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CLEANSTART

MICROFINANCE OPPORTUNITIES FOR A CLEAN ENERGY FUTURE

Note to the Reader

The purpose of this publication is to provide a methodological guide to expanding access to clean energy for poor people and micro-entrepreneurs through microfinance and strengthened energy value chains. This guide is intended to support consultation processes that the UN Capital Development Fund (UNCDF) and the United Nations Development Programme (UNDP)/Global Environment Facility (GEF) are undertaking in CleanStart countries. It may also serve as a useful tool for broader consultations by others seeking to advance the Rio+20 commitments on energy.

This publication is part of the CleanStart agenda to improve understanding and awareness of the potential of microfinance to stimulate the adoption of sustainable clean energy while drawing attention to the knowledge and skills needed to add clean energy financing to lending portfolios. More detailed and targeted research and technical papers related to this subject will follow as CleanStart refines its approach — based on the first phase of implementation and documentation of its initial experiences.

This publication will be particularly useful for microfinance institutions aiming to broaden their range of financial products and move into the clean energy sector; energy companies seeking to expand their market to the base of the pyramid; and national governments seeking practical means to advance their sustainable development agenda and meet their commitments made at Rio+20.

This guide is divided into three parts. Section I frames the issue of energy poverty and its impact on the lives of poor people. It then explores the potential of decentralised clean energy solutions as well as promising emerging models that could boost their adoption, especially the role that microfinance institutions and strengthened clean energy value chains could play in helping poor people shift towards clean energy solutions. Section II details the CleanStart programmatic approach with its different components and facilities, and the way it intends to help create national agendas to increase access to clean energy for the poor. Lastly, Section III lays out the added value of the programme to the microfinance sector as well as the key positive transformations that low-cost clean energy brings to the lives of the poor.

This publication is the outcome of the initial research for the CleanStart initiative. It builds on the CleanStart Policy Brief discussed during the official launch of the programme at the United Nations Conference on Sustainable Development in Rio de Janeiro in June 2012.

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ACRONYMS

ADC	Austrian Development Cooperation
BoP	Base of Pyramid
CO2	Carbon Dioxide
EDI	Energy Development Index
GEF	Global Environment Facility
IEA	International Energy Agency
kWe	Kilowatts Electrical
LDCs	Least Developed Countries
LEDs	Light-emitting diodes
LNG	Liquefied Natural Gas
MDGs	Millennium Development Goals
MFIs	Microfinance Institutions
NGOs	Non-governmental Organizations
ODA	Official Development Assistance
O&M	Operations and Maintenance
PBAs	Performance-based Agreements
PoAs	Programmes of Activities
PV	Photovoltaic
Sida	Swedish International Development Agency
SMART	Specific, Measurable, Achievable, Relevant and Time-bound
UNCDF	UN Capital Development Fund
UNDP	United Nations Development Programme
UN	United Nations

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This publication is a joint product of the UN Capital Development Fund (UNCDF) and the United Nations Development Programme (UNDP). We would like to recognize the many partners who have made financial and other contributions to the energy sector projects described in this document. These include the Global Environment Facility (GEF), the facility's Small Grants Programme, the MDG Carbon Facility, and a wide range of bilateral donors. None of these projects would have been possible without the cooperation and significant financial and technical contributions of the beneficiary countries themselves.

CleanStart has been developed in close collaboration with the United Nations Environment Programme, the Frankfurt School of Finance and Management, MicroEnergy Credits, MicroEnergy International, Arc Finance and Columbia University.

Special thanks to the Swedish International Development Agency (Sida) and the Austrian Development Cooperation (ADC), whose generous financial contributions made this publication possible.

FOREWORD

More than one-quarter of the world's population lacks access to clean electricity, while about 2.7 billion people are forced to spend disproportionate amounts of their time and resources on traditional biomass for cooking and heating. Where modern energy services are unavailable, people resort to expensive and unsustainable alternatives, which can exacerbate energy insecurity and leave communities more vulnerable to the effects of climate change.

Increasing access to clean, reliable and affordable energy would reduce poverty and accelerate progress toward the Millennium Development Goals. Providing reliable and efficient clean energy to the rural and urban poor can significantly reduce CO_2 emissions, boost productive and income-generating activities and reduce household expenditures for costly and non-environmentally friendly fuels such as kerosene and diesel. Thanks to recent technological developments, efforts to expand access to clean energy now depend less on technology and more on financing arrangements, backed by a policy environment that is focused on serving the poor.

The *Sustainable Energy for All* initiative, recently launched by UN Secretary-General Ban Ki-moon, draws global attention to the importance of energy for sustainable development and poverty alleviation, and calls for specific commitments from the private sector and national governments. The goal is to meet three objectives by 2030: ensuring universal access to modern energy services; doubling the rate of improvement in energy efficiency; and doubling the share of renewable energy in the global energy mix.

In response, the UN Capital Development Fund (UNCDF) is partnering with the United Nations Development Programme (UNDP) on *CleanStart*, a programme to help poor households and micro-entrepreneurs access financing from microfinance institutions for low-cost clean energy. Microfinance institutions, which by definition target low-income clients, are well placed to provide the products and services micro-entrepreneurs need to pursue clean energy opportunities.

CleanStart promotes appropriate financing arrangements, supports quality assurance measures for end users, and addresses key gaps in energy value chains to contribute to a mutually beneficial cycle of investment and building awareness, as well as create a new market segment with higher returns for participating institutions. CleanStart aims to help lift at least 2.5 million people out of energy poverty by 2017 and to establish a viable concept for a much wider uptake.

This publication shares the experience of UNCDF and UNDP in designing the CleanStart approach, one of the latest endeavours of our respective work in Financial Inclusion and Energy Access for All. It is hoped that by jointly leveraging our respective strengths and combining resources, we can help make the goal of universal access to modern energy services for all a reality.

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Executive Secretary a.i.
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Director of Environmental Finance
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Photo : IDEI – Sarah Butler-Sloss/ Ashden Awards

SUMMARY

Energy is central to nearly every major challenge and opportunity the world faces today. Whether it is jobs, security, climate change, food production or poverty, sustainable energy for all is essential for strengthening economies, protecting ecosystems and achieving equity.

UN Secretary-General Ban Ki-moon is leading a new global initiative called "Sustainable Energy for All". This initiative calls for private sector and national commitments and aims to attract global attention to the importance of energy for development and poverty alleviation. The goal is to meet three objectives by 2030:

1. ensuring universal access to modern energy services;
2. doubling the rate of improvement in energy efficiency;
3. doubling the share of renewable energy in the global energy mix.

To recognize energy's crucial role in sustainable economic development, the United Nations General Assembly has designated 2012 as the International Year of Sustainable Energy for All.

In an effort to help achieve these objectives, the UN Capital Development Fund (UNCDF), together with the United Nations Development Programme (UNDP), has developed an approach to increase poor households' access to sustainable, low-cost clean energy[1] through microfinance services that are supported by an enabling policy environment and energy value chain. UNCDF and UNDP have designed a $26 million global programme – CleanStart – to translate the approach

1 Clean energy includes renewable energy, fossil fuels that emit little greenhouse gas such as liquefied petroleum gas and traditional fossil and biomass fuels that use technologically advanced processing, practices and/or products such as energy-efficient cookers.

into practice across six developing countries[2] in Asia and Africa and help at least 2.5 million people move out of energy poverty by 2017. The CleanStart programme is expected to create a business model for expanded use in other developing countries.

In a world where more than 1.6 billion people lack access to electricity and 2.7 billion people rely on the traditional – and typically polluting – use of biomass for cooking and heating, access to clean energy has become a key development challenge[3]. However, with increasing production scale and ongoing technical development, clean energy equipment has become more available and with improved performance and operating life. Clean energy systems are also becoming progressively less expensive both in absolute terms and also relative to most popular fossil-fuel alternatives. However, lack of appropriate end-user finance schemes has impeded reaching low-income market segments on a wide-scale.

Appropriate financing arrangements – combined with targeted quality assurance of technologies being financed and technical advisory services – are key to overcoming this market failure. In countries with mature microfinance markets, microfinance institutions (MFIs) are well placed to supply such financial products if certain business model assumptions are validated. By their nature, MFIs are focused on expanding outreach to the poor and have access to low-income people and unique knowledge of their needs. Clean energy, in return, has the potential to improve the quality of MFIs' loan portfolios and create a new, higher-return 'star' segment of the market. Carbon credit markets, particularly voluntary ones, are potential additional income streams for MFIs developing this opportunity.

CleanStart uses an innovative methodology to address the demand and supply-side barriers to energy access built around **four key components:** financing for clean energy, technical assistance for clean energy value chains and finance, knowledge and learning, and advocacy and partnership. These key components are laid out in Section II of this publication. The lessons learnt from first-generation projects and insights gained from discussions with MFIs suggest that the countries with the most developed microfinance and energy markets provide the best environment for CleanStart. The added value of CleanStart is to help remove barriers MFIs face as they move to introduce and expand end-user finance for low-income households and micro-entrepreneurs.

LONG-TERM VISION

In a context in which the international outlook for Official Development Assistance (ODA) is dim, it is increasingly evident that fostering market-based solutions and mobilizing the private and financial sectors will be critical to achieve progress in energy access. Over the long run, CleanStart aims to dramatically expand energy financing for the poor, without the use of subsidies, in developing countries with high levels of energy poverty. It is expected that the positive outcomes for MFIs – such as the improved viability of core financial products and a higher rate of revenue; a more enabling policy and business environment to support clean energy microfinance; and improved productivity and ability to repay microfinance loans as the poor break out of energy poverty – will ensure the sustainability of development results beyond the life of the programme.

2 Provisional candidate countries include Bangladesh, Cambodia, Nepal, Philippines, Ethiopia, Kenya, Malawi, Mali, Tanzania and Uganda.

3 International *Energy Agency, Energy for All: Financing Access for the Poor—Excerpt of the World Energy Outlook 2011,* IEA, Paris, 2011.

Section I

1. ENERGY POVERTY: RISING NUMBERS

About 1.6 billion people across the globe do not have access to modern energy services, such as electricity in their homes, and more than 2.7 billion people rely on the traditional and typically polluting use of biomass for cooking, lighting and domestic heating[4]. Energy poverty[5] is a serious obstacle to social and economic development and particularly to achieving the Millennium Development Goals (MDGs), such as poverty reduction, improvement in health and education services and access to clean water and sanitation.

The use of traditional biomass is not a problem in and of itself, but the associated harvest of biomass resources is often unsustainable and inefficient combustion on open fires and outdoors causes significant damage to the environment (deforestation) and human health[6]. In addition to the health and environmental consequences of the inefficient combustion of solid fuels, the "energy-poor" also suffer the economic consequences of insufficient power for productive income-generating activities and for other basic services. Furthermore, it has been found that people living on less than $2 a day spend a substantial portion (ranging from 15 to 30 percent) of their incomes on energy[7].

Conventional approaches to expanding modern energy access, mostly through national grid extension, fail to reach many of the poor. Meanwhile, off-grid solutions relying on diesel produce expensive, low-quality energy, emit carbon dioxide (CO_2) and impose vulnerability because of volatile oil prices. In urban and peri-urban areas, connecting poor people in informal settlements remains the single biggest inhibitor of access to energy for the poor. Urban energy markets in some countries are opening up to private energy services that are willing to connect poor people's homes, but high initial connection fees dampen demand.

Rural electrification programmes typically extend the grid incrementally from large demand centres to smaller ones, reaching towns and settlements in reverse order of the capital cost required. The further an area is from the existing grid, the more dispersed and poorer its population, and greater are the technical and economic difficulties confronting viable grid extension. Therefore, many poor people in rural areas lack modern energy simply because the grid does not reach them.

The International Energy Agency (IEA) projects that, with current investment plans and approaches to expanding energy access, the number of people without electricity will decline by only 200 million between 2000 and 2030, leaving 1.4 billion people in the dark. Meanwhile, the number of people relying on traditional biomass is set to rise from 2.4 billion in 2000 to 2.8 billion in 2030. It is estimated that approximately USD 48 billion of capital is required on average per year to achieve basic universal access to modern energy by 2030[8].

The lack of access to modern energy services is one reason impeding developing countries' efforts to break the poverty cycle. Most of these countries are concentrated in South Asia and sub-Saharan Africa, as shown

4 International Energy Agency, *Energy for All: Financing Access for the Poor – Excerpt of the World Energy Outlook 2011,* IEA, Paris, 2011.

5 'Energy poverty' refers to a situation where 'access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses' is not established (IEA, United Nations Development Programme and United Nations Industrial Development Organization, 2010).

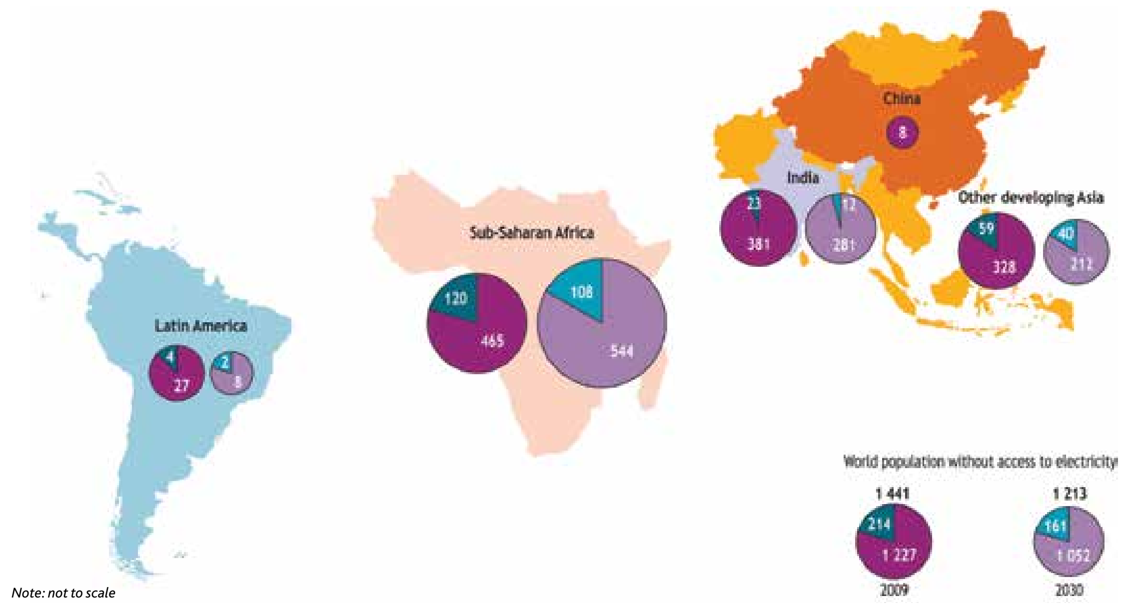
6 Indoor air pollution results in approximately 100,000 avoidable deaths per month globally due to respiratory ailments, World Health Organization, *Health in the Green Economy, 2011.*

7 UN-Energy, *The Energy Challenge for Achieving the Millennium Development Goals,* New York, 2005.

8 International *Energy Agency, Energy for All: Financing Access for the Poor – Excerpt of the World Energy Outlook 2011,* IEA, Paris, 2011.

in Figure 1. Despite the absence of a specific MDG for energy, it is clear that this widespread lack of access to modern energy services severely impedes progress in meeting most of the MDGs (Annex 1 shows energy-MDG linkages). Unequal access to modern energy closely correlates with wider inequality in human development. The direct link between human development and access to energy services is apparent from the strong correlation between the Human Development Index[8] and the Energy Development Index[10] (Figure 2).

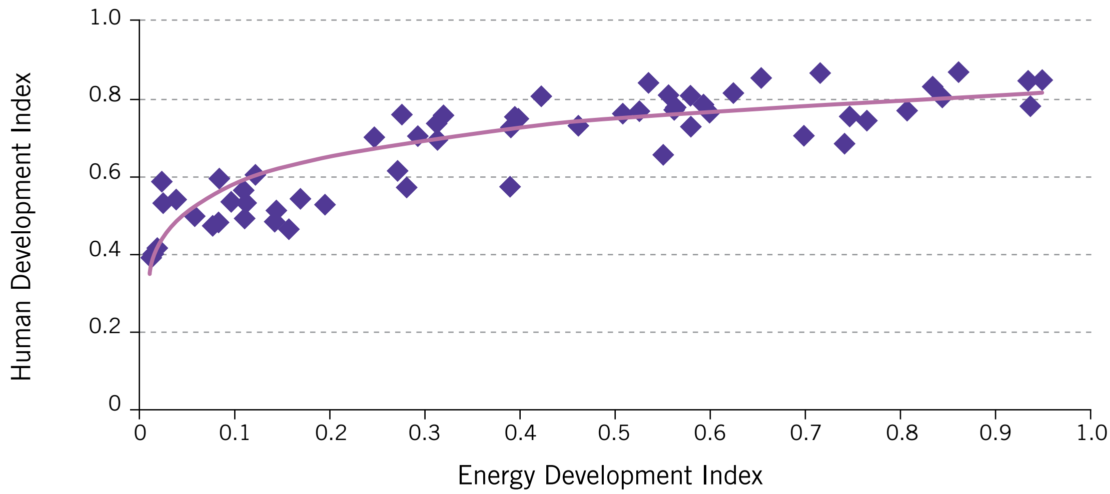
Figure 1. Number of people without access to electricity in rural and urban areas in the New Policies Scenario (million)



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the UNCDF, UNDP or the UN.

Source: OECD/IEA World Energy Outlook 2010, Figure 8.1, 240.

Figure 2. Comparison of the Human Development Index to the Energy Development Index



Source: OECD/IEA World Energy Outlook 2010, Figure 8.17, 265.

9 The Human Development Index is a comparative measure of life expectancy, literacy, education and standard of living in countries worldwide.

10 The Energy Development Index (EDI) is an indicator that tracks progress in a country's or region's transition to the use of modern fuels and serves as measure of energy poverty.

2. THE POTENTIAL OF DECENTRALISED CLEAN ENERGY

The failure of governments to achieve significant electrification in many countries has seen the growth of decentralised energy solutions based mostly on fossil fuel, such as diesel-fuelled micro-grids and liquefied petroleum gas. Unregulated diesel micro-grids are common where entrepreneurs provide power services to local communities. With relatively small investments ranging from $50 to $250, entrepreneurs can purchase a generator with a capacity of 0.5 kilowatts electrical (kWe) that enables battery recharging at a fairly low cost. This low barrier to entry has enabled the development of a highly competitive industry. However, concerns over energy security, oil price volatility and climate change are driving efforts to find decentralised clean energy solutions.

Decentralised clean energy gives developing countries a pathway to sustainable energy security, particularly in remote and rural areas where the transmission and distribution of energy generated from fossil fuels is generally very costly. The local production of energy in a cleaner and sustainable manner offers a viable long-term solution. This would also significantly reduce the negative health impact caused by the combustion of fossil fuels. While the higher upfront costs of clean energy has been a critical inhibitor to its widespread adoption, technological improvements and changes in market forces have resulted in a substantial decrease in costs. Technologies, both at the household level (such as solar home systems) and at the mini-grid level servicing 50 to 100 households, have also increasingly been found to be amongst the cheapest solutions for sustainable energy access in various countries[11].

Off-grid solutions

In recent years, important technological innovations have been introduced. These innovations have not only created new applications, but also generated new possibilities and opportunities for poor households to access clean energy. These innovations include:

- highly efficient low-power lighting units incorporating white light-emitting diodes (LEDs);
- small photovoltaic (PV) units for low-cost, small-scale electricity production;
- micro-hydroelectric installations and wind turbines;
- standardized design and construction of biogas units for households;
- cleaner, highly efficient biomass-fuelled cookers;
- upgrades of traditional water mills for grinding and milling grain; and
- treadle pumps that harnesses human power effectively for high-value uses.

Clean energy technologies particularly offer opportunities to modernise thermal energy services for the poor. While much attention in the energy and climate change debate focuses on electricity, thermal energy or heat supersedes all other energy uses at nearly 50 percent[12] of total global energy consumption. In the developing world, thermal energy is required for cooking, heating and other processes such as drying. Technologies using solar energy for water heating and crop drying, or using biogas and biomass more efficiently and in a cleaner manner, offer promising options for modernizing energy services for the poor.

Grid-complementary solutions

Beyond grid-substituting technologies, there is a growing interest in grid-complementary solutions. This option enables unconnected households to access applications that require the use of the electricity and gas grids for recharging or refilling energy applications. This occurs frequently in urban areas where grids are present, but low-income households are unconnected because their settlements are informal. Energy service companies offer powerful batteries, sometimes for free, and charge a recharging fee to customers to let them power lights, televisions, water heaters, fans and other household and retail appliances. Similar services are offered by gas companies using canisters of liquefied petroleum gas[13].

Technical development and expanding production scale has given clean energy equipment wider availability and better performance and operating life. The same is true

11 Glemarec, Yannick, *Financing off-grid sustainable energy access for the poor,* Energy Policy, vol. 47, issue S1, 2012, pages 87-93.

12 Forty-seven percent of the final total energy consumption in the world is for heat. International Energy Agency, *Cogeneration and Renewables: Solutions for a low carbon future,* IEA, Paris, 2011.

13 Annex 2 presents an overview of the many options available for clean energy and renewable/fossil-fuel hybrid systems, together with associated economic and social applications.

of the components needed for clean energy systems, such as inverters, charge controllers and voltage regulators, as well as efficient end-use equipment such as LED lighting fixtures.

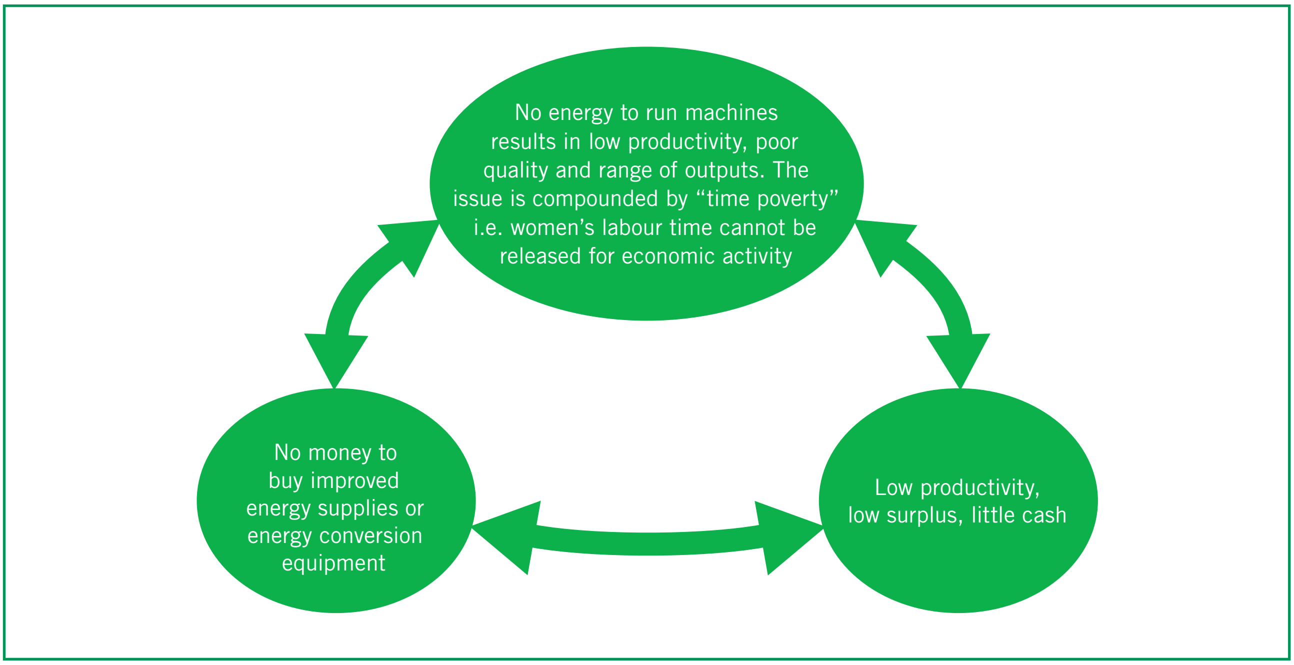
However in urban and rural areas alike, the costs of equipment, recharging and refilling are obstacles to the uptake of both off-grid or grid-complementary solutions, leaving markets underdeveloped and supply chains weak. In countries with increasing infrastructure for clean energy systems and services, efforts to expand the provision of clean energy in villages and townships now depend less on technology and more on improved financing models to make energy accessible and affordable to low-income consumers, backed by a policy environment and energy value chain that is focused on reaching the poor.

3. REMOVING FINANCIAL BARRIERS TO ENERGY ACCESS: THE NEED FOR END-USER FINANCE

Access to sustainable sources of clean, reliable and affordable energy relates not only to physical infrastructure (e.g. electricity grids), but also to energy affordability, reliability and its commercial viability. Large numbers of people across the globe suffer a vicious cycle of energy poverty, in which they stay energy poor because they do not have the means to buy improved energy services even when they have access to them (Figure 3). Access to cash is crucial because acquiring improved energy services frequently means switching to an energy technology that costs money, from one that does not. There is evidence that the continued growth in clean energy markets, which initially reflected sales to people living above the poverty line in urban or peri-urban areas, is constrained from reaching new market segments by the absence of appropriate end-user financing[14].

The rural poor live in subsistence economies that do not generate cash surpluses, limiting their purchasing power and opportunity to shift to modern energy services. Most rural poor also find it difficult to obtain the credit needed to pay high up-front costs for energy services. The cost of capital itself is high; and because income cycles are agriculture dependent and thus irregular, adherence to regular repayment schedules is challenging. Government and donor energy strategies for the poor continue to focus mostly on their basic energy needs and have yet to pay adequate attention to raising incomes and livelihoods, which could potentially increase the affordability of energy services.

Figure 3: The vicious cycle of energy poverty



Source: United Nations Industrial Development Organization (UNIDO), 2005.

14 Glemarec, Op.cit.2012.

End-user financing takes many forms that fall within the basic models of dealer cash sales, consumer credit through commercial banks or MFIs, and fee-for-service, in which the equipment remains the property of the service provider.

- **Dealer cash sales.** Clean energy technology suppliers or dealers sell directly to customers for cash. Some sales are on credit, usually to be repaid over three to 12 months, particularly where international financial institutions such as the World Bank make credit available through commercial banks.
- **Consumer credit.** Local financial institutions provide loans to end users to buy clean energy systems. Commercial banks may either lend directly to consumers (as in Kenya through Equity Bank) or provide lines of credit to MFIs (as in Sri Lanka through Sarvodaya Economic Enterprise Development Services). Sometimes, international financial institutions provide support, as in Bangladesh, India and Nepal. Usually, suppliers of clean energy systems receive cash from end users, who receive support through the credit facility. Sometimes a prior guarantee or service agreement exists between financial institutions and suppliers, and sometimes credit to end users is tied to certified suppliers with or without prior agreements.
- **Fee-for-service.** Customers pay an energy service company, which makes clean energy affordable to very low-income customers and minimizes customers' longer-term risks as the ownership and maintenance of the energy system lies with the company. This is usually part of a much larger energy investment by commercial financiers that is very often supported by funding from government or multilateral sources. Service fees are usually low enough for customers to pay cash, but sometimes MFIs help customers pay fees with very short-term borrowing or overdrafts.

By volume of sales, the dominant models are dealer cash sales and consumer credit through commercial banks. However, these models limit adoption by the poor for the following reasons: growth is constrained by limits on the availability of credit; features of existing credit products are tailored mostly to the needs of high and middle-income consumers; and the high transaction costs facing energy service companies and traditional banks in delivering systems and financing to low-income consumers living mostly in rural areas. Furthermore, credit provided by energy service companies is limited because they lack the lending or leasing expertise that financial institutions have and providing credit is a significant drain on their working capital.

Appropriate financing arrangements are thus critical to overcoming this market failure. Several decentralised clean energy solutions such as home PV systems, household biogas units and community-based micro-hydropower have been widely adopted through technology promotion and financial support. In almost all cases, public investments provide a partial subsidy and enforce standards and quality control. The private sector provides the technology, often under warranty and with repair and maintenance services, while appropriately structured end-user financing by MFIs, non-governmental organizations (NGOs) or banks enables poor consumers to purchase it. Clients typically use loans to pay 50 to 100 percent of the cost of the systems and, in some cases, bear the cost of repair and maintenance. These first-generation projects began with household biogas in Nepal and home PV systems first in Nepal and Sri Lanka, and then in Bangladesh, Kenya and Tanzania. They have been shown to be sufficiently robust to be effective in other countries as well[15].

In countries with maturing microfinance markets, particularly in LDCs, MFIs are well placed to supply finance schemes tailored to the needs of poor consumers. By focusing on expanding financial outreach to the poor, MFIs have unrivalled knowledge of, relationships with, and access to low-income people. They have extensive branch networks on the ground and an inherent knowledge about the communities in which they operate and, most of all, how poor clients manage finances. In return, clean energy has the potential to improve the quality of MFIs' loan portfolios and create a new, higher-return 'star' segment of the market.

15 Under the Biogas Support Programme in Nepal, for example, a subsidy of about 30 percent was available for covering 30 percent of plant costs, while 20 percent could be contributed by the user in-kind (e.g. labour or locally available construction materials). The remaining 50 percent was supplied through cash contributions from users. United Nations Development Programme, *Towards an 'Energy Plus' Approach for the Poor: A review of good practices and lessons learned from Asia and the Pacific,* Bangkok, 2011.

4. GOING BEYOND FINANCIAL BARRIERS

While cost is an important factor, experience proves that well designed financing schemes alone will not be enough to ensure adoption of clean energy systems to the desired and required scale. A number of studies show that complementary informational, institutional, regulatory and behavioural instruments will be required to remove non-economic hurdles[16] (refer to Annex 3 for examples of common key barriers). A UNDP review of 17 initiatives on energy access for the poor in the Asia-Pacific region concluded that those that were able to achieve a significant expansion benefitted from a **strong commitment from their national governments** – a commitment reflected in policy documents and supported by budgetary allocations[17]. Additionally, a recent survey of investors[18] found that the most powerful incentive mechanism for renewable energy deployment in developing countries was the establishment of clear national targets for renewable energy.

Besides the existence of clear national targets, the experience of the first generation of market driven projects for energy access highlights the **importance of raising awareness, closely involving prospective customers and developing their skills.** A lesson learnt in the past few years is that many approaches to off-grid renewable energy barriers tend to emphasize economic and technical barriers, but ignore or downplay end-user values and behaviour.[19] Findings from independent evaluations of sustainable energy projects have found that sustainable market development involves different groups of *interdependent* stakeholders. These stakeholders include the users of the technology, supply chain players (i.e. retailers and maintenance technicians), policy makers and financiers.[20] Each of these groups of stakeholders typically encounters a number of barriers (often non-financial) that prevent them from using or supporting the sustainable energy technology; as such it is very important to consider the barriers using a **value chain approach**. Only by addressing the combined financial and non-financial barriers of these various stakeholders can there be a significant impact on the sector.[21]

Quality control will also play an equally critical role in the adoption of clean energy devices by communities. Products must be extensively tested among the purported users (including women) before launching, and they should be robust and tamper-proof, particularly when disseminated in remote rural locations. Substandard performance will cause a general decline in demand for clean energy systems and correspondingly discourage financing institutions from entering the clean energy market due to the higher risk of loan defaults. Hence it is imperative that technological risks are reduced by establishing some standards and regulating the quality of the devices that are used in projects. For example, supplier buy-back or maintenance guarantees for large systems (e.g. efficient stoves for institutions) can also reduce the risk of technological failure.

In summary, for the most effective impact, energy access projects should adopt an **integrated sector-wide approach** which would include strengthening of conducive policies, institutional capacity development, private sector support, entrepreneurial skills development, productive uses of energy for income generation and the facilitation of access to finance and markets. Furthermore, better understanding of the difference in the way men and women use energy will be critical in ensuring the effectiveness of energy projects. Such an integrated approach will lead to improved household living standards while increasing the capacity to pay for energy and other services. Poverty reduction impacts can be maximized only when such measures are built into the energy access programs.


Photo : Kunal Ghevaria

16 Glemarec, Op. cit. 2012.

17 UNDP, Towards an 'Energy Plus' Approach for the Poor: A review of good practices and lessons learned from Asia and the Pacific, 2011.

18 United Nations Environment Programme, *Financing renewable energy in developing countries: A study and survey by UNEP Finance Initiative on the views, experiences and policy needs of energy financiers.*

19 Sovacool et al, 2011

20 Worlen, Christine, Meta-Evaluation of Climate Mitigation Evaluations, GEF Evaluation Office, Washington D.C., 2011.

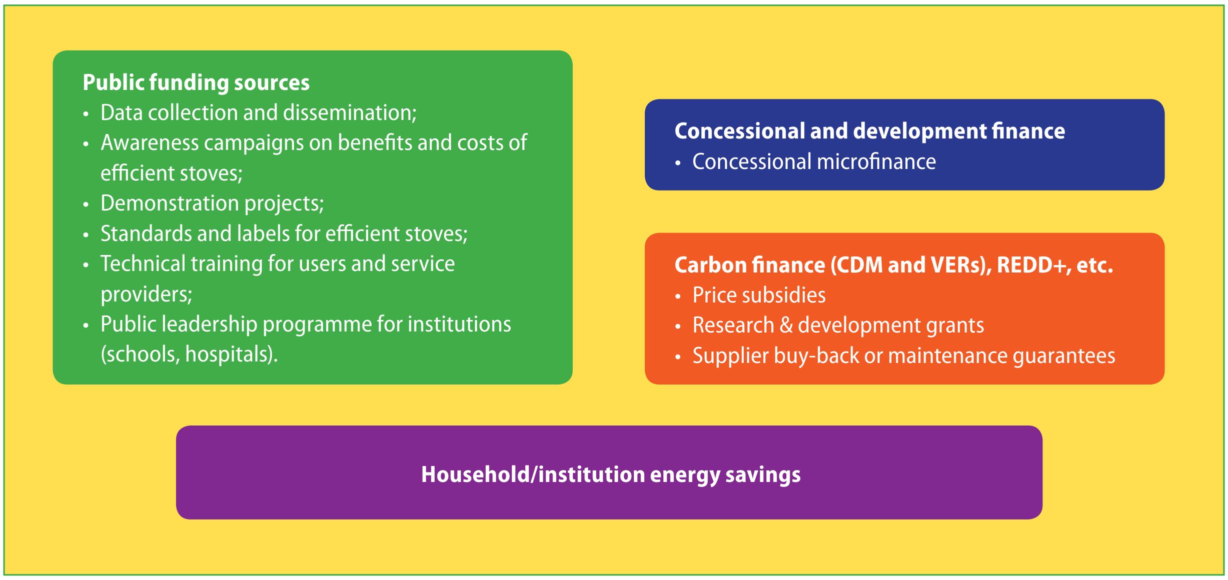
21 Glemarec., Op. cit., 2012.

Text box 1

Selecting an optimal policy and financing mix

The direct financing model for MFIs can operate in the context of a broader policy and financing scheme that combines and sequences funding and revenue streams based on the specific challenges facing a particular technology option. Figure 4 uses the example of energy-efficient cookers to illustrate a possible mix of public policies and funding sources to overcome barriers to the uptake of energy-efficient stoves, using concessional credit through microfinance as the cornerstone policy to overcome high upfront costs for households and institutions.

Figure 4: Selecting an optimal policy and financing mix for energy-efficient stoves



Source: Glemarec, Yannick (2011). *Catalyzing Climate Finance: A Guidebook on Policy and Financing Options to Support Green, Low-Emission and Climate-Resilient Development*. United Nations Development Programme, New York, NY, USA

Photo : AG Bank – David Fulford/ Ashden Awards

Section II

5. CLEANSTART – MICROFINANCE OPPORTUNITIES FOR A CLEAN ENERGY FUTURE

In response to the increasing challenges posed by energy poverty and leveraging on the potential of end user finance, the UN Capital Development Fund (UNCDF) and the United Nations Development Programme (UNDP) have pooled their resources and technical expertise to establish and operate a global programme to create microfinance opportunities for a clean energy future. It is called CleanStart for short to describe clean pathways for poor people to move out of energy poverty and jump-start their permanent access to modern energy with access to sustainable financial services, supported by an enabling policy environment and energy value chain that responds to their needs. The programme aims to help at least 2.5 million people in Asia and Africa move out of energy poverty by 2017.

The approach adopted by the programme is made up by four independent though mutually supportive components:

- **Finance for clean energy** that uses the capabilities of MFIs to provide end-user financing for sustainable and low-cost decentralised clean energy technologies and services to low-income households and micro-entrepreneurs.
- **Technical assistance for clean energy value chains and finance** to remove barriers to the successful deployment of those technologies and services for which MFIs provide microfinance.
- **Knowledge and learning** that improves understanding and awareness of microfinance's potential to stimulate the adoption of sustainable clean energy, as well as of the knowledge and skills needed to add clean energy finance to lending portfolios.
- **Advocacy and partnership** that supports the efforts of national and international actors to create an enabling policy and business environment and builds links with related sectors.

5.1 Programming finance for clean energy

This component provides targeted assistance to selected MFIs in countries where conditions are judged most favourable for the achievement of the CleanStart model.[22] Selected MFIs are helped to take advantage of opportunities and mitigate risks associated with scaling up end-user finance for clean energy systems and services. CleanStart considers partnering with MFIs as well as refinancing institutions that provide access to a large number of smaller institutions with good rural outreach. This strategy will enable institutional diversity, wide outreach and testing of different lending models.

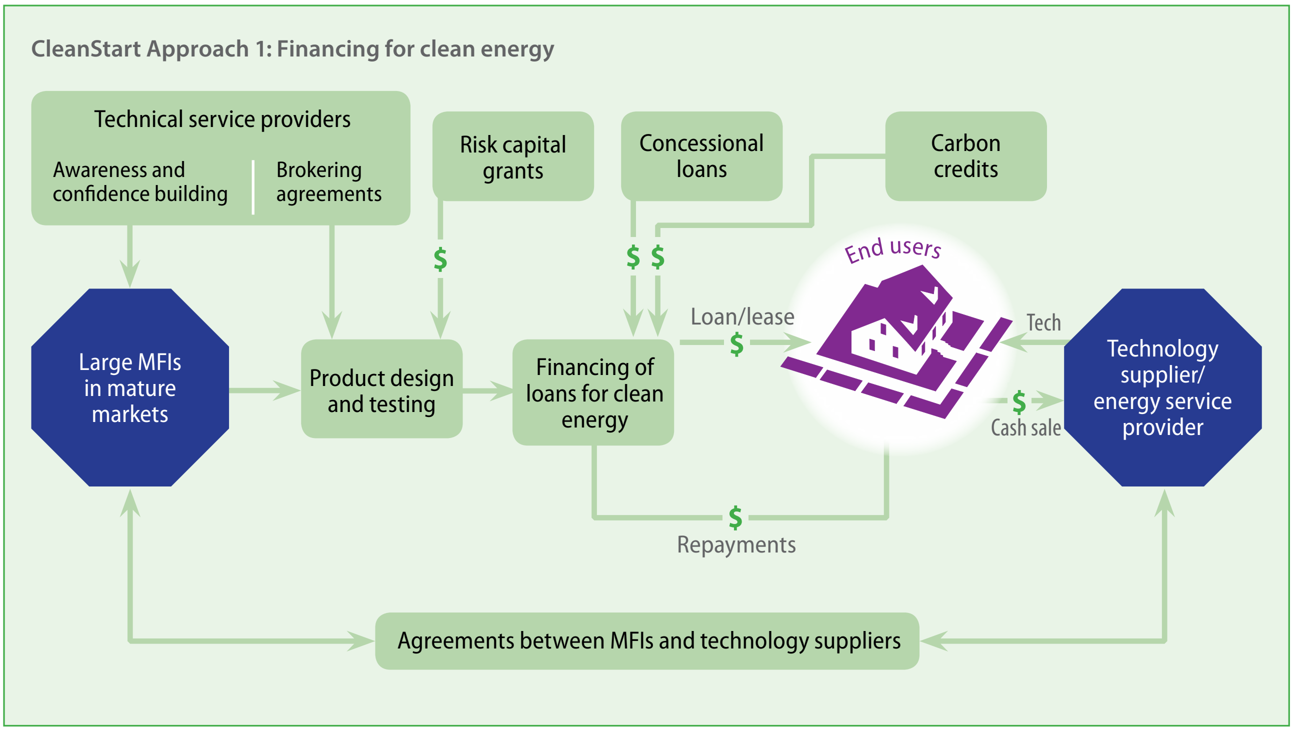
CleanStart strengthens MFI capabilities by providing:

- **pre-investment technical assistance** to build awareness and confidence based on international experience and to develop outline business plans;
- **risk capital grants** to cover the up-front cost of introducing a new product line;
- **concessional loans** to provide access to initial liquidity to finance clean energy lending before MFIs deploy their own equity and existing lines of credit to scale up their lending.

Figure 5 provides a graphic explanation of CleanStart's business model for financing clean energy.

22 The lessons from first-generation projects and insights from discussions with MFIs suggest that the countries with the most developed microfinance and energy markets provide the best environment for CleanStart.

Figure 5: CleanStart business model for financing clean energy



a. Pre-investment technical assistance

Building awareness and confidence

MFIs expressing initial interest are invited to send staff to a structured course of awareness raising and confidence building. The course and associated events demystify clean energy lending and expose MFIs to the potential value of clean energy finance. This may involve exposure visits to see how other MFIs currently deliver end-user finance; classroom orientation to provide an overview of technologies as well as financing and partnership models available in other countries; and discussions to enable participants to openly and critically address issues in a group of peers, international experts and MFI practitioners with track records in clean energy financing.

Technical assistance to develop business plans

MFI staff participating in the awareness and confidence-building course are assisted to prepare an outline business plan for their organisation to develop and roll out financing for clean energy products. These business plans should be endorsed by the senior management of the MFI and become the basis of a formal application for a risk capital grant and or concessional loan.

b. Risk capital grants for market entry

Given the early stage in the development of clean energy financing, significant upfront investment costs, including those for midcourse corrections, often block the introduction of end-user finance through MFIs. The experience of first-generation clean energy projects in developing countries was that start-up subsidies were important catalysts for the rapid adoption and scaling up of clean energy financing, not just by MFIs but also for other financial institutions and clean energy suppliers. Risk capital grants cover the upfront costs of market research, product development and roll-out, upgrading systems, product marketing and staff training. These subsidies have limited duration, until participating MFIs reach the critical mass needed to standardize products and processes, which is estimated to take three years at most.

CleanStart explores the possibility of providing additional risk capital grants for innovation to test and develop new business models. These can potentially include carbon finance; expansion to new technologies or project areas; loans for productive end-use or household utilities; or loans for local energy retailers or manufacturers.

c. Concessional loans

Concessional loans capitalize initial clean energy financing. This is necessary because the lines of credit ordinarily available to MFIs, including wholesale finance from banks and donors, may not be available for clean energy financing. In part, this stems from perceptions that clean energy lending raises risk exposure. Results are expected to demonstrate that clean energy loans are not inherently more risky than traditional microfinance, particularly if clean energy clients are traditional MFI clients. As MFIs build their clean energy-lending portfolio, they better understand the degree and likelihood of credit risk and structure risk in the pricing of their clean energy loans. That means the subsidy can be eliminated after the term of the guarantee. The need for external financing to capitalize clean energy lending should decrease with time.

5.2 Technical assistance for clean energy value chains and finance

This component aims to remove barriers to the sustainable deployment of technologies and services for which the selected MFIs provide microfinance. It moves away from a technology-driven supply approach to become more technology-neutral and client demand-oriented. In practice, this means rigorous diagnostics to identify client need and demand and deploying technical assistance to remove supply chain barriers that effectively fail to match supply with latent demand. Furthermore, the use of financing mechanisms is maximized when both the participating financial institutions and their clients fully understand the financial and technical risks of the assets to be secured or financed.

CleanStart strengthens the energy value chain through:

- **Market research** to understand end-user energy needs, technology options and price points;
- **Brokering partnerships between MFIs and energy suppliers** to expose MFIs to the potential for cooperation with suppliers of clean energy systems and services, as well as help broker risk-sharing agreements;
- **Financial product development and roll-out** to develop appropriate clean energy financing products for end-users in partnership with suppliers of clean energy;
- **Strengthening energy supply chains** to address gaps in the supply chain of technologies or services chosen for lending;
- **End-user awareness** of the benefits provided by new fuels and technologies and financing opportunities.

a. Market research

MFIs are assisted to conduct market research to gain a good understanding of energy needs and resource availability in MFI operating areas, as well as current energy expenditures, client willingness and client ability to pay for clean energy. The research also helps identify technology options and providers that can address the demand for energy services. Another goal is to design appropriate financial products based on a sound understanding of client needs, especially the distinct energy and financing needs of women, and assess the likely impacts of adoption.

b. Brokering partnerships between MFIs and energy suppliers

CleanStart supports inputs necessary to expose MFIs to the potential for cooperation with suppliers of clean energy systems and services, as well as help broker risk-sharing agreements. This includes both upfront technical assistance to participating MFIs and technology providers as they choose the technologies to be commercialized, and the most appropriate business model for a given customer base.

Brokering partnerships may involve a range of operational activities including scoping the possibilities, technology expos, energising and enthusing respective market communities, making the case to potential partners, early relationship building, managing expectations, helping to develop an initial outline for collaboration, and helping partners reach agreement. MFIs should be encouraged to explore partnerships with an array of technology suppliers, while any one supplier may enter arrangements with one or more MFIs.

c. Financial product development and roll-out

Participating MFIs are provided with technical assistance to develop appropriate clean energy financing products for end-users in partnership with suppliers of clean energy. MFIs are also assisted to understand the fundamental features and profiles of the energy assets and services for which they provide financing and develop the most appropriate mix and type of energy lending products for end-users. Technical assistance involves the following:

- designing and testing lending products;
- collecting feedback on tests and fine-tuning the product;
- managing delinquencies in energy portfolios;
- developing staff capacity (e.g. product marketing, credit assessment, technology);
- developing results-based staff incentives;
- rolling-out products on a wider scale.

d. Strengthening energy supply chain

Participating energy suppliers are assisted to address gaps in the supply chain of technologies or services chosen for lending. This includes improving understanding about client needs and adapting technologies and services accordingly, as well as conducting financial viability assessments for technologies/services to be deployed. Furthermore, the programme supports suppliers to strengthen quality assurance and capability to market and reliably deliver, install and maintain technologies and services. Quality assurance guidelines are developed for each clean energy technology product offered on a lending basis in line with the type and specification of hardware to be deployed in specific environments. Selected partners are also assisted in developing business plans to help mobilize investments.

The precise design of the technical assistance package to address operations and maintenance (O&M) services is rolled into the specific design of a country intervention. Broadly, the technical assistance design for O&M is guided by the need to ensure the following:

- Reduce the cost of future O&M via local capacity development, standardization, guidance and training to users;
- Institutional and financial provisions are in place to cover O&M via:
  - community-based organizations;
  - mandatory O&M requirements for suppliers; or
  - arrangements that are most appropriate for the technology or locality.

e. End-user awareness

To ensure up-take, the programme works with partner MFIs and suppliers as well as key local actors such as community mobilisers, NGOs and industry networks to raise substantial client awareness of the benefits provided by new fuels and technologies and accompanying financing opportunities. It also involves showing end-users how to use and maintain the energy assets purchased and the after-sales service obligations of the supplier.

5.3 Programming global knowledge and learning

CleanStart supports MFIs and other stakeholders gain confidence in and learn from the results of the programme and other initiatives, which indirectly help expand the development of end-user financing globally. This is practically and strategically important because clean energy finance is still at an embryonic stage.

a. Increased knowledge and skills

An improved and more comprehensive body of knowledge covering the supply and demand of clean energy end-user financing lets stakeholders make reliable investment decisions. These stakeholders include MFIs, clean energy companies, carbon traders, communities, households, financiers and governments.

Grants for research into practice

CleanStart provides **grants for research into practice** in response to knowledge gaps among stakeholders. It is driven by the need to improve the practices of key stakeholders, including governments and donors. The research therefore focuses on three areas:

- **Financial products**: Research provides insights on product characteristics across contexts and client profiles, approaches to market research and product development and effective product management.
- **Delivery systems and partnerships**: Research considers alternative arrangements to deliver financial and energy services to clients; factors for successful partnership between MFIs, energy companies and carbon brokers; and approaches to managing partnerships.
- **Business processes**: Research identifies best practices in managing business processes, particularly regarding clean energy financing and MFIs' overall portfolio of products and services.

Grants for research into impact

The impact of financing clean energy under the CleanStart approach is studied through carefully designed and independently conducted research focusing in three areas:

- **Client value, impact and demand for clean energy finance:** Research assesses the potential benefits of clean energy and end-user financing towards reducing poverty and meeting low-income households' and micro-entrepreneurs' energy needs. It may aim to improve understanding of the needs and preferences of potential customers, quantify current energy expenditures and customers' willingness and ability to pay for clean energy systems, or quantify how existing energy practices affect climate change and the benefits of shifting to clean energy systems and services.
- **Institutional value and the supply of clean energy finance:** Research assesses the potential benefits of clean energy and end-user financing for suppliers such as MFIs, energy companies and carbon market players. It may improve understanding of the voluntary carbon market, best practices to stimulate demand, the emergence of innovative partnership models, and why solutions do or do not work for clients and providers.
- **Impact of policy and regulation:** Research assesses the extent to which national policies and regulations encourage or impede the poor's microfinance-assisted adoption of clean energy technologies, policy measures to encourage and facilitate access to carbon market financing for clean energy, and how to integrate clean energy into policy dialogue on the Millennium Development Goals (MDGs).

b. Training curricula on clean energy financing and training grants

Technical assistance develops training curricula and materials for MFI personnel and makes these materials available to the public. CleanStart negotiates agreements with internationally recognized microfinance training programmes to integrate the clean energy finance curriculum into the programmes' broader microfinance training. Grants to fund scholarships may be part of packages negotiated with these training programmes.

c. Communication of knowledge

Research outputs will be consolidated in a series of publications. The publications will be widely disseminated in the microfinance, clean energy and carbon trading sectors and other stakeholders.

Communication of knowledge activities includes at least the following:

- A CleanStart website to make the programme's knowledge products freely available, serving as a global repository of knowledge on end-user finance for clean energy, while providing a platform for discussion, dialogue and learning among practitioners.
- CleanStart training products, research outputs, and support to workshops, conferences and other forums will be published to spark a dialogue on microfinance for clean energy.
- Events organised or supported by CleanStart to promote a dialogue on microfinance for clean energy, including workshops, conferences and other types of forums.

5.4 Programming advocacy and partnership to influence enabling policy and business environments

The challenge of improving low-income households' access to clean energy systems and services is daunting. End-user finance tackles only one aspect of it and only where the business environment for MFIs allows end-user finance to massively expand.

A number of broader interventions are needed to create a more enabling environment. In addition to providing direct financial and technical support, CleanStart conducts advocacy to influence donors, governments and commercial actors to provide additional financing, or design and implement complementary activities in the clean energy sector. This involves collaboration with:

- **Governments and donors** that are working on energy policy and regulatory regimes, as well as expanding finance and capacity development support for energy value chains;
- **National and international commercial banks and wholesale financing institutions** that refinance microfinance portfolios;

- **Carbon brokers** that are working on energy projects and trading on the major voluntary and compulsory carbon markets;

CleanStart builds partnerships with related programmes nationally and internationally, identifying mutual interests and synergies and raising awareness of clean energy's potential to contribute to the MDGs and mitigate climate change. It provides limited amounts of direct support by, for example, deploying technical assistance experts to participate in programme design and help incorporate the concerns of clean energy microfinance into partners' programmes.

These strategies build on existing upstream policy support and reform initiatives that UNDP applies in many countries, often as part of GEF projects, to put in place appropriate legal and regulatory frameworks for decentralised energy services, support countries' mainstreaming of energy access into their poverty reduction strategies, and get donors and governments to commit to scaling up energy investments nationally.

Through advocacy and partnerships, CleanStart aims to leverage available resources and realize their full potential by providing practical and sustainable approaches to end-user finance. Table 1 below demonstrates the additional resources CleanStart seeks to leverage by collaborating with other actors or programmes in MFI refinancing, energy value chain development, and carbon financing.

Table 1: Leverage potential of CleanStart

Collaboration	Leverage potential (USD)
MFI refinancing	30–40 million
Support to clean energy value chain	18–25 million
Revenues from carbon financing	7.5–10 million
Total leverage potential	55.5–75 million


Photo : Aprovecho – David Fulford/ Ashden Awards

5.5 Selecting programme countries

The infancy of clean energy end-user financing and the scale of the end-user financing gap make it essential that the limited investment in CleanStart is used to generate a substantial body of good practices, experience, knowledge and skills. These, in turn, will be needed to leverage significantly greater investment and the wide adoption, adaptation and replication of models and practices around the globe. Therefore, country selections are done strategically, selecting the most enabling environments to ensure the programme's success.

The lessons from first-generation projects and insights from discussions with MFIs suggest that countries with the most developed microfinance and energy markets provide the best environment for CleanStart. CleanStart adds value by helping remove the barriers that prevent MFIs from introducing and scaling up end-user finance for low-income households and micro-entrepreneurs.

To assess the **maturity of a country's microfinance market,** CleanStart uses eight indicators:

1. Institutional diversity
2. Microfinance institutions in country
3. Client outreach
4. Profitability of industry
5. Portfolio quality
6. Infrastructure support for Industry
7. Availability of funds to expand lending activities
8. Lending product diversification

To determine the **maturity of a country's energy market**, CleanStart relies on 'the scale of GEF funding available' as a proxy indicator. CleanStart finalizes target countries through a detailed assessment of the clean energy market in each country. The rollout of basic microfinance for clean energy products will depend on the selection of a core set of technologies or services that are proven and appropriate to the needs of the poor in each programme country.

Text box 2

Comparative advantages of MFIs in providing clean energy

The phenomenal growth of MFIs in the last decade has been partly supported by a market approach to providing financial services to low-income people wherein most MFIs, though not all, cover at least their costs. They have done this by minimizing operating costs, pricing their products realistically and, perhaps most importantly, understanding the needs and limitations of their customers. The following capabilities of MFIs allow scaling up the provision of sustainable financing to low-income converters to clean energy:

- MFIs have unrivalled knowledge of, relationships with, and access to low-income people in developing countries. Their borrowers exceed 100 million globally, as the number of customers for savings and payment services grows exponentially.
- MFIs have experience, systems and discipline for sustainably managing credit operations and, in some countries, large institutions. With a gross loan portfolio of $45 billion that is less than 5 percent at risk, MFIs demonstrate how to lend billions of dollars in small loans while effectively managing credit risks. The strength of MFIs in mature microfinance markets have allowed them to offer significant refinancing facilities from domestic and foreign entities including banks, development finance institutions and private equity funds.

With their growing experience of actively marketing products, particularly on the back of growth in flexible and open savings services, MFIs have learnt the value of marketing and after-sales service in attracting and retaining depositors, which it had hitherto not needed for borrowing, where rationing and not marketing is more important. This marketing capability – to better understand the needs of low-income people and then develop, test and scale-up tailored financial services to meet their needs – instils confidence in MFIs' ability to market financing solutions for poor people's energy needs.

Section III

6. ADDING VALUE TO THE MICROFINANCE SECTOR

6.1 Value proposition for MFIs

The traditional core business of MFIs has been loans and savings accounts. Loans are typically $100 to $200 for first-time customers, rising to $300 to $500 for customers seeking to grow their mostly home-based businesses and to as much as $5,000 for entrepreneurs and agricultural production and processing.

In mature microfinance markets, clients typically have gone through several loan cycles. Most clients continue taking basic microloans mostly for consumption, financing repayment with income from several existing livelihood sources. Others graduate from general microloans to slightly larger loans for home income generation, and a few others go onto much larger loans for micro-enterprises outside the home. Most continue to increase their debt or at least become eligible for larger loans as they establish track records of repayment and gain confidence that their income will continue to grow.

The growing challenge for MFIs in mature microfinance markets is not liquidity to finance loan portfolios, but growth limits on their lending portfolios with existing clients as local markets become saturated. It is not unusual to see higher default and withdrawal rates where MFIs have made several cycles of loans. The traditional strategy for MFIs has been to open new branches and induct new borrowers into their programmes. Apart from the direct and organizational costs of branch expansion, this intensifies competition among MFIs, creating pressure to take on evermore risky loans.

In short, MFIs in mature microfinance markets are beginning to face the problems of too much liquidity chasing too few investment opportunities for existing clients, and of too much liquidity chasing too few new clients as competition intensifies. The problem of competition is evident only in a few, very mature microfinance markets, such as Bangladesh. In mature microfinance markets, clean energy offers MFIs the potential to improve the viability and prospects of their core savings and loans services, as well as expand their product line in a high-growth and lucrative market segment. MFIs also can access a completely new revenue stream by selling carbon credits on the voluntary carbon market.

The ability of clean energy to either reduce household expenses or increase incomes presents a potential breakthrough for MFIs struggling with declining yields from their existing savings and loan portfolios. Not only do the expenditure savings reduce the risk of default, but savings can also make an enterprise more viable and let MFIs market new savings products to absorb savings as people use clean energy.

6.2 Addition of a new product line in a high-growth market segment

Increasingly, the clean energy sector is seen by MFIs as having the potential to be a “star” lending segment of the future. The declining cost of some basic clean energy technologies – such as more efficient biomass-fuelled cookers, LEDs and solar lanterns, which now cost less than $60 – makes them suitable for cross-selling to clients with general-purpose loans. An example would be top-up loans or additional energy loans. This makes such loans easy to roll out without significant upfront research or development costs, and with minimal orientation for loan officers. For bigger-ticket items such as home PV systems, biogas and solar-powered water pumps, which can cost $200 to $1,000, MFIs will require greater upfront investment to align clean energy systems with the needs of home income generation and micro-enterprise borrowers.

For clients who do not wish to bear the liability and risk of owning a clean energy system, cannot afford the upfront cost, or lack confidence in unfamiliar technology, MFIs can finance lease- or hire-purchase agreements or offer to finance the monthly fees of energy services. This is arranged through formal negotiated agreements with energy system suppliers and service providers, which usually retain ownership of the systems while MFIs provide financing to cover equipment rentals and fees for energy services. This type of financing is especially suited to MFIs existing lending models.

Clean energy financing therefore presents a strong value proposition to MFIs by adding a new product line with significant latent demand and high growth potential over the next 10 to15 years. Another attractive factor is this financing can be delivered cheaply by selling it with existing lending services, though some upfront investment is necessary for research, product development and negotiating agreements with energy system suppliers and service providers.

Text box 3

Client Protection

Enhanced access to finance should bring benefits, and not harm, to clients. MFIs can take a number of measures to maximise the benefits of energy financing and mitigate the risk of over-indebting clients. This includes careful designing and pricing of energy loans so that repayments are in line with what clients have been paying to use traditional energy. This is to ensure clients not only have the willingness, but also ability to pay for energy loans. MFIs should also provide clear, sufficient and timely information about the terms and conditions of the financing product to ensure clients make an informed financial decision. To prevent over-indebtedness, MFIs also need to have in place internal systems to closely monitor the quality of the energy portfolio. Moreover, MFIs and energy providers should educate prospective clients about the benefits and risks of purchasing the energy asset and establish client feedback/complaint mechanisms that are accessible and responsive.

Given the importance of responsible finance, all grantees are strongly encouraged to endorse the Client Protection Principles of the Smart Campaign*.

* The purpose of the Campaign, which is housed at the Center for Financial Inclusion, and the Principles is to ensure that providers of financial services to low-income populations take concrete steps to protect their clients from potentially harmful financial products and ensure that they are treated fairly.

6.3 Carbon markets as potential revenue streams

Carbon financing is a potential revenue stream to support micro-level clean energy projects, and can assist the project proponent, including energy service providers and MFIs, to access other types of financing. In some programmes, such as the distribution of energy efficient lamps or efficient cooking stoves, the revenue received from the sale of generated emission reductions may be the only source of revenues generated by the activity. In programmes where renewable energy is generated and sold to end-users, carbon revenues increase the activity's internal rate of return and serve as a catalyst for attracting investors. For example, UNDP has supported companies such as Manna Energy Limited to use carbon finance as a means to fund small-scale water treatment and energy systems for dozens of rural communities in Rwanda[23]. Similarly, MFIs such as XacBank in Mongolia have worked with MicroEnergy Credits (carbon aggregator) to use carbon finance to cross-subsidize client education to improve effective use of energy technologies that might otherwise not have been provided. This has also offered MFIs an opportunity to generate additional revenue streams.

As an example, prices for voluntary emission reductions vary from $1 to $10 per ton depending on contracts, with most estimated at around $7. Assuming a conservative estimate of $5 per ton and very conservative emission reductions of 0.5 tons per client, Table 2 presents a potential income stream that can be generated across a range of clients.

23 http://www.mannaenergy.com/projects-rwanda.php

Table 2: Potential revenue stream across numbers of customers

Number of clients	Annual carbon revenue
1,000	$2,500
10,000	$25,000
25,000	$62,500
50,000	$125,000
100,000	$250,000
1,000,000	$2,500,000

While these annual revenues are small compared with revenue from financial services, carbon revenues are renewable for up to 20 years in certain cases. A typical home PV system avoiding 0.5 tons of CO_2 per year has an operating life of 10 to 15 years. Assuming generously that the loan takes three years to repay and an MFI has sold 1,000 systems, the carbon trade could generate additional revenue of $250,000 to $375,000 over the life of the home PV system. This would depend on the number of partners involved and the nature of the contracts.

Programmes of Activities (PoAs) are an especially relevant carbon finance tools for small-scale clean energy systems. They facilitate large-scale emission reductions by bundling hundreds, thousands and even millions of individual, similar activities that, by themselves, are too small to apply the often costly carbon credit certification processes. PoAs are a recent facility under the Clean Development Mechanism of the Kyoto Protocol, the world's main carbon credit scheme. Other schemes, such as the Voluntary Carbon Standard and the Gold Standard, have adopted comparable facilities that allow for the bundling of emission reduction projects in which the location and characteristics are unknown when the programme is launched. PoAs can bring sustainable development to people and places that have barely benefited from carbon finance, particularly rural communities and poor households. Programmatic climate mitigation projects feature prominently on the agenda of international climate talks and are likely to continue to attract support, even as the Kyoto Protocol's first commitment period draws to an end.

Although PoAs and other types of carbon finance schemes can be powerful tools to leverage carbon finance for small-scale energy applications, they require specialized knowledge of carbon finance rules and regulations. They are often complicated to structure and manage, especially vis-a-vis relationships with MFIs and commercial banks. The CleanStart approach seeks to fill these knowledge gaps, providing support and incentives for the actors and agencies able to help MFIs form collaborative partnerships to explore their potential.

7. LOW-COST CLEAN ENERGY: CHANGING LIVES

The CleanStart approach, by removing financial and non financial barriers to energy access, seeks to break the vicious cycle of energy poverty in which more than 20 percent of the global population finds itself. Stepping out of energy poverty by adopting clean energy systems can bring four key benefits to low-income households and micro-enterprises: (i) reduced energy expenses; (ii) increased net incomes; (iii) reductions in household expenses, particularly for health care; and (iv) savings in time and effort.

7.1 Reduced household expenditures through fuel savings

Measured across countries, Base of the Pyramid[24] (BoP) households use nearly 10 percent of their expenditures on energy[25]. Approximately 80 percent of this expenditure is devoted to fuel for cooking and lighting, with firewood being the primary fuel for cooking and kerosene being the primary fuel for lighting in the poorest of BoP households across Asia and Africa. According to many studies, expenditures have been reduced by 20 to 50 percent through fuel wood savings by using improved cook stoves that are more efficient and less polluting, biogas plants and other clean energy applications[26]. In this way, reducing energy expenditures without foregoing access to energy can significantly

24 The BoP population segment is defined as those with annual incomes up to and including $3,000 per capita per year.

25 World Resources Institute and International Finance Corporation, *The Next 4 Billion: Market Size and Business Strategy at the Base of the Pyramid*, Washington D.C. 2007.

26 United Nations Development Programme, *Towards an 'Energy Plus' Approach for the Poor: A review of good practices and lessons learned from Asia and the Pacific,*. Bangkok, 2011.

improve household finances, creating disposable income. Additionally, technological advancements have also led to the development of dual-fuel stoves that can be fired with biomass or Liquefied Natural Gas (LNG) or other stoves that run on biofuel. This creates a level energy playing field in which households can reduce their energy bill as people switch fuels in response to price fluctuations.

Increasing access to electricity services reduces or eliminates expenditures for kerosene lighting, dry cell batteries for sound equipment, and car batteries for televisions. Small solar PV systems and solar lanterns are emerging as increasingly affordable and efficient options for household use with the continuing trend of a declining cost per kilowatt-hour of electricity generated. Such systems may be used for running lights, televisions and radios for a few hours every day, usually replacing kerosene, candles, dry cells and lead-acid batteries externally charged by diesel generators. In Bangladesh, monthly expenses on kerosene in electrified households were only $0.65, less than half of the $1.50 paid by households without electricity[27]. Multi-country case studies conducted by UNDP[28] found that the monetary gain from clean energy savings varied widely between countries and technologies but were nonetheless moderate to significant. Introducing home PV systems reduced expenditures on kerosene and dry cells by more than 30 percent in Bangladesh and 80 percent in Nepal.

By contrast, a study in Indonesia found that monthly instalments paid for home PV systems were much higher than the savings from reduced kerosene usage[29]. However, potential cost savings were found not to drive the spread of home PV systems. Rather, people were willing to pay for the vastly superior quality of lighting and elimination of fire hazards and toxic fumes.

7.2 Increased net revenues from existing income-generation in homes and micro-enterprises

Electricity favours the development of home enterprises, including the production of handicrafts, textiles, embroidery, garments, processed food and woodworking in Indonesia; and processed clove nuts, cigarettes, joysticks ('magic' candles for children's birthdays) and woven goods in Sri Lanka.[30] The most widespread use of energy for income generation is lighting, which extends working hours by allowing shops and businesses to stay open until late at night.

Clean energy technologies, in addition to electricity generation, can enhance productivity and improve livelihoods. In Sikkim, a state in northeast India, more than 150 cardamom growers have increased the value of their produce by drying it using biomass gasifiers. Cardamom dried in this way conserves its natural colour, contains 35 percent more oil and does not carry a burnt odour, as does cardamom dried using the traditional method. It fetches prices 10 to 20 percent higher in local trading centres. The technology makes the working atmosphere healthier while the more efficient combustion of fuel wood brings savings of 50 to 60 percent[31]. Low-cost gasifiers similar to those used in Sikkim can be used for other produce, including tobacco, ginger and cashews.


Photo : EandCo

7.3 Reduced health care expenses

Clean energy technologies, in particular non-combustion-based options, can offer benefits with respect to air pollution and related health concerns. Improving traditional biomass use can significantly reduce local

27 Ibid.

28 Ibid.

29 United Nations Development Programme, *Financing Options for Renewable Energy,* Bangkok, 2008.

30 Ibid.

31 Ibid.

and indoor air pollution (as well as greenhouse gas emissions, deforestation and forest degradation) and lower associated health impacts, particularly for women and children in developing countries. The 570 million households that continue to depend on traditional biomass are exposed to indoor air pollution that causes 35 percent higher mortality rate than in electrified houses. As this exposure is particularly high among women and children, who spend the most time near poorly ventilated stoves, females make up 59 percent of all deaths attributable to indoor air pollution. [32]. As infants are often carried on their mothers' backs or kept close to a warm indoor hearth, they spend many hours breathing indoor smoke during their first year of life. As a result, 56 percent of all deaths attributable to indoor air pollution are children less than 5 years old. According to a World Health Organization study in 2006, if half of the population cooking with solid fuels in 2005 switch to cooking on an improved stove by 2015, this would generate $65 million in health care savings.

7.4 Time savings and expanded alternative time investments

Introducing technologies such as biogas and improved cookers significantly reduces the time and toil spent collecting and processing fuel wood and cooking. Time saved from collecting fuel wood is 40–50 percent and can amount to four to eight hours per day.[33] This is particularly important for women and young girls, who are mostly responsible for collecting fuel wood and cooking. Many children, especially girls, do not attend primary school because they have to carry wood and water.

7.5 Intangible benefits

Other benefits of clean energy valued by low-income families are improved lighting for children's studies, power for room fans and information and communication technologies, and extended socializing that is no longer limited to daylight hours. The rapid acquisition of televisions, refrigerators and fans after electricity becomes available, indicate the preferences of the poor and the high value they placed on these intangible benefits. Anecdotal evidence exists of improved school enrolment. For example, among rural households in Nicaragua, 72 percent of children in a household with electricity attend school, compared with 50 percent of those in a household without electricity.

32 The Worldwatch Institute, Energy for Development: The Potential Role of Renewable Energy in Meeting the Millennium Development Goals.

33 Various researchers have reported average time savings of 0.16 hours from the use of improved cookers in India, up to three hours from the use of biogas plants in Nepal, and up to 3.5 hours from the use of biogas plants in Sri Lanka. Savings are especially high in fuel-scarce areas. If one adds to this the time saved from cooking and cleaning, total time savings brought about by the use of biogas plants can total six to seven hours per day.

8. SUSTAINABILITY AND LONG-TERM VISION

CleanStart has been designed as a market-based approach to expanding energy access for poor people. This is achieved through end-user financing for clean energy products, coupled with an energy value chain that responds to low-income households and micro-entrepreneurs' needs. The CleanStart approach ensures the sustainability of energy access by building:

(i) a regulatory environment based on policy makers who are more knowledgeable and able to respond to MFIs;

(ii) a stronger financial sector infrastructure offering products and services based on tried and tested financial products for energy services, as well as delivery systems and partnerships that meet the financial service needs of poor households and micro-entrepreneurs;

(iii) MFIs that are capable of generating sufficient income to sustain and grow their services, with additional funding mechanisms to support new MFI market leaders.

These three mutually reinforcing spheres of action lead to the sustainable market-based development of the clean energy sector, enabling MFIs to further sustain and grow their services while addressing the key development challenges of access to energy. Through access to end-user finance, low-income households and micro-entrepreneurs will break out of the vicious cycle of energy poverty and jump-start their access to modern energy and improve their livelihoods and lives.

The sustainable nature of the approach documented in this publication is captured in CleanStart's long-term vision: **to dramatically scale up energy financing for the poor, without subsidies, beyond the initial six developing countries in Asia and Africa** paving the way to strengthened economies; protected ecosystems and enhanced equity.

ANNEXES

ANNEX 1: LINKAGES BETWEEN ENERGY AND MDGS

MDGs	Energy Linkages
1. Eradicate extreme poverty and hunger	Energy inputs such as electricity and fuels are essential to generate jobs, industrial activities, transportation, commerce, micro-enterprises and agriculture outputs. Most staple foods must be processed, conserved, and cooked, requiring energy from various fuels.
2. Achieve universal primary education	To attract teachers to rural areas, electricity is needed for homes and schools. Study after dusk requires illumination. Many children, especially girls, do not attend primary schools because they have to carry wood and water to meet family subsistence needs.
3. Promote gender equality and empower women	Lack of access to modern fuels and electricity contributes to gender inequality. Women are responsible for most household cooking and water boiling activities. This takes time away from other productive activities as well as from educational and social participation. Access to modern fuels eases women's domestic burdens and allows them to pursue educational, economic and other opportunities.
4. Reduce child mortality	Diseases caused by unboiled water and respiratory illnesses caused by the effects of indoor air pollution from traditional fuels and stoves, directly contribute to infant and child diseases and mortality.
5. Improve maternal health	Women are disproportionately affected by indoor air pollution, and water or food-borne illnesses. Lack of electricity in health clinics, lack of illumination for nighttime childbirth and the daily drudgery and physical burden of fuel and water collection and transport, all contribute to poor maternal health conditions, especially in rural areas.
6. Combat HIV/AIDS, malaria and other diseases	Electricity for communication equipment, such as radios and televisions, can spread important public health information to combat deadly diseases. Health care facilities, doctors and nurses, all require electricity (for illumination, refrigeration, sterilization, etc.) to deliver effective health services.
7. Ensure environmental sustainability	Energy production, distribution and consumption have many adverse effects on the local, regional, and global environment. These effects include: indoor, local and regional air pollution; local airborne particulates; land degradation; acidification of land and water; and climate change. Cleaner energy systems are needed to address all of these effects and to contribute to environmental sustainability.
8. Develop a global partnership for development	The World Summit for Sustainable Development (WSSD) called for partnerships between public entities, development agencies, civil society and the private sector to support sustainable development, including the delivery of affordable, reliable and environmentally sustainable energy services.

ANNEX 2: SUMMARY OF TECHNOLOGY OPTIONS

Technical options	Experience worldwide	Commercial status and applications
Photovoltaic (PV) (from tens of watts to several kilowatts)	Extensive, 2,600 megawatt peak (MWp) installed globally by end of 2005; global production in 2004 was around 600 MWp, with growth in excess of 30 percent per year	Fully commercial, very wide range of applications including off-grid community uses and large grid-integrated systems Agricultural uses include water pumping, small-scale irrigation, lighting and low-power agricultural processing
Small, wind electric turbines [200 watts–50 kilowatt electric (kWe)]	Extensive, around 200,000 units worldwide	Commercial and evolving rapidly; well-suited to water pumping for small-scale irrigation, battery-charging applications for running lights and communications and for use in hybrid power systems for AC power generation
PV/wind small hybrids (50–500 watts)	Extensive use in Mongolia, especially by nomadic herdsmen	Commercial systems produced in China, the only large market for small hybrids
PV/diesel hybrids [20–500 kilowatt hours (kWh) per day]	Extensive, especially for telecommunications	Fully commercial and the preferred option for remote telecommunications; commercially evolving for village power and rural agricultural applications
Wind/diesel hybrids (20–2,000+ kWh per day)	Significant, not yet extensive	Commercial, often competitive and evolving; especially relevant to island communities; major programme initiated in Chile (Chiloe Islands) for wind/diesel mini-grids
Small modular bio-power (SMB) (10–100+ kWe)	Commercial prototype installations underway	Commercial prototypes in operation in United States of America and Philippines; first 12 kWe commercial prototype powered mini-grid in Aklan Province, Philippines; SMB system installed in 2003 is powering a coconut processing and products facility in Aklan
Bioenergy systems [0.5–20+ megawatts electric (MWe)]	Extensive, in wood and agro-processing industries worldwide, especially South-East Asia and most OECD countries	Commercial site-engineered systems, relevant only to the extent that sustainable sources of biomass residue are available locally
Micro-hydropower (0.1 kWe–1 MWe)	Extensive, good experience in many developing countries including China, India, Indonesia, Philippines and Nepal	Fully commercial; wide variations in design, performance, reliability and price; huge potential for economic power supply in Asian countries with intact watersheds
Multifunction platforms [1–0 horsepower (hp)]	UNDP pilot deployment (250 units) in Mali; to be expanded elsewhere in Africa	Small, engine-driven mobile "platforms" that use belt drive to couple generators, grinders, millers and other equipment to a rotating shaft driven by a small engine; diesel fuel and biofuels derived from local plants are being used; support women's groups in rural agriculture

Technical options	Experience worldwide	Commercial status and applications
Rice-hull gasification [10–100 kilowatt thermal (kWth)]	Hundreds of systems used in China and India to produce heat and, in some cases, electricity	Process heat is used for crop drying and fish drying and, in some applications, for refrigeration (via an absorption chiller)
Diesel generators (5 kWe to several MWe)	Extensive, worldwide	Fully commercial at sizes ranging from several kilowatts to tens of megawatts; with high-quality maintenance, diesel gensets can operate reliably for 20,000 hours or more; rural applications are usually for medium– to large-scale irrigation and for village mini-grids, especially for lighting, entertainment and information (television, radio)
Propane-driven gensets	Extensive international experience	Fully commercial
Cycle-charge diesel systems (battery/inverter added to diesel or propane-fired genset)	Used in remote power applications and for village power in some countries	Fully commercial; especially applicable when low-power daytime electricity is required for isolated, 24-hour-powered, community mini-grids; the systems serve as a "platform" for adding PV and wind electric components to reduce diesel or propane fuel use while maintaining full reliability

Application	System type	Temperature, daily heat delivery range
Cleaning, sanitation	Solar water heating (flat-plate units)	40–700C
Production of high-value fruits, spices, exotic house plants, among others	Greenhouses	Around 20–300C
Crop drying (coffee, tea, fruit)	Hot air systems such as solar "tents" and dryers, sometimes with electric fans for air movement; often combined with backup propane units for heat production	40–700C
Drying of beef, fruits and vegetables	Flat-plate air collectors	40–700C
Poultry processing	Solar hot water (flat-plate or concentrating systems for high-temperature water)	40–1000C
Poultry processing	Combustion of poultry litter as a source of both process heat and power generation to operate processing facilities	High temperature
Coffee drying and processing	Coffee husks used as fuel for biomass furnaces to provide heat for drying and processing	100–700 kWth
Rice-paddy drying	Rice-hull-fired dryer made by Pasig Agricultural and Industrial Supply Corporation of the Philippines; 230 kg per hour rice hulls dry 8,000 kg per hour of paddy	
Seaweed processing (cleaning, drying, chipping)	SMB units for production of electricity, shaft horsepower, and heat; rice-hull combustion/gasification systems for drying	

Application	Renewable energy systems	Typical peak
Water pumping	PV and wind electric water pumping are well-established commercial options	0.3–2+ kilowatts peak (kWp) (PV)
Irrigation, especially drip irrigation and micro-spray techniques, some-times incorporating fertilizer deliver	PV, wind electric submersible and floating pumps, micro-hydropower generation	1–3 kWp
Livestock watering	PV, wind electric submersible and floating pumps, electric or solar heating to prevent water freezing	0.5–1 kWp
Electric fencing for range manage-ment, gate opening	High-voltage, current-limited supply from PV, wind electric, with batteries, inverters, transformers	20–100 watts (50 watts/15 kilometres of fencing)
Farm lighting, including for security and safety of scattered buildings	PV/battery-system lighting, typically low-voltage DC, fluorescent lamps	50–500 watts
Forced ventilation in greenhouses, crop dryers (coffee, tea, sesame seeds)	PV-driven fans	0.1–1 kWp
Chicken egg incubation	PV [50–75 watts peak (Wp)] with insulated box and heating elements for hatching 60 eggs	50–75 Wp
Chicken-raising	PV for lights, ventilation	0.3–1.0 kWp
Lighting (poultry, livestock, fish,	UNDP pilot deployment (250 units) in Mali; to be expanded elsewhere in Africa	Small, engine-driven mobile "platforms" that use belt drive to couple generators, grinders, millers and other equipment to a rotating shaft driven by a small engine; diesel fuel and biofuels derived from local plants are being used; support women's groups in rural agriculture
Aeration for aquaculture (shrimp and fish farms)	PV, wind electric air pumps; 800 Wp, 500 amp-hours (Ah) battery, DC motor, paddle wheel for a 150-square-metre pond	0.2–1 kWp
Light for night fishing in Indonesia, Philippines per lantern	PV rechargeable fluorescent lanterns	10–20 watts
Pest control (moths) per lantern	PV lanterns with kerosene insect traps, electrical traps (Winrock International India)	10–20 watts
Refrigeration for veterinary applications	PV vaccine refrigeration	50–100 watts
Refrigeration (fruit and other crops, meats, fish, poultry, dairy products)	Wind or PV/fossil fuel hybrid-powered refrigeration units (compressor-driven)	0.5–10+ kWp

Application	Renewable energy systems	Typical peak
Decentralised, refrigerated, storage units for milk	Wind electric with double wall ice storage, or with fossil backup (experimental)	
Ice-making (flake ice for fishing)	PV/propane hybrid-powered ice maker demonstrated as commercial system in Mexico; wind electric ice makers are not developed for commercial use	2–10 kWp
Telecommunication (for example, to permit local fishermen to determine market prices and opportunities in major urban markets)	PV-powered cell phones, PV-powered satellite phone kiosks as operated by Grameen Shakti in Bangladesh	0.2–0.3 kWh
Radio and television information	PV– and PV/wind hybrid–powered radio and television sets to provide weather information to farmers and herdsmen and to owners of food shops	
Grinding of corn, wheat, and millet, and milling of grain, hulling rice paddy	PV/wind/hybrid-powered electric grinders and millers	0.5 kWe–several kWe
Reduction of post-harvest grain losses	PV-powered, ultrasound generator to keep rodents away from grain storage; vacuum packing	50–200 watts

Application	Renewable energy systems	Typical peak
Potable water supply	PV and wind electric water pumping and distribution, with filtration and disinfection (drip chlorination, mixed oxidant process, ultraviolet lights)	0.3–5 kWp (PV) 0.5–10+ kWp (wind)
Health clinics	PV/wind hybrid SMB for operating water pumping/filtration/pressurized distribution, lighting, ventilation; solar thermal water heating (propane backup); PV vaccine refrigerators	0.5–20 kWe
Water desalination	SMB or micro-hydropower systems can provide the power and energy requirements of desalination equipment.	
Internet server for telemedicine	PV with small genset as backup	0.3–0.5 kWp
Internet kiosks for Internet access, e-mail and computer services	PV with small genset as backup	0.2 kWp
Rural telephones (cellular systems)	PV, PV/wind hybrids, PV recharging of cellular telephone batteries is now starting to be a rural commercial activity	100 Watts peak (Wp)
Integrated community services (for example, Greenstar Foundation)	PV, wind, SMB, hybrids	> 1 kWp

Application	Renewable energy systems	Typical peak
Schools and training centres	PV/wind/genset hybrids or SMB or micro-hydropower for extended power (daytime into evening)	1–5 kWp
Community centres	PV/wind/genset hybrids or SMB or micro-hydropower for extended power (daytime into evening)	1–5 kWp
Churches and mosques	PV	1–5 kWp
Public lighting (roads, markets)	PV integrated street/public lighting	50 Wp–100 Wp

System type	Operating hours	Characteristics	kWh from RE (percent)	Cost of Service
Small gasoline and diesel gensets (0.5 kWe–5 kWe)	Evening only, 3–5 hours typically; not reliable	Individually owned gensets, sometimes with informal connections to one or several neighbouring houses; dangerous, unreliable, expensive and widely used	0	US$0.50–US$1.00 per lighting fixture per month
Cycle-charge diesel genset	Full-time system	Diesel genset runs several hours daily; battery/inverter subsystem permits full-time availability of AC power	0	US$0.40–US$0.60/kWh
PV systems (50–75 watts peak)	Full-time system availability	50-watt system provides < 200 kWh of DC electricity per day under ideal sunlight conditions	100	US$1.00–US$2.00/kWh
PV/wind hybrid with battery, inverter	Full-time system availability	50-100 watts of PV coupled with 100–300 watts small, wind electric generators for locations with good solar and wind resources.	100	US$0.50–US$1.00/kWh
SMB system	Full-time system availability	5 kWe (small amount of diesel or propane fuel may be required for start-up); suitable for schools, clinics, enterprises among others	95–100	US$0.25–US$0.50/kWh once routine, commercial production is underway

ANNEX 3: LIST OF BARRIERS TO SCALING UP ACCESS TO CLEAN ENERGY

Barrier	Description
1.Information barriers	
Knowledge gaps	Consumers, lenders, developers, utility companies and planners, both in developed and developing countries, often lack adequate information about clean technologies, how to assess them and how to implement them.
Reliability concern	Clean energy technologies might still suffer from bad press due to performance concerns associated with earlier technology generations or inexperienced service providers.
Lack of green champions	The lack of active promoters in favour of clean energy can be a drawback in some countries compared to fossil fuel-based industries which tend to have well organized lobbies.
Higher cost perception	Consumers often give greater weight to upfront costs compared to recurring costs. Even if an investment is cost-effective over a few years, the necessity to pay the initial investment costs may deter consumers.
2.Institutional barriers	
Limited capacity to formulate green policies and strategies	There may be limited capacity in assessing risks and opportunities, engaging stakeholders in defining a vision and articulate it into concrete policies and strategies.
Weak policy implementation and enforcement	Government may not be in a position to implement cross-sectoral policies and enforce existing standards. Limited administrative capacity may also delay issuance of sitting license for clean energy plants and deter investment.
3.Technical barriers	
Lack of technical skills	There may be a lack of technical skills to install, operate and maintain clean technologies.
Lack of certification facilities	There may be a lack of national standards and certified operators to guarantee the quality and safety of clean energy facilities and facilitate licensing/permitting processes.
4.Regulatory barriers	
Legacy energy policies/regulations	Historical regulatory structures and policies in both developed and developing countries often favour fossil fuels and nuclear power.
State monopolies and power purchase agreements	Where power utilities have a monopoly on electrical power production and distribution, independent power producers may not be able to sell power to the utility or to third parties through power purchase agreements.
Discriminatory grid policies	Some utilities may engage in discriminatory grid policies (higher prices for transmission access for clean energy and/or remotely located facilities, etc.)
Administrative barriers	Multiple restrictions on location and construction for clean energy technologies such as wind turbines due to concerns relating to noise, unsightliness, safety and wildlife; or protracted approval delays.

Barrier	Description
5.Financial Barriers	
Split incentives landlords/tenants	In the construction sector, for example, developers and builders are reluctant to pay for initial clean energy investment that they might not be able to recoup from tenants.
Higher risk management costs	Because of perceived higher technology risks and return uncertainty, risk management products (e.g. insurance, hedging products, etc.) are more expensive for clean energy technologies.
Subsidies for conventional fuels	The International Energy Agency has estimated that global annual subsidies for fossil fuels exceed US$500 billion and allow fossil and nuclear energy to be sold at artificially low prices.
Lower returns on investments	Returns on investment for clean energy projects can be lower or subject to higher uncertainty than those for more conventional energy projects.
Higher upfront costs	Clean energy technologies are often more expensive than conventional technologies and subject to longer payback periods. Available loan terms may be too short relative to the equipment or investment lifetime.
Transaction costs	Transaction costs per kW of capacity for clean energy technologies are often higher because of the smaller relative size of the projects. Bank regulations and investment policies, often designed for larger conventional energy projects, can be inadequate or unsuitable for smaller, more numerous, distributed clean energy projects.

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