety requirements, and efficiency demands while accounting for their physical capabilities and time limitations.

- **Marketing and Customer Acquisition:** Develop women-centric marketing using female role models, targeted messaging, and appropriate communication channels. Create accessible purchasing environments with women-friendly spaces and female sales agents.

- **Financing and Purchase:** Implement flexible financing that accommodates women's irregular income patterns and limited collateral. Options may include Pay-As-You-Go (PAYGo) options, group lending schemes, and partnerships with microfinance institutions.

- **Implementation and Support:** Provide training and support that fits women's schedules, covering technology use, business skills, and ongoing advisory services. Extend support to include market linkages and installation assistance.

- **Ongoing Engagement and Growth:** Place women in leadership roles across sales and technical positions to create role models and challenge stereotypes. Systematically collect gender-disaggregated data to drive continuous improvement.

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To support companies in implementing these changes, the research provides a comprehensive KPI framework measuring progress across customer acquisition, financial performance, product usage, customer experience, business operations, and value chain integration. This systematic approach helps companies track their gender-smart journey while identifying new opportunities for growth and impact.

While individual companies can take significant steps towards gender inclusion, truly scaling these approaches requires broader systemic change. The research underscores the need for a supportive ecosystem, including targeted policies and incentives, to enable more companies to adopt and scale gender-smart PURE business models.

CREATING AN ENABLING ENVIRONMENT

Current policy frameworks often follow a gender-neutral approach, failing to address women's unique barriers in accessing and adopting PURE technologies. To accelerate change, the study identifies four key areas for policy intervention:

- Cooperative models offer a powerful pathway for increasing women's access to PURE technologies. Policymakers should develop regulatory frameworks that facilitate women's energy cooperatives, including legal recognition for collective ownership and streamlined registration processes. Success requires appropriate incentive structures like bulk purchase subsidies, tax benefits, and cooperative-specific financing products.
- Financial incentives must be tailored to address women's specific constraints. This includes capital subsidies for women entrepreneurs, guarantee funds to address collateral requirements, and dedicated credit lines with grace periods aligned to agricultural cycles. Results-based financing (RBF) tied to women's participation targets can encourage companies to adopt inclusive practices, while tax benefits and preferential procurement policies can create stable market opportunities.
- Developing gender-smart business models requires comprehensive support combining regulatory guidance, capacity building, and innovation funding. Clear guidelines for gender-inclusive practices should be established, alongside certification systems that recognize and reward companies excelling in inclusion. Technical assistance programs can help companies implement effective gender integration strategies, while dedicated innovation funds support the development of women-centric solutions.
- Awareness-building and behaviour-change campaigns are essential for increasing adoption. Successful approaches include women demo champions, mobile demonstration units, and peer learning networks. Agricultural extension services should be leveraged by training workers in gender-sensitive technology promotion and establishing women-focused demonstration farms.

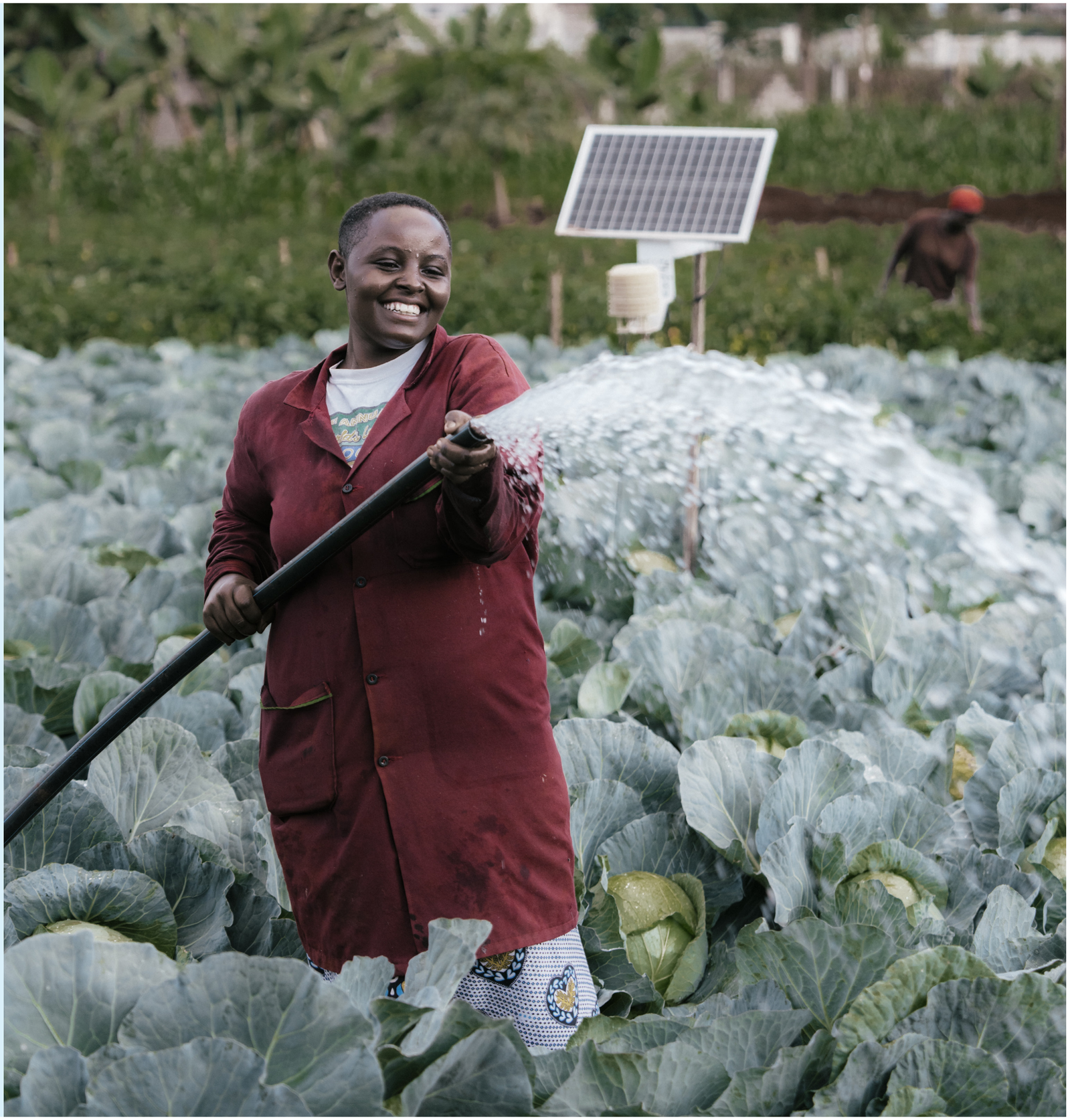
By implementing these policy recommendations in coordination with financial institutions, technology providers, and government agencies, stakeholders can create an enabling environment that supports the scaling of gender-smart PURE business models while maximizing benefits for women participants.

MOVING FORWARD

The potential impact of closing gender gaps in PURE technology access is substantial. Research indicates that improving women's access to productive resources could boost farm yields by 20-30 per cent and increase total agricultural output by 2.5-4 per cent. The economic impact is equally significant - closing the gender productivity gap could generate annual gains of US$100 million in Malawi, US$105 million in Tanzania, and US$57 million in Uganda.

Achieving success requires systematic changes across multiple dimensions, including comprehensive data collection, gender-responsive product development, and supportive policy frameworks. By implementing these recommendations, stakeholders can help unlock the transformative potential of PURE technologies while building sustainable businesses that serve this underserved market.

The opportunity is clear, addressing the gender gap in PURE technology access and adoption not only advances women's economic empowerment but also represents a significant market opportunity for companies willing to adapt their business models to better serve women customers.



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INTRODUCTION

Women are crucial stakeholders as entrepreneurs in sectors such as agriculture and agribusiness value chains worldwide, comprising 40 per cent of the global agricultural workforce - and as much as 60 per cent in many regions.[1,2] In Africa, women make up 58 per cent of the self-employed population and contribute around 13 per cent of the continent's gross national product (GDP).[3] In the agriculture sector, for example, women are essential to planting, cultivating, and harvesting, as well as processing, logistics, and sales. Despite their contributions, women face unique challenges that hamper their productivity and growth, subsequently weakening economic growth and limiting the growth of the businesses that depend on them. Women farmers and women entrepreneurs are often perceived as less productive than their male counterparts because of inequalities in access to technology, energy, land, labour, agricultural inputs (e.g., fertilizer and improved seeds), and information.[4]

PURE technologies can be especially transformational for daily business operations for women in various value chains such as agricultural, commercial, and industrial businesses. Access to PURE appliances, products and services[5] and financing makes it affordable for micro-enterprises and farmers to generate local jobs, increase household income and contribute to economic growth. For women-owned enterprises, PURE products can extend working hours or enhance agro-processing, manufacturing, or service delivery. Access to PURE products such as solar water pumps (SWPs) and solar milling can reduce the time women spend on household and farm chores and lessen the drudgery associated with women's work. In turn, this allows women to use their time for other productive activities, such as establishing a new business, growing an existing business, or participating in social and community activities.

GOGLA has conducted extensive research on measuring some of the impacts through the GOGLA impact calculator and GOGLA's Powering Opportunity study. These findings highlight various impacts including enhanced income-generating opportunities. For example, the GOGLA Powering Opportunity in East Africa report found that 34 per cent of households were more economically active once they purchased a Solar-Home-System (SHS), while 86 per cent reported that their children had more time to study.[6] It is widely recognized that increased access to energy services, products, and technologies directly contributes to economic development. However, greater attention is needed to realize these benefits for female entrepreneurs, farmers and household customers, given existing gender gaps and limited evidence in the sector (see Figure 1 for an overview of some key challenges facing PURE companies).

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1 IFC. 2016. Investing in Women along Agribusiness Value Chains.
2 ILO (2020), Empowering Women at Work Policies and Practices for Gender Equality in Supply Chains.
3 World Bank. 2019, Profiting from Parity- Unlocking the Potential of Women's Businesses in Africa
4 Ibid.
5 Different terminology will be used in the report but could be referencing appliances, technologies, products, and services
6 GOGLA. (2019). Powering Opportunity in East Africa: Proving Off-Grid Solar is a Power Tool for Change.

FIGURE 1: CHALLENGES AND LIMITATIONS IN TERMS OF A GENDER FOCUS IN THE PURE SECTOR

1 Off-grid solar and PURE companies, impact investors, donors, FinTechs and agriTechs often adopt **gender neutral approaches that do not address women's needs.**[7]

2 Many PURE companies **compartmentalize gender programming**, which can lead to de-prioritization when other business challenges arise. Additionally, PURE companies often have limited resources and in-house expertise to guide effective gender-inclusive strategies.

3 Off-grid companies and impact investors also struggle to scale or integrate customer-centric approaches that can lead to more insights into the different needs of women and men. This is often due to **constraints in funding, capacity, pipeline or other business challenges.**[8]

4 PURE companies may feel overwhelmed by **general barriers to expanding customer bases** to include women, and low-income or rural customers. Many incorrectly assume that adaptations needed for products, financing or services will not be financially viable.[9]

5 **Women often face limited access to information and decision-making power when adopting new technologies. Their ability to finance new approaches or assets is constrained by factors such as limited collateral (e.g., land ownership) and restricted access to financial services.**[10]

6 Time- and labour-saving assets can help women use their time more efficiently. **But rural women are less likely than men to access or own labour-saving tools**, whether for reducing time on unpaid household labour (e.g., biodigesters) or facilitating agricultural production (e.g., weeders, seeders, spreaders, ploughs, tractors).[11]

7 **Existing PURE technologies, especially labour-saving tools are often designed for men**, making them too large, heavy, or impractical for women. Many women also find them to be too dangerous to keep near children.[12]

8 **Even when PURE companies have good sex-disaggregated consumer data, they often lack the skills to analyse or apply it to** business operations such as research and development (R&D), marketing, sales, financial products, and customer care.

9 **Limited supportive policies and incentives from governments to recognize and address the gender gap in PURE**, including lack of targeted subsidies or regulatory frameworks that could help overcome barriers women face in accessing and benefiting from PURE technologies and services.[13]

7 ENERGIA (2022). Building the business case for women's inclusive financing in last-mile renewable markets
8 Ibid
9 Ibid.
10 Jones, M. (2020), Reducing Post-Harvest Losses Through Better Gender Integration
11 CGAP (2023). Strengthening Rural Women's Climate Resilience: Opportunities for Financial and Agricultural Service Providers
12 Vemireddy, V. and Choudhary, A. (2021). A systematic review of labor-saving technologies: Implications for women in agriculture
13 ENRGIA (2021), Policy Brief: Why Energy access and gender equality are inextricably linked

PURE technologies and business models are at different stages of development. Some, such as SWPs, solar off-grid refrigeration units and e-mobility are considered “near-to-market”, Others, such as e-cooking and cold storage are classified as “emerging markets”, while others, such as solar milling and solar dryers fall under “horizon markets” as their business models are still relatively nascent.[14] As these technologies and business models evolve, serving women as customers can enable PURE companies to realize both social and economic benefits across their business operations, customer engagement, and sales.

Women represent an untapped market segment, and serving this segment can also help PURE companies attract impact capital, needed to test and refine their business models. There are billions of dollars targeting climate-smart, gender-smart and/or ESG-focused investment available for the private sector to capitalize upon. For example, the influential 2XGlobal,[15] recently released a focus on gender-smart investments for climate action.

Gender inclusivity can benefit PURE companies but requires sex-disaggregated data collection and analysis. Without this, companies may struggle to identify customer segments they serve well and which represent untapped opportunities. Current off-grid sector metrics often use households as the measurement unit, assuming equal benefits for all members. However, gender norms mean women may benefit differently from technologies, and many women-led agri-value chain businesses are informal or home-based, making them hard to capture through household measurements. To serve women customers effectively, PURE companies need a gender-intelligent, data-driven approach that recognizes the differences in how women and men live and access resources. This means understanding women’s economic activities, constraints, and behaviours to inform product design and delivery models, rather than relying on gender-neutral strategies.

AUDIENCE, SCOPE, AND OBJECTIVE OF RESEARCH

GOGLA members offer a range of solutions including solar lighting, power systems, irrigation, cooling, milling, drying, and communication technologies, among many others. These innovations are instrumental in powering homes, businesses and public facilities while also contributing to improvement in income, health, and education.

Building on the success of its members in expanding access to solar energy kits (lanterns and home systems), GOGLA is identifying opportunities for scaling PURE appliances and products in off- and weak-grid communities. The potential to generate both economic and social benefits via PURE technologies is vast, especially for populations who are most vulnerable to climate shocks. As part of its focus on PURE technologies, GOGLA is also committed to building gender-inclusive businesses to meet women’s energy needs. This research aims to:

- Enhance PURE companies’ understanding of women’s roles and needs within the PURE ecosystem.
- Develop practical insights and guidelines for PURE companies to understand and serve women as customers.
- Promote the implementation of gender-inclusive practices to foster gender inclusion in the PURE market.

The intended audience includes PURE companies, impact investors, Development Finance Institutions (DFIs), donors, and development actors interested in supporting SDGs 5, 7, and 13. The research focused on Kenya, India, and Uganda due to their relative maturity in terms of available technologies characterized by a robust ecosystem of PURE companies and a significant customer base.

14 GOGLA (2023). Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE). Handbook for Governments and Development Partners

15 https://www.2xglobal.org/what-we-do/

OVERVIEW OF THE PURE ECOSYSTEM AND WHY THE NEED FOR A GENDER LENS

DEFINITIONS OF PRODUCTIVE USES OF ENERGY

PURE solutions have the potential to mechanize agriculture, power enterprises, and electrify public infrastructure across sub-Saharan Africa and South Asia. The term “productive use of renewable energy” (PURE) can mean different things to different people. Experts, government officials, and other stakeholders have yet to agree on a single definition. In some cases, they are referred to as productive uses of energy (PUE), or livelihood technologies (often used in India), and the World Bank often uses the term productive use leveraging solar energy (PULSE).

For the interest of this report, the following definitions by GOGLA will be used: Off-grid solar appliances and products that are energy-efficient and powered often by direct current (DC) and include both household and small business appliances and productive use of renewable energy (PURE) appliances. Due to the growing market interest among weak-grid geographies, off-grid solar appliances, products, and services capable of operating under alternate current (AC) are also included in this report. Off-grid solar appliances and products include:

1. Household and small business appliances and products: Solar lights and home systems, commonly sold with phone charging, televisions, fans, refrigeration units, e-cookers, and radios, are typically considered household items, but significant numbers are used in small businesses. For example, a refrigerator may be used in a shop, or a TV may be used in a restaurant. This category of technology represents by far the largest PURE market share.

2. PURE appliances and products enable improved or new income-generating activities, often in agriculture. These products include solar-powered water pumps, refrigeration units, cold rooms, heating, and agri-processing equipment.

However, it should be noted that access to electricity alone does not guarantee productive energy use - other factors play a crucial role. These include access to financing, technical knowledge, people’s skills, government policies, available infrastructure, market access, social relationships, and community characteristics. Because of this complex interplay, some researchers take a wider view of what “productive use of renewable energy” means. They include both electric and non-electric energy sources that not only support income generation but also improve overall well-being.[16] For example, energy access might help children study at night, allow health clinics to store vaccines, or give women more time for work or education by reducing household chores. This broader definition recognizes that energy can create value in two ways: firstly, directly through income-generating activities (like powering a grain mill), and secondly, indirectly by improving education, health, and gender equality within communities. Viewing PURE through this wider lens helps ensure that projects and policies consider the needs of all individuals, particularly women, who might otherwise be overlooked in energy planning.

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16 D. Gad and P. Leone. (2024). *Productive use of energy of women-owned micro-, small-, and medium-sized enterprises: Insights from food and textile businesses in selected African countries*.

MARKET OVERVIEW AND CURRENT STATUS OF PURE TECHNOLOGIES

Currently, 685 million people live without access to electricity.[17] Distributed Renewable Energy Solutions (DREs), especially off-grid solar technologies, reach nearly 500 million people, support over 10 million businesses, and power hundreds of thousands of smallholder farms.[18] The off-grid energy industry has witnessed significant growth in the PURE sector, with over 60,000 SWPs and solar off-grid refrigeration units sold in the past two years.[19]

Off-grid solar solutions hold significant potential to enhance agricultural value chains, boost production volumes, enhance nutrition and food security, and provide essential post-harvesting, storage, and transportation solutions.[20] Among larger off-grid solar solutions, household and commercial refrigeration, televisions, and fans are the most in demand. In terms of their short-term contributions to socioeconomic development and poverty reduction, SWPs, agricultural cold chain refrigeration, and commercial refrigeration for small and medium enterprises (SMEs) rank highest.[21]

Overall, global solar energy kit sales reached 4.6 million units, with appliance sales increasing from 1.53 million in 2022 to 1.79 million in 2023.[22] The GOGLA Global Off-grid Solar Market Report Semi-annual Sales and Impact Data for the second half of 2023[23] reveals significant insights across the three priority markets - Kenya, India, and Uganda.

Kenya leads the market, accounting for 74 per cent of total sales, with televisions dominating the appliance sector at 76 per cent.[24] However, the market showed mixed performance, with solar water pump sales marginally increasing by 1 per cent and refrigeration unit sales declining 49 per cent.

India represents 92 per cent of South Asia's off-grid solar market, shifting towards weak-grid and hybrid systems. Solar energy kit sales decreased 19 per cent to 322,000 units compared to the first half of 2023, with fans dominating appliance sales at 92 per cent (out of 21,238 units sold). The (PAYGo) market remains underdeveloped.

Uganda demonstrated dynamic market trends, with 7,813 appliance units sold in the second half of 2023. Televisions constituted 80 per cent of sales, accompanied by 845 SWPs, 224 fans, and 468 refrigeration units, showing a 55 per cent increase from the previous year.

These markets illustrate the evolving landscape of off-grid solar technologies, highlighting the increasing sophistication of renewable energy solutions and appliance integration.

However, despite the growing interest and enthusiasm surrounding PURE, the sector remains underexplored, and many key stakeholders - including policymakers and user groups - are not fully aware of the potential benefits these technologies offer.[25] This is particularly evident in the significant knowledge gap regarding how these technologies can serve women's energy needs. While PURE activities from SMEs, agriculture, and retail can greatly benefit from increased electricity access, the ability to realize these benefits is not equally distributed. Activities span various sectors, including agriculture (e.g., irrigation, grain milling, and food processing), commercial enterprises (e.g., hairdressing and restaurants), and industrial applications (e.g., clothing and construction),[26] but access to and control over these technologies often follows traditional gender patterns. This sector-wide limitation has stunted the development of innovative solutions and viable business models that could both generate revenue and effectively address women's distinct needs as PURE consumers.[27]

17 Energy Sector Management Assistance Program (ESMAP). Off-Grid Solar Market Trends Report 2024: Outlook (English). Washington, D.C.: World Bank Group.

18 GOGLA (2023). Powering Adaptation and Climate Justice: The Critical Role of Off-Grid Solar Technologies.

19 GOGLA (2024). Leveraging Energy Access and Off-Grid Technologies to Realize National Social and Economic Development Priorities

20 IRENA and FAO (2021). Renewable energy for agri-food systems – Towards the Sustainable Development Goals and the Paris agreement.

21 GOGLA (2023). Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE). Handbook for Governments and Development Partners.

22 Energy Sector Management Assistance Program (ESMAP). 2024. Off-Grid Solar Market Trends Report (English). Washington, D.C. : World Bank Group.

23 GOGLA. 2023. Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data.

24 The vast majority of which were sold bundled with SHS

25 Ibid

26 Hirmer, S. and Guthrie, P. (2017) The benefits of energy appliances in the off-grid energy sector based on seven off-grid initiatives in rural Uganda.

27 D. Gad and P. Leone. (2024). Productive use of energy of women-owned micro-, small-, and medium-sized enterprises: Insights from food and textile businesses in selected African countries

GENDER LENS IN PURE

The intersection of gender and productive energy use presents a complex landscape that demands careful consideration. While PURE technologies offer significant potential to enhance women's economic activities across multiple sectors - from agriculture and agri-food processing to dairy production, retail, and cooking - persistent gender disparities fundamentally shape how these technologies are accessed and utilized.[28] Understanding these dynamics is crucial for developing effective strategies that can truly support women's economic empowerment through renewable energy solutions.

STRUCTURAL BARRIERS AND GENDER DYNAMICS

The challenges women face in accessing and benefiting from PURE technologies are deeply interconnected with broader social and economic structures. Gender dynamics significantly influence decision-making processes around appliance acquisition, often limiting women's influence, even for products they predominantly use in their daily activities.[29] This power imbalance is starkly reflected in user demographics, where women represent only one-third of off-grid product end-users, despite being primary users of technologies such as food processing equipment, refrigeration units for small shops, and agricultural processing tools like grain mills.[30]

Traditional gender norms have created and reinforced distinct patterns in economic activities that directly impact energy use and technology adoption. While men typically dominate sectors requiring higher energy inputs, such as large-scale agriculture and fishing, women are often concentrated in post-harvest tasks and food preparation activities.[31] These patterns are not merely coincidental but

BOX 1: PURE TECHNOLOGY MARKET STATUS

Commercially Available Technologies	Near-to-Market Technologies	Emerging Technologies
Off-Grid Solar Kits/Appliances: Most established market option. • 590,000 TVs sold in Sub-Saharan Africa (2022). • 830,000 fans sold in South Asia (2022). • Average business income increase: US$52/month. **Clean Cooking Solutions:** • A billion people lack access. • Biomass cookstoves hold the largest revenue share. • Growing carbon market opportunities.	**SWPs:** • 42 quality-tested models available. • Suitable for 0.5-5 acres. • Part of the US$14 billion addressable market. **Solar Refrigeration Units (SRUs)** • Essential for reducing food waste. • Market potential: US$811 million in India. • Payback period: 1-6 years.	**Solar Milling:** • Projected market: US$417 million by 2030. • Limited companies testing prototypes. **Solar Drying:** • Development phase. • Potential for cocoa, coffee, and fish processing. **Egg Incubators:** • Expanding in East and Southern Africa. **Solar Sewing Machines:** • Designed for remote areas. • 90% less power consumption than standard machines.

Source: Compiled from various reports. See Annex 2 for details.

28 Asian Development Bank (ADB), Gender tool kit: Energy going beyond the meter, 2012.

29 ENERGIA (2020). The role of appliances in achieving gender equality and energy access for all

30 Ibid

31 A. Pueyo, M. Carreras, G. Ngoo, Exploring the linkages between energy, gender, and enterprise: Evidence from Tanzania, World Dev. 128 (2020) ; Ngoo G., Kooijman A., Gender and energy country briefs: Tanzania, 2020

are actively reinforced by societal norms that define what constitutes “appropriate” economic roles for women and men.

Even within sectors, studies highlight that women typically occupy lower positions in the production value chain and tend to engage in less mechanized activities.[32] For example, in Tanzania, men primarily handle crop sales and cash crop cultivation, whereas women focus on subsistence farming for household consumption.[33] This positioning has significant implications for their ability to benefit from and invest in productive energy technologies.

Research reveals distinct patterns in how men and women utilize energy in their economic activities, reflecting deeper structural inequalities in access to resources and opportunities. In terms of business type and energy needs, male-owned businesses tend to utilize electricity for activities such as welding, car repair, and sawmill operations, while women-owned enterprises predominantly rely on traditional cooking fuels like charcoal, firewood, and gas.[34] This segregation is particularly evident in the high concentration of women in food vending businesses, which often rely on traditional energy sources.

The diversification of energy sources further illuminates gender disparities. Male-owned businesses typically access a wider range of energy sources, while women’s enterprises remain largely reliant on traditional fuel sources.[35] This limitation not only affects their operational efficiency but also their potential for business growth and innovation.

Furthermore, consumption patterns reveal that women-owned businesses generally show lower electricity usage, a trend that correlates strongly with their prevalence in informal, micro-sized enterprises and limited access to formal business registration and skilled labour.[36]

OPPORTUNITIES AND POSITIVE IMPACTS

Despite these significant challenges, evidence suggests that PURE technologies hold substantial potential for supporting women’s economic empowerment. Studies have shown that when women-owned enterprises gain access to electricity, they can achieve higher profitability rates, effectively challenging long-held assumptions about their business potential.[37] This finding underscores the transformative potential of appropriate energy access.

The impact of PURE technologies extends beyond direct profitability. These solutions can significantly reduce manual labour burdens and improve time efficiencies, which is particularly crucial for women who often balance business responsibilities with household duties.[38] Additionally, technologies such as solar refrigeration and food processing equipment can help women add value to agricultural products and reduce post-harvest losses, enabling them to capture more value in agricultural supply chains.[39] Realizing these opportunities begins with understanding women’s specific energy needs and requirements, followed by addressing the interconnected challenges of access to finance, technical knowledge, market access, and enabling policies.

© Popo Africa

32 ENERGIA (2019). The ENERGIA gender and energy research programme: A short overview of the results

33 A. Pueyo, M. Carreras, G. Ngoo (2020), Exploring the linkages between energy, gender, and enterprise: Evidence from Tanzania, *World Dev. 128*.

34 M.O. Asibey, K.A. Ocloo, O. Amponsah (2021), Gender differences and productive use of energy fuel in Ghana’s rural non-farm economy. *Energy 215, 119068*.

35 ENERGIA (2019). The ENERGIA gender and energy research programme: A short overview of the results

36 Wiese, K. (2020). *Energy 4 all?* Investigating gendered energy justice implications of community-based micro-hydropower cooperatives in Ethiopia

37 Pueyo, S. Bawakyillenuo, M. Carreras (2020), Energy use and enterprise performance in Ghana: How does gender matter? *Eur. J. Dev. Res. 32, 1249–1287*

38 Ibid

39 FAO. (2021). Reducing Food Loss and Waste in Uganda.

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METHODOLOGY AND APPROACH

The approach taken to the mapping of PURE ecosystems with a gender lens was to identify which PURE solutions can have the greatest impact for women in specific agri-business value chains, which are anchored around two main elements – firstly, women centred design; and secondly, sex-disaggregated data. By placing women at the centre of the PURE ecosystem, this research examines business models, constraints, and opportunities in the PURE ecosystem through the lens of creating and delivering value to women customers. Using tools such as customer personas and customer journey mapping coupled with strategies for the collection and use of gender-disaggregated data, the research aims to present practical and actionable insights. These findings will help PURE companies and other stakeholders realize the business opportunity of serving women as customers.

MAPPING THE PURE ECOSYSTEM WITH GENDER LENS

The research team created a framework to map out the PURE ecosystems and better understand which PURE technologies are most relevant to different segments of women within specific value chains. By examining specific PURE technologies, their relevance to the roles and tasks that women perform in specific value chains, the barriers to adoption and opportunities for impact, the mapping exercise provided insights on which technologies and business models the rest of the research study should prioritize and focus on.

Designing a framework to map out the PURE ecosystems, which encompass the entire network of stakeholders, infrastructure, policies, and market conditions that enable the productive use of renewable energy technologies – requires a multi-dimensional approach, especially when focusing on women's involvement. Most existing research focuses on:

- Demand (women): How they might use PURE technologies and the barriers they face, or
- Supply (companies): The specific business challenges for various technologies.

The mapping framework combined these two elements to highlight opportunities for stakeholders to intervene and address constraints to scaling inclusive PURE technologies that benefit women.

Below is the structure for the PURE gender lens mapping framework used in this research. It is further expanded in Section 4 based on the literature review and data collection, key-informant interviews (KII's), and the fieldwork with three PURE companies.

1. **Identification of key PURE technologies:** The team started by identifying PURE technologies along with a brief description of each technology, its current applications, and its potential for scale-up. A few examples below:

- solar irrigation and pumping
- fixed SRUs (e.g., containerized)/mobile refrigeration
- milk chillers
- solar drying and dehydrating
- solar mills and crushers
- efficient electric cooking & food preparation
- agricultural value-added tools (e.g., OVO solar egg incubator)
- lighting and entertainment systems
- sewing machine

2. **Relevance mapping for sector or value chain:** For each segment identified, the team mapped the relevant PURE technologies in different value chains. For example, solar pumps with user-friendly designs and minimal maintenance requirements can be particularly suitable for women farmers, enabling them to manage irrigation more effectively. Similarly, access to refrigeration technology can be especially valuable for women retailers and dairy entrepreneurs, allowing them to extend product shelf life, reduce spoilage, and maximize their sales opportunities (see example in Table 1)

3. **Segmentation of women's roles in various value chains and sectors:** The research categorized different segments of women based on their roles within various value chains, such as horticulture, dairy, manufacturing, retail, and so on. This involved understanding the specific tasks performed by women in these sectors and how they can benefit from PURE technologies.

4. **Barriers to adoption:** The research identified the barriers preventing women from adopting these technologies, including financial, technical, cultural, or regulatory barriers. Understanding these barriers helps in designing strategies to overcome them.

5. **Opportunities for impact:** The team assessed the potential impact of each PURE technology on women's productivity, income, health, and empowerment. This included both quantitative and qualitative benefits.

6. **Business models and policy recommendations:** The research explored different business models that could facilitate women's adoption of PURE technologies. Also, it provided policy recommendations to support these business models and encourage broader adoption of PURE technologies.

7. **Priority setting and research focus:** Based on the above analysis, the team prioritized the technologies and business models that showed the most promise. These priorities guided the focus of the rest of the research study, ensuring that it addressed the most impactful and feasible options.

Challenges and limitations: It is important to acknowledge several limitations of the research approach. Given the relatively nascent nature of several of the PURE technologies, the data on potential benefits for women and related business models are limited. The team addressed some of these challenges by looking at adjacent sectors such as agriculture and financial inclusion. While this provided valuable insights, it's important to acknowledge that the transferability of findings may vary across contexts.

Additionally, while this report's initial definition of productivity encompassed a broad spectrum of benefits - including reduced drudgery, improved health outcomes, and positive environmental impacts beyond pure income generation - the research scope primarily focused on available technologies that directly contribute to economic productivity and income generation. Technologies that could mechanize or reduce the burden of domestic work and care responsibilities, which disproportionately fall on women, were not extensively covered. This limitation reflects constraints in data availability and the current market focus of many PURE technology solutions.

Nonetheless, it represents an important area for future research given the significant impact of unpaid care work on women's ability to participate in income-generating activities. All clear assumptions and gaps have been highlighted as far as possible throughout the analysis.

TABLE 1: ILLUSTRATIVE EXAMPLE MAPPING PURE ECOSYSTEM LENS – FULL TABLE IN ANNEX 3

Sector/ Value chain	Women's roles	Relevant PURE technology	Barriers to adoption	Opportunities for Impact	Business Models and Companies[40]	Policies / Incentives to scale	Priority setting
Dairy (Milk production, processing, and distribution)	Women's responsibilities include milking cows and delivering the milk to the cooperative collection centres. Lack of access to cold storage means women have to either sell at lower prices or lose some milk to spoilage.	Milk chillers/ Cold storage	• High upfront costs for purchasing and installing milk chillers and cold storage facilities. • Limited access to reliable electricity in rural areas for powering the equipment. • Maintenance and repair challenges, particularly in remote locations.	• Improved preservation of milk quality, reducing spoilage and resulting in higher income from dairy products. • Extended shelf life of perishable dairy products, enabling access to distant markets. • Greater flexibility in timing of milk collection and processing.	Instalments/ Koolboks Baridi Devidaya Solar Solutions Surechill	Working through dairy cooperatives could increase affordability.	There are relatively few providers, with most solutions having been tested through agri-value chain development projects.

Based on this initial mapping, the research also incorporates different data sources and impact metrics, including the GOGLA impact calculator and findings from GOGLA Powering Opportunity study, in addition to the data collection efforts by 60 Decibels in the off-grid sector which many PURE companies have been collaborating on. The following key research activities were conducted:

Desk research and literature review: A comprehensive review of existing knowledge, evidence, and lessons learned from the PURE sector, as well as from adjacent industries such as PAYGo solar, microfinance, and supply chain finance among others.

Consultations and key informant interviews: The research team undertook a series of 19 key informant interviews.

- **Staff from PURE companies:** 11 PURE companies with a focus on Kenya, Uganda, and India as far as possible.
- **PURE subject matter experts (SMEs):** Interviewed eight SMEs representing various key PURE-focused organizations. GOGLA Working Groups, such as those focused on Productive Uses of Renewable Energy and Impact, were also engaged as an initial starting point.

Women customer interviews and focus groups discussions: The research team developed a detailed data collection tool and trained representatives from PURE companies, including Agsol, Oorja, and SureChill, to conduct interviews and focus groups with existing women customers. The number of interviews conducted by each company ranged from 14 to 22 and depended on their current customer outreach. The research team collaborated with companies to ensure that the women represented the distinct categories of women customers currently being served. The data collection tools were designed to enable companies to use the data collected to better understand their customers' needs. Data was collected from June to August 2024.

40 Note that this list of companies is indicative and not exhaustive

Develop personas and customer journey mapping: The collected data was used to develop a set of personas representing women PURE consumers. Personas are descriptive summaries of typical consumers that include an overview of their situation, context, needs, motivations, and benefits sought. People with similar characteristics are combined into an “archetype”, allowing for a better understanding of specific customer groups. Personas also capture behaviours and attitudes (e.g., around risk-taking in business), highlight pain points for women consumers, and identify potential entry points for PURE companies. The personas help PURE companies to better understand potential women consumers, enabling them to design and deliver appropriate products and services. The main elements of the personas outlined include (See Annex 4 for examples of customer personas):

- **Demographics:** Information such as location (rural/urban), family composition, education, and literacy.
- **Behavioural aspects:** Behaviours and underlying drivers (e.g., gender norms), including attitudes to technology, sources of information, decision-making, and control of resources.
- **Livelihoods:** Livelihood profile including value chain, income streams, market activities, labour activities, assets, energy needs, and so on.
- **Technology access and use:** Current access to PURE technologies, identifying opportunities and highlighting how access to new technology changes women’s roles or activities, along with its impact on income, time use, and household wellbeing.
- **Pain points:** Challenges and barriers related to accessing, adopting, and using new technologies
- **Company changes:** Ways PURE companies can alleviate the pain points and contribute to increased income and well-being for the persona.

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MAPPING THE PURE ECOSYSTEM WITH A GENDER LENS

Gender norms, roles, and relations often lead to differentiated engagement of women and men within various sectors and value chains. Consequently, not all PURE solutions are equally relevant to both genders; any analysis must begin with an understanding of women's specific roles in these value chains. Traditionally, women have had limited access to mechanization compared to men, even in family-based enterprises. This disparity is largely due to gendered socio-economic barriers that restrict women's decision-making power and access to credit for economic activities.[41] As a result, the lack of mechanization forces women to operate at lower productivity levels while facing higher levels of labour-intensive work.

The informal economy exhibits distinct gender characteristics: women typically outnumber men as a proportion of workers, yet they earn, on average, lower wages than their male counterparts. Women's informal activities are often concentrated in the least profitable segments of the formal economy, typically engaging in a narrow range of increasingly saturated, low-income activities such as small-scale food production.[42] This concentration limits their income potential and constrains their available time and resources, hindering their ability to invest in their businesses, enhance their skills, and contribute more significantly to the economy.

OVERVIEW OF SECTOR AND VALUE CHAINS

HORTICULTURE/ CROP PRODUCTION/ SMALL-SCALE AGRI-PROCESSING ENTERPRISE/ FISHERIES/ FORESTRY (FRUITS, VEGETABLES, SEEDS, NUTS AND HERBS)

Women's current roles and challenges

Agriculture represents the cornerstone of women's employment in developing regions, particularly in Southeast Asia and Sub-Saharan Africa, where women constitute 50 per cent of the agricultural labour force. This is in stark contrast to the Americas, where women's participation is around 20 per cent and the global average of 40 per cent.[43] The significance of women's agricultural engagement is particularly evident in Asia, where 57 per cent of female workers are involved in agriculture, while in Africa, this percentage rises to 63 per cent.[44] In India, women comprise nearly 75 per cent of full-time farm workers and are responsible for 60-80 per cent of total food production.[45,46] Their involvement extends across various agricultural subsectors, with particularly high engagement in livestock management (70 per cent), tea plantations and cotton cultivation (47 per cent), oilseeds production (45 per cent), and vegetable production (39 per cent).[47]

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41 Edoardo Masset and Suchi Kapoor Malhotra. (2024). Mechanization supports women farmers' productivity, but impact on empowerment is inconclusive.

42 ILO. (2018). Women and men in the informal economy: a statistical picture.

43 FAO. (2011) The role of women in agriculture. ESA Working Paper No. 11-02 March 2011.

44 Agarwal. (2011). Food Crises and Gender Inequality. DESA Working Paper No. 107 ST/ESA/2011/DWP/107.

45 Oxfam. (2013). Oxfam India Policy Brief.

46 Government of India, Ministry of Agriculture and Farmers' Welfare. (2020). "Agricultural Census."

47 FAO. (2011) The role of women in agriculture. ESA Working Paper No. 11-02 March 2011.

The gender division of labour in agricultural value chains varies by region but typically follows consistent patterns. Women usually handle labour-intensive tasks such as sowing, weeding, applying fertilizers and pesticides, harvesting, and threshing. In post-harvest activities, they are primarily responsible for food processing, transportation, and marketing at local levels. In forestry, women manage seedlings and are primarily responsible for gathering food, fodder, and fuelwood. Their role extends to coastal regions, where they are crucial in aquaculture, particularly in post-harvest activities such as net making and repair, fish processing, and river fishing.[48] Women are primarily responsible for post-harvest processing, including drying and value-added activities like oil extraction and preserves. Currently, much of this processing is done manually and lacks sufficient mechanization.[49] Men typically lead activities like advanced irrigation, purchasing agricultural inputs, transporting fruits and vegetables (when using vehicles), negotiating prices and selling bulk products to brokers and middlemen. In contrast, women focus on on-site farming tasks, such as land preparation, shallow well water pumping, harvesting, cleaning, sorting fruits and vegetables, selling in local markets, and small-scale processing, like sun-drying mangoes or bananas.

Despite their significant contributions, women farmers face substantial challenges that limit their productivity and economic potential. They typically earn about 22 per cent less than their male counterparts and struggle with limited access to essential inputs such as seeds, fertilizers, and labour. Access to critical services like training and insurance remains restricted, and reliable cold chain infrastructure is often unavailable. This gender productivity gap results in significant economic losses. For example, Malawi loses $100 million, Tanzania $105 million, and Uganda $57 million annually due to gender inequalities in agriculture.[50] Research indicates that if women had the same access to productive resources as men, they could increase farm yields by 20-30 per cent and boost total agricultural output by 2.5-4 per cent.[51]

Relevant PURE technologies

The adoption of PURE technologies presents significant opportunities to address the challenges faced by women in agriculture. These solutions specifically target the labour, time, and infrastructure constraints that disproportionately affect women farmers, helping transform agricultural productivity and market access while increasing incomes and reducing physical burden.[52]

Key technologies and their relevance for women farmers include:

- **Solar irrigation systems:** Enable access to water for cultivation, helping address women's limited access to conventional irrigation infrastructure while reducing the physical labor burden of manual irrigation.[53]

- **Post-harvest processing mills:** Reduce the time and effort required for manual processing tasks, improving product quality while allowing women to engage in other productive activities.[54]

- **Solar-powered refrigeration:** Extends produce shelf life by improving cold chain access, helping reduce post-harvest losses and enabling women to preserve products for market access.[55]

DAIRY (MILK PRODUCTION, PROCESSING, AND DISTRIBUTION)

Women's current roles and challenges

The dairy sector exhibits strong growth potential globally, with particularly promising trends in developing regions. In Sub-Saharan Africa, milk production is projected to increase substantially over the next decade, driven by the expansion of herds and a growing demand for fresh dairy products.[56] Eastern Africa leads the continent contributing to total milk production output, estimated at 11 million tons.[57,58] Dairy production in Africa is expected to rise

48 FAO. (2011). State of food and agriculture. Women and agriculture: Closing the gender gap for development. *Rome: Food and Agriculture Organization of the United Nations*

49 Aphlis. (2023). The role of women in reducing postharvest loss.

50 UN Women, UNDP, UNEP, and the World Bank Group. (2015). THE COST OF THE GENDER GAP IN AGRICULTURAL PRODUCTIVITY in Malawi, Tanzania, and Uganda.

51 FAO. (2011). State of food and agriculture. Women and agriculture: Closing the gender gap for development. *Rome: Food and Agriculture Organization of the United Nations*.

52 ESI Africa. (2024). Growing off-grid solar energy in agriculture. The escalating impact of climate change is impacting traditional farming practices; D. Gad and P. Leone. (2024). Productive use of energy of women-owned micro-, small-, and medium-sized enterprises: Insights from food and textile businesses in selected African countries. *Helyon 10(2024). e32313*.

53 IFPRI Blog (2019) – Making Small Scale Irrigation Work for Women.

54 Grassi, F.Landberg, J and Huyer, S. (2015) Running Out of Time: The Reduction of women's work burden in agricultural production

55 UNEP and FAO. 2022. Sustainable Food Cold Chains: Opportunities, Challenges and the Way Forward.

56 OECD and FAO. (2023). OECD-FAO Agricultural Outlook 2023-2032.

57 FAO. (2023). DAIRY MARKET REVIEW Overview of global market developments in 2023.

58 FAO. Livestock and enteric methane.

significantly, fuelled by population and income growth. While intra-regional trade is increasing, particularly within the East African Community (EAC), the sector remains predominantly smallholder-driven and operates in informal markets.[59] India presents a remarkable case in the global dairy landscape, contributing 22 per cent of global milk production, making it the world's largest producer and consumer of milk.[60] The sector's significance is evident in its 5 per cent contribution to India's GDP and its role in sustaining over 80 million families.[61] Women comprise over 80 per cent of India's 100 million dairy farmers, yet they encounter substantial challenges in maximizing their output and earnings.[62] Despite the sector's importance, approximately 22 per cent of dairy farmers in India live below the poverty line.[63]

Women's roles in dairy value chains, while crucial, remain largely informal and face significant constraints. They serve as primary caretakers and milkers, but their participation in downstream activities is limited by various barriers. These challenges are particularly pronounced in Eastern Africa, where women's significant engagement in the dairy sector contrasts with their limited market participation.[64] The commercialization of dairy farming under liberalized markets has produced mixed outcomes - while some women have experienced improved socio-economic status, others have faced exacerbated gender inequities and social disparities.[65]

Women in the dairy sector face multiple interconnected challenges that limit their productivity and economic potential. Their limited access to modern dairy processing technology and cold chain infrastructure negatively affects product quality, while restricted access to formal value chains confines them to less profitable informal markets. Insufficient training in modern dairy practices and limited veterinary services impact their ability to maintain healthy livestock. Additionally, traditional gender norms often restrict their participation in commercial activities. These challenges are compounded by women's limited access to finance, constraining their ability to adopt new technologies or expand their businesses.[66]

Relevant PURE technologies

PURE technologies offer significant potential to address the challenges faced by women in the dairy sector. These solutions focus on improving milk preservation, enabling value addition, and facilitating market access, thereby helping women transition from informal to formal market participation.[67]

Key technologies and their relevance for women dairy farmers include:

- **Solar-powered milk cooling systems:** Enable immediate milk cooling at collection points, reducing spoilage significant and particularly benefiting women who handle evening milk collection when grid power may be unreliable.[68]
- **Solar-powered processing equipment:** Allows value-added product creation, such as yogurt and cheese, improving women's income potential while reducing manual processing time.[69]
- **Refrigeration and cold storage solutions:** Extend product shelf life from hours to days, enabling access to formal markets and reducing pressure to sell immediately at lower prices.[70]
- **Solar Powered Milking machines:** Reducing physical strain (e.g., wrist, shoulder, and back pain), decreasing milking time, and lower overall labour intensity for women farmers.[71]

59 Abdulsamad, A. and Gereffi, G. (2016). East Africa Dairy Value Chains: Firm Capabilities to Expand Regional Trade.; Bingi, S. and Tondel, F. (2015) Recent Developments in the Dairy Sector in Eastern Africa. European Centre for Development Policy

60 FAO. (2024). Gateway to dairy production and products

61 Government of India. (2024). Ministry of Fisheries, Animal Husbandry & Dairying: World Milk Day.

62 DFC. (2024). Increasing milk production and empowering small farmers in eastern India.

63 Ibid.

64 Gerald Katothya. (2017). Gender assessment of dairy value chains: evidence from Kenya, Rome, FAO.

65 FAO. (2024). Eastern African dairy value chains: what prospects for women in trade? Gender policy developments for inclusive dairy markets and trade in Ethiopia, Kenya and Rwanda. Rome.

66 ibid

67 D. Gad and P. Leone. (2024). Productive use of energy of women-owned micro-, small-, and medium-sized enterprises: Insights from food and textile businesses in selected African countries. *Helyon 10(2024). e32313*.

68 IRENA and FAO. 2021. Renewable energy for agri-food systems – Towards the Sustainable Development Goals and the Paris agreement. Abu Dhabi and Rome. https://doi.org/10.4060/cb7433en

69 USAID (2018), "Clean energy for productive use in post- harvest value chains: An integrated literature review with field work for the Kenya and Senegal dairy sectors", U.S. Agency for International Development, Washington, DC.

70 UNEP and FAO. 2022. Sustainable Food Cold Chains: Opportunities, Challenges and the Way Forward. Nairobi, UNEP and Rome, FAO.

71 Efficiency for Access 2023 Evaluating appliance performance in the field results from milking machine testing

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RETAIL (FOOD PRODUCTION IN THE INFORMAL SECTOR)

Women's current roles and challenges

The informal food sector, particularly street-vendor food, has evolved from an occasional meal option into a vital source of affordable nutrition for the urban poor worldwide. Studies show that over 2.5 billion people consume street food daily, making it a crucial component of urban food security.[72] In major cities, the sector's significance is evident through various indicators: in Bamako, Mali, street food accounts for 19-27 per cent of household food budgets, while in Lusaka, Zambia, food vendors serve approximately 81 million meals annually.[73]

The sector is characterized by intense labour demands, with vendors typically working six days per week for around ten hours daily, not including additional time spent on ingredient sourcing and preparation. The longevity of vendor participation - averaging between six to eight years - indicates that street vending represents a stable employment option rather than a temporary income source.[74] In urban areas like Bangkok, Thailand, or Lusaka, Zambia, the sector's popularity is driven primarily by its affordability and proximity to residential areas.[75]

Despite the growing interest in street food, relatively little research has focused on the informal food processing sector, particularly in urban settings. While there was a brief resurgence of interest in informal food processing in the 1980s, primarily around women's labour burdens and the adoption of appropriate technologies,[76] these discussions largely focused on rural, domestic production and overlooked women as key economic players in food processing.

Women operating in this sector face distinct operational challenges. Most enterprises rely heavily on heat generated from purchased wood, making energy costs a significant burden. While energy planning often emphasizes electricity supply, traditional solid fuels remain the primary energy source for cooking and heating.[77] The lack of adequate cooling and preservation facilities leads to significant food

72 FAO, IFAD, UNICEF, WFP and WHO. 2023. The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum. Rome, FAO.

73 Chukuezi, C. O. (2010). Entrepreneurs of the streets: Socio-economic features of street food vending in Owerri, Nigeria. *European Journal of Social Sciences 14(2), 183-188.*; Mosupye, F M. and von Holy, A. (1999). Microbiological quality and safety of ready-to-eat street-vended foods in Johannesburg, South Africa. *Journal of Food Protection 62(11):* 1278-1284; Muzaffar, A. T., Huq, I. and Mallik, B. A. (2009). Entrepreneurs of the streets: An analytical work on the street food vendors of Dhaka City. *International Journal of Business and Management 4(2):* 80-88.; FAO. 2012. The State of Food Insecurity in the World.

74 Stacey Giroux, Jordan Blekking, Kurt Waldman, Danielle Resnick, Daniel Fobi. (2021). Informal vendors and food systems planning in an emerging African city, *Food Policy, Volume 103, 2021, 101997, ISSN 0306-9192*; Ag Bendech, M et al., (2013). Street food vending in urban Ghana: Moving from an informal to formal sector. *GhanaWeb.*

75 Article, 292956.; Graffham, A., Zulu, R. and Chibanda, D. (2005). Improving the safety of street vended foods in southern Africa. *Final report, CPHP Project R8272*.

76 Tinker, I. (1987). *The Case for Legalizing Street Foods. Ceres, 20, 26-31.*

77 Matinga, Margaret N., Mohlakoana, Nthabiseng, de Groot, Jiska, Knox, Abigail, & Bressers, Hans. (2018). Energy use in informal food enterprises: A gender perspective. Journal of Energy in Southern Africa, 29(3), 1-9. 7

waste and limits business growth potential. Additionally, these entrepreneurs operate with minimal social and legal protections, limited financing options, and inadequate access to modern technologies.

Relevant PURE technologies

PURE technologies offer transformative solutions for women in the informal food sector, addressing critical challenges in energy access, food preservation, and business operations. These technologies focus on improving operational efficiency while reducing costs and food waste, particularly important for women operating with limited resources.[78]

Key technologies and their relevance for women food vendors include:

- **Refrigeration and cold storage solutions:** Extend food shelf life and reduce waste, allowing for bulk purchasing and improved inventory management, ultimately increasing profit margins.[79]
- **Energy-efficient cooking solutions:** Reduce fuel costs compared to traditional methods while improving working conditions and food preparation efficiency.[80]
- **Solar Home Systems (SHS):** Enable extended operating hours and improve safety, particularly beneficial for women working in informal markets with limited infrastructure.[81]

RETAIL (MICROENTERPRISES AND SMALL-SCALE PRODUCTION)

Women's current roles and challenges

The retail sector represents significant opportunities for women entrepreneurs, particularly in microenterprises and small-scale production. In Kenya, for example, wholesale and retail trade is the dominant sector, accounting for 57 percent of licensed enterprises, and women lead a majority (62%) of microenterprises across sectors.[82] In India, retail is one of the primary sectors for women-owned enterprises, with 78 per cent operating from home.[83] The garment industry is particularly significant with women constituting nearly 60 per cent of workers globally, rising to 80 per cent in some regions.[84] Women entrepreneurs in this sector face multiple interconnected challenges. Financial barriers are particularly acute; with 80 per cent of women entrepreneurs relying on informal sources such as e.g. self-financing due to limited access to formal financial services.[85] In the garment industry, women are more likely than their male counterparts to engage in home-based production or work for smaller enterprises at the lower tiers of the supply chain. These women often operate in precarious conditions lacking social security, labour law protections, healthcare, or minimum wage guarantees. The challenges are compounded by high levels of informality, minimal social and legal protections, and the disproportionate burden of unpaid care work. Given their household care responsibilities, women often prefer enterprises that can be run from home and require relatively low startup capital.[86]

Relevant PURE technologies

PURE technologies offer transformative solutions for women operating retail microenterprises, particularly as the sector transitions toward more sustainable and digital practices. These solutions focus on enabling home-based operations while improving efficiency and market access.[87]

Key technologies and their relevance for women entrepreneurs include:

- **SHS:** Enable extended operating hours for home-based businesses and improve working conditions, particularly beneficial for garment workers and other small-scale producers, with studies showing potential revenue increases of 30-40 per cent.[88] SHS also enable mobile phone charging, enabling women to access digital tools and platforms.

78 Efficiency for Access. (2023) Keep It Cool: Harnessing Cold Storage to Reduce Food Loss & Support Sustainable Food Systems in Emerging Economies

79 Ibid

80 Matinga, Margaret N et al., (2018). Energy use in informal food enterprises: A gender perspective. *Journal of Energy in Southern Africa, 29(3), 1-9. 7* ; Clean Cooking Alliance. (2023). Clean Cooking as a Catalyst for Sustainable Food Systems: 2023 Status Report

81 Swati Anindita Sarker et al., (2020) Economic Viability and Socio-Environmental Impacts of Solar Home Systems for Off-Grid Rural Electrification in Bangladesh, *Energies 13*, no. 3

82 CGAP. (2024). Segmentation of Women-Led Nano and Micro-enterprises: A Guide to Knowledge Resources.

83 Ibid

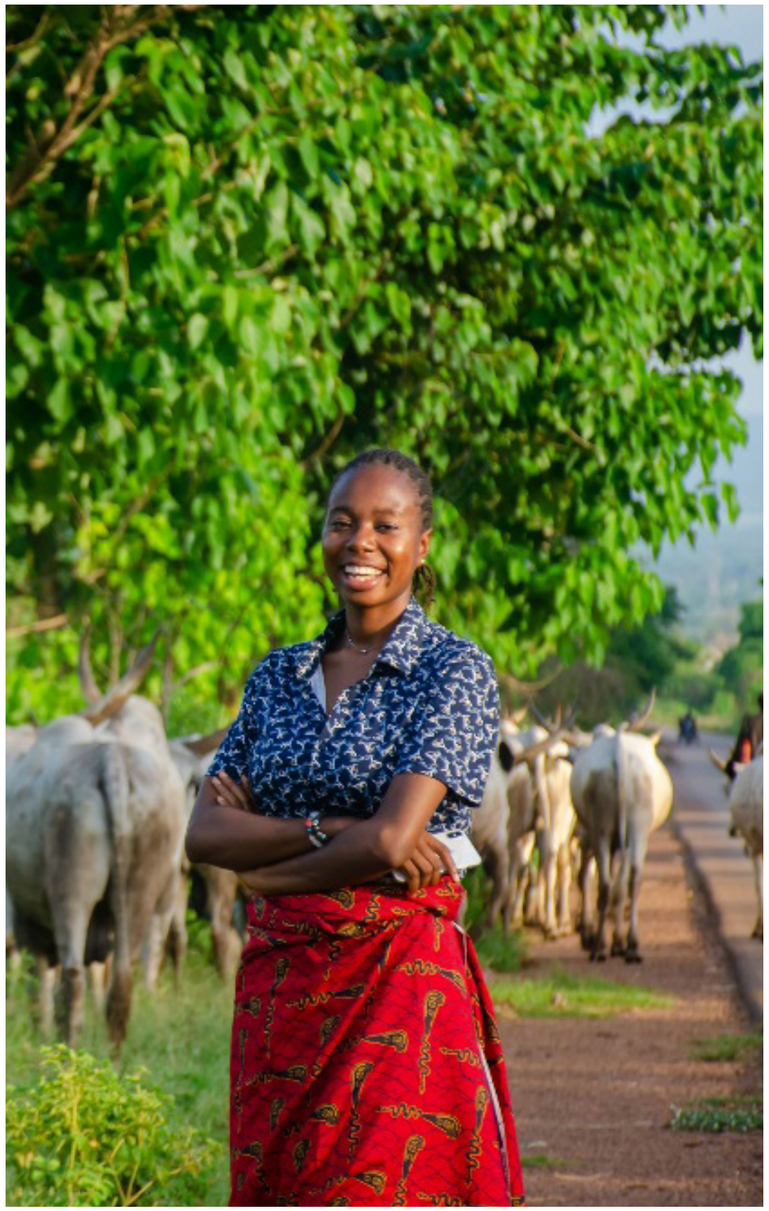
84 ILO. (2023). How to achieve gender equality in global garment supply chains.

85 CGAP. (2024). Segmentation of Women-Led Nano and Micro-enterprises: A Guide to Knowledge Resources.

86 GIZ. (2023). Women Entrepreneur Financing and Investment Toolkit Catalysing Inclusive Economic Growth. ; ILO. (2023). How to achieve gender equality in global garment supply chains. [128] Chen, M. A., & Sinha, S. (2016). Home-based workers and cities. Environment and Urbanization, 28(2), 343-358

87 D. Gad and P. Leone. (2024). Productive use of energy of women-owned micro-, small-, and medium-sized enterprises: Insights from food and textile businesses in selected African countries. *Helyon 10(2024). e32313.*

88 Shakti Sustainable Energy Foundation (2021) Assessing the Feasibility of Solar Applications in Micro, Small and Medium Enterprises (MSMEs) in Rural India



- **PAYGo:** Facilitate formal financial inclusion and help build credit history, enabling access to formal financing. This is particularly important for women who have traditionally been excluded from formal financial services.[89]

LIVESTOCK AND POULTRY

Women's current role and challenges

Livestock and poultry rearing represent crucial economic activities for rural women, particularly due to their low capital and land requirements. The poultry sector in Africa demonstrates significant economic potential as the regional and global demand for chicken meat and eggs is rising at an exponential rate. Globally, rural women represent two-thirds of low-income livestock keepers, underscoring their central role in small-scale livestock development.[90] In India, an agriculturally driven nation, women control a substantial portion of the livestock sector, providing various avenues for income generation. For many women, livestock represents a crucial non-land productive asset that supports their livelihoods and contributes to household food security. Small-scale, marginal, and landless farmers in rural areas in India own more than 70 per cent of the livestock, with self-employed women more likely than men to engage in livestock production.[91]

Energy needs in livestock and poultry operations span multiple activities typically managed by women. In poultry farming, reliable heating during brooding is essential for chick survival and growth, yet many women rely on inefficient and potentially hazardous traditional heating methods such as kerosene lamps or charcoal burners. In livestock operations, water access is a critical energy challenge – women frequently spend significant time and physical effort manually collecting and transporting water for animals due to a lack of mechanized pumping systems.[92] Processing and preservation of animal products present additional energy challenges. Without access to reliable cold storage, women struggle to preserve perishable items such as milk and eggs, often forcing immediate sales at lower prices. For poultry operations, lack of consistent power for lighting affects egg production cycles and limits operating hours. In feed processing, limited access to mechanized, energy-efficient solutions forces women to resort to manual methods, increasing labour intensity and reducing productivity.[93]

The energy-related challenges in the livestock and poultry sector are exacerbated by several interconnected factors. Women's limited access to capital restricts their ability to invest in energy-efficient equipment, while unreliable grid electricity in rural areas forces continued dependence on traditional energy sources like kerosene and firewood, driving higher operating costs. These issues are further complicated by insufficient knowledge about available energy solutions and limited technical support for maintaining energy systems, creating a cycle that perpetuates inefficient energy use in livestock and poultry operations.[94]

89 Hamayan, Mansoor (2024) , NextBillion Rethinking Credit Scoring: A Pay-As-You-Go Pioneer Explores Innovative Solutions in Africa.; Kumaraswamy, Sai Krishna (2021) CGAP Does PAYGo Solar Improve Women's Lives? A Look at the Evidence.

90 Thornton, P.K. (2003). Locating poor livestock keepers at the global level for research and development targeting. Land Use Policy 20(4):311-322

91 Vijayalakshmy, K et al., (2023). The Role of Rural Indian Women in Livestock Production. *European Journal of Humanities and Social Sciences, 3(1), 91–98.*

92 ESI Africa. (2024). Growing off-grid solar energy in agriculture. The escalating impact of climate change is impacting traditional farming practices.

93 CGIAR Gender Platform. (2024) Mechanization Supports Women Farmers' Productivity, but Impact on Empowerment Is Inconclusive.

94 FAO. (2013). *UNDERSTANDING and INTEGRATING GENDER ISSUES into LIVESTOCK PROJECTS and PROGRAMMES.* AgriLinks. (2023). *Women-Inclusive Livestock Development Helps Improve Women's Empowerment*.

Relevant PURE solutions

PURE technologies offer important solutions for women in livestock and poultry production, primarily focusing on improving productivity and reducing labour intensity.[95]

Key technologies and their relevance for women livestock keepers include:

- **Solar-powered incubation and brooding systems:** Enable better control over poultry production cycles and improve chick survival rates, particularly beneficial for women managing small-scale poultry operations.[96]
- **Cold chain solutions:** Extend the shelf life of animal products like milk and eggs, enabling access to more distant markets and better prices.[97]
- **Solar water pumping:** Provide a reliable and efficient water supply for livestock, significantly reducing time and effort spent on manual water collection and transportation.[98]

GENDER GAPS IN PURE TECHNOLOGY ACCESS AND USE

Recent research reveals complex gender dynamics in the adoption and use of productive-use appliances. While 64 per cent of survey participants indicate no gender-based preferences in product selection, a significant 36 per cent consider gender as a relevant factor in purchase decisions.[99] This manifests in distinct product preferences: women show higher interest in sewing machines and electric cookers, while men favour SWPs. Notably, products like hand power tools show unexpectedly lower demand among women, highlighting the importance of gender-sensitive product design that considers physical requirements such as height and strength.[100]

The gender gap in energy access remains significant, with men comprising 68 per cent of registered energy customers, according to 60 Decibels data from the Why Off-Grid Energy Matters 2024 Report.[101] However, once access is achieved, the improvements in quality of life are remarkably equal between genders. Product-specific variations reflect traditional gender roles - women represent 59 per cent of clean cooking customers and 42 per cent of solar lantern users, but only 20-30 per cent in larger systems like solar home systems, appliances, and mini-grids. This disparity often relates to financing requirements and household decision-making dynamics.[102]

Location significantly influences energy transition patterns, with rural residents more likely (67 per cent) to climb the energy ladder compared to peri-urban (39 per cent) or urban (28 per cent) residents. Gender disparities persist in this progression, with 49 per cent of women advancing compared to 56 per cent of men. However, the economic impact of productive use is substantial - 81 per cent of users report an increased income, with appliance users experiencing the highest benefits (89 per cent). Notably, women often show greater economic gains than men when they have access to these technologies.[103] Box 2 further outlines gender-disaggregated data from the 60 Decibels report.

The comprehensive data from the 60 Decibels report highlights the complex relationship between gender and access to PURE technology. While women face significant barriers to accessing larger energy systems, with only 20-30 per cent access rates, their success metrics often exceed those of men once access is achieved. The data shows that 81 per cent of women report income increases, with 39 per cent reporting significant income boosts - higher than men's 36 per cent. Furthermore, 89 per cent of women report improved quality of life, demonstrating that the primary challenge lies in access rather than utilization effectiveness.

95 D. Gad and P. Leone. (2024). Productive use of energy of women-owned micro-, small-, and medium-sized enterprises: Insights from food and textile businesses in selected African countries. *Helyon 10(2024). e32313.*

96 SELCO Foundation (2021) Sustainable Energy in Poultry Value Chain; Ahmed, Abrahim Dawed, Gelan Dule Dahesa, and Isayas Asefa Kebede. (March 30, 2024). Energy Ecosystems of Ethiopia: With Special Focus on Solar Power Applications to Poultry Sector: A Review. *Mathews Journal of Veterinary Science 8*, no. 1

97 IRENA and FAO (2021). Renewable energy for agri-food systems – Towards the Sustainable Development Goals and the Paris agreement.

98 IRENA and FAO (2021). Renewable energy for agri-food systems – Towards the Sustainable Development Goals and the Paris agreement.; ESI Africa. (2024). Growing off-grid solar energy in agriculture. The escalating impact of climate change is impacting traditional farming practices.

99 D. Gad and P. Leone. (2024). Productive use of energy of women-owned micro-, small-, and medium-sized enterprises: Insights from food and textile businesses in selected African countries. *Helyon 10(2024). e32313.*; 60 Decibels (2024). Why off-grid energy matters, 2024.

100 Ibid

101 60 Decibels (2024). Why off-grid energy matters, 2024.

102, 103 Ibid

Technology-specific analysis reveals particularly promising outcomes in several areas. In refrigeration, 85 per cent of women report improved life quality compared to 77 per cent of men, while clean cooking solutions show 89 per cent of women reporting improved quality of life. Water pump technology has demonstrated a remarkable impact, with women reporting 93 per cent quality of life improvement. These success rates are complemented by encouraging financial metrics - 73 per cent of women access credit through PURE technology programs, with 86 per cent reporting improved outcomes and only 3 per cent reporting negative outcomes, a lower rate than men's 4 per cent.

These findings point to clear priorities for future interventions. The sector needs to focus on developing gender-responsive product design and marketing strategies that address women's specific needs and constraints. This should be coupled with innovative financing mechanisms that recognize women's strong performance as borrowers while accounting for their unique financial challenges. Additionally, comprehensive support systems for technology adoption and utilization must be established, alongside policies that actively promote equitable access to productive-use technologies. By addressing these key areas, the sector can work to close the access gap while building on women's demonstrated capacity for effective technology utilization.[104]

© Agsol

104 60 Decibels (2024). Why off-grid energy matters, 2024.

BOX 2: 60 DECIBELS - GENDER-PURE TECHNOLOGY IMPACT STORY

The below findings showcase gender segregation by technology such as clean cooking, SHS and solar appliances (refrigerators, solar water pumps, and TVs) from the 60 Decibels Why Off-Grid Energy Matters 2024 Report.

Breaking the Binary: When Women Win, Everyone Benefits

- In almost every technology category, when women report high benefits, overall community adoption and economic impacts increased.
- Most striking example: 89% of women refrigerator users report increased income vs. 88% of men - proving gender-responsive design drives equal success.
- Critical Insight: Technologies designed with women in mind become universal solutions.

The Access-Impact Paradox

- While only 20-30% of women access larger energy systems (SHS, appliances, mini-grids), those who do, report:
  - 81% income increase (equal to men),
  - 39% significant income boost (higher than men's 36%),
  - 89% improved quality of life (exceeding men in several categories).
- Key Implication: The gender gap isn't in impact - it's in access.

Technology-Specific Success Stories

1. Refrigeration Revolution
   - 85% of women report improved life quality vs 77% of men.
   - Equal 88% productive use rates between genders.
   - Demonstrates perfect alignment between gender-specific needs and universal benefits.
2. Clean Cooking Transformation
   - 89% of women report improved quality of life.
   - Despite being traditionally "women's technology," benefits men nearly equally (88%).
   - Yet only 9% of women vs 11% of men report productive use - indicating untapped economic potential.
3. Water Pump Paradigm
   - Women report 93% quality of life improvement.
   - 84% of women productive use vs 91% of men.
   - Reveals opportunity to close the gender gap in agricultural productivity.

The Financial Bridge

- 73% of women access credit (vs 76% of men).
- For 73% of women, this is their first credit access.
- When women access finance:
  - 86% report improved outcomes.
  - Only 3% report negative outcomes (vs 4% for men).
  - Demonstrates lower risk profile for women borrowers.

Critical Implications for Action

1. *Design Priority:* Technologies designed for women's success become universal solutions for all.
2. *Access Gap:* Focus is needed on bridging initial access barriers, not capability-building.
3. *Financial Innovation:* Women prove to be lower-risk borrowers with higher impact potential.
4. *Economic Multiplier:* When women access productive technologies, benefits extend beyond gender lines.
5. *Market Opportunity:* Significant untapped potential in women's productive use of traditional technologies.

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OPPORTUNITIES FOR IMPACT

All appliances mentioned in the section above and highlighted in the mapping in Table 1 have the potential to have a transformational impact on gender outcomes, albeit in different ways. For example, a systematic review across 62 studies predominantly from lower-middle-income and low-income countries in sub-Saharan Africa and South Asia (for example, Ethiopia, Tanzania, Ghana, India, and Nepal) reveals positive impacts of mechanisation (which many PURE technologies can provide) on women's availability of additional time ability to accumulate additional assets and contributions to groups and collectives.[105] Existing evidence so far suggests that clean cooking and SWPs have the largest impact on time savings for women.[106] On the other hand, access to and ownership of cold storage, and agri-processing for micro-entrepreneurship significantly impact women's income. SWPs also considerably impact income; however, it is worth noting that female ownership of these appliances is lower as highlighted in Box 2.

Below is a brief overview of several PURE appliances and some of their benefits across 1) Increased productive time, 2) Income generation and diversification, 3) Health and well-being benefits and 4) Empowerment and decision-making. Technologies include SWPs, cold storage/cold chain tech, solar drying and dehydrating, solar mills and crushers, clean cookstoves, agricultural value-added tools (i.e. OVO solar egg incubator), lighting and entertainment systems (e.g. TVs), and sewing machines. More evidence needs to be collected to strengthen the depth of the insights on the impact of PURE technologies on women's lives.

INCREASED PRODUCTIVE TIME

Women often bear the burden of collecting water which can involve long walks and heavy lifting. SWPs significantly reduce the time and energy spent on this task, allowing women to engage in other productive activities, and self-care, thereby contributing to their overall well-being. Solar fridges can improve food storage, reducing spoilage and food waste. This is particularly important for women who are often responsible for food preparation. Solar fridges can decrease the time women spend sourcing and managing food, allowing them more time for education, income-generating activities, or rest, which can improve overall well-being. For example, access to cold storage has been shown to save two hours per week due to less frequent trips to the market.[107]

Solar drying can significantly reduce the time needed to dry fruits, vegetables, and other agricultural products compared to traditional methods, which often require longer exposure to sunlight or artificial drying methods.[108] By utilizing solar drying, women can increase the quantity of produce they process within a given period, leading to greater opportunities for selling dried products and increasing household income. With reduced time spent on drying food, women can allocate their time to other important activities, such as education or income-generating tasks.

105 CGIAR. (2024). Mechanization supports women farmers' productivity, but impact on empowerment is inconclusive.

106 Shell Foundation. (2024). Results Based Financing for Productive Use Appliances to Promote Gender Outcomes.

107 ENERGIA. (2020). The role of appliances in achieving gender equality and energy access for all. and CDC Group (2019). How innovation in off-grid refrigeration impacts lives in Kenya: Practical thinking. on investing for development. CDC Insight series

108 EL-Mesery, Hany S. et all. (2022). Recent developments in solar drying technology of food and agricultural products: A review. Renewable and Sustainable Energy Reviews Volume 157, April 2022, 112070.

Solar milling systems operate faster than manual milling, allowing women to allocate their time to other income-generating activities or family responsibilities. For example, it takes 30 minutes to grind a kilogram of flour by hand, while a machine could do the same work in a minute reducing time spent by almost 97 per cent.[109]

Improved cookstoves can cook food faster and more efficiently, freeing up time for women to engage in education, income-generating activities, or self-care and this shift can improve overall quality of life. Evidence from Nigeria suggests that switching to improved cook stoves (ICS) saved 0.75 hours per day in fuel collection and 1.44 hours per day on cooking.[110]

INCOME GENERATION AND DIVERSIFICATION

SWPs can enable women to irrigate crops more efficiently, potentially tripling agricultural yields and improving family food security.[111] With lower or zero energy expenses, women save money that can be reinvested into other areas of their businesses or households. Reduced energy costs translate into higher margins, enabling better returns on investment in agriculture and related sectors.

Owning cold storage facilities may improve women's creditworthiness, facilitating access to microloans and other financial services to expand their businesses. Cold storage facilities also give women greater control over when and how to sell their produce, leading to more favourable terms and improved income stability. For example, one study shows that cold storage users increase their gross revenues by 70 per cent.[112] Research by BII (previously CDC) on M-KOPA solar refrigerators indicates benefits to women including weekly time savings, reduced stress, lower costs, and opportunities to start or expand small businesses such as selling vegetables and fruits, and ice or beverages (cold water, soda, juices, drinks, and milk).[113]

Solar dryers provide a controlled environment that can improve the efficiency of drying processes, leading to better quality products in less time. This efficiency can allow women to focus on other agricultural or economic activities. Solar drying can enhance the product, which can lead to higher market prices. This economic benefit can empower women and contribute to better household nutrition.

Solar milling installations allow women to take on roles as operators or managers, providing new job opportunities in their communities. Considering a base tariff (US$0.60 per kW), a flour milling microenterprise can earn a daily gross profit of US$5.573.[114] By reducing fuel costs and cooking time, clean cookstoves can enable women to invest savings into education or small businesses, promoting economic independence and empowerment.

HEALTH AND WELL-BEING BENEFITS

Reducing the physical and time burdens associated with water collection can reduce stress and improve mental health, allowing women more opportunities for relaxation and social engagement. SWPs provide reliable access to clean water, which is crucial for reducing waterborne diseases that disproportionately affect women and children. Access to clean water also supports better hygiene and overall health, as over 91 million people in Africa fall ill from food-borne diseases.[115]

There is evidence that irrigated agriculture in warm climates may intensify lethal heat stress due to heat and humidity exposure. Based on research from 60 Decibels, most farmers still use buckets and watering cans for irrigation.[116] Improved irrigation leads to better crop yields, which can enhance family nutrition. Since women play a crucial role in food preparation and nutrition, better access to water for irrigation can improve dietary quality. Additionally, SWPs can provide water for drinking and washing, further improving household hygiene and sanitation levels.

Cold storage helps keep food fresh and free of contaminants for longer, decreasing the negative consequences of food-borne diseases. Improved access to a variety of stored foods enables families to maintain a more balanced diet. This is crucial for women's health, particularly during pregnancy and lactation, when good nutrition is vital. Solar fridges all provide storage for vaccines and medicines, improving

109 Smith. A. (1998). New Mill Design Grinds More Grain for Less Money. *Volume 8, Number 1 of ATF.*

110 Onyeneke, R. et al., (2019). Improved Cook-stoves and Environmental and Health Outcomes: Lessons from Cross River State, Nigeria.

111 CLASP. (2019). Use and Benefits of Solar Water Pumps.

112 Takeshima, H. et al. (2023). Solar-powered cold-storage and agrifood market modernization in Nigeria. *Agricultural Economics. Volume54, Issue2 March 2023 Pages 234-255*

113 Sanni, M. (2019). How innovation in off-grid refrigeration impacts lives in Kenya. *CDC (Now BII).*

114 A2EI. (2020). Productive Use Report- Evaluation of Solar Powered Agricultural Technologies for Productive-Use Applications: A Modeling Approach.

115 WHO. Food Safety.

116 60 Decibels (2024). Why off-grid energy matters, 2024.

health services in rural areas where women often serve as primary caregivers and health workers. By making milling more accessible, solar technology enables women to process grains more effectively, contributing to improved food security for their families and communities.

The use of clean cookstoves reduces exposure to harmful smoke and particulate matter, decreasing the incidence of conditions such as chronic obstructive pulmonary disease (COPD) and lung cancer among women. This reduction helps lower the risk of respiratory diseases and related health issues, particularly for women and children who spend more time indoors. Fuel collection is often viewed as women's least liked and most high-risk activity due to associated dangers and accidents. Efficient cooking allows for better food preparation, helping women provide more nutritious meals for their families. This is especially important for maternal and child well-being. Using clean cookstoves can reduce the risk of burns and accidents associated with traditional cooking methods, contributing to overall safety in the household. According to the WHO, there is substantial evidence that household air pollution (HAP) caused by solid fuels can increase health risks, particularly for women and children, who generally have greater exposure in the household. HAP is globally linked to around 2.5 million premature deaths a year[117] and is the greatest health risk for women and girls in Sub-Saharan Africa (SSA). A study suggests that replacing traditional biomass-burning stoves across SSA could save more than 463,000 lives and US$66 billion in health costs annually.[118]

EMPOWERMENT AND DECISION-MAKING

Enhanced resilience to climate impacts improves overall community health.[119] SWPs enhance climate change and water scarcity resilience of the community[120] and create opportunities for women to actively participate in management of resources. This increases women's control of water resources and make important decisions on how the water is used in the household and in agricultural activities. Solar refrigeration enhances community resilience, particularly in areas prone to food shortages. Women's roles in food security can be bolstered by having access to reliable food storage.[121] Programs that provide solar refrigeration technologies often include training for women, enhancing their skills and knowledge, which can boost confidence and community standing. Women involved in solar drying become the knowledge bearers who pass on information to others thus changing the perception of their community members to not only be recipients but also teachers and leaders. This change in roles and responsibilities challenges the gender norms to ensure that women have a higher level of participation in the household and community management. Clean cookstoves contribute to lower greenhouse gas emissions while freeing women's time from fuel collection, enabling their participation in governance structures and decision-making forums.

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117 World Health Organization (2024). Household air pollution.

118 Penn, M. (2023). Study: Most Households in Africa Would Benefit By Upgrading Their Stoves. *Duke University*.

119 Oliver W. Johnson, et al. (2020). Intersectionality and energy transitions: A review of gender, social equity and low-carbon energy, *Energy Research & Social Science*, Volume 70, 101774, ISSN 2214-6296,

120 CGIAR. (2024). Mechanization supports women farmers' productivity, but impact on empowerment is inconclusive.

121 IRENA and FAO (2021). Renewable energy for agri-food systems – Towards the Sustainable Development Goals and the Paris agreement.

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BARRIERS TO ADOPTION

While several barriers to the adoption of PURE technologies affect both women and men, many are more acute for women given their lower decision-making power within the household, limited access to mobile phones, challenges in access to appropriate and affordable finance, limited information about technologies and other normative constraints such as mobility and time poverty.

SOCIAL AND CULTURAL CONSTRAINTS, AND LIMITED INSIGHT ON WOMEN CUSTOMERS

Poor suitability of available technologies for women's activities: The availability of PURE technologies in rural agricultural communities is often hindered by affordability challenges, limited supplier interest, poor infrastructure, and varying motivations from governments and donors. As a result, many PURE technologies are either inappropriately designed - either over-engineered or under-engineered - or focused on renewable energy and efficiency levels that exceed the actual needs of users. Additionally, there has been significant underinvestment in research and development for essential technologies like dryers and processors in horticulture, as well as PURE products for dairy value chains, despite women's prominent roles in these sectors. Evidence from Agsol's experience highlights how traditional milling equipment required both physical strength and technical maintenance capabilities, which were culturally seen as exclusively male domains.[122]

To address these issues, technology targeting should prioritize cooperative groups of women - typically organized in teams of three to four - rather than adopting an individual customer approach. This shift recognizes the different ways men and women engage in agricultural and economic activities. Suppliers and donors should enhance their assessments of local markets and the specific needs of women to ensure that the range of available PURE equipment aligns with community requirements.

Interviews with PURE companies during this research have highlighted the physiological benefits of these technologies for women. Unlike diesel generators and milling machines, which require multiple people and often trucks for transportation, SWPs and mills are more compact and user-friendly, featuring simple on-off switch operation. Solar irrigation systems, in particular, empower solo female farmers to operate independently, eliminating the need for male assistance required by traditional

122 Agsol Interview, 2024

methods. Unfortunately, these ergonomic considerations are frequently overlooked in the R&D process, which tends to prioritize the typical male user, leaving women's needs inadequately addressed.

Women user data and company performance benchmarks are lacking: One of the main underlying impediments to gaining further insights on women as customers is the lack of reliable data on PURE overall, including gender-disaggregated data. Interviews revealed that PURE companies have placed limited focus on analysing relevant gender-related portfolio data issues, making it harder to evaluate which financing programs, products or models may be more successful in servicing women customers and women-led or women-owned micro, small and medium enterprises (WMSMEs). Questions around how strong uptake by end-users may be, how stable loan repayments will be and what kind of equity returns can be expected, by gender, are all key, unanswered questions. SunCulture's experience reveals how household dynamics further complicate data collection - while women may be primary users of technology, purchasing decisions and formal ownership often remain with male household members, making it impossible to accurately track usage patterns through conventional metrics.[123]

LIMITED ACCESS TO MARKETS AND RESOURCES

Limited demand and poor market linkage: Rural producers often struggle to unlock demand for their produce due to their location and market position,[124] presenting a key barrier to rural economic development across various regions. From a value chain perspective, it is vital to consider the level of demand and market linkage before, or in addition to, intervening with PURE promotion for value addition on a particular commodity.

Women play a significant role in horticultural production, yet they often face greater challenges than men in accessing resources, markets and decision-making opportunities. If women cannot access larger markets where they can retail their products, then an investment in equipment and/or processes that add value to goods is financially unviable. Many gender-agnostic networks and associations do not offer services tailored to their female members' needs or account for the social dynamics within families and communities that influence the business operations of women-led enterprises.[125] S4S Technologies' experience in India illustrates additional spatial constraints - women often lack their own space to operate equipment, requiring permission from male family members to use household land. They also face community resistance when processing activities create noise or smell, forcing them to seek alternative locations and further limiting their market access options.[126]

It is key to recognize that women entrepreneurs are often constrained by gender norms that require them to prioritize household and care responsibilities. As a result, leading women entrepreneurs may choose to keep their businesses smaller and adopt less aggressive growth paths impacting their links to markets, and so on. Women perform 76.2 per cent of unpaid care work globally - more than three-quarters of the total hours provided - and spend on average 2.4 plus more hours per day on unpaid care work than men, even while running a business.[127] Women experience a greater overlap between their personal and professional responsibilities due to gender division of roles in society.

Poor availability of appropriate PURE equipment for women's economic activities: Household members and enterprises in rural areas with poor or limited electrification frequently report having constrained access to, machinery, tools, and equipment. Retail stores often focus on essentials such as groceries, or at most, small basic household electronics. Hardware stores that sell, for example, kitchen appliances, and farming machines are generally only found in larger more central towns.[128] Yet, even in these larger central towns, equipment quality is often low and after-sales support is limited. Women and men also have different PURE equipment needs based on their economic activities (as highlighted above in section 5). For example, they may need access to egg incubators or thrashing or milling, while men might be more involved in the production of higher-value goods and therefore can afford PURE technologies such as solar water pumps compared to milling which is focused on processing the less expensive food commodities.[129] Although the PURE equipment markets are expanding, NGOs and donors still provide much of the technologies. As a result, the range of available equipment remains restricted, with promoters focusing on technologies rather than allowing a natural market to develop. More focus needs to be placed on the value chains that women are already economically active in as entrepreneurs so they can afford the PURE technologies that align with their business and household activities.

123 SunCulture Interview, 2024

124 GET.Transform (2024). Barriers to Scaling Productive Use of Energy - Sun Connect News.

125 Patnaik, Sasmita, Shaily Jha, and Tanvi Jain. 2021. Improving Women's Productivity and Incomes Through Clean Energy in India. New Delhi: Council on Energy, Environment and Water.

126 S4S Interview 2024

127 ILO. (2018). Care work and care jobs for the future of decent work. Geneva: ILO and World Bank. 2024. Women, Business and the Law 2024.

128 GET.Transform (2024). Barriers to Scaling Productive Use of Energy - Sun Connect News.

129 Agsol Interview, 2024; ENERGIA Interview, 2024

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FINANCIAL CONSTRAINTS

High-upfront equipment costs and low affordability of women: Another barrier mentioned both in research and in interviews conducted for this study highlighted that PURE equipment which can lead to enhanced economic activity, is often too expensive or unaffordable for the targeted end-users.[130] Solar mills, cooling equipment, pumps, irrigation systems, and even many of the power tools and appliances used in the services sector can cost hundreds to thousands of US dollars.[131]

For example, Koolboks' products cost between US$1000 to USD$3000[132] which is a substantial investment given that farms in Sub-Saharan Africa are often too small (and focused on subsistence agriculture) to generate an income above the poverty line of USD 1.90 per day. Average annual incomes, generally range from around US$400 to US$900 in 2021.[133] Given that gender gaps in agricultural productivity are considerable, ranging from almost 11 per cent in Ethiopia to 28 per cent in Malawi, income differences should be a central focus when addressing affordability constraints, pricing and access to credit models by PURE companies.[134] SureChill's Cooling-as-a-Service model removes some of these barriers.[135] A low deposit is required to access the rental model. Applicants need to demonstrate that they will use the fridge in a business context, making it easier for businesses to access the necessary cooling equipment without a large upfront investment. Further focus is needed on the affordability constraints of customers, particularly for women.

Women have less access to consumer credit and interest rates are high: Many potential PURE customers lack the financial resources to invest upfront in equipment, making access to financial services essential. However, limited bank outreach in rural areas, coupled with high interest rates and stringent collateral requirements, significantly hinders adoption. Interviews conducted during this research revealed that high bank interest rates pose a major obstacle for end-users and suppliers when purchasing equipment. The financial service industry also makes it particularly challenging for women to obtain loans, due to barriers such as registration requirements, collateral, margin money, and general lack of trust in their repayment capacity. S4S Technologies observes that even women running successful businesses face challenges due to the lack of basic financial documentation and credit history creating a circular barrier - without formal records of business success, they cannot access institutional finance for growth. This challenge is particularly acute when land titles and other traditional forms of collateral remain in male family members' names.[136] In India, for instance, 54 per cent of women-owned micro-enterprises remain unregistered. While 93 per cent of women micro-entrepreneurs have bank accounts, over half rely on cash transactions for their income and expenses.[137] Additionally, financiers are often reluctant to approve loans for clean energy products due to the novelty of these technologies and their limited understanding of these energy solutions.

130 GET.Transform (2024). Barriers to Scaling Productive Use of Energy - Sun Connect News.
131 Ibid
132 Koolboks Interview, 2024
133 GET.Transform (2024). Barriers to Scaling Productive Use of Energy - Sun Connect News.
134 UN Women (2019). The Gender Gap in Agriculture Productivity in sub-Saharan Africa: Causes, Costs and Solutions.
135 SureChill Interview, 2024
136 S4S interview 2024
137 Patnaik, Sasmita, Shaily Jha, and Tanvi Jain. 2021. Improving Women's Productivity and Incomes Through Clean Energy in India. New Delhi: Council on Energy, Environment and Water.

Numerous PURE companies are actively developing product financing solutions for end-users, yet suppliers still struggle to secure capital at affordable rates due to inherent business risks. For example, an interview with Simusolar revealed that the company is implementing a pay-as-you-grow system that allows customers to make equipment payments via phone during the loan period. To strengthen portfolio quality, Simusolar has temporarily paused its Gender Action Plan to focus on business sustainability. Concurrently, the company is expanding into formalized commodity value chains, such as avocado oil. While historically 30 per cent of customers were women, the impact of this strategic shift in commodity focus on gender inclusion remains to be assessed.[138]

However, for small, stand-alone solar equipment, PAYGO sales mechanisms may have limited effectiveness. Such equipment often requires specific adaptations for both power supply and payment methods, making it relatively expensive.[139] Moreover, a diverse range of applications is necessary to address the varied needs of rural economies. While there is considerable attention on mills, pumps, cooling, and cooking solutions, other critical sectors such as power tools, ICT, processing, packaging, beauty, and textiles also require focus. Unfortunately, not all of these can be adapted for PAYGO solar systems. Therefore, a more flexible financing instrument is essential to support a broader range of products and services for women customers.

Financial instruments not adapted to end-user constraints resulting from gender norms: Instead of formal lending services, many potential female customers in rural areas prefer to borrow money informally from family, friends, or Village Savings and Loan Associations (VSLAs). A study in India found that about 65 per cent of the women micro-entrepreneurs relied on family members to make business decisions.[140] Women need the buy-in of family members to finance the livelihood appliance or scale their business. As women may not own assets, they may have to depend on family members for collateral, margin money, co-borrowing support, or seek their approval to take on any financial commitment related to PURE technologies.[141] It is therefore key that financial instruments, including disbursement mechanisms, are designed to account for social norms, increasing the chance of successful adoption. This requires close engagement with local banks, supported by identifying viable PURE solutions and financial mechanisms that meet the needs of the potential end-user.

LACK OF AWARENESS AND CULTURAL KNOWLEDGE

End-user behaviour change and overcoming women's hesitancy: Wider PURE adoption requires substantial behavioural change among end-users. Illustrating the value proposition for a new product is critical to achieving adoption, and most low-income households are cautious about making a purchase until the technology is proven by early adopters - who are difficult to find in rural settings. An interview with CEEW highlighted the even greater challenge of finding so-called women demo champions. This difficulty reflects deeper structural barriers - women face both social restrictions and practical constraints when taking on public-facing roles promoting new technologies. In turn, this creates a circular barrier where the lack of visible female technology users makes it harder to build trust and acceptance among other potential women users.[142] Resistance to change, such as prolonged food storage through refrigeration or shifts in farming roles, can be strong in rural areas.

Rural communities have seen many innovations introduced and then abandoned in their lifetimes - they are aware and also fear that utilization of these new products or services may require them to take on substantial debt. What is often misinterpreted as risk aversion among women is actually a heightened sense of risk awareness. Acumen's experience with its investees involved in solar irrigation projects found that women's careful evaluation of new technologies reflects their need to protect limited household resources.[143] Similarly, Simusolar observed that women farmers' preference for certain crop types and payment plans was driven by the need for reliable, consistent income rather than maximizing potential returns.[144] This insight is further supported by S4S Technologies' experience, where women entrepreneurs carefully evaluated technology investments not just for business returns, but for their potential impact on overall household welfare.[145] Their hesitancy to adopt new technologies stemmed from a sophisticated understanding of household financial dynamics and responsibilities rather than resistance to innovation.

Technical failure or low utilization/slow payback of a PURE asset presents a particular threat to women's livelihoods and family welfare. As CEEW's research in India showed,

138 Simusolar Interview, 2024
139 GET.invest. (2022). GET.TRANSFORM — Energy for Rural Industrialisation Productive use of Energy 2.0.
140 Patnaik, Sasmita, Shaily Jha, and Tanvi Jain. 2021. Improving Women's Productivity and Incomes Through Clean Energy in India. New Delhi: Council on Energy, Environment and Water.
141 Ibid.
142 CEEW interview, 2024
143 Acumen Interview, 2024
144 Simusolar Interview 2024
145 S4S interview 2024

women's adoption decisions were heavily influenced by concerns about maintenance requirements and operational reliability, given their primary responsibility for household food security.[146] The differing support ecosystems between regions also affect risk assessment - while India has stronger institutional support through CSR mandates and established women's groups, companies in Africa report more limited support structures for women entrepreneurs considering technology investments. For instance, Dharma Life, a social enterprise, operates through a network of 20,000 rural entrepreneurs, 78 per cent of whom are women, selling socially impactful products like clean cooking devices and solar lighting.[147] Despite women's strong community ties and potential influence, their sales performance lagged behind that of male colleagues due to a lack of capital for demonstration products, transportation, and communication expenses. In response, Dharma Life, supported by Value for Women and Shell Foundation, first piloted and then scaled a solution in Karnataka, India, providing 3,000 women agents with startup kits including product samples and demonstration materials. Agents co-financed 30 per cent of the kits, making the program more sustainable while improving women's sales performance and income-earning opportunities.[148]

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146 Patnaik, Sasmita, Shaily Jha, and Tanvi Jain. 2021. Improving Women's Productivity and Incomes Through Clean Energy in India. New Delhi: Council on Energy, Environment and Water.

147 Dharma Life.

148 Acumen and Value for Women (2024). Pathways to Growth: Gender Smart Business Actions that Work.

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TOWARDS GENDER-SMART PURE BUSINESS MODELS

Women represent a significant untapped market opportunity in the PURE sector, yet they face distinct barriers to accessing and benefiting from these technologies. This section presents evidence-based principles and strategies for developing gender-smart business models to help PURE companies better serve women customers while building more sustainable and profitable businesses. Drawing from extensive research across Kenya, Uganda, and India, primary stakeholder interviews, insights from GOGLA impact metrics and 60 Decibels' sector data, this section outlines:

- Core principles for gender-smart business approaches,
- Practical implementation strategies for gender-smart approaches

As documented through field research and case studies in the section below, women customers often show higher satisfaction levels and are more likely to be first-time users of these technologies, representing a crucial growth segment for the PURE sector. Our analysis shows that successful gender-smart approaches require moving beyond simple product modifications to building comprehensive ecosystems that address women's constraints while leveraging their strengths as customers, entrepreneurs, and agents of change.

GENDER-SMART BUSINESS APPROACHES ALONG THE CUSTOMER JOURNEY

Successful implementation of gender-smart business approaches requires careful attention to each stage of the customer journey.

1. RESEARCH & PRODUCT DEVELOPMENT

Understanding Women's Context

A fundamental principle of gender-smart business approaches is developing a deep understanding of women's unique context in PURE markets. This requires recognizing the complex web of constraints women face, from limited access to technology and resources to restricted decision-making power within households and communities. This understanding must extend beyond constraints to identify specific opportunities for market expansion and impact through women's empowerment. Companies that successfully navigate this landscape can develop targeted interventions that both overcome barriers and leverage women's potential as key drivers of technology adoption and economic growth.

Product Design Considerations

Product design must prioritize women's needs and constraints, focusing on ergonomics, safety, and efficiency suitable for their use. Technologies should be designed to address tasks primarily performed by women while adapting to their physical characteristics and time constraints. This approach recognizes that women have different physical use cases and requirements than men.

Examples in Action

Agsol's MicroMill demonstrates thoughtful design integration through its automated and lightweight characteristics, featuring push-button technology that eliminates demanding maintenance and physical labour requirements. Oorja's solar pumps allow women to operate independently without requiring male assistance for setup and operation - a critical design feature in regions like Uttar Pradesh, India where gender roles are traditionally rigid. Similarly, Khetworks' micro solar pumps are designed to be lightweight and compact, making them portable and easy to use for women farmers working on smaller plots.

2. MARKETING & CUSTOMER ACQUISITION

Women-Centric Marketing Strategies

Effective marketing to women requires tailored approaches that account for their social networks and information access. This includes using female role models in advertising, showcasing specific benefits for women's lives and livelihoods, and utilizing communication channels that are popular among women. Marketing strategies should recognize that women often have different media consumption habits and social networks than men.

Distribution Approaches

Distribution strategies must be designed to overcome women's mobility constraints and create comfortable purchasing experiences. This involves partnering with women's groups and microfinance institutions, creating women-friendly retail spaces, and training female sales agents. These approaches make products more accessible to women and help create a more relatable purchasing experience.

Examples in Action

S4S Technologies works effectively with nonprofits and leverages existing networks to identify and reach potential women entrepreneurs. Oorja uses local networks and partnerships to identify and engage women farmers. CEEW has been successful with hyper-local engagement through district-level technology demonstrations where women attend with family members, creating opportunities for direct experience with the technology while respecting social norms.[149] Wala demonstrates successful inclusive outreach strategies, achieving 56 per cent women farmers and 19 per cent youth participation, while specifically designing distribution approaches to include disabled farmers through portable solar pump solutions.[150]

3. FINANCING & PURCHASE

Flexible Financing Options

Traditional financing often excludes women, making it crucial for PURE businesses to innovate with flexible, accessible financing models. These approaches should account for women's irregular or seasonal income patterns while helping build their credit history and financial literacy. Flexible financing can take various forms, such as PAYGo models, group lending schemes, or partnerships with microfinance institutions.

Examples in Action

Companies have pioneered various approaches to increase accessibility. S4S Technologies facilitates bank loans with five to seven-year tenures at 6 per cent with no down payment requirements.[151] SunCulture has developed "pay as you grow" financial plans tailored to each product.[152] SureChill's Cooling as a Service model requires only a

149 CEEW Interview, 2024

150 Efficiency for Access. 2025 Wala: Cultivating Solar-Powered Irrigation for Smallholder Farmers in Malawi

151 S4S Interview, 2024

152 SunCulture Interview 2024

minimal deposit, resulting in 50 per cent women customers. KoolBoks, with 65-70 per cent women customers and notably better repayment rates than men, has increased accessibility by removing formal business registration requirements during credit assessment. Instead, it evaluates potential customers based on adequate space and their own credit criteria. Wala's innovative "Pay-as-you-Grow" model for irrigation equipment and long-term payment terms through farmer groups, has proven successful, with smallholder farmers demonstrating the ability to make timely repayments under appropriate enabling conditions.[153]

4. IMPLEMENTATION & SUPPORT

Training and Capacity Building

Comprehensive training and support are essential for successful technology adoption. This includes detailed instruction on technology use and maintenance, business skills development, and advisory services on best practices. After-sales support must be adapted to women's schedules, recognizing that many women balance household responsibilities, childcare, and elder care alongside their business activities. This could mean offering flexible support hours outside standard business times, such as early morning, evening, or weekend assistance, and providing multiple channels for accessing help including phone, messaging, and in-person options. These accommodations ensure long-term success by making support services accessible when women can actually use them.

Complementary Services

Support should extend beyond basic training to include market linkages, raw material access where relevant, and installation support. These services create additional touchpoints with customers while building stronger relationships and enhancing the overall impact of technology.

Examples in Action

S4S Technologies initially provided comprehensive support to build women's confidence with the technology, demonstrating that intensive early support is crucial for adoption. Their support package includes raw material access, training, and market linkages to food industry customers. SunCulture offers complete support through site assessments, installation assistance, and thorough equipment training. CEEW's experience shows the importance of having successful women users share their experiences at community events to build trust and acceptance.

5. ONGOING ENGAGEMENT & GROWTH

Women in Leadership Roles

Involving women in sales and technical roles can increase trust, improve communication with female customers, and provide valuable employment opportunities. This approach helps create relatable role models while challenging gender stereotypes about technical professions. Women in these roles can better understand and address the concerns of female customers, leading to more effective communication and higher sales conversion rates.

Measurement and Evaluation

Robust measurement of gender-specific outcomes is crucial for understanding and improving gender-smart approaches. This involves collecting gender-disaggregated data, tracking impacts on time savings, income changes, decision-making power, and monitoring shifts in community perceptions. Systematic collection and analysis of this data enables continuous improvement while demonstrating the value of gender-inclusive approaches.

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153 Efficiency for Access. 2025 Wala: Cultivating Solar-Powered Irrigation for Smallholder Farmers in Malawi

Examples in Action

Several companies demonstrate strong results in women's engagement and impact measurement. S4S Technologies has successfully onboarded 3,000 women entrepreneurs and reached 300,000 women smallholder farmers. SunCulture has achieved over 30 per cent women account holders and data shows that 18 per cent of female customers started new businesses because of their products, with 91 per cent reporting increased income from income-generating activities. Oorja maintains a mandate for 13 per cent women representation in farmer groups. Wala has successfully connected over 40 farmer groups of in total 1,669 farmers (56 per cent women), to off-takers in the soya bean value chain, demonstrating effective ongoing support and market linkage creation. These companies' experiences show that while formal account holders might be male, actual usage and benefits often extend to women in the household.

COMPANY CASE STUDIES: SURECHILL, AGSOL AND OORJA

The following case studies of SureChill, AGSOL, and Oorja demonstrate how detailed customer insights can transform business models to better serve women customers in the PURE sector. Through comprehensive research that included primary data collection and analysis, each company developed nuanced customer personas that capture the diverse needs, challenges, and aspirations of their women customers. These personas, spanning from micro-entrepreneurs to farmers, have enabled the companies to identify critical pain points and opportunities to enhance their product offerings, financing models, and support services. The insights continue to inform strategic decisions and product development across all customer segments. Personas associated with the company case studies are available in Annex 5 below.

SURECHILL CASE STUDY: DELIVERING ACCESS TO RELIABLE COOLING FOR WOMEN ENTREPRENEURS IN KENYA AND NIGERIA

SureChill is revolutionizing access to reliable cooling in regions with unavailable or inconsistent power, particularly benefiting women entrepreneurs in Kenya and Nigeria. Their innovative solar-powered refrigerators, which maintain cool temperatures for up to three days without electricity, are transforming lives and businesses. With 43 per cent of their customers being women, SureChill's Cooling-as-a-Service (CaaS) model is breaking down barriers to affordable refrigeration.

The company's unique approach only requires a small deposit and proof of revenue generation, making it accessible to women who often prioritize family investments over business assets. This model enables women to start or expand micro-enterprises, from selling cold drinks and perishables to preserving fish and dairy products. The impact extends beyond individual businesses, fostering community development and even supporting healthcare initiatives by enabling the storage of temperature-sensitive medicines.

SureChill's technology, which uses water and ice as a natural energy store, not only provides reliable cooling but also operates more efficiently than conventional fridges. This innovation is proving crucial for women entrepreneurs, allowing them to reduce food waste, improve profit margins, and diversify their product offerings. As SureChill continues to expand its reach, it's not just cooling products – it's empowering women and driving local economies. Beyond women entrepreneurs, the impact of SureChill's refrigerators extends to healthcare facilities, allowing remote pharmacies and clinics to store temperature-sensitive medicines.

SureChills women customers – who are they, how do they benefit, what are their challenges and how can SureChill serve them better

SureChill's solar fridges cater to three key female customer personas:

The Survivor (35-50 years old, primary education) started her business out of necessity. She learned about SureChill from local vendors or savings groups, considering how it could help sell cold drinks and reduce spoilage. She opts for CaaS with support from her savings group. The fridge brings a small but noticeable increase in daily income. The fridge reduces her daily stress about food spoilage and provides a stable platform for business growth, allowing her to better support her family's needs.

Key Journey Elements:

- **Awareness:** Hears about SureChill from local vendors or savings groups.
- **Consideration:** Evaluates the impact on her ability to sell cold drinks and reduce food spoilage.
- **Purchase Decision:** Opts for CaaS, seeks support from savings group or family.
- **Usage:** Experiences a small but noticeable increase in daily income.
- **Challenges:** Limited information, decision-making approval, understanding of terms and conditions.

Potential Opportunities for SureChill to Support the Survivor

- **Accessible financing:** Partner with local savings groups to create awareness of how the fridge is accessible with minimal upfront costs.
- **Basic business training:** Provide simple, practical training on inventory management and basic bookkeeping with fridge purchase. Be flexible with training times to account for care responsibilities.
- **Community support:** Organize local user groups for peer support, knowledge sharing, and mutual support.
- **Simple technology education:** Offer in-person demonstrations and pictorial guides for fridge operation and maintenance.
- **Women-centric starter kit:** Bundle the fridge with a curated inventory of high-margin cold products popular among women customers, helping jumpstart their business

The Grower (30-45 years old, secondary education) runs an established shop with consistent growth. Observing other businesses using SureChill fridges, she evaluates their potential for boosting sales and expanding her product range. She invests in a fridge as part of her growth strategy, significantly increasing sales of cold drinks and perishables. The fridge becomes a key asset, substantially boosting overall sales and profitability, enabling her to compete more effectively and consider further business expansion.

Key Journey Elements:

- **Awareness:** Observes other businesses using SureChill fridges.
- **Consideration:** Evaluates potential for increasing sales and expanding product range.
- **Purchase Decision:** Invests as part of business growth strategy.
- **Usage:** Significantly boosts sales of cold drinks and perishables.
- **Challenges:** Needs more storage capacity as business grows, struggles with accessing capital for larger investments.

Potential Opportunities for SureChill to Support the Grower

- **Advanced business development:** Offer workshops on business expansion and employee management, addressing challenges specific to women-led businesses.
- **Gender-aware marketing support:** Provide marketing materials and strategies that resonate with women customers to help promote their expanded product range.
- **Tailored financial products:** Partner with MFIs to offer larger loans for women entrepreneurs, using business growth potential as collateral.
- **Work-life balance tools:** Introduce digital tools for sales and inventory tracking that can be managed remotely, helping balance business and family responsibilities.

The Visionary (25-40 years old, college-educated) manages multiple businesses or has ambitious expansion plans. She actively researches innovative technologies, conducting thorough cost-benefit analyses. She invests in multiple SureChill units, integrating them into her broader business strategy and using them as a competitive advantage across multiple locations. The fridges catalyze rapid business growth, enabling her to expand into new product lines and markets, significantly increasing overall profitability and supporting her ambitious plans for a business empire.

Key Journey Elements:

- **Awareness:** Actively researches innovative technologies and learns about SureChill through business networks or trade shows.
- **Consideration:** Conducts thorough cost-benefit analysis and evaluates potential for scaling across multiple locations.
- **Purchase decision:** Decides to invest in multiple units as part of a strategic business plan.
- **Usage:** Integrates fridges into broader business processes and uses them as a competitive advantage.
- **Challenges:** Needs larger capital at more affordable rates, balancing business growth with family responsibilities.

Potential Opportunities for SureChill to Support the Visionary

- **Women's leadership package:** Offer discounted rates for multiple fridge purchases, coupled with leadership training tailored for women managing multiple business locations or planning to expand across multiple locations.

- **Strategic business consulting:** Provide high-level consulting on integrating refrigeration into broader business strategies addressing the unique challenges of women entrepreneurs.

- **Networking opportunities:** Facilitate connections with other successful women entrepreneurs and potential investors, creating a supportive ecosystem.

- **Family-friendly technology solutions:** Offer advanced features like remote monitoring and analytics, allowing efficient management while balancing family responsibilities.

- **Women empowerment branding:** Develop co-branding opportunities that highlight the success of women entrepreneurs, positioning them as SureChill brand ambassadors and inspiring other women in business.

Conclusion

With a strong focus on reliability and affordability, evidenced by an industry-leading Net Promoter Score of 45, SureChill provides a tool for economic empowerment and improved quality of life for women in developing regions. By tailoring its approach to women at different stages of entrepreneurship - from Survivors to Visionaries - SureChill can deepen its impact. Through accessible financing, targeted business support, and customized product solutions, SureChill can empower women to transform their businesses and lives. These customer-centric strategies can help position SureChill as a true partner in women's economic empowerment, driving customer success and sustainable company growth in the expanding off-grid refrigeration market.

AGSOL CASE STUDY: REVOLUTIONIZING THE MILLING INDUSTRY AND ADDRESSING AFFORDABILITY CONSTRAINTS THROUGH SOLAR MILLS IN EAST AFRICA

Agsol is revolutionizing the milling industry in East Africa with its innovative solar-powered MicroMill, addressing critical issues of environmental impact, gender inequality, and economic inefficiency in rural milling practices. Founded in 2016, this social enterprise is transforming lives and businesses by providing sustainable agricultural and energy solutions for off-grid farming communities. Its flagship product, the Agsol MicroMill, offers a clean, efficient, and cost-effective alternative to traditional diesel-powered mills. Designed for female operators, the MicroMill is user-friendly, lightweight, and capable of processing smaller grain batches, saving time and improving access for smallholder farmers. This innovation is proving crucial for women entrepreneurs, helping them to reduce operational costs, improve profit margins, and diversify their services.

Agsol's customer-centric approach, combined with innovative financing models like "pay-as-you-earn," is breaking down barriers to affordable milling technology. This model enables women to start or expand micro-enterprises without the burden of high upfront costs or collateral requirements. The impact extends beyond individual businesses, fostering community development by improving access to essential food processing services.

As of 2024, Agsol is scaling up production and distribution, with the potential to significantly transform the milling landscape in Sub-Saharan Africa. Their efforts contribute to several sustainable development goals, including gender equality, affordable clean energy, and economic growth in rural areas. By empowering women entrepreneurs and energizing local economies, Agsol is catalyzing positive change in rural communities across East Africa.

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Agsol's women customers – who are they, how do they benefit, what are their challenges and how can Agsol serve them better.

Agsol Customer Personas and Opportunities

The Enthusiast (Female, 32-38 years old, primary education)
The Enthusiast is a married mother of two to three children in rural Kenya. Ambitious and driven, she joined a women's group to access Agsol's solar mill. While quick to adapt to new technology, she struggles to balance growing business responsibilities and household duties. Her primary education limits her business management skills, particularly in financial planning and growth strategies. She struggles with occasional technical issues and lacks capital for expansion. Despite these challenges, she's determined to succeed, navigating traditional gender roles while striving to become a respected businesswoman in her community.

Key Journey Elements:

- **Awareness:** Hears about solar mills from radio advertisements or local markets.
- **Consideration:** Attends demonstrations and calculates potential savings.
- **Purchase Decision:** Secures a SACCO loan and convinces her husband of the investment's worth.
- **Usage:** Adapts quickly and offers milling services to neighbours.
- **Challenges:** Time management, technical issues, and limited business skills.

Opportunities for Agsol and Partners to Support the Enthusiast:

- **Targeted training:** Advanced user workshops for technical and business skills that accommodate women's schedules and responsibilities, including childcare support during sessions.
- **Diversification support:** Guidance on expanding into value-added products.
- **Financial partnerships:** Strengthen SACCO relationships for easier loan access.
- **Family engagement workshops:** Organize sessions that include husbands and family members to promote shared decision-making and support for women's entrepreneurship.
- **Women's business mentorship:** Establish a mentorship program pairing experienced women mill operators with new enthusiasts to provide guidance and support.

The Pragmatist (Female, 40-52 years old, partial primary education)
The Pragmatist is a widowed mother of three or more children in remote rural Kenya. She reluctantly joined a group to purchase Agsol's solar mill out of necessity. Her limited exposure to technology and partial primary education make adapting to the mill challenging. She struggles with group decision-making, lacks confidence in using the new technology, and faces time poverty juggling multiple responsibilities as a single parent. Financial constraints and limited market understanding further complicate her journey. Despite initial hesitation, she gradually engages with the mill, seeing it as a potential path to stability.

Key Journey Elements:

- **Awareness:** Learns from NGO workers or women's group meetings.
- **Consideration:** Participates in group discussions, slowly warms to the idea.
- **Purchase Decision:** Agrees to group purchase, contributes from Rotating Savings and Credit Association(ROSCA) savings.
- **Usage:** Initially defers to others, gradually starts using the mill herself.
- **Challenges:** Limited technical knowledge, group dynamics, and confidence issues.

Opportunities for Agsol and Partners to Support the Pragmatist:

- **Literacy-friendly resources:** Develop visual, audio, and hands-on training materials that don't rely on written text, ensuring accessibility for women with limited formal education.
- **Flexible financing options:** Partner with local savings groups or microfinance institutions to create women-friendly financial products that accommodate irregular incomes and limited collateral.
- **Gradual skill building:** Step-by-step learning program to provide training on efficient mill management techniques that help women balance their business with household responsibilities.
- **Peer support:** Facilitate regular meetings for women mill operators to share experiences, build confidence, and collectively problem-solve.

Conclusion

As Agsol continues to expand its presence in East Africa, they're not just providing milling services – it's fostering a new generation of rural women entrepreneurs. Their solar-powered MicroMill technology, combined with inclusive financing models, and women-centric support programs, demonstrates how technological innovation, when paired with gender-sensitive business models, can drive both rural economic development and women's empowerment in the agricultural sector.

OORJA CASE STUDY: EMPOWERING WOMEN FARMERS WITH SOLAR-POWERED SOLUTIONS IN RURAL INDIA

Oorja is pioneering the concept of "Farming as a Service" at the intersection of sustainable agriculture and clean energy. Oorja is transforming the lives of smallholder farmers with a strong focus on empowering women. Their innovative solar-powered irrigation and milling are revolutionizing farming practices and livelihoods in rural communities, especially in the eastern part of Uttar Pradesh. As a Farming as a Service company, Oorja provides essential agricultural services on a Pay-Per-Use basis, making modern farming techniques more accessible. Their solar-powered solutions are designed to significantly increase crop yields and income for low-income communities, including small and marginal farmers, low-income households, and women farmers when linked to productive activities on their farms.

Oorja's Pay-Per-Use model, requiring only a small membership fee and no capital investment, makes modern farming technologies accessible to smallholder farmers. This approach allows farmers, especially women, to access reliable and affordable irrigation, diversify crops, and increase yields without the burden of equipment ownership. Initially tying registration to land ownership, Oorja quickly recognized this excluded many women. They adjusted their approach, removing the land ownership requirement and mandating that at least two out of every 15 registered members at each project site where solar pumps are installed must be women.

The impact of Oorja's services is significant. By replacing diesel-powered pumps with solar energy, they reduce carbon emissions and ease the physical burden on women farmers who previously relied on male family members to operate heavy equipment. However, Oorja faces challenges in the socially conservative areas where it operates, where entrenched gender norms often limit women's participation in farming. Despite these obstacles, Oorja remains committed to inclusivity, continually adapting its services and outreach to empower women farmers in these communities.

Oorja's women customers – who are they, how do they benefit, what are their challenges and how can Oorja serve them better.

Oorja Detailed Customer Personas and Opportunities

The Aspiring Agri-Entrepreneur (30-45 years old, primary or some secondary education)

The Aspiring Agri-Entrepreneur works on her husband's farm to support household income. She learns about Oorja's solar pumps from the company sales agents, community networks and agricultural input suppliers, considering how it could improve irrigation efficiency, reduce irrigation costs and enable crop diversification and intensification. She discusses the possibility with her husband, who makes the final decision to adopt the Pay-Per-Use model. The solar pump significantly reduces irrigation time and labour, allowing her to explore new farming techniques and business ventures. It brings a noticeable increase in farm productivity and gradually improves household income, boosting her confidence and decision-making role within the family and community.

Key Journey Elements:

- **Awareness:** Learns about Oorja's solar pumps through the company's sales agent or community networks.
- **Consideration:** Discusses with husband and evaluates benefits against current irrigation methods.
- **Purchase decision:** Husband decides to adopt Oorja's services and signs up for the Pay-Per-Use model.
- **Usage:** Begins using the solar pump, irrigates crops more efficiently, explores crop diversification and utilizes time saved for other farm activities.
- **Challenges:** Limited decision-making authority, community scepticism about the expanded role, balancing traditional responsibilities with new opportunities.

Opportunities for Oorja to support the Aspiring Agri-Entrepreneur:

- **Targeted communication:** Develop marketing materials that showcase women in active farming roles to challenge stereotypes.
- **Joint decision-making support:** Provide tools and information that encourage joint husband-wife decision-making in adopting new technologies.
- **Women's networking:** Facilitate connections among women farmers using Oorja's services for peer support and knowledge sharing.
- **Flexible usage models:** Develop options that allow for a gradual increase in usage as the farmer expands her operations.

The Stability-Focused Farmer (45-55 years old, no formal education)
The Stability-Focused Farmer comes from a traditional farming background, focusing on consistency and stability of income. She hears about Oorja's solar pumps from other farmers or village elders but relies on younger family members for detailed information. Her son or relatives decide to adopt Oorja's services, and she agrees with some hesitation. The solar pump reduces her physical labour, ensures more consistent yields, and modestly increases cultivated area. While it does not drastically change her approach, it provides reliability and modest improvements, allowing her to continue farming despite age or physical limitations.

Key Journey Elements:

- **Awareness:** Hears about Oorja's services from other farmers or village elders.
- **Consideration:** Discusses potential benefits with family members, especially adult children.
- **Membership decision:** Son or other family members decide to adopt Oorja's services.
- **Usage:** Uses solar pump for irrigation, focusing on maintaining current crops and experiencing reduced physical labour.
- **Challenges:** Skepticism towards new technology, limited understanding of the Pay-Per-Use model.,

Opportunities for Oorja to support the Stability-Focused Farmer:

- **Women-centric technology education:** Develop women-only, hands-on training sessions with pictorial guides to overcome scepticism and literacy barriers. Focus on practical operation and benefits of the solar pump.
- **Intergenerational engagement:** Create programs that involve older women farmers and their adult children in learning about the technology, bridging the gap between traditional and modern farming methods.
- **Simplified Pay-Per-Use Model explanation:** Develop clear, visual materials explaining the Pay-Per-Use model in simple terms, emphasizing how it aligns with seasonal farming needs and potential cost savings.
- **Peer demonstration network:** Establish a network of successful women users to demonstrate the pump's benefits to potential new users, leveraging the trust in community knowledge sharing.

Conclusion

As Oorja continues to expand its reach, it's not just providing irrigation – it's cultivating a new generation of empowered farmers, particularly women, in rural India. Their solar-powered milling service could further support farmers by providing affordable and accessible post-harvest processing within their communities, opening new market opportunities. By providing accessible, affordable, and sustainable energy services, Oorja is energizing local economies, paving the way for more inclusive and sustainable agricultural practices, and demonstrating the transformative potential of the Farming as a Service model in addressing rural poverty and gender inequality.

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GENDER-DISAGGREGATED KPI FRAMEWORK FOR PURE COMPANIES

Gender-disaggregated KPIs are essential for PURE companies because they reveal critical insights that gender-neutral data obscures. As highlighted in the report, women face unique constraints in accessing and adopting PURE technologies, from limited decision-making power to financial barriers and time poverty. Without gender-disaggregated data, companies may miss significant market opportunities or inadvertently design products and services that fail to meet women's needs.

These KPIs can help companies understand who they are truly serving and, importantly, who they're not reaching. For instance, while 68 per cent of registered energy customers are men, the actual end-users often include women. This distinction matters for product design, marketing strategies, and impact measurement. Gender-disaggregated data also helps companies attract impact capital, with investors increasingly focused on gender-smart investments. Moreover, this data enables companies to develop more effective business models that address women's specific constraints while identifying untapped growth opportunities in the market.

GENDER-DISAGGREGATED KPI FRAMEWORK FOR PURE COMPANIES:

The framework provides a comprehensive structure for measuring and tracking gender-related metrics across six key dimensions:

1. **Customer acquisition and demographics:** Tracks basic customer data and business profiles, helping companies identify their customer base and product engagement. This includes monitoring both registered customers and actual end-users, as these may differ.

Basic Customer Data
- Percentage of registered customers who are women
- Percentage of actual end-users who are women (may differ from registered customers)
- Average age of women customers vs. men customers
- Education level distribution among women vs. men customers
- Household size and composition for women vs. men customers
- Geographic distribution (rural/urban) of women vs. men customers

Business Profile
- Percentage of women vs. men customers who are:
  - Individual entrepreneurs
  - Part of cooperatives/groups
  - Informal vs. formal businesses
  - Average years in business for women vs. men customers
  - Primary sector/value chain participation by gender

2. **Financial performance and access:** Measures both product financing patterns and business performance metrics, revealing how different financing methods impact women and men and tracking the financial impact of PURE technologies on their businesses.

Product Financing
- Percentage of women vs. men using different payment methods:
  - Cash upfront
  - PAYGo/installments
  - Group financing
  - Other financing mechanisms
- Default rates by gender
- Average loan size by gender
- Percentage requiring spousal/family member approval for financing
- Average time to loan approval by gender

Business Performance
- Average monthly revenue generated using PURE technology by gender
- Profit margins by gender
- Return on investment period by gender
- Average increase in income after technology adoption by gender
- Percentage able to reinvest in business expansion by gender

3. **Product usage and impact:** Evaluates technology adoption patterns, economic impact (such as time and money saved), and broader social impacts including changes in household dynamics and community status.

Technology Adoption
- Product utilization rates by gender
- Frequency of use by gender
- Technical support requests by gender
- Training session attendance rates by gender
- Technology confidence scores by gender

Economic Impact
- Hours saved per week using technology by gender
- Additional income generated through technology use by gender
- New business opportunities created by gender
- Job creation (direct/indirect) by gender
- Market access improvement by gender

Social Impact

- Decision-making power changes within the household
- Community status/leadership role changes
- Time spent on unpaid care work before/after technology adoption
- Health and safety improvements
- Quality of life improvement scores

4. **Customer experience and satisfaction:** Assesses product satisfaction and the effectiveness of support services using gender-specific feedback and ratings.

Product Satisfaction

- Net Promoter Score by gender
- Product satisfaction ratings by gender
- Ease of use ratings by gender
- After-sales service satisfaction by gender
- Price satisfaction ratings by gender

Support Services

- Training satisfaction rates by gender
- Technical support accessibility ratings by gender
- Business advisory service utilization rates by gender
- Complaint resolution rates by gender
- Preferred communication channel effectiveness by gender

5. **Business operations and inclusion:** Examines internal gender metrics within the company itself and evaluates the effectiveness of market outreach strategies by gender.

Internal Gender Metrics

- Percentage of women in:
  - Sales force
  - Technical support roles
  - Management positions
  - Distribution network
- Gender pay gap across roles
- Retention rates by gender

Market Outreach

- Marketing campaign effectiveness by gender
- Channel preference and effectiveness by gender
- Community engagement participation rates by gender
- Referral rates by gender
- Brand awareness levels by gender

6. **Value Chain Integration:** Measures the broader impact on women-owned businesses in the supply chain and improvements in market access and linkages.

Supply Chain Impact

- Number of women-owned businesses in supply chain
- Volume of business with women-owned suppliers
- Payment terms compliance for women-owned businesses
- Technical support provided to women-owned suppliers
- Growth in women-owned supplier businesses

Market Linkages

- Access to new markets facilitated by gender
- Business partnership formation rates by gender
- Value chain position improvements by gender
- Market information access improvements by gender
- Price negotiation power improvements by gender

Note: Companies should select and adapt KPIs based on their specific context, business model, and capacity. Not all metrics will be relevant or feasible for every organization.

It's important to note that the KPIs presented in this framework are not based on existing data collection practices but rather represent a forward-looking proposal for metrics that PURE companies should consider tracking. These suggested indicators have been carefully selected to align with key principles of gender-responsive business models, creating a dual benefit: advancing women's economic empowerment while strengthening business performance. While some companies may already track certain metrics, many of these KPIs represent new areas of measurement that can help companies better understand and capture gender-specific opportunities and challenges.

This aspirational framework serves as a roadmap for companies seeking to enhance their gender-responsive practices. The indicators are designed to help businesses move beyond basic gender statistics toward a more comprehensive understanding of how their products, services, and operations impact and serve women. By adopting these metrics, companies can better identify market opportunities, improve product design, strengthen customer service, and ultimately create more inclusive and successful business models.

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POLICY AND INCENTIVES FRAMEWORK

CURRENT POLICY LANDSCAPE AND GAPS IN EXISTING POLICIES AND INCENTIVES

The PURE sector currently faces significant challenges in reaching and serving women effectively and the current policy landscape around PURE technologies reveals significant gaps in addressing gender-specific needs and barriers.[154] Despite women comprising a large share of the workforce in sectors such as agriculture and retail in emerging economies, existing policies often take a gender-neutral approach that fails to address the unique constraints women face in accessing and adopting PURE technologies.

Limited recognition of gender-specific barriers: Current policy frameworks fail to fully address the complex barriers women face in PURE technology access and adoption. Research shows that women experience restricted access to land ownership and collateral, severe time poverty due to household responsibilities, and limited mobility and decision-making power within households. For instance, in agricultural settings, while women may be the primary users of technologies, land is often registered in their husband's name, creating barriers to accessing financing. The situation is particularly challenging in India, where 61 per cent of women-owned micro-enterprises remain unregistered,[155] significantly limiting their access to formal financial services and support mechanisms.

Digital exclusion presents another critical barrier, with women having lower access to mobile phones and digital financial services compared to men. This digital gender gap limits their ability to participate in modern payment systems and access information about PURE technologies. As highlighted in the report's findings from 60 Decibels, while 73 per cent of women purchased energy products on credit, their access to digital financial services remains constrained.

Women face multiple intersecting constraints that are often overlooked in policy design. Interviews with PURE companies and experts highlight that these barriers are particularly acute in rural areas where traditional gender norms and limited infrastructure compound challenges.

Insufficient support for women-owned PURE businesses: Current policy frameworks provide insufficient support for women-owned PURE businesses, failing to address their unique operational challenges. Women entrepreneurs face greater barriers to accessing formal credit, with prohibitively high interest rates. Research highlights that even when women have bank accounts (93 per cent in some studies), more than half rely primarily on cash transactions for their business operations. This reflects a broader pattern where women's businesses often remain informal, operating outside the formal financial system.

Traditional business support programs rarely account for the fact that women often need family approval for business investments or that they tend to adopt more risk-averse business strategies (as outlined in previous sections)

154 GOGLA (2023). Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE). Handbook for Governments and Development Partners.

155 Microsave Consulting, 2024 Decoding the financial health of women-owned microbusinesses

156 Ibid.

due to family responsibilities. Current business support systems fail to address the unique challenges faced by women entrepreneurs in the PURE sector.

Data and integration gaps: A critical weakness in current policy frameworks is the lack of reliable gender-disaggregated data on PURE technology adoption and usage.[156] This data gap hinders efforts to evaluate which financing programs, products, or models best serve women customers. The report notes that even basic portfolio data is often limited, making it challenging to analyse gender gaps and evaluate program effectiveness.

The integration of PURE initiatives with broader gender equality programs remains inadequate. There is limited coordination between energy-focused policies and gender empowerment initiatives, resulting in missed opportunities for leveraging existing women's programs and networks. This disconnect is particularly evident in agricultural extension services, where PURE technologies could be integrated more effectively with existing women-focused agricultural programs. The sector's lack of gender-disaggregated data makes it difficult to design effective interventions.

RECOMMENDATIONS FOR GENDER-INCLUSIVE PURE POLICIES

Addressing affordability through cooperative models: Supporting women's cooperatives represents a crucial strategy for increasing access to PURE technologies among women in rural areas. Research shows collective approaches can help overcome key barriers individual women face, from limited financial resources to restricted decision-making power. S4S Technologies' successful work with women's collectives to establish processing centres demonstrates how cooperative models can create sustainable business opportunities while ensuring technology adoption.

To enable these cooperative approaches, policymakers should develop regulatory frameworks that facilitate the formation and operation of women's cooperatives in the PURE sector. This includes providing legal recognition for collective ownership models and streamlining registration processes. Creating special legal status for women's energy cooperatives, along with clear governance guidelines, can help address sector-specific challenges while ensuring sustainable operations.

The success of collective purchasing relies on appropriate incentive structures. One example would be governments supported bulk purchase subsidies for women's groups, complemented by tax benefits for cooperative ownership and support for shared service centres. Drawing from successful programs in India, these measures can include matching grants, bulk pricing agreements with suppliers, and cooperative-specific financing products to reduce per-unit costs and improve accessibility.

Group mechanisms, such as VSLAs and revolving funds specifically for PURE investments, provide crucial support for cooperative approaches. Collective collateral mechanisms and group liability models can help overcome traditional barriers to credit access, while savings-linked programs and community-managed maintenance funds enhance sustainability. SureChill's Cooling-as-a-Service model demonstrates how shared access can reduce individual financial burdens while making essential technologies available to more users.

For maximum impact, these cooperative support mechanisms should be integrated into broader gender-inclusive PURE policies, ensuring coordination between financial institutions, technology providers, and government agencies. Regular monitoring and adaptation of support mechanisms can help ensure long-term sustainability while maximizing benefits for women participants.

Subsidies and financial incentives: Innovative financing approaches have proven crucial for increasing women's access to PURE technologies. The report highlights several successful models, such as Simusolar's pay-as-you-grow system and Sure Chill's low-deposit rental program, which demonstrate how alternative financing structures can significantly improve accessibility. These examples show that carefully designed financial incentives can help overcome the substantial barriers women face in accessing and adopting PURE technologies.

Targeted support for women-owned businesses forms the foundation of an effective financial incentive system. This should begin with capital subsidies specifically designed for women entrepreneurs adopting PURE technologies, complemented by preferential lending terms that acknowledge women's unique financial constraints. The creation of guarantee funds can help address the persistent challenge of collateral requirements, which often exclude women from traditional financing. Dedicated credit lines for women entrepreneurs, combined with appropriate working capital support and grace periods aligned with agricultural seasons, can provide the comprehensive financial support needed for sustainable business development.

RBF represents another powerful tool for promoting gender inclusion in the PURE sector. Critically, these mechanisms must recognize and address the fundamental economic disparities that impact women's participation, with income differences between women and men needing to be a central focus in affordability constraints and pricing and access to credit models by PURE companies. RBF mechanisms should be explicitly tied to women's participation targets, with specific incentives for reaching women in underserved areas. Companies achieving

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meaningful gender equality outcomes should receive additional rewards, encouraging broader adoption of inclusive practices. These mechanisms can be strengthened through milestone-based disbursement systems and robust verification processes for gender outcomes. The financial design must explicitly account for systemic income inequalities that create barriers to women's access to PURE services, ensuring that pricing models and credit assessments do not perpetuate existing economic disparities. Additional incentives for innovative approaches can help drive continued evolution and improvement in gender-inclusive business models.

Tax and policy incentives complete the financial support framework. Companies demonstrating strong gender inclusion practices should receive tax benefits, while women-focused PURE initiatives can benefit from import duty exemptions. Preferential procurement policies can help create reliable market opportunities for women-owned businesses, while accelerated depreciation allowances can improve their financial sustainability. The establishment of special economic zones for women entrepreneurs, combined with preferential land allocation policies, can create supportive ecosystems for women-led PURE businesses to thrive.

Support for gender-smart business models: The development of gender-smart business models requires a comprehensive support framework that combines regulatory guidance, capacity building, and innovation support. Companies like Oorja and S4S Technologies demonstrate how gender-smart approaches can succeed by effectively integrating women throughout their value chains and adapting their business models to address women's specific constraints and opportunities.

Establishing effective regulatory frameworks forms the foundation for gender-smart business development. Guidelines for gender-inclusive business practices should be clearly defined and standardized across the PURE sector, providing companies with concrete benchmarks for gender integration. Certification systems for gender-smart businesses can create market recognition and incentives for companies that excel in gender inclusion, while robust monitoring mechanisms ensure accountability and track progress toward gender outcomes. These frameworks must be flexible enough to accommodate different business models while maintaining clear gender-inclusive standards.

Capacity building represents a crucial investment in developing gender-smart businesses. Technical assistance programs should help PURE companies understand and implement effective gender integration strategies throughout their operations. Support for gender-sensitive product design ensures that technologies meet women's specific needs and preferences, as demonstrated by Agsol's efforts to make their milling machines more accessible to women users. Training in women-centric marketing and distribution helps companies effectively reach and serve female customers, drawing on successful examples like S4S Technologies' work with women processors.

Innovation support drives continuous improvement in gender-smart approaches. Dedicated funds for gender-focused PURE innovations can stimulate new solutions to persistent challenges, while support for pilot projects allows companies to test and refine new approaches. Research funding focused on understanding women's needs and preferences helps ensure that innovations address real market demands. This combination of financial and technical support for innovation helps the PURE sector evolve to better serve women customers while creating new opportunities for women entrepreneurs.

Awareness building and behaviour change campaigns: Behaviour change, and awareness building represent critical elements for increasing women's adoption of PURE technologies. The report highlights successful examples like CEEW's innovative work with women demo champions and Dharma Life's extensive network of rural entrepreneurs, demonstrating how targeted awareness initiatives can effectively drive technology adoption among women. These programs show that when women see peers successfully using and benefiting from PURE technologies, they are more likely to adopt them.

Comprehensive public education campaigns must clearly communicate the benefits of PURE technologies specifically for women, supported by demonstration projects that showcase concrete success stories from their communities. These efforts should be reinforced by information materials developed in local languages to ensure accessibility and relevance. Mobile demonstration units can bring technology awareness directly to rural communities, while women-focused help desks provide ongoing support and information. Peer learning networks can create sustainable knowledge-share channels and mutual support among women users.

Agricultural extension services offer a crucial pathway for integrating PURE technology awareness into existing rural support systems. Extension workers should receive specialized training in gender-sensitive PURE technology promotion, to communicate effectively with women farmers and entrepreneurs. PURE technologies should be systematically incorporated into agricultural support programs, with women-focused demonstration farms providing practical examples of successful implementation. Women-specific training modules can address unique challenges and opportunities, while mentor farmer programs create role models within communities. Technology assessment tools can help extension workers and women farmers evaluate which PURE solutions best fit their needs.

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CONCLUSION

The research findings demonstrate the significant potential and persistent challenges of building gender-inclusive businesses to meet women's energy needs in the PURE sector. Women play crucial roles across agricultural and enterprise value chains yet face disproportionate barriers in accessing and benefiting from PURE technologies. These barriers span gender norms, limited access to finance, lack of product adaptation to women's needs, and insufficient awareness and technical knowledge.

The case studies from India, Kenya, and Uganda highlight that successful implementation of gender-inclusive PURE initiatives requires careful attention to the local context and strong stakeholder coordination. While the research begins by understanding women's current roles shaped by sectoral segregation and gender norms, the ultimate goal is to expand opportunities beyond these traditional constraints. What works in one context may need significant modification in another, particularly when addressing deeply rooted gender norms and cultural practices. Programs must be designed with active participation from women in target communities, ensuring interventions align with their needs, capabilities, and aspirations for advancement into new roles and sectors.

When PURE technologies are thoughtfully designed and delivered with women's constraints in mind, they can generate substantial positive impacts - from increased productive time and income generation to improved health outcomes and enhanced decision-making power. Companies like Agsol, SureChill, and Oorja demonstrate that gender-smart business approaches - including flexible financing, women-centric product design, and complementary support services - can successfully reach and serve women customers while building viable businesses.

Effective coordination between PURE companies, financial institutions, government agencies, and community organizations emerges as critical for success. These stakeholders must work together cohesively, sharing knowledge and learning from each other's experiences, underpinned by robust monitoring systems that track progress and enable continuous improvement based on user feedback.

The path forward requires moving beyond gender-neutral approaches to recognize women as a distinct customer segment with specific needs, preferences and barriers. Programs need frameworks that can adapt to changing circumstances while maintaining clear accountability for gender outcomes. By adopting the recommendations outlined in this report for gender-responsive business models and enabling policies, stakeholders can help unlock the transformative potential of PURE technologies to enhance women's productivity, income and overall well-being while growing sustainable businesses that serve this underserved market. Success ultimately depends on building local capacity and ensuring initiatives can continue beyond initial funding periods through long-term sustainability planning.

ANNEX 1: GLOSSARY

2X Challenge: Launched at the 2018 G7 Summit as a commitment by the Development Finance Institutions (DFIs) to collectively mobilize US$ 3 billion (now at investments totalling US$ 16.3 billion) in private sector investments in developing country markets over three years. The initiative was developed to help 2X Challenge members identify which transactions could be reported towards the shared target in investments that benefit women.

Agricultural Value Chain: The series of activities involved in producing, processing, and selling agricultural goods. Energy technologies like solar-powered irrigation, milling, and refrigeration help women farmers move beyond subsistence farming by improving efficiency and market access.

Cooling-as-a-Service (CaaS): A business model where customers pay for refrigeration or cooling as a service rather than purchasing equipment outright. This model helps reduce high upfront costs and allows small businesses, including women entrepreneurs, to access reliable cooling solutions.

Distributed Renewable Energy Solutions (DREs): DRE is a collection of assets that generate, supply, store, and manage energy locally, using renewable resources like solar, wind, hydro, or biomass. DRE systems can be stand-alone, off-grid, or mini-grid systems, and can be used to provide energy for varied purposes, including lighting, cooking, heating, and cooling.

Energy Ladder: The progression households and businesses make from using low-quality energy sources, such as biomass and kerosene, to cleaner and more efficient options like solar or electric-powered systems. The transition improves productivity, health, and economic opportunities.

Gender-Inclusive: An approach that addresses the preferences, needs, and constraints of women and men. Also referred to as gender-smart or gender-responsive.

Gender-Disaggregated Data: Data that is collected and analyzed separately for men and women to identify differences in access, usage, and impact of technologies or services. This helps companies and policymakers design targeted interventions that better serve women's needs.

Renewable Energy (RE) Products: In this report, RE Products refer to technologies for enterprises and individual consumers that rely on renewable energy sources. Examples include off-grid solar products, solar-powered irrigation pumps, improved cookstoves, and bio-digesters.

Women-Owned Enterprise: Using the International Finance Corporation (IFC) definition, an enterprise qualifies as a woman-owned enterprise if it meets the following criteria:

(a) ≥ 51 per cent owned by woman/women; or

(b) ≥ 20 per cent owned by woman/women; AND

- Has ≥ one woman as CEO/COO/President/Vice President.
- Has ≥ 30 per cent of the board of directors composed of women, where a board exists.

Micro, Small, and Medium Enterprises: Enterprises can be differentiated according to size, based on three criteria: number of employees, total assets, and annual sales. Using the IFC criteria:

- **Micro-enterprises:** Fewer than 10 employees, total assets of less than US$ 100,000, and annual sales of less than US$ 100,000.
- **Small enterprises:** 10 to 49 employees, total assets up to US$ 3 million, and annual sales up to US$ 3 million.
- **Medium-sized enterprises:** 50 to 300 employees, US$ 3 million to US$ 15 million in total assets, and up to US$ 15 million in annual sales.

Last-Mile Distribution Renewable Energy Sector: The final stage of goods or services distribution to end-user consumers in the RE sector.

Off-Grid Solar (OGS): An electricity supply not connected to a central grid system. OGS solutions include mini-grid systems and stand-alone technologies, classified as:

- Pico (compact, lightweight solar photovoltaic panels to generate just a few watts of power in a wide range of small and portable applications),
- Solar home systems.
- Appliances.[157]

157 World Bank and GOGLA. (2020). The 2020 Global Off-Grid Solar Market Trends Report.

PAYGo: Pay-As-You-Go solar businesses provide household-scale solar energy with a payment scheme tailored to the budgets of bottom-of-the-pyramid customers. Historically focused on financing solar home systems, the PAYGo financing industry is now expanding rapidly into providing credit for smartphones and even experimenting with cash loans.

Results-Based Financing (RBF): A funding model in which financial support is tied to achieving measurable outcomes, such as increased adoption of renewable energy technologies by women.

Productive Use of Renewable Energy (PURE): Off-grid solar appliances and products are energy-efficient and powered often by direct current (DC), including household and small business appliances and productive use of renewable energy (PURE) appliances. Due to the growing market interest among weak-grid geographies, off-grid appliances, products, and services capable of operating under alternate current (AC) are also included in this report.

Time Poverty: A situation where individuals, particularly women, have limited time for income-generating or personal development activities due to heavy unpaid responsibilities, such as household work, childcare, and food preparation.

Village Savings and Loan Associations (VSLAs): Community-led financial groups that provide members, particularly women, with access to savings, small loans, and credit. VSLAs help women invest in business activities and PURE technologies without requiring formal banking services.

Weak-Grid Areas: Areas where electricity from the national grid is unreliable, inconsistent, or available for only a few hours per day. These areas often require hybrid energy solutions, including off-grid or backup renewable power.

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ANNEX 2: PURE TECHNOLOGY MARKET STATUS

PURE COMMERCIAL MARKET TECHNOLOGIES:

Off-Grid Solar Kits/Appliances: Off-grid solar kits are currently the most established and widely commercialized option in the off-grid solar market. These kits are often paired with efficient DC appliances such as televisions, radios, fans, and hair clippers. In 2022, GOGLA-affiliated companies sold over 590,000 televisions to households and micro, small and medium Enterprises (MSMEs) in Sub-Saharan Africa, while in South Asia, fan sales reached nearly 830,000.[158] Evidence shows that using off-grid solar energy kits in businesses like hair salons, restaurants, and retail shops can increase monthly income by an average of US$52.[159] However, despite the vast potential of solar energy kits and DC appliances to support MSMEs, high costs remain a barrier, especially for consumers predominantly living below the poverty line.

Clean Cooking: Globally, around 2.6 billion people lack access to clean cooking solutions.[160] To achieve universal access to clean cooking by 2030, a significant acceleration in adoption is needed.[161] Biomass cookstoves currently hold the largest revenue share in the clean cooking industry, and between 2019 and 2020, this was the only subsector to see an increase in aggregated revenue.[162] Most revenue from clean cooking solutions comes from companies serving both rural and urban areas.[163] An increasing number of companies are tapping into carbon markets, and this trend is expected to grow with new digitized verification methods that can track real-time consumer behaviour.[164] Many companies are diversifying their product lines across different fuel types, seeing this as a critical growth strategy.[165] However, access to consumer financing for clean cooking remains limited.[166]

PURE NEAR-TO-MARKET TECHNOLOGIES:

Solar water pumps (SWPs): Currently, 42 different VeraSol quality-tested SWPs are available for smallholder farmers, typically ranging up to 1 kW and suitable for land areas of 0.5 to 5 acres.[167] These pumps are distributed by various companies, including local retailers affiliated with leading manufacturers like Lorentz and Grundfos, as well as providers of PAYGo financing, such as SunCulture and Simusolar.

Solar Refrigeration Units (SRUs): SRUs are essential for extending the shelf life of perishable goods, enhancing their value, and reducing food waste. In Uganda, it is estimated that 20-40 per cent of milk is wasted due to inadequate cooling options.[168] Typically designed for income generation, the SRU units (usually below 540L) are

158 GOGLA (2023). Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data.

159 GOGLA. (2019). Powering Opportunity in East Africa: Proving Off-Grid Solar is a Power Tool for Change. And Lighting Global Africa (2022). The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Uganda.

160 World Health Organization (2024). Household air pollution.

161 United Nations. (2019). Sustainable Development Goal 7.

162 Clean Cooking Alliance (2022). 2022 Clean Cooking Industry.

163 International Energy Agency. (2020). Energy Access Outlook.

164 Clean Cooking Alliance. (2022). Clean Cooking Industry Snapshot.

165 World Bank. (2020). The State of Access to Modern Energy Cooking Services

166 Ibid.

167 VeraSol. (2021). Quality Assurance for Solar Water Pumps. and GOGLA. (2023). Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE). Handbook for Governments & Development Partners.

168 FAO. (2021). Reducing Food Loss and Waste in Uganda. and Uganda Off-Grid Energy Market Accelerator (UOMA). (2019). Productive use of off-grid energy The business case in Uganda's dairy value chain.

used for chilling beverages and food in retail settings or cooling milk for small agricultural producers. Off-grid solar vaccine storage also falls under this category, with the total addressable market for off-grid solar vaccine refrigeration in India estimated at around USD 811 million in rural areas with weak or no grid access.[169]

Evidence indicates that the economics of SWPs and SRUs in agricultural markets are highly favourable, with payback periods ranging from 1 to 6 years.[170] Together, they represent a US$14 billion addressable market for cold storage and SWPs across sub-Saharan Africa and India, potentially improving the livelihoods of over 22 million smallholder farmers in these regions.[171]

PURE EMERGING TECHNOLOGIES:

Solar Milling: Small-scale solar milling presents an efficient alternative to the prevalent diesel-powered grain milling in sub-Saharan Africa and South Asia.[172] The projected serviceable market for solar milling in SSA is estimated to reach US$417 million by 2030, provided that further cost reductions and efficiencies are achieved.[173] However, demonstrating the value addition of these technologies – such as reducing operational costs or enabling engagement in broader agricultural value chains like flour production – remains essential.

In SSA, only a handful of companies, such as Agsol (Kenya) and Nadji.Bi (Senegal), are testing prototypes and business models for these emerging technologies.[174] Conversely, in South Asia - particularly India - local manufacturing of solar-powered small-scale milling technologies has reduced entry prices, facilitating adoption in rural areas. As a result, solar milling in India is considered "near-to-market."[175]

Solar Drying: Solar-powered dryers and electronic thermostat drying chambers hold the potential to replace traditional drying methods (e.g., for cocoa, coffee, or fish[176]) in productive regions of SSA, Latin America, and South Asia. However, these products are still in the developmental phase.[177]

Egg Incubators: Although still a niche technology, the commercialization of solar-powered egg incubators is expanding across East and Southern Africa. These direct current (DC) egg incubators can operate fully automatically, providing mechanized egg turning and temperature control for 24 hours a day and are closely linked to women's existing activities in agricultural value chains.

Solar Sewing Machines: Solar-powered sewing machines are designed for use in remote areas, benefiting rural communities and micro-entrepreneurs, particularly women. For example, a project by Ashoka in Cameroon provides solar-powered sewing machines and seamstress training to socially disadvantaged women. Notable examples include:

- Powtech, which offers a solar sewing machine that can also provide mobile charging, cooling, and illumination.
- Resham Sutra, which uses 90 per cent less power than standard machines.
- SolarWorks, which supplies solar power systems for sewing machines and other appliances.
- Selco Foundation, which enhances existing machines by attaching a permanent magnet DC motor, improving efficiency by 25 per cent.

169 Solar Energy Corporation of India. (2020). Market Potential for Solar Refrigeration.
170 Lighting Global Africa (2022). The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Uganda.
171 Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors (2022), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC
172 GOGLA (2023). Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE). Handbook for Governments and Development Partners.
173 Lighting Africa. (2019). The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Sub-Saharan Africa.
174 Agsol. (2021). Innovative Solar Milling Solutions.
175 GOGLA (2023). Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE). Handbook for Governments and Development Partners.
176 See for examples Millennium Engineers in Tanzania
177 Ibid.

ANNEX 3: MAPPING OF THE PURE ECOSYSTEM WITH A GENDER LENS

Sector/Value chain	Women's roles	Relevant PURE technology	Barriers to adoption	Opportunities for impact	Business models and companies	Policies / Incentives to scale	Priority setting
Horticulture/ Crop production	Women's responsibilities typically include the watering of plants using traditional/ low-tech methods which are often time-consuming, on average women spend 7 hours a week collecting water for irrigation purposes. Irrigation is usually done by collecting water in buckets or watering cans from boreholes[179]	Solar pumping; Solar irrigation.	• Initial high investment costs. • Technical knowledge and skills required for installation and maintenance. • Limited access to financing options for purchasing solar.	• Increased access to water for irrigation, reducing reliance on manual watering methods. • Time and labour savings, allowing women to allocate more time to other productive activities. • Improved crop yields and income generation opportunities	Installments: Sun Culture Simusolar Community Based CInI • B2B and B2C Aptech Africa ; For-profit social enterprise • Khetworks	Collective models such as Self Help Group's (SHGs) can pool resources to increase affordability.	A growing number of companies. Awareness and demand is also on the rise.
Dairy (Milk production, processing, and distribution)	Women's responsibilities include milking cows and delivering the milk to the cooperative collection centres. Lack of access to cold storage means women have to either sell at lower prices or lose some milk to spoilage.	Milk chillers/ Cold storage	• High upfront costs for purchasing and installing milk chillers and cold storage facilities. • Limited access to reliable electricity in rural areas for powering the equipment. • Maintenance and repair challenges, particularly in remote locations.	• Preservation of milk quality and reduction of spoilage, leading to higher incomes from dairy products. • Extended shelf life of perishable dairy products, enabling access to distant markets. • Time flexibility in milk collection and processing.	Instalments/ Koolboks Baridi Devidaya Solar Solutions Surechill	Working through dairy cooperatives could increase affordability.	Relatively few providers. Mostly tested through agri-value chain development projects.

178 Note that this list of companies is illustrative and not exhaustive

179 CLASP.

Sector/Value chain	Women's roles	Relevant PURE technology	Barriers to adoption	Opportunities for impact	Business models and companies	Policies / Incentives to scale	Priority setting
Small-Scale Agri-Processing Enterprise (fruits, vegetables, seeds, nuts and herbs)	Women are primarily responsible for the post-harvest processing of agricultural produce including drying and value-added processing (oil extraction, preserves etc.), Much of this is currently done manually or is not mechanized sufficiently	Solar drying / dehydration Cold storage	• Lack of awareness about solar drying technologies and their benefits. • Initial investment costs for solar drying equipment.	• Value addition to agricultural produce, leading to higher prices and increased income. • Reduction of post-harvest losses and extended shelf life of dried products. • Flexibility in processing various crops throughout the year.	Dehytech – Service provider; Grekkon Oorja Koolboks SureChill	• Working through more affordable cooperatives. • Tax exemptions on solar products could motivate sector participation. • Embedded supply chain financing.	Rapid increase in companies going into solar drying. Increase in gender mainstreaming projects in supply chains.
		Solar mills and crushers	• Initial investment costs for solar milling and crushing equipment. • Technical knowledge and maintenance requirements. • Limited access to financing options for purchasing solar mills. • Cultural dynamics around gendered roles in the enterprise	• Improved grain processing efficiency, reducing manual labour and time. It takes 30 minutes to grind a kilogram of flour by hand, while a machine could do the same work in a minute – reducing time spent by almost 97%. • Increased production capacity and quality of processed grains. • Expansion of income-generating opportunities through milling services.	B2C and B2B - AGSOL B2B - Productive Solar Solutions	• Partnerships with financial institutions to offer affordable loans or leasing options for acquiring solar equipment. • Establishing community-based milling cooperatives to collectively invest in solar-powered milling. • Training programs and workshops to build women's technical capacity in operating solar-powered mills and crushers	Relatively few providers. Mostly tested through agri-value chain development projects which have not achieved much scale.

Sector/Value chain	Women's roles	Relevant PURE technology	Barriers to adoption	Opportunities for impact	Business models and companies	Policies / Incentives to scale	Priority setting
Retail (Food production in informal sector)	Within households and home-based food production enterprises women are responsible for the majority of the cooking and collecting of firewood. In sub-Saharan Africa, Women spend an average of 2.1 hours a day collecting firewood and in biomass-dependent communities, they spend up to 4 hours a day cooking.	Efficient electric/clean cooking	• High upfront costs for purchasing efficient cooking stoves or electric cooking appliances. • Lack of awareness about the benefits of efficient cooking technologies and resistance to changing traditional cooking practices. • Limited availability and affordability of clean cooking fuels and appliances in rural markets.	• Reduces the time spent collecting firewood and cooking, allowing women to allocate time to other productive activities or rest. • Minimizes indoor air pollution and respiratory illnesses associated with traditional cooking methods. • Enables women to pursue income-generating activities instead of spending time on fuelwood collection and cooking.	Biolite Bright Life Burn ATEC Greenway	• Subsidies or rebates to make efficient cooking stoves and electric appliances more affordable for women. • Behavioural change, and communication campaigns to raise awareness about the health, economic, and environmental benefits of efficient cooking technologies. • Public-private partnerships to improve the distribution and affordability of clean cooking fuels and appliances in rural markets.	Increasing the number of companies. Cookstove market is being stimulated through development programs.

Sector/Value chain	Women's roles	Relevant PURE technology	Barriers to adoption	Opportunities for impact	Business models and companies	Policies / Incentives to scale	Priority setting
Retail (Microenterprises-services)	Given women's household care responsibilities, they often prefer enterprises that can be run from the home and require relatively limited start-up capital. With access to lighting and charging systems, women can sign up as mobile money agents or set up a small-scale retail store.	Lighting and phone charging systems (SHS).	• High upfront investment costs for purchasing solar lighting and phone charging systems, especially for solopreneurs or informal home-based entrepreneurs. • Challenges in accessing affordable financing options for purchasing solar energy products. • Limited understanding of the benefits of solar lighting systems and phone charging stations. • In some markets there is limited availability of solar lighting and phone charging systems in rural markets.	• Provides lighting for women to safely complete household chores and activities during the evening. • Enables women to engage in income-generating activities (mobile money agents) or educational pursuits after dark. • Allows women to charge mobile phones for communication and access to markets and information. • Reduces health risks due to indoor air pollution.	SolarAid in Zambia and Malawi (cash up front or installments if you are an agent); RDG in Zambia, PayGo model with agent network; Engie, d.light, BrightLife	• Strengthening distribution networks to improve the availability and accessibility of solar energy products in rural areas. • Subsidies or financing schemes to make solar lighting and phone charging systems more affordable for women. • Public awareness campaigns to educate women about the benefits of solar energy products. • Financing and skill-building packages for women agents.	Increasing interest in women as agents for financial services and other value chains

Sector/Value chain	Women's roles	Relevant PURE technology	Barriers to adoption	Opportunities for impact	Business models and companies	Policies / Incentives to scale	Priority setting
Retail/ Manufacturing	Given women's household care responsibilities they often prefer enterprises that can be run from the home and require relatively limited start-up capital. With access to a sewing machines within the household, women are able to engage in piece work sewing, and handicrafts for garment manufacturers.	Sewing machines	• High upfront investment costs for purchasing sewing machines, which may be prohibitive for some women entrepreneurs. • Limited sewing and tailoring skills among women, particularly in rural areas. • Challenges in accessing markets for selling sewn products, especially for women starting small businesses. • Limited availability of maintenance and repair services for sewing machines in rural areas.	• Enables women to start or expand sewing businesses, offering tailoring services or producing garments for sale. • Provides opportunities for women to develop sewing and tailoring skills, enhancing their employability. • Allows women to diversify their income sources and increase resilience to economic shocks.	Solar Sister in Rwanda, Uganda, South Sudan, door to door sales; Kick Start International, door to door sales SELCO Foundation	• Subsidies or financing models to make sewing machines more affordable for women entrepreneurs. • Market linkage initiatives to connect women entrepreneurs with buyers and market opportunities. • Establishing community-based sewing cooperatives to share resources and provide collective support for women in the sewing business.	Growing number of companies. Awareness and demand is also on the rise.

Sector/Value chain	Women's roles	Relevant PURE technology	Barriers to adoption	Opportunities for impact	Business models and companies	Policies / Incentives to scale	Priority setting
Poultry	Women play vital roles in poultry production, handling tasks from egg collection to marketing. They manage small-scale operations, providing income for families and ensuring food security.	Egg incubator	• High upfront investment costs for purchasing egg incubators may be prohibitive for small-scale women poultry farmers. • Limited understanding of egg incubation techniques and equipment operation. • Access to Quality Inputs: Challenges in accessing quality fertilized eggs or chicks for incubation.		Ovo Solar egg incubator in Kenya, PayGo	Working through dairy cooperatives could increase affordability.	Relatively few providers. Mostly tested through agri-value chain development projects

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