Eco-Village Development as Climate Solution Proposals from South Asia

Second Edition: May 20, 2016

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Proposals from South Asia

Introduction

This publication highlights local solutions that improve livelihoods in villages and resilience to climate change, while also reducing environmental degradation and greenhouse gas emissions. It was produced by INFORSE, the International Network for Sustainable Energy, in cooperation with Climate Action Network South Asia (CANSA), Integrated Sustainable Energy and Ecological Development Association (INSEDA from India), INFORSE-South Asia, as well as with Grameen Shakti (Bangladesh), Centre for Rural Technology Nepal (CRT/N), Integrated Development Association (IDEA from Sri Lanka) and Women's Action for Development (WAFD from India).

Many people have contributed to this publication, and we thank them for their contributions.

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INFORSE-South Asia: http://www.inforse.org/asia/EVD.htm
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Summary

Despite a long period of growth and reduced poverty, South Asia is still home to a large portion of the global poor. For instance, 433 million people in the region have no access to electricity. In order to eradicate poverty and improve lives, economic growth is needed to provide essential public services such as infrastructure, education and health. While accelerated and sustainable development is the best route to a feasible climate change adaptation strategy, it has the potential to raise challenges in climate change mitigation through its traditional relationship with energy consumption. One related obstacle for the development is that the region is very dependent on imports of fossil fuel to meet its energy demand. This makes the national economies in the regions very vulnerable to frequent fossil fuel price fluctuations.

These challenges can be met by moderating the need for conventional energy needed for development. Energy efficiency and conservation, low-carbon electricity, and diversifying the energy mix in favour of renewables are identified as the 3 key pillars for all the countries in South Asia to achieve emission cutbacks. Increasing the share of renewable and sustainable energy such as micro-hydro, solar, wind, biogas and so on in the energy mix is central to securing the energy future of South Asia. On a local level these solutions can be combined with other sustainable development solutions in eco-village development (EVD) strategies. There has already been some success in implementing small scale, energy efficient, renewable energy technology solutions in all South Asian countries, successes that can be modified and implemented in other places as well. There are also barriers in the capacities to extend these RET solutions, regarding funding, in the national political frameworks for development, as well in as regional and international structures.

To achieve development with low emissions in South Asia requires favourable domestic policies and international cooperation to mobilise finance and technology. It also requires new forms of decentralized development that involves beneficiaries in developing more contextual solutions such as EVD solutions, in addition to the centralised solutions primarily promoted today.

The EVD involves the implementation of inexpensive, renewable energy technology and capacity building activities for climate change adaptation and mitigation in villages. It includes a collaborative approach with deep involvement of community members in the planning and implementation stages. EVD is an integrated approach of creating development-focused, low-carbon communities of practice in pre-existing villages. This bundle of practices include mitigation technologies like small household size biogas plants, smokeless stoves, solar energy technology (such as solar drying units), and adaptation technologies like improved, organic farming, roof-water harvesting and others. The concept aims at the use of solutions that are low-cost, pro-poor, replicable, income generating, climate resilient, and with low emissions, both of local pollutants and of greenhouse gases. The concept includes adapting solutions to local needs and circumstances while including a bottom-up, multi-stakeholder approach, gender mainstreaming and, technology transfers where appropriate.

To realise development with the EVD concept at the center, supportive policies are needed for implementing decentralised solutions. There also has to be focus on low-cost mitigation solutions like improved cook stoves. To realize this, governance needs to be smoother and more responsive to the changing climate situation than it is today. The policies also need to focus on local capacity building, combination of climate adaptation and mitigation and other co-benefits, and importantly, include gender mainstreaming. Funding should include a "small technologies fund", and be easily accessible for rural populations.

While many policy recommendations are similar throughout South Asia, there are national differences, for instance in particular in India is a need for simplifying funding structures and requirements, while in Nepal there is a need for certification of organic food to support alternative livelihoods.

Both on the South Asian regional level, and internationally, climate funding should support local solutions and there should be mechanisms for technology exchanges, to facilitate technology transfer. The coming climate agreements, the Green Climate Fund, and the UNFCCC Climate Technology Center and Network can play important roles, if they maintain a focus on local solutions.

In addition to policy recommendations, this publication also brings documentation from the villages in South Asia, showing examples of what the villagers want and of successes that are the basis of the Eco-village development concept in the region.

CHAPTER 1

Eco-Village Development in South Asia as Climate Solution

1.1 CONTEXT: POVERTY, DEVELOPMENT AND CLIMATE CHANGE

South Asia has experienced a long period of robust economic growth, with a growth rate of 7% for 2015 and projections of 7.4% growth for 2016 (World Bank, 2015). This strong growth has translated to some extent into declining poverty and impressive improvements in human development. According to the World Bank, the percentage of people living on less than $1.25 a day fell in South Asia from 61% to 36% between 1981 and 2008. The proportion of poor is now lower in South Asia than at any time since 1981.

Despite this, the South Asian region is home to many of the developing world's poor. For example, there are more people living in poverty in 8 Indian states than there are in the 26 poorest African countries (UNDP Human Development Report, 2010).

1.56 billion people in South Asia struggle for access to energy, sanitation, safe drinking water, nutrition, and health services (UNDP, 2014). Climate change makes the situation grimmer, since by the 2050s it could decrease the cultivation area of high-yielding wheat by 50% due to heat stress in the Indo-Gangetic plains. This can have severe effects on food-crop productivity by affecting the rice-growing regions of India and Bangladesh, which are also affected by inundation from rising sea-levels. The yields of maize and sorghum, grains commonly consumed by the poor, also could decrease by 16% and 11%, respectively. This could spell trouble for South Asian countries, which have a massive responsibility to eradicate multi-dimensional poverty and to safeguard extremely vulnerable populations from the catastrophic effects of climate change.

Fig 1.1 Poverty, development and climate change

1.2 ENERGY CHALLENGES IN SOUTH ASIA

Energy Access

Access to affordable energy is the key to lifting people out of poverty and to creating the necessary infrastructure to provide health care, education, sanitation, clean water, food security, and employment. With recent economic growth, the South Asian region also has witnessed rapid growth in energy consumption. Even so, 433 million people across the region have no access to electricity, with India alone accounting for 306 million (World Energy Outlook, 2013).

Energy Inefficiency, Insecurity and Fiscal Deficit

South Asia uses far more energy for every dollar of Gross Domestic Product (GDP) than any other region because of inefficient modes of production. Faced with rapidly rising energy demand, South Asia's inefficient energy system is characterized by energy that is imported, expensive, and environmentally unsustainable. It relies on coal, oil, unsustainable wood, and natural gas. Currently, there is extreme dependence on fossil fuels that are often imported and consume a high portion of the region's export earnings.

A few years ago, South Asia collectively had the highest inflation rate among the developing regions of the world. Due to cheaper oil, this has dropped recently to amongst the lowest inflation rates. This clear link between oil prices and inflation indicates the extent of the energy dependence of the region. The volatility in fossil-fuel prices also increases the fiscal deficit of the region, as these countries provide huge oil subsidies to consumers. The use of subsidies to make energy more affordable for the common people while also stemming inflationary forces (from generally increasing oil prices) adds to the expenses of the region's governments. This isn't an ideal situation as it creates an unfavourable imbalance between expenses and revenues for a country, adding to costs for state exchequers. For instance, energy subsidies cost Bangladesh USD $1.9 billion in 2013, while India spent over USD $20 billion in 2014.

Polluting Energy Sources

The prominence of carbon-intensive fossil fuels in our energy mix will continue unless there is a dramatic shift from the business as usual development. The ease of access to these fuels is a major obstacle to wider use of renewables. For example, coal is the most abundant fossil-fuel resource in South Asia, and India is the world's third-largest coal producer. These domestic reserves, coupled with relatively easy access to affordable imported coal, will keep coal as the fuel of choice in a business-as-usual scenario, which is disastrous for the environment. India's vast coal reserves tend to have a high ash content and a low calorific value. Thus, the current supply of coal is inefficient, and it generates more pollution. The low quality of much of its coal prevents India from being anything but a small exporter of coal (traditionally to the neighbouring countries of Bangladesh, Nepal and Bhutan) and conversely, is responsible for sizable imports, mainly from Australia, China, Indonesia, and South Africa.

On the basis of Purchasing Power Parity (PPP), South Asia energy intensity is lower than the world average, including the United States and China. Energy intensity is based on commercial fuels. These low numbers also reflect a high proportion of non-commercial energy, e.*g.,* traditional biomass, etc.

Fig 1.2 Potential for Biogas Energy

1.3 GHG EMISSIONS FROM ENERGY and ASSOCIATED THREATS

The largest contributor to man-made greenhouse gas (GHG) emissions are fossil-fuel combustion and industrial processes. The Intergovernmental Panel on Climate Change (IPCC), a globally recognised scientific authority on the issue, has concluded in its 5th Assessment Report (AR5, 2014) that global surface temperature change by the end of the 21st century is very likely to exceed 3°C, high above the sustainable level, which is well below 2'C. With 0.8^{0}C or more global average warming already occurring, rainfall and weather patterns have begun to change, leading to agricultural losses, cyclones and floods that are more intense as well as more frequent, and record-breaking temperatures, with 2015 ranking as the hottest year on record since record keeping began in 1880. The previous hottest year was 2014, and by many estimates 2016 will dethrone 2015,setting the stage for a worrying trend.

The IPCC recommends that all countries achieve net-zero emissions of GHG (CO_2 and other gases) between 2050 and 2070 in order to keep global warming below 2°C. Also known as carbon neutrality, net-zero emissions aim at removing as much carbon as is added into the atmosphere. This scenario requires a radical transformation in the energy mix of all. Currently, it is composed largely of fossil fuels, and it must shift towards a heavier reliance on renewables. In addition, must be carbon sinks such as forests. Without any mitigating action, GHG emissions are expected to almost double or even

triple by 2050 compared to 2010 and temperatures will rise to levels that will be very hard for human civilisation to tolerate. Thus, large-scale of economic and energy transformations are necessary in each country.

As a result of recent economic growth and increasing demand for energy, South Asia's GHG emissions are increasing annually, with India accounting for 75% of the region's emissions. The AR5 also lists South Asia as one of the regions in the world most vulnerable to adverse effects of climate change. The poor will suffer the most severe impacts.

Limiting the increase in global mean temperature to less than 2°C imposes tough constraints on cumulative global GHG emissions. We are all challenged going forward, to meet energy demand at affordable costs, to reduce the dependence on fossil-fuel, and reduce GHG emissions.
For energy importing regions like South Asia, a development strategy of using more indigenous, clean-energy resources and fewer imports can support stable development without the current economic problems associated with energy imports.
The only sustainable, long-term solution is an environmentally conscious pathway to adopt greener, low-carbon solutions.

1.4 NEED FOR LOW CARBON PATHWAY

South Asia needs to achieve economic growth rates between 8% to 10% per year for 2 to 3 decades to eradicate poverty, to provide employment to its growing population, and to improve the quality of life for its people. Economic growth is needed to provide essential public services such as infrastructure, education, and health services as well as to create opportunities for productive employment. Sustained growth coupled with a growing population and limited natural resources put immense stress on natural resources and on the environment. The major threat to the sustainability of South Asia's development arises from energy use, which also drives GHG-emissions.

These challenges can be met by increasing energy efficiency through innovations in technology and processes, as well as by increased use of renewable energy, resulting in lower emission increases and eventually, in emission reductions.

Fig 1.3 Solar Technology for Island Dwellers

1.5 SOLUTION FOR ALTERNATIVE CO-BENEFITS PATHWAY: PRO-POOR ECO-VILLAGE DEVELOPMENT

To achieve decarbonisation of the economy while ensuring development, policy makers in South Asia must pay attention to new pro-poor strategies. The benefits of moving to a low carbon energy future include sustainable and affordable energy for the rural poor, reduced imports of carbon-intensive fossil fuels, and greening of the global commons. The solution is to implement a comprehensive, development-oriented decarbonization strategy that is inexpensive, can accommodate local needs, promotes mitigation and adaptation, and is gender-inclusive.

Sustainable Energy Solutions and SAARC

Energy efficiency and conservation, low-carbon electricity, and switching fuel from hydrocarbons to renewables are identified as the 3 key pillars in any plan for all countries in South Asia to reduce GHG emissions. Increasing the share of renewable and sustainable energy such as micro-hydro, solar, wind, biogas, sustainable bio-fuels, and tidal is central for energy security in the region. Locally, these solutions can be combined with other sustainable solutions in eco-village development. In addition to the domestic efforts of South Asian countries, regional collaborative strategies and its follow-up by the South Asian Association for Regional Cooperation (SAARC) are keys to achieving eco-village development in the region with benefits for climate.

Successful implementations of small-scale, energy-efficient Renewable Energy Technology (RET) solutions in various South Asian countries can be modified and replicated across the region. For instance, Integrated Development Association (IDEA) in Sri Lanka has demonstrated improved cook stoves for more efficient, leading to reduced biomass use. This technology was transferred to community-based organizations (CBOs) for further dissemination. In Nepal, the Centre for Rural Technology (CRT/N) has promoted and implemented micro-hydro systems with the direct involvement of beneficiary communities, through the formation of a consumer society. In India, Integrated Sustainable Energy and Ecological Development Association (INSEDA) designed and built various household and small industrial biogas plants of several capacities and building materials. Flexible modifications allow this technology to be used elsewhere in the world.

1.6 CHALLENGES TO PRO-POOR ECO-VILLAGE DEVELOPMENT

Efforts in pro-poor eco-village development (EVD) have been either demonstration-based or project-scale interventions rather than programmatic and policy approaches. Accordingly, the barriers faced by these efforts are characteristic to developing countries:

- Lack of awareness of climate change and of its impacts amongst the general population
- Low levels of technical expertise in villages new to EVD-related activities.
- Inadequate climate financing available, including from developed countries
- Government policies that benefit fossil fuels over renewable energy
- Insufficient intra-regional clean-energy cooperation and trade in solutions in South Asia
- Low transparency and accountability in regulatory processes.
- Low public participation in development proposals.

These obstacles hinder investment in and development of pro-poor EVD. It is estimated that South Asia will require over USD $6 trillion for new energy infrastructure by 2030, using the existing centralised approach for energy supply and use. Globally, private-sector financing funds most of the low-carbon development, and is also a potential source of funding for South Asian countries.

Recognising limited budgetary resources and competing demands to meet the basic needs of the people, the Paris Climate Agreement of 2015 include climate finance of USD $100 billion per year from 2020 through the Green Climate Fund (GCF) and other climate finance channels. This funding must be in addition to official development aid (ODA) and other existing funding if it is to cover the targeted needs. Implementation at this funding level has been hard to come by with only $10.2 billion pledged thus far for 4 years for the GCF starting in 2015. While the modalities and instruments of climate financing are still being debated, it is important to start implementing those low-carbon, clean technologies that are less expensive. Options include solar powered devices, Improved Cookstoves (ICS), biogas, improved water mills for electrification, and inexpensive micro-irrigation.

Innovative finance is needed also to overcome budgetary constraints preventing clean-energy adoption. For instance, In Sri Lanka, the Renewable Energy for Rural Economic Development (RERED) programme incentivized the adoption of solar, wind, and micro-hydro power in rural households, while simultaneously making provisions for easier loan terms to finance them. Important supplementary finance mechanisms include microfinance schemes like those implemented in Bangladesh and India by Grameen Shakti and Women's Action For Development (WAFD), as well as NGO mediation in securing bank loans for beneficiaries as done by CRT/N (Centre For Rural Technology, Nepal) in Nepal. . However, more generous financial commitments from the rest of the world are vital to realising a well-below 2'C or 1.5 degree scenario.

Meeting ambitious renewable energy targets requires favourable domestic policies and international cooperation to mobilise finance and technology. It also requires new forms of development involving the users in realising more decentralised solutions such as eco-village development solutions, in addition to the centralised solutions primarily promoted today.

CHAPTER 2

Eco-Village Development

A Low-Carbon, Equitable, Scalable, Pro-Poor, Low-Cost Model of Development

The Eco-Village Development (EVD) concept was conceived a decade ago in India as a novel and integrated approach to achieving low-cost, low-carbon development for rural populations. It is now promoted and further developed by organisations in four countries (Bangladesh, Nepal, Sri Lanka, and India) in South Asia.

2.1 THE CONCEPT

The Eco-Village Development concept involves the implementation at village-level of appropriate, inexpensive renewable-energy technology (RET) and capacity-building activities for climate-change adaptation and mitigation. It takes a collaborative approach by involving community members deeply in planning and implementation, while also giving them the tools to be resilient while facing climate change. EVD is an integrated approach of creating development-focused, low-carbon communities of practice in existing villages. The bundle of practices includes mitigation technologies like small, household-sized biogas plants, smokeless stoves, solar-energy technology, improved water mills to generate electric power, stand-alone systems like pico-/micro-hydro power for rural electrification, and solar-powered drying units. It also includes adaptation technologies such as organic farming, roof-water harvesting, water-lifting technologies like hydraulic ram pumps, and other solutions.

Fig 2.1 Smokeless Stoves and Organic Gardening in the Eco-Village Development Project

The rationale for choosing villages as the focal point of this model is that they are home not only to some of the poorest people in the South Asian region, but also to the majority of the population. Furthermore, some of these people are also the most vulnerable to climate-mediated risks due to a combination of geographical location with endemic economic, informational, and social deprivation. Usually left at the fringes of national and sub-regional governmental policy making, villages are ill equipped to cope with the rapidly evolving but little understood impacts of climate change on their land and livelihoods. Village communities also are ideal for illustrating the concept of contextually

appropriate, small-scale innovations in adaptation and mitigation. International and national policies have raised their attention on emission reductions, but the village population presently has a very low *per capita* rate of emissions and, thus, focusing on mitigation of existing emissions alone is not ideal for them. Planning for a low-carbon future is more vital. Adaptation has gained increasing importance in the wake of permanently altered ecosystems and climate cycles in the region.

2.2 THE IMPORTANCE

An Important Solution for Achieving Low Carbon and Inclusive Development

We have had over 15 years of experience with EVD technologies. We have accrued a compilation of comprehensively documented evidence supporting this concept, based on our practical experience in developing eco-villages, first in India, and now in Bangladesh, Nepal, and Sri Lanka as well. These projects result in proven, effective green development solutions with extensive socio-economic co-benefits. Their benefits are as follows:

Real-World Application and Validation: By selecting existing villages and rural settlements rather than building experimental settlements on new sites, the EVD concept's real-world feasibility can be proven. EVD-project villages have contributed valuable insights and feedback during interactions with community members. This bottom-up approach to problem-solving honors the cultural practices and traditions of the communities, contributing to acceptance by the community members. Community members have proven to be more eager to implement technologies after seeing them in action. When the larger potential is considered, the South Asian region, with its millions of small, medium, and big villages, has immense potential for village-to-village diffusion of the concept. Once any village-level intervention has been implemented and tested successfully, it can serve as a training–cum-demonstration unit that other villages can emulate and adapt to their own needs. This diffusion of technology can be supported by external agents, like national and state governments, NGOs, agricultural and rural universities, financial institutions (especially the Development Banks), and perhaps even private-sector organizations as part of their Corporate Social Responsibility (CSR) commitments.

Low Cost: Financing for climate-change actions is very scarce, and it is essential to optimize available resources. To do this, wherever possible, unconventional, low-cost building materials have been used, such as bamboo instead of bricks. Innovations in processes and designs also have helped to lower costs.

Replicability: This EVD model and its bundle of technologies have been replicated successfully in diverse cultures and geographies. They have, with appropriate variations, succeeded in coastal areas near the Bay of Bengal, in deserts and plains in Rajasthan, and in the Himalayan mountain ranges. By allowing flexibility and eschewing a one-size-fits-all approach, this model adapts inherently, and can succeed in other parts of the world as well.

Income Generation: The EVD model confers valuable economic benefits through various offering. It includes training, mostly aimed at women) in building some of the components for the renewable energy technologies. EVD also provides free professional training sessions in organic farming, beekeeping, food preservation, packaging, and marketing.

Adaptation and Reduced Migration: In some ecologically fragile landscapes such as mountainous regions, livelihoods are extremely sensitive to climate variances. Therefore, employment-based migration has been a common adaptation strategy in the mountains of Nepal and India. By integrating income generation into the programme, some of the pressure of employment-based migration is reduced. EVD also supplies other commonly needed adaptation solutions, such as water-harvesting techniques and construction of greenhouses in which to grow vegetables and herbs in climate-controlled environments.

Mitigation: Installations of Renewable Energy Technologies (RETs) such as solar, wind, and biogas energy technologies have replaced conventional energy sources that have higher carbon emissions. Despite the low *per capita* emissions of villagers, mitigation of emissions is an important part of the strategy, including reduction of future emissions with renewable solutions to cover the growing energy demands that accompany development.

Health: An additional drawback of traditional energy use for cooking, whether the fuel is biomass or coal, is the heavy smoke generated by conventional cooking and energy fuels, which exposes women and children to unhealthy and toxic fumes. Local solutions such as biogas and improved cook-stoves drastically reduce respiratory problems from cooking, both in households and in small businesses.

Contextual Innovation of Low-Carbon Technologies According to The Needs of The People: The concept takes into consideration the geographical landscape, the requirements of the people, and resource endowments, in order to design technologies that are customized to the requirements of the setting. For instance, very small one-cubic-meter and two-cubic-meter biogas plants that can be installed in households with fewer cattle or smaller livestock. Very low-cost bamboo-based solar dryers can be constructed, enabling poor people to use the technology.

Gender Mainstreaming: Women are disproportionately affected by climate change, adding to their drudgery. Therefore, as key stakeholders, it is women who have been treated as the target beneficiaries. It is they who have been involved in a deeply consultative process. Women are also the focus of most income-generation training activities for this reason.

Self-help groups are organized for the women and girls of the community so that they can have a safe place in which to share their concerns and their needs in relation to the environment. These groups perform a supportive role and have been pivotal tools of empowerment for women who otherwise are conditioned culturally to remain silent.

Bottom-up, Decentralized Approach: Conventional policy making is a very centralized, top-down activity that often is disconnected from realities on the ground. Actively engaging with end-users

through community meetings, workshops, and other grassroots practices has allowed us to address and to articulate some of the climate-related challenges faced by village residents.

Technology Transfers and Capacity-Building: EVD emphasizes self-help and ownership through technology transfer. Too often, aid projects hand out technology without providing beneficiaries with training in maintenance and repair. With EVD, technicians are embedded within the communities, and they go on to train interested people in the use, up-keep, and repair of the solutions provided. This procedure has been followed with biogas plants, roof rainwater harvesting, greenhouses, and solar dryer technologies.

Enhanced Energy Access: The target communities often live in remote settlements and small villages that are off the grid or that suffer the effects of inadequate energy infrastructure. Providing access to alternative energy improves the quality of life of them significantly.

Multi-stakeholder Partnerships: Design and implementation of the projects has been done through a network of grassroots practitioners, technical experts, academic institutes, non-government organizations, and end-users. Local governmental representatives also have been involved in the consultative process. This has led to a much more rounded approach to problem-solving and a large corpus of traditional, epistemic, technical, and policy-related knowledge that can be used to implement EVD effectively in other, different villages.

2.3 FOCUS ON LOCAL ORGANISATION

The key to success for any development project is the active participation of local communities, sub-communities, and rural households.

Fig 2.3 Active participation of villagers in project development

To facilitate this broad-based participation, community members are organized into support groups. These groups and communities are trained and provided with skill updates (refresher courses and training) from time to time. Through this mechanism, they can be involved more actively in development activities meant for their benefit. It also instils in them a sense of ownership of the technology, reducing the probability that they will lose interest and abandon it.

2.4 THE SOLUTIONS - RENEWABLE ENERGY TECHNOLOGIES

Cooking Devices

Household Biogas Plants: Biogas is a source of renewable fuel that can be used for cooking and household lighting while also providing clean organic manure in the form of biogas slurry. Under the EVD programme, plants as small as one cubic meter are being constructed. Experimental designs have been used that allow these plants to take less space, an important requirement in mountainous regions. Typically, at least three or four cows are needed to fuel the operation of a regular-sized biogas plant, which produces about two cubic meters of gas daily. However, with the smallest plants of one cubic meter, two cows are enough to feed the plants based on the requirement of 25 kilos of manure a day. The by-product from biogas is very useful in agriculture as an organic fertilizer. The bio-slurry consists of ingredients that are very rich in nitrogen content; therefore, bio-slurry is good source of nutrients for plants. Biogas is very popular in the South Asian region, especially in Nepal and India. Small household-sized biogas plants also have been able to earn carbon credits.

Improved Cookstoves (ICSs): These stoves burn firewood more efficiently, cutting the amount of firewood needed for operation. They also keep the kitchen smoke free, an important measure for preventing respiratory illnesses in women and children. Several models are available, made of burned clay, metal, or a combination of the two materials.

The 2-pot Anagi stove is a very successful model of ICS. The dissemination and commercialization of the Anagi ICS in Sri Lanka, under the Improved Cookstove Programme (ICSP), has been one of the largest-scale successful interventions in South Asia in terms of sustainability. Training has been provided for potters, which has contributed to the successful commercialization of the stove. It is fully commercialized now, with over 300,000 stoves being produced annually and marketed throughout the country through private distributors. According to studies, it is estimated that emission reductions of 111-260 Kg CO_2 per year per person can be achieved with the "Anagi" stoves.

Portable Improved Cook Stove: Portable metal ICSs are gaining popularity gradually in South Asia, especially in the aftermath of the earthquake in Nepal in April, 2015. These cookstoves have health benefits, they reduce firewood consumption, and they lower GHG emissions. They can be of great value to commercial households in South Asia that run small businesses such as tea shops. In addition, they are ideal for rural households that do not have separate kitchens.

Improved Large-Scale Biomass Stoves for Rural Household Industries: Immense potential exists in Sri Lanka for improving combustion in large-scale cooking and in rural household industries. Most of the rural household industries involved in food processing use inefficient conventional stoves and practices, which consume large quantities of firewood at a high cost. With the introduction of efficient large-scale biomass stoves, firewood consumption is reduced significantly, cutting the cost and the emissions at the same time, while helping to strengthen and sustain rural industries and livelihoods.

Electricity

Solar Lights: Solar-cell-(PV)-powered homes in non-grid-connected areas are a staple solution for increasing energy access for the poor. The price of solar PV systems has dropped substantially in recent years. In addition to solar home systems, smaller solar lanterns are available. In Nepal, one-Watt lanterns, locally known as “solar-tukis”, are used widely. Shared charging stations for lamps and mobile phones are an effective means of sharing a solar cell panel for those who cannot afford a solar PV home system.

Improved Water Mill: This technology helps generate off-grid electricity for mountainous countries like Nepal, where there are plenty of water resources and there is a tradition of constructing water mills due to the geography of the region. The technology uses the energy of falling water, kinetic energy, which it converts first to mechanical, and then to electrical, energy. It is a valuable source of power for domestic use as well as for energy-using micro-enterprises.

Hydraulic Ram Pump: The Hydraulic Ram Pump (Hydram) is a simple and innovative technology that uses the pressure created by a head of water to drive some of the water upwards using the kinetic energy of water. Use of Hydrams contributes towards rural livelihoods and improves hygiene by providing water to the communities for micro-irrigation-integrated agro-practices and sanitation. Hydrams have been used to generate employment with comprehensive capacity-building training allowing the technology to be manufactured locally, and providing further employment through the production of hydram accessories and spare parts.

Agriculture and Food Production

Organic Farming and Kitchen Gardening: Organic farming using organic manure or biogas slurry improves the quality of the soil. It also improves the quality, nutritive value, and taste of the food grown, thus making a direct positive impact on the health of the growers. By providing a source of chemical-free, nutritious food, it enhances the health of the family. Excess produce can also be sold for a good price locally, proving to be a valuable source of income.

Organic Compost-Making Baskets: These compost baskets are made out of loosely woven bamboo. They work with natural decomposition processes to convert cow dung along with other agriculture waste and organic material into high-quality organic compost in three months. One basket provides enough compost for use on 250 square meters of land, enough for a good-sized kitchen garden.

Rooftop rainwater harvesting: Rainwater from roof catchments can be channelled into storage tanks and this can be used for household activities as well as for kitchen gardening. If filters are used, this water can also be used for drinking.

4.

Domestic Solar Dryer: Low-cost, bamboo-framed solar dryers can be used to dry excess produce hygienically for use in the off-season time. These dryers prevent wastage and spoilage of foods. Importantly, drying also adds value to the produce, which then can be sold in the market. Many users of this technology have been able to supplement their regular income through the sale of solar-dried produce. Several other models of dryers are available as well, and these are made with either wood or metal. Bamboo also has been used in India to build lighter, more inexpensive versions of solar dryers, bringing down construction costs significantly.

8.

Greenhouse: Traditional greenhouses can be expensive to construct and the materials aren't always easy to procure in remote areas. Therefore, the design being adopted for the EVD programme is a low-cost model that is constructed out of a bamboo or wooden frame and ultraviolet-stabilized plastic. These closed structures help grow vegetables, herbs, or flowers in off-season times. They also protect plants from being ravaged by animals, birds, and other plant eaters.

Beyond Implementation

The EVD solutions do not end with implementation of mitigation and adaptation technologies and practices. They include important capacity-building activities such as training the beneficiaries in the use and maintenance of the technologies, giving them follow-up training sessions and technical advice, creating support groups, and giving them assistance in livelihood-generating activities. EVD is a comprehensive, forward-looking, socially responsible, pro-poor, low-cost answer to the complex challenge of climate change.

CHAPTER 3

Actions Needed to Build Sustainable Villages on a Large Scale

Eco-village development (EVD) of existing villages was conceived as a means to achieve climate-resilient, low-cost, socio-economic progress for the rural poor. In a world in which economic deprivation severely limits climate-change mitigation and adaptation options, EVD offers innovative solutions. Grassroots practitioners are implementing many EVD solutions on the ground, but gaps in policies, institutional practices, and other provisions can prevent them from succeeding fully. If these concerns are addressed, local climate actions can become more effective. The recommendations presented in this chapter are based on the experiences of grassroots practitioners from India, Nepal, Bangladesh and Sri Lanka.

3.1 THE ROADMAP FOR POLICY MAKERS

1. Shift to a scalable, low-cost, low-carbon, pro-poor model of climate mitigation and adaptation that also supports sustainable development.
2. Combine traditional knowledge, scientific research, and grassroots practitioners' experiences for more effective mitigation and adaptation.
3. Tailor low-carbon solutions to each situation, geographic location, and needs of the intended beneficiaries.
4. Involve stakeholders, especially end users, more deeply and comprehensively in the processes of design, implementation, and oversight.
5. Implement demonstration-based, replicable low-carbon development strategies that are easy to tailor to specific requirements.
6. Advocate for decentralized environmental solutions and employ a grassroots approach supporting development activities in rural, remote, and hard-to-access settlements, where centralized interventions are insufficient or expensive.
7. Promote innovative financing mechanisms and access to financial resources, especially in rural areas.
8. Champion the mainstreaming of gender-related concerns in all stages of climate-action strategies.
9. Educate stakeholders about the impacts of climate change and about coping strategies through training sessions and workshops.

Fig 3.1 Villagers meeting and roadmap planning for policy makers

3.2 RECOMMENDATIONS FOR THE SOUTH ASIAN REGION:

The first step to implementing effective climate-related interventions is to ensure that the national governance and institutions are robust and capable of implementing plans effectively. Recommendations listed below would lay strong foundations supporting such interventions.

Governance, Institutions and Administration

i) Environmental changes are being experienced intensely and understanding of the problems and solutions required is evolving rapidly. Climate-related governance needs to be much smoother and more responsive, as well as quicker to adapt to the realities of our changing world. As such, fast-tracking the necessary climate-related legislation is a key to success, so the relevant governance mechanisms should operate under an independent, streamlined system.

ii) There is a general scarcity of information about all the governmental assistance programmes for green technologies. Economically disadvantaged target beneficiaries often are unaware of funds for which they are eligible. Resource-poor groups and individuals need to be able to learn of these potential sources of help in time to avail themselves of them. For this purpose, they require timely, accessible, egalitarian access of information in clear, usable formats that will serve them well in their inquiries and proposals. Funds should be allocated for civil-society organizations working in the target areas so that they can train and assist target beneficiaries in accessing adaptation and mitigation funds.

iii) At the policy level, there should be more emphasis on low-cost mitigation solutions like organic farming, improved cook-stoves, household-level water management, household solar solutions, and biogas technology, which have a range of co-benefits that include cleaner manure, waste management, and biomass energy production. Considering the high energy-to-output ratio in these countries, energy-efficiency technologies that reduce carbon emissions and use fewer resources should be given more support.

iv) More emphasis should be placed on community-based adaptation activities. South Asia is a region with a large number of climate-vulnerable and at-risk populations that are already facing the effects of climate change. Therefore, resilience-building activities should be conducted to help communities adapt to the effects of climate change. Training topics should include livelihood training, sustainable agricultural techniques, renewable-energy technologies, and water management.

v) Emphasis should be placed on local innovations that are more suited to adaptation over a range of geographical landscapes.

vi) Considering the paucity of climate finance, there should be support for low-cost, grassroots-oriented demonstration-based projects for green technology. Such projects, such as the EVD programme, do not require too much initial investment and allow for flexibility in choosing which technologies are appropriate in a given context.

Other Recommendations

A single-window approach should be implemented by the state and central governments to channel all grants and subsidies for mitigation technologies. Separate schemes and implementation requirements that vary from state to state can be confusing for potential beneficiaries. This is especially true for India. Even for central governmental schemes, such as the National Biogas and Manure Management Programme, there are differences in the levels of subsidies between different states. This kind of diffused approach also makes it harder for a single organization to monitor the efficacy of such schemes.

In India, at the central government and state levels, there should be one designated portal, an agency that would coordinate or facilitate implementation between all levels of government. Information about this portal agency should be freely available at easily accessible locations including in the villages.

In Nepal, climate-, environment- and energy-related programs often are undertaken by different ministries. The lack of coordination produces redundant actions within the overall climate initiative. The different ministries have common interests in protecting the environment, raising standards of living, and furthering sustainable development. They would be helped greatly in these missions by the presence of a single window through which the fund is channeled, with regular monitoring activities and reporting of the results to all concerned stakeholders and ministries.

In Sri Lanka, most of the rural development programmes have had elements of low-carbon solutions in their implementation agendas. However, climate-change adaptation and mitigation have not been identified prominently or emphasized in these rural programmes. Climate-change adaptation and mitigation must be highlighted in rural development programmes to educate and sensitize communities.

Multi-Stakeholder Processes

1. Civil-society organizations, members of beneficiary communities, epistemic communities, and official representatives should be a part of decision-making processes to frame climate policies and to delineate budgets. Broad-based participation is a critical part of effective planning processes. Unfortunately, this only happens to a very limited extent, and end-users generally are not represented in the consultative processes.
2. A grassroots approach should be taken to planning and implementation, also to the lowest level of administration and decisionmaking. For instance, in India, NGO practitioners have found that state officials at the block level are often unaware of policies that are implemented at the state level.
3. The communities and grassroots organizations could engage in community-level research and development, performing assessments of needs and vulnerability for programmes.
4. Monitoring, Reporting and Verification (MRV) of governmental programmes should be transparent, with accountability towards all stakeholders. Programme assessments should be shared with members of the civil society and the public.

Other Recommendations

- There should be periodic meetings and workshops to elicit reviews and feedback about potential needs for mid-course correction of programmes. NGOs at the grassroots as well as at national, state, district, and block levels should participate in these exercises, as should financial institutions such as the National Bank for Agriculture and Rural Development (NABARD).
- National reviews should be held annually. Statewide reviews should occur every six months, and block-level reviews should be held each month. Such frequent reviews will allow for nimble, expeditious course correction if needed, as well as ensure that funds are used for their intended purpose. Funding should be allocated for participation in these review meetings. The private sector should be included as well, particularly those industries that support Corporate Social Responsibility (CSR) objectives.
- In Sri Lanka, at the grassroots level, representatives from civil-society- and community organizations can take part in the national working group and climate-adaptation cells that are recognized and coordinated by the government. This can include local, national, and international NGOs active at the grassroots level, bringing community perspectives into the process. Civil-society members can also engage actively in climate-related processes at the Civil Society Organizations' Forum, which is a platform for coordination among such organizations.

Capacity-Building

1. Current state-led renewable-energy (RE) technology programmes which feature technology hand-outs or subsidies alone are ineffective. Beneficiaries need preparation and continuing support for success. Thus, it is essential to arrange comprehensive training sessions on the use and maintenance of RE technology, including refreshers and follow-up support, for the beneficiaries.
2. Documentation of resources for climate adaptation and mitigation should be done in the local languages and made easily accessible.
3. Technology infrastructure, especially that which provides access to the internet, should be strengthened. Access to information is vital for community members seeking to learn about and to live with climate-change risks, dangers, and solutions.
4. Demonstrations of solutions need to be organized. Training alone does not always suffice. Exchange- or demonstration visits are needed for the communities at which specific programmes are aimed. Opportunities to see feasible, proven solutions in action and to ask questions will motivate target communities to embrace these technologies more readily and, especially important for the long term, learn how to use them.

Other Recommendations

In Nepal, villagers generally have to travel far from home for a week or more just to attend capacity-building activities. Those who look after livestock have difficulty leaving their residence for so long. To reach more of each community, each ward of the Village Development Committee should have a designated common building for the community, one that has the facilities to accommodate capacity-building training sessions within the community's area.

Adopting Solutions with Co-benefits

Present governmental funding for climate-change mitigation and adaptation needs to be applied more meaningfully and productively. A comprehensive strategy requires programmes that are linked more strongly to sustainable development and to climate goals as stated in the INDCs.

Other Recommendations

Existing state welfare or development programmes should be tied to the achievement of national climate-related goals. One example of such a programme that should be tied to climate-related goals is the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in India, which has a very comprehensive nationwide reach.

Gender Mainstreaming

1. Assistance for climate-related schemes for women should be fast-tracked. This is especially vital for women in rural areas, who require much more support to avail themselves of schemes aimed at helping them and who are affected disproportionately by climate change. Socio-economic constraints and cultural taboos make it even more challenging for women to approach authority figures or to obtain the information that they require.
2. Officials need to be educated concerning and sensitized to gender-related socio-economic issues. They also need to be trained in correct behaviour appropriate to assisting women who are, or may become, programme beneficiaries. In addition, increasing the numbers of women on staff as officers to work with women would encourage potential beneficiaries to approach officials with greater confidence.
3. Capacity-building training for women provides knowledge, a key to empowering them. For example, providing income-generation training along with any low-carbon technology adoption not only secures the livelihoods of women who receive it, but also supports more successful adoption of the same solution by others.
4. There should be national versions of the "Environment and Gender" Index of the kind introduced in COP-19. They would provide a publicly available index that would allow Civil Society Organizations (CSOs) to evaluate the progress of governments in mainstreaming gender-related issues into climate policies.

5. Financing schemes that are women-friendly are vital to expediting large-scale implementation of local mitigation technologies. Women are the primary users of the proposed household technologies that can reduce their hardship and drudgery as well as contribute to mitigation of climate-change effects. Also, as the primary caretakers of the house and children, women are key household decisionmakers. Given access to money and information, they can adopt these mitigation technologies, which will benefit their entire families.

Other Recommendations

In some developing countries like Nepal, there is a trend of male migration into the Middle East or East Asia in search of jobs. As a result, the male-to-female ratio is decreasing. Most of the rural villages are now largely inhabited by women and children, so the process of disseminating loans by financial institutions to improve access to EVD solutions needs to be modified in keeping with the needs of women. For instance, single women who intend to start up business ventures associated with EVD solutions or renewable-energy technologies (RETs) can be provided loans that do not require collateral, or if any group of women wants to start new ventures, they could be provided a loan on the basis of group guarantees. Similar criteria can be used in cases of floating subsidy amounts on various RETs and EVD solutions.

Financing

1. Funds should be designated specifically for the support of local, green, grassroots innovations.
2. A "Small-Technologies Fund" should be set up for RETs that have low set-up costs and that are ideal for rural settings. Such action fits within the purview of the Clean Technology Fund.
3. Governments should draft regulations that encourage private sources to advance green funding. Diversified sources of private institutional investments in the forms of equity sharing, market-rate loans, concessional loans, and carbon funds drawn from tax levies or from "cap and trade" schemes can be used to finance climate actions.
4. Easy financing should be introduced for rural populations. Rural populations generally lack access to financial institutions. Without access to financing mechanisms, even motivated farmers or potential eco-entrepreneurs abandon their ventures. In such circumstances, the concept of micro-financing with innovative financing model must be introduced in the community to increase access to sustainable solutions, allowing residents to develop their villages. Some micro-financing for renewable energy is used successfully in South Asia for this purpose, but the practice must be expanded to all areas of need.
5. The financing protocols that are being used by banks in urban areas should be different from those used for rural areas. Moreover, policies should be formulated in such a way that collateral is not required for poor people living in villages. Villagers often need to walk very long distances to access financing institutions; therefore, the process of sanctioning loans should be fast and hassle-free. There should also be rural offices for such institutions. Banks, too, should have a sense of social responsibility to make investments in rural areas. Although the local Micro-Finance Institutes (MFIs) are present in some rural areas, their interest rates are usually higher than those charged by banks.

6. There should be reforms in subsidy disbursement to improve the results of RET projects. There should be a cautious application of direct subsidies on RETs, contingent on their proper use by the beneficiary. This accountability will instill a sense of ownership amongst beneficiaries.

Other Recommendations

Two subsidy-related reforms for financing RETs need to be enacted. The first is the introduction of subsidies in the interest rate of loans taken to implement RETs. This way the initial interest rate can be reduced, bringing costs down and thus, encouraging the poor to invest in such technologies. Secondly, a gradual trend needs to be developed wherein provision of a subsidy is contingent on satisfaction of certain conditions. Only after the successful installation and implementation of the solution should the end-user be provided with the allocated investment subsidy amount. The role of civil societies will be vital in this case, as they will be the ones responsible for monitoring and evaluating the cases as well as for recommending the type and amount of subsidy required for each case.

Income Generation

1) The livelihoods of a large portion of the population of South Asia are dependent on agricultural or agro-industrial activities. Support for climate-resilient activities is important, as is support for sustainable agricultural methods like organic farming and other low-carbon solutions.
2) Training in income-generation activities should be provided especially wherever economic migration is large. Grassroots NGOs that organise or provide income-generation training on climate-resilient and low-carbon solutions should be supported in their efforts through financial assistance as well as through linkages with colleges and universities to enrich the quality of their trainings.

Other Recommendations

1. Certification is required to encourage organic farming. Organic farming products do not have a separate market or the provision of certification from a recognized national authority. As a result, the organic produce has to compete with "conventionally grown" agro-products, to which chemical fertilizer has been applied. The latter often are cheaper than organic products. A separate market has to be created for organic produce. These products should bear a tag indicating that they are organic and identifying the certifying authority. Monitoring agencies at the local level are needed to ensure quality standards of organic produce. If there is a system to endorse the farmer's produce as meeting organic standards, farmers can be guaranteed a good price for their produce. This will motivate them further to discard chemical fertilizers and to shift their attention to organic farming.

2. Providing training in income-generation activities will not ensure increases in income -generation capacity. Allied trainings should teach marketing strategies, pricing, and packaging along with income-generation training. There have been instances in which the trainees have passed training modules with flying colors but still were unable to make a living out of the skills that they had learned. Marketing technique and an understanding of market access must be integrated with income-generation training.

Private Sector Involvement

i) The private sector could become a key ally in support of climate-sensitive actions. Climate-change mitigation activities can be integrated into their Corporate Social Responsibility (CSR) mandates. It is important to foster more links between CSR programmes and grassroot NGOs. Private companies with CSR programmes should be encouraged to diversify into energy-related programmes. They can support EVD either by funding or by providing training in capacity development; they can supply tools, technology, and training for skill development and income generation.

ii) The private sector needs to be convinced to diversify its investments into green investment portfolios, including portfolios of socially responsible, rural-based low-carbon technologies. The South Asian region offers a rich matrix of climate-mitigation investment opportunities that can support EVD with appropriate products and services. Opportunities for socially valuable business activities are manifold with the large-scale dissemination of EVD.

Regional Cooperation

I. Because the availability of appropriate technology is critical to climate-change mitigation and adaptation solutions, a technology exchange bank or mechanism for South Asian countries should be established in which local, low-cost technologies are documented comprehensively, along with their use cases. This compilation should serve as a library of information about RETs and other EVD solutions. Member countries from South Asia should be able to access the designs and specifications of these technologies either freely or through a license (subsidized) or membership fee, depending on costs and complexity.

II. There should be a system for sending trained practitioners and technicians to implement RETs for interested countries. This would allow low-cost mitigation and adaptation technologies to be developed and shared easily, resulting in a more effective climate strategy for South Asia.

III. If a joint South Asian Climate Fund is established, it can serve as an important pooled source of climate funds for the region, supporting activities within each country, as proposed in the present document. Money for this could come from official development-assistance funds, considering the link between climate change and natural catastrophes, and from innovative climate-related funding sources. These regional measures are to supplement, not to replace, international mechanisms such as the Green Climate Fund (GCF).

3.3 INTERNATIONAL RECOMMENDATIONS

Importance of International Cooperation

While national and sub-national development programmes must address policy issues to succeed in promoting development with local solutions, international cooperation is also vital to the large-scale success of EVD in South Asia.

The countries must themselves provide the national frameworks to bring their village population out of poverty with programmes as EVD. International assistance, however, must be supportive. It must be open to the local solutions and public participation that are key to implementing the EVD concept. The need for international assistance to succeed with climate mitigation and adaptation is expressed in the INDCs of the South Asian countries.

International funding should emphasize low-cost mitigation solutions that also contribute to development, gender balance, food security, *etc.*, such as biogas technology and improved cookstoves. For instance, it must contribute part of the up-front costs of EVD solutions, which are higher in many cases than those of less sustainable alternatives.

International financial support should complement national funding, should help to keep local support transparent, and should fit into the "single window" approach that we propose for national funding.

Climate-related funding can provide some of the resources for EVD and other local solutions that have low greenhouse-gas emissions. These local solutions should be a priority in the climate financing specified in the Paris agreement and in the decisions on short-term actions that were agreed at COP21. They also should be included in existing international development assistance. Funding specifications must ensure, however, that this financing is not given at the expense of official development assistance as well as that the terms and conditions associated with financial assistance do not contravene the interests of the beneficiary countries.

In the short term, we propose:

- That South Asian countries include EVD solutions in their project requests to the GCF.
- That other climate funding, whether bilateral, multilateral, or via the Global Environment Fund (GEF), *etc.*, give priority to EVD solutions.
- That regional and multilateral financial institutions prioritize climate funding, including EVD, in the follow-up to the COP21 agreements.
- That a 'Leapfrog Fund' be established with global mitigation financing to support development towards low-carbon economies, with the focus on EVD solutions.

The UNFCCC climate-technology mechanism also should facilitate the exchange of knowledge, experience, and technologies in support of EVD. Dissemination must include solutions from the North as well from the South, and should support possible improvements, adaptations, and optimisations of technologies and solutions to fit specific national or local conditions. Assistance provided through the UNFCCC climate-technology mechanism also should include quality control, as international quality standards can lead to better satisfaction for users and long lifetimes for solutions.

Whenever EVD solutions are applicable, the South Asian countries should include them in their requests for technology transfer. The same applies to the coming technology innovation and development opportunities within the purview of the UNFCCC technology mechanism and its Climate Technology Center and Network (CTCN). With the implementation of the Paris agreement they shall in the future also deal with innovation and technical development, in addition to transfer of technology.

CHAPTER 4

What Villagers Want

A bottom-up approach to solving problems requires actively engaging with and listening to the actual beneficiaries to understand their most urgent needs and problems. Our partners spoke directly to villagers in their respective regions, gaining feedback and a better understanding of their priorities. In Chapter Four, we present brief summaries of individual villagers' experiences and their statements of need. These cases and the projects involved are discussed more broadly in the context of Chapter Five.

4.1 INDIA

- ***Income Generation; Women's Empowerment***

Fig 4.1.1 Bimla with her solar dryer

Bimla said:
"I want to learn an income generating skill so that I can earn money for myself and my family. I would also like to have the confidence to help my community with the knowledge that I gain."

Bimla, a shy fifty-year-old woman, lives in a village in Uttarakhand in the sub-Himalayan region in India. She and her family have earned a sparse living from the proceeds of her husband's shop.

Solution: WAFD and INSEDA built a low-cost bamboo-based solar dryer so that Bimla could preserve what she grew in her kitchen garden. She was also taught value-addition techniques like pickling produce, making preserves from flowers and fruits, and making chutney. She was trained in packaging so that she could sell her produce at a higher rate and earn some money. She reports that her sense of self-worth has increased and that her prestige in the community has risen. By getting involved in the self-help groups, she started to be seen as a leader within the group and as a role model. She also motivates women in five other villages in which WAFD is active.

In their projects, WAFD and INSEDA provide free technical assistance. They also pay part of the cost of installing the technology for the beneficiaries. Millions of women in rural India can benefit from low-cost solar dryers to preserve food that otherwise is lost to spoilage, and in the same time generate new income.

- ***Food Security***

Community Members said: *"We want to learn modern and organic methods of farming so that we don't lose our crops to drought and infestations while also growing healthy food free of chemicals. In the next two to five years we dream of the entire village practicing organic farming."*

Fig 4.1.2 Community dialogue in India

The villagers of Ban ki Dhani are subsistence farmers in the Indian state of Rajasthan. They have experienced large periods of drought, with devastating effects on agricultural productivity. The climate is changing faster than people can cope with it, and traditional farming practices have yielded few results.

Solution: INSEDA trained farmers in this community how to use biogas slurry with organic farming techniques. The farmers learned sustainable modern agricultural methods to increase the productivity of their lands.

Over four million biogas plants have been installed in India. The technology has proven to be a valuable source of energy as well as manure for farming and gardening. Enough potential remains to accommodate eight million additional household-size plants.

Roof-runoff rainwater-harvesting tanks have been demonstrated to show the villagers how to save and use rainwater. Further, at the request of the villagers, WAFD also will also train them in preserving and in adding value to their harvest so that it is not lost to spoilage.

4.2 BANGLADESH

- ***Energy Access***

Mohammad Zoiful is one of the millions of climate refugees fleeing destructive climate anomalies in Bangladesh. Driven from his home, Zoiful is living in an off-the-grid colony for displaced people, with limited access to reliable energy or potable water.

Fig 4.2.1 Mohammad Zoiful

Ibrahim Mia said:

"I want safe access to light so that my daughter can study in peace."

Solution: Solution: With Grameen Shakti's help, Mohammad Zoiful installed a solar home system that provides his family with enough electricity to run a few lights and to charge his phone. Sometimes it is also enough to run a fan. Zoiful and his family no longer have to live in darkness.

Grameen Shakti alone has distributed more than one million solar home systems in Bangladesh in off-grid areas. They also have provided the users with credits to pay for the systems.

Safe Energy Access

Ibrahim Mia is a farmer who lives in the small village of Khowamuri.
Even though this village lies a mere 35 kilometres away from Dhaka, Bangladesh's capital city, the village is not connected to the grid. This forces the inhabitants to rely on non-renewable fuels such as kerosene for energy and light.

Fig 4.2.2 Ibrahim Mia and his wife

Mohammad Zoiful said:

"I want access to a reliable source of energy."

EVD Solution: In a settlement with little infrastructure and no grid-connected electricity, Ibrahim's only source of light at night came from conventional kerosene-fuelled lamps. These lamps pose a serious safety hazard, with fires breaking out quite often from their use. Installing solar lights on the roof of his home have freed Ibrahim Mia from reliance on kerosene lamps. He and his family now have a secure and reliable source of light that allows his daughter to study by at night as well.

4.3 NEPAL

Livelihood Training

- ***Parvati Dahal is one of the 8 Million Who Were Affected by Nepal's Earthquake of April 29 in 2015***

Fig 4.3.1 Parvati Dahal

Parvati Dahal said:

"I want our environment to be conserved but I also want environmentally sustainable methods of income generation and livelihoods training to be given to our youth so that they stop leaving home in search of jobs."

She is a village elder residing in the Chyamrangbesi Village Development Committee (VDC). She represents a growing number of rural inhabitants with an increasing awareness of the social and economic havoc that environmental degradation can cause.

EVD Solution: Various EVD solutions including micro-irrigation tools, solar water pumps, improved water mills, and hydraulic ram pumps are available to make tremendous improvements in villagers' agrarian livelihoods. In a country that employs 75 per cent of its population in agriculture and allied sectors, there is vast potential for implementing such technologies in support of agricultural productivity. CRT-Nepal has been giving vocational training to the youth of the area in organic farming and above-mentioned technologies

- ***Renewable Energy Technology for Women Empowerment***

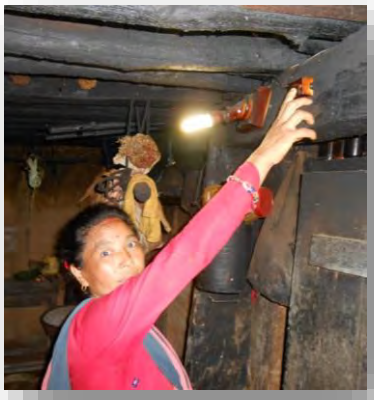

Fig 4.3.2 Indra Kumari switching the light on.

Indra Kumari Gurmachhan said:

"Renewable - energy technologies or any ***other technologies that are brought to enhance*** *the rural livelihood should be able to instil a sense of empowerment among women and must be able to provide income-generating opportunities for women."*

Mrs. Indra Kumari Gurmachhan is deputy chairman of Improved Water Mill Electrification (IWME), a management committee located in Dahar-8, Ranichuri VDC, Sindhuli. When she remembers days when she had to live in darkness, she feels she is very lucky to see proper lighting available within her lifetime.

Solution: An IWME project has helped many families to save money that otherwise would have been spent on batteries and kerosene to operate radios and torchlights. In earlier days, the women of the family had only the hours of daylight to prepare meals. Now that they have access to electricity *via* improved water mills, they can work in the kitchen for longer periods of time, spare some time to chat with their family members, and play with their children. IWME has helped to improve the lifestyle of women in the beneficiary population, and has freed them from having to spend household funds on traditional sources of energy. It also has enabled them to become involved in additional income-generating activities.

4.4 SRI LANKA

- ***Decrease Energy Intensity and Lower Costs***

Solution: IDEA in Sri Lanka has installed more efficient industrial stoves for household industry use. The new stoves require significantly less wood for cooking than do traditional stoves.

In fact, the consumption of firewood has been reduced by as much as 50 per cent in some household industries.

The wood collected from Rajapakse's backyard is enough to fuel the more efficient stove, so the family no longer needs to buy wood.

Fig 4.4.1 Rajapakse

Rajapakse said:

"I want to cut down the consumption of wood for cooking for my milk toffee making business. Our traditional stove requires a lot of wood, which is expensive to buy and tedious for me and my wife to gather."

Rajapakse and his wife can cook food as well as make toffees for his business a lot faster with the new stoves, which also produce less smoke than the older technology did.

Improved industrial cook stoves can aid thousands of small household industries, making their workspaces less smoky and reducing the need to buy fuel wood.

- ***Energy Efficiency and Technology Transfer***

Dharmaratne is a small-scale brick producer in the Anuradhapura district in Sri Lanka. He works alone in his little workshop, producing thousands of bricks using a temporary brick kiln

Solution: IDEA taught Dharmaratne the use of biomass waste as an input for his brick manufacturing.

It also contributed an improved design for a more efficient, low-polluting brick kiln that has better heat circulation.

Fig 4.4.2 Dharmaratne

Dharmaratne said:

"I want a less polluting, time saving solution for manufacturing bricks. I also want to prevent wastage (broken bricks) in the process."

The improved kiln uses both firewood and rice husk as fuels. This has helped reduce the amount of pollution caused from conventional methods of brick production while also lowering the consumption of firewood. Importantly, for Dharmaratne, the process now takes less time and reduces the number of bricks that break in the firing by about 15 per cent.

There is immense potential for replacing conventional materials with bio-waste for many small and medium-scale industries in Sri Lanka.

4.5 SOUTH ASIA

- ***Efficient Cookstoves with Chimneys***

Fig 4.5. Cooking on 3-stone

Women cooking in the smoky kitchen say:

"We want smoke-free kitchens and stoves that need less fuelwood."

*M*any villages in South Asia use the traditional three-stone cooking method, often in smoke-filled kitchens without chimneys.

Smoke in the kitchen causes diseases including infections in the lungs and eyes. In many areas, the increasing shortage of available fuel-wood means that people must either spend more time collecting fuel wood or use more money to buy it.

Gathering fuel wood and cooking generally are considered to be women's work, so the fuelwood and the smoke affect mainly women. Harvesting more and more fuelwood in the nearby areas also causes more desertification.

EVD solution: Fuel-efficient cookstoves often with chimney and/or the use of biogas for cooking can alleviate these problems. Several models of improved cooking stoves are available.

CRT in Nepal, IDEA in Sri Lanka, and Grameen Shakti in Bangladesh have been disseminating improved cookstoves for more than a decade. INSEDA in India, Grameen Shakti, and CRT also have biogas-dissemination programs.

CHAPTER 5

Local Success Stories

Local success stories from our four EVD project countries have highlighted the many benefits of this approach to low-carbon development. As is demonstrated by these representative beneficiaries, EVD has delivered more than just low-carbon solutions. These solutions and practices have had profoundly positive impacts on the lives of the people, including providing new access to critical inputs for sustenance and opportunities to achieve a higher standard of living.

5.1 BANGLADESH

Solar Powered Clustered Houses at Kuakata costal area

With its shallow continental shelf, high population density, tropical monsoon climate, strong southerly warm-season winds, and high tidal range, Bangladesh is already prone to grave damage in its frequent exposure to floods, and cyclones. Evidence is growing, however, that climate change will exacerbate these dangers, increasing storm intensities as the seas warm and exposing more of the land to ever-rising ocean waters.

This combination of factors is projected to lead to a large-scale loss of life and of livelihoods, creating a new category of displaced populations known as climate refugees. In addition to cyclones, coastal erosion, land subsidence, flash floods, and saline water intrusions are common natural calamities in the coastal belt alongside of The Bay of Bengal.

Cyclone Sidr, one of the worst natural disasters, hit Bangladesh's coastal belt on November 15, 2007, leading to about 4,000 deaths and hundreds of injuries. Many houses became enmeshed in the soil through the force of the cyclone. The coastal districts of Patuakhali and Barguna were severely affected. Many people lost their homes and migrated to other districts.

Mohammad Zoiful and his family were amongst those affected. He now lives in one of the 80 houses in OrkaPalli , a settlement near the coastal embankment of Kuakata Beach in the Patuakhali District, about 320 kilometers south of Dhaka, the capital city of Bangladesh. Known locally as the "The Daughter of the Sea", Kuakata Beach is famous for its views of sunrises and sunsets. Homes were constructed there by the Government of Bangladesh in 2008 in the aftermath of Cyclone Sidr. They now house families from different parts of the country, primarily victims of recent cyclone disasters. Zoiful, his wife, and his three children live in a two-bedroom house in the settlement.

Fig 5.1.1 Mohammad Zoiful and his family with installed solar-powered light.

Like many others in the area, Zoiful is a fisherman by profession. He goes far out to sea in his boat to catch deep-water fish, then sells them in the market, making a very modest income between 2000

to 4000 Bangladeshi Taka per month. The Fisheries Division imposes some restrictions on fishing during the breeding period of Bangladesh's national fish, the Hilsa. This regulation increases Zoiful's income insecurity.

The settlement is not connected to the grid, adding to Zoiful's woes. Five years ago, however, Grameen Shakti installed Solar Home Systems (SHSs) for his and others' families. Zoiful acquired a 20-Wp SHS on an installment-payment plan. His home is now one of 60 households in the village that have installed SHSs. The local Prayer Hall Mosque and the Satellite Health Clinic are also connected to solar power. With the solar home system, Zoiful can switch on 2 tube lights and charge his mobile phone. He can also run a fan.

More importantly, his children too can study by solar-powered rather than kerosene-fuelled light. Earlier, studying at night was difficult and in addition kerosene lamps are a potential cause of fires. In addition, Zoiful's wife can cook more easily for her family at night.

Zoiful shares his observations of how difficult it was to gather essential items when he and his family were fleeing from their home during the night of the cyclone. He couldn't find many of their important possessions by the weak light of the kerosene lamp. Now, it is easy to gather all essentials quickly by the illumination of solar-powered lights during cyclone alerts. Preparing for potential disasters has become easier for people in the area because of SHSs. Residents also are better informed about the weather forecast because they have solar-powered televisions and radios as well.

Families in the village receive further critical services through the work of other NGOs. For instance, the NGO-run Shangjog Satellite Clinic provides necessary health services. All of the families cook their meals in improved cooking stoves, which are more efficient than traditional cookstoves. The new stoves also keep kitchens smoke-free, because each one has a built-in chimney. Interestingly, water-borne diseases that are common in other coastal areas have decreased in this locality. This new settlement is serving as a model site for the introduction of sustainable practices.

Extreme weather events such as Cyclone Sidr have wrought massive damage to the regular livelihoods of these families, transforming them into climate refugees. At least the Solar Home Systems have brought light into their homes, making daily life easier.

Solar Powered Khowamuri Village in Manikganj District

Once the sun sets, areas surrounding the off-grid village Khowamuri grow dark. In the village, though, many houses shine in the night like little beacons of light, through the power of solar energy. Household solar systems have given villagers access to light at night even though their village is not connected to the electricity grid.

Khowamuri is situated in the Singair Sub-district of Manikganj District of Bangladesh, a mere 35 Kilometers away from Dhaka. In a population of about 50 households, most villagers have to burn kerosene, an inexpensive fossil fuel, to satisfy their daily energy needs.

Fig 5.1.2 Ibrahim Mia and his wife

34-Year-old Ibrahim Mia is a farmer living in the village. He grows paddy, wheat, banana, and other crops in the fertile land surrounding his house. In 2014, Grameen Shakti installed a Solar Home System (SHS) of 20 Wp in his house. Ibrahim's family now can use three LED lights, which are energy-efficient and environmentally friendly.

… Ibrahim's family, like the others, formerly used kerosene fuel every day for *kupis* and lanterns. This practice consumed between 5-6 litres of kerosene each month and exposed the family to harmful levels of smoke in the house. Ibrahim explained how the burning of kerosene also covered the tin roof of his house in a thick film of soot. Several other households also had fires break out because of the kerosene lamps. These problems now are all in the past for Ibrahim, since solar energy is a safe, inexpensive, and clean source of energy.

What is more important for Ibrahim is that his daughter now studies by solar light after dark. His wife can sew clothes under the bright light of the LED lamps. Ibrahim reported that, with electrification, he too has been able to make use of his spare hours during the night to do household work as well as that related to farm activities, such as making and repairing netting.

Solar-powered lights have been installed in his yard and cattle-house to enhance security. Now that he can charge his mobile phone through a solar-powered outlet, Ibrahim can contact the central market to sell his agricultural produce at competitive rates. His wife, Rupali, can contact her parents through the mobile phone to let them know that she is safe.

Solar energy even supports new social opportunities for the villagers. Ibrahim's family does not have television, but many of their neighbours invite them over to watch popular Bangla films or the latest news bulletins.

Having televisions has now helped to inform many of the villagers of what is happening in the country as well as in the rest of the world.

Like most of the families in the Khowamuri village, Ibrahim's family drinks pure water from a tube-well. Fortunately, access to pure drinking water has been established in the Singair area.

However, health concerns regarding arsenic pollution as well as high iron content have been major issues in the area. Therefore, most of the villagers now use traditional sand-aggregate filtration systems in mud-made water pots. This removes some of the iron from the water.

The village Khowamuri is now well along the path of sustainable and environment friendly development.

Fig 5.1.3 Rupali sewing in solar-powered light at night

5.2 INDIA

Mukesh and his Greenhouse

Mukesh Bahuguna is a man with a distinguished lineage. He is the grandson of Ganga Prasad, a veteran Gandhian freedom fighter, and of Savitridevi, a grassroots environmental activist who played an important role in stopping the indiscriminate felling of trees when the Hill Campus of the Pant Nagar University was being constructed. Taking inspiration from the Chipko tree-hugging movement, the women in Ranichauri tied rakhis on the trees, a symbol of the bond of love between brothers and sisters. They declared, "these are our brothers. If you cut these trees you are killing our brothers."

Fig 5.2.1 Mukesh and his green house

In the state of Uttarakhand, which witnesses mass migrations of youth and men in search of easier livelihoods, Mukesh is an outlier. Like many other young people in the villages around Ranichauri, Mukesh, who completed his graduation degree in 2005, could have chosen to leave home in search of rosier employment opportunities in the plains below. But he opted to stay back, determined to make his living in the mountains.

Mukesh had seen a few greenhouses in operation with the owners earning really good from growing and selling different types of vegetables. Importantly, in the shelter of the greenhouses, the plants didn't need to suffer from sporadic rainfall or temperamental weather.

Inspired by these growers, Mukesh decided to build a greenhouse in which to grow vegetables. He travelled to many places to learn more about the technology but returned disappointed on hearing how expensive building them would be. He approached the state horticulture department, as he had heard that there was a subsidy of 75% for greenhouses. But here, too, he was disappointed, as the conditions of financial assistance were difficult, and he did not meet the stipulated requirements of landholding size, water resources, and funds.

Discouraged, he returned home, taking up part-time jobs. In 2011, he started working as a volunteer with the Eco Village Development project in Ranichauri. There, he discussed his desire to have a low-cost solar greenhouse built. INSEDA was intrigued by his request and started working on a design, experimenting with low-cost materials and alternative construction methods to plan a greenhouse for him. By the end of 2012, a greenhouse measuring 3 meters x 5 meters had been constructed on his small plot of land.

Excited, Mukesh got to work on it. In 2013, he bought two kilos of seeds of *malta*, a citrus fruit, to sow in the greenhouse. The saplings were ready for sale in nine months. He sold those for Rs. 10 per plant and earned Rs. 32,730 at the end of the first year. After that experiment, he decided to grow some mustard greens. These were ready for harvesting after one and a half months. He was able to

grow seventy kilos of the mustard greens, which he sold at Rs.10 per kilo, thus earning Rs. 700 more from this. These mustard greens were more tender and tasted much better than those grown by conventional means, which meant that there was high demand for them and they sold out instantly. Thus, in 2013, Mukesh was able to earn a total of Rs.33,430.

Thus encouraged, he became more ambitious, and thought of preparing apple saplings. Apple trees were in demand and could be sold at three times the price? of malta saplings. He bought apple seeds from Himachal Pradesh at quite a high price. He thought that the apple plants would go for at least Rs. 35 each. Unfortunately, the apple seeds did not germinate at all, and he could not get any plants. The year 2014, therefore, was a loss for Mukesh.

Early in January of 2015, Mukesh again planted *malta* seeds, which would be ready to sell by the end of the year. He hoped to earn at least Rs. 20000 from the sale of these.

Pleased with the success of the greenhouse, Mukesh requested that another unit be built for him. So, this time WAFD and INSEDA made another experimental greenhouse for him in April, 2015, using bamboo for the structure. He hopes to grow vegetables in this greenhouse to earn a better income.

He estimates that once he starts growing vegetables in the second greenhouse he should be able to earn at least between Rs. 50,000 to 60,000 per year.

Mukesh is very happy today because investing in the greenhouse paid off for him. The cost of the first greenhouse was Rs. 35,000, to which he contributed Rs. 5,000 and some of his own labour during construction. INSEDA and WAFD paid for the rest. He recovered his portion of the cost of the greenhouse within the first year itself and even earned a profit. For Mukesh, the return was high, as he had spent only Rs. 5,000 and the rest of the cost had been borne by the project. A decade on, Mukesh is finally realizing his dream.

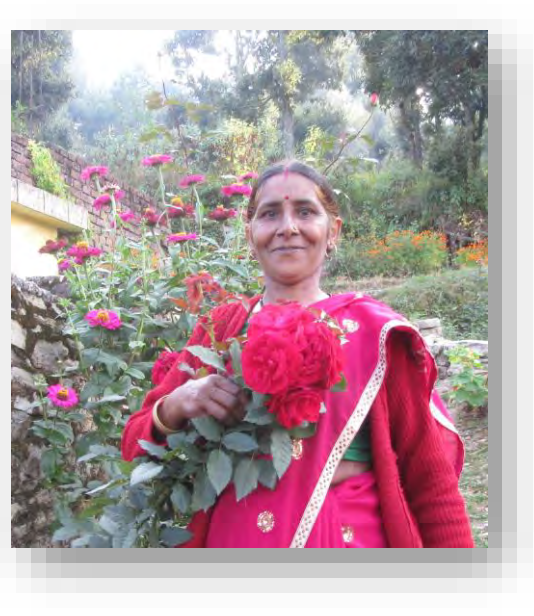

Fig 5.2.2 Bimla with flowers for juice making

Bimla and her solar dryer

Bimla is fifty-five years old and lives in the village of Jagdhar, in the Chamba block of the Himalayan state of Uttarakand. Her husband owns a small shop selling daily necessities. The earnings from this shop were barely enough to meet their household expenses. About ten years ago, Bimla was able to grow enough wheat, millet, and beans to last them for the year, which, along with the modest earnings from their shop, were enough to sustain them. But over the last few years, climate-mediated changes in rainfall and temperature have made it harder to grow crops. Bimla and tens of thousands of subsistence growers like her have found their livelihoods and quality of life severely impacted by climate change.

Changes have been made in land-use patterns to support a growing population and to cope with falling productivity. Forest cover has been reduced to make way for infrastructural development, and agro-ecological zones have shifted to accommodate permanent changes in weather. All of these factors have created unexpected problems for people like Bimla.

The local people tell us that monkeys, wild boars, and birds such as parrots have started to encroach in regular village settlements in large numbers. Regular wildlife habitats and sources of food are disappearing because of direct human intervention or from food-chain losses due to increasing temperatures. Wild animals cause major crop depredation. They consume wild berries and fruit that form a traditional part of the diets of villagers.

When we met Bimla, she was in the habit of collecting and sun-drying wild apricots as well as greens such as the stems of the colocasia plant, a traditional food among the villagers. While these foods dried in the open sun, she had to watch them closely to ensure that the monkeys did not spoil them or eat them, while also protecting them from sudden showers, dust, and flies. Thus, drying foods limited her ability to do other tasks during the drying time. In 2011, to solve this problem, WAFD and INSEDA designed a very inexpensive solar dryer for domestic use. The device was made of wood and covered with a poly sheet. It cost only Rs. 1,500.

She was very happy with the outcome. Not only did the dryer work much faster, the colour and taste of the produce also improved substantially. Most importantly, it freed her up to do other work without needing to worry about running back home if it rained to take in the drying food. A short while later, she got a second dryer.

Fig 5.2.3 Bimla with her solar dryer

Fig 5.2.4 Bimla and her organic garden

This design is a tunnel-shaped dryer, made out of a bamboo frame covered with a plastic sheet. It includes a solar panel and two small DC fans to remove the excess moisture from the solar dryer. The dryer cost Rs. 5,000. By experimenting with a variety of designs and of inexpensive materials, INSEDA made a piece of technology that would have cost many times that amount in the market. Bimla's financial worries continued, however. Later, during one of the monthly women's groups' meetings that were organized by WAFD, participants discussed the problems with monkeys and wild boars. They identified crops that could repel these animals. It was found that turmeric, chillies, colacasia, and ginger were among the crops that would not be eaten by monkeys. WAFD also trained participants to dry and to process the produce so that it could be sold at a higher rate in the open market.

Spurred on by this knowledge, Bimla decided to give it a try. She grew turmeric, chillies, and colocasia in her field. After harvest, she boiled the turmeric for a few minutes to make sure the colour of the turmeric became stronger. She then dried all of the turmeric in the two solar dryers. Similarly, after harvesting the chillies, she dried the chillies in the solar dryers. After drying them completely, she pounded the turmeric and chillies into powder, a popular flavour and spice addition for food.

Her yield was about 10 kilos of turmeric. After drying and powdering it, she was able to sell it at a much higher price than she would have gotten selling it raw. She sold the turmeric at Rs. 300 per kg, while the dried wild apricots and chilli powder brought Rs. 200 per kg each. She also made juice from the bright red rhododendron flowers that grow abundantly in the region, selling 5 liters of the juice at Rs. 85 per litre. She made lime squash from the lime tree that stood outside her house and sold that for Rs. 50 per litre. Her total earnings came out to Rs. 5,875.

Today, Bimla is much more confident and plans to grow turmeric on a larger plot of land. In fact, encouraged by her success, other women in her village and in surrounding villages have approached us to request installation of similar technology. Thus, Bimla, once shy and unassuming, has become a role model for her community.

Bimla's most valued possessions now are the two simple domestic solar dryers. These basic technologies have transformed her life, her self-esteem, and the respect that she receives in the community. Bimla now works as a motivator and volunteer, sharing her story with women's groups in five other villages so that they, too, can benefit.

Fig 5.2.5 Purni Devi carrying water

Purnidevi's Rooftop Rainwater Harvesting Structure

On a normal day, sixty-year-old Purni Devi, like literally millions of other women and girls around India, must walk many miles each day to collect water for themselves and for their families.

Warming temperatures and falling water tables have worsened water access. The burden of collecting water means valuable time is taken from them that otherwise might be invested in their health, education, and well-being. It also makes these women and children more vulnerable to assault en-route to collecting water.

Living in the mountains of Uttarakhand, by definition, adds further physical discomfort and burden to residents' lives. Purni Devi's house is 7,400 feet higher than the main village of Maun, with only six other houses nearby. There is no road leading up to the little hamlet, no well, and no source of water, either natural or state-provided. She has to walk many times each day, two km each way, through the narrow, uneven, steep mountain path in the forest to the University Campus, where there is a tap from which she can draw water and carry it back to her home. This round trip to and from the water supply is undertaken four or five times a day, taking many hours each day. Purni Devi can carry only 10-12 liters of water in each trip. She has five adult members in the house as well as

two buffaloes to tend. Therefore, a constant water supply is essential to perform all household chores while ensuring there is enough for human consumption and other activities.

All of this helps to explain why Purni Devi's eyes lit up when, at a village meeting, INSEDA and WAFD were discussing low-cost technologies that can help reduce women's drudgery as well as conserve water. "Please make a roof water-harvesting tank for me. I have to walk long distance for collectin g water. This will help me for at least a few months a year," she requested.

A bamboo-based roof-runoff water-storage tank was made for her. Now, during the rainy season, the rainwater from the roof does not get wasted. It is collected into the tank through a pipe connecting the roof with the tank. Seeing Purni Devi's tank, five more rainwater-harvesting tanks have been installed in her village cluster.

Fig 5.2.6 Bamboo based rain water storage tank

The collected water is used in washing utensils and clothes, as well as to water her kitchen garden. Further, if it is filtered, this water is potable.

Once the water in the tank had been depleted, the women beneficiaries spoke to the guard at the university campus and worked out a deal with him. He allowed them to use a long water pipe to bring water to fill their tanks. Thus, even if there were no rains, these women would have access to water near their homes all through the year.

The cost of building one 3.000-litre tank comes to Rs. 14,000. Since the base is made of bamboo and no bricks are used, it is also environmentally friendly.

Purni Devi lists a range of benefits to having the technology installed. She saves four or five hours each day, as she does not have to walk to collect water. With the time that she has saved, she can do her work without rushing, while also taking a little time to rest. Her problem of getting enough water for washing clothes and utensils as well as for other household work has been solved, with enough water left over for her livestock and to water her kitchen garden.

When we met with her recently, it had rained the previous night. The 3,000-litre bamboo-based rooftop rainwater tank was already half full. Purni Devi was happy. She wouldn't have to take the long walk to collect water for the next few days.

Fig 5.2.7 Kidi Devi and her biogas plant

Kidi Devi's Compost Basket and Biogas Plant

Kidi Devi lives in the village of Maun in mountainous terrain. Access to Maun is difficult. It is very far from Chamba, and even from Ranichauri. The road downslope to Maun is long, and coming back from the village takes even longer.

Kidi Devi became a member of WAFD in 2011, and two years later, she became the volunteer WAFD representative for the village of Maun. She doesn't have much land, but Kidi Devi has not let that stop her from adopting the technologies introduced by WAFD. In 2012, she obtained the **organic compost basket,** and since then, she has used her organic compost in her kitchen garden. She was pleasantly surprised to find that, for the same amount of dung input, the organic compost basket gave her three times as much compost for soil fertilization as her previous methods had yielded. She says that the crops are better now: the plants grow to be bigger than ever, the kitchen garden now boasts more blooms, and the produce has seen a two-fold increase. Kidi Devi managed to earn Rs. 15000 by selling 3-4 quintals of peas.

Looking at these earnings, one might think that water must be easily available, but that is not so. Water is a huge problem in the village of Maun. Every day, at least three hours are lost to fetching water for household needs. Unfortunately, there was no space enough to install a water harvesting tank, but she did have enough space for a biogas plant.

The concept of the biogas plant is familiar to any Indian with a school education. In the mountainous village of Maun, however, it is not just an idea covered in a science book. A biogas plant has been an important part of Kidi Devi's everyday reality since 2015. INSEDA and WAFD constructed the two-cubic-metre biogas plant for her in July of 2015. She now makes tea and does her daily cooking using biogas.

To start the biogasification process, 25 kg dung and 25L water are added to the slurry-mixing tank of the biogas plant and then mixed. This tank feeds the digester, in which fermentation of the slurry produces the biogas. The biogas then travels through the pipeline and fuels the gas stove in Kidi Devi's kitchen. The outlet tank collects the used slurry, which is then taken out and allowed to dry. Kidi Devi uses this in her farming.

The biogas plant now fulfils most of her cooking requirements. The only two things for which she does not use it are making chapatis and making dals like rajma. She says that the chapatis made on the chulha have a different taste and that her family did not enjoy the chapatis made on the gas stove. Because she now uses using the biogas plant, her exposure to the chulha smoke has now declined to only 90 minutes in a day, down from her many hours per day in the smoke before she had biogas. She says that the biogas plant has freed her from her previous dependency on expensive Liquefied Petroleum Gas (LPG) cylinders. Earlier, she would wait for the cylinder to be delivered to her house, a process that could take many days. Quite often, on the day of delivery of the cylinder, she would not have any money in the house and would have to forego it. You can hear the sadness in her voice when she recounts this. She quickly bounces back and describes the current situation: *"Now when the cylinder is delivered, I barely feel the need to use it. In fact, if someone else needs a cylinder and does not have the money at the time, I give it her."*

The biogas plant changed Kidi Devi's situation in the kitchen, but it was being appointed WAFD volunteer that transformed her. She says she has learnt how to talk to people and how to carry herself when addressing others. Earlier, she would not speak much, but becoming a volunteer meant she had to talk! She participates in the Mahila Mandal Dal meetings, and motivates others to adopt the technologies introduced by WAFD so that they, too, can benefit. She talks about a recent incident to explain how she has become vocal. *"The men and women from the village had been hired to construct a wall by the Block Development Office. The men only had to put cement on the bricks to construct the wall, whereas the women had the more labour-intensive task of carrying the materials required for the construction. The men were going to be paid Rs. 350, whereas the women were to get Rs. 200. When I found out about this difference in wages, I told the authorities that if you pay us Rs. 200 then we will do the work worth Rs. 200."*

Kidi Devi continues and says that, earlier, if a woman in the village spoke her mind, she was looked down upon. *"But now, all the village men and elders have become used to listening to our opinion, and some of them welcome it, too." "We now feel that, yes, we have a voice."*
And to think, it all started with a few EVD technologies.

5.3 SRI LANKA

Mr. Dharmaratne's Improved Brick Kiln

Mr. Dharmaratne is a small-scale brick producer in the Anuradhapura district of Sri Lanka. He owns his own workshop space and kiln. For the additional supply of water, he has dug a well on his premises. He has been producing bricks for nearly fifteen years as a permanent income-earning activity, supporting his wife, two sons, and daughter. He has plantations spread over an acre of land, on which he grows coconut, banana, betel, hog plum, breadfruit, and black pepper. From these, he earns a subsistence living in addition to that from his brick business.

He works alone, with no assistance even from his family members. The dimensions of the bricks he makes are 9 inches x 6 inches x 4 inches. He currently sells them at a rate of Sri Lankan Rs 13 per brick. He uses a single mould for the bricks, which is made from wood. Dharmaratne produces around 15,000 bricks per season.

Fig 5.3.1 Dharmaratne making bricks with rice husk brick mixture

IDEA trained Mr. Dharmaratne in making a brick mixture using rice husk. They also shared with him a technique for better brick-kiln stacking, leading to a more efficient production process, and taught him brick-firing processes using rice husk. They first collected and analyzed clay samples from the area where Dharmaratne collected brick-making clay. After determining the mix of clay, sawdust, and/or paddy husk in the clay, IDEA experimented with various mixtures of clay and rice husk to compare them for quality and feel. They then trained him on the ideal mixture to use. IDEA helped Dharmaratne to upgrade his kiln from the inefficient, fuel-intensive, and wasteful temporary kiln that he was using to a permanent brick kiln. This new kiln has permanently constructed walls at three sides, a roof, and three firewood openings. Importantly, both firewood and rice husk can be used as firing fuels. This kiln also has additional firing channels. With the upgraded procedures, the stacking of bricks inside the kiln is done systematically with interlayer gaps to be filled with paddy husk to improve the heat circulation and to get the maximum heat benefit. The improvements in the brick kilns has reduced the consumption of firewood substantially, creating additional economic benefits for brickmakers such as Dharmaratne

Fig 5.3.2 Dharmarantne's improved and permanent brick kiln

while also reducing tree-felling for firewood. This, in turn, has eliminated significant amounts of carbon dioxide emissions into the atmosphere. Utilization of bio-waste in brick-making has reduced indiscriminate dumping. The burning of rice husk and sawdust that pollute waterways and the atmosphere has also decreased.

Mr. Dharmaratne is delighted with this technology. With the upgraded clay/rice-husk mixture, there is less than 5 % wastage in production. This is a major improvement over the previous wastage of about 15 %. He also uses less clay in his mixture which is an important environmental benefit because of the hazards associated with extracting clay from the soil. He uses less wood, since the new kiln can utilize rice husk as well. In fact, he now uses one cubic yard of firewood supplemented with rice husk, as opposed to seven or eight cubic yards of firewood, to make 3,000 bricks. He also saves on time because of the efficiency of the kiln.

There is plenty of scope for disseminating this technology in Sri Lanka, where the abundant energy resources are rice husk and firewood. Since rice consumption is widespread and rice cultivation is extensive, rice husk has tremendous potential as a source of energy.

Mr. Rajapakse's Improved Industrial Cookstove with Two Potholes

Mr Rajapakse is a former Sri Lankan government employee who owns a small milk-toffee business run from his own house. Before he started his business, his entire family relied on the earnings from his former job. In 1994, on retiring, he started his business along with his wife, who initially worked as his assistant. Even though he hired two assistants once his business took off, of late, with a shortage of labour in the region, he and his wife are back to running the business themselves. In this situation, ease of operations is vital, and one of the most important production assets that has an impact on time and convenience is Mr. Rajapakse's stove.

Until 2003, he used a conventional single-burner wood-fuelled stove. The fuelwood for this stove needed to be bought, and the single-burner, less efficient design meant that it took longer to make Rajapakse's toffee mixture. Then, in 2003, IDEA and ARECOP (The Asia Regional Cookstove Program) conducted a series of training programmes on stove design, construction, and installation for trainees covering ten districts. They wanted to implement a few pilot projects to identify local small/medium-scale industries. The objective was to give the trainees some practical experience while also giving industry owners the benefit of an improved industrial stove. This, in turn, could minimize the negative impacts of their activities on the environment. Four small to medium-scale industries were chosen for the venture.

Mr. Rajapakse was one of the chosen beneficiaries. For Mr. Rajapakse, making milk toffees takes serious thought. He has experimented with different mixtures and recipes before coming up with the perfect mix for his milk toffees. He now has three recipes among which he alternates to make toffees. The capacity of production is around 40,000 pieces per month. He uses his own three-wheeler to distribute the toffees. Over the years, he has established a good relationship with local shops with the price and quality of his toffees. He reports a secured profit of around Sri Lankan Rupees 20,000 per month from his business, with a realistic potential to be increased, if more people can be deployed.

Fig 5.3.3 Rajapakse with his improved cookstove

Making the milk toffees is a long, time-consuming process. The main ingredients of the recipe are coconut milk, milk powder, and sugar. The production process begins with scraping out the flesh of coconuts. These scrapings are then used to squeeze out the coconut milk. The squeezed-out pulp is not wasted, but dried and used to produce coconut oil that is usually used for packaging and sealing activities since it is not suitable for cooking. Then all the ingredients are mixed in the right proportions. One of the main processes in milk-toffee making is to heat up and continuously stir the mixture until it achieves the perfect texture and consistency for the toffees to be cut and prepared. Initially, a conventional single stove was used for heating the mixture. Mr. Rajapakse reported that many firewood sticks were not fully burnt and there was heavy smog in the workspace. On average, more than half of a cubic yard of firewood, over 13.5 cubic feet, was consumed to make 8,000 pieces of milk toffee. As Mr Rajapakse stated, there were instances in which he had to use about one cubic yard for the same output.

In contrast, Rajapakse now reports that, with the installation of the new two-burner household industrial stove, the efficiency of the toffee-making process has improved substantially and his productivity has increased. He has completely stopped buying firewood because of the significantly reduced need. The amount of firewood required to produce 8,000 pieces of toffee is around four to five cubic feet, a reduction of firewood consumption by more than 50%. The firewood collected from his backyard is enough to run the modified cookstove, bringing down the costs of production. Moreover, with the reduced smoke from the efficiently designed stove, the workshop's environment has become much more comfortable.

Mr. Rajapakse is so pleased with the cookstove that, 12 years later, he still uses the same modified stove, having made just a few replacements of the stove accessories.

In terms of the environment, the reduction of firewood consumption has helped to minimize the felling of trees. Similar interventions undertaken through the project collectively have helped to reduce carbon emissions significantly.

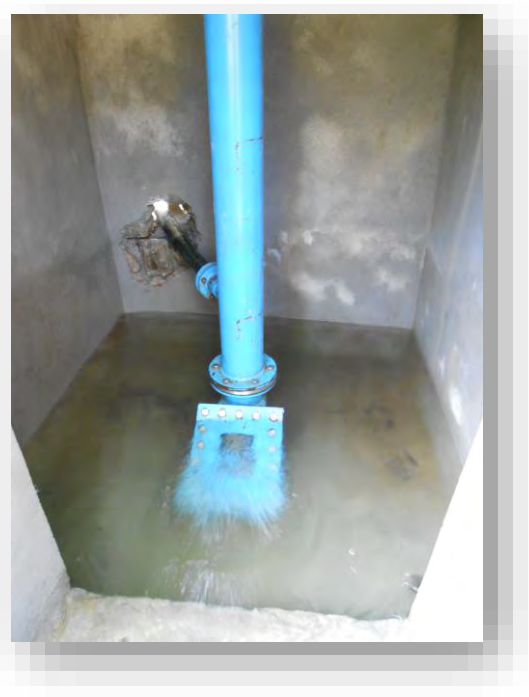

Fig 5.4.1 Hydram

5.4 NEPAL

Hydraulic Ram Pump (Hydram) to Improve Water Access in Rural Nepal

In the Kavrepalanchowk district, a growing trend has the male population migrating either to the Middle East or to Kathmandu in search of jobs. The women of the village located at Sanogaun-5, Balthali VDC have set an example by initiating and completing the community-based hydraulic ram-pump project.

These women's initiatives were given a boost by Center for Rural Technology, Nepal's (CRT/N) Hydram project, in which CRT/N, along with their partners Ghatta Owner Association, UNDP (GEF-SGP), and the Rural Energy and Technology Service Centre (RETSC), made an arrangement to enhance the livelihoods of marginalized communities by providing access to ample water to facilitate irrigation as well as to improve personal and community sanitation. The installation of the hydram in the village allowed irrigation facilities to reach the farmlands of the beneficiaries and encouraged villagers to construct toilets to improve their sanitation. The project benefited 150 people from 35 households of the village.

By integrating micro-irrigation practices (sprinklers) with hydram, approximately 3.3 hectares of land now have irrigation facilities to cultivate high-value crops like vegetables. Farmers who were previously forced to practice only traditional cropping patterns and to cultivate conventional crops like wheat, millet, barley, and mustard oil seeds now, thanks to the presence of the Hydram system, are attracted to grow high-value crops like coriander, cauliflower, cabbage, potatoes, and tomatoes. Today, farmers can think of cultivating off-season vegetables in plastic tunnels because of the availability of water.

The beneficiaries are also able to distribute water equitably for irrigation among themselves, thus maintaining the system efficiently and fairly, solving conflicts regarding water use among the users while determining and collecting tariffs.

The real impact, however, was seen almost as a by-product of the collective efforts of the community's women and the constant follow-up trainings by the project partners. To uphold the dignity of women, the stakeholders, including the women themselves, helped to raise awareness among the community members and to construct 35 units of toilets. This initiative contributed towards the improvement of health, hygiene, and sanitation within the community. "I do not have to fear physical hazards and wild animals during the night time since there is a toilet within my backyard", remarks an excited Mrs. Urmila Tamang, who now has access to her own toilet. With toilet facilities in residents' backyards, open defecation was brought to an end in the community, thereby improving the hygiene and sanitation status of the beneficiaries. Furthermore, the risks of snake and insect bites and of other physical hazards have been eliminated, along with the stigmas of

open defecation and menstruation. Through septic-tank management, Urmila and the other beneficiaries now have an additional option of using human excreta in conjunction with agro wastes to produce organic fertilizers for their kitchen gardens or even for farmlands.
"Previously, it was difficult to find privacy in order to manage during menstruations, but now I am able to manage my period hygienically and with dignity. Besides, I am teaching my children to use toilets and I am happy that my daughter, when she grows older, does not have to go through the problems that I had for finding private spaces in the open field for defecation. Today I can afford to sleep for longer hours as I won't have any hassle of waking up early in the morning and finding concealed areas in the surroundings to be used as toilets. There won't be the foul smell of urine and human feces in our surrounding environment any more," comments Urmila, with a sense of achievement and victory.

The collective impact of this development has been felt the most in the status of women in the Nepalese community at Sanigaun-5, Balthali. Not only has the project improved women's communication skills, it also has given them greater confidence, leadership, and decision-making capacities.

Fig 5.4.2 Women's contribution towards the project

Fig 5.4.3 Toilet and water tank built after Hydram installation

Improved Water Mill for Electrification in Sindhuli District:

Fig 5.4.4 Improved water mill

The Improved Water Mill technology complements the essence of the eco-village development concept. Not only is it a source of clean energy, it also has cobenefits that can enhance rural livelihoods. It is ideal for the hilly terrain of Nepal, which has plenty of water resources and enough height for the system to work. Over the last few decades, many changes have been made to the technology, making it more efficient, time-saving, and versatile in use. The Center for Rural Technology, Nepal (CRT/N) has implemented an enhanced version of the technology, known as the Improved Water Mill Electrification (IWME) system. This is being used for rural community electrification and to integrate micro-enterprises that use electricity generated from IWM. Importantly, much training on income-generation solutions is also integrated into the programme.

The main reason for the success of IWME technology was its direct contribution to the livelihood of the people. Cereal crops like maize, wheat, and rice have always been among the main food crops for rural Nepal. The water mill allows these crops to be processed easily prior to their consumption. IWM technology therefore has displaced traditional diesel-based agro-processing units, thus contributing to the reduction of GHGs in an ambient environment. Micro-industries, too, can use this technology to run more cost-effectively. Additionally, innovative financing approaches were introduced through this IWME program in order to improve access to technology and to initiate micro-enterprise in rural communities.

The IWME programs have been implemented in villages that do not have access to the national grid. In the absence of a national grid, the people from the Sindhuli area made use of kerosene lamps, torches, candles, and solar tukis (rechargeable solar lighting systems). The illumination provided by these sources of light was not enough for the households to perform household chores efficiently or, perhaps, to study. The desire for an efficient source of electricity for lighting and entertainment purposes (TV and radio) was the main reason for the beneficiary community's request for an IWME programme.

Light and Training to a *Chicken Farm*

One of the beneficiaries of the IWME system is Mr. Janak Bahadur Thapa, affectionately known in his village as “The Chicken Man”. This unassuming man has been a chicken farmer for many years now, running his popular poultry business in the Sindhuli district. CRT/N’s selection committee chose him to receive comprehensive training on poultry farming because he already had some basic knowledge about the poultry business. Before receiving training, he estimated that he lost a fifth to a quarter of each batch of 50 chickens. With the training, he learned that insufficient illumination in the

chicken shed and a faulty design were the main culprits. Before the training, he either didn't use any light in the shed or utilized weaker solar lights, because of which many chickens died. After his training, Mr. Thapa's first move was to upgrade the quality of the chicken shed, as well as to improve the feeding schedule and quality of the feed used. He reports that mortality rates have decreased to 4% in each batch of 50.

Each batch of chicks requires 45-60 days to turn into adults. and then they are sold in the market. The chickens are consumed in his own village, as there are lots of meat lovers in his community. He sells the chickens at the rate of 250 per kg (the average weight of one chicken is 2.5 kg). So, from one batch of chickens, he makes a profit of approximately NPR 11,000, providing an important boost to his previous income.

Fig 5.4.5 IWME Chicken Man

Other income generating opportunities generated by IWM

Light to Tailoring

Fig 5.4.6 *Mrs. Prem Kumari Ale in her*

Tailoring is a job that puts a lot of stress on eyes. Nonetheless, to make a living, Mrs. Prem Kumari Ale had no other choice but to use a flashlight or a solar lantern with very low luminance to stitch clothing at night. Before electrification through the IWME project, she was able to operate her tailoring business only during daylight hours, and even then for just a limited period of time due to her need to do her household chores. To make a living from her established business, however, despite difficulties due to lack of sufficient light, she had to work at night. During festive seasons, she had to reject many customers, as she could never complete the orders of her customers on time. Electrification changed her life for the better. For instance, recently, during the teez (festival celebrated by women only), she was able to work for long hours during the nights and completed many orders from her customers. Working the additional hours at night has enabled her to increase her income level by 30-40%.

Replacing the diesel mill

Fig 5.4.7 Paddy processing in rice huller

The implementation of the IWME programme has meant phasing out certain traditional fossil-fuel-run technologies that existed in the village. However, the project has ensured alternate livelihoods for people who lost businesses that were based on traditional fuels. In addition to his role as a chicken farmer, Mr. Janak Thapa is the operator of an IWME power house at Dahar, Ranichuri-8. Prior to the IWME project, he used to operate a diesel mill for agro-processing in the village. It was during his training that he realized that fossil-fuel-based technologies are undesirable from an environment point of view. He was told that the IWME program would displace diesel mills for agro-processing. Since IWME was going to displace his business, the community agreed to select him as an operator of the rice huller that was integrated with IWME. His responsibilities included switching on and shutting down the IWME system. He was also responsible for processing the paddy grown by the village people. The project committee paid him NPR 2,000/month for his salary, while he had to submit the earnings made by using the rice huller to the project committee. Till date, on average, the rice huller has been able to earn NPR 1,600/month. Other than tariff collection, this is another source of income from the IWME system. A flat-rate tariff system has been used to collect bills from the beneficiaries. For each bulb, the beneficiary household is paying NPR.15; therefore, in a month, each household pays NPR. 60 to use the electricity generated by the IWME project. A family running a poultry enterprise is paying NPR. 75/month.. The committee has also set a minimum usage fee. Each household will have to pay NPR. 45, whether they light only one bulb or 4 bulbs.

In earlier days, processing in the diesel-based mill was very expensive compared to processing in a rice huller integrated with IWM. The cost of processing 1 Muri of paddy (approximately 70 kg) in a diesel mill is NPR 70, whereas processing same quantity in an IWM system now cost only NPR 25/kg.

Fig 5.4.8 Rice huller integrated with IWME

GHG-emission reduction potential

The processing speed of IWME is similar to that of a diesel mill, which is two Muri/hour. The presence of an IWME system in the community has led to reduction of the use of fossil fuel to process agro-products, which means the emissions associated with the agro-sector have also been reduced through use of the improved water mill. From the mill owner's perspective, he will no longer need to travel to the city center to buy diesel at a cost of 115 Rs/liter. Not having to fetch diesel fuel has been

a relief to the owner, as it has enabled him to save the time and energy spent on hauling it to his village. When the diesel mill was operating, 35 liters of diesel were consumed within three months. This resulted in the emission of 92.14 kg of CO_2 (potentially 1105.63 kg on annual basis) within that period of time. Operation of the IWM thus has contributed in offsetting the aforementioned emission generated from the diesel-based agro-processing mill.

In all, about 36 families benefit from this installation. It provides them with enough energy for domestic lighting, for operation of rice hullers, and for running micro-enterprises such as poultry farming and bamboo-stool manufacturing.

The project adopted an innovative financing scheme to pay for the technology. For instance, a smart subsidy process was implemented for financing the project. For the installed system, the project contributed 50% of the project cost, while the community managed to provide the remaining funds required for installation. CRT/N also played the role of facilitators in establishing connections between the community and the financing institutions. The innovative part in this financing mechanism was the fact that the bank provided loans without any requirement of collateral and they provided loans to the registered group of women residing in the beneficiary community, a demographic that finds it hard to successfully apply for loans otherwise.

The IWME technology has not only improved energy access, but also has occasioned implementation of innovative financing to allow the economically disadvantaged to install green technology solutions. For beneficiaries like the Chicken Man, it is a means to earn a stable livelihood as well.

ABBREVIATIONS

GDP	Gross Domestic Product
PPP	Purchasing Power Parity
GHG	Greenhouse Gases
IPCC	Intergovernmental Panel on Climate Change
AR5	Fifth Assessment Report
HDI	Human Development Index
SAARC	South Asian Association for Regional Cooperation
RET	Renewable Energy Technology
IDEA	Integrated Development Association
CBO	Community Based Organizations
INSEDA	Integrated Sustainable Energy and Ecological Development Association
WAFD	Women's Action For Development
CRT-N	Centre for Rural Technology, Nepal
GCF	Green Climate Fund
ODA	Official Development Assistance
RERED	Renewable Energy for Rural Economic Development
NGO	Non-Governmental Organizations
GW	Gigawatts
EVD	Eco-Village Development
CSR	Corporate Social Responsibility
SHG	Self-Help Groups
ICS	Improved Cookstoves
COP 21	UNFCCC Conference of Parties 21
UNFCCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee
RETSC	Rural Energy and Technology Service
IWME	Improved Water Mill Electrification
	NRP Nepalese Rupee , Rs Indian Rupees

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The International Network for Sustainable Energy which was formed at the Global Forum in Rio in 1992 is a meeting place for NGOs working at the grassroots level as well as at national, regional and international levels, all united on a common strategy for a long-term sustainable development. The INFORSE network is facilitating practical and political exchange of experiences among NGOs, liaising with concerned multilateral agencies, creating political and public awareness, and seeking support for NGO activities. It lobbies to promote sustainable energy solutions - renewable energy and energy efficiency - which utilise decentralised approaches.

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DIB is a Danish NGO, which implements projects in developing countries, focusing on challenges and sustainable solutions for climate, environment and poverty. DIB was founded in 1988 by a group of architects who would promote sustainable human settlement in developing countries.

INFORSE-South Asia Coordinator
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INFORSE South Asia is one of the 7 regional networks of INFORSE. It includes NGOs from India, Bangladesh, Nepal and Sri Lanka that support a low-carbon, sustainable development agenda for the region.

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Integrated Sustainable Energy and Ecological Development Association is a network of grassroots NGOs and individuals who were working on ecological solutions and clean development. It was registered as a national NGO in 1995. It provides implementation and capacity building solutions in renewable technology like biogas to mostly rural populations in India. INSEDA has been developing low-cost, pro-poor, low-carbon mitigation EVD technologies for two decades.

WAFD - Women's Action For Development
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Women's Action for Development has been working with a focus on women since 1978. For the last 20 years WAFD has been working on environmental issues, especially climate change and its effects on rural women. It has been implementing the EVD concept in villages for the last fifteen years in India. It also has been providing about 1500 poor urban women easy access to small credit through a microfinance scheme.

INFORSE National Focal Point – India

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All India Women's Conference is a non-profit NGO established in 1927. It has 150,000 members in 500+ branches across the country working for empowerment of women in India. It has a wide experience is solar dryers and solar lanterns. AIWC is co-focal point to the UNFCCC Women Gender Constituency.

INFORSE National Focal Point - Sri Lanka

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Integrated Development Association (IDEA) is a registered non-profit, non-governmental organization based in Kandy. IDEA was established in March 1990 with the aim of playing an active role in contributing towards sustainable development efforts in the field of natural resources in development, management and conservation. It has won the confidence of a large number of grassroots level CBOs seeking technical assistance in rural energy technologies and environment-oriented programmes over the years.

INFORSE National Focal Point -Nepal

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Centre for Rural Technology, Nepal (CRT/N) is a professional non-governmental organization engaged in developing and promoting appropriate rural technologies effective in meeting the basic needs and improving livelihood of rural people. The organization is actively engaged in upgrading traditional technologies as well as developing new technologies with diversified and versatile applications to meet rural needs.

INFORSE National Focal Point – Bangladesh

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Grameen Shakti has been working since 1996 to promote renewable energy technologies to the rural people with a credit system, to protect the environment and to improve standards of living. Grameen Shakti has already reached 1.5 million households with Solar Home Systems in rural areas of the country.

CANSA - Climate Action Network South Asia
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Climate Action Network South Asia (CANSA) has been on the driving seat to pursue "climate change and development" issues both within and outside the region as a platform of over 140 South Asian civil society organisations who come together and speak out in the national, regional and international climate change fora. CANSA places climate change, equity and sustainable development issues on the global agenda for the benefit of poor people and countries.